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Offshore containers and associated lifting sets —

Part 2: Design, manufacture and marking of lifting sets

Conteneurs offshore et dispositifs de levage associés —

Partie 2: Conception, fabrication et marquage des dispositifs de levage associés

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

A list of all the parts of ISO 10855 can be found on the ISO website.

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Introduction

ISO 10855 (all parts) meets the requirements of IMO MSC/Circ.860[10] for the design, construction, inspection, testing and in-service examination of offshore containers and the associated lifting sets which are handled in open seas.

This document does not specify certification requirements for offshore containers which are covered by the IMO Circular 860 and SOLAS. IMO MSC/Circ.860 requires certification of offshore containers "by national administrations or organizations duly authorized by the Administration", which should take account of both the calculations and the testing, "taking into account the dynamic lifting and impact forces that can occur when handling such equipment in open seas". Further information about certification can be found in informative Annex C of this document.

ISO 10855 (all parts) does not cover operational use or maintenance, for which there are a number of industry guidelines which can be referred to. Some are listed in the bibliography.

Under conditions in which offshore containers are often transported and handled, the 'normal' rate of wear and tear is high, and damage necessitating repair will occur. However, containers designed and manufactured according to ISO 10855 (all parts) will have sufficient strength to withstand the normal forces encountered in offshore operations, and not suffer complete failure even if subject to more extreme loads.

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Offshore containers and associated lifting sets —

Part 2:
Design, manufacture and marking of lifting sets

1 Scope

This document specifies requirements for lifting sets for use with containers in offshore service, including technical requirements, marking and statements of conformity for single and multi-leg slings, including chain slings and wire rope slings.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test*

EN 818-4:1996, *Short link chain for lifting purposes — Safety — Part 4 — Chain slings - Grade 8*

EN 1677-1, *Components for slings — Safety — Part 1: Forged steel components, Grade 8*

EN 13414-1, *Steel wire rope slings — Safety — Part 1: Slings for general lifting service*

EN 13889, *Forged steel shackles for general lifting purposes — Dee shackles and bow shackles — Grade 6 – Safety*

ABNT NBR 13545, *Lifting purposes — Shackles Safety*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
lifting set
items of integrated lifting equipment used to connect the offshore container to the lifting appliance

Note 1 to entry: This can comprise one or multi-leg wire rope or chain slings (with or without a top leg) and shackles, whether assembly secured or not.

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3.2
assembly secured shackle
shackle fitted to a sling leg and secured by a seal or similar device so as to signal unambiguously whether or not the shackle has been exchanged

Note 1 to entry: Shackles that are assembly secured, i.e. cannot be separated from the lifting sling, are considered to be part of the lifting sling.

4 Symbols

WLL	working load limit
WLL_S	minimum working load limit of each shackle
WLL_{min}	minimum calculated working load limit from Annex A
WLL_{off}	maximum lifting capacity of a lifting set to be used on an offshore container

NOTE 1 WLL_{off} is the symbol that is marked on the lifting sets.

ϑ	is the angle between a sling leg and the vertical, in degrees
R	rating [i.e. the maximum gross mass (MGM), of the container including permanent equipment and its cargo] in kg, but excluding the lifting set
T	tare mass (i.e. the mass of an empty container including any permanent equipment but excluding cargo and lifting set) in kg
P	payload (i.e. the maximum permissible mass of cargo which can be safely transported by the container) in kg
T_D	design air temperature (i.e. a minimum reference temperature used for the selection of steel grades used in offshore containers and equipment) expressed in degrees centigrade
S	mass of the lifting set in kg

NOTE 2 $P = R - T$

NOTE 3 R, T and P are, by definition in units of mass, kilograms (kg). Where design requirements are based on the gravitational forces derived from these values, those forces are indicated thus: Rg, Tg and Pg the units of which are in Newtons or multiples thereof.

5 Technical requirements

5.1 General requirements

5.1.1 Slings shall be rated for their intended angle of use. In all cases 4-leg slings shall be rated as for 3-leg slings. In no case shall a sling be rated for an angle of the sling leg to the vertical in excess of 45°.

NOTE Top legs are calculated as single legs.

For specific angles less than 45° the sling shall be rated at the WLL_{min} according to the particular angle of the legs to the vertical. This shall be calculated as follows.

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For 2-leg slings used at an angle ϑ to the vertical, the WLL shall be given by the formula:

$WLL_{min} = 2 \times WLL_{min}$ for a single leg $\times \cos \vartheta$

For 4-leg slings used at an angle ϑ of any leg to the vertical, the WLL shall be given by the formula:

$WLL_{min} = 3 \times WLL_{min}$ for a single leg $\times \cos \vartheta$

For chain slings this is in accordance with the alternative method of rating in EN 818-4:1996, Annex A.

5.1.2 Where two 2-leg slings are selected to function as a 4-leg sling, they shall be calculated as for a 4-leg sling.

5.1.3 Hinge type coupling components shall not be used.

NOTE This restriction is to avoid the possibility of the coupling seizing in the folded position due to corrosion and subsequently failing when forced straight under load.

5.2 Dimensions and strength of lifting sets

5.2.1 To allow for the dynamic amplification that will be experienced in offshore lifting in adverse weather and sea states, the WLL of the lifting sets for offshore containers shall be determined using Annex A. Except for containers with ratings below 2 000 kg, the container rating R shall be multiplied by an enhancement factor to give the minimum working load limit (WLL_{min}) of the lifting set. For intermediate container ratings the WLL_{min} values shall be interpolated.

5.2.2 The WLL_{min} from Annex A shall be used for determination of the nominal size of the lifting set.

The master link which is to be attached to the crane hook shall have minimum dimensions of 270 mm × 140 mm internally.

5.2.3 The minimum WLL of each shackle (WLL_S) shall be calculated as given in Table 1, where ϑ is the angle of the sling leg to the vertical and WLL_{min} is the minimum WLL determined from Annex A.

Table 1 — Required minimum shackle working load limit (WLL_S)

4-leg sling	2-leg sling	Single leg sling
$WLL_{min}/(3 \times \cos \vartheta)$	$WLL_{min}/(2 \times \cos \vartheta)$	WLL_{min}

5.2.4 The lifting set shall be of sufficient length to allow easy handling by operators. The top link or master link shall be able to reach down to a height of no more than 1,3 m above the container bottom when the sling hangs over the long side of the container.

5.3 Chain slings

Chain slings shall meet all requirements of EN 818-4.

5.4 Wire rope slings

5.4.1 Wire rope slings shall meet all requirements of EN 13414-1 with restrictions as applied in 5.4.2 and 5.4.3.

5.4.2 Wire rope shall be 6-stranded and of type 6 × 19 or 6 × 36.

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5.4.3 The termination of wire rope shall be a ferrule secured thimble.

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

5.4.4 Wire rope grade 1770 or 1960 shall be used. The WLL shall be calculated on the basis of the actual rope grade used.

NOTE This also applies when slings are rated and marked in accordance with the note in 5.1.1.

5.5 Shackles

5.5.1 Shackles shall be Grade 6 or Grade 8 and meet all requirements of 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 %.

5.5.2 Shackles shall be restricted to bolt type pin with a hexagon head, hexagon nut and split cotter pin.

5.6 Materials

5.6.1 Impact testing

Steels shall be impact tested by the Charpy impact (V-notch) method in accordance with ISO 148-1. The impact test temperature shall be equal to the design air temperature T_D and the minimum average impact energy shall be 42 J. However, for welded components (e.g. chains, links,) it shall be sufficient only to take impact test samples in the weld with the notch centred in the fusion line. The position of the weld shall be accurately identified by etching with a suitable reagent before cutting the notches. The minimum average impact energy of the weld shall be 27 J.

Where the cross section of the material to be tested is too small to allow the standard test specimen to be taken (10 mm × 10 mm), the required energy values shall be reduced as follows:

— 10 mm × 7,5 mm: $\frac{5}{6}$ of the minimum average impact energy for standard size specimens;

— 10 mm × 5,0 mm: $\frac{2}{3}$ of the minimum average impact energy for standard size specimens.

For tests where the size of the test piece is too small (diameter less than 13 mm), tests may be carried out on sample material which shall be of the same specification and heat treatment.

5.6.2 Welding

In addition to the requirements of EN 818-4, qualification of the welding process shall be in accordance with ISO 15613.

5.6.3 Materials used in wire rope slings

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

NOTE Where wire rope slings are to be used at temperatures below −40 °C the manufacturer will be consulted.

5.6.4 Galvanizing

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

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5.6.5 Material certificates

The materials used in all components shall be supplied with an inspection certificate to either ISO 10474, type 3.1, or, in the case of materials in ferrules and thimbles, to ISO 10474, type 2.2, with content as detailed in Clause 6.

6 Certificates

6.1 Preparation of certificates

Certificates provided in support of claims of compliance with the requirements of this document shall be prepared in accordance with ISO 10474 and contain the information specified in the relevant product standard, together with that specified in 6.2 or 6.3 as appropriate.

6.2 Single component certificates

Single components used in slings conforming to this document shall have certificates as specified in 5.6.5, containing the information specified in the relevant product standard together with the following, as a minimum:

— manufacturer's name, mark and contact location;

— date of issue for the certificate (YYYY-MM-DD);

— certificate number;

— description of the component;

— identification of the relevant product standard;

— material specification including chemical composition and mechanical properties;

— results from tests specified in the relevant product standard and this document;

— record of the unique identification number or mark carried by the component;

— manufacturer's authorized signature.

6.3 Sling certificates

Slings conforming to this document shall be supplied with a certificate (type ISO 10474:2013, 3.1) containing the information specified in the relevant product standard together with the following, as a minimum:

— manufacturer's name, mark and contact location;

— date of issue for the certificate (YYYY-MM-DD);

— sling certificate number;

— description of the sling, including unique identification number or mark;

— reference to each single component's unique identification mark (if new components are installed before re-certification, this shall include reference to the previous certificate number and the new component's unique identification mark);

— nominal size and length of the sling;

— WLL_{off} together with the appropriate angle to the vertical for multi-leg slings and the method of rating;

— date of sling manufacture or re-certification;

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— a statement that the sling described has been designed, manufactured and tested in accordance with this document;

— manufacturer's authorized signature.

In addition:

— for wire rope slings, the grade of terminal fittings and the rope together with a statement that the sling conforms to EN 13414-1;

— for chain slings, the grade mark 8 and a statement confirming that the sling conforms to EN 818-4 and providing cross reference to the results of any final testing of mechanical properties after heat treatment.

7 Marking

7.1 In addition to the marking required by the relevant individual component standards, the requirements of 7.2 to 7.4 apply.

7.2 Shackles fitted to a sling, without being assembly secured, shall be indelibly marked with a unique identification.

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

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

As an alternative to marking slings with a tag, one of the following methods may be used for marking.

— Method 1: The marking required by 7.5 may be marked on a ferrule on wire rope slings.

— Method 2: Slings may be marked with a small tag with only an ID number on it. All other information required by 7.5 shall be available, either electronically or by other means.

NOTE Dropped objects such as an identification tag on an offshore container lifting set can be a major health and safety issue. The risk of such accidents can be reduced or removed if one of the alternative solutions are used. However, national authorities or other stakeholders might not accept such alternative marking.

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

7.5 The marking on tags for chain and wire rope slings shall include:

— number of this document;

— unique identification number of the sling;

— number of legs;

— diameter of chain or wire rope used, including the top leg where fitted;

— WLL_{off} in tonnes;

— shackle size in tonnes;

— maximum angle of the sling legs to the vertical;

— mass of the lifting set (S) in kg.

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NOTE An example of an identification tag for chain slings is shown in Annex B.

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Annex A
(normative)

Determination of minimum required working load limit (WLL_{min}) of the lifting set

Table A.1 shows determination of minimum required working load limit.

Table A.1 — Determination of minimum required working load limit

Container rating (R) (kg)	**Enhancement factor**	**Minimum required working load limit of the lifting set** (WLL_{min}) (tonnes)
500	—	7,00
1 000	—	7,00
1 500	—	7,00
2 000	3,500	7,00
2 500	2,880	7,20
3 000	2,600	7,80
3 500	2,403	8,41
4 000	2,207	8,83
4 500	2,067	9,30
5 000	1,960	9,80
5 500	1,873	10,30
6 000	1,766	10,60
6 500	1,733	11,26
7 000	1,700	11,90
7 500	1,666	12,50
8 000	1,633	13,07
8 500	1,600	13,60
9 000	1,567	14,10
9 500	1,534	14,57
10 000	1,501	15,01
10 500	1,479	15,53
11 000	1,457	16,02
11 500	1,435	16,50
12 000	1,413	16,95
12 500	1,391	17,38
13 000	1,368	17,79
13 500	1,346	18,18
14 000	1,324	18,54
14 500	1,302	18,88
15 000	1,280	19,20
15 500	1,267	19,64
16 000	1,254	20,06

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Table A.1 *(continued)*

Container rating (R) (kg)	**Enhancement factor**	**Minimum required working load limit of the lifting set** (WLL_{min}) (tonnes)
16 500	1,240	20,47
17 000	1,227	20,86
17 500	1,214	21,24
18 000	1,201	21,61
18 500	1,188	21,97
19 000	1,174	22,31
19 500	1,161	22,64
20 000	1,148	22,96
20 500	1,143	23,44
21 000	1,139	23,92
21 500	1,135	24,39
22 000	1,130	24,86
22 500	1,126	25,33
23 000	1,121	25,79
23 500	1,117	26,25
24 000	1,112	26,70
24 500	1,108	27,15
25 000	1,104	27,59

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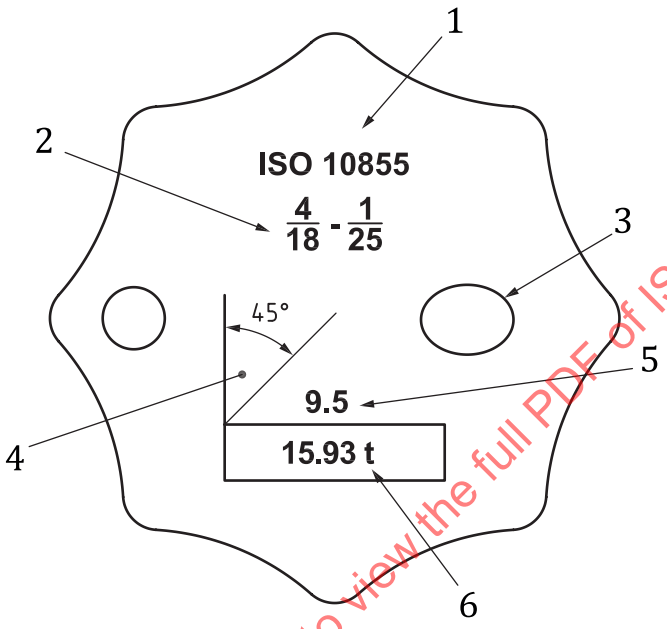
Annex B
(informative)

Example of identification tag for chain slings

Figures B.1 and B.2 show an example of an identification tag for chain slings.



Key

1 ISO number
2 four legs of 18 mm, one top leg of 25 mm (example)
3 manufacturer's mark
4 sling leg angle
5 shackle size
6 WLL_{off} (t)

Figure B.1 — Front of identification tag

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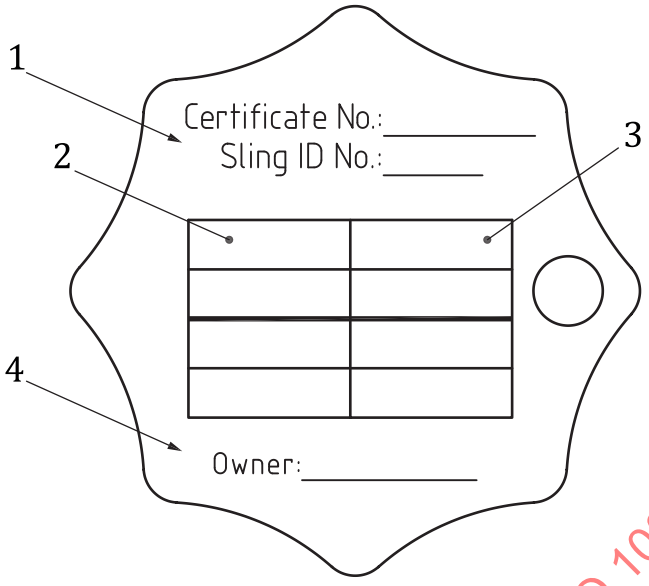

Key

1 certificate number (and unique identification number if applicable)
2 column 1: inspectors mark, inspection suffix and date of periodic inspections (shall be of format YY-MM-DD)
3 column 2: shackle ID number
4 the owner's name may optionally be included

Figure B.2 — Back of identification tag

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