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**Ships and marine technology — Bulk  
carriers — Construction quality of hull  
structure**

*Navires et technologie maritime — Vraquiers — Qualité de construction  
de la structure de la coque*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15401 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 8, *Structures*.

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## Introduction

The aim of this International Standard is to provide guidelines for good shipbuilding production conditions.

Details, where appropriate, given in this International Standard were developed with reference to applicable International Association of Classification Societies (IACS) rules and requirements.

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# Ships and marine technology — Bulk carriers — Construction quality of hull structure

**SAFETY PRECAUTIONS** — It is the responsibility of the user of this International Standard to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.

## 1 Scope

This International Standard specifies the quality requirements for the hull construction of steel bulk carriers. It does not apply to double-skin bulk carriers.

Requirements for the maintenance and repair of steel bulk carriers are given in ISO 15402.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 8501-1:1988, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings* and its Informative Supplement of 1994, *Representative photographic examples of the change of appearance imparted to steel when blast-cleaned with different abrasives*.

ISO 8503-1:1988, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces*.

IMO A.798 (19), *Guidelines for the selection, application and maintenance of corrosion prevention systems of dedicated seawater ballast tank*.

ISO 15402, *Ships and marine technology — Bulk carriers — Repair quality of hull structure*.

## 3 Terms and definitions

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

### 3.1

#### **bulk carrier**

ship which is generally constructed with a single deck, topside tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk

### 3.2

#### **length $L$**

the definition is taken from the rules of classification societies

## 4 Quality control through construction

### 4.1 Steel material

4.1.1 Upon arrival in the yard, all steel materials intended for ship construction shall be checked against quality certificates. A visual inspection shall be carried out to confirm their quality.

4.1.2 All steel materials shall be stored according to sizes and brand and kept flat.

4.1.3 All steel materials shall be issued against material allocation sheets according to the construction plan.

4.1.4 A quality inspection shall be carried out on the steel materials before processing.

Special attention shall be paid to the following points of quality control:

- a) material quality documentation;
- b) size, brand, charge number and batch number;
- c) minus tolerance in thickness for plates and sections;
- d) lamination and surface defects;
- e) any defects in large forgings and castings.

### 4.2 Steel processing

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#### 4.2.1 Marking and cutting

4.2.1.1 Necessary pretreatments such as: levelling, straightening, derusting and application of shop primer shall be carried out on the plates and sections before putting them into production.

4.2.1.2 Numerical control cutting and other highly efficient high-precision cutting shall be used to the widest possible extent to improve cutting accuracy.

4.2.1.3 Information related to material property, charge number and batch number shall be filed for important members.

4.2.1.4 Special attention shall be paid to the following points of quality control:

- a) size deviation;
- b) angular deviation;
- c) marks such as processing symbols, codes and technological numbers;
- d) cutting accuracy;
- e) dimensions of configuration.

#### 4.2.2 Forming

4.2.2.1 Hot or cold bending of steel plates and sections shall be performed according to the applicable technology requirements for different properties and grades of materials.

4.2.2.2 Special attention shall be paid to the following points of quality control:

- a) heating temperature;
- b) accuracy of bending.



### 4.3 Fitting and assembly

#### 4.3.1 Fitting and assembly of parts and members

**4.3.1.1** The accuracy requirements of block assembly shall be met for the fitting and assembly of parts and members. Protective primer shall be repaired after welding.

**4.3.1.2** Special attention shall be paid to the following points of quality control:

- a) geometrical dimensions of parts and members;
- b) installation locations;
- c) excessive gap before welding;
- d) deformation.

#### 4.3.2 Block assembly

**4.3.2.1** Block assembly should generally be carried out on a platform or jig.

**4.3.2.2** Pre-outfitting of parts and members shall be done according to applicable design drawings.

**4.3.2.3** The accuracy that meets the requirements given in the following pages for general assembly shall also be met for block assembly.

**4.3.2.4** Block assemblies may be coated after inspection.

**4.3.2.5** Special attention shall be paid to the following points of quality control:

- a) marking accuracy; <https://standards.iteh.ai/catalog/standards/sist/8fcbccf6-f54d-4878-a642-32684418baac/iso-15401-2000>
- b) installation accuracy of internal structure joints inside the block;
- c) accuracy of block configuration and its dimensional size;
- d) accuracy of block edges;
- e) correctness of assembling reference lines;
- f) flatness of face plate and location deviation of main engine bed;
- g) installation locations of key components, such as shaft boss, rudder horn, etc.

#### 4.3.3 Erection on shipway/dock

**4.3.3.1** Marking on the shipway/dock shall be carried out with corresponding symbols and marks.

**4.3.3.2** Placing the reference block in position, and then proceeding with successive blocks shall be done according to the shipway/dock assembly schedule.

**4.3.3.3** During the construction process, all temporary openings in strength members and their closing-up shall comply with the requirements set out in the applicable construction drawings and/or standards.

**4.3.3.4** Removing temporary welding pieces and lifting eyepieces shall be done according to usual practice (refer to Table 37).

**4.3.3.5** After completing shipway/dock assembly, the hull shall be coated or the (block) coating repaired according to specified requirements before launching.

**4.3.3.6** Special attention shall be paid to the following points of quality control:

- a) accuracy of marking on the shipway/dock;
- b) correctness of location of the reference block;
- c) frame spacing at block junctions;
- d) alignment accuracy of structural members;
- e) straightness of base line;
- f) alignment accuracy of propeller shaft centreline;
- g) marking accuracy of loadline and draft marks;
- h) principal dimensions of the hull.

## **4.4 Welding**

### **4.4.1 Preparation before welding**

Welding materials, preparation of weld joints and assembly accuracy shall comply with classification society requirements set out in quality control documents.

The welding zone shall be free of rust, scales, grease, moisture or other dirt.

The environmental condition of the welding area shall be kept in good order.

Tack welding shall be carried out according to specified technological procedures.

Wherever new materials or new welding technologies are adopted, test reports and welding procedures shall be submitted to the classification society for approval.

### **4.4.2 Welding process**

All welding shall be carried out according to the methods and conditions as required by the welding technology procedures. Proper measures for minimizing welding deformation shall be taken.

### **4.4.3 Welding inspection**

**4.4.3.1** Inspection of welding shall be carried out throughout the whole process of welding including inspections before, during and after welding, as well as the inspection of finished weldments.

**4.4.3.2** All welds shall be visually examined first.

**4.4.3.3** Quality inspection of welded seams shall be carried out according to specified requirements. Either X-ray detection, ultrasonic detection or other inspection methods approved by the classification society shall be adopted.

**4.4.3.4** Leg sizes (leg length and throat depth) of fillet welds shall comply with the design plan and relevant codes as approved by the classification society.

**4.4.3.5** Welded joints on the strength deck, shell plate and interior strength members in the mid-length region shall be inspected in accordance with the non-destructive inspection plan approved by the classification society.

**4.4.3.6** Welds not conforming to the requirements of quality standards shall be rectified and repaired, and shall be inspected again.

#### 4.4.4 Quality control

Special attention shall be paid to the following points of quality control:

- a) qualification of welders;
- b) welding materials;
- c) welding codes;
- d) groove sizes and seam clearance;
- e) cleanness of welding region;
- f) preheating and heat-retaining;
- g) welding deformation;
- h) sizes of welded seams;
- i) integrity of all-around welds;
- j) surface and inner defects in welding seam.

#### 4.5 Tightness test

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##### 4.5.1 General requirements

**4.5.1.1** The tightness test shall be conducted after the main hull and the structure are completed. All accessories affecting the tightness should be fixed and non-destructive testing shall be correctly completed.

**4.5.1.2** All welding seams related to the tightness test, shall be free of scales, slugs, coatings (excluding primers) or any grease (refer to Table 48).

**4.5.1.3** The tightness test for the hull structure shall be performed with either water jet, hydrostatic pressure, air pressure or other equivalent methods depending on the hull strength and tightness requirement.

**4.5.1.4** The tightness test may be performed on blocks.

**4.5.1.5** The location and requirements for the tightness test shall be in compliance with the requirements of the classification society.

##### 4.5.2 Quality control

Special attention shall be paid to the following points of quality control:

- a) cleaning of welded seams;
- b) test pressure;
- c) test procedure;
- d) test duration;
- e) inspection for deformation and leakage.

## 4.6 Coating

### 4.6.1 Pretreatment of steel surface

Surface pretreatment of steel shall be done in general by means of shot-blasting, abrasive blasting and chemical cleaning (shop primer shall be applied after derusting).

Surface pretreatment shall be done in accordance with the quality stipulations given in Table 45.

Shop primer shall be applied according to the quality stipulations given in Table 46.

### 4.6.2 Shop primer touch-up

Any damaged shop primer shall be touched up after completion of the welding process.

### 4.6.3 Second derusting and surface cleaning

Second derusting and surface cleaning shall be done in accordance with the quality stipulations given in Table 47 and Table 48.

### 4.6.4 Coating work

#### 4.6.4.1 Precoating

Precoating shall be done for the spots and areas that cannot be easily accessed or which are difficult to reach to obtain the required film thickness by spraying.

#### 4.6.4.2 Coating

Coating may be done by means of either airless spraying or roller application, etc.

#### 4.6.4.3 Quality control

Special attention shall be paid to the following points of quality control:

- a) environmental conditions affecting coating operation;
- b) appearance of coat;
- c) wet film thickness or dry film thickness;
- d) film thickness allocation.

5 Hull construction accuracy

5.1 Steel material

5.1.1 Surface defects of steel plates shall be kept within the limits given in Table 1.

Table 1 — Surface defects of steel plates

Items	Requirements
<p>Pits, flaking, scars, scratches and air bubbles</p>	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p style="text-align: center;">Depth of defect, <math>d</math> (mm)</p> <p style="text-align: center;">Defect area ratio (%)</p> </div> <div style="flex: 2; padding-left: 20px;"> <p>(1) <b>Zone A</b> is in excellent order, with very slight surface defects less than 0,2 mm and no repairing is required.</p> <p>(2) <b>Zone B</b> is in good order, with a certain amount of permissible surface defects, and no repairing is required. Area enclosed by full line denotes plate with thickness less than 20 mm and area enclosed by dotted line (including straight line) denotes plates with thickness from 20 mm to 50 mm.</p> <p>(3) <b>Zone C</b> is in disorder, and repairing is required, i.e. there are certain amounts of impermissible surface defects that shall be repaired according to the requirement.</p> <p>(4) Repair method for surface defects:                      for <math>d &lt; 0,07 t</math>, by grinding (but in any case <math>d \leq 3</math> mm);                      for <math>0,07 t \leq d \leq 0,2 t</math>, by built-up welding and followed by grinding, where <math>d</math> is defect depth, in millimetres; <math>t</math> is plate thickness, in millimetres.</p> <p>When the defect depth exceeds 20 % of the plate thickness and the defect area exceeds 2 % of the plate area, this part of the plate shall be replaced.</p> </div> </div>