TÜRK LOYDU

Chapter 55 - Construction, Repair and Testing of Freight Containers

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This latest edition incorporates all rule changes. The latest revisions are shown with a vertical line. The section title is framed if the section is revised completely. Changes after the publication of the rule are written in red colour.

Unless otherwise specified, these Rules apply to ships for which the date of contract for construction as defined in TL- PR 29 is on or after 1st of July 2024. New rules or amendments entering into force after the date of contract for construction are to be applied if required by those rules. See Rule Change Notices on TL website for details.

"General Terms and Conditions" of the respective latest edition will be applicable (see Rules for Classification and Surveys).

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Construction, Repair and Testing of Freight Containers

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SECTION 1

GENERAL

A. Application

1. Scope

1.1 The present rules applies to containers used in international transport by sea, railway and road excluding containers specially designed for air transport.

1.2 Every new container shall be approved in accordance with the provisions either for type-testing or for individual testing.

B. Definitions

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

1. *Container* means an article of transport equipment:

1.1 of a permanent character and accordingly strong enough to be suitable for repeated use

1.2 specially designed to facilitate the transport of goods by one or more modes of transport without intermediate reloading

1.3 designed to be secured and/or readily handled, having corner fittings for these purposes

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

1.4.1 at least 14 m^2 or

1.4.2 at least 7 m^2 if it is fitted with top corner fittings.

The term *container* includes neither vehicles or 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. *International transport* means transport between points of departure and destination situated in the territory of two countries..

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

5. *Type of container* means the container design type complies with the requirements of the present rules.

6. *Type-series container* means any container manufactured in accordance with the approved design type.

7. *Prototype* means a container representative of those manufactured or to be manufactured in a design type series.

8. *Maximum operating gross weight* or *Rating* or *R* means the maximum allowable combined weight of the container and its cargo.

9. *Tare weight* means the weight of the empty container including permanently affixed ancillary equipment.

10. *Maximum permissible payload* or *P* means the difference between maximum operating gross weight or rating and tare weight.

C. Other Applicable Rules

For the construction of containers with all their equipment, the following rules are to be applied correspondingly:

- TL Rules, Chapter 4, Machinery, Section 1

- TL Rules, Chapter 5, Electric

- TL Rules, Chapter 2, Materials

- TL Rules, Chapter 3, Welding

- TL Rules, Chapter 15, Refrigerating Installations

SECTION 2

CERTIFICATION

A. Works Approval

1. Works where containers or ancillary parts intended to be manufactured must be qualified in respect of shop facilities, quality control, production methods and workmanship for the work to be carried out. Qualification is certified to the works in the form of an approval.

2. The application for approval to be made by the works shall contain particulars of the scope of production, organization, technical facilities and production methods as well as of the qualifications of the working staff including supervisors. Approval may be granted following scrutiny of the application and inspection.

3. The validity period of an approval granted in accordance with these Rules is 3 years. If work is regularly performed under the TL's supervision during the validity of the approval, the validity period may be extended on application by 3 years at a time without further checking.

4. If no work has been performed under the TL's supervision for more than one year, the approval may be granted anew on expiry of its validity period only if the conditions for doing so continue to exist and this is demonstrated during a further works inspection. The approval may then again be granted for a validity period of 3 years.

5. TL is to be informed about any changes in works facilities, in production methods or in the composition and qualification of the staff which affect the conditions for approval.

B. Test Station Approval

1. The application for approval of test station is to be made by the works to TL with the following documents:

1.1 General description of the test station

1.2 Equipment and measuring instrument available at the test station

1.3 Types of containers to be subjected to tests

2. TL performs inspection of the test station and participates in the tests of containers.

3. If the inspection and test results are positive, TL approves the test station and issues the certificate of approval.

C. Types of Tests

1. Review of Design Documents

1.1 The documents required for examination are to be submitted to TL Head Office in good time before the commencement of production and testing.

1.2 The documents are to contain the followiing:

- Drawings showing the arrangement, dimensions,and materials of the structural components of the container;

- Particulars of jointing methods (welding) and connections envisaged;

- Particulars of the origin of important ancillary parts (such as fittings, bottom and wall elements);

- Proof calculations insofar as customary or necessary for the type of container concerned;

- For thermal containers, additional documents in accordance with Section 4, A.2;

1.3 TL may require to be supplied additional drawings and documents.

2. Type Tests

2.1 The "type test" following the examination of the documents serves to furnish proof that the container type complies with the requirements in respect of mechanical strength and function. The necessary tests are described in Sections 3 and 4 and are carried out in the presence of a TL surveyor.

2.2 A report of the type test will be prepared; if the results are satisfactory, a certificate will be issued.

2.3 The type tests may be carried out at different times and frequencies. TL differentiates as follows:

2.3.1 The **Prototype Test** is the initial test of a novelty or a greatly modified design. The container is generally fabricated as a single item. However, evidence of the materials used must be at hand and the construction and materials must correspond to those of the planned series.

2.3.2 The **Type Test** serves to furnish the proof mentioned in 2.1, especially in cases where design modifications are put into effect subsequent to the prototype test. The container to be tested must be a product from the series concerned and should be taken from the first ten containers.

TL reserves the right to recognize the prototype test as a type test, provided that no substantial modifications have been made.

2.3.3 **Repeat Type Tests** are a repetition of the type test and may become necessary in the case of large construction series, reorganisation of fabrication or extended interruptions in the fabrication of a series.

Repeat type tests will be stipulated on a case-by-case basis.

3. In-production Tests

3.1 Supervision of production

In order to check the conformity of the containers of a series with the container tested in conformity with 2., TL carries out the supervision of production through its Surveyors. The frequency of the checks depends on the requirements the containers are subject to and on the nature of the test order.

The type of supervision is indicated on the certificates issued and on the individual containers.

3.2 In order to furnish evidence of the construction remaining uniform within the series, TL's Surveyor shall be given access to the records of the inplant quality control system.

3.3 Apart from the checks in accordance with 3.2, **repeat tests** may be necessary as strength and operational tests . The nature and frequency of these tests depend on the container type, the cargo to be transported, and the number of containers in the series; further particulars hereon are contained in Sections 3 and 4.

D. Design Principles

1. General

The principles mentioned hereafter apply to freight containers and, where applicable, to swap bodies of all sizes and types. They are essentially in agreement with the relevant standards (ISO and EN).

2. Dimensions, Weights, Tolerances

2.1 The tables given in Annex A show the main dimensions, total weights and most important tolerances of the containers standardized by ISO 1496 (Series 1). References to possible deviations in connection with individual types of construction are contained to the necessary extent in Section 2 under "Design Requirements".

2.2 The maximum permissible gross weights indicated in Annex A are maximum weights laid down by standardization. In keeping with normal practice, gross, net and tare weights are defined as follows:

$$R = P + T$$

where

R is the maximum permissible gross weight of the container including cargo,

P is the maximum permissible payload (maximum net weight) and

T is the weight of the empty container or the average tare weight of a container series.

Equipment parts (such as lashing elements, refrigerating equipment) normally remaining attached to the container even when transported empty are included in T.

2.3 The laying down of an (ISO) gross weight rating for a container or a container series does not preclude prototypes or certain containers of a series or even certain structural components of containers from being designed and tested for higher maximum permissible gross weights.

2.4 Details of dimensions and weights on the containers and in certificates shall be harmonized with the specification concerned and, if possible, standardized within any one constructional series. Where major weight deviations cannot be avoided owing to the construction, the manner of marking and the documentation are to be specially agreed upon. In the case of tank containers it may be advisable, depending on the cargo, to ascertain and document the individual deadweight.

3. Construction

3.1 Main structure

3.1.1 A container consists, as a rule, of a base frame and a roof frame connected to each other by corner posts.

3.1.2 The corner structure serving as a support for transportation, for lifting and clamping purposes and as a platform for stacking may be constructed as part of the corner post or as an independent structural element connected in a positive way with the corner post.

3.1.3 Bottom, walls, doors, and roof as far as provided are laid or hung in the framework and welded, bolted, riveted, screwed or glued to the latter, depending on the material and construction used. Stiffeners may be provided to absorb loads acting at right angles to the surfaces unless the plating is capable of doing so.

3.2 Design details

3.2.1 Corner posts and corner fittings

3.2.1.1 The corner posts shall feature a sufficient late thickness or be reinforced by corrugations or other stiffening means in such a way that the compressive and bending stresses resulting from the stacking load can be safely absorbed without buckling. The corner post must be connected to the corner fittings over its full cross section, either a sufficient projection length of the corner fittings with respect to the corner post flanks being chosen or an adequate welding joint being ensured by chamfering (single bevel butt joint).

3.2.1.2 Such materials and dimensions shall be chosen for the corner structures (corner fittings) that the high, even shocklike operating loads are safely absorbed.

Cast corner fittings are to be in accordance with international standard ISO 1161.

Welded corner and securing fittings shall conform to the standards currently in force with regard to strength and dimensions. The chosen method of welding execution shall ensure that no crevice corrosion can occur. Methods of welding execution require the approval of TL. The quality assurance procedure shall be agreed with TL.

The projection length of the corner fittings with regard to the roof and base structures shall equal:

11 mm – 17,5 mm	relative to the lowest point of the base structure including the end transverse members but exclusive of the bottom side rails. In respect of the bottom side rails, a 4 mm projection length should remain.
6 mm	relative to the uppermost point of the roof including the top side rails and any screw or rivet heads.

3.2.2 Base structure

3.2.2.1 The bottom corner fittings shall be capable of bearing and transmitting, by themselves, all loads in the container.

3.2.2.2 Cross members and floor plates or planks shall withstand the loads due to cargo and vehicles (fork lift trucks). When dimensioning a wooden floor, in particular a plank floor, due regard shall be paid to the frequently repeated (wheel) loads with regard to the fact that the bearing strength of the wood does not remain constant and to the possible variation of the wood quality.

3.2.2.3 No part of the base structure shall deflect more than 6 mm below the lower support surfaces of the bottom corner fittings under a dynamic load or a corresponding static load (1.8 R) acting uniformly on the floor.
The base structure shall resist all forces, especially transverse forces, which arise from the cargo in service.

3.2.2.4 The base shall be tight against transient underflooding and sufficiently protected against corrosion and rot. Gaps between metal parts and wooden flooring, especially at the ends of wooden members, shall be filled with a suitable sealing compound which does not become brittle.

3.2.2.5 In view of the high level of wear, it is recommended to reinforce or cover the floor (with an entrance plate) in the vicinity of the door.

3.2.2.6 Reinforcements shall be provided in the area of the recess for semitrailers (gooseneck tunnel) to absorb the wheel loads and cargo pressure. As a rule, these reinforcements shall consist of longitudinal and transverse tunnel members with further reinforcement being brought about by constructing the tunnel roof as a load-bearing membrane.

The standardized dimensions of the gooseneck tunnel are to be in accordance with ISO 1496/1.

3.2.2.7 If cut-outs for fork lift pockets or other openings are provided in the bottom side rails, adequate overlapping of the reinforcing plates shall be ensured.

The standardized dimensions and spacings of fork lift pockets are to be in accordance with ISO 1496/1.

3.2.2.8 If lifting edges are provided on the bottom side rails, they shall be constructed to the standard represented by Fig. A.1 of Annex A.

3.2.2.9 With regard to the local stressing of the bottom side rails by shunting shocks during transportation by rail, the connections of the bottom side rails to the corner fittings shall be made with special care and, where necessary, be reinforced or stiffened.

3.2.2.10 In order to prevent the base structure and transverse members of the container on the one hand and the longitudinal members of the vehicle on the other from being stressed too much during road transportation, there shall be provided either

– sufficient contact surface according to Fig. A.2 in Annex A or

  a sufficient number of adequately strong transverse members which, however, may project relative to the other transverse members.

  The prescribed number and spacings of these transverse members are shown in Figs. A.3 and A.11 of Annex A.

  The maximum load to be transmitted by the support areas shall not exceed the value 2 R including the augmentation for dynamic load cases.

  The contact surfaces of a smooth base structure or the bottom faces of those transverse members forming part of a base structure and serving for load transfer to a vehicle shall lie in a plane, the design distance of which from the bottom faces of the corner fittings shall amount to between 11 mm and 17.5 mm in accordance with 3.2.1.2.

3.2.3 Roof

3.2.3.1 Roofs shall be shaped in such a way that as little water as possible may collect on them. Cambering is recommended.

Where roofs are to be capable of supporting not only persons but also cargo, attention shall expressly be drawn to this fact, giving details of the surface pressure to be expected, and a corresponding test shall be conducted.

3.2.3.2 In the area of corner fittings, reinforcements such as laminations of at least 4 mm thickness shall be provided in such a way that the roofing will still be protected with the spreaders offset by 200 mm in transverse direction and by 225 mm in longitudinal direction.

3.2.3.3 The support frames for tarpaulins covering open-top containers shall be so designed or dimensioned as to ensure a positive connection between the top side rails.

3.2.3.4 It must be possible so to clamp and secure detachable roof elements as to preclude any incorrect handling and/or to permit the condition of the means of clamping and securing to be visually checked from the ground (outside) even if the container is on a railway wagon.

3.2.4 Side structures

3.2.4.1 Wall elements shall be so connected with each other and with the surrounding frames that strength, dimensional stability and weatherproofness are sufficiently maintained under the repeated loads to be expected.

3.2.4.2 Hinged or detachable walls or wall sections shall be so clamped and secured as to preclude any incorrect handling and/or to permit the condition of the clamps and securements to be visually checked from the ground (outside).

3.2.5 Doors, flaps and manholes

3.2.5.1 Doors, flaps and manholes form part of the surrounding structural elements such as walls, roofs, bottoms, tank shells, etc. In certain cases they replace these structural elements, e.g. the double-leaf door of a general cargo container replaces an end wall. As a consequence, doors, flaps and manholes as well as their locking elements are required to withstand all loads that the associated structural elements are subject to according to Section 3.

3.2.5.2 If flaps or manhole covers cannot be positively fitted into the surrounding structural element, the opening shall be stiffened as necessary.

3.2.5.3 The necessary seals shall be robust, flexible and durable; they shall not become brittle even under heavy solar irradiation and shall be resistant to the cargo to be carried.

E. Materials

1. General

In general, only materials which have been made by manufacturers approved by TL may be used. Approval is granted in accordance with the TL's Rules; application for approval is to be made to TL's Head Office. Upon application, TL may recognize approvals granted by neutral other testing authorities or grant approval on the basis of regular tests of the products.

2. Steel Materials

2.1 Rolled steels

2.1.1 Ordinary and higher strength hull structural steels satisfying TL's Rules for Materials as well as weldable structural steels may be used. Other equivalent structural steels with a minimum yield point of 235 N/mm^2 may be used with TL's consent. The requirements for special steels (such as weather-resistant structural steels, steels tough at subzero temperatures or high strength steels with minimum yield points above 355 N/mm^2) will be laid down from case to case.

2.1.2 Structural steels showing, apart from sufficient strength, the properties required for the respective application (e.g. good bending properties, weldability) shall be used for secondary, non-loadbearing components of containers. Welded connections between these steels and those specified in 2.1.1 shall not negatively affect the structural components.

2.2 Steel castings and steel forgings

Steel castings and forgings with the following mechanical properties are to be used :

Steel castings ; with tensile strength of at least 400 N/mm^2

Steel forgings ; with tensile strength of at least 400 N/mm^2

Corner fittings ; with yield stress not less than 220 N/mm^2, tensile strength of at least 430 N/mm^2, relative elongation A_5 at least 25%, relative reduction of area Z = 40% and impact strength at least KV^{-20} = 27 J and KV^{-40} = 21 J.

3. Aluminium Alloys

3.1 Wrought alloys

Wrought aluminium alloys must show sufficient resistance to corrosion in a seawater-laden atmosphere.

The chemical composition and mechanical properties shall conform to TL Material Rules.

3.2 Cast alloys

Cast aluminium alloys shall have quality properties sufficient for the relevant application. Corner fittings made from cast aluminium alloys are subject to TL's special approval, evidence of sufficient strength properties having to be furnished.

4. Wooden Materials

4.1 Manufacturers of wooden components for containers (solid wood, laminwood or plywood) shall have an independent works control department. A laboratory equipped with suitable, calibrated testing instruments must be available.

4.2 Only service-proven species of timber, that is, timber featuring good resistance to water, atmospheric conditions, fungi and insect infestations as well as good mechanical properties appropriate to the application and a low swelling and shrinking tendency shall be used for any wooden components used in the manufacture of containers.

F. Jointing Methods

1. Welding

TL Rules, Chapter 3 – Welding shall be applied.

2. Bolted and Riveted Connections

It is assumed that jointing elements conforming to the relevant standards and laid down in the purchaser's specification will be used and the connections made in accordance with current engineering practice.

3. Adhesive joints

The suitability of adhesive joints (e.g. for fixing of wall panels) shall be proved in a procedure test. The type and scope of this test shall be agreed in each individual case.

G. Marking and Documentation

1. Marking

1.1 Containers which have been tested in accordance with C.3.1 are marked with:

- An adhesive label , normally on the left door (Tank containers: beside the tank rating plate)

- The number of the type certificate, the TL stamp, and the tank test number are additionally die-stamped into the rating plate of the tank of tank containers.

1.2 TL stamps and labels refer to the as manufactured (as-delivered) condition of the container. Their renewal after repair or loss is permitted only in consultation with TL's Head Office or competent Inspection Office. Labels are issued only by TL.

1.3 In respect of the transportation of dangerous goods, the marking is to be made in accordance with the legal provisions (e.g. IMO Code).

1.4 In all other respects, for marking of containers the international standard ISO 6346 "Freight Containers – Coding, identification and marking" is to be complied with.

2. Documentation

2.1 Type certficate

The testing of the container type, that is, the review of the documentation (drawings etc.) and the load and operating tests, is certified in the type certificate.

2.2 Individual certificate

The testing of the individual containers of a series (supervision of production and individual testing in accordance with C.3.1) is confirmed by an individual certificate.

SECTION 3

REQUIREMENTS and TESTS

A. General Requirements

1. Load Assumptions

1.1 The loads relevant for the individual structural components follow from the test conditions contained in B., unless different details are furnished by the purchaser. When choosing the safety margins in respect of the possible failures, material fatigue, normal manufacturing inaccuracies, and possible differences in quality of the materials shall be taken into account.

1.2 Where roofs are to be capable of supporting not only persons but also cargo (e.g. thermal containers for suspended cargo), the load indicated by the purchaser shall be taken into account when designing and testing the container.

2. Deformations

2.1 On completion of the load tests in accordance with B.2.1 to 2.14, the container shall not exhibit any permanent deformation which affects its usefulness and traffic safety (loading capability, tightness). Reference values for some permitted permanent deformations are indicated in B, Table 3.3.

2.2 The end structure shall be sufficiently rigid to ensure that a transverse force of 150 kN applied to the highest point of this plane does not cause the sum of the changes in length of the diagonals to exceed 60 mm.

2.3 The side structure shall be sufficiently rigid to ensure that a 75 kN shear force applied to the highest point of this plane does not cause the point of application of this force to shift longitudinally by more than 25 mm.

2.4 Platform containers with fixed or foldable end walls shall be sufficiently rigid to ensure that a shear force of 50 kN applied at the top corner fitting does not cause a longitudinal deflection of more than 42 mm.

B. Tests

1. General

1.1 The tests indicated below are the minimum requirements in respect of ISO general cargo containers and, where applicable, in respect of all special types of ISO Series I freight containers (see Annex A, Table A.1). They should also form the basis for testing containers not conforming to the standards.

1.2 The strength tests according to these Regulations shall be carried out exclusively as static tests in order to obtain comparable and reproducible test data. Allowances have been made in the test loads for dynamic load components. Accordingly, care shall be taken to apply the test loads slowly (without noticeable delay or acceleration) and to keep them effective for at least 5 minutes.

1.3 During the tests, deformation measurements shall be carried out at certain points of the container under test. Care shall be taken to carry out zero measurements prior to, and after, the application of loads or forces.

1.4 Repeat tests :

Table A.3 in Annex A furnishes a basis for the frequency of repetition of individual tests during fabrication. The exact test programme shall be laid down in each individual case.

1.5 The routine testing (identity of materials, workmanship, dimensional stability, operational testing of closures and locks, tightness) is carried out at random at the Surveyor's discretion during fabrication.

1.6 The tests detailed in B.2. may be carried out in any sequence within a complete type test, with the following exceptions:
Test no. 1 (stacking) shall be carried out before tests nos. 2 and 3 (lifting from the top and bottom corner fittings). Test no. 13 (weatherproofness) shall be carried out last.

1.7 With the door-fitted wall under transverse loading, tightness of the door seal to spray shall be proved under half the test load.

1.8 The test loads shall be applied in such a way that the rigidity of the structural component under load is not changed and the effect intended (uniformly distributed or point load) is achieved.

2. Description of the Tests

2.1 Test no. 1 - Stacking

This test is intended to show whether a fully loaded container can support the total weight stacked on top of it as per the table below. The accelerations of the vessel and the relative misalignment of containers due to clearances in the guide rails shall be taken into account.

The container under test shall be placed on four level pads, one under each bottom corner fitting or equivalent corner structure. The pads shall be positioned centrally under the corner fittings and have approximately the same base area as the corner fittings. The container shall have a load uniformly distributed over its floor in such a way that the total weight of the container equals 1.8 R.

The container shall be loaded with vertical loads which are applied either to all four corner fittings simultaneously or at each pair of one end. The loads are to be taken from the table below.

Care shall be taken to ensure that the plane of application of forces and the plane of the supports under the container remain horizontal and unchanged during testing. The force shall be applied through an intermediate pad with the same base area as a corner fitting. Each intermediate pad shall be offset by 25.4 mm laterally and 38 mm longitudinally.

When testing platform containers with foldable end walls, the stacking test shall also be performed with the end walls folded.

Table 3.1

Type of container	Total test load (applied to all 4 corner posts simultaneously) [kN]	Test load on each end frame [kN]	Allowable stacking weight [kg]
1 A, 1 AA + 1 AAA + 1 AX	3.392	1.696	192.000
1 B, 1 BB + 1 BBB + 1 BX	3.392	1.696	192.000
1 C, 1 CC + 1 CX	3.392	1.696	192.000
1 D + 1 DX	896	448	50.800

2.2 Test No. 2 – Lifting from the top corner fittings

This test is intended to prove that containers can be lifted by their top corner fittings using a vertically applied load-carrying means.

Containers of sizes 1 D, 1 DX, 1 E and 1 F shall be raised using standard lifting gear in such a way that the angle of the lifting wires is 30 to the vertical.

This test is also intended to show whether the loading capability of the floor is adequate to withstand the acceleration forces encountered in loaded containers when handled by cranes.

The container under test shall have a load uniformly distributed over the floor in such a way that the combined weight of the container and test load equals 2 R. The container shall be lifted at the four top corners in such a way that no substantial acceleration or deceleration forces occur.

Platform containers with fixed and foldable end walls shall keep the following dimensions (measured over the top corner fittings) at a loading of 1 R:

Table 3.2

Type of container	L max. empty	L min. loaded to 1 R
1 AAA, 1 AA, 1 A and 1 AX	12.202	12.172
1 BBB, 1 BB, 1 B and 1 BX	9.135	9.105
1 CC, 1 C and 1 CX	6.068	6.042
L = longitudinal distance between outer edges of corner fittings		

2.3 Test No. 3 – Lifting from the bottom corner fittings

This test is intended to prove that the container can be lifted by means of lifting devices bearing on the bottom corner fittings only and attached to a single transverse central spreader beam above the container.

This test shall be carried out on containers of all sizes.

It shall also be carried out on 1 E and 1 F containers if they are equipped with bottom corner fittings.

The container under test shall have a load uniformly distributed over its floor in such a way that the combined weight of the container and the test load equals 2 R.

The container shall be carefully lifted by its four bottom corner fittings in such a way that no noticeable acceleration or deceleration forces occur. The lifting forces shall be applied at an angle of:

30 to the horizontal for 1 AAA, 1 AA, 1 A and 1 AX containers

37 to the horizontal for 1 BBB, 1BB, 1 B and 1 BX containers

45 to the horizontal for 1CC, 1 C and 1 CX containers

60 to the horizontal for 1 D and 1 DX containers.

The lines of action of the lifting forces and the outer faces of the corner fittings are to be no farther apart than 38 mm.

During lifting, the lifting equipment shall bear on the bottom corner fittings only. The lifting equipment shall be similar to the lifting devices customary in handling practice.

2.4 Test No. 4 – Restraint test (longitudinal)

This test is intended to prove the ability of the container to withstand longitudinal external restraint caused by dynamic acceleration loads of up to 2 g during movement by rail.

Containers of all sizes and also 1 E and 1 F containers with bottom corner fittings shall be subjected to longitudinal forces. 1 E and 1 F containers shall additionally be subjected to transverse forces.

The container shall have a load uniformly distributed over the floor in such a way that the combined weight of the container and the test load equals 1 R.

The container is to be anchored at one end through the bottom apertures of the bottom corner fittings. A force acting horizontally and equivalent to 2 R in total shall be applied to the container through the bottom apertures of the other corner fittings, first towards and then away from the anchor points.

2.5 Test No. 5 – Loading the end wall

This test is intended to prove the ability of the container to withstand longitudinal external forces which are imposed by dynamic loads up to 2 g during movement by rail.

Each end of a container is to be tested when one end is blind and the other is equipped with a door. In the case of symmetrical construction, one end only need be tested. Containers shall be subjected to an internal load of 0.4 ´ P. Bulk containers and 1 E and 1 F containers shall be subjected to an internal load of 0.6 ´ P. The internal load shall be uniformly distributed over the wall under test. The arrangement shall allow free deflection of the wall.

2.6 Test no. 6 – Loading the side walls

This test is intended to prove the ability of the container to withstand the forces resulting from ship movements.

Each side wall (or only one in the case of symmetrical construction) shall be separately subjected to a uniformly distributed internal load of 0.6 ´ P. The load shall be applied in such a way as to allow free deflection of the side wall and the top and bottom side rails.

Open top containers shall be tested in the state in which they are used in service, e.g. with removable roof bows in position. Special arrangements may be made for 40-foot containers.

2.7 Test No. 7 – Loading the roof

This test is intended to show whether a rigid roof

- is capable of withstanding the loads imposed by persons working on it, or

- if intended to carry hanging loads, has a loading capability corresponding to the load, but at least 1 490 kg per metre of usable internal container length, if a vertical acceleration of 2 g is taken into account.

The tests shall be carried out as follows:

- A load of 300 kg shall be uniformly distributed over an area of 600 mm by 300 mm located at the weakest point of the container roof.

- The roof shall be loaded with twice the weight of the intended hanging cargo, but with at least 2 ´ 1490 kg/m, with the container resting only on its four bottom corner fittings.

2.8 Test No. 8 – Loading the floor

This test is intended to prove the ability of the container floor to withstand the concentrated dynamic loads imposed by fork lift trucks or similar devices during loading and unloading operations.

The test is carried out on containers of all sizes.

The test shall be performed using a rubber-tyred test vehicle loaded to an axle weight of 5 460 kg, that is, 2 730 kg per wheel. The nominal wheel width shall be 180 mm and the centres of the two wheels shall be 760 mm apart. The contact area of any one wheel shall be circumscribed by a rectangle measuring 185 mm by 100 mm. Each wheel shall have an actual contact area of not more than 142 cm^2 lying within the above mentioned rectangle.

2.9 Test No. 9 – End wall rigidity (transverse rigidity)

This test is intended to prove the ability of containers to withstand the transverse racking forces in the end frames resulting from ship movements.

The container under test is to be placed in unladen (tare) condition on four level pads, one under each bottom corner fitting, and to be anchored through the bottom apertures in such a way that no vertical movement is possible. Lateral restraint of an end wall is to be provided only at the bottom corner fitting diagonally opposite to, and in the same end frame as, the top corner fitting to which force is applied. Where the two end frames are tested separately, vertical anchoring shall be provided only at the end frame under test.

Forces of 150 kN shall be applied either separately or simultaneously to each of the top corner fittings on one side of the container parallel to both the end wall and the base plane. The forces shall be applied first towards and then away from the top corner fittings. Where the end walls of the containers are identical, only one end wall need be tested. Where an end wall is essentially asymmetrical about its own vertical centre line, the end wall shall be tested from both sides.

2.10 Test No. 10 – Side wall rigidity (longitudinal rigidity)

This test is intended to prove the ability of containers to withstand the longitudinal racking forces in the side frames resulting from ship movements.

The container under test is to be placed in unladen (tare) condition on four level pads, one under each bottom corner fitting, and to be anchored through the bottom apertures in such a way that no vertical movement is possible. Longitudinal restraint of a side wall is to be provided only at the bottom corner fitting opposite to, and in the same side frame as, the top corner fitting to which force is applied.

Forces of 75 kN shall be applied either separately or simultaneously to each of the top corner fittings at one end of the container parallel to both the side wall and the base plane. The forces shall be applied first towards and then away from the top corner fittings.

Platform containers with fixed or foldable end walls shall be loaded with a force of 50 kN on one or both top corner fittings of an end wall, parallel to the side and base planes. The forces shall be applied first towards and then away from the bottom corner fittings. The deflection of the end wall shall not exceed 42 mm.

In the case of a container with two identical side walls, only one side wall need be tested.

2.11 Test No. 11 – Lifting by means of a fork lift truck

This test is intended to prove the ability of 1 CC, 1 C, 1 CX, 1 D, 1 E and 1 F containers to withstand the loads encountered when being lifted and transported by fork lift trucks.

a) 1 CC, 1 C and 1 CX containers equipped with only one set of fork lift pockets and 1 D, 1 DX, 1 E and 1 F containers:

The container shall have a load uniformly distributed over its floor in such a way that the combined weight of the container and the test load equals 1.6 R. The container shall be supported on two horizontal bars, each 200 mm wide and projecting 1 828 mm ± 3 mm into the fork lift pockets, measured from the outside face of the container side wall. The bars shall be centred within the pockets.

b) 1 CC, 1 C and 1 CX containers equipped with two sets of fork lift pockets:

The procedure in a) applies to the outer fork lift pockets, while the inner ones are subject to the following procedure:

The container shall have a load uniformly distributed over its floor in such a way that the combined weight of the container and the test load equals 0.625 R. The container shall be supported on two horizontal bars as in a), inserted into the additional inner fork lift pockets.

2.12 Test No. 12 – Lifting by means of grappler arms

This test is intended to prove the ability of suitably equipped containers to withstand the loads encountered when being handled by means of grappler arms.

The container under test shall have a load uniformly distributed over its floor in such a way that the combined weight of the container and the test load equals 1.25 R. The container shall be supported at the four positions where provision has been made for the grappler arms. Each of the support surfaces shall measure 32 mm by 254 mm and be located clear of the safety lip.

2.13 Test No. 13 – Weatherproofness

This test is intended to prove the ability of the container to protect its cargo adequately against external moisture.

All the exterior joints and seams shall be tested by means of a jet of water from a nozzle of 12.5 mm inside diameter, at a pressure of approx. 1 bar corresponding to a head of water of 10 m. The nozzle shall be held at a distance of 1.5 m from the container under test. The jet shall be traversed at a rate of 100 mm/sec.

Procedures involving the use of several nozzles are acceptable only on condition that each joint or seam is covered in the same way as when using a single nozzle.

2.14 Test No. 14 – Tensile loading of the lashing lugs

This test is intended to prove the ability of the lashing points of a correspondingly equipped container to withstand the dynamic loading forces resulting from ship movement.

A test load equal to 1.5 times the specified lashing force shall be applied to the lashing point to be tested. Wherever possible, the test load shall be applied at an angle of about 45 to the horizontal and maintained for at least 5 minutes.

Table 3.3 Principles for container testing

No.	Scope of type test and/or design requirements	Measuring point	Test procedure		Permissible values	
			Internal load	Method of test loading or test load	Elastic deformation [mm]	Permanent deformation [mm]
1	Stacking	Corner post	Load of 1.8 R–T uniformly distributed over floor	Vertical load on each corner post 848 kN for: 1 A, 1 AA, 1 AAA, 1 AX 1 B, 1 BB, 1 BBB, 1 BX 1 C, 1 CC, 1 CX 224 kN for 1 D containers. Pads offset by: – 25 mm laterally – 38 mm longitudinally	4,5	2
		Transverse member			6**	3
		Bottom side rail			6**	40’ length: 4 30’ length: 3 20’ length: 3
2	Lifting from the 4 top corner fitting	Transverse member	Load of 2.0 R–T uniformly distributed over floor	The lifting load shall be applied as follows: vertical: 40’ load 30’ load 20’ load 60° to horizontal: 10’ load		3
		Bottom side rail				40’ length: 4 30’ length: 3 20’ length: 3
3	Lifting from the 4 Bottom corner fitting	Transverse member	Load of 2.0 R–T uniformly distributed over floor	The lifting load shall be applied as follows: 30° to horizontal: 40’ 37° to horizontal: 30’ 45° to horizontal: 20’ 60° to horizontal: 10’		3
		Bottom side rail				40’ length: 4 30’ length: 3 20’ length: 3
4	Restraint test (longitudinal)	Bottom side rail	Load of 1.0 R–T uniformly distributed over floor	A horizontal load shall be applied through the bottom corner fittings first towards and then away from the anchor points.		vertical: 40’ length: 4 30’ length: 3 20’ length: 3 10’ length: 2 horizontal: acc. to ISO standard 668
5	Strength of end walls including doors	See TL container type test report	unladen	Internal load uniformly distributed over wall for 40’ length 30’ length 20’ length 10’ length } 0,4 P 20’ and 10’ non-pressurized dry bulk containers: 0,6 P		Walls: 9* Doors : 6*
6	Strength of side walls	See TL container type test report	unladen	Internal load, uniformly distributed over wall: 0,6 P		40’ length } 9* 30’ length 20’ length } 7* 10’ length

* The permissible values for permanent deformations shall be applied only if the returns are adequate, i.e. the standard external dimensions are not exceeded.

** Maximum permissible deflection below the plane of the corner fitting supports

Table 3.3 Principles for container testing (continued)

No	Scope of type test and/or design requirements	Measuring point	Test procedure		Permissible values	
			Internal load	Method of test loading or test load	Elastic deformation [mm]	Permanent deformation [mm]
7	Strength of roof	Weakest part of roof	unladen	300 kg are uniformly distributed over an area of 600 mm ´ 300 mm in the weakest part of the roof. If hanging cargo is to be transported, the roof shall be rested at twice the design load with a minimum of 2 ´ 1490 kg/m		3
8	Strength of floor	Transverse members including side rails	unladen	Test vehicle: Test load: 5460 kg Wheel base: 760 mm Wheel contact area: 142 cm^2 /per wheel The test vehicle shall transverse the entire floor area of the container.		4
		Gooseneck tunnel				5
9	Transverse rigidity	See TL container type test report	unladen	150 kN horizontally: The loads shall be applied first towards and then away from the top corner fittings. If a test load of 75 kN is used, the doors are required to be weatherproof.	The difference between the changes in length measured diagonally shall not exceed the following values	
					60	10
10	Longitudinal rigidity	See TL container type test report	unladen	75 kN horizontally: The loads shall be applied first towards and the away from the top corner fittings. Not applicable to 10' containers	25	40' length: 9 30' length: 8 20' length. 6
11	Lifting from fork-lift pockets (where provided	Transverse member	Test load is uniformly distributed over floor	1. Fork-lift pockets for use in loaded condition: 1.6 R–T		3
		Bottom side rail		2. Fork-lift pockets for transport when empty: 0.625 R–T		40' length: 5 30' length: 4 20' length: 3 10' length: 3
12	Lifting at base of grappler arm contact area (where provided	Transverse member	Load of 1.25 R–T is uniformly distributed over floor.	Lifting loads to be applied vertically at the 4 grappler arm contact areas.		3
		Bottom side rail				40' length: 5 30' length: 4 20' length: 3 10' length: 3

Table 3.3 Principles for container testing (continued)

No	Scope of type test and/or design requirements	Measuring point	Test procedure		Permissible values	
			Internal load	Method of test loading or test load	Elastic deformation [mm]	Permanent deformation [mm]
13	Weather-proofness	All joints and seams	Unladen	Nozzle diameter: 12.5 mm Pressure, water: 1 bar Distance of nozzle from container: 1.5 m Transversing speed: 100 mm/sec	Water must not penetrate into the container	
14	Cargo securing system (where provided) as per Annex F of ISO 1496–1	Anchor points Lashing points	unladen	1.5 times the intended load shall be applied	No deformations – of the lashing equipment – of the container structure	
15	Supporting of load transfer areas (as per Annex B of ISO 1496–1)	Transverse member		Test load of 0,5 R–T on each load transfer pair		
		Transverse member		Test load of (1,5 R–T)/n on each pair of intermediate transfer areas: n = no. of transfer area pairs		

SECTION 4

THERMAL CONTAINERS

A. General Requirements

1. Definitions

1.1 Thermal containers are freight containers with insulated walls, doors, floor and roof which retard the rate of heat transmission between the inside and outside boundary surfaces.

1.1.1 Insulated containers are thermal containers without cooling or heating appliances.

1.1.2 Refrigerated containers are thermal containers cooled by an expendable refrigerant such as ice, dry ice or liquefied gas or by a mechanical refrigerating machinery set or an absorption-type refrigerating system.

1.1.3 Heated containers are thermal containers with heating appliances.

1.1.4 Refrigerated and heated containers are thermal containers equipped with heating appliances in addition to the equipment indicated in 1.1.2.

1.1.5 Removable refrigerating units are cold- or heat-producing sets or appliances designed for temporary attachment to insulated containers (clip-on units).

1.1.6 MA containers are refrigerated and heated containers which are suitable for refrigerated transport in a modified atmosphere.

1.1.7 CA containers are refrigerated and heated containers equipped with appliances for producing and regulating the atmosphere.

2. Documents for Examination

In addition to the documents listed in Section 2, C.1, the following shall be submitted for examination in connection with thermal containers:

– Drawings and data relating to the insulation

– Particulars of the manufacturer, type and rating of the intended refrigerating and heating appliances

– If the refrigerating and heating appliances are also to be tested, the documents listed in B.2 as well.

3. Requirements Applicable to the Design and Construction of Thermal Containers

3.1 General

3.1.1 The materials used for the construction of thermal containers shall be resistant to corrosion or be durably protected against corrosion by adequate measures. Only materials which do not adversely affect the cargo may be used for the parts of the container interior which are in contact with the refrigerating air and for the corresponding structural components of the refrigerating and/or heating appliances.

3.1.2 Every thermal container shall be so constructed as to enable it to be closed in an airtight manner. The standard type is equipped with a doubleleaf end wall door. Except in the case of insulated containers according to A.1.1.1, the other end wall shall be designed and constructed in such a way that it can be fitted within the standardized container dimensions with the necessary refrigerating and/or heating appliances or possesses the closable openings, standardized by position and size, for the temporary air-side connection of removable refrigerating units. After connection of these appliances the standardized dimensions of the container may be exceeded.

3.1.3 The internal surface shall be of such a nature as to permit thorough cleaning to be easily carried out. The detergents and cleaning methods normally used shall have no adverse effect on the lining.

3.1.4 Provisions shall be made to ensure that cleaning water can drain away completely.

3.2 Insulation

3.2.1 Insulation materials for thermal containers shall be odourless and, if possible, non- hygroscopic.

3.2.2 The insulation on the side which is warmer in normal operation shall be provided with a water-vapour-proof lining.

3.2.3 The insulation of the individual limiting surfaces shall be equal with regard to their heat restraining capacity. In designing the roof insulation, the greater level of insolation shall be taken into account.

3.3 Ventilation

Where ventilation of the inner space is provided, the air inlets and outlets shall be protected against the ingress of water. The inlets and outlets shall be located in the upper part of the container where possible and shall be provided with a means of closure.

3.4 Drains

3.4.1 The air coolers shall be provided with drip trays and adequate water outlets.

3.4.2 Operationally necessary drainage equipment shall operate automatically in all operating and temperature conditions.

3.4.3 Drains that can be shut off shall be capable of being operated from the outside.

3.5 Temperature monitoring equipment

3.5.1 At least two independent measuring points with separate readouts shall be provided for measuring the internal container temperature, so that the temperatures can be monitored from the outside.

3.5.2 Unless special requirements apply, a maximum total error of 0.5 K is permissible in respect of the indication and measuring accuracy.

4. Marking

With regard to the marking of thermal containers, in addition to the requirements in Section 2, G. The following rules shall be complied with:

4.1 The usable cubic capacity is to be stated on the outside of the container.

4.2 If refrigerated containers are cooled by dry ice or liquefied gas, a notice to this effect is to be applied to the outside of the container in a clearly visible manner.

4.3 MA/CA containers shall display a notice drawing attention to the risk of suffocation due to lack of oxygen.

4.4 Where thermal containers are intended and equipped for the transport of hanging cargo, the maximum allowable payload for such cargo is to be stated near the door inside the container.

5. Testing of Thermal Containers

5.1 General

5.1.1 The thermal container and the built-in or built-on appliances shall be checked for the quality of the workmanship. The protection of sensitive structural components against damage shall be checked at the same time.

5.1.2 The measuring devices to be used for the tests are subject to the following tolerances:

Temperature measuring devices	± 0,5 K
Power measuring devices	± 2 %
Flow measuring devices	± 3 %
Pressure measuring devices	± 5 %

5.2 Strength tests

5.2.1 The strength testing of thermal containers is governed where applicable by the particulars contained in Section 3, B.2.1 to B.2.14.

5.2.2 Where thermal containers are also intended for the carriage of hanging cargo, the suitability of the roof structure for carrying such a load shall be ascertained.

5.2.3 Strength tests shall be carried out with built-in refrigerating and/or heating appliances or equivalent appliances in cases where such appliances contribute to the strength of the container.

5.3 Tightness test

5.3.1 General

5.3.1.1 The tightness test shall in principle be carried out only after completion of all the strength tests in accordance with 5.2, but before the tests to determine the coefficient of heat transfer in accordance with 5.4.

5.3.1.2 During the tightness test the inside and outside temperatures of the container shall be between 15 °C and 25 °C; the difference between the two shall not however exceed 3 K.

5.3.1.3 The thermal container to be tested shall be in a normally equipped condition and shall be closed in the usual manner.

5.3.1.4 Refrigerating and/or heating appliances positioned inside the standardized container dimensions shall be in place during testing.

5.3.1.5 Containers equipped with apertures in one end wall that can be shut off for the temporary air-side attachment of removable refrigerating units are to be tested without these units and with normally closed apertures.

5.3.2 Procedure

The tightness test shall be carried out at an internal gauge pressure of 250 Pa ± 10 Pa. The air flow measured in m^3/h required to maintain this pressure is designated the air leakage rate.

5.3.3 Requirements

5.3.3.1 Refrigerated and heated containers according to 5.3.1.4 constructed as described in 3.1.2 shall have an air leakage rate not exceeding 10 m^3/h.

5.3.3.2 Insulated containers according to 5.3.1.5 shall have an air leakage rate not exceeding 8 m3/h.

5.3.3.3 For each door installed additionally compared with 3.1.2, the value given in 5.3.3.1 or 5.3.3.2, as applicable, may be exceeded by 5 m^3/h.

5.3.3.4 The air leakage rates for MA/CA containers shall be agreed on individually from case to case.

5.4 Determination of the heat transfer coefficient

5.4.1 General

5.4.1.1 The heat transfer coefficient shall be determined only when the strength tests and the tightness test have been carried out.

5.4.1.2 The thermal container to be tested shall be in a normally equipped condition and shall be closed in the usual manner. Refrigerating and/or heating appliances positioned inside the standardized container dimensions shall be in place during testing.

5.4.1.3 Due to the lower cost, the heat transfer coefficient is usually determined by means of an internal heating test. However, if the test is to be carried out using the internal cooling method, special arrangements shall be made with the Society.

5.4.1.4 The internal heating test shall be carried out in a test room protected from direct sunlight and arranged in such a way that the temperature differences stated in 5.4.2.3 b) and d) can be maintained. The surfaces of the test room shall not have any particular radiation- reflecting properties.

5.4.2 Definitions

5.4.2.1 The total heat transfer rate U is defined by the equation

$$U = \frac{Q}{\Theta_i - \Theta_e} \qquad [W/K]$$

Where

Q [W] electrical heat output including ventilator heat

Qe [°C] average exterior temperature of the container

Qi [°C] average interior temperature of the container

The average exterior temperature Qe of the container is the arithmetic mean of the 12 temperature values measured at a distance of 10 cm from the exterior walls at the 8 corners and at the centres of the side walls, roof and floor.

The average interior temperature Qi of the container is the arithmetic mean of the 12 temperature values measured at a distance of 10 cm from the interior walls at the 8 corners and at the centres of the side walls, roof and floor.

5.4.2.2 The average wall temperature Q is derived from:

$$\Theta = \frac{\Theta_i + \Theta_e}{2} \qquad [°C]$$

It shall be between 20 °C and 32 °C in steady-state condition, with the difference between the interior and exterior temperatures being not less than 20 K.

5.4.2.3 The steady-state condition is achieved when, in addition to 5.4.2.2, the following requirements are met:

a) The maximum difference between the coldest and the warmest measuring point inside the container equals, at any one time, 3 K.

b) The maximum difference between the coldest and the warmest measuring point outside the container equals, at any one time, 3 K.

c) The maximum difference between any two average interior temperature values Qi equals 1.5 K.

d) The maximum difference between any two average exterior temperature values Qe equals 1.5 K.

e) The maximum difference between the lowest and the highest heat output Q equals 3% of the lowest figure.

5.4.2.4 The heat transfer coefficient k is derived from:

$$k = \frac{U}{A} \qquad [W/m^2K]$$

where

$$A = \sqrt{A_e \cdot A_i} \qquad [m^2]$$

that is, the geometric mean of the exterior surface area Ae and the interior surface area Ai of the container.

5.4.3 Procedure

5.4.3.1 The container, which is equipped with appliances for heating and air circulation, shall be set up in the test room in such a way that air can flow around all sides of it.

5.4.3.2 The air flow outside the container shall be as uniform as possible everywhere and shall not exceed 2 m/s at a distance of 10 cm from the roof and the side walls, measured halfway along the container.

5.4.3.3 The air flow within the container shall reach such a value that the conditions indicated in 5.4.2.3 a) are met.

5.4.3.4 The container shall be heated electrically. The heating shall be adjusted in such a way as to fulfill the requirements according to 5.4.2.3. However, under no circumstances shall the interior temperature reach values which are unacceptable with regard to the materials used.

5.4.3.5 All temperature measuring points and the container walls shall be protected from thermal radiation.

5.4.3.6 After the steady-state condition defined in 5.4.2.3 has been reached, the temperatures and the heat output values shall be measured every half hour for a period of 8 hours.

5.4.4 Requirements

The overall heat transfer rate shall be determined according to the formula indicated in 5.4.2 and shall not exceed the value laid down for the individual application by the purchaser.

The heat transfer coefficient may likewise be determined in accordance with 5.4.2.4.

5.4.5 Equivalent test methods

If the heat transfer of thermal containers is determined on the basis of other testing standards or codes, the test results will be confirmed by TL, indicating the standard or code used, provided that the test method in question is equivalent to that prescribed by TL.

6. Testing of Series-Manufactured Thermal Containers

6.1 Prototype testing of a thermal container shall be carried out in accordance with 5. If the thermal container is to be tested together with its refrigerating and/or heating appliances, an operational test in accordance with B.9 shall also be carried out. If arrangements are made with regard to certification of the refrigerating performance, an additional performance test shall be carried out in accordance with B.8.

6.2 The repetition of individual tests within a production series is in general to be done according to Annex A, Table A.3. This results in the following arrangement:

6.2.1 The tightness test according to 5.3 is performed on each container of a series.

6.2.2 The operational test according to B.9 is performed on each refrigerating and/or heating appliance.

6.2.3 The determination of the heat transfer carried out according to 5.4 for one container of a series is regarded as adequate for production series of 100 containers, if within such a series no changes take place in the design, the materials used or the production methods.

6.2.4 In the case of production series of more than 100 containers, the number of heat transfer measurements according to 5.4 shall be agreed with TL.

6.2.5 In the case of production series of more than 100 containers, TL may, upon application by the manufacturer, accept the heat transfer measurement carried out for one container of this series as adequate for a maximum of 200 containers if the manufacturer has established and maintains a quality assurance system in accordance with a recognised standard (e.g. ISO 9000).

6.2.6 The number of performance tests to be carried out on refrigerating and/or heating appliances is governed by B.10.2.1.

7. Guidance Concerning the Arrangement of Thermal Containers on Board Ship

7.1 General

7.1.1 Prior to arranging thermal containers on board ship, a check shall be made to ascertain whether the ship's electricity supply is adequate for the additional operation of these containers.

7.1.2 Thermal containers and their equipment shall also be suitable for carriage on deck.

7.1.3 The containers shall be arranged in such a way that temperature checks can also be made in bad weather.

7.2 Arrangement on deck

When arranged on deck, the containers shall as far as possible be protected against the wash of the sea.

7.3 Arrangement below deck

7.3.1 When arranging thermal containers below deck, it shall be borne in mind that refrigerating systems equipped with air-cooled condensers require a large quantity of fresh air.

The calculation of the minimum air requirement may be based on the following power specifications:

– 20'-refrigerated container: approx. 7,5 kW

– 40'-refrigerated container: approx. 11,0 kW

In the case of a mixed cargo (frozen cargo/fruit cargo), a power-reducing factor of approx. 0.7 can generally be reckoned with.

Appropriate measures, e.g. air duct systems, shall be taken to ensure that the temperature distribution inside such cargo spaces is as uniform as possible.

7.3.2 Refrigerated containers, the refrigerating appliances of which operate on dry ice or liquefied gas, are not to be taken below deck.

7.4 Operating instructions

Operating instructions are to be delivered on board with each refrigerated container.

B. Refrigerating and/or Heating Appliances for Thermal Containers

1. Scope

1.1 The following regulations apply to cold- or heat-producing appliances which are built into the containers or designed as removable (clip-on) units.

1.2 Performance tests according to 8. shall be carried out if performance data of cold- or heat-producing appliances are to be certified by TL. Such certificates may be issued either in conjunction with the thermal container or separately.

2. Documents for examination

The following documents shall be submitted for examination:

– Description of the refrigerating and/or heating appliances and calculation of the heat balance

– Drawings of the arrangement of the refrigerating and/or heating appliances

– Drawings of the refrigerant compressor and a drawing of the crankshaft

– Drawings of all units and vessels under pressure of the refrigerant or liquefied gas

– Schematic diagram of the refrigerant circuit

– Particulars of temperature measuring devices

– Detailed wiring diagram of the electrical equipment including all necessary connection data.

3. Construction and Design of the Refrigerated Appliances

3.1 Number of refrigerator sets and design principles

3.1.1 Every refrigerated container shall be provided with a refrigerating appliance which - apart from the electric power supply - operates independently.

3.1.2 Where only one refrigerator set is provided, it shall be so designed as to be capable of maintaining the required lowest internal temperature of the container at maximum ambient temperature on the basis of a daily service period not exceeding 18 hours. The ambient temperature shall be taken as 38 °C unless higher temperatures have been specified.

3.1.3 Where two or more refrigerator sets are provided for one container, the required lowest internal temperature shall be capable of being maintained in continuous operation even after failure of any one refrigerator set.

3.1.4 Where two entirely independent refrigerator systems, each equipped with its own evaporator, are provided for refrigerating the container, they may be jointly considered as one refrigerator set for the purpose of 3.1.2, that is, they

shall jointly maintain the required lowest internal temperature on the basis of a daily service period not exceeding 18 hours.

3.1.5 Refrigerated containers for the transport of dangerous goods (e.g. peroxide) are to be equipped with two entirely independent refrigerating units. Each of these units shall be capable of fulfilling the requirements under 3.1.2 independently.

If the unit in service fails or cannot maintain the required internal temperature because of a fault, the spare unit shall automatically take over the refrigeration of the container.

Where faults developed by a refrigerating unit in service are reported to a permanently manned station, this automatic changeover facility may be dispensed with.

3.2 Safety equipment

3.2.1 Measures shall be taken which cause the compressor drive to be automatically switched off if the maximum permissible working pressure is exceeded.

3.2.2 Vessels and units under pressure which can be isolated in normal operation and which contain liquid refrigerant shall be equipped with a safety valve. Blown-off refrigerant must be safely drained away.

3.2.3 Where a group 1 refrigerant is used in systems with a weight of charge not exceeding 25 kg, the installation of a maximum pressure governor that automatically cuts off the compressor drive - irrespective of the type of drive - whenever the maximum permissible working pressure is exceeded may be accepted as an adequate safety device However, this requires that the shut-off devices of refrigerant-containing vessels that can be completely isolated are not equipped for actuation in normal operation.

3.3 Pressure gauges

Suction and delivery pressure gauges are required only for the performance test or the operating trials, provided that group 1 refrigerants are used and that the weight of charge does not exceed 50 kg. The pressure gauges may be removed on completion of testing; however, the connections shall remain accessible for subsequent check measurements.

4. Construction and Design of Heating Appliances

4.1 Design basis

Heating appliances shall be so designed as to be capable of maintaining an internal temperature of + 16 °C at an ambient temperature of – 20 °C on the basis of a daily service period of 18 hours, unless special requirements of the purchaser are to be taken into account.

5. Electrical Equipment

5.1 All parts of the electrical equipment shall conform to the latest state of the art with respect to their use aboard seagoing ships (see also TL Rules, Chapter 5, Electric and ISO 1496-2, Section 7).

5.2 All electrical equipment components intended to be used aboard seagoing ships shall be chosen and designed in such a way that they remain operational at the voltage and frequency variations occurring in normal ship service.

5.3 All electric motors used shall be designed for continuous duty and shall be tested on a suitable test bed.

5.4 The power consumption per refrigerated container shall not exceed 15 kW.

5.5 The length of the flexible connecting cable shall be at least 15 m or shall equal one container length plus 6 m, as required.

6. Remote Monitoring of Thermal Containers

6.1 Where remote monitoring of thermal containers is effected by means of data transmission via electrical cable, the requirements of ISO standard 10368 shall be complied with.

7. Marking

The refrigerator manufacturer shall furnish at least the following information on a permanently attached nameplate:

– Maker, year of manufacture, type designation and serial number,

– Refrigerant and weight of charge,

– Electrical connection data,

and, if internal combustion engines are present:

– Flash point of the liquid fuel used.

8. Performance Testing of the Refrigerating and/or Heating Appliances

8.1 General

8.1.1 The purpose of the performance test is to prove the sufficiency of the refrigerating and/or heating appliance design for the intended application of the thermal container.

8.1.2 The refrigerating and/or heating appliances which are to undergo performance testing shall in general be tested in combination with a thermal container with a known rate of heat transfer.

8.1.3 The container shall be set up in a test room in which temperatures which correspond to the subsequent conditions of service of the container can be maintained. If this is not possible, TL will decide on the method to be used for the conversion from the test conditions to the normal operating conditions.

8.2 Procedure

8.2.1 After the ambient conditions indicated have been reached, the refrigerating or heating equipment shall be started up.

After the steady-state condition has been reached, the following measurement data shall be recorded at intervals of ≤ 30 minutes:

– Temperatures inside and outside the container

– Power consumption of the supplementary heating including the fans.

8.2.2 After the steady-state condition has been reached, the design temperatures shall be kept constant for a period of at least 8 hours.

8.2.3 For the performance test of a refrigerating appliance, following this an additional heating load of at least 25% of the total heat transfer valid for the reference data shall be applied in the interior of the container. The required interior temperatures shall be kept constant for a further 4 hours.

8.2.4 Details of performance testing of refrigerating appliances not operating on the principle of a refrigerator with a pressure-cooled evaporator shall be agreed with TL in each individual case.

8.3 Requirements

8.3.1 Refrigerating appliances

It shall be proved that the required interior temperatures can be maintained under the conditions indicated in 8.2.3.

8.3.2 Heating appliances

It shall be proved that the required interior temperatures can be maintained for a period of at least 4 hours at a maximum running time of 75 %. Allowance is to be made for the difference in the rate of heat transfer between the container used for testing and the reference data for the type of container in question.

9. Operational Testing of the Refrigerating and/or Heating Appliances

9.1 The operational test shall be carried out to prove that the modes of operation "refrigerating", "defrosting" and, where provided, "heating" can be effected properly and with each type of drive proposed.

9.2 The automatic operation of the refrigerating and/or heating appliances shall be tested by changing the setting of the space thermostat.

9.3 The satisfactory functioning of the safety devices (e.g. overpressure and underpressure cut-outs) and the temperature measurement and recording devices is to be proved.

10. Scope of Testing of Refrigerating and Heating Appliances in the Case of Series Production

10.1 Prototype testing of a refrigerating and/or heating appliance shall be carried out in accordance with 8. and 9.

10.2 Tests within a production series

10.2.1 The number of performance tests to be carried out on refrigerating and/or heating appliances in accordance with 8. and 9. shall be agreed with **TL**. Existing experience and the spare capacity measured in respect of the prototype will be taken into account.

10.2.2 The operational test described in 9. shall as a rule be performed on every refrigerating and/or heating appliance. For large production series, on application by the manufacturer tests may be conducted according to an agreed random sampling system, provided that:

– the manufacturer maintains an approved quality assurance system,

– reports of the operational tests on the individual refrigerating and heating appliances are prepared by the manufacturer.

SECTION 5

TANK CONTAINERS

A. Application

Within the meaning of this section, tank containers shall be deemed to include tank swap bodies and other transportable tanks, unless otherwise specified. The rules and regulations to be applied in detail to the different types of tank container shall be established before commencing testing.

1. Cargoes

Tank containers are used to transport liquid, gaseous or solid cargoes in bulk. These cargoes are classified as dangerous goods or as nondangerous goods.

1.1 Dangerous goods

Cargoes which according to at least one national or international code, body of regulations or the like can be assigned to one (or more) dangerous goods class(es) are considered to be dangerous goods.

1.2 Non-dangerous goods

Cargoes other than those described in 1.1 are deemed to be non-dangerous goods.

2. Approval

2.1 Tank containers for dangerous goods

Tank containers for transporting dangerous goods must be approved in accordance with their purpose and with the national and international regulations applicable to the intended traffic routes. Such approvals are normally awarded by the competent authorities. TL conducts the necessary tests (including the recurring tests) in conformity with the applicable regulations after receiving authorization from the relevant authority

2.2 Tank containers for non-dangerous goods

Tank containers for transporting non-dangerous goods shall conform to the latest developments in technology and comply with the national and international regulations applicable to the intended traffic routes. TL conducts the tests (including the recurring tests) required according to these regulations and according to any official rules which may also be applicable.

2.3 Tests and inspections

TL carries out the following tests and inspections:

– Inspection of the design and fabrication documents (inspection of drawings) (including testing of the container on the basis of ISO 1496-3)

– Type test

– Individual acceptance test

– Supervision of series production

– Repeat tests

– For approved tanks:

Every 2 1/2 years: a tightness test and a visual inspection

Every 5 years: a tightness test, a visual inspection and a pressure test.

2.4 Certification

The tests and inspections carried out on the tank containers are confirmed by issuing certificates (including individual and type certificates for tests of new tank containers, attestations with regard to recurring tests).