RULES FOR CLASSIFICATION(STEEL SHIPS)

Part 5 MACHINERY INSTALLATIONS

2020. 9.

Machinery Rule Development Team

- Main Amendments -

(1) Effective date : 1 Jan. 2021 (Date of which contracts for construction are signed)

◉ In reflection of the IACS UR M52 (Rev.2), the requirements for grease lubricated stern tube bearings have been newly added.

(2) Effective date : 1 Jul. 2021 (Date of which contracts for construction are signed)

◉ In accordance with the new establishment of Annex 5-7 of the Guidance for internal combustion engines supplied with low pressure gas, the duplicated requirement for submission of plans and documents has been deleted, and the references have been updated.

◉ In reflection of new technology, the requirements for gas turbines have been completely revised.

◉ The application to the piping arrangements of the internal combustion engines has been clarified.

◉ It has been clarified that splitted sleeves are to be protected in the approved method by the Society using type approved corrosion resisting materials.

◉ The kind of materials for steel plates for boiler has been rectified.

◉ The thickness of corrosion allowance for pressure vessels has been revised to increase or decrease according to the corrosive environment rather than the fixed value of 1 mm.

(3) Effective date : 1 Jul. 2021 (Date of the application for certification)

◉ Manufacturer approval as a prerequisite for accreditation of Work's certificate has been deleted.

Present	Amendment	Reason
# CHAPTER 1 GENERAL ## Section 2 Plans and Documents **201. ~ 202. 〈omitted〉** **203. Plans and documents to be submitted by the licensor and licensee of internal combustion engines 【See Guidance】** **1.** Documents to be submitted by the designer/licensor(hereinafter referred to as "licensor") and the manufacturers/licensee(hereinafter referred to as "licensee") are to be in accordance with **Table 5.1.4** for approval, **Table 5.1.5** for information. A complete set of drawings and data given in **Table 5.1.6** are to be provided for attending Surveyor's review at his request for test and inspection. **2.** The procedure of documents submission and approval between engine licensor, licensee and the Society is to comply with **Annex 5-11** of the Guidance. **3.** The submission of plans and documents of the gas fueled engines is to comply with the requirements specified otherwise by the Society in addition to **Par 1**. *(2018)* (hereafter, omitted)	# CHAPTER 1 GENERAL ## Section 2 Plans and Documents **201. ~ 202. 〈same as the present〉** **203. Plans and documents to be submitted by the licensor and licensee of internal combustion engines 【See Guidance】** **1.** Documents to be submitted by the designer/licensor(hereinafter referred to as "licensor") and the manufacturers/licensee(hereinafter referred to as "licensee") are to be in accordance with **Table 5.1.4** for approval, **Table 5.1.5** for information. A complete set of drawings and data given in **Table 5.1.6** are to be provided for attending Surveyor's review at his request for test and inspection. **2.** The procedure of documents submission and approval between engine licensor, licensee and the Society is to comply with **Annex 5-11** of the Guidance. **3.** The submission of plans and documents of the gas fueled engines is to comply with **Table 1** in **Annex 5-7** of the Guidance in addition to **Par 1**. *(2018) (2021)* (hereafter, same as the present Rules)	〈Pt 5 Rules〉 - Revised according to Annex 5-7 of the Guidance which has reflected IACS UR M78 for Internal combustion engines supplied with low pressure gas. 〈application date: the date of contract for construction on or after 1 July 2021〉

Present	Amendment	Note
CHAPTER 1 GENERAL	**CHAPTER 1 GENERAL**	〈Pt 5 Rules〉
Section 2 Plans and Documents	**Section 2 Plans and Documents**	(Amendment) amend the requirements for gas turbine 〈application date: the date of contract for construction on or after 1 July 2021〉
204 〈omitted〉	**204 〈same as the present〉**	
205. Plans and documents to be submitted by the manufacturers of gas turbine	**205. Plans and documents to be submitted by the manufacturers of gas turbine**	
1. Plans for approval	**1. Plans and documents for approval *(2021)***	
(1) Sectional assembly	(1) Sectional assembly	
(2) Discs (and/or rotors) of turbine and compressor	(2) Discs (and/or rotors) of turbine and compressor	
(3) Combustion chambers	(3) Combustion chambers	
(4) Details of fixing of moving and stationary blades	(4) Details of fixing of moving and stationary blades	
(5) Shaft couplings and bolts	(5) Shaft couplings and bolts	
(6) Piping arrangements fitted to turbine (including fuel oil, lubricating oil, cooling water, pneumatic and hydraulic system, and indicating pipe materials, pipe sizes and service pressures)	(6) Piping arrangements fitted to turbine (including fuel oil, lubricating oil, cooling water, pneumatic and hydraulic system; and information of materials, sizes and working pressures of pipes)	
(7) Pressure vessels and heat exchangers (classified in Class I and Class II defined in **Ch 5**) attached to turbine	(7) Pressure vessels and heat exchangers (classified as Class I and Class II in accordance with **Ch 5**) attached to gas turbine	
(8) Details of turbine installation	(8) Details of gas turbine installation	
(9) Turbine Particulars (type and product number of turbine, power and number of revolutions per minute of turbine and compressors at maximum continuous rating, gas pressure and temperatures at turbine inlet and outlet, pressure losses in inlet and exhaust ducts, ambient condition intended for operation, service fuel oil and lubricating oil)	(9) Gas turbine particulars (type and product number of turbine, maximum continuous output, maximum peak power, speed at maximum continuous output of gas generator and power turbine, compressor discharge temperature and power turbine inlet temperature at maximum continuous output, ambient condition intended for operation, service fuel oil and lubricating oil)	- Revised the details of the gas turbine particular.
(10) Welding details of principal components	(10) Welding details of principal components	
(11) Critical speeds of turbine rotors and compressors	(11) Critical speeds of turbine rotors and compressors	
(12) Number of moving blades in each stage	(12) Number of moving blades in each stage	
(13) Number and arrangements of stationary blades	(13) Number and arrangements of stationary blades	
	(14) Lists of safety devices including those specified in **404.**	- Add lists of safety device

Present	Amendment	Note
		〈Pt 5 Rules〉
2. Documents (1) Material specifications of principal components (2) General arrangement (3) Starting arrangement (attached to turbine) (4) Inlet air and exhaust gas arrangements (5) Diagram of turbine control systems (6) Calculation sheets for strength of principal components (7) Calculation sheets for vibration of turbine blades (8) Operation instructions for fuel oil control systems (9) Illustrative drawing of cooling method for each part of turbine (10) Maintenance instructions	**2. Plans and documents for reference *(2021)*** (1) Material specifications of principal components (2) General arrangement (3) Starting arrangement ~~(attached to turbine)~~ (4) Inlet air and exhaust gas arrangements (5) Diagram of gas turbine control systems (6) Documents including calculations or test results to demonstrate the suitability and strength of principal components (7) Calculation sheets for vibration of turbine blades (8) Operation instructions for fuel oil control systems (9) Illustrative drawing of cooling method for each part of turbine (10) Maintenance instructions (11) Report of failure mode and effects analysis (FMEA) (12) Documentation of containment in the event of blades burst	- Regardless attached or not - Documents verifying strength based on test results are also accepted. - Add FEMA report and documentation of containment
(hereafter, omitted)	(hereafter, same as the present Rules)	

Present	Amendment	Reason
# CHAPTER 1 GENERAL ## Section 3 Tests and Inspections **301. Shop Tests** **1.** Before installation on board, machinery installations are to be tested and inspected at the plant provided with sufficient facilities necessary for the tests in accordance with the relevant requirements of each Chapter and shop trials deemed appropriate by the Society are to be carried out. **【See Guidance】** **2.** For the acceptance of Work's certificate (W), the manufacturer is in principle to have the manufacturer approval in accordance with **Ch 6** of **Guidance for Approval of Manufacturing Process and Type Approval, Etc.** *(2017)* **【See Guidance】** **3.** The manufacturer who intend to issue Work's certificate (W) or Test Report (TR) are to carry out tests and inspections on their responsibility. The acceptance by the Society shall not absolve the manufacturer from this responsibility. **4.** The Surveyor is to review Work's certificate (W) and Test Report (TR) for compliance with the agreed or approved specifications. Where the Rules require Work's certificate (W) or Test Report (TR), the surveyor may at any time require the tests to be carried out in his presence or that the surveyor check elements of the production control. *(2017)* (hereafter, omitted)	# CHAPTER 1 GENERAL ## Section 3 Tests and Inspections **301. Shop Tests** **1.** Before installation on board, machinery installations are to be tested and inspected at the plant provided with sufficient facilities necessary for the tests in accordance with the relevant requirements of each Chapter and shop trials deemed appropriate by the Society are to be carried out. **【See Guidance】** ~~**2.** For the acceptance of Work's certificate (W), the manufacturer is in principle to have the manufacturer approval in accordance with **Ch 6** of **Guidance for Approval of Manufacturing Process and Type Approval, Etc.** *(2017)* **【See Guidance】**~~ **2.** The manufacturer who intend to issue Work's certificate (W) or Test Report (TR) are to carry out tests and inspections on their responsibility. The acceptance by the Society shall not absolve the manufacturer from this responsibility. **3.** The Surveyor is to review Work's certificate (W) and Test Report (TR) for compliance with the agreed or approved specifications. Where the Rules require Work's certificate (W) or Test Report (TR), the surveyor may at any time require the tests to be carried out in his presence or that the surveyor check elements of the production control. *(2017)* (hereafter, same as the present Rules)	〈Pt 5 Rules〉 (Amendment) Deletion of manufacturer approval as a prerequisite for accreditation of Work's certificate. 〈application date: the date of application for certification on or after 1 July 2021〉 - Manufacturer approval as a prerequisite for accreditation of Work's certificate has been deleted in accordance with IACS UR M72.

Present	Amendment	Reason
# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 1 General **101. Application** **1. ~ 3. 〈omitted〉** **4. Piping arrangements** Piping arrangements are also to comply with the requirements of **Ch 6** in addition to the requirements of this Chapter. **5. ~ 7. 〈omitted〉** **8. Gas fueled engines** The gas fueled engines installed on liquefied gas cargo carriers using cargo as fuel subject to **Pt 7, Ch 5** are to comply with the requirements in **Pt 7, Ch 5, Sec 5** and **Sec 16** in addition to the relevant requirements specified in this Chapter. The gas fueled engines installed on Ships using low-flashpoint fuels of below 60 °C other than ships carrying liquified gases in bulk and ships carrying CNG in bulk are to comply with the requirements in the **Rules** for Ships using Low-flashpoint Fuels in addition to the relevant requirements specified in this Chapter. *(2018)* (hereafter, omitted)	# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 1 General **101. Application** **1. ~ 3. 〈same as the present〉** **4. Piping arrangements** Piping arrangements are to comply with the requirements of **Ch 6** except specially specified in this Chapter. *(2021)* **5. ~ 7. 〈same as the present〉** **8. Gas fueled engines** The gas fueled engines installed on liquefied gas cargo carriers using cargo as fuel subject to **Pt 7, Ch 5** are to comply with the requirements in **Pt 7, Ch 5, Sec 5** and **Sec 16** in addition to the relevant requirements specified in this Chapter. The gas fueled engines installed on Ships using low-flashpoint fuels of below 60 °C other than ships carrying liquified gases in bulk and ships carrying CNG in bulk are to comply with the requirements in the **Rules** for Ships using Low-flashpoint Fuels in addition to the relevant requirements specified in this Chapter. In addition, Internal combustion engines supplied with low pressure gas are to comply with the requirements given in **Annex 5-7.** *(2018) (2021)* (hereafter, same as the present Rules)	〈Pt 5 Rules〉 - Clarify that the requirements specified in this chapter conflicted with the requirements in Ch.6. 〈application date: the date of contract for construction on or after 1 July 2021〉 - Reference to Annex 5-7 has been newly introduced. 〈application date: the date of contract for construction on or after 1 July 2021〉

Present	Amendment	Reason
CHAPTER 2 MAIN AND AUXILIARY ENGINES **Section 2 Internal Combustion Engines** **201. ~ 210. 〈omitted〉** **211. Tests and Inspections** **1. Test of engine components** (1) The engine manufacturer is in principle to have the manufacturer approval in accordance with **Ch 6** of **Guidance for Approval of Manufacturing Process and Type Approval, Etc.** The engine manufacturer is to have a quality control system that is suitable for the actual engine types to be certified by the Society. The quality control system is also to apply to any sub-suppliers. The Society reserves the right to review the system or parts thereof. Materials and components are to be produced in compliance with all the applicable production and quality instructions specified by the engine manufacturer. *(2017)* **【See Guidance】** (hereafter, omitted)	**CHAPTER 2 MAIN AND AUXILIARY ENGINES** **Section 2 Internal Combustion Engines** **201. ~ 210. 〈same as the present〉** **211. Tests and Inspections** **1. Test of engine components** (1) ~~The engine manufacturer is in principle to have the manufacturer approval in accordance with **Ch 6** of **Guidance for Approval of Manufacturing Process and Type Approval, Etc.**~~ The engine manufacturer is to have a quality control system that is suitable for the actual engine types to be certified by the Society. The quality control system is also to apply to any sub-suppliers. The Society reserves the right to review the system or parts thereof. Materials and components are to be produced in compliance with all the applicable production and quality instructions specified by the engine manufacturer. *(2017)* **【See Guidance】** (hereafter, same as the present Rules)	<Pt 5 Rules> (Amendment) Deletion of manufacturer approval as a prerequisite for accreditation of Work's certificate. <application date: the date of application for certification on or after 1 July 2021> - Manufacturer approval for engine manufacturers as a prerequisite for accreditation of Work's certificate has been deleted in accordance with IACS UR M72.

〈Present〉

Table 5.2.4 Test and inspection of engine components (continued)

Component	Material properties[1]	Non-destructive examination[2]	Hydraulic testing[3]	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines[6]	Component certificate
Cross head	KRC(C+M)	W(UT+CD)			Random	CH	KRC
Connecting rod with cap	KRC(C+M)	W(UT+CD)		W	Random, of all surfaces, in particular those shot peened	All	KRC
Coupling bolts for crankshaft	KRC(C+M)	W(UT+CD)		W	Random, of interference fit	All	KRC
Bolts and studs for main bearings	W(C+M)	W(UT+CD)				D〉300 mm	
Bolts and studs for cylinder heads	W(C+M)	W(UT+CD)				D〉300 mm	
Bolts and studs for connecting rods	W(C+M)	W(UT+CD)		TR of thread making		D〉300 mm	
Tie rod	W(C+M)	W(UT+CD)		TR of thread making	Random	CH	KRC
High pressure fuel injection pump body	W(C+M)[8]		W			D〉300 mm	
	W(C+M)[8]		TR			D≤300 mm	
High pressure fuel injection valves (only for those not autofretted[7])			W			D〉300 mm	
			TR			D≤300 mm	
High pressure fuel injection pipes including common fuel rail	W(C+M)[8]		W for those that are not autofretted[7]			D〉300 mm	
	W(C+M)[8]		TR for those that are not autofretted[7]			D≤300 mm	
High pressure common servo oil system	W(C+M)[8]		W			D〉300 mm	
	W(C+M)[8]		TR			D≤300 mm	
Cooler, both sides[4]	W(C+M)[9]		W			D〉300 mm	

〈Present〉

Table 5.2.4 Test and inspection of engine components (continued)

Component	Material properties[1]	Non-destructive examination[2]	Hydraulic testing[3]	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines[6]	Component certificate
Accumulator	W(C+M)[8]		W			All engines with accumulators with a capacity of 〉0.5 l	
Piping, pumps, actuators, etc. for hydraulic drive of valves, if applicable	W(C+M)[8]		W			〉800 kW/cyl.	
Engine driven pumps (oil, water, fuel, bilge) other than high pressure fuel injection pump body and pump for hydraulic drive of valve above			W			〉800 kW/cyl.	
Bearings for main, crosshead, and crankpin	TR(C)	TR (UT for full contact between base material and bearing metal)		W[8]		〉800 kW/cyl.	

NOTES:

C : Chemical composition
M : Mechanical properties
CD : Crack detection by Magnetic particle test or liquid penetrant test
UT : Ultrasonic testing
CH : Crosshead engines
GJL : Grey iron casting
GJS : Spheroidal graphite iron casting
GS : Steel casting
D : Cylinder bore diameter
KRC : KR Certificate
W : Work's certificate (refer to **Ch 1, 301. 2**)
TR : Test report
X : Visual examination of accessible surfaces by the Surveyor

(1) Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).
(2) Non-destructive examination means e.g. ultrasonic testing, crack detection by magnetic particle tests or liquid penetrant tests.
(3) Hydraulic testing is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.
(4) Charge air coolers need only be tested on the water side.
(5) Hydraulic testing is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.
(6) For the small auxiliary engines at discretion of the Society, **Ch 2, 101. 1** is to be applied.
(7) Manufacturers using autofretted method are to obtain the manufacturer approval by the Society. *(2018)*
(8) The manufacturer approval in accordance with **Ch 1, 301. 2** may be omitted. *(2020)*
(9) The application of classification for pressure vessels given in **Ch 5, 303. 1** is to be complied with. *(2020)*

〈Amendment〉

Table 5.2.4 Test and inspection of engine components (continued)

Component	Material properties[1]	Non-destructive examination[2]	Hydraulic testing[3]	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines[6]	Component certificate
Cross head	KRC(C+M)	W(UT+CD)			Random	CH	KRC
Connecting rod with cap	KRC(C+M)	W(UT+CD)		W	Random, of all surfaces, in particular those shot peened	All	KRC
Coupling bolts for crankshaft	KRC(C+M)	W(UT+CD)		W	Random, of interference fit	All	KRC
Bolts and studs for main bearings	W(C+M)	W(UT+CD)				D〉300 mm	
Bolts and studs for cylinder heads	W(C+M)	W(UT+CD)				D〉300 mm	
Bolts and studs for connecting rods	W(C+M)	W(UT+CD)		TR of thread making		D〉300 mm	
Tie rod	W(C+M)	W(UT+CD)		TR of thread making	Random	CH	KRC
High pressure fuel injection pump body	W(C+M)[8]		W			D〉300 mm	
	W(C+M)[8]		TR			D≤300 mm	
High pressure fuel injection valves (only for those not autofretted[7])			W			D〉300 mm	
			TR			D≤300 mm	
High pressure fuel injection pipes including common fuel rail	W(C+M)[8]		W for those that are not autofretted[7]			D〉300 mm	
	W(C+M)[8]		TR for those that are not autofretted[7]			D≤300 mm	
High pressure common servo oil system	W(C+M)[8]		W			D〉300 mm	
	W(C+M)[8]		TR			D≤300 mm	
Cooler, both sides[4]	W(C+M)[7]		W			D〉300 mm	

〈Amendment〉

Table 5.2.4 Test and inspection of engine components (continued)

Component	Material properties[1]	Non-destructive examination[2]	Hydraulic testing[3]	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines[6]	Component certificate
Accumulator	W(C+M)~~[8]~~		W			All engines with accumulators with a capacity of 〉0.5 l	
Piping, pumps, actuators, etc. for hydraulic drive of valves, if applicable	W(C+M)~~[8]~~		W			〉800 kW/cyl.	
Engine driven pumps (oil, water, fuel, bilge) other than high pressure fuel injection pump body and pump for hydraulic drive of valve above			W			〉800 kW/cyl.	
Bearings for main, crosshead, and crankpin	TR(C)	TR (UT for full contact between base material and bearing metal)		W~~[8]~~		〉800 kW/cyl.	

NOTES:

C : Chemical composition
M : Mechanical properties
CD : Crack detection by Magnetic particle test or liquid penetrant test
UT : Ultrasonic testing
CH : Crosshead engines
GJL : Grey iron casting
GJS : Spheroidal graphite iron casting
GS : Steel casting
D : Cylinder bore diameter
KRC : KR Certificate
W : Work's certificate ~~(refer to **Ch 1, 301. 2**)~~
TR : Test report
X : Visual examination of accessible surfaces by the Surveyor

(1) Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).
(2) Non-destructive examination means e.g. ultrasonic testing, crack detection by magnetic particle tests or liquid penetrant tests.
(3) Hydraulic testing is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.
(4) Charge air coolers need only be tested on the water side.
(5) Hydraulic testing is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.
(6) For the small auxiliary engines at discretion of the Society, **Ch 2, 101. 1** is to be applied.
~~(7) Manufacturers using autofretted method are to obtain the manufacturer approval by the Society. *(2018)*~~
~~(8) The manufacturer approval in accordance with **Ch 1, 301. 2** may be omitted. *(2020)*~~
(7) The application of classification for pressure vessels given in **Ch 5, 303. 1** is to be complied with. *(2020)*

Present	Amendment	Note
# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 4 Gas Turbines **401. Materials, Construction and Strength** **1. Materials** (1) Materials of the components of gas turbine specified below (hereinafter referred to as the principal components of gas turbine) are to comply with the requirements in **Pt 2, Ch 1**. (A) Discs (or rotor), stationary blades and moving blades of turbine (B) Discs, stationary blades and moving blades of compressor (C) Turbine and compressor casings (D) Combustion chambers (E) Turbine output shaft (F) Connecting bolts for main components of turbine (G) Shaft coupling and bolts (H) Pipes, valves and fittings attached to gas turbine classified in Class I or Class II in Pt **5, Ch 6.**	# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 4 Gas Turbines **401. General** **1. Definitions *(2021)*** (1) **Principal components** means the following; (A) Discs (or rotor), stationary blades and moving blades of turbine (B) Discs, stationary blades and moving blades of compressor (C) Turbine and compressor casings (D) Combustion chambers (E) Turbine output shaft (F) Connecting bolts for main components of turbine (G) Shaft coupling and bolts (H) Pipes, valves and fittings attached to gas turbine classified in Class I or Class II in Pt **5, Ch 6.** (2) **Main propulsion gas turbine** is a gas turbine essential for propulsion of the ship. It is included that gas turbines are used to drive generators to supply electric power to propulsion motors in electric propulsion ships and excluded that gas turbines are temporarily used as booster to achieve maximum speed. (3) **Gas turbine** is consisting of upstream rotating compressors coupled to downstream turbines, and a combustion chamber in-between. The power turbine in multiple shaft configurations is also included. (4) **Gas generator** is an assembly of components of gas turbine that produces heated pressurized gas. (5) **Power turbine** is a turbine which is driven by the gases from a gas generator, producing power output through an independent shaft.	〈Pt 5 Rules〉 (Amendment) amend the requirements for gas turbine 〈application date: the date of contract for construction on or after 1 July 2021〉 - Add 401. General & 1. Definitions - Add the definition of Gas turbine, Gas Generator and power turbine.

Present	Amendment	Note
		〈Pt 5 Rules〉
	402. Materials	
	1. Materials for principal components of gas turbine are in principle to comply with the requirements in **Pt 2, Ch 1**.	- Moved from 401. 1 (1)
(2) The principal components of gas turbine (excluding bolts, pipes, valves and fittings) are to be subjected to the non-destructive tests specified in **Pt 2, Ch 1, 501. 10** and **601. 10**.	2. The principal components of gas turbine (excluding bolts, pipes, valves and fittings) are to be subjected to the non-destructive tests specified in **Pt 2, Ch 1, 501. 10** and **601. 10**.	
(3) The materials used in high temperature parts are to have properties suitable for the design performance and service life against corrosions, thermal stresses, creeps and relaxations. In case where the base material coated with corrosion-resistant surfacing, the coating material is to have such properties that it is hardly detached from the base material as well as not to impair the strength of the base material.	3. The materials used in high temperature parts are to have properties suitable against corrosions, thermal stresses, creeps and relaxations in order to achieve the intended performance and the intended service life. In case where the base material coated with corrosion-resistant surfacing, the coating material is to have properties so that it is hardly detached from the base material as well as not to impair the strength of the base material.	- Corrected sentences for easy understanding.
2. Construction and installations	**403. Construction and installations**	
(1) Gas turbines are to be so designed that no excessive vibration and surging are induced within the speed range of normal operation.	1. Gas turbines are to be so designed that no excessive vibration and surging, etc. are induced within the speed range of normal operation.	
(2) Each part of a gas turbine is to have such constructions as no detrimental deformations caused by their thermal expansion.	2. Each part of a gas turbine is to have such constructions as no detrimental deformations caused by its thermal expansion.	
(3) Where the main components of gas turbines are of welded construction, they are to comply with the requirements in **Ch 5, Sec 4**.	3. Where the main components of gas turbines are of welded construction, they are to comply with the requirements in **Ch 5, Sec 4**.	
(4) In the event of failure of the main source of electrical power, the gas turbines for main propulsion are to be so designed as not to cause gas generator to stop, or to enable to restart immediately after the gas generator stopping.	~~(4) In the event of failure of the main source of electrical power, the gas turbines for main propulsion are to be so designed as not to cause gas generator to stop, or to enable to restart immediately after the gas generator stopping.~~	- Automatic restart is not required.
(5) Gas turbines are to be installed on the seatings so that no excessive structural constraints are caused by thermal expansion.	4. Gas turbines are to be installed ~~on the seatings~~ so that no excessive structural constraints are caused by thermal expansion.	
	5. The casing of gas turbines is to be designed such that contains debris in the event of a blade burst. Containment strength calculations, or other method such as numerical simulation or test, verifying the above requirement are to be submitted. *(2021)*	- The requirements for containment is added.

Present	Amendment	Note
402. Safety devices	**404. Safety devices**	〈Pt 5 Rules〉
	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)*	- UR M60 2.1 added.
1. Governors and overspeed protective devices (1) Main gas turbines are to be provided with over speed protective devices to prevent the turbine speed from exceeding more than 15 % of the maximum continuous speed. Where a main gas turbine incorporates a reverse gear, electric transmission, controllable pitch propeller or other free-coupling arrangement, a speed governor independent of the over speed protective device is to be fitted and is to be capable of controlling the speed of the unloaded gas turbine without bringing the over speed protective device into operation. (2) The governors of gas turbines to drive generators are to conform to the requirements in **Pt 6, Ch 1, 302. 2**. However, when gas turbines used for main propulsion machinery in electric propulsion ships are used to drive generators to supply electric power exclusively to propulsion motors, the requirements in **Pt 6, Ch 1, 1602. 2.** are to be applied.	**2. Governors and overspeed protective devices** (1) ~~Main~~ Gas turbines are to be provided with over speed protective devices to prevent the turbine speed from exceeding more than 15 % of the maximum continuous speed. Where a ~~main~~ gas turbine incorporates a reverse gear, electric transmission, controllable pitch propeller or similar, a speed governor independent of the over speed protective device is to be fitted and is to be capable of controlling the speed of the unloaded gas turbine without bringing the over speed protective device into action. (2) The governors of gas turbines to drive generators are to comply with the requirements in **Pt 6, Ch 1, 302. 2**. However, when gas turbines are used to drive generators to supply electric power to propulsion motors in electric propulsion ships, the requirements in **Pt 6, Ch 1, 1602. 2.** are to be applied.	- Correct according to Korean version. - The installation place for hand trip gear is clearly defined.
2. Emergency stopping devices (1) Hand trip gear for shutting off the fuel in an emergency is to be provided at the maneuvering station. (2) Gas turbines are to be provided with automatic fuel oil shut-off devices that operate in the following cases. In addition, means are to be provided so that alarms will be issued at the control station when the automatic fuel oil shut-off devices come into action.	**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**.	

Present	Amendment	Note
(A) Overspeed (B) Unaccepted lubricating oil pressure drop (C) Unacceptable lubricating oil pressure drop of reduction gear (D) Loss of flame during operation (E) Excessive vibration (F) Excessive axial displacement of each rotor (Except for gas turbines with rolling bearings) (G) Excessive high temperature of exhaust gas (H) Excessive high vacuum pressure at the compressor inlet **3. Alarms** Audible and visible alarming devices listed in **Table 5.2.6** are to be provided.	~~(A) Overspeed~~ ~~(B) Unaccepted lubricating oil pressure drop~~ ~~(C) Unacceptable lubricating oil pressure drop of reduction gear~~ ~~(D) Loss of flame during operation~~ ~~(E) Excessive vibration~~ ~~(F) Excessive axial displacement of each rotor (Except for gas turbines with rolling bearings)~~ ~~(G) Excessive high temperature of exhaust gas~~ ~~(H) Excessive high vacuum pressure at the compressor inlet~~ ~~**3. Alarms**~~ ~~Audible and visible alarming devices listed in **Table 5.2.6** are to be provided.~~	〈Pt 5 Rules〉 - Deleted duo to the duplication with Table 5.2.6.

Present

Table 5.2.6 Alarming Device

Monitored parameter	Alarm	Shutdown(2)
Overspeed	○	○
Unaccepted lubricating oil pressure drop	○(1)	○
Unaccepted lubricating oil pressure drop of reducing gear	○(1)	○
High differential pressure across lubricating oil filter	○	
High lubricating oil temperature	○	
Low oil fuel supply pressure	○	
High oil fuel temperature	○	
High cooling medium temperature	○	
High bearing temperature	○	
Loss of flame during operation	○	○
Automatic starting failure	○	
Excessive vibration	○(1)	○
Excessive axial displacement of each rotor (Except for gas turbines with rolling bearings)	○	○
Excessive high temperature of exhaust gas	○(1)	○
Excessive high vacuum pressure at the compressor inlet	○(1)	○
Loss of control system	○	

NOTES :
(1) Alarms are to be activated at the suitable setting points prior to arriving the critical condition for the activation of shutdown devices.
(2) Suitable alarms are to be operated by the activation of shutdown devices.

Amendment

Table 5.2.6 Alarms and shutdowns *(2021)*

Monitored parameter [H=High L=Low O=Abnormal status]	Alarm	Shutdown(2)	
		Gas turbine used for main propulsion	Gas turbine other than used for main propulsion
Overspeed	H	●	●
Lubricating oil pressure	L(1)	●	●
Lubricating oil pressure of reducing gear	L(1)	●	
Differential pressure across lubricating oil filter	H		
Lubricating oil temperature	H		
Oil fuel supply pressure	L		
Oil fuel temperature	H		
Cooling medium temperature	H		
Bearing temperature	H		
Flame and ignition failure	O	●	●
Automatic starting failure	O	●	●
Excessive vibration	O(1)	●	●
Excessive axial displacement of rotor ~~(Except for gas turbines with rolling bearings)~~	O	●(3)	
Power turbine inlet temperature	H(1)	●	●
Exhaust gas temperature	H(1)	●	●
Vacuum pressure at the compressor inlet	H(1)	●	
Loss of control system power	O		

NOTES : [● = apply]
(1) Alarms are to be activated at the suitable setting points prior to arriving the critical condition for the activation of shutdown devices.
(2) Suitable alarms are to be operated by the activation of shutdown devices.
(3) Except for gas turbines with rolling bearings.

Note

〈Pt 5 Rules〉

- Divided into main propulsion use and others.

- Shutdown for automatic starting failure is added according to 405. 3. (2)
- Alarms and shutdowns for power turbine inlet temperature are added.
- According to M60, rectify that exception of rolling bearing is only related to shutdown.

Present	Amendment	Note
		〈Pt 5 Rules〉
4. Automatic temperature controls The following turbine services are to be fitted maintain steady state conditions throughout the normal operating range of the main gas turbine : (1) Lubricating oil supply (2) Oil fuel supply (or automatic control of oil fuel viscosity as alternative) (3) Exhaust gas	**5. Automatic temperature controls** The following turbine services are to be fitted with automatic temperature controls so as to maintain steady state conditions throughout the normal operating range of the main propulsion gas turbine : (1) Lubricating oil supply (2) Oil fuel supply (or automatic control of oil fuel viscosity as alternative) (3) Exhaust gas	
5. Fire detection and extinction in acoustic enclosures Where an acoustic enclosure is fitted which completely surrounds the gas generator and the high pressure oil pipes, a fire detection and extinguishing system is to be provided for the enclosure.	**6. Fire detections and extinguishing systems in enclosures** Where an enclosure is fitted which completely surrounds the gas generator and the high pressure oil pipes, fire detections and extinguishing systems are to be provided for the enclosure.	
403. Associated Installations	**405. Associated Installations**	
1. Air inlet systems The air inlet system is to have such construction and arrangement that intrusion of harmful particles and water into the compressor can be minimized. Additionally, means are to be provided so that the detrimental effects caused by salt deposits in suction air can be minimized.	**1. Air inlet systems** Air inlet systems are to be so designed and located that the possibility of ingress of harmful objects can be minimized. If necessary, means are to be provided to prevent icing in the air inlet. When specified limits for inlet air quality is required by the gas turbine manufacturer's, suitable filtration system is to be provided to control the ingress of water, particles and corrosive marine salts within these limits. Ducts and components adjacent to inlet airflow such as filters, demisters, silencers and anti-icing devices are to be constructed and mounted to minimize the risk of loose parts entering the gas turbine. *(2021)*	
2. ~ 3. 〈omitted〉	**2. ~ 3. 〈same as the present〉**	
4. Ignition arrangements (1) Each device in ignition arrangements is to be composed of two or more systems independent with each other. (2) The cable of electric ignition device is to have good electrical insulation and to be laid in such a way that it is hardly damaged. (3) 〈omitted〉	**4. Ignition arrangements** (1) Each ignition arrangement is to be consist of two or more systems independent with each other. (2) Cables of electric ignition device are to have good electrical insulation and to be laid in such a way that it is hardly damaged. (3) 〈same as the present〉	

Present	Amendment	Note
		〈Pt 5 Rules〉
5. Fuel oil arrangements (1) Sufficient consideration is to be given to the prevention of clogging of the fuel manifolds and fuel nozzles due to solid particles contained in the fuel, and also to the prevention of corrosions of turbine blades and other parts due to salts and similar corrosive substances. (2) The fuel oil arrangements are additionally to comply with the requirements in **Ch 6, Sec 9**.	**5. Fuel oil arrangements** (1) Sufficient consideration is to be given to the prevention of any clogging of ~~the~~ fuel manifolds and fuel nozzles due to solid particles contained in the fuel, and also to the prevention of corrosions of turbine blades and other parts due to corrosive substances such as salts. (2) The fuel oil arrangements are additionally to comply with the requirements in **Ch 6, Sec 9**.	
6. Lubricating oil arrangements (1) Gas turbines for main propulsion are to be provided with an effective emergency supply of lubricating oil which comes into service automatically and has sufficient amount of oil to ensure adequate lubrication until the turbine is brought to rest, in case of failure of the lubricating oil supplying system. The emergency supply may be obtained from a gravity tank or from an auxiliary lubricating oil pump driven by the turbine. (2) Lubricating oil arrangements are additionally to comply with the requirements in **Ch 6, Sec 8**.	**6. Lubricating oil arrangements** (1) Main propulsion gas turbines are to be provided with an effective emergency supply of lubricating oil which comes into service automatically and has sufficient amount of oil to ensure adequate lubrication until the turbine is brought to rest, in case of failure of the lubricating oil supplying system. The emergency supply may be obtained from a gravity tank or from an auxiliary lubricating oil pump driven by the turbine. (2) Lubricating oil arrangements are additionally to comply with the requirements in **Ch 6, Sec 8**.	
404. Tests and inspections	**406. Tests and inspections**	
1. Hydraulic test For gas turbines and their accessories hydrostatic tests are to be carried out at pressures specified below. (1) Casing : 1.5 times the design pressure (2) Piping system : Pressures specified in **Ch 6, 1404.**	**1. Hydraulic test** For gas turbines and their accessories hydrostatic tests are to be carried out at pressures specified below. (1) Casing : 1.5 times the design pressure (2) Piping system : Pressures specified in **Ch 6, 1404.**	
2. Balancing test For rotating assemblies of turbines and compressors, dynamic balancing tests are to be carried out after their assembly.	**2. Balancing test** For rotating assemblies of turbines and compressors, dynamic balancing tests are to be carried out after their assembly.	
3. Overspeed test For turbine rotors, excess speed tests are to be carried out at 115 % of the maximum continuous rotational speed or over at least for 2 *minutes* after completion of manufacture.	**3. Overspeed test** For turbine rotors, excess speed tests are to be carried out at 115 % of the maximum continuous rotational speed or over at least for 2 *minutes* after completion of manufacture.	

Present	Amendment	Note
		〈Pt 5 Rules〉
4. Shop trials For gas turbines, shop tests are to be carried out including the test of safety devices specified in **402.** above by the test procedure deemed appropriate by the Society. In this case the Society may request tests regarding starting characteristics and critical speeds of rotor shafts.	**4. Shop trials** For gas turbines, shop tests are to be carried out including the test of safety devices specified in **404.** above by the test procedure deemed appropriate by the Society. In this case the Society may request tests regarding starting characteristics and critical speeds of rotor shafts.	
5. On-board tests The sea trials for gas turbines for main propulsion are to be carried out according to the programme approved by the Society. The gas turbines are to be sufficiently able to ensure their function and reliable under all service condition, and are not to be set up any abnormal vibration at the engine working speed. However, for the gas turbines certified and carried out the shop tests, the on-board tests may be considered appropriately at the discretion of the Society. ⚓	**5. On-board tests** The sea trials for gas turbines for main propulsion are to be carried out according to the programme approved by the Society. The gas turbines are to be sufficiently able to ensure their function and reliable under all service condition, and are not to be set up any abnormal vibration at the engine working speed. However, for the gas turbines certified and carried out the shop tests, the on-board tests may be considered appropriately at the discretion of the Society. ⚓	

Present	Amendment	Reason
CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS **Section 2 Shaftings** **201. ~ 203. 〈omitted〉** **204. Propeller shaft and stern tube shaft** **1. ~ 2. 〈omitted〉** **3. Sleeves** (1) ~ (3) 〈omitted〉 (4) Security of sleeves (A) Sleeves are to be shrunk or forced on the shaft by pressure and they are not to be secured by pins or bolts. (B) Sleeves are to be made in a single piece. if made of two or more lengths, the jointing of the separate pieces is to be done by an approved method of the Society. *(2020)* (hereafter, omitted)	**CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS** **Section 2 Shaftings** **201. ~ 203. 〈same as the present〉** **204. Propeller shaft and stern tube shaft** **1. ~ 2. 〈same as the present〉** **3. Sleeves** (1) ~ (3) 〈same as the present〉 (4) Security of sleeves (A) Sleeves are to be shrunk or forced on the shaft by pressure and they are not to be secured by pins or bolts. (B) Sleeves are to be installed in one piece in principle. Where installed by two or more pieces, shafts not protected by sleeves is to be protected by corrosion resisting material with rubber or synthetic resin etc.. The corrosion resisting materials are to be type approved by Society and installed by an approved method. *(2021)* (hereafter, same as the present Rules)	〈Pt 5 Rules〉 (Amendment) - Reflect Request for Establishment/ Revision of Classification Technical Rules 'MAM4800-238-2020' 〈application date: the date of contract for construction on or after 1 July 2021〉 - It is clarified that splitted sleeves are to be protected in the approved method by the Society using type approved corrosion resisting materials. With reference to Machinery Installations of Ship's of the Korean Government and other society rules, the requirements that can be constructed by welding have been added.

Present	Amendment	Reason
# CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS ## Section 2 Shaftings **205. 〈omitted〉** **206. Stern tube bearing and sealing device** **1.** The length of stern bearing in the stern tube or of strut bearing supporting the weight of propeller is to comply with the following requirements. (1) The bearings are to be type approved by the Society in their materials, construction and lubricating arrangements when rubber or synthetic materials are used. (2) ~ (4) 〈omitted〉 (5) 〈new〉 (hereafter, omitted)	# CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS ## Section 2 Shaftings **205. 〈same as the present〉** **206. Stern tube bearing and sealing device** **1.** The length of stern bearing in the stern tube or of strut bearing supporting the weight of propeller is to comply with the following requirements. (1) The bearings are to be type approved by the Society in their materials, construction and lubricating arrangements when rubber or synthetic materials are used. (2) ~ (4) 〈same as the present〉 (5) For grease lubricated bearings, the length of a grease lubricated bearing is to be not less than 4.0 times the required diameter of the shaft in way of the bearing. *(2021)* (hereafter, same as the present Rules)	〈Pt 5 Rules〉 (Amendment) - Reflect IACS UR M52(Rev.2 Nov 2019) 〈application date: the date of contract for construction on or after 1 Jan 2021〉 - The requirement for grease lubricated bearings has been newly added.

Present

CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS

Section 4 Power Transmission Systems

401. ~ 406. 〈omitted〉

407. Tests and inspections

1. ~ 3. 〈omitted〉

4. Flexible couplings *(2019)*

(1) The certification of flexible couplings is to be issued as required by **Table 5.3.8.**

Table 5.3.8 Certification of flexible couplings

Items	Certificate	Issued by	Remarks
Non-metallic type flexible couplings (rubber, silicon, etc.) ≥ 100 kW	Product	Society	
	Type approval	Society	
	Material	Manufacturer	Torque transmitting parts
	NDE	Manufacturer	Torque transmitting parts
Metallic type flexible coupling (spring type, etc.) ≥ 100 kW	Product	Society	
	Type approval	Society	For use of propulsion only
	Material	Manufacturer	Torque transmitting parts
	NDE	Manufacturer	Torque transmitting parts
NOTES: Issued by Society means KR Certificate Issued by Manufacturer means Work's certificate <u>(refer to Ch 1, 301. 2)</u>			

(hereafter, omitted)

Amendment

CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS

Section 4 Power Transmission Systems

401. ~ 406. 〈same as the present〉

407. Tests and inspections

1. ~ 3. 〈same as the present〉

4. Flexible couplings *(2019)*

(1) The certification of flexible couplings is to be issued as required by **Table 5.3.8.**

Table 5.3.8 Certification of flexible couplings

Items	Certificate	Issued by	Remarks
Non-metallic type flexible couplings (rubber, silicon, etc.) ≥ 100 kW	Product	Society	
	Type approval	Society	
	Material	Manufacturer	Torque transmitting parts
	NDE	Manufacturer	Torque transmitting parts
Metallic type flexible coupling (spring type, etc.) ≥ 100 kW	Product	Society	
	Type approval	Society	For use of propulsion only
	Material	Manufacturer	Torque transmitting parts
	NDE	Manufacturer	Torque transmitting parts
NOTES: Issued by Society means KR Certificate Issued by Manufacturer means Work's certificate ~~(refer to Ch 1, 301. 2)~~			

(hereafter, same as the present)

Reason

〈Pt 5 Rules〉

(Amendment) Deletion of manufacturer approval as a prerequisite for accreditation of Work's certificate. 〈application date: the date of application for certification on or after 1 July 2021〉

- Deleted because manufacturer approval as a prerequisite for accreditation of Work's certificate has been deleted in the Rules.

Present

CHAPTER 5 BOILERS AND PRESSURE VESSELS

Section 1 Boilers

101. ~ 106. 〈omitted〉

107. Allowable stress

Table 5.5.2 Allowable Stress (*f*)

Kind of materials		Allowable stress N/mm^2 (1)											
		250 °C and below	300 °C	350 °C	375 °C	400 °C	425 °C	450 °C	475 °C	500 °C	525 °C	550 °C	575 °C
Steel plates for boiler	*RSP* 42	110	104	103	96	88	76	57	39				
	RSP 46	122	117	113	106	95	80	58	39				
	RSP 49	124	122	121	114	102	84	58	39				
	RSP 46*A*	122	117	113	113	113	108	101	90	69	48		
	RSP 49*A*	124	122	121	121	121	117	106	91	69	48		
	RSP 56*A*	157	147	137	137	137	131	119	99	69	48		

(hereafter, omitted)
(hereafter, omitted)

Amendment

CHAPTER 5 BOILERS AND PRESSURE VESSELS

Section 1 Boilers

101. ~ 106. 〈same as the present〉

107. Allowable stress

Table 5.5.2 Allowable Stress (*f*)

Kind of materials		Allowable stress N/mm^2 (1)											
		250 °C and below	300 °C	350 °C	375 °C	400 °C	425 °C	450 °C	475 °C	500 °C	525 °C	550 °C	575 °C
Steel plates for boiler	*RSP 24*	110	104	103	96	88	76	57	39				
	RSP 30	122	117	113	106	95	80	58	39				
	RSP 32	124	122	121	114	102	84	58	39				
	RSP 30A	122	117	113	113	113	108	101	90	69	48		
	RSP 32A	124	122	121	121	121	117	106	91	69	48		
	~~*RSP 56A*~~	~~157~~	~~147~~	~~137~~	~~137~~	~~137~~	~~131~~	~~119~~	~~99~~	~~69~~	~~48~~		

(hereafter, same as the present Rules)
(hereafter, same as the present Rules)

Reason

〈Pt 5 Rules〉

(Amendment) Revise the kind of materials for steel plates for boiler 〈application date: the date of contract for construction on or after 1 July 2021〉

- Reflect the changed kind of materials for steel plates for boiler in Pt 2, Ch 1, 302.

- Deleted because not mentioned in Pt 2.

Present	Amendment	Reason
CHAPTER 5 BOILERS AND PRESSURE VESSELS **Section 3 Pressure Vessels** **301. ~ 308. 〈omitted〉** **309. Shell plates and end plates** **1.** The thickness of shell plates or end plates is not to be less than the required thickness prescribed in **Table 5.5.15** and further is not to be less than 5 mm except where specially approved by the Society in consideration of the diameter, pressure, temperature, materials, etc. (hereafter, omitted)	**CHAPTER 5 BOILERS AND PRESSURE VESSELS** **Section 3 Pressure Vessels** **301. ~ 308. 〈same as the present〉** **309. Shell plates and end plates** **1.** The thickness of shell plates or end plates is not to be less than the required thickness prescribed in **Table 5.5.15** and further is not to be less than 5 mm except where specially approved by the Society in consideration of the diameter, pressure, temperature, materials, etc. (hereafter, same as the present Rules)	〈Pt 5 Rules〉 (Amendment) Revise the thickness of corrosion allowance for pressure vessels 〈application date: the date of contract for construction on or after 1 July 2021〉 - See Table 5.5.15 on the next page.

Present	Amendment	Reason
Table 5.5.15 The Thickness of Shell Plates and End Plates	**Table 5.5.15 The Thickness of Shell Plates and End Plates**	〈Pt 5 Guidance〉
Shell plates and end plates: Shell plates – Cylindrical: $T=\frac{PD_1}{2fJ-1.2P}+1.0$	Shell plates and end plates: Shell plates – Cylindrical: $T=\frac{PD_1}{2fJ-1.2P}+c$	- The corrosion allowance is change from fixed value '1 mm' to 'c'.
Shell plates – Spherical: $T=\frac{PR_1}{2fJ-0.2P}+1.0$	Shell plates – Spherical: $T=\frac{PR_1}{2fJ-0.2P}+c$	
End plates – Dished(1): $T=\frac{PR_2E}{2fJ-0.2P}+1.0$	End plates – Dished(1): $T=\frac{PR_2E}{2fJ-0.2P}+c$	
End plates – Semi-spherical: $T=\frac{PR_2}{2fJ-0.2P}+1.0$	End plates – Semi-spherical: $T=\frac{PR_2}{2fJ-0.2P}+c$	
End plates – Semi-ellipsoidal(2): $T=\frac{PD_2}{2fJ-0.2P}+1.0$	End plates – Semi-ellipsoidal(2): $T=\frac{PD_2}{2fJ-0.2P}+c$	
P = Design pressure (MPa) J ~ R_1 <omitted> R_2 = Inside crown radius (mm). $E=\frac{1}{4}\left(3+\sqrt{\frac{R_2}{r}}\right)$ r = Inside knuckle radius (mm).	P = Design pressure (MPa) J ~ R_1 <same as the present> R_2 = Inside crown radius (mm) $E=\frac{1}{4}\left(3+\sqrt{\frac{R_2}{r}}\right)$ r = Inside knuckle radius (mm) c = Corrosion allowance(3) (mm)	
NOTES : (1) ~ (2) 〈omitted〉	NOTES : (1) ~ (2) 〈same as the present〉 (3) The corrosion allowance is to be 1/6 of the required thickness or 1 mm, whichever is less. However, pressure vessels containing corrosive liquids or gases may increase the corrosion allowance, and pressure vessels containing non-corrosive liquids or gases or pressure vessels using corrosion resistant materials may reduce the corrosion allowance. *(2021)*	- Revise that the corrosion allowance can be changeable case by case not only fixed value '1 mm'.
(hereafter, omitted)	(hereafter, same as the present Rules)	

Rules for the Classification of Steel Ships

(Final)

Part 5 Machinery Installations

2020. 9.

Machinery Rule Development Team

Effective Date : 1 January 2021

(The contract date for ship construction)

Present	Amendment	Remark
CHAPTER 7 STEERING GEARS Section 1 - 2 〈same as the present Rules〉 Section 3 Controls 301. 〈same as the present Rules〉 302. Failure detection and response of all types of steering control systems *(2017)* **1. 〈same as the present Rules〉** **2. System response upon failure** 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. Alternatively the rudder can be set to return to the mid-ship/neutral position in the event of a failure. 303. 〈same as the present Rules〉 Section 4 - 6 〈same as the present Rules〉	CHAPTER 7 STEERING GEARS Section 1 - 2 〈same as the present Rules〉 Section 3 Controls 301. 〈same as the present Rules〉 302. Failure detection and response of all types of steering control systems *(2017)* **1. 〈same as the present Rules〉** **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. Alternatively the rudder can be set to return to the mid-ship/neutral position in the event of a failure.~~ rudder is to stop in the current position without manual intervention or, is to return to the midship/neutral position. 303. 〈same as the present Rules〉 Section 4 - 6 〈same as the present Rules〉	(Amended) - Reflecting IACS UR E25 (Rev. 1 Dec 2019), the requirement has been amended so that the rudder can respond to failures without manual intervention when detecting failure.

RULES FOR CLASSIFICATION(STEEL SHIPS)

Part 5 MACHINERY INSTALLATIONS

2020. 9.

Machinery Rule Development Team

- Main Amendments -

(1) Effective date : 1 Jul. 2021 (Date of which contracts for construction are signed)

◉ In accordance with the new establishment of Annex 5-7 of the Guidance for internal combustion engines supplied with low pressure gas, the duplicated requirement for submission of plans and documents has been deleted, and the references have been updated.

(2) Effective date : 1 Jul. 2021 (Date of the application for certification)

◉ Manufacturer approval as a prerequisite for accreditation of Work's certificate has been deleted.

Present	Amendment	Reason
# CHAPTER 1 GENERAL ## Section 2 Plans and Documents **203. Plans and documents to be submitted by the licensor and licensee of internal combustion engines *(2018)*** **【See Rule】** **1.** In application to **203. Table 5.1.5** and **Table 5.1.6** of the Rules, the special sheet required by the Society is given in **Annex 5-11**, **Table 1**. **2.** In application to **203. 3** of the Rules, the submission of plans and documents of the gas fueled engines is to comply with **Table 5.1.1** of the Guidance in addition to **203. 1** of the Rules. *(2018)* **Table 5.1.1 Additional documents for gas fueled engines** 〈omitted〉 Table 5.1.2 ~ Table 5.1.7 〈omitted〉 (hereafter, omitted)	# CHAPTER 1 GENERAL ## Section 2 Plans and Documents **203. Plans and documents to be submitted by the licensor and licensee of internal combustion engines *(2018)*** **【See Rule】** **1.** In application to **203. Table 5.1.5** and **Table 5.1.6** of the Rules, the special sheet required by the Society is given in **Annex 5-11**, **Table 1**. **2.** ~~In application to **203. 3** of the Rules, the submission of plans and documents of the gas fueled engines is to comply with **Table 5.1.1** of the Guidance in addition to **203. 1** of the Rules. *(2018)*~~ ~~**Table 5.1.1 Additional documents for gas fueled engines**~~ ~~〈omitted〉~~ Table 5.1.1 ~ Table 5.1.6 〈numbering changed accordingly〉 (hereafter, same as the present Rules)	〈Pt 5 Guidance〉 (Amendment) Deleted due to the duplication with Annex 5-7 of the Guidance which has reflected IACS UR M78 for Internal combustion engines supplied with low pressure gas. 〈application date: the date of contract for construction on or after 1 July 2021〉 - Table 5.1.1 deleted. - Change numbering due to the deletion of Table 5.1.1

No	A/R (1)	Drawings and data
1	R	Arrangement drawing of fuel gas system
2	A	Schematic layout of fuel gas system and ventilation system
3	A	Detailed drawing of fuel gas piping system
4	A	Arrangement drawing if relief valve is installed for charge air system or engine exhaust gas system

~~No~~	~~A/R (1)~~	~~Drawings and data~~
~~1~~	~~R~~	~~Arrangement drawing of fuel gas system~~
~~2~~	~~A~~	~~Schematic layout of fuel gas system and ventilation system~~
~~3~~	~~A~~	~~Detailed drawing of fuel gas piping system~~
~~4~~	~~A~~	~~Arrangement drawing if relief valve is installed for charge air system or engine exhaust gas system~~

Present	Amendment	Reason
# CHAPTER 1 GENERAL ## Section 3 Tests and Inspections **301. Shop trials** **1.** In application to **301. 1** of the Rules, auxiliary to be inspected means only the essential auxiliaries. For the items of tests and inspections not specified in the Rules or Guidance, consideration will be given to the discretion of the Society. **【See Rule】** **2.** In case that the manufacturer has an approval of quality assurance system or KR certificate (KRC) after testing in the presence of surveyor, the manufacturer approval in accordance with **301. 2** of the Rules may be dispensed. *(2017)* **【See Rule】** **3.** In application to **301. 2** of the Rules, if the manufacturer who intend to issue Work's certificate (W) does not have the manufacturer approval in accordance with **Ch 6** of **Guidance for Approval of Manufacturing Process and Type Approval, Etc.** and also not have the exemption in accordance with **2**, the manufacturer is to carry out tests and inspections in the presence of the Surveyor. In this case, KR Certificate (KRC) is issued by the Society. *(2017)* **4.** In application to **301. 2** of the Rules, A Work's Certificate (W) may be considered equivalent to a Society Certificate under the following cases. *(2017)* (1) The test was witnessed by the Society Surveyor, or (2) An quality assurance system agreement is in place between the Society and the manufacturer or material supplier, or (3) The Work's certificate (W) is supported by tests carried out by an accredited third party that is accepted by the Society and independent from the manufacturer and/or material supplier. (hereafter, omitted)	# CHAPTER 1 GENERAL ## Section 3 Tests and Inspections **301. Shop Tests** **1.** In application to **301. 1** of the Rules, auxiliary to be inspected means only the essential auxiliaries. For the items of tests and inspections not specified in the Rules or Guidance, consideration will be given to the discretion of the Society. **【See Rule】** ~~**2.** In case that the manufacturer has an approval of quality assurance system or KR certificate (KRC) after testing in the presence of surveyor, the manufacturer approval in accordance with **301. 2** of the Rules may be dispensed. *(2017)* **【See Rule】**~~ ~~**3.** In application to **301. 2** of the Rules, if the manufacturer who intend to issue Work's certificate (W) does not have the manufacturer approval in accordance with **Ch 6** of **Guidance for Approval of Manufacturing Process and Type Approval, Etc.** and also not have the exemption in accordance with **2**, the manufacturer is to carry out tests and inspections in the presence of the Surveyor. In this case, KR Certificate (KRC) is issued by the Society. *(2017)*~~ **3.** In application to **301. 2** of the Rules, A Work's Certificate (W) may be considered equivalent to a Society Certificate under the following cases. *(2017)* (1) The test was witnessed by the Society Surveyor, or (2) An quality assurance system agreement is in place between the Society and the manufacturer or material supplier, or (3) The Work's certificate (W) is supported by tests carried out by an accredited third party that is accepted by the Society and independent from the manufacturer and/or material supplier. (hereafter, same as the present)	〈Pt 5 Guidance〉 (Amendment) Deletion of manufacturer approval as a prerequisite for accreditation of Work's certificate. 〈application date: the date of application for certification on or after 1 July 2021〉 - Deleted because manufacturer approval as a prerequisite for accreditation of Work's certificate has been deleted in the Rules.

Present	Amendment	Reason
CHAPTER 2 MAIN AND AUXILIARY ENGINES **Section 2 Internal Combustion Engines** **203. Safety devices** **1.** Internal combustion engines supplied with low pressure gas are to comply with the requirements given in **Annex 5-7.** **2. ~ 7. 〈omitted〉** (hereafter, omitted)	**CHAPTER 2 MAIN AND AUXILIARY ENGINES** **Section 2 Internal Combustion Engines** **203. Safety devices** ~~**1.** Internal combustion engines supplied with low pressure gas are to comply with the requirements given in **Annex 5-7.**~~ **1. ~ 6. 〈same as the present〉** (hereafter, same as the present Rules)	〈Pt 5 Guidance〉 - Move to Ch 2, 101. 8 of the Rules. 〈application date: the date of contract for construction on or after 1 July 2021〉

Present	Amendment	Reason
# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 2 Internal Combustion Engines **211. Tests and inspections** **1.** In application to **Table 5.2.4** of the Rules, necessary actions for prohibition of arc strike are to be taken at magnetic particle test by prod method. **2.** In the application **211. 1** (1) of the Rules, in case that engine manufacturers or their sub-suppliers intend to obtain the acceptance of Work's certificate (W) for engine components in **Table 5.2.4** of the Rules, the manufacturer approval of engine manufacturer is required. Where the engine manufacturer has an approval of quality assurance system, the manufacturer approval may be dispensed. *(2017)* **【See Rule】** **3. ~ 6. 〈omitted〉** (hereafter, omitted)	# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 2 Internal Combustion Engines **211. Tests and inspections** **1.** In application to **Table 5.2.4** of the Rules, necessary actions for prohibition of arc strike are to be taken at magnetic particle test by prod method. ~~**2.** In the application **211. 1** (1) of the Rules, in case that engine manufacturers or their sub-suppliers intend to obtain the acceptance of Work's certificate (W) for engine components in **Table 5.2.4** of the Rules, the manufacturer approval of engine manufacturer is required. Where the engine manufacturer has an approval of quality assurance system, the manufacturer approval may be dispensed. *(2017)* **【See Rule】**~~ **2. ~ 5. 〈same as the present〉** (hereafter, same as the present)	〈Pt 5 Guidance〉 (Amendment) Deletion of manufacturer approval as a prerequisite for accreditation of Work's certificate. 〈application date: the date of application for certification on or after 1 July 2021〉 - Deleted because manufacturer approval for engine manufacturers as a prerequisite for accreditation of Work's certificate has been deleted in the Rules. - Numbering changed.

RULES FOR CLASSIFICATION(STEEL SHIPS)

Part 5 MACHINERY INSTALLATIONS

2021. 02.

Machinery Rule Development Team

- Main Amendments -

(1) Effective date : 1 Jan. 2021 (Date of the application for drawing approval)

◉ The acceptability criteria for crankpin oil bore in accordance with IACS UR M53 (Rev.4) has been revised.

(2) Effective date : 1 Jul. 2021 (Date of which contracts for construction are signed)

◉ The eductor has been removed from the essential auxiliaries.

◉ The detail requirements for the omission of plans and documents for steam turbines have been added.

◉ The detailed acceptable means for protection against cylinder overpressure have been provided.

◉ In accordance with IACS UR M51 (Rev.4), Table 5.2.2 Shop Trials and Table 5.2.3 Sea Trials of internal combustion engine have been modified.

◉ The conflict has been found and revised between IACS UI242 (Rev.2), Ship Safety Act and Pt 5, Appendix 5-1 of the Guidance.

◉ The formula for the permissible torque of flexible coupling has been revised.

◉ Type approval for sealing devices of azimuth thruster has been deleted.

◉ The service life of control valves and accumulators for electronically-controlled diesel engines has been deleted.

◉ The shaftings with no forward stern tube bearing have been added on alignment sensitive installations.

Present	Amendment	Note
# CHAPTER 1 GENERAL ## Section 1 General **101. Application** **1.** In application to **101. 1** of the Rules, where redundant propulsion systems and steering systems are installed, the requirements in Annex 5-10 may be applied additionally. **【See Rule】** **102. Definitions** **1.** The essential auxiliaries given in **102. 5** of the Rules are as follows; **【See Rule】** (1) 〈omitted〉 (2) Auxiliary machinery for the safety of life and ship (A) Pumps Bilge pumps, ballast pumps, fire pumps (including fire pump for emergency use, fixed fire extinguishing system and associated system), eductors provided instead of bilge pump (hereafter, omitted)	# CHAPTER 1 GENERAL ## Section 1 General **101. Application** **1.** In application to **101. 1** of the Rules, where redundant propulsion systems and steering systems are installed, the requirements in Annex 5-10 may be applied additionally. **【See Rule】** **102. Definitions** **1.** The essential auxiliaries given in **102. 5** of the Rules are as follows; **【See Rule】** (1) 〈same as the present〉 (2) Auxiliary machinery for the safety of life and ship (A) Pumps Bilge pumps, ballast pumps, fire pumps (including fire pump for emergency use, fixed fire extinguishing system and associated system)~~, eductors provided instead of bilge pump~~ *(2021)* (hereafter, same as the present Rules)	<Pt 5 Guidance> (Amendment) Reflecting Request for Establishment/ Revision of Classification Technical Rules MET4800-371-2020 <application date: the date of contract for construction on or after 1 July 2021> - The eductor was removed from the essential auxiliaries in consideration of other classification cases and effectiveness.

Present	Amendment	Note
CHAPTER 1 GENERAL	**CHAPTER 1 GENERAL**	<Pt 5 Guidance>
Section 2 Plans and Documents	**Section 2 Plans and Documents**	(Amendment) Reflecting Request for Establishment/ Revision of Classification Technical Rules <application date: the date of contract for construction on or after 1 July 2021>
204. Plans and documents to be submitted by the manufacturers of steam turbines 【See Rule】	**204. Plans and documents to be submitted by the manufacturers of steam turbines 【See Rule】**	
1. The various piping diagrams given in **204. 2** of the Rules are to include the piping diagrams of steam, lubricating oil, drain, and are to be stated materials, dimension and working pressure for pipes belonging to Class I or II according to requirements of **Pt 5, Ch 6** of the Rules.	**1.** The various piping diagrams given in **204. 2** of the Rules are to include the piping diagrams of steam, lubricating oil, drain, and are to be stated materials, dimension and working pressure for pipes belonging to Class I or II according to requirements of **Pt 5, Ch 6** of the Rules.	
2. Whenever the manufacturers propose modification of construction, particulars or materials, the reasons of modification and the associated plans and documents are to be submitted by the manufacturer.	**2.** Whenever the manufacturers propose modification of construction, particulars or materials, the reasons of modification and the associated plans and documents are to be submitted by the manufacturer.	
3. The plans and documents to be submitted for reference of all type of steam turbine intended to be installed for the first time on the ship which is going to be registered by the Society, are as follows; (1) Plans given in **204. 1** of the Rules (2) Documents given in **204. 2** of the Rules, steam condition at every stage at the continuous maximum output, natural frequencies of blade and nozzle (whichever calculated values or measured values), and operation and service manual of stem turbine	**3.** The plans and documents to be submitted for reference of all type of steam turbine intended to be installed for the first time on the ship which is going to be registered by the Society, are as follows; (1) Plans given in **204. 1** of the Rules (2) Documents given in **204. 2** of the Rules, steam condition at every stage at the continuous maximum output, natural frequencies of blade and nozzle (whichever calculated values or measured values), and operation and service manual of stem turbine	
4. Where the application for omission of plans and document for approval are submitted according to the requirements of **203. 1** (2) (B) of the Guidance, the submission of those same as the plans and documents for approved type of steam turbine may be omitted.	**4.** Where the particulars, list and application for omission of plans and document for approval are submitted, the submission of those same as the plans and documents for approved type of steam turbine may be omitted. The list is to include the subject of approved plans and documents relation to the components and units specified in **204. 1** and **2** of the **Rules**, steam turbine serial number, name of shipyard and hull number. *(2021)*	- the detail requirements for the omission of plans and documents are added.
(hereafter, omitted)	(hereafter, same as the present Rules)	

Present	Amendment	Note
# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 2 Internal Combustion Engines **203. Safety devices** **1.** Internal combustion engines supplied with low pressure gas are to comply with the requirements given in **Annex 5-7.** **2.** In application to **203. 2** of the Rules, other acceptable means may includes methods to prevent over pressure by tension of cylinder head bolts. **【See Rule】** (hereafter, omitted)	# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 2 Internal Combustion Engines **203. Safety devices** **1.** Internal combustion engines supplied with low pressure gas are to comply with the requirements given in **Annex 5-7.** **2.** In application to **203. 2** of the Rules, other acceptable means may be considered as follows. *(2021)* **【See Rule】** (1) Methods to prevent over pressure by tension of cylinder head bolts (2) Devices that activate the alarm and automatically stop or slow down the engine when cylinder overpressure occurs by installing cylinder pressure sensors capable of continuously monitoring (3) Other devices deemed appropriate by the Society (hereafter, same as the present Rules)	<Pt 5 Guidance> (Amendment) Reflect Request for Establishment/Revision of Classification Technical Rules 'MAM4300-1943-2020' 〈application date: the date of contract for construction on or after 1 July 2021〉 - Detailed acceptable means for protection against cylinder over-pressure are provided.

〈Present〉

Table 5.2.2 Programme for Shop Trials of Internal Combustion Engine

Use of engines / Test items		Propulsion engines driving propeller or impeller only(2)	Engines driving generators for electric propulsion and main power supply(3)	Propulsion engines also driving power take off (PTO) generator(4)	Engines driving essential auxiliaries(2)
110 % power run		15 *minutes* at the speed of 1.032 times of the rated engine speed or after steady conditions have been reached, whichever is shorter(1)	15 *minutes* at the rated engine speed	15 *minutes* at the rated engine speed	15 *minutes* at the rated engine speed
Approved intermittent overload (if applicable)		testing for duration as agreed with the manufacturer	–	testing for duration as agreed with the manufacturer	testing for duration as agreed with the manufacturer
Load tests	100 % power run(5)	60 *minutes* at the rated engine speed	60 *minutes* at the rated engine speed	60 *minutes* at the rated engine speed	30 *minutes* at the rated engine speed
	90 % or Normal continuous cruise power run(6)	20 *minutes* at engine speed in accordance with characteristics of propeller	–	20 *minutes* at engine speed in accordance with characteristics of propeller or the rated engine speed	–
	75 % power run		20 *minutes* at the rated engine speed		20 *minutes* at engine speed in accordance with the nominal power consumption curve
	50 % power run				
	25 % power run(6)				
Reverse maneuvering test(7)		○	–	–	–
Governor characteristics test		○	○	○	○
Performance test of alarm and safety devices		○	○	○	○
Overhaul inspection(8)		○	○	○	○

NOTES :

1. For electronically controlled diesel engines, integration tests are to be carried out in accordance with **211. 5** (4) of the Guidance.
2. (1) through (8) in this Table are subject to the following;
   (1) When the test report for identical engine and turbocharger configuration is presented proving the compatibility for overloaded operation, the 110 % power run may be waived. *(2019)*
   (2) After the trials, the fuel delivery system is to be blocked so as to limit the engines to run at not more than 100 % power, unless intermittent overload power is approved by the Society.
   (3) After running on the test bed, the fuel delivery system is to be adjusted so that full power plus a 10 % margin for transient regulation can be given in service after installation onboard. The transient overload capability is required so that the required transient governing characteristics are achieved also at 100 % loading of the engine, and also so that the protection system utilised in the electric distribution system can be activated before the engine stalls.
   (4) After running on the test bed, the fuel delivery system is to be adjusted so that full power plus a margin for transient regulation can be given in service after installation onboard. The transient overload capability is required so that the electrical protection of downstream system components is activated before the engine stalls. This margin may be 10 % of the engine power but at least 10 % of the PTO power.
   (5) The readings are to be taken twice at an interval of at least 30 *minutes.*
   (6) The test item may be dispensed with when deemed appropriate by the Society.
   (7) The test item applies only to direct reversible engines.
   (8) Random checks of components to be presented for inspection after works trials are left to the discretion of the attending Surveyor. *(2018)*

〈Amendment〉

Table 5.2.2 Programme for Shop Trials of Internal Combustion Engine

Test items \ Use of engines		Propulsion engines driving propeller or impeller only[2]	Engines driving generators for electric propulsion and main power supply[3]	Propulsion engines also driving power take off (PTO) generator[4]	Engines driving essential auxiliaries[2]
110 % power run		15 *minutes* at the speed of 1.032 times of the rated engine speed or after steady conditions have been reached, whichever is shorter[1]	15 *minutes* at the rated engine speed	15 *minutes* at the rated engine speed	15 *minutes* at the rated engine speed
Approved intermittent overload (if applicable)		testing for duration as agreed with the manufacturer	–	testing for duration as agreed with the manufacturer	testing for duration as agreed with the manufacturer
Load tests	100 % power run[5]	60 *minutes* at the rated engine speed	60 *minutes* at the rated engine speed	60 *minutes* at the rated engine speed	30 *minutes* at the rated engine speed
	90 % or Normal continuous cruise power run[6]	20 *minutes* at engine speed in accordance with characteristics of propeller	–	20 *minutes* at engine speed in accordance with characteristics of propeller or the rated engine speed	–
	75 % power run[6]		20 *minutes* at the rated engine speed		20 *minutes* at engine speed in accordance with the nominal power consumption curve
	50 % power run[6]				
	25 % power run[6]				
Reverse maneuvering test[7]		○	–	–	–
Governor characteristics test		○	○	○	○
Performance test of alarm and safety devices		○	○	○	○
Overhaul inspection[8]		○	○	○	○

NOTES :

1. For electronically controlled diesel engines, integration tests are to be carried out in accordance with **211. 5** (4) of the Guidance.
2. (1) through (8) in this Table are subject to the following;
   (1) When the test report for identical engine and turbocharger configuration is presented proving the compatibility for overloaded operation, the 110 % power run may be waived. *(2019)*
   (2) After the trials, the fuel delivery system is to be blocked so as to limit the engines to run at not more than 100 % power, unless intermittent overload power is approved by the Society.
   (3) After running on the test bed, the fuel delivery system is to be adjusted so that full power plus a 10 % margin for transient regulation can be given in service after installation onboard. The transient overload capability is required so that the required transient governing characteristics are achieved also at 100 % loading of the engine, and also so that the protection system utilised in the electric distribution system can be activated before the engine stalls.
   (4) After running on the test bed, the fuel delivery system is to be adjusted so that full power plus a margin for transient regulation can be given in service after installation onboard. The transient overload capability is required so that the electrical protection of downstream system components is activated before the engine stalls. This margin may be 10 % of the engine power but at least 10 % of the PTO power.
   (5) The readings are to be taken twice at an interval of at least 30 *minutes.*
   (6) The sequence is to be selected by the engine manufacturer. *(2021)*
   (7) The test item applies only to direct reversible engines.
   (8) Random checks of components to be presented for inspection after works trials are left to the discretion of the attending Surveyor. *(2018)*

〈Present〉

Table 5.2.3 Programme for Sea Trials (on-board tests) of Internal Combustion Engine

Use of engines / Test items		Propulsion engines driving propeller or impeller only[1]	Engines driving generators for electric propulsion and main power supply[2]	Propulsion engines also driving power take off (PTO) generator	Engines driving essential auxiliaries
110 % power run[3]		30 *minutes* at the speed of 1.032 times of the rated engine speed	10 *minutes* at the 110 % rated electrical power of generator	–	–
Approved intermittent overload (if applicable)		testing for duration as agreed with the manufacturer	–	–	testing for duration as agreed with the manufacturer
Load tests	100 % power run	4 *hours* at the rated engine speed	1 *hour* at the 100 % rated electrical power of generator	4 *hours* at the rated engine speed	30 *minutes* at the rated engine speed
	90 % or Normal continuous cruise power run	2 *hours* at engine speed corresponding to nominal continuous cruise power	–	2 *hours* at 100% propeller branch power at rated engine speed[4], 1 *hours* at 100% PTO branch power at rated engine speed	–
	75 % power run	reasonable hours at the rated engine speed for 1 or 2 kind of power run	–		
	50 % power run				
	25 % power run				
Minimum engine speed test		○	–	–	–
Starting maneuvering test[5]		○	○	○	○
Reverse maneuvering test[6]		○	–	–	–
UMA test[7]		○	○	○	○
Alarms and safety devices test[8]		○	○	○	○
Test for fitness of fuel oil[9]		○	○	○	○

Table 5.2.3 Programme for Sea Trials (on-board tests) of Internal Combustion Engine (continued)

NOTES: (1) through (9) in this Table are subject to the following;

(1) For controllable pitch propellers, the tests are to be carried out at the maximum achievable power if 100 % cannot be reached, the tests are to be carried out at the various pitches.

(2) Each engine is to be tested 100 % electrical power for at least 60 min and 110 % of rated electrical power of the generator for at least 10 min. This may, if possible, be done during the electrical propulsion plant test, which is required to be tested with 100 % propulsion power (i.e. total electric motor capacity for propulsion) by distributing the power on as few generators as possible. The duration of this test is to be sufficient to reach stable operating temperatures of all rotating machines or for at least 4 hours. When some of the gen. set(s) cannot be tested due to insufficient time during the propulsion system test mentioned above, those required tests are to be carried out separately. Demonstration of the generator prime movers' and governors' ability to handle load steps as described in **Pt 6, Ch 1, 202. 2 of the Rules.**

(3) The test may be dispensed with when deemed appropriate by the Society in consideration of the result of the shop trials.

(4) The test is to be carried out unless already covered in 100 % power run.

(5) The direct reversible engines are to be carried out ahead and astern starting repeatedly without replenishment, and the other engines are to be carried out starting and stop repeatedly without replenishment.

(6) For controllable pitch propellers in reverse pitch, for the direct reversible engine in reverse rotational direction during stopping tests, passages through the barred speed range are to be demonstrated in accordance with **211. 6** (2) of the Guidance.

(7) The test is to be carried out for ships which are going to be registered as ships provided with unattended machinery automatic systems.

(8) The monitoring and alarm systems are to be checked to the full extent for all engines, except items already verified during the works trials.

(9) The test is to be carried out for the engines used residue oil or equivalent thereto. However, the test may be dispense with when deemed appropriate by the Society or in the case of that the fitness was certified at the shop trial.

〈Amendment〉

Table 5.2.3 Programme for Sea Trials (on-board tests) of Internal Combustion Engine

Use of engines / Test items		Propulsion engines driving propeller or impeller only(1)	Engines driving generators for electric propulsion and main power supply(2)	Propulsion engines also driving power take off (PTO) generator	Engines driving essential auxiliaries
110 % power run(3)		30 *minutes* at the speed of 1.032 times of the rated engine speed	10 *minutes* at the 110 % rated electrical power of generator	–	–
Approved intermittent overload (if applicable)		testing for duration as agreed with the manufacturer	–	–	testing for duration as agreed with the manufacturer
Load tests	100 % power run	4 *hours* at the rated engine speed	1 *hour* at the 100 % rated electrical power of generator	4 *hours* at the rated engine speed (4)	30 *minutes* at the rated engine speed
	90 % or Normal continuous cruise power run	2 *hours* at engine speed corresponding to nominal continuous cruise power	–	–	–
	75 % power run	reasonable hours at the rated engine speed for 1 or 2 kind of power run	–	–	–
	50 % power run		–	–	–
	25 % power run		–	–	–
Minimum engine speed test		○	–	–	–
Starting maneuvering test(5)		○	○	○	○
Reverse maneuvering test(6)		○	–	–	–
UMA test(7)		○	○	○	○
Alarms and safety devices test(8)		○	○	○	○
Test for fitness of fuel oil(9)		○	○	○	○

Table 5.2.3 Programme for Sea Trials (on-board tests) of Internal Combustion Engine (continued)

NOTES: (1) through (9) in this Table are subject to the following;

(1) For controllable pitch propellers, the tests are to be carried out at the maximum achievable power if 100 % cannot be reached, the tests are to be carried out at the various pitches. For controllable pitch propellers, the test at the speed of 1.032 × rated engine speed is not required. *(2021)*

(2) Each engine is to be tested 100 % electrical power for at least 60 min and 110 % of rated electrical power of the generator for at least 10 min. This may, if possible, be done during the electrical propulsion plant test, which is required to be tested with 100 % propulsion power (i.e. total electric motor capacity for propulsion) by distributing the power on as few generators as possible. The duration of this test is to be sufficient to reach stable operating temperatures of all rotating machines or for at least 4 hours. When some of the gen. set(s) cannot be tested due to insufficient time during the propulsion system test mentioned above, those required tests are to be carried out separately. Demonstration of the generator prime movers' and governors' ability to handle load steps as described in **Pt 6, Ch 1, 202. 2 of the Rules.**

(3) The test is to be carried out in case that engine adjustment permit (See **Table 5.2.2** Note 2. (2)). However, the test may be dispensed with when deemed appropriate by the Society in consideration of the result of the shop trials. *(2021)*

(4) The test is to be carried out for 2 hours with 100 % propeller branch power at rated engine speed (unless already covered in the test at 100 % power run). In addition, the test is to be carried out for 1 hour with 100 % PTO branch power at rated engine speed. *(2021)*

(5) The direct reversible engines are to be carried out ahead and astern starting repeatedly without replenishment, and the other engines are to be carried out starting and stop repeatedly without replenishment.

(6) For controllable pitch propellers in reverse pitch, for the direct reversible engine in reverse rotational direction during stopping tests, passages through the barred speed range are to be demonstrated in accordance with **211. 6** (2) of the Guidance.

(7) The test is to be carried out for ships which are going to be registered as ships provided with unattended machinery automatic systems.

(8) The monitoring and alarm systems are to be checked to the full extent for all engines, except items already verified during the works trials.

(9) The test is to be carried out for the engines used residue oil or equivalent thereto. However, the test may be dispense with when deemed appropriate by the Society or in the case of that the fitness was certified at the shop trial.

Present	Amendment	Note
CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS **Section 1 General** **102. Other propulsion and maneuvering machinery 【See Rule】** In application to **102.** of the Rules, it may be complied with the following; **1. Water-jet propulsion systems and azimuth or rotatable thrusters** water-jet propulsion systems or azimuth or rotatable thrusters are to comply with the requirements given in **Annex 5-1.** **2.** Bow or side thrusters and their control units (hereinafter called **"thrusters"**) are to comply with the followings. *(2019)* (1) Plans and documents Before the work is commenced, the manufacturers are to submit the following plans and documents in triplicate to the Society for approval. (A) General arrangement of thruster (B) Sectional assembly (including materials of principal component) (C) Controlling diagrams (D) Shaft arrangement and sealing devices(sealing devices to be type approved by the Society) (hereafter, omitted)	**CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS** **Section 1 General** **102. Other propulsion and maneuvering machinery 【See Rule】** In application to **102.** of the Rules, it may be complied with the following; **1. Water-jet propulsion systems and azimuth or rotatable thrusters** water-jet propulsion systems or azimuth or rotatable thrusters are to comply with the requirements given in **Annex 5-1.** **2.** Bow or side thrusters and their control units (hereinafter called **"thrusters"**) are to comply with the followings. *(2019)* (1) Plans and documents Before the work is commenced, the manufacturers are to submit the following plans and documents in triplicate to the Society for approval. (A) General arrangement of thruster (B) Sectional assembly (including materials of principal component) (C) Controlling diagrams (D) Shaft arrangement and sealing devices~~(sealing devices to be type approved by the Society)~~ (hereafter, same as the present Rules)	<Pt 5 Guidance> (Amendment) Reflect Request for Establishment/Revision of Classification Technical Rules 'MAM4300-1943-2020' 〈application date: the date of contract for construction on or after 1 July 2021〉 - Deleted the requirement for type approval of sealing device since type approval for sealing devices of azimuth thruster is deleted.

Present	Amendment	Note
CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS **Section 4 Power Transmission Systems** **406. Shaft couplings** *(2017)* 1. In the application 406. 2 of the Rules, the wording "to have sufficient strength against the torque" means complying with the following requirements. *(2019)* **【See Rule】** (1) The permissible nominal torque T_{KN} of the flexible coupling is to be complied with following formula. $T_{KN} \geq T_N \quad (\mathrm{kN \cdot m})$ where: T_N = Nominal torque (highest mean torque in continuous service) $T_N = \frac{9.55 \times P}{n} \quad (\mathrm{kN \cdot m})$ where: P = Maximum output in continuous service (kW) n = Number of revolution at maximum output in continuous service (rpm) (hereafter, omitted)	**CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS** **Section 4 Power Transmission Systems** **406. Shaft couplings** *(2017)* 1. In the application 406. 2 of the Rules, the wording "to have sufficient strength against the torque" means complying with the following requirements. *(2019)* **【See Rule】** (1) The permissible torque T of the flexible coupling used in main propulsion shafting systems is to be complied with following formula. *(2021)* $T \geq 2.933 \times 10^4 \left(\frac{P}{n}\right) \quad (\mathrm{N \cdot m})$ where: P = Maximum output in continuous service (kW) n = Number of revolution at maximum output in continuous service (rpm) (hereafter, same as the present Rules)	<Pt 5 Guidance> (Amendment) The permissible torque of flexible coupling <application date: the date of contract for construction on or after 1 July 2021> - Revise the formula for the permissible torque of flexible coupling

Present	Amendment	Note
Annex 5-1 Requirements for the Water-jet Propulsion Systems and Azimuth or Rotatable Thrusters **1. Water-jet propulsion systems** (1) ~ (3) 〈omitted〉 (4) System design (A) Number of propulsion systems (a) 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. As a result, the requirements for auxiliary steering gear specified in **Ch 7, Sec 2** of the Rules may not apply to propulsion systems. **2. Azimuth or rotatable thrusters** (1) ~ (3) 〈omitted〉 (4) System design (A) Thrusters (a) 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. As a result, the requirements for auxiliary steering gear as specified in **Ch 7, Sec 2** of the Rules do not apply to thrusters. (b) ~ (d) 〈omitted〉 (B) ~ (C) 〈omitted〉 (D) Sealing devices Sealing devices for steering parts of azimuth steering gears are to be type approved by the society in their materials, construction and arrangement. (hereafter, omitted)	**Annex 5-1 Requirements for the Water-jet Propulsion Systems and Azimuth or Rotatable Thrusters** **1. Water-jet propulsion systems** (1) ~ (3) 〈same as the present〉 (4) System design (A) Number of propulsion systems (a) 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. In this case, for ships not engaged in international voyage the requirements for auxiliary steering gear specified in **Ch 7, 201. 1** of the Rules may be omitted. *(2021)* **2. Azimuth or rotatable thrusters** (1) ~ (3) 〈same as the present〉 (4) System design (A) Thrusters (a) 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. In this case, for ships not engaged in international voyage the requirements for auxiliary steering gear specified in **Ch 7, 201. 1** of the Rules may be omitted. *(2021)* (b) ~ (d) 〈same as the present〉 (B) ~ (C) 〈same as the present〉 (D) Sealing devices Sealing devices for steering parts of azimuth steering gears and propeller shafts are to be approved by the society in their materials, construction and arrangement. *(2021)* (hereafter, same as the present Rules)	〈Pt 5 Guidance〉 (Amendment) Reflect Request for Establishment/Revision of Classification Technical Rules 'MAM4300-1943-2020' 〈application date: the date of contract for construction on or after 1 July 2021〉 - IACS UI242 (Rev.2), Ship Safety Act and Pt 5, Appendix 5-1 of the Guidance conflict was found and corrected. - Type approval for sealing devices of azimuth thruster is deleted.

Present	Amendment	Note
Annex 5-3 Guidance for Calculation of Crankshaft Stress (2)	**Annex 5-3 Guidance for Calculation of Crankshaft Stress (2)**	〈Pt 5 Guidance〉
7. Acceptability Criteria	**7. Acceptability Criteria**	(Amendment) Revise acceptability criteria for calculation of crankshaft stress 〈application date: the date of contract for construction on or after 1 July 2021〉
The sufficient dimensioning of a crankshaft is confirmed by a comparison of the equivalent alternating stress and the fatigue strength. This comparison has to be carried out for the crankpin fillet, the journal fillet, the outlet of crankpin oil bore and is based on the formula.	The sufficient dimensioning of a crankshaft is confirmed by a comparison of the equivalent alternating stress σ_v and the fatigue strength σ_{DW}. This comparison has to be carried out for the crankpin fillet, the journal fillet, the outlet of crankpin oil bore and acceptability factor Q is based on the following formula. *(2021)*	
$Q = \frac{\sigma_{DW}}{\sigma_V} \geq 1.15$	$Q = \frac{\sigma_{DW}}{\sigma_V}$	- revised according to the original text in ICAS UR M53
where, Q : Acceptability factor	Adequate dimensioning of the crankshaft is ensured if the smallest of all acceptability factors Q satisfies the criteria: $Q \geq 1.15$	
(hereafter, omitted)	(hereafter, same as the present Rules)	

Present	Amendment	Note
〈Appendix IV Evaluation of Fatigue Tests〉 ***(2018)***	**〈Appendix IV Evaluation of Fatigue Tests〉** ***(2018)***	〈Pt 5 Guidance〉
4. Full size testing (3) Use of results and crankshaft acceptability (A) In order to combine tested bending and torsion fatigue strength results in calculation of crankshaft acceptability, see Annex 5-3, 7, the Gough-Pollard approach can be applied for the following cases: Related to the crankpin diameter: $Q=\left(\sqrt{\left(\frac{\sigma_{BH}}{\sigma_{DWCT}}\right)^2+\left(\frac{\tau_{BH}}{\tau_{DWCT}}\right)^2}\right)^{-1}$ where: σ_{DWCT} : fatigue strength by bending testing τ_{DWCT} : fatigue strength by torsion testing Related to crankpin oil bore: $Q=\left(\sqrt{\left(\frac{\sigma_{BO}}{\sigma_{DWOT}}\right)^2+\left(\frac{\tau_{TO}}{\tau_{DWOT}}\right)^2}\right)^{-1}$ where: σ_{DWOT} : fatigue strength by bending testing τ_{DWOT} : fatigue strength by torsion testing (hereafter, omitted)	**4. Full size testing** (3) Use of results and crankshaft acceptability (A) In order to combine tested bending and torsion fatigue strength results in calculation of crankshaft acceptability (see **Annex 5-3, 7**), the Gough-Pollard approach and the maximum principal equivalent stress formulation can be applied for the following cases: *(2021)* Related to the crankpin diameter: $Q=\left(\sqrt{\left(\frac{\sigma_{BH}}{\sigma_{DWCT}}\right)^2+\left(\frac{\tau_{BH}}{\tau_{DWCT}}\right)^2}\right)^{-1}$ where: σ_{DWCT} : fatigue strength by bending testing τ_{DWCT} : fatigue strength by torsion testing Related to crankpin oil bore: $Q=\frac{\sigma_{DWOT}}{\sigma_v};\qquad \sigma_v=\frac{1}{3}\sigma_{BO}\bullet\left(1+2\sqrt{1+\frac{9}{4}\left(\frac{\sigma_{TO}}{\sigma_{BO}}\right)^2}\right)$ where: σ_{DWOT} : fatigue strength by means of largest principal stress from torsion testing ~~τ_{DWOT} : fatigue strength by torsion testing~~ (hereafter, same as the present Rules)	(Amendment) Reflecting IACS UR M53 (Rev.4 Aug 2019) 〈application date: the date of application for plan approval on or after 1 Jan. 2021〉 - The maximum principal equivalent stress formulation was evaluated to be more appropriate than the multi-axial Gough Pollard formulation.

Present	Amendment	Note
Annex 5-8 The Additional Requirements on Electronically-Controlled Diesel Engines **1. ~ 3. 〈omitted〉** **4. Construction and Associated Installations** (1) General Essential components are to be so arranged that the normal operation of the main propulsion machinery is capable of being sustained or restored even though one of them becomes inoperable, except where special consideration is given by the Society to the reliability of a single arrangement. A single component provided for each cylinder, of which spare is not required, may be acceptable in case where the failed part can be isolated. (2) Control valves (A) Control valves are to be capable of retaining the expected functions for a period prescribed by the manufacturer. In principle, this period is to be set up at least 3 years. (B) Control valves are to be independently provided for each function(e.g. fuel injection, exhaust valve driving). (3) Accumulators and common accumulators (A) Accumulators and Common Accumulators are to comply with the requirements in **Pt 5, Ch 5, Sec 3** of the Rules. (B) Accumulators are to be capable of retaining the expected functions for a period prescribed by the manufacturer. In principle, this period is to be set up at least 3 years. (hereafter, omitted)	**Annex 5-8 The Additional Requirements on Electronically-Controlled Diesel Engines** **1. ~ 3. 〈same as the present〉** **4. Construction and Associated Installations** (1) General Essential components are to be so arranged that the normal operation of the main propulsion machinery is capable of being sustained or restored even though one of them becomes inoperable, except where special consideration is given by the Society to the reliability of a single arrangement. A single component provided for each cylinder, of which spare is not required, may be acceptable in case where the failed part can be isolated. (2) Control valves (A) Control valves are to be capable of retaining the expected functions for a period prescribed by the manufacturer. ~~In principle, this period is to be set up at least 3 years.~~ *(2021)* (B) Control valves are to be independently provided for each function(e.g. fuel injection, exhaust valve driving). (3) Accumulators and common accumulators (A) Accumulators and Common Accumulators are to comply with the requirements in **Pt 5, Ch 5, Sec 3** of the Rules. (B) Accumulators are to be capable of retaining the expected functions for a period prescribed by the manufacturer. ~~In principle, this period is to be set up at least 3 years.~~ *(2021)* (hereafter, same as the present Rules)	<Pt 5 Guidance> (Amendment) Deletion of the service life for control valves and accumulators <application date: the date of contract for construction on or after 1 July 2021> - In the case of control valves and accumulators of electronically controlled diesel engines, maintenance is usually required through a professional service engineer from the manufacturer, so a three-year service life was set. However, since recently repairs by ship crews have become common, the service life needs to be deleted.

Present	Amendment	Note
Annex 5-12 Shaft Alignment *(2017)*	**Annex 5-12 Shaft Alignment *(2017)***	<Pt 5 Guidance>
1. ~ 2. 〈omitted〉	**1. ~ 2. 〈same as the present〉**	(Amendment) amend the requirements for shaft alignment <application date: the date of contract for construction on or after 1 July 2021>
3. Stern tube bearing slope boring *(2019)*	**3. Stern tube bearing slope boring *(2019)***	- Add shafting with no forward stern tube bearing on alignment sensitive installations.
(1) The slope boring angle calculation (single or double slope) is to be based on a static afloat condition with a hot engine and fully immersed propeller. (2) If the calculated relative slope between the shaft and the aft most bearing is greater than 0.3×10^{-3} rad, the relative slope is to be reduced by means of slope boring or bearing inclination. (3) On alignment sensitive installations (e.g. tankers, bulkers and twin screw vessels) it is recommended to apply the double slope design on the aft stern tube bearings.	(1) The slope boring angle calculation (single or double slope) is to be based on a static afloat condition with a hot engine and fully immersed propeller. (2) If the calculated relative slope between the shaft and the aft most bearing is greater than 0.3×10^{-3} rad, the relative slope is to be reduced by means of slope boring or bearing inclination. (3) On alignment sensitive installations (e.g. tankers, bulkers and twin screw vessels and shafting with no forward stern tube bearing) it is recommended to apply the double slope design on the aft stern tube bearings. *(2021)*	
4. Shaft Alignment Procedure *(2019)*	**4. Shaft Alignment Procedure *(2019)***	
The shaft alignment procedure is to be submitted for review and is to be based on the submitted shaft alignment calculations. As a minimum, the shaft alignment procedure is to include the following. (1) ~ (4) 〈omitted〉 (5) Stern tube bearing run-in procedure : For alignment sensitive installation (e.g. tankers, bulkers and twin screw vessels), it is recommended to conduct a run-in procedure before the stern tube bearings are exposed to higher service speeds and rudder angles.	The shaft alignment procedure is to be submitted for review and is to be based on the submitted shaft alignment calculations. As a minimum, the shaft alignment procedure is to include the following. (1) ~ (4) 〈same as the present〉 (5) Stern tube bearing run-in procedure : For alignment sensitive installation (e.g. tankers, bulkers and twin screw vessels and shafting with no forward stern tube bearing), it is recommended to conduct a run-in procedure before the stern tube bearings are exposed to higher service speeds and rudder angles. *(2021)*	
(hereafter, omitted)	(hereafter, same as the present Rules)	

Guidance Relating to the Rules for the Classification of Steel Ships

(Development Review : For external opinion inquiry)

Part 5 Machinery Installations

2020. 9.

Machinery Rule Development Team

Effective Date : 1 January 2021

(The contract date for ship construction)

Present	Amendment	Remark
CHAPTER 7 STEERING GEARS	CHAPTER 7 STEERING GEARS	
Section 1 - 2 〈same as the present Rules〉	Section 1 - 2 〈same as the present Rules〉	
Section 3 Controls	Section 3 Controls	
301. 〈same as the present Rules〉	301. 〈same as the present Rules〉	
302. 〈newly added〉	302. Failure detection and response of all types of steering control systems *(2021)* **1.** In application to **302. 1** of the Rules, for hydraulic locking failure, refer also to **103., 104.** and **301. 7** of the Guidance.	(Newly added) - Reflecting IACS UR E25 (Rev. 1 Dec 2019), the additional references have been specified in case of hydraulic locking failure.
303. 〈same as the present Rules〉	303. 〈same as the present Rules〉	
Section 4 - 6 〈same as the present Rules〉	Section 4 - 6 〈same as the present Rules〉	

RULES FOR CLASSIFICATION OF STEEL SHIPS

(Development Review : For external opinion inquiry)

Part 5 Machinery Installation

2020. 09.

Machinery Rule Development Team

- Main Amendments -

(1) Reflecting request for establishment/revision <ships contracted for construction on or after 2021/01/01>

◉ Material test for valves and fittings

- Impractical restriction for use of cast iron with an elongation of 12 % or above has been deleted

(2) Reflecting request for establishment/revision <ships contracted for construction on or after 2021/07/01>

◉ <ENP4800-6041-2020 : arrangement of Scuppers and sanitary discharge>

- Requirements for arrangements of scuppers and sanitary pipes has been harmonized with ICLL Reg.22

Present	Amendment	Reason
CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT **Section 1 General** **101. to 102. <omitted>** **103. Valves and fitting** [See Guidance] **1. to 3. <omitted>** **4. Service limitations for cast iron for valves and pipe fittings** (1) Valves and pipe fittings made of cast iron with an elongation of 12 % or above can be used for valves and pipe fittings in the piping system with a design temperature of 350 °C or less, and they may be used only where deemed appropriate by the Society. (2)to (3) <omitted> <hereafter omitted>	**CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT** **Section 1 General** **101. to 102. <same as the present>** **103. Valves and fitting** [See Guidance] **1. to 3. <same as the present>** **4. Service limitations for cast iron for valves and pipe fittings** (1) Valves and pipe fittings made of cast iron with an elongation of 12 % or above can be used for valves and pipe fittings in the piping system with a design temperature of 350 °C or less. ~~and they may be used only where deemed appropriate by the Society.~~ (2)to (3) <same as the present> <hereafter same as the present>	〈effective daet : 2021.1.1.〉 - Impractical restriction for use of cast iron with an elongation of 12 % or above has been deleted

Present	Amendment	Reason
Section 3 Sea Suction and Overboard Discharge	**Section 3 Sea Suction and Overboard Discharge**	
301. to 302. <omitted>	**301. to 302. <same as the present>**	
303. Scuppers and sanitary discharge	**303. Scuppers and sanitary discharge**	
1. to 3. Scuppers of exposed decks 【See Guidance】 Scuppers draining weather decks and spaces within superstructures or deck houses not fitted with efficient weathertight doors are to be led overboard.	**1. to 3. Scuppers of exposed decks** 【See Guidance】 Scuppers draining weather decks and spaces within superstructures or deck houses not fitted with efficient weathertight doors are to be led overboard.	
4. Non-return valves of scuppers and sanitary pipes Scuppers and sanitary pipes from spaces below the freeboard deck or from spaces within enclosed superstructures or enclosed deckhouses on the freeboard deck are to be led to the bilges or to suitable sanitary tanks. Alternatively, they may be led to overboard where they are provided with valves in accordance with the following requirements. 【See Guidance】 (1) Each separate discharge is to have one automatic non-return valve with a positive means of closing it from a position above the freeboard deck or, alternatively, one automatic non-return valve having no positive closing means and one stop valve controlled from above the freeboard deck. However, where the scuppers lead overboard through the shell plating in way of manned engine room, the fitting to the shell plating of a locally operated positive closing valve, together with a non-return valve inboard, will also be accepted. The means for operating the positive action valve from above the freeboard deck are to be readily accessible and provided with an indicator showing whether the valve is open or closed. (2) to (3) <omiotted>	**4. Non-return valves of scuppers and sanitary pipes** Scuppers and sanitary pipes from spaces below the freeboard deck or from spaces within enclosed superstructures or enclosed deckhouses on the freeboard deck are to be led to the bilges or to suitable sanitary tanks. Alternatively, they may be led to overboard where they are provided with valves in accordance with the following requirements. 【See Guidance】 (1) Each separate discharge is to have one automatic non-return valve with a positive means of closing it from a position above the freeboard deck or, alternatively, one automatic non-return valve having no positive closing means and one stop valve controlled from above the freeboard deck. The means for operating the positive action valve from above the freeboard deck are to be readily accessible and provided with an indicator showing whether the valve is open or closed. However, where the scuppers lead overboard through the shell plating in way of machinery spaces, a locally operated positive closing valve at the shell, together with a non-return valve inboard, is acceptable. The controls of the valves shall be in an easily accessible position. ~~The means for operating the positive action valve from above the freeboard deck are to be readily accessible and provided with an indicator showing whether the valve is open or closed.~~ (2) to (3) <same as the present>	- Requirements for arrangements of scuppers and sanitary pipes has been harmonized with ICLL Reg.22

GUIDANCE RELATING TO RULES FOR CLASSIFICATION OF STEEL SHIPS

(Development Review : For external opinion inquiry)

Part 5 Machinery Installation

2020. 09.

Machinery Rule Development Team

- Main Amendments -

(1) Reflecting request for establishment/revision <ships contracted for construction on or after 2021/01/01>

◉ Material test for pipe fittings and valves

- To accept work's certificate in lieu of class certification.

◉ Material test for valves and fittings

- Impractical restriction for use of cast iron with an elongation of 12 % or above has been deleted

(2) Reflecting request for establishment/revision <ships contracted for construction on or after 2021/07/01>

◉ Arrangements of scupper and discharge

- Table in ICLL Reg.22 has been added.

◉ Means for operating the ballast valves

- To remain operable of ballast valves, when the valves are install in the spaces where there is a possibility of flooding due to grounding or collision,

Present	Amendment	Reason
CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT **Section 1 General** **101. to 102. <omitted>** **103. Valves and fittings [See Rule]** **1.** In application to **103. 1.** (1) and **4.** (1) of the Rules, "the Society may accept to use valves and fittings made of materials which meet Korean Industrial Standards or Equivalent." means the following valves and fittings.	**CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT** **Section 1 General** **101. to 102. <same as the present>** **103. Valves and fittings [See Rule]** **1.** In application to **103. 1.** (1) ~~and **4.** (1)~~ of the Rules, "the Society may accept to use valves and fittings made of materials which meet Korean Industrial Standards or Equivalent." means the following valves and fittings.	〈effective daet : 2021.1.1.〉 - Unpractical restriction for use of for use of cast iron with an elongation of 12 % or above has been deleted

Materials	Design Temperature (°C)	Nominal diameter (D) : A Design pressure (P) : MPa
Carbon and low alloy steel, cast iron with an elongation of 12 % or above	< 300 and	$D \leq 50$ or $P \times D \leq 250$
Copper alloy	< 200 and	$D \leq 50$ or $P \times D \leq 150$

<newly added>

2. to 3. <omitted>

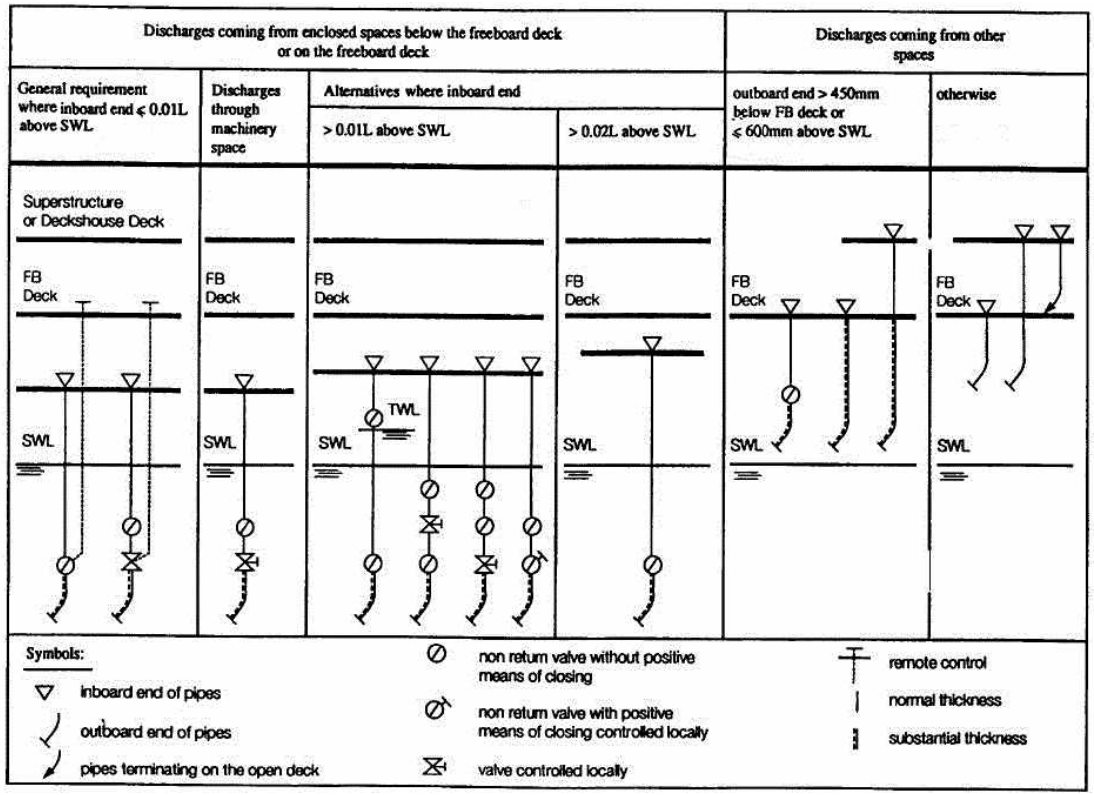
Materials	Design Temperature (°C)	Nominal diameter (D) : A Design pressure (P) : MPa
Carbon and low alloy steel, stainless steel, cast iron with an elongation of 12 % or above	< 300 and	$D \leq 50$ or $P \times D \leq 250$
Copper alloy	< 200 and	$D \leq 50$ or $P \times D \leq 150$

<newly added>

2. In application to “"to comply with the relevant requirement of **Pt 2, Ch 1.**” in **103. 1.** (1) of the Rules, work’s certificate with manufacturing process approved by the Society may be accepted. Where, however, it is deemed to be necessary by the Society, the attendance of the Surveyor is required for material tests.

- To accept work’s certificate in lieu of class certification.

3. to 4. <same as the present>

Present	Amendment	Reason
Section 3 Sea inlet and Overboard Discharge **301. to 302. <omitted>** **303. Scuppers and sanitary discharge** **1.** <omitted> **2. Non-return valves of scuppers and sanitary pipes** In application to **303. 4** of the Rules, discharge from spaces under the freeboard deck is to comply with the following. **【See Rule】** (1) Discharge from under the freeboard deck (A) to (C) <omitted> <newly added> <hereafter omitted>	**Section 3 Sea inlet and Overboard Discharge** **301. to 302. <same as the present>** **303. Scuppers and sanitary discharge** **1.** <same as the present> **2. Non-return valves of scuppers and sanitary pipes** In application to **303. 4** of the Rules, discharge from spaces under the freeboard deck is to comply with the following. **【See Rule】** (1) Discharge from under the freeboard deck (A) to (C) <same as the present> (D) Acceptable arrangements of scupper and discharge are to comply with **Table 5.6.2**. **Table 5.6.2. Acceptable arrangements of scupper and discharge**  <hereafter same as the present>	- Table in ICLL Reg.22 has been added.

Present	Amendment	Reason
Section 4 Bilge and Ballast System	**Section 4 Bilge and Ballast System**	
401. to 405. <omitted>	**401. to 405. <same as the present>**	
406. Pipe systems and their fittings	**406. Pipe systems and their fittings**	
1. <omitted>	**1.** <same as the present>	
<newly added>	**2. Means for operating the ballast valves** In application to "provided that there is a readily accessible manual means to the valves upon loss of power" in **406. 7** (2) of the Rules, manual means to the valves are not to be located in double bottoms, side tanks, bilge hopper tanks or void spaces, where manual means are not operable when the spaces are flooded.	- To remain operable of ballast valves, when the valves are install in the spaces where there is a possibility of flooding due to grounding or collision,
2. <omitted>	**3.** <same as the present>	
<hereafter omitted>	<hereafter same as the present>	

Present	Amendment	Reason
Section 12 Refrigerating Machinery **1201. General** [See Guidance] **1. Application** (1) The requirements in this Section apply to the refrigerating machinery of refrigerating chamber using the primary refrigerants listed below and forming the refrigerating cycle used for refrigeration, etc.. However, the refrigerating machinery with compressors of 7.5 kW or less and the refrigerating machinery using primary refrigerants other than those listed below are to be as deemed appropriate by the Society. *R* 22 : *CHClF*2 *R* 134*a* : *CH*2*FCF*3 *R* 404*A* : *R* 125/*R* 143*a*/*R* 134*a* (44/52/4 *wt%*) *CHF*2*CF*3/*CH*3*CF*3/*CH*2*FCF*3 *R* 407*C* : *R* 32/*R* 125/*R* 134*a*(23/25/52 *wt%*) *CH*2*F*2/*CHF*2*CF*3/*CH*2*FCF*3 *R* 410*A* : *R* 32/*R* 125 (50/50 *wt%*) *CH*2*F*2/*CHF*2*CF*3 *R* 507*A* : *R* 125/*R* 143*a*(50/50 *wt%*) *CHF*2*CF*3/*CH*3*CF*3 (2) <omitted> <hereafter omitted>	**Section 12 Refrigerating Machinery** **1201. General** [See Guidance] **1. Application** (1) The requirements in this Section apply to the cargo refrigerating machinery of refrigerating chamber using the primary refrigerants listed below and forming the refrigerating cycle used for refrigeration, etc.. However, the cargo refrigerating machinery with compressors of 7.5 kW or less and the cargo refrigerating machinery using primary refrigerants other than those listed below are to be as deemed appropriate by the Society. *R* 22 : *CHClF*2 *R* 134*a* : *CH*2*FCF*3 *R* 404*A* : *R* 125/*R* 143*a*/*R* 134*a* (44/52/4 *wt%*) *CHF*2*CF*3/*CH*3*CF*3/*CH*2*FCF*3 *R* 407*C* : *R* 32/*R* 125/*R* 134*a*(23/25/52 *wt%*) *CH*2*F*2/*CHF*2*CF*3/*CH*2*FCF*3 *R* 410*A* : *R* 32/*R* 125 (50/50 *wt%*) *CH*2*F*2/*CHF*2*CF*3 *R* 507*A* : *R* 125/*R* 143*a*(50/50 *wt%*) *CHF*2*CF*3/*CH*3*CF*3 (2) <same as the present> <hereafter same as the present>	- To be harmonized with Korean version of Rules.

GUIDANCE RELATING TO RULES FOR CLASSIFICATION OF STEEL SHIPS

(Development Review : Internal Opinion Inquiry)

Part 5 Machinery Installation

2020. 12.

Machinery Rule Development Team

- Main Amendments -

(1) Reflecting request for establishment/revision <ships contracted for construction on or after 2021/07/01>

◉ Requested from Equipment team : Temperature restriction for usage of rubber seated butterfly valves

◉ ENP4500-3490-2020 : Flange rating for CO2 piping

◉ ENP4500-2353-2020 : Equivalent method for screw-down non-return valves

◉ ENP4800-2352-2020 : Exception of piping requirements for permanent ballast tank

◉ Requested from Ulsan branch office : Harmonization with Korean version

◉ Requested from KOMSA : UV protection for plastic pipes installed in external area

Present	Amendment	Reason
CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT **Section 1 General** **101. to 102. <omitted>** **103. Valves and fittings [See Rule]** **1. to 3.** <omitted> **4.** Rubber seat butterfly valves are to be dealt with under the following requirements ; (1) Application Rubber seat butterfly valves (hereinafter referred to as the butterfly valve) may not to be used for the applications below. However, they may be used according to the discretion of the Society. (A) Outlet valves fitted to the tank carrying flammable or combustible liquid (e.g., fuel oil, crude oil, etc.) and subjected to the liquid head, installed in the engine room or area susceptible to fire. However, they may be as those installed within the cargo oil tanks or outlet valves leading to the pump room of oil tankers. (B) Valves in piping system with a design pressure exceeding 1.6 MPa (C) Valves in piping system with a design temperature exceeding 70 °C (D) Valves in piping system handling special liquids other than water and oil (E) Valves in the fuel oil piping system within the engine room in case they have such a construction that the internal lining rubber is extended to the abutting face of flange for using as a gasket. <omitted>	**CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT** **Section 1 General** **101. to 102. <same as the present>** **103. Valves and fittings [See Rule]** **1. to 3.** <same as the present> **4.** Rubber seat butterfly valves are to be dealt with under the following requirements ; (1) Application Rubber seat butterfly valves (hereinafter referred to as the butterfly valve) may not to be used for the applications below. However, they may be used according to the discretion of the Society considering manufacturers' specification. (A) Outlet valves fitted to the tank carrying flammable or combustible liquid (e.g., fuel oil, crude oil, etc.) and subjected to the liquid head, installed in the engine room or area susceptible to fire. However, they may be as those installed within the cargo oil tanks or outlet valves leading to the pump room of oil tankers. (B) Valves in piping system with a design pressure exceeding 1.6 MPa (C) Valves in piping system with a design temperature exceeding 70 °C (D) Valves in piping system handling special liquids other than water and oil (E) Valves in the fuel oil piping system within the engine room in case they have such a construction that the internal lining rubber is extended to the abutting face of flange for using as a gasket. <hereafter, same as the present>	<Requested by Marine & Ocean Equipment Team>

Present	Amendment	Reason
104. Type of connection	**104. Type of connection**	
1. to 5. <omitted>	**1. to 5. <same as the present>**	
<newly added>	**6. Pressure rating of CO2 fire extinguishing** In application to **104. 1** of the Rules, the pressure rating of pipe connections such as flanges from the distribution station to nozzle is to be not less than the maximum pressure developed during the discharge of CO2 into protected spaces. **【See Rule】**	<ENP4500-3490-2020>
<hereafter, omitted>	<hereafter, same as the present>	

Present	Amendment	Reason
Section 4 Bilge and Ballast System	**Section 4 Bilge and Ballast System**	
401. General	**401. General**	
1. <omitted>	**1. <same as the present>**	
2. In application to **401. 2** (1) of the Rules, where void spaces and cofferdams do not affect to ship's stability and are located above the load water line, the spaces may be drained by installation of a separate bilge pump(a portable pump may be accepted) or by gravity, instead of fixed bilge piping system connected to main bilge line. However, where draining by gravity, this pipe is to be provide with a quick-acting self-closing valve located in a readily accessible position. **【See Rule】**	**2. Piping arrangement** (1) In application to **401. 2** (1) of the Rules, where void spaces and cofferdams do not affect to ship's stability and are located above the load water line, the spaces may be drained by installation of a separate bilge pump(a portable pump may be accepted) or by gravity, instead of fixed bilge piping system connected to main bilge line. However, where draining by gravity, this pipe is to be provide with a quick-acting self-closing valve located in a readily accessible position. **【See Rule】**	
<newly added>	(2) **401. 2** (2) of the Rules does not apply to permanent ballast water in sealed tanks.	<ENP4800-2352-2020>
<newly added>	**3. Piping arrangement** In application to **Sec 4** of the Rules, a stop valve and a non return valve in series is regarded as equivalent for screw-down non-return valves.	<ENP4800-2353-2020>
<hereafter, omitted>	<hereafter, same as the present>	

Present	Amendment	Reason
Annex 5-5 Requirements of Equipment for Gas welding	**Annex 5-5 Requirements of Equipment for Gas welding**	
1. to 3 <omitted>	**1. to 3** <same as the present>	
4. In case where permanent piping is arranged between the gas bottles and working area, the following requirements are to be complied with : (1) to (2) <omitted> (3) The procedures of piping arrangement are to be as specified below : (A) <omitted> (B) Except when used in a working area, gas bottles are to be kept closed by stop valves which are fitted in a store room, and warning notices to this effect are to be placed in a store room and working area. *(2017)* <hereafter, omitted>	**4.** In case where permanent piping is arranged between the gas bottles and working area, the following requirements are to be complied with : (1) to (2) <same as the present> (3) The procedures of piping arrangement are to be as specified below : (A) <same as the present> (B) Stop valves are to be fitted on oxygen and acetylene gas piping at adequate locations of the penetrations through the casing of the store room and working area. Except when used in a working area, gas bottles are to be kept closed by stop valves which are fitted in a store room, and warning notices to this effect are to be placed in a store room and working area. *(2017)* <hereafter, same as the present>	<Requested by Ulsan branch office> - To be harmonized with Korean version.

Present	Amendment	Reason
Annex 5-6 Plastic Piping System	**Annex 5-6 Plastic Piping System**	
1. to 4. <omitted>	**1. to 4.** <same as the present>	
5. Requirements for pipes/piping systems depending on service and/or locations	**5. Requirements for pipes/piping systems depending on service and/or locations**	
(1) to (5) <omitted>	(1) to (5) <same as the present>	
<newly added>	(6) Where plastic pipes are to be installed in external areas, such pipes are to be protected against ultraviolet radiation.	<Requested by KOMSA>
<hereafter, omitted>	<hereafter, same as the present>	