CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF SEA-GOING STEEL SHIPS

AMENDMENTS

2021

Effective from 1 July 2021

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PART ONE
PROVISIONS OF CLASSIFICATION

Revision explanation

1. Blue underline is to highlight new insertions, strikethrough line is to highlight deleted conte nts and cross line may be used to highlight deleted tables or figures.
2. No change in the English text means that only Chinese text is editorially revised while the change of corresponding English version is not needed.

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CHAPTER 1 GENERAL

Section 1 CHINA CLASSIFICATION SOCIETY AND ITS MAIN SERVICES

1.1.4 Main services

1.1.4.1 The services of CCS are mainly as follows:

(1) Classification services for ships, offshore installations and related industrial products (including containers): development and maintenance of rules, plan approval, surveys and certification;

(2) Statutory services for ships, offshore installations and related industrial products, when so authorized: development of technical regulations for statutory surveys, plan approval, surveys and certification;

(3) Surveys and certification delegated by other ship survey organizations, surveys related to notarial matters and safety assessment as well as verification surveys and certification of ships and offshore installations , and investigation of major maritime safety accidents;

(4) Verification, surveys and certification of related industrial facilities and products used on land, and surveys and certification delegated by foreign ship survey organizations for marine facilities and products as well as related industrial facilities and products used on land;

(5) ISM audit and certification;

(6) ISPS audit and certification;

(7) Maritime Labor Convention (MLC) inspection and certification;

(8) Services for EU Regulations on the monitoring, reporting and verification (MRV) of CO_2 emissions from maritime transport and IMO Data collection system for fuel oil consumption of ships (DCS);

~~(7)~~(9) Survey and assessment of ship's technical conditions;

~~(8)~~(10) Certification of quality management systems and environmental management systems in accordance with ISO 9000 and ISO 14000 series or equivalent standards;

~~(9)~~ (11) Technical research for classification of ships and offshore installations, safety on waters and environmental protection, survey of marine facilities and products as well as related industrial facilities and products used on land, and research on the application of information technology;

~~(10)~~ (12) Other services.

CHAPTER 2 SCOPE AND CONDITIONS OF CLASSIFICATION

Section 1 GENERAL PROVISIONS

2.1.3 Definitions

2.1.3.1 Unless expressly provided otherwise, for the purpose of the Rules:

(19) A **fishing vessel** is a vessel used for commercially catching fish or other living resources of the sea.

(34) **Critical structural areas** are locations which have been identified from calculations to require monitoring or from the service history of the subject ship or from similar or sister ships (if available) to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

Section 2 RULES FOR CLASSIFICATION

2.2.1 Basis for classification

2.2.1.2 The rules and relevant applicable guidelines published by CCS are the basis and ~~sole~~ criteria for classification.

2.2.4 Application

2.2.4.4 The intact stability, subdivision and damage stability, fire safety are the conditions of classification of ships and are to comply with PART TWO and PART SIX of the Rules (while for fishing vessels, provisions of Chapter 5 of PART EIGHT of the Rules are to be complied with), with attention being paid to the relevant requirements of the flag Administration, if any.

2.2.4.6 Unless otherwise specially required, Materials and welding are to comply with CCS Rules for Materials and Welding.

Section 4 APPLICATION AND FEES

2.4.1 Application

2.4.1.2 The responsibilities of both parties, characters of classification and class notations, particulars of the ship, etc., are to be clearly specified in the application or contract/agreement. Submitting the application or signing the contract/agreement means that the applicant will have no objection that the representative(s) of third-party independent audit organizations, e.g. representative(s) of an Accredited Certification Body (ACB), IACS observer(s), etc., and the representative(s) of the European Commission (EC), representative(s) of the flag State, assessor(s) of the Entity for the Quality Assessment and Certification of Organisations Recognised by the European Union(QACE), IMO observer(s) and representative(s) of IACS QSCS (Quality System Certification Scheme) Advisory Committee (AVC) may visit onboard or a manufacturer or a shipyard to carry out an audit or an assessment as provided in Article 8(1) of Regulation (EC) No. 391/2009, and will facilitate such audit/assessment.

2.4.1.4 CCS has established an Occupational Health and Safety Management System for the purpose of guaranteeing the occupational health and safety of Surveyors. An application for any classification or statutory survey service by CCS means that the applicant respects this system of CCS and that he is committed to provide conditions for the safety of CCS Surveyors entering the facilities related to the requested survey service in accordance with the national requirements of the State of nationality of the Surveyor and the State where the survey unit is located and/or the technical safety requirements developed by the local competent authorities or equivalent technical standards[①], including permanent or temporary means of access and facilities for inspections, compartment environment and safety precautions. CCS Surveyors will confirm the safety of survey conditions with the applicant and persons designated by him prior to performing specific surveys.

Section 7 STATUTORY SERVICES

2.7.2 Basis for statutory services

2.7.2.1 The statutory requirements for convention ships are referred to international conventions or codes and the amendments thereto, mainly including:

— International Convention for the Prevention of Pollution from Ships, 1973, as modified by the 1978 and 1997 Protocols;

Section 12 AVAILABILITY AND CONFIDENTIALITY OF INFORMATION

2.12.2.3 Notwithstanding the general duty of confidentiality owed by CCS to its client in accordance with its Rules, CCS' clients hereby accept that CCS will implement IACS' Procedure for Early Warning[②] which requires each IACS Member to provide its fellow IACS Members with relevant technical information on serious failures of hull structures and engineering systems, as defined in the IACS' Procedure for Early Warning (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and utilized. CCS will provide its client with written details of such information upon sending the same to IACS Members

Section 13 LIABILITY, DISAGREEMENT AND ARBITRATION

2.13.1 Liability of each party

2.13.1.12 Shipowners have the obligation to maintain the validity of class and statutory certificates.

Appendix 1 LIST OF CLASS NOTATIONS FOR SEA-GOING SHIPS

4. Where multiple class notations for type of ship are assigned, such individual notations are to be separated by the sign "/", i.e. ~~Offshore~~ Tug/Offshore Supply Ship~~; Ore/Bulk/Oil Carrier~~.

① Refer to CCS Guidelines for ~~Clients on~~ Site Safety of Survey.

② For details, refer to IACS PR2A "Procedure for Hull Failure Incident Reporting" and PR2B "Procedure for Early Warning of Serious Hull Failure Incidents - "Early Warning Scheme – EWS".

Type Notations Table A

Class notation	Description		Technical requirements[①]
General Dry Cargo Ship	General dry cargo ships	Ships intended primarily to carry dry cargo, and also liquid cargo contained in vessels, other than bulk carriers, container ships, ro-ro cargo ships, refrigerated cargo ships, cement carriers, livestock carriers, wood chip carriers, deck cargo ships and general dry cargo ships of double side skin construction. For general dry cargo ships of double side-skin construction, with double side-skin extending for the entire length of the cargo area, and for the entire height of the cargo hold to the upper deck, the notation "Double Side Skin" is to be added after their type notation and separated by a comma ",", i.e. General Dry Cargo Ship, Double Side Skin.	Ch. 2, Pt. 2 of the Rules
Fishing Vessel	Fishing vessels	~~Ships provided with fishing equipment~~ Vessels provided with fishing machinery, engaged in fishery production activities and used for commercially catching fish or other living resources of the sea	Rules for Construction of Ocean-going Steel Fishing Vessels; Ch. 5, Pt. 8 of the Rules
LNG Carrier	LNG carriers	Liquefied gas carriers dedicated to carrying liquefied natural gas. The notations Type 1G/Type 2G/Type 2PG/ Type 3G or Type IG/Type IIG/Type IIPG/ Type IIIG are to be added for preventive measures to preclude the escape of cargo, as stated in column Description for the notation Liquefied Gas Carrier	Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk; Ch.20, Pt.2 of the Rules
		Where LNG carriers are adapted for FSUs, the notation "LNG-FSU" (Liquefied Nature Gas-Floating Storage Unit) is to be added after LNG Carrier and separated by a comma ",", i.e. LNG Carrier, LNG-FSU	Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk; Implementation Guidelines for Liquefied Nature Gas Carriers Adapted for Floating Storage Units
		Where LNG carriers are fitted with LNG regasification systems, the notation "REGAS" is to be added after LNG Carrier and separated by a comma ",", i.e. LNG Carrier, REGAS	Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk; Chapters 1 and 4 of the Rules for Construction and Equipment of Liquefied Natural Gas Floating Storage and Regasification Units; Section 4, Chapter 7 of the Rules for Offshore Oil and Gas Processing Systems

① The technical requirements listed in this Table are the basic ones for ships assigned to the notation; in other special cases involving ship types, special consideration is to be given by CCS according to the ship's specific conditions.

Special Duties Notations **Table C**

Class notation	Description		Technical requirements[①]
Public Affair Ship	Public affair ships	~~Ships owned or operated by the Government and used only for non-commercial services~~ Ships used for administrative purposes of the Government	1. For ships not less than 20 m in length, in accordance with Ch. 8, Pt. 8 of the Rules; for high speed craft, in accordance with Rules for Construction and Classification of Sea-Going High Speed Craft. 2. For ships less than 20 m in length, in accordance with Rules for Construction of Coastal Boats. 3. For ships carrying more than 12 passengers, in accordance with technical requirements for passenger ships 4. Where special provisions are specified by the Administration, such provisions are to be implemented for paragraphs 1 to 3 above

Special Features Notations **Table E**

Class notation	Description		Technical requirements
Strengthened for Deck Cargoes	Strengthened for deck cargoes	The deck structure of specified deck cargo area is designed to be strengthened. The permissible loads, in ××× t/m^2, in cargo area of strengthened deck are to be indicated in operation documents. ~~The notation is only to be added after "Offshore Supply Ship"~~	The cargo deck plating in deck cargo area to comply with the requirements of 11.3.2 of Sec. 3, Ch. 11, Pt. 2 of the Rules. The cargo deck framing in deck cargo area to comply with the requirements for cargo deck plating as specified in Sec. 4, Ch. 11, Pt. 2 and Sec. 8, Ch. 2, Pt. 2 of the Rules

Special Equipment and System Notations **Table G**

Non-propulsion	Non-propulsion machinery	This notation is assigned to those ships not fitted with propulsion equipment used for main propulsion purposes ~~or those ships fitted with propulsion machinery used only for purposes such as lateral thrusting, operational actions or auxiliary propulsion during tugging~~, and is to be added after the type notation. In case of a type notation indicating that the ship is not self-propelling, e.g. "Barge, Oil Barge, Pontoon Barge, Floating Dock, Hopper Barge, Split Hopper Barge", this notation need not be added	Ch.11, Pt. 3 of the Rules
Auxiliary Propelling/ Maneuvering Units	Auxiliary propelling/ maneuvering units	For ships fitted with auxiliary propelling / maneuvering units which are intended not for navigation purposes, but only for locally adjusting operation position of the ship or auxiliary propelling during towing, etc., this notation may be added	Ch.11, Pt. 3 of the Rules
ALDR	Air lubrication for drag reduction	Sea-going ships provided with air lubrication systems for drag reduction	Ch. 1& 2 of the Guidelines for Surveys of Air Lubrication System for Drag Reduction of Ships

[①] The technical requirements listed in this Table are the basic ones for ships assigned to the notation; in other special cases involving ship types, special consideration is to be given by CCS according to the ship's specific conditions.

Class Notations for Green Eco-Technologies **Table I-3**

Class notation	Description		Technical requirements
WAP（RWS）	~~Propulsion system with sail assistance~~ Rigid Wing Sails	This notation may be assigned upon request by the shipowner, where relevant requirements of the Rules for Green Eco-Ships are satisfied	Rules for Green Eco-Ships

Appendix 2 DIAGRAMS OF MANDATORY SHIP TYPES FOR SHIPS HAVING ESP NOTATION

2 Ship Type and Enhanced Survey Programme (ESP) Notations

2.1 Oil tanker

The ship type notation “Oil Tanker”, or equivalent, and the notation “ESP” are to be assigned to ~~sea-going~~ self-propelled ships[①] which are constructed generally with integral tanks and intended primarily to carry oil in bulk.

2.2 Bulk carrier

The ship type notation “Bulk Carrier”, or equivalent, and the notation “ESP” are to be assigned to ~~sea-going~~ self-propelled ships which are constructed generally with single deck, double bottom, hopper side tanks and topside tanks and with single or double side skin construction in cargo length area and intended primarily to carry dry cargoes in bulk.

2.3 Ore carrier

The ship type notation “Ore Carrier”, or equivalent, and the notation “ESP” are to be assigned to ~~sea-going~~ self-propelled ships which are constructed generally with single deck, two longitudinal bulkheads and a double bottom throughout the cargo length area and intended primarily to carry ore cargoes in the ~~centre~~ holds only. Typical midship sections are given in Figure 2.3.

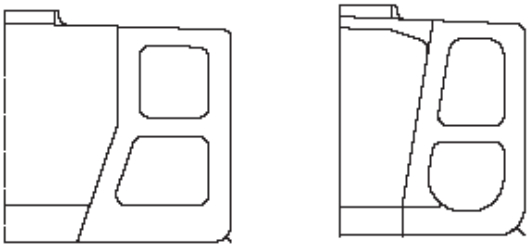

Figure 2.3

2.4 Combination carrier

(2) The ship type notation “Ore/Oil Carrier”, or equivalent, and the notation “ESP” are to be assigned to ~~sea-going~~ self-propelled ships which are constructed generally with single deck, two longitudinal bulkheads and a double bottom throughout the cargo length area and intended primarily to carry ore cargoes in the centre holds or of oil cargoes in centre holds and wing tanks.

(3) The ship type notation “Oil/Bulk/Ore (OBO) carrier”, or equivalent, and the notation “ESP” are to be assigned to ~~sea-going~~ self-propelled ships which are constructed generally with single deck, double bottom, hopper side tanks and topside tanks, and with single or double side skin construction in the cargo length area, and intended primarily to carry oil or dry cargoes, including ore, in bulk.

2.5 Self-unloaders

The ship type notation “Self-Unloaders", or equivalent, and the notation "ESP" are to be assigned to ~~sea-going~~ self-propelled ships which are constructed generally with single deck, double bottom, hopper side tanks and topside tanks and with single or double side skin construction in cargo length area and intended to carry and self-unload dry cargoes in bulk.

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① Self-propelled ships are ships with mechanical means of propulsion not requiring assistance from another ship during normal operation.

CHAPTER 3 INSPECTIONS OF PRODUCTS

Section 1 GENERAL PROVISIONS

3.1.8 Invalidation, suspension and cancellation of approval certificate

3.1.8.3 CCS will cancel the certificate within the period of its validity when CCS identifies that one of the following conditions exists at the manufacturer:

~~(6) there was any fraud, falsification, deliberate concealment of facts or any other illegal conduct on the part of the manufacturer in seeking approval certificates or product documents by CCS;~~

(6) there was any fraud, falsification, deliberate concealment of facts or any other illegal conduct on the part of the manufacturer in the process of design, manufacture or survey of marine products;

3.1.9 Cancellation of marine product certificate/equivalent document

3.1.9.1 Marine product certificate/equivalent document will be automatically cancelled in one of the following conditions:

(2) CCS is not informed in a timely manner as required or no remedial action has been ~~promptly~~ taken to quality problems of products or no assistance given to investigation by CCS;

Section 3 DESIGN APPROVAL

3.3.5 Renewal audit

3.3.5.1 The renewal audit for the Design Approval Certificate is to be carried out within 3 months before the expiry date of the certificate. The manufacturer is to send a written application to CCS and inform CCS of any change to the product design. CCS is to:

(1) ~~re-examine~~ verify the drawings to check any change to the design or specifications of the products to the applicable rules or standards;

Section 4 TYPE APPROVAL

3.4.1 General requirements

3.4.1.3 The manufacturer is to have a quality management system certificate based upon ~~ISO9000~~ ISO9001or the equivalent standards and issued by an accredited certification body, the certificate is to be kept valid.

3.4.8 Renewal audit

3.4.8.2 Where there is no change to the technical requirements for product approval and design, part or all of the type approval test items may ~~in general~~ be dispensed with; ~~and~~ if necessary, CCS may require all test items ~~a retest~~.

Section 5 WORKS APPROVAL

3.5.1 General requirements

3.5.1.3 The manufacture is to have obtained the quality management system certificate issued on the basis of ~~ISO9000~~ ISO9001 or equivalent standard and maintained valid.

3.5.7 Renewal audit

3.5.7.3 If there is no change to the technical requirements for product approval and product design ~~and approval basis~~, part or all of the test items may be exempted; if necessary, CCS may require all test items.

Section 8 CLASS NOTATIONS FOR PRODUCTS

3.8.1 General requirements

3.8.1.4 Class notations applicable to marine products include but not limited to in Table 3.8.1.4.

Class Notations for Marine Products Table 3.8.1.4

Class notation	Applicable products	Description	Technical requirements to be complied with
Hongkong Convention	All marine products	To meet requirements of Hongkong Convention on control of harmful substances	Appendixes 1 and 2 of the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009, and resolution ~~MEPC.197(62)~~

Class notation	Applicable products	Description	Technical requirements to be complied with
			MEPC.269(68) − ~~2011~~ 2015 Guidelines for the Development of the Inventory of Hazardous Materials

Section 10 ALTERNATIVE CERTIFICATION SCHEME

3.10.2 Conditions

3.10.2.1 The conditions for the manufacturer to be granted the permission to carry out inspection and testing without the presence of a Surveyor are that:

3.10.5 Issuance and validity of Alternative Certification Scheme

3.10.5.1 CCS will issue the product inspection scheme attached with an Alternative Certification Scheme to a manufacturer at his request for whom the drawing examination and on-site audit have been completed according to 3.10.2 and 3.10.3 and who is found to comply with the following requirements:

(2) product quality is found upon CCS inspection ~~experience~~ and quality system check to be continually kept stable during the period of holding the approval certificate for one or more types of products;

Appendix 1A
LIST OF CERTIFICATION REQUIREMENTS FOR CLASSED MARINE PRODUCTS

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
Hull									
6.10	Accommodation ladder, ramp	X	–	–	–	–	–	X	
Machinery (including machinery equipment of refrigerated vessels)									
10	Machinery equipment								
~~10.11~~	~~Sea water desalting arrangement~~	~~X~~	~~–~~	~~–~~	~~–~~	~~–~~	~~–~~	~~X~~	~~Applicable to supply of fresh water for operation of fresh water cooling system of main and auxiliary engines~~
10.~~12~~11	Monitor, foam monitor	X	–	–	X	O	–	X	Applicable to external fire-fighting of fire-fighting ships applying for class notations of Fire Fighting Ship N
10.~~13~~12	~~Steering gear~~ Steering arrangements	~~X~~	~~–~~	~~X~~	~~O~~	~~O~~	~~–~~	~~X~~	In addition to the steering gear, steering arrangements also include heading control system, rudder indicator, simplified operation box, starting box and alarm box for steering arrangements
10.12.1.1	Steering gear (below 630 kNm)	X	–	–	X	O	~~–~~	X	
10.12.1.2	Steering gear (of or more than 630 kNm)	X	–	–	X	O	~~X~~	X	
~~10.12.2~~	~~Heading control system~~								~~This product is a statutory product and the requirements for its certification are shown in Appendix 1B 4.12~~
~~10.12.3~~	~~Rudder indicator~~								~~This product is a statutory product and the requirements for its certification are shown in Appendix 1B 4.5~~

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
10.12.4	Simplified operation box, starting box and alarm box for steering arrangements								See Appendix 1A, 13.11 for certification and inspection requirements
10.~~14~~13	Fin stabilizer	X	–	–	–	–	–	X	
10.14	Foundation bolts of main engines	X	–	–	–	–	–	–	Applicable to engines with cylinder diameter >300 mm; inspection is to be carried out according to the drawing of arrangement of foundation of main engine provided by the diesel engine manufacturer. The drawing is to include the following: Bolts (Mounting bolts and tightening bolts) Quantity, bolt diameter, bolt material (grade and performance), tightening bolt arrangement, thrust block arrangement
13.20	Cable management system	X	–	–	–	–	–	X	Applicable to ships applying for class notation of ~~high pressure~~ shore power
13.21	Distribution panel for high voltage shore power connection	X	–	–	–	–	–	X	Applicable to ships applying for class notation of ~~high pressure~~ shore power
13.22	Control panel for high voltage shore power switch in	X	–	–	–	–	–	X	Applicable to ships applying for class notation of ~~high pressure~~ shore power
13.33	Low voltage shore power box	X	–	–	–	–	–	X	Applicable to ships applying for class notation of shore power

Appendix 1B
LIST OF CERTIFICATION REQUIREMENTS FOR STATUTORY MARINE PRODUCTS①

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
3.32	Helicopter deck ~~platform~~ foam fire-extinguishing arrangement	X	–	–	X	O	–	X	
3.33	Helicopter land area foam fire-extinguishing arrangement	~~X~~	–	–	~~X~~	O	–	X	
~~3.33~~ 3.34	Fixed fire-extinguishing arrangement for gallery discharge duct	X	–	–	X	O	–	X	
~~3.34~~ 3.35	Inert gas system	X	–	–	X	O	–	X	
~~3.35~~ 3.36	Portable foam applicator	X	–	–	X	O	–	X	
~~3.36~~ 3.37	Portable fire extinguisher	X	–	–	X	O	–	X	
~~3.37~~ 3.38	Trolley type fire extinguisher	X	–	–	X	O	–	X	
~~3.38~~ 3.39	Water jet/spray nozzle	–	X	–	X	–	–	X	
~~3.39~~	Fire hoses	–	X	–	X	–	–	X	

① In case of any discrepancy between the list and the requirements of the flag State requirements, the provisions of the flag State Administration shall prevail.

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
3.40									
~~3.40~~ 3.41	Fireman's protective clothing (insulation clothing)	–	X	–	X	–	–	X	
~~3.41~~ 3.42	Lifeline	–	X	–	X	–	–	X	
~~3.42~~ 3.43	Self-contained compressed air breathing apparatus	X	–	–	X	O	–	X	
~~3.43~~ 3.44	Compressed air breathing apparatus	X	–	–	X	O	–	X	
~~3.44~~ 3.45	Emergency escape breathing device	X	–	–	X	O	–	X	
~~3.45~~ 3.46	Low location lighting system	–	X	–	X	–	–	X	
~~3.46~~ 3.47	Equivalent low location lighting system	–	X	–	X	–	–	X	
~~3.47~~ 3.48	Electrical safety lamp (explosion-proof electrical safety lamp)	–	X	–	X	–	–	X	For fireman's outfit specified in Chapter 3 of FSS Code
~~3.48~~ 3.49	Portable oxygen concentration measuring device	X	–	–	X	O	–	X	
~~3.49~~ 3.50	Fixed oxygen analyzing and gas detecting equipment	X	–	–	X	O	–	X	
~~3.50~~ 3.51	Fixed hydrocarbon gas detection system	X	–	–	X	O	–	X	
~~3.51~~ 3.52	Smoke detection system	X	–	–	X	O	–	X	
~~3.52~~ 3.53	Fixed fire detection and alarm system	X	–	–	X	O	–	X	
~~3.53~~ 3.54	Two-way portable radiotelephone apparatus of an explosion-proof type for fire-fighters	X	–	–	X	O	–	X	

Appendix 2A
LIST OF CERTIFICATION REQUIREMENTS FOR CLASSED MARINE PRODUCT PARTS

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
Machinery (including machinery equipment of refrigerated vessels)									
10	Machinery equipment								
10.3	Diesel engine								
~~.1~~	~~Welding bedplate~~	~~X~~	~~=~~	~~=~~	~~=~~	~~=~~	~~X~~	~~X1~~	~~C/E to be provided for steel plate and steel casting material~~
~~.2~~	~~Bearing seat (steel casting)~~	~~X~~	~~–~~	~~–~~	~~–~~	~~–~~	~~X~~	~~X1~~	~~C/E to be provided for steel casting material~~
~~.3~~	~~Welded frame~~	~~X~~	~~–~~	~~–~~	~~–~~	~~–~~	~~X~~	~~X1~~	~~C/E to be provided for steel plate and steel casting /forging material~~
~~.4~~	~~Weld frame~~	~~X~~	~~=~~	~~=~~	~~=~~	~~=~~	~~X~~	~~X1~~	~~C/E to be provided for steel plate and steel casting /forging material~~
~~.5~~	~~Block body (iron casting)~~	~~=~~	~~X~~	~~=~~	~~=~~	~~=~~	~~X~~	~~X1~~	~~C/E to be provided for casting/forging material (cylinder diameter > 300 mm)~~
~~.6~~	~~Crankcase explosion relief valves~~	~~–~~	~~X~~	~~–~~	~~X~~	~~–~~	~~–~~	~~X~~	

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
.7	Piston crown	X	=	=	=	=	X	X1	C/E to be provided for casting/forging material (cylinder diameter > 400 mm)
.8	Cylinder liner	=	X	=	=	=	X	X1	C/E to be provided for casting material (cylinder diameter > 300 mm)
.9	Crankshaft	X	–	–	–	–	X	X1	C/E to be provided for casting/forging material
.10	Crank	X	–	–	–	–	X	X1	C/E to be provided for casting/forging material, applicable to structure semi-integrated crankshaft
.11	Main shaft journal (forging) and shaft journal with flange	X	–	–	–	–	X	X1	C/E to be provided for forging material, applicable to structure semi-integrated crankshaft
.12	Crankshaft connecting bolt (semi-built crankshaft)	X	=	=	=	=	X	X1	C/E to be provided for casting/forging material
.13	Piston rod	X	–	–	–	–	X	X1	C/E to be provided for casting/forging material (cylinder diameter > 400 mm)
.14	Connecting rod (including bearing cover)	X	–	–	–	–	X	X1	C/E to be provided for forging material
.15	Crosshead	X	–	–	–	–	X	X1	C/E to be provided for casting/forging material (applicable to crosshead engine)
.16	Cylinder cover	X	–	–	–	–	X	X1	C/E to be provided for casting/forging material (cylinder diameter > 300 mm)
.17	Tie rod	X	–	–	–	–	X	X1	C/E to be provided for blank material (applicable to crosshead engine)
.18	Connecting rod upper/ lower bolt	–	X	–	–	–	X	X1	C/E to be provided for blank material (cylinder diameter > 300 mm)
.19	Main bearing bolt	–	X	–	–	–	X	X1	C/E to be provided for blank material (cylinder diameter > 300 mm)
.20	Foundation bolts of main engines	X	–	–	–	–	X	X1	C/E to be provided for blank material (cylinder diameter > 300 mm)
.21	Cylinder cover bolt	=	X	=	=	=	X	X1	C/E to be provided for blank material (cylinder diameter > 300 mm)
.22	High pressure fuel/servo oil pipe	X	–	–	X	O	–	X	Also applicable to common rail pipe
.23	High pressure fuel injection valve	=	X	=	=	=	=	X	
.24	High pressure fuel injection pump	X	–	–	–	–	–	X	Also applicable to high pressure servo oil pump
.25	Accumulator for fuel oil or servo oil system	X	=	=	=	=	X	X1	Applicable to the capacity > 0.5l
.26	Piping, pump, actuator for hydraulic driven valves	X	–	–	–	–	X	X1	C/E to be provided for casting/forging material, if applicable
.27	engine-driven pump (oil, water, fuel, bilge water)	X	–	–	X	O	–	X1	Applicable to power > 800 kW/cyl
.28	Main starting valve	X	–	–	–	–	–	X1	
.29	Start air pipe	X2	–	–	–	–	X	X1	

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
~~.30~~	~~Pipe of class III~~	~~–~~	~~X~~	~~–~~	~~–~~	~~–~~	~~X~~	~~X~~	
~~.31~~	~~Flexible hose assembly, for piping of Classes I and II or more than 50 mm in diameter~~	~~X~~	~~=~~	~~=~~	~~X~~	~~O~~	~~=~~	~~X~~	
~~.32~~	~~Flexible hose assembly: except for above-mentioned~~	~~=~~	~~X~~	~~=~~	~~X~~	~~=~~	~~=~~	~~X~~	
~~.33~~	~~Corrugated expansion joint~~	~~–~~	~~X~~	~~–~~	~~X~~	~~–~~	~~–~~	~~X~~	
~~.34~~	~~Engine-driven air bottle~~	~~X~~	~~–~~	~~–~~	~~–~~	~~–~~	~~–~~	~~X~~	
~~.35~~	~~Motors (50 kW and over)~~	~~X~~	~~–~~	~~–~~	~~X~~	~~O~~	~~–~~	~~X~~	
~~.36~~	~~Motors (below 50 kW)~~	~~–~~	~~X~~	~~–~~	~~X~~	~~–~~	~~–~~	~~X~~	
~~.37~~	~~Heat exchanger~~	~~X~~	~~–~~	~~X~~	~~O~~	~~O~~	~~–~~	~~X~~	~~Including lubricating oil cooler, fuel oil cooler, sea/fresh water cooler and air cooler~~
~~.38~~	~~Turbocharger~~	~~X~~	~~–~~	~~X~~	~~O~~	~~O~~	~~–~~	~~X~~	~~Applicable to its rotating parts and case~~
~~.39~~	~~Oil mist detector~~	~~–~~	~~X~~	~~–~~	~~X~~	~~–~~	~~–~~	~~X~~	
~~.40~~	~~Speed governor~~	~~–~~	~~X~~	~~–~~	~~X~~	~~–~~	~~–~~	~~X~~	~~Applicable to electronic speed governor~~
~~.41~~	~~Control and alarm box/cabinet of diesel engine~~	~~X~~	~~–~~	~~–~~	~~X~~	~~O~~	~~–~~	~~X~~	~~Including safety alarm system~~
~~.42~~	~~Electric control system~~	~~–X~~	~~=~~	~~=~~	~~X~~	~~O~~	~~=~~	~~X~~	~~Applicable to electric control diesel engine~~
10.3.1	Diesel engine (cylinder diameter > 300 mm or single cylinder power >400 kW)								
.1	Welding bedplate	X	—	—	—	—	X	X[1]	W to be provided for material properties; W to be provided for NDT
.2	Bearing seat (steel casting)	X	—	—	—	—	X	X[1]	W to be provided for material properties; W to be provided for NDT
.3	Welded frame	X	—	—	—	—	X	X[1]	W to be provided for material properties; W to be provided for NDT
.4	Cylinder block (iron casting)	—	X	—	—	—	—	X[1]	Applicable to engines with power >400kW/cyl; W to include hydraulic tests
.5	Welded cylinder block	X	—	—	—	—	X	X[1]	Applicable to crosshead engines; W to be provided for material properties; W to be provided for NDT
.6	Engine block body (iron casting)	—	X	—	—	—	X	X[1]	Applicable to engines with power >400kW/cyl; W to include mechanical properties (for ductile cast iron) and hydraulic tests
.7	Cylinder liner	—	X	—	—	—	X	X[1]	Applicable to engines with cylinder diameter >300mm ; W to include material properties and hydraulic tests
.8	Cylinder cover(iron casting)	—	X	—	—	—	X	X[1]	Applicable to engines with cylinder diameter >300mm; W to include hydraulic tests
.9	Cylinder cover(steel casting, forging)	X	—	—	—	—	X	X[1]	Applicable to engines with cylinder diameter >300mm; W to be provided for material properties; W to be provided for NDT and hydraulic tests

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
.10	Piston crown	X	—	—	—	—	X	X[1]	Applicable to engines with cylinder diameter >400mm; W to be provided for material properties; W to be provided for NDT
.11	Crankshaft	X	—	—	—	—	X	X[1]	C/E to be provided for material properties; W to be provided for NDT; W to be provided for scantling inspection (including surface condition)
.12	Crank, Main shaft journal (forging) and shaft journal with flange	X	—	—	—	—	X	X[1]	Applicable to structure-semi-integrated crankshaft; C/E to be provided for material properties; W to be provided for NDT; W to be provided for scantling inspection (including surface condition)
.13	Exhaust valve casing	—	X	—	—	—	—	X[1]	Applicable to crosshead engines; W to include hydraulic test;
.14	Piston rod	X	—	—	—	—	X	X[1]	W Applicable to crosshead engines with cylinder diameter >400mm; C/E to be provided for material properties; W to be provided for NDT
.15	Crosshead	X	—	—	—	—	X	X[1]	Applicable to crosshead engines; C/E to be provided for material properties; W to be provided for NDT
.16	Connecting rod (including bearing cover)	X	—	—	—	—	X	X[1]	C/E to be provided for material properties; W to be provided for NDT; W to be provided for scantling inspection (including surface condition)
.17	Crankshaft connecting bolt (semi-built crankshaft)	X	—	—	—	—	X	X[1]	C/E to be provided for material properties; W to be provided for NDT; W to be provided for scantling inspection (including surface condition)
.18	Main bearing bolt	—	X	—	—	—	X	X[1]	Applicable to engines with cylinder diameter >300mm ; W to include material properties and NDT
.19	Cylinder cover bolt	—	X	—	—	—	X	X[1]	Applicable to engines with cylinder diameter >300mm ; W to include material properties and NDT
.20	Connecting rod upper/ lower bolt	—	X	—	—	—	X	X[1]	Applicable to engines with cylinder diameter >300mm; W to include material properties and NDT
.21	Tie rod	X	—	—	—	—	X	X[1]	Applicable to crosshead engines; W to be provided for material properties; W to be provided for NDT; test report to be provided for scantling inspection (including surface condition)
.22	High pressure fuel injection pump	—	X	—	—	—	—	X	W to include material properties and hydraulic test

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
									(manufacturer with cylinder diameter ≤ 300mm may submit hydraulic test report)
.23	High pressure fuel injection valve	—	X	—	—	—	—	X	W to include hydraulic test (manufacturer with cylinder diameter ≤ 300mm may submit hydraulic test report)
.24	High pressure fuel injection pipe (including fuel common rail)	—	X	—	X	—	—	X	W to include material properties and hydraulic test (manufacturer with cylinder diameter ≤ 300mm may submit hydraulic test report)
.25	High pressure servo oil pipe (including common rail pipe)	—	X	—	X	—	—	X	W to include material properties and hydraulic test (manufacturer with cylinder diameter ≤ 300mm may submit hydraulic test report)
.26	Heat exchanger	—	X	X	O	O	—	X	Engine-driven heat exchanger is applicable to engines with cylinder diameter >300mm; including: lubricating oil cooler, fuel oil cooler, sea/fresh water cooler, air cooler; W to include raw material properties and hydraulic test
.27	Accumulator	—	X	—	—	—	—	X[1]	Applicable to the capacity ＞ 0.5 *l*; W to include material properties and hydraulic test
.28	Piping, pump, actuator for hydraulic driven valves	—	X	—	—	—	—	X[1]	Applicable to engines with power ＞800kW/cyl; W to include material properties and hydraulic test; pipes to be furnished with WA; pumps to be furnished with TA;
.29	Other engine-driven pump (oil, water, fuel, bilge water) except for .22 and .28	—	X	—	X	O	—	X	Applicable to engines with power ＞800kW/cyl; W to include hydraulic test;
.30	Main bearing bush, crosshead bush, crank pin bush	—	X	—	—	—	—	—	Applicable to engines with power ＞800kW/cyl; W to include chemical composition, NDT (for contact surfaces between base material and bearing bush) and scantling inspection (including surface condition)
.31	Crankcase explosion relief valves	—	X	—	X	—	—	X	
.32	Oil mist detector	—	X	—	X	—	—	X	
.33	Turbocharger (Class C)	X	—	—	X	O	—	X	
.34	Turbocharger(Class A and Class B)	—	X	—	X	O	—	X	
.35	Speed governor	—	X	—	X	—	—	X	Applicable to electronic governor
.36	Main starting valve	X	—	—	—	—	—	X[1]	
.37	Start air pipe	X2	—	—	—	—	X	X[1]	
.38	Flexible hose assembly, for piping of Classes I and II or	X	—	—	X	O	—	X	

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
	more than 50 mm in diameter								
.39	Flexible hose assembly: except for above-mentioned	—	X	—	X	—	—	X	
.40	Corrugated expansion joint	—	X	—	X	—	—	X	
.41	Engine-driven air bottle	X	—	—	—	—	—	X	
.42	Motors (50 kW and over)	X	—	—	X	O	—	X	
.43	Motors (below 50 kW)	—	X	—	X	—	—	X	
.44	Control and alarm box/cabinet of diesel engine	X3	—	—	X	O	—	X	Including safety alarm system
.45	Electric control system	—	X	—	X	O	—	X	Applicable to electric controlled diesel engine
10.3.2	Diesel engine (cylinder diameter ≤300mm and single cylinder power ≤400 kW, rated power≥100kW)								
.1	Welding bedplate	X	—	—	—	—	X	X[1]	W to be provided for material properties; W to be provided for NDT
.2	Bearing seat (steel casting)	X	—	—	—	—	X	X[1]	W to be provided for material properties; W to be provided for NDT
.3	Welded frame	X	—	—	—	—	X	X[1]	W to be provided for material properties; W to be provided for NDT
.4	Engine block body	—	X	—	—	—	X	X[1]	W to include mechanical properties of the material
.5	Crankshaft	X	—	—	—	—	X	X[1]	C/E to be provided for material properties
.6	Crankshaft connecting bolt (semi-built crankshaft)	X	—	—	—	—	X	X[1]	C/E to be provided for material properties
.7	Connecting rod	X	—	—	—	—	X	X[1]	C/E to be provided for material properties
.8	Cylinder liner	—	X	—	—	—	X	X[1]	W to include material properties
.9	High pressure fuel injection pump	—	X	—	—	—	—	X	W to include material properties and hydraulic test report
.10	High pressure fuel injection valve	—	X	—	—	—	—	X	W to include hydraulic test or hydraulic test report to be provided
.11	High pressure fuel injection pipe (including fuel common rail)	—	X	—	X	—	—	X	W to include material properties and hydraulic test report
.12	High pressure servo oil pipe (including common rail pipe)	—	X	—	X	—	—	X	W to include material properties and hydraulic test report
.13	Accumulator	—	X	—	—	—	—	X[1]	Applicable to the capacity > 0.5 *l*; W to include material properties and hydraulic test
.14	Turbocharger(Class C)	X	—	—	X	O	—	X	
.15	Turbocharger(Class A and Class B)	—	X	—	X	O	—	X	
.16	Speed governor	—	X	—	X	—	—	X	Applicable to electronic governor
.17	Crankcase explosion relief valves	—	X	—	X	—	—	X	
.18	Oil mist detector	—	X	—	X	—	—	X	
.19	Control and alarm box/cabinet of diesel engine	X[3]	—	—	X	O	—	X	Including safety alarm system

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
.20	Electric control system	—	X	—	X	O	—	X	Applicable to electric controlled diesel engine
10.3.3	Diesel engine (rated power ＜100kW ＝								
.1	Crankshaft	X[2]	—	—	—	—	X	X	
.2	Connecting rod	X[2]	—	—	—	—	X	X	
.3	Electric control system	—	X	—	X	O	—	X	Or carry out type test according to requirements of CCS
10.3.4	EGR system(if fitted)								EGR system is not separately certified. The certification requirements for pipes and fittings, motors, electric control boxes and valves used in the system are given in the corresponding provisions in Appendix 1A
.1	EGR unit	X	—	—	—	—	—	X	
.2	Pump	X	—	—	X	—	—	X	Power of diesel engine ≥ 2250kW, or cylinder diameter＞300mm
.3	EGR fan	X	—	X	O	O	—	X	Fan power ≥100kW
.4	Electrical control box	X	—	—	—	—	—	X	Electrical control box with motor power≥100kW
.5	Alkali fluid system	X	—	—	X	—	—	X	
.6	Washwater treatment unit	X	—	—	X	—	—	X	
.7	Tank (pressure vessel)	X	—	—	—	—	—	X	EGR residue /NaOH overflow tank, storage tank
.8	15ppm oil meter								to comply with the requirements of MEPC.107(49); certification requirements are as given in the corresponding provisions of Appendix 1B
.9	Discharge water monitoring system								to comply with the requirements of MEPC. 307(73); certification requirements are as given in the corresponding provisions of Appendix 1B
.10	Control, monitoring, alarming and safety system	X	—	X	—	—	—	X	may be approved and certified together with the corresponding system of the engine
~~10.11~~	~~Sea water desalting arrangement~~								
~~.1~~	~~Pump~~	~~X~~	~~—~~	~~—~~	~~X~~	~~O~~	~~—~~	~~X~~	
~~.2~~	~~Motors (50 kW and over)~~	~~X~~	~~—~~	~~—~~	~~X~~	~~O~~	~~—~~	~~X~~	
~~.3~~	~~Motors (below 50 kW)~~	~~—~~	~~X~~	~~—~~	~~X~~	~~—~~	~~—~~	~~X~~	
10.~~12~~11	Monitor, foam monitor								
10.~~13~~12	~~Steering gear~~ Steering arrangements								Heading control system, rudder indicator, simplified operation box, starting box and alarm box for steering arrangements are to be surveyed in accordance corresponding requirements
10.12.1	Steering gear								
.1	Hydraulic cylinder	X	–	–	–	–	–	X	If the cylinder body is casting, C/E is to be provided for material
.2	Rudder tiller	X	–	–	–	–	X	X1	Applicable to casting/forging material

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
.3	Cylinder body, end cover, rotor	X	–	–	–	–	X	X1	Applicable to rotating blade type steering gear
.4	Hydraulic power unit	X	–	–	–	–	–	X	
.5	Flexible hose assembly, for piping of Classes I and II or more than 50 mm in diameter	X	–	–	X	O	–	X	
.6	Flexible hose assembly: except for above-mentioned	–	X	–	X	–	–	X	
.7	Electrical control box	X	–	–	–	–	–	X	
10.~~14~~13	Fin stabilizer								
.1	Fin	X	–	–	–	–	–	X1	C/E to be provided for steel casting and steel plate
.2	Fin shaft	X2	–	–	–	–	X	X1	
.3	Crosshead	X2	–	–	–	–	X	X1	
.4	Crosshead body steel casting	X	–	–	–	–	X	X1	
.5	Hydraulic cylinder	X	–	–	–	–	–	X	
.6	Hydraulic power unit	X	–	–	–	–	–	X	
.7	Electrical control box	X	–	–	–	–	–	X	
13.33	Low voltage shore power box								
.1	Circuit breaker	–	X	–	X	–	–	X	Applicable to shore power connection/distribution switch
.2	Contactor	–	X	–	X	–	–	X	
.3	Electric meter	–	X	–	X	–	–	X	
.4	Insulation monitor	–	X	–	X	–	–	X	
.5	Relay	–	X	–	X[4]	–	–	X	
.6	Fuse	–	X	–	X[4]	–	–	X	
.7	Wire cable	–	X	–	–	–	X	X	

Appendix 2C
LIST OF CERTIFICATION REQUIREMENTS FOR LIFTING APPLIANCE PARTS

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
1	Derrick system (including derrick type crane)								
.2	~~Moving~~ Detachable parts	X	–	–	–	–	X	X[1]	Refer to paragraph 1.2.1(5), Chapter 1 of CCS Rules for Lifting Appliances of Ships and Offshore Installations Plan approval may not be required for rigging designed in accordance with the standards accepted by CCS
.3	Rigging	X	–	–	–	–	X	X[1]	Plan approval may not be required for rigging designed in accordance with the standards accepted by CCS
2	Crane								
.6	Rigging	X	–	–	–	–	X	X[1]	Plan approval may not be required for rigging designed in accordance with the standards accepted by CCS
4	Submersible launching arrangement	X	–	–	–	–	–	X	

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
.3	Rigging	X	–	–	–	–	X	X[1]	Plan approval may not be required for rigging designed in accordance with the standards accepted by CCS

CHAPTER 4 SURVEYS DURING CONSTRUCTION①

Section 3 TESTING PROCEDURES OF WATERTIGHT COMPARTMENTS

4.3.1 General requirements

Annex 1
Procedures for Testing Tanks and Tight Boundaries
Part A - SOLAS Ships②

Test Requirements for Tanks and Boundaries **Table 1**

	Tank or boundary to be tested	Test type	Test head or pressure	Remark
18	Chain lockers	Leak and structural[1]	Top of chain pipe	
19	L.O. sump. tanks and other similar tanks/spaces under main engines	Leak[9]	See 4.4.3 through 4.4.6, as applicable	
20	Ballast ducts	Leak and structural[1]	The greater of - ballast pump maximum pressure, or - setting of any pressure relief valve	

① The requirements for initial classification surveys of ships under construction are given in 5.14.2 of Section 14 of Chapter 5.

② Ships to which the SOLAS Convention is applicable.

Appendix 1 HULL SURVEY FOR NEW CONSTRUCTION

Items for Hull Survey Table 1

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS[①] requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
	Shipbuilding quality control function								
1	Welding								
1.1	Welding consumables	Works approval of the manufacturer by CCS	Review approval status and patrol, verify storage, handling and treatment in accordance with manufacturer's requirements	~~Chapter 2 of PART THREE of Rules for Materials and Welding~~ UR W17		Consumable specification and approval status	Not required	Identify consumables against approved list	
								Verify temporary and permanent storage facilities	e.g. kept dry, covered, where applicable heated
								Verify traceability	e.g. random batch number checking
1.2	Welder qualification	Qualified welders	Review of welder certification and patrol	IACS Rec.47		Shipyard's records with individual's identification	Not required	Verify welder qualification standard, e.g. class or recognised standard approval	
								Verify welder approved for weld position	
								Verify validity of qualification certificate	
1.3	Welding – mechanical properties (welding procedures)	All weld joint configurations, positions and materials to be covered by weld procedures approved by CCS	Review and patrol	~~Chapters 3 and 5 of PART THREE of Rules for Materials and Welding~~ UR W28		Approved weld procedure specification and welding plan relevant to the ship project or process	Not required	Verify procedures are available at relevant workstations	

[①] IACS Recommendations indicated in this Table are not mandatory requirements, IACS UI are given in CCS Guidelines for Implementation of Statutory Surveys (Ships Engaged on International Voyages).

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
		CCS witnesses all new weld procedure qualification tests carried out in the shipyard whenever CCS is surveying in the shipyard	Witness					Verify weld procedures records have been approved and cover all weld processes and positions in accordance with Rules or recognised standards and are available for the Surveyor's reference	
1.3a	Welding equipment	Correctly calibrated and maintained	Patrol and review			Shipbuilder's maintenance and calibration records	Not required	Verify condition of machinery and equipment	
								Verify machines are calibrated by appropriate staff	
								Verify calibration carried out in accordance with manufacturer's recommendations	
								Verify calibration in accordance with maintenance schedule	
1.3b	Welding environment	Satisfactory environment	Patrol	IACS Rec.47			Not required	Verify welding areas clean, dry, well lit	
								Confirm relevant measures taken for any pre or post heat treatment, drying of surfaces prior to welding	
								Confirm shielding gases, fluxes protected	
1.3c	Welding supervision	Sufficient number of skilled supervisors	Review and patrol	IACS Rec.20 and Rec.47				Verify supervision is effective	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
1.4	Welding – surface discontinuities	Substantially free from significant indications, satisfactory profile and size	Visual examination, surface detection techniques, review of documents and patrol of operator	IACS Rec.20 and Rec.47		Shipbuilder's and recognised standards and Rules as applicable, welding and NDT plans, NDT report	Not required	Identify workstations where NDT is carried out, e.g. panel line butt welds, castings into hull structure	
								Verify NDT carried out in accordance with approved plans where applicable	
								Verify suitability of NDT methods	
								Verify operators suitably qualified particularly where sub-contractors have been employed	
								Verify NDT is carried out according to the acceptable process	
								Review NDT records	
1.5	Welding – embedded discontinuities	NDT is to be carried out by qualified operators capable of ensuring that welds are substantially free from significant indications	Radiography and ultrasonic testing, review of documents and patrol of operator, examination of films	IACS Rec.20 and Rec.47		Shipbuilder's and recognised standards and Rules as applicable, welding and NDT plans, NDT reports, operator qualifications	Not required	Identify workstations where NDT is carried out, e.g. panel line butt welds, castings into hull structure	
								Verify NDT carried out in accordance with approved plans where applicable	
								Verify suitability of NDT methods	
								Verify operators suitably qualified particularly where sub-contractors have been employed	
								Verify that records have been completed and in accordance with	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
								recoginsed standards, e.g. IQI and sensitivity recorded	
								Verify that reports and radiographs have been evaluated correctly by the shipbuilder. Systematic review of radiographs carried out by the Surveyor	
								Verify equipment calibration satisfactory and in accordance with manufacturer's and recognised standards requirements	
								Verify NDT is carried out according to the acceptable process	
2	Steel preparation and fit-up								
2.1	Surface preparation, marking and cutting	Traceability and acceptability of material, check of steel plates & profiles, materials type, scantling identification, testing marks	Patrol	IACS Rec.47		Material certificates, shipbuilder's marking/cutting production documents at the workstation – documents retained at the facility	Not required	Verify stockyard storage satisfactory	
								Verify material traceability, e.g. stamping identification against material certification, archiving of records	
								Verify transfer marking after treatment line	
								Verify standard of shot-blasting and priming	
								Verify suitability of primer	
								Verify that steel	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
								grades can be identified	
								Verify machinery adjusted to maintain within IACS or manufacturer's recommendations	
								Verify accuracy of marking and cutting	
								Verify storage of piece parts	
2.2	Straightening	Approval of straightening methods/procedures against deformation	Patrol and review	IACS Rec.47		Recognised standards, approved procedures	Not required	Verify that straightening processes are approved for the grade and type of steel, e.g. TMCP, z plate	
								Verify that plates and sections are within recognised tolerances	
2.3	Forming	Maintain material properties. Acceptance of forming method against unproper deformations	Patrol	IACS Rec.47		Shipbuilder's procedure for hot forming	Not required	Verify that temperature control is exercised by the operator	
								Verify that suitable methods of temperature control are available when forming special steels and materials	
								Verify that forming processes are acceptable	
2.4	Conformity with alignment/fit-up/gap criteria	Check alignment/fit-up/gap against reference standards	Patrol	IACS Rec.47		Shipbuilder's and recognised standards and Rules as applicable	Not required	Verify the processes to ensure satisfactory fit-up and alignment at all workstations	
								Verify that edge preparations are	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
								reinstated where lost during fitting operations	
								Verify remedial procedures are in place to compensate for wide gaps and alignment deviations	
2.5	Conformity for critical areas, when defined, with alignment/fit-up or weld configuration	Check alignment/fit-up/gap against approved drawings	Witness and review	IACS Rec.47		Shipbuilder's and recognised standards and Rules as applicable, approved plan or standard, builder's records	Approved plans of critical areas if applicable	Verify that the information relevant to the latest approved drawings is available at the workstations	
								Verify the processes to ensure satisfactory fit-up and alignment at all workstations	
								Verify that edge preparations are reinstated where lost during fitting operations	
								Verify remedial procedures are in place to compensate for wide gaps and alignment deviations	
3	Steelwork process, e.g. sub-assembly, block, grand and mega block assembly, pre-erection and erection, closing plates	Compliance with approved drawings, visual examination of welding and material, check alignment and deformations	Patrol of the process and witness of the completed item	IACS Rec.47		Approved plans, shipbuilder's inspection records, shipbuilder's and recognised standards and Rules as applicable, construction plan (steelwork subdivision)		Verify that the information relevant to the latest approved drawings is available at the workstations	
								Verify that correct weld sizes have been adopted	
								Verify operation of the welding processes at the different work stages is satisfactory	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
								Verify that piece parts are identifiable	
								Verify that fit-ups are within recognised tolerances	
								Verify that correct welding requirements specified in No.1 of this Table have been adopted	
								Verify processes for closing plates etc. are acceptable	
								Confirm that hull structure ~~steelwork~~ is in accordance with the approved plan	
4	Remedial work and alteration	Welding, check against deformation, alignment	Review records and witness	IACS Rec.47		Permanent record of shipyard surveyable items		Verify that records have been maintained of significant deviations from the approved plans, for situations such as mis-cut openings, re-routing outfit items	
								Verify that all deviations brought to the attention of the Surveyor by the shipbuilder are acceptable	
5	Tightness testing, including leak and hose testing, hydropneumatic testing	Absence of leaks	Review and witness of the test	~~Section 3, Chapter 4 of this PART~~ UR S14	Reg. II-1/11 of SOLAS, as amended	Approved tank testing plan, shipbuilder's inspection records	Approved tank testing plan	Confirm that tank testing is carried out in accordance with the approved plan	
								Confirm the methods used to carry out leak testing	
								Confirm that correct	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
								test pressures maintained for leak, hose and hydro and hydropneumatic testing is satisfactory	
								Verify that adequate records of the tank testing have been maintained	
6	Structural testing	Structural adequacy of the design	Review and witness of the test	~~Section 3, Chapter 4 of this PART~~ UR S14	Reg. II-1/11 of SOLAS, as amended	Approved tank testing plan, shipbuilder's inspection records	Approved tank testing plan	Confirm that tank testing is carried out in accordance with the approved plan	
								Confirm that correct test pressure maintained for testing is satisfactory	
								Verify that adequate records of the tank testing have been maintained	
7	Corrosion protection systems, e.g. coatings, cathodic protection, impressed current except for coating system subject to PSPC	Salt water ballast tanks with boundaries formed by the hull envelope, and also bulk carrier hold internal surfaces, coamings and hatch covers are to have an efficient protective coating. The safety of cathodic systems to be dealt with separately	Review and report on builder's & manufacturer's documentation	~~Section 6, Chapter 1 of PART TWO of the Rules, UI SC122~~ UR Z8 & Z9 , UI SC122, UR F1	Reg. II-1/3-2 of SOLAS, as amended	Manufacturer's and builder's specifications	Corrosion protection specifications	Verify that applied coatings are approved and review records of application	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
								Verify that adequate records have been maintained and copied to the ship construction file	
	Application of antifouling systems		Review		AFS Convention	Painting specification	Paint specification and Mfg Declaration	Verify that adequate records have been maintained and copied to the ship construction file	
7.1	Application of protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers subject to PSPC	Monitor implementation of the coating inspection requirements	Patrolling and review	UI SC223	Reg. II-1/3-2 of SOLAS, as amended	Signed and verified tripartite Agreement	Coating Technical File	Verify that applied coatings are approved and review records of application in accordance with Chapter 7 of Annex to MSC.215(82)	
8	Installation, welding and testing of the following:								
8.1	Hatch covers	Tightness and securing	Witness	~~Section 3, Chapter 4 of this PART~~ UR S14 and IACS Rec. 14	Reg. 13, 14, 15 and 16 of ILLC ’66	Approved tank testing plan, shipbuilder’s inspection records	Details required, structural drawings	Confirm leak test of hatch covers	
								Confirm operation and securing test	
8.2	Doors and ramps integral with the shell and bulkheads	Tightness and securing	Witness	~~Section 3, Chapter 4 of this PART~~ UR S14	Reg. II-1/18 of SOLAS as amended, Reg. 12 and 21 of ILLC ’66	Approved tank testing plan, shipbuilder’s inspection records	Details required	Confirm leak test	
								Confirm operation and securing test	
								Confirm safety device operation	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
								Ensure correct maintenance logs/manuals supplied with the ship construction file	
8.3	Rudders	Fitting	Witness	~~Section 3, Chapter 4 of this PART~~ UR S14		Approved plan, shipbuilder's inspection records	Details required, structural drawings	Confirm alignment and mounting and fitting up to the connection to the tiller	
								Confirm function test	
								Verify fitting of pintles and all securing bolts	
								Verify all fit-up records including all clearances maintained and placed into the ship construction file	
8.4	Forgings and castings	Compliance with approved drawings, visual examination of welding and material, check alignment and deformations	Patrol of the process and witness of the completed item	~~Chapters 5 and 6 of Rules for Materials and Welding~~ UR W7 & W8		Approved plans, shipbuilder's inspection records, shipbuilder's and recognised standards and Rules as applicable, construction plan (steelwork subdivision)	Copies of certificates of forgings and castings	Verify castings and forgings against material certificate	
								Verify that correct welding and fit-up requirements specified in Nos. 1, 2.4 and 2.5 of this Table have been adopted	
								Verify that material certificates are included in the ship construction file	
	Appendages							Verify that correct welding and fit-up requirements specified in reference 1, 2.4 and 2.5 of this Table have been adopted	
8.5	Equipment	Tightness and	Witness		Reg. II-1/16 &	Approved tank testing	Details	Verify that correct	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS① requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
	forming the watertight and weathertight integrity of the ship, e.g. overboard discharges, air pipes, ventilators	securing			16-1 of SOLAS, as amended; Reg. 17, 18, 19, 20, 22, 23 of ILLC '66	plan, shipbuilder's inspection records	required	welding and fit-up requirements specified in Nos. 1, 2.4 and 2.5 of this Table have been adopted	
								Verify compliance with Load Line Convention 1966 as amended - i.e. all fittings in accordance with the record of freeboard assignment	
				~~Appendix 4 of Chapter 2, PART THREE of the Rules~~ UR P3				Verify closing devices, e.g. air pipes, vents etc are of approved type	
								Verify material certificates for overboard discharges where applicable	
								Verify record of freeboard assignment and all material certificates included in the ship construction file	
	Freeboard marks and draft marks	Within allowable tolerances and in accordance with the freeboard assignment	Witness	UI-LL4	Reg. 4, 5, 6, 7 and 8 of ILLC'66		Details required	Verify freeboard marks in accordance with load line assignment	
								Verify draft marks in accordance with the agreed tolerances specified by the builder unless more onerous flag State requirements	
	Principal	Within allowable	Review and witness	IACS Rec. 47			Details	Verify principal	

No.	Shipbuilding function	Survey requirements for classification	Survey method required for classification	~~Rules and~~ IACS© requirements	Statutory requirements and relevant reference	Documentation available to Surveyor during construction	Ship construction file	Specific activities	Proposals for the project
	dimensions	tolerances					required	dimensions in accordance with recognised standard	
								Verify dimensions included in the ship construction file	
	Safety Construction certification	No outstanding imperfections or defects	Witness		Reg. I/7 or Reg. I/10 of SOLAS, as amended (as appropriate).			Verify that Administration requirements have been incorporated into the hull structure	

Shipbuilder's name	
Project	
Project duration	
Kick-off meeting date	
Representing builder	
CCS Surveyor	

Appendix 2 SHIPBUILDING AND REPAIR QUALITY STANDARD

1 Shipbuilding and Remedial Quality Standards for New Construction

1.6 Fabrication and fairness

1.6.1 Flanged longitudinals and flanged brackets (see Table 1.6.1);
1.6.2 Built-up sections (see Table 1.6.2);
1.6.3 Corrugated bulkheads (see Table 1.6.3);

CHAPTER 5 SURVEYS AFTER CONSTRUCTION

Section 1 GENERAL PROVISIONS

5.1.5 Definitions

5.1.5.3 The following definitions are added for bulk carriers in addition to those in 5.1.5.1 of this Chapter:

(2) A **double skin bulk carrier** is a ship which is constructed generally with single deck, double bottom, topside tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk, including such types as ore carriers and combination carriers,[①] in which all cargo holds are bounded by a double-side skin (regardless of the width of the wing space). Common Structural Rules[②] does not apply to ore and combination carriers.

5.1.6 Preparations for survey

5.1.6.1 Conditions for survey

(4) Sufficient illumination is to be provided to reveal corrosion, deformation, fractures, damages or other structural deterioration, as well as the condition of the coating.

5.1.6.4 Survey at sea or at anchorage[③]

(5) Self-propelled ships having the notation ESP (hereinafter referred to as ESP ships) are to comply with, in addition to 5.1.6.4(1) to (4), the following requirements:

② If the depth of the webs is more than 1.5 m, rafts or boats alone may be allowed only:

a. when the coating of the under deck structure is in GOOD condition and there is no evidence of wastage; or
b. if a permanent means of access is provided in each bay[④] to allow safe entry and exit. This means:
   (a) access direct from the deck via a vertical ladder and a small platform fitted approximately 2 m below the deck in each bay; or
   (b) access to deck from a longitudinal permanent platform having ladders to deck in each end of the tank. The platform is, for the full length of the tank, be arranged in level with, or above, the maximum water level needed for rafting of under deck structure. For this purpose, the ullage corresponding to the maximum water level is to be assumed not more than 3 m from the deck plate measured at the midspan of deck transverses and in the middle length of the tank, e.g. in respect to oil tankers (including double hull oil tankers) and chemical tankers, see Figure 5.1.6.4(5)②.

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① For combination carriers and combination carriers with longitudinal bulkheads, additional requirements are specified in Section 6 of this Chapter.

② PART TEN of the Rules (2012 version) and its 2013 and 2014 amendments or PART NINE of the Rules (2015 version) and its subsequent versions (including amendments).

③ Reference is made to IACS Recommendation No.39 − Guidelines for Use of Boats or Rafts for Close-up Surveys.

④ Bay is the area between adjacent transverse frames or transverse bulkheads.

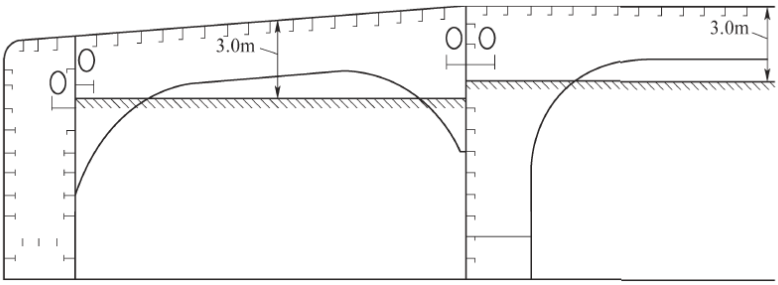

Figure 5.1.6.4(5)② Maximum Water Level in a Tank

If neither of the above conditions are met, then staging or an "other equivalent means" is to be provided for the survey of the under deck areas.

5.1.10 Repairs

5.1.10.1 Any damage in association with wastage over the allowable limits (including buckling, grooving, detachment or fracture), or extensive areas of wastage over the allowable limits, which affects or, in the opinion of the Surveyor, will affect the ship's structural, watertight or weathertight integrity, is to be promptly and thoroughly repaired (see 5.1.5.1(~~9~~8)).

5.1.17 Acceptance criteria

(2) Acceptance criteria for pitting corrosion of CSR ships

① Side structures of bulk carriers

~~The minimum remaining thickness in pits, grooves or other local areas is to be greater than the following~~:

The minimum remaining thickness in pits, grooves or other local areas is to be greater than:

a. 75% of the as-built thickness, in the frame and end brackets webs and flanges;

b. 70% of the as-built thickness, in the side shell, hopper tank and topside tank plating attached to the each side frame, over a width up to 30 mm from each side of it~~.~~,

without being greater than $t_{ren.}$

Section 3 RETROSPECTIVE REQUIREMENTS FOR EXISTING SHIPS

5.3.5 Strength and securing of small hatches on the exposed fore deck and air pipes, ventilator pipes and their closing devices thereover

5.3.5.1 Application

(1) General dry cargo ships (excluding container ships, vehicle carriers, ro-ro ships and woodchip carriers), ore carriers, combination carriers (e.g. oil/bulk/ore carriers, ore/oil carriers) and bulk carriers that are contracted for construction prior to 1 January 2004, of 100 m in length or more.

Section 6 ADDITIONAL REQUIREMENTS FOR HULL AND EQUIPMENT SURVEYS OF OIL TANKERS

5.6.3 Intermediate surveys

5.6.3.2 Oil Tankers 5 to 10 years of age

5.6.3.3 Oil Tankers 10 to 15 years of age

Section 7 ADDITIONAL REQUIREMENTS FOR HULL AND EQUIPMENT SURVEYS OF BULK CARRIERS

5.7.3 Intermediate surveys

5.7.3.2 Bulk carriers 5 to 10 years of age

5.7.3.3 Bulk carriers 10 to 15 years of age

Section 12 SURVEYS OF PROPELLER SHAFTS AND TUBE SHAFTS

5.12.4 Survey related to notation SCM

5.12.4.3 For oil-lubricated propeller shafts, the shaft condition monitoring (SCM) is to be verified during each annual survey of the ship, covering:

Appendix 11A SURVEY PROGRAMME

1 Preamble

1.1 Scope

(1) The present survey programme covers the minimum extent of overall surveys, close-up surveys, thickness measurements and pressure testing within the cargo (length) area, cargo holds, ballast tanks, including fore and aft peak tanks, required by Sections 6 to 8 of this Chapter.

8 Identification of tanks for tank testing

12 Damage experience related to the ship

Hull Damages for Sister or Similar Ships (if available) in the Case of Design Related Damage

Cargo hold, tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

Appendix 11B SURVEY PLANNING QUESTIONNAIRE

(Bulk Carriers/Oil Tankers/Chemical tankers)

1 The following information will enable the owner in co-operation with CCS to develop a survey programme complying with the requirements of this Chapter. It is essential that the owner provides, when completing the present questionnaire, up-to-date information. The present questionnaire, when completed, is to provide all information and material required by this Chapter.

Information on access provision for close-up surveys and thickness measurement

2 The owner is to indicate, in the table below, the means of access to the structures subject to close-up survey and thickness measurement.

Hold/ Tank No.	Structure	①C (Cargo)/B (ballast tank)	Permanent means of access	Temporary means of access	Rafts	Ladders	Direct access	Other means (please specify)
F.P. (oil tankers/ bulk carriers/ chemical tankers)	Fore peak							
A.P. (oil tankers/ bulk carriers/ chemical tankers)	Aft peak							
Cargo holds (bulk carriers)	Hatch side coamings							
	Topside sloping plate							
	Upper stool plating							
	Cross deck							
	Side shell, frames & brackets							
	Transverse bulkhead							
	Hopper tank plating							

Hold/ Tank No.	Structure	①C (Cargo)/B (ballast tank)	Permanent means of access	Temporary means of access	Rafts	Ladders	Direct access	Other means (please specify)
	Lower stool							
	Tank top plating							

CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF SEA-GOING STEEL SHIPS

AMENDMENTS

2021

PART TWO HULL

Revision explanation

1. Blue underline is to highlight new insertions, strikethrough line is to highlight deleted contents and cross line may be used to highlight deleted tables or figures.

2. No change in the English text means that only Chinese text is editorially revised while the change of corresponding English version is not needed.

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CHAPTER 1 GENERAL

Section 3 MATERIALS

1.3.1 General requirements

1.3.1.7 The material factor *K* of hull structural steel is given in Table 1.3.1.7.

Material Factor *K* **Table 1.3.1.7**

Yield strength R_{eH} (N/mm^2)	Material factor *K*	Yield strength R_{eH} (N/mm^2)	Material factor *K*
235	1.0	355	0.72
265	0.92	390	0.68 (0.66①)
315	0.78	460	0.62②

Notes:

① only apply to the strength deck and hatch coaming of containerships complying with the requirements of 7.1.1.4 of Section 1, Chapter 7 of this PART;

② only apply to upper deck plating, hatch coaming plate and top plating with the range of thickness 50 mm < t ≤ 100 mm onboard container ships.

③ for materials with yield strength not listed in the table, the material factor may be specially considered.

1.3.3 Requirements for steel used for refrigerated space structures

1.3.3.1 Where the minimum design temperature t_D of the steel falls below 0℃ in refrigerated spaces, in addition to the requirements of 1.3.2 of this Section, the steel grade for the deck plating, webs of deck girders, longitudinal bulkhead strakes attached to deck and beams for supporting hatchway covers and their face plates is to comply with the requirements of Table 1.3.3.1.

Steel Grade of Structural Members in Refrigerated Spaces **Table 1.3.3.1**

Thickness (mm)	~~0 ~ -10℃~~ 0℃＞t_D≥-10℃		~~-10 ~ -25℃~~ -10℃＞t_D≥-25℃		~~-25 ~ -40℃~~ -25℃＞t_D≥-40℃	
	Mild steel	Higher tensile steel	Mild steel	Higher tensile steel	Mild steel	Higher tensile steel
$t \leq 12.5$	B	AH	D	DH	E	EH
$12.5 < t \leq 25.5$	D	DH	E	EH	Specially considered①	Specially considered②
$t > 25.5$	E	EH	Specially considered①	Specially considered②	Specially considered①	Specially considered②

Notes: ① Austenitic stainless steel may generally be used.

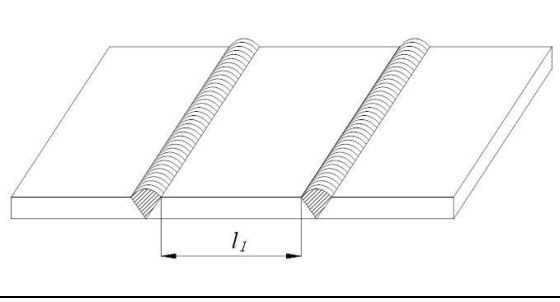
② Grade FH may generally be used.

Section 4 WELD DESIGN FOR HULL STRUCTURES

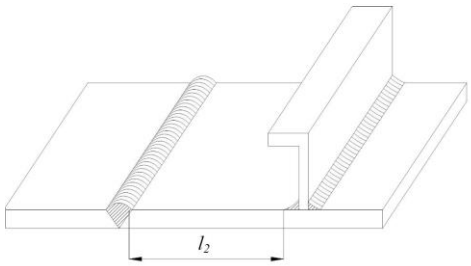
1.4.1 General requirements

1.4.1.4 Parallel welded seams in the main hull structures are to be spaced an adequate distance apart. The distance l_1 between two parallel butt welded seams is not to be less than 100 mm, and the butt welded seams are not to be intersected with an acute angle. Where a butt welded seam is in parallel with a fillet welded seam, the distance l_2 between them is not to be less than ~~50~~10 mm. The distance between the above

two welded seams is in general the distance between inner edges of two weld toes (as shown in Figure 1.4.1.4).



Distance between butt weld toes



Distance between butt and fillet weld toes

Figure 1.4.1.4

1.4.2 Welding consumables

1.4.2.1 Welding consumables used for hull structures are to comply with the requirements of CCS Rules for Materials and Welding. The grade of welding consumables selected is to be suitable for the grade of hull structural steel, and is to comply with the requirements of Table 1.4.2.1. Welding consumables of H47 steels are to be selected by referring to CCS Guidelines for Application of Thick Higher Strength Steel Plates for Ships and welding consumables of other steels are to be selected by referring to CCS Guidelines for Inspection of Hull Welds.

Selection of Welding Consumables **Table 1.4.2.1**

Hull structural steel grade / Grade of welding consumables	A	B	D	E	AH27 AH32 AH36	DH27 DH32 DH36	EH27 EH32 EH36	FH27 FH32 FH36	AH40	DH40	EH40	FH40
1	×											
2	×	×	×									
3	×	×	×	×								
1Y	×				×②							
2Y	×	×	×		×	×						
3Y	×	×	×	×	×	×	×					
4Y	×	×	×	×	×	×	×	×				
2Y40	①	①	①		×	×			×	×		
3Y40	①	①	①	①	×	×	×		×	×	×	
4Y40	①	①	①	①	×	×	×	×	×	×	×	×
5Y40	①	①	①	①	×	×	×	×	×	×	×	×

Notes: "×" means applicable;

① When joining structural steels of normal strength, it is not recommended to use a much higher grade of welding consumable.

② When using Grade 1Y welding consumables, the material thicknesses should not exceed 25 mm.

1.4.4 Fillet welds

Weld Factors **Table 1.4.4.2**

7. Structure in hoppers of hopper dredgers		
(1) Bulkhead boundary connections	0.44	At bottom and bilge
	0.34	At deck and coamings
(2) Cross members ~~in side tanks~~ to longitudinal bulkheads	0.44	
(3) Pillar end connections	0.34	
(4) Hopper door hinges of self-unloading ships	0.44	Deep penetration

(Excerpt)

Section 5 DIRECT STRENGTH CALCULATIONS

1.5.2 Motions and accelerations

(4) The maximum pitch angle ψ_m is to be calculated as follows, but need not be greater than 0.14 rad:

$$\psi_m = 0.25\frac{a_0}{C_b} \qquad \text{rad}$$

where: C_b — block coefficient;

a_0 — acceleration factor, to be calculated as follows:

$$a_0 = f_\gamma\left(3\frac{C}{L} + C_V\frac{V}{\sqrt{L}}\right)$$

where: f_r — service coefficient, see 1.5.1.7 of this Section;

$C_V = \frac{\sqrt{L}}{50}$, not to be greater than 0.2;

V — maximum service speed, in kn;

C — coefficient, see 2.2.3.1 of Section 2, Chapter 2 of this PART;

L — length of ship, in m.

Section 7 FORE DECK FITTINGS

1.7.2 Strength and securing of small hatches on the exposed fore deck

~~1.7.2.1 The provisions of this Section apply to the strength of, and securing devices for, small hatches fitted on the exposed deck within the forward 0.25 *L*. The small hatches are designed for access to spaces below the deck and are capable of being closed weathertight or watertight, as applicable. Their opening is normally 2.5 m^2 or less.~~

~~1.7.2.2 Hatches designed for emergency escape need not comply with the requirements of 1.7.2.8(1), 1.7.2.8(2), 1.7.2.9(3) and 1.7.2.10 of this Section. Securing devices of hatches designed for emergency escape are to be of a quick-acting type (e.g., one action wheel handles are provided as central locking devices for latching/unlatching of hatch cover) operable from both sides of the hatch cover. The maximum force needed to open the securing device is not to exceed 150 N, and the use of a spring equalizing, counterbalance or other suitable device on the hinge side to reduce the force needed for opening such hatch covers is acceptable. These requirements apply to new vessels, contracted for construction on or after 1 July 2007, by the time of delivery; to vessels contracted for construction prior to 1 July 2007, by the compliance date specified in 5.3.5 of Chapter 5, PART ONE of the Rules, or by the due date of the first special survey after 1 July 2007, whichever is later. Completion prior to 1 July 2007 of a special survey with a due date after 1 July 2007 cannot be used to postpone compliance.~~

~~1.7.2.3 For all ships of 80 m or over in length, where the height of the exposed deck in way of the hatch is less than 0.1 *L* or 22 m above the summer load waterline, whichever is the lesser, the strength and securing of small hatches on the exposed deck over the forward 0.25 *L* are to comply with the requirements of 1.7.2 of this Section.~~

1.7.2.1 The provisions of this Section apply to the strength of, and securing devices for, small hatches fitted on the exposed deck over the forward 0.25 *L* ,where the height of the exposed deck in way of the hatch is less than 0.1 *L* or 22 m above the summer load waterline, whichever is the lesser, for all ships of 80 m or over in length.

1.7.2.2 Small hatches are hatches designed for access to spaces below the deck and capable of being closed weather-tight or watertight, as applicable. Their opening is normally 2.5 m^2 or less.

1.7.2.3 Hatches designed for emergency escape need not comply with the requirements of 1.7.2.8(1), 1.7.2.8(2), 1.7.2.9(3) and 1.7.2.10 of this Section. Securing devices of hatches designed for emergency escape are to be of a quick-acting type (e.g., one action wheel handles are provided as central locking devices for latching/unlatching of hatch cover) operable from both sides of the hatch cover. The maximum force needed to open the securing device is not to exceed 150 N, and the use of a spring equalizing, counterbalance or other suitable device on the hinge side to reduce the force needed for opening such hatch covers is acceptable. These requirements apply to new vessels, contracted for construction on or after 1 July 2007, by the time of delivery; to vessels contracted for construction prior to 1 July 2007, by the compliance date specified in 5.3.5 of Chapter 5, PART ONE of the Rules, or by the due date of the first special survey after 1 July 2007, whichever is later. Completion prior to 1 July 2007 of a special survey with a due date after 1 July 2007 cannot be used to postpone compliance.

Section 12 STRUCTURAL ARRANGEMENT

1.12.2 Arrangement of watertight bulkheads

1.12.2.1 All ships are to be fitted with at least the following watertight bulkheads:

(5) the number of watertight bulkheads and their distribution along the ship's length for oil tankers of 600 deadweight tons and above are to comply with the requirements of Chapters ~~2~~3 and ~~3~~4 of MARPOL Annex I, in addition to the requirements of (1) to (3) above.

1.12.4 Arrangement of after peak and machinery space bulkheads and stern tube

1.12.4.1 Bulkheads are to be fitted separating the machinery space from cargo and accommodation spaces forward and after and made watertight up to the bulkhead deck of passenger ships and the freeboard deck of cargo ships. An aft peak bulkhead is also to be fitted and made watertight up to the bulkhead deck or the freeboard deck. The aft peak bulkhead may, however, be stepped below the bulkhead deck or the freeboard deck, provided the degree of safety of the ship as regards subdivision is not thereby diminished.

1.12.7 Other openings and their closing appliances

1.12.7.1 All access openings in bulkheads at ends of enclosed superstructures are to comply with the following requirements:

(2) Unless otherwise permitted by the flag Administration, doors are to open outwards and be protected against wave impact.

1.12.14 Access and its openings and other requirements

1.12.14.3 When implementing the provisions of 1.12.14.1 and 1.12.14.2 of this Section, for oil tankers of less than 5,000 tons deadweight, openings of smaller dimesions may be provided subject to the agreement of the flag State Administration, provided that the ability to traverse such openings or to remove an injured person can be proved. However in any case, the size of openings is not to be less than 400 mm × 600 mm or 450 mm × 550 mm ~~and the structural member with openings is required to have sufficient strength~~.

CHAPTER 2 HULL STRUCTURES

Section 2 LONGITUDINAL STRENGTH

2.2.1 General requirements

2.2.1.2 For ships complying with the following conditions, special considerations are required for longitudinal strength ~~and documents for such ships are to be submitted to CCS for approval~~:

(1) For ships having one or more of the following characteristics, direct calculations are in general to be carried out~~;~~, of which, ~~see 2.2.9 of this Section for~~ direct calculation of wave loads is given in 2.2.9 of this Section:

$L/B \leq 5$

$B/D \geq 2.5$

$L \geq 500$ m

$C_b < 0.6$

(2) For ships having large deck openings, the longitudinal strength at combined bending and torque is to be checked according to the requirements in Section 10, Chapter 7 of this PART.

(3) For ships having large flare, additional bending moment caused by slamming may be considered.

(4) For ships intended for the carriage of special cargoes (e.g. heated cargoes), ships of unusual type or ships of unusual design, direct calculations are to be carried out in accordance with properties of cargoes or ship's type; where direct calculations are impracticable, design loads are to be determined by means of model test.

2.2.9 Direct calculation of wave loads

2.2.9.4 For specific ships, e.g. engineering ships which need to carry out short-term operation, short-term prediction of wave loads is to be used to determine wave loads in the operating condition based on the most severe short-term sea state provided by the designer. The period of short-term prediction is generally taken as 3 hours or the operating hours provided by the designer, whichever is greater.

Section 3 SHELL PLATING

2.3.7 Openings in shell plating

2.3.7.3 Sea inlets and other openings are to have well rounded corners. The thickness of sea inlet box plating and its steel grade ~~is~~ are not to be lower than ~~the same as that of~~ the adjacent shell. For ships of 90 m or over in length, this thickness is not to be less than 12 mm, but need not exceed 25 mm.

Section 6 DOUBLE BOTTOMS

2.6.1 General requirements

2.6.1.4 Manholes are to be cut in the floors and side girders. Except for lightened floors, the depth of manholes is not to exceed 50% of that of the double bottom, unless edge reinforcement is provided. Manholes cut in floors are to be arranged along a straight line in the fore and aft direction for easy access. Manholes or lightening holes are not permitted ~~in way of the~~ within the range of floor ends (generally taken as 1 spacing of longitudinals in way of the longitudinal bulkhead or 600 mm, whichever is greater)

and in the side girders for one frame space from transverse bulkheads, unless the edges of holes are strengthened. The edges of all holes are to be smoothed.

Section 15 STRENGTHENING AT ENDS OF SHIP

2.15.1 Fore peak strengthening

2.15.1.11 Where the side shell is framed transversely, the perforated flats are to comply with the following requirements:

(1) The area of perforations in each flat is not to be less than 10% of the total area of the flat.

(2) The plate thickness t of the perforated flat is not to be less than that obtained from the following formula:

$$t = 0.023L + 5 \quad \text{mm}$$

where: L — length of ship, in m.

(3) Where the perforated flat is framed transversely, ~~Beams are~~ one beam is at least to be fitted at alternate frames below the perforated flat, and their sectional area A without attached plating is not to be less than that obtained from the following formula:

~~$A = 0.13L + 4$ cm^2~~

$$A = (0.13L + 4)CK \quad \text{cm}^2$$

where: L — length of ship, in m.

C — coefficient, C =1 when beams are fitted at alternate frames; C =0.5 when beams are fitted at every frame;

K — material factor.

Where the perforated flat is framed longitudinally, an appropriate number of transverses are to be fitted below the perforated flat, and the size of transverses and longitudinals is to be specially considered.

(4) Scantlings of the brackets connecting the beams of the perforated flat to the frames are to comply with the requirements in 1.2.6 of this PART.

Section 18 HELICOPTER DECKS

2.18.2 Plans and documents

2.18.2.2 Loading manual is to include information on models and parameters of helicopters to be used, (including maximum takeoff weight, ~~diameter of rotor~~ overall length of helicopter (including rotation of rotor), size of wheel print and tracking width).

CHAPTER 3 EQUIPMENT AND OUTFITS

Section 2 ANCHORING AND MOORING EQUIPMENT

3.2.3 Chain cables

3.2.3.2 Wire rope may be used in place of chain cable on ships with less than 40 m in length and subject to the following conditions:

(1) The wire ropes are to have a total length equal to 1.5 times the corresponding length of stud link chain cables required in Table 3.2.1.1(2), and a minimum breaking load equal to that given for the corresponding stud link chain cable of Grade CCS ~~AM~~1.

(2) A short length of chain cable is to be fitted between the wire rope and the anchor, having a length equal to 12.5 m or the distance from the anchor in the stowed position to the winch, whichever is the lesser.

(3) All surfaces being in contact with the wire need to be rounded with a radius of not less than 10 times the wire rope diameter (including stem).

3.2.3.5 Grade CCS~~AM~~1 material having a tensile stress of less than 400 N/mm^2 is not to be used in association with high holding power anchors. Grade CCS~~AM~~3 material is to be used only for chains of 20.5 mm or more in diameter.

3.2.3.6 The total length of chain given in Table 3.2.1.~~2~~1(2) is to be divided in approximately equal parts between the two bower anchors.

Section 5 EMERGENCY TOWING ARRANGEMENTS

3.5.6 Requirements for the arrangements and components

3.5.6.2 Different solutions on design of chafing gear may be used. If a chafing chain is used, the following requirements are to be complied with:

(1) the chafing chain is to be stud link chain and is to extend from the strongpoint to a point at least 3 m beyond the fairlead;

(2) one end of the chafing chain is to be suitable for connection to the strongpoint. The other end is to be fitted with a standard pear-shaped open link allowing connection to the towing pennant via a standard bow shackle. A typical outboard chafing chain end and a pear-shaped open link are shown in Figure 3.5.6.2(2);

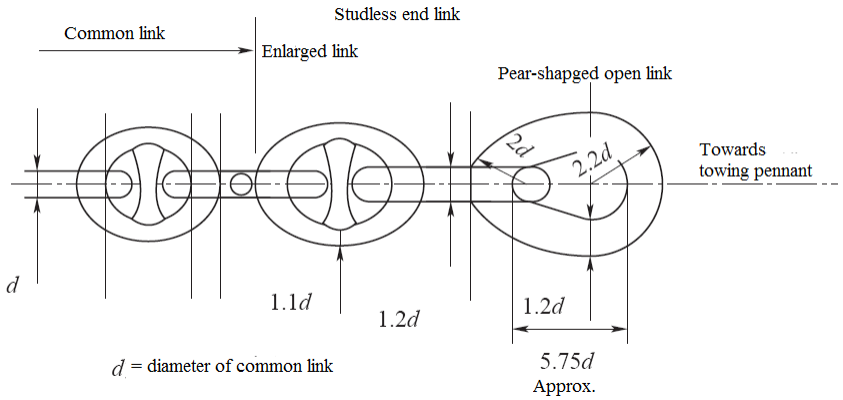


Figure 3.5.6.2(2) Typical Outboard Chafing Chain End

(3) in addition to this Section, the chafing chain is to be designed, manufactured, tested and certified in accordance with the relevant requirements of Section 2, Chapter 10 of PART ONE of CCS Rules for Materials and Welding;
(4) chafing chains are to be made of ~~A~~M2 or ~~A~~M3 chain steel by manufacturers approved by CCS;
(5) the nominal diameter of common links for chafing chains is to comply with the values indicated in Table 3.5.6.2(5) and the nominal diameter of other links are to be determined according to Figure 3.5.6.2(2);
(6) the chafing chain is to be stowed in such a way that it can be rapidly connected to the strongpoint.

Section 6 SHIPBOARD FITTINGS AND SUPPORTING HULL STRUCTURES ASSOCIATED WITH TOWING AND MOORING ON CONVENTIONAL VESSELS

3.6.4 Mooring

3.6.4.3 Load considerations

(1) The minimum design load applied to supporting hull structures for shipboard fittings is to be 1.15 times the minimum breaking strength of the mooring line according to 3.2.4 of this ~~Section~~ Chapter.
(2) The minimum design load applied to supporting hull structures for winches is to be 1.25 times the intended maximum brake holding load, where the maximum brake holding load is to be assumed not less than 80% of the minimum breaking strength of the mooring line according to 3.2.4 of this ~~Section~~ Chapter. For supporting hull structures of capstans, 1.25 times the maximum hauling-in force is to be taken as design load.
(3) When a safe working load SWL greater than that determined according to 3.6.4.6 is requested by the applicant, then the design load is to be increased in accordance with the appropriate SWL/design load relationship.
(4) The design load is to be applied to fittings in all directions that may occur by taking into account the arrangement shown on the towing and mooring arrangements plan. Where the mooring line takes a turn at a fitting the total design load applied to the fitting is equal to the resultant of the design loads acting on the line, refer to Figure 3.6.3.3(5). However, in no case does the design load applied to the fitting need to be greater than twice the design load on the line.

3.6.4.4 Shipboard fittings may be selected from an accepted industry standard and at least based on the minimum breaking strength of the mooring line according to 3.2.4 of this ~~Section~~ Chapter.
Mooring bitts (double bollards) are to be chosen for the mooring line attached in figure-of-eight fashion if the industry standard distinguishes between different methods to attach the line, i.e. figure-of-eight or eye splice attachment.
When the shipboard fitting is not selected from an accepted Industry standard, the design load used to assess its strength and its attachment to the ship is to be in accordance with 3.6.4.3 and 3.6.4.5 of this Section. Mooring bitts (double bollards) are required to resist the loads caused by the mooring line attached in figure-of-eight fashion. It is to be observed that in this case either of the two posts of the mooring bitt can be subjected to a force twice as large as that acting on the mooring line. For strength assessment beam theory or finite element analysis using net scantlings is to be applied, as appropriate. Corrosion additions are to be as defined in 3.6.6. A wear down allowance is to be included as defined in 3.6.7. At the discretion of the classification society, load tests may be accepted as alternative to strength assessment by calculations.

3.6.4.6 Safe Working Load (SWL)

(1) The Safe Working Load (SWL) is the load limit for mooring purpose.

(2) Unless a greater SWL is requested by the applicant according to 3.6.4.3(3), the SWL is not to exceed the minimum breaking strength of the mooring line according to 3.2.4 of this ~~Section~~ Chapter.

(3) The SWL, in t, of each shipboard fitting is to be marked (by weld bead or equivalent) on the deck fittings used for mooring. For fittings intended to be used for, both, mooring and towing, TOW, in t, according to 3.6.3.6 is to be marked in addition to SWL.

(4) The above requirements on SWL apply for the use with no more than one mooring line.

(5) The towing and mooring arrangements plan mentioned in 3.6.5 is to define the method of use of mooring lines.

Appendix 1 GUIDELINES FOR CALCULATION OF BENDING MOMENT AND SHEAR FORCE DISTRIBUTION

2.4 Semi spade rudder with one elastic support

Data for the analysis

~~l_{10} – l_{50} = lengths of the individual girders of the system, in m;~~

l_{10} – l_{40} = lengths of the individual girders of the system, in m;

~~I_{10} – I_{50} = moments of inertia of these girders, in cm^4.~~

I_{10} – I_{40} = moments of inertia of these girders, in cm^4.

CHAPTER 5 DOUBLE HULL OIL TANKERS

Section 2 SHELL PLATING

5.2.5 Side shell plating

5.2.5.1 Where longitudinal side framing is adopted, the thickness t of side shell plating within 0.4L amidships is to comply with the following requirements:

(4) In calculation of t_1, except the minimum range of high tensile steel stipulated in Section 2 of Chapter 2, the material factor K may be taken as 1.

Section 4 DOUBLE BOTTOM STRUCTURE

5.4.2 Bottom girders

5.4.2.10 The inner framing of duct keels is to comply with the following requirements:

(3) ~~Discontinuous~~ ~~i~~Inner bottom longitudinals and bottom longitudinals are ~~also~~ to be fitted ~~in duct keels~~ within the duct keel on the centreline of the ship, which may be intercostal in way of transverse framing members.

Section 13 CARGO TANK HATCHWAYS

5.13.2 Requirements for cargo tank hatchways

5.13.2.4 ~~Ullage holes and s~~Sighting ports having a diameter not less than 150 mm are to be provided in the covers. These holes are to be provided with effective closing appliances to ensure oil-tightness.

CHAPTER 6 SINGLE HULL OIL TANKERS

Section 2 SHELL PLATING AND DECKS

6.2.4 Side shell plating

6.2.4.1 The thickness t of side shell plating within 0.4L amidships is to comply with the following requirements:

(4) For calculation of t_1, except for the minimum scope of higher tensile steels specified in Section 2 of Chapter 2, the material factor K may be taken as 1.

CHAPTER 7 CONTAINER SHIPS

Section 1 GENERAL PROVISIONS

7.1.1 Application

7.1.1.3 Where the hull structural higher tensile steels of more than 50 mm and up to 100 mm in thickness with the minimum yield strength greater than 355 N/mm^2 are used on board container ships, the requirements of CCS Guidelines for ~~Inspection~~ Application of Thick Higher Strength Steel Plates for Ships are to be complied with.

Section 8 BOW SIDE STRUCTURE STRENGTHENING

7.8.1 General requirements

7.8.1.3 The bow slamming head h_s under consideration is to be obtained from the following formula:

$$h_s = C_s\left(0.22 + 0.15\tan\alpha\right)\left(0.4V\sin\beta + 0.6\sqrt{L}\right)^2 \quad \text{m}$$

where: C_s = 0.144 (C – 0.5h_1), and not to be greater than 0.8;

where: h_1 — vertical distance between summer load line and the point under consideration, in m, see Figure 7.8.1.3(1). For shell plating, the point is to be taken at centre of plate panel; for members, the point is to be taken at mid-span;

C — coefficient of wave, see 2.2.3.1 of this PART;

α — flare angle at the point under consideration, defined as angle (°) between vertical line and shell plating tangent in the cross section, see Figure 7.8.1.3(1);

β — entrance angle at the point under consideration, defined as angle (°) between centreline and shell plating tangent in the horizontal plane, see Figure 7.8.1.3(2);

V — ~~maximum design speed when fully loaded~~ maximum service speed, in kn;

L — length of ship, in m, but need not be taken as greater than 250 m.

Section 9 ADDITIONAL REQUIREMENTS FOR CONTAINER SHIPS OF GREATER THAN 250 M IN LENGTH

7.9.11 Transverse bulkhead of container hold

7.9.11.4 The scantlings of watertight transverse bulkhead platings and stiffeners are to be determined in accordance with the requirements of Section 12, Chapter 2 of this PART. ~~But the thickness of plating of the lowest strake of bulkheads need not be increased by 1 mm above that obtained from calculation, and t~~The design head h is to be determined in accordance with the following requirements:

(1) For watertight transverse bulkhead platings, the design head h is to be determined in accordance with the following requirements (whichever is the greatest):

① vertical distance measured from the lower edge of the plate in a strake to the deepest equilibrium waterline obtained from the applicable damage stability calculations;

② vertical distance measured from the lower edge of the plate in a strake to the freeboard deck;

③ 2.5 m.

(2) For stiffeners, the design head h is to be determined in accordance with the following requirements (whichever is the greatest):

① vertical distance measured from the mid-span of stiffeners to the deepest equilibrium waterline obtained from the applicable damage stability calculations;
② vertical distance measured from the mid-span of stiffeners to the freeboard deck;
③ 2 m.

CHAPTER 8 BULK CARRIERS

Section 1 GENERAL PROVISIONS

8.1.1 Application

8.1.1.3 CSR bulk carriers are to comply with the requirements ~~for bulk carrier structure (CSR)~~ in PART NINE of the Rules. Wood chip carriers specifically designed and constructed for carrying wood chips are to comply with the requirements of CCS Guidelines for Hull Structure of Wood Chip Carriers.

8.1.2 Class notations

8.1.2.2 Bulk carriers ~~of double side skin construction~~ complying with the provisions of this Chapter, of which all cargo holds are bounded by double side skin construction of not less than 1000 mm breadth between the inner shell and the outer shell, are to ~~may~~ be assigned one of the following notations:

(1) "Bulk Carrier, Double Side Skin" for double side skin bulk carriers;

(2) "Bulk Carrier, Double Side Skin, Strengthened for Heavy Cargoes" for double side skin bulk carriers strengthened for heavy cargoes;

(3) "Bulk Carrier, Double Side Skin, Strengthened for Heavy Cargoes, Holds a,b,… may be empty" for double side skin bulk carriers strengthened for heavy cargoes with specified or alternate holds empty.

8.1.2.3 Typical bulk carriers of 150 m or over in length and constructed with single deck, double bottom, topside tanks and hopper tanks in the cargo hold region and of single side skin or double side skin construction are to be assigned one of the following harmonized notations: ~~of~~ BC-A; ~~,~~ BC-B; ~~or~~ BC-C ~~respectively~~. The harmonized notations and relevant design loading conditions are to comply with the requirements of Section 12 of this Chapter.

Section 3 SIDE FRAMING

8.3.3 Main Frames

8.3.3.4 The section modulus W of the main frames in holds is not to be less than that obtained from the following formula:

~~$W = 5.8\,sh_1l^2K$ cm^3~~

$$W = 5.8sh_1l^2K \quad \text{cm}^3$$

where: s — spacing of frames, in m;

K — material factor;

h_1 — vertical distance, in m, measured between the midpoint of the span of frames and a point situated at $0.01L + 0.8$ above the load waterline, see Figure 8.3.3.4, where: L — the length of ship, in m;

l — span of frame, in m, i.e. the distance measured between the intersection of sloping plating with the side shell; for $l < 0.25D$, to be taken as $0.25D$ (D being moulded depth, in m).

Section 7 ADDITIONAL REQUIREMENTS FOR LOADING MANUALS AND LOADING INSTRUMENTS

8.7.1 Application

8.7.1.2 Hold mass curves are calculated and drawn in accordance with Appendix 2 of this Chapter.

Section 12 HARMONIZED NOTATIONS AND CORRESPONDING DESIGN LOADING CONDITIONS FOR BULK CARRIERS

8.12.2 Application

8.12.2.1 ~~This Section applies to single side skin and double side skin bulk carriers of 150 m or over in length.~~ Typical bulk carriers of 150 m or over in length and constructed with single deck, double bottom, topside tanks and hopper tanks in the cargo hold region and of single side skin or double side skin construction are to comply with relevant requirements of this Section.

Section 14 DOUBLE SIDE STRUCTURE

8.14.1 General requirements

8.14.1.1 This Section applies to the ~~determination of arrangements and scantlings of frames in~~ double side skin construction within the cargo area of ~~double side skin~~ bulk carriers.

CHAPTER 9 ROLL ON-ROLL OFF SHIPS, PASSENGER SHIPS, RO-RO PASSENGER SHIPS AND FERRIES

Section 2 HULL STRUCTURE

9.2.6 Vehicle deck

9.2.6.2 ~~Where vehicle deck framing is fitted with deck transverses and girders, their scantlings may be determined by direct calculations in accordance with the relevant requirements of Section 7 of this Chapter.~~ The strength of primary supporting members of vehicle deck is to comply with relevant requirements in Section 7 of this Chapter.

Section 6 VEHICLE RAMPS

9.6.1 Structural strength of vehicle ramps

9.6.1.1 Vehicle ramps are to comply with ~~T~~the relevant requirements of Section 21, Chapter 2 of this PART ~~are to be complied with~~.

~~9.6.2 Framing of vehicle ramps~~

9.6.1.2 The strength of vehicle ramps is to be checked in accordance with the following requirements:

(1) the ramp is in a lowered position;

(2) the design vehicle load multiplied by coefficient 1.1 is the load acting on the ramp at its worst position and the mass of the ramp is also to be considered;

(3) allowable bending stress $[\sigma] = 141/K$, in N/mm^2, with K being the material factor; allowable deflection $[f] = l/200$ mm, with l being the distance between the supporting points of primary structures of vehicle ramps, in mm.

9.6.3~~2~~ Connecting hinges of vehicle ramps

9.6.2.1 Connecting hinges of vehicle ramps are to comply with ~~T~~the following requirements ~~are to be complied with~~:

~~(1) The diameter d of the axial pin of hinges is to comply with the following:~~

$$d \geq \sqrt{\frac{1.27F}{[\tau]}} \text{ ~~mm~~}$$

~~(2) The size of the central eye plate of hinges is to comply with the following:~~

$$\frac{F}{b_0 t_0} \leq [\tau], \text{ ~~—~~ } b_0 \geq d$$

~~(3) The size of the eye plates on both sides of hinges is to comply with the following:~~

$$\frac{F}{2t_1 t_2} \leq [\tau] \text{ ~~,—~~ } t_1 \geq d/2$$

~~where: F —— maximum shear force sustained by hinges, in N;~~

~~t_1, t_2, b_0, t_0, d —— see Figure 9.6.3;~~

~~$[\tau]$ —— allowable shear stress, to be taken as $[\tau] = 81.6/K$, in N/mm^2, K being the material factor.~~

(1) The diameter d of the axial pin is to comply with the following:

$d \geq d_0$ mm

(2) The size of the central eye plate of hinges is to comply with the following:

$$\frac{F}{2b_0t_0} \leq [\tau], \quad b_0 \geq d_0$$

(3) The size of the eye plates on both sides of hinges is to comply with the following:

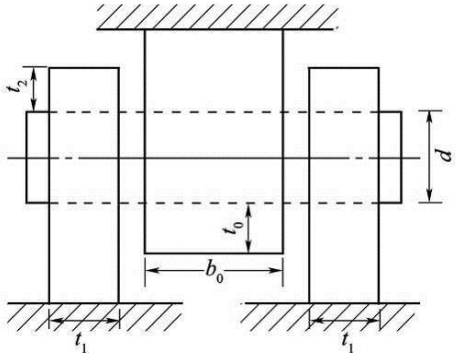
$$\frac{F}{4t_1t_2} \leq [\tau], \quad t_1 \geq d_0 / 2$$

where: d_0 — minimum required diameter of the axial pin, $d_0 = 0.92\sqrt{\frac{F}{[\tau]}}$ mm;

F— maximum force transmitted by the hinge, in N;

t_1, t_2, b_0, t_0, d — size of hinge parts, in mm, see Figure 9.6.2.1;

$[\tau]$ — allowable shear stress, to be taken as $[\tau] = 81.6/K$, in N/mm^2, K being the material factor.



~~Figure 9.6.3 (in mm)~~ **Figure 9.6.2.1 Hinge Size**

Section 7 DIRECT CALCULATIONS

~~**9.7.2 Design loads**~~

~~9.7.2.1 For the acceleration of ship motions, see the relevant requirements of Section 5, Chapter 1 of this PART.~~

~~9.7.2.2 For direct strength calculation of vehicle deck structure, the design load P_V of deck is to be calculated as follows:~~

~~$P_V = (g + 0.5a_v)M$ kN~~

~~where: g — acceleration due to gravity, $g = 9.81$ m/s^2;~~

~~a_v — vertical composite acceleration, in m/s^2, see 9.7.2.1 of this Section;~~

~~M — mass of vehicle considered, in t.~~

~~9.7.2.3 For direct calculation of transverse strength, the ship is assumed to heel to maximum heeling angle (if hull structures are not symmetrical to the longitudinal centerline, rolling towards portside and rolling towards starboard are to be considered separately) and the design load is to be calculated as follows:~~

~~(1) Vertical load P_V and transverse load P_t of vehicle deck are to be respectively calculated as follows:~~

~~$P_V = (g\cos\varphi_m + 0.5a_v)M$ kN~~

~~$P_t = (g\sin\varphi_m + 0.5a_t)M$ kN~~

~~where: g —— acceleration due to gravity, g = 9.81 m/s^2;~~

~~φ_m —— maximum heeling angle, see 9.7.2.1 of this Section, to be taken not less than 0.35;~~

~~a_v —— vertical composite acceleration, in m/s^2, see 9.7.2.1 of this Section;~~

~~a_t —— transverse composite acceleration, in m/s^2, see 9.7.2.1 of this Section;~~

~~M —— mass of vehicle considered, in t.~~

~~(2) Vertical load P_V and transverse load P_t of superstructure deck and deckhouse deck are to be respectively calculated as follows:~~

~~$$P_V = m_0 (g\cos\varphi_m + 0.5a_v) \quad \text{kN/m}^2$$~~

~~$$P_t = m_0 (g\sin\varphi_m + 0.5a_t) \quad \text{kN/m}^2$$~~

~~where: m_0 —— design load, in t/m^2, which is to include the mass of deck and to be taken not less than 0.25 t/m^2;~~

~~g —— acceleration due to gravity, g = 9.81 m/s^2;~~

~~φ_m —— maximum heeling angle, see 9.7.2.1 of this Section, to be taken not less than 0.35;~~

~~a_v —— vertical composite acceleration, in m/s^2, see 9.7.2.1 of this Section;~~

~~a_t —— transverse composite acceleration, in m/s^2, see 9.7.2.1 of this Section.~~

~~(3) The hydrostatic pressure, which is to be calculated in accordance with 1.5.3.2 of Section 5 of Chapter 1, is to be taken as the external sea pressure.~~

9.7.2 Design loads and loading conditions

9.7.2.1 For the acceleration of ship motions, see the relevant requirements of Section 5, Chapter 1 of this PART

9.7.2.2 For direct strength calculation of vehicle deck structure, the deck load is to be calculated as follows:

Vehicle load $P_h = (g + 0.5a_v)M$ kN

Uniformly distributed load $p_{d_h} = (g + 0.5a_v)p$ kN/m^2

Deck weight load $p_{s_h} = (g + 0.5a_v)m_s$ kN/m^2

where: g — acceleration due to gravity, to be taken as 9.81 m/s^2;

a_v — vertical composite acceleration, in m/s^2, see 9.7.2.1 of this Section;

M — design vehicle mass, in t;

p — design uniformly distributed load of vehicle deck, in t/m^2, not to be less than 0.25 t/m^2;

m_s —deck weight, in t/m^2.

9.7.2.3 For direct calculation of transverse strength, the ship is assumed to heel to maximum heeling angle (if hull structures are not symmetrical to the longitudinal centerline, rolling towards portside and rolling towards starboard are to be considered separately) and the design load is to be calculated as follows:

(1) Vertical load and transverse load of vehicle deck are to be respectively calculated as follows:

Vertical load of vehicle $P_{r_v} = (g\cos\varphi_m + 0.5a_v)M$ kN

Transverse load of vehicle $P_{r_t} = (g\sin\varphi_m + 0.5a_t)M$ kN

Uniformly distributed vertical load $p_{d_r_v} = (g\cos\varphi_m + 0.5a_v)p$ kN/m^2

Uniformly distributed transverse load $p_{d_r_t} = (g\sin\varphi_m + 0.5a_t)p$ kN/m^2

Deck weight vertical load $p_{s_r_v} = (g\cos\varphi_m + 0.5a_v)m_s$ kN/m^2

Deck weight transverse load $p_{s_r_t} = (g\sin\varphi_m + 0.5a_t)m_s$ kN/m^2

where: g— acceleration due to gravity, to be taken as 9.81 m/s^2;

φ_m —maximum heeling angle, see 9.7.2.1 of this Section, to be taken not less than 0.35;

a_v —vertical composite acceleration, in m/s^2, see 9.7.2.1 of this Section;

a_t —transverse composite acceleration, in m/s^2, see 9.7.2.1 of this Section;

M — design vehicle mass, in t;

p — design uniformly distributed load of vehicle deck, in t/m^2, not to be less than 0.25 t/m^2;

m_s — deck weight, in t/m^2.

(2) Vertical load and transverse load of superstructure deck and deckhouse deck are to be respectively calculated as follows:

Vertical load $p_{u_r_v} = (g\cos\varphi_m + 0.5a_v)m_0$ kN/m^2

Transverse load $p_{u_r_t} = (g\sin\varphi_m + 0.5a_t)m_0$ kN/m^2

where: g — acceleration due to gravity, to be taken as 9.81 m/s^2;

φ_m —maximum heeling angle, see 9.7.2.1 of this Section, to be taken not less than 0.35;

a_v —vertical composite acceleration, in m/s^2, see 9.7.2.1 of this Section;

a_t —transverse composite acceleration, in m/s^2, see 9.7.2.1 of this Section;

m_0 — design load including deck weight, in t/m^2, not to be less than 0.25 t/m^2.

(3) The hydrostatic pressure p_{hs}, which is to be calculated in accordance with 1.5.3.2 of Section 5 of Chapter 1, is to be taken as the external sea pressure.

9.7.2.4 Conditions of direction calculations of vehicle deck strength and transverse strength are give in Tables 9.7.2.4(1) and (2) respectively.

Conditions of direction calculations of vehicle deck strength

Table 9.7.2.4(1)

No.	Condition	Load component
1	Vehicle load condition	Vehicle load P_h Deck weight load p_{s_h}
2	Uniformly distributed load condition	Uniformly distributed load P_{d_h} Deck weight load p_{s_h}

Conditions of direction calculations of transverse strength

Table 9.7.2.4(2)

No.	Condition	Load area	Load component
1	Vehicle load condition	Vehicle deck	Vehicle vertical load P_{r_v} Vehicle transverse load P_{r_t} Deck weight vertical load $p_{s_r_v}$ Deck weight transverse load $p_{s_r_t}$
		Superstructure and deckhouse	Vertical load $p_{u_r_v}$ Transverse load $p_{u_r_t}$
		External	Hydrostatic pressure p_{hs}
2	Uniformly distributed load condition	Vehicle deck	Uniformly distributed vertical load $p_{d_r_v}$ Uniformly distributed transverse load $p_{d_r_t}$ Deck weight vertical load $p_{s_r_v}$ Deck weight transverse load $p_{s_r_t}$

No.	Condition	Load area	Load component
		Superstructure and deckhouse	Vertical load $p_{u_r_v}$ Transverse load $p_{u_r_t}$
		External	Hydrostatic pressure p_{hs}

9.7.4 Model and boundary conditions for transverse strength calculation

9.7.4.2 For the fore and aft end planes of the model, the displacement in the longitudinal direction and the rotation about the coordinate axis perpendicular to the longitudinal direction are to be taken as zero. ~~For intersections A, B, C, D of inner bottom plating and side shell plating within fore and aft end planes, the displacement in vertical direction is to be taken as zero; for intersections A and B of inner bottom plating and side shell plating at portside, the displacement in transverse direction is to be taken as zero (see Figure 9.7.4.2).~~ ; For intersection lines *AA´*, *BB´*, *CC´*, *DD´* of side ring frame or web frame and side shell plating, the displacement in vertical direction is to be taken as zero. For the intersection line *A B´* of inner bottom and portside shell plating, the displacement in transverse direction is to be taken as zero. Where inner bottom is not provided, the constraint of displacement in transverse direction may be applied to the intersection line *EF* of centre keelson and bottom plating (or similar position), see Figure 9.7.4.2.

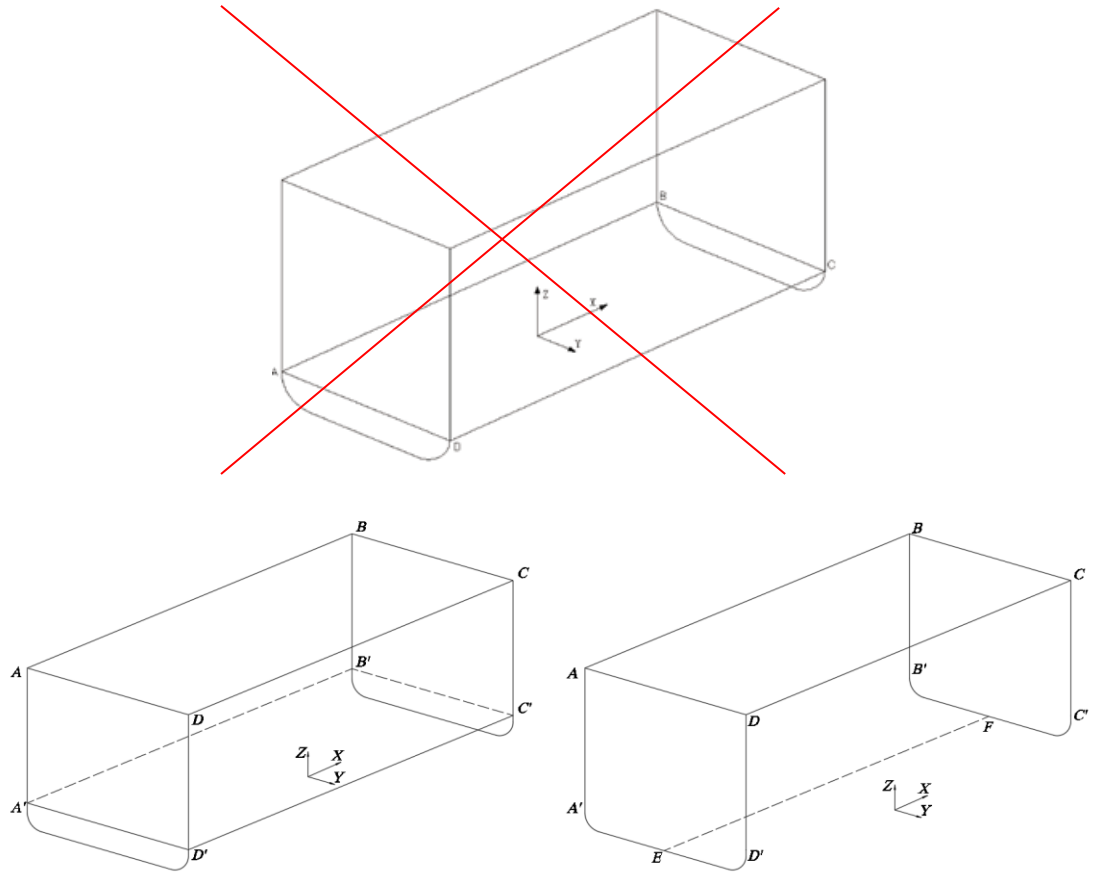


Figure 9.7.4.2 Boundary Condition

CHAPTER 13 FLOATING CRANES

Section 2 LONGITUDINAL STRENGTH

13.2.1 General requirements

13.2.1.2 For fixed type floating crane ~~lifting conditions~~, where the still water bending moment obtained from calculation is a sagging moment in lifting conditions, an additional bending moment (sagging moment) induced by the maximum horizontal component force which is imposed on the hull structure by the maximum load lifted is to be added.

13.2.1.3 For lifting conditions, the wave bending moment and wave shear force regarding the intended area of operation may be determined according to Section ~~8~~2, Chapter ~~1~~2 of ~~this~~ PART TEN.

CHAPTER 15 SEMI-SUBMERSIBLE VESSELS

Section 1 GENERAL PROVISIONS

15.1.2 Definitions

15.1.2.1 **Semi-submersible vessel** means a ship, designed to load and unload cargoes, which is capable of being in a semi-submerged condition, with large open weather cargo deck and generally fitted with a forward or aft high superstructure or deckhouse or pontoon.

Section 3 HULL FRAMING

16.3.4 Side framing

16.3.4.1 The ship's sides are normally longitudinally framed, and the side longitudinals within 0.1*D* from bottom and deck are to continuously pass through transverse bulkheads. The section modulus *W* of side longitudinals is, in addition to satisfying relevant requirements of 2.7.5, Chapter 2 of this PART, not to be less than that obtained by the following formula:

$$W = 7.2s(h+1.2)l^2K \qquad \text{cm}^3$$

where: *s* — spacing of longitudinals, in m;

h — vertical distance measured from the longitudinal under consideration to deck line at side amidships, in m, but not less than 2.5 m;

l — span of longitudinal, in m;

K — material factor.

CHAPTER 20 MEMBRANE TANK LIQUEFIED GAS CARRIERS

APPENDIX 1 DIRECT CALCULATION OF HULL STRUCTURES WITHIN THE CARGO TANK REGION

4 RESULT EVALUATION

4.3 Buckling assessment

4.3.4 Panel buckling is to be based on the "net thickness method". In calculation of critical buckling stress, plating thickness is to be taken as the calculated net thickness obtained from deducting the Standard Thickness Deduction, as given in Table 4.3.4, from the as-built thickness.

Standard thickness deduction **Table 4.3.4**

Location	Standard thickness deduction t_c (mm)
~~① decks as ballast tank boundary, side shell plating, inner bottom plating, transverse bulkheads, plate floors, double bottom girders and double side stringers;~~ ~~② transverse web frames of ballast tanks, double bottom plate floors and girders double side stringers~~ Structural members forming ballast tank boundary and located in ballast tanks, e.g. deck plating, side shell plating, inner bottom plating, hopper slope plating, transverse bulkheads, transverse web frames, double bottom floors, double bottom girders, double side stringers etc.	1.5
Other structural members	1.0

APPENDIX 2 STRUCTURAL STRENGTH ASSESSMENT OF HULL AND PUMP TOWER UNDER SLOSHING LOADS

7 STRUCTURAL VIBRATION EVALUATION OF PUMP TOWER

7.5 Restrictions for avoiding resonance

7.5.2 Where sufficient frequency reserve cannot be guaranteed, vibration response analysis is to be carried out to the pump tower structure in the cargo tank adjacent to the engine room of whole ship FE model. The peak value of pump tower vibration response is not to be greater than 15 mm/s.

APPENDIX 3 CALCULATION OF TEMPERATURE FIELD AND THERMAL STRESS

3.2 Mode of heat transfer

3.2.1 For the calculation of hull temperature field, the following modes of heat transfer are assumed:

(4) radiation heat transfer between plates of hull structure and external environment ~~(if necessary)~~;

(5) radiation heat transfer between shell plating and inner hull plating (~~if necessary~~ when the temperature

field is used for calculation of nominal thermal Boil Off Rate).

3.5 Selection of steel grades

~~3.5.2 The determination of steel grades of hull structure is to be based on predictive calculation result of temperature field in low-temperature environment and in case of failure of primary insulation. The standards for the steel grades of hull structure are given in relevant provisions of 6.2 of Chapter 6 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gas in Bulk.~~

3.5.2 The scope of application of steel grades in different environmental conditions is given in Table 3.5.2.

Scope of application of steel grades **Table 3.5.2**

	IGC	USCG	USCG (Alaskan waters)	Equator
Scope of application of steel grades	Whole cargo tank area	Inner hull and connected members of cargo tank area	Inner hull and connected members of cargo tank area	Not applicable

3.5.3 The steel grades of hull materials are to be selected in accordance with Table 6.5 of Chapter 6 of PART THREE of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gas in Bulk.

3.5.4 For environmental conditions of USCG and USCG (Alaskan waters), the steel grade of deck stringer plate and sheer strake is not to be lower than grade E, and the bilge strake is to be grade D or E.



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PART THREE
MACHINERY INSTALLATIONS

Revision explanation

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2. No change in the English text means that only Chinese text is editorially revised while the change of corresponding English version is not needed.

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CHAPTER 2 PUMPING AND PIPING SYSTEMS

Appendix 1 PRODUCTION AND APPLICATION OF PLASTIC PIPES ON SHIPS①

① It is addressed by IACS according to the provisions of IMO resolution A.753(18) and its amendments.

CHAPTER 3 SHIP'S PIPING AND VENTILATING SYSTEMS

Section 11 VENTILATION

3.11.1 General requirements

3.11.1.1 Machinery spaces of category A are to be adequately ventilated so as to ensure that when machinery or boilers therein are operating at full power in all weather conditions including heavy weather, an adequate supply of air is maintained to the spaces for the safety and comfort of personnel and the operation of the machinery.

Any other machinery space is to be adequately ventilated appropriate for the purpose of that machinery space.

Ventilators of machinery spaces required to be continuously ventilated are to be of a height of coaming complying with the relevant requirements of 1.12.7.4(6), PART TWO of the Rules without having to fit weathertight closing appliances, so that they can be used in all weather conditions. However, where due to vessel size and arrangement this is not practicable, lesser heights for ventilator coamings may be accepted with provision of weathertight closing appliances in accordance with the requirements of 1.12.7.4(7), PART TWO of the Rules in combination with other suitable arrangements to ensure an uninterrupted, adequate supply of ventilation to these spaces.

Section 6 CARGO TANK VENTING ARRANGEMENTS

5.6.2 Pressure/vacuum and venting systems

5.6.2.2 The vent and/or pressure/vacuum valve stand pipes are to be connected to the highest part of each tank, and where combined systems are adopted, a means of isolation is to be provided between each tank and a common main. Any means of isolation must continue to permit the flow caused by thermal variations in a cargo tank in accordance with the provisions of 5.6.1.1(2). ~~Where the cargo tanks are not fitted with separate pressure/vacuum valves, means are to be provided for maintaining the venting in the tanks when the branch pipes are being isolated.~~ If cargo loading and ballasting or discharging of a cargo tank or cargo tank group is intended, which is isolated from a common venting system, that cargo tank or cargo tank group are to be fitted with a means for over-pressure or under-pressure protection as required in 5.6.1.1(3) of this Section. Any isolation is also to continue to permit the passage of large volumes of vapour, air or inert gas mixtures during cargo loading and ballasting, or during discharging.

CHAPTER 9 DIESEL ENGINES

Section 9 ALARMS AND SAFEGUARDS FOR EMERGENCY DIESEL ENGINES

9.9.2 Alarms and safeguards

9.9.2.3 The alarm system ~~(including the indication)~~ is to function in accordance with the relevant requirements of PART SEVEN of the Rules, with additional requirements that grouped alarms are to be arranged in the bridge.

Section 10 ~~TYPE TEST, WORKS ACCEPTANCE TEST AND SHIPBOARD TRIALS~~ SURVEY AND CERTIFICATION[①]

9.10.1 Approval and certification of diesel engines[①]

9.10.2 Type testing[①]

① (1) The new requirements of type approval and type testing (including Appendix 4 and Appendix 5 of this Chapter) apply to engines for which the date of an application for type approval certification is dated on or after 1 July 2016.

(2) The "date of application for type approval" is the date of documents accepted by CCS as request for type approval certification of a new engine type or of an engine type that has undergone substantive modifications in respect of the one previously type approved, or for renewal of an expired type approval certificate.

(3) Engines with an existing type approval on 1 July 2016 are not required to be re-type approved in accordance with the new requirements until the current type approval becomes invalid. The certification of such engines may be carried out in accordance with the current type approval and related submitted documentation.

CHAPTER 11 SHAFTING AND PROPELLERS

Section 3 SHAFT TRANSMISSION UNITS

11.3.8 Transverse propulsion arrangement

11.3.8.2 Material and test of transverse propulsion arrangement and its components are to comply with the relevant requirements of ~~the Rules~~ CCS Rules for Materials and Welding.

11.3.8.8 Alarm is to be in the bridge with individual or groupwise indicator for the following faults:

(1) ~~stop of prime mover~~ overload of prime mover and servo unit;

(2) power failure of remote control system;

(3) power failure of alarm system;

(4) low level in lubrication oil tank (if fitted);

(5) low lubrication oil pressure (if forced lubrication oil system);

(6) low level in hydraulic supply tank;

(7) low pressure in hydraulic system.

11.3.8.9 Individual indication in the bridge is required for:

(1) ~~overload~~ running and stop of prime mover ~~and servo unit~~;

(2) propeller pitch for controllable pitch propeller plants;

(3) direction of rotation and r.p.m. for fixed propeller plants~~;~~.

~~(4) power failure of alarm system.~~

Section 4 PROPELLERS

11.4.4 Fitting of propellers to screwshafts

11.4.4.3 Where the torques are transmitted completely by the keys, the effective sectional area of the key in shear is not to be less than the value determined by the following formula, and the tensile strength of the material is to be equal to or greater than that of the shaft material:

$$BL \geq \frac{d^3}{2.35 d_m} \qquad \text{mm}^2$$

where: B — breadth of the key, in mm;

L — effective length of the key, in mm;

d — diameter required for the intermediate shaft, in mm, to be taken as 800 N/mm^2 when the tensile strength of intermediate shaft material is greater than 800 N/mm^2 during calculation;

d_m — diameter of shaft at mid-length of the key, in mm.

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RULES FOR CLASSIFICATION OF SEA-GOING STEEL SHIPS

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PART FOUR
ELECTRICAL INSTALLATIONS

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CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.3.3 Explosion protection

1.3.3.3 The electrical equipment allowed to be fitted in spaces subject to an explosion hazard, e.g. battery rooms, lamp stores and paint lockers (including ventilation ducts), is to comply with the following requirements:

(1) The electrical equipment is to be installed in paint stores and in ventilation ducts serving such spaces only when it is essential for operational services. Such equipment is to be of a certified safe type listed in 1.3.3.2(1) to (5) of this Section. For other spaces, the electrical equipment of certified safe types listed in 1.3.3.2 of this Section may be fitted, and the explosion groups and temperature classes of such equipment are at least to comply with the requirements in Table 1.3.3.3.

(2) Cables (through runs or terminating cables) of armoured type or installed in metallic conduits are to be used.

(3) The switches, protective devices and motor control gear for the electrical equipment installed in such spaces are to interrupt all poles or phases and preferably are to be located in non-hazardous spaces.

In addition, the relevant requirements for paint locker ventilation openings, battery rooms, oil tankers and ships carrying vehicles with fuel in their tanks for their own propulsion are given in 1.3.3.4, 1.3.3.5 of this Section, and Sections 11, 16 and 17 of Chapter 2.

Explosion Group and Temperature Class **Table 1.3.3.3**

Location	Group①	Temperature class①
Battery rooms	II C②	T1
Paint lockers	II B	T3
Lamp stores	II A	T3
Ammonia plant rooms③	II A	T1
Acetylene storage rooms	II C	T2
Spaces carrying dangerous goods	According to the category of dangerous goods carried	According to the category of dangerous goods carried
Tunnels for pipes containing oil with a flash point of 60℃ or below	II A	T3

Notes: ① The explosion groups and temperature classes of electrical equipment listed in this Table and hereinafter in this PART are according to the relevant requirements of IEC Publication 60079: Electrical Apparatus for Explosive Gas Atmospheres or of GB 3836: Electrical Apparatus for Explosive Atmospheres.

② Explosion groups II A, II B and II C of electrical equipment listed in this PART are applicable only to intrinsically safe apparatus and flame-proof apparatus. For other types of explosion-proof electrical equipment, Group II is to be used.

③ Electrical equipment installed in R717 refrigerator room is to comply with the requirements in Section 5 of Chapter 2 of PART FIVE of the Rules.

CHAPTER 2 ELECTRICAL INSTALLATIONS IN SHIPS

Section 2 EMERGENCY SOURCE OF ELECTRICAL POWER

2.2.2.2 The transitional source of emergency electrical power required in 2.2.1.5 of this Section is to be of sufficient capacity to supply at least the following services, if they depend upon an electrical source for their operation:

(1) for half an hour:

① the lighting required in 2.2.2.1(1) (except for 2.2.2.1(1) ③) and navigation lights and other signal lights required in 2.2.2.1(2)① of this Section;

Section 4 POWER SUPPLY AND DISTRIBUTION

2.4.4.1 The maximum voltages of ~~DC and~~ AC distribution systems are not to exceed the values given in Table 2.4.4.1.

Maximum Voltages of AC Distribution Systems **Table 2.4.4.1**

No.	Application	Max. voltage (V)
1	For power equipment permanently installed and connected by permanent wiring	15,000
2	(1) For ~~power,~~ heating and cooking equipment permanently installed and connected by permanent wiring~~, except space heaters.~~ ~~(2) For power and heating equipment (except space heaters) permanently installed where connection by flexible cable is necessary because of the application, e.g. movable cranes.~~ (~~3~~2) For portable equipment, which is not hand-held during operation, and with connection by socket outlet ~~and flexible cable~~ which incorporates an earth continuity conductor of a size in accordance with 1.3.4.5 of this PART~~, e.g. welding transformer~~	1,000
3	(1) For lighting permanently installed ~~and heaters in accommodation and public spaces~~ (2) For socket outlets supplying the following (which are not specified in items 2 and 4 in the table): ① equipment with double insulation; ② equipment earthed by earth continuity conductors of a size in accordance with 1.3.4.5 of this PART	250
4	For socket outlets used in spaces where particular risks due to exposure and conductivity may exit~~, e.g. exceptionally damp or confined spaces~~: (1) supplied with or without the use of isolating transformers; (2) where a safety isolating transformer is used supplying one consuming device only. Both wires of such systems are to be insulated from earth	~~50~~ 55① 250
5	Instrumentation and control equipment②	55③ 250

Note: ① For socket outlets with rated voltage up to 24V, the maximum voltage is 55V.

②For the control voltage of distribution systems operating at a voltage above 500 V, see 2.4.4.2 of this Section.

③ For instrumentation and control equipment with rated voltage up to 48V, the maximum voltage is 55V.

2.4.4.2 For distribution systems operating at a voltage above 500 V, the control voltage is to be limited to ~~250~~230 V, except where all control devices of the distribution systems operating at a voltage not exceeding 1000 V are enclosed in appropriate control boxes.

2.4.4.4 The maximum voltages of DC distribution systems are not to exceed the values given in Table 2.4.4.4.

Maximum Voltages of DC Distribution Systems **Table 2.4.4.4**

No.	Application	Max. voltage (V)
1	Power equipment	1500

No.	Application	Max. voltage (V)
2	Cooking equipment, heating equipment, lighting and socket outlets	500
3	Communication equipment, instrumentation	250
4	Socket outlets supplying power for life boats/rafts	55

2.4.9.2 For AC distribution systems, final sub-circuits rated over 16A are not to supply more than one equipment, except that they only supply socket outlets with current rating not greater than 32A.

Section 6 AUXILIARY MACHINERIES

2.6.1.1 Motors rated at ~~0.5~~1.0 kW or above and motors required for essential services are to be supplied from distribution boards by separate final sub-circuits.

Section 9 SAFETY SYSTEMS FOR SHIPS AND PERSONS ONBOARD

2.9.1.1 In order to sound general emergency signals, a general emergency alarm system comprised of the ship's whistle or siren and additionally an electrically operated bell or klaxon or other equivalent apparatus, is to be provided on all passenger ships and cargo ships of 500 gross tonnage and above. In passenger ships, the alarm is to be capable of being given separately or simultaneously to crew and passengers. Cargo ships of 500 gross tonnage and above may not be fitted with an independent general emergency alarm system when a public address system meeting the requirements of 2.9.2.1 (1) to (8) has already been provided.

2.9.2.1 Cargo ships of 500 gross tonnage and above are to be provided with a public address system in compliance with the following requirements:
(1) capable of broadcasting messages from the navigation bridge and fire control station etc. to all spaces where crew are normally present and muster stations;
(2) no operation required of receivers to accept the broadcast message;
(3) protected against unauthorized use;
(4) amplifiers have sufficient output power so that all loudspeakers for the purpose of emergency announcement can be operated at the same time;
(5) arranged to prevent feedback or any other interference;
(6) with the ship underway in normal conditions, the minimum sound pressure level for broadcasting emergency announcements is to be:
① in interior spaces 75 dB(A) and at least 20 dB(A) above the speech interference level;
② in exterior spaces 80 dB(A) and at least 15 dB(A) above the speech interference level;
(7) capable of being supplied by both main and emergency power sources;
(8) if the public address system is used to give the general alarm, ~~the general emergency alarms as required by 2.9.1 of this Section may not be fitted, provided that~~ the following requirements are to be fulfilled:
① the performance requirements of 2.9.1 of this Section are to be complied with;
② at least two amplifiers are to be provided, each of them separately supplied;
③ the loudspeaker circuits are to be so arranged that an announcement at a reduced acoustic irradiation is maintained in the event of a failure of an amplifier or loudspeaker circuit;
④ where loudspeakers with built-in volume controls are used, the volume controls are to be disabled by the release of the alarm signal;
⑤ it is to be possible to transmit the clearly audible alarm signal at all times and other simultaneous signal transmissions are to be automatically interrupted;
⑥ an independent short-circuit protection is to be provided for each loudspeaker.

Section 18 ADDITIONAL REQUIREMENTS FOR SHIPS CARRYING DANGEROUS GOODS

2.18.3 Carriage of solid dangerous goods in bulk, including classes 4.1, 4.2, 5.1, 9 and MHB creating explosive dust atmosphere~~Carriage of solid dangerous goods in bulk and capable of creating explosive dust atmosphere only, including classes 4.1, 4.2, 5.1, 9 and MHB~~

2.18.4 Carriage of ~~cargoes capable of creating explosive gas atmosphere only, including~~ flammable liquids having a flashpoint below 23℃ (classes 3, 6.1 and 8), flammable gas in packaged form (class 2.1), miscellaneous dangerous substances emitting flammable gases in packaged form (class 9) and substances emitting flammable gases in contact with water (solid class 4.3 and MHB generating flammable gases in contact with water)

Characteristics of Electrical Equipment for Use in Hazardous Areas (Example)

Table 2.18.5.1

Dangerous goods	IMO class	Dominant risk①	Protection against explosive dust atmosphere	Protection against explosive gas atmosphere	
			Degree of protection	Explosion group	Temperature class
Aluminium ferrosilicon powder UN1395	4.3	H_2	—	IIC	T2
Aluminium silicon powder uncoated UN1398	4.3	H_2	—	IIC	T2
Aluminium smelting by-products or Aluminium remelting by-products UN3170	4.3	H_2	—	IIC	T2
Ammonium nitrate UN1942	5.1	Combustible	—	Intrinsically safe equipment	—
Ammonium nitrate based fertilizer UN2067	5.1	Combustible	—	Intrinsically safe equipment	—
Ammonium nitrate based fertilizer UN2071	9		—	Intrinsically safe equipment	—
Ammonium nitrate based fertilizer (non-hazardous)	-		—	Intrinsically safe equipment	—
Brown coal briquettes	MHB(CB and/or SH)	Dust, methane	IP55	IIA	T4
Coal	MHB(CB and/or SH and/or WF and/or CR)	Dust, methane	IP55	IIA	T4
Direct reduced iron (A)	MHB(SH and/or WF)	H_2	—	IIC	T2
Direct reduced iron (B)	MHB(SH and/or WF)	H_2	—	IIC	T2
Direct reduced iron (C)	MHB(SH and/or WF)	H_2	—	IIC	T2
Ferrophosphorus (including briquettes)	MHB(WF and/or WT)	H_2	—	IIC	T1
Ferrosilicon, with at least 25% but less than 30% silicon, or 90% or more silicon (including briquettes)	MHB(WF and/or WT)	H_2	—	IIC	T1
Ferrosilicon UN1408, with 30% or more but less than 90% silicon(including briquettes)	4.3	H_2	—	IIC	T1
Iron oxide, spent or sponge iron, spent UN1376	4.2	Dust	IP55	IIA	T2
Seed cake, containing vegetable oil UN1386	4.2	Hexane	—	IIA	T3
Seed cake UN2217	4.2	Hexane	—	IIA	T3
Silicomanganese(low-carbon)	MHB(WF and/or WT and/or TX)	H_2	—	IIC	T1
Sulphur UN1350(crushed lump and coarse grained)	4.1	Combustible, dust	IP55	—	T4
Zinc Ashes UN1435	4.3	H_2	—	IIC	T2

Wood torrefied	MHB(CB and/or SH and/or CR)	Combustible, dust	IP55	—	T3
Wood pellets, containing additives and/or binders	MHB(WF)	Dust	IP55	—	T3
Wood pellets, not containing any additives and/or binders	MHB(OH)	Dust	IP55	—	T3

Note: ① The term “risk” relates only to the risk of explosion due to dangerous goods and electrical appliances.

CHAPTER 3 CONSTRUCTION AND TESTING OF ELECTRICAL EQUIPMENT

Section 6 POWER AND LIGHTING TRANSFORMERS

3.6.6 Tests

3.6.6.1 Performance tests (winding resistance measurement, voltage ratio measurement and check of phase displacement, short-circuit impedance and load loss measurement, no-load loss and no-load current measurement, etc.) and t~~T~~he tests in 3.6.6.2 to 3.6.6.6 of this Section are at least to be carried out to all transformers at the manufacturer. However, the test required in 3.6.6.2 may only be carried out to the first product for batch products of the same type and specification.

Section 7 STORAGE BATTERIES

3.7.5.1 Each crate or tray is to be provided with a durable nameplate securely attached, indicating the manufacturer's name, type designation, voltage and ~~date of delivery,~~ the ampere-hour rating at a specific rate of discharge (preferably that corresponding to the duty for the specific application 5 h, 10 h or 20 h rating)~~and the relative density of the electrolyte (when the battery is fully charged in the case of a lead-acid battery)~~.

CHAPTER 4 SUPPLEMENTARY REQUIREMENTS FOR CARGO SHIPS OF LESS THAN 500 GROSS TONNAGE

Section 1 CARGO SHIPS OF LESS THAN 500 GROSS TONNAGE

4.1.5 ~~Supply of c~~Control box for navigation lights

4.1.5.1 The control box of navigation lights may be supplied by the main switchboard and the reserve power source.

4.1.5.2 The alarms for failure required in 2.7.4.4 of this PART may not be satisfied.

Appendix 2
TYPE APPROVAL PROCEDURE FOR CABLE TRAYS/PROTECTIVE CASINGS MADE OF PLASTIC MATERIALS

2.3.1 Flame retardant test

The cable trays/protective casings are to be at least flame retardant. They are to be tested in accordance with Table 2.3.1.

Flame Retardant Test **Table 2.3.1**

Procedure according to	Test parameters	Other information
IEC 60092-101, or	– Flame application: 5 times 15 s each – Interval between each application: 15 s or 1 time 30 s	− The burnt out or damaged part of the specimen by not more than 60 mm long − Equipment design and the choice of materials is to reduce the likelihood of fire ensuring where surfaces of the specimen can be exposed to external fire they do not contribute to the fire growth
IEC60695-11-5~~2-2~~	Test criteria based upon application	

2.3.2 Smoke and toxicity test

The cable trays/protective casings are to be tested in accordance with Part 2 of 2010 FTP Code adopted by IMO Resolution MSC.307(88) ~~the IMO Fire Test Procedures Code (FTPC), resolution MSC.61(67), Part 2 – Smoke and Toxicity Test,~~ as amended by IMO Resolution MSC.437(99), or any international or national standard.

2.4 Special requirements

2.4.1 Resistivity test

Cable trays/protective casings passing through a hazardous area are to be electrically conductive.

The volume resistivity level of the cable trays/protective casings and fittings is to be below 10^5 Ω and the surface resistivity is to be below 10^6 Ω. The cable trays/protective casings are to be tested in accordance with IEC62631-3-1 and IEC62631-3-2 ~~IEC 60093~~.

The resistance to earth from any point in these appliances is not to exceed 10^6 Ω.

CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF SEA-GOING STEEL SHIPS

AMENDMENTS

2021

PART FIVE REFRIGERATED CARGO INSTALLATIONS

Revision explanation

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CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.2 Refrigerants

1.1.2.1 The provisions of this PART are applicable to the ~~following~~ refrigerants listed in Table 1.1.2.1:

~~R717 Ammonia (NH_3);~~

~~R22 Monochlorodifluoromethane ($CHClF_2$);~~

~~R134a Tetra fluoro ethane (CH_2F-CF_3).~~

Refrigerants Table 1.1.2.1

Refrigerant No.	Chemical formula or composition	Blending Ratio
R717	NH_3	-
R134a	CH_2F-CF_3	-
R404A	CHF_2CF_3(R125)/CH_3CF_3(R143a)/CH_2FCF_3(R134a)	（44%/52%/4%）
R407C	CH_2F_2(R32)/CHF_2CF_3(R125)/CH_2FCF_3(R134a)	(23%/25%/52%)
R410A	CH_2F_2(R32)/CHF_2CF_3(R125)	(50%/50%)
R507A	CHF_2CF_3(R125)/CH_3CF_3(R143a)	(50%/50%)

1.1.2.2 Where other refrigerants are to be used, relevant information is to be submitted for approval.

1.1.2.3 In addition, consideration is to be given to the relevant provisions for the application scope of refrigerants specified by the flag State Administration.

Section 2 TESTS

1.2.1 Pressure tests

1.2.1.1 Pressure tests after completion of manufacturing

(1) On completion of manufacturing, components and parts exposed to the pressure of the refrigerants are to be subject to strength and leak tests as detailed in Table 1.2.1.1.

Test Pressure **Table 1.2.1.1**

Component or part	Strength test (hydraulic)	Leak test (pneumatic)
Pressure vessels	1.5*p*	1.0*p*
Compressors:		
Cylinders	1.5*p*	1.0*p*
Crankcase	1.5*p*	1.0*p*
Valves and fittings	2.0*p*	1.0*p*
Pressure piping, welded fabricated headers, air coolers, etc.	1.5*p*	1.0*p*

Notes: ① *p* is the design pressure, see Table 2.1.4.1.

② The leak test normally requires an air pressure to be applied to the component while submerged in water. Alternative methods for leak test may be considered if practicable.

(2) Components exposed to the pressure of brine or cooling water are to be hydraulically tested to 1.5*p*, but in no case less than 0.34 MPa.

(3) For components not suitable for hydraulic pressure test, the relevant test program is to be submitted to CCS for approval if air pressure test is adopted in lieu of hydraulic pressure test.

CHAPTER 2 REFRIGERATING PLANT

Section 1 GENERAL PROVISIONS

2.1.2 Number of units

2.1.2.1 In ships intended for the carriage of refrigerated cargo, at least two complete refrigerating units are to be provided.

~~Where only two refrigerating units are fitted, the working parts are to be interchangeable.~~

2.1.2.2 In ships classed for restricted service where the total capacity of the refrigerated chambers is less than 1,500 m^3, only one complete refrigerating unit may be provided, but a standby compressor is to be fitted as an addition.

2.1.4 Design pressure of refrigerating plant

2.1.4.1 The design pressure of the high pressure side and the low pressure side of the refrigerating plant is to be not less than the values given in Table 2.1.4.1 respectively.

Design Pressure of Refrigerating Plant **Table 2.1.4.1**

Refrigerant	Design pressure of high pressure side① (MPa)	Design pressure of low pressure side② (MPa)
R717	2.2	1.7
R134a	1.4	1.1
R404A	2.5	2.0
R407C	2.4	1.9
R410A	3.3	2.6
R507A	2.5	2.0

Notes: ① High pressure side means the pressed parts of the compressor between its exhausting side and expansion valve.

② Low pressure side means the pressed parts from behind the expansion valve to suction valve of the compressor. Where the change-over of the plant (e.g. for defrosting) will put these parts under high pressure, they are to be designed and tested to the specified pressure of high pressure side.

2.1.4.2 Where any other refrigerant is used, the design pressure of high pressure side and low pressure side of the refrigerating plant is to be not less than the saturated vapour pressure at 56℃ and 46℃ respectively.

Section 3 PRESSURE VESSELS, PIPING, FITTINGS AND ACCESSORIES

2.3.1 Pressure vessels

2.3.1.1 ~~Welded steel cylindrical~~ Among refrigerants specified in 1.1.2.1 of Chapter 1 of this PART, pressure vessels for refrigerants R717 ~~and R22~~ are to be constructed in accordance with the relevant provisions for Class I ~~II~~ pressure vessels specified in Chapter 6, PART THREE of the Rules, and in CCS Rules for Materials and Welding. Other pressure vessels for refrigerants are to comply with the relevant requirements for Class II pressure vessels. The design pressure of

pressure vessels for refrigerants is to comply with the requirements of Table 2.1.4.1 of this Chapter.

2.3.1.2 Where pressure vessel cylinders are made of steel tubes, these are to be seamless, electrical resistance welded or longitudinally submerged arc welded. Forge butt welded and spirally welded tubes are not to be used.

2.3.1.3 All pressure vessels with a design temperature below -40℃ and also vessels with a design temperature below 0℃ where the pressure/saturation temperature relationship does not apply, are to be manufactured from steels with mechanical properties, including notch toughness, suitable for the thickness and the lowest design temperature, and relevant information is to be submitted.

2.3.2 Pressure piping

2.3.2.1 ~~The wall thickness of a~~All steel pressure pipes for the refrigerating plant ~~is~~are to ~~be determined in accordance~~ comply with the relevant provisions specified in Chapter 2, PART THREE of the Rules. Among refrigerants specified in 1.1.2.1 of Chapter 1 of this PART, piping for refrigerants R717 is to be considered as Class I piping and class of pipings for other refrigerants is to comply with the relevant requirements of 2.1.5 of Chapter 2 of PART THREE of the Rules .

2.3.4 Filters

2.3.4.1 Suitable filters are to be provided in the refrigerant gas lines in the following positions:

(1) suction lines to compressors;

(2) liquid lines before expansion valves.

Wire gauze in filters is to be sufficiently robust and well supported to prevent disintegration. The material of wire gauzes is to be corrosion-resistant to refrigerants. The refrigerant piping is to be designed according to the characteristics of refrigerants, and pipelines are to be fitted with suitable means for separating, storing and purifying refrigerants.

2.3.4.2 The filters are to be so installed and arranged that the filters may be repaired and maintained without interrupting the supply of refrigerants.

2.3.8 Liquid receiver and ~~L~~liquid level indication

2.3.8.1 Refrigeration system is to be provided with necessary liquid receivers, the capacity of which is to be such that all refrigerants filled in the refrigerating unit may be received during the maintenance and repairing. If independent liquid receiver is provided for each refrigerating unit, the capacity of receiver is to be capable of receiving the refrigerant filled in the refrigerating unit.

2.3.8.~~1~~2 Refrigerant liquid receivers are to be provided with liquid level indicators. If the level indicator constructed of glass is used, it is to be of the flat glass type. The indicators ~~is~~are to be provided with ~~a~~ self closing valves in lower and upper connections ~~which is capable of being closed~~ so as to prevent the loss of refrigerant in the event of breakage of the indicator.

All liquid level indications are to be capable of withstanding the maximum working pressure.

Section 4 CONTROL, ALARM AND SAFETY SYSTEMS

2.4.2 Alarm

2.4.2.1 The items of monitoring and alarms are not to be less than hose given in Table 2.4.2.1. Audible and visual fault alarms for the refrigerating plant are to be given at the appropriate control station or room.

Items of Monitoring and Alarms for the Refrigerating Plant① Table 2.4.2.1

No.	Item	Display	Alarm
1	Air temperature in the refrigerated cargo chambers	Temperature	High and low
2	Failure of air cooler fans	–	Failure
3	Bilge water level in the refrigerated cargo chambers	–	High
4	Condenser cooling water outlet temperature	Temperature	High
5	Compressor shutdown in the event of failure	–	Shutdown
6	Lubricating oil pressure of compressors	Pressure	Low
7	Suction pressure of compressors	Pressure	Low
8	Exhaust pressure of compressors	Pressure	High
9	Failure of seawater circulating pumps	–	Failure
10	Ammonia leakage in refrigerating machinery spaces	–	Leakage②
11	Brine cooler inlet and outlet	Temperature	High (outlet)
12	Failure of brine circulating pumps	–	Failure
13	Brine return tank level	–	Low

Note: ① Where the refrigerating machinery space is unattended, the fault alarms are to be relayed to the engineers' accommodation or other location where an engineer on duty stays.

② For setting of concentration for ammonia leakage alarm in refrigerating machinery space, see 2.5.5.3 of this Chapter.

2.4.3 Safety

2.4.3.1 The refrigerating plant is to be provided with safety systems to automatically shut down the compressors in the following events:

(4) requirements specified in 2.5.5.3 of this Chapter for safety protection after ~~before gas concentration attaining to the minimum limit of explosion in the event of~~ ammonia leakage in the refrigerating machinery space;

Section 5 LOCATION OF REFRIGERATING MACHINERY SPACE OR UNIT

2.5.1 Refrigerating machinery spaces

2.5.1.1 Where R717 is used as the refrigerant, the machinery compartment is to be isolated by gastight bulkheads and decks from any adjacent accommodation or working spaces. ~~The compartment is to have doors capable of being opened outwards and self-closed.~~

2.5.1.2 Machinery using ~~R134a~~ refrigerants other than R717 will not, in general, be subject to restriction on location. Where relatively large plants are adopted, they are to be installed in a separate compartment.

2.5.1.3 R717 is to be installed in dedicated gastight compartments. Except for small compartments, at least two access doors as apart from each other as possible, which are capable of

being opened outwards and self-closed, are to be provided for R717 refrigerating machinery space.

2.5.1.~~3~~4 In each R717 refrigerating machinery space at least two gas masks with canisters are to be provided near the entrance to that space and are to be kept in a box with glass window for immediate use when necessary.

2.5.1.~~4~~5 The arrangements of the refrigerating machinery are to be such that all components are to be easily accessible for inspection or overhaul. Sufficient space is to be provided for cleaning and renewal of the tubes in brine coolers and condensers.

2.5.2 Ventilation and lighting

2.5.2.1 Any refrigerating machinery space is to be provided with an efficient mechanical ventilation system. The ventilation is to provide at least 30 air changes per hour in the refrigerating machinery space.

~~The R717 refrigerating machinery space is to be provided with a ventilation system separated from other ventilation systems.~~

2.5.2.2 The suction ducts of the ventilation systems are to be constructed of steel or other equivalent material, and the exhaust ports of the ventilation systems are to be located in positions where no danger will arise. In the case of ~~R22 or R134a~~ refrigerating machinery spaces other than R717, power exhaust ventilation systems are to be fitted with the suction inlets located at the lowest part of such spaces. Ventilation in R717 refrigerating machinery space is to comply with the relevant requirements in 2.5.3.1.

~~2.5.2.3 The R717 refrigerating machinery space is to be provided with an emergency ventilation system, and the capacity of which is to provide at least 40 air changes per hour. If the capacity of the normal ventilation system in the refrigerating machinery space is increased to an amount of not less than 40 air changes per hour for that space, the emergency ventilation system may be dispensed with.~~

~~2.5.2.4 Where the R717 refrigerating machinery space is provided with an emergency water-spraying system capable of being operated from a position outside such space, the emergency ventilation system may be dispensed with.~~

2.5.2.~~5~~3 The mechanical ventilation for the refrigerating machinery space is to be capable of being controlled from two positions, and one of which is to be situated in a suitable position outside such space.

2.5.2.4 The fans in R717 refrigerating machinery space are to be of non-sparking type and the material and design of the fan are to comply with the requirements of 3.3.5 of Chapter 3, PART SIX of the Rules. Where the ventilation of R717 refrigerating machinery space is located within the ventilation corridor, the electrical motors are to be of certified safe type, and the explosion groups and temperature classes are not to be lower than IIA T1.

2.5.2.5 Sufficient lighting is to be provided in refrigerating machinery space. Lighting fittings required to be operating after the emergency shut-off of R717 refrigerating machinery space due to leakage of ammonia are to be of certified safe type, and the explosion groups and temperature classes are not to be lower than IIA T1.

2.5.3 Use of ~~ammonia~~R717 as a refrigerant

~~2.5.3.1 Ammonia refrigerating machinery is to be installed in dedicated gastight compartments. Except for small compartments, at least two access doors are to be provided.~~

2.5.3.~~2~~1 Compartments containing ~~ammonia~~R717 machinery (including process vessels) are to be fitted with:

(1) a negative ventilation system independent of ventilation systems serving other ship spaces and ~~having a~~ the capacity of the refrigerating machinery space is to meet the requirements of 2.5.2.1 ~~of not less than 30 changes per hour based upon the total volume of the space~~; other suitable arrangements may be considered; Suction inlets of R717 refrigerating machinery space is to be located on the upper part of the compartment. The ventilation inlets of R717 refrigerating machinery space is to be from the safe area and the exhaust ports are to be lead to the safe location on the open deck;

(2) an emergency ventilation system independent of ventilation systems serving other ship spaces and the capacity of which is to provide at least 40 air changes per hour. If the capacity of the normal ventilation system in the refrigerating machinery space is increased to an amount of not less than 40 air changes per hour for that space, the emergency ventilation system may be dispensed with;

(3) if emergency water-spraying system is accepted in lieu of emergency ventilation system as equivalent, the emergency water-spraying system is to meet the requirements of 2.5.4 of this section; the emergency water-spraying system is to be capable of being operated from a position outside the refrigerating machinery space;

(~~2~~4) a fixed ~~ammonia~~ R717 vapor detector system with alarms inside and outside the compartment;

(~~3~~5) water screens above all access doors, operable manually from outside the compartment;

(~~4~~6) an independent bilge system.

2.5.3.~~3~~2 ~~At least two sets of breathing apparatus and protective clothing are to be available.~~ At least the following safety and protective equipment are to be provided outside of the R717 refrigerating machinery space and the storage location is to be marked for identification and restoration in the event of a refrigerant leak:

(1) two sets of protective clothing (helmet, face masks, boots, gloves etc.);

(2) two sets of independent respirators (at least for 30 min use);

(3) two goggles;

(4) two 30 kg bottles of boric acid;

(5) two emergency electric torches (to be certified safe type and the explosion groups and temperature classes are not to be lower than IIA T1);

(6) one electrical insulation resistance meter.

2.5.3.~~4~~3 ~~Ammonia~~ R717 piping is not to pass through accommodation spaces.

2.5.3.~~5~~4 In case of ammonia plants of fishing vessels under 55 m in length or other ammonia plants with a quantity of ammonia not greater than 25 kg, the plants are permitted to be located in the machinery space, provided that:

(1) the area where the ~~ammonia~~R717 machinery is installed is served by a hood with a negative ventilation system, so as not to permit any leakage of ammonia from dissipating into other areas in the space;

(2) a water spray system is provided for the said area;

(3) the requirements in 2.5.3.~~2~~1(2), 2.5.3.~~3~~2(1) and 2.5.3.~~4~~3 above are met.

2.5.4 Water-spraying system for R717 refrigerating machinery space

2.5.4.1 The system is to be independent and contains only fresh water, but may also be used for supply to the water screens.

2.5.4.2 The discharge nozzles in the space(s) protected are to be positioned such that the spray is directed over the entire area containing the ammonia refrigeration machinery. The spray volume of the water-spraying system is to be capable of absorbing the leaked ammonia.

2.5.4.3 The supply water of water-spraying system is to be pressurized. The pressurized system is to consist of two pumps and a tank which is to be fitted with adequate safety relief arrangements, pressure gauge(s), level control and level gauge.

2.5.4.4 Means are to be provided to automatically maintain the required pressure and the water level in the tank. In the event of low pressure or the low level, an audible alarm is to sound in the refrigeration machinery room and control room.

2.5.4.5 The water-spraying system is to be arranged to automatically start when the concentration of ammonia in the space exceeds 300 ppm.

2.5.4.6 If water-spraying system is fitted in the refrigerating machinery space, all electrical equipment in the space is to be to IP44 enclosure.

2.5.5 R717 vapor detection and alarm system

2.5.5.1 The detector is to be of a certified safe type, and the explosion groups and temperature classes are not to be lower than IIA T1 and to be suitable for the low temperature working environment.

2.5.5.2 The arrangement of R717 vapor detector is to meet the following requirements:

(1) The refrigerating machinery spaces; one detector per 36 m^2 of the space floor area.

(2) One detector in the exhaust duct of the refrigerating machinery space ventilation system.

(3) One detector in the access corridors leading to the ammonia refrigerating machinery spaces.

(4) One detector in the ammonia storage space.

2.5.5.3 The alarming and safety protection after detection of ammonia leak are to meet the following requirements:

(1) When the concentration of ammonia exceeds 25 ppm, the detectors are to activate alarms.

(2) When the concentration of ammonia exceeds 300 ppm, the detectors in the refrigerating machinery space are to automatically stop the refrigerating plant and automatically activate the emergency ventilation system.

(3) When the ammonia concentration exceeds 5000 ppm, all non-explosion proof electrical equipment in the refrigerating machinery space are to be cut off.

Section 6 SAFETY DEVICES

2.6.1 Relief valves and safety valves

2.6.1.4 All pressure vessels or other components of refrigerant systems which could become filled with liquid refrigerant and isolated are to be provided with safety discs ~~and~~or relief valves ~~in series~~, the discharge being led to a safe place above deck. ~~Pressure gauges showing intermediate pressure are to be fitted between the safety discs and relief valves in series.~~

CHAPTER 3 REFRIGERATED CARGO HOLDS/CHAMBERS

Section 1 DESIGN OF CARGO HOLDS/CHAMBERS

3.1.1 Airtightness of holds/chambers

3.1.1.5 Where cooling pipes pass through watertight deck plating and bulkheads, the fittings ~~and packing of the glands~~ are to be both fire resisting and watertight. Refrigerating pipelines are to be effectively insulated outside the chambers they serve, except within insulated brine coolers and control rooms.

Section 2 ACCESSORIES

3.2.2 Installation requirements for remote reading temperature instruments

3.2.2.1 At least two instruments are to be provided for each refrigerating system, with the sensing elements so connected that in the event of a failure of any one instrument, it is to be ensured that other temperature instruments are capable of testing the temperature of each hold/chamber ~~at least one sensing element will be operative for each hold/chamber either in the hold/chamber or in its air circulating system~~.

3.2.5 Drainage from refrigerated cargo spaces

3.2.5.2 ~~Drains which are led from lower holds/chambers and cooler trays situated on the tank top are to be fitted with liquid sealed non-return bilge traps. Drains from 'tween decks and from cooler trays which are situated well above the tank top are also to be fitted with liquid sealed traps, but the non-return valves may be omitted if desired.~~ Drains which are led from cooler trays situated in the hold/chamber are to be fitted with liquid sealed traps. The inside diameter of drains is not to be less than 38 mm.

Section 3 INSULATION

3.3.2 Insulation material

3.3.2.2 The insulants used for the refrigerated cargo holds/chambers are to be suitably resistant to fire and resistant to flame spread~~of low flame spread~~. The materials used and their adhesives are to be subject to approval by CCS. If chemical foam type of insulation is proposed, the process is to be subject to approval by CCS and the insulants are to be tested according to the recognized standards (e.g.: GB8624-2012 class B2 and other equivalent standards).

3.3.2.3 The covering on the surface of insulant is to be with the same performance to resist fire and flame spread as that of insulants.

3.3.4 Insulated plugs and panels

3.3.4.1 Insulated removable plugs are to be provided in the insulation where required for easy access to the bilge, bilge suction wells, cooler and chamber drains and tank manhole lids.

Insulated removable panels are to be provided for access to tank air and sounding pipes and drains. If necessary corrosion protection has been considered for the material of air, sounding and drains pipes, insulated removable panels may be dispensed with.



CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF SEA-GOING STEEL SHIPS

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PART SIX

FIRE PROTECTION, DETECTION AND EXTINCTION

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CHAPTER 2 FIRE EXTINCTION SYSTEMS

Section 1 WATER FIRE-EXTINGUISHING SYSTEMS

2.1.2 Number and arrangement of fire pumps

~~2.1.2.2 The emergency fire pump is to be so arranged that the total suction head of the pump will not exceed 4.5 m under all conditions of list and trim likely to be encountered in service and the suction piping is to be designed to minimize suction losses.~~

2.1.2.2 The arrangement of emergency fire pump is to comply with the requirements of Chapter 12 of the International Code for Fire Safety Systems (FSS Code).

CHAPTER 3 FIRE SAFETY MEASURES

Section 3 PROTECTION OF CARGO PUMP ROOMS ON OIL TANKERS

3.3.5 Non-sparking fans

3.3.5.2 Design criteria

(1) The air gap between the impeller and the casing is not to be less than 0.1 times the shaft diameter in way of the impeller bearing but not less than 2 mm. It need not be more than 13 mm.

Section 4 MISCELLANEOUS

3.4.15 Arrangement of oxygen, acetylene cylinders

3.4.15.1 Storage of oxygen, acetylene cylinders is to meet the following requirements:

(8) Prominent and permanent “NO SMOKING” signs are to be displayed at the gas cylinder storage room.

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PART SEVEN

AUTOMATION SYSTEMS

Revision explanation

1. Blue underline is to highlight new insertions, strikethrough line is to highlight deleted conte nts and cross line may be used to highlight deleted tables or figures.
2. No change in the English text means that only Chinese text is editorially revised while the change of corresponding English version is not needed.

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CHAPTER 3 REQUIREMENTS FOR CLASS NOTATION AUT-0 OF PERIODICALLY UNATTENDED MACHINERY SPACES

Section 9 FIRE PRECAUTIONS AND PROTECTION AGAINST FLOODING

3.9.1.3 Special requirements for fire detection systems

(1) An automatic fire detection system is to be fitted in the machinery spaces.

(2) The system is to be designed with self-monitoring properties. Power or system failures are to initiate an audible alarm distinguishable from the fire alarm.

(3) The fire detection indicating panel is to be located on the navigation bridge, fire control station, or other accessible place where a fire in the machinery space will not render it inoperative.

(4) The fire detection indicating panel is to indicate the place of the detected fire in accordance with the arranged fire zones by means of a visual signal. Audible signals clearly distinguishable in character from any other audible signals are to be audible throughout the navigation bridge and the accommodation area of the personnel responsible for the operation of the machinery space.

(5) Fire detectors are to be of such types, and so located, that they will rapidly detect the onset of fire in conditions normally present in the machinery space. Consideration is to be given to avoiding false alarms. The type and location of detectors are to comply with the relevant requirements of the International Convention for the Safety of Life at Sea, 1974 (hereinafter referred to as SOLAS Convention) and the International Code for Fire Safety Systems (hereinafter referred to as FSS Code) as well as CCS rules. A combination of detector types is recommended in order to enable the system to react to more than one type of fire symptom.

(6) Fire detector zones are to be arranged in a manner that will enable the operating staff to locate the seat of the fire. The arrangement of the fire detection system, the number of loops and the location of detector heads are to be approved in each case and comply with the relevant requirements of SOLAS Convention and FSS Code. Air currents created by the machinery are not to render the detection system ineffective.

(7) When fire detectors are provided with the means to adjust their sensitivity, necessary arrangements are to be ensured to fix and identify the set point.

(8) When it is intended that a particular loop or detector is to be temporarily switched off, this state is to be clearly indicated. Reactivation of the loop or detector is to be performed automatically after a preset time.

(9) The fire detection indicating panel is to be provided with facilities for functional testing.

(10) The fire detection system is to be fed automatically from the emergency source of power by separate feeder if the main source of power fails, and to comply with the requirements of 2.9.6, PART FOUR of the Rules.

(11) Facilities~~, such as manually operated call points,~~ are to be provided in the fire detection system to release manually the fire alarm from the passageways having entrances to engine and boiler rooms, navigation bridge and control station in engine room.

(12) The fire detection system is to be tested upon installation on board to confirm compliance with the rule requirements for function.

CHAPTER 4 REQUIREMENTS FOR MACHINERY NOTATIONS OF CONSTANTLY ATTENDED MACHINERY SPACES

Section 2 REQUIREMENTS FOR AUTOMATION OF SHIPS WITH CLASS NOTATION MCC

4.2.4 Fire precautions

4.2.4.1 The fire precautions are in general to comply with the requirements for fire detection and fire alarm systems in 3.9.1.~~1~~3 of this PART (the areas of an engine room which can be seen from the CCS may be exempted from the required sensors) and the requirements in 3.9.1.2 (except (4)) of this PART.

CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF SEA-GOING STEEL SHIPS

AMENDMENTS

2021

PART EIGHT
ADDITIONAL REQUIREMENTS

Revision explanation

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CHAPTER 5 ADDITIONAL REQUIREMENTS FOR FISHING VESSELS

Section 1 GENERAL PROVISIONS

5.1.1 General requirements

5.1.1.1 The provisions of this Chapter apply to fishing vessels.

5.1.1.2 Fishing vessels complying with the Rules for Construction of Ocean-going Steel Fishing Vessels are to be assigned the Fishing Vessel class notation.

5.1.1.3 Unless expressly provided by this Chapter, fishing vessels are to comply with the relevant requirements of PART ONE of the Rules.

5.1.2 Definitions

5.1.2.1 The definitions of this Chapter are as the following:

(1) Length L_L: refers to 96% of the total length of the waterline at 85% of the minimum moulded depth on the upper edge of the keel plate, or the length along the waterline from the leading edge of the bow to the center of the rudder stock, whichever is greater. For fishing vessels without rudder stock, the length L_L is taken as 96% of the total length of the waterline at 85% of the smallest depth. If the shape of the bow above the waterline at the minimum depth of 85% is concave, the foremost end of the total length and the front edge of the bow shall be measured from the point where the last point of the shape of the bow above the waterline is projected vertically on the waterline (see figure 5.1.2.1-1).For fishing vessels whose keel is designed to be inclined, the waterline for measuring this length should be parallel to the design waterline at 85% of the minimum moulded depth D_{min}. The waterline is obtained by drawing a tangent line parallel to the keel line of the fishing vessel and tangent to the depth arc of the working deck in the figure below. In this case, the minimum depth is the vertical distance measured from the upper edge of the keel plate to the upper side of the beam at the side of the working deck at the tangent point (see figure 5.1.2.1-2).

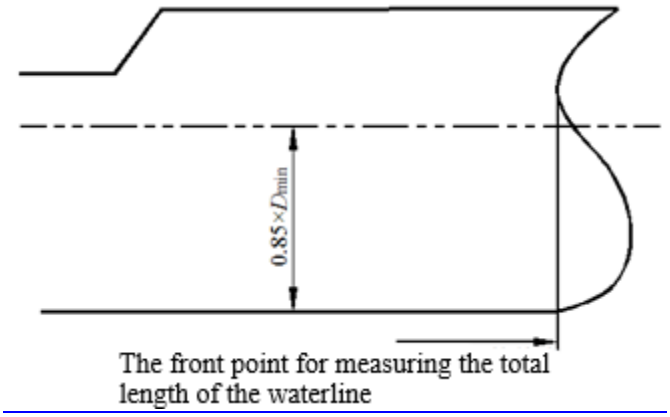


Figure 5.1.2.1-1 The front point for measuring the total length of the waterline, for fishing vessels with recessed bow shape.

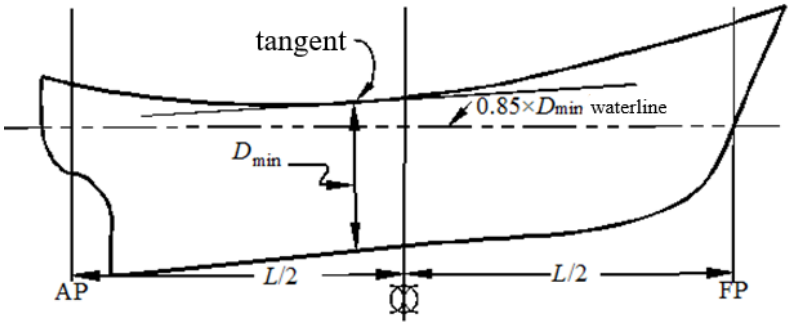


Figure 5.1.2.1-2 The length of a leaning keel fishing vessel

(2) Keel line: refers to the line that passes through the following specific points in the vessel and is parallel to the slope of the keel: for metal hull fishing vessels, it is the line of the upper edge of the keel or the line of intersection between the inner edge of the hull plate and the keel; if there is a bar keel, then it is the intersection point between the bar keel extension line and the inner side of the hull plate. For non-metallic fishing vessels, it is the intersection of the respective extension lines of the outer surface of the bottom and the outer surface of the bar keel; if there is no bar keel, it is the bottom point.

(3) Breadth B: refers to the maximum width in a fishing vessel. For a metal shell, the breadth is measured at the midship to the inner surface of the hull; for a fishing vessel with other material shells, the breadth is measured at the midship to the outer surface of the hull.

(4) Depth D: the vertical distance measured from the upper edge of the keel plate to the upper edge of the beam at the side of the working deck. For fishing vessels with wooden and mixed material structures, the vertical distance is measured from the lower edge of the keel notch. If the shape of the lower part of the midship section is concave, or when thickened keel wing panels are installed, the vertical distance is measured from the point where the inward extension line of the flat part of the bottom of the ship intersects with the side of the keel. If the working deck is stepped and its raised part extends beyond the point that determines the moulded depth, the moulded depth shall be measured to the extended dashed line of the lower part of the deck, which is parallel to the raised part of the deck. If there are no special regulations, it generally refers to the depth of the middle of the ship.

(5) Working deck: is generally the lowest complete deck above the deepest operating waterline from which fishing is undertaken. In vessels fitted with two or more complete decks, the lower deck as a working deck provided that the deck is situated above the deepest operating waterline.

Where the lowest complete deck above the deepest operating waterline is stepped, the lowest line of the deck and the continuation of that line parallel to the upper part of the deck is taken as the working deck.

Discontinuous working deck, stepped working deck,

① Where a recess in the working deck does not extend to the sides of the ship, the upper part of the deck is taken as the working deck (see figure 5.1.2.1-3).

② Recesses not extending from side to side in a deck below the exposed deck, designated as the working deck, may be disregarded, provided all openings in the weather deck are fitted with weathertight closing appliances.

③ Recesses not extending from side to side in a deck below the exposed deck, designated as the working deck, may be disregarded, provided all openings in the weather deck are fitted with weathertight closing appliances.

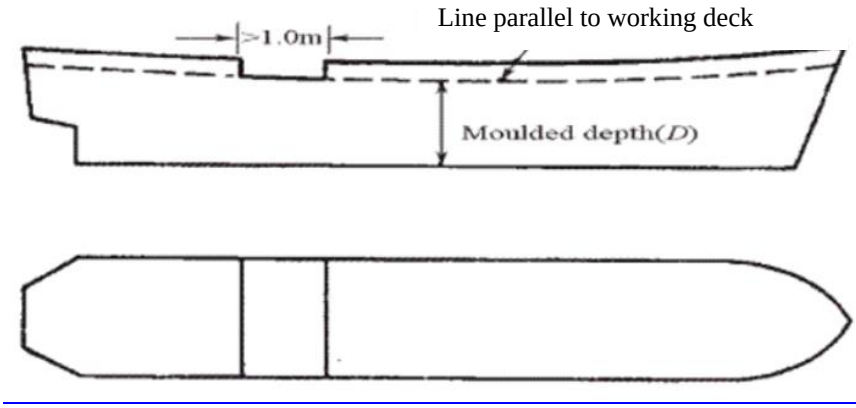


Figure 5.1.2.1-3 the working deck of a recess

Section 2 SURVEYS DURING CONSTRUCTION

5.2.1 Requirements for surveys and tests of fishing vessels

5.2.1.1 Unless expressly provided by this Section, surveys and tests of fishing vessels are to comply with the provisions of Sections 1 and 2, Chapter 4, PART ONE of the Rules.

5.2.1.2 Unless expressly provided by the flag State, the list of certification for statutory products of fishing vessels is to comply with the relevant requirements of Chapter 3 , PART ONE of the Rules.

5.2.1.3 Tests of fishing vessels are to comply with the requirements of 4.2.3, Section 2, Chapter 4, PART ONE of the Rules, except that 4.2.3.3(3) is not applicable. The tightness tests of compartments are to comply with the requirements of Part B, Annex 1, Section 3, Chapter 4, PART ONE of the Rules.

5.2.1.4 For hull surveys carried out in accordance with Appendix 1, Chapter 4, PART ONE of the Rules, statutory requirements of relevant SOLAS regulations corresponding to tightness test and structural test in Table 1 of this Appendix may not apply. Statutory requirements of SOLAS or ILLC ’66 corresponding to other shipbuilding function in Table 1 are to be replaced by relevant requirements of the Administration of the flag State.

Annex 2 of Appendix 1, Chapter 4, PART ONE of the Rules is not applicable to fishing vessels.

5.2.1.5 Unless expressly provided, Appendix 2 , Chapter 4 , PART ONE of the Rules is not applicable to fishing vessels.

5.2.1.6 At surveys during construction of fishing vessels, survey items are at least to include:

(1) inspecting the hull structure of fish hold to ensure that the materials, scantlings, construction, arrangement and installation are in accordance with the approved plans, diagrams, specifications, calculations and other technical documentation and that the workmanship is in all respects satisfactory;

(2) confirming the validity of the fish hold polyurethane foam test report;

(3) confirming the availability of the alarm system fitted in the refrigerated room and fish hold.

Section 3 SURVEYS AFTER CONSTRUCTION

5.3.1 General requirements

5.3.1.1 For the purpose of maintaining the validity of certificates, fishing vessels which have been classed with CCS are to be subject to the surveys as specified in this Section.

5.3.1.2 Unless expressly provided by this Section, surveys after construction of fishing vessels are to comply with the provisions of Chapter 5, PART ONE of the Rules.

5.3.1.3 The following requirements in Chapter 5, PART ONE of the Rules are not applicable to surveys after construction of fishing vessels:

(1) provisions of Sections 3, 5, 6, 7, 8, 16, 17 and 18;

(2) Appendixes 2, 3, 6, 10, 11, 12, 13, 17, 18, 19 and 20.

5.3.1.4 At surveys after construction of fishing vessels, survey items are at least to include:

(1) inspecting the general conditions of fish hold;

(2) confirming the availability of the alarm system fitted in the refrigerated room and fish hold.

Section 4 INTACT STABILITY

5.4.1 General requirements

5.4.1.1 Compliance with the requirements for intact stability is a condition for classification of ships.

5.4.1.2 The intact stability of fishing vessels is to comply with the requirements of this Section, or it is to be demonstrated that their intact stability is in compliance with the requirements of the flag State Administration.

5.4.1.3 This Section applies to ocean-going fishing vessels of 24 m and over in length L_L.

5.4.2 Plans and documents

5.4.2.1 The following plans and documents are to be submitted for approval or confirmation:

(1) Stability calculations for loading conditions or loading manual;

(2) Curves or table of allowable height of center of gravity or allowable initial metacentric height;

(3) Coordinates of opening of flooding angles and curves or table of flooding angles.

5.4.2.2 The following plans and documents are to be submitted for information:

(1) General arrangement;

(2) Lines and offsets;

(3) Hydrostatic curves or table;

(4) Stability cross curves or table;

(5) Capacity curves or table;

(6) Arrangement of bilge keels;

(7) Plan of load line marks and draught;

(8) Auxiliary calculations for windage area and moment of area, icing, etc.;

(9) Cross-sectional area (if applicable);

(10) Arrangement of fixed ballast (if applicable);

(11) Approved inclining test report or light ship survey report;

(12) Arrangement of portable fish-hold divisions (if applicable);

(13) Arrangement of fishing machinery (if applicable).

5.4.2.3 The above information may be reduced as appropriate for fishing vessels of which the intact stability has been approved.

5.4.3 Requirements for intact stability

5.4.3.1 The intact stability of fishing vessels is to comply with the relevant requirements of IMO resolution MSC.267(85) – International Code on Intact Stability, 2008 (2008 IS Code), Part B. For fishing vessels with B/D ≥ 2.5, the requirements of 2.2.3 of Part A of the Code may be substituted by the following criteria:

(1) The heeling angle corresponding to the maximum righting lever is not to be less than 15°;

(2) The area under the curve of righting levers is not be less than 0.07 m·rad up to an angle of 15° when the maximum righting lever occurs at 15° and 0.055 m·rad up to an angle of 30° when the maximum righting lever occurs at 30° or above. Where the maximum righting lever occurs at angles of between 15° and 30°, the corresponding area under the righting lever curve is to be:

$$0.055+0.001(30^\circ-\varphi_{max})\ \text{m}\cdot\text{rad}$$

where: φ_{max}——The heeling angle corresponding to the maximum righting lever（°）.

5.4.3.2 The angle of heel at which progressive flooding of fish-holds could occur through hatches which remain open during fishing operations and which cannot rapidly be closed shall be at least 20° unless the stability criteria of the righting lever curve of 5.4.3.1 can be satisfied with the respective fish-holds partially or completely flooded.

5.4.3.3 Vessels engaged in particular fishing methods where additional external forces are imposed on the vessel during fishing operations, shall take account of the effects of external forces on stability.

5.4.3.4 For special type fishing vessels such as beam trawler, net vessel, cage vessel etc, the special requirements (if applicable) of the Administration shall be satisfied.

5.4.3.5 For fishing vessels, the condition where ice accretion is likely to occur will have bad effects on the stability, so icing should be taken into account in the analysis of loading conditions. The following allowance shall be made in the icing calculations:

(1) 30kg/m^2 on exposed weather decks;

(2) 7.5kg/m^2 for projected lateral area of each side of the vessel above the water plane;

(3) the icing weight of the projected lateral area of rails, all kinds of booms, girder (except masts) and rigging, and the icing weight of the projected lateral area of other small objects shall be computed by increasing the total projected area of continuous surfaces by 5% and the static moments of this area by 10%.

If there is a significant difference between the icing conditions and the above requirements, the icing standard may be 0.5 to 2 times the required; if the expected icing exceeds 2 times the above-mentioned requirement, more stringent requirements can be adopted.

Section 5 DAMAGE STABILITY

5.5.1 General requirements

5.5.1.1 Compliance with the applicable requirements for damage stability is a condition for classification of vessels.

5.5.1.2 The damage stability of vessels is to comply with the requirements of this Section, or it is to be demonstrated that their damage stability is in compliance with the requirements of the flag State Administration.

5.5.1.3 Vessels of 100 m in length and over and the total number of persons carried is 100 or more should be checked for damage stability according to the requirements of this section.

5.5.2 Plans and documents

5.5.2.1 The following plans and documents are to be submitted for approval or confirmation:

(1) Calculations of damage stability;

(2) Damage control plan.

5.5.2.2 The following plans and documents are to be submitted for information:

(1) General arrangement of doors and windows;

(2) General arrangement of scuttles, ventilators and air pipes;

(3) Plans and documents stated in 5.4.2 of this Chapter.

5.5.3 Requirements for damage stability

5.5.3.1 The damage stability of vessels is to comply with the relevant requirements of Regulation 14, Chapter III of *INTERNATIONAL REGULATIONS FOR THE SAFETY OF FISHING VESSELS.*

Section 6 LOAD LINE MARKS AND MARKING

5.6.1 Load line marks

5.6.1.1 The load line marks and marking for ocean-going fishing vessels are to comply with the provisions of Section 11, Part 2 of this Rule.

5.6.1.2 If the load lines of certain seasons are not applicable due to the particularity of the fishing vessel or the nature of the business or restricted by navigation, these load line segments may not be mapped.

Section 7 STRUCTURAL ARRANGEMENT

5.7.1 General Provisions

5.7.1.1 The provisions of this section apply to ocean-going steel fishing vessels of 24 m and over in length.

5.7.2 Arrangement of watertight bulkheads

5.7.2.1 Fishing vessels shall be fitted with a collision bulkhead and at least watertight bulkhead in the before and after end of the main machinery space. Such watertight bulkheads shall be extended up to the working deck.

5.7.2.2 Watertight subdivision bulkhead whether transverse or longitudinal shall be prevented ingress of water from any direction in the water pressure produced in intact and damage condition. In all cases, watertight subdivision bulkheads shall be capable of supporting at least the pressure due to a head of water up to the working deck. In damage condition，water pressure shall be taken into account in the balance , including the worst condition of intermediate stage of flooding.

5.7.2.3 Steps and recesses in watertight bulkheads shall be as strong as the bulkhead at the place where each occurs.

5.7.3 Arrangement of collision bulkheads

5.7.3.1 The distance between collision bulkheads and forward perpendicular of fishing vessels shall be meets the following requirements:

(1) not less than 0.05*L* and not more than 0.08*L* for vessels of 45m in length and over;

(2) not less than 0.05*L* and not more than 0.05*L* plus 1.35m for vessels of less than 45m and more than 24m in length, expect as may be allowed by CCS;

(3) less than 2.0m for vessels of 24m in length and over.

5.7.3.2 Where any part of the ship below the waterline extends forward of the forward perpendicular, e.g., a bulbous bow, the distances specified in paragraph 5.7.3.1 of this Section shall be measured from a point at mid-length of the extension forward of the forward

perpendicular or from a point 0.015*L* forward perpendicular, whichever is lesser.

5.7.3.3 The bulkhead may have steps or recesses provided they are within the limits prescribed in paragraph 5.7.3.1 of this Section.

5.7.3.4 Where a long forward superstructure is fitted, the collision bulkhead shall be extended weathertight to the deck next above the working deck. The extension and collision bulkhead can be fitted on the different cross section provided it is located within the limits given in paragraph 5.7.3.1 of this Section and the part of the deck which forms the step is made effectively weathertight.

5.7.3.5 The pipes piercing the collision bulkhead shall be fitted with stop values capable of being operated from above the working deck, the valve being located inside the forepeak at the collision bulkhead with a indicator being used for show that the value turn on or off. The fitting of the valve without institution operated from above the working deck on the after side of the collision bulkhead shall be authorized, provided that the valve is readily accessible under all service conditions and the space in which it is located is not a cargo space. All valves shall be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable.

5.7.3.6 No doors, manholes, access openings, or any other openings shall be fitted in the collision bulkhead below the working deck The number of openings in the collision bulkhead above the working deck shall be restricted to the minimum compatible with the design and normal operation of the vessels. All such openings shall be capable of being closed weathertight.

5.7.4 Stern tubes

5.7.4.1 In all cases stern tubes shall be enclosed in watertight spaces of moderate volume, to minimize the danger of water penetrating into the ship in case of damage to stern tube arrangements.

5.7.5 Openings and their closing appliances

5.7.5.1 The number of openings in watertight subdivisions is to be kept to a minimum compatible with the design and proper working of the fishing vessels. Where penetrations of watertight bulkheads and internal decks are necessary for access, piping, ventilation, electrical cables, etc., arrangements are to be made to maintain the watertight integrity.

5.7.5.2 The acceptability height of hatchways coamings and sills for openings are to comply with the requirements in Table 5.7.5.2:

The acceptability height of hatchways coamings and sills for openings Table 5.7.5.2

Opening position / Item	Position 1	Position 2
Superstructure and deckhouse sill (mm)	380	300/150
Sill of companionways (mm)	380	300/150
Machinery space opening	600	300

(mm)		
Height of hatch coamings (mm)	600	450/300

5.7.5.3 Weathertight doors

(1) all access openings in bulkheads of enclosed superstructure and other outer structures through which water could enter and endanger the vessel, shall be fitted with doors permanently attached to the bulkhead, framed and stiffened so that the whole structure is of equivalent strength to the unpierced structure, and weathertight when closed. As an alternative measure, where the stairway in deckhouse could be enclosed in substantially constructed companionways fitted with weathertight door, the outer door need not to be weathertight. The means for securing these doors weathertight shall consist of gaskets and clamping devices or other equivalent means and shall be permanently attached to the bulkhead or to the doors themselves, and shall be so arranged that they can be operated from each side of the bulkhead;

(2) weathertight doors directly access to exposed space are to open outwards.

5.7.5.4 Fish-holds and other hatchways, miscellaneous openings in working deck and superstructure decks are to comply with the following requirements:

(1) the hatchways coamings are to have substantially constructed according to its positions. Where operating experience has shown justification, the height of these coamings may be reduced, or the coamings omitted entirely, provided that the safety of vessels is not thereby impaired. In this case, the hatchway openings shall be kept as small as practicable and the covers be permanently attached by hinges or equivalent means and be capable of being rapidly closed and battened down;

(2) the structure of hatchways closed by wood covers in Positions 1 and 2 and the means for keeping them weathertight are to comply with the relevant requirements of Regulation 15 of the Amendments to Annex I of Annex B to the Protocol of 1988 Relating to the *International Convention on Load Lines, 1966*;

(3) the structure of hatchways closed by covers other than wood in Positions 1 and 2 and the means for keeping them weathertight are to comply with the relevant requirements of Regulation 6 of Chapter II of *Convention for the Safety of Fishing Vessels*.

5.7.5.5 Machinery space openings are to comply with the following requirements:

(1) machinery space openings are to be appropriate framed and efficiently enclosed by steel casings. Where machinery casings are not protected by other structures，the strength shall be considered specially. Access openings in such casings are to be fitted with weathertight doors, the sills of which are not less than 600 mm. Where machinery casings are not protected by other structures, double watertight doors are to be required for ships assigned freeboards less than those based on relevant requirements. An inner sill is not less than 230mm in conjunction with the outer sill of 600 mm; The non-return valve which is to be closed directly and controlled locally shall be provided for sea inlet and discharge of the enclosure space between the double doors;

(2) opening shall be fitted with hatchway covers permanently attached to the bulkhead, framed and stiffened so that the whole structure is of equivalent strength to the unpierced structure, and weathertight when closed except access opening.

5.7.5.6 Other deck openings are to comply with the following requirements:

(1) where it is essential for fishing operations, flush deck scuttles of the screw, bayonet or equivalent type and manholes may be fitted provided these are capable of being closed watertight and such devices shall be permanently attached to the adjacent structure, except secured by closely spaced bolts. Having regard to the size and disposition of the openings and the design of the closing devices, metal-to-metal closures may be fitted that they are effectively watertight;

(2) openings other than hatchways, machinery space openings, manholes and flush scuttles in the working or superstructure deck shall be protected by enclosed structures fitted with weathertight doors or their equivalent. Companionways shall be situated as close as practicable to the centerline of the vessels.

5.7.5.7 Ventilators are to comply with the following requirements:

(1) ventilators to spaces below working deck or decks of enclosed superstructures are to have coamings of steel or other equivalent material, substantially constructed and efficiently connected to the deck. For vessels of 45m in length and over, the height above deck of ventilators coamings shall be at least 900mm on the working deck and at least 760mm on the superstructures deck. For vessels of less than 45m in length, the height of these coamings shall be 760mm and 450mm respectively;

(2) coamings of ventilators shall be of equivalent strength to the adjacent structure and capable of being closed weathertight by closing appliances permanently attached to the ventilators or adjacent structure. The closing appliances shall be permanently attached to the ventilators; Where other vessels such not fitted as this, the closing appliances shall be stored near the specified ventilators and convenient for use. Where the coaming of any ventilators exceeds 900mm in height, it shall be specially supported.

The thickness of ventilator coamings shall be not less than the requirements in Table 5.7.5.7, but need not exceed that of the deck.

Thickness of Ventilator Coamings Table 5.7.5.7

Internal diameter of coaming (mm)	Thickness of coaming (mm)	Internal diameter of coaming (mm)	Thickness of coaming (mm)
≤200	7.5	350	9.0
250	8.0	400	9.5
300	8.5	≥450	10.0

(3) the coamings of ventilators extend to more than 4.5 m above the working deck, and the coamings of ventilators extend to more than 2.3 m above the superstructures deck, need not be fitted with closing arrangements for vessels of 45m in length and over. The coamings of Ventilators extend to more than 3.4 m above the working deck , and the coamings of Ventilators extend to more than 1.7 m above the superstructures deck, need not be fitted with closing arrangements for vessels of less than 45m in length;

(4) Ventilators passing through superstructures other than enclosed superstructures are to have substantially constructed coamings of steel or other equivalent material at the working deck.

5.7.5.8 Air pipes are to comply with the following requirements:

(1) where air pipes to tanks and void spaces below deck extend above the working or the superstructure decks, the exposed parts of the pipes shall be of strength equivalent to the adjacent

structures and fitted with appropriate protection. Openings of air pipes shall be provided with means of closing, permanently attaches to the pipe or adjacent structure.

The minimum wall thickness of air pipes above weather deck is to be:

6.0 mm for pipes of 80 mm external diameter or smaller;

8.5 mm for pipes of 165 mm external diameter or greater.

Intermediate minimum thicknesses are to be determined by linear interpolation;

(2) the height of air pipes above deck to the point where water may have access below shall be at least 760mm on the working deck and at least 450mm on the superstructure deck.

5.7.5.9 Freeing ports are to comply with the following requirements:

(1) where bulwarks on weather parts of the working deck or superstructures deck form wells, sufficient measures shall be provided to discharge of shipped water rapidly and freed of water;

(2) freeing ports area of bulwarks are to comply with the requirements of Regulation 14 of Chapter II of *Convention for the Safety of Fishing Vessels*.

5.7.5.10 Fish-holds gangway and other similar openings are to comply with the following requirements:

(1) fish-holds gangway of both sides of the vessels below working deck and other similar openings shall be fitted with the door open outwards, which are designed to ensure that they have equivalent watertight and structural integrity to the adjacent shell plating. The number of openings above is to be kept to a minimum compatible with the design and proper working of the fishing vessels;

(2) the lower edge of opening mentioned in(1) shall not be lower than the parallel of the side working deck, and the lowest point of the parallel shall be fitted at least 230mm above the top edge of the deepest operating waterline.

5.7.6 **Arrangement of double bottoms**

5.7.6.1 For vessels of 45m in length and over but less than 60m, a double bottom shall be fitted at least between front bulkhead of engine and collision bulkhead or close to these place as far as possible; For vessels of 60m in length and over but less than 75m, a double bottom shall be fitted in the area except engine at least, and that is to be extended to the collision bulkhead and the afterpeak bulkhead or close to these place as far as possible; For vessels of 45m in length and over, a double bottom shall be fitted in the midship that is to be extended to the collision bulkhead and the afterpeak bulkhead or close to these place as far as possible.

5.7.6.2 Where a double bottom is required to be fitted the inner bottom shall be continued out to the vessel's sides in such a manner as to protect the bottom to the turn of the bilge. Such protection will be deemed satisfactory if the inner bottom is not lower at any part than a plane parallel with the keel line and which is located not less than a vertical distance h measured from the keel line, h is to be less than *B/20*. However, in no case is the value of h to be less than 760 mm, and need not be taken as more than 2,000 mm.

5.7.6.3 A double bottom need not be fitted in way of watertight tanks, including dry tanks of moderate size, provided the safety of the vessel is not impaired in the event of bottom or side damage.

5.7.6.4 Small wells constructed in the double bottom in connection with drainage arrangements of fish-holds shall not extend downward more than necessary. A well extending to the outer bottom is, however, permitted at the after end of the shaft tunnel. Other wells (e.g. for lubricating oil under main engines) may be permitted if satisfied that the arrangements give protection equivalent to that afforded by a double bottom complying with the requirements of this section. The vertical distance from the bottom of such a well to a plane coinciding with the keel line shall not be less than $h/2$ or 500 mm.

5.7.7 **Arrangement of cofferdams**

5.7.7.1 Cofferdams are to be provided between compartments intended for fuel oil in double bottom and those intended for fresh water for boilers and drinking.

5.7.7.2 Cofferdams are only required between fuel oil tanks in double bottom and tanks immediately above where the inner bottom plating is subjected to the head of fuel oil contained therein, as in the case of a double bottom with its top raised at the sides. Where a corner to corner situation occurs for such tanks, they are not considered to be adjacent.

5.7.7.3 Cofferdams are to be provided between non-edible oil tanks, fish tanks and fresh water tanks; if the spaces between the fish tanks and non-edible oil tanks meet the requirements specified in 3.3.1.2, 3.3.1.3 or 3.3.1.4 of Part 1 of *Rules for Construction of Ocean-going Steel Fishing Vessels*, cofferdams are not needed.

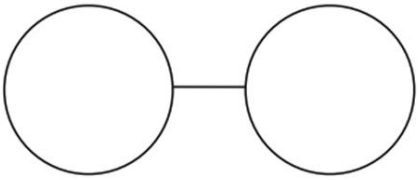
5.7.8 **Arrangement of chain lockers**

5.7.8.1 Spurling pipes and cable lockers are to be watertight up to the deck exposed to weather. However, the bulkhead between separate chain lockers (Figure 5.7.8.1(1)) or the common bulkhead between adjacent lockers (Figure 5.7.8.1(2)) need not be watertight.

5.7.8.2 Where means of access are provided, they are to be closed by a substantial cover and secured by closely spaced bolts.

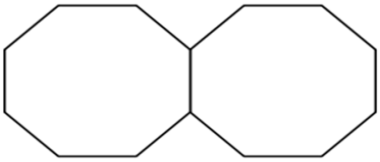
5.7.8.3 Where a means of access to spurling pipes or cable lockers is located below the weather deck, the manhole covers and securing appliances are to be in consistence with recognized standards (e.g., i) ISO 5894-1999; ii) China: GB 11628-1989 Ship Manhole Cover; iii) India: IS 15876-2009 “Ship and Marine Technology manholes with bolted covers”; iv) Japan: JIS F2304, “Ship’s Manholes” and JIS F2329, “Marine Small Size Manhole”; v) Korea: KSV 2339:2006 and KS VISO5994; vi) Norway: NS 6260:1985 to NS 6266:1985; vii) Russia: GOST 2021-90 “Ship’s steel manholes, Specifications”), or equivalent to the watertight manhole covers. The use of butterfly nuts and/or hinged bolts as the securing appliances of manhole covers is prohibited.

5.7.8.4 Spurling pipes through which anchor cables are led are to be provided with permanently attached closing appliances (e.g. steel plates in halves hooked over the spurling pipe tops, or canvas covers lashed) to minimize water ingress.



chain locker A chain locker B

Figure 5.7.8.1(1)



chain locker A chain locker B

Figure 5.7.8.1(2)

Section 8 FIRE SAFETY

5.8.1 General requirements

5.8.1.1 This Section applies to ocean-going fishing vessels of 24m in length and over.

5.8.1.2 The fire safety of fishing vessels is to meet the requirements of this Section, taking into account the requirements of the flag State Administration, if any.

5.8.1.3 The fire safety of fishing vessels of 45m in length and over is to comply with the relevant provisions of the Convention for the Safety of Fishing Vessels.

5.8.2 Plans and documents

5.8.2.1 The following plans and documents are to be submitted for approval or confirmation:

(1) Fire protection zone division plan and typical fire protection node plan;

(2) Fire insulation arrangement plan, deck covering arrangement plan and fire door arrangement plan;

(3) Ventilation system arrangement plan;

(4) Fixed fire extinguishing system arrangement plan and fire extinguishing dose calculation sheet;

(5) Water fire extinguishing system arrangement plan;

(6) Arrangement plan of fixed fire detection and alarm system;

(7) Control system diagram of quick closing valve for fuel and lubricating oil tanks;

(8) Fire control plan;

(9) Other plans and documents considered necessary by CCS.

5.8.3 Product certificate

5.8.3.1 All the main materials, equipment and devices used for fire protection of fishing vessels are to have corresponding CCS product certificates. For details, please refer to the relevant requirements in Appendix 1 B List of Requirements for Certification of Ship's Statutory Products of Chapter 3, Part 1 of this Rules.

5.8.4 Use of substitutes

5.8.4.1 Any special type of equipment, appliance, fire extinguishing agent or device mentioned in this Section may be replaced by other types of equipment without reducing efficiency, but relevant calculation, test or use experience are to be provided.

5.8.5 Fire safety requirements for fishing vessels of 30m in length and over but less than 45m

5.8.5.1 Structural fire protection

(1) The hull, superstructure, decks and deckhouses are to be constructed of non-combustible materials.

(2) The decks and bulkheads separating machinery spaces of category A from accommodation spaces, service spaces or control stations are to be constructed to "A-0" class standard. Decks and bulkheads separating other machinery spaces from accommodation, service spaces and control stations are to be "A-0" class standard. Decks and bulkheads separating the skipper's cabin from the wheelhouse, control stations from accommodation and service spaces are to be constructed to "B" class standard.

(3) The bulkheads of corridors serving accommodation spaces, service spaces and control stations are to be of "B-0" class divisions.

(4) Any bulkhead of corridor serving accommodation spaces, service spaces and control stations is to extend from deck to deck unless a continuous ceiling of the same class as the bulkhead is fitted on both sides of the bulkhead, in which case the bulkhead may terminate at the continuous ceiling.

(5) Interior stairways serving accommodation spaces, service spaces or control stations are to be made of steel or other equivalent material. Such stairways are to be within enclosures constructed of "B-15" class divisions, provided that, where a stairway penetrates at least two decks.

(6) Doors and other closures of openings in bulkheads and decks referred to in 5.8.5.1 (2) to (4) of this Section, doors fitted to stairway enclosures referred to in 5.8.5.1 (5) of this Section, and doors fitted in engine and boiler casings, are to be as far as practicable equivalent in resisting fire to the divisions in which they are fitted. Doors to machinery spaces of category A are to be self-closing.

(7) Lift trunks which pass through the accommodation and service spaces are to be constructed of steel or other equivalent material and to be provided with means of closing which will permit control of draught and smoke.

(8) The boundary bulkheads and decks of spaces containing any emergency source of power, and bulkheads and decks between galleys, paint rooms, lamp rooms or any store-rooms which contain appreciable quantities of highly flammable materials and accommodation spaces, service spaces or control stations, are to be constructed of "A" class divisions. However, "B-15" class divisions between a galley and accommodation spaces, service spaces and control stations may be accepted when the galley contains electrically heated furnaces, electrically heated hot water appliances or other electrically heated appliances only.

(9) Highly flammable products are to be carried in suitably sealed containers.

(10) When bulkheads or decks required by this Section to be "A" or "B" class divisions, are penetrated for the passage of by electrical cables, pipes, trucks, ducts, etc., arrangements are to be

made to ensure that the fire integrity of the division is not impaired.

(11) Air spaces enclosed behind ceilings, panellings or linings in accommodation spaces, service spaces and control stations are to be divided by close-fitting draught stops spaced not more than 7 m apart.

(12) Windows and skylights to machinery spaces are to be as follows:

① where skylights can be opened, they are to be capable of being closed from outside the space. Skylights containing glass panels are to be fitted with external shutters of steel or other equivalent material permanently attached;

② glass or similar materials are not to be fitted in machinery space boundaries. This does not preclude the use of wire-reinforced glass for skylights and glass in control rooms within the machinery spaces; and

③ wire-reinforced glass is to be used in skylights referred to in 5.8.5.1(12) ① of this Section.

(13) Insulating materials in accommodation spaces, service spaces except domestic refrigerating compartments, control stations and machinery spaces are to be non-combustible. The surface of insulation fitted on the internal boundaries of machinery spaces of category A is to be impervious to oil or oil vapours.

(14) Within compartments used for stowage of fish, combustible insulation are to be protected by close-fitting cladding.

5.8.5.2 Ventilation system

(1) Except ventilators serving spaces in which stoves are installed can have no closing appliances in accordance with 5.8.5.3 (2) of this Section, means are to be provided to stop fans and close main openings to ventilation systems from outside the spaces served .

(2) Means are to be provided for closing, from a safe position, the annular spaces around funnels.

(3) Ventilation openings may be permitted in and under the doors in corridor bulkheads except that such openings are not to be permitted in and under stairway enclosure doors. The openings are to be provided only in the lower half of a door. Where such opening is in or under a door, the total net area of any such opening or openings is not to exceed 0.05m^2. When such opening is cut in a door, it is to be fitted with a grille made of non-combustible material.

(4) Ventilation ducts for machinery spaces of category A or galleys are not to, in general, pass through accommodation spaces, service spaces or control stations. If the ducts are to be constructed of steel or equivalent material and arranged to preserve the integrity of the divisions, this arrangement can be permitted.

(5) Ventilation ducts of accommodation spaces, service spaces or control stations are not to, in general, pass through machinery spaces of category A or through galleys. If the ducts are to be constructed of steel or equivalent material and arranged to preserve the integrity of the divisions, this arrangement can be permitted.

(6) Store-rooms containing flammable products and exceeding 4m^2 are to be provided with ventilation arrangements which are separate from other ventilation systems. Ventilation are to be arranged at high and low levels and the inlets and outlets of ventilators are to be positioned in safe areas. Suitable wire mesh guards to arrest sparks are to be fitted over inlet and outlet ventilation openings.

(7) Ventilation systems serving machinery spaces are to be independent of systems serving other spaces.

(8) Where trunks or ducts serve spaces on both sides of "A" class bulkheads or decks, dampers are to be fitted so as to prevent the spread of fire and smoke between compartments. Manual dampers are to be operable from both sides of the bulkhead or the deck. Where the trunks or ducts with a free cross-sectional area exceeding $0.02m^2$ pass through "A" class bulkheads or decks, automatic self-closing dampers are to be fitted. Where the trunks with a free cross-sectional area exceeding $0.02m^2$ serving compartments situated only on one side of such bulkheads, unless the ducts are of steel in the vicinity of passage through the deck or bulkhead, the openings are to be lined with a steel sheet sleeve and comply in that portion of the duct with the following:

① for ducts with a free cross-sectional area exceeding $0.02m^2$, the sleeves are to have a thickness of at least 3 mm and a length of at least 0.9m. When passing through bulkheads, this length are to preferably be divided evenly on each side of the bulkhead. Ducts or sheet sleeve fitted to these ducts are to be provided with fire insulation. The insulation are to have at least the same fire integrity as the bulkhead or deck through which the duct passes. Equivalent penetration protection may be provided; and

② ducts with a free cross-sectional area exceeding $0.075m^2$ are to be fitted with fire dampers in addition to the requirements of ① above. The fire damper is to operate automatically, but is also to be capable of being closed manually from both sides of the bulkhead or deck. The damper is to be provided with an indicator which shows whether the damper is open or closed. Fire dampers are not required, however, where ducts pass through spaces surrounded by "A" class divisions, without serving those spaces, provided those ducts have the same fire integrity as the bulkheads which they penetrate.

5.8.5.3 Heating installations

(1) Electric radiators are to be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiator are to be fitted with an element so exposed that clothing, curtains or other similar materials can be scorched or set on fire by heat from the element.

(2) Heating by means of open fires are not to be permitted. Heating stoves and other similar appliances are to be firmly secured and adequate protection and insulation against fire are to be provided beneath and around such appliances and in way of their uptakes. Uptakes of stoves which burn solid fuel are to be so arranged and designed as to minimize the possibility of becoming blocked by combustion products and are to have a ready means for cleaning. Dampers for limiting draughts in uptakes are still to leave an adequate area open when in the closed position. Spaces in which stoves are installed are to be provided with ventilators of sufficient area to provide adequate combustion-air for the stove. Such ventilators are to have no means of closure and their position is to be such that closing appliances in accordance with 5.7.5.7 in Section 7 of this Chapter are not required.

(3) Open flame gas appliances, except cooking stoves and water heaters, are not to be permitted. Spaces containing any such stoves or water heaters are to have adequate ventilation to remove fumes and possible gas leakage to a safe place. All pipes conveying gas from container to stove or water heater are to be of steel or other approved material. Automatic safety gas shut-off devices are to be fitted to operate on loss of pressure in the gas main pipe or flame failure on any

appliance.

5.8.5.4 Miscellaneous items

(1) Exposed surfaces within accommodation spaces, service spaces, control stations, corridor and stairway enclosures and the concealed surfaces behind bulkheads, ceilings, panellings and linings in accommodation spaces, service spaces and control stations are to have low flame-spread characteristics.

(2) Paints, varnishes and other finishes used on exposed interior surfaces are not to be capable of producing excessive quantities of smoke or toxic gases or vapours.

(3) Primary deck coverings within accommodation and service spaces and control stations, are to be of approved material which will not readily ignite or give rise to toxic or explosive hazards at elevated temperatures.

(4) In accommodation and service spaces and control stations, pipes penetrating "A" or "B" class divisions are to be of approved materials capable of withstanding the temperature required by the division. Due to arrangement reasons, the pipes conveying oil or combustible liquids that pass through accommodation and service spaces are to be approved fire-resistant material.

(5) Materials readily rendered ineffective by heat are not to be used for overboard scuppers, sanitary discharges and other outlets which are close to the waterline and where the failure of the material in the event of fire would give rise to danger of flooding.

(6) All waste receptacles, other than those used in fish processing, are to be constructed of non-combustible materials with no openings in the sides and bottom.

(7) Machinery driving fuel oil transfer pumps, fuel oil unit pumps and other similar fuel pumps are to be fitted with remote controls situated outside the space concerned so that they can be stopped in the event of a fire arising in the space in which they are located.

(8) Drip trays are to be fitted, where necessary, to prevent oil leaking into bilges.

5.8.5.5 Storage of gas cylinders and dangerous materials

(1) Cylinders for compressed, liquefied or dissolved gases are to be clearly marked by means of prescribed identifying colours, have a clearly legible identification of the name and chemical formula of their contents and be properly secured.

(2) Cylinders containing flammable or other dangerous gases and expended cylinders are to be stored, properly secured, on open decks and all valves, pressure regulators and pipes leading from such cylinders are to be protected against damage. Cylinders are to be protected against excessive variations in temperature, direct rays of the sun, and accumulation of snow. Due to arrangement reasons, such cylinders an be permitted to be stored in compartments complying with the requirements of 5.8.5.5 (3) to (5) of this Section.

(3) Spaces containing highly flammable liquids, such as volatile paints, paraffin, benzol, etc., and, where permitted, liquefied gas, are to have direct access from open decks only. Pressure-adjusting devices and relief valves are to exhaust within the compartment. Where boundary bulkheads of such compartments adjoin other enclosed spaces, they are to be gastight.

(4) Except as necessary for service within the space, electrical wiring and fittings are not to be permitted within compartments used for the storage of highly flammable liquids or liquefied gases. Where such electrical fittings are installed, they are to be approved safety devices. Sources of heat are to be kept clear of such spaces and "No smoking" and "No naked light" notices are to be displayed in a prominent position.

(5) Separate storage are to be provided for each type of compressed gas. Compartments used for the storage of such gases are not to be used for storage of other combustible products nor for tools or objects not part of the gas distribution system.

5.8.5.6 Means of escape

(1) Stairways and ladders leading to and from all accommodation spaces and in spaces in which the crew is normally employed, other than machinery spaces, are to be so arranged as to provide ready means of escape to the open deck and, thence, to the survival craft:

① at all levels of accommodation at least one means of escape is be provided. Where two or more means of escape are provided, they are to be as widely separated as possible, which include the normal means of access from each restricted space or group of spaces;

② a corridor or a part of a corridor from which there is only one route of escape is not to preferably exceed 5 m in length and, in no case, be greater than 7 m in length; and

③ stairways and corridors used as means of escape are not to be less than 700 mm in clear width, and are to have a handrail on one side. Stairways and corridors with a clear width of 1800mm and over are to have handrails on both sides. "Clear width" is considered the distance between the handrail and the bulkhead on the other side or between the handrails on both sides. The angle of inclination of stairways is to be, in general, 45 °but not greater than 50 °and in machinery spaces and small spaces not more than 60 °. Doorways which give access to a stairway is to be of the same size as the stairway.

(2) Two means of escape are to be provided from every machinery space of category A which are to be as widely separated as possible. Vertical escapes are to be by means of steel ladders. Where the size of the machinery spaces makes it impracticable, one of these means of escape may be omitted. Where the length of machinery space of category A is less than 7m, one means of escape can be permitted.

5.8.5.7 Automatic fire detection and alarm system

(1) Where appreciable amounts of combustible materials are used on the construction of accommodation spaces, service spaces and control stations, special consideration are to be given to the installation of an automatic fire detection and alarm system in those spaces, having due regard to the size of those spaces, their arrangement and location relative to control stations.

5.8.5.8 Fire pump

(1) Each fishing vessel is to be equipped with water fire extinguishing system. The minimum number and type of fire pumps to be fitted are to be as follows:

① one power pump not dependent upon the main machinery for its motive power; or

② one power pump driven by main machinery, provided that the propeller shafting can be readily disconnected or provided that a controllable pitch propeller is fitted.

(2) Sanitary, bilge, ballast, general service or any other pumps may be used as fire pumps if they comply with the requirements of this chapter and do not affect the ability to cope with pumping of the bilges. Fire pumps are to be so connected that they cannot be used for pumping oil or other flammable liquids.

(3) Centrifugal pumps or other pumps connected to the fire main through which backflow could occur are to be fitted with non-return valves.

(4) The total capacity of main power-operated fire pumps are to be at least:

$$Q=(0.15\sqrt{L(B+D)}+2.25)^2 \ m^3/h$$

Where: *L*——Length, m

B——Breadth, m

D——Depth, m.

(5) Where two independent power-operated fire pumps are fitted, the capacity of each pump is not to be less than 40% of the quantity required by 5.8.5.8(4) of this Section.

(6) When main power fire pumps are delivering the quantity of water required by 5.8.5.8(4) of this Section through the fire main, fire hoses and nozzles, the pressure maintained at any hydrant is not to be less than 0.20N/mm^2.

(7) The emergency fire pump of fishing vessel is to be fitted are to be as follows:

① if a fire in any one compartment could put all the fire pumps out of action, there is generally to be an emergency fire pump. This emergency fire pump can be portable.

② the emergency fire pump is to be capable of delivering water through the jet required by 5.8.5.10 (1) of this Section.

③ the fixed emergency fire pump can be driven by diesel engine or motor, and is to meet the requirements as follows:

——the emergency fire pump is generally to be capable of maintaining a water jet with a range of 12m and over from the fire hydrant at the highest position of the fishing vessel (the number of fire hydrants is set as the following provision), and the pressure at the hydrant is not to be less than the provisions in 5.8.5.8(6) of this Section;

——when the emergency fire pump runs, the number of fire hydrants used at the same time is not to be less than one;

——the outlet pipe of the emergency fire pump is to be connected to the fire main;

——the emergency fire pump is to be located outside the engine room and within spaces easily accessible, and be set above working deck as far as possible, and supplied water by an independent submarine valve located outside the main fire pump space.The locations of the pump and its suction are to be such that the pump can still run effectively at the lowest draught that may be encountered in the operation of fishing vessels. The emergency fire pump is to be self-priming;

——if the emergency fire pump is driven by motor, it is to be powered by emergency power supply and the continuous running time is not to be less than 3 hours when the main power supply is cut off;

——if the emergency fire pump is directly driven by the diesel engine or indirectly driven by the emergency diesel generator set, the diesel engine is to be capable of being readily started in its cold condition down to the temperature of 0℃, and its fuel flash point (closed cup test) is not to be lower than 43℃, and fuel tank is to contain sufficient fuel to enable the pump to run on full load for at least 3 h. In addition sufficient reserves of fuel is to be available to enable the pump to be run on full load for an additional 9 h.

④ portable power emergency fire pump is suitable to be driven by diesel engine. fuel tank is to contain sufficient fuel to enable the pump to run on full load for at least 3 h. In addition sufficient reserves of fuel is to be available to enable the pump to be run on full load for an additional 9 h. The pump is to be equipped with necessary accessories.

⑤ for the emergency fire pump which is allowed to use portable power, the permanent sea connection device for emergency use is generally to be set outside the machinery space. The use of hose to absorb water directly from the outboard is to be approved by CCS.

⑥ the suction pipeline of emergency fire pump is to be designed to minimize the loss of suction head.

⑦ the emergency fire pump along with its submarine valve and other necessary valves are to be operable from outside compartments containing main fire pumps in a position not likely to be cut off by a fire in those compartments.

5.8.5.9 Fire mains

(1) Where more than one hydrant is required to provide the number of jets specified in 5.8.5.10 (1) of this Section, a fire main is to be provided.

(2) Materials readily rendered ineffective by heat are not to be used for fire mains, unless adequately protected.

(3) Where fire pump delivery pressure can exceed the designed working pressure of fire mains, relief valves is to be fitted.

(4) Fire mains are not to have any connection to any system other than those required for fire fighting, except for the purpose of washing the deck and anchor chains and operation of bilge ejectors, subject to the efficiency of the fire-fighting system being maintained.

(5) Where fire mains are not self-draining, suitable drain cocks is to be fitted where frost damage may be expected.

5.8.5.10 Fire hydrant, fire hose and water nozzles

(1) Fire hydrants are to be positioned so as to allow easy and quick connection of fire hoses and so that at least one jet can be directed into any part of the vessel which is normally accessible during navigation.

(2) The jet required in 5.8.5.10 (1) of this Section is to be from a single length of fire hose.

(3) In addition to the requirements of 5.8.5.10 (1) of this Section, machinery spaces of category A are to be provided with at least one hydrant complete with fire hose and dual purpose nozzle. The fire hydrant is to be located outside the space and near the entrance.

(4) For every required fire hydrant, there is to be one fire hose. At least one spare fire hose is to be provided in addition to this requirement.

(5) Single length of fire hose is not to exceed 20 m.

(6) Fire hoses is to be of an approved material. Each fire hose is to be provided with couplings and a jet /water mist dual-purpose nozzle.

(7) Except where fire hoses are permanently attached to the fire main, the couplings of fire hoses and nozzles are to be completely interchangeable.

(8) The nozzles, as required by 5.8.5.10 (6) of this Section are to be appropriate to the delivery capacity of the fire pumps fitted, but in any case are to have a diameter of not less than 12 mm.

5.8.5.11 A sufficient number of approved portable fire extinguishers are to be provided in control stations and accommodation and service spaces to ensure that at least one extinguisher of a suitable type is readily available for use in any part of such spaces. The total number of extinguishers in these spaces is not to be less than three.

5.8.5.12 Fire-extinguishing appliances in machinery spaces

(1) Water fire-extinguishing system is to be provided in machinery spaces.

(2) Machinery spaces are to be provided with at least a 45L foam extinguisher or its equivalent, so that foam or its equivalent can be directed onto parts of fire hazards.

5.8.5.13 One of the portable fire extinguishers intended for use in any space is to be stowed near an entrance to that space.

5.8.5.14 Fire-extinguishing appliances are to be kept in good order and available for immediate use at all times.

5.8.6 Fire safety requirements for fishing vessels of less than 30m in length

5.8.6.1 Structural fire protection

(1) The hull, superstructure, structural bulkheads, decks and deckhouses are to be constructed of steel or other equivalent materials.

(2) The surface of insulation fitted on the internal boundaries of machinery spaces of category A and spaces where oil products may enter is to be impervious to oil or oil vapours.

(3) All thermal insulation of accommodation spaces is to be constructed of non-combustible materials. Within compartments used for stowage of fish, combustible insulation are to be protected by close-fitting cladding.

(4) Doors between machinery spaces and accommodation spaces are to be steel or other equivalent materials. A door may be allowed between the kitchen and the dining room, but it is to be made of non- combustible materials; the kitchen and the dining room can be regarded as one common lounge and divided into two appropriate cabins where only electrically cooking appliances are fitted in the kitchen.

5.8.6.2 Ventilation system

(1) Ventilation systems serving machinery spaces are to be independent of systems serving other spaces, and the main air inlets and outlets are to be able to be closed from outside the spaces, and the ventilation ducts are not to, as far as possible, pass through other spaces.

(2) Ventilation ducts are to be made of steel or other non-combustible materials.

(3) All power ventilations are to be able to be stopped from easily accessible positions outside the spaces serviced.

5.8.6.3 Heating installations

(1) Electric radiators are to be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiator are to be fitted with an element so exposed that clothing, curtains or other similar materials can be scorched or set on fire by heat from the element.

(2) Heating by means of open fires are not to be permitted. Heating stoves and other similar appliances are to be firmly secured and adequate protection and insulation against fire are to be provided beneath and around such appliances and in way of their uptakes. Uptakes of stoves which burn solid fuel are to be so arranged and designed as to minimize the possibility of becoming blocked by combustion products and are to have a ready means for cleaning. Dampers for limiting draughts in uptakes are still to leave an adequate area open when in the closed position. Spaces in which stoves are installed are to be provided with ventilators of sufficient area to provide adequate combustion-air for the stove.

(3) Open flame gas appliances, except cooking stoves and water heaters, are not to be permitted. Spaces containing any such stoves or water heaters are to have adequate ventilation to remove

fumes and possible gas leakage to a safe place. All pipes conveying gas from container to stove or water heater are to be of steel or other approved material. Automatic safety gas shut-off devices are to be fitted to operate on loss of pressure in the gas main pipe or flame failure on any appliance.

5.8.6.4 Miscellaneous items

(1) Exposed surfaces within accommodation spaces, service spaces, control stations, corridor and stairway enclosures and the concealed surfaces behind bulkheads, ceilings, panellings and linings in accommodation spaces, service spaces and control stations are to have low flame-spread characteristics.

(2) Paints, varnishes and other finishes used on exposed interior surfaces are not to be capable of producing excessive quantities of smoke or toxic gases or vapours.

(3) Primary deck coverings within accommodation and service spaces and control stations, are to be of approved material which will not readily ignite or give rise to toxic or explosive hazards at elevated temperatures.

(4) In accommodation and service spaces and control stations, pipes penetrating "A" or "B" class divisions are to be of approved materials capable of withstanding the temperature required by the division. Due to arrangement reasons, the pipes conveying oil or combustible liquids that pass through accommodation and service spaces are to be approved fire-resistant material.

(5) Materials readily rendered ineffective by heat are not to be used for overboard scuppers, sanitary discharges and other outlets which are close to the waterline and where the failure of the material in the event of fire would give rise to danger of flooding.

(6) All waste receptacles, other than those used in fish processing, are to be constructed of non-combustible materials with no openings in the sides and bottom.

(7) Machinery driving fuel oil transfer pumps, fuel oil unit pumps and other similar fuel pumps are to be fitted with remote controls situated outside the space concerned so that they can be stopped in the event of a fire arising in the space in which they are located.

(8) Drip trays are to be fitted, where necessary, to prevent oil leaking into bilges.

5.8.6.5 The storage of gas cylinders and dangerous materials is to meet the requirements of 5.8.5.5 of this Section.

5.8.6.6 Means of escape

(1) At least one entrance together with necessary stairways or staircases from all accommodation spaces and in spaces in which the crew is normally employed, other than machinery spaces, are to be so arranged as to lead to the open deck.

(2) At least one means of escape is to be provided from every machinery space of category A.

(3) A corridor or a part of a corridor from which there is only one route of escape is not to exceed 5 m in length.

5.8.6.7 Fire pump

(1) At least one power fire pump is to be provided, which can be driven by independent power or driven by main machinery.

(2) The capacity of fire pump is to be at least calculated according to the following formula, but it is not to be less than 16m^3/h and not to exceed 30 m^3/h in any case.

$$Q=(0.15\sqrt{L(B+D)}+2.25)^2 \quad m^3/h$$

Where: *L*——Length, m

B——Breadth, m

D——Depth, m.

(3) Sanitary, bilge, ballast or general service pumps may be used as fire pumps if they cannot be often used for pumping oil. If they are occasionally used for lightering or pumping fuel oil, suitable conversion devices are to be installed.

5.8.6.8 Fire mains

(1) Where more than one hydrant is required to provide the number of jets specified in 5.8.6.9 (1) of this Section, a fire main is to be provided.

(2) Materials readily rendered ineffective by heat are not to be used for fire mains, unless adequately protected.

(3) Where fire pump delivery pressure can exceed the designed working pressure of fire mains, relief valves is to be fitted.

(4) Fire mains are not to have any connection to any system other than those required for fire fighting, except for the purpose of washing the deck and anchor chains and operation of bilge ejectors, subject to the efficiency of the fire-fighting system being maintained.

(5) Where fire mains are not self-draining, suitable drain cocks is to be fitted where frost damage may be expected.

5.8.6.9 Fire hydrant, fire hose and water nozzles

(1) Fire hydrants are to be positioned so as to allow easy and quick connection of fire hoses and so that at least one jet can be directed into any part of the vessel which is normally accessible during navigation.

(2) The jet required in 5.8.6.9 (1)of this Section is to be from a single length of fire hose.

(3) In addition to the requirements of 5.8.6.9 (1) of this Section, machinery spaces of category A are to be provided with at least one hydrant complete with fire hose and dual purpose nozzle. The fire hydrant is to be located outside the space and near the entrance.

(4) For every required fire hydrant, there is to be one fire hose. At least one spare fire hose is to be provided in addition to this requirement.

(5) Single length of fire hose is not to exceed 20 m.

(6) Fire hoses is to be of an approved material. Each fire hose is to be provided with couplings and a jet /water mist dual-purpose nozzle.

(7) Except where fire hoses are permanently attached to the fire main, the couplings of fire hoses and nozzles are to be completely interchangeable.

(8) The nozzles, as required by 5.8.6.9 (6) of this Section are to be appropriate to the delivery capacity of the fire pumps fitted, but in any case are to have a diameter of not less than 12 mm.

5.8.6.10 A sufficient number of approved portable fire extinguishers are to be provided in control stations and accommodation and service spaces to ensure that at least one extinguisher of a suitable type is readily available for use in any part of such spaces. The total number of extinguishers in these spaces is not to be less than three.

5.8.6.11 Fire-extinguishing appliances in machinery spaces

(1) Water fire-extinguishing system is to be provided in machinery spaces.

(2) Machinery spaces are to be provided with two foam extinguishers or its equivalent equipment, so that foam or its equivalent can be directed onto parts of fire hazards.

5.8.6.12 One of the portable fire extinguishers intended for use in any space is to be stowed near an entrance to that space.

5.8.6.13 Fire-extinguishing appliances are to be kept in good order and available for immediate use at all times.

CHAPTER 8 ADDITIONAL REQUIREMENTS FOR PUBLIC AFFAIR SHIPS

Section 1 GENERAL PROVISIONS

8.1.1 General requirements

~~8.1.1.1 This Chapter applies to ships owned or operated by the Government and used only for non-commercial services (hereinafter referred to as public affair ships).~~

8.1.1.1 This Chapter applies to public affair ships. Public affair ships mean ships used for the purpose of government administrative management.

8.1.1.2 Public affair ships are, in addition to provisions of this Chapter, to comply with applicable provisions of other PARTs and Chapters of the Rules.

8.1.1.3 Where special provisions for public affair ships are specified by the Administration of the flag State, such provisions are to be implemented.

8.1.2 Class notation

8.1.2.1 Public affair ships complying with requirements of this Chapter are to be assigned the following class notation:

Public Affair Ship

8.1.3 Hull structures

~~8.1.3.1 In addition to provisions of 8.1.3.2, hull structures of public affair ships are to satisfy the requirements of Chapter 2, PART TWO of the Rules.~~

~~8.1.3.2 Hull structures of patrol ships[⊕] are to satisfy the requirements of CCS Guidelines for Hull Structures of Public Affair Ships.~~

8.1.3.1 Hull structures are to satisfy the requirements of CCS Guidelines for Hull Structures of Public Affair Ships at Sea.

~~[⊕] Public affair ships engaged in inspection, on-site supervision, evidence collection, anti-smuggling and other services, e.g. as maritime patrol ships, fishery supervision and law enforcement ships.~~

CHAPTER 10 ADDITIONAL REQUIREMENTS FOR PETROLEUM ASPHALT CARRIERS

Section 1 GENERAL PROVISIONS

10.1.3 Definitions

10.1.3.1 For the purpose of this Chapter:

(2) Independent tank means a cargo tank which is not connected with or is not a component part of the hull structure. The independent tank is not necessary to the structural integrity of hull. The independent tank is to be connected to the hull by means of supporting structures to prevent slippage and deflection of the tank. Supporting structures are to include vertical supports, anti-rolling arrangements, anti-pitching arrangements and anti-flotation arrangements.

10.1.4 Plans and documents

10.1.4.3 For petroleum asphalt carriers fitted with independent tanks, the following plans and documents are to be additionally submitted for approval:

(1) Arrangement plan of cargo tank and its supporting ~~means~~ structures (vertical supports, anti-rolling arrangements, anti-pitching arrangements and anti-flotation arrangements);

~~(2) Arrangement plan of longitudinal and transverse limiting devices of cargo tank;~~

~~(3) Structural plan of anti-flotation arrangements for cargo tanks;~~

(~~4~~2) Drawing and arrangement diagram of high level alarm system for cargo tank bilge well.

In addition, the following documents are to be submitted for information:

(1) ~~Stress~~ Strength calculations for cargo tank supporting ~~means~~ structures;

(2) When temperature of cargo being carried is over 180℃, thermal field distribution calculation of cargo tank is to be submitted. Where the thermal field analysis shows that temperature transmitting to main hull structure is over 80℃, analysis of thermal stress of cargo tank area is to be submitted.

10.1.5 Direct calculation of hull structural strength

10.1.5.2 For asphalt carriers of 150 m or above in length with independent cargo tanks, primary members (longitudinal and transverse) of the cargo area are to be directly calculated according to Appendix 1 of this Chapter.

Section 2 CONSTRUCTION AND ARRANGEMENT OF SHIP

10.2.2 Arrangement of ship

10.2.2.3 Passages for inspection in independent cargo areas are to comply with the following requirements:

(7) fixed or portable staging is to be installed as necessary for inspection of cargo tanks, cargo tank vertical supports, anti-rolling arrangements, anti-pitching arrangements, anti-flotation arrangements ~~supports and restraints (e.g. anti-pitching, anti-rolling and anti-flotation chocks)~~, cargo tank insulation etc. This staging is not to impair the clearances specified in 10.2.2.3(1) to 10.2.2.3(4);

10.2.4 Independent tank

10.2.4.6 The independent tank is to be supported by adequate ~~supporting means~~ vertical supports such that it is not connected with the hull structure directly. The ~~supporting means~~ vertical supports ~~is~~ are generally to be of a material with good heat insulation. If the mechanical and physical properties of such material may change at high temperature, effective measures are to be taken to ensure that the mechanical and physical properties will not be decreased significantly.

10.2.4.9 Suitable ~~supports~~ anti-pitching arrangements are to be provided to withstand a longitudinal collision force acting on the independent tank corresponding to the total weight of the tank and 1/2 cargo in the forward direction and the total weight of the tank and 1/4 cargo in the aft direction without deformation likely to endanger the tank structure. On calculating supporting force, friction force is to be included.

The above-mentioned supports may be taken into consideration together with locating devices.

10.2.4.10 Suitable ~~supports~~ anti-rolling arrangements are to be provided to prevent the independent tank from slipping transversely and turning over. In general, supports are to be provided at high level to prevent the tank from turning over and stoppers to be provided at low level to prevent the tank from slipping. The stress calculation may be referred to the calculation of cargo securing force as specified in CCS Guidelines for Preparation of Cargo Securing Manual.

The above-mentioned supports may be taken into consideration together with locating devices.

10.2.4.12 Anti-flotation arrangements are to be provided for independent tanks. The anti-flotation arrangements are to be suitable to withstand an upward force caused by an empty tank in a hold space flooded to the summer load draught of the ship~~, without plastic deformation likely to endanger the hull structure. Consequently, when checking the anti-flotation arrangements, independent cargo tanks are to be taken as empty for calculation and their loads are to be taken as 1.33 times which the floatation of the independent tank minus the weight of the independent tank when the cargo tank is flooded to the summer load line draught~~.

The design clearance between anti-flotation arrangements and hull is generally taken between 40 to 60 mm.

10.2.7 Piping

10.2.7.1 ~~A bilge well is to be provided at a suitable position~~ Bilge water of hold space~~. Water in the bilge well~~ is to be discharged overboard by a pump and the pump may be the bilge pump in the machinery space. High-level alarm is to be provided near the bilge suction ~~in the bilge well~~, audible and visual high-level alarms and controls are to be provided in the navigation bridge and cargo control room (if provided), and it is recommended that such alarm signal and control extend to the central control cabin of the engine room.

Appendix 1 DIRECT CALCULATION OF STRUCTURAL STRENGTH OF ASPHALT CARRIERS FITTED WITH INDEPENDENT CARGO TANKS

1 General provisions

1.1 Application

1.1.1 This Appendix is applicable to direct calculation of structural strength of asphalt carriers ~~of 90 m or above in length, of single bottom with longitudinal framing and~~ fitted with independent cargo tanks as required in 10.1.5 of this Chapter.

1.1.2 For asphalt carriers to which this Appendix is applicable, the direct strength analysis for cargo tank hull structure, independent tanks as well as supporting ~~and stopping~~ structures is to be carried out according to this Appendix.

2 Structural modelling

2.1 Model and element

2.1.2 The model is to include hull structure, independent tanks as well as supporting ~~and stopping~~ structures. However, the global load condition model does not need to include the independent tanks in the fore and aft cargo tank areas as well as supporting ~~and~~ ~~stopping~~ structures.

2.1.3 The element is to be meshed according to the provisions in 1.5.6.3 to 1.5.6.6, Chapter 1, PART TWO of the Rules. The supporting ~~and stopping~~ structures of the independent tanks are normally designed as not carrying any tension. Therefore, the rigidity of the supporting structures ~~and~~ ~~stopping arrangements~~ is to be simulated by rod elements but the tensile stress is not to occur in these rod elements. ~~Pilot calculation may be carried out, and iterative analysis is to be carried out by progressively removing rod elements with tensile stress in order to obtain the final result. The stopping structure against rolling and pitching has two contact surfaces and two rod elements may be used to simulate the two contact surfaces respectively.~~

3 Loads and conditions

3.1 General requirements

3.1.1 In the assessment condition of cargo tank structure, global load and local load are to be considered, including vertical bending moment, external sea water pressure, liquid pressure of the cargo tank; in the assessment of the supporting ~~stopping~~ structure, the local loads are considered, ~~and~~ the inertia force in the forward and aft direction generated by the cargo tank and the cargo due to the collision of hull is assumed, and the upward force acting on the independent tank due to flooding of hull is assumed.

3.2 Calculation conditions

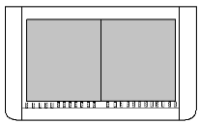
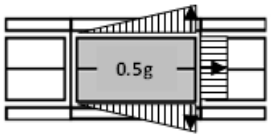
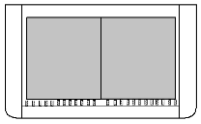
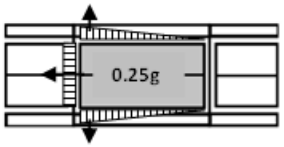
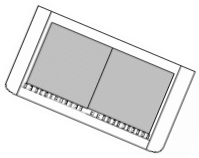
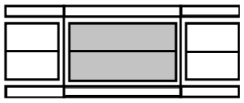
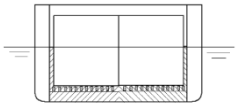
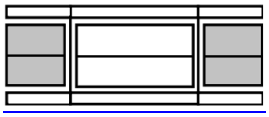
3.2.2 Fine mesh assessment is to be carried out for areas with supporting ~~stopping~~ structures. For possible high stress areas, the element size is to accurately simulate the structural shape. It is recommended that the size is not greater than *s*/8, where *s* is the spacing of members.

3.2.3 The assessment of supporting ~~stopping~~ structures is also to be carried out according to the applicable conditions in Table 3.2.3. ~~In general, the longitudinal and transverse stopping structures of the independent tank are to be checked according to the conditions listed in Table 3.2.3.~~ All conditions are local load conditions, among which LC1 and LC2 are ~~checking~~ anti-pitching

conditions ~~of longitudinal stopping structures and,~~ LC3 is ~~checking~~ anti-rolling conditions ~~of transverse stopping structures~~ and LC4 is anti-flotation condition.

Assessment Conditions of Supporting ~~stopping~~ Structures

Table 3.2.3

<table>
<tr><td colspan="5">Checking conditions of stopping block</td><td colspan="2"></td></tr>
<tr><td>Condition</td><td>Draught</td><td>Bending moment</td><td>External pressure</td><td>Internal pressure</td><td colspan="2">Pattern of loading</td></tr>
<tr><td>LC1</td><td>NA</td><td>NA</td><td>NA</td><td>P_i</td><td></td><td></td></tr>
<tr><td colspan="7">Internal pressure $P_i = \rho g(h + 2.5 f_r) + \rho \times (0.5g)x$, for aft bulkhead, x is 0, for forward bulkhead, x is to be taken as the length of the independent tank</td></tr>
<tr><td>Condition</td><td>Draught</td><td>Bending moment</td><td>External pressure</td><td>Internal pressure</td><td colspan="2">Pattern of loading</td></tr>
<tr><td>LC2</td><td>NA</td><td>NA</td><td>NA</td><td>P_i</td><td></td><td></td></tr>
<tr><td colspan="7">Internal pressure $P_i = \rho g(h + 2.5 f_r) + \rho \times (0.25g)x$, for aft bulkhead, x is to be taken as the length of the independent tank, for forward bulkhead, x is 0</td></tr>
<tr><td>Condition</td><td>Draught</td><td>Bending moment</td><td>External pressure</td><td>Internal pressure</td><td colspan="2">Pattern of loading</td></tr>
<tr><td>LC3</td><td>d</td><td>NA</td><td>P_e</td><td>P_i</td><td></td><td></td></tr>
<tr><td colspan="7">NA—Not applicable;
External pressure $P_e = \rho g\left[(d - z)\cos\varphi + |y|\sin\varphi\right]$ starboard side (water entry side)
$= \rho g\left[(d - z)\cos\varphi - |y|\sin\varphi\right]$ port side (water exit side), and not less than 0;
where:
y — transverse distance measured from the considered point to the centreline;
z — vertical distance measured from the considered point to the baseline.
φ — the maximum roll angle, to be taken as not greater than 30°.
Internal pressure $P_i = \rho g(h + 2.5 f_r) + \rho \times (0.5g)h_y$, where h_y is the transverse distance from the pressure calculation point to the highest point of the top left corner of the independent tank.</td></tr>
<tr><td>Condition</td><td>Draught</td><td>Bending moment</td><td>External pressure</td><td>Internal pressure</td><td colspan="2">Pattern of loading</td></tr>
<tr><td>LC4</td><td>d</td><td>NA</td><td>NA</td><td>P_i</td><td></td><td></td></tr>
<tr><td colspan="7">Internal pressure $P_i = \rho g d$</td></tr>
</table>

4 Yield and buckling strength assessment

4.1 Yield strength assessment

4.1.3 For the refined analysis of the supporting ~~stopping~~ structures assessment condition, the permissible stress is to be taken as follows:

$$\text{permissible equivalent membrane stress}=\begin{cases}\text{1.4 times the permissible stress of the cargo tank model,}\\ \quad\text{the element size of the fine area is } s/8\\ \text{1.6 times the permissible stress of the cargo tank model,}\\ \quad\text{the element size of the fine area is } s/16\end{cases}$$

CHAPTER 11 DYNAMIC POSITIONING SYSTEMS

Section 1 GENERAL PROVISIONS

11.1.1 General requirements

11.1.1.1 This Chapter applies to dynamic positioning (DP) systems installed on board ships or offshore units (hereinafter referred to as vessels). ~~The components and systems covered by this Chapter are also to comply with the relevant requirements for main class.~~

11.1.4 Plans and documents

11.1.4.1 For dynamically positioned vessels, the following plans and documents are to be submitted for approval ~~in addition to those required for main class~~:

(1) Technical description of the DP system, at least including the following:

① function description of the power system and power management;

② system arrangement and configuration: physical separation (DP-3), thruster, switchboard, power generator set, auxiliary system;

③ redundancy groups (DP-2/3);

④ WCFDI (DP-2/3);

⑤ safe termination time (DP-2/3, if applicable).

Section 2 SYSTEM ARRANGEMENT

11.2.4 Display and alarm arrangements

11.2.4.3 Each DP control station is to be fitted with alarms and displays as specified in Table 11.2.4.3. ~~The alarm and display arrangements are also to comply with the relevant requirements from main class rules and applicable class notations.~~

Section 5 CONTROL SYSTEM AND MEASURING SYSTEM

11.5.6 Position reference systems

~~11.5.6.14 Position reference systems are to comply with the relevant main class rules for electrical, mechanical, and pneumatic components and subsystems.~~

11.5.7 Sensor systems

~~11.5.7.9 The sensor systems are to comply with the relevant main class rules for electrical, mechanical, and pneumatic components and subsystems.~~

CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF SEA-GOING STEEL SHIPS

AMENDMENTS

2021

PART NINE

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PART 9-1 GENERAL HULL REQUIREMENTS

Chapter 2 GENERAL ARRANGEMENT DESIGN

Section 2 SUBDIVISION ARRANGEMENT

1 WATERTIGHT BULKHEAD ARRANGEMENT

~~**1.2 Opening in Watertight Bulkheads**~~

~~**1.2.1**~~
~~The number of openings in watertight bulkheads is to be kept a minimum, where penetrations of watertight bulkheads and internal decks are necessary for access, piping, ventilation, electrical cables. Arrangements are to be made to maintain the watertight integrity.~~

~~**1.2.2**~~
~~The tightness, operability and indication of the doors in watertight bulkheads are to be in accordance with Ch II-1, Reg 13-1 of SOLAS Convention, as amended.~~

3 AFT PEAK BULKHEADS

3.1 General

3.1.2
The aft peak bulkhead may be stepped below the ~~bulkhead~~ freeboard deck, provided that the degree of safety of the ship as regards subdivision is not thereby diminished.

3.1.4
~~The aft peak bulkhead may terminate at the first deck above the deepest draught at the aft perpendicular, provided that this deck is made watertight to the stern or to the transom.~~
Provided that the aft peak bulkhead extends above the deepest load line, termination of the afterpeak bulkhead on a watertight deck lower than the freeboard deck can be accepted. In order to provide such a watertight deck a tight sealing of the rudder stock shall be fitted in way of this deck or above.

Section 3 COMPARTMENT ARRANGEMENT

4 DELETED ~~FORE END COMPARTMENT~~

~~**4.1 General**~~

~~4.1.1~~
~~The fore peak and other compartments located forward of the collision bulkhead may not be arranged for the carriage of fuel oil or other flammable products.~~

5 DELETED ~~FUEL OIL TANKS~~

~~**5.1 Arrangement of Fuel Oil Tanks**~~

~~5.1.1~~

~~Fuel oil tanks are to be arranged in accordance with the requirements in SOLAS Ch II-2, Reg 4.2 and MARPOL, Annex I, Ch 3, Reg 12A.~~

6 DELETED ~~AFT END COMPARTMENT~~

~~6.1 Sterntube~~

~~6.1.1~~
~~Sterntubes are to be enclosed in a watertight space (or spaces) of moderate volume. Other measures to minimise the danger of water penetrating into the ship in case of damage to the sterntube arrangement may be taken at the discretion of the Society.~~

~~*CCS 6.1.1a Stern tubes are to be enclosed in watertight spaces of moderate volume. Other measures to minimize the danger of water penetrating into the ship in case of damage to the stern tube arrangement may be taken subject to approval.*~~

Chapter 3 STRUCTURAL DESIGN PRINCIPLES

Section 1 MATERIAL

2 HULL STRUCTURAL STEEL

2.6 Stainless steel

2.6.1
The reduction of strength of stainless steel with increasing temperature is to be taken into account in the calculation of the material factor, *k* and in the material Young's modulus, *E*.

Stainless steels are considered by the Society on a case-by-case basis.

CCS 2.6.1a The material Young's modulus, E, the material factor, k, and minimum yield stress, R_{eH}, are to comply with the requirements respectively for elastic modulus specified in [1.3.6.2] and for material factor K and minimum yield strength R_{eHT} specified in [1.3.6.3], Section 3, Chapter 1, Part 2 of CCS Rules for Classification of Sea-Going Steel Ships.

Section 6 STRUCTURAL DETAIL PRINCIPLES

7 DOUBLE BOTTOM STRUCTURE

7.5 Bilge keel

7.5.2 Design
The design of single web bilge keels is to be such that failure to the web occurs before failure of the ground bar. This may be achieved by ensuring the web thickness of the bilge keel does not exceed that of the ground bar.

Bilge keels of a different design, from that shown in Figure 18, are to be specially considered by the Society.

CCS 7.5.2a Where bilge keels are fitted, they are not to be welded directly to the shell plating. A ground bar, or doubler, is to be fitted on the shell plating and the ground bar or doubler may be welded directly to the shell and kept continuous. ~~Bull welds in the bilge keels and those in the ground bar or doubler are to be staggered, and bull welds in the ground bar or doubler and those in the shell plating are to be staggered.~~ Butt welds, in the bilge keel and ground bar, are to be well clear of each other and of butts in the shell plating.

Chapter 4 LOADS

Section 2 DYNAMIC LOAD CASES

2 DYNAMIC LOAD CASES FOR STRENGTH ASSESSMENT

2.2 Load combination factors

2.2.1

Table 5: Load combination factors, LCFs for BSR and BSP load cases - Strength assessment

Load component		LCF	BSR-1P	BSR-2P	BSR-1S	BSR-2S
Hull girder loads	M_{WV}	C_{WV}	0.1-0.2f_T	0.2f_T -0.1	0.1-0.2f_T	0.2f_T -0.1
	Q_{WV}	C_{QW}	(0.1-0.2f_T) f_{lp}	(0.2f_T -0.1) f_{lp}	(0.1-0.2f_T) f_{lp}	(0.2f_T -0.1) f_{lp}
	M_{WH}	C_{WH}	1.2- 1.1f_T	1.1f_T -1.2	1.1f_T -1.2	1.2-1.1 f_T
	M_{WT}	C_{WT}	0	0	0	0
Longitudinal accelerations	a_{surge}	C_{XS}	0	0	0	0
	$a_{pitch-x}$	C_{XP}	0	0	0	0
	gsinφ	C_{XG}	0	0	0	0
Transverse accelerations	a_{sway}	C_{YS}	0.2-0.2f_T	0.2f_T -0.2	0.2f_T -0.2	0.2-0.2f_T
	a_{roll-y}	C_{YR}	1	-1	-1	1
	gsinθ	C_{YG}	-1	1	1	-1
Vertical accelerations	a_{heave}	C_{ZH}	0.7-0.4f_T	0.4f_T-0.7	0.7-0.4f_T	0.4f_T-0.7
	a_{roll-z}	C_{ZR}	1	-1	~~1~~ -1	~~-1~~ 1
	$a_{pitch-z}$	C_{ZP}	0	0	0	0

Table6: Load combination factors, LCFs for OST and OSA load cases - Strength assessment

Load component		LCF	OST-1P	OST-2P	OST-1S	OST-2S
Hull girder loads	M_{WV}	C_{WV}	-0.3-0.2f_T	0.3+0.2f_T	-0.3-0.2f_T	0.3+0.2f_T
	Q_{WV}	C_{QW}	(-0.35-0.2f_T)f_{lp}	(0.35+0.2f_T)f_{lp}	(-0.35-0.2f_T)f_{lp}	(0.35+0.2f_T)f_{lp}
	M_{WH}	C_{WH}	-0.9	0.9	0.9	-0.9
	M_{WT}	C_{WT}	-$f_{lp\text{-}OST}$	$f_{lp\text{-}OST}$	$f_{lp\text{-}OST}$	-$f_{lp\text{-}OST}$
Longitudinal accelerations	a_{surge}	C_{XS}	0.1f_T -0.15	0.15-0.1f_T	0.1f_T -0.15	0.15-0.1f_T
	$a_{pitch\text{-}x}$	C_{XP}	0.7-0.3f_T	0.3f_T -0.7	0.7-0.3f_T	0.3f_T -0.7
	gsinφ	C_{XG}	0.2f_T-0.45	0.45-0.2f_T	0.2f_T-0.45	0.45-0.2f_T
Transverse accelerations	a_{sway}	C_{YS}	0	0	0	0
	$a_{roll\text{-}y}$	C_{YR}	0.4f_T-0.25	0.25-0.4f_T	0.25-0.4f_T	0.4f_T-0.25
	gsinθ	C_{YG}	0.1-0.2f_T	0.2f_T-0.1	0.2f_T-0.1	0.1-0.2f_T
Vertical accelerations	a_{heave}	C_{ZH}	0.2f_T-0.05	0.05-0.4f_T	0.2f_T-0.05	~~0.05 -0.4f_T~~ 0.05 -0.2f_T
	$a_{roll\text{-}z}$	C_{ZR}	0.4f_T-0.25	0.25-0.4f_T	0.25-0.4f_T	0.4f_T-0.25
	$a_{pitch\text{-}z}$	C_{ZP}	0.7-0.3f_T	0.3f_T-0.7	0.7-0.3f_T	0.3f_T-0.7

Section 5 EXTERNAL LOADS

SYMBOLS

For symbols not defined in this section, refer to Ch 1, Sec 4.

λ : Wave length, in m.

B_x : Moulded breadth at the waterline, in m, at the considered cross section.

x, y, z : X, Y and Z coordinates, in m, of the load point with respect to the reference coordinate system defined in Ch 4, Sec 1, [1.2.1]

f_{xL} : Ratio as defined in Ch 4, Sec 2.

f_{yB} : Ratio between Y-coordinate of the load point and Bx, to be taken as:

$f_{yB} = \frac{|2y|}{B_x}$, but not greater than 1.0.

~~$f_{yB} = 0$~~ $f_{yB} = 1.0$ when $B_x = 0$

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Section 6 INTERNAL LOADS

2 PRESSURES AND FORCES DUE TO DRY BULK CARGO

2.3 Dry cargo characteristics

2.3.2 Definition of upper surface of dry bulk cargo for partially filled cargo holds

For any partially filled cargo hold, as defined in [2.2.2], including non-prismatic holds, the effective upper surface of the cargo is to be made of three parts:

- One central horizontal surface of breadth $B_H/2$, in m, at a height $h_{C\text{-}CL}$, in m, above the inner bottom

- A sloped surface at each side with an angle $\psi/2$, in degrees, between the central horizontal surface, and the side shell or inner hull, as shown in Figure 3, or the hopper plating, as shown in Figure 4, as the case may be.

The height of cargo surface h_C, in m, is to be calculated at mid length of the considered cargo hold and is to be taken as constant over the length of the hold as follows:

For $|y| \le \frac{B_H}{4}$: $h_C = h_{C_CL}$

For $\frac{B_H}{4} < |y| \le \frac{B_2}{2}$: ~~$h_C = h_{C_CL} - \left(|y| - \frac{B_H}{2}\right)\tan\left(\frac{\varphi}{2}\right)$~~ $h_C = h_{C_CL} - \left(|y| - \frac{B_H}{4}\right)\tan\left(\frac{\psi}{2}\right)$

For $|y| > \frac{B_2}{2}$: $h_C = 0$

……

2.3.3 Mass and density

Table3: Dry bulk cargo mass and density for strength assessment in flooded condition

Ship type	Cargo mass Cargo density	Homogeneous loading condition		Alternate loading condition		
		Fully filled hold	Partially filled hold	Fully filled hold	Partially filled hold	Hold loaded with ρ_C=1.78 t/m^3(2)
~~No BC notation~~	~~M~~	~~$M = M_H$~~		~~N/A~~		
	~~ρ_C~~	~~ρ_C = maximum value specified in the loading manual~~				
~~BC-C~~	~~M~~	~~$M = M_H$~~		~~N/A~~		
	~~ρ_C~~	~~$\rho_C = \left(\frac{M_H}{V_{Full}}\right)$~~				
No BC notation	M	$M = M_H$	N/A	N/A		
	ρ_C	ρ_C = maximum value specified in the loading manual				
BC-C	M	$M = M_H$	N/A	N/A		
	ρ_C	$\rho_C = \left(\frac{M_H}{V_{Full}}\right)$				
BC-B	M	$M = M_H$	$M = M_H$	N/A		
	ρ_C	$\rho_C = \left(\frac{M_H}{V_{Full}}\right)$	ρ_C = 3.0 (1)			
BC-A	M	$M = M_H$	$M = M_H$	$M = M_{HD}$	$M = M_{HD}$	$M = M_{HD}$
	ρ_C	$\rho_C = \left(\frac{M_H}{V_{Full}}\right)$	ρ_C = 3.0 (1)	$\rho_C = \left(\frac{M_{HD}}{V_{Full}}\right)$	ρ_C=3.0 (1)	ρ_C = 1.78

(1) To be taken as 3.0 unless an alternative maximum cargo density is specified in the loading manual.
(2) To be applied for bulk carriers that are required to carry cargoes with a density less than or equal to 1.78 t/m^3.

2.5 Shear Load

2.5.1

For FE strength assessment and FE fatigue assessment, the following shear load pressures are to be considered in addition to the dry bulk cargo pressures defined in [2.4] when the load point elevation, z, is lower or equal to z_c:

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3 PRESSURES AND FORCES DUE TO DRY CARGOES IN FLOODED CONDITIONS

3.1 Vertically corrugated transverse watertight bulkheads

3.1.6 Pressures and forces on vertically corrugated transverse bulkheads of non-flooded cargo holds

The static pressure P_{bs}, in kN/m^2, at a point of the vertically corrugated transverse bulkhead located, located at the level z from the baseline, due to dry bulk cargo of a non-flooded cargo hold acting on the intact side of the transverse bulkhead which is flooded on the other side is to be taken as:

$P_{bs}=\rho_C g K_{C\text{-}f}(z_C - z)$, but not less than 0.

The resultant force F_{bs}, in kN, acting on a corrugation is to be taken as:

~~$F_{bs} = \rho_C g s_C \frac{(z_C - h_{DB} - h_{LS})^2}{2} K_C$~~

$$F_{bs} = \rho_C g s_C \frac{(z_C - h_{DB} - h_{LS})^2}{2} K_{C-f}$$

Section 8 LOADING CONDITIONS

5 STANDARD LOADING CONDITIONS FOR FATIGUE ASSESSMENT

5.1 Oil tanker

5.1.1

The standard loading conditions to be applied to oil tankers for fatigue assessment as required in Ch 9, Sec 1, [6.2], are defined in Table 22 to Table 24. Where fuel oil tanks, other oil tanks or fresh water tanks are arranged in way of the cargo hold region, the filling level of them are to be taken as full for both simplified stress analysis according to Ch 9, Sec 4 and direct strength analysis according to Ch 7 and Ch 9, Sec 5. ~~For simplified stress analysis according to Ch 9, Sec 4, the filling level of them are to be taken as half height, measured from z_{top} to the lowest point of tank.~~

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5.2 Bulk carriers

5.2.1

The standard loading conditions to be applied to bulk carriers for fatigue assessment as required in Ch 9, Sec 1, [6.3] are defined in Table 25, to Table 31 according to their additional service feature notations and the location of the assessed details. Where fuel oil tanks, other oil tanks or fresh water tanks are arranged in way of the cargo hold region, the filling level of them are to be taken as full for both simplified stress analysis according to Ch 9, Sec 4 and direct strength analysis according to Ch 7 and Ch 9, Sec 5. ~~For simplified stress analysis according to Ch 9, Sec 4, the filling level of them are to be taken as half height, measured from z_{top} to the lowest point of tank.~~

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Chapter 8 BUCKLING

Section 4 BUCKLING REQUIREMENTS FOR DIRECT STRENGTH ANALYSIS

5 STRUTS, PILLARS AND CROSS TIES

5.1 Buckling criteria

5.1.1

The compressive buckling strength of struts, pillars and cross ties is to satisfy the following criterion:

$\eta_{pillar} \leq \eta_{all}$

The buckling strength of elementary plate panels of cross ties is to satisfy the following criterion:

$\eta_{plate} \leq \eta_{all}$

Where:

η_{pillar} : Maximum utilisation factor of struts, pillars or cross ties, as defined in Ch 8, Sec 5, [3.1].

η_{plate} : Maximum plate utilisation factor calculated according to UP-B, as defined in Ch 8, Sec 5, [2.2].

Section 5 BUCKLING CAPACITY

SYMBOLS

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γ_{GEB} : Stress multiplier factor of global elastic buckling capacity.

2 BUCKLING CAPACITY OF PLATES AND STIFFENERS

2.1 Overall stiffened panel capacity

2.1.1

The elastic stiffened panel limit state is based on the following interaction formula, which sets a precondition for the buckling check of stiffeners in accordance with [2.3.4]:

~~$\frac{P_z}{c_f} = 1$~~

$$\frac{\gamma}{\gamma_{GEB}} = 1$$

~~where c_f and P_z are defined in [2.3.4].~~ where the stress multiplier factor corresponding to global elastic buckling capacity, γ_{GEB}, is to be calculated based on the following formulae:

$\gamma_{GEB} = \gamma_{GEB,bi+\tau}$ for $\tau \neq 0$ and ($\sigma_x > 0$ or $\sigma_y > 0$)

$\gamma_{GEB} = \gamma_{GEB,bi}$ for $\tau = 0$ and ($\sigma_x > 0$ or $\sigma_y > 0$)

$\gamma_{GEB} = \gamma_{GEB,\tau}$ for $\tau \neq 0$ and ($\sigma_x \leq 0$ and $\sigma_y \leq 0$)

where $\gamma_{GEB,bi+\tau}$, $\gamma_{GEB,bi}$ and $\gamma_{GEB,\tau}$ are stress multiplier factors for different load combinations as defined in [2.1.2], [2.1.3] and [2.1.4], respectively. For the calculation of $\gamma_{GEB,bi+\tau}$, $\gamma_{GEB,bi}$ and $\gamma_{GEB,\tau}$, neither σ_x nor σ_y shall be taken less than 0.

σ_x, σ_y : Applied normal stresses to the plate panel, in N/mm^2, to be taken as defined in [2.2.7].

τ : Applied shear stress, in N/mm^2, to be taken as defined in [2.2.7].

2.1.2

The stress multiplier factor $\gamma_{GEB,bi}$ for the stiffened panel subjected to biaxial loads is taken as:

$$\gamma_{GEB,bi} = \frac{\pi^2}{L_{B1}^2 L_{B2}^2} \frac{[D_{11}L_{B2}^4 + 2(D_{12} + D_{33})n^2 L_{B1}^2 L_{B2}^2 + n^4 D_{22} L_{B1}^4]}{L_{B2}^2 N_x + n^2 L_{B1}^2 K_{tran} N_y}$$

where:

N_x : Load per unit length applied on the edge along *x* axis of the stiffened panel, in N/mm, taken as $N_x = \sigma_{x,av}(t_p s + t_w h_w + t_f b_f)/s$

N_y : Load per unit length applied on the edge along *y* axis of the stiffened panel, in N/mm, taken as $N_y = c\sigma_y t_p$

L_{B1} : Stiffener span, in mm, equal to spacing between primary supporting members, i.e. $L_{B1} = l$. For vertically stiffened side shell of single side skin bulk carriers, $L_{B1} = 0.8l$.

L_{B2} : Width of the stiffened panel, in mm, taken as 6 times of the stiffener spacing, i.e. 6s.

n : Number of half waves along the direction perpendicular to the stiffener axis. The factor $\gamma_{GEB,bi}$ is to be minimized with respect to the wave parameter n, i.e. to be taken as the smallest value larger than zero.

K_{tran} : Coefficient taken as 0.9.

c : Factor taking into account the stresses in the attached plating acting perpendicular to the stiffener axis:

$c = 0.5(1 + \Psi)$ for $0 \leq \Psi \leq 1$

$c = \dfrac{1}{2(1 - \Psi)}$ for $\Psi < 0$

Ψ : Edge stress ratio for case 2 according to Table 3.

$\sigma_{x,av}$: Average stress for both plate and stiffener with Poisson correction, taken as:

$\sigma_{x,av} = \sigma_x - \nu\sigma_y A_s/(A_p + A_s) \geq 0$ for $\sigma_x > 0$ *and* $\sigma_y > 0$

$\sigma_{x,av} = \sigma_x$ for $\sigma_x \leq 0$ or $\sigma_y \leq 0$

$D_{11}, D_{12}, D_{22}, D_{33}$: Bending stiffness coefficients, in Nmm, of the stiffened panel, defined as:

$$\left.\begin{aligned} D_{11} &= \frac{EI_{eff}10^4}{s} \\ D_{12} &= \frac{Et_p^3\nu}{12(1-\nu^2)} \\ D_{22} &= \frac{Et_p^3}{12(1-\nu^2)} \\ D_{33} &= \frac{Et_p^3}{12(1+\nu)} \end{aligned}\right\}$$

I_{eff} : Moment of inertia, in cm^4, of the stiffener including effective width of attached plating, the same as *I* defined in [2.3.4].

2.1.3

The stress multiplier factor $\gamma_{GEB,\tau}$ for the stiffened panel subjected to pure shear load is taken as:

$$\gamma_{GEB,\tau} = \frac{\sqrt[4]{D_{11}^3 D_{22}}}{(L_{B1}/2)^2 N_{xy}}\left[8.125 + 5.64\sqrt{\frac{(D_{12}+D_{33})^2}{D_{11}D_{22}}} - 0.6\frac{(D_{12}+D_{33})^2}{D_{11}D_{22}}\right] \quad for\ D_{11}D_{22} \geq (D_{12}+D_{33})^2$$

$$\gamma_{GEB,\tau} = \frac{\sqrt{2D_{11}(D_{12}+D_{33})}}{(L_{B1}/2)^2 N_{xy}}\left[8.3 + 1.525\frac{D_{11}D_{22}}{(D_{12}+D_{33})^2} - 0.493\frac{D_{11}^2 D_{22}^2}{(D_{12}+D_{33})^4}\right] \quad for\ D_{11}D_{22} < (D_{12}+D_{33})^2$$

where

$N_{xy} = \tau t$

2.1.4

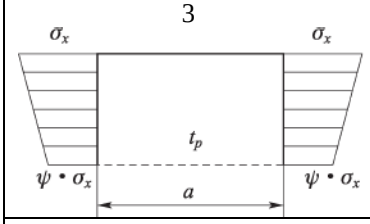
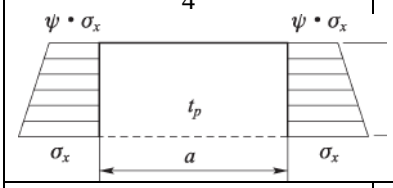
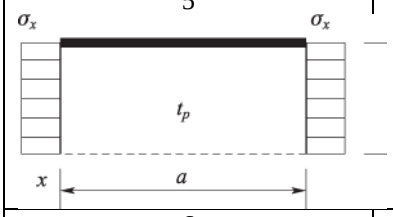
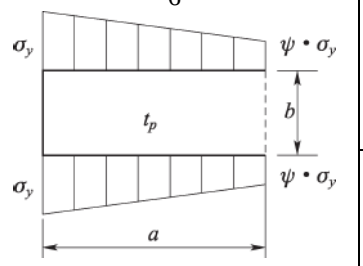
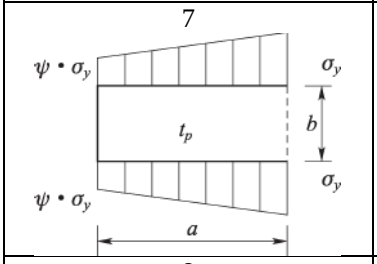
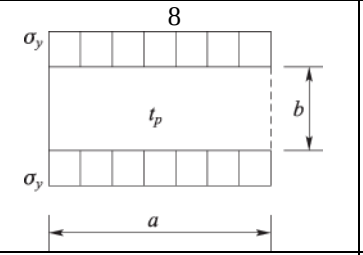
The stress multiplier factor $\gamma_{GEB,bi+\tau}$ for the stiffened panel subjected to combined loads is taken as:

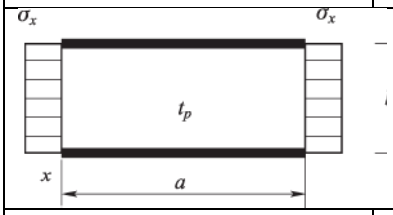
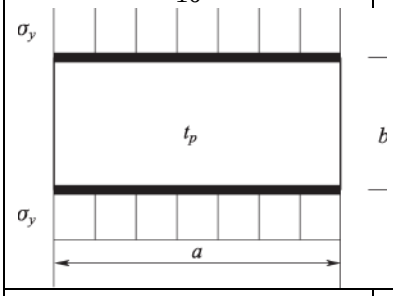
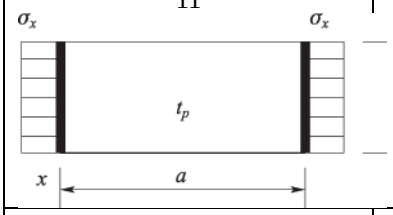
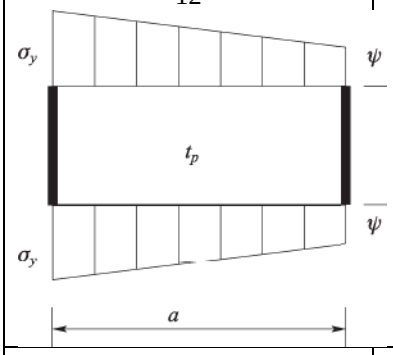
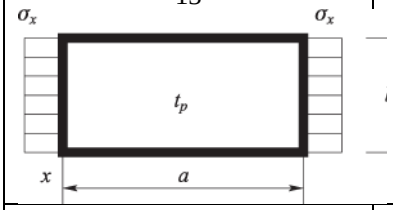
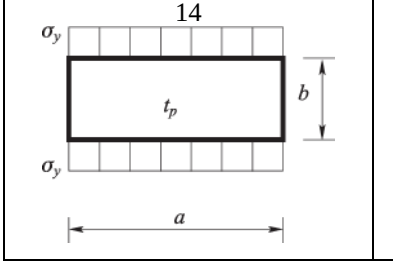
$$\gamma_{GEB,bi+\tau} = \frac{1}{2}{\gamma_{GEB,\tau}}^2 \left[-\frac{1}{\gamma_{GEB,bi}} + \sqrt{\frac{1}{{\gamma_{GEB,bi}}^2} + 4\frac{1}{{\gamma_{GEB,\tau}}^2}} \right]$$

where $\gamma_{GEB,bi}$ and $\gamma_{GEB,\tau}$ are as defined in [2.1.2] and [2.1.3], respectively.

2.2 Plate capacity

Table3: Buckling factor and reduction factor for plane plate panels

Case	Stress Ratio ψ	Aspect Ratio α	Buckling factor K	Reduction factor C
3 	$1 \geq \psi \geq 0$		$K_x = \dfrac{4(0.425+1/\alpha^2)}{3\psi+1}$	$C_x = 1$ for $\lambda \leq 0.7$ $C_x = \dfrac{1}{\lambda^2+0.51}$ for $\lambda > 0.7$
	~~$0 > \psi \geq -1$~~ $0 > \psi \geq -1$		$K_x=4(0.425+1/\alpha^2)(1+\Psi)-5\Psi(1-3.42\Psi)$	
4 	$1 \geq \psi \geq -1$		$K_x = \left(0.425+\dfrac{1}{\alpha^2}\right)\dfrac{3-\psi}{2}$	
5 	—	$\alpha \geq 1.64$	$K_x=1.28$	
		$\alpha < 1.64$	$K_x = \dfrac{1}{\alpha^2}+0.56+0.13\alpha^2$	
6 	$1 \geq \psi \geq 0$		$K_y = \dfrac{4(0.425+\alpha^2)}{(3\psi+1)\alpha^2}$	~~$C_x = 1$~~ $C_y = 1$ for $\lambda \leq 0.7$ ~~$C_x = \dfrac{1}{\lambda^2+0.51}$~~ $C_y = \dfrac{1}{\lambda^2+0.51}$ for $\lambda > 0.7$
	$0 > \psi \geq -1$		~~$K_y = 4(0.425+\alpha^2)(1+\psi)\dfrac{1}{\alpha^2} - 5\psi(1-3.42\psi)\dfrac{1}{\alpha^2}$~~ $K_y = 4(0.425+\alpha^2)(1+\psi)\dfrac{1}{\alpha^2} - 5\psi(1-3.42\psi)\dfrac{1}{\alpha^2}$	
7 	$1 \geq \psi \geq -1$		$K_y = (0.425+\alpha^2)\dfrac{(3-\psi)}{2\alpha^2}$	
8 	—		$K_y = 1+\dfrac{0.56}{\alpha^2}+\dfrac{0.13}{\alpha^4}$	
9	—		K_x=6.97	$C_x = 1$ for $\lambda \leq 0.83$ $C_x = 1.13\left(\dfrac{1}{\lambda}-\dfrac{0.22}{\lambda^2}\right)$ for $\lambda > 0.83$

Case	Stress Ratio ψ	Aspect Ratio α	Buckling factor K	Reduction factor C
				
10 	—	$K_y = 4 + \frac{2.07}{\alpha^2} + \frac{0.67}{\alpha^4}$		~~$C_x = 1$~~ $C_y = 1$ for $\lambda \le 0.83$ ~~$C_x = 1.13\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$~~ $C_y = 1.13\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$ for $\lambda > 0.83$
11 	—	$\alpha \ge 4$	$K_x = 4$	$C_x = 1$ for $\lambda \le 0.83$ $C_x = 1.13\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$ For $\lambda > 0.83$
		$\alpha < 4$	$K_x = 4 + 2.74\left[\frac{4-\alpha}{3}\right]^4$	
12 	—	K_y=K_y determined as per case 2		For $\alpha < 2$: C_y=C_{y2} For $\alpha \ge 2$ $C_y = \left(1.06 + \frac{1}{10\alpha}\right) C_{y2}$ Where: C_{y2} : C_y determined as per case 2
13 	—	$\alpha \ge 4$	$K_x = 6.97$	$C_x = 1$ for $\lambda \le 0.83$ $C_x = 1.13\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$ for $\lambda > 0.83$
		$\alpha < 4$	$K_x = 6.97 + 3.1\left[\frac{4-\alpha}{3}\right]^4$	
14 	—	$K_y = \frac{6.97}{\alpha^2} + \frac{3.1}{\alpha^2}\left[\frac{4 - 1/\alpha}{3}\right]^4$		~~$C_x = 1$~~ $C_y = 1$ for $\lambda \le 0.83$ ~~$C_x = 1.13\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$~~ $C_y = 1.13\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$ for $\lambda > 0.83$

2.2.7 Applied normal and shear stresses to plate panels

The normal stresses, σ_x and σ_y, in N/mm^2, to be applied for the overall stiffened panel capacity and the plate panel capacity calculations, as given in [2.1.1] and [2.2.1] respectively, are to be taken as follows:

- For FE analysis, the reference stresses as defined in Ch 8, Sec 4, [2.4].
- For prescriptive assessment, the axial or transverse compressive stresses calculated according to Ch 8, Sec 3, [2.2.1], at load calculation points of the considered elementary plate panel, as defined in Ch 3, Sec 7, [2].
- For grillage analysis where the stresses are obtained based on beam theory, the stresses taken as:

$$\sigma_x = \frac{\sigma_{xb} + \nu\sigma_{yb}}{1 - \nu^2}$$

$$\sigma_y = \frac{\sigma_{yb} + \nu\sigma_{xb}}{1 - \nu^2}$$

where

σ_{xb}, σ_{yb}: Stress, in N/mm^2, from grillage beam analysis respectively along x or y axis of the attached ~~buckling panel~~ plate of girders.

The shear stress τ, in N/mm^2, to be applied for the overall stiffened panel capacity and the plate panel capacity calculations, as given in [2.1.1] and [2.2.1] respectively, are to be taken as follows:

- For FE analysis, the reference shear stresses as defined in Ch 8, Sec 4, [2.4].
- For prescriptive assessment of the plate panel capacity, the shear stresses calculated according to Ch 8, Sec 3, [2.2.1], at load calculation points of the considered elementary plate panel, as defined in Ch 3, Sec 7, [2].
- For prescriptive assessment of the overall stiffened panel capacity, the shear stresses calculated according to Ch 8, Sec 3, [2.2.1], at the following load calculation point:
  - At the middle of the full span, l, of the considered stiffener.
  - At the intersection point between the stiffener and its attached plating.
- For grillage beam analysis, $\tau = 0$ in the attached ~~buckling panel~~ plate of girders.

2.3 Stiffeners

2.3.2 Web thickness of flat bar

For accounting the decrease of the stiffness due to local lateral deformation, the effective web thickness of flat bar stiffener, in mm, is to be used in [2.1] and [2.3.4] for the calculation of the net sectional area, A_S, the net section modulus, Z, and the moment of inertia, I, of the stiffener and is taken as:

$$t_{w_red} = t_w\left(1 - \frac{2\pi^2}{3}\left(\frac{h_w}{s}\right)^2\left(1 - \frac{b_{eff1}}{s}\right)\right)$$

2.3.4 Ultimate buckling capacity

…

M_0: Bending moment, in Nmm, due to the lateral deformation w of stiffener:

~~$M_0 = F_E\left(\frac{P_z w}{c_f - P_z}\right)$ with $c_f - P_z > 0$~~

$M_0 = F_E\frac{\gamma}{\gamma_{GEB} - \gamma}w_0$ with precondition $\gamma_{GEB} - \gamma > 0$

where γ_{GEB} is the stress multiplier factor of global elastic buckling capacity as defined in [2.1].

…

P_z : Nominal lateral load, in N/mm^2, acting on the stiffener due to stresses, σ_x, σ_y and τ, in the attached plating in way of the stiffener mid span:

$$P_z = \frac{t_p}{s}\left(\sigma_{xl}\left(\frac{\pi s}{l}\right)^2 + 2c\gamma\sigma_y + \sqrt{2}\tau_1\right)$$

$$\sigma_{xl} = \gamma\sigma_x\left(1 + \frac{A_s}{s t_p}\right) \text{ But not less than 0}$$

$$\tau_1 = \gamma|\tau| - t_p\sqrt{R_{eHp}E\left(\frac{m_1}{a^2} + \frac{m_2}{b^2}\right)} \geq 0 \text{ but not less than 0}$$

σ_y : Stress applied on the edge along y axis of the buckling panel, in N/mm^2, but not less than 0.

- For FE analysis, σ_y is the FE corrected stress as defined in [2.3.6] in the attached plating in the direction perpendicular to the stiffener axis.
- For prescriptive assessment, σy is the maximum compressive stress calculated according to Sec 3, [2.2.1], at load calculation points of the stiffener attached plating, as defined in Sec 3, [1.2.2].
- For grillage beam analysis, σy is the stress acting along the y-axis of the attached buckling panel.

τ : Applied shear stress, in N/mm^2.

- For FE analysis, τ is the reference shear stress as defined in Sec 4, [2.4.2] in the attached plating.
- For prescriptive assessment, τ is the shear stress at the attached plate calculated according to Sec 3, [2.2.1 at the following load calculation point.
  - At the middle of the full span, l, of the considered stiffener
  - At the intersection point between the stiffener and its attached plate.
- For grillage beam analysis, τ = 0 in the attached buckling panel.

m_1, m_2 : Coefficients taken equal to:

$m_1 = 1.47, m_2 = 0.49$ for $\alpha \geq 2$

$m_1 = 1.96, m_2 = 0.37$ for $\alpha < 2$

c : Factor taking into account the stresses in the attached plating acting perpendicular to the stiffener's axis:

$c = 0.5(1 + \Psi)$ for $0 \leq \Psi \leq 1$

$c = \frac{1}{2(1 + \Psi)}$ for $\Psi < 0$

Ψ : Edge stress ratio for case 2 according to Table 3.

w : Deformation of stiffener, in mm:

$w = w_0 + w_1$

~~w_1 : Deformation of stiffener, in mm, at mid-point of stiffener span due to lateral load P. In case of uniformly distributed load, w_1 is to be taken as:~~

~~$$w_1 = C_t \frac{|P| s l^4}{384 \times 10^7 EI} \quad \text{in general}$$~~

~~$$w_1 = C_t \frac{5|P| s l^4}{384 \times 10^7 EI} \quad \text{for stiffeners sniped at both ends}$$~~

~~$$w_1 = C_t \frac{2|P| s l^4}{384 \times 10^7 EI} \quad \text{for stiffeners sniped at one end and continuous at the other end.}$$~~

~~c_f : Elastic support provided by the stiffener, in N/mm^2:~~

~~$$c_f = F_E \left(\frac{\pi}{l}\right)^2 (1 + c_p)$$~~

~~$$c_p = \frac{1}{1 + \frac{0.91}{c_{xa}} \left(\frac{12I}{s t_p^3} 10^4 - 1\right)}$$~~

~~c_{xa} : Coefficient to be taken as:~~

~~$$c_{xa} = \left[\frac{l}{2s} + \frac{2s}{l}\right]^2 \quad \text{for } l \geq 2s$$~~

~~$$c_{xa} = \left[1 + \left(\frac{l}{2s}\right)^2\right]^2 \quad \text{for } l < 2s$$~~

σ_w : Stress due to torsional deformation, in N/mm^2, to be taken as:

~~$$\sigma_w = E y_w \left(\frac{t_f}{2} + h_w\right) \Phi_0 \left(\frac{\pi}{l}\right)^2 \left(\frac{1}{1 - \frac{0.4 R_{eH_s}}{\sigma_{ET}}} - 1\right) \quad \text{for stiffener induced failure } (SI).$$~~

$$\sigma_w = E y_w \left(\frac{t_f}{2} + h_w\right) \Phi_0 \left(\frac{m_{tor}\pi}{l_{tor}}\right)^2 \left(\frac{1}{1 - \frac{\gamma \sigma_a}{\sigma_{ET}}} - 1\right) \quad \text{with precondition } \sigma_{ET} - \gamma\sigma_a > 0 \quad \text{for stiffener induced failure } (SI).$$

~~l_{tor}~~ : Stiffener span, distance equal to spacing between primary supporting members, i.e. ~~l_{tor}~~ = l. When the stiffener is supported by tripping brackets, ~~l_{tor}~~ should be taken as the maximum spacing between the adjacent primary supporting members and fitted tripping brackets.

Φ_0: Coefficient taken as:

~~$$\Phi_0 = \frac{l}{h_w} 10^{-3}$$~~

$$\Phi_0 = \frac{l_{tor}}{m_{tor} h_w} 10^{-4}$$

σ_{ET} : Reference stress for torsional buckling, in N/mm^2, to be taken as:

~~$$\sigma_{ET} = \frac{E}{I_p} \left[\frac{c\pi^2 I_\omega 10^2}{l^2} + 0.385 I_T\right]$$~~

$$\sigma_{ET} = \frac{E}{I_p} \left[\left(\frac{m_{tor}\pi}{l_{tor}}\right)^2 I_w \cdot 10^2 + \frac{1}{2(1+\nu)} I_T + \left(\frac{l_{tor}}{m_{tor}\pi}\right)^2 \varepsilon \cdot 10^{-4}\right]$$

I_ω : Net ~~sectional~~ sectorial moment of inertia of the stiffener, in cm^6, about point C as shown in Figure 1, as defined in Table 5.

m_{tor} : Number of half waves within l_{tor}, taken as a positive integer so as to give smallest reference stress for torsional buckling.

ε : Degree of fixation, in mm^2, to be taken as:

~~$\varepsilon = 1 + \dfrac{\left(\frac{l}{\pi}\right)^2 10^{-3}}{\sqrt{I_\omega \left(\frac{0.75s}{t_p^3} + \frac{e_f - 0.5t_f}{t_w^3}\right)}}$~~

$\varepsilon = \left(\frac{3b}{t_p^3} + \frac{2h_w}{t_w^3}\right)^{-1}$ for bulb, angle, L2 , L3 and T profiles;

$\varepsilon = \left(\frac{t_p^3}{3b}\right)$ for flat bars.

Table5: Moments of inertia

	Flat bars (1)	Bulb, angle, L2, L3 and T profiles
I_P	$\dfrac{h_w^3 t_w}{3 \cdot 10^4}$	$\left(\dfrac{A_w (e_f - 0.5t_f)^2}{3} + A_f e_f^2\right) 10^{-4}$
I_T	$\dfrac{h_w t_w^3}{3 \cdot 10^4}\left(1 - 0.63\dfrac{t_w}{h_w}\right)$	$\dfrac{(e_f - 0.5t_f) t_w^3}{3 \cdot 10^4}\left(1 - 0.63\dfrac{t_w}{e_f - 0.5t_f}\right) + \dfrac{b_f t_f^3}{3 \cdot 10^4}\left(1 - 0.63\dfrac{t_f}{b_f}\right)$
I_ω	$\dfrac{h_w^3 t_w^3}{36 \cdot 10^6}$	For bulb, angle, L2 and L3 profiles ~~$\dfrac{A_f e_f^2 b_f^2}{12 \cdot 10^6}\left(\dfrac{A_f + 2.6A_w}{A_f + A_w}\right)$~~ $\dfrac{A_f^3 + A_w^3}{36 \cdot 10^6} + \dfrac{e_f^2}{10^6}\left(\dfrac{A_f b_f^2 + A_w t_w^2}{3} - \dfrac{(A_f b_f + A_w t_w)^2}{4(A_f + A_w)}\right)$ For T profiles $\dfrac{b_f^3 t_f e_f^2}{12 \cdot 10^6}$
(1) t_w is the net web thickness, in mm. t_{w_red} as defined in [2.3.2] is not to be used in this table.		

2.3.6 FE corrected stresses for stiffener capacity

When the reference stresses x and y obtained by FE analysis according to Ch 8, Sec 4, [2.4] are both compressive, ~~they are~~ σ_x is to be corrected according to the following ~~formulae~~ formula:

• If $\sigma_x < \nu\sigma_y$:

$\sigma_{xcor} = 0$

~~$\sigma_{ycor} = \sigma_y$~~

~~• If $\sigma_y < \nu\sigma_x$:~~

~~$\sigma_{xcor} = \sigma_x$~~

~~$\sigma_{ycor} = 0$~~

~~• In the other cases:~~

~~$\sigma_{xcor} = \sigma_x - \nu\sigma_y$~~

~~$\sigma_{ycor} = \sigma_y - \nu\sigma_x$~~

~~$\sigma_{xcor} = \sigma_x - \nu\sigma_y \geq 0$~~

~~• If $\sigma_x \geq \nu\sigma_y$:~~

~~$\sigma_{xcor} = \sigma_x - \nu\sigma_y$~~

Appendix 1 STRESS BASED REFERENCE STRESSES

2 REFERENCE STRESSES

2.1 Regular Panel

2.1.1 Longitudinal stress

…

• For overall stiffened panel buckling and stiffener buckling assessments, $\sigma_x(x)$ applied on the shorter edge of the attached plate is to be taken as:

$$\sigma_x = \frac{\sum_1^n A_i \sigma_{xi}}{\sum_1^n A_i}$$

…

Chapter 9 RULE GENERAL PRINCIPLE

Section 3 FATIGUE EVALUATION

6 WELD IMPROVEMENT METHODS

6.1 General

6.1.1

Post-weld fatigue strength improvement methods are to be considered as a supplementary means of achieving the required fatigue life, and subjected to quality control procedures and corrosion protection in accordance with Pt 1, Ch 3, Sec 4. ~~The benefit from post-weld treatment can only be applied for corrosion free condition and may only be considered provided that a protective coating is applied after the post-weld treatment and maintained during the design life time.~~

6.4 Applicability

6.4.1

The application of post-weld improvement and fatigue improvement factor provided in this section is subject to following limitations:

- ……
- ~~This benefit can only be achieved in a corrosion free condition and may only be considered provided that a suitable protective coating is applied after the post-weld Treatment and maintained during the design life time.~~

Chapter 12 CONSTRUCTION

Section 2 FABRICATION BY WELDING

2 WELDING PROCEDURES, WELDING CONSUMABLES AND WELDERS

2.1 General

2.1.1

All welding is to be carried out by approved welders, in accordance with approved welding procedures, using approved welding consumables, in compliance with the Rules of the Society.
Personnel manning automatic welding machines and equipment are to be competent, sufficiently trained and certified by the Society as specified in Society Rules or Guidelines for welding.

CCS 2.1.1a The approval of welding consumables, welding procedures and qualification tests of welders are to comply with the requirements of Chapters 2,3 and 4 of PART THREE of CCS Rules for Materials and Welding.

CCS 2.1.1b ~~The qualification tests of automatic submerged arc welding operators are to comply with the requirements of Section 3, Chapter 3 of CCS Guidelines for Inspection of Hull Welds.~~ Personnel manning fully mechanized and automatic welding equipment, such as submerged arc welding, gravity welding, electro-gas welding and MAG welding with auto-carriage, etc., are to comply with the requirements of [4.1.1.5] of Chapter 4 of PART THREE of CCS Rules for Materials and Welding.

Section 3 DESIGN OF WELD JOINTS

2 TEE OR CROSS JOINT

2.4 Partial or full penetration welds

2.4.6 Locations required for partial penetration welding

Partial penetration welding as defined in [2.4.2], is to be used in the following locations (see examples in Figure 3):

….

b) End connection of ~~L~~longitudinal/transverse bulkhead primary supporting member including buttress structure ~~end connections~~ to the double bottom and both end connections of backing bracket, where it is fitted.

….

2.5.2

….

Table 3 Weld Factors for Miscellaneous Fittings and Equipment

Item	Connection to	f_{weld}
Hatch cover	Watertight/oil-tight joints	0.48(1)
	At ends of stiffeners	0.38 (2)
	Elsewhere	0.24
Mast, derrick post, crane pedestal, etc.	Deck / Underdeck reinforced structure	0.43
Deck machinery seat	Deck	0.24
Mooring equipment seat	Deck	0.43
Ring for access hole type cover	Anywhere	0.43
Stiffening of side shell doors and weathertight doors	Anywhere	0.24
Frames of shell and weathertight doors	Anywhere	0.43
Coaming of ventilator and air pipe	Deck	0.43
Ventilators, etc., fittings	Anywhere	0.24
Ventilators, air pipes, etc., coaming to deck	Deck	0.43
Scupper and discharge	Deck	0.55
Bulwark stay	Deck	0.24
Bulwark plating	Deck	0.43

Guard rail, stanchion	Deck	0.43
Cleats and fittings	Hatch coaming and hatch cover	~~0.60~~ 0.24(3)

(1) For bulk carrier hatch covers f_{weld} = 0.38 for watertight joints

(2) For bulk carrier hatch covers f_{weld} = 0.24 at ends of stiffeners

(3) Minimum weld factor. Where $t_{as\text{-}built}$ >11.5 *mm* l_{leg} need not exceed $0.62t_{as\text{-}built}$. Penetration welding may be required depending on design.

….

PART 9-2 SHIP TYPES

Chapter 1 BULK CARRIERS

Section 2 STRCUTURAL DESIGN PRINCIPLES

3 STRUCTURAL DETAIL PRINCIPLES

3.3 Deck structures

3.3.5 Protection against wire rope

Wire rope grooving in way of cargo holds openings is to be prevented by fitting suitable protection such as half-round bar on the hatch side girders (i.e. upper portion of topside tank plates) ~~or~~ and hatch end beams in cargo hold and upper portion of hatch coamings.

3.3.6 Protection of cargo hatch opening corners against mechanical damage

Specific measures are to be arranged to prevent the hatch opening corners from mechanical damage incurred by coming into direct contact with the vertical grab wire under normal operations.

Section 3 HULL LOCAL SCANTLINGS

3 TRANSVERSE VERTICALLY CORRUGATED WATERTIGHT BULKHEADS SEPARATING CARGO HOLDS IN FLOODED CONDITION

3.2 Bending, shear and buckling check

3.2.2 Shear buckling check of the bulkhead corrugation webs

The shear stress τ , calculated according to [3.2.1], is to comply with the following formula:

$\tau \leq \tau_C$

where:

τ_C : Critical shear buckling stress, in N/mm^2, to be taken as:

~~$\tau \leq \tau_C$~~ $\tau_C = \tau_E$ for $\tau_E \leq \frac{R_{eH}}{2\sqrt{3}}$

$$\tau_c = \frac{R_{eH}}{\sqrt{3}}\left(1 - \frac{R_{eH}}{4\sqrt{3}\tau_E}\right) \quad \text{for} \quad \tau_E > \frac{R_{eH}}{2\sqrt{3}}$$

……

Section 5 CARGO HATCH COVERS

2 ARRANGEMENTS

2.1 DELETED ~~Height of hatch coamings~~

~~2.1.1~~

~~The height of hatch coamings is not to be less than:~~

- ~~600 mm in position 1~~
- ~~450 mm in position 2.~~

~~2.1.2~~

~~The height of hatch coamings in positions 1 and 2 closed by steel covers provided with gaskets and securing devices may be reduced with respect to the above values or the coamings may be omitted entirely, on condition that the Administration is satisfied that the safety of the ship is not thereby impaired in any sea conditions.~~

~~In such cases the scantlings of the covers, their gasketing, their securing arrangements and the drainage of recesses in the deck are considered by the Society on a case-by-case basis.~~

~~*CCS 2.1.2a The height of hatch coamings may be reduced, on condition that the Administration is satisfied that the safety of the ship is not thereby impaired and that effective measures are taken. In such cases, the scantlings of hatch covers, the arrangement of gaskets and securing devices are to comply with the relevant requirements of this Section, taking into account the strength and arrangement of pressure heads, stoppers and securing devices as well as the effectiveness of drainage and sealing materials.*~~

Chapter 2 OIL TANKERS

Section 1 GENERAL ARRANGEMENT DESIGN

2 SEPARATION OF CARGO TANKS

2.1 General

2.1.1

~~The cargo pump room, cargo tanks, slop tanks and cofferdams are to be positioned forward of machinery spaces. Main cargo control stations, control stations, accommodation and service spaces are to be positioned aft of cargo tanks, slop tanks and spaces which isolate cargo or slop tanks from machinery spaces, but not necessary aft of the oil fuel bunker tanks and ballast tanks.~~

The designer's attention is to be drawn on the arrangement of the cargo pump room, cargo tanks, slop tanks and cofferdams, main cargo control stations, control stations, accommodation and service spaces as well as on the need to separate the cargo tanks from the machinery space.

~~2.1.2~~

~~A cofferdam is to be provided to separate the cargo tanks from the machinery space. Pump room, ballast tanks or fuel oil tanks may be considered as cofferdam for this purpose.~~

Section 3 HULL LOCAL SCANTLING

2 VERTICALLY CORRUGATED BULKHEADS

2.2 Scantling requirements

Table 7 : Values of C_i

Bulkhead	At lower end of l_{cg}	At mid-length of l_{cg}	At upper end of l_{cg}
Transverse bulkhead	C_1	C_{m1}	0.65 C_{m1}
Longitudinal bulkhead	C_3	C_{m3}	0.65 C_{m3}

where:

……

R_{bt} : Coefficient taken as:

~~$R_{bt} = \frac{A_{bt}}{b_{ib}}\left(1+\frac{l_{ib}}{b_{ib}}\right)\left(1-\frac{b_{av-t}}{h_{st}}\right)$~~ $R_{bt} = \frac{A_{bt}}{b_{ib}}\left(1+\frac{l_{ib}}{b_{ib}}\right)\left(1+\frac{b_{av-t}}{h_{st}}\right)$ for transverse bulkheads

R_{bl} : Coefficient taken as:

~~$R_{bl} = \frac{A_{bl}}{I_{ib}}\left(1+\frac{l_{ib}}{b_{ib}}\right)\left(1-\frac{b_{av-l}}{h_{sl}}\right)$~~ $R_{bl} = \frac{A_{bl}}{I_{ib}}\left(1+\frac{l_{ib}}{b_{ib}}\right)\left(1+\frac{b_{av-l}}{h_{sl}}\right)$ for longitudinal bulkheads.

……

Section 4 HULL OUTFITTIGS

1 SUPPORTING STRUCTURES FOR COMPONENTS USED IN EMERGENCYTOWING ARRANGEMENTSs

1.1 General

1.1.1

It is the responsibility of the designer to provide ~~E~~emergency towing arrangements ~~are to be~~ fitted at both the bow and stern of every tanker with a deadweight of 20,000 tonnes or more, as required by SOLAS, as amended.

1.1.2

The designer is reminded that design and construction of the towing arrangements ~~is~~ are to be approved by the Flag Administration or the Society on their behalf.