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GUIDELINES FOR STRENGTH ASSESSMENT OF SHIPS WITH SPECIFIC SERVICE AREA OR SERVICE ROUTE OR SERVICE LIFE

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CONTENTS

CHAPTER 1 GENERAL

1.1 General Provisions

1.1.1 The Guidelines are applicable to ore carriers and container ships with specific service area/service route/service life.

1.1.2 Specific service area means the navigation area specially restricted for the ship.

1.1.3 Specific service route means the route specially restricted for the ship.

1.1.4 Specific service life means the design service life of the ship less than 20 years. Ship with a design service life of 15 years is to be assessed according to the requirements of Chapter 5 of the Guidelines, and ship with the other design service life is to be specially considered.

1.1.5 The shipowner and designer are to provide the requirements for specific service area or specific route of the ship, and specify the navigation area or route.

1.1.6 In addition to ships with the class notation of CSR, other ship types may also be implemented by reference.

1.2 Class Notations

1.2.1 Class notation SZ(XX) is to be assigned to the ships with specific service area, where XX is the description of specific service area, such as SZ (Bohai).

1.2.2 Class notation SL (XX-YY) is to be assigned to the ships with specific route, where XX and YY are the name of the arrival/departure port and other restricted information (such as the information of port/location on the way), such as SL (Yantai - Dalian).

1.2.3 Class notation DL (XX) is to be assigned to the ships with specific service life, where XX is the design service life, in year, and less than 20, such as DL (15).

1.2.4 Class notations for specific service area/service route and specific service life may be assigned respectively or simultaneously.

1.3 Assessment Methods

1.3.1 The hull scantling calculation and strength assessment are to be carried out in accordance with CCS Rules for Classification of Sea-going Steel Ships, Guidelines for Direct Strength Analysis of Hull Structures of Ore Carriers, Guidelines for Fatigue Strength of Ship Structure, Guidelines for Spectrum-Based Fatigue Assessment of Hull Structure and other applicable rules and guidelines (hereinafter collectively referred to as the rules).

1.3.2 When hull structural strength analysis is carried out for ships with specific service area/service route according to the requirements of the rules, the strength factor and fatigue factor are to be used to correct the motion and wave load stipulated in the rules so as to reflect the difference between the wave environment of specific service area/service route and that of the non-restricted navigation area. See Chapter 3 and Chapter 4 for details.

1.3.3 For ships with specific service life, two aspects, i.e.: corrosion and design fatigue life are to be taken into consideration for the influence of design service life on scantlings of structural member and structural strength. See Chapter 5 for details.

CHAPTER 2 SERVICE AREA, SERVICE ROUTE AND WAVE SCATTER DIAGRAM

2.1 Specific Service Area and Service Route

2.1.1 The specific service area information provided by the shipowners and the designers is to specify the sea area, including the longitude and latitude of the boundary if necessary. The specific service route information is to include the arrival and departure ports or marker points on the way for route. The above-mentioned service area or service route information may also be reflected in the relative class notations.

2.2 Wave Scatter Diagram of Specific Service Area

2.2.1 The wave environment of different sea areas in the world is different. The long-term sea state of a certain sea area is described by the wave scatter diagram, which includes the possible short-term sea state in the area and the probability of each short-term sea state. Figure 2.2.1 shows an example of the division of global sea areas, in which the global sea areas are divided into 104 sea areas. The Northwest Pacific Wave Statistics gives the wave scatter diagram of various sea areas in waters near China. The sea state data database may give a more precise division of sea areas, with a spatial resolution between 0.2 ° and 1 ° (22.2 km - 111 km).

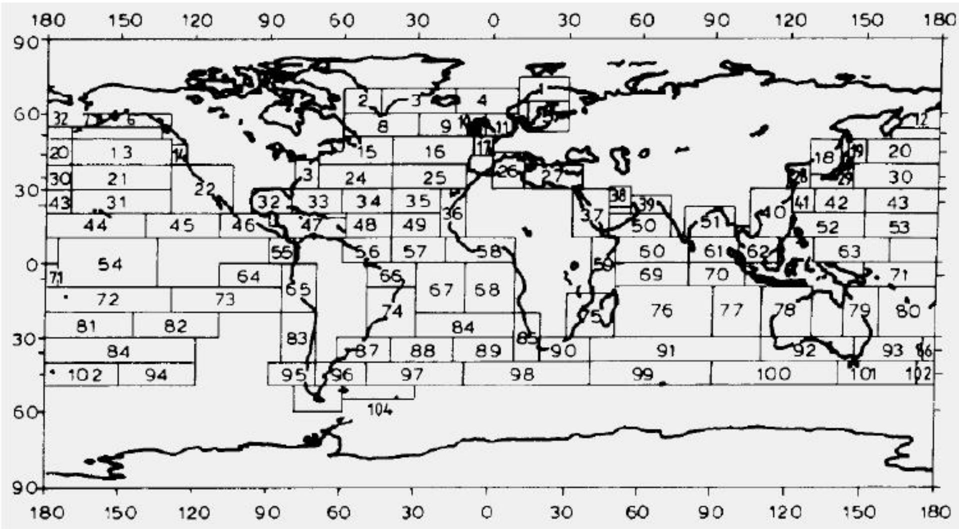

Fig.2.2.1 Division of Global Sea Areas

2.2.2 Where a specific service area consists of several sea areas, its wave scatter diagram is to be obtained by combining the wave scatter diagrams of all sea areas constituting the service area. If the designer does not provide the detailed information, the time proportion of the wave scatter diagram for each sea area may be calculated according to the area proportion of each sea area in a specific service area. The North Atlantic wave scatter diagram given in IACS Rec.34 (see Figure 2.4.2) is obtained by the combination of wave scatter diagrams of sea areas 8, 9, 15 and 16 constituting the North Atlantic in Figure 2.2.1.

2.3 Wave Scatter Diagram of Specific Service Route

2.3.1 The wave scatter diagram of a specific service route is to be obtained by combining the wave scatter diagrams of the sea areas via the route. If the designer does not provide the detailed information, the time proportion of wave scatter diagram in each sea area is to be calculated according to the route length within the sea area.

2.3.2 Taking an example of a specific service route, Table 2.3.2 (1) shows the time proportion of each sea area for China-Guinea route, and Table 2.3.2 (2) shows the wave scatter diagram of China-Guinea route.

Time Proportion of Each Sea Area for China-Guinea Route Table 2.3.2(1)

Sea area	Time proportion
41	4%
40	8%
62	10%
61	9%
70	5%
76	18%
75	8%
90	9%
85	6%
58	6%
84	5%
68	12%

Wave Scatter Diagram of China-Guinea Route Table 2.3.2(2)

10.5	0	0	0	0	0	0	0.09	0.09	0.09	0	0
9.5	0	0	0	0	0	0.09	0.09	0.09	0.09	0	0
8.5	0	0	0	0	0.12	0.13	0.32	0.24	0.24	0.09	0
7.5	0	0	0	0.12	0.33	0.71	0.87	0.74	0.59	0.15	0
6.5	0	0	0.22	0.42	1.19	2.09	2.59	1.92	1.03	0.47	0
5.5	0	0	0.52	1.71	3.86	6.06	6.08	4.11	1.98	0.61	0.15
4.5	0	0.32	2	6.08	12.17	16.41	13.88	8.09	3.33	0.95	0.38
3.5	0.1	1.34	7.86	20.9	35.76	37.96	25.69	11.87	4.13	1.11	0.29
2.5	0.36	6.58	29.35	62.99	78.94	60.26	29.83	10.55	2.76	0.63	0
1.5	2.68	26.37	75.55	101.51	78.39	37.9	12.4	3.09	0.56	0	0
0.5	10.35	34.2	42.08	26.14	9.51	2.21	0.22	0	0	0	0
Wave height /period	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5

2.4 North Atlantic Wave Scatter Diagram

2.4.1 The sea state characteristics of a specific service area/service route are to be reflected by comparing the ship motion and load under the sea state of a specific service area/service route with the results under the sea state of the North Atlantic. The North Atlantic wave scatter diagram is generally taken from IACS Rec.34, as shown in Figure 2.4.1.

Wave Height	Wave Period (Zero-cross)																	
	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5
0.5	0.0	0.0	1.3	133.7	865.6	1186.0	634.2	186.3	36.9	5.6	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1.5	0.0	0.0	0.0	29.3	986.0	4976.0	7738.0	5569.7	2375.7	703.5	160.7	30.5	5.1	0.8	0.1	0.0	0.0	0.0
2.5	0.0	0.0	0.0	2.2	197.5	2158.8	6230.0	7449.5	4860.4	2066.0	644.5	160.2	33.7	6.3	1.1	0.2	0.0	0.0
3.5	0.0	0.0	0.0	0.2	34.9	695.5	3226.5	5675.0	5099.1	2838.0	1114.1	337.7	84.3	18.2	3.5	0.6	0.1	0.0
4.5	0.0	0.0	0.0	0.0	6.0	196.1	1354.3	3288.5	3857.5	2685.5	1275.2	455.1	130.9	31.9	6.9	1.3	0.2	0.0
5.5	0.0	0.0	0.0	0.0	1.0	51.0	498.4	1602.9	2372.7	2008.3	1126.0	463.6	150.9	41.0	9.7	2.1	0.4	0.1
6.5	0.0	0.0	0.0	0.0	0.2	12.6	167.0	690.3	1257.9	1268.6	825.9	386.8	140.8	42.2	10.9	2.5	0.5	0.1
7.5	0.0	0.0	0.0	0.0	0.0	3.0	52.1	270.1	594.4	703.2	524.9	276.7	111.7	36.7	10.2	2.5	0.6	0.1
8.5	0.0	0.0	0.0	0.0	0.0	0.7	15.4	97.9	255.9	350.6	296.9	174.6	77.6	27.7	8.4	2.2	0.5	0.1
9.5	0.0	0.0	0.0	0.0	0.0	0.2	4.3	33.2	101.9	159.9	152.2	99.2	48.3	18.7	6.1	1.7	0.4	0.1
10.5	0.0	0.0	0.0	0.0	0.0	0.0	1.2	10.7	37.9	67.5	71.7	51.5	27.3	11.4	4.0	1.2	0.3	0.1
11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.3	13.3	26.6	31.4	24.7	14.2	6.4	2.4	0.7	0.2	0.1
12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	4.4	9.9	12.8	11.0	6.8	3.3	1.3	0.4	0.1	0.0
13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.4	3.5	5.0	4.6	3.1	1.6	0.7	0.2	0.1	0.0
14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.2	1.8	1.8	1.3	0.7	0.3	0.1	0.0	0.0
15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.6	0.7	0.5	0.3	0.1	0.1	0.0	0.0
16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0

Fig.2.4.1 North Atlantic Wave Scatter Diagram

CHAPTER 3 SERVICE AREA/SERVICE ROUTE FACTORS

3.1 Service Area/Service Route Factor

3.1.1 The service area/service route factor is to include strength factor and fatigue factor.

3.1.2 The strength factor reflects the wave load characteristics of a specific service area/service route at the exceedance probability level of 10^{-8}, which is used for the correction of wave load in yield, buckling and ultimate strength assessment.

3.1.3 The fatigue factor reflects the wave load characteristics of a specific service area/service route at the exceedance probability level of 10^{-2}, which is used for the correction of wave load in fatigue strength assessment.

3.2 Strength factor

3.2.1 Strength factor α , which reflects the influence of the difference between the wave environment in a specific service area/service route and that in a non-restricted navigation area on the wave load, is to be calculated according to the following formula and is not less than 0.5:

$$\alpha = \frac{L_{SL-8}}{L_{NA-8}}$$

where: L_{SL-8} — Long-term value of ship motion and load under wave environment of specific service area/service route, at 10^{-8} exceedance probability, see 3.4 for calculation method;

L_{NA-8} — Long-term value of ship motion and load under North Atlantic wave environment, at 10^{-8} exceedance probability. See 3.4 for calculation method.

3.2.2 When the average wave period of wave scatter diagram for a specific service area/service route is obviously different from that of the North Atlantic wave scatter diagram, the exceedance probability of the above-mentioned long-term value is to be calculated based on the actual period of motion and load obtained from each scatter diagram, and the period of time for calculating the total number of frequency is to be 20 years.

3.2.3 In general, the following strength factor of motion and load is to be taken into consideration:

(1) vertical wave bending moment α_{BM}

(2) horizontal wave bending moment α_{HBM}

(3) wave torque α_{TOR}

(4) vertical wave shear force α_{SF}

(5) heave acceleration $\alpha_{A\text{-}heave}$

(6) sway acceleration $\alpha_{A\text{-sway}}$

(7) surge acceleration $\alpha_{A\text{-surge}}$

(8) roll angle α_{ROLL}

(9) pitch angle α_{PITCH}

(10) wave dynamic pressure α_{PRE}

3.2.4 The strength factors of vertical and horizontal wave bending moment are calculated based on the position of amidship while those of wave torque and vertical wave shear force are to take in way of the position between 0.25L and 0.75L, whichever is the larger. Each motion and acceleration strength factor is to be calculated based on the position of the center of gravity when the ship is fully loaded. The wave dynamic pressure strength factor is to be calculated by taking the position in way of waterline of the amidship.

3.2.5 According to the needs of strength assessment, the strength factors of other motions and loads may also be added and approved by CCS.

3.3 Fatigue Factor

3.3.1 Fatigue factor β, which reflects the influence of the difference between wave environment in specific service area/service route and that in a non-restricted navigation area on the fatigue load, is to be calculated according to the following formula:

$$\beta = \frac{L_{SL-2}}{L_{NA-2}}$$

where: L_{SL-2} — Long-term value of ship motion and load under wave environment of specific service area/service route, at 10^{-2} exceedance probability, see 3.4 for calculation method;

L_{NA-2} — Long-term value of ship motion and load under North Atlantic wave environment, at 10^{-2} exceedance probability. See 3.4 for calculation method.

3.3.2 In general, the following fatigue factor of motion and load is to be taken into consideration:

(1) vertical wave bending moment β_{BM}
(2) horizontal wave bending moment β_{HBM}
(3) wave torque β_{TOR}
(4) vertical wave shear force β_{SF}
(5) heave acceleration $\beta_{A\text{-heave}}$
(6) sway acceleration $\beta_{A\text{-sway}}$
(7) surge acceleration $\beta_{A\text{-surge}}$
(8) roll angle β_{ROLL}
(9) pitch angle β_{PITCH}
(10) wave dynamic pressure β_{PRE}

3.3.3 The calculating position of fatigue factor is shown in Figure 3.2.4. According to the needs of fatigue strength assessment, the fatigue factors of other motions and loads may also be added and approved by CCS.

3.4 Long-term Prediction of Motion and Load

3.4.1 The three-dimensional linear method based on potential flow theory is to be applied for ship hydrodynamic analysis and transfer function calculation of each motion and load so as to predict the long-term extreme values.

3.4.2 Generally, the full load condition is selected as the loading condition for calculation. The

hydrodynamic model is to meet the following requirements:
(1) The mass model is to have sufficient accuracy to reflect the mass distribution of lightweight and loaded ship;
(2) The hydrodynamic mesh is to be able to accurately simulate the hull shape, and the relative error between the model displacement and the loading calculation results is not to be greater than 1%.
3.4.3 The hydrodynamic analysis is to be calculated according to the following requirements:
(1) The calculated wave direction angle ranges from 0^o to 360^o , and the wave direction interval is not to be more than 30^o ;
(2) The range of wave frequency is to cover those under various sea states, taking 0.15 ~ 1.8rad/s with an interval of 0.05rad/s;
(3) When calculating the transfer function of strength factor, the speed is to be taken as 5 knots; and when calculating the transfer function of fatigue factor, the speed is to be 75% of the maximum service speed.
3.4.4 According to the transfer function of each motion and load, the North Atlantic wave scatter diagram and specific service area/service route wave scatter diagram are to be used for long-term prediction, respectively.
3.4.5 Long-term prediction is to be carried out in accordance with the following requirements:
(1) The short-term sea state is to be calculated in the form of short peak wave, and the square of cosine function is to be used to calculate the energy spreading function.
(2) Generally, the PM spectrum is to be taken as the wave spectrum. The wave spectrum given by the sea state data (wave scatter diagram) is to be used for the sea area, if provided.
(3) Equal probability distribution is to be conducted for each wave direction angle.

CHAPTER 4 HULL STRUCTURAL STRENGTH ASSESSMENT

4.1 Assessment Methods

4.1.1 For the hull structure of ships navigating in specific service area/service route, the calculation of scantlings of structural member and strength assessment are to be carried out according to the applicable rules. In the process of assessment, the wave load is to be corrected according to the methods stipulated in this Chapter.

4.2 Motion and Load Correction

4.2.1 The strength factor or fatigue factor is to be used to correct the motion and load in the rules, and the correction of motion is only for its amplitude. For example, for roll angle:

$$\varphi_{m-sl} = \alpha_{ROLL}\,\varphi_m$$

where: φ_{m-sl} — Roll angle used for strength assessment of ships navigating in specific service area/service route;

α_{ROLL} — strength factor of roll angle;

φ_m — Roll angle given in the rules, see 1.5.2.1(2), Chapter 1, PART TWO in CCS Rules for Classification of Sea-going Steel Ships.

4.2.2 The amplitude of wave bending moment and wave shear force for hull girder in the rules are to be corrected by strength factor or fatigue factor, and the distribution along the ship length is to remain unchanged.

4.2.3 Wave dynamic pressure and cargo hold loads are to be corrected by the strength factor or fatigue factor of dominant load parameters under loading conditions, as shown in 4.4.2, 4.4.3 and 4.6.2.

4.2.4 The wave bending moment of hogging for hull girder corrected by the strength factor is not to be less than 85% of the long-term value under the specific service area/service route environment.

4.3 Longitudinal Strength

4.3.1 The longitudinal strength is to be assessed according to the requirements of the rules, and the wave bending moment, wave shear force and wave torque of the hull girder are to be corrected by relative strength factors.

4.3.2 The minimum section modulus, W_0 of the longitudinal strength is required to be corrected by coefficient, α_{BMT}, which is to be calculated according to the following formula:

$$\alpha_{BMT} = 0.37 + 0.63 * \alpha_{BM}$$

4.3.3 When checking the longitudinal strength of the bending torsion combination for ships with large openings according to the requirements of the rules, the vertical wave bending moment, horizontal wave bending moment and wave torque stipulated in the rules are to be corrected in accordance with their strength factors respectively.

4.4 Direct Strength Calculation of Cargo Holds

4.4.1 The direct strength calculation of cargo holds is to be carried out according to the requirements of the rules. For all wave loads under the same loading condition, the strength factor of dominant load parameters uniformly under the loading condition is to be corrected according to the method mentioned in 4.2.1.

4.4.2 For the dominant load parameters under various loading condition groups of ore carriers, see Table 4.4.2.

Dominant Load Parameters under Various Loading Condition Groups for Ore Carriers

Table 4.4.2

loading condition group	HSM	HSA	FSM	BSR	BSP	OST	OSA
Dominant load parameter	Vertical wave bending moment	Bow vertical acceleration	Vertical wave bending moment	Roll angle	Wave dynamic pressure at waterline	Torque in way of the position at 0.25L	Pitch acceleration

4.4.3 For the dominant load parameters under various loading condition groups of container ships, see Table 4.4.3.

Dominant Load Parameters under Various Loading Condition Groups for Container Ships

Table 4.4.3

Loading condition	LC1~LC6	LC7、LC8	LC9	LC10
Dominant load parameter	Vertical wave bending moment	Roll angle	Longitudinal acceleration	--

4.5 Direct Calculation of Global Strength of Ship

4.5.1 The direct calculation of global strength of container ship is to be carried out according to the requirements of the CCS Rules for Classification of Sea-going Steel Ships, and the strength factor is to be used to correct the dominant load parameters (vertical wave bending moment, horizontal wave bending moment and wave torque) of design wave under each wave condition.

4.5.2 The direct calculation of global strength of ore carrier is to be carried out according to the Guidelines for Direct Strength Analysis of Hull Structures of Ore Carriers. The dominant load parameters (vertical wave bending moment, vertical wave shear, bow vertical acceleration, bow transverse acceleration and roll angle) of the design wave are to be taken the long-term prediction values of wave scatter based on specific service area/service route.

4.6 Fatigue Strength

4.6.1 The fatigue strength is to be checked according to the Guidelines for Fatigue Strength of

Ship Structure, and the combination contributors of stress calculation are to remain unchanged. For each motion and wave bending moment in the simplified stress analysis (nominal stress), the relative fatigue factor is to be used for correction.

4.6.2 For the motion and wave load in the hot spot stress fatigue analysis, all wave loads under the loading condition are to be corrected according to the fatigue factors of the dominant load under each loading condition. The dominant load parameters of each loading condition are shown in Table 4.6.2.

Dominant Load Parameters under Loading Condition for Hot Spot Fatigue Analysis Table 4.6.2

Loading condition	H1、H2、F1、F2	R1P、R2P、R1S、R2S	P1P、P2P、P1S、P2S
Load parameter	Vertical wave bending moment	Roll angle	Wave dynamic pressure

4.6.3 For container ships navigating in specific service areas/service routes, when the fatigue strength of the hatch corner is checked by the global finite element model according to the CCS Rules for Classification of Sea-going Steel Ships, the dominant load parameters of design wave (vertical wave bending moment, horizontal wave bending moment and wave torque) are to be corrected by the relative strength factors. When calculating the stress range, the shape parameters of Weibull distribution may be calculated according to the rules, or may be obtained by matching the long-term extreme value of the dominant load parameters corresponding to the working stress range.

4.7 Fatigue Spectrum Analysis

4.7.1 The fatigue spectrum analysis of ships navigating in specific service areas/service routes is to be carried out according to the Guidelines for Spectrum-Based Fatigue Assessment of Hull Structure. In the process of assessment, the wave scatter diagram of a specific service area/service route is to be used as the environmental conditions and reflected in the class notation.

4.8 Container Securing

4.8.1 For container ships navigating in specific service areas, when calculating the container fastening load, the fastening loads are to be corrected according to the requirements of “7 Specific Route and Season” in Appendix 1, Chapter 7, PART TWO of CCS Rules for Classification of Sea-going Steel Ships.

CHAPTER 5 SHIPS WITH DESIGN SERVICE LIFE OF 15 YEARS

5.1 Scantlings of Structural Member

5.1.1 The scantlings of structural member are to be reduced according to Table 5.1.1 and rounded according to the requirements of 5.1.2 on the basis of calculation and strength assessment.

5.1.2 Rounding requirements: for plate thickness, the decimal may be ignored if less than or equal to 0.25mm; taken as 0.5mm if greater than 0.25mm and less than 0.75mm; and taken as 1.0mm if greater than or equal to 0.75mm.

5.1.3 The thickness requirements of secondary structural member are to be determined by the position of its attached plating.

5.1.4 Where several plate thicknesses of structural members/plating is required to reduce, the reduction value with the minimum thickness requirement is to be used for the whole plating.

5.1.5 After the scantlings of the combined structural sections are assessed according to the requirements of the rules and results are satisfactory, the plate thickness is to be reduced and rounded according to the position of plating according to Table 5.1.1.

5.1.6 After the scantlings of structural member is determined according to the requirements of the rules, the section modulus is to be recalculated after deducting the reduction values required in Table 5.1.1, and the specifications of structural sections are to be determined according to the section modulus.

Reduction Values of Plating Thickness for Ships with Design Service Life of 15 Years

Table 5.1.1

<table>
<tr><th>Hold type</th><th colspan="2">Structural member</th><th>Reduction value (mm)</th></tr>
<tr><td rowspan="4">Ballast tank, sewage tank, slop tank and anchor chain tank</td><td rowspan="2">Facing plate of primary supporting member</td><td>Within the range of 3 at the hold top[1]</td><td>0.50</td></tr>
<tr><td>Other positions</td><td>0.38</td></tr>
<tr><td rowspan="2">Other members</td><td>Within the range of 3 at the hold top[1]</td><td>0.43</td></tr>
<tr><td>Other positions</td><td>0.30</td></tr>
<tr><td rowspan="6">Cargo hold of ore carrier[2]</td><td rowspan="3">Transverse bulkhead</td><td>Upper part[2]</td><td>0.60</td></tr>
<tr><td>Lower stool: inclining plate, vertical plating and top plating</td><td>1.30</td></tr>
<tr><td>Other parts</td><td>0.75</td></tr>
<tr><td colspan="2">Inner bottom plating</td><td>0.93</td></tr>
<tr><td rowspan="2">Longitudinal bulkhead</td><td>Upper part[2]</td><td>0.45</td></tr>
<tr><td>Other parts</td><td>0.50</td></tr>
<tr><td rowspan="2">Cargo hold of container ship</td><td colspan="2">Transverse bulkhead</td><td>0.13</td></tr>
<tr><td colspan="2">Other structural members</td><td>0.25</td></tr>
</table>

Hold type	Structural member	Reduction value (mm)
Exposed in air	Open deck plating	0.43
	Other structures	0.25
Exposed in sea water	Side plating between minimum design ballast waterline and structural waterline	0.38
	Shell plating in way of other positions	0.25
Oil fuel tank and lubricating oil tank		0.18
Fresh water tank		0.18
Empty tank	Occasional manned spaces, such as those that can only be accessed through manholes, pipe tunnels, etc., and the inner surface of the stool space adjacent to the dry bulk cargo tank or ballast cargo tank	0.18
Dry tank	The interior of machinery space, pump room, storage room, rudder space and other compartments	0.13

(1) Only applicable to cargo tanks and ballast tanks with open deck as the tank top, measuring from 3m vertically downward parallel to the tank top.

(2) The upper part is equivalent to one-third of the height of the cargo tank measured from the tank top (it is included in this article if the deck is also a part of the boundary of the cargo tank).

5.2 Fatigue Strength

5.2.1 For ships with the class notation DL (15), the fatigue strength is to be assessed according to the Guidelines for Fatigue Strength of Ship Structure. In the process of assessment, the model is to take the scantlings of structural member before reduction, and the corrosion correction coefficient is to be calculated according to the following two formulas:

$$f_{ch} = 1.075$$

$$f_{cl} = 1.125$$

When checking the fatigue strength according to 3.1.2 in Chapter 3 of the Guidelines for Fatigue Strength of Ship Structure, the design service life is to be taken as $T_D = 15$, in years.

5.2.2 When checking the fatigue strength according to the Guidelines for Spectrum-Based Fatigue Assessment of Hull Structures, the corrosion correction factor stipulated in 3.2.3 of the Guidelines is to be taken as 1.1. The design fatigue life is to be taken as 15 years and reflected in the class notation.