

Rules for

Certification of Cargo Containers



1998

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New York, NY 10048 USA

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 8 Appendix A Approval plates required for containers certified in accordance with the International Convention for Safe Containers (CSC) and the International Convention for the Transport of Containers under Customs Seal (TIR).
- Section 15 Appendix B Association of American Railroads Container Chassis for TOFC Service Standard Specification M-943-80.
- Appendix C International Road Federation Limits of Motor Vehicle Sizes and Weights.
- Section 1 Appendix D International Convention for Safe Containers (CSC).

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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.

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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.

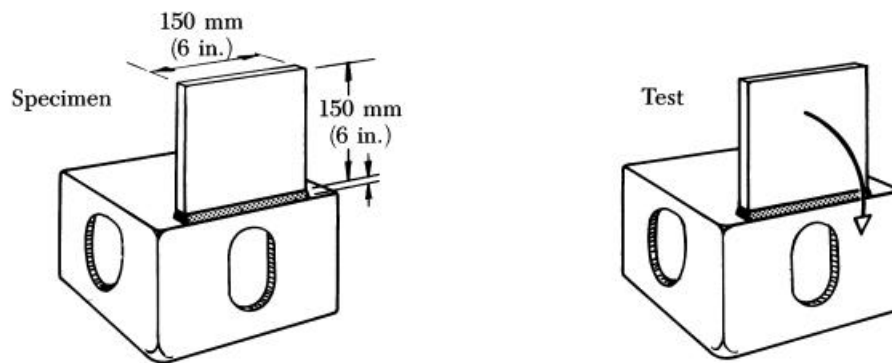
3.5 Qualification

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

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

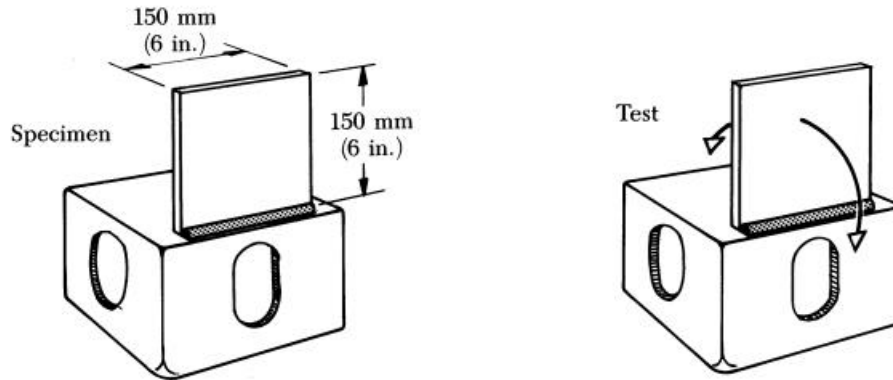
Test: The corner casting is to be secured and the sheet is to be bent 180° towards the corner fitting. The axis of the bend is to be parallel to the axis of the weld.

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

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



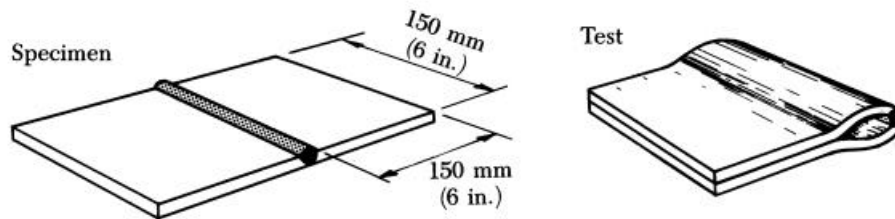
Specimens: The plates are to be 150 mm (6 in.) x 150 mm (6 in.). The welds are to be a minimum of 150 mm (6 in.) in length. The throat size of the fillet weld is to be equal to the thickness of the thinner material.

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

<i>Material:</i>	1.2 mm (.048 in.) to 1.2 mm (.048 in.) sheet			
<i>Test Position:</i>	F	H	V	OH
<i>Qualifies for:</i>	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 (.04 in.).

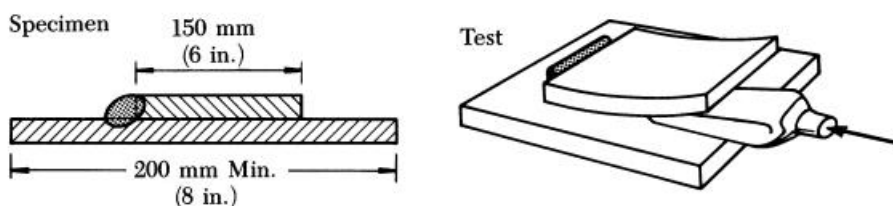
Test: One sheet is to be secured and the other is to be bent 180° back towards the held end. The axis of the bend is to be parallel to the axis of the weld.

Criterion: A weld will be considered satisfactory if:

- No cracks are evident after bending.
- 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

<i>Material:</i>	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			
<i>Test Position:</i>	F	H	V	OH
<i>Qualifies for:</i>	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 ac-

cordance 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.

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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 ($\frac{1}{4}$ 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 (29 $\frac{1}{4}$ 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 (18 $\frac{1}{2}$ 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 grapple 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 (1 1/2 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 60° 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 supporting 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]:

30° for 40 ft containers

37° for 30 ft containers

45° for 20 ft containers

60° 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 Grapppler 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 cm² (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

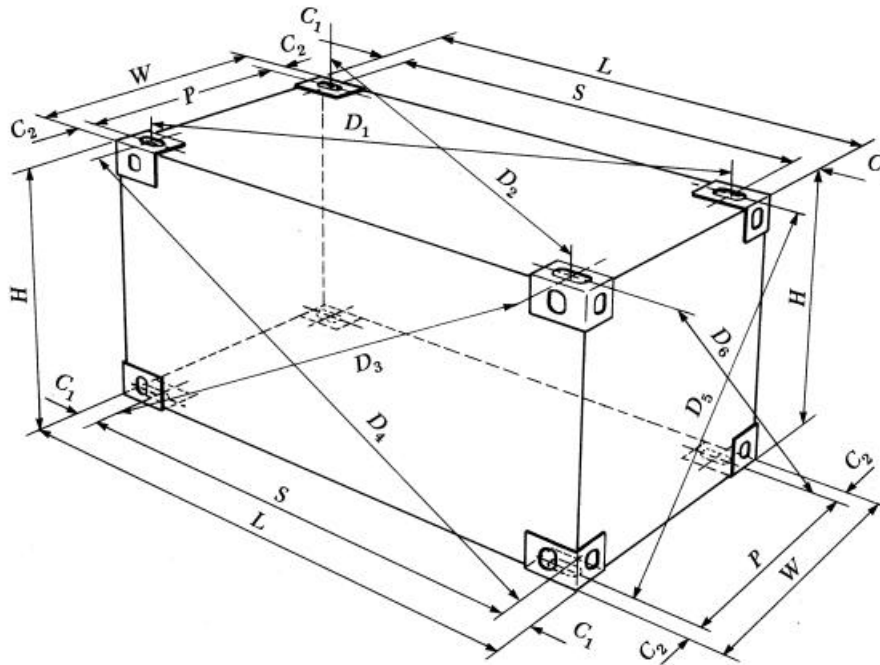
Basis

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. $K_2 = |D_5 - D_6|$

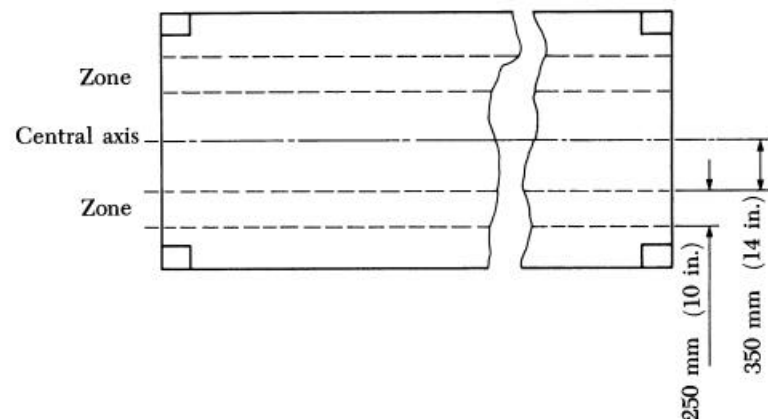
FIGURE 6.1 (continued)

<i>Dimensions and tolerances</i>				
	<i>10 ft container mm (ft, in.)</i>	<i>20 ft container mm (ft, in.)</i>	<i>30 ft container mm (ft, in.)</i>	<i>40 ft container mm (ft, in.)</i>
Length (external)	2991 ⁺⁰ ₋₅ (9 ft 9 ³ / ₄ ⁺⁰ _{-3/16} in.)	6058 ⁺⁰ ₋₆ (19 ft 10 ¹ / ₂ ⁺⁰ _{-1/4} in.)	9124 ⁺⁰ ₋₁₀ (29 ft 11 ¹ / ₄ ⁺⁰ _{-3/8} in.)	12192 ⁺⁰ ₋₁₀ (40 ft 0 ⁺⁰ _{-3/8} in.)
S	2787 (9 ft 1 ²³ / ₃₂ in.)	5853 (19 ft 2 ⁷ / ₁₆ in.)	8918 (29 ft 3 ⁷ / ₈ in.)	11985 (39 ft 3 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 ³¹ / ₃₂ in.)	2259 (7 ft 4 ³¹ / ₃₂ in.)	2259 (7 ft 4 ³¹ / ₃₂ in.)	2259 (7 ft 4 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.)
K₁(max)	10 (³ / ₈ in.)	13 (¹ / ₂ in.)	16 (⁵ / ₈ in.)	19 (³ / ₄ in.)
K₂(max)	10 (³ / ₈ in.)	10 (³ / ₈ in.)	10 (³ / ₈ in.)	10 (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

Load transfer zones



Load transfer areas—20 ft containers

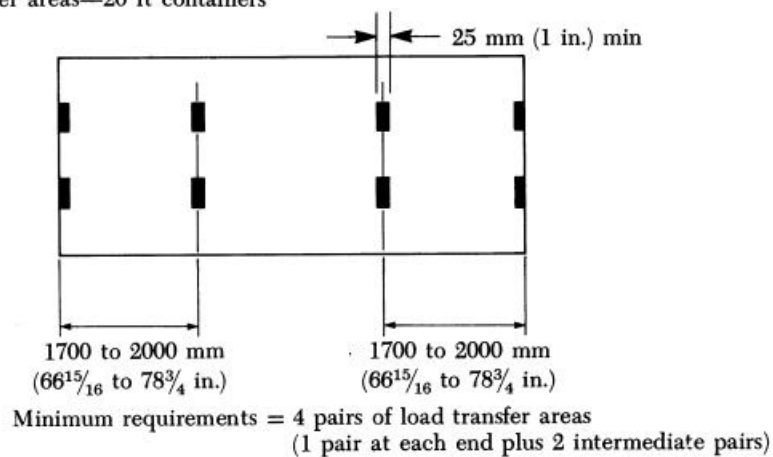
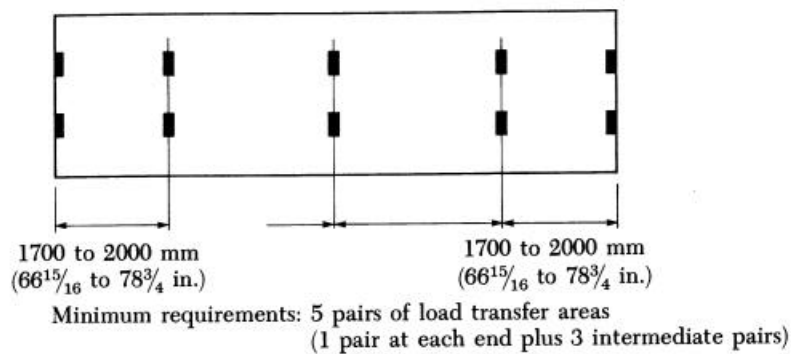
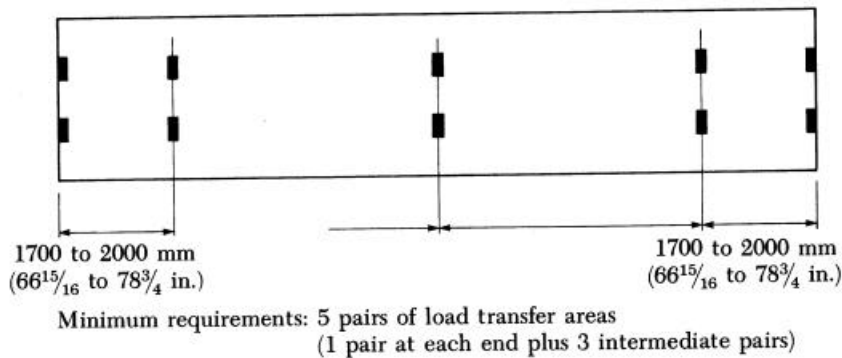


FIGURE 6.2 (continued)

Load transfer areas—30 ft containers



Load transfer areas—40 ft containers



Load transfer areas—40 ft containers with gooseneck tunnel

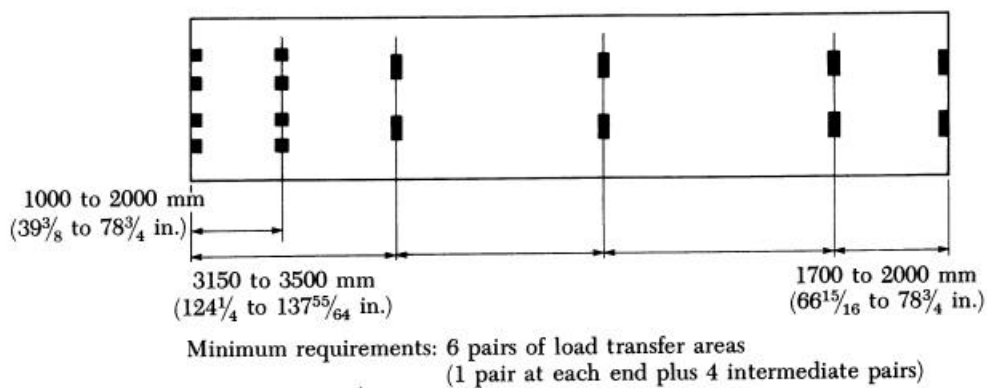


FIGURE 6.2 (continued)

Minimum Requirements for Load Transfer Areas in Vicinity of Gooseneck Tunnel

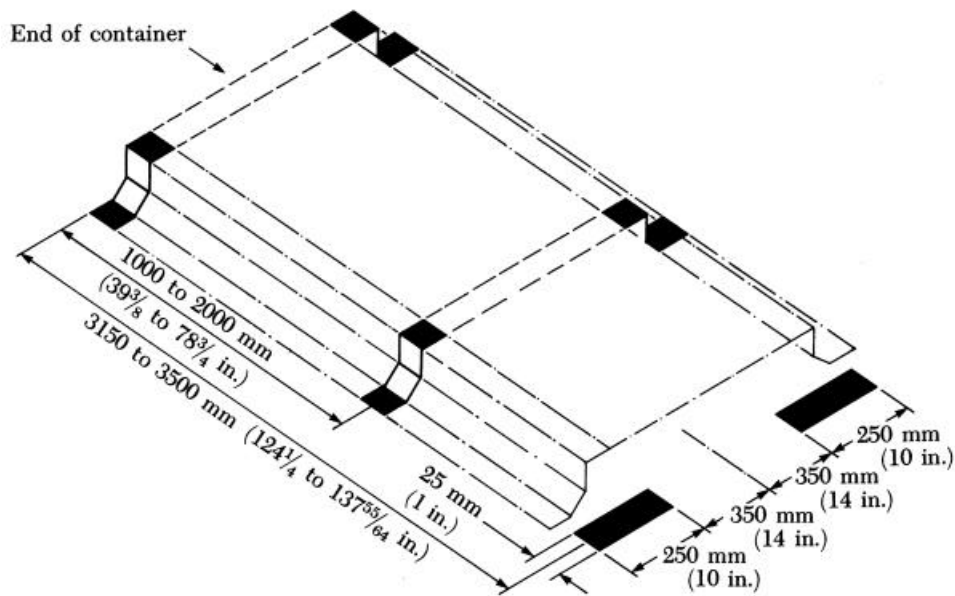
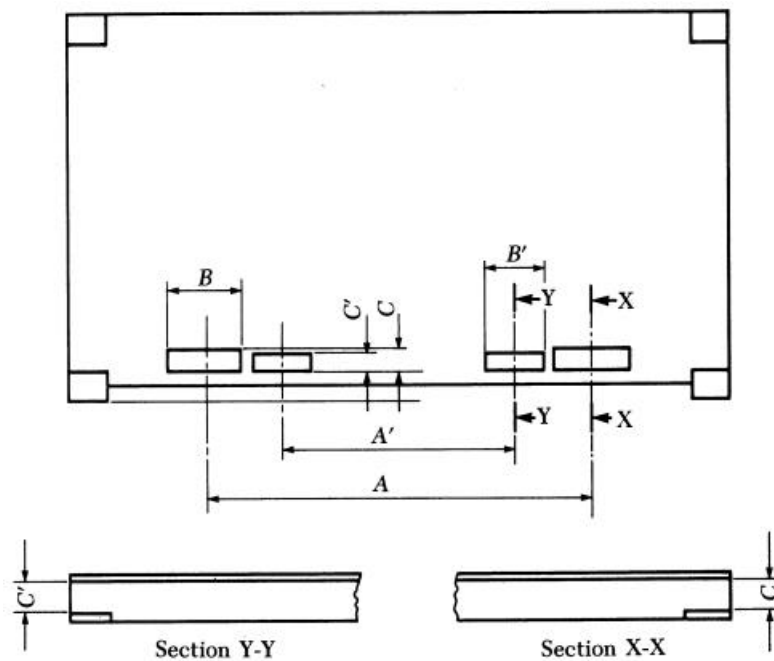


FIGURE 6.3 Location and Dimensions for Forklift Pockets



Dimensions and Tolerances

	<i>Fork pockets for loaded and unloaded containers</i>	<i>Fork pockets for unloaded containers only</i>
	<i>mm (in.)</i>	<i>mm (in.)</i>
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 Grapppler Lifting Areas

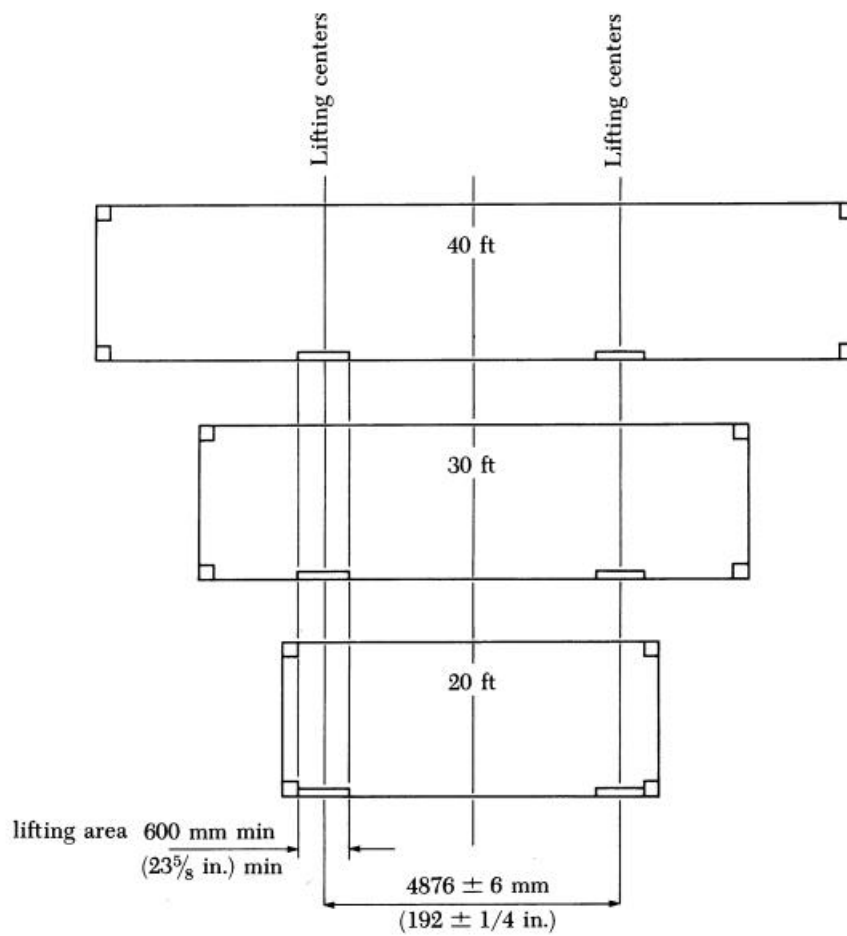
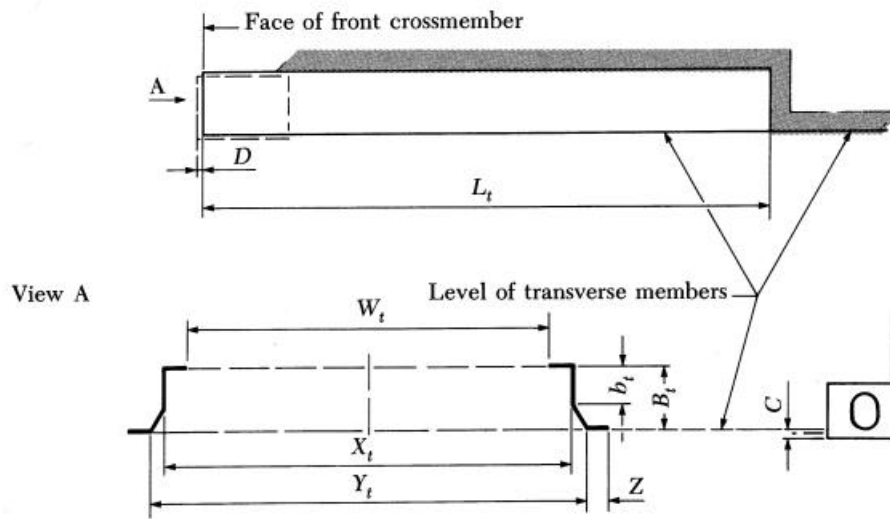


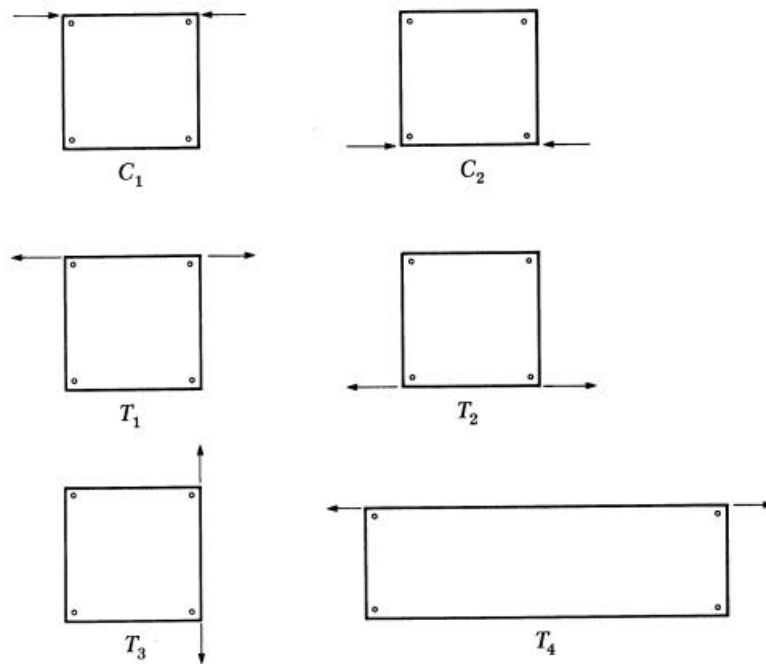
FIGURE 6.5 Location and Dimensions for Gooseneck Tunnels



Dimensions and Tolerances

Length mm (in.)	L_t	3150 to 3500 (124 to 138)
	D	6^{+1}_{-2} ($\frac{1}{4}-\frac{3}{32}$)
Width mm (in.)	W_t	930 max ($36\frac{5}{8}$ max)
	X_t	1029^{+3}_{-0} ($40\frac{1}{2}-\frac{1}{8}$)
	Y_t	1070 min 1130 max ($42\frac{1}{8}$ min $44\frac{1}{2}$ max)
	Z	25 min (1 min)
Height mm (in.)	B_1	120^{+0}_{-3} ($4\frac{23}{32}-\frac{1}{8}$)
	b_1	35 min 70 max ($1\frac{3}{8}$ min $2\frac{3}{4}$ max)
	C	$12.5^{+5}_{-1.5}$ ($\frac{1}{2}-\frac{1}{16}$)

FIGURE 6.6 Lashing Loads (Forces)



$$C_1 = 100 \text{ kn (22400 lbf)}$$

$$C_2 = 150 \text{ kn (33700 lbf)}$$

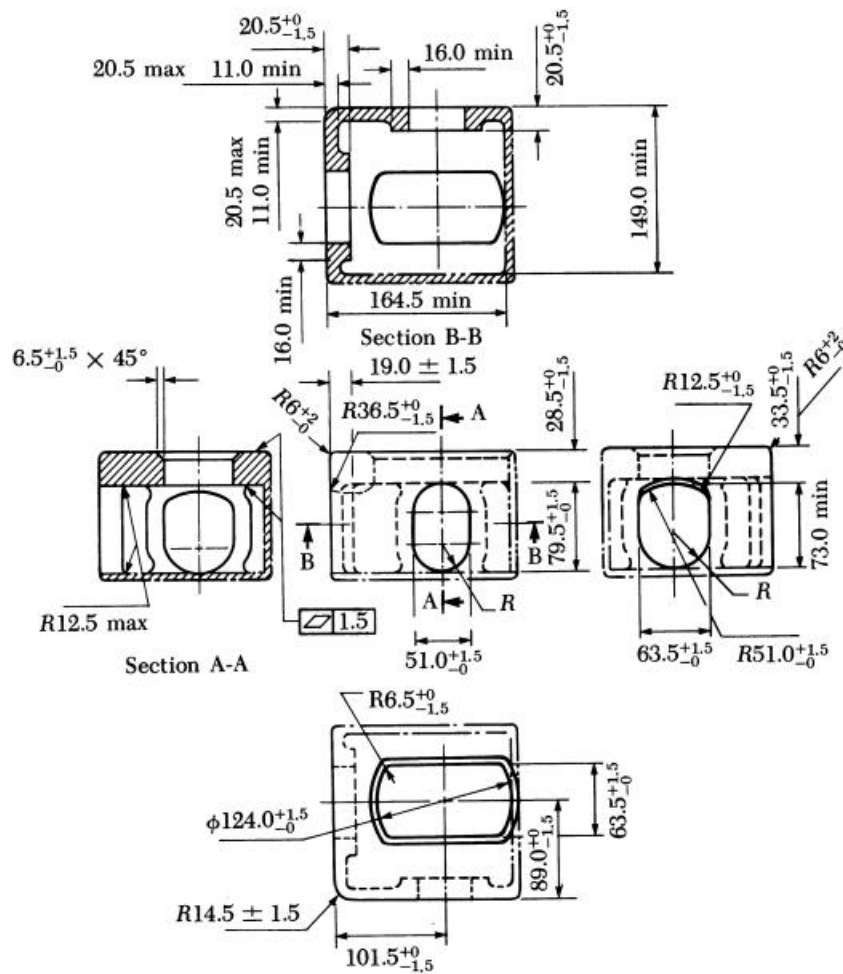
$$T_1 = 150 \text{ kn (33700 lbf)}$$

$$T_2 = 150 \text{ kn (33700 lbf)}$$

$$T_3 = 1/2 R$$

$$T_4 = 100 \text{ kn (22400 lbf)}$$

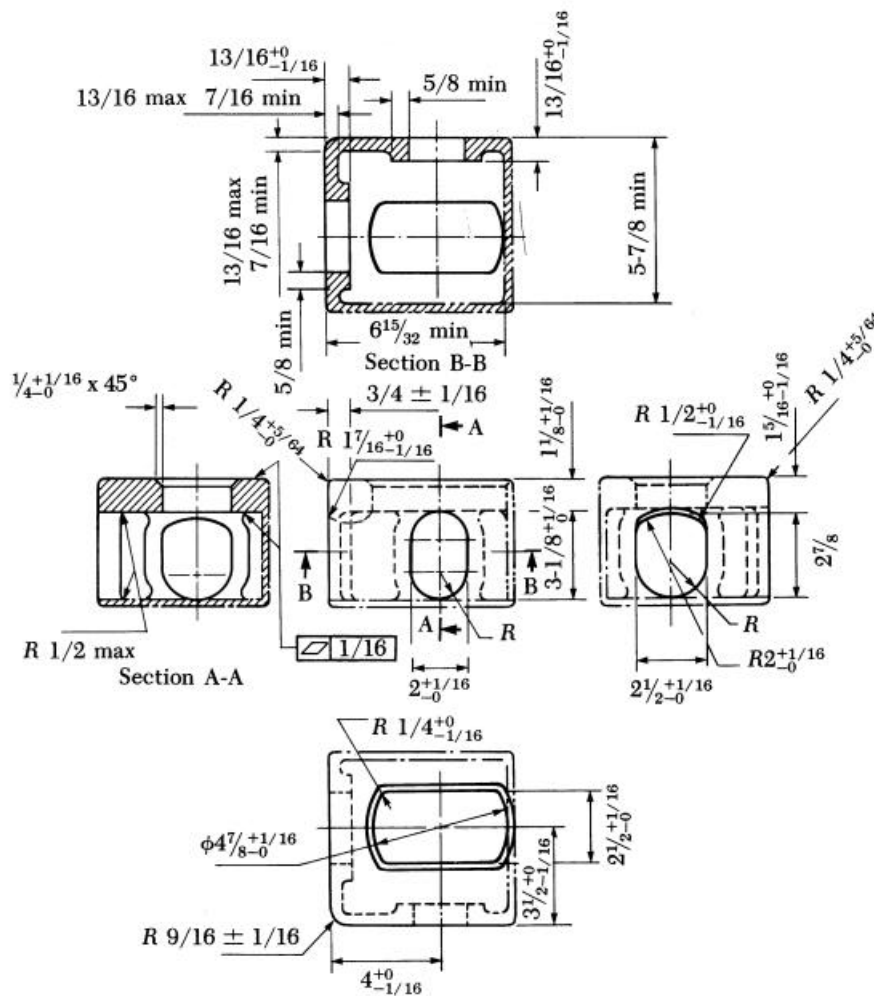
FIGURE 6.7 Top Corner Fitting—Millimeters



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.

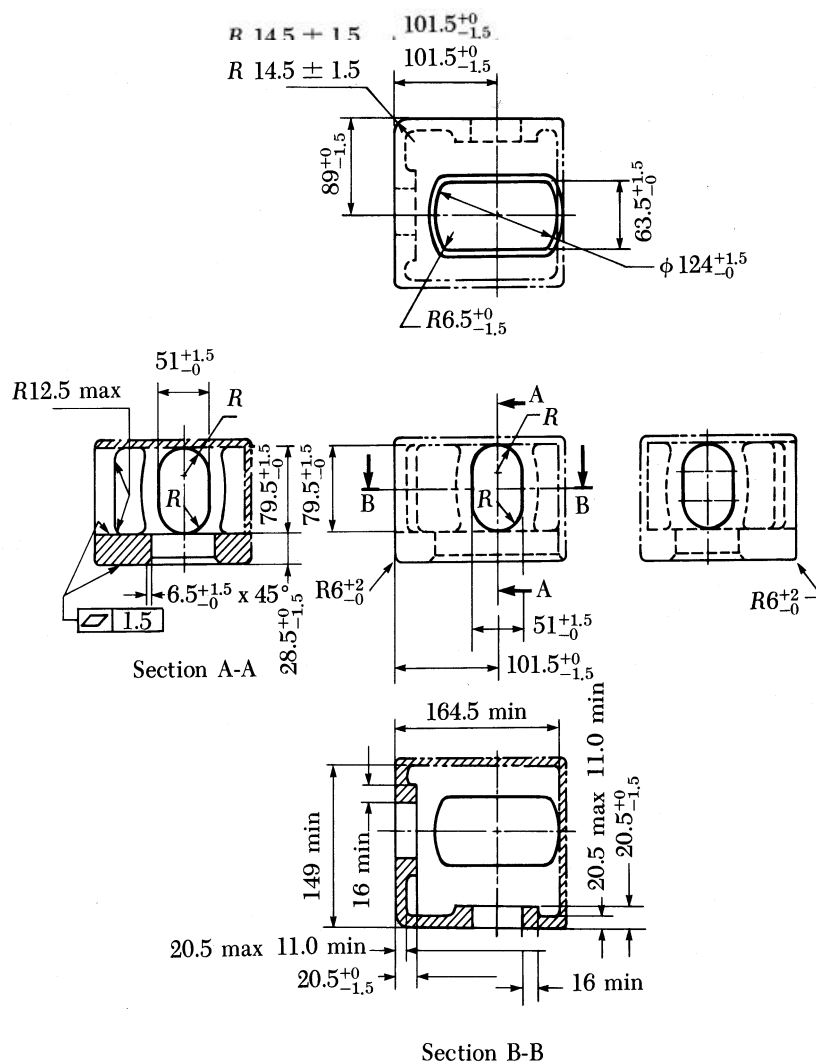
FIGURE 6.7 (continued) Top Corner Fitting—Inches



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.

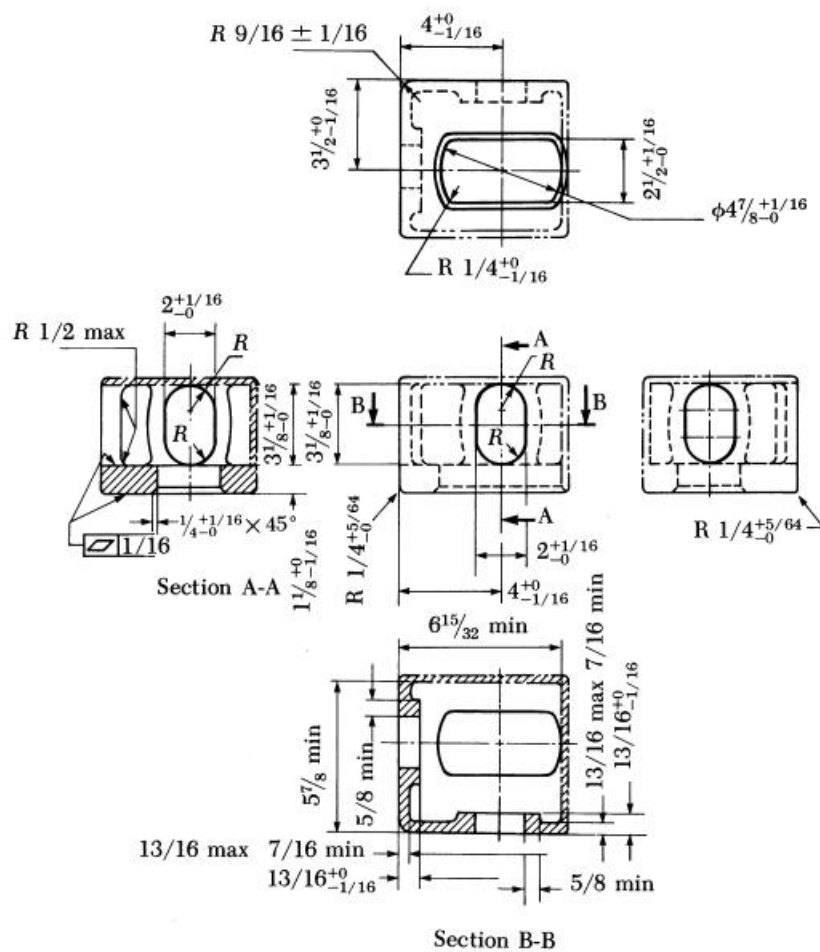
FIGURE 6.7 (continued) Bottom Corner Fitting—Millimeters



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 1.8R, 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 2R.

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 2R.

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]:

- 30° for 40 ft containers
- 37° for 30 ft containers
- 45° for 20 ft containers
- 60° 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 60° 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 1.6R. 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 0.625R. 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 1.25R. 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 (2 C\, 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 (3/8 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 45° to the horizontal plane.
Interior sides	45° upwards and downwards
Ceiling level	45° 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/cm² (15 psi) pressure in conjunction with the use of a 12.5 mm (1/2 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.

