

STANDARD

DNVGL-ST-E271

Edition August 2017

2.7-1 Offshore containers



FOREWORD

DNV GL standards contain requirements, principles and acceptance criteria for objects, personnel, organisations and/or operations.

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CHANGES – CURRENT

General

This document supersedes the June 2013 edition of DNV-STC-2.7-1.

The purpose of the revision of this service document is to comply with the new DNV GL document reference code system and profile requirements following the merger between DNV and GL in 2013. Changes mainly consist of updated company name and references to other documents within the DNV GL portfolio.

Some references in this service document may refer to documents in the DNV GL portfolio not yet published (planned published within 2017). In such cases please see the relevant legacy DNV or GL document. References to external documents (non-DNV GL) have not been updated.

Editorial corrections

In addition to the above stated changes, editorial corrections may have been made.

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SECTION 1 GENERAL

1.1 Introduction

This standard was first published in May, 1989 as DNV Certification Note 2.7-1 *Offshore freight containers*. It was prepared because other regulations at the time, whether international codes, national requirements or rules published by Det Norske Veritas, did not specifically cover offshore containers. A revised certification note was issued in May 1995. In April 2006 it was revised again and reissued as DNV Standard for certification 2.7-1. The basic strength and design requirements from the original edition were retained at these revisions.

Many other standards, codes and regulations exist for containers, container-like units and related types of equipment. International standards, codes and regulations considered relevant have been taken into account when preparing this standard for certification. The most important of these are IMO's circular MSC/Circ.860 and EN 12079. The European Committee for Standardization, CEN, issued a European standard for offshore containers, EN 12079, in 1999, and a revised edition, split into three parts, was issued in 2006. The requirements for design, testing and production of offshore containers in EN 12079 are directly based on DNV Standard for certification 2.7-1. The relationship between this standard and other standards, codes and regulations is outlined in sub-chapter 1.3.

The standard is concerned with certification of all types of offshore containers as transport units. The three typical phases of transport are: shoreside (e.g. by fork lift truck), by supply vessel and lifting to and from offshore installations. The standard includes design requirements related to all three phases.

Under conditions in which offshore containers are often transported and handled, the normal rate of wear and tear is high, and damage necessitating repair will occur. However, containers designed and certified according to this standard should have sufficient strength to withstand the normal forces encountered in offshore operations, and not suffer complete failure even if subject to more extreme loads.

1.1.1 Consequences

- Existing offshore containers that DNV GL has certified according to previous versions of Standard for Certification No. 2.7-1 will in most cases also comply with the new edition. Re-certification is generally not required.
- Containers certified to this standard will comply with the requirements of MSC/Circ.860.
- Containers certified to this standard will also comply with the requirements in EN12079 parts 1 and 2, and certification to this standard may be included at no extra cost.

1.2 Scope

This standard applies for transport related requirements for offshore containers with respect to design, manufacture, testing, certification, marking and periodic inspection.

The standard covers the container structure and any permanent equipment for handling, filling, emptying, refrigerating, heating and safety purposes.

The intention is that offshore containers shall meet the following requirements:

Be safe in use with regard to:

- lives
- environment
- hazard to the vessel/installation.

Be suitable for repeated use through choice of:

- material
- protection
- ease of repair and maintenance.

The requirements in this standard are based on a number of assumptions regarding the handling and operation of offshore containers:

- They are lifted individually by crane hook attached to top link of lifting set.
- They are not lifted by spreaders or using ISO container fittings.
- They can be lifted anywhere (worldwide) by any crane with sufficient capacity and speed.
- For containers only approved for limited operation area (temperate climate) see [App.J](#).
- They are only stacked if they are designed for this.
- They are stacked only onshore or on offshore installations. Not to be stacked during transport on ships.
- Cargo or loose installations are properly secured in the container.
- The container is designed to give adequate protection to its cargo or to installations inside.
- They are handled according to IMO's Code of safe practice for supply vessels.
- Handling and operation is in accordance with local regulations.

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DNV GL may approve alternative solutions that are found to represent an overall safety standard equivalent to the requirements in this standard. Such approval may be revoked if subsequent information indicates that the chosen alternative is not satisfactory.

When the word container is used throughout the standard, it means an offshore container.

Use of the word shall implies a mandatory requirement when seeking the approval of DNV GL. Use of the word should implies a recommended approach, where comparable solution may also be acceptable.

The terms DNV 2.7-1 or 2.7-1 are generally used as short terms for DNV Standard for certification No. 2.7-1 and DNVGL-ST-E271.

The passages throughout this standard marked Guidance Note and Note are not to be taken as requirements by DNV GL. Guidance notes are intended as practical advice or recommendations for the designer, manufacturer or operator, while notes provide information.

This standard often refers directly to various standards (EN, ISO etc.), or to other recognised standard. Recognised standard means a standard found acceptable by DNV GL.

1.3 Relationship with other standards, codes and regulations

1.3.1 The International Maritime Organization (IMO)

IMO has issued both the *International Convention for Safe Containers, CSC*, and the *International Maritime Dangerous Goods* code, IMDG. Both of these are mandatory international regulations. IMO has recognised that the CSC convention is not directly applicable for offshore containers that are handled in open seas, and has issued a circular (MSC/Circ.860) with guidelines on certification of offshore containers. The IMDG code also requires that containers and portable tanks that are handled in open seas should be certified for this purpose.

Containers certified to this standard also comply with MSC/Circ.860, and this will be referenced in the certificates. The circular is reproduced at [App.G](#).

IMO has also issued the code of safe practice for the carriage of cargoes and persons by offshore supply vessels (OSV code) which includes guidelines for handling, stowage and securing of cargoes.

1.3.2 ISO standard freight containers (ISO Containers)

Containers that are intended for sea transport on container ships are normally designed according to an applicable part of ISO 1496. Containers that are certified to CSC are in general also designed as ISO containers.

Offshore containers designed and certified according to this standard can also be designed and certified according to CSC And ISO 1496.

1.3.3 European Standard EN 12079

The European Standard EN 12079 *Offshore containers and associated lifting sets* consists of 3 parts, see [Table 1-1](#).

Table 1-1

<i>EN 12079 part:</i>	<i>Title</i>	<i>Equivalent sections in this standard</i>
Part 1	Offshore containers – design, manufacture and marking	Sec.1 , Sec.3 , Sec.4 , Sec.5 , Sec.6 , Sec.7
Part 2	Lifting sets – Design, manufacture and marking	Sec.8
Part 3	Periodic inspection, examination and testing	Sec.9

Offshore containers and lifting sets certified to this standard also comply fully with EN12079 part 1 and 2 respectively, and this may be referenced in the certificates.

1.3.4 DNVGL-ST-E272 2.7-2 Offshore service modules

When an offshore container is designed and equipped to be placed on board a fixed or floating offshore installation to perform specific services, it may be subject to regulations applying on the installation and to the area where it is placed. [DNVGL-ST-E272 2.7-2 Offshore service modules](#) covers containers designed for such requirements.

1.3.5 DNVGL-ST-E273 2.7-3 Portable offshore units

Many portable units intended for offshore use are not containers as defined in this standard. However, there is often a need for verification and certification of such units. DNV GL has therefore prepared standard [DNVGL-ST-E273 2.7-3 Portable offshore units](#) with requirements for design, manufacture, testing etc. for units normally up to 100000 kg.

Portable offshore units are not intended to carry goods (general cargo) as their primary function but may be used for equipment that is not possible/impractical or too heavy to transport in offshore containers. Portable offshore units may be designed for subsea use and for single transport events.

All portable offshore units are evaluated for safe handling and transport and assigned to an Operational Class for the offshore handling. Additional operational procedures may be required. There are three Operational Classes with limiting significant wave height:

- Class R60 - Lift from/to vessel in max Hs = 6.0 m
- Class R45 - Lift from/to vessel in max Hs = 4.5 m
- Class R30 - Lift from/to vessel in max Hs = 3.0 m

1.3.6 Regulations for lifting appliances

Offshore containers are not lifting equipment as defined by ILO, by the European Community's Machinery Directive or by standard for lifting appliances, [DNVGL-ST-0377](#) and [DNVGL-ST-0378](#). Instead they are considered to be cargo units as defined in these codes and directives.

However, requirements from these regulations and standards have been taken into account in the requirements in this standard, e.g. in the intervals for periodic surveys.

1.4 National authorities

In cases where national authorities have stricter requirements than this standard, these may be incorporated in the certification procedures.

Guidance note:

Some national authorities may consider offshore containers to be lifting equipment.

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1.5 Definitions

1.5.1 Offshore container

An offshore container is a portable unit with a maximum gross mass not exceeding 25000 kg, for repeated use in the transport of goods or equipment, handled in open seas, to, from or between fixed and/or floating installations and ships.

An offshore container comprises permanently installed equipment, see [1.4.4].

Guidance note:

Other permanent or loose equipment will not be covered by the certification unless specially agreed with DNV GL. However, supporting structure for heavy equipment, machinery, etc. will be approved according to [4.4.11].

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Offshore containers are also defined by the requirements throughout the standard. Refer to definitions of primary and secondary structure below and in [4.1].

Units for offshore lifting that are intended for installation and not for repeated transport are not considered to be containers. Likewise, units that do not have an outer framework with pad eyes are not considered to be containers. Hence, these units are not covered by this standard. (See however the definition of waste skip in [1.2.2].) Many such portable units may be eligible for certification according to [DNVGL-ST-E273 Portable Offshore Units](#).

Offshore containers may be divided into 3 main categories:

a) Offshore freight container:

Offshore container built for the transport of goods. Examples of offshore freight containers:

- general cargo container: a closed container with doors
- cargo basket: an open top container for general or special cargo (e.g. pipes, risers)
- tank container: a container for transport of dangerous or non-dangerous fluids
- bulk container: container for transport of solids in bulk
- special container: container for transport of special cargo (e.g. garbage compactors, equipment boxes, bottle racks).

b) Offshore service container:

Offshore container built and equipped for a special service task, mainly as temporary installation. (Examples are, laboratories, workshop, stores, power plants, control stations, wireline units).

c) Offshore waste skip

An open or closed offshore container used for the storage and removal of waste. Normally constructed from flat steel plates forming the load bearing sections of the container, bracing in the form of steel profiles, e.g. channel or hollow section, being fitted horizontally around sides and ends. Waste skips may be open or have loose or hinged covers

In addition to the pad eyes for the lifting set these containers may also have side mounted lugs suitable for attachment of the lifting equipment mounted on a skip lift vehicle.

1.5.2 Freight container

Re-usable transport container, used for international traffic and designed to facilitate the carriage of goods by one or more modes of transport (including marine) without intermediate reloading.

1.5.3 Units for transportation offshore

Portable unit or package with a maximum gross mass not exceeding 50000 kg, for repeated or single use with a primary service function, handled in open seas, to, from or between fixed and/or floating offshore installations and ships. Units of this type are not considered to be offshore containers.

1.5.4 Permanent equipment

Equipment that is attached to the container and which is not cargo.

Guidance note:

May include lifting sets, additional fittings for handling and securing, filling, emptying, cooling and heating, intermediate decks, securing points, garbage compactors, etc.

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1.5.5 Primary structure

Load carrying and supporting frames and load carrying panels.

Primary structure includes the following structural components:

- load carrying and supporting frames
- load carrying panels (floor, tweendecks)
- fork lift pockets
- pad eyes
- supporting structures for tanks
- supports for heavy equipment
- corner/knee brackets.

Primary structure is divided into two sub-groups:

- a) Essential and non-redundant primary structure are the main structural elements which transfer the resulting cargo load to the crane hook or fork lift truck (i.e. forming the load path from the payload to the lifting sling), and will at least include:
 - top and bottom side rails
 - top and bottom end rails
 - corner posts
 - pad eyes
 - fork lift pockets.

Other primary structure may also be considered essential and or non-redundant.

- b) Non-essential primary structure are e.g. floor plates and other structural elements for which the main function is other than described in a). Deflector plates, stacking fittings and end plates on hollow section are considered to be in this category. This sub-group also includes protective frame members.

Side and roof panels (including corrugated panels) are not considered to be part of the primary structure and shall not be taken into account when evaluating the strength of the container. For waste skips the requirements in [4.1.1] apply.

1.5.6 Secondary structure

Parts that are not considered as load carrying for the purposes of the design calculations. Secondary structure includes the following components:

- doors, wall and roof panels, covers on skids
- panel stiffeners and corrugations
- structural components used for tank protection only (not frame members, see [1.4.5])
- internal securing points.

1.5.7 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 especially for type testing or selected at random from a production series. If manufactured specially, it is expected that the tools and the production process are comparable to those to be used for subsequent production.

1.5.8 Owner

The legal owner of the offshore container or a delegated nominee.

1.5.9 Lifting set

Items of integrated lifting equipment used to connect the offshore container to the lifting appliance. This can comprise single or multi leg slings (with or without a top leg) and shackles, whether assembly secured or not.

1.5.10 Assembly secured shackle

Shackle fitted to a sling leg and secured by a seal or similar device, so as to signal, unambiguously, whether or not the shackle has been exchanged.

Guidance note:

Shackles that are captive in the thimbles are also considered as assembly secured.

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Note:

Shackles that are assembly secured, i.e. cannot be separated from the lifting sling, are considered to be part of the lifting sling. See [9.3].

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1.6 List of symbols

R rating or maximum gross mass of the offshore container including permanent equipment and its cargo, in kg; but excluding the lifting set

Guidance note 1:

The mass of the lifting set is not included in *R* because the lifting set is often not available at the time of certification and because it may be replaced during the lifetime of the container.

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T tare mass
See [DNVGL-RP-C202](#).

P	payload The maximum permissible mass of cargo which may safely be transported by the container, in kg. ($P = R - T$)
S	the mass of the lifting set
F	design load, in N
L	length of container, in mm
R_e	specified minimum yield stress at room temperature, in N/mm^2 .
R_m	specified minimum tensile strength at room temperature, in N/mm^2 .
$R_{p0.2}$	0.2% proof stress at room temperature, in N/mm^2 .
RSL	resulting sling load on pad eyes, in N.
T_D	the design temperature is a reference temperature used for the selection of steel grades used in offshore containers and equipment
g	standard acceleration of gravity ($\sim 9.81 \text{ m/s}^2$).
l_n	nominal length of structural member, in mm
n	number of sling legs
t	material thickness, in mm.
β	angle of sling leg from vertical in degrees
y	deflection of structural member, in mm
σ_e	the von Mises equivalent stress, in N/mm^2 .
ψ	load factor
WLL	working load limit, in tonnes. Maximum mass that a lifting component is authorized to sustain in lifting service

Guidance note:

The WLL for lifting components that is specified in standards, product specifications, etc. is normally the WLL for general lifting service. For the special application of lifting sets fitted to offshore containers, the WLL is enhanced as described in [Sec.8](#).

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The WLL to be used in certificates and marked on lifting sets shall be the maximum rating of an offshore container on which the sling can be used, at the given sling leg angle.

Note 2:

The rating (WLL) of the lifting set is not necessarily the same as the rating (MGM) of the container to which it is attached.

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Note 3:

The term safe working load (SWL) is not used in this standard. This term is not clearly defined for containers and should, therefore not be used when referring to offshore containers. The term working load limit (WLL) is only used for lifting sets, not for containers.

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SECTION 2 APPROVAL AND CERTIFICATION PROCEDURES

2.1 General

Offshore containers designed, manufactured, tested and marked in compliance with the following requirements may be certified by DNV GL. At the end of the certification process a product certificate is issued by DNV GL and the numbered DNV GL certification emblem is affixed to the container.

Certification consists of the following steps:

- design review
- inspection and testing of prototype
- production inspection and testing
- plating and marking
- issuance of certificates.

An application for approval and certification should be sent to the local DNV GL office who will forward this to the approval office. The application shall include:

- short description of the container type(s) (size, function, special features, etc.)
- specification of standards and regulations to be covered
- preferred type of approval scheme (see [2.2.1])
- place of manufacture (if applicable)
- if individual approval is sought: the number of containers to be manufactured.

2.2 Approval

2.2.1 Approval schemes

If a manufacturer plans to build only one container, or a single, limited batch of containers, DNV GL may give an individual (case-by-case) approval valid for that batch only. The manufacturer must specify the number of containers to be covered by the case-by-case approval.

If series production is intended the containers will be type approved.

The company applying for type approval of a container type must be the owner of the design, or have a written acceptance from the owner of the design that the type approval certificate can be issued in the name of the company. The company must take the sole responsibility for the conformity of the product to the applicable requirements. The company must provide information about all places of manufacture. If a type approved container design is manufactured at different places of manufacture, prototype testing shall normally be carried out at each manufacturing plant. Each container manufactured according to a case-by-case or type approval shall be certified by DNV GL.

Lifting sets for offshore containers may be type approved according to [App.H](#) of this standard.

DNV GL type approvals are listed in DNV GL approval finder on DNV GL's web site www.dnvgl.com

2.2.2 Approval to other standards

Offshore containers that are certified to this standard will also comply with the guidelines in IMO's circular MSC/Circ. 860. and with EN 12079 part 1 and 2 respectively. Therefore these codes will normally be listed in the DNV GL type approval and offshore container certificates.

Offshore tank containers for dangerous goods shall be certified according to the IMDG Code in addition to certification to this standard.

Upon request, or if considered a necessary part of the certification needed for a container, DNV GL may also certify offshore containers to other international or national standards or regulations.

2.2.3 Documents for approval and information

For design review, the documentation is to be submitted for approval to the applicable DNV GL local station electronically, preferably as a PDF file correctly formatted for printing, or in three paper copies in ample time before manufacturing.

For approval:

- Plans showing arrangement, dimensions, maximum gross mass, payload, scantlings of strength members, sling angle, pad eyes and design details as well as materials to be used material standards should be specified.
- Particulars of joining methods (welding, bolted or riveted connections). Welds to be indicated with welding symbols to a recognized standard.

For information (1 copy):

- Design calculations if available, including lifting set calculations.
- Other documentation as required for special purpose containers or for special equipment.

Note:

As part of the approval DNV GL will always verify the strength of a container design, and this may include performing detailed strength analysis. However, calculations to optimise the design will not be performed by DNV GL.

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Documentation to be presented to the local DNV GL Office attending surveyor:

- information about welders' qualification
- information about welding procedures
- information about NDT operator's qualifications
- information about NDT procedures
- particulars of corrosion protection and painting (type, application, dry film thickness)
- plating and marking.

2.2.4 Design review

This implies a review of:

- strength of structure, including design details
- material specifications
- welding and other joining methods
- lifting set
- supporting structures for other permanent equipment.


Where experience and/or other findings show that safety hazards may arise in connection with items not covered directly by the existing requirements, DNV GL may decide to lay down at any time supplementary requirements to maintain the overall safety standard.

2.3 Certification

2.3.1 Survey and certification

Before production starts, DNV GL shall verify that the manufacturer has qualified welders approved welding procedures and that they are capable of manufacturing the containers.

Production shall be carried out according to the manufacturer's quality plan. During production, DNV GL will normally perform inspections in accordance with [Sec.5](#).



Alternatively, certification may be based on surveillance of the manufacturer's quality assurance system. On the basis of this system, the terms of survey and testing and the frequency of attendance by a DNV GL surveyor may be defined in a manufacturing survey arrangement (MSA).

An MSA is an agreement in the form of a document stating the role of DNV GL and the manufacturer in connection with manufacturing survey and certification for a specific range of materials/components.

For each container produced a DNV GL certificate will be issued by the authorised DNV GL surveyor.

Note:

Since the lifting set is often not delivered by the container manufacturer, and normally will be replaced during the lifetime of a container, the certificate need not include the lifting set.

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For tank containers for dangerous goods, a DNV GL certificate for the tank container or portable tank shall be issued in addition to the offshore container certificate.

2.3.2 Testing and inspection

2.3.2.1 Prototype testing

Whether a single container or a series of containers shall be built, prototype tests shall be carried out. As these tests should not damage the container, no special prototype has to be built for testing. Test requirements are given in [4.6].

2.3.2.2 Production testing

If a series of containers shall be built, strength tests shall be carried out on a percentage of these. Test requirements are given in [5.4].

2.3.2.3 Production inspection

Manufacturing shall be under survey according to approved drawings and specifications. Manufacturing inspection requirements are given in [5.6].

2.4 Certification of existing containers

Existing containers that have not previously been certified by DNV GL according to this standard may in certain cases be considered for certification.

Containers that have been certified by other certifying bodies will not automatically be accepted as complying with the requirements in this standard. DNV GL reserves the right to review design, inspect and test any container before issuing the certificates described in 2.3.1 above.

All relevant available documentation shall be submitted for review. If the documentation is incomplete, additional requirements may be specified by DNV GL. This may include calculations, taking out samples to determine material properties and re-welding of important welds.

Each existing container shall be thoroughly inspected, including the use of NDT to the extent required by the DNV GL surveyor. The lifting test as described in [4.6.3.2] shall be performed. Other tests, such as the 2-point lifting test described in [4.6.3.3] or the vertical impact test as described in [4.6.4] may in some cases also be required.

If the container is not found to comply fully with the requirements of this standard, DNV GL may specify required modifications, de-rating or other limitations.

2.5 Maintenance of certificate

To maintain the validity of the offshore container certificate, the container shall be inspected annually as described in Sec.9.

Such periodic inspection may be carried out by DNV GL or by other inspection bodies recognized by national authorities to carry out such inspections. However, major repairs or modifications which may alter the certificate shall be approved by DNV GL.

Inspection bodies should normally meet the requirements for type B inspection bodies in ISO/IEC 17020 or equivalent standards.

After substantial repair or modification of a container, it may need to be recertified, see [9.2].

Periodic inspections of offshore tank containers for dangerous goods according to the IMDG Code can only be carried out by DNV GL or other certifying bodies authorised to perform such inspections.

2.6 Summary of procedures

The procedures for individual and type approval are outlined below.

Before production starts, DNV GL shall verify the qualifications of the manufacturer.

Certification emblems are allocated and distributed to the local DNV GL survey office for application by the attending DNV GL surveyor.

2.6.1 Procedure for individual (case-by-case) approval and certification

- 1) Application is sent through local DNV GL station to the approval office.
- 2) Order confirmed and fees agreed.
- 3) Drawings, documentation and calculations reviewed and approval given by the approval office.
- 4) Prototype offshore container manufactured under supervision of a DNV GL surveyor.
- 5) Container tested according to prototype test requirements, witnessed by a DNV GL surveyor.
- 6) Production proceeds according to the manufacturer's quality plan with the necessary surveys by DNV GL (or surveys according to an agreed manufacturing survey arrangement if applicable). Production tests according to list in [5.6].
- 7) DNV GL surveyor issues the DNV GL certificate for each container and affixes the emblem.

2.6.2 Procedure for type approval and certification

- 1) Application sent through local DNV GL station to the approval office.
- 2) Order confirmed and fees agreed.
- 3) Drawings, documentation and calculations reviewed and approval given by the approval office.
- 4) Prototype offshore container manufactured under supervision of a DNV GL surveyor.
- 5) Container tested according to prototype test requirements, witnessed by a DNV GL surveyor.
- 6) Test report reviewed by the approval office.
- 7) A type approval certificate, valid for 4 years, will be issued to the manufacturer by the approval office.
- 8) Type approved offshore container entered in DNV GL's register of type approved products.
- 9) Production proceeds according to the manufacturer's quality plan with the necessary surveys by DNV GL (or surveys according to an agreed manufacturing survey arrangement if applicable). Production tests according to list in [5.4].
- 10) DNV GL surveyor issues the DNV GL certificate for each container and affixes emblem.

SECTION 3 MATERIALS

3.1 Steel

3.1.1 General

Requirements for materials in lifting sets are given in [8.4].

In this section, the references to detail requirements are generally to EN standards or DNV GL rules for classification: Ships (DNVGL-RU-SHIP). Other recognised standards for equivalent materials may also be used.

The chemical composition, mechanical properties, heat treatment and weldability shall be suitable for the purpose. Steels shall comply with the material requirements of the recognised standard and the additional requirements specified below.

Steels for welding shall be made by open hearth, the electric furnace or the basic oxygen steel process. Steels in primary structure shall be killed. Only materials with non-ageing properties shall be used.

Extra high strength steels, with specified yield stress above 500 N/mm², shall not be used.

When materials of different galvanic potential are joined together, the design shall be such that galvanic corrosion is avoided.

Welding consumables shall be according to recognized standards for welding consumables

Tensile testing shall be carried out according to EN 10002-1 or DNVGL-RU-SHIP Pt.2 Ch.1.

In order to avoid initiation of brittle fracture, the steels shall possess adequate fracture energy. Steels for primary structures shall be tested by the Charpy impact (V-notch) method according to EN 10045-1 or DNVGL-RU-SHIP Pt.2 Ch.1.

Impact test temperatures shall be as given in Table 3-1. The requirements for design temperature T_D , can be seen in [4.1.5].

Table 3-1 Impact test temperature. Structural steel for primary structural members

<i>Material thickness, t, in mm</i>	<i>Impact test temperature in °C</i>
t ≤ 12	$T_D + 10$
12 < t ≤ 25	T_D
t > 25	$T_D - 20$

Requirements for impact energy depend on the specified minimum yield stress of the steel. The average energy absorption for 3 base material specimens with their axis parallel to the final rolling direction shall not be less than given in Figure 3-1.

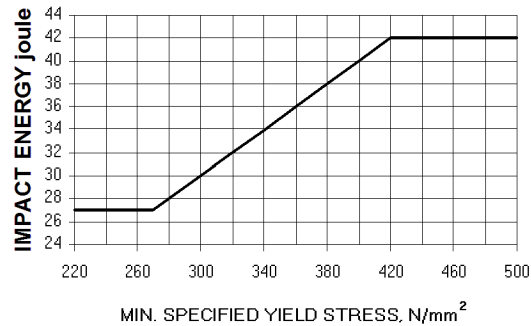


Figure 3-1 Charpy V-notch requirements for steel

For base material specimens with their axis transverse to the final rolling direction the requirement is 2/3 of that for longitudinally oriented specimens. No single value shall be less than 70% of the required average values. If standard specimens cannot be made, the required energy values are reduced as follows:

- 10 × 7.5 mm → 5/6 of above values
- 10 × 5.0 mm → 2/3 of above values

For steel members with thickness less than 6 mm, impact testing is not required. Austenitic steels need not be impact tested.

3.1.2 Rolled, forged and cast steels in offshore container structures

3.1.2.1 Groups of steel

Structural steels for primary structure shall be carbon steel, carbon-manganese steel, carbon-manganese micro-alloyed steel or low-alloyed steel.

Rolled steel shall comply with the requirements in EN 10025 (hot rolled plates and profiles), EN 10210 or EN 10219 (hollow sections) or with [DNVGL-RU-SHIPS PT.2 Ch.2 Sec.1](#) and [DNVGL-RU-SHIP Pt.2 Ch.2 Sec.2](#) and with the additional requirements given in this section.

Stainless steel of grade 22Cr duplex (ferritic-austenitic) steel with designation UNS S31803 shall comply with the requirements in EN 10028 or ASTM A240/240M or other relevant standards. Use of other grades of stainless steel will be specially considered by DNV GL.

Plates that will be subjected to tensile loads through the thickness of the plate shall comply with EN 10164 or [DNVGL-RU-SHIP Pt.2 Ch.2 Sec.1](#), with quality Z25 or better.

3.1.2.2 Forged and cast steel

Steel forgings shall be carbon or carbon-manganese steels. Such forgings shall be made from killed and fine-grain treated non-ageing steel.

For chemical and mechanical properties of alloy steel forgings, reference shall be made to EN 10250-2, Open die steel forgings for general engineering purposes — Part 2: Non-alloy quality and special steels and to EN 10250-3, Open die steel forgings for general engineering purposes — Part 3: Alloy special steels, or [DNVGL-RU-SHIP Pt.2 Ch.2 Sec.6](#).

The chemical composition shall be suitable for the thickness in question.

Alloy steels shall be delivered in quenched and tempered condition.

Steel castings shall comply with ISO 3755.

ISO corner fittings made from cast steel shall fulfil the requirements in [Table 3-2](#) and [Table 3-3](#):

Table 3-2 Chemical composition (ladle analysis) ¹⁾

Chemical composition %										
<i>C</i> <i>max.</i>	<i>Mn</i>	<i>Si</i> <i>max.</i>	<i>P</i> <i>max.</i>	<i>S</i> <i>max.</i>	<i>Cr</i> <i>max.</i>	<i>Ni max.</i>	<i>Cu</i> <i>max.</i>	<i>Mo</i> <i>max.</i>	<i>Al</i> ²⁾ <i>min</i>	<i>Cr+Ni+Cu+Mo</i> <i>max.</i>
0.20	0.90 to 1.50	0.50	0.035	0.035	0.25	0.30	0.20	0.08	0.015	0.70
1) The carbon equivalent $C_{eq} = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$ (%) shall not exceed 0.45%										
2) other grain refiners may be accepted										

Table 3-3 Mechanical properties

<i>Yield strength</i> <i>R_e</i> <i>min.</i> <i>N/mm²</i>	<i>Tensile strength</i> <i>R_m</i> <i>N/mm²</i>	<i>Elongation</i> <i>A5</i> <i>min.</i> <i>%</i>	<i>Reduction of area</i> <i>Z</i> <i>min.</i> <i>%</i>	<i>Impact energy</i> <i>KV</i> <i>at -20°C</i> <i>min.</i> <i>joule</i>
220	430 to 600	25	40	27

3.1.2.3 Forged bolts, nuts and pins

Bolt assemblies considered as essential for structural and operational safety shall conform to ISO 898 or other recognised standard. Impact energy shall be documented where the bolt size allows a Charpy-V specimen to be taken out, and shall be a minimum of 42J at - 20° C (for sub-size specimens see 3.1.1).

Pins used in structural connections shall conform to relevant part of EN 10083 Quenched and tempered steels or other recognised standard.

3.2 Aluminium

The chemical composition, heat treatment, weldability and mechanical properties shall be suitable for the purpose.

When materials of different galvanic potential are joined together, the design shall be such that galvanic corrosion is avoided.

Aluminium used in offshore containers shall be wrought alloys, i.e. be made by rolling or extruding. Aluminium alloys and tempers specified in Table 3-4 and Table 3-5 can be used. Use of other alloys or tempers will be specially considered by DNV GL.

Table 3-4 Aluminium alloys and tempers for rolled products

Alloy		Temper	Yield strength (N/mm ²)		Tensile strength <i>R_m</i> minimum or range (N/mm ²)
ISO 209-1	AA ¹⁾		ISO/ AA	Delivery condition ²⁾ (<i>R_{p0.2}</i>)	
AlMg2.5	5052	0/0	65	65	165-215
		HAR/H32	130	65	210-260
		HBR/H34	150	65	230-280
AlMg3	5754	0/0	80	80	190-240
		HAR/H32	130	80	220-270
		HBR/H34	160	80	240-280
AlMg3.5	5154A	0/0	85	85	215-275
		HAR/H32	180	85	250-305
		HBR/H34	200	85	270-325
AlMg4	5086	0/0	100	100	240-310
		HAR/H32	185	100	275-335
		HBR/H34	220	100	300-360
AlMg3Mn	5454	0/0	85	85	215-285
		HAR/H32	180	85	250-305
		HBR/H34	200	85	270-325
AlMg4.5Mn	5083	0/0	125	125	275-350
		HAR/H32	215	125	305-380

Table 3-5 Aluminium alloys and tempers for extruded products

Alloy		Temper	Yield strength (N/mm ²)		Tensile strength <i>R_m</i> minimum or range (N/mm ²)
ISO 209-1	AA ¹⁾		ISO/AA	Delivery condition ²⁾ (<i>R_{p0.2}</i>)	
AlSi0.5Mg	6063	TB/T4	65	65	130
		TF/T6	170	65	205
AlSi1MgMn	6082	TB/T4	110	110	205
		TF/T6	250 (for t ≤ 5 mm)	110	290
		TF/T6	260 (for t > 5 mm)	110	310

¹⁾ AA = American Aluminium Association
²⁾ In calculations, yield strength is not to exceed 70% of ultimate tensile strength

3.3 Non-metallic materials

Timber, plywood, fibre reinforced plastics and other non-metallic materials shall normally not be used in primary structures, but may be used in secondary structures.

Due regard shall be given to strength, durability, suitability and possible hazards caused by use of these materials.

3.4 Material certificates

Materials used for construction of offshore containers shall be furnished with documentation in accordance with Table 3-6. All materials for primary structure shall be identifiable against the certificates.

Table 3-6 Documentation of materials

<i>Structure</i>	<i>Minimum documentation requirements^{a)}</i>		
	<i>Inspection certificate type 3.2^{b)}</i>	<i>Inspection certificate type 3.1^{c)}</i>	<i>Test report type 2.2</i>
ISO-corner fittings	X		
Pad eyes	X		
Other primary structural members		X	
Secondary structural members			X
^{a)} Material documentation as defined in EN 10204 (2004) ^{b)} Certificate issued by DNV GL or other recognized certifying body. (Equivalent to 3.1C in ISO 10474) ^{c)} Certificate issued by the manufacturer. (Equivalent to 3.1B in ISO 10474)			

SECTION 4 DESIGN

4.1 General

An offshore container shall have sufficient strength to allow loading and unloading in open seas from a ship deck with a sea state up to significant wave heights of 6 m. Consideration shall be given in the design to local impact loads, e.g. from hitting other deck cargo or rigid parts of the ship structure, which may cause extreme loads in such conditions.

Guidance note 1:

For containers with special features, additional design requirements may be applicable. Such special features may be related to e.g. additional fittings for other methods of handling or thermal containers with refrigeration machinery, etc.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Guidance note 2:

If equipment carried in or installed in an offshore container cannot withstand the lifting or shock loads, such equipment should be protected or supported on dampers, or the container should be handled only when conditions allow.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Guidance note 3:

For service containers, it is recommended that the rating, R, is chosen higher than the estimated fitted out mass, i.e. to specify a certain payload even if the container is not intended to carry cargo. This will allow for changes in the amount and mass of equipment fitted in a service container during its operational life, and it will enable the container to carry a certain amount of non-permanent equipment.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Guidance note 4:

For containers with exposed aluminium, the danger of sparks caused by the impact of aluminium against corroded steel (thermite reactions) should be taken into account. National authorities may have restrictions on the use of aluminium containers on offshore installations.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.1.1 Structural design

Containers shall be designed as structural frames (primary structure), with non-load bearing cladding where necessary (secondary structure). Only the primary structure shall be considered in the design calculations.

However, on waste skips with trapezium shaped sides and with open top or only a non-stressed cover above the bracing where the pad eyes are attached, the whole structure may be considered as primary structure, and the skip may be calculated as a monocoque construction.

All connections between frame members and between pad eyes and frame members shall be designed to give good continuity. Where beams of different cross sections meet, they shall normally be aligned as far as possible, and measures shall be taken to minimize stress concentrations on webs or flanges.

Offshore containers may be constructed with partly removable primary structure. Bolted or pinned connections will be specially considered by DNV GL with regards to both strength and securing.

Removable beams, walls or covers shall be secured in such a way that they will not fall off even if a securing device is damaged

4.1.2 Stability against tipping

To prevent the containers from overturning (tipping) on a moving deck, they shall be designed to withstand 30° tilting in any direction without overturning. Cargo may be assumed evenly distributed with centre of gravity at the half height of the container. For dedicated purpose containers with a fixed centre of gravity (e.g. bottle racks, service containers or tank containers) the actual centre of gravity shall be used. If the stability of a container cannot be verified through calculations, DNV GL may require a tilting test, see [4.6.5].

4.1.3 Protruding parts and top protection

Protruding parts on the outside of the container frame that may catch or damage other containers or structures shall be avoided. Minor protrusions on the sides may be allowed after special consideration. Protective structure or deflector plates may be required at protrusions.

Doors, handles, hatch cleats etc. shall be so placed or protected that they do not catch the lifting set. Supporting pads and fork pockets may protrude below the bottom frame of containers, but shall have deflector plates to prevent snagging.

Guidance note 1:

Deflector plates should be designed such that the angle between the outer plane (e.g. of bottom rail or wall) and the free edge of the plate is not more than 35°. Deflector plates on the underside of the container should be placed at, or as near as practical to, the outer edges of the container.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Pad eyes may protrude above the top level of the container frame (see also [4.4.1]).

Stacking fittings and guides and other structures that protrude above the top of the container frame shall be designed and located such that they may not catch on structures on the ship or on other deck cargoes during lifting operations, and be designed such that the risk of damage to other containers or cargoes from these is minimized. They shall also be designed such that damage to the stacking fittings does not cause damage to the pad eyes.

Guidance note 2:

Particular attention should be given to avoiding the risk of catching in openings in the bulwarks of supply vessels.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Parts of the permanently attached lifting sets will often hang over the side of the top frame. If containers are designed for stacking, the corners shall be raised above the frame and roof sufficiently to prevent damage to the lifting set.

4.1.4 Top protection

The following types of containers shall be provided with top protection:

- All open frame containers (i.e. containers without walls and a roof); and
- all open top containers with permanent internal fittings and/or equipment (i.e. where there is a risk of the crane hook or the sling set snagging inside the container)

Note:

Other types of open top containers (e.g. cargo baskets with temporary equipment that is bolted down) may also cause snagging hazards. Such containers are not covered by the requirements in this section; in such cases the snagging hazards should be addressed operationally.

---e-n-d---o-f---n-o-t-e---

Top protection may be fixed, hinged or removable and shall be capable of being securely fitted to the container. Top protection shall be either rigid or flexible and be made from a robust material (e.g. plates, grating, GRP, tarpaulin, nets/mesh, webbing, etc). Grating or other rigid top protection shall have opening size not more than 1500 mm². Nets and webbing shall have opening size not more than 50 × 50 mm..

Rigid top protection shall have a non-slip surface and be designed for a load of 3 kN uniformly distributed over an area of 600 × 300 mm, located anywhere on the top protection.

Flexible top protection shall be capable of supporting a central load equal to 0.03 × R × g. However, the design load shall not be less than 1 kN and need not be more than 3 kN. The strength of the top protection shall be documented.

Guidance note:

Flexible top protection may stretch or deform if subjected to the design load, provided it does not fail and does not come into contact with internal fittings or equipment.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t---

The top protection shall be located as high up as practical, normally not lower than the lower flange of the top frame members. Fixtures for the top protection shall be such that they do not cause a snagging hazard. Where possible the top protection shall cover the entire roof of the container; small openings may be incorporated, e.g. to permit the passage of slings when pad eyes are located below the top protection.

In the case of long baskets where top protection is required, and where the pad eyes are not located at the ends of the baskets, top protection need not extend over the whole length of the basket, but shall at least extend between the pad eyes and 1 m beyond the pad eyes, such that the sling set (including fore runner) cannot enter the basket.

Containers with flexible top protection shall be marked with the following "Not for personnel access" [or "Do not walk on top"].

4.1.5 Design temperature

The design air temperature, T_D , shall not be taken higher than the (statistically) lowest daily mean temperature for the area where the offshore container shall operate and shall not be higher than -20°C . For containers that are exclusively to be used in areas with temperate climate.

4.2 Structural strength

The required strength of a container is found by calculations and verified by prototype tests, as described in [4.6].

Guidance note:

Calculation methods may be:

- manual
- 2- or 3-dimensional frame analysis
- Finite Element Methods (on whole frame or special areas, e.g. pad eyes).

See [App.C](#) for advice on these methods.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t---

4.2.1 Allowable stresses

For the design loads defined in the following, no equivalent stress level shall (unless otherwise specified) exceed:

$$\sigma_e = 0.85 \times C$$

where σ_e is the Von Mises equivalent stress and C is defined below:

For steel:

$$C = R_e$$

For aluminium:

Base material:

$$C = R_{p0.2} \text{ but not to be taken greater than } 0.7 \times R_m$$

Weld and heat affected zone:

$$C = \text{yield strength in the weld and heat affected zone}$$

See [Table 3-4](#) and [Table 3-5](#) for yield strength of the approved aluminium qualities.

Guidance note:

The strength of aluminium alloys is considerably reduced in welds and heat affected zones. The reduction depends on material properties, initial tempering and type of product (rolled, extruded). Materials not listed in [Tables 3-4](#) and [Table 3-5](#) will be considered in each case.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.2.2 Load distribution

In these calculations, internal loads shall be assumed evenly distributed on the offshore container floor. For tank containers, other containers with permanently mounted heavy equipment and for dedicated purpose containers, the actual distribution of the internal load shall be used in the calculations.

4.2.3 Lifting loads

4.2.3.1 Lifting with lifting set

The design load on the primary structure shall be taken as:

$$F_L = 2.5 \times R \times g$$

To achieve this the internal load shall be taken as $F_i = (2.5 \times R - T) \times g$,

Guidance note:

Calculated deflections should be checked. Reference is made to allowable deflections in prototype tests, see [\[4.6.3.2\]](#).

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Pad eyes shall be designed for a total vertical load of:

$$F_p = 3 \times R \times g$$

The load F_p shall be considered as being evenly distributed between $(n - 1)$ pad eyes where n is the actual number of pad eyes. For calculation purposes n shall not exceed 4 or be less than 2.

To find resulting sling force on the pad eyes, the sling angle must be taken into account. Hence, the resulting sling load (RSL) on each pad eye will be:

$$RSL = \frac{3 \times R \times g}{(n - 1) \times \cos v}$$

where v is the angle between a sling leg and the vertical, assumed to be 45° unless a smaller angle is specified.

Guidance note 1:

Containers without roof may have insufficient strength and stiffness to pass the 2 point lifting test ([\[4.6.3.3\]](#)). In order to avoid building prototypes that will not pass the test, the ability of an open top container to withstand the load occurring in the 2-point lifting test should be checked by a suitable calculation method. In these calculations, the nominal yield stress, R_e , of the material should not be exceeded. The calculations do not replace prototype testing.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Guidance note 2:

Containers can be excessively flexible without having high calculated stresses. These calculations should therefore also be used to verify that the deflections (both maximum and relative) will be acceptable.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Containers with only a single pad eye may be approved after special consideration by DNV GL. The design load for such a pad eye shall be taken as:

$$F_p = 5 \times R \times g$$

For requirements for lifting sets, see [Sec.8](#).

4.2.3.2 Lifting with fork lift truck

The mass of the lifting set, S , shall be taken into account when calculating the strength of the fork pockets.

Guidance note:

If S is not known, an estimated mass of the lifting set may be used in the calculations.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

The design load on the primary structure shall be taken as:

$$F_F = 1.6 \times (R + S) \times g$$

To achieve this, the internal load shall be taken as:

$$F_i = [1.6 \times (R + S) - T] \times g$$

Where fork pockets are only intended for empty handling of the container, the design load shall be taken as $F_F = 1.6 \times (T+S) \times g$. For marking of containers with such pockets see [6.1].

4.2.4 Impact loads

Impact loads are dynamic loads of very short duration. Ideally, dynamic calculations or tests should be carried out. However, for most applications it is sufficient to carry out simplified static calculations as outlined below to verify the local strength, and to perform a vertical impact test (see [4.6.4]) to verify the container's overall ability to withstand such loads.

When simplified calculations are used, and each beam is considered separately, due consideration shall be given to the support conditions for this beam.

4.2.4.1 Horizontal impact

The main frame structure shall be dimensioned to withstand a local horizontal impact force acting at any point. This force may act in any horizontal direction on the corner post. On all other frame members in the sides the load may be considered as acting at right angles to the side. Where relevant, the calculated stresses shall be combined with lifting stresses. However, only stresses resulting from static lifting loads (R g) need to be considered.

The following values shall be used for the static equivalents to an impact load:

$$F_{HI} = 0.25 \times R \times g \text{ for corner posts}$$

$$F_{HI} = 0.25 \times R \times g \text{ for side rails of the bottom structure}$$

$$F_{HI} = 0.15 \times R \times g \text{ for other frame members of the side structure, including the top rails}$$

Calculated equivalent stresses shall not exceed:

$$\sigma_e = C$$

C is defined in [4.2.1]

Maximum calculated deflections with these loads shall not exceed:

$$y = \frac{l_n}{250}$$

where:

For corner posts and bottom side rails:

l_n = the total length of the rail or post.

For other frame members:

l_n = the length of the shortest edge of the wall being considered

For horizontal impact on tank containers for dangerous cargoes see also [4.5.2.1].

4.2.4.2 Vertical impact

Maximum vertical impact forces are likely to occur when a container is lowered down to a heaving ship deck. If the deck is at an angle, the first impact will be on a corner. Such impact forces can not readily be simulated by static forces. As dynamic calculations will be very complex, it is usually sufficient to verify the strength by a vertical impact test as described in [4.6.4].

In addition, the side rails and end rails in the bottom shall be able to withstand vertical point forces at the centre span of:

$$F_{VI} = 0.25 \times R \times g$$

Calculated equivalent stresses shall not exceed:

$$\sigma_e = C$$

C is defined in [4.2.1].

Calculated deflections shall not exceed

$$y = \frac{l_n}{250}$$

where:

l_n = the total length of the rail.

4.2.5 Minimum material thickness

The following minimum material thickness requirements apply:

- Those parts of corner posts and bottom rails forming the outside of a container: $t \geq 6$ mm.
However, for containers with a max. gross mass $R < 1000$ kg the minimum material thickness shall be 4 mm.
- All other parts of primary structure: $t \geq 4$ mm.
- Secondary structure made from metallic materials: $t = 2$ mm. Secondary structural components used only for protection (e.g. of tanks) must however have sufficient thickness to give adequate protection.
- On waste skips of monocoque design (see [1.4.1]c) the minimum thickness within an area of 100 mm from the side edges shall be 6 mm. The remaining parts of the side and bottom structure shall be min. 4 mm.

Guidance note:

The thickness both of primary and secondary structure may have to be increased beyond these values after special considerations. Such considerations may include material used, rating, design, function of the structural component and corrosion allowances.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.3 Welding

4.3.1 Welding of pad eyes

All main welds between pad eyes and the primary frame structure shall always be full penetration welds.

Guidance note:

Fillet welding of additional supporting welds on pad eyes and on Pad eye supporting structure may be acceptable after special consideration.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.3.2 Welding of other primary structure

Essential and non-redundant primary structural members shall be welded with full penetration welds.

Fork pockets shall be connected to the bottom rails with full penetration welds, but if the fork pockets pass through the bottom rail, fillet welds may be used. For other primary structure, fillet welds may be permitted after special agreement with DNV GL.

Welding of secondary structure

Secondary structures may be welded with fillet welds. Intermittent fillet welding of secondary structure is acceptable, but measures shall be taken to avoid corrosion if water intrusion could cause problems.

Welds between primary and secondary structures are considered to be welding of secondary structure.

4.4 Design details

4.4.1 Pad eyes

See also [App.D](#) for guidance on the positioning and design of the pad eyes.

Pad eyes shall not protrude outside the side boundaries of the container, but may protrude above the top of the container.

In order to prevent lateral bending moments on pad eyes, they shall be aligned with the sling to the centre of lift, with a maximum manufacturing tolerance of $\pm 2.5^\circ$.

Any difference in the diagonal measurements between lifting point centres shall not exceed 0.2% of the nominal length of the diagonal, or 5 mm, whichever is the greater.

The diameter of holes in pad eyes shall match the shackle used, clearance between shackle pin and pad eye hole shall not exceed 6% of the shackle pin diameter.

Pad eye maximum concentrated hot spot stresses at the hole edges shall not exceed $2 \times Re$ at design load.

Note:

A simple method for calculating pad eyes is shown in [App.D](#)

---e-n-d---o-f---n-o-t-e---

The thickness of the pad eye at the hole shall not be less than 75% of the inside width of the joining shackle.

Guidance note:

When the pad eye thickness is below the 75% limit, it can be increased by welding on cheek plates or by inserting a thick walled pipe or drilled out boss through the pad eye. See [App.D](#) for strength calculations of such structures.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Pad eyes shall be welded to the frame with full penetration welds. If the lifting force is transferred through the thickness of a plate (the z-direction), plates with specified through thickness properties must be used.

4.4.2 Intermediate cargo decks

When intermediate cargo decks are fitted, they shall normally be designed for a uniformly distributed load of at least:

$$F_T = 0.5 \times P \times \psi \times g$$

where Load factor:

$$\psi = 3.0$$

When intermediate cargo decks are designed only to be used for dedicated cargoes that have other load distribution than half the total payload, the design load requirement may be modified accordingly.

4.4.3 Stacking and stacking fittings

If offshore containers are designed to be stacked onshore or on offshore installations, stacking height shall normally not exceed 2 levels of containers. Waste skips with trapezium shaped sides may be designed for stacking of several units in empty condition.

Stacking guides on top rails or on the underside of a container shall be designed to prevent lateral movement and to prevent tipping of the upper container.

Guidance note:

A static heel angle of 15° should be assumed, and wind pressure on the container side should be taken into account

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Offshore containers that are also certified to CSC and/or ISO 1496 shall in addition be designed for stacking on container ships according to CSC and/or ISO 1496.

See also [4.1.3].

4.4.4 ISO-corner fittings

Offshore freight containers may be fitted with corner fittings according to ISO 1161 at the top and bottom for strengthening and lashing purposes. However, containers shall not be lifted offshore with shackles in these corner fittings.

Guidance note:

It is recommended not to fit ISO corners to the top of offshore containers unless the container have dimensions according to ISO 668.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.4.5 Floor

Containers liable to fill with water, e.g. open topped, shall have a suitable drainage facility.

4.4.6 Fork lift pockets

Offshore containers may be fitted with one or more sets of fork lift pockets in the bottom structure.

The minimum opening of the fork lift pockets shall be 200 mm × 90 mm.

Fork lift pockets shall be located such that the container is stable during handling with fork lift truck.

Container length, height, width and rating shall be taken into account. Pockets shall be located as far apart as practical. Centre distance shall be at least 900 mm (where possible), but need not be more than 2050 mm.

Guidance note 1:

It is recommended that pockets are located and used according to [Table 4-1](#).

Table 4-1 Recommended fork pocket distances and operational limitations

<i>Container length L (mm)</i>	<i>Min. distance between centres of pockets (mm)</i>	<i>Limitations</i>
L < 6000	According to the above requirements.	If $3000 \leq L < 6000$, the pockets for loaded handling should be spaced at least 1500 mm apart.
$6\ 000 \leq L \leq 12\ 000$	2050	Pockets for loaded handling
	900	Pockets for empty handling
$12\ 000 < L \leq 18\ 000$	2050	Empty handling only
L > 18000	-	No pockets

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Special requirements apply for fork pockets on tank containers for dangerous cargoes, see [\[4.5.2\]](#).

Fork pockets shall extend across the full width of the base frame and shall pass through or be attached to the base. If attached to the underside of the base rails, deflector plates shall be used.

Fork pockets shall have closed tops and sides. The bottom face of fork pockets may be fully closed or have partial openings. Openings in bottom plates shall have such size and location as to minimize the risk that the fork tines may penetrate or seize in the opening, or that they damage the free edges at the cut-out is minimized. Openings in the bottom of fork pockets are not allowed in way of the bottom side girders or less than 200 mm from the inside of these girders.

Guidance note 2:

Openings in the bottom of fork pockets will facilitate inspection and maintenance and will reduce the risk of loose items being retained in the pockets which could subsequently fall out during lifting operations. Placing the pockets clear of the ground will reduce the risk of picking up gravel and rocks.

Such openings in the bottom may be damaged by fork lift trucks. This should be taken into account in the design and when inspecting the containers. See also [\[9.2.2.8\]](#)

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

If a container is fitted with pockets that are only for empty handling, the container shall be marked according to [\[6.1\]](#).

The shear area in the bottom side rail shall be sufficient taking into account the reduction of vertical shear area in way of the fork lift pockets. If additional strengthening is placed on top of the side girder, this shall be in line with the web(s) of the bottom girder, extend at least 100 mm outside the pocket opening at each end and be welded with full penetration welds.

Guidance note 3:

The area surrounding the fork pocket openings may be damaged by the fork lift truck. Strengthening, protection or guides on the side girders at fork pocket openings may reduce the damages to the side girders.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.4.7 Driving ramps

The max. allowable axle load on driving ramps shall be equal to the payload (P), but need not be more than 5808 kg. However, some containers may be designed to be loaded with one or more unit cargoes with a mass that would require a higher max. axle load. The max. allowable axle load shall be $0.8 \times$ the test load.

The strength of driving ramps on offshore containers shall be verified by testing, see [\[4.6.2\]](#).

Note:

Axle load 5808 kg is equivalent to a test load of 7260 kg, as required for ISO freight containers by ISO 1496-1.

---e-n-d---o-f---n-o-t-e---

Note:

Parts of driving ramps and their locking devices may also form part of the primary structure frame, e.g. act as top rail.

---e-n-d---o-f---n-o-t-e---

Driving ramps are to be clearly marked with the max. allowable axle load.

4.4.8 Container walls

Each container wall including the doors shall be designed to withstand an internal load of $F_W = 0.6 \times P \times g$ evenly distributed over the whole surface, without suffering any permanent deformation.

4.4.9 Doors and hatches

Doors and hatches including hinges and locking devices shall be designed for at least the same horizontal forces as the primary structure. Locking devices shall be secure against opening of the doors during transport and lifting. Double doors shall have at least one locking device on each door, locking directly to the top and bottom frame.

Locking arrangements shall be protected to prevent dislodgement by impact.

Hinges shall be protected against damages from impact loads.

Doors shall be capable of being secured in the open position.

If weathertightness is required the doors shall be equipped with gaskets.

4.4.10 Internal securing points

Containers for general cargoes shall have internal securing points.

Guidance note:

Normally at least 12 points are recommended. Hinged lashing points are recommended.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Each internal lashing point shall be designed for at lashing forces of least 10 kN.

4.4.11 Tugger points

If tugger points (attachments used for handling without lifting) are fitted, they shall be:

- designed for a load equal to the container rating, R
- attached to the primary structure
- placed as far down on the structure as possible
- placed within the outer edges of the container.

4.4.12 Equipment

Equipment installed in offshore containers shall be designed and installed to withstand the dynamic loading and other environmental forces to which it may be exposed.

The following factors shall be considered:

— Load factor:

$$\Psi = 3.0$$

— Safety factor against breaking:

$$SF = 2.0$$

Permanent equipment installed in a container is considered to be part of the container.

Any external connections, e.g. a supply of pressurised air or electrical connections shall be protected against damage.

4.4.13 Coating and corrosion protection

Offshore containers shall be suitable for the offshore environment by means of construction, use of suitable material and/or corrosion and paint protection.

All offshore container roofs, including those constructed from chequer plate, shall be coated with a permanent non-slip medium.

Guidance note:

Steel:

Surfaces to be painted should be blast cleaned to Sa 2 ½ according to ISO 8501-1

Shop primers should be inorganic zinc/ethyl/silicate based or equivalent.

Paint should have good adhesion, wear resistance and durability

Aluminium:

Surface treatment is normally not required for aluminium

Surfaces to be painted should be blast cleaned to SA 2 ½ with non-metallic material. Primer should be vinyl or epoxy based.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.5 Tank containers and bulk containers

Offshore containers for liquid or solid bulk cargoes are subject to international regulations or standards according to this section and may also be subject to other codes and requirements.

In addition to the design requirements already specified in preceding parts of this section, the frame shall be designed to also protect the tank and fittings (valves, man-holes etc.). See also [4.1.3] and [4.2.4].

4.5.1 Tank containers

Tank containers for liquids shall be designed and tested according to relevant parts of ISO 1496/3.

Note:

Only containers with tanks that are intended for transport of cargo are considered to be tank containers.

Other types of tanks, e.g. processing plants, storage tanks etc. that are empty during transport, are considered to be service equipment, and are not normally covered by approval and certification to this standard.

---e-n-d---o-f---n-o-t-e---

4.5.2 Tank containers for dangerous goods

Tank containers for dangerous goods must fulfil the requirements of the IMDG Code Chapter 6.7, and shall be designed according to a recognised code for pressure vessels. A tank and its supports shall be able to withstand lifting and impact loads in addition to dynamic forces as specified in the IMDG code. Also due account shall be taken of fluid surge arising from partly filled tanks.

Offshore tank containers for dangerous goods shall comply with the following requirements for fork lift pockets on tank containers in the IMDG Code:

"6.7.3.13.4 Forklift pockets shall be capable of being closed off. The means of closing forklift pockets shall be a permanent part of the framework or permanently attached to the framework. Single-compartment portable tanks with a length less than 3.65 m need not have closed off forklift pockets provided that:

- .1 the shell and all the fittings are well protected from being hit by the forklift blades; and
- .2 the distance between the centres of the forklift pockets is at least half of the maximum length of the portable tank."

Note:

The IMDG Code (Ch.4.2) does not allow portable tanks with dangerous cargo to be lifted with fork lift truck unless they are less than 3.65 m long and comply with the quoted subparagraphs.1 and .2 above.

---e-n-d---o-f---n-o-t-e---

Guidance note:

Where there is a danger of spillage from valves or connections, it is recommended to fit drip pans.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.5.2.1 Impact protection on tank containers for dangerous cargoes

On tank containers for dangerous cargoes, all parts of the tank and fittings shall be suitably protected from impact damage. In addition to the requirements of [4.1.3] and [4.2.4], the following applies:

Top

The top of the tank and fittings shall be protected by beams, plates or grating. No part of the tank or fittings shall extend above a level 100 mm below the top of the framework (i.e. the top of the side or end rails).

It shall not be possible for any part of the lifting set to foul on fittings, manhole cleats or other protrusions on the tank.

Sides

Protective beams shall be placed at or near the location where the tank shell is nearest to the outer plane of the sides. Beams shall be spaced sufficiently close to give the necessary protection.

At maximum calculated elastic deflection of any side member, the residual clearance between this member and any part of the tank shell or fittings shall be at least 10 mm.

Bottom

No part of the underside of the tank shell (including sumps) and bottom valves or other fittings, shall extend below a level 150 mm above the bottom of the framework (the underside of the side or end rails). Any such part extending below 300 mm above the bottom of the framework, shall be protected by beams or plating.

Tank containers designed with direct connection between the tank and the side or top frame elements will be subject to special consideration.

4.5.3 Containers for bulk solids

These may be either pressurised tanks or non-pressurised containers for gravity discharge.

The design of bulk containers shall be according to relevant parts of ISO 1496/3 or 1496/4 and shall in addition be suitable for offshore service.

4.5.4 Bulk Containers for solid dangerous goods

Bulk containers for dangerous goods shall comply with the IMDG code Ch.6.9.

Only closed bulk containers of type BK 2, as defined in the IMDG code are allowed as offshore bulk containers for dangerous goods.

Bulk containers shall be siftproof, i.e. shall not leak any fine grained cargo.

The tank or shell, filling and discharge devices etc. shall be so constructed and arranged as to be protected against the risk of being wrenched off or damaged during transport and handling.

The filling and discharge devices shall be capable of being secured against unintended opening. Protection arrangements will be specially considered by DNV GL.

4.6 Prototype testing

4.6.1 Introduction

The tests described in [4.6.3] and [4.6.4] are required for all offshore container types, and shall be considered as design requirements. Prototype tests shall be witnessed by DNV GL.

Guidance note 1:

Prototype testing may not replace design review, but may in certain cases be a partial substitute for strength calculations. The container used for type testing should be a prototype as defined in [1.4.7].

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

The tare mass (excluding lifting set) shall be verified by weighing before tests are performed. If the tare mass deviates from the estimated value, the payload shall be adjusted accordingly.

The test masses shall normally be evenly distributed inside the prototype.

Guidance note 2:

Where steel or concrete weights are used it is advised that these are placed on wooden battens to get more even load distribution and prevent damage to the floor.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

If it is not possible to place all the test mass inside the offshore container, some of it may be placed outside or under, provided that this gives a loading on the structure similar to the distribution on the offshore container loading at the actual condition.

If the container has an additional cargo deck, the test load shall normally be evenly divided between the bottom floor and the additional deck, see [4.4.2]. If the additional deck is removable, it will be necessary to carry out the testing with the test load divided between the additional deck and the floor, as well as with the whole test load on the bottom floor.

Guidance note 3:

If the additional deck is close to either the top or bottom of the container, other test load distributions than described above may be considered.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

NDT of important welds shall be carried out after prototype testing is completed.

Service containers should be tested before they are fitted out with insulation and equipment.

Guidance note 4:

It is advisable to make a conservative estimate of the Max. Gross Mass for a service container. Retesting of service containers which turn out to be heavier than the estimated value will be expensive and time consuming if it has to be stripped of insulation and equipment.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.6.2 Test equipment and calibration

4.6.2.1 Test mass and or test load

The test mass (or test load) shall be verified using calibrated weights or a calibrated load cell (with handset or direct readout).

Guidance note 1:

Examples of appropriate means of application of test mass/ test load are:

- calibrated test blocks
- water bags
- sand bags
- free weights
- a suitable test rig.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.6.2.2 Calibration

If a load cell and hand set is used it shall be calibrated annually, in accordance with EN ISO 7500-1, or other recognized standard to an accuracy of $\pm 2\%$

Guidance note 2:

Should a load cell be overloaded or receive a shock load (e.g. from being dropped) it is recommended that the load cell and handset be re-calibrated before further use.

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Where used, test blocks shall be calibrated, as a minimum, every second year in accordance with acceptable international or national standards. The measured mass, in kilograms, of each block shall be legibly and durably marked on each block.

Guidance note 3:

Care should be taken in the storage of calibrated concrete blocks so as prevent the absorption of water having an influence on the actual block mass.

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4.6.3 Lifting tests

4.6.3.1 General

The container shall be lifted by a lifting set with an angle to the vertical equal to the design angle. It shall be carefully lifted in such a way that no significant acceleration forces occur. It shall be held for 5 minutes before measurements are taken.

Guidance note:

Where a lifting set intended for regular use on the container is used at the lifting test, care should be taken to ensure that no overloading, deformation or distortion is induced in the lifting set. It should be visually inspected after the load test.

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4.6.3.2 All point lifting

The prototype shall be loaded up to a total gross mass of $2.5 \times R$. The test load may be obtained by putting in an internal test mass of $((2.5 \times R) - T)$.

No deflections during testing shall be greater than $1/300$ of the span of the member. The container shall show no significant permanent deformations or other damages after testing.

Guidance note:

In order to allow free deflection of all parts of the container, it should normally be lifted clear of the ground. Test jigs that allow free deflection will be specially considered by DNV GL.

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4.6.3.3 2-point lifting (diagonal lifting test)

Offshore containers with four pad eyes shall also be lifted from only two pad eyes, situated diagonally opposite each other, with a total mass of $1.5 \times R$. This can be achieved by loading it with an internal test mass of $((1.5 \times R) - T)$. If the container is unsymmetrical two diagonal lifting tests will be required.

After the testing there shall be no significant permanent deformation.

Guidance note:

Elastic deformations during lifting should also be observed. The DNV GL surveyor should ensure that elastic deformations are acceptable.

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4.6.4 Vertical impact test

The container, with its internal test mass corresponding to payload P , shall be either lowered or dropped on to a workshop floor of concrete or other rigid structure. This floor may be covered with a sheeting of wood planks with thickness not exceeding 50 mm.

Guidance note:

If the offshore container is lowered from a crane, the suspending wire and hook may dampen the impact compared to a free-fall drop test. Therefore the impact speed should be greater if a lowering test is used.

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In both cases, the offshore container shall be so inclined that each of the bottom side and end girders connected to the lowest corner forms an angle of not less than 5° with the floor. However, the greatest height difference between the highest and lowest point of the underside of the offshore container corners need not be more than 400 mm.

The impacting corner shall be the one expected to have the lowest rigidity. (On closed dry cargo containers this will normally be at the door end.)

No significant permanent damage shall occur. Small cracks in welds and minor deformations may be repaired. Only one of the following tests is required:

4.6.4.1 Alternative 1: drop test

Internal load equal to payload (P) shall be sufficiently secured and the offshore container shall be inclined as above. See illustration of drop test in [App.F](#).

The offshore container shall be suspended from a quick release hook. When released, the offshore container shall drop freely for at least 5 cm, to give it a speed at initial impact of at least 1 m/s.

4.6.4.2 Alternative 2: lowering test

Internal load equal to payload (P) shall be sufficiently secured and the offshore container shall be inclined as detailed above.

The offshore container shall be lowered to the floor at a constant speed of not less than 1.5 m/s.

Note:

Warning: These tests may cause considerable tremors in a building!


---e-n-d---o-f---n-o-t-e---

4.6.5 Other tests

Other tests may be required. These shall be agreed in advance with DNV GL. When applicable, the method of testing shall as far as possible be in accordance with tests described in relevant ISO standards for freight containers.

Open top containers with an overall length of 6.5m or more, with fork pockets designed for loaded lifting, shall be loaded to a total uniform gross mass of $1.6(R+S)g$ and lifted clear of the ground using the fork pockets. No deflections during testing shall be greater than $1/300$ of the span of the member. The offshore container shall show no permanent deformation or other damage after testing.

Strength testing of driving ramps shall be performed with a test vehicle with the axle load evenly distributed between two tyres. Each tyre shall have a surface area not exceeding 142 cm^2 , with a nominal centre distance 760 mm. The test load on the axle shall be $= 1.25 \times P$, but need normally not be more than 7260



kg. For containers designed to transport unit cargoes with a mass (UC) that would give a higher axle load than 5808 kg, the test load shall be $2 \times UC$.

Example of other tests that may be required:

- internal load on walls, doors or removable sides
- 30° tilt test
- fork pocket lift test
- internal restraint tests on tank containers.

Tanks for dangerous cargoes shall in addition be tested according to the requirements of the IMDG code.

SECTION 5 PRODUCTION

5.1 General

Production shall be performed according to approved drawings, specifications and procedures.

The manufacturer shall present a quality plan for acceptance before production starts. Relevant production documents (see [5.5]) shall also be presented for acceptance before start of production.

The manufacturer shall ensure the quality of procedures and facilities by implementing a quality management system at least in accordance with ISO 9001. The quality management system shall be to the satisfaction of DNV GL. DNV GL may perform an audit at the manufacturer to verify the quality management system and that they are qualified to manufacture containers according to this standard.

Guidance note 1:

If the quality management system at a manufacturer is not fully satisfactory, DNV GL can consider if certification of containers is still possible, provided the scope of DNV GL surveys is adjusted accordingly.

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Guidance note 2:

It is recommended that a meeting is arranged between the manufacturer and DNV GL before the start of production of any new container type, to agree on production and inspection procedures.

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5.2 Primary structure

During production, and on the finished product, it shall be possible to identify the materials used for the primary structure with the corresponding documentation. If the marking is not visible on the finished product, a log shall be kept of the components to identify and ensure traceability of the materials.

5.2.1 Approved Welders

Welders shall be approved by DNV GL according to a recognised standard, e.g. EN 287-1, EN ISO 9606-1, ISO 9606-2, ASME Boiler and pressure vessel code section IX or ANSI/AWS D1.1.

Where certification of welders is performed by other IACS (International Association of Classification Societies) members or independent organisations, e.g. accredited or nationally approved certification bodies, recognition of such certification will be evaluated on a case by case basis. DNV GL reserves the right, however, to require verification of welder's qualifications when deemed necessary. Such verification may include testing prior to production, extra NDT and/or welding production tests.

5.2.2 Welding procedures

Approved welding procedures shall be used for the welding to be carried out on the primary structure.

Preliminary welding procedure specifications shall form the basis for the preparation of welding procedure tests.

Welding procedure specifications, welding procedure qualification tests and approval of welding procedures shall be in accordance with relevant parts of EN ISO 15607, EN ISO 15609-1, EN ISO 15614-1, EN ISO 15614-2, [DNVGL-RU-SHIP Pt.2 Ch.4 Sec.5](#) or other recognised standard (e.g. ANSI/AWS D1.1) and with the requirements stated below.

Impact tests are required as part of the welding procedure qualification tests. Test temperatures and test results shall comply with the requirements given in [3.1.1]. For $t > 12$ mm four sets of impact tests shall be made: one set in the weld metal, one set at the fusion line, one set in the heat affected zone (HAZ) 2 mm away from fusion line and one set 5 mm away from fusion line.

Guidance note:

The rules and standards specify a range for which a welding procedure is valid, depending on material, thickness, position etc. The impact test temperature should be the temperature applicable for the largest thickness covered by the WPS (see [Table 3-1](#)).

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

5.2.3 Inspection of welds

Welds shall be subject to visual inspection and non-destructive examination (NDT). Unless otherwise agreed in an MSA, all welds shall be 100 % visually inspected.

NDT methods should be chosen with due regard to the conditions influencing the sensitivity of the methods and to the welding method used. Structural welds shall be examined as stipulated in columns I and II in [Table 5-1](#) after production testing. Inspections as stipulated in columns III and IV or other inspections will be decided by the DNV GL surveyor in each case.

If welding is by oxyacetylene process (oxyfuel welding), ultrasonic and radiographic examination shall be required in addition to magnetic particle examination.

The specified percentages refer to the total length of weld for each structural assembly in question. The categories of the structural members shall be agreed with DNV GL in each case.

Table 5-1 NDT of structural welds

Category of member	Type of examination			
	I	II	III	IV
	Visual examination	Magnetic particle examination ¹⁾	Ultrasonic examination ²⁾	Radiographic Examination ²⁾
Primary structure: Essential/ Non-redundant	100%	100% ³⁾	100% pad eyes 20% all other	10%
Primary structure: Non-essential	100%	20%	20%	10%
Secondary structure	100%	SPOT ⁴⁾	SPOT ⁴⁾	SPOT ⁴⁾

1) Dye penetrant examination shall be used where magnetic particle examination is not possible.
 2) Depending on material thickness and accessibility for UT equipment
 3) This amount of NDT need not be applied to welds between fork pockets and floor plates or intermediate structure between these. The extent of NDT on these welds will be decided by the DNV GL surveyor in each case.
 4) Spot means random examination to the discretion of the DNV GL surveyor

5.2.4 NDT procedures and NDT operators

5.2.4.1 Non-destructive testing (NDT) methods

NDE methods shall be according to [Table 5-2](#), or to [DNVGL-RU-SHIP Pt.2 Ch.4 Sec.7](#) or other recognised standards.

Table 5-2 Standards for NDT methods

<i>Visual</i>	<i>Magnetic particle</i>	<i>Dye penetrant</i>	<i>Ultrasonic</i>	<i>Radiography</i>
EN ISO 17637	EN ISO 17638	ISO3452-1	EN ISO 17640	EN ISO 17636-1 ^a and EN ISO 17636-2 ^a
^a Class B improved radiographic techniques shall be used				

5.2.4.2 Weld acceptance criteria

The soundness of welded joints shall comply with [Table 5-3](#), or with [DNVGL-RU-SHIP Pt.2 Ch.4 Sec.7](#) or other recognised standards.

Table 5-3 NDT acceptance criteria

<i>Visual</i>	<i>Magnetic particle</i>	<i>Dye penetrant</i>	<i>Ultrasonic</i>	<i>Radiography</i>
EN ISO 5817 ^a	EN ISO 23278	EN ISO 23277	EN ISO 11666	ISO 10675-1 ^b
Level B	Level 1	Level 1	Level 2	Level 1
^a for aluminium EN ISO10042				
^b for aluminium EN ISO 10675-2				

The stipulated acceptance criteria may in certain cases be modified or made more severe, at the discretion of DNV GL, depending on the local stress conditions and the limitations of the NDT-methods to determine location and size of defects.

5.2.4.3 Non-destructive testing (NDT) operators

NDT operators shall be certified according to a national certification scheme or have qualifications accepted by DNV GL to a similar level.

They shall be qualified, in accordance with EN ISO 9712, to a minimum of level 2, or to an equivalent level according to other recognized standards.

NDT operators shall undertake non-destructive examination in accordance with [Table 5-1](#) and issue reports describing weld quality, containing at least the following information:

- the NDT methods and procedures used
- the NDT-parameters necessary for a proper assessment
- acceptance standard used
- confirmation of acceptance or rejection
- clearly distinguish between accepted and rejected welds
- the number of repairs carried out to meet the specified acceptance standard
- NDT operator's level of qualification.

5.3 Secondary structure

Secondary structure shall prevent cargo from falling out of the container and, if required, prevent water from entering the cargo. Manufacturing procedures shall reflect this.

Welds between primary and secondary structures shall be performed as for secondary structures and shall be examined as such.

The welding procedures used for secondary structure shall be according to the relevant part of EN ISO 15607, ISO 15614-1 or other recognised standard.

Welds on secondary structures shall be examined as stipulated in [Table 5-1](#). The qualifications of NDT operators and the NDT methods shall be to the satisfaction of the DNV GL surveyor.

5.4 Production testing

5.4.1 Lifting test

During production, some offshore containers shall be strength tested. An all point lifting test as described in [\[4.6.3.2\]](#) shall be carried out. The number of offshore containers to be tested shall be agreed in advance and will depend on the total number in the production series. Offshore containers for testing shall be chosen at random after the production of a batch is finished.

[Table 5-4](#) may be used as a guide for the surveyor to decide the number of offshore containers to be tested.

Table 5-4 Containers to be production tested

<i>Total number in series</i>	<i>Number to be tested¹⁾</i>
1 – 5	1
6 – 10	2
11 – 20	3
21 – 40	4
≥ 40	10%

1) This may include the prototype test.

5.4.2 Weatherproofness testing

If a type of offshore containers is specified to be weathertight, the following weathertightness tests shall be carried out:

For the prototype and 10% of the containers in a production series, this testing shall be done with water as described in ISO 1496-1, (see [6.14](#)), Test No. 13 Weatherproofness.

For the remaining containers, the water test may be replaced by a simple light test, using the following procedure:

An inspector will enter the container. The doors are then closed, at least 3 minutes should elapse to allow the inspector to become accustomed to the darkness, before a powerful light is shone on all external surfaces.

The offshore container shall be free from any observable light penetration.

5.5 Production documentation

The certification of each container type shall be based on the following documentation, which shall be retained by the manufacturer for at least 5 years:

- approved drawings, including a general arrangement drawing
- structural calculations
- type approval certificate (where relevant)
- material documentation
- welding procedure qualifications (WPQ)
- welding procedure specifications (WPS)
- welder's qualification certificates

- report on traceability of materials in the primary structure
- report from manufacturing inspection
- report from dimensional control
- report from non-destructive examination (NDT).
- report from prototype testing
- report from production testing
- report from final inspection.

The various reports may be combined as practical.

Parts of this documentation shall be collated in an as built dossier which shall be delivered with the container. (One dossier may cover a batch of identical units.)

The as built dossier shall at least include:


- general arrangement drawing
- material documentation
- welding procedure specifications (WPS)
- report on traceability of materials
- report from manufacturing inspection
- report from dimensional control
- report from non-destructive examination (NDT)
- report from production testing
- report from final inspection
- DNV GL's offshore container certificate.

5.6 Inspection and certification

The production inspection required by [2.3] shall include:

- dimensional control
- visual inspection of weld preparation, welding, alignment, material marking etc.
- review of material certificates
- review of WPS/WPQ, welders qualification tests, welding consumables
- review of equipment documentation as necessary
- review of NDT documentation and report
- review of the marking and plating required by Sec.6 and Sec.7.

When an authorised DNV GL surveyor has carried out the manufacturing inspection, witnessed testing and reviewed the production documentation:

- A DNV GL certificate for the offshore container will be issued.
- The DNV GL offshore container emblem will be affixed to the container.
- The authorised DNV GL surveyor shall hard stamp  and the certificate number into the bottom frame below the emblem or in other suitable location on the primary structure near the emblem.
- It may be agreed in a manufacturing survey arrangement, as described in [2.3.1], that a manufacturer may perform the three tasks listed above. Certificates prepared by the manufacturer must be endorsed by DNV GL before they are valid. Manufacturers with MSA agreements may use the DNV GL MSA steel hard stamp as provided as part of their MSA.

For offshore tank containers certified for dangerous goods the dossier shall also include DNV GL's tank container certificate.

For offshore service containers certified to [DNVGL-ST-E272](#) the relevant certificate and any other relevant documentation required by the standard shall also be included.

SECTION 6 MARKING

6.1 Safety marking

The tops of closed containers and the top rails of open and framed containers shall be marked to clearly delineate their perimeter, particularly in poor light. This marking shall be as follows:

- a) a band of solid contrasting colour not less than 100 mm wide round the roof perimeter of closed containers; if the roof of the container is recessed below the top perimeter rail, at least the top surface of the top rail shall be marked.
- b) open and framed containers, shall be marked with either hatching in a contrasting colour on the top rails or the top rail shall be a solid light colour.

Where a container is fitted with fork pockets designed for handling the container when empty only (e.g. on some tanks and long baskets) then the words Empty Lift Only shall be clearly displayed near each set of fork pockets in characters not less than 50mm high.

Aluminium containers shall be marked ALUMINIUM CONTAINER on all four sides in letters at least 75 mm high. See guidance 4 in [4.1].

Other safety markings that may be required by DNV GL shall be in characters not less than 50 mm high.

6.2 Identification and certification markings

The manufacturer's serial number shall be welded on the container structure in characters at least 50 mm high

Each container shall also be marked with a container number issued by the owner as a unique identification which should be the common cross-reference on in-service certification and shipping documentation.

This container number shall be prominently displayed on all sides of the container in characters of a contrasting colour, not less than 75 mm high.

Guidance note:

For open side containers it may be necessary to attach panels specifically to carry the container number.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

If a container has a roof, the container number shall be displayed on the roof, in characters at least 300 mm high, or less if space is limited. The marking shall be carried out in such a way as to avoid incorrect interpretation (e.g. by underlining). Where applicable the lower edge of the marking shall be positioned near the side of the container in which the door is located.

The container number may be changed by the owner or if the ownership changes. In this case the marking shall be changed, the inspection plate be changed or replaced and the certificate revised.

For certification marking applied by DNV GL, see [5.6].

6.3 Information markings

Information marking shall normally be placed on a door if the container has end doors, or in other prominent place on the side of containers without such doors.

Each container shall be clearly marked, in characters at least 50 mm high of contrasting colour, with:

- maximum gross mass (in kg)
- tare mass (in kg)
- payload (in kg).

Guidance note 1:

On each container, a matt black square of sufficient size should be provided for information markings such as destination, cargo hazard etc.

When the owner is a leasing or rental company, the words on hire to may appear across the top to identify the user.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Guidance note 2:

When an offshore container is transporting dangerous goods, it must be marked with placards in accordance with the IMDG code.

The placarding for dangerous goods should be according to the IMDG code Chapter 5.3. There should be sufficient space for a placard on the black panel. (Placards are diamond shaped, 250x250 mm.) These placards must be removed when the container no longer contains dangerous goods.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

If applicable, a container shall be clearly marked with relevant electrical hazard classification and zone marking according to ATEX Directive (94/9/EC)

6.4 Marking of lifting set

The lifting set and its components shall be marked as described in [Sec.8](#).

6.5 Other marking

The user of the container may add additional information marking such as owner's name etc. However, to avoid misinterpretation additional marking should be kept to a minimum.

If the container is fitted with an intermediate deck the payload of the deck shall be displayed on the inside of the container in a position where it is clearly visible at all times, in characters of a contrasting colour not less than 50 mm high.

Note:

Offshore containers are not covered by the EU Machinery Directive, and CE marking is not required on offshore containers, but lifting sets should be CE marked in accordance with the Machinery Directive.

---e-n-d---o-f---n-o-t-e---

SECTION 7 PLATING OF CONTAINERS

7.1 General

Containers shall be fitted with a data plate and an inspection plate. Plates shall be made of corrosion resistant material securely attached externally in a manner designed to avoid unauthorised or accidental removal. The plates shall be fitted to an end door, or, on containers with no such doors, in a prominent position.

Aluminium rivets have been found to be unsuitable as a fixing method in the offshore environment and shall not be used.

The information on the plates shall be in the English language; (provision for a second language may be made at the option of the owner).

The text shall be permanently and legibly marked on the plates in characters not less than 4 mm in height.

Note:

The data plate and the inspection plate may be combined into one plate.

---e-n-d---o-f---n-o-t-e---

The data plate shall not be removed from the container, but if the plate is becoming illegible it may be replaced by an identical plate. The inspection plate may be replaced when there is no more space to record inspections.

7.2 Data plate

When containers are certified by DNV GL the data plate shall be headed
OFFSHORE CONTAINER DATA PLATE
DNV GL 2.7-1

Guidance note:

For containers certified by DNV GL, this marking may be combined with marking according to EN 12079-1 thus:

OFFSHORE CONTAINER DATA PLATE
DNV GL 2.7-1/EN 12079-1

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

The data plate shall contain the following information:

- a) name of manufacturer
- b) month/year of manufacture
- c) manufacturer's serial number
- d) maximum gross mass (kg) at the design sling angle
- e) tare mass (kg)
- f) payload (kg) and intermediate deck payload (if applicable)
- g) DNV GL certificate number and DNV GL hard stamp, (see [5.6])
- h) design temperature.

A recommended format for the data plate, when certified by DNV GL, is shown in [Figure 7-1](#).

OFFSHORE CONTAINER DATA PLATE*

DNV GL 2.7-1

Name of manufacturer:	
Month/year of manufacture:	
Manufacturer's serial no:	
Maximum gross mass:	kg at ° sling angle
Tare mass:	kg
Payload: Container	kg
Intermediate deck	kg
Certificate no:	
Design Temperature:	°C

* See also guidance in [7.2].

Figure 7-1 Information plate

7.3 Inspection plate

When containers are certified by DNV GL the plate shall be headed
OFFSHORE CONTAINER INSPECTION PLATE
DNV GL 2.7-1

Guidance note 1:

For containers certified by DNV GL, this marking may be combined with marking according to EN 12079-3 thus:

OFFSHORE CONTAINER INSPECTION PLATE
DNV GL 2.7-1/EN 12079-3

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

The plate shall contain the following information:

- owner's container number (see [6.2])
- owner's name
- date of last inspection.

To avoid confusion, the plate shall not carry the date of the next inspection. Provision shall be made on the plate to facilitate permanent marking to record a minimum of 9 inspections.

A recommended format for the inspection plate, when certified by DNV GL, is shown in Figure 7-2:



OFFSHORE CONTAINER INSPECTION PLATE*		
DNV GL 2.7-1		
Container No.:		
Name of Owner:		
Inspections:		

* See also guidance in [\[7.3\]](#)

Figure 7-2 Inspection plate

At each periodic or other inspection, this plate shall be marked as described in [\[9.2\]](#).

Guidance note 2:

Users of containers should regard the information plate as prima facie evidence of certification status.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Guidance note 3:

Containers with less than 30 days currency of certification should not be shipped to any offshore installation, except by prior agreement with the shipper.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

SECTION 8 LIFTING SETS

8.1 General requirements

The lifting set (chain or wire rope slings and shackles) shall be specially designed for use on offshore containers, and shall normally not be removed from the container except for replacement.

The slings shall be attached to the pad eyes on containers by shackles. Shackle bolts shall be secured to prevent unwanted opening of the shackle.

Guidance note:

When a service container or other offshore container is installed for an extended period on an offshore installation, the lifting set may be removed for the duration of the installation period.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

When a lifting set on a container is replaced, the new set shall be made to the original specification or equivalent and certified and marked accordingly.

The manufacturer shall ensure the quality of procedures and facilities by implementing a quality management system at least in accordance with ISO 9001. The quality management system shall be to the satisfaction of DNV GL.

8.2 Approval and certification of lifting sets

Only lifting sets that are approved by DNV GL shall be used on certified offshore containers. Lifting sets and components shall be tested according to the applicable standards.

Normally lifting slings (chain or wire rope) and the main components shall be type approved. Type approval shall be according to [App. H Type approval of lifting sets for offshore containers](#). Before a type approval certificate can be issued, manufacturers of lifting sets and lifting set components will be audited by DNV GL. In order to retain the type approval, manufacturers will be audited regularly by DNV GL.

Note:

The components which require type approval are shackles, chains, links (including master links and master link assemblies intermediate links, end links) and couplings. Wire rope, ferrules and thimbles do not have to be type approved.

---e-n-d---o-f---n-o-t-e---

Product certificates issued by the manufacturer based on their type approval shall be according to [\[8.5\]](#).

In special cases DNV GL may issue product certificates instead of type approval certificates. This procedure may be used if no type approved products are available or if a manufacturer has not received a type approval certificate at the time the products are delivered. Such DNV GL product certificates may be issued for individual products or batches of products.

Guidance note 1:

If lifting set certificates are also issued by agents for a manufacturer, these lifting certificates should contain references to the manufacturer's certificate and to DNV GL's type approval.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Lifting sets and components shall comply with a recognized standard and with the additional requirements given in this section. Design, testing and certification shall be according to the specified standard.

Guidance note 2:

Lifting sets for offshore containers approved and certified according to this section are generally also considered to be loose lifting equipment and this should be reflected in the certificates. Where appropriate, the lifting set should be CE marked.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

8.3 Design of lifting sets

Slings shall be rated for their intended angle of use. In all cases four leg slings shall be rated as for three leg slings. Normally the sling leg angle from vertical for two and four leg slings should be 45°, but smaller angles can be used. In no case shall a sling be designed with an angle of the sling legs to the vertical larger than 45°.

In order to facilitate handling and improve safety, it is often advisable to use an extra (top) leg with a ring and or link above the master link. The top link should be sized to facilitate hooking on to a crane forerunner.

Guidance note:

It is recommended that the master link to be attached to the crane hook should have minimum internal dimensions 270 × 140 mm.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

The lifting set shall be of sufficient length to allow easy handling by operators. The top link or master link shall be able to reach down to a height of no more than 1.3 m above the container bottom when the sling hangs over the long side of the container.

Where two 2-legged slings are selected to function as a 4-legged sling, they shall be calculated as for a 4-legged sling. See also [8.6] for special marking requirement.

Note:

When 2 separate 2-legged slings are used, the angle from vertical is not the same as the angle between the 2 parts.

---e-n-d---o-f---n-o-t-e---

The allowable tolerances of shackles to pad eyes are given in [4.4.1].

App.E contains examples on how to select lifting slings and lifting set components for both standard and non-standard lifting sets. This appendix also includes tables with working load limits for single, two and four leg chain and wire rope slings.

8.3.1 Dimensions and strength of lifting sets

To allow for the dynamic amplification that will be experienced in offshore lifting in adverse weather and sea states, the minimum working load limit, WLL_{min} of the lifting sets for offshore containers shall be determined for the lifting set and each of its components according to the requirements below.

Table 8-1 shall be used for determination of the minimum working load limit, WLL_{min} for lifting sets. In this table the rating of a container is multiplied by an enhancement factor to give an enhanced requirement for the working load limit. This enhancement factor reflects the additional dynamic loads in offshore lifting. The enhancement factor is higher for light containers because light containers are subject to the most severe dynamic amplification. For containers with rating up to 2000 kg the WLL_{min} has not been calculated using an enhancement factor, but instead the minimum value given in Table 8-1 shall be used.

Table 8-1 Determination of working load limit

<i>Rating (kg)</i>	<i>Enhancement factor</i>	<i>Minimum required working load limit (WLL_{min}) (t)</i>
500	-	7.00
1 000	-	7.00
1 500	-	7.00
2 000	3.500	7.00
2 500	2.880	7.20
3 000	2.600	7.80
3 500	2.403	8.41
4 000	2.207	8.83
4 500	2.067	9.30
5 000	1.960	9.80
5 500	1.873	10.30
6 000	1.766	10.60
6 500	1.733	11.26
7 000	1.700	11.90
7 500	1.666	12.50
8 000	1.633	13.07
8 500	1.600	13.60
9 000	1.567	14.10
9 500	1.534	14.57
10 000	1.501	15.01
10 500	1.479	15.53
11 000	1.457	16.02
11 500	1.435	16.50
12 000	1.413	16.95
12 500	1.391	17.38
13 000	1.368	17.79
13 500	1.346	18.18
14 000	1.324	18.54
14 500	1.302	18.88
15 000	1.280	19.20
15 500	1.267	19.64

<i>Rating (kg)</i>	<i>Enhancement factor</i>	<i>Minimum required working load limit (WLL_{min}) (t)</i>
16 000	1.254	20.06
16 500	1.240	20.47
17 000	1.227	20.86
17 500	1.214	21.24
18 000	1.201	21.61
18 500	1.188	21.97
19 000	1.174	22.31
19 500	1.161	22.64
20 000	1.148	22.96
20 500	1.143	23.44
21 000	1.139	23.92
21 500	1.135	24.39
22 000	1.130	24.86
22 500	1.126	25.33
23 000	1.121	25.79
23 500	1.117	26.25
24 000	1.112	26.70
24 500	1.108	27.15
25 000	1.104	27.59

Note:

The enhancement factors are only included in Table 8-1 for information purposes. They are only used for calculating the WLL_{min} values in the last column, and are not necessary for any other calculations.

---e-n-d---o-f---n-o-t-e---

The enhanced WLL_{min} value from [Table 8-1](#) is used to determine the nominal size of each part of the lifting set, and applies for all components and configurations, i.e. for single, two and four leg lifting slings with any angle, for shackles, links and couplings

For intermediate container ratings the working load limit values may be interpolated.

8.3.1.1 Standard lifting sets

Four leg chain or wire rope slings

Slings with legs 45 ° to the vertical. Forerunners (5th leg) are calculated as single legs.

Slings shall be selected from a recognized standard for lifting slings or from a DNV GL type approval certificate, and shall have WLL at least as big as the WLL_{min} from Table 8-1. App.E includes tables with WLL for chain and wire rope slings based on EN 818-4 and EN 13414-1.

Shackles

The minimum working load limit of each shackle (WLL_s) shall be calculated as given in Table 8-2 where WLL_{min} is determined from Table 8-1.

Table 8-2 Minimum shackle working load limit (WLL_s)

<i>Required minimum shackle WLL_s</i>		
<i>4 legged sling</i>	<i>2 legged sling</i>	<i>Single leg sling</i>
$WLL_{min} / (3 \times \cos 45^\circ)$	$WLL_{min} / (2 \times \cos 45^\circ)$	WLL_{min}

Shackles shall be selected from a recognized standard for shackles or lifting components or from a DNV GL type approval certificate, and shall have WLL at least as big as the WLL_s from Table 8-2.

8.3.1.2 Non-standard lifting sets

Each component of a lifting set may be individually calculated. This may be necessary if the sling leg angle is other than 45°, if the sling is asymmetric or if non-standard components are used.

Note:

The sling leg is not necessarily the weakest part of the lifting set. If sling leg angle is < 45° from the vertical, the load on each leg is reduced, and it may be possible to use a smaller chain or wire rope dimension. However, the load on the master link assembly is not reduced. Consequently, it may be necessary to assemble a special sling. See examples 2 and 3 in App.E.

---e-n-d---o-f---n-o-t-e---

The required working load limit for each component in 2 and 4 leg lifting sets can be determined from the formula:

$$\text{Required WLL} = WLL_{min} / (n \times \cos \beta)$$

This can be expressed in the following table.

Table 8-3 Minimum working load limit (WLL_s) for sling leg components and shackles

<i>Required minimum WLL_s for sling leg components and shackles</i>		
<i>4 legged sling</i>	<i>2 legged sling</i>	<i>Single leg sling</i>
$WLL_{min} / (3 \times \cos \beta)$	$WLL_{min} / (2 \times \cos \beta)$	WLL_{min}

where:

- WLL_{min} = as determined from Table 8-1
- β = the angle of the sling leg to the vertical

Components (chain, wire rope, shackles, links, and couplings) with the required WLL_s shall then be selected from a recognized standard or from DNV GL type approval certificates

For single leg lifting sets, forerunners and master links, the required $WLL = WLL_{min}$

If a wire rope sling shall be designed based on the properties of a wire rope, this can be calculated as shown in [App.E](#), example 3. Thimbles and ferrules of the appropriate size for the wire rope dimension shall be used.

8.3.2 Lifting set components

8.3.2.1 Chain slings

Chain slings shall be according to EN 818-4 grade 8 or other recognized standard. Other grades may be accepted after special consideration by DNV GL.

8.3.2.2 Wire rope slings

Wire rope slings shall be according to EN 13414-1 or other recognised standard.

Wire rope grade 1770 or 1960 shall be used. The working load limit may be determined based on the specified rope grade.

Wire rope shall be 6-stranded and of type 6×19 or 6×36 and may be fibre cored or steel cored.

The terminations of wire rope legs shall be ferrule secured eyes with thimbles, and comply with EN 13411 - 3 or other recognised standard.

Guidance note:

As an aid to inspection, ferrules which permit the tail end of the rope to be visible are recommended.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

8.3.2.3 Shackles

Shackles shall be according to EN 13889 or EN 1677-1, or other recognised standard. with the additional requirements:

- the minimum breaking force for shackles shall not be taken as less than 5 times the WLL
- the tolerance on the nominal diameter of the shackle pin shall be -1/+3%.

Note:

Shackles are normally separate components from the chain or wire rope slings, and are often supplied separately from these. Shackles are considered as part of the lifting sling if assembly secured. (See also [\[9.3.1\]](#).)

---e-n-d---o-f---n-o-t-e---

Shackles shall be of bolt type with hexagon nut and split pin. Screw pin shackles shall not be used.

Guidance note:

On existing containers where location and design of pad eyes are such that it is not possible to use shackles with nut and split pins, screw pin shackles may be used. They should be secured to prevent unintentional withdrawal.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

8.3.2.4 Couplings

Couplings for mechanical assembly of slings can be certified after special consideration. Such couplings shall be designed only for opening with special tools, and the bolt shall be of a design that can not be replaced by standard bolts intended for other purposes.

Hinged type couplings shall not be used.

Note:

This restriction is to prevent the coupling from seizing in the folded condition and subsequently failing when forced straight under load.

---e-n-d---o-f---n-o-t-e---

8.4 Materials

Steels shall comply with the material requirements of the recognised standard, have good ductility at low temperatures, and be able to withstand dynamic loads.

Steels in chains, links, shackles and couplings shall be impact tested by the Charpy impact (V-notch) method in accordance with [3.1.1]. The impact test temperature shall be equal to the design air temperature T_D and the minimum average impact energy shall be 42J. However, for welded components (chains, links etc.) it shall be sufficient only to take impact test samples in the weld with the notch centred in the fusion line. The position of the weld shall be accurately identified by etching with a suitable reagent before cutting the notches. The minimum average impact energy of the weld shall be 27 J.

Materials in wire ropes, ferrules and thimbles shall be in accordance with applicable standards.

Galvanising shall only be carried out under the control of the manufacturer of the component.

Materials used in each separate component of the lifting set (e.g. chains, bows and bolts for shackles, links and wire ropes) shall be supplied with traceable works material certificates (inspection certificates, type 3.1) according to EN 10204.

Other items such as thimbles and ferrules shall be supplied with material certificates according to EN 10204, test report type 2.2.

8.5 Certificates for lifting sets and components

The certificates required by [8.2] for lifting sets and lifting set components shall contain the information specified in the relevant product standard, together with that specified in [8.5.1] or [8.5.2] as appropriate.

The WLL to be used in certificates and marked on lifting sets shall be the maximum rating of an offshore container on which the sling can be used, at the given sling leg angle.

Note:

The rating (WLL) of the lifting set is not necessarily the same as the rating (MGW) of the container to which it is attached.

---e-n-d---o-f---n-o-t-e---

The lifting set certificate numbers should normally be included on the DNV GL offshore container certificate and the certificates attached to it. However, if the owner or operator has a system for keeping track of each container and lifting set, other procedures may be used.

8.5.1 Sling certificates

Certificates for chain or wire rope slings shall at least include the following information:

- manufacturer's name, mark and location
- date of issue for the certificate (preferably in ISO format: YYYY-MM-DD)
- sling certificate number
- reference to DNV GL type approval certificate when relevant
- description of the sling, including unique identification number or mark; reference to each single component's unique identification mark (if new components are installed before re-certification reference to previous certificate number and the new components unique identification mark)
- nominal size and length of the sling
- working load limit (WLL) together with the designed angle to the vertical for multi-leg slings
- date of sling manufacture or re-certification
- confirmation that the sling described has been designed, manufactured and tested in accordance with this standard
- signature of the authorised DNV GL surveyor, or of the manufacturer when the certificate is issued according to a type approval issued by DNV GL.

In addition:

- for wire rope slings, the grade of terminal fittings and the rope together with information about which standard the sling conforms to;
- for chain slings, the grade mark together with information about which standard the sling conforms to. For chain slings assembled by welding, cross reference to the results of any final testing of mechanical properties after heat treatment;
- for assembly secured slings, reference to the certificates for the shackles.

8.5.2 Component certificates

Certificates for chains, shackles, master links and master link assemblies and couplings shall at least include the following information:

- manufacturer's name, mark and location
- date of issue for the certificate (preferably in ISO format: YYYY-MM-DD)
- certificate number
- reference to DNV GL type approval certificate when relevant
- description of the component
- information about which standard the sling conforms to
- reference to material certificates or material specification including chemical composition and mechanical properties
- results from tests specified in the relevant product standard and in this section
- record of the unique identification number or mark carried by the component
- signature of the authorised DNV GL surveyor, or of the manufacturer when the certificate is issued according to a type approval issued by DNV GL.

8.6 Marking of lifting sets

The various components in the lifting set shall be marked according to the applicable standard.

Shackles shall be indelibly marked with a unique identification.

Guidance note:

Such marking must be applied using low stress stamps, the height of which should be a minimum of 5 mm, and positioned away from areas of highest tensile stress i.e. applied to the straight section of the body adjacent to the eye.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Slings shall be marked with an identification tag permanently attached to the top assembly of the sling. An example is shown in [Figure 8-1](#). The tag shall be made of metal with the marking permanently embossed or stamped. The tag shall be 8-sided for grade 8 chain slings and round for wire rope slings. The text shall be permanently and legibly marked on the tags in characters not less than 4 mm in height.

Where two 2 leg slings are selected to function as a 4 leg sling, both shall be marked as a 4 leg sling.

Marking on tags for chain and wire rope slings that have been type approved or individually certified by DNV GL shall include:

- when applicable: the CE mark
- reference to this standard¹⁾
- the certificate number and, if applicable, the unique identification number of the sling²⁾
- the number of legs
- diameter of chain or wire rope used, including the top leg where fitted
- WLL of the lifting set
- maximum angle of the sling legs from the vertical
- identification number of each shackle.

1) This marking shall be DNV GL 2.7-1

The marking may be combined with marking according to EN 12079-1 thus: DNV GL 2.7-1/EN 12079-1

- 2) Since one certificate may cover several lifting sets, it may be necessary to include both the certificate number and a unique identification number to get a unique identification.

For inspection marking on the tag at periodic surveys see [9.5].

An example of an identification tag for a chain sling is shown below.

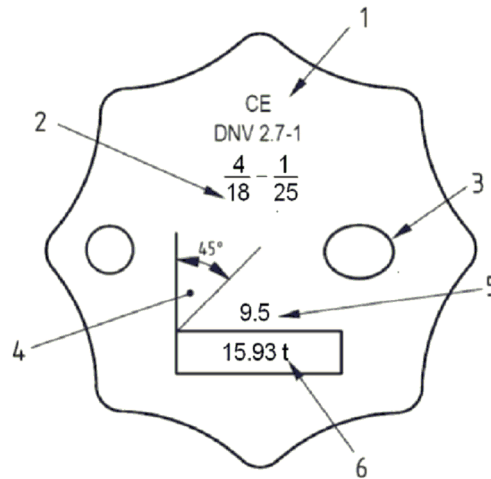


Figure 8-1 Example of identification tag for a chain sling – front of identification tag

- 1) CE mark and Reference to DNV GL 2.7-1
- 2) 4 legs of 13mm, 1 forerunner of 22 mm (example)
- 3) Manufacturer's mark
- 4) Sling angle
- 5) Shackle size
- 6) WLL (according to [8.5])

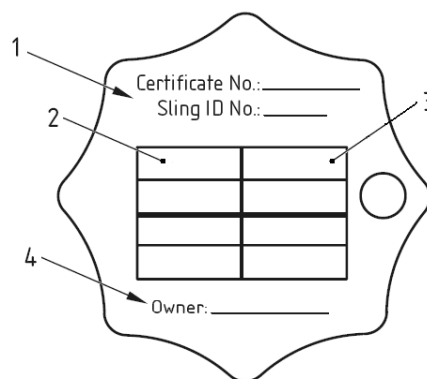



Figure 8-2 Example of identification tag for a chain sling – Back of identification tag

- 1) Certificate number (and unique identification number if applicable)

- 
- 2) Column 1: inspector's mark, inspection suffix and date of periodic inspections (shall be of format YY-MM-DD)
 - 3) Column 2: shackle ID number
 - 4) The owner's name may optionally be included

SECTION 9 PERIODIC EXAMINATION, TESTS AND REPAIRS

9.1 General

The basic conditions for maintaining the validity of container certificates are given in [2.5].

It is the responsibility of the owner or an appointed representative to retain current certification for each container, to arrange for periodic inspection, to record substantial repairs, modifications or changes in identification etc., and to maintain adequate records to ensure traceability.

Guidance note:

If a container has not been in use and has exceeded its periodic inspection date, it should be inspected before it is taken into use. The same applies for offshore service containers that have remained in service on an offshore installation past the due inspection date.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Before carrying out a periodic examination or test, the inspector should refer to the initial certificate and, if possible, to the last inspection report.

9.2 Inspection, test and repairs on containers

9.2.1 Schedule of examination and tests

Containers shall be periodically examined and tested in accordance with the schedule listed in Table 9-1. The inspector may require other or additional tests and examinations, and dismantling if considered necessary.

Guidance note:

National authorities may have stricter requirements for periodical inspections.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

When a lifting test is required, the non-destructive testing and thorough visual examination shall both be carried out after the lifting test.

Table 9-1 Schedule of examination and tests of offshore containers

Time or interval	Type of inspection			
	Lifting test as described in 4.6.3.2	NDT of pad eyes ²⁾	Visual inspection	Suffix to be marked on inspection plate
At intervals not exceeding 12 months	NA	NA	Yes	V
At intervals not exceeding 48 months	NA	Yes	Yes	VN
After substantial repair or alteration ¹⁾	Yes	Yes	Yes	T

1) A substantial repair or alteration means any repair and/or alteration carried out, which may, in the opinion of the surveyor, affect the primary elements of the offshore container, or elements which contribute directly to its structural integrity.
2) Including supporting structure if relevant.

Suffix T: to indicate proof load test, NDT and visual examination.
Suffix VN: to indicate NDT and visual examination.
Suffix V: to indicate visual examination only.

Offshore tank containers for dangerous goods shall in addition to the above be inspected by DNV GL or another authorised inspection body in accordance with the IMDG code.

9.2.2 Visual inspection

9.2.2.1 General

The visual inspection shall be of the exterior and the interior of the container without cargo to ensure that the container is fit for use. All load bearing parts, especially the base structure, shall be inspected. For containers with fixed equipment, the inspector shall determine whether access to load bearing parts is adequate.

The inspection shall be carried out in a situation providing sufficient lighting and other facilities necessary to allow it to be carried out safely and effectively. The facility shall include suitable means of lifting and supporting the container for the purposes of inspecting the under-side.

9.2.2.2 Markings

The markings and plates shall be checked to ensure that they meet the requirements of this standard and other relevant regulations and standards.

9.2.2.3 Welds

Welds in the primary structure shall be visually inspected to ensure freedom from visible defects.

9.2.2.4 Pad eyes and lashing points

All pad eyes and lashing points shall be visually inspected for distortion, mechanical damage or any other sign of distress or overload.

9.2.2.5 Structure

The structure shall be visually inspected for corrosion, mechanical damage or injurious deformation.

9.2.2.6 Door closures

Doors, frames, seals, hinges, locks, etc shall be visually inspected and functionally checked to ensure that they operate in a satisfactory manner without undue force being required.

9.2.2.7 Floor

The floor to check that it is not deformed and that it shows no signs of distress or overload. Drainage facilities, where fitted, shall be inspected, drain holes shall be clear of debris.

9.2.2.8 Fork pockets

Fork pockets shall be visually inspected inside.

Guidance note:

Fork pockets are usually not painted inside and may be heavily corroded. Fork pockets with openings in the bottom plate may be damaged by fork lift trucks. This should be taken into account when inspecting the fork pockets.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

9.2.3 Non-destructive testing

NDT to be carried out according to the requirements in [5.2.4].

9.2.4 Use of Eddy current testing at periodic inspections

For periodic inspections Eddy current testing (ET) can be accepted. Eddy current testing shall be performed according to EN ISO 17643 or [DNVGL-CG-0051](#).

Note 1:

Eddy Current Testing is a recognized NDT method that has the advantage that it can be performed without stripping off the paint on a welded connection.

---e-n-d---o-f---n-o-t-e---

ET can only be used on painted surfaces provided the surface to be investigated is free from damage. Structures with very rough and/or damaged surfaces shall not be inspected by ET.

If indications are found in the ET inspection the paint is to be stripped off and the weld shall be inspected by means of the relevant NDT techniques and acceptance criteria referred in [\[5.2.4\]](#).

Personnel performing ET testing shall be qualified and certified to ET level 2 or 3 in accordance with EN ISO 9712 or other equivalent recognised standard or certification schemes.

Note 2:

Since no acceptance criteria are specified for ET only experienced and competent operators should perform such inspections.

---e-n-d---o-f---n-o-t-e---

9.2.5 Repairs and modifications of containers

After renewal or substantial repair of damaged parts of the primary structure of a container, it shall be recertified. This may include strength testing. Renewal or repair of damaged parts shall be carried out using approved manufacturing procedures and materials which are at least equivalent to the original

The repair shall be noted on the certificate and the repair report should be attached to the certificate as an appendix.

If a container is rebuilt, repaired with different materials or profiles with different cross sections or otherwise significantly modified (including increased rating), it shall be re-approved, new prototype tests according to [\[4.6\]](#) may be required and a new certificate shall be issued. The old certificate shall be marked "Deleted" and attached to the new certificate.

9.2.6 Marking of the inspection plate

On satisfactory completion of the examination and/or test(s), the inspection plate, described in [\[7.3\]](#), shall be marked with the date of inspection, the inspectors mark and the relevant suffix as detailed in [Table 9-1](#).

9.3 Inspection, test and repairs on lifting sets

9.3.1 Schedule of examination and tests

Lifting sets shall be inspected at intervals not exceeding 1 year in accordance with the schedule listed in [Table 9-2](#). The inspector may require other or additional inspections, examinations or tests.

On satisfactory completion of the examination, the inspector shall check that the lifting set is marked as described in [\[8.6\]](#)

When the schedule requires a load test, any non-destructive examination and visual inspection shall be carried out after the load test.

Shackles that are not assembly secured may be inspected independently of the lifting sling. Shackles that are assembly secured shall be inspected as part of the lifting sling. See also [\[9.4\]](#).

Table 9-2 Schedule of examination and tests of lifting sets for offshore containers

Time or interval	Applicable to	Type of inspection			
		Load test	NDT	Visual inspection	Suffix to be marked on sling tag
At intervals not exceeding 12 months	Complete lifting set	NA	NA	Yes	V
At intervals not exceeding 48 months	Sling components and joining links excluding legs	Either NDT or load test ²⁾		Yes	VN or T
	Chain sling legs	Either NDT or load test ^{2) 3)}		Yes	VN or T
	Shackles	NA	NA	Yes	V
	Wire rope legs	NA	NA	Yes	NA
After substantial repair or alteration ¹⁾	Complete lifting set	Yes	Yes	Yes	T
<p>1) A substantial repair or alteration means any repair and/or alteration carried out, which may, in the opinion of the surveyor, affect the primary elements of the offshore container, or elements which contribute directly to its structural integrity.</p> <p>2) Test according to applicable standards.</p> <p>3) NDT to be performed on the end links of each leg + 10% of the leg length. The location of the 10% to be based on the visual examination.</p>					

Suffix T: to indicate proof load test, NDT and visual examination.

Suffix VN: to indicate NDT and visual examination.

Suffix V: to indicate visual examination only.

9.3.2 Load testing of chain sling legs

Load testing of chain sling legs A test load equal to $2 \times$ WLL of a single leg rated in accordance with EN 818-4 (Table 3) +/- 2%, shall be applied to each leg without shock. The load shall be applied for a minimum of 2.5 minutes before measurements are taken.

9.3.3 Non-destructive testing of sling components except wire rope legs

Magnetic particle examination shall be carried out according to the requirements in [5.2.4].

9.3.4 Visual inspection of the lifting set

The inspection shall be carried out in a situation providing sufficient lighting and other facilities necessary to allow it to be carried out safely and effectively.

9.3.5 Chain and wire rope slings and components.

Inspection of chain and wire rope slings and components shall be carried out in accordance with EN 818-6 and 13414-2 as applicable.

9.3.6 Shackles

Shackles shall be visually inspected.

9.3.7 Marking of the lifting set tag

On satisfactory completion of examination and/or test(s), the sling identification tag, described in [8.6], shall be marked in column 1 on the back of the identification tag, with the date of inspection, the inspector's mark and the relevant suffix as detailed in Table 9-2.

If shackles are replaced, column 2 on the back of the tag shall be revised or the tag replaced.

9.4 Inspection, test and repairs on tank containers

Offshore tank containers that are certified for dangerous goods according to the IMDG code are subject to 5-year periodic inspections and tests, and to intermediate 2.5-year periodic inspections and tests.

Such inspections and tests, which can only be carried out by DNV GL or other authorised certifying bodies, shall include the tank, its fittings and accessories, the container frame and its lifting set and the data plates and markings. Items which are normally to be inspected are listed on the relevant DNV GL form.

9.5 Inspection reports

When, in the opinion of the inspector, a container and its lifting set is suitable for service, an Inspection Report shall be issued. If containers and lifting sets are inspected separately, separate reports may be used, and if shackles that are not assembly secured are inspected separately from the lifting sling, another report may be used for the shackles.

The inspection reports shall be attached to the container certificate or be inserted in the as built dossier.

The inspection report shall show at least the following information:

- a) container/lifting set identification (including owner's container number)
- b) owner's name, or delegated nominee
- c) certificate number
- d) date and number of the preceding certificate of examination, name of person who issued it and of the employer
- e) the total gross mass in kilograms applicable to the all points lifting test and the method of test (where relevant)
- f) details of NDE carried out (where relevant)
- g) a statement that the container/lifting set described was thoroughly examined and that the particulars are correct
- h) reference where appropriate to any report issued to the owner arising from the test/inspection process
- i) confirmation that the inspection plate/lifting set tag was marked
- j) date of inspection (date of report also to be shown if different from date of inspection)
- k) the DNV GL mark and the signature and unique identification mark of the inspector.

APPENDIX A LIST OF REFERENCES

A.1 Standards for containers

Table A-1 Standards for containers

<i>Reference</i>	<i>Title</i>
DNVGL-ST-E272	2.7-2 Offshore service modules
DNVGL-ST-E273	2.7-3 Portable offshore units
EN 12079-1	Offshore containers and associated lifting sets – Part 1: Offshore container - Design, manufacture and marking
EN 12079-2	Offshore containers and associated lifting sets – Part 2: Lifting sets - Design, manufacture and marking
EN 12079-3	Offshore containers and associated lifting sets – Part 3: Periodic inspection, examination and testing
ISO 668	Series 1 freight containers – Classification, dimensions and ratings
ISO 1161	Series 1 freight containers – Corner fittings – Specification
ISO 1496-1	Series 1 freight containers - Specification and testing - Part 1: General cargo containers for general purposes
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

A.2 International regulations

Table A-2 International regulations

<i>Reference</i>	<i>Title</i>
CSC	The International Convention for Safe Containers
IMDG Code	The International Maritime Dangerous Goods Code
MSC/Circ.860	Guidelines for the approval of offshore containers handled in open seas
ATEX 94/9/EC Directive	Equipment intended for use in Potentially Explosive Atmospheres
	Code of safe practice for the carriage of cargoes and persons by offshore supply vessels (OSV code)

A.3 Standards for materials

Table A-3 Standards for materials

<i>Reference</i>	<i>Title</i>
EN 10002-1	Metallic materials - Tensile testing - Part 1: Method of test (at ambient temperature)
EN 10025	Hot-rolled products of non-alloy structural steels - Technical delivery conditions
EN 10113-1	Hot-rolled products in weldable fine grain structural steels - Part 1: General delivery conditions
EN 10113-2	Hot-rolled products in weldable fine grain structural steels - Part 2: Delivery conditions for normalized/normalized rolled steels
EN 10113-3	Hot-rolled products in weldable fine grain structural steels - Part 3: Delivery conditions for thermo mechanical rolled steels
EN 10045-1	Metallic materials - Charpy impact test - Part 1: Test method
EN 10088	Stainless steels - Part 1: List of stainless steels
EN 10164	Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions
EN 10204	Metallic products - Types of inspection documents
EN 10210-1	Hot finished structural hollow sections of non-alloy and fine grain structural steels. Technical delivery requirements
EN 10219-1	Cold formed welded structural sections of non-alloy and fine grain steels. Technical delivery requirements
EN 10250-2	Open die steel forgings for general engineering purposes - Part 2: Non-alloy quality and special steels
EN 10250-3	Open die steel forgings for general engineering purposes - Part 3: Alloy special steels
EN ISO 7500-1	Metallic materials. Verification of static uniaxial testing machines. Tension/compression testing machines. Verification and calibration of the force-measuring system
ISO 209-1	Wrought aluminium and aluminium alloys - Chemical composition and forms of products - Part 1: Chemical composition
ISO 630	Structural steels - Plates, wide flats, bars, sections and profiles
ISO 1161	Series 1 freight containers - Corner fittings - Specification
ISO 3755	Cast carbon steels for general engineering purposes
ISO 10474	Steel and steel products -- Inspection documents

A.4 Standards for welding and welders

Table A-4 Standards for welding and welders

<i>Reference</i>	<i>Title</i>
EN 287-1	Approval testing of welders - Fusion welding - Part 1: Steels

<i>Reference</i>	<i>Title</i>
EN 1011-1	Welding - Recommendations for welding of metallic materials - Part 1: General guidance for arc welding
EN 1011-2	Recommendations for welding of metallic materials - Part 2: Guidance for ferritic steels
EN ISO 5817	Welding. Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded). Quality levels for imperfections
EN ISO 9606-1	Approval testing of welders - Fusion welding - Part 1: Steels
EN ISO 9606-2	Approval testing of welders - Fusion welding - Part 2: Aluminium and aluminium alloys
NS-EN ISO 15607	Specification and qualification of welding procedures for metallic materials - General rules
NS-EN ISO 15609-1	Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 1: Arc welding
EN ISO 15614-1	Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys
EN ISO 15614-2	Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 2: Arc welding of aluminium and its alloys
EN ISO 10042	Welding - Arc-welded joints in aluminium and its alloys - Quality levels for imperfections
ANSI/AWS D1.1	Structural Welding Code - Steel
ASME	Boiler and Pressure Vessel Code Section IX - Welding and brazing qualifications

A.5 Standards for inspection and NDE

Table A-5 Standards for inspection and NDE

<i>Reference</i>	<i>Title</i>
EN ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel
EN ISO 17637	Non-destructive testing of welds - Visual testing of fusion-welded joints
EN ISO 3452-1	Non-destructive testing -- Penetrant testing -- Part 1: General principles
EN ISO 23277	Non-destructive testing of welds - Penetrant testing of welds - Acceptance levels
EN ISO 17638	Non-destructive testing of welds - Magnetic particle testing
EN ISO 23278	Non-destructive testing of welds - Magnetic particle testing of welds - Acceptance levels
EN ISO 17636-1	Non-destructive testing of welds. Radiographic testing. Part 1. X- and gamma-ray techniques with film
EN ISO 17636-2	Non-destructive testing of welds. Radiographic testing. Part 2. X- and gamma-ray techniques with digital detectors
EN ISO 17643	Non-destructive testing of welds -- Eddy current testing of welds by complex-plane analysis
EN ISO 11666	Non-destructive testing of welds - Ultrasonic testing - Acceptance levels
EN ISO 17640	Non-destructive testing of welds - Ultrasonic testing - Techniques, testing levels, and assessment

<i>Reference</i>	<i>Title</i>
EN ISO 10675-1	Non-destructive testing of welds -- Acceptance levels for radiographic testing -- Part 1: Steel, nickel, titanium and their alloys
EN ISO 10675-2	Non-destructive testing of welds -- Acceptance levels for radiographic testing -- Part 2: Aluminium and its alloys
DNVGL-CG-0051	Non-destructive testing

A.6 Standards for lifting sets

Table A-6 Standards for lifting sets

<i>Reference</i>	<i>Title</i>
EN 13411	Terminations for Steel wire ropes - Safety - part 3: Ferrules and ferrule securing
EN 13414-1	Steel wire rope slings - Safety - part 1: Wire rope slings
EN 13414-2	Steel wire rope slings - Safety - part 2: Safety criteria and inspection procedures
EN 13889	Forged steel shackles for general lifting purposes - Dee shackles and bow shackles - Grade 6 - Safety
EN 1677 - 1	Components for slings - Safety - Part 1: Forged steel components - Grade 8
EN 1677 - 4	Components for slings - Safety - Part 4: Links, Grade 8
EN 818-4	Short link chain for lifting purposes - Safety - Part 4: Chain slings - Grade 8
EN 818-6	Short link chain for lifting purposes - Safety - Part 6: Chain slings - Specification for use and maintenance to be provided by the manufacturer
ISO 2415	Forged shackles for general lifting purposes -- Dee shackles and bow shackles
US Federal Specification RR-C-271	Shackles. Type IV, Class 6

A.7 Various

Table A-7 Various

<i>Reference</i>	<i>Title</i>
DNVGL-RU-SHIP	DNV GL rules for classification: Ships
ISO 9001	Quality management systems - Requirements
ISO/IEC 17020	General criteria for the operation of various types of bodies performing inspection
BS 8118 Pt. 1	Structural use of aluminium - Code of Practice for design
ISO 8501-1	Preparation of steel substrates before application of paints and related products -- Visual assessment of surface cleanliness -- Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 898	Mechanical properties of fasteners

APPENDIX B EXAMPLE OF OFFSHORE CONTAINER

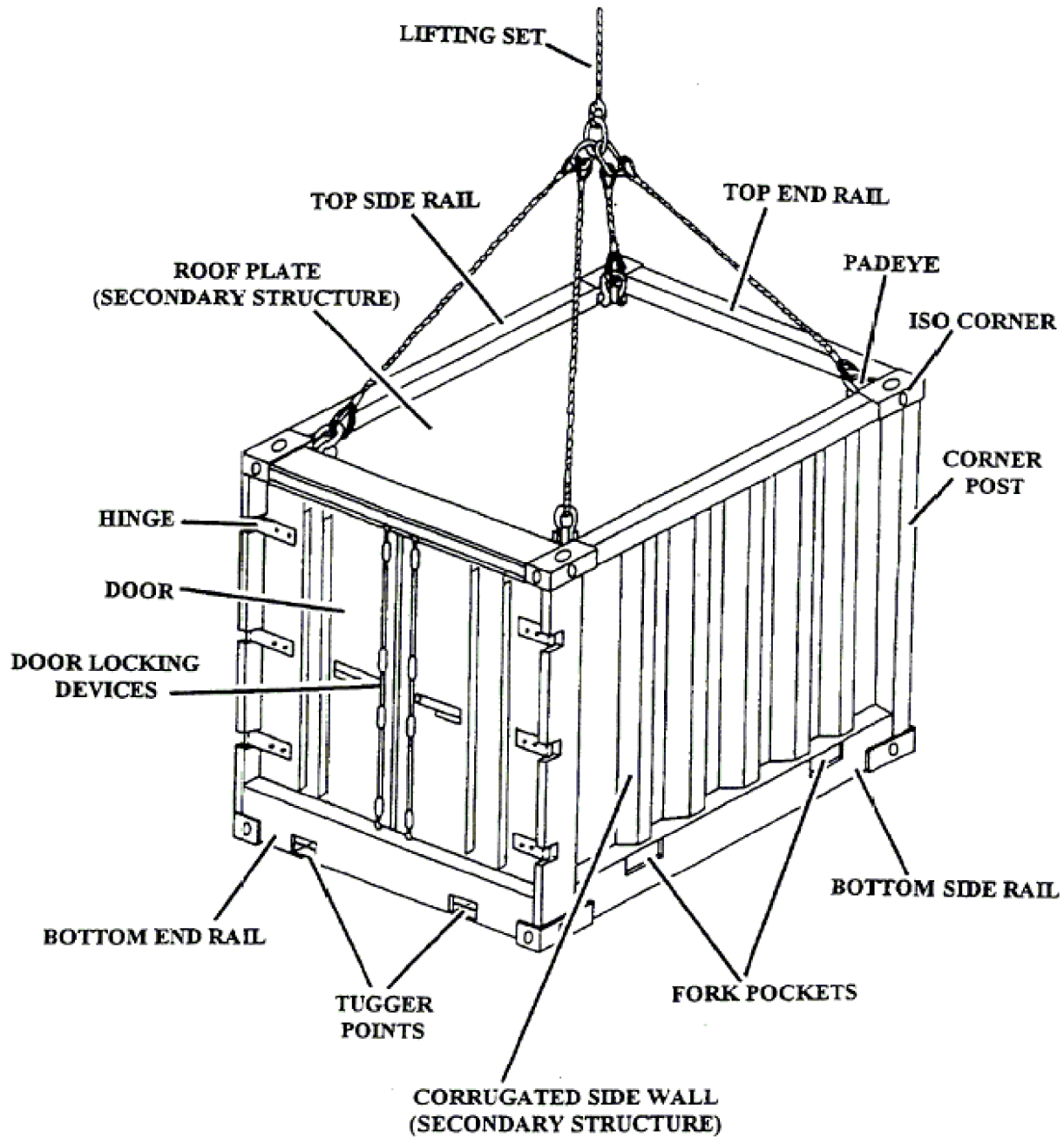


Figure B-1 General cargo container

APPENDIX C GUIDELINES AND EXAMPLES ON STRENGTH CALCULATIONS

C.1 Calculation of the frame

Since secondary structures (walls, roof) are not to be included in the strength calculations, a preferred way to check the overall strength of the container is to make a three dimensional beam model. If FEM modelling is used, only primary structure members should be included.

Before generating the model it must be considered what structural elements to include. This should basically be the primary structure of the unit as defined in [1.4.5].

Special considerations must be taken e.g. if there are removable beams, doors, top rails etc, or if they are bolted or discontinuous. A good procedure is to calculate the strength without taking the removable items into account. An evaluation of how the deflections of the remaining structure will influence the removable structure/locking mechanisms should then be performed. If the removable structure is included in the strength calculation, careful consideration about the ability to transfer forces and moments should be taken before calculation/modelling.

Depending on the geometry, special details may also have to be verified using local models or manual calculations based on output generated from the result file e.g. FEM or detailed calculations.

The model should be loaded as realistically as possible. Where equipment with a specific footprint shall be installed, point loads may be used in beam models. (In FEM models, loads describing the footprints may be used.) Otherwise the load should be evenly distributed on the beams.

In order to load the container as realistically as possible, the lifting set should also be included in the model. Elements which are not able to transfer bending moments should be used. (Hinged ends or beams with moment of inertia close to zero)

The boundary conditions applied to the model are important in order to achieve good results. These should be considered for each container and each load case individually. But as a general rule, for 4-point and 2-point Load Cases, the container should only be fixed at the lifting point. Loads shall be applied where applicable. For some element programmes, to make the matrix equations solvable, spring supported boundary conditions for transformation in x and y directions in bottom corners may be used, see Figure C-1. For symmetrically loaded containers, this will influence the results to a very small degree. For containers with asymmetric loads, the centre of gravity must be in line with the lifting point.

Remember always to check that the reaction force in lifting points conforms to the specified total load.

Example:

Table C-1 Boundary conditions 4-point lifting

	<i>x-trans.</i>	<i>y-trans.</i>	<i>z-trans.</i>	<i>x-rot.</i>	<i>y-rot.</i>	<i>z-rot.</i>
Lifting point	fixed	fixed	fixed	free	free	free
Bottom corners	k=10N/mm	k=10N/mm	free	free	free	free

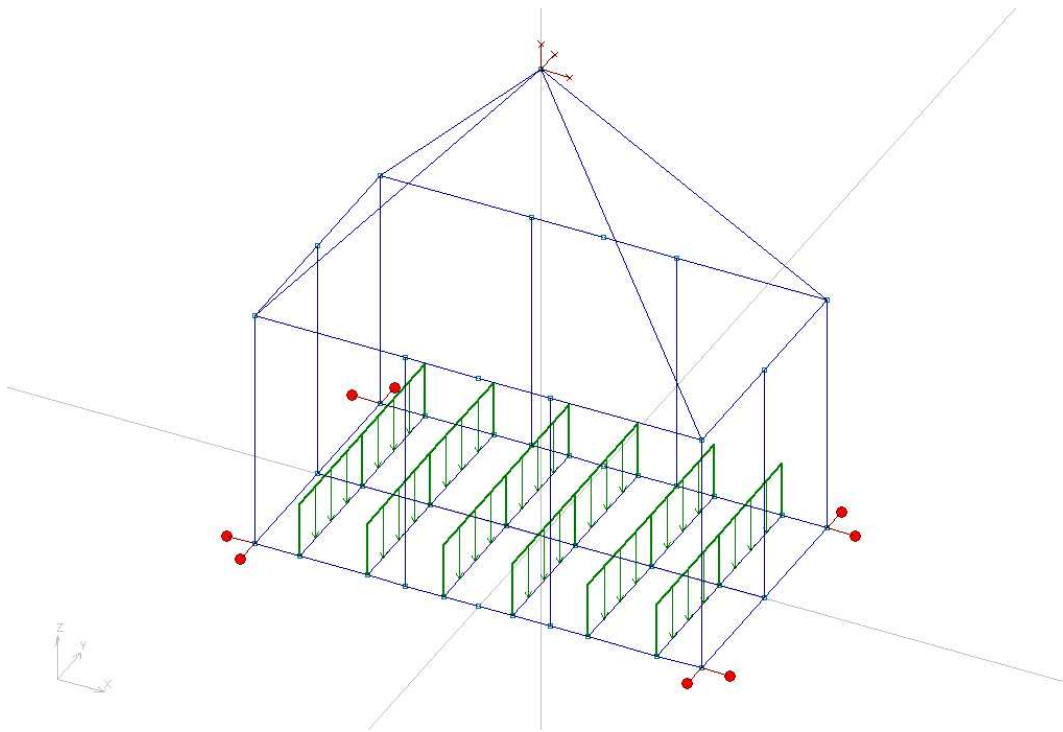


Figure C-1 4-point lifting

C.2 Calculation of the shear stress at fork pockets in bottom side rail

Shear force may induce cracking in the side girder due to the reduction of shear area in the side rail because of the fork pocket. When lifted from pad eyes, the vertical shear area in the web above and below the fork pocket must be sufficient to take the shear force. But generally more critical for design is when the container is lifted from fork pockets. Then only the vertical area in the side rail web above the fork pockets will be effective. It is therefore important that sufficient vertical shear area is left in the side rail webs in way of the fork pockets. When there is not sufficient shear area above the fork pockets, additional vertical shear area must be added, e.g. as shown in Figure C-2.

NB! The area in the top and bottom flanges should not be included as shear area in the shear stress calculation.

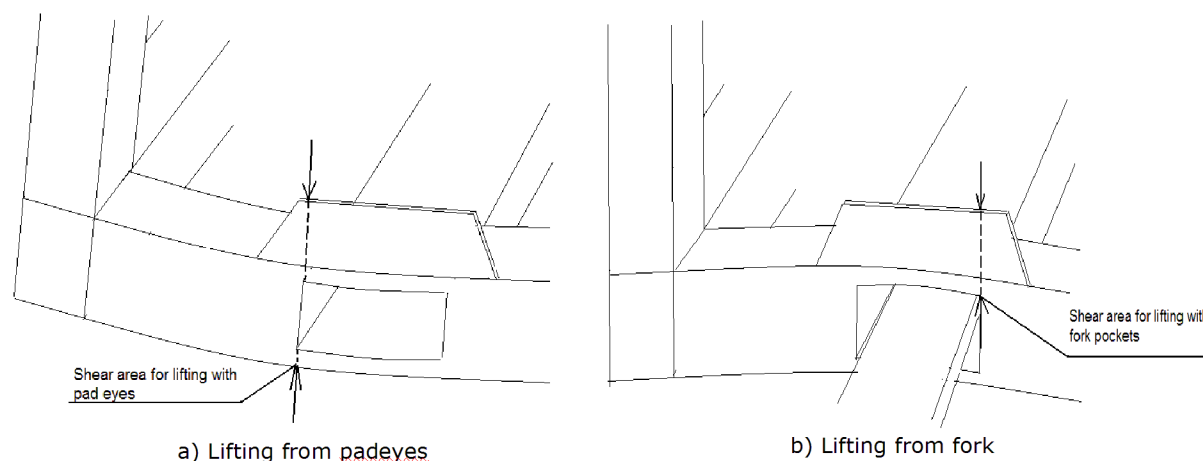


Figure C-2 Shear area at fork pockets

Example C-1: Lifting from pad eyes

$$\tau = \frac{F}{A_{shear}}$$

where:

- F = shear force in side rail at fork pocket (loading to be based on the applicable ψ)
- A_{shear} = vertical area above and below each fork pocket
- ψ = load factor for 4-point lifting = 2.5

C.3 Calculation of wall and door plates

As stated in [4.4.8] walls and doors should be able to withstand an internal load of $F_w = 0.6 p \cdot g$ evenly distributed over the whole surface, without suffering permanent deformation.

For some containers it may be considered necessary to verify the strength (e.g. for large unstiffened panels). Depending on geometry and support, applicable formulas for flat plates would be acceptable.

For containers with corrugated walls, a stiffener with equivalent section modulus Z , as the corrugation with spacing s can be made for calculation purposes. (See Figure C-3).

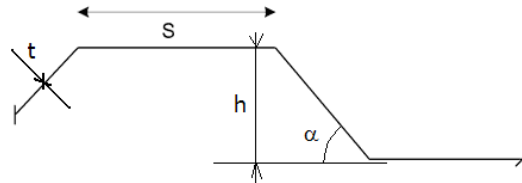


Figure C-3 Corrugated panel

$$Z = \frac{h \cdot t}{2} \left(\frac{h}{3 \cdot \sin \alpha} + s \right) \text{ cm}^3$$

where h, t and s are in cm.

APPENDIX D DESIGN OF PAD EYE

In addition to the basic requirements in [4.4.1], the designer of an offshore container should take the following into account:

D.1 Pad eye position

The pad eyes should be positioned on the container to preclude, as far as practicable, the risk of slings fouling against the container or its cargo during normal use. Pad eyes should be so designed as to permit free movement of the shackle and sling termination without fouling the pad eye. They should as far as possible be designed to avoid damage from other containers.

Pad eye that are placed vertically and aligned towards a central point can normally accommodate variations in sling angles, i.e. a lifting set with the legs 45° from vertical can be replaced with a longer lifting set, giving a smaller angle to the vertical without any adverse effect on the pad eyes or the container. If the pad eyes instead are positioned at an angle to the vertical, they can not accommodate any variation in the sling angle and the legs must always be of exactly the right length.

Containers that are designed to have the centre of gravity offset from the geometric centre may be fitted with lifting sets of asymmetric length, so that the container will hang horizontally when lifted. If the lifting set is asymmetric, the pad eyes must be aligned towards the lifting centre.

D.2 Design

Pad eye that are partly slotted into primary structure members are generally considered to be preferable, but other designs will also be considered for approval.

The pad eye design must take into account the size and shape of the shackles that are going to be used. Once the pad eye has been designed, only one size of shackle will fit.

Since shackles come in standard sizes, the designer should determine the size of the shackles to be used before designing the pad eyes. He must take into account the thickness of the shackle pin, the inside width and length of the shackle and the free space needed to fit the shackle.

Dee or bow (omega) shackles are usually designed according to one of the common standards used internationally (EN 13889, US Federal Specification RR-C-271 or ISO 2415). However, some shackle manufacturers use their own standards, with different design and sizes of shackles. Standard shackle sizes according to EN 13889 are given in the following table.

Table D-1 Standard shackles

<i>Nominal WLL (tonnes)</i>	<i>Pin diameter* (mm)</i>	<i>Inside width at pin (mm)</i>	<i>Inside length of dee shackles (mm)</i>	<i>Inside length of bow shackles (mm)</i>
3.25	19	27	47	57
4.75	22	31	52	65
6.5	25	36	65	76
8.5	28	43	74	88
9.5	32	46.5	83	101
12	35	51.5	87	108
13.5	38	57	104	126
17	42	60	115	139
25	50	74	139	168

Nominal WLL (tonnes)	Pin diameter* (mm)	Inside width at pin (mm)	Inside length of dee shackles (mm)	Inside length of bow shackles (mm)
* According to 8.3.2.3 the shackle pins shall have a tolerance of -0/+3% on the diameter.				

Guidance note:

The rated WLL of shackles of the same size may vary due to the use of materials of different strength. EN 13889 is for shackles of Grade 6, but it is also possible to design shackles according to e.g. EN 1677-4 (for forged lifting components of grade 8) in combination with the standard sizes listed above.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Since screw pin shackles are not allowed (see [8.3.2.3]), the pad eyes must be located such that there is sufficient space to fit shackles with pin, nut and split cotter pins.

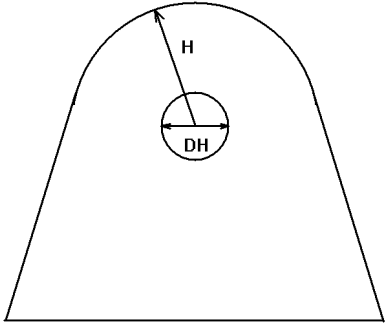
D.3 Pad eye strength

According to [4.4.1], the max. concentrated stresses at the bolt hole (geometry effects and contact stress) should be below 2 × minimum specified yield stress, i.e. 2 × Re, at the design load. The method outlined below can be used to determine the minimum size of a pad eye which satisfies this requirement:

Maximum concentrated hot spot stresses at the hole edges shall not exceed 2 × Re at design load.

More refined methods can of course be used if an optimised pad eye design is required. In such cases the calculations should be submitted with the approval documentation.


The two following criteria should be fulfilled:

<p>1. Tear-out stress</p> $Re \geq \frac{3 \times RSL}{2 \times H \times t - D_H \times t}$ <p>2. Contact stress</p> $Re \geq 23.7 \times \sqrt{\frac{RSL}{D_H \times t}}$	 <p>Figure D-1 Pad eye</p>
--	--

where:

- R_e = minimum specified yield strength of the pad eye material in N/mm²
- RSL = resulting sling load in N
- H = the shortest distance from centre of bolt hole to edge of pad eye in mm
- D_H = bolt hole diameter in mm
- t = pad eye thickness in mm.

Equation 1 is verifying that the stress level at the edge of the bolt hole is acceptable, assuming a stress concentration factor of 3.



Equation 2 is the formula for peak compressive stresses at the contact line between two concentric cylinders of steel, with a difference in diameter of 6%.

If fillet welded cheek plates are used to obtain the pad eye thickness required in [\[4.4.1\]](#) (clearance between pad eye and inside of shackle) these should not be taken into account in equation 1. The contact stress criterion may be calculated using the total thickness of pad eye and cheek plates.

APPENDIX E CALCULATIONS OF LIFTING SETS

As an aid to those who need to select lifting sets according to [Sec.8](#) of this standard, this Appendix includes some examples on calculating and selecting various types of lifting sets for offshore containers. It also includes tables with WLLs for chain and wire rope slings at various leg angles, based on standard chains and wire ropes.

E.1 Examples of calculations

E.1.1 Example 1 - selecting a standard lifting set: chain sling (45°) with forerunner

Choosing a chain sling and shackles for a container with Maximum Gross Mass, R = 12 tonnes, with a four leg sling, angle of legs 45°.

Chain dimensions:

- From [Table 8-1](#), find $WLL_{min} = 16.95$ tonnes.
- From [Table E-1](#), column for four leg slings with 45°, select a WLL value of at least 16.95 tonnes.
- Find chain dimension for legs in the left column, 16 mm.
- From [Table E-1](#), column for single leg, select a WLL value of at least 16.95 tonnes.
- Find chain dimension for forerunner in the left column, 25 mm.

Shackle dimension:

- From [Table 8-1](#), find $WLL_{min} = 16.95$ tonnes.
- From [Table 8-2](#), find WLL_s

$$WLL_s = \frac{16.95}{3 \cdot \cos 45^\circ} = 7.99 \cdot \text{tonnes}$$

- Select a shackle with a WLL of at least 7.99 tonnes, either from a standard (e.g. EN 13889) or from a DNV GL type approval certificate.

Standard chain slings are normally assembled by welding, and the sizes of master links and quad assemblies (i.e. master and intermediate links) for standard chain slings are selected by the chain sling manufacturer.

E.1.2 Example 2 - assembling a non-standard a lifting set: chain sling with 30° leg angle, with forerunner

Assemble a chain sling for a container with maximum gross mass, R = 7.5 tonnes, with a four leg sling, angle of legs 30° from vertical.

Required data:

Max. gross mass: R = 7 500 kg
 Sling leg angle: $\beta = 30^\circ$
 Configuration: Four legs with forerunner
 Type of sling: Chain sling

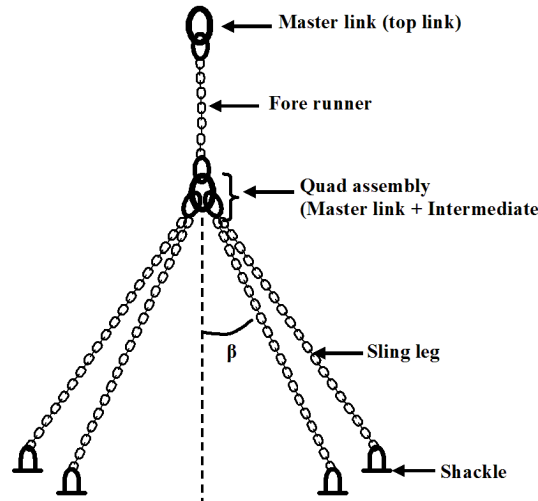


Figure E-1 Four legged chain sling lifting sling with fore runner

Master link dimension:

- From [Table 8-1](#), find $WLL_{min} = 12.50$ tonnes.
- Select a master link with a WLL of at least 12.50 tonnes, either from a standard (e.g. EN 1677-4) or from a DNV GL type approval certificate.

Forerunner dimension:

- From [Table 8-1](#), find $WLL_{min} = 12.50$ tonnes.
- From [Table E-1](#), column for single leg, select a WLL value of at least 12.50 tonnes.
- Find chain dimension for forerunner in the left column, 20 mm.

Quad assembly dimension:

- From [Table 8-1](#), find $WLL_{min} = 12.50$ tonnes.
- Select a quad assembly with a WLL of at least 12.50 tonnes, either from a standard (e.g. EN 1677-4) or from a DNV GL type approval certificate.

Guidance note:

Guidance: The intermediate links may be calculated separately, using the following formula:

$$WLL_{int.link} = \frac{WLL_{min}}{2 \cdot \cos \alpha}$$

Where WLL_{min} is taken from [Table 8-1](#), and α is the angle of the intermediate links to the vertical.

---e-n-d---o-f---g-u-i-d-a-n-c-e---o-t-e---

Sling leg dimensions:

- From [Table 8-1](#), find $WLL_{min} = 12.50$ tonnes.

- From [Table E-1](#), column for four leg slings with 30°, select a WLL value of at least 12.50 tonnes.
- Find chain dimension for sling leg in the left column, 13 mm.

Shackle dimension:

- From [Table 8-1](#), find $WLL_{min} = 12.50$ tonnes.
- From [Table 8-2](#), find WLL_s

$$WLL_s = \frac{WLL_{min}}{3 \cdot \cos\beta} = \frac{12.50}{3 \cdot \cos 30^\circ} = 4.81 \cdot \text{tonnes}$$

- Select a shackle with a WLL of at least 4.81 tonnes, either from a standard (e.g. EN 13889) or from a DNV GL type approval certificate.

E.1.3 Example 3 - assembling a non-standard lifting set: wire rope sling with 37.5° leg angle, with forerunner

Assemble a wire rope sling for a container with maximum gross mass, $R = 17$ tonnes, with a four leg sling, angle of legs 37.5° from vertical.

Required data:

- Max. gross mass:* $R = 17000$ kg
Sling leg angle: $\beta = 37.5^\circ$
Configuration: Four legs with forerunner
Type of wire rope: Fibre cored wire rope, grade 1770

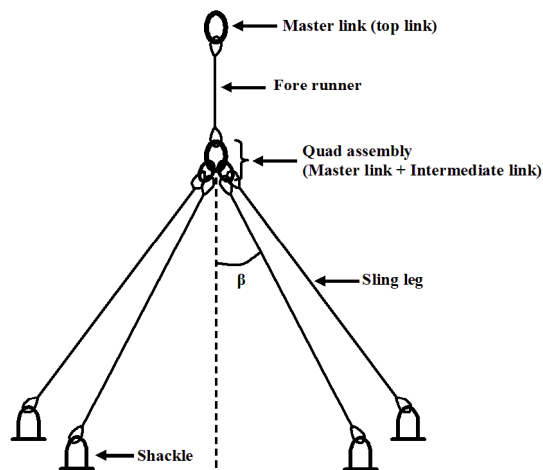


Figure E-2 Four legged wire rope lifting sling with fore runner

Master link dimension:

- From [Table 8-1](#), find $WLL_{min} = 20.86$ tonnes.
- Select a master link with a WLL of at least 20.86 tonnes, either from a standard (e.g. EN 1677-4) or from a DNV GL type approval certificate.

Forerunner dimension:

- From [Table 8-1](#), find $WLL_{min} = 20.86$ tonnes.
- Select a wire rope with a WLL of at least 20.86 tonnes.

Guidance note:

If non-standardised wire ropes shall be used, the WLL for the wire rope sling can be found using the following formula:

$$WLL = \frac{BL_{min} \cdot K_T \cdot n \cdot \cos \beta}{5 \cdot g}$$

Where:

- BL_{min} = minimum breaking force of the rope in kN
- K_T = factor which allows for the efficiency of the termination, for ferrule secured terminations $K_T = 0.9$, for spliced terminations $K_T = 0.8$
- n = 1 for single leg slings and forerunners
= 2 for 2 leg slings
= 3 for 3 and 4 leg slings
- β = sling leg angle to the vertical
- g = acceleration of gravity

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Quad assembly dimension:

- From [Table 8-1](#), find $WLL_{min} = 20.86$ tonnes.
- Select a quad assembly with a WLL of at least 20.86 tonnes, either from a standard (e.g. EN 1677-4) or from a DNV GL type approval certificate.

Guidance: The intermediate links might be calculated separately, using the following formula:

$$WLL_{int.link} = \frac{WLL_{min}}{2 \cdot \cos \alpha}$$

Where WLL_{min} is taken from [Table 8-1](#), and α is the angle of the intermediate links to the vertical.

Sling leg dimensions:

- From [Table 8-1](#), find $WLL_{min} = 20.86$ tonnes.
- Calculate the Required WLL for each leg, using formula given in [\[8.3.1.2\]](#):

$$\text{Required} \cdot WLL = \frac{20.86}{3 \cdot \cos 37.5^\circ} = \underline{8.76 \cdot \text{tonnes}}$$

- Select a wire rope with a WLL of at least 8.76 tonnes (if non-standardised wire ropes shall be used, see formula as given for fore runner).

Shackle dimension:

- From [Table 8-1](#), find $WLL_{min} = 20.86$ tonnes.
- From [Table 8-3](#), find WLL_s

$$WLL_s = \frac{20.86}{3 \cdot \cos 37.5^\circ} = 8.76 \cdot \text{tonnes}$$

- Select a shackle with a WLL of at least 8.76 tonnes, either from a standard (e.g. EN 13889) or from a DNV GL type approval certificate.

E.2 Chain sling dimensions

Based on EN 818-4.

Table E-1 Working load limits for 1, 2 and 4 leg chain slings at different angles

Nominal size of sling	Working load limits in tonnes										
	Single leg sling and forerunners	Four leg slings at					Two leg slings at				
(mm)		45°	40°	35°	30°	25°	45°	40°	35°	30°	25°
10 ¹⁾	3.15	[6.7]	7.24	7.7	8.2	8.6	[4.5]	[4.8]	[5.2]	[5.5]	[5.7]
13	5.30	11.2	12.2	13.0	13.8	14.4	7.5	8.1	8.7	9.2	9.6
16	8.00	17.0	18.4	19.7	20.8	21.8	11.3	12.3	13.1	13.9	14.5
18	10.0	21.2	23.0	24.6	26.0	27.2	14.1	15.3	16.4	17.3	18.1
19	11.2	23.8	25.7	27.5	29.1	30.5	15.8	17.2	18.3	19.4	20.3
20	12.5	26.5	28.7	30.7	32.5	34.0	17.7	19.2	20.5	21.7	22.7
22	15.0	31.8	34.5	36.9	39.0	40.8	21.2	23.0	24.6	26.0	27.2
23	16.0	33.9	36.8	39.3	41.6	43.5	22.6	24.5	26.2	27.7	29.0
25	20.0	42.4	46.0	49.1	52.0	54.4	28.3	30.6	32.8	34.6	36.3
26	21.2	45.0	48.7	52.1	55.1	57.6	30.0	32.5	34.7	36.7	38.4
28	25.0	53.0	57.5	61.4	65.0	68.0	35.4	38.3	41.0	43.3	45.3
32	31.5	66.8	72.4	77.4	81.8	85.6	44.5	48.3	51.6	54.6	57.1
36	40.0	84.9	91.9	98.3	103.9	108.8	56.6	61.3	65.5	69.3	72.5
40	50.0	106.1	114.9	122.9	129.9	135.9	70.7	76.6	81.9	86.6	90.6

1) Slings with WLL values below 7.0 may not be used on offshore containers, see [Table 8-1](#).

E.3 Wire rope sling dimensions

Based on EN 13414-1

Table E-2 Working load limits for 1, 2 and 4 leg wire rope slings at different angles fibre cored rope, grade 1770

Nominal size of sling	Working load limits in tonnes										
	Single leg sling and forerunners	Four leg slings at					Two leg slings at				
(mm)		45°	40°	35°	30°	25°	45°	40°	35°	30°	25°
18 ¹⁾	3.40	7.2	7.8	8.4	8.8	9.2	[4.8]	[5.2]	[5.6]	[5.9]	[6.2]
20 ¹⁾	4.35	9.2	10.0	10.7	11.3	11.8	[6.2]	[6.7]	7.1	7.5	7.9
22	5.20	11.0	12.0	12.8	13.5	14.1	7.4	8.0	8.5	9.0	9.4
24	6.30	13.4	14.5	15.5	16.4	17.1	8.9	9.7	10.3	10.9	11.4
26	7.20	15.3	16.5	17.7	18.7	19.6	10.2	11.0	11.8	12.5	13.1
28	8.40	17.8	19.3	20.6	21.8	22.8	11.9	12.9	13.8	14.5	15.2
32	11.0	23.3	25.3	27.0	28.6	29.9	15.6	16.9	18.0	19.1	19.9
36	14.0	29.7	32.2	34.4	36.4	38.1	19.8	21.4	22.9	24.2	25.4
40	17.0	36.1	39.1	41.8	44.2	46.2	24.0	26.0	27.9	29.4	30.8
44	21.0	44.5	48.3	51.6	54.6	57.1	29.7	32.2	34.4	36.4	38.1
48	25.0	53.0	57.5	61.4	65.0	68.0	35.4	38.3	41.0	43.3	45.3
52	29.0	61.5	66.6	71.3	75.3	78.8	41.0	44.4	47.5	50.2	52.6
56	33.5	71.1	77.0	82.3	87.0	91.1	47.4	51.3	54.9	58.0	60.7
60	39.0	82.7	89.6	95.8	101.3	106.0	55.2	59.8	63.9	67.5	70.7

1) Ropes with WLL values below 7.0 may not be used on offshore containers, see [Table 8-1](#).

Table E-3 Working load limits for 1, 2 and 4 leg wire rope slings at different angles steel cored rope, grade 1770

Nominal size of sling	Working load limits in tonnes										
	Single leg sling and forerunners	Four leg slings at					Two leg slings at				
(mm)		45°	40°	35°	30°	25°	45°	40°	35°	30°	25°
18 ¹⁾	3.70	7.8	8.5	9.1	9.6	10.1	[5.2]	[5.7]	[6.1]	[6.4]	[6.7]
20 ¹⁾	4.60	9.8	10.6	11.3	12.0	12.5	[6.5]	7.0	7.5	8.0	8.3
22	5.65	12.0	13.0	13.9	14.7	15.4	8.0	8.7	9.3	9.8	10.2
24	6.70	14.2	15.4	16.5	17.4	18.2	9.5	10.3	11.0	11.6	12.1
26	7.80	16.5	17.9	19.2	20.3	21.2	11.0	12.0	12.8	13.5	14.1
28	9.00	19.1	20.7	22.1	23.4	24.5	12.7	13.8	14.7	15.6	16.3
32	11.8	25.0	27.1	29.0	30.7	32.1	16.7	18.1	19.3	20.4	21.4
36	15.0	31.8	34.5	36.9	39.0	40.8	21.2	23.0	24.6	26.0	27.2
40	18.5	39.2	42.5	45.5	48.1	50.3	26.2	28.3	30.3	32.0	33.5
44	22.5	47.7	51.7	55.3	58.5	61.2	31.8	34.5	36.9	39.0	40.8
48	26.0	55.2	59.8	63.9	67.5	70.7	36.8	39.8	42.6	45.0	47.1
52	31.5	66.8	72.4	77.4	81.8	85.6	44.5	48.3	51.6	54.6	57.1
56	36.0	76.4	82.7	88.5	93.5	97.9	50.9	55.2	59.0	62.4	65.3
60	42.0	89.1	96.5	103.2	109.1	114.2	59.4	64.3	68.8	72.7	76.1

1) Ropes with WLL values below 7.0 may not be used on offshore containers, see [Table 8-1](#).

Table E-4 Working load limits for 1, 2 and 4 leg wire rope slings at different angles fibre cored rope, grade 1960

Nominal size of sling	Working load limits in tonnes										
	Single leg sling and forerunners	Four leg slings at					Two leg slings at				
(mm)		45°	40°	35°	30°	25°	45°	40°	35°	30°	25°
18 ¹⁾	3.47	7.4	8.0	8.5	9.0	9.4	4.9	5.3	5.7	6.0	6.3
20 ¹⁾	4.30	9.1	9.9	10.6	11.2	11.7	6.1	6.6	7.0	7.4	7.8
22	5.19	11.0	11.9	12.8	13.5	14.1	7.3	8.0	8.5	9.0	9.4
24	6.17	13.1	14.2	15.2	16.0	16.8	8.7	9.4	10.1	10.7	11.2
26	7.25	15.4	16.7	17.8	18.8	19.7	10.3	11.1	11.9	12.6	13.1
28	8.41	17.8	19.3	20.7	21.8	22.9	11.9	12.9	13.8	14.6	15.2
32	10.98	23.3	25.2	27.0	28.5	29.8	15.5	16.8	18.0	19.0	19.9
36	13.89	29.5	31.9	34.1	36.1	37.8	19.7	21.3	22.8	24.1	25.2
40	17.16	36.4	39.4	42.2	44.6	46.7	24.3	26.3	28.1	29.7	31.1
44	20.74	44.0	47.7	51.0	53.9	56.4	29.3	31.8	34.0	35.9	37.6
48	24.78	52.6	56.9	60.9	64.4	67.4	35.0	38.0	40.6	42.9	44.9
52	29.00	61.5	66.6	71.3	75.3	78.9	41.0	44.4	47.5	50.2	52.6
56	33.59	71.3	77.2	82.5	87.3	91.3	47.5	51.5	55.0	58.2	60.9
60	38.55	81.8	88.6	94.7	100.1	104.8	54.5	59.1	63.1	66.8	69.9

1) Ropes with WLL values below 7.0 may not be used on offshore containers, see [Table 8-1](#).

Table E-5 Working load limits for 1, 2 and 4 leg wire rope slings at different angles steel cored rope, grade 1960

Nominal size of sling	Working load limits in tonnes										
	Single leg sling and forerunners	Four leg slings at					Two leg slings at				
(mm)		45°	40°	35°	30°	25°	45°	40°	35°	30°	25°
18 ¹⁾	4.1	8.8	9.5	10.2	10.8	11.3	5.9	6.4	6.8	7.2	7.5
20 ¹⁾	5.1	10.9	11.8	12.6	13.3	13.9	7.2	7.8	8.4	8.9	9.3
22	6.2	13.2	14.3	15.2	16.1	16.9	8.8	9.5	10.2	10.7	11.2
24	7.4	15.7	17.0	18.1	19.2	20.1	10.4	11.3	12.1	12.8	13.4
26	8.7	18.4	19.9	21.3	22.5	23.6	12.3	13.3	14.2	15.0	15.7
28	10.0	21.3	23.1	24.7	26.1	27.3	14.2	15.4	16.4	17.4	18.2
32	13.1	27.8	30.2	32.3	34.1	35.7	18.6	20.1	21.5	22.7	23.8
36	16.6	35.2	38.1	40.8	43.1	45.1	23.5	25.4	27.2	28.7	30.1
40	20.6	43.6	47.2	50.5	53.4	55.9	29.1	31.5	33.7	35.6	37.3
44	24.8	52.6	56.9	60.9	64.4	67.4	35.0	38.0	40.6	42.9	44.9
48	29.6	62.7	67.9	72.6	76.8	80.3	41.8	45.3	48.4	51.2	53.6
52	34.7	73.6	79.7	85.3	90.1	94.3	49.1	53.1	56.8	60.1	62.9
56	40.2	85.3	92.4	98.8	104.4	109.3	56.8	61.6	65.9	69.6	72.9
60	46.1	97.7	105.9	113.2	119.7	125.3	65.2	70.6	75.5	79.8	83.5

1) Ropes with WLL values below 7.0 may not be used on offshore containers, see [Table 8-1](#).

APPENDIX F EXAMPLE OF DROP TEST

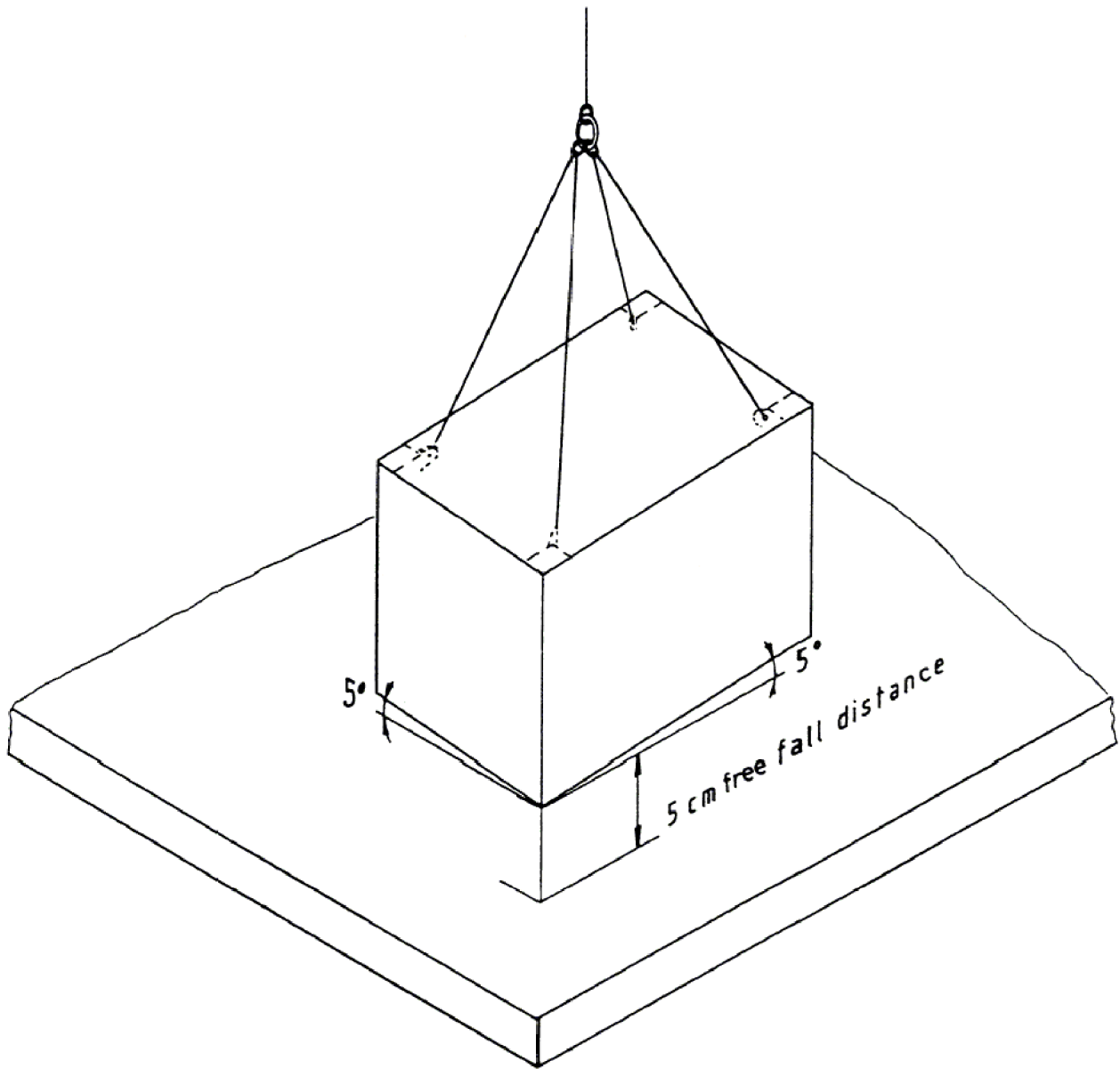


Figure F-1 Vertical impact test, (see also [3.7.2])

APPENDIX G MSC/CIRC.860

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Ref. T3/1.01

MSC/Circ.860
22 May 1998

GUIDELINES FOR THE APPROVAL OF OFFSHORE CONTAINERS HANDLED IN OPEN SEAS

- 1 The Maritime Safety Committee, at its sixty-ninth session (11 to 20 May 1998), considered and approved draft revised Guidelines for the approval of offshore containers handled in open seas, as set out in the annex to this circular.
- 2 These Guidelines are based on the provisions contained in the annex to MSC/Circ.613, which have been updated to reflect more clearly the relevant provisions in the Recommendation on Harmonized Interpretation and Implementation of the International Convention for Safe Containers (CSC), 1972, as amended (CSC/Circ.100) and the IMDG Code and recent practice in the design of offshore containers.
- 3 Member Governments are invited to bring these Guidelines to the attention of all parties concerned with the approval, manufacture, inspection and operation of offshore containers.
- 4 This Circular replaces MSC/Circ.613 dated 18 June 1993.

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ANNEX

**GUIDELINES FOR THE APPROVAL OF OFFSHORE CONTAINERS
HANDLED IN OPEN SEAS**

- 1 The Maritime Safety Committee, at its sixty-second session, approved amendments to the Recommendation on Harmonized Interpretation and Implementation of the International Convention for Safe Containers, 1972 (CSC). The revised Recommendation was circulated as CSC/Circ.100 dated 30 June 1993 and has been included as a supplement in the 1996 edition of the CSC.
- 2 Paragraph 3.3 of the revised Recommendation on Harmonized Interpretation and Implementation of the CSC states that the Convention does not apply to offshore containers that are handled in open seas. There are several reasons for applying special design and testing parameters to offshore containers:
 - .1 the tests set out in Annex II to the CSC are designed to cover the forces on containers encountered in general marine transport, loading and unloading in ports and in inland transport. However, offshore containers are used to supply offshore installations and are typically shipped on the open deck of purpose-built supply vessels and are lifted onto and off the offshore installation by cranes on the installations. Such operations may often take place in very unfavourable weather and sea conditions;
 - .2 spreader beams, as used for lifting ordinary containers, cannot be used when lifting offshore containers; and
 - .3 the types of offshore containers used are often purpose-built and include closed and open dry cargo containers, dry bulk cargo containers and portable tanks. Offshore containers, unlike ISO containers, are not standardized with regard to sizes or gross mass; many have a smaller base area than the 7 m² in the lower limiting definition of a container in the CSC.
- 3 Sections 12 and 13 of the General Introduction to the International Maritime Dangerous Goods (IMDG) Code recognize the special nature of offshore containers and portable tanks. These sections state that the design and testing of offshore containers and offshore tank-containers should take into account the dynamic lifting and impact forces that may occur when a container or tank is handled in open seas in adverse weather and sea conditions and that the requirements for such containers and tanks should be determined by the approving competent authority.
- 4 For the purposes of these guidelines, "offshore containers" should be taken to mean portable units specially designed for repeated use in the transport of goods or equipment to, from or between fixed and/or floating offshore installations and ships. Such units include containers and portable tanks for dangerous goods as defined in sections 12 and 13 of the General Introduction to the IMDG Code.
- 5 These guidelines are intended to assist approving competent authorities in developing detailed requirements for offshore containers. For the purposes of these guidelines, the "approving competent authority" includes organizations duly authorized by the Administration.

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Approval

- 6 Approving competent authorities should base their approval of offshore containers both on calculations and on testing, taking into account the dynamic lifting and impact forces that may occur when handling in open seas.

Design

- 7 Offshore containers should be fitted with special pad eyes, suitable for the attachment of purpose-built slings connected with shackles. Where ISO corner fittings are mounted in conjunction with pad eyes, these corner fittings are not intended for lifting offshore.
- 8 In order to facilitate handling in open seas, offshore containers should be pre-slung. Such slings should be permanently attached to the container and considered to be part of the container. The dynamic forces which occur when handling containers in open seas will be higher than those encountered during normal quayside handling. This should be taken into account when determining the requirements for slings on offshore containers by multiplying the normal safety factor for slings by an additional factor. The fact that light containers will be subject to relatively higher dynamic forces than heavier containers should also be taken into account. Minimum material requirements for impact toughness should be specified when high strength steel is used in e.g. chains, links and shackles.
- 9 Since offshore containers may not always be secured on supply vessels, such containers should be designed so as to withstand 30° tilting in any direction when fully loaded. Cargo may normally be assumed to be evenly distributed with the centre of gravity at the half height of the container, but on containers for dedicated transport (e.g. special bottle rack containers for gas bottles in fixed positions) the actual centre of gravity should be used.
- 10 Protruding parts on an offshore container that may catch on other containers or structures should be avoided. Doors and hatches should be secured against opening during transport and lifting. Hinges and locking devices should be protected against damage from impact loads.
- 11 Strength calculations should include lifting with the attached lifting sling and any other applicable means of handling (e.g. lifting with fork lift trucks). Impact loads on the sides and bottom of containers should also be considered in these calculations and impact properties should be included in the requirements for structural steel materials. However, calculations, including static equivalency of point loads in combination with the tests as set out in paragraph 13 should normally be considered sufficient.
- 12 Containers are sometimes temporarily used on floating or fixed offshore installations as storage space, laboratories, accommodation or control stations, etc. When used this way, the container will also be subject to the regulations applicable for the offshore installation in addition to transport related requirements based on these guidelines.

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Testing

- 13 At least one offshore container of each design type should be subjected to the following tests:
- .1 **4-point lifting test**

Internal load: a uniformly distributed load such that the total mass of the container and test load is equal to 2.5R, where R is the maximum allowable combined mass of the container and its cargo. The container should be lifted with a lifting sling attached to each of its four pad eyes with an angle to the vertical equal to the design angle.
 - .2 **2-point lifting test**

Internal load: a uniformly distributed load such that the total mass of the container and test load is equal to 1.5R. A container fitted with four pad eyes should be lifted from only two pad eyes situated diagonally opposite each other.
 - .3 **Vertical impact test**

Internal load: a uniformly distributed load such that the total mass of the container and test load is equal to R. The container should be suspended at an inclined angle with the lowest corner at least 50 mm above a rigid floor. The container should then be quickly released so that it will have a speed of at least 1 m/s on initial impact.
 - .4 **Other tests**

Other tests, designed to demonstrate the ability of a container type to withstand other handling or transport forces, such as those described in relevant standards or the CSC, may also be required by the approving competent authority.
- 14 The tested offshore container should suffer no permanent damage or deformation in any of the tests which would render it incapable of being used for its designed purpose.
- 15 In order to ensure that offshore containers of the same design type are manufactured to the approved design, the approving competent authority should examine and test as many units as it considers necessary.
- 16 Offshore containers that have been designed, manufactured, tested and approved according to these guidelines should be clearly marked "Offshore Container" on an approval plate in accordance with the appendix. The details shown in the appendix represent minimum requirements.

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Inspection

- 17 Offshore containers should be inspected at least annually, as deemed appropriate, by the approving competent authority. The date of inspection and the mark of the inspector should be marked on the container, preferably on a plate fitted for this purpose. The inspection plate may be combined with the approval plate (paragraph 16) and any other official approval or data plates on a single base plate. It should be noted that the inspection plates on offshore containers commonly show the date of the last inspection unlike Safety Approval Plates on containers subject to the CSC which are marked with the date when the first periodic examination is due and in the case of containers covered by a periodic examination scheme (PES), with the date by which the next examination is due.

Standards and rules

- 18 The following standards and rules on offshore containers, not all of which cover all aspects of the design and testing in these guidelines, are known to exist or be under preparation and should be consulted as appropriate:
- BS 7072: British Standard Code of Practice for Inspection and Repair of Offshore Containers;
 - Det Norske Veritas (DNV): Certification Note 2.7-1, Offshore Containers;
 - Det Norske Veritas (DNV): Certification Note 2.7-2, Offshore Service Containers; and
 - pr EN 12079: Offshore Containers - Design, construction, testing, inspection and marking (under preparation by the European Committee for Standardization (CEN)).

APPENDIX

OFFSHORE CONTAINER		
Name of manufacturer:		
Month/year of manufacture:		
Identification No:		
Maximum gross mass:	Kg	lb
Tare-mass:	Kg	lb
Payload:	Kg	lb
Approval No:		

Approval Plate

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APPENDIX H TYPE APPROVAL OF LIFTING SETS FOR OFFSHORE CONTAINERS

H.1 Introduction

This appendix outlines the procedure and conditions for obtaining DNV GL type approval for lifting sets and lifting set components for offshore containers. It also specifies the conditions for manufacturing and certifying type approved equipment.

Type approval certificates are issued to manufacturers of lifting sets or to manufacturers of components for lifting sets.

Such type approval is applicable for lifting sets and components that are certified according to [8.2].

Lifting sets that are type approved to DNV GL 2.7-1 may also be suitable for use in other applications that are not offshore containers. For other applications, requirements for the safety factors, documentation and marking may be different from those described in this standard.

H.2 Scope

This appendix applies to all parts of the lifting sets for offshore containers. A type approval may cover any of the following items:

- assembled single or multi leg chain slings
- assembled single or multi leg wire rope slings
- components for lifting sets (chains, wire ropes, links, shackles, couplings).

A type approval certificate may cover a range of products (e.g. different sizes).

The appendix is based on the following rules and standards:

- Sec.8 of DNV GL 2.7-1
- European standards for slings and components for lifting purposes. Other standards for slings or components may also be accepted after special consideration.

H.3 General

H.3.1 Documentation to be submitted

When applying for type approval, the applicant shall inform which standard(s) the products shall be approved to, and submit the documentation listed below.

H.3.1.1 Documentation for type approval of lifting slings

Applicable for chain slings assembled by welding or mechanically assembled and wire rope slings. Shackles will only be considered as part of the lifting sling if they are assembly secured.

- a) Specification of the lifting sling, including applicable standards, material grades, the range of sizes for each component (except for thimbles and ferrules), including dimensions, working load limit (WLL), proof load (PL) and breaking load (BL).
- b) Assembly drawing of the lifting sling, and detailed drawing of each component, where relevant.
- c) Copies of relevant material documentation.
- d) List of suppliers for the various components.
- e) Information on subcontractors, where relevant.
- f) Instructions for selecting and assembling lifting slings for each application, including determination of required strength and selection of components to be used, etc.
- g) Description of all manufacturing procedures (e.g. for wire rope slings: the assembly of the sling legs with terminals etc. and for chain slings see [3.1.2]).

- h) Details of the identification tag for the slings.
- i) A description of the test methods and the procedures for all relevant prototype and production tests.

At least 2 copies shall be submitted of the items as listed above.

H.3.1.2 Documentation for type approval of lifting set components

Applicable for chains, links, link assemblies, shackles and couplings.

- a) Specification of the components, including applicable standards, material grades, the range of sizes for each component, including dimensions, working load limit (WLL), proof load (PL) and breaking load (BL).
- b) Detailed drawings of each component.
- c) Copies of relevant material documentation.
- d) A description of the manufacturing procedures (forming, welding, heat treatment, surface treatment, etc.). Capacities (e.g. furnaces), heat treatment temperatures and tolerances, heating and cooling rates and other relevant information to be included.
- e) Information on subcontractors, where relevant.
- f) Details of marking on components.
- g) A description of the test methods and procedures for all relevant prototype and production tests.

At least 2 copies shall be submitted of the items as listed above.

H.3.1.3 General documentation from the manufacturer

- a) A brief description of the production facilities.
- b) Laboratory and testing facilities (if applicable).
- c) A brief description of the quality assurance (QA) system, including a copy of any certificates held for the QA system.

At least 1 copy of these documents should be submitted.

All product information received by DNV GL remains the property of the client and will be treated with full confidentiality.

H.3.2 Validity

The validity of a type approval is normally limited to a period of four (4) years.

H.3.3 Renewal

Application for renewal of type approval certificates should be made not later than 3 months before the expiry of the type approval certificate.

Replacement of components for type approved chain or wire rope slings:

DNV GL shall be informed of new sub suppliers of shackles, chains and links who are not listed on the type approval certificate. DNV GL shall be informed and review new suppliers of wire ropes. DNV GL does not have to be informed of new sub suppliers of thimbles and ferrules. Any other significant change of the type approved product or the production process shall be reported.

If necessary, a new type approval certificate will be issued. Renewed testing may be required if the changes affect the properties of the product.

H.4 Design requirements

The lifting set and its components shall comply with the requirements given in [Sec.8](#), and be designed in accordance with the recognised standards for lifting slings and components.

If shackles are assembly secured (see definition in [\[1.4.10\]](#)), they can be included in the type approval of lifting slings.

When chain or wire rope slings are type approved, the slings must be made from type approved components as described in [8.2].

H.5 Materials and material testing

Steels shall comply with the material requirements of Sec.8. Chemical composition, materials testing and mechanical properties shall also be according to the relevant recognised standard. Steels shall have good ductility at low temperatures and be able to withstand dynamic loads.

Steels in chains, links, rings, shackles and couplings shall be impact tested by the Charpy impact (V-notch) method according to [3.1] and [8.4].

The impact test temperature shall be equal to the design temperature, T_D but shall not be taken higher than -20°C . This also applies for App. J *Offshore containers for use in temperate climates only*.

Impact tests shall be carried out according to EN 10045-1, DNVGL-RU-SHIP Pt.2 Ch.1. or other recognized standard. Steel bars with diameter less than 13 mm (e.g. for chain links) need not be impact tested. However, sufficient impact strength should be ensured by the choice of materials and by using the proper production process. If the length of the finished product (after welding and heat treatment) is too small to allow preparation of specimens, special specimens of sufficient length shall be made from the same materials and with the welding and heat treatment.

H.6 Prototype testing

Prototype tests of components and assembled slings shall be carried out at the manufacturer or at a recognised laboratory and witnessed by a DNV GL surveyor.

Reports with test results shall also describe the tests carried out. Material certificates shall be enclosed. These shall include results of impact strength tests. Test reports shall be either prepared or endorsed by the surveyor.

Components and assembled slings shall be subjected to all tests specified in the applicable standard.

Note:

If a manufacturer wishes, they may have their components approved for higher rating than the minimum values required by the selected standard, provided all the strength related properties are increased proportionately. (Example: If a shackle shall be approved for higher WLL and MBL than required by EN 13889, the proof load must be increased proportionally.)

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H.7 Marking and traceability

Slings and components for lifting sets shall be marked according to the applicable standards. The identification tag on slings should be in accordance with [8.6].

Each component of the lifting set shall be marked such that it is traceable through the production process.

H.8 Requirements related to manufacturers

As required by [8.1] the manufacturer must ensure the quality of products by implementing a quality system at least in accordance with EN ISO 9001.

Before a type approval certificate is issued, DNV GL will audit the manufacturer. This audit will be based on the following elements:

- An audit of the quality system.
- The required tests and inspections shall be standard procedures included in the manufacturer's quality system procedures.
- The manufacturer must demonstrate that they are experienced in the manufacturing of the products in question.

Certificate retention surveys are to be carried out by DNV GL at prescribed intervals agreed in each case and specified in the type approval certificate.

H.9 Type approval certificate

Type approval certificates for lifting sets or components for lifting sets will be issued by the DNV GL approval office when the prototype test report has been found satisfactory.

The type approval certificate will at least contain the following information:

- product designation and description
- name and address of the manufacturer
- basis for approval (rules and standards)
- fields of application and operational limitations
- approval conditions
- for slings: list of components, components suppliers and DNV GL type approval references for components
- list of documentation
- type tests carried out
- validity period
- requirements for certificate retention surveys.
- marking requirements.

The main data from each type approval certificate will be published in DNV GL's electronic register of type approved products at www.dnvgl.com.

Information relating to requirements or tests outside the scope of this appendix may be added if agreed with the manufacturer.

H.10 Production and certification

H.10.1 Production testing

Testing during production shall be in accordance with the relevant sling or component standards. When slings are assembled from type approved components (e.g. chain slings with couplings), the assembled slings shall be tested. See also the note on test loads in [H.6] of this appendix.

From each coil of wire rope, a sample length shall be tested to breaking load, with the terminations normally applied by the sling manufacturer. Additional proof load testing may be done according to EN 13414-1.

Guidance note:

This breaking load test is included because experience has shown that for each particular type of steel wire rope the strength reduction caused by the terminations may vary, and because faults or poor quality in wire ropes may be difficult to detect by other methods such as proof load testing. If a test shows an excessive strength reduction at the termination, further inspection and testing should be performed, and if necessary the wire rope should be rejected.

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Impact testing of materials in accordance with [H.5] of this appendix shall be performed on every production lot.

H.10.2 Lifting set certificate

Lifting sets or lifting set components certified by a manufacturer according to a DNV GL type approval shall be delivered with a product certificate containing at least the information listed in [8.5]. The certificates shall include the following text.

This certificate is based on DNV GL type approval no. TAS-xxxx.



Note:

If national certificates for lifting equipment (based on ILO's form 3 certificates for loose gear) are issued by agents for a manufacturer, these certificates should contain references to the manufacturer's certificate and to DNV GL's type approval.

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If a manufacturer does not have a valid type approval, the certificates for lifting sets or lifting set components can be issued by DNV GL.

The documents referred to on the product certificate shall be retained by the manufacturer.

APPENDIX I APPROVAL PROGRAMME FOR TEST FACILITIES ENGAGED IN LOAD TESTING AND NDT INSPECTION OF OFFSHORE CONTAINERS

I.1 General

I.1.1 Scope

According to this standard offshore containers are subject to requirements for load testing. Tests may be prototype tests (described in [4.6]), production tests (Sec.5) or tests of existing units at periodic inspections or after extensive repairs or modifications (Sec.9).

After load tests offshore containers shall be inspected by suitable NDT methods. See Sec.5 and Sec.9.

Such tests and inspections shall be carried out in a manner accepted by DNV GL. In addition to this, it is the responsibility of the test facilities that they comply with all applicable safety regulations.

Testing and NDT may be carried out by manufacturers of offshore containers themselves, or by others on behalf of manufacturers or owners. In order to be approved according to this Approval Programme, the applicant should normally be able to perform all the tests required by DNV GL 2.7-1.

Firms providing such services can be approved according to this Approval Programme. This approval is voluntary and does not replace the requirements found in DNV GL 2.7-1 with regard to DNV GL witnessing load testing, and performing inspections according to DNV GL 2.7-1. However, based on this approval, DNV GL may consider setting up a manufacturing survey arrangement for production testing, where DNV GL's presence at production tests is limited.

In the following, firms performing the services described here are referred to as the supplier.

I.1.2 Objective

The objective of this approval programme is to ensure that the supplier has the necessary technical equipment and facilities commensurate with providing a professional service, that he has qualified personnel, and that he has implemented written systems for training, control, verification and reporting.

I.1.3 Extent of engagement

This approval programme defines the procedure required for obtaining approval in order to perform:

- prototype and production load test
- post load test NDT of new offshore containers
- NDT of existing offshore containers.

The criteria cover quality systems, administrative procedures and work procedures.

I.1.4 Validity

The approval will be valid for four (4) years. Procedures for issuing and renewing approvals are described in [I.4] in this appendix, cancellation of approval is described in [I.6] in this appendix.

I.2 Requirements to supplier

A certificate of approval will be awarded and maintained on the basis of compliance with the following.

I.2.1 Submission of documents

The following documents shall be submitted for review:

- an outline of the supplier's organisation and management structure, including any subsidiaries to be included in the approval
- a list of subsidiaries or nominated agents, if applicable
- experience of the supplier in the specific service area
- a list of operators, technicians and inspectors' documented training and experience within the relevant service area, including qualifications according to recognised national, international or industry standards, as relevant
- description of equipment used for the particular service for which approval is sought
- a guide for operators of such equipment
- training programmes for operators, technicians and inspectors
- check lists and report formats for recording results of the services referred to in [\[I.2.12\]](#)
- quality manual and/or documented procedures covering the requirements given in [\[I.2.2\]](#)
- evidence of approval/acceptance by other certification bodies, if any
- information on other activities which may present a conflict of interest.

I.2.2 Quality assurance system

The supplier shall have a documented quality system, covering at least:

- maintenance and calibration of the equipment
- training programmes for the supervisors and the operators
- supervision and verification of operation to ensure compliance with the approved operational procedures
- quality management of subsidiaries and agents (if applicable)
- job preparation
- recording and reporting of information
- periodic review of work process procedures, complaints, corrective actions, issuance, maintenance and control of documents.

An implemented quality assurance system complying with the ISO 9001 standard or equivalent, and including the items listed above will be considered acceptable.

I.2.3 Qualification of personnel

The supplier is responsible for the qualification and training of its supervisors and operators fulfilling recognised national, international or industry standards as applicable (see [\[I.2.4\]](#) and [\[I.2.5\]](#)).

Responsible personnel should at least be familiar with:

- the reporting system
- the national statutory and rule requirements for offshore containers in question
- with respect to offshore containers, the inspector should have, as a minimum, a knowledge and adequate practical experience of
- the statutory requirements relating to offshore containers
- the provisions of DNV GL 2.7-1
- the various types of offshore containers in service
- the correct methods of slinging and handling offshore containers
- the loads, stresses and strains affecting containers when handled under adverse offshore conditions, particularly those affecting lifting points
- methods of testing containers
- defects likely to be found in containers and acceptable levels of wear, distortion and deterioration in relation to safety in use
- welding methods and procedures and qualifications of welders
- the various methods of non-destructive testing (NDT) and a good understanding of how they work as well as of their limitations

- the visual inspection as required by DNV GL 2.7-1
- the signs of weakness and defects to look for
- any other relevant items shall be included.

The qualification scheme should also include maintenance of the qualifications.

I.2.4 Supervisor

The supplier shall have a supervisor responsible for the correct execution of testing, measurements and interpretation of NDT results and for the professional standard of the operators and their equipment, including the professional administration of the working procedures.

The supervisor shall be qualified with respect to NDT according to a recognised industrial NDT standard; e.g. ISO 9712 Level 2 or other recognized standard.

I.2.5 Operators

The operator performing the NDT shall be certified according to ISO 9712 Level 2 or other recognized standard.

I.2.6 Personnel records

The supplier is required to keep records of the approved supervisor and operators. The records shall contain information on age, formal education, training and experience in load testing and NDT of the individuals.

I.2.7 Equipment

The test mass (or test load) to be used shall be verified using calibrated weights, or a calibrated load cell and handset. Examples of appropriate means of application of test mass or test load are calibrated test blocks, water bags, sand bags, free weights, or a suitable test rig.

If a load cell and hand set is used it shall be calibrated annually, in accordance with an acceptable standard. Should a load cell be overloaded or receive a shock load (e.g. from being dropped) it is recommended that the load cell and handset be re-calibrated before further use.

Where used, test blocks shall be calibrated, as a minimum, every second year in accordance with acceptable international or national standards. The measured mass, in kilograms, of each block shall be legibly and durably marked on each block. Care should be taken in the storage of calibrated concrete blocks so as to prevent the absorption of water having an influence on the actual block mass.

Suitable supporting structures to enable the underside of the container to be safely inspected, should be available at the testing site.

I.2.8 Procedures and instructions

The supplier shall have documented work procedures that are at least to contain information on inspection preparation, method of load testing and application of test mass, selection and identification of test locations, surface preparation and calibration checks, report preparation and contents.

Application of loads:

- Normally loads should be evenly distributed over the floor (and intermediate decks).
- Offshore containers for a dedicated use may have concentrated loads at fixed points. In such cases the test loads shall be applied at the same points.
- Loads on tank containers: Test loads that can not be placed inside the tank should be distributed, e.g. by suspending weights from (webbing) straps slung over the tank shell.

- Test jigs may be used instead of conventional testing after special consideration. The test jig must give realistic load application to all parts of a container that shall be tested, and the container must be free to deflect.

As a minimum the procedure for conducting load tests should be according to [I.2.8.1] to [I.2.8.3] below.

I.2.8.1 Lifting tests

I.2.8.1.1 General

The container shall be lifted by a lifting set with an angle to the vertical equal to the design angle. The container shall be clear of the ground throughout the test.

The container shall be carefully lifted in such a way that no significant acceleration forces occur. It shall be held for 5 minutes before measurements are taken.

I.2.8.1.2 All-point lifting

The container shall be loaded to a total gross mass of 2.5 R and lifted clear of the ground, using all the pad eyes. (The test load may be obtained by putting in an internal test mass of $((2.5 \times R) - T)$.) No deflections during testing shall be greater than 1/300 of the span of the member. The offshore container shall show no permanent deformation or other damage after testing.

I.2.8.1.3 Two-point lifting

An offshore container fitted with four pad eyes shall also be lifted from only two pad eyes, situated diagonally opposite each other, with a total mass of 1.5 R. (This can be achieved by putting in an internal test mass of $((1.5 \times R) - T)$. After the test there shall be no permanent deformation.

I.2.8.2 Vertical impact test

I.2.8.2.1 General

The container shall be lowered or dropped on to a workshop floor of concrete or other rigid structure.

This floor may be covered with a sheathing of wooden planks with a thickness not exceeding 50 mm (2 inches). If the container is lowered from a crane, the suspending wire and hook may dampen the impact compared to a free-fall drop test. Therefore the impact speed should be greater if a lowering test is used.

In both cases, the container shall be inclined so that each of the bottom side and end rails connected to the lowest corner forms an angle of not less than 5° with the floor.

However, the greatest height difference between the highest and lowest point of the underside of the container corners need not be more than 400 mm.

The impacting corner shall be the one expected to have the lowest rigidity. On closed dry cargo containers this will normally be at the door end.

No significant permanent damage shall occur. Cracks in welds and minor deformations may be repaired.

One of the following procedures shall be carried out:

I.2.8.2.2 Drop test

Container to be inclined as described above. The container shall be suspended from a quick release hook. When released, the container shall drop freely for at least 50 mm to give it a speed at initial impact of at least 1 m/s.

I.2.8.2.3 Lowering test

An internal load equal to the payload (P) shall be safely secured and the container shall be inclined as described above. The container shall be lowered to the floor at a constant speed of not less than 1.5 m/s.

Note! these tests may cause considerable tremors in a building.

I.2.8.3 Other tests

When required other tests may have to be carried out for containers of unusual configuration. These shall be agreed in advance with DNV GL.

Tanks for dangerous cargoes shall in addition be tested according to the requirements of the IMDG code.

I.2.8.4 Non-destructive examination

Suitable NDT should be used after the tests are completed. Method and extent to be agreed with the DNV GL surveyor.

This NDT does not replace the NDT that is required during the production of new containers by [5.2.3].

I.2.9 Administrative procedures

The supplier shall have an order reference system where each engagement is traceable to the container identification.

I.2.10 Verification

The supplier shall verify that the service provided is carried out in accordance with approved procedures. Executed verification should be documented.

I.2.11 Sub-contractors

The supplier shall give information of agreements and arrangements if any part(s) of the services provided are subcontracted. Particular emphasis shall be given to quality management by the supplier in the following-up of such subcontracts. Subcontractors, providing anything other than subcontracted personnel or equipment shall also meet the requirements of [2.1] to [2.12] as well as [I.3].

I.2.12 Reporting

Load tests and NDT inspection shall be reported. Load testing and post load testing NDT inspections may be reported in the same or in separate reports.

I.2.12.1 Contents of reports

The following information, as a minimum, should be included:

- container identification (including manufacturer's serial number and/or owner's container number)
- name of owner or delegated nominee
- report number
- container tare mass and added test loads applied in each of the tests performed
- a description of the arrangement and execution of the tests, including load distribution
- measured deflections or deformations during and after the tests, as applicable
- any damages found after the test
- details of NDT carried out (extent and findings)
- reference, where appropriate, to any report issued to the owner arising from the process
- date of examination (date of signature or report also to be shown if different from date of examination)
- any other information relevant to structural evaluation
- name of organization, unique identification mark and the signature of the responsible person.

I.2.12.2 Prototype or production tests

Reports should either be made by the supplier and countersigned by the DNV GL surveyor, or written fully by the surveyor (practice may vary in different geographical areas.)

Additional information in prototype test reports:

- Net mass confirmed by weighing.

I.2.12.3 Tests on existing containers

Reports should be made by the supplier. If the container is tested for re-certification after extensive repair or modification, reports should either be made by the supplier and countersigned by the DNV GL surveyor, or written by the DNV GL surveyor.

Additional information to be given in test and inspection reports for existing containers:

- a statement that the container described was inspected and/or tested and that the particulars are correct
- name of organization, unique identification mark and the signature of the person carrying out the inspections
- confirmation that the inspection plate was marked.

I.3 Repairs on containers identified as a result of load tests and on

I.3.1 General

If a container is damaged (whether as a result of testing, or existing damages are detected by the supplier), the owner shall be advised as soon as practicable. The container shall not be used until it is repaired and inspected. Additional tests may be necessary after repairs.

The repairs shall be carried out in accordance with the requirements for design and manufacture of containers set out in [Sec.3](#) and [Sec.4](#). In case of major repairs, the repair procedure, materials used, section sizes, welding and welding procedures shall be approved by DNV GL.

Note:

Where a need for repair is identified, it may be necessary to make adequate arrangements for the safe transportation of the damaged container to a location specified by the owner.

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I.4 Approval procedures

I.4.1 Review of documentation

The documentation specified in [\[I.2.1\]](#) will be reviewed by DNV GL. Additional information may be requested.

I.4.2 Initial audit

After evaluating the information received from the supplier, a DNV GL surveyor will perform an audit of the supplier. Additionally, approval of the supplier is conditional upon a satisfactory practical demonstrations of all standard prototype load tests and NDT inspection performance. The reporting systems will also be evaluated.

I.4.3 Special procedures related to control of supplier's relationship with the parent company

If a parent company applies to DNV GL for inclusion of nominated agents and or subsidiaries in the certificate of approval, the parent company must have implemented a quality assurance system certified in accordance with ISO 9001. The parent company shall ensure effective controls of agents and or subsidiaries even when the agents or subsidiaries have an equally effective quality control system complying with ISO 9001.

Such approvals shall be based upon an evaluation of the quality assurance system implemented by the parent company against ISO 9001.

DNV GL will follow-up adherence to the certified quality assurance system by also performing audits on such agents or subsidiaries against ISO 9001.

I.4.4 Certificate of approval

If the submitted documentation, the surveyor's audit and the practical demonstrations are all found to be satisfactory, the supplier will receive a DNV GL certificate of approval.

I.4.5 Renewal of approval

Renewal of the certificate of approval shall be made at intervals not exceeding 4 years. Verification shall be through audits confirming, or otherwise, that approved conditions are being maintained. Intermediate audits may be required, if found necessary by DNV GL. At least three months before the period of validity expires, the supplier shall apply for renewal of the certificate of approval.

I.5 Information on alteration to the certified service operation system

I.5.1 Alteration

In case alteration to the certified service operation system of the supplier is made, such alteration shall be reported immediately to DNV GL. A re-audit may be required when deemed necessary.

I.6 Cancellation of the certificate of approval

I.6.1 Right to cancel

DNV GL reserves the right to withdraw the certificate of approval in the following instances:

- where the service was improperly performed or the results were improperly reported
- where a surveyor finds deficiencies in the approved service operation system of the supplier, and corrective action appropriate is not taken within reasonable time
- where the supplier fails to give information of any alteration, as in [I.5.1]
- where an intermediate audit, if requested as described in [I.4.5], has not been carried out
- where wilful acts or omissions are ascertained.

I.6.2 Information

DNV GL reserves the right to inform interested parties on cancellation of the certificate of approval.

I.6.3 Re-approval

A supplier that has had the certificate of approval withdrawn may apply for re-approval after a period of six (6) months.

APPENDIX J OFFSHORE CONTAINERS FOR USE IN TEMPERATE CLIMATES ONLY

J.1 Introduction

The design temperature, as specified in [Sec.4](#), is used to determine the impact energy requirements for the steel used in the primary structure of offshore containers.

According to [\[4.1.5\]](#) the design temperature, T_D , for offshore containers shall not be higher than -20°C . This appendix specifies alternative requirements for offshore containers that are only to be used in tropical and temperate areas of the world. In the areas defined in this appendix, a higher design temperature may be used. The design temperature for lifting set components according to [Sec.8](#) has not been changed.

Important: Containers certified according to this appendix are only certified for use in the area described in [\[J.2\]](#) of this appendix, and they are not certified for use in any other areas. The marking required by [\[N.4\]](#) of this appendix shall be retained on these containers as long as they are used as offshore containers.

J.2 Area

This appendix shall only be applied to offshore containers that are exclusively used in the following areas: Between 36° North and 36° South and in Australian Waters.

J.3 Design temperature

The design temperature, T_D , for the container structure shall not be taken higher than the (statistically) lowest daily mean temperature for the area where the offshore container shall operate and shall not be higher than 0°C .

Guidance note:

Some areas within the defined zones may in the winter have lowest daily mean temperature below 0°C . For such areas, containers must comply with [\[4.1.5\]](#).

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

The design temperature, T_D , for lifting sets shall not be taken higher than -20°C .

J.4 Marking

In addition to the marking required in [Sec.6](#), containers that are designed in accordance with this appendix shall be marked as follows:

On the same side of the container as the information plate, the following text shall be prominently and indelibly displayed in characters of a contrasting colour, not less than 75 mm high:

ONLY TO BE USED IN TEMPERATE CLIMATES

J.5 Data plate

In addition to the information required in [\[7.2\]](#), the data plate on containers that are designed in accordance with this appendix shall be marked with the following text, in characters not less than 4 mm high:

The plate shall be headed

OFFSHORE CONTAINER DATA PLATE
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and the design temperature shall be marked

Design Temperature: 0°C

Data plates shall not be removed from the container.

CHANGES – HISTORIC

There are currently no historical changes for this document.

About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping our customers make the world safer, smarter and greener.

SAFER, SMARTER, GREENER