

# IACS Common Structural Rules for Double Hull Oil Tankers, January 2006

## Background Document

### SECTION 8/5 – SCANTLING REQUIREMENTS AFT END

**NOTE:**

- This TB is published to improve the transparency of CSRs and increase the understanding of CSRs in the industry.
- The content of the TB is not to be considered as requirements.
- This TB cannot be used to avoid any requirements in CSRs, and in cases where this TB deviates from the Rules, the Rules have precedence.
- This TB provides the background for the first version (January 2006) of the CSRs, and is not subject to maintenance.

**IACS**

INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES LTD.

---

**© IACS - the International Association of Classification Societies and the International Association of Classification Societies Limited**

All rights reserved.

Except as permitted under current English legislation no part of this work may be photocopied, stored in a retrieval system, published, performed in public, adapted, broadcast, transmitted, recorded or reproduced in any form or by means, without prior permission of the copyright owner.

Where IACS has granted written permission for any part of this publication to be quoted such quotation must include acknowledgement to IACS.

Enquiries should be addressed to the Permanent Secretary,  
International Association of Classification Societies Ltd,  
36 Broadway  
London, SW1H 0BH  
Telephone: +44 (0)20 7976 0660  
Fax: +44 (0)20 7808 1100  
Email: [PERMSEC@IACS.ORG.UK](mailto:PERMSEC@IACS.ORG.UK)

### **Terms and Conditions**

The International Association of Classification Societies (IACS), its Member Societies and IACS Ltd. and their directors, officers, members, employees and agents (on behalf of whom this notice is issued) shall be under no liability or responsibility in contract or negligence or otherwise howsoever to any person in respect of any information or advice expressly or impliedly given in this document, or in respect of any inaccuracy herein or omission herefrom or in respect of any act or omission which has caused or contributed to this document being issued with the information or advice it contains (if any).

Without derogating from the generality of the foregoing, neither the International Association of Classification Societies (IACS) nor IACS Ltd. nor its Member Societies nor their directors, officers, members, employees or agents shall be liable in contract or negligence or otherwise howsoever for any direct, indirect or consequential loss to any person caused by or arising from any information, advice, inaccuracy or omission given or contained herein or any act or omission causing or contributing to any such information, advice, inaccuracy or omission given or contained herein.

Any dispute concerning the provision of material herein is subject to the exclusive jurisdiction of the English courts and will be governed by English Law.

**TABLE OF CONTENTS:**

<b>5</b>	<b>AFT END.....</b>	<b>4</b>
5.1	General.....	4
5.2	Bottom Structure .....	5
5.3	Shell Structure.....	6
5.4	Deck Structure .....	6
5.5	Tank Bulkheads.....	7
5.6	Watertight Boundaries .....	7
5.7	Miscellaneous Structures .....	8

## 5 AFT END

### 5.1 General

The requirements for structural arrangements, structural details and compartment arrangement considerations were taken from existing Rule requirements and internal practices of LR, ABS, and DNV. In particular, this includes the more highly prescriptive limitations on the minimum depth of primary support structures, which were taken from existing rule requirements, but were also formulated in a manner consistent with what was used in the requirements addressing cargo block region.

Criteria related to scantling requirements and design loads have been formulated in a manner consistent with the approach used amidships.

Where possible, and as applicable, scantling criteria refer to the amidships criteria and other criteria applicable to all structures, i.e., buckling criteria of *Section 10* of the Rules. Formulations for structure at the aft end of the ship are somewhat simplified, as the permissible stress factors do not explicitly address hull girder stress components. Such components are accounted for in a less direct manner. Further, the criteria for stiffeners and primary support members incorporates flexibility and judgment with respect to analysis of the required bending and shear strength by way of the selection of bending moment and shear force distribution factors. The applied bending moment and shear force distribution factors are based on selected formulas for simple beam analysis. This analysis approach is consistent with criteria in portions of existing Rule requirements of LR, ABS, and DNV.

With respect to loads, the loads in the aft end are calculated in a consistent manner with the load in the amidships region, however, some simplifications have been made to the internal tank loads and external pressures for structure outside of the cargo region.

The load basis, structural models and acceptance criteria for the scantling requirements for plating, local support member (stiffeners) and primary support members are incorporated by reference to *Section 8/3* of the Rules, meaning the load basis, structural models and acceptance criteria for the fore and aft ends are the same.

#### 5.1.1 Application

- 5.1.1.a The requirements of *Section 8/5.1* to 5.9 of the Rules apply to structure between the aft peak bulkhead and the aft end of the ship.
- 5.1.1.b It is considered that for *Section 8/5.1.1.2* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.
- 5.1.1.c The relation between the net scantlings and the gross scantlings as specified in *Section 8/5.1.1.3* of the Rules is general and consistent with that used in cargo tank region.

#### 5.1.2 General scantling requirements

- 5.1.2.a It is considered that for *Section 8/5.1.2.1* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.

- 5.1.2.b The text of *Section 8/5.1.2.2* of the Rules is based on LR Rules Pt 3, Ch 5,2.2.4.
- 5.1.2.c It is considered that for *Section 8/5.1.2.3* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.
- 5.1.2.d *Section 8/5.1.2.4* of the Rules specifies the extent of application of the section modulus and shear requirements to local and primary support members. Considering possible particular hull shape in the end region, the application of shear and bending requirements is decided to take “between end supports” instead of “clear of end brackets” for this region taking account the possibility of less effectiveness of the end brackets.
- 5.1.2.e The general notes of *Section 8/5.1.2.5* of the Rules are introduced based on the paragraph in ABS Rules Pt.5 Ch.1 Sec.4/1.5.
- 5.1.2.f *Section 8/5.1.2.6* of the Rules includes the general requirements for air and drain holes, which are consistent with the criteria in portions of existing Rule requirements of ABS, DNV and LR (e.g. LR Rules Pt 4, Ch 9,5.8, DNV Rules Pt.3 Ch.1 Sec.6/A406).

### **5.1.3 Structural continuity**

- 5.1.3.a This subsection includes the general requirements for structural continuity of longitudinal strength members, which are consistent with the criteria in portions of existing Rule requirements of ABS, DNV and LR (e.g. DNV Rules Pt.3 Ch.1 Sec.5/C104 and C105, LR Rules Pt.3 Ch.6/1.3).

### **5.1.4 Minimum thickness**

- 5.1.4.a The requirements of minimum thickness in amidships are generally applicable to the structure aft of the aft peak bulkhead. In addition, required minimum thickness for pillar bulkheads are derived from the criteria and practice in the existing Rule requirements of ABS, DNV and LR and calibration with the existing ships.

## **5.2 Bottom Structure**

### **5.2.1 General**

- 5.2.1.a The requirements of *Section 8/5.2.1.1* of the Rules are based on LR Rules Pt 3, Ch 6,6.1. Similar requirements are contained in ABS Rules Pt.3, Ch.2 Sec.5/9.1 and DNV Rules Pt.3 Ch.3 Sec.2/E405.
- 5.2.1.b The requirement of *Section 8/5.2.1.2* of the Rules that the centreline girder extend as far aft as practicable comes from ABS Rules Pt.3 Ch.2 Sec.4/3.1. The intent of the second part of *Section 8/5.2.1.2* of the Rules is that the centreline structure continues, usually in the form of a diaphragm plate, on to the stern frame to provide continuity of strength and support to the stern structure.

### **5.2.2 Aft peak floors and girders**

- 5.2.2.a The requirements in *Section 8/5.2.2.1* of the Rules are based on recent work undertaken by DNV. The requirements have been introduced as a result of ships experiencing fatigue cracks in AP tanks due to propeller induced vibration. Typical 80–100rpm for the propeller with 4–6 blades will result in a blade frequency in the range of 5.3–10Hz. To avoid vibration it is generally recommended to keep the

natural frequency 15% above the 2nd harmonic excitation (equals two times the blade frequency). Based on this, a vibration analysis has been carried out for typical stiffeners (length and scantlings) on floors and girders, assuming various end constraints (hinged to clamped). From this analysis the criteria as given were obtained.

- 5.2.2.b The requirements in *Section 8/5.2.2.3* of the Rules are based on ABS Rules Pt.3, Ch.2 Sec.13/5.5 and DNV Rules Pt.3 Ch.3 Sec.2/E405.

### **5.2.3 Stern frames**

- 5.2.3.a The requirements of *Section 8/5.2.3.1* to *5.2.3.7* of the Rules are based on ABS Rules Pt.3, Ch.2 Sec.13/3.
- 5.2.3.b It is considered that for *Section 8/5.2.3.8* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.

## **5.3 Shell Structure**

### **5.3.1 Shell plating**

- 5.3.1.a The requirements of *Section 8/5.3.1.1* of the Rules are based on ABS Rules Pt.3, Ch.2 Sec.2/5.1 with adjustments for the net thickness requirements.
- 5.3.1.b The requirements of *Section 8/5.3.1.2* and *5.3.1.3* of the Rules are based on ABS Rules Pt.3, Ch.2 Sec.2/5.13 with adjustments for the net thickness requirements.
- 5.3.1.c It is considered that for *Section 8/5.3.1.4* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.
- 5.3.1.d The requirements of *Section 8/5.3.1.5* of the Rules are based on LR Rules Pt 3, Ch 6,7.3.2.

### **5.3.2 Shell local support members**

- 5.3.2.a It is considered that for this topic, no information in addition to that shown in the Rules is necessary to explain the background.

### **5.3.3 Side shell primary support members**

- 5.3.3.a It is considered that for requirements of *Section 8/5.3.3.1* to *5.3.3.4* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.
- 5.3.3.b The requirements of *Section 8/5.3.3.5* of the Rules are consistent with that for cargo tank region.

## **5.4 Deck Structure**

### **5.4.1 Deck plating**

- 5.4.1.a It is considered that for *Section 8/5.4.1.1* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.
- 5.4.1.b The requirements of *Section 8/5.4.1.2* of the Rules are based on ABS Rules Pt.3 Ch.2 Sec.3/Table 2 with slight modification.

#### **5.4.2 Deck stiffeners**

5.4.2.a It is considered that for this topic, no information in addition to that shown in the Rules is necessary to explain the background.

#### **5.4.3 Deck primary support members**

5.4.3.a It is considered that for *Section 8/5.4.3.1* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.

5.4.3.b The requirements of *Section 8/5.4.3.2* of the Rules are in line with the requirements of *Section 8/2.6.4.1* of the Rules for cargo tank region.

5.4.3.c The requirements of *Section 8/5.4.3.3* of the Rules are general and common to existing Rule requirements of ABS, DNV and LR.

#### **5.4.4 Pillars**

5.4.4.a The requirements of this subsection are derived from the criteria and practice in portions of existing Rule requirements of ABS, DNV and LR (e.g. LR Rules Pt 4, Ch 1,4.4, ABS Rules Pt.3 Ch.2 Sec.8/3 and DNV Rules Pt.3 Ch.1 Sec.3/C800).

### **5.5 Tank Bulkheads**

#### **5.5.1 General**

5.5.1.a The requirements are general and common to existing Rule requirements of ABS, DNV and LR.

#### **5.5.2 Construction**

5.5.2.a The requirements are general and common to existing Rule requirements of ABS, DNV and LR.

#### **5.5.3 Scantlings of tank boundary bulkheads**

5.5.3.a It is considered that for *Section 8/5.5.3.1* to *5.5.3.3* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.

5.5.3.b The requirements of *Section 8/5.5.3.4* of the Rules are in line with the requirements of *Section 8/2.6.6.1* of the Rules for cargo tank region.

### **5.6 Watertight Boundaries**

#### **5.6.1 General**

5.6.1.a It is considered that for this topic, no information in addition to that shown in the Rules is necessary to explain the background.

#### **5.6.2 Aft peak bulkhead**

5.6.2.a It is considered that for *Section 8/5.6.2.1* and *5.6.2.2* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.

### **5.6.3 Scantlings of watertight boundaries**

- 5.6.3.a It is considered that for *Section 8/5.6.3.1 to 5.6.3.3* of the Rules, no information in addition to that shown in the Rules is necessary to explain the background.
- 5.6.3.b The requirements are in accordance with ABS Rules Pt.3 Ch.2 Sec.9/5.7.2 with modification to a rounded ratio to suit the format of similar requirements of web depth in other sections.

## **5.7 Miscellaneous Structures**

### **5.7.1 Pillar bulkheads**

- 5.7.1.a The requirements are based on DNV Rules Pt.3 Ch.1 Sec.9/E300.

### **5.7.2 Rudder trunk**

- 5.7.2.a The rudder trunk is to be made watertight and is to be designed to withstand a water heads equivalent to that of shell plating in the same location. Present Rule requirements are generally not as descriptive as JTP criteria. Existing class criteria are contained in LR Rules Pt 3, Ch 13,2.6.6, DNV Rules Pt.3 Ch.1 Sec.8/A500 and ABS internal guidance.

### **5.7.3 Stern thruster tunnels**

- 5.7.3.a The requirements are based on ABS Rules Pt.5 Ch.5 Sec.6/5.7.