Rules for

Certification of Cargo Containers

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American Bureau of Shipping
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the State of New York 1862

Foreword

The American Bureau of Shipping, with the aid of industry, published the first edition of these Rules as a Guide in 1968. Since that time, the Rules have reflected changes in the industry brought about by development of standards, international regulations and requests from the intermodal container industry. These changes are evident by the inclusion of programs for the certification of both corner fittings and container repair facilities in the fourth edition, published in 1983.

In this fifth edition, the Bureau will again provide industry with an ever broadening scope of services. In response to requests, requirements for the newest program, the Certification of Marine Container Chassis, are included. Additionally, the International Maritime Organization's requirements concerning cryogenic tank containers are included in Section 9.

On 21 May 1985, the ABS Special Committee on Cargo Containers met and adopted the Rules contained herein.

On 6 November 1997, the ABS Special Committee on Cargo Containers met and adopted updates/revisions to the subject Rules. The intent of the proposed changes to the 1987 edition of the ABS "Rules for Certification of Cargo Containers" was to bring the existing Rules in line with present design practice. The updated proposals incorporated primarily the latest changes to IACS Unified Requirements and ISO requirements.

The effective date of the Rule changes is 13 May 1998 in line with other 1998 ABS Rules.

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Section 1 Appendix D International Convention for Safe Containers (CSC).

Section 1 Conditions of Certification

1.1 Certification

The Certification process consists of a) the development of Rules, Guides, standards and other criteria for the design and construction of containers, for materials and equipment, b) the review of design and survey during and after construction to verify compliance with such Rules, Guides, standards or other criteria and c) the issuance of certificates when such compliance has been verified.

The Rules, Guides and standards are developed by Bureau staff and passed upon by committees made up of container manufacturers, naval architects, marine engineers, shipbuilders, engine builders, steel makers and by other technical, operating and scientific personnel associated with the worldwide maritime and container industry. Theoretical research and development, established engineering disciplines, as well as satisfactory service experience are utilized in their development and promulgation. The Bureau and its committees can act only upon such theoretical and practical considerations in developing Rules, Guides and standards.

1.3 Certificates and Reports

Plan review and surveys during and after construction are conducted by the Bureau to verify to itself and its committees that a container is in compliance with the Rules, Guides, standards or other criteria of the Bureau and to the satisfaction of the attending Surveyor. All reports and certificates are issued solely for the use of the Bureau, its committees, its clients and other authorized entities.

1.5 Approval of the Prototype Container

Certification will be based primarily upon the container meeting the design considerations in Section 6, the performance tests in Section 7 for all containers, and additional design considerations and tests in Sections 9 and 10 for tank containers and thermal containers. When a prototype container meets the requirements of the Rules and has passed the required tests the Prototype Test Certificate will be issued.

1.7 Certification of Production

Certification of the production units will be based upon the satisfactory conclusion of container plan review, prototype approval, the production tests required by Section 7, the acceptance of the manufacturer's quality control procedures and the survey of each container. Additional tests are required for tank containers and for thermal containers as set forth in Sections 9 and 10. The production units, when considered acceptable to the Bureau, will be certified and a Container Production Certificate issued.

When a container is accepted for general service a decal, as shown in Figure 1.1, signifying that the container is in compliance with the Rules, is to be affixed to the container. When a container is accepted for special service under 1.17.2, a decal as shown in Figure 1.2 signifying that the container meets the requirements for its intended service is to be affixed to the container.

1.9 Optional Inspection

When requested by an Owner the Bureau may also inspect containers in accordance with Owner specifications in addition to the inspection required by the Rules for certification.

1.11 Representations as to Certification

Certification is a representation by the Bureau as to the structural fitness for a particular use or service in accordance with its Rules, Guides and standards. The Rules of the American Bureau of Shipping are not meant as a substitute for the independent judgment of professional designers, naval architects and marine engineers nor as a substitute for the quality control procedures of shipbuilders, container manufacturers, steel makers, suppliers, manufacturers and sellers of marine materials, machinery or equipment. The Bureau, being a technical society can only act through Surveyors or others who are believed by it to be skilled and competent.

The Bureau represents solely to the container manufacturer, container Owner or client of the Bureau that when certifying it will use due diligence in the development of Rules, Guides and standards and in using normally applied testing standards, procedures and techniques as called for by the Rules, Guides, standards and other criteria of the Bureau. The Bureau further represents to the container manufacturer, container Owner or other client of the Bureau that its certificates and reports evidence compliance only with one or more of the Rules, Guides, standards or other criteria of the Bureau in accordance with the terms of such certificate or report. Under no circumstances whatsoever are these representations to be deemed to relate to any third party.

1.13 Responsibility and Liability

Nothing contained in any certificate or report is to be deemed to relieve any designer, builder, Owner,

manufacturer, seller, supplier, repairer, operator, other entity or person of any warranty express or implied. Any certificate or report evidences compliance only with one or more of the Rules, Guides, standards, or other criteria of the American Bureau of Shipping and is issued solely for the use of the Bureau, its committees, its clients, or other authorized entities. Nothing contained in any certificate, report, plan or document review or approval is to be deemed in any way a representation or statement beyond those contained in the paragraphs entitled, "Representations as to Certification." The validity, applicability and interpretation of any certificate, report, plan or document review are governed by the Rules, Guides, and standards of the American Bureau of Shipping who shall remain the sole judge thereof.

1.15 Authorization

The Committee of the American Bureau of Shipping has authorized the Surveyors to the Bureau to carry out the necessary surveys, when requested to do so by the owners or builders of cargo containers, to insure compliance with the following requirements and to certify compliance.

1.17 Scope

1.17.1 General Service

These Rules are intended to apply to new cargo containers which are:

Of a permanent character and accordingly strong enough to remain serviceable for a reasonable period after repeated use.

Specially designed to facilitate the carriage of goods, by one or more modes of transport, without intermediate reloading.

Fitted with devices permitting their ready handling, particularly their transfer from one mode of transport to another.

Containers which do not meet the criteria stated herein will be specially considered.

1.17.2 Special Service

The Bureau is prepared to consider special modified requirements applicable to cargo containers where it can be shown that the special requirements are consistent with the intended service conditions. In such case a prototype is to meet performance tests based on intended service.

1.19 Containers Not Built Under Surveillance

Individual existing containers, or sample units from an existing container series, which have not been built to the requirements of these Rules, but which are submitted for certification, are to be subjected to testing in accordance with the requirements of these Rules. Where found satisfactory, they will be certified accordingly.

1.21 Approval of Modified Containers

The owner of a container which has been approved in accordance with the requirements of the CSC and has been modified in a manner resulting in structural changes is to notify the Bureau of those changes. The Bureau may require retesting of the modified container as appropriate prior to recertification.

1.23 Loading, Handling, and Securing

These Rules are published on the understanding that responsibility for securing containers, for control of stacking loads, and for reasonable handling and loading, as well as for avoidance of distributions of weight which are likely to set up abnormally severe stresses in containers, does not rest upon the Committee, or the Bureau.

1.25 Governmental and Regulatory Agency Requirements

When authorized by an Administration signatory to international conventions, and upon request, the certification procedure may be extended and containers surveyed for compliance with the provisions of the conventions, and certified thereto in the manner prescribed.

The International Convention for Safe Containers (CSC) is an international agreement to which ABS is authorized to certify containers. As an assist to the reader, the convention is reproduced in Appendix F.

1.27 Disagreement and Interpretation

Disagreement regarding the interpretation of the Rules, is to be referred to the Bureau for resolution. In case of disagreement between the Owners or builders and the Surveyors to the Bureau regarding the material, workmanship, extent of repairs, or application of these Rules relating to any container certified or proposed to be certified by this Bureau, an appeal may be made in writing to the Committee, who will order a special survey to be held. Should the opinion of the Surveyor be confirmed, the expense of this special survey is to be paid by the party appealing.

1.29 Effective Date of Rule Change

Changes to these Rules are to become effective six months from the date on which the Committee approves them. However, the Bureau may bring into force individual changes before that date if necessary or appropriate.

FIGURE 1.1 Emblem—General Service

This is a representation of the blue emblem that will be affixed to each Bureau-approved cargo container that meets the criteria of these Rules.

FIGURE 1.2 Emblem—Special Service

This is a representation of the blue emblem that will be affixed to each Bureau-approved cargo container that meets the requirements of its intended service.

Section 2 Design Review

2.1 Application for Certification

The application for the certification of containers is to include a statement that the containers will be built in conformance to these Rules; that they will be manufactured under a quality control program acceptable to the Bureau; that they will be available for inspection during manufacture and testing and that they will be tested in accordance with prescribed procedures. The application is also to affirm that changes in design, materials, or fabrication methods will not be made without written approval.

Each application is to be accompanied by plans and data of the container to be certified. The plans are to delineate the arrangements and structural details of the containers as they are to be built. In addition to the plans a test agenda is to be submitted which details the actual load values and identifies the load medium to be used during the testing of the prototype.

2.3 New Design Series

For the application of each design series to be certified, plans and data including at least the following are to be submitted:

ABS Application form—one copy*
ABS Container data form—one copy*
ABS Data Form Supplement for Thermal Containers [if applicable]—one copy*
ABS Data Form Supplement for Tank Containers [if applicable]—one copy*
ABS Material identification form—four copies*
Following drawings—four copies each:

General arrangement
Sub-assemblies
Detail of components
Markings, including data plates

Prototype test agenda—one copy
Quality control procedures—one-time requirement for each manufacturing facility.

2.5 Approved Design Series

For the application of additional units to be certified to an approved design series, the submittal is to include at least the following:

ABS Container Data form—one copy*
ABS Data Form Supplement for Thermal Containers [if applicable]—one copy*
ABS Data Form Supplement for Tank Containers [if applicable]—one copy*
Marking drawing—if owner has changed—four copies

2.7 Changes

When changes are being made to an application or to an approved design series, the submittal is to include at least the following:

ABS Container Data form—one copy*
ABS Data Form Supplement for Thermal Containers [if applicable]—one copy*
ABS Data Form Supplement for Tank Containers [if applicable]—one copy*
ABS Material Identification form—one copy*
Design comparison table
Marking drawing—if owner has changed—four copies
General assembly, subassembly and detail drawings as appropriate showing any revision from original design—four copies
All changes will be reviewed and if the modifications are deemed significant retesting of those parts of the container affected by the modification may be required.

2.9 Certification to Other Requirements

When the application includes a request for certification to governmental requirements, international conventions, or other standards, the submittal is to include the necessary information required for the reviews.

*To assist clients in providing the information necessary for the certification of the container the Bureau has printed application forms, available upon request.

Section 3 Materials and Fabrication

3.1 Material Standards

Except where specifically approved, all structural materials are to conform to an established specification or recognized national standard. In the selection of materials due regard is to be given to established practices in the country in which the material is produced and the purpose for which the material is intended, the expected service, and the nature of construction of the container.

3.3 Welders

The Surveyor is to be satisfied that the welders are proficient in the type of work that they are called upon to do either through requiring any or all of the tests outlined in the following paragraphs or through due consideration of the system, training apprenticeship, plant testing, inspection, etc.

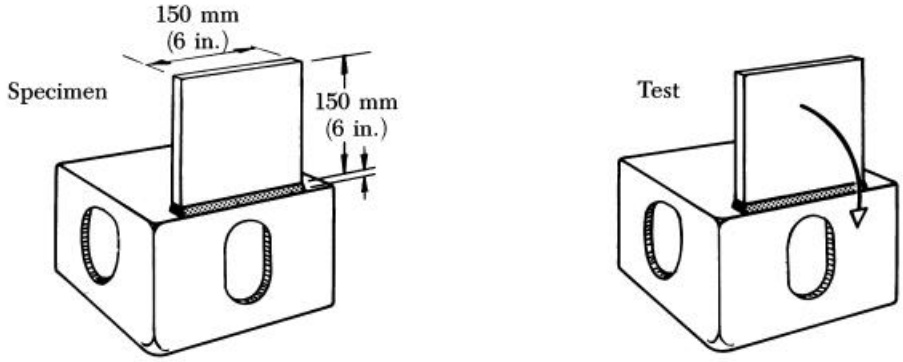
3.5 Qualification

The tests, if required for qualification in the various positions for different materials and thicknesses, are given in Figures 3.1 through 3.4. Test positions are flat (F), horizontal (H), vertical (V), and overhead (OH). Testing in V and OH qualifies the welder for all positions.

Alternatively, upon the request of the employer, the welder may be qualified by use of radiography tests except for gas metal arc welding with the short-circuit transfer technique, for which the tests shown in Figures 3.1 through 3.4 are required.

FIGURE 3.1 Square Groove Butt Joint

Material:	6.0 mm (¼ in.) Sheet to Casting			
Test Position:	F	H	V	OH
Qualifies for:	F	F, H	F, H, V	F, H, OH



Specimen: The plate is to be 150 mm (6 in.) x 150 mm (6 in.). The weld is to be a minimum of 150 mm (6 in.) in length and is to be welded from one side only. The root gap is to be 2.0 mm ($^{5}/_{64}$ in.).

Test: The corner casting is to be secured and the sheet is to be bent 180° towards the corner fitting. The axis of the bend is to be parallel to the axis of the weld.

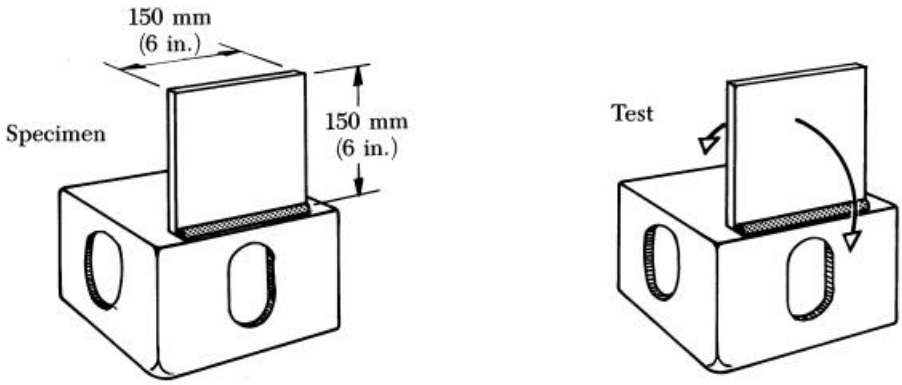
Criterion: A weld will be considered satisfactory if:

a. No cracks are evident after bending.

b. Due to the severity of the test, cracks do occur; but the fractured face shows no evidence of defects, and the throat is equal to or greater than the thickness of the sheet steel. Breaks in the base metal shall not be cause for weld rejection.

FIGURE 3.2 T-Joint Fillet Weld

Material:	3.0 (Z\, in.) Sheet to Casting and 6.0 (Z\v in.) Sheet to Casting			
Test Position:	F	H	V	OH
Qualifies for:	F	F, H	F, H, V	F, H, OH



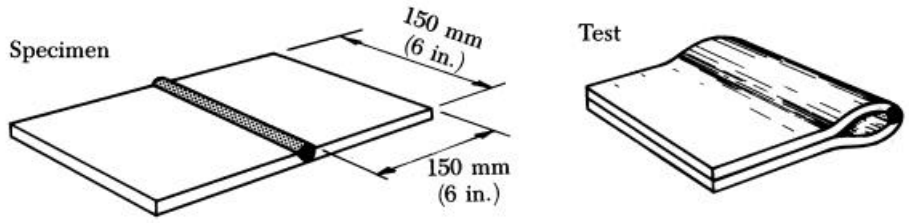
Specimens: The plates are to be 150 mm (6 in.) x 150 mm (6 in.). The welds are to be a minimum of 150 mm (6 in.) in length. The throat size of the fillet weld is to be equal to the thickness of the thinner material.

Test: The corner fitting is to be secured and the sheet is to be bent back and forth until failure.

Criterion: A weld will be considered satisfactory if the fracture surface shows complete fusion at the faying surface.

FIGURE 3.3 Square Groove Butt Joint

Material:	1.2 mm (.048 in.) to 1.2 mm (.048 in.) sheet			
Test Position:	F	H	V	OH
Qualifies for:	F	F, H	F, H, V	F, H, OH



Specimen: The plates are to be 150 mm (6 in.) x 150 mm (6 in.). The weld is to be a minimum of 150 mm (6 in.) in length. The root gap is to be 1.0 mm (C \ nv in.).

Test: One sheet is to be secured and the other is to be bent 180º back towards the held end. The axis of the bend is to be parallel to the axis of the weld.

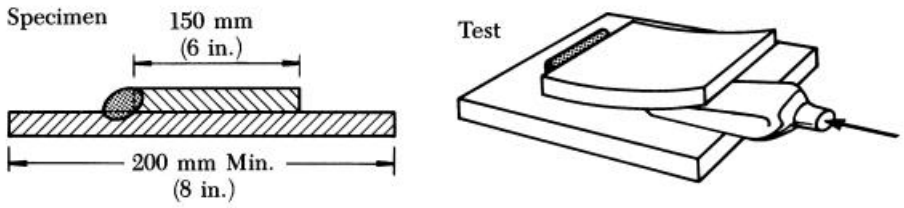
Criterion: A weld will be considered satisfactory if:

a. No cracks are evident after bending.

b. Due to the severity of the test, cracks do occur; but the fractured face shows no evidence of defects, and the throat is equal to or greater than the thickness of the sheet steel. Breaks in the base metal shall not be cause for weld rejection.

FIGURE 3.4 Lap Joint Fillet Weld

Material:	1.2 mm (.048 in.) to 1.2 mm (.048 in.) Sheet and 2.0 mm (.080 in.) to 4.0 mm (.157 in.) Sheet			
Test Position:	F	H	V	OH
Qualifies for:	F	F, H	F, H, V	F, H, OH



Specimen: The top plates are to be 150 mm (6 in.) x 150 mm (6 in.). The bottom plates are to be a minimum of 200 mm (8 in.) x 200 mm (8 in.) The welds are to be a minimum of 150 mm (6 in.) in length. The throat of the fillet weld is to be equal to the thickness of the thinner material.

Test: A cold chisel is to be wedged between the two sheets until failure.

Criterion: A weld will be considered satisfactory if the fracture surface shows complete fusion at the faying surface.

Section 4 Quality Control

4.1 Quality Control Manual

The principal manufacturers engaged in the production of containers are to submit a quality control manual which gives in detail those inspections and controls which are to be followed to assure that the quality of the production units are comparable to that of the prototype. The quality control manual is to contain the information listed in 4.1.1 through 4.1.5. This manual is to be initially submitted to ABS for review in order that compliance may be verified with this section of the Rules. Subsequent to a satisfactory review by ABS, the manufacturing facility is subject to an audit by the attending Surveyor to confirm compliance with the quality control procedures outlined in the submitted manual. All changes or revisions to the manual including any quality control procedures are to be submitted to the Bureau for review.

4.1.1 Description of Organization

A description of the manufacturers organization consisting of management, purchasing, production, and quality control functions is to be shown in the manual. Evidence to support adequate manning levels of inspection at the various manufacturing stages is to be provided by the manufacturer.

4.1.1.1 The line of responsibility for the quality control function is to be independent from the production function.

4.1.1.2 The quality control function is to be shown to be adequately staffed in order to maintain control of the purchased materials, manufacturing processes, testing as applicable, and final acceptance of the finished container.

4.1.1.3 Arrangements for introducing approved design and production changes to ensure that they are acted upon at the appropriate production stage are to be addressed in the manufacturer's manual or procedures.

4.1.1.4 The manual or procedures is to address the manufacturer's system of performing internal audits and corrective actions.

4.1.1.5 It is to be shown in the manual or procedures that compliance with these Rules is evidenced during the ABS review process and demonstrated to the attending Surveyor during periodic audits of the manufacturer.

4.1.2 Material Identification

Methods are to be established and covered in the manual or procedures to control and identify all material, including methods for welding electrode identification. Structural material identification arrangements such as mill test reports (MTR's), material purchase orders, etc. are to be sufficient to enable the MTR to be traceable to the material.

4.1.2.1 Arrangements to ensure that supplies and services from a sub-supplier meet with the design requirements are to be addressed in the manual or procedures.

4.1.2.2 Identifiable test data for materials and components is to be made available for the attending Surveyor.

4.1.2.3 Arrangements are to be made by the manufacturer to demonstrate proper storage of stock materials and spare parts which is consistent with good industry practice.

4.1.3 Workmanship Quality

Methods are to be established to assure workmanship of consistently acceptable quality. Jigs or fixtures suitable for maintaining dimensional accuracy during repeated use are to be provided at the mainframe assembly points or locations. The manual or procedures are to address that the jigs or fixtures are periodically verified by the manufacturer's quality control function.

4.1.4 Control Records

The procedures for maintaining records are to be adequate to assure the proper identification of material and satisfactory checks on workmanship.

4.1.4.1 A system of documentation at the stages of manufacturing containers is to be covered in the manufacturer's manual or procedures. The system employed is to be demonstrated to the attending Surveyor. This system may be comprised of traveler forms, inspection checklists or procedures evidencing inspections being performed at the various stages of manufacturing.

4.1.4.2 The records of inspection, tests, and results of examinations and corrections are to be complete and reliable for each container. The record of inspection is to contain the manufacturer's identification numbers, dates of delivery and names and addresses of purchasers.

4.1.5 Fabrication Quality Control Methods

The weld procedures and inspection techniques employed in the fabrication of containers are to be to the satisfaction of the attending Surveyor. Special attention is to be given to the methods for proving the adequacy of the corner fittings, and their attachment to the main structural members. The quality of corner fittings may be verified by certification in accordance with Section 14. In any circumstance, copies of the certified MTR's for the corner fittings are to be made available to the attending Surveyor.

4.1.5.1 All stages of the container manufacturing as shown above together with the final dimensional examinations necessary are to be under the responsibility of the quality control function.

4.1.5.2 The rejection procedure and rejected component identification arrangements are to be clearly defined by the manufacturer.

4.1.5.3 All welding to be performed in the fabrication of the container or its subassemblies is to be carried out by qualified personnel in the positions for which they are qualified to weld.

4.2 Quality Control Surveillance

The manufacturer's production facilities and quality control methods are to be available for audit by the Surveyor during his periodic visits. When, in the judgment of the Surveyor, unacceptable workmanship, faulty material, or inadequate quality control procedures are evident, certification may be suspended pending corrective action to the Surveyor's satisfaction.

4.2.1 All weld procedure specifications (WPS), procedure qualification records (PQR), and welder's performance qualification records are to be in accordance with recognized standards and are to be reviewed to the satisfaction of the attending Surveyor.

4.2.2 All nondestructive examinations performed by the manufacturer are to be accomplished by personnel qualified to conduct such inspections in accordance with recognized standards. Where nondestructive examinations are performed, it is to be demonstrated that such testing is properly recorded by the manufacturer and found to be to the satisfaction of the attending Surveyor.

4.3 Factory Approval Certificate

Manufacturing and testing facilities for proving prototype and production containers are to be approved by ABS. The scope of the approval process will include that the following steps be completed:

4.3.1 The manufacturer is to submit a written application for ABS Factory Approval.

4.3.2 The manufacturer is to submit three (3) copies of their quality control manual and applicable procedures as listed in these Rules. Supplemental information in the way of company brochures, profile, description of facilities, equipment, storage, process flow diagrams, etc. may be provided for reference purposes.

4.3.2.1 A review letter is issued to the manufacturer describing the evaluation of all elements of the manufacturer's system governing the control and quality of the product.

4.3.3 An audit of the manufacturer's facility is performed after issuance of the ABS review letter to the manufacturer. This audit is performed by an ABS Surveyor working in close cooperation with the manufacturer's representative, to confirm implementation of the quality control system.

4.3.4 The approval of the manufacturer's facility is contingent upon successful completion of the review process in such a manner that there are no outstanding comments and upon successful completion of the initial audit by an attending Surveyor.

4.3.5 The validity of the Factory Approval Certificate is subject to the continued maintenance of conditions under which the approval was granted by ABS. Periodic audits of the manufacturer are to be performed on an annual basis.

Section 5 Definitions

5.1 General

The following definitions for symbols and terms are used throughout these Rules.

5.3 Maximum Gross Weight (*R*)*

R or rating is the maximum allowable combined mass of the container and its cargo to which the container is tested and is expressed in kilograms and pounds.

5.5 Design Gross Weight

The design gross weight is the weight rating on which the structural design of the container is based, and is to be equal to or greater than the maximum gross weight.

5.7 Tare (*T*)

T or *tare* is the mass of the empty container, including its normal complement of fittings, equipment and devices and is expressed in kilograms and pounds.

5.9 Payload (*P*)

P or *payload* is the difference between *R* and *T* and is expressed in kilograms and pounds.

5.11 Design Load

The design load is the minimum statically applied load which the container is to be designed to withstand.

5.13 Design Load Factor

The design load factor is a factor which takes into account, insofar as practicable, the static and dynamic loads and other applicable considerations.

5.15 Reference Mass

The reference mass is that mass which is to be multiplied by the design load factor to obtain the design load.

5.17 Floor Load

The floor load is the combined static and dynamic load imposed on the floor by the cargo and by the wheels of handling equipment.

5.19 End Load

The end load is the combined static and dynamic load imposed by the cargo on the container walls or doors, or both, which are perpendicular to the longitudinal axis of the container.

5.21 Side Load

The side load is the combined static and dynamic load imposed by the cargo on the container walls or doors, or both, which are perpendicular to the transverse axis of the container.

5.23 Roof Load

The roof load is the combined static and dynamic load imposed on the roof of a container.

5.25 Specified Dimensions

The specified dimensions of the length, width, and height of a container are the maximum allowable outside dimensions.

5.27 Prototype

A prototype is a representative unit of a series of identical containers built under conditions which duplicate, insofar as is practicable, the conditions under which all of the containers in the series are to be fitted.

5.29 Production Units

Production units are identical containers built under conditions which duplicate, insofar as is practicable, the conditions under which the prototype was built.

5.31 Corner Fitting

A corner fitting is a fixture consisting of standard apertures and faces which provide a common interface for handling and securing containers.

*When Assembly Resolution A.737(18) of the International Convention for Safe Containers (CSC) comes into force the term *"maximum gross weight"* will become "*maximum operating gross mass."* The CSC and Resolution A.737(18) have been reproduced in Annex D.

Section 6 Design Considerations

6.1 General Specifications

Construction is to be structurally sound and when appropriate, weathertight. All fittings and appurtenances are to be within the maximum outside dimensions of the container. The main frame, corner structures, sides, and ends are to have sufficient structural strength to remain serviceable and withstand, without significant permanent deformation, the static and dynamic loads imposed by lifting the container by top or bottom corner fittings, the stacking loads, and the impact and racking loads encountered in normal service. The floor structure is to be strong enough to support the payload under dynamic loading conditions encountered in normal service and concentrated fork-lift truck axle loads. The specific design loading requirements are to be not less than those given in 6.11. The manufacturer is responsible for designing the container with sufficient strength to withstand the design loads, and is to include factors of safety allowing for fatigue, normal wear and tear, manufacturing fabrication techniques, and material properties.

6.3 Service Conditions

6.3.1 General

Containers used in multimodal transport should be serviceable under normal operation in weather conditions ranging from tropical to arctic zones. Each transport mode has its own operating load requirements which can be expressed as accelerations in the vertical, transverse or longitudinal direction.

6.3.2 Marine

Containers operating in the marine mode are often stowed in vertical stacks within the cells in a ship's hold. When stowed in this manner, containers will be restrained at the end frames against longitudinal and transverse movement by the cell structure. The reactions of the entire stack of containers are taken through the four bottom corner fittings of the lowest container. Containers may also be stowed on deck or in a hold restrained by lashings, deck fittings, or both. Containers are normally stowed with the longitudinal axis of the container parallel to that of the ship.

It is assumed that the combined effect of a vessel's motions and gravity results in an equivalent 1.8 times gravity for vertical acceleration, an equivalent 0.6 times gravity for transverse acceleration, and an equivalent 0.4 times gravity for longitudinal acceleration, acting individually.

6.3.3 Highway

Containers operating in the highway mode are carried by container chassis which provide support and restraint through the bottom corner fittings, the base structure, or through a combination of the two.

It is assumed that the combined effect of a vehicle's motions resulting from road conditions, curves, braking, and gravity results in an equivalent 1.7 times gravity downward for vertical acceleration, an equivalent 0.5 times gravity upward for vertical acceleration, an equivalent 0.2 times gravity for transverse acceleration, and an equivalent 0.7 times gravity for longitudinal acceleration.

6.3.4 Rail

Containers operating in the rail mode are carried by railcars in two primary systems: container on a flat car (COFC) in which the container is supported and restrained through the bottom corner fittings; and trailer on a flat car (TOFC) in which the container and its chassis are carried as a single unit on the railcar.

It is assumed that the combined effect of a railcar's motions resulting from the ride characteristics of the railcar, switching operations, and gravity results in an equivalent 1.7 times gravity downward for vertical acceleration, and equivalent 0.3 times gravity for transverse acceleration, and an equivalent 2.0 times gravity for longitudinal acceleration.

6.3.5 Terminal Handling

Handling equipment will subject the container to certain forces that must be considered when designing a container. The lowering of containers onto supports produces a dynamic load. It is assumed that the combined effect of this dynamic load and gravity results in an equivalent 2.0 times gravity downward for vertical acceleration.

6.5 Dimensional Tolerances

6.5.1 Overall Dimensions

The overall dimensions of the container may vary from the specified dimensions within the tolerances shown in Figure 6.1. Tolerances for intermediate specified dimensions may be obtained by interpolation.

6.5.2 Corner Fitting Location Tolerances

The tolerances for the distance between the centers of apertures of corner fittings for the length, width,

and height are to be equal to the tolerances of the overall dimensions of the length, width, and height.

6.5.3 Diagonal Tolerances

The value of diagonal tolerances K1 and K2 are not to exceed those given in Figure 6.1.

6.5.4 Measurement Criteria

The dimensions and tolerances apply when measured at a temperature of 20°C (68°F). Measurements taken at temperatures appreciably different are to be adjusted accordingly.

6.7 Design Features

6.7.1 Corner Design

A container is to have four top and four bottom corner fittings, oriented to define the corners of a hypothetical rectangular box. Figure 6.7 illustrates the recommended dimensions and tolerances of corner fittings. The dimensions of the corner fittings in Figure 6.7 are the same as those specified in International Organization for Standardization (ISO) Standard 1161 Series 1 freight containers—Corner Fittings—Specifications. The corner fittings are to meet the strength requirements imposed on the containers by handling methods described in Section 6, but are to be not less than the strength requirements specified by ISO Standard 1161. Although Figure 6.7 illustrates corner fittings as separate elements of construction which must be attached to corner posts to form the corner structures of a container, the figures and references to "corner fittings" in the text do not preclude the use of corner structures having the necessary apertures as an integral feature of some other structural member, i.e., post, rail, or crossmember.

6.7.2 Roof Clearance

The top corner fittings are to protrude a minimum of 6 mm (¼ in.) above the highest point of the roof or upper structure. The transverse and longitudinal areas adjacent to the top corner fittings may be designed with reinforcements or "doubler plates" to protect the roof from being punctured during top lifting operations. Such reinforcements may extend the full width of the container and not more than 750 mm (29¼ in.) from each end and may not protrude above the top surface of the corner fitting.

6.7.3 Load Transfer Area

The base structure of a container is to be provided with a load transfer area in accordance with Figure 6.2, which may be formed by the bottom surfaces of the crossmembers or corresponding substructure. The plane of the load transfer area shall be positioned 12.5 mm +5, –1.5 (Z\x in. + C\zn – Z\zn)* above the plane formed by the lower faces of the bottom corner fittings. Containers fitted with intermediate transverse members having a spacing of 1000 mm (39C\, in.) or less, and recessed as required, comply with this requirement. Except for the bottom side rails and the bottom corner fittings, no part of the container is to project below the plane of load transfer areas. However, the transverse and longitudinal areas adjacent to the bottom corner fittings may be designed with reinforcements or "doubler plates" to protect the base from being damaged during handling and securing operations. Such reinforcements may not extend more than 470 mm (18½ in.) from the side faces of the bottom corner fittings and not more than 550 mm (22 in.) from each end of the container with the bottom surface recessed not less than 5 mm (C\zn in.) above the bottom surface of the corner fitting.

The transfer of load between the underside of the bottom side rails and the carrying vehicle is not provided for in these Rules. The transfer of load between side rails, or fork-lift pockets, and handling equipment should only occur when provisions have been made in accordance with 6.9.1 and 6.9.2.

6.9 Optional Design Features

6.9.1 Fork-Lift Pockets

Fork-lift pockets may be provided for handling containers in the loaded or unloaded condition. The fork-lift pockets are to meet the dimensional requirements specified in Figure 6.3 and pass completely through the base structure of the container so that lifting devices may be inserted from either side. Fork-lift pockets are to be provided with a base strap or equivalent at each end.

6.9.2 Lifting Areas

Lifting areas may be provided for handling containers in the loaded or unloaded condition by means of grappler arms or similar devices. The lifting areas are to meet the location requirements specified in Figure 6.4.

6.9.3 Gooseneck Tunnels

Tunnels may be provided in containers to accommodate chassis goosenecks. The tunnels are to

**Note* This is the location of the load transfer area, it is not a tolerance. To phrase the load transfer requirement another way: The load transfer area is to be on a plane located not less than 11 mm (M\zn in.), nor more than 17.5 mm (ZZ\zb in.) above the plane formed by the lower surfaces of the bottom corner fittings.

meet the dimensional requirements specified in Figure 6.5.

6.9.4 Cargo Securing Devices

Cargo securing devices may be provided in containers for securing cargo.

6.11 Design Loading Specifications

6.11.1 General

The design loads on which the requirements of this section are based take into account, as far as practicable, the dynamic loads likely to be encountered in container operation. Factors such as characteristics of load application, load repetition, load reversal and container life are to be considered in the design of the container. Due regard is to be given to local stresses resulting from attachment devices used for handling and securing a container.

6.11.2 Corner Structure Loads—Stacking

Type of load
Concentrated compression
Direction of load
Vertically downward, eccentrically applied, and equally distributed among the four corner structures.
Reference mass
R
Design load factor
1.8 x 8*; each corner to take one fourth of the design load.
Basis
The container corner structure is to have sufficient strength to allow containers to be stacked when transported by vessels. Vertical accelerations imposed by vessel motions (pitch and heave) are to be considered. The maximum vertical acceleration caused by combined pitching and heaving, taking into account the time phasing, may be assumed to be 0.8 g. When the equivalent dynamic force of 0.8 g is added to the static force of 1.0 g, the resulting total force may be taken as 1.8 g. It is assumed that the containers are stacked 9* high in cell guides. Normal cell clearance may be assumed to be 38 mm (1Z\x in.) in the longitudinal direction and 25 mm (1 in.) in the transverse direction.

*For 10 ft containers the design load factor is 1.8 x 5 for 6 containers in a stack.

**For 10 ft containers the lifting forces are to be applied at an angle of 60º to the horizontal.

6.11.3 Lifting Loads

a. ***Lifting from Top***
Type of load
Concentrated tension
Direction of load
Vertically** upward, applied tension at pick-up points on four top corner fittings.
Reference mass
R
Design load factor
2.0; each corner to take one fourth of the design load.
Basis
The container top corner fittings and associated components are to be capable of suspending the loaded container when lifted by any of the suitable lifting devices.

b. ***Lifting from Bottom***
Type of load
Concentrated tension
Direction of load
Applied at pick-up points on four bottom corner fittings, acting parallel to the sides, along a line drawn from the bottom corner fitting through a point located above the roof at midlength at the following angles [to the horizontal]:
30º for 40 ft containers
37º for 30 ft containers
45º for 20 ft containers
60º for 10 ft containers
Reference mass
R
Design load factor
2.0; each corner to take one fourth of the resultant load due to angle based on a vertical component equal to *R/2*.
Basis
The container bottom corner fittings and associated components are to be capable of supporting the loaded container when lifted by any of the suitable lifting devices.

c. ***Lifting from Fork Lift Pockets***
Type of load
Concentrated
Direction of load
Vertically upward applied at pick-up area
Reference mass
R
Design load factor
1.6
Basis
The loaded container is to be capable of being supported on two horizontal bars each 200 mm

(8 in.) wide, projecting 1828 mm (72 in.) into the fork pocket.

d. ***Lifting from Grappler Arm Positions***
Type of load
Concentrated
Direction of load
Vertically upward, applied at four lifting positions
Reference mass
R
Design load factor
1.25
Basis
The loaded container is to be capable of being supported at the four positions where provision has been made for lifting equipment.

6.11.4 Floor Loads

a. ***Wheeled Vehicle***
Type of load
Concentrated wheeled vehicle load
Direction of load
Vertically downward
Reference mass
5460 kg total (2730 kg per wheel)
12000 lb. total (6000 lb. per wheel)
Design load factor
1.0
Basis
The container floor is to be capable of withstanding concentrated loads imposed by an industrial truck or other vehicle with a maximum axle loading of 5460 kg (12000 lb.). The minimum wheel width is to be assumed to be 180 mm (7 in.) with an imprint area not greater than 142 cm^2 (22 $in.^2$) per wheel. The minimum wheel center to center distance may be assumed to be 760 mm (30 in.).

b. ***Cargo***
Type of load
Concentrated cargo load
Direction of load
Vertically downward
Reference mass
P
Design load factor
2.0
Basis
The container floor is to be able to withstand a concentrated cargo load, uniformly distributed from side to side, over any 3 m (10 ft). The load is considered to be twice the maximum cargo mass (2P) of which 22680 kg (50000 lb.) is to be uniformly distributed over the mid 3 m (10 ft) with the balance of the load uniformly distributed over the remaining area of the container floor.

6.11.5 Floor and Rear Panel Loads

a. ***Cargo***
Type of load
Uniformly distributed
Direction of load
Longitudinally outward
Reference mass
P
Design load factor
0.4
Basis
Front and rear end panels are to be capable of withstanding the forces imposed by transport equipment operations, assuming acceleration during rail car impact. The front end panel is to be of sufficient strength to withstand the forces encountered during emergency brake application when the container is transported by highway vehicles.

b. ***Racking***
Type of load
Concentrated
Direction of load
Transverse, applied at top corners
Design load
150 kN. (33700 lbf)
Basis
Front and rear end panels are to be capable of withstanding the racking imposed on the bottom container in a stack when the containers are carried on deck under conditions affording limited external racking restraint.

6.11.6 Side Panel Loads

a. ***Cargo***
Type of load
Uniformly distributed
Direction of load
Transversely outward
Reference mass
P
Design load factor
0.6
Basis
Side panels are to be capable of withstanding forces imposed by vessel motions. Vessel rolling may be assumed to be isochronous, simple harmonic type motion. The minimum period for one complete roll may be assumed to be 13 seconds. The maximum distance of the center of gravity of the container from the vessel's roll axis may be assumed to be 13.70m (45 ft).

b. ***Racking***

Type of load
Concentrated
Direction of load
Longitudinal, applied at top corners
Design load
75 kN. (16850 lbf)
Basis
Side panels are to be capable of withstanding the racking imposed on the bottom container in a stack when the containers are carried on deck under conditions affording limited external racking restraint.

6.11.7 Lashing

Type of load
Concentrated
Direction of load
Longitudinal, transverse and vertical, applied at corner fittings
Design load
Refer to Figure 6.6
Basis
Top and bottom corner fittings are subject to externally applied loads transmitted through that aperture or face of the corner fitting perpendicular to the load.

Each corner fitting may be subject to longitudinal, transverse and vertical forces applied individually or simultaneously, provided that:

The longitudinal and transverse components are not to exceed the magnitude specified in Figure 6.6, but in no case, is the resultant to exceed 150 kN (33700 lbf).

The longitudinal, transverse and vertical components are not to exceed the magnitude specified in Figure 6.6; but in no case, is the resultant to exceed 300 kN. (67400 lbf)

The top and bottom corner fittings are to each, in conjunction with the container structure, be capable to withstanding each of these loads when applied to any end or side aperture of the external faces. The container is to be capable of withstanding the reaction to each of the loads illustrated by Figure 6.6.

6.11.8 Roof Load

Type of load
Uniformly distributed applied over an area 600 mm x 300 mm (24 in. x 12 in.) located on the top of the container.
Direction of load
Vertically downward
Reference mass
200 kg (440 lb)
Design load factor
1.5
Basis
Container roof structure is to be capable of supporting two 100 kg (220 lb) workers on the container roof.

6.11.9 Base Structure Loads

Type of load
Concentrated
Direction of load
Longitudinal, applied through bottom apertures of bottom corner fittings
Reference mass
R
Design load factor
2
Basis
The base structure is to be capable of withstanding the forces imposed by transport equipment operations, assuming acceleration during rail car impact.

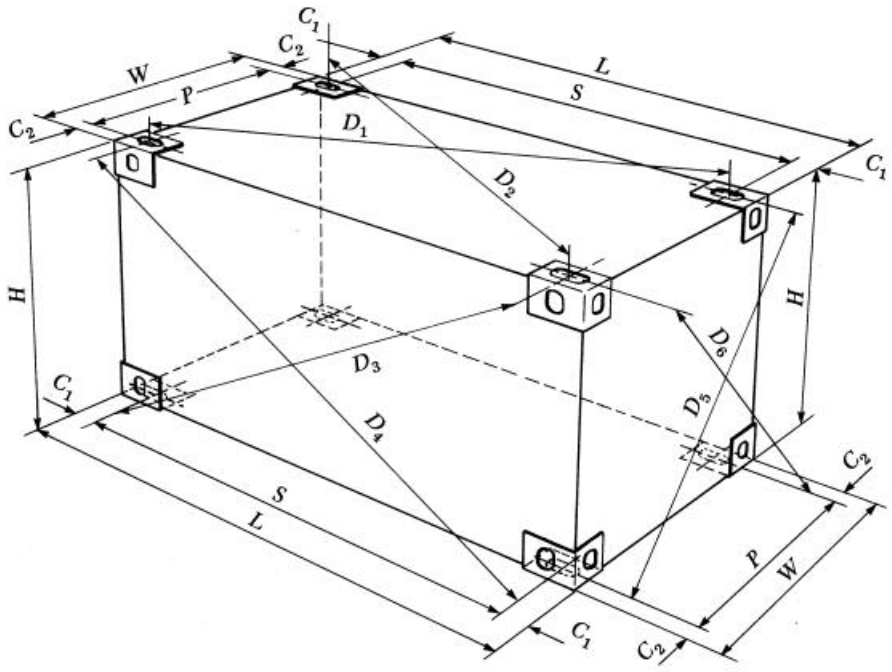
6.11.10 Cargo Securing Device Loads (where provided)

Type of load
Concentrated tension
Direction of load
Applied away from the cargo securing device in all directions
Reference loads*
10 kN (2200 lbf) for an anchor point in the base structure; 5 kN (1100 lbf) for a lashing point in any part of the container other than the base structure.
Design load factor
1.5
Basis
Cargo securing devices are to be capable of withstanding the inertial forces imposed by cargo in transit.

*The reference loads for platform and platform based containers: 30 kN (6600 lbf) for an anchor point and 10 kN (2200 lbf) for a lashing point.

FIGURE 6.1 Assembled Corner Fittings—Diagonal Tolerances

Overall length, height and width dimensions are measured along the appropriate edges.



S = Length between centers of apertures in corner fittings
P = Width between centers of apertures in corner fittings
C_1 = Corner fitting measurement $101.5^{+0}_{-1.5}$ mm ($4^{+0}_{-1/16}$ in)
C_2 = Corner fitting measurement $89^{+0}_{-1.5}$ mm ($3\ 1/2^{+0}_{-1/16}$ in)
L = External length of the container
W = External width of the container
H = External height of the container
D = Distance between centres of apertures, or projected reference points there from, of diagonally opposite corner fittings, resulting in six measurements: D_1, D_2, D_3, D_4, D_5 and D_6
K_1 = Difference between D_1 and D_2 or between D_3 and D_4; i.e. $K_1 = |D_1 - D_2|$ or $K_1 = |D_3 - D_4|$
K_2 = Difference between D_5 and D_6; i.e. $K_2 = |D_5 - D_6|$

FIGURE 6.1 (continued)

	Dimensions and tolerances			
	10 ft container mm (ft, in.)	*20 ft container mm (ft, in.)*	*30 ft container mm (ft, in.)*	*40 ft container mm (ft, in.)*
Length (external)	2991^{+0}_{-5} ($9\ ft\ 9\frac{3}{4}{}^{+0}_{-3/16}$ in.)	6058^{+0}_{-6} ($19\ ft\ 10\frac{1}{2}{}^{+0}_{-1/4}$ in.)	9124^{+0}_{-10} ($29\ ft\ 11\frac{1}{4}{}^{+0}_{-3/8}$ in.)	12192^{+0}_{-10} ($40\ ft\ 0^{+0}_{-3/8}$ in.)
S	2787 ($9\ ft\ 1\frac{23}{32}$ in.)	5853 ($19\ ft\ 2\frac{7}{16}$ in.)	8918 ($29\ ft\ 3\frac{1}{8}$ in.)	11985 ($39\ ft\ 3\frac{7}{8}$ in.)
Width	2438^{+0}_{-5} ($8\ ft\ 0^{+0}_{-3/16}$ in.)	2438^{+0}_{-5} ($8\ ft\ 0^{+0}_{-3/16}$ in.)	2438^{+0}_{-5} ($8\ ft\ 0^{+0}_{-3/16}$ in.)	2438^{+0}_{-5} ($8\ ft\ 0^{+0}_{-3/16}$ in.)
P	2259 ($7\ ft\ 4\frac{31}{32}$ in.)	2259 ($7\ ft\ 4\frac{31}{32}$ in.)	2259 ($7\ ft\ 4\frac{31}{32}$ in.)	2259 ($7\ ft\ 4\frac{31}{32}$ in.)
Height	2438^{+0}_{-5} ($8\ ft\ 0^{+0}_{-3/16}$ in.)	2438^{+0}_{-5} ($8\ ft\ 0^{+0}_{-3/16}$ in.)	2438^{+0}_{-5} ($8\ ft\ 0^{+0}_{-3/16}$ in.)	2438^{+0}_{-5} ($8\ ft\ 0^{+0}_{-3/16}$ in.)
	2591^{+0}_{-5} ($8\ ft\ 6^{+0}_{-3/16}$ in.)	2591^{+0}_{-5} ($8\ ft\ 6^{+0}_{-3/16}$ in.)	2591^{+0}_{-5} ($8\ ft\ 6^{+0}_{-3/16}$ in.)	2591^{+0}_{-5} ($8\ ft\ 6^{+0}_{-3/16}$ in.)
	2743^{+0}_{-5} ($9\ ft\ 0^{+0}_{-3/16}$ in.)	2743^{+0}_{-5} ($9\ ft\ 0^{+0}_{-3/16}$ in.)	2743^{+0}_{-5} ($9\ ft\ 0^{+0}_{-3/16}$ in.)	2743^{+0}_{-5} ($9\ ft\ 0^{+0}_{-3/16}$ in.)
	2896^{+0}_{-5} ($9\ ft\ 6^{+0}_{-3/16}$ in.)	2896^{+0}_{-5} ($9\ ft\ 6^{+0}_{-3/16}$ in.)	2896^{+0}_{-5} ($9\ ft\ 6^{+0}_{-3/16}$ in.)	2896^{+0}_{-5} ($9\ ft\ 6^{+0}_{-3/16}$ in.)
K_1(max)	10 ($\frac{3}{8}$ in.)	13 ($\frac{1}{2}$ in.)	16 ($\frac{5}{8}$ in.)	19 ($\frac{3}{4}$ in.)
K_2(max)	10 ($\frac{3}{8}$ in.)	10 ($\frac{3}{8}$ in.)	10 ($\frac{3}{8}$ in.)	10 ($\frac{3}{8}$ in.)

Note Attention of manufacturers is drawn to the vital importance of accurately maintaining the reference dimensions of *S* and *P*.

FIGURE 6.2 Location and Dimensions for Load Transfer Areas

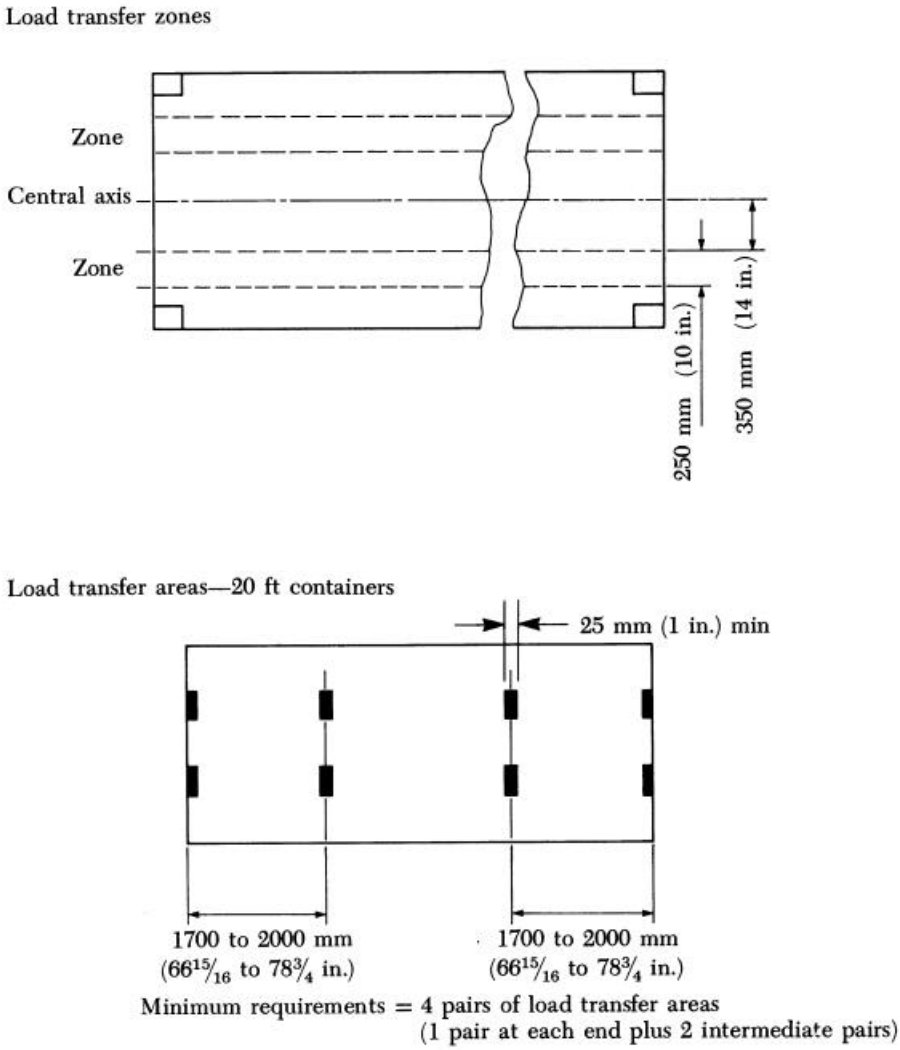
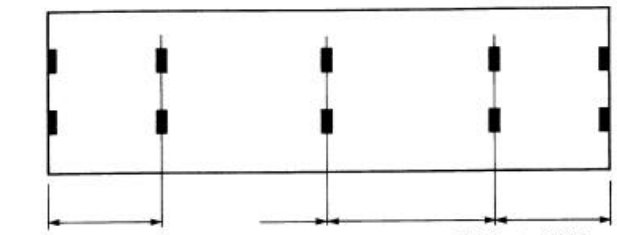


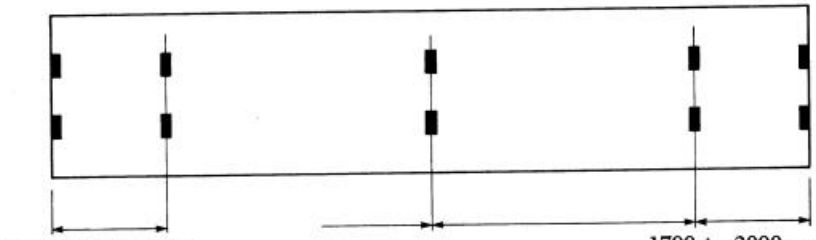
FIGURE 6.2 (continued)

Load transfer areas—30 ft containers



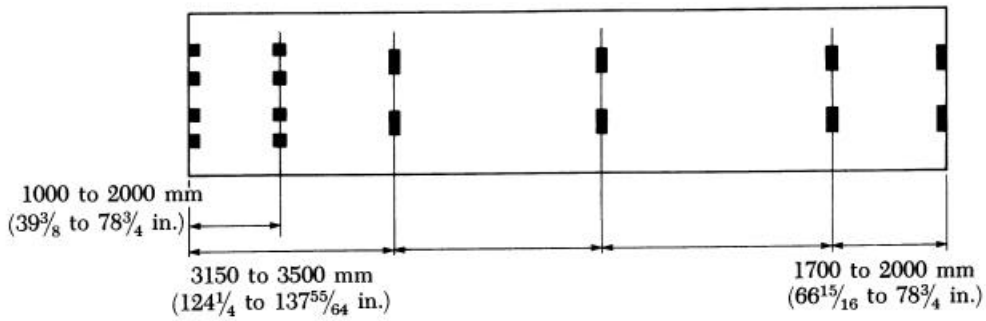
Minimum requirements: 5 pairs of load transfer areas
(1 pair at each end plus 3 intermediate pairs)

Load transfer areas—40 ft containers



Minimum requirements: 5 pairs of load transfer areas
(1 pair at each end plus 3 intermediate pairs)

Load transfer areas—40 ft containers with gooseneck tunnel



Minimum requirements: 6 pairs of load transfer areas
(1 pair at each end plus 4 intermediate pairs)

FIGURE 6.2 (continued)

Minimum Requirements for Load Transfer Areas in Vicinity of Gooseneck Tunnel

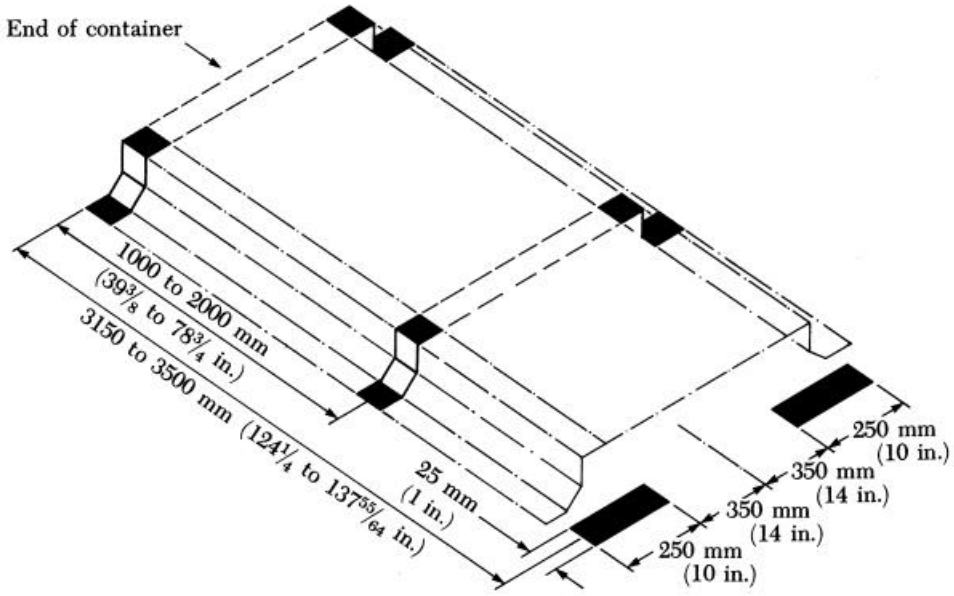
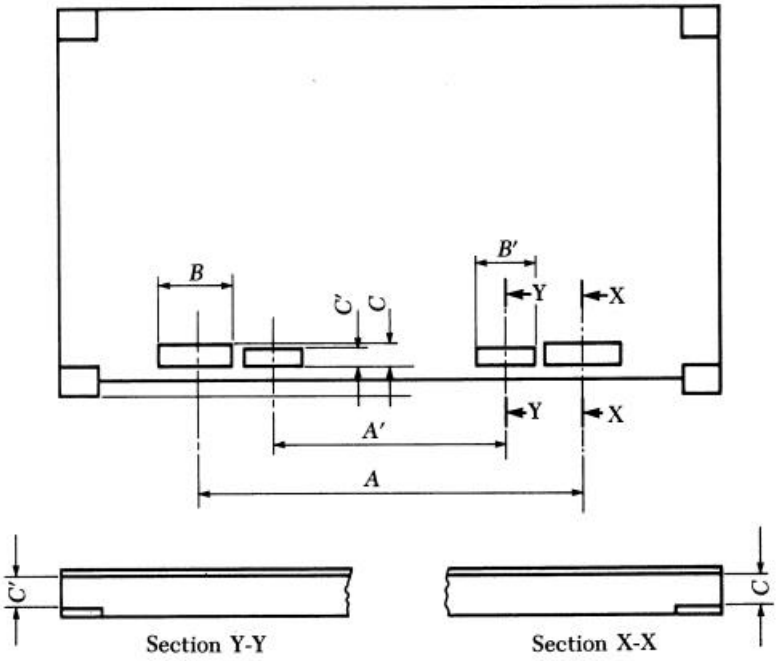


FIGURE 6.3 Location and Dimensions for Forklift Pockets



	Dimensions and Tolerances	
	Fork pockets for loaded and unloaded containers *mm* *(in.)*	*Fork pockets for unloaded containers only* *mm* *(in.)*
A	2050 ± 50 (81 ± 2)	—
B	355 min (14 min)	—
C	115 min (4½ min)	—
A´	—	900 ± 50 (36½ ± 2)
B´	—	305 min (12 min)
C´	—	102 min (4 min)

FIGURE 6.4 Location and Dimensions for Grappler Lifting Areas

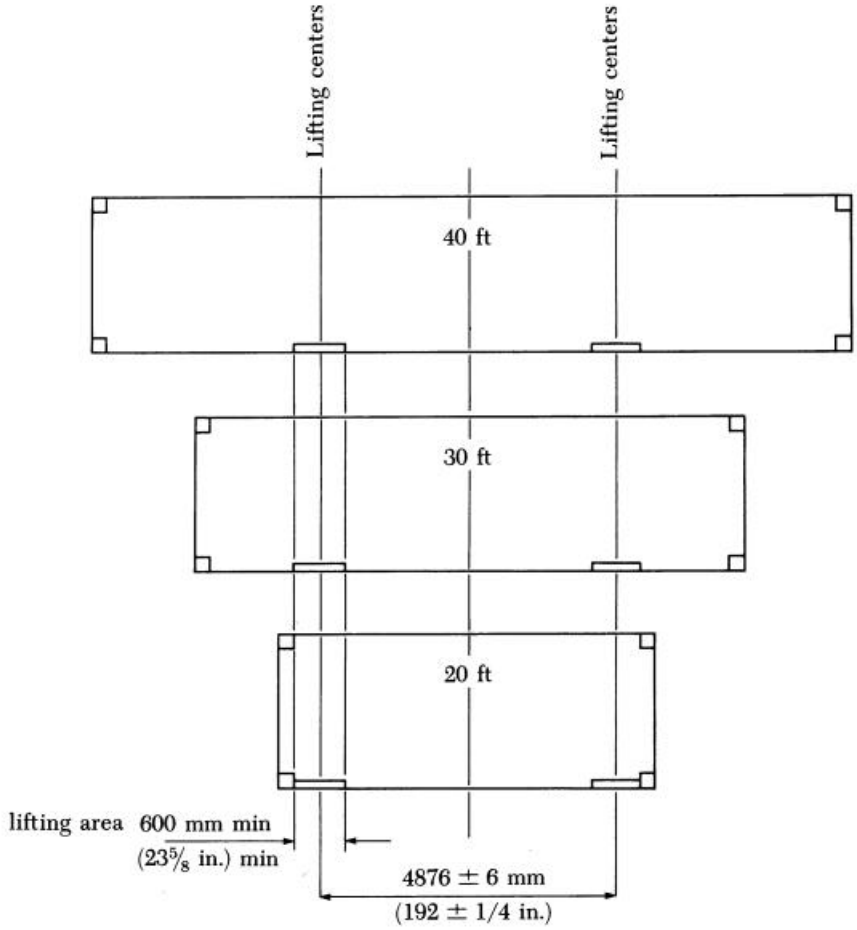
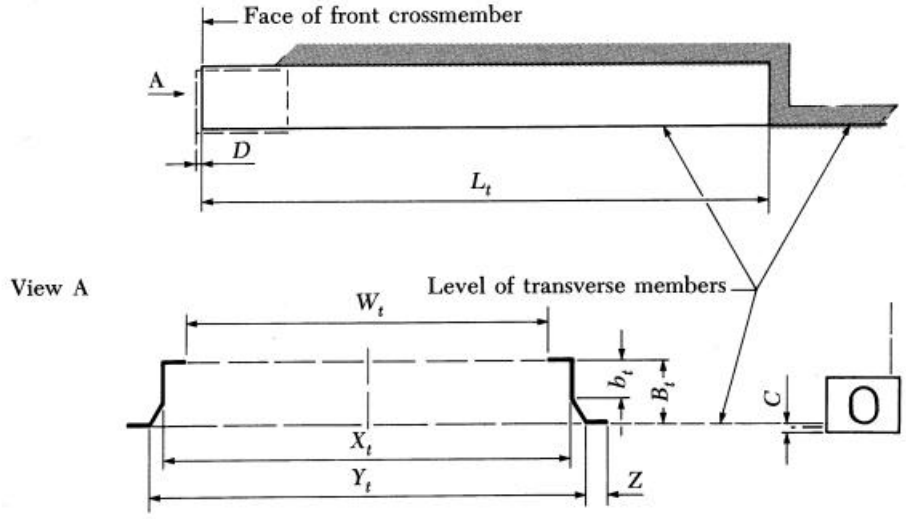


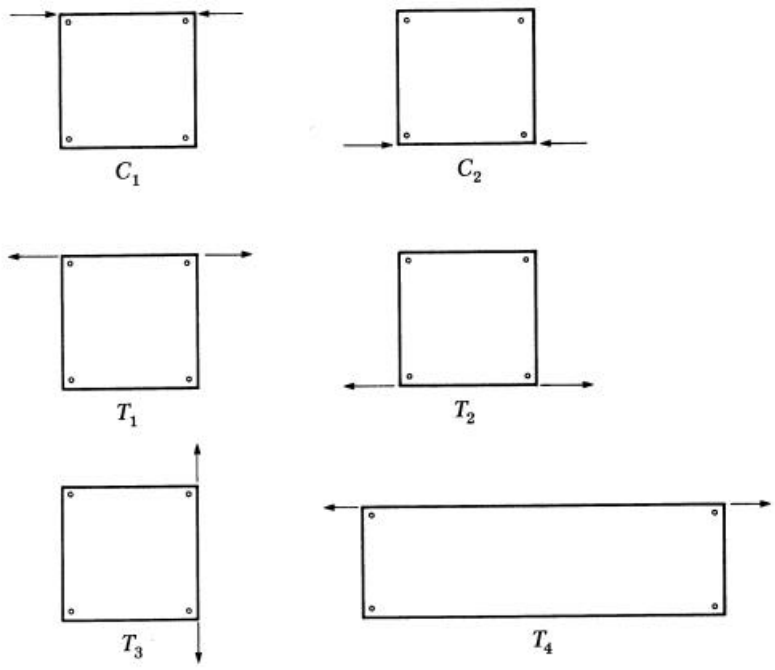
FIGURE 6.5 Location and Dimensions for Gooseneck Tunnels



Dimensions and Tolerances

Length *mm* (*in.*)	L_t	3150 to 3500 (124 to 138)
	D	6^{+1}_{-2} ($1/4^{+3/64}_{-3/32}$)
Width *mm* (*in.*)	W_t	930 max (36⅝ max)
	X_t	1029^{+3}_{-0} ($40\frac{1}{2}^{+1/8}_{-0}$)
	Y_t	1070 min 1130 max (42⅛ min 44½ max)
	Z	25 min (1 min)
Height *mm* (*in.*)	B_1	120^{+0}_{-3} ($4^{23/32^{+0}}_{-1/8}$)
	b_1	35 min 70 max (1⅜ min 2¾ max)
	C	$12.5^{+5}_{-1.5}$ ($1/2^{+3/16}_{-1/16}$)

FIGURE 6.6 Lashing Loads (Forces)



C_1 = 100 kn (22400 lbf)

C_2 = 150 kn (33700 lbf)

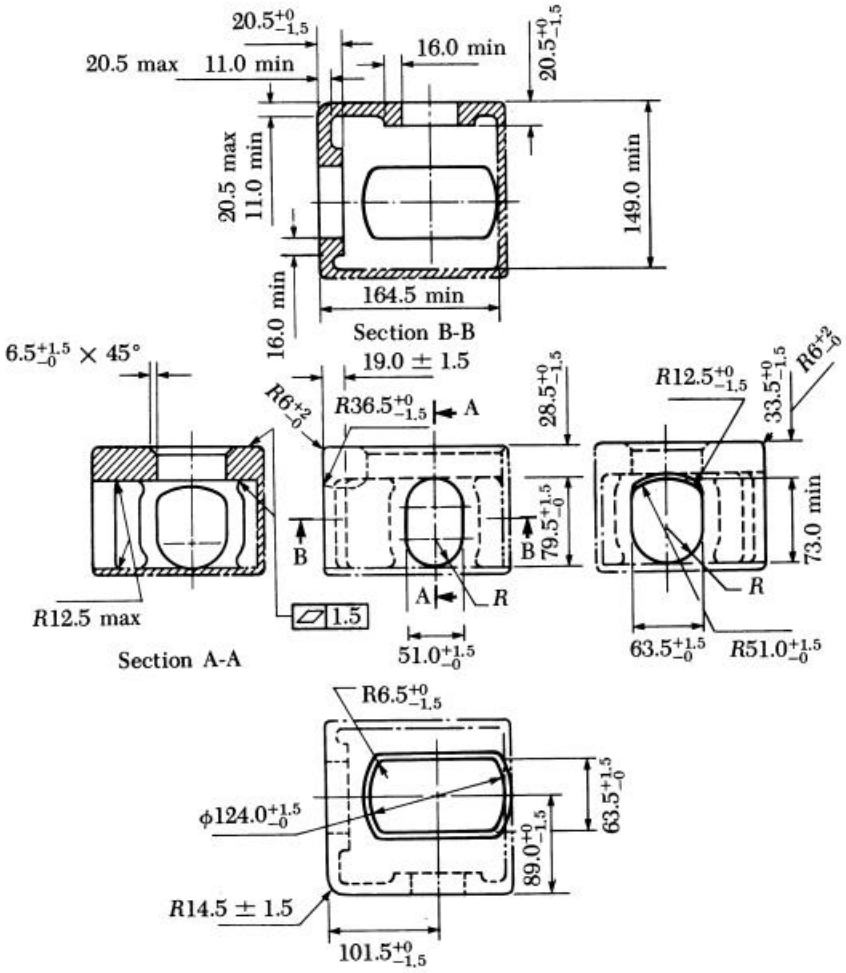
T_1 = 150 kn (33700 lbf)

T_2 = 150 kn (33700 lbf)

T_3 = 1/2 R

T_4 = 100 kn (22400 lbf)

FIGURE 6.7 Top Corner Fitting—Millimeters

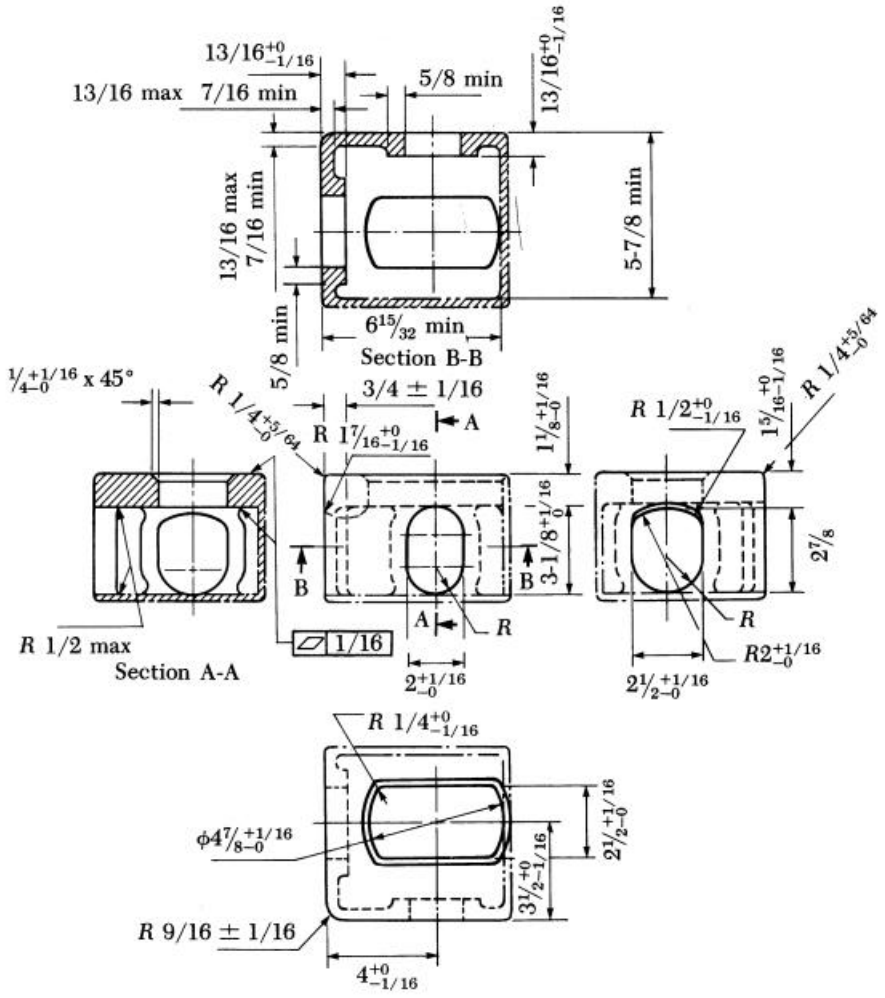


Notes

1 Solid and broken lines (— and - -) show surfaces and contours which must be physically duplicated in the fitting.

2 Phantom lines (— - —) show optional walls which may be used to develop a box-shaped fitting.

FIGURE 6.7 (continued) Top Corner Fitting—Inches

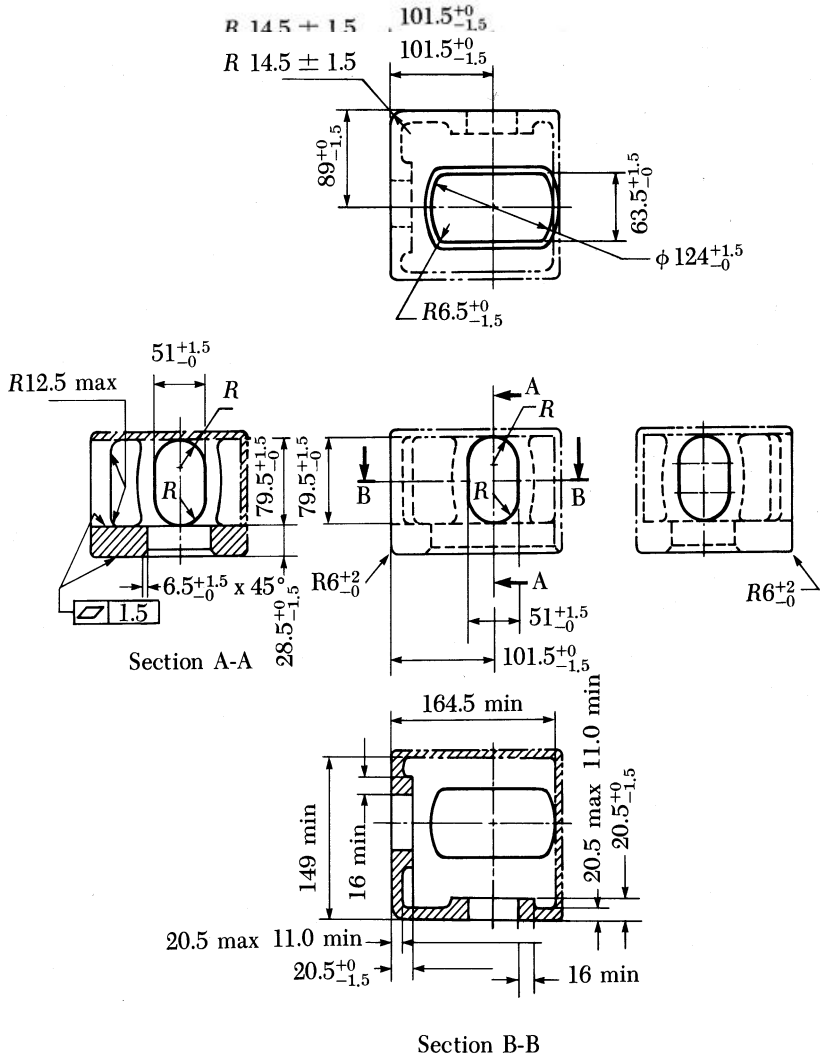


Notes

1 Solid and broken lines (— and - -) show surfaces and contours which must be physically duplicated in the fitting.

2 Phantom lines (— - —) show optional walls which may be used to develop a box-shaped fitting.

FIGURE 6.7 (continued) Bottom Corner Fitting—Millimeters

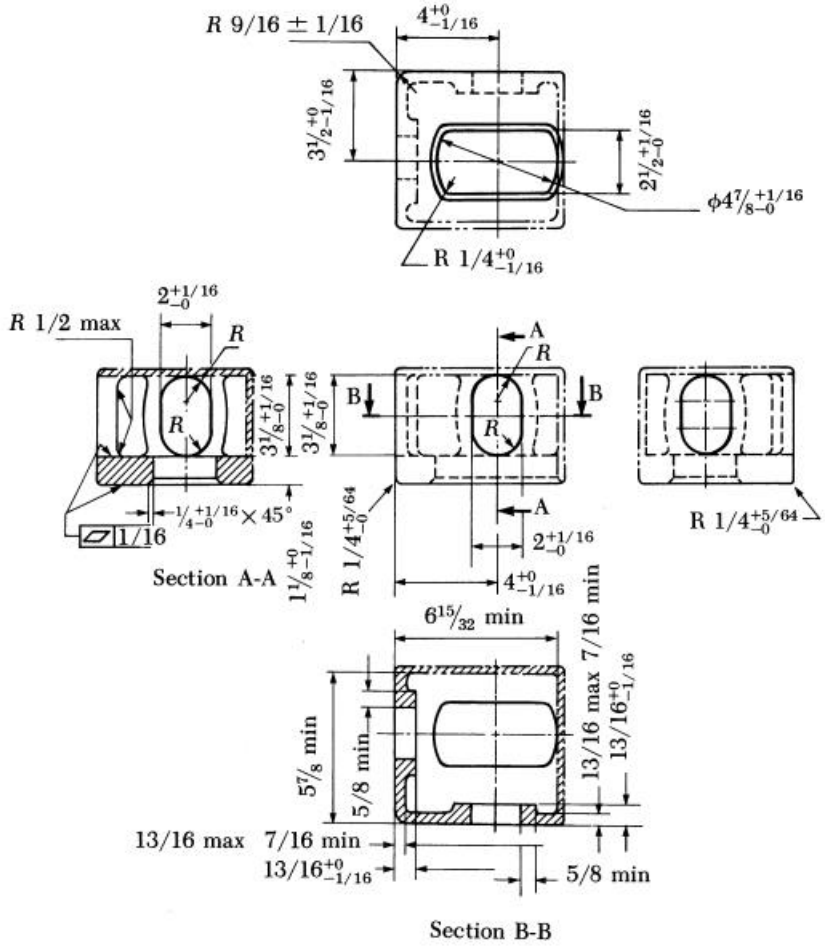


Notes

1 Solid and broken lines (— and - -) show surfaces and contours which must be physically duplicated in the fitting.

2 Phantom lines (— - —) show optional walls which may be used to develop a box-shaped fitting.

FIGURE 6.7 (continued) Bottom Corner Fitting—Inches



Notes

1 Solid and broken lines (— and - -) show surfaces and contours which must be physically duplicated in the fitting.

2 Phantom lines (— - —) show optional walls which may be used to develop a box-shaped fitting.

Section 7 Testing

7.1 General

Cargo containers for general service* are not to be inferior to those which have met the prescribed tests in 7.11 1 through 7.11.16. Tests are primarily static in nature to provide comparable and repeatable test data while minimizing the complexity and cost of test equipment. The prescribed test loads take into account, insofar as practicable, the combined static and dynamic loads anticipated in service. As previously defined in Section 5, R and P are expressed in units of mass. Some of the following test requirements are based upon the inertial gravitational forces derived from these values and will be shown as Rg and Pg. Representative deflection measurements are to be taken and recorded during the tests.

7.3 Alternatives

The prescribed tests are not intended to be restrictive. The Bureau is prepared to consider alternative test procedures provided they can be shown to be not less effective. Tests not required under these Rules will be certified upon request. The tests may relate to particular in-service conditions or be performed using test loads in a manner other than prescribed.

7.5 Acceptance Criteria

Upon application of the prescribed test load or force the container is not to exhibit significant permanent deformation or weakening of the structure, nor is the container, after removal of any load or force, to be dimensionally altered so as to render it unsuitable for use, or affect its handling, securing or interchangeability.

7.7 Prototype Tests

The prescribed tests, 7.11.1 through 7.11.16 are required to be performed on a prototype. The tests are to be witnessed by a Surveyor. The tests need not all be performed on the same container, nor in the sequence listed. However, the tests are not to be performed on more than two representative containers; the dimensional check is to be done first; and the weathertightness test is to be performed on the same container that has undergone the racking tests. The dimensional check is to be repeated upon completion of all structural tests. The test loads/forces are to be applied in a manner that will allow free deflection of the container under test.

When the result of any test is not satisfactory, the test is to be repeated on a minimum of two additional containers to demonstrate satisfactorily the adequacy of the design.

7.9 Production Tests

The prescribed tests 7.11.1 and 7.11.16 are to be performed on each production unit. If the manufacturing operation has sufficient jigs and fixtures to control dimensions, and the quality control procedures assure their accuracy, the frequency of performing 7.11.1 may be modified.

A pull test is to be performed using a force equivalent to 2 *R/4* on each corner post assembly. However, if the quality control procedures of corner post and corner fitting assembly are deemed adequate, the pull test may be performed on one container from each lot of fifty (50) containers or fraction thereof. The Surveyor is to witness representative production tests during periodic visits to the plant of the manufacturer. Records of production tests are to be made available to the Surveyor during the periodic visits.

7.11 Tests

7.11.1 Dimensional Check

Prior to the start of the following structural tests the empty container is to be measured to insure compliance with the dimensional specifications in 6.5. The dimensional check is to be repeated upon completion of the structural tests.

7.11.2 Stacking

The container under test is to be placed on four supports in the same horizontal plane; one under each bottom corner fitting, with the base structure free to deflect. It is to be uniformly loaded to 1.8*R*, except that tank containers (See Section 9) may be tested in the tare condition. The container under test is to be subjected to a vertical stacking force of 848 kN (190640 lbf)** on each of the top corner fittings in such a manner that the planes of application of the forces and the supports of the container remain horizontal and unchanged during the test. The forces are to be applied to the four top corner fittings through a pad of the same plan area as a corner fitting, having a chamfered aperture of the same size as that of the bottom face of a bottom corner fitting. The pads used to apply the force to the container under test must be

*See Section 1.17.1

**Derived from a superimposed mass of 8 containers stacked on top of one container each rated at 24000 kg (52900 lb) with an acceleration of 1.8g. For 10 ft containers the stacking force is 224 kN (50400 lbf) derived from a superimposed mass of 5 containers stacked on top of one container each rated at 10160 kg (22400 lb) with an acceleration of 1.8g.

of sufficient size and strength to permit full application of the ram force. The force is to be applied to the four top corner fittings simultaneously. The application of force is to simulate the base structure of a superimposed container and the top pads are to be interconnected in such a way as to minimize top pad rotation or torsional effect. The applied force is to be held for not less than five minutes for each position.

This test is to be repeated with four eccentric applications of force offset in the same direction by 25 mm (1 in.) laterally and 38 mm (1½ in.) longitudinally. The line of force should be maintained at the centroid of the pads. End frames may be tested individually to equivalent loads as described above.

7.11.3 Lifting From The Top Corner Fittings

The container under test is to be placed on four supports in the same horizontal plane; one under each bottom corner fitting, with the base structure free to deflect. It is to be uniformly loaded to 2*R*.

The container is to be lifted vertically* by its four top corner fittings in such a way that no significant acceleration or deceleration forces are applied. The container is to be suspended for not less than five minutes, and then lowered to its original position.

7.11.4 Lifting From The Bottom Corner Fittings

The container under test is to be placed on four supports in the same horizontal plane; one under each bottom corner fitting, with the base structure free to deflect. It is to be uniformly loaded to 2*R*.

The container is to be lifted vertically by its four bottom corner fittings in such a way that no significant acceleration or deceleration forces are applied. The lifting forces are to be applied parallel to the sides such that the lifting slings meet above the roof at midlength at the following angles [to the horizontal]:

30º for 40 ft containers
37º for 30 ft containers
45º for 20 ft containers
60º for 10 ft containers

The lifting slings are to be kept 38 mm (1½ in.) from the side face of the corner fittings. The container is to be supported for not less than five minutes and then lowered to its original position.

*For 10 ft containers the lifting forces are to be applied at an angle of 60º to the horizontal.

7.11.5 Lifting From Fork-lift Pockets—For Loaded Containers (where provided)

The container under test is to be uniformly loaded to 1.6*R*. The container is to have two fork tines or equivalent inserted into the pockets. The load application to the pocket surface by the fork tine is to be uniformly distributed over an area 200 mm (8 in.) wide by 1828 mm (72 in.) long. The container is to be lifted to a position clear of all obstructions, supported in this position for five minutes, and then lowered to its original position.

7.11.6 Lifting From Fork-lift Pockets—For Unloaded Containers (where provided)

The container under test is to be uniformly loaded to 0.625*R*. The container is to have two fork tines or equivalent inserted into the pockets. The load application to the pocket surface by the fork tine is to be uniformly distributed over an area 200 mm (8 in.) wide by 1828 mm (72 in.) long. The container is to be lifted to a position clear of all obstructions, supported in this position for five minutes, and then lowered to its original position.

7.11.7 Lifting From Grappler Arm Position (where provided)

The container under test is to be uniformly loaded to 1.25*R*. The container is to have four lift shoes or equivalent placed in contact with the grappler arm pads or positions. The load application is to be equally distributed on four bearing areas of 32 mm (1¼ in.) by 254 (10 in.). The container is to be supported for five minutes and then lowered to its original position.

7.11.8 Floor Strength (Concentrated)

The container under test is to be empty and is to be placed on four supports in the same horizontal plane; one under each bottom corner fitting, with the base structure free to deflect.

A vehicle with a front axle load of 5460 kg (12000 lb), 2730 kg (6000 lb) per wheel, is to be maneuvered over the entire floor area in a longitudinal direction, making a minimum of nine passes. One pass is to be made along each side with the front wheels as close to the side walls as practicable.

7.11.9 Restraint

The container under test is to be placed on four supports in the same horizontal plane; one under each bottom corner fitting, with the base structure free to deflect, and is to be uniformly loaded to *R*. The container is to be secured through the bottom apertures of the bottom corner fittings at one end by twist locks or equivalent devices.

A force equal to $2Rg$ is to be applied longitudinally through the bottom apertures of the bottom corner fittings at the opposite end of the container by twist locks or equivalent devices. The force is to be applied to the container first in compression then in tension, each application being held for five minutes. The container is to have both sides tested; if they are identical only one side need be tested.

7.11.10 End Panel Strength

The container under test is to be positioned in such a manner that the end panel is free to deflect over its entire surface. A load or force equal to $0.4Pg$ is to be uniformly distributed over the inside surface of the end panel. The load is to be applied in such a manner that the effect of the load is being distributed only to the end panel and not the supporting structure. The test load is to be held for five minutes, then gradually removed.

The container is to have both end panels tested; if they are identical only one end need be tested.

7.11.11 Side Panel Strength

The container under test is to be positioned in such a manner that the side panel is free to deflect over its entire surface. A load or force equal to $0.6Pg$ is to be uniformly distributed over the inside surface of the side panel. The load is to be applied in such a manner that the effect of the load is being distributed only to the side panel and not the supporting structure. The test load is to be held for five minutes, then gradually removed.

The container is to have both side panels tested; if they are identical then only one side need be tested.

7.11.12 Roof Strength

The container under test is to be placed on four supports in the same horizontal plane; one under each bottom corner fitting. A load equal to 300 kg (660 lb) is to be uniformly distributed over an area of 600 mm x 300 mm (24 in. x 12 in.) located so as to have the most adverse orientation with respect to the unsupported area of the roof sheet. The load is to be kept in place for five minutes then removed.

7.11.13 Transverse Racking

The container under test is to be empty and is to be placed on four supports in the same horizontal plane; one under each bottom corner fitting.

The container is to be restrained against lateral and vertical movement by means of twist locks or equivalent devices acting through the bottom apertures of the bottom corner fittings. A compression and then a tension force of 150 kN (33,700 lbf) is to be applied to each of the two top corner fittings on one side of the container. The line of action of the compression and tension force is to be parallel to the end and base planes of the container. The compression force is to be applied through a pad equal in size to the side face of the corner fitting with the line of force at the center of the pad. The pad is to be of sufficient strength to prevent deformation by the ram. The tension force is to be applied by a device whose contact area is to be as large as possible and applied to the inside surface of the outer wall of the corner fitting through the center of the side aperture. The forces are to be gradually applied, held for five minutes, then gradually removed.

The container is to have both ends tested; if they are identical, only one end need be tested. When testing one end frame, lateral and vertical restraint is to be applied only at the end frame under test.

The diagonals of the end frame to be tested are to be measured before the application of force and under full test load. With the container under full test load the sum of the changes in the length of the two diagonals is not to exceed 60 mm (2C\, in.).

7.11.14 Longitudinal Racking

The container under test is to be empty and is to be placed on four supports in the same horizontal plane; one under each bottom corner fitting.

The container is to be restrained against longitudinal and vertical movement by means of twist locks or equivalent devices acting through the bottom apertures of the bottom corner fittings. A compression and then a tension force of 75 kN (16,850 lbf) is to be applied to each of the two top corner fittings on one end of the container.

The line of action of the compression and tension force is to be parallel to the side and base planes of the container. The compression force is to be applied through a pad equal in size to the end face of the corner fitting with the line of force at the center of the pad. The pad is to be of sufficient strength to prevent deformation by the applied ram. The tension force is to be applied by a device whose contact area is to be as large as possible and applied to the inside surface of the outer wall of the corner fitting through the center of the end aperture. The forces are to be gradually applied, held for five minutes and then gradually removed.

The container is to have both sides tested; if they are identical only one side need be tested. When testing one side frame, longitudinal and vertical restraint is to be applied only at the side frame under test.

The deflection of the top of the container with respect to the bottom of the container with container under full test load is not to exceed 25 mm (1 in.).

7.11.15 Cargo Securing Devices (where provided)

Cargo securing devices are to be proof tested with a tensile force equal to 1.5 times the reference load using a shackle or hook having a maximum diameter of 10 mm (C\, in.). The reference load* for an anchor point securing device installed in the floor or base structure is not to be less than 10 kN (2200 lbf). The reference load* for a lashing point securing device installed on the interior sides or at ceiling level is 5 kN (1100 lbf). The force is to be applied as indicated below and held for five (5) minutes and released. Each type of cargo securing device is to be tested.

Location:	Direction of forces:
Floor	Perpendicularly to the axis of the container structural members 45º to the horizontal plane.
Interior sides	45º upwards and downwards
Ceiling level	45º downwards

7.11.16 Weathertightness

The container is to be tested for weathertightness by applying a stream of water over all exterior surfaces. The character of the stream of water is to satisfy the Surveyor that the test is reasonable and effective. An example of acceptable parameters controlling the test include: 1 kgf/cm^2 (15 psi) pressure in conjunction with the use of a 12.5 mm (Z\x in.) inside diameter nozzle held at a distance of 1.5 m (5 ft) from the part under test with a rate of movement over the exterior of approximately 100 mm (4 in.) per second. Upon completion of this test, the container is considered to be satisfactory if the interior is free from the penetration of water.

*The reference loads for platform and platform based containers: 30 kN (6600 lbf) for an anchor point and 10 kN (2200 lbf) for a lashing point.

Section 8 Marking

8.1 Identification and Data Markings

For minimum identification purposes, each container is to be permanently marked by the manufacturer with the following information:

Manufacturer's name and address
Manufacturer's serial number
Month and year of manufacture
American Bureau of Shipping emblem
Maximum gross weight
Tare
Payload
Design type number

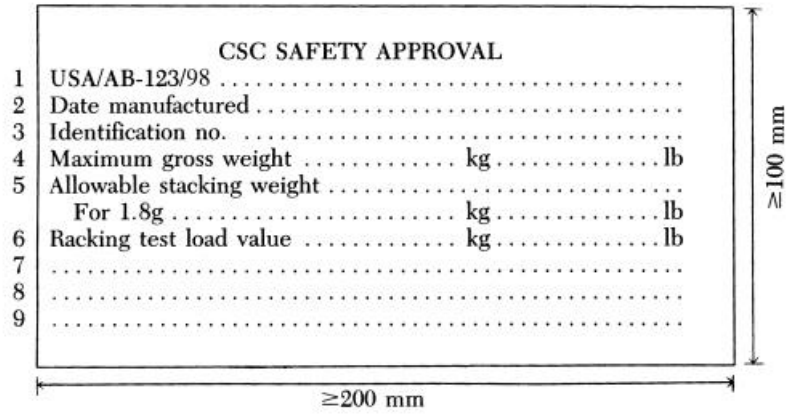
8.3 Additional Markings

Additional markings are to be applied as required by international conventions, governmental regulations or other requirements. See Appendices A-1 and A-2 for examples of the plates required by the International Convention for Safe Containers (CSC)* and the Customs Convention (TIR).

Appendix A-3 is an example of a consolidated data plate that is an acceptable method of plating the container and complying with the marking requirements of both the CSC* and the TIR.

*When Assembly Resolution A.737(18) of the International Convention for Safe Containers comes into force the present terms on the CSC plate will become maximum operating gross mass (kg and lb), allowable stacking load for 1.8g (kg and lb) and transverse racking test force (newtons). The CSC and Resolution A.737(18) have been reproduced in Annex D.

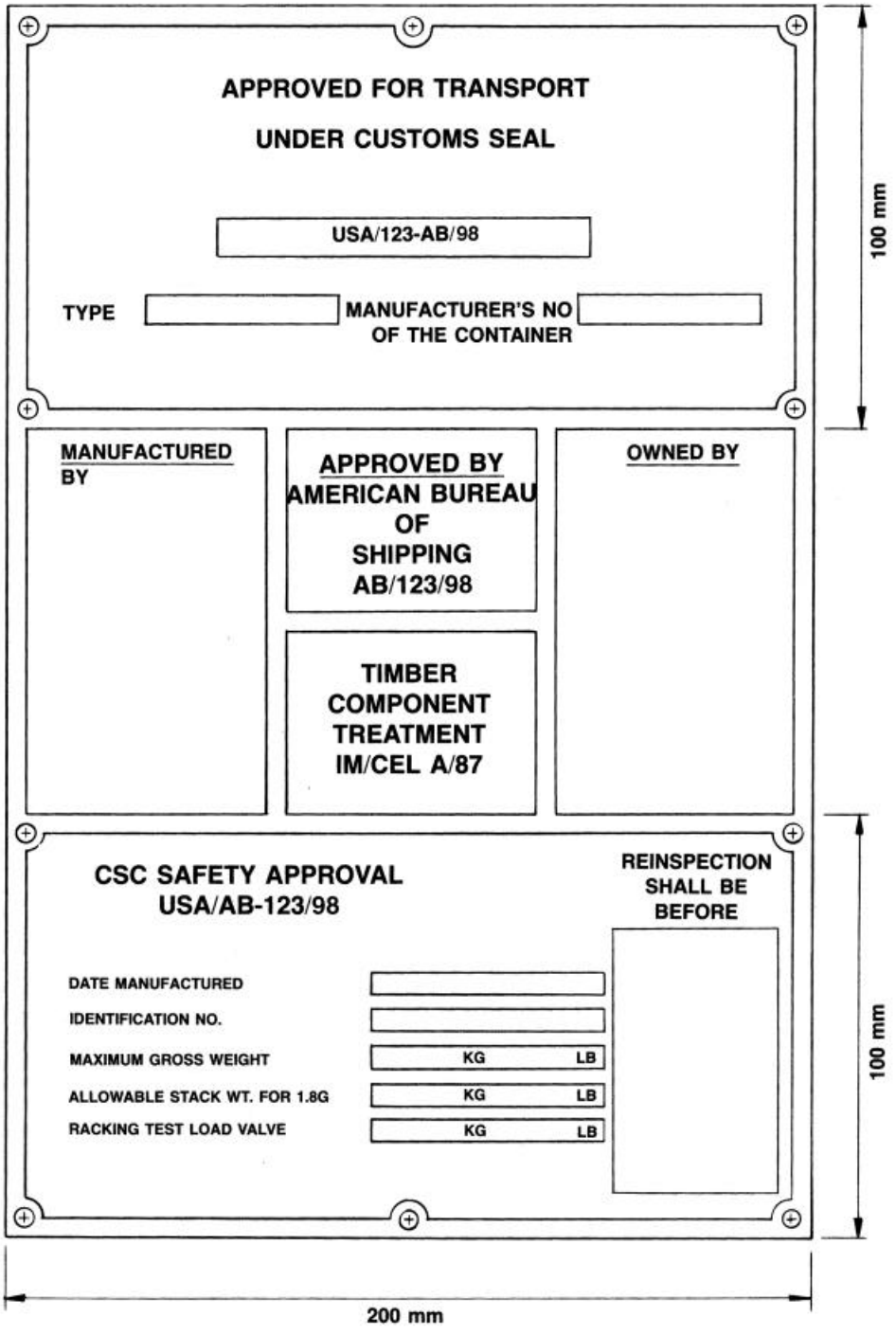
Appendix A-1 International Convention For Safe Containers (CSC) Approval Plate



1 Country of Approval Reference as given in the example on line 1. (The country of Approval should be indicated by means of the distinguishing sign used to indicate country of registration of motor vehicles in international road traffic.)
2 Date (month and year) of manufacture.
3 Manufacturer's identification number of the container or, in the case of existing containers for which that number is unknown, the number allotted by the Administration.
4 Maximum operating gross weight (kg and lb).
5 Allowable Stacking Weight for 1.8g (kg and lb).
6 Transverse Racking Test Load Value (kg and lb).
7 End wall strength to be indicated on plate only if end walls are designed to withstand a load of less than 0.4 times the maximum permissible payload, i.e. 0.4 *P*.
8 Side wall strength to be indicated on plate only if the side walls are designed to withstand a load of less or greater than 0.6 times the maximum permissible payload, i.e. 0.6 *P*.
9 First maintenance examination date (month and year) for new containers and subsequent maintenance examination dates (month and year) if plate used for this purpose.

Appendix A-2 Customs Convention on the International Transport of Goods Under Cover of TIR Carnets (TIR Convention) Approval Plate

Appendix A-3


APPROVED FOR TRANSPORT
UNDER CUSTOMS SEAL
USA/123-AB/98
TYPE
MANUFACTURER'S NO OF THE CONTAINER
100 mm
MANUFACTURED BY
APPROVED BY AMERICAN BUREAU OF SHIPPING AB/123/98
TIMBER COMPONENT TREATMENT IM/CEL A/87
OWNED BY
CSC SAFETY APPROVAL
USA/AB-123/98
REINSPECTION SHALL BE BEFORE
DATE MANUFACTURED
IDENTIFICATION NO.
MAXIMUM GROSS WEIGHT
ALLOWABLE STACK WT. FOR 1.8G
RACKING TEST LOAD VALVE
KG LB
100 mm
200 mm

Section 9 Tank Containers

9.1

In addition to the requirements of Section 1 through 8 of these Rules, certification of tank containers is to include compliance with the requirements in this section.

9.3 Certification

9.3.1 Tank Containers Built Under Survey

Tank Containers which have been built to the full requirements of the Rules, to the satisfaction of the Surveyors to the Bureau, will be certified and distinguished by the symbol ✠ AB.

9.3.2 Tank Containers Not Built Under Survey

Tank containers which have not been built under Survey to this Bureau, but which are submitted for certification, will be subjected to a special condition survey. Where found satisfactory, they will be certified and distinguished by the symbol **AB**.

9.3.3 Certification Application

The application to be submitted in accordance with Section 2, and is also to include the following:

Application for tank containers CTR AB 214A.*
Data form supplement for tank containers CTR AB 216B.*
Details of fabrication, including welding procedure specifications and procedures qualification records (WPS/PQR), and degree/type of non-destructive testing.
Details of internal/external coils including materials specifications, dimensions and weld details.
Details of all openings, nozzles, covers, and attachment mountings.
Design data including design minimum and maximum pressures, design temperatures, and thickness and type of any insulation.
Full design calculations including shell and head stresses, opening reinforcements, and saddle or mounting stresses due to tank supports.
Data plate drawings as required.
Details of valves, fittings, heaters, covers, and other attachments including pressure and temperature ratings and material specifications.
Required capacity calculations, capacity and pressure settings of pressure relief devices.

9.3.4 Continuance of Certification

The continuance of certification of tank containers is conditional upon the requirements for periodic in-service inspection and testing in 11.3.

9.5 Definitions

The following definitions for symbols and terms regarding tank containers are used throughout this section.

9.5.1 Tank Container

A tank container is a container for transport of bulk liquids and gases with a minimum capacity of 450 liters (119 gallons) and which includes two basic elements, the tank or tanks and the framework.

9.5.2 Compartment

A compartment is any fluid tight section of the tank formed by the shell, ends, or internal bulkheads. Baffles, surge plates or other perforated plates do not form tank compartments within the meaning of this definition.

9.5.3 Total Capacity

Total capacity is the volume of water at 20°C (68°F) which will completely fill the tank.

9.5.4 Ullage

Ullage is the portion of the "total capacity" of a tank container not occupied by its liquid commodity, expressed as a percentage of that total capacity.

9.5.5 Gas

A gas is a gas or vapor having a vapor pressure greater than 3 bar absolute (43 psia) at 50°C (122°F) or as otherwise defined by a competent authority.

9.5.6 Liquid

A liquid is a fluid substance having a vapor pressure not greater than 3 bar absolute (43 psia) at 50°C (122°F).

9.5.7 Hazardous Commodities

Hazardous commodities are those substances classified as hazardous by a competent authority.

*To assist clients in providing the information necessary for the certification of the container, the Bureau has printed application forms, available upon request.

9.5.8 Maximum Allowable Working Pressure (MAWP)

MAWP is the tank design pressure above which the tank shall not be operated.

9.5.9 Test Pressure

Test pressure is the internal gauge pressure at which the tank is tested. This pressure is measured at the top of the tank with the container in its normal operating position.

9.5.10 Competent Authority

The authority or authorities designated as such in each country or in each specific case by the governments concerned for the approval of tank containers.

9.7 Design Considerations

9.7.1 General Specifications

Construction is to be structurally sound and weathertight. All fittings and appurtenances are to be within the maximum outside dimensions of the tank container. The main frame and corner structures are to have sufficient strength to remain serviceable and withstand, without significant permanent deformation, the static and dynamic loads imposed by stacking loads, lifting the tank container by top and bottom corner fittings and the impact and racking loads encountered in normal service. The base structure is to be strong enough to support the weight of the tank and cargo under the dynamic loading conditions encountered in normal service. The specific design loading requirements are not to be less than those given in 6.11 and 9.7.2. The manufacturer is responsible for designing the tank container with sufficient strength to withstand the design loads and is to include factors of safety allowing for fatigue, normal wear and tear, manufacturing fabrication techniques and material properties.

9.7.2 Tank Specifications

Tanks whose maximum allowable working pressure (MAWP) is 1.03 bar (15 psig) or greater are to be designed and constructed in accordance with a recognized pressure vessel code and the requirements of 9.7.2 through 9.7.9. Tanks whose MAWP is less than 1.03 bar (15 psig), intended for the transport of hazardous cargo, are to be designed using a recognized pressure vessel code as a guide. Tanks whose MAWP is less than 1.03 bar (15 psig), intended for the transport of non-hazardous cargo, are not required to be designed in accordance with a recognized pressure vessel code, but are to be designed in accordance with 9.7.2 through 9.7.9 and good engineering practice. The materials used in construction of the tank are to be suitable for, or adequately protected from, the commodities intended to be transported. Due regard is to be given to the problems of commodity and ambient temperatures, corrosive atmospheres, the possibility of uncontrolled cargo release in fire, etc.

Each tank is to be firmly secured in structural elements of the framework. The tank is to be capable of being filled and emptied without removal from the framework and is to be capable of withstanding the static head pressure produced by upending the tank container while loaded to its maximum gross weight (R).

In general, tanks and their supports are to be capable of absorbing the following dynamic loads. Design load factors for inertial effects, resulting from motion of the commodity during transport are to be considered as: 2.0 times gravity longitudinal, 1.0 times gravity transverse and 2.0 times gravity vertical. All inertial loads may be considered to act singly, to be evenly distributed and to be applied through the geometric center of the tank. The above loadings are not considered to give an increase in pressure in the vapor space. For design purposes, an equivalent pressure loading may be used. The design of the tank is to include consideration of both commodity vapor pressure and pressure from dynamic loads. Where necessary, allowance for corrosion of the tank shell is to be included when determining the shell thickness.

Each tank without vacuum relief devices is to be designed to withstand an external pressure of at least 0.42 bar (6 psig). Each tank with vacuum relief devices is to be designed to withstand an external pressure of at least 0.21 bar (3 psig).

9.7.3 Tank Openings and Fittings

All tank openings except those fitted with pressure relief devices, are to be provided with closures to prevent accidental escape of the contents. Tank openings located below the normal liquid level of the contents and fitted with a valve capable of being operated manually are to be provided with at least one additional means of closure on the outlet side of the valve. Such additional means of closure may be a fluid tight cap, bolted blank flange, or other suitable protection against accidental escape of the contents.

Tank fittings are to be of a proven design and attached to the tank in such a manner as to minimize the risk of damage. Protective covers or housings are to be employed where necessary to comply with this requirement. A clearance of at least 25.4 mm (1 in.) is to be provided between external fittings and the planes formed by the out-

side surfaces of the corner fittings. All tank fittings are to be clearly marked to indicate their appropriate functions. Quick disconnect fittings are not permitted for tank containers intended for the transport of hazardous commodities.

9.7.4 Pressure and Vacuum Relief Devices

Pressure relief devices, where provided, are to be connected to the vapor space of the tank located as near to the top of the tank and as near to the geometric center of the tank as practicable.

Pressure relief devices are to have sufficient relieving capacity to provide unrestricted venting and prevent a rise in internal tank pressure in excess of 1.5 times the MAWP during the complete engulfment of the tank in fire.

The primary relief device is to be set to function in a range of no less than 100% and no greater than 125% of the MAWP.

Spring-loaded pressure relief valves are to close after discharge at a pressure not less than 90% of the start-to-discharge pressure and remain closed at all lesser pressures, and are to be constructed in a manner to prevent unauthorized adjustment of the relief setting.

Fusible elements are not to be protected from direct communication with external heat sources.

Vacuum relief devices, where provided, are to be designed to provide total containment of the product and are to be set to open at a nominal external overpressure of not less than 0.21 bar (3 psig) but not greater than the external pressure for which the tank is designed.

For hazardous commodities, the pressure and vacuum relief devices are to comply with the requirements applicable to their intended service. Each pressure and vacuum relief device is to be plainly and permanently marked with the pressure at which it is set to operate.

9.7.5 Inspection and Maintenance Openings

Tank containers are to be provided with a manway or other opening to allow for complete internal inspection. The size of the manway is to be a minimum of 460 mm (18 in.) in diameter and is to be determined by the need for men and equipment to enter the tank to inspect, maintain, or repair its interior. Adequate provisions are to be made for the application of sealing devices to all access openings.

9.7.6 Gauging Devices

Gauging devices, where provided, are to be of substantial construction. Sight glasses are not permitted.

9.7.7 Insulation

Insulation, where provided, is to be such that the insulation will not affect compliance with specified requirements nor interfere with the proper function of the tank fittings. Where insulation is provided to reduce the required venting capacity, it is to remain effective at all temperatures up to 649°C (1200°F) and be jacketed with a material having a melting point of 649°C (1200°F) or greater.

9.7.8 Heating or Refrigeration

Heating or refrigeration, where provided, is to be such that it will avoid the development of excessive temperatures and stresses, and suitable operational safeguards are to be provided. The design of internal heating and cooling or external coils will be reviewed as pressure retaining components. Where electrical equipment is installed for the above purposes, the design, installation, and functionality shall be verified as acceptable.

9.7.9 Fork-Lift Pockets

Fork-lift pockets, when provided, are to be for handling the tank container only when empty and are to be marked accordingly. Fork-lift pockets, when provided, are to have a center to center dimension of 2050 mm ±50 (81 in. ±2) and are otherwise to be constructed in accordance with 6.9.1 and tested in accordance with 7.11.6.*

9.9 Construction

9.9.1 General

Construction is to be carried out under the surveillance of a Surveyor. The manufacturer is responsible for the quality of the work. The Surveyor is to satisfy himself that procedures and workmanship, as well as the materials used, are in accordance with the Rule requirements and reviewed plans.

9.9.2 Welder Qualification

The Surveyor is to satisfy himself that all welders and welding operators to be employed in the construction of tank containers are properly qualified and are experienced in the work proposed. The Surveyor is also to be satisfied as to the employment of a sufficient number of skilled supervisors to ensure a thorough supervision and control of all welding operations. Inspection of welds is to be carried out to the satisfaction of the Surveyor.

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*The IMDG Code, in Part 13.1.18.5, requires fork-lift pockets of tank container to be capable of being closed off. ISO 1496/3, in section 5.1.9, states that fork-lift pockets shall not be provided in tank containers.

9.9.3 Post Weld Heat Treatment

Post weld heat treatment is to be performed as required by the latest edition of the chosen pressure vessel design code.

9.9.4 Radiography

Radiography, if specified, is to be performed in accordance with the latest edition of the chosen pressure vessel design code. All welded joints to be radiographed are to be prepared as follows:

The weld ripples or weld surface irregularities, on both the inside and outside, are to be removed by any suitable mechanical process to such a degree that the resulting radiographic contrast due to any irregularities cannot mask or be confused with the image of any objectionable defect. Also, the weld surface is to merge smoothly into the plate surface. The finished surface of the reinforcement of all butt-welded joints may be flush with the plate or may have a reasonably uniform crown.

9.9.5 Passivation

The passivation of stainless steel may be required by regulation when the tank container is intended for the carriage of hydrogen peroxide and certain other reactive commodities. It is the manufacturer's responsibility to passivate the tank container with a solution that will effectively passivate the internal surfaces of the tank including the piping, valves, and any material surface that will come in contact with the commodity. Records concerning the passivation are to be made available to the attending Surveyor.

9.11 Testing

9.11.1 General

Tank containers presented for testing are to be fully assembled and ready for intermodal service. All welding, including shell to bearer supports, is to be completed prior to testing. All valves and fittings, with the exception of the pressure relief devices, are to be fitted to the tank prior to hydrostatic pressure testing. Insulated tanks are to be hydrostatically pressure tested before the insulation is installed.

The tests outlined in this section are to be carried out in the presence of a Surveyor on the prototype tank container that has successfully completed the tests required by Section 7 as applicable. Tests 7.11.1 and 9.11.4 are to be performed in the presence of a Surveyor on each tank container to be certified. The required loadings in each test should be applied in such a manner as to allow free deflection on the container section under test.

For those tests that require the tank container to be loaded to its maximum gross weight or greater the tank is to be filled, and if necessary, a supplemental external loading is to be provided when necessary in order to achieve the specified test loading. Any supplemental loading is to be evenly distributed on the tank in such a manner that the forces are transmitted through the tank supports.

Alternative test procedures will be accepted if they are considered by the Bureau to be equivalent.

9.11.2 Longitudinal Inertia

The container under test is to be loaded to R and positioned with its longitudinal axis vertical. It is to be supported by the downward facing bottom corner fittings and restrained from horizontal movement through the bottom apertures of the bottom corner fittings at the upper end of the base structure. The container is to be held in this position for five minutes then returned to its original position. No restraints are to be fixed to the top corner fittings.

9.11.3 Lateral Inertia

The container under test is to be loaded to R and positioned with its transverse axis vertical. It is to be supported by the downward facing bottom corner fittings and restrained from horizontal movement through the bottom apertures of the bottom corner fittings at the upper side of the base structure. The container is to be held in this position for five minutes then returned to its original position. No restraints are to be fixed to the top corner fittings.

9.11.4 Pressure Test

The container under test is to be in an upright position on firm ground. This test is to be carried out after all required prototype testing has been completed and before any insulation is fitted. The tank, together with its associated pipework and fittings, is to be hydrostatically pressure tested to a pressure not less than 1.5 times the MAWP, but not less than 1.03 bar (15 psig). Alternate test pressures will be considered based on tank design and special service conditions.

Relief devices, where fitted, are to be rendered inoperative or removed. All pressure parts are to be completely filled with water. The pressure is to be measured at the top of the tank. The pressure is to be held for ten minutes then released. The tank shall show no signs of leakage, permanent deformation or other abnormality which would render it unsuitable for use.

If traces of a testing liquid cannot be tolerated, a pneumatic test with a suitable leak detection method may be performed in lieu of a hydrostatic test provided the test pressure is not less than 1.25 times the MAWP and provided this test method is not in conflict with any additional competent authority requirements requiring approval as per 9.15.*

When internal coils are provided, the coil system is to be hydrostatically tested to 13.8 bar (200 psig) or 1.5 times the rated pressure of the coil system, which ever is greater.

9.11.5 Walkway Test

The container under test is to be in an upright position on firm ground. A load equal to 300 kg (660 lb) is to be uniformly distributed over an area of 600 mm x 300 mm (24 in. x 12 in.) located so as to have the most adverse orientation with respect to the unsupported area of the walkway. The load is to be kept in place for five minutes then removed.

9.11.6 Ladder Test

The container under test is to be in an upright position on firm ground. A load equal to 200 kg (440 lb) is to be suspended from the center of the widest rung. The load is to be kept in place for five minutes then removed.

9.13 Marking

In addition to the marking required by Section 8 each container is to be marked with the following information:

Test pressure and date, and date of next retest.
Maximum allowable working pressure.
Total capacity.
✠ **AB** or **AB** (see 9.3.1 or 9.3.2).

9.15 Other Requirements

The Bureau is prepared to review tank containers for compliance with the International Maritime Dangerous Goods Code (IMDG Code); the United States Department of Transportation Hazardous Materials Regulations; the International Convention concerning the carriage of dangerous goods by rail (RID); the European Agreement concerning the international carriage of dangerous goods by road (ADR); Transport Canada (TC); American Association of Railroads (AAR); or other recognized standards and regulations.

When a review in accordance with these regulations is requested, the information required to be submitted in 9.3.3 is to also include the following:

List of hazardous commodities to be carried
Calculations for pressure boundary and tank supports based on applicable regulations.
Relief valve venting calculations for all hazardous commodities to be carried.

*Air and gas are hazardous when used as a testing medium, therefore it is recommended that special precautions are to be taken when a pneumatic test is being performed.

Section 10 Thermal Cargo Containers

10.1 General

In addition to the requirements of Sections 1 through 8 of these Rules, a thermal container will be certified to its thermal capabilities and is to comply with the requirements in 10.3 through 10.11. A thermal container has insulated walls, doors, floor and roof, which retard the transmission of heat between the inside and the outside of the container. A thermal container may have its own mechanical refrigeration system or it may be cooled by an external source.

10.3 Certification

The certification of the thermal capabilities of a container is to be to the manufacturer's design internal temperature rating at a specific ambient temperature with the heat loss or gain expressed as the overall coefficient of heat transfer in kcal/hr (Btu/hr). These Rules apply to containers with a maximum U factor as given in the following table based upon an internal temperature of –18°C (0°F) and an external temperature of +38°C (100°F). Containers having greater U factors will be subject to special consideration.

	Nominal size of container					
	10 ft x 8 ft	***20 ft x 8 ft 20 ft x 8 ft 6 in***	***30 ft x 8 ft 30 ft x 8 ft 6 in***	***30 ft x 9 ft 6 in***	***40 ft x 8 ft 40 ft x 8 ft 6 in***	***40 ft x 9 ft 6 in***
U factor						
kcal/hr/C:	12.90	22.37	31.83	34.39	41.30	43.85
Btu/hr/F:	28.45	49.31	70.18	75.82	91.05	96.67

The above values correspond to an overall *K* factor (as defined in 10.9.3a) of 0.344 kcal/hr/m^2/C (0.0704 Btu/hr/ft^2/F)

10.5 Application

In addition to the plans and data to be submitted for review as required by Section 2, the following plans and data are also to be submitted as appropriate:

Full particulars of the arrangement, nature, and construction of the insulation including density, *K* factor, specific heat, and its protection from damage.

Details of the design heat load such as, design overall K factor, mean surface area, estimated air leakage, design internal temperature, design ambient temperature and total design heat load to be absorbed by the cooling unit.

The rating of the cooling unit in kcal/hr (Btu/hr) at specific internal and ambient temperatures.

The standard to which the cooling unit is rated.

The standards to which the refrigerant system of the cooling unit is constructed.

The manufacturer and model of the cooling unit.

10.7 Design Considerations

10.7.1 Cooling Unit

The container cooling unit is to be capable of maintaining the design internal temperature with the cooling unit cycling 80% on and 20% off during a 24-hour period at the design ambient air temperature. If the unit is electrically driven, the lowest variation of voltage and the lowest frequency expected in transit is to be used in determining the required cooling capability and the adequacy of the air circulating fans. The effect of radiant heat is to be considered when containers are designed to be carried on the open deck. The operation of the cooling unit is to be controlled by at least one suitably located temperature sensing device.

10.7.2 Insulation

The insulation of the wall, floors, and roof of the container is to be complete and installed in an effective manner. Insulation exposed to damage when loading or unloading the container is to be suitably protected.

10.7.3 Heating Arrangements

Where it is expected that ambient air temperatures will be encountered which will be lower than the temperature at which the container cargo is to be carried, arrangements for heating the container together with suitable controls are to be provided.

10.7.4 Refrigerants

The selection and use of refrigerants is to be in accordance with the *Handbook for the Montreal Protocol On Substances That Deplete The Ozone Layer,* second edition, October 1991.

10.7.5 Cryogenic Fluids

Containers using cryogenic fluids that have an operating temperature below minus 73ºC (minus 100ºF) as the cooling medium will be subject to special con-

sideration and details of the cooling arrangements are to be submitted for review.

10.7.6 Openings and Drains

All openings are to be weathertight except that ventilators, necessary for the preservation of cargoes, are to be designed to prevent the entrance of water due to rainstorms and sea water spray. Openings provided for drainage are to have a minimum internal diameter of a suitable size. Each drain is to be capable of being closed from the outside of the container or be fitted with arrangements which will automatically prevent the entrance of water into the container. Openings and drains are also to be designed to keep the entrance of outside air to a minimum unless such air leakage is designed as part of the ventilation system. Customs regulations require screens on drains.

10.7.7 Temperature Measuring Devices

Each container is to be fitted with at least one indicating thermometer capable of withstanding over the road shock and shipboard vibration. They are to be of a type not affected by weather conditions or sea water spray. In addition, when only one temperature indicator is installed, the container is to be fitted with an arrangement for checking the temperature with a test thermometer.

10.9 Testing

10.9.1 General

The tests outlined in this section are to be carried out in the presence of a Surveyor on the prototype thermal container that has successfully completed the tests required by Section 7.

Test 10.9.3 is to be performed on one additional container, from each lot of 100 or fewer containers of the same order. The Surveyor is to review the results of this test during periodic visits to the plant of the manufacturer.

Test 7.11.1, 7.11.16, 10.9.2, and 10.9.5 are to be performed on each production unit. Alternatives to 10.9.2 will be considered upon request. The Surveyor is to witness representative production tests during periodic visits to the plant of the manufacturer. The manufacturer is to keep such records as necessary to satisfy the Surveyor that the production testing has been performed. The records are to be made available to the Surveyor during periodic visits to the plant of the manufacturer.

The Bureau is prepared, in cases where a container has been certified according to Section 10 and the refrigeration machinery has been certified to the requirements of Section 13 of these Rules, to accept additional containers of the same design series having machinery of identical capacity also certified to the requirements of Section 13 without repeating the thermal prototype tests required by this section.

10.9.2 Air Leakage Test

An air leakage test is to be conducted on the prototype to determine the rate of air leakage. The internal and ambient temperatures are to be within the range of 15ºC to 25ºC (59ºF to 77ºF) and are to be stabilized within 3ºC (5.4ºF) of each other. An air flow metering device and manometer are to be connected to the container with the manometer not part of the air delivery system. The flow measuring device is to be accurate to ±3% of the measured air flow rate with the manometer accurate to ±5%. The air flow to maintain the pressure, once steady state conditions have been achieved, is to be recorded. The air leakage rate is to be determined while retaining an internal air pressure of 250 Pa ±10 Pa [25.4 mm ±1 mm] water gauge while achieving steady state, and the rate is not to exceed $10 m^3/h$. The air pressure is to be released before opening the container doors.

10.9.3 Heat Leakage Test

The heat leakage test is to establish the heat leakage for prototype and that the overall coefficient of heat transfer of the prototype is not greater than the manufacturer's design rating. This test is to be performed on the prototype after completion of the air leak test specified in 10.9.2.

a ***Electric Heating Method*** Where the test room is equipped with air conditioning to stabilize the temperature external to the container, the quantity of heat necessary to maintain a steady temperature inside the container may be measured with a watt hour meter having an accuracy of ±2% of quantity measured. The air inside the container is to circulate over the electric space heaters, and temperature measuring devices are to be installed to determine that the heat is evenly distributed and to ensure that the required temperatures are maintained. The internal and external temperature measuring devices are to be located 100 mm (4 in.) from any wall, floor, or roof, as per Figure 10.1. Temperature measuring devices are to be accurate to ±0.5ºC (1ºF). The air outside the container is to circulate over the external surfaces of the container at a velocity of not greater than 2 m/s in the vicinity of the temperature measuring devices. All temperature measuring devices are to be protected against radiation. This test is to be performed for a period of not less than eight hours with the following steady-state conditions satisfied:

The test is to be performed with a mean wall temperature between 20ºC and 32ºC (68ºF and 90ºF) and a temperature difference between inside and outside not less than 20ºC (36ºF).

Maximum difference between the warmest and coldest inside points at any one time is to be 3ºC (5.4ºF).

Maximum difference between warmest and coldest outside points at any one time is to be 3ºC (5.4ºF).

Maximum difference between any two average inside air temperatures θ_i at different times is to be 1.5ºC (2.7ºF).

Maximum difference between any two average outside air temperatures θ_e at different times is to be 1.5ºC (2.7ºF).

Maximum percentage between the lowest and the highest power dissipation Watt (Btu/hr) values is not to exceed 3% of the lowest figure.

All readings are to be recorded at intervals of not more than 30 minutes with at least 17 sets of readings taken during maintenance of the steady-state conditions.

In no case is the temperature inside the container to exceed that permissible for the type of insulation being used.

Heat Leakage Calculation: The overall heat leakage is to be expressed by the total heat transfer rate U in kcal/hr/C (Btu/hr/F), as obtained from the following equation using at least 17 sets of readings taken during steady-state conditions:

$$U = [Q/(qe - qi)]$$

Q = power dissipated by the operation of internal heaters and fans, kcal/hr (Btu/hr)

q_e = average outside air temperature, degrees C (F)

q_i = average inside air temperature, degrees C (F)

q = mean wall temperature = $(q_e + q_i)/2$

The value of U is to be corrected to the standard mean wall temperature of 20ºC using a method relating U to the mean wall temperature.

The coefficient of heat transfer, K in kcal/hr/m^2/C (Btu/hr/ft^2/F), is such that $K = U/S$ where

S = mean surface area of the container in m^2 (ft^2), which is the geometric mean of the inside surface area S_i, and the outside surface area S_e, as obtained from the following equation.

$$S = \sqrt{S_i S_e}$$

If any areas are corrugated, the projected area is to be used. All temperature measuring instruments placed inside and outside the container are to be protected against radiation.

b ***Alternate Heat Sink Method*** The rate of heat transfer in kcal/hr (Btu/hr) into the container is to be determined by the heat sink principle with test conditions of minus 18ºC (0ºF) inside the container and 38ºC (100ºF) and 50% relative humidity in a test room. A brine is circulated through cooling coils inside the container and also through a brine heater located outside the container. Since the brine flow rate is the same in all parts of the circuit, the heat gain of the container can be calculated from the measured quantity of heat which has been added to the brine heater as electrical energy. This figure is found by multiplying the heat added to the brine heater by the ratio of the rise in brine temperature in the container to rise in temperature of the brine heater, and subtracting from this quantity the heat introduced into the container by auxiliary equipment such as blowers, fans, and space heaters.

$$\text{Rate of heat transfer} = (\Delta T_1 H_2/\Delta T_2) - H_1$$

ΔT_1 = temperature rise of the brine in the air cooling coil inside the container in degrees C (F)

T_2 = temperature rise of the brine from inlet to outlet of the comparison brine heater in degrees C (F)

H_1 = the sum of all of the items of auxiliary heat added to the container interior for the purpose of the test, such as fans and blowers, controlling heat in kcal/hr (Btu/hr)

H_2 = heat absorbed in the comparison brine heater in kcal/hr (Btu/hr)

c ***Alternative Cryogenic Fluid Method*** Alternatively, the rate of heat transfer may be determined by the use of a cryogenic fluid with test conditions of minus 18ºC (0ºF) inside the container and 38ºC (100ºF) in a test room. No humidity control is used. The container cooling unit is operated until the internal temperature has been lowered to the required temperature. After the container has been precooled a liquid cryogenic unit, such as a nitrogen unit, is operated to provide the refrigerator function. The test is conducted for a period of 4 hours and the loss of cryogenic fluid is measured by weighing the unit at 30 minute intervals, and the refrigeration effect to maintain a steady state condition is calculated with the results given in kcal/hr (Btu/hr).

10.9.4 Performance Test

The container is to be placed in a room with the average temperature outside the container maintained within ±1.5ºC (2.7ºF) of the design ambient temperature. Temperature measuring devices are to be located 100 mm (4 in.) from any wall, floor, or roof, as per Figure 10.1 and are to be protected from radiation. The container is to be cooled down to its

design temperature using its own cooling unit. The average interior temperature is to be maintained to be within ±1.5ºC (2.7ºF) of the design temperature for eight hours. After this period, a heater having a capacity of at least 25% of the total heat leakage rate determined from the previous heat leakage test, is to be positioned inside the container and turned on. Temperatures are to be recorded at intervals of not more than 30 minutes. The cooling unit is to maintain the average interior temperature within ±1.5ºC (2.7ºF) of the design temperature for a period of at least four hours.

10.9.5 Operational Tests

The machinery or equipment providing the refrigeration function is to be operated on each container in order to check that the machinery, controls, air circulating fans and associated equipment are operating satisfactorily. The refrigeration machinery manufacturer's commissioning tests conducted on the cooling unit would also satisfy this requirement.

10.11 Marking

In addition to the markings given in Section 8 of these Rules, the cooling unit is to be marked in accordance with 13.7 and the container is to be marked as follows:

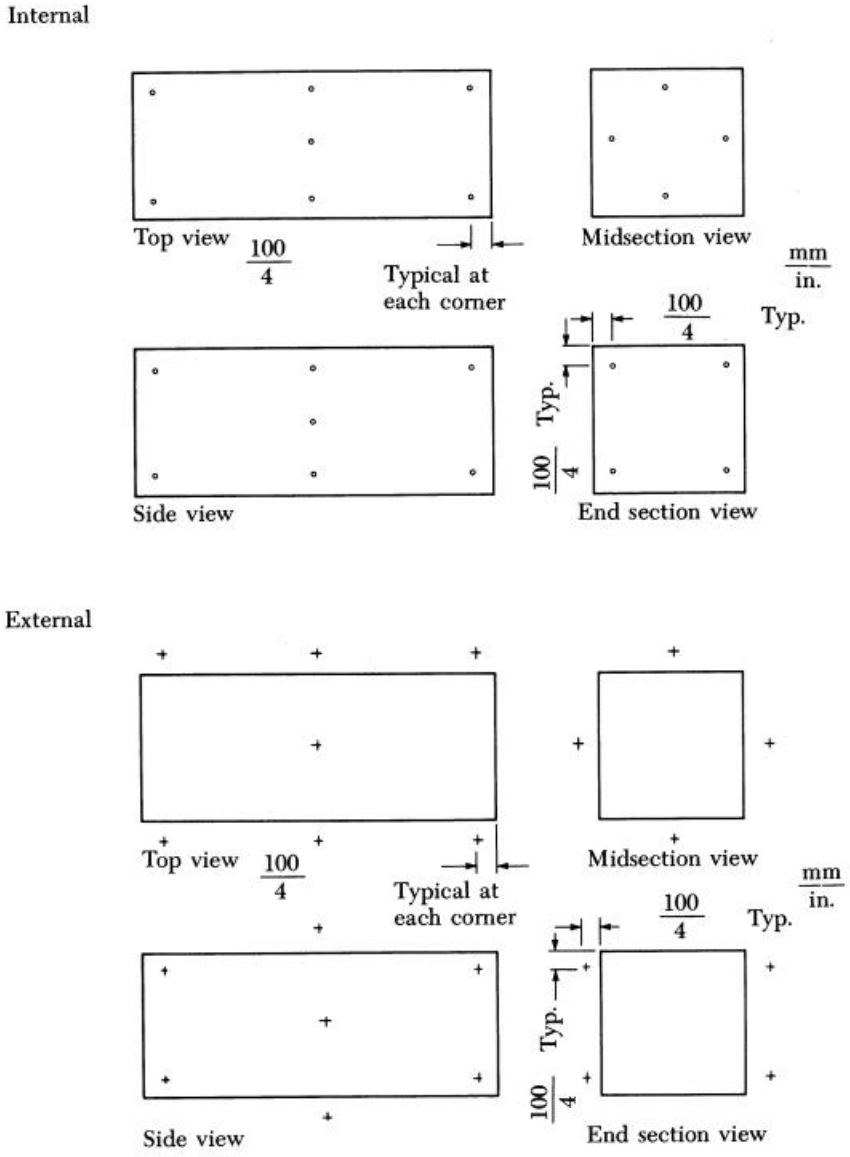
Design Rating of the Cooling Unit in kcal/hr or Btu/hr at
_____°C (_____°F) ambient temperature and
_____°C (_____°F) internal temperature
Design Rating of the Container in kcal/hr or Btu/hr at
_____°C (_____°F) ambient temperature and
_____°C (_____°F) internal temperature
with a *U* factor of _____

10.13 Other Requirements

The Bureau is also prepared to certify thermal containers in accordance with the testing requirements of the Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for Such Carriage (ATP). The certification to the testing requirements of the ATP will be considered sufficient to comply with the requirements of this section.

ABS is authorized to witness the air circulation and ventilation tests so that the applicable containers may be registered with ATO-DLO to carry flower bulbs.

FIGURE 10.1 Schematic of Locations of Temperature Probes



Section 11 Container Surveys

11.1 General

This section describes the periodic surveys for the continuance of certification for tank containers, regulatory surveys and miscellaneous surveys related to in-service conditions of all containers.

11.3 Periodic Surveys for the Continuance of Certification of Tank Containers

11.3.1 General

Each tank container that has been certified to these Rules is to be surveyed for continuance of certification. The continuance of certification of a tank container is conditional upon the Rule requirements for periodical surveys being duly carried out.

11.3.2 Preparation

It is the responsibility of the owner to insure that any tank to be internally inspected is clean of all cargo residue, is gas or fume free, and contains an atmosphere capable of supporting life.

Insulated or shielded tank containers are to have the insulation or shielding removed to the extent deemed necessary by the attending Surveyor to complete the inspection in accordance with 11.3.6. The markings and all approval plate data are to be legible and are to be verified by the attending Surveyor.

11.3.3 Inspection and Testing

Each tank container is to be inspected in accordance with 11.3.4, 11.3.5, and 11.3.6 at intervals not exceeding two and one-half years. Each tank container is to be inspected and tested in accordance with 11.3.4, 11.3.5, 11.3.6, and 11.3.7 at intervals not exceeding five years.

11.3.4 Inspection of Frame

The frame and its attachment to the corner fittings are to be inspected for weld defects, deformation, or other abnormalities which may render the container unfit for service.

11.3.5 Pressure Relief Devices

Pressure relief devices, where fitted, are to be inspected for corrosion, defects, deformation, and leakage. Spring loaded pressure relief valves are to be removed and tested to the set pressure marked on the valve. Rupture discs, or fusible plugs, where fitted, are to be removed and inspected for corrosion, cracking, or any other abnormality which may render them unfit for service.

11.3.6 Inspection of the Tank Container

The tank container is to be inspected for excessive corrosion, leakage, deformation, dents, defects in welds, or any other condition which may indicate a weakness in the tank. The piping, valves, and gaskets are to be inspected for conditions that may render the tank unfit for service.

11.3.7 Pressure Test

When required by 11.3.3 each tank or pressure vessel upon completion of the above inspections is to be tested in accordance with 9.11.4.

11.3.8 Acceptance

When the tank container is found or placed in satisfactory condition and tested to the satisfaction of the attending Surveyor, the data plate is to be stamped and the date of inspection, Surveyor's initials, the symbol **AB** and a Tank Container Periodic Inspection Report issued.

11.5 Regulatory Surveys

11.5.1 Safety Surveys

When requested by an owner, a container survey will be carried out for compliance to the examination requirements of the International Convention for Safe Containers (CSC).

11.5.2 Tank Container Surveys

When requested by an owner, a tank container survey will be carried out for compliance to the periodic inspection and testing requirements of the United States Department of Transportation Specifications for IM portable tanks; the International Maritime Dangerous Goods Code (IMDG Code); the International Convention concerning the carriage of goods by rail (CIM), Annex 1, International Regulations concerning the carriage of dangerous goods by rail (RID); and the European Agreement concerning the international carriage of dangerous goods by road (ADR). The tank container survey will include internal inspection and testing where required.

11.5.3 Thermal Container Survey

When requested by an owner, a thermal container that has been certified to the requirements of the Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for Such Carriage (ATP), will be surveyed for continued compliance.

11.7 Miscellaneous Surveys

11.7.1 Condition and Repair Surveys

When requested by an owner, a survey will be carried out stating the condition of a container and the recommended repairs.

11.7.2 Thermal Container Loading Surveys

When requested by an owner, a container survey will be carried out on thermal containers prior to loading cargo. The survey will be a general survey and will include the operation of the refrigeration machinery, if fitted.

11.7.3 Tank Container Cleanliness Surveys

When requested by an owner a tank container cleanliness survey will be carried out to determine that the tank is clean and dry. A visual internal and external examination is to be conducted to determine that the tank shell, fittings, and valves are free from pitting, corrosion, contamination, discoloration, water, or other conditions to the extent specified by the owner.

Section 12 Certification of Container Repair Facilities

12.1 General

This section describes the procedures whereby container repair facilities may be certified. Certification is a process by which a repair facility is assessed in regard to its ability to control and maintain the quality of repairs and is not intended to enforce any particular standard.

12.1.1 Applicability

The following provisions are applicable to repair or refurbishment shops considered permanent by virtue of facilities and that are engaged in the repair of general cargo containers. ABS Rules do not cover the certification of tank container repair facilities.

12.3 Approval of Repair Facilities

12.3.1 Application

An applicant desiring approval is to submit an application* that is to include an outline of its organization, personnel qualifications, plant capacity, types of containers repaired, material control, equipment, and control procedures.

12.3.2 Verification

The repair facility is to be audited by a Surveyor of the Bureau to verify the submitted data and ascertain the suitability of the facility for approval in accordance with these Rules and the Program for the Certification of Container Repair Facilities.

12.3.3 Approval

When found satisfactory, a certificate of approval will be issued to the repair facility as a plant capable of carrying out repairs in accordance with an approved practice. The approval of the plant is valid for one year.

12.3.4 Periodic Visits

Access to the plant is to be permitted to the Surveyor at any reasonable time in order that periodic surveys may be made as considered necessary.

12.3.5 Withdrawal of Approval

Facilities found not to be maintaining compliance with conditions under which approval was granted will be advised of the circumstances, and approval will be withdrawn unless immediate corrections are made.

12.5 Repair Procedures

12.5.1 General

All containers are to be examined internally and externally for the general condition of structure, welds, fasteners, panels, flooring, door gaskets, and closing devices. It is the responsibility of the repair facility to bring to the attention of the container owner any condition that may affect the service of the container.

12.5.2 Specifications

Repairs are to be completed in a manner consistent with the container manufacturers' specifications, owners' specifications or approved repair manuals.

12.5.3 Materials

All materials used for repairs are to duplicate or be equivalent to original construction. Hardness checks or other test means are to be used as necessary to identify material quality.

12.5.4 Welding

All welding is to be carried out using filler metal compatible with the base metal. All welding to carbon steel corner castings is to be done with low hydrogen electrodes unless specially approved otherwise.

All welders employed in the repair of general cargo containers are to be qualified for the work which they are called upon to perform. This qualification may be either through reviewing the quality of workmanship, consideration of the system of employment, training, apprenticeship, or requiring the welder to be tested. If testing is deemed necessary it is to be in accordance with the tests shown in Figures 3.1 through 3.4.

12.5.5 Records

Records of all repaired containers are the responsibility of the repair facility and are to be maintained for a minimum period of two years.

*To assist clients in providing the information, printed forms are available upon request.

12.7 Testing

12.7.1 Structural

When testing is conducted, the procedure is to be not less effective for any particular test than that described in Section 7.

12.7.2 Weathertightness

Weathertightness testing using water, light, or smoke is to be carried out on all units repaired under these provisions except for those repairs where weathertightness is not applicable.

12.7.3 Dimensional

Dimensional checks are to be performed upon containers which have had major structural repairs to main frame members.

12.9 Special Containers

The repairs and surveys to thermal containers may be subject to national or international regulations and may be subject to verification on behalf of or by a regulatory agency.

Section 13 Certification of Container Refrigeration Machinery

13.1 General

The certification of container refrigeration machinery (CRM) will be to a rating in kcal/hr (Btu/hr) specified by the manufacturer and based upon the submission and review of plans, data, the satisfactory completion of prototype tests, and quality control surveillance during construction. When a container refrigeration machinery unit is accepted for certification, a decal is shown in Figure 13.1 signifying that the unit is in compliance with the Rules is to be affixed to the unit.

The result of the capacity test of the prototype is not to be less than the design rating. The net refrigerating capacity of any production unit, when tested, is not to be less than 95% of the design rating.

When the prototype or a representative unit fails one of the tests required in 13.9, that test which it failed must be repeated to the satisfaction of the Surveyor.

13.1.1 Certification by Design Series

When a series of identical units is to be certified, certification is to be on the basis of a single prototype tested in accordance with 13.9.1 through 13.9.5 and production tests of each unit in accordance with 13.9.4 and 13.9.6. The manufacturer is to attest to construction, testing, material quality, and workmanship. Endorsement for quality control is to be made by the attending Surveyor.

13.1.2 Certification by Quality Assurance

Upon application from a manufacturer, consideration will be given to the certification of units in accordance with the Bureau's Quality Assurance Program for CRM.

13.1.3 Certification of Existing Units

Existing CRM units which have not been built under survey to this Bureau will be subject to special consideration. When a series of identical existing units is to be certified, certification is to be on the basis of a single representative unit tested in accordance with 13.9.1 through 13.9.5 and tests of each unit in accordance with 13.9.4 and 13.9.6. Where found satisfactory, they will be certified accordingly.

13.3 Certification Application

The application is to be submitted in triplicate and is to include the following, as applicable:

Completed application form
Material specifications, including welding or brazing details, for all refrigerant retaining parts
General arrangement and flow diagram
General arrangement of compressor and data sheet
Piping and valve details
Condenser details
Evaporator details
Receiver details
Electrical load analysis for all design conditions
Electrical one line diagram including size and type of cables
Motor and generator specification sheets or nameplate data
Details and arrangements of electrical control and monitoring devices
Prime mover specification sheet with the general arrangements showing the fuel storage and starting details
Quality control document in accordance with 13.11

13.5 Design Review

Plans are to be submitted for review of each container refrigeration machinery type to be certified. Prior to the actual commencement of the testing of the prototype unit, the Surveyor is to have on hand plans which delineate the arrangements and details of the prototype as built. When modifications are made to a previously tested design, revised plans are to be submitted to determine if additional prototype testing will be required.

13.7 General Design Considerations

13.7.1 Dynamic Stress

The refrigeration units are to be designed to operate under the following conditions:

A dynamic load of 2g in the longitudinal, transverse, and vertically downward directions and 0.5g in the vertically upward direction.
A 22.5 degree momentary inclination in any direction or a 15 degree permanent inclination in any direction.

13.7.2 Exposed Surfaces

All exposed surfaces of the units are to be suitable for the marine environment.

13.7.3 Construction Standards

Electrical components, pressure vessels, piping, valves, and fittings are to be designed, constructed, and tested in accordance with recognized standards acceptable to the Bureau.

13.7.4 Design Pressure

The design pressure for all parts of the system containing refrigerant under pressure is not to be less than indicated below.

Refrigerant No.	*Design pressure kg/cm^2 (psig)*
11	1.5 (21)
12	12.0 (169)
21	3.3 (46)
22	19.6 (278)
113	1.1 (15)
114	3.8 (53)
500	14.3 (203)
502	21.2 (302)

13.7.5 Pressure Relief Device

The refrigeration system is to be protected by a pressure relief device. The device is to be located in the high pressure side of the system and is to operate at a pressure not less than 1.0, nor more than 1.5 multiplied by the design pressure. Fusible plugs will be specially considered.

13.7.6 Prime Movers

Prime movers, other than electric motors, will be accepted on vendor's statement of suitability for the intended service, subject to a review of the plans and data required by 13.3.

13.9 Testing

13.9.1, 13.9.2, and 13.9.3 are in substantial agreement with Air Conditioning and Refrigeration Institute, Standard 1110-77.

13.9.1 Capacity Test (Calibrated Box Method)

a ***Description*** The refrigeration machinery unit is to be mounted on a calibrated box calorimeter located in a test chamber. With the unit in operation, the heat input to the calibrated box is to be adjusted to establish specific steady state conditions within the box. The heat input is then measured and added to the heat gain through the walls of the calibrated box to determine the heat removing capacity of the unit.

b ***Test Procedure*** The unit is to be started and the return air to the evaporator brought to within 1.1°C (2°F) of the internal temperature at which the unit is to be rated. The average temperature in the ambient space (inside the test chamber) is to be maintained to within 1.1°C (2°F) of the ambient temperature for which the unit is to be rated. Means for air circulation within the test chamber may be provided. Steady state conditions are to be maintained for one hour as evidenced by five complete sets of readings taken at 15 minute intervals.

c ***Duration of Test*** The test run is to consist of at least nine consecutive sets of readings (two hours), including the above five sets of steady state readings, begun at 15 minute intervals. Readings are to include all temperatures and electrical power inputs.

d ***Capacity*** The amount of heat transferred from the air in the refrigerated space to the refrigerant, less heat added by fan, drive, and other sources within the unit is the net refrigerating capacity. The net refrigerating capacity is determined by the following formula.

$$q_n = P_c + P_d + K\,(t_o - t_a) \text{ Watts}$$
$$q_n = 3.41\,(P_c + P_{d)} + K\,(t_o - t_a) \text{ Btu/hr}$$

q_n = net refrigerating capacity
P_c = electrical input to variable electric heat test units, Watts
P_d = electrical input to miscellaneous electrical devices in the calorimeter, Watts
K = heat transfer constant of the calibrated box calorimeter, *W/C* (Btu/hr/F)
t_o = average temperature of ambient air C (F)
t_a = average temperature of air in calorimeter C (F)

13.9.2 Start Test

The unit is to be operated for one hour after which the refrigeration unit is to be stopped for five minutes or duration of the control system time delay, whichever is less, and restarted. The temperature of the air entering both the condenser and the evaporator is to be maintained at 38°C (100°F) during the test. This test is to be conducted twice, with the refrigeration unit running ten minutes after each restart.

13.9.3 Continuous Operation Test

The unit is to provide one hour of continuous refrigeration, without interruption. The return air is to be maintained at 21°C (70°F) dry bulb with a minimum relative humidity of 50%. The ambient temperature is to be maintained at 49°C (120°F). The test is to be conducted using externally supplied power and is to be repeated using the unit's self contained power source, if provided.

13.9.4 Operational Test

The unit's electrical system and control system are to be tested during the operation of the unit in accordance with approved quality control procedures.

13.9.5 System Pressure and Leak Test—Prototype Units

The high pressure side of the refrigeration system is to be subjected to a pressure test at the set pressure of the pressure relief device. If the relief device could be damaged by this test, it may be temporarily removed or otherwise protected from damage. After completion of the pressure test, the relief device is to be reinstalled. The complete refrigeration system is then to be pressurized to the design pressure, and a leak test is to be carried out.

13.9.6 System Pressure and Leak Test—Production Units

The high pressure side of the refrigeration system is to be subjected to a pressure test at a pressure not less than the lesser of:

The set pressure of the pressure relief device*, or:
The operating pressure of the compressor high-pressure cut-off switch, if fitted.**
The complete refrigeration system is then to be pressurized to the design pressure, and a leak test is to be carried out.

13.11 Quality Control Document

The quality control document is to include the following:

A description of the quality control organization
Evidence of adequate manning levels to insure inspection at the various construction stages
Procedures to control and identify material
Procedures to control acceptance of vendor supplied items
Procedures to insure workmanship of constantly acceptable quality
Procedures for maintaining quality control records
Manufacturers' recommended production tests

13.13 Marking

The following information is to be permanently marked on a plate suitable for the marine environment and attached to each unit where it can be viewed when the machinery is in operation.

Manufacturer:
Model Number:
Design rating in kcal/hr or Btu/hr:
_____@_____°C_____°F Ambient Temp and
_____@_____°C_____°F Internal Temp
Horsepower:
Hertz, volts and phase:
Refrigerant:
Serial Number:
Operating Number (if applicable):
Fuel of prime mover:
Unit weight fully charged:

FIGURE 13.1 Emblem

This is a representation of the emblem for approved container refrigeration machinery units.

*If the pressure relief device could be damaged by this test, it may be temporarily removed or otherwise protected from damage. After completion of the pressure test, the relief device is to be reinstalled.

**Proper functioning of the cut-off switch is to be verified during the course of the pressure test.

Section 14 Certification of Carbon Steel Container Corner Castings

14.1 General

The certification of carbon steel container corner castings will be to the requirements contained herein or other approved specifications based upon the submission and review of design plans, material specifications, the satisfactory completion of testing, and quality control surveillance during manufacture. The corner fittings referred to in this section are the same as those referred to in 6.7.1 and shown in Figure 6.7. Corner fittings of unique design for special purpose containers will also be considered for certification provided the strength requirements are not less than those specified by ISO Standard 1161.

14.1.1 Certification by Heat Treatment Lot

The certification of corner castings may be on the basis of a single heat treatment lot, tested in accordance with 14.13, and examined in accordance with 14.15. The manufacturer is to attest to testing, material quality and workmanship. The Surveyor is to witness the mechanical tests unless the plant is approved under 14.1.2

14.1.2 Certification by Quality Assurance

Upon application from a manufacturer, consideration will be given to the certification of container corner castings without the witnessing of mechanical tests by the Surveyor, on the basis of compliance with the Material, Machinery, and Equipment Certification (MMEC) Program administered by the American Bureau of Shipping Level II Assessment—Quality Assurance Criteria (Supplement S-3) for Container Corner Castings.

14.3 Definitions

The following definitions for symbols and terms regarding container corner castings are used throughout this section.

14.3.1 Heat

A heat is the quantity of steel made from a single pouring.

14.3.2 Heat Treatment Lot

Heat treatment lot is the quantity of casting from the same specification subjected to the same heat treatment at the same time.

14.5 Certification Application

Prior to commencement of manufacture, the application is to be submitted in triplicate for each design to be certified and is to include the following:

Material specifications including chemical composition and mechanical properties
Manufacturing process
Detail drawings
Test agenda

14.7 Process of Manufacture

The steel is to be made by the open-hearth, electric furnace, or basic oxygen process. Other processes of manufacture will be specially considered.

14.9 Heat Treatment

All castings are to be either fully annealed, normalized, or normalized and tempered.

14.11 Material Specifications

Corner castings are to be made of carbon steel according to the chemical and mechanical properties listed in 14.11.2 and 14.13.3. Other material specifications submitted for certification of corner castings will be specially considered.

14.11.1 Chemical Analysis

An analysis of each heat of steel is to be made by the manufacturer to determine the percentages of the elements specified below. The chemical analysis is to be made from a sample taken during the pouring of the heat. If drillings are to be used from a finished casting, they are to be taken not less than 6 mm (¼ in.) beneath the surface. The chemical composition thus determined is to conform to the requirements prescribed in Section 14.11.2. Chemical analysis certificates are to be provided to the Surveyor.

14.11.2 Chemical Requirements:

Composition (maximum percent)				
Carbon	*Manganese*	*Silicon*	*Sulfur*	*Phosphorus*
0.25	1.20	0.80	0.06	0.05

The manganese may exceed 1.20% provided that the carbon content plus one-sixth of the manganese content does not exceed 0.45%.

14.13 Tension Test

One tension test is to be performed on a specimen from each heat treatment lot. The tension test is to be performed in accordance with the American Society for Testing and Materials (ASTM) Standard A 370—Mechanical Testing of Steel Products, or equivalent. The mechanical properties thus determined are to conform to the requirements specified in Section 14.13.3.

14.13.1 Tension Test Specimen

Test bars are to be poured in special blocks, similar to those shown in ASTM A 370, from the same heat as the casting represented, and are to be heat treated in production furnaces to the same procedure as the castings they represent. Alternatively, test coupons may be cut from the heat treated castings or cast integrally. Test specimens are to be machined to the form and dimensions shown in ASTM A 370. If any specimen is machined improperly or if flaws are revealed by machining or during testing, the specimen may be discarded and another substituted from the same heat treatment lot.

14.13.2 Retests

If the results of the mechanical tests do not conform to the requirements specified, heat-treated castings may be reheat-treated and retested, but not more than twice.

14.13.3 Tensile Properties:

Minimum tensile strength	450 N/mm^2 (65 ksi)
Minimum yield strength	240 N/mm^2 (35 ksi)
Minimum elongation in 50 mm (2 in.)	22%
Minimum reduction in area	30%

14.13.4 Charpy Impact Test

Charpy impact test properties are to be determined on each heat from a set of three Charpy V-notch specimens made from a test coupon in accordance with ASTM A 370, and tested at a test temperature of –20°C (–4°F). The acceptance requirements are to be the value of energy absorbed. The minimum average absorbed energy value of three specimens is to be 20 Joules (15 ft lb), with not more than one value permitted to fall below the average minimum and no value permitted below 13 Joules (10 ft lb).

14.15 Inspections

14.15.1 Dimensional Inspection

Each casting is to be inspected by the manufacturer to insure compliance with the dimensional requirements of Section 6. Satisfactory records of such inspection are to be available to the Surveyor.

14.15.2 Visual Inspection

Each casting is to be inspected by the manufacturer for general appearance and surface defects. The castings are to be free from defects. Satisfactory records of such inspections are to be available to the Surveyor.

14.15.3 Internal Discontinuities Examination

One casting from each 400 (50 sets) are to be examined by the manufacturer for internal discontinuities using either radiographic or ultrasonic methods.

a ***Radiographic Examination*** Castings are to be examined for internal discontinuities by means of X-ray or gamma rays. The procedure is to be in accordance with ASTM Recommended Practice E 94 and Method E 142. The types and degrees of discontinuities considered are to be judged by ASTM Reference Radiograph E 446. Basis for acceptance is to be as follows:

Nature of Defects	*Radiographic Acceptance Criteria*
Blow holes	Level 4
Inclusions	Level 4
Shrinkholes category CA, AB, CC, or CD	Level 3
Cracks	None
Quench cracks	None

b ***Ultrasonic Inspection*** Castings are to be examined for internal discontinuities by means of ultrasonic inspection. The inspection procedure is to be in accordance with ASTM Specification A 609. Methods of testing and basis of acceptance are to be agreed upon.

14.17 Marking

Each corner casting will be identified with the foundry identification mark and AB to signify compliance with the Rules.

Section 15 Certification of Container Chassis

15.1 General

A marine container chassis is a vehicle built specifically for the purpose of transporting a marine cargo container, so that when the container is placed upon the chassis, the unit produced serves the same function as a full semitrailer. Examples of different types of chassis are shown in Figures 15.2 through 15.6.

This section provides the requirements for the interface between marine containers and the container chassis. This section does not provide requirements for flatbed trailers or trucks used for the transport of containers.

The certification of chassis will be to the requirements contained herein or other approved specifications based upon the submission and review of design plans, material specifications, and a quality control program. Approval is also based on the satisfactory completion of the prototype tests in 15.15.1 through 15.15.19, the production tests in 15.15.1 through 15.15.6, and the survey of each chassis. Certification will be to the gross vehicle weight rating (GVWR) specified by the applicant.

The GVWR may be higher than weights which can be legally transported over any highway. It is the operator's responsibility to check the maximum combined vehicle weight for the country or state of operation and to operate within that limit. To assist clients in determining the allowable GVWR for a particular country we have reprinted tables published by the International Road Federation that detail the limits of motor vehicle sizes and weights for most countries. (See Appendix C).

The GVWR is the rated structural capacity of the chassis, including the tare weight of the chassis being supported by the kingpin and axle(s) with the load uniformly distributed over its cargo bearing area. The GVWR is to be specified in kilograms or pounds. It is the manufacturer's responsibility to designate a GVWR limited by the component with the lowest working rating. Consideration is to be given to the ratings of the suspension system, tires, rims, bearings, hubs, axles, brakes, subframe, etc. Consideration of environmental and operational factors may require the manufacturer to reduce the nominal rating of the components or the chassis. The GVWR represents the load that may be continually sustained by the components in the system.

15.1.1 Specifications

The chassis manufactured in accordance with the requirements specified herein will conform to the standards, requirements, and recommended practices, of the following codes at the time of manufacture:

American National Standards Institute (ANSI)
International Organization for Standardization (ISO)
Truck Trailer Manufacturers Association (TTMA)
Society of Automotive Engineers (SAE)

To assist manufacturers, the Association of American Railroads Specification M-943-80, Container Chassis for TOFC Service is shown in these Rules in Appendix B.

Engineering information provided herein notwithstanding, the manufacturer shall remain solely responsible for the design and performance of the chassis in its intended service.

15.1.2 Chassis Built Under Survey

Chassis which have been built to the full requirements of the Rules, and to the satisfaction of the Surveyors to the Bureau, will be certified and distinguished by the Emblem shown in Figure 15.1.

15.1.3 Chassis Not Built Under Survey

Individual existing chassis which have not been built to the requirements of these Rules, but which are submitted for certification, are to be subjected to testing in accordance with the requirements of these Rules. Where found satisfactory they will be certified accordingly.

FIGURE 15.1 Emblem—General Service

This is a representation of the emblem that will be affixed to each Bureau-approved marine container chassis.

FIGURE 15.2 Flatframe Chassis for Twenty Foot Container

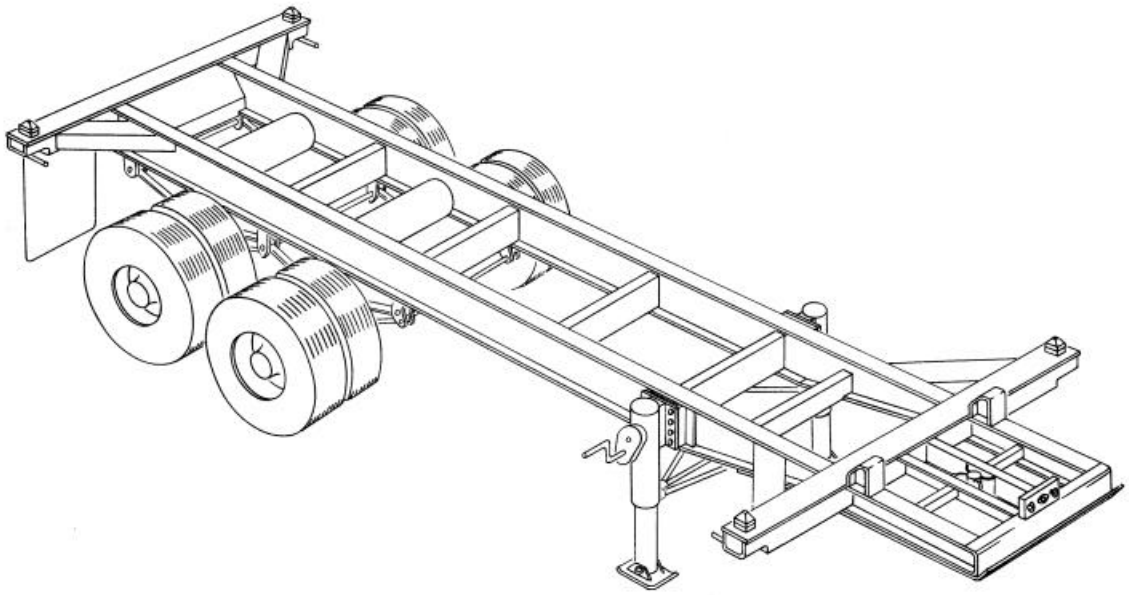
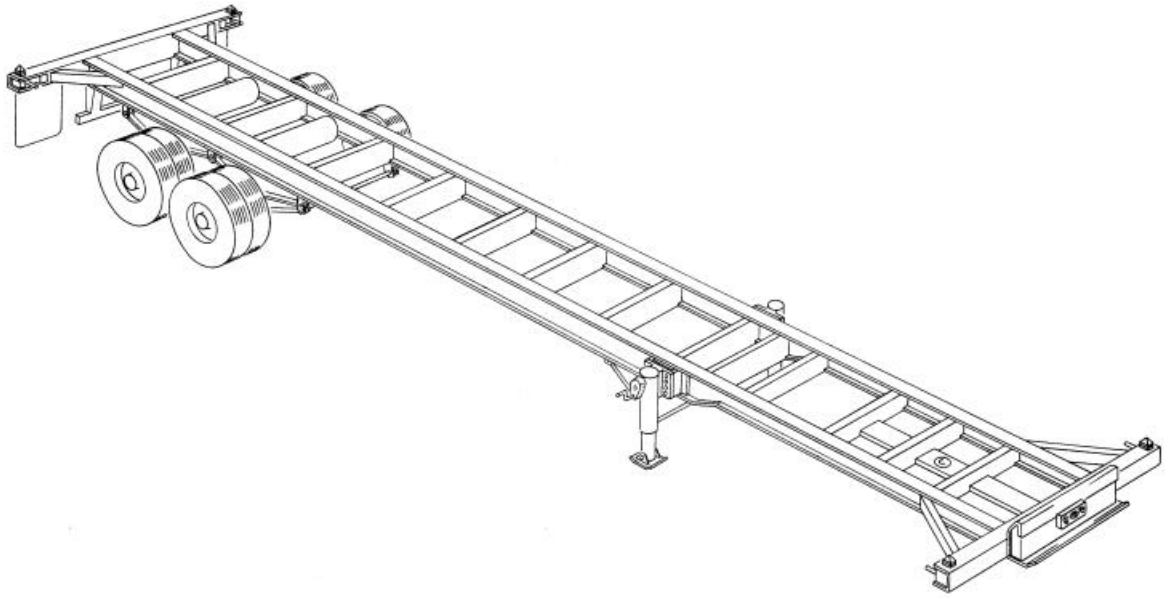


FIGURE 15.3 Flatframe Chassis for Forty Foot Container



15.1.4 Optional Inspection

When requested by an owner the Bureau may also inspect chassis in accordance with owner specifications in addition to the inspection required by the Rules for certification.

15.1.5 Loading, Handling and Securing

These Rules are published with the understanding that the responsibility for securing a chassis and for the reasonable handling and loading of chassis including the avoidance of weight distributions which are likely to set up abnormally severe stresses, does not rest upon the Committee, or the Bureau.

15.1.6 Application for Certification

The application* for the certification of chassis by design series is to include a statement that the equipment will be built in conformance to approved plans; that they will be manufactured under a quality control program acceptable to the Bureau; that they will be available for inspection during manufacture and testing; and that they will be tested in accordance with prescribed procedures. The application is also to affirm that changes in design, materials, or fabrication methods will not be made without written approval from the Bureau.

15.1.7 Certification by Design Series

For the application of each design series to be certified, plans and data including at least the following are to be submitted:

Application/Chassis data/Material identification—four copies
Welding procedures—four copies
Specified torque for fasteners—four copies
Drawings—four copies each
- General arrangement
- Sub-assemblies
- Details of components
- Markings and data plates

Test agenda—four copies
Quality control procedures—a one time requirement for each manufacturing facility.

15.1.8 Certification of an Approved Design Series

For the certification of additional units of an approved design series, the submittal is to include at least the following:

Application form
Chassis Data—one copy
Marking Drawing—four copies only if owner has changed

15.1.9 Design Changes

When changes are being made to an application* or to an approved design series, the applicant is to submit at least the following:

Chassis Data—one copy
General Assembly, sub assembly, and detail drawings, showing any revision from original design—four copies
Marking Drawing—four copies only if owner has changed

All changes will be reviewed. If the modifications are deemed significant, retesting of those parts of the chassis affected by the modification may be required.

15.1.10 Application for Certification of Existing Units

Any owner of an existing chassis may apply to the Bureau for certification. The application is to include the date of manufacture, the manufacturer's serial number, the operating number, the GVWR, and a test agenda which identifies the load values to be used during the testing of the chassis.

15.1.11 Certification to Other Requirements

When the application includes a request for certification to governmental requirements, international conventions, or other standards, the submittal is to include the necessary information required for the reviews.

15.3 Construction

The manufacturer is responsible for the quality of workmanship. The Surveyor is to satisfy himself that procedures and workmanship, as well as the material used, are in accordance with the reviewed plans and the requirements of these Rules.

*To assist clients in providing the information necessary for the certification of container chassis the Bureau has printed application forms, available upon request.

FIGURE 15.4 Gooseneck Chassis for Forty Foot Container

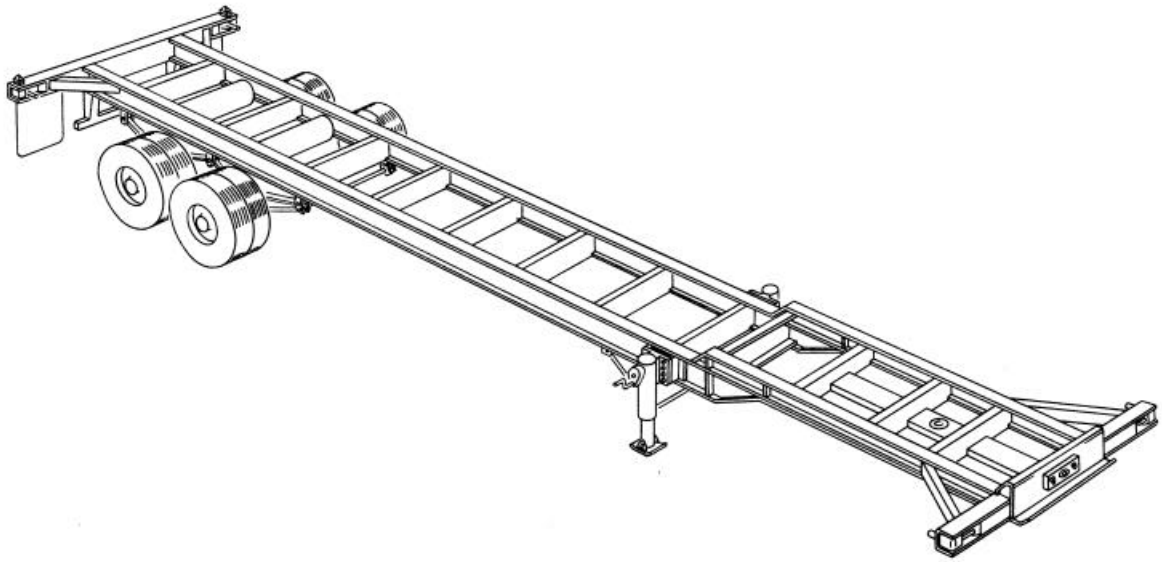
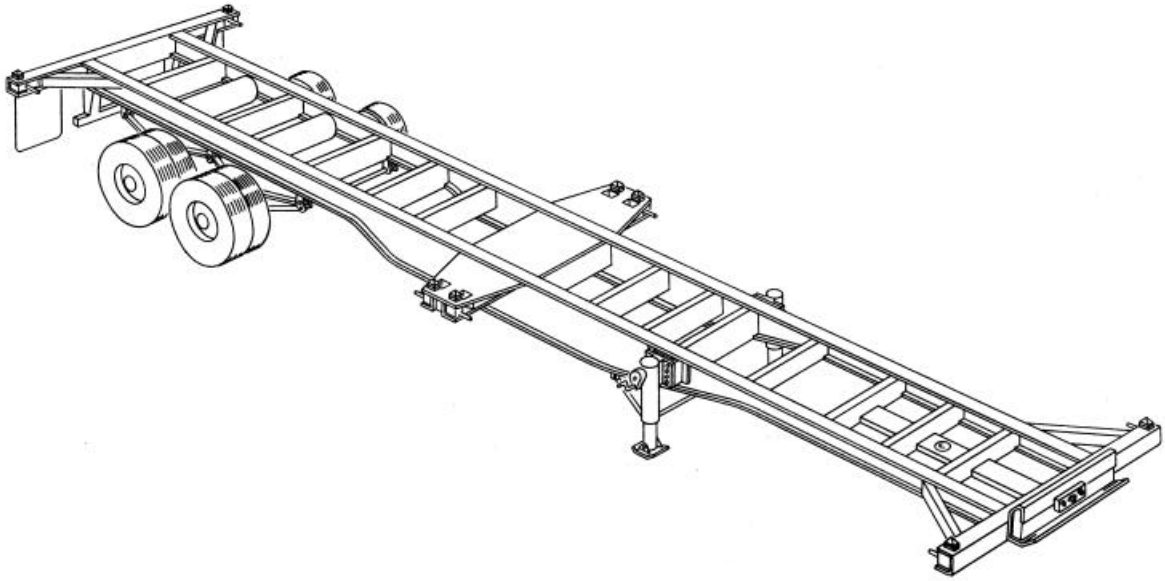


FIGURE 15.5 Combination Chassis for Twenty Foot or Forty Foot Containers



15.3.1 Material Standards

Except where specifically approved, all structural materials are to conform to an established specification. In the selection of materials due regard is to be given to established practices in the country in which the material is produced and the purpose for which the material is intended, the expected service, and the nature of construction of the chassis.

15.3.2 Quality Control Document

The manufacturer is to submit a quality control document which details those inspections and controls which are to be followed to ensure production units of quality at least equal to that of the prototype. The quality control document is to contain the information listed in paragraphs 4.1.1 through 4.1.5. It is also to contain the procedures of the production tests 15.15.1 through 15.15.6.

15.3.3 Welding

Welding is to comply with the requirements of this section unless approved otherwise. In all instances, welding procedures and filler metals are to produce sound welds that have strength and toughness comparable to that of the base material.

15.3.4 Workmanship and Supervision

The Surveyor is to be satisfied that all welders and welding operators are properly qualified and are experienced in the type of work proposed and in the proper use of the welding processes and procedures to be followed. The Surveyor is to be satisfied that a sufficient number of skilled supervisors will be employed to ensure thorough supervision and control of all welding operations.

15.3.5 Environment

Proper precautions are to be taken to ensure that all welding is done under conditions where the welding site is protected against the harmful effects of moisture, wind and severe cold. Paint or oil mist and other contaminants which tend to cause weld porosity are to be kept from the vicinity where welding is in progress.

15.3.6 Preheat

The use of preheat is to be considered when welding higher-strength steels, materials of thick cross sections, materials subject to high restraint, and when welding under high humidity or when the temperature of the steel is below 0°C (32°F). The control of interpass temperature is to be specially considered when welding quenched and tempered higher-strength steels. When preheat is used, the base metal temperature is to be in accordance with the accepted welding procedure and to the satisfaction of the Surveyor.

15.3.7 Low-Hydrogen Electrodes or Welding Processes

The use of low-hydrogen electrodes or welding processes is recommended for welding all higher-strength steel weldments subject to high restraint. When using low-hydrogen electrodes or processes, proper precautions are to be taken to ensure that the electrodes, fluxes, and gases used for welding are clean and dry.

15.3.8 Weld Soundness and Surface Appearance

All welds are to be sound and crack free throughout the weld cross section and fused to the base material. Welds are to be reasonably free from imperfections such as lack of fusion, incomplete penetration, slag inclusions, and porosity. The surfaces of welds are to be visually inspected and are to be regular and uniform with a minimum amount of reinforcement and reasonably free from undercut and overlap. Welds and adjacent base metal are to be free from injurious arc strikes. When required by an approved plan or by a specification, contour grinding is to be carried out to the Surveyor's satisfaction.

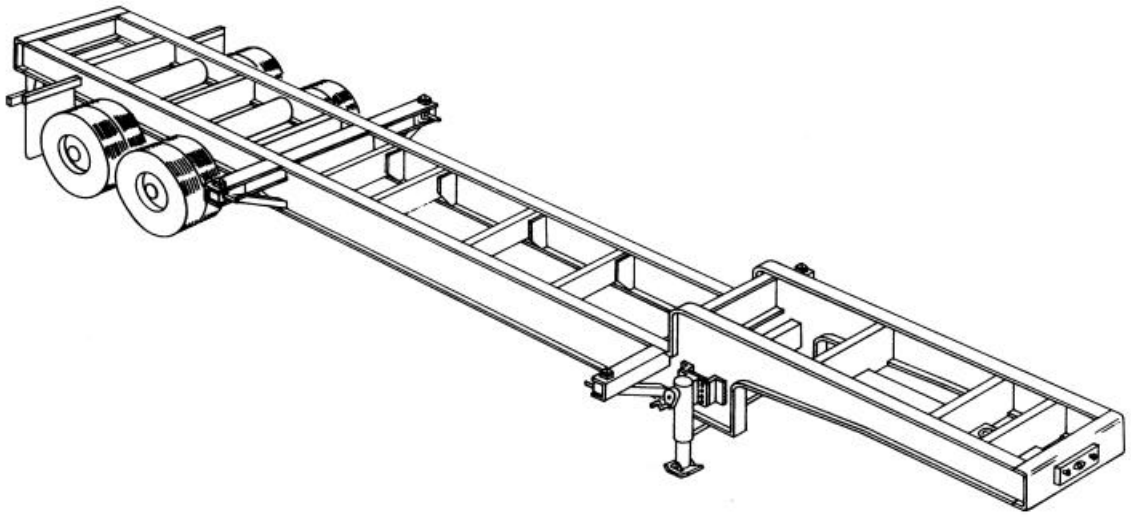
15.3.9 Repair Welding

Unsatisfactory welding as determined by visual inspection, or non-destructive test methods is to be corrected by the removal of the defective weld and/or adjacent material. The defective weld area is to be rewelded using a procedure consistent with the base material and to the satisfaction of the attending Surveyor. Removal by mechanical means of minor surface defects such as arc strikes, scratches or shallow gouges may be permitted at the discretion of the attending Surveyor.

15.3.10 Quality Control

To assure quality, sample welds may be required to be made periodically by welders and operators at the discretion of the Surveyor. Sample welds are to be made, at the location of production welding, using the same equipment, material and filler metal as intended for production. The sample welds are to be examined for workmanship and may be required to be sectioned, etched and examined for weld soundness. When necessary, measures are to be taken to correct unacceptable workmanship. The Surveyor is to be satisfied that the welders and operators are proficient in the type of work which they are called upon to perform through due consideration of the system of employment, training, apprenticeship, plant testing, inspection, etc., employed.

FIGURE 15.6 Dropped Frame Chassis for Twenty Foot Tank Container



15.5 Definitions

15.5.1 Air Brake System

A brake system which uses compressed air as a means of transmitting pressure or force from driver control to service brakes and emergency brakes.

15.5.2 Axle

Rectangular, square, or circular steel sections with spindles pressed onto the end about which wheels rotate.

15.5.3 Axle Setting

Single axle setting: the distance from the centerline of the axle to the rear surface of the chassis. Tandem axle setting the distance from the centerline, between the front and rear axles of the tandem to the rear surface of the chassis.

In some countries other than the United States the measurement is made from the centerline of the kingpin.

15.5.4 Bogie

A removable, self-contained assembly of axles, wheels, springs and suspension and brake components built specifically for use as rear wheels under a chassis. When the assembly is not removable, it is called “undercarriage” or “running gear.”

15.5.5 Bolster

A transverse structural member designed to support and hold the container in a fixed position. Examples of common types of bolsters are shown in Figure 15.7.

15.5.6 Check Valve

A device which is used to isolate automatically one part of the air brake system from another. A one-way check valve provides free air flow in one direction only. A two-way check valve permits actuation of the brake system by either of two brake application valves.

15.5.7 Drain Valve

A valve or petcock fitted to the air reservoir or other low point in the air system to allow for drainage of moisture that may have condensed in the air system.

15.5.8 Fenders

Rigid structures mounted over tires to prevent damage from debris picked up by the tires. Also known as mudguards.

15.5.9 Fifth Wheel

A device used to connect a truck tractor to a chassis in order to permit articulation between the units. It is generally composed of a trunnion plate and latching mechanism mounted on the truck tractor.

15.5.10 Front Pin Locking Device

A container securement device that, when locked, prevents the container from disengaging from the chassis. (See Figure 15.8.)

15.5.11 Glad Hands

Fittings for connection of air brake lines between vehicles.

15.5.12 Gooseneck

The forward portion of the chassis that fits into the recess, or tunnel, of containers constructed in accordance with 6.9.3. See Figure 15.9.

15.5.13 Gross Vehicle Weight Rating (GVWR)

The structural capacity of a chassis supported at the kingpin and axles with the load uniformly distributed along its length. In some countries other than the United States this includes the weight of the tractor.

15.5.14 Gross Weight

The weight of a chassis and a container with the weight of its entire contents. For the definition of gross weight relating to containers, see Section 5.

15.5.15 Harness

A set of wires used to transmit electrical power through the chassis.

15.5.16 Horn

A structural member on the front of a chassis to serve as a gathering device for guiding a container into its proper place on the chassis for securement. In transit the horn provides a mechanical stop to prevent forward movement of the container with respect to the chassis. Frequently the horn serves as a mounting place for the connection box. Also known as "container guide" or "stop." (See Figure 15.9.)

15.5.17 Kingpin

The pin on a chassis that mates with the fifth wheel of a truck tractor while coupling the two units together. See Figure 15.10.

15.5.18 Landing Gear

Devices generally adjustable in height, used to support the front end of a chassis in an approximately level position when disconnected from the towing vehicle. Also called "Supports." See Figure 15.11.

15.5.19 Landing Legs

Vertically adjustable supporting members of a landing gear to which sandshoes or wheels are attached.

15.5.20 Running Lights

Marker, clearance, and identification lights of a chassis. (See Figure 15.12.)

15.5.21 Sandshoe

A horizontal steel plate used on a landing gear (supports) which serves as the ground contact surface. Sometimes used in combination with a wheel type landing gear.

15.5.22 Semitrailer

A vehicle equipped with one or more axles and constructed so that the front end, and a substantial part of its own weight and that of its load, rests upon a truck tractor. A container chassis is a special type of semitrailer.

15.5.23 Seven-Way Plug (7-way plug; 7-way connector)

The electrical connector carrying seven circuits which transmits electrical power from the tractor to the chassis. A 6-way plug or connector contains six circuits, etc. See Figure 15.13.

15.5.24 Spring Suspension

A suspension utilizing one or more cambered steel leaves to absorb road shocks from the axles and transfer loads through suspension components to the suspension subframe.

15.5.25 Hangers

The brackets used to mount the suspension to the subframe. Made to accommodate the end of the spring.

15.5.26 Suspension

A means whereby the axle or axles of a unit are attached to the vehicle frame. Designed in such a manner that road shocks are absorbed through springs (leaf, air, torsion, or other), thus reducing the forces entering the frame. Overslung suspension is a suspension where the spring passes over the axle. Underslung suspension is a suspension where the spring passes under the axle.

15.5.27 Tare Weight

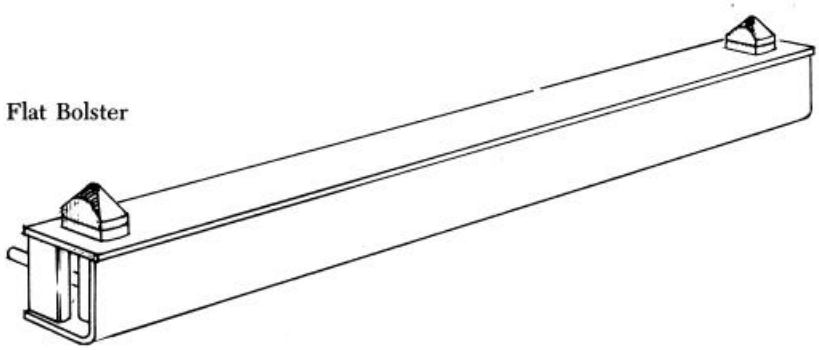
The weight of a chassis without the container.

15.5.28 Truck Tractor

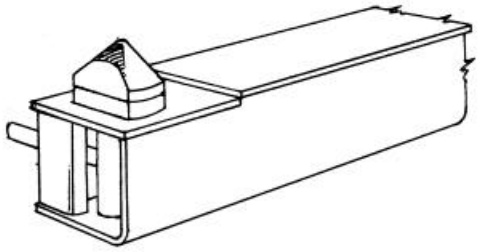
A powered motor vehicle used for pulling a chassis or semitrailer and so constructed as to carry part of the chassis weight and load.

FIGURE 15.7 Typical Bolsters

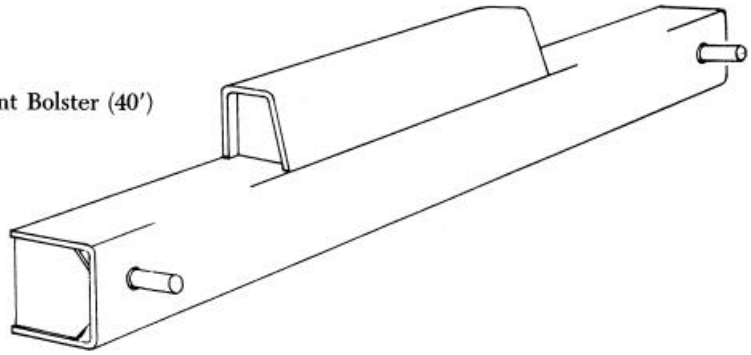
Flat Bolster



Stepped Bolster



Front Bolster (40′)



15.5.29 Twist Lock

A securement device consisting of a rotatable head and fixed collar that projects into the bottom aperture of a bottom corner fitting to prevent the disengagement of the container from the chassis when the rotatable head is in the locked position. (See Figure 15.14.)

15.5.30 Undercarriage

Consists of the complete subframe suspension, with one or more axles which may be interconnected, and wheels, tires and brakes.

15.5.31 Upper Coupler Assembly

Consists of the upper coupler plate, reinforcement framing and kingpin mounted on a chassis.

15.5.32 Upper Coupler Plate

A plate structure through which the kingpin neck and collar extend. The bottom surface of the plate contacts the fifth wheel when the chassis is coupled.

15.7 Design Considerations

The chassis is to have sufficient structural strength to remain serviceable and withstand, without significant permanent deformation, the static and dynamic loads imposed by normal service in highway, railway, and shipboard service when loaded to its GVWR. The specific design loading requirements are to be not less than those given in 15.7.1 times the GVWR. The manufacturer is responsible for designing the chassis with sufficient strength to withstand the design loads and is to include factors of safety allowing for fatigue, normal wear and tear, manufacturing fabrication techniques, and material properties. The chassis shall be operable in climate conditions varying from –45°C to 54°C (–50°F to 130°F).

15.7.1 Direction of Forces

Acceleration of forces relative to the longitudinal axis of the chassis are:

Direction	*Accelerations*
Downward	1.7G
Upward	0.5G
Lateral	0.3G
Longitudinal	3.5G

G represents the acceleration due to gravity.

The above values are for railway and road requirements. When the chassis is to be used for shipboard service, the downward acceleration of force is to be 1.8G. The acceleration of forces are assumed to act singly or simultaneously in any combination.

15.7.2 Load Transfer Areas

The chassis is to be capable of accepting the container loads in the vertical downward direction by one or more of the three possible means listed herein.

- **a** By accepting loads from the container corner fittings through the front and rear supporting bolsters in the area of the container securement devices only.
- **b** By accepting loads from the container base structure through the chassis main frame in area specified as the load transfer zones in Figure 6.2.
- **c** By any combination of the above.

15.7.3 Container Securing Devices

The chassis is to be capable of absorbing the lateral forces shown in 15.7.1 through the fittings (and gooseneck, when provided) mounted on one side of the chassis, acting in either direction, when the container is loaded to its maximum gross weight. The chassis is to be capable of absorbing the longitudinal forces shown in 15.7.1 through the fittings mounted on one end of the chassis, acting in either direction. The twist locks are to be capable of withstanding 2.5 times the tare weight of the chassis in a vertical upward direction. The securing devices are to restrain the container from moving laterally, longitudinally, or vertically more than 25 mm (1 in.).

15.7.4 Chassis Securing Points

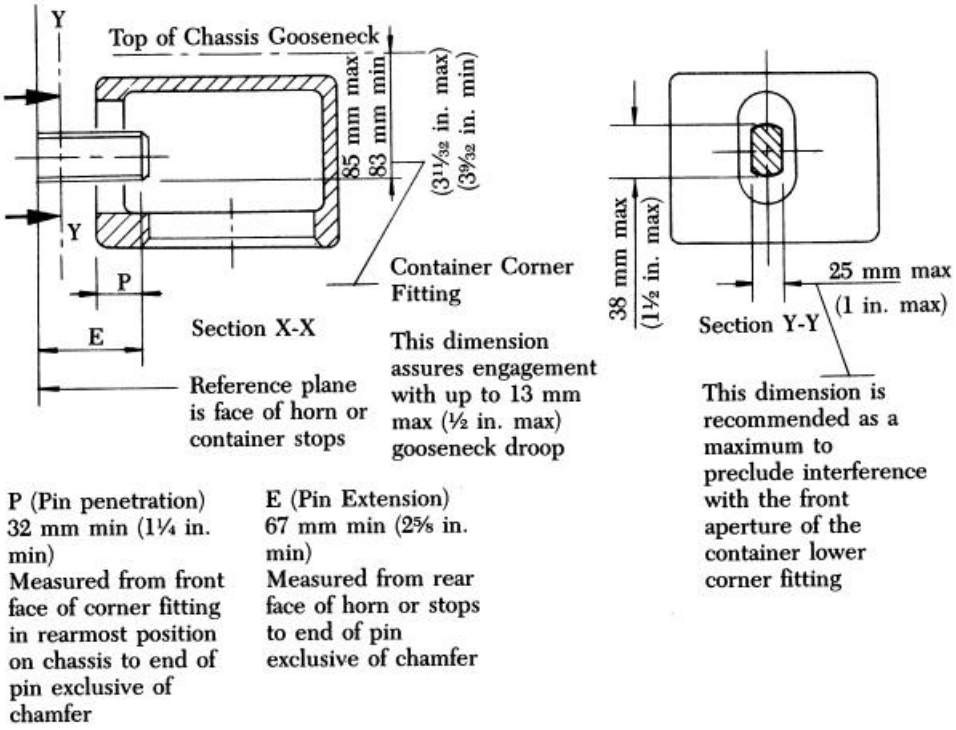
Securing points on chassis (see Figure 15.15), when provided, are to be designed for the purpose of securing the chassis to the ship's deck and are to have an aperture or apertures each capable of accepting only one lashing. The securing point should permit varying directions of the lashing to the ship's deck. If more than one aperture is fitted to one securing point, each aperture is to have the same strength as is required or the securing point in the table below. The same number of securing points are to be provided on each side of the chassis, the minimum number being two, the maximum is six.

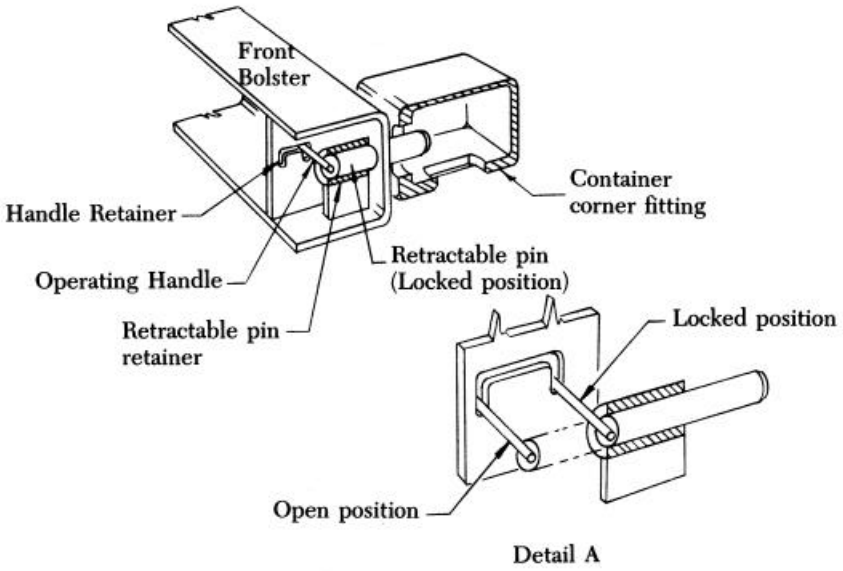
The minimum required strength for each securing point is to be determined by the following formula:

$$Sr = \frac{GVWR \times 10 \times 1.2}{n}$$

Sr = minimum required strength for each securing device
GVWR = the Gross Vehicle Weight Rating
n = the minimum number of securing points on one side of the chassis

FIGURE 15.8 Front Pin Locking Device





Securing points should be capable of transferring the load from the lashings to the structure of the chassis. Securing points are not to be fitted to the bumpers or axles of any chassis, unless these latter items are specially constructed and the loads are directly transmitted to the chassis. Securing points on chassis should be located so as to ensure an effective restraint by the lashings. Securing points should be located in positions where the lashings can be readily and safely attached. This should be taken into account, particularly where side-guards, or fenders are fitted to the chassis. The internal free passage of the aperture should be not less than 80 mm (3 in.). The aperture need not be circular in shape. A marking in a clearly visible color should indicate each securing point on the vehicle.

15.9 Design Features

15.9.1 Container Securing Devices

Securing devices are to be provided for each container size for which the chassis is designed. All securing devices are to be capable of being locked and unlocked to the corner fittings of either a loaded or unloaded container without undue force.

The twist lock and collar of a securing device are to be in accordance with Figure 15.14. The operating handle is to be capable of rotating 90 degrees and is to be parallel with the bolster when in a locked position. The pin of a front pin locking device is to be in accordance with Figure 15.8. The locking pin is to penetrate the corner fitting 32 mm (1¼ in.) minimum when measured from the face of the front corner fitting.

The dimensions for the distance between the centers of the container securing devices, and the value of the difference of the diagonal tolerances are not to exceed those given in Figure 15.18.

15.9.2 Kingpin

A coupling pin, commonly referred to as a kingpin, is to be provided for coupling the chassis to the fifth wheel of the tractor. The location of the kingpin is to be specified by the applicant. The dimensions of the kingpin are to be in accordance with ISO 337 as shown in Figure 15.10. The kingpin is to be designed to meet the rail mode operational conditions required by AAR Specification 7-931-83, Part 4.2.3. The kingpin is to be hardened to 380–420 on the Brinell scale or equivalent.

The kingpin is to be mounted in accordance with ISO 337. Alternative methods of mounting will be considered provided they are no less effective. If the alternative method of mounting provides for welding, the process including the grade and/or specification of the electrodes is to be submitted for review.

15.9.3 Chassis Support

A chassis support is to be provided to support the chassis when it is not coupled to a truck tractor. The chassis support includes the landing gear assembly, bracing, mounting brackets, and fasteners that connect these items to the chassis.

The distance between the landing gear and the transverse center line of the kingpin, is to be specified by the applicant. Where manually operated landing gears are used, they are to be equipped with heavy duty wheels or pads (sand shoes) and heavy duty axles. The lifting capacity of both landing gear legs is to be a minimum of 17,235 kg (38,000 lbs.), with 135.6 Nm (100 ft. lbs.) of torque delivered to the input shaft.

The mounting holes for the landing gear box or plate are to be in two vertical rows 190 mm (7½ in.) apart, center to center, horizontally and 51 mm (2 in.) apart, center to center, vertically, as shown in Figure 15.16.

The landing gear leg spacing dimensions are to be a minimum of 1143 mm (45 in.) from the inside edge of the wheels or sand shoes, and a maximum of 2235 mm (88 in.) from the outside edge of the wheels or sand shoes. There is to be no cross bracing which results in less than 305 mm (12 in.) road clearance. See Figure 15.11. Chassis are not to be supported solely by their own landing legs during transport.

15.9.4 Couplers

Coupling devices i.e. glad hands, are to be provided for connecting air brake lines between the chassis and the tractor. They are to be so designed that the service brake line and emergency line brake cannot be misconnected.

15.11 Electrical System and Reflectors

The electrical system, including the connector socket, the quantity and type of lamps, the quantity and type of reflectors, are to be submitted for review. All electrical components are to meet the requirements of the government* where the chassis is intended for service. (See Figures 15.12 and 15.17.)

15.11.1 Connector Socket

The connector socket** is to be designed in accordance with paragraph 4.3 of ISO 3731 or 4.3 of ISO 3732 determined by the design voltage of the chassis. (See Figure 15.13).

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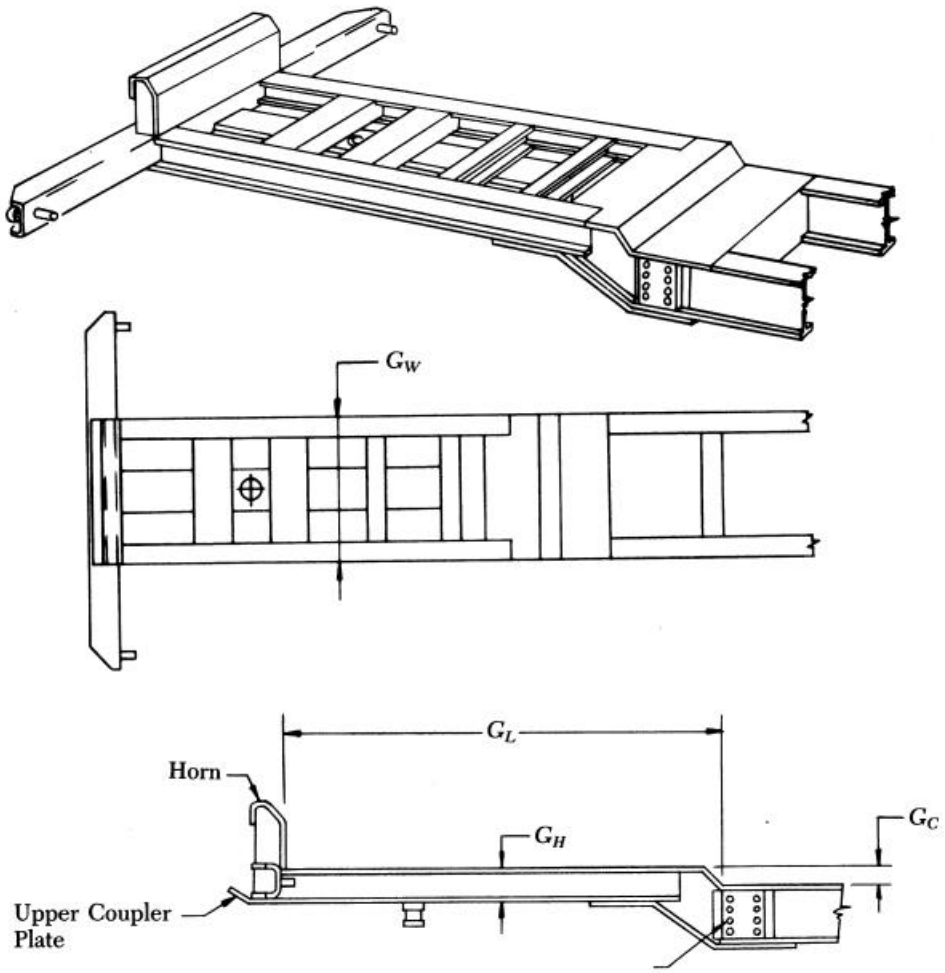
*The United States requirements for the electrical system is published by the Bureau of Motor Carrier Safety in the Code of Federal Regulations, Title 49, Part 393.

**The connector socket is to be designed to receive the connector plug, which is not part of these requirements, also shown in Figure 15.13.

FIGURE 15.9 Gooseneck



Chassis Gooseneck Dimensions

		Millimeters	Inches
Gooseneck Length	G_L	3124 Max	123 Max
Gooseneck Width	G_W	1016^{+0}_{-3}	$40^{+0}_{-Z\setminus,}$
Gooseneck Height Above Upper Coupler Plate	G_H	121 Min	4¾ Min
Gooseneck Height Above Main Frame	G_C	$121^{+0}_{-1.5}$	$4¾^{+0}_{-}$ $Z\setminus z$

The chassis gooseneck illustrated is compatible with the tunnel dimensions shown in Figure 6.5. It may not be compatible with existing non-standard tunnel type containers.

15.11.2 Wiring

A conventional seven wire cable is to be installed as shown in Figure 15.17. The wiring harness is to be made in two main sections coupled by a watertight junction box just ahead of the rear bolster. Separate harnesses from the electrical socket are to be provided inside the front bolster for the front marking lights. The harness is to be supported by grommets through the upper coupler area and secured along the main rails with non-metallic or plastic coated clips. Where the hardness passes through crossmembers, bolsters, or other steel components, rubber grommets are to be used.

15.11.3 Lamps

The quantity and location of lamps are to be as shown in Figure 15.12 or as required by the country of intended service. The lamps are to be recessed from the sides and ends of the chassis for protection.

15.11.4 Reflectors

The quantity and location of reflectors are to be as shown in Figure 15.12 or as required by the country of intended service. The reflectors are to be recessed from the sides and ends of the chassis for protection.

15.13 Testing Requirements

15.13.1 Prototype Tests

The prescribed tests, 15.15.1 through 15.15.19 are required to be performed on a prototype. The tests are to be witnessed by a Surveyor. The tests need not all be performed on the same chassis, nor sequence listed. However, the tests are not to be performed on more than two representative chassis; the dimensional check is to be done first.

When the result of any test is not satisfactory, the test is to be repeated on a minimum of two additional chassis to demonstrate satisfactorily the adequacy of the design.

15.13.2 Production Tests

The prescribed tests 15.15.1 and 15.15.6 are to be performed on each production unit. If the manufacturing operation has sufficient jigs and fixtures to control dimensions, and the quality control procedures assure their accuracy, the frequency of performing the dimensional check may be modified.

The Surveyor is to witness representative production tests during periodic visits to the plant of the manufacturer. Records of production tests are to be made available to the Surveyor during the periodic visits.

15.15 Tests

15.15.1 Dimensional Check

The chassis under test is to be measured to ensure compliance with the dimensional specifications in Figure 15.18.

15.15.2 Attachment/Fastener Fabrication Check

The attending Surveyor is to verify that all welded components and those secured by fasteners are fabricated in accordance with reviewed prints. Fasteners are to be checked for the manufacturers specified torque.

15.15.3 Kingpin Alignment Test

The kingpin is to be tested for alignment on the longitudinal and transverse centerlines. A gauge, as shown in Figure 15.19 is to be placed in contact with the upper coupler plate and slid over the kingpin. The kingpin must pass through the slot in the gauge with the top of the gauge in contact with the upper coupler plate.

15.15.4 Axle Alignment Test*

The chassis is to be placed on a level surface. The unloaded vehicle is to be rolled back and forth to avoid brake applications. The vehicle *must* be level from side to side as well as from front to rear. Remove the outer wheels or affix extenders to the axle ends to achieve a straight line from the kingpin to the axle. (See Figure 15.20.)

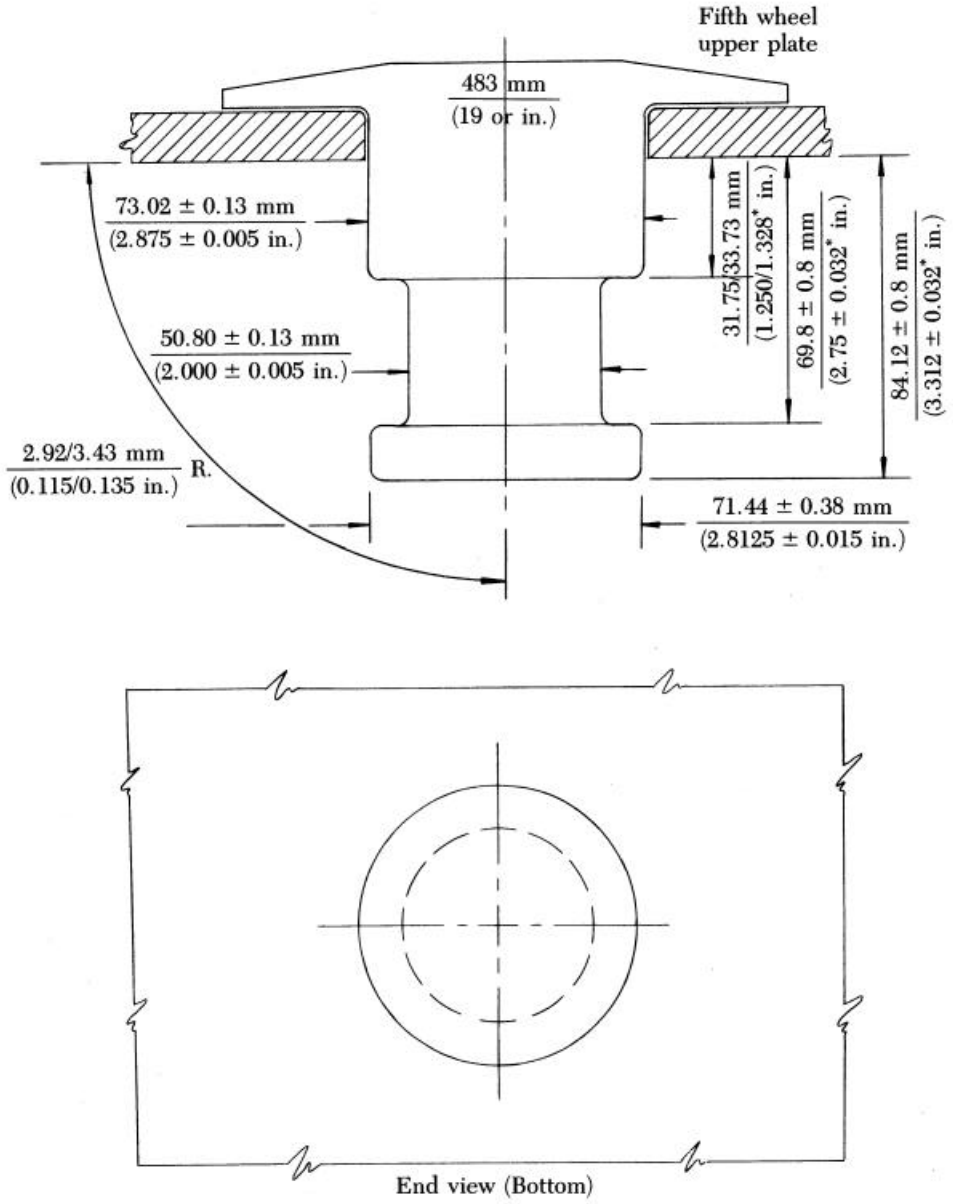
a The distance from the kingpin to the axle on both sides of the front axle are to be measured. The distances are to be equal, within 3 mm (Z\, in.).

b When tandem axles are provided the distances between axles are to be measured on both sides of the chassis. The distances are to be equal, within 1.5 mm (Z\zn in.).

c The lateral centerline of the chassis body and axles are to be determined. The distances between the centerlines should not exceed 6 mm (¼ in.).

*This test is intended as a guide for the alignment of axles on newly manufactured and rebuilt chassis and describes one procedure for measuring chassis axle alignment with simple tools. Other procedures will also be considered.

FIGURE 15.10 Fifth Wheel Kingpin



15.15.5 Electrical System Test

The chassis is to be in a normal operating position coupled to a tractor, with its electrical connector plug connected to the tractor's power supply. The chassis is to be examined for:

Installation of all wiring and connector sockets
Installation of grommets
Quantity, type and location of lamps
Operation of all lamps, i.e., running, directional, brake

15.15.6 Air Brake System Test

The chassis may be road tested for proper operation of both service and emergency brake systems. Alternatively the chassis may be tested using the procedure described below and as shown in Figure 15.21.

a The chassis couplers (glad hands) are to be connected to air lines through air line couplers. The shut-off valve in the control (service) line is to be closed. Air is to be allowed to enter through the supply (emergency) line. The air pressure is to be between 7.7 and 8.4 kg/cm^2 (110 to 120 psi). The valve in the control (service) line is to be opened and the brakes should apply.

b Close the valve in the air supply line and in the control (service) line leaving service brakes applied. The pressure at the gauges is to be recorded and held for five minutes. A drop in pressure exceeding .35 kg/cm^2 (5 psi) is considered unacceptable. The system is to be checked for leaks. If there are any, they must be repaired. Then this procedure is to be repeated until the system holds the pressure as prescribed above.

c With the valves in the air supply line and in the control (service) line closed, uncouple the control (service) glad hands. The air in the control (service) line will exhaust into the atmosphere. The brakes should release. The drain cock in the supply line is to be opened and the pressure is to be allowed to drop gradually, the relay emergency valve should function and apply the brakes.

d After the air in the supply (emergency) line of relay emergency valve systems is exhausted, there is to be no air flowing out of the exhaust port of the drain.

The drain cock in the supply (emergency) lines is to be closed. The valve in the air supply line is to be opened. The brakes, which were applied in the emergency application, should release.

15.15.7 Kingpin and Upper Coupler Assembly Test

The chassis is to be placed on a level asphalt or concrete surface. The landing gear legs are to be extended to maintain the chassis in a level position. A container is to be placed on the chassis and secured with the chassis own container securing devices. The container is to be loaded with an evenly distributed load. The weight of the container with its load, plus the chassis is to equal the GVWR. A tractor is to couple its fifth wheel with the kingpin of the chassis. The approach and coupling is to be sudden. The tractor is to be moved 3 m (10 ft) forward, returned to its starting position and uncoupled from the chassis. The test is to be done three times. The first test is to be with the tractor in line with chassis; the second approach is to be 90 degrees to the roadside; the third approach is to be 90 degrees to the curbside.

15.15.8 Grappler Lift Test

The chassis is to be placed on a level asphalt or concrete surface. The landing gear legs are to be extended to maintain the chassis in a level position. A container is to be placed on the chassis and secured with the chassis own container securing devices. The container is to be raised leaving the chassis suspended by its own securing devices. The chassis shall remain suspended for a period of not less than five minutes.

15.15.9 Chassis Landing Gear System Strength Test

The chassis is to be placed on a level asphalt or concrete surface. The landing gear legs are to be extended to maintain the chassis in a level position. A container is to be placed on the chassis resting in its normal operating position, i.e. on the four twist lock pads or two twist lock pads and its tunnel. The container is to be secured with the chassis own container securing devices. The container is to be loaded with an evenly distributed load. The container with its load, plus the chassis, is to equal the GVWR. The loaded container is to remain on the chassis for not less than five minutes.

Note: Some production plant procedures facilitate handling of in-process running gear assemblies by caging (securing the brakes in not applied position) the spring brakes on the assemblies. It is necessary, therefore, that the inspection procedure be applied after all other required system checks have been performed.

FIGURE 15.11 Landing Gear Spacing and Road Clearance

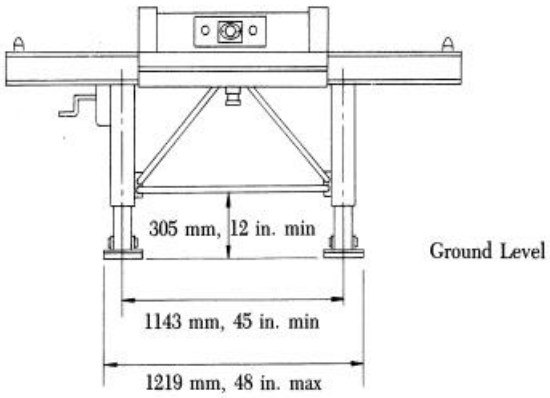
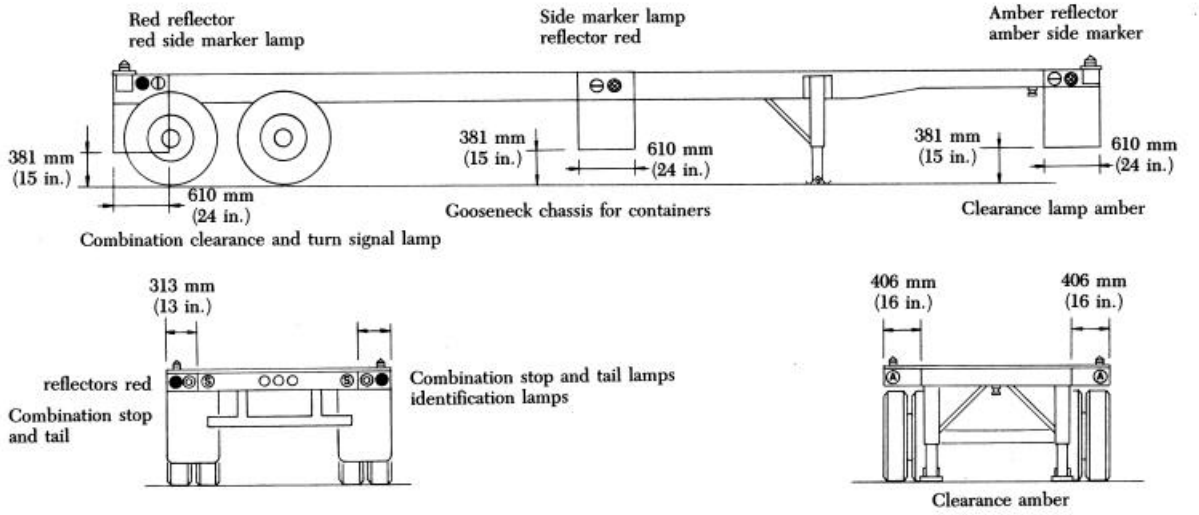


FIGURE 15.12 Lamp and Reflector Layout



Key
- ○○○ Identification lamps
- ◎ Combination clearance and turn signal lamp
- Ⓢ Combination stop and tail
- ⊗ Turn signal lamp
- Ⓓ Side marker-red
- ⊖ Side marker-amber
- ● Reflector-red
- ● Reflector-amber
- ○ Clearance-red
- Ⓐ Clearance-amber

Notes (referenced in sketches)

(1) All lamps must be marked, certified, and meet visibility requirements.

(2) A license plate lamp is also required though not shown in sketches.

(3) Side marker lamps should be located within the indicated zones shown in the sketch. DOT requires that the rear side marker lamps be not less than 15 inches nor more than 60 inches from the ground. TTMA recommends that all side markers be not less than 15 inches nor more than 60 inches from the ground.

(4) Intermediate side marker lamps and reflectors are not required on trailers less than 30 feet overall length. The overall trailer length may be computed exclusive of either the dolly or the tongue.

(5) Reflectors shall not be less than 15 inches nor more than 60 inches from the ground.

(6) Rear clearance and identification lamps on dump and opentop trailers may be located on the rear sill and be in compliance, provided this is as high as practicable.
Rear clearance and identification lamps on closed van trailers where the door opening height is less than one inch smaller than the trailer body inside height and the door header is not greater than approximately two inches with less than one inch of available space for mounting lamps may be located on the rear sill and be in compliance, provided this is as high as practicable.

(7) Front clearance lamps must indicate extreme width even if this location is not at the top or front of the trailer in the case of a small diameter tank, the proper location would be on front of rear fenders.

(8) Front clearance lamps are not required at top on removable front bulk-head. Mounting must be on rigid part of front member. Front clearance lamps may be mounted at the frame level on platform trailers with permanent front bulk-heads if a higher mounting would reflect into the drivers eyes by way of the side view mirror.

15.15.10 Chassis Support Strength Test

The chassis is to be placed on a level asphalt or concrete surface. The landing gear legs are to be extended to maintain the chassis in a level position. A container is to be placed on the chassis and secured with the chassis own container securing devices. The container is to be loaded with an evenly distributed load. The weight of the container with its load, plus the chassis, is to equal 1.7 times the GVWR. The front of the chassis to be supported by a tractor or other device, but the kingpin is not to be engaged. The chassis front is to be elevated until the landing gear support legs are 50 to 100 mm (2 to 4 in.) above the test surface then lowered until the complete load is reimposed gradually on the chassis support.

15.15.11 Drop Test

The chassis is to be placed on a level asphalt or concrete surface. The landing gear legs are to be extended to maintain the chassis in a level position. A container is to be placed on the chassis and secured with the chassis own container securing devices. The container is to be loaded with an evenly distributed load. The weight of the container with its load, plus the chassis, is to equal the GVWR. The front end of the chassis is to be elevated by a tractor until the support legs are 90 mm (3½ in.) above the test surface. The tractor is not to engage the kingpin but is to extend under the chassis the minimum distance required to support the chassis in a static condition. The tractor is to be accelerated abruptly permitting the chassis to drop and the landing gear to impact on the asphalt or concrete surface. This test is to be repeated ten times.

15.15.12 Landing Gear Bracing Test, Longitudinal

The chassis is to be placed on a level asphalt or concrete surface. The chassis is to be empty and coupled to a tractor or otherwise secured to withstand the forces to be applied. The landing gear legs are to be extended to maintain the chassis in a level position.

A force equal to 6350 kg (14000 lb) is to be applied simultaneously to each of the extended landing gear legs. The force is to be applied parallel to the longitudinal axis of the chassis at midpoint on the centerline of the axle of the landing gear shoe. The force is to be applied first toward the rear of the chassis and then toward the front of the chassis.

In each case the force is to be held for not less than five minutes.

15.15.13 Landing Gear Strength Test, Longitudinal

The chassis is to be placed on a level asphalt or concrete surface. The chassis is to be empty and coupled to a tractor or otherwise secured to withstand the forces to be applied. The landing gear legs are to be extended to maintain the chassis in a level position.

A 5,900 kg (13,000 lb) horizontal force is to be applied parallel to the longitudinal axis of the chassis at midpoint on the center line of the axle of the landing gear. The force is to be applied first toward the front of the chassis and then toward the rear of the chassis. The force is to be held for not less than five minutes. Upon removal of the force, the torque delivered at the input shaft to extend or retract the legs is not to exceed 135.6 Nm (100 ft lb).

This test may be waived if: test 15.15.12 Landing Gear Bracing Test, Longitudinal, was conducted with the landing gear in place; and tubes simulating the landing gear were not used; and the results of the test are considered satisfactory.

15.15.14 Landing Gear Bracing Test, Lateral

The chassis is to be placed on a level asphalt or concrete surface. The chassis is to be empty and coupled to a tractor or otherwise secured to withstand the forces to be applied. The landing gear legs are to be extended to maintain the chassis in a level position.

A force equal to 9,075 kg (20,000 lb) is to be applied to the landing gear legs parallel to the transverse axis of the chassis. The force is to be applied to the extended legs on the centerline of the axle of the landing gear shoe. The force is to be divided with 5,900 kg (13,000 lb) being applied inward and 3,175 kg (7,000 lb) being supplied outward simultaneously.

15.15.15 Landing Gear Strength Test, Lateral

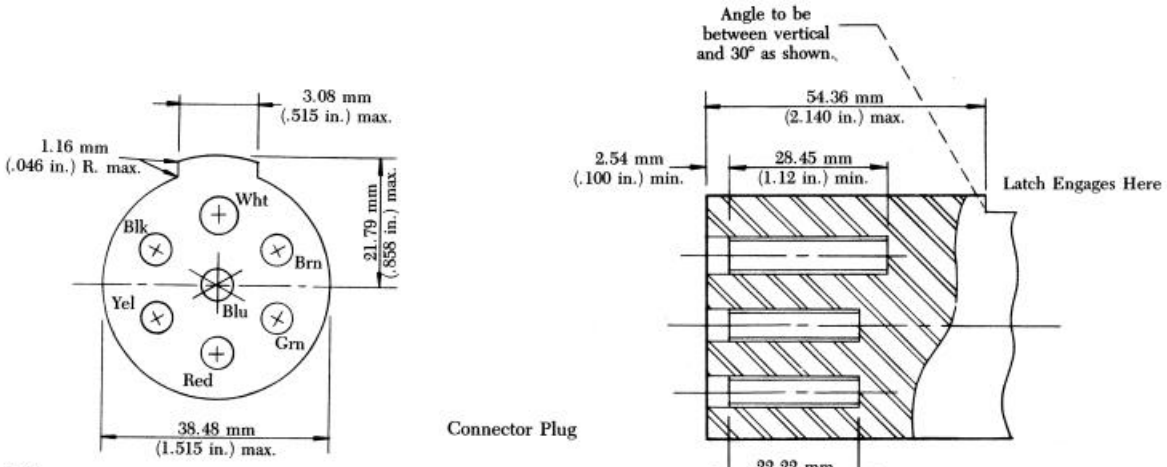
The chassis is to be placed on a level asphalt or concrete surface. The chassis is to be empty and coupled to a tractor or otherwise secured to withstand the forces to be applied. The landing gear legs are to be extended to maintain the chassis in a level position.

A force equal to 5,900 kg (13,000 lb) is to be applied to the landing gear legs parallel to the transverse axis of the chassis. The force is to be applied inward at the centerline of the axle of the landing gear shoe.

The force is to be held for not less than five minutes. Upon removal of the force, the torque delivered at the input shaft to extend or retract the legs is not to exceed 135.6 Nm (100 ft lb).

Note: If the landing gear legs are provided with wheels instead of sand shoes, the force is to be applied 25 mm (1 in.) above the bottom of the leg.

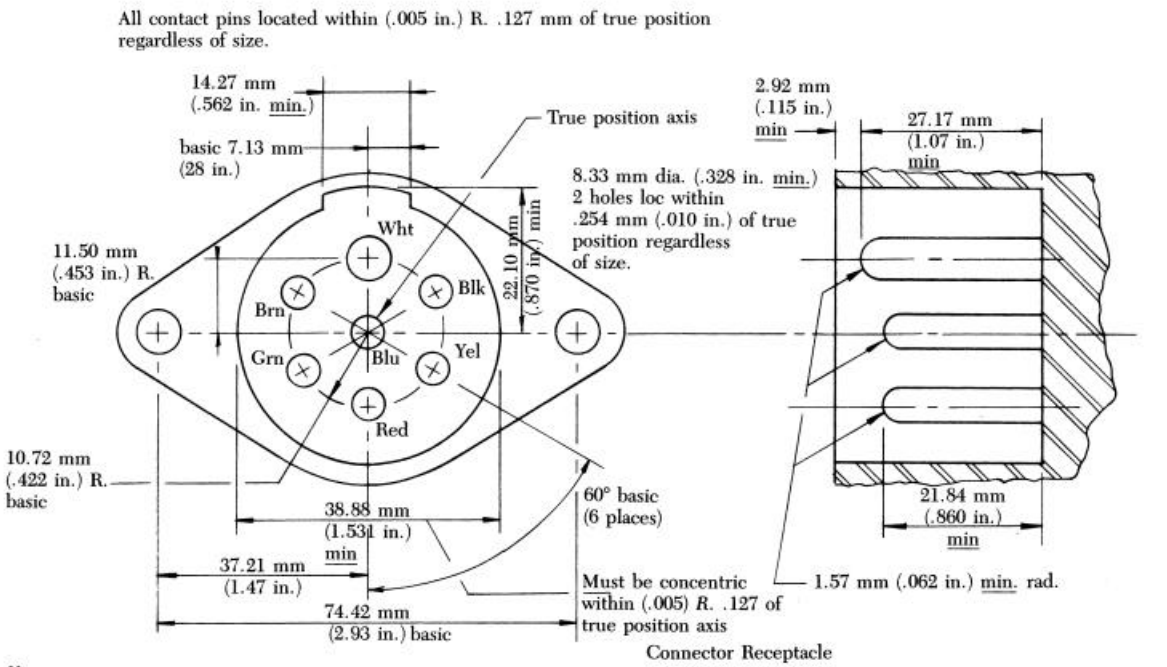
FIGURE 15.13 Seven Conductor Electrical Connector



Note

1 The contacts are identified when looking into the open end of the connector plug, actual marking should appear on terminal end. All dimensions in parenthesis are inches.

Conductor Identification	*Wire Color*	*Lamp and Signal Circuits*
Wht	White	Ground return to towing vehicle
Blk	*Black	Clearance, side-marker, and identification lamps
Yel	Yellow	Left-hand turn signal and hazard signal lamps
Red	Red	Stop lamps and antilock devices
Grn	Green	Right-hand turn signal and hazard signal lamps
Brn	*Brown	Tail, clearance, side-marker lamps and license plate lamps
Blu	Blue	Auxiliary



Notes

1 External contact no. 1¼$^{+.002}_{-.005}$ round (6.35$^{+.015}_{-.127}$)

2 External contacts no. 2-thru-7 inclusive $^{3}/_{16}{}^{+.002}_{-.005}$ round (4.75$^{+.051}_{-.127}$)

3 The contacts are identified when looking into the open end of the insert. Actual markings should appear on terminal end. All dimensions in parenthesis are millimeters.

15.15.16 Landing Gear Strength Test, Vertical

The chassis is to be placed on a level asphalt or concrete surface. A container is to be placed on the chassis. The container is to be secured with the chassis own securing devices. The landing gear legs are to be extended to maintain the chassis in a level position. The container is to be loaded to a landing gear axle weight of 31,750 kg (70,000 lb).

The load is to be held for not less than five minutes. Upon removal of the load, the torque delivered at the input shaft to extend or retract the legs in low gear is not to exceed 135.6 Nm (100 ft lb).

15.15.17 Landing Gear Strength Test, Component

The chassis is to be placed on a level asphalt or concrete surface. The landing gear legs are to be extended to maintain the chassis in a level position. A container is to be placed on the chassis. The container is to be secured with the chassis own securing devices.

The container is to be loaded to a landing gear axle weight of 1.5 times the landing gears rating. The legs are to be retracted 76 mm (3 in.) and then extended 76 mm (3 in.).

Upon removal of the load, the torque delivered at the input shaft to extend or retract the legs in low gear is not to exceed 135.6 Nm (100 ft lb).

15.15.18 Landing Gear Strength Test, Lifting

The chassis is to be placed on a level asphalt or concrete surface. A container is to be placed on the chassis. The container is to be secured with the chassis own securing devices. The landing gear legs are to be extended 370 mm (14½ in.) or until the chassis is level. The container is to be loaded to a front axle weight equal to the design rating of the landing gear.

The low gear of the landing gear assembly is to be engaged. Torque is to be applied to the input shaft to extend the legs 25 mm (1 in.). The torque is to be measured at the input shaft. The average torque measured during the extension procedure is not to exceed 135.6 Nm (100 ft lb).

15.15.19 Securing Point Strength Test

The chassis is to be placed on a level asphalt or concrete surface. The landing gear legs are to be extended to maintain the chassis in a level position. The chassis is to be empty and secured to withstand the forces to be applied.

1. The securing ring is to be measured. The dimensions are to be within the minimum and maximum dimensions shown.

2. A force equal to the GVWR times 10 times 1.2 divided by the total number of securing points on each side of the chassis is to be applied in tension to a securing ring. The force is to be applied three times. The line of force is to be at 30°, 60°, and 90° to the longitudinal axis of the chassis, while at 60° downward to the horizontal plane.

The force is to be held for not less than five minutes. Upon removal of the force, the securing point is not to exhibit any deformation.

FIGURE 15.14 Twist Lock Securing Device

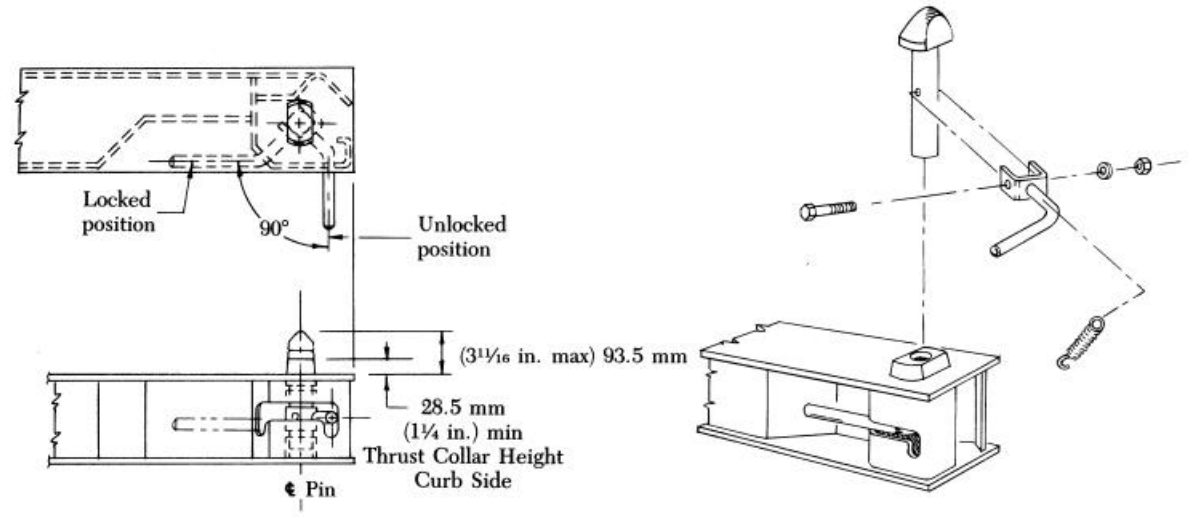


FIGURE 15.15 Chassis Securing Point

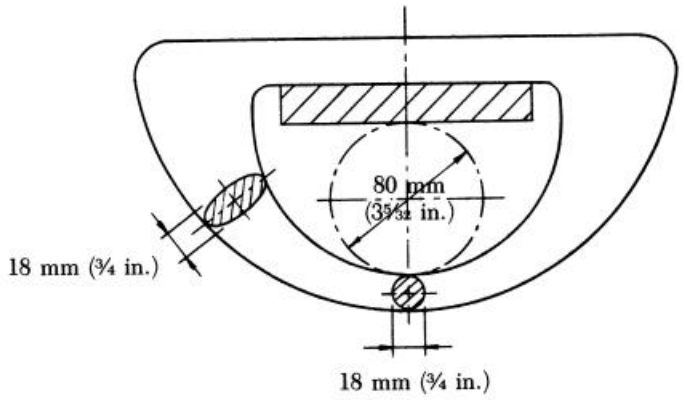


FIGURE 15.16 Mounting Hole Pattern in Landing Gear Support Bracket

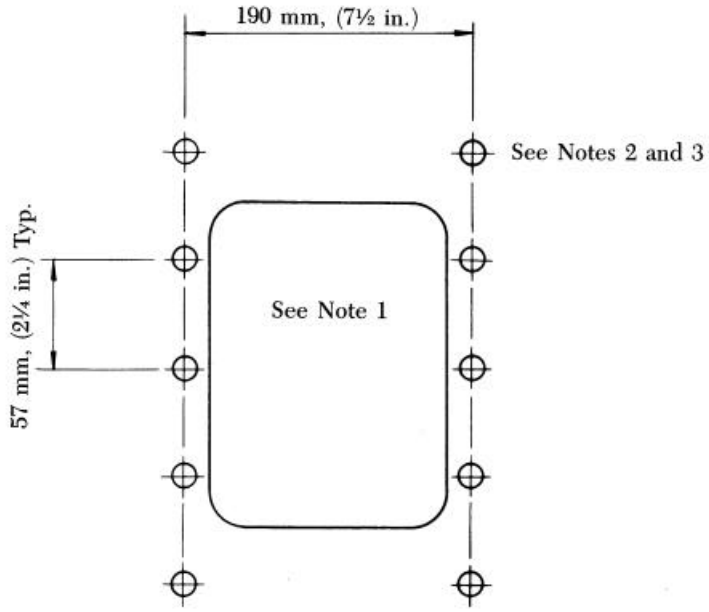
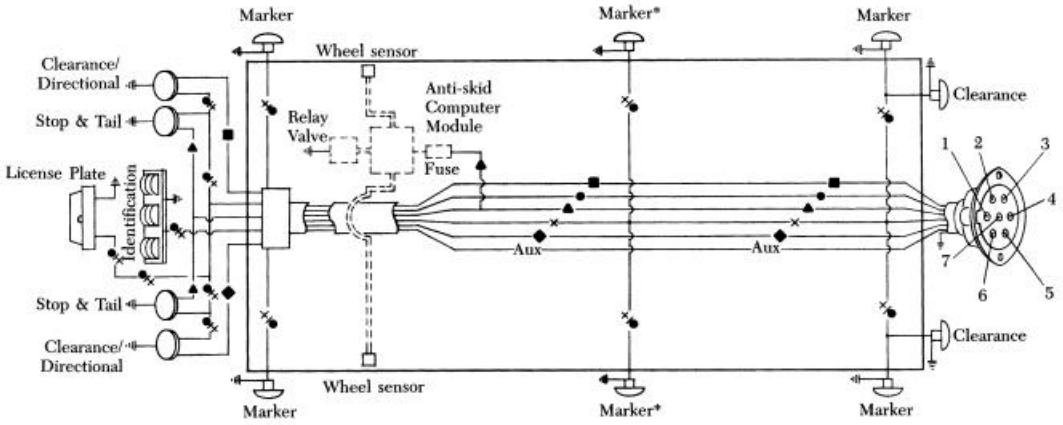


FIGURE 15.17 Electrical System Schematic

Conductor No.	*Color*	*Key*	*Lamp and Signal Circuits*
1	White	⊣⊢	Ground Return to Towing Vehicle
2†	Black	×	Clearance, Side Marker, and Identification Lamps
3	Yellow	■	Left-Hand Turn Signal and Hazard Signal Lamps
4	Red	▲	Stop Lamps, Anti-lock Devices (When Installed)
5	Green	◆	Right-Hand Turn Signal and Hazard Signal Lamps
6†	Brown	●	Tall, Clearance, Side-Marker and License Plate Lamps
7	Blue	AUX	Auxiliary, Optional Lamps, Dome, Etc.

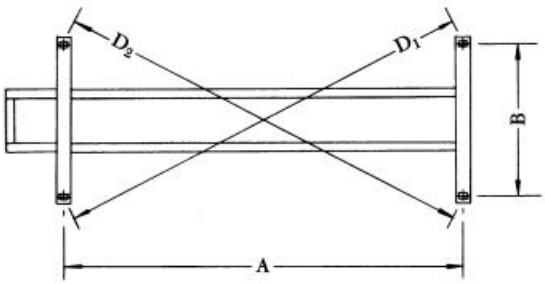


Rear Plug for Doubles Operation Only.

*Omitted on units less than 30 ft. long.

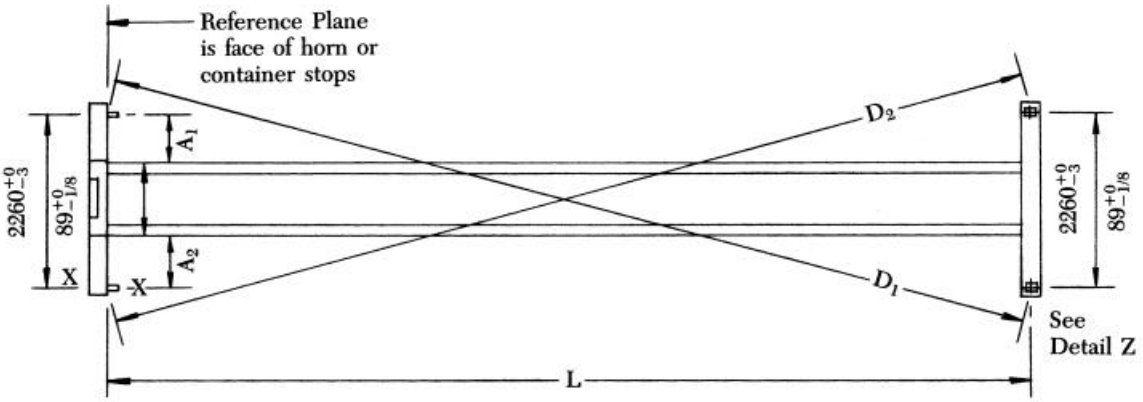
†Conductor No. 2 Black and No. 6 Brown should be balanced •/x x/• = optional.

FIGURE 15.18 Dimensional Requirements Straight Frame Chassis



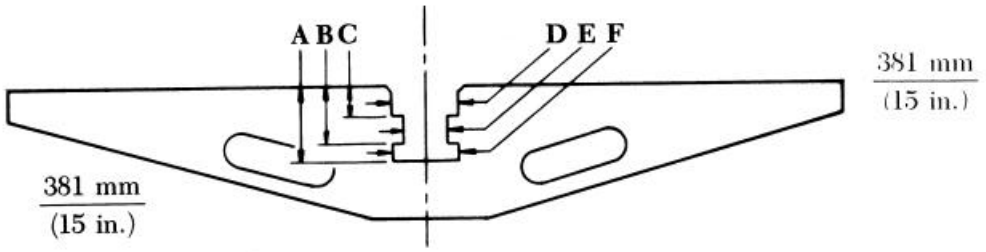
Freight Container Designation	*Length (external)* mm	ft	in.	A mm	ft	in.	B mm	ft	in.	K Max = D_1 • D_2 or D_2 • D_1 mm	in.
40-FT	12192	(40	0)	11985 ± 6	(39	3⅞ ± ¼)	2260^{+0}_{-3}	(7	$5^{+0}_{-1/8}$)	16	⅝
30-FT	9125	(29	11¼)	9818 ± 6	(29	3⅛ ± ¼)	2260^{+0}_{-3}	(7	$5^{+0}_{-1/8}$)	13	½
20-FT	6058	(19	10½)	5853 ± 6	(19	2⁷⁄₁₆ ± ¼)	2260^{+0}_{-3}	(7	$5^{+0}_{-1/8}$)	10	⅜
10-FT	2991	(9	9¾)	2787 ± 6	(9	1²³⁄₃₂ ± ¼)	2260^{+0}_{-3}	(7	$5^{+0}_{-1/8}$)	6	¼

Dimensional Requirements
Gooseneck Chassis



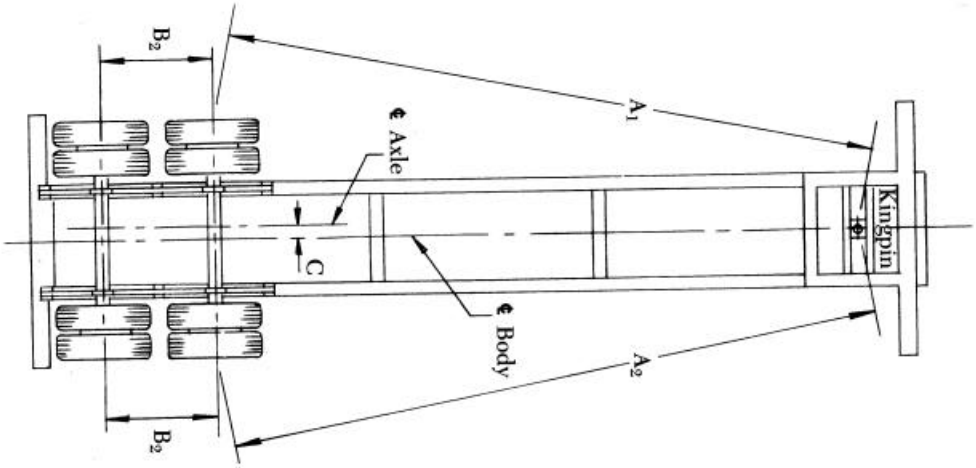
Container size mm	ft	in.	*L* mm	ft	in.	*K Max* mm	in.
12192	40	0	11985 ± 6	(39	8¼ ± ¼)	16	(⅝)

FIGURE 15.19 Kingpin Gauge



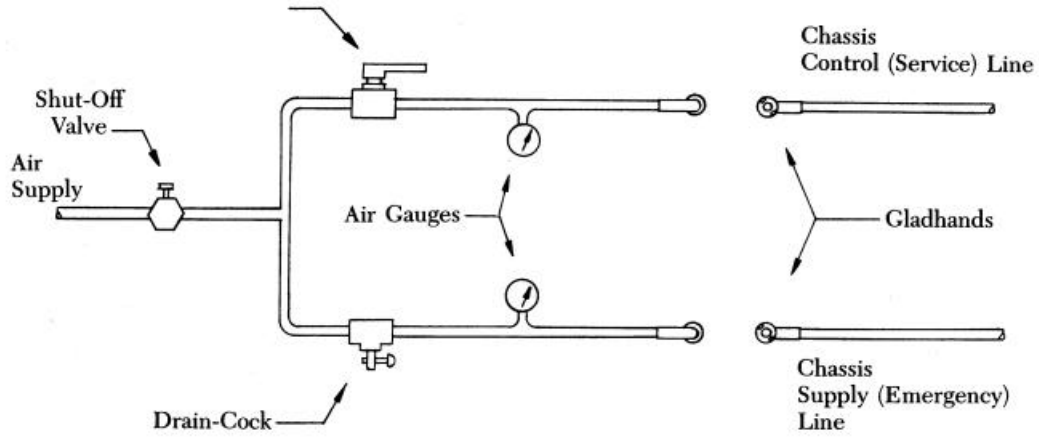
A	*B*	*C*	*D*	*E*	*F*
86.31 mm (3.398 in.)	67.59 mm (2.661 in.)	36.35 mm (1.431 in.)	74.55 mm (2.935 in.)	53.42 mm (2.103 in.)	74.78 mm (2.944 in.)

FIGURE 15.20 Axle Alignment



$A_1 = A_2, \pm 3$ mm (⅛ in.)
$B_1 = B_2, \pm 1.5$ mm (1/16 in.)
$C = <6$ mm (¼ in.)

FIGURE 15.21 Brake System Test



Appendix B Association of American Railroads Container Chassis for TOFC Service Standard Specification M-943-80

Adopted: 1974
Effective: March 1, 1981
Revised: 1975, 1977, 1978, 1980

1.0 Scope

These specifications define the design requirements for container chassis. It is not the intent of these specifications to place restrictions on the structural design methods or the use of any materials.

2.0 Objectives

These specifications are intended to provide minimum requirements for the purchase and construction of container chassis to be used for transporting domestic and international containers in both rail and highway modes of transport. Chassis certified under the specification must meet all applicable Federal, State and Association of American Railroads regulations. Chassis described herein are not suitable for the transportation of hazardous materials in tank containers.

3.0 General Description

3.1 Size

Chassis size (length and width) must conform to applicable Government regulations. Dimensional details of chassis are to be controlled to permit application, removal and locking of containers built to Section 4.2 of AAR Specification M-930 (see page 96). The combination of container and chassis design height shall not exceed 13′6″.

3.2 Weight Ratings

For purpose of strength requirements and testing under this specification, chassis are assigned design maximum gross weights for chassis and loaded containers depending on container length capacity.

Chassis capable of carrying one or more containers having combined length no greater than 20 feet are assigned 50,000 pound design maximum gross weight. Chassis capable of carrying containers with combined length greater than 20 feet are assigned 65,000 pound design maximum gross weight. For nominal container lengths and gross weights, see AAR Specification M-930, Closed Van-Type Dry Cargo Containers for COFC Service, latest revision. (See page 96).

4.0 Strength Requirements

4.1 General

4.1.1 While transporting containers in rail or highway modes or when handled in terminal operations, the chassis structure will be subjected to dynamic forces resulting from accelerations imposed by the environment. For purposes of determining general design loads, the design maximum gross weight is multiplied by the factors set forth below. The point or points of application of the resulting static forces are given in Paragraph 2. (Direction is to be taken as relative to the horizontal plane of top of chassis.)

	DIRECTION	
Vertical	**Lateral**	**Longitudinal**
1.7	**.3**	**3.5**

For the purpose of this Specification, gross container weights and maximum fully assembled chassis weights are to be utilized for all container lengths except 35 and 40 foot containers. For these containers, a chassis design weight of 6,700 pounds is to be used. Resultant container design weight to be used for design purposes is 58,300 pounds.

4.1.2 Design loads derived from the factors in Paragraph 4.1.1 are assumed to act singly or simultaneously in any combination but within the limits set by the following mutually exclusive conditions:

4.1.2.1 When in transit, either on rail cars or on the highway, chassis will be supported by the upper coupler and tires, and will be restrained laterally by the upper coupler tires, and will be restrained longitudinally through the kingpin.

4.1.2.2 When being handled in terminal operations, chassis constructed with side rails may be supported

by lifting pads which engage the underside of the side rails at four locations.

4.1.3 Specific chassis new components must meet individual strength requirements set forth in Section 4.2 of this specification. The general load factors will govern overall chassis design except where specific load factors are specific for individual structural components.

4.1.4 The design must be such that under action of the general design loads the chassis shall not exhibit permanent deformation or weakening of the structure. Where deformation of individual structural components is acceptable when components are evaluated under specific load factors, the deformation criteria is specified in paragraph stating the associated load factor.

4.1.5 Chassis to be designed to support container and restrain container at locations on container capable of withstanding imposed forces. Vertical restraint is to be achieved at container corner castings.

4.2 Strength Requirements for Individual Structural Components of Chassis

4.2.1 Longitudinal, lateral, and vertical forces tending to separate container from chassis are resisted by a system of restraints.

4.2.1.1 Lateral stops shall be provided to withstand load transverse to longitudinal centerline of chassis in horizontal plane equal to .3 times maximum gross weight of container. Force to be distributed over stops at one side only.

4.2.1.2 Longitudinal stops shall be provided to withstand longitudinal force of 2.5 times maximum gross container weight. Force to be distributed equally over stops at one end of chassis.

4.2.1.3 Securement system shall withstand 2.5 times gross chassis weight for lifting operations in terminals.

4.2.1.4 Chassis Bolsters—The loads shown in Sections 4.2.1.1 and 4.2.1.2 and the vertical load shown in 4.2.1.4.1 are assumed to act singly or simultaneously in any combination.

4.2.1.4.1 Chassis bolsters containing container locks and supporting container corner castings distribute container weight to chassis frame. Chassis bolsters containing container locks and supporting corner castings are to withstand downward vertical load equal to 1.7 times maximum gross container weight.

4.2.1.4.2 All chassis bolsters are to withstand vertical loads (upward and downward) generated by dynamic conditions specified in Section 4 of this specification. When applicable chassis bolsters are to withstand lateral and longitudinal force requirements defined in Paragraph 4.2.1.1 and 4.2.1.2 of this section. On gooseneck chassis, front horn assembly and gooseneck will be designed for applicable vertical, lateral, and longitudinal forces.

4.2.1.5 Bottom Side Rails

4.2.1.5.1 For chassis with side rails subject to lifting from the bottom by means of the arm type bottom-edge method, the lifting forces can be assumed to be imposed onto the under part of the side rail through four bearing areas (lifting shoes) at least 18 inches long and 72 square inches in area. It shall be assumed that the four bearing areas will share the load equally. It is not necessary that the chassis structure contact the entire area of the lifting shoe or bearing area. The minimum distance between bearing areas or lifting shoes on each side on the chassis will be assumed to be:

Chassis Length	Center to Center Spacing of Lifting Shoes (minimum)
15′–30′	10′
Over 30′	16′

4.2.1.5.2 To accommodate the lifting shoes, the chassis must be designed with a clear, unobstructed area, on each side, of 8″ wide starting at outer edge of side rail of container, whichever is widest and a length of 2′ less than the length of the chassis, starting 1′ in from each end of the chassis as shown in Figure No. 4-A of the AAR Specification No. M-931, Highway Trailers all types for TOFC Service, latest revision (see page 100).

4.2.1.6 **Kingpin and Upper Coupler Assembly** Kingpin and upper coupler assembly must be designed to meet operational conditions of the rail mode listed in Table 1, AAR Specification M-931 (see page 105).

4.2.1.7 **Chassis Support**

4.2.1.7.1 **General**

See AAR Specification No. M-931, Section 4.2.4.1 (see page 105).

4.2.1.7.2 **Dynamic Capacity**

4.2.1.7.2.1 Chassis support must withstand without damage 4000 cycles of application of sufficient load

to produce a combined chassis plus container gross weight equal to or exceeding the designed maximum gross weight equal to or exceeding the designed maximum gross weight specified in Table 1, Specification M-931 (see page 105).

4.2.1.7.2.2 Chassis support must withstand ten nominal 3 inch drops onto landing gear with chassis loaded to the design maximum gross weight.

4.2.1.7.3 **Static Capacity** See AAR Specification No. M-931, Section 4.2.4.4 (see page 105).

4.2.1.8 **DOT Bumper** See AAR Specification No. M-931, Section 4.2.5 (see page 106).

5.0 Structural Requirements

5.1 General

Chassis to be of configuration that permits loading and unloading container from overhead.

5.2 Interface Dimensions

5.2.1 Interface dimensions and tolerances must comply with those shown in Figures 1 and 2.

5.3 Container Restraints and Securement Devices

5.3.1 Longitudinal and lateral stops to be located on chassis to prevent container from sliding off either side or either end of chassis.

5.3.2 Stop to be located in manner that free movement of container relative to chassis does not exceed 1 inch in longitudinal, lateral, and vertical direction.

5.3.3 A securement device to be provided for each bottom corner casting of container.

5.3.4 Securement devices to prevent separation of container from chassis.

5.3.5 With securement device in locked position, engagement between lock and corner casting must be maintained under all operating conditions, including effect of wear and dimensional tolerances. Twistlock must have positive lock to prevent rotation when in locked position.

5.3.6 Horizontal pin type locks to have minimum 1¼ inch penetration into corner casting from outermost vertical surface of corner casting, with container in rearmost position on chassis. Only full vertical diameter portion of pin is considered for this requirement.

5.3.6.1 Horizontal pin lock design to provide maximum 1 inch clearance between corner casting with corner casting against forward stop and end of pin, with pin in unlocked position.

5.3.6.2 Design to provide clearance or other protection for lock pin during loading and unloading operation.

5.3.7 Securement devices must have provision to accept a railroad seal in a manner that requires breaking of seal to open lock.

5.3.8 Securement device configuration and materials to be such that constant exposure to marine and industrial atmospheres does not render lock inoperative.

5.3.9 Securement system is to have AAR approval. Drawings showing details and application, calculations and material specifications are to be submitted to the AAR for approval. Sample securement device applied to a section of chassis bolster or frame to be submitted only upon request. This information is to be submitted in sixteen (16) copies.

5.4 Upper Coupler Assembly

See AAR Specification No. M-931, Section 5.4 (see page 106).

5.5 Chassis Support

See AAR Specification No. M-931, Section 5.7 except that minimum permissible transverse spacing between landing gear wheels or shoes may be 45 inches (see page 106).

6.0 Testing

6.1 General

See AAR Specification No. M-931, Section 6.0 (see page 106).

6.2 Kingpin and Coupler Assembly

Kingpin and upper coupler shall withstand test procedures in Table II of AAR Specification M-931 (see page 97) without failure or permanent deformation that will not allow checking by kingpin gauges illustrated in Figure 8 of the AAR Specification No. M-931 (see page 102). Condition numbers in Table II of M-931 relate directly to operational data conditions in Table I of M-931.

6.3 Strength for Straddle Lifting

The chassis shall be supported equally on four liftshoes (or the equivalent), each having a bearing area of 4″ x 18″ and located as described in Section

4.1.2.2. A container loaded to produce a combined chassis plus container gross weight of 1.7 times the design maximum gross weight specified in Section 3.2 shall be placed on the chassis for this test, using the four outermost container support locations. The loaded chassis shall remain on the supports for a period of not less than 5 minutes.

6.4 Chassis Support Strength

6.4.1 **Dynamic** The chassis is to be loaded in a manner to produce a combined gross weight equal to or exceeding the design maximum gross weight specified in Section 3.2 shall be placed on the chassis for this test, using the four outermost container support locations. The loaded chassis shall remain on the supports for a period of not less than 5 minutes.

6.5 Chassis Support and Securement Device Strength

6.5.1 **Dynamic** The chassis is to be loaded in a manner to produce a combined gross weight equal to or exceeding the design maximum gross weight specified in Section 3.2. The landing gear legs are to be extended to position the kingpin support plate 46 to 48 inches above ground level. Then chassis front is to be elevated until landing gear is 2 to 4 inches above ground and lowered until complete load is reimposed gradually without impact on chassis support. This cycle is repeated 4,000 times.

6.5.2 **Drop Test** Chassis to be loaded in same manner as for Section 6.4.1 above, and landing gear legs are to be extended to same position. Then front end of chassis is to be elevated by a tractor until support legs are 3 to 3½ inches above test surface. Tractor must not engage kingpin and is to extend under chassis the minimum distance required to support chassis in a static condition. Tractor is to be accelerated abruptly and at the highest rate possible, permitting chassis to drop. Chassis support must withstand 10 nominal 3 inch drops. Chassis landing gear is to impact on an asphalt test surface which is level and smooth prior to test. Asphalt is to be 1 to 2 inches thick and laid upon a firm base, typical for supporting heavy duty paved parking areas or upon concrete or steel base.

6.5.3 **Longitudinal Strength** See AAR Specification No. M-931, Section 6.7.3 (See page 97).

6.5.4 **Lateral Strength** See AAR Specification No. M-931, Section 6.7.4 (see page 97).

6.6 Landing Gear Strength

See AAR Specification No. M-931, Section 6.8 (see page 98).

7.0 Brake System

7.1

Brake system must comply with Department of Transportation regulations.

7.2

Glad hands to be mounted on portion of structure recessed to locate glad hands flush with or recessed beyond outboard normal plane of structure. Glad hands must be replaceable without having to reach under the chassis.

7.3

Air brake lines to be accessible to permit repair with container mounted on chassis where practical.

7.4

Brake system shall be tested in accordance with Truck Trailer Manufacturers Association Recommended Practice RP No. 12-78.

8.0 Electrical System

See AAR Specification No. M-931, Section 9.0 (see page 98).

9.0 Special Features

9.1

Mud flaps to be mounted at extreme rear of chassis where possible.

9.2

Number, type, and size of reflective lenses shall meet Federal requirements.

9.3

A weatherproof container for necessary papers and documents to accompany the chassis must be attached to an accessible area of the frame on the nose end.

10.0 Certification Plaque

10.1

Chassis purchased under these specifications will be so identified by a stamped or etched Aluminum or stainless steel plate affixed to the outside surface of center beam. The plate will bear at least the words, “This chassis meets Specification M-943-00 of the Association of American Railroads and be provided by the manufacturer or owner. “00” represents the latest revision year pertinent to chassis. The certification plaque can only be applied if the trailer complies with the latest revision of the specification in

effect at the time of order. It is desirable to place all certification information on this plaque that may be required by governmental agencies. Data demonstrating that chassis is certifiable is to be furnished to purchaser and/or the AAR upon request.

11.0 Markings

Each chassis shall have name or initials of owners or lessee and chassis number applied to chassis in letters and figures not less than three inches high.

12.0 Center of Gravity

Chassis builder shall furnish purchaser with vertical center of gravity of empty complete with kingpin support plate 48 inches above tire running surface.

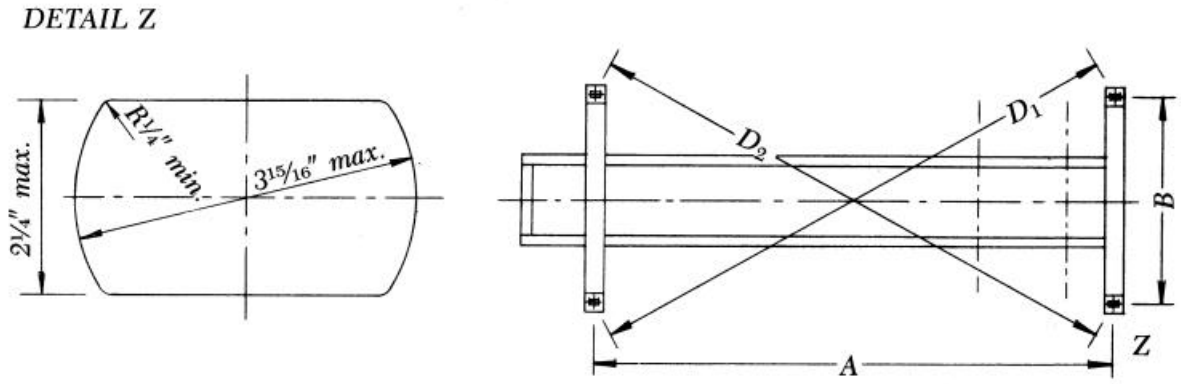
13.0 Chassis Underneath Clearance

See Section 13, AAR Specification M-931 (see page 98).

14.0 Approval

All chassis of an untried type must be approved by the AAR. A chassis shall be considered an untried type when it does not fall into the category of conventional straight or gooseneck chassis or where design and configuration are not similar to designs in service. Applications will include sixteen (16) sets of design or arrangement drawings to include retail or sub-assembly drawings as necessary and stress analysis.

FIGURE 1 Four Twistlock Chassis/Container Interface Dimension

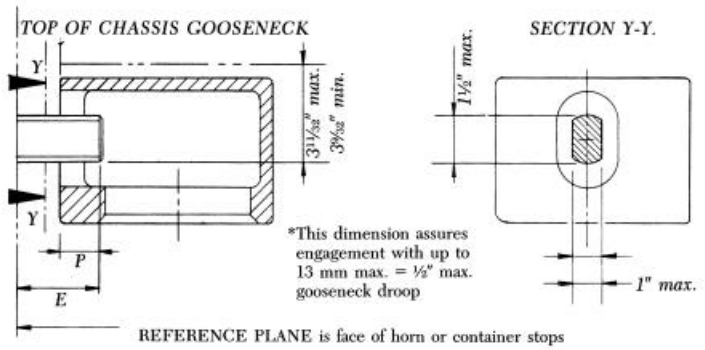


Freight Container Designation	Length		A		B		$K = D_1 - D_2$ or $D_2 - D_1$	
	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches
1A, 1AA	40	0	39	3⅞ ±¼	7	$5^{+0}_{-⅛}$		⅝ max.
1B, 1BB	29	11¼	29	3⅛ ±¼	7	$5^{+0}_{-⅛}$		½ max.
1C, 1CC	19	10½	19	2 7/16 ±¼	7	$5^{+0}_{-⅛}$		⅜ max.
1D	9	9¾	9	1 23/32 ±¼	7	$5^{+0}_{-⅛}$		¼ max.
35′	35	0	34	3⅞ ±¼	7	$5^{+0}_{-⅛}$		9/16 max.
24′	24	0	23	3⅞ ±¼	7	$5^{+0}_{-⅛}$		7/16 max.

Note: The dimensions shown above are presented as a guide for the manufacture of container chassis and are the result of several years of proven experience.

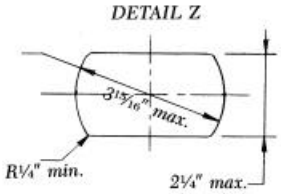
Under conditions of extreme cumulative tolerances on both the container and its corner fittings in one direction and the chassis and its twistlocks in the other direction, an extremely rare interference may occur, but the possibility is so remote that the additional expense of maintaining tighter tolerances is felt to be unwarranted.

FIGURE 2 40-Foot Gooseneck Chassis Interface Dimensions



NOTES
1. The sum of $A_1 + A_2 + B$ must equal $89"^{+0}_{-1/8}$
2. $D_1 - D_2$ or $D_2 - D_1$ must equal ⅜" max.
3. All the chassis securement devices shall be able to be locked to the corner fittings of either a loaded or unloaded container without the assistance of outside equipment when the front of the chassis is supported either at its kingpin or by its landing gear.

$A_1 - 24½" \pm ⅛$
$A_2 - 24½" \pm ⅛$
$B—40"^{+0}_{-1/8}$
outside dimension of gooseneck beams



*This dimension is recommended as a maximum to preclude interference with the front aperture of the container lower corner fitting.

P (PIN PENETRATION)
1¼" min.
measured from front face of corner fitting in rearmost position on chassis to end of pin exclusive of chamfer.

E (PIN EXTENSION)
2⅜" min.
measured from rear face of horn or stops to end of pin exclusive of chamfer.

Association of American Railroads
Mechanical Division
Manual of Standards and Recommended Practices
SPECIFICATION M-930-85
Standard
CLOSED VAN-TYPE DRY CARGO CONTAINERS FOR COFC SERVICE
Adopted, 1972; Revised, 1976, 1980, 1983, 1985
Effective: March 1, 1981

4.1 Corner Fittings

The container shall be equipped with four top and four bottom corner fittings as shown in Figures 2 and 3. Although the corner fittings shown in Figures 2 and 3 are the only ones accepted for use on a container as defined by this requirement, there are several other non-standard designs in use. Appendices B and C illustrate the corner fittings used on a large number of 24-foot and 35-foot containers. It should be noted that these corner fittings do not comply with either this or ISO standards. They are acceptable providing the maximum height of the bottom of the aperture in the bottom corner fittings does not exceed 1Z\, inches.

4.2 Exterior Sizes

The container shall conform to the dimensions and tolerances shown below and illustrated in Figure 1.

	Nominal	Actual	Tolerance
Length	40′	40′0″	Plus 0″ Minus C\,″
	35′	35′0″	Plus 0″ Minus C\,″
	30′	29′11Z\v″	Plus 0″ Minus C\,″
	24′	24′0C\n″	Plus 0″ Minus C\,″
	20′	19′10Z\x″	Plus 0″ Minus Z\v″
	10′	9′9C\v″	Plus 0″ Minus C\zn″
Width			
	8′	8′0″	Plus 0″ Minus C\zn″
Height			
	8′	8′0″	Plus 0″ Minus C\zn″
	8′6″	8′6Z\x″	Plus 0″ Minus C\v″
	9′0″	9′0″	Plus 0″ Minus C\zn″
	*9′6″	9′6″	Plus 0″ Minus C\zn″

*Applies only to 40-foot containers with Tunnel Sections at the front end of their superstructure for use with Gooseneck Type Chassis.

TABLE 2 Test Requirements, Trailers to 65,000 Lbs. Maximum Gross Weight (MGW)

Testing Equivalent

Condition	*Direction of Load*	*Loading*	*Cycles*	*Point of Application*	*Area of Application*
1 *Note:* This test to be conducted after No. 3	Forward and aft.	3.5 MGW	1 each direction	2M\,″ Dia. of kingpin.	2M\,″ x 1Z\v″
2	Fore and aft.	+.4MGW to −.4MGW	500,000	2M\,″ Dia. of kingpin.	2M\,″ x 1Z\v″
3	Side to side	2″ x MGW	100,000	Torque applied to piggyback stanchion locked to kingpin.	17Z\x″ wide x 24″ long plate with hole for kingpin and locked to plate.
4	Vertical	+.335 MGW to .67 MGW	1,000,000	Plate at center of kingpin.	17Z\x″ wide x 24″ long with hole in center for kingpin
5 *Note:* This test to be conducted after No. 6	Up and down	1.0 MGW	1 each direction	Plate at center of kingpin.	17Z\x″ wide x 24″ long with hole in center for kingpin
6	Upward	0 to .55 MGW	1,000	Plate located 16″ rear of kingpin to center of plate.	17Z\x″ wide x 24″ long with hole in center for kingpin

Note See Figures 9 and 10 of AAR Specification M-931, latest revision, for test load locations on kingpin and kingpin test fixture.
Trailers exceeding 60,000 lbs. will be required to meet Kingpin and Coupler Assembly Testing Requirements effective July 1, 1980.

6.7 Trailer Support Strength

6.7.1 Dynamic

6.7.1.1 Except for tank trailers, trailers to be loaded in accordance with Figure 15. (See page 103.) Landing gear legs to be extended to position kingpin support plate 46″ to 48″ above ground level. Then trailer front end is to be elevated until landing gear is 2 to 4 inches above ground and lowered until complete load is reimposed gradually without impact on trailer support. This cycle is repeated 4,000 times.

6.7.1.2 Except for tank trailers, trailer to be loaded in accordance with Figure 16. (See page 107.) Landing gear legs to be extended to position kingpin support plate 46 to 48 inches above ground level.

Then trailer front end is to be elevated until landing gear is 2 to 4 inches above ground and lowered until complete load is reimposed gradually without impact on trailer support. This cycle to be repeated 1,500 times.

6.7.2 Drop Test

Trailer is to be loaded uniformly to produce a load of 32,500 lbs. on trailer support with landing gear legs extended to position kingpin support plate 46 to 48 inches above test surface. Then front end of trailer is to be elevated by a tractor until landing gear legs are 3 to 3½″ above test surface. Tractor must not engage kingpin and is to extend under front of trailer the minimum distance required to support trailer in a static condition. Tractor is to be accelerated abruptly and at highest rate possible, permitting trailer to drop. Trailer support must withstand 10 nominal 3″ drops. Trailer landing gear is to impact on an asphalt test surface which is to be level and smooth prior to test. Asphalt to be 1 to 2 inches thick and laid upon a firm base, typical for supporting heavy duty paved parking areas or upon concrete or steel. Test to be repeated for each leg of the landing gear for one drop with the opposite leg retracted so that there is a three-inch difference between the legs. Successful completion of this test will be taken as satisfying the requirements of Section 4.2.2.4, third paragraph.

6.7.3 Longitudinal Strength

Test devices dimensionally simulating landing gear or landing gear inner legs may be substituted for actual landing gear during the test. Load is to be in horizontal plane and applied parallel to longitudinal axis of trailer. Load of 14,000 lbs. minimum shall be applied to each landing gear at location described in Section 4.2.4.4. Test load to be applied both towards door end of trailer and towards front end of trailer.

6.7.4 Lateral Strength

Test devices described in paragraph 6.7.3 may be used for this test. A load of 20,000 lbs. is to be applied to the trailer support in a direction perpendicular to the longitudinal axis of the trailer, and at the location described in Section 4.2.4.4. Test load shall be applied in one direction only. In the event construction of each side of trailer support is different, test shall be made in both the inboard and outboard directions.

6.7.5 Durability

Following a break-in period of 20 cycles at 17,500 pounds, trailer support is to be cycled 200 times to lift a total load of 35,000 pounds a distance of 3 inches. Total travel of 8 inches is to be used during cycle. The test must be performed at no less than 4 and no more than 8 cycles per hour at a constant input shaft RPM.

6.8 Landing Gear Strength

6.8.1 Longitudinal and Lateral Strength

A single landing gear leg supported by its manufacturer's recommended mounting bracket and brace attachment brackets is to be tested with its inner leg extended 14½ inches or fully extended if travel is less than 14½ inches. A load of 13,000 pounds is to be applied at midpoint on centerline of axle or within one inch of the bottom of the landing gear inner leg (excluding the foot member) for models without axles. This load is to be applied parallel to longitudinal axis of the trailer in both the fore and aft directions and also in a direction perpendicular to the longitudinal axis of the trailer in an inward direction. (See Figure 11, page 108.)

Upon removal of the consecutive test load in the longitudinal and transverse direction, the torque delivered at the input crank shaft to extend or retract the leg shall not exceed 600 inch-pounds.

6.8.2 Vertical Strength

A single landing gear leg with gearbox (crankside) supported by its manufacturer's recommended mounting bracket and brace attachment brackets is to be tested with its inner leg extended 14½ inches or fully extended if travel is less than 14¼ inches. A load of 70,000 pounds is to be applied in vertical direction into the end of the inner leg with or without its foot member. (See Figure 12, page 108.)

Upon removal of the test load in the vertical direction, the torque delivered at the input shaft to extend or retract the leg shall not exceed 600 inch-pounds.

6.8.3 Component Strength

A single landing gear leg with gear box (crankside) supported by its manufacturer's recommended mounting bracket and brace attachment brackets is to be tested with its inner leg fully retracted. With a load of 0.75 times the landing gear's rated lifting capacity per Section 6.8.4 applied in a vertical direction into the end of the inner leg, torque is to be applied to input shaft until the inner leg is extended three inches. (See Figure 13, page 109.)

Upon removal of the test load in the vertical direction, the torque delivered at the input shaft to extend or retract the leg shall not exceed 600 inch-pounds.

6.8.4 Lifting Capacity

The rated lifting capacity is the maximum load, W, that a pair of landing gear legs supported by the landing gear manufacturer's recommended mounting bracket and brace attachment brackets, will elevate one inch when an average input torque of 1200 inch-pounds is applied at the input crank shaft with the load equally divided to each leg. The vertical load shall be applied into the end of the inner leg which shall be extended 14½ inches or one inch less than fully extended if travel is less than 15½ inches. The minimum permissible rated lifting capacity is 38,000 pounds. (See Figure 14, page 109.)

9.0 Electrical System

9.1

Lighting system shall be 12-volt design.

9.2

Number, type and location of lights shall meet Federal Motor Vehicle Standard 108.

9.3

No opening is to be left where lights are mounted or wires run through structure that will allow water to pass into the cargo or insulation area.

9.4

Lights shall be recessed from sides and ends for protection.

9.5

Conventional seven conductor electrical connector socket wired and installed, as shown in Figure 17, page 110.

9.6

Where an integral wiring harness is not used, a junction box is to be located at rear sill to protect wiring connectors.

13.0 Underneath Clearance

The trailer must have underneath clearance as shown in Figure 18, page 107.

FIGURE 2 Trailer Support Requirements

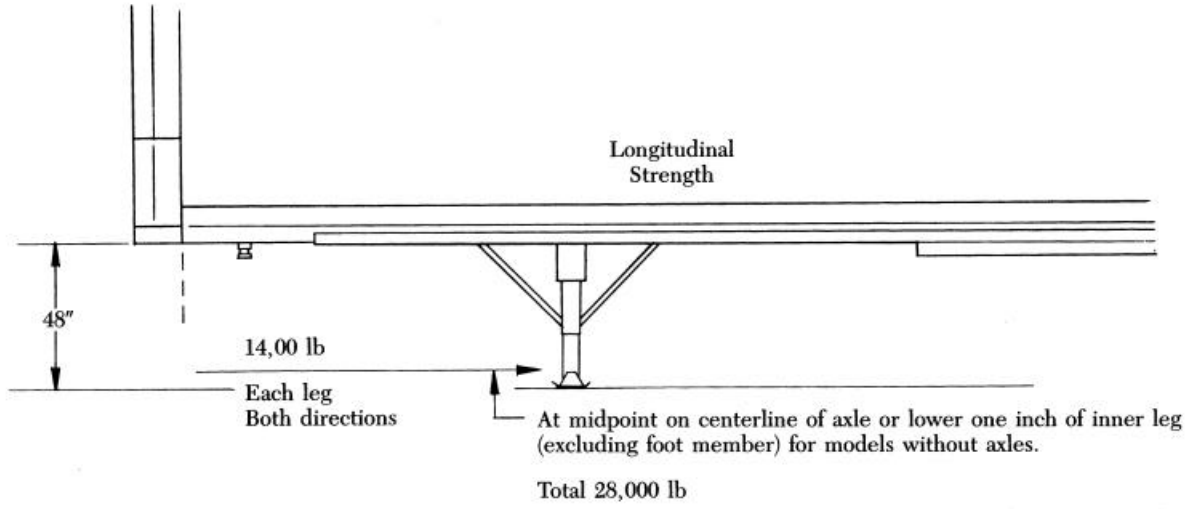


FIGURE 3 Trailer Support Requirements

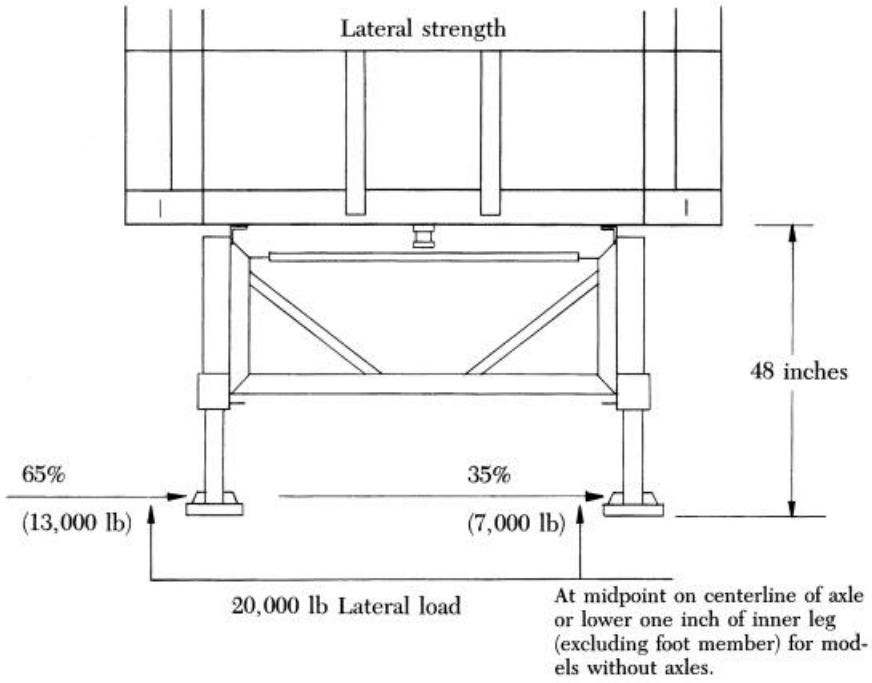


FIGURE 4-A Trailer Lift Pads

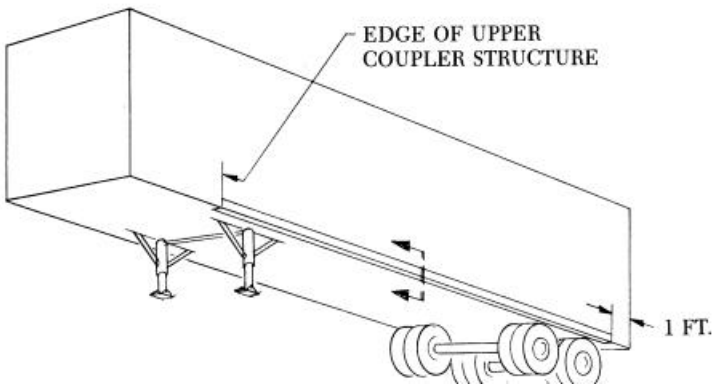
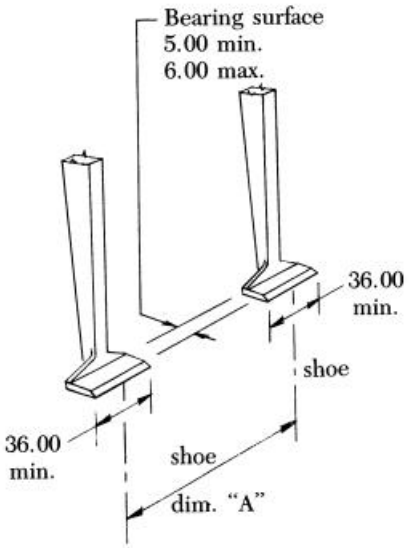
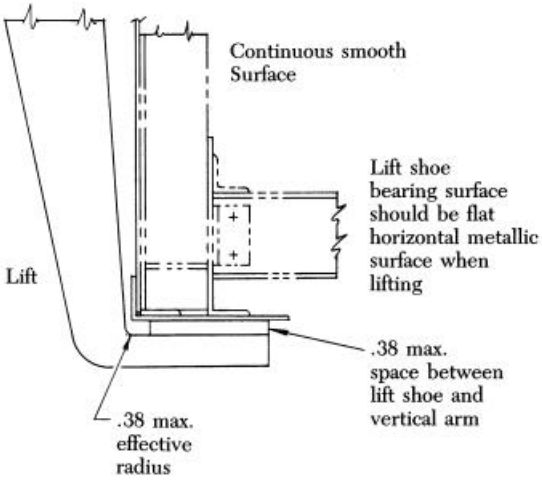


FIGURE 4-B Lifting Device Requirements

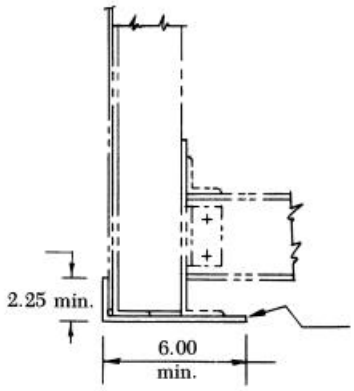


Data reflects minimum requirements for all lifting devices

FIGURE 4-B Lifting Device Requirements

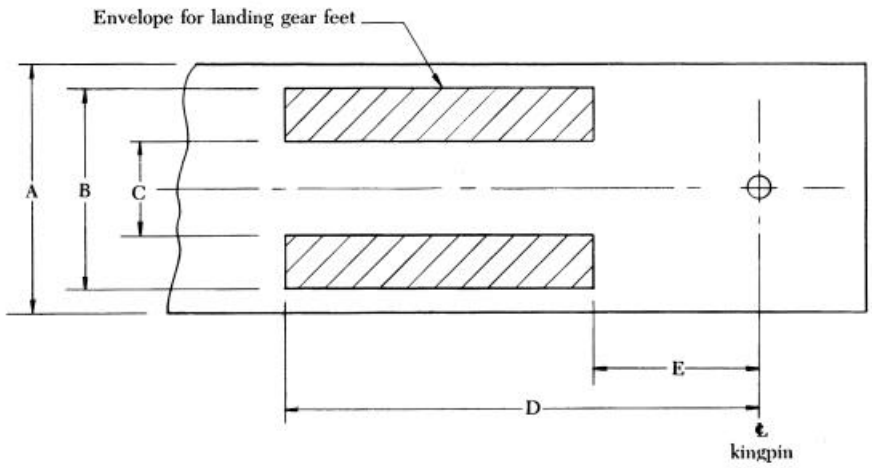


TRAILER LENGTH	SHOE LOCATION DIM. "A"
LESS THAN 30′	10′ MIN.
30′ TO 40′	16′ MIN.
41′ TO 48′	20′ MIN.



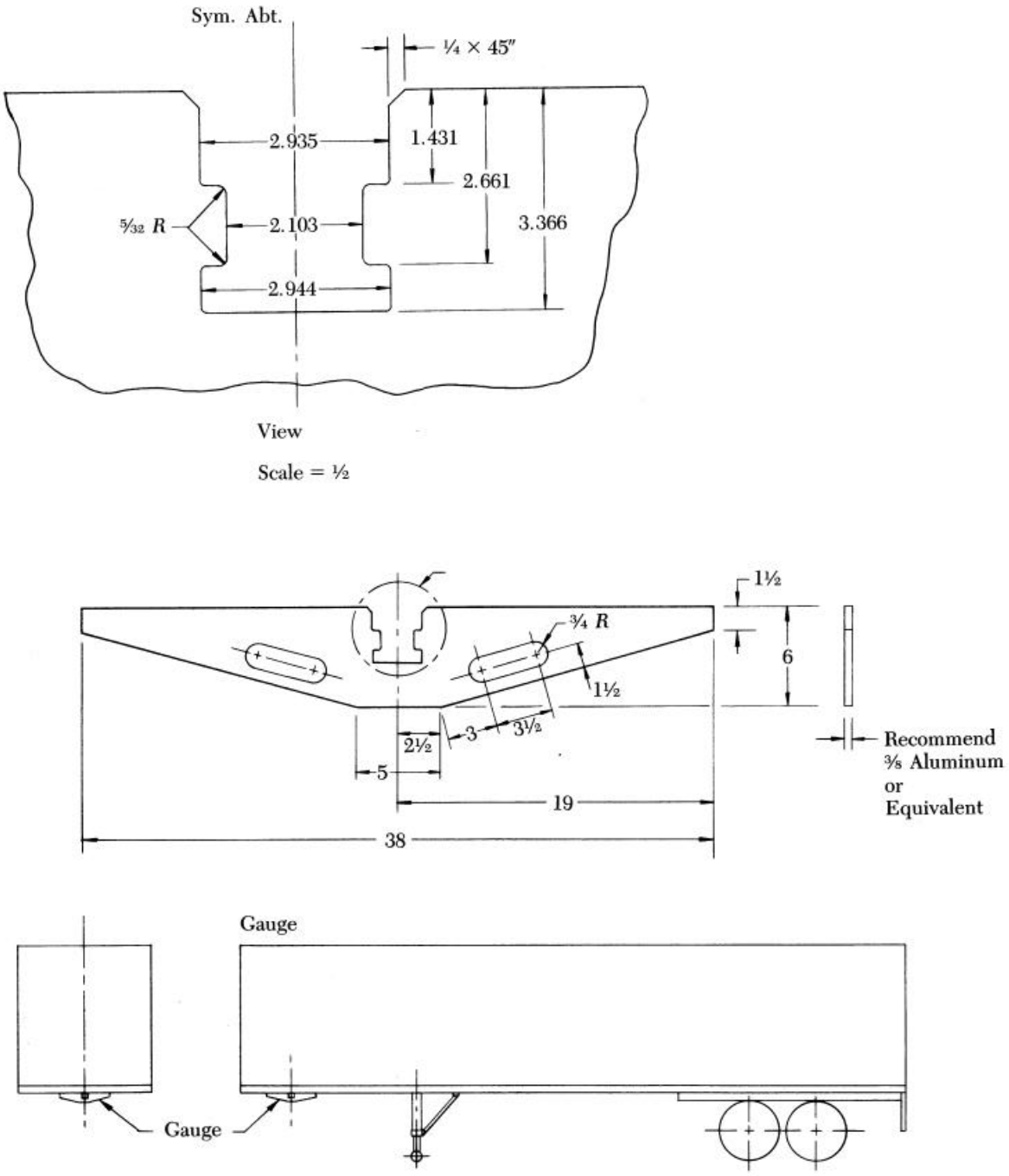
Section
Lift pad

FIGURE 6 Landing Gear Foot Envelope (See 5.7.4)



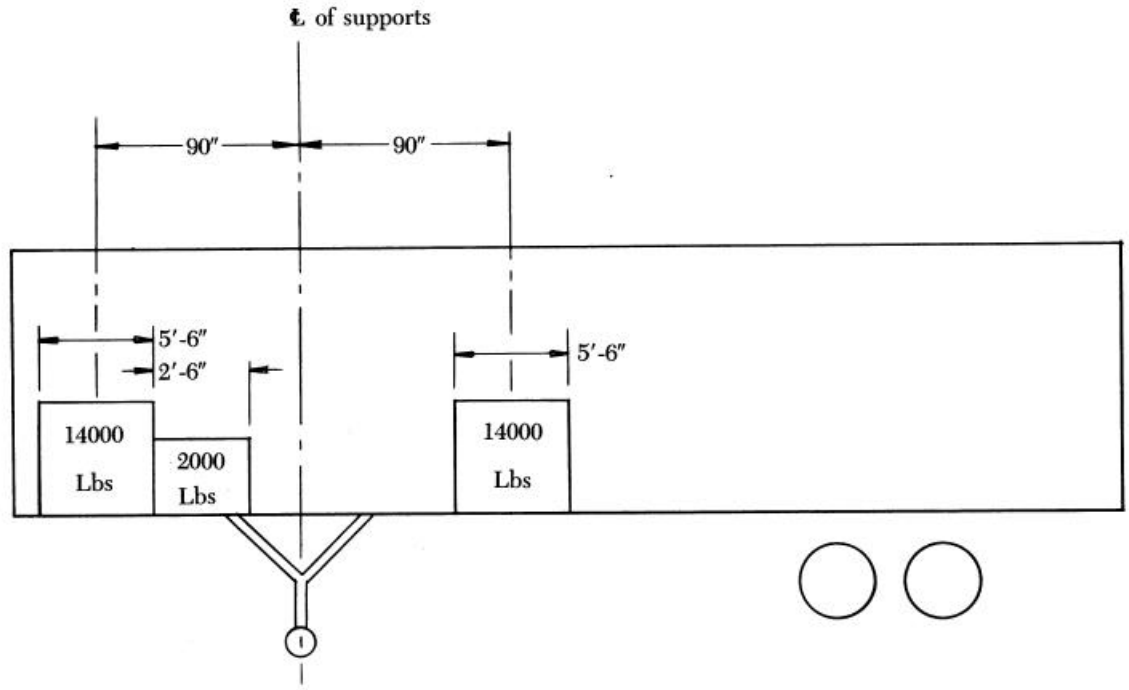
Dimensions (inches)					
		C Minimum			
A	B Maximum	Trailers Except Container Chassis and Flatbeds	Container Chassis and Flatbeds	D Maximum	E Minimum
96	88	50	45	146	45
102	94	50	45	146	45

FIGURE 8 Kingpin and Apron Plate Gauge



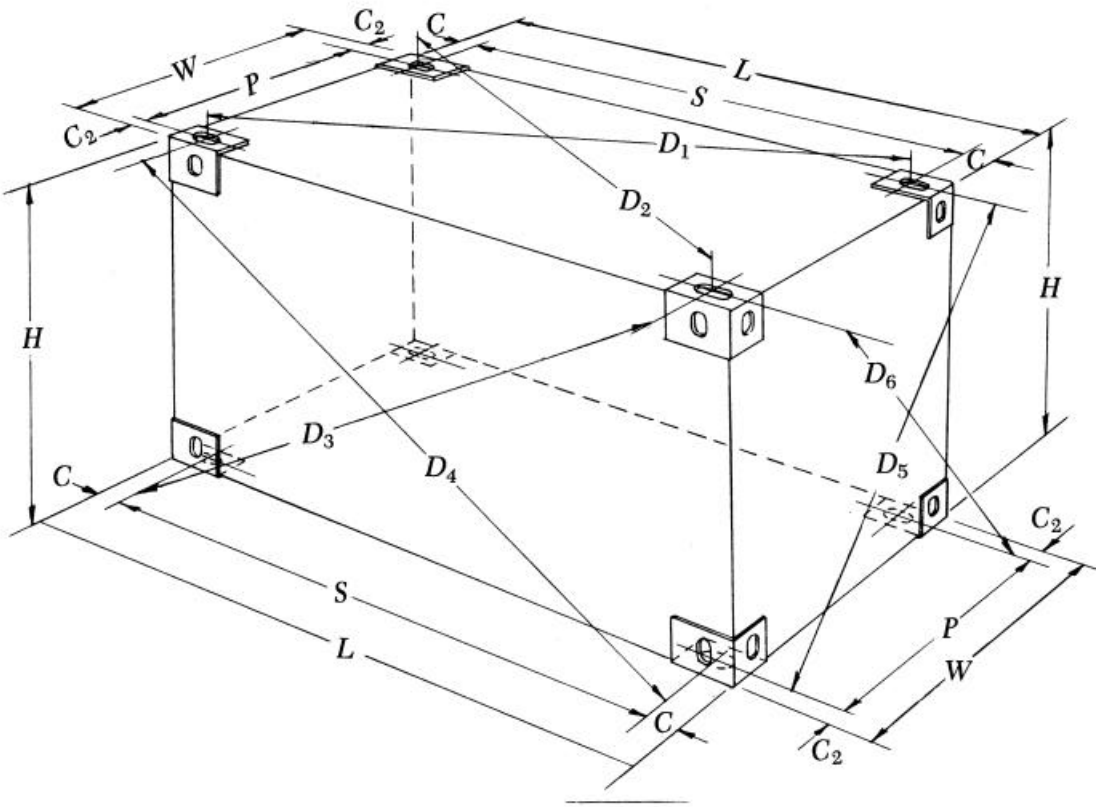
Check Kingpin and Apron Plate on Longitudinal and Transverse Centerlines. Plate Top of Gauge in contact with Apron Plate and slide over Kingpin. If the Kingpin will not pass through the Kingpin slot, with the top of the Gauge in contact with the Apron Plate, the assembly does not conform to TTMA Recommended Practices.

FIGURE 15 Trailer Support Distributed Loading for Dynamic Capacity Cycling Requirements (See 4.2.4.3 and 6.7.1.1)



NOTE: ALL LOADS UNIFORMLY DISTRIBUTED OVER FULL WIDTH OF TRAILER. Not Applicable To Tank Trailers

FIGURE 1 Assembled Corner Fitting—Diagonal Tolerances



S = Length between centers of apertures in corner fittings
P = Width between centers of apertures in corner fittings
C_1 = Corner fitting measurement $4^{+0}_{-1/16}$ inches
C_2 = Corner fitting measurement $3\frac{1}{2}^{+0}_{-1/16}$ inches
L = External length of container
W = External width of container
D = Distance between centers of apertures of diagonally opposite corner fittings resulting in 6 measurements, D_1 D_2 D_3 D_4 D_5 and D_6
K_1 = Difference between D_1 and D_2 or between D_3 and D_4; i.e., $K_1 = D_1 - D_2$ or $K_1 = D_2 - D_1$ or $K_1 = D_3 - D_4$ or $X_1 = D_4 - D_3$
K_2 = Difference between D_5 and D_6; i.e., $K_2 = D_5 - D_6$ or $D_6 - D_5$
H = Overall height

Nominal Length Ft.	S		P		K_1 Max. in.	K_2 Max. in.
	Ft.	In.	Ft.	In.		
40	39	3⅞	7	4 31/32	¾	⅜
35	34	3⅞	7	4 31/32	11/16	⅜
30	29	3⅛	7	4 31/32	⅝	⅜
24	23	4 1/16	7	4 31/32	9/16	⅜
20	19	2 7/16	7	4 31/32	½	⅜
10	9	1 23/32	7	4 31/32	⅜	⅜

Note: Dimensions S and P are reference dimensions only. The tolerances to be applied to S and P are governed by the tolerances shown for the overall length (L) and overall width (W)

Association of American Railroads
Mechanical Division
Manual of Standards and Recommended Practices
AAR Specification M-931-85
HIGHWAY TRAILERS, ALL TYPES, FOR TOFC SERVICE
Standard
Adopted 1972; Revised, 1975, 1976, 1977, 1978, 1979, 1980, 1982, 1985
Effective for Trailers Ordered After March 1, 1986

4.2.4.1 General

In this specification, the term "trailer support" includes both landing gear assemblies (with axles, wheels and/or sand shoes, etc.) bracing, mounting brackets, fasteners connecting these items and that portion of the trailer to which landing gear and bracing is attached.

The trailer support is to be considered as a complete system with due regard given to interaction of various components.

4.2.4.3 Dynamic Capacity

Trailer support must withstand without damage, 4000 cycles of application of 30,000 lbs. for trailers of 65,000 lbs. maximum gross weight. Except for tank trailers, loads to be directly over landing gear as shown in Figure 15. Except for tank trailers, trailer support must withstand without damage 1,500 cycles of application and removal of 10,000 lbs. load to be directly over landing gear as shown in Figure 16. Trailer support must withstand ten nominal 3-inch free drops onto landing gear with trailer uniformly loaded to produce a static load equal to .5 MGW on the trailer support.

4.2.4.4 Static Capacity

Trailer support must be designed to withstand a 28,000 pound horizontal load applied parallel to the longitudinal axis of trailer. This load is to be applied at midpoint on centerline of axle or within one inch of the bottom of the landing gear inner leg (not including the foot member) for models without axles, and with the landing gear extended the distance required to locate the upper coupler plate 48 inches above ground level. (See Figure 2, page 99.)

Trailer support must be designed to withstand a 20,000 pound horizontal load applied in a direction 90 degrees to the longitudinal axis of the trailer. Sixty-five percent of this load will be applied to the outside of a leg pushing inward and thirty-five percent of the load will be applied to the inside of the other leg pushing outward. These loads are to be applied at midpoint on centerline of axle or within one inch of the bottom of the landing gear inner leg (not including the foot member) for models without axles and with the landing gear leg extended the distance required to locate the upper coupler plate 48 inches above ground level. (See Figure 3, page 99.)

Trailer support must be designed to withstand 70,000 pounds vertical load applied concurrently to longitudinal axis of each landing gear assembly. This force to be applied in direction towards underside of trailer.

TABLE 1 Trailer to 65,000 Lbs. Maximum Gross Weight (MGW)

		Operational Data	
Condition	*Force and Direction*	*Derivation*	*Frequency of Load*
1	Shear load horizontal 3.5 MGW fore and aft.	Humping	Once in life on rail car.
2	Shear load horizontal .4 MGW fore and aft	Normal operation	Routine cycling
3	Side sway	Sway on piggyback stanchion	Intermittent 100 cycles per day/ 100 cycles per year/10 years.
4	Vertical at kingpin center .335 MGW to .67 MGW	Normal operation .67 to 1.33 of ½ MGW kingpin load	Routine cycling
5	Vertical at kingpin center 1.0 MGW up and down	Extreme bump 2.0 of ½ MGW kingpin load	Once in life of trailer on rail car
6	Vertical applied 16″ aft of kingpin 0 MGW to .55 MGW up.	Loading of trailer on car 1.1 of ½ MGW kingpin load	Routine cycling 100 cycles per year/10 years

4.2.5

Department of Transportation (D.O.T.) Bumper

D.O.T. bumper to be in accordance with Truck Trailer Manufacturers Association Recommended Practice.

5.4 Upper Coupler Assembly

Upper coupler assembly contains and supports kingpin and forms portion of body underframe or substructure that rests on truck tractor fifth wheel and railcar trailer hitch.

5.4.1

Bottom surface of upper coupler assembly and extensions thereof must be designed to provide protection to crossmembers, air lines, etc., during coupling and uncoupling operations and during all normal TOFC operating conditions.

5.4.1.1 Truck tractor must be able to engage trailer kingpin when approaching from any direction on or forward of the kingpin lateral centerline.

5.4.1.2 Railcar hitches must be able to be raised to kingpin and lowered from kingpin with no interference with or damage occurring to trailer underframe or items attached to trailer.

5.7 Trailer Support

5.7.1

Landing gear to be located from centerline of kingpin in keeping with Truck Tractor Semi Trailer Interchange Coupler Dimensions shown in SAE J-701, latest revision, and to provide a stable support for trailer.

5.7.2

Where manually operated landing gears are used, they must be of the two speed type.

5.7.3

Landing gear to be equipped with heavy duty wheels or pads and heavy duty axles.

5.7.4

Permissible envelope for location of landing gear feet relative to the trailer kingpin is shown in Figure 6 on page 101.

5.7.5

There is to be no cross axle or bracing which results in less than 12 inches normal road clearance.

5.7.6

Vertical height of mounting bracket to provide fully extended and fully retracted dimensions shown in Figure 5.

5.7.7

Mounting bracket to contain mounting holes located in pattern shown in Figure 7.

5.7.8

Landing gear and all bracing attachments are to be made by mechanical fasteners. All fasteners are to incorporate a locking feature in their design.

6.0 Testing

6.1 General

Trailers shall be able to pass satisfactorily, the test described in this section such that on completion, the trailer shall remain serviceable and shall not show permanent deformation resulting in any abnormality which would make it unsuitable for use and shall not meet requirements of Section 4.0.

A certificate showing the date of latest calibration of the test instruments shall be made available.

Test equipment and methods of testing described are not intended to be restrictive. Alternate equivalent methods to accomplish the desired result may be employed. Testing is required if the trailers being purchased are of a new design model which has never been tested or are substantially different from previously tested designs. (The Mechanical Division of AAR reserves the right to judge whether or not differences are substantial enough to require testing.) If trailers being purchased are a design that has previously been tested in accordance with the following prescribed procedure, the submission on the complete previous test results will be required.

6.2 Kingpin and Upper Coupler Assembly

Kingpin and upper coupler structure shall withstand test procedures in Table II without failure or permanent deformation that will not allow checking by kingpin gauges illustrated in Figure 8. (See page 102.) Condition numbers in table relate directly to operation data conditions in Section 4.2.3.

6.3 Floor Strength

The floor system structure is to be physically tested in accordance with Appendix A. The floor rating established by the above testing must equal or exceed 12,000 lbs. on front axle.

6.4 Strength for Straddle Lifting

The trailer shall be supported equally on four liftshoes (or the equivalent) each having a bearing area of 4″ x 18″ and located as described in 5.2. The trailer shall be loaded uniformly to 1.7 times its gross weight for this test and shall remain on the supports for a period of not less than 5 minutes.

FIGURE 16 Trailer Support Concentrated Loading for Dynamic Capacity Cycling Requirements (See 4.2.4.3 and 6.7.1.2

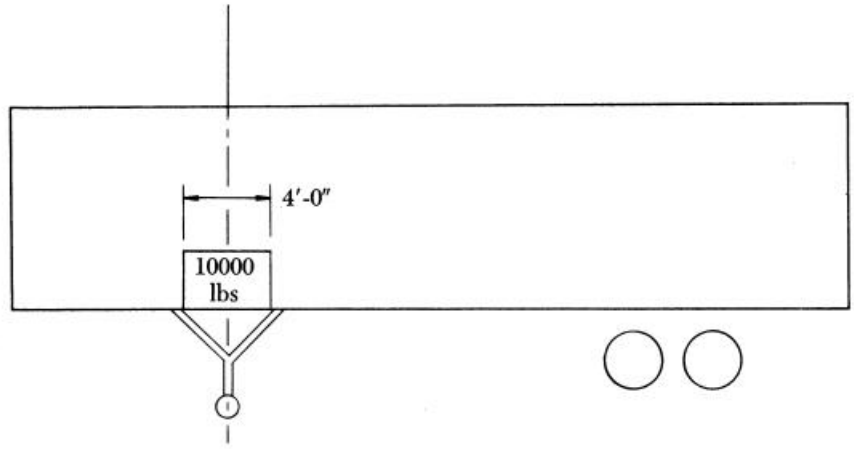
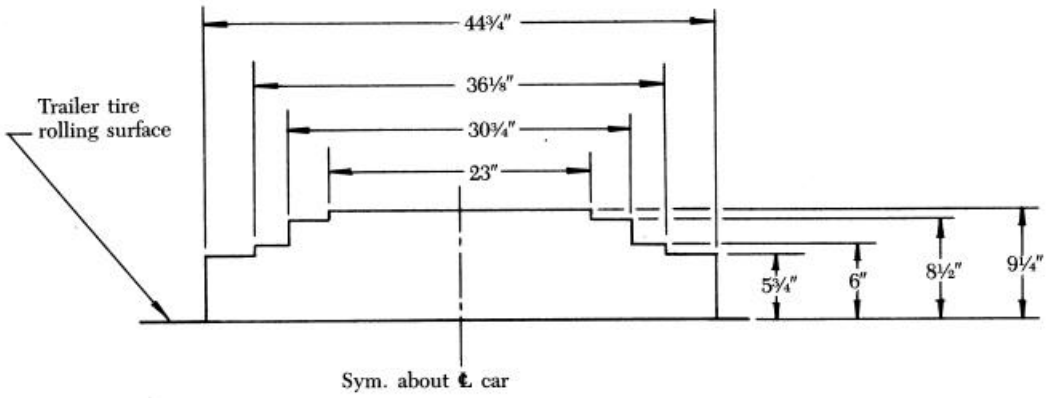


FIGURE 18 Trailer Clearance Envelope for Flat Cars



Note: dimensions shown are nominal, working clearances to be added.

*10″ For cars intended for overhead loading only.

FIGURE 11 Landing Gear Longitudinal and Lateral (Bending) Strength (See 6.8.1)

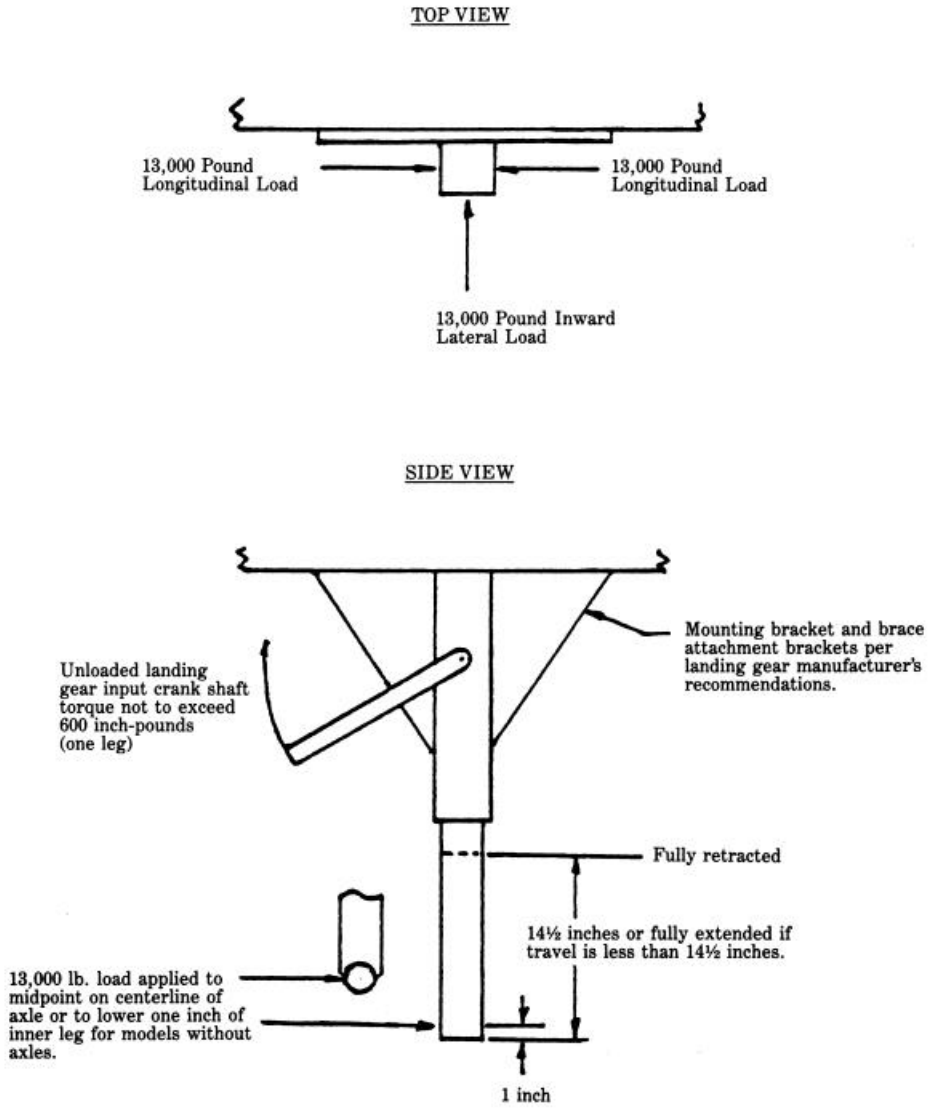


FIGURE 12 Landing Gear Vertical (Compression) Strength (See 6.8.2)

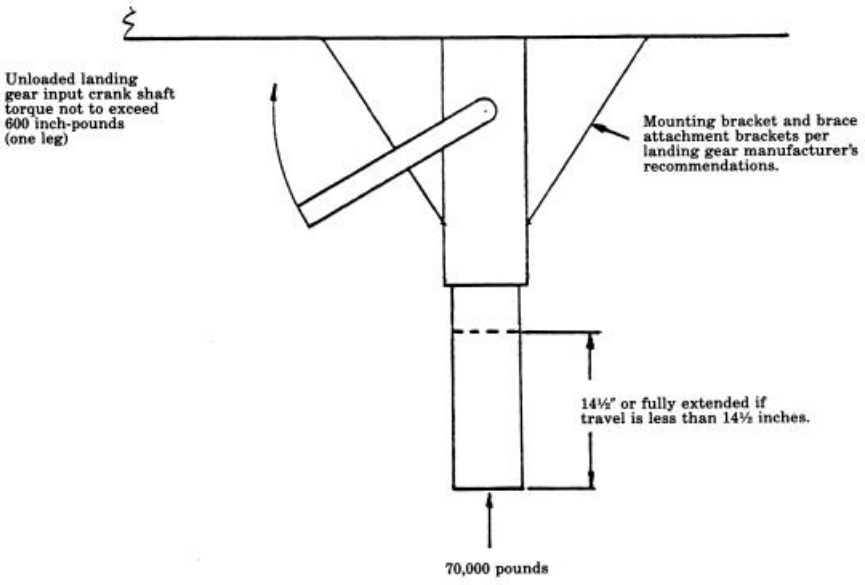


FIGURE 13 Landing Gear Component Strength (See 6.8.3)

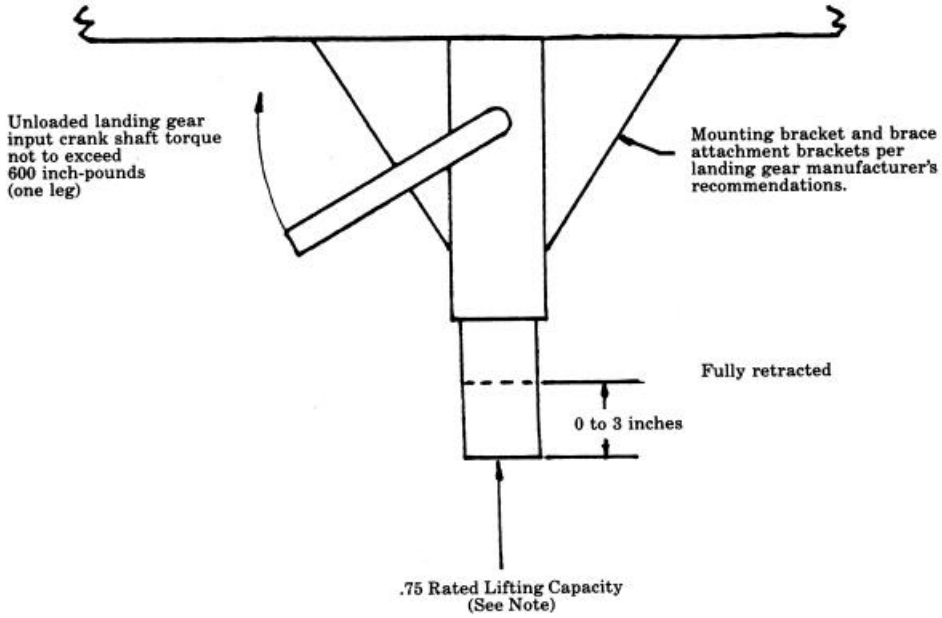


FIGURE 14 Landing Gear Lifting Capacity (See 6.8.4)

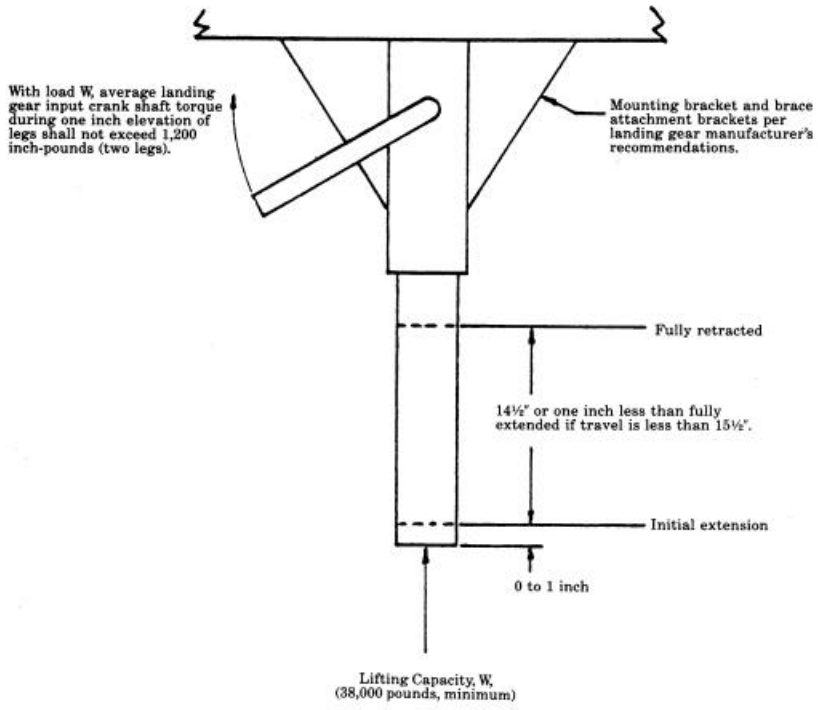
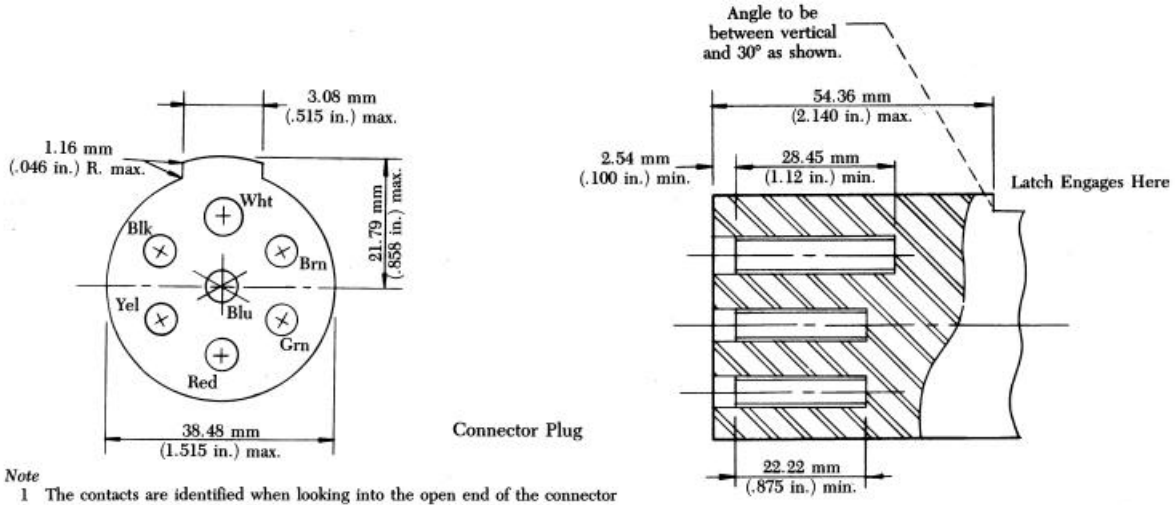


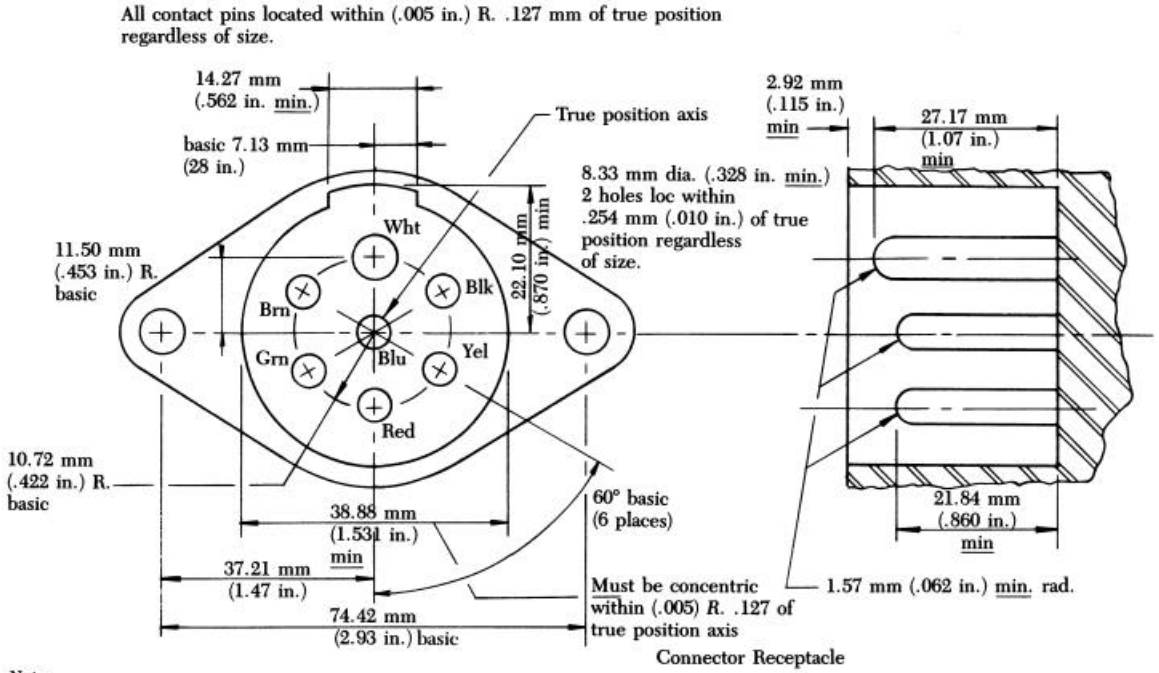
FIGURE 17 Seven Conductor Electrical Connector



Note

1 The contacts are identified when looking into the open end of the connector plug, actual marking should appear on terminal end. All dimensions in parenthesis are inches.

Conductor Identification	*Wire Color*	*Lamp and Signal Circuits*
Wht	White	Ground return to towing vehicle
Blk	*Black	Clearance, side-marker, and identification lamps
Yel	Yellow	Left-hand turn signal and hazard signal lamps
Red	Red	Stop lamps and antilock devices
Grn	Green	Right-hand turn signal and hazard signal lamps
Brn	*Brown	Tail, clearance, side-marker lamps and license plate lamps
Blu	Blue	Auxiliary



Notes

1 External contact no. 1¼$^{+.002}_{-.005}$ round (6.35$^{+.051}_{-.127}$)

2 External contacts no. 2-thru-7 inclusive 3/16$^{+.002}_{-.005}$ round (4.75$^{+.051}_{-.127}$)

3 The contacts are identified when looking into the open end of the insert. Actual markings should appear on terminal end. All dimensions in parenthesis are millimeters.

Appendix C Limits of Motor Vehicle Sizes and Weights

AFRICA

COUNTRY	WIDTH	HEIGHT	LENGTH				AXLE LOAD		MAXIMUM GROSS WEIGHT (1)									
			SINGLE UNIT		TRUCK SEMI-TRAILER	OTHER COMBI-NATIONS	SINGLE	TANDEM	2	3	2-S1	2-S2	3-S1	3-S2	2-2	2-3	3-2	3-3
			TRUCK	BUS														
	meters	meters	meters	meters	meters	meters	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Algeria (3)	2,5	—	11,0	12,0	15,0	18,0	13,0	(7)	19,0	26,0	35,0							
Angola (3)	2,5	4,0	12,0	12,0	15,0	18,0	10,0	16,0	16,0	22,0	26,0	32,0	32,0	38,0	32,0	38,0	38,0	38,0
Benin (4)(5)(19)	2,5	—	11,0	12,0	15,0	18,0	9,5 11,5(4)	—	—	—	35,0							
Botswana (2)	2,5	4,1	12,5	12,5	17,0	20,0	8,2	18,0	Dependent upon axle spacing									
Bourkina-Fasso	2,5		11,0	12,0	15,0 18,0	18,0 22,0	11,0	28,0	11,0	18,0		32,0		40,0	28,0	35,0		
Burundi (2)	2,5	4,0	12,0	12,0	14,0	22,0	13,0	—	18,0	21,0	20,0	24,0	24,0	28,0	30,0			
Cameroon (2)	2,5	4,0	11,0	11,0	15,0	20,0	10,0	17,0	16,0	35,0								
Central African Rep.	2,5	4,0	11,0	12,0	14,0	18,0	13,0	16,0	16,0	22,0	35,0							
Chad (19)(20)	2,5	—	11,0 12,0 (6)	12,0	14,0	18,0(21)	10,0	20,0	16,0	22,0	30,0	35,0						
Congo Republic (2)	2,5	—	11,0	12,0	15,0	18,0	13,0	(7)	19,0	26,0	38,0							
Djibouti (2)	2,5	—	11,0	12,0	15,0	18,0	13,0	(7)	19,0	26,0	38,0							
Egypt (31)(2)	2,6	3,5	12,0	12,0	15,0	20,0	10,0	16,0	Dependent on axle spacing									
Ethiopia	2,4	3,8	11,0	11,0	14,0	18,0	8,0		Dependent upon axle spacing									
Gabon	2,5	4,8	11,0	12,0	15,0	20,0	10,0	16,0	16,0	22,0	22,0	32,0	32,0	38,0	32,0	38,0	38,0	38,0
Gambia (2)	2,3	—	8,4	8,4			(14)	(14)	Dependent upon number of wheels									
Ghana	2,5	3,4	11,0	11,0	13,0	13,0	10,2	—	16,3	24,4	24,4	32,5	32,5	32,5	32,5	32,5	32,5	32,5
Guinea-Bissau	2,5	4,0	12,0	15,0	18,0	18,0	16,0	16,0	22,0	26,0	32,0	32,0	32,0	38,0	32,0	38,0	38,0	38,0
Ivory Coast	2,5	4,0	11,0	12,0	15,0	18,0	10,0	17,0	16,0	23,0	25,0	32,0	32,0	41,0				
Kenya	2,5	4,2	11,0	11,0	15,0	18,0	8,0 10,0	16,0 24,0	16,0	22,0	26,0	34,0	34,0	40,0	34,0	40,0	40,0	46,0
Lesotho	2,5	4,1	12,5	12,5	17,0	20,0	Dependent on tire and axle spacing											
Liberia (19)	2,5	4,0	11,0	11,0	14,5	18,0	10,0	15,0	15,0	23,0	25,0	32,0	32,0	40,0				
Libya (2)	2,6	4,2	12,0	12,0	15,0	20,0	10,0	16,0	16,0	22,0	24,0	30,0	30,0	36,0	34,0	40,0	40,0	40,0
Madagascar (Malagasy)	2,5	4,0	12,0	12,0	15,0	18,0	10,0	16,0	16,0	22,0	Dependent upon axle spacing, not to exceed 36 tons							
Malawi (2)	2,5	4,3 (13)	11,0	11,0	15,2	18,3	8,0	16,0	16,0	24,0	24,0	32,0	32,0	40,0	32,0	40,0	40,0	40,0
Mali (3)	2,5	4,0	11,0	11,0	15,0	18,0	11,0	16,0	16,0	23,0	25,0	38,0	41,0	41,0	35,0	38,0	38,0	38,0

COUNTRY	WIDTH	HEIGHT	LENGTH				AXLE LOAD		MAXIMUM GROSS WEIGHT (1)									
			SINGLE UNIT		TRUCK SEMI-TRAILER	OTHER COMBI-NATIONS	SINGLE	TANDEM	2	3	2-S1	2-S2	3-S1	3-S2	2-2	2-3	3-2	3-3
			TRUCK	BUS														
	meters	meters	meters	meters	meters	meters	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Mauritius	2,5	3,6	9,1	11,0	10,1	11,0	10,0	(7)	15,0	20,0								
Morocco (20)	2,5	4,0	11,0	12,0	15,0	18,0	13,0	—	19,0	26,0	38,0							
Mozambique (2)	2,5	4,0	12,0	12,0	15,0	18,0	10,0	16,0	16,0	22,0	26,0	32,0	32,0	38,0	32,0	38,0	38,0	38,0
Niger	2,5		11,0		14,0	18,0 22,0	11,5	(7)	17,0	24,5	28,0	38,0	38,0	40,0	42,0			
Nigeria (7)	2,5	4,0	11,0	11,0	14,0	18,0	10,0	16,0	14,6 16,0	16,0 24,0	20,0 24,0	24,0 32,0	22,0 32,0	24,0 32,0	Not to exceed 32,0			
Reunion Island (2)	2,5	—	11,0	12,0	15,0	18,0	10,0 13,0	—	15,0	20,0	25,0 38,0							
Rwanda (2)	2,5	4,0	12,0	12,0	14,0	22,0	—	—	12,0	18,0	20,0	24,0	24,0	28,0	32,0	32,0	32,0	32,0
Senegal (3)	2,5	—	11,0 12,0(6)	12,0	18,0	22,0	10,0	(26)	16,0	22,0	32,0							
Seychelles Islands (10)	2,3	2,9	7,0	7,0	7,0	(10)	—	—	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
Sierra Leone	2,9	3,3	9,1	10,0	13,6	19,3	10,0	25,4	13,0	18,0	30,5	30,5	35,6	50,0	35,6	35,6	40,6	35,6
Somalia	2,5	4,5	10,0 11,0(6)	11,0	14,0	18,0	10,0	16,0	14,0	18,0	18,0	28,0	28,0	32,0	28,0	32,0	32,0	36,0
South Africa	2,5	4,1	12,5	12,5	17,0	20,0	8,2(12)	16,4(12)	15,9	24,1	24,1	32,3	32,3	40,5	32,3	40,5	40,5	48,7
Swaziland	2,5	4,1	12,5	12,5	17,0	20,0	8,2(12)	16,5(12)	15,0	24,0	24,0	Dependent on axle spacing						
Tanzania (3)	2,5	4,4	10,0 11,0(6)	11,0	14,0	18,0	8,0	14,5	13,0	19,5	21,0	27,5	27,5	34,0	29,0	35,0	35,0	35,0
Tunisia (2)	2,5	4,0	11,0	12,0	15,0	18,0	11,0	(22)	19,0	26,0	30,0	38,0	38,0	48,0	42,0	51,0	51,0	59,0
Uganda (7)(29)	2,5	4,0	11,0	11,0	15,0	18,0	8,0(30)	14,5	13,0	18,0	18,0	27,5	27,5	32,0	27,5	35,0	35,0	35,0
Zaire (2)	2,5	4,0	12,0	12,0	14,0	22,0	8,0	12,0	12,0	18,0	20,0	24,0	24,0	28,0	32,0			
Zambia (2)	2,5	3,8	11,0	11,0	15,5	22,0	(16)	(17)	Dependent on number of wheels and axle spacing (18)									
Zimbabwe	2,5	4,6	12,5	12,5	17,0	22,0	8,2	16,4	Dependent upon axle spacing									

1. See vehicle type nomenclature, page 8.
2. 1981 report.
3. Latest available report, 1977.
4. Maximum axle load limits vary in accordance with different roads of the network.
5. Vehicle maximum gross weight figures are applicable to specific road sections.
6. Three axle vehicles have the highest limit.
7. Subject to other regulations related to axle distances and number of wheels.
10. Trailers may be used only with special permissionm of the Dept. of Transport.
12. For dual tire arrangement.
13. Two-deck buses are permitted 4,57 m height.
14. No more than 3/4 of the gross weight of a motor vehicle shall be transmitted on the road surface by any two wheels.
16. Two-tire axle maximum load: 8,0 tons.
    Four-tire axle maximum load: 10,0 tons.
17. Single-tire arrangement; maximum axle load: 14,5 tons. Dual-tire arrangement; maximum axle load: 16,33 tons. Triple axle with weight evenly distributed over twelve wheels: 23,0 tons.
18. Vehicle on unpaved roads require permission for over 6,5 tons gross weight. Granting of permit dependent on strength of road and structures.
19. Latest available report, 1974.
20. All self-propelled vehicles or trailors must not exceed 5 tons per meter of length measured between the first and the last axle.
21. 20 meters for vehicle types 3-2 and 3-3.
22. 13,0 tons; for tandem axles separated 0,9 m. For tandem axles separated 1,35 m or more: 19,0 tons.
26. $l = 7 + 0.25\left(\frac{d - 90}{5}\right)$ where 90 cm < d < 150 cm.
29. Special permits for special sizes and widths
30. Maximum wheel load 2,5 tons.
31. Truck, semi-trailers and truck and trailer combinations with load capacity greater than 13,0 tons need specific permission from Ministry of Transport. Also special permits for axle loads exceeding noted limits.

NORTH, CENTRAL & SOUTH AMERICA

COUNTRY	WIDTH	HEIGHT	LENGTH				AXLE LOAD		MAXIMUM GROSS WEIGHT (1)									
			SINGLE UNIT		TRUCK SEMI-TRAILER	OTHER COMBI-NATIONS	SINGLE	TANDEM	2	3	2-S1	2-S2	3-S1	3-S2	2-2	2-3	3-2	3-3
			TRUCK	BUS														
	meters	meters	meters	meters	meters	meters	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Argentina	2,5	(2)	11,0	12,0	17,3	(3)	10,6	18,0	Dependent upon axle spacing to 42,0 tons maximum									
Bahamas (26)	2,4	3,7	9,1	9,1	9,1	9,1	(4)	(4)	No regulation									
Barbados	2,3	(4)	7,6	9,1	7,6		(4)				11,2		11,2					
Bermuda	2,3	(2)	6,3	9,3	(2)	(2)	Axle loads and gross weight depend on vehicle size											
Bolivia (25)	2,5	3,8	10,0		15,3		8,0	12,0	No regulations									
Brazil	2,6	4,4	13,2	13,2	18,15	19,8	10,0	17,0	15,0	22,0	25,0	32,0	32,0	39,0	35,0	42,0	42,0	45,0
Canada (5)	2,6	4,1 4,5	12,2 12,5	12,2 12,5	20,0 24,4	20,0 20,4	8,0 10,0	16,0 20,0	12,0 16,0	20,0 28,5	28,5 29,0	28,5 38,5	28,5 38,5	36,5 47,2	28,5 39,0	36,5 48,5	38,0 49,0	40,5 57,5
Chile (24)	2,5	3,8	10,0	11,0	14,0	18,0 22,0	6,0 12,0	21,0	Dependent upon axle spacing									
Colombia	2,6	3,5	12,0	12,0	16,8	20,0	8,2	14,5	Dependent upon tire size, axle spacing									
Costa Rica (26)	2,5	4,0	10,0 11,0(7)	12,0	16,7	18,3	9,0	16,5	13,8	23,0	23,0	30,5	30,5	37,4	32,2		37,4	
Dominican Republic	2,5	4,0	10,0 11,0(7)	11,0	14,0 15,3(8)		9,0(9)		Dependent on tire size and axle spacing									
Ecuador	2,6	3,8	10,7	10,9	17,0	18,3	11,0	19,0	16,5	24,5	27,5	35,5	35,5	38,7	38,5	43,8	43,8	46,4
Falkland Islands	No legislation in existence																	
French Guiana (24)	2,5	—	11,0	12,0	15,0	18,0	10,0	(13)	19,0	26,0	38,0							
Guadeloupe	2,5	4,0	11,0	12,0	15,0	18,0	13,0	13,0	19,0	26,0	38,0							
Guatemala	2,5	41,1	12,0	12,0	16,8	18,3 20,0(22)	9,0	15,5	14,0	20,5	23,0	29,5	29,5	36,0	28,0	36,0	36,0	36,0
Haiti (19)	2,5	3,5	11,0	11,0	15,0	18,0	12,0	20,0	No regulations									
Honduras (26)	2,5	3,8	10,0 11,0(7)	11,0	15,3	18,3	8,0	14,5	12,0	18,5	20,0	26,5	26,5	33,0	28,0	34,5	34,5	37,0
Jamaica (15)(24)	2,5	3,2	9,1	9,8	12,8	12,8	8,9	8,9	13,5	13,5	22,5							
Martinique	2,5	—	11,0	12,0	15,0	18,0	9,0	14,5	14,0	19,5	23,0	28,5	28,5	34,0	32,0		37,5	

COUNTRY	WIDTH	HEIGHT	LENGTH				AXLE LOAD		MAXIMUM GROSS WEIGHT (1)									
			SINGLE UNIT		TRUCK SEMI-TRAILER	OTHER COMBI-NATIONS	SINGLE	TANDEM	2	3	2-S1	2-S2	3-S1	3-S2	2-2	2-3	3-2	3-3
			TRUCK	BUS														
	meters	meters	meters	meters	meters	meters	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Mexico (16)	2,5	4,2	12,2	12,3	17,0	22,2	10,0	18,0	13,5	23,5	23,5	33,5		41,5	33,5	—	43,5	51,5
Montserrat (26)	2,1		6,7	6,7					10,0									
Netherlands Antilles (26)	2,5	3,5	10,0	11,0	14,0	18,0	No Regulations											
Nicaragua (26)	2,5	3,8	11,0	11,0	17,0	18,5	8,0	14,5 (21)	12,0	18,5	20,0	26,5	26,5	33,0	28,0	34,5	34,5	41,0
Panama	2,5	4,1	11,0 12,0(7)		15,3	19,9	10,0	16,4	Dependent on axle spacing to maximum of 37,5 tons									
Paraguay	2,5	4,0	10,5	12,0	20,0	20,0	10,0	17,0	15,0	22,0	25,0	32,0	32,0	39,0	35,0	40,0	40,0	40,0
Peru	2,6	4,0	10,5 11,5	11,5 12,2	12,0 14,0	16,4 20,0	10,0 11,0	16,0 18,0	14,0 17,0	20,0 24,0	24,0 28,0	30,0 35,0	30,0 35,0	42,0	34,0 39,0	45,0	45,0	45,0
Puerto Rico	2,4	4,1	10,6	10,6	15,2	15,2	As authorized by license or certificate of registration											
St. Christopher, Nevis	2,3		6,7	6,7	7,6				5,1		5,1							
St. Lucia (26)	2,28	—	(22)	(22)	—	—	—	—	Maximum gross weight 8,3 metric tons									
Saint Pierre et Miquelon	2,5		11,0	12,0	15,0	18,0	13,0	—	19,0	26,0	38,0	Dependent upon axle spacing						
El Salvador	2,5	3,8	10,0 11,0(7)	11,0	14,0	18,3	8,0	14,9	12,0	18,9	20,0	26,9	26,9	33,8	28,0	33,8	33,8	
Surinam (25)	2,5	3,8	11,0				8,0		Dependent upon tire size and axle spacing									
Trinidad-Tobago (26)	2,4	3,9	8,4	9,0	10,5	13,5	8,0	8,0	(23)									
United States (5)	2,44 2,74	4,11 4,42	10,7 18,3	10,7 18,3	16,7 24,4	(20) 25,9	9,1 10,9	14,5 18,2	Dependent upon axle spacing									
Uruguay	2,5(2)	4,0	12,0	13,2	16,5	20,0	10,0	16,0	15,0	21,0	25,0	31,0	37,0					
Venezuela (24)	2,6	3,9	10,7 12,2(7)	10,7 12,2(7)	15,3	18,3	8,5	14,5	12,0	18,6	20,0			30,0	28,0			33,0

1. See vehicle type nomenclature, page 8.
2. Regulations vary with type of vehicle.
3. 18,5 meters for truck-tractor with semi-trailer. 20,50 meters for truck-tractor with semi-trailer and trailer.
4. Not regulated.
5. Regulations vary by Province or State. Figures indicate range of variation in maximum limits.
7. Three or more axle vehicles have the highest limit.
8. Vehicle type 3-S2 has the highest limit.
9. Dependent on tire size and other conditions.
13. 2 axle, 15 t. 3 axles, 25 t.
15. Special Permit may be granted for vehicles exceeding these limits.
16. Limits shown are for Class A highways. Class B highways have lower limits.
17. Regulations vary with type of vehicle. Type 2-S1 is 14,00 m; Type 2-S2 and 3-S1 is 14,50 m; 3-S2 is 15,25 m.
19. Latest available report: 1971.
20. Not permitted.
21. Varies from 14,52 to 25,81 tons according to the distance between group of axles.
22. 50% wheel base.
23. Present legal limit is 33,600 lbs. per 2-axle vehicle, or 10 long tons. Heavier vehicles or 3 axle will be allowed by special permission up to 60,000 lbs. GVW; semi-trailer up to 100,000 lbs.
24. 1977 report.
25. 1974 report.
26. 1981 report.

EUROPE

COUNTRY	WIDTH	HEIGHT	LENGTH				AXLE LOAD		MAXIMUM GROSS WEIGHT (1)									
			SINGLE UNIT		TRUCK SEMI-TRAILER	OTHER COMBI-NATIONS	SINGLE	TANDEM	2	3	2-S1	2-S2	3-S1	3-S2	2-2	2-3	3-2	3-3
			TRUCK	BUS														
	meters	meters	meters	meters	meters	meters	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Austria	2,5	4,0	12,0	12,0	16,0	18,0	10,0	16,0	16,0	22,0	26,0	32,0	32,0	38,0	32,0	38,0	38,0	38,0
Belgium	2,5	4,0	12,0	12,0	15,5	18,0	10,0 12,0(33)	16,0 20,0(9)	19,0	26,0	29,0	39,0		44,0	39,0	44,4	44,0	44,0
Bulgaria (10)	2,5	4,0	12,0	12,0	16,5	22,0	10,0(27)	(28)	16,0	26,0	35,0	35,0	35,0	35,0	40,0	40,0	40,0	40,0
Cyprus (3)(2)	2,4	3,4	9,1	9,1	14,0	14,0	5,0	12,0	12,0									
Czechoslovakia	2,5	4,0	12,0	12,0	15,5	22,0	10,0 11,0	11,5 18,0(9)	16,0 17,0(9)		26,0 28,0(9)			42,0(9)				48,0(9)
Denmark	2,5	4,0	12,0	12,0	15,5	18,0	10,0	16,0	18,0	24,0	26,0	38,0	32,0	44,0	38,0	42,0	44,0	44,0
Finland	2,5	4,0	12,0	13,0	16,0	22,0	10,0	16,0	16,0	22,0	Depends on distance between outer axles, not to exceed 48,0 tons							
France	2,5	—	11,0	11,0 12,0	15,5	18,0	13,0	(7)	19,0	26,0	38,0	38,0	38,0	38,0	38,0	38,0	38,0	38,0
Germany (West)	2,5	4,0	12,0	12,0	15,0	18,0	10,0	16,0	16,0	22,0	26,0	36,0	32,0	38,0		38,0	38,0	38,0
Gibraltar	2,5	4,1	11,0	12,0	15,6	15,6	10,0	16,0	16,0	24,0	24,0	32,0						
Great Britain	2,5	4,6(8)	11,0	12,0	15,5	18,0 25,9(3)	10,5	20,3(9)	16,3(9)	24,4(9)	24,4(9)	32,5(9)						
Greece	2,5	4,0	12,0	12,0	15,0	18,0	10,0 13,0(21)	20,0	19,0	26,0	29,0	38,0	40 tons, except for tankers to Yugoslavia					
Hungary	2,5	4,0	12,0	12,0	16,0	18,0 22,0	10,0	16,0(9)	20,0	24,0	28,0	32,0	32,0	38,0	32,0	38,0	38,0	38,0
Iceland	2,5	3,8	12,0	12,0	15,0	18,0	6,0(17)	8,0(17)	(18)									
Ireland	2,5	4,6(8)	12,0	12,0	15,5	18,0	10,5	20,0 34,0(9)	16,0 26,0(9)	24,0 39,0(9)	24,0 39,0(9)	32,0 52,0(9)	32,0 52,0(9)	38,0(9)	32,0 52,0(9)	38,0(9)	38,0(9)	38,0(9)
Italy	2,5	4,0	12,0	12,0	15,5	18,0	12,0	17,0 20,0(9)	18,0	24,0	30,0	40,0	36,0	44,0	40,0	43,2	44,0	44,0
Luxembourg	2,5	4,0	10,0 11,0(6)	12,0 18,0(23)	15,5	18,0 25,0(24)	13,0	19,0	19,0	26,0	38,0	38,0	38,0	38,0	40,0	40,0	40,0	40,0
Malta (15)	2,5	3,2	8,7 9,1(6)															
Monaco	2,5		11,0	12,0	15,0	18,0	13,0	(9)	19,0	26,0	38,0							
Netherlands	2,5	4,0	11,0	12,0	15,5	18,0	10,0	18,0(25)	20,0	30,0	30,0	40,0	40,0	50,0	40,0	50,0	50,0	50,0(26)
Norway	2,5	4,5(29)	12,4	12,4	15,5 16,0(30)	18,0 22,0(31)	6,0 10,0	9,0 16,0	12,0 20,0	15,0 26,0	18,0 30,0	21,0 36,0	21,0 36,0	24,0 42,0	24,0 40,0	27,0 46,0	27,0 46,0	27,0 50,0
Poland	2,5	4,0	12,0	12,0	16,0	18,0(34)	8,0	14,5(9)	16,0	24,0	32,0	32,0	32,0	42,0	32,0	42,0	42,0	42,0
Portugal	2,5	4,0	12,0	12,0	15,0(11)	18,0	10,0	16,0	16,0	22,0	26,0	32,0	32,0	38,0	32,0	38,0	38,0	38,0
Romania (22)	2,5	4,0	12,0	12,0	15,0	22,0	10,0 7,5	16,0 12,0	16,0 12,0	22,0 18,0	26,0 19,5	32,0 21,0	32,0 21,0	38,0 27,0	32,0 21,0	38,0 27,0	38,0 27,0	38,0 27,0
Spain	2,5	4,0	12,0	12,0	16,5	18,0	13,0	14,7	20,0(12)	26,0 (7)(12)	38,0(7)(12)							
Sweden	2,6	—	—	—	24,0	24,0	10,0	16,0	Depends on distance between outer axles, not to exceed 51,4 tons									
Switzerland	2,3(13)	4,0	10,0 12,0(6)	12,0	16,0	18,0	10,0	18,0	16,0	19,0 25,0(32)	26,0	28,0						
Turkey	2,5	4,0	10,0 11,0	12,0	15,0	18,0	10,0	16,0	16,0	22,0	26,0	32,0	32,0	38,0	36,0	38,0	38,0	38,0
Yugoslavia (15)(20)	2,5	4,0	11,0 12,0(6)		15,0	18,0	10,0	16,0										

1. See vehicle type nomenclature, page 8.
2. 1977 report.
3. Special permission may be granted for vehicles exceeding these limits.
6. Three or more axle vehicles have the highest limit.
7. Maximum weight for a tandem axle is 7,35 tons for the most heavily loaded axle, where the distance in the two axles is 0,9 m. This weight increases beyond 14,7 tons by 700 kg. per 0,05 m of distance beyond 0,9 m, but must not exceed 21 tons for a distance of 1,35 m between the axles with a maximum of 10,5 tons for the most heavily loaded axle.
8. Only for buses.
9. Dependent on axle spacing and other conditions.
10. 1981 report.
11. Truck semi-trailer is allowed to have 15,5 m when used for transportation of containers.
12. Provided it does not exceed 5,0 tons per meter of length measured between the first and the last axle.
13. On some main roads: 2,50 m.
15. Latest available report: 1971.
17. A maximum of 10,0 tons for single axle and 16,0 tons for tandem axle is allowed on 82% of the state roads.
18. A maximum gross weight of 38,0 tons is allowed on 82% of the state roads and 28,0 tons on the remaining 18%.
20. The maximum gross weight for all types and categories of vehicles, with or without trailer, is limited only by the maximum axle loads permitted.
21. 10 tons, no power; 13 tons with power.
22. Romania permitted weight depends on road quality.
23. Maximum length for semi-trailer buses.
24. Maximum length for coupled vehicles.
25. For wide spread tandem (more than 2 meters between axles), maximum load is 20 tons.
26. Maximum gross train weight is 50,0 tons. The number and position of the axles determine the gross vehicle's weight.
27. 6,0 tons for steerable axle.
28. 6,5 to 10,0 depending on axle spacing.
29. Only trailers.
30. With steerable rear axles.
31. Limited to raods for timber transport.
32. 25 tons if at least 2 axles are driven.
33. 10 tons with no power. 12 tons with power.
34. 22,0 m for 3 vehicles.

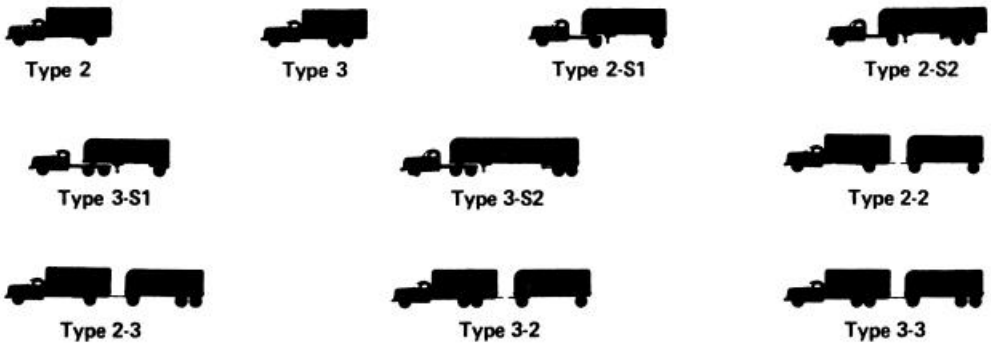
ASIA, MIDDLE EAST AND OCEANIA

COUNTRY	WIDTH	HEIGHT	LENGTH				AXLE LOAD		MAXIMUM GROSS WEIGHT (1)									
			SINGLE UNIT		TRUCK SEMI-TRAILER	OTHER COMBI-NATIONS	SINGLE	TANDEM	2	3	2-S1	2-S2	3-S1	3-S2	2-2	2-3	3-2	3-3
			TRUCK	BUS														
	meters	meters	meters	meters	meters	meters	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Afganistan (18)	2,5	4,0	12,0	12,0	16,0	24,0	8,0	14,0	16,0	24,0	24,0	34,0	36,0					44,0
Bahrain	2,5	4,0	12,0	12,0	15,0	18,0	11,2	14,7(38)	16,3	22,4	32,5							
Hong Kong (3)	2,5	4,6	11,0	12,0	16,0		10,0	20,0	16,0	24,0	24,0	34,0	32,0	38,0	(36)			
India	2,5 2,7	3,8 4,8(4)	11,0	11,0	16,0	18,0	10,2	18,0	16,2	24,0	26,4	34,2	34,2	42,0	36,6	44,4	44,4	52,2
Indonesia (18)	2,5	3,5	11,0	12,0	14,0	18,0	5,0 7,0(41)	8,0 12,0(41)	9,0	11,0	13,0	21,0			16,0			
Iran	2,5	4,0	10,0	11,0	16,0	18,0	13,0	20,0	19,0	26,0	26,0	32,0	32,0	38,0	30,0	32,0	38,0	40,0
Iraq	2,6	4,1	12,0	12,0	16,5	20,0	12,0	18,0	18,0	24,0	30,0	36,0	36,0	42,0	42,0	48,0	48,0	54,0
Israel	2,5	4,0	11,0 12,0(6)	12,0	15,5(7)	18,0(7)	13,0	21,0	19,0	27,0	32,0	33,0	40,0	48,0	38,0	46,0	52,0	54,0
Japan	2,5	3,8	12,0	12,0	12,0(9)	12,0	10,0		Total weight not to exceed 20 tons (10)									
Jordan	2,6	4,2	10,0 12,0(6)	12,0	16,2	18,5	13,0	18,0	21,0	27,0	36,0	36,0		40,0	36,0	44,0		48,0
Korea (8)(28)	2,5	3,5	12,0	12,0	12,0	12,0	10,0	—	Total weight not to exceed 20 tons									
Kuwait	3,5	4,0	12,0	12,0	15,0	26,0	10,0	16,0 19,0 (38)	Not to exceed 40,0 tons									
Lebanon	2,5	3,8	11,0	12,0	14,0	18,0	14,0	14,7 (11)	19,0	26,0	35,0							
Malaysia (12)(13)(28)	2,3	3,2(2)	9,1	9,1	11,2	12,2	8,1	12,2	18,3									
Pakistan (18)	2,5	4,0	11,0	11,0	15,0	18,0	8,0	14,5	12,0	21,0	35,0	42,0						
Philippines	2,5	4,5	10,0	11,0	11,0	14,0	8,0	14,5	16,0	22,0	33,0	33,0	33,0	33,0	(42)	(42)	(42)	(42)
Samoa (27)																		
Saudi Arabia	2,6	4,2	12,0	12,0	17,0	20,0	13,0	21,0	20,0		33,0			45,0				45,0
Singapore	2,5	3,2	10,0	12,0	11,0		10,0	20,0	16,0	24,0								
Sri Lanka	2,5	3,8 4,6(29)	10,0 11,0	10,7	14,0	17,0			15,3	20,0	21,0	27,5	26,5	30,5				
Syria (30)	2,5	3,8	10,0 11,0(6)	11,0	14,0	18,0	12,0		18,0	22,0	24,0	26,0	26,0	35,0	26,0		30,0	
Taiwan	2,5	3,8	11,0	12,2	18,0	20,0	10,0	14,5	15,0	21,0	35,0	42,0						
Thailand (17)(18)	2,5	(4)	10,0	12,0	15,0	18,0	9,1	16,4	12,0	21,0	21,1	28,4	30,1	37,4	30,2		39,2	
United Arab Emirates	2,6	4,2	12,0	—	17,0	21,0	13,5	20,0	19,0		30,0			44,0				44,0
Yemen Arab Republic	2,75	4,5	12,0		18,0		7,0	18,0 30,0	18,0	24,0	30,0	37,0	37,0	45,0	37,0	45,0	45,0	45,0
Australia (20)	2,5	4,0 4,4	11,0 20,1	11,0 20,1	16,5 20,1	17,0 30,5	8,1 9,0	13,2 16,5	Dependent on axle spacing and other regulations									
Fiji Islands (18)	2,5(21)	3,4	10,1	10,1	10,1	10,1	8,0	14,5	16,0	22,5	24,0	30,5	30,5	38,8				
New Caledonia	2,5	3,8(34)	11,0	12,0	15,0	18,0	13,0	(31)	19,0	26,0	38,0							
New Zealand	2,5(22)	4,3	12,3(23)	12,3(23)	(24)	19,0(25)	8,2(26)	15,5(26)	13,6	19,9	(42)	(42)	(42)	(42)	30,3	36,3	36,3	39,0
Papua New Guinea	2,5	4,3	9,5	10,0(32)	13,7	15,3	8,1	16,2	Dependent upon axle spacing and other regulations									

1. See vehicle type nomenclature, page 8.
2. 4,57 m for double-deck buses.
3. The Commissioner for Transport may authorize sizes and weights in excess of these.
4. Depends on the type of body build.
6. 3 or more axle vehicles have the highest limit.
7. Each component vehicle must not exceed 12,0 m of length.
8. To exceed these limitations requires approval of the Ministry of Transport (Korea).
9. This limit is 16,5 m for vehicles operating in the National Motorway System.
10. Special vehicles up to 34,0 tons in total weight can be operated in the National Motorway System.
11. Each component of the tandem axle is allowed an increase of 0,35 tons for every 5 cms over 0,90 m up to a maximum of 14 tons, provided that the maximum gross weight of the vehicle is not exceeded.
12. Maximum axle loads and maximum gross weight of vehicles vary on different routes of the highway network.
13. Maximum gross weight regulations exclude special purpose vehicles and trailors for indivisible loads.
17. The maximum gross vehicle weight limitations are the ones permitted only on primary and secondary roads.
18. 1981 report.
20. Regulations vary by States. Figures indicate range of variation in maximum limits.
21. Vehicles carrying sugar cane only: 3,05 m.
22. Agricultural vehicles may be up to 3,7 m subject to travel conditions.
23. Distance ahead of rear axle limited to 8,3 m; rear overhang limited to 4 m.
24. Limits based on distance ahead of rear axle to the "turntable."
25. Subject also to the restriction in Note (24) and ability to drive around inside a circle of 25 m diameter.
26. Limits effective in mid-1974 for twin tired axles. Lower limits apply on many roads.
27. Latest available report: 1971.
28. 1977 report.
29. Double deck buses 4,6 m.
30. Weights are authorized by annual permits and licenses.
31. See note 7, page 6.
32. 11,3 m for approved buses.
34. Taller vehicles under driver's responsibility.
36. The Commissioner of Transport may authorize vehicles of the type.
38. Depending on axle spacing.
41. Only for Class I roads (470 Km).
42. Based on evaluation of vehicle diagram.

ENGLISH	COUNTRY	WIDTH	HEIGHT	LENGTH				AXLE LOAD		MAXIMUM GROSS WEIGHT			
				SINGLE UNIT		TRUCK SEMI-TRAILER	OTHER COMBI-NATIONS	SINGLE	TANDEM	2	2-S1	3-S2	3-3
				TRUCK	BUS								
		meters	meters	meters	meters	meters	meters	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
ESPANOL	PAIS	ANCHO	ALTURA	LONGITUD TOTAL				CARGA POR EJES		PESO MAXIMO TOTAL			
				SINGLE UNIT		CAMION SEMI-REMOLQUE	OTRAS COMBI-NACIONES	SIMPLES	TANDEM	2	2-S1	3-S2	3-3
				CAMIONES	BUS								
		metros	metros	metros	metros	metros	metros	toneladas metricas	toneladas metricas	toneladas metricas	toneladas metricas	toneladas metricas	toneladas metricas
FRANCAIS	PAYS	LARGEUR	HAUTEUR	LONGUEUR				POIDS PAR ESSIEU		POIDS			
				VEHICLE ISOLE		VEHICLE ARTICULE	TRAIN ROUTIER	ESSIEU SIMPLE	ESSIEU DOUBLE	2	2-S1	3-S2	3-3
				CAMION	BUS								
		metres	metres	metres	metres	metres	metres	metrique tonnes	metrique tonnes	metrique tonnes	metrique tonnes	metrique tonnes	metrique tonnes
DEUTSCH	LAND	BREITE	HOEHE	LANGE				GEWICHT PRO ACHSE		HOCHSTGESAMTGEWICHT			
				EINZELFAHRZEUG		SATTEL-SCHLEPPER	LASTZUG	EINZEL-ACHSE	DOPPEL-ACHSE	2	2-S1	3-S2	3-3
				LASTKRAFT-WAGEN	OMNIBUS								
		meters	meters	meters	meters	meters	meters	metrisch tonnen	metrisch tonnen	metrisch tonnen	metrisch tonnen	metrisch tonnen	metrisch tonnen

VEHICLE TYPES —



Notation

The figure shows silhouettes of most basic commercial vehicle types in regular operation as designated by code based on axle arrangement. The first digit indicates the number of axles of the truck or truck-tractor. The letter "S" indicates a semitrailer, and the digit immediately following an "S" indicates the number of axles on the semitrailer. Any digit other than the first in a combination, when not preceded by an "S", indicates a trailer and the number of its axles. For instance, a 2-S2 combination is a two-axle truck-tractor with a tandem-axle semitrailer. A 3-S1-2 combination is a three-axle truck-tractor with tandem rear axles, a semitrailer with a single axle, and a trailer with two axles.

All data as of March 31, 1985

Appendix D International Convention for Safe Containers, 1972*

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*The present edition incorporates rectifications introduced as a consequence of a Proc⬟s-Verbal of Rectification dated 25 June 1976.

Preamble

THE CONTRACTING PARTIES,

RECOGNIZING the need to maintain a high level of safety of human life in the handling, stacking and transporting of containers,

MINDFUL of the need to facilitate international container transport,

RECOGNIZING, in this context, the advantages of formalizing common international safety requirements,

CONSIDERING that this end may best be achieved by the conclusion of a convention,

HAVE DECIDED to formalize structural requirements to ensure safety in the handling, stacking and transporting of containers in the course of normal operations, and to this end

HAVE AGREED as follows:

Article I

General obligation under the present Convention

The Contracting Parties undertake to give effect to the provisions of the present Convention and the annexes hereto, which shall constitute an integral part of the present Convention.

Article II

Definitions

For the purpose of the present Convention, unless expressly provided otherwise:

1 *Container* means an article of transport equipment:

(a) of a permanent character and accordingly strong enough to be suitable for repeated use;

(b) specially designed to facilitate the transport of goods, by one or more modes of transport, without intermediate reloading;

(c) designed to be secured and/or readily handled, having corner fittings for these purposes;

(d) of a size such that the area enclosed by the four outer bottom corners is either:

(i) at least 14 m^2 (150 sq ft) or

(ii) at least 7 m^2 (75 sq ft) if it is fitted with top corner fittings.

The term *container* includes neither vehicles nor packaging; however, containers when carried on chassis are included.

2 *Corner fittings* means an arrangement of apertures and faces at the top and/or bottom of a container for the purposes of handling, stacking and/or securing.

3 *Administration* means the Government of a Contracting Party under whose authority containers are approved.

4 *Approved* means approved by the Administration.

5 *Approval* means the decision by an Administration that a design type or a container is safe within the terms of the present Convention.

6 *International transport* means transport between points of departure and destination situated in the territory of two countries to at least one of which the present Convention applies. The present Convention shall also apply when part of a transport operation between two countries takes place in the territory of a country to which the present Convention applies.

7 *Cargo* means any goods, wares, merchandise and articles of every kind whatsoever carried in the containers.

8 *New container* means a container the construction of which was commenced on or after the date of entry into force of the present Convention.

9 *Existing container* means a container which is not a new container.

10 *Owner* means the owner as provided for under the national law of the Contracting Party or the lessee or bailee, if an agreement between the parties provides for the exercise of the owner's responsibility for maintenance and examination of the container by such lessee or bailee.

11 *Type of container* means the design type approved by the Administration.

12 *Type-series container* means any container manufactured in accordance with the approved design type.

13 *Prototype* means a container representative of those manufactured or to be manufactured in a design type series.

14 *Maximum operating gross weight or rating* or *R* means the maximum allowable combined weight of the container and its cargo.

15 *Tare weight* means the weight of the empty container including permanently affixed ancillary equipment.

16 *Maximum permissible payload* or *P* means the difference between maximum operating gross weight or rating and tare weight.

Article III

Application

1 The present Convention applies to new and existing containers used in international transport, excluding containers specially designed for air transport.

2 Every new container shall be approved in accordance with the provisions either for type-testing or for individual testing as contained in annex I.

3 Every existing container shall be approved in accordance with the relevant provisions for approval of existing containers set out in annex I within five years from the date of entry into force of the present Convention.

Article IV

Testing, inspection, approval and maintenance

1 For the enforcement of the provisions in annex I every Administration shall establish an effective procedure for the testing, inspection and approval of containers in accordance with the criteria established in the present Convention, provided, however, that an Administration may entrust such testing, inspection and approval to organizations duly authorized by it.

2 An Administration which entrusts such testing, inspection and approval to an organization shall inform the Secretary-General of the Inter-Governmental Maritime Consultative Organization (hereinafter referred to as "the Organization") for communication to Contracting Parties.

3 Application for approval may be made to the Administration of any Contracting Party.

4 Every container shall be maintained in a safe condition in accordance with the provisions of annex I.

5 If an approved container does not in fact comply with the requirements of annexes I and II the Administration concerned shall take such steps as it deems necessary to bring the container into compliance with such requirements or to withdraw the approval.

Article V

Acceptance of approval

1 Approval under the authority of a Contracting Party, granted under the terms of the present Convention, shall be accepted by the other Contracting Parties for all purposes covered by the present Convention. It shall be regarded by the other Contracting Parties as having the same force as an approval issued by them.

2 A Contracting Party shall not impose any other structural safety requirements or tests on containers covered by the present Convention, provided however, that nothing in the present Convention shall preclude the application of provisions of national regulations or legislation or of international agreements, prescribing additional structural safety requirements or tests for containers specially designed for the transport of dangerous goods, or for those features unique to containers carrying bulk liquids or for containers when carried by air. The term *dangerous goods* shall have that meaning assigned to it by international agreements.

Article VI

Control

1 Every container which has been approved under article III shall be subject to control in the territory of the Contracting Parties by officers duly authorized by such Contracting Parties. This control shall be limited to verifying that the container carries a valid Safety Approval Plate as required by the present Convention, unless there is significant evidence for believing that the condition of the container is such as to create an obvious risk to safety. In that case the officer carrying out the control shall only exercise it in so far as it may be necessary to ensure that the container is restored to a safe condition before it continues in service.

2 Where the container appears to have become unsafe as a result of a defect which may have existed when the container was approved, the Administration responsible for that approval shall be informed by the Contracting Party which detected the defect.

Article VII

Signature, ratification, acceptance, approval and accession

1 The present Convention shall be open for signature until 15 January 1973 at the Office of the United Nations at Geneva and subsequently from 1 February 1973 until 31 December 1973 inclusive at the Headquarters of the Organization at London by all States Members of the United Nations or Members of any of the specialized agencies or of the International Atomic Energy Agency or Parties to the Statute of the International Court of Justice, and by any other State invited by the General Assembly of the United Nations to become a Party to the present Convention.

2 The present Convention is subject to ratification, acceptance or approval by States which have signed it.

3 The present Convention shall remain open for accession by any State referred to in paragraph 1.

4 Instruments of ratification, acceptance, approval or accession shall be deposited with the Secretary-General of the Organization (hereinafter referred to as "the Secretary-General").

Article VIII

Entry into force

1 The present Convention shall enter into force twelve months from the date of the deposit of the tenth instrument of ratification, acceptance, approval or accession.

2 For each State ratifying, accepting, approving or acceding to the present Convention after the deposit of the tenth instrument of ratification, acceptance, approval or accession, the present Convention shall enter into force twelve months after the date of the deposit by such State of its instrument of ratification, acceptance, approval or accession.

3 Any State which becomes a Party to the present Convention after the entry into force of an amendment shall, failing an expression of a different intention by that State,

(a) be considered as a Party to the Convention as amended; and

(b) be considered as a Party to the unamended Convention in relation to any Party to the Convention not bound by the amendment.

Article IX

Procedure for amending any part or parts of the present Convention

1 The present Convention may be amended upon the proposal of a Contracting Party by any of the procedures specified in this article.

2 Amendment after consideration in the Organization:

(a) Upon the request of a Contracting Party, any amendment proposed by it to the present Convention shall be considered in the Organization. If adopted by a majority of two thirds of those present and voting in the Maritime Safety Committee of the Organization, to which all Contracting Parties shall have been invited to participate and vote, such amendment shall be communicated to all Members of the Organization and all Contracting Parties at least six months prior to its consideration by the Assembly of the Organization. Any Contracting Party which is not a Member of the Organization shall be entitled to participate and vote when the amendment is considered by the Assembly.

(b) If adopted by a two-thirds majority of those present and voting in the Assembly, and if such majority includes a two-thirds majority of the Contracting Parties present and voting, the amendment shall be communicated by the Secretary-General to all Contracting parties for their acceptance.

(c) Such amendment shall come into force twelve months after the date on which it is accepted by two thirds of the Contracting Parties. The amendment shall come into force with respect to all Contracting Parties except those which, before it comes into force, make a declaration that they do not accept the amendment.

3 Amendment by a conference:

Upon the request of a Contracting Party, concurred in by at least one third of the Contracting Parties, a conference to which the States referred to in article VII shall be invited will be convened by the Secretary-General.

Article X

Special procedure for amending the annexes

1 Any amendment to the Annexes proposed by a Contracting Party shall be considered in the Organization at the request of that Party.

2 If adopted by a two-thirds majority of those present and voting in the Maritime Safety Committee of the Organization to which all Contracting Parties shall have been invited to participate and to vote, and if such majority includes a two-thirds majority of the Contracting Parties present and voting, such amendment shall be communicated by the Secretary-General to all Contracting Parties for their acceptance.

3 Such an amendment shall enter into force on a date to be determined by the Maritime Safety Committee at the time of its adoption unless, by a prior date determined by the Maritime Safety Committee at the same time, one-fifth or five of the Contracting Parties, whichever number is less, notify the Secretary-General of their objection to the amendment. Determination by the Maritime Safety Committee of the dates referred to in this paragraph shall be by a two-thirds majority of those present and voting, which majority shall include a two-thirds majority of the Contracting Parties present and voting.

4 On entry into force any amendment shall, for all Contracting Parties which have not objected to the amendment, replace and supersede any previous provision to which the amendment refers; an objection made by a Contracting Party shall not be binding on other Contracting Parties as to acceptance of containers to which the present Convention applies.

5 The Secretary-General shall inform all Contracting Parties and Members of the Organization of any request and communication under this article and the date on which any amendment enters into force.

6 Where a proposed amendment to the annexes has been considered but not adopted by the Maritime Safety Committee, any Contracting Party may request the convening of a conference to which the States referred to in article VII shall be invited. Upon receipt of notification of concurrence by at least one third of the other Contracting Parties, such a conference shall be convened by the Secretary-General to consider amendments to the annexes.

Article XI

Denunciation

1 Any Contracting Party may denounce the present Convention by effecting the deposit of an instrument with the Secretary-General. The denunciation shall take effect one year from the date of such deposit with the Secretary-General.

2 A Contracting Party which has communicated an objection to an amendment to the annexes may denounce the present Convention and such denunciation shall take effect on the date of entry into force of such an amendment.

Article XII

Termination

The present Convention shall cease to be in force if the number of Contracting Parties is less than five for any period of twelve consecutive months.

Article XIII

Settlement of disputes

1 Any dispute between two or more Contracting Parties concerning the interpretation or application of the present Convention which cannot be settled by negotiation or other means of settlement shall, at the request of one of them, be referred to an arbitration tribunal composed as follows: each party to the dispute shall appoint an arbitrator and these two arbitrators shall appoint a third arbitrator, who shall be Chairman. If, three months after receipt of a request, one of the parties has failed to appoint an arbitrator or if the arbitrators have failed to elect the Chairman, any of the parties may request the Secretary-General to appoint an arbitrator or the Chairman of the arbitration tribunal.

2 The decision of the arbitration tribunal established under the provisions of paragraph 1 shall be binding on the parties to the dispute.

3 The arbitration tribunal shall determine its own rules of procedure.

4 Decisions of the arbitration tribunal, both as to its procedures and its place of meeting and as to any controversy laid before it, shall be taken by majority vote.

5 Any controversy which may arise between the parties to the dispute as regards the interpretation and execution of the award may be submitted by any of the parties for judgment to the arbitration tribunal which made the award.

Article XIV

Reservations

1 Reservations to the present Convention shall be permitted, excepting those relating to the provisions of articles I to VI, XIII, the present article and the annexes, on condition that such reservations are communicated in writing and, if communicated before the deposit of the instrument of ratification, acceptance, approval or accession, are confirmed in that instrument. The Secretary-General shall communicate such reservations to all States referred to in article VII.

2 Any reservations made in accordance with paragraph 1:

(a) modifies for the Contracting Party which made the reservation the provisions of the present Convention to which the reservation relates to the extent of the reservation;

(b) modifies those provisions to the same extent for the other Contracting Parties in their relations with the Contracting Party which entered the reservation.

3 Any Contracting Party which has formulated a reservation under paragraph 1 may withdraw it at any time by notification to the Secretary-General.

Article XV

Notification

In addition to the notifications and communications provided for in articles IX, X and XIV, the Secretary-General shall notify all the States referred to in article VII of the following:

(a) signatures, ratifications, acceptances, approvals and accessions under article VII;

(b) the dates of entry into force of the present Convention in accordance with article VIII;

(c) the date of entry into force of amendments to the present Convention in accordance with articles IX and X;

(d) denunciations under article XI;

(e) the termination of the present Convention under article XII.

Article XVI

Authentic texts

The original of the present Convention, of which the Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General, who shall communicate certified true copies to all States referred to in article VII.

IN WITNESS WHEREOF the undersigned Plenipotentiaries, being duly authorized thereto by their respective Governments, have signed the present Convention.*

DONE at Geneva this second day of December, one thousand nine hundred and seventy-two.

Annex I

Regulations for the testing, inspection, approval and maintenance of containers

CHAPTER I—Regulations common to all systems of approval

Regulation 1

Safety Approval Plate

1 (a) A Safety Approval Plate conforming to the specifications set out in the appendix to this annex shall be permanently affixed to every approved container at a readily visible place, adjacent to any other approval plate issued for official purposes, where it would not be easily damaged.

(b) On each container, all maximum gross weight markings shall be consistent with the maximum gross weight information on the Safety Approval Plate.

(c) The owner of the container shall remove the Safety Approval Plate on the container if:

(i) the container has been modified in a manner which would void the original approval and the information found on the Safety Approval Plate, or

(ii) the container is removed from service and is not being maintained in accordance with the Convention, or

(iii) the approval has been withdrawn by the Administration.

2 (a) The plate shall contain the following information in at least the English or French language:

"CSC SAFETY APPROVAL"

Country of approval and approval reference

Date (month and year) of manufacture

Manufacturer's identification number of the container or, in the case of existing containers for which that number is unknown, the number allotted by the Administration

Maximum operating gross weight (kg/lb)

Allowable stacking weight for 1.8*g* (kg/lb)

Transverse racking test load value (kg/lb).

(b) A blank space should be reversed on the plate for insertion of end-wall and/or side-wall strength values (factors) in accordance with paragraph 3 of this regulation and annex II, tests 6 and 7. A blank space should also be reserved on the plate for the first and subsequent maintenance examination dates (month and year) when used.

3 Where the Administration considers that a new container satisfies the requirements of the present Convention in respect of safety and if, for such container, the end-wall and/or side-wall strength values (factors) are designed to be greater or less than those stipulated in annex II, such values shall be indicated on the Safety Approval Plate.

4 The presence of the Safety Approval Plate does not remove the necessity of displaying such labels or other information as may be required by other regulations which may be in force.

Regulation 2

Maintenance and examination

1 The owner of the container shall be responsible for maintaining it in safe condition.

2 (a) The owner of an approved container shall examine the container or have it examined in accordance with the procedure either prescribed or approved by the Contracting Party concerned, at intervals appropriate to operating conditions.

(b) The date (month and year) before which a new container shall undergo its first examination shall be marked on the Safety Approval Plate.

(c) The date (month and year) before which the container shall be re-examined shall be clearly marked on the container on or as close as practicable to the Safety Approval Plate and in a manner acceptable to that Contracting Party which prescribed or approved the particular examination procedure involved.

(d) The interval from the date of manufacture to the date of the first examination shall not exceed five years. Subsequent examination of new containers and re-examination of existing containers shall be at intervals of not more than 30 months. All exami-

*Signatures omitted.

nations shall determine whether the container has any defects which could place any person in danger.

3 (a) As an alternative to paragraph 2, the Contracting Party concerned may approve a continuous examination programme if satisfied, on evidence submitted by the owner, that such a programme provides a standard of safety not inferior to the one set out in paragraph 2 above.

(b) To indicate that the container is operated under an approved continuous examination programme, a mark showing the letters **ACEP** and the identification of the Contracting Party which has granted approval of the programme shall be displayed on the container on or as close as practicable to the Safety Approval Plate.

(c) All examinations performed under such a programme shall determine whether a container has any defects which could place any person in danger. They shall be performed in connection with a major repair, refurbishment, or on-hire/off-hire interchange and in no case less than once every 30 months.

4 For the purpose of this regulation *the Contracting Party concerned* is the Contracting Party of the territory in which the owner is domiciled or has his head office. However, in the event that the owner is domiciled or has his head office in a country the government of which has not yet made arrangements for prescribing or approving an examination scheme and until such time as the arrangements have been made, the owner may use the procedure prescribed or approved by the Administration of a Contracting Party which is prepared to act as the Contracting Party concerned. The owner shall comply with the conditions for the use of such procedures set by the Administration in question.

CHAPTER II—Regulations for approval of new containers by design type

Regulation 3

Approval of new containers

To qualify for approval for safety purposes under the present Convention all new containers shall comply with the requirements set out in annex II.

Regulation 4

Design type approval

In the case of containers for which an application for approval has been submitted, the Administration will examine designs and witness testing of a prototype container to ensure that the containers will conform with the requirements set out in annex II. When satisfied, the Administration will notify the applicant in writing that the container meets the requirements of the present Convention and this notification shall entitle the manufacturer to affix the Safety Approval Plate to every container of the design type series.

Regulation 5

Provisions for approval by design type

1 Where the containers are to be manufactured by design type series, application made to an Administration for approval by design type shall be accompanied by drawings, a design specification of the type of container to be approved and such other data as may be required by the Administration.

2 The applicant shall state the identification symbols which will be assigned by the manufacturer to the type of container to which the application for approval relates.

3 The application shall also be accompanied by an assurance from the manufacturer that he will:

(a) produce to the Administration such containers of the design type concerned as the Administration may wish to examine;

(b) advise the Administration of any change in the design or specification and await its approval before affixing the Safety Approval Plate to the container;

(c) affix the Safety Approval Plate to each container in the design type series and to no others;

(d) keep a record of containers manufactured to the approved design type. This record shall at least contain the manufacturer's identification numbers, dates of delivery and names and addresses of customers to whom the containers are delivered.

4 Approval may be granted by the Administration to containers manufactured as modifications of an approved design type if the Administration is satisfied that the modifications do not affect the validity of tests conducted in the course of design type approval.

5 The Administration shall not confer on a manufacturer authority to affix Safety Approval Plates on the basis of design type approval unless satisfied that the manufacturer has instituted internal production-control features to ensure that the containers produced will conform to the approved prototype.

Regulation 6

Examination during production

In order to ensure that containers of the same design type series are manufactured to the approved design, the Administration shall examine or test as many units as it considers necessary, at any stage during production of the design type series concerned.

Regulation 7

Notification of administration

The manufacturer shall notify the Administration prior to commencement of production of each new series of containers to be manufactured in accordance with an approved design type.

CHAPTER III—Regulations for approval of new containers by individual approval

Regulation 8

Approval of individual containers

Approval of individual containers may be granted where the Administration, after examination and witnessing of tests, is satisfied that the container meets the requirements of the present Convention; the Administration, when so satisfied, shall notify the applicant in writing of approval and this notification shall entitle him to affix the Safety Approval Plate to such container.

CHAPTER IV—Regulations for approval of existing containers and new containers not approved at time of manufacture

Regulation 9

Approval of existing containers

1 If, within five years from the date of entry into force of the present Convention, the owner of an existing container presents the following information to an Administration:

(a) date and place of manufacture;

(b) manufacturer's identification number of the container if available;

(c) maximum operating gross weight capability;

(d) (i) evidence that a container of this type has been safely operated in maritime and/or inland transport for a period of at least two years, or

(ii) evidence to the satisfaction of the Administration that the container was manufactured to a design type which had been tested and found to comply with the technical conditions set out in annex II, with the exception of those technical conditions relating to the end-wall and side-wall strength tests, or

(iii) evidence that the container was constructed to standards which, in the opinion of the Administration, were equivalent to the technical conditions set out in annex II, with the exception of those technical conditions relating to the end-wall and side-wall strength tests;

(e) allowable stacking weight for 1.8 *g* (kg/lb); and

(f) such other data as required for the Safety Approval Plate;

then the Administration, after investigation, shall notify the owner in writing whether approval is granted; and if so, this notification shall entitle the owner to affix the Safety Approval Plate after an examination of the container concerned has been carried out in accordance with regulation 2. The examination of the container concerned and the affixing of the Safety Approval Plate shall be accomplished not later than 1 January 1985.

2 Existing containers which do not qualify for approval under paragraph 1 of this regulation may be presented for approval under the provisions of chapter II or chapter III of this annex. For such containers the requirements of annex II relating to end-wall and/or side-wall strength tests shall not apply. The Administration may, if it is satisfied that the containers in question have been in service, waive such of the requirements in respect of presentation of drawings and testing, other than the lifting and floor-strength tests, as it may deem appropriate.

Regulation 10

Approval of new containers not approved at time of manufacture

If, on or before 6 September 1982, the owner of a new container which was not approved at the time of manufacture presents the following information to an Administration:

(a) date and place of manufacture;

(b) manufacturer's identification number of the container if available;

(c) maximum operating gross weight capability;

(d) evidence to the satisfaction of the Administration that the container was manufactured to a design type which had been tested and found to comply with the technical conditions set out in annex II;

(e) allowable stacking weight for 1.8 *g* (kg/lb); and

(f) such other data as required for the Safety Approval Plate;

the Administration, after investigation, may approve the container, notwithstanding the provisions of chapter II. Where approval is granted, such approval shall be notified to the owner in writing, and this notification shall entitle the owner to affix the Safety Approval Plate after an examination of the container concerned has been carried out in accordance with regulation 2. The examination of the container concerned and the affixing of the Safety Approval Plate shall be accomplished not later than 1 January 1985.

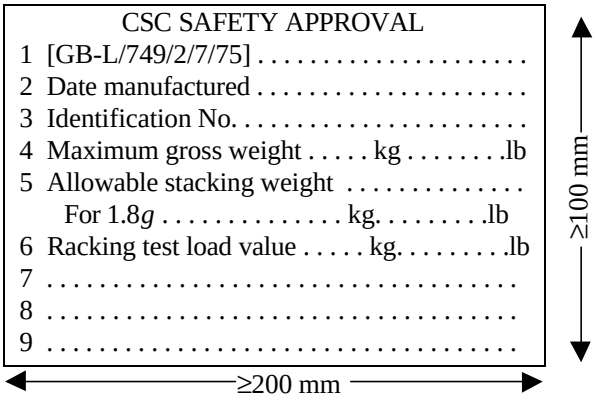
CHAPTER V—Regulations for approval of modified containers

Regulation 11
Approval of modified containers

The owner of an approved container that has been modified in a manner resulting in structural changes shall notify the Administration or an approved organization duly authorized by it of those changes. The Administration or authorized organization may require retesting of the modified container as appropriate prior to recertification.

APPENDIX

The Safety Approval Plate, conforming to the model reproduced below, shall take the form of a permanent, non-corrosive, fireproof rectangular plate measuring not less than 200 mm by 100 mm. The words **CSC SAFETY APPROVAL** of a minimum letter height of 8 mm, and all other words and numbers of a minimum height of 5 mm shall be stamped into, embossed on or indicated on the surface of the plate in any other permanent and legible way.



1 Country of approval and approval reference as given in the example on line 1. (The country of approval should be indicated by means of the distinguishing sign used to indicate country of registration of motor vehicles in international road traffic.)
2 Date (month and year) of manufacture.
3 Manufacturer's identification number of the container or, in the case of existing containers for which that number is unknown, the number allotted by the Administration.
4 Maximum operating gross weight (kg and lb).
5 Allowable stacking weight for 1.8*g* (kg and lb).
6 Transverse racking test load value (kg and lb).
7 End-wall strength to be indicated on plate only if end-walls are designed to withstand a load of less or greater than 0.4 times the maximum permissible payload, i.e. 0.4 *P*.
8 Side-wall strength to be indicated on plate only if the side-walls are designed to withstand a load of less or greater than 0.6 times the maximum permissible payload, i.e. 0.6 *P*.
9 First maintenance examination date (month and year) for new containers and subsequent maintenance examination dates (month and year) if plate is used for this purpose.

Annex II

Structural Safety Requirements and Tests

Introduction

In setting the requirements of this annex, it is implicit that in all phases of the operation of containers the forces as a result of motion, location, stacking and weight of the loaded container and external forces will not exceed the design strength of the container. In particular, the following assumptions have been made:

(a) The container will so be restrained that it is not subjected to forces in excess of those for which it has been designed;

(b) the container will have its cargo stowed in accordance with the recommended practices of the trade so that the cargo does not impose upon the container forces in excess of those for which it has been designed.

Construction

1 A container made from any suitable material which satisfactorily performs the following tests without sustaining any permanent deformation or abnormality which would render it incapable of being used for its designed purpose shall be considered safe.

2 The dimensions, positioning and associated tolerances of corner fittings shall be checked having regard to the lifting and securing systems in which they will function.

Test loads and test procedures

Where appropriate to the design of the container, the following test loads and test procedures shall be applied to all kinds of containers under test:

1 LIFTING

The container, having the prescribed internal loading, shall be lifted in such a way that no significant acceleration forces are applied. After lifting, the container shall be suspended or supported for five minutes and then lowered to the ground.

(A) Lifting from corner fittings

TEST LOADINGS AND APPLIED FORCES	TEST PROCEDURES
Internal loading: A uniformly distributed load such that the combined weight of container and test load is equal to 2*R*. In the case of a tank-container, when the test weight of the internal load plus the tare weight is less than 2*R*, a supplementary load distributed over the length of the tank is to be applied to the container. **Externally applied forces:** Such as to lift the combined weight of 2*R* in the manner prescribed (under the heading TEST PROCEDURES).	(i) *Lifting from top corner fittings:* Containers greater than 3,000 mm (10 ft) (nominal) in length shall have lifting forces applied vertically at all four top corner fittings. Containers of 3,000 mm (10 ft) (nominal) in length or less shall have lifting forces applied at all four top corner fittings, in such a way that the angle between each lifting device and the vertical shall be 30°. (ii) *Lifting from bottom corner fittings:* Containers shall have lifting forces applied in such a manner that the lifting devices bear on the bottom corner fittings only. The lifting forces shall be applied at angles to the horizontal of: 30° for containers of length 12,000 mm (40 ft) (nominal) or greater, 37° for containers of length 9,000 mm (30 ft) (nominal) and up to but not including 12,000 mm (40 ft) (nominal), 45° for containers of length 6,000 mm (20 ft) (nominal) and up to but not including 9,000 mm (30 ft) (nominal), 60° for containers of length less than 6,000 mm (20 ft) (nominal).

(B) Lifting by other additional methods

Internal loading: A uniformly distributed load such that the combined weight of container and test load is equal to 1.25*R*. In the case of a tank-container, when the test weight of the internal load plus the tare weight is less than 1.25*R*, a supplementary load distributed over the length of the tank is to be applied to the container. **Externally applied forces:** Such as to lift the combined weight of 1.25*R*, in the manner prescribed (under the heading TEST PROCEDURES).	(i) *Lifting from fork lift pockets:* The container shall be placed on bars which are in the same horizontal plane, one bar centered within each fork-lift pocket which is used for lifting the loaded container. The bars shall be of the same width as the forks intended to be used in the handling, and shall project into the fork pocket 75% of the length of the fork pocket. (ii) *Lifting from grappler arm positions:* The container shall be placed on pads in the same horizontal plane, one under each grappler-arm position. These pads shall be of the same sizes as the lifting area of the grappler arms intended to be used.

(iii) *Other Methods*

Where containers are designed to be lifted in the loaded condition by any method not mentioned in *(A)* or *(B)*(i) and (ii) they shall also be tested with the internal loading and externally applied forces representative of the acceleration conditions appropriate to that method.

2 STACKING

1 For conditions of international transport where the maximum vertical acceleration forces vary significantly from 1.8*g* and when the container is reliably and effectively limited to such conditions of transport, the stacking load may be varied by the appropriate ratio of acceleration forces.

2 On successful completion of this test the container may be rated for the allowable superimposed static stacking weight which should be indicated on the Safety Approval Plate against the heading **ALLOWABLE STACKING WEIGHT FOR 1.8*g* (kg/lb).**

TEST LOADINGS AND APPLIED FORCES	TEST PROCEDURES
Internal loading:	
A uniformly distributed load such that the combined weight of container and test load is equal to 1.8*R*. Tank-containers may be tested in the tare condition.	The container, having the prescribed internal loading, shall be placed on four level pads which are in turn supported on a rigid horizontal surface, one under each bottom corner fitting or equivalent corner structure. The pads shall be centralized under the fittings and shall be of approximately the same plan dimensions as the fittings.
Externally applied forces:	
Such as to subject each of the four top corner fittings to a vertical downward force equal to 0.25 x 1.8 x the allowable superimposed static stacking weight.	Each externally applied force shall be applied to each of the corner fittings through a corresponding test corner fitting or through a pad of the same plan dimensions. The test corner fitting or pad shall be offset with respect to the top corner fitting of the container by 25 mm (1 in.) laterally and 38 mm (1½ in.) longitudinally.

3 CONCENTRATED LOADS

TEST LOADINGS AND APPLIED FORCES	TEST PROCEDURES
(a) On roof	
Internal loading:	
None.	
Externally applied forces:	
A concentrated load of 300 kg (660 lb) uniformly distributed over an area of 600 mm x 300 mm (24 in x 12 in).	The externally applied forces shall be applied vertically downwards to the outer surface of the weakest area of the roof of the container.
(b) On floor	
Internal loading:	
Two concentrated loads each of 2,730 kg (6,000 lb) and each applied to the container floor through a contact area of 142 cm^2 (22 sq in).	The test should be made with the container resting on four level supports under its four bottom corners in such a manner that the base structure of the container is free to deflect. A testing device loaded to a weight of 5,460 kg (12,000 lb) that is 2,730 kg (6,000 lb) on each of two surfaces, having, when loaded, a total contact area of 284 cm^2 (44 sq in) that is 142 cm^2 (22 sq in) on each surface, the surface width being 180 mm (7 in) spaced 760 mm (30 in) apart, centre to centre, should be manoeuvred over the entire floor area of the container.
Externally applied forces:	
None.	

4 TRANSVERSE RACKING

TEST LOADINGS AND APPLIED FORCES	TEST PROCEDURES
Internal loading:	
None.	The container in tare condition shall be placed on four level supports, one under each bottom corner, and shall be restrained against lateral and vertical movement by means of anchor devices so arranged that the lateral restraint is provided only at the bottom corners diagonally opposite to those at which the forces are applied.
Externally applied forces:	
Such as to rack the end structures of the container sideways. The forces shall be equal to those for which the container was designed.	The externally applied forces shall be applied either separately or simultaneously to each of the top corner fittings on one side of the container in lines parallel both to the base and to the planes of the ends of the container. The forces shall be applied first towards and then away from the top corner fittings. In the case of containers in which each end is symmetrical about its own vertical centreline, one side only need be tested, but both sides of containers with asymmetric ends shall be tested.

5 LONGITUDINAL RESTRAINT (STATIC TEST)

When designing and constructing containers, it must be borne in mind that containers, when carried by inland modes of transport, may sustain accelerations of $2g$ applied horizontally in a longitudinal direction.

TEST LOADINGS AND APPLIED FORCES	TEST PROCEDURES
Internal loading:	
A uniformly distributed load, such that the combined weight of a container and test load is equal to the maximum operating gross weight or rating, *R*. In the case of a tank container, when the weight of the internal load plus the tare is less than the maximum gross weight or rating, *R*, a supplementary load is to be applied to the container.	The container, having the prescribed internal loading, shall be restrained longitudinally by securing the two bottom corner fittings or equivalent corner structures at one end to suitable anchor points.
Externally applied forces:	
Such as to subject each side of the container to longitudinal compressive and tensile forces of magnitude *R*, that is, a combined force of $2R$ on the base of the container as a whole.	The externally applied forces shall be applied first towards and then away from the anchor points. Each side of the container shall be tested.

6 END-WALLS

The end-walls should be capable of withstanding a load of not less than 0.4 times the maximum permissible payload. If, however, the end-walls are designed to withstand a load of less or greater than 0.4 times the maximum permissible payload such a strength factor shall be indicated on the Safety Approval Plate in accordance with annex I, regulation 1.

TEST LOADINGS AND APPLIED FORCES	TEST PROCEDURES
Internal loading: Such as to subject the inside of an end-wall to a uniformly distributed load of 0.4*P* or such other load for which the container may be designed.	The prescribed internal loading shall be applied as follows: Both ends of a container shall be tested except that where the ends are identical only one end need to be tested. The end-walls of containers which do not have open sides or side doors may be tested separately or simultaneously. The end-walls of containers which do have open sides or side doors should be tested separately. When the ends are tested separately the reactions to the forces applied to the end-wall shall be confined to the base structure of the container.
Externally applied forces: None.	

7 SIDE-WALLS

The side-walls should be capable of withstanding a load of not less than 0.6 times the maximum permissible payload. If, however, the side-walls are designed to withstand a load of less or greater than 0.6 times the maximum permissible payload, such a strength factor shall be indicated on the Safety Approval Plate in accordance with annex I, regulation 1.

TEST LOADINGS AND APPLIED FORCES	TEST PROCEDURES
Internal loading: Such as to subject the inside of a side-wall to a uniformly distributed load of 0.6*P* or such other load for which the container may be designed.	The prescribed internal loading shall be applied as follows: Both sides of a container shall be tested except that where the sides are identical only one side need be tested. Side-walls should be tested separately and the reactions to the internal loading shall be confined to the corner fittings or equivalent corner structures. Open-topped containers shall be tested in the condition in which they are designed to be operated, for example, with removable top members in position.
Externally applied forces: None.	

Supplement

Recommendation on harmonized interpretation and implementation of the International Convention for Safe Containers, 1972, as amended*

1 General

The various points concerning harmonized interpretation and implementation of the International Convention for Safe Containers (CSC), 1972 as amended, on which consensus has so far been reached are given below.

2 Definitions (article II, paragraphs 8 and 9)

New container and *existing container*. Where necessary, individual Administrations should determine the date on which the construction of a container shall be deemed to have commenced for purposes of determining whether a container should be considered as "new" or "existing".

3 Application (article III, paragraph 1)

3.1 *Swap bodies/demountables.* It is agreed that the CSC does not have to be applied to containers known as swap bodies/demountables and designed and used for carriage by road only or by rail and road only and which are without stacking capability and top lift facilities.

3.2 This agreement also applies to such swap bodies/demountables transported by sea on condition that they be mounted on a road vehicle or rail wagon. It does not, however, apply to swap bodies/demountables used in transoceanic services.

3.3 *Offshore containers.* It is agreed that the CSC does not apply to offshore containers that are handled in open seas. Offshore containers may be subject to different design and testing parameters as determined by the Administration.

4 Entry into force (articles III and VIII)

All containers should be inspected and affixed with Safety Approval Plates by the Administration of the Contracting Party not less than five years from the date of entry into force of the Convention for that Party.

5 Testing, inspection and approval (article IV, paragraphs 1 and 2): selection of organizations entrusted to carry out these functions

Administrations will require a basic description of the organizations to be entrusted with testing, inspection and approval functions, together with evidence of their technical capability to carry this out, and will have to satisfy themselves as to the financial well-being of such organizations. The Administrations will, furthermore, have to satisfy themselves that the organizations are free from undue influence by any container owner, operator, manufacturer, lessor, repairer or others concerned who may have a vested interest in obtaining container approval.

6 Approval of containers for foreign owners or manufacturers (article IV, paragraph 3) and reciprocity

6.1 Where possible, Contracting Parties should make every effort to provide facilities or means to grant approvals to foreign container owners or manufacturers seeking their approval of containers in accordance with the provisions of the Convention.

6.2 Approval of containers would be facilitated if classification societies or other organizations approved by one Contracting Party could be authorized to act for other Contracting Parties under arrangements acceptable to the parties involved.

7 Maintenance and structural modifications (article IV)

7.1 Development of detailed guidelines on standards of maintenance will create an unnecessary burden for Administrations attempting to implement the Con-

*This text is taken from CSC/Circ. 100. The previous circular (CSC/Circ. 67) was revised to take into account the amendments to the text of the Convention in 1991 and 1992.

vention as well as for owners. The interpretation of the provision "the owner of the container shall be responsible for maintaining it in safe condition" (annex I, regulation 2, paragraph 1 of the Convention) should be such that the owner of a container (as defined in article II, paragraph 10 of the Convention) should be held accountable to the Government of any territory on which the container is operated for the safe condition of that container. The owner should be bound by the existing safety laws of such a territory and such law or regulation as may implement the control requirements of article VI of the Convention. But the methods by which owners achieve under the provisions of article IV the safe condition of their containers, that is the appropriate combination of planned maintenance, procedures for refurbishment, refit and repair and the selection of organizations to perform this work, should be their own responsibility. If there is clear evidence for believing that an owner is repeatedly failing to achieve a satisfactory level of safety, the Government of the territory in which the owner has his Head Office or domicile should be requested to ensure that appropriate corrective action is taken.

7.2 The responsibility of the owner to maintain his container in a safe condition includes the responsibility to ensure that any modifications carried out on an approved container do not adversely affect or render inaccurate the information recorded on the Safety Approval Plate. Under the provisions of annex I, chapter V, regulation 11, the owner of a container which has been modified in a manner resulting in structural changes shall notify the Administration or an approved organization duly authorized by it of those changes. The Administration or authorized organization may determine whether the results of the original tests conducted in accordance with annex II for the initial container approval remain valid for the modified container.

7.3 If an owner removes a container from service requiring compliance with the Convention and does not maintain that container in accordance with the provisions of the Convention, or makes structural modifications without following the procedures in 7.2 above, the owner must remove the Safety Approval Plate.

8 Withdrawal of approval (article IV, paragraph 5)

With regard to withdrawal of approval, the *Administration concerned* should be considered as the Administration which issued the approval. While any Contracting Party may exercise control over container movement pursuant to article VI, only the Administration which approved the container has the right to withdraw its approval. When approval has been withdrawn, the Administration concerned should require the removal of the Safety Approval Plate.

9 Control (article VI)

9.1 General

For the purposes of effecting control (as envisaged in article VI of the Convention) Contracting Parties should only appoint government bodies.

9.2 Containers which are not defective but which have no Safety Approval Plate or which have an incorrectly completed plate

Such containers should be stopped. However, where evidence can be produced either to the effect that such container has been approved under the terms of the Convention or to the effect that such container meets the standards of the Convention, then the authority exercising control may permit the container to proceed to its destination for unloading, with the proviso that it shall be plated as expeditiously as may be practicable and not reloaded before it has been correctly plated under the Convention.

9.3 Containers which are "out of date"

A container found to have marked on or near to its Safety Approval Plate a next maintenance examination date which is in the past should be stopped. However, the competent authority exercising control may permit the container to proceed to its destination for unloading with the proviso that it should be examined and updated as expeditiously as may be practicable and not reloaded before this has been done.

9.4 Unsafe containers (article VI, paragraph 1, third sentence)

Where a container is found by the authority exercising control to have a defect which could place a person in danger, then the container should be stopped. However, if the container can be safely moved (e.g. to a place where it can be restored to a safe condition, or to its destination) the officer exercising control may permit such movement on such conditions as the officer may specify with the proviso that the container shall be repaired as expeditiously as may be practicable and not reloaded before this has been done.

9.5 International movement of containers under control

It is recognized that in any of the cases set out in 9.2, 9.3 and 9.4 the owner may wish to remove his container to another country where the appropriate corrective action can be more conveniently carried out. Control officers may permit such movements, in accordance with the provisions of 9.2, 9.3 and 9.4 as

appropriate, but should take such measures as may be reasonably practicable to ensure that the appropriate corrective action is indeed taken. In particular, the control officer permitting such a movement should consider whether it would be necessary to inform the control officer or officers in the other country or countries through which the container is to be moved. Further consideration of the practical aspects of this matter is needed.

9.6 Notification concerning unsafe containers of a given approved series

It is suggested that if a considerable number of containers in a given approved series are found to be unsafe as a result of defects which may have existed prior to approval (article VI, paragraph 2), it may be desirable for Administrations to notify the Organization as well as the Contracting Party concerned.

10 Safety Approval Plate (regulation 1)

10.1 The following approaches to complying with certain of the data requirements of the Convention, listed in this section, are deemed to be in conformity therewith.

10.2 A single approval number may be assigned to each owner for all existing containers in a single application for approval which could be entered on line 1 of the plate.

10.3 The example given in line 1 of the model Safety Approval Plate (see appendix to annex I of the Convention) should not be construed so as to require the inclusion of the date of approval in the approval reference.

10.4 The appendix to annex I of the Convention can be interpreted so as to allow the use of the owner's ISO alphanumeric identification codes, on either new or existing containers. This may be done even if the manufacturer's serial number is available, as long as the applicant keeps a record correlating his identification numbers with the manufacturer's serial numbers.

10.5 Where marking of the end-wall or side-wall strength on the plate is not required (e.g. a container with an end-wall or side-wall strength equal to 0.4*P* or 0.6*P*, respectively) a blank space need not be retained on the Safety Approval Plate for such marking but can be used instead to meet other data requirements of the Convention, e.g. subsequent date marks.

10.6 Where end-wall or side-wall strength is required to be marked on the Safety Approval Plate, this should be done as follows:

— in the English Language:
END-WALL STRENGTH
SIDE-WALL STRENGTH

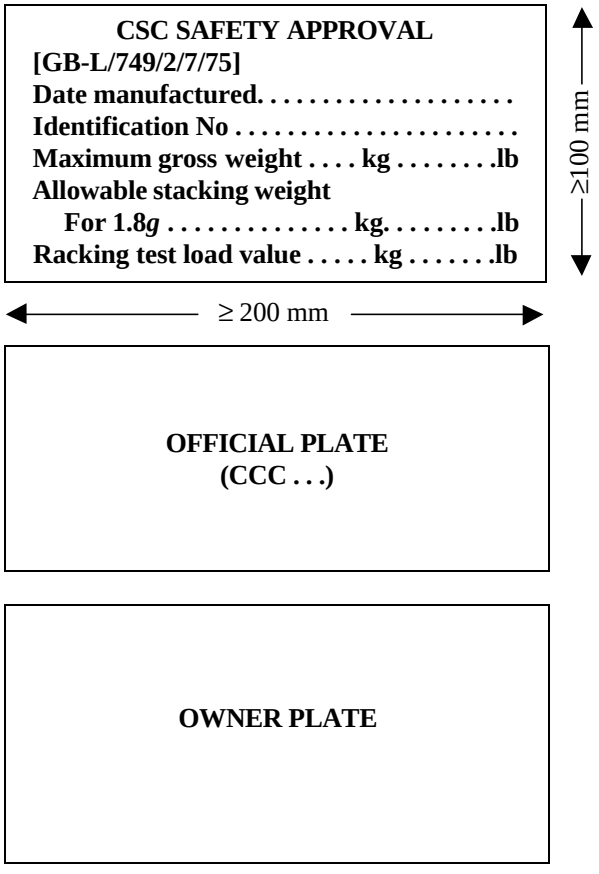
— in the French language:
RÉSISTANCE DE LA PAROI D'EXTRÉMITÉ
RÉSISTANCE DE LA PAROI LATÉRALE.

10.7 In cases where a higher or lower wall strength is to be marked on the Safety Approval Plate, this can be done briefly by referring to the formula related to the payload *P*.

Example: **SIDE-WALL STRENGTH 0.5*p*.**

10.8 With respect to the material characteristics of the Safety Approval Plate (see appendix to annex I of the Convention) each Administration, for purposes of approving containers, may define *permanent*, *non-corrosive* and *fireproof* in its own way or simply require that Safety Approval Plates be of a material which it considers meets this definition (e.g., a suitable metal).

10.9 Regulation 1 of annex I requires that the Safety Approval Plate be affixed adjacent to any approval plate issued for official purposes. To comply with this requirement, when practicable, the CSC Safety Approval Plate may be grouped with the data plates required by other international conventions and national requirements on one base plate. The base plate should be conveniently located on the container. One example of such a grouped data plate is given below.



10.10 For the purposes of this Convention, the word *weight* is considered to be equivalent to the word *mass*, and therefore can be used on the Safety Approval Plate. When the 1993 amendments to the annexes to the Convention come into force, the word **MASS** should replace **WEIGHT** on plates fitted to containers after the amendments come into force.

11 Maintenance and examination procedures (regulation 2)

11.1 Choice of examination procedure

11.1.1 The Convention allows owners the option of having containers examined at intervals specified in the Convention in accordance with an examination scheme prescribed or approved by the Administration concerned, as set out in regulation 2, paragraph 2, and hereinafter referred to as "PERIODIC EXAMINATION SCHEME"; or under a continuous examination programme approved by the Administration concerned, as set out in regulation 2, paragraph 3, and hereinafter referred to as "CONTINUOUS EXAMINATION PROGRAMME".

11.1.2 Both procedures are intended to ensure that the containers are maintained to the required level of safety and both should be considered equal, provided the Administration is satisfied with the examination schemes submitted by the owner.

11.1.3 The owner should be allowed the option of having his fleet covered by one examination procedure and the remaining part of his fleet covered by the other procedure, and provision should be made to allow an owner to change the procedure applicable to their containers.

Elements to be included in the examination

11.2.1 For containers under a periodic examination scheme

11.2.1.1 While Administrations may specify factors to be taken into account in a container examination scheme, it should not be necessary at this time to agree on a specific list of factors or minimum listing of parts of a container which should be included in an examination. However, each examination should include a detailed visual inspection for defects or other safety-related deficiencies or damage which will render the container unsafe.

11.2.1.2 It is accepted that a visual examination of the exterior of the container will normally be sufficient. However, an examination of the interior should also be performed if reasonably practicable (e.g. if the container is empty at the time). Furthermore, the underside of the container should be examined. This may be done either with the container supported on a skeletal chassis or, if the examiner considers it necessary, after the container has been lifted on to other supports.

11.2.1.3 The person performing the external examination should have the authority to require a more detailed examination of a container if the condition of the container appears to warrant such examination.

11.2.2 For containers under a continuous examination programme

11.2.2.1 Under an approved continuous examination programme a container is subject to examinations and inspections during the course of normal operations. These are:

.1 *thorough examinations*, which are examinations conducted in connection with a major repair, refurbishment, or on-hire/off-hire interchange; and

.2 *routine operating inspections*, which are frequent inspections performed with the object of detecting any damage or deterioration which might necessitate corrective action.

11.2.2.2 Thorough examinations should be carried out in accordance with the requirements of 11.2.1 and care should be taken to ensure that any damaged parts or components have been adequately and safely repaired or replaced. Although Administrations may specify factors to be taken into account during routine operating inspections, normally a visual inspection of the exterior and the underside should be sufficient.

11.3 Personnel carrying out examinations

The examination of a container should be carried out by a person having such knowledge and experience of containers as will enable him to determine in accordance with 11.2.1 and 11.2.2 whether it has any defect which could place any person in danger.

11.4 Container markings for examinations

11.4.1 For containers under a periodic examination scheme

The use of decals should be allowed to indicate the date of the first examination and subsequent re-examination of a container examined at intervals specified in the Convention provided that:

.1 the relevant date (month and year) is shown in internationally recognizable words or figures on the decals or on the plate itself;

.2 the date of the first examination for new containers is shown by decals or otherwise

on the plate itself as regulation 2.2 of annex I of the CSC requires; and

.3 the decals are coloured in accordance with the year of examination as follows:

BROWN	1986	1992	1998
BLUE	1987	1993	1999
YELLOW	1988	1994	2000
RED	1989	1995	etc.
BLACK	1990	1996	
GREEN	1991	1997	

11.4.2 For containers under a continuous examination programme

A container examined under an approved continuous examination programme should bear a decal showing the letters **ACEP** and the identification of the Administration which has granted the approval, in a similar manner to that stated in annex I, appendix 1, paragraph 1. This decal should be placed on or as close as practicable to the Safety Approval Plate.

11.4.3 Use of decals

The use of decals for containers under a periodic examination scheme should remain optional and in no way derogate from the relevant provisions of the Convention to which reference is made above. The responsibility for developing and introducing a decal system should remain with the owners.

12 Records of examinations

It will be desirable to require that owners keep an examination record which should include, in addition to identification of the containers, a record of the date of last examination and a means of identifying the examiner. There is no need to standardize the method by which such records should be kept and the existing record systems may be accepted at least for a transitional period. Such records should be made available within a reasonable time to the Administration on its request. There is no requirement to keep records of routine operating inspections.

13 Frequency of examinations

13.1 For containers under a periodic examination scheme

13.1.1 The Convention recognizes that it may be necessary to examine containers more frequently than every 30 months when they are subject to frequent handling and transhipment. It should be borne in mind, however, that any significant reduction in the 30-month interval between examinations would create severe examination control problems. It should be noted that where containers are subjected to frequent handling and transhipment they are also liable to be subjected to frequent checking.

13.1.2 Therefore, in determining whether it is acceptable that the interval between examinations under the Convention should be the maximum of 30 months, proper account should be taken of intermediate examinations, having regard to their extend and to the technical competence of the persons by whom they are performed.

13.2 For containers under a continuous examination programme

Containers examined under an approved continuous examination programme are subject to a thorough examination in connection with a major repair, refurbishment or on-hire/off-hire interchange and in no case less than once every 30 months.

14 Modifications of existing containers

Applicants for approval of existing containers might be required to certify that, to the best of their knowledge, any modifications previously carried out do not adversely affect safety or the relevance to those containers of the information presented with the application in accordance with annex I, regulation 9, paragraph 1(d)(ii) and (iii). Alternatively, applicants should submit details of the modification for consideration.

15 Test methods and requirements (annex II)

Containers tested in accordance with the methods described in ISO Standard 1496 should be deemed to have been fully and sufficiently tested for the purposes of the Convention, except that tank-containers provided with fork-lift pockets must be additionally tested in accordance with annex II, test 1(B)(i).

16 Stacking test (annex II, paragraph 2)

16.1 The following can be used as guidance in interpreting paragraphs 1 and 2 of the stacking test:

> For a 6-high stacking of 20-ton (20,320 kg/ 44,800 lb) containers the mass on the bottom container would be 5 × 20 tons (20,320 kg/ 44,800 lb), i.e. 100 tons (101,600 kg/224,000 lb). Thus, in the case of a 20-ton container with 6-high stacking capability the plate should indicate: **ALLOWABLE STACKING MASS FOR 1.8*g*: 101,600 kg/224,000 lb.**

16.2 The following may be useful guidance for determining allowable stacking mass:

> The allowable stacking mass for 1.8*g* may be calculated by assuming a uniform stack loading on the cornerpost. The stacking test load

applied to one corner of the container shall be multiplied by the factor $\frac{4}{1.8}$ and the result expressed in appropriate units.

16.3 The following is a useful example of how the allowable stacking mass could be varied, as prescribed in paragraph 1 of the stacking test:

If on a particular journey the maximum vertical acceleration on a container can be reliably and effectively limited to 1.2*g*, the allowable stacking mass permitted for that journey would be the allowable stacking mass stamped on the plate multiplied by the ratio of 1.8 to 1.2 (i.e. allowable stacking mass on the plate $\times \frac{1.8}{1.2}$ = stacking mass permitted for the journey).

Resolution A.737(18)
(adopted on 4 November 1993)

Amendments to the International Convention for Safe Containers (CSC), 1972

THE ASSEMBLY,

RECALLING article IX of the International Convention for Safe Containers (CSC), 1972, on the procedure for amending any part of the Convention,

HAVING CONSIDERED the amendments to the International Convention for Safe Containers (CSC), 1972, adopted by the Maritime Safety Committee at its sixty-first session and communicated to all Contracting Parties in accordance with paragraph 2(a) of article IX of that Convention,

1. ADOPTS, in accordance with paragraph 2(b) of article IX of the International Convention for Safe Containers (CSC), 1972, the amendments to the Convention and its annexes set out in the annex to the present resolution;

2. NOTES that, in accordance with paragraph 2(c) of article IX of the Convention, the said amendments shall enter into force 12 months after the date on which they are accepted by two thirds of the Contracting Parties;

3. REQUESTS the Secretary-General, in conformity with paragraph 2(b) of article IX of the Convention, to communicate the said amendments to all Contracting Parties for their acceptance.

Annex

Amendments to the International Convention for Safe Containers (CSC), 1972

1 Paragraphs 14 to 16 of article II (Definitions) are amended to read:

"14 *Maximum operating gross mass* or *Rating* or *R* means the maximum allowable sum of the mass of the container and its cargo. The letter *R* is expressed in units of mass. Where the annexes are based on gravitational forces derived from this value, that force, which is an inertial force, is indicated as *Rg*.

15 *Tare* means the mass of the empty container, including permanently affixed ancillary equipment.

16 *Maximum permissible payload* or *P* means the difference between maximum operating gross mass or rating and tare. The letter *P* is expressed in units of mass. Where the annexes are based on the gravitational forces derived from this value, that force, which is an inertial force, is indicated as *Pg*."

New paragraphs 17 to 19 are added as follows:

"17 The word *load*, when used to describe a physical quantity to which units may be ascribed, signifies mass.

18 The word *loading*, for example, as in *internal loading*, signifies force.

19 The letter *g* means the standard acceleration of gravity; *g* equals 9.8 m/s^2"

2 Annex I, subparagraph 1(b) of regulation 1 is amended to read:

"(b) On each container, all maximum operating gross mass markings shall be consistent with the maximum operating gross mass information on the Safety Approval Plate."

Subparagraph 2(a) is amended to read:

"(a) The plate shall contain the following information in at least the English or French language:

"CSC SAFETY APPROVAL"
Country of approval and approval reference
Date (month and year) of manufacture
Manufacturer's identification number of the container or, in the case of existing containers for which that number is unknown, the number allotted by the Administration
Maximum operating gross mass (kg and lbs)
Allowable stacking load for 1.8 *g* (kg and lbs)
Transverse racking test force (newtons)"

A new paragraph 5 is added as follows:

"5 A container, the construction of which was completed prior to . . . . . .*, may retain the Safety Approval Plate as permitted by the Convention prior to that date as long as no structural modifications occur to that container."

3 Annex I, subparagraphs 1(c) and 1(e) of regulation 9 are amended to read:

"(c) maximum operating gross mass capability;"

"(e) allowable stacking load for 1.8*g* (kg and lbs); and"

4 Annex I, subparagraphs (c) and (e) of regulation 10 are amended to read:

"(c) maximum operating gross mass capability;"

"(e) allowable stacking load for 1.8*g* (kg and lbs); and"

5 Annex I, the fourth, fifth and sixth lines of the model of the Safety Approval Plate reproduced in the appendix are amended to read:

"MAXIMUM OPERATING GROSS MASS . . . kg . . .lbs
ALLOWABLE STACKING LOAD FOR 1.8*g* . . .kg . . .lbs
TRANSVERSE RACKING TEST FORCE . . . . ..newtons"

6 Annex I, items 4 to 8 of the appendix are amended to read:

"4 Maximum operating gross mass (kg and lbs).

5 Allowable stacking load for 1.8 *g* (kg and lbs).

6 Transverse racking test force (newtons).

7 End-wall strength to be indicated on plate only if end-walls are designed to withstand a force of less or greater than 0.4 times the gravitational force by maximum permissible payload, i.e. 0.4*Pg*.

8 Side-wall strength to be indicated on plate only if the side-walls are designed to withstand a force of less or greater than 0.6 times the gravitational force by maximum permissible payload, i.e. 0.6*Pg*."

7 The first sentence of the Introduction to annex II (Structural safety requirements and tests) is amended to read:

"In setting the requirements of this annex, it is implicit that, in all phases of the operation of containers, the forces as a result of motion, location, stacking and gravitational effect of the loaded container and external forces will not exceed the design strength of the container."

8 Annex II, section 1(A)—Lifting from corner fittings—the text concerning test loadings and applied forces is amended to read:

"TEST LOAD AND APPLIED FORCES

Internal load:

A uniformly distributed load such that the sum of the mass of container and test load is equal to 2*R*. In the case of a tank-container, when the test load of the internal load plus the tare is less than 2*R*, a supplementary load, distributed over the length of the tank, is to be added to the container.

Externally applied forces:

Such as to lift the sum of a mass of 2 *R* in the manner prescribed (under the heading TEST PROCEDURES)."

9 Annex II, section 1(B)—Lifting by any other additional methods—is amended to read:

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*Date of entry into force of the amendments.

"TEST LOAD AND APPLIED FORCES	TEST PROCEDURES
Internal load: A uniformly distributed load such that the sum of the mass of container and test load is equal to 1.25*R*. **Externally applied forces:** Such as to lift the sum of a mass of 1.25*R* in the manner prescribed (under the heading TEST PROCEDURES).	(i) *Lifting from fork-lift pockets:* The container shall be placed on bars which are in the same horizontal plane, one bar being centred within each fork-lift pocket which is used for lifting the loaded container. The bars shall be of the same width as the forks intended to be used in the handling, and shall project into the fork pocket 75% of the length of the fork pocket.
Internal load: A uniformly distributed load such that the sum of the mass of container and test load is equal to 1.25*R*. In the case of a tank-container, when the test load of the internal load plus the tare is less than 1.25*R*, a supplementary load, distributed over the length of the tank, is to be added to the container. **Externally applied forces:** Such as to lift the sum of a mass of 1.25*R* in the manner prescribed (under the heading TEST PROCEDURES).	(ii) *Lifting from grappler-arm positions:* The container shall be placed on pads in the same horizontal plane, one under each grappler-arm position. These pads shall be of the same sizes as the lifting area of the grappler arms intended to be used. (iii) *Other methods:* Where containers are designed to be lifted in the loaded condition by any method not mentioned in (A) or (B)(i) and (ii) they shall also be tested with the internal load and externally applied forces representative of the acceleration conditions appropriate to that method."

10 Annex II, paragraphs 1 and 2 of section 2—STACKING—are amended to read:

"1 For conditions of international transport where the maximum vertical acceleration varies significantly from 1.8*g* and when the container is reliably and effectively limited to such conditions of transport, the stacking load may be varied by the appropriate ratio of acceleration.

2 On successful completion of this test, the container may be rated for the allowable superimposed static stacking load, which should be indicated on the Safety Approval Plate against the heading ALLOWABLE STACKING LOAD FOR 1.8*g* (kg and lbs)."

11 Annex II, section 2—STACKING—the text concerning test loadings and applied forces is amended to read:

"TEST LOAD AND APPLIED FORCES

Internal load:

A uniformly distributed load such that the sum of the mass of container and test load is equal to 1.8*R*. Tank-containers may be tested in the tare condition.

Externally applied forces:

Such as to subject each of the four top corner fittings to a vertical downward force equal to $0.25 \times 1.8 \times$ the gravitational force of the allowable superimposed static stacking load."

12 Annex II, section 3—CONCENTRATED LOADS—is amended to read:

"TEST LOAD AND APPLIED FORCES	TEST PROCEDURES
Internal load: None. **Externally applied forces:** A concentrated gravitational force of 300 kg (660 lbs) uniformly distributed over an area of 600 mm × 300 mm (24 in. × 12 in.) **Internal load:** Two concentrated loads each of 2,730 kg (6,000 lbs) and each added to the container floor within a contact area of 142 cm^2 (22 sq in). **Externally applied forces:** None."	**(a) On roof** The externally applied forces shall be applied vertically downwards to the outer surface of the weakest area of the roof of the container. **(b) On floor** The test should be made with the container resting on four level supports under its four bottom corners in such a manner that the base structure of the container is free to deflect. A testing device loaded to a mass of 5,460 kg (12,000 lbs) [that is, 2,730 kg (6,000 lbs) on each of two surfaces] having, when loaded, a total contact area of 284 cm^2 (44 sq in) [that is, 142 cm^2 (22 sq in) on each surface], the surface width being 180 mm (7 in) spaced 760 mm (30 in) apart, centre to centre, should be manoeuvred over the entire floor area of the container.

13 Annex II, the heading and subheading of section 4—TRANSVERSE RACKING—are amended to read respectively:

"TEST LOAD AND APPLIED FORCES' and **"Internal load:".**

14 Annex II, section 5—LONGITUDINAL RESTRAINT (STATIC TEST)—the text concerning test loadings and applied forces is amended to read:

"TEST LOAD AND APPLIED FORCES

Internal load:

A uniformly distributed load, such that the sum of the mass of a container and test load is equal to the maximum operating gross mass or rating *R*. In the case of a tank-container, when the mass of the internal load plus the tare is less than the maximum gross mass or rating, *R*, a supplementary load is to be added to the container.

Externally applied forces:

Such as to subject each side of the container to longitudinal compressive and tensile forces of magnitude *Rg*, that is, a combined force of 2*Rg* on the base of the container as a whole."

15 Annex II, the first paragraph of section 6—END-WALLS—is amended to read:

"The end-walls should be capable of withstanding a force of not less than 0.4 times the force equal to gravitational force by maximum permissible payload. If, however, the end-walls are designed to withstand a force of less or greater than 0.4 times the gravitational force by maximum permissible payload, such a strength factor shall be indicated on the Safety Approval Plate in accordance with annex I, regulation 1."

16 Annex II, section 6—END-WALLS—the text concerning test loadings and applied forces is amended to read:

"TEST LOAD AND APPLIED FORCES

Internal load:

Such as to subject the inside of an end-wall to a uniformly distributed force of 0.4*Pg* or such other force for which the container may be designed.

Externally applied forces:

None."

17 Annex II, the first paragraph of section 7—SIDE-WALLS—is amended to read:

"The side-walls should be capable of withstanding a force of not less than 0.6 times the force equal to the gravitational force by maximum permissible payload. If, however, the side-walls are designed to withstand a force of less or greater than 0.6 times the gravitational force by maximum permissible payload, such a strength factor shall be indicated on the Safety Approval Plate in accordance with annex I, regulation 1."

18 Annex II, section 7—SIDE-WALLS—the text concerning test loadings and applied forces is amended to read:

"TEST LOAD AND APPLIED FORCES

Internal load:

Such as to subject the inside of a side-wall to a uniformly distributed force of $0.6Pg$ or such other force for which the container may be designed.

Externally applied forces:

None."