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CHINA CLASSIFICATION SOCIETY INTERNATIONAL SHIP  
CLASSIFICATION

**GUIDELINES FOR STATUTORY  
SURVEYS OF INLAND WATERWAY  
SHIPS**

2015

**PART THREE TONNAGE MEASUREMENT**



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# CHAPTER 1 GENERAL PRINCIPLES

## Section 1 GENERAL PROVISIONS

### 1.1.1 Application

1.1.1.1 The tonnage of the ship is to be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969.

1.1.1.2 The gross tonnage and net tonnage calculated according to CHAPTER 2 and CHAPTER 3 of this Part are to be used for the technical requirements of PART FIVE to PART NINE of this Part of the Guidelines.

### 1.1.2 General requirements

1.1.2.1 For the purpose of this PART, meter is the calculation unit adopted in tonnage measurement, and centimeter is to be used in the calculation. The final calculated tonnages is to be given in rounded figures without decimals.

1.1.2.2 The volume included in tonnage calculation is to be measured to the inner surface of hull plate or inner surface of structural boundary in metal ships; or outer surface of hull plate or outer surface of structural boundary in non-metal ships.

1.1.2.3 For multi-purpose ships, the total volume is to be measured according to the type of ship. The type of ship corresponding to the greater total volume is to be taken to calculate gross tonnage and net tonnage.

1.1.2.4 In general, the ship's tonnage may be measured according to the plans, but the ship's arrangement is to be checked to be in agreement with the plans.

### 1.1.3 Definitions

1.1.3.1 *Gross tonnage* means the measure of the overall capacity of a ship determined according to the requirements of this PART.

1.1.3.2 *Net tonnage* means the measure of the useful capacity of a ship determined according to the requirements of this PART.

1.1.3.3 A *tonnage deck* means normally the first continuous deck over waterline, from which the tonnage is measured and calculated. Where there is raised fore or quarter deck, the lowest line of the deck and its extension parallel to the raised part of the deck are to be taken as the tonnage deck, shown as 1.1.2.3.

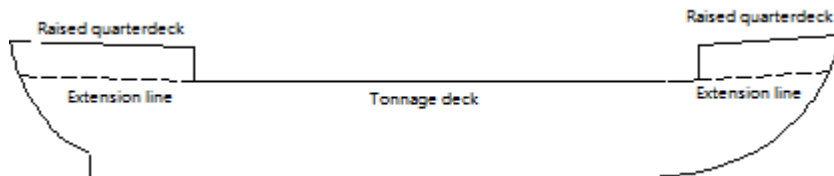


Figure 1.1.3.3

1.1.3.4 An *enclosed space* means a space which is bounded by the ship shell, bulkheads, fixed partitions, decks or cover plating. The part of hull under the tonnage deck is enclosed space.

1.1.3.5 An *open space* means a space other than endorsed spaces.

## CHAPTER 2 GROSS TONNAGE

### Section 1 GROSS TONNAGE

#### 2.1.1 Gross tonnage

2.1.1.1 The gross tonnage (GT) of a ship is to be determined by the following formula:

$$GT = K_1 V$$

where,  $K_1$ ---coefficient, determined by the following formula or as selected from Table 2.1.1.1;  $K_1$  is rounded to the fourth decimal place;

$$K_1 = 0.23 + 0.016 \lg V$$

$V$ --- total volume of ship measured according to the requirements of this PART, in m<sup>3</sup>, determined by the following formula:

$$V = V_1 + V_2 + V_3 + V_4$$

where,  $V_1$ ---mold capacity of all enclosed spaces under the tonnage deck, in m<sup>3</sup>, as shown in 3.1.1;

$V_2$ ---mold capacity of all enclosed spaces above the tonnage deck, in m<sup>3</sup>, as shown in 3.1.2;

$V_3$ ---mold capacity of included fixed open spaces for passenger<sup>1</sup> above the tonnage deck, in m<sup>3</sup>, as shown in 3.1.3;

$V_4$ ---mold capacity of included fixed open spaces for cargo<sup>2</sup> above the tonnage deck, in m<sup>3</sup>, as shown in 3.1.4.

Table 2.1.1.1

$V$	$K_1$	$V$	$K_1$	$V$	$K_1$
50	0.2572	5000	0.2892	28000	0.3012
100	0.2620	6000	0.2905	30000	0.3016
200	0.2668	7000	0.2915	32000	0.3021
300	0.2696	8000	0.2924	34000	0.3025
400	0.2716	9000	0.2933	36000	0.3029
500	0.2732	10000	0.2940	38000	0.3033
600	0.2745	12000	0.2953	40000	0.3036
700	0.2755	14000	0.2963	42000	0.3040
800	0.2764	16000	0.2973	44000	0.3043
900	0.2773	18000	0.2981	46000	0.3046
1000	0.2780	20000	0.2988	48000	0.3049
2000	0.2828	22000	0.2995	50000	0.3052
3000	0.2856	24000	0.3001	52000	0.3055
4000	0.2876	26000	0.3006	54000	0.3057

Note: For the intermediate values of capacity, the coefficient  $K_1$  is determined by interpolation.

2.1.1.2 Volumes within the split-hull barges and dredgers, shown as shaded parts in Fig 2.1.1.2 are to be included in the total volume of the ship, notwithstanding that the space within the hull is temporarily opened to water of the river when discharging cargo.

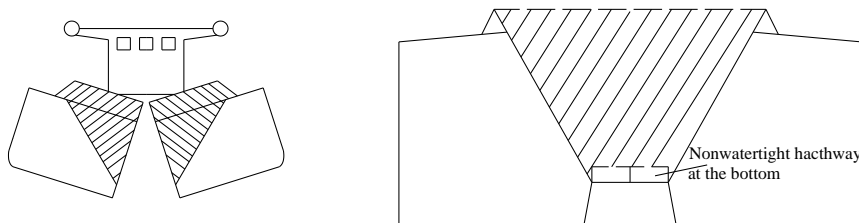


Figure 2.1.1.2

2.1.1.3 For tuck net boat and live fish transportation ship open to river water, the volume of the hull can be measured referring to the requirement of 2.1.1.2.

<sup>1</sup> The included fixed open spaces for passenger mean the fixed non-enclosed spaces for passenger above the tonnage deck determined according to PART 7 of the Guidelines.

<sup>2</sup> The included fixed open spaces for cargo mean the non-enclosed spaces and coverless cargo hatch spaces above the tonnage deck which are fixed for carrying deck cargo on deck cargo ship, well-deck ship, ro/ro ship, ro/ro passenger ship type 1, ro/ro passenger ship type 2, vehicle-passenger ferry, train ferry and container ship etc.

- 2.1.1.4 Spaces not included in the gross tonnage:
- (1) funnel exposed to the weather (including the partition spaces in the funnel);
  - (2) skylights (including the skylights for light going through and ventilation in the engine room casing and the accommodation spaces);
  - (3) mast, kingpost, positioning spud;
  - (4) ventilator and air pipe;
  - (5) hatches other than cargo hatches;
  - (6) enclosed spaces above the tonnage deck where personnel are unable to access;
  - (7) sponson part of the sponson deck;
  - (8) the passageway between the side walls bulkhead of deckhouse and the bulwark (or guard railing) on both sides of ship;
  - (9) false bow part and false stern part;
  - (10) parts of the connection bridge under the tonnage deck for catamarans;
  - (11) side thruster channel, hawse pipe and sea chest.

## Section 2 NET TONNAGE

### 2.2.1 Net tonnage

2.2.1.1 The net tonnage (NT) of a ship is to be determined by the following formula:

$$NT = K_2 GT$$

where,  $GT$ ---gross tonnage calculated according to this PART;

$K_2$ ---coefficient, selected from Table 2.2.1.1.

Table 2.2.1.1

Type of ship	K <sub>2</sub>	Type of ship	K <sub>2</sub>
Dry cargo ship, liquid ship	0.56	Hatch barge, liquid barge	0.74
Passenger ship, restaurant pontoon, ro/ro passenger ship type 1, ro/ro ship	0.60	Ro/ro passenger ship type 2, vehicle-passenger ferry, train ferry	0.52
Container ship	0.65	Floating dock	0.50
Deck cargo ship, well-deck ship	$0.65 - 0.3 \frac{H}{D}$	Other ships	0.30
Self-unloading sand ships, hopper barges (ships), split hopper barges (ships)	0.35		

Notes: ① For deck cargo ship, well-deck ship (including deck cargo barge, well-deck barge),  $K_2 = 0.65 - 0.3 \frac{H}{D}$ , where

H is the vertical distance from the cargo deck to the baseline, D is the moulded depth of the ship, if  $\frac{H}{D} < 0.5$ , then

$$\frac{H}{D} = 0.$$

- ② Hatch barge is a non-self-propelled ship carrying dry cargo (excluding deck cargo barge, well-deck barge and container barge);
- ③ Liquid barge is a non-self-propelled ship carrying liquid;
- ④ Dry cargo ship means self-propelled vessel carrying dry cargoes in bulk, excluding deck cargo ship, well-deck ship and container ship);
- ⑤ Liquid ship is a self-propelled ship carrying liquid;
- ⑥ Other ships refer to ships not carrying passengers, such as working ships, pushers (tugs), engineering ships (excluding hopper barges/ships, split hopper barges/ships), pontoons (excluding restaurant pontoons) and so on.

2.2.1.2 For other types of ships,  $K_2$  can be determined referring to Tab 2.2.1.1 on the basis of the ships' characters of transportation.

## CHAPTER 3 MEASUREMENT AND CALCULATION

### Section 1 MEASUREMENT AND CALCULATION

#### 3.1.1 Moulded capacity $V_1$ of enclosed spaces under the tonnage deck

3.1.1.1 Moulded capacity of enclosed spaces under the tonnage deck  $V_1$  is to be determined by the following 3 parts:

- (1) main body – part between forward and after perpendiculars;
- (2) Appendage – part before forward perpendicular and part behind after perpendicular;
- (3) Counter – propeller boss and streamline body (if any).

3.1.1.2 The capacity  $V_1$  of enclosed spaces under the tonnage deck is to be measured according to any method mentioned in 3.1.1.3~3.1.1.7 based on the provided plans.

3.1.1.3 The capacity  $V_1$  of enclosed spaces under the tonnage deck is to be measured according to the following method:

(1) For the capacity  $V_{11}$  of main body, the capacity  $V_{11}$  of main body is to be measured using Simpson's First Rule:

Length of tonnage deck is to be measured, and is to be divided according to Tab 3.1.1.3. The depths at these points of division and at the fore and the aft extreme points of the length will be measured. The depths of every point in ships with metal shell plate are the vertical distances from the upper side of the plate keel to the lower side of the tonnage deck, minus 1/3 of the heights of corresponding camber. The depth is to include the thickness of the plate in ships with non-metal shell plate. The depths at these points of division of the length are to be divided into 4 equal parts each. The breadth is to be measured at the points of division and at the top and bottom points of the depth. Then each transverse sectional area is to be calculated by applying Simpson's Rule, based on the above-mentioned breadths. Then the moulded capacity below the tonnage deck  $V_{11}$  is to also be calculated by applying Simpson's Rule, based on the transverse sectional areas.

Table 3.1.1.3

Length of tonnage measurement space L (m)	Numbers of Division
$L \leq 37$	6
$37 < L \leq 55$	8
$L > 55$	10

(2) For the capacity  $V_{12}$  of appendage, the part before forward perpendicular and the part behind after perpendicular are equally divided into 2 respectively. The capacity of the part before forward perpendicular and the capacity of the part behind after perpendicular are to be measured according to the method mentioned in 3.1.1.3 (1).

(3) For the capacity  $V_{13}$  of counter, the capacity  $V_{13}$  of counter is to be measured by geometrical method according to the actual shapes.

3.1.1.4 The capacity  $V_{11}$  of main body and the capacity  $V_{12}$  of appendage are to be measured according to lines drawing or Bon Jean curve by static method. The capacity  $V_{13}$  of counter is to be measured according to 3.1.1.3 (3) (if the line drawing or Bon Jean curve contains the counter, the capacity  $V_{13}$  of counter is to not be measured separately.)

3.1.1.5 For ships without line drawing and Bon Jean curve, the capacity  $V_{11}$  of main body and the capacity  $V_{12}$  of appendage are to be measured according to hydrostatic data. The capacity  $V_{13}$  of counter is to be measured according to 3.1.1.3 (3) (if hydrostatic data contain the counter, the capacity  $V_{13}$  of counter is to not be measured separately.) The capacity  $V_{11}$  of main body and the capacity  $V_{12}$  of appendage are to be calculated according to the following formulae:

$$V_{11} + V_{12} = k \left[ C_b + \frac{(D-d)(C_{wp} - C_b)}{d} \right] L_s B D' \quad \text{m}^3$$

where,  $k$  ---coefficient, for mono-hull ships,  $k = 1$ , and for catamarans,  $k = 2$ ;

$d$  ---design full load draft, in m;

$C_b$  ---block coefficient in design full load draft;

$C_{wp}$  ---water plane coefficient in design full load draft;

$L_s$  ---length of design full load waterline, in m;

$B$  ---moulded breadth of ship, in m;  $B$  is taken as the moulded breadth of the demi-body for catamarans;

$D$  ---moulded depth, in m;

$D'$  ---corrected moulded depth, in m; determined by the following formula:

$$D' = D + \frac{2}{3}h + \frac{1}{6}(h_s + h_w) \quad \text{m}^3$$

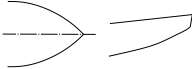
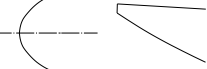

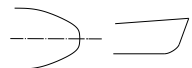


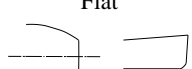


where,  $h$  ---height of camber, in m;  
 $h_s$  ---height of forward sheer, in m;  
 $h_w$  ---height of aft sheer, in m.

3.1.1.6 For ships of 30 m or less in length and without plans and documents, the moulded capacity  $V_1$  of enclosed spaces under the tonnage deck may also be calculated by the following formula:

$$V_1 = kCLBD$$

where,  $k, B, D$  ---the same in 3.1.1.5 of this SECTION;  
 $L$  ---Length of tonnage deck, in m;  
 $C$  ---coefficient, obtained by multiplication of shape coefficients for bow, stern and bottom which can be selected from Table 3.1.1.6. If  $C < 0.7$ , then  $C = 0.7$ .

Table 3.1.1.6

Bow shape (Plan view, Side view)	Coefficient	Stern shape (Plan view, Side view)	Coefficient	Bottom shape (Amidship transverse section)	Coefficient
Fined 	0.85	Sledge 	0.85	Lean 	0.94
Round 	0.90	Cruiser 	0.93	Spoon 	0.96
Flat 	0.95	Square 	0.96	Bluff 	0.98

Notes: ① For bow or stern shape coefficients, interpolation may be taken according to the actual plan and side shapes. For example, the side view of a ship's bow is fined and its plan view is flat, then the bow shape coefficient may be taken as:

$$\frac{0.85 + 0.95}{2} = 0.90$$

② For the ship with a half tunnel recess at the stern, the stern shape coefficient is 98% of the value in table. For ship with a whole tunnel recess at the stern, the stern shape coefficient is 97% of the value in table.

3.1.1.7 Where the hull is simple geometrical shape, its mold capacity under the tonnage deck may be measured and calculated by corresponding geometrical method without consideration of ship length.

3.1.1.8 For open-type ship without hatch covers, its mold capacity under the tonnage deck is to be determined according to shaded part as shown in Fig. 3.1.1.8.

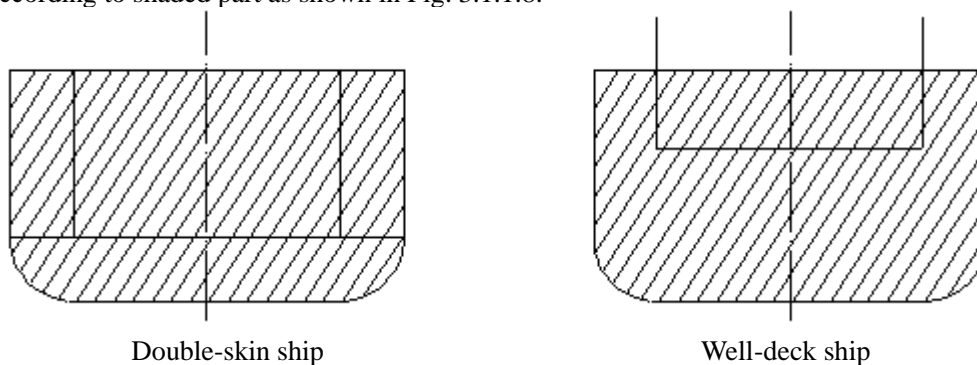


Figure 3.1.1.8

### 3.1.2 Moulded capacity $V_2$ of enclosed spaces above the tonnage deck

3.1.2.1 Capacity between the tonnage deck and the upper deck:

The length between the fore and aft extreme points is to be measured in the longitudinal center plane of the ship at the half height between the decks, and is to be divided according to Tab 3.1.1.3. The horizontal breadths at these points of division and also at the extreme points of the length are to be measured at the half height. Based on the breadths so obtained, the horizontal area is to be then calculated by applying Simpson's Rule. The capacity is the product of its horizontal area and the mean height between the decks.

The heights at the points of division are the vertical distances measured from the underside surface of the upper deck to the upper surface of the tonnage deck. The mean height is the average value of the heights measured.

3.1.2.2 Measurement and calculation of the capacity of forecastle, poop, bridge and fore and aft raised decks are to be carried out with reference to 3.1.2.1. The dimensions are to be measured to the inner surfaces of the outer enclosures.

3.1.2.3 Capacity of the deckhouses:

- (1) Where a deckhouse is of stream-line shape, its capacity is to be calculated with reference to 3.1.2.1;
- (2) Where a deckhouse is rectangular in shape, its capacity is to be the product of the mean length, mean breadth and mean height;
- (3) Where a deckhouse is of other geometrical shape, its capacity is to be calculated by corresponding geometrical method.

3.1.2.4 Capacity of hatchways:

- (1) The product of the mean length and the mean breadth measured to the inner surfaces of the hatch coamings multiplied by the mean height will give the capacity of hatchway above the tonnage deck;

The height of a hatchway is to be the vertical height measured from the lower side of the deck to the lower side of the hatch cover. In the case of a hatchway having different heights, an arithmetic mean is to be taken.

- (2) The capacity of hatch is to not be considered if it is included in the capacity between the tonnage deck and the upper deck.

3.1.2.5 Measurement and calculation of the capacity of cargo oil pot, rotary engine room and expansion tank on the tonnage deck are to be carried out with reference to 3.1.2.3 and 3.1.2.4.

### **3.1.3 Mold capacity $V_3$ of fixed open spaces for passenger above the tonnage measurement deck**

3.1.3.1 For spaces carrying passenger with an overhead covering, the capacity is the product of deck area carrying passenger multiplied by mean height from the lower side of overhead covering to the upper surface of the deck carrying passenger.

3.1.3.2 For spaces carrying passenger without an overhead covering, the capacity is the product of deck area carrying passenger multiplied by height of 1.90m. If the deck area carrying passenger (surface passenger standing on) is the platform (or bed board, ceiling board) below freeboard deck, the height is  $(1.90 - W)$  m, where:  $W$  is the distance from the deck area carrying passenger (or bed board, ceiling board) to the freeboard deck (m).

3.1.3.3 When measuring and calculating deck area for passenger, the dimensions are to be measured to the inner surfaces of bulwark (guardrails).

3.1.4 Mold capacity  $V_4$  of fixed open spaces for cargo above the tonnage deck

3.1.4.1 Where there is fixed (or removable) overhead covering, the capacity is the product of deck area carrying cargo multiplied by mean height from the lower side of overhead covering to the upper surface of the for cargo deck.

3.1.4.2 Where there is fixed (or removable) coaming but without deck covering, the capacity is the product of deck area carrying cargo multiplied by mean height of coaming. Where the height of coaming is less than 0.1 times of the ship's breadth, 0.1 times of the ship's breadth is to be taken.

3.1.4.3 Where there are bow and stern transverse flaps but no coamings at sides, its capacity is the product of bow and stern transverse flaps' mean height and mean breadth multiplied by length between bow and stern transverse flaps. Where the height of bow and stern transverse flaps is less than 0.1 times of the ship's breadth, 0.1 times of the ship's breadth is to be taken.

3.1.4.4 Where there is no coaming or deck covering, the capacity is the product of deck area carrying cargo and 0.1 times of the ship's breadth.

3.1.4.5 For ro/ro ship, ro/ro passenger ship type 1, ro/ro passenger ship type 2, vehicle-passenger ferry and train ferry, the capacity of the vehicle space on exposed deck is the product of the deck area of vehicle space multiplied by the even height of the barriers at both sides when no fixed or movable sheds, and this even height is less than 2.5m, to be taken as 2.5m. For ro/ro ship specially carrying merchantable vehicles, the even height of the barriers at both sides is to be taken as the height of the vehicle when it is less than the later.

3.1.4.6 The capacity of containers  $V_{4h}$  over the deck, platform or hatch coaming is to be obtained from the following formula in accordance with the geometric dimension of container's stacking:

(1) The number and dimension of containers for tonnage measurement are to be selected according to ICC type containers;

(2) The number of containers for measurement is to be determined according to the designed number of containers and type. When the designed number of containers is taken as the number of containers carrying cargoes and empty containers or all empty containers, the sum of the number of containers carrying cargoes and half of empty containers are taken. When the designed number of containers contain several types of containers, the capacity corresponding to the external dimension is converted to the number of containers of ICC type containers. The obtained number of containers is to be given in rounded figures without decimals;

(3) the external dimension of ICC type containers is taken as 6.058m×2.438m×2.591m (L x W x H);

(4) the geometric dimensions of container's stacking are to be determined according to the number and dimension of containers determined according to (1)~(3) and the container layers;

(5) The capacity  $V_{4h}$  of containers over the deck, platform or hatch coaming is to be obtained from the following formula:

$$V_{4h} = 0.5 \sum S_i H_i \quad \text{m}^3$$

where,  $i$  — serial number of container space;

$S_i$  — actual loading area of each container space (including the space between containers), in  $\text{m}^2$ ;

$H_i$  — average height of the container above the deck or platform or hatch coaming at each space, when carrying, in m.

(6) The capacity calculated in (5) does not include the capacity of cargo hatch. When cargo spaces are fitted with coverless cargo hatch and hatch coaming, the capacity of the cargo hatch is to be calculated according to 3.1.4.7;

(7) When calculating the capacity  $V_{4h}$  of containers over the deck, platform or hatch coaming, the space between containers between cargo spaces is to not be included (the cargo spaces mentioned in this Section refer the container spaces formed by different cargo holds and platforms);

(8) When ships have several types of designed number of containers, the designed number of container of each type is to be calculated according to (1)~(7) and the greater one is to be taken for measurement.

3.1.4.7 The capacity of hatchway without hatch cover is the product of mean length and mean breadth measured to the inner surfaces of the hatch coamings multiplied by mean height of the hatch coamings. Where the height of hatch coaming of well-deck ships is less than 0.1 times of the ship's breadth, 0.1 times of the ship's breadth is to be taken (for well-deck ships carrying containers, the average height of hatch coaming is still taken as the actual height).

3.1.4.8 For floating docks, the capacity of the exposed part above the buoyancy box deck is calculated according to the following formulae:

$$V_{4h} = 0.5SH$$

where,  $S$  — area of the floating space, in  $\text{m}^2$ ;

$H$  — height from the buoyancy box deck to the safe deck, in m.

3.1.4.9 For self-unloading sand ships, the capacity of the exposed part above the tonnage deck is to be calculated according to the cargo shape measured from the tonnage deck to the top edge of hatching coaming (the enclosed area formed by inclined wall of hopper above the tonnage deck and the hatch coaming is to not be included). The hatch coaming is taken as the actual height.

3.1.4.10 When measuring according to the aforementioned method, the capacity included under the tonnage deck is to not be calculated separately.