

GUIDANCE NOTES

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CHINA CLASSIFICATION SOCIETY

GUIDELINES FOR HULL STRUCTURE OF  
WOODCHIP CARRIERS

2020

Effective from 1 July 2020

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**Compilation principles:**

As a supplement to the requirements of CCS Rules for Classification of Sea-going Steel Ships, this Guidelines provides the technical provisions of hull structure for woodchip carriers.

## Section 1 GENERAL PROVISIONS

### 1.1 Application

1.1.1 This Guidelines is applicable to the design and manufacture of steel sea-going woodchip carriers specially used for woodchips transportation.

1.1.2 The provisions of this Guidelines applies to the determination of structural arrangement and member scantlings of cargo hold areas fitted with single deck, double bottom, hopper tanks and single skin but without topside tank. A typical cross section of a woodchip carrier is shown in Figure 1.1.2.

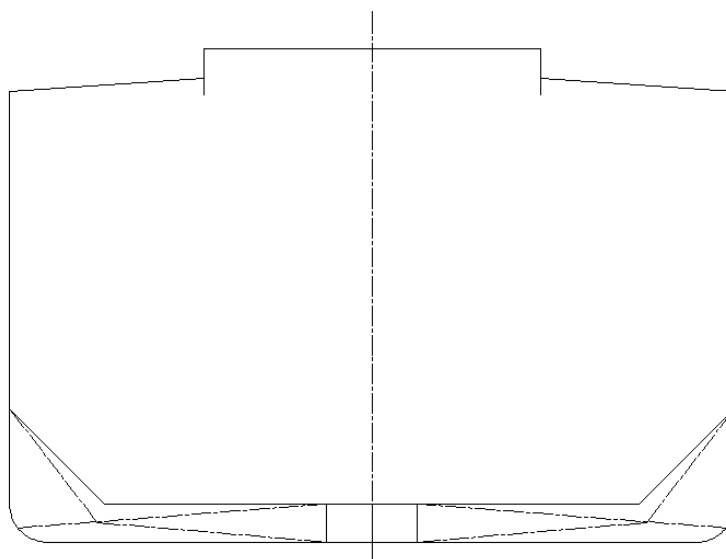


Figure 1.1.2

1.1.3 Where no special restrictions are required for cargo handling methods (the restrictions refer to that the power shovel, the grab with the weight of more than 10 tons or other methods which may often damage the cargo hold structure is not used for loading and unloading of the cargo), the loading manual, loading instrument and cargo hatch cover of the woodchip carriers are also to comply with the relevant requirements of Chapter 8, PART TWO of the CCS Rules for Classification of Steel Sea-going Ships.

1.1.4 Any provisions not covered by this Guidelines are to comply with the relevant requirements of Chapter 1 and Chapter 2, PART TWO of the CCS Rules for Classification of Steel Sea-going Ships (herein after called the Rules).

1.1.5 In this Guidelines, the ballast hold means the cargo hold which is used as carrying ballast water, and the dry cargo hold means the hold only carrying woodchips.

### 1.2 Class notation

1.2.1 Woodchip carriers complying with the provisions of this Guidelines are eligible to assign the class notation: Woodchip Carrier.

### 1.3 Drawings and information

1.3.1 The drawings and information are to comply with the requirements of Section 1, Chapter 2, PART Two in the Rules.

#### **1.4 Arrangement and structural configuration**

1.4.1 The hull structures are to be so arranged to be in compliance with the relevant requirements of Section 12, Chapter 1, PART TWO in the Rules.

1.4.2 Woodchip carriers are generally to be provided with cargo holds which are used as carrying ballast water, such holds are to be filled with ballast water during the ballast voyage.

1.4.3 The bottom and the strength deck outside the line of cargo hatchways openings onboard the woodchip carrier, are to be framed longitudinally within the cargo hold areas. Inside the line of openings, the strength deck is to be framed transversely.

1.4.4 Transverse webs composed of web frames and transverses are to be provided from the strength deck to hopper tank slopping plate. The transverse webs are to be fitted in the line with bottom plate floors, and the spacing of transverse webs may be determined by the direct calculation.

## **Section 2 LONGITUDINAL STRENGTH**

### **2.1 General requirements**

2.1.1 Except the provisions of this Section, the longitudinal strength of hull girders is to meet the requirements of Section 2, Chapter 2, PART TWO in the Rules.

2.1.2 Where the cargo hold deck opening is large, the longitudinal strength of combined bending and torsional moments is to be checked in accordance with the requirements of Section 2, Chapter 7, PART TWO in the Rules.

## **Section 3 HULL FRAMING**

### **3.1 General requirements**

3.1.1 This Section applies to arrangement and structural members of double bottom, hopper tank and side frame of cargo hold areas, and those not covered in this Section are to meet the requirements of Chapter 2, PART TWO in the Rules.

3.1.2 Except those stipulated in this Section, any boundaries of ballast holds (including the partial ballast holds in port) are not to be lower than the deep tank requirements of Section 13, Chapter 2, PART TWO in the Rules.

### **3.2 Double tanks**

3.2.1 Where the double bottom tanks are interconnected with hopper tanks, the scantlings are to comply with the deep tank structural member requirements of Section 13, Chapter 2, PART TWO in the Rules.

3.2.2 For woodchip carriers of 150m and over in length, the thickness of solid floors may be determined by direct calculation, but the minimum thickness is not to be less than that obtained from the following formula:

$$t_{min} = 0.6\sqrt{L} + 3, \text{ mm}$$

where:  $L$  — length of ship, in m, to be taken not greater than 300 m in calculation.

3.2.3 For woodchip carriers of 150m and over in length, where the double bottom is longitudinally framed and verified by direct calculation, the thickness of center and side girders may be determined by direct calculation, but the minimum thickness is not to be less than that obtained from the following formula:

$$t_{min} = 7.5 + 0.02L \text{ mm}$$

Where:  $L$ — length of ship, in m, to be taken not greater than 300 m in calculation.

3.2.4 For woodchip carriers of 150m and over in length, the thickness of watertight solid floors and girders are also to meet the deep tank requirements of Section 13, Chapter 2, PART TWO in the Rules, in addition to the requirements of 3.2.2 and 3.2.3 in this Section.

3.2.5 Where fork lift trucks are used for handling cargo in holds, the reinforcement of inner bottom plating and framing are to comply with the relevant requirements of Section 21, Chapter 2, PART TWO in the Rules.

### 3.3 Hopper tanks

3.3.1 This requirement applies to hopper tanks framed longitudinally, watertight bulkheads are to be fitted, as far as practicable, in the hopper tanks in way of watertight bulkheads in holds. Otherwise, wash bulkheads are to be fitted.

3.3.2 The sloping plate is to meet the relevant requirements of Section 5, Chapter 8, PART Two in the Rules.

3.3.3 The longitudinals of sloping plate are to meet the relevant requirements of 8.5.3.1 of Section 5, Chapter 8, PART TWO in the Rules.

3.3.4 The section modulus  $W$  of bottom longitudinals within hopper tank is not to be less than the requirement of Section 6, Chapter 2, PART TWO in the Rules. The section modulus  $W$  of side longitudinals and bilge longitudinals within the hopper tank is not to be less than the requirement of Section 7, Chapter 2, PART TWO in the Rules.

3.3.5 The transverse supporting structural members are also to meet the applicable requirements of 8.5.4, Chapter 8, PART TWO in the Rules. Where transverse supporting web frames are difficult to fit due to linear thinness, non-watertight transverse webs may be provided in lieu of the above-mentioned bottom transverses, side shell transverse and slopping plating transverses, the thickness and stiffeners of such webs are to meet the requirements of 3.3.6~3.3.7.

3.3.6 The thickness,  $t$  of non-watertight bulkheads or wash bulkheads is not to be less than  $t$  that obtained from the following formula, and not to be less than 8 mm:

$$t = 12s \quad \text{mm}$$

Where:  $s$ — spacing of stiffeners, in m.

3.3.7 The section modulus  $W$  of stiffeners on non-watertight bulkheads or wash bulkheads is not to be less than 50% of that obtained in accordance with the deep tank requirements of Section 13, Chapter 2, PART TWO in the Rules.

### 3.4 Side framing

3.4.1 Where a freeboard corresponding to or exceeding the uncorrected tabular values of the International Convention on Load Lines, 1966 can be obtained for a woodchip carrier with

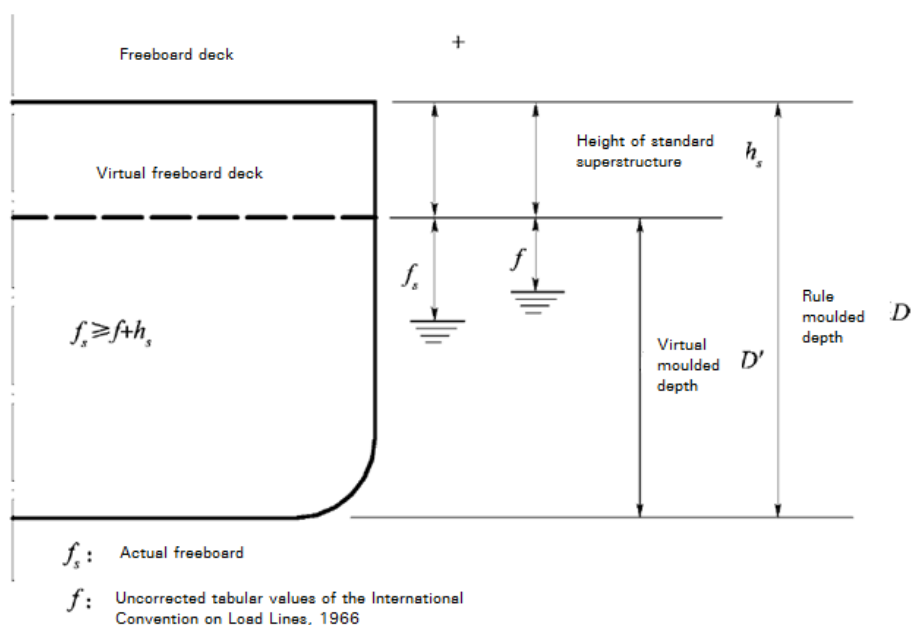
excessive freeboard, i.e. by considering the carrier to have a virtual moulded depth  $D'$  at least one standard superstructure height less than the Rule moulded depth  $D$  (see Figure 3.4.1), the Rule moulded depth  $D$  may be replaced by the virtual moulded depth  $D'$ , and the freeboard deck may be replaced by the virtual freeboard deck when the requirements of 3.4.2, 3.4.3 and 3.4.6 of this Section are applied.

$$D' = D - h_s$$

$h_s$ — the standard height of superstructure, in m;

$h_s = 1.05 + 0.01L_L$  m, and  $1.8 \leq h_s \leq 2.3$  ;

$L_L$ — load line length of ship, in m.



**Figure 3.4.1**

3.4.2 Main frames of dry cargo areas are generally to meet the relevant requirements of Section 7, Chapter 2, PART TWO in the Rules. Where direct calculation or other commonly used empirical formulae are applied to determine the scantlings of each structural member, the relevant calculations together with assumptions used and descriptions are to be submitted to CCS for examination, however, the section modulus of main frames is not to be less than 85% of that specified in Section 7, Chapter 2, PART TWO in the Rules.

3.4.3 The side stringers uniformly fitted to support the main frames within the dry cargo hold areas are to meet the requirements of 2.7.3.1, Section 7, Chapter 2, PART TWO in the Rules, of which  $h$  is the vertical distance, in m, measured from the mid-span of side stringer to virtual freeboard deck.

3.4.4 In addition to the requirements of Section 7, Chapter 2, PART TWO in the Rules, the main frames and the side stringers supporting frames within the ballast hold areas are to meet the requirements of Section 13, Chapter 2, PART TWO in the Rules.

3.4.5 The thickness of lower bracket of frames is not to be less than that of the frame webs, and is also to meet the relevant requirements of 8.3.4, Section 3, Chapter 8, PART TWO in the Rules.

3.4.6 The scantlings of web frames supporting side stringers are to be determined by direct calculation based on the assumptions that their both ends are rigidly fixed and that they are subject to concentrated loadings transmitted by side stringers (the considered pressure head being the distance from the mid-span of side stringers to the virtual freeboard deck at side or the top of deep tank, in m), with the permissible bending stress being taken as  $93.2K$ , in  $\text{N/mm}^2$ , and the allowable shear stress as  $83.4/K$ , in  $\text{N/mm}^2$ , of which  $K$  is the material factor.

3.4.7 The web depth of web frame supporting side stringers is not to be less than that obtained from the following formula:

$$h=125l \quad \text{mm}$$

where:  $l$ — span of main structural members, in m.

3.4.8 Where the frames are of asymmetrical in their transverse section and the span exceeding 5 m, tripping brackets are to be fitted close to the mid-span of every second frame.

3.4.9 The thickness of web frame and side stringer web is not to be less than  $s/80$  ( $s$  is the spacing of stiffener or the depth of web without stiffener, in mm), the scantling of web stiffeners is to meet the relevant requirements of 16.3.7, Chapter 16, PART TWO in the Rules.

## Section 4 BULKHEADS

### 4.1 General requirements

4.1.1 The watertight bulkheads are to comply with the requirements of Section 12, Chapter 2, PART TWO in the Rules.

4.1.2 Stools, if fitted at the top and bottom of the corrugated watertight bulkhead, the scantlings are to comply with the applicable requirements of 8.4.1.2, Chapter 8, PART TWO in the Rules.

4.1.3 The lower stools, if fitted at the corrugated watertight bulkhead of dry cargo hold, is also to meet the applicable requirements of 8.9.4.1, Chapter 8, PART TWO in the Rules.

### 4.2 Corrugated bulkheads of ballast hold

4.2.1 The thickness  $t$  of corrugated bulkhead is not to be less than that obtained from the following formula:

$$t=3.75s\sqrt{hK}+2.5 \quad \text{mm}$$

Where:  $s$ — width of corrugation flange or width of corrugation web, in m, whichever is the greater;

$h$ — vertical distance, in m, measured from lower edge of strake to the tank top in way of longitudinal centerline, but not less than  $0.4D$ ;

$K$ — material factor.

4.2.2 The section modulus  $W$  and moment of inertia  $I$  of a corrugation of bulkheads are not to be less than those obtained from the following formulae respectively:

$$W=8.8s(h+1.2)l^2K \quad \text{cm}^3$$

$$I=3.2 Wl/K \quad \text{cm}^3$$

Where:  $s$ — breadth of a corrugation, in m;

$h$ — vertical distance, in m, measured from mid-span of the corrugation to the tank top in way of longitudinal centerline;

$l$ — span of corrugation, in m;

$K$ — material factor.

4.2.3 Where the transverse bulkheads forms boundaries of ballast holds, upper and lower stools, if fitted are to meet the applicable requirements of 8.9.4.1, Chapter 8, PART TWO in the Rules.

4.2.4 For cargo holds act as ballast tanks or other necessary cargo holds considered, the connection between the flange plate and web plate of corrugated bulkheads are generally to be welded.

4.2.5 The thickness of lowest stake of lower stool side plating of watertight bulkhead in ballast hold is not to be less than that of the inner plating where the same material is used.

## **Section 5 DIRECT STRENGTH CALCULATION OF CARGO HOLD AREAS**

### **5.1 General requirements**

5.1.1 For the woodchip carriers of 150m and over in length, the direct strength calculation of cargo hold areas is to be carried out in accordance with the requirements of this Section.

5.1.2 The direct strength calculations for cargo holds are applicable to the evaluation of strength of the primary structures within cargo hold areas in typical loading conditions and are to be submitted to CCS for information.

### **5.2 Structural modeling**

5.2.1 The structural modeling of holds is to meet the requirements of Section 5, Chapter 1, PART TWO in the Rules.

### **5.3 Boundary conditions**

5.3.1 The boundary conditions are to meet the requirements of 4.2 of Appendix 1, Chapter 8, PART TWO in the Rules.

### **5.4 Motions and accelerations**

5.4.1 The ships' motions and accelerations are to be calculated in accordance with the requirements of 1.5.2, Section 5, Chapter 1, PART TWO in the Rules.

### **5.5 Loads**

#### **5.5.1 External sea pressure**

The external sea pressure is to be calculated in accordance with the requirements of 1.5.3, Section 5, Chapter 1, PART TWO in the Rules.

#### **5.5.2 Dry bulk cargo pressure**

The dry bulk cargo pressure is to be calculated in accordance with the requirements of 1.5.4, Section 5, Chapter 1, PART TWO in the Rules.

#### **5.5.3 Liquid pressure in tank**

The liquid pressure in tank is to be calculated in accordance with the requirements of 1.5.5, Section 5, Chapter 1, PART TWO in the Rules.

### **5.6 Loading conditions**

5.6.1 Normally, the loading conditions under consideration are to cover the most severe conditions in ship design. The corresponding loading conditions are to be selected from Table 3.2.1 of Appendix 1, Chapter 8, PART TWO in the Rules for check. For more severe loading conditions in the loading manual which are not covered by Table 3.2.1, direct strength analysis is also to be carried out.

### **5.7 Allowable stresses**

5.7.1 The allowable stresses of each primary structural member are to meet the requirements of 5.1 of Appendix 1, Chapter 8, PART TWO in the Rules.

### **5.8 Buckling strength check**

5.8.1 For the hull structural plate panel, buckling strength check is to be carried out based on the direct calculated stress results in accordance with the requirements of 1.5.9 of Section 5, Chapter 1, PART TWO in the Rules, and the standard thickness reduction is to be determined according to the Table 6.1.1 of Appendix 1, Chapter 8, PART TWO in the Rules.

5.8.2 The buckling safety factor of plate panel is not to be less than that specified in Table 6.1.2 of Appendix 1, Chapter 8, PART TWO in the Rules.

## **Section 6 FATIGUE ASSESSMENT**

### **6.1 General requirements**

6.1.1 For the woodchip carriers of 150m and over in length, the fatigue strength check of cargo hold areas is to be carried out for the following locations within the cargo hold areas by reference of the CCS Guidelines for Fatigue Strength of Ship Structure:

- (1) connections of longitudinals (bottom and deck) to transverse web frames;
- (2) connections of longitudinals (bottom and deck) to transverse bulkheads;
- (3) connections of hopper tanks to inner bottom plates;
- (4) connections of inner bottoms to lower stool sloping plates;
- (5) connections of transverse corrugated bulkheads to lower stool top plates;
- (6) connections of transverse corrugated bulkheads and upper stool bottom plates;
- (7) connections of frames of cargo holds to deck and hopper tanks;
- (8) connections of the ends of cantilevers;
- (9) hatch corners of cargo holds.