# Offshore Containers Diploma (OSC) Global

# Workbook

Lifting Equipment Engineers Association
Lifting Standards Worldwide

## Welcome to the Offshore Containers (Global) Diploma

The Diploma is LEEA's globally recognised, industry-standard qualification for lifting equipment testers, inspectors, examiners, repairers and maintainers. The Diploma qualification is essential for anyone engaged in the testing, inspection and examination of offshore containers and responsible for assessing their suitability for continuing service.

**Key areas covered in this training course:**

- Working on site
- The examiners' tools and equipment
- Offshore Container standards
- Types of examination
- Terms, Definitions and Symbols
- Design and Construction
- Lifting Eyes (Pad Eyes)
- Lifting Media
- Certification
- Lifting Set Design
- Container Testing
- Lifting Set Testing
- Inspection Report Contents
- Pre-trip Inspections
- In-Service Thorough Examination
    - Safety Precautions

### Learning Outcomes

Upon successful completion of this Diploma course, students will acquire the knowledge that will assist them to perform the 'thorough examination' of offshore containers in service and validate or otherwise assess their fitness for a further period of service, applying conditions as may be necessary.

**This course does not include ISO containers.**

Students will be able to refer to and extrapolate information from sources to support their analysis of lifting equipment suitability for continued service.

## Working on-site

As a professional in the lifting equipment industry, there are high expectations of you to perform your role to mitigate risk and keep people safe. This is of paramount importance and should always be the priority focus of your work.

Secondly, our stakeholders, customers and employers rightly expect the highest professional standards from all those working in such a high-risk industry. So you are expected to be competent in your technical abilities, but moreover, as a professional, you must also manage your standards of service, both internally to your employer, and externally to your customers and other stakeholders.

Let's look at LEEA's vision statement:


*Notes:*

## TEAM Card

On successful completion of this training course and the associated end-point assessment, you will be awarded the LEEA Diploma in Offshore Containers (Global), and where applicable, the LEEA TEAM Card.

As a TEAM Card holder, there is an expectation that you will perform your role to the very best of your ability, meeting the requirements of a 'competent person' as defined by LEEA in its COPSULE.

Our industry 'end-users' are actively encouraged to use LEEA member companies that employ qualified and competent individuals. They are assured that by using LEEA TEAM Card holders, they are putting their lifting equipment into safe hands and minimising their risks as duty holders and owners of such equipment.


In order that we continue ***"raising standards in the lifting equipment industry"***, each of us has our own part to play. As a lifting equipment examiner/inspector/tester, employed by a LEEA member company, you share this responsibility and have a particularly important role!

During this section of the course, we will look at how we approach our work on a day-to-day basis. Our considerations must include:

a. **Pre-Job Information**

b. **Representing your employer: your role as an ambassador**

c. **Reporting and signing-in**

d. **During the job**

e. **Completing the job**



So before we consider getting into our vehicle and travelling to the customer's site, we should pause and think about the following:

## a) Pre-Job Information

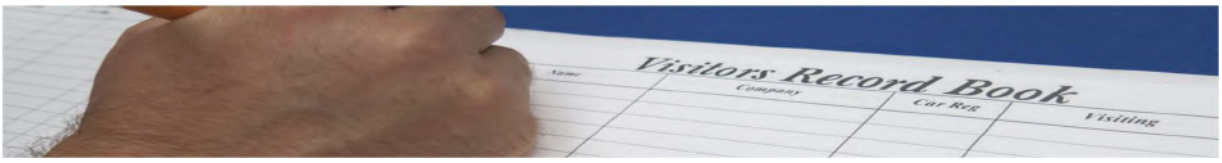
1. What task(s) am I expected to do at the site today?
2. Who am I to report to when I get there?
3. Do I have all the necessary paperwork and work instructions from my employer?
4. What equipment will I need to complete the task(s)?
5. Any requirements for access storage or workshop areas?
6. How to access the site, particularly access for test weights and adequacy of floors and passages?
7. How long is the task(s) expected to take?

## b) Representing Your Employer

1. Are my vehicle and uniform/overalls clean?
2. Do I have appropriate footwear?
3. Is my PPE suitable for the task(s) expected of me? Do I have alternatives in case I have to change my method of work?
4. Has the risk assessment or JSA (job safety analysis) been completed, or do I have to conduct this alone when I arrive at the site? Will I simply have to review the existing JSA?
5. Is there a method statement for the work? Has this been discussed and agreed?
6. Make sure you notify the customer of your arrival time on site

## c) Reporting and Signing In

1. Report to main reception and sign in officially
2. Meet with your designated contact
3. Information is to be exchanged about the work to be done and safety precautions to be adopted, both from the examiner's and site personnel point of view
4. Agree a meeting time for when you have finished your work for a debrief
5. Discuss communication arrangements so that your whereabouts is known, and you can be contacted at all times to ensure you are safe and well whilst working on site



## d) During the job:

**Firstly, you must consider the basic requirements for the examination to be effective:**

1. Adequate access to the equipment shall be provided
2. The equipment should be reasonably clean, and the examiner should have means to clean local areas
3. The examiner should have visual aids and tools required for the examination, including adequate natural or artificial lighting

Then;

4. Conduct your job safety analysis review before starting work – make sure any changes are recorded as they arise
5. Is a permit to work required?
6. Confirm the identity of the equipment against the work sheet instruction or users record of the lifting equipment
7. Isolation of the work area as necessary and put into place any additional control measures as may be necessary


8. Toolbox talk with colleagues if applicable before starting the job
9. Talk to equipment operators/user. Are there any issues they may have noticed with the equipment?

(**Note:** this is particularly important as the user is usually the first to recognise faults or other issues arising)



10. Make sure all information is recorded regarding the equipment (e.g. location, serial numbers, ID plates and safety markings, etc.)

11. Detail your findings for the report together with any defects found

12. Maintain the safety of the area you are working through awareness of your surroundings and what is happening. You may need to change the RA/JSA if new control measures are needed due to changing hazards

## e) Completing the job:

1. Did you carry out post-examination operational checks?

2. Has equipment been stowed in designated storage areas or parked in a safe area?

3. Have all barriers and signs been removed from cordoned areas?

4. Let equipment users know that you have finished your work, and that the equipment has been returned to service

5. Complete your reports, identifying any issues and your recommendations; safety critical issues are your priority, and the owner of the equipment must be notified of these immediately. If the equipment is to be removed from service, ensure it is suitably quarantined and marked, **"DO NOT USE"**

6. Identify and detail any repairs that may need carrying out and a timescale in which this should be completed

7. Have your debrief meeting with the site contact to present your report summary

8. Ensure your customer is completely satisfied before you leave site

**IMPORTANT!**

LEEA Members represent the highest standards within our industry. You are an ambassador for your company and your profession; it is essential that your personal behaviours are exemplary, and your competencies are consistently maintained through our active participation in continuous professional development (CPD).


**Why is it important to pre-arrange a sign off meeting with your customer prior to starting work on site?**

- To ensure that checks can be made of the work area and customer is happy
- To ensure customer is available for you to present your report summary
- To ensure that work permits and control measures are removed
- To ensure that the customer can carry out operational checks of the equipment

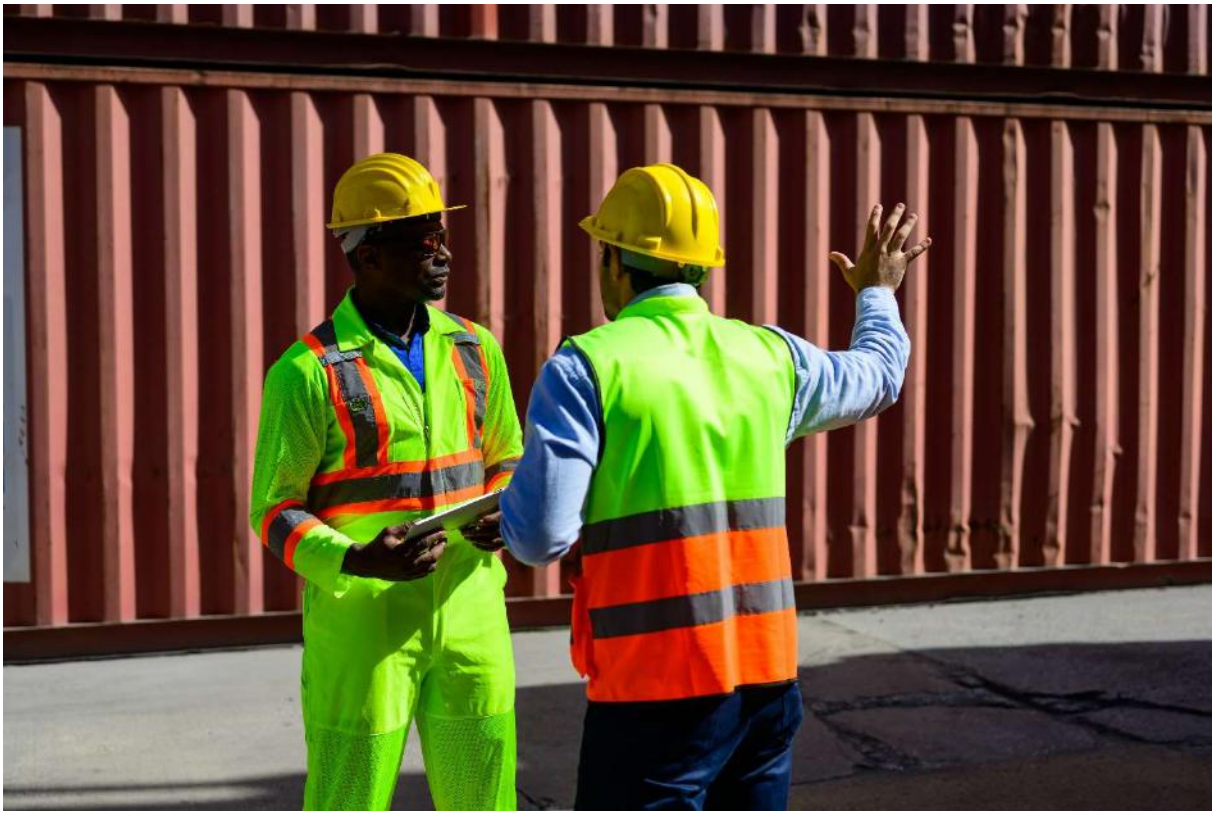
*Notes:*

## Equipment for Carrying Out On-Site Thorough Examinations

### Tools

The offshore container examiner will require a selection of hand tools in the course of their work. The selection of tools will depend on the nature of the job.

A broader perspective on tools required may include access equipment (MEWP, scaffolding, cleaning equipment etc.) You may also need to consider the types of lifting equipment you need for moving or lifting containers.



You should be appropriately trained to use all equipment you are supplied with and have the appropriate PPE. Both hand and power tools should be maintained in a safe and operable condition.

**Measuring Equipment:** Calibration of measuring equipment should be carried out in accordance with relevant standards, and this is verified by LEEA during compliance audits.

**Lighting** It is very important that the area of inspection is well lit with natural or artificial light so that defects can be identified. Torches or portable lighting stations may be required to help you.

*Notes:*

The area where you are carrying out the inspection should be reasonably clean and free of contaminants that may affect the equipment you are inspecting. As an examiner you may not be able to see deterioration or damage that may be present due to excessive dust, oils and grease etc. It is therefore imperative to ascertain whether the container needs cleaning prior to the examination taking place.

It is recommended that you carry basic cleaning materials such as rags, dustpan and brush, a wire brush and PH neutral cleaning fluids in the event that you have to clean the item(s) being inspected.

Ensure any data sheets and chemical warnings are adhered to for the use of such products and your JSA/risk assessment reflects this.


*Notes:*

## Offshore Container Standards

Wherever possible, this training course is based upon global best practice; references are made to standards throughout to specified standards which have been adopted in the formulation of LEEA guidance.

The standards we will refer to during the course are as follow:


**Guidance applicable to Offshore Containers**

The guidance that led to the development of a European Harmonised Standard for Offshore Containers was from the International Maritime Organisation (IMO) Marine Safety Committee Circular 860 (MSC/Circular 860).

This Circular was intended to guide national authorities in developing approval and certification requirements for offshore containers. It recommends that new offshore containers be approved, prototype tested and certified by duly authorized bodies.

The Circular led to the development of BS EN 12079, which then caused BS 7072 to be withdrawn in 1999. The initial European Standard was superseded in 2006 by a newer version and more recently, by the BS EN ISO 10855 series of standards.

Due to the robustness of offshore containers, a large number of BS 7072 and BS EN 12079 units still exist in service. Consequently, the inspector should also be familiar with these standards.

**Withdrawn Standards for Offshore Containers**

| Standard Number | Standard Name | Status |
|---|---|---|
| BS 7072: 1989 | British Standard Code of Practice for inspection and repair of offshore containers | Withdrawn |
| BS EN 12079 – 1: 2006 | Offshore containers and associated lifting sets – Part 1: Offshore containers – Design, manufacture and marking | Withdrawn |
| BS EN 12079 – 2: 2006 | Offshore containers and associated lifting sets – Part 2: Lifting sets – Design, manufacture and marking | Withdrawn |
| BS EN 12079 – 3: 2006 | Offshore containers and associated lifting sets – Part 3: Periodic inspection, examination and testing | Withdrawn |

**Current Standards for Offshore Containers**

| Standard Number | Standard Name |
|---|---|
| Det Norske Veritas Germanischer Lloyd (DNVGL) DNVGL-ST-E271 | 2.7-1 - Offshore Containers – August 2017 (supersedes June 2013 edition) |
| BS EN ISO 10855 – 1: 2018 | Offshore containers and associated lifting sets – Part 1: Offshore containers – Design, manufacture and marking of offshore containers |
| BS EN ISO 10855 – 2: 2018 | Offshore containers and associated lifting sets – Part 2: Lifting sets – Design, manufacture and marking of lifting sets |
| BS EN ISO 10855 – 3: 2018 | Offshore containers and associated lifting sets – Part 3: Periodic inspection, examination, and testing |

*Notes:*

## BS 7072: 1989 – British Standard

**Code of Practice for Inspection and Repair of Offshore Containers**

This British Standard was withdrawn on the 15th October 1999 with the advent of BS EN 12079. However, all inspection bodies and inspection personnel should be aware that there are still many of these containers being operated. When requested to inspect and test containers built to BS 7072, all personnel involved should make themselves aware of the requirements of this standard.

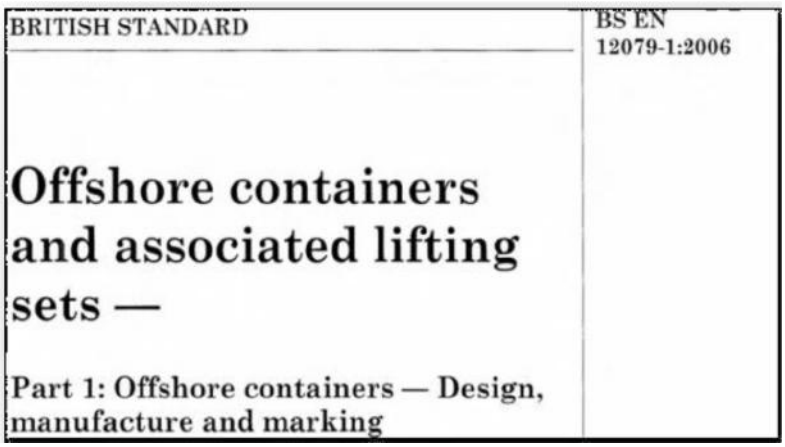
**Note**

Oil and Gas UK following the recommendation of Maritime and Coastguard Agency (Marine Guidance Note 282), prohibited the use of BS 7072 containers being used in UK waters for the purpose of carrying dangerous goods from the 1st January 2015. This is not a global prohibition so inspection personnel should make themselves aware of the regulations required by the national government local to them.

**BS EN 12079 – 1: 2006 Offshore Containers and Associated Lifting Sets**

- Part 1: Offshore containers – Design, manufacture and marking

This European Standard sets down the requirements for the design, manufacture, and markings for the offshore container.


BRITISH STANDARD

BS EN 12079-1:2006

Offshore containers and associated lifting sets —

Part 1: Offshore containers — Design, manufacture and marking

*Notes:*

**BS EN 12079 – 2: 2006 Offshore Containers and Associated Lifting Sets**

- Part 2: Lifting sets – Design, manufacture and marking

This European Standard sets down the requirements for the design, manufacture, and markings for the lifting set.


**BS EN 12079 – 3: 2006 Offshore Containers and Associated Lifting Sets**

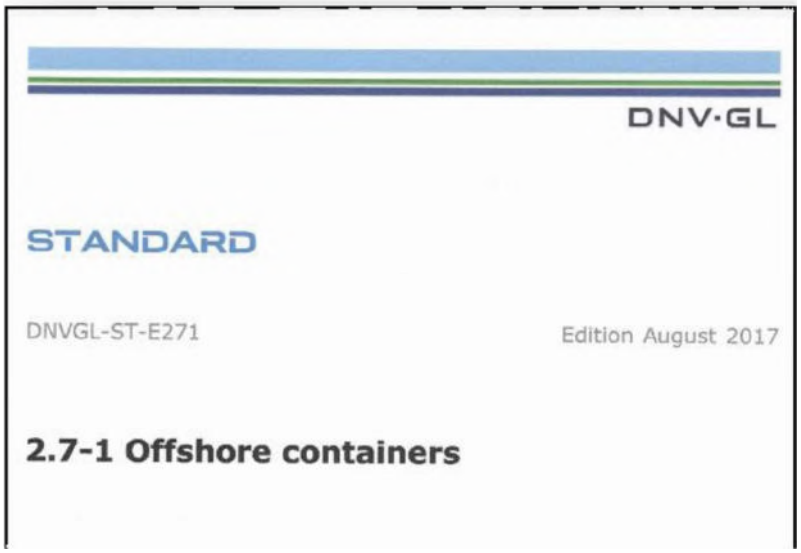
- Part 3: Periodic inspection, examination and testing

This European Standard sets down the requirements for the periodic inspections, examinations, and tests for both the offshore container and the lifting set. Now superseded by BS EN ISO 10855-3 2018.

**DNV GL-ST-E271**

Det Norske Veritas Germanischer Lloyd (DNV GL) is an independent organisation with dedicated risk professionals with the purpose of safeguarding life, property and the environment.

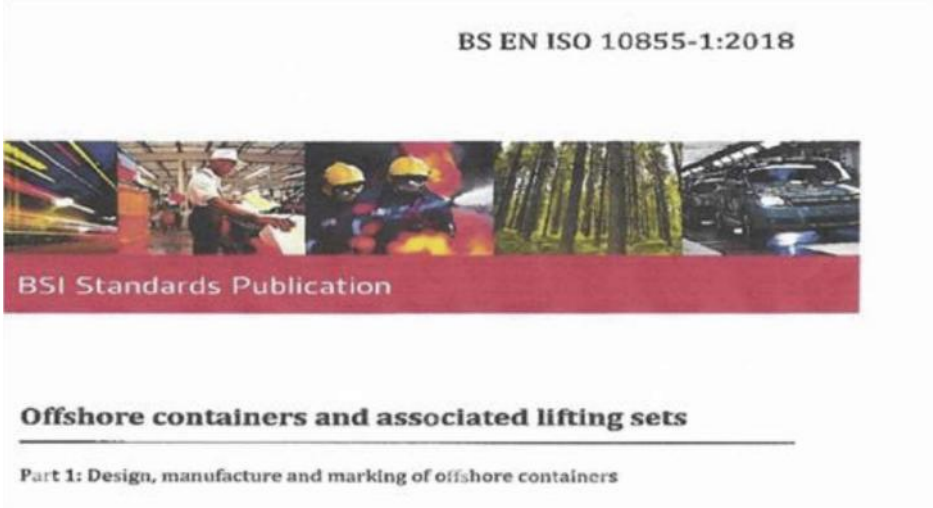
The DNV GL Standards for Certification are used globally and the Standard No 2.7-1 for offshore containers is used extensively worldwide.




**BS EN ISO 10855-1: 2018 Offshore Containers and Associated Lifting Sets**

- Part 1: Design, manufacture and marking of offshore containers

ISO 10855 (all parts) meets the requirements of IMO MSC/ Circ.860 for the design, construction, inspection, testing and in-service examination of offshore containers and associated lifting sets which are handled in open seas.

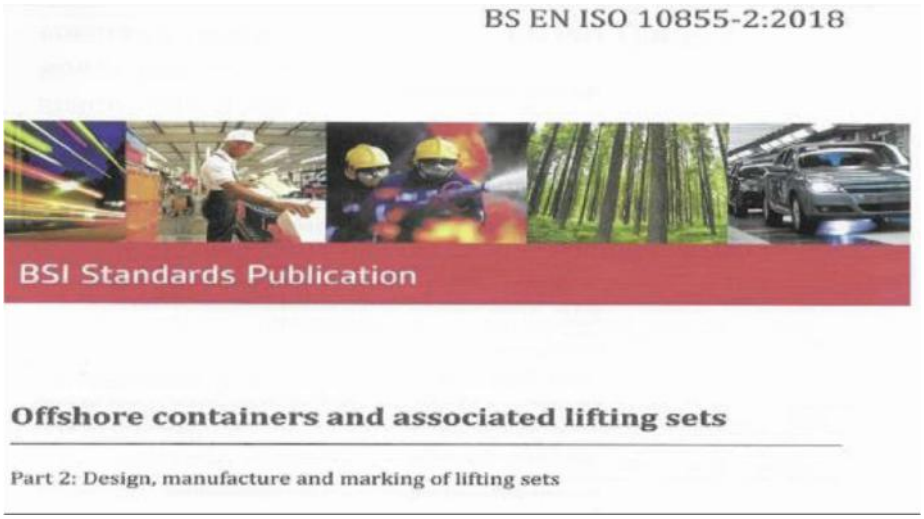




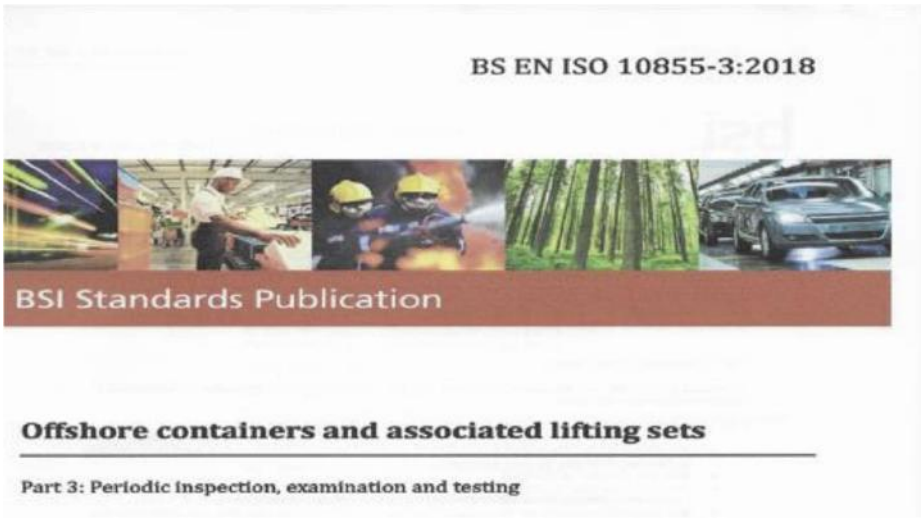
**BS EN ISO 10855-2: 2018 Offshore Containers and Associated Lifting Sets**

- Part 2: Design, manufacture and marking of lifting sets




**EN ISO 10855-3: 2018 Offshore Containers and Associated Lifting Sets**

- Part 3: Periodic inspection, examination, and testing




*Notes:*

**Codes of Practice**

The International Maritime Organisation (IMO) is the United Nations' specialized agency responsible for improving maritime safety and preventing pollution from ships.

The International Maritime Dangerous Goods Code, written by the IMO and first published in 1965, has become the standard guide to all aspects of handling dangerous goods and marine pollutants in sea transport.

The Code lays down basic principles: detailed recommendations for individual substances, materials and articles, and a number of recommendations for good operational practice, including advice on terminology, packing, labelling, stowage, segregation and handling, and emergency response action.

Various offshore containers are utilised to carry dangerous loads so will come within the scope of the International Maritime Dangerous Goods Code.

**Terms and Definitions**

This module offers essential terms, definitions and symbols used for offshore containers.

**Offshore Container**

Portable unit for repeated use in the transport of goods or equipment handled in open seas, to from and between fixed and/or floating installations and ships.

Both BS EN ISO 10855 and DNVGL-ST-E271 containers have a maximum gross mass of 25,000kg. Offshore containers are subdivided into 3 categories:

1. Offshore freight container built for the transport of goods
2. Offshore service containers built and equipped for a special service task usually as a temporary installations such as laboratories, workshops, stores, or power plants
3. Offshore waste skips which can be open or closed for the storage or removal of waste

**Offshore Freight Container**

Examples of offshore freight containers can include:

**Tank container**

**General cargo**

**Cargo basket**


**Gas cylinder rack**

Offshore service containers can include:

**Swing jib container**

**Lubrication pump**

**Stores**

**Offshore Waste Skip**

Open or closed offshore container used for the storage and removal of waste.

In addition to the pad eyes for the lifting set, the boat shaped containers may also have side mounted lifting lugs suitable for use with the lifting equipment mounted on a skip lift vehicle.


**Permanent Equipment**

Permanent Equipment is equipment which is attached to the container which is not cargo.

This may include lifting sets, refrigeration units, securing points and shelves.

*Notes:*

**Primary Structure**

Load carrying, supporting frames and load carrying panels. The primary structure can be subdivided into 2 groups.

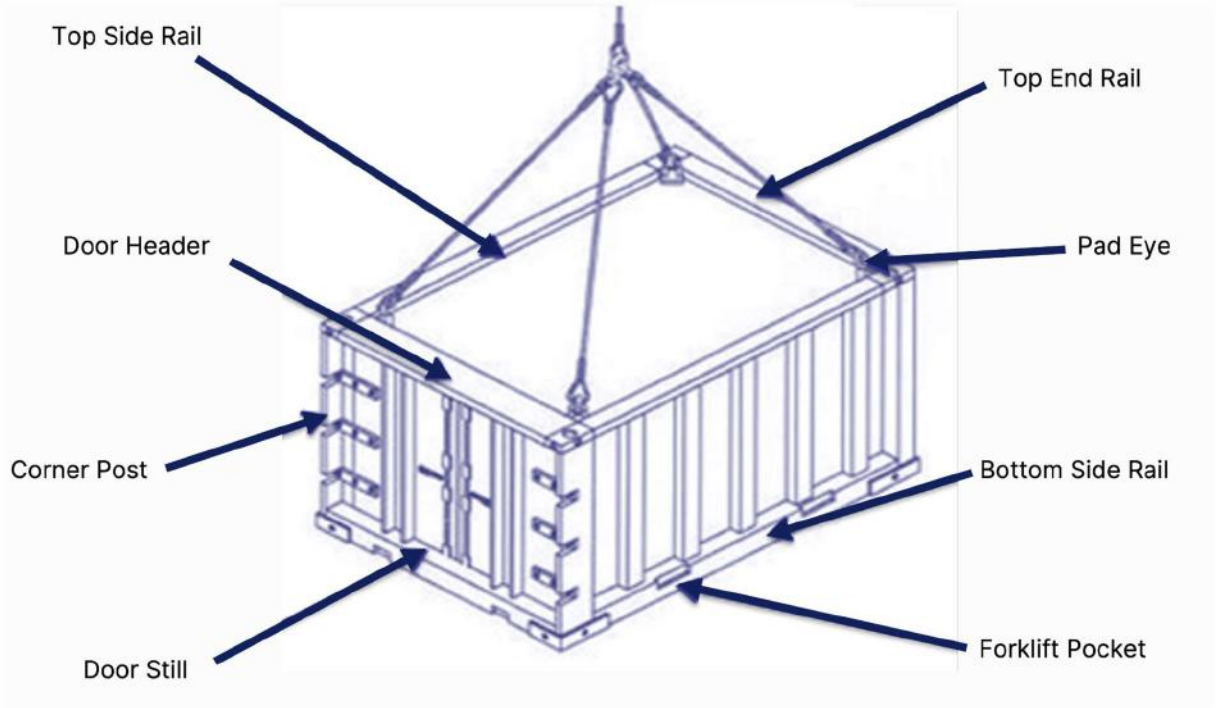
**1. Essential primary structure**

Essential primary structure which transfers the cargo load to the crane hook. Forms the load path from the payload to the lifting set and will include at least:

- Top and bottom side rails
- Top and bottom end rails
- Corner posts
- Pad eyes

**2. Non-essential primary structure**

Non-essential primary structure which are parts of the container such as the floor plates and protective frame members on tank containers.




*Notes:*

**Secondary Structure**

Secondary structure is defined as parts that are not considered as load-carrying for the purpose of design calculations.

Secondary structure items include:

- Doors, walls, and roof panels
- Panel stiffeners
- Structural components used for tank protection only
- Internal securing points


**Other Definitions:**

**Prototype**

Equipment item used for type testing, considered to be representative of the product for which conformity is being claimed. It may be either fabricated especially for type testing or selected at random from a production series.

**Owner**

The legal owner of the offshore container or the delegated nominee of that body.

**Lifting Set**

The items of integrated lifting equipment used to connect the offshore container to the lifting appliance.

*Notes:*

**Symbols**

- **T** – Tare mass or the mass of the empty container including any permanent equipment (but excluding the lifting set and the cargo) in kg
- **P** – Payload or the maximum permissible mass of cargo that may be safely transported by the container in kg
- **R** – or the 'maximum gross mass' MGM, (sometimes referred to as 'maximum gross weight' (MGW)) of the container including permanent equipment and the cargo (but excluding the lifting set) in kg.
- **S** – Mass of the lifting set-in kg

> The mass of the lifting set is not included in the rating or the tare mass as this is often added later to the container and there is often the case where the lifting set will be changed out. In some cases, this lifting set media may be changed from steel wire rope to chain resulting in a heavier lifting set.

**Example**

T – Tare mass or the mass of the empty container including any permanent equipment but excluding the lifting set and the cargo in kg.

The example below is for a container with a tare mass of 725kg.


P – Payload or the maximum permissible mass of cargo that may be safely transported by the container in kg.

The example below is for of a container with a payload of 5275kg.


*Notes:*

R – Rating or the 'maximum gross mass' (MGM) of the container including permanent equipment and the cargo (but excluding the lifting set) in kg.

The example below is for a container with a rating (MGM) of 6000kg. This example also shows the design angle.

The MGM or rating is the tare mass and payload added together.


**General Design**

An offshore container shall have sufficient strength to allow unloading and loading from supply vessels offshore operating in sea states with significant wave heights of 6 metres and to withstand impact from heavy seas.

Impacts can also occur when the container hits the deck, rigid parts of the structure or other containers; this often happens when the crane is loading and unloading containers from the supply vessel.

To prevent the containers from overturning on a moving deck, they are designed to withstand tilting in any direction of 30° without overturning when loaded at its Maximum Gross Mass, when empty or any intermediate condition.

The centre of gravity would be considered by the designer to be at half-height of the container, unless the container is designed for a specific load like bottle racks. This is because the actual centre of gravity will be below half height and the actual centre of gravity would be required to be used for design purposes. DNVGL-ST-E271 requires a tilt test where the container's ability to tilt cannot be verified through calculations.

Protruding parts of the container that may catch other containers or structures shall be avoided.


Stacking fittings and guides, and other structures that protrude above the top of the container frame shall be designed and located to minimise the potential to catch on structures on the ship or on other deck cargoes during lifting operations.

They shall also be designed to minimise the risk of damage to other containers or cargoes from these.

Containers that are designed for stacking with the lifting set hanging over the side of the top frame shall be fitted with a method of protection for those exposed parts.

*Notes:*

The example below has the corners raised to a sufficient height above the frame and roof to prevent unintentional contact with, and damage to, the lifting set.


Containers shall be designed as structural frames (primary structure), with non-load bearing cladding where necessary (secondary structure).

On certain types of containers, e.g. waste skips with trapezium shaped sides, with only a non-stressed cover above the bracing where the pad eyes are attached, the whole structure may be considered as a primary structure, and the design calculations may treat such a container as a monocoque construction.

The design temperature for the containers shall not be higher than the lowest daily mean (average) temperature where the offshore container is to operate and in no case shall be higher than -20°C.

**Note**

Impact loads are dynamic loads of very short duration. Ideally, dynamic calculations or tests should be carried out to verify the ability of a container to withstand such loads.

**Horizontal Impact**

The main frame structure dimensions shall 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. To protect against these horizontal impact loads acting on the corner posts, there will often be protective non- load bearing cladding welded over the corner posts.

**Internal Forces on Container Walls**

Each container wall, including the doors, shall be designed to withstand an internal force evenly distributed over the whole surface, without suffering any permanent deformation.

**Vertical Impact**

A vertical impact test shall be carried out in accordance the standard being worked to.

Maximum vertical impact forces are likely to occur when a container is lowered onto the deck of a heaving supply vessel.

If the deck is at an angle, the first impact will be on a corner.

**Minimum Material Thickness**

The following minimum material thickness (t) requirements shall apply.

| | |
|---|---|
| For R≥ 1000 kg, thickness = | 6 mm |
| For R≤ 1000 kg, thickness = | 4 mm |

**Note**

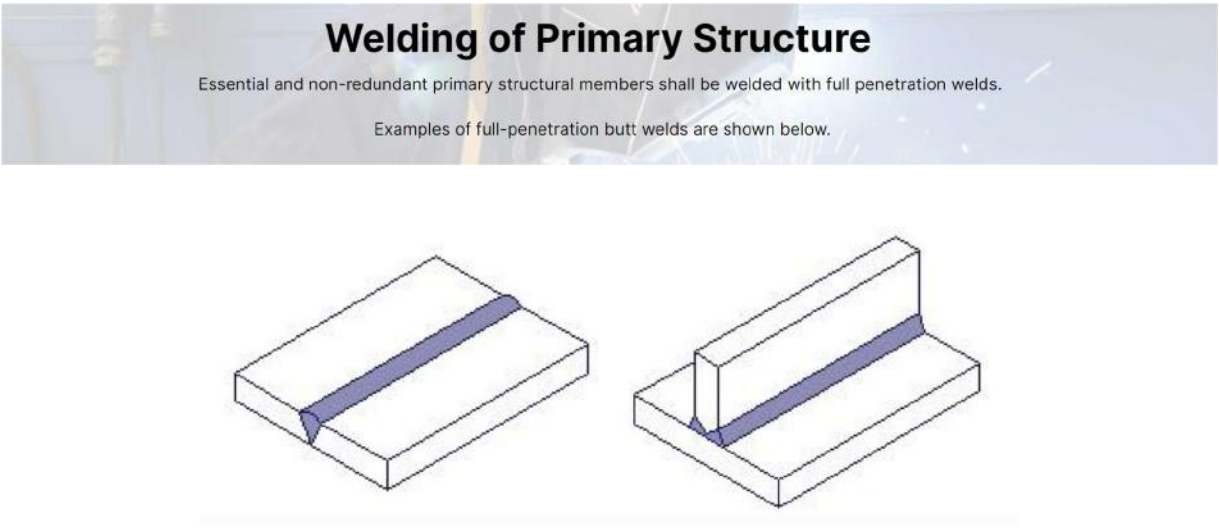
R = Rating (see module 4 – Terms Definitions and Symbols)

For external parts of corner posts and bottom rails i.e., parts forming the outside of the container:

- For all other parts of the primary structure: thickness = 4 mm
- For secondary structure made from metallic materials: thickness = 2 mm

For waste skips of monocoque design, within an area of 100mm from the side edges a minimum thickness of metallic material of 6mm and for the remaining side structures a minimum thickness of 4mm.

These thicknesses may have to be increased beyond these values to take account of special considerations such as rating, design, corrosion allowances etc.




For other primary structure, the use of fillet welds shall be justified by design appraisal.

**Welding of Pad Eye**

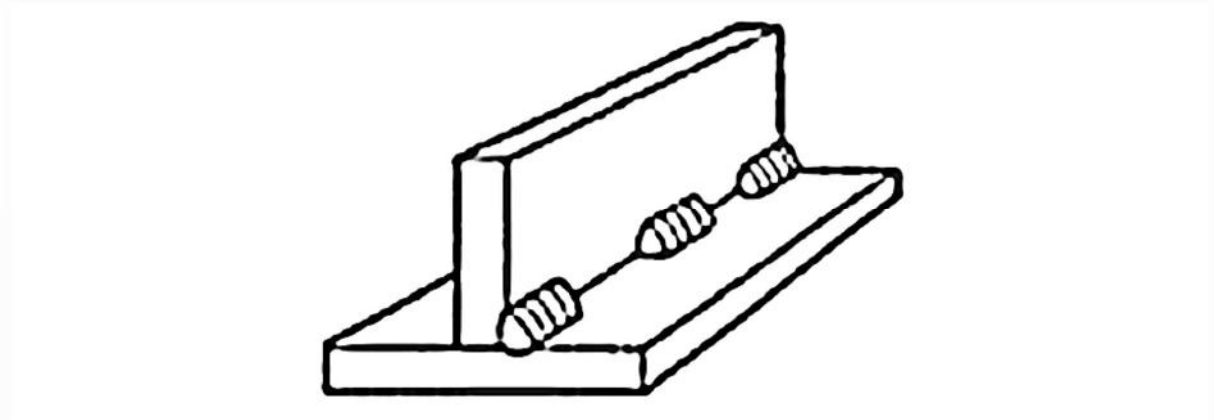
All main welds between pad eyes and the primary frame structure shall always be full penetration welds.



**Welding of Secondary Structure**

Intermittent fillet welding of secondary structure is acceptable, but measures shall be taken to avoid corrosion if water intrusion could cause problems. An example of fillet welding is shown below.



## Additional Design Details

**Floor**

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

**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 such 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 damage from impact loads. Doors shall be capable of being secured in the open position. If weather tightness is required, the doors shall be equipped with seals.


**Intermediate Cargo Decks**

When intermediate cargo decks, are fitted they shall be designed to withstand a uniformly distributed force.

**Driving Ramps**

Offshore containers may be fitted with driving ramps. The strength of driving ramps shall be verified by test loading.

The test shall be performed with a test vehicle, with the axle load evenly distributed between two tyres.

The test load shall be 1.25 x the payload (P) but no more than 7260 kg.

Driving ramps are to be marked with the maximum allowable load, which shall be 0.8 x the test load.

**Note**

These requirements only apply to ramps used for driving into containers, not to smaller ramps used for hand-loading trolleys.

**Internal Lashing Points**

General cargo containers will have internal securing lashing points (recommended at least 12) and each will be designed to withstand a force of at least 10 kN. The foldable/hinged type are preferred.

**Forklift Pockets**

Forklift pockets shall:

- Be installed in the bottom structure and have a closed top
- Pass all the way through the base
- Have means to prevent the container falling off the forks
- Minimum internal dimensions of the forklift pockets shall be 200 mm x 90 mm
- Located so that the container is stable during handling and driving, taking into account the dimensions (container length, height, width) and rating
- Located as far apart as practicable but need not be more than 2050mm apart from the centre of pocket to centre of pocket
- The bottom of the pocket may be fully closed but it is recommended that openings are provided to facilitate maintenance and to minimise the risk of loose items being retained in the pockets

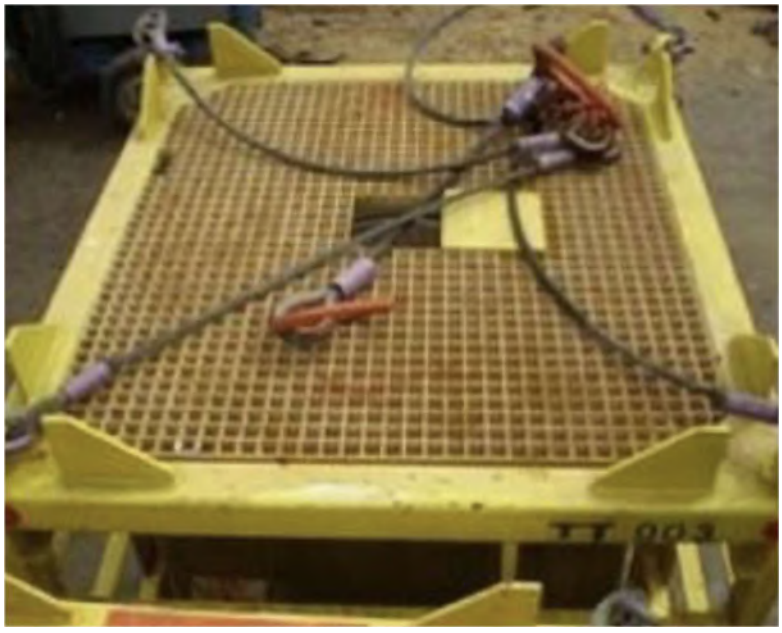
**Forklift Pockets Recommended Distances: DNVGL–ST-E271**

| Recommended Fork Pocket Distance and Operational Limitations | | |
|---|---|---|
| Container length L (mm) | Min distance between centres of pockets (mm) | Limitations |
| Length under 6000 | 900 but no more than 2050 | Between 3000 and 6000 the fork pockets should be spaced at least 1500mm apart |
| Length between 6000 and 12000 | 2050 | Pockets for loaded handling |
| Length between 6000 and 12000 | 900 | Pockets for empty handling |
| Length between 12000 and 18000 | 2050 | Empty handling only |
| Length over 18000 | - | No Pockets |

**Top Protection**

The top of all open frame containers and of all open top containers with permanent internal fittings, machinery, or other installations where crane hooks or forerunners may snag, shall be protected with grating or plates.

This may be fixed, hinged or removable. Top protection shall be capable of being secured.



**ISO Corner Fittings**

Where ISO corner fittings are mounted to offshore containers, they shall conform to ISO 1161.

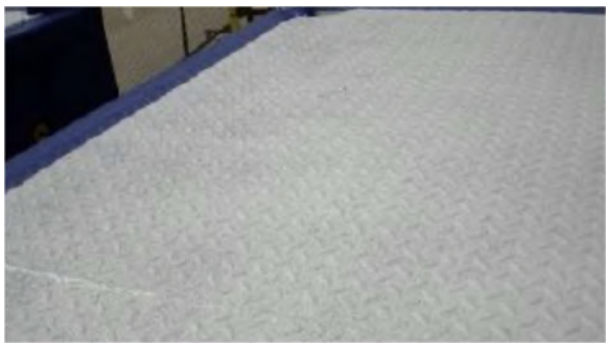
**Note**

Lifting offshore with shackles in these corner fittings is not acceptable.

**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.



**Tank Containers**

**General**

In addition to complying with other relevant design codes and requirements, tank containers shall be suitable for offshore service.

**Frame**

The frame shall be designed to protect the tank and equipment (valves, man-holes, etc.).

**Tanks or Fluids**

Tanks for dangerous cargoes shall fulfil the requirements of the IMDG code and be designed according to a recognized code for pressure vessels. A tank and its support shall be able to withstand lifting and impact loads.

**Impact Protection - 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.

The top of the tank and its fittings shall be protected by beams, plates or grating. No part of the tank or its fittings shall extend to within 100 mm of the top of the framework.

**Top**

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

**Sides**

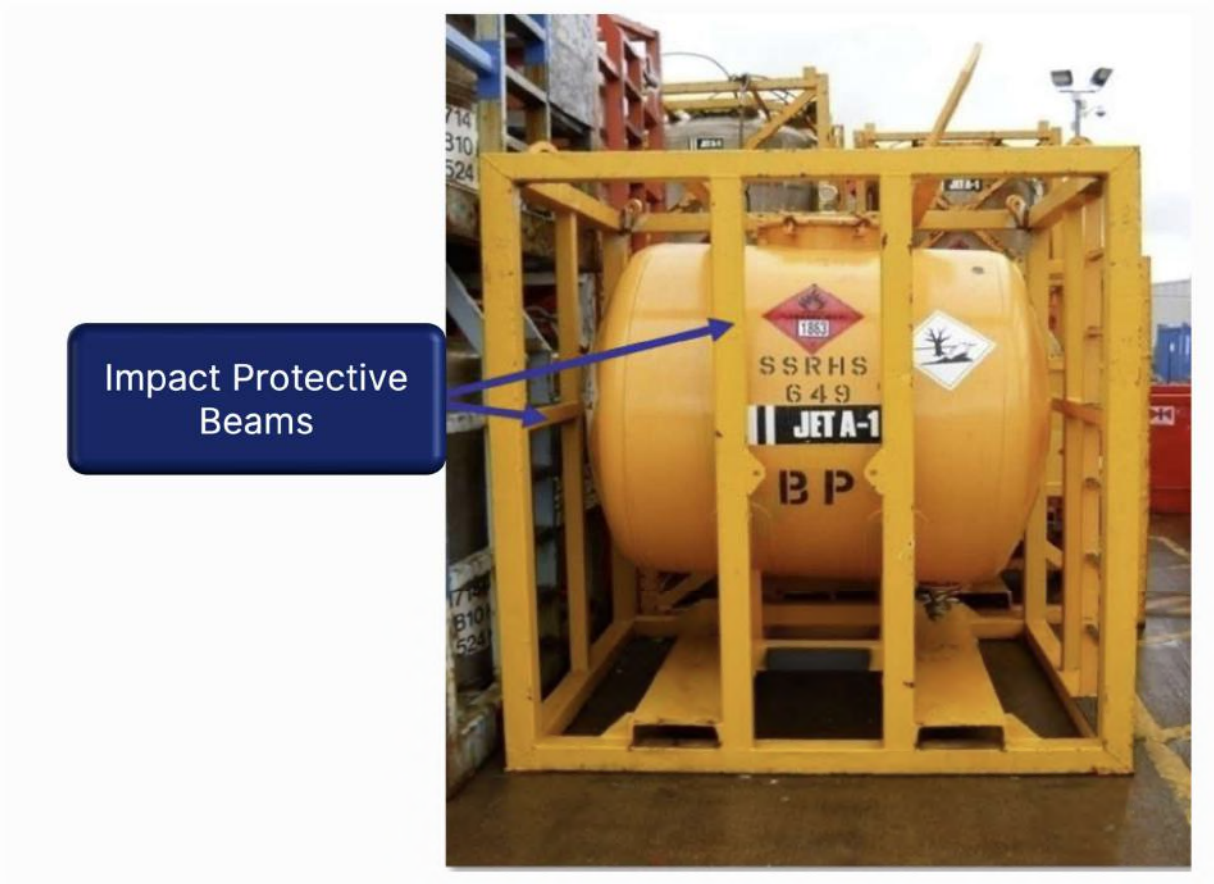
Protective beams shall be placed at or near the location where the tank shell is nearest to the outer plane of the sides.

**Bottom**

No part of the underside of the tank shall extend below a level 150 mm above the bottom of the framework. Any part that extends to within 300 mm of 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 shall be subject to special consideration.






*Notes:*

**Pad Eyes**

Offshore containers use pad eyes at the top corner of the containers to attach the lifting set via a shackle.

The pad eyes are more secure than an ISO corner on an offshore container and even when ISO corner fittings are provided on an offshore container, these should never be used for lifting offshore. This is due to the shackles being twisted in the ISO corner fitting.

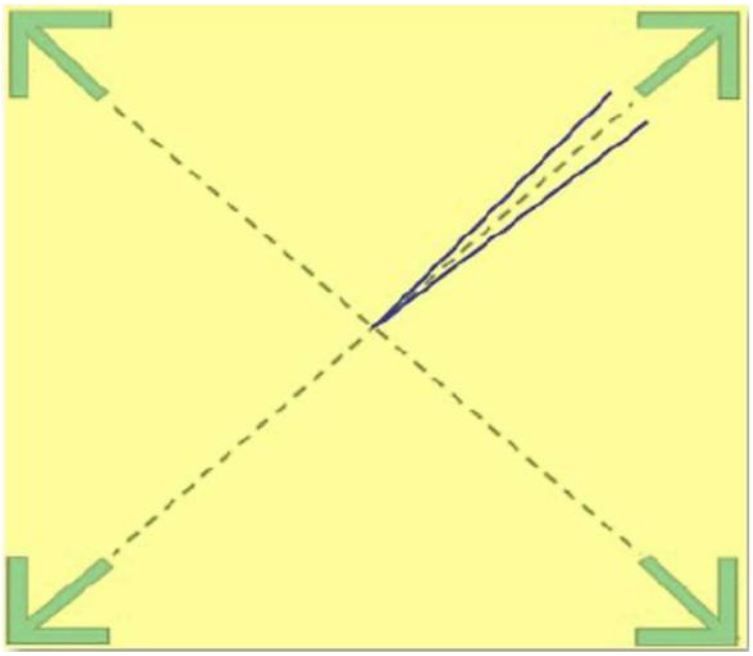
**Note**

Only connect slings to the pad eye using nut, bolt, and pin type shackle (preferred).

**Pad Eye Design**

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 ±2.5°.

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



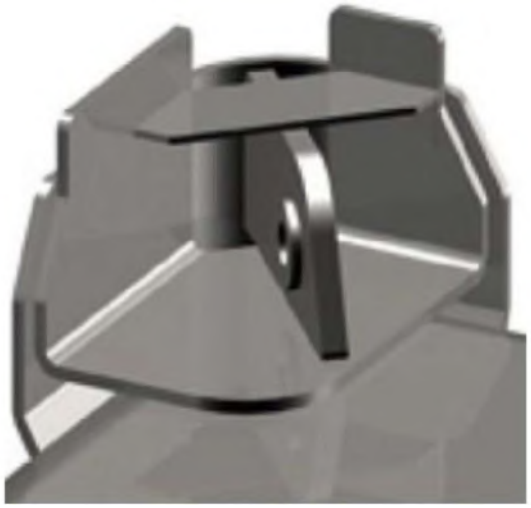
The diameter of holes in pad eyes shall match the shackle used. Clearance between shackle pin and pad eye hole shall not exceed 6% of the nominal shackle pin diameter.

To minimize the shackle pin seizing in the hole, it is recommended to select nominal shackle size and bore in pad eye as close as possible to 6% limit.

Pad eyes shall not protrude outside the boundaries of the container other than vertically upward and shall, as far as possible, be designed to avoid damage from other containers.

Lifting points shall 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 shall be welded to the frame with full penetration welds.



Pad eyes 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.

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

Pad eyes partly slotted into primary structure members are generally considered to be preferable.

Pad eye design must take into account the size and shape of the shackles that are going to be used.

When the pad eye has been designed, only one size of shackle will fit.

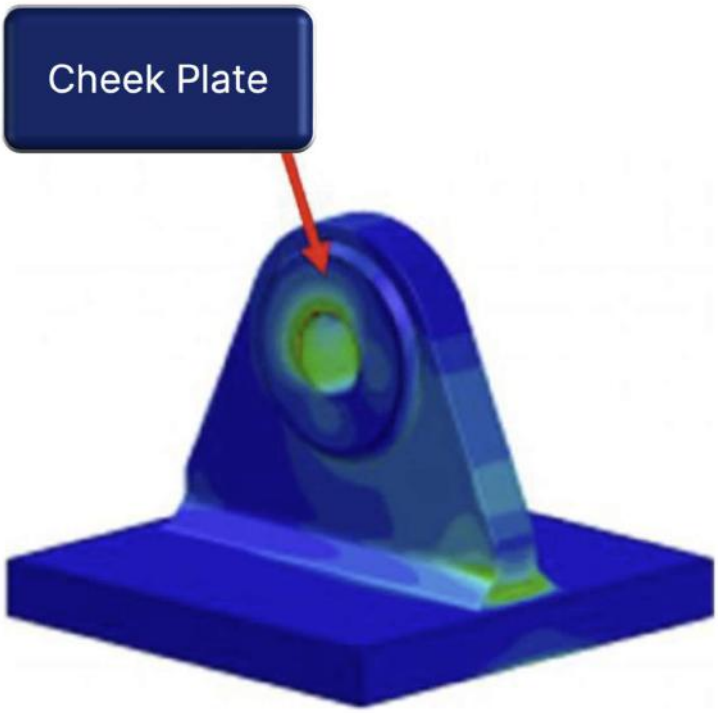
Shackles come in standard sizes therefore the designer should determine the size of the shackles to be used before designing the pad eyes.

The diameter of the shackle pin (pad eye hole diameter to be a maximum of 6% larger than the nominal diameter of the shackle pin). The inside (jaw) width (pad eye thickness to be a minimum of 75% of the shackle jaw width) and length of the shackle and the free space needed to fit the shackle must all be considered.

BS EN ISO 10855-1 requires the tolerance between pad eye thickness and inside width of shackle not to exceed 25% of the inside width of the shackle.

DNVGL-ST-E271 requires that the thickness of the pad eye at the hole shall not be less than 75% of the inside width of the shackle.

The requirements for the pad eye are actually the same although different terminology is used.
If the requirement above cannot be met the thickness can be increased by welding on cheek plates.



| Standard Shackles in Accordance with BS EN 13889 | | | | |
|---|---|---|---|---|
| Nominal WLL (tonnes) | Pin Diameter (mm) | Jaw Width (mm) | Inside Length of Dee Shackles (mm) | Inside Length of Bow Shackles (mm) |
| 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 |

**Pad Eye Design**

One restriction in the requirements of BS EN ISO 10855-2 that the designers need to be aware of is the preference for shackles with bolt type pin with hexagon head, hexagon nut and safety cotter pin to be fitted. Therefore, sufficient space is required surrounding the pad eye to enable this type of pin to be fitted and removed.

More information reference pad eye design can be found in the LEEA Guidance Document **048**.

**Non-Standard Pad Eye**

The picture below illustrates a non-standard pad eye fitted to an ISO container. This container would not have sufficient strength to withstand the dynamic forces that can be experienced when lifting the container offshore.

**Marking Requirements and Data Plates**

**Container Safety Markings**

The tops of closed containers and the top rails of open and framed containers shall be marked as follows:

- A band of solid contrasting colour not less than 100 mm wide around roof perimeter
- On a recessed roof which is below the top perimeter rail, the top surface of the top rail shall be marked

**Open and Framed Containers**

Marked on the top surface of the top rails with hatching in a contrasting colour or a solid light colour.


**Forklift Pocket Markings**

Container fork pockets (handling empty container only) will have the words “empty lift only" clearly displayed near each set of fork pockets.

The characters must not be smaller than 50mm high.

A fully laden container must not be lifted using the fork pockets, instead the correct lifting set will be used.

**Identification Markings**

Containers shall have the fabricator's serial number welded on in characters at least 50mm high so that if stencilled markings becoming illegible, the container can be traced.

In addition, each container shall be marked with a unique container number, issued by the owner, as a prime identifier for use as the common cross-reference on all in-service certification and shipping documentation.


The container number shall be prominently and indelibly displayed on all sides of the container as viewed from ground level in characters of a contrasting colour of not less than 75mm high.


Characters will be at least 300mm displaying the container number on the roof of the container. This is to assist the crane driver in placing the loads in the correct area.

If space is an issue, then characters should be as large as possible.

Marking shall be carried out in such a way as to avoid incorrect interpretation (e.g., by underlining).

Position the lower edge of the marking on the container near the door where applicable, so the crane driver can put the doors facing outwards.

**Information Markings**

Each container shall be clearly and indelibly marked with:

- Maximum gross mass (kg)
- Tare mass (kg)
- Payload (kg)

The maximum gross mass, tare mass and payload shall be displayed in characters of a contrasting colour not less than 50mm high.

A matt black panel of appropriate size may be provided for the application of temporary information. It is recommended that this panel be located on a door, where fitted.

Other Markings

**Intermediate deck**

If an intermediate deck is fitted:

- Payload of the deck displayed on the inside of the container in contrasting colour characters and the characters shall be a minimum of 50 mm high


**BS EN ISO 10855–1 Container Data Plate Markings**

Offshore containers shall be fitted with a plate carrying the following information:

- Manufacturer's serial number
- Month and year of manufacture
- Maximum gross mass in kilogrammes (excluding lifting set) at the design sling angle
- Tare mass in kilogrammes
- Payload in kilogrammes and intermediate deck payload if applicable
- Certificate of conformity number
- Design temperature
- Identification of body issuing the certificate of conformity

The plate shall be headed "**OFFSHORE CONTAINER DATA PLATE – ISO 10855-1**"

The plate shall be made of corrosion-resistant material securely attached in a prominent position- on a container with doors, on the door.

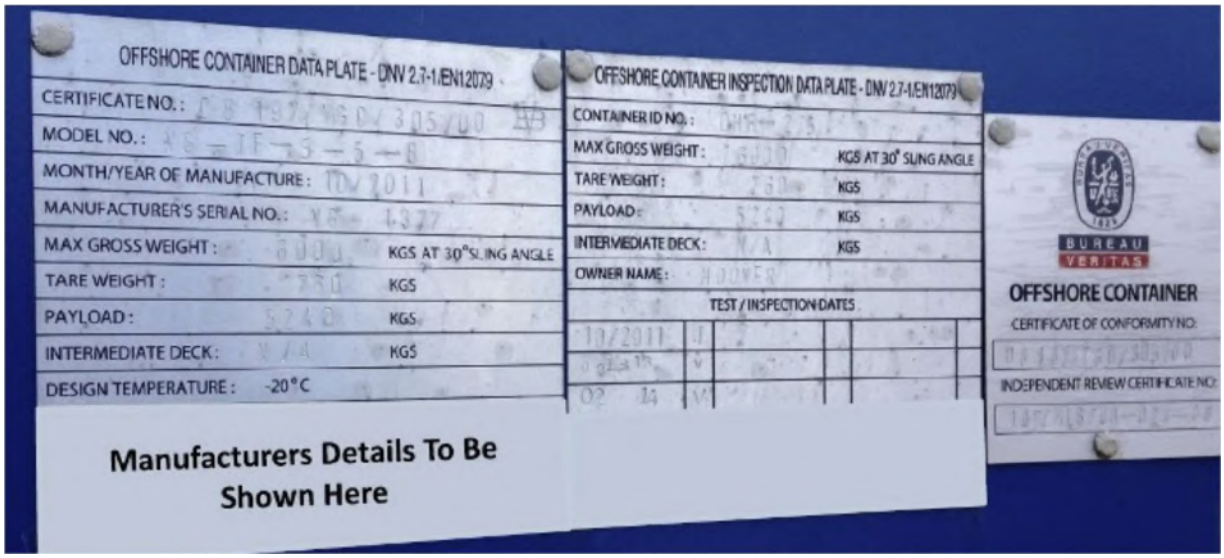
The information on the plate shall be in English primarily, but provisions for a second language may be made. The text shall be in characters of not less than 4mm high.



**DNVGL-ST-E271 Container Data Plate Markings**

Det Norske Veritas offshore containers will also have "**OFFSHORE CONTAINER DATA PLATE DNVGL-ST-E271 / BS EN ISO 10855 – 1**" marked, similar to the image below.




Users and inspectors of DNVGL-ST-E271 containers can regard the data plate as prima facie evidence (sufficient evidence) of certification status.

**BS EN ISO 10855–3 Container Inspection Plate**

The plate shall be headed "**OFFSHORE CONTAINER INSPECTION PLATE – ISO 10855-3**"
The plate shall be made of corrosion resistant material securely attached in a prominent position, on a container with doors, on the door. The information on the plate shall be in the English language primarily, but provisions for a second language may be made. The text shall be in characters of not less than 4mm high.

The plate shall contain the following information:

- Owner's container number
- Owner's name
- Date of last inspection

Provisions shall be made on the inspection plate for at least 9 inspections.

The inspection plate is very often combined with the original data plate.




**DNVGL-ST-E271 Container Inspection Plate**

When certified by DNV, the plate shall be headed "**OFFSHORE CONTAINER INSPECTION PLATE – DNVGL-ST-E271**"

The plate shall be made of corrosion resistant material securely attached in a prominent position- on a container with doors, on the door. The information on the plate shall be in English primarily, but provisions for a second language may be made. The text shall be in characters of not less than 4mm high.

The plate shall contain the following information:

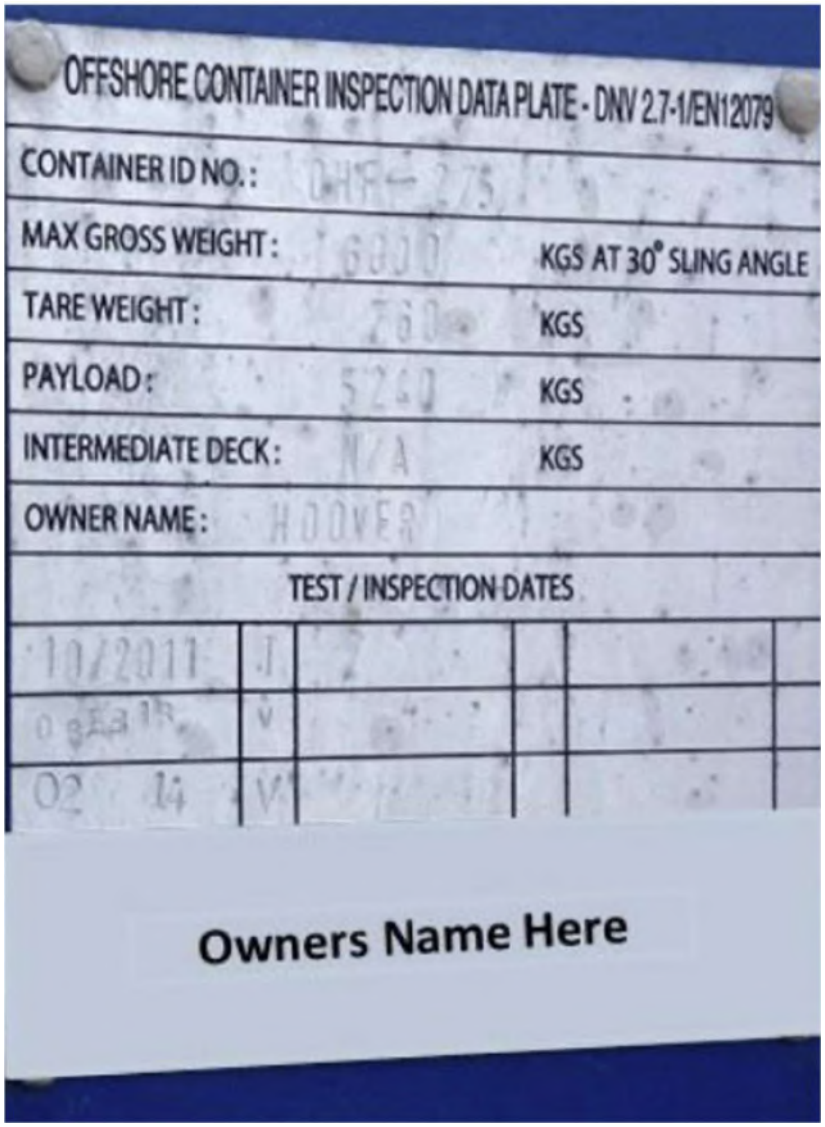
- Owner's container number
- Owner's name
- Date of last inspection

Provisions shall be made on the inspection plate for at least 9 inspections.



This inspection plate is very often combined with the original data.




*Notes:*

**Lifting Set Markings**

In addition to the marking requirements of the individual component standards, BS EN ISO 10855-2 also requires the individual shackles that are not assembly secured are marked with an individual unique identification.

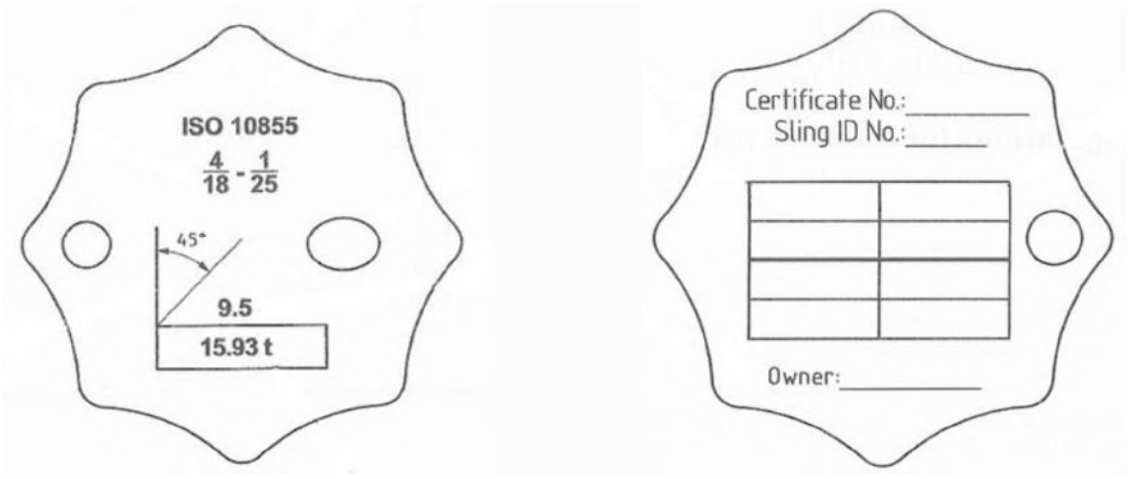
A common method of marking the individual shackles is to relate them to the container and the lifting set.

For example, a container with the serial number 52419089 will have a lifting set serial number of 52419089/A and each of the shackles have the unique number 52419089/B/C/D/E.

The unique identification number should be applied using low stress stamps, with a minimum height of 5mm and applied in areas of low stress.

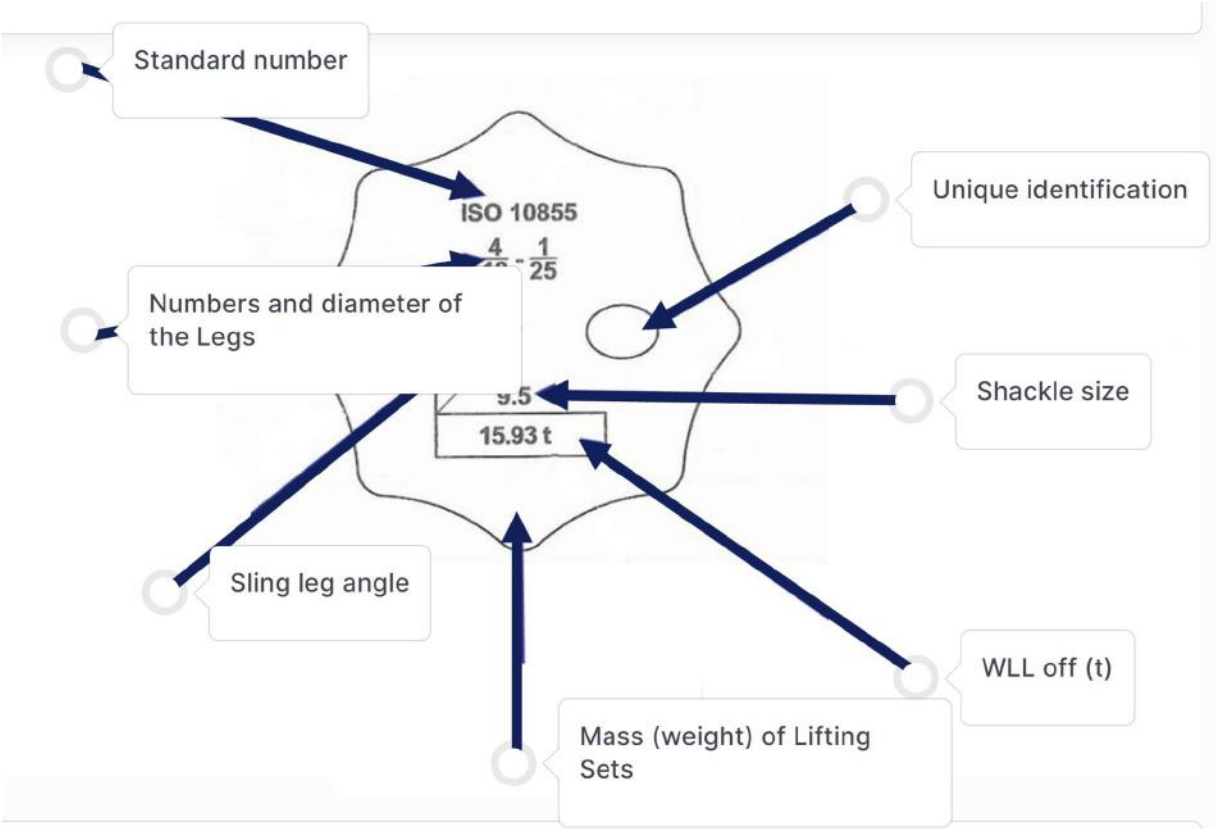
Slings shall be marked with an identification tag permanently attached to the top assembly of the sling. The tag shall be made of metal with the marking permanently embossed or stamped. The tag shall be 8 sided for chain and round for wire rope slings.

Where 2 x 2 leg slings function on a container as a 4-leg sling, both shall be marked as a 4-leg sling. This is often the case in long baskets and open top waste skips, where if it was a standard 4 leg sling this would obstruct the loading as the sling would lay in the container. If 2 x 2 leg slings are fitted, these can be hung over the ends therefore not obstructing the loading area.



The example below is for a chain sling, but these markings are also required on wire rope slings by BS EN ISO 10855-2.

On this tag, the 9.5 indicates the size of the shackles.




*Notes:*

**Certification**

**Type Testing**

Any change of design, specification of material and method of manufacture outside normal manufacturing tolerances, which may lead to a modification of the mechanical properties defined in BS EN ISO 10855-1, shall require that the relevant type tests are carried out on the modified container.

The purpose of type testing is to confirm they possess the mechanical properties specified.

Type testing may not replace design review. Non-destructive examination (NDE) in accordance with the relevant ISO will be required after testing.

**When type testing is being carried out, follow these guidelines where possible:**

- Evenly distribute the test masses inside the container
- Where this is not possible, some of the test mass can be placed outside or under the container, providing that the loading on the structure is similar to the distribution of the container loading in operating condition
- If the container has an additional cargo deck, distribute the test mass evenly between the floor and the removable deck.
- The test must also be carried out with all the test mass on the floor when the deck has been removed

The test mass or test load shall be verified using calibrated weights or a calibrated load cell and handset.
Examples of suitable means of applications are:

- Calibrated test blocks
- Water bags
- Free weights
- Suitable test rig


**Note**

Load cells and handsets when used are required by ISO 7500-1 to have an accuracy of ± 2% and be calibrated annually. If a load cell is shock loaded from being dropped or overloaded, it is recommended that it is re-calibrated before further use.

Where test blocks are used, these shall be calibrated every second year as a minimum, and the measured mass in kilogrammes be legibly and durably marked on each block.

Concrete blocks can absorb water, which may affect the actual block mass - take care to avoid this when storing them.

**Lifting Test**

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 during the test.

The container shall be carefully lifted so that no significant acceleration forces occur. It shall be held for 5 minutes before measurements are taken.

**All-Point Lifting Test**

The container shall be loaded to a total mass of 2.5 x maximum gross mass (R-Rating) and lifted clear of the ground using all pad eyes. The total mass can be obtained by loading an internal test mass of 2.5 x R – T.

No deflections during testing shall be greater than 1/300 of the span of the member. There shall be no permanent deformation or other damage shown after the test.

If the container lifting set is used for this test, there will have been damage caused by the overloading. Avoid this by using specially designed test slings.

**Two-Point Lifting Test**

An offshore container fitted with 4 pad eyes shall also be lifted using 2 diagonally situated pad eyes. The total test mass for the 2-point lifting test shall be 1.5 x R.

The offshore container shall show no permanent deformation or other damage after testing.



**Post-Lifting Test Inspection and Examination**

On completion of the lifting test, carry out a non-destructive examination and visual inspection of the pad eyes.

**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.

**i Notes**

- **Note 1:** This floor may be covered with a sheathing of wooden planks with a thickness not exceeding 50 mm.
- **Note 2:** 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.



**Note**

- **Note 3**: Cracks in welds and minor deformations may be repaired.

One of the following procedures shall be carried out:

**Drop test**

An internal load equal to the payload (P) shall be safely secured and the container shall be inclined as described previously.

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 1m / second.

**Lowering test**

An internal load equal to the payload (P) shall be safely secured and the container shall be inclined as described previously.

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

**Note**

- **Note 4**: Warning, these tests may cause considerable tremors in the building!

**Other Tests**

Open top containers with an overall length of 6.5m or more and with fork pockets designed for loaded lifting shall be loaded to a total uniformly distributed gross mass of 1.6 (R+S) 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.

Tanks for dangerous cargoes shall be tested according to the requirements of the **IMDG Code**.

*Notes:*

**Certification**
**(General)**

All containers shall be issued with a certificate of conformity to show compliance with the relevant standard the container has been constructed to. The certificate shall be kept by the owner for as long as he is in possession of the container.

All certificates relating to design, materials, welding, fabrication, NDE, testing and final inspections shall be kept in the "as built" dossier held by the manufacturer of the container.

This documentation must be retained for a minimum of 10 years by the manufacturer. Information which is not commercially sensitive from the "as built" dossier shall be copied to the owner.

For dangerous goods containers, these shall be certified in accordance with the IMDG code. Each container shall have its own serial number as specified in the marking requirements.

**Certificate of Conformity**

Certificate of conformity shall contain the following information:

- Manufacturer's serial number
- Unique identification number
- Description of the container including:
    - External dimensions
    - Number of lifting points
    - Name of manufacturer
    - Month/year of manufacture
    - Maximum gross mass excluding lifting set (kg)
    - Tare mass excluding lifting set (kg)
    - Payload (kg)
    - Reference to the as built dossier
    - Total loading in kN applicable to the all-points lifting test for the batch of containers tested
    - Angle of lifting set legs (from vertical)
    - Minimum nominal shackle bolt diameter
- Conformity to other requirements and/ or codes
- Statement that the container described has been designed, fabricated and tested in accordance with ISO 10855-1
- Manufacturer's serial numbers of those containers from the production batch subject to testing
- Remarks
- Signature on behalf of the body issuing the certificate of conformity

*Notes:*

**Wire Rope**

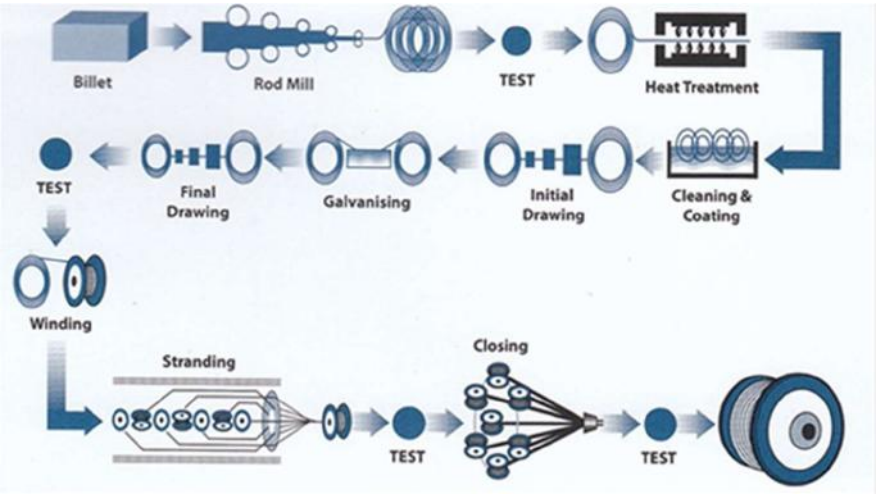
Wire rope and chain slings permanently fitted to offshore containers are specified as 'permanent equipment' in the standard, ISO10855-1. They are also known as a 'lifting set'. Lifting sets and permanent equipment are not classified as cargo.

Before we look at the technical requirements of lifting sets for offshore containers, let us first look at wire ropes, wire rope slings, chain and chain slings.

Wire rope is a good medium for making slings. They are lighter than the equivalent capacity chain slings. Due to its construction, there are a large number of small wires at the surface and so is more susceptible to damage than a chain. Additionally, if a sling is bent around a corner of the load or repeatedly used to lift identical loads, the rope will take on a permanent set.

There are many constructions of wire rope which use a variety of wire sections, wire diameters and methods of spinning the wires together to obtain very different characteristics of rope with different properties for specific duties.

The process starts at the steel wire rope manufacturing plant where a block of steel is extruded, shaped into a round bar and collected in coils. Following testing and heat treatment, the coils of the rod are drawn through dies, reducing the rod into smaller size wires. During the drawing process, surface finishing is also applied before a final test. The finished coils of wire are then supplied to wire rope manufacturers for the construction of the final product.



Ropes are produced from firstly establishing the core, which is made of metal wires or an organic material such as natural or synthetic fibres (Fibre Core, or FC).

Metal wire cores can be produced in several types of construction:

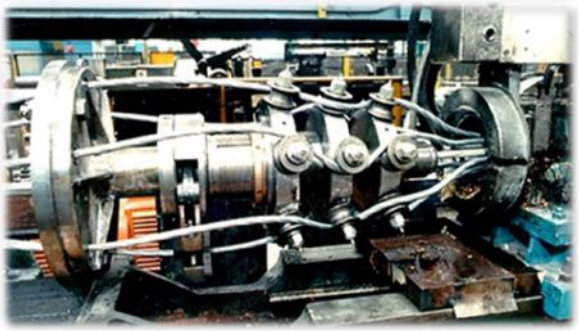
- **Wire Stranded Core (WSC)** - This type of core can be either one single wire as the core, or more typically the core construction is the same as the outer strands
- **Independent Wire Rope Core (IWRC)** - This type of core is made up of a core and strands so is actually a smaller wire rope that is used as the core

To form the rope, a number of single wires are twisted (laid) together to form a strand. A number of strands are then taken and twisted (laid) together around the core to form the rope.

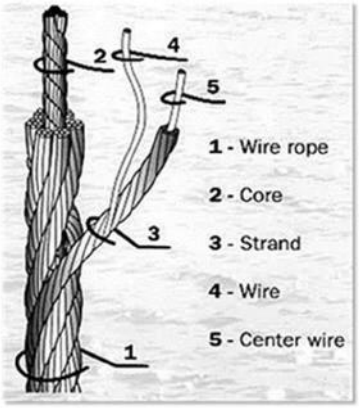
For sling manufacture, ropes formed from round section wire are used. Although slings can be made from any suitable six or eight stranded ropes, six-stranded are by far the more common. We will therefore limit our considerations to six-stranded ropes but exactly the same principles apply to eight stranded ropes.

**Stranding:** stranding takes place when all the wires are brought together at the forming point. Wires used during this and the closing operation are spun into the correct helical shape, this process is called preforming. This reduces the internal stresses in the strands and the rope meaning that if the wires and strands are cut, they do not spring out of the rope formation.

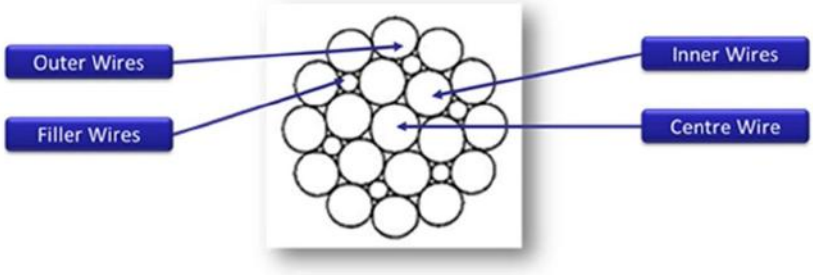
**Preforming:** this gives certain advantages with regards to the performance of the rope in that it results in a relatively inert (dead) rope that is more resistant to kinking, it becomes easier to handle so when such a rope is cut wires will stay in position, broken wires do not stick out, therefore, making it less dangerous to the user and that the rope is more flexible.



**Strand Construction:** a single wire, known as a king-wire, is taken and then the remainder of the required number of wires are twisted around this to form a strand.




- **Outer wires:** all wires positioned in the outer layer of a spiral rope or in the outer layer of wires in the outer strands of a stranded rope
- **Inner wires:** all wires of intermediate layers positioned between the centre wire and outer layer of wires in a spiral rope or all other wires except centre, filler and outer wires in a stranded rope
- **Filler wires:** wires used in filler construction to fill up the gaps in between the layers
- **Centre wires:** wires positioned at the centre of a spiral rope or the centres of strands of a stranded rope



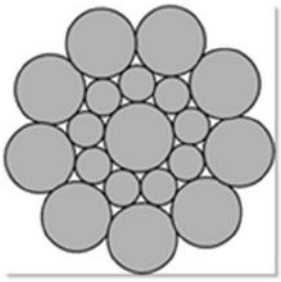

A single wire, known as a 'king wire', is taken and then the remainder of the required number of wires are twisted around this to form a strand. Wire sizes and the manner in which they are laid up can be adjusted to give varying performance characteristics to the rope for different service duties. The most common wire rope for sling manufacture is 6 x 19. However, 6 x 36 is also widely used, but other constructions can be employed. 6 x 19 means that there are 6 strands, each of which has 19 wires, and 6 x 36 means that there are 6 strands each of which has 36 wires. Both of these are equal lay ropes.

This illustration shows a wire rope construction made of 6 outer strands with each outer strand made up of 19 wires.

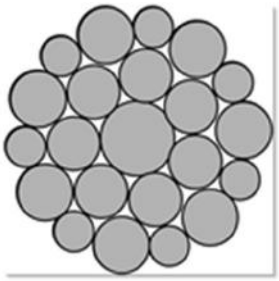
6 x 19 Construction

There are generally four different methods of constructing the wire rope:

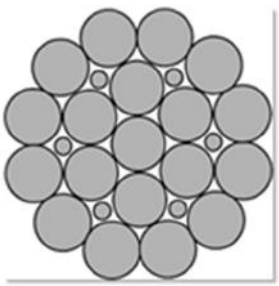
- Seale Construction – this is a parallel lay strand with the same number of wires in both layers



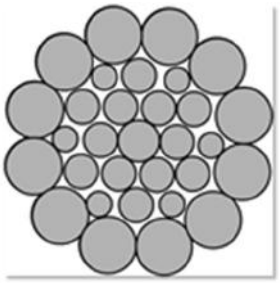
- Warrington Construction – a parallel lay strand having an outer layer containing alternately large and small wires



- Filler Construction – a parallel lay strand having an outer layer containing twice the number of wires than the inner layers with filler wires in the valleys between the layers



- Combined Construction – a parallel lay strand having three or more layers laid in one operation and formed from a combination of the previous strand types



**Grades of Wire Rope Wire tensile strength/grade**
Wire ropes are supplied in different grades. The grade of the wire rope based upon the tensile strength of the wires in N/mm². ISO and DNV standards specify that grades 1770 and 1960 are to be utilised for lifting set wire rope slings.

| Rope Grade | Wire tensile strength grade | |
|---|---|---|
| | Minimum | Maximum |
| 1770 | 1570 | 1960 |
| 1960 | 1770 | 2160 |
| 2160 | 1960 | 2160 |

**Wire Rope Finish:** coatings and plating are added to the wire to provide protection such as galvanising (a surface coat of zinc is given to the wire). This coating will resist oxidisation which will improve the corrosion resistance of the wire rope. The coating is normally referenced by the quality and mass of the coating applied, and its adherence to the steel on which it is applied. This will depend on the standard to which the wire is manufactured.

By way of example, we can look at EN 12385-2 which uses the symbol 'U' to denote an uncoated or bright finish.
For zinc coating the symbol will depend on the class of the coated finish:

- **Class B** zinc coating is designated '**B**'
- **Class A** zinc coating is designated '**A**'

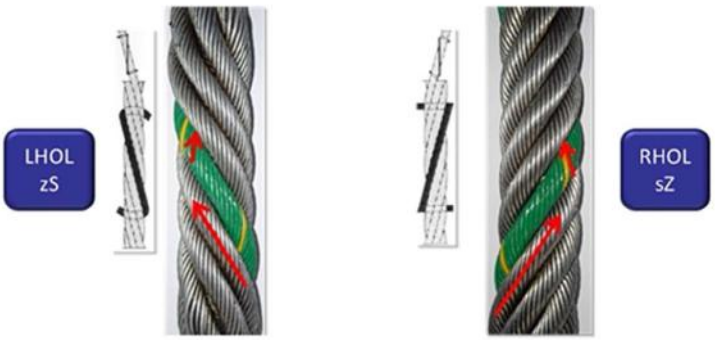
*Notes:*

**Rope Lay**
Rope lay refers to the way in which the wires are laid when forming the strands and the way in which the strands are laid when forming the rope. There are 2 types of lay:

- Ordinary (regular) lay:

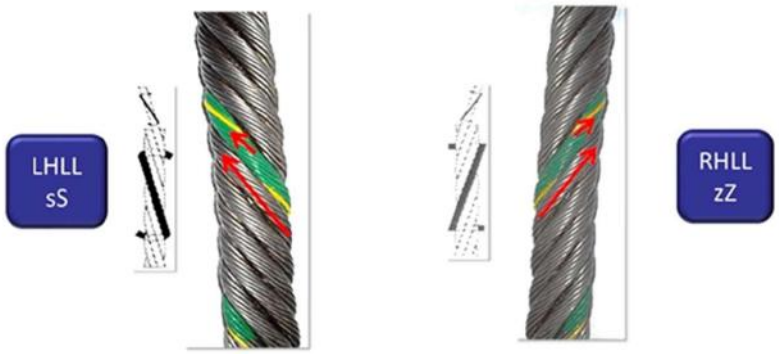
- **Lang's lay:** (not suitable for manufacturing wire ropes slings)

**Ordinary lay**
The wires that make up the strand and the strands that make up the rope are laid in opposite directions. When formed, this gives the impression that the wires are running the length of the wire rope.



The lower case letter indicates the direction of the wires and the capital letter, the direction of the strands.

**Lang's lay**
The wires that make up the strand are laid in the same direction as the strands in the rope. When formed the wires quite clearly run across the diameter of the rope. Due to the tendency of the rope to unwind, Lang's lay ropes are not suitable for wire rope slings.



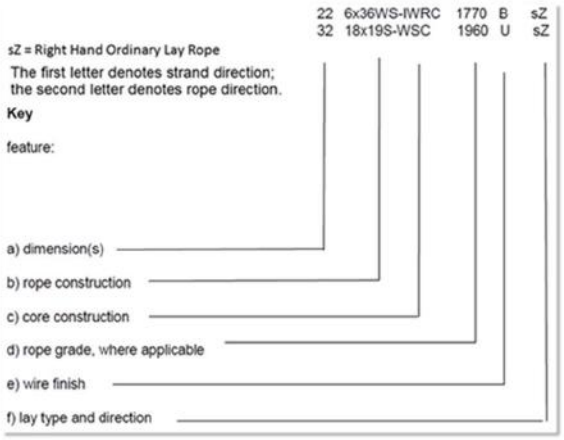

**Rope Details and Designation**
The following is a list of typical information that might be required with the rope:

- Length of rope
- Standard to which the rope conforms
- Nominal diameter of rope*
- Construction of rope*
- Type of core*
- Grade of rope*
- Wire finish*
- Direction of lay and type of lay*
- If the rope is preformed
- If special lubrication has been applied
- Minimum breaking load

* EN 12385-2 for example, requires the designation to be made up of the six pieces of information indicated above.

*Notes:*

**Example:**
A 20mm diameter right-hand ordinary lay wire rope of 6 x 36 Warrington-Seale construction with a wire core made in 1770 grade wire with a bright finish. Following BS EN 12385 the designation will then be 20 6x36WS-IWRC 1770 U sZ.




**Wire Rope Slings**

ISO and DNV standards state that wire rope slings used for lifting sets should conform to EN13414-1. In addition, the ropes used shall only be of 6x19 or 6x36 construction.

Wire rope slings give the user a versatile and safe means of connecting loads to lifting appliances, provided that they are used in the correct manner and dangerous lifting practices and service damage are avoided.

In many cases the use of a wire rope sling in preference to, for example, a chain sling is a matter of the personal choice of the user. There are however applications where wire rope slings are preferred to other types of slings and similarly, there are applications where other types of slings may be preferable to wire rope slings.

Most global standards call for multi-leg slings to be rated and marked with their WLL expressed in terms of the inclination angle to the vertical, e.g. 0-45°.

**Eye terminations single slings:**

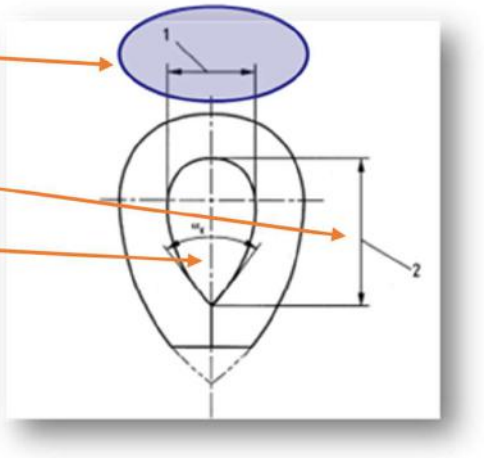
Eye terminations single slings are produced by taking a length of wire rope and forming an eye at each end. Multi-leg slings are made in exactly the same way except that the eyes at the top of the sling are made through a master link. If terminal fittings are required, these can be attached by making the eye through the fitting. To help the eye keep its shape and to give the rope protection a thimble is used.
This is often known as a 'hard eye' and this is advised when fittings are to be made onto the sling as permanent attachments.



**Thimbles**
Thimbles are to be visually inspected for surface defects liable to damage the rope or injure the user. Thimbles of any size should comply with the following dimensions:

- 2.5 to 3.5 x rope diameter (dimension 1)
- 1.5 to 2 x dimension 1
- Angle ≤ 50°




**Sling Terminations**
ISO 10855-2 states that all wire rope slings used for offshore container lifting sets shall have ferrule secured thimble eyes.

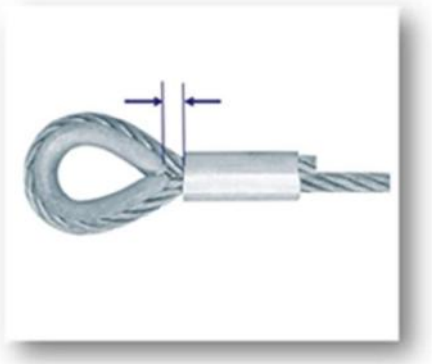
**Ferrules**
Ferrules are made from different materials for different types of rope, care is therefore required to ensure compatibility of the ferrule material to the rope. There are also different shapes of ferrules for the different types of termination. Global standards recognise the differing methods of terminating a wire rope, but generally give the same termination efficiency for all ferrule secured terminations of 90%.

**Turn Back Loop**
When square-cut ferrules are used, in order to ensure that the rope is fully engaged within the ferrule it is necessary for a small amount of the tail to protrude through the ferrule. Standards provide guidance on the length of this…EN standards state that this should be no more than one half of the rope diameter. However, if the rope has been cut by a heat process a portion of the rope will have become annealed (softened) in the heat-affected area. The protruding tail in this case should be no more than an amount equal to one diameter of the rope and positioned so that none of the annealed section is within the ferrule.

**Flemish Eye**
The outer strands of the rope shall be divided into two equal groups. The core shall be assigned to one of these groups. The length of rope divided shall depend on the size of eye to be formed. Both groups of strands shall then be re-laid together in opposing directions.

Cross Section of a Pressed Ferrule Termination

When a thimble is fitted, the size and shape of the correctly sized thimble will dictate the length and width of the eye. Typically, after pressing the clearance between the base of the thimble and the ferrule should be approximately 1.5 times the nominal rope diameter for a thimble without a point, and 1 times the nominal diameter for a thimble with a point unless specified otherwise by a competent person. Note: Upper eyes shall always be fitted with thimbles, and if lower terminal fittings are used, the eyes shall always be fitted with thimbles.



**Chain Slings**

ISO and DNV standards state that chain slings used for lifting sets should conform to EN818-4.

**Types of load chain**
Chain is the most basic of lifting media, and although it is far heavier than rope it has a far longer life and is far more robust. It can better withstand rough usage, is less likely to damage, is almost perfectly flexible and can be stored for long periods without serious deterioration.

In use it tends to show evidence of damage better than wire rope or textiles, consequently examination is more reliable. Therefore, it remains the principal component of much lifting equipment. In this unit we will consider the various grades of chain in use in our industry today.

**Short link chain**
A short link chain is the only chain allowed for lifting purposes.

- 'Fine tolerance' chain is used in lifting machines and should never be used to manufacture chain clings!
    - Usually grade T, DT or DAT
        - Each link must fit precisely into the load pocket wheel of the hoist!

- 'Medium tolerance' chain is generally used in the manufacture of lifting slings
    - Usually, grade 8
    - Can be found marked T(8)

**Recognising Different Chain Grades**

A fine tolerance chain may be recognised in two ways.

The calibrating process has the effect of removing all of the residual scales from the heat treatment process and many of the finish treatments include corrosion-resistant finishes. As a result, it has a bright finish and of course, there is also the grade mark. Fine tolerance chains to EN 818 use the letters 'T', 'DAT' and 'DT' to indicate the type of treatment given to the chain and its intended application.

Should a sling be found in use manufactured from fine tolerance chain grades, it should be removed from service immediately. However, there is a slight problem here, which may apply to some older chain slings that can still be found in use.



| Grades | | |
|---|---|---|
| Fine Tolerance | Medium Tolerance | Mean stress at the specific minimum breaking force N/mm² |
| M | 4 (40) | 400 |
| P | 5 | 500 |
| S | 6 (60) | 630 |
| T | 8 (80) | 800 |
| V | 10 (100) | 1000 |
| | 12 | 1200 |

**Grade Marks**

**T**he chain grade mark should appear at regular intervals throughout the entire length of the load chain. By way of example, British standards call for the grade mark of the chain to appear at every 20th link or, at intervals of 1 metre, whichever is the least distance. The links must be stamped or embossed on the least stressed part of the chain, i.e. on the side of the link opposite the weld.

Grade 8 Medium Tolerance Chain

**EN 818-4**

**Short link chain for lifting purposes – Safety – Part 4: Chain slings – Grade 8**

This standard specifies the requirements related to safety methods of rating and testing of single, 2, 3 or 4 leg, and endless chain slings assembled by:

- Mechanical joining devices
- Welding
- Using short link grade 8 medium tolerance lifting chain conforming to BS EN 818–2 together with the appropriate range of components of the same grade

**Components and Assembly Methods**
Chain sling assemblies are manufactured in various material and heat-treatment combinations to produce the different grades and to suit differing service conditions. The end fittings are attached to the chain by mechanical joining devices for offshore container lifting sets.

All grades are available in welded construction but only grades 8 (or 80), 10 (or 100) and 12 (or 120) are available constructed with mechanical joining devices.

**Chain Connector Pins**
These pins are common for connecting components to the load chain. Manufacturers use their own patented pins of different shapes and sizes, usually oval or round in shape. They are held securely in place using roll pins. Some connectors use 1, others have two roll pins.

*Notes:*

**Lifting Sets**

Lifting sets are items of integrated lifting equipment used to connect the offshore container to the lifting appliance. This can comprise one or multi leg slings (with or without a forerunner/top leg) and shackles, whether assembly
secured or not.

**Symbols**

| | |
|---|---|
| **WLL** | Working load limit |
| **WLL s** | Minimum working load limit of each shackle |
| **WLL min** | Minimum calculated working load limit from enhancement factor table |
| **WLL off** | Maximum lifting capacity of a lifting set to be used on an offshore container (Symbol required to be marked on the lifting set) |
| **S** | Mass of the lifting set in kg |

*Notes:*

**Dimensions and Strength of Lifting Sets**

To allow for the dynamic amplification experienced in offshore lifting in adverse weather and sea states, the working load limit of the lifting sets for offshore containers are determined using the tables shown. The greater the maximum gross mass of the container, the smaller the enhancement factor.

For intermediate container ratings, the WLL shall be interpolated. (Worked out as mid rating).

BS 7072 required that all lifting sets have a WLL of 1.3 times the Maximum Gross Mass of the offshore container that it was designed for.

The table below shows the large differences that you may find when inspecting lifting sets fitted to different standards of containers.

| BS 7072 Maximum gross mass | Minimum WLL of lifting set | BSEN 12079 Maximum gross mass | Minimum WLL of lifting set |
|---|---|---|---|
| 2000kg | 2.6 tonnes | 2000kg | 7 tonnes |
| 25000kg | 32.5 tonnes | 25000kg | 27.6 tonnes |

*Notes:*

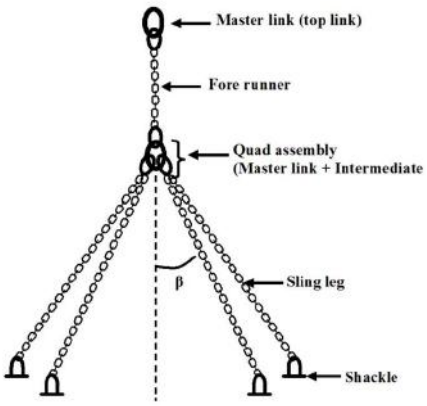
**Determination of Working Load Limit**

| Container Rating *(R)* (kg) | Enhancement Factor | Minimum Required Working Load Limit of the Lifting Set (WLL min) (tonnes) |
|---|---|---|
| **500** | N/A | **7.00** |
| **1000** | N/A | **7.00** |
| **1500** | N/A | **7.00** |
| **2000** | 3.500 | **7.00** |
| **2500** | 2.880 | **7.20** |
| **3000** | 2.600 | **7.80** |
| **3500** | 2.403 | **8.41** |
| **4000** | 2.207 | **8.83** |
| **4500** | 2.067 | **9.30** |
| **5000** | 1.960 | **9.80** |
| **5500** | 1.973 | **10.30** |
| **6000** | 1.766 | **10.60** |
| **6500** | 1.733 | **11.26** |
| **7000** | 1.700 | **11.90** |
| **7500** | 1.666 | **12.50** |
| **8000** | 1.633 | **13.07** |
| **8500** | 1.600 | **13.60** |
| **9000** | 1.567 | **14.10** |
| **9500** | 1.534 | **14.57** |
| **10000** | 1.501 | **15.01** |
| **10500** | 1.479 | **15.53** |
| **11000** | 1.457 | **16.02** |
| **11500** | 1.435 | **16.50** |
| **12000** | 1.413 | **16.95** |
| **12500** | 1.391 | **17.38** |
| **13000** | 1.368 | **17.79** |
| **13500** | 1.346 | **18.18** |
| **14000** | 1.324 | **18.54** |
| **14500** | 1.302 | **18.88** |
| **15000** | 1.280 | **18.54** |
| **15500** | 1.267 | **18.88** |
| **16000** | 1.254 | **19.20** |
| **16500** | 1.240 | **20.47** |
| **17000** | 1.227 | **20.86** |
| **17500** | 1.214 | **21.24** |
| **18000** | 1.201 | **21.61** |
| **18500** | 1.188 | **21.97** |
| **19000** | 1.174 | **22.31** |
| **19500** | 1.161 | **22.64** |
| **20000** | 1.148 | **22.96** |
| **20500** | 1.143 | **23.44** |
| **21000** | 1.139 | **23.92** |
| **21500** | 1.135 | **24.39** |
| **22000** | 1.130 | **24.86** |
| **22500** | 1.126 | **25.33** |
| **23000** | 1.121 | **25.79** |
| **23500** | 1.117 | **26.25** |
| **24000** | 1.112 | **26.70** |
| **24500** | 1.108 | **27.15** |
| **25000** | 1.104 | **27.59** |

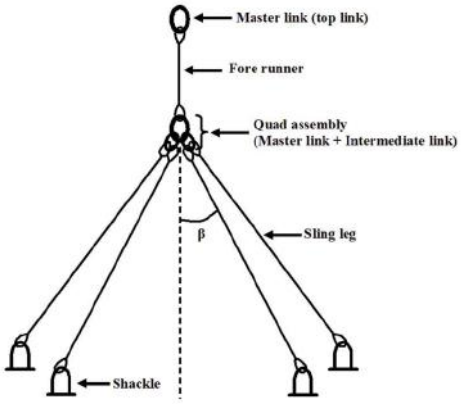
There are no dynamic factors for containers rated under 2000kg. For these, use a minimum value of 7t.

**General Requirements (all lifting sets)**

- Slings must be rated for their angle of use
- 4-leg slings must be rated as 3-leg slings
- The maximum slinging angle to be used is 45° from the vertical
- Fore runner / top legs – these are always rated as single leg slings




**4-Leg Chain Sling Lifting Set with Fore Runner / Top Leg**




**4-Leg Wire Rope Sling Lifting Set with Fore Runner / Top Leg**

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

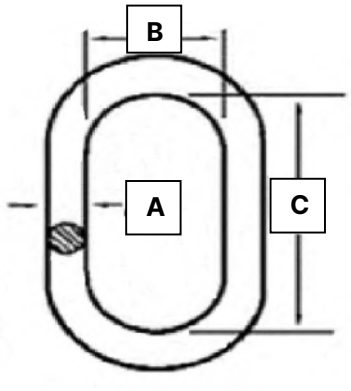
The slings are to be attached to the pad eyes on containers by shackles. Shackle bolts shall be secured to prevent unwanted opening of the shackle.

**Note:** For specific angles less than 45˚, the sling may be rated at the WLL according to the particular angle of the legs to the vertical. The formula to calculate this:

| Sling used at an angle to the vertical | Formula to be used |
|---|---|
| **2-leg sling** | WLL = 2 x WLLmin for a single leg x cosine ß angle |
| **4-leg sling** | WLL = 3 x WLLmin for a single leg x cosine ß angle |
| **2 x 2-leg slings used as a 4-leg** | Calculated as for a 4-leg sling |

**Master Links**

The recommendation is that the master link to be attached to the crane hook shall have minimum dimensions of (C) 270mm x (B) 140mm internal.




**Assembly Secured Shackle**

A 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.

**Shackles**

Shackles shall meet the requirements of BS EN 13889 or EN 1677-1 or ABNT NBR 13545 with the additional requirement that the tolerance on the nominal diameter of the shackle pin shall be -0/ +3%.

Shackles shall be restricted to bolt type pin with hexagon head, hexagon nut and split cotter pin. DNVGL-ST-E271 states that the minimum breaking force shall not be taken as less than 5 times the WLL, and the tolerance on the nominal diameter of the shackle pin can be -1/ +3%.

The minimum WLL of each shackle shall be calculated as given in the table below:

| Required Minimum Shackle WLL | | |
|---|---|---|
| **4-Leg Sling** | **2-Leg Sling** | **Single Leg Sling** |
| WLLmin ÷ (3 x Cos ß) | WLLmin ÷ (2 x Cos ß) | WLLmin |

Where β is the angle of the sling leg from vertical and the WLLmin is the minimum WLL determined from the tables earlier in this module.

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 1.3m above the container bottom when the sling hangs over the long side of the container.

This is why the lifting set is often designed with a 5th leg (Forerunner). It enables the rigger to stay on the deck whilst connecting the container lifting set to the crane hook, instead of standing on the top of the container in hazardous conditions.

**Chain Slings**

- Chain slings shall meet all requirements of BS EN 818-4
- DNV allows for other recognized standards and other grades to be used after special consideration

This would also allow for higher grades of chain to be used, making the lifting set lighter and therefore easier to handle.

**Wire Rope Slings**

Wire rope slings shall meet the requirements of BS EN 13414-1 with the following restrictions:

- Wire rope shall be 6-stranded and either 6 x 19 or 6 x 36 construction
- The termination shall be a ferrule secured

**Note**

As an aid to inspection, ferrules which permit the tail end of the rope to be visible are recommended. This will not always be possible as some rig owners prohibit the use of these parallel ferrules and state that the tapered ferrules shall be used.

Wire rope grade 1770 or 1960 shall be used. If the grade of the rope is unknown, the inspector should always default to the lowest grade.

DNVGL-ST-E271 allows for other recognized standards to be used and states that thimbles will be fitted which is a requirement of BS EN 13414-1 when terminal fittings are fitted.

**Lifting Set Design**

As shown from the tables included in the standard, there is a requirement for the Working Load Limit (WLL) of the lifting set to be much greater in some cases than the Maximum Gross Mass (MGM) of the offshore container.

The Minimum WLL of the lifting set is calculated by multiplying the MGM of the container by the enhancement factor given for the particular MGM of the container.

Example:

A container with an MGM of 10000kg to BS EN ISO 10855-2-2 and DNVGL-ST-E271 must have an enhancement factor of 1.501 applied to give a Minimum WLL of the lifting set of 15.01 tonnes.

For an offshore container to BS EN 7072, the enhancement factor is always 1.3 x MGM of the container. This would mean an offshore container with an MGM of 10000kg designed to BS 7072 would have a lifting set fitted with a Minimum WLL of 13 tonnes.

The tables on the following slides show the WLL of chain and steel wire rope slings and nominal diameters to be used.

The following tables show the WLL of chain and steel wire rope slings and nominal diameters to be used.

## Chain – BS EN 818-4

| Working Load Limits for 1,2 and 4 Leg Chain Slings at Different Angles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Size of Sling (mm) | Working Load Limit in tonnes | | | | | | | | | | |
| | Single Leg and 5th Leg | 4 Leg slings at | | | | | 2 Leg slings at | | | | |
| | | 45° | 40° | 35° | 30° | 25° | 45° | 40° | 35° | 30° | 25° |
| 10 | 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 |

## SWR – BS EN 13414-1 Fibre Core Grade 1770

| Working Load Limits for 1,2 and 4 Leg Wire Rope Slings at Different Angles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Size of Sling (mm) | Working Load Limit in tonnes | | | | | | | | | | |
| | Single Leg and 5th Leg | 4 Leg slings at | | | | | 2 Leg slings at | | | | |
| | | 45° | 40° | 35° | 30° | 25° | 45° | 40° | 35° | 30° | 25° |
| 18 | 3.40 | 7.2 | 7.8 | 8.4 | 8.8 | 9.2 | 4.8 | 5.2 | 5.6 | 5.9 | 6.2 |
| 20 | 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 |

**Lifting Set Design – SWR – BS EN 13414-1 Steel Core Grade 1770**

| Working Load Limits for 1,2 and 4 Leg Wire Rope Slings at Different Angles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Size of Sling (mm) | Working Load Limit in tonnes | | | | | | | | | | |
| | Single Leg and 5th Leg | 4 Leg slings at | | | | | 2 Leg slings at | | | | |
| | | 45° | 40° | 35° | 30° | 25° | 45° | 40° | 35° | 30° | 25° |
| 18 | 3.70 | 7.8 | 8.5 | 9.1 | 9.6 | 10.1 | 5.2 | 5.7 | 6.1 | 6.4 | 6.7 |
| 20 | 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 | 21.1 | 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 | 11.80 | 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 |

*Notes:*

## Lifting Set Design – SWR – BS EN 13414-1 Fibre Core Grade 1960

| Working Load Limits for 1,2 and 4 Leg Wire Rope Slings at Different Angles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Size of Sling (mm) | Working Load Limit in tonnes | | | | | | | | | | |
| | Single Leg and 5th Leg | 4 Leg slings at | | | | | 2 Leg slings at | | | | |
| | | 45° | 40° | 35° | 30° | 25° | 45° | 40° | 35° | 30° | 25° |
| 18 | 3.47 | 7.4 | 8.0 | 8.5 | 9.0 | 9.4 | 4.9 | 5.3 | 5.7 | 6.0 | 6.3 |
| 20 | 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 |

## Lifting Set Design – SWR – BS EN 13414-1 Steel Core Grade 1960

| Working Load Limits for 1,2 and 4 Leg Wire Rope Slings at Different Angles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Size of Sling (mm) | Working Load Limit in tonnes | | | | | | | | | | |
| | Single Leg and 5th Leg | 4 Leg slings at | | | | | 2 Leg slings at | | | | |
| | | 45° | 40° | 35° | 30° | 25° | 45° | 40° | 35° | 30° | 25° |
| 18 | 4.1 | 8.8 | 9.5 | 10.2 | 10.8 | 11.3 | 5.9 | 6.4 | 6.8 | 7.2 | 7.5 |
| 20 | 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 | 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 | 38 | 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 |

**Sling Diameters**

It is vitally important that the inspector can check these tables against the actual diameter of the sling fitted to the container. It is strongly advised that these tables are printed out as an aid to training and also for your future reference as an inspector.

Example:

Let's use the example of the container with an MGM of 10000kg.

The container lifting set must have a minimum WLL of 15.01 tonnes. If the container has a 4-leg grade 1770, fibre core steel wire rope sling used at a design angle of 45° fitted with a top (5th) leg, then using the tables just shown, the minimum diameter of the 5th leg would be 40mm as this has a WLL of 17.0 tonnes and the 4 leg sling diameter would be a minimum of 26mm as this WLL is 15.3 tonnes at 45°.

If grade 1960 steel core steel wire rope was used in the same configuration- the 5th leg diameter would be a minimum of 36mm with a WLL of 16.6 tonnes and the 4-leg sling at 45° diameter would be a minimum of 24mm with a WLL of 15.7 tonnes.

If chain was the lifting medium for the same 10000kg container, the 5th leg diameter would be at least 23mm giving a WLL of 16 tonnes and the 4-leg sling at 45° would be 16mm giving a WLL of 17 tonnes.

**Shackle Size**

The pad eyes for containers are designed for a specific size of shackle to fit. The designer will use the table below in conjunction with the minimum WLL to calculate the size of shackle and therefore the minimum thickness of the pad eye and the maximum diameter of the pad eye hole.

Example:

Use the previous example of a 10000kg MGM container with an enhancement factor of 1.501 to give the minimum WLL of the lifting set of 15.01 tonnes, to calculate the shackle size.

| Required Minimum Shackle WLL | | |
|---|---|---|
| 4-Leg Sling | 2-Leg Sling | Single Leg Sling |
| WLL min / (3 x cos β) | WLL min / (2 x cos β) | WLL min |

WLL min / (3 x cos β)

The WLL minimum is 15.01 tonnes.

15.01 ÷ (3 x cosine45°) → 15.01 ÷ (3 × 0.707) → 15.01 ÷ 2.121 = **7.08** tonne shackle

This size is not available so the next size up is used – 8.5 tonnes

**Shackle to Pad Eye Size**

An 8.5 tonne WLL shackle has the following dimensions that the designer must be aware of when designing the pad eyes:

A pin diameter of 28mm and inside (jaw) width at pin of 43mm

The pad eye hole diameter must be a maximum of 6% of the pin diameter, therefore the pad eye hole diameter for an 8.5 tonne shackle must have a maximum diameter of 29.68mm. This is easily calculated by 28 x 1.06 = 29.68mm

The jaw width must be a minimum of 75% of the pad eye's thickness to stop excess lateral movement in the shackle, therefore for an 8.5 tonne shackle the pad eye must have a minimum thickness of 32.25mm. This is easily calculated by 43 x 0.75 = 32.25mm

**Lifting Set Size Examples:**

So, in summary, for an offshore container with an MGM of 10000kg designed to BS EN IOS 10855, the lifting set and pad eye dimensions would be:

- 4 leg grade 1960 steel core steel wire rope sling with a design angle of 45° and a 5th leg to facilitate safe handling
- 5th leg - 36mm diameter
- 4-leg sling at 45° - 24mm
- Shackles fitted - 8.5 tonne
- Pad eye minimum thickness – 32.25mm
- Pad eye maximum hole diameter – 29.68mm

It is strongly recommended that these dimensions are checked to be correct as part of the periodic inspections for offshore containers, especially when replacement lifting sets are fitted as it is commonplace for the lifting set sizes to be incorrectly calculated.

Requirements of the lifting set for an offshore container with an MGM of 25000kg to be constructed from Grade 1960 steel core steel wire rope with a design angle of 45° fitted with a 5th (top) leg.

This has an enhancement factor of 1.104 applied. The minimum WLL of the lifting set to be fitted is 27.59 tonnes.
Using the tables provided for steel wire rope with a steel core grade 1960, the 5th leg would be a minimum of 48mm which gives a WLL of 29.6 tonnes.

Using the tables provided for steel wire rope with a steel core grade 1960, the 4-leg element of the sling would be a minimum of 32mm which gives a WLL of 27.8 tonnes at 45°.

The shackle size is calculated by the formula: **WLL min / (3 x cos β)**

(3 x cos β) = 3 x 0.707 = 2.121

27.59 ÷ 2.121 = 13.008 tonnes = **13.5 tonnes** shackle.

13.5 tonnes shackle has a pin diameter of 38mm and a jaw width of 57mm.



**This would then dictate the maximum hole diameter of the pad eye to be 6% larger than the pin diameter:**

38 x 1.06 = **40.28mm** Maximum pad eye hole diameter.

The minimum width of the pad eye is required to be within 25% of the shackle jaw width.

57 x 0.75 = **42.75mm** Minimum pad eye thickness.

*Notes:*

**Examination of Offshore Containers**

Extract from BS EN 10855-3

**Recommended knowledge and experience of staff responsible for inspection of offshore containers**
With respect to containers, the inspector should have as a minimum, knowledge and adequate practical experience of:

- The statutory requirements relating to offshore containers
- The provisions of this standard
- 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 examination (NDE) and a good understanding of how they work and their limitations
- The visual inspection as required by this standard and the signs of weakness and defects to look for

**Period Schedule: BS EN ISO 10855-3**

The table below shows the requirements of BS EN ISO 10855-3 for the periodic inspection, examination, and testing of offshore containers.

| Time or Interval | Inspection/Examination/Test | | | |
|---|---|---|---|---|
| | Lifting Test | Non-Destructive Examination (NDE) | Visual Inspection | Marking to be made on Plate |
| Initial Certification | As required by BS EN ISO 10855-1 | | | |
| At Intervals not Exceeding 12 Months | Not Applicable (b) | Not Applicable (b) | YES | V |
| At Intervals not Exceeding 48 Months | Not Applicable (b) | YES | YES | VN |
| After Substantial Repair or Alteration (a) | YES | YES | YES | T |

a. A substantial repair or alteration means any repair and/ or alteration carried out which may in the opinion of an inspection body, affect the primary elements of the offshore container or elements which contribute directly to it's structural integrity.
b. The inspection body may require other additional inspections, examination and or tests.



**Period Schedule: BS 7072**

The table below shows the requirements of BS 7072 for the periodic inspection, examination and testing of offshore containers for any containers that may be encountered built to this standard.

| Time or Interval | Inspection/Examination/Test | | | |
|---|---|---|---|---|
| | Proof Load Test 2 x MGM | Non-Destructive Examination (NDE) of the Lifting Points | Visual Inspection | Marking to be made on Plate |
| Initial Certification | YES | YES | YES | T |
| At Intervals not Exceeding 6 Months | NO | At the discretion of the competent person | YES | V or VN |
| At Intervals not Exceeding 12 Months | NO | YES | YES | VN |
| At Intervals not Exceeding 24 Months | YES | YES | YES | T |
| After Substantial Repair or Alteration | YES | YES | YES | T |

**Periodic Schedule: DNVGL-ST-E271**

The table below shows the requirements of DNVGL-ST-E271 for the periodic inspection, examination, and testing of offshore containers.

| Time or Interval | Inspection/Examination/Test | | | |
|---|---|---|---|---|
| | Lifting Test | Non-Destructive Examination (NDE) of Pad Eyes (2) | Visual Inspection | Marking to be made on Plate |
| At Intervals not Exceeding 12 Months | Not Applicable | Not Applicable | YES | V |
| At Intervals not Exceeding 48 Months | Not Applicable | 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, affects the primary elements of the offshore container or elements which contribute to its structural integrity.
2. Including supporting structure if relevant.

**IMDG Requirements**

Offshore tanks for the carriage of dangerous goods are required under the IMDG code undergo 2.5-year periodic inspections.

2.5-year inspection shall include but not be limited to:

- General visual survey of piping, valves, instruments, tank structure, insulation, markings etc.
- Internal visual inspection
- Leak tightness test of the tank and its connections
- Corrosion protection


Offshore tanks for the carriage of dangerous goods are required under the IMDG code to undergo 2.5-year periodic inspections.

5-year inspection shall consist of all items listed under the 2.5 year inspection and in addition the following:

- All valves to be serviced and proven tight
- Relief valves to be serviced, reset and tested to correct specified pressure
- All instrumentation to be calibrated
- Insulation to be inspected, if hard insulation is provided to be removed to allow thorough inspection of tank underneath
- If vacuum insulated, the outer shell integrity to be proven by a leak test
- Thickness measurements, especially where corrosion is likely to occur
- NDT and close up internal inspections of the shell welds to be completed



**Note**

It may not be within the scope of your inspection/test to carry out this mandatory inspection/ testing and you should always make that clear on the inspection test report that you complete.

**Periodic Visual Inspection**

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

A simple walk around the container may indicate some faults with the unit before the in-depth inspection commences and may also identify additional hazards that are not identified on the risk assessment. Control measures would then need to be taken before continuing with the inspection.

Carry out the inspection in a location with 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.

The image shown, shows a hole in the bottom side rail of the container which had been previously identified during a visual inspection and had not been repaired.

The structure underneath should be closely inspected for defects such as this and defects such as heavy corrosion, gouges, cuts, and cracks. If there is no facility to enable the container underside to be inspected, this should be reported as a limited inspection.

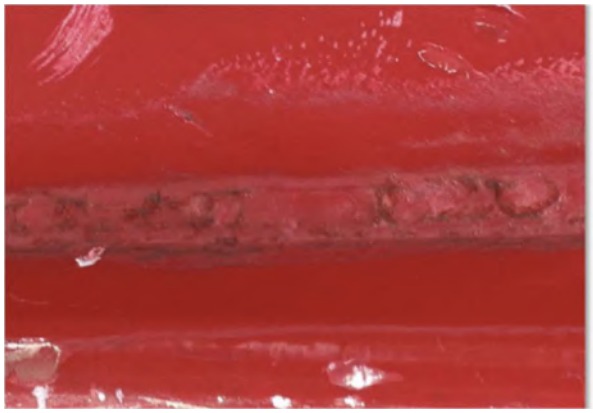
**Markings**

Check the markings and plates to ensure they meet the requirements of BS EN ISO 10855-1 and are clear and legible. This includes the safety markings on the container, such as any perimeter boundary markings. If these are not clear, there could be an incident in poor light conditions where anyone on the top of the container may fall.

**Welds**

Visually inspect welds in the primary structure to ensure there are no visible defects. Also visually inspect welds on the intermediate deck supports if fitted, as these decks are often loaded.

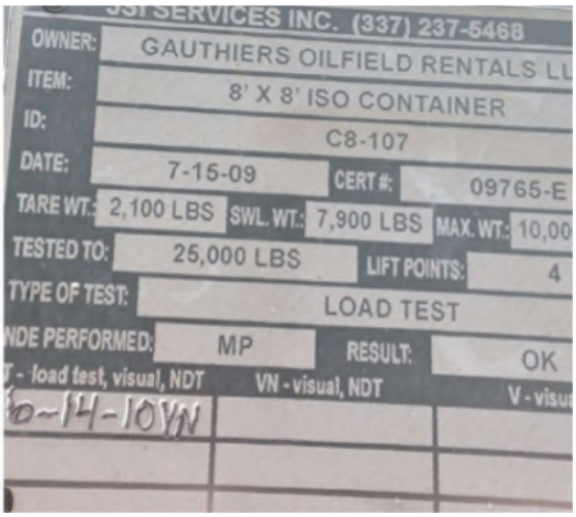
The images below show a weld that has been very poorly repaired. Any suspected cracks in the primary structure welds should then have the most suitable method of NDE carried out.



**Pad Eyes and Lashing Points**

Visually inspect all pad eyes and lashing points for distortion, mechanical damage or other sign of distress or overload. Often the damage caused to pad eyes is by other containers impacting with the pad eye.

The image on the left shows a pad eye that has been welded on to a normal ISO container; this was identified only because of the data plate (shown below on the right) and as is shown, it was inspected and NDE carried out.



**Structure**

Visually inspect the structure for corrosion, mechanical damage or injurious deformation. An offshore container will often have protective sacrificial plates fitted to protect the primary parts of the container.

**Do not mistake these for the primary structure or you may be carrying out more testing than is required.**


**Door Closures**

Visually inspect doors, frames, seals, hinges, locks, etc. and perform a functional check to ensure that they operate in a satisfactory manner without undue force being required.

The locking bars connected to the door header and sill are often bent due to the impact of other containers. These can easily be identified during an inspection as they will have a springy attitude when released.



**Floor**

Visually inspect the floor to check that it is not deformed and that it shows no signs of distress or overload. Inspect drainage facilities where fitted, e.g., drain holes shall be clear of debris. Note that any water that enters the container will naturally settle in the corners, causing more corrosion there.

**Marking of the Inspection Plate**

On satisfactory completion of the inspection, examination, and tests (when applicable), permanently mark the plate with:

The date (YYYY-MM-DD) of the inspection, examination, and tests, together with the unique identification mark of the competent person and one of the following suffices:

- Suffix T indicating proof load test, non-destructive examination, and visual inspection; or
- Suffix VN indicating non-destructive examination and visual inspection; or
- Suffix V; indicating visual inspection only


If the inspector is in doubt about the condition of any offshore container, they should always use the appropriate method of non-destructive examination (NDE) to confirm their suspicions. Often an inspector is asked to carry out a single trip inspection to enable the container to be backloaded from the installation.

The inspector should use the appropriate method of NDE to confirm the safety of the operation. If this is unfeasible, then the container should be backloaded within another serviceable container.

Then the inspection report should be completed and issued to the owner.

*Notes:*



**Inspection Report Contents**

After the container has been examined and passed fit for purpose, the inspector will make a report containing the following minimum information:

- Container identification (including owner's container number)
- Name of owner or delegated nominee
- Report number
- Statement that the container is suitable for service
- Total gross mass in kg, applicable to the 'all points' lifting test and the method of test (where relevant)
- Details of NDE if carried out
- Statement that the container described was inspected/ examined and or tested and that the particulars are correct
- Reference to any report issued to the owner arising from the process
- Confirmation that the Inspection Plate was marked; date of examination (and date of signature or report if different from date of examination)
- Name of organization, person and authentication by the person carrying out the inspection, examination or test either by signature or other secure means
- Comments on any limits to the scope of inspection

**Notes**

- **Note 1:** Details of the examination of the lifting set may also be given on the inspection report for the container.
- **Note 2:** This report may be combined with the initial Certificate of Conformity.

The owner shall ensure that:

- Containers are maintained in accordance with the standard
- If a container is damaged so that it does not comply with the standard, it is not used until it is repaired and inspected by an inspection body
- Repairs are carried out in accordance with the requirements for design and manufacture of containers set out in BS EN ISO 10855-1
- Repair facilities used can ensure the quality of the procedures and facilities by a quality assurance system at least in accordance with EN ISO 9001 or EN ISO 3834-2;
- Following repair, the container is inspected and where relevant tested by the inspection body. The owner shall provide the inspection body with full details of the repairs that have been carried out
- Following modification, the container is submitted for re-certification

**Notes**

- **Note 1:** If the user or any of his agents detects any structural damage or corrosion which may affect the load bearing integrity of the container, it is strongly recommended that they advise the owner as soon as practicable.
- **Note 2:** Where a need for repair is identified, it will be necessary to make adequate arrangements for the safe transportation of the damaged container, to the location specified by the owner.

**Examination of Lifting Sets**

Extract from BS EN ISO 10855-3

**Recommended knowledge and experience of staff responsible for inspection of lifting sets intended for use with offshore containers**

Regarding lifting sets, the inspector should have as a minimum, a knowledge and adequate practical experience of:

- Statutory requirements relating to lifting sets
- Provisions of this standard
- Various types of offshore containers in service
- Correct methods of slinging and handling offshore containers
- Loads, stresses and strains affecting the lifting sets when used for lifting offshore containers in adverse offshore conditions
- Methods of testing lifting sets
- Defects likely to be found in lifting sets and acceptable levels of wear, distortion and deterioration in relation to safety in use
- Various methods of NDE and a good understanding of how they work and their limitations
- Visual examination as required by this standard and the signs of weakness and defects to look for

**Periodic Schedule: BS EN ISO 10855-3**

The table below shows the requirements of BS EN ISO 10855-3 for the periodic inspection, examination and testing of the lifting sets fitted to offshore containers. The sling components and chain sling leg marking is dependent upon whether tested or NDE is carried out.

<table>
<tr><th rowspan="2">Time or Interval</th><th rowspan="2">Applicable to</th><th colspan="4">Inspection/Examination/Test</th></tr>
<tr><th>Load Test</th><th>Non-Destructive Examination (NDE)</th><th>Visual Inspection</th><th>Marking to be made on Tag</th></tr>
<tr><td>Initial Certification</td><td>Complete Lifting Set</td><td colspan="4">As required by BS EN ISO 10855 - 2</td></tr>
<tr><td>Intervals not Exceeding 12 Months</td><td>Complete Lifting Set</td><td>-</td><td>Not Applicable</td><td>YES</td><td>V</td></tr>
<tr><td rowspan="4">Intervals not Exceeding 48 Months</td><td>Sling Components</td><td colspan="2" rowspan="2">Either Load Test or NDE</td><td>YES</td><td>T or VN</td></tr>
<tr><td>Chain Sling Legs</td><td>YES</td><td>T or VN</td></tr>
<tr><td>Shackles</td><td>Not Applicable</td><td>Not Applicable</td><td rowspan="2">YES</td><td rowspan="2">N/A</td></tr>
<tr><td>Wire Rope Legs</td><td>Not Applicable</td><td>Not Applicable</td></tr>
<tr><td>After Substantial Repair or Alteration</td><td>Complete lifting set</td><td>YES</td><td>YES</td><td>YES</td><td>T</td></tr>
</table>

**Periodic Schedule: BS 7072**

BS 7072 instructs that the lifting set is visually thorough examined at the time of the container inspection. This would be with intervals not exceeding 6 months.

There is no direction given as to any testing or NDE periods. In line with LOLER, the NDE and any load testing of the lifting set would be carried out at the discretion of the Competent Person.

**Periodic Schedule: DNVGL-ST-E271**

The table below shows the requirements of DNVGL-ST-E271 for the periodic inspection, examination and testing of lifting sets fitted to offshore containers.

<table>
<tr><th colspan="2" rowspan="2">Time or Interval / Applicable to</th><th colspan="4">Inspection/Examination/Test</th></tr>
<tr><th>Load Test</th><th>Non-Destructive Examination (NDE)</th><th>Visual Inspection</th><th>Marking to be made on Tag</th></tr>
<tr><td>Intervals not Exceeding 12 months</td><td>Complete Lifting Set</td><td>Not Applicable</td><td>Not Applicable</td><td>YES</td><td>V</td></tr>
<tr><td rowspan="3">Intervals not Exceeding 48 Months</td><td>Sling Components</td><td colspan="2" rowspan="2">Either Load Test or NDE</td><td>YES</td><td>T or VN</td></tr>
<tr><td>Chain Sling Legs</td><td>YES</td><td>T or VN</td></tr>
<tr><td>Shackles and Wire Rope Legs</td><td>Not Applicable</td><td>Not Applicable</td><td>YES</td><td>V</td></tr>
<tr><td>After Substantial Repair or Alteration</td><td>Complete Lifting Set</td><td>YES</td><td>YES</td><td>YES</td><td>T</td></tr>
</table>

**Periodic Visual Inspections: Lifting Sets**

The lifting set periodic visual inspections shall be carried out at the set periods in the respective standards.

This inspection should be carried out in a methodical manner to minimise the chances of missing vital areas of the lifting set. The inspection shall be carried out with normally corrected vision, in a situation providing sufficient light and other facilities necessary to allow it to be carried out safely and effectively

- Is the area clear from contaminants that can harm the equipment under examination or the examiner themselves?
- Is the examination area safe from hazards, moving traffic, ongoing lifting operations etc.?

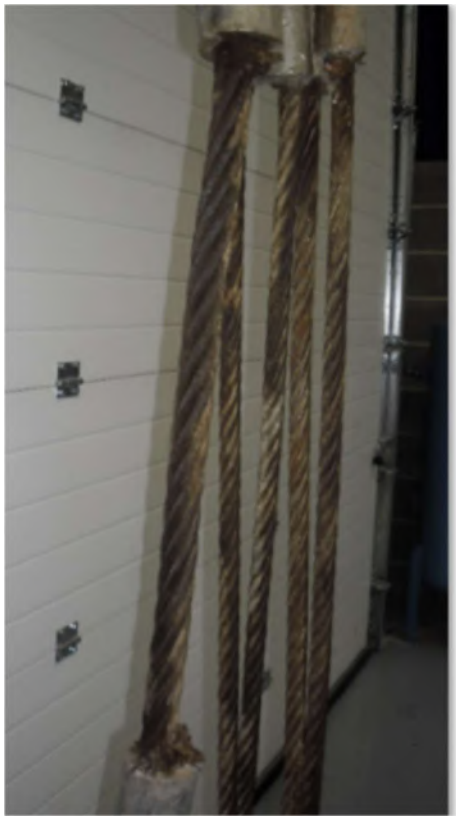
**Note**

If the examiner is concerned for their own safety, it will not allow 100% concentration on the equipment examination.

**Periodic Visual Inspection: Lifting Sets - Wire Rope Slings**

Steel wire rope slings shall be inspected in accordance with the requirements of BS EN 13414-2.

Chain slings shall be inspected in accordance with BS EN 818-6.




**Markings**

Check the markings for the lifting set are clear and legible; unidentifiable lifting sets can be a danger. You may even find an incorrect size lifting set is fitted.

**Master Link**

Start with the master link that is fitted to either the top leg of the sling or the master link that is fitted to a 2 leg sling. Inspect the master link for:

- Distortion/ twisting
- Stretch 0%
- Wear, to be under 8% of diameter (LEEA Recommendation)
- Excessive corrosion (pitting)
- Welds for cracks (potential NDE?)
- Hydrogen Embrittlement (Exposer to Acids)

**Top Leg**

Moving logically down the sling, the top leg is next to be visually inspected. The number of allowable broken wires in accordance with BS EN 13414-2 are as follows:

Randomly Distributed Broken Wires: 6 randomly distributed broken outer wires in a length of 6d but no more than 14 randomly distributed broken wires in a length of 30d where d is the nominal rope diameter.

Concentrated Broken Wires: 3 adjacent broken outer wires in one strand.

Loss of Nominal Diameter of the Wire Rope: Over 10% loss of the nominal diameter.

**Ferrules**

The sling should be withdrawn from service if there is:

- Wear
- Distortion
- Cracking
- Looseness in the ferrule
- Crushing

*Notes:*

**Thimbles**

The thimbles that are fitted should have no signs of:

- Twisting
- Stretch (signs of overload)
- Sharp edges
- Crushing
- Looseness

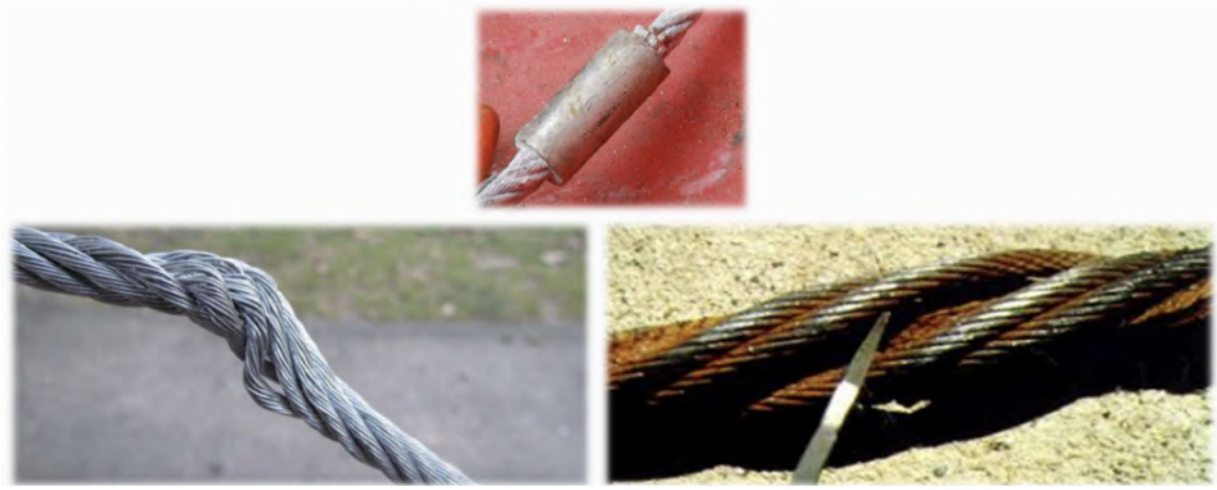
The image below shows a substandard example of thimble fitting. This image was taken of a new sling.

The wire rope should show no indications of being pulled out of the ferrule.

Inspect the rope for kinks, core or strand protrusion, bird caging and loose strands.

A common cause of crushed wire ropes is when the lifting set is permanently fitted and is impacted by swinging loads whilst hanging over the sides of the offshore container.

The wire rope shall not have heavy corrosion which causes pitting of the wires, affecting the strength of the rope.



Inspect the whole length of the top leg.

It is recommended that the lifting set is removed from the container prior to the inspection to facilitate a thorough inspection.

If the inspector is using ladders or an uncomfortable access method, it is more likely that the inspector will miss vital areas of the inspection. The inspector would also require more control measures to be put in place due to the fact they are working at height.

**Shackles**

The shackles that are fitted to the lifting set are the last component part of the lifting set that requires periodic inspection. Remove all shackles to enable a thorough inspection to take place. During the Examination Check for:

- Markings are clear and legible
- Confirm shackle is right size for container
- Jaw width is suitable for the pad eyes
- Confirm pin and body are of the same grade and manufacturer
- The pin is free to rotate when the nut is tight on the pin
- The cotter pin is fitted and serviceable
- Body and pin are not distorted
- Body and pin are not worn by over 8% (LEEA recommendation)
- Heavy deep pitted corrosion
- Fatigue / Hydrogen embrittlement cracking

**Periodic Visual Inspection: Lifting Sets - Chain Slings**

**Markings**

Check the markings for the lifting set are clear and legible; unidentifiable lifting sets can be a danger. You may even find an incorrect size lifting set is fitted.


**Master Link**

Start with the master link that is fitted to either the top leg of the sling or the master link that is fitted to a 2 leg sling.

Inspect the master link for:

- Inspect the master link for distortion/ twisting
- Stretch 0%
- Wear, to be under 8% of diameter (LEEA Recommendation)
- Excessive corrosion (pitting)
- Welds for cracks (potential NDE?)
- Hydrogen Embrittlement (Exposer to Acids)

**Top Leg**

Inspect the chain top leg for:

- Wear, to be under 8% of diameter (LEEA Recommendation)
- Distorted links,
- Elongation due to overloading, 0%
- Elongation due to wear at load bearing points, Maximum 5%
- Heavy deep pitted corrosion,
- Articulation,
- Nicks, cracks, gouges.
- Hydrogen Embrittlement (Exposer to Acids)

As the inspection progresses down the sling, the master link assembly and the sub links are examined.

Examination Criteria as per previously mentioned Master link.





Check all four chain legs for wear, distorted links, elongation due to overloading, elongation due to wear at load bearing points, corrosion, articulation, nicks, cracks, gouges.

Pay particular attention to the chain at the area where it hangs over the side of the container.

Examine all 4 sides of the chain of all 4 legs of the chain.

Examination criteria as per previously mentioned top leg.

**Testing of Offshore Containers**

**Periodic Schedule: BS EN ISO 10855-3**

The table below shows the requirements of BS EN ISO 10855-3 for the periodic inspection, examination and testing of offshore containers. The highlighted column shows the testing requirements.

| Time or Interval | Inspection/Examination/Test | | | |
|---|---|---|---|---|
| | Lifting Test | Non-Destructive Examination (NDE) | Visual Inspection | Marking to be made on Plate |
| Initial Certification | As required by BS EN ISO 10855 - 1 | | | |
| At Intervals not Exceeding 12 Months | Not Applicable (b) | Not Applicable (b) | YES | V |
| At Intervals not Exceeding 48 Months | Not Applicable (b) | YES | YES | VN |
| After Substantial Repair or Alteration (a) | YES | YES | YES | T |

a. A substantial repair or alteration means any repair and/ or alteration carried out which in the opinion of an inspection body, affects the primary elements of the offshore container or elements which contribute to it's structural integrity.
b. The inspection body may require other additional inspections, examination and or tests.

**Periodic Schedule: BS 7072**

The table below shows the requirements of BS 7072 for the periodic inspection, examination and testing of offshore containers for any containers that may be encountered built to this standard. The highlighted column shows the testing requirements.



| Time or Interval | Inspection/Examination/Test | | | |
|---|---|---|---|---|
| | Proof Load Test 2 x MGM | Non-Destructive Examination (NDE) of the Lifting Points | Visual Inspection | Marking to be made on Plate |
| Initial Certification | YES | YES | YES | T |
| At Intervals not Exceeding 6 Months | NO | At the discretion of the competent person | YES | V or VN |
| At Intervals not Exceeding 12 Months | NO | YES | YES | VN |
| At Intervals not Exceeding 24 Months | YES | YES | YES | T |
| After Substantial Repair or Alteration | YES | YES | YES | T |

**Periodic Schedule: DNVGL-ST-E271**

The table below shows the requirements of DNVGL-ST-E271 for the periodic inspection, examination, and testing of offshore containers. The highlighted column shows the testing requirements.

| Time or Interval | Inspection/Examination/Test | | | |
|---|---|---|---|---|
| | Lifting Test | Non-destructive Examination (NDE) of Pad Eyes (2) | Visual Inspection | Marking to be made on Plate |
| At Intervals not Exceeding 12 Months | Not Applicable | Not Applicable | YES | V |
| At Intervals not Exceeding 48 Months | Not Applicable | 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 in the opinion of the surveyor, affects the primary elements of the offshore container or elements which contribute to its structural integrity.
2. Including supporting structure if relevant.

**IMDG Requirements**

It may not be within the scope of your inspection/test to carry out this mandatory inspection/ testing and you should always make that clear on the inspection test report that you complete.

Offshore tanks for the carriage of dangerous goods are required under the IMDG code to undergo 2.5 year periodic inspections.

A 2.5 year inspection shall include but not be limited to:

- General visual survey of piping, valves, instruments, tank structure, insulation, markings etc.
- Internal visual inspection
- Leak tightness test of the tank and its connections
- Corrosion protection

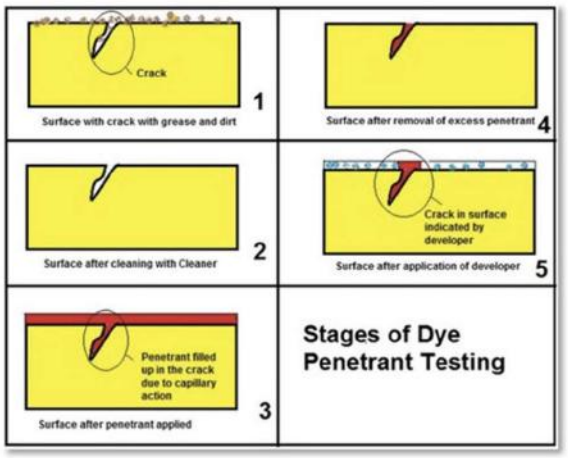
A 5 year inspection shall consist of all items listed under the 2.5 year inspection and in addition the following:

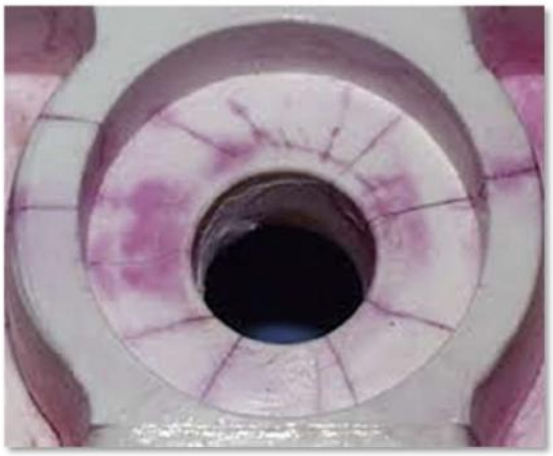
- All valves to be serviced and proven tight
- Relief valves to be serviced, reset and tested to correct specified pressure
- All instrumentation to be calibrated
- Insulation to be inspected; remove hard insulation to allow thorough inspection of tank underneath
- If vacuum insulated, the outer shell integrity to be proven by a leak test
- Thickness measurements, especially where corrosion is likely to occur
- NDT and close up internal inspections of the shell welds to be completed

**Types of Tests**

**Liquid/Dye Penetrant Testing (PT)**

Penetrant testing locates surface-breaking discontinuities by covering the item with a penetrating liquid, drawn into the discontinuity by capillary action. After removal of excess penetrant, the indication is made visible by applying a developer (colour contrast or fluorescent).

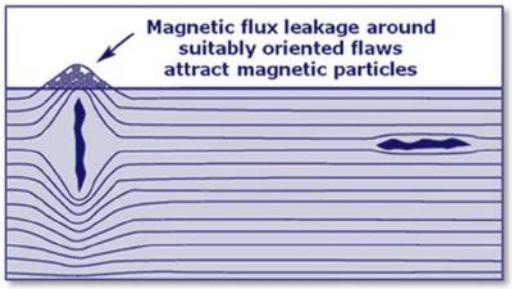


**Magnetic Particle Inspection**

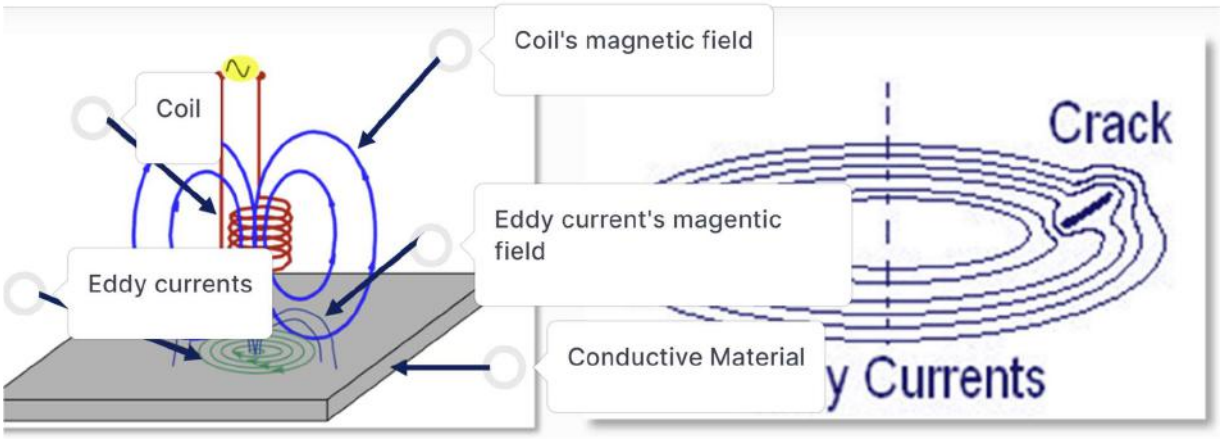
Magnetic particle inspection (MPI) is used to locate surface and slightly sub-surface discontinuities in ferromagnetic materials by introducing a magnetic flux into the material.

- White background lacquer is applied to the area to be inspected
- Items are magnetized and then sprayed with a solution of suspended iron filings
- Cracks or imperfections near the surface will distort the magnetic field
- Will attract the iron filings revealing the flaw by an accumulation of particles along the line of the crack
- Sub-surface defects by an accumulation in the area over the fault



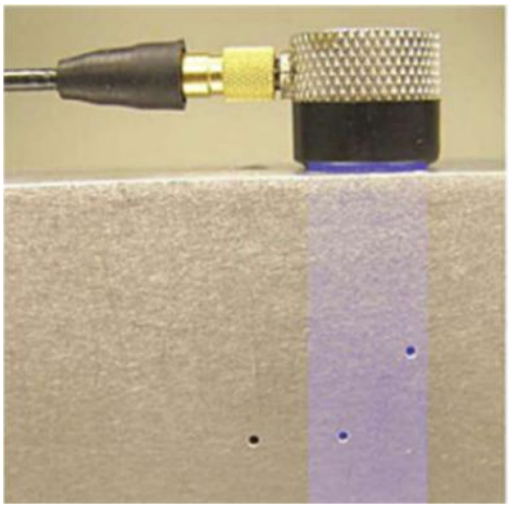
**Eddy Current Inspection**

Eddy current inspection is based on inducing electrical currents in the material being inspected and observing the interaction between those currents and the material. Eddy currents generated by coils in the test probe are monitored by measuring the coils electrical impedance. As it is an electromagnetic induction process, direct electrical contact with the sample is not required; but the material must be an electrical conductor.



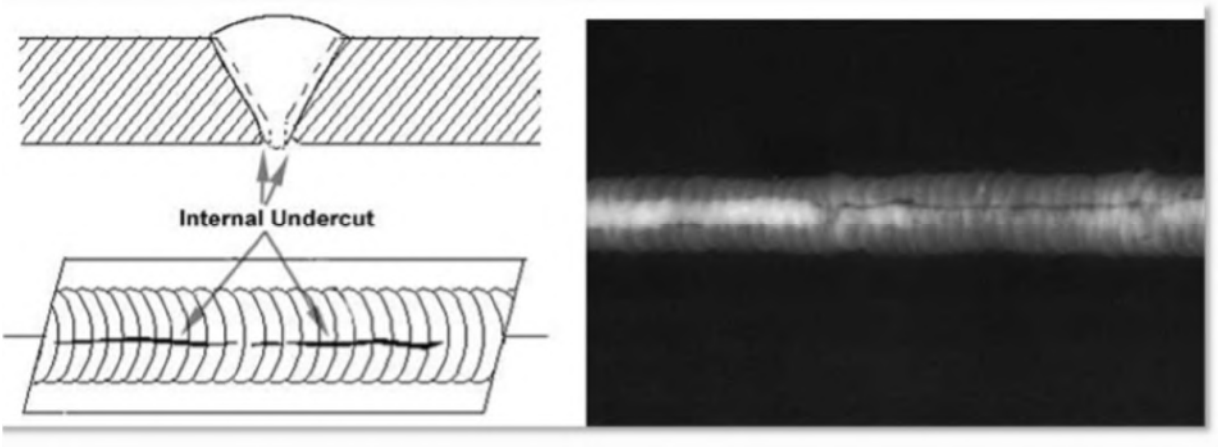

**Ultrasonic Testing**

Ultrasonic testing (UT) measures the time for high frequency (0.5-50MHz) pulses of ultrasound to travel through the inspection material. If a discontinuity is present, the ultrasound returns to the probe in a period other than would be expected of a fault free specimen.



**Radiography**

Radiography testing (RT) monitors the varying transmission of ionising radiation through a material with the aid of photographic film or fluorescent screens to detect changes in density and thickness. It will locate internal and surface-breaking defects. As shown on the weld defect below, this would have been impossible to detect with a surface only method of NDE.




*Notes:*

**Inspection Report Requirements**

## Inspection Report Contents

| The Inspection Report for an Offshore Container as a Minimum Should Contain at least the Following | |
|---|---|
| 1 | Container identification (including owner's container number) |
| 2 | Name of owner or delegated nominee |
| 3 | Report number |
| 4 | Statement that the container is suitable for service |
| 5 | Total gross mass in kg, applicable to the all points lifting test and the method of test (where relevant) |
| 6 | Details of NDE carried out (where relevant) |
| 7 | Statement that the container described was inspected/examined and or tested and that the particulars are correct |
| 8 | Reference, where appropriate, to any report issued to the owner arising from the process |
| 9 | Confirmation that the Inspection Plate was marked; date of examination (date of signature or report also to be shown if different from date of examination) |
| 10 | Name of organization, person and authentication by the person carrying out the inspection, examination or test either by signature or other secure means |
| 11 | Comments on any limits to the scope of inspection |
| | **Note 1:** Details of the examination of the lifting set may also be given on the inspection report for the container. |
| | **Note 2:** This report may be combined with the initial Certificate of Conformity. |

The course modules so far have covered the in-depth inspection and testing that is required for offshore containers.

This final module will cover the user pre-trip inspection that is required before shipping.

This is a very basic level inspection carried out as a final check but is often just as important as the periodic inspections and tests because it may have been some time since the periodic inspection/test and the container and lifting set's condition may have deteriorated.

Immediately before transporting a container offshore and before its return trip, the container shall be inspected by a person appointed by the user. The user shall ensure that the person appointed is competent for this purpose.
The appointed Competent Person shall check the validity of the certification by reference to the inspection plate, and verify that the container, including its lifting set, is free from obvious defects rendering it unfit for use.



The appointed Competent Person shall confirm, by signature and date, that the inspection has been carried out in accordance with the minimum requirements below and that the container and lifting set comply with all elements before being released for shipment. This confirmation of inspection shall be retained at least until the end of the trip, or, where the container has been involved in an incident, until the completion of related investigations.

**Pre-Trip Inspections**

| Pre-Trip Inspections – Minimum Required Checks | |
|---|---|
| 1 | Check the inspection plate(s) to ensure that inspection dates are current |
| 2 | Check the container for obvious signs of damage or excessive corrosion |
| 3 | Check the lifting set for obvious signs of damage |
| 4 | Check the lifting set to ensure correct and secure connection and all parts are present and correct |
| 5 | Check the container roof, forklift pockets and frames on open framed containers for potential dropped objects |
| 6 | Check the container doors are closed and the locking mechanism secured |

**Summary**

On completion of this training course, you will sit your end-point assessment (exam) for the qualification of Offshore Containers Diploma (Global). On successful completion, you will receive a LEEA Diploma and TEAM Card. Existing TEAM Card holders will have this qualification added to their profile.

You'll be trained to perform the 'thorough examination' of offshore containers in service and validate, or otherwise, their fitness for a further period of service, applying conditions as may be necessary.

Students will be able to refer to and extrapolate information from sources to support their analysis of lifting equipment suitability for continued service.

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