Rules for Classification and Construction

VI Additional Rules and Guidelines

1 Container Technology

1 Guidelines for the Construction, Repair and Testing of Freight Containers
The following Guidelines come into force on April 1st, 1995

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Section 1

General Instructions and Guidance

A. General Test Conditions

1. Scope

1.1 These Regulations apply to freight containers and their built-in or built-on refrigerating, heating, filling, emptying, and safety equipment.

1.1.1 These Regulations also apply correspondingly to other freight containers, such as swap bodies and special containers for use on offshore installations.

1.2 Containers within the scope of these regulations are freight containers that can be used repeatedly and which are

– of open or closed, box- or tank-like or platform-based design,
– of a durable nature and so resistant as to withstand all loads to be expected during transportation,
– provided with equipment permitting their easy handling, in particular during their transfer from one means of transportation to another.

1.3 These Regulations refer both to the building and testing of new containers and to the testing of used containers and their repair.

1.4 Containers that do not fully correspond to the definition given in 1.2 or which are subject to special conditions of use may be tested in general accordance with these Regulations and/or in accordance with an agreed specification.

2. Rules and standards also applicable

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

I – Ship Technology, Part 1, Chapter 2 - "Machinery Installations" of Section 1 "General Rules and Instructions", Chapter 3 - Rules for the Construction of Electrical Installations, Chapter 4, Section 2 - Rules for the Construction of Refrigerating Installations, and

II - Materials and Welding Technology, Parts 1, 2 and 3.

2.2 Reference is made to the international container standards, especially ISO 1496 "Series 1 Freight Containers - Specification and Testing" and to the corresponding EN standards for swap bodies.

2.3 The conditions for approval of containers according to the Convention for Safe Containers (CSC) of December 2nd, 1972 are, in principle, fulfilled if the containers are constructed and tested in accordance with these regulations.

2.4 The national and/or international rules as may be applicable are to be complied with where the transportation of dangerous goods in containers is concerned.

3. Testing procedure

3.1 Container testing by the Society normally covers the design documents, trials, and production (for types of tests, see B.).

3.2 A certificate is issued by the Society (Head Office or the competent Surveyor) on the results of the tests. Depending on the type of container and test concerned, plates, steel-die stampings and labels serve as test evidence on the container itself (see F-marking and Documentation).

4. Works approvals

4.1 Works where containers or ancillary parts intended for them are manufactured or where containers are repaired 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.
4.2 General representation of the process of container testing

![Diagram of container testing process]

4.3 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 (cf. GL Rules for Welding, Annex A). Approval may be granted following scrutiny of the application and inspection.

4.4 The validity period of an approval granted in accordance with these Rules is 3 years. If work is regularly performed under the Society’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.

4.5 If no work has been performed under the Society’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.

4.6 The Society 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.

4.7 With regard to qualification and approval in respect of welding practice, see also E.1.

B. Types of tests

1. Examination of design and construction documents

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

1.2 The documents to be sent in for examination shall comprise:
a) Drawings showing the arrangement, dimensions, and materials of the structural components of the container;
b) Particulars of jointing methods (welding) and connections envisaged;
c) Particulars of the origin of important ancillary parts (such as fittings, bottom and wall elements);
d) Proof calculations insofar as customary or necessary for the type of container concerned;
e) For thermal containers, additional documents in accordance with Section 3, A.2;
f) For CSC approval, additional documents depending on the competent approving authority.

1.3 The examined documents are sent, marked with the Society's inspection stamp, to:
– the manufacturer
– the competent GL Inspection Office
– the relevant approving authority, if necessary.

The modifications to be effected or the guidance to be complied with are notified by being entered in the examined documents and/or the Society's covering letter. The drawings must be clearly assigned to the type of container to be tested so that they may serve as supporting documents for the Surveyor when carrying out the test and issuing certificates.

1.4 Where other testing bodies are involved, the documents shall be submitted in a number to be agreed on beforehand.

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 2 and 3 and are carried out in the presence of a GL surveyor.

2.2 A report of the type test will be prepared; if the results are satisfactory, a certificate will be issued (cf. F.). A printed form issued by the Society is to be used for the test report.

2.3 The type tests may be carried out at different times and frequencies. The Society 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 (2.3.1). The container to be tested must be a product from the series concerned and should be taken from the first ten containers.

The Society 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., the Society 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; cf. F..

3.2 In order to furnish evidence of the construction remaining uniform within the series, the Society's Surveyor shall be given access to the records of the in-plant 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 2 and 3.

4. Testing of impregnations and coatings

4.1 Impregnations

4.1.1 Upon application, the Society will test for compliance with impregnation specifications issued by certain authorities such as the Australian Quarantine and Inspection Service (protection against infestation).
The test specimens are selected at random by the Surveyor and shall be unambiguously marked (GL test specimen stamp). The test specimens shall, if possible, be cut in such a way that their volumes can be calculated.

4.1.2 The test specimens are to be sent to the Society’s Head Office together with a list containing the following details:
- Serial test specimen number
- Lot or batch number
- Brief designation of the structural component (roof, end or side walls, bottom)
- Supplier of the structural component
- Recipient (container manufacturer)
- Designation of the impregnating agent
- Sampling date.

The test specimen need bear only the serial test specimen number, the sampling date and the GL test specimen stamp.

4.1.3 In order to reduce the testing expenditure, documents furnished by the manufacturer, in particular certificates issued by independent institutions, may be recognized. It must be possible to associate the documents with the lots or batches supplied.

4.1.4 The test results concerning satisfactory impregnation will be confirmed in the certificates.

4.2 Coatings

The testing of the structure of a coat of paint or other surface treatment and the associated preparatory works (sandblasting etc.) during the production of containers or on used containers necessitates a special order to the Society and will be carried out only by arrangement.

5. Testing of suitability for certain cargoes

5.1 To ascertain the suitability of a container for being loaded with a sensitive, aggressive or otherwise unusual cargo, e.g. in respect of tightness, cleanliness, insulation, refrigerating machinery or other equipment as well as construction in general, the Society carries out surveys upon special request (e.g. "butter test").

5.2 Where the loading of such cargo is subject to the approval procedure of an official authority, the application for testing is to be routed via this authority.

6. Testing of used containers

6.1 Testing to ascertain the state of conservation

6.1.1 Individual containers, parts of series or series of containers may be checked by the Society for their state of conservation and operational safety and reliability within the scope of existing rules (e.g. CSC).

6.1.2 Apart from a close visual inspection (especially of the base structure), testing may also include load and operational tests. The selection of the containers to be tested (in the case of random tests) and the frequency of the tests are to be agreed upon in each individual case while having regard to the container type, their age, and the number of containers in the series.

6.1.3 The Society may, by special arrangement, carry out the regular supervision of the condition of containers (series), e.g. in conjunction with repair supervision in accordance with 6.3.

6.2 Testing for certificate renewal

In the case of containers where the validity of the certificate depends on repeat tests at certain intervals, e.g. on hydrostatic pressure tests where tank containers are concerned, testing shall be carried out in the presence of a GL Surveyor.

6.3 Testing of repairs

6.3.1 A GL Surveyor may be called in to establish and assess a case of damage as well as to test a container upon completion of a repair.

6.3.2 In the case of heavy damage to tank containers, where the validity of the certificate depends on their safe condition, the Society’s Head Office shall be informed. Repair drawings showing arrangement, dimensions and materials shall be submitted to Head Office. A Surveyor shall be called in to supervise the necessary tests prior to re-commissioning the container.

6.3.3 The Society monitors the quality of container repairs in shops inspected and authorized by it. This supervision of repair standards is carried out at random and is independent of surveys of individual containers in accordance with 6.3.1 and 6.3.2 (cf. Section 4.).
C. Construction characteristics (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.

2.5 No parts projecting beyond the rated external dimensions (length, width, height) of the container are to be permanently attached to it.

3. Construction

3.1 Main elements

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 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 plate 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). (See also Section 1, E.1.5).

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 corresponding to international standards are shown in Annex A (Figs. A.1 and A.2). 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 the Society. The quality assurance procedure shall be agreed with the Society.

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 (cf. Section 2, A.2.2).

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 shown in Fig. A.3 of Annex A.

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 shown in Fig. A.4 of Annex A.

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.5 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.6 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.7 and A.15 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 (cf. Section 2, B.2.6).

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 Walls

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 (see also E., jointing methods).

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 2.

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.

3.2.6 Other guidance

A sufficient number of suitable lashings shall in general be provided in the container in order to secure the cargo against displacement due to the state of the sea or due to inclinations attributable to other sources. The construction and extent of these appliances are subject to the conditions imposed by the user.

D. Materials

1. General guidance

1.1 Only materials with guaranteed properties (strength; low-temperature toughness where applicable; bending properties; weldability; resistance to corrosion and/or rot; etc.) are to be used for all load-bearing components of containers as well as for tanks, piping, valves and fittings of containers intended for liquid or gaseous cargo. Unless otherwise provided hereinafter or unless special arrangements have been made, the Society’s Rules for Materials 1, recognized standards (e.g. DIN EN 10025) or other equivalent standards shall be taken as a basis in this respect. As regards tank containers intended for the transportation of dangerous goods, the respective legal provisions shall additionally be complied with.

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

1.3 Unless otherwise required hereinafter, the materials shall be covered at least by works test certificates conforming, at present, to EN 10204. 3.1 C (GL) acceptance test certificates conforming to EN 10204 shall be produced for cast steel as well as for materials intended for containers for dangerous goods. In special cases or at the explicit request of the purchaser, check tests of the actual material supplied shall be carried out under the Society’s supervision. All materials and structural components shall be marked in such a way that an unambiguous identification of the manufacturing mill or plant, the material grade and the heat or batch is possible. With regard to the marking of castings, see 2.2.9.

1.4 Thermal containers shall in addition comply with the requirements according to Section 3, A.3.1.1.

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2. Steel materials

2.1 Rolled steels

2.1.1 Ordinary and higher strength hull structural steels satisfying the Society’s Rules for Materials as well as weldable structural steels, e.g. conforming to DIN EN 10025, or pipe materials, e.g. conforming to DIN 1626, DIN 1629, may be used for the components mentioned in 1.1. Other equivalent structural steels with a minimum yield point of 235 N/mm² may be used with the Society’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/mm²) 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-load-bearing components of containers. Welded connections between these steels and those specified in 2.1.1 shall not negatively affect the structural components.

2.2 Cast steel

2.2.1 Cast steel grades GS-38, GS-45 and GS-52 to DIN 1681 as well as GS-C 25 to DIN 17245 and cast steel grades conforming to DIN 17182 may be used for castings for the components specified in 1.1. Cast steel for corner fittings shall meet the requirements of paragraph 2.3.3. Cast steel grades satisfying other rules or standards may also be used with the Society’s consent, provided that they are equivalent to the foregoing grades in respect of mechanical characteristics and weldability.

2.2.2 Unless otherwise agreed on, steel castings (except those for corner fittings) are subject to the quality requirements and test conditions contained in Chapter 2 of the Rules for Materials of Germanischer Lloyd in association with the standards.

2.2.3 Steel castings for corner fittings shall conform to the following requirements:

– The composition of each charge shall conform to Table 1 and shall be certified by the manufacturer.

Deviations from the chemical composition require the Society's consent.

– The mechanical properties shall meet the requirements of Table 2.

Deviations require the Society's consent.

2.2.4 The steel castings shall be supplied in either normalized or heat-treated condition, depending on the cast steel grade.

2.2.5 Steel castings shall not exhibit any defects (such as shrinkholes, blowholes or cracks) which may adversely affect their use and adequate working. Unimportant sand marks and slag spots, small cold shuts and minor scabs shall be gouged out if necessary.

2.2.6 Elimination of defects (including so-called blemishes) by welding is permissible only with the Society's consent 2.

In observance of the Society's Rules for Materials, Chapter 2, Section 4.A., the welding process, heat treatment process and scope of testing shall be agreed with the Society prior to the commencement of such welding work.

2 Preconditions for the granting of the welding permission are: employment of trained welders supervised during work, use of suitable, approved welding filler metals, workmanlike removal and crack detection testing of the defect area, preheating for welding to approx. 100°C if necessary, subsequent stress-relief annealing; in the case of major defects, renewed normalizing, machining of the welded areas and crack detection testing by means of non-destructive testing methods.
Table 1.1  Chemical composition (melt analysis) ¹

<table>
<thead>
<tr>
<th>Composition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C max</td>
</tr>
<tr>
<td>0,20</td>
</tr>
</tbody>
</table>

¹ The carbon equivalent \( C_{eq} = C + \frac{Mn}{6} - \frac{Cr}{5} + \frac{Mo}{5} + \frac{V}{5} + \frac{Ni}{15} + \frac{Cu}{15} \) (%) shall not exceed 0,45 %.

² Aluminium may be partly or completely replaced by other fine-grain-forming elements.

Table 1.2  Mechanical properties

<table>
<thead>
<tr>
<th>Yield point ( R_{eH} ) [N/mm²] min</th>
<th>Tensile strength ( R_m ) [N/mm²]</th>
<th>Elongation ( A_5 ) [%] min</th>
<th>Reduction in cross-section ( Z ) [%] min</th>
<th>Impact energy ( KV ) ¹ [Joule] min bei –20 °C ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>220</td>
<td>430 to 600</td>
<td>25</td>
<td>40</td>
<td>27</td>
</tr>
</tbody>
</table>

¹ Average value from three specimens:
One individual value may be lower than, but not less than 70 % of the average value.

² If lower testing temperatures are demanded by the purchaser in special cases, these are to be agreed with the Society.

2.2.7  With all cast steel grades, testing shall consist of tensile and notched bar impact tests.

For sampling, pieces shall be grouped into test lots according to melting and heat treatment batches.

The test specimens shall in general be cast integrally with the casting and may be cut off only after final heat treatment and stamping.

Where integral casting is not possible, test specimens shall be taken from odd pieces or separately cast test specimen coupons, by agreement with the Surveyor.

2.2.8  Where the material is tested by the Society, all castings shall be presented to the Surveyor for checking in respect of their as-cast condition and their dimensions. Dimensional and visual checks are usually carried out at random. At the request of the Surveyor, non-destructive tests, e.g. by means of magnetic particle or dye penetrant methods, shall be carried out should serious defects be suspected.

In the case of container corner fittings, one out of every 400 castings originating from the same charge shall be tested for internal defects by an appropriate method.

2.2.9  Each casting shall be marked with the manufacturer’s symbol and the charge number (at least the last three digits). Agreements between purchaser and foundry shall be reached as regards additional markings such as drawing or item numbers.

Where the material testing is carried out by the Society, each casting tested by the Surveyor shall be marked with the \( GL \) test stamp; all other castings forming part of the delivery in question shall be marked with the stamp for batch testing \( GL \).

³ In place of the \( GL \) stamp, another type of marking such as the cast-in letters "GL" may be used for identifying GL-tested castings provided that the Society has consented hereto.
Test specimens and castings from which test specimens have been taken shall be marked with the test specimen stamp "T".

2.3 Stainless steels

2.3.1 Stainless steels shall be selected with respect to their resistance to corrosion considering the cargo to be transported and the conditions of working (welding). Unless otherwise agreed upon in detail, steels conforming to DIN 17440 or, with the Society’s consent, equivalent steels conforming to other rules or standards may be considered.

2.3.2 Only grades suitable for welding applications and with guaranteed resistance to intercrystalline corrosion in the welded condition (without heat treatment) may be used for weldments. These are in general the titanium- or tantalum/niobium-stabilized grades or those with a reduced carbon content (approx. 0.02% - 0.05% C).

3. Aluminium alloys

3.1 Wrought alloys

3.1.1 Wrought aluminium alloys must show sufficient resistance to corrosion in a seawater-laden atmosphere. Unless otherwise agreed upon in a particular case, the alloys Al Mg 3, Al Mg 4.5 Mn, Al Mg Si 0.5, Al Mg Si 0.7 or Al Mg Si 1 to DIN 1725 Part 1 shall be used.

3.1.2 The chemical composition and mechanical properties shall conform to the Society’s Rules for Materials and the relevant standards.

In respect of weldments, only the strength in the soft condition may be taken into account.

The Society may agree to the use of a higher strength value if corresponding evidence is furnished, e.g. in an approval test.

3.2 Cast alloys

3.2.1 3.1.1 applies as appropriate to the corrosion resistance of cast aluminium alloys. The following cast alloys to DIN 1725 Part 2 may be used; see Table 1.3.

3.2.2 Cast aluminium alloys shall have quality properties sufficient for the relevant application. Corner fittings made from cast aluminium alloys are subject to the Society’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.

4.3 Solid wood

Grown wood used in container construction must be long-fibred and of good quality, that is, free from sap, deleterious knots and other defects. Twisted grain timber or wood cut across the grain shall not be used.

The timber used must either be well seasoned and sufficiently dry or be expertly dried in suitable drying kilns.

4.4 Plywood, laminwood

Plywood and other wooden elements made up of parts glued together shall consist, in all their layers, plies or parts, of timber of a strength sufficient for the application concerned. The quality requirements for plywood boards shall be laid down in accordance with DIN 68705, page 2, or other equivalent standards. When manufacturing plywood boards etc., proven types of glue shall be used. The glued joints shall conform to DIN 68705 AW 100 as well as to DIN 53251 and DIN 53255.
4.5 Wood protection

All wood should be protected against infestation by fungi and/or insects by impregnating it with a service-proven wood preservative (cf. B.4). The underside of wooden floor parts should, if possible, be sealed by suitable means (e.g. phenolic resin) to protect them against moisture.

5. Plastic materials

5.1 Glass-fibre-reinforced plastics used as linings or coatings of wall and roof elements shall be of service-proven quality and applied in accordance with proven methods. The strength of the coating and of the core layers (wood, plastic, etc.) shall be adapted to one another in accordance with the requirements in Section 2, B.2. The Society reserves the right to require special proof.

5.2 Plastic materials used as coatings, linings or insulation in containers shall withstand the climatic and mechanical stresses occurring and shall not give off any substances detrimental to health or the cargo (see also Section 3, A.3).

5.3 For requirements in respect of sealing elements, see C.3.2.5.

E. Jointing methods

1. Welding

1.1 Conditions applying to works and shops

1.1.1 Works and shops wishing to carry out welding work on containers shall be approved by the Society in this respect (see also Section 1, A.4.). The TC Approval Regulations shall be complied with in respect of tank containers for the transportation of dangerous goods. The works and shops shall possess appropriate facilities permitting expert welding work of high-quality workmanship. These facilities shall include working places protected against atmospheric influences, machinery and equipment for expert preparation of the joints to be welded, safe and reliable welding machinery and equipment, and stationary or portable drying spaces or cabinets for storing the welding filler metals and consumables.

1.1.2 For assembly and welding, it is advisable to use jigs in order to ensure dimensional stability of the structural components. These jigs shall be of such a configuration that the weld seams are easily accessible and can be welded in the most favourable position possible (cf. also i.a. 1.6.5). Tack welds shall be avoided wherever possible.

1.2 Welders, welding supervisors

1.2.1 All welding work on structural parts in accordance with Section 1, D.1.1 may only be carried out only by adequately qualified welders approved by the Society who hold valid welder’s qualification certificates. The welders shall have been qualified in accordance with DIN EN 287 or (with the Society’s consent) other equivalent standards in one or more qualification groups in such a way that the field of work in question (materials, thicknesses of structural components, welding process and positions, welding filler metals, etc.) is covered thereby. The supplementary provisions in the Society’s Rules for Welding with regard to inclusions and exclusions shall be observed (e.g. the requirement for additional fillet weld test pieces if fillet welds are to be made as well). Welders who are to weld vertical downward seams shall have been qualified in this position as well (see 1.3.1 and 1.6.5).

1.2.2 The validity of a welder’s certificate (normally two years), the conditions for maintaining the validity of certificates and the re-examinations are governed by the particulars of DIN EN 287 and the Society’s Rules for Welding.

1.2.3 Every works or shop carrying out welding work shall have in its employ a welding supervisor, proof of whose professional qualifications shall be furnished to the Society. Depending on the type and scope of the welding work to be carried out, the welding supervision may be performed by, e.g., a welding specialist or a welding engineer. The welding supervision is to be approved by the Society. Changes in respect of the welding supervisors shall be communicated to the Society without delay. The welding supervisor shall responsibly supervise the preparation and execution of the welding work (see also 1.6.8).

1.3 Welding processes, procedure testing

1.3.1 Only welding processes, the suitability of which for the application concerned is accepted on the basis of general experience or has been proved in a procedure test shall be used. Procedure tests supervised by the Society shall in any case be conducted on corner fittings for vertical downward welding and single-side welding of hollow metal sections to furnish proof of satisfactory shop procedures and adequate qualitative properties under production conditions in the user’s works. Moreover, the Society is also entitled to call for procedure testing for other welding processes or materials (e.g. special structural steels).

1.3.2 The scope of testing, samples, test specimens and requirements are laid down on a case-by-case basis by analogy with the Society’s Rules for Welding in accordance with the range of application applied for. Welders employed in procedure tests are consid-
ered qualified in the welding technique concerned and/or in connection with the respective materials, provided that the procedure tests have been successfully completed. Where further welders or operator groups are to be employed in the case of a subsequently enlarged range of application, the welders and operator groups are to be adequately trained and tested (see 1.2.1).

1.4 Welding filler metals and consumables

1.4.1 All welding filler metals and consumables used (such as rod electrodes, gas-shielded welding wires, etc.) shall have been approved by the Society in accordance with the Society’s Rules for Welding. The required quality grade depends on the base materials to be welded.

1.4.2 Filler metals and consumables of any quality grade may be used for ordinary-strength hull structural steels and equivalent structural steels such as steel grades Fe 360 or Fe 430 to DIN EN 10025 (cf. Section 1. D.2.1.1). Grade 2 Y and 3 Y filler metals and consumables (where necessary, those with the extension H 15, H 10 or H 5) shall be used for higher-strength hull structural steels and equivalent structural steels such as Fe 510 to DIN EN 10025. The filler metals and consumables last mentioned shall be preferred for welding rimming structural steels and cast steels.

1.4.3 Particulars of the range of application of the approvals of welding filler metals and consumables for other materials (such as austenitic stainless steels or aluminum alloys) are contained in the Society’s Rules for Welding.

1.4.4 Welding filler metals and consumables for other materials may also be tested and approved in conjunction with the procedure in question. However, such approvals remain restricted to the user’s works and have a maximum validity period of one year unless repeat tests are carried out. Filler metals and consumables included in the procedure test in this way may be replaced with other equivalent filler metals and consumables of corresponding quality, approved as such by the Society.

1.5 Configuration of welded joints

1.5.1 The welded joints shall be designed from the outset in such a way that they are easily accessible during manufacture and can be made in the most favourable welding sequence and welding position possible. Care shall be taken that only the inevitable minimum of residual welding stresses and distortions will remain in the structural components after manufacture. Small distances of the welded joints from one another and local accumulations of welds shall be avoided.

1.5.2 Welding in cold-formed areas with more than 5 % permanent elongation is to be avoided as far as possible in the case of structural steels susceptible to strain ageing. Welding work may be carried out in cold-formed and adjacent areas of hull structural steels and equivalent structural steels (e.g. of quality groups B, D, D 1, D 2, DD 1 and DD2 to DIN EN 10025) provided that the following minimum bending radii (inside) are adhered to (Table 1.4).

Table 1.4

<table>
<thead>
<tr>
<th>Sheet / plate thickness range</th>
<th>Minimum bending radius (internal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 4 mm</td>
<td>1 × sheet thickness</td>
</tr>
<tr>
<td>over 4 to 8 mm</td>
<td>1.5 × sheet/plate thickness</td>
</tr>
<tr>
<td>over 8 to 12 mm</td>
<td>2.0 × plate thickness</td>
</tr>
</tbody>
</table>

Depending on the bending process, a larger bending radius than that indicated above may be necessary.

1.5.3 Butt-welded joints (such as straight butt welds, V- or double-V welds) and corner or cross joints (such as single-bevel butt welds) shall normally be designed in such a way that the full plate or shape cross section is fused. To achieve this, the structural components shall be prepared with appropriate weld shapes to DIN standards (e.g. DIN 8551, DIN 8552 etc.), being given a sufficient included angle between the planes of the fusion faces, a sufficient air gap, and the smallest possible depth of the root faces, depending on the sheet or plate thickness. Special weld shapes require the Society’s approval; where necessary, the weld shapes are laid down in connection with a procedure test.

1.5.4 Fillet welds shall, wherever possible, be so designed as to be continuous on both sides (cf. C.3.2.1). Welds intermittent on the inside may be chosen for welding walls etc. to the inside of the framework. Only fillet welds continuous on both sides or intermittent fillet welds with scallops in the webs may be provided for tanks, with the fillet welds taken around the stiffener or scallop ends to seal them. The fillet throat depends on the load in each case, and calculated proof of its adequacy shall be furnished in cases of doubt. The "a" dimension shall not exceed 0.7 t (t = thickness of the thinner part). With the exception of fillet welds on walls and similar structural components made of sheet metal, the fillet weld throat "a" shall be not less than 2.5 mm and, on corner fittings, not less than 3.5 mm.
1.5.5 Overlapped welded joints shall be used only in connection with structural components subject to relatively small loads and shall, wherever possible, be used only parallel to the direction of the main stress. The overlap width shall be at least 1.5 \( t + 15 \text{ mm} \), \( t \) being the thickness of the thinner plate. The fillet welds shall be executed in accordance with 1.5.4.

1.6 Manufacture and testing

1.6.1 The structural components shall be clean and dry in the area of the weld. Any scale, rust, flammecutting slag, grease, paint (with the exception of permitted production coatings with a film thickness of up to 20 \( \mu \) approx.) and dirt shall be thoroughly removed prior to welding. Where plates, shapes or structural components are provided with a corrosion-reducing production coating (shop primer) prior to welding, this coating shall not affect the quality of the welded joints.

1.6.2 When preparing and fitting together the structural components, care shall be taken to comply with the specified weld shapes and gap widths (air gaps). If the permissible gap width is slightly exceeded, it may be reduced by deposit welding on the fusion faces of the joint. Filling pieces or wires shall not be welded in. Larger gaps may be closed by welding in a sufficiently large metal strip or shaped section.

1.6.3 Plates and sections shall be accurately aligned, in particular in structures interrupted by crossing members. A displacement of the edges relative to one another of more than 15 % of the plate or section thickness or more than 3 mm, whichever is the smaller, is not acceptable.

1.6.4 During welding operations, the areas where work is carried out shall be protected against atmospheric influences. In cold air (below 0 °C) suitable measures shall be taken (covering, heating the corner fittings) to ensure satisfactory execution of the welded joints. Welding shall cease at temperatures below -10 °C. Any rapid cooling down shall be avoided, especially when welding corner fittings.

1.6.5 Welding work shall be carried out in the most favourable welding position possible. Welding in a vertical downward position shall be avoided wherever possible on corner fittings and is not to be carried out at the corner fitting/corner post connection, even after a procedure test for vertical downward welding in general and irrespective of the approval of the welding metals and consumables. The use of a suitable welding sequence shall ensure the least possible restriction of the shrinkage of the weld seams.

1.6.6 In welding operations, care shall be taken to achieve uniform penetration, perfect fusion down to the root, and uniform, not excessively convex weld surfaces. In the case of multi-pass welding, slag originating from the preceding runs shall be thoroughly removed. Cracks (including broken tack welds), larger pores or slag inclusions etc. are not to be welded over but shall be gouged out.

1.6.7 The repair of major material or workmanship defects may be carried out only after the Society has given its consent. Minor surface defects shall, wherever possible, be eliminated only by shallow grinding. Defects which reach deeper into the weld shall be cleanly gouged out and rewelded.

Where in the case of cracks total or partial replacement of the structural component concerned is not demanded or the cracks may be closed by welding with the Society’s consent, the length and configuration of the crack shall be unambiguously ascertained by means of a suitable crack detection technique, the crack cut out to beyond its ends and subsequently welded up.

1.6.8 Workmanlike accomplishment of the welding shall be ensured by careful control carried out by the shop concerned (see 1.2.2). The Society will check the welding work at random during fabrication and, where necessary, during the final inspection after completion. The Society is entitled to reject insufficiently checked structural components and to require them to be submitted anew following a successful in-shop check and on completion of any repairs necessary.

1.6.9 In cases of doubt, the Society is entitled to demand that additional tests (such as non-destructive tests to furnish evidence of the satisfactory weld quality) be carried out on important structural components. The type and scope of the tests will be laid down by the Society from case to case. For testing of tank containers, see Section 6.

2. Bolted and riveted connections

2.1 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.

2.2 The adequate strength of a connection is in general considered proven if the tests in Section 2 have been conducted without giving cause for complaint. The Society is entitled to call for a procedure test in special cases. Where necessary, calculations serving as evidence shall be submitted together with the documents subject to examination.
2.3 All the elements of the connection shall be resistant to seawater. Subsequent application of a coat of anti-corrosive paint is not considered sufficient. The possibility of contact corrosion is especially to be reckoned with. In the case of tank and bulk containers, the jointing elements shall moreover be resistant to the substances intended to be carried in these containers.

2.4 Connections between steel and aluminium structural components shall be made in such a way as to be corrosion-inhibiting in a service-proven manner.

2.5 Bolted connections shall be locked in certain cases. This may in particular apply to the mounting of refrigerating machinery sets or parts thereof as well as to safety valves and fittings.

2.6 With regard to the locking of bolted connections for customs purposes, the official regulations shall apply.

2.7 Proof shall be furnished that the rivet material is not embrittled by clinching the rivets.

3. Adhesive joints

3.1 The suitability (durability) 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. Previous experience may be taken into account.

3.2 In respect of joint preparation and handling conditions, the instructions given by the adhesive manufacturer shall be complied with.

3.3 The components of the adhesive joints shall be insensitive to the climatic and chemical actions to be expected and harmless with respect to the cargo to be transported.

F. Marking and documentation

1. Marking

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

a) An adhesive label in conformity with Annex B, B., normally on the left door
(Tank containers: beside the tank rating plate)

b) The number of the type certificate (FC No.), the GL stamp, and the tank test number are additionally die-stamped into the rating plate of the tank of tank containers.

1.2 GL 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 the Society's Head Office or competent Inspection Office. Labels are issued only by the Society.

1.3 CSC plate: The Safety Approval Plate required by the Law covering the Convention for Safe Containers (CSC) of December 2nd, 1972 shall be durably fixed, be resistant to fire and corrosion, and contain the particulars shown in Annex B, B.2.. The Approval Reference will be laid down by the competent approving authority.

1.4 Markings relating to checking by the customs authorities shall be affixed in accordance with the provisions issued by the competent authority.

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

1.6 Markings in connection with approval for railway traffic (e.g. in accordance with UIC conditions) shall be made in accordance with the provisions issued by the railway administrations.

1.7 Where wooden structural components have been impregnated and tested on the basis of special rules or regulations, the containers may be marked with a permanently affixed label corresponding to the national provisions in question.

1.8 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 certificate

2.1.1 The testing of the container type, that is, the scrutiny of the documentation (drawings etc.) and the load and operating tests, is certified in the type certificate (see Annex B, C.1.). This certificate also contains the most important particulars of type and design, manufacturer and purchaser.

2.1.2 In the case of small series, the results obtained while testing a preceding series may be referred to as regards the type certificate, by agreement with the Society's Head Office.
2.2 Individual certificates

2.2.1 The testing of the individual containers of a series (supervision of production and individual testing in accordance with B.3.1) is confirmed by an individual certificate (see Annex B, C.2. or C.3, as applicable).

2.2.2 The individual certificates covering containers subjected to regular checks in accordance with B.6.1.3 may be renewed or their validity may be extended.

2.2.3 Special tests and repair or damage surveys of containers may be informally certified by the Society’s Head Office or the Inspection Office that has carried out the tests or surveys.
Section 2

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 (wood!) shall be taken into account.

1.2 Where the Society is requested to certify conformity with the law covering the convention for safe containers (CSC) and with the ISO standards, at least the test loads according to B. shall be applied in the type test.

1.3 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 (cf. Section 3, B.5.2.2).

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 2.3.

2.2 Elastic deformations under load depend on the construction; their admissibility is governed by the individual transportation conditions. The return of the base structure as per Section 1, C.3.2.1.2 shall be so chosen within the range indicated therein that the lower face of the base structure does not deflect more than 6 mm below the lower bearing planes of the corner fittings with the container loaded to 1.8 R.

2.3 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.

2.4 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.

2.5 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 guidance

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.

We recommend that the GL type testing report, in which the aforementioned measuring points are indicated, be used for recording the test results.

1.4 Repeat tests (cf. Section 1, B.3.3):

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 (cf. Section 2, B.2.9 and B.2.13).

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.

**Guidance:**

The test load of 3,392 kN per container is derived from 9-high stacking, i.e. 8 containers each weighing 24,000 kg at an acceleration of 1.8 g are stacked on top of a container. (The corner posts of such containers are tested with a test load of 848 kN).

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.

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.

**Table 2.1**

<table>
<thead>
<tr>
<th>Type of container</th>
<th>Total test load (applied to all 4 corner posts simultaneously) [kN]</th>
<th>Test load on each end frame [kN]</th>
<th>Allowable stacking weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A, 1 AA + 1 AAA + 1 AX</td>
<td>3.392</td>
<td>1696</td>
<td>192,000</td>
</tr>
<tr>
<td>1 B, 1 BB + 1 BBB + 1 BX</td>
<td>3.392</td>
<td>1696</td>
<td>192,000</td>
</tr>
<tr>
<td>1 C, 1 CC + 1 CX</td>
<td>3.392</td>
<td>1696</td>
<td>192,000</td>
</tr>
<tr>
<td>1 D + 1 DX</td>
<td>896</td>
<td>448</td>
<td>50800</td>
</tr>
</tbody>
</table>
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>
<thead>
<tr>
<th>Type of container</th>
<th>L max. empty</th>
<th>L min. loaded to $1 , R$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 AAA, 1 AA, 1 A und 1 AX</td>
<td>12.202</td>
<td>12.172</td>
</tr>
<tr>
<td>1 BBB, 1 BB, 1 B und 1 BX</td>
<td>9.135</td>
<td>9.105</td>
</tr>
<tr>
<td>1 CC, 1 C und 1 CX</td>
<td>6.068</td>
<td>6.042</td>
</tr>
</tbody>
</table>

$L$ = longitudinal distance between outer edges of corner fittings

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 $0.4 \times \, P$. Bulk containers and 1 E and 1 F containers shall be subjected to an internal load of $0.6 \times \, P$. 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 $0.6 \times \, P$. 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

a) is capable of withstanding the loads imposed by persons working on it, or
b) 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) 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.

b) The roof shall be loaded with twice the weight of the intended hanging cargo, but with at least \(2 \times 1490 \text{ kg/m}\), 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 cm² 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.

Concerning the combination of this test with test no. 9, see Section 2, B.1.7.

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 2.3 Principles for container testing

<table>
<thead>
<tr>
<th>No.</th>
<th>Scope of type test and/or design requirements</th>
<th>Measuring point</th>
<th>Test procedure</th>
<th>Permissible values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Method of test loading or test load</td>
<td>Elastic deformation [mm]</td>
</tr>
<tr>
<td>1</td>
<td>Stacking</td>
<td>Corner post</td>
<td>Internal load</td>
<td>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</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transverse member</td>
<td>Load of 1.8 R–T uniformly distributed over floor</td>
<td>6 **</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bottom side rail</td>
<td></td>
<td>40' length: 4 30' length: 3 20' length: 3</td>
</tr>
<tr>
<td>2</td>
<td>Lifting from the 4 top corner fittings</td>
<td>Transverse member</td>
<td>Load of 2.0 R–T uniformly distributed over floor</td>
<td>The lifting load shall be applied as follows: vertical: 40' load 30' load 20' load 60° to horizontal: 10’ load</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bottom side rail</td>
<td></td>
<td>40' length: 4 30' length: 3 20' length: 3</td>
</tr>
<tr>
<td>3</td>
<td>Lifting from the 4 bottom corner fittings</td>
<td>Transverse member</td>
<td>Load of 2.0 R–T uniformly distributed over floor</td>
<td>The lifting load shall be applied as follows: vertical: 40° load 30° load 20° load 60° to horizontal: 10’ load</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bottom side rail</td>
<td></td>
<td>40' length: 4 30' length: 3 20' length: 3</td>
</tr>
<tr>
<td>4</td>
<td>Restraint test (longitudinal)</td>
<td>Bottom side rail</td>
<td>Load of 1.0 R–T uniformly distributed over floor</td>
<td>A horizontal load shall be applied through the bottom corner fittings first towards and then away from the anchor points.</td>
</tr>
<tr>
<td>5</td>
<td>Strength of end walls including doors</td>
<td>See GL container type test report</td>
<td>Unladen</td>
<td>Internal load uniformly distributed over wall for 40° length 30° length 20° length 10° length 20' and 10' non-pressurized dry bulk containers: 0.6 P</td>
</tr>
<tr>
<td>6</td>
<td>Strength of side walls</td>
<td>See GL container type test report</td>
<td>Unladen</td>
<td>Internal load, uniformly distributed over wall: 0.6 P</td>
</tr>
</tbody>
</table>

* 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 2.3 Principles for container testing (continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>Scope of type test and/or design requirements</th>
<th>Measuring point</th>
<th>Test procedure</th>
<th>Permissible values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Internal load</td>
<td>Method of test loading or test load</td>
<td>Elastic deformation [mm]</td>
</tr>
<tr>
<td>7</td>
<td>Strength of roof</td>
<td>Weakest part of roof</td>
<td>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</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Strength of floor</td>
<td>Transverse members including side rails</td>
<td>Test vehicle: Wheel load: 5460 kg Wheel base: 760 mm Wheel contact area: 142 cm² / per wheel The test vehicle shall transverse the entire floor area of the container.</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gooseneck-tunnel</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Transverse rigidity</td>
<td>See GL container type test report</td>
<td>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.</td>
<td>60</td>
</tr>
<tr>
<td>10</td>
<td>Longitudinal rigidity</td>
<td>See GL container type test report</td>
<td>75 kN horizontally: The loads shall be applied first towards and the away from the top corner fittings. Not applicable to 10’ containers.</td>
<td>25</td>
</tr>
<tr>
<td>11</td>
<td>Lifting from fork-lift pockets (where provided)</td>
<td>Transverse member</td>
<td>1. Fork-lift pockets for use in loaded condition: 1.6 R–T 2. Fork-lift pockets for transport when empty: 0.625 R–T</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bottom side rail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Lifting at base of grappler arm contact area (where provided)</td>
<td>Transverse member</td>
<td>Load of 1.25 R–T is uniformly distributed over floor. Lifting loads to be applied vertically at the 4 grappler arm contact areas.</td>
<td>3</td>
</tr>
</tbody>
</table>
### Table 2.3 Principles for container testing  (continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>Scope of type test and/or design requirements</th>
<th>Measuring point</th>
<th>Internal load</th>
<th>Test procedure</th>
<th>Permissible values</th>
</tr>
</thead>
</table>
| 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 (for angle of tensile force see Annex F of ISO 1496-1) | 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  
Transverse member | Test load of 0.5 R–T on each load transfer pair  
Test load of (1.5 R–T)/n on each pair of intermediate transfer areas:  
n = no. of transfer area pairs |
Section 3

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 1, B.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 double-leaf 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.

3.6 Construction and design of the refrigerating appliances

See B.3.

4. Marking

With regard to the marking of thermal containers, in addition to the requirements in Section 1, F. 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 (see also Section 1, B.).

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 2, 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 (see also Section 2, B.2.7).

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 m³/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 m³/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 m³/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. The interior walls at the 8 corners and at the centres of the side walls, roof and floor.

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

\[
U = \frac{Q}{\Theta_i - \Theta_e} \quad [\text{W/K}]
\]

where

\( Q \) [W] electrical heat output including ventilator heat
\( \Theta_i \) [°C] average interior temperature of the container
\( \Theta_e \) [°C] average exterior temperature of the container

The average exterior temperature \( \Theta_e \) 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 \( \Theta_i \) 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 \( \Theta \) is derived from:

\[
\Theta = \frac{\Theta_i + \Theta_e}{2} \quad [\text{°C}]
\]

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 \( \Theta_i \) equals 1.5 K.

d) The maximum difference between any two average exterior temperature values \( \Theta_e \) 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:

\[
k = \frac{U}{A} \quad [\text{W/m²K}]
\]

where

\[
A = \sqrt{A_e \cdot A_i} \quad [\text{m²}]
\]
that is, the geometric mean of the exterior surface area $A_e$ and the interior surface area $A_i$ 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 (e.g. ATP), the test results will be confirmed by the Society, indicating the standard or code used, provided that the test method in question is equivalent to that prescribed by the Society.

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 the Society.

6.2.5 In the case of production series of more than 100 containers, the Society 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 Internal combustion engine drives

7.4.1 Thermal containers equipped with an internal combustion engine may be arranged below deck, provided that the flash point of the liquid fuel used is 60 °C or above.

7.4.2 Where internal combustion engines operate on liquid fuels, the flash point of which is below 60 °C, they may be arranged below deck together with the containers only on condition that the fuel tanks have been completely emptied or removed. The removed fuel tanks or the drained fuel shall be stored in a space approved for this particular purpose.

7.4.3 Even where arrangement below deck is permitted in accordance with 7.4.1, the operation of internal combustion engines is not permissible there.

7.4.4 The operation of internal combustion engines, the liquid fuel of which has a flash point below 60 °C, is permitted on the open deck provided that such operation is not at variance with legal provisions of the national authorities having competence in respect of accident prevention and safety in shipping.

Tanks for these fuels may be refilled only with the engines stopped and cold and under the supervision of the responsible officer.

7.4.5 Operation on board of internal combustion engines operating on gaseous fuels is not permitted. Prior to arranging such units on board, all fuel tanks which have not been fully drained or fully purged of gas shall be removed and stored in a well restrained manner in spaces specially approved for this purpose.

7.5 Operating instructions

Operating instructions shall 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 the Society. 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 refrigerating 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 Working pressures

3.2.1 The following maximum permitted working pressures apply to refrigerator sets equipped with air-cooled condensers and using the normal refrigerants:

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 22</td>
<td>25 bar</td>
</tr>
<tr>
<td>R 134 a</td>
<td>17 bar</td>
</tr>
</tbody>
</table>

3.3 Safety equipment

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

3.3.2 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.

3.3.3 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.

3.4 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.

3.5 Other particulars

The particulars indicated in 3.1 to 3.4, 5, and 7, apply by analogy, where applicable, to any types of appliances not expressly mentioned.

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 GL Rules for Construction Part 1, Chapter 3 "Electrical..."
Installations” and ISO 1496-2, Section 7 “Electrical aspects of thermal containers”).

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. Rubber sheathed cables of type "H07RN-F" or an equivalent type shall be used.

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, the Society 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 the Society 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.; see also 1.2.

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 the Society. 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 4

Repairing of Containers

A. Guidelines for the Authorization of Container Repair Workshops

1. Approval of the workshop

1.1 Workshops desiring to work under the authorization of GL require approval by the Society in accordance with Section 1, A.4.

1.2 A member of the workshop management and his deputy, who as workshop experts are responsible for ensuring compliance with the approval conditions, shall be designated and their names communicated to the Society. Furthermore, the names of the welding supervisor and his deputy, who are in charge of supervising the workshop's welding operations and are adequately trained for this task, shall be communicated to the Society.

1.3 The workshop, once authorized, undertakes to carry out maintenance and repair work on its own responsibility in accordance with the stipulations of this section.

2. Supervision

2.1 The Society makes sure by means of random visits by its surveyors that the standard of the workshop and the quality of the work as established at the time of approval are maintained.

2.2 The competent GL Inspection Office or, if need be, the Society's Head Office shall be informed whenever repairs are to be made to a container in respect of which the validity of the certificate depends on regular surveys, inspections and tests, or whenever the customer expressly requests that the damage or the repair be checked by the Society, or whenever a special certificate or attestation is to be issued.

2.3 The Society's surveyor shall at all times be granted access to all shop facilities used for container repairs and, upon demand, be permitted to inspect the material control records insofar as they refer to the technical quality.

2.4 The Society shall be informed of any changes in shop facilities, in working techniques or in the structure and qualifications of the personnel which affect the conditions under which the suitability of the workshop was originally established. New working techniques, in particular the use of a welding technique which is new to the workshop concerned, shall be indicated to the Society.

3. Execution of repairs

3.1 The workshop concerned shall in all cases be responsible for the quality of the repair work and for ensuring conformity with these Regulations. The correct repair may be certified by the Society on special request.

3.2 When replacing constructional components, care shall be taken to ensure that the new parts are equivalent to the ones replaced, especially where load-bearing main elements are concerned.

3.3 Special care shall be taken to ensure that GL-approved welding consumables and filler metals suitable for the material involved are used. In cases of doubt, the competent GL Inspection Office or the Society's Head Office shall be consulted.

3.4 The length of girder sections to be welded in as replacements shall equal $2 \times$ girder height (height of steel section), but at least 300 mm.

3.5 Corner posts shall be replaced as a whole. Welding-in of sections is permissible only under certain conditions and requires careful preparation of the joining areas and the weld edges.

3.6 Dents in sheet steel panels shall be remedied by fairing only on condition that they are shallow and not bordered by kinks. Otherwise a new section is to be put in.

3.7 Wooden constructional parts

3.7.1 Repairs to wooden constructional parts, especially plywood elements, shall be carried out according to practice-proven methods which have been agreed with both the customer and the Society. Special guidelines for working with glass-fibre-reinforced plastics (facilities available) shall be observed.

3.7.2 When replacing wooden elements, the regulations with regard to impregnation shall be complied with. Impregnation by means of brush-applied coats is insufficient.
3.8 All repair work shall be done in such a way that the correct bond condition is re-established.

4. Testing, marking

4.1 Strength tests are generally not required for normal general cargo containers on completion of the repair work, since even in the case of new construction not every container of a series is subjected to strength tests. However, the Society’s Surveyor may call for a strength test of the constructional part concerned in justified cases after extensive repairs or repairs where the workmanship is questionable.

4.2 In the case of repairs to containers where the validity of the respective certificate depends on regular surveys, random strength tests only are required, unless there are reasonable doubts on the basis of the nature of the damage or the execution of the repair work as to whether the normal load-bearing capacity of the constructional parts in question has been re-established and unless the validity of the certificate depends on the strength testing (e.g. hydrostatic testing of tank containers).

4.3 Weatherproofness or tightness tests, e.g. on completion of door repairs, may in general be carried out in the works without a GL Surveyor being called in. Exceptions to this are tightness tests of tank containers and refrigerating and heating systems, where a GL Surveyor shall as a rule be called in in connection with the operational test.

4.4 Marking

4.4.1 Markings in connection with a certificate, the validity of which depends on regular surveys and inspections shall, if so desired, be renewed in accordance with the instructions of the Surveyor called in.

4.4.2 If a repair marking is to include a reference to the works authorization, the type of such a marking shall be agreed with the Society’s Head Office.
Section 5

Special Containers for use on Seagoing Ships and Offshore Installations

A. General

1. Containers arranged on the open deck and occupied by personnel shall be treated, with regard to their strength, in the same way as living quarters on seagoing ships and offshore installations.

1.1 The containers shall comply with the conditions stated in Sections 1 and 2 of these Regulations.

1.2 Containers intended for use in multi-modal (i.e. in international) traffic require CSC approval. The necessary type approval test will be certified by the Society if the latter is commissioned accordingly.

1.3 Special containers within the meaning of this Regulation are:
   – Living and sleeping containers
   – Exhibition and day-room containers
   – Office and measurement/testing containers
   – Laboratory and workshop containers.

1.4 The conditions for storage containers shall be established in consultation with the Society's Head Office.

2. Dimensioning

2.1 Plating

2.1.1 The plating for walls, roofs and floors must not be less than 4 mm thick.

2.2 Stiffening

2.2.1 The container is exposed at its place of arrangement (the ship's weather deck) to wind, weather and the wash of the sea.

The section modulus including the plating shall not be less than the following values:

   a) Unprotected front wall  \( W = 63 \text{ cm}^3 \)
   b) Protected front wall, side wall and end wall  \( W = 30 \text{ cm}^3 \)

2.2.2 The section moduli specified under 2.2.1 are valid for

   – a stiffener spacing  \( a = 500 \text{ [mm]} \)
   – a stiffener length  \( l = 2300 \text{ [mm]} \)

In the case of different dimensions, the moduli shall be determined by interpolation.

2.3 If the walls and roofs are dimensioned in accordance with 2., a corresponding proof calculation is sufficient.

3. Doors

3.1 The strength of the doors shall be equivalent to the wall strength.

At least 2 dogs shall be provided as door catches.

The door sills of containers on the open weather deck shall be at least 200 mm high, measured from the deck.

4. Windows

4.1 Windows in special containers shall be installed in accordance with DIN-ISO 1751 and 3903. When transporting the containers, it is recommended to protect the windows with cover panels which can be placed over them from the outside.

B. Structural fire protection

1. Living and office containers

1.1 In terms of fire safety, such containers shall be treated in the same way as living quarters on board seagoing ships and offshore installations (see Part 1 - Seagoing Ships, Chapter 1, Section 22 of the Construction Rules for Seagoing Ships and Part 1 - Seagoing Ships, Chapter 4, Section 11 of the Construction Rules for Offshore Installations).
Chapter 1  Section 5  C  Special Containers for use on Seagoing Ships and Offshore Installations

1.2 All insulating materials, walls, sub-structures and wall and roof claddings shall be non-flammable and approved.

1.3 Primary deck coverings, if used, shall consist of a hard-to-ignite, approved material which does not present any danger of poisoning or explosion at elevated temperatures.

1.4 Wall and ceiling coatings and paints shall have a low fire propagation capacity, shall be approved and shall not produce unusually large quantities of smoke and other toxic substances.

2. Workshop and laboratory containers

2.1 The classification of the containers according to the rules for seagoing ships and offshore installations is dependent on their designated purpose (type of laboratory, work with a naked flame, etc.) and shall be done in each case in consultation with the Society's Head Office.

2.2 In principle, the requirements stated in 1.2 to 1.4 shall apply; where work with a naked flame is to be carried out, however, deck coverings, if used, shall be of sheet steel, concrete or an equivalent material.

3. Drawings containing particulars of the structural fire protection equipment and of the type, manufacturer and GL approval (See-Berufsgenossenschaft approval in the case of German ships) of the materials and structures shall be submitted in advance for authorization.

4. In consultation with the Society’s Head Office and, where applicable, with the consent of the competent flag state administration, the aforementioned requirements may be deviated from in particular cases (e.g. for the installation of fire alarms).

C. Special containers, electrical equipment

1. General

All electrical equipment is governed in principle by the Rules for Classification and Construction, Part 1 - Seagoing Ships, Chapter 3 "Electrical Installations" of Germanischer Lloyd.

2. Special features

2.1 Protection of persons

For the protection of persons working at testing facilities and jobsites, fault-current protection switches and emergency cut-outs shall be provided.

2.2 Protection from foreign bodies and water

Type of protection inside the container: IP 22.

Type of protection outside the container: IP 56. If flooding is likely from time to time, type of protection IP 67 is required.

2.3 Earthing

The container (exterior) shall be electrically connected to the ship's hull.

2.4 Explosion protection

If containers are arranged in areas where there is a danger of explosion, the relevant GL Rules shall be complied with.

2.5 Electricity supply

The power supply to the containers shall be capable of being led and switched off from a separate feeder box. The feeder box shall have a means of indicating whether it is live and which feeder is switched on.

Plug-in devices (power circuits > 16 A AC or 10 A DC) shall be interlocked in such a way that the plug cannot be inserted or withdrawn if the sockets are live.

2.6 Emergency exit illumination (battery-powered emergency lamp)

If the power supply fails, it shall be ensured that the emergency exit (container door) is illuminated by means of a battery-powered lamp. The stand-by switch must be available at all times.

2.7 Alarm and intercom systems

An alarm emitter (bell or loudspeaker) shall be provided in case of emergencies (general alarm).
Section 6

Tank Containers

A. Definition

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 (e.g. pulverulent) cargoes in bulk. These cargoes are classified as dangerous goods or as non-dangerous 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. Germanischer Lloyd conducts the necessary tests (including the recurring tests) in conformity with the applicable regulations after receiving authorization from the relevant authority (see 2.3).

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.

Germanischer Lloyd conducts the tests (including the recurring tests) required according to these regulations and according to any official rules which may also be applicable (see 2.3).

2.3 Tests and inspections

Germanischer Lloyd 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).
### Table A.1 Weights, measurements and tolerances

<table>
<thead>
<tr>
<th>ISO designation of container</th>
<th>Max. permitted gross weight [kg]</th>
<th>External dimensions</th>
<th>Distance between centres of holes in corner fittings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length [mm]</td>
<td>Height [mm]</td>
<td>Width [mm]</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>H</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Lingitudinally S [mm]</td>
<td>crosswise P [mm]</td>
<td>Permitted difference d₁ of diagonals [mm]</td>
</tr>
<tr>
<td></td>
<td>Permitted difference d₂ of diagonals [mm]</td>
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<td></td>
</tr>
<tr>
<td>1 AAA</td>
<td>30.480</td>
<td>12.192 –10</td>
<td>2.896 –5</td>
</tr>
<tr>
<td>1 AA</td>
<td></td>
<td></td>
<td>2.591 –5</td>
</tr>
<tr>
<td>1 A</td>
<td></td>
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<td>2.438 –5</td>
</tr>
<tr>
<td>1 AX</td>
<td></td>
<td></td>
<td>&lt; 2.438</td>
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<tr>
<td>1 BB</td>
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<td>1 B</td>
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<td>2.438 –5</td>
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<td>10.160</td>
<td>2.991 –5</td>
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<td>1 D</td>
<td></td>
<td></td>
<td>2.438 –5</td>
</tr>
<tr>
<td>1 DX</td>
<td></td>
<td></td>
<td>&lt; 2.438</td>
</tr>
</tbody>
</table>

1. Allowable difference of the diagonals of whole-center of the corner castings of bottom and roof areas.
2. Allowable difference of the diagonals of hole center of the corner castings of front walls, see following sketch.
** In certain countries there are legal limitations to the overall height of vehicle and load.

---

![Diagram](image-url)
Table A.2

<table>
<thead>
<tr>
<th>No.</th>
<th>Test</th>
<th>Container type</th>
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</thead>
<tbody>
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<td>General cargo</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Open top</td>
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<tr>
<td></td>
<td></td>
<td>(“Open top”)</td>
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<tr>
<td></td>
<td></td>
<td>Platform with</td>
</tr>
<tr>
<td></td>
<td></td>
<td>end wall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Platform without</td>
</tr>
<tr>
<td></td>
<td></td>
<td>end wall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thermal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tank</td>
</tr>
<tr>
<td>1</td>
<td>Stacking</td>
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</tr>
<tr>
<td>2</td>
<td>Lifting at top</td>
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</tr>
<tr>
<td></td>
<td>corner fittings</td>
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</tr>
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<td>3</td>
<td>Lifting at bottom</td>
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<tr>
<td></td>
<td>corner fittings</td>
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<td>4</td>
<td>Restraint (longitudinal)</td>
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<td>5</td>
<td>Loading the end wall</td>
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</tr>
<tr>
<td>6</td>
<td>Loading the side wall</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Loading the roof</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Loading the floor</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>End wall rigidity</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Side wall rigidity</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Lifting by fork-lift pockets</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Lifting by grappling arm lifting areas</td>
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</tr>
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</tr>
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<tr>
<td>13</td>
<td>Weatherproofness</td>
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<td>14</td>
<td>Lashing eyes</td>
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<tr>
<td>15</td>
<td>U value determination</td>
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<tr>
<td>16</td>
<td>Refrigeration</td>
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<tr>
<td>17</td>
<td>Logitudinal inertia</td>
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<tr>
<td>18</td>
<td>Lateral inertia</td>
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</tr>
<tr>
<td>19</td>
<td>Pressure test</td>
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<tr>
<td>20</td>
<td>Dynamic external restraint</td>
<td>As substitute for tests marked x)</td>
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</table>

1) If provided
2) Walkways and ladders
Table A.3

<table>
<thead>
<tr>
<th>Type of repeat or intermediate test</th>
<th>Number of containers produced</th>
</tr>
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<tbody>
<tr>
<td>Weatherproofness test of door in accordance with Section 2, B.2.13</td>
<td>🗒 10 50 100 250 1000 🗒</td>
</tr>
<tr>
<td>Measurement of air leakage rate in accordance with Section 3, A.5.3</td>
<td>🗒 10 50 100 250 1000 🗒</td>
</tr>
<tr>
<td>Weatherproofness test of entire container in accordance with Section 2, B.2.13 (guide value)</td>
<td>🗒 10 50 100 250 1000 🗒</td>
</tr>
<tr>
<td>Lifting test in accordance with Section 2, B.2.2 or tensile test on corner posts with load 0.5 R</td>
<td>🗒 10 50 100 250 1000 🗒</td>
</tr>
<tr>
<td>Loading the floor on accordance with Section 2, B.2.8</td>
<td>🗒 10 50 100 250 1000 🗒</td>
</tr>
<tr>
<td>Repeat type test for thermal containers (guide value) For series of over 100, see Section 3, A.6.2.5</td>
<td>🗒 10 50 100 250 1000 🗒</td>
</tr>
<tr>
<td>Stacking test for general cargo containers (guide value)</td>
<td>🗒 10 50 100 250 1000 🗒</td>
</tr>
<tr>
<td>Repeat type test for general cargo containers (guide value)</td>
<td>🗒 10 50 100 250 1000 🗒</td>
</tr>
</tbody>
</table>
Excerpt from ISO 1161

Fig. A.1  Standard Corner Fittings – Top Corner Fitting
Fig. A.2   Standard Corner Fittings  –  Bottom Corner Fitting
Excerpt from ISO1496/1

**Fig. A.3 Gooseneck Tunnel**
Excerpt from ISO 1496/1

Fig. A.4 Fork Lift Pockets

<table>
<thead>
<tr>
<th>Container</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pockets (loaded container)</td>
</tr>
<tr>
<td></td>
<td>[mm]</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1CC, 1C, 1CX</td>
<td>2.050 ± 50</td>
</tr>
<tr>
<td>1D, 1DX</td>
<td>900 ± 50</td>
</tr>
</tbody>
</table>
This part of the wall shall not be more than $12\frac{3}{4}$ from the inside of the lip. Grapper arm contact area to be flat and level with corner clean and square.

Where stops are provided at ends of pockets they shall be sloped as indicated.

Fig. A.5 Grappler Arm Lifting Areas
Details or requirements for transfer areas in base structure of containers for vehicle transport

Fig. A.6  Floor Support Areas

Load transfer areas for 1CC, 1C or 1CX containers

Fig. A.7

Minimum requirement with regard to pairs of load transfer areas

Fig. A.8

Requirements applicable if 5 pairs of load transfer areas are to be fitted
Load transfer areas for 1BBB, 1BB, 1B or 1BX containers

Minimum requirement: 5 pairs of load transfer areas

Fig. A.9

Requirement if 6 pairs of load transfer areas are to be fitted

Fig. A.10
Load transfer areas for 1AAA, 1AA, 1A or 1AX containers

Minimum requirement: 5 pairs of load transfer areas

Fig. A.11

Requirements applicable if 6 pairs of load transfer areas are to be fitted

Fig. A.12
Load transfer areas for 1AAA, 1AA, 1A or 1AX containers with gooseneck tunnel

Minimum requirement: 6 pairs of load transfer areas

Fig. A.13

Requirements applicable if 7 pairs of load transfer areas are to be fitted

Fig. A.14
Minimum requirements for load transfer areas in the vicinity of the gooseneck tunnel

Fig. A.15
### Container - Dimensions

<table>
<thead>
<tr>
<th>Size</th>
<th>Length (side view)</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>53' (16150mm)</td>
<td></td>
<td>8' 6&quot;</td>
<td>9' 6 1/2&quot;</td>
</tr>
<tr>
<td>40' (14935mm)</td>
<td></td>
<td></td>
<td>9' 6&quot;</td>
</tr>
<tr>
<td>40' (14630mm)</td>
<td></td>
<td></td>
<td>9' 6 1/2&quot;</td>
</tr>
<tr>
<td>45' (13720mm)</td>
<td></td>
<td>8'</td>
<td>9' 6&quot;</td>
</tr>
<tr>
<td>43' (13103mm)</td>
<td></td>
<td>8'</td>
<td>(2438mm) 8' 6&quot;</td>
</tr>
<tr>
<td>40' ISO (12192mm)</td>
<td></td>
<td>8'</td>
<td>8' 6&quot; 9' 6&quot;</td>
</tr>
<tr>
<td>40' EURO (12192mm)</td>
<td></td>
<td></td>
<td>8' 6&quot;</td>
</tr>
<tr>
<td>40' Bell Lines (12192mm)</td>
<td></td>
<td></td>
<td>2500mm 8' 6&quot;</td>
</tr>
<tr>
<td>35' (10660mm)</td>
<td></td>
<td>8'</td>
<td>8' 6&quot; 8' 8'</td>
</tr>
<tr>
<td>30' (9125mm)</td>
<td></td>
<td>8'</td>
<td>8' 6&quot;</td>
</tr>
<tr>
<td>24' (Matson) (7430mm)</td>
<td></td>
<td>8' od. 8' 6&quot;</td>
<td>8' 6&quot; 9' 6&quot;</td>
</tr>
<tr>
<td>2x20' (2x6058mm)</td>
<td></td>
<td>8'</td>
<td>8' 6&quot;</td>
</tr>
</tbody>
</table>

Common for all containers in the transverse measure from center to center point of the holes of corner castings = 2259 mm

* The indicated dimensions of the container sizes not covered by ISO standards are provisional.

![Container view on top](image-url)

Fig. A.16
Annex B

A. Stamp

1. G L on the bottom left corner fitting at the door-side.

B. Label

1. If possible on the left door of standard containers (box containers); on platform containers and flats, protected as far as possible near the CSC plate.

2. CSC plate

The Safety Approval Plate, conforming to the model reproduced below, shall take the form of a permanent, non-corroding, fire-proof rectangular plate measuring not less than 200 mm × 100 mm. The words “CSC Safety Approval” with a minimum letter height of 8 mm shall be stamped into, embossed on or indicated in any other permanent and legible way on its surface; all other words and numbers shall have a minimum height of 5 mm.

Country of approval and approval reference according to the example in line 1. (The country of approval shall be indicated by means of the distinguishing letters used to indicate the country of registration of motor vehicles in international road traffic.)

Date (month and year) of manufacture.

Manufacturer’s identification number of the container or, in the case of existing containers for which this number is unknown, the number allocated by the Administration.

Maximum operating gross weight (kg and lbs).

Permitted stacking weight at 1.8 g (kg and lbs).

Load value for transverse racking test (kg and lbs).

The end wall strength is to be indicated on the plate only if the end walls are designed to withstand a load of less or greater than 0.4 times the maximum permitted payload, i.e. 0.4 P.

The side wall strength is to be indicated on the plate only if the side walls are designed to withstand a load of less or greater than 0.6 times the maximum permitted payload, i.e. 0.6 P.

First maintenance examination date (month and year) for new containers and subsequent maintenance examination dates (month and year) if plate is used for this purpose.
3. Authorization of new containers

**International Convention for Safe Containers (CSC)**

- Application for Approval
- Inspection of drawings
- Prototype Test
- GL - Type Certificate

Approval of Container type by approval authority and confirmation of the CSC approval no.

Supervision of the series construction of the containers in accordance with the CSC Act (Rule 6)

GL - Certification of each container

The owner of the container shall be responsible for maintaining it in safe condition

Maintenance and Examination

- **Alternative (1)**
  - The period between the date of manufacture of the container and the date of the first inspection may not exceed five years
  - Further re-examinations shall take place at least every 30 month (2.5 years)

- **Alternative (2)**
  - ACEP
    - The containers are subject to an Approval Continuous Examination Programme conducted by the CSC approval authority
C. Specimens

I. Type certificate

Germanischer Lloyd

Typ-Zertifikat für Container Nr.

Type Certificate for Containers

CSC-Zulassungsbezeichnung

CSC approval Reference

Ein Container des unten beschriebenen Typs wurde einer Typ-Prüfung unterzogen.

A Container of the type described below underwent a type-test.

Die Bedingungen des CSC sind erfüllt.

The CSC conditions are fulfilled.

Der Container entspricht □ in vollem Umfange □ soweit anwendbar

The Container corresponds fully where applicable


to the ISO Recommendation and the Requirements of G.L. for the Construction and Testing of Containers.

ISO-(DIN) Normbezeichnung

Designation

Typbezeichnung des Herstellers / Lieferers:

Type designation of the manufacturer / supplier

Ort und Datum der Typ-Prüfung:

Place and date of type test

Die Container dieser Serie erhalten nachstehende Plakette

The Container in this series will be provided with the following label

Das Zertifikat gilt für die mit folgenden Identifizierungsnummern versehenen Container, die dem geprüften Typ entsprechen:

This Certificate is valid for the containers with the following identification numbers which correspond to the type tested

Bau-Nrn. des Herstellers:

Serial nos. of manufacturer

<table>
<thead>
<tr>
<th>Hersteller:</th>
<th>Eigner:</th>
<th>Lieferer:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>Owner</td>
<td>Supplier</td>
</tr>
</tbody>
</table>

Stichprobenweise Fertigungsüberwachung der Serie.

Random inspection of production

U-Wert der Isolierung:

U-factor of the insulation

Zul. Gesamtgewicht R:

Permissible gross weight

Leergewicht

Tare weight

Netto-Rauminhalt:

Net cubic capacity

W/K

Dieses Zertifikat gilt für die mit folgenden Identifizierungsnummern versehenen Container, die dem geprüften Typ entsprechen:

This Certificate is valid for the containers with the following identification numbers which correspond to the type tested

<table>
<thead>
<tr>
<th>Bau-Nrn. des Herstellers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = ausgeführt / performed</td>
</tr>
</tbody>
</table>

F 55 - 95
(Type certificate (continued))

<table>
<thead>
<tr>
<th>Zeichnungsprüfvermerke vom</th>
<th>Tagebuch Nr.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>notes on examination of drawing, dated</td>
<td>diary No.</td>
</tr>
</tbody>
</table>

Bauweise, Werkstoff (Kurzbeschreibung) - Constructions, Material (brief description)

<table>
<thead>
<tr>
<th>Innenmaße:</th>
<th>Länge: mm</th>
<th>Breite: mm</th>
<th>Höhe: mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>internal dimensions</td>
<td>length</td>
<td>width</td>
<td>height</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Türoffnung:</th>
<th>Breite: mm</th>
<th>Höhe: mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>door opening</td>
<td>width</td>
<td>height</td>
</tr>
</tbody>
</table>

Zeichnungsprüfvermerke vom Tagebuch Nr.: notes on examination of drawing, dated diary No.

Bauweise, Werkstoff (Kurzbeschreibung) - Constructions, Material (brief description)

<table>
<thead>
<tr>
<th>Lfd. Nr.</th>
<th>Umfang der Typ-Prüfung</th>
<th>Besondere Bemerkungen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Stapeln stacking</td>
<td>Extent of the Type Test</td>
</tr>
<tr>
<td>2.</td>
<td>Heben an den oberen Eckbeschlägen</td>
<td>Additional remarks</td>
</tr>
<tr>
<td>3.</td>
<td>Heben an den unteren Eckbeschlägen</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Längsbeanspruchung des Bodenrahmens</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Stirnwend-Belastung</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Seitenwend-Belastung</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Dach-Belastung</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Boden-Belastung (Radlasten)</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Verwindung (Belastung in Querrichtung)</td>
<td></td>
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<tr>
<td>10.</td>
<td>Verwindung (Belastung in Längsrichtung)</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Gabelstaplertaschen-Test</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Prüfung der Spritzwasserdichtigkeit</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Sonstige Prüfungen:</td>
<td></td>
</tr>
</tbody>
</table>

2R = P = R - T

F = kN

kg

Zul. Stapelungsgewicht bei 1,8g (CSC): Allowable stacking weight for 1,8g (CSC)

kg

Wood immunization treatment (according to Makers statement):

<table>
<thead>
<tr>
<th>Lfd. Nr.</th>
<th>Umfang der Typ-Prüfung</th>
<th>Besondere Bemerkungen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>2.</td>
<td>Heben an den oberen Eckbeschlägen</td>
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<td>3.</td>
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<tr>
<td>4.</td>
<td>Längsbeanspruchung des Bodenrahmens</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Stirnwend-Belastung</td>
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</tr>
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<td></td>
</tr>
<tr>
<td>13.</td>
<td>Sonstige Prüfungen:</td>
<td></td>
</tr>
</tbody>
</table>

X = ausgeführt / performed
2. Individual Certificate (General Cargo Container)

**Germanischer Lloyd**

Container Certificate No.
CSC-Approval Reference

THIS IS TO CERTIFY that the container described below corresponds to the prototype which has been constructed and tested in accordance with the GL Regulations and ISO Recommendations. The quality control arrangements at the manufacturer’s works and the random tests are kept under continuous review by the Surveyor to Germanischer Lloyd. The CSC conditions are fulfilled.

ISO-Type:

Tare weight T : 
Max. Payload P : 
Max. Gross weight R :

Net-Cube:

Stacking test load:
Racking test load:

GL-Type approval No. * : Date of inspection * :

Manufacturer / Supplier:

Manufacturer’s serial No.: Date of manufacture:

Operator:

Owner:

Owner’s identification marking: Operator’s identification marking:

Remarks:

Hamburg, 

Surveyor to Germanischer Lloyd

F 64/86 * the stamp will be found on the left corner post, the label nearby at a protected place.
### 3. Collective Certificate (General Cargo Containers)

#### **Germanischer Lloyd**  
**Container Certificate No.**  
**CSC-Approval Reference**

THIS IS TO CERTIFY that the containers described below correspond to the prototype which has been constructed in accordance with the GL Regulations and ISO Recommendations. The quality control arrangements at the works and the random tests are kept under continuous review by the Surveyor to Germanischer Lloyd, and are fulfilled.

**ISO-Type:**

<table>
<thead>
<tr>
<th>Max. Gross weight</th>
<th>Max. Payload</th>
<th>Tare weight</th>
<th>Net Cube</th>
<th>Allowable Stacking</th>
<th>Weight for 1.8 g</th>
<th>Racking test load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Manufacturer / Supplier</th>
<th>Date of inspection from</th>
<th>to</th>
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</table>

<table>
<thead>
<tr>
<th>Owner</th>
<th>Operator</th>
<th>Owner's identification marking</th>
<th>Operator's identification marking</th>
<th>Manufacturer's identification marking</th>
<th>Manufacturer's serial No.</th>
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</tbody>
</table>

**Remarks:**

Hamburg,  

\*\* the stamp will be found on the left corner post, the label nearby at a protected place.  

Surveyor to Germanischer Lloyd

*Surveyor to Germanischer Lloyd*
Annex C

List of the most important standards for container construction

The body of international standards for containers consists at present of the following standards, tentative standards and recommendations:

ISO 668  Series 1 freight containers – Classification dimensions and ratings
ISO 830  Freight containers – Terminology
ISO 1161 Series 1 Freight containers – Corner fittings – Specification
ISO 1894 General purpose Series 1 freight containers – Minimum internal dimensions
ISO 6346  Freight containers – Coding, identification and marking
ISO 6359  Freight containers – Consolidated data plate
ISO 3874  Series 1 Freight containers – Handling and securing
ISO 8323  Freight containers – Air / surface (intermodel) general purpose containers – Specification and tests
ISO 1496-1 Series 1 freight containers – Specification and testing
   Part 1:   General cargo containers for general purposes
ISO 1496-2 Series 1 freight containers – Specification and testing
   Part 2:   Thermal containers
ISO 1496-3 Series 1 freight containers – Specification and testing
   Part 3:   Tank containers for liquids, gases and pressurized dry bulk
ISO 1496-4 Series 1 freight containers – Specification and testing
   Part 4:   Non-pressurized containers for dry bulk
ISO 1496-5 Series 1 freight containers – Specification and testing
   Part 5:   Platform and platform – based containers
List of the most important standards for swap body construction

EN 283  Swap bodies; testing
EN 284  Class C swap bodies, dimensions and general requirements
EN 452  Class A swap bodies

DIN 15190 Part 101  Land containers
Principal dimensions, corner fittings, tests