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Ships and marine technology — Loose gear of lifting appliances on ships — Shackles

Navires et technologie maritime — Accessoires mobiles des appareils de levage sur les navires — Manilles

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Foreword

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For an explanation on 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

The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Ships and marine technology — Loose gear of lifting appliances on ships — Shackles

1 Scope

This International Standard specifies the types and basic parameters, technical requirements, marking, storage, and transportation, use and maintenance of shackles, loose gear of lifting appliances on ships.

This International Standard is applicable to lifting appliances on ships.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 2415, *Forged shackles for general lifting purposes — Dee shackles and bow shackles*

ISO 16855, *Ships and marine technology — Loose gear of lifting appliances on ships — General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2415 and ISO 16855 apply.

4 Types and basic parameters

4.1 Dee shackles

For the shapes and dimensions of Dee shackles, see A.1.

4.2 Bow shackles

For the shapes and dimensions of Bow shackles, see A.2.

4.3 Pins of shackles

For the types of pins of shackles (Type W, Type X, and Type Y), see A.3.

4.4 Pinholes of shackles

For the diameters of pinholes of shackles, see A.4.

4.5 Designation method of models

The model of shackles shall be designated as follows:

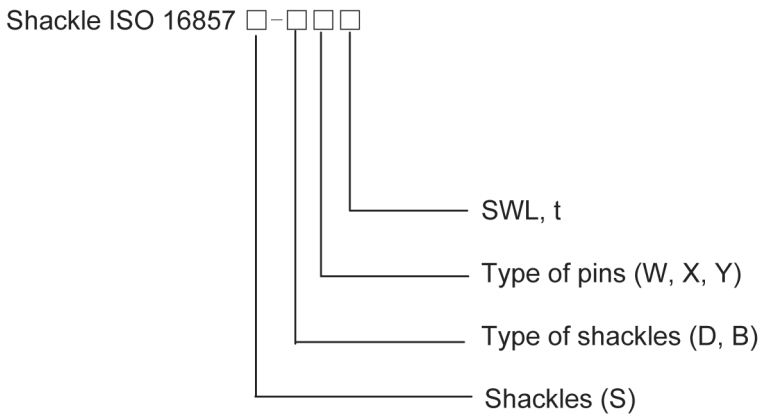

Figure 1 — Example

EXAMPLE 1 Dee shackles with Type W pins and 20 t SWL:

Shackle ISO 16857 S-DW20

EXAMPLE 2 Bow shackles with Type X pins and 10 t SWL:

Shackle ISO 16857 S-BX20

5 Technical requirements

5.1 Materials

5.1.1 Shackle materials shall use solid steel manufactured by Martin furnaces, electric furnaces, or oxygen top blown converters; it is recommended to use the electroslag remelting process.

5.1.2 For the chemical composition of shackle materials, see Table 1. Other materials can be used (see 5.6).

Table 1 — Chemical composition of shackle materials

Materials	Chemical composition (heat analysis) %						
	C	Si	Mn	P	S	Cr	Al
Carbon steel	0,17–0,24	0,17–0,35	0,45–0,80	≤0,035	≤0,035	≤0,030	≥0,025
Carbon-manganese steel	0,17–0,24	0,20–0,35	1,20–1,50	≤0,035	≤0,035	≤0,030	≥0,025

5.1.3 For the mechanical properties of shackle materials, see Table 2. Other mechanical properties can be used (see 5.6).

Table 2 — Mechanical properties of shackle materials

Materials	Mechanical properties						
	Tensile strength R_m MPa	Yield point R_{eH} MPa			Elongation A %		Impact energy A_K J
	Diameters or thicknesses of steel mm						
	≤100	≤16	>16–40	>40–60	≤50	≤100	≤60
Carbon steel	402–490	255	245	235	–	22	48
Carbon-manganese steel	510–608	353	343	333	22	–	41

NOTE 1 The values listed in the table refer to mechanical properties at normal temperature.

NOTE 2 For diameters or thicknesses >60 mm, the impact energy and yield point under strain aging conditions are determined by the supplier and purchaser based on demand.

NOTE 3 If materials have no obvious yield points, the yield point R_{eH} shall be the yield strength $R_{P0,2}$.

5.1.4 When the design temperature of lifting appliances on ships is below −10°C, the impact energy test temperature of shackle materials shall satisfy the requirements of related certification organizations, such as classification societies.

5.2 Forging and heat treatment

5.2.1 Shackle bodies need to be forged with seamless solid blanks, and two pinholes shall be coaxial and concentric with two outsides of eyes; pins shall be cut from bars, and machined after forging.

5.2.2 Heat treatment shall be made after shackle forging to achieve the properties specified in 5.1, with no more than three times of heat treatment.

5.3 Surface and internal quality of shackles

5.3.1 The surface of shackles shall be smooth and clean, without any defect such as burrs, cracks, folding, and burning.

5.3.2 Defects in shackles cannot be rewelded.

5.3.3 Shoulders or heads of pins (Type W and Type Y) after assembly shall fit into the bodies. When thread pins are screwed up, visible residual threads between dimensions of shackles (W) shall not be more than 1 pitch. After the correct assembly of pins, in no case shall the inner width (W) of the bodies be obviously reduced.

5.3.4 Threads shall meet the requirements of ISO 261, and the fit accuracy of threads is 6g/6H.

5.4 Test

5.4.1 Each shackle shall be proof-tested, with test loads given in Table 3. Proof load shall be applied to each shackle with a testing machine or test weight for a duration of not less than 5 min.

Table 3 — Proof load for shackles

Safe working load (SWL) kN	Proof load (PL) kN
≤245	2 × SWL
>245	1,22 × SWL + 196

5.4.2 After proof testing, each shackle shall be thoroughly examined for deformation, cracks, or other defects and to ensure that its rotating parts can rotate freely. Increment of the body length (*S*) or length increment measured from the mark between the crown and pin shall not exceed 0,25 % thereof or 0,5mm, whichever is greater.

5.4.3 When shackles of various specifications are manufactured for the first time or upon the request of related organizations, such as classification societies, static strength tests shall be carried out for shackles, the ultimate strength load during the test is four times the safe working load. After 5 min of the static strength test, shackles shall not break or deform to the extent that they lose the bearing capacity.

5.5 Inspection

5.5.1 Inspection shall be made after the production of shackles, to ensure that surface and internal quality satisfies the requirements in 5.3 and the requirements in 5.4.2 after the test.

5.5.2 For shackles that pass the test, the manufacturer shall provide technical documents such as certifications.

5.6 Other requirements

For other shackles (type or SWL, materials), strength shall be calculated during the design and the result should meet the test requirements in 5.4.3. Commercially available forged shackles that meet industry standards in terms of SWL, design factor, forging reduction, heat treatment, bolt threading, testing, and inspection are acceptable as agreed upon by the supplier and the purchaser.

6 Marking

6.1 Marking of shackles shall be permanently distinct with the following items:

a) safe working load, in t;

b) test date;

c) shackle number;

d) manufacturer's stamp or the stamp of test unit.

6.2 Marks shall be stamped at the shackle bodies near the pinholes to facilitate check.

6.3 For the shackles of small size, should the place where marking is restricted, the marks of number and date can be eliminated.

7 Storage and transportation

7.1 During storage, the machined surfaces of shackles that pass the test shall be painted with anti-rust oil, and their non-machined surfaces shall be painted with anti-rust paint.

7.2 Secure package shall be made for shackles to prevent collision during transportation.

8 Use and maintenance

8.1 Upon installation on the lifting appliances, shackles shall be checked before each use, with major check items as follows:

a) wear;

b) normal operation of moving parts;

c) no abnormal conditions such as loose pins and nuts or defects;

d) there is no crack, scratch, heat damage, including welding slag, or arc striking mark in shackle bodies.

8.2 Shackle defects found during check shall be repaired and cannot be used until confirmation by experienced personnel. Shackles shall be scrapped under the following circumstances.

a) There are defects in shackles, such as crack, heat damage, including welding slag, or arc striking mark, which prevent them from use.

b) The diameter dimension of the worn moving part reaches 10 % of the total diameter dimension. The length dimension of corroded thread reaches 15 % of its total length dimension.