

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

## Background Document

### SECTION 11 – GENERAL REQUIREMENTS

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- The content of the TB is not to be considered as requirements.
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## **1 HULL OPENINGS AND CLOSING ARRANGEMENTS**

### **1.1 Shell and Deck Openings**

#### **1.1.1 General**

1.1.1.a The requirements are based on LR Rules Pt 3 Ch 11/7.1.

#### **1.1.2 Cargo tank hatches – materials**

1.1.2.a The requirements are based on LR Rules Pt 3 Ch 11/7.1.

#### **1.1.3 Cargo tank access coamings**

1.1.3.a The requirements are based on LR Rules Pt 3 Ch 11/7.2.

1.1.3.b To clarify “the thickness of the coaming plate is to be not less than 10 mm. Where the coaming height as fitted exceeds 600 mm, the thickness may require be to be increased, or edge stiffening fitted”, while LR Rules say “and” rather than “or”, either one of the two measures mentioned is considered acceptable.

1.1.3.c The text about large covers and those configured with our well rounded shape is based on present practice and was added as a result of comments received from industry.

#### **1.1.4 Cargo tank access hatch covers**

1.1.4.a The requirements are based on LR Rules Pt 3 Ch 11/7.2.

1.1.4.b The statement - “The requirements of ... do not apply to dished covers or covers of other specially approved design” has been added. It is considered that the dished cover is popular and may be exempted.

#### **1.1.5 Machinery access openings – protection**

1.1.5.a The requirements are based on ABS Rules 5-1-1/3.3.

#### **1.1.6 Small hatches on the exposed fore deck**

1.1.6.a The requirements are taken from IACS UR S26 and ABS Rules 3-2-15/14.

#### **1.1.7 Manholes and flush deck scuttles**

1.1.7.a The requirements are based on LR Rules Pt 3 Ch 11/6.2.

#### **1.1.8 Other openings**

1.1.8.a The requirements are based on ABS Rules 3-2-15/21.3.

#### **1.1.9 Escape openings**

1.1.9.a The requirements are based on LR Rules Pt 3 Ch 11/6.1.10.

#### **1.1.10 Rope hatches**

1.1.10.a The requirements are based on LR Rules Pt 3 Ch 11/6.1.4

### **1.1.11 Portable plates**

1.1.11.a The requirements are based on LR Rules Pt 3 Ch 11/6.1.12 and provisions of LR Rules in LR Rules Pt 3 Ch 11/6.4.15.

### **1.1.12 Tank cleaning and ullage openings**

1.1.12.a The scantlings and arrangement for tank cleaning and ullage openings are to be such that they watertight and meet the requirements for portable plates as indicated in 1.1.11.

## **1.2 Ventilators**

### **1.2.1 General**

1.2.1.a These requirements are based on and implement into the Rules the requirements of the International Convention on Load Lines, Regulation 19, with the understanding that the requirements presently in the “Machinery” Rules of each society will be retained, and the requirements of IACS UR S27.

### **1.2.2 Details, arrangements and scantlings for ventilators**

1.2.2.a The text of the requirements comes from ABS Rules 3-2-17.9.3, LR Rules Pt 3 Ch 12/2.2.1 and Table 12.2.1, IACS UR S27 and applicable portions of IACS UI LL36.

### **1.2.3 Applied loading on ventilators**

1.2.3.a The text of the requirements comes from IACS UR S27.

### **1.2.4 Strength requirements for ventilators and their closing devices**

1.2.4.a The text of the requirements comes from IACS UR S27.

### **1.2.5 Closing appliances**

1.2.5.a The requirements are based on ABS Rules 3-2-17/9.3.3 and ICLL 1966 Regulation 19.

### **1.2.6 Fire dampers**

1.2.6.a The requirements are based on text within ABS Rules 3-2-17/9.3.1.

## **1.3 Air and Sounding Pipes**

### **1.3.1 General**

1.3.1.a These requirements are based on and implement into the Rules the requirements of the International Convention on Load Lines, Regulation 20 with the understanding that other piping and pumping requirements presently in the Rules of each society will be retained, and the requirements of IACS UR S27.

### **1.3.2 Height**

1.3.2.a The requirements are based on ICLL 1966 Regulation 20.

1.3.2.b The text of 1.3.2.4 is based on LR Rules Pt 3 Ch 12/3.2.5 and DNV Pt.3 Ch.1 Sec.11 I306.

### **1.3.3 Details, arrangement and scantlings for air and sounding pipes**

1.3.3.a The requirements are based on IACS UI LL36 and IACS URS27.

### **1.3.4 Applied loading on air and sounding pipes**

1.3.4.a The text of the requirements comes from IACS UR S27.

### **1.3.5 Strength requirements for air and sounding pipes and their closing devices**

1.3.5.a The text of the requirements comes from IACS UR S27.

### **1.3.6 Closing appliances for air pipes**

1.3.6.a The requirements are based on LR Rules Pt 3, Ch 12/3.3.1 through 3.3.4 and have been modified slightly.

1.3.6.b The statement “Air pipes are not to be fitted with valves that may impair the venting function.” comes from DNV Rules Pt.4 Ch.6, Sec.4 K102.

## **1.4 Deck Houses and Companionways**

### **1.4.1 Applicability**

1.4.1.a Scantlings of deckhouses and companionways have been separated from superstructures for two reasons:

(a) Only normal superstructure on standard tanker designs with length of 150 metres or more length is forecastles.

(b) Determining loads on forecastle sides will be same as forward end shell.

Therefore superstructure requirements are to be incorporated in with hull scantling requirements.

1.4.1.b Scantlings in this text are gross scantlings. Gross scantlings have been selected because the principal source of scantling requirements of this section is IACS UR S3, which is also based on gross scantlings.

1.4.1.c Additionally explicit wastage allowances for deckhouses do not exist in ABS, DNV and LR making implementation of a net thickness difficult.

### **1.4.2 Materials**

1.4.2.a This text clarifies material applicability to steel structure with material strength and other properties as indicated in *Section 6/1*. Use of other materials is considered the exception for standard tanker designs and approval of designs using other materials is left to the individual Classification Society.

### **1.4.3 Definitions**

1.4.3.a The definition of deckhouse taken from DNV Pt 3 Ch 1 Sec 10 A203 is in accordance with ICLL 1966.

1.4.3.b Definition of companionway chosen to tie in with ICLL 1966, which is a structure required to protect an opening which if open could lead to flooding.

1.4.3.c The definition is general wording extracted from ICLL 1966 and various rule paragraphs. The last sentence is taken from LR Rules Pt 3 Ch 8/1.3.

#### **1.4.4 Structural continuity**

- 1.4.4.a The text of 1.4.4.1 – 1.4.4.4 is taken from DNV Rules, Pt.3 Ch.1 Sec.10 B101.
- 1.4.4.b The text of 1.4.4.5 is taken from LR Rules Pt 3 Ch 8/2.6.4.

#### **1.4.5 Deck plating**

- 1.4.5.a Deck plate thickness is based on LR Rules Pt 3 Ch 8/2.3. The minimum thickness after reduction of 10% inside deckhouses is provided in accordance with LR, ABS and DNV Rules. The formulas have been modified to reflect scantlings based on the material factor defined in *Section 6/1.1.4*, rather than using the direct ratio of the material yield stress.

#### **1.4.6 Deck longitudinals and beams**

- 1.4.6.a Requirements for deck longitudinals and beams are based on ABS Rules 3-2-7, and employ a material factor defined in *Section 6/1.1.4*, for the employment of higher yield strength materials.

#### **1.4.7 Deck girders and transverses**

- 1.4.7.a Requirements for girders and transverses of deckhouses are based on ABS Rules 3-2-8/5, and employ a material factor defined in *Section 6/1.1.4*, for the employment of higher yield strength materials.
- 1.4.7.b Proportions (thickness and depth) are taken from ABS Rules 3-2-8/5.7.
- 1.4.7.c Text is included in 1.4.7.1, 1.4.7.3 and 1.4.7.4 to permit alternative means of analysis strength analyses, i.e., grillage analysis, to a defined alternative means.

#### **1.4.8 Pillars**

- 1.4.8.a Requirements for pillars are based on ABS Rules, 3-2-8/3, with expansion to cover all material grades identified in *Section 6.1*.

#### **1.4.9 Exposed bulkheads**

- 1.4.9.a The requirements are taken from ABS Rules 3-2-11/3.1.

#### **1.4.10 Exposed bulkhead plating**

- 1.4.10.a The requirements are in accordance with IACS UR S3.
- 1.4.10.b LR and DNV Rules apply a  $k$  factor to appropriately adjust scantlings for higher strength materials, while ABS Rules do not. The scantlings formulas used in the JTP Rules employ a material factor defined in *Section 6/1.1.4*, for the employment of higher yield strength materials
- 1.4.10.c The higher strength factor has not been incorporated in the minimum thickness formula contained in 1.4.10.2. In LR, for minimum thickness, the  $k$  factor is applied to  $(5.0 + 0.01L_3)$  for the lowest tier, while it is applied to  $0.01L_3$  for the upper tiers. The higher strength material correction for the minimum thickness is not made by DNV and it is not made by ABS.

#### **1.4.11 Exposed bulkhead stiffeners**

- 1.4.11.a The requirements are in accordance with IACS UR S3.

1.4.11.b LR and DNV Rules apply a  $k$  factor to appropriately adjust scantlings for higher strength materials, while ABS Rules do not. The scantlings formulas used in the JTP Rules employ a material factor defined in *Section 6/1.1.4*.

#### **1.4.12 Stiffener end attachments for stiffeners on exposed bulkhead**

1.4.12.a The requirements are in accordance with IACS UR S3 in General.

#### **1.4.13 Web arrangements for webs on exposed bulkheads**

1.4.13.a The requirements are in accordance with LR Rules Pt 3 Ch 8/2.6.3 and 2.6.4.

1.4.13.b A paragraph for raised-quarter-deck bulkheads in ABS Rules 3-2-11/3.9 has not been included based on the understanding that there will be no raised quarter decks on typical standard tanker designs.

#### **1.4.14 Closing arrangements for openings in deck houses and companionways**

1.4.14.a This states the general requirements for doors, common to LR, ABS and DNV Rules, and the primary source being ICLL 1966. It is noted that a sentence of 1.4.14.2 has been included such that weather-tight doors designed in accordance with a national or international standard will be accepted.

1.4.14.b The text of 1.4.14.4 includes SOLAS requirements from SOLAS II-2/4.5.2 for positioning doors and windows/side-scuttles on the bulkheads facing cargo areas are incorporated.

#### **1.4.15 Sills of access openings**

1.4.15.a Text for sill heights incorporates requirements common to the LR, DNV, ABS rules and ICLL 1966 Regulations 12, 17 and 18.

#### **1.4.16 Access openings in machinery casings on type 'A' freeboard tankers**

1.4.16.a Specific requirements for tankers incorporated from ICLL 1966, Regulation 26. Opening sentence is an addition to text of ICLL 1966, but more explicitly, merely states the normal preferred case.

#### **1.4.17 Windows and side scuttles**

1.4.17.a Side scuttles chosen in lieu of "port-lights" as side scuttle is the terminology used in ICLL 1966.

1.4.17.b Text for windows and scuttles incorporated requirements common to the LR, DNV, ABS Rules (Refer to 3-2-17/7.5) ICLL 1966 Regulation 23 and SOLAS II-2/4.5.2.

### **1.5 Scuppers, Inlets and Discharges**

#### **1.5.1 Drains -enclosed spaces**

1.5.1.a The requirement comes from LR Rules Pt 3 Ch 12/4.1.3.

#### **1.5.2 Drains - open spaces**

1.5.2.a The requirement comes from ICLL Regulation 22.



### **1.5.3 Prevention of water passing inboard**

- 1.5.3.a The requirement comes from ICLL 1966 Regulation 22, and IACS UI LL11.
- 1.5.3.b Figure 11.1.3 is taken from IACS UI LL11.

### **1.5.4 Sea inlets**

- 1.5.4.a The requirement comes from ICLL Regulation 22.

### **1.5.5 Shell valves and fittings**

- 1.5.5.a Installation -The requirement comes from ABS Rules 4-6-2/9.13.
- 1.5.5.b Material -The requirement comes from ICLL 1966 Regulation 22.

### **1.5.6 Unattended machinery space**

- 1.5.6.a The requirement comes from DNV Rules Pt 3 Ch2 Sec 11 K500.

### **1.5.7 Pipes**

- 1.5.7.a Material -The requirement comes from ICLL 1966 Regulation 22. It is noted that plastic pipes may be considered for inboard pipes subject to compliance with IACS Unified Requirement P4.
- 1.5.7.b Thickness -The requirement comes from IACS UI LL36.

### **1.5.8 Rubbish chutes, offal and similar discharges**

- 1.5.8.a The requirement comes from LR Rules Pt 3, Ch 12/4.3 with some modification, ICLL 1966 Regulation 22 and IACS UI LL11.

## **2 CREW PROTECTION**

The requirements of this sub-section are applicable to all ship types. However, thorough review has only been carried out of the requirements applicable to tankers. Therefore, the text in “General” has been included to reflect this fact.

The text is in accordance with ABS Rules 3-2-17/3.1, which also covers general requirements in LR and DNV Rules.

Table and 11.2.2 are in accordance with the ABS Rules 3-2-17/ Table 1 and are developed based on LL50, with additional clarifications as necessary. It was decided to include the entire contents of the table, applicable to all ship and freeboard types, rather than remove portions not applicable to tankers and with length not greater than or equal to 150 metres.

### **2.1 Bulwarks and Guardrails**

#### **2.1.1 General**

- 2.1.1.a The requirements are based on ICLL 1966, Regulations 25 and 26. Similar requirements are contained in the LR, ABS and DNV Rules.
- 2.1.1.b The requirement that guard rails are to be provided at the boundary of first tier deckhouses and ends of superstructures comes from IACS UI LL14. On first tier deck house, bulwark option in LR Rules is considered as being replaced by LL14.
- 2.1.1.c Bulwarks or guard rails are to be at least 1.0m in height measured above sheathing, and are to be constructed as required. The phrase “above sheathing” is taken from LR Rules Pt 3 Ch 8/5.1.1 as it reflects the ICLL 1966 intent (crew protection) more precisely.

#### **2.1.2 Construction of bulwarks**

- 2.1.2.a It is realised that these are general requirements for bulwarks amidships and at the aft end of the ship. Fore end bulwarks are generally designed to be in excess of the rule requirements.
- 2.1.2.b The requirements for minimum thickness comes from the DNV Rules Pt 3 Ch1 Sec 10 D301 except the ABS minimum of 6.5mm thickness has been used in lieu of 6.0mm found in the DNV rules.
- 2.1.2.c Spacing of stays comes from DNV Rules Pt 3 Ch1 Sec 10 D302.
- 2.1.2.d Section Modulus at Deck - The requirements are taken from LR Rules Pt 3 Ch 8/5.2.3 with minor revision, but no change to the requirements.
- 2.1.2.e Underdeck Supports and Reinforcement of Bulwarks in way of Openings and Fittings - The requirements are taken from LR Rules LR Rules Pt 3 Ch 8/5.2.
- 2.1.2.f Freeing Ports -No specific text is proposed for this paragraph at this time as tankers have no wells or bulwarks, but reference is made to other portions of the Societies’ Rules.

#### **2.1.3 Construction of guard rails**

- 2.1.3.a These requirements are in accordance with ICLL 1966 Regulation 25(3) and IACS UI LL47.

- 2.1.3.b Size of Openings - It is noted that there is a difference between DNV and ABS wording. The latter is proposed as the intent of ICLL 1966 (for crew protection) is believed to specify the clearance rather than centre to centre distance. The indicated title is chosen to amplify this intent, as is clear from the reference to “opening” below the lowest course in the Convention.
- 2.1.3.c The rules require stanchions to be fitted with brackets every third stanchion, while it is noted that individual societies have accepted arrangements without brackets, yet no uniform interpretation exists for this. Therefore, not alternative has been provided in the Rules.

#### **2.1.4 Additional requirements for bulwarks and guard rails related to spill containment**

- 2.1.4.a The requirements of 2.1.4.1 are taken from DNV Rules Pt 5 Ch 3 Sec 3 E101.
- 2.1.4.b The requirements of 2.1.4.2 and 2.1.4.4 are taken from DNV Rules Pt 5 Ch 3 Sec 3 B107, SOLAS II-2/4.5.1.6. Reference is also made to UR Regulations in 33 CFR 155.310(c).
- 2.1.4.c The text of 2.1.4.2 is derived from text of DNV Rules Pt 3 Ch 1 Sec 3 C903. In general, it is viewed that long gutter bars with expansion joints should be avoided, as indicated by problems in service with arrangements fitted with expansion joints.

#### **2.1.5 Additional requirements for deeper loading**

- 2.1.5.a ICLL 1966 Regulation 26 is for deeper loading of tankers having minimum Table A freeboard. For most, if not all of tankers today modified requirements in accordance with Reg. 2(5), may be applied. This title is chosen to reflect this intent of ICLL 1966.
- 2.1.5.b Ships with ‘Table A’ or ‘Table B-100’ freeboard (i.e., a freeboard less than that based on Table B-60<sup>\*1</sup>) are to have open rails fitted for at least half the length of the exposed parts of the weather deck. Alternatively, if a continuous bulwark is fitted, the minimum freeing area is to be at least 33 % of the total area of the bulwark.<sup>\*2</sup> The freeing area is to be placed in the lower part of the bulwark.

\*1. Amplification of LR Rules to define applicable freeboard more explicitly.

\*2. From LR Rules

- 2.1.5.c Ships with Table B-60 Freeboard  
Ships with ‘Table B-60’ freeboard (i.e., a freeboard less than that based on Table B but not less than Table B-60<sup>\*1</sup>) are to have a minimum freeing area of at least 25 % of the total area of the bulwark.<sup>\*2</sup> The freeing area is to be placed in the lower part of the bulwark.

\*1. Amplification of LR Rules to define applicable freeboard more explicitly.

\*2. From LR Rules

## **2.2 Tank Access**

### **2.2.1 Access to tanks in the cargo tank region**

- 2.2.1.a Tank access is addressed in *Section 5/5.3*, and appropriate reference is made here to *Section 5/5.3*.

## **2.3 Bow Access**

### **2.3.1 General**

- 2.3.1.a The text is in accordance with ABS Rules 3-2-17/3.3. Reference is made to ICLL 1966 Regulations 25, 26 and 27, IACS UI LL 50 and SOLAS II-1/3-3.

### **3 SUPPORT STRUCTURES AND STRUCTURAL APPENDAGES**

#### **3.1 Support Structure for Deck Equipment**

##### **3.1.1 General**

- 3.1.1.a This section covers the most common and important items of deck equipment, commonly fitted on standard tanker designs. Due to time constraint common explicit strength standards have not been developed for all possible types of equipment that could be fitted.
- 3.1.1.b Scantling criteria are developed for use with capacity assessment based on simplified engineering analysis.
- 3.1.1.c Permissible stresses are average stress levels and do not cover areas of stress concentration predicted by plate element analysis. Two permissible stress levels are indicated, one corresponding to “normal” loads and one to “extreme” loads.
- 3.1.1.d Application – In general items addressed are the major common outfitting items on decks of tankers. Included are the requirements for the strength of foundations of items covered by UR S27, Strength requirements for Fore Deck Fittings and Equipment, and the IMO requirements in MSC/Circ.1175, Guidance on Shipboard Towing and Mooring Equipment.

##### **3.1.2 Supporting structures for anchoring windlass and chain stopper**

- 3.1.2.a The requirements in the sub-section are based on existing practice of LR, DNV and ABS and IACS UR S27.
- 3.1.2.b Design Loads due to Anchoring Operation -In accordance with DNV Rules Pt.3 Ch.3 Sec.3 B 105, LR Pt 3 Ch 13/7.6,7.8 and ABS Rules Pt.3 Ch.5 Sec.1 11.3.
- 3.1.2.c Design Loads due to green Seas in the Forward 0.25L - Taken from IACS UR S27 4.2.1.
- 3.1.2.d Resultant Force in the Bolts for Green Sea Design Loads - Taken from IACS UR S27 4.2.1. Scope of bolt scantlings limited to green seas in accordance with scope of UR S27.
- 3.1.2.e Forces in Supporting Structure - Based on existing practice of LR, ABS and DNV Rules/practice.
- 3.1.2.f Allowable Stresses for Anchoring Design Load - Allowable Stresses for anchoring design loads consistent with extreme load.
- 3.1.2.g Allowable Stresses for Green Sea Design Loads -Allowable Stresses for bolts taken from IACS UR S27 5.2. According to UR S27, the safety factor against bolt proof strength is to be not less than 2.0. While “50% of bolt proof strength” is proposed in the text, “50% of yield strength of bolt material” for axial forces. The allowable stresses in supporting structures are as indicated in MSC/Circ.1175.

##### **3.1.3 Supporting structures for mooring winches**

- 3.1.3.a The requirements in the sub-section are based on existing practice of LR, DNV and ABS and based on URS27 appropriately modified to cater for the particular loads associated with mooring winches.

- 3.1.3.b The requirements of URS27 for holding down bolts of windlasses are applied to mooring winches within the fwd 0.25L. While in principal requirements for holding down bolts should be applied along the length, it is considered that the environmental loads proposed within URS27 are only applicable to the fore ship. Therefore no requirements for holding down bolts of mooring winches aft of 0.25L are proposed at this time.
- 3.1.3.c The requirements are based on IACS UR S27 but have been extended to include a common JTP standard for support structures of windlasses are introduced.
- 3.1.3.d Design Loads due to Mooring Operation - Design load is based on the maximum load for which the mooring winch rated. (Note: DNV guidance on maximum load is provided in DNV Rules Pt.3 Ch.3 Sec.3 G500 and DNV Rules Pt 3 Ch 3 Sec 5 B300.) Design load with winch brake effective consistent with requirements for anchor windlass on the assumption that winch brake is designed to be stronger than the braking strength of the rope. Paragraph 3.1.3.8 of the Rules reflect 100 percent of the break holding load, noting that OCIMF guidance recommends that the brake should be set at 60 to 80 percent of the line's breaking strength. The load of 125% of the breaking strength of the mooring line comes from MSC/Circ.1175.
- 3.1.3.e Allowable Stresses for Mooring Operation Design Loads - Allowable stresses consistent with 3.1.2.

### **3.1.4 Supporting structure for cranes, derricks and lifting masts**

- 3.1.4.a The Rules in this sub-section are ONLY for the hull structures and not for lifting appliances. Criteria for application of the strength criteria are taken from DNV Rules Pt 3 Ch 3 Sec 5 A100 with clarification in bending moment.
- 3.1.4.b The requirements have been developed based on the size and configuration of deck equipment/fittings typically found on tankers. For this reason the requirements are not suitable for application on other types of ships.
- 3.1.4.c JTP requirements limited to the deck attachment of the appliance to the deck and support structure since treatment of the crane post/pedestal is different between LR, ABS and DNV.
- 3.1.4.d Dynamic loads due to wind, heel and trim are included in a single "dynamic factor" of 1.3 in harbour (DNV Pt.3 Ch.3 Sec.5 A501) and as indicated by actual computed acceleration for the design sea state conditions and wind loads for at sea operations, with a 1.5 "dynamic factor" lower bound for at sea, in accordance with DNV practical interpretation of Rules.
- 3.1.4.e The definition of SWL is taken from LR, ABS and DNV.
- 3.1.4.f Definition of self weight is defined by JTP and is considered consistent with present LR, ABS and DNV practice.
- 3.1.4.g Definition of overturning moment is taken from LR, ABS and DNV.
- 3.1.4.h Definition of crane pedestal and post is made by combining LR, ABS and DNV different terminology.
- 3.1.4.i Designer of the support structure is responsible for submitting basic load (force) data for the lifting appliance in order to obtain approval.
- 3.1.4.j Structural Arrangement - General statements are included similar to requirements in the LR Rules and ABS internal guidance.

- 3.1.4.k Derrick Masts and Derrick Posts - The criteria stated are generally common to modern tanker lifting appliances presently being used / approved. Support at two levels has not been required.
- 3.1.4.l Crane Posts/Pedestals -The requirements are taken from ABS internal guidance and general practice of LR and DNV.
- 3.1.4.m Welding of non-continuous crane pedestals and heavily loaded underdeck structure in way or crane pedestals are required to have full penetration welding as required in 3.1.4.14. This is consistent with DNV present practice, and is required to facilitate NDE of these welds.
- 3.1.4.n Strength Criteria - The design loads and allowable stresses of LR, ABS, and DNV are different but produce a consistent standard of support structure. The design loads and allowable stresses adopted were taken from DNV requirements due to their relative simplicity.
- 3.1.4.o Design Loads due to Lifting Operation -Design loads taken from DNV Pt 3 Ch 3 Sec 5 A500.
- 3.1.4.p Allowable Stresses - Design loads taken from DNV Pt 3 Ch 3 Sec 5 A600.

### **3.1.5 Supporting structures for components used in emergency towing arrangements on tankers**

- 3.1.5.a The text is a general compilation of requirements from Resolution MSC 35(63), LR Rules, ABS Rules, DNV Rules and MSC/Circ.1175.
- 3.1.5.b Definitions and applicability are taken from MSC.35(63).
- 3.1.5.c Documentation - Details of the overall arrangement of the Emergency Towing Arrangement are required to assist the design verification process.
- 3.1.5.d Structural Arrangement - Requirements are taken from LR Rules Pt 3 Ch 13/9.1.1 with minor changes.
- 3.1.5.e Strength Criteria - MSC.35(63) requires working strength of other components to be sufficient to withstand the load anticipated during the towing operation.
- 3.1.5.f Choice of design load and allowable stress has been based on assessment of the criticality of the emergency towing arrangement.
- 3.1.5.g Design Load due to Emergency Towing -Design load is based on an “extreme” load case, consistent with the design strength of MSC 35(68).
- 3.1.5.h Allowable Stress - Allowable stresses in supporting structure is based on “extreme” load-case and are consistent with requirements of MSC/Circ.1175.

### **3.1.6 Supporting structures for bollards and bitts, fairleads, stand rollers, chocks and capstans**

- 3.1.6.a The text of this sub-section covers implements into Rules the Requirements related to support structure in way of deck fittings covered by MSC/Circ.1175.
- 3.1.6.b General statements made in 3.1.6.1, 3.1.6.2, 3.1.6.3, 3.1.6.6, 3.1.6.7, and 3.1.6.8 are basic strength and structural continuity requirements presently contained in LR, ABS and DNV requirements.
- 3.1.6.c Design Loads are Safe Working loads as specified in MSC/Circ.1175.

- 3.1.6.d Allowable Stress - Allowable stresses in supporting structure is based MSC/Circ.1175 and are consistent with stresses used in other JTP support structure for “extreme” loads. The maximum permissible shear stress is taken as 58 percent of material yield, with is consistent with other JTP requirements, not 60 percent as permitted by MSC/Circ.1175.
- 3.1.6.e The load acting point is consistent with MSC/Circ.1175 and similar requirements for Emergency Towing Arrangements.

### **3.1.7 Supporting structures for other deck equipment or fittings which are subject to specific approval**

- 3.1.7.a This sub-section covers other common deck equipment where there are currently no published strength standards within all three of LR, ABS and LR Requirements.
- 3.1.7.b The requirements are intended to establish general principles which are intended to achieve a common strength standard which are embellished as required by each society’s particular requirements.
- 3.1.7.c Development of scantling criteria for support of these items could be considered for future work.
- 3.1.7.d Structural Arrangement - Design principal is that the support structure on the ship should be strong enough to resist the design loads imposed on it by the equipment/fittings. Attention of the user is drawn to the fact that design loads may act in-plane and out of plane.
- 3.1.7.e Lifting Appliances for Personnel - Taken from existing LR, ABS and DNV practice.
  - (a) The design of the primary support members of the ship normally integrates quite well with arrangement with of lifeboat davits/ramps or can be easily adapted. Therefore, provided primary support members are arranged close by, the main support issues for these items are for local stiffening to facilitate load transmission or avoidance of structural hard spots.
  - (b) The main support issues for passenger lifts are for local stiffening to facilitate load transmission or avoidance of structural hard spots.
  - (c) The main support issues for accommodation ladders are for local stiffening to facilitate load transmission or avoidance of structural hard spots.
- 3.1.7.f Masts for Navigation Aids - Taken from existing LR, ABS and DNV practice.
- 3.1.7.g Wave Deflectors/Breakwaters - Taken from existing LR, ABS and DNV practice.

### **3.1.8 Support and attachment of miscellaneous deck fittings which are not subject to specific approval**

- 3.1.8.a This sub-section covers other miscellaneous deck fittings where support issues are related to minor structural detailing in order to avoid creation of stress concentrations.
- 3.1.8.b Supports for Pipework and Raised Platforms/Walkways -Deck attachments for these items are often based on doublers or lapped connections to above deck stiffening.
- 3.1.8.c Supports for Cargo Manifold Supports and Pipe Supports - Design loads for cargo manifold can be quite significant, but this is normally addressed because pipes are supported off an integrated manifold support/spill tray/raised platform.



## 3.2 Docking

### 3.2.1 Docking arrangements

3.2.1.a Docking arrangement has never been a class item and should continue to be so, for the simple reason that many aspects are not beyond verification by the Surveyor. However, a docking plan is required for large vessels by each of the three societies. Since structural arrangement in some instances is dependant upon the docking arrangement, the builder is held responsible to furnish the vessel a docking plan appropriate to the particular vessel; but, the majority of its contents will be outside the scope of classification, its approval by the society is not required.

### 3.2.2 Docking plan

3.2.2.a General information is provided to indicate what should be addressed in a docking plan.

## 3.3 Bilge Keels

### 3.3.1 Construction and materials

3.3.1.a The requirements for bilge keels are based on the following:

- (a) LR Rules Part 3, Chapter 10/5.6
- (b) ABS Rules Pt 3, Ch 2, Sec 2, Paragraph 13 and Pt 6, Ch 1, Sec 2, Paragraph 25
- (c) DNV Rules Pt. 3 Ch.1 Sec.6 A408 and Pt.5 Ch.1 Sec.3 G100

3.3.1.b The figures that are included are copied from LR Rules Figure 10.5.6, with modification to suit arrangements where bilge keels “terminate on an internal longitudinal stiffening member”, as shown in *Figure (b)* and added *Figures 11.3.5(d)* and *11.3.5(e)*.

3.3.1.c References to arrangement requirements for ice strengthened ships are not included, as they are outside the scope of these Rules.

### 3.3.2 Ground bars

3.3.2.a The text and figures come from LR Rules Part 3, Chapter 10/5.6 and Figure 10.5.6 and DNV Rules Pt. 3 Ch.1 Sec.6 A408.

### 3.3.3 End details

3.3.3.a The text and figures come from LR Rules Part 3, Chapter 10/5.6, with modification to suit arrangements where bilge keels “terminate on an internal longitudinal stiffening member”, as shown in *Figure (b)* and added *Figures 11.3.5(d)* and *11.3.5(e)*.

### 3.3.4 Welding

3.3.4.a The text and figures come from LR Rules Part 3, Chapter 10/5.6. Specific weld scantlings provided in Table 11.3.1 are based on LR Rules Part 3, Chapter 10/5.6.15 and Table 10.2.1 item 15.

## **4 EQUIPMENT**

### **4.1 Equipment Number Calculation**

#### **4.1.1 Requirements**

- 4.1.1.a The text is in accordance with IACS UR A1.2.
- 4.1.1.b It is noted that LR, ABS and DNV each use an equipment letter (numeral) designation. In the JTP Rules this has been deleted since each society has its own recording system.

### **4.2 Anchors and Mooring Equipment**

#### **4.2.1 General**

- 4.2.1.a The text is in accordance with IACS UR A1.1.1.

#### **4.2.2 Limitations**

- 4.2.2.a The text is in accordance with IACS UR A1.1.2 and UR A1.1.3.

#### **4.2.3 Assumptions**

- 4.2.3.a The text is in accordance with IACS UR A1.1.4 and UR A1.1.5.

#### **4.2.4 Documentation**

- 4.2.4.a The text is similar to DNV Rules Pt 3 Ch 3 Sec 3/A200. Documentation on towing and mooring arrangement plans are also included in the documents to be submitted, as required by MSC/Circ.1175.

#### **4.2.5 Anchors**

- 4.2.5.a Two anchors ready for use with the third anchor being a spare - The text is in accordance with IACS UR A1.1.1.
- 4.2.5.b Of an approved design, etc - are in extracts from LR Rules Pt 3 Ch 13/7.2 and IACS UR A1.4.3.1.
- 4.2.5.c Anchor mass and table 11.4.1 are in accordance with IACS UR A1.4.1 and Table 1

#### **4.2.6 Ordinary anchors**

- 4.2.6.a The text is in accordance with IACS UR A1.4.1.
- 4.2.6.b The first sentence of ABS Rules Pt.3 Ch.5 Sec.1/7 “Anchor Types” is used as the text. Understanding that stock anchors will not be used on oil tankers of 150m or more in length, the description of stock anchors in LR and DNV Rules is not included.

#### **4.2.7 High holding power anchors**

- 4.2.7.a The requirements are in accordance with IACS UR A1.4.1.2 for which the text is selected from LR Rules Pt.3 Ch.13/7.3, ABS Rules Pt.3 Ch.5 Sec.1/7 and DNV Rules Pt.3 Ch.3 Sec.3 D500.
- 4.2.7.b SHHP anchors in IACS UR A1.4.1.3 are not included due to their limitation of usage up to 1500kg.

#### 4.2.8 Chain cables

- 4.2.8.a Applicable portions of ABS Rules Pt.3 Ch.5 Sec.1/1 and LR Rules Pt.3 Ch.13/7.4.5 are used as the text. *Table 11.4.1* is based on IACS UR A1.2 Table 1.

#### 4.2.9 Chain lockers

- 4.2.9.a The requirements are based on DNV Rules Pt.3 Ch.3 Sec.3 B104, LR Rules Pt.3 Ch.13/ 7.8.4 and 7.8.5.
- 4.2.9.b The use of the term “adequate” with respect to the size of the chain locker is noted as ambiguous, but is consistent with today’s Rule text. It may be retained for the present time.

#### 4.2.10 Securing and emergency release of chain cable

- 4.2.10.a There are different strength requirements for attachments between LR and DNV as follows:
- (a) (See LR Pt 3 Ch 13/7.8.6.) a working strength of not less than 63.7kN (6.5 tonne-f) or 10 per cent of the breaking strength of the chain cable, whichever is the greater.
  - (b) (See DNV Pt 3 Ch 3 Sec 3 B104) a force of not less than 15% nor more than 30% of the minimum breaking strength of the chain cable
- 4.2.10.b Since 10% of breaking strength will exceed 63.7kN for EN about 400, DNV Rules require more strength. Also, LR Rules do not specify the maximum strength accordingly, 15% ~ 30% of the breaking strength, which is identical to IACS Recommendation No. 10 1.2.2(a), is used.

#### 4.2.11 Chain stoppers

- 4.2.11.a Applicable portions of ABS Rules Pt.3 Ch.5 Sec.1/1 and LR Rules Pt.3 Ch 13/7.8.2 are used as the text.

#### 4.2.12 Tests

- 4.2.12.a Test requirements of anchors, chain cables, wires and ropes are indicated in the following portions:
- (a) ABS: Pt.2 Ch.2 Sec.1 Anchors and Sec.2 Anchor Chains (not specify requirements for Wires and Ropes)
  - (b) LR: Pt.2 Ch.10 Equipment for Mooring and Anchoring and Pt.3 Ch.13 /7.4.1 and 7.4.2 Chain Cable Grades
  - (c) DNV: Pt.2 Ch.2 Sec.6 Bars for Chain Cable, Pt.3 Ch.3 Sec.3 D Anchor, E Anchor Chain Cables and G Towlines and Mooring Hawsers
- 4.2.12.b While ABS and DNV requires tensile strength of grade 1 chains 370 – 490N/mm<sup>2</sup>, LR specifies the same 300 – 490N/mm<sup>2</sup> with a note of grade 1 material having a tensile stress of less than 400N/mm<sup>2</sup> not to be used in association with high holding power anchors. Also, ABS Rules Pt.2 Ch.2 Sec.1/7 require bend test, drop tests, hammering tests on cast-steel anchors in addition to proof tests required by LR & DNV Rules.

#### 4.2.13 Mooring lines and towlines

4.2.13.a The policy for size and number of mooring lines and towlines as a guide is the same for all three class societies.

4.2.13.b The text comes from ABS Rules, and *Table 11.4.2* is taken directly from the DNV Rules, which is nearly identical to the same in the ABS Rules. LR Rules recommend the strength of mooring lines and towlines to be determined based on breaking load of one anchor cable while ABS and DNV Rules provide them in the table based on IACS Recommendation 10. A comparison of DNV/ABS and LR values is as follows:

EN	Mooring Lines				Towlines	
	ABS/DNV			LR	ABS/ DNV BS (tf)	LR BS (tf)
	BS(tf)	number	Total BS	Total BS		
1570-1669	34	5	170	<b>210</b>	<b>96.0</b>	84.0
1930-2079	41	5	205	<b>250</b>	<b>119.1</b>	100.0
2380-2529	49	5	245	<b>307</b>	<b>148.2</b>	122.8
2870-3039	51	6	306	<b>368</b>	<b>150.0</b>	147.2
3400-3599	60	6	360	<b>417</b>	150.0	<b>166.8</b>
4000-4199	66	7	462	<b>477</b>	150.0	<b>190.8</b>
4600-4799	69	7	483	<b>550</b>	150.0	<b>220.0</b>
5200-5499	71	8	568	<b>606</b>	150.0	<b>242.4</b>
6100-6499	73	9	657	<b>694</b>	150.0	<b>277.6</b>
7400-7899	74	11	814	<b>816</b>	150.0	<b>326.4</b>
8900-9399	75	13	<b>975</b>	<b>975</b>	150.0	<b>390.0</b>
10700-11499	75	16	<b>1200</b>	1085		<b>434.0</b>
11500-12399	75	17	1275	<b>1342</b>		<b>536.8</b>
12400-13399	75	18	1350	<b>1471</b>		<b>588.4</b>
14600-16000	75	21	1575	<b>1631</b>		<b>652.4</b>

4.2.13.c Since there are not so much difference in the suggested strength and length, DNV/ABS Table, which is based on IACS Recommendation.

#### 4.2.14 Increased number or strength of mooring lines

4.2.14.a Recommendation on ships regularly using exposed berths is in accordance with LR Pt.3 Ch.13/7.5.3, and reference to OCIMF “Mooring Equipment Guidelines” is added.

4.2.14.b The increment due to A/EN ratio given by the ABS Rules Pt.3 Ch.5 Sec.1/9.1 is not included since such high A/EN ratios will not be applicable to tankers.

#### 4.2.15 Alternative mooring arrangement

4.2.15.a The text is a combination of LR Pt.3 Ch.13/7.5.5, ABS Rules Pt.3 Ch.5 Sec.1/9.1 and DNV Rules Pt 3 Ch 3 Sec 3, note to the Table C1.

#### 4.2.16 Securing mooring lines

4.2.16.a The text is from LR Pt.3 Ch.13/7.5.6.

#### **4.2.17 Bollards and bitts, fairleads, stand rollers and chocks**

4.2.17.a The text is in accordance with existing LR, ABS and DNV rule requirements and MSC/Circ.1175.

#### **4.2.18 Mooring winches**

4.2.18.a It is noted that consistent with present practice, mooring winch design and capacity an item subject to class approval. The text is from LR Pt.3 Ch.13/7.5.6.

#### **4.2.19 Windlass**

4.2.19.a Requirements for windlass design are indicated in:

- (a) LR Rules Part 3, Chapter 13, Section 7/7.6
- (b) DNV Rules Pt.3 Ch.3 Sec.3 F
- (c) ABS Rules Part 4, Chapter 5, Section 1

4.2.19.b Many items in the Rules address items normally addressed by the machinery staff of each society, not the hull staff. These items have been not been included.

4.2.19.c Support structure for the windlass (and chain stopper) is covered separately.

#### **4.2.20 Anchor windlass trial**

4.2.20.a The requirements are generally same in three societies. ABS Rules Pt.3 Ch.7 Sec.2/1 and LR Rules Pt.2 Ch.13/7.6.4 are used as the text.

#### **4.2.21 Stowage and deployment arrangements for anchors**

4.2.21.a The requirements are generally same in three societies. The text is made assembling portions of ABS Rules Pt.3 Ch.5 Sec.1/13, DNV Rules Pt.3 Ch.3 Sec.3 B 101 thru 103 and LR Rules Pt.2 Ch.13/ 7.8.3.

#### **4.2.22 Dimensions and scantling of hawse pipes and anchor pockets**

4.2.22.a The requirements are generally same in three societies. The text is made assembling portions of ABS Rules Pt.3 Ch.5 Sec.1/13, DNV Rules Pt.3 Ch.3 Sec.3 B 101 thru 103 and LR Rules Pt.2 Ch.13/ 7.8.3.

#### **4.2.23 Hull reinforcement**

4.2.23.a The requirements are generally same in three societies. The text is made assembling portions of LR Rules Pt.3 Ch.13/7, ABS Rules Pt.3 Ch.5 Sec.1 and Pt.3 Ch.7 Sec.2/1, DNV Rules Pt.3 Ch.3 Sec.3.

#### **4.2.24 Testing**

4.2.24.a The requirements are generally same in three societies. The text is made assembling portions of ABS Rules Pt.3 Ch.5 Sec.1/13 and Pt.3 Ch.7 Sec 2/1, DNV Rules Pt.3 Ch.3 Sec.3 B 101 thru 103 and LR Rules Pt.2 Ch.13/ 7.8.3 applicable to testing.

### **4.3 Emergency Towing**

#### **4.3.1 General requirements**

4.3.1.a The text is extracted from applicable regulations in SOLAS 1974.

## 5 TESTING PROCEDURES

### 5.1 Tank Testing

#### 5.1.1 Application

- 5.1.1.a All the class societies use IACS UR S14, with few alterations, as basis for their requirements for testing of tanks and boundaries. Additional notes relative to ABS, LR and DNV requirement for testing of tanks and boundaries are as provided below. Reference is also made to LR Rules Pt 1 Ch 1/8.3, ABS Rules Pt 3 Ch 7 Sec 1 and DNV Rules Pt 3 Ch1 Sec 1 D.
- 5.1.1.b LR does not specify sizes of independent tanks.

#### 5.1.2 Definitions

- 5.1.2.a ABS Rule text was used as a starting point in the document preparation. Generally, the text is based on ABS Rules Pt 3 Ch 7 Sec 1 except as noted in the following.
- 5.1.2.b Shop primer is defined as prefabrication primer by LR
- 5.1.2.c Protective coating is defined as final coating or temporary coating by ABS.
- 5.1.2.d Wording has been changed from UR S14 text to remove reference to tightness testing being carried out in conjunction with the structural test.
- 5.1.2.e Leak testing is defined as air testing by ABS.
- 5.1.2.f Hydrostatic testing is not defined by LR and DNV, while it is referred to in Structural testing and Hydropneumatic testing.

#### 5.1.3 Test procedures

- 5.1.3.a The text is taken from ABS Rules Pt 3 Ch7 Sec 1/3.1.

#### 5.1.4 Structural testing

- 5.1.4.a ABS Rule text was used as a starting point in the document preparation. Generally, the text is based on ABS Rules Pt 3 Ch 7 Sec 1 except as noted in the following.
- 5.1.4.b The sentence “When structural testing is carried out afloat it is to be performed by filling each tank and cofferdam separately to the test head given in *Table 11.5.1*.” is obtained from LR and DNV wording.
- 5.1.4.c The last phrase of “With about half the number of tanks full, the bottom and lower side shell in the empty tanks is to be examined and the remainder of the lower side shell examined when the water has been transferred to the remaining tanks.” deals with examination of the bottom and lower side shell with where ballast tanks of double hull tankers are empty. DNV specify the draft at the maximum practical attainable draft instead of about half the number of tanks full in LR.
- 5.1.4.d The last paragraph “Tank boundaries are to be tested at least from one side. Tanks to be tested for structural adequacy (see Note 1 to *Table 11.5.1*) are to be selected so that all representative structural members are tested for the expected tension and compression.” comes from ABS.

### **5.1.5 Leak testing**

- 5.1.5.a The text is based on ABS Rules Pt 3 Ch 7 Sec 1.
- 5.1.5.b Wording has been added to state that testing at pressures of higher than 0.20 bars is not recommended.

### **5.1.6 Hose testing**

- 5.1.6.a The text is based on ABS Rules Pt 3 Ch 7 Sec 1.

### **5.1.7 Other methods of testing**

- 5.1.7.a The text is based on ABS Rules Pt 3 Ch 7 Sec 1.

### **5.1.8 Application of coating – protective coating**

- 5.1.8.a The text is based on ABS Rules Pt 3 Ch 7 Sec 1. The second sentence addressing any discolouration or disturbance is in accordance with LR.

### **5.1.9 Temporary coating**

- 5.1.9.a The text is based on ABS Rules Pt 3 Ch 7 Sec 1.
- 5.1.9.b The paragraph beginning “Silicate based shop primer may ...” comes from a DNV guidance note.

#### **Table 11.5.1**

The following comments are noted:

- (a) In general, structures not applicable for Crude Oil carriers or Product Carriers are removed from the table.
- (b) LR requirement of “a head of water, representing the maximum pressure experienced in service” for double bottom has been removed assuming that such head will be below “head of water to the bulkhead deck” in ABS requirements.
- (c) In the case of Note 1, it is noted that the last sentence of this footnote reflects the fact that there is not a unified application by ABS, LR and DNV to the structural testing requirements for cargo space boundaries and tanks for segregated cargoes or pollutants as applied to the subsequent vessels of a newbuilding series.
- (d) For watertight bulkheads, hose testing (with alternative means including leak testing allowed in Note 4) is proposed in accordance with ABS Rules, while LR requires leak testing (alternative means of testing will be considered) for pump room bulkheads not forming tank boundaries. The proposal is considered to comply with SOLAS requirements which are referred to in DNV requirements.
- (e) For watertight test of doors/hatches, DNV Rules indicate acceptance criteria of maximum water leakage of 1 litre per minute.
- (f) For double plate rudders, structural testing (with Note 1) is required for each type of rudders in accordance with LR requirement. Caution to avoid over pressure is added in Note 6.