Amendments of the Rules for Classification of Steel Ships

(Development Review : For external opinion inquiry)

Part 5 Machinery Installations

2022. 08.

Machinery Rule Development Team

- Main Amendments -

(1) Effective date : 1 Jan. 2023 (Date of which contracts for construction are signed)

◉ The requirement for safety devices of gas turbines has been revised to reflect IACS UR M60 (Rev.1 Nov 2021).

(2) Effective date : 1 Jan. 2023 (Application date for certification of a new turbocharger type or of a turbocharger type that has undergone substantive modifications in respect of the one previously type approved, or for renewal of an expired type approval certificate)

◉ IACS UR M73 (Rev.1 Mar 2022) on change of effective date of the requirements for turbocharger has been reflected.
- The effective date of Ch 1, 211. has been changed.
- The effective date of Ch 2, 202. 3 (3), (4), (5) has been changed.
- The effective date of Ch 2, 211. 2 (1) has been changed.

(3) Effective date : 1 Jul. 2023 (Date of which contracts for construction are signed)

◉ The reference for Guidance for Prevention Systems of Pollution from Ships has been added.

◉ The requirements for the Water-jet Propulsion Systems and Azimuth or Rotatable Thrusters have been updated and upgraded.

◉ The requirement for hydraulic tests of fittings directly welded to pressure vessels has been clarified.

◉ The requirements for hydraulic locking of steering gears have been revised to reflect IACS UR M42 (Rev.6 Mar 2022) and UR E25 (Rev.2 Mar 2022).

Present	Amendment	Reason
# CHAPTER 1 GENERAL ## Section 1 General **101. Application** **1.** The requirements of this Part apply to the machinery installations intended for the ships which have no special limitations for their service area and purpose. For machinery installations intended for the ships having any limitations for their service area or intended for the small ships, the requirements in this Part may be modified. Special consideration is to be given to the ships with any limitations for their purpose. **【See Guidance】** *(Omitted)* **7.** The ships for navigation in polar waters and the vessels for polar and ice breaking service are to comply with the relevant requirements in **Ch 2 of Guidance for Ships for Navigation in Ice**, and **Ch 3 of Guidance for Ships for Navigation in Ice** respectively, in addition to the requirements in this part. **8.** Ships using low-flashpoint fuels of below 60 °C other than ships carrying liquified gases in bulk and ships carrying CNG in bulk are also to meet with the requirements in Rules for Ships using Low-flashpoint Fuels, in addition to the requirements in this part. *(2018)* *(New)* *(Omitted)*	# CHAPTER 1 GENERAL ## Section 1 General **101. Application** **1.** The requirements of this Part apply to the machinery installations intended for the ships which have no special limitations for their service area and purpose. For machinery installations intended for the ships having any limitations for their service area or intended for the small ships, the requirements in this Part may be modified. Special consideration is to be given to the ships with any limitations for their purpose. **【See Guidance】** *(Omitted)* **7.** The ships for navigation in polar waters and the vessels for polar and ice breaking service are to comply with the relevant requirements in **Ch 2 of Guidance for Ships for Navigation in Ice**, and **Ch 3 of Guidance for Ships for Navigation in Ice** respectively, in addition to the requirements in this part. **8.** Ships using low-flashpoint fuels of below 60 °C other than ships carrying liquified gases in bulk and ships carrying CNG in bulk are also to meet with the requirements in Rules for Ships using Low-flashpoint Fuels, in addition to the requirements in this part. *(2018)* **9.** The ships that installed abatement systems to prevent air pollutants are to comply with the relevant requirements in **Guidance for Prevention Systems of Pollution from Ships**, in addition to the requirements in this part. *(2023)* *(Omitted)*	〈Pt 5 Rules〉 (Amendment) Add a reference for Guidance for Prevention Systems of Pollution from Ships 〈application date: the date of contract for construction on or after 1 July. 2023〉 To add the provision referring the Guidance

Present	Amendment	Note
# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 4 Gas Turbines **401. ~ 403. 〈omitted〉** **404. Safety devices** **1.** Gas turbines are to be provided with automatic safety systems and devices for safeguards against hazardous conditions arising from malfunctions in their operation. The design of safety devices is to be evaluated with failure mode and effects analysis. *(2021)* **2. Governors and overspeed protective devices** (1) ~ (2) 〈omitted〉 **3.** Hand trip gear for shutting off the fuel in an emergency is to be provided at the local control position and, where applicable, at the gas turbine control station. *(2021)* **4. Alarms and shutdowns *(2021)*** Gas turbines are to be provided with audible and visible alarming devices, and a quick closing device (shutdown device) which automatically shuts off the fuel supply to the gas turbines as a minimum in listed in **Table 5.2.6**. (hereafter, omitted)	# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 4 Gas Turbines **401. ~ 403. 〈same as the present〉** **404. Safety devices** **1.** Gas turbines are to be provided with automatic safety systems and devices for safeguards against hazardous conditions arising from malfunctions in their operation. The design of safety devices is to be evaluated with failure mode and effects analysis. *(2021)* **2. Governors and overspeed protective devices** (1) ~ (2) 〈same as the present〉 **3.** Hand trip gear for shutting off the fuel in an emergency is to be provided at the local control position and, where applicable, at the gas turbine control station. *(2021)* **4. Alarms and shutdowns *(2021)*** Gas turbines are in principle to be provided with audible and visible alarming devices, and a quick closing device (shutdown device) which automatically shuts off the fuel supply to the gas turbines ~~as a minimum~~ in listed in **Table 5.2.6**. However, alarm and shutdown devices can be added or omitted, taking into account the result of FMEA specified in **Par** 1. *(2023)* (hereafter, same as the present Rules)	〈Pt 5 Rules〉 (Amendment) Reflecting IACS UR M60(Rev.1 Nov 2021) 〈application date: the date of contract for construction on or after 1 Jan. 2023〉 - UR M60 3.1

Present	Amendment	Note
CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS **Section 5 〈New〉**	**CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS** **Section 5 Water-jet propulsion systems *(2023)*** **501. General** **1. Application** (1) The requirements in this Section apply to the water-jet propulsion systems (hereinafter referred to as "propulsion systems") intended for main propulsion and steering driven by high speed engines. (2) For items not specified in this Section, the relevant requirements specified in **Pt 5** and **Pt 6** apply. (3) Equivalency Propulsion systems which do not comply with the requirements of this Section may be accepted provided that they are deemed to be equivalent by the Society according to **Pt 1 Ch 1 105.** **2. Definitions** The terms used in this Section are defined as follows: (1) **Water-jet propulsion systems** are systems that accelerates water sucked from outside the ship by the impeller, ejects it backward, and use the propulsive thrust generated at this time for propulsion and steering of the ship. Includes the following components: (A) Shaftings (main shafts, bearings, shaft couplings, coupling bolts and sealing devices) (B) Water intake ducts (C) Water-Jet pump units (D) steering gears and reversing systems	〈Pt 5 Rules〉 (Amendment) Update and upgrade the requirements for the Water-jet Propulsion Systems and Azimuth or Rotatable Thrusters 〈application date: the date of contract for construction on or after 1 July. 2023〉 - Annex 5-1 1 (1) - Annex 5-1 1 (1) (F)

Present	Amendment	Note
	(2) **Impeller** is a rotating assembly provided with blades to give energy to the water. (3) **Main shaft** is a shaft that transmits power to the impeller blades. (4) **Water intake duct** is the part that leads the water sucked from the water intake to the impeller inlet. (5) **Nozzle** is the part that ejects water accelerated by the impeller. (6) **Deflecter** is the device serving as a rudder by leading the water injected from the nozzle either to port or to starboard. (7) **Reverser** is the device to thrust the ship to go astern by reversing the flow direction of the water injected from the nozzle. (8) **High speed engine** is the high-rotating-speed internal combustion engine specified in **Pt 1, Ch 2, 303. 3** of the Guidance or gas turbine. (9) **Water-jet pump units** are consist of impellers, impeller casings, stators, stator casings, nozzles, bearings, bearing housing and sealing devices. (10) **Stators** are assemblies composed of rows of stationary vanes that reduce any swirl added to water by impellers. (11) **Steering gears and reversing systems** are those systems consisting of deflectors, reversers and steering actuating systems driving defectors or reversers. (12) **Steering actuating system** consists of a steering gear power unit, a steering actuator and, for hydraulic or electrohydraulic steering gears, the hydraulic piping. (13) **Steering system** is a ship's directional control system, including steering gear, steering gear control system and rudder (including the rudder stock) if any, or any equivalent system for applying force on the ship hull to cause a change of heading or course. (14) **Declared steering angle limits** are the operational limits in terms of maximum steering angle, or equivalent, according to manufacturers' guidelines for safe operation, also taking into account the ship's speed or propeller torque/speed or other limitation; the "declared steering angle limits" are to be declared by the steering system manufacturer for each ship specific non-traditional steering means. ship manoeuvrability tests, such as those in the Standards for ship manoeuvrability (IMO Res. MSC.137(76)) are to be carried out with steering angles not exceeding the declared steering angle limits.	

Present	Amendment	Note
	3. Plans and Documents to be Submitted Before the work is commenced, the shipyard or the manufacturers of propulsion systems are to submit plans in triplicate and a copy of documents specified below, to the Society. (1) Plans (A) Particulars, specifications, material specifications, detail of welding procedures (B) General arrangement and sectional assembly drawings (showing the materials and dimensions of various parts including the water intake duct, etc.) (C) Shafting arrangement (showing the arrangements, shapes and construction of the main engine, gear, clutch, coupling, main shaft, main shaft bearing, thrust bearing, sealing device, impeller, etc.) (D) Details of water intake duct (E) Construction of impeller (showing the detailed blade sections, the maximum diameter of blade from the centre of the main shaft, number of blades, and material specifications) (F) Details of bearing and sealing device (including thrust bearing), in the case of roller bearing, together with specifications of such bearings and the calculation sheets for the life times of roller bearings. (G) Details of deflectors and reversers (H) Piping diagrams (hydraulic systems, lubricating systems, cooling water systems and etc.) (I) Arrangements of control systems and diagram of hydraulic and electrical systems (including safety devices, alarm devices and automatic steering) (J) Arrangements and diagram of an alternative source of power (K) Diagram of indication devices for deflector positions (L) Details of hydraulic actuators (2) Documents (A) Torsional vibration calculation sheets and calculation sheets of the bending natural frequency when bending vibration due to self-weight is expected. (B) Strength calculation sheets for deflector and reverser (C) Others deemed necessary by the Society	- Annex 5-1 1 (2)

Present	Amendment	Note
	502. Materials, Construction and Strength **1. Materials** The materials of parts of the propulsion system are to be suitable for service conditions, and the following important components are to comply with the requirements in **Pt 2, Ch 1**. However, the Society may accept to use those made of materials which comply with Korean Industrial Standards or standards as considered equivalent therto. (1) Main shaft, shaft coupling and coupling bolts (2) Nozzle and impeller (3) Impeller casings, stator casings and bearing housings (4) Water intake duct which are composing a part of shell plating (including shaft cover) (5) Mounting flanges and bolts of water-jet pump units (6) Deflectors and reversers **2. Construction and strength** (1) Main shaft The minimum diameter of the main shaft is to be not less than the value determined by the following formula: $$d_s = k \cdot \sqrt[3]{\frac{P}{N}}$$ where: d_s : Required diameter of main shaft (mm) P : Maximum continuous output of main engine (kW) N : Number of revolutions of main shaft at the maximum continuous output (rpm) k : Values shown in **Table 5.3.9**	- Annex 5-1 1 (3)

Present	Amendment	Note

Table 5.3.9 Values of k according to Fitting Method

Shaft material \ Position / Fitting method		Fitting part of shaft with impeller and shaft coupling				Other positions
		With key way	With spline	With flange coupling	Force fitting	
Carbon steel or low alloy steel	Shaft of Class 2	105	108	102	102	105
	Shaft of Class 1	a_1=100 a_2=80 in Notes	a_1=102 a_2=82 in Notes	a_1=98 a_2=78 in Notes		a_1=100 a_2=80 in Notes
Austenitic stainless steel						
Precipitation hardened stainless steel		80	82	78	78	80

NOTES

For $200 \leq \sigma_y \leq 400$

$k = a_1 - 0.1(\sigma_y - 200)$

For $\sigma_y > 400$

$k = a_2$

σ_y : Specified yield point or 0.2 % of proof strength of shaft material ($\mathrm{N/mm^2}$)

(2) Shaft couplings and coupling bolts

(A) The minimum diameter of the shaft coupling bolts at the joining face of the couplings is to be not less than the value determined by the following formula:

$$d_b = 15{,}300\sqrt{\frac{P}{N} \cdot \frac{1}{nDT_b}}$$

where:

d_b : Required diameter of shaft coupling bolt (mm)

P : Maximum continuous output of main engine (kW)

N : Number of revolutions of main shaft at the maximum continuous output (rpm)

Present	Amendment	Note
	n : Number of bolts D : Pitch circle diameter (mm) T_b : Specified tensile strength of bolt material (N/mm^2) (B) The thickness of the shaft coupling flange at the pitch circle is not to be less than the required diameter of shaft coupling bolts determined by the formula in (A) above. However, it is not to be less than 0.2 times the required diameter of the corresponding shaft. (C) The fillet radius at the base of the flange is not to be less than 0.08 times the diameter of the shaft. The fillets are to have a smooth finish. Where the fillet is recessed in way of nuts and bolt heads, the fillet radius at the base of the flange is not to be less than 0.125 times the diameter of the shaft. (3) Water intake duct, etc. The water intake duct, impeller casing and nozzle are to have strength according to the design pressure, and consideration is to be given for corrosion. (4) Impeller blade The strength of the impeller blade at root is to be determined so that the following formula is satisfied. In this case, the allowable stress value of the material is, in principle, to be 1/1.8 of the specified yield point (or 0.2 % of proof strength). $S \geq \frac{5.8 \times 10^5 P}{Lt^2 Z N_i} + 2.2 \times 10^{-7} D^2 N_i^2$ where: S : Allowable stress of impeller material (N/mm^2) P : Maximum continuous output of main engine (kW) N_i : Value obtained by dividing the number of revolutions of impeller by 100 (rpm/100) Z : Number of impeller blades L : Width of impeller blade at root (mm) t : Maximum thickness of impeller blade at root (mm) D : Diameter of impeller (mm)	

Present	Amendment	Note
	3. Torsional vibration and bending vibration of main shaft (1) General (A) Notwithstanding the requirements specified in above **501. 3** (2) (A) concerning to submission of the torsional vibration calculation sheets for the main shafting systems, submission of those may be omitted in cases where the shafting system is of the same type as previously approved one or it can be readily assumed that the shafting system has no excessive vibration stress. (B) Measurements of torsional vibration to confirm accuracy of the estimated value are to be carried out. In cases, however, submission of the torsional vibration calculation sheets is omitted according to the requirements in above (A), or the Society considers that there is no critical vibration within the service speed range, the measurement of torsional vibration may be omitted. (2) Allowable limit of torsional vibration stress The torsional vibration stress of the shafting system is to be in accordance with the following requirements within the service speed range of the shafting system. (A) The torsional vibration stresses produced when the revolutions of the engine are within the range from 80 % to 105 % of maximum continuous revolutions are not to exceed τ_1 given in following: $\tau_1 = A - B \times \lambda^2 \quad (\lambda \leq 0.9)$ $\tau_1 = C \quad (0.9 < \lambda \leq 1.05)$ where: τ_1 : Allowable limit of torsional vibration stresses $(\mathrm{N/mm^2})$ λ : Ratio of the number of maximum continuous revolutions to the number of service revolution of the engine A, B and C : Values shown in **Table 5.3.10**	

Present	Amendment	Note

Table 5.3.10 Values of A, B and C

	Carbon steel or low alloy steel		Austenitic stainless steel	Martensite precipitation hardened type stainless steel
	Shaft of Kind 1	Shaft of Kind 2		
A	24.3	9.0	26.4	39.6
B	24.1	6.2	26.4	37.1
C	4.8	4.0	5.0	9.6

In case where the specified tensile strength of materials of carbon steel shafts or low alloy steel shafts of Kind 1 exceeds 400 $\mathrm{N/mm^2}$ the value of τ_1 may be increased by multiplying the factor k_m given in the following formula:

$$k_m = (T_s + 160)/560$$

where:

k_m : Correction factor

T_s : Specified tensile strength of main shaft material ($\mathrm{N/mm^2}$)

(B) The torsional vibration stresses of the main shaft within the range below and at 80 % of the maximum continuous revolutions of the engine are not to exceed τ_2 given in following. In case where torsional vibration stresses exceed the value calculated by the formula of τ_1 shown in (A), the barred speed ranges are to be imposed and can be approved on condition for transient operation by passing through rapidly this range.

$$\tau_2 = 2.3\tau_1$$

where:

τ_2 : Allowable limit of torsional vibration stresses for transient operation within the range of $\lambda \leq$ 0.8 ($\mathrm{N/mm^2}$)

Present	Amendment	Note
	(3) Bending vibration For the main shafting system of the propulsion system, consideration is to be given to natural vibrations due to bending of the shafting system. **503. System design** **1. Number of propulsion systems** (1) In general, a minimum of two propulsion systems are to be provided for ships. Propulsion systems are to be designed so that the failure of any one system does not result in the performance of all of the other systems. (2) In cases where the ship is not engaged in international voyage, a single propulsion system installation may be considered notwithstanding the requirements specified in above (1). In this case, the functions of propulsion, steering and reversing are to be designed with redundancy in the following arrangements: (A) At least two prime movers are to be provided. (B) At least two steering actuating systems for steering and reversing are to be provided. (C) Electric supply is to be maintained or restored immediately in cases where there is a loss of any one of the main generators in service so that the functioning of at least one of prime movers and one of steering actuating systems, is maintained by the arrangements specified in **504. 1**. **2. General of steering gears and reversing systems** (1) The steering systems of water-jet propulsion systems are to comply with the requirements for the performance and arrangement of non-traditional steering systems in **Annex 5-1** of the Guidance. (2) The reverser is to be such that it provide sufficient power for going astern to secure proper control of the ship in all normal circumstances, and when transferred from ahead to astern runs, it is to have an astern power to provide effective breaking for the ship. (3) The reverser is to have sufficient strength against the thrust at the maximum astern power output.	- Annex 5-1 1 (4) (A) - Annex 5-1 1 (4) (B)

Present	Amendment	Note
	(4) The design pressure for calculations to determine the scantlings of piping and other components of steering gear subject to internal hydraulic pressure are to be at least 125% of the maximum working pressure expected under the worst permissible operating condition, taking into account any pressure which may exist in the low pressure side of systems. Design pressures are no to be less than relief valve setting pressures.	
	3. Steering actuating systems	
	(1) Where pressure vessels such as accumulators, etc. are used in steering actuating systems, their strength is to comply with the relevant requirements in **Ch 5**.	- Annex 5-1 1 (4) (C)
	(2) Hydraulic piping systems used in steering actuating systems are to comply with the relevant requirements in **Ch 6** in addition to this **Par**.	
	(3) The strength of steering actuators is to comply with the requirements specified in **Ch 7, 404**.	
	(4) The construction of oil seals in steering actuators is to comply with the requirements specified in **Ch 7, 405**.	
	(5) Suitable arrangements to maintain the cleanliness of the hydraulic fluid are to be provided taking into consideration the type and design of the steering actuating system.	
	(6) Arrangements for bleeding air from steering actuating system are to be provided where necessary.	
	(7) Relief valves are to be fitted to any part of the hydraulic system which can be isolated and in which pressure can be generated from the power source or from external forces. The setting pressure of the relief valves is not to be less than 1.25 times the maximum working pressure but not to exceed the design pressure. The minimum discharge capacity of the relief valves are not to be less than total capacity of pumps which provided power for steering actuators. Under such conditions the rise in pressure is not to exceed 10 % of the setting pressure. In this regard, due consideration is to be given to the extreme foreseen ambient conditions in respect of oil viscosity. **【See Guidance】**	
	(8) A low level alarm is to be provided for each hydraulic fluid reservoir to give the earliest practicable indication of hydraulic fluid leakage. This alarm is to be audible and visual and to be given on the navigating bridge and at a position from which the main engine is normally controlled.	

Present	Amendment	Note
	(9) In cases where flexible hoses are used for steering actuating systems, the construction and strength of such flexible hoses are to comply with the requirements specified in Ch 6, 102. 5.	
	4. Stoppers	- Annex 5-1 1 (4) (D)
	(1) Propulsion systems are to be provided with stoppers for deflectors in order to limit steering angles.	
	(2) Propulsion systems are to be provided with positive arrangements, such as limit switches, for stopping deflectors before the stoppers are reached. These arrangements are to be activated by the actual movements of deflectors and not through control systems for steering. Mechanical links may be used for this purpose.	
	5. Lubricating oil systems	- Annex 5-1 1 (4) (J)
	(1) Lubricating oil systems for propulsion systems are to comply with those relevant requirements specified in Ch 6, Sec 8.	
	(2) Lubricating oil arrangements of propulsion systems are to be provided with alarm devices which give visible and audible alarms on navigation bridge and at positions from which main engines are normally controlled in the event of any failure of the supply of lubricating oil or an appreciable reduction of lubricating oil pressure.	
	6. Sealing devices	- Annex 5-1 1 (4) (L)
	The materials, constructions and arrangements of sealing devices for shaftings and water-jet pump units, other than gland packing type sea water sealing devices, are to be approved by the Society.	

Present	Amendment	Note
	504. Electrical installations **1. Main source of electrical power 【See Guidance】** (1) Where the main source of electrical power is necessary for propulsion, steering and reversing of the ship, the system is to be so arranged that electric supplies to relevant equipment are maintained, or restored immediately in the case of a loss of any one of the generators in service, to ensure the functions of propulsion, steering and reversing of at least one of the propulsion systems, its associated control systems and its indication devices for deflectors positions by the following arrangements: (A) Where the electrical power is normally supplied by one generator, adequate provisions are to be made for automatic starting and connecting to main switchboards of standby generators of sufficient capacity to maintain the functions of the above with automatic restarting of important auxiliaries including sequential operations in cases where there is a loss of electrical power of the generator in operation. (B) Where the electrical power is normally supplied by more than one generator simultaneously in parallel operations, provisions are to be made to ensure that, in cases where there is a loss of electrical power of one of generating sets, the remaining ones are kept in operation to maintain the functions of the above. **2.** Where the propulsion power exceeds 2,500 kW per propulsion system, an alternative source of power is to be provided in accordance with the following. **【See Guidance】** (1) Any alternative source of power is to be capable of automatically supplying alternative power within 45 seconds to the deflector compling with the following requirement and its associated control system and its indication devices for deflector positions. (A) The alternative source of power is to be capable of changing direction of the ship's directional control system from one side to the other at declared steering angle limits at an average rotational speed of not less than 0.5 degree/s with the ship running ahead at one half of the maximum ahead speed or 7 knots, whichever is greater. (2) In every ship of 10,000 gross tonnage and upwards, the alternative power supply is to have a capacity for at least 30 min of continuous operation and in any other ship for at least 10 min. (3) The alternative source of power is to be either: (A) emergency source of electric power; or (B) an independent source of power located in the steering gear compartment and used only for this purpose.	- Annex 5-1 1 (4) (E) - Annex 5-1 1 (4) (F)

Present	Amendment	Note
	(4) Automatic starting arrangements for generators or prime movers of pumps used as the independent source of power specified in (3) (B) are to comply with the requirements for starting devices and performance in **Pt 6, Ch 1, 203, 6**. **3. Electrical Installations for Steering gears and Reversing systems 【See Guidance】** Where hydraulic pumps for steering actuating systems are driven by electric motors, electrical installations for steering and reversing systems are to comply with the following requirements. (1) Steering system of each propulsion system is to be served by at least two exclusive circuit fed directly from the main switchboard. However, one of the circuits may be supplied through the emergency switchboard. An auxiliary electric or electrohydraulic steering gear associated with a main electric or electrohydraulic steering gear may be connected to one of the circuits supplying this main steering gear. The circuits supplying an electric or electrohydraulic steering gear shall have adequate rating for supplying all motors which can be simultaneously connected to them and may be required to operate simultaneously. (2) Cables used in those exclusive circuits required in above (1) are to be separated as far as practicable throughout their length. (3) Audible and visual alarms are to be given on navigation bridges in the event of any power failure to electric motors for hydraulic pumps. (4) Means for indicating that electric motors for hydraulic pumps are running are to be installed on navigation bridges and positions from which main engines are normally controlled. (5) Short circuit protection and overload alarms are to be provided for such circuits and motors respectively. Overload alarms are to be both audible and visible and are to be situated in conspicuous positions in places from which main engines are normally controlled. (6) Protection against excess current, including starting currents, if provided, is to be for not less than twice the full load current of those motors or circuits so protected, and to be arranged to permit the passage of any appropriate starting currents. (7) Where a three-phase supply is used, alarms are to be provided that will indicate failure of any one of the supply phases. Such alarms are to be both audible and visible and are to be situated in conspicuous positions in places from which main engines are normally controlled.	- Annex 5-1 1 (4) (G)

Present	Amendment	Note
	505. Control systems	- Annex 5-1 1 (4) (H)
	1. General	
	(1) The requirements for controls not specified in this Section are to be complied with the requirements specified in **Ch 7, Sec 3**.	
	(2) Reversing systems are to be controlled in local control stations for main propulsion or in steering stations. Means are to be provided in local control stations for main propulsion or in steering stations for disconnecting any control systems, operable from navigation bridges, from reversing systems they serve.	
	(3) In the event of any failure of remote control devices for reversing systems, preset positions of reversers are to be maintained until control of such systems can be gained at local control stations for main propulsion or in steering stations.	
	(4) Independent control devices are to be provided for propulsion systems. Where multiple propulsion systems are designed to operate simultaneously, they may be control by a single device such as a joystick.	
	(5) Those control devices specified in above (4) are to be so designed that any failure of one such control device does not result in the failure of the others.	
	(6) For those items concerned with safety, alarms and control devices for propulsion systems not specified in this Section, the related requirements specified in **Pt 9, Ch 3** are to apply.	
	2. Monitoring	- Annex 5-1 1 (4) (I)
	(1) Indication devices for deflector positions	
	(A) Deflector positions are to be indicated on navigation bridges and in steering stations.	
	(B) Indication devices for deflector positions are to be independent of control systems.	
	(2) Indication devices for reverser positions Reverser positions are to be indicated on navigation bridges and at control stations including steering stations and monitoring stations for propulsion systems.	
	(3) Indication devices for impeller speed Impeller speeds are to be indicated on navigation bridges and at control stations including steering stations and monitoring stations for propulsion systems.	

Present	Amendment	Note
	506. Tests and Inspections **1. Shop tests** (1) Hydrostatic tests at pressures 1.5 times design pressure for impeller casings, stator casings and bearing housings are to be carried out. (2) Hydrostatic tests are to be carried out at a pressure of at least 0.2 MPa or 1.5 times the design pressure whichever is higher for the forward bearing tube of the main shaft and the sealing device. (3) The tests specified in **Ch 7, 501.** for steering actuating systems are to be carried out. (4) Performance tests of control, safety and alarm devices are to be carried out. (5) For the impellers of the water-jet pump units, dynamic balancing tests are to be carried out. **2. Tests after installation on board** (1) Leak tests of hydraulic piping systems at pressures at least equal to the maximum working pressure after installed on board are to be carried out. (2) Leak tests of sealing devices for water-jet pump units at working oil pressure are to be carried out. (3) Operation tests of propulsion systems as far as practicable are to be carried out. **3. Sea trials** The following tests are to be carried out during sea trials. However, those tests other than tests required in (2) and (3) may be carried out either at dockside or in dry dock. (1) Measurement of torsional vibration is to be in accordance with **Ch 4, 103**. (2) Tests on steering capability specified in **503. 2** (1). (3) Test on operation of controls for steering and reversing systems, including tests on change-overs of control systems between navigation bridges and steering stations, and change-overs between manual steering and automatic steering, if automatic steering is provided. (4) Tests on measures for maintaining power supplies and on the alternative source of power required by **504. 1** and **2**. (5) Tests on means of communication between navigation bridges and steering stations, and between engine rooms and steering stations. (6) Tests on the functioning of relief valves for preventing over-pressure. (7) Tests on the functioning of alarm and safety devices, and indication devices for deflector positions, reverser positions and impeller speed, and running indicators of electric motors for steering actuating systems. (8) Tests on the functioning of stoppers. (9) Ship manoeuvrability tests, such as according to Resolution MSC.137(76) on Standards for ship manoeuvrability, are to be carried out with steering angles not exceeding the declared steering angle limits.	- Annex 5-1 1 (5)

Present	Amendment	Note
Section 6 〈New〉	**Section 6 Azimuth thrusters *(2023)***	〈Pt 5 Rules〉
	601. General	(Amendment) Update and upgrade the requirements for the Water-jet Propulsion Systems and Azimuth or Rotatable Thrusters 〈application date: the date of contract for construction on or after 1 July. 2023〉
	1. Application	
	(1) The requirements in this Section apply to ships equipped with azimuth thrusters (including pod thrusters) intended for main propulsion and steering.	
	(2) For items not specified in this Section, the relevant requirements specified in **Pt 5** and **Pt 6** apply.	
	(3) Equivalency Propulsion systems which do not comply with the requirements of this Section may be accepted provided that they are deemed to be equivalent by the Society according to **Pt 1 Ch 1 105**.	- Annex 5-1 2 (1)
	2. Definitions	
	The terms used in this Section are defined as follows.	
	(1) **Thruster** is a unit equipped with a propeller (impeller) in order to produce thrust.	- UR draft 3.
	(2) **Azimuth thruster** is a thruster capable of providing omni-directional thrust by being rotated around the vertical axis. Azimuth thruster is made up of the following components. (A) Propellers and propeller shafts (B) Gears, clutches and gear shafts for transmission of propulsion torque (when integrated in thrusters) (D) Azimuth thruster casings (E) Steering gears	

Present	Amendment	Note
	(3) **Rotating podded electrical thruster** (hereinafter referred to as "**pod thruster**") is an azimuth thruster with the propeller directly driven by the electrical prime mover. (4) **Azimuth thruster casing** is watertight structures including steering columns (or struts), pods, propeller nozzles, etc. (5) **Steering system** is a ship's directional control system, including steering gear, steering gear control system and rudder (including the rudder stock) if any, or any equivalent system for applying force on the ship hull to cause a change of heading or course. (6) **Steering-propulsion unit** is a unit intended for both propulsion and steering of the ship (for example, an azimuth thruster or a pod thruster). (7) **Steering gear** is the machinery, actuators, power units, and auxiliary equipment applied to turn the rudder or thruster or equivalent about the axis of rotation in both directions for the purpose of steering the ship. (8) **Steering actuating system** consists of a steering gear power unit, a steering actuator and, for hydraulic or electrohydraulic steering gears, the hydraulic piping. (9) **Steering actuator** is a steering gear component which converts power into mechanical action to control the rotation of the rudder or thruster or equivalent. (A) In case of electric steering: electric motor and driving pinion (B) In case of electro hydraulic steering: hydraulic motor and driving pinion (10) **Peak steering torque** is the maximum expected torque corresponding to a large course change in rough sea. (11) **Working steering torque** is the maximum expected torque during sea trials. (12) **Course keeping steering torque** is the torque for course keeping at small steering angles. (13) **Declared steering angle limits** are the operational limits in terms of maximum steering angle, or equivalent, according to manufacturers' guidelines for safe operation, also taking into account the ship's speed or propeller torque/speed or other limitation; the "declared steering angle limits" are to be declared by the steering system manufacturer for each ship specific non-traditional steering means. ship manoeuvrability tests, such as those in the Standards for ship manoeuvrability (IMO Res. MSC.137(76)) are to be carried out with steering angles not exceeding the declared steering angle limits.	

Present	Amendment	Note
	3. Plans and Documents to be Submitted	- Annex 5-1 2 (2)
	Before the work is commenced, the shipyard or the manufacturers of thrusters are to submit plans in triplicate and a copy of documents specified below, to the Society.	
	(1) Plans	
	(A) Particulars, specifications, material specifications, details of welding procedures	
	(B) General arrangement and sectional assembly drawings (showing the materials and dimensions of various parts including nozzle)	
	(C) Details of fixed pitch/controllable pitch propeller, shafting arrangement, gears, shaft couplings, coupling bolts, clutch and gear shafts	- UR draft 5.5
	(D) Details of steering gears (details of steering actuating systems, gears, bearings, etc.)	
	(E) Sealing arrangements, exposed to seawater	- UR draft 5.3
	(F) Piping systems (hydraulic systems, lubricating systems, cooling water systems, etc.)	
	(G) Details of azimuth thruster casings	
	(H) Arrangements of control systems and diagram of hydraulic and electrical systems (including safety devices, alarm devices and automatic steering)	
	(I) Arrangements and diagrams of an alternative source of power	
	(J) Diagrams of indication devices for azimuth angles	
	(2) Documents	
	(A) Torsional vibration calculation sheets of shafting	
	(B) Strength calculations of fixed pitch/controllable pitch propeller blade thickness, pitch control mechanism, shafts, shaft coulings, gears, azimuth thruster casings, load carrying components of the steering gear	- UR draft 5.4
	(C) Operating manual	
	(D) Service life calculations of roller bearings and propeller pull-up length calculations sheets, etc.	
	(E) Others considered to be necessary by the Society	

Present	Amendment	Note
	602. Materials, Construction and Strength	- Annex 5-1 2 (3)
	1. Materials used for azimuth thruster casings, bedplates for supporting thrusters and the construction of the torque-transmitting components of thrusters are to comply with the requirements in **Pt 2, Ch 1**.	
	2. Materials, constructions and strength of shaftings, propellers, gears and steering gears are to be applied with appropriate modifications of the relevant requirements of **Ch 3**, **Ch 4** and **Ch 7**.	
	3. Materials, constructions and strength of piping systems and auxiliaries are to be applied with appropriate modifications of the relevant requirements of **Ch 6**.	
	603. System design	
	1. Number of thrusters	- Annex 5-1 2 (4)
	(1) In general, a minimum of two thrusters is to be provided for ships. Thrusters are to be designed so that the failure of one thruster does not result in the performance of any other thrusters.	
	(2) In cases where the ship is not engaged in international voyage, a single thruster installation may be considered notwithstanding the requirements specified in above (1). In this case, the functions of propulsion, steering and reversing are to be designed with redundancy in the following arrangements:	
	(A) At least two prime movers are to be provided.	
	(B) At least two independent steering actuating systems are to be provided. However, such steering actuating systems may have one gear wheel.	
	(C) Electric supply is to be maintained or restored immediately in the case of loss of any main generators in service so that the functioning of at least one of prime movers and one of steering actuating systems, is maintained by the arrangements specified in **604. 1**.	

Present	Amendment	Note
	2. Steering gears	- Annex 5-1 2 (4) (B)
	(1) The steering gears of azimuth thrusters are to comply with the requirements for the performance and arrangement of non-traditional steering systems in **Annex 5-1** of the Guidance.	
	(2) Design pressure for calculations to determine the scantlings of piping and other components of steering gears subject to internal hydraulic pressure are to be at least 125% of the maximum working pressure expected under the worst permissible operation conditions after taking into account any pressure which may exist in low pressure sides of such systems. Design pressures are not to be less than relief valve setting pressures.	
	(3) The rate of turning for steering gears is to be not less than 1.0 rpm in static conditions of ships if astern power is obtained by turning steering-propulsion unit.	
	(4) Steering-propulsion units are to be prevented from sudden turning in the case of single failure either in the steering gear or in control system power supply. Where brakes are provided they are to be of the fail-to-close type and their aggregate capacity is not to be less than peak steering torque. In the above the slewing ring may be considered as a non-failing component. To fulfil the above requirement it will normally be required with at least two pinions acting on the slewing ring.	- UR draft 7.2.1
	(5) The steering gear is to be provided with a device limiting the maximum torque in the steering gear. The load limiting device is to have a set value not less than the peak steering torque.	- UR draft 7.2.2
	(6) The steering gear is to be designed for the highest of the peak steering torque, brake torque and load limiting device set point. Additionally, it is to be dimensioned for high cycle loads with respect to course keeping and working torque.	- UR draft 7.2.3

Present	Amendment	Note
	3. Steering actuating systems Where the steering actuating system is hydraulic or electro-hydraulic, the steering actuating system driven by hydraulic power is to be installed in accordance with the following requirements. (1) Where pressure vessels such as accumulators, etc. are used in the steering actuating systems, their strength is to comply with the relevant requirements in **Ch 5**. (2) Hydraulic piping systems used in the steering actuating systems are to comply with the relevant requirements in **Ch 6** in addition to this **Par**. (3) Suitable arrangements to maintain the cleanliness of hydraulic fluids are to be provided after taking into consideration the types and designs of such hydraulic systems. (4) Arrangements for bleeding air from hydraulic systems are to be provided where necessary. (5) Relief valves are to be fitted to any part of hydraulic systems which can be isolated and in which pressure can be generated from power sources or from external forces. The setting pressure of such relief valves is not to be less than 1.25 times the maximum working pressure but not to exceed the design pressure. The minimum discharge capacity of relief valves are not to be less than 110% of the total capacity of pumps which provide power for hydraulic motors. Under such conditions, any rise in pressure is not to exceed 10% of the setting pressure. In this regard, due consideration is to be given to any extreme foreseen ambient conditions in respect to oil viscosity. (6) Low level alarms are to be provided for hydraulic fluid tanks to give the earliest practicable indication of any hydraulic fluid leakage. These alarm are to be audible and visual and to be given on navigation bridge and at positions from which main engines are normally controlled. (7) In cases where flexible hoses are used for hydraulic systems, the construction and strength of such flexible hoses are to comply with the requirements specified in **Ch 6, 102. 5**.	- Annex 5-1 2 (4) (C)

Present	Amendment	Note
	4. Lubricating oil systems	- Annex 5-1 2 (4) (I)
	(1) Lubricating oil systems for thrusters are to comply with the relevant requirement specified in **Ch 6, Sec. 8**.	
	(2) Lubricating oil arrangements of thrusters are to be provided with alarm devices which give visible and audible alarms on navigation bridges and at positions from which main engines are normally controlled in the event of any failure of the supply of lubricating oil or any appreciable reduction of lubricating oil pressure.	
	5. Cooling systems	- Annex 5-1 2 (4) (J)
	(1) Cooling systems of thrusters are to comply with the requirements specified in **Ch 6, Sec. 7**.	
	(2) The ventilation and cooling systems are to maintain the machinery and equipment of steering-propulsion units within the temperatures for which they were designed to operate.	- UR draft 9.1
	(3) Where water cooling is used the cooler is to be arranged to avoid water leakage inside the steering-propulsion units.	- UR draft 9.2
	6. Sealing Devices	
	Sealing devices for steering parts of steering propulsion units and propeller shafts are to be approved by the society in their materials, construction and arrangement.	- Annex 5-1 1 (4) (D)
	7. Position of steering gears	- Ch 7, 208. & UR draft 11
	(1) The steering gears of steering-propulsion units are to be installed in an enclosed compartment readily accessible and, as far as possible, separated from machinery spaces.	
	(2) The steering gear compartment of steering-propulsion unit is to be provided with suitable arrangements to ensure working access to steering gear machinery and controls. These arrangements are to include handrails and gratings or other non-slip surfaces to ensure suitable working conditions in the event of hydraulic fluid leakage.	

Present	Amendment	Note
	604. Electrical installations **1. Main source of electrical power 【See Guidance】** (1) Where the main source of electrical power is necessary for propulsion and steering of the ship, the system is to be so arranged that electric supplies to relevant equipment are maintained, or restored immediately in the case of a loss of any one of the generators in service, to ensure the functions of propulsion and steering of at least one thruster, its associated control systems and its indication devices for azimuth angles by the following arrangements: (A) Where the electrical power is normally supplied by one generator, adequate provisions are to be made for the automatic starting and the connecting to main switchboards of standby generators of sufficient capacities to maintain the functions of the above with automatic restarting of important auxiliaries, including sequential operations, in cases of loss of electrical power to generators in operation. (B) Where the electrical power is normally supplied by more than one generator simultaneously in parallel operations, provisions are to be made to ensure that, in cases where there is a loss of electrical power to one of such generating sets, the remaining ones are kept in operation to maintain the functions of those above. **2.** Where the propulsion power exceeds 2,500 kW per thruster, an alternative source of power is to be provided in accordance with the following. **【See Guidance】** (1) Any alternative source of power is to be capable of automatically supplying alternative power within 45 seconds to the steering gear complying with the following requirement and its associated control system and its indication devices for azimuth angle. (A) The alternative source of power is to be capable of changing direction of the ship's directional control system from one side to the other at declared steering angle limits at an average rotational speed of not less than 0.5 degree/s with the ship running ahead at one half of the maximum ahead speed or 7 knots, whichever is greater. (2) In every ship of 10,000 gross tonnage and upwards, the alternative power supply is to have a capacity for at least 30 min of continuous operation and in any other ship for at least 10 min.	- Annex 5-1 2 (4) (E) - Annex 5-1 2 (4) (F)

Present	Amendment	Note
	(3) The alternative source of power is to be either: (A) emergency source of electric power; or (B) an independent source of power located in the steering gear compartment and used only for this purpose. (4) Automatic starting arrangements for generators or prime movers of pumps used as the independent source of power specified in (3) (B) are to comply with the requirements for starting devices and performance in **Pt 6, Ch 1, 203, 6**. **3. Electrical installations for steering-propulsion units 【See Guidance】** Electrical installations for steering-propulsion units are to comply with the following requirements. (1) Steering system of each thruster is to be served by at least two exclusive circuit fed directly from the main switchboard. However, one of the circuits may be supplied through the emergency switchboard. An auxiliary electric or electrohydraulic steering gear associated with a main electric or electrohydraulic steering gear may be connected to one of the circuits supplying this main steering gear. The circuits supplying an electric or electrohydraulic steering gear shall have adequate rating for supplying all motors which can be simultaneously connected to them and may be required to operate simultaneously. (2) Cables used in those exclusive circuits required in above (1) are to be separated as far as practicable throughout their length. (3) Audible and visual alarms are to be given on navigation bridges and at the position from which the main engine is normally controlled in the event of any power failure to electric motors for propulsion and steering. (4) Means for indicating that electric motors for steering are running are to be installed on navigation bridges and those positions from which main engines are normally controlled. (5) Short circuit protection and overload alarms are to be provided for such circuits and motors respectively. Overload alarms are to be both audible and visible and are to be situated in conspicuous positions in those places from which main engines are normally controlled. (6) Any protection against excess current, including starting currents, if provided, is to be for not less than twice the full load current of motors or circuits so protected, and is to be arranged to permit passage of appropriate starting currents. (7) Where a three-phase supply is used, alarms are to be provided that will indicate failure of any one of the supply phases. Such alarms are to be both audible and visible and are to be situated in conspicuous positions in places from which main engines are normally controlled.	- Annex 5-1 2 (4) (G)

Present	Amendment	Note
	605. Control systems	- Annex 5-1 1 (4) (H)
	1. General	
	(1) The requirements for controls not specified in this **Section** are to be complied with the requirements specified in **Ch 7, Sec 3**.	
	(2) Independent control devices are to be provided for thrusters. Where multiple thrusters are designed to operate simultaneously, they may be control by a single device such as a joystick.	
	(3) Those control devices specified in above (2) are to be so designed that a failure of any one control device does not result in the failure of the others.	
	(4) It is to be possible to override operational limitations (e.g. steering angle limits) dedicated to equipment protection by remotely controlling thrusters from the navigating bridge, when required to initiate an emergency manoeuvre. The override procedure is to be documented in the operating manual of the unit and displayed at its control position(s).	- UR draft 4.4
	2. Monitoring	- UR draft 10.1
	(1) The monitoring systems are to provide at least the following and individual indications are to be provided on the bridge. (A) Overload of prime mover and steering gear driver (B) Propeller speed (C) Propeller pitch for CP propeller (D) Direction of thrust and/or direction of rotation for fixed propeller (E) Angular position of steering-propulsion units (F) Electrical supply to the alarm and monitoring systems available (G) Electrical supply to the steering gear available	
	(2) Indication of the angular position of steering-propulsion units is to be independent from the control system and also be locally indicated in steering-propulsion unit's compartment.	

Present	Amendment	Note
	3. Alarms Audible and visual alarms are to be provided on bridge and at the position from which the main engine is normally controlled to indicate the failure scenarios in **Ch 7, 302. 1** and the following. (1) lowering of liquid level of hydraulic fluid tanks caused by hydraulic leakage from steering actuating system (2) power failure to electric motor for propulsion and steering (3) overload of prime mover and steering gear driver (4) lowering of lubricating oil pressure (5) high temperature of electric motor cooling medium inlet/outlet (6) sea water ingress into propeller pods (for pod thrusters) (7) potential hydraulic leakage from actuating system, found and indicated at the earliest (as applicable) (8) lowering of hydraulic oil pressure (as applicable) (9) high temperature of lubricating oil (as applicable)	- UR draft 10.1

Present	Amendment	Note
	606. Additional requirements for pod thrusters	
	1. Means to detect any ingress of sea water into propeller pods are to be provided, and audible and visual alarms are to be given on navigation bridges and at positions from which main engines are normally controlled.	- Annex 5-1 2 (5)
	2. Means for discharging sea water from propeller pods are to be provided.	
	3. Where cooling fans are provided for propulsion motors, main cooling fans with sufficient capacities at maximum output of propulsion motors as well as auxiliary cooling fans with sufficient capacities at normal output of propulsion motors are to be provided. These cooling fans are to be arranged so that they can easily changed over. However, such auxiliary fans may be omitted provided that exclusive cooling fans are provided for thrusters.	
	4. Where cooling fans are provided for propulsion motors, control means for stopping such fans and closing any inlets and outlets of air for such fans from safe positions in the case of fire, are to be provided.	
	5. For pods providing direct access to their interior space for maintenance and examination, the arrangement is to ensure protection to both equipment and personnel.	- UR draft 12.3
	607. Tests and Inspections	
	1. Shop tests	- Annex 5-1 2 (6)
	(1) Tests and inspections of shafting arrangement, propellers, gears and steering systems are to be applied with appropriate modifications of the relevant requirements of **Ch 3** and **Ch 7**.	
	(2) Tests and inspections of piping systems and auxiliaries such as hydraulic systems, lubricating oil systems and cooling systems are to be applied with appropriate modifications of the relevant requirements of **Ch 6**.	
	(3) After assembly, azimuth thruster casings are to be carried out pressure tests at the larger value between 0.2 MPa and the following pressure of a water head equivalent to 1.5 D or 2 d whichever is smaller. However, airtight tests may be acceptable for propeller nozzles at pressures of 0.05 MPa.	
	where:	
	(A) D : The depth of ship (m)	
	(B) d : The design maximum load draught (m)	

Present	Amendment	Note
	2. Tests after installation on board (1) Leak tests of sealing devices for propeller shafts and steering gears are to be carried out at working pressure after installation on board. (2) Leak tests of hydraulic systems for steering gears are to be carried out at pressures at least equal to maximum working pressures after installation on board. However, when it is difficult to carry out such tests after installation on board, such tests may be carried out as shop tests. (3) Operation tests of the thruster, including the following, is to be carried out. (A) Smooth operation of the manually controlled turning mechanism (B) Operation of the reduction gear and seals (C) Turning time, pressure and temperature of the systems (4) If applicable, performance tests (excluding discharging devices) for the arrangement specified in **606.** is to be carried out. **3. Sea trials** The following tests are to be carried out during sea trials. However, those tests other than tests required in (2) and (3) may be carried out either at dockside or in dry dock. Also, when it is difficult to carry out tests on the functioning of relief valves after installation on board, these tests may be carried out as shop tests. (1) Torsional vibration of shafting are to be applied with the requirements of **Ch 4, 103.**. (2) Tests on steering capability specified in **603. 2** (1) and (3). (3) Tests on the operation of controls for steering, including tests on change-overs of control systems between navigation bridges and azimuth thruster compartments, and change-overs between manual steering and automatic steering, if automatic steering is provided. (4) Tests on measures for maintaining power supplies and on the alternative source of power required by **604. 1** and **2**. (5) Tests on means of communication between navigation bridges and the azimuth thruster compartments, and between engine rooms and azimuth thruster compartments. (6) Tests on the functioning of relief valves for preventing over-pressure. (7) Tests on the functioning of monitoring, alarms and safety devices. (8) Ship manoeuvrability tests, such as according to Resolution MSC.137(76) on Standards for ship manoeuvrability, are to be carried out with steering angles not exceeding the declared steering angle limits.	- UR draft 14.2

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CHAPTER 5 BOILERS AND PRESSURE VESSELS

Section 3 Pressure Vessels

301. ~ 318. 〈omitted〉

319. Tests and inspections

1. Hydraulic tests

Pressure vessels and their fittings attached directly to a pressure vessel are to be subjected to hydraulic test according to **Table 5.5.17** after construction in the presence of the Surveyor. **【See Guidance】**

Table 5.5.17 Hydraulic Test Pressure

Item	Test pressure
Class 1 and Class 2 pressure vessels(1)	1.5 times the design pressure
Heat exchangers and other special vessels not applicable to the above	To be determined in each case
Fittings directly affected by pressure of Class 1 and Class 2 pressure vessels	2 times the design pressure of the pressure vessel
NOTE : (1) Class 3 pressure vessels considered necessary by the Society are to be subjected to hydraulic test.	

(hereafter, omitted)

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CHAPTER 5 BOILERS AND PRESSURE VESSELS

Section 3 Pressure Vessels

301. ~ 318. 〈same as the present〉

319. Tests and inspections

1. Hydraulic tests

Pressure vessels and their fittings attached directly to a pressure vessel are to be subjected to hydraulic test according to **Table 5.5.17** after construction in the presence of the Surveyor. **【See Guidance】**

Table 5.5.17 Hydraulic Test Pressure

Item	Test pressure
Class 1 and Class 2 pressure vessels(1)	1.5 times the design pressure
Heat exchangers and other special vessels not applicable to the above	To be determined in each case
Fittings directly affected by pressure of Class 1 and Class 2 pressure vessels (not directly welded to pressure vessels)	2 times the design pressure of the pressure vessel
NOTE : (1) Class 3 pressure vessels considered necessary by the Society are to be subjected to hydraulic test.	

(hereafter, same as the present)

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〈Pt 5 Rules〉

(Amendment) Hydraulic tests of fittings directly welded to pressure vessels 〈application date: the date of contract for construction on or after 1 July. 2023〉

- For fittings that are directly welded to the pressure vessels, it is clarified to conduct a hydraulic test at 1.5 times the design pressure.

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Present	Amendment	Note
# CHAPTER 7 STEERING GEARS ## Section 1 General **101. 〈omitted〉** **102. Terminology** **1.** The terms used in this Chapter are defined as follows: (1) ~ (5) 〈omitted〉 (6) **Control system** is the equipment by which orders are transmitted from the navigating bridge to the power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables. (hereafter, omitted)	# CHAPTER 7 STEERING GEARS ## Section 1 General **101. 〈same as the present〉** **102. Terminology** **1.** The terms used in this Chapter are defined as follows: (1) ~ (5) 〈same as the present〉 (6) **Control system** is the equipment by which orders are transmitted from the navigating bridge to the power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables. Steering gear control system is also understood to cover "the equipment required to control the steering gear power actuating system". *(2023)* (7) **Maximum working pressure** means the maximum expected pressure in the system when the steering gear is operated to comply with **202. 1.** *(2023)* (8) **Hydraulic locking** means all situations where two hydraulic systems (usually identical) oppose each other in such a way that it may lead to loss of steering. It can either be caused by pressure in the two hydraulic systems working against each other or by hydraulic "by-pass" meaning that the systems puncture each other and cause pressure drop on both sides or make it impossible to build up pressure. *(2023)* (hereafter, same as the present)	〈Pt 5 Rules〉 (Amendment) Reflecting IACS UR M42 (Rev.6 Mar 2022) and UR E25 (Rev.2 Mar 2022) 〈application date: the date of contract for construction on or after 1 July. 2023〉 - UR M42 (Rev.6) Appendix 1 1 - Add the definition not reflected in UR M42. - Reflecting UR M42 (Rev.6) Appendix 1 9, the definition of hydraulic locking has been added.

Present	Amendment	Note
Section 3 Controls	**Section 3 Controls**	〈Pt 5 Rules〉
301. 〈omitted〉	**301. 〈same as the present〉**	
302. Failure detection and response of all types of steering control systems *(2017)*	**302. Failure detection and response of all types of steering control systems *(2017)***	
1. Failure detection	**1. Failure detection**	
(1) The most probable failures that may cause reduced or erroneous system performance are to be automatically detected and at least the following failure scenarios are to be considered: (A) Power supply failure (B) Earth fault on AC and DC circuits (C) Loop failures in closed loop systems, both command and feedback loops (normally short circuit, broken connections and earth faults) (D) Data communication errors (E) Programmable system failures (Hardware and software failures) (F) Hydraulic locking (G) Deviation between rudder order and feedback. Deviation alarm is to be initiated if the rudder's actual position does not reach the set point within acceptable time limits for the closed loop control systems (e.g. follow-up control and autopilot). Deviation alarm may be caused by mechanical, hydraulic or electrical failures.	(1) The most probable failures that may cause reduced or erroneous system performance are to be automatically detected and at least the following failure scenarios are to be considered: *(2023)* (A) Power supply failure (B) Earth fault on AC and DC circuits (C) Loop failures in closed loop systems, both command and feedback loops (normally short circuit, broken connections and earth faults) (D) Data communication errors (E) Programmable system failures (Hardware and software failures) ~~(F) Hydraulic locking~~ (F) Deviation between rudder order and feedback. Deviation alarm is to be initiated if the rudder's actual position does not reach the set point within acceptable time limits for the closed loop control systems (e.g. follow-up control and autopilot). Deviation alarm may be caused by mechanical, hydraulic or electrical failures.	- Reflect UR E25 (Rev.2)
(2) All failures detected are to initiate audible and individual visual alarm on the navigation bridge.	(2) All failures detected are to initiate audible and individual visual alarm on the navigation bridge.	
2. System response upon failure *(2021)*	**2. System response upon failure *(2021)***	
The failures (as defined but not limited to those in **1.** (1)) likely to cause uncontrolled movements of rudder are to be clearly identified. In the event of detection of such failure, the rudder is to stop in the current position without manual intervention or, is to return to the midship/neutral position.	The failures (as defined but not limited to those in **1.** (1)) likely to cause uncontrolled movements of rudder are to be clearly identified. In the event of detection of such failure, the rudder is to stop in the current position without manual intervention or, is to return to the midship/neutral position. For mechanical failures such as sticking valves and failure of static components (pipes, cylinders), the system response without manual intervention is not mandatory, and the operator can follow instructions for emergency procedures in case of such failures, in accordance with **104. 2.** *(2023)*	- Reflecting UR E25 (Rev.2), Clarify that the system response to mechanical failure is not mandatory.
(hereafter, omitted)	(hereafter, same as the present)	