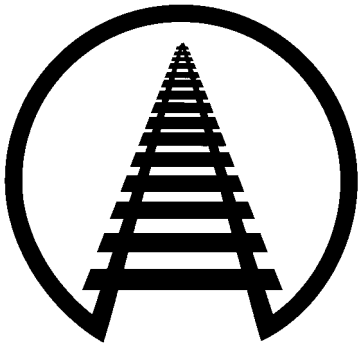
INTERMODAL LOADING GUIDE for Products in Closed Trailers and Containers

Circular No. 43-E
Pamphlet No. 45
BOE Pamphlet No. 6C



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Supersedes BOE Pamphlet No. 6C Issued 1990,
AAR Circular 43-D Issued June 2001, and
Intermodal Loading Guide Issued July 1995 (Incl. 1997, 1998, 2001 Revisions)

Approved by
DAMAGE PREVENTION & FREIGHT CLAIM COMMITTEE
HAZARDOUS MATERIALS BOE COMMITTEE

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METHODS RECOMMENDED FOR HAZARDOUS MATERIALS LOADING

The methods listed below have been recommended for hazardous materials loading by the Hazardous Materials (BOE) Committee. They are found in Section IV of this publication. Those marked with an asterisk (*) have been impact-tested to 8 mph.

Special Bulkhead Braces

Information on and illustrations of special bulkhead braces are available from the Association of American Railroads by contacting the Bureau of Explosives or Damage Prevention and Loading Services. These bulkhead braces are approved but rarely used. The information is available for shippers who may need a system to ship special hazardous materials like ammunition or explosives.

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SECTION I—INTRODUCTION

A—GENERAL

The *Intermodal Loading Guide for Products in Closed Trailers and Containers* is intended to be a comprehensive manual for loading of commodities in trailers and containers for shipment by rail. Incorporated into this publication are AAR Circular 43-E, Rules Governing the Loading, Blocking, and Bracing of Freight in Closed Trailers and Containers for TOFC/COFC Service (see Section II); the approved loading and bracing information contained in AAR Bureau of Explosives Pamphlet No. 6C on hazardous materials; and AAR Pamphlet No. 45 on general loading in closed trailers and containers.

The "General Rules," as contained in Circular 43-E or supplements thereto, are issued by the Association of American Railroads and have been formulated for the purpose of providing safe methods of loading in closed trailers or containers. These General Rules must be observed. References to, or illustrations of, trailers in this publication include both containers and trailers.

It must be understood that trailers or containers may move in a backwards or reverse direction for all or a portion of their journey. During its journey, normal transportation forces may shift an unsecured load or cause lading to exert excessive pressure against the nose, rear doors, or sidewalls. Lading that is improperly blocked and braced can shift to one side of the vehicle and cause the vehicle to lean on the flatcar. A container or trailer leaning on a flatcar can cause a sideswipe or contribute to a derailment. Weight of a load that is concentrated in a small area and not properly distributed throughout the trailer or container can also cause a vehicle floor to collapse. It is imperative that trailers or containers moving in rail service be loaded by the shipper in strict compliance with the General Rules. Shipper is defined in these rules as that party (or his agent) who is responsible for the physical loading and securement of the lading in the trailer or container.

The general information and loading methods contained in this publication apply to shipments transported in the USA, Canada, and Mexico.

The loading methods, as described in this Intermodal Loading Guide, are approved by the Damage Prevention and Freight Claim Committee and Hazardous Materials BOE Committee of the Association of American Railroads and are minimum standards that have been evaluated and approved. These minimum standards offer practical guidelines on the subjects covered. As these are minimum standards, it may be necessary to supplement these methods in some instances.

The securement standards specified in AAR closed trailer/container loading publications are intended for safe transit of the trailer/container and railcar from origin to destination and for prevention of lading and equipment damage. These standards do not address unloading practices.

Wherever gallons are identified in this document, the term refers to US gallons. For other units, see conversion charts on page 1-4.

If loading procedures, illustrations, or principles contained in this publication appear not to cover a specific shipment being tendered for TOFC/COFC movement, contact the origin carrier's *loss and damage prevention representative* for assistance and/or instructions.

Loading and bracing methods not currently approved may receive consideration for approval and publication under the "Damage Prevention and Loading Services Procedures Governing Evaluation and Acceptance of New Closed Car Loading and Bracing Methods and Materials," General Information Bulletin No. 2. Submit request to Director, Damage Prevention and Loading Services, AAR/TTCI, 7001 Weston Parkway, Suite 200, Cary, NC 27513.

For additional information concerning intermodal open top loads, consult the AAR *Open Top Loading Rules Manual*, Section 7, "Rules for Loading All Commodities on Open Top Trailers and Containers for Rail Transport," issued by the AAR Safety and Operations Department.

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

B—LOADING AND RESTRAINING SHIPMENTS OF HAZARDOUS MATERIALS

Loading of hazardous material must conform to the regulations of the agency of authority of the countries within which the shipment will move. Some, but not all, regulations are as follows:

- Department of Transportation Regulations as published in Bureau of Explosives Tariff 6000 series and supplements thereto
- Transportation of Dangerous Goods Regulations and supplements thereto as administered by the Transport of Dangerous Goods Directorate (Transport Canada)
- Mexican shipments are governed by Bureau of Explosives Tariff 6000 series and supplements thereto

Carrier is to be specifically informed on shipping orders as to the presence, type, characteristics, and volume of all hazardous materials.

All packages intended for TOFC and COFC shipments of hazardous materials in the United States must meet appropriate US DOT hazardous material regulations concerning packaging specifications, labeling, and marking as specified in CFR Title 49.

Section IV of this publication contains information on recommended methods for loading and restraining shipments of hazardous materials for TOFC/COFC movement. The methods illustrated in this publication are published to offer recommended guidelines when establishing loading and restraining configurations for hazardous materials shipments. Methods recommended for use with hazardous materials are indicated in the table of contents for Section IV and by the BOE logo on each method as illustrated here.

The manufacturer or the manufacturer's authorized agent of the securement system must provide the shipper with installation instructions to prevent improper installation that could lead to failure of the securement system.

NOTE: Pneumatic dunnage bags must *not* be used to secure shipments of hazardous materials.

All methods included have successfully passed the Association of American Railroad's Standard Impact Tests in force at the time of testing. The procedure was changed in 1990 by reducing the maximum impact speed from 8 mph to 6 mph for all hazardous classes except explosives, which still must be secured with methods tested at 8 mph. This loading guide now contains methods that have been tested at both 6 mph and 8 mph. Those methods that were tested at 8 mph are indicated by an asterisk in the listing on page v.

In general, the regulations of the United States Department of Transportation, the National Transportation Agency of Canada, and Transport Canada require that packages of hazardous materials or dangerous commodities be securely loaded, blocked, and braced to prevent them from changing position, falling to the floor, or sliding into each other during transportation. The U.S. regulations, as found in CFR Title 49, read, in part, as follows:

> "**Sec. 174.55 General Requirements. (a)** Each package containing a hazardous material being transported by rail in a freight container or transport vehicle must be loaded so that it cannot fall or slide and must be safeguarded in such a manner that other freight cannot fall onto or slide into it under conditions normally incident to transportation. When this protection cannot be provided by using other freight, it must be provided by blocking and bracing. For examples of blocking and bracing in freight containers and transport vehicles, see Bureau of Explosives Pamphlet Nos. 6 and 6C (now incorporated into this *Intermodal Loading Guide*).
>
> **(b)** Each package containing a hazardous material bearing package orientation markings prescribed in Sec. 172.312 of this subchapter must be loaded within a transport vehicle or freight container to remain in the correct position indicated by those markings during transportation.

> **(c)** The doors of a freight container or transport vehicle may not be used to secure a load that includes a package containing a hazardous material unless the doors meet the design strength requirements of Specification M-930 (for freight containers) and M-931 (for trailers) in the AAR's *Manual of Standards and Recommended Practices* and the load is also within the limits of the design strength requirements for the doors.

As a result of revisions to 49 CFR § 174.55 as shown above, Department of Transportation conditional special approval SA-861102 authorizing the use of TY-GARD™ restraint systems is no longer applicable. The subject restraint systems are now authorized by the regulations as currently written.

Special Rules for Explosives

1. Division 1.1, 1.2, or 1.3 explosives must be loaded, blocked, and braced within or on the truck body or trailer so that packages will not change position under impact from each end at a speed of at least 8.1 mph. Each truck body or trailer must be secured on the railcar so that it will neither permanently change position nor show evidence of failure or impending failure of the trailer securement method when impacted from each end at a speed of at least 8.1 mph. (Ref. 49 CFR § 174.101 (o)(2))

2. For the TOFC or COFC transportation of Division 1.1, 1.2, or 1.3 explosives, trailers or truck bodies must meet the requirements of Part 177 of the Department of Transportation Regulations applicable to shipments of explosives by motor vehicle (Ref. 49 CFR § 174.101 (o)(1)), and requirements of AAR interchange rules.

3. Divisions 1.1 and 1.2 explosives may not be loaded, transported, or stored in a railcar equipped with any type of lighted heater or open-flame device, or electric devices having exposed heating coils. Additionally, Divisions 1.1 and 1.2 explosives may not be loaded in a railcar equipped with any apparatus or mechanism utilizing an internal combustion engine in its operation. (Ref. 49 CFR § 174.101 (L), 174.112)

4. Explosives must not be loaded into trailers or truck bodies equipped with automatic heating or refrigerating machinery unless these are disconnected from the source of power for their operation, and all fuel tanks for heaters or refrigerating machinery are drained. (Ref. 49 CFR § 174.101 (o)(5))

5. Metal floor plates must be completely covered with wood, plywood, fiber, or composition sheets of adequate thickness and strength to prevent contact of the metal floor plates with the packages of explosives during transportation. Covering metal floor plates is not necessary for carload shipments loaded by the Department of Defense provided the explosives are of such nature that they are not liable to leakage of dust, powder, or vapor that might become the cause of an explosion. (Ref. 49 CFR §174.104 (b)(8))

6. Trailers or containers equipped with mechanical restraining devices must not be used for shipments of explosives (such as TNT., dynamite, black powder, bulk propellant powders, and similar explosives, except as a component part of ammunition or propelling charges) that are liable to shift or become lodged in the mechanism in the event of container failure.

Special Rules for Flammable Liquids and Gases

Flammable liquids and flammable gases must not be loaded into trailers or truck bodies equipped with any type of lighted heater or open-flame device, nor into a railcar equipped with any apparatus or mechanism using an internal combustion engine in its operation. In addition, they also may not be loaded into a truck body or trailer equipped with any automatic heating or refrigerating apparatus, unless it is of the non-sparking or explosion-proof types. There should be no combustion apparatus in the lading space and no connection for return of air from the lading space to any combustion apparatus. No part of the lading may be heated over 129 °F (54 °C). (Ref. 49CFR § 174.200, § 174.300)

Recommended Location for Placards on Containers

To ensure that the required placards are visible during the transportation of containers on double-stack cars, it is recommended that the bottom of the placard is at least 5 ft above the bottom rail and at least 5 ft in from the corner post on the sides.

C—CONVERSION CHART

Capacity (Volume):

1 gallon (US liquid)	=	0.832 gallon (gal), Imperial
	=	3.78 liter (L)
	=	0.031 barrel, US liquid
	=	3785.43 cubic centimeters (cm^3)

Weight:

1 ounce	=	28.35 gram (g)
1 pound	=	453.6 g
	=	.4536 kilogram (kg)
1 ton	=	907.2 kg
	=	9072 metric ton
1.1023 ton	=	1 metric ton

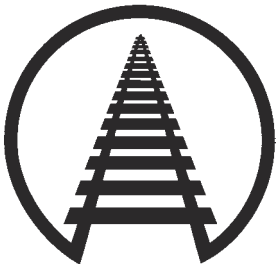
Length:

1 inch	=	25.4 millimeters (mm)
	=	2.54 centimeters (cm)
1 foot	=	304.8 mm
	=	30.48 cm
	=	.3048 meter (m)
1 yard	=	3 feet (ft)
	=	91.44 cm
	=	.9144 m
1 mile	=	5,280 ft
	=	1609.34 m
	=	1.6093 kilometers (km)
0.6214 mi	=	1 km

SECTION II—CIRCULAR 43-E

CIRCULAR 43-E

RULES GOVERNING THE LOADING, BLOCKING AND BRACING OF FREIGHT IN CLOSED TRAILERS AND CONTAINERS FOR TOFC/COFC SERVICE



Issued by:

ASSOCIATION OF AMERICAN RAILROADS

A—INTRODUCTION

These rules, which supersede Circular 43-D as issued in 2001, apply both to trailers and containers regardless of shipping plan used. Reference to, or illustrations of, trailers in this publication includes both containers and trailers.

These rules are designed for the benefit of all parties concerned. By adhering to the rules, both lading and equipment will be protected in the absence of unusual circumstances.

It must be understood that trailers or containers may move in a backwards or reverse direction for all or a portion of their journey. During its journey, normal transportation forces will shift an unsecured load or cause lading to exert excessive pressure against the nose, rear doors, or sidewalls. It is therefore imperative that trailers or containers moving in rail service be loaded by the shipper in strict compliance with the General Rules as contained in this publication. Shipper is defined in these rules as that party or his agent who is responsible for the physical loading and securement of the lading in the trailer or container.

If loading rules, illustrations, or principles contained in this publication appear not to cover a specific shipment being tendered for TOFC/COFC movement, contact the origin carrier's *loss and damage prevention representative* for assistance and/or instructions.

Loading rules contained herein apply to shipments transported in the USA, Canada, and Mexico.

General information and approved loading methods for TOFC/COFC shipments are published in Sections III and IV of this *Intermodal Loading Guide*.

B—GENERAL RULES

The following rules have been formulated for the purpose of providing *safe* methods of loading closed trailers and containers and *must* be observed. The primary purpose of these rules is safe transit of trailers and containers from origin to destination. Reference to, or illustration of, trailers in this publication includes both trailers and containers.

1. Inspection and Selection of Equipment

A. It is the equipment supplier's responsibility to furnish trailers that are clean and have sound roofs, sides and end walls, smooth floors, and snug-fitting doors. **There must be no obvious damage, distress, weakened parts, or weakened sections.** Any exception is cause for rejection. **The trailer or container must be appropriate for the lading it is to transport.** The shipper also has a responsibility to inspect the trailer or container at origin to see that it is suitable to carry lading safely to destination.

B. It is important that **trailers or containers** be clean and free from nails and other protruding objects.

C. If trailer or container supplied is not suitable for loading and shipper elects to load this trailer or container rather than reject it, it is the shipper's responsibility to properly prepare the trailer or container .

2. Planning of Load

A. Plan loading to prevent damage to lading and equipment. Lading that is obviously unsuitable for movement in a trailer or container, as far as safety in handling and protection to lading and equipment are concerned, is not to be loaded.

3. Maximum Weights, Weight Distribution, and Center of Gravity

A. The load weight *must not* exceed the limit as stated on the manufacturer's plate. Combined weight of trailer and lading may not exceed 65,000 lb.* Combined weight of container and lading may not exceed the weight specified below for the length of container being loaded:

Nominal Length (ft)	Maximum Gross Weight (lb)** (Lading Plus Tare)
53	67,200
48	67,200
45	67,200
40	67,200
28	52,900
20	52,900

*Maximum weights as defined in current AAR Specification M-931-04 for trailers (effective 2/1/04 and subject to revisions thereto.

**Maximum weights as defined in current AAR Specification M-930-08 for containers (implemented 10/2008), and subject to revisions thereto.

B. Lading weight in trailers or containers must be evenly distributed both crosswise and lengthwise, and combined weight of lading and trailer or container must conform to all federal, state, provincial, and local regulations and transportation service requirements used at origin and to final destination. (See Illustrations 1, 2, 3, and 4.)

C. Combined center of gravity (measured from top of rail) of car, trailer or container, and load is not to exceed 98 in.

4. Hazardous Materials/Hazardous Substances

A. Loads containing any quantity of hazardous materials/hazardous substances must conform to the regulations of the agency of authority of the countries within which the shipment will move. Some but not all regulations are as follows:

- Department of Transportation Regulations as published in Bureau of Explosives Tariff 6000 series and supplements thereto
- Transportation of Dangerous Goods Regulations and supplements thereto, as administered by the Transport of Dangerous Goods Directorate (Transport Canada)
- Mexican shipments are governed by Bureau of Explosives Tariff 6000 series and supplements thereto.

B. Carrier is to be specifically informed on shipping orders as to the presence, type, characteristics, and volume of all hazardous materials/hazardous substances.

5. Loading and Securement

A. Secure lading to prevent both lengthwise and crosswise movement. If the lading is rigid in nature and/or very dense, such as boxes of nuts and bolts, machinery, metal beams, brick, lumber, cut paper, etc., or if the shape of the lading is such that the area of door contact is minimal, such as with cylindrical objects like drums or rolled paper, blocking and bracing is necessary. Vehicle doors are neither designed nor intended to restrain commodities with these characteristics. Such products must be loaded and secured in conformance with the rules and illustrations in this publication and in other applicable AAR commodity loading publications.

Trailer/container doors may not be used to secure loads containing hazardous materials.

The doors of the vehicle, meeting AAR trailer specification M-931 and AAR container specification M-930, can be relied on to secure *non-hazardous materials* lading only under the following conditions:

1. The load consists of multi-unit lading such as boxes of food-stuff, tissue, or soft paper products, furniture, appliances, etc., not exceeding 40,000 lb, covering a minimum of 60% of the door area and evenly distributed throughout the vehicle.

2. Lading must be loaded tightly lengthwise and crosswise and flush to the rear doors of the vehicle allowing no room for movement. If any void exists, fill void space with recommended dunnage.

3. The doors must fit squarely, the hinges must be tight, and locking bars must be in good condition and function properly.

See Illustration 46 in Section III.

B. Fill voids and apply blocking and bracing to maintain proper lengthwise and crosswise weight distribution during transit and to prevent lading from damaging doors, nose, and walls or from falling out when doors are opened.

C. Secure machinery or other equipment that has a high center of gravity to prevent tipping. (See Illustration .)

D. Use lumber that is of sound material and free of defects that impair its strength or interferes with proper nailing. (See Illustration 32 in Section III.)

E. Use adequate size and number of nails in the construction and the securement of blocking and bracing within the trailer or container. (See Table A on page 3-22 and Table B on page 3-23 of Section III.)

F. Do not nail into the walls of trailers or containers. Toe-nailing is not permitted, except as specifically exempted by applicable AAR commodity loading publications.

G. Strapping used for load securement must be of sufficient strength and amount and be properly applied so as to secure the load from crosswise or lengthwise movement.

H. The combined joint strength of steel straps used must be equal to the weight of the lading being secured, except as provided in approved loading methods in Section IV of this *Intermodal Loading Guide.* (See Table E on page 3-27 of Section III.)

I. High-tension band sizes 1¼ in. and 2 in. used for load securements are to be marked to indicate manufacturer's or supplier's name and the letters "AAR."

Markings shall consist of the letters "AAR," the manufacturer's or distributor's name or abbreviated name, or registered trademark, or symbol, or AAR code consisting of two digits. Markings shall be in characters not less than ⅛ in. high for steel die imprint and not less than ¼ in. high for paint, ink surface printing, or embossing, spaced at not more than 5 ft intervals.

Markings applied to high tension bands manufactured to metric dimensions must be followed by the letter "M" of the same size as the original marking.

The following methods of marking for purpose of identification have been assigned to manufacturers and suppliers whose products have been tested by the AAR and found to meet the requirements of this Rule.

Name	Method of Marking	Markings
ITW/Acme Packaging	Steel Embossed	AAR 11
ITW/Signode	Steel Embossed	AAR 11
Samuel Strapping Systems	Steel Die Imprint, Ink Print	AAR 22, 33, 47
Gerrard-Ovalstrapping	Ink Print	AAR 52
Garibaldi (Chili)	Steel Die Imprint, Ink Print, Paint Embossed	AAR 20
Hankum Co., Ltd.	Ink Print	AAR 26
Maillis Strapping Systems-USA, Inc.	Ink Print	AAR 57
DuBose Strapping	Ink Print	AAR 58

IMPORTANT—High tension bands must be applied to packages and/or loads with markings facing outward.

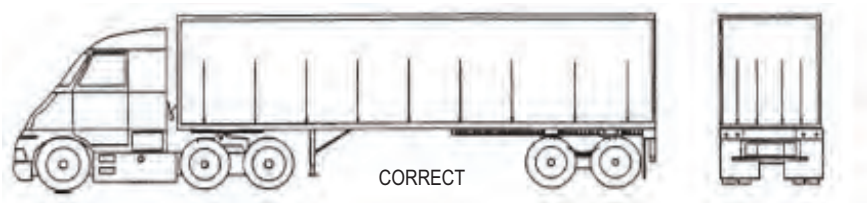
J. Coiled steel and other dense products must be stowed to conform to Illustration 3. A minimum of three runners each 2.7 ft long based on 48 in. on-center spacing are required for each skid or pallet for steel coils and similar products of concentrated weight weighing up to 3,500 lb. The following chart may be used as a guideline when shipping dense products greater than 3,500 lb.

DOMESTIC TRAILERS/CONTAINERS					
Guide to Minimum Required Length of Longitudinal Runners					
	Spacing of Longitudinal Runners (ft)				
Payload Weight	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**
4,000	3.3	2.6	2.2	1.9	1.6
5,000	4.1	3.3	2.7	2.3	2.0
6,000	4.9	3.9	3.3	2.8	2.5
7,000	5.7	4.6	3.8	3.3	2.9
8,000	6.5	5.2	4.4	3.7	3.3
9,000	7.4	5.9	4.9	4.2	3.7
10,000	8.2	6.5	5.4	4.7	4.1
11,000	9.0	7.2	6.0	5.1	4.5
12,000	9.8	7.8	6.5	5.6	4.9
13,000	10.6	8.5	7.1	6.1	5.3
14,000	11.4	9.2	7.6	6.5	5.7
15,000	12.3	9.8	8.2	7.0	6.1
16,000	13.1	10.5	8.7	7.5	6.5
17,000	13.9	11.1	9.3	7.9	6.9
18,000	14.7	11.8	9.8	8.4	7.4
19,000	15.5	12.4	10.3	8.9	7.8
20,000	16.3	13.1	10.9	9.3	8.2
21,000	17.2	13.7	11.4	9.8	8.6
22,000	18.0	14.4	12.0	10.3	9.0
23,000	18.8	15.0	12.5	10.7	9.4
24,000	19.6	15.7	13.1	11.2	9.8
25,000	20.4	16.3	13.6	11.7	10.2

Individual carrier approval must be gained when shipping products of concentrated weight greater than 3,500 lb.

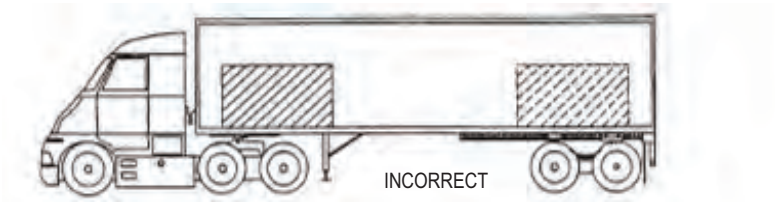
6. Special Equipment

Some trailers and containers are equipped with special interior fixtures. Properly fasten and lock such equipment in place. Properly secure all special equipment in trailers and containers when empty. The use of any type of material handling equipment to unlock and raise or lower and lock special equipment is prohibited.



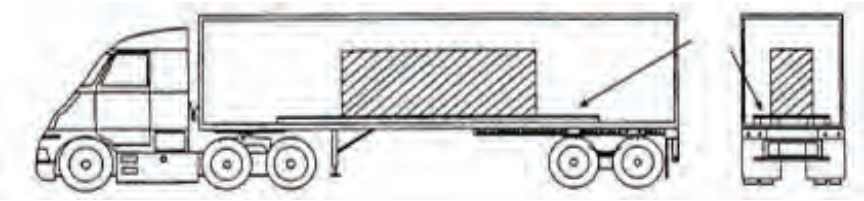
Trailers/containers are designed for uniform load distribution as shown. Distribute the lading equally between the rear tires and the king pin that transfers its load to the truck tractor.

Illustration No. 1



Units loaded in either position indicated are incorrect because weight is not equally distributed to tires and king pin.

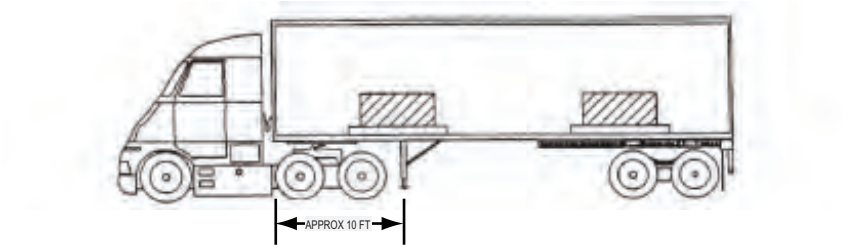
Illustration No. 2



HIGHLY CONCENTRATED LOADS

Not more than 25,000 lb uniformly distributed in any 10 linear ft can be loaded on trailers meeting the specifications of AAR *Manual of Standards and Recommended Practices*, Specification M-931 or on containers meeting the specifications of *MSRP* Specification M-930. Item A is a skid of adequate length, width, and construction to properly distribute weight. Trailers in intermodal service not meeting the M-931 specifications or containers in intermodal service not meeting the M-930 specifications may be of lower floor strength. Considerations of such must be a part of any load planning, particularly that of highly concentrated loads, e.g., steel coils.

Illustration No. 3



TOFC trailers and containers on chassis are often left unsupported by truck tractors and are lifted by cranes. In positioning two concentrated weight units as illustrated, position the forward unit for equal weight distribution on the landing gear (approximately 10 ft from nose).

Illustration No. 4

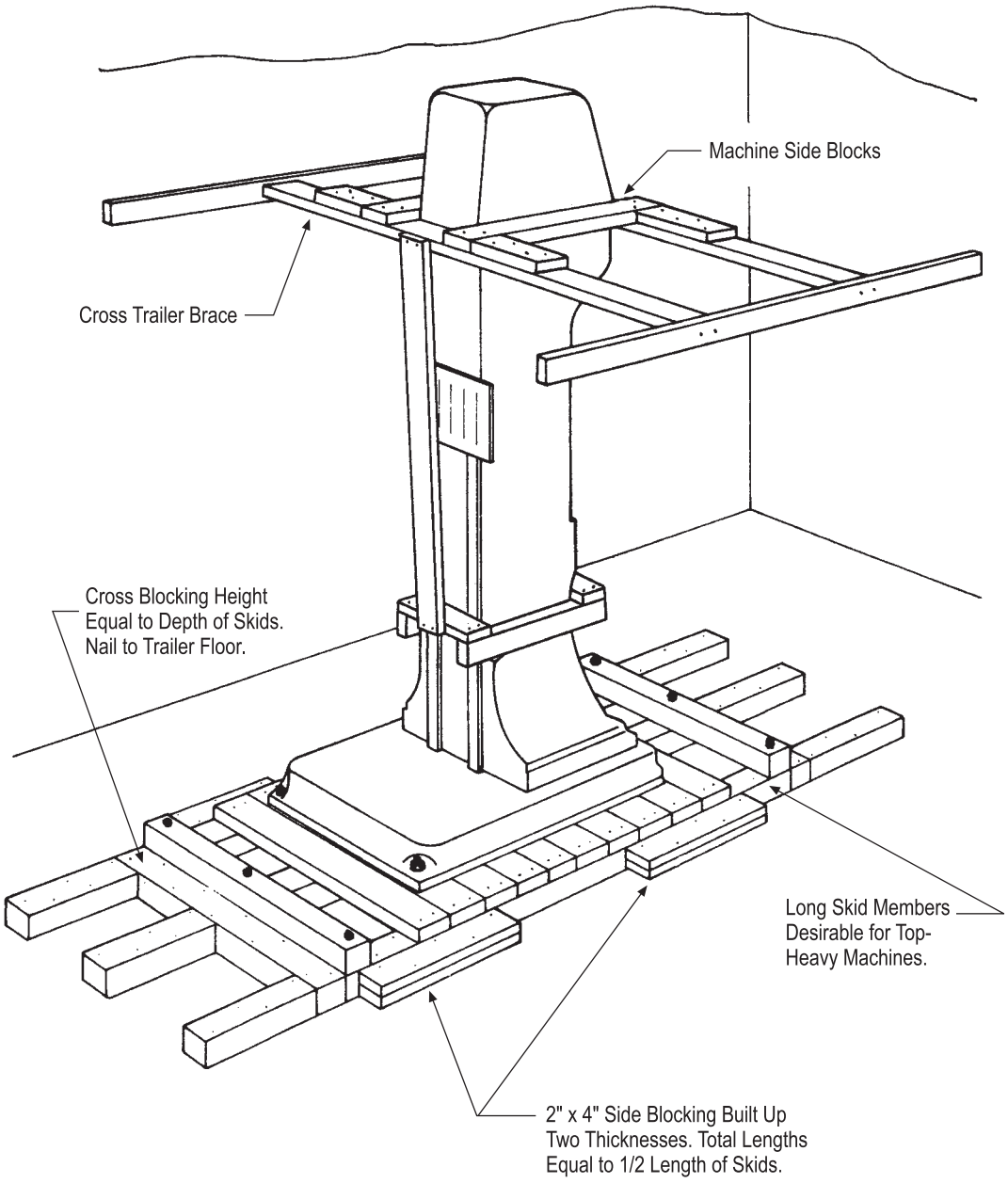


Illustration No. 5

Top-Heavy Machinery—Not Leg Type

SECTION III—GENERAL INFORMATION

LOADING

A—LOAD PLANNING

A-1—Inspect lading prior to loading of trailer or container. Do not load damaged lading.

A-2—Evenly distribute the weight of load from side to side and end to end in trailer or container and to a uniform height insofar as lading permits. Place lighter shipping containers on top of heavier shipping containers with separating material used as needed between layers. Load like-sized shipping containers in stacks, and use divider material between stacks of different sizes or types of shipping containers and shipping containers of different densities. (See Illustration 6.) Not more than 25,000 lb uniformly distributed in any 10 linear feet can be loaded on trailers meeting the specifications of M-931or on containers meeting the specifications of M-930. (See Illustration 3.)

A-3—Place shipping containers in the position to best utilize the shipping containers' inherent strength (See Illustration 7.)

A-4—Fill all lengthwise space with lading or with lading and filler material, or appropriately block and brace, unless loaded to a specific method. (See Items C-1 through C-5 for details.) (See Illustration .)

A-5—Fill all crosswise space with lading or with lading and filler material. Use appropriate bracing or filler material to maintain vertical alignment and to prevent crosswise movement. (See Illustrations , 25, 26, 27, 28 and 29.) A four-unit pinwheel pattern may be effective in reducing voids.

A-6—In manually loaded shipments, use bonded block patterns for fiberboard shipping containers and key-sack or brick-wall loading patterns for bag loads. (See Illustrations 9, 10, 11 and 12 on bags and boxes.) Load cylindrical-shaped items, such as drums, pails, or rolls of paper, in a recessed or in-line loading pattern. (See Illustration 13 and 14.)

A-7—Never exceed marked or recommended restraining capacities for special interior fixtures.

A-8—Handle and load all freight according to shippers' printed directions, such as "This Side Up," "Do Not Drop," "Clamp Here," etc.

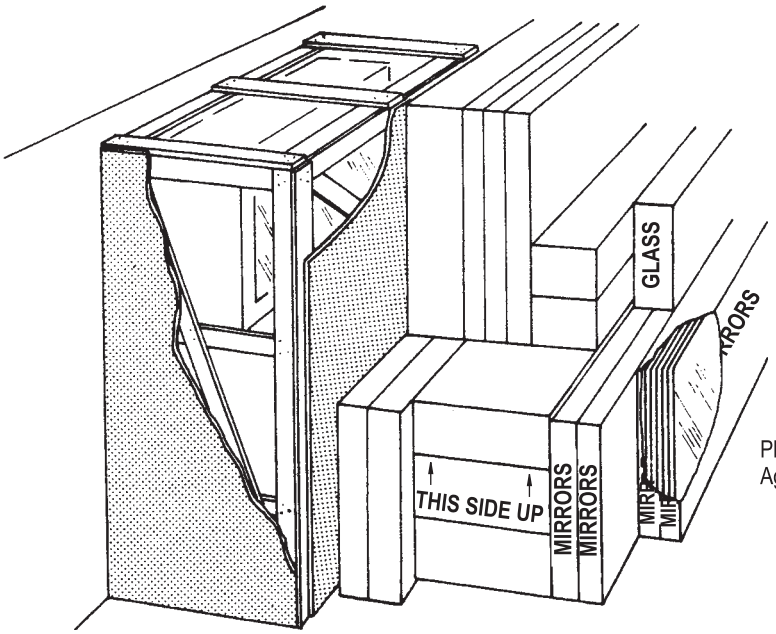
A-9—Segregate irregular lading (see Illustration 15) from remainder of lading using blocking and bracing or separators and dividers. (See Parts C and D of this section.)

A-10—Load longest dimension of narrow-base items lengthwise of trailer or container. (See Illustration 6.)

A-11—No commodity of a contaminating nature may be loaded in the same trailer or container with commodities liable to be contaminated thereby, unless properly segregated or protected.

A-12—Use a trailer or container liner or apply plastic sheeting to the top and rear of lading that is susceptible to damage from moisture, water, dust, etc.

A-13—Stop-off Trailers or Containers—Load consignments in reverse order to that in which they will be unloaded. Separately block or brace each individual consignment where necessary. Intermediate receivers are to reload in a level manner of brace or rebrace, if necessary, the remaining portion of the lading destined to subsequent receiver(s).

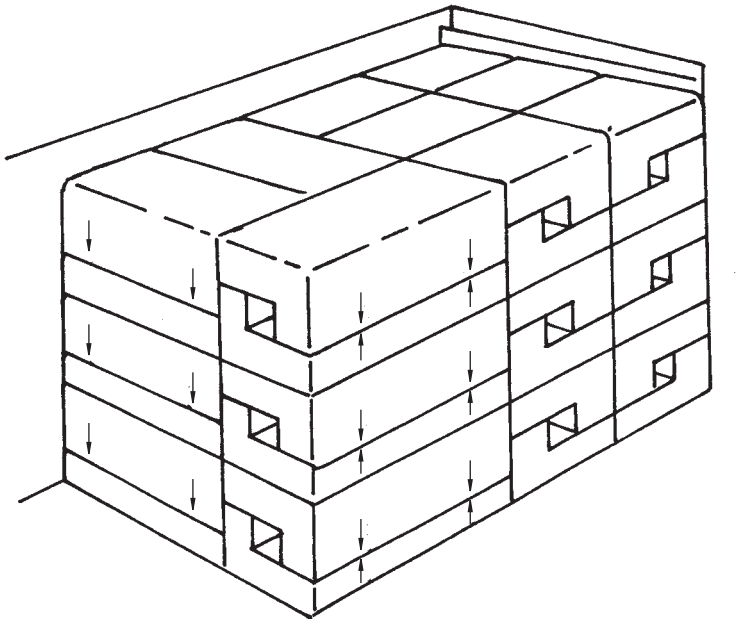


Place Glass Lengthwise
Against Side Walls

Open crate contains large piece. Two layers of corrugated fibreboard (cut away for better perspective) are used to protect against the possibility of small boxes falling or moving into open crate. Load mirrors, marble tops, KD tables, and/or bed ends, etc., on edge lengthwise of trailer.

Illustration No. 6

Stowing Mixed Sizes and Products
(Items A-2 and A-10)



Load furniture in accordance with the arrows except articles in form fitting containers which may be inverted.

Illustration No. 7

Placement of Odd-Shaped Containers
(Item A-3)

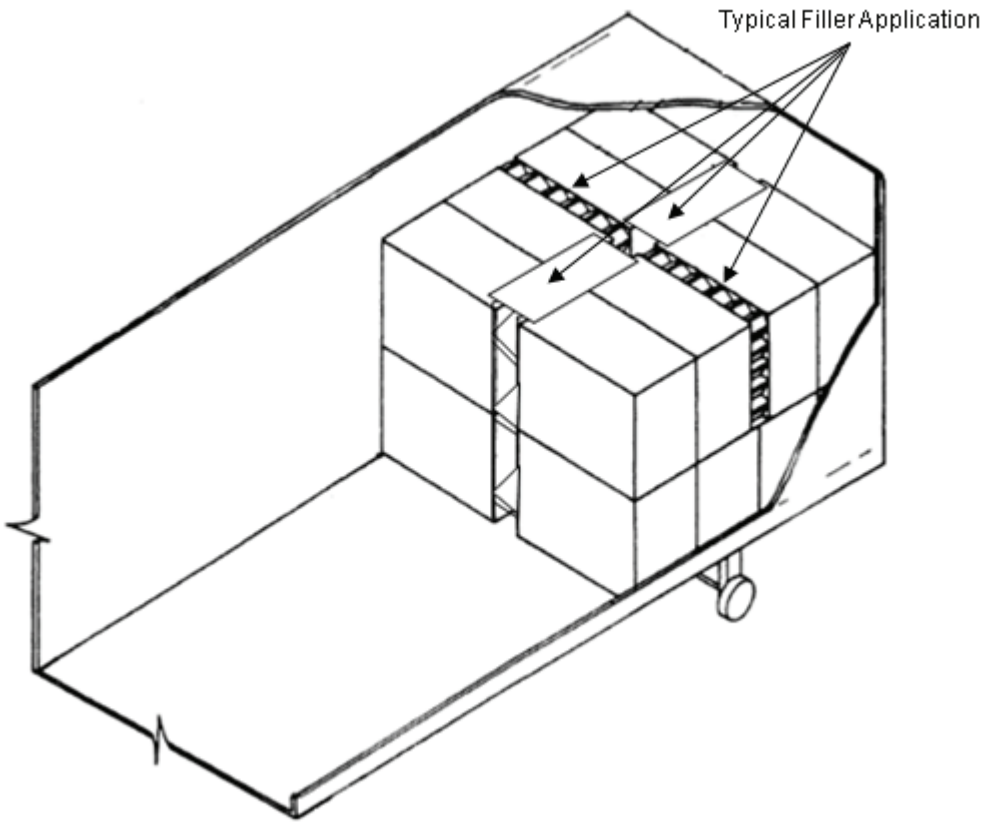


Illustration No. 8

Use of Filler Material in Loads of Unitized Shipping Containers

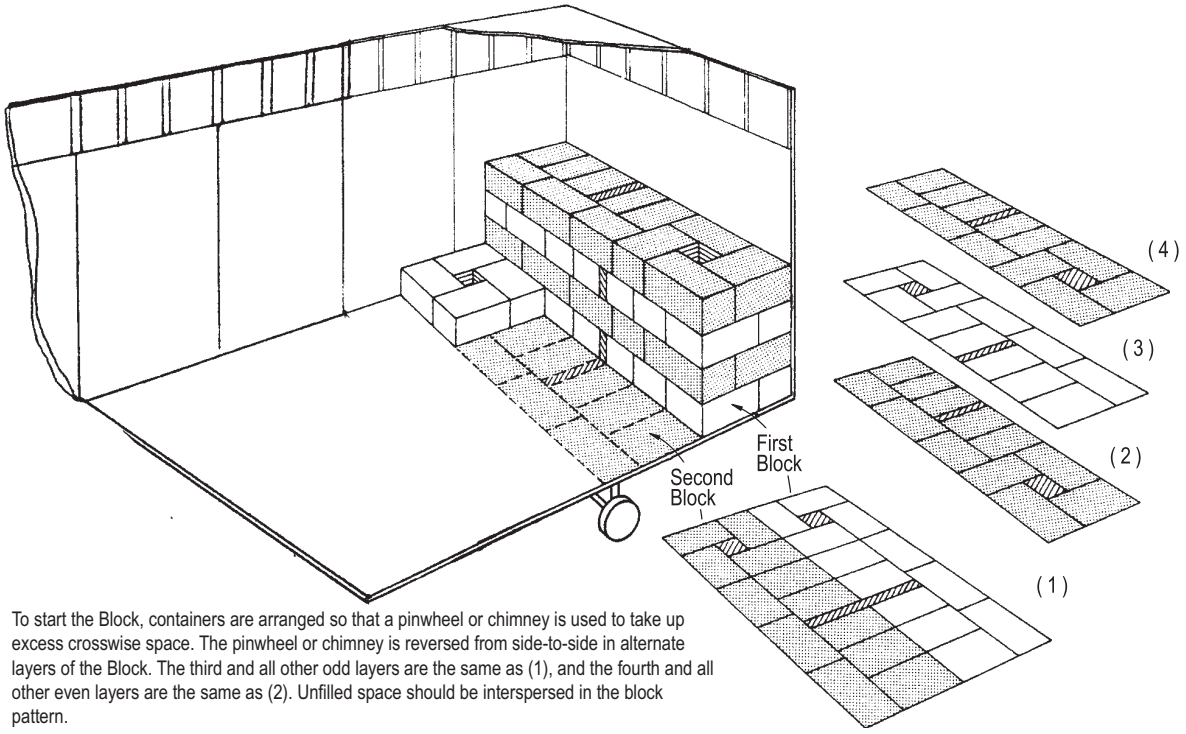
Filler Construction: Lengthwise void fillers are to be of uniform strength over the face of the void filler and capable of withstanding a load of 1,500 lb/ft^2 (test full dimension filler sheet).

Make the height and width dimensions of the filler material as near as possible the same as the dimensions of the faces of the units they will be separating.

In two-layers loads, limit fillers to the top layer whenever possible. If fillers are used in both top and bottom layers, place the top layer filler directly above the bottom layer filler.

Do no reuse filler material if it has been damaged and is no longer capable of filling the intended void or if there is any evidence of creasing damage to the filler that might reduce the compression strength of the filler.

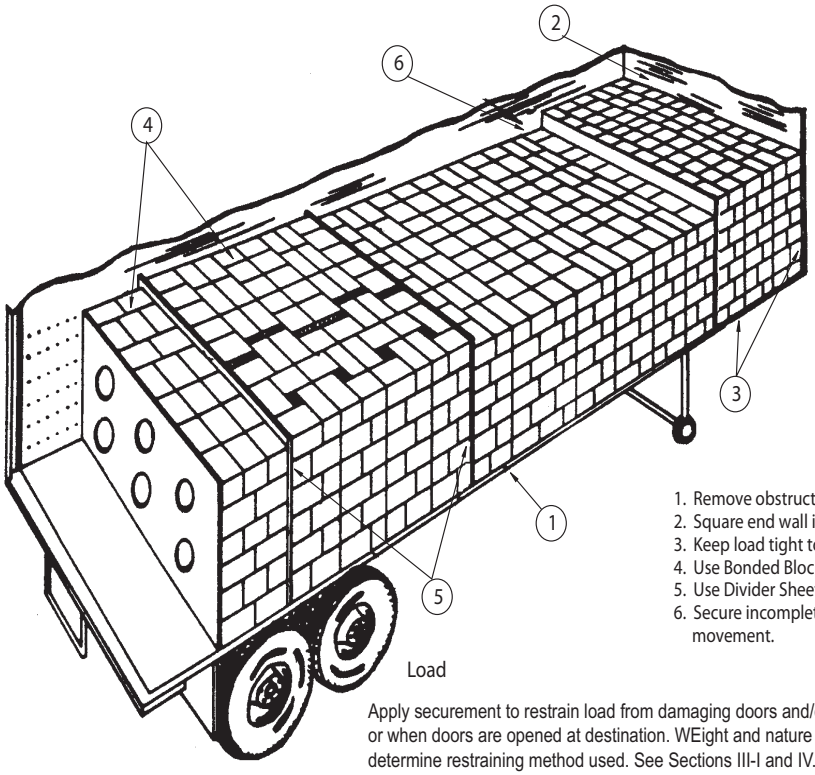
Do not use lengthwise void filler material as a bulkhead or in lieu of a bulkhead.



To start the Block, containers are arranged so that a pinwheel or chimney is used to take up excess crosswise space. The pinwheel or chimney is reversed from side-to-side in alternate layers of the Block. The third and all other odd layers are the same as (1), and the fourth and all other even layers are the same as (2). Unfilled space should be interspersed in the block pattern.

Illustration No. 9

Bonded Block Pattern for Manual Loading
(Item A-6)



1. Remove obstructions from walls and floors.
2. Square end wall if needed.
3. Keep load tight to end and side walls.
4. Use Bonded Block method of loading.
5. Use Divider Sheets between different size containers.
6. Secure incomplete layer of containers to prevent movement.

Apply securement to restrain load from damaging doors and/or lading from falling out during transit or when doors are opened at destination. WEight and nature of lading and type of trailer will determine restraining method used. See Sections III-I and IV.

Illustration No. 10

Loading Fiberboard Containers
(Item A-6)

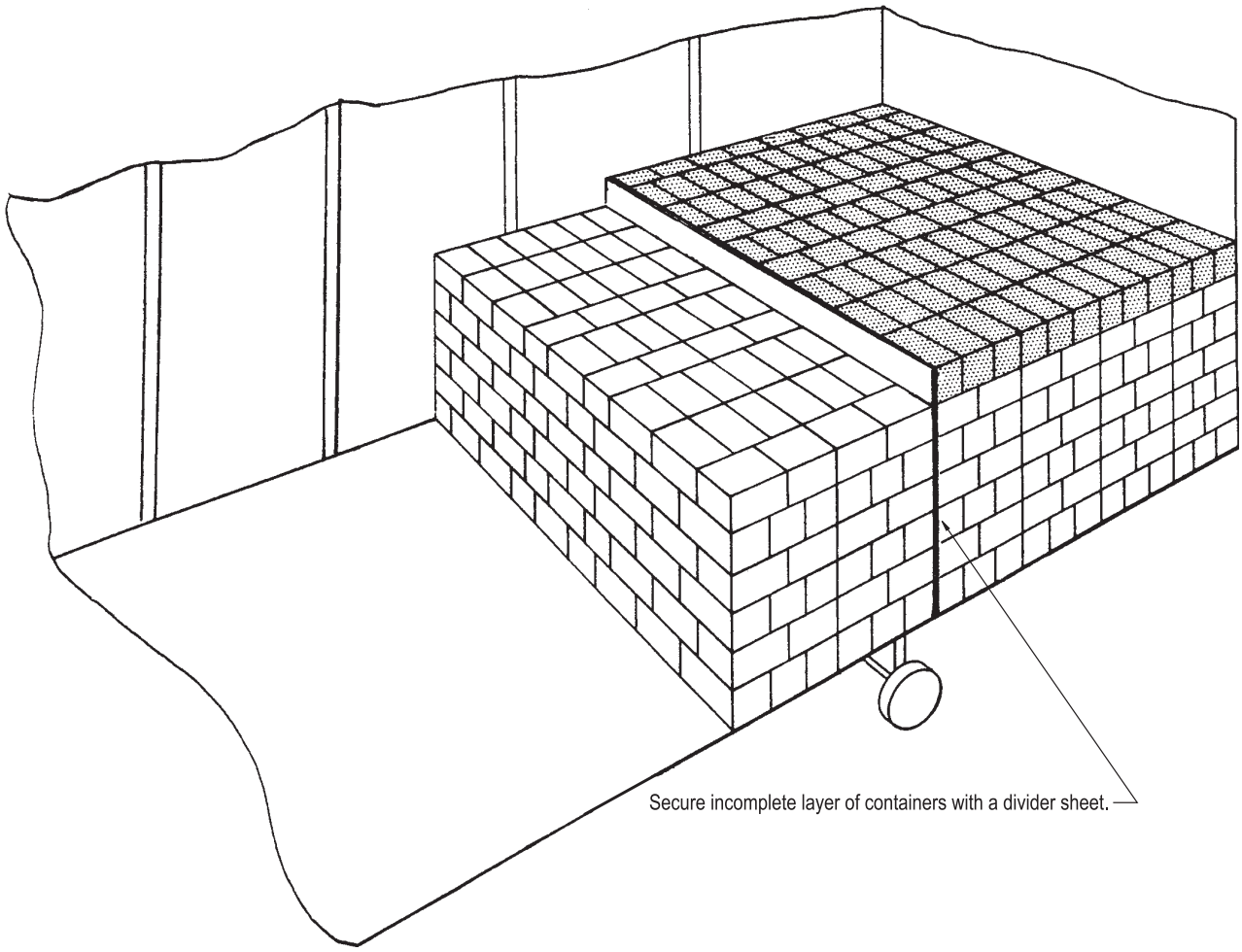


Illustration No. 11

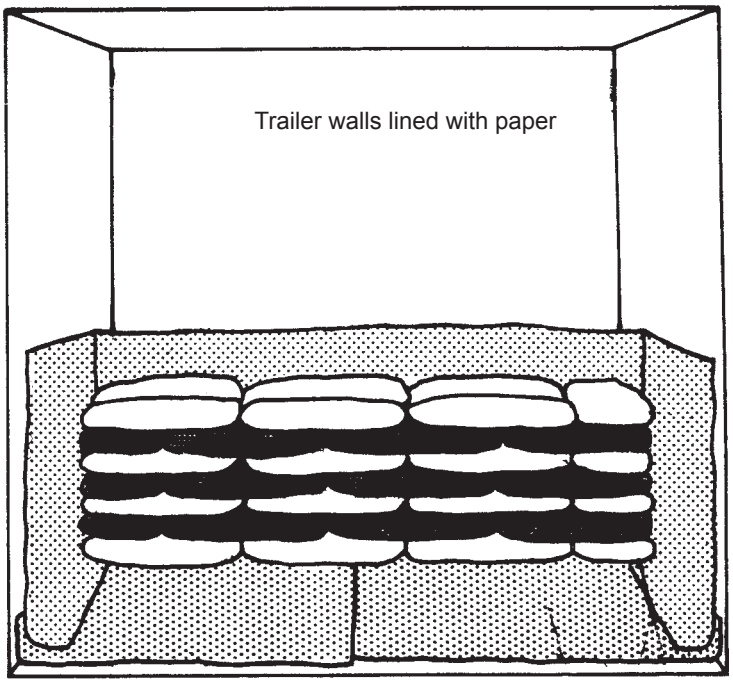
Incomplete Layer
(Item A-6)

Load incomplete layer from sidewall to sidewall. If containers in incomplete layer vary in size or weight, load as follows:

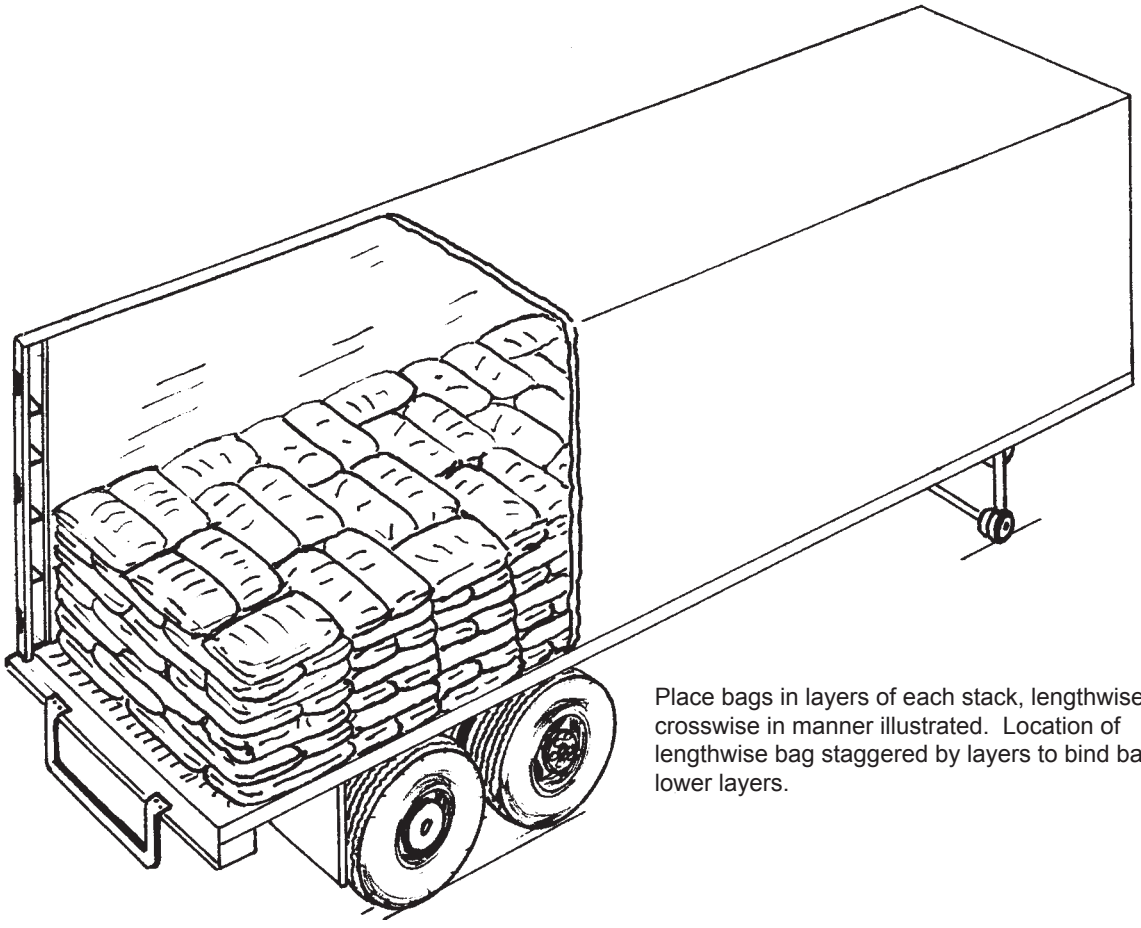
1. If there is a sufficient number of same-size rectangular containers, load the incomplete layer in a bonded-block pattern.

2. If there are not sufficient same-size rectangular containers, load the containers crosswise from sidewall to sidewall. If there is more than one size of container, load large, heavy containers closest to the end wall; then the next largest, heavy container, etc.

3. Secure incomplete layer of containers to prevent movement.



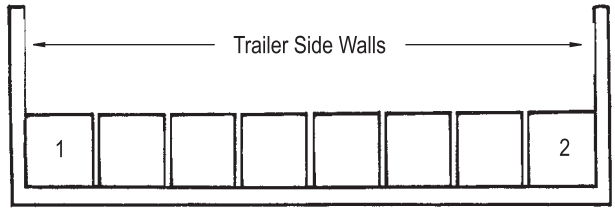
Apply Securement to restrain load from damaging doors and/or lading from falling out during transit or when doors are opened at destination. Weight and nature of lading and type of trailer will determine restraining method used. See Sections III-I and IV.



Place bags in layers of each stack, lengthwise and crosswise in manner illustrated. Location of lengthwise bag staggered by layers to bind bags in lower layers.

Illustration No. 12

Manually Loaded Bags
(Item A-6)



Load containers nos. 1 and 2 in opposite corners of trailer. The remaining containers in stack to be equally spaced between containers nos. 1 and 2.

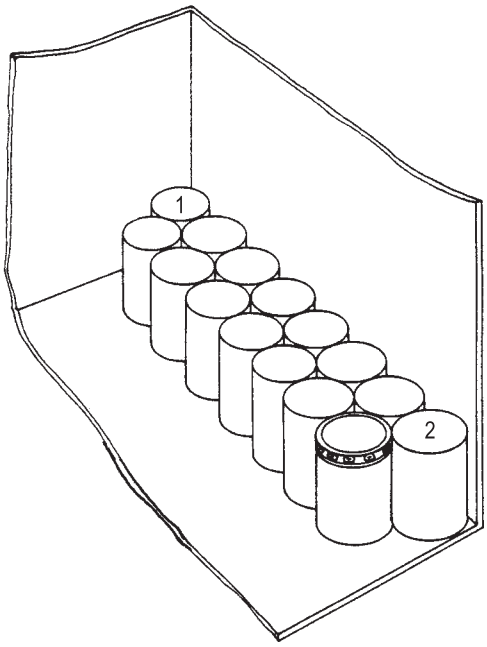
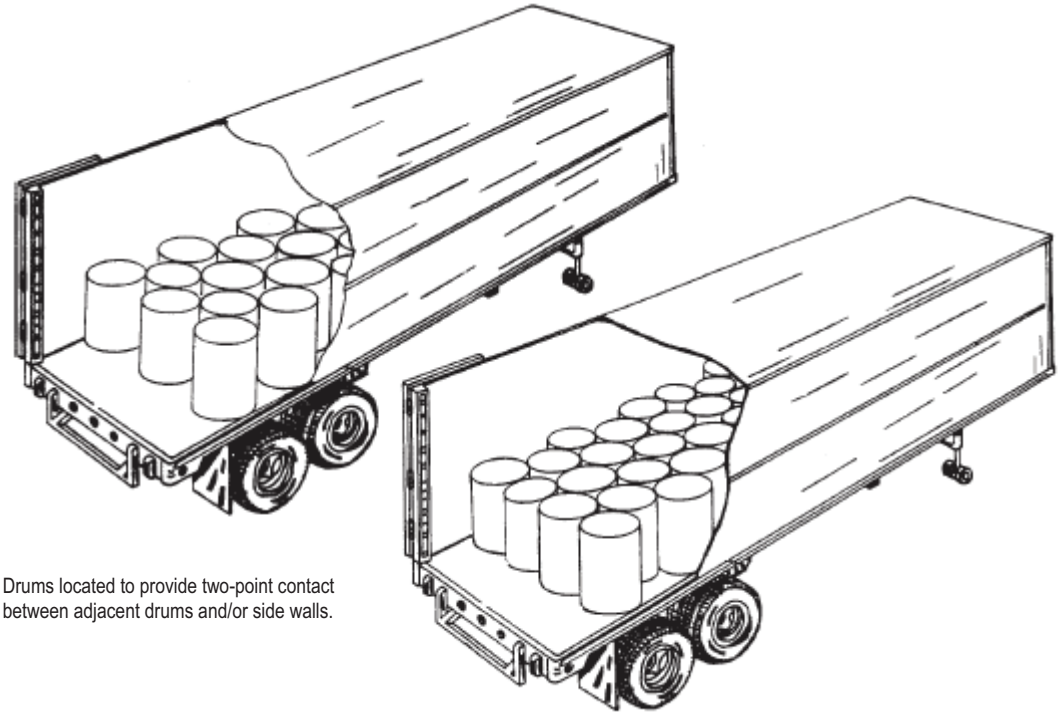


Illustration No. 13

Recessed Cylindrical Containers in Adjacent Stacks
(Item A-6)



Drums located to provide two-point contact between adjacent drums and/or side walls.

Apply securement to restrain load from damaging doors and/or lading from falling out during transit or when doors are opened at destination. Weight and nature of lading and type of trailer/container will determine restraining method used. See Section IV.

Illustration No. 14

Recessed Method of Loading Straight-Sided Drums
(Item A-6)

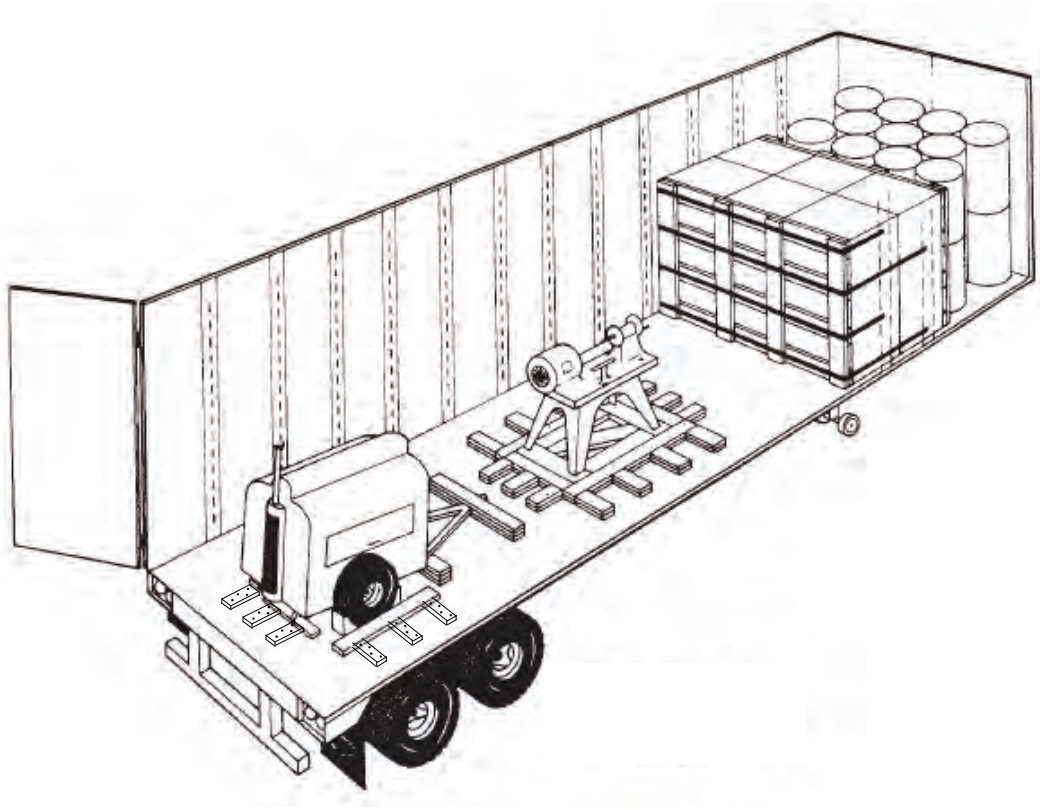


Illustration No. 15

Segregate Irregular Lading
(Item A-9)

B—UNITIZATION

Unitizing shipping containers is an efficient means of handling, storing, loading, transporting, and unloading that contributes to efficient utilization of equipment. The following guidelines suggest ways to obtain the best stack stability in unit loads.

ON WOODEN PALLETS

B-1—Stack shipping containers in a bonded-block or other comparable unitizing method. (See Illustrations 16 and 17.) If units consist of bags or bales, use adequate separator material between the product and the pallet. (See Illustration 31.)

B-2—Provide palletized units with unit-to-unit contact with minimum overhang of shipping containers on pallets. (See Illustration 18.)

B-3—No underhang on pallets is allowed lengthwise of trailer or container unless filler material is used or underhang otherwise compensated for. Illustration 19 shows a method of filling underhang on pallets by using expanded corrugated honeycomb fiberboard with glued facings of single-wall corrugated fiberboard. Adhere to limitations described on illustration.

B-4—Maintain vertical alignment of shipping containers by use of space fillers, corrugated sleeves, corner protectors and strapping, shrink-wrapping, stretch-wrapping, spot-gluing, or other similar methods. (See Illustrations 20, 28, and 29.)

B-5—Take up all lengthwise voids between pallet loads by use of load-restraining devices or filler material. (See Illustration 8.)

B-6—Load as many units across the trailer or container as practical and as long as units are loaded in a straight line lengthwise. Fill all crosswise void space with appropriate bracing or filler material to maintain vertical alignment and to prevent crosswise movement. (See Illustrations 20, 28, and 29.)

B-7—In double-layer wooden pallet loads, have units equal in height to ensure pallet contact both longitudinally and laterally. If this is not the case, then separate stacks of units with suitable divider sheets. (See Illustration 23.)

B-8—Where 4-way entry is required, 2-way entry pallets may be modified. (See Illustration 21.)

ON SLIP SHEETS

B-9—Stack shipping containers on slip sheets in a bonded block or other comparable unitizing method.

B-10—Provide units with unit-to-unit contact lengthwise in trailer or container. See Illustrations and 19 for a method of filling lengthwise voids (rows and layers of different size units) to provide a solid face for applying securement.

B-11—Maintain vertical alignment of shipping containers on slip sheets by use of space fillers, corrugated sleeves, comer protectors and strapping, shrink-wrapping, stretch-wrapping, spot-gluing, or other similar methods. (See Illustrations 20, 28, and 29.)

B-12—Take up all lengthwise void between units by use of load-restraining devices, shipping containers, or filler material. (See Illustration .)

B-13—Load as many units across the trailer or container as practical and as long as units are loaded in a straight line lengthwise in the trailer or container. Fill all crosswise void space with appropriate bracing or filler material to maintain vertical alignment and to prevent crosswise movement. (See Illustrations 20, 28, and 29.)

B-14—Tape the lips of slip sheets to protect them and to prevent them from bunching up when the units are loaded.

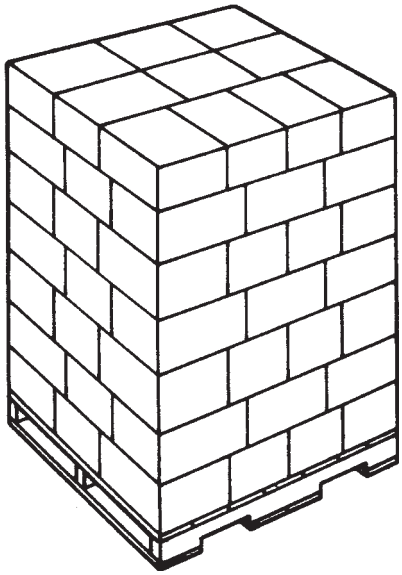


Illustration No. 16

Palletized Boxes
(Item B-1)

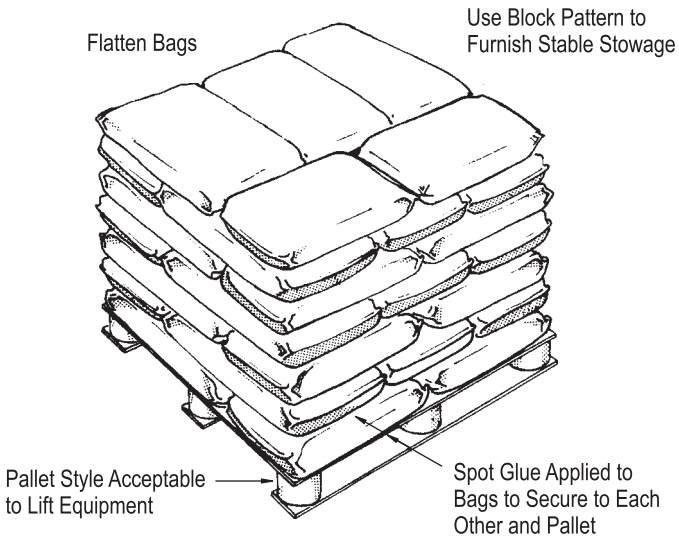
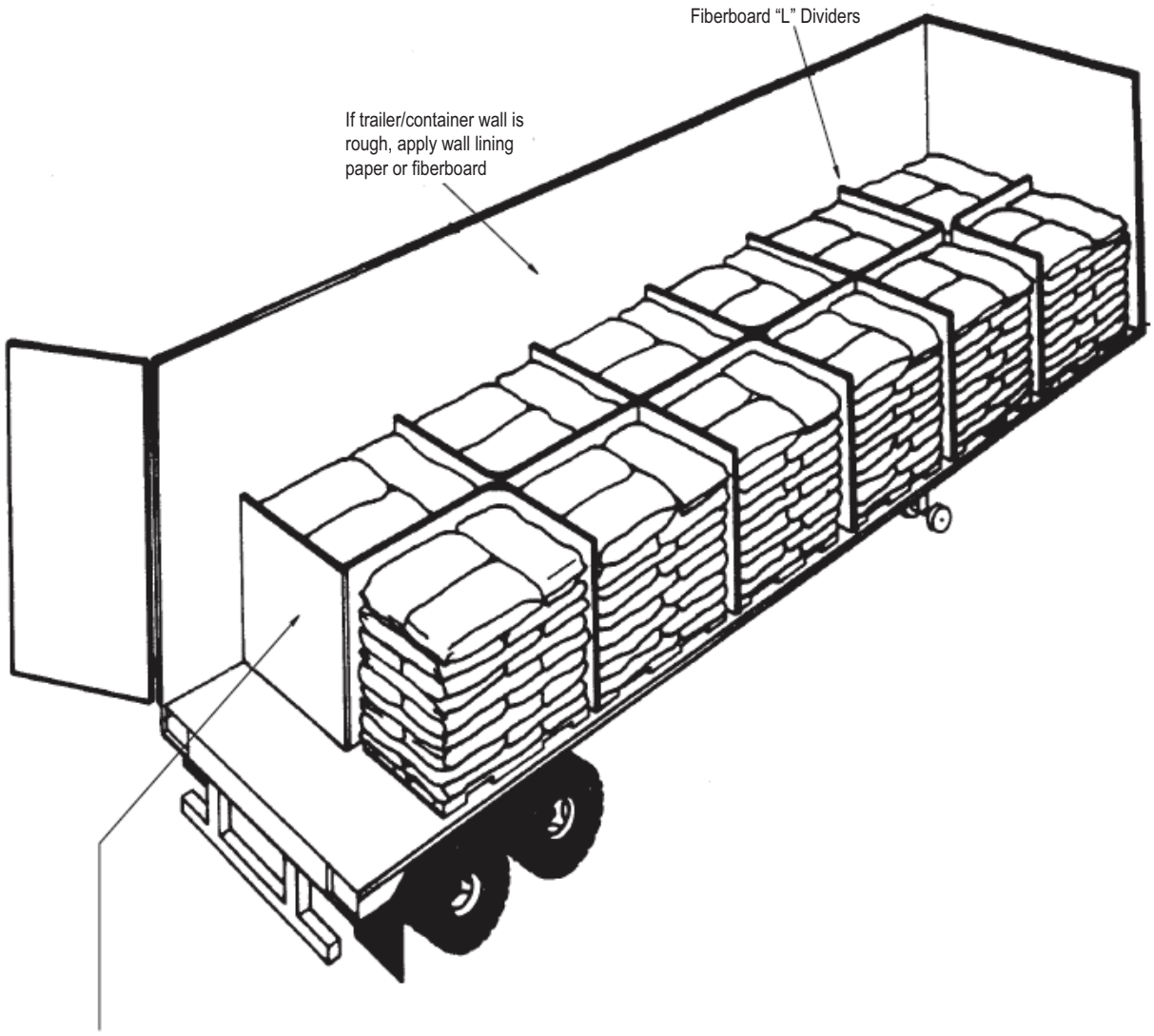


Illustration No. 17

Palletized Bags
(Item B-1)



Apply securement to restrain load from damaging doors and/or lading from falling out during transit when doors are opened at destination. Weight and nature of lading and type of trailer/container will determine restraining method used. See Section III-I and Section IV.

Note: If pallet is hand-loaded in trailer/container, use same type pattern.

Illustration No. 18

Palletized Bag Loading
(Item B-2)

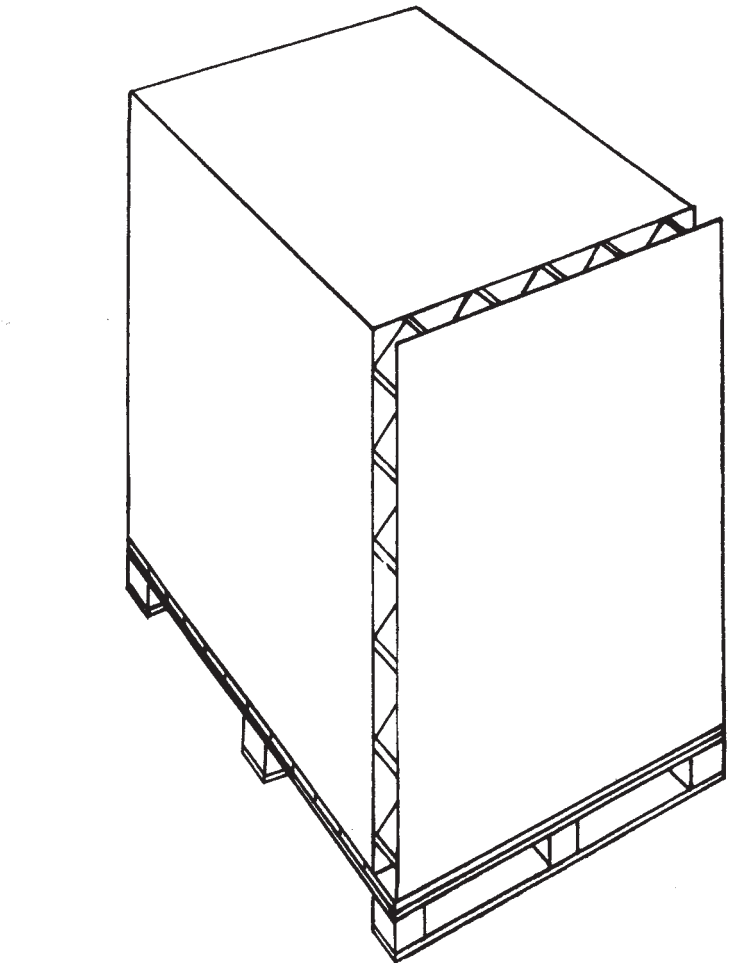


Illustration No. 19

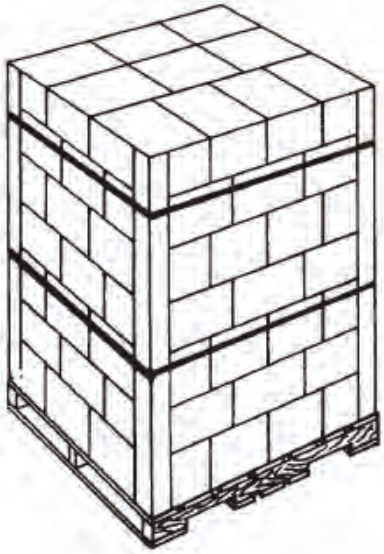
Use of Lengthwise Filler Material
on Wood Pallet to Fill Lengthwise Void Space
(Items B-3 and B-10)

1. Filler Construction: Lengthwise void fillers are to be of uniform strength over the face of the void filler and capable of withstanding a load of 1,500 lb/ ft^2 (test full dimension filler sheet).

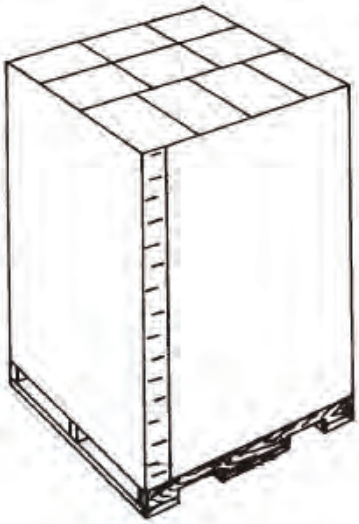
2. Make the height and width dimensions of the faces of the filler material as near as possible the same as the dimensions of the faces of the units they will be separating.

3. Do not reuse filler material if it has been damaged and is no longer capable of filling the intended void or if there is any evidence of creasing or damage to the filler that might reduce the compression strength of the filler.

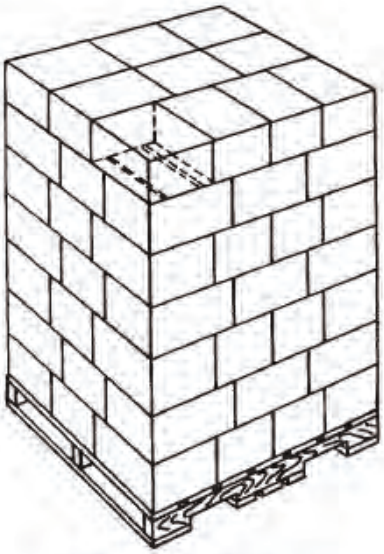
4. Do not use lengthwise void filler material as a bulkhead or in lieu of a bulkhead.



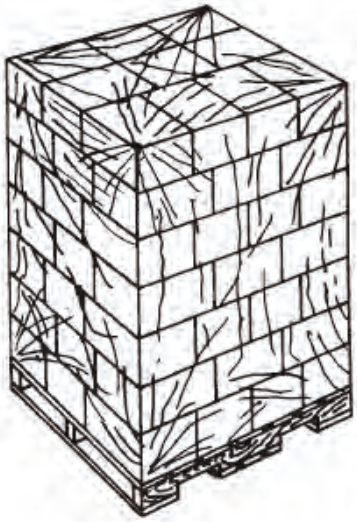
Corner Posts and Strapping
Corner Posts May Be Made From Plywood, Hardboard, Multi-Wall Corrugated Fibreboard or Other Suitable Material



Corrugated (Fibreboard) Sleeves



Spot Gluing of Containers
Double Dash Represents Glue Lines.



Pallet Load Utilizing
One of the Stretch Wrap or Shrink-Wrapping Films

Illustration No. 20

Examples of Maintaining Vertical Alignment of Unitized Containers
(Items B-4, B-6, B-11, and B-13

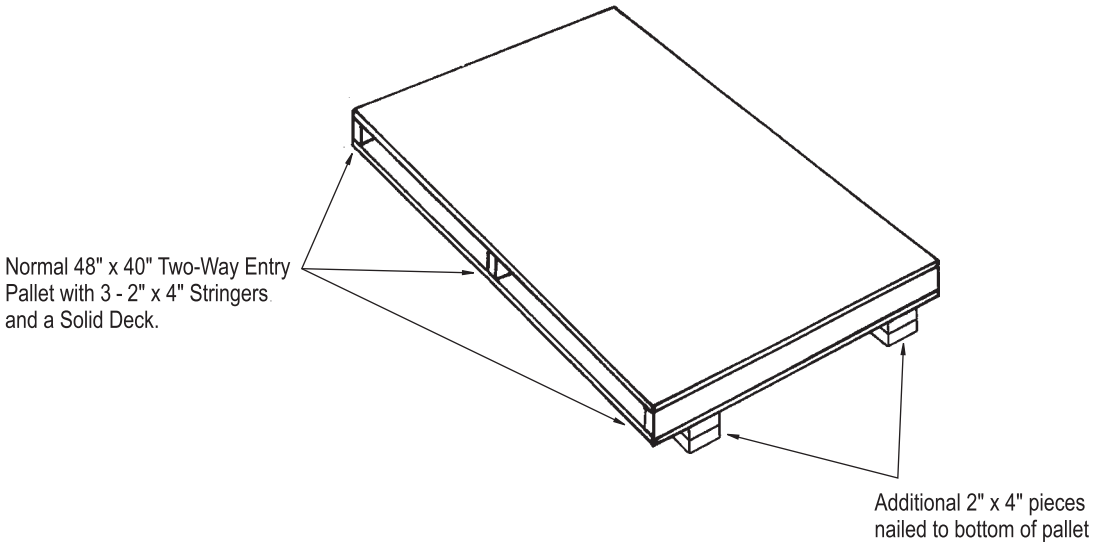


Illustration No. 21

A Method of Preparing Two-Way Entry Pallets
(Item B-8)

C—FILLERS, DIVIDERS AND SEPARATORS

FILLERS AND DIVIDERS

C-1—Those structures used to fill the lengthwise space in a trailer or container not occupied by the lading or used to segregate the lading are designated according to types as fillers and dividers.

C-2—Use fillers to square off bowed or angled end walls before trailer or container is loaded. (See Illustration 22.)

C-3—Separate different type containers lengthwise by use of plywood sheets or fiberboard of sufficient height to protect the tallest stack of containers. (See Illustration 24.)

C-4—Separate different sizes of the same type of containers by divider sheets. (See Illustrations 23 and 24, **Sketch 2**.)

C-5—Use fillers to take up crosswise space in trailer to prevent movement in the load and to permit ready removal of lading. (See Illustrations 25, 26, 27, 28, and 29.)

SEPARATORS

C-6—When commodities in different type containers or units are loaded in more than one layer, use separator material to provide an even base for the upper layers. Use separators adequate to carry weight of lading. Generally ½ in. plywood sheets or other suitable material may be used. If units consist of bags or bales, use fiberboard protection between separator material and tops of lower units. (See Illustrations 30 and 31.)

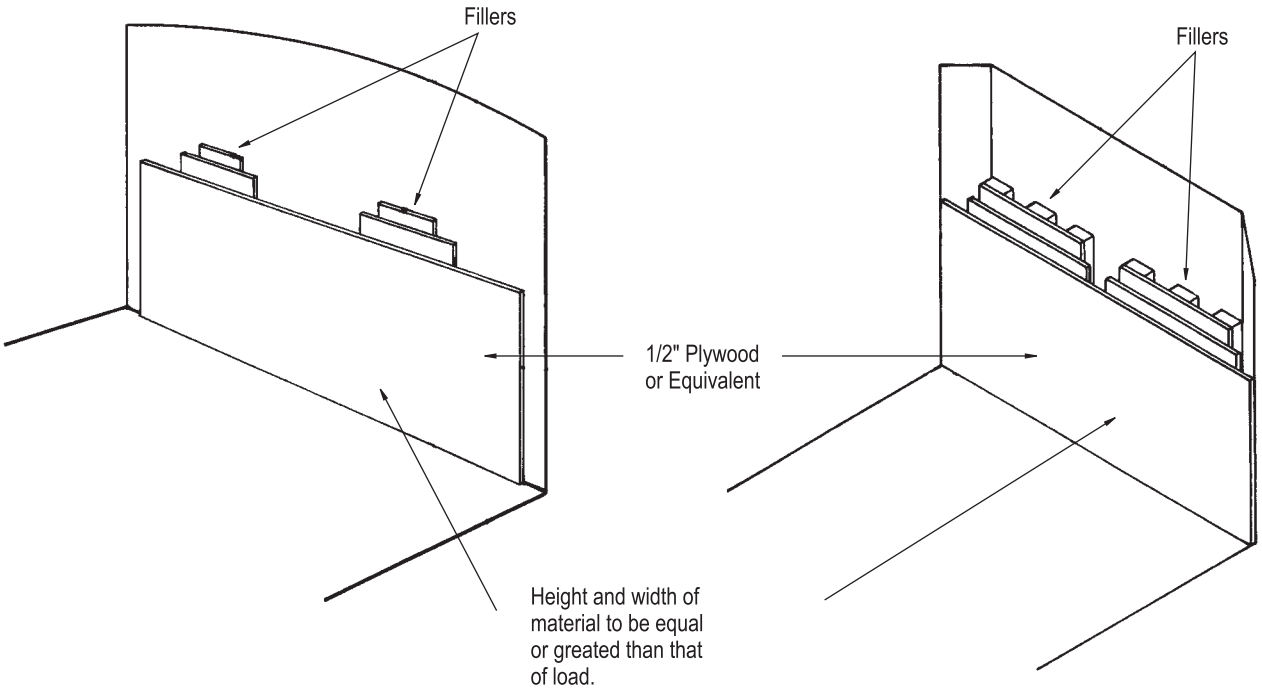
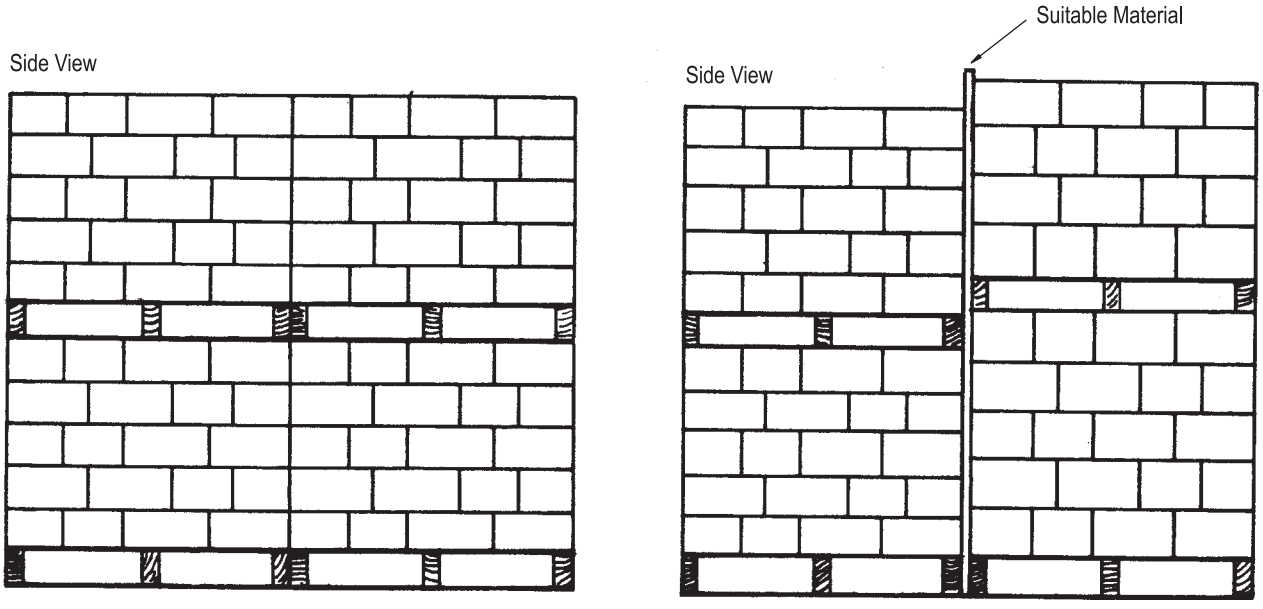


Illustration No. 22

Methods of Using Fillers to Square Off
Angled or Bowed End Walls
(Item C-2)

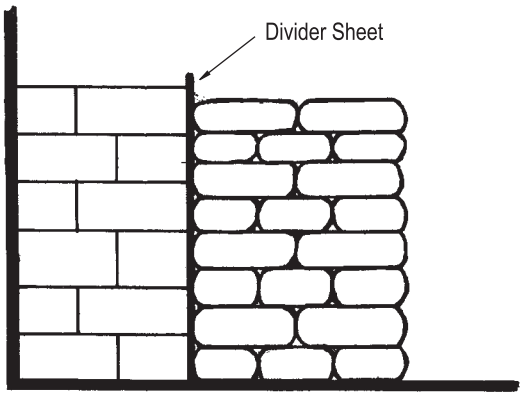


PROPER
Wood pallets in the same horizontal plane in the trailer insuring pallet-to-pallet contact.

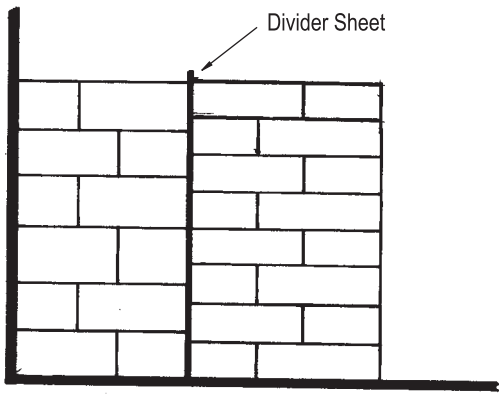
PROPER
Wood pallets not in the same horizontal plane lengthwise of trailer, but a divider sheet added to insure no wood to product contact longitudinally.

Illustration No. 23

Unitized Double-Layer Wood Pallet Loads
(Item B-7)



Use full width and height sheets of sufficient strength to prevent deformation of fibreboard containers.



Use full width and height sheets of fibreboard, preferrably 80 point solid fibreboard.

Illustration No. 24

Divider Sheets
(Items C-3 and C-4)

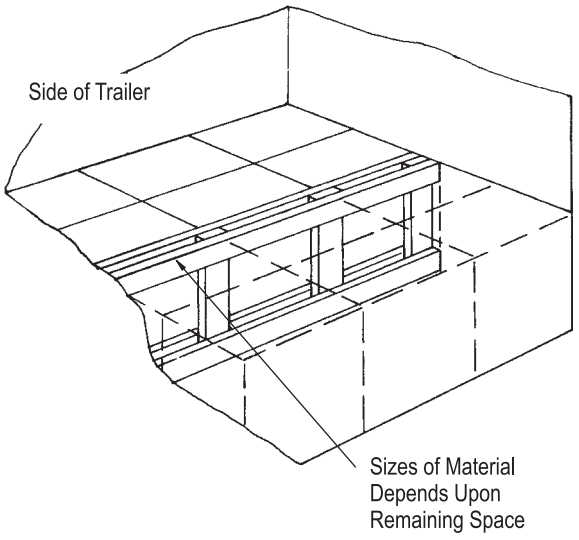


Illustration No. 25

Center Blocking and Bracing
(Items A-5, C-5, and D-19)

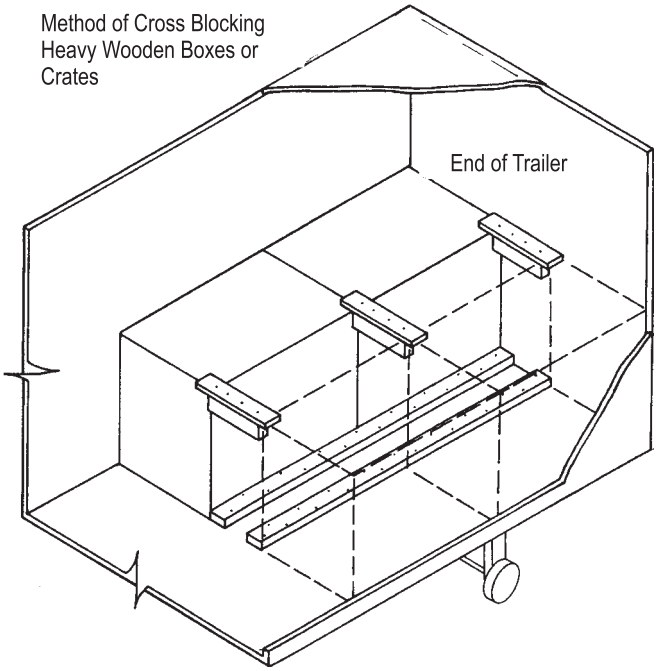


Illustration No. 26

Center Blocking and Bracing
(Items A-5, C-5, and D-19)

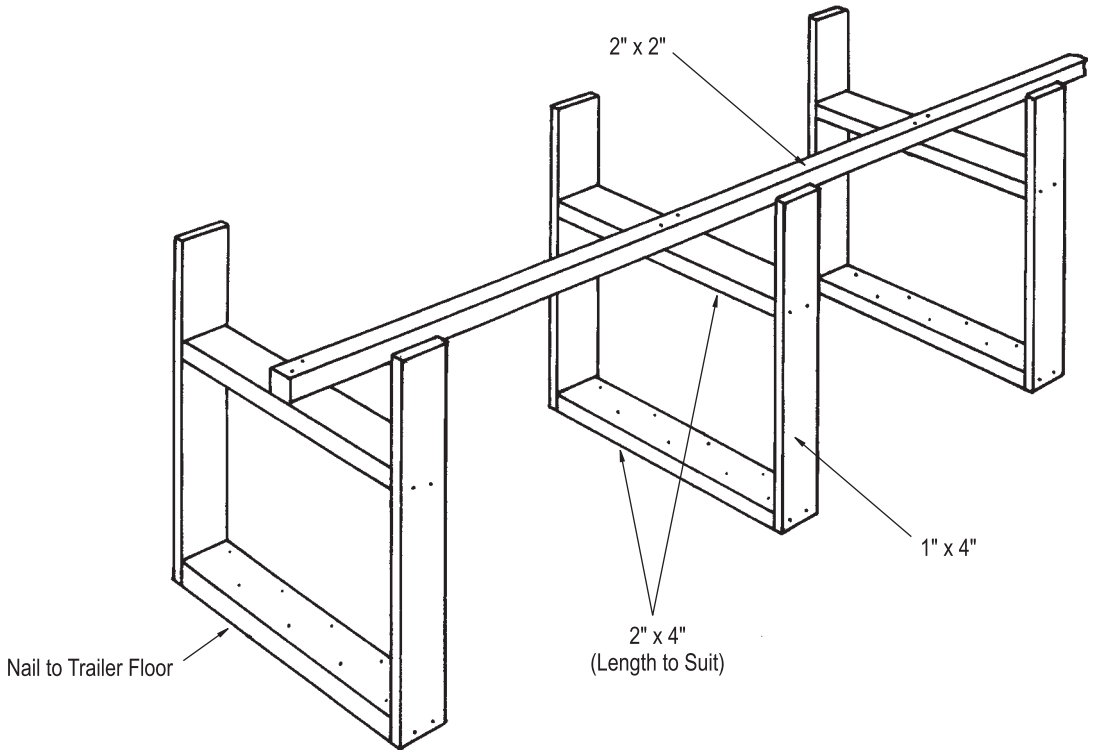
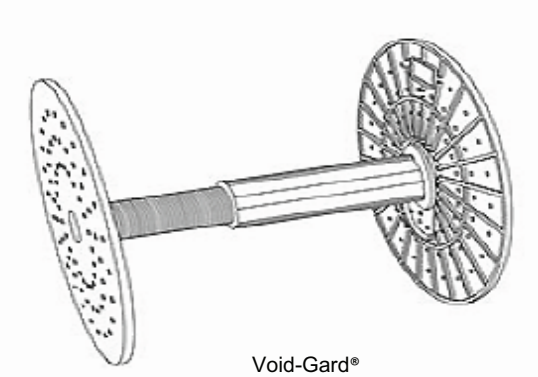
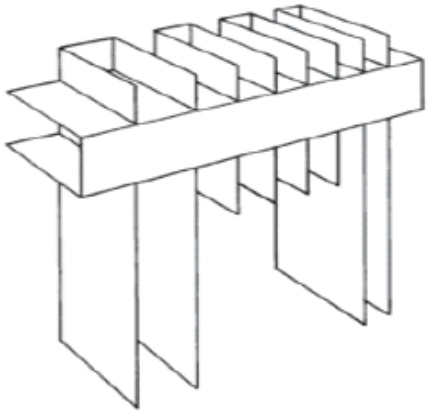


Illustration No. 27

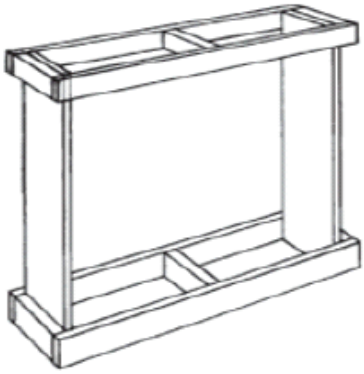
Center Blocking and Bracing
(Items A-5, C-5, and D-19)



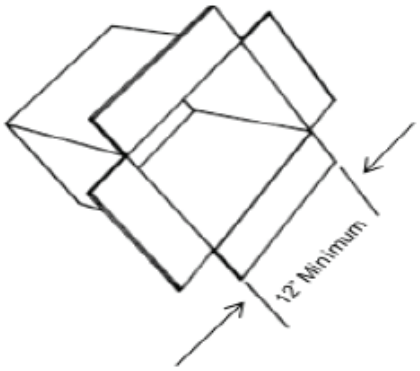
Void-Gard®



Slotted ad Folded Corrugated Fibreboard



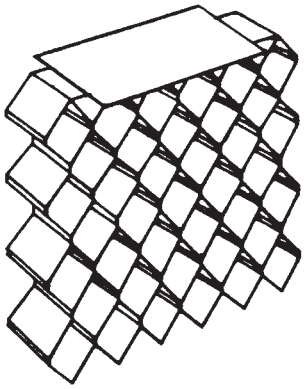
Wood Construction



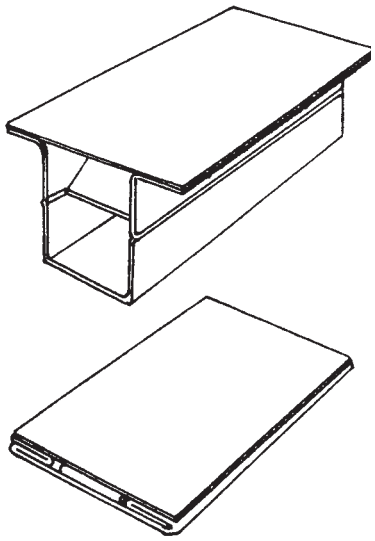
Tube Type Corrugated Fibreboard

Illustration No. 28

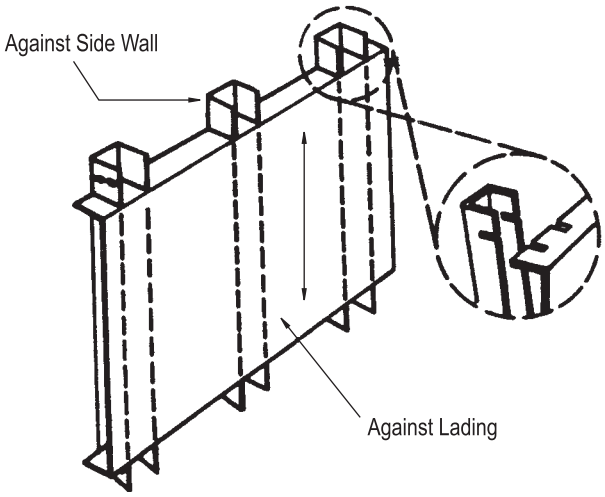
Examples of Fillers to Occupy Unfilled Crosswise Space
(Items A-5, B-4, B-6, B-11, B-13, C-5, and D-19)



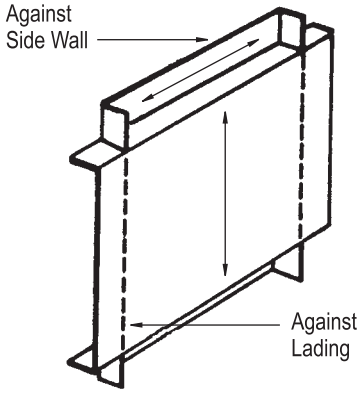
Honeycomb Style



Collapsible - May Be Used With Film Wrapped Units
Where Excluded By Specific Loading N



Flanged Tubes Interlocked With Flanged Sheets



Interlocked Flanged Sheets

NOTE: Use fillers of sufficient size to maintain alignment and to protect containers from falling into the crosswise void. Arrows indicate direction of corrugation.

Illustration No. 29

Examples of Corrugated Fillers to Occupy Unfilled Crosswise Space
(Items A-5, B-4, B-6, B-11, B-13, C-5, and D-19)

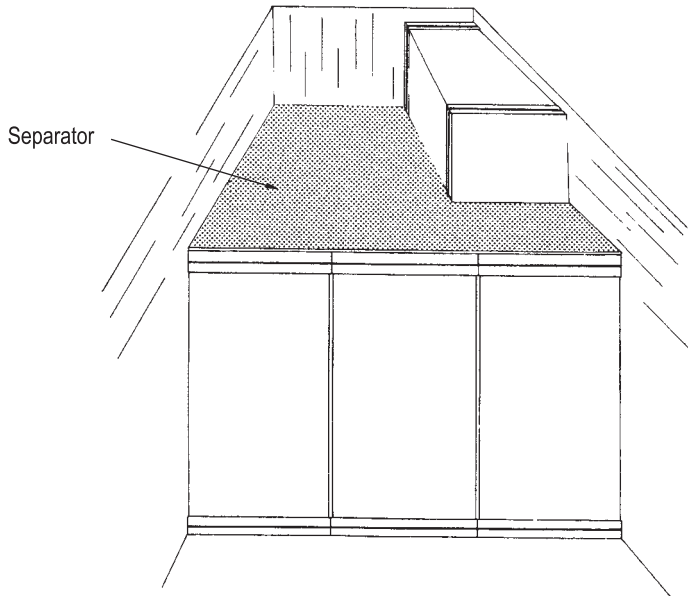


Illustration No. 30

Separator Materials Between Layers When Required
(Item C-6)

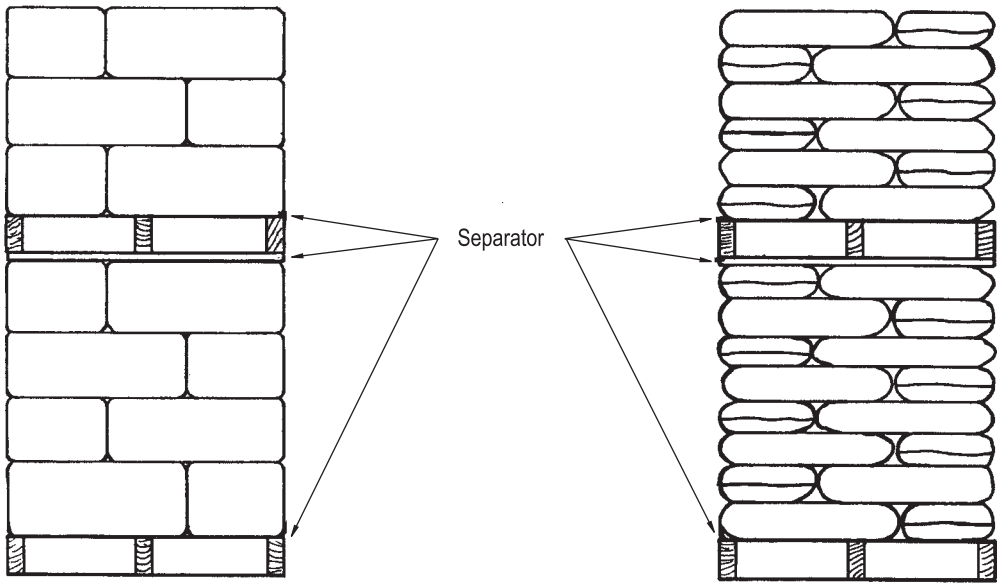


Illustration No. 31

Unitized Double-Layer Wood Pallet Loads
(Items B-1 and C-6)

SECUREMENT

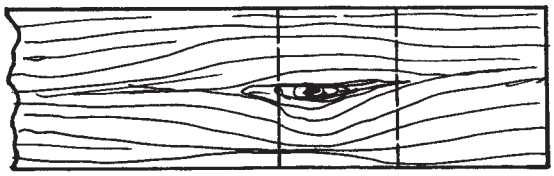
D—WOOD

D-1—Use properly seasoned lumber for trailer blocking and bracing. Do not use green lumber because it does not have the strength or stiffness qualities of dry lumber. Green lumber under certain conditions will give off quantities of moisture that can have harmful effects on some commodities. For specific information on the types and characteristics of lumber used for blocking and bracing, refer to Appendix A.

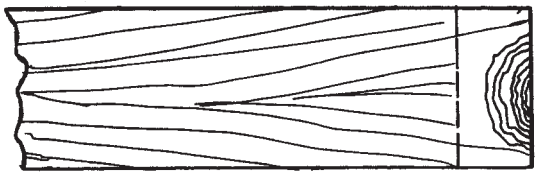
D-2—Properly store lumber used for blocking and bracing to protect it from the elements, preventing rot or decay from affecting its strength.

D-3—When selecting the size of lumber for blocking and bracing, give consideration to the weight, size, and nature of the commodity to be secured.

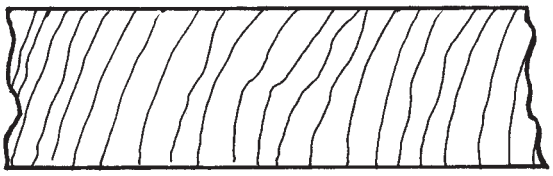
D-4—Select all blocking and bracing material from sound lumber free from crossgrain or dry rot. Do not use lumber with knots, knotholes, and checks or splits that affect its strength or interfere with proper nailing. (See Illustration 32.)



Large knots weaken members. Cut off as shown and use short pieces for cleats, etc.



Cut off knots that interfere with nailing at dotted line as shown.



Never use lumber with cross grain for structural members.

Do not reject lumber with small amount of bark.

Illustration No. 32

Selecting Wood Blocking and Bracing Material
(Item D-4)

D-5—Bull boards may be inserted into slotted doorposts at rear of trailer to restrain low-density material. Use minimum 2 in. × 4 in. lumber (preferably hardwood), free of knots or other strength-impairing defects, and of suitable length to fit snugly between doorposts. Use a sufficient number of bull boards to prevent lading from contacting rear doors. (See chart below.) When necessary, use a wooden gate and fiberboard or plywood buffer material to fill remaining void space and evenly distribute lading forces. (See Illustration 33)

Restraint Device	Capacity
2 in. × 4 in. bull board	5,600 lb*
2 in. × 6 in. bull board	8,000 lb*
2 in. × 4 in. "T" brace	7,000 lb*
2 in. × 6 in. "T" brace	10,000 lb*

*Figures developed through testing of bull boards and "T" braces constructed of yellow pine.

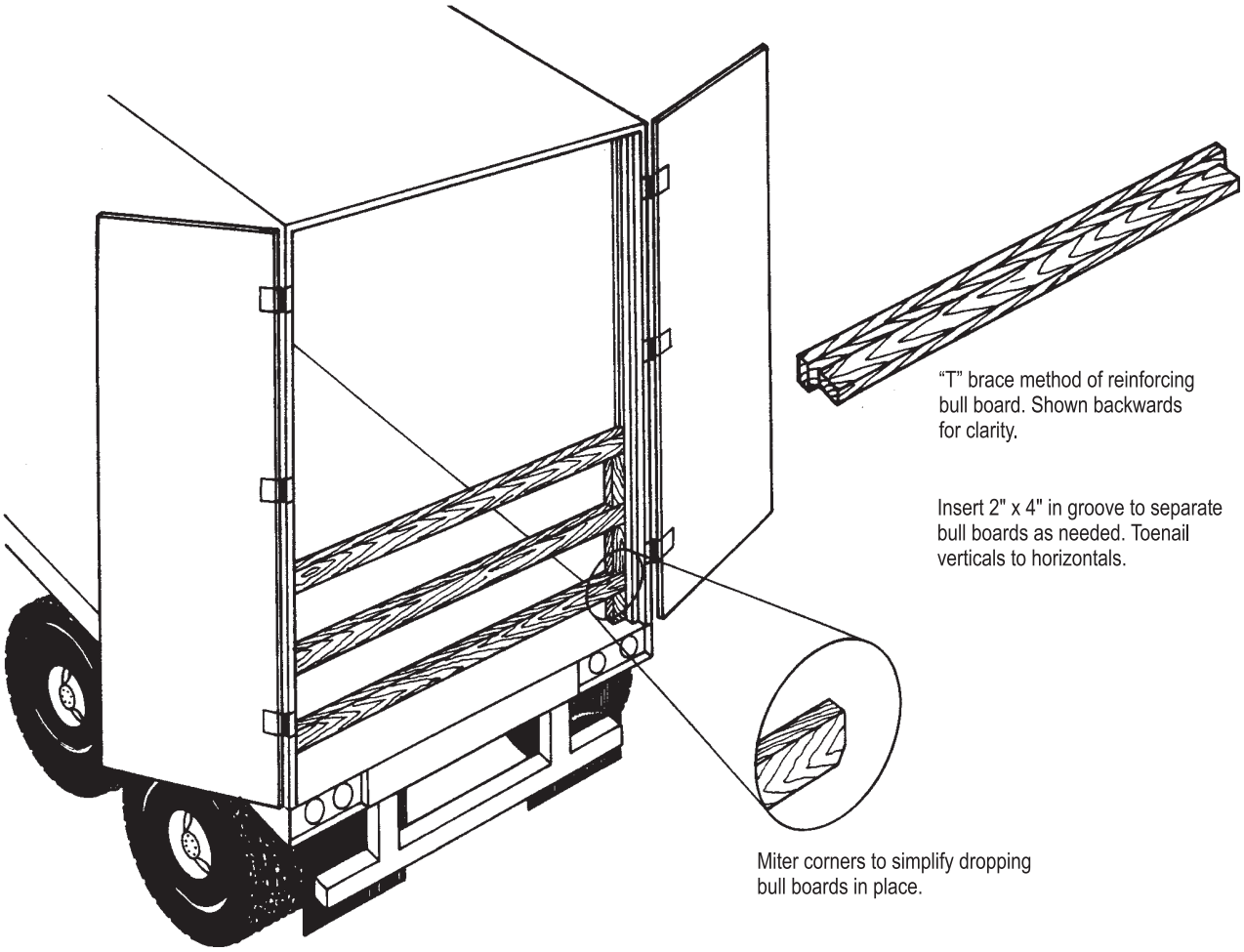


Illustration No. 33

Use of Slotted Doorposts
(Item D-5)

NAILS AND NAILING

D-6—Sizes of nails shown for the construction and assembly of blocking and bracing and the securing of same within the trailer or container are based on use of common nails. When heavy blocking and bracing material is used, spikes may be necessary. Table A shows the sizes of common nails, power-driven nails and staples, and spikes that are used in trailer or container bracing and blocking.

Do not nail into the walls of trailers or containers. Toenailing is not permitted except when specified in an approved securement method.

TABLE A Common Nails, Power-Driven Nails, Power-Driven Staples, and Spikes

	Common Nails		Power-Driven Nails		Power-Driven Staples		Spikes	
Size Penny Weight	Length (in.)	Wire Diameter (in.)	Length (in.)	Wire Diameter (in.)	Length (in.)	Wire Diameter (in.)	Length (in.)	Wire Diameter (in.)
6d	2	.113	—	—	—	—	—	—
8d	2½	.131	2⅜	.113	2½, 2	.080	—	—
10d	3	.148	3	.120	¾	.080	3	.192
12d	3¼	.148	3¼	.131	3, 3¼	—	3¼	.192
16d	3½	.162	3½	.131	—	.080	3½	.207
20d	4	.192	4	.145	3½	.080	4	.225
30d	4½	.207	4¾	.165	3½	—	4½	.244
40d	5	.225	5⅛	.165	—	—	5	.263
50d	5½	.244	—	—	—	—	5½	.283
60d	6	.263	—	—	—	—	6	.283
5⁄16	—	—	—	—	—	—	7	.312
⅜	—	—	—	—	—	—	8	.375

D-7—Consider the relation of the number, size, and kind of nails to the size and kind of lumber used in blocking and bracing. Use sufficient nails, because the strength of blocking and bracing increases directly with the number and size of nails. Do not use nails where they will be in direct tension, but preferably in lateral resistance as shown in Illustrations 34 and 35.

D-8—Drive nails into side grain of lumber because they have 50% more holding power than when driven into the end grain and there is less probability of their splitting the wood. Drive all nails straight.

D-9—To facilitate driving, prevent splitting, and increase the holding power of the nail, pre-drill holes slightly smaller than the diameter of the shank of the nail.

D-10—Use nails of such length to develop the necessary holding power through ample penetration into trailer floors and other blocking and bracing members. The nailing schedule shown in Table B will be of assistance in determining the proper size to use.

TABLE B Sizes of Nails and Spikes for Various Thicknesses of Material

Thickness of Material (Rough Lumber) Holding Head of Nail or Spike	Thickness of Material (Rough Lumber) Holding Point of Nail						
	1 in.	1¼ in.	2 in.	3 in.	4 in.	5 in.	6 in.
1 in.	6d *8d	6d *8d	10d *12d	16d —	16d —	16d —	16d —
2 in.	10d *12d	10d 12d	16d —	20d 30d	40d 50d	40d 60d	40d 60d
3 in.	16d 20d	20d *30d	30d 40d	40d 60d	60d 7 in. spike	7 in. spike —	8 in. spike —
4 in.	40d *50d	40d *50d	50d 60d	60d 7 in. spike	7 in. spike 8 in. spike	8 in. spike —	9 in. spike —
5 in.	50d 60d	60d —	60d 7 in. spike	7 in. spike 8 in. spike	8 in. spike 9 in. spike	9 in. spike —	10 in. spike —
6 in.	7 in. spike —	7 in. spike —	7 in. spike 8 in. spike	8 in. spike 9 in. spike	9 in. spike 10 in. spike	10 in. spike —	10 in. spike —

d—Penny *Nails clinched

D-11—Nails one size smaller than those used for medium or soft wood may be used for extremely hard woods, such as Group IV of Table B in Appendix A.

D-12—Table B shows nail and spike sizes that are used in the construction and assembly of trailer or container blocking and bracing.

D-13—When using automatic-type nailers, sizes of nails may be less than those specified if number driven is increased by one third and the size substitution as follows is adhered to:

Common Nails		Power Driven Nails
10d	or	8d or 10d
20d	or	16d or 20d

TABLE C Lateral Resistance of Nails (in pounds) When Nailed through 2 in. Thick Flooring and into 1¼ in. Trailer Floor – Hardwoods (Group IV)

Size of Common Nail (d)				
8	10	12	16	20
344 lb	733 lb	916 lb	956 lb	1043 lb

Load applied is at a 90°angle to the shank or direction of driving of nail point in the securing wood.

NOTE: For types of lumber, see Table B in Appendix A.

FLOOR BLOCKING

D-14—Securely nail to trailer or container floors all floor blocking to prevent lengthwise movement. Reinforce with backup cleats not less than 2 in. × 4 in. material and at least 18 in. in length. Stagger nails or spikes. The size and amount of lumber and nails required will be dictated by weight of lading. (See Table C above and Tables A, B, C, and D in Appendix A.) (See Illustrations 34, 35, and 36.)

D-15—Use floor blocking as shown in Illustration 34 of not less than 2 in. × 4 in. or 2 in. × 6 in. material and extend or exceed full width of the boxed or crated article against which it bears to prevent concentrated pressure or shearing of the container. For shipments on skids, use floor blocking of the same thickness as the skid members as shown in Illustrations 35 and 36 with backup cleats placed in line with the skid members.

D-16—Use floor blocking applied against beveled or mitered skids the same thickness as the skid member (see Illustration 36) and reinforce with backup and hold-down cleats secured to the trailer or container floor. Avoid excessive mitering of the ends of the skids to prevent the skidded article from riding over the floor blocking. If beveling or mitering is necessary to facilitate handling, do not exceed one third of the thickness of the skid member.

D-17—Illustration 36 shows the use of a hold-down cleat that is nailed to the floor cleats and extends over the floor blocking member and the skid runner. Height of this cleat is equal to that of crosswise skid member.

SIDE OR CENTER BRACING

D-18—Have dimensions of side or center bracing sufficient to properly hold the load in position in the trailer or container. Keep double-decked loads (two or more units high) in alignment by full-height dividers. (See Section IV for possible exceptions.)

D-19—Illustrations 28 and 29 depict different methods of constructing crosswise void fillers. These may be taped or glued directly to the trailer or container wall. If palletized units are loaded, fillers may be used in the void space down center of trailer or container. See Illustrations 25, 26, and 27 for other means of side and center bracing using constructed wood forms.

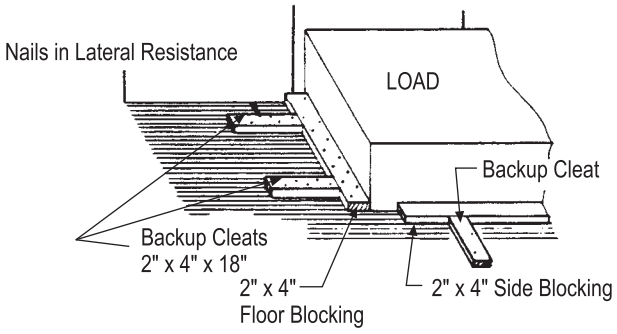


Illustration No. 34

Floor Blocking
(Items D-7, D-14, and D-15)

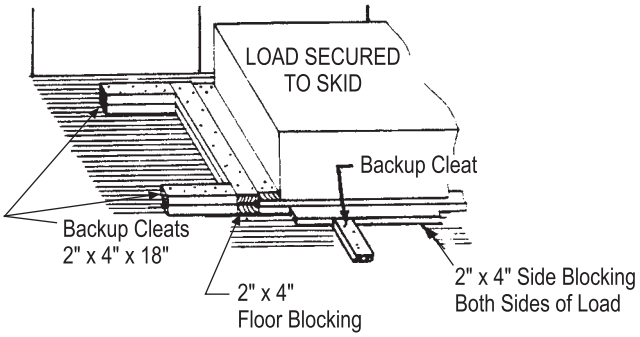


Illustration No. 35

Floor Blocking
(Items D-7, D-14, and D-15)

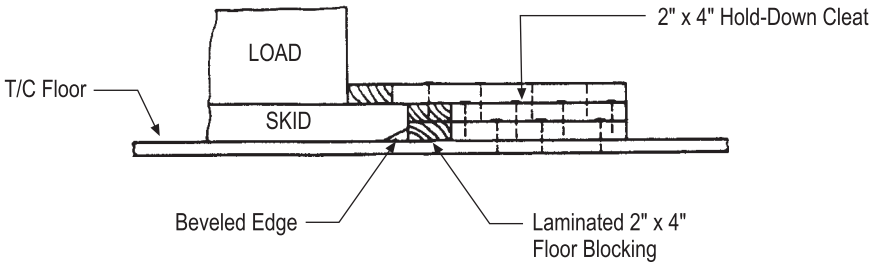


Illustration No. 36

Floor Blocking
(Items D-7, D-14, and D-15)

REINFORCEMENT OF LENGTHWISE BLOCKING TO TRAILER FLOORS

D-20—Reinforcement of lengthwise blocking placed cross-trailer or container can be provided by the use of diagonal blocking to the trailer or container floor. *Do not apply this blocking at an angle greater than 45° with the trailer/container floor.* If possible, position diagonal at the upper third of the load. (See Illustrations 37 and 38.)

D-21—Table D contains approximate lengths of floor diagonals that will be of such a length that the angle will not exceed 45°.

TABLE D Lengths of Diagonals to Trailer Floor (ft)

Height of Application of Diagonal Brace to Cross Brace or Load Above Trailer Floor	Minimum Length of Diagonal Brace Required
1	1½
1½	2¼
2	3
2½	3½
3	4¼
3½	5
4	5¾
4½	6½
5	7¼
5½	7¾
6	8½

D-22—Rear gates may be braced against corner posts where trailers or container s are so constructed. Double-miter diagonal members extending to the trailer or container floor and reinforce by a backup cleat of at least 2 in. × 4 in. × 18 in. material. Drive nails perpendicular to floor for maximum holding power of nails. (See Illustration 38.)

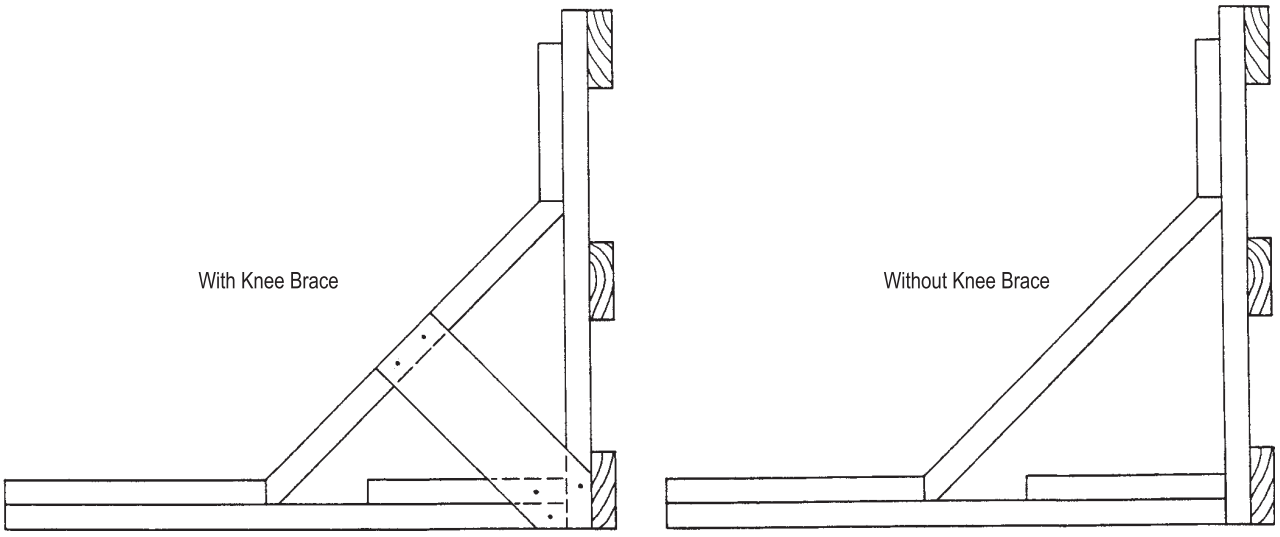


Illustration No. 37

Floor Blocking—Diagonal Brace
(Item D-20)

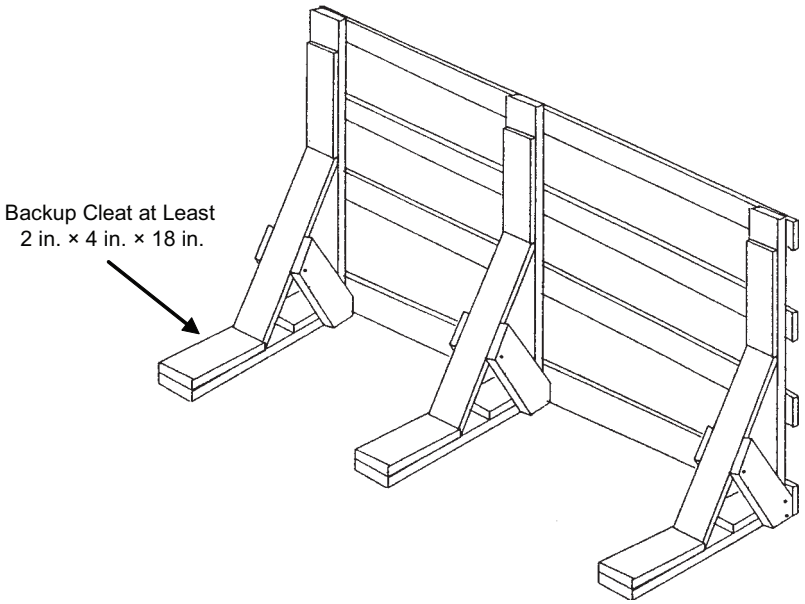


Illustration No. 38

Rear Gate with Floor Blocking and Knee Braces
Items D-20 and D-22

TOP-HEAVY ARTICLES

D-23—Prevent top-heavy articles from falling or tipping over in transit by bracing at a point approximately opposite the upper third of the article.

INCOMPLETE LAYER BRACING

D-24—Avoid incomplete layers in shipments whenever possible. However, when incomplete layers have to be loaded, use full face and height bulkhead for light-weight commodities. For heavier commodities, unitize the rear portion of the incomplete layer to the bottom layer. Unitize with 1¼ in. steel straps with appropriate bulkheads and protection between straps and lading.

E—STEEL STRAPPING

E-1—The combined joint strength of the number of straps for rigid braced loads in each longitudinal impact direction must equal the weight of the lading being secured, except as provided in approved loading methods.

E-2—Use the proper combination of steel straps, seals, sealing tools, notches, or crimps to provide the minimum joint strength for sizes listed below. See Illustration 39 for examples of notches or crimps.

TABLE E

Width and Thickness (in.)	Width and Thickness (mm)	Minimum Breaking Strength (lb)	Minimum Joint Strength (lb)	Minimum No. of Pairs of Notches on Joint	Minimum No. of Pairs of Crimps on Joint					
					Surface Finish					
Securement Bands		—	—	Surface Finish All Types	Uncoated—Dry		Coated-Not Waxed		Waxed	
1¼ × .031	32 × .75	4750	3565	2	3		3		4	
1¼ × .035	—	4750	3565	2	3		3		4	
1¼ × .044	—	6750	5065	4	4		4		4	
1¼ × .050	—	6750	5065	4	4		4		4	
—	—	—	—	—	Std.	Grit	Std.	Grit	Std.	Grit
2 × .044	—	10600	7950	4	4	4	4	4	6	4
2 × .050	—	10600	7950	4	4	4	4	4	6	4
2 × .065	—	13800	10350	4	4	4	4	4	6	4

NOTE: A sufficient number of seals must be applied to accommodate the minimum number of pairs of notches or crimps.

E-3—The above minimum number of notches or crimps is based on current general recommendation of high tension banding manufacturers on the basis of tensioning and sealing tools being in proper operating condition. A lesser number of notches or crimps may be used provided the shipper can demonstrate that the joint has the minimum strength shown in the table under column "Minimum Joint Strength (lb)."

In all cases, use a sufficient number of notches or crimps to achieve the minimum joint strength (lb), as shown in the column headed "Minimum Joint Strength (lb)."

E-4—Use strap protectors, such as corner guards or metal plates, sufficient to provide a suitable radius to protect straps at all points on lading having sharp edges and/or sharp corners.

E-5—Be sure tensioning and sealing equipment is used correctly. Check the tools periodically to ensure correct operating condition.

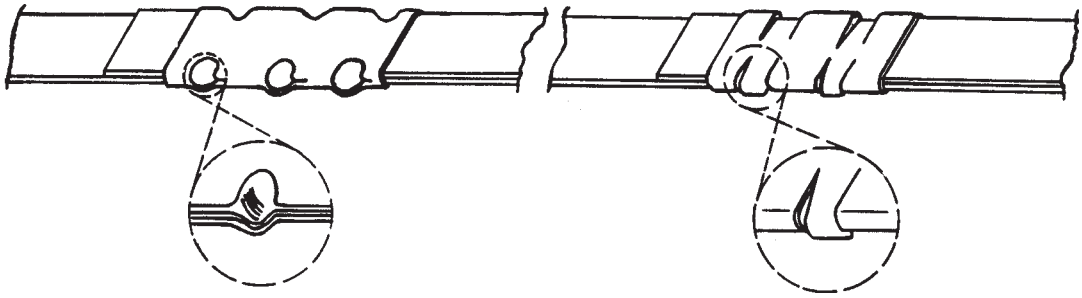


Illustration No. 39

Crimp and Notch-Type Seal Joints
(Item E-2)

ANCHORED LOAD

E-6—This method of bracing is used only in trailers or containers equipped with belt rails attached to the sidewalls or with logistics posts, or in systems using temporary anchoring devices applied to floor that are capable of securing the weight desired.

E-7—The number, size, and strength of steel strapping required under these methods are dependent upon the weight and dimensions of the commodity loaded. See Section IV for approved loading methods.

E-8—The anchored load provides rigid bracing of the lading by the use of steel straps secured to the trailer or container sidewalls with load anchors or floor with approved anchor plates.

E-9—Apply load anchors per manufacturers' instructions using correct anchors with appropriate belt rails or logistics posts. (See Illustration 40.) Install load anchors a minimum of 18 in. behind face of load and stagger so no more than two are secured in vertical alignment. (See Illustration 41.) Use gates constructed per Illustrations 40 and 42 with these load anchors. The restraining capacity of two 1¼ in. × .031 in. steel straps, which are correctly sealed and anchored on each sidewall and correctly tensioned and sealed across the face of the lading, is 7,100 lb.

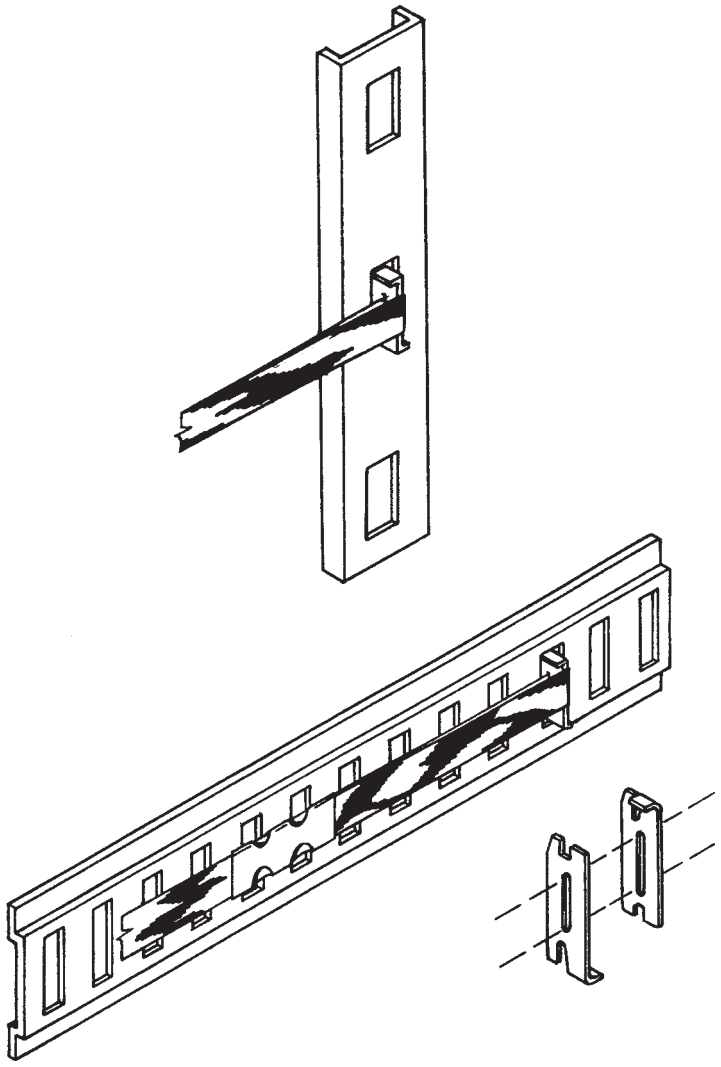
E-10—When two or more steel straps are used, tension the straps simultaneously to bring the load back uniformly in position and seal the straps. (See Illustration 42.)

CORNER OR GATE PROTECTION

E-11—Provide corner or gate protection to prevent damage to the lading caused by pressure of the steel straps. See Illustration 43 for corner protection and Illustrations 41 and 42 for examples of gate construction.

E-12—When steel straps contact gates or corner protection members, drive staples over these straps to prevent them from slipping or dropping out of position while in transit.

E-13—Illustrations 41 and 42 show a completed anchored load and the application of steel straps to a gate with truss block construction.



The anchors must be attached at least 18″ back of the face of the load. For most lading, it will be necessary that proper end gates, trusses, and/or reaction strap applications be employed to ensure protection for the lading.

Illustration No. 40

Load-Restraining Systems—Load Anchors
(Item E-9)

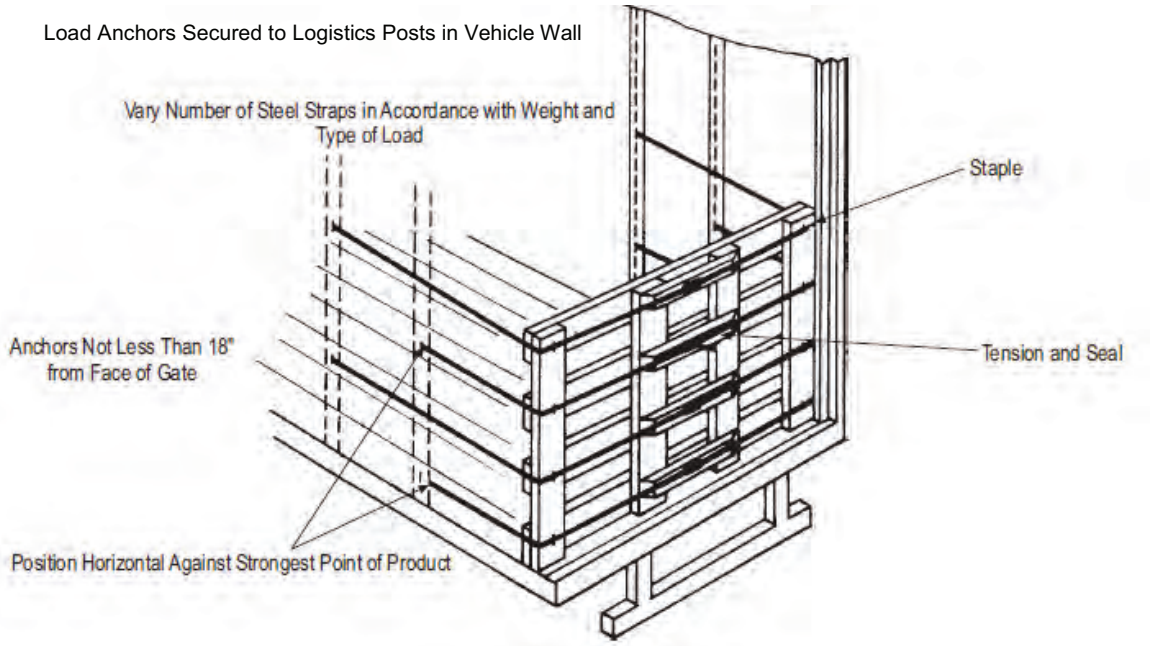


Illustration No. 41

Anchored Load—Securing Gate
Use of Truss Blocks
(Items E-9 and E-13)

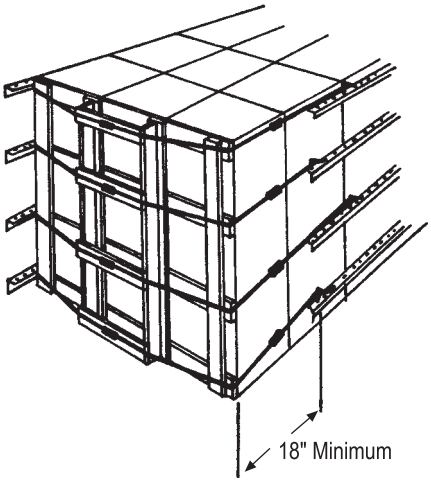


Illustration No. 42

Steel Strap Anchored Gate for Anchored Loads
(Items E-9, E-10, and E-13)

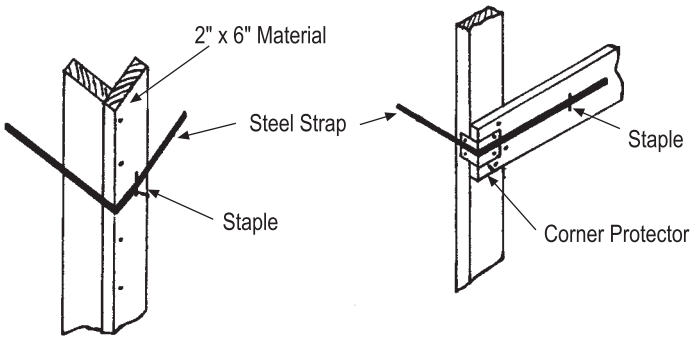


Illustration No. 43

Corner Protection
(Item E-11)

F—NONMETALLIC STRAPPING

A. The following bonded or woven polyester cord strapping has been approved for use in closed cars, trailers, or containers for approved loading and securement methods in which the use of polyester cord strapping is specified:

Size	ASTM Type*	Company/Strap Designation	Strap I.D.
1¼ in. wide	Type 1 A—Grade 4	Caristrap International CW105WGSD	CW105WGSD
1¼ in. wide	Type 1 A—Grade 4	Caristrap International CWW105WOJ	CWW105WOJ
1½ in. wide	Type 1 A—Grade 5	Caristrap International CWW125WOJ	CWW125WOJ
1¼ in. wide	Type 1 A—Grade 4	Carolina Strapping and Buckles Company CS-2040	CS-2040
1½ in. wide	Type 1 A—Grade 5	Carolina Strapping and Buckles Company CS-2055	CS-2055
1¼ in. wide	Type 1 A—Grade 4	Cordstrap BV CC-105	AAR CORDSTRAP CC-105
1¼ in. wide	Type 1 A—Grade 4	Signode Packaging Systems PW100EH	AAR 11
1¼ in. wide	Type 1 A—Grade 4	Tapex American Corp. TEXband 105WXH	AAR TEXband 105 WXH
1½ in. wide	Type 1 A—Grade 5	Tapex American Corp. TEXband 125WXH	AAR TEXband 125 WXH

1. **Grade 4** strapping is to have a minimum break strength* of 3,285 lb.

2. **Joined Grade 4** strapping is to have a minimum joint strength* of 2,464 lb (75% of minimum break strength).

3. **Grade 5** strapping is to have a minimum break strength* of 5,400 lb.

4. **Joined Grade 5** strapping is to have a minimum joint strength* of 4,050 lb (75% of minimum break strength).

5. The strap is to be clearly marked with the Strap I.D. in accordance with the strap marking requirements of AAR Circular 42-J, “General Rules Covering the Loading of Carload Shipments of Commodities in Closed Cars.”

6. The straps are to be tensioned and joined using the correct buckle and tensioning tools in accordance with manufacturer’s instructions. It is important that the buckle be applied correctly to maintain strap tension. Split and knot the strap on the tensioning side of the buckle after tensioning, when possible, to ensure against strap slippage.

7. Use strap hangers or tape to maintain correct strap position.

* See ASTM Standard D3950, “Standard Specification for Strapping, Non-metallic,” for information on strapping type and grade and testing procedures.

B. The following polyester plastic strapping has been approved for use in trailers or containers for approved loading and securement methods in which the use of polyester plastic strapping is specified.

TABLE F Approved Type IV polyester strapping

(For the latest update to this table, go to the TTCI Web site at http://www.aar.com/otlr.htm

AAR ID	Manufacturer/ Distributor	Approved Through (Mo/Yr)	Approved Size in. (mm)								Approved Joint Type
			5/8 (15.9)		3/4 (19.1)		1 (25.4)		1 3/4 (32.0)		
			.035	.040	.040	.050	.040	.050	.032	.040	
30	Acme[a/]	2/10	X	X	X	X	X[b/]	X[b/]			H, F
30	Acme[a/]	12/12	X[c/]	X[c/]						X[b/]	H, F
59	Cyklop—Brazil	10/11	X	X	X						F. S
53	Polychem Corp.	6/10	X	X							H, F
53	Polychem Corp.	1/12			X						F
53	Polychem Corp.	9/12				X					F
22	Samuel Strapping Sys.[d/]	9/12	X	X	X	X					H, F
22	Samuel Strapping Sys.[d/]	11/11					X				F
22	Samuel Strapping Sys.[d/]	1/13						X			F
11	Signode[a/]	2/10	X	X	X	X	X[b/]	X[b/]			H, F
11	Signode[a/]	12/12	X[c/]	X[c/]						X[b/]	H, F
55	Strapex[a/]	2/10	X	X	X						H, F
55	Strapex[a/]	12/12	X[c/]	X[c/]						X[b/]	H, F
57	Mallis Strapping Systems—USA	11/12	X	X	X						F
57	Mallis Strapping Systems—USA	3/11	X	X							H
57	Mallis Strapping Systems—USA	10/11				X		X			F
51	Gerrard-Ovalstrapping[d/]	9/12	X	X	X	X					H, F
51	Gerrard-Ovalstrapping[d/]	11/11					X				F
51	Gerrard-Ovalstrapping[d/]	1/13						X			F
21	Plantec Polimeros Industrial Ltda.—Brazil	12/09		X	X						S, F
60	Teufelberger GesmbH—Austria	10/12	X	X	X						H, F
63	Hangzhou Fuyang Hua Chen Plastic Co. Ltd.—China	9/12	X	X							F
64	Interpet S. A.	3/10		X	X						F
64	Interpet S. A.	5/11	X								F
65	U.S. Strapping Company	6/10	X	X	X						F
66	Strapack Embalagens Ltd[a/]	6/10	X	X	X						F
67	NHXXL Synthetic Fibre Inc.	8/10		X							F
68	Fromm Plastics GmbH Germany	10/10	X[b/]	X[b/]	X	X					H, F
69	Hiroyuki Industries (M) SDN. BHD.	11/10	X								F
26	Hankum Co., Ltd.	5/12	X	X							F
27	Green Span Packaging System - Indonesia	12/12	X								F
12	Haining Tricot Plastic	1/13	X	X							F

H = Heat-sealed (hot knife) joint
F = Friction-welded joint
S = Seal, approved metal (metal seal joints must be approved systems)

Strapping in the table above may be used only where specified in an approved figure or as an allowable substitution for steel banding under the applicable figures in Section 5 of the AAR *Open Top Loading Rules Manual*.

Strapping in the table above is for smooth-sided polyester plastic type strap only unless otherwise denoted.

a/ Associated with Illinois Tool Works (ITW) as a manufacturer employing common production procedures and specifications
b/ Friction-weld only approved joint type
c/ Embossed-type strap
d/ Associated with Samuel Manutech Strapping Companies as a manufacturer employing common production procedures and specifications.

1. The strap is to have a minimum break strength* of 1,200 lb.

2. The strap is to be sealed with a friction weld of heat seal joint (sealless) with a joint strength of 900 lb (75% of minimum break strength).

3. The strap is to be clearly marked with the strap I.D. spaced at not more than 5 ft intervals.

G—TY-GARD 2000®

Ty-Gard 2000® is a laminated fabric barrier material that is constructed of the following material:

Backing
Base material—spun-bonded polyester
Unit weight—1.35 oz/yd^2
Thickness—9 mil
Sheet grab tensile—29 lb (MD) 24 lb (CD)
Tear—11 lb (MD) 12 lb (CD)
Mullen burst—36 psi

Strength Material (CORD)
Base material—hybrid polyester fiber
Yarn count—22/in.
Denier—1500
Filament count—546
Type—DSP high modulus fibers
Elongation at break—10%
Modulus elongation at 10 lb—3%

Use of Ty-Gard 2000 as a lading restraint (in trailers) is restricted to trailers with horizontally oriented side-wall panels. Bond to the contour of corrugations in containers.

Loads are normally separated into two or more sections with each section secured with two 16 in. wide Ty-Gard 2000 flexible barriers. As a general guide, each Ty-Gard 2000 barrier can restrain up to 8,800 lb of lading. To secure the Ty-Gard 2000 to the trailers sidewalls, cut two lengths of Ty-Gard 2000 for each band required and apply the adhesive strip to each sidewall in the predetermined position. The Ty-Bond 2000 strips are a minimum of 60 in. long and are located 36 in. back from the face of the load. Pull the Ty-Gard 2000 strips across the face of the load overlapping ends at least 1 ft and tension using Ty-Gard tools. The tensioned barriers are then sealed with 4 ft long strips of Ty-Patch bonded to the Ty-Gard 2000 barriers. Ty-Gard 2000 has been approved for use as a restraining system for several different commodities. For more specific information, refer to Section IV, Tested and Approved Securement Methods.

* See ASTM Standard D3950, “Standard Specification for Strapping, Non-metallic,” for information on strapping type and grade and testing procedures.

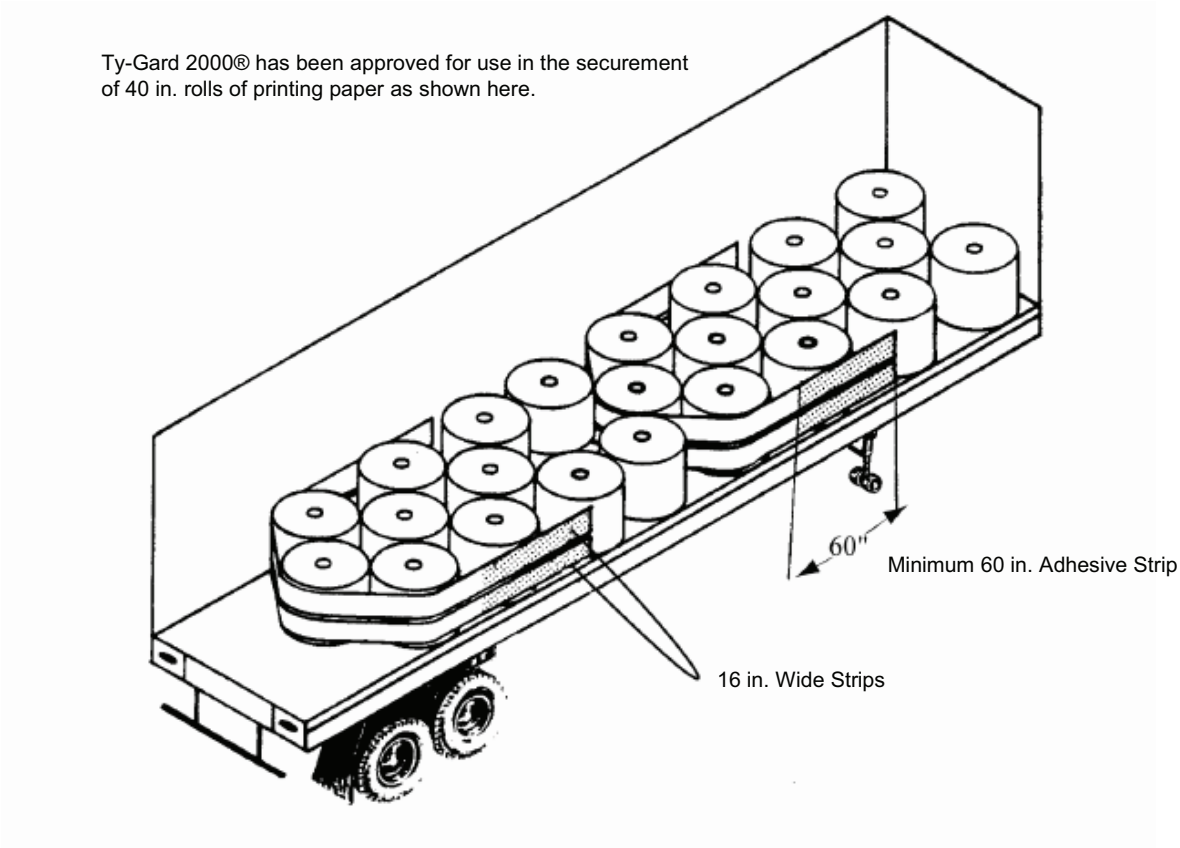


Illustration No. 44

Example of an Approved Ty-Gard 2000® Load

H—SECTION H CANCELLED 2009

I—REAR DOORS

Trailer/container doors may not be used to secure loads containing hazardous materials. Under certain conditions, as outlined in Section II (Circular 43-E), Rule 5A below, trailer doors can be relied on to secure non-hazardous materials lading.

5. Loading and Securement

A. Secure lading to prevent both lengthwise and crosswise movement. If the lading is rigid in nature and/or very dense, such as boxes of nuts and bolts, machinery, metal beams, brick, lumber, cut paper, etc., or if the shape of the lading is such that the area of door contact is minimal, such as with cylindrical objects like drums or rolled paper, blocking and bracing is necessary. Vehicle doors are neither designed nor intended to restrain commodities with these characteristics. Such products must be loaded and secured in conformance with the rules and illustrations in this publication and in other applicable AAR commodity loading publications.

Trailer/container doors may not be used to secure loads containing hazardous materials.

The doors of the vehicle, meeting AAR trailer specification M-931 and AAR container specification M-930, can be relied on to secure non-hazardous materials lading only under the following conditions:

1. The load consists of multi-unit lading such as boxes of food-stuff, tissue, or soft paper products, furniture, appliances, etc., not exceeding 40,000 lb, covering a minimum of 60% of the door area and evenly distributed throughout the vehicle.

2. Lading must be loaded tightly lengthwise and crosswise and flush to the rear doors of the vehicle allowing no room for movement. If any void exists, fill void space with recommended dunnage.

3. The doors must fit squarely, the hinges must be tight, and locking bars must be in good condition and function properly.

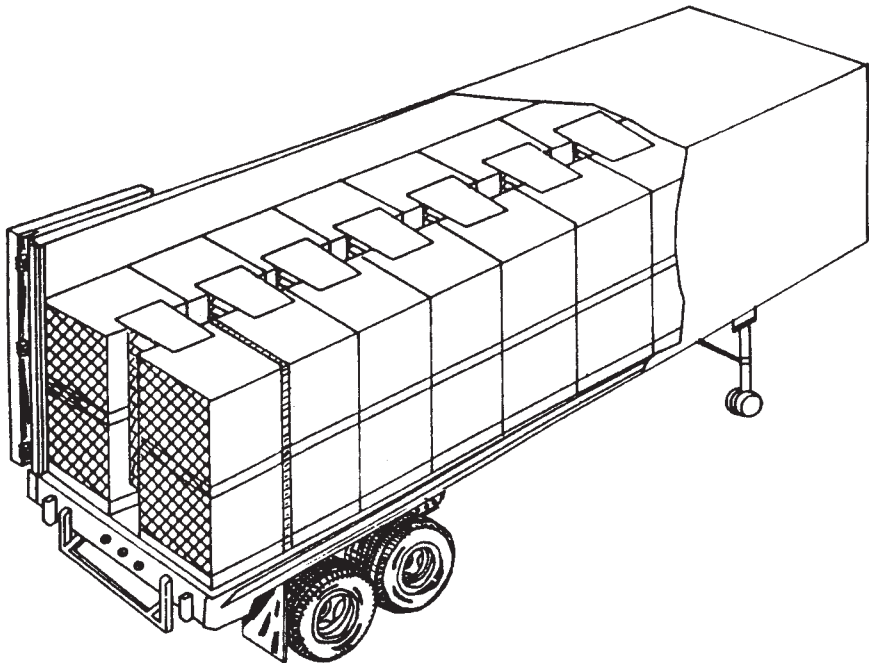


Illustration No. 46

Example of Load that Could Conform
to Rule 5A as Stated Above

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SECTION IV—TESTED AND APPROVED SECUREMENT METHODS

Methods contained in this section have been tested according to AAR procedures for evaluation and acceptance of new loading and bracing systems. These procedures involve evaluation of the method during simulation and/or field test shipments. Methods in this section have been approved by the Damage Prevention and Freight Claim Committee.

- Methods marked with a diamond (♦) have been recommended for hazardous materials loading by the Bureau of Explosives Steering Committee.
- Methods marked with an asterisk (*) have been tested to 8 mph.

- Methods marked with a diamond (♦) have been recommended for hazardous materials loading by the Bureau of Explosives Steering Committee.
- Methods marked with an asterisk (*) have been tested to 8 mph.

Cross Reference—Securement Methods

Type of Commodity/Container and Approved Securement Method

- Methods marked with a diamond (♦) have been recommended for hazardous materials loading by the Bureau of Explosives Steering Committee.
- Methods marked with an asterisk (*) have been tested to 8 mph.

Palletized Bag Loads

Palletized or Slip-Sheeted Box Loads

Case Goods on Slip Sheets

Paper Products

Packaged Brick

Various Commodities

Bulk Boxes

- Methods marked with a diamond (♦) have been recommended for hazardous materials loading by the Bureau of Explosives Steering Committee.
- Methods marked with an asterisk (*) have been tested to 8 mph.

Lumber Products

Commercial Refrigeration Units

Intermediate Bulk Containers

Roofing Shingles

Wheeled Vehicles

Dry Bulk Commodities

- Methods marked with a diamond (♦) have been recommended for hazardous materials loading by the Bureau of Explosives Steering Committee.
- Methods marked with an asterisk (*) have been tested to 8 mph.

A—STEEL STRAPPING

Method A-1—Palletized Steel Products Secured Using a Controlled Floating Load (Maximum Weight 45,000 lb)

The following procedures have been tested and found successful in the loading and bracing of palletized steel products. Follow these procedures, without exception, in all loads using this bracing method. Divide the total weight of lading, in the trailer, into two approximately equal units.

Illustration No. 47:

Item	No. of Pieces	Description
A	1 per package	Intersectional seal crimped to both package straps to prevent slippage during transportation. (See **Sketch 1**—for circular shaped products.)
B	4 per trailer 2 per unit	Wooden gate constructed of 2 in. × 6 in. and 1 in. × 6 in. material per **Sketches 3 and 6**. For loads with more than three rows, use additional uprights placed at appropriate locations.
C	4 per trailer	Guide Rail—2 in. × 6 in. × 10 ft lumber placed alongside of trailer sidewall approximately 5 ft from the nose and the door of the trailer. Secure in place with sixteen 16d nails for each guide rail.
D	2 per each Item E	Load cushioning seals secured to Item E by crimping twice and nailing to trailer floor with eight double-headed nails. Place approximately at the mid-point of Item C. Locations of the cushioning seals crosswise of the trailer are dependent on pallet sizes. Place centered under each row.
E	Minimum 6 per trailer	2 in. × .044 in. high-tension steel strap. Place through Items D and secure at mid-point by crimping. Use additional straps if more than three rows per unit.
F	2 per Item E	2 in. seals. After load is in correct location with Items B, secure Items E with two seals per strap, crimped twice.
G	2 per each Item E placed on each Item B	Load cushioning seals used as snubbers. Apply one to each end of Item E. After Items F have been secured, crimp twice and nail to Item B with eight double-headed nails for each application.
H	1 per trailer	Doorway protection—2 pieces of 2 in. × 4 in. × 72 in. laminated hardwood lumber. Nail to trailer floor 14 in. or more from trailer door.
I	4 per trailer	Backup cleats—2 pieces of 2 in. × 4 in. × 14 in. laminated lumber. Place against Item H and nail to trailer floor.

NOTE: Maximum lading weight that can be secured using one unitizing strap (Item E) and two load-cushioning seals (Item D) is 7,500 lb. Not more than 25,000 lb uniformly distributed in any 10 linear feet can be loaded on trailers meeting the specifications of the AAR *Manual of Standards and Recommended Practices*, Section I, Specification M-931. See Illustration 3.

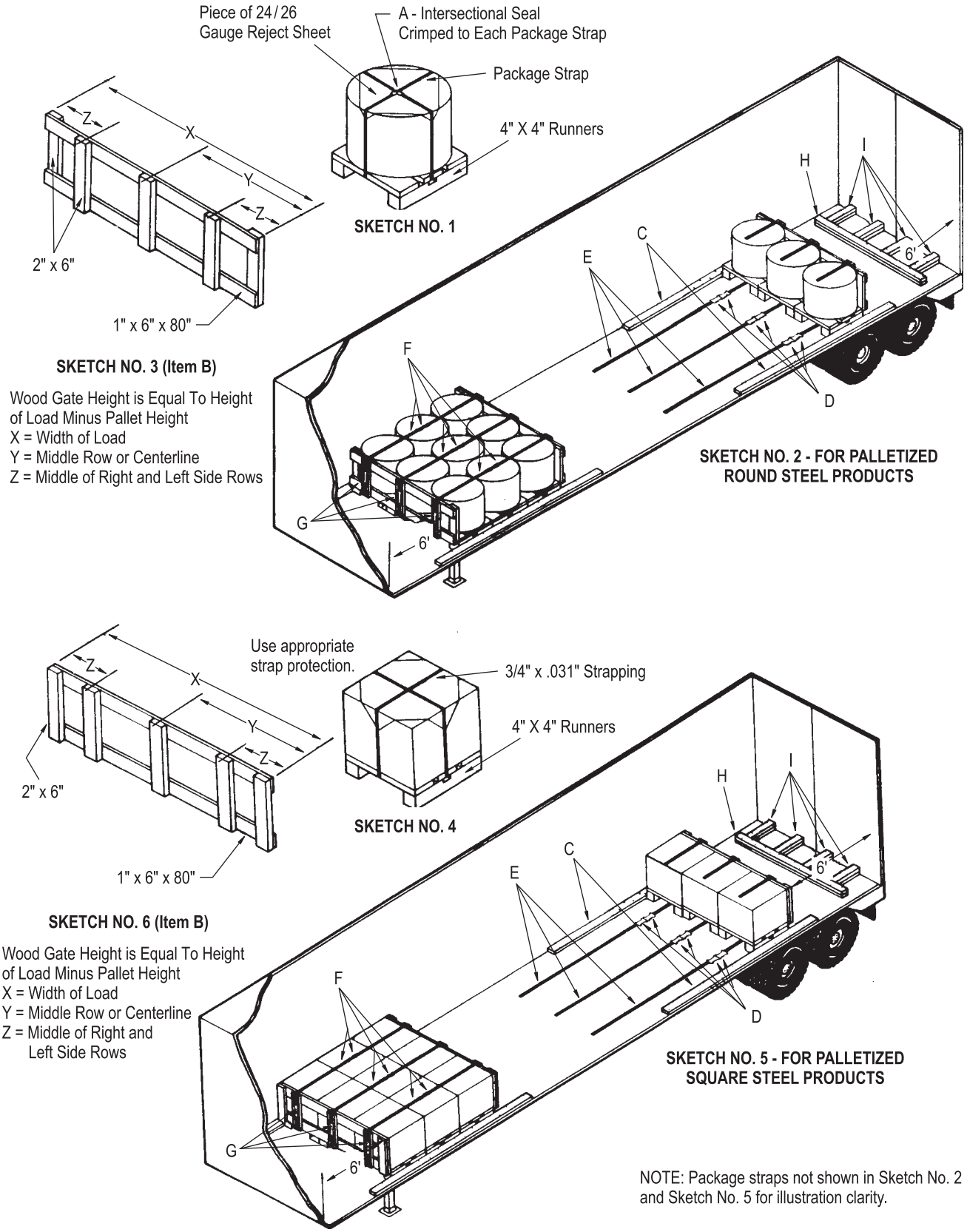


Illustration No. 47

Method A-1
Palletized Steel Products Secured Using a Controlled Floating Load

Method A-2—Seventy-Nine 55-Gallon Closed Head Drums Secured with Anchor Plates and Steel Straps (Maximum Weight 44,500 lb)

Illustration No. 48:

1. Load the trailer or container with 79 drums in a 4-3-4 pattern with the last stack containing 2 drums for a total of 23 stacks. POsition the anchor plates in voids along each sidewall at the fourth and sixteenth stacks.

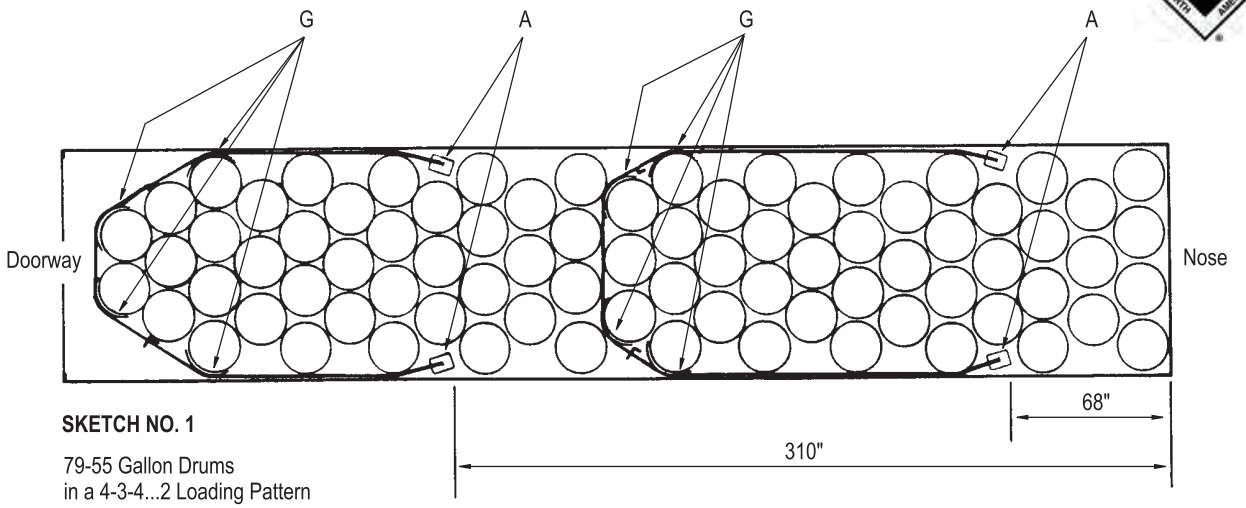
2. Use nails for the anchor plates that are the same wire size as a 16d nail, but only 2¼ in. long. The design of the anchor plate requires 19 nails for securement. Position the anchor plates for the first bulkhead 68 in. from the nose. Position the second set of anchor plates 310 in. from the nose. Angle each anchor plate 2½ in. from the sidewall at the rear of the anchor plate and 1 in. at the front. (See **Sketch 3**.)

3. Extend steel straps (1¼ in. × .031 in.) from the anchor plates to and around the twelfth and twenty-third stacks, forming bulkheads at these points. Use solid fiberboard material (similar to roll paper cores) ½ in. thick as buffer material between the steel straps and the drums at the eleventh, twelfth, twenty-first, and twenty-third stacks. This requires approximately 200 ft of steel strap for both bulkheads.

4. Use one 2 ft long piece of strap for each anchor plate, placed between the anchor plate and the securement straps, to protect the securement straps from being damaged by the anchor plates. (See **Sketch 4**.)

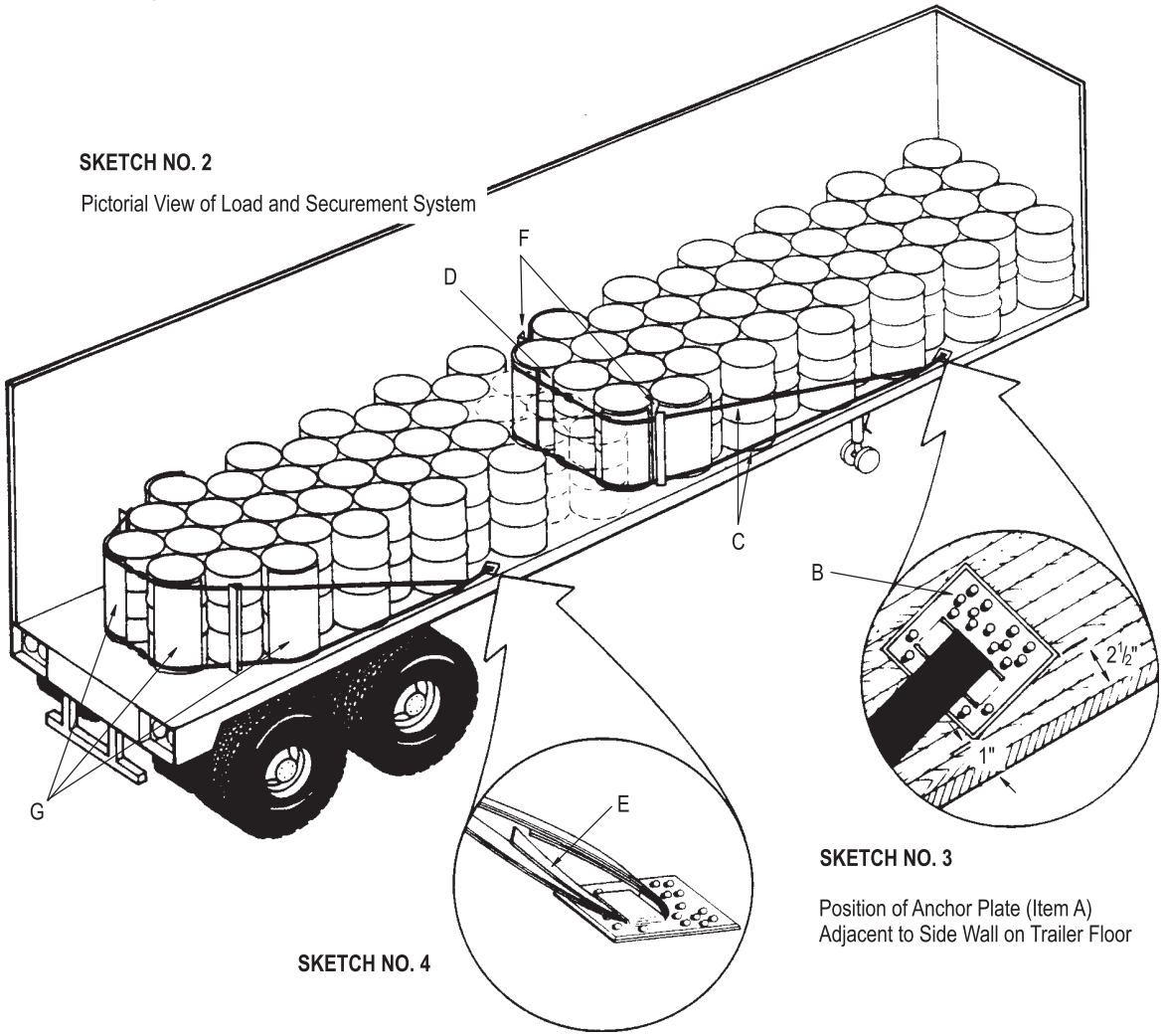
5. Use two strap stays (separators) for each bulkhead. Position them near each load face to maintain horizontal alignment of the straps. The strap stays are made from chipboard corner protectors with slots cut in them to allow the straps to pass through. See **Sketches 1 and 2** for additional details.

Item	No. of Pieces	Description
A	4	SG-type anchor plates nailed to trailer floor.
B	76	16d anchor plate nails (19 per anchor plate).
C	4	50 ft × 1¼ in. × .031 in. steel straps (2 per barrier).
D	24	Crimp-type seals with abrasive inner coating for 1¼ in. × .031 in. steel straps (12 per barrier).
E	4	2 ft × 1¼ in. × .031 in. steel straps for protection between securement straps and anchor plates. (See **Sketch 4**.)
F	4	Chipboard stays to maintain horizontal alignment of straps at load faces (2 per barrier).
G	8	.500 in. thick solid fiberboard drum protectors (4 per barrier).



SKETCH NO. 1

79-55 Gallon Drums
in a 4-3-4...2 Loading Pattern



SKETCH NO. 2

Pictorial View of Load and Securement System

SKETCH NO. 3

Position of Anchor Plate (Item A)
Adjacent to Side Wall on Trailer Floor

SKETCH NO. 4

Illustration No. 48

Method A-2
79 55-Gallon Closed-Head Drums Secured with Anchor Plates and Steel Straps

Method A-3—Steel Drums in a 4-3-4 Pattern Secured with Wall Anchor and Steel Straps

Use the following bracing method for a load in a 4-3-4 pattern. The method of bracing involves restraint of the drums by use of steel straps attached to material glued to the sidewalls of the trailer/container.

Illustration No. 49:

1. Select a trailer/container for loading that has inside linings of steel, fiberglass, or plywood sheets oriented so the longest dimension is horizontal. This spreads the forces over as many side posts as possible.

NOTE: Do not use this trailer loading method with vertically oriented plywood sidewall panels.

2. This method uses a wall anchor constructed of 4 in. wide nylon webbing 19 in. long with a metal buckle at one end. For each section loaded, use four wall anchors, two per trailer/container side. Place them approximately 8 ft from the trailer/container nose at a height of 8 in. and 28 in. above the trailer/container floor. The adhesive used to attach the anchors to the wood lining is a 3M-type 5230 wood adhesive. The linear length of each glue line is approximately 16 in. Allow sufficient curing time (approximately 72 hours).

3. Load drums into two sections. Each of the two sections should contain approximately one half of the total drums to be loaded. The last stack in each section should contain three drums as shown.

4. Use four pieces of steel strap, 1¼ in. × .031 in. or equivalent, approximately 10 ft long to secure the completed first section. Pass each strap through the buckle of the wall anchor and seal it with two seals. After loading the remaining drums, bring the four straps around to the front of the section and simultaneously tension and seal them. Use drum protectors at four locations, two on each side of the section, where the strap is bent around the face of the drums. Use a fiberboard strap stay to prevent the strap from slipping down at each side of the unit.

5. Secure the second section the same way with the anchors placed about 7 ft from the face of the section or about 20 ft from the nose of the trailer/container if prepared according to this illustration.

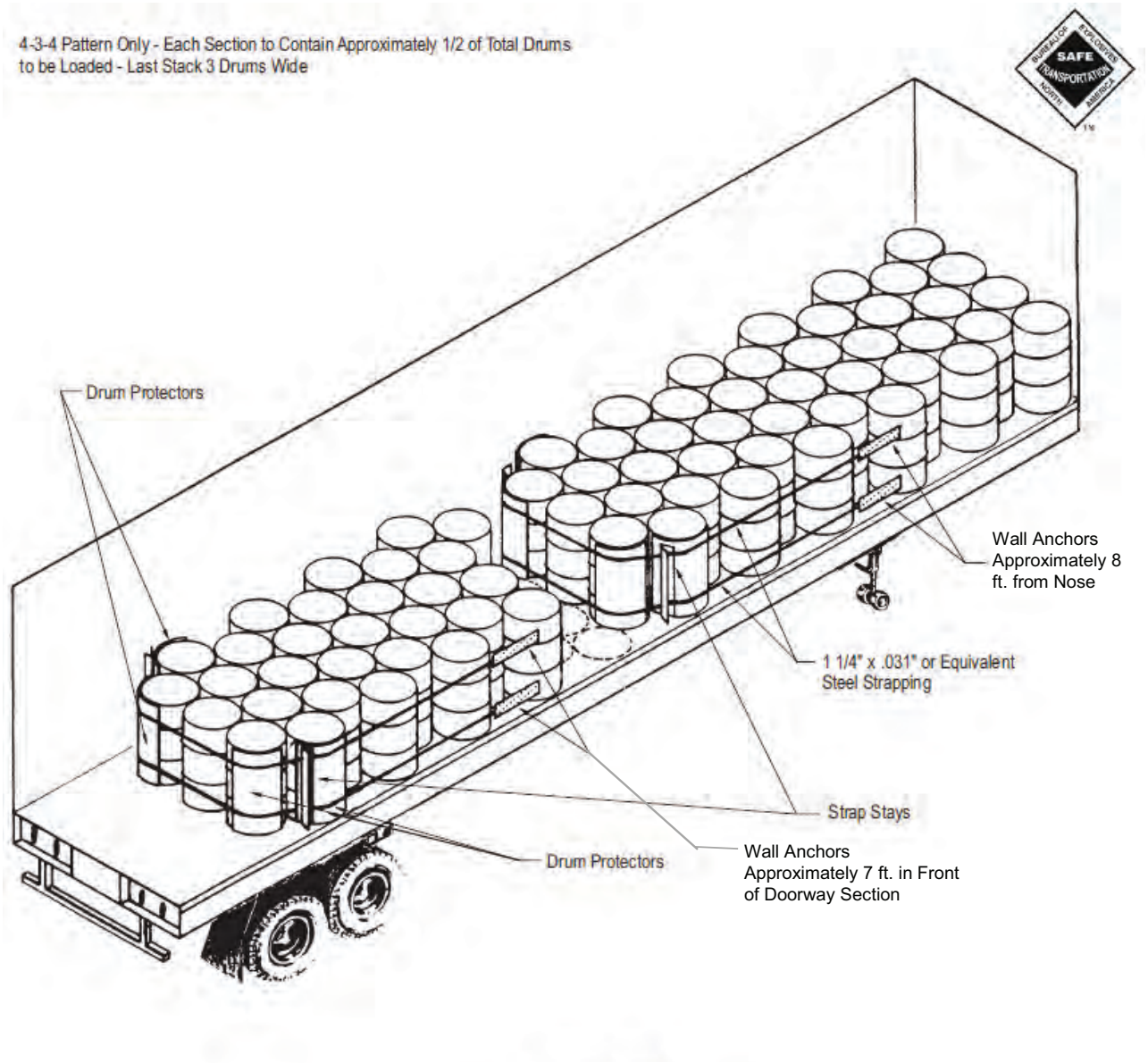


Illustration No. 49

Method A-3
Steel Drums in a 4-3-4 Pattern Secured with Wall Anchors and Steel Traps

Method A-4—Steel Drums in a 4-4 Pattern Secured with Wall Anchors and Steel Straps

Illustration No. 50:

1. Select trailers/containers for loading that have inside linings of steel, fiberglass, or plywood sheets oriented so the longest dimension is horizontal. This spreads the forces over as many side posts as possible.

NOTE: Do not use this trailer loading method with vertically oriented plywood sidewall panels.

2. The wall anchor is of 4 in. wide nylon webbing, 19 in. long, with a metal buckle at one end. The adhesive used to attach the anchors to the wood lining is a 3M-type 5230 wood adhesive. Allow sufficient curing time (approximately 72 hours). The linear length of each glue line is approximately 16 in. Place the wall anchors 10 ft from the nose of the trailer/container. With this bracing method, each section has six wall anchors, three per trailer/container side. Place anchors at a height of 8 in., 18 in., and 28 in. above the floor.

3. Use six lengths of 1¼ in. × .031 in. or equivalent steel strap, approximately 15 ft long, to secure each section. Pass each strap through the buckle of the wall anchor and seal it with two seals. After completion of loading the first section, bring the six straps around the front of the section and simultaneously tension and seal them.

4. Use drum protectors at two locations, one at each corner of the section where the strap is brought around the face of the drum. Use a fiberboard strap stay to prevent the strap from slipping down at each side of the unit.

5. Load the remaining drums. Place the wall anchors about 10 ft in front of the rear section. This provides a minimum of 8 ft to 10 ft distance between the wall anchors and the front of the doorway section. Simultaneously tension and seal the strapping on this doorway section. Use four drum protectors for the doorway section as shown in this illustration.

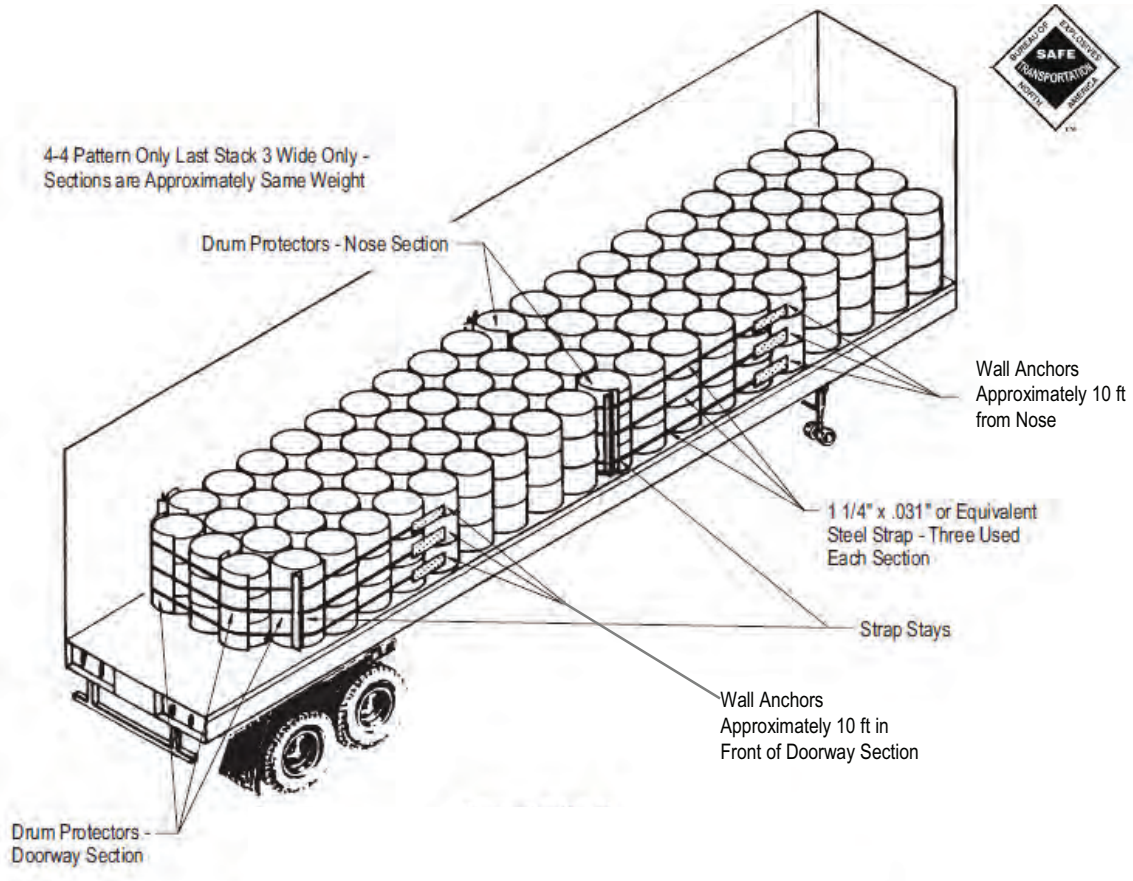


Illustration No. 50

Method A-4
Steel Drums in a 4-4 Pattern Secured with Wall Anchors and Steel Traps

Method A-5—40 in. Diameter Roll Printing Paper Secured by Two Steel Strap Barriers

Use this loading method for 40 in. diameter rolls loaded in a 2-1-2 pattern in a trailer or container for intermodal service. This method was tested in a 96 in. wide trailer.

Illustration No. 51:

1. Divide the load into two sections, each containing approximately half of the load. End the first section with a single roll stack (point roll—A).

2. Nail anchor plates, threaded with two 1¼ in. × .031 in. securement straps, to the trailer/container floor under the two-roll stack, six stacks back from the face of the first section (rolls B). Secure anchor plates to the trailer/container floor with 16d common nails. Use the maximum number of nails allowed by the plate design. Seal the securement straps at the anchor plates using two grit-type seals with two crimps per seal. Place a 12 in. long piece of 1¼ in. strap between the anchor plate and the securement straps to act as a buffer.

3. Locate anchor plates for the rear section of the load under the two-roll stack that is five stacks back from the rear of the load (rolls C). Attach 1¼ in. × .031 in. steel strapping in the same manner as above.

4. Load rolls located at the anchor positions on risers. Risers are corrugated fiberboard or equivalent material. Minimum riser height is 4 in. Use one riser 30 in. square or two risers 30 in. × 6 in. at each location. Riser(s) at each location must have a total load carrying capacity of 6,000 lb/ft^2.

5. Simultaneously tension straps at the rear of the load and seal them with two grit-type seals per strap with two crimps per seal.

6. Use strap stays made of slotted chipboard corner protectors or 2 in. × 4 in. lumber taped to the rolls or strap hangers to prevent straps from dropping out of position if some slack develops in transit.

7. A minimum 8 in. void is required between the last rolls and the trailer doors to ensure lading does not contact doors.

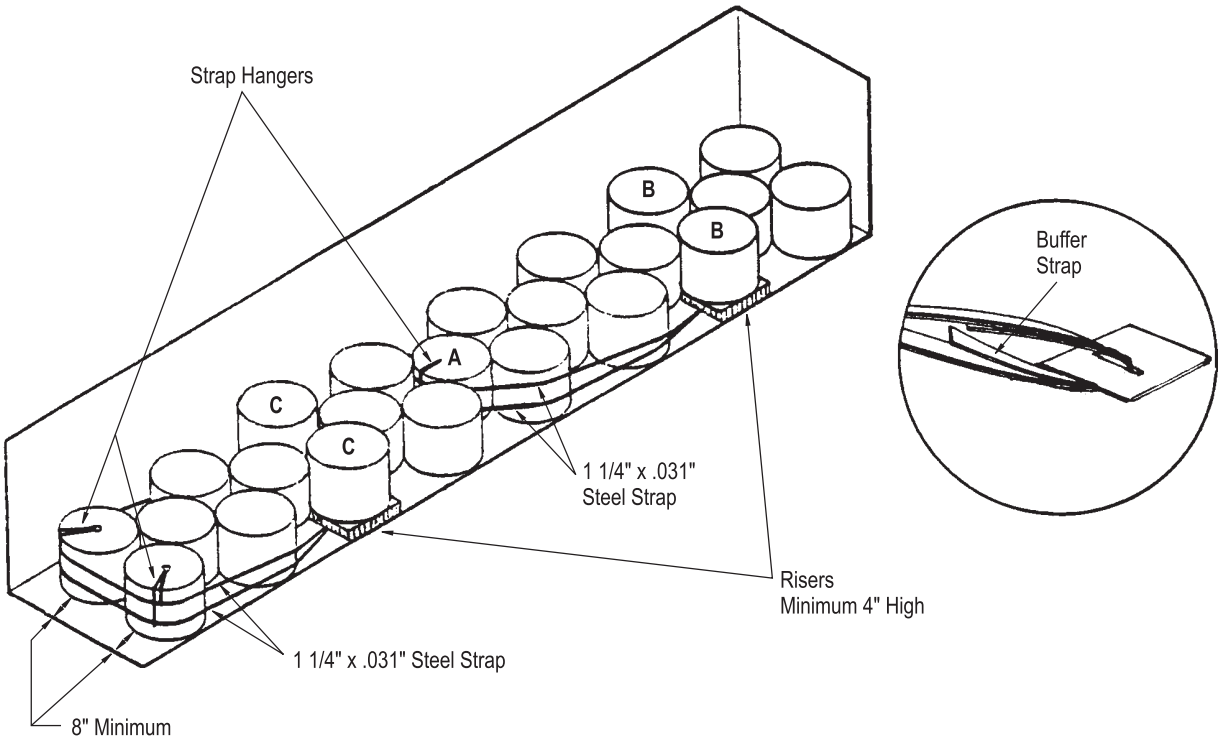


Illustration No. 51

Method A-5
40 in. Diameter Roll Printing Paper Secured by Two Steel Strap Barriers

B—TY-GARD 2000

Method B-1—Drums Loaded in Two or Three Sections Secured with Ty-Gard 2000 Barriers

Use the following bracing method for drums loaded only in a 4-3-4 pattern. The method of bracing involves restraint of the drums by use of Ty-Gard 2000 barriers that are attached to the sidewalls of the trailer/container. When used in trailers, restrict use of this method to trailers with horizontally oriented sidewall panels.

Illustration No. 52:

1. Load the drums into two or three sections. The three-section load has been successfully impact-tested up to 8 mph. The two-section load has been successfully impact-tested to 6 mph.

   a) In the two-section load, each section contains approximately one half of the total drums to be loaded.

   b) In the three-section load, each section contains approximately one third of the total drums to be loaded.

   c) The last stack in each section should contain three drums as shown in the illustration.

2. Secure each section with two 16 in. wide strips of the Ty-Gard 2000 bulkhead material. Attach this to the sidewalls (per manufacturer's instructions) with an adhesive strip at least 60 in. long and at least 36 in. back from face of load.

3. Drum protection consists of drum protectors or angleboard strips. If angleboard strips are used, apply three thicknesses of .250 in. solid fiberboard or equivalent at the rear barrier at the door of the trailer/container and two thicknesses at the other barrier(s) in the load.

4. Close and seal the Ty-Gard 2000 barriers for each section in accordance with manufacturer's instructions. Tape the bulkhead to the drum protectors to prevent slippage during handling.

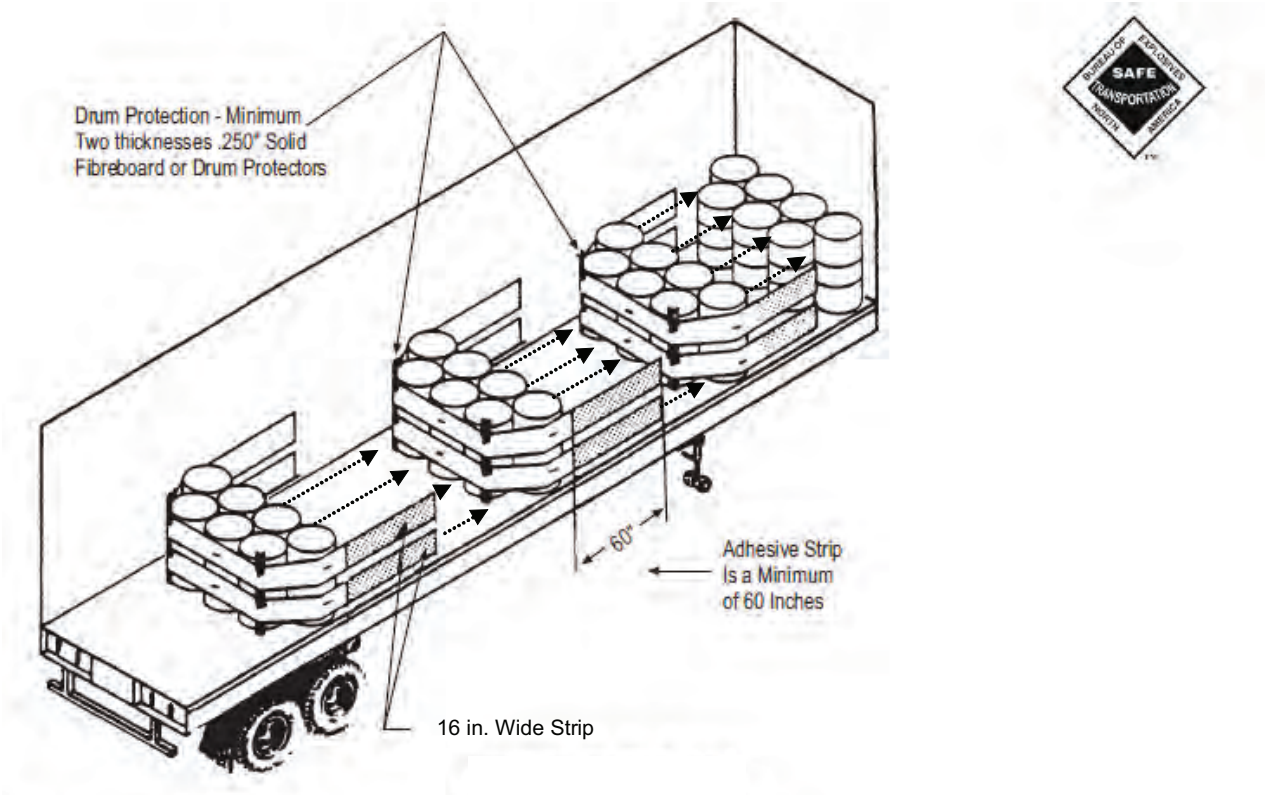


Illustration No. 52—Sketch 1

Method B-1
Drums Loaded in Three Sections Secured with Ty-Gard 2000® Barriers

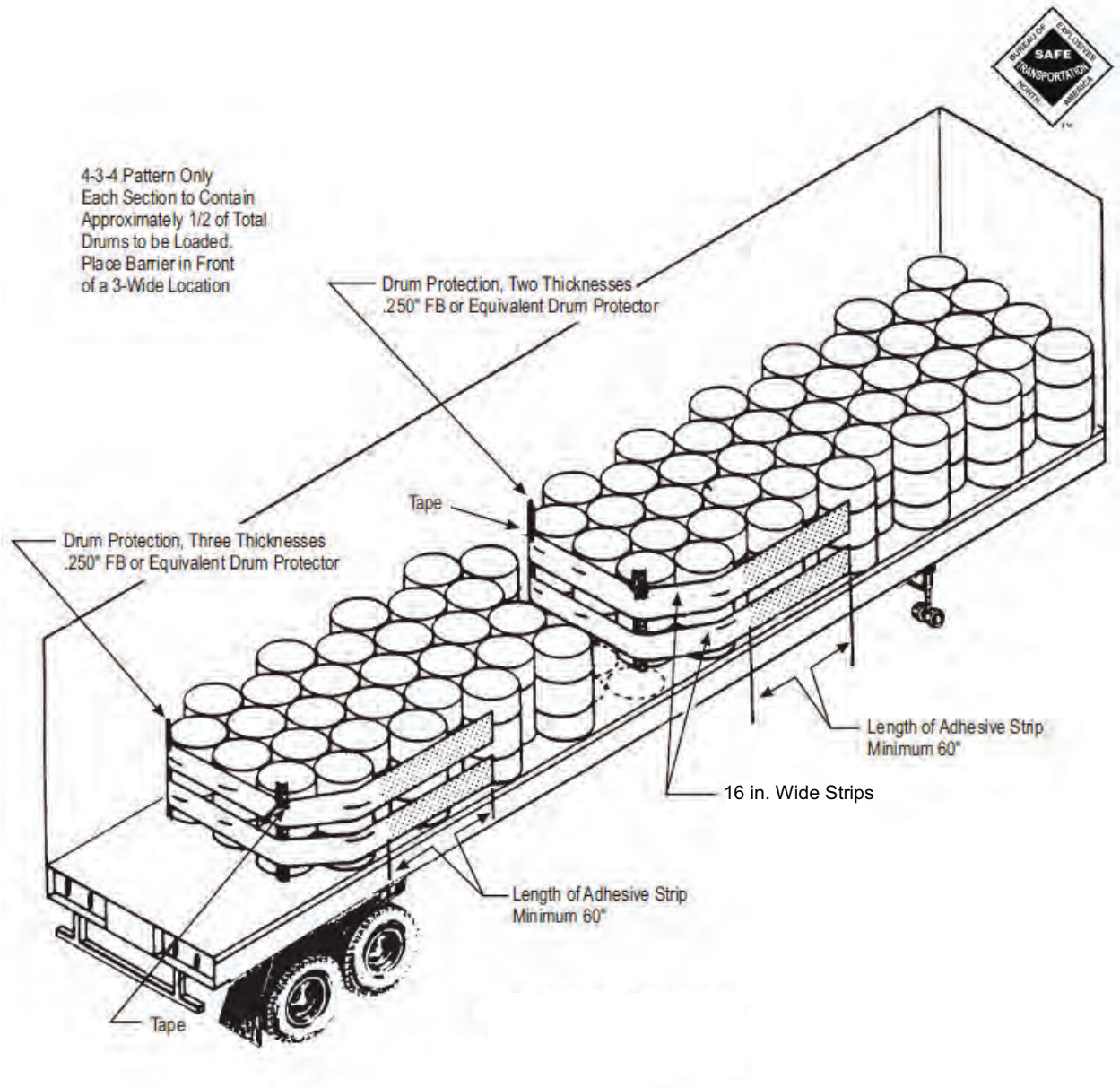


Illustration No. 52– Sketch 2

Method B-1
Drums Loaded in Two Sections Secured with Ty-Gard 2000® Barriers

Method B-2—Mixed Load Secured with Ty-Gard 2000 Barriers

Use the following bracing method for a mixed load containing either drums, bin pallets, or palletized products. The method of bracing involves restraint of the products by use of Ty-Gard 2000 that is attached to the sidewalls of the trailer/container. When used with trailers, restrict the load to trailers with horizontally oriented sidewall panels.

This method uses a Ty-Gard 2000 barrier. See Section III-G for barrier material specifications.

Illustration No. 53:

1. Drums (either steel or polyethylene) can be loaded only in a 4-3-4 pattern. The last stacks in these sections should contain three drums as shown in the illustration. Use suitable dividers between different product mix. When drums are loaded, this can be ¼ in. plywood or equivalent.

2. Secure each section with two 16 in. wide strips of Ty-Gard 2000. Attach this to the sidewalls (per manufacturer's instructions) with an adhesive strip at least 60 in. long and at least 36 in. back from the face of the load. When used with containers with corrugated sidewalls, follow contour of the corrugations.

3. Drum protection is required for sections containing drums. This may consist of drum protectors or angleboard strips. If angleboard strips are used, apply two thicknesses of .250 in. solid fiberboard or equivalent at each barrier of the trailer/container. Corner protection is required for palletized goods.

4. Close and seal the Ty-Gard 2000 barriers for each section in accordance with the manufacturer's instructions.

The load shown in Illustration 53 was the actual load tested. For illustration clarity, portions of the load have been omitted.

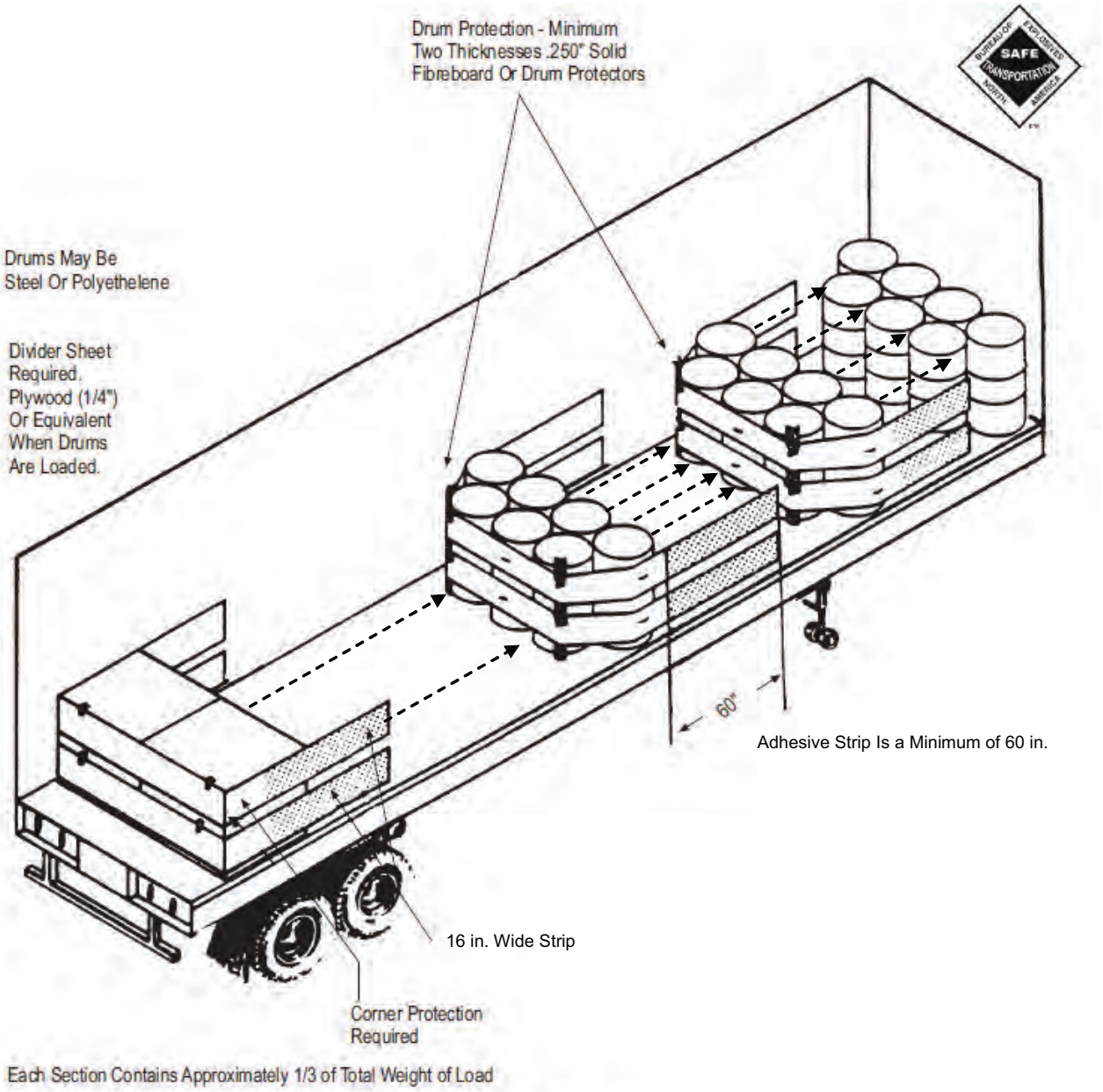


Illustration No. 53

Method B-2
Mixed Load Secured with Ty-Gard 2000® Barriers

Method B-3—Double-Layer Load Secured with Ty-Gard 2000 Barriers in a 20 ft Container

The following bracing method uses Ty-Gard 2000 barriers that are attached to the sidewalls of a container. See Section III-G for barrier material specifications.

Illustration No. 54:

1. This load may contain double-decked drums loaded in a 4-4 pattern (with the last stack in each section only containing drums three wide) or bin pallets or any palletized product two layers high. Any combination of product mix is acceptable. Each section contains approximately one half of the total weight in the container.

2. Use suitable dividers between different product mix. When drums are loaded, this can be ¼ in. plywood or equivalent.

3. Secure each layer of each section with two 16 in. wide strips of Ty-Gard 2000. Attach these to the sidewalls (per manufacturer's instructions) with an adhesive strip at least 60 in. long and at least 36 in. back from the face of the load. When used with containers with corrugated sidewalls, follow the contour of the corrugations.

4. Drum protection is required for sections containing drums. This may consist of drum protectors or angleboard strips. If angleboard strips are used, apply two thicknesses of .250 in. solid fiberboard or equivalent at each barrier of the container. Corner protection is required for palletized goods.

5. Close and seal the Ty-Gard 2000 barriers for each section in accordance with manufacturer's instructions.

The load shown in Illustration 54 was the actual load tested.

The following separators have been evaluated and found acceptable for one-time use with this loading method. These separators were tested under simulated conditions and their acceptance may be withdrawn if loads exhibit consistent load failures. If used with hazmat loads, these panels must be compatible with the contents of drums.

Name	Thickness	Description	Vendor
Drum Tite®	3.0 mm, 3.2 mm	Eucalyptus hardboard	Lodge Lumber
Drum Sep	3.2 mm	Eucalyptus hardboard	Pasadena Skid and Pallet Inc.
Ship Tite 2	.375 in.	Corrugated (*not* for use with corrosives)	Allegheny Industrial Associates
Ship Tite 3	.625 in.	Corrugated (*not* for hazmat use)	Allegheny Industrial Associates
Ship Tite 5	3.2 mm	Corrugated	Allegheny Industrial Associates
Generic	3.0 mm	Eucalyptus hardboard	Greif
PlyVeneer®	3.0 mm	Wood veneer with a Kraft linerboard overlay	PlyVeneer Products
Tier 55™	1.0 in., 0.50 in.	Corrugated	Damage Prevention Company

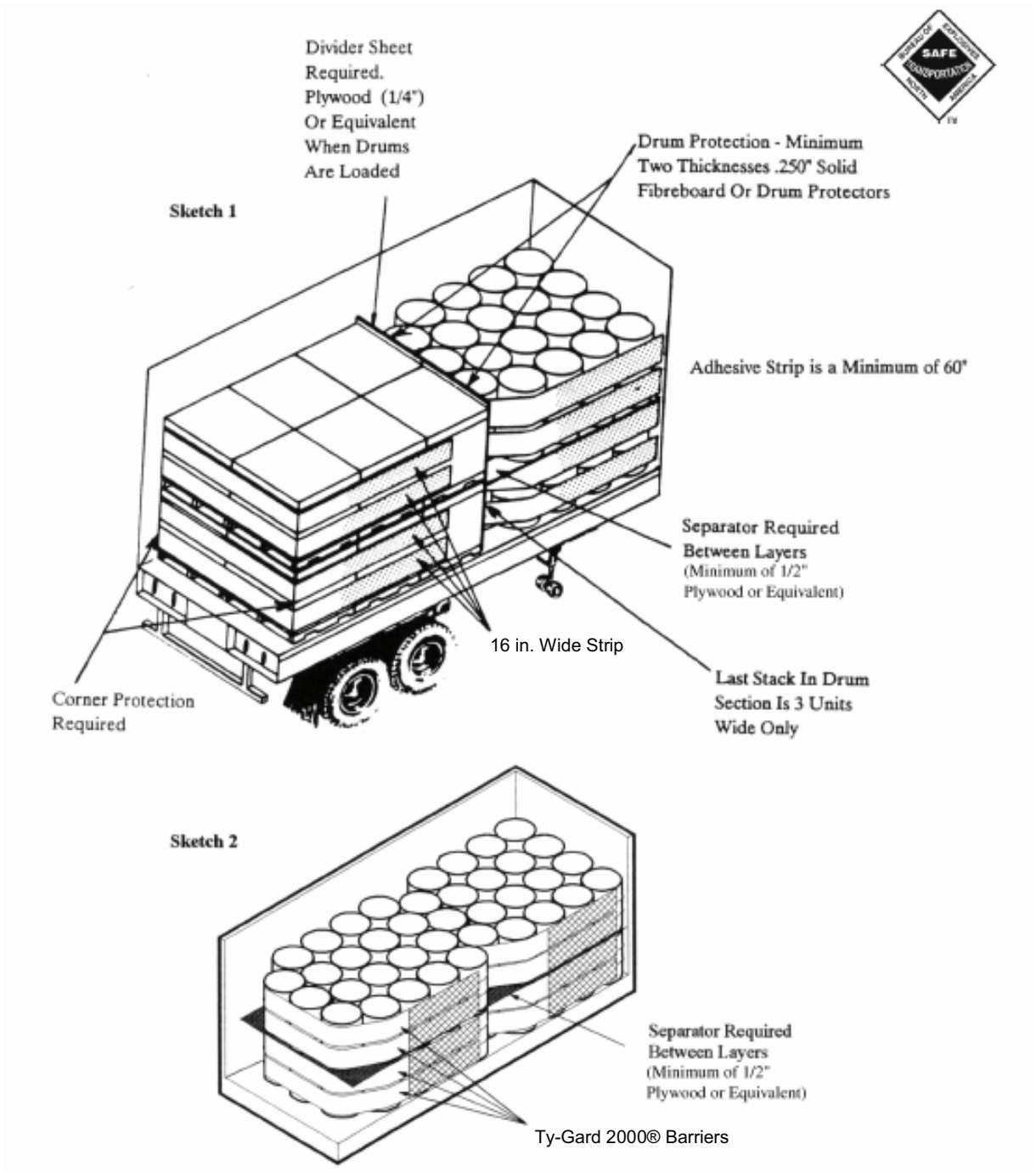


Illustration No. 54

Method B-3
Double Layer Load Secured with
Ty-Gard 2000® Barriers in a 20 ft Container

Method B-4—40 in. Diameter Roll Printing Paper Secured with Ty-Gard 2000 Barriers

This method uses Ty-Gard 2000 barriers. See Section III-G for barrier material specifications. Restrict use of this method to trailers with horizontally oriented sidewall panels. It was tested in a 102 in. wide trailer.

Illustration No. 55:

1. This method is restricted to a 2-1-2 pattern of 40 in. rolls of printing paper. The only exception is the first and second stack in the second section which are placed in a 2-2 pattern. If the length of the trailer allows, a 2-1-2 pattern can be used throughout. The last stack of each section has a single roll for placement of the Ty-Gard 2000 barriers. Each section contains approximately one half the weight of the load.

2. Secure each section with two 16 in. wide strips of the Ty-Gard 2000. Attach these to the sidewalls (per manufacturer's instructions) with an adhesive strip 60 in. long and at least 36 in. back from the face of the load.

3. Close and seal the Ty-Gard 2000 barriers for each section in accordance with the manufacturer's instructions.

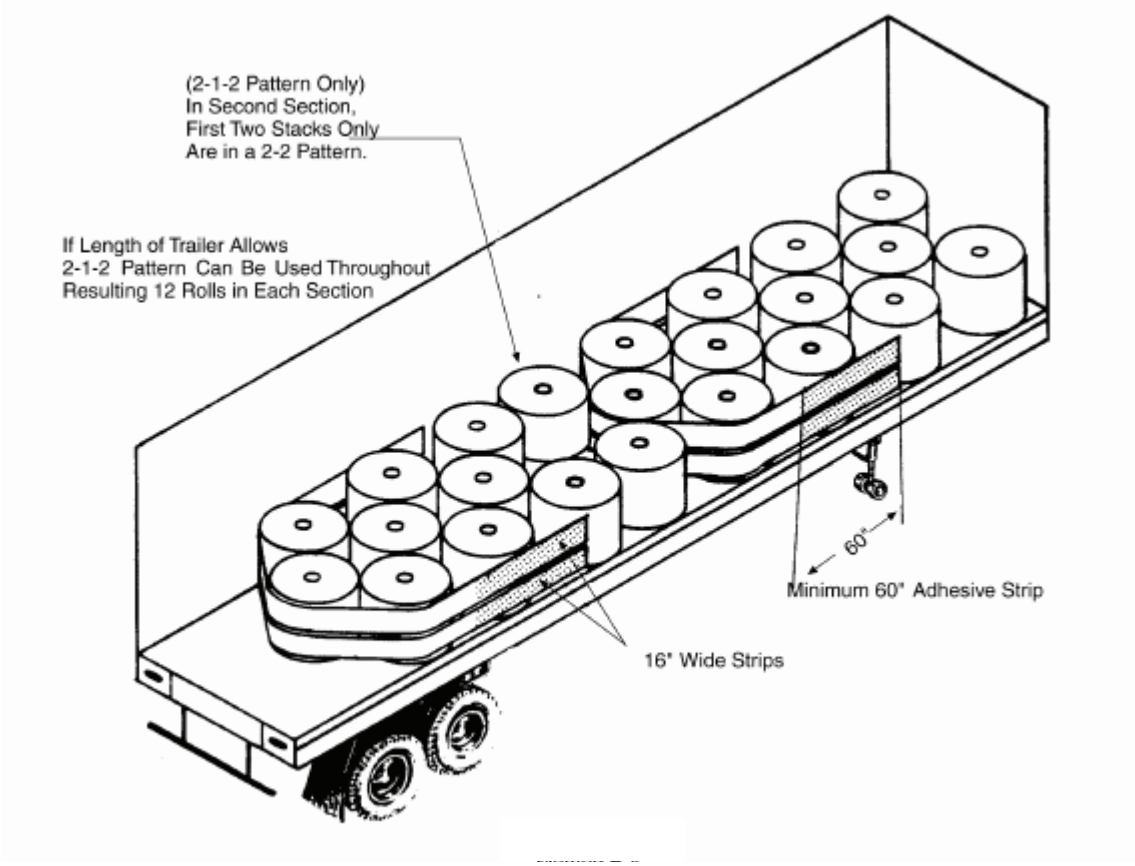


Illustration No. 55

Method B-4
40 in. Diameter Roll Printing Paper Secured with Ty-Gard 2000® Barriers

Method B-5—Brick Secured with Floor Blocking and Ty-Gard 2000 Barriers

Use this bracing method for packaged brick. It involves restraint of the brick by use of floor blocking and Ty-Gard 2000 barriers attached to the sidewalls of the trailer. Restrict use of this method to trailers with horizontally oriented sidewall panels. See Section III-G for barrier material specifications.

Stretch wrapping of the brick units is recommended to help maintain the integrity of the units.

Illustration No. 56:

1. Load brick multi-pack units (cubes) three units wide in two sections as shown in the illustration. Ensure that all package bands are secure, tight, and intact before loading. *Do not load cubes with loose or broken bands.* Place corrugated fiberboard or equivalent material between the stacks.

2. Place the first section, containing approximately half of the load, tight against the trailer nose. Place corrugated fiberboard across the face of the brick units to act as a buffer material between the brick units and the barrier.

3. Secure the brick using two 16 in. wide strips of Ty-Gard 2000. Attach these to the sidewalls (per manufacturer's instructions) with an adhesive strip 60 in. long and at least 36 in. back from the face of the load. Tape the Ty-Gard 2000 to the corrugated fiberboard to prevent sagging if it becomes slack in transit.

4. Close and seal each strip of Ty-Gard 2000 per manufacturer's instructions.

5. Nail laminated 2 in. × 4 in. × 8 ft cross-trailer floor blocking 1 in. from the face of the brick units using twenty-two 16d power-driven nails. *Placing the floor blocking 1 in. away from the face is crucial to the success of this method of bracing.* This allows the barrier to receive initial forces, and then the floor blocking can work in conjunction with the barrier. Nail five 2 in. × 4 in. × 18 in. laminated backup cleats perpendicular to the floor blocking using five 16d power-driven nails. Stagger the nails to prevent splitting of the blocking.

6. Load the second section of lading in the rear of the trailer. Location of this lading may be dependent on required spacing for proper weight distribution.

7. Secure the front and rear of the second section with Ty-Gard 2000 and floor blocking in the same manner as the rear of the first section.

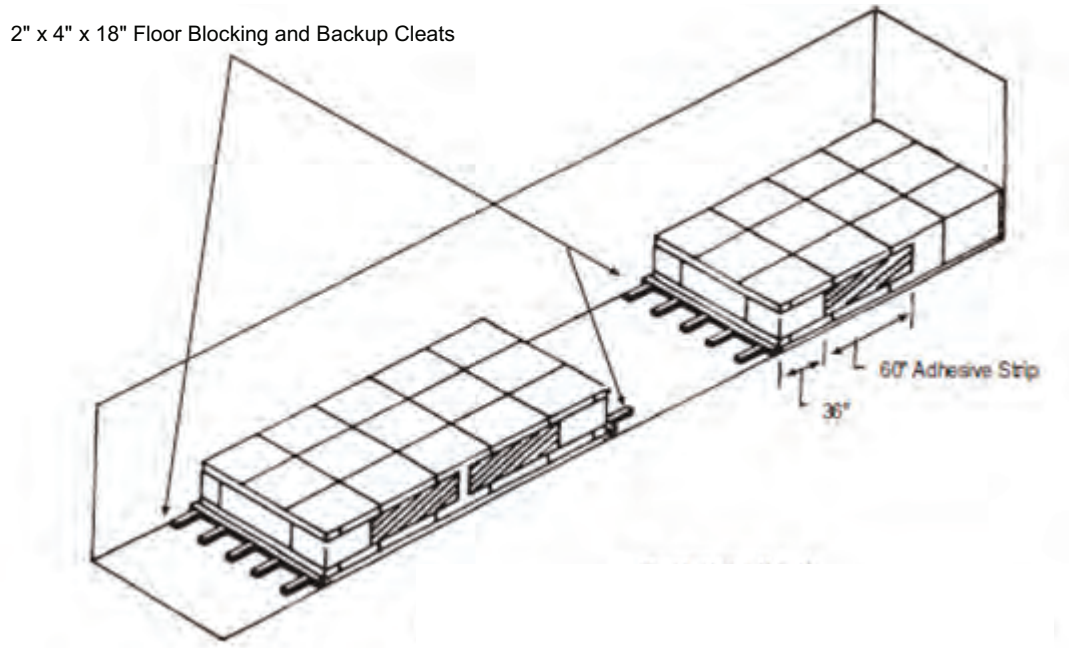


Illustration No. 56

Method B-5
Brick Secured with Floor Blocking and Ty-Gard 2000® Barriers

Method B-6—Bulk Boxes Secured with Floor Blocking and Ty-Gard 2000 Barriers

Use this bracing method for bulk fiberboard boxes secured to pallets, bulk bins, etc. Size the bulk fiberboard box to fit the dimensions of its pallet and secure it to the pallet. The method involves restraint of bulk containers by use of floor blocking and Ty-Gard 2000 barriers that are attached to the sidewalls of the trailer. Restrict use of this method to trailers with horizontally oriented sidewall panels.

This method uses Ty-Gard 2000 barriers. See Section III-G for barrier material specifications.

Illustration No. 57:

1. Divide the load into two sections. Each section should contain one half the weight of the load.

2. Secure each section with two 16 in. wide strips of the Ty-Gard 2000. Attach these to the sidewalls (per manufacturer's instructions) with an adhesive strip 60 in. long and at least 36 in. back from the face of the load.

3. Load the bulk containers in two rows, one against each sidewall, starting at the nose of the trailer.

4. Place guide rails of 2 in. × 4 in. lumber in the center void adjacent to each row. Center the guide rails 18 in. from each end of each section. Secure with 12d power-driven nails.

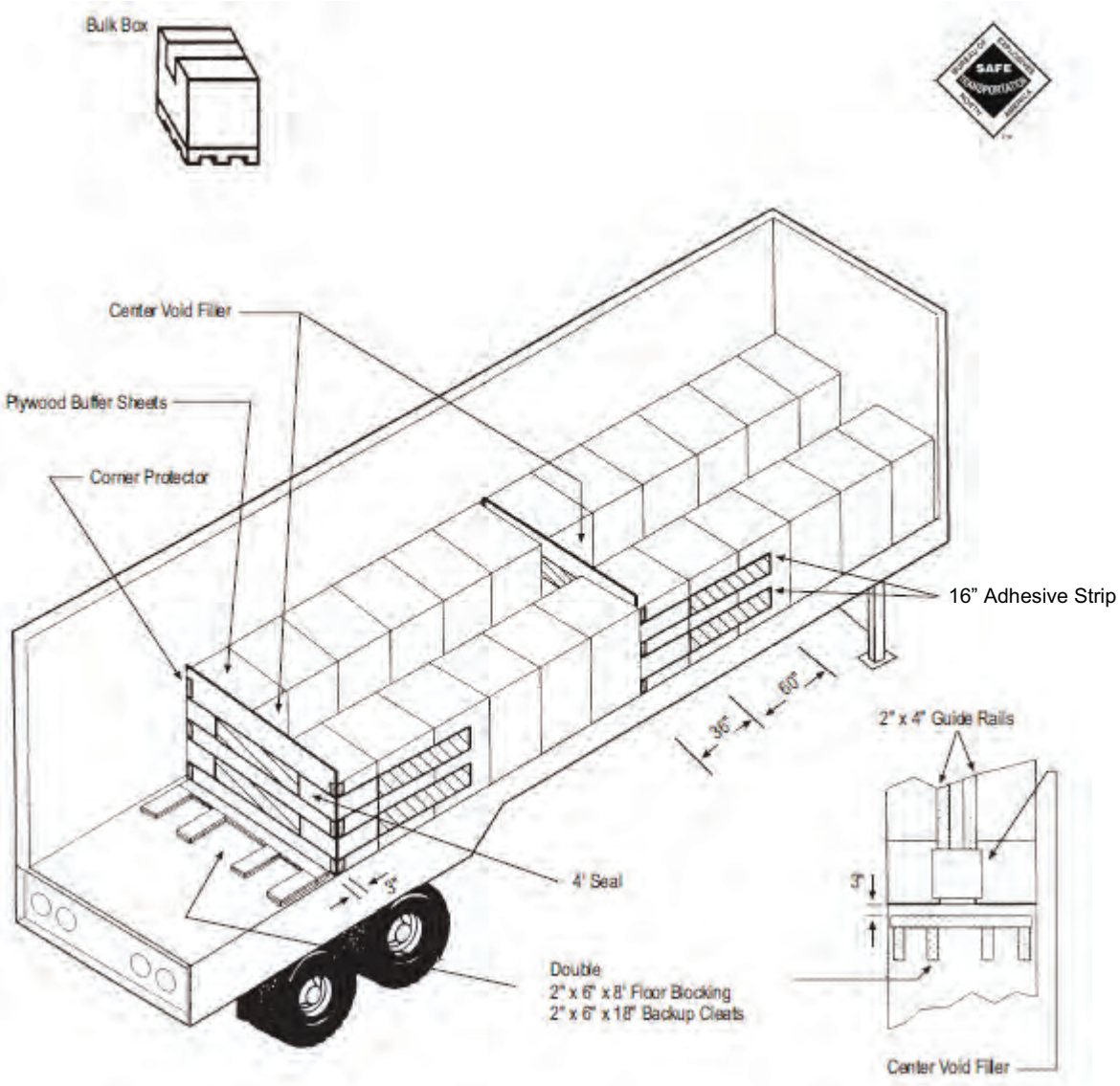
5. Use plywood sheets, ½ in. × 4 ft × 8 ft, as buffer sheets between the lading and the Ty-Gard 2000 barriers. Use corner protectors under the Ty-Gard 2000 barriers to protect the barriers from the edges of the buffer sheets and to prevent crushing of the bulk containers at the corners.

6. A center void filler is required in the last stack in each section, behind the barriers, to maintain lading position.

7. Close and seal each strip of Ty-Gard 2000 per manufacturer's instructions.

8. Nail laminated 2 in. × 6 in. × 8 ft cross-trailer floor blocking 3 in. from the face of the last section using thirty-six 12d (18 per layer) power-driven nails. *Placing the floor blocking 3 in. away from the face is crucial to the success of this method of bracing.* This allows the Ty-Gard 2000 barrier to receive initial forces, and then the floor blocking can work in conjunction with the barrier.

9. Nail four 2 in. × 6 in. × 18 in. laminated backup cleats perpendicular to the floor blocking using eight 12d (four per layer) power-driven nails. Stagger the nails to prevent splitting of blocking.



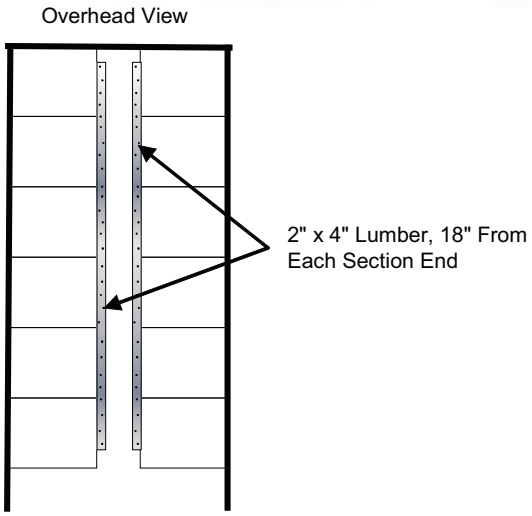


Illustration No. 57

Method B-6
Bulk Boxes Secured with Floor Blocking and Ty-Gard 2000® Barriers

Method B-7—Intermediate Bulk Containers for Liquids Secured with Ty-Gard 2000 Barriers

Use this bracing method for intermediate bulk containers for liquids. Size the intermediate bulk container to fit the dimensions of its pallet and secure it to the pallet. The method involves restraint of the intermediate bulk containers by use of Ty-Gard 2000 barriers that are attached to the sidewalls of the trailer. Restrict use of this method to trailers with horizontally oriented sidewall panels or containers.

Illustration No. 57A:

1. Load the intermediate bulk containers in a pinwheel pattern in two rows, one against each sidewall, starting at the nose of the trailer as shown in Illustration 57A**, Sketch 2**. Use corrugated fiberboard or honeycomb void fillers to fill crosswise voids between the rows. The containers may be loaded in a single layer or with an incomplete second layer, provided maximum weight limitations are not exceeded.

2. Divide the floor layer into three sections. **Sketch 2** shows the barrier locations in the load as tested. In general, each section should contain approximately one third the weight in the layer.

3. Secure each floor layer section with two 16 in. wide strips of the Ty-Gard 2000. Secure the Ty-Gard 2000 to the sidewalls with an adhesive strip at least 60 in. long and located at least 36 in. back from the face of the lading. Follow manufacturer's instructions for application.

4. If an incomplete second layer is loaded, position it in the center of the trailer to maintain proper weight distribution. Secure the incomplete layer at both the front and rear by three 16 in. wide strips of the Ty-Gard 2000. Secure the Ty-Gard 2000 to the sidewalls with an adhesive strip at least 60 in. long and located at least 36 in. back from the face of the lading. Follow manufacturer's instructions for application.

5. Use combination wood/honeycomb core divider panels (¾ in. thick), ½ in. thick plywood sheets, or equivalent material between the first and second layer intermediate bulk containers.

6. Close and seal each strip of Ty-Gard 2000 per manufacturer's instructions. Tape the Ty-Gard 2000 to the intermediate bulk containers to prevent sagging if it becomes slack in transit.

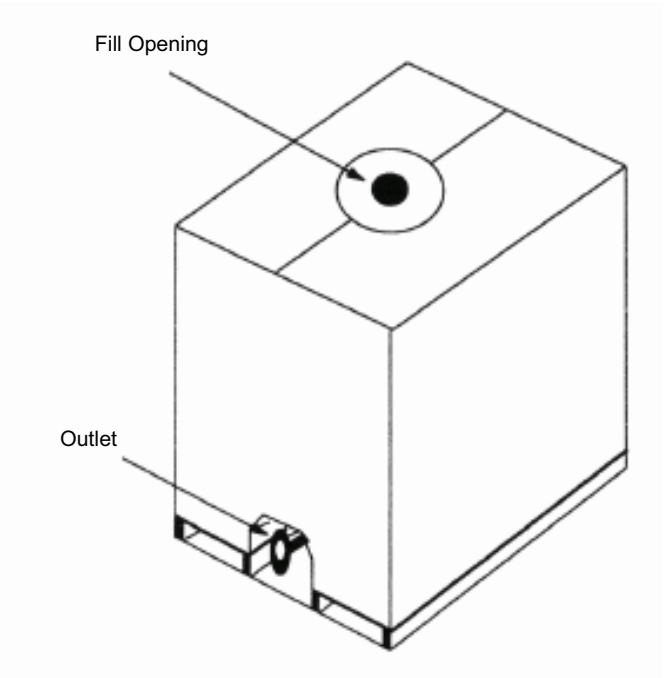


Illustration No. 57A, Sketch 1

Method B-7
Typical Intermediate Bulk Container

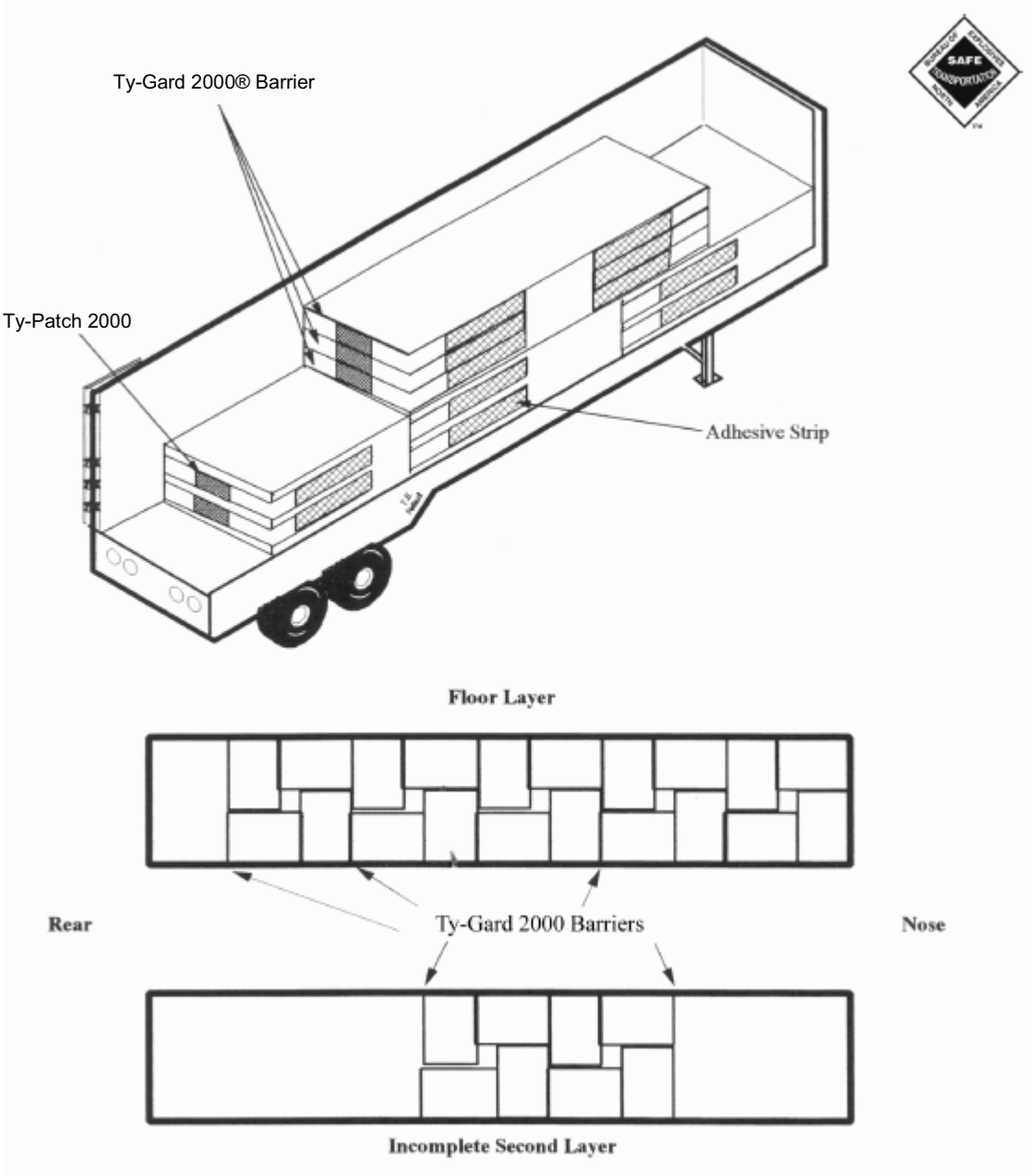


Illustration No. 57A, Sketch 2

Method B-7
Intermediate Bulk Containers Secured with Ty-Gard 2000® Barriers

Method B-8—Seventy-Eight to Eighty Tight-Head 55-Gallon Steel or Plastic Drums in Two Layers Secured by Ty-Gard 2000 in a 20 ft ISO Container

Use this loading method for 55-gallon steel or plastic tight-head drums in two layers in a 20 ft ISO container. Steel drums should have the W-style rolling hoop. Up to 80 drums can be loaded in a 4-4 pattern. A 4-3-4 or 4-4 pattern can also be used for 78-drum loads.

NOTE: Limit use of this loading method to 20 ft ISO containers.

Illustration No. 57B:

80-Drum Loads (Sketches 1 and 2):

1. Load forty drums in a 4-4 pattern in each layer for an eighty-drum load. Use ½ in. thick plywood, or equivalent strength, as a separator between each layer. The separator material runs the full width of the container and the full length of the load.

2. Secure the nose section of the load through the use of Ty-Gard 2000 barriers after the fifth stack. Secure each layer with two 16 in. wide strips of Ty-Gard 2000. Attach the Ty-Gard 2000 to the sidewalls (per manufacturer's instructions) with an adhesive strip at least 60 in. long and at least 36 in. back from the face of the last stack in this section. When used with containers with corrugated sidewalls, follow the contour of the corrugations.

3. Load the remaining drums in a 4-4 pattern. For securement of the rear of the load, position a ½ in. thick plywood sheet, 6 ft in length with width equal to the height of the drums, on its side edge and centered behind the last stack of each layer (two required). Secure the plywood sheet in the top layer to the drums with tape or strips of Ty-patch material. Position the plywood sheets between the drums and the Ty-Gard 2000 barriers. These sheets help keep the center drums in the last stack in position.

4. Secure the rear of the load using two Ty-Gard 2000 16 in. wide barriers per layer. Attach each barrier to the sidewalls of the container (per manufacturer's instructions) with an adhesive strip at least 60 in. long and at least one stack back from the face of the load. When used with containers with corrugated sidewalls, follow the contour of the corrugations.

5. Tension and seal all Ty-Gard 2000 barriers in accordance with the manufacturer's instructions.

80-Drum Loads (Modified Pattern)

6. Load forty drums in a 4-3-4-3-4-4-3-4-3-4-4 pattern in each layer for an eighty drum load. Use ½ in. thick plywood, or equivalent strength, as a separator between each layer. The separator material runs the full width of the container and the full length of the load.

7. Secure the nose section of the load through the use of Ty-Gard 2000 barriers after the sixth stack. Encompass only the center two drums of the sixth stack inside the barrier, leaving the two drums adjacent the sidewalls outside the barriers. Secure each layer with two 16 in. wide strips of Ty-Gard 2000. Attach the Ty-Gard 2000 to the sidewalls (per manufacturer's instructions) with an adhesive strip at least 60 in. long and at least 36 in. back from the face of the last stack in this section. When used with containers with corrugated sidewalls, follow the contour of the corrugations.

8. Load the remaining drums in a 4-3-4-3-4 pattern. For securement of the rear of the load, position a ½ in. thick plywood sheet, 6 ft in length with width equal to the height of the drums, on its side edge and centered behind the last stack of each layer (two required). Secure the plywood sheet in the top layer to the drums with tape or strips of Ty-patch material. Position the plywood sheets between the drums and the Ty-Gard 2000 barriers. These sheets help keep the center drums in the last stack in position.

9. Secure the rear of the load using two Ty-Gard 2000 wide barriers per layer. Attach each barrier to the sidewalls of the container (per manufacturer's instructions) with an adhesive strip at least 60 in. long and at least one stack back from the face of the load. When used in containers with corrugated sidewalls, follow the contour of the corrugations.

10. Tension and seal all Ty-Gard 2000 barriers in accordance with the manufacturer's instructions.

78-Drum Loads (Sketches 3 and 4):

11. Loads containing 78 drums can be loaded in 10 stacks using a 4-4 pattern or 11 stacks using a 4-3-4 pattern. If using a 4-4 pattern, secure the nose section after the fifth stack. If using a 4-3-4 pattern, secure the nose section after the sixth stack. See **Sketches 3 and 4** of the illustration. Use ½ in. thick plywood, or equivalent strength, as a separator between each layer. The separator material runs the full width of the container and the full length of the load.

12. If a 4-4 pattern is used, position three drums in each layer of the last stack in the container as shown in **Sketch 3**. Plywood sheets are not required at the end of the layers.

13. If a 4-3-4 pattern is used, position four drums in each layer of the last stack in the container as shown in **Sketch 4**. For securement of the rear of the load, position a ½ in. thick plywood sheet, 6 ft in length with width equal to the height of the drums, on its side edge and centered behind the last stack of each layer (two required). Secure the plywood sheet in the top layer to the drums with tape or strips of Ty-patch material. Position the plywood sheets between the drums and the Ty-Gard 2000 barriers. These sheets help keep the center drums the last stack in position.

14. Secure each section of the load using two Ty-Gard 2000 16 in. wide barriers per layer. Attach each barrier to the sidewalls of the container (per manufacturer's instructions) with an adhesive strip at least 60 in. long and at least one stack back from the face of the load. When used with containers with corrugated sidewalls, follow the contour of the corrugations.

15. Tension and seal all Ty-Gard 2000 barriers in accordance with the manufacturer's instructions.

NOTE: These load patterns and securement applications can be used for lesser numbers of drums. In these instances, the nose section of the load should contain approximately half of the load. Maintain proper weight distribution.

The following separators have been evaluated and found acceptable for one time use with this loading method. These separators were tested under simulated conditions and their acceptance may be withdrawn if loads exhibit consistent load failures. If used with hazmat loads, these panels must be compatible with the contents of drums.

Name	Thickness	Description	Vendor
Drum Tite	3.0 mm, 3.2 mm	Eucalyptus hardboard	Lodge Lumber
Drum Sep	3.2 mm	Eucalyptus hardboard	Pasadena Skid and Pallet Inc.
Ship Tite 2	.375 in.	Corrugated (*not* for use with corrosives)	Allegheny Industrial Associates
Ship Tite 3	.625 in.	Corrugated (*not* for hazmat use)	Allegheny Industrial Associates
Ship Tite 5	3.2 mm	Corrugated	Allegheny Industrial Associates
Generic	3.0 mm	Eucalyptus hardboard	Greif
PlyVeneer®	3.0 mm	Wood veneer with a Kraft linerboard overlay	PlyVeneer Products
Tier 55	1.0 in., 0.50 in.	Corrugated	Damage Prevention Company

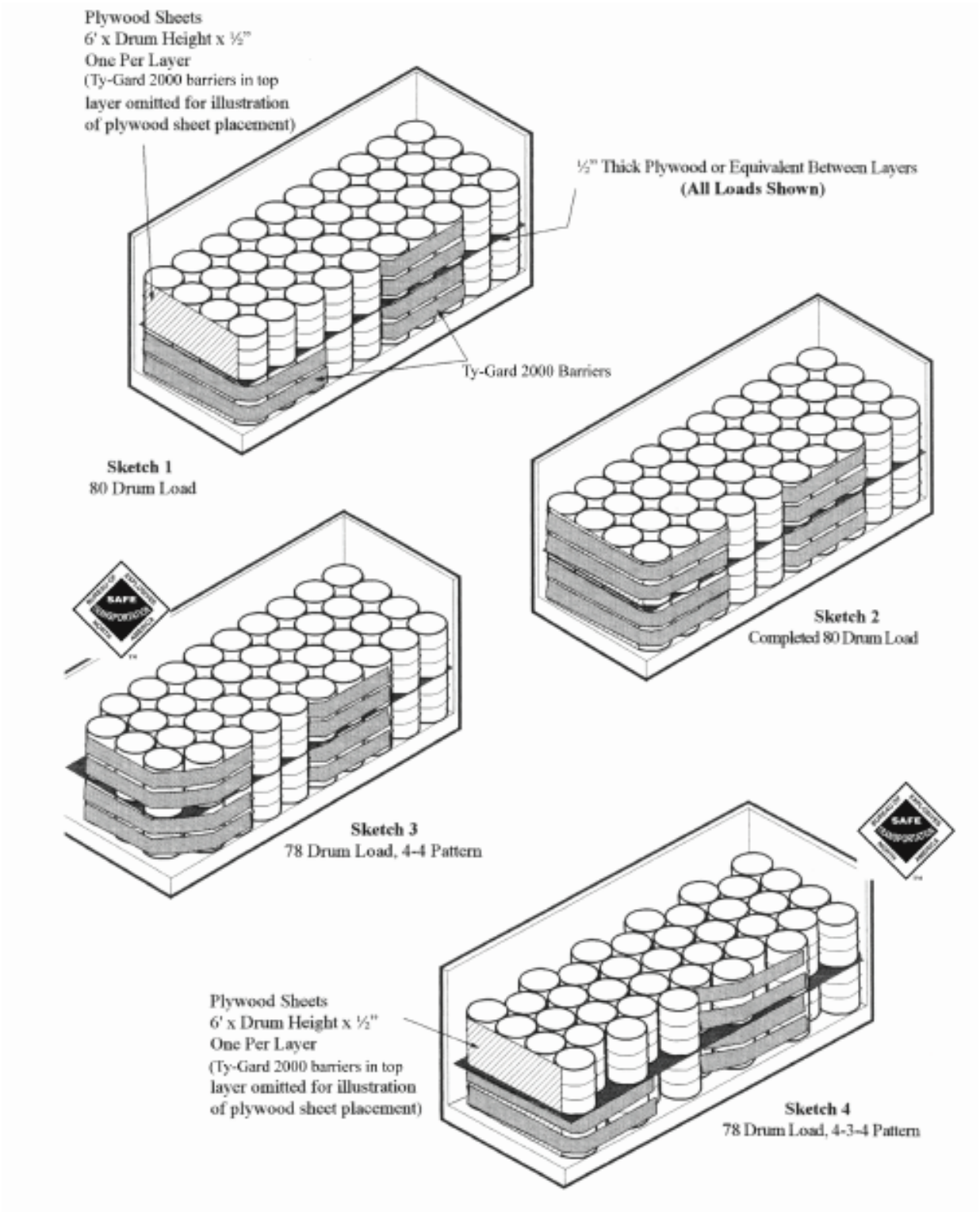


Illustration No. 57B

78 to 80 Tight-Head 55-Gallon Steel or Plastic Drums in Two Layers
Secured by Ty-Gard 2000® in a 20 ft ISO Container

C—PALLA-GARD™/DRUM-TITE™—CANCELLED

Method C-1—Cancelled November 2009

Method C-2—Cancelled November 2009

Method C-3—Cancelled November 2009

D—FREIGHTMATE™—CANCELLED

Method D-1—Cancelled June 2011

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E—RUBBER MATS

Method E-1—Coils on Skids with Rubber Mats on Floor in Refrigerated Equipment

Use refrigerated trailers only with floors made up of "T" rails or with ribbed floors.

The following procedures have been tested and found successful for delivering coils on skids with masticated rubber sheets on floors in refrigerated TOFC.

Illustration No. 62:

1. Only the following rubber sheet has been evaluated and found acceptable for this loading method:

Type:	Masticated Rubber Sheets (Load Grip®)—National Rubber Technologies Corp.
Thickness:	¼ in.
Weight:	17 g/in.^{3} average.
Tensile strength:	ASTM D-412, 677 psi average
Durometer hardness:	ASTM D-676, Shore A Type, 80 I average
Tear resistance:	ASTM D-624, Die B Nicked Specimens, 410 ppi average

Specifications for Load Grip® also can be found in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

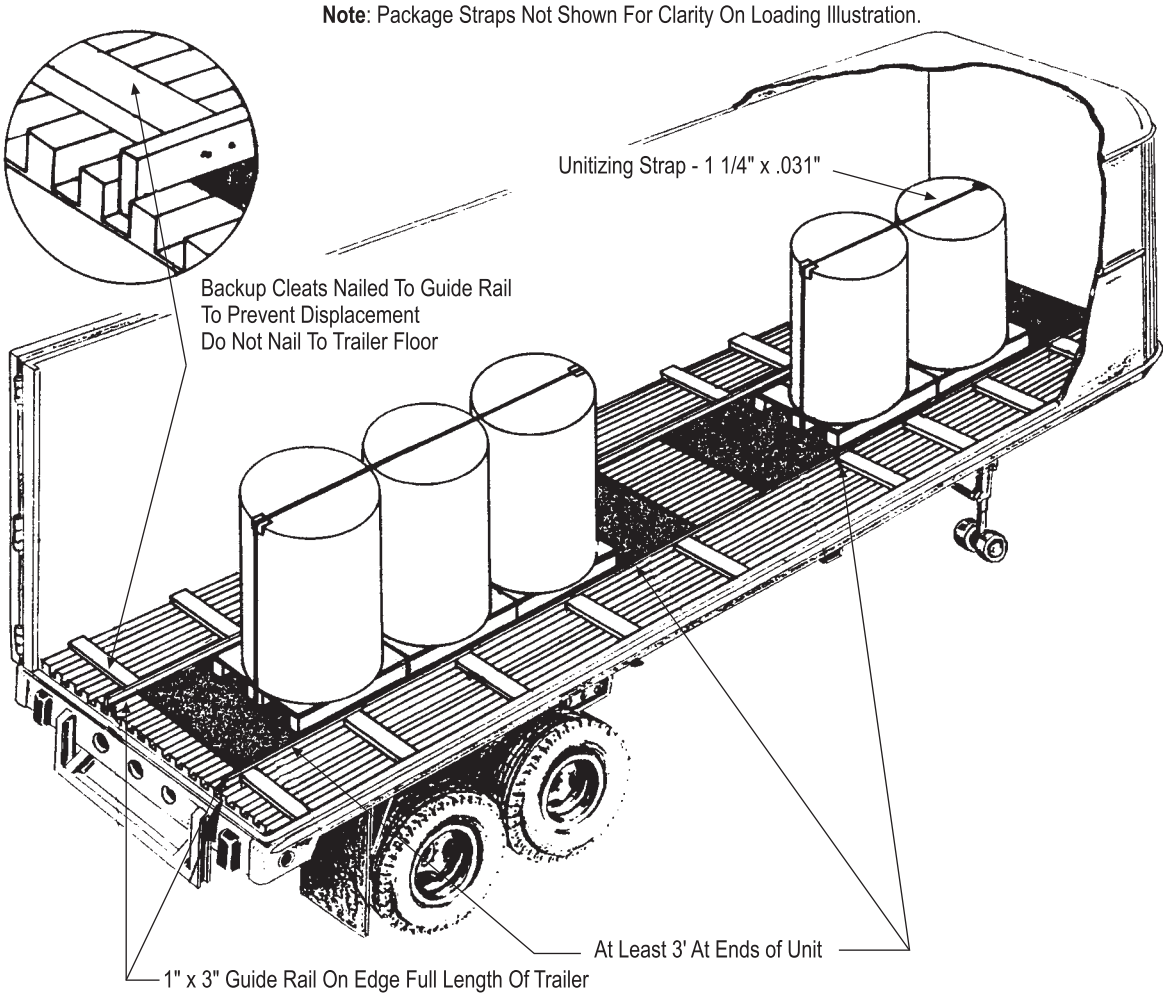
2. Use this loading method for a maximum of six coils loaded into two bays. Place two or three coils as a unit at the nose of the trailer. Position coils to give proper weight distribution lengthwise in the trailer. Place the remaining coils as a unit at least 3 ft from the doors of the trailer. No single coil units may be used. Use unitizing straps (1¼ in. × .031 in. or equivalent) around each unit. The packaging straps on each coil have an intersectional seal used to prevent slippage of these straps.

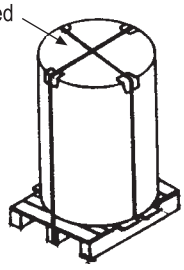
3. Cut the rubber mat 6 ft longer than each unit of coils. Place the unit of coils 3 ft from each end of the sheet. The location of the nose unit may be less than 3 ft due to weight distribution considerations. Have the width of the rubber mat greater than the width of the skid. It is recommended that mat width be no more than 4 in. to 8 in. greater than skid width.

4. Use 1 in. × 3 in. boards placed on edge in the channels of the floor, abutting the rubber mat. Boards run full length of trailer.

5. Use 2 in. × 4 in. backup cleats that are equal in length to the space between the guide rail and the side of the trailer. Use a minimum of three per unit on each side of the coils, keeping them evenly spaced. Nail to guide rail to prevent displacement. *Do not nail to trailer floor.*

NOTE: If individual coils exceed 3,500 lb, consult with your serving railroad.





Detail Of Coil Before Loading.

Concept Tested With 1 1/4" Package Strap.

Any lengthwise Underhang Of Coil On Skid Is To Be Filled.

Illustration No. 58

Method E-1
Coils on Skids with Rubber Mats on Floor in Refrigerated Equipment

Method E-2—Coils on Skids with Rubber Mats on Floor (Hardwood Flooring)

Use general service trailers or containers with hardwood floors. When using this loading method, position coils to achieve proper weight distribution and minimize the chances for improper weight distribution if slight lengthwise lading shift occurs.

NOTE: If individual coils exceed 3,500 lb, consult with your serving railroad.

The following procedures have been tested and found successful for delivering coils on skids with masticated or rebonded rubber mats on floors.

Illustration No. 63:

1. Only the following rubber sheet has been evaluated and found acceptable for this loading method:

Type:	Masticated Rubber Sheets (Load Grip®)—National Rubber Technologies Corp.
Thickness:	⅛ in.
Weight:	17 g/in.^{3} average
Tensile strength:	ASTM D-412, 677 psi average
Durometer hardness:	ASTM D-676, Shore A Type, 80 I average
Tear resistance:	ASTM D-624, Die B Nicked Specimens, 410 ppi average

Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 7513	0.250 in.	Allegheny Industrial Associates, an ITW company
Rubber Restraint Mat BC548	0.250 in.	Amorim Industrial Solutions

Specifications for these rubber mats are provided in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. Use this loading method for a maximum of six coils loaded into two sections. Place two or three coils as a unit at the nose of the trailer. Position coils to give proper weight distribution lengthwise in the trailer. Place the remaining coils as a unit at least 3 ft from the doors of the trailer. No single coil units may be used. Use unitizing straps (1¼ in. × 0.31 in. or equivalent) around each unit. The packaging straps on each coil have an intersectional seal used to prevent slippage of these straps.

3. Cut the rubber mat 6 ft longer than each unit of coils. Place the unit of coils 3 ft from each end of the sheet. The location of the nose unit may be less than 3 ft due to weight distribution considerations. Have the width of the rubber mat greater than the width of the skid. It is recommended that the mat width be no more than 4 in. to 8 in. greater than the skid width.

4. Use 2 in. × 4 in. guide rails as long as each rubber mat on each side of each unit, abutting the rubber mat. Secure guide rails with 12d nails staggered 6 in. on center.

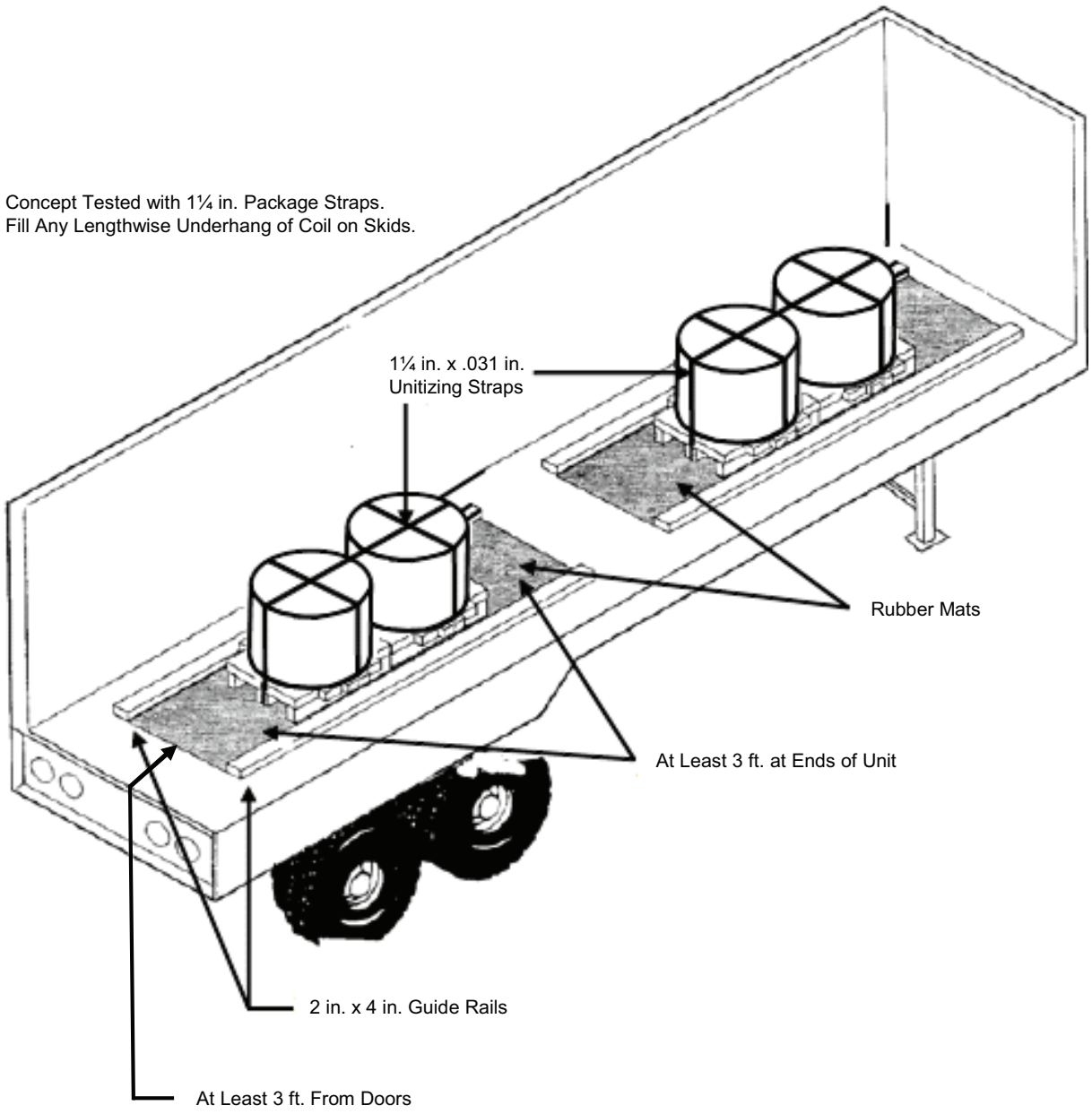


Illustration No. 59

Method E-2
Coils on Skids with Rubber Mats on Floor
(Hardwood Flooring)

Method E-3—Wire Cable Coils in Cradles Using Guide Rails and Rubber Mats

Use this loading method for small to large coils of wire cable. Divide the total weight of the lading into two approximately equal sections. During actual testing, each individual coil weighed approximately 6,180 lb.

NOTE: If individual coils exceed 3,500 lb, consult with your serving railroad.

Use general service trailers or containers with hardwood floors. Some lading shift may occur when using this loading method. Position coils to achieve proper weight distribution and to minimize the chances for improper weight distribution if slight lengthwise lading shift occurs.

Illustration No. 64:

1. Depending on the individual coil sizes, up to six 1¼ in. × 0.031 in. steel packaging bands are needed. Thread the bands longitudinally through the eye of the coil and equally spaced around the coil's circumference.

2. Fabricate cradles from wood 4 × 4s. The cradles have a length and width at least the same as the wire coils.

3. Place the coils on the fabricated wooden cradles. Support the wire coils with wood 2 × 4s that are bolted to the cradles. Secure the coils to the cradles by wrapping one 1¼ in. × 0.031 in. steel band laterally around the outside of the wire coil and the support blocking.

4. On each side of the trailer/container, abut and nail two wooden 2 in. × 4 in. guide rails edge to edge using minimum 12d nails. Place nails 4 in. on center staggered. The guide rail width needs to be a little wider (½ in. to 1 in.) than the width of the cradles. The extra width allows the load to float within the guide rails. The guide rails extend 3 ft past the load for a proper load-floating area.

5. Load the coils in two sections. Position one section near the nose of the trailer. Position the unit to give proper weight distribution lengthwise of the trailer/container. Place the second section at least 3 ft from the trailer/container doors. Place rubber mats to extend 3 in. to 4 in. beyond each end of each coil unit. If more than one mat is required under a coil unit, overlay the ends of the mats 4 in. to 6 in.

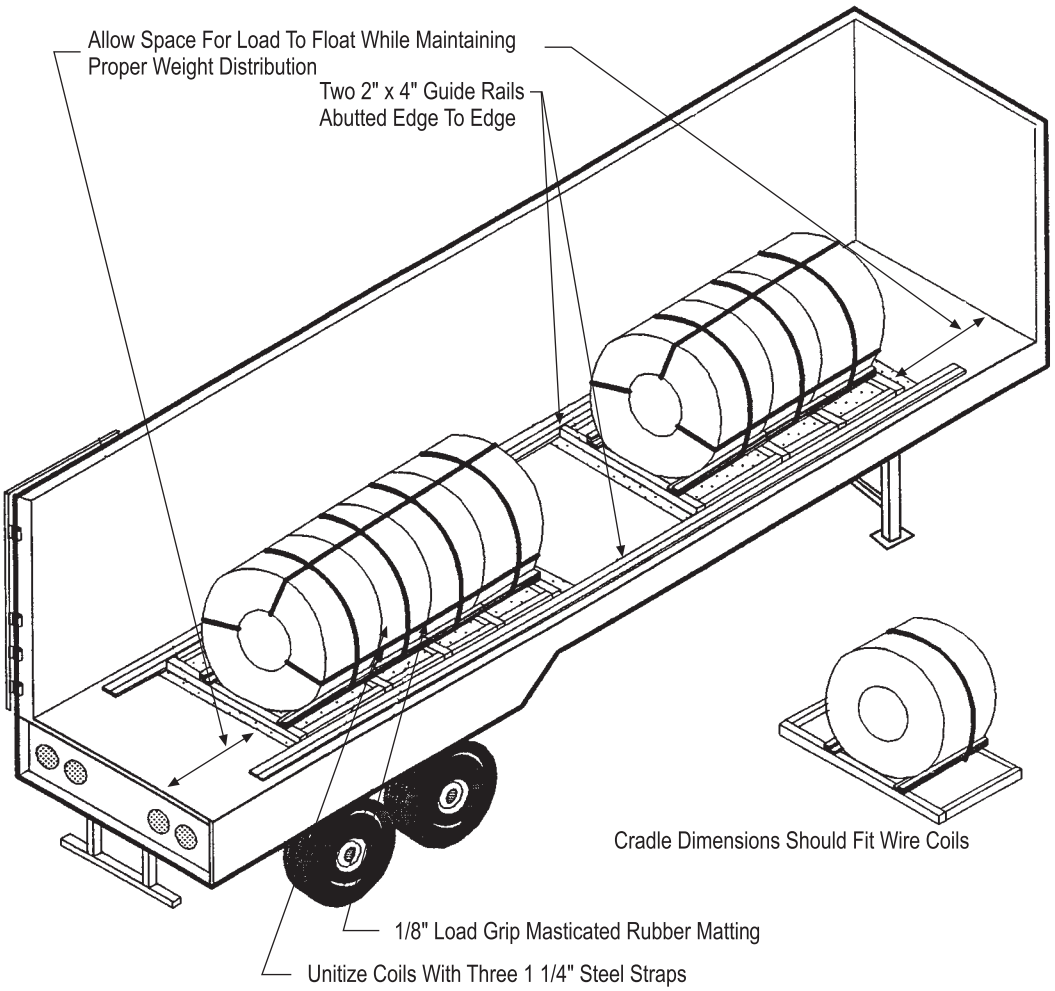
Only the following rubber sheet has been evaluated and found acceptable for this loading method:

Type:	Masticated Rubber Sheets (Load Grip®)—National Rubber Technologies Corp.
Thickness:	3 mm (0.125 in.) thick
Weight:	17 g/in.^{3} average
Tensile strength:	ASTM D-412, 677 psi average
Durometer hardness:	ASTM D-676, Shore Type, 80 I average
Tear resistance:	ASTM D-624, Die B Nicked Specimens, 410 ppi average

Specifications for Load Grip® also can be found in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

6. Unitize three to four coils in each section with three 1¼ in. × 0.031 in. steel bands. Thread the bands longitudinally through the eyes of the coils at 4, 8, and 12 o'clock positions.



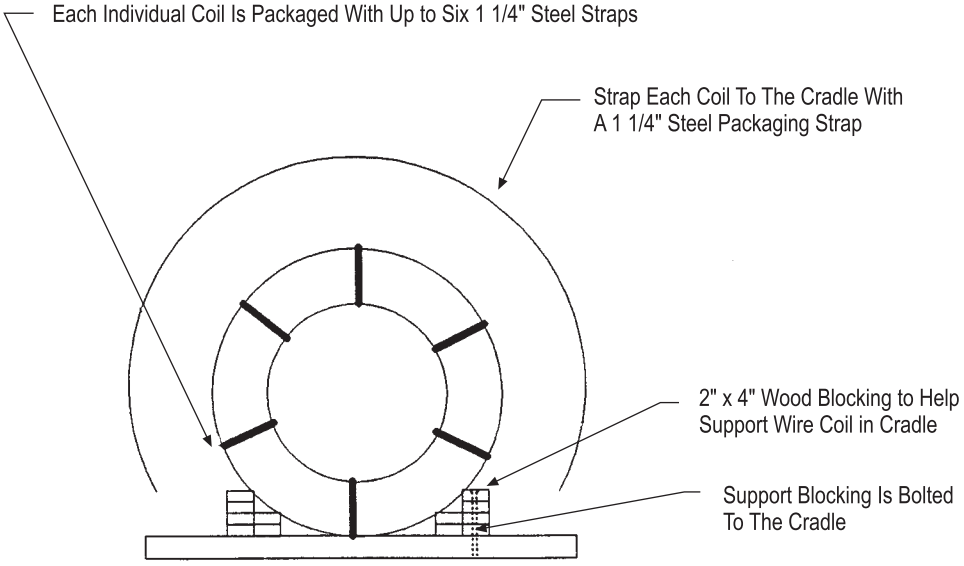


Illustration No. 60

Method E-3
Wire Cable Coils in Cradles Using Guide Rails and Rubber Mats

Method E-4—58 in. Diameter Roll Pulpboard on End Using Rubber Mats

Use this method for 58 in. diameter roll pulpboard loaded on end in a 1-1 offset pattern in a trailer or container for intermodal service. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 65:

1. Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Description	Vendor
TransMat™ 7513	3mm (0.125 in.)	Continuous rolls	Allegheny Industrial Associates, an ITW company
TransMat™ 6900	2mm (0.080 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	
	3mm (0.125 in.)	Continuous rolls	
TransMat™ 8060	2mm (0.080 in.)	Continuous rolls	
Rubber Restraint Mat BC548	2mm (0.080 in.) 3mm (0.125 in.)	Continuous rolls	Amorim Industrial Solutions
Load Grip® 5	1.5mm (0.059 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	National Rubber Technologies Corp.
	2mm (0.080 in.)	3 ft × 3 ft square sections	
Load Grip® 6	2 mm (0.080 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	
Zro-Shift™	2 mm (0.080 in.)	30 in. × 42 in. sheets	Sunrise Manufacturing Inc.
Load Lock™	3mm (0.125 in.)	Continuous rolls	RB Rubber Products, Inc.
Brown Bear™ Friction Mat 101	2mm (0.080 in.) 3mm (0.125 in.	Continuous rolls	Circle, Inc.
Load Secure™ 6910	2mm (0.080 in.)	Continuous rolls	Regupol America

Specifications for these rubber mats are in Appendix D. The mats are not secured to the trailer floor.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. Divide the load into two sections. The nose section should consist of three or four rolls. Use the appropriate size mat for the number of rolls being loaded.

> If *four rolls* are loaded in the nose section, use two 4 ft × 17 ft mats at the nose placed side by side. The following may also be used: two rows of five 3 ft × 3 ft sections of approved rubber mats and one 3 ft × 20 in. section of approved rubber mat installed end to end with the next-to-last mat in each row cut to 20 in. to allow more of the last mat to be under the last roll; or one row of four 30 in. × 42 in. sections of approved rubber mat installed end to end and centered under the rolls in the nose section.
>
> If *three rolls* are loaded in the nose section, use two 4 ft × 14 ft mats at the nose placed side by side. The following may also be used: two rows of four 3 ft × 3 ft sections of approved rubber mats and one 3 ft × 20 in. section of approved rubber mat installed end to end with the next to last mat in each row cut to 20 in. to allow more of the last mat to be under the last roll; or one row of four 30 in. × 42 in. sections of approved rubber mat installed end to end and centered under the rolls in the nose section.

3. If *four rolls* are loaded in the nose section, load the four rolls tightly starting against the nose and using a 1-1 offset pattern. See **Sketch 3.**

4. If *three rolls* are loaded in the nose section, load the first roll so it is centered in the trailer against the nose. Place void fillers, 3 in. × (void width) × 48 in. corrugated fiberboard with 1,500 lb minimum crush strength, on either side of the trailer at the nose. Position void fillers so that the crush strength is crosswise to the trailer or container. If using multiple void fillers in tandem, unitize them to restrict independent movement. See **Sketch 2.** Ladder-type lumber side-blocking can be used as an alternative to the void fillers provided it is 3 in. in height and extends a minimum of 48 in. from the nose of the trailer. Lumber side-blocking may also be used as an alternative provided it is 3 in. in height, extends a minimum of 48 in. from the nose of the trailer, and is secured adequately using 12d nails. Load the next two rolls tightly lengthwise against opposite sidewalls of the trailer as shown in **Sketch 2.**

5. A minimum of 3 ft of void is required between the lading and the trailer doors. Position the rear section to obtain the proper load weight distribution, and maintain the 3 ft void at the rear of the trailer.

6. Load the rear section consisting of four rolls by using two 4 ft × 16 ft mats placed side by side or by using an appropriate number of 3 ft × 3 ft or 30 in. × 42 in. sections of approved rubber mat placed side by side and centered under the rolls. Position the mats to extend a minimum of 6 in. beyond the rolls at each end of each mat. Place the rolls on the mats in a 1-1 offset pattern.

7. Unitize the rear section (at trailer doors) with one approved polyester cord strap or one ⅝ in. × .040 in. approved polyester plastic strap. Position the unitizing strap at a maximum height of 4 ft above the trailer floor. Be sure the strap is level. Tension and seal the straps using proper tensioning and sealing tools.

> If using approved polyester cord strap, a wire buckle with legs (prongs) on the same side of the frame and that has a non-slip surface is required. See Section III-F for approved polyester cord strapping.
>
> If using a ⅝ in. × .040 in. approved polyester plastic strap, a heat seal, a friction weld, or metal seals may be used to seal the strap. A minimum joint strength of 900 lb is required. See Section III-F for approved polyester plastic strapping.

8. Position two strap hangers on each trailer sidewall at the rear section as indicated in **Sketch 1** to maintain proper strap alignment and to prevent straps from slipping out of position. Strap hangers may be solid fiberboard secured by use of adhesive, tape, or staples; or looped cord strap secured by staples. Use adhesive or tape that is heat and cold resistant for this purpose. Do not use tape as the strap hanger. If additional strap hangers are positioned on the rolls, be sure they are positioned so that the strap remains level.

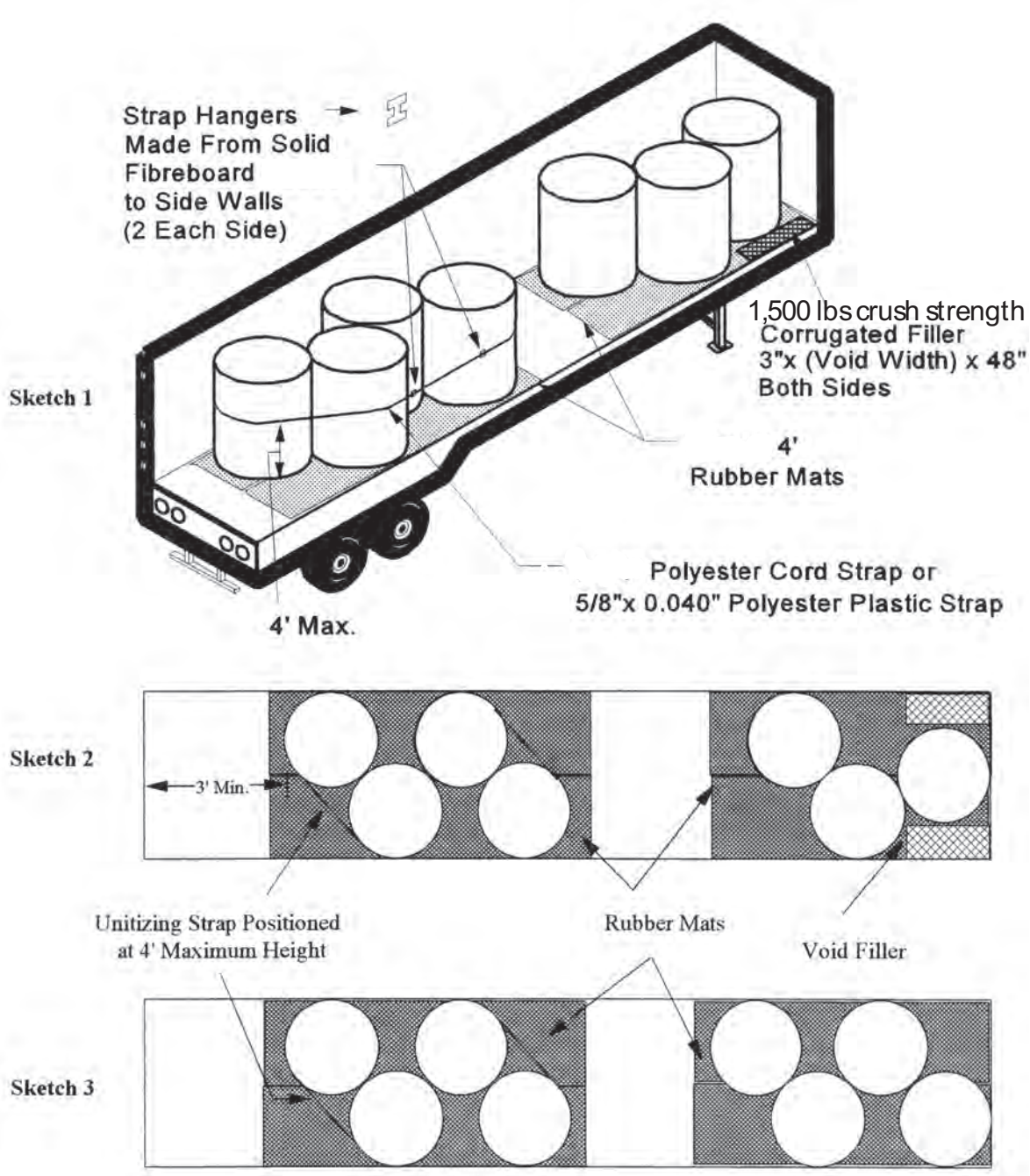


Illustration No. 61

Method E-4
58 in. Diameter Roll Pulpboard on End Using 4 ft Wide Rubber Mats

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Method E-5—50 in. Diameter Rolls of Wrapping Paper on End Using Rubber Mats

Use this loading method for 50 in. diameter roll wrapping paper loaded on end in a 1-1 offset pattern in a trailer or container for intermodal service. This method was tested in a 102 in. wide trailer. Plan the load to *equalize the weight on each side of the trailer or container*. Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 66:

1. Use ¼ in. thick rubber mats.

Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 7513	0.250 in.	Allegheny Industrial Associates, an ITW company
Rubber Restraint Mat BC548	0.250 in.	Amorim Industrial Solutions

Specifications for these rubber mats are in Appendix D.

2. Divide the load into two sections, each containing approximately half of the load.

3. Load the first section in a 1-1 offset pattern starting at the nose of the trailer.

4. Load the second section also in a 1-1 offset pattern approximately 180 in. behind the first section. This section should be at least 3 ft from the doors when loading is completed.

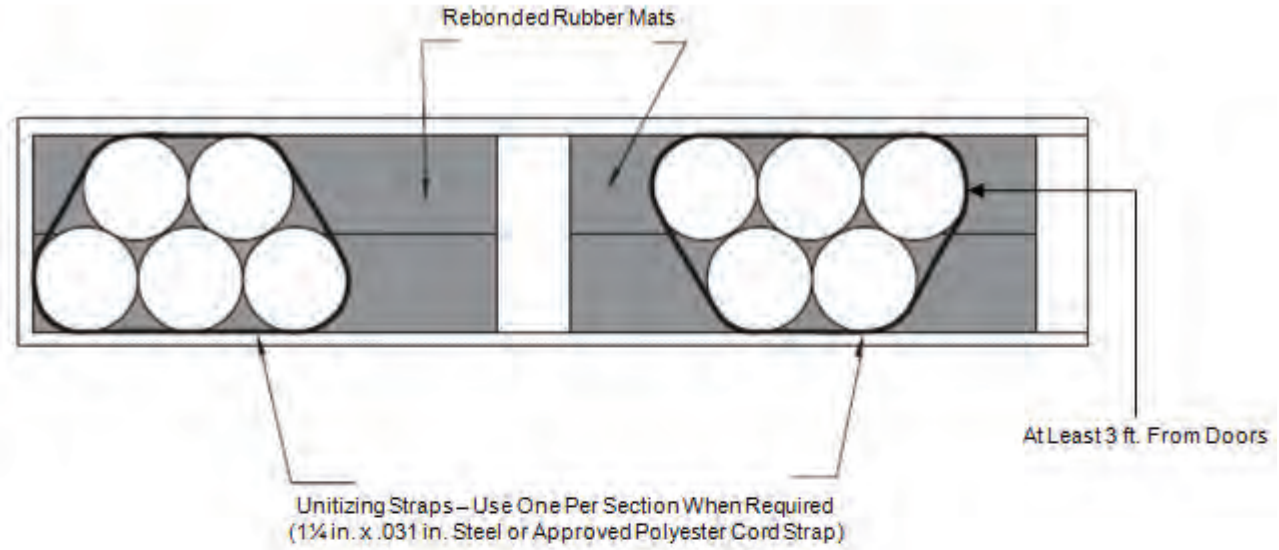
5. Load each section on two 4 ft × 17 ft × ¼ in. thick rubber mats placed side by side. An equal amount of rubber mat extends from under the front and rear of the second section. Do not secure the mats to the trailer floor.

6. If roll width exceeds 1.5 times roll diameter (75 in. for a 50 in. diameter roll), unitize each section with one 1¼ in. × 0.031 in. steel strap or one approved polyester cord strap using the correct buckle in accordance with manufacturer's instructions (see Section III-F for approved polyester cord strapping). Tension and seal straps using proper tensioning and sealing tools. Use strap hangers or tape to maintain proper strap alignment.

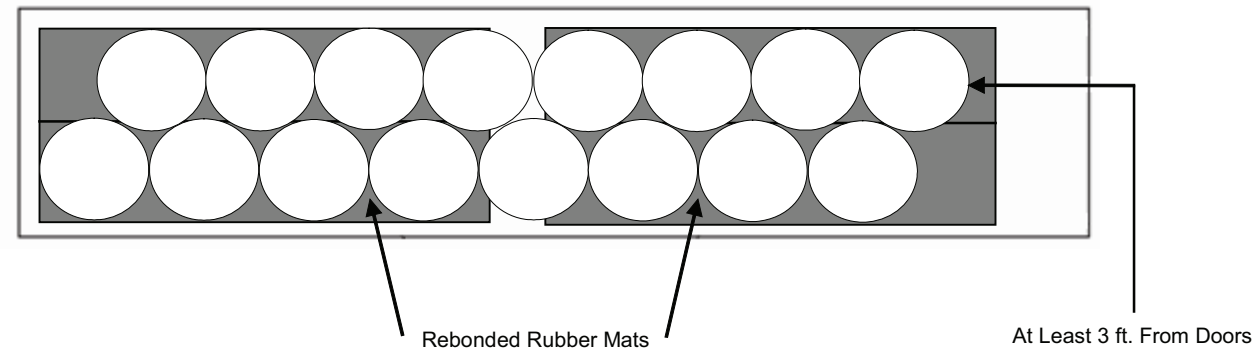
NOTE: Rolls can be loaded in one section starting at the nose and continuing to the rear of the trailer if necessitated by the number of rolls being loaded. Use the same number and size of rubber mats as specified above.

Place two mats in the nose of the trailer and two at the rear of the lading. See Illustration 62 for an example of this type load. Unitizing straps are not required for rolls loaded in one section from the nose of the trailer.

NOTE: Do not use rubber mats if torn or otherwise damaged.



Sketch 1
50 in. Diameter Roll Wrapping Paper Loaded in Two Sections



Sketch 2
50 in. Diameter Roll Wrapping Paper Loaded in One Section

Illustration No. 62

Method E-5

Method E-6—Bilge-Loaded Large-Diameter Roll Paper on Wood Cradles

Use this method for large-diameter bilge-loaded roll paper. The loading method utilizes fabricated wood cradles to secure the commodity. Some shifting of the rolls on the cradles can occasionally occur. If the rolls are neither wrapped nor given end protection, regard the outer plies and ends as protective packaging for the rolls. Therefore, chafing, scuffing, and/or edge abrasion of the outer plies and ends may occur when shipping this product using this loading method.

Illustration No. 67:

1. Package the rolls using two ⅜ in. × 0.020 in. packaging bands.

2. Manufacture the cradles from ½ in. plywood and 2 in. × 4 in. lumber. The cradle length equals the length of the rolls to be shipped. The width should be 50% of the diameter of the rolls (minimum). The outside wedge height should be high enough to allow lifting with forklift tines, 5 in. minimum. The top face of the cradle has ¼ in. rebonded rubber mats affixed with adhesive. The bottom face of the cradle has a ¼ in. masticated rubber mat affixed with adhesive. The adhesive used is "Sure Seal 90-8-30A."

Use rebonded rubber mats ¼ in. thick.

Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 7513	0.250 in.	Allegheny Industrial Associates, an ITW company
Rubber Restraint Mat BC548	0.250 in.	Amorim Industrial Solutions

Specifications for these rubber mats are in Appendix D.

The masticated rubber mats have the following specifications:

Type:	Masticated Rubber Sheets (Load Grip®)—National Rubber Technologies Corp.
Thickness:	¼ in.
Weight:	17 g/in.^{3} average
Tensile strength:	ASTM D-412, 677 psi average
Durometer hardness:	ASTM D-676 Shore A Type, 80 I average
Tear resistance:	ASTM D-624, Die B Nicked Specimens, 410 ppi average

Specifications for Load Grip® also can be found in Appendix D.

3. Secure the rolls to the cradles by two straps. The straps may be either ¾ in. × 0.031 in. steel strapping or approved polyester cord strap using the correct buckle in accordance with manufacturer's instructions (see Section III for approved polyester cord strapping). Thread the straps through the cradles and tension them around the rolls.

4. Load the rolls down the center of the trailer with their cores lengthwise. If the difference between the roll diameter and the inside trailer width exceeds 18 in., stagger the rolls against opposite sidewalls.

5. Apply minimum 2 in. × 4 in. side blocking where required.

6. Apply minimum 2 in. × 4 in. floor blocking tight to doorway end of cradle with minimum 2 in. × 4 in. backup cleats.

NOTE: Cradles may be reused as long as they are in good condition and the rubber mats on the top and bottom surfaces are not damaged.

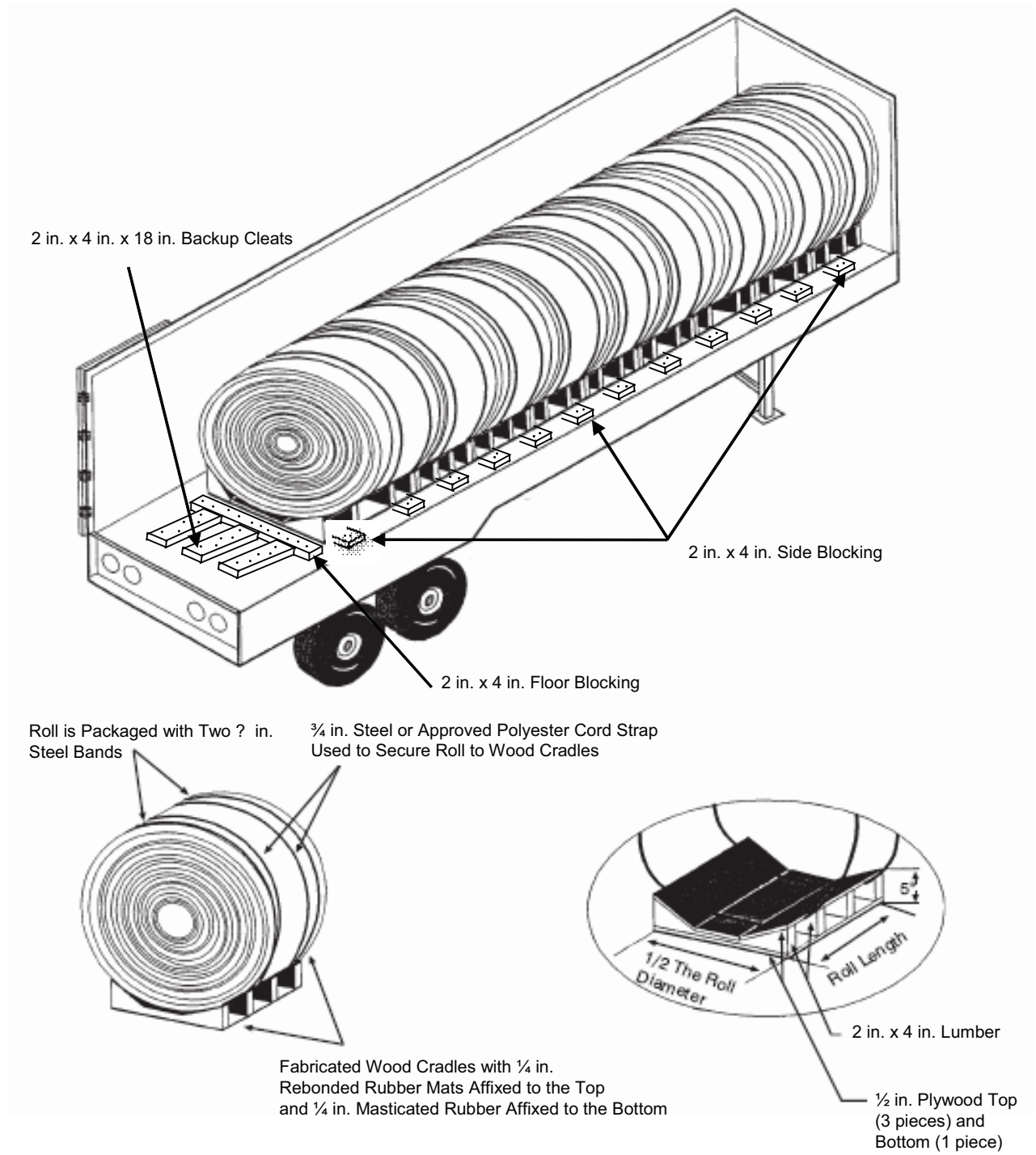


Illustration No. 63

Method E-6
Bilge-Loaded, Large-Diameter Roll Paper on Wood Cradles

Method E-7—Closed-Head Steel Drums in a 3-4-3 Pattern on Rubber Matting with Steel or Approved Polyester Cord Strapping

Use the following bracing method for 55-gallon closed-head steel drums loaded in a 3-4-3 pattern. The method utilizes ¼ in. masticated rubber matting and steel or approved polyester cord strapping.

Illustration No. 68:

1. Only the following rubber sheet has been evaluated and found acceptable for this loading method:

Type:	Masticated Rubber Mats (Load Grip®)—National Rubber Technologies Corp.
Thickness:	¼ in. thick × 61½ in. wide × length of load plus 18 in.
Weight:	17 g/in.^{3} average
Tensile Strength:	ASTM D-412, 677 psi average
Durometer Hardness:	ASTM D-676 Shore A Type, 80 I average
Tear Resistance:	ASTM D-624, Die B Nicked Specimens, 410 ppi average

Specifications for Load Grip® can also be found in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

NOTE: Mat is a minimum of 61½ in. wide and a minimum of 18 in. longer than the load. Adjust the length to suit each load.

2. Lay the rubber matting down the center of the trailer floor as the drums are loaded.

3. Load the first three stacks into the trailer in a 3-4-3 pattern.

4. Unitize the drums with one strap. Use 1¼ in. × 0.031 in. steel strap or approved polyester cord strap using the correct buckle in accordance with manufacturer's instructions (see Section III-F for approved polyester cord strapping). Use tape or fiberboard strap stays to prevent strap from slipping down on drums.

5. Continue loading drums (3-4-3) until the end of the load.

6. Unitize the last three rows with one 1¼ in. × 0.031 in. steel strap or approved polyester cord strap using the correct buckle in accordance with manufacturer's instructions (see Section III-F for approved polyester cord strapping). Use tape or strap stays to prevent strap from slipping down on drums.

7. Leave a minimum 3 ft of space between the back of the load and the trailer doors.

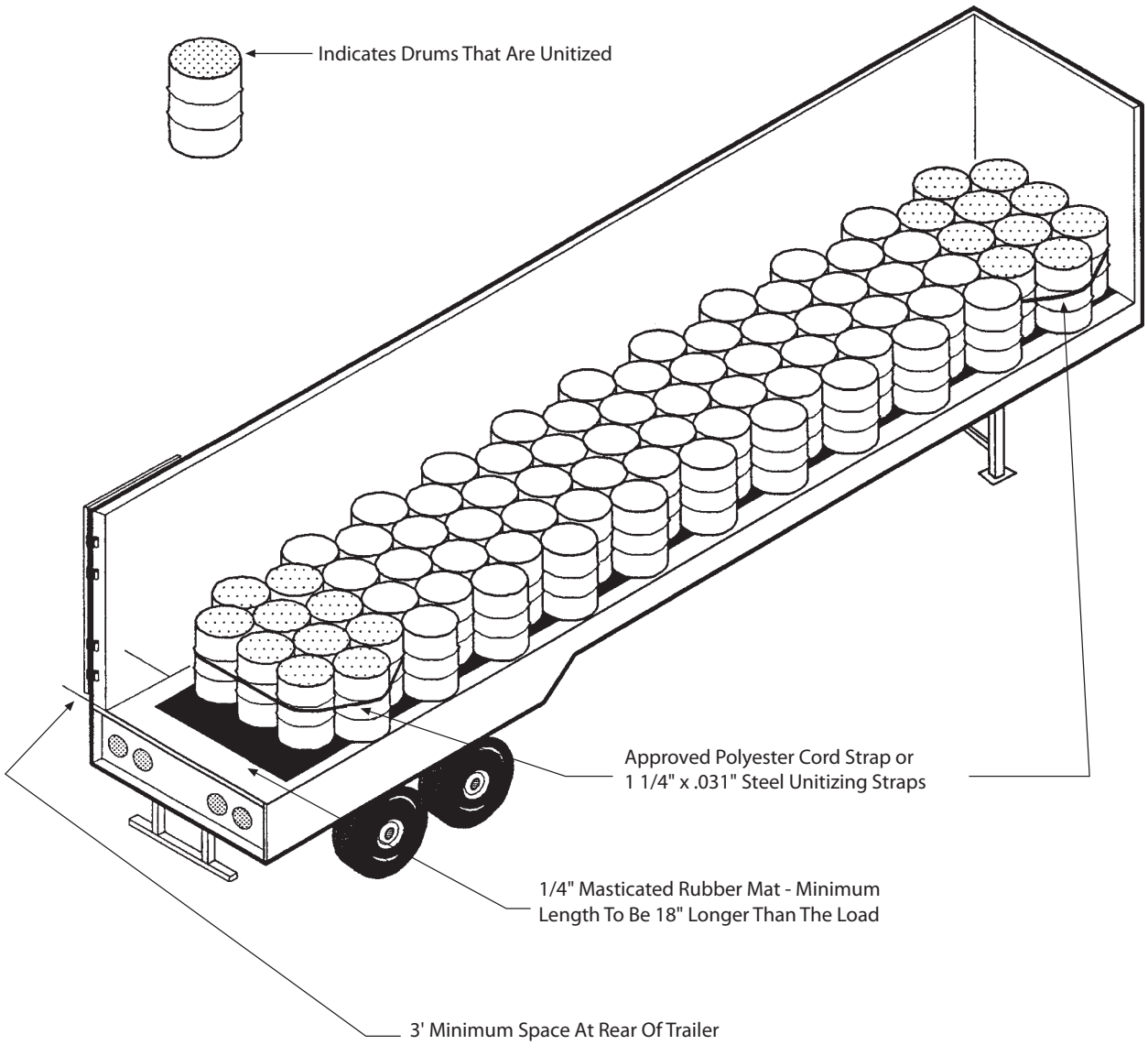


Illustration No. 64

Method E-7
Closed-Head Steel Drums in a 3-4-3 Pattern on Rubber
Matting with Steel or Approved Polyester Cord Strap

Method E-8—Through Loads of 58 in. Diameter Roll Pulpboard on End Using Two 3 ft Wide Rubber Mats

Use this method for through loads of 58 in. diameter roll pulpboard loaded as a single section, on end, in a 1-1 offset pattern in a trailer or container for intermodal service. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 69:

1. Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 7513	3 mm (0.125 in.)	Allegheny Industrial Associates, an ITW company
TransMat™ 7010		
TransMat™ 6510		
Rubber Restraint Mat BC548	3 mm (0.125 in.)	Amorim Industrial Solutions

Specifications for these rubber mats are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. An even or odd number of rolls may be loaded. Use a 3 ft × 12 ft mat at the nose and a 3 ft × 17 ft mat at the rear. Do not secure the mats to the trailer floor.

3. If loading an even number of rolls, place the first mat on the floor at the nose, aligning the longitudinal centerline of the mat along the longitudinal centerline of the trailer. Load the first four rolls tightly starting against the nose and using a 1-1 offset pattern. See **Sketches 1 and 2.**

4. Place the second mat 11 ft to 12 ft behind the first mat. Continue to load the trailer in a 1-1 offset pattern until finished. Position the second mat to extend a minimum of 6 in. beyond the rear of the load.

5. If loading an odd number of rolls, place the first mat on the floor at the nose, aligned along the longitudinal centerline of the trailer. Load the first roll so it is centered in the trailer against the nose. Place void fillers, 3 in. × (void width) × 48 in. corrugated fiberboard with 1,500 lb minimum crush strength, on either side of the trailer at the nose. Position void fillers so that the crush strength is crosswise to the trailer or container. If using multiple void fillers in tandem, unitize them to restrict independent movement. See **Sketch 3.** Lumber side-blocking can be used as an alternative to the void fillers provided it is 3 in. in height, extends a minimum of 48 in. from the nose of the trailer, and is secured adequately using 12d nails. Ladder-type side-blocking may also be used as an alternative provided it is 3 in. in height and extends a minimum of 48 in. from the nose of the trailer.

6. Place the second mat 5 ft behind the first mat. Continue to load the trailer in a 1-1 offset pattern until finished. Position the second mat to extend a minimum of 6 in. beyond the rear of the load.

7. Leave a minimum of 3 ft between the lading and the trailer doors.

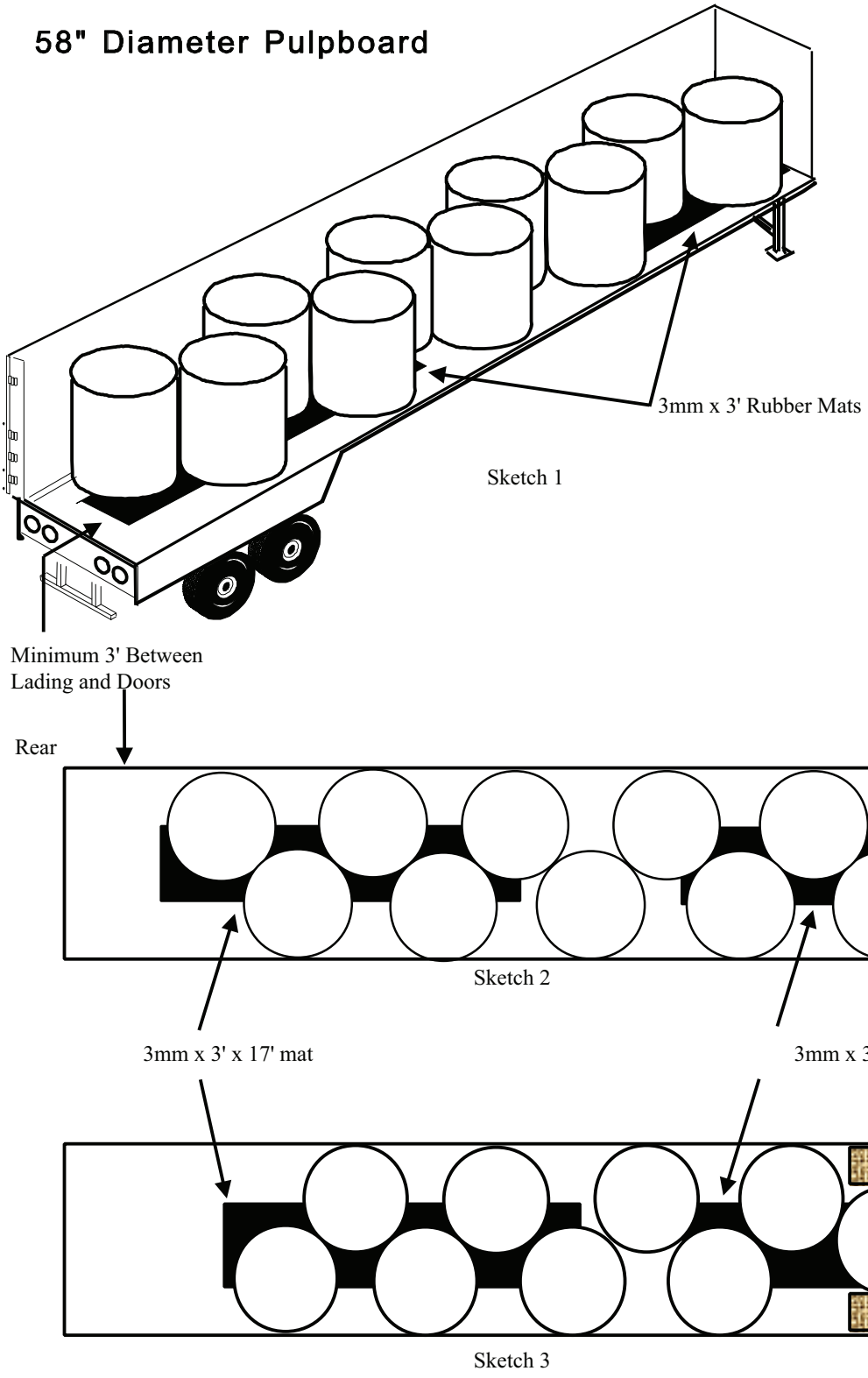


Illustration No. 65

Method E-8
Through Loads of 58 ft Diameter Roll Pulpboard on End Using 3 ft Wide Rubber Mats

Method E-9—Cancelled

Method E-10—Roll Pulpboard on End Using Rubber Mats with an Incomplete Second Layer

Use this loading method for roll pulpboard loaded on end in a 1-1 offset pattern, with an incomplete second layer, in a trailer or container for intermodal service. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 71:

1. Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 7513	3 mm (0.125 in.)	Allegheny Industrial Associates, an ITW company
Rubber Restraint Mat BC548	3 mm (0.125 in.)	Amorim Industrial Solutions

Specifications for these rubber mats are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. Load the rolls on two 3 mm thick rubber mats placed down the center of the trailer. A 4 ft × 10 ft rubber mat extends from the nose of the trailer. Place a 4 ft × 17 ft mat at the rear of the load so that it extends 2 in. to 3 in. beyond the end of the lading. Do not secure the mats to the trailer floor.

3. Load the rolls in one section in a 1-1 offset pattern starting at the nose of the trailer.

4. Load the incomplete layer approximately in the center of the trailer. Secure the incomplete layer with two blocking rolls at both the front and rear as shown in the illustration. The blocking rolls should extend a minimum of 6 in. above the bottom of the adjacent layer rolls. This is accomplished by loading rolls of smaller width in the floor layer under the second layer or using roll risers under the blocking rolls. Roll risers are a minimum 6 in. × 6 in. × 30 in. corrugated fiberboard or equivalent material placed lengthwise in the trailer. If the risers are made of corrugated fiberboard, position with the corrugations vertical. If they are made of other material, follow the manufacturer's instructions for positioning. Minimum crush strength of 6,000 lb/ft^2 is required for the risers.

5. Leave a minimum of 3 ft of void space between the lading and the trailer doors.

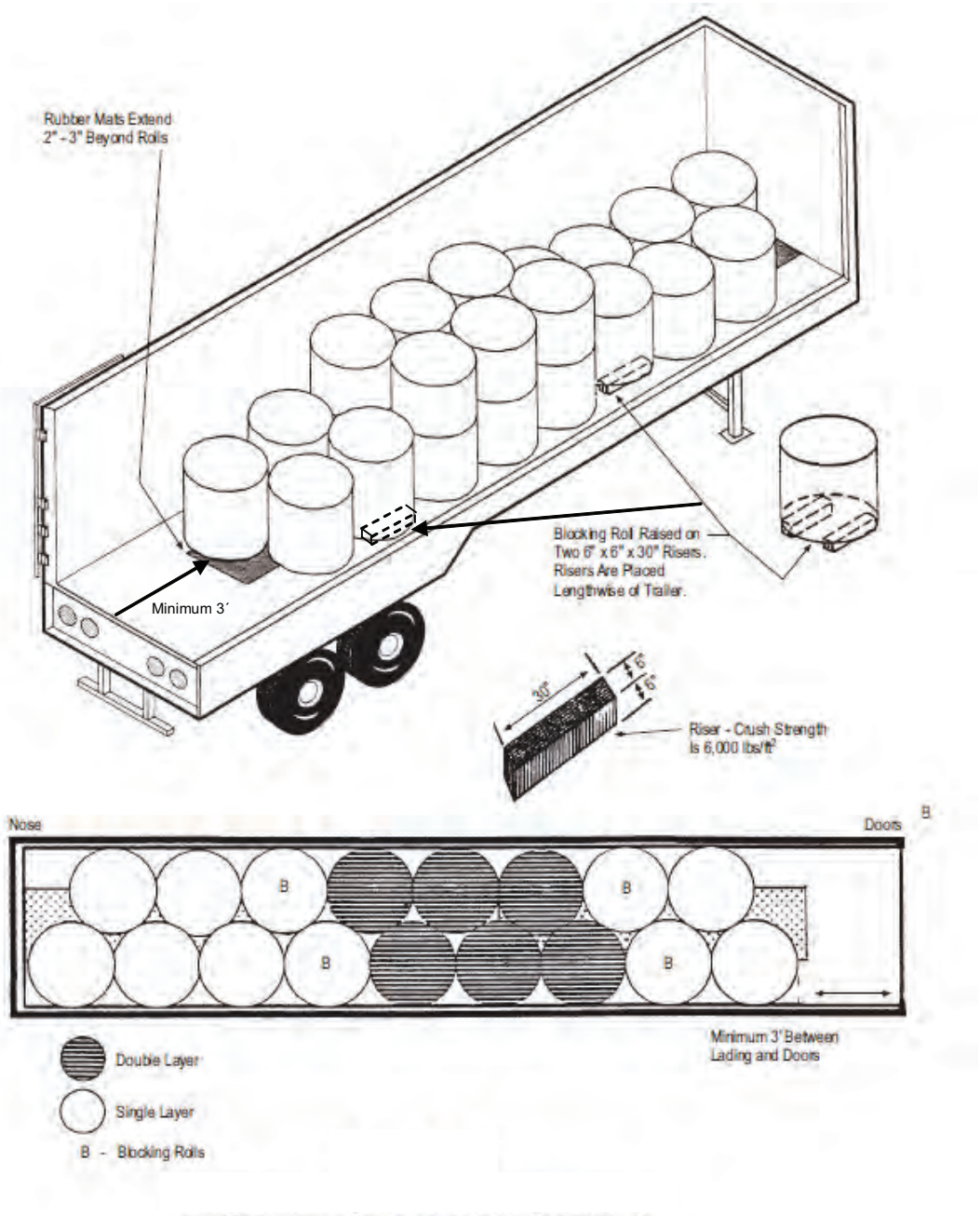


Illustration No. 67

Method E-10
Roll Pulpboard on End Using Rubber Mats with an Incomplete Second Layer

Method E-11—Cancelled

Method E-12—45 in. Diameter Roll Paper on End Secured Using Rubber Mats

Use this loading method for 45 in. diameter roll paper loaded on end in a 2-1-2 type of pattern in a trailer or container for intermodal service. The load pattern may vary slightly from the basic 2-1-2 pattern depending on the number of rolls in the shipment and weight distribution requirements. Illustration 69 shows the load configuration used for testing this concept. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

NOTE: Use trailers/containers only with wood floors.

Illustration No. 73:

1. Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Description	Vendor
TransMat™ 6510	3 mm (0.125 in.)	Continuous rolls	Allegheny Industrial Associates, an ITW company
TransMat™ 8060	2 mm (0.080 in.)		
Rubber Restraint Mat BC548	3 mm (0.125 in.)	Continuous rolls	Amorim Industrial Solutions
Load Grip® 3	3 mm (0.125 in.)	Continuous rolls	National Rubber Technologies Corp.
Load Grip® 5	1.5 mm (0.059 in.)	Continuous and perforated rolls and 21 in. × 48 in. and 21 in. × 49 in. sheets	

Specifications for these rubber mats are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. Place a 2 ft × 12 ft rubber mat in the nose of the trailer extending lengthwise down the center of the trailer, or place three 21 in. × 48 in. or 21 in. × 49 in. rubber sheets end-to-end and centered under the first four stacks in the nose of the trailer with the rearmost mat extending approximately 6 in. beyond the doorward face of the last roll of the fourth stack. Do not secure the mat to the trailer floor. Load the rolls in one section in a 2-1-2 type pattern starting at the nose of the trailer and going back to within 14 ft of the end of the load, about four stacks.

3. Place two 2 ft × 14 ft mats at the rear of the load running lengthwise of the trailer with one mat 12 in. from each sidewall positioned to extend 2 in. to 3 in. beyond the end of the lading; or place two rows of four 21 in. × 48 in. or 21 in. × 49 in. rubber sheets end-to-end and positioned 14 in. from each sidewall with the rearmost mat extending approximately 20 in. beyond the doorward face of the last rolls loaded. Do not secure the mats to the trailer floor.

4. Load the remaining rolls into the trailer with the last three stacks in a 2-1-2 pattern as shown.

5. Unitize the last three stacks (five rolls) using one 1¼ in. × 0.031 in. steel strap or one approved polyester cord strap using the correct buckle in accordance with manufacturers instructions. (See Section III-F for approved polyester cord strapping.) Tension and seal the straps using proper tensioning and sealing tools. Use strap hangers or tape to maintain proper strap alignment and to prevent straps from slipping out of position.

6. Leave a minimum of 3 ft of void space between the lading and the trailer doors.

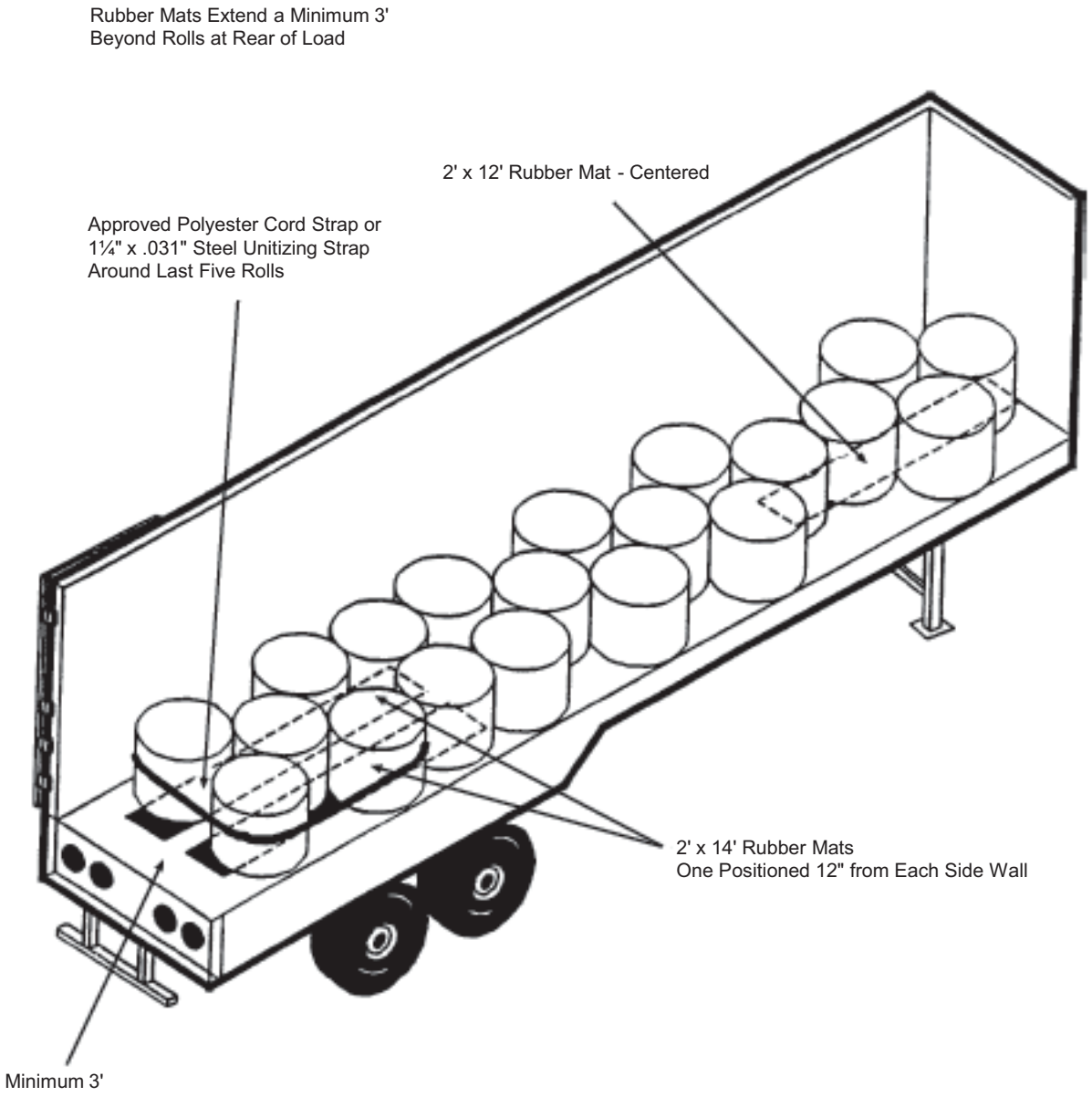


Illustration No. 69

Method E-12
45 in. Diameter Roll Paper on End Using 2 ft Wide Rubber Mats

Method E-13—50 in. Diameter Newsprint on End Using 1 ft Wide Rubber Mats

Use this loading method for 50 in. diameter newsprint loaded on end in a 1-1 offset pattern in a trailer or container for intermodal service. An incomplete layer may be loaded. This method was tested in a 102 in. wide trailer. Plan the load to *equalize the weight on each side of the trailer or container*. Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

NOTE: Due to the nature of this concept, some header damage could occur. If this is considered objectionable, do not use this loading and bracing method.

Illustration No. 74:

1. Only the following rubber mat has been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 6510	3 mm (0.125 in.)	Allegheny Industrial Associates, an ITW company

Specifications for this rubber mat are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. Load the floor layer rolls on two 1 ft wide rubber mats that are centered under each row of rolls and extend from the nose of the trailer the full length of the load and 3 in. beyond the end of the load.

3. Load the rolls tightly in one section in a 1-1 offset pattern starting at the nose of the trailer.

4. If an incomplete layer is loaded, it may be necessary to center the incomplete layer to provide proper weight distribution. The incomplete layer may be secured using one of two different concepts.

   a. Secure the incomplete layer by placing a 1 ft × 4 ft × 3 mm rubber mat between each layer in multiple layer stacks. Position the rubber mats with the 4 ft dimension lengthwise of the trailer. The last stack in the trailer should be a single layer stack if this option is used.

   b. Secure the incomplete layer with blocking rolls at both the front and rear as shown in the illustration. The blocking rolls should extend a minimum of 6 in. above the bottom of the adjacent layer rolls. This is accomplished by loading rolls of smaller width in the floor layer under the second layer or by using roll risers under the blocking rolls. Roll risers are a minimum 6 in. × 6 in. × 30 in. corrugated fiberboard or equivalent material placed lengthwise in the trailer. If the risers are made of corrugated fiberboard, position with the corrugations vertical. If they are made of other material, follow the manufacturer's instructions on positioning. Minimum crush strength of 6,000 lb/ft^2 is required for the risers.

5. Leave a minimum of 3 ft of void space between the lading and the trailer doors.

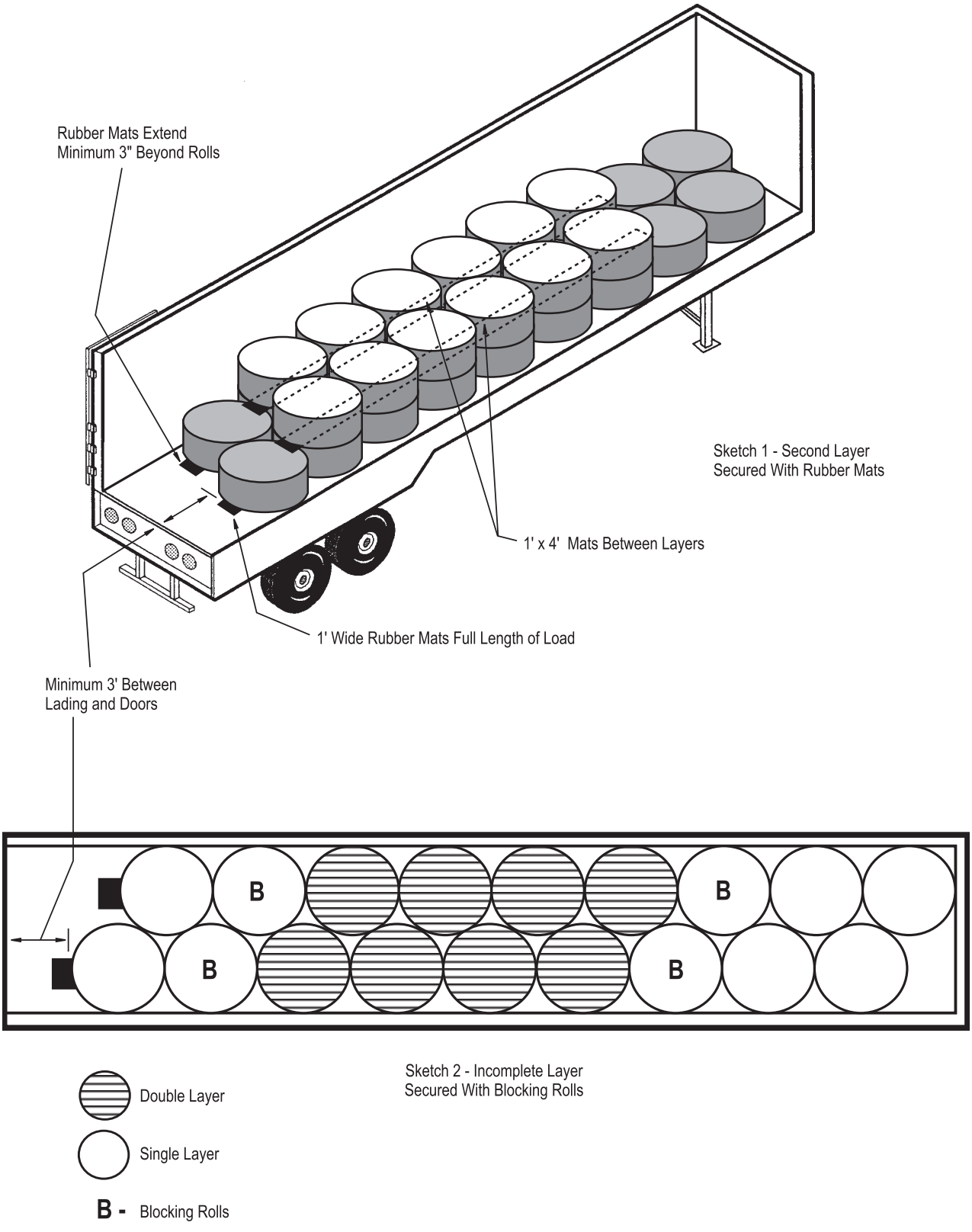


Illustration No. 70

Method E-13
50 in. Diameter Newsprint on End Using 1 ft Wide Rubber Mats

Method E-14—40 in. to 45 in. Diameter, Large Width Roll Paper on End in Two Sections Using Two 2 ft Wide Rubber Mats Under Each Section and Steel Strapping

Use this method for 40 in. to 45 in. diameter, large-width roll paper loaded on end in a 2-1 pattern in a trailer or container for intermodal service. The rubber floor mats are 2 ft wide and extend 8 in. beyond each end of each section of rolls.

NOTE: Due to the nature of this concept some edge damage and/or header damage could occur due to roll rocking. If this is objectionable, do not use this loading and bracing method.

Illustration No. 75:

The mats are not secured to the trailer floor.

1. Only the following rubber mat has been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 6510	3 mm (0.125 in.)	Allegheny Industrial Associates, an ITW company

Specifications for this rubber mat are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. The load is divided into two sections, each containing three rolls. *The width of the rolls is at least 6 in. less than the inside height of the trailer/container.*

3. Position two 2 ft wide rubber strips so they will be centered under the two-roll-wide stack for each section, approximately 16 in. to 18 in. from the sidewalls. Use mats of sufficient length to extend 8 in. beyond each end of each section of the load.

4. Load the first section in a 2-1 pattern starting about 3½ ft from the nose of the trailer. Load the first two rolls next to each other along the longitudinal centerline of the trailer as shown in the illustration. Centered the third roll in the trailer in the recess between the first two rolls.

5. Unitize the first section with two 1¼ in. × 0.031 in. steel straps, one positioned 24 in. from top of rolls and one 18 in. from the floor as shown in Illustration 71. Tension and seal the straps using proper tensioning and sealing tools. Use strap hangers or tape to maintain proper strap alignment and to prevent straps from slipping out of position.

6. Position corrugated fiberboard void fillers 1 ft wide × 5 ft long with 1,500 lb minimum crush strength on edge between the sidewall and each of the rolls in the first (two-wide) stack. Use void fillers of sufficient thickness to fill the void. If using multiple void fillers in tandem, unitize them to restrict independent movement.

7. The second section also consists of three rolls loaded in a 2-1 pattern. Load and unitize it in the same manner as the first section. Position this section as far from the doors as possible while maintaining proper weight distribution (a minimum of 4 ft from the doors when loading is completed). It may be necessary to adjust the position of both sections to provide proper lengthwise weight distribution in the trailer.

CAUTION: Ensure that the floor of the trailer is not overloaded when loading wide rolls. The load may not exceed 2,500 lb/linear ft lengthwise of the trailer for any 1 ft section.

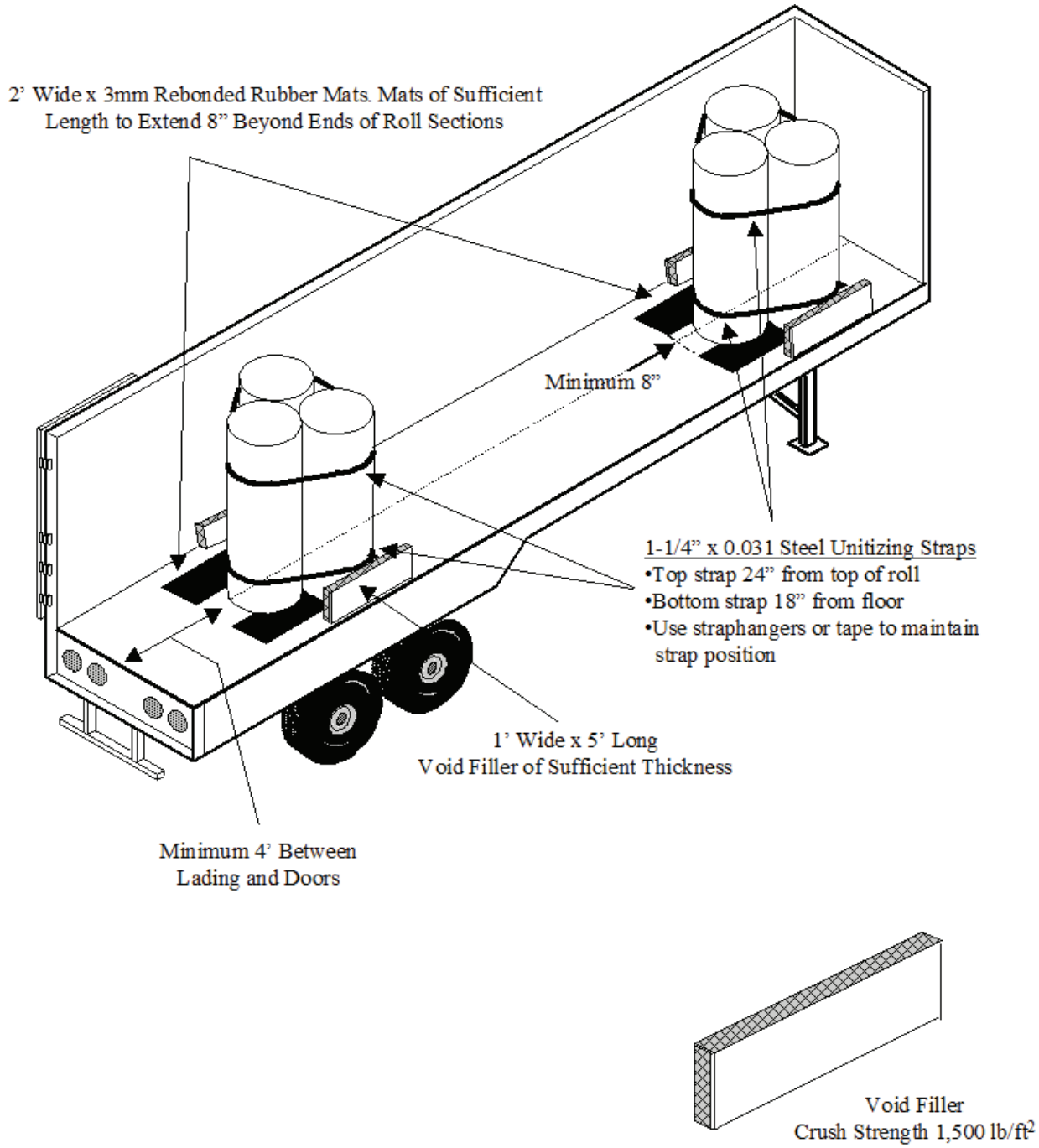


Illustration No. 71

Method E-14
40 in. to 45 in. Diameter Roll Paper on End in Two Sections
Using Two 2 ft Wide Rubber Mats Under Each Section

Method E-15—Skidded or Palletized Flat Paper Stock Secured Using Rubber Mats and D.I.D. Bags

Use this method for sheet flat paper stock or flat paper stock in boxes or on skids or pallets. Unitize the paper by stretch-wrapping (90 gauge film) with three wraps at the top and bottom and two wraps around the middle of the unit, or by using packaging bands or a skid top and packaging bands. The stretch-wrap should extend down and encompass the top of the pallet. *Use trailers/containers only with wood floors.*

Illustration No. 76:

1. Only the following rubber mat has been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
Load Grip® 2	3 mm (0.125 in.)	National Rubber Technologies Corp.

Specifications for this rubber mat are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged. Do not reuse D.I.D. bags used for load securement.

2. Position a 4 ft wide rubber mat down the center of the trailer extending from the nose. This mat extends under all but the last two stacks in the load.

3. Fill all lateral void space with appropriate filler material. Load the first stack consisting of two units with one unit placed against the nose and a sidewall and the other unit placed against the nose and the opposite sidewall. Load the following stacks with two unit stacks loaded against alternate sidewalls and one unit stack centered in the trailer. Follow this load configuration until reaching the last two stacks in the load. **Sketch 2** shows the load used in testing this concept. The number of stacks and the number of units in each stack will vary depending on the weight of the units, the shipment requirements, and the weight distribution requirements.

4. Secure all stacks against lateral shifting. Use void fillers or 1 in. × 4 in. × 8 ft lumber nailed to the skid or pallet runners and extending across the trailer width, except in the last two stacks where a disposable inflatable dunnage (D.I.D.) bag is utilized.

5. Load the last two stacks consisting of two units each with one unit in each stack against each sidewall. Place a 4 ft × 4 ft rubber mat under each unit in the last two stacks.

6. Position one minimum Level 1 D.I.D. bag lengthwise in the center void of the last two stacks. Use D.I.D. bags long enough to extend over two stacks of lading and wide enough to extend from 4 in. above the floor to the top of the lading. Minimum D.I.D. bag size is 36 in. × 84 in. If the center void filled by the D.I.D. bag is larger than 12 in. after inflation of the bag, place full-size void fillers (capable of withstanding a load of 1,500 lb/ft^2) alongside the D.I.D. bag. Position the D.I.D. bag 4 in. above the trailer floor. Inflate the D.I.D. bag to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction, (e.g., domestic intermodal truckload carriers or IMC containers).

7. The back of the load should be at least 3 ft from the doors when loading is completed.

NOTE: An updated listing of verified D.I.D. bags can be found on the TTCI Web site at http://www.aar.com/dpls/pfds/PPPPD_Verification_List.pdf

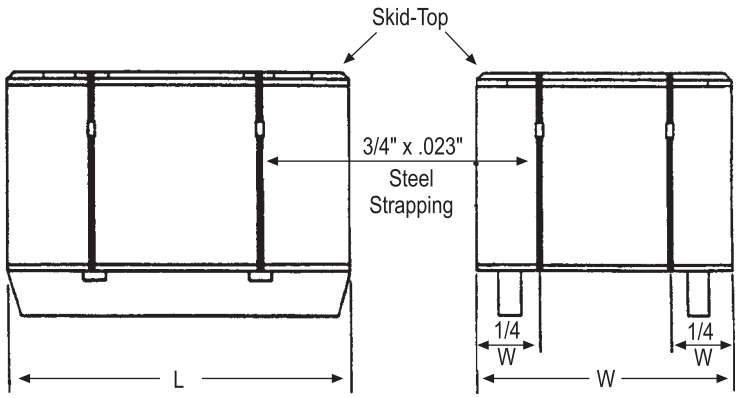


Illustration No. 72– Sketch 1

Method E-15
Use of a Skid Top and Packaging Bands

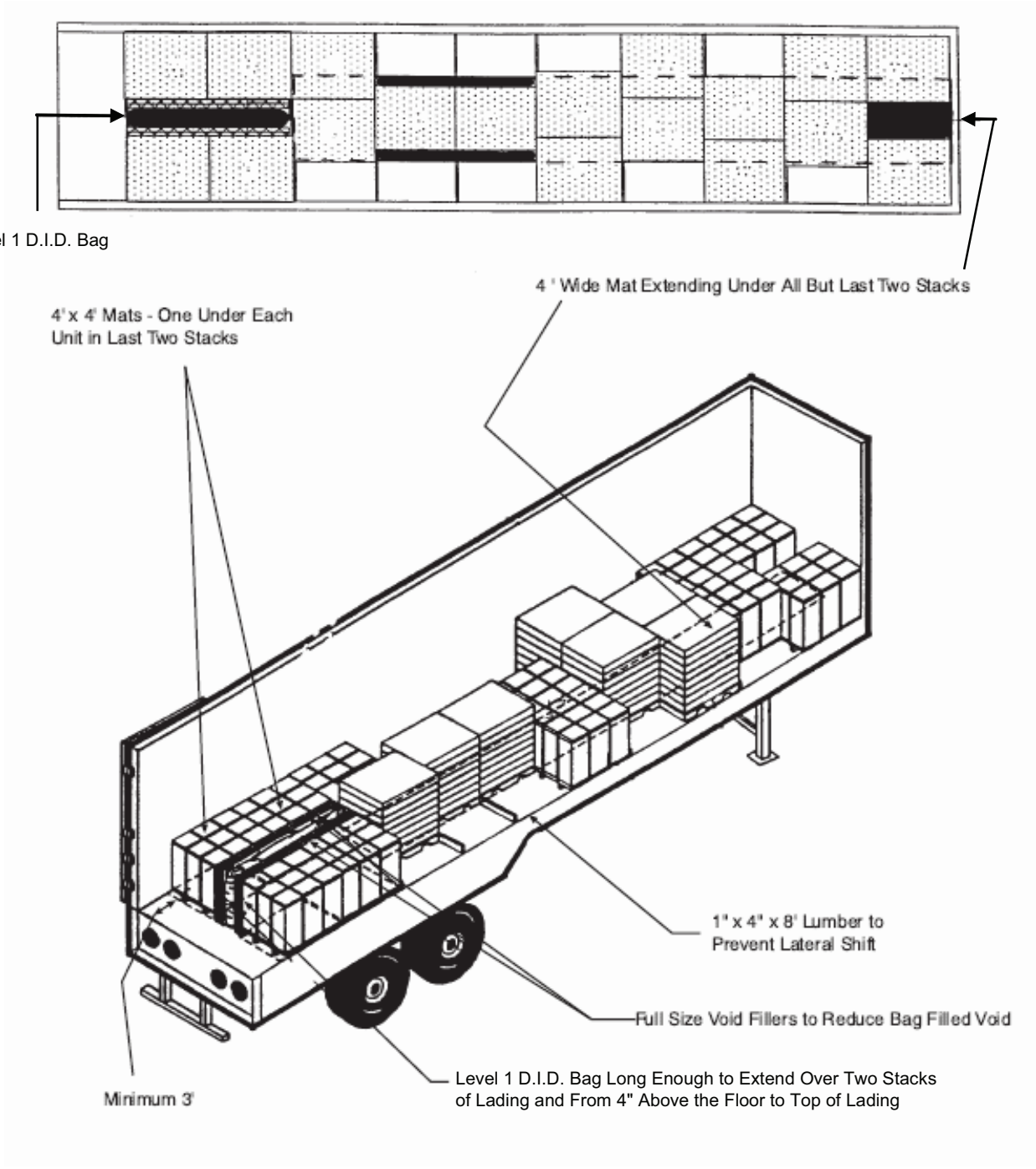


Illustration No. 72– Sketch 2

Method E-15
Skidded or Palletized Flat Paper Stock Secured Using Rubber Mats and D.I.D. Bags

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Method E-16—Palletized Roofing Shingles Secured Using 1 ft Wide Rubber Mats

Use this method for roofing shingles on double-deck pallets. Unitize the shingles by stretch-wrapping (90 gauge film) with three wraps at the top and bottom and two wraps around the middle of the unit. The stretch-wrap should extend down and encompass the top of the pallet. *Use trailers/containers with wood floors only.*

Illustration No. 77:

1. Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 6510	3 mm (0.125 in.)	Allegheny Industrial Associates, an ITW company
Load Grip® 2	3 mm (0.125 in.)	National Rubber Technologies Corp.

Specifications for these rubber mats are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. Divide the load into two sections with two rows per section. Each section contains approximately half of the load.

3. Load each row in each section on a 1 ft wide rubber mat centered under the row. The rubber mat extends 6 in. from under the front and rear of each row. Do not secure the mats to the trailer floor.

4. The first section consists of two rows of pallets loaded down the center of the trailer as shown in the illustration. Position the first stack about 4 ft from the nose of the trailer.

5. The second section also consists of two rows of pallets loaded down the center of the trailer about 5 ft behind the first section. This section should be at least 3 ft from the doors when loading is completed. Adjust the void at the nose and between the first and second sections of lading, if necessary, to provide proper weight distribution and maintain the minimum 3 ft void at the rear of the trailer.

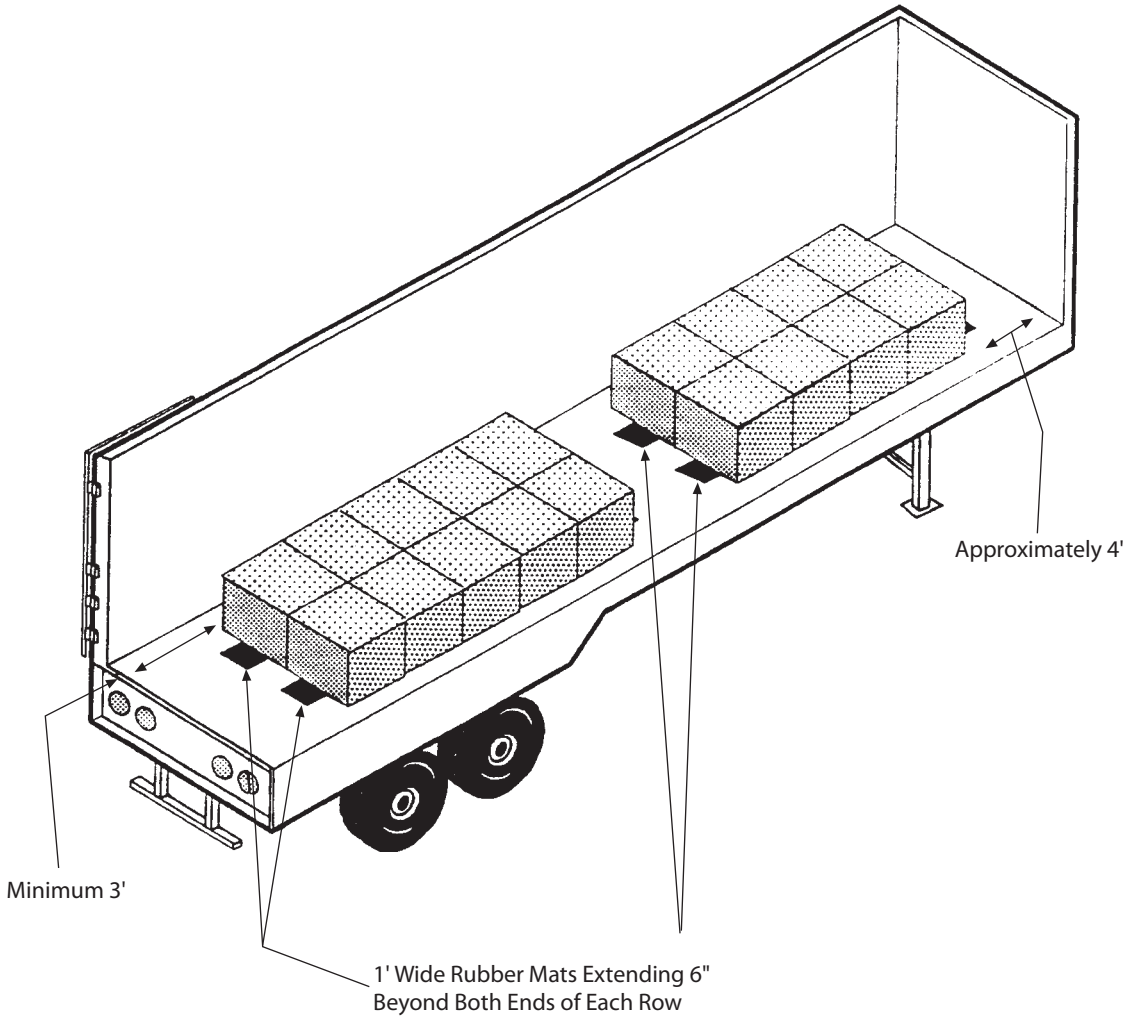

Illustration No. 73

Method E-16
Palletized Roofing Shingles Secured Using Robber Mats

Method E-17—40 in. Diameter Roll Paper on End Secured Using 2 ft Wide Rubber Mats

Use this loading method for 40 in. diameter roll paper loaded on end in a 2-1-2 type of pattern in a trailer or container for intermodal service. The load pattern may vary slightly from the basic 2-1-2 pattern depending on the number of rolls in the shipment and weight distribution requirements. Illustration 73A shows the load configuration used for testing this concept. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Use trailers/containers with wood floors only.

NOTE: Due to the nature of this concept, some header damage could occur. If this is considered objectionable, do not use this loading and bracing method.

Illustration No. 77A:

1. Only the following rubber mat has been evaluated and found acceptable for this loading method:

Name	Thickness	Vendor
TransMat™ 6510	3 mm (0.125 in.)	Allegheny Industrial Associates, an ITW company
Regupol America	2mm (0.080 in.)	Regupol America 6910

Specifications for this rubber mat are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. Load rolls into the trailer. The load pattern may vary slightly from the basic 2-1-2 pattern, but the last three stacks must be in a 2-1-2 pattern as shown.

3. Place two 2 ft × 9 ft mats at the rear of the load running lengthwise of the trailer with one mat 12 in. from each sidewall. Position mats so they will extend 2 in. to 3 in. beyond the end of the lading. Do not secure the mats to the trailer floor. See Illustration.

4. Unitize the last four stacks (six rolls) using one 1¼ in. × 0.031 in. steel strap or one approved polyester cord strap using the correct buckle in accordance with manufacturer's instructions. (See Section III-F for approved polyester cord strapping). Tension and seal the straps using proper tensioning and sealing tools. Use strap hangers or tape to maintain proper strap alignment and to prevent straps from slipping out of position.

5. Leave a minimum of 3 ft of void space between the lading and the trailer doors.

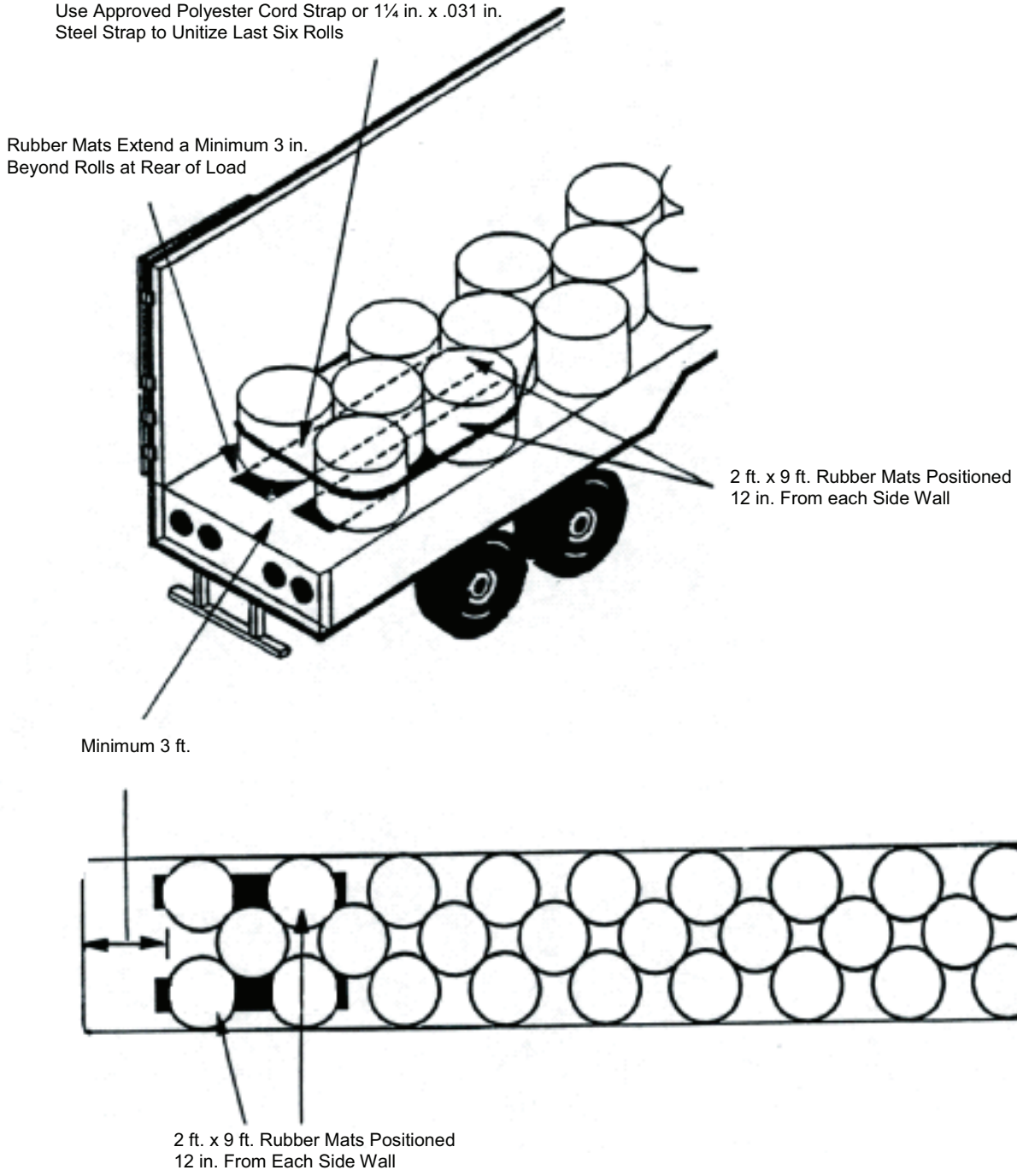

Illustration No. 73A

Method E-17

Method E-18—Split Loads of 58 in. Diameter Roll Pulpboard on End Using Rubber Mats

(If loading split loads of 58 in. diameter roll pulpboard on end in trailers having large metal plates approximately 9 ft in length at the nose, use Method E-19.)

Use this method for split loads of 58 in. diameter roll pulpboard loaded on end in a 1-1 offset pattern in a trailer or container for intermodal service. A maximum of eight rolls may be loaded in a trailer or container using this method. The loads generally consist of seven or eight rolls loaded in two sections in the trailer or container. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 77B:

1. Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Description	Vendor
TransMat™ 7513	3mm (0.125 in.)	Continuous rolls	Allegheny Industrial Associates, an ITW company
TransMat™ 6900	2mm (0.080 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	
	3mm (0.125 in.)	Continuous rolls	
TransMat™ 8060	2mm (0.080 in.)	Continuous rolls	
Rubber Restraint Mat BC548	2mm (0.080 in.) 3mm (0.125 in.)	Continuous rolls	Amorim Industrial Solutions
Load Grip® 5	1.5mm (0.059 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	National Rubber Technologies Corp.
	2mm (0.080 in.)	3 ft × 3 ft square sections	
Load Grip® 6	2 mm (0.080 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	
Zro-Shift™	2 mm (0.080 in.)	30 in. × 42 in. sheets	Sunrise Manufacturing Inc.
Load Lock™	3mm (0.125 in.)	Continuous rolls	RB Rubber Products, Inc.
Brown Bear™ Friction Mat 101	2mm (0.080 in.) 3mm (0.125 in.	Continuous rolls	Circle, Inc.
Load Secure™ 6910	2mm (0.080 in.)	Continuous rolls	Regupol America

Specifications for these rubber mats are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. The nose section consists of three or four rolls. Place the first mat on the floor at the nose, centered in the trailer as shown in **Sketches 2 and 3**. Use the appropriate size mat for the number of rolls being loaded.

> If *four rolls* are loaded in the nose section, use a 3 ft × 17 ft mat at the nose. The following may also be used: One row of five 3 ft × 3 ft sections and one 3 ft × 20 in. section of approved rubber mat installed end to end with the next to last mat in the row cut to 20 in. to allow more of the last mat to be under the last roll; or one row of four 30 in. × 42 in. sections of approved rubber mat installed end to end and centered under the rolls in the nose section.
>
> If *three rolls* are loaded in the nose section, use a 3 ft × 14 ft mat at the nose. The following may also be used: One row of four 3 ft × 3 ft sections and one 3 ft × 20 in. section of approved rubber mat installed end to end with the next to last mat in the row cut to 20 in. to allow more of the last mat to be under the last roll; or one row of four 30 in. × 42 in. sections of approved rubber mat installed end to end and centered under the rolls in the nose section.

3. If *four rolls* are loaded in the nose section, load the four rolls tightly starting against the nose and using a 1-1 offset pattern. See **Sketch 2.**

4. If *three rolls* are loaded in the nose section, load the first roll so it is centered in the trailer against the nose. Place void fillers, 3 in. × (void width) × 48 in. corrugated fiberboard with 1,500 lb minimum crush strength, on both sides of the first roll between roll and trailer walls. Position void fillers so that the crush strength is crosswise to the trailer or container. If using multiple void fillers in tandem, unitize them to restrict independent movement. See **Sketch 3.** Lumber side-blocking can be used as an alternative to the void fillers provided it is 3 in. in height, extends a minimum of 48 in. from the nose of the trailer, and is secured adequately using 12d nails. Ladder-type lumber side-blocking may also be used as an alternative provided it is 3 in. in height and extends a minimum of 48 in. from the nose.

5. Load the next two rolls tightly lengthwise against opposite sidewalls of the trailer as shown in **Sketch 3.**

6. A minimum of 3 ft of void is required between the lading and the trailer doors. Position the rear section to obtain the proper load weight distribution and maintain the 3 ft void at the rear of the trailer.

7. Load the rear section, consisting of four rolls, using two 3 ft × 14 ft mats. Position the mats at the opposite sidewalls of the trailer. Position the mats to extend a minimum of 6 in. beyond the rolls at each end of each mat. Place the rolls on the mats in a 1-1 offset pattern. See **Sketches 2 and 3.** The following also may be used: two rows of four 3 ft × 3 ft sections of approved rubber mat and one 3 ft × 20 in. section installed end-to-end with the next to last mat in each row cut to 20 in. to allow more of the last 3 ft × 3 ft mat to be under the last roll and positioned approximately equidistant from each sidewall; two rows of four 30 in. × 42 in. sections of approved rubber mat installed end-to-end and positioned approximately equidistant from each sidewall. Position the mats to extend a minimum of 6 in. beyond the rolls.

8. Unitize the rear section (at trailer doors) with one approved polyester cord strap or one ⅝ in. × .040 in. approved polyester plastic strap. Position the unitizing strap at a maximum height of 4 ft above the trailer floor. Be sure the strap is level. Tension and seal the straps using proper tensioning and sealing tools.

> If using approved polyester cord strap, a wire buckle with legs (prongs) on the same side of the frame and that has a non-slip surface is required. (See Section III-F for approved polyester cord strapping.)
>
> If using a ⅝ in. × .040 in. approved polyester plastic strap, a heat seal, a friction weld, or metal seals may be used to seal the strap. A minimum joint strength of 900 lb is required.

See Section III-F for approved polyester plastic strapping.

9. Position two strap hangers on each trailer sidewall at the rear section as indicated in **Sketch 1** to maintain proper strap alignment and to prevent straps from slipping out of position. Strap hangers may be solid fiberboard secured by use of adhesive, tape, or staples; or looped cord strap secured by staples. Use adhesive or tape that is heat and cold resistant for this purpose. Do not use tape as the strap hanger. If additional strap hangers are positioned on the rolls, be sure they are positioned so the strap remains level.

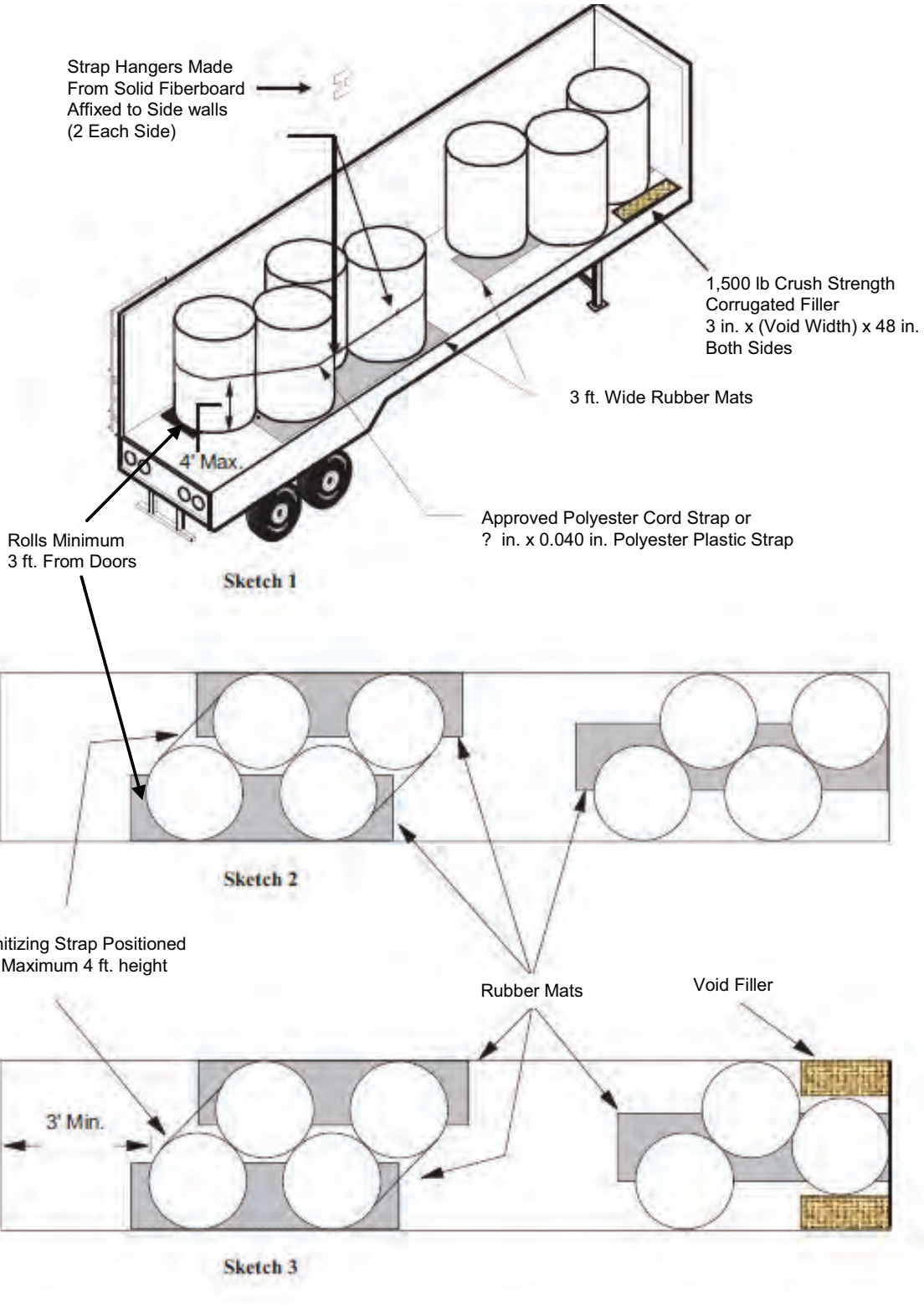

Illustration No. 73B

Method E-18
Split Loads of 58 in. Diameter Roll Pulpboard on End Using Robber Mats

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Method E-19—Split Loads of 58 in. Diameter Roll Pulpboard on End Using Rubber Mats when Stowed in Trailers Having Large Metal Plates Approximately 9 ft in Length at the Nose

Use this method for split loads of 58 in. diameter roll pulpboard loaded on end in a 1-1 offset pattern for intermodal service in a trailer or container having wood floors with large metal plates approximately 9 ft in length at the nose. A maximum of eight rolls may be loaded in a trailer or container using this method. The loads generally consist of seven or eight rolls loaded in two sections in the trailer or container. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 77C:

1. Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Description	Vendor
TransMat™ 7513	3mm (0.125 in.)	Continuous rolls	Allegheny Industrial Associates, an ITW company
TransMat™ 6900	2mm (0.080 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	
	3mm (0.125 in.)	Continuous rolls	
TransMat™ 8060	2mm (0.080 in.)	Continuous rolls	
Rubber Restraint Mat BC548	2mm (0.080 in.) 3mm (0.125 in.)	Continuous rolls	Amorim Industrial Solutions
Load Grip® 5	1.5mm (0.059 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	National Rubber Technologies Corp.
	2mm (0.080 in.)	3 ft × 3 ft square sections	
Load Grip® 6	2 mm (0.080 in.)	Continuous and perforated rolls and 30 in. × 42 in. sheets	
Zro-Shift™	2 mm (0.080 in.)	30 in. × 42 in. sheets	Sunrise Manufacturing Inc.
Load Lock™	3mm (0.125 in.)	Continuous rolls	RB Rubber Products, Inc.
Brown Bear™ Friction Mat 101	2mm (0.080 in.) 3mm (0.125 in.	Continuous rolls	Circle, Inc.
Load Secure™ 6910	2mm (0.080 in.)	Continuous rolls	Regupol America

Specifications for these rubber mats are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. The nose section consists of three or four rolls and may be loaded in-line or using a 1-1 offset pattern. When loading in-line, place the first mat on the floor at the nose, centered in the trailer as shown in **Sketches 1, 2, and 3**. When loading using a 1-1 offset pattern, place two mats side by side centered in the trailer as shown in **Sketches 4 and 5**. Use the appropriate size mat for the number of rolls being loaded. The mats are not secured to the trailer floor.

   If *three rolls* are loaded *in-line* at the nose section, use a 3 ft × 16 ft mat at the nose or appropriate number of laterally centered 3 ft × 3 ft approved square mats or 30 in. × 42 in. sections of approved rubber mats installed end-to-end so that a minimum of 6 in. extends beyond the last rolls.

   If *four rolls* are loaded *in-line* at the nose section, use a 3 ft × 21 ft mat at the nose or appropriate number of laterally centered 3 ft × 3 ft approved square mats or 30 in. × 42 in. sections of approved rubber mats installed end-to-end so that a minimum of 6 in. extends beyond the last rolls.

If *three rolls* are loaded using a *1-1 offset* pattern at the nose, use two 3 ft × 14 ft mats at the nose or an appropriate number of 3 ft × 3 ft approved square mats or 30 in. × 42 in. sections of approved rubber mats installed end-to-end so that a minimum of 6 in. extends beyond the last roll and are positioned side by side centered laterally under the rolls.

If *four rolls* are loaded using a *1-1 offset* pattern at the nose, use two 3 ft × 17 ft mats at the nose or an appropriate number of 3 ft × 3 ft approved square mats or 30 in. × 42 in. sections of approved rubber mats installed end-to-end so that a minimum of 6 in. extends beyond the last rolls and are positioned side by side centered laterally under the rolls.

3. If *three rolls* are loaded *in-line* at the nose section, load the first roll so it is centered in the trailer against the nose. Continue loading the remaining two rolls in the nose tightly in-line down the center of the trailer. Place void fillers, 3 in. × (void width) × 48 in. corrugated fiberboard with 1,500 lb minimum crush strength, between each roll and the adjacent sidewall. If using multiple void fillers in tandem, unitize them to restrict independent movement. See **Sketches 1 and 2.**

4. If *four rolls* are loaded *in-line* at the nose section, load the first roll so it is centered in the trailer against the nose. Continue loading the remaining three rolls in the nose tightly in-line down the center of the trailer. Place void fillers, 3 in. × (void width) × 48 in. corrugated fiberboard with 1,500 lb minimum crush strength, between each roll and the adjacent sidewall. If using multiple void fillers in tandem, unitize them to restrict independent movement. See **Sketch 3.**

5. If *three rolls* are loaded in a *1-1 offset* pattern at the nose section, load the first roll so it is centered in the trailer against the nose. Place void fillers, 3 in. × (void width) × 48 in. corrugated fiberboard with 1,500 lb minimum crush strength, on both sides of the first roll between roll and trailer walls. Position void fillers so that the crush strength is crosswise to the trailer or container. If using multiple void fillers in tandem, unitize them to restrict independent movement. See **Sketch 4**. Ladder-type side-blocking may also be used as an alternative provided it is 3 in. in height and extends a minimum of 48 in. from the nose of the trailer.

6. Load the next two rolls tightly lengthwise against opposite sidewalls of the trailer as shown in **Sketch 4**.

7. If *four rolls* are loaded in a *1-1 offset* pattern at the nose section, load the four rolls tightly starting against the nose using a 1-1 offset pattern. See **Sketch 5**.

8. A minimum of 3 ft of void is required between the lading and the trailer doors. Position the rear section to obtain the proper load weight distribution and maintain the 3 ft void at the rear of the trailer.

9. Load the rear section, consisting of four rolls, using two 3 ft × 14 ft mats. Position the mats at the opposite sidewalls of the trailer. Position the mats to extend a minimum of 6 in. beyond the rolls at each end of each mat. Place the rolls on the mats in a 1-1 offset pattern. See **Sketches 1 through 5.**

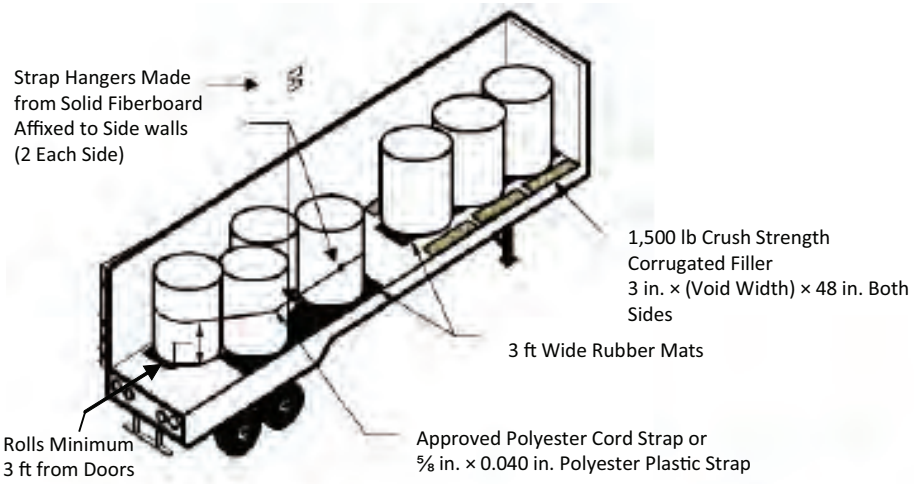
10. Unitize the rear section (at trailer doors) with one approved polyester cord strap or one 5⁄8 in. × .040 in. approved polyester plastic strap. Position the unitizing strap at a maximum height of 4 ft above the trailer floor. Be sure the strap is level. Tension and seal the straps using proper tensioning and sealing tools according to the strap manufacturer's instructions.

If using approved polyester cord strap, a wire buckle with legs (prongs) on the same side of the frame and that has a non-slip surface is required. See Section III-F for approved polyester cord strapping.

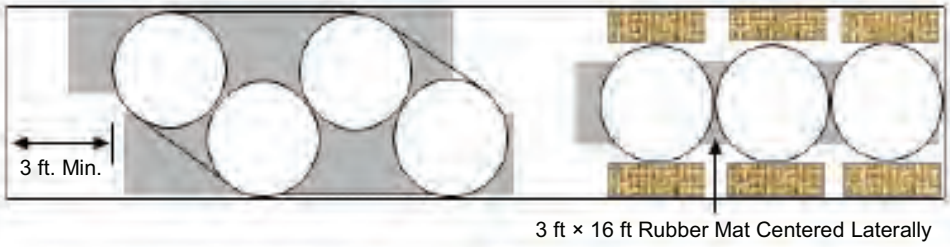
If using a 5⁄8 in. × .040 in. approved polyester plastic strap, a heat seal, a friction weld, or metal seals may be used to seal the strap. A minimum joint strength of 900 lb is required. See Section III-F for approved polyester plastic strapping.

11. Position two strap hangers on each trailer sidewall at the rear section as indicated in **Sketch 1** to maintain proper strap alignment and to prevent straps from slipping out of position. Strap hangers may be solid fiberboard secured by use of adhesive, tape, or staples; or looped cord strap secured by staples. Use adhesive or tape that is heat and cold resistant for this purpose. Do not use tape as the strap hanger. If additional strap hangers are positioned on the rolls, be sure they are positioned so the strap remains level.

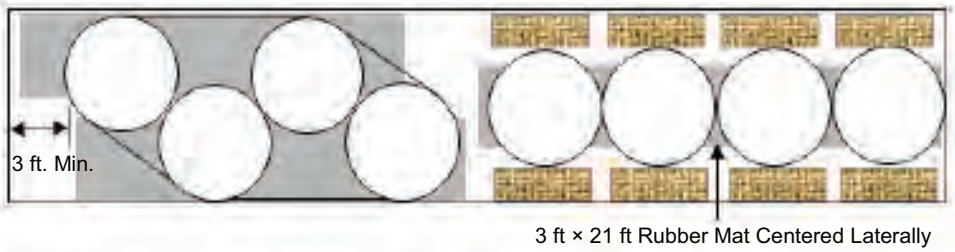
Sketch 1



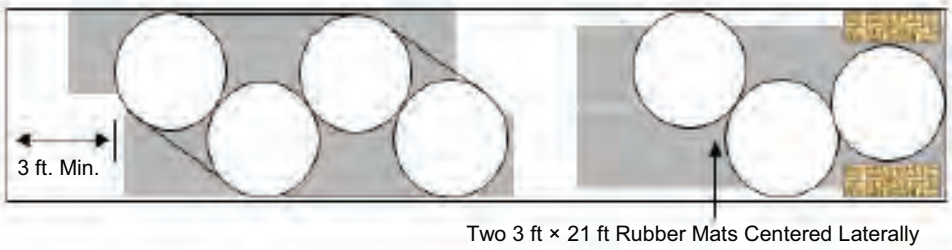
Sketch 2



Sketch 3



Sketch 4



Sketch 5

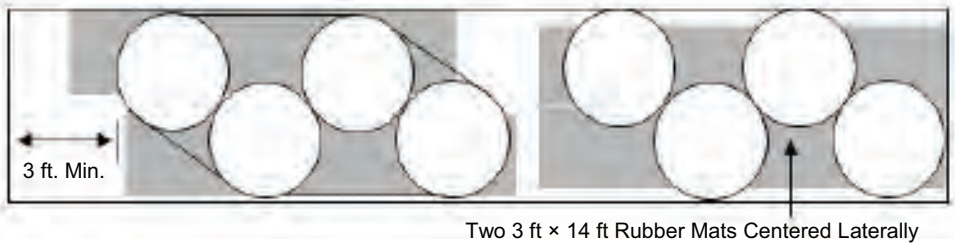


Illustration No. 73C

Method E-19
Split Loads of 58 in. Diameter Roll Pulpboard on End Using Rubber Mats in Trailers/Containers with Partial Metal Floors in the Nose
(Other sizes of approved mats may also be applied as described in the E-19 verbiage.)

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Method E-20—50 in. Diameter Printing and Other Type Paper on End Using Rubber Mats

Use this loading method for 50 in. diameter printing paper, newsprint, brown paper, and pulpboard loaded on end in a 1-1 offset pattern in a trailer or container for intermodal service. This method was tested in a 102 in. wide trailer. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

NOTE: Due to the nature of this concept, some header damage could occur. If this is considered objectionable, do not use this loading and bracing method.

Illustration No. 77D:

1. Only the following rubber mats have been evaluated and found acceptable for this loading method:

Name	Thickness	Description	Vendor
TransMat™ 8060	2 mm(0.080 in.)	Continuous and perforated rolls	Allegheny Industrial Associates, an ITW company
Load Grip® 6	2 mm(0.080 in.)	Continuous and perforated rolls and 21 in. × 48 in. sheets	National Rubber Technologies Corp.

Specifications for this rubber mat are in Appendix D.

NOTE: Do not reuse rubber mats if torn or otherwise damaged.

2. Place two 2 ft × 7 ft mats in the nose of the trailer and center them under the first two rolls adjacent to each sidewall of the trailer, or place two 21 in. × 48 in. rubber mats end-to-end and centered under the first two rolls adjacent to each sidewall of the trailer. Do not secure the mats to the trailer floor. Load five stacks tightly in one section in a 1-1 offset pattern starting at the nose of the trailer.

3. Place two 2 ft × 14 ft mats at the rear of the load running lengthwise of the trailer and position them so that they will be centered under the remaining rolls, or place four 21 in. × 48 in. rubber mats end-to-end and centered under the last three stacks of the load. Position mats so that they will extend 6 in. beyond the end of the lading. Do not secure the mats to the trailer floor.

4. Load the remaining rolls tightly into the trailer in a 1-1 offset pattern against the previously loaded rolls.

5. Unitize the last two stacks (four rolls) using one 1¼ in. × 0.031 in. steel strap or one approved polyester cord strap using the correct buckle in accordance with manufacturer's instructions. (See Section III-F for approved polyester cord strapping.) Tension and seal the straps using proper tensioning and sealing tools. Use strap hangers or tape to maintain proper strap alignment and to prevent straps from slipping out of position.

6. Leave a minimum of 3 ft of void space between the lading and the trailer doors.

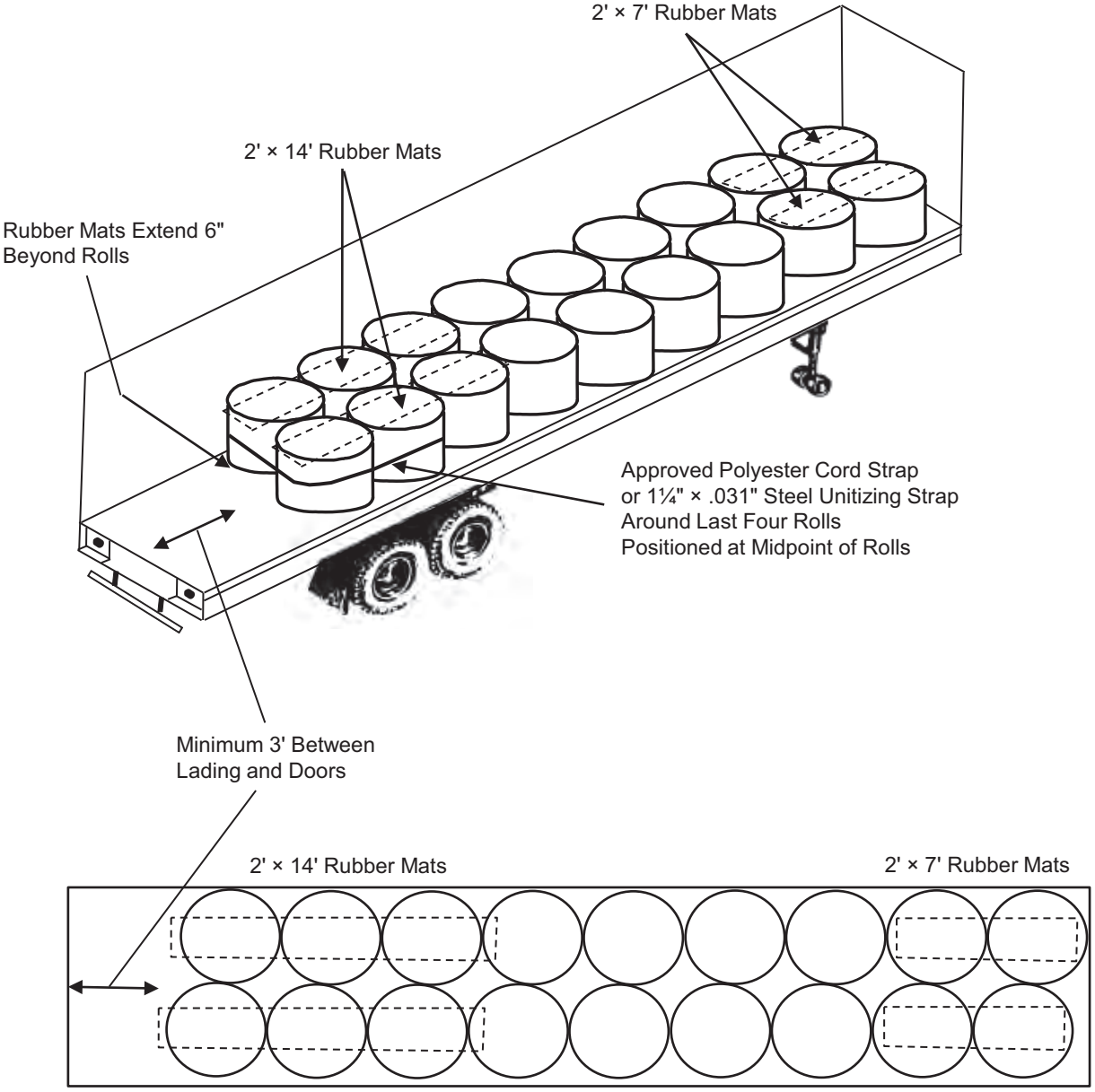


Illustration No. 73D

Method E-20
50 in. Diameter Printing Paper on End Using 2 ft Wide Rubber Mats

F—DISPOSABLE INFLATABLE DUNNAGE (D.I.D.) BAGS

Method F-1—Case Goods on Slip Sheets Secured with Friction Panels and D.I.D. Bags

Restrict this load to slip sheet loads unitized by minimum 90 gauge stretch-wrap. Follow manufacturer's instructions regarding the minimum number of wraps to be used for this application, but in all cases use a minimum of three wraps for the top and bottom layers and two wraps for the center layers. Fill all crosswise voids with an appropriate void filler.

Illustration No. 78:

1. Plan the load so crosswise void space is minimized. Use appropriate filler material to prevent crosswise movement.

2. Place units in the trailer/container with a minimum of 4 in. between them for the placement of minimum Level 1 48 in. × 96 in. disposable inflatable dunnage (D.I.D.) bags to control lengthwise load movement. The D.I.D. bags must be either a minimum Level 1 bag as described in AAR General Information Bulletin No. 9, "Product Performance Profile for Pneumatic Dunnage," or supplements thereto. The Stopak two-ply square paper bag or ITW/Centerload two-ply square paper bag also may be used to fill crosswise void space from 12 in. to 24 in. to control lengthwise movement.

3. Lading weight in trailers and containers must be evenly distributed both crosswise and lengthwise, and the combined weight of lading must conform to all federal, state, provincial, and local regulations and transportation service requirements used at origin and to final destination.

4. Use the D.I.D. bags at three locations in the load: the third and fourth stacks, sixth and seventh stacks, and the last two stacks. The illustration shows 11 units in each row in a 102 in. wide trailer. Other size trailers/containers with varying numbers of units also may be loaded.

5. Place friction panels (17 to 23 point solid fiberboard sheets with latex adhesive on both sides or equivalent) between units and sidewalls at all locations where D.I.D. bags are used. Have the panel sized to fit the size of the units.

6. When the center void filled by a minimum Level 1 D.I.D. bag is larger than 12 in. after inflation, place additional full-size void fillers capable of withstanding a load of 1,500 lb/ft^2 alongside the D.I.D. bags. Inflate the D.I.D. bags to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction (e.g., domestic intermodal truckload carriers or IMC containers), except when square D.I.D. bags are used. Inflate square bags to 2.5 psi. Recheck D.I.D. bag pressures after all are inflated.

NOTE: Do not reuse D.I.D. bags used for load securement.

NOTE: An updated listing of verified D.I.D. bags can be found on the TTCI Web site at http://www.aar.com/dpls/pfds/PPPPD_Verification_List.pdf

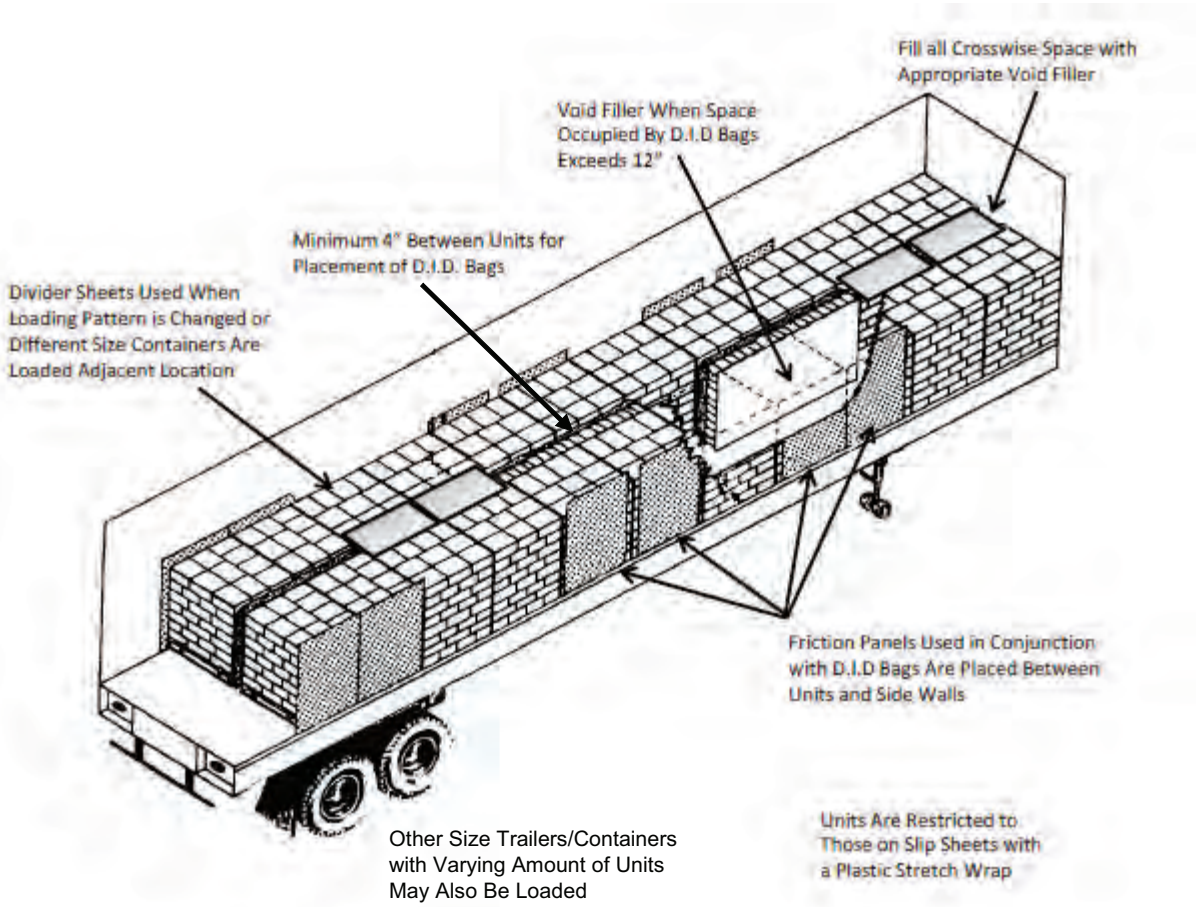


Illustration No. 74

Method F-1
Case Goods on Slip Sheets Secured with Friction Panels and D.I.D. Bags in Trailers/Containers

Method F-2—Case Goods Secured with D.I.D. Bags

Use this method for case goods unitized on pallets or slip sheets by minimum 90 gauge stretch-wrap. Follow manufacturer's instructions regarding the minimum number of wraps to be used, but in all cases use a minimum of three wraps for the top and bottom layers and two wraps for the center layers. The load that was tested weighed 45,000 lb.

Illustration No. 79:

1. Cover rough surfaces or projections of the sidewall with fiberboard sheets or other suitable material.

2. Plan the load so crosswise space is minimized. Use appropriate void fillers to prevent crosswise movement.

3. Lading weight in trailers and containers must be evenly distributed both crosswise and lengthwise, and the combined weight of lading must conform to all federal, state, provincial, and local regulations and transportation service requirements used at origin and to final destination.

4. Use D.I.D. bags to control lengthwise load movement. The D.I.D. bags must be either a minimum Level 1 bag as described in AAR General Information Bulletin No. 9, "Product Performance Profile for Pneumatic Dunnage," or supplements thereto. The Stopak two-ply square paper bag or ITW/Centerload two-ply square paper bag also may be used to fill crosswise void space from 12 in. to 24 in. to control lengthwise movement.

Sketch 1: Use this method for loads in which the lading is positioned against the front end wall.

5. Use D.I.D. bags at two locations in the load: at the fourth and fifth stacks and at the last two stacks. The illustration shows ten units in two rows. Depending on trailer/container size and unit weight, varying numbers of units may also be loaded. In any case, the first D.I.D. bag restrains approximately one half the load. Use D.I.D. bags wide enough to extend from 4 in. above the floor to the top of the lading. Minimum D.I.D. bag size is one 48 in. × 96 in. bag at each location.

6. Place units in the trailer/container with a minimum 4 in. center void between the units where the D.I.D. bags are located. Leave a 24 in. (approximate) space between the rear of the load and the trailer/container doors.

7. When the center void filled by the D.I.D. bag is larger than 10 in. after inflation of the bag, except when using a Stopak or ITW/Centerload Technologies square bag, place additional full-size void fillers capable of withstanding a load of 1,500 lb/ft^2 alongside the D.I.D. bags. Position the D.I.D. bags 4 in. above the trailer/container floor. Inflate the D.I.D. bags to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction (e.g., domestic intermodal truckload carriers or IMC containers), except when square D.I.D. bags are used. Inflate square bags to 2.5 psi. Recheck D.I.D. bag pressures after all are inflated.

Sketch 2: Use this method for case goods unitized on pallets when there is unfilled lengthwise pallet underhang and/or for case goods unitized on pallets or slip sheets that are loaded away from the front end wall to obtain proper weight distribution.

8. Use D.I.D. bags adjacent to every stack in the load. The D.I.D. bags contact the full surface of the units along the center void of the trailer/container as shown in the illustration. The illustration shows ten units in two rows. Depending on trailer/container size and unit weight, varying numbers of units may also be loaded. Use D.I.D. bags wide enough to extend from 4 in. above the floor to the top of the lading. Minimum D.I.D. bag size is one 48 in. × 96 in. bag at each location.

9. When the center void filled by a minimum Level 1 D.I.D. bag is larger than 10 in. after inflation of the bag, place additional full-size void fillers capable of withstanding a load of 1,500 lb/ft^2 alongside the D.I.D. bags. Position the D.I.D. bags 4 in. above the trailer floor. Inflate the D.I.D. bags to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction (e.g., domestic intermodal truckload carriers or IMC containers), except when square D.I.D. bags are used. Inflate square bags to 2.5 psi. Recheck D.I.D. bag pressures after all are inflated.

10. Leave a 24 in. (approximate) space between the rear of the load and the trailer/container doors.

NOTE: Do not reuse D.I.D. bags used for load securement.

NOTE: An updated listing of verified D.I.D. bags can be found on the TTCI Web site at http://www.aar.com/dpls/pfds/PPPPD_Verification_List.pdf

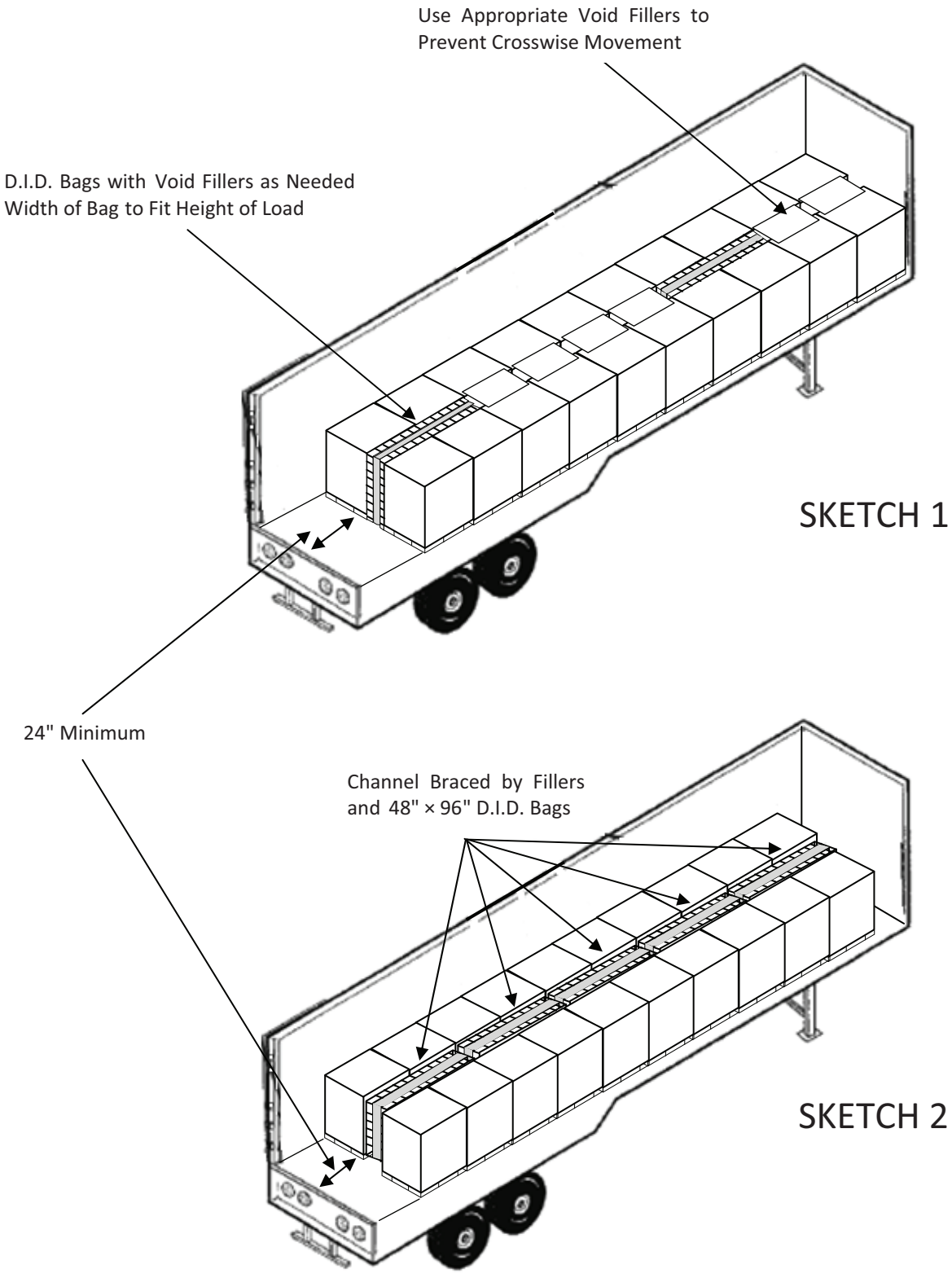


Illustration No. 75

Method F-2
Palletized Case Goods Secured with D.I.D. Bags

Method F-3—Split Loads of Case Goods or Fiberboard Tray Packs Secured with D.I.D. Bags

Use this method for case goods or fiberboard tray packs unitized on pallets by minimum 90 gauge stretch-wrap. Follow manufacturer's instructions regarding the minimum number of wraps to be used, but in all cases use a minimum of three wraps that extend over the pallet edge to help maintain vertical alignment. Tray packs may have sharp edges and may require facing material to guard against contact with adjacent disposable inflatable dunnage (D.I.D.) bags.

Illustration No. 79A:

1. Cover rough surfaces or projections of the sidewall with fiberboard sheets or other suitable material.

2. Plan the load so that crosswise space is minimized. Use appropriate void fillers to prevent crosswise movement.

3. For maximum load restraint, fill any pallet underhang along the sidewalls with properly sized void fillers.

4. Lading weight in trailers and containers must be evenly distributed both crosswise and lengthwise, and combined weight of lading must conform to all federal, state, provincial, and local regulations and transportation service requirements used at origin and to final destination.

5. Place units in the trailer/container with a minimum 4 in. center void between the units where the D.I.D. bags are located. Leave a minimum of 36 in. (approximate) space between the rear of the load and the container doors.

6. Use D.I.D. bags to control lengthwise load movement. The D.I.D. bags must be either a minimum Level 1 bag as described in AAR General Information Bulletin No. 9, "Product Performance Profile for Pneumatic Dunnage" or supplements thereto; or the Stopak two-ply square paper bag or Centerload two-ply square paper bag also may be used to fill crosswise void space from 12 in. to 24 in. to control lengthwise movement.

7. Use D.I.D. bags adjacent to every stack in the load except that at the nose. The D.I.D. bags contact the full surface of the units along the center void of the container as shown in the illustration. The illustration shows five stacks loaded in the nose of the container. Position the first stack against the nose wall one-wide, braced laterally to restrict crosswise movement and follow it with four two-wide stacks. Then create a void space to obtain proper weight distribution and follow that with four stacks loaded at the rear. Depending on container size and unit weight, varying numbers of units also may be loaded. Use D.I.D. bags wide enough to extend from 4 in. above the floor to the top of the lading. Protect the D.I.D. bags from rough surfaces, e.g., pallet edges, by use of proper facing material. Secure the D.I.D. bags from vertical displacement during transit by use of double-sided tape or other appropriate methods.

8. When the center void filled by the D.I.D. bags is larger than 10 in. after inflation of the bag (except when using approved large void bags), place additional full-size void fillers capable of withstanding a load of 1,500 lb/ft^2 alongside the D.I.D. bags to reduce the void to between 4 in. and 10 in. Position the D.I.D. bags 4 in. above the trailer floor. Inflate the D.I.D. bags to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction (e.g., domestic intermodal truckload carriers or IMC containers).

NOTE: Do not reuse D.I.D. bags used for load securement.

NOTE: An updated listing of verified D.I.D. bags can be found on the TTCI Web site at http://www.aar.com/dpls/pfds/PPPPD_Verification_List.pdf

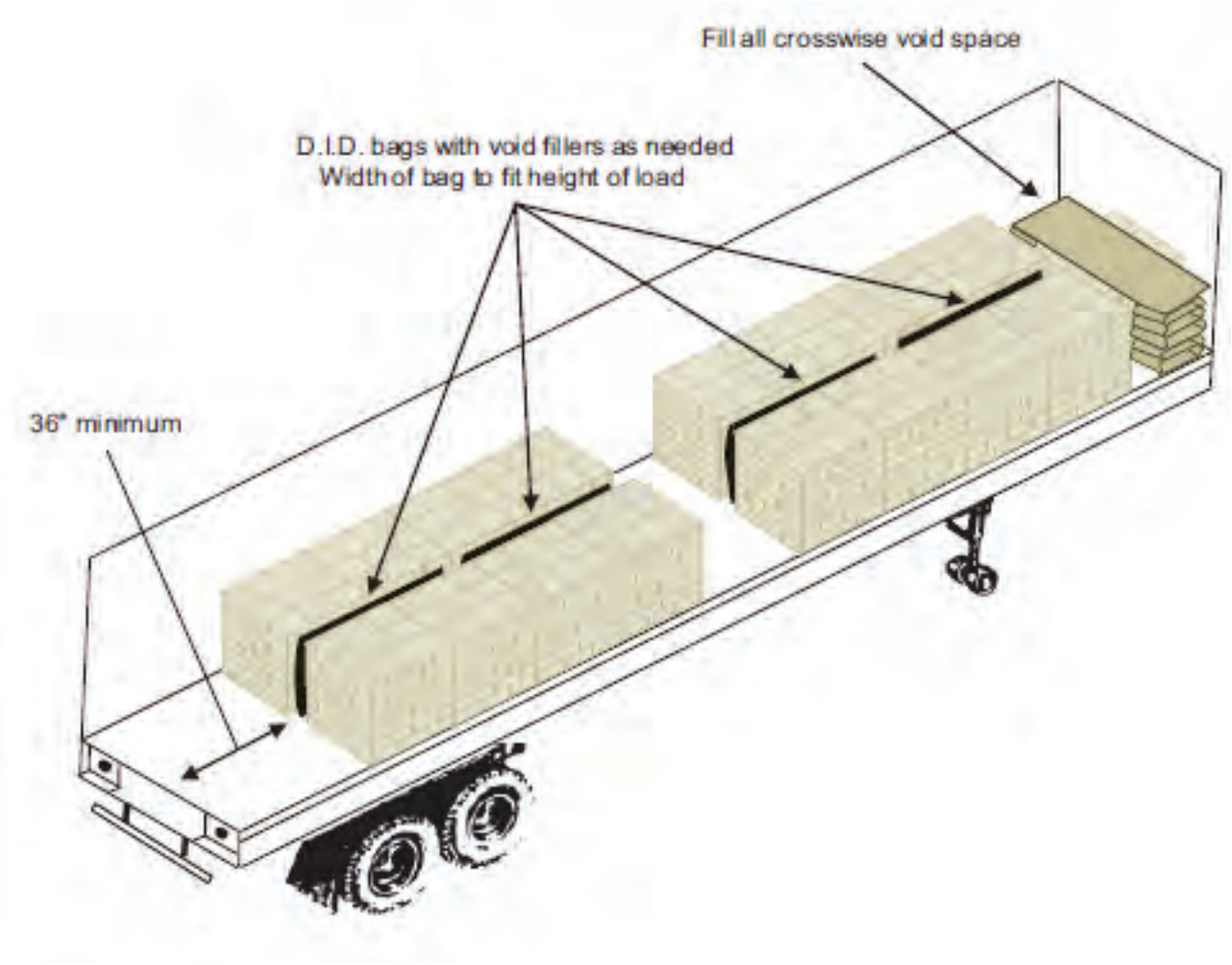


Illustration No. 75A

Method F-3
Split Loads of Case Goods or Fiberboard Tray Packs
Secured with D.I.D. Bags

G—WOOD

Method G-1—40 in. Diameter Rolls of Printing Paper Secured with Wood Blocking and Two Unitizing Straps

Restrict this loading method to single-layer, 2-1-2 pattern loads of 40 in. diameter roll printing paper in trailers/containers for TOFC/COFC service. This method was tested in a 102 in. wide trailer. Plan the load to *equalize the weight on each side of the trailer or container*. Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 80:

1. Unitize the last five rolls (at the doorway) with two 1¼ in. × .031 in. or equivalent steel straps. Seal these with two seals per strap, with two crimps per seal. Use a strap holder to keep these straps in position. A 1¾ in. polyester web strap also may be used.

The following may be used as alternatives to 1¼ in. × .031 in. steel strap:

a. 1¾ in. polyester web strap with proper hardware and ratchet tension device

b. Approved polyester cord strapping using the correct buckle in accordance with manufacturer's instructions. (See Section III-F for approved polyester cord strapping.) Split the strap end on the tension side of the buckle and knot after tensioning. Follow manufacturer's/supplier's instructions for tensioning and sealing strap used.

2. Nail a double 2 in. × 6 in. × 8 ft 0 in. floor block against the last rolls perpendicular to the trailer/container sidewall. Use fourteen 8d nails per layer. If 12d nails are used, only seven are needed per layer.

3. Nail four double 2 in. × 4 in. × 18 in. backup cleats perpendicular to the 2 in. × 6 in. lumber. Use three nails minimum per layer for these cleats. Place two cleats 8 in. off the centerline of each roll of paper as shown.

4. Fill any remaining space with 2 in. lumber 18 in. long, with a width equal to the void size, placed parallel to the 2 in. × 6 in. block (see detail on illustration) and nail it in position.

If rough-cut lumber is used for blocking, use minimum 12d nails.

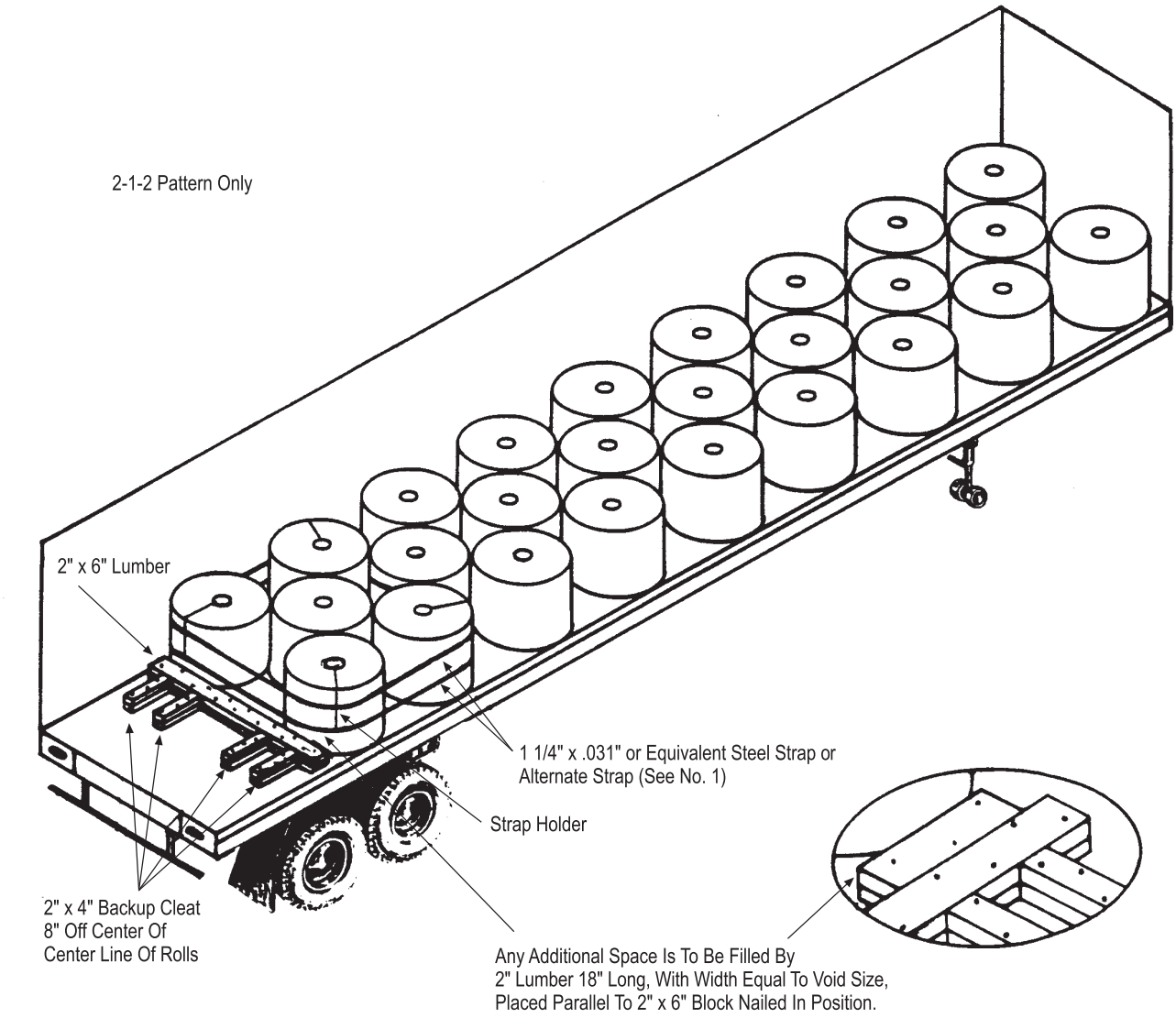


Illustration No. 76

Method G-1
4 in. Diameter Rolls of Printing Paper Secured with
Wood Blocking and Two Unitizing Straps

Method G-2—Double-Layer Drum Load Secured with "T" Gates in a 20 ft Container

This method loads drums two layers high in a 20 ft container.

Illustration No. 81:

1. Load thirty-nine drums in a 4-3-4 pattern in each layer. Use ¼ in. thick plywood as a separator between each layer. This separator material runs the full length and width of the container.

2. The load ends with the four-wide stack of drums in the doorway. Place a ½ in. thick piece of plywood upright at the door of the container. Use this to protect the drums from the "T" gates used to prevent movement of the drums in the container.

3. Construct the "T" gates of 2 in. × 6 in. material with a length equal to the full width of the container interior plus an additional 2 in. for insertion into the doorway bracing slots. Nail two additional pieces perpendicular to these boards as shown in the detail of the illustration.

4. Use six of these units to brace this load, with three units per layer of drums. Use spacers between each of these units to evenly position these "T" gate units between each rolling hoop on the drums.

5. Miter the ends of the "T" gate unit to facilitate installation into the doorway bracing slots. See illustration for a view of the completed load.

The following separators have been evaluated and found acceptable for one-time use with this loading method. These separators were tested under simulated conditions, and their acceptance may be withdrawn if loads exhibit consistent load failures. If used with hazmat loads, these panels must be compatible with the contents of drums.

Name	Thickness	Description	Vendor
Drum Tite	3.0 mm, 3.2 mm	Eucalyptus hardboard	Lodge Lumber
Drum Sep	3.2 mm	Eucalyptus hardboard	Pasadena Skid and Pallet Inc.
Ship Tite 2	.375 in.	Corrugated (*not* for use with corrosives)	Allegheny Industrial Associates
Ship Tite 3	.625 in.	Corrugated (*not* for hazmat use)	Allegheny Industrial Associates
Ship Tite 5	3.2 mm	Corrugated	Allegheny Industrial Associates
Generic	3.0 mm	Eucalyptus hardboard	Greif
PlyVeneer®	3.0 mm	Wood veneer with a Kraft linerboard overlay	PlyVeneer Products
Tier 55	1.0 in., 0.50 in.	Corrugated	Damage Prevention Company

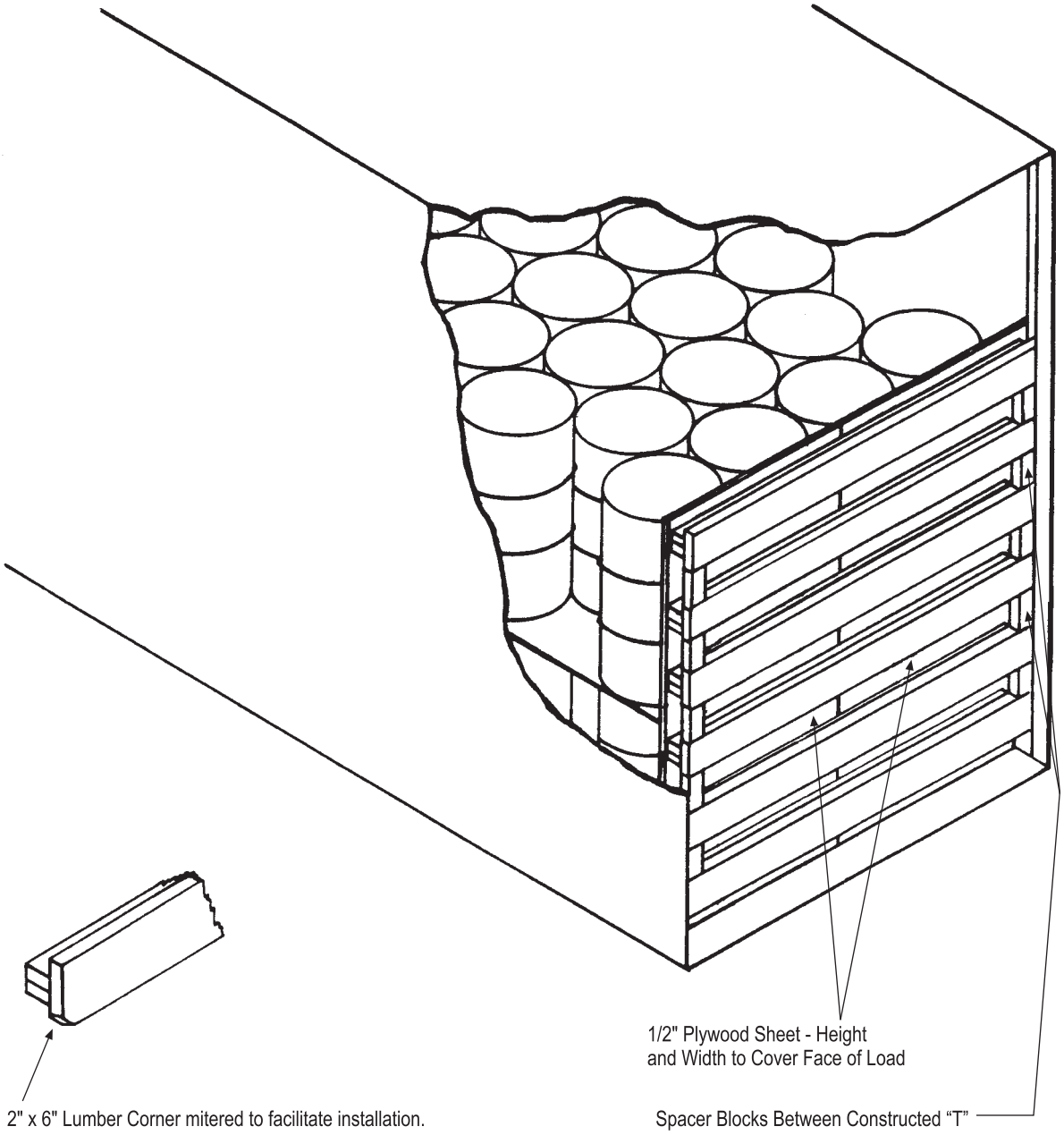


Illustration No. 77

Method G-2
Double-Layer Drum Load Secured with "T" Gates in a 20 ft Container

Method G-3—Double-Layer 55-Gallon (Closed-Head) Steel Drums in 20 ft Containers with Bracing Slots 1 in. or Greater in Depth or with Protruding Rear Corner Posts

The following procedures have been tested and found successful in loading and bracing 55-gallon (closed-head) drums in 20 ft containers equipped with bracing slots or protruding rear corner posts. Follow these procedures, without exception, in all loads using this bracing method.

Illustration No. 82:

1. Prior to loading, inspect containers to ensure there are no damaged corner posts. Any protruding nails or screws in the floors must be drawn, redriven, and/or tightened.

2. Position drums directly opposite each other on opposite sides of a separator.

CAUTION: Trailer/container must have brace slots adjacent to corner posts or have doorposts that extend a minimum of 2½ in.

Item	No. of Pieces	Description
A	3	Two-layer bulkhead. (See **Sketch 1**.)
B	2	Plywood decking—¼ in. × (container width minus ¼ in.) × (length as required).
C	1	Separator ¼ in. plywood × (load height) × (container width, minus 1 in.).
D	3	Horizontal fill—6 in. × 30 in. × (thickness required). Nail to bulkhead and/or nailing piece.
E	2	Nailing piece—2 in. × 6 in. × 30 in.
F	2	Vertical fill—6 in. × 30 in. × (thickness required). Nail to bulkhead.
G	5	Retainer piece—2 in. × 6 in. × length to fit into brace slots adjacent to corner posts (inside container width if brace slots are not present). Nail to bulkhead vertical or horizontal pieces.

The following separators have been evaluated and found acceptable for one-time use with this loading method. These separators were tested under simulated conditions, and their acceptance may be withdrawn if loads exhibit consistent load failures. If used with hazmat loads, these panels must be compatible with the contents of drums.

Name	Thickness	Description	Vendor
Drum Tite	3.0 mm, 3.2 mm	Eucalyptus hardboard	Lodge Lumber
Drum Sep	3.2 mm	Eucalyptus hardboard	Pasadena Skid and Pallet Inc.
Ship Tite 2	.375 in.	Corrugated (*not* for use with corrosives)	Allegheny Industrial Associates
Ship Tite 3	.625 in.	Corrugated (*not* for hazmat use)	Allegheny Industrial Associates
Ship Tite 5	3.2 mm	Corrugated	Allegheny Industrial Associates
Generic	3.0 mm	Eucalyptus hardboard	Greif
PlyVeneer®	3.0 mm	Wood veneer with a Kraft linerboard overlay	PlyVeneer Products
Tier 55	1.0 in., 0.50 in.	Corrugated	Damage Prevention Company

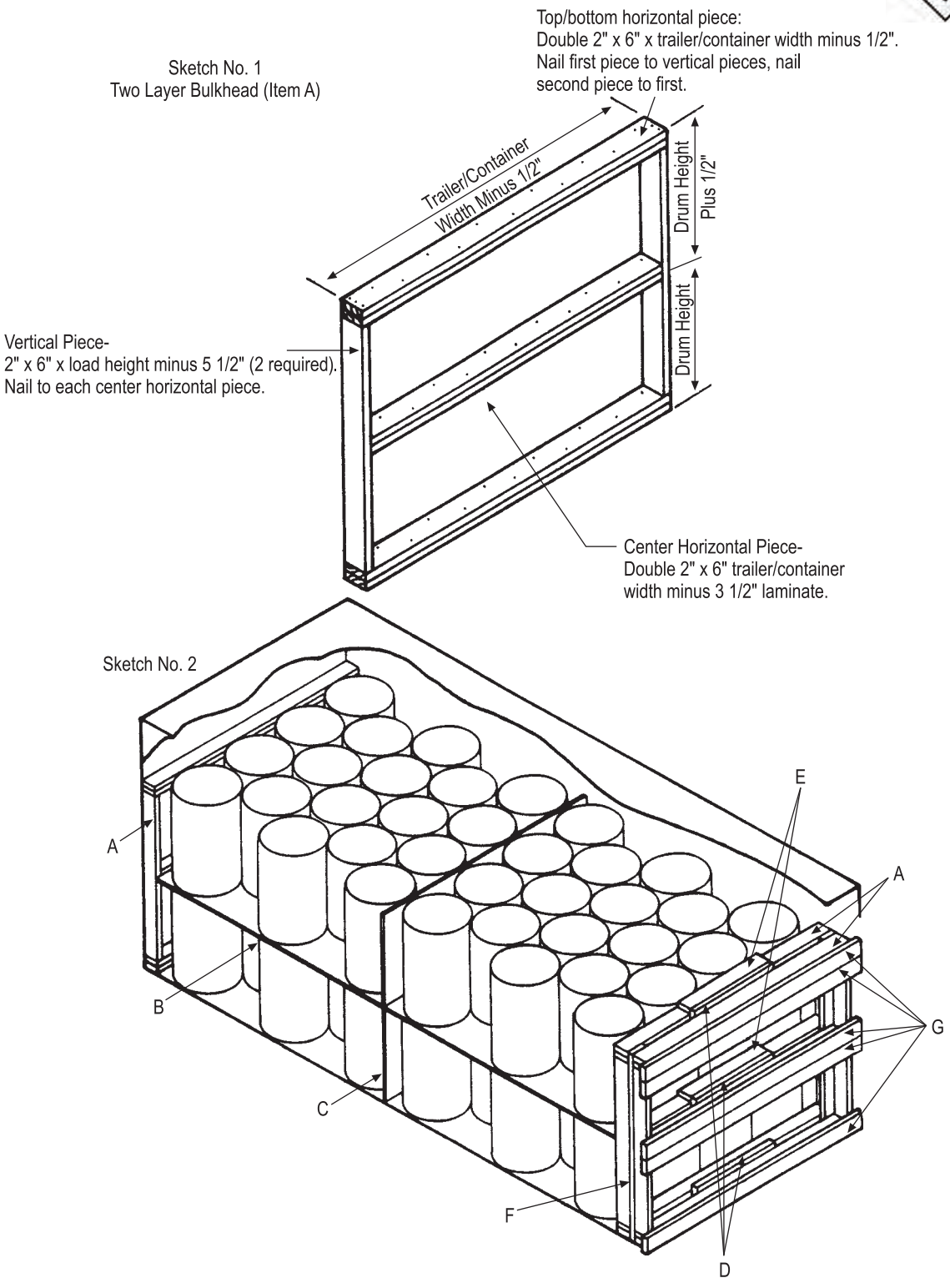


Illustration No. 78

Method G-3
Double-Layer 55-Gallon (Closed Head) Steel Drums in 20 ft Containers
with Bracing Slots 1 in. or Greater in Depth or with Protruding Rear Corner Posts

Method G-4—55-Gallon Open-Head (Steel) Drums or Closed-Head (Steel or Polyethylene) Drums in Trailers/Containers with Bracing Slots 1 in. or Greater in Depth or with Protruding Rear Corner Posts

The following procedures have been tested and found successful in loading and bracing 55-gallon drums in trailers or containers equipped with bracing slots or protruding rear corner posts. Follow these procedures, without exception, in all loads using this bracing method.

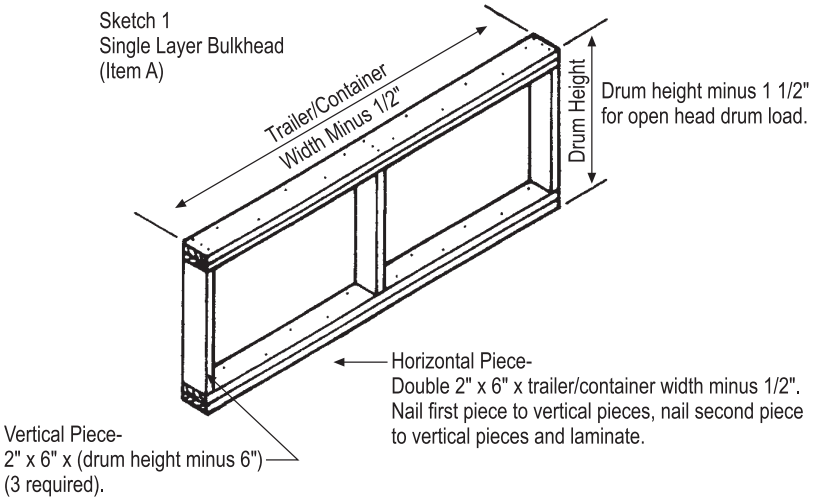
Illustration No. 83:

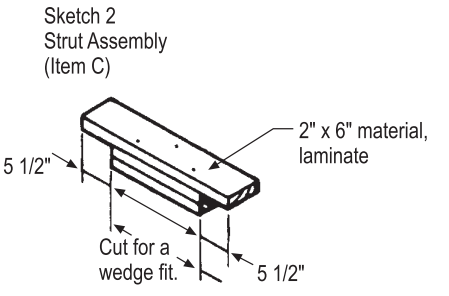
1. Prior to loading, inspect trailers/containers to ensure there are no damaged corner posts. Any protruding nails or screws in the floors must be drawn, redriven, and/or tightened.

2. Position drums directly opposite each other on opposite sides of a separator.

CAUTION: Trailer/container must have brace slots adjacent to corner posts or have doorposts that extend a minimum of 2½ in.

Item	No. of Pieces	Description
A	3	Single layer bulkhead. Nail to trailer/container floor. (See **Sketch 1**.)
B	4 (open-head drums) 2 (closed-head drums)	½ in. plywood separator (load height) × (trailer width, minus 1 in.)
C	3	Strut—Two 2 in. × 2 in. × (length cut to fit, laminated and toe-nailed to bulkheads at each end).
D	3	Horizontal fill—6 in. × 30 in. × (thickness required). Nail to bulkhead and/or nailing piece.
E	3	Length cut to fit into brace slots adjacent to corner posts (inside trailer/container width if brace slots are not present). Nail top and bottom pieces to bulkhead and nail other piece to vertical pieces.
F	9 (open-head drums)	Risers laminated 2 in. × 6 in. × (sufficient length to support width of stack). Required for open-head drums only.





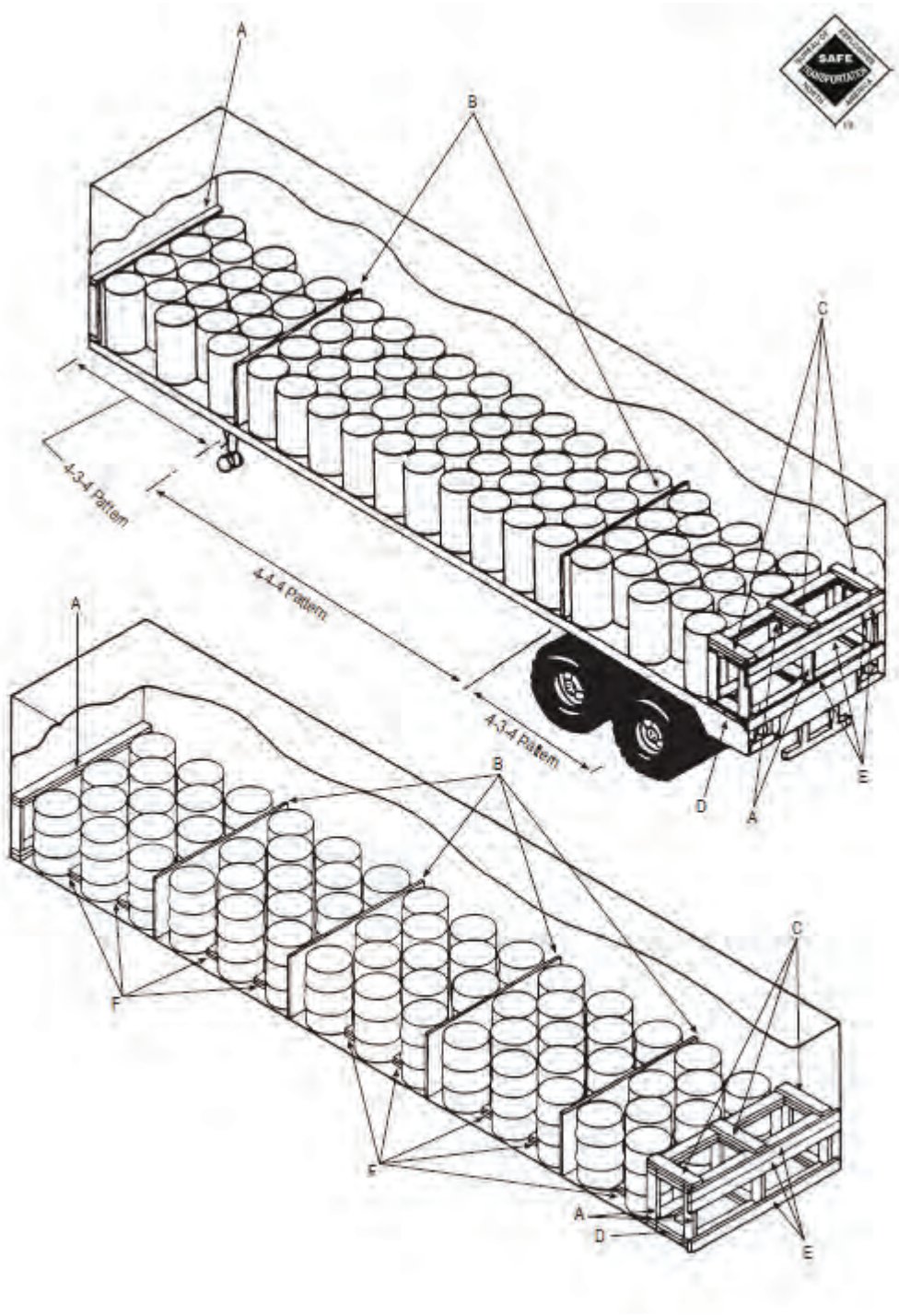


Illustration No. 79

Method G-4
55-Gallon (Open Head) Steel Drums in Trailers/Containers with
Bracing Slots 1 in. or Greater in Depth or with Protruding Rear Corner Posts

Method G-5—58 in. Diameter Rolls of Pulpboard on End Using Floor Blocking

Use this loading method for 58 in. diameter roll pulpboard loaded on end in a 1-1 offset pattern in a trailer or container for intermodal service. This method was tested in a 102 in. wide trailer. Plan the load to *equalize the weight on each side of the trailer or container*. Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 84:

1. Divide the load into two sections, each containing approximately half of the load.

2. The first section consists of four rolls starting at the nose of the trailer/container. Brace the last roll of this section with two floor blocks each consisting of a double 2 in. × 6 in. × 36 in. long floor block with two double 2 in. × 6 in. backup cleats 24 in. long. Install one of the two floor blocks adjacent to the roll and perpendicular to the sidewall. Install the other block adjacent to the roll at approximately 45° to the first block. Nail floor blocking and backup cleats to the trailer/container floor with 16d power-driven nails staggered 4 in. on center.

3. Load the second section in a 1-1 pattern between 75 in. and 85 in. behind the first section. Brace the first and last rolls with the same configuration of blocking used in the first section.

4. Use one of two types of strapping to unitize each section:

    a. A 1¾ in. polyester web strap and buckle assembly having a 15,000 lb capacity rating. Use one strap around each section placed approximately 12 in. down from the top edge of the roll. Pretension each strap.

    b. A 1¼ in. × .031 in. steel strap. Use one strap around each section. Install straps approximately 12 in. down from the top edge of each roll. Seal straps on both sections with two grit-type seals per strap with two crimps per seal.

5. Use polyester filament tape or equivalent to suspend the unitizing strap from the top of the rolls in both sections.

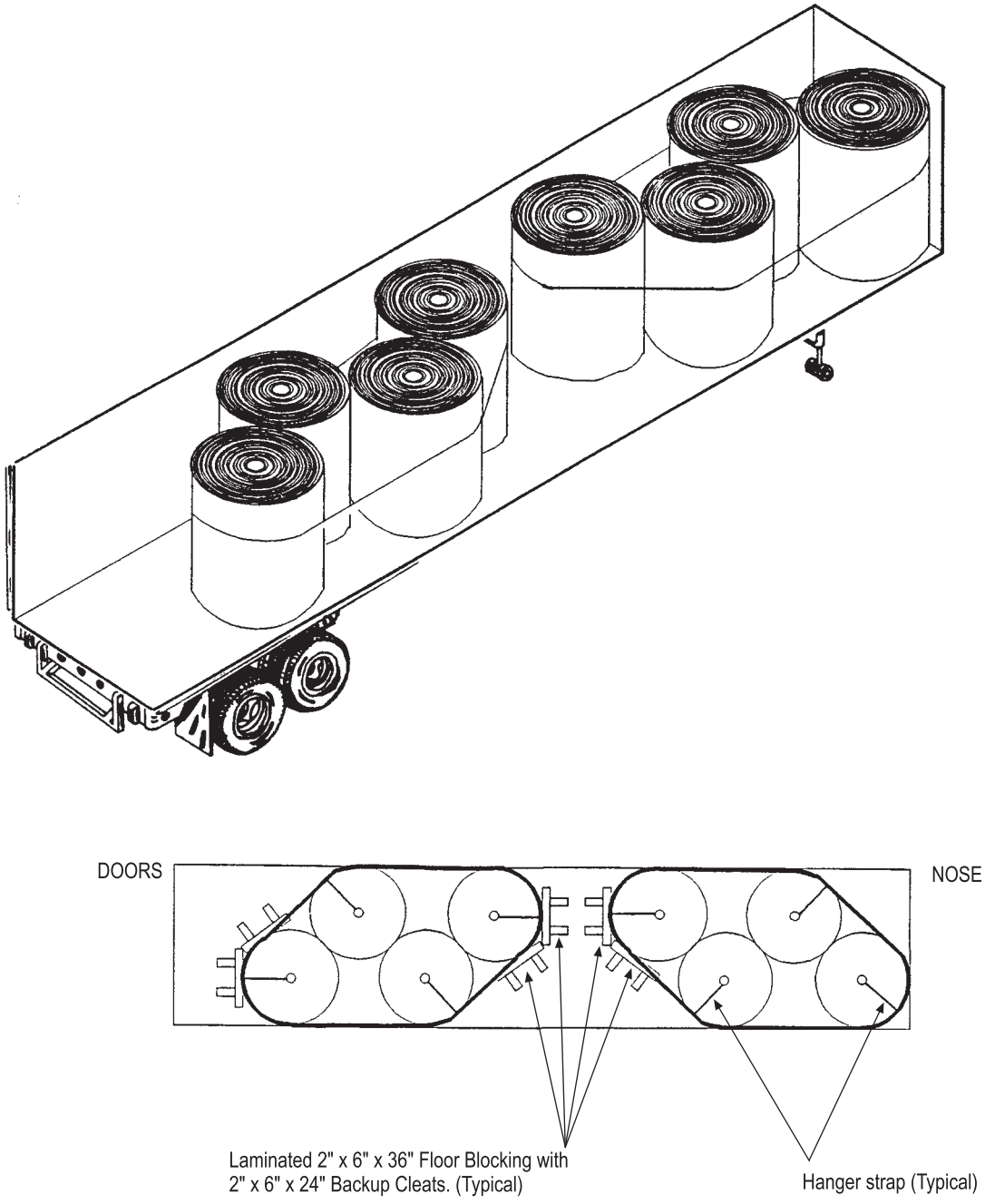


Illustration No. 80

Method G-5
58 in. Diameter Rolls of Pulpboard on End Using Floor Blocking

Method G-6—Dimensional Lumber Secured by Floor Blocking and D.I.D. Bags

Use this loading and bracing method for dimensional lumber loaded lengthwise in two rows in a trailer or container for intermodal service. Load lading to the front end wall.

Illustration No. 85:

1. Unitize each stack of lumber approximately 2 ft from each end with one 1¼ in. × .031 in. steel strap. Stacks positioned at the trailer/container doorway should have two 1¼ in. × .031 in. unitizing straps around the doorway end. Seal the unitizing straps with two seals having a minimum of four crimps. Corner protectors are recommended to protect the product from the steel strapping.

2. Install D.I.D. bags (minimum Level 1x, 30 in. wide × height of load) in center void to maintain lateral alignment. Use single-wall corrugated fiberboard sheets (minimum) on each side of the D.I.D. bag for protection. Inflate the D.I.D. bags to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction (e.g., domestic intermodal truckload carriers or IMC containers). Position bags 1 in. above floor. Space filled by inflatable dunnage should not exceed 12 in.

3. The floor blocking at the doorway end of each row consists of two 2 in. × 6 in. × 4 ft laminated pieces of softwood lumber reinforced with two 2 in. × 6 in. × 2 ft laminated backup cleats. Assemble the blocking according to **Sketch 2**. After laying the first 2 in. × 6 in. floor block on the trailer floor across the end of a row of lading, lay two pieces of 1¼ in. punched steel strapping 4 ft long on top of the block. Then hand-drive 16d common nails through the prepunched holes, through the blocking, and into the floor. Do the same for the backup cleats. Laminate a second piece of 2 in. × 6 in. lumber to the floor blocking using 16d nails as shown.

NOTE: Do not use a power nailer because deflection of the nail may occur if it is not properly aligned with the strap holes. Do not reuse D.I.D. bags used for load securement.

NOTE: An updated listing of verified D.I.D. bags can be found on the TTCI Web site at http://www.aar.com/dpls/pfds/PPPPD_Verification_List.pdf

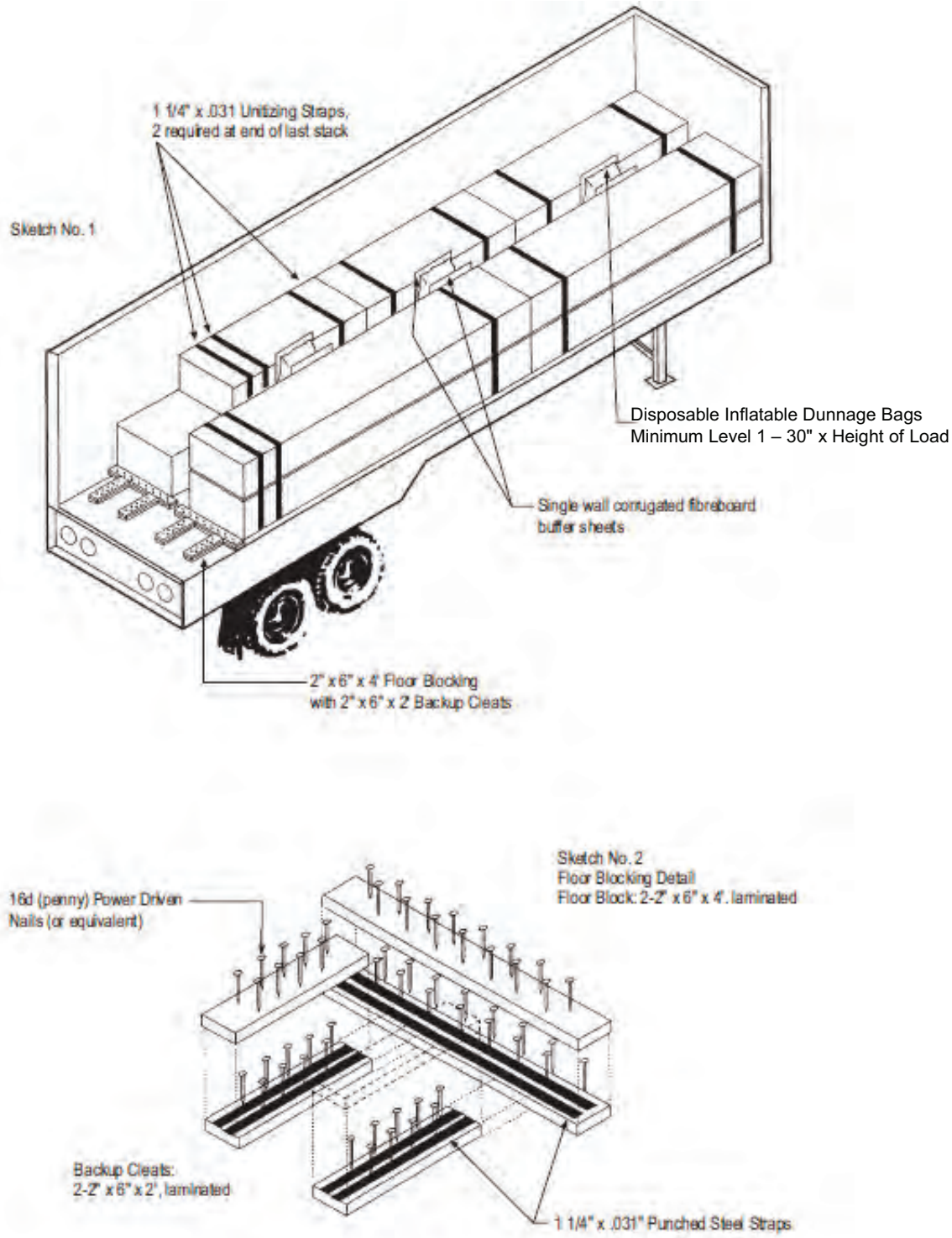


Illustration No. 81

Method G-6
Dimensional Lumber Secured by Floor Blocking and D.I.D. Bags

Method G-7—58 in. Diameter Roll Pulpboard on End Using Pre-Assembled Wood Blocking

Use this loading method for 58 in. diameter roll pulpboard loaded on end in a 1-1 offset pattern in a trailer or container for intermodal service. Plan the load to *equalize the weight on each side of the trailer or container.* Because roll weights vary, this will require attention to pre-planning. *A balanced load is required for the stability and success of this loading method.*

Illustration No. 86:

1. The pre-assembled blocking is constructed from four pieces of 2 in. × 6 in. × 24 in. softwood lumber. Assemble the blocking as shown in Illustration 82– **Sketch 1**. Place the crossbrace on top of the three backup cleats and nail it with four to five 12d nails at each backup cleat.

2. Divide the load into two sections, each containing approximately half of the load.

    a. The first section starts at the nose of the trailer/container. Brace the last roll of this section with two of the pre-assembled units. Install one of the blocking units adjacent to the roll with the crossbrace perpendicular to the sidewall.

    b. Install the second blocking unit adjacent to the roll at a 30° to 45° angle to the first. Place a 20 gauge strip of sheet metal, approximately equal to the size of the exposed area of the backup cleats, on top of each backup cleat. Nail the units through the sheet metal to the trailer/container floor with eight 12d power-driven nails staggered on each backup cleat.

3. Load the second section in a 1-1 pattern between 75 in. and 85 in. behind the first section. Brace the first and last rolls of this section in the same manner as the last roll in the first section.

NOTE: Tilting of rolls can occur during normal transit, resulting in slight edge or bilge flattening. Use of unitizing straps (e.g., 1¼ in. × .031 steel strap) may reduce tilting.

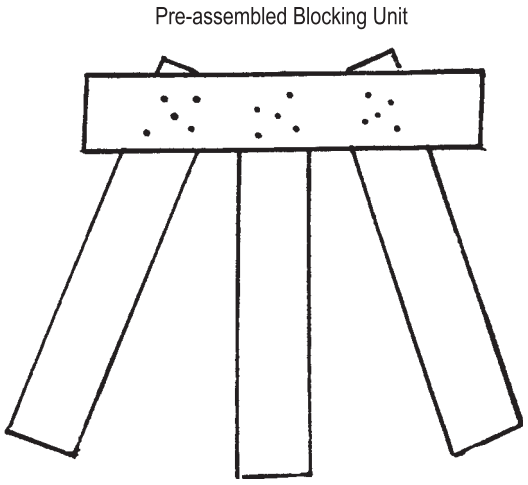


Illustration No. 82– Sketch 1

Method G-7
58 in. Diameter Roll Pulpboard on End Using Pre-Assembled Wood Blocking

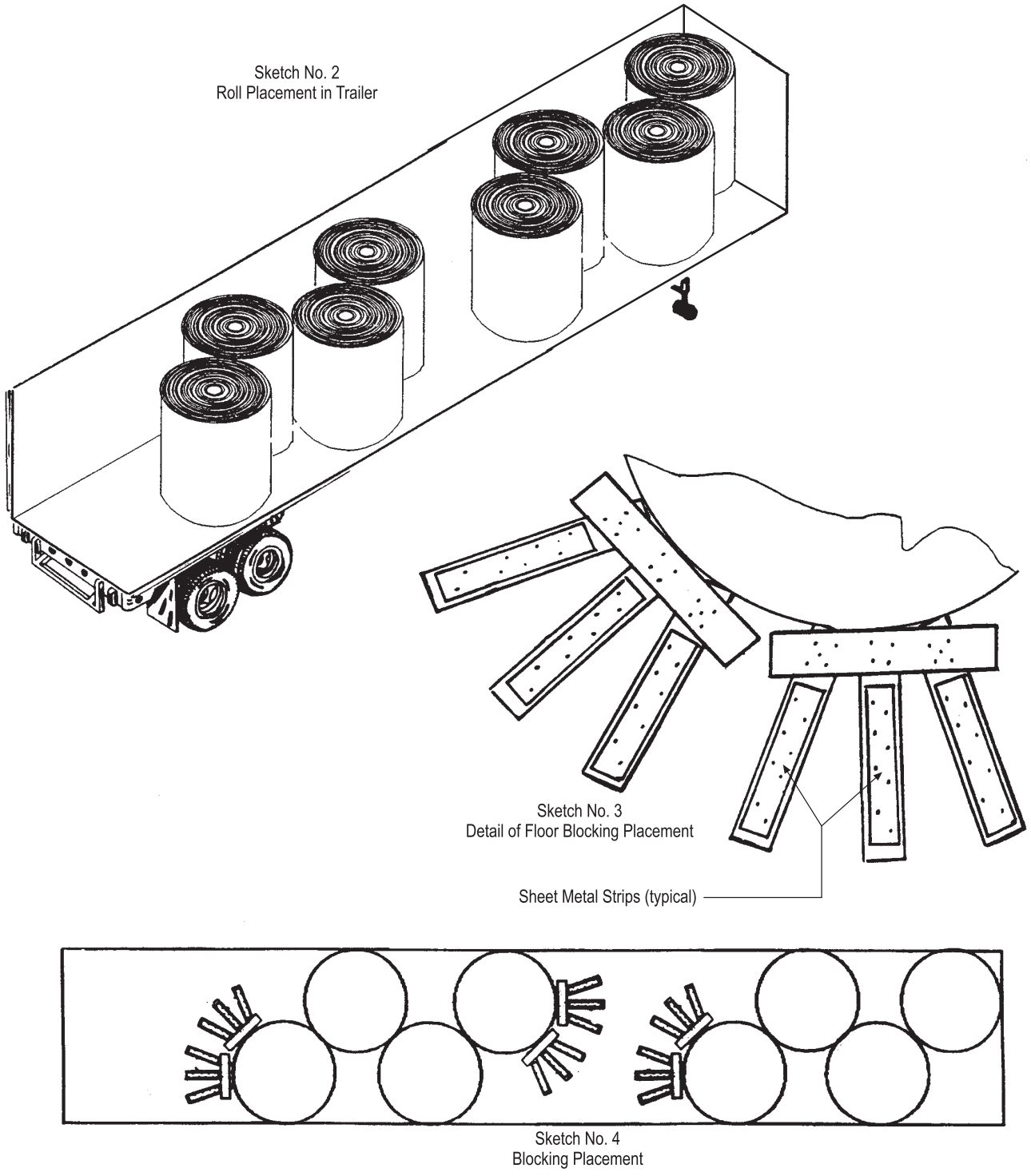


Illustration No. 82

Method G-7
58 in. Diameter Roll Pulpboard on End Using Pre-Assembled Wood Blocking

Method G-8—Unitized Products Secured by Wood Bulkheads

Use this method for unitized products loaded in two rows. The load tested weighed 45,900 lb.

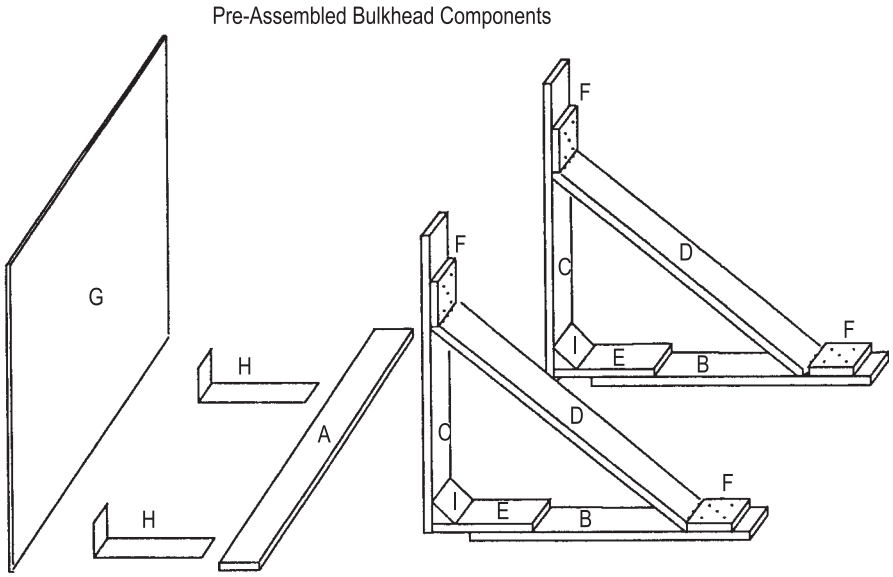
Illustration No. 87:

Brace each row at the rear of the trailer/container with a wood bulkhead constructed as illustrated in Illustration 83–**Sketch 1**. Items B, C, D, E, F, and I are pre-assembled. This assembly constitutes the brace.

Assemble the bulkhead by first nailing item A to the two braces. Staple the facing sheet of oriented strand board (OSB), or equivalent, to the brace uprights and floor block (A) using twenty-two to twenty-eight ⅜ in. × 1½ in. staples. Nail the two pieces of sheet metal around the corner of each brace using 16d glue-coated, power-driven nails or equivalent.

Each bulkhead is 48 in. wide. In 96 in. wide trailers/containers, offset the length of each row by pinwheeling units or by using suitable lengthwise void filler so that one bulkhead can overlap the other, as shown in Illustration 83–**Sketch 2**.

Secure each bulkhead to the trailer floor with forty-two 16d glue-coated, power-driven nails or equivalent.



A - 1" x 5½" x 46½" Hardwood (Oak)
B - 1" x 6" x 35½" Hardwood (Oak)
C - 1" x 6" x 46½" Hardwood (Oak)
D - 2" x 6" x 46½" Softwood (#2 Pine)
E - 1" x 6" x 18" Hardwood (Oak)
F - 1" x 6" x 5½" Softwood (#2 Pine)
G - ½" x 48" x 48" Oriented Strand Board (OSB)
H - 22 Gauge Sheet Metal, 5" Tall x 24" Long x 5" Wide
I - 4" x 4" Wedge Block (Gum)

Illustration No. 83– Sketch 1

Method G-8
Unitized Products Secured by Wood Bulkheads

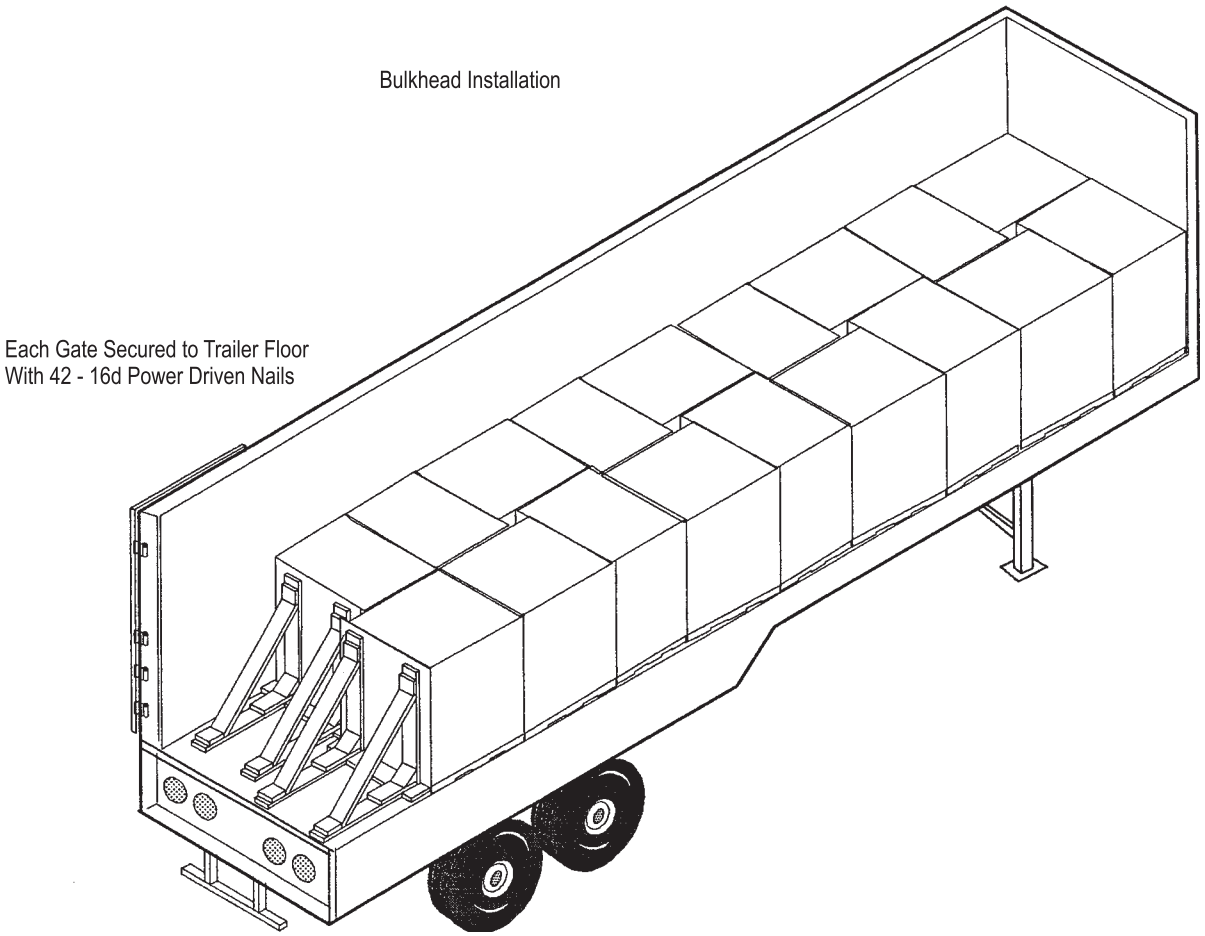


Illustration No. 83– Sketch 2

Method G-8
Unitized Products Secured by Wood Bulkheads

Method G-9—Commercial Refrigeration Units Secured by Floor Blocking and D.I.D. Bags

Use this loading method for commercial refrigeration units, typically display cases used in retail stores. The illustrated load is representative of the type of loads shipped. The number, size, shape, weight, and arrangement of units may vary, however, for each shipment utilizing this method.

Illustration No. 88:

1. Line the trailer/container sidewalls and nose with single-wall corrugated fiberboard. Tape may be used to keep the fiberboard in place. Do not use nails or staples to attach the fiberboard to the walls.

2. Load the units lengthwise of the trailer/container and place them in two rows, one along each sidewall. Load the backs of the units against the sidewalls.

3. Install Level 2, 18 in. × 36 in. disposable inflatable dunnage (D.I.D.) bags vertically between the ends of the units in each row. The D.I.D. bags prevent damaging contact between units and help maintain load tightness. Place corrugated fiberboard buffer sheets on each side of the D.I.D. bags. Inflate the D.I.D. bags to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction (e.g., domestic intermodal truckload carriers or IMC containers). Check the D.I.D. bag pressure 30 minutes after installation to make sure no leakage has occurred. Use tape to secure D.I.D. bags and buffer sheets in place.

4. Reinforce tall units with 2 in. × 4 in. lumber bolted to the side panels as shown in the illustration. This may not be possible on some units with finished end panels.

5. Crosswise bracing can be accomplished in three ways:

- Nail two pieces of 2 in. × 6 in. lumber to the end panel reinforcement as shown for units A and B in the illustration. The units so braced are of the same length with this bracing used at both ends of the units. Use nails long enough to penetrate into the end panel reinforcement but not go completely through to the end panel.
- Install Level 2, 18 in. × 36 in. D.I.D bags horizontally, lengthwise, in the center void between units if the void does not exceed 8 in. Be sure the front panels of units so braced are capable of withstanding the pressure exerted by the D.I.D. bag. Inflate the D.I.D. bags to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction (e.g., domestic intermodal truckload carriers or IMC containers). Check the D.I.D. bag pressure 30 minutes after installation to make sure no leakage has occurred.
- Use laminated 2 in. × 4 in. × 9 in. to 12 in. side-blocking in the center void against the ends of the units as shown in the illustration.

6. Secure each row by floor blocking and backup cleats. Construct floor blocking by nailing one 2 in. × 6 in. × 36 in. piece of lumber to the edge of a second similar piece with two to three nails to form an L-shaped block. Position this floor block against the row of lading as shown in the illustration and nail it to the floor with six 16d nails staggered to prevent splitting. Use two sets of 2 in. × 6 in. × 18 in. backup cleats for each row. Position the backup cleats as shown and secure them using three 16d nails per lamination.

NOTE: Fluorescent bulbs, detachable panels, shelves, dividers and trim pieces, and any other loose or easily detachable components can be displaced during transit due to normal vibration inputs. These components should be securely taped in place or removed and individually packaged. Do not reuse D.I.D. bags used for load securement.

NOTE: An updated listing of verified D.I.D. bags can be found on the TTCI Web site at http://www.aar.com/dpls/pfds/PPPPD_Verification_List.pdf

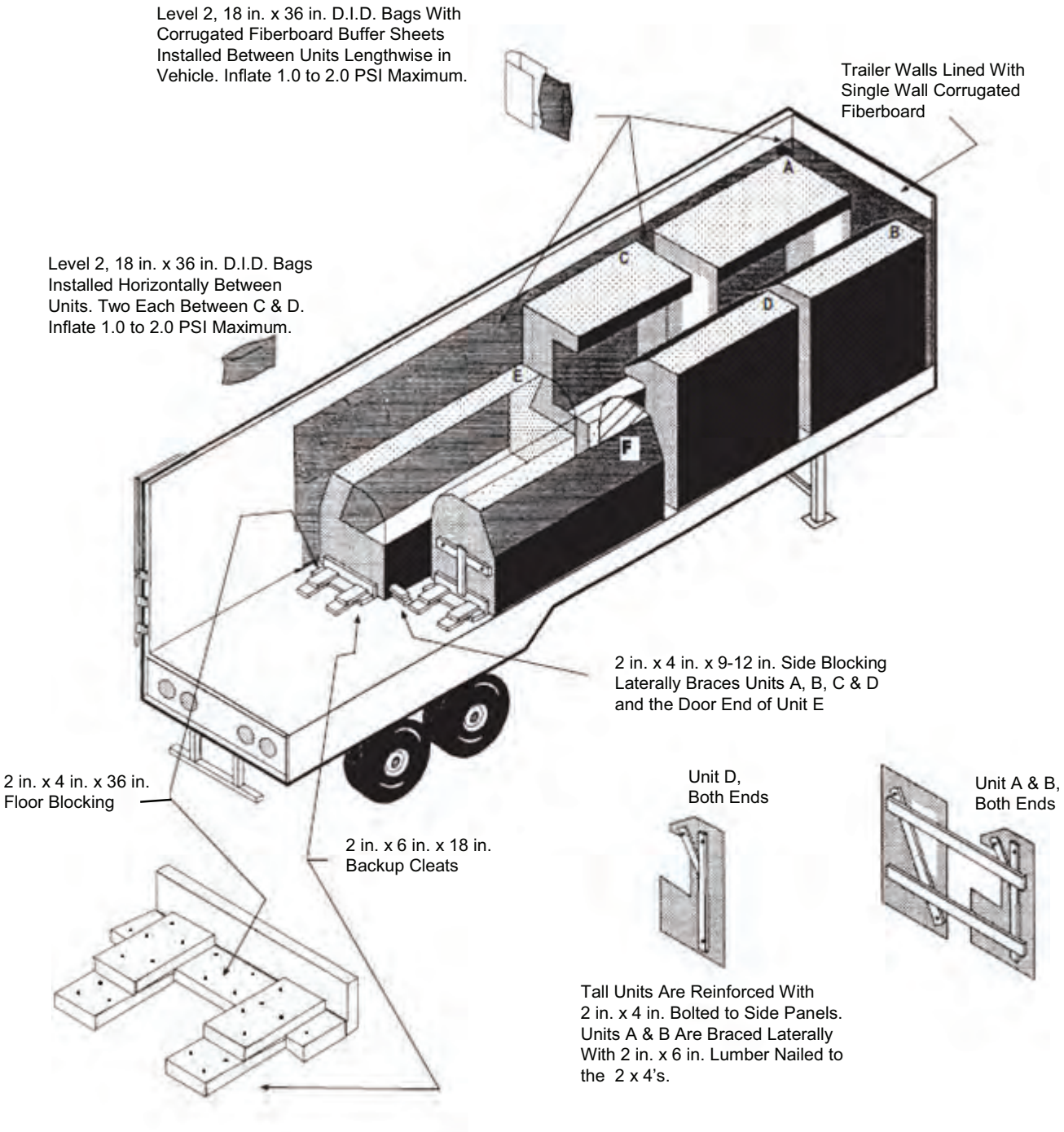


Illustration No. 84

Method G-9
Commercial Refrigeration Units Secured by
Floor Blocking and D.I.D. Bags

Method G-10—Bilge-Loaded 40 in. Diameter Paper Rolls Using Steel or Approved Polyester Cord Strapping and Wood Blocking

Use this method for 40 in. diameter roll paper loaded on bilge with the cores orientated crosswise of the trailer/container. The loading method utilizes steel or approved polyester cord strapping (see Section III-F for approved polyester cord strapping), wood blocking, and wooden chocks. The paper rolls may be of varying widths.

Illustration No. 89:

1. Divide the load into two sections, each containing approximately half the load. Use temporary chocks to secure stacks during loading and unloading.

2. Load the first section starting at the nose of the trailer/container. Load the rolls adjacent to each other across the trailer/container. Center each stack of rolls laterally.

3. Before loading the last three stacks on the floor, cut strapping consisting of three 1¼ in. × .031 in. steel strapping or approved polyester cord strapping (See Section III-F for approved polyester cord strapping), fold it in half, and place it on the floor with the looped end at the rear of the last stack loaded. Space the strapping evenly across the stack or center it on rolls, depending on the number of rolls across the trailer/container. Place one 2 in. × 6 in. board the width of the stack inside the loop of the strapping and nail it to the floor. Laminate a second 2 in. × 6 in. board of the same length on top of the first board, sandwiching the strapping between them. See detail on illustration.

4. Load the next floor stack on top of the strapping. Place the top half of the folded-over strapping back over the previous loaded stacks toward the nose of the trailer. The bottom half of the strap remains on the floor. Load the remaining two floor- and two second-layer stacks.

5. Bring the top half of the straps back over the rolls, and tension and seal the ends of each of the three straps. Before sealing, place a 2 in. × 4 in. board the width of the stack inside the strapping across the face of the second-layer stack. After sealing, drive a staple over each strap to secure the crosswise board in position. This board is not required if the width of the second-layer stacks is three rolls or less and all rolls in the second layer are secured by the securement straps.

6. Nail to the floor blocking consisting of at least three 8 in. wooden chocks backed up with one upright 2 in. × 6 in. board and two laminated 2 in. × 6 in. If the floor-layer stack consists of more than three rolls, use one chock for each roll adjacent to the floor blocking.

7. Load the second section identically to the first section with the addition of a 2 in. × 4 in. across the face of the first-layer stack as well as the second-layer stack inside the strapping. After sealing, drive staples over the straps to secure each crosswise board in position. These boards are not required if the width of the stacks is three rolls or less and all rolls in the these stacks are secured by the securement straps.

8. If the total crosswise void is 12 in. or greater, install lengthwise guide rails consisting of 2 in. × 4 in. boards along both sides of the floor stacks to prevent lateral movement. The guide rails run the entire length of the load and are spaced approximately 1 in. away from the edge of the rolls. Secure guide rails with 12d nails staggered 18 in. on center.

9. If the lateral void between the end of the second-layer stacks and the sidewalls of the trailer in either section is equal to more than half the width of the rolls, install a void filler to prevent lateral movement of the rolls. The illustration shows use of Level 1 D.I.D. bags installed between the end of the second-layer stacks and the sidewalls. Use corrugated fiberboard buffer sheets between the trailer sidewalls and the bags. Inflate the bags to 1 psi. Check D.I.D. bag pressure 30 minutes after inflation to ensure no leakage has occurred. Tape void fillers to rolls and/or trailer walls to prevent displacement.

The load shown in Illustration 85 was the actual load tested.

NOTE: An updated listing of verified D.I.D. bags can be found on the TTCI Web site at http://www.aar.com/dpls/pfds/PPPPD_Verification_List.pdf

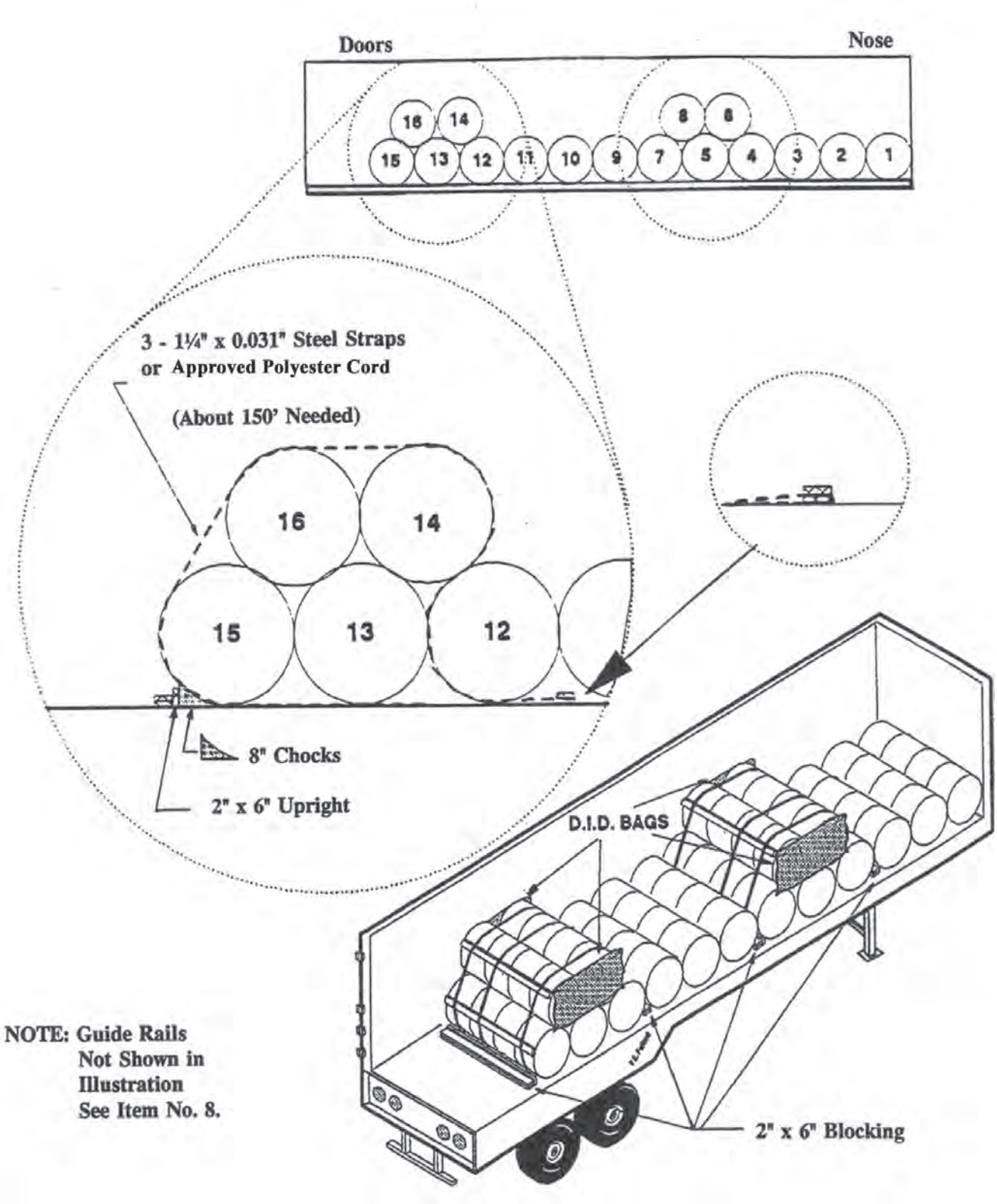


Illustration No. 85

Method G-10
Bilge-Loaded 40 in. Diameter Paper Rolls Using Steel
or Approved Polyester Cord Strapping and Wood Blocking

H—SPECIAL EQUIPMENT

Method H-1—Various Commodities Secured with Door SavR™

The Door SavR™ load securement device is a permanently installed bulkhead hinged at the trailer threshold. It is designed to lay flat (acting as a dock plate) for loading and hinges up and locks in position for load restraint.

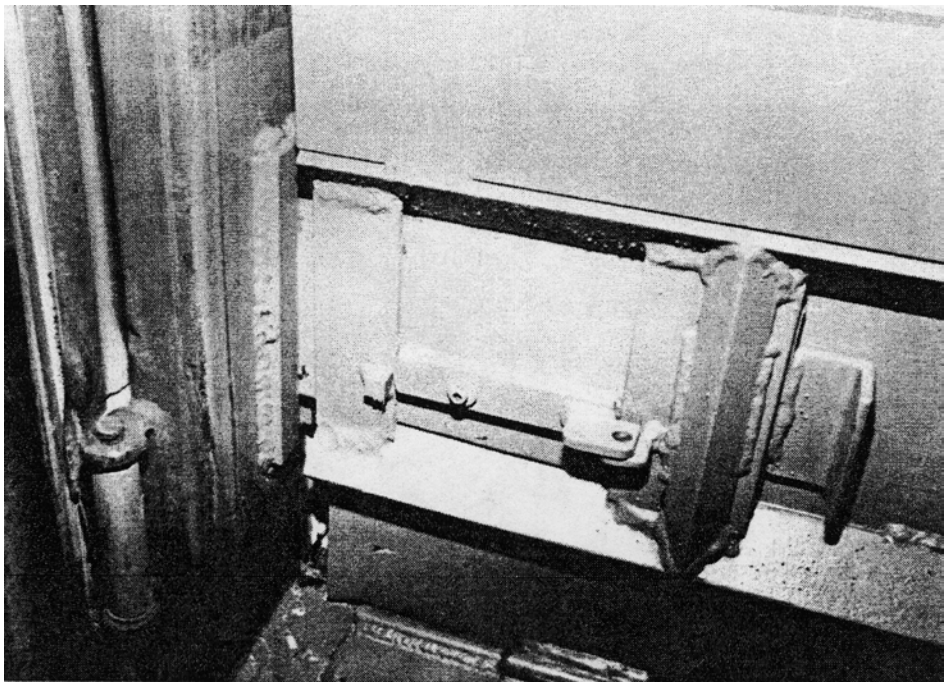
This permanent bulkhead has been proven to successfully restrain loads up to 48,000 lb.

Application of Restraining Device—Illustration No. 90:

1. The bulkhead is 18 in. tall and made of heavy gauge steel. It is permanently attached to a trailer at the threshold by five hinges. One ⅜ in. × 5 in. sliding latch secures the bulkhead on each side to the trailer doorposts in an upright position.

2. The latches engage into slots in the doorposts. A retainer bar mounted on the latch prevents the latch from disengaging from the doorpost once secured.

3. Fill all lengthwise space in the trailer with lading or dunnage. Use appropriate buffer material between the lading and the bulkhead. The illustration shows examples of wood gates that could be used to prevent damage to the lading at the bulkhead.



Close-up of locking latch and retainer bar.

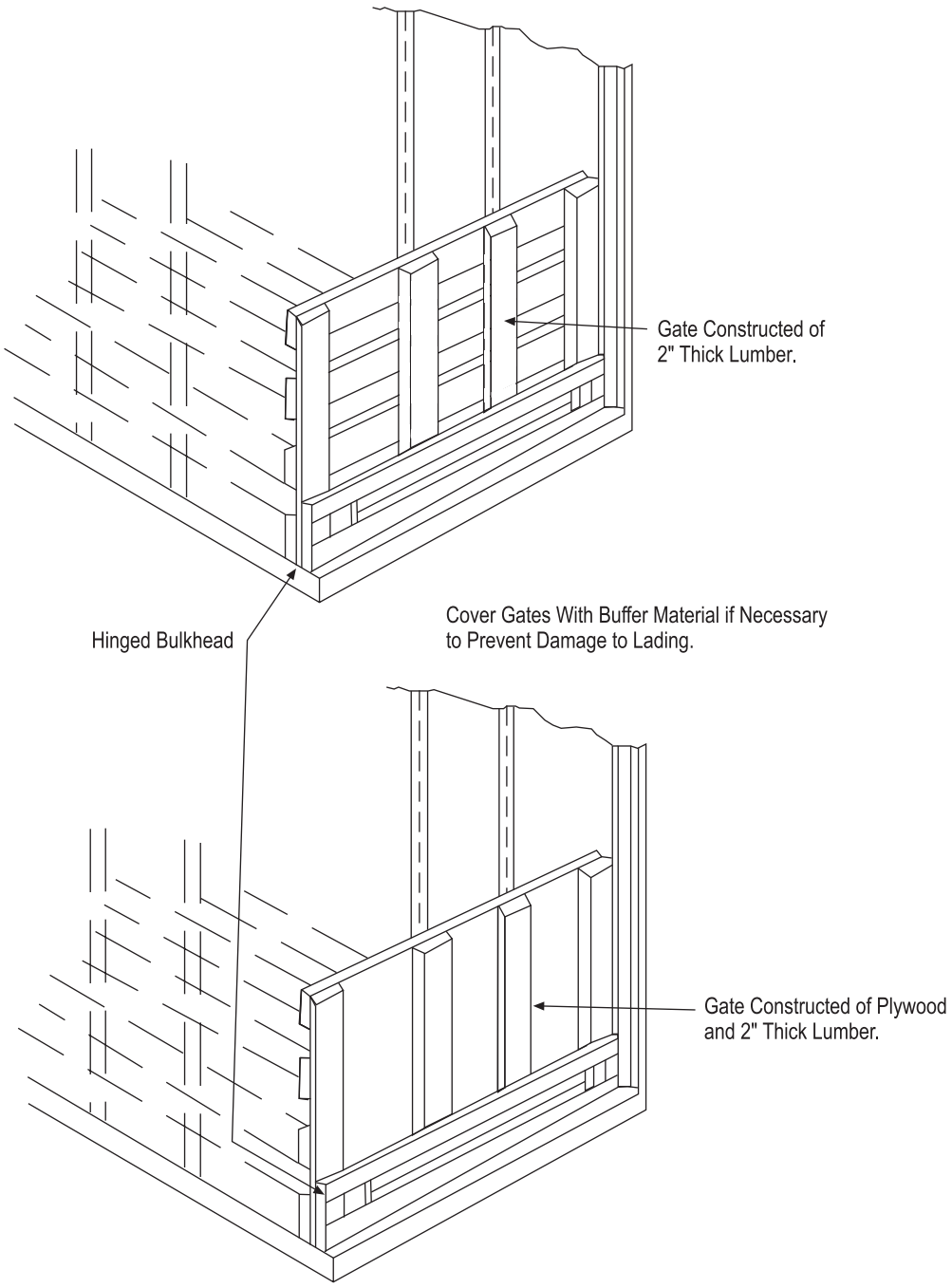


Illustration No. 86

Method H-1
Various Commodities Secured with Door SavR™

Method H-2—Various Commodities Secured with Permanent Floor Anchors and Strapping

General—Floor Anchors

Permanent floor anchors are intended to be used in conjunction with strapping systems that form barriers that restrict load movement. The anchors are hinged to mount flush with the floor when not used. Install two sets of anchors in the trailer/container floor. The first set is intended to secure lading loaded in the nose, and the second set is intended to secure the load at the trailer/container doorway. It is suggested that the second set of anchors be a minimum of 15 ft from the doorway threshold, particularly if the trailer/container will be used for a variety of commodities.

Method of Bracing—Illustration No. 91:

1. Use 1¼ in. × .031 in. steel strapping to form barriers. Use an appropriate size and number of straps for the weight of the load to be restrained. Refer to Section II (Circular 43-E) and Section III-E for information on steel strap application.

2. Use buffer material of sufficient size and strength to protect the lading from contact with strapping and related hardware. See illustration for examples.

3. When lading is to be loaded directly over the floor anchors, use risers of sufficient size and strength to prevent lading contact with the anchor or related strap hardware.

4. Strap hangers, tape, or equivalent is necessary to keep the strap barriers in position should the load shift away from the barrier, causing it to become slack. See illustration for examples.

Close-up of floor anchor

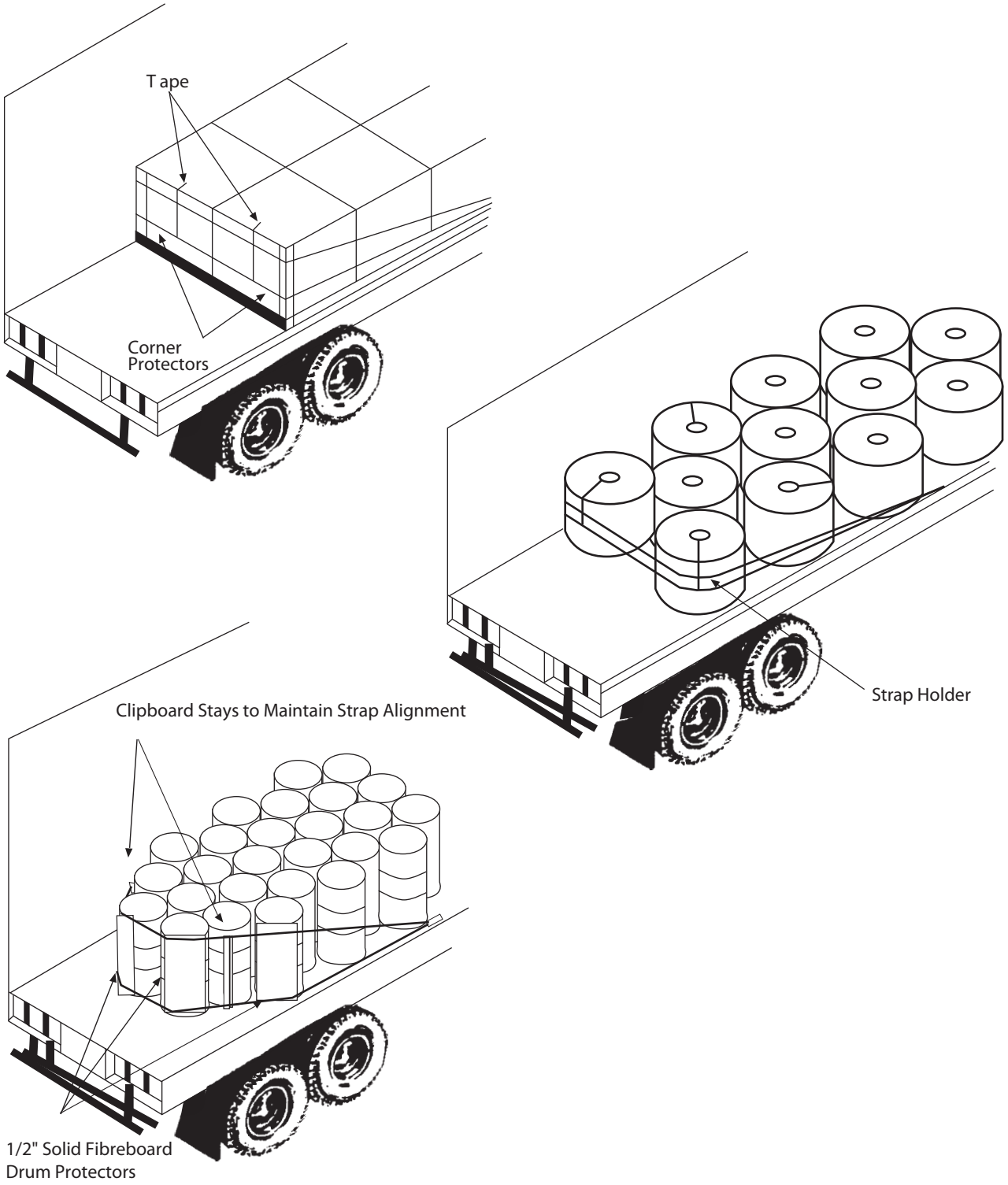


Illustration No. 87

Method H-2
Various Commodities Secured with Permanent Floor Anchors and Strapping

Method H-3—55-Gallon Drums Secured by a Wood Gate and Special Blocking Devices for Belt Rails in Refrigerated Trailers

Use this loading and bracing method for 55-gallon steel or polyethylene drums loaded in refrigerated trailers only with "T" rail floors or ribbed floors.

Illustration No. 92:

Loading of drums in a 4-3-4 pattern is recommended. However, a 3-2-3 pattern may also be utilized if necessary. Load the drums in two equal sections as shown in Illustration 88– **Sketch 3**. The load may be broken down into more than two sections if desired. However, load dividers of ⅝ in. thick plywood with polyethylene foam pads are required between each section.

The belt rail block used for this method is detailed in Illustration 88– **Sketch 1**, and specifications for the rubber mats and polyethylene foam pads used are listed below.

POLYETHYLENE FOAM PADS	
Density	1.5 lb/ft^3
Dimensions	4 in. thick × 12 in. wide × drum height
MASTICATED RUBBER MATS	
Fiber-reinforced black-rubber compound	
Thickness	0.09 in.
Tensile Strength (per ASTM-D-412 Die C):	
Parallel to grain flow	700 psi minimum
Perpendicular to grain flow	300 psi minimum
Elongation (per ASTM D-412):	
Parallel to grain flow	15% minimum
Perpendicular to grain flow	40% minimum
Hardness, Shore A (per ASTM D-2240):	80 +/-5
Heat Aging, after 70 Hours (per ASTM D-573):	
Change in tensile strength	+/- 25% maximum
Change in elongation	+/- 25% maximum
Change in hardness, Shore A	+/- 10 points. maximum
Ozone resistance (tear strength across grain after 50 hours of 80 parts per hundred million)	110 ppi minimum
Tear Strength (per ASTM D-624, Die B):	
Parallel to grain flow	120 ppi minimum
Perpendicular to grain flow	250 ppi minimum

METHOD OF BRACING

1. Load the first two stacks of drums on the trailer floor using either the 4-3-4 or 3-2-3 load pattern.

2. Place the remaining drums in the first section of the load (approximately one half of the load) in the trailer on 0.09 in. thick rubber mats utilizing the same load pattern as the first two stacks. The last stack in this section will have the same number of drums as the first stack.

3. Use a ⅝ in. thick sheet of plywood as a divider between the load sections. Glue polyethylene foam pads, 4 in. thick by 12 in. wide and the full height of the drums, to the plywood sheet to align with the drums in the last stack of the first load section. Three or four pads are required depending on the load pattern used. Place the divider across the trailer with the foam pads against the drums in the last stack of the first section.

4. Load the remaining drums in the second section on the 0.09 in. rubber mats. The first stack of the second section should have the same number of drums as the last stack of the first section. The last stack of the second section should have the same number of drums as the first stack in the section. See Illustration 88– **Sketch 3**.

5. Place a wooden gate constructed of 2 in. × 6 in. treated lumber, as shown in Illustration 88– **Sketch 2**, at the rear of the load. Locate three or four polyethylene foam pads on the gate to align with each drum in the last stack of the load.

6. Secure the gate against the load using four specially designed metal blocking devices that lock into five slots in the sidewall belt rails. Locate two devices on each wall as illustrated.

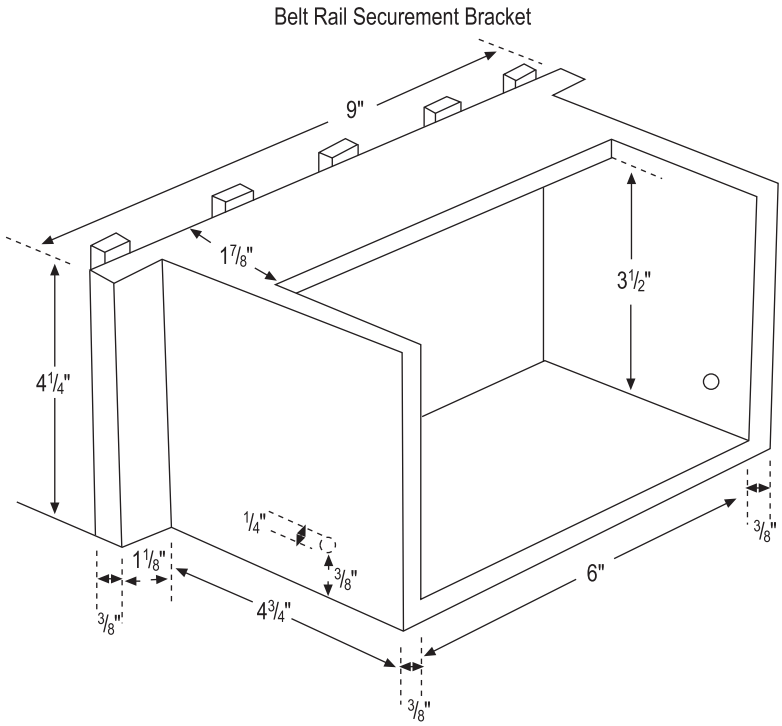


Illustration No. 88– Sketch 1

Methods H-3 and H-4
55-Gallon Drums Secured by a Wood Gate and Special Blocking Devices
for Belt Rails in Refrigerated Trailers

End Gate for 3-2-3 Pattern Load

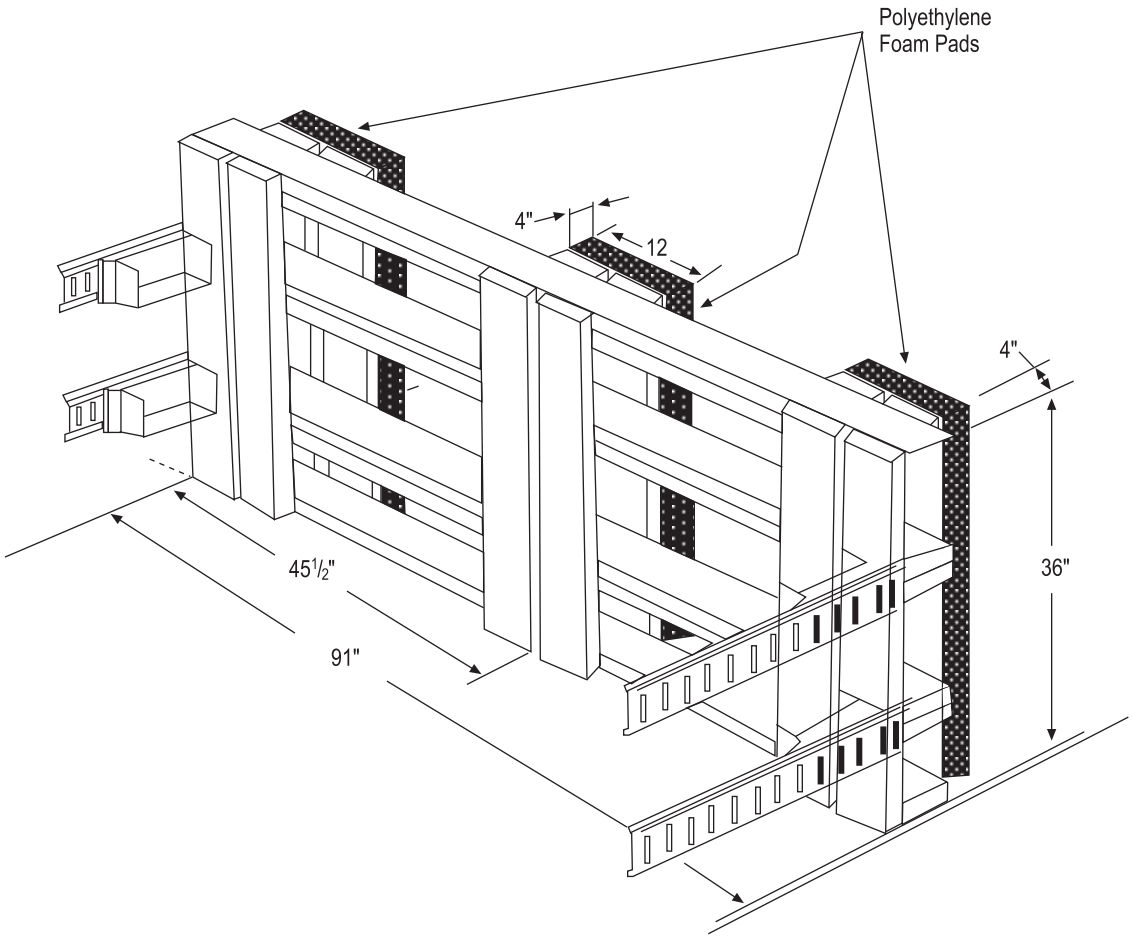


Illustration No. 88– Sketch 2

Methods H-3 and H-4
55-Gallon Drums Secured by a Wood Gate and Special Blocking Devices
for Belt Rails in Refrigerated Trailers

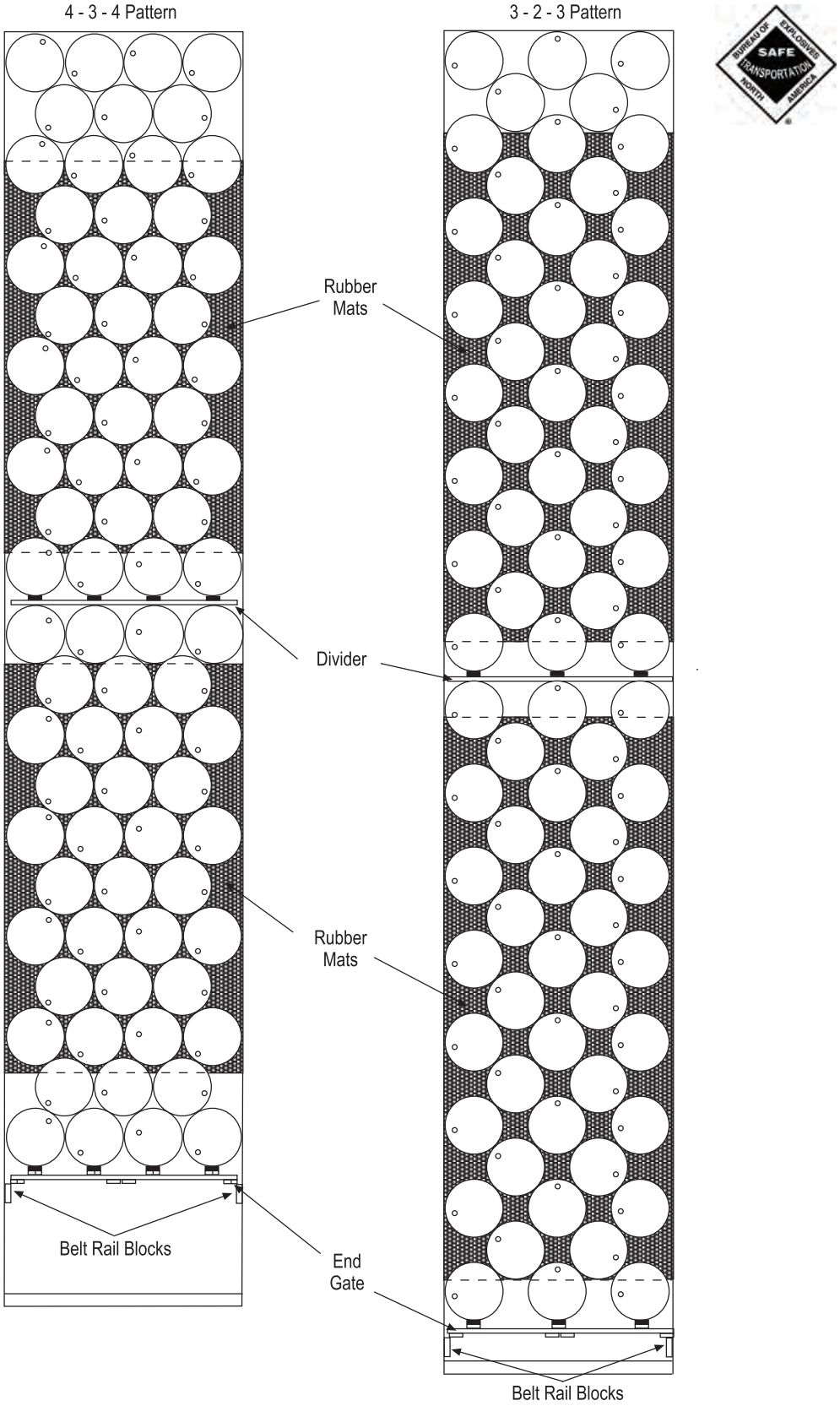


Illustration No. 88– Sketch 3

Methods H-3 and H-4
55-Gallon Drums Secured by a Wood Gate and Special Blocking Devices
for Belt Rails in Refrigerated Trailers

Method H-4—Mixed Load Secured by a Wood Gate and Special Blocking Devices for Belt Rails in Refrigerated Trailers

Use this loading and bracing method for mixed loads containing 55-gallon steel or polyethylene drums, 55-gallon fiber drums, and palletized product or mixtures thereof. Use refrigerated trailers only with "T" rail floors or ribbed floors. When fiber drums are loaded, load them only in a 4-3-4 pattern.

Loading of steel and polyethylene drums in a 4-3-4 pattern is recommended. However, a 3-2-3 pattern may be utilized if necessary.

Separate different types of lading from one another using ⅝ in. thick plywood divider sheets as shown.

The belt rail block used for this method is detailed in Illustration 88, **Sketch 1**, and specifications for the rubber mats and polyethylene foam pads used are listed in the description of Loading Method H-3.

Method of Bracing—Illustration No. 93:

1. The load illustrated was the actual load tested.

2. Load fibre drums toward the nose of the trailer. A ⅝ in. thick plywood divider sheet is required on both ends of sections containing fibre drums. Glue four polyethylene foam pads, 4 in. thick by 12 in. wide and full height of the drums, to each plywood sheet to align with drums in the last stack of the section. Place the divider sheets across the trailer, with foam pads against the drums in the first and last stack.

3. Use a ⅝ in. thick plywood divider sheet at the rear of each section of steel or polyethylene drums (except at the rear of the trailer where the end gate is used). Glue polyethylene foam pads, 4 in. thick by 12 in. wide and full height of the drums, to the plywood sheet to align with the drums in the last stack of the load section. Three or four pads are required depending on the load pattern used. Place the divider across the trailer with the foam pads against the drums in the last stack of the section.

When different sections of drums are loaded next to each other, the last stack of the front section and the first stack of the following section should have the same number of drums.

4. All lading in the rear of the trailer behind any fibre drums should be placed on 0.09 in. thick rubber mats. If the fibre drum section extends more than one third of the way back in the load, all lading in the rear two thirds of the load should be placed on 0.09 in. thick rubber mats.

5. Place a wood gate constructed of 2 in. × 6 in. treated lumber, as shown in Illustration 88, **Sketch 2**, at the rear of the load. Locate three or four polyethylene foam pads on the gate to align with each drum in the last stack of the load.

6. Secure the gate against the load using four specially designed metal blocking devices that lock into five slots in the sidewall belt rails. Locate two devices on each wall as illustrated.

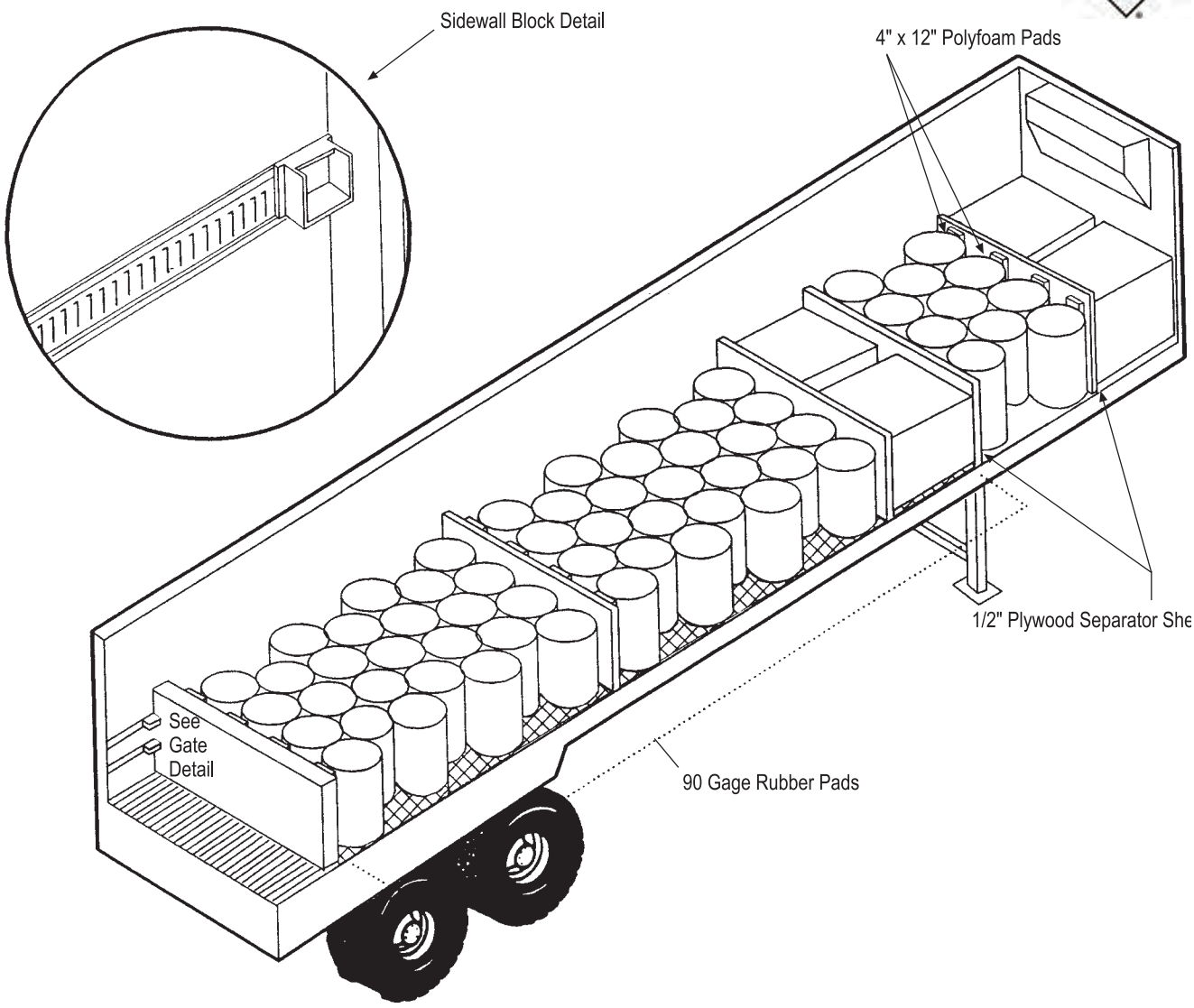


Illustration No. 89

Method H-4
Mixed Load Secured by a Wood Gate and Special Blocking Devices
for Belt Rails in Refrigerated Trailers

Method H-5—Plywood Secured by Steel Strapping to Permanent Floor Tracks

Use this loading and bracing method for unitized plywood loaded in trailers equipped with permanent floor tracks.

Method of Bracing—Illustration No. 94:

1. Load plywood units in three separate sections, each having up to three stacks, two layers high.

2. Position the first section 21 in. away from the front end wall. Leave a space of 24 in. between each section of lading. If floor tracks do not extend all the way to the front end wall or doors, adjust the positioning of the lading accordingly.

3. Secure each section to permanent floor tracks with 1¼ in. × .031 in. steel straps, one per floor track. Secure the straps to the floor tracks using two grit-type seals with two crimps per seal at each end of each strap. This illustration covers trailers with three floor tracks. If the trailer loaded has four floor tracks, use four straps for each section of lading.

4. Corner protectors are recommended under the securement straps to prevent damage to lading and to minimize slack straps. A single solid fiberboard corner protector extending under all three straps and 6 in. beyond the straps offers the best protection.

5. Edge damage at the floor can be prevented by placing 2 in. × 4 in. lumber on edge crosswise of the trailer between the securement straps and the lading.

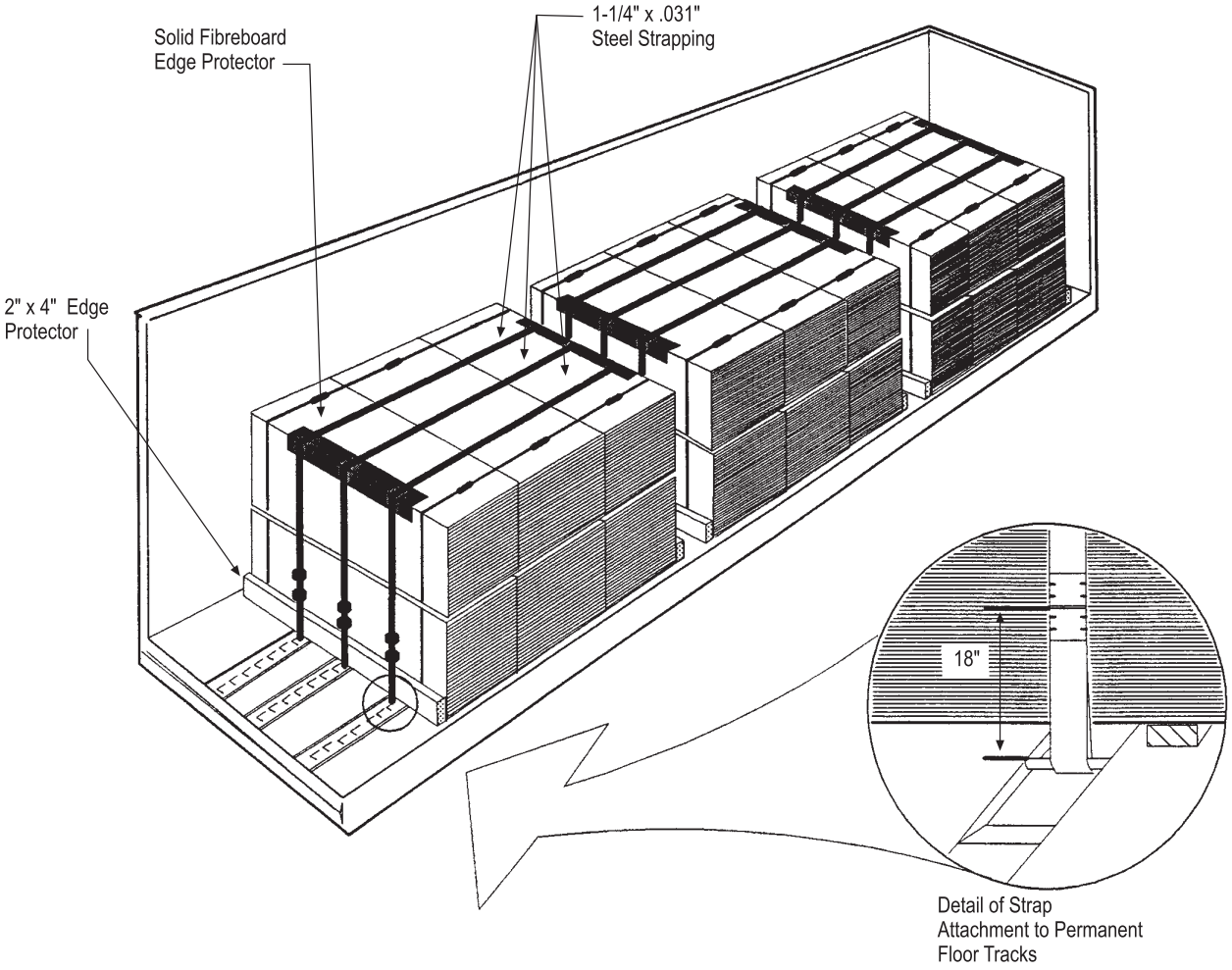


Illustration No. 90

Method H-5
Plywood Secured by Steel Strapping to Permanent Floor Tracks

Method H-6—Palletized Commodities Secured by Nylon Web Strap Assemblies and Floor Blocking

Use this loading and bracing method for palletized commodities. Follow manufacturer's instructions regarding the minimum number of wraps to be used for this application, but in all cases use a minimum of three wraps for the top and bottom layers and two wraps for the center layers.

Load units in two rows. When crosswise space exceeds 4 in., alternate stacks against opposite sidewalls and use appropriate crosswise void fillers. Line trailer with single-wall corrugated fiberboard.

Method of Bracing—Illustration No. 95:

1. Prior to loading, calculate the overall length of the load. Install 5 ft long sections of Series "E" belt rails, two per sidewall, positioned 1 ft and 3 ft above trailer floor. Position them lengthwise so that the belt rails extend beyond the rear face of the load approximately 1 ft. Attach each belt rail section to three sidewall posts using twelve ⅛ in. × 1 in. long self-tapping sheet metal screws (four screws per sidewall post).

2. Secure 1¾ in. nylon web strap assemblies to the belt rails approximately 2 ft in from the rear load face. Strap assemblies have a 16 ft overall length; 4 ft fixed end length with three-piece 4,500 lb capacity (parallel loading) anchors; 15,000 lb capacity ratchet-type buckle; and minimum 9,500 lb tensile capacity polyester webbing. Temporarily tape the straps against the trailer sidewalls for loading.

3. When loading, install single-wall, corrugated fiberboard sheets between the units in the last four stacks. Install two sheets of corrugated fiberboard between the units in the last stack and the trailer sidewalls at the strap anchors.

4. When loading is complete, install one minimum Level 1, 48 in. × 96 in. D.I.D. bag in the center void between the last two stacks. Inflate the D.I.D. bag to 1 psi or up to 2 psi maximum if the transportation vehicle is of rigid, ribbed sidewall construction (e.g., domestic intermodal truckload carriers or IMC containers).

5. Install a ¾ in. plywood gate. Gate height should be equal to load height and 2 in. less than the trailer width. Nail three 2 in. × 6 in. × 36 in. uprights to the plywood sheet with six 6d nails each. Position per diagram.

6. Tension the web straps across gate. Use a buckle handle extension tool to achieve sufficient tension. Secure the straps in position by stapling the straps to the middle gate upright or by taping them with strapping tape or equivalent.

7. Install floor blocking and backup cleats 12 in. *away* from plywood gate. Secure the blocking with twenty 16d power-driven nails (or equivalent) per lamination. Secure the backup cleats with eight 16d nails each.

NOTE: An updated listing of verified D.I.D. bags can be found on the TTCI Web site at http://www.aar.com/dpls/pfds/PPPPD_Verification_List.pdf

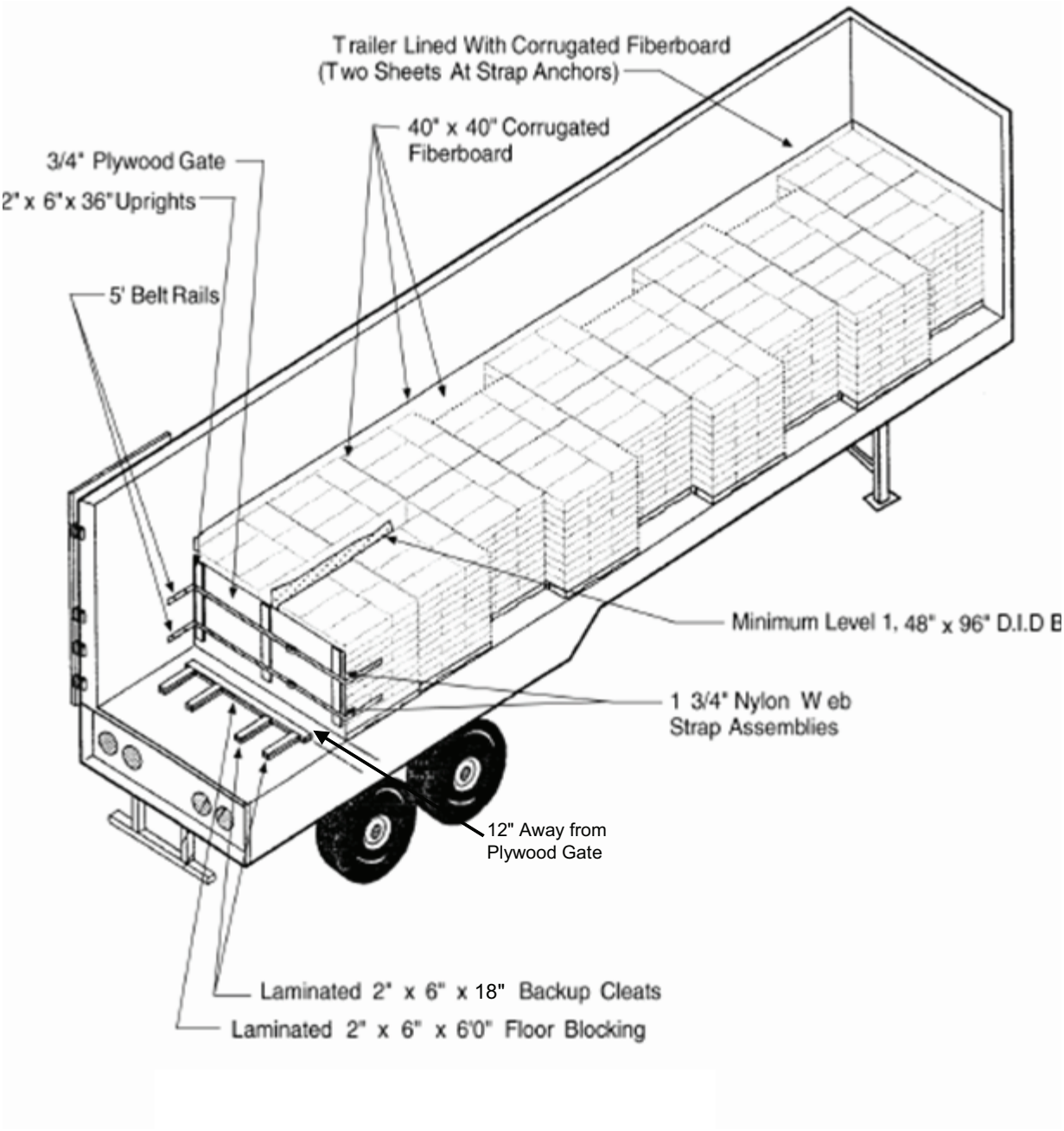


Illustration No. 91

Method H-6
Palletized Commodities Secured by Nylon Web Strap

Method H-7—Cancelled

Method H-8—Cancelled

Method H-9—Cancelled

Method H-10—Cancelled

Method H-11—Metal Coils on Platforms/Skids or in Cradles Secured by Web Straps Attached to Cargo Sleds in 20 ft Dry Containers

The shipper is responsible for inspecting the container to ensure that it is suitable to carry lading safely to destination. *There must be no obvious damage, distress, weakened parts or weakened sections.* Any exception is cause for rejection.

Use this loading method for small (3,500 lb) to large (25,000 lb) metal coils on platforms/skids with eyes vertical/horizontal or cradled within the sled. When using this loading method, position coils to achieve proper weight distribution. Secure coils to the platforms/skids with 1¼ in. × 0.031 in. steel straps or an equivalent stretch film roping method to prevent movement on the platforms/skids during transit.

Illustration No. 96:

The following has been evaluated and found acceptable for this loading method:

Name	Vendor
Universal Cargo Sled (UCS) with anchor points and bracing chocks	Holland Company

1. Load the coil/platform units down the center of the cargo sled using the illustrations as a guide while maintaining proper load balance within load limits. *Utilize a sufficient number of web strap assemblies, as required by the loading pattern.* See **Sketches 1, 2,** and **3** strap assembly requirements.

2. Coil/platform units may be loaded two wide when spacers (e.g., foam) are used between coils to maintain coil-to-spacer contact. Secure the spacers in place to maintain positioning during transit. See **Sketch 2**.

3. Position coils loaded on their bilges down the center of the sled. Place a sufficient number of timbers on each side of each coil to adequately nest the coil and restrict lateral movement. The amount of timbers used is determined by the coil size and the bevel placed adjacent each coil. See **Sketch 3**. *Protect the straps from sharp edges as needed.*

4. Anchor each single coil and/or tandem combination using 4 in. wide web strap assemblies. Place a sufficient number of strap assemblies around the front and rear of each single or side-by-side unit application at the base of the coil(s) and through the cores of coils stowed on their bilges. Place a sufficient number of assemblies across the top of each single coil greater than 36 in. in width as shown in the illustrations and over each single coil stowed on its bilges. Anchor web straps to the cargo sled using "B" hooks inserted into the anchor points located along each side of the sled. Use web strap assemblies (strap, ratchets, and related hardware) with a minimum load rating of 18,000 lb. Tension straps using ratchets.

Be sure straps are straight, not twisted, before tensioning.

5. Properly place and position the blocking chocks in the container to engage the bull-board slots. Carefully place the sled with lading into the container to engage the chocks.

TABLE A Strap Assembly Requirements

Coils Upright on Platforms			Coils on Bilge		
Coil Weight (lb)	**Strap Assembly's Base/Coil**	**Strap Assembly's Crossover/Coil (widths > 36 in.)**	**Coil Weight (lb)**	**Strap Assembly's Coil Core/Coil**	**Strap Assembly's Crossover/Coil**
< 10,000	2	1	< 10,000	2	1
10,001 – 15,000	2	1	10,001 – 15,000	2	1
15,001 – 20,000	2	1	15,001 – 20,000	2	1
20,001 – 25,000	4	2	20,001 – 25,000	2	1

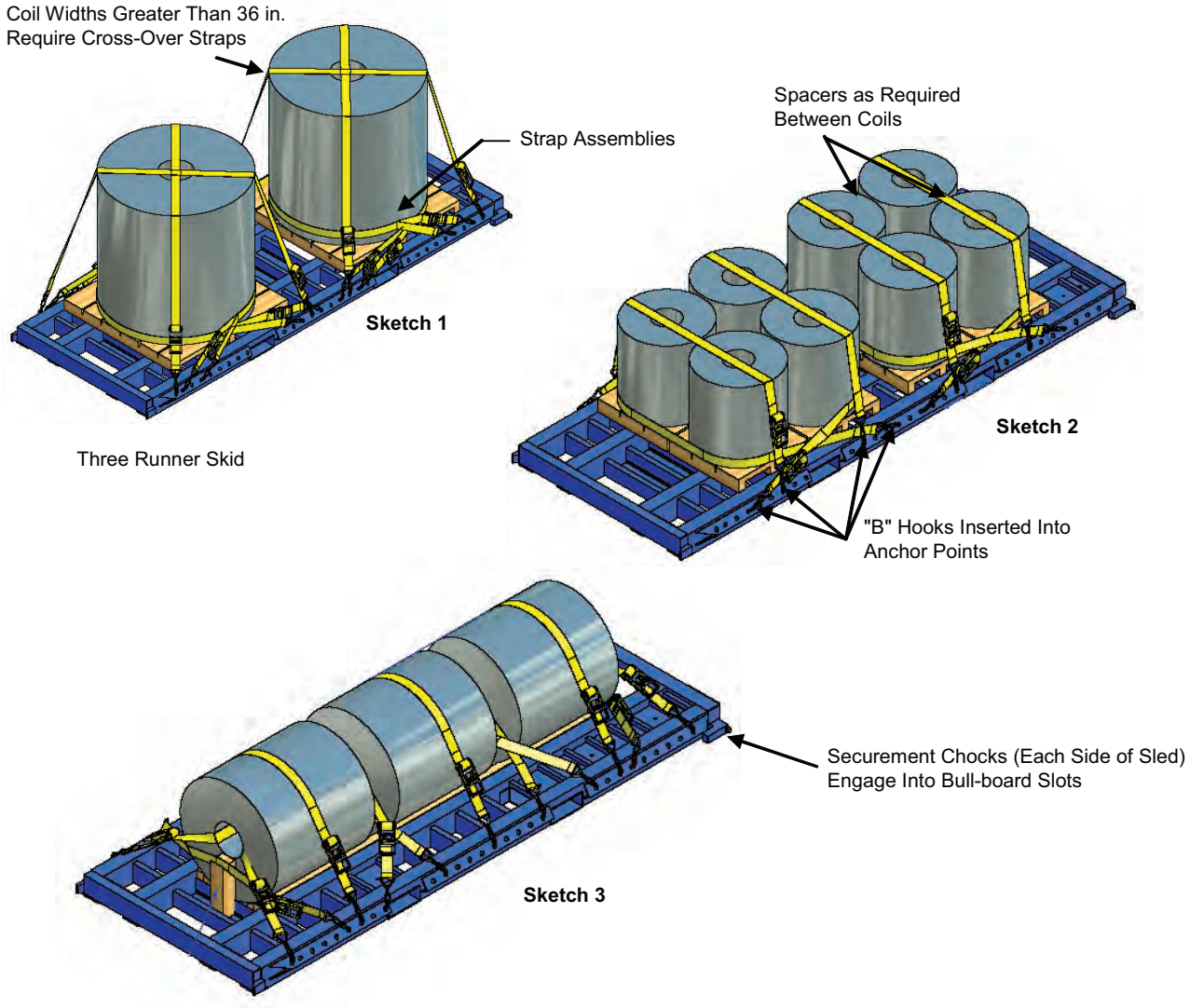


Illustration No. 92

Method H-11
Metal Coils on Platforms/Skids in 20 ft Dry Containers

Method H-12—A Barless Liner System to Transport Bulk Dry Flowable Commodities in 20 ft, 40 ft, and 40 ft High-Cube Closed ISO Containers

Use this method for shipping dry flowable commodities in bulk inside of 20 ft, 40 ft, and 40 ft high-cube closed ISO containers. The maximum weight shipped may not exceed the load limit of the particular vehicle of conveyance. Lading weight in trailers and containers must be evenly distributed both crosswise and lengthwise, and the combined weight of lading must conform to all federal, state, provincial, and local regulations and transportation service requirements.

Illustration No. 97:

1. Cover rough surfaces or projections of the sidewall with fiberboard sheets or other suitable material.

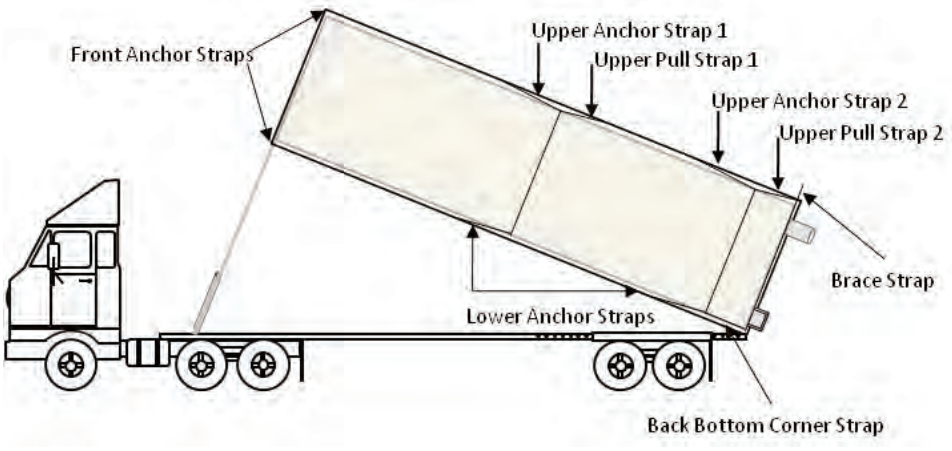
2. Follow the manufacturer's instructions for installation and securement of the barless liner system.

    - Place the liner in the container toward the back. Liner is packaged to unfold as it is dragged toward the nose.
    - Place a steel bar through the bottom front straps (located on each of the bottom front corners of the liner) and sleeve.
    - Secure the top front with a snap hook at each corner of the nose using one of the three loops that allows the top of the liner to come closest to the top of the container.
    - Hook the back bottom liner strap to one end of the hook-and-strap device and hook the other end to the back of the container. Pull tight to stretch the liner fully along the length of the container.
    - Connect the lower anchor straps to the container rings and pull tight. This will distribute the weight of the filled liner along its length when the container is tilted.
    - First, connect the back upper anchor straps to the container rings (one section at a time) and pull tight. Second, connect the forward upper anchor straps (one section at a time) and pull tight. There should be no slack between the forward section of the liner and the anchor straps. Following this procedure will distribute the weight evenly along the length of the liner.
    - Using a snap hook, raise the back of the liner with the brace strap. To attain the proper height, step on the blue strap located at the bottom back corner of the liner and pull the strap tight until the back corners are stretched tight. This will appear to lift the liner off the container floor by a couple of inches.
    - After the liner is installed, fill the liner with air until it has filled itself out in the container. Then, remove the air hose and connect the elastic straps on the upper back of the liner to the door hooks on the top back of the container.

NOTE: Be sure the liner is stretched tight the length of the container prior to filling to ensure proper weight distribution and liner length. If liner is loose between anchor straps, too much weight will be placed on the straps and the liner will be too short once it reaches the back of the container.

Only the following barless liner systems have been evaluated and found acceptable for application with this loading method:

Name	Vendor
20 ft standard barless baffle container liner	AsiaTek
40 ft standard barless baffle container liner	
40 ft hi-cube barless baffle container liner	



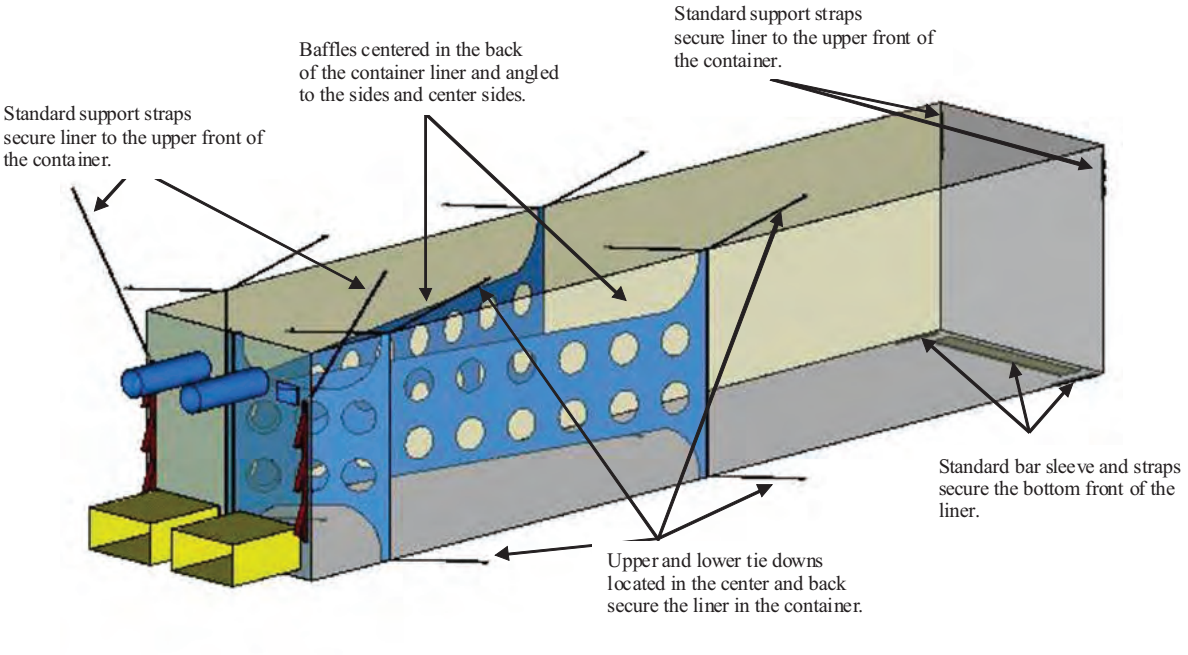


Illustration No. 93

Method H-13—A Securement System for Wheeled Vehicles in ISO Containers in Intermodal Service

The following method has been tested and found successful in loading wheeled vehicles in intermodal service. The maximum weight per vehicle during testing was 4,780 lb, and the maximum load weight per container was 43,000 lb. The various size units were loaded from one to three wide. The floor rating at the time of testing was 24,000 lb.

Illustration No. 98:

1. Before loading, inspect the container to ensure that a sufficient number of lashing points in good order are available and that the floor shows no signs of excessive wear that might hinder vehicle placement and support.

2. Vehicle spacing is limited by the number of available lashing points and the weight of vehicles. The combined weight of vehicles and container must conform to all federal, state, provincial, and local regulations and transportation service requirements used at origin and final destination.

3. All vehicle batteries must be disconnected and terminals taped. Secure all handles, latches, and other devices to prevent movement during transportation.

4. Vehicles should be loaded into the container facing in with brake on, if so equipped.

5. Use floor blocking adjacent to each tire at the vehicle front and rear, except when loaded tight to the nose wall. If metal floor components prevent chock contact with tires, locate the chock tight to a rigid vehicle frame component to negate longitudinal movement of the vehicle during transit.

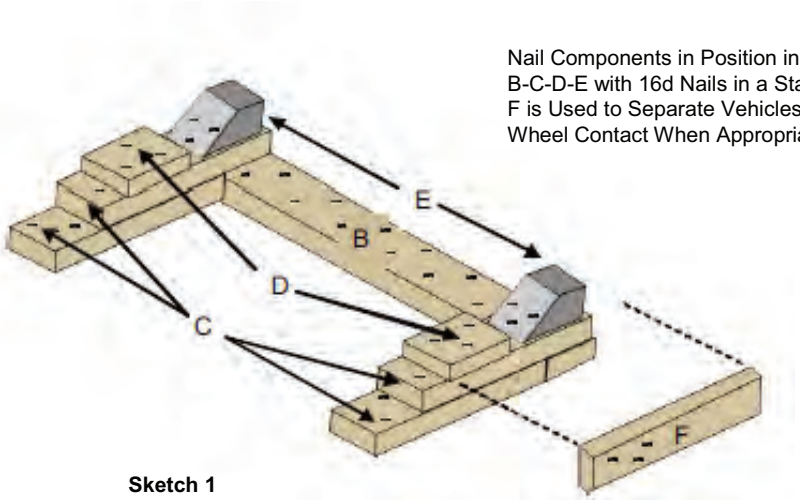
6. Fabricate floor blocking using nominal sizes indicated on **Sketch 1**. Nail in a staggered pattern with 16d nails approximately every 3 in.

Item	No. of Pieces	Description
A	1	Floor blocking (See **Sketch 1**).
B	1	2 in. × 6 in. × outside width of vehicle
C	4	2 in. × 6 in. × 18 in.
D	2	2 in. × 6 in. × 9 in.
E	2	Composite or wood chock
F	1	2 in. × 6 in. between wheels when needed

7. When stowed one wide, use floor blocking adjacent to the outside of each tire. Nail boards 2 in. × 6 in. × ½ in. diameter of tire to the floor using 16d nails.

Tie down each stack of vehicles at the front and rear by applying a ⅜ in. aircraft cable (approximately14,400 lb tensile) running crosswise through each vehicle where accessible and securing it to anchor points on each side of the container; one side by clamps and the opposite side by turnbuckle. See the following photos.

NOTE: Ensure that the turnbuckle is secured against movement during transit.



Nail Components in Position in the Following Order:
B-C-D-E with 16d Nails in a Staggered Pattern.
F is Used to Separate Vehicles from Wheel to
Wheel Contact When Appropriate.

Sketch 1
Floor Blocking (Item A)

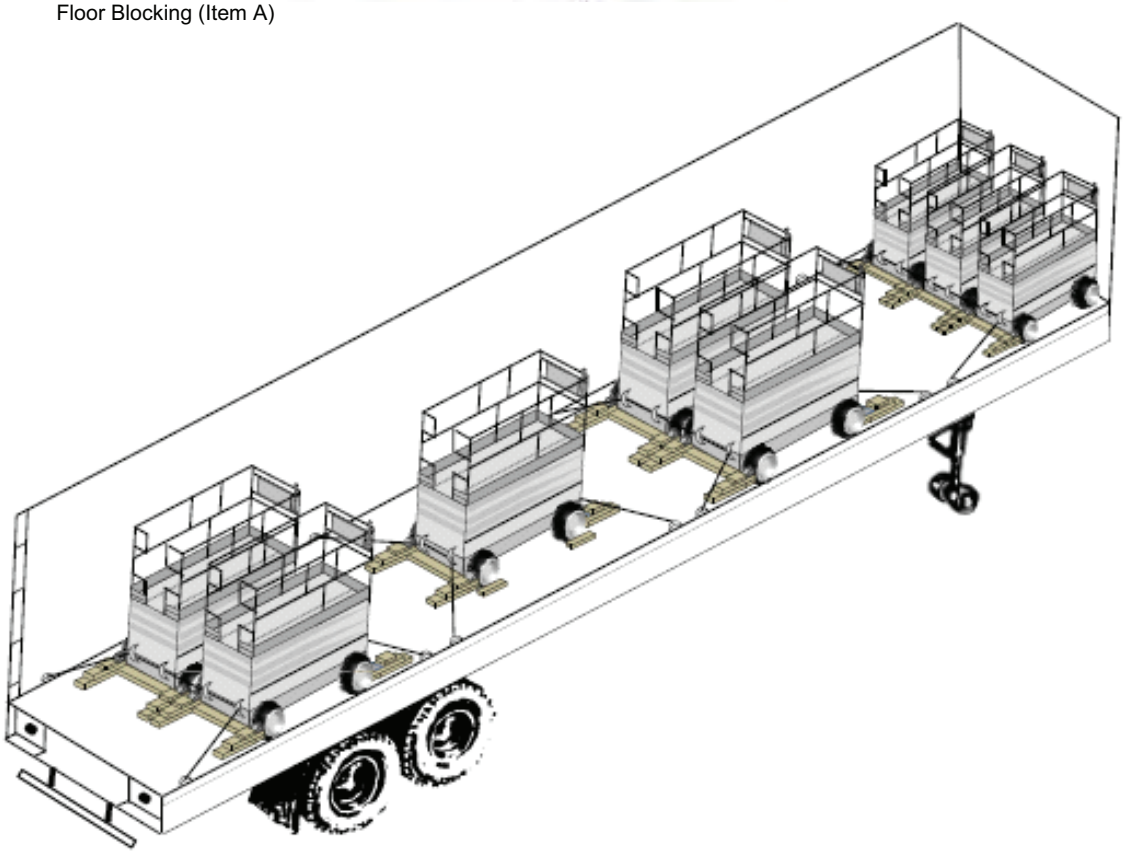


Illustration No. 94

Method H-13
Wheeled Vehicles in ISO Containers

Method H-14—Case Goods Secured with Super Wedge® Manufactured by Logistick, Inc.

The following method has been tested and found successful in loading and bracing case goods unitized on pallets secured by Super Wedge® manufactured by Logistick, Inc., when shipped in equipment having metal-lined sidewalls. Follow manufacturer's installation guide for securing the dunnage to the sidewalls. The test load weighed approximately 44,000 lb.

Illustration No. 99:

1. Cover rough surfaces or projections of the sidewall with fiberboard sheets or other suitable material, except between sidewall and Super Wedge.

2. Use a securement system by Logistick, Inc., to secure the load from lengthwise movement. The compartmentized system is composed of Super Wedge, 2 in. × 4 in. floor blocking, honeycomb void fillers, and either 4 in. × 4 in. lumber beams or two 2 in. × 4 in. laminated lumber beams.

3. Plan the load so crosswise spaces are minimized, and fill all lateral void space with appropriate fillers to prevent crosswise movement.

4. Divide the load into three sections with the units stowed in two rows. Begin loading the units tight to the nose wall and adjacent to each sidewall. The floor blocking at the end of sections one and two consists of two 2 in. × 4 in. × 96 in. laminated boards laid tight to the adjacent pallet stringers and nailed to the floor. Use a minimum of ten 16d nails in a staggered pattern per layer. Use one 3½ in. thick by 8 ft wide by 50 in. high void filler having minimum crush strength of 1,500 lb/ft^2 between sections and positioned above the floor blocking between sections.

5. The floor blocking at the end of section three consists of two 2 in. × 4 in. × 96 in. laminated boards laid tight to the adjacent pallet stringers, reinforced with three backup cleats each two 2 in. × 4 in. × 18 in. laminated boards nailed to the floor. Use a minimum of ten 16d nails in a staggered pattern per layer for the 96 in. boards and a minimum of four 16d nails in a staggered pattern for the 18 in. boards.

6. Firmly attach three Super Wedges to each sidewall according to the manufacturer's instructions. Space the wedges vertically equidistant to cover the upper two thirds of the adjacent unit height and position them away from the face of the load to allow for insertion of a 1 in. thick void filler having minimum crush strength of 1,500 lb/ft^2 between the load and the 4 in. × 4 in. or two 2 in. × 4 in. laminated beams installed with 3 in. dimension upright.

7. Cut the beams to size according to Super Wedge manufacturer's instructions. Proper installation will result in the trailer walls expanding outward *slightly.*

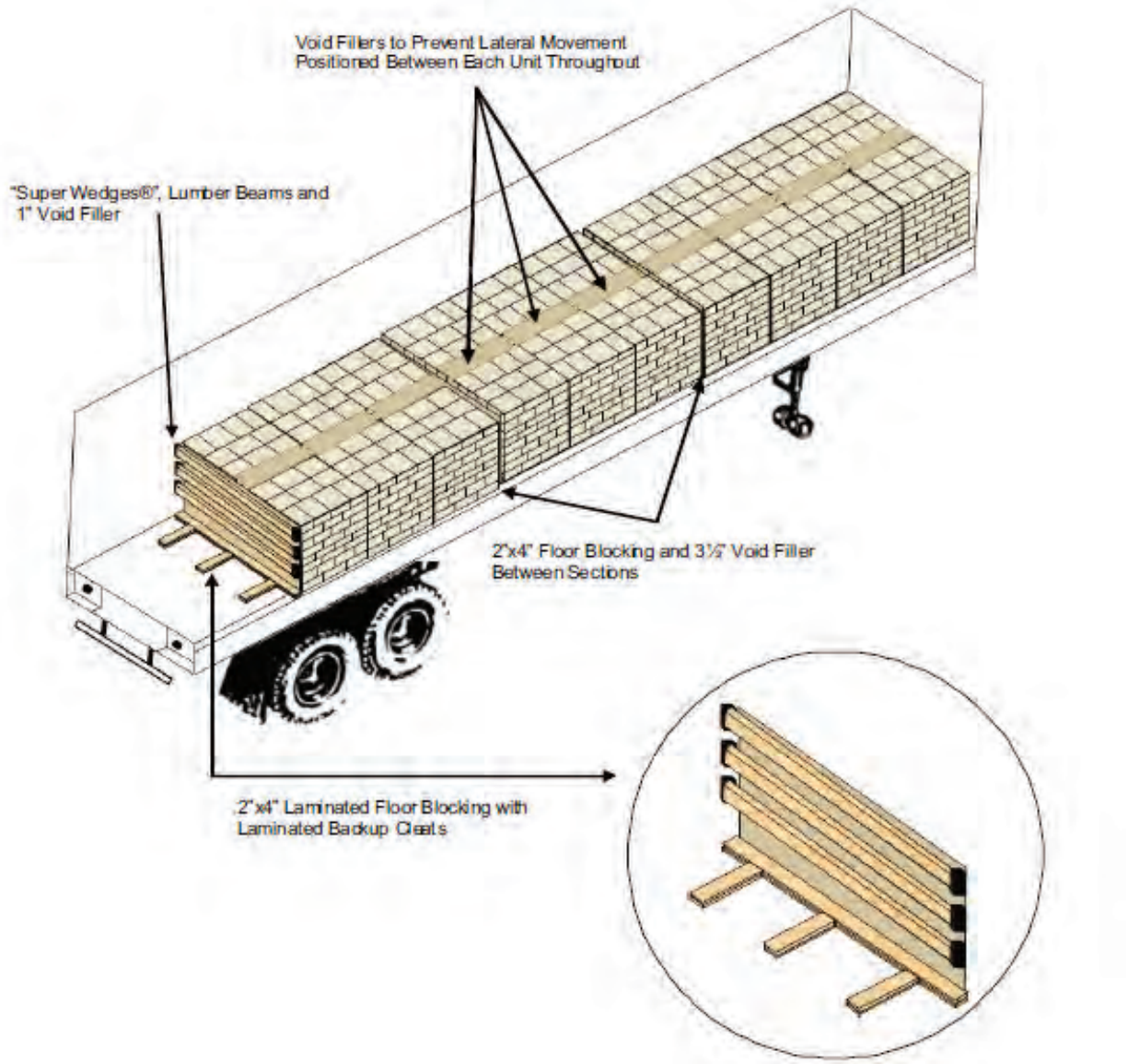


Illustration No. 95

Method H-14
Case Goods Secured with "Super Wedge®" Manufactured by Logistick, Inc.

I—NON-METALLIC STRAPPING

Method I-1—76 to 80 Tight-Head Steel or Plastic, 55-Gallon Drums in Two Layers Secured with 1¼ in. Wide Polyester Cordstrap® Composite Strapping (CC) 105 in 20 ft ISO Containers

Use this method for 76 to 80 tight-head steel or plastic drums loaded in a 20 ft ISO container. *The load limit for this system must not exceed 40,000 lb.* The method of bracing involves restraint of the drums by use of *1¼ in. wide Cordstrap® composite strapping (CC) 105* attached to the container D-rings are attached to other Cordstrap applications by use of CB10 metal buckles. (Follow the manufacturer's instructions for buckle application.) Use one 2 in. × 4 in. × 74 in. long wood board with ends cut at 45° angles at the rear of the container. During testing, horizontal straps were tensioned to approximately 1,438 lbf with a pneumatic tensioner having a 90 psi air supply. *If using a CT 32PN pneumatic tensioner, it should be operated at no more than 100 psi, at which the tension is maximized at approximately 1,700 lb.*

Illustration No. 100:

NOTE: Approved for hazmat use only with 80-steel-drum loads.

80-Drum Loads (Illustration 96– Sketch 1)

1. Select containers that are equipped with suitable D-rings at locations consistent with the load plan. It is the shipper's responsibility to inspect and ensure that the D-rings are in sound condition and that the load does not exceed the capacity of the D-rings for the container being loaded.

2. Install looped vertical Cordstraps and buckles using the container's D-rings:

   - Locate the first set approximately 6 ft from the front of the load, with the buckle above load height.
   - Locate the second set approximately 11 ft from the front of the load, with the buckle above load height.
   - Locate the third set approximately 14 ft from the front of the load, with the buckle positioned in the middle of the strap. Protect the buckle from contact with adjacent drums.
   - Always make sure that the strap is flat to the surface; avoid making a spiral turn.

NOTE: A pneumatic tensioner may be used to tension the verticals while recognizing the force limitations of the D-rings. A hand-held windlass tensioner also may be used.

3. Install a looped, diagonal Cordstrap and buckle from the bottom D-ring of the first vertical set to the buckle of the third vertical set. Do this to both sides.

4. On the first set of vertical Cordstraps,

   - Loop a new horizontal run approximately 10 ft long around the vertical strap and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
   - Loop a similar 10 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
   - Temporarily hold the ends of these lengths with tape or magnets to the side of the container.
   - Repeat for the other side of the container.

5. On the second set of vertical Cordstraps,

   - Loop a new horizontal run approximately 13 ft long around the vertical strap and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
   - Loop a similar 13 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
   - Temporarily hold the ends of these lengths with tape or magnets to the side of the container.
   - Repeat for the other side of the container.

6. On the third set of vertical Cordstraps,

- Loop a new horizontal run approximately 10 ft long around the vertical strap and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
- Loop a similar 10 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
- Temporarily hold the ends of these lengths with tape or magnets to the corner of the container.
- Repeat for the other side of the container.

7. Proceed to load the bottom and top layers of the first six stacks of drums in a 4-4-3-4-3-4 pattern. Use ¼ in. plywood or equivalent horizontal separators as needed.

8. After the sixth stack of drums is added,

- Pull the ends of the *top* Cordstrap installed on the *first set* of vertical straps from both sides together. Connect the ends with the buckles (two) and *use the pneumatic tensioner* to secure the top layer of drums.
- Pull the ends of the *bottom* cordstrap installed on the *first set* of vertical straps from both sides together. Connect the ends with the buckles (two) and *use the pneumatic tensioner* to secure the bottom layer of drums.

NOTE: Always spread the two horizontal straps on each drum layer out toward the rolling hoops. This will help to spread the load over the strongest part of the drum.

9. Proceed to load the drums in a 4-3-4-3-2 pattern for the bottom and top layers. Use ½ in. plywood or equivalent horizontal separators as needed. The last row should consist of two drums that are positioned in the middle.

10. Loop a Cordstrap approximately 10 ft long from the bottom rear D-ring and position it for securing a 2 in. × 4 in. × 74 in. long wood board. Do this to both sides.

11. After the last row of drums is added,

- Pull the ends of the *top* cordstrap installed on the *third set* of vertical straps from both sides together. Connect the ends with the buckles (two) and *use the pneumatic tensioner* to secure the top drum layer.
- Pull the ends of the *bottom* Cordstrap installed on the *third set* of vertical straps from both sides together. Connect the ends with the buckles (two) and *use the pneumatic tensioner* to secure the bottom layer.

12. Load the remaining four drums at each corner of the container.

NOTE: Install drum protection to preclude strap damage to the corner drums if shipping plastic drums.

13. After the last corner drums are loaded,

- Pull the ends of the *top* cordstrap installed on the *second set* of vertical straps from both sides together. Connect the ends with the buckles (two) and *use the pneumatic tensioner* to secure the top drum layer.
- Pull the ends of the *bottom* Cordstrap installed on the *second set* of vertical straps from both sides together. Connect the ends with the buckles (two) and *use the pneumatic tensioner* to secure the bottom layer.

14. Place a 2 in. × 4 in. × 74 in. long wood board (ends cut at a 45° angle) upright on edge on the floor against the center floor drums, and pull the ends of the cordstraps from both sides together. Connect the ends with the buckles (two) and *use the pneumatic tensioner* to secure the board in position.

NOTE: Use strap hangers or tape to maintain strap positioning at the rear face of the load.

78-Drum Loads (Illustration 96– Sketch 2)

15. Load 78-drum loads in 11 stacks using a 4-3-4-3-4-4-3-4-3-4-3 pattern from the nose to the rear.

16. Secure each section of the load using similar methodology to that noted in numbers 1 through 14. The location and estimated length of strapping is adjusted for the respective load pattern to be used. See Illustration 96, **Sketch 2**.

76-Drum Loads (Illustration 96– Sketch 3)

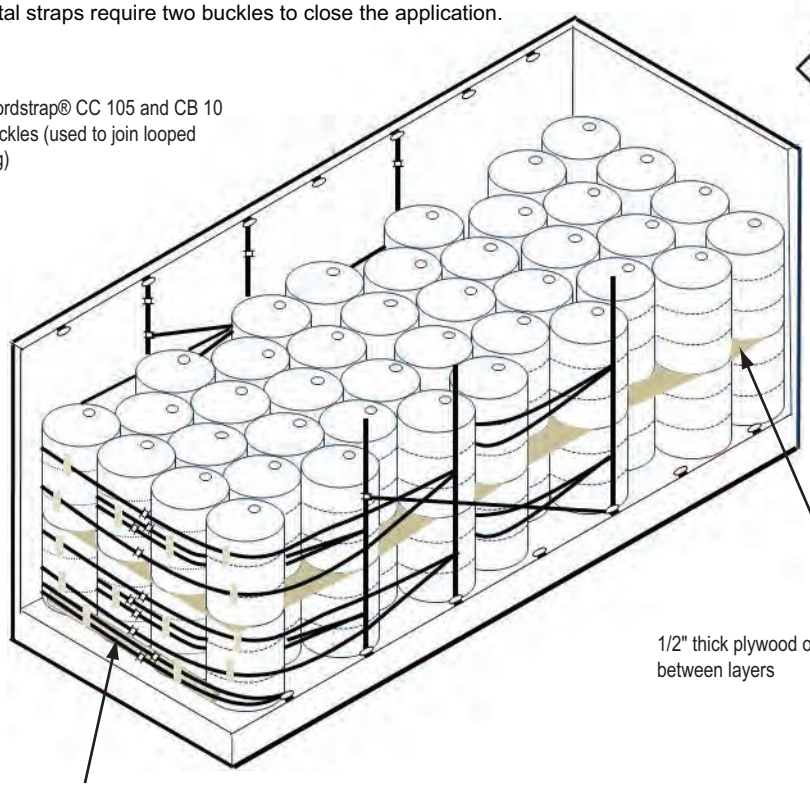
17. Loads containing 76 drums can be loaded in 10 stacks using a 4-4-4-3-4-4-4-4-3-4 pattern from the nose to the rear.

18. Secure each section of the load using methodology similar to that noted in paragraphs 1 through 14 above. The location and estimated length of strapping are adjusted for the respective load pattern to be used. See Illustration 96– **Sketch 3**.

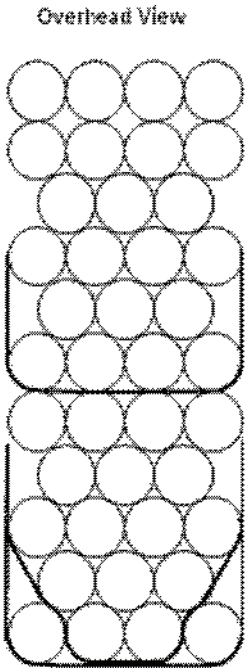
The following separators have been evaluated and found acceptable for one-time use with this loading method. These separators were tested under simulated conditions, and their acceptance may be withdrawn if loads exhibit consistent load failures. If used with hazmat loads, these panels must be compatible with the contents of the drums.

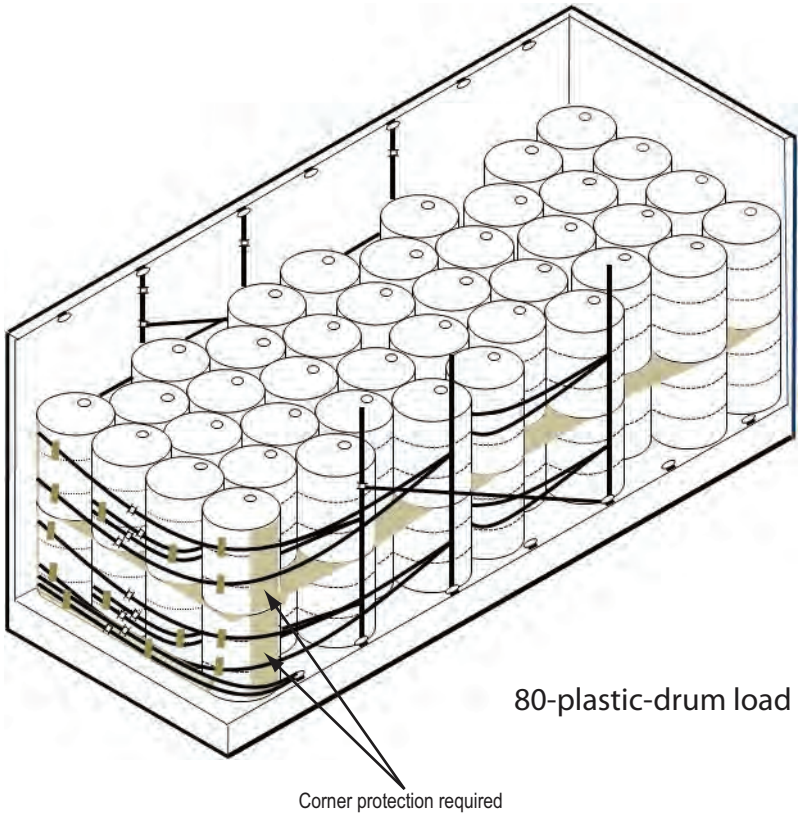
Name	Thickness	Description	Vendor
Drum Tite	3.0 mm, 3.2 mm	Eucalyptus hardboard	Lodge Lumber
Drum Sep	3.2 mm	Eucalyptus hardboard	Pasadena Skid and Pallet Inc.
Ship Tite 2	.375 in.	Corrugated (*not* for use with corrosives)	Allegheny Industrial Associates
Ship Tite 3	.625 in.	Corrugated (*not* for hazmat use)	Allegheny Industrial Associates
Ship Tite 5	3.2 mm	Corrugated	Allegheny Industrial Associates
Generic	3.0 mm	Eucalyptus hardboard	Greif
PlyVeneer®	3.0 mm	Wood veneer with a Kraft linerboard overlay	PlyVeneer Products
Tier 55	1.0 in., 0.50 in.	Corrugated	Damage Prevention Company

NOTE: All looped horizontal straps require two buckles to close the application.



80-steel-drum load

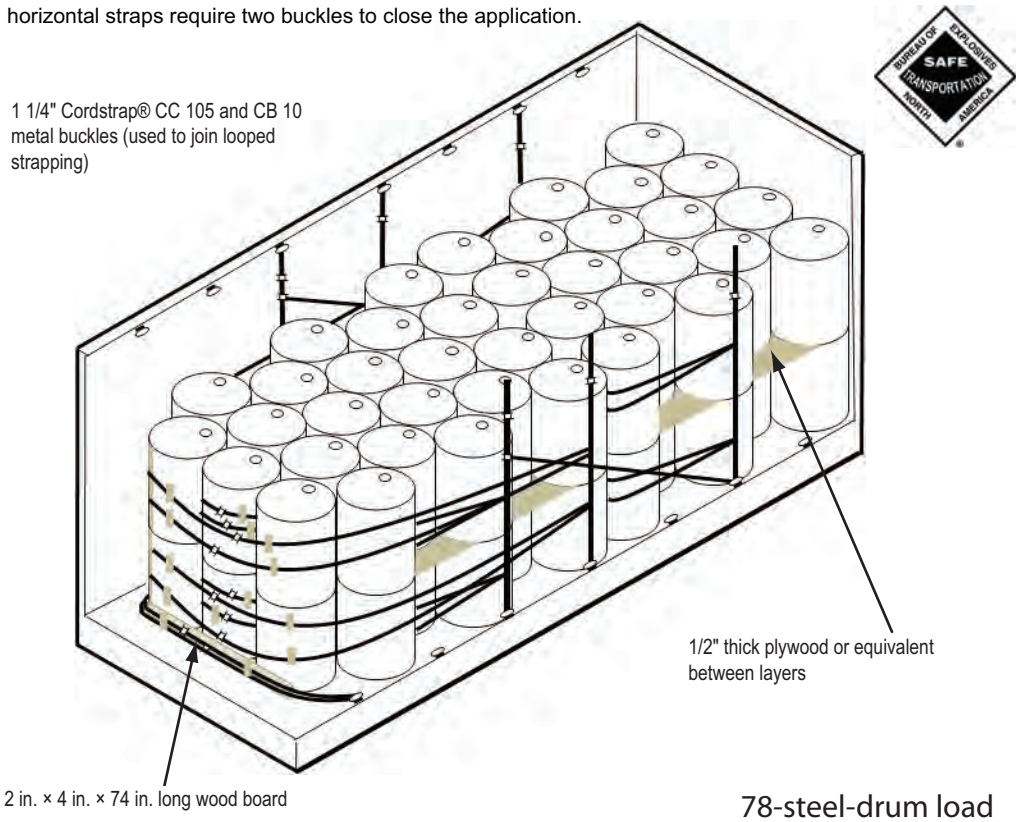




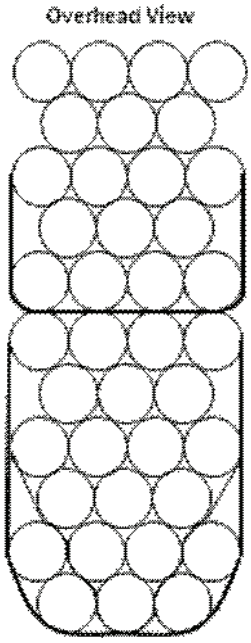
80-plastic-drum load

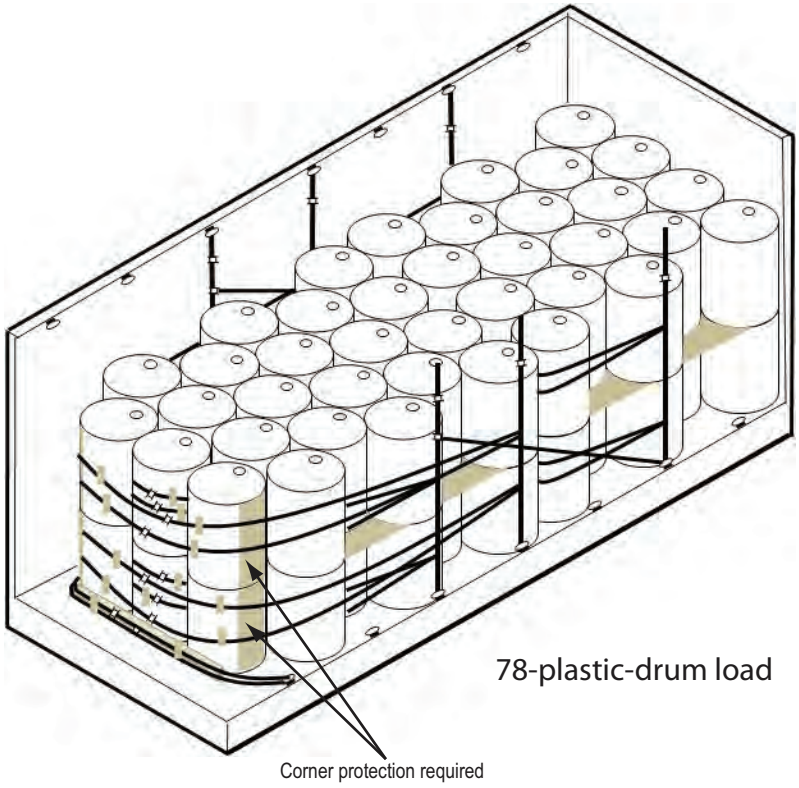
Illustration No. 96– Sketch 1

NOTE: All looped horizontal straps require two buckles to close the application.



78-steel-drum load

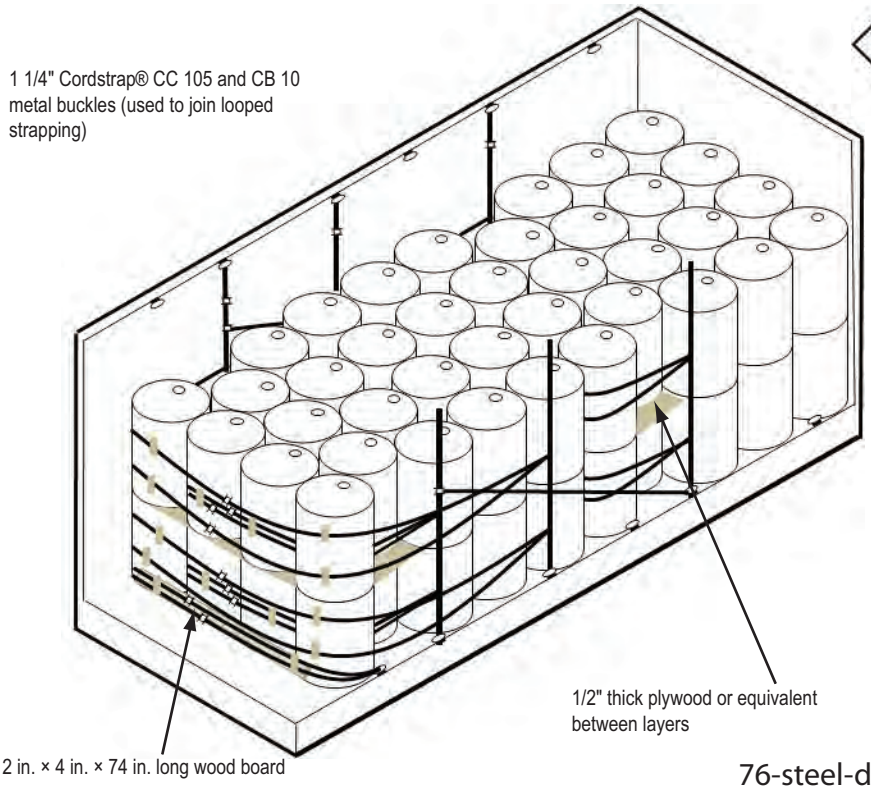




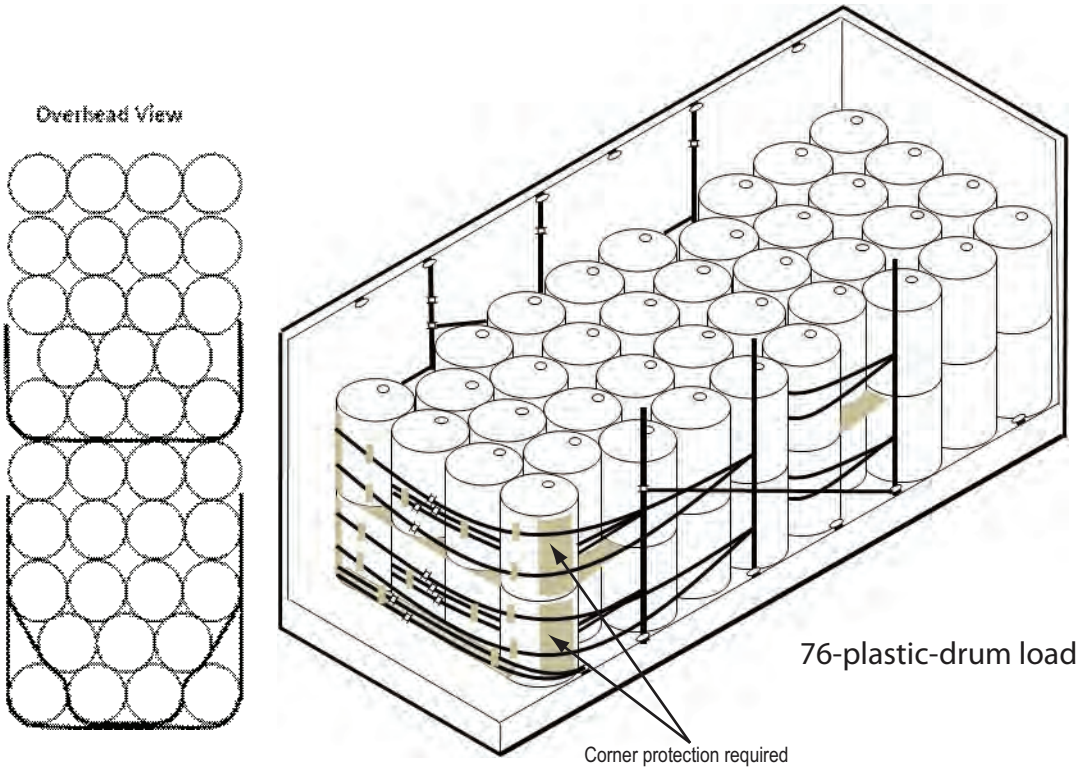
78-plastic-drum load

Illustration No. 96– Sketch 2

NOTE: All looped horizontal straps require two buckles to close the application.



76-steel-drum load



76-plastic-drum load

Illustration No. 96– Sketch 3

Method I-2—80 Tight-Head Steel, 55-Gallon Drums in Two Layers Secured with 1¼ in. Wide Polyester Woven Cord Strapping (CS) 2040 by Carolina Strapping and Buckles Company in 20 ft ISO Containers

Use this method for eighty tight-head steel drums loaded in a 20 ft ISO container. *The load limit for this system must not exceed 40,000 lb.* The method of bracing involves restraint of the drums by use of *1¼ in. wide polyester woven cord strapping (CS) 2040* attached to the container D-rings and attached to other strap applications by use of CS 3035 metal buckles. (Follow the manufacturer's instructions for buckle application.) During testing, horizontal straps were tensioned with a manual windlass tensioner (CS 4060).

Illustration No. 101:

1. Select containers that are equipped with suitable D-rings at locations consistent with the load plan. It is the shipper's responsibility to inspect and ensure that the D-rings are in sound condition and that the load does not exceed the capacity of the D-rings for the container being loaded.

2. Install looped vertical straps and buckles using the container's D-rings:

   - Locate the first set approximately 6 ft from the front of the load, with the buckle above load height.
   - Locate the second set approximately 11 ft from the front of the load, with the buckle above load height.
   - Locate the third set approximately 14 ft from the front of the load, with the buckle positioned in the middle of the strap. Protect the buckle from contact with adjacent drums.
   - Always make sure that the strap is flat to the surface; avoid making a spiral turn.

NOTE: A pneumatic tensioner may be used to tension the straps while recognizing the force limitations of the D-rings. A hand-held windlass tensioner also may be used.

3. Install a looped, diagonal strap and buckle from the bottom D-ring of the first vertical set to the buckle of the third vertical set. Do this to both sides.

4. On the first set of vertical straps,

   - Loop a new horizontal run approximately 10 ft long around the vertical straps and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
   - Loop a similar 10 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
   - Temporarily hold the ends of these lengths with tape or magnets to the side of the container.
   - Repeat for the other side of the container.

5. On the second set of vertical straps,

   - Loop a new horizontal run approximately 13 ft long around the vertical straps and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
   - Loop a similar 13 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
   - Temporarily hold the ends of these lengths with tape or magnets to the side of the container.
   - Repeat for the other side of the container.

6. On the third set of vertical straps,

   - Loop a new horizontal run approximately 10 ft long around the vertical strapping and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
   - Loop a similar 10 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
   - Temporarily hold the ends of these lengths with tape or magnets to the corner of the container.

- Repeat for the other side of the container.

7. Proceed to load the bottom and top layers of the first six stacks of drums in a 4-4-3-4-3-4 pattern. Use ¼ in. plywood or equivalent horizontal separators as needed.

8. After the sixth stack of drums is added,

- Pull the ends of the *top* strap installed on the *first* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use a tensioner to secure the top layer of drums.
- Pull the ends of the *bottom* strap installed on the *first* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use a tensioner to secure the bottom layer of drums.

NOTE: Always spread the two horizontal straps on each drum layer out toward the rolling hoops. This will help to spread the load over the strongest part of the drum. Use strap hangers at the face of the load to maintain strap position.

9. Proceed to load the drums in a 4-3-4-3-2 pattern for the bottom and top layers. Use ¼ in. plywood or equivalent horizontal separators as needed. The last row should consist of two drums that are positioned in the middle.

10. Loop a strap approximately 10 ft long from the bottom rear D-ring and position it for securing the doorward lower face of the last stack. Do this to both sides.

11. After the last row of drums is added,

- Pull the ends of the *top* strap installed on the *third* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the top drum layer.
- Pull the ends of the *bottom* strap installed on the *third* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the bottom layer.

12. Load the remaining four drums at each corner of the container.

13. After the last corner drums are loaded,

- Pull the ends of the *top* strap installed on the *second* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the top drum layer.
- Pull the ends of the *bottom* strap installed on the *second* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the bottom layer.

14. Pull the ends of the straps installed at the rear D-rings from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the bottom layer.

The following separators have been evaluated and found acceptable for one time use with this loading method. These separators were tested under simulated conditions and their acceptance may be withdrawn if loads exhibit consistent load failures. If used with hazmat loads, these panels must be compatible with the contents of the drums.

Name	Thickness	Description	Vendor
Drum Tite	3.0 mm, 3.2 mm	Eucalyptus hardboard	Lodge Lumber
Drum Sep	3.2 mm	Eucalyptus hardboard	Pasadena Skid and Pallet Inc.
Ship Tite 2	.375 in.	Corrugated (*not* for use with corrosives)	Allegheny Industrial Associates
Ship Tite 3	.625 in.	Corrugated (*not* for hazmat use)	Allegheny Industrial Associates
Ship Tite 5	3.2 mm	Corrugated	Allegheny Industrial Associates
Generic	3.0 mm	Eucalyptus hardboard	Greif
PlyVeneer®	3.0 mm	Wood veneer with a Kraft linerboard overlay	PlyVeneer Products
Tier 55	1.0 in., 0.50 in.	Corrugated	Damage Prevention Company

NOTE: All looped horizontal straps require two buckles to close the application.

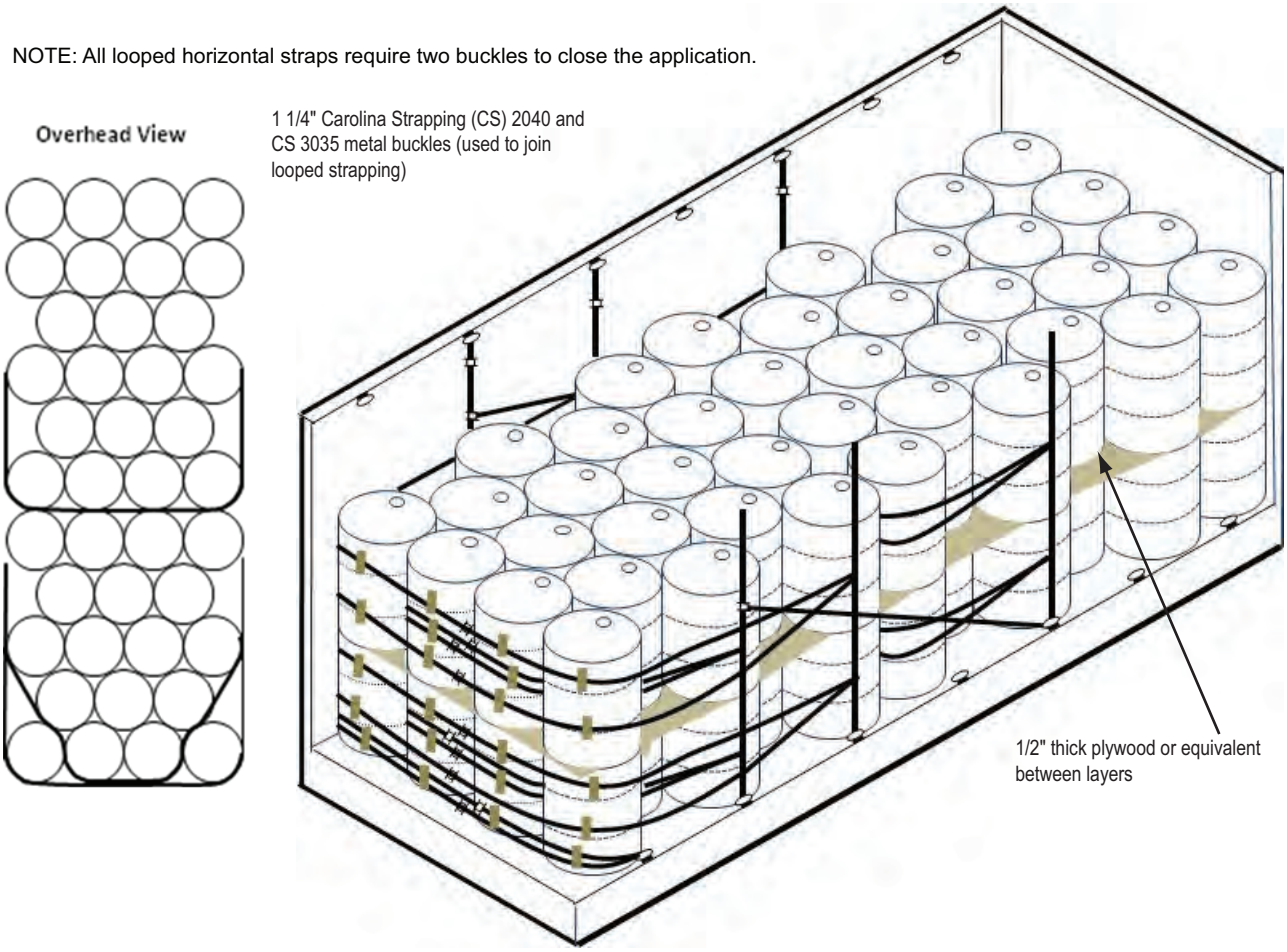


Illustration No. 97

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Method I-3—78 Tight-Head Plastic, 55-Gallon Drums in Two Layers Secured with 1¼ in. Wide Polyester Woven Cord Strapping (CS) 2040 by Carolina Strapping and Buckles Company in 20 ft ISO Containers

Use this method for seventy-eighty tight-head plastic drums loaded in a 20 ft dry container. *The load limit for this system must not exceed 40,000 lb.* The method of bracing involves restraint of the drums by use of *1¼ in. wide polyester woven cord strapping (CS) 2040* attached to the container D-rings and attached to other strap applications by use of CS 3035 metal buckles. (Follow the manufacturer's instructions for buckle application.) During testing, horizontal straps were tensioned with a manual windlass tensioner (CS 4060).

Illustration No. 102:

1. Select containers that are equipped with suitable D-rings at locations consistent with the load plan. It is the shipper's responsibility to inspect and ensure that the D-rings are in sound condition and that the load does not exceed the capacity of the D-rings for the container being loaded.

2. Install looped vertical straps and buckles using the container's D-rings at each side of the container:

   - Locate the first set approximately 6 ft from the front of the load, with the buckle above load height.
   - Locate the second set approximately 11 ft from the front of the load, with the buckle above load height.
   - Locate the third set approximately 14 ft from the front of the load, with the buckle positioned in the middle of the strap. Protect the buckle from contact with adjacent drums.
   - Always make sure that the strap is flat to the surface; avoid making a spiral turn.

NOTE: A pneumatic tensioner may be used to tension the straps while recognizing the force limitations of the D-rings. A hand-held windlass tensioner also may be used.

3. Install a looped, diagonal strap and buckle from the bottom D-ring of the first vertical set to the buckle of the third vertical set. Do this to both sides.

4. On the first set of vertical straps,

   - Loop a new horizontal run approximately 10 ft long around the vertical strap and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
   - Loop a similar 10 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
   - Temporarily hold the ends of these lengths with tape or magnets to the side of the container.
   - Repeat for the other side of the container.

5. On the second set of vertical straps,

   - Loop a new horizontal run approximately 13 ft long around the vertical strap and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
   - Loop a similar 13 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
   - Temporarily hold the ends of these lengths with tape or magnets to the side of the container.
   - Repeat for the other side of the container.

6. On the third set of vertical straps,

   - Loop a new horizontal run approximately 10 ft long around the vertical strap and position/tape it in place about 1½ ft from the floor for the bottom layer of drums.
   - Loop a similar 10 ft run and position/tape it about 4½ ft from the floor for the top layer drums.
   - Temporarily hold the ends of these lengths with tape or magnets to the corner of the container.

- Repeat for the other side of the container.

7. Proceed to load the bottom and top layers of the first six stacks of drums in a 4-4-3-4-3-4 pattern. Use ¼ in. plywood or equivalent horizontal separators as needed.

8. After the sixth stack of drums is added,

- Pull the ends of the *top* strap installed on the *first* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use a tensioner to secure the top layer of drums.
- Pull the ends of the *bottom* strap installed on the *first* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use a tensioner to secure the bottom layer of drums.

NOTE: Always spread the two horizontal straps on each drum layer out toward the rolling hoops. This will help to spread the load over the strongest part of the drum. Use strap hangers at the face of the load to maintain strap position.

9. Proceed to load the drums in a 4-3-4-3-2 pattern for the bottom and top layers. Use ¼ in. plywood or equivalent horizontal separators as needed. The last row should consist of two drums that are positioned in the middle.

10. Loop a strap approximately 10 ft long from the bottom rear D-ring and position it for securing the doorward lower face of the last stack. Do this to both sides.

11. After the last row of drums is added,

- Pull the ends of the *top* strap installed on the *third* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the top drum layer.
- Pull the ends of the *bottom* strap installed on the *third* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the bottom layer.

12. Load the remaining four drums at each corner of the container and place sufficient protection at the outside of each drum to preclude the strap from creasing the adjacent drums.

13. After the last corner drums are loaded,

- Pull the ends of the *top* strap installed on the *second* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the top drum layer.
- Pull the ends of the *bottom* strap installed on the *second* set of vertical straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the bottom layer.

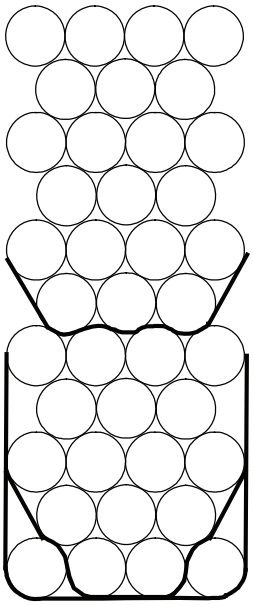
14. Place a 2 in. × 4 in. × 74 in. long wood board (ends cut at a 45° angle) upright on edge on the floor against the center floor drums and pull the ends of the straps from both sides together. Connect the ends with the buckles (two) and use the tensioner to secure the board in position.

The following separators have been evaluated and found acceptable for one time use with this loading method. These separators were tested under simulated conditions and their acceptance may be withdrawn if loads exhibit consistent load failures. If used with hazmat loads, these panels must be compatible with the contents of the drums.

Name	Thickness	Description	Vendor
Drum Tite	3.0 mm, 3.2 mm	Eucalyptus hardboard	Lodge Lumber
Drum Sep	3.2 mm	Eucalyptus hardboard	Pasadena Skid and Pallet Inc.
Ship Tite 2	.375 in.	Corrugated (*not* for use with corrosives)	Allegheny Industrial Associates
Ship Tite 3	.625 in.	Corrugated (*not* for hazmat use)	Allegheny Industrial Associates
Ship Tite 5	3.2 mm	Corrugated	Allegheny Industrial Associates
Generic	3.0 mm	Eucalyptus hardboard	Greif
PlyVeneer®	3.0 mm	Wood veneer with a Kraft linerboard overlay	PlyVeneer Products
Tier 55	1.0 in., 0.50 in.	Corrugated	Damage Prevention Company

NOTE: All looped horizontal straps require two buckles to close the application.

Overhead View



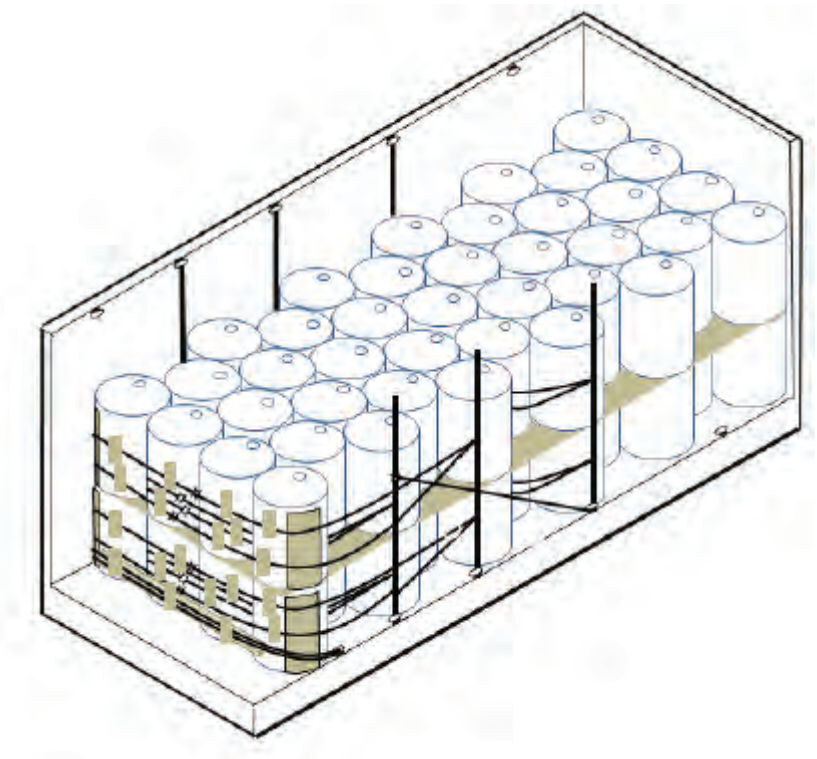


Illustration No. 98

SECTION V—APPENDICES

Appendix A—Wood Blocking and Bracing Specifications

Relative strength values of lumber, such as stiffness, bending, and compression strength qualities and the ability to resist shocks, are important. Equally important are the factors of nail-holding qualities and resistance against splitting.

TABLE A

Nominal Thickness Rough Lumber (in.)	Actual Thickness S4S (in.)
2 × 4	1½ × 3½
2 × 6	1½ × 5½
2 × 8	1½ × 7¼
4 × 4	3½ × 3½
4 × 6	3½ × 5½
4 × 8	3½ × 7¼

Dimensions shown are the minimum commercial sizes for lumber to be used in the construction of center gates, end gates, doorway blocking, and bracing. See Table B. Table C shows species of wood most commonly used.

TABLE B

Group I Soft Woods	Specific Gravity	Group II and III Medium Woods	Specific Gravity	Group IV Hard Woods	Specific Gravity
Cottonwood	0.37	Douglas Fir	0.51	Ash	0.64
Fir (Balsam)	0.41	Hemlock	0.44	Beech	0.67
Fir (White)	0.42	Maple (Hard Black)	0.62	Elm	0.66
Pine (Lodgepole)	0.43	Larch	0.59	Hickory	0.80
Pine (Ponderosa)	0.42	Pine (So, Yellow)	0.59	Maple (Hard-Sugar)	0.68
Pine (White East)	0.37	Pine (Norway)	0.47	Oak (White)	0.71
Pine (White West)	0.42	Cedar (Port Oxford)	0.44	Oak (Red)	0.66
Spruce (White)	0.45	Sweet Gum	0.53		
Poplar (Yellow)	0.43				

Lumber recommended for use in trailer blocking and bracing is found in Group II and III woods. Use commercial sizes. When soft woods (Group I) are substituted, use the next larger commercial size per the following:

TABLE C

Group II and III Woods Medium (in.)	Group I Woods Soft (in.)
Size 2 × 3	Size 2 × 4
Size 2 × 4	Size 2 × 6
Size 2 × 6	Size 2 × 8
Size 3 × 4	Size 3 × 6
Size 4 × 4	Size 4 × 6
Size 4 × 6	Size 4 × 8
Size 6 × 6	Size 6 × 8
Size 6 × 8	Size 6 × 10

TABLE D Withdrawal Power of Common and Threaded Nails (Allowable Loads in Pounds Per Inch of Penetration)

Specific Gravity	Size of Nails			
	8d	12d	16d	20d
0.75	87	—	—	127
0.68	69	78	85	101
0.67	66	75	82	97
0.66	64	72	79	94
0.62	55	62	68	80
0.51	34	38	42	49
0.47	27	31	34	40
0.45	25	28	30	36
0.44	23	26	29	34
0.43	22	25	27	32
0.42	21	23	25	30
0.41	21	22	24	29
0.37	15	17	19	22

For types of lumber, see Table B.

Appendix B—Damage Prevention Product Vendor List

Revised November 1, 2010

Purpose:

This list is provided as a service to rail customers and member carriers. The Association of American Railroads does not endorse or guarantee the use or reliability of the products produced or distributed by the vendors listed herein.

The list is divided into two sections. The first contains an alphabetical listing of vendors; the second is organized by product category. This list is not a complete list, and any vendors not shown have not been intentionally left out. Addresses shown are generally the company's headquarters office address. Each company may also have regional offices and/or regional contacts for product availability and distribution.

Submit Changes to:

Mr. Gary L. Held, Director
Damage Prevention and Loading Services
AAR/TTCI
7001 Weston Parkway, Suite 200
Cary, NC 27513
(919) 651-5027
Fax: (919) 651-5405
email: gary.held@railinc.com

ALPHABETICAL LIST

United States

Allegheny Industrial Associates—An ITW Company
311 Plus Park Blvd., Suite #110
Nashville, TN 37217
(800) 444-6337
(615) 399-9987
Fax: (615) 399-9982
Products:
- Beverage Bulkheads
- Contour Polyfoam Pads
- D.I.D. Bags
- Polyester Cord Strap
- Rebonded Rubber Mats
- Risers
- Separators
- Void Fillers

Acme Packaging Systems/ITW
13500 S. Perry Avenue
Riverdale, IL 60627-1182
(708) 849-2500
Fax: (708) 849-4945
Products:
- Plastic Strap
- Steel Strap

Amorim Industrial Solutions
26112 110th Street
Trevor, WI 53179
(800) 558-3206
Fax: (262) 862-2500
Products:
- Rebonded Rubber Mats

Ancra International
4880 West Rosecrans Avenue
Hawthorne, CA 90250
(310) 973-5000
Products:
- Beam End Sockets
- Cargo Restraining Devices
- Corner Protectors
- Custom Design Products
- Shoring Beams
- Strap Anchors
- Strap Assemblies
- Winches

BJK Industries, Inc.
P.O. Box 2949
Fort Smith, AR 72913
(501) 646-9300
Products:
- Trailer Liners

Boomerang Packaging, Inc.
15344 Vantage Parkway E.
Houston, TX 77032
(281) 590-5163
(800) 214-2803
Fax: (281) 590-9755
Products:
- Polyester Cord Strap

Caristrap International, Inc.
1760 Fortin Blvd.
Laval, Quebec, Canada H7S 1N8
(450) 667-4700
(800) 361 9466
Fax: (450) 663-1520
Products:
- Cargo Restraining Devices
- Custom Design Products
- Industrial Tapes
- Non-wovens
- Plastic Strap
- Polyester Cord Strap
- Strap Anchors

Centerload Shipping Technologies/ITW Shippers
3165 Diablo Avenue
Hayward, CA 94545
(800) 304-0031
Products:
- D.I.D. Bags

Cordstrap USA
1101 South Sylvania
Sturtevant, WI 53177
(262) 898-6670
Fax: (262) 898-6677
Products:
- Polyester Cord Strap

Circle Inc.
Specialized Paper Converting
911 Milwaukee Avenue
Burlington, WI 53105
(262) 539-4400
Fax: (262) 539-4409
Products:
- Bulkheads
- Contour Buffer Pads
- Corner Protectors
- Custom Designed Products
- D.I.D. Bags
- Risers Rubber Mats
- Void Fillers

Corrugated Systems, Inc.
14700 Harvard Avenue
Dolton, IL 60419
(708) 201-0070
Fax: (708) 849-0668
Products:
- Bulkheads
- D.I.D. Bags
- Risers
- Separators
- Void Fillers

Cougar Packaging Designers, Inc.
800 Regency Drive
Glendale Heights, IL 60139
(630) 539-7361
Fax: (630) 539-7398
Products:
- Cushion Contour Polyfoam Pads

The Damage Prevention Company
4120 Brighton Blvd.
Unit A-23
Denver, CO 80216
(303) 295-3003
Products:
Bulkheads
- Coil/Roll Side and Edge Protectors
- Contour Buffer Pads
- **(**Corner Protectors
- Custom Design Products
- D.I.D. Bags
- Risers
- Separators
- Thermal Barriers
- Void Fillers

Dunnage Systems, Inc.
P.O. Box 656
Sheridan, AR 72150
(800) 288-4830
(870) 942-4830
Fax: (888) 942-4710
Products:
- Air Compressors
- Bulk Containers
- Bulkheads
- Contour Buffer Pads
- D.I.D. Bags
- Risers
- Separators
- Slip Sheets
- Void Fillers

E. J. Brooks
World Headquarters
8 Microlab Road
Livingston, NJ 07039
(800) 458-SEAL
(973) 597-2900
(973) 597-2919
Products:
- Security Seals
- Locking Devices

Fleet Products and Equipment, L.L.C
1920 Swift Avenue, Suite 202
N. Kansas City, MO 64116
(816) 221-1664
Products:
- Bulk Containers
- Cargo Restraint Devices
- D.I.D. Bags
- Separators
- Slip Sheets
- Stretch Wrap
- Void Fillers

Gerrard Ovalstrapping
Forest Products Division
120-55th Street N.E.
Fort Payne, AL 35967-8140
(256) 845-1914
Fax: (256) 845-1493
Products:
- Polyester Cord Strap

Greif, Inc.—Now ITW Down River
701 West Scott Avenue
Woodland, WA 68674
(360) 225-9995
Fax: (866) 675-2391
Products:
- Buffer Material / Contour Buffer Pads
- Bulkheads
- Car Liner Sheets
- Corner Protectors
- D.I.D. Bags
- Drum Separators
- Honeycomb Panels
- Risers / Separator Pads
- Slip Sheets / Tier Sheets

Holland Company
1000 Holland Dr
Crete, IL 60417
(708) 672-2300
Products:
- Car components
- Cargo Sleds

HEX-A-COMB

See Pregis

Industrial Packaging Supplies
10 Jack Casey Court
Fountain Inn, SC 29644
(864) 862-1500
(864) 862-1005
Products:
- D.I.D. Bags
- Plastic Strap
- Steel Strap

Interlake Packaging Corp.
1515 W. Mohawk Drive
Tomahawk, WI 54487
(715) 453-2223
Fax: (715) 453-7972
Products:
- Void Fillers
- Corrugated

International Dunnage LLC
3216 Center Street
Thunderbolt, GA 31404 USA
(912) 355-8884
Fax: (912) 355-7234
Products:
- D.I.D. Bags
- Straps and Buckles
- Inflator Tools

Instrumented Sensor Technology
4704 Moore St.
Okemos, MI 48864 USA
(517) 349-8487
Fax: (517) 349-8469
Products:
- Shock and Vibration Recorders
- Accelerometers
- Temperature and Humidity Recorders Data Loggers
- Data Acquisition

IRECO LLC
805 Golf Lane
Bensenville, IL 60106
(630) 741-0155
Fax: (630) 595-0646
Products:
- Lading Anchors

ITW CargoSafe
1203 N. Main Street
Mt Pleasant, TN 38474
(931) 380-9428
Products:
- Beam End Sockets
- Cargo Restraint Devices
- Corner Protectors
- Load Bars
- Shoring Beams
- Strap Anchors
- Strap Assemblies
- Track
- Winches

Ride Rite/ITW Shippers
300 South Edgar
Fordyce, AR 71742
(800) 468-1230
Products:
- D.I.D. Bags

Kinedyne Corp.
3701 Greenway Circle
Lawrence, KS 66046-5442
(785) 841-4000
Fax: (785) 841-3668
Products:
- Beam End Sockets
- Cargo Restraint Devices
- Corner Protectors
- Custom Design Products
- Shoring Beams
- Strap Anchors
- Strap Assemblies
- Winches

Koneta Rubber Company
Matting Division
1400 Lunar Drive
Wapakoneta, OH 43895
(419) 739-4200
Products:
- Rubber Mats

Lansmont Corporation
Ryan Ranch Research Park
17 Mandeville Court
Monterey, CA 93940 USA
(831) 655-6600
Products:
- Data Loggers
- Temperature Recorders
- Humidity Recorders
- Vibration Measurement Tools
- Test Instruments

Lat-Lon
2300 South Jason Street
Denver, CO 80223
(877) 300-6566
(303) 937-7406
Fax: (303) 531-5754
Products:
- Data Recorders

Logistick
19880 State Line Road
South Bend, IN 46637-1545
(800) 758-5840
(574) 271-2565
Fax: (574) -271-2574
Products:
- Blocking and Bracing Devices
- Strapping
- D.I.D. Bags
- Void Fillers
- Security Seals
- Corner Protectors

Lock 'n' Pop
20508 56th Avenue, West
Lynwood, WA 98036
(800) 225-3009
Products:
- Lock 'n' Pop

Lodge Lumber Company Inc.
5001 Oates Road
Houston, TX 77213
(713) 672-6679
Fax: (713) 672-5135
Products:
- Separators

Maillis Strapping Systems
404 Wall Street
Fountain Inn, SC 29644-2035
(877) 962-4648
Products:
- Polyester Strapping
- Plastic Strapping
- Strapping Tools

Menasha Packaging Company
1645 Bergstrom Road
Neenah, WI 54957
(920) 751-1000
Products:
- Corrugated Boxes
- Corrugated Fanfold
- Bulk Containers

Moldwood Corp.
104 Mallard Circle
York, AL 36925
(205) 392-5257
Products:
- Core Plugs

National Rubber Technologies Corp.
1505 Hickory Hills Lane
Brookfield, WI 53045
(800) 785-3986
(262) 785-7536
Fax: (262) 785-7537
Products:
- Custom Design Products
- Masticated Rubber
- Rubber Mats

Packaging Un-Limited Inc.
2215 Augustine Street
Covington, KY 41014
(859) 431-6194
Fax: (859) 431-0808
Products:
- Bulkheads
- Corrugated Pallets
- Custom Wood and Paper Products
- Edge Protectors
- Poly Foam pads
- Risers
- Roll Headers
- Separator Pads
- Void Fillers

Pasadena Slid and Pallet Co.
5202 Red Bluff Road
Pasadena, TX 77508
(281-991-0190
Fax: 281-991-0905
Products:
- Eucalyptus Hardboard
- Skids and Pallets
- Corrugated Pallets
- Palletizing Materials

Pensacola Skid and Pallet
351 Becks Lake Road
Cantonment, FL 32533
(850) 968-1504
Fax: (850) 968-9393
Products:
- Pre-assembled Bulkheads

PlasTech Inc.
70 S. Eaton Ct.
Lakewood, CO 80226
(800) 919-6919
(303) 202-0852
Fax: (303) 202-0454
Products:
- Separators
- Slip Sheets
- D.I.D. Bags
- Void Fillers

PlyVeneer Products
800 48th Street
Springfield, OR 97478
(866) 447-0771
(541) 747-0771
Fax: (541) 747-0775
Products:
- Ply Veneer Panels

Pregis Corp.
1650 Lake Cook Road, Suite 400
Deerfield, IL 60015
(847) 597-2200
(800) 834-9441
Products:
- Void Fillers
- Die Cut Honeycomb
- Honeycomb Pallets

Prom Industries
13812 N.E. Clark Road
Vancouver, WA 98685
(360) 573-3611
Fax: (360) 573-8110

RB Rubber Products
904 E. 10th Avenue
McMinnville, OR 97128
(503) 472-4691 / (800) 525-5530
Fax: (503) 434-4455 / (800) 888-1183

RC Packaging Systems, Inc.
4935 Technical Drive
Milford, MI 48381
(248) 684-6363
Fax: (248) 685-3521
Products:
- Polyester Cord Strap

RFTrax—Now IONX
515 S. Franklin Street
West Chester, PA 19382
(484) 653-2600
Products:
- Rail Asset Tracking
- Data Acquisition Devices

Shockwatch Corp.
W. Mockingbird Lane
Dallas, TX 75247
(800) 527-9497
Fax: (214) 638-4512
Products:
- Data Acquisition Monitors

S-Line (Now Ancra)

Safety Corporation of America -
(Formerly: Vetter Systems, Inc.)
1005 International Drive
Oakdale, PA 15071
(412) 695-3100
Fax: (412) 695-3232
Products:
- Rubber Lifting Bags

Samuel Strapping Systems
1455 James Parkway
Heath, OH 43056
(800) 222-1855
Fax: (614) 863-7330
Products:
- Steel Strap
- Plastic Strap

ITW Shippers
1203 N. Main Street
P.O. Box 69
Mt. Pleasant, TN 38474
(615) 379-7731
(800) 933-7731
Fax: (615) 379-7735
Products:
- Air Compressors
- Angleboard
- Bulk Containers
- Coil/Roll Edge Protectors
- Contour Buffer Pads
- D.I.D. Bags
- Load Bars
- Roll Risers
- Rubber Mats
- Separators
- Slip Sheets
- Void Fillers

Ship Tech International, Inc.
385 Montana Drive
P.O. Box 492
Seely Lake, MT 59868
(800) 771-2196
(406) 677-2907
Fax: (406) 677-5021
Products:
- Bulkheads
- Contour Buffer Pads
- D.I.D Bags
- Poyester Cord Strapping
- Rebonded Rubber Mats
- Risers
- Void Fillers

Signode/ITW
800 Corporate Woods Parkway
Vernon Hills, IL 60061
(800) 323-2464
Fax: (847) 913-9078
Products:
- Load Cushioners
- Plastic Strap
- Polyester Cord Strapping
- Steel Strapping
- Strap Anchors

Southern Bracing Systems, Inc.
P.O. Box 761
Rome, GA 30161
(706) 291-4206
Fax: (706) 291-0229
Products:
- Bulkheads
- Cargo Restraining Devices
- Contour Buffer Pads
- Corner Protectors
- Custom Design Products
- D.I.D. Bags
- Polyester Cord Strap
- Risers
- Rubber Mats
- Separators
- Laminated Bulkhead (Ty-gard™)
- Void Fillers

Southern Strapping Systems
1900 Parish Drive
Rome, GA 30161
(800) 524-7513
Fax: (706) 291-0229
Products:
- Polyester Strapping

Sunrise Arkansas, Inc.
400 Airline Drive
Benton, AR 72015
(800) 264-5411
Fax: (501) 778-6335
Products:
- Bulkheads
- D.I.D. Bags
- Risers
- Separators
- Void Fillers

Sunrise Mfg., Inc
2665 Mercantile Drive
Rancho Cordova, CA 95742
(800) 748-6529
Fax: (916) 635-9730
Products:
- Buf-Bags
- Bulkheads
- D.I.D. Bags
- Laminated Bulkheads (Ty-gard™)
- Polyester Strap
- Rubber Matting
- Separators
- Slip Sheets
- V-Boards
- Void Fillers

Sunrise Washington, Inc.
5900-A N.E. 88th Street #119
Vancouver, WA 98665
(360) 574-3512
(888) 485-4085
FAX: (360) 574-7695
Products:
- Buf-Bags
- Bulkheads
- D.I.D. Bags
- Corner Protectors
- Void Fillers
- Laminated Bulkheads Ty-Gard 2000)
- Corrugated Pallets
- Rubber Matting
- Polyester Strap
- Slip Sheets
- Stretch Film
- Roll Risers
- Security Seals

SPC Solutions
500 South 59th Avenue West
Duluth, MN 55807
(800) 705-5279
(218) 624-8945
Fax: (218) 624-8949
Products:
- Angle board
- Beam and Sockets
- Beverage Bulkheads
- Bulk Containers
- Bulkheads
- Car Liner Sheets
- Cargo Restraining Devices
- Core Plugs
- Corner Posts
- Corner Protectors
- Contour Buffer Pads
- Cushion Contour Poly Foam Pads
- Custom Design Products
- DID Bags
- Laminated Bulkheads
- Load Bars
- Metal Blocking Devices
- Rebonded Rubber Pads
- Risers
- Rubber Mats
- Separators
- Shore and Beams
- Slip Sheets—Paper and Plastic
- Strap Anchors
- Strap Assemblies
- Stretch Wrap Equipment and Film
- Thermo Barriers
- Top Caps
- Void Fillers

Syn-tex USA (Now ITW/Shippers)

Tapex American Corporation
2626 20th Street
Port Huron, MI 48061-0233
(810) 987-4722
Fax:(810) 987-4728
Products:
- Polyester Cord Strap

TydenBrammall
409 Hoosier Drive
Angola, IN 46703
800⁄348-4777
Products:
- Security Seals

Ultimate Systems Ltd.
1430 N. Main St
Delphos, OH 45833
(419) 692-3005
Fax: (419) 692-1401
Products:
- Rubber Mats

UNSA America
5921 Thurston Ave.
Virginia Beach, VA 23455
(757) -552-0507
Fax: (757) 490-1548
Products:
- Bulk bags
- D.I.D. Bags

US Dunnage LLC
144 Wood Street
Crossett, AR 71635
(870) 304-2247
(866) 407-2247
Fax: (870) 364-2288
Products:
- D.I.D. Bags

Vin-Tex Sealers, Inc.
1447 W. Ardmore Avenue
Itasca, IL 60143
(800) 770-1920
Fax: (630) 773-3913
Products:
- D.I.D. Bags (Nylon Reinforced Urethane)

Walnut Industries Inc.
1356 Adams Road
Bensalem, PA 19020
(800) 523-6536
(215) 638-7847 (in PA)
Fax: (215) 638-4939
Products:
- Laminated Bulkheads (Ty-gard™)

ALPHABETICAL LIST

Canada

Ancra Canada Ltd.
6710 Maritiz Dr #2
Mississauga, Ontario
L5W 0A1 Canada
(866) 962-0055
Fax: (866) 792-0058
Products:
- Beam End Sockets
- Cargo Restraining Devices
- Corner Protectors
- Shoring Beams
- Strap Assemblies
- Strap Anchors
- Winches

Caristrap International, Inc.
1760 Fortin Boulevard
Laval, Quebec Canada H7S 1N8
(450) 667-4700
(800) 361 9466
Fax: (450) 663-1520
Products:
- Cargo Restraining Devices
- Custom Design Products
- Industrial Tapes
- Non Wovens
- Plastic Strap
- Polyester Cord Strap
- Strap Anchors

Cascades Enviropac Inc.
541, Melchers/P.O. Box 1620
Berthierville, Quebec Canada J0K 1A0
(450) 836-1799
Fax: (450) 836-8235
Products:
- Honeycomb Products
- Polyester Cord Strap
- Rubber Mat

Converdis Inc.
601 rue Melchers
Canada
(450) 836-7026
Products:
- Honeycomb Products
- Polyester Cord Strap
- Rubber Mat

Complete Packaging Systems
1375 Hopkins Street
Whitby, Ontario, Canada L1N 2C2
(905) 668-4200
(866) 858-8800
Fax: (905) 666-6565
Products:
- D.I.D. Bags
- Friction Mats
- Polyester Cord Strapping
- PET Strapping Steel Strapping
- Seals and Buckles
- Edge Protectors
- Stretch Film
- Strapping Tools

Gerrard-Ovalstrapping
735 Oval Court
Burlington, Ontario L7L 5L1
(905) 632-3662
Fax: (905) 639-2290
Products:
- Polyester Cord Strap

IRECO
Ronsco, Inc.
1440 St. Catherine St. W.
Suite 712
Montreal, Quebec H3G 1R8
(514) -866-1033
Fax: (514) -866-8421

Kinedyne Canada Limited
160 Dynamic Drive
Toronto, Ontario M1V 5A5
(416) 291-7168
Fax: (800) 663-7318
Products:
- Beam End Sockets
- Cargo Restraint Devices
- Corner Protectors
- Custom Design Products
- Shoring Beams
- Strap Anchors
- Strap Assemblies
- Winches

Maillis Strapping Systems
209 Wulftec Street
Ayer's Cliff Quebec
Canada J0B 1C0
(877) 985-3832
Products:
- Polyester Strapping

National Rubber Technologies Corp.
394 Symington Avenue
Toronto, Ontario M6N 2W3
(800) 387-8501
(416) 657-1111
Fax: (416) 652-4212
Products:
- Custom Design Products
- Masticated Rubber
- Rubber Mats

Provincial Paper Products
6935 Davand Drive
Missisauga, Ontario L5T 1L5
(905) 670-7928
(866) 753-1532
Fax: (905) 670-0531
Products:
- Bulkheads
- D.I.D. Bags
- Industrial Tapes
- Risers
- Separators
- Stretch Wrap Equipment and Films
- Void Fillers

Samuel Strapping Systems
743 Warden Avenue
Scarborough, Ontario M1L 4A9
(800) 607-8727
Products:
- D.I.D. Bags
- Plastic Strap
- Steel Strap
- Strap Anchors
- Polyester Strap
- Stretch Film
- Seals and Buckles

Signode Canada/ITW Canada
241 Gough Road
Markham, On L3R 5B3
(905) 479-9754
(800) 387-5173
Fax:(905) 479-4869
Products:
- D.I.D. Bags
- Load Cushioners
- Plastic Strapping
- Steel Strapping
- Strap Anchors

Syn-tex Convertors Ltd./ITW Canada
211 Hutchings Street
Winnipeg, Manitoba R2X 2R4
(204) 632-5667
(800) 667-0241
Fax: (204) 633-4125
Products:
- D.I.D. Bags (Woven Polypropylene)

Product Category List

* Canada
# US and Canada

Air Compressors
Dunnage Systems Inc.
ITW Shippers

Angleboard
ITW Shippers

Beam End Sockets
*Ancra Canada Ltd.
Ancra International
ITW CargoSafe
*Kinedyne Canada Ltd.
Kinedyne Corp.
SPC Solutions

Beverage Bulkheads
Allegheny Industrial Associates—An ITW Company
SPC Solutions

Bulk Containers
Dunnage Systems Inc.
Fleet Products and Equipment, L.L.C.
ITW Shippers
SPC Solutions

Bulk Containment (Grain) Doors
Menasha Corp.

Bulk Liners
AsiaTek

Bulkheads
Circle, Inc.
Corrugated Systems, Inc.
The Damage Prevention Company
Dunnage Systems Inc.
Greif—Now ITW DownRiver
Packaging Un-Limited Inc.
Pregis
*Provincial Paper Prod.
Southern Bracing Systems, Inc.
SPC Solutions
Sunrise Arkansas, Inc.
Sunrise Mfg., Company
Sunrise Washington, Inc.

Bulkheads (Pre-assembled)
Pensacola Skid and Pallet

Car Liner Sheets
Menasha Corp.
SPC Solutions

Cargo Restraining Devices
*Ancra Canada Ltd.
Ancra International
#Caristrap International, Inc.
Fleet Products and Equipment, L.L.C.
ITW CargoSafe
*Kinedyne Canada, Ltd.
Kinedyne Corp.
Southern Bracing Systems, Inc.

Core Plugs
Moldwood Corp.
SPC Solutions

Corner Protectors
*Ancra Canada Ltd.
Ancra International
Circle, Inc.
The Damage Prevention Co.
ITW CargoSafe
*Kinedyne Canada, Ltd.
Kinedyne Corp.
Southern Bracing Systems, Inc.
SPC Solutions
Sunrise Mfg., Inc.
Sunrise Washington Inc.

Contour Buffer Pads
Circle Inc.
The Damage Prevention Co.
Dunnage Systems Inc.
Greif—Now ITW DownRiver
ITW Shippers
Southern Bracing Systems, Inc.
SPC Solutions

Cushion Contour Polyfoam Pads
Allegheny Industrial Associates—An ITW Company
Cougar Packaging Designers, Inc.
Packaging Un-Limited Inc.
SPC Solutions
Sunrise Washington Inc.

Custom Design Products
*Ancra Canada Ltd.
Ancra International
#Caristrap International, Inc.
Circle, Inc.
The Damage Prevention Co.
Damage Prevention Industries, Inc.
*Kinedyne Canada, Ltd.
Kinedyne Corp.
#National Rubber Technologies Corp.
Packaging Un-Limited Inc.
Pregis
Southern Bracing Systems, Inc.
SPC Solutions
Sunrise Mfg., Inc.
Sunrise Washington inc.

Data Recorders
Instrumented Sensor Technology Inc.
Lansmont
Lat-Lon
RFTrax—Now IONX
Shockwatch

D.I.D. Bags
Allegheny Industrial Associates—An ITW Company
Centerload Shipping Technologies/ITW Shippers
Circle Inc.
Complete Packaging Systems
Corrugated Systems, Inc.
The Damage Prevention Co.
Dunnage Systems Inc.
Fleet Products and Equipment, L.L.C.
Greif—Now ITW DownRiver
Industrial Packaging Supplies
Industrial Packaging Systems, Inc.
Ride Rite/ITW Shippers
International Dunnage
Packaging Un-Limited Inc.
*Provincial Paper Products
ITW/Shippers Products
Shipping Systems, Inc.
*Signode Canada/ITW Canada
Southern Bracing Systems, Inc.
SPC Solutions
Sunrise Arkansas, Inc.
Sunrise Mfg., Company
Sunrise Washington Inc.
*Syn-tex Convertors Ltd./ITW Canada
UNSA USA
US Dunnage
Vin-Tex Sealers, Inc.

Doorway Protection Strips
Industrial Packaging Supplies

Edge Protectors (Coils and Rolls)
Complete Packaging Systems
The Damage Prevention Co.
Packaging Un-Limited Inc.
ITW Shippers
Sunrise Mfg., Inc.
Sunrise Washington Inc.

Friction Panels/Mats
Greif—Now ITW DownRiver
Key Tech Corporation

Industrial Tapes
Allegheny Industrial Associates—An ITW Company
#Caristrap International, Inc.
*Provincial Paper Products

Laminated Bulkheads
Southern Bracing Systems, Inc. (Ty-gard 2000)
SPC Solutions (Ty-gard 2000)
Sunrise Mfg., Inc. (Ty-gard 2000)
Walnut Industries Inc. (Ty-gard 2000)

Load Bars
ITW CargoSafe
*Kinedyne Canada, Ltd.
Kinedyne Corp.
ITW Shippers
SPC Solutions

Load Cushioners
*Signode Canada, Inc./ITW Canada
ITW/Signode

Masticated Rubber
#National Rubber Technologies Corp.

Non-Wovens
#Caristrap International, Inc.
Carolina Strapping
Complete Packaging Systems
Cordstrap USA
Maillis Strapping
Tapex American Corp.
Southern Strapping
Sunrise Mfg., Inc.
Sunrise Washington Inc.

Plastic Strap
Acme Packaging Systems/ITW Shippers
Complete Packaging Systems
Industrial Packaging Supplies
Interlake Packaging Corp.
Maillis Strapping
*Samuel Strapping Systems
*Signode Canada Inc./ITW Canada
ITW/Signode Corp.

Polyester Cord Strapping
Allegheny Industrial Associates—An ITW Company
Boomerang Packaging, Inc.
#Caristrap International, Inc.
*Cascades Enviropac Inc.
Converdis Inc.
Cordstrap USA
*Gerrard-Ovalstrapping
Maillis Strapping
RC Packaging Systems, Inc.
ITW/Signode
Southern Strapping
Tapex American Corporation

Rebonded Rubber Pads
Allegheny Industrial Associates—An ITW Company
Circle, Inc.

Risers
Allegheny Industrial Associates—An ITW Company
Circle Inc.
Corrugated Systems, Inc.
The Damage Prevention Co.
Dunnage Systems Inc.
Greif—Now ITW DownRiver
Menasha Packaging Company
Packaging Un-Limited Inc.
*Provincial Paper Products
ITW Shippers
Southern Bracing Systems, Inc.
SPC Solutions
Sunrise Arkansas, Inc.
Sunrise Mfg., Company
Sunrise Washington Inc.

Rubber Mats
Allegheny Industrial; Associates—An ITW Company
Amorim Industrial Solutions
*Cascades Enviropac Inc.
Circle, Inc.
*Converdis Inc.
Koneta Rubber Company
#National Rubber Technologies Corp. (US and Canada)
Southern Bracing Systems, Inc.
ITW Shippers
SPC Solutions
Sunrise Mfg., Inc.
Sunrise Washington Inc.

Security Seals
Complete Packaging Systems
E. J. Brooks

Separators
Allegheny Industrial Associates—An ITW Company
Circle, Inc.
Complete Packaging Systems
Corrugated Systems, Inc.
The Damage Prevention Co.
Dunnage Systems Inc.
Fleet Products and Equipment, L.L.C.
Greif—Now ITW DownRiver
Lodge Lumber
Packaging Un-Limited Inc.
Pasadena Skid and Pallet, Inc.
*Provincial Paper Products
ITW Shippers
Southern Bracing Systems
SPC Solutions
Sunrise Arkansas, Inc.
Sunrise Mfg., Company
Sunrise Washington Inc.

Shoring Beams
*Ancra Canada Ltd.
Ancra International
ITW CargoSafe
*Kinedyne Canada Ltd.
Kinedyne Corp.
SPC Solutions

Slip Sheets
Circle, Inc.
Dunnage Systems Inc.
Fleet Products and Equipment, L.L.C.
ITW Shippers
SPC Solutions

Steel Strapping
Acme Packaging Systems/ITW
Industrial Packaging Supplies
Samuel Strapping Systems
*Signode Canada Inc./ITW Canada
ITW/Signode
SPC Solutions

Strap Anchors
*Ancra Canada Ltd.
Ancra International
#Caristrap International, Inc.
IRECO
ITW CargoSafe
*Kinedyne Canada Ltd.
Kinedyne Corp.
*Signode Canada Inc.
ITW/Signode
SPC Solutions

Strap Assemblies
*Ancra Canada Ltd.
Ancra International
ITW CargoSafe
*Kinedyne Canada Ltd.
Kinedyne Corp.

Stretch Wrap Equipment and Film
Complete Packaging Systems
Fleet Products and Equipment, L.L.C.
*Provincial Paper Products
SPC Solutions
Sunrise Mfg., Inc.
Sunrise Washington Inc.

Thermal Barriers
The Damage Prevention Co.
SPC Solutions

Trailer Liners
AsiaTek
BJK Industries, Inc.

Void Fillers
Allegheny Industrial Associates—An ITW Company
Circle Inc.
Corrugated Systems, Inc.
The Damage Prevention Co.
Dunnage Systems Inc.
Fleet Products and Equipment, L.L.C.
Greif—Now ITW DownRiver
Industrial Packaging Supplies
Packaging Un-Limited Inc.
Pregis
*Provincial Paper Products
ITW Shippers
Southern Bracing Systems, Inc.
SPC Solutions
Sunrise Arkansas, Inc.
Sunrise Mfg., Inc.

Winches
*Ancra Canada Ltd.
Ancra International
ITW CargoSafe
*Kinedyne Canada, Ltd.
Kinedyne Corp.

Appendix C—Other Publications of Interest

The following are publications that may be of interest to shippers responsible for loading trailers or containers.

Code of Safe Practice for Cargo Storage and Securing—Published by the International Maritime Organization, Second Edition 2003, ISBN Number 92-801-5145-2.

Order From: IMO Publishing Service
4 Albert Embankment
London SE1 7SR
United Kingdom
e-mail: sales@imo.org

AAR Open Top Loading Rules Manual—Sections 1–7—Issued by the AAR Safety and Operations Department.

Order From: TTCI
P.O. Box 79780
Baltimore, MD 21279-0780
Phone: (877) 999-8824
Online Ordering: www.aarpublications.com
www.aar.com

Intermodal LTL Guide – Published by AAR/TTCI.

Order From: TTCI
P.O. Box 79780
Baltimore, MD 21279-0780
Phone: (877) 999-8824
Online Ordering: www.aarpublications.com
www.aar.com

International Safe Transit Association
1400 Abbott Road, Suite 310
East Lansing, MI 48823-1900
Phone: (517) 333-3437
www.ista.org

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Appendix D—Rubber Mat Specifications

RUBBER MAT SPECIFICATIONS (TYPICAL VALUES)

Supplier: Allegheny Industrial Associates—An ITW Company

TransMat™ 8060		
Density:	ASTM D–297:	.80 g/cm^3
Tensile:	ASTM D–412:	175 psi
Elongation:	ASTM D–412:	90%
Hardness:	ASTM D–2240:	Shore A: 40–60 (points)
Tear:	ASTM D–624:	50 ppi (Die C)
Compression Properties:	ASTM F–36:	100 psi—15–25%, Recovery 80%
Coefficient of Friction:	ASTM D–1894:	1.3
TransMat™ 7513		
Density:	ASTM D–297:	46.7 lb/ft^3
Tensile:	ASTM D–412:	200 psi
Elongation at Break:	ASTM D–412:	125%
Hardness:	ASTM D–2240	Shore A: 40–60 (points)
Tear:	ASTM D–624:	50 ppi (Die C)
Compression Set B:	ASTM D–395:	40% maximum (25% Deflection, 158 °F/22 hours)
Compression Set (Foam):	ASTM D3676:	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
TransMat™ 7010		
Density:	ASTM D–297:	50 lb/ft^3
Tensile:	ASTM D–412:	120 psi
Elongation at Break:	ASTM D–412:	75–105%
Hardness:	ASTM D–2240	Shore A: 35–55 (points)
Tear:	ASTM D–624:	70 ppi (Die C)
Compression Set B:	ASTM D–395:	70% maximum (25% Deflection, 158 °F/22 hours)
Compression Set(Foam):	ASTM D3676:	80% maximum (50% Deflection, 158 °F/22 hours)
Compression Properties:	ASTM F–36:	100 psi – 15–25%, 200 psi—30–40%, 300 psi—35–45%, 400 psi—45–55%
Coefficient of Friction:	ASTM D–1894:	1.195
TransMat™ 6900		
Density:	ASTM D–297:	52 lb/ft^3
Tensile:	ASTM D–412:	100 psi
Elongation:	ASTM D–412:	95% (Die C)
Hardness:	ASTM D–2240	Shore A: 45–55 (points)
Tear:	ASTM D–624:	40 ppi (Die C)
Compression Set B:	ASTM D–395:	40% maximum (25% Deflection, 158 °F/22 hours)
Compression Set (Foam):	ASTM D3676:	30% maximum (50% Deflection, 158 °F/22 hours)
Compression Properties:	ASTM F–36:	100 psi—20–30%
Coefficient of Friction:	ASTM D–1894:	1.2
TransMat™ 6510		
Density:	ASTM D–297:	40 lb/ft^3
Tensile:	ASTM D–412:	75 psi
Elongation at Break:	ASTM D–412:	60%
Hardness:	ASTM D–2240	Shore A: 20–60 (points)
Tear:	ASTM D–624:	20 ppi (Die C)
Compression Set B:	ASTM D–395:	20–30 (25% Deflection, 158 °F/22 hours)
Compression Set (Foam):	ASTM D3676:	20–30 (50% Deflection, 158 °F/22 hours)
Compression Properties:	ASTM F–36:	100 psi—25–35%, 200 psi—40–50%, 300 psi—50–60%, 400 psi—60–70%
Coefficient of Friction:	ASTM D–1894:	1.083

Rubber Mat Specifications (Typical Values)

Supplier: National Rubber Technologies Corp.

Load Grip		
Thickness:		1⁄8 in. and 1⁄4 in.
Weight:		17 g/in.^{3} average
Tensile Strength:	ASTM D–412:	677 psi average
Durometer Hardness:	ASTM D–676:	Shore Type: 80 I average
Tear Resistance:	ASTM D–624:	Die B Nicked Specimens: 410 ppi average
Load–Grip 2		
Density:		74.8 lb/ft^3 (maximum)
Tensile:	ASTM D–412:	100 psi minimum—machine direction (Die C) 150 psi minimum—across machine direction
Elongation at Break:	ASTM D–412:	100%
Tear:	ASTM D–624:	25 ppi—both directions
Hardness:	ASTM D–2240:	Shore A: 40 ± 10 (points)
Compression Set B:	ASTM D–395:	60% (24 hours at 21 °C)
Coefficient of Friction:	TAPPI TB16OM-92:	0.9
Load–Grip 3		
Density:		69 lb/ft^3 (maximum)
Tensile:	ASTM D–412:	250 psi minimum—with grain (Die C) 150 psi minimum—across grain
Elongation at Break:	ASTM D–412:	30% minimum—with grain (Die C) 60% minimum—across grain
Tear:	ASTM D–624:	60 ppi—with grain (Die B) 100 ppi—across grain
Hardness:	ASTM D–2240:	Shore A: 50 ± 10 (points)
Compression Set B:	ASTM D–395:	50% (22 hours at room temp.)
Coefficient of Friction:	TAPPI TB16OM-92:	0.7
Load–Grip 5		
Tensile:	ASTM D–412:	5.3 (768.5) with grain Die C 3.3 (478.5) across grain
Elongation:	ASTM D–412:	18% with grain 74% across grain
Tear:	ASTM D–624:	35 (199.5)—with grain (Die B) 53 (302.1)—across grain
Hardness:	ASTM D–2240:	Shore A: 79 (points)
Coefficient of Friction:	ASTM D–1894:	1.15
Load–Grip 6		
Thickness		0.08 in. (2 mm)
Tensile:	ASTM D–412:	210 psi (Die C)
Elongation:	ASTM D–412:	90% (Die C)
Tear:	ASTM D–624:	70 pi (Die B)
Density	ASTM D–297:	0.8g/cm^3
Hardness:	ASTM D–2240:	Shore A: 45 to 65 (points)
Coefficient of Friction:	ASTM D–1894:	1.0

Supplier: Amorim Industrial Solutions

Rubber Restraint Mat BC548		
Density:	ASTM D–3676:	52 lb/ft^3
Tensile:	ASTM D–412:	185 psi
Elongation at Break:	ASTM D–412:	100%
Tear:	ASTM D–624:	75 ppi (Die C)
Compression Set B:	ASTM D–395:	32% maximum (25% Deflection, 158 °F/22 hours)
Compression Properties:	ASTM F–36:	100 psi—15% 400 psi—45%
Coefficient of Friction:	ASTM D–1894:	0.965

Supplier: RB Rubber Products, Inc.

Friction Mat

Density:	ASTM D–3676:	64.59 lb/ft^3
Tensile:	ASTM D–412:	327.6 psi
Elongation at Break:	ASTM D–412:	83.1%
Tear:	ASTM D–624:	149.2 (16 f/in.)
Hardness:	ASTM D–2240:	Shore A: 63 (points)
Coefficient of Friction:	ASTM D–1894:	.980

Supplier: Circle, Inc.

Brown Bear™ Friction Mat 101

Density:	ASTM D–3676:	52 lb/ft^3 minimum
Tensile:	ASTM D–412:	200 psi, minimum, with grain
Elongation at Break:	ASTM D–412:	125%, minimum, with grain
Tear:	ASTM D–624:	85 ppi, minimum, with grain 150 ppi, minimum, across grain
Coefficient of Friction:	ASTM D–1894:	0.965

Supplier: Sunrise Manufacturing

ZRO-SHIFT™

Density:	ASTM D–297:	54 lb/ft^3
Tensile:	ASTM D–412:	149 psi
Elongation at Break:	ASTM D–412:	80–95%
Hardness:	ASTM D–2240:	Shore A: 50–55 (points)
Tear:	ASTM D–624:	45 ppi (Die C)
Compression Set B:	ASTM D–395:	40% maximum (25% deflection, 158 °F/22 hours)
Coefficient of Friction:	ASTM D–1894:	0.91

Supplier: Regupol America

Load Secure™ 6910

Density:	ASTM D–297:	53.9 lb/ft^3
Tensile Wide:	ASTM D–412:	216.2 psi
Tensile Across:	ASTM D–412:	256.76 psi
Elongation Across:	ASTM D–412:	74.23%
Elongation Wide:	ASTM D–412:	66.62%
Hardness:	ASTM D–2240:	Shore A: 68.4 (points)
Tear:	ASTM D–624:	12.42 n /mm (Die C)

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