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CHINA CLASSIFICATION SOCIETY

RULES FOR CONSTRUCTION OF SEA-GOING SHIPS ENGAGED ON DOMESTIC VOYAGES

AMENDMENTS

2025

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PART TWO HULL

CONTENTS

CHAPTER 1 GENERAL

Section 7 SHIPS NAVIGATING IN RESTRICTED SERVICE

1.7.1 General requirements

1.7.1.4 For passenger ships, ferries, traffic ships and public affair ships engaged in restricted service that are not high-speed and whose main hull is made of aluminum alloy, hull structures are to comply with the requirements of CCS Guidelines for Structure of Non-High-Speed All-Aluminum Alloy Sea-Going ships.

1.7.3 Reduction of rule scantlings of structural members

1.7.3.4 For ships of less than 65 m in length and engaged in restricted service, the~~The requirements for~~ minimum thickness of plating ~~after reduction~~ is to comply with the following requirements:

(1) ~~For ships of less than 65 m in length,~~ the thickness of shell plating is to be not less than 5 mm~~.~~;

(2) ~~For ships of less than 65 m in length,~~ the thickness of strength deck is to be not less than 5 mm and the thickness of other decks is to be not less than 4 mm~~.~~;

(3) ~~For ships of less than 65 m in length,~~ the thickness of inner bottom plating in double bottom is to be not less than 5 mm~~.~~;

(4) ~~For ships of less than 65 m in length,~~ the thickness of weather tight steel hatch covers is to be not less than 5 mm.

CHAPTER 2 HULL STRUCTURES

Section 1 GENERAL PROVISIONS

2.1.3 Direct strength calculation and fatigue strength assessment for hull structure

2.1.3.1 For general dry cargo ships of 150 m or over in length, FE direct strength calculation and verification are to be carried out for the strength of primary structural members within cargo area. When containers are carried, reference may be made to applicable requirements of Appendix 2, Chapter 7 of this PART. When bulk cargoes are carried, reference may be made to applicable requirements of Appendix 1, Chapter 8 of this PART.

2.1.3.2 For general dry cargo ships of 150 m or over in length, the fatigue strength check may be carried out for the following structural members in the cargo area. For check method, reference may be made to CCS Guidelines for Fatigue Strength of Ship Structure:

(1) connections of longitudinals (bottom, side, deck and inner shell) to transverse web frames;

(2) connections of longitudinals (bottom, side, deck and inner shell) to transverse bulkheads;

(3) connections of hopper tank sloping plate or inner shell to inner bottoms (if any);

(4) connections of transverse bulkheads to inner bottoms and girders.

Section 19 BULWARKS AND GUARDRAILS

2.19.3 Guardrails

2.19.3.1 Guardrails fitted on superstructure and freeboard decks are to have at least three courses. The opening below the lowest course of the guardrails is not to exceed 230 mm. The other courses are to be not more than 380 mm apart. In the case of ships with rounded gunwales the guardrail supports are to be placed on the flat of the deck. In other locations, guardrails with at least two courses are to be fitted.

2.19.3.2 Where external glass balustrades are fitted, reference may be made to relevant requirements of Section 8, Chapter 9 of this PART.

CHAPTER 3 EQUIPMENT AND OUTFITS

Section 1 RUDDERS

3.1.9 Strength of rudder horns and rudder trunk

3.1.9.1 Rudder horns

The bending moments and shear forces are to be determined by a direct calculation or in line with the guidelines given in 2.4 and 2.5 of Appendix 1 for semi spade rudder with one elastic support and semi spade rudder with 2-conjugate elastic support respectively.

The section modulus around the horizontal x-axis W is not to be less than:

$$W = M_b K / 67 \quad \text{cm}^3$$

where: M_b — bending moment at the section considered, in N·m.

The shear stress τ is not to be larger than:

$$\tau = 48/K \quad \text{N/mm}^2$$

where: K — material factor as given in 3.1.1.3(2) or 3.1.1.3(5) of this Section.

(1) Equivalent stress

At no section within the height of the rudder horn is the equivalent stress to exceed $120/K$ N/mm^2.

The equivalent stress σ_v is to be calculated by the following formula:

$$\sigma_v = \sqrt{\sigma_b^2 + 3\left(\tau^2 + \tau_T^2\right)} \quad \text{N/mm}^2$$

where: $\sigma_b = M_b / Z_x$, in N/mm^2;

Z_x — section modulus of rudder horn at the section considered, in cm^3;

$\tau = B_1 / A_h$, in N/mm^2;

B_1 — supporting force in the pintle bearing, in N;

A_h — effective shear area of rudder horn in y-direction, in mm^2;

$\tau_T = M_T 10^3 / 2 A_T t_h$, in N/mm^2;

M_T — torsional moment, in N·m;

A_T — area in the horizontal section enclosed by the rudder horn (including the area of inner hollow area), in mm^2;

t_h — plate thickness of rudder horn, in mm;

K — material factor, as given in 3.1.1.3(2) or 3.1.1.3(5) of this Section respectively.

Section 2 ANCHORING AND MOORING EQUIPMENT

3.2.3 Chain cables

3.2.3.5 ~~The inboard end of the chain cables is to be secured to the hull structure~~ The inboard end of the chain cable is to be connected to the structure by fasteners and so arranged that they will be capable of being immediately released from a position easily accessible outside the chain locker. Fasteners and their hull support structures are to be able to withstand breaking load which is not less than 15% and not greater than 30% of the anchor chain fitted.

Section 7 SUPPORT STRUCTURE FOR DECK EQUIPMENT

3.7.3 Supporting structure for cranes, derricks and lifting masts

~~3.7.3.12 In all conditions, the stresses taken in calculation for the supporting structures and foundations of lifting appliances are not to exceed the permissible values given in Table 3.7.3.12.~~

~~**Permissible Stress** **Table 3.7.3.12**~~

~~Type of element~~	~~Permissible stress~~
~~Grillage~~	~~Direct stress: $[\sigma] = 0.67R_{eH}$~~ ~~Shear stress: $[\tau] = 0.39R_{eH}$~~

~~Plate element~~	~~Equivalent stress: $[\sigma_e] = 0.80R_{eH}$~~

~~where: R_{eH} — yield stress of material, in N/mm^2.~~

3.7.3.12 In all conditions, the stresses taken in calculation for the supporting structures and foundations of lifting appliances are not to exceed the permissible values as follows:

(1) Strength assessment by means of beam theory or grillage analysis:

Direct stress: $0.67R_{eH}$

Shear stress:$0.39R_{eH}$

Direct stress means the sum of bending stress and axial stress, with the corresponding shear stress acting perpendicular to the direct stress. Stress concentration factors are not considered.

(2) Strength assessment by means of FE analysis method:

Von Mises stress: $0.8R_{eH}$

R_{eH} is specified minimum yield stress of material, in N/mm^2.

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

2 The Forces on Rudder–Rudder Stock

2.4 Semi spade rudder with one elastic support

Data for the analysis

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

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

Z — spring constant of support in the rudder horn:

$Z=1/(f_b+f_t)$ kN/m, for the support in the rudder horn (see Figure 2.4.1);

f_b — unit displacement of rudder horn, in m, due to a unit force of 1 kN acting in the centre of support:

$$f_b = \frac{1.3h^3}{6.18I_n} \text{ m/kN (guidance value);}$$

I_n — moment of inertia of horizontal section of rudder horn around the x-axis, in cm^4 (see also Figure 2.4.1);

f_t — unit displacement due to torsion, in m/kN;

$$f_t = \frac{he^2 \sum u_i / t_i}{3.14 \times 10^8 F_T^2} \text{ m/kN}$$

F_T — ~~mean sectional area of rudder horn~~ mean of areas enclosed by outer and inner boundaries of the thin walled section of rudder horn (excluding the area of the inner hollow area), in m^2;

u_i — breadth in [mm] of the individual plates forming the ~~mean horn sectional~~ F_T area;

t_i — thickness within the individual breadth u_i, in mm;

h — Height of the rudder horn, in m, defined in Figure 2.4.1. This value is measured downwards from the upper rudder horn end, at the point of curvature transition, to the mid-line of the lower rudder horn pintle;

e — distance as defined in Figure 2.4.2, in m, measured to $h/2$ of the height of the rudder horn;

2.5 Semi spade rudder with 2-conjugate elastic support

Data for the analysis

K_{11}, K_{12}, K_{22}: Rudder horn compliance constants calculated for rudder horn with 2-conjugate elastic supports (Figure 2.5.1).The 2-conjugate elastic supports are defined in terms of horizontal displacements, y_i, by the following equations:

at the lower rudder horn bearing:

$$y_1 = -K_{12}B_2 - K_{22}B_1$$

at the upper rudder horn bearing:

$$y_2 = -K_{11}B_2 - K_{12}B_1$$

where: y_1, y_2 — horizontal displacements, in m, at the lower and upper rudder horn bearings, respectively;

B_1, B_2 — horizontal support forces, in kN, at the lower and upper rudder horn bearings, respectively;

K_{11}, K_{12}, K_{22}: — obtained, in m/kN, from the following formulae:

$$K_{11}=1.3\times\frac{\lambda^3}{3EJ_{1h}}+\frac{e^2\lambda}{GJ_{th}}$$

$$K_{12}=1.3\times\left[\frac{\lambda^3}{3EJ_{1h}}+\frac{\lambda^2(h-\lambda)}{2EJ_{1h}}\right]+\frac{e^2\lambda}{GJ_{th}}$$

$$K_{22}=1.3\times\left[\frac{\lambda^3}{3EJ_{1h}}+\frac{\lambda^2(d-\lambda)}{EJ_{1h}}+\frac{\lambda(h-\lambda)^2}{EJ_{1h}}+\frac{(h-\lambda)^3}{3EJ_{2h}}\right]+\frac{e^2\lambda}{GJ_{th}}$$

where: h — height of the rudder horn, in m, defined in Figure 2.5.1. This value is measured downwards from the upper rudder horn end, at the point of curvature transition, to the mid-line of the lower rudder horn pintle;

λ— length, in m, as defined in Figure 2.5.2. This length is measured downwards from the upper rudder horn end, at the point of curvature transition, to the mid-line of the upper rudder horn bearing. For $\lambda = 0$, the above formulae converge to those of spring constant Z for a rudder horn with 1-elastic support, and assuming a hollow cross section for this part;

e — rudder-horn torsion lever, in m, as defined in Figure 2.5.1 (value taken at $z = h/2$);

J_{1h} — moment of inertia of rudder horn about the x-axis, in m^4, for the region above the upper rudder horn bearing. Note that J_{1h} is an average value over the length λ (see Figure 2.5.1);

J_{2h} — moment of inertia of rudder horn about the x-axis, in m^4, for the region between the upper and lower rudder horn bearings. Note that J_{2h} is an average value over the length $h - \lambda$ (see Figure 2.5.1);

J_{th} — torsional stiffness factor of the rudder horn, in m^4. For any thin wall closed section:

$$J_{th}=\frac{4F_T^2}{\sum_i \frac{u_i}{t_i}} \quad \text{m}^4$$

F_T — mean of areas enclosed by outer and inner boundaries of the thin walled section of rudder horn(excluding the area of the inner hollow area), in m^2;

μ_i — length, in mm, of the individual plates forming the ~~mean horn sectional~~ F_T area;

t_i — thickness, in mm, of the individual plates mentioned above.

Note that the J_{th} value is taken as an average value, valid over the rudder horn height.

For a generic section of the rudder horn, located in the region above its upper bearing, the following stresses are to be calculated:

τ_S — shear stress, in N/mm^2, to be obtained from the following formula:

$$\tau_s=\frac{F_{A1}+F_{A2}}{A_H} \quad \text{N/mm}^2$$

τ_T — torsional stress, in N/mm^2, to be obtained for hollow rudder horn from the following formula:

$$\tau_T=\frac{M_T 10^{-3}}{2F_T t_H} \quad \text{N/mm}^2$$

For solid rudder horn, τ_T is to be calculated based on the specific geometrical shape.

where:

F_{A1}, F_{A2} — support forces, in N;

A_H — effective shear sectional area of the rudder horn, in mm^2, in y-direction;

M_T — torque, in N·m;

F_T — mean of areas enclosed by outer and inner boundaries of the thin walled section of

rudder horn(excluding the area of the inner hollow area), in m^2;

t_H— Plate thickness of rudder horn, in mm. For a given cross section of the rudder horn, the maximum value of τ_T is obtained at the minimum value of t_H.

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

Section 2 HULL STRUCTURE

9.2.3 Transverse strength

9.2.3.1 For roll on-roll off ships, ro-ro passenger ships and ferries carrying vehicles, the transverse strength of the hull is to be checked in accordance with the relevant requirements of Section 7 of this Chapter.

CHAPTER 16 ORE CARRIERS

Section 1 GENERAL PROVISIONS

16.1.1 Application

16.1.1.4 For relevant requirements for maximum cargo density and loading and unloading in multiple ports of ore carriers, see CCS Guidelines for Direct Strength Analysis of Hull Structure of Ore Carriers.

CHAPTER 18 TWIN-HULL CRAFT

Appendix 1 DIRECT STRENGTH CALCULATION OF TWIN-HULL CRAFT

5 Yielding Strength Assessment

~~5.1.2 If meshes finer than those specified in Section 5, Chapter 1 of this Chapter are used, the average stress value of all fine meshes under the specified mesh size is to be taken.~~

5.1.~~3~~2 Where the loads are applied in accordance with 2.2.1 to 2.2.3 of this Appendix, the equivalent stress of plate element within fine mesh area is not to be greater than $1.2\times235/K$ (K is material factor). Where the loads are applied through equivalent design wave in 2.2.4 of this Appendix, the equivalent stress of plate element within fine mesh area is not to be greater than $1.5\times235/K$ (K is material factor).

CHINA CLASSIFICATION SOCIETY

RULES FOR CONSTRUCTION OF SEA-GOING SHIPS ENGAGED ON DOMESTIC VOYAGES

AMENDMENTS

2025

PART THREE
MACHINERY INSTALLATIONS

CONTENTS

CHAPTER 1 GENERAL

Section 2 GENERAL PROVISIONS

1.2.11 Clean energy and power

1.2.11.7 Ships using liquefied petroleum gas as fuel are, in addition to the relevant provisions of this PART, to comply with relevant requirements of CCS Guidelines for Ships Using Liquefied Petroleum Gas Fuel.

1.2.11.8 Ships using ammonia as fuel are, in addition to the relevant provisions of this PART, to comply with relevant requirements of CCS Guidelines for Ships Using Ammonia Fuel.

CHAPTER 4 MACHINERY PIPING SYSTEMS

Section 8 THERMAL OIL SYSTEM

4.8.1 General requirements

4.8.1.2 Heating of liquid cargoes with flash points below 60℃ is in general to be arranged by means of double circuit systems, with a ~~separate~~ secondary system located completely within the cargo area. However, a single circuit system may be accepted on the following conditions:

(1) System is so arranged that a positive pressure in the coil is to be at least 3 m water column above the static head of the cargo when circulating pump is not in operation.

(2) The thermal oil system expansion tank is to be fitted with high and low level alarms.

(3) Means are to be provided in the thermal oil system expansion tank for detection of flammable cargo vapors. Applicable portable equipment may be accepted.

(4) Valves for ~~the individual~~ each heating coil~~s~~ are to be provided with locking arrangement to ensure that the coils are under static pressure at all times.

CHAPTER 6 BOILERS AND PRESSURE VESSELS

Section 5 THERMAL OIL HEATERS

6.5.5 Monitoring and protection

6.5.5.1 Monitoring and protective measures are to be provided for thermal oil heaters according to Table 6.5.5.1.

Monitoring and Alarm Items for Thermal Oil Heaters **Table 6.5.5.1**

Items to be monitored	Local control			Remark
	Indication	Alarm	Automatic shutoff	
Thermal oil expansion tank level	×	Low	×	High alarm is also to be provided for single circuit thermal oil system
Thermal oil flow or pressure	×	Low	×	
Thermal oil outlet temperature	×	High	×	
Combustion air pressure or forced ventilation①		Low or shutoff	×	
Oil fuel pressure①	×	Low		Standby pumps to start automatically
Heavy oil fuel temperature or viscosity①	×	Low and great		For heavy oil fuel only
Uptake temperature①	×	High	×	
Burner flame or ignition①		Flameout/failure	×	Each burner to be monitored
Exhaust temperature②	×	High		

Notes:

× = functional requirement

① Applicable for oil-fired heaters.

② Applicable for exhaust gas heaters.

CHAPTER 11 SHAFTING AND PROPELLERS

Section 3 SHAFT TRANSMISSION UNITS

11.3.4 Clutches and control devices

11.3.4.7 In case the control device of the clutch loses power, the clutch is to be able to maintain its current state until power is restored. Otherwise, an uninterrupted backup power source (e.g. electrical power source or air source) is to be provided.

CHINA CLASSIFICATION SOCIETY

RULES FOR CONSTRUCTION OF SEA-GOING SHIPS ENGAGED ON DOMESTIC VOYAGES

AMENDMENTS

2025

PART FOUR ELECTRICAL INSTALLATIONS

CONTENTS

CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.2.1 For the purpose of this PART:

(27) Uninterruptible power system (UPS)[1] is a combination of converters, switches and energy storage ~~means~~ devices (such as ~~for example~~ batteries), constituting a power system for maintaining continuity of load power in case of AC input power failure.

Section 3 DESIGN, CONSTRUCTION AND INSTALLATION

1.3.1.17 The UPS unit for emergency services in 3.9.1.1, Section 9, Chapter 3, PART FOUR of the Rules for Classification of Sea-going Steel Ships is to be suitably located for use in an emergency. UPS units utilising valve regulated sealed batteries may be located in compartments with normal electrical equipment, provided the ventilation arrangements are in accordance with the requirements of IEC 62040-1, IEC 62040-2, IEC 62040-3, IEC 62040-4 and/or IEC62040-5-3 publication (as applicable), or an acceptable and relevant national or international standard.

[1] Refer to IEC 62040-3 Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements.

CHAPTER 2 ELECTRICAL INSTALLATIONS IN SHIPS

Section 2 EMERGENCY SOURCE OF ELECTRICAL POWER

2.2.1.13 UPS units specified in Section 9, Chapter 3, PART FOUR of the Rules for Classification of Sea-going Steel Ships may be used to provide an alternative power supply or transitional power supply to emergency services as defined in 2.2.2 and 2.2.3 of this Section.

2.2.2.1(2) for the power supply to the following equipment, the power supply period of ships navigating in the greater coastal service area is 12h, and the power supply period of ships navigating in the coastal service area is 6h:

① the navigation lights and other signal lights required in Chapter 8, PART FOUR in the existing Statutory Regulations for Domestic Ships ;

② VHF radio equipment, MF radio installation (if any), ship earth station (if any) and MF/HF radio equipment (if any) required in Chapter 4, PART FOUR in the existing Statutory Regulations for Domestic Ships;

③ all internal communication equipment required in an emergency[①];

④ the navigational aids as required in Chapter 5, PART FOUR of the existing Statutory Regulations for Domestic Ships, where such provision is unreasonable or impracticable, ships of less than 5,000 gross tonnage may not to meet this requirement, subject to agreement;

⑤ the fire detection and fire alarm system, and the fire door holding and release system; and

⑥ for intermittent operation of the daylight signaling lamp, the ship's whistle, the manually operated call points and all internal signals that are required in an emergency (e.g. general emergency alarm system, alarms for warning of the release of extinguishing media);

⑦ One of the fire pumps as required in Chapter 2-2, PART FOUR of the existing Statutory Regulations for Domestic Ships;

⑧ Automatic sprinkler pump (if any);

⑨ Emergency bilge pump and all equipment essential for the operation of electrically powered remote controlled bilge valve;

unless such services mentioned above in ③ to ⑥ have an independent supply for the specified period from an accumulator battery ~~or have an uninterruptible power system (UPS) complying with the requirements of Section 9 of Chapter 3, PART FOUR in the CCS Rules for Classification of Sea-going Steel Ships~~ suitably located for use in an emergency; ~~If ventilation is provided according to IEC Publication 62040 or other acceptable standards, the UPS device with valve regulated type battery may be placed in the same compartment with electrical equipment;~~

2.2.3.1(3) for the power supply to the following equipment, the power supply period of ships navigating in the greater coastal service area is 6h, and the power supply period of ships navigating in the coastal service area is 3h:

① the navigation lights and other signal lights required in Chapter 8, PART FOUR of the existing Statutory Regulations for Domestic Ships;

② VHF radio installation, MF radio installation (if any), ship earth station (if any) and MF/HF radio installation (if any) required in Chapter 4, PART FOUR of the existing Statutory Regulations for

[①] The internal communication equipment required in an emergency case is to include: (1) Important telephone system; (2) Emergency engine telegraph; (3) Public address system; (4) Communication in an emergency; (5) Communication facilities between the officer on duty and the crew responsible for closing the watertight door that cannot be closed from the central control station; (6) Communication facilities between the navigation bridge and the main fire control station.

Domestic Ships;

③ all internal communication equipment as required in an emergency[①];

④ the navigational aids for ships of 5,000 gross tonnage and above as required in Chapter 5, PART FOUR in the existing Statutory Regulations for Domestic Ships;

⑤ the fire detection and fire alarm system;

⑥ intermittent operation of the daylight signaling lamp, the ships whistle, the manually operated call points and all internal signals that are required in an emergency (e.g. general emergency alarms system, alarms for warning of the release of extinguishing media, etc.);

⑦ One of the fire pumps as required in Chapter 2-2, PART FOUR of the existing Statutory Regulations for Domestic Ships;

unless such services mentioned above in ③ to ⑥ have an independent supply for the specified period from an accumulator battery ~~or have an uninterruptible power system (UPS) complying with the requirements of Section 9 of Chapter 3, PART FOUR in CCS Rules for Classification of Sea-going Steel Ships~~ suitably located for use in an emergency; ~~If ventilation is provided according to IEC Publication 62040 or other acceptable standards, the UPS device with valve regulated type battery may be placed in the same compartment with electrical equipment;~~

Section 5 PROTECTION

2.5.9.5 Permanently fixed cables between the shore connection box and the main or emergency switchboard are to be protected by a circuit-breaker or an isolating switch and fuses. Such protection is to be fitted in the shore connection box.

Section 18 ADDITIONAL REQUIREMENTS FOR SHIPS CARRYING DANGEROUS GOODS

2.18.5.1 Where solid dangerous goods in bulk (solid dangerous goods capable of creating explosive gas atmosphere) and MHB are to be carried, electrical equipment of certified safe type installed in hazardous areas are to be in compliance with the minimum requirements of Table 2.18.5.1.

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

Table 2.18.5.1

Dangerous goods	IMO class	Dominant risk[①]	Protection against explosive dust atmosphere	Protection against explosive gas atmosphere	
			Degree of protection	Explosion group	Temperature class
Aluminium ferrosilicon powder UN1395	4.3	H_2	—	IIC	T2
Aluminium silicon powder uncoated UN1398	4.3	H_2	—	IIC	T2
Aluminium smelting by-products or Aluminium remelting by-products UN3170	4.3	H2	—	IIC	T2
Aluminium smelting/remelting by-products, processed	MHB(WF and/or WT and/or CR)	H2	—	IIC	T1

[①] The internal communication equipment required in an emergency case is to include: (1) Important telephone system; (2) Emergency engine telegraph; (3) Public address system; (4) Communication in an emergency.

Dangerous goods	IMO class	Dominant risk[①]	Protection against explosive dust atmosphere	Protection against explosive gas atmosphere	
			Degree of protection	Explosion group	Temperature class
Ammonium nitrate UN1942	5.1	—	—	—	T4
Ammonium nitrate-based fertilizer UN2067	5.1	—	—	—	T4
Ammonium nitrate-based fertilizer UN2071	9	—	—	—	T4
Ammonium nitrate-based fertilizer	—	—	—	—	T4
Ammonium nitrate-based fertilizer MHB	MHB(OH)	—	—	—	T4
Brown coal briquettes	MHB (CB and/or SH)	Dust, methane	IP55	IIA	T4
Coal	MHB (CB and/or SH and/or WF and/or CR)	Dust, methane	IP55	IIA	T4
Direct reduced iron (A)	MHB (SH and/or WF)	H_2	—	IIC	T2
Direct reduced iron (B)	MHB (SH and/or WF)	H_2	—	IIC	T2
Direct reduced iron (C)	MHB (SH and/or WF)	H_2	—	IIC	T2
Direct reduced iron (D)	MHB (SH and/or WF)	H_2	—	IIC	T2
Ferrophosphorus (including briquettes)	MHB (WF and/or WT)	H_2	—	IIC	T1
Ferrosilicon, with at least 25% but less than 30% silicon, or 90% or more silicon ~~(including briquettes)~~	MHB (WF and/or WT)	H_2	—	IIC	T1
Ferrosilicon UN1408, with 30% or more but less than 90% silicon(including briquettes)	4.3	H_2	—	IIC	T1
Iron oxide, spent or sponge iron, spent UN1376	4.2	Dust	IP55	IIA	T2
Seed cake, containing vegetable oil UN1386(b)	4.2	Hexane	—	IIA	T3
Seed cake UN2217	4.2	Hexane	—	IIA	T3
Seed cakes and other residues of processed oily vegetables	MHB (SH)	Dust	IP55	IIA	T3
Silicomanganese (low-carbon)	MHB(WF and/or WT and/or TX)	H_2	—	IIC	T1
Solidified fuels recycled from paper and plastics	MHB (SH)	Combustible	IP55	—	T3
Sugarcane biomass pellets	MHB(CB and/or WF and/or WT and/or OH)	Combustible, dust	IP55	IIA	T3
Sulphur UN1350 (crushed lump and coarse grained)	4.1	Combustible, dust	IP55	—	T4
Zinc Ashes UN1435	4.3	H_2	—	IIC	T2
Wood torrefied	MHB(CB and/or SH	Combustible, dust	IP55	—	T3

Dangerous goods	IMO class	Dominant risk①	Protection against explosive dust atmosphere	Protection against explosive gas atmosphere	
			Degree of protection	Explosion group	Temperature class
	and/or CR)				
Wood pellets, containing additives and/or binders	MHB(WF)	Dust	IP55	—	T3
Wood pellets, not containing any additives and/or binders	MHB(OH)	Dust	IP55	—	T3

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