RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part D Machinery Installations

Rules for the Survey and Construction of Steel Ships
Part D 2023 AMENDMENT NO.1
Guidance for the Survey and Construction of Steel Ships
Part D 2023 AMENDMENT NO.1

Rule No.29 / Notice No.28 30 June 2023
Resolved by Technical Committee on 25 January 2023

ClassNK
NIPPON KAIJI KYOKAI

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part D Machinery Installations

2023 AMENDMENT NO.1

Rule No.29 30 June 2023

Resolved by Technical Committee on 25 January 2023

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

Rule No.29 30 June 2023
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

“Rules for the survey and construction of steel ships” has been partly amended as follows:

Part D MACHINERY INSTALLATIONS

Amendment 1-1

Chapter 1 GENERAL

1.4 Tests

Paragraph 1.4.2 has been amended as follow.

1.4.2 Mass-production Equipment

For equipment manufactured by a mass-production system deemed appropriate by the Society, a test procedure suited to the production method may be accepted in place of the tests specified in the Rules upon the request of the manufacturer, notwithstanding the requirements of **1.4.1-1** above. Such requests are to be made by submitting the application form (**Form-5-1**).

Chapter 13 PIPING SYSTEMS

13.5 Bilge and Ballast Piping

13.5.1 General*

Sub-paragraph -11 has been amended as follows.

11 ~~In cases where a tank is intended to be used for both fuel oil and ballast water, adequate provisions, such as blank flanges or spool pieces, are to be made to prevent any mixing of fuel oil and ballast water in the ballast pipe when carrying fuel oil and in the fuel oil pipe when carrying ballast water~~ Ballast piping system is not to be connected with a fuel oil tank. However, the requirements may be dispensed with where as deemed appropriate by the Society in consideration of the arrangements of the ballast piping system.

13.9 Fuel Oil Systems

13.9.1 General*

Sub-paragraph -5 has been deleted, and Sub-paragraphs -6 to -8 have been renumbered to Sub-paragraphs -5 to -7.

(-1 to -4 are omitted.)

~~**5** In cases where a ship alternates between carrying fuel oil and ballast water in the same compartment, pipes are to be so arranged that the fuel oil can be pumped out from any compartment at the same time that ballast water is being discharged from any other compartment. In cases where settling or service tanks are provided, each having a capacity sufficient to permit 12 *hours* of normal service without replenishment, the above requirement may be modified.~~

~~**6**~~**5** Two fuel oil service tanks for each type of fuel used on board that is necessary for propulsion and vital systems or equivalent arrangements are to be provided.

~~**7**~~**6** The capacity of each fuel service tank required in ~~-6~~**5** is to be sufficient for at least 8 *hours* at maximum continuous rating of the main engine and normal operating load of the generators at sea.

~~**8**~~**7** In addition to **13.9**, fuel oil systems are to comply with the requirements in **4.2, Part R**.

Chapter 25 SPECIAL REQUIREMENTS FOR MACHINERY INSTALLED IN SHIPS WITH RESTRICTED AREA OF SERVICE AND SMALL SHIPS

25.2 Modified Requirements

25.2.1 Ships with Class Notation "*Coasting Service*" or Equivalent

Sub-paragraph -4(6) has been amended as follows.

4 For ships with the Class Notation "*Coasting Service*" or equivalent, which are not engaged in international voyages, or whose gross tonnage is less than 500 *tons*, the following requirements may be applied in addition to the requirements given in **-1** to **-3** above.

(1) The requirements specified in **1.3.1-5** need not apply.
(2) The requirements specified in **1.3.8** need not apply. (however, only for those ships not engaged in international voyages)
(3) The requirements specified in **1.3.9** need not apply.
(4) Appropriate devices specified in **5.2.4-3** may be replaced with emergency fixing bolts for clutches to enable the ship to obtain navigable speed.
(5) Appropriate devices specified in **7.2.2-8**, may be replaced with propeller pitch-fixing devices to enable the ship to obtain a navigable speed.
(6) The requirements specified in **13.5.10**, **13.6.1-5**, **13.8.5**, **13.9.1-~~6~~5** and **13.9.1-~~7~~6** need not apply.

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 30 June 2023.

Amendment 1-2

Chapter 2 RECIPROCATING INTERNAL COMBUSTION ENGINES

2.1 General

Paragraph 2.1.1 has been amended as follows.

2.1.1 General*

(-1 to -5 are omitted)

6 Gas-fuelled engines to which **Chapter 16, Part N** applies are to be in accordance with ~~the requirements specified otherwise by the Society~~ **Annex 16.1.1-2** or **Annex 16.1.1-3** of **Part N** in addition to ~~those in~~ this chapter.

7 Gas-fuelled engines to which **Chapter 16, Part N** does not apply (**Part GF** applies instead) are to be in accordance with **Annex 1.1.3-2** or **Annex 1.1.3-3** of **Part GF** in addition to ~~those in~~ this chapter.

2.1.2 Terminology*

Sub-paragraph -4 has been amended as follows.

4 For low pressure gas-fuelled engines, the terminology is in accordance with ~~the requirements specified otherwise by the Society~~ **1.4 of Annex 1.1.3-3, Part GF**.

2.6 Tests

Paragraph 2.6.1 has been amended as follows.

2.6.1 Shop Tests*

1 (Omitted)

2 For reciprocating internal combustion engines, the purpose of the shop trials is to verify design premises such as engine power, safety against fire, adherence to approved limits such as maximum pressure, and functionality as well as to establish reference values or base lines for later reference in the operational phase. The programme is to be in accordance with the following: ~~are to be carried out according to the test procedure deemed appropriate by the Society.~~

(1) The following preparations are to be made before carrying out the engine tests:
   (a) All relevant equipment for the safety of attending personnel such as oil mist detection arrangements, overspeed protective devices and any other shut down functions are to be made available and are to be operational.
   (b) The overspeed protective device is to be set to a value which is not higher than the allowable overspeed value. This set point is to be verified by the surveyor.
   (c) The engines are to be run as prescribed by the engine manufacturer.
   (d) All fluids used for testing purposes (fuel oils, lubrication oils, cooling water, etc., including all fluids used temporarily or repeatedly for testing purposes only) are to be suitable for their intended purposes (i.e., they are to be clean, preheated if necessary and cause no harm to engine parts).

(2) For all stages of testing, the following **(a)** to **(c)** ambient conditions are to be recorded and the pertaining operation values (normally the following **(d)** to **(k)** items) for each load point are to be measured and recorded by the engine manufacturer. All results are to be compiled in an

acceptance protocol to be issued by the manufacturer. Calibration records for the instrumentation are to be presented to the attending surveyor. In addition, crankshaft deflection is to be checked and recorded in the results in cases where such a check is required by the manufacturer during the operating life of the engine.

(a) Ambient air temperature
(b) Ambient air pressure
(c) Atmospheric humidity
(d) Power
(e) Speed
(f) Fuel index (or equivalent reading)
(g) Maximum combustion pressures (only when the cylinder heads installed are designed for such measurement)
(h) Exhaust gas temperature at the turbine inlet and from each cylinder
(i) Charge air temperature
(j) Charge air pressure
(k) Turbocharger speed

(3) All measurements conducted at the various load points are to be carried out under steady operating conditions. However, provision is to be made for time needed by the surveyor to carry out visual inspections for all load points. The readings for 100 % power (rated power at rated speed) are to be taken twice at an interval of at least 30 *minutes*.

(4) In cases where a no-load operation is conducted for adjusting engine conditions, the fuel delivery system, manoeuvring system and safety devices are to be properly adjusted by the manufacturer before the operation.

(5) The programme shown in **Table D2.7** is to be used for the shop trials of reciprocating internal combustion engines. In this case, refer to the *JIS* specified below or those considered equivalent thereto for more details on each respective testing procedure. However, additional tests may be requested by the Society depending on the engine application, service experience, or other relevant reasons. In addition, alternatives to the detailed tests may be agreed between the manufacturer and the Society when the overall scope of tests is found to be equivalent.

(a) In the case of reciprocating internal combustion engines used as main propulsion machinery (including those used as main propulsion machinery for electric propulsion ships);
JIS F 4304 "Shipbuilding - Internal combustion engines for propelling use-shop test code"

(b) In the case of reciprocating internal combustion engines driving other generators or essential auxiliary machinery;
JIS F 4306 "Shipbuilding - Water cooled four-cycle generator diesel engines"

(6) The following **(a)** to **(c)** are to be inspected. However, a part of or all of these inspections may be postponed until shipboard testing when agreed to by the Society.

(a) Jacketing of high-pressure fuel oil lines, including the system used for the detection of leakage
(b) Screening of pipe connections in piping containing flammable liquids
(c) Temperature of hot surface insulation
Random temperature readings are to be compared with corresponding readings obtained during the type test. This is to be done while running at the rated power of engine. If the insulation is modified subsequently to the type test, the Society may request temperature measurements as required by the type test.
In the case of reciprocating internal combustion engine with an application for approval of use dated before 1 July 2016 which is an engine type that does not have the results of

temperature measurements required by the type test, temperature measurements are to be performed by a procedure deemed appropriate by the Society.

(7) Category *C* turbochargers installed on reciprocating internal combustion engines used as main propulsion machinery are to be checked for surge margins in accordance with the following. However, if successfully tested earlier on an identical configuration of the engine and turbocharger (including the same nozzle rings), submission of this test report may be accepted instead.

(a) For 4-stroke engines, the operations given in the following **i)** and **ii)** are to be performed without any indication of surging.

i) While at maximum continuous rating (maximum continuous power and speed), speed is to be reduced with the constant torque (fuel index) down to 90 % power.

ii) While at 50 % power and 80 % speed, speed is to be reduced to 72 % while keeping constant torque (fuel index).

(b) For 2-stroke engines, the surge margin is to be demonstrated by at least one of the following **i)** to **iii)**:

i) The engine working characteristics established at shop tests of the engine is to be plotted into the compressor chart of the turbocharger (established in a test rig). There is to be at least a 10 % surge margin in the full load range, i.e., working flow is to be 10 % above the theoretical mass flow at the surge limit where there are no pressure fluctuations.

ii) A sudden fuel cut-off to at least one cylinder at the following **1)** and **2)** loads is not to result in continuous surging and the turbocharger is to be stabilised at the new loads within 20 *seconds*. For applications with more than one turbocharger, the fuel supply to the cylinders closest upstream to each turbocharger is to be cut off.

1) The maximum power permitted for one cylinder misfiring.

2) The engine load corresponding to a charge air pressure of about 0.06 *MPa*, but without auxiliary blowers running.

iii) No continuous surging and the turbocharger is to be stabilised at the new load within 20 *seconds* when the power is abruptly reduced from 100 % to 50 % of the maximum continuous power.

(8) For electronically controlled engines, integration tests are to be made to verify that the response of the complete mechanical, hydraulic and electronic system is as predicted. The scope of these tests is to be determined based on a risk analysis by a method deemed appropriate by the Society and agreed with the Society, prior to the tests. The tests may be carried out using other alternative methods, subject to special consideration by the Society.

3 For low pressure gas-fuelled engines (specified in **4.2.2 of Annex 1.1.3-3, Part GF** or **5.2.2 of Annex 16.1.1-3, Part N**), the following requirements are to be complied with.

(1) The requirements specified in **-2(1)** to **(7)** apply subject to following **(2)** to **(5)** requirements.

(2) For dual fuel engines, the tests specified in **Table D2.7** are to be carried out for both diesel and gas mode. Tests for the gas mode are to be carried out based on the maximum power available in the gas mode (see **2.5.1-1(1) of Annex 1.1.3-3, Part GF** or **2.5.1-1(1) of Annex 16.1.1-3, Part N**). The 110 % load test is not required for the gas mode.

(3) In addition to the preparations specified in **-2(1)**, measures to verify that gas fuel piping for the engine is gas tight are to be carried out prior to the start-up of the engine.

(4) In addition to **-2(2)** and **(3)**, the following engine data are to be recorded.

(a) The item listed in **-2(2)(f)** is to be measured and recorded for both gas and diesel, as applicable

(b) Gas pressure and temperature

(5) The engines are to undergo integration tests to verify that the responses of the complete

mechanical, hydraulic and electronic systems are as predicted for all intended operational modes. The scope of these tests is to be agreed to with the Society for selected cases based upon risk analysis by a procedure deemed appropriate by the Society and is to at least include the following incidents. The tests may be carried out using simulation or other alternative methods, subject to special consideration by the Society.

(a) Failure of ignition (spark ignition or pilot injection systems)

(b) Failure of a cylinder gas supply valve

(c) Failure of combustion (to be detected by e.g. misfiring, knocking, exhaust temperature deviation, etc.)

(d) Abnormal gas pressure

(e) Abnormal gas temperature

4 To shop trials of the high pressure gas-fuelled engines specified in **4.2.2 of Annex 1.1.3-2, Part GF** or **5.2.2 of Annex 16.1.1-2, Part N**, the requirements for the shop trials of low pressure gas-fuelled engines specified in **-3** apply mutatis mutandis.

~~**3 For reciprocating internal combustion engines with novel design features or for those with no service records, tests are to be carried out to verify their durability according to the procedure deemed appropriate by the Society.**~~

~~**4**~~**5** (Omitted)

~~**5**~~**6** (Omitted)

~~**6**~~**7** (Omitted)

Table D2.7 has been added as follows.

Table D2.7 Programme for Shop Trials of Engines

Test items		Use of engines		
		Reciprocating internal combustion engines used as main propulsion machinery(1)	Reciprocating internal combustion engines driving generators (including those used as main propulsion machinery of electric propulsion ships) (2)	Reciprocating internal combustion engines driving auxiliaries (excluding auxiliary machinery for specific use etc.) (1)
Load test	110 % power run	15 *minutes* or until steady conditions have been reached, which is shorter, at 1.032 n_0 (n_0 is the rated engine speed) or more (3), (4)	15 *minutes* after having reached steady conditions at n_0	15 *minutes* after having reached steady conditions at n_0
	100 % power run	60 *minutes* at n_0	60 *minutes* at n_0	30 *minutes* at n_0
	90 % power run (or normal continuous cruise power) (5), (6)	30 *minutes* at engine speed in accordance with nominal propeller curve	—	—
	75% power (5), (6)		30 *minutes* at n_0	30 *minutes* in accordance with the nominal power consumption curve (7)
	50% power (5), (6)			
	25% power (5), (6)			
Idle run (5)		—	An adequate time at n_0	—
Reversing manoeuvres (8)		○	—	—
Intermittent overload (9)		○	—	○
Governor test		—	○	—
Performance of monitoring, alarm and safety devices		○	○	○
Open-up inspection		○	○	○

Notes:

(1) After testing has been completed, 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. In the case of propulsion engines also driving power take-off generators, the fuel delivery system is to be adjusted so that overload of generator (110 % power) can be given in service and the electrical protection of downstream system components is activated before the engine stalls.

(2) After testing has been completed, the fuel delivery system is to be adjusted such that overload (110 % power) can be given in service after installation on board, so that the governing characteristics including the activation of generator protective devices can be fulfilled at all times.

(3) Submission of a test report for identical engine and turbocharger configuration proving their compatibility for over-loaded operation may be accepted as substitutions for the 110 % power run.

(4) In the case of propulsion engines also driving power take-off generators, the test is to be carried out at n_0 for 15 *minutes* after having reached a steady operating condition.

(5) The sequence is to be selected by the engine manufacturer.

(6) The testing time may be shortened to 20 *minutes* for engines having cylinder bores of 400 *mm* or less when deemed appropriate by the Society.

(7) Only for variable speed engines.

(8) The test item applies only to direct reversible engines.

(9) Only for engines for which intermittent overload is approved. The test is to be performed for the duration agreed upon with the manufacturer.

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 30 June 2023.

2. Notwithstanding the amendments to the Rules, the current requirements apply to the surveys for which the application is submitted to the Society before the effective date.

Amendment 1-3

Chapter 2 RECIPROCATING INTERNAL COMBUSTION ENGINES

2.4 Safety Devices

2.4.3 Protection against Crankcase Explosion*

1 Reciprocating internal combustion engines having a cylinder bore not less than 200 *mm* or a crankcase with a gross volume not less than 0.6 m^3 are to be provided with crankcase explosion relief valves of an approved type for preventing any overpressure in the event of an explosion within the crankcase. Crankcase explosion relief valves are to be in accordance with the following requirements:

((1) to (5) are omitted.)

2 The number and locations of the explosion relief valves specified in **-1** are to be in accordance with **Table D2.3**.

(-3 and -4 are omitted.)

Table D2.3 has been amended as follows.

Table D2.3 Number and Location of Explosion Relief Valves

Cylinder bore (*mm*)	Number and location of explosion relief valves
200 to ~~below~~ 250	At least one valve near each end, but, ~~over 8 crankthrows,~~ an additional valve is to be fitted near the middle of the engine in the case of more than 8 crankthrows.
over 250 to ~~below~~ 300	At least one valve in way of each alternate crankthrow, with a minimum of two valves.
over 300 ~~and over~~	At least one valve in way of each crankthrow.

Chapter 18 AUTOMATIC AND REMOTE CONTROL

18.3 Automatic and Remote Control of Main Propulsion Machinery or Controllable Pitch Propellers

18.3.3 Bridge Control Devices*

Sub-paragraphs (3) and (4) have been amended as follows.

Bridge control devices are to comply with the following **(1)** through **(4)** as well as requirements in **18.3.2**.

((1) and (2) are omitted.)

(3) Bridge control devices are to be provided with visual and audible alarms which give the officer in charge of the navigational watch enough time to assess navigational circumstances in an emergency before the safety systems of main propulsion machinery specified in **18.1.2(14)(b)** or **(c)** go into effect~~.~~ except in cases in which total failure of main propulsion machinery will occur within a short period of time.

(4) Bridge control devices are to be provided with ~~an~~ the override arrangement specified in **18.2.6-3** for the following safety systems of main propulsion machinery:

(a) Safety systems which perform as specified in **18.1.2(14)(b)**

(b) Safety systems which perform as specified in **18.1.2(14)(c)** ~~(~~, except in cases ~~where the~~ in which total failure of main propulsion machinery will occur within a short period of time.~~)~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 1 July 2023.

2. Notwithstanding the amendments to the Rules, the current requirements apply to ships for which the date of contract for construction is before the effective date.

Amendment 1-4

Chapter 9 BOILERS, ETC. AND INCINERATORS

9.3 Design Requirements

9.3.5 Considerations for Installing

Sub-paragraph -2 has been amended as follows.

2 Boilers are to be installed so that they are clear of any bulkheads as far as practicable. ~~*(See,* **21.3.3, Part C.**~~*)*

Chapter 12 PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES

12.2 Thickness of Pipes

Note of Table D12.6(1) has been amended as follows.

Table D12.6(1) Minimum Thickness of Steel Pipes

Services of pipes	Location of pipes		Minimum thickness of the encircled alphabets correspond to those in **Table D12.6.(2)**
(Omitted)			
Air pipes, Overflow pipes, Sounding pipes	passing through tanks except for cargo oil tanks		Ⓔ
	passing through cargo oil tanks		Ⓑ
	For air pipes and sounding pipes for fuel oil tanks passing through the cargo holds of the bulk carrier defined in **1.3.1(13), Part B**		Ⓓ
	For tanks forming a part of ship's structure		Ⓖ
	Exposed portions of air pipes which terminate above freeboard deck and superstructure deck (Note 1)	(Note 3)	Ⓔ
		(Note 4)	Ⓖ
(Omitted)			

Notes:

1 (Omitted)
2 (Omitted)
3 For air pipes in the position I or II defined in ~~**20.1.2,**~~ **1.4.3.2, Part 1**, **Part C** leading to spaces below the freeboard deck, enclosed super structure or enclosed deck house.
4 (Omitted)
5 (Omitted)

Chapter 13 PIPING SYSTEMS

13.4 Scuppers, Sanitary Discharges, etc.

13.4.1 General*

Sub-paragraph -2 has been amended as follows.

2 Scupper pipes, draining weather decks and spaces within superstructures and deckhouses, which are not provided with access openings equipped with closing means in accordance with the requirements in ~~**18.3.1,**~~ **11.3.2.6, Part 1, Part C**, are to be led overboard.

Sub-paragraph -4(2) has been amended as follows.

4 Scupper pipes from spaces below the freeboard deck are to be led directly into inboard bilge wells. Alternatively, they may be led to overboard in cases where they are provided with valves in accordance with the following requirements:

(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 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.

(2) However, in cases where the vertical distance from the load line to the inboard end of the scupper pipe exceeds $0.01L_f$, the scupper pipe may have two automatic non-return valves without any positive means of closing in lieu of valves prescribed in **(1)**. In this case, the inboard valve is to be located above the level of the deepest subdivision draught specified in ~~**4.1.2(3), Part C of the Rules**~~**2.3.1.2(3), Part 1, Part C** and is to always be accessible for inspection under service conditions.

13.4.4 Ash-shoots and Rubbish-shoots

Sub-paragraph -6 has been amended as follows.

6 For those ships in which the damage stability requirements specified in ~~**Chapter 4, Part C of the Rules**~~**2.3, Part 1, Part C** are applied; the following requirements are to be satisfied in cases where the inboard end of the chute is below the freeboard deck.

(1) Inboard-end hinged covers/valves are to be watertight.

(2) Valves are to be a screw-down non-return valve fitted in an easily accessible position above the deepest load line.

(3) Screw-down non-return valves are to be controlled from positions above the bulkhead deck and provided with open/closed indicators. Valve controls are to be clearly marked: “Keep closed when not in use.”

13.5 Bilge and Ballast Piping

13.5.8 Bilge Wells*

Sub-paragraph -1 has been amended as follows.

1 The depth of bilge wells constructed in double bottoms and the vertical distance between the bottom plating and the bottom of bilge wells are to comply with the requirements in ~~**6.1.3-2,**~~ **10.2.1.2, Part 1, Part C**.

Paragraph 13.5.10 has been amended as follows.

13.5.10 Dewatering Arrangements for Bulk Carriers, etc.*

For bulk carriers defined in ~~**31A.1.2(1),**~~ **An1.2.1(1), Annex 1.1, Part 2.2, Part C**, bilge or ballast systems capable of being brought into operation from a readily accessible enclosed space, the location of which is accessible from the navigation bridge or continuously manned propulsion machinery control rooms without traversing exposed decks, are to be provided for draining and pumping those spaces specified in the following **(1)** and **(2)**.

(1) Ballast tanks forward of the collision bulkhead specified in ~~**13.1.1,**~~ **2.2.1.1, Part 1, Part C**

(2) Dry or void spaces other than chain lockers, in which any part extends forward of the foremost cargo hold and a volume that exceeds 0.1 % of the ship's maximum displacement volume

13.6 Air Pipes

Paragraph 13.6.5 has been amended as follows.

13.6.5 Additional Requirements for Air Pipes Fitted on Exposed Fore Decks*

For ships with a ~~*L*~~L_C, specified in ~~**15.2.1-1,**~~**1.4.3.1-1, Part 1, Part C,** of 80 *m* or more and where the height of the exposed deck in way of the item is less than 0.1 ~~*L*~~L_C or 22 *m* above the designed maximum load line, whichever is the lesser, all air pipes located on the exposed deck over the forward 0.25 ~~*L*~~L_C are to be of sufficient strength to resist green sea force.

13.8 Sounding Pipes

13.8.5 Water Level Detection and Alarm Systems for Bulk Carriers, etc.*

Sub-paragraph -1 has been amended as follows.

1 For bulk carriers defined in ~~**31A.1.2(1),**~~ **An1.2.1(1), Annex 1.1, Part 2.2, Part C**, water level detection and alarm systems are to be provided for giving audible and visual alarms in the navigation bridge, in accordance with the following **(1)** to **(4)**:

(1) In each cargo hold, the systems are to give alarms when the water level reaches the following **(a)** and **(b)** at the aft end of the cargo hold.
   (a) A height of 0.5 *m* above the inner bottom
   (b) A height not less than 15 % of the depth of the cargo hold but not more than 2.0 *m*

(2) In any ballast tank forward of the collision bulkhead specified in ~~**13.1.1,**~~ **2.2.1.1, Part 1, Part C**, the system is to give an alarm when the liquid in the tank reaches a level not exceeding 10 % of the tank capacity.

(3) In any dry or void space other than a chain locker, any part of which extends forward of the

foremost cargo hold and the volume of which exceeds 0.1 % of the ship's maximum displacement volume, the system is to give an alarm at a water level of 0.1 *m* above the deck.

(4) The systems are to have constructions and functions deemed appropriate by the Society.

13.8.6 Water Level Detection and Alarm Systems for Single Hold Cargo Ships*

Sub-paragraph -1 has been amended as follows.

1 Cargo ships, other than bulk carriers defined in ~~**31A.1.2(1)**~~**An1.2.1(1), Annex 1.1 Part 2-2, Part C**, having a length (L_f) of less than 80 *m* and a single cargo hold below the freeboard deck or cargo holds below the freeboard deck which are not separated by at least one bulkhead made watertight up to that deck, are to be fitted in such space or spaces with water level detection and alarm systems in accordance with the following **(1)** to **(3)**:

(1) These water level detection and alarm systems are to give an audible and visual alarm at the navigation bridge when the water level above the inner bottom in the cargo hold reaches a height of not less than 0.3 *m*, and another when such level reaches not more than 15 % of the mean depth of the cargo hold.

(2) The systems are to be fitted at the aft end of the hold, or above its lowest part where the inner bottom is not parallel to the designed waterline. In cases where webs or partial watertight bulkheads are fitted above the inner bottom, the fitting of additional detectors may be required.

(3) The systems are to have constructions and functions deemed appropriate by the Society.

Chapter 14 PIPING SYSTEMS FOR TANKERS

14.3 Piping Systems for Cargo Oil Pump Rooms, Cofferdams and Tanks adjacent to Cargo Oil Tanks

14.3.2 Ballast Tanks adjacent to Cargo Oil Tanks*

Sub-paragraph -1 has been amended as follows.

1 The requirements given in **14.3.2** are also applied to ballast tanks used as cofferdams at the fore and aft ends of cargo oil tanks in accordance with the requirements given in ~~**29.1.2-2(3),**~~ **2.1.1.1-1(3), Part 2-7, Part C**. However, other requirements will be applied, if the fore ends of these ballast tanks are located forward of the collision bulkhead.

14.5 Piping Systems for Combination Carriers

14.5.2 Terminology

Sub-paragraph (1) has been amended as follows.

The terms used in **14.5** are defined as follows:

(1) Combination carriers are defined as ore/oil carriers ~~specified in **30.7.1, Part C**~~ and as *B/O* carriers ~~specified in **31.8.1, Part C**~~.

((2) to (9) are omitted.)

Chapter 15 STEERING GEARS

15.2 Performance and Arrangement of Steering Gears

15.2.2 Performance of Main Steering Gear

Sub-paragraph (2) has been amended as follows.

The main steering gear is to be:

(1) Capable of putting the rudder over from 35 *degrees* on one side to 35 *degrees* on the other side with the ship at its load draught and running ahead at the speed specified in **2.1.8, Part A** and, under the same conditions, from 35 *degrees* on either side to 30 *degrees* on the other side in not more than 28 *seconds*;

(2) Operated by power when the main steering gear has to meet the requirements in **(1)** or when the diameter of the upper stock is required in ~~**Chapter 3**~~ **Chapter 13, Part 1, Part C** to be over 120 *mm* (calculated with a material factor K_S =1 where K_S is less than 1, and excluding the increase required for ships which have strengthening for navigation in ice, the same being referred hereinafter); and

(3) So designed that they will not be damaged at maximum astern speed; however, this design requirement need not be proved by trials at maximum astern speed and maximum rudder angle.

15.2.3 Performance of Auxiliary Steering Gear*

Sub-paragraph (2) has been amended as follows.

The auxiliary steering gear is to be:

(1) Capable of putting the rudder over from 15 *degrees* on one side to 15 *degrees* on the other side in not more than 60 *seconds* with the ship at its load draught and running ahead at one half of the speed specified in **2.1.8, Part A** or 7 *knots*, whichever is greater, and capable of being brought speedily into action in an emergency; and

(2) Operated by power where necessary to meet the requirement in **(1)** and in any case when the diameter of upper stock is required in ~~**Chapter 3,**~~ **Chapter 13, Part 1, Part C** to be over 230 *mm*.

Paragraph 15.2.6 has been amended as follows.

15.2.6 Alternative Source of Power

In cases where the diameter of upper stock is required in ~~**Chapter 3,**~~ **Chapter 13, Part 1, Part C** to be over 230 *mm*, an alternative source of power is to be provided in accordance with the following:

((1) to (3) are omitted.)

15.4 Materials, Constructions and Strength of Steering Gears

Paragraph 15.4.7 has been amended as follows.

15.4.7 Tillers, etc. *

1 The scantlings of tillers, etc., made of forged steels or cast steels, which transfer power from the rudder actuator to the rudder stock, are to be so determined so that the bending stress does not exceeding $118/K(N/mm^2)$ and the shearing stress does not exceeding $68/K(N/mm^2)$ when the rudder torque T_R is applied.

where

T_R : Rudder torque specified in ~~**3.3,**~~ **13.2.3, Part 1, Part C** (*N-m*).

K : Material coefficient of the tiller, specified in ~~**3.1.2,**~~**13.2.1.2, Part 1, Part C**

2 Notwithstanding the requirement specified in **-1**, the scantlings of rapson-slide type or trunk piston type tillers may be determined according to the following **(1)** to **(4)**:

(1) The vertical section of each side of tiller boss at the centre line of rudder stock is to comply with the following formulae:

$(D^2 - d^2)H \geq 170T_RK$

$H/d \geq 0.75$

where

D : Outer diameter of boss (*mm*).

d : Inner diameter of boss (*mm*).

H : Depth of boss (*mm*).

T_R : Rudder torque specified in ~~**3.3,**~~**13.2.3, Part 1, Part C** (*N-m*).

K : Material coefficient of the tiller, specified in ~~**3.1.2,**~~**13.2.1.2, Part 1, Part C**

(2) The section modulus of an arm about its vertical axis is to be not less than that obtained from the following formula:

$$Z_{TA} = 11\left(1 - \frac{r}{R_1}\right)T_RK$$

where

Z_{TA} : Required section modulus of the arm about its vertical axis (mm^3).

r : Distance from the centre of rudder stock to the section (*mm*).

R_1 : Length of the tiller arm measured from the centre of the rudder stock to the point of application of the driving force (*mm*). In cases where this length varies in accordance with rudder angle, R_1 is the maximum length within 35 *degrees* of rudder angle.

T_R : Rudder torque specified in ~~**3.3,**~~ **13.2.3, Part 1, Part C** (*N-m*).

K : Material coefficient of the tiller, specified in ~~**3.1.2,**~~ **13.2.1.2, Part 1, Part C**

(3) The sectional area of an arm at its outer end is to be not smaller than that obtained from the following formula:

$$A_R = 18.5\frac{T_R}{R_2}K$$

where

A_R : Required sectional area of the arm at its outer end (mm^2).

R_2 : Length of the tiller arm measured from the centre of the rudder stock to the point of application of the driving force (*mm*). In cases where this length varies in accordance with rudder angle, R_2 is the length at 0 *degrees* of rudder angle.

T_R : Rudder torque specified in ~~**3.3,**~~ **13.2.3, Part 1, Part C** (*N-m*).

K : Material coefficient of the tiller, specified in ~~**3.1.2,**~~ **13.2.1.2, Part 1, Part C**

(4) In cases where a tiller having two arms which have power units that are connected to each arm and these two power units are driven simultaneously, the scantlings of the arms may be reduced from those required in **(2)** and **(3)** to a value recognized by the Society.

3 Notwithstanding the requirement specified in **-1**, the scantlings of rotary vane type rudder actuators of forged steels or cast steels may be determined according to the following requirements, in addition to those requirements specified in **15.4.4**.

(1) Scantlings of the boss are to comply with the requirement specified in **-2(1)**.

(2) The section modulus about the vertical axis and the sectional area of vane is to be not less than that obtained from the following formulae:

$$Z_v = 11\left(\frac{B}{D+B}\right)\frac{T_R}{n}K$$

$$A_R = 37\left(\frac{1}{D+B}\right)\frac{T_R}{n}K$$

where

Z_v : Required section modulus of vane about the vertical axis (mm^3).

A_R : Required sectional area of vane (mm^2).

D : Outer diameter of boss (*mm*).

B : Height of vane measured from outer surface of boss (*mm*).

n : Number of vanes.

T_R : Rudder torque specified in ~~**3.3,**~~ **13.2.3, Part 1, Part C** (*N-m*).

K : Material coefficient of the vane, specified in ~~**3.1.2,**~~ **13.2.1.2, Part 1, Part C**

4 In cases where tillers which are separated into two pieces are bolted, there are to be at least two bolts on each side of the head. The diameter of bolts at bottom of thread is not to be less than that obtained from the following formula. In such case, the thickness of any coupling flange is to not less than three-fourth of the diameter of the bolts.

$$d_b = 1.45\sqrt{\frac{T_R}{nb}K}$$

where

d_b : Required diameter of bolts at bottom of thread (mm).
T_R : Rudder torque specified in ~~**3.3,**~~**13.2.3, Part 1, Part C** (N-m).
K : Material coefficient of the bolt, specified in ~~**3.1.2**~~ **13.2.1.2, Part 1, Part C**
n : Number of bolts on each side of the head.
b : Distance from the centre of rudder stock to the centre of bolt (cm).

5 Tillers are to be coupled, using a key, to rudder stocks by shrinkage fitting, force fitting or the bolted method. However, tillers may be coupled without a key, in cases where the fitting methods are in compliance to the satisfaction of the Society.

6 Scantlings of rotary vane type rudder actuators of nodular graphite cast iron are to be specified to not to be applied with bending stress exceeding $94/K$ *(N/mm*^{2}), or shearing stresses exceeding $54/K$ *(N/mm*^{2}) under the rudder torque T_R applied. Alternatively, the scantlings may be determined according to the requirements specified in **-3**, using 1.2 *times* the rudder torque T_R specified in ~~**3.3,**~~ **13.2.3, Part 1, Part C** as rudder torque for calculating.

Chapter 16 WINDLASSES AND MOORING WINCHES

16.2 Windlasses

16.2.4 Design*

Sub-paragraph -2(7) has been amended as follows.

2 Mechanical designs of windlasses are to be according to the following requirements:
((1) to (6) are omitted.)
(7) Hull supporting structures of windlasses and chain cable stoppers are to be according to the following requirements:
(a) Hull supporting structures of windlasses and chain cable stoppers are to comply with the requirements specified in ~~**Chapter 27,**~~ **14.3.1.5, Part 1, Part C** or **Chapter 23, Part CS**.
(b) For those ships of 80 *m* or more in length ~~*L*~~L_C that are specified in ~~**15.2.1-1,**~~ **1.4.3.1-1, Part 1, Part C**, all windlass mounts on an exposed deck over the forward 0.25 ~~*L*~~L_C line are to be of sufficient strength in cases where the height of the exposed deck in way of the item is mounted is less than 0.1 ~~*L*~~L_C or 22 *m* above the designed maximum load line, whichever is lesser.
(c) The strength of any above deck framing and hull structure supporting a windlass and its securing bolt is to be according to the requirements in ~~**10.7.1,**~~ **10.4.2.3, Part 1, Part C** or **10.6.1, Part CS**.

Chapter 25 SPECIAL REQUIREMENTS FOR MACHINERY INSTALLED IN SHIPS WITH RESTRICTED AREA OF SERVICE AND SMALL SHIPS

25.2 Modified Requirements

25.2.2 Ships with the Class Notation "*Smooth Water Service*" or Equivalent

Sub-paragraph -2 has been amended as follows.

2 For ships with an upper stock diameter of not more than 120 *mm* as calculated by the formula in ~~**Chapter 3,**~~ **Chapter 13, Part 1, Part C** (however, in cases where K_S is less than 1, calculations are to be made with a material factor K_S = 1.), the provisions of the auxiliary steering gear specified in **15.2.1** above may be omitted in cases where spare parts for consumables, such as packing and bearings, are provided for power-driven main steering gear or in cases where spare steering wires are provided for manually-powered main steering gear.

Annex 12.1.6 PLASTIC PIPES

Note of Table 1 has been amended as follows.

Table 1 Fire Endurance Requirements Matrix

N	Piping Systems	Location										
		A	B	C	D	E	F	G	H	I	J	K
(Omitted)												
SANITARY/DRAINS/SCUPPERS												
23	Deck drains (internal)	L1W[4]	L1W[4]	—	L1W[4]	○	—	○	○	○	○	○
24	Sanitary drains (internal)	○	○	—	○	○	—	○	○	○	○	○
25	Scuppers and discharges (overboard)	○[1,8]	○[1,8]	○[1,8]	○[1,8]	○[1,8]	○	○	○	○	○[1,8]	○
(Omitted)												

Notes:

(1) LOCATION

(Omitted)

(2) ABBREVIATIONS

(Omitted)

(3) FOOTNOTES

(1 to 7 are omitted.)

8 : Scuppers serving open decks in positions I and II, as defined in ~~**20.1.2, Part C of the Rules**~~**1.4.3.2, Part 1, Part C,** are to be "×" throughout unless fitted at the upper end with the means of closing capable of being operated from a position above the freeboard deck in order to prevent downflooding.

(9 to 15 are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 1 July 2023.

2. Notwithstanding the amendments to the Rules, the current requirements apply to the following ships:

(1) ships for which the date of contract for construction is before the effective date; or

(2) sister ships of ships subject to the current requirements for which the date of contract for construction is before 1 January 2025.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part D Machinery Installations

2023 AMENDMENT NO.1

Notice No.28 30 June 2023
Resolved by Technical Committee on 25 January 2023

Notice No.28 30 June 2023
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Guidance for the survey and construction of steel ships" has been partly amended as follows:

Part D MACHINERY INSTALLATIONS

Amendment 1-1

D1 GENERAL

D1.3 General Requirements for Machinery Installations

D1.3.1 General

Sub-paragraph -2 has been amended as follows.

2 The u~~U~~nconventional machinery referred to in **1.3.1-2, Part D of the Rules** is ~~any~~ the machinery with novel design features (e.g. gas only engines) specified in **1.1.3, Part D of the Rules**.

D2 RECIPROCATING INTERNAL CONBUSTION ENGINES

D2.1 General

D2.1.1 General

Sub-paragraph -2 has been deleted.

~~**2** The wording "the requirements specified otherwise by the Society" in **2.1.1-6, Part D of the Rules** means **Annex 3 "GUIDANCE FOR HIGH PRESSURE DUAL FUEL ENGINES"** or **Annex 4 "GUIDANCE FOR LOW PRESSURE DUAL FUEL ENGINES"** of **Part N** for gas-fuelled engines to which **Chapter 16, Part N of the Rules** apply, and **Annex 3 "GUIDANCE FOR HIGH PRESSURE GAS-FUELLED ENGINES"** or **Annex 4 "GUIDANCE FOR LOW PRESSURE GAS-FUELLED ENGINES"** of **Part GF** for gas-fuelled engines to which **Chapter 16, Part N of the Rules** does not apply (**Part GF of the Rules** apply instead).~~

Paragraph D2.1.2 has been deleted.

~~**D2.1.2 Terminology**~~

~~The wording "the requirements specified otherwise by the Society" in **2.1.2-4, Part D of the Rules** means **1.4 of Annex 4, Part GF** or **1.4 of Annex 4, Part N.**~~

D2.6 Tests

Paragraph D2.6.1 has been amended as follows.

D2.6.1 Shop Tests

~~**1** The purpose of the shop trials specified in **2.6.1-2, Part D of the Rules** is to verify design premises such as engine power, safety against fire, adherence to approved limits such as maximum pressure, and functionality as well as to establish reference values or base lines for later reference in the operational phase. The programme is to be in accordance with the following:~~

~~(1) The preparations specified in **B1.4.2-16** are to be made before any tests are carried out.~~

~~(2) For all stages of testing, the following **(a)** to **(c)** ambient conditions are to be recorded and the pertaining operation values (normally the following **(d)** to **(k)** items) for each load point are to be measured and recorded by the engine manufacturer. All results are to be compiled in an acceptance protocol to be issued by the manufacturer. Calibration records for the instrumentation are to be presented to the attending surveyor. In addition, crankshaft deflection is to be checked and recorded in the results in cases where such a check is required by the manufacturer during the operating life of the engine.~~

~~(a) Ambient air temperature~~

~~(b) Ambient air pressure~~

~~(c) Atmospheric humidity~~

~~(d) Power~~

~~(e) Speed~~

~~(f) Fuel index (or equivalent reading)~~

~~(g) Maximum combustion pressures (only when the cylinder heads installed are designed for such measurement)~~

~~(h) Exhaust gas temperature at the turbine inlet and from each cylinder~~

~~(i) Charge air temperature~~

(j) Charge air pressure
(k) Turbocharger speed

(3) All measurements conducted at the various load points are to be carried out under steady operating conditions. However, provision is to be made for time needed by the surveyor to carry out visual inspections for all load points. The readings for 100 % power (rated power at rated speed) are to be taken twice at an interval of at least 30 *minutes*.

(4) In cases where a no-load operation is conducted for adjusting engine conditions, the fuel delivery system, manoeuvring system and safety devices are to be properly adjusted by the manufacturer before the operation.

(5) The programme shown in **Table D2.6.1-1** is to be used for the shop trials of reciprocating internal combustion engines. In this case, refer to the *JIS* specified below or those considered equivalent thereto for more details on each respective testing procedure. However, additional tests may be requested by the Society depending on the engine application, service experience, or other relevant reasons. In addition, alternatives to the detailed tests may be agreed between the manufacturer and the Society when the overall scope of tests is found to be equivalent.

(a) In the case of reciprocating internal combustion engines used as main propulsion machinery (including those used as main propulsion machinery for electric propulsion ships);
JIS F 4304 "Shipbuilding - Internal combustion engines for propelling use-shop test code"

(b) In the case of reciprocating internal combustion engines driving other generators or essential auxiliary machinery;
JIS F 4306 "Shipbuilding - Water cooled four-cycle generator diesel engines"

(6) The following **(a)** to **(c)** are to be inspected. However, a part of or all of these inspections may be postponed until shipboard testing when agreed to by the Society.

(a) Jacketing of high-pressure fuel oil lines, including the system used for the detection of leakage

(b) Screening of pipe connections in piping containing flammable liquids

(c) Temperature of hot surface insulation
Random temperature readings are to be compared with corresponding readings obtained during the type test. This is to be done while running at the rated power of engine. If the insulation is modified subsequently to the type test, the Society may request temperature measurements as required by the type test.
In the case of reciprocating internal combustion engine with an application for approval of use dated before 1 July 2016 which is an engine type that does not have the results of temperature measurements required by the type test, temperature measurements are to be performed in accordance with **8.4.2-2(10), Part 8 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

(7) Category *C* turbochargers installed on reciprocating internal combustion engines used as main propulsion machinery are to be checked for surge margins in accordance with the following. However, if successfully tested earlier on an identical configuration of the engine and turbocharger (including the same nozzle rings), submission of this test report may be accepted instead.

(a) For 4-stroke engines, the operations given in the following **i)** and **ii)** are to be performed without any indication of surging.

i) While at maximum continuous rating (maximum continuous power and speed), speed is to be reduced with the constant torque (fuel index) down to 90 % power.

ii) While at 50 % power and 80 % speed, speed is to be reduced to 72 % while keeping constant torque (fuel index).

(b) For 2-stroke engines, the surge margin is to be demonstrated by at least one of the following **i)** to **iii)**:

i) The engine working characteristics established at shop tests of the engine is to be plotted into the compressor chart of the turbocharger (established in a test rig). There is to be at least a 10 % surge margin in the full load range, i.e., working flow is to be 10 % above the theoretical mass flow at the surge limit where there are no pressure fluctuations.

ii) A sudden fuel cut-off to at least one cylinder at the following **1)** and **2)** loads is not to result in continuous surging and the turbocharger is to be stabilised at the new loads within 20 *seconds*. For applications with more than one turbocharger, the fuel supply to the cylinders closest upstream to each turbocharger is to be cut off.

1) The maximum power permitted for one cylinder misfiring.

2) The engine load corresponding to a charge air pressure of about 0.06 *MPa*, but without auxiliary blowers running.

iii) No continuous surging and the turbocharger is to be stabilised at the new load within 20 *seconds* when the power is abruptly reduced from 100 % to 50 % of the maximum continuous power.

2 For low-pressure gas-fuelled engines (specified in **4.2.2 of Annex 4, Part GF** or **5.2.2 of Annex 4, Part N**), the following requirements are to be complied with.

(1) The requirements specified in **-1(1)** to **(7)** apply subject to following **(2)** to **(5)** requirements.

(2) For dual fuel engines, the tests specified in **Table D2.6.1-1** are to be carried out for both diesel and gas mode. Tests for the gas mode are to be carried out based on the maximum power available in the gas mode (see **2.5.1-1(1) of Annex 4, Part GF** or **2.5.1-1(1) of Annex 4, Part N**). The 110 % load test is not required for the gas mode.

(3) In addition to the preparations specified in **-1(1)**, measures to verify that gas fuel piping for the engine is gas tight are to be carried out prior to the start-up of the engine.

(4) In addition to **-1(2)** and **(3)**, the following engine data are to be recorded.

(a) The item listed in **-1(2)(f)** is to be measured and recorded for both gas and diesel, as applicable

(b) Gas pressure and temperature

(5) The engines are to undergo integration tests to verify that the responses of the complete mechanical, hydraulic and electronic systems are as predicted for all intended operational modes. The scope of these tests is to be agreed to with the Society for selected cases based upon risk analysis (see **8.3, Chapter 8, Part 6 of Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**) and is to at least include the following incidents. The tests may be carried out using simulation or other alternative methods, subject to special consideration by the Society.

(a) Failure of ignition (spark ignition or pilot injection systems)

(b) Failure of a cylinder gas supply valve

(c) Failure of combustion (to be detected by e.g. misfiring, knocking, exhaust temperature deviation, etc.)

(d) Abnormal gas pressure

(e) Abnormal gas temperature

3 To shop trials of the high pressure gas-fuelled engines specified in **4.2.2 of Annex 3, Part GF** or **5.2.2 of Annex 3, Part N**, the requirements for the shop trials of low pressure gas-fuelled engines specified in **-2** apply mutatis mutandis.

4 The wording "a procedure deemed appropriate by the Society" in **2.6.1-3, Part D of the Rules** means the tests specified in **Chapter 8, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

1 The wording "a procedure deemed appropriate by the Society" in **2.6.1-2(6)(c), Part D of the Rules** means the tests specified in **8.5.2-2(10), Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

2 The wording "a procedure deemed appropriate by the Society" in **2.6.1-3(5), Part D of the Rules** means the tests specified in **8.3, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

~~5~~**3** In cases where the manufacturer has a quality system deemed appropriate by the Society, dynamic balancing tests specified in **2.6.1-~~4~~6, Part D of the Rules** for category *B* turbochargers may be substituted by manufacturer tests. In such cases, the submission or presentation of test records may be required by the Society.

~~6~~**4** In cases where the manufacturer has a quality system deemed appropriate by the Society, the overspeed tests specified in **2.6.1-~~5~~7, Part D of the Rules** for categories *B* turbochargers may be substituted for by manufacturer tests. In such cases, the submission or presentation of test records may be required by the Society.

~~7~~**5** The wording "a procedure deemed appropriate by the Society" in **2.6.1-~~6~~8, Part D of the Rules** means the tests specified in **Chapter 11, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

Table D2.6.1-1 has been deleted.

Table D2.6.1-1 Programme for Shop Trials of Engines

Test items		Use of engines		
		Reciprocating internal combustion engines used as main propulsion machinery(1)	Reciprocating internal combustion engines driving generators (including those used as main propulsion machinery of electric propulsion ships) (2)	Reciprocating internal combustion engines driving auxiliaries (excluding auxiliary machinery for specific use etc.) (1)
Load test	110 % power run	15 *minutes* or until steady conditions have been reached, which is shorter, at 1.032 n_0 (n_0 is the rated engine speed) or more.(3), (4)	15 *minutes* after having reached steady conditions at n_0	15 *minutes* after having reached steady conditions at n_0
	100 % power run	60 *minutes* at n_0	60 *minutes* at n_0	30 *minutes* at n_0
	90 % power run (or normal continuous cruise power) (5), (6)	30 *minutes* at engine speed in accordance with nominal propeller curve	—	—
	75% power (5), (6)		30 *minutes* at n_0	30 *minutes* in accordance with the nominal power consumption curve (7)
	50% power (5), (6)			
	25% power (5), (6)			
Idle run (5)		—	An adequate time at n_0	—
Reversing manoeuvres (8)		o	—	—
Intermittent overload (9)		o	—	o
Governor test		—	o	—
Performance of monitoring, alarm and safety devices		o	o	o
Open up inspection		o	o	o

Notes:

(1) After testing has been completed, 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. In the case of propulsion engines also driving power take off generators, the fuel delivery system is to be adjusted so that overload of generator (110 % power) can be given in service and the electrical protection of downstream system components is activated before the engine stalls.

(2) After testing has been completed, the fuel delivery system is to be adjusted such that overload (110 % power) can be given in service after installation on board, so that the governing characteristics including the activation of generator protective devices can be fulfilled at all times.

(3) Submission of a test report for identical engine and turbocharger configuration proving their compatibility for over loaded operation may be accepted as substitutions for the 110 % power run.

(4) In the case of propulsion engines also driving power take off generators, the test is to be carried out at n_0 for 15 *minutes* after having reached a steady operating condition.

(5) The sequence is to be selected by the engine manufacturer.

(6) The testing time may be shortened to 20 *minutes* for engines having cylinder bores of 400 *mm* or less when deemed appropriate by the Society.

(7) Only for variable speed engines.

(8) The test item applies only to direct reversible engines.

(9) Only for engines for which intermittent overload is approved. The test is to be performed for the duration agreed upon with the manufacturer.

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 30 June 2023.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to the surveys for which the application is submitted to the Society before the effective date.

Amendment 1-2

D13 PIPING SYSTEMS

D13.5 Bilge and Ballast Piping

D13.5.1 General

Sub-paragraph -4 has been added as follows.

4 The wording "where as deemed appropriate by the Society" specified in **13.5.1-11, Part D of the Rules** means the case where an oily-water separator with an appropriate processing capacity or no openings for the discharging ballast water to the ocean is provided and the oily ballast water is intended to discharge on the shore.

D13.9 Fuel Oil Systems

D13.9.1 General

Sub-paragraph -3 has been amended as follows.

3 The wording "fuel oil service tanks" specified in **13.9.1-~~6~~5, Part D of the Rules** refers to those fuel oil tanks which contain only fuel of a quality ready for use and that meet any specifications required by the equipment manufacturer. In this case, service tanks are to be declared as such and they are not to be used for any other purpose.

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 30 June 2023.

Amendment 1-3

D13 PIPING SYSTEMS

D13.2 Piping

D13.2.5 Bulkhead Valves

Sub-paragraph -3 has been amended as follows.

3 The requirements for pipes piercing collision bulkheads specified in **13.2.5-1 and -2, Part D of the Rules** apply only to those extending below the freeboard deck. However, in accordance with the provisions of ~~**13.1.5(2), Part C of the Rules**~~**2.2.1.5(2), Part 1, Part C of the Rules**, those pipes piercing the extension part of the collision bulkhead (the weathertight part above the freeboard deck) and opening into enclosed spaces behind such bulkheads, are to be fitted with non-return valves on the aft side of the bulkhead.

D13.5 Bilge and Ballast Piping

D13.5.3 Size of Bilge Suction Pipes

Sub-paragraph -3 has been amended as follows.

3 Internal diameters of the bilge suction pipes for ships with unusually large freeboard

~~For information on~~ When calculating internal diameters of bilge suction pipes for ships with unusually large freeboards,~~ see **C1.1.3-2(2)(i)**~~ "*D*" may be replaced with the vertical distance from the top of the keel to an assumed freeboard deck.

D13.8 Sounding Pipes

D13.8.5 Water Level Detection and Alarm Systems for Bulk Carriers, etc.

Sub-paragraph -3(2) has been amended as follows.

3 The wording "the systems to have constructions and functions deemed appropriate by the Society" in **13.8.5-1(4), Part D of the Rules** means those systems complying with the following requirements and being of a type approved by the Society in accordance with the provisions of **Chapter 5, Part 7 of the Approval and Type Approval of Materials and Equipment for Marine Use** or those systems approved by an organization deemed appropriate by the Society in accordance with the Resolution *MSC.*188(79).

(1) (Omitted)

(2) Protection of the enclosures of electrical components for the systems is to satisfy the following **(a)** to **(c)**:

(a) The requirements of IP68 for those installed in spaces, tanks or cargo holds. This includes all adjacent spaces considered to be simultaneously flooded under damage stability calculations of the spaces/tanks/cargo holds required by the provisions of ~~**Chapter 4,**~~ **2.3, Part 1, Part C of the Rules** or the requirements for ships to be assigned reduced freeboard in accordance with **Part V of the Rules**;

(b) The requirements of IP56 for those installed on exposed decks above the spaces/tanks/cargo holds; and

(c) The provisions of **Part H of the Rules** for any of those not specified in **(a)** or **(b)** above.

((3) to (8) are omitted.)

D14 PIPING SYSTEMS FOR TANKERS

D14.3 Piping Systems for Cargo Oil Pump Rooms, Cofferdams and Tanks adjacent to Cargo Oil Tanks

D14.3.2 Ballast Tanks adjacent to Cargo Oil Tanks

Sub-paragraph -3(2) has been amended as follows.

3 Air vent pipes of ballast tanks adjacent to cargo oil tanks (**14.3.2-4, Part D of the Rules**)

(1) (Omitted)

(2) The total sectional area of air vent pipes in cases where high level alarms or hatchways specified in ~~**29.12.2**~~**14.1.2.1, Part 2-7, Part C of the Rules** are provided in ballast tanks adjacent to cargo oil tanks may be larger than the sectional area under the requirements of **13.6.3(1), Part D of the Rules** or 1,000 cm^2 whichever is smaller.

D15 STEERING GEARS

D15.1 General

D15.1.1 Scope

Sub-paragraphs -2(1) and (2) have been amended as follows.

2 Quadrants, chains, rods and leading-block of manual steering gears are to be as specified in the following requirements:

(1) The scantlings of quadrants are to comply with the following requirements in **(a)** to **(c)**:

(a) In cases where three arms are provided, scantlings of quadrants are not to be less than those given in the following:

i) Boss:

$$H_c = 4.27 \cdot \sqrt[3]{T_R K_Q}$$

$$D_c = 7.69 \cdot \sqrt[3]{T_R K_Q}$$

ii) Arm at its root:

$$B_c = 3.29 \cdot \sqrt[3]{T_R K_Q}$$

$$T_c = 1.67 \cdot \sqrt[3]{T_R K_Q}$$

iii) Arm at its outer end:

$$B_0 = 2.22 \cdot \sqrt[3]{T_R K_Q}$$

$$T_0 = 1.07 \cdot \sqrt[3]{T_R K_Q}$$

where

T_R : Rudder torque specified in ~~**3.3,**~~**13.2.3, Part 1, Part C of the Rules** (*N-m*).

K_Q : Material coefficient of the quadrant, specified in ~~**3.1.2**~~**13.2.1.2, Part 1, Part C of the Rules**.

H_c : Required depth of boss (*mm*).

D_c : Required outer diameter of boss (*mm*).

B_c : Required breadth of arm at its root (*mm*).

T_c : Required thickness of arm at its root (*mm*).

B_0 : Required breadth of arm at its end (*mm*).

T_0 : Required thickness of arm at its end (*mm*).

(b) In cases where two arms are provided, the breadth and thickness of such arms are to be not less than 1.1 *times* those specified in **(a)**. In cases where four arms are provided, the breadth and thickness of such arms may be reduced to 0.9 *times* those specified in **(a)**.

(c) In cases where loose quadrants are used in addition to tillers fixed to rudder stocks, any arms of loose quadrants may be of the dimensions given in **(a)iii)** throughout their length.

(2) The diameter of studless chains for steering is not to be either less than 9.5 *mm* or less than the value obtained from the following formula, whichever is greater.

$$d_s = 3.36 \sqrt{\frac{T_R K_c}{R}}$$

where

d_s : Required diameter of chains for steering (*mm*).

T_R : Rudder torque specified in ~~**3.3,**~~**13.2.3, Part 1, Part C of the Rules** (*mm*).

K_c : Material coefficient of the chain, specified in ~~**3.1.2,**~~ **13.2.1.2, Part 1, Part C of the Rules**.

R : Length of tiller or radius of quadrant measured from the centre of rudder stock to the centre line of steering chains (mm).

((3) to (8) are omitted.)

D15.4 Materials, Constructions and Strength of Steering Gears

D15.4.7 Tillers, etc.

Sub-paragraph -2 has been amended as follows.

2 The wording "to the satisfaction of the Society" specified in **15.4.7-5, Part D of the Rules** means to comply with the requirements specified in ~~**1.2**~~ **1.1 of the Appendix C1** "**Reference Data for Design**", of **Part C**.

D16 WINDLASSES AND MOORING WINCHES

D16.2 Windlasses

D16.2.4 Design

Sub-paragraph -1(2) has been amended as follows.

1 The continuous duty pull specified in **16.2.4-2(2)(a)** is based on the following conditions:

(1) Ordinary stockless anchors are used.

(2) The anchor masses are assumed to be the masses as given in ~~**Chapter 27,**~~ **14.3, Part 1, Part C of the Rules** and **Chapter 2, Part L of the Rules**.

(3) One anchor is hoisted at a time.

(4) The effects of buoyancy and hawse pipe efficiency (assumed to be 70 %) have been accounted for.

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 1 July 2023.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to the following ships:

(1) ships for which the date of contract for construction is before the effective date; or

(2) sister ships of ships subject to the current requirements for which the date of contract for construction is before 1 January 2025.

Amendment 1-4

D18 AUTOMATIC AND REMOTE CONTROL

D18.3 Automatic and Remote Control of Main Propulsion Machinery or Controllable Pitch Propellers

D18.3.3 Bridge Control Devices

Sub-paragraph -3 has been amended as follows.

3 The following may be considered as examples of those "cases ~~where the~~in which total failure of main propulsion machinery will occur within a short period of time" given in **18.3.3(3)** and **18.3.3(4)(b), Part D of the Rules**:

(1) Over-speed

(2) Abrupt pressure drops of lubricating oil to main bearings

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 1 July 2023.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships for which the date of contract for construction is before the effective date.