Guidance Relating to Rules for Classification of Steel Ships

(Development Review : For external opinion inquiry)

Part 5 Machinery Installations

2024. 01.

Machinery Rule Development Team

- Main Amendments -

(1) Effective date : 1 Jul. 2024 (Date of contracts for construction)

◉ The application of the requirements for deadship recovery has been clarified.

◉ The requirements for shop trials and sea trials for reciprocating internal combustion engines for main propulsion with PTO generators have been revised.

◉ The requirements for non-destructive testing for welds of pressure vessels are newly added.

(2) Effective date : 1 Jul. 2024 (Date of application for approval)

◉ Reflecting IACS UR M53 (Rev.5 May 2023), use of results and crankshaft acceptability in guidance for calculation of crankshaft stress has been revised.

◉ Reflecting IACS UR M56 (Rev.4 Corr.2 Mar 2023), reference to ISO standards has been corrected.

Present	Amendment	Note
# CHAPTER 1 GENERAL ## Section 1 General **103. Construction, materials and installation 【See Rule】** In application to **103. 7** of the Rules, where insulation for surfaces of machinery installations e.g. turbo blowers, etc, is difficult, consideration will be given to the discretion of the Society. (hereafter, omitted)	# CHAPTER 1 GENERAL ## Section 1 General **103. Construction, materials and installation 【See Rule】** **1.** In case of ships complied with the following, the requirements of **103. 3** of the Rules may not be applied. *(2024)* **【See Rule】** (1) Cargo ships with a gross tonnage less than 500 tons, or (2) Ships not engaged in international voyage **2.** In application to **103. 7** of the Rules, where insulation for surfaces of machinery installations e.g. turbo blowers, etc, is difficult, consideration will be given to the discretion of the Society. (hereafter, same as the present)	〈Pt 5 Guidance〉 (Amendment) Clarified the application of the requirements for deadship recovery 〈application date: the date of contract for construction on or after 1 July. 2024〉 - In line with the application of SOLAS, deadship recovery requirements have been amended so that cargo ships with a gross tonnage of less than 500 tons or ships not engaged in international voyages may not be subject to deadship recovery requirements.

Present	Amendment	Reason
# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 2 Internal Combustion Engines **211. Tests and inspections** **Table 5.2.2 Programme for Shop Trials of Internal Combustion Engine**	# CHAPTER 2 MAIN AND AUXILIARY ENGINES ## Section 2 Reciprocating Internal Combustion Engines **211. Tests and inspections** **Table 5.2.2 Programme for Shop Trials of Reciprocating Internal Combustion Engine**	〈Pt 5 Guidance〉 (Amendment) The requirements for sea trials of reciprocating internal combustion engine have been revised. 〈application date: the date of contract for construction on or after 1 Jul. 2024〉

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)
〈omitted〉				
Reverse maneuvering test(7)	○	-	-	-
Governor characteristics test	○	○	○	○
Performance test of alarm and safety devices	○	○	○	○
Overhaul inspection(8)	○	○	○	○
〈omitted〉				

(hereafter, omitted)

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)
〈same as the present〉				
Reverse maneuvering test(7)	○	-	○	-
Governor characteristics test	○	○	○	○
Performance test of alarm and safety devices	○	○	○	○
Overhaul inspection(8)	○	○	○	○
〈same as the present〉				

(hereafter, same as the present)

- It is clarified that reverse maneuvering test are to be carried out because propulsion engines also driving power take off (PTO) generator also serves as the main engine.

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
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
Minimum engine speed test	○	-	-	-
Starting maneuvering test[5]	○	○	○	○
Reverse maneuvering test[6]	○	-	-	-
〈omitted〉				

(hereafter, omitted)

Amendment

Table 5.2.3 Programme for Sea Trials (on-board tests) of Reciprocating 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	30 *minutes* at the speed of 1.032 times of 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
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
Minimum engine speed test	○	-	○	-
Starting maneuvering test[5]	○	○	○	○
Reverse maneuvering test[6]	○	-	○	-
〈same as the present〉				

(hereafter, same as the present)

Reason

〈Pt 5 Guidance〉

- It is clarified that minimum engine speed test and reverse maneuvering test are to be carried out because propulsion engines also driving power take off (PTO) generator also serves as the main engine.

Present	Amendment	Note
# CHAPTER 5 BOILERS AND PRESSURE VESSELS ## Section 4 Welding for Boilers and Pressure Vessels **404. Radiographic examination 【See Rule】** **1.** In application to **404.** of the Rules, ultrasonic examination may be substituted for radiographic examination subject to the approval by the Society.	# CHAPTER 5 BOILERS AND PRESSURE VESSELS ## Section 4 Welding for Boilers and Pressure Vessels **404. Radiographic examination 【See Rule】** **1.** In application to **404.** of the Rules, ultrasonic examination may be substituted for radiographic examination subject to the approval by the Society. **2.** The acceptance levels and required quality levels for radiographic testing are provided in table below. *(2024)* **The acceptance levels and required quality levels for Radiographic Testing** Quality Levels (ISO 5817:2014 applies)(1) / Testing Techniques/ levels (ISO 17636-1:2022 applies)(1) / Acceptance levels (ISO 10675-1:2021 applies)(1) B / B(class) / 1 Note: (1) Or any recognized standard agreed with the Society and demonstrated to be acceptable	〈Pt 5 Guidance〉 (Amendment) Reflects GCH4800-51-2023, a request for revision for the non-destructive testing requirements of pressure vessels 〈application date: the date of contract for construction on or after 1 July. 2024〉 - Newly added non-destructive testing requirements for welds of pressure vessels.

<table>
<tr><th>Present</th><th>Amendment</th><th>Note</th></tr>
<tr><td>(hereafter, omitted)</td><td>3. The acceptance levels and required quality levels for ultrasonic testing are provided in table below. (2024)

The acceptance levels and required quality levels for Ultrasonic Testing
<table><tr><th>Quality Levels (ISO 5817:2014 applies)(1)</th><th>Testing Techniques/Levels (ISO 17640:2018 applies)(1)</th><th>Acceptance Levels (ISO 11666:2018 applies)(1)</th></tr><tr><td>B</td><td>at least B</td><td>2</td></tr><tr><td colspan="3">Note:
(1) Or any recognized standard agreed with the Society and demonstrated to be acceptable</td></tr></table>
(hereafter, same as the present)</td><td>〈Pt 5 Guidance〉</td></tr>
</table>

Present	Amendment	Reason
Annex 5-3 Guidance for Calculation of Crankshaft Stress (2)	**Annex 5-3 Guidance for Calculation of Crankshaft Stress (2)**	〈Pt 5 Guidance〉 (Amendment) Reflecting IACS UR M53 (Rev.5 May 2023), guidance for calculation of crankshaft stress has been revised. 〈application date: the date of application for approval on or after 1 Jul. 2024〉
〈Appendix IV Evaluation of Fatigue Tests〉 ***(2018)***	**〈Appendix IV Evaluation of Fatigue Tests〉** ***(2018)***	
1. ~ 3. 〈omitted〉	**1. ~ 3. 〈same as the present〉**	
4. Full size testing	**4. Full size testing**	
(1) ~ (2) 〈omitted〉	(1) ~ (2) 〈same as the present〉	
(3) Use of results and crankshaft acceptability	(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)*	(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)* *(2024)*	- The equations for stress at the crankpin needed to be updated to clarify that they are done at the fillet.
Related to the crankpin diameter:	At the crankpin fillet:	- It was revised to consider further bending stresses due to misalignment and bedplate deformation as well as due to axial and bending vibrations. Corrected typos. $\tau_{BH} \rightarrow \tau_H$
$Q=\left(\sqrt{\left(\frac{\sigma_{BH}}{\sigma_{DWCT}}\right)^2+\left(\frac{\tau_{BH}}{\tau_{DWCT}}\right)^2}\right)^{-1}$	$Q=\left(\sqrt{\left(\frac{\sigma_{BH}+\sigma_{add}}{\sigma_{DWCT}}\right)^2+\left(\frac{\tau_H}{\tau_{DWCT}}\right)^2}\right)^{-1}$	- Added quotation phrases to refer to descriptions of other parameters.
where:	where:	
σ_{DWCT} : fatigue strength by bending testing	σ_{DWCT} : fatigue strength by bending testing	
τ_{DWCT} : fatigue strength by torsion testing	τ_{DWCT} : fatigue strength by torsion testing	
	for other parameters see **2**. (1) (C), **2**. (2) (B) and **4**.	
Related to crankpin oil bore:	Related to crankpin oil bore:	
$Q=\frac{\sigma_{DWOT}}{\sigma_v}$; $\sigma_v=\frac{1}{3}\sigma_{BO}\cdot\left(1+2\sqrt{1+\frac{9}{4}\left(\frac{\sigma_{TO}}{\sigma_{BO}}\right)^2}\right)$	$Q=\frac{\sigma_{DWOT}}{\sigma_v}$; $\sigma_v=\frac{1}{3}\sigma_{BO}\cdot\left(1+2\sqrt{1+\frac{9}{4}\left(\frac{\sigma_{TO}}{\sigma_{BO}}\right)^2}\right)$	
where:	where:	
σ_{DWOT} : fatigue strength by means of largest principal stress from torsion testing	σ_{DWOT} : fatigue strength by means of largest principal stress from torsion testing	

Present	Amendment	Reason
Related to the journal diameter: $Q=\left(\sqrt{\left(\frac{\sigma_{BG}}{\sigma_{DWJT}}\right)^2+\left(\frac{\tau_G}{\tau_{DWJT}}\right)^2}\right)^{-1}$ where: σ_{DWJT} : fatigue strength by bending testing τ_{DWJT} : fatigue strength by torsion testing (hereafter, omitted)	At the journal fillet: $Q=\left(\sqrt{\left(\frac{\sigma_{BG}+\sigma_{add}}{\sigma_{DWJT}}\right)^2+\left(\frac{\tau_G}{\tau_{DWJT}}\right)^2}\right)^{-1}$ where: σ_{DWJT} : fatigue strength by bending testing τ_{DWJT} : fatigue strength by torsion testing for other parameters see **2**, (1) (C), **2**. (2) (B) and **4**. (hereafter, same as the present)	〈Pt 5 Guidance〉 - The equations for stress at the journal needed to be updated to clarify that they are done at the fillet. - It was revised to consider further bending stresses due to misalignment and bedplate deformation as well as due to axial and bending vibrations. - Added quotation phrases to refer to descriptions of other parameters.

Present

Annex 5-4 Strength Calculation for Gears of Power Transmission Systems

1. ~ 4. 〈omitted〉

5. General influence factors

Table 3 Values of K_1

Kind of gear	K_1 (ISO grades of accuracy*)					
	3	4	5	6	7	8
Spur gear	2.1	3.9	7.5	14.9	26.8	39.1
Helical gear	1.9	3.5	6.7	13.3	23.9	34.8

NOTE
* ISO grades of accuracy according to ISO 1328-2:2020. In case of mating gears with different grades of accuracy the grade corresponding to the lower accuracy is to be used.

(hereafter, omitted)

Amendment

Annex 5-4 Strength Calculation for Gears of Power Transmission Systems

1. ~ 4. 〈same as the present〉

5. General influence factors

Table 3 Values of K_1

Kind of gear	K_1 (ISO grades of accuracy*)					
	3	4	5	6	7	8
Spur gear	2.1	3.9	7.5	14.9	26.8	39.1
Helical gear	1.9	3.5	6.7	13.3	23.9	34.8

NOTE
* ISO grades of accuracy according to ISO 1328-1:2013. In case of mating gears with different grades of accuracy the grade corresponding to the lower accuracy is to be used.

(hereafter, same as the present)

Reason

〈Pt 5 Guidance〉

(Amendment) Reflecting IACS UR M56 (Rev.4 Corr.2), reference to ISO standards has been corrected. 〈application date: the date of application for approval on or after 1 July 2024〉

- Reflecting IACS UR M56 (Rev.4 Corr.2), reference to ISO standards has been corrected.