Container Securing Devices

JULY 2013
FOREWORD

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Standards for Certification (previously Certification Notes) are publications that contain principles, acceptance criteria and practical information related to the Society's consideration of objects, personnel, organisations, services and operations. Standards for Certification also apply as the basis for the issue of certificates and/or declarations that may not necessarily be related to classification.

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Any comments may be sent by e-mail to rules@dnv.com

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CHANGES – CURRENT

General
This document supersedes Standards for Certification No. 2.23, July 2011.

Text affected by the main changes in this edition is highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

Main Changes

• Sec.1 General
  — Table 1-1: Additional documentation requirements have been introduced.
  — Table 1-2 Additional documentation requirements for fully automatic locks is new.

• Sec.4 Type approval
  — [4.4]: is new.

Editorial Corrections
In addition to the above stated main changes, editorial corrections may have been made.
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1 General

1.1 Preamble
The main objective of introducing this Standard for Certification is to present the requirements to container securing equipment in a more logical and user-friendly manner. Another important objective is to align the requirements with industry standards with a proven track record, and to remove or adjust excessively stringent requirements which do not improve the safety level.

1.2 Application
The requirements in this Standard for Certification are supplementary to those given in the DNV Rules for Classification of Ships (the Rules) Pt.5 Ch.2 Sec.6. They apply to integral container support fittings and fixed and portable container securing equipment, except cell guides and lashing bridges. Additionally, they apply to fixed securing points and DNV certified portable securing devices used for lashing of vehicles, in accordance with the requirement given in the Rules Pt.5 Ch.2 Sec.4 B1207.

1.3 Scope
This Standard for Certification describes the procedures and requirements for obtaining product certificates for securing devices.

The following topics are covered:

— materials and welding
— design approval
— prototype testing
— production testing
— marking.

1.4 Definitions
Container: Freight container according to ISO Standard, or other specially approved container.

Container securing devices: Loose and fixed equipment and integral support fittings used for securing and supporting of containers.

Container securing equipment: Loose and fixed securing devices which do not form an integral part of the ship.

Container support fittings: Fittings welded into tank tops, decks, bulkheads or hatch covers, i.e. fittings that form an integral part of the ship structure.

Lashing: A system for securing of containers using non-rigid devices such as lashing rods and turnbuckles, or a securing device used in a lashing system, e.g. a lashing rod.

Maximum securing load, MSL: The allowable load capacity for a device used to secure cargo to a ship.

Minimum breaking load, \( P_m \): The tested minimum breaking load of a container securing device.

Usage factor: \( \eta = P_m / MSL \), i.e. the inverse of safety factor.

Proof load, \( P_l \): The required test load during production testing of container securing devices.

Prototype: An equipment item considered to be representative for the production and the product to be approved, used for prototype testing. The prototype may either be manufactured specially for type testing or selected at random from a production series. If manufactured specially, it is assumed that the tools and the production process are comparable to those used for subsequent production.

1.5 Documentation
Documentation shall be submitted as per Table 1-1.

<table>
<thead>
<tr>
<th>Table 1-1 Documentation requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Object</strong></td>
</tr>
<tr>
<td>Securing device</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
For general requirements to documentation, see the Rules Pt.0 Ch.3 Sec.1.
For a full definition of documentation types, see the Rules Pt.0 Ch.3 Sec.2.

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully automatic twistlocks</td>
<td>Z120 – Test procedure at manufacturer</td>
<td>Operational test procedure including:</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— description of test arrangement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>— loading scenario</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z130 – Report from test at manufacturer</td>
<td>Operational test report endorsed by a DNV surveyor, including:</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— description of test arrangement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>— applied loads</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>— results</td>
<td></td>
</tr>
</tbody>
</table>
2 Certification

2.1 General
According to the Rules Pt.5 Ch.2 Sec.6 A300, all container securing devices, except cell guides and lashing bridges, shall be delivered with product certificates. Product certificates are in general issued based on material certification, design approval, prototype testing and production testing. Design approval may be either type approval or case-by-case approval, i.e. an approval which is only valid for a single delivery. Production testing may in certain cases be replaced by calculations. The various approval and test schemes are described in detail in the following sections.

2.2 Certification procedure
The flowchart in Figure 2-1 gives an overview of the procedure for obtaining a product certificate, with references to relevant sections.

![Flowchart over the product certification procedure](image-url)
3 Materials and welding

3.1 General
Integral container support fittings shall be delivered with Det Norske Veritas material certificates. Other loose and fixed container securing equipment shall be delivered with works material certificates from the manufacturer.

3.2 Container support fittings

3.2.1 Container support fittings intended for welding into the hull structure shall be made of forged or cast carbon or carbon-manganese steels, or shall be cut from rolled materials of normal or high-strength hull structural steel. The materials shall comply with relevant chapters and sections of the Rules Pt.2 and the additional requirements given in this subsection.

3.2.2 The carbon content of cast and forged steel shall not exceed 0.23%.

3.2.3 Specified minimum yield stress for castings and forgings shall not exceed 400 N/mm².

3.3 Container securing equipment

3.3.1 Container securing equipment, i.e. loose and non-integral fixed container securing devices, shall be made of forged or cast steel or machined from rolled material. The materials shall comply with a recognised national or international standard, and are to meet the additional requirements given in this subsection. Specifications deviating from the requirements given herein may be evaluated on the basis of documented experience or comprehensive test results. It may be required that the materials be delivered from manufacturers approved by the Society.

3.3.2 Carbon and carbon-manganese steels shall be fully killed.

3.3.3 For items produced without any welding, the following applies:
— For carbon and carbon-manganese steels the C-content shall not exceed 0.40%.
— For alloy steels the C-content shall not exceed 0.45%.
— Ferritic nodular cast iron may be used, provided that the material satisfies grade NV 2 requirements as given in the Rules Pt.2 Ch.2 Sec.8 A and B.

In other respects the chemical composition shall comply with the recognised standard.

3.3.4 For welded items, the following applies:
— When welding is used in the production, the chemical composition shall be appropriate for the welding process, dimensions and heat treatment process in question.
— The carbon content of carbon and carbon-manganese steels manufactured with welding is in general not to exceed 0.23%.
— If the carbon content exceeds 0.23% preheating may be required, and normalising or stress relief heat treatment shall be carried out after welding; after heat treatment, the weld and heat-affected zone should be examined for cracks through suitable non-destructive testing.
— For thicknesses up to about 30 mm, when flash welded and heat treated according to subsection 3.4 after welding, a carbon content of up to 0.35% for carbon and carbon-manganese steels and 0.40% for alloy steels may be accepted.

In other respects the chemical composition shall comply with the recognised standard.

3.3.5 Specified minimum yield stress for carbon and carbon-manganese steels shall not exceed 400 N/mm² when normalised, and 480 N/mm² when quenched and tempered. High-tensile alloy steels may be accepted upon special consideration of the material properties and the intended application.

In other respects the mechanical properties shall comply with the recognised standard.

3.4 Heat treatment
Castings and forgings of carbon and carbon-manganese steel shall be supplied in normalised or quenched and tempered condition. Rolled materials shall be supplied in the heat treatment condition prescribed in the recognised specification.
Alloy steels shall be quenched and tempered. Ferritic nodular cast iron shall be subjected to satisfactory heat treatment if not otherwise agreed.
3.5 Mechanical tests

3.5.1 Testing shall be carried out in accordance with relevant chapters of the Rules Pt.2 or with recognised standards, taking into consideration the additional requirements given in [3.5.2] to [3.5.4].

3.5.2 When a number of pieces are heat treated in the same furnace charge, a batch testing procedure may be adopted, using pieces from each batch for test purposes. One tensile test and one set of impact tests shall be made from each batch. The batch shall consist of pieces of about the same size and from the same cast, heat treated in the same furnace charge and with a total mass not exceeding 2 tonnes.

3.5.3 For chain cables produced in continuous lengths, one tensile test and one set of impact tests shall be taken from cable produced from the same steel cast unless the length is more than 1000 metres, in which case tests shall be taken from every 1000 metres or fraction thereof. The impact tests shall be taken clear of the weld. Test materials are obtained by supplying the cable with extra links.

3.5.4 Impact testing shall be carried out as Charpy V-notch tests according to the procedure given in the Rules Pt.2 Ch.1 Sec.2.

For integral container support fittings, testing shall be carried out at the temperature required for hull structural materials in the adjacent area or at 0°C, whichever is lower. The minimum absorbed energy shall meet the requirements given in the relevant chapter and section of the Rules Pt.2.

For loose and non-integral container securing equipment, the average absorbed energy of three test specimens shall be as given in Table 3-1. One individual value may be below the specified value; however, it must not be less than 70% of that value. For rolled and forged materials, test specimens may be taken in the longitudinal direction. In castings the direction of the test specimens is optional.

<table>
<thead>
<tr>
<th>Product</th>
<th>Impact energy [J]</th>
<th>Test temperature [°C]</th>
<th>Above weather deck</th>
<th>Below weather deck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolled products</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>s_f ≤ 270(^1)</td>
<td>27</td>
<td>-20 or design operating temperature(^2), whichever is lower</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>s_f ≥ 355(^1)</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forged steel</td>
<td>27</td>
<td>-20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cast steel</td>
<td>27</td>
<td>-20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferritic nodular cast iron</td>
<td>12</td>
<td>-20</td>
<td>-20</td>
<td></td>
</tr>
</tbody>
</table>

1) For intermediate values the required impact energy shall be obtained through linear interpolation.
2) For tests performed at temperatures below -20°C, the required impact energy may be specially considered.
4 Type approval

4.1 General
Type approval is based on plan approval and prototype testing, and will be issued in accordance with the general requirements outlined in the Rules Pt.1 Ch.1 Sec.4 and Standard for Certification No. 1.1. The type approval scheme consists of two alternatives, with two different certificates:

— Type approval certificates are issued to manufacturers of components. Such certificates are based on a review of the design, i.e. plan approval, and are issued for products that have been manufactured and prototype tested, and is only valid for the one manufacturing plant. Certificates are valid for 2 or 4 years and will be entered in the register of Approved Products and Manufacturers, available on the Society’s internet pages.

— Design assessment for type approval certificates are issued to designers of components. Design assessment for type approval certificates are based only upon a review of the design of a component. However, before any product certificates for securing devices can be issued based on this scheme, prototype tests have to be carried out. Normally, prototype tests have to be done by each manufacturer of a product, but after special consideration the Society may accept that prototype testing not be repeated when production is started by a new manufacturer. Design assessment for type approval certificates are valid for 4 years and will be entered in the register of approved products and manufacturers, available on the Society’s internet pages.

Manufacturers that produce components covered by a design assessment for type approval certificate can, upon request, be given a type approval certificate. This certificate will always refer to the holder of the design assessment for type approval certificate, and does not give the manufacturer any right to manufacture the product without the consent of the designer. Such type approval is recommended for products that are produced in series or where the designer and manufacturer expect repeat orders.

One type approval or design assessment for type approval certificate may cover different variations of the same basic type of device. Variations may include e.g. different materials, lengths or breaking loads. Each variation may have to be prototype tested.

4.2 Plan approval

4.2.1 For each equipment item, plans shall be submitted as required by Table 1-1.

4.2.2 Approval will be based on an evaluation of the strength of each securing device, as described in the following subsections. However, factors related to safe use will also be considered:

— Securing devices that function as mechanisms must have safe and reliable operation throughout their operational lifespan.
— The risk of incorrect application of securing devices should be minimised through design, marking or labelling and user instructions.
— For devices that may have small margins against malfunction or failure, a more detailed analysis of safety will be considered; such smaller margins may for instance be related to:
  — wear or corrosion
  — small contact areas for load transfer
  — difficult or impossible verification that the device is properly attached and locked after application
  — enhanced need for maintenance.

For securing devices based on novel design solutions, or where the Society has special concern linked to the conditions described above, the design approval may be given for a limited time. The Society reserves the right to re-evaluate the design and, if necessary, withdraw type approvals. This will normally not have any consequences for devices that are already certified and delivered to the user. Product certificates will not be withdrawn unless a securing device is shown not to be safe and reliable in use.

4.2.3 Cargo securing devices may be subject to tension, compression or shear forces, or combinations thereof. The forces may be static or dynamic. However, during prototype testing the test specimens will normally be subject to one type of static force at a time.

During operation, securing devices are normally subjected to cyclic loads. This shall be taken into account in the design and choice of materials, so that the possibility of fatigue failure is minimised.

For some devices subject to compression loads, e.g. tension/pressure elements and long bridge stackers, buckling strength may have to be considered.
In general the Maximum Securing Load, MSL, in cargo securing devices is not to exceed the following:

\[ MSL = h \cdot P_m \], as defined in 1.3.

The maximum securing load in container securing devices is typically 50% of the minimum breaking load. Table 4-1 lists some of the most common types of securing devices, with figures and typical MSL.

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>Figure</th>
<th>Typical MSL [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lashing rod</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Turnbuckle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Penguin Hook</td>
<td></td>
<td>240</td>
</tr>
<tr>
<td>4</td>
<td>D-Ring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lashing plate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Twist lock (single)</td>
<td></td>
<td>210</td>
</tr>
<tr>
<td>7</td>
<td>Twistlock (linked)</td>
<td></td>
<td>210</td>
</tr>
<tr>
<td>8</td>
<td>Flush ISO socket</td>
<td></td>
<td>250</td>
</tr>
<tr>
<td>9</td>
<td>Pedestal ISO socket</td>
<td></td>
<td>250</td>
</tr>
</tbody>
</table>
The minimum breaking load is normally to be verified by prototype testing as described in [4.3].

For integral support fittings, the influence on the breaking load by the supporting hull structure is to be taken into account, e.g. location of stiffeners below flush sockets.

4.3 Prototype testing

Type approval certificates are issued after satisfactory prototype tests have been carried out. Integral support fittings may, upon special consideration, be exempt from prototype testing.

4.3.1 Prototype testing of each item shall be performed on at least two samples. Test loads shall be applied in a test rig simulating the actual service conditions. All test samples shall withstand at least the specified minimum breaking strength. A test result report describing the test arrangement, supports, test angles, applied loads and results shall be issued.

4.3.2 For support fittings which are to be welded into the hull structure, the test condition shall simulate the welded, in-service condition.

4.3.3 Prototype testing may be replaced by suitable calculations in cases where testing is impractical, e.g. for certain types of integral support fittings.

4.4 Operational testing of fully automatic locks

4.4.1 For Fully Automatic Locks (FAL) operational testing shall be carried out in addition to prototype testing as given in [4.3]. Type approval certificate are issued after satisfactory prototype tests and operational tests have been carried out.
4.4.2 Operational test shall be performed on at least two test specimens. The test arrangement shall represent realistic stowage of ISO containers secured by FAL. The load scenario shall demonstrate that the FAL is capable of withstanding transverse racking forces in combination with lifting forces induced by rolling within the given MSL values. The test procedure shall be reviewed by DNV upon plan approval of the FAL.

4.4.3 The operational test shall be witnessed by a DNV surveyor.

5 Case-by-case approval
As an alternative to type approval, the product certification may be based on case-by-case design approval in accordance with approval principles described in [4.2], and prototype testing described in [4.3].

6 Production testing

6.1 General
6.1.1 Production testing shall be carried out as follows:
For items produced in large quantities, at least 0.5% of all items shall be proof tested. At least one item from each lot (including prototypes) shall be tested. For items with welded parts subject to tensile loads, at least 2% of all items shall be proof tested.
The test load to be applied in proof tests is normally to be taken as 1.1 times the maximum securing load. Upon completion of the proof test, each item shall be examined and confirmed to be free of deformations and significant defects.
6.1.2 The certification may, as an alternative to the production testing described in [6.1.1], be based on a scheme for non-destructive examination. The details of such a scheme shall be agreed in a Manufacturing Survey Arrangement.
6.1.3 Non-standardised securing equipment, such as wires and chains, will be specially considered.

7 Marking
Each item shall be marked with suitable identification marking such as to allow traceability to the product certificate. The marking should include the manufacturer’s/supplier’s name or mark, type designation and, if relevant, charge or heat number.
CHANGES – HISTORIC

Note that historic changes older than the editions shown below (if any), have not been included.

July 2011 edition

This is a new document.