Rules for the Classification of Steel Ships

(Part 3 Hull Structure)

HULL RULE DEVELOPMENT TEAM

- Main Amendments -

(1) Effective date : 1 July 2019

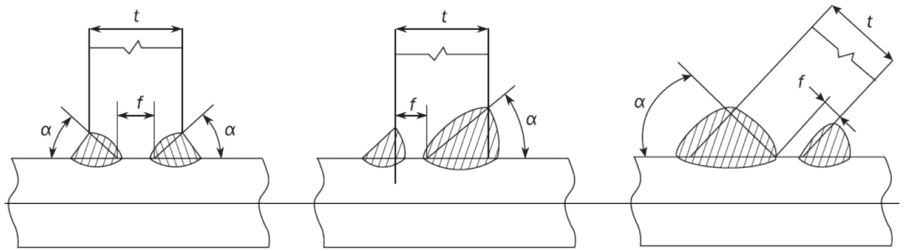
◉ Revision of requirements of weldings

◉ Revision of requirements for gudgeon of stern frame

◉ Newly added requirements of bilge keel

◉ Revision of requirements for watertight doors of watertight bulkhead

◉ Flow through method

Present	Amendment
CHAPTER 1 GENERAL	**CHAPTER 1 GENERAL**
Section 1 ~ 4 <omitted>	**Section 1 ~ 4 <same as the present Rule>**
Section 5 Weldings	**Section 5 Weldings**
501. General	**501. General** <u>*(2019)*</u>
1. ~ 4. <omitted>	**1. ~ 4.** <same as the present Rule>
~~**5. Partial and full penetration welds**~~ ~~(1) In areas with high tensile stresses or areas considered critical, full or partial penetration welds are to be used. In case of full penetration welding, the root face is to be removed, e.g. by gouging before welding of the back side. For partial penetration welds the root face, f, is, to be taken between 3 mm and t/3. The groove angle made to ensure welding bead penetrating up to the root of the groove, α, is usually from 40° to 60°. The welding bead of the full/partial penetration welds is to cover root of the groove. Examples of partial penetration welds are given below.(See **Fig 3.1.2**)~~  ~~**Fig. 3.1.2 Partial penetration welds**~~ ~~(2) For partial penetration welds with one side bevelling the fillet weld at the opposite side of the bevel is to have F2.~~	<u><deleted></u>

Present	Amendment
~~(3) Locations required for full penetration welding~~ ~~(A) Floors to hopper/inner bottom plating in way of radiused hopper knuckle.~~ ~~(B) Connection of vertical corrugated bulkhead to the lower hopper plate and to the inner bottom plate within the cargo hold region, when the vertical corrugated bulkhead is arranged without a lower stool.~~ ~~(C) Connection of vertical corrugated bulkhead to top plating of lower stool.~~ ~~(D) Crane pedestals and associated bracketing and support structure.~~ ~~(E) For toe connections of longitudinal hatch coaming end bracket to the deck plating, full penetration weld for a distance of 300 mm from toe of coaming termination bracket is required.~~ ~~(F) Rudder horns and shaft brackets to shell structure.~~ ~~(4) Locations required for full or partial penetration welding~~ ~~(A) Connection of hopper sloping plate to longitudinal bulkhead (inner hull).~~ ~~(B) For Abutting plate panels with thickness less than or equal to 12 mm, forming outer shell boundaries below the scantling draught, including but not limited to: sea chests, rudder trunks, and portions of transom - full penetration.~~ ~~For thickness greater than 12 mm – partial penetration.~~ ~~(C) Corrugated bulkhead lower stool side plating to lower stool top plate.~~ ~~(D) Corrugated bulkhead lower stool side plating to inner bottom.~~ ~~(E) Corrugated bulkhead lower stool supporting floors to inner bottom.~~ ~~(F) Corrugated bulkhead gusset and shedder plates.~~ ~~(G) Lower 15% of the length of built-up corrugation of vertical corrugated bulkheads.~~ ~~(H) Lower hopper plate to inner bottom.~~	<deleted>
Table 3.1.11 Kinds and sizes of fillet weld (Unit : mm) <omitted>	**Table 3.1.11 Kinds and sizes of fillet weld (Unit : mm)** <same as the present Rule>
Table 3.1.12 Application of fillet weld <omitted>	**Table 3.1.12 Application of fillet weld** <same as the present Rule>

Present	Amendment
CHAPTER 2 STEMS AND STERN FRAMES	**CHAPTER 2 STEMS AND STERN FRAMES**
Section 1 Stems **Section 2 Stern Frames**	**Section 1 Stems** **Section 2 Stern Frames**
201. ~ 208. <omitted>	**201. ~ 208. <same as the present Rule>**
209. Gudgeon	**209. Gudgeon** ***(2019)***
~~**1.** The bearing length of pintle, l_p, is to be such that~~ ~~$d_p \le l_p \le 1.2d_p$ (mm)~~ ~~where:~~ ~~d_p = diameter of pintle (mm)~~ **2.** The length of the pintle housing in the gudgeon is not to be less than the pintle diameter d_p. **3.** The thickness of the pintle housing is not to be less than 0.25 d_p. For ships specified in **Pt 4, Ch 1, 104.,** ~~however,~~ the thickness of the pintle housing is to be appropriately increased. ⚓	**1.** The depth of gudgeon is not to be less than the length of pintle bearing **2.** The thickness of the gudgeon is not to be less than 0.25 d_p. For ships specified in **Pt 4, Ch 1, 104.,** the thickness of the gudgeon is to be appropriately increased. where: d_p = Actual diameter of the pintle measured at the outer surface of the sleeve(mm). ⚓

Present	Amendment
CHAPTER 3 <omitted> **CHAPTER 4 PLATE KEELS AND SHELL PLATINGS**	**CHAPTER 3 <same as the present Rule>** **CHAPTER 4 PLATE KEELS AND SHELL PLATINGS**
Section 1 ~ Section 2 <omitted> **Section 3 Shell Plating below Strength Deck**	**Section 1 ~ 2 <same as the present Rule>** **Section 3 Shell Plating below Strength Deck**
301. ~ 304. <omitted>	**301. ~ 304. <same as the present Rule>**
305. Bilge plates [See Guidance]	**305. Bilge plates [See Guidance]**
1. ~ 3. <omitted>	**1. ~ 3.** <same as the present Rule>
<newly added>	**4.** Where bilge keels are fitted, special consideration is to be given to both the material and the arrangement. *(2019)*
Section 4 ~ Section 7 <omitted>	**Section 4 ~ Section 7 <same as the present Rule>**

Present	Amendment
CHAPTER 5 ~ 13 <omitted> **CHAPTER 14 WATERTIGHT BULKHEADS**	**CHAPTER 5 ~ 13<same as the present Rule>** **CHAPTER 14 WATERTIGHT BULKHEADS**
Section 1 ~ Section 3 <omitted> **Section 4 Watertight Doors**	**Section 1 ~ 3 <same as the present Rule>** **Section 4 Watertight Doors**
401. <omitted>	**401. <same as the present Rule>**
402. Type of watertight doors **【See Guidance】**	**402. Type of watertight doors** **【See Guidance】**
1. Watertight doors are to be of sliding type. ~~Hinged or rolling type may, however, be accepted having regard to the position or the service condition of the door.~~	**1.** Watertight doors are to be of sliding type. *(2019)*
2. Notwithstanding the provisions in **1** above, where watertight door is as small as crew can pass, the watertight door may be of hinged type or rolling type, except where the doors are required to be capable of being closed remotely in accordance with **404. 2.**	**2.** Notwithstanding the provisions in **1** above, where watertight door is as small as crew can pass, the watertight door may be of hinged type or rolling type, except where the doors are required to be capable of being closed remotely in accordance with **404. 2.**
3. ~ **4.** <omitted>	**3.** ~ **4.** <same as the present Rule>
403. ~ 408. <omitted>	**403. ~ 408. <same as the present Rule>**
409. Sliding doors **【See Guidance】**	**409. Sliding doors** **【See Guidance】** *(2019)*
~~**1.** Sliding watertight doors are to be capable of being operated from an accessible position above the bulkhead deck and are to have an index at the operating positon showing whether the door is open or closed. This remote control of the door may, however, be omitted where the Society is satisfied with such an arrangement having regard to the service condition of the door.~~	
2. Where the above control means is operated by rods, the lead of operating rods is to be as direct as possible and the screw is to work in a nut of gun-metal or other approved material.	**1.** Where a sliding watertight door is operated by rods, the lead of operating rods is to be as direct as possible and the screw is to work in a nut of gun-metal or other approved material.
~~**3.** Sliding doors controlled from remote positions are also to be capable of being operated at the position of the door.~~	
4. The frames of vertically sliding watertight doors are to have no groove at the bottom in which dirt might lodge and prevent the door from closing.	**2.** The frames of vertically sliding watertight doors are to have no groove at the bottom in which dirt might lodge and prevent the door from closing.
	3. Sliding watertight doors below the bulkhead deck of passenger ships are to be capable of being closed from an accessible position above the bulkhead deck by hand-operated mechanism.
410. ~ 411. <omitted>	**410. ~ 411. <same as the present Rule>**

Guidance Relating to the Rules for the Classification of Steel Ships

(Part 3 Hull Structure)

HULL RULE DEVELOPMENT TEAM

- Main Amendments -

(1) Effective date : 1 July 2019

- ◉ Reflection of requirements for material according to revision of UR S6(R9)
- ◉ Revision of requirements for bilge keel
- ◉ Revision of requirements for bow impact pressure of ships for having large flare
- ◉ Newly added requirements for forecastle of fishing vessels
- ◉ Newly added requirements for escape trunk of shaft tunnels
- ◉ Correction of clerical errors

Present	Amendment

Present

CHAPTER 1 GENERAL

Section 1 ~ 2 <omitted>
Section 4 Materials

401. ~ 405. <omitted>

406. Special requirements for application of steels

~~**1.** For the ships carrying low temperature cargo, the application of steels which is exposed to low temperature cargo is in accordance with **Table 3.1.5.** However, if the structure can be released the thermal stress, it is to be in accordance with the discretion by the Society.~~

~~**Table 3.1.5** (1)~~

~~Designed temp *T* (°C)~~	~~Thickness of steels *t* (mm)~~						
	~~*t*≤10~~	~~10<*t*≤15~~	~~15<*t*≤20~~	~~20<*t*≤25~~	~~25<*t*≤30~~	~~30<*t*≤40~~	~~40<*t*≤50~~
~~-10 ≤ *T*~~	~~*A*~~			~~*B*~~		~~*D*~~	~~*E*~~
~~-20 ≤ *T* < -10~~	~~*B*~~	~~*D*~~		~~*E*~~			
~~-30 ≤ *T* < -20~~	~~*E*~~				~~*RL* 24*A*~~		~~*RL* 24*B*~~
~~-40 ≤ *T* < -30~~	~~*RL* 24*A*~~			~~*RL* 24*B*~~			~~(2)~~
~~-50 ≤ *T* < -40~~	~~*RL* 24B~~			~~(2)~~			

~~NOTE~~

~~(1) For the members having designed temperature under -50°C, or strength deck exposed low temp, they may be needed steels having more higher tenacity by due to thickness of plate and structure.~~

~~(2) It is to be in accordance with the discretion by the Society.~~

Amendment

CHAPTER 1 GENERAL

Section 1 ~ 2 <same as the present Guidance>
Section 4 Materials

401. ~ 405. <same as the present Guidance>

406. Special requirements for application of steels ***(2019)***

<deleted>

Present	Amendment
(see below)	

Present

2. The application of steels for ships designed to operate in area with low air temperatures is to comply with the following requirements: *(2017)*

(1) For ships intended to operate in areas with low air temperatures (below and including -20°C), e.g. regular service during winter seasons to Arctic or Antarctic waters, the materials in exposed structures are to be selected based on the design temperature t_D, to be taken as defined in (5). Materials in the various strength members above the lowest ballast water line (BWL) exposed to air are not to be of lower grades than those corresponding to classes Ⅰ, Ⅱ and Ⅲ, as given in **Table 3.1.6,** depending on the categories of structural members(SECONDARY, PRIMARY and SPECIAL). For non-exposed structures(except as indicated in Note [5] of **Table 3.1.6**) and structures below the lowest ballast water line, see **405.** of the Rules.

Table 3.1.6 Application of material classes and grades – Structures exposed at low temperatures

Structural member category	Material class	
	Within 0.4L amidships	Outside 0.4L amidships
○ SECONDARY: - Deck plating exposed to weather, in general - Side plating above BWL - Transverse bulkheads above BWL [5]	I	I
<omitted>	<omitted>	<omitted>
<omitted>	<omitted>	<omitted>

Notes :

[1] Plating at corners of large hatch openings to be specially considered. Class Ⅲ or grade *E*, *EH* 32, *EH* 36 and *EH* 40 to be applied in positions where high local stresses may occur.

[2] Not to be less than grade *E*, *EH* 32, *EH* 36 and *EH* 40 within 0.4L amidships in ships with length exceeding 250 m

[3] In ships with a breadth exceeding 70 m at least three deck strakes to be class Ⅲ.

[4] Not to be less than grade *D*, *DH* 32, *DH* 36 and *DH* 40.

[5] Applicable to plating attached to hull envelope plating exposed to low air temperature. At least one strake is to be considered in the same way as exposed plating and the strake width is to be at least 600mm.

Amendment

Present	Amendment
	(see below)

1. The application of steels for ships designed to operate in area with low air temperatures is to comply with the following requirements: *(2017)*

(1) For ships intended to operate in areas with low air temperatures (below -10°C), e.g. regular service during winter seasons to Arctic or Antarctic waters, the materials in exposed structures are to be selected based on the design temperature t_D, to be taken as defined in **2**. Materials in the various strength members above the lowest ballast water line (BWL) exposed to air(including the structural members covered by the Note [5] of **Table 3.1.6**) and materials of cargo tank boundary plating for which **3.** is applicable are not to be of lower grades than those corresponding to classes Ⅰ, Ⅱ and Ⅲ, as given in **Table 3.1.6,** depending on the categories of structural members(SECONDARY, PRIMARY and SPECIAL). For non-exposed structures(except as indicated in Note [5] of **Table 3.1.6**) and structures below the lowest ballast water line, see **405.** of the Rules.

Table 3.1.6 Application of material classes and grades – Structures exposed at low temperatures

Structural member category	Material class	
	Within 0.4L amidships	Outside 0.4L amidships
○ SECONDARY: - Deck plating exposed to weather, in general - Side plating above BWL - Transverse bulkheads above BWL [5] - Cargo tank boundary plating exposed to cold cargo [6]	I	I
<omitted>	<omitted>	<omitted>
<omitted>	<omitted>	<omitted>

Notes :
[1] Plating at corners of large hatch openings to be specially considered. Class Ⅲ or grade *E*, *EH*32, *EH*36 and *EH*40 to be applied in positions where high local stresses may occur.
[2] Not to be less than grade *E*, *EH*32, *EH*36 and *EH*40 within 0.4L amidships in ships with length exceeding 250 m
[3] In ships with a breadth exceeding 70 m at least three deck strakes to be class Ⅲ.
[4] Not to be less than grade *D*, *DH*32, *DH*36 and *DH*40.
[5] Applicable to plating attached to hull envelope plating exposed to low air temperature. At least one strake is to be considered in the same way as exposed plating and the strake width is to be at least 600mm.
[5] For cargo tank boundary plating exposed to cold cargo for ships other than liquefied as carriers, see **3**.

Present	Amendment

Present

(2) ~ (4) <omitted>

(5) The design temperature is to be taken as the lowest mean daily average air temperature in the area of operation. For seasonally restricted service the lowest value within the period of operation applies.(**see Fig 3.1.10**)

· Mean: Statistical mean over observation period (at least 20 years)
· Average: Average during one day and night
· Lowest: Lowest during year
· MDHT = Mean Daily High (or maximum) Temperature
· MDAT = Mean Daily Average Temperature
· MDLT = Mean Daily Low (or minimum) Temperature

For the purpose of issuing a Polar Ship Certificate in accordance with the Polar Code, the design temperature t_D shall be no more than 13°C higher than the Polar Service Temperature (PST) of the ship. In the Polar Regions, the statistical mean over observation period is to be determined for a period of at least 10 years.

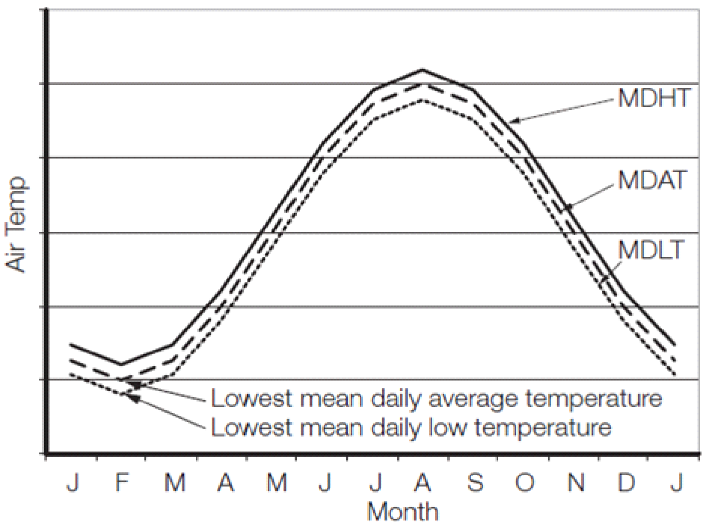


Fig 3.1.10 Commonly used definitions of temperatures

Amendment

(2) ~ (4) <omitted>

2. The design temperature is to be taken as the lowest mean daily average air temperature in the area of operation. For seasonally restricted service the lowest value within the period of operation applies.(**see Fig 3.1.10**)

· Mean: Statistical mean over observation period (at least 20 years)
· Average: Average during one day and night
· Lowest: Lowest during year
· MDHT = Mean Daily High (or maximum) Temperature
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For the purpose of issuing a Polar Ship Certificate in accordance with the Polar Code, the design temperature t_D shall be no more than 13°C higher than the Polar Service Temperature (PST) of the ship. In the Polar Regions, the statistical mean over observation period is to be determined for a period of at least 10 years.

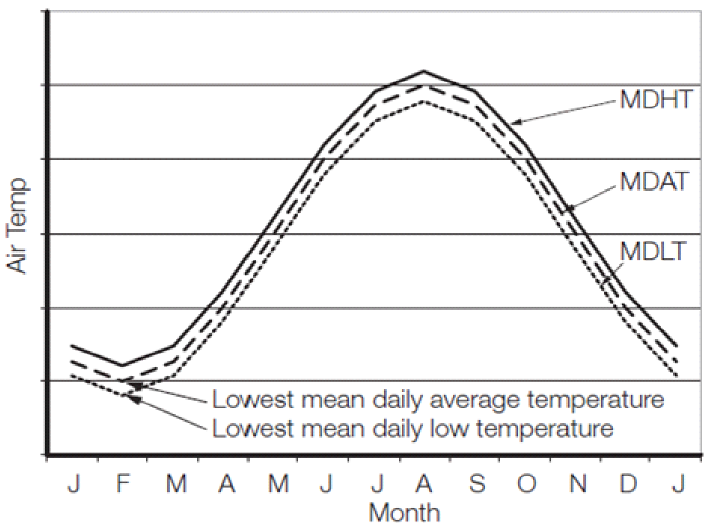


Fig 3.1.10 Commonly used definitions of temperatures

Present	Amendment

Table 3.1.7 Material grade requirements for classes I, II and III at low temperatures

Class Ⅰ

Plate thickness in (mm)	-20/-25 °C		-26/-35 °C		-36/-45 °C		-46/-55 °C	
	MS	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*
t≤10	*A*	*AH*	*B*	*AH*	*D*	*DH*	*D*	*DH*
10 〈t≤15	*B*	*AH*	*D*	*DH*	*D*	*DH*	*D*	*DH*
15 〈t≤20	*B*	*AH*	*D*	*DH*	*D*	*DH*	*E*	*EH*
20 〈t≤25	*D*	*DH*	*D*	*DH*	*D*	*DH*	*E*	*EH*
25 〈t≤30	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*
30 〈t≤35	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*
35 〈t≤45	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*
45 〈t≤50	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*

Class Ⅲ

Plate thickness in (mm)	-20/-25 °C		-26/-35 °C		-36/-45 °C		-46/-55 °C	
	MS	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*
t≤10	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*
10 〈t≤20	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*
20 〈t≤25	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*
25 〈t≤30	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*
30 〈t≤35	*E*	*EH*	-	*FH*	-	*FH*	-	-
35 〈t≤40	*E*	*EH*	-	*FH*	-	*FH*	-	-
40 〈t≤50	-	*FH*	-	*FH*	-	-	-	-

Class Ⅱ

Plate thickness in (mm)	-20/-25 °C		-26/-35 °C		-36/-45 °C		-46/-55 °C	
	MS	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*
t≤10	*B*	*AH*	*D*	*DH*	*D*	*DH*	*E*	*EH*
10 〈t≤20	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*
20 〈t≤30	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*
30 〈t≤40	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*
40 〈t≤45	*E*	*EH*	-	*FH*	-	*FH*	-	-
45 〈t≤50	*E*	*EH*	-	*FH*	-	*FH*	-	-

Notes :

The symbols in the table mean the grades of steel as follows :

AH : *AH* 32, *AH* 36 and *AH* 40,
DH : *DH* 32, *DH* 36 and *DH* 40,
EH : *EH* 32, *EH* 36 and *EH* 40,
FH : *FH* 32, *FH* 36 and *FH* 40
MS : Mild steels,
HT : High tensile steels

Present	Amendment

Table 3.1.7 Material grade requirements for classes I, II and III at low temperatures

Class I

Plate thickness in (mm)	-11/-15°C		-16/-25°C		-26/-35°C		-36/-45°C		-46/-55°C	
	MS	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*
$t \le 10$	*A*	*AH*	*A*	*AH*	*B*	*AH*	*D*	*DH*	*D*	*DH*
$10 < t \le 15$	*A*	*AH*	*B*	*AH*	*D*	*DH*	*D*	*DH*	*D*	*DH*
$15 < t \le 20$	*A*	*AH*	*B*	*AH*	*D*	*DH*	*D*	*DH*	*E*	*EH*
$20 < t \le 25$	*B*	*AH*	*D*	*DH*	*D*	*DH*	*D*	*DH*	*E*	*EH*
$25 < t \le 30$	*B*	*AH*	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*
$30 < t \le 35$	*D*	*DH*	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*
$35 < t \le 45$	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*
$45 < t \le 50$	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*

Class II

Plate thickness in (mm)	-11/-15°C		-16/-25°C		-26/-35°C		-36/-45°C		-46/-55°C	
	MS	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*
$t \le 10$	A	*AH*	*B*	*AH*	*D*	*DH*	*D*	*DH*	*E*	*EH*
$10 < t \le 20$	B	*AH*	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*
$20 < t \le 30$	D	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*
$30 < t \le 40$	D	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*
$40 < t \le 45$	E	*EH*	*E*	*EH*	-	*FH*	-	*FH*	-	-
$45 < t \le 50$	E	*EH*	*E*	*EH*	-	*FH*	-	*FH*	-	-

Class III

Plate thickness in (mm)	-11/-15°C		-16/-25°C		-26/-35°C		-36/-45°C		-46/-55°C	
	MS	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*	*MS*	*HT*
$t \le 10$	*B*	*AH*	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*
$10 < t \le 20$	*D*	*DH*	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*
$20 < t \le 25$	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*
$25 < t \le 30$	*D*	*DH*	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*
$30 < t \le 35$	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*	-	-
$35 < t \le 40$	*E*	*EH*	*E*	*EH*	-	*FH*	-	*FH*	-	-
$40 < t \le 50$	*E*	*EH*	-	*FH*	-	*FH*	-	-	-	-

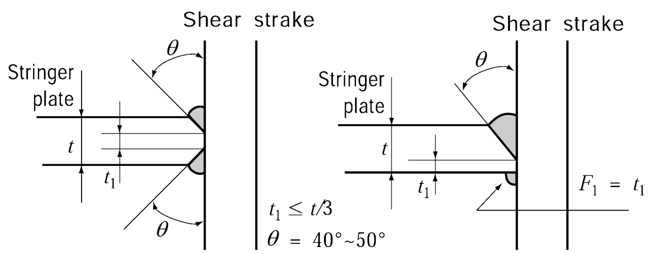
Notes :

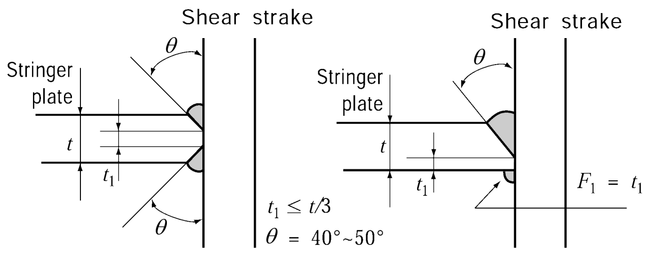
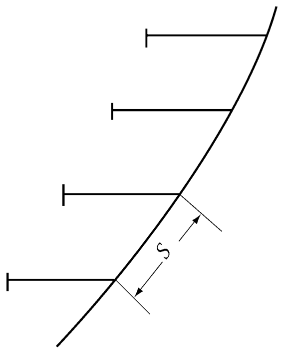
The symbols in the table mean the grades of steel as follows :

AH : *AH* 32, *AH* 36 and *AH* 40,
DH : *DH* 32, *DH* 36 and *DH* 40,
EH : *EH* 32, *EH* 36 and *EH* 40,
FH : *FH* 32, *FH* 36 and *FH* 40
MS : Mild steels,
HT : High tensile steels

Present	Amendment
	3. Cold cargo for ships other than liquefied gas carriers For ships other than liquefied gas carriers, intended to be loaded with liquid cargo having a temperature below -10°C, e.g. loading from cold onshore storage tanks during winter conditions, the material grade of cargo tank boundary plating is defined in **Table 3.1.7** base on the following: - t_c design minimum cargo temperature in °C - steel grade corresponding to Class I as given in **Table 3.1.6** The design minimum cargo temperature, t_c is to be specified in the loading manual.
Section 5 ~ 8 <omitted>	**Section 5 ~ 8 <same as the present Guidance>**

Present	Amendment
CHAPTER 2 STEMS AND STERN FRAMES	**CHAPTER 2 STEMS AND STERN FRAMES**
Section 1 <omitted>	**Section 1 <same as the present Guidance>**
Section 2 Stern Frames	**Section 2 Stern Frames**
202. ~ 207. <omitted>	**202. ~ 207. <same as the present Guidance>**
210. Rudder trunk	**210. Rudder trunk**
1. Materials, welding and connection to hull	**1. Materials, welding and connection to hull**
(1) This requirement applies to both trunk configurations (extending or not below stern frame).	(1) This requirement applies to both trunk configurations (extending or not below stern frame).
(2) The steel used for the rudder trunk is to be of weldable quality, with a carbon content not exceeding 0.23% on ladle analysis and a carbon equivalent C_{EQ} not exceeding 0.41.	(2) The steel used for the rudder trunk is to be of weldable quality, with a carbon content not exceeding 0.23% on ladle analysis or a carbon equivalent C_{EQ} not exceeding 0.41%. *(2019)*
(3) ~ (4) <omitted>	(3) ~ (4) <same as the present Guidance>
2. <omitted>	**2. <same as the present Guidance>**

Present	Amendment
CHAPTER 3 <omitted> **CHAPTER 4 PLATE KEELS AND SHELL PLATINGS** **Section 1 <omitted>** **301. <omitted>** **303. Sheer strakes for midship part** Attentions to be paid as to sheer strakes (1) ~ (3). (4) At least for 0.6L amidship the manner of the welding construction of T type joints between sheer strakes and stringer plates of strength deck is, in general, to be as shown in **Fig 3.4.1** as a standard. However, where the thickness of stringer plates is less than 13 mm, fillet weld of F1 grade may be acceptable without edge preparation.	**CHAPTER 3 <same as the present Guidance>** **CHAPTER 4 PLATE KEELS AND SHELL PLATINGS** **Section 1 <same as the present Guidance>** **301. <same as the present Guidance>** **303. Sheer strakes for midship part** Attentions to be paid as to sheer strakes (1) ~ (3). (4) At least for 0.6L amidship the manner of the welding construction of T type joints between sheer strakes and stringer plates of strength deck is, in general, to be as shown in **Fig 3.4.1** as a standard. However, where the thickness of stringer plates is less than 13 mm, fillet weld of F1 grade may be acceptable without edge preparation.  **Fig 3.4.1 Welding construction of joints between sheer strakes and stringer plates of strength deck**

Present	Amendment
305. Bilge plate **1.** ~ **2. <omitted>** **3.** The bilge strake in the midship part are to be carefully worked so that deformations of the bilge circle may not exceed 1/3 of thickness of bilge strake amidships.  **Fig 3.4.1 Welding construction of joints between sheer strakes and stringer plates of strength deck**  **Fig 3.4.2 Measurements and shell plating stiffened in a spacing S**	**305. Bilge plate** **1.** ~ **2.** <same as the present Guidance> **3.** The bilge strake in the midship part are to be carefully worked so that deformations of the bilge circle may not exceed 1/3 of thickness of bilge strake amidships.

<table>
<tr><th>Present</th><th>Amendment</th></tr>
<tr><td>4. Where bilge keel plates are fitted, the plates welded directly to bilge strakes are to be of same kind of bilge strakes. However, grade of the plates may be generally of A-grade in any kind of steel plating.</td><td>4. Where bilge keel plates are fitted in the midship part, special consideration is to be given to both the material and the arrangement. (2019)

(1) Material

The material of the bilge keel and ground bar is to be of the same yield stress as the material to which they are attached. In addition, when the bilge keel extends over a length more than 0.15L, the material of the bilge keel and ground bar is to be of the same grade as the material to which they are attached.

(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 Fig 3.4.2, are to be specially considered by the Society.

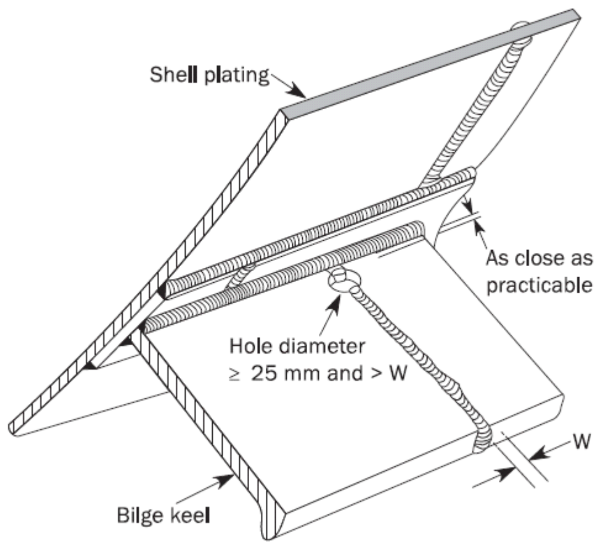


Fig 3.4.2 Bilge keel construction</td></tr>
</table>

Present	Amendment
	(3) Ground bars Bilge keels are not to be welded directly to the shell plating. A ground bar, or doubler, is to be fitted on the shell plating as shown in **Fig 3.4.2** and **Fig 3.4.3**. In general, the ground bar is to be continuous. The gross thickness of the ground bar is not to be less than the gross thickness of the bilge strake or 14mm, whichever is the lesser. (4) End details The ground bar and bilge keel ends are to be tapered or rounded. Tapering is to be gradual with a minimum ratio of 3:1, see items (a), (b), (d) and (e) in **Fig 3.4.3**. Rounded ends are to be as shown in item (c) of **Fig 3.4.3**. Cut-outs on the bilge keel web, within zone 'A' (see items (b) and (e) of **Fig 3.4.3**) are not permitted. The end of the bilge keel web is to be not less than 50 mm and not greater than 100 mm from the end of the ground bar, see items (a) and (d) of **Fig 3.4.3.** Ends of the bilge keel and ground bar are to be supported by either transverse or longitudinal members inside the hull, as indicated as follows: • Transverse support member is to be fitted at mid length between the end of the bilge keel web and the end of the ground bar, see items (a), (b) and (c) of **Fig 3.4.3**. • Longitudinal stiffener is to be fitted in line with the bilge keel web, it is to extend to at least the nearest transverse member forward and aft of zone 'A' (see items (b) and (e) of **Fig 3.4.3**) Alternative end arrangements may be accepted, provided that they are considered equivalent.

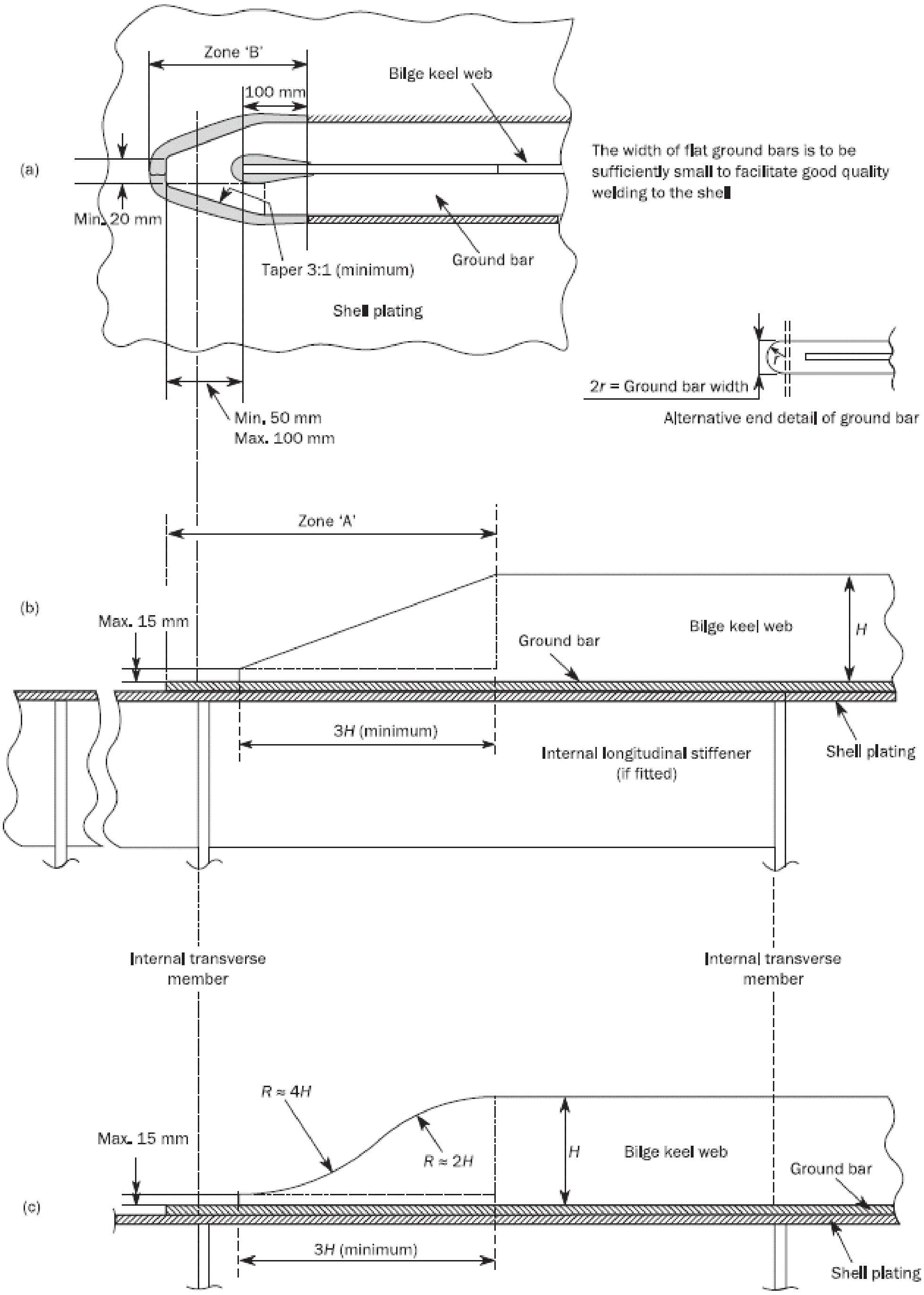
Present	Amendment
	

Fig 3.4.3 Bilge keel end design

Present	Amendment

Figure 20 : Bilge keel end design (continued)

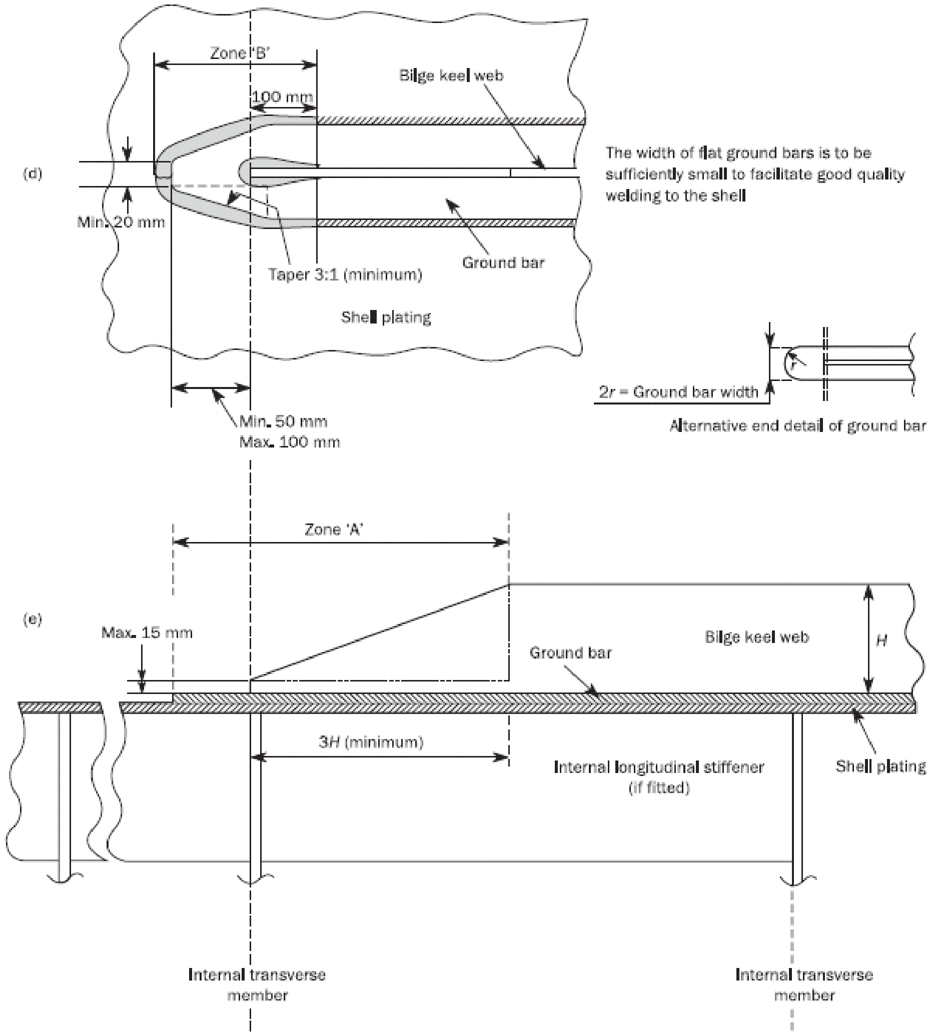
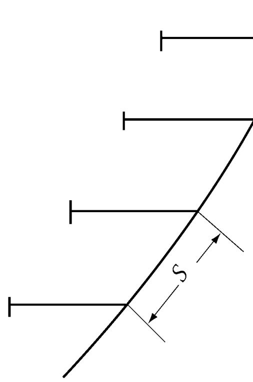


Fig 3.4.3 Bilge keel end design (continued)

Present	Amendment
Section 4 Special Requirements for Shell Plating	**Section 4 Special Requirements for Shell Plating**
401. Shell plating at a location where flare is specially large For ships with large flare like as pure car carriers, the thickness of shell plate above the load line for 0.1L forward is not to be less than that obtained from the following formula: $S\sqrt{\frac{\psi P}{\sigma_y}\times 10^3}$ (mm) S = spacing of frames, or spacing of girders or longitudinal shell stiffeners, whichever is the smaller. (m) σ_y = specified yield stress of materials (N/mm^2) ψ = as obtained from following formula $\psi = \frac{3\eta^2 - 2\sqrt{1+3\eta^2}+2}{12\eta^2}$ η = spacing of frames, or spacing of girders or longitudinal shell stiffeners, whichever is the greater(m), divided by S. P = slamming impact pressure as specified in **Ch 8, 108.**(kPa)	**401. Shell plating at a location where flare is specially large** ***(2019)*** **1.** For ships with large flare like as pure car carriers, the thickness of shell plate above the load line for 0.2L forward is not to be less than that obtained from the following formula: $S\sqrt{\frac{\psi P}{\sigma_y}\times 10^3}$ (mm) S = spacing of frames, or spacing of girders or longitudinal shell stiffeners measured along the shell plating, whichever is the smaller. (m) σ_y = specified yield stress of materials (N/mm^2) ψ = as obtained from following formula $\psi = \frac{3\eta^2 - 2\sqrt{1+3\eta^2}+2}{12\eta^2}$ η = spacing of frames, or spacing of girders or longitudinal shell stiffeners measured along the shell plating, whichever is the greater(m), divided by S. P = slamming impact pressure as specified in **Ch 8, 108.**(kPa) **2.** For ships whose L and C_b are not less than 250 m and 0.8 respectively, the provisions of **Sub-part 1 Ch 10, Sec 1, 3.3** of Rule **Pt 13** are to be applied.

Present	Amendment
402. Shell plating stiffened in a spacing remarkably different from the frame spacing Where the spacing of stiffening members on shell plating is remarkably different from the spacing, actual spaces is to be used in calculating the thickness of shell plating.(See **Fig 3.4.2**)	**402. Shell plating stiffened in a spacing remarkably different from the frame spacing** Where the spacing of stiffening members on shell plating is remarkably different from the spacing, actual spaces is to be used in calculating the thickness of shell plating.(See **Fig 3.4.4**) *(2019)*  **Fig 3.4.4 Measurements and shell plating stiffened in a spacing S**
404. ~ 405. <omitted>	**404. ~ 405. <same as the present Guidance>**
Section 6 ~ 7 <omitted>	**Section 6 ~ 7 <same as the present Guidance>**

<table>
<tr><th>Present</th><th>Amendment</th></tr>
<tr><td>

CHAPTER 5 ~ 7 <omitted>

CHAPTER 8 FRAMES

Section 1 General

105. ~ 106. <omitted>

108. Frames at a location where flare is specially large

1. For ships with large flare like as pure car carriers, the plastic section modulus Z_p of transverse frames and side longitudinals, which are fitted in the bow flare position considered to endure large wave impact pressure, above the load line for 0.1 L forward is not to be less than that obtained from the following formula.

Required plastic section modulus : $Z_p = \frac{PSl_s^2}{16\sigma_y \cos\theta_s} \times 10^3$ (cm^3)

Where,

S = frame spacing (m)

l_s = unsupported length of frame as obtained from the following formula (m)

$l_s = l - l_{b1} - l_{b2}$

l = refer to **Fig 3.8.1**

l_{b1} and l_{b2} = bracket length for span correction as obtained from the following formulae

$l_{b1} = b_1(1 - \frac{h_0}{h_1}) \times 10^{-3}$

$l_{b2} = b_2(1 - \frac{h_0}{h_2}) \times 10^{-3}$

b_1, b_2, h_0, h_1 and h_2 = refer to **Fig 3.8.1**

</td><td>

CHAPTER 5 ~ 7 <same as the present Guidance>

CHAPTER 8 FRAMES

Section 1 General

105. ~ 106. <same as the present Guidance>

108. Frames at a location where flare is specially large *(2019)*

1. For ships with large flare like as pure car carriers, the thickness t_w of web plates and the plastic section modulus Z_p of transverse frames and side longitudinals, which are fitted where the bow flare located above the load line and forward of 0.2 L is considered to endure large wave impact pressure, are not to be less than that obtained from the following formula.

Required thickness of web plate : $t_w = \frac{648PSl_s}{h_0 \sigma_y \cos\theta_s}$ (mm)

Required plastic section modulus : $Z_p = \frac{PSl_s^2}{16\sigma_y \cos\theta_s} \times 10^3$ (cm^3)

Where,

S = frame spacing measured along the shell plating (m)

l_s = unsupported length of frame as obtained from the following formula (m)

$l_s = l - l_{b1} - l_{b2}$

l = refer to **Fig 3.8.1**

l_{b1} and l_{b2} = bracket length for span correction as obtained from the following formulae

$l_{b1} = b_1(1 - \frac{h_0}{h_1}) \times 10^{-3}$

$l_{b2} = b_2(1 - \frac{h_0}{h_2}) \times 10^{-3}$

b_1, b_2, h_0, h_1 and h_2 = refer to **Fig 3.8.1**

</td></tr>
</table>

Present	Amendment
σ_y = specified yield stress of the material (N/mm²) θ_s = frame list angle to side shell (deg), refer to **Fig 3.8.2** P = slamming impact pressure as obtained from the following formula (kPa) $P = \frac{1}{2}\rho C_e K_P (\frac{\nu_n}{\cos\beta_0})^2$ ρ = sea water density, 1.025 (t/m³) β_0 = relative impact angle between wave surface and a point under consideration on ship's surface as obtained from the following formula (deg) $\underline{\beta_0 = \phi + \phi_h^* - 35}$ ϕ = as obtained from the following formula (deg) $\phi = \tan^{-1}(\frac{1}{\tan\beta_k \cos\gamma})$ β_k = as obtained from the following formula (deg) $\underline{\beta_k = \beta_{k1} - \sqrt{40-\beta} \quad (\beta \le 40^o)}$ $\underline{\beta_k = \beta_{k1} + \sqrt{\beta - 40} \quad (\beta > 40^o)}$ β = shell angle at the section under consideration (deg) (see **Fig 3.8.3**) β_{k1} = as obtained from the following formula (deg) $\underline{\beta_{k1} = 40\{1.2(0.8 - X/L)(1.2 - X/L) + 1\} - 0.02(D_z - d)(D_z - d - 20)}$ X = longitudinal distance from the aft end of L to the section under consideration (m) D_z = vertical distance from base line at the middle of L to the section under consideration (m)	

Present	Amendment
	σ_y = specified yield stress of the material (N/mm^2) θ_s = frame list angle to side shell (deg), refer to **Fig 3.8.2** P = slamming impact pressure as obtained from the following formula (kPa) $P = \frac{1}{2}\rho C_e K_P (\frac{\nu_n}{\cos\beta_0})^2$ ρ = sea water density, 1.025 (t/m^3) β_0 = relative impact angle between wave surface and a point under consideration on ship's surface as obtained from the following formula (deg) $\beta_0 = \phi - \phi_b$ ϕ = as obtained from the following formula (deg) $\phi = \tan^{-1}(\frac{1}{\tan\beta_k \cos\gamma})$ β_k = as obtained from the following formula (deg) $\beta_k = \beta_{k1} - \sqrt{45-\beta}$ ($\beta \le 45^o$) $\beta_k = \beta_{k1} + \sqrt{\beta - 45}$ ($\beta > 45^o$) β = shell angle at the section under consideration (deg) (see **Fig 3.8.3**) β_{k1} = as obtained from the following formula (deg) $\beta_{k1} = 45\{0.95(0.8 - X/L)(1.2 - X/L) + 1\} - 0.02(D_z - d)(D_z - d - 20)$ X = longitudinal distance from the aft end of L to the section under consideration (m) D_z = vertical distance from base line at the middle of L to the section under consideration (m)

Present	Amendment
γ = shell angle at the section under consideration (deg) (see **Fig 3.8.3**) ϕ_h^* = ~~angle of heel~~ as obtained from the following formula $\phi_h^* = 0$ (where, $\frac{(D_1-d)^2}{BdC_b} \le 0.5$) $\phi_h^* = \{7.8\frac{(D_1-d)^2}{BdC_b} - 3.9\}\cos\gamma$ (deg) (where, $\frac{(D_1-d)^2}{BdC_b} > 0.5$) ~~$D_1$ = vertical distance, at the midship, from the top of keel to the top of uppermost continuous deck beam (m)~~ K_P= coefficient obtained from the formula in **Table 3.8.1** C_e= coefficient obtained from the following formula $C_e = \frac{\beta_0}{40} + 0.25$ (where, $\beta_0 \le 30^o$) $C_e = 1.0$ (where, $\beta_0 > 30^o$) ν_n = maximum relative velocity between wave surface and a point under consideration on ship's surface as obtained from the following formula (m/s) $\nu_n = \frac{\nu_x \tan\beta_k + \nu_z \tan\alpha \tan\beta_k}{\sqrt{\tan^2\alpha + \tan^2\beta_k + \tan^2\alpha \tan^2\beta_k}}$	γ = shell angle at the section under consideration (deg) (see **Fig 3.8.3**) ϕ_b = as obtained from the following formula $\phi_b = (\frac{\phi_{bF} - 33}{0.15})(X/L - 0.8) + 33$ (where, $0.8 \le X/L < 0.95$) $\phi_b = \phi_{bF}$ (where, $0.95 \le X/L$) $\phi_{bF} = 35$ (where, $L < 200$) $\phi_{bF} = -L/25 + 43$ (where, $200 \le L < 400$) $\phi_{bF} = 27$ (where, $400 \le L$) K_P= coefficient obtained from the formula in **Table 3.8.1** C_e= coefficient obtained from the following formula $C_e = \frac{\beta_0}{40} + 0.25$ (where, $\beta_0 \le 30^o$) $C_e = 1.0$ (where, $\beta_0 > 30^o$) ν_n = maximum relative velocity between wave surface and a point under consideration on ship's surface as obtained from the following formula (m/s) $\nu_n = \frac{\nu_x \tan\beta_k + \nu_z \tan\alpha \tan\beta_k}{\sqrt{\tan^2\alpha + \tan\beta_k + \tan^2\alpha \tan^2\beta_k}}$

Present	Amendment
ν_x = longitudinal relative velocity at a point under consideration on ship's surface as obtained from the following formula (m/s) $\nu_x = (1 - C_1)\nu_{xo}$ C_1 = coefficient obtained from the formula in **Table 3.8.2** ν_{x0} = longitudinal relative velocity at the waterline as obtained from following formula (m/s) $\nu_{x0} = \nu_s + C_2\sqrt{Lg}$ ν_s = 0.36 V (m/s) V = speed of ship (kt) g = gravity acceleration, 9.81 (m/s^2) C_2 = coefficient obtained from the formula in **Table 3.8.2** ν_z = relative velocity at a point under consideration on ship's surface in the direction of ship's depth as obtained from the following formula (m/s) $\nu_z = (1 - C_3)\nu_{zo}$ C_3 = coefficient obtained from the formula in **Table 3.8.2** ν_{z0} = relative velocity at the waterline in the direction of ship's depth as obtained from the following formula (m/s)	ν_x = longitudinal relative velocity at a point under consideration on ship's surface as obtained from the following formula (m/s). However, ν_x is to be greater than 0. $\nu_x = (1 - C_1)\nu_{xo}$ C_1 = coefficient obtained from the formula in **Table 3.8.2** ν_{x0} = longitudinal relative velocity at the waterline as obtained from following formula (m/s) $\nu_{x0} = \nu_s + C_2\sqrt{Lg}$ ν_s = 0.36 V (m/s) V = speed of ship (kt) g = gravity acceleration, 9.81 (m/s^2) C_2 = coefficient obtained from the formula in **Table 3.8.2** ν_z = relative velocity at a point under consideration on ship's surface in the direction of ship's depth as obtained from the following formula (m/s). However, ν_z is to be greater than 0. $\nu_z = (1 - C_3)\nu_{zo}$ C_3 = coefficient obtained from the formula in **Table 3.8.2** ν_{z0} = relative velocity at the waterline in the direction of ship's depth as obtained from the following formula (m/s)

Present	Amendment
$\nu_{z0} = C_4 \sqrt{Lg}$ C_4 = coefficient obtained from the formula in **Table 3.8.2** α = as obtained from the following formula $\alpha = \tan^{-1}(\frac{\tan\beta_k}{\tan\gamma})$ Z_P = plastic section modulus of frame, where the frame is joined to shell plate with a right angle, as obtained from the following formula. (cm^3) $Z_P = 0.1 A_f h + \frac{1}{2000} h^2 t_w$ A_f = sectional area of flange (cm^2) h = depth of web plate (mm) t_w = thickness of web plate (mm)	$\nu_{z0} = C_4 \sqrt{Lg}$ C_4 = coefficient obtained from the formula in **Table 3.8.2** α = as obtained from the following formula $\alpha = \tan^{-1}(\frac{\tan\beta_k}{\tan\gamma})$ Z_P = plastic section modulus of frame, where the frame is joined to shell plate with a right angle, as obtained from the following formula. (cm^3) $Z_P = 0.1 A_f h + \frac{1}{2000} h^2 t_w$ A_f = sectional area of flange (cm^2) h = depth of web plate (mm) t_w = thickness of web plate (mm)

Present	Amendment
(see below)	

Table 3.8.1 Coefficient K_p

β_0	K_p
$\beta_0 < 3^0$	255.85
$3^0 \leq \beta < 4^0$	$758.60\ e^{-0.3623\beta_0}$
$4^0 \leq \beta < 6^0$	$453.91\ e^{-0.2339\beta_0}$
$6^0 \leq \beta < 10^0$	$335.41\ e^{-0.1835\beta_0}$
$10^0 \leq \beta < 15^0$	$173.61\ e^{-0.1176\beta_0}$
$15^0 \leq \beta < 18^0$	$80.523\ e^{-0.0664\beta_0}$
$18^0 \leq \beta_0$	$1+\frac{\pi}{4}cot^2\beta_0$

Table 3.8.2 Coefficient C_1, C_2, C_3 and C_4

C_1	$(4.40\xi - 6.31)\zeta$
C_2	$0.100\xi + 0.435F_n - 0.162$
C_3	$(\frac{6.37}{\xi - 0.449} + 10.73)\zeta^2$
C_4	$(-1.270F_n + 0.410)\xi + 0.758F_n - 0.038$

Note :

ξ = $x/(L/2)$, however, ξ is to be greater than 0.8

x = longitudinal distance to the section under consideration from the midship (m)

ζ = $z/(L/2)$, however, ζ is to be greater than 0

z = height from the load line to the section under consideration (m)

F_n = $\nu_s/\sqrt{Lg}$

Present	Amendment
	(see below)

Table 3.8.1 Coefficient K_p

β_0	K_p
$\beta_0 < 3^0$	255.85
$3^0 \leq \beta < 4^0$	$758.60\ e^{-0.3623\beta_0}$
$4^0 \leq \beta < 6^0$	$453.91\ e^{-0.2339\beta_0}$
$6^0 \leq \beta < 10^0$	$335.41\ e^{-0.1835\beta_0}$
$10^0 \leq \beta < 15^0$	$173.61\ e^{-0.1176\beta_0}$
$15^0 \leq \beta < 18^0$	$80.523\ e^{-0.0664\beta_0}$
$18^0 \leq \beta_0$	$1 + \frac{\pi}{4} cot^2 \beta_0$

Table 3.8.2 Coefficient C_1, C_2, C_3 and C_4

C_1	$(4.40\xi - 6.31)\zeta$
C_2	$0.095\xi + 0.191 F_n - 0.127$
C_3	$(\frac{11.8}{\xi - 0.459} + 4.96)\zeta^2$
C_4	$(-0.629F_n + 0.338)\xi + 0.666F_n - 0.109$

Note :

ξ = $x/(L/2)$, however, ξ is to be greater than 0.6

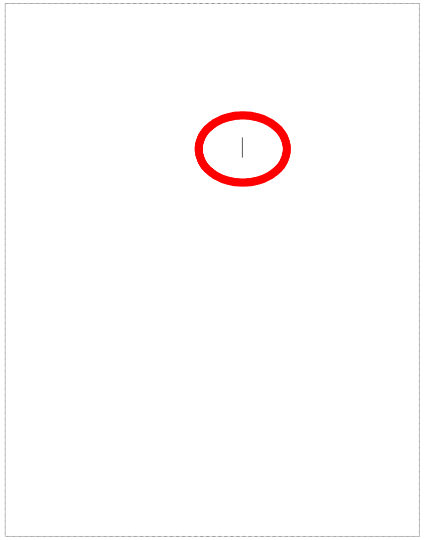
x = longitudinal distance to the section under consideration from the midship (m)

ζ = $z/(L/2)$, however, ζ is to be greater than 0

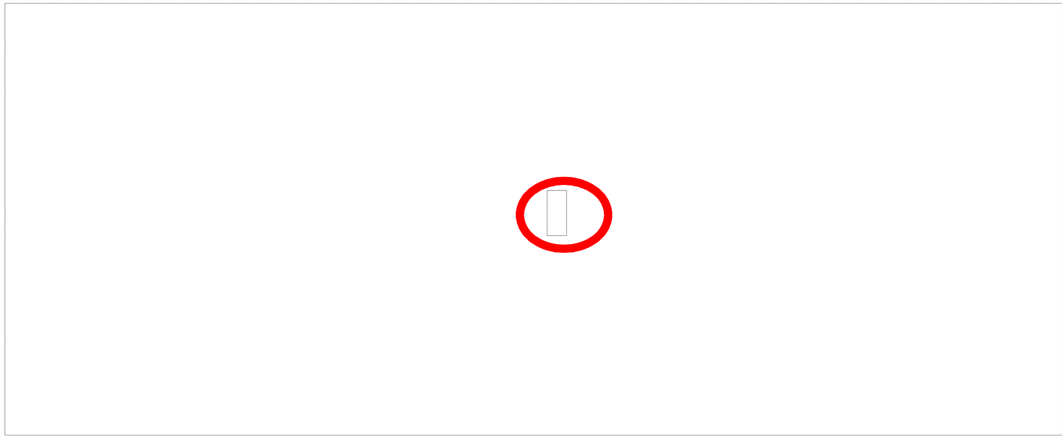
z = height from the load line to the section under consideration (m)

F_n = $\nu_s / \sqrt{Lg}$

Present	Amendment
2. For ships with large flare like as pure car carriers, the scantling of web frames supporting side longitudinals, which are fitted in the bow flare position considered to endure large wave impact pressure, ~~above the load line for 0.1 *L* forward~~ is to be in accordance with requirements of side stringers supporting transverse frames in **Ch 9, 104.** **Fig 3.8.1 Modified Span Length of Frames** **Fig 3.8.2**	

Present	Amendment
	2. For ships with large flare like as pure car carriers, the scantling of web frames supporting side longitudinals, which are fitted in the bow flare located above the load line and forward of 0.2 L is considered to endure large wave impact pressure, is to be in accordance with requirements of side stringers supporting transverse frames in **Ch 9, 104.**  **Fig 3.8.1 Modified Span Length of Frames** **Fig 3.8.2**

Present	Amendment
Fig 3.8.3 Shell Angle **Section 3 ~ 5 <omitted>**	

Present	Amendment
	 **Fig 3.8.3 Shell Angle** **Section 3 ~ 5 <same as the present Guidance>**

Present	Amendment

Present

CHAPTER 9 WEB FRAMES AND SIDE STRINGERS

Section 1 General

104. Web frames and side stringers at a location where flare is specially large

1. For ships with large flare like as pure car carriers, the thickness t_{wG} of web plate and section modulus Z_G, of side stringers supporting transverse frames and web frames supporting these side stringers, which are fitted in the bow flare position considered to endure large wave impact pressure, ~~above the load line for 0.1 L forward~~ are not to be less than those obtained from the following formulae.

Required thickness of web plate : $t_{wG} = \dfrac{433\,PS_G l_G}{d_{wG}\,\sigma_y \cos\theta_G}$ (mm)

Required section modulus :

$$Z_G = \frac{PS_G l_G^2}{24\sigma_y \cos\theta_G} \times 10^3 \text{ (cm}^3\text{)}$$

where,

P = slamming impact pressure as specified in **Ch 7, 108.** (kPa)

S_G = spacing of girder (m)

l_G = unsupported length of girder taking into account geometry of girder at end parts (m). Where form of girder at end parts is arc form such as **Fig 3.8.1** this length is to be modified considering it triangle, as follows.

(1) To join R-ENDs together. (AB)
(2) To draw tangent line $A'B'$ with arc, parallel to AB.
(3) To put point A'' so that $AA'' = (2/3)AA'$ and to put B'' so that $BB'' = (2/3)BB'$, and triangle $OA''B''$ is considered as bracket of triangle.

Amendment

CHAPTER 9 WEB FRAMES AND SIDE STRINGERS

Section 1 General

104. Web frames and side stringers at a location where flare is specially large *(2019)*

1. For ships with large flare like as pure car carriers, the thickness t_{wG} of web plate and section modulus Z_G, of side stringers supporting transverse frames and web frames supporting these side stringers, which are fitted in the bow flare located above the load line and forward of 0.2 L is considered to endure large wave impact pressure, are not to be less than those obtained from the following formulae.

Required thickness of web plate : $t_{wG} = \dfrac{433\,PS_G l_G}{d_{wG}\,\sigma_y \cos\theta_G}$ (mm)

Required section modulus :

$$Z_G = \frac{PS_G l_G^2}{24\sigma_y \cos\theta_G} \times 10^3 \text{ (cm}^3\text{)}$$

where,

P = slamming impact pressure as specified in **Ch 7, 108.** (kPa)

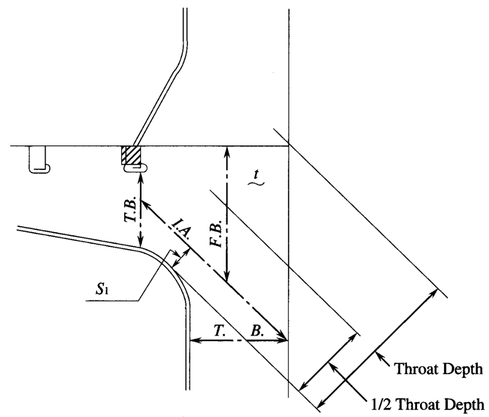
S_G = spacing of girder (m)

l_G = unsupported length of girder taking into account geometry of girder at end parts (m). Where form of girder at end parts is arc form such as **Fig 3.8.1** this length is to be modified considering it triangle, as follows.

(1) To join R-ENDs together. (AB)
(2) To draw tangent line $A'B'$ with arc, parallel to AB.
(3) To put point A'' so that $AA'' = (2/3)AA'$ and to put B'' so that $BB'' = (2/3)BB'$, and triangle $OA''B''$ is considered as bracket of triangle.

Present	Amendment
$l_G = l - l_{b1} - l_{b2}$ l : refer to **Fig 3.8.1** l_{b1} and l_{b2} = bracket length for span correction as obtained from the following formulae (m) $l_{b1} = b_1(1 - \frac{d_{wG}}{h_1}) \times 10^{-3}$ $l_{b2} = b_2(1 - \frac{d_{wG}}{h_2}) \times 10^{-3}$ b_1, b_2, h_1 and h_2 : refer to **Fig 3.9.1** d_{wG} = depth of web plate (mm) σ_y = specified yield stress of the material (N/mm^2) $\underline{\theta_s}$ = angle between girder and vertical axis of shell plate (deg). Refer to **Fig 3.9.2** Z_G = section modulus of girder as obtained from the following formula. (cm^3) $Z_G = 0.1 A_{fG} d_{wG} + \frac{1}{3000} d_{wG}^2 t_{wG}$ A_{fG} = sectional area of flange (cm^2)	$l_G = l - l_{b1} - l_{b2}$ l : <u>length of girder measured along the shell plating,</u> refer to **Fig 3.8.1** l_{b1} and l_{b2} = bracket length for span correction as obtained from the following formulae (m) $l_{b1} = b_1(1 - \frac{d_{wG}}{h_1}) \times 10^{-3}$ $l_{b2} = b_2(1 - \frac{d_{wG}}{h_2}) \times 10^{-3}$ b_1, b_2, h_1 and h_2 : refer to **Fig 3.9.1** d_{wG} = depth of web plate (mm) σ_y = specified yield stress of the material (N/mm^2) $\underline{\theta_G}$ = angle between girder and vertical axis of shell plate (deg). Refer to **Fig 3.9.2** Z_G = section modulus of girder as obtained from the following formula. (cm^3) $Z_G = 0.1 A_{fG} d_{wG} + \frac{1}{3000} d_{wG}^2 t_{wG}$ A_{fG} = sectional area of flange (cm^2) <u>t_{wG} = thickness of web plate of girder (mm)</u>

Present	Amendment
	2. Buckling strength of the web plates of girders supporting frames in above **1.** is to be in accordance with followings. compressive stress σ_a for the web plates is not to exceed the critical value σ^*_{acr} obtained from the following. $\sigma^*_{acr} = \sigma_{acr}$ (N/mm²), where $\sigma_{acr} \le \frac{\sigma_y}{2}$ $\sigma^*_{acr} = \sigma_y (1 - \frac{\sigma_y}{4\sigma_{acr}})$ (N/mm²), where $\sigma_{acr} > \frac{\sigma_y}{2}$ σ_y = as specified in **1.** σ_{acr} = reference buckling stress of the web plates as obtained from the following formula $\sigma_{acr} = 3.6E(\frac{t^*_{wG}}{S})^2$ (N/mm²) $E = 2.06 \times 10^5$, Modulus of elasticity (N/mm²) t_{wG} = as specified in **1.** σ_a = compressive stress working on web plates as obtained from the following formula $\sigma_a = \frac{0.5PS_G}{t_{wG}\cos\theta_G}$ (N/mm²) P, S_G and θ_G = as specified in **1.**
3. <omitted>	**3.** <same as the present Guidance>
	4. For ships whose L and C_b are not less than 250 m and 0.8 respectively, the provisions of **Sub-part 1 Ch 10, Sec 1, 3.3** of Rule **Pt 13** are to be applied.

Present	Amendment
Section 5 Cantilever Beams	**Section 5 Cantilever Beams**
503. Connections	**503. Connections**
1. To prevent the buckling of end brackets of cantilever beams connected with web frames, stiffeners are to be fitted to the brackets with at suitable spacing in order to make their panels smaller as shown in **Fig 3.9.4.**	**1.** To prevent the buckling of end brackets of cantilever beams connected with web frames, stiffeners are to be fitted to the brackets with at suitable spacing in order to make their panels smaller as shown in **Fig 3.9.4.**
Fig 3.9.4 Compensation of bracket	 **Fig 3.9.4 Compensation of bracket**
2. <omitted>	**2.** <same as the present Guidance>
CHAPTER 10 ~ 17 <omitted>	**CHAPTER 10 ~ 17 <same as the present Guidance>**

Present	Amendment
CHAPTER 10 ~ 15 <omitted> **CHAPTER 16 SUPERSTRUCTURES**	**CHAPTER 10 ~ 15 <same as the present Guidance>** **CHAPTER 16 SUPERSTRUCTURES**
Section 1 General	**Section 1 General**
<newly added>	**101. General** ***(2019)*** The forecastle for fishing vessels, may be omitted provided that they are satisfied with the relevant requirements of **Standard for Fishing Vessel's Structure** of **Fishing Vessel Act.**
102. Application In application to **102. 2** of the Rules, the construction and scantlings of the superstructures above the third tier are to be applied as if they are in third tier.	**102. Application** In application to **102. 2** of the Rules, the construction and scantlings of the superstructures above the third tier are to be applied as if they are in third tier.
Section 3 Access Opening in Superstructure End Bulkheads	**Section 3 Access Opening in Superstructure End Bulkheads**
301. Closure for access opening Where the sill of access opening is to make hindrance to the passage of heavy spare parts, etc., removable sill may be provided subject to approval by the Society. ⚓	**301. Closure for access opening** Where the sill of access opening is to make hindrance to the passage of heavy spare parts, etc., removable sill may be provided subject to approval by the Society. ⚓

Present	Amendment
CHAPTER 17 ~ 18 <omitted> **CHAPTER 19 TUNNELS AND TUNNEL RECESSES** <newly added>	**CHAPTER 17 ~ 18 <same as the present Guidance>** **CHAPTER 19 TUNNELS AND TUNNEL RECESSES** **Section 1 General *(2019)*** **101. Arrangement** In application to **101. 3** of the Rules, escape trunks of passenger ships are to be in accordance with SOLAS II-1/13.11.1. **110. Ventilators and escape trunks** Escape trunks of passenger ships are to be in accordance with SOLAS II-1/13.11.1.

Present	Amendment
Annex 3-2 Guidance for the Direct Strength Assessment **I. General <omitted>** **II. Direct Global Structural Analysis** **1.General** (1) Application (A) ~ (B) <omitted> (C) It is recommended to use a return period of at least 20 years in North atlantic for design loads, which is equivalent to 10^{-8} probability level. (D) ~ (E) <omitted> (2) ~ (3) <omitted>	**Annex 3-2 Guidance for the Direct Strength Assessment** **I. General <same as the present Guidance>** **II. Direct Global Structural Analysis** **1.General** (1) Application (A) ~ (B) <same as the present Guidance> (C) It is recommended to use design loads in North atlantic, which is equivalent to 10^{-8} probability level of exceedance. *(2019)* (D) ~ (E) <same as the present Guidance> (2) ~ (3) <same as the present Guidance>