RULES FOR THE SURVEY AND CONSTRUCTION OF INLAND WATERWAY SHIPS

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF INLAND WATERWAY SHIPS

Rules for the Survey and Construction of Inland Waterway Ships
2020 AMENDMENT NO.1
Guidance for the Survey and Construction of Inland Waterway Ships
2020 AMENDMENT NO.1

Rule No.64 / Notice No.36 30 June 2020
Resolved by Technical Committee on 22 January 2020

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 INLAND WATERWAY SHIPS

RULES

2020 AMENDMENT NO.1

Rule No.64 30 June 2020

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Rule No.64 30 June 2020
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF INLAND WATERWAY SHIPS

"Rules for the survey and construction of inland waterway ships" has been partly amended as follows:

Amendment 1-1

Part 2 CLASS SURVEYS

Chapter 1 GENERAL

1.1 Surveys

1.1.3 Intervals of Class Maintenance Surveys*

Sub-paragraph -4 has been amended as follows.

4 The classed ships may be subject to Unscheduled Surveys when the confirmation of the status of the ship by survey is deemed necessary in cases where the Society ~~suspects the ship of not being in continued compliance with the Rules and Regulations of the Society, and of not being properly maintained and operated by the ship owner~~ considers the ship to subject to **1.4-3** of the **CONDITIONS OF SERVICE FOR CLASSIFICATION OF SHIPS AND REGISTRATION OF INSTALLATIONS**.

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 30 June 2020.

Amendment 1-2

Part 7 MACHINERY INSTALLATIONS

Chapter 2 DIESEL ENGINES

2.4 Safety Devices

Paragraph 2.4.1 has been amended as follows.

2.4.1 Speed Governors and Overspeed Protective Devices

1 Each diesel engine used as main propulsion machinery in diesel ships is to be provided with a speed governor so adjusted to prevent the engine speed from exceeding the number of maximum continuous revolutions by more than 15%.

2 In addition to this speed governor, each diesel engine used as main propulsion machinery in diesel ships that has a continuous maximum output of 220 *kW* or above, which can be declutched or which drives a controllable pitch propeller, is to be provided with a separate overspeed protective device. The overspeed protective device, including its driving gear, are to be independent from the governor required by **-1**, and be so adjusted that the engine speed may not exceed the number of maximum continuous revolutions by more than 20%.

3 Diesel engines used to drive generators are to be provided with governors specified in the requirements in ~~**2.4.2, Part 8**~~ **-5**. However, if a diesel engine which is used as main propulsion machinery for an electric propulsion ship drives a generator used to supply electrical power exclusively to propulsion motors, the requirements specified in **5.1.2-2, Part 8** are to be applied.

4 In addition to the speed governor, each diesel engine used as main propulsion machinery of electric propulsion ships and those diesel engines used to drive generators that have a maximum continuous output of 220 *kW* or above are to be provided with a separate overspeed protective device. The overspeed protective device, including its driving gear, are to be independent from the governor required by **-3**, and be so adjusted that the engine speed may not exceed the number of maximum continuous revolutions by more than 15%.

5 Speed governors of reciprocating internal combustion engines driving generators are to be have the following characteristics:

(1) Reciprocating internal combustion engines driving main generators

(a) Momentary speed variations are, in principle, to be 10 % or less of the maximum rated speed when the rated loads of generators are suddenly thrown off. However, in cases where it is difficult to meet the above requirements, the characteristics of such governors may be acceptable in the following cases.

i) In cases where momentary variations are 10 % or less of the rated speed when the maximum load on board is suddenly thrown off and the speed is returned to within 1 % of the final steady speed in not more than 5 *seconds*, momentary variations in excess of 10 % of rated speeds may be acceptable in cases where rated loads of such generators are suddenly thrown off.

ii) The momentary variations given in **i)** above, in cases where the rated loads of generators suddenly thrown off are less than any adjusted values of the intervention of overspeed devices as required by **-4**.

(b) Momentary speed variations are, in principle, to be 10 % or less of the maximum rated speed when 50 % of the rated loads of generators are suddenly thrown-on followed by the remaining 50 % of such loads suddenly being thrown-on after an interval to restore

the steady state. Speeds are to return to within 1 % of final steady speeds in not more than 5 *seconds*.

(c) In cases where the throwing-on methods are difficult according to the requirements in **(b)** above, and where a three-stage or more throwing-on method is adopted, throw-on power calculation sheets which take into consideration **i)** to **iv)** are to be submitted to the Society for approval:

i) power restoration after blackout,

ii) sequential starting,

iii) starting with large start-up loads, or

iv) instantaneous load transfers in cases where one set of generators fails (during parallel running).

(d) At all loads in ranges between no loads and rated loads, all permanent speed variations are to be within ± 5 % of the maximum rated speed.

(2) Reciprocating internal combustion engines driving emergency generators

(a) Momentary speed variations are not to exceed the values specified in **(1)(a)** in cases where total emergency consumer loads are suddenly thrown off.

(b) Momentary speed variations are, in principle, not to exceed the values specified in **(1)(b)** and speeds are to return to within 1 % of final steady speeds in not more than 5 *seconds* in cases where total emergency consumer loads are suddenly thrown-on. However, if it is difficult to meet the above requirements and in cases where the following **i)** through **iii)** requirements are adopted, a throwing-on in steps method may be used.

i) Total emergency consumer loads are to be thrown-on within 45 *seconds* after blackout.

ii) Prime movers are to be designed so that the maximum step loads in emergency consumer loads are to be thrown-on at one time.

iii) Documents such as thrown power calculations specifying the adoption of throwing-on in steps are to be submitted.

(c) At all loads in ranges between no loads and total emergency consumer loads, all permanent speed variations are not to exceed the values specified in **(1)(d)** above.

(3) Reciprocating internal combustion engines driving *a.c.* generators operating in parallel

(a) The load sharing specified in **2.4.14-4** and **-5, Part 8**, is ensured, and

(b) Facilities are to be provided to adjust the governor sufficiently enough to permit adjustments of loads not exceeding 5 % of rated loads at normal frequencies.

Part 8 ELECTRICAL INSTALLATIONS

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.4 Rotating Machines

Paragraphs 2.4.1 and 2.4.2 have been amended as follows.

2.4.1 Prime Movers for Generators

Prime movers for generators are to be constructed in accordance with the requirements given in **Part 7** ~~and, in addition, their governors are to be in accordance with the requirements given in **2.4.2**~~.

2.4.2 Characteristics of Governors

Characteristics of governors for prime movers driving generators are to comply with the requirements specified in **2.4.1-5, Part7**.

~~**1** The characteristics of governors on prime movers for main generators are that such governors be capable of maintaining speeds within the following limits:~~

~~(1) Momentary speed variations are, in principle, to be 10% or less of the maximum rated speed when the rated loads of generators are suddenly thrown off. However, in cases where it is difficult to meet the above requirements, the characteristics of such governors may be acceptable in the following cases.~~

~~(a) In cases where momentary variations are 10% or less of the rated speed when the maximum load on board is suddenly thrown off and the speed is returned to within 1% of the final steady speed in not more than 5 *seconds*, momentary variations in excess of 10% of rated speeds may be acceptable in cases where rated loads of such generators are suddenly thrown off.~~

~~(b) The momentary variations given in **(a)** above, in cases where rated loads of generator are suddenly thrown off are less than any adjusted values of the intervention of overspeed devices as required by **2.4.1-4, Part 7**.~~

~~(2) Momentary speed variations are, in principle, to be 10% or less of the maximum rated speed when 50% of the rated loads of generators are suddenly thrown on followed by the remaining 50% of such loads suddenly being thrown on after an interval to restore the steady state. Speeds are to return to within 1% of final steady speeds in not more than 5 *seconds*. In cases where it is difficult to meet the above requirements or in cases where certain installations require different characteristics and the prime movers have mean effective pressures of 1.35 *MPa* or more, the following methods of throwing-in-steps may be acceptable:~~

~~Total throw-on loads at the 1st power stage (%) = $80/P_{me}$~~
~~Total throw-on loads at the 2nd power stage (%) = $135/P_{me}$~~
~~Total throw-on loads at the 3rd power stage (%) = $180/P_{me}$~~
~~Total throw-on loads at the 4th power stage (%) = $225/P_{me}$~~
~~Total throw-on loads at the 5th power stage (%) = $270/P_{me}$~~
~~Total throw-on loads at the 6th power stage (%) = 100~~
~~P_{me}: Declared power mean effective pressure (*MPa*)~~

~~However, in cases where the above throwing on methods apply, manufacturers or shipyards are requested to submit throw-on power calculation sheets to the Society for approval, and such sheets are to demonstrate that the throw-on loads and base loads at each step of the operation do not exceed those values determined by the formulae above under any of the **(a)** to **(d)** circumstances given below:~~

~~(a) at times of power restoration after blackout,~~

~~(b) at times of sequential starting,~~

~~(c) at times of starting with large start-up loads, or~~

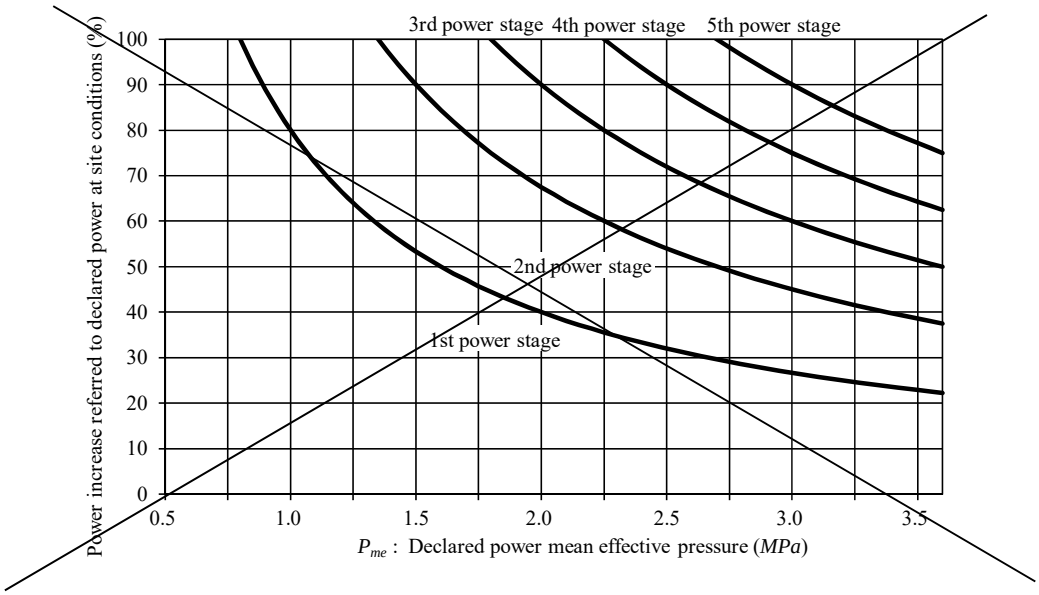
~~(d) at times of instantaneous load transfers in cases where one set of generators fails (during parallel running).~~

~~(3) At all loads in ranges between no loads and rated loads, any permanent speed variations are to be within ± 5% of the maximum rated speed.~~

~~**2** In the case of *a.c.* generating sets operating in parallel, the governor characteristics of prime movers are to be such that the load sharing specified in **2.4.14-4** and **-5** is ensured, and facilities are to be provided to adjust the governor sufficiently enough to permit adjustments of loads not exceeding 5% of rated loads at normal frequencies.~~

Fig. 8.2.1 has been deleted.

~~Fig. 8.2.1 Reference values for maximum possible sudden power increases as a function of brake mean effective pressure (P_{me}) at declared power (four-stroke diesel engines)~~



EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 30 June 2020.

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

Amendment 1-3

Part 8 ELECTRICAL INSTALLATIONS

Chapter 1 GENERAL

1.2 Testing

Paragraph 1.2.1 has been amended as follows.

1.2.1 Shop Tests*

1 The electrical equipment specified below is to be tested in accordance with the respective requirements in this Part at the place of manufacture or at other locations having adequate apparatus for testing and inspections. However, tests for any equipment with small capacities as specified in **(4)** and **(5)** are to be conducted as deemed appropriate by the Society.

(1) Rotating machines for propulsion and their respective control equipment
(2) Main generators
(3) Main switchboards
(4) Motors for auxiliary machinery specified in **1.1.5-1(1)** to **1.1.5-1(3), Part 7** (hereinafter referred to as "motors for essential services" in this Part)
(5) Controlgears for those motors specified in **(4)** above
(6) Transformers for power and lighting of single phase 1 *kVA* or more and three phase 5 *kVA* or more. However, those transformers used only for special services such as those ones for Suez Canal Search Lights, etc. are to be excluded
~~(7) Power semiconductor converters of not less than 5 *kW* and their respective accessories that are used for supplying power to the electrical equipment specified in **(1)** to **(5)** above~~
(~~8~~7) Other electrical equipment as deemed necessary by the Society

2 Any electrical equipment used for auxiliary machinery for specific use for those ships specified in **1.1.5-1(4)** and **1.1.5-1(5), Part 7** as well as those deemed necessary by the Society are to be tested in accordance with the respective requirements in this Part.

3 For those electrical equipment manufactured by mass production, test procedures suited to their production methods, notwithstanding the requirements given in **-1**, may be applied subject to Society approval.

4 Electrical equipment and cables shown in the following items **(1)** to **(4~~5~~5)** are to be subjected to type tests for each type of products.

(1) Circuit breakers
(2) Electromagnetic contactors
(3) Explosion-protected electrical equipment
(4) Cables for power, lighting and internal communications
(5) Semiconductor converters for power of not less than 5 *kW* that are used for supplying power to the electrical equipment specified in **-1(1)** to **(5)** above

5 Electrical equipment and cables having a certificate considered acceptable to the Society may be exempted partially or wholly from the tests and inspections.

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.3 System Design (Protection)

Paragraph 2.3.12 has been added as follows.

2.3.12 Harmonic Filters

1 Where harmonic filters are installed on the main busbars of electrical distribution systems, except when the harmonic filters are installed for single application frequency drives such as pump motors, the ship is to be fitted with facilities to continuously monitor the Total Harmonic Distortion (THD) values experienced by the main busbars as well as to alert the crew in cases where the value exceeds the upper limits given in **2.1.2-4**. The Total harmonic distortion (THD) value is to be recorded in the engine log book, but this reading may be logged electronically in cases where the engine room is provided with systems which automatically log such values.

2 The protection arrangements for harmonic filters specified in **-1** are to comply with the following requirements:

(1) Arrangements are to be provided to alert in the event of activation of the protection of a harmonic filter circuit.

(2) The protection of a harmonic filter circuit is to be arranged in conformity with the following requirements:

(a) A harmonic filter is to be arranged as a three-phase unit with individual protection provided for each phase. The activation of the protection arrangement for a single phase is to result in automatic disconnection of the entire filter.

(b) A current unbalance detection system independent of the overcurrent protection is to be provided to alert the crew in the case of current unbalance.

(3) Consideration is to be given to additional protection for individual capacitor elements, such as relief valves or overpressure disconnectors, in order to protect against damage from rupturing. This consideration is to take into account the type of capacitors used.

Section 2.12 has been amended as follows.

2.12 Semiconductor Converters for Power

2.12.1 General*

1 The requirements given in this **2.12** are to apply to semiconductor converters for power (hereinafter referred to as "converters") not less than 5 *kW*. ~~However, the requirement given in **2.12.4** is to apply to converters less than 5 *kW*, too.~~

2 Converters are to be in accordance with all applicable requirements given in this Part, and standards are, as far as practicable, to be deemed appropriate by the Society.

2.12.2 Construction and Location

1 ~~Semiconductor valve units, semiconductor stacks or semiconductor elements~~ Converters are to be arranged so that they can be ~~removed from equipment without dismantling the complete unit~~ repaired or replaced.

2 Effective means are to be provided in convertors to prevent any accumulation of moisture and condensation unless such convertors are located in air-conditioned spaces.

3 Transformers for converters are to be of two separate windings.

4 In case where semiconductor elements are connected in a series or in parallel, they are to be arranged so that voltages or currents for each element will become equal as far as practicable.

5 Converters are to be installed with effective cooling devices in order to maintain temperature

rises of semiconductor elements or semiconductor stacks below allowable levels. In such cases, such equipment is to be installed in such a manner that coolant circulation is not impeded and that the temperature of the air at inlets to air-cooled semiconductor elements or semiconductor stacks does not exceed allowable values.

6 Converters are to be separated from resistors, steam pipes or other sources of radiant heat as far as practicable.

2.12.3 Protective Devices, etc.

1 In cases where forced cooling devices are provided, converters are to be arranged so that they can~~-~~not remain loaded unless effective cooling is maintained.

2 In case where necessary, means are to be provided to guard against any transient over-voltage caused by switching and breaking of circuits and any *d.c.* voltage rise due to regenerative power.

~~**3** Protecting fuses for semiconductor elements are to be co-ordinated with characters of semiconductor elements as far as practicable.~~

4~~3~~ Over voltages in those supply systems to which convertors are connected are to be limited by suitable ~~devices~~ means to prevent any damage.

5~~4~~ Semiconductor elements and filter circuits are to be protected by fuses, etc. In addition, consideration is to be given to how the failure of converters may affect other equipment.

~~**2.12.4 Harmonic Filters**~~

~~**1** Where harmonic filters are installed on the main busbars of electrical distribution systems, except when the harmonic filters are installed for single application frequency drives such as pump motors, the ship is to be fitted with facilities to continuously monitor the Total Harmonic Distortion (THD) values experienced by the main busbars as well as to alert the crew in cases where the value exceeds the upper limits given in **2.1.2-4**. The Total harmonic distortion (THD) value is to be recorded in the engine log book, but this reading may be logged electronically in cases where the engine room is provided with systems which automatically log such values.~~

~~**2** The protection arrangements for harmonic filters specified in **-1** are to comply with the following requirements:~~

~~(1) Arrangements are to be provided to alert in the event of activation of the protection of a harmonic filter circuit.~~

~~(2) The protection of a harmonic filter circuit is to be arranged in conformity with the following requirements:~~

~~(a) A harmonic filter is to be arranged as a three-phase unit with individual protection provided for each phase. The activation of the protection arrangement for a single phase is to result in automatic disconnection of the entire filter.~~

~~(b) A current unbalance detection system independent of the overcurrent protection is to be provided to alert the crew in the case of current unbalance.~~

~~(3) Consideration is to be given to additional protection for individual capacitor elements, such as relief valves or overpressure disconnectors, in order to protect against damage from rupturing. This consideration is to take into account the type of capacitors used.~~

~~**2.12.5 Shop Tests***~~

~~**1** Converters and their accessories are to be tested in accordance with the requirements in this **2.12.5**. However, those tests required by **-2** below may be omitted, subject to Society approval, for those products which are produced in a series of identical types from the second unit onward.~~

~~**2** Temperature rise tests for converters and their accessories are to be carried out under normal working conditions, and temperature rise for the interiors of converters is not to exceed manufacturer specified values and the temperature rise for the exteriors of converters (e.g., the connecting parts of busbars and cables for switchboards as well as coils, contactors and resistors) is not to exceed those values specified in the requirements given in **2.8.3**. Furthermore, temperature~~

~~test methods for semiconductor element connections are to be as deemed appropriate by the Society.~~
~~**3** Instruments, switching devices and protective devices fitted in converters are to be checked for normal operation under operating conditions.~~
~~**4** Converters are to withstand high voltages by applying the following *a.c.* voltages for a period of 1 *minute* between semiconductor elements or live parts of accessories charged with main circuit potential and earths.~~

~~Testing voltage (V) = $1.5EP_r$ + 1,000 (minimum 2,000 V)~~

~~EP_r : Maximum voltage values are to be impressed on the reverse side of convertor circuit arms~~

~~In cases where *d.c.* voltages are less than 100 V, minimum testing voltages may be 1,500 V. Semiconductor elements are to be short-circuited before such tests.~~
~~**5** High voltage tests between live parts and earths for accessories charged with auxiliary circuit potential are to be in accordance with the requirements given in **2.8.4-4**.~~
~~**6** Immediately after such high voltage tests have been performed, insulation resistance between live parts of converters and their accessories and earths is not to be less than 1 $M\Omega$ when tested with *d.c.* voltages of at least 500 V.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 30 June 2020.

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

Part 2 CLASS SURVEYS

Chapter 1 GENERAL

1.1 Surveys

1.1.3 Intervals of Class Maintenance Surveys*

Sub-paragraph -2 has been amended as follows.

2 Planned Machinery Surveys are to be carried out as specified in **(1)** and **(2)**. However, in the case of azimuth thrusters, surveys of gears, gear shafts, shaft couplings, bearings and clutches for propulsion as well as azimuth steering gear may be carried out concurrently with survey specified in **-1(6)** above. In addition to the above, in consideration of the navigating area and operating mode, the intervals of Class Maintenance Surveys may be in accordance mutatis mutandis with standards deemed appropriate by the Society.

(1) In the Continuous Machinery Survey, survey items are to be examined at the interval not exceeding 6 *years*.

(2) In the Planned Machinery Maintenance Scheme, survey items are to be examined according to the survey schedule table specified in **9.1.3** and at the general examination (including review of maintenance records) which is to be carried out every year.

1.2 Specialized Ships, Installations, and Apparatus

Paragraph 1.2.3 has been deleted.

~~**1.2.3 Surveys of Water Jet Propulsion Systems, etc.***~~

~~Surveys of water jet propulsion systems and azimuth thrusters are to be carried out as specified separately by the Society.~~

Chapter 3 ANNUAL SURVEYS

3.3 Annual Surveys for Machinery

Paragraphs 3.3.3 and 3.3.4 have been added as follows.

3.3.3 Surveys of Water Jet Propulsion Systems, etc.

1 For ships fitted with water jet propulsion systems, the surveys are to be carried out in accordance with the following **(1)** and **(2)**:

(1) The general conditions of propulsion systems are to be confirmed to be in good order.

(2) The following **(a)** to **(d)** tests are to be carried out:

(a) Performance tests of steering systems;

(b) Tests on operation of controls for steering systems, including tests on change-overs of

control systems between navigation bridges and auxiliary steering stations, and change-overs between manual steering and automatic steering, if provided;

(c) Tests on the functioning of alarm and safety devices, and indication devices for deflector positions, reverser positions and impeller speed, and running indicators of electric motors for steering actuating systems;

(d) Specific tests for the supply of the alternative sources of power for propulsion systems.

2 For ships fitted with azimuth thrusters, the surveys are to be carried out in accordance with the following **(1)** and **(2)**:

(1) The general conditions of propulsion systems are to be confirmed to be in good order.

(2) The following **(a)** to **(e)** tests are to be carried out:

(a) Performance tests of azimuth steering gears;

(b) Tests on the functioning of alarm and safety devices as well as indication devices for azimuth angles, propeller speeds and direction of rotation and pitch positions, and running indicators of electric motors for azimuth steering gears;

(c) Tests on the operation of controls for steering, including tests on change-overs of control systems between navigation bridges and azimuth thruster compartments, and change-overs between manual steering and automatic steering, if provided;

(d) Specific tests for the supply of the alternative sources of power for propulsion systems;

(e) For azimuth thrusters which incorporate electric motors in propeller pods, performance tests of the following are to be carried out:

i) Audible and visual alarms for ingress of sea water into propeller pods;

ii) Fire detection and alarm systems in propeller pods (if provided);

iii) Cooling fans and auxiliary cooling fans for propulsion motors (if provided);

iv) Control means for stopping cooling fans for propulsion motors and closing any inlets and outlets of air for such fans (if provided).

3.3.4 Surveys of Selective Catalytic Reduction (SCR) Systems, etc.

1 For ships fitted with selective catalytic reduction (SCR) systems, the surveys are to be carried out in accordance with the following **(1)** to **(5)**:

(1) The general conditions of SCR systems are to be confirmed to be in good order.

(2) General examinations of ventilation systems for reductant agent storage tank compartments are to be carried out.

(3) General examinations of specific safety and protective equipment for SCR systems are to be carried out.

(4) Instructions and operation manuals of SCR systems are to be confirmed to be kept on board.

(5) Performance tests of the following **(a)** to **(f)** are to be carried out:

(a) Control, safety and alarm devices;

(b) Change-over devices of exhaust gas pipes and their corresponding indicators;

(c) Remote shut-off devices for reductant agent storage tank valves;

(d) Remote stopping devices for reductant agent supply pumps;

(e) Safety showers; and

(f) Eyewashers.

2 For ships fitted with exhaust gas cleaning systems, the surveys are to be carried out in accordance with the following **(1)** to **(4)**:

(1) The general conditions of exhaust gas cleaning systems are to be confirmed to be in good order.

(2) General examinations of safety and protective equipment for exhaust gas cleaning systems.

(3) Instructions and operation manuals of exhaust gas cleaning systems are to be confirmed to be kept on board.

(4) Performance tests of the following **(a)** to **(f)** are to be carried out:

(a) Control, safety and alarm devices;
(b) Change-over devices of exhaust gas pipes and their corresponding indicators;
(c) Remote shut-off devices of cocks or valves directly fitted to sodium hydroxide solution storage tanks (if fitted);
(d) Remote stopping devices for sodium hydroxide solution supply pumps (if fitted)
(e) Safety showers (if fitted); and
(f) Eyewashers (if fitted).

3 For ships fitted with exhaust gas recirculation systems, the surveys specified in **-2** above are to be carried out (in this case the term "exhaust gas cleaning systems" is to be read as "exhaust gas recirculation systems").

Chapter 4 INTERMEDIATE SURVEYS

4.3 Intermediate Surveys for Machinery

Paragraphs 4.3.4 and 4.3.5 have been added as follows.

4.3.4 Surveys of Water Jet Propulsion Systems, etc.

For ships fitted with water jet propulsion systems or azimuth thrusters, the surveys are to be carried out in accordance with **3.3.3-1** and **-2** respectively.

4.3.5 Surveys of Selective Catalytic Reduction (SCR) Systems, etc.

For ships fitted with selective catalytic reduction (SCR) systems, exhaust gas cleaning systems or exhaust gas recirculation systems, the surveys are to be carried out in accordance with **3.3.4-1**, **-2** and **-3** respectively.

Chapter 5 SPECIAL SURVEYS

5.3 Special Surveys for Machinery

Table 2.5.6 has been amended as follows.

Table 2.5.6 Additional Requirements at Special Surveys for Machinery

Items	Examinations
1 ~~Diesel~~ Reciprocating internal combustion engines (main propulsion machinery and auxiliary machinery for propulsion, manoeuvring and personnel safety)	(a) The essential part of the crankcase and cylinder jacket, the foundation bolts, the chock liners and the tie rod bolts are to be generally examined. (b) The doors of the crankcase and the explosion relief devices of the crankcase and scavenge space are to be generally examined. (c) The anti-vibration dampers, detuners, balancers, and compensators are to be generally examined. (d) The crankshaft alignment is to be checked and if necessary, adjusted.
(Omitted)	

Paragraphs 5.3.4 and 5.3.5 have been added as follows.

5.3.4 Surveys of Water Jet Propulsion Systems, etc.

1 For ships fitted with water jet propulsion systems, in addition to the surveys specified in **3.3.3-1**, the surveys are to be carried out in accordance with the following **(1)** to **(5)**:

(1) Waterjet pump units are to be opened up and it is to be confirmed that their principal components are in good working order;

(2) Shafting bearings are to be opened up and the following tests are to be carried out:

(a) The principal components of shafting are to be confirmed to be in good order;

(b) Non-destructive tests of the contact faces of impeller bosses and main shafts (keyways and flanges), and coupling bolts are to be carried out;

(3) Holding parts and pins of deflectors or reversers are to be opened up and it is to be confirmed that they are in good working order;

(4) Oil piping for lubrication is to be examined; and

(5) Sea water piping for lubrication is to be examined.

2 For ships fitted with azimuth thrusters, in addition to the surveys specified in **3.3.3-2**, inspections of the supporting parts of azimuth steering gear are to be carried out.

5.3.5 Surveys of Selective Catalytic Reduction (SCR) Systems, etc.

1 For ships fitted with selective catalytic reduction (SCR) systems, in addition to the surveys specified in **3.3.4-1**, the surveys are to be carried out in accordance with the following **(1)** to **(3)**:

(1) Internal examinations of reductant agent storage tanks are to be carried out.

(2) In cases where reductant agents are carried in tanks which form part of the ship hull, the pressure tests required for "cargo tank" in **Table 2.5.5** are to be carried out. In cases where pressure tests at specified pressures have been conducted in the presence of the Master or any other representative personnel of the ship at suitable occasions prior to the survey, such pressure tests may be regarded as the pressure tests required for Special Surveys.

(3) The following **(a)** to **(c)** equipment is to be opened for examinations:

(a) SCR chambers;

(b) Reductant agent supply pumps;

(c) Other items as deemed necessary by the Society.

2 For ships fitted with exhaust gas cleaning systems, in addition to the surveys specified in **3.3.4-2**, the surveys are to be carried out in accordance with the following **(1)** to **(3)**:

(1) Internal examinations of sodium hydroxide solution storage tanks (if fitted).

(2) In cases where sodium hydroxide solutions are carried in tanks which form part of the ship hull, the pressure tests required for "cargo tank" in **Table 2.5.5** are to be carried out. In cases where pressure tests at specified pressures have been conducted in the presence of the Master or any other representative personnel of the ship at suitable occasions prior to the survey, such pressure tests may be regarded as the pressure tests required for Special Surveys.

(3) The following **(a)** and **(b)** equipment is to be opened for examinations:

(a) Sodium hydroxide solution supply pumps and washwater supply pumps (if fitted);

(b) Other items as deemed necessary by the Society.

3 For ships fitted with exhaust gas recirculation systems, in addition to the surveys specified in **3.3.4-3**, the surveys specified in **-2** above are to be carried out (in this case the term "exhaust gas cleaning systems" is to be read as "exhaust gas recirculation systems").

Chapter 6 DOCKING SURVEYS

6.1 Docking Surveys

Paragraph 6.1.1 has been amended as follows.

6.1.1 Surveys in Dry Dock or on Slipway*

1 At Docking Surveys, examinations listed in **Table 2.6.1** are to be carried out in the dry dock or on the slipway after cleaning the outer shell.

2 For ships fitted water jet propulsion systems, the surveys are to be carried out in accordance with the following **(1)** to **(3)**:

(1) In cases where water-lubricated bearings for waterjet pump units are adopted, bearing wear down is to be measured;

(2) The mounting of waterjet pump units to hull structures (including flanges and bolts) is to be examined;

(3) Water intake ducts are to be confirmed to be in good working order.

3 For ships fitted with azimuth thrusters, the surveys are to be carried out in accordance with the following **(1)** and **(2)**:

(1) Visual inspections of steering columns, propeller pods and propellers (including bolt locking and other fastening arrangements) are to be carried out;

(2) Examinations on sealing devices for azimuth steering gears, propeller shafts and propeller blades are to be carried out.

Table 2.6.1 has been amended as follows.

Table 2.6.1 Requirements for Docking Surveys

Items	Examinations
(Omitted)	
4 Bush of stern tube bearing or shaft bracket bearing	・The wear down of the bearing or the clearance between the propeller shaft (Except in the case of azimuth thrusters which use roller bearings as bearings for propeller shafts) or stern tube shaft, and the bearing is to be measured and recorded.
5 Sealing devices for stern tube and shaft bracket bearing	・In the case of oil or freshwater lubricated stern tube bearings, the efficiency of the oil or freshwater gland is to be checked.
6 Propeller	・Propellers are to be examined. Where a controllable pitch propeller is fitted, the pitch control device is to be examined without dismantling.
(Omitted)	

Chapter 8 PROPELLER SHAFT AND STERN TUBE SHAFT SURVEYS

8.1 Propeller Shaft and Stern Tube Shaft Surveys

Paragraph 8.1.3 has been amended as follows.

8.1.3 Preventive Maintenance System*

Notwithstanding the requirements in **8.1.1** above, where the ship is equipped with oil lubricated stern tube bearings and appropriate stern tube oil sealing devices as approved by the Society, the survey items of 1, 3, 4, 5 and 7 in **Table 2.8.1** may be replaced with a general examination of the shafting system and, for the weardown measuring and recording specified in item 8 in **Table 2.8.1**, they may be carried out while the propeller is installed in lieu of the timing after re-installation; this, however, is provided that all condition monitoring data taken according to the approved preventive maintenance system is found to be within permissible limits. Furthermore, omission of the survey items of 2, 9 and 10 in **Table 2.8.1** may be allowed except in the case of keyed connections.

(1) Based upon Society approved preventive maintenance systems, at least the following **(a)** ~~through~~ to **(d)** are to be properly monitored and recorded for diagnosing lubricating conditions of shafting systems and performing preventive system maintenance. Moreover, the notation "*Propeller Shaft Condition Monitoring System*" (abbreviated as "*PSCM"*) is to be affixed to the classification characters of ships whose preventive maintenance systems are approved by the Society.

((a) and (b) are omitted.)

(c) Bearing temperature. In the case of azimuth thrusters which use roller bearings as the bearings for propeller shafts, however, vibrations of the power transmission systems in the propulsion systems or the Fe-density of the lubricating oil in the azimuth thruster casings may be acceptable.

((d) is omitted.)

(2) Based upon Society approved preventive maintenance systems, at least the following **(a)** to **(e)** are to be properly monitored and recorded for diagnosing lubricating conditions of shafting systems and performing preventive system maintenance. Moreover, the notation "*Propeller Shaft Condition Monitoring System・A*" (abbreviated as "*PSCM・A"*) is to be affixed to the classification characters of ships whose preventive maintenance systems are approved by the Society.

((a) to (c) are omitted.)

(d) Bearing temperature. In the cases of azimuth thrusters which use roller bearings as the bearings for propeller shafts, however, the vibrations of the power transmission systems in the propulsion systems or the Fe-density of the lubricating oil in the azimuth thruster casings may be acceptable.

((e) is omitted.)

Chapter 9 PLANNED MACHINERY SURVEYS

9.1 Planned Machinery Surveys

Table 2.9.1 has been amended as follows.

Table 2.9.1 Open-up Surveys of Machinery and Equipment

Items	Examinations
1 ~~Diesel~~ Reciprocating internal combustion engines (main engine)	(Omitted)
2 Power transmission systems and shafting systems (except for those for which item 5 is applicable)	・Reduction gears, reversing gears and clutch gears are to be opened up to the Surveyor's satisfaction, and the gears, shafts, bearings and couplings are to be examined. ・The essential parts of flexible couplings are to be opened up. ・Thrust shafts, intermediate shafts and their bearings (excluding stern tube bearings and shaft bracket bearings) are to be examined by removing the upper bearing halves or their bearing metals and thrust pads and turning the shaft. ・The essential parts of other power transmission gears are to be subjected to open-up examinations to the Surveyor's satisfaction.
3 Auxiliary engines	Auxiliary engines driving generators, auxiliary machinery essential for main propulsion and auxiliary machinery for manoeuvring and personnel safety are to be handled in accordance with the requirements applicable to main engines.
4 Water jet propulsion systems	・Hydraulic pumps for steering actuating systems are to be opened up. ・Lubricating oil pumps are to be opened up. ・Coolers are to be opened up. ・Other items considered to be necessary by the Society are to be opened up.
5 Azimuth thrusters	・For gears, gear shafts, shaft couplings, bearings and clutches for propulsion, these items are to be opened up as deemed necessary by the Surveyor so that they can be inspected. However, this may be carried out concurrently with the surveys specified in **Chapter 8**. ・For gears, gear shafts, shaft couplings and bearings for steering, these items are to be opened up as deemed necessary by the Surveyor so that they can be inspected. However, this may be carried out concurrently with the surveys specified in **Chapter 8**. ・Hydraulic pumps and hydraulic motors for azimuth steering gears are to be opened up. ・Lubricating oil pumps are to be opened up. ・Coolers are to be opened up. ・Other items considered to be necessary by the Society are to be opened up.
~~4~~6 Auxiliary machinery (except for those for which item 4 or 5 is applicable)	(Omitted)

Table 2.9.2 has been amended as follows.

Table 2.9.2 Surveys of Machinery and Equipment in place of the Planned Machinery Surveys

Items	Examinations
1 ~~Diesel~~ Reciprocating internal combustion engines (main engine)	・Inside of cylinders and inside and outside of cylinder covers are to be examined. However, pistons need not to be removed unless deemed necessary by the surveyor. ・Crank pin bearings in the number of one third of cylinders are to be removed and examined by turning the crank shaft. ・Blades and bearings for turbo chargers are to be examined.
(Omitted)	

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 1 July 2020.

Amendment 1-5

Part 2 CLASS SURVEYS

Chapter 2 CLASSIFICATION SURVEYS

2.1 Classification Survey during Construction

2.1.2 Submission of Plans and Documents for Approval*

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

1 When it is intended to build a ship for classification by the Society, the following plans and documents are to be submitted for the approval by the Society before the work is commenced. The plans and documents may be submitted for examination by the Society prior to making an application for the classification of the ship as stipulated otherwise by the Society.
((1) is omitted.)
(2) Machinery
((a) to (g) are omitted.)
(h) Waterjet propulsion systems (if fitted):
Plans and data specified in **19.1.3, Part D of the Rules for the Survey and Construction of Steel Ships**
(i) Azimuth thrusters (if fitted):
Plans and data specified in **20.1.3, Part D of the Rules for the Survey and Construction of Steel Ships**
(j) Selective catalytic reduction systems and associated equipment (if fitted):
Plans and data specified in **21.1.3(1), Part D of the Rules for the Survey and Construction of Steel Ships**
(k) Exhaust gas cleaning systems and associated equipment (if fitted):
Plans and data specified in **22.1.3(1), Part D of the Rules for the Survey and Construction of Steel Ships**
(l) Exhaust gas recirculation systems and associated equipment (if fitted):
Plans and data specified in **23.1.3(1), Part D of the Rules for the Survey and Construction of Steel Ships**
(~~h~~m) Electrical installations:
Plans and data specified in **1.1.6, Part 8**
((3) to (5) are omitted.)

2.1.3 Submission of Other Plans and Documents

Sub-paragraph -1(7) has been amended as follows.

1 When it is intended to build a ship to the classification with the Society the following plans and documents are to be submitted, in addition to those required in **2.1.2**:
((1) to (6) are omitted.)
(7) The following plans and documents related to machinery:
((a) to (c) are omitted.)
(d) Selective catalytic reduction systems and associated equipment (if fitted):

Plans and data specified in **21.1.3(2), Part D of the Rules for the Survey and Construction of Steel Ships**

(e) Exhaust gas cleaning systems and associated equipment (if fitted):
Plans and data specified in **22.1.3(2), Part D of the Rules for the Survey and Construction of Steel Ships**

(f) Exhaust gas recirculation systems and associated equipment (if fitted):
Plans and data specified in **23.1.3(2), Part D of the Rules for the Survey and Construction of Steel Ships**

((8) and (9) are omitted.)

2.1.6 Documents to be Maintained On Board*

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

1 At the completion of a classification survey, the Surveyor confirms that the finished versions of the following applicable drawings, plans, manuals, lists, etc., are on board. For barges, these drawings, etc. need not be on board, however, are to be kept appropriately by the owner of barges (or the management company of barges).

((1) is omitted.)

(2) Other documents

((a) to (f) are omitted.)

(g) Instructions and operation manuals (including cautionary notes for the safety of the operators) for the following equipment when fitted on the ship: selective catalytic reduction systems and associated equipment; exhaust gas cleaning systems and associated equipment; or exhaust gas recirculation systems and associated equipment.

((3) is omitted.)

2.3 River Trials and Stability Experiments

2.3.1 River Trials*

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

1 In the Classification Survey of all ships, river trials specified in following **(1)** to **(9)** are to be carried out in full load condition, in the calmest possible water and weather condition and in deep unrestricted water. However, where river trials cannot be carried out in full load condition, river trials may be carried out in an appropriate loaded condition.

((1) is omitted.)

(2) Steering test and the change-over test from the main to auxiliary steering gears. In the case of waterjet propulsion systems or azimuth thrusters, however, tests are to be as otherwise stipulated by the Society.

((3) to (9) are omitted.)

Part 7 MACHINERY INSTALLATIONS

Chapter 1 GENERAL

1.3 General Requirements for Machinery Installations of Tugs and Pushers

1.3.1 General*

Sub-paragraph -8 has been renumbered to Sub-paragraph -9, and Sub-paragraph -8 has been added as follows.

8 Ships provided with waterjet propulsion systems or azimuth thrusters are to comply with the requirements of **Chapter 19 and Chapter 20, Part D of the Rules for the Survey and Construction of Steel Ships**, respectively.

Sub-paragraph -9 has been amended as follows.

~~**8**~~**9** The exhaust gas treatment systems specified in the following **(1)** and **(2)** fitted onto machinery installations are to ~~be to the satisfaction of the Society~~ comply with the requirements of **Chapter 21** and **Chapter 22, Part D of the Rules for the Survey and Construction of Steel Ships**, respectively.

(1) Selective catalytic reduction (SCR) systems

(2) Exhaust gas cleaning systems (EGCS) (excluding those specified in **2.1.1-4**)

Part 8 ELECTRICAL INSTALLATIONS

Chapter 3 DESIGN OF INSTALLATIONS

Section 3.3 has been amended as follows.

3.3 Steering Gear, Waterjet Propulsion Systems, Azimuth Thrusters, etc.

3.3.1 ~~General~~ Steering Gear
See **Chapter 12, Part 7**.

3.3.2 Waterjet Propulsion Systems
See **Chapter 19, Part D of the Rules for the Survey and Construction of Steel Ships**.

3.3.3 Azimuth Thrusters
See **Chapter 20, Part D of the Rules for the Survey and Construction of Steel Ships**.

3.3.4 Selective Catalytic Reduction Systems and Associated Equipment
See **Chapter 21, Part D of the Rules for the Survey and Construction of Steel Ships**.

3.3.5 Exhaust Gas Cleaning Systems and Associated Equipment
See **Chapter 22, Part D of the Rules for the Survey and Construction of Steel Ships**.

3.3.6 Exhaust Gas Recirculation Systems and Associated Equipment
See **Chapter 23, Part D of the Rules for the Survey and Construction of Steel Ships**.

EFFECTIVE DATE AND APPLICATION (Amendment 1-5)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Rules, the current requirements apply to waterjet propulsion systems, azimuth thrusters, SCR systems, EGCS or EGR systems whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.

Amendment 1-6

Part 7 MACHINERY INSTALLATIONS

Chapter 1 GENERAL

1.3 General Requirements for Machinery Installations of Tugs and Pushers

1.3.1 General*

Sub-paragraph -2 has been amended as follows.

2 Special consideration is to be given to the reliability of any of the single essential machinery and components listed below. In addition, for ships in which unconventional machinery is used as the main propulsion machinery and propulsion shafting system, additional machinery which enables the ship to proceed at a navigable speed in the event of possible failure of the machinery may be required by the Society.

(1) For ~~diesel~~ ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships):
~~Diesel~~ Reciprocating internal combustion engines ~~used as the main propulsion machinery~~, high elastic couplings, reduction gears and propulsion shafting systems

(2) For electric propulsion ships (only those specified in **5.1.1-1, Part H of the Rules for the Survey and Construction of Steel Ships**, hereinafter the same in this Part):
Propulsion motors, reduction gears and propulsion shafting systems

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.1 General

2.1.1 General*

Sub-paragraph -1 has been amended as follows.

1 The requirements of this Chapter apply to ~~diesel~~ reciprocating internal combustion engines which are used as the main propulsion machinery or used to drive generators and auxiliaries (hereinafter referred to in this Chapter as all auxiliaries excluding auxiliary machinery for specific use etc.).

Chapter 3 POWER TRANSMISSION SYSTEMS

3.3 Strength of Gears

3.3.3 Allowable Tangential Loads for Bending Strength*

Table 7.3.1 has been amended as follows.

Table 7.3.1 Values of K_1[(3)(4)]

Driving unit	Construction	Use	
	Kind of coupling	Gear for main propulsion	Gear for auxiliaries
Steam turbine Gas turbine Electric motor	Single-stage reduction gear Multiple-stage reduction gear	1.00 1.00[(1)], 1.10[(2)]	1.15 1.15
~~Diesel engine~~ Reciprocating internal combustion engine	Hydraulic or electromagnetic coupling High elastic coupling Elastic coupling	1.00 0.90 0.80	1.15 1.05 0.95

Notes:

(1) Applicable only to gearing connected directly to the main propulsion shafting system.

(2) Applicable to gearing connected, through effective flexible couplings, to the propulsion shafting system.

(3) Where one pinion meshes with more than two wheels, 0.9 *times* these values may be used for the value of K_1.

(4) The value of K_1 for rigid couplings is to be approved by the Society.

Chapter 4 SHAFTINGS

4.2 Materials, Construction and Strength

4.2.2 Intermediate Shafts*

Table 7.4.1 has been amended as follows.

Table 7.4.1 Values of F_1

~~For~~ In cases where steam turbines ~~installation,~~ gas turbines ~~installation~~ are used as main propulsion machinery, or in the case of ~~diesel installation~~ reciprocating internal combustion engines with slip type coupling[(1)]~~,~~ or electric propulsion ~~installation~~	For all other ~~diesel installations~~ reciprocating internal combustion engines than those noted in the left hand column
95	100

Note:

(1) Slip type coupling signifies hydraulic coupling, electromagnetic coupling or the equivalent.

Chapter 5 PROPELLERS

5.1 General

5.1.3 Materials

Sub-paragraph -2 has been amended as follows.

1 (Omitted)
2 Propellers are to have been subjected to non-destructive tests on their principal parts in accordance with **7.2.9, Part K of the Rules for the Survey and Construction of Steel Ships**.

5.2 Construction and Strength

Paragraph 5.2.1 has been amended as follows.

5.2.1 Thickness of Blade*

1 The thickness of the propeller blades at a radius of 0.25R and 0.6R (where R is the radius of the propeller) for solid propellers and at a radius of 0.35R and 0.6R for controllable pitch propellers is not to be less than the values given by the following formula. The thickness of the highly skewed propeller blades is to conform with the provisions specified ~~elsewhere~~ in **2** given below.

$$t = \sqrt{\frac{K_1}{K_2}\frac{H}{ZN_0\ell}SW}$$

Where:
t: Thickness of blades (excluding the fillet of blade root) (cm)
H: Maximum continuous output of main propulsion machinery (kW)
Z: Number of blades
N_0: Number of maximum continuous revolutions (rpm) ~~per minute~~ divided by 100 ~~(rpm/100)~~
ℓ: Width of blade at radius in question (cm)
K_1: Coefficient of the radius in question given by the following formula:

$$K_1 = \frac{30.3}{\sqrt{1 + k_1\left(\frac{P'}{D}\right)^2}}\left(k_2\frac{D}{P} + k_3\frac{P'}{D}\right)$$

D: Diameter of propeller (m)
k_1, k_2, k_3: Values given in **Table 7.5.1**
P': Pitch at radius in question (m)
P: Pitch at radius of 0.7R (m)~~s~~ (R = Radius of propeller (m))
K_2: Coefficient given by the following formula:

$$K_2 = K - \left(k_4\frac{E}{t_0} + k_5\right)\frac{D^2N_0^2}{1000}$$

k_4, k_5: Values given in **Table 7.5.1**
E: Rake at the tip of the blade (Measuring from face side base line and taking positive value for backward rake) (cm)
t_0: Imaginary thickness of blade at propeller shaft centreline (t_0 may be obtained by drawing the each side line which connects the blade tip thickness with the thickness

at 0.25R (or 0.35R for a controllable pitch propeller), in the projection of the blade section along the maximum blade thickness line.) (*cm*)

K: Value depending upon the type of the propeller material given in **Table 7.5.2**

S: (Omitted)

W: (Omitted)

Table 7.5.1 Values of k_1, k_2, k_3, k_4 and k_5

(Table is omitted.)

Table 7.5.2 has been amended as follows.

Table 7.5.2 Values of K

Material		K
Copper alloy castings	*KHBsC*1	1.15
	*KHBsC*2	
	*KAlBC*3	1.3
	*KAlBC*4	1.15
Stainless steel forgings for propellers	*KSCSP*1, *KSCSP*2, *KSCSP*3	1.0
	*KSCSP*4	0.9

Notes:

(1) For the blades of materials different from those specified in the above table, the value of K is to be ~~determined in each case~~ as deemed appropriate by the Society.

(2) For propellers having a diameter of 2.5 *metres* or less, the value of K may be taken as the value in the above Table multiplied by the following factor:

$2 - 0.4D$ for $2.5 \geq D > 2.0$

1.2 for $2.0 \geq D$

2 The thickness of highly skewed propeller blades, depending upon the skew angle (i.e. the angle, on the expanded blade drawing, between the line connecting the centre of the propeller shaft with the point at the blade tip on the centre line of blade width and the tangential line drawn from the centre of the propeller shaft to the centre line of blade width (*See* **Fig. 7.5.1**)) is to comply with either of the following **(1)** or **(2)**:

(1) In cases where the skew angle exceeds 25 *degrees* but is 60 *degrees* or less

(a) The blade thicknesses at radii 0.25R (0.35R for a controllable pitch propeller) and 0.6R are not to be less than the values obtained from multiplying those values calculated by the formulae in **1 above** by coefficient A given below

$$A = 1 + B\frac{\theta - 25^\circ}{60^\circ}$$

where

θ: skew angle (*degrees*)

B: 0.2 at 0.25R (or 0.35R for a controllable pitch propeller) and 0.6 at 0.6R

(b) Blade thickness t_x at any radius between 0.6R and 0.9R is not to be less than the value determined by the following formula. Moreover, this thickness is to provide sufficient strength against loads imparted during reversing manoeuvres, etc.

$$t_x = 0.003D + \frac{(1-x)(t_{0.6} - 0.003D)}{0.4} \ (mm)$$

where

D: diameter of propeller (*mm*)

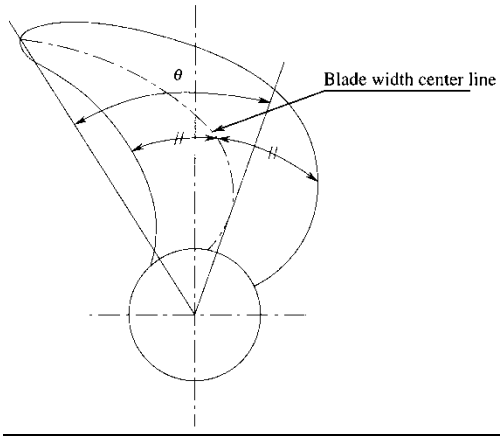
x: ratio of the radius (equals 2*r*/*D*, where *r* is the radius (*mm*))

$t_{0.6}$: blade thickness at 0.6R as required in **(a)** above (*mm*)

(2) In cases where the skew angle exceeds 60°
Based upon the precise calculation sheet of propeller strength submitted by the manufacturer or designer, blade thickness is to be determined by the Society on a case by case basis.

Fig. 7.5.1 and Fig. 7.5.2 have been renumbered to Fig. 7.5.2 and Fig.7.5.3, and Fig. 7.5.1 has been added as follows.

Fig. 7.5.1 Definition of Skew Angle



~~2~~**3** The fillet radius between the root of a blade and the boss of the propeller, on the pressure side at the maximum blade thickness part, is to be not less than the value of R_0 given by the following formula:

$$R_0 = t_r + \frac{(e - r_B)(t_0 - t_r)}{e}$$

R_0: Required radius of the fillet (cm)
t_r: Required thickness of blades at a radius of $0.25R$ (or $0.35R$ for a controllable pitch propeller) specified in **1** (cm)
t_0: Same as that used in **1**
r_B: Boss ratio of propeller
e: 0.25 (or 0.35 for a controllable pitch propeller)

~~3~~**4** Special consideration will be given to the thickness of the blades or the radius of the fillet, notwithstanding the requirements in **1** ~~or~~to ~~2~~**3** above, provided that detailed data and calculations are submitted to the Society and considered appropriate.

Paragraph 5.2.2 has been amended as follows.

5.2.2 Controllable Pitch Propellers*

1 The thickness of the controllable pitch propeller blade and the fillet radius between the root of a blade and the boss of the propeller is to be in accordance with the requirements specified in **5.2.1**.

2 The diameter of blade fixing bolts of controllable pitch propellers is not to be less than the value calculated by the following formula~~:~~. However, in cases where documents deemed appropriate by the Society are submitted and it can be demonstrated that the blade fixing bolts satisfy the strength requirements specified in the Rules, this requirement may be dispensed with.

$$d = 0.55\sqrt{\frac{1}{\sigma_a n}\left(\frac{AK_3}{L} + F_c\right)}$$

where

d : Required diameter of blade fixing bolt (*mm*) (*See* **Fig. 7.5.~~1~~2**)

A : Value given by the following formula, where H, N_0 and Z are the same as those specified in **5.2.1-1**:

$$A = 3.0 \times 10^4 \frac{H}{N_0 Z}$$

K_3 : Value given by the following formula:

$$K_3 = \left\{ \left(\frac{D}{P} \right)^2 \times (0.622 - 0.9x_0)^2 + (0.318 - 0.499x_0)^2 \right\}^{\frac{1}{2}}$$

x_0 : Ratio of the radius from the centreline of the propeller shaft ~~at~~to the boundary between the "blade flange and pitch control gear" ~~to~~ and the propeller radius (*See* **Fig. 7.5.~~1~~2**). Where x_0>0.3, the ratio is to be taken as 0.3.

L : Mean value of $L_1$and L_2 (cm)

where L_1 and L_2 are the lengths of lines constructed from the centre of the bolts located on the edge of each side that are perpendicular to the line passing through the rotating centre of the flange at a pitch angle of β. (*See* **Fig. 7.5.~~2~~3**)

F_c : Centrifugal force (*N*) of propeller blade given by the following formula:

$$F_c = 1.10 \times mR'N_0^2$$

m : Mass of one blade (kg)

R' : Distance between the centre of gravity of the blade and the centre line of the propeller shaft (cm)

n : Number of bolts on the face side of blade

σ_a : Allowable stress of bolt material given by the following formula (N/mm^2):

$$\sigma_a = 34.7 \times \left(\frac{\sigma_B + 160}{600} \right)$$

σ_B : Specified Tensile strength of bolt material (N/mm^2)

where σ_B >800 N/mm^2, it is to be taken as 800 N/mm^2.

Other symbols are the same as those given in the formula of **5.2.1-1**.

3 For blade fixing bolts, either corrosion-resistant materials are to be used or special means precluding their direct contact with sea water are to be provided.

4 The thickness of the flange for fitting the blade to the pitch control gear (the thickness as measured from the seat of fixing bolt or nut to the boundary face between the flange and the pitch control gear) is to be not less than the value calculated by the following formula:

$$t_f = 0.9d$$

where

t_f : Thickness of flange (*mm*) (*See* **Fig. 7.5.~~1~~2**)

d : Required diameter of bolt calculated by the formula specified in **2** (*mm*)

(-5 to -9 are omitted.)

Fig. 7.5.~~1~~2 Measuring Method of Blade Fixing Bolt Dimensions
(Figure is omitted.)

Fig. 7.5.~~2~~3 Determination of *L*
(Figure is omitted.)

5.3 Force Fitting of Propellers

5.3.1 Pull-up Length*

Sub-paragraph -1 has been amended as follows.

1 In cases where a propeller is force fitted onto a propeller shaft without the use of a key, the pull-up length is to be in accordance with the following **(1)** to **(3)**:

(1) Pull-up length by force fitting is to be within the range of the lower and upper limits ~~of pull-up length are to be~~ as given by the following formulae. ~~For~~However, a taper ~~of~~ is not to be more than 1/15, ~~these limits of pull-up length are to be subject to the satisfaction of the Society:~~ and special consideration is required in cases where propellers are force fitted onto propeller shafts through sleeves.

$$L_1 = PK_E + K_C(C_b - C_0)$$

$$L_2 = K_E K_W \frac{({K_{R1}}^2 - 1)}{\sqrt{(3{K_{R1}}^4 + 1)}} + K_c(C_b - C_0)$$

$$L_3 = 19.6K_E({K_{R1}}^2 - 1) + K_c(C_b - C_0)$$

L_1 : Lower limit of pull-up length against slipping at the reference temperature 35 °C (*mm*)

L_2 : Upper limit of pull-up length against detrimental deformations at the reference temperature 0 °C (*mm*) (in cases other than the case of L_3 shown below)

L_3 : Upper limit of pull-up length against detrimental deformations at the reference temperature 0 °C (*mm*) (in cases where the material of boss is manganese bronze casting and K_{R1}<1.89)

K_W : ~~The v~~Value given by the following formula. ~~**Table 7.5.3**. In cases where the material of propeller boss is other than those specified in **Table 7.5.3**, the value is to be determined by the Society in each case.~~For cast iron, the value is not to exceed 30 % of the nominal tensile strength.

$$K_W = 0.7\sigma_{0.2}$$

$\sigma_{0.2}$: Value of 0.2 % proof stress of propeller boss material as specified in **Table 7.5.3** (N/mm^2)

Table 7.5.3 has been amended as follows.

~~Table 7.5.3 Values of K_4, K_5, K_6, K_7 and K_w~~

~~Material of propeller boss~~	~~K_4~~	~~K_5~~	~~K_6~~	~~K_7~~	~~K_w~~
~~*KHBsC1*~~	~~9.27~~	~~1.65~~	~~0.55~~	~~1.20~~	~~123~~
~~*KHBsC2*~~	~~9.27~~	~~1.65~~	~~0.55~~	~~1.20~~	~~123~~
~~*KAlBC3*~~	~~8.49~~	~~1.40~~	~~0.55~~	~~1.20~~	~~172~~
~~*KAlBC4*~~	~~8.49~~	~~1.40~~	~~0.55~~	~~1.20~~	~~193~~

Table 7.5.3 0.2 % proof stress of propeller boss material

Propeller boss material	0.2 % proof stress (N/mm^2)
*KHBsC*1	175
*KHBsC*2	
*KAlBC*3	245
*KAlBC*4	275

Note:

(1) For materials different from those specified in the above table, the value is to be as deemed appropriate by the Society.

K_{R1} : Rate of R_1 to R_0 (R_1/R_0)

K_{R2} : Rate of R_2 to R_0 (R_2/R_0)

R_0 : Radius of the propeller shaft at the midpoint of taper in the axial direction (mm)

R_1 : Radius of propeller boss at the determinant point of the propeller boss ratio (mm)

R_2 : Inner radius at the section corresponding to R_0 in the case of a hollow propeller shaft (mm). For solid propeller shafts, the value is to be 0.

C_b : Temperature of propeller boss at time of fitting propeller (°C)

C_0 : Reference temperature: 35°C for L_1 (at which the space between boss and shaft tends to be loose), and 0°C for L_2 and L_3 (at which the space between boss and shaft tends to shrink)

P : Value of minimum required surface pressure given by the following formula (N/mm_2):

~~$P = \frac{2.0T}{SB}\left\{-2.8tan\alpha + \sqrt{0.0169 + B\left(\frac{F_V}{T}\right)^2}\right\}$~~ $P = \frac{qT}{SB}\left\{-qtan\alpha + \sqrt{\mu^2 + B\left(\frac{F_V}{T}\right)^2}\right\}$

q : Safety factor not to be less than 2.8 against friction slip at the reference temperature 35 °C

S : Contact area between propeller shaft and propeller boss on the drawing (mm^2)

α : Half angle of the taper at the propeller shaft cone part (rad)

B : ~~$0.0169 - 7.84tan^2\alpha$~~ Value given by the following formula

$B = \mu^2 - q^2tan^2\alpha$

μ : Coefficient of friction, equal to 0.13

T : Thrust force given by the following formula (N)

$T = 1.76 \times 10^3(H/V_s)$

V_s : Ship speed at maximum continuous output (kt)

F_V : Tangential force acting on contact surface given by the following formula (N)

$F_V = \frac{9.55cH}{N_0R_0} \times 10^4$

c : Value given by one of following

i) ~~1.0 f~~For turbines ~~ships;~~, geared reciprocating internal combustion engine

drives and electric drives, and for direct reciprocating internal combustion engine drives with hydraulic, electromagnetic or high elasticity couplings 1.0

ii) For ~~diesel ships,~~direct reciprocating internal combustion engine drives (except in case of **i)** above)

1.2 or the value given by the following formula, whichever is greater. However, where a detailed report on the maximum torque acting on the fitted portion of the propeller under all operating conditions including transient conditions has been submitted to the satisfaction of the Society, it may comply with the provisions specified otherwise.

$$c = (0.194\ln D + 0.255)\left\{\left(\frac{N_C}{N_0}\right)^2 + 1.047\frac{Q_v N_0}{H} \times 10^{-2}\right\}$$

Q_V: Torsional vibratory torque acting on the fitted portion of the propeller at a rotational speed of resonant critical within the range of above 25 % of the number of maximum continuous revolutions (*N-m*)

H, N_0, D: Same as those specified in **5.2.1-1**, However, D is to be taken as 2.6 *m* for D <2.6 *m* and as 10.2 *m* for D >10.2 *m*.

N_c: Number of revolutions (*rpm*) at resonant critical divided by 100

K_E : Value given by the following formula (mm^3/N):

~~$$K_E = \frac{R_0}{\tan\alpha}\left\{\left(\frac{K_{R1}^2 + 1}{K_{R1}^2 - 1}\right)K_1 + 4.85\left(\frac{1 + K_{R2}^2}{1 - K_{R2}^2}\right) + K_2\right\} \times 10^{-6}$$~~

~~In cases where the material of the propeller shaft is other than forged steel or the material of propeller boss is other than specified in **Table 7.5.3**, the value is to be determined by the Society as considered appropriate.~~

~~K_1 and K_2 : Values given in **Table 7.5.3**~~

$$K_E = \frac{R_0}{tan\alpha}\left\{\frac{1}{E_b}\left(\frac{K_{R1}^2 + 1}{K_{R1}^2 - 1} + \nu_b\right) + \frac{1}{E_s}\left(\frac{1 + K_{R2}^2}{1 - K_{R2}^2} - \nu_s\right)\right\}$$

ν_b : Poisson's ratio for propeller boss material as specified in **Table 7.5.4**

ν_s : Poisson's ratio for propeller shaft material as specified in **Table 7.5.5**

E_b : Modulus of elasticity of propeller boss material as specified in **Table 7.5.4** (N/mm^2)

E_s : Modulus of elasticity of propeller shaft material as specified in **Table 7.5.5** (N/mm^2)

Table 7.5.4 has been added as follows.

Table 7.5.4 Poisson's ratio, modulus of elasticity and coefficient of linear thermal expansion of propeller boss material

Material	Poisson's ratio	Modulus of elasticity (N/mm^2)	Coefficient of linear thermal expansion (mm/mm^oC)
KHBsC1	0.33	1.08×10^5	17.5×10^{-6}
KHBsC2			
KAlBC3		1.18×10^5	
KAlBC4			
Cast iron	0.26	0.98×10^5	12.0×10^{-6}
Cast steel	0.29	2.06×10^5	

Note:

(1) For materials different from those specified in the above table, the value is to be as deemed appropriate by the Society.

Table 7.5.5 has been added as follows.

Table7.5.5 Poisson's ratio, modulus of elasticity and coefficient of linear thermal expansion of propeller shaft material

Material	Poisson's ratio	Modulus of elasticity (N/mm^2)	Coefficient of linear thermal expansion ($mm/mm°C$)
Forged steel	0.29	2.06×10^5	12.0×10^{-6}

Note:

(1) For materials different from those specified in the above table, the value is to be as deemed appropriate by the Society.

K_C : Value given by the following formula (mm/°C):

~~$K_C = \left(K_S + K_J \frac{C_b - C_S}{C_b - C_0}\right)\left(\ell_0 - \frac{R_0}{\tan\alpha}\right) \times 10^{-5}$~~

$$K_C = \left\{(\lambda_b - \lambda_S) + \frac{(C_b - C_S)}{(C_b - C_0)}\lambda_S\right\}\left\{\ell_0 - \frac{R_0}{tan\alpha}\right\}$$

~~In cases where the material of the propeller shaft is other than forged steel or the material of propeller boss is other than specified in **Table 7.5.3**, the value is to be determined by the Society as considered appropriate.~~

C_S : Temperature of propeller shaft at time of fitting propeller (°C)

λ_b : Coefficient of linear thermal expansion of propeller boss material as specified in **Table 7.5.4** (mm/mm°C)

λ_S : Coefficient of linear thermal expansion of propeller shaft material as specified in **Table 7.5.5** (mm/mm°C)

ℓ_0 : Half length of the tapered part in the propeller boss hole in the axial direction (mm)

~~K_S and K_J : Values given in **Table 7.5.3**~~

(2) Prior to final pull-up according to **(1)** above, the contact area between the mating surfaces is to be checked. Non-contact bands extending circumferentially around the boss or over the full length of the boss are not acceptable.

(3) After final pull-up according to **(1)** above, the propeller is to be secured by a nut on the propeller shaft. The nut is to be secured to the shaft.

Chapter 6 TORSIONAL VIBRATION OF SHAFTINGS

6.1 General

Paragraph 6.1.1 has been amended as follows.

6.1.1 Scope

1 The requirements of this Chapter apply to power transmission systems for propulsion and propulsion shafting systems (except propellers), shafting systems for transmitting power from main propulsion machinery to generators, crankshafts of ~~diesel~~ reciprocating internal combustion engines used as main propulsion machinery and shafting systems of generating plants using ~~diesel~~ reciprocating internal combustion engines.

2 The requirements of this Chapter apply mutatis mutandis to the shafting systems of auxiliaries (hereinafter referred to in this Chapter as all auxiliaries excluding auxiliary machinery for specific use etc.) driven by ~~diesel~~ reciprocating internal combustion engines.

6.1.2 Data to be Submitted

Sub-paragraph -1 has been amended as follows.

1 Torsional vibration calculation sheets covering the following items are to be submitted for approval:

(1) Natural frequency calculation tables for one node and two nodes vibration, and also for more nodes vibrations if necessary

(2) Calculation results of the torsional vibration stress at each resonant critical within a speed range up to 120% of the number of maximum continuous revolutions; and, in cases of ~~diesel installations~~ reciprocating internal combustion engines, those of the torsional vibration stress for the flank appearing in the speed range from 90 to 120% caused by a resonance of the first major order (i.e., the *n* th or *n*/2 th order where *n* denotes the number of cylinders) having its critical speed above 120% of the number of maximum continuous revolutions.

(3) Arrangement of crank throws and firing order (in cases of ~~diesel installation~~ shafting systems driven by reciprocating internal combustion engines)

(4) For propulsion shafting systems intended to be continuously operated under one cylinder misfiring condition, calculation results of the torsional vibration stress with any one cylinder misfiring giving rise to the highest torsional vibration stress.

6.2 Allowable Limit

Paragraph 6.2.1 has been amended as follows.

6.2.1 Crankshafts

The torsional vibration stresses on the crankshafts of ~~diesel~~ reciprocating internal combustion engines ~~used as main propulsion machinery~~ of ~~diesel~~ ships in which the reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships) are to be in accordance with the following requirements **(1)** through **(4)**:

(1) For continuous operation, when the number of revolutions is within the range of 80% to 100% of the number of maximum continuous revolutions, the torsional vibration stresses are not to exceed τ_1 given in following:

(a) For 4-stroke cycle in-line ~~diesel~~ engines or 4-stroke cycle Vee type ~~diesel~~ engines with firing intervals of 45° or 60°, the value of τ_1 is given by the following formula:

$$\tau_1 = 45 - 24\lambda^2$$

(b) For 2-stroke cycle ~~diesel~~ engines or 4-stroke cycle Vee type ~~diesel~~ engines other than shown in **(a)** above, the value of τ_1 is given by the following formula:

$$\tau_1 = 45 - 29\lambda^2$$

τ_1: Allowable limit of torsional vibration stresses for the range of $0.8 < \lambda \leq 1.0$ (N/mm^2)

λ: Ratio of the number of revolutions to the number of maximum continuous revolutions

(2) When the number of revolutions is within the range of 80% and below the number of maximum continuous revolutions, the torsional vibration stresses are not to exceed τ_2 given below. Furthermore, in cases where the stresses exceed the value calculated by the formula of

τ_1 in **(1)**, the barred speed ranges specified in **6.3** are to be imposed.

$\tau_2 = 2\tau_1$

τ_2: Allowable limit of torsional vibration stresses for the range of $\lambda \leq 0.8$ (N/mm^2)

λ: Ratio of the number of revolutions to the number of maximum continuous revolutions

(3) When the number of revolutions is within the range of the number of maximum continuous revolutions to 115%, the torsional vibration stresses are not to exceed τ_3 given in the following:

(a) For 4-stroke cycle in-line ~~diesel~~ engines or 4-stroke cycle Vee type ~~diesel~~ engines with firing intervals of $45°$ or $60°$, the value of τ_3 is given by the following formula:

$$\tau_3 = 21 + 237(\lambda - 0.8)\sqrt{\lambda - 1}(1 < \lambda \leq 1.15)$$

(b) For 2-stroke cycle ~~diesel~~ engines or 4-stroke cycle Vee type ~~diesel~~ engines other than shown in **(a)** above, the value of τ_3 is given by the following formula:

$$\tau_3 = 16 + 237(\lambda - 0.8)\sqrt{\lambda - 1}(1 < \lambda \leq 1.15)$$

τ_3: Allowable limit of torsional vibration stresses for the range of $1.0 < \lambda \leq 1.15$ (N/mm^2)

λ: Ratio of the number of revolutions to the number of maximum continuous revolutions

(4) In cases where the tensile strength of the shaft material exceeds 440 N/mm^2, and its yield strength exceeds 225 N/mm^2, the values of τ_1, τ_2 and τ_3 given in **(1)**, **(2)** and **(3)** may be increased by multiplying the factor f_m given in the following formula:

(a) For τ_1 and τ_3

$$f_m = 1 + \frac{2}{3}\left(\frac{T_s}{440} - 1\right)$$

(b) For τ_2

$$f_m = \frac{Y}{225}$$

Where:

f_m: Correction factor for allowable limit of torsional vibration stress concerning the shaft material

T_s: Specified tensile strength of the shaft material (N/mm^2). However, the value of T_s for calculating f_m is not to exceed 760 N/mm^2 for carbon steel forgings, and 1080 N/mm^2 for low alloy steel forgings.

Y: Specified yield strength of the shaft material (N/mm^2)

Paragraph 6.2.2 has been amended as follows.

6.2.2 Intermediate Shafts, Thrust Shafts, Propeller Shafts and Stern Tube Shafts*

1 For ~~diesel~~ ships <u>in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships)</u>, the torsional vibration stresses on the intermediate shafts, thrust shaft, propeller shafts and stern tube shafts made of steel forgings (excluding stainless steel, etc.) are to be in accordance with the following requirements **(1)** and **(2)**. However, those shafts classified as either propeller shafts Kind 2 or stern tube shafts Kind 2 are to be deemed appropriate by the Society.

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

2 For ~~diesel~~ ships <u>in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships)</u>, the torsional vibration stresses on the propeller shafts and stern tube shafts made of stainless steel forgings, etc. are to be in accordance

with the following requirements **(1)** and **(2)**.
((1) and (2) are omitted.)

3 The allowable limits of torsional vibration stresses on the shafts made of materials other than specified in **-1** and **-2**, and the allowable limits of torsional vibration stresses on the intermediate shafts, thrust shafts, propeller shafts and stern tube shafts ~~for steam turbine ships, gas turbine ships, and~~ for electric propulsion ships~~,~~ or for ~~diesel~~ ships in which reciprocating internal combustion engines are used as main propulsion machinery which have electromagnetic slip couplings between main propulsion machinery and main propulsion systems are to be deemed appropriate by the Society.

6.2.3 Shafting System of Generating Plants

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

1 The torsional vibration stresses on the crankshafts of ~~diesel~~ reciprocating internal combustion engines used for generating plants (hereinafter referred to in **6.2.3** and **6.2.5** as including propulsion generating plants used for electric propulsion ships) are to be in accordance with the following requirements **(1)** and **(2)**:

(1) When the number of revolutions is within the range of 90% to 110% of the number of maximum continuous revolutions, the torsional vibration stresses are not to exceed τ_1 given in the following:

(a) For 4-stroke cycle in-line ~~diesel~~ engines or 4-stroke cycle Vee type ~~diesel~~ engines with firing intervals of 45° or 60°, the value of τ_1 is given by the following formula:

$\tau_1 = 21$ (N/mm^2)

(b) For 2-stroke cycle ~~diesel~~ engines and 4-stroke cycle Vee type ~~diesel~~ engines other than shown in **(a)** above, the value of τ_1 is given by the following formula:

$\tau_1 = 16$ (N/mm^2)

((2) is omitted.)

2 The torsional vibration stresses on the generator shafts of generating plants using ~~diesel~~ reciprocating internal combustion engine are to be in accordance with the following requirements **(1)** and **(2)**:
((1) and (2) are omitted.)

Paragraph 6.2.5 has been amended as follows.

6.2.5 Avoidance of Major Criticals

The major criticals of one node vibration (e.g. the *n* th and *n*/2 th order for 4-stroke cycle and the *n* th order for 2-stroke cycle where *n* denotes the number of cylinders) in in-line ~~diesel~~ engines are not to exist, except when approval of the Society is specifically obtained, within the following speed ranges:

For main propulsion shafting system $0.8 \leq \lambda \leq 1.1$

For shafting system of generating plants $0.9 \leq \lambda \leq 1.1$

Where:

λ: Ratio of the number of revolutions at the major critical to the number of maximum continuous revolutions

Chapter 7 BOILERS, ETC. AND INCINERATORS

7.1 General

7.1.2 Terminology

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

Terms used in this Part are defined as follows:

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

(3) "Exhaust gas boilers" are boilers which generates steam or hot water using only exhaust gases from ~~diesel~~ reciprocating internal combustion engines, have independent steam spaces or hot wells and have outlets for steam or hot water.

(4) "Exhaust gas economizers" are those equipment which generates steam or hot water using only exhaust gases from ~~diesel~~ reciprocating internal combustion engines and do not have independent steam spaces or hot wells.

((5) to (7) are omitted.)

7.4 Incinerators

7.4.3 Construction and Fittings*

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

The construction and fittings of incinerators are to comply with the requirements in the following **(1)** to **(9)**.

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

(3) Uptakes from combustion chambers are to satisfy the following **(a)** to **(c)**:

(a) They are not to be connected to the exhaust gas pipes from ~~diesel~~ reciprocating internal combustion engines and gas turbines.

((b) and (c) are omitted.)

((4) to (7) are omitted.)

Chapter 11 PIPING SYSTEMS

11.9 Fuel Oil Systems

11.9.4 Drip Trays and Drainage Systems*

Sub-paragraph -1 has been amended as follows.

1 Metal drip trays of a sufficient depth are to be provided under all equipment that uses or handles fuel oil such as ~~diesel~~ reciprocating internal combustion engines (except main propulsion machinery), burners, fuel oil pumps, fuel oil heaters, fuel oil coolers and fuel oil filters as well as fuel oil tanks. In cases where it is not practicable to provide metal drip trays, coamings are to be

provided to hold any oil spillage.

Paragraph 11.9.6 has been amended as follows.

11.9.6 Fuel Oil Systems for ~~Diesel~~ Reciprocating Internal Combustion Engines*

1 (Omitted)

2 Two fuel oil pumps of the same capacity are to be provided for both ~~diesel~~ reciprocating internal combustion engines used to drive electrical generators and auxiliary machinery for which redundancy is required. The total capacity of the two pumps is to be enough to ensure a sufficient supply of oil at maximum continuous output of the engine, and the capacity of each pump is to be sufficient enough to ensure the navigable speed of the ship in cases where the other pump fails. The above requirement, however, does not apply to cases where each engine is provided with a dedicated fuel oil supply pump that has enough capacity to ensure a sufficient supply of oil at maximum continuous output.

3 Fuel oil filters are to be provided for the fuel oil supply piping systems of ~~diesel~~ reciprocating internal combustion engines. The filters for ~~diesel~~ reciprocating internal combustion engines used as main propulsion machinery are to be capable of being cleaned without stopping the supply of filtered oil. The fuel oil filters are to be provided with valves or cocks for depressurization before being opened.

4 (Omitted)

11.12 Cooling Systems

11.12.1 Cooling Pumps

Sub-paragraph -2 has been amended as follows.

2 Two cooling pumps of the same capacity are to be provided for ~~diesel~~ reciprocating internal combustion engines used to drive electrical generators and auxiliary machinery for which redundancy is required. The total capacity of the two pumps is to be enough to ensure a sufficient supply of water (oil) at maximum continuous output of the engine. In addition, the capacity of each pump is to be sufficient enough to ensure the navigable speed of the ship in cases where the other pump fails. The above requirement, however, does not apply to cases where each engine is provided with a dedicated cooling that has enough capacity to ensure a sufficient supply of water (oil) at maximum continuous output.

Paragraph 11.12.3 has been amended as follows.

11.12.3 Cooling Systems for ~~Diesel~~ Reciprocating Internal Combustion Engines*

In cases where river water is used for the direct cooling of the propulsion machinery, ~~diesel~~ reciprocating internal combustion engines driving electrical generators, or any auxiliary machinery for which duplication is required, strainers, which are arranged so as they are capable of being cleaned without stopping the supply of filtered cooling water to the respective engines, are to be provided between the river water suction valve and the cooling river water pump.

Chapter 14 AUTOMATIC AND REMOTE CONTROL

14.2 System Design

14.2.2 Supply of Power

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

3 Supply of pneumatic pressure
The supply of control air is to be in accordance with the following:
((1) is omitted.)
(2) In cases where starting air reservoirs of ~~diesel~~ reciprocating internal combustion engines used as main propulsion machinery are used as control air reservoirs, pressure reducing valves are to be duplicated or a spare pressure reducing valve is to be provided on board.
((3) to (5) are omitted.)

14.2.7 Use of Computers*

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

2 Control systems, alarm systems and safety systems which constitute computer based systems are to comply with the following **(1)** to **(3)**:
((1) is omitted.)
(2) Back-up means
(a) In cases where one computer simultaneously performs fuel control (governor control, electronic injection control, etc.) and remote control of main propulsion machinery ~~in diesel or turbine ships, or~~ of ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships) or in cases where one computer simultaneously performs output control (rotational speed control, load control, etc.) and remote control of main propulsion machinery in electric propulsion ships, one of the following systems is to be provided in the case of computer failure. However, where this requirement is impracticable, relevant systems are to comply with requirements deemed appropriate by the Society.
i) Stand-by computer
ii) Governor-controlled back-up systems operated at the main control station
(b) Safety systems are to be provided with back-up means which can be used in a timely manner in the event of the failure of the computer in service.
i) Stand-by computer
ii) Safety systems that do not rely on computers
(c) In cases where visual display units (VDU) are adopted as indicators for the alarm systems stipulated in this chapter, at least two VDUs are to be installed, or other arrangements deemed appropriate by the Society are to be considered.
((3) is omitted.)

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

14.3.2 Remote Control Devices for Main Propulsion Machinery or Controllable Pitch Propellers*

Sub-paragraph -1(3) has been amended as follows.

1 General

Remote control devices for main propulsion machinery or controllable pitch propellers are to comply with the following requirements in **(1)** to **(6)**:

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

(3) In cases where the speed of the ~~diesel~~ reciprocating internal combustion engines used as main propulsion machinery is controlled by governors, the governors are to be adjusted so that main propulsion machinery may not exceed 103% of maximum continuous revolutions. These governors are to be capable of maintaining a safe minimum speed.

((4) to (6) are omitted.)

Sub-paragraph -4 has been amended as follows.

4 Remote starting of main propulsion machinery in ~~diesel~~ ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships)

Starting by means of remote control devices for main propulsion machinery is to comply with the following:

((1) to (4) are omitted.)

14.3.4 Safety Measures*

Sub-paragraph -1(3) has been amended as follows.

1 Safety measures for main propulsion machinery or controllable pitch propellers

Safety measures for main propulsion machinery or controllable pitch propellers are to comply with the following requirements in **(1)** to **(3)**:

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

(3) With respect to safety measures for main propulsion machinery driven by ~~diesel~~ reciprocating internal combustion engines, the requirements specified in **2.4.5-1** are to be applied.

Sub-paragraph -3 has been amended as follows.

3 Self-reversing ~~diesel~~ reciprocating internal combustion engines

Remote control devices for self-reversing ~~diesel~~ reciprocating internal combustion engines are to be at least provided with the following safety measures:

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

14.5 Automatic and Remote Control of Electric Generating Sets

14.5.1 General

Sub-paragraph -3 has been amended as follows.

3 In cases where ~~diesel~~ reciprocating internal combustion engines used to drive propulsion generators are remotely started, the number of starts is to conform to the required number specified in **2.5.3**.

Sub-paragraph -6 has been amended as follows.

6 With respect to safety measures for electric generating set driven by ~~diesel~~ reciprocating internal combustion engines, the requirements specified in **2.4.5-1** are to be applied.

14.6 Automatic and Remote Control of Auxiliary Machinery

Paragraph 14.6.9 has been amended as follows.

14.6.9 ~~Diesel~~ Reciprocating Internal Combustion Engines

With respect to the safety measures for auxiliary machinery driven by ~~diesel~~ reciprocating internal combustion engines, the requirements specified in **2.4.5-1** are to be applied.

Part 8 ELECTRICAL INSTALLATIONS

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.4 Rotating Machines

Paragraph 2.4.1 has been amended as follows.

2.4.1 Prime Movers ~~for~~ driving Generators

Prime movers ~~for~~ driving generators are to be constructed in accordance with the requirements given in **Part 7** and, in addition, their governors are to be in accordance with the requirements given in **2.4.2**.

2.4.11 Shafts of Rotating Machine*

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

3 The shafts of generators are to comply with the following requirements:
((1) and (2) are omitted.)
(3) In case where generators are driven by ~~diesel~~ reciprocating internal combustion engines, torsional vibrations of shaftings~~s~~ are to comply with those relevant requirements given in **Chapter 6, Part 7**.

Table 8.2.3 has been amended as follows.

Table 8.2.3 Values of F_1

Bearing arrangements of rotating machines	Generators driven by ~~diesel~~ reciprocating internal combustion engines through slip type couplings (Note)	Generators driven ~~diesel~~ by reciprocating internal combustion engines other than those mentioned in the left-hand column
In cases where bearings are arranged at both sides of rotating machines	110	115
In cases where no bearings are arranged at prime movers or load sides of rotating machines	120	125

Note: Slip type couplings in this case refer to hydraulic couplings, electro-magnetic couplings or their equivalent.

EFFECTIVE DATE AND APPLICATION (Amendment 1-6)

1. The effective date of the amendments is 1 July 2020.
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 1-7

Part 7 MACHINERY INSTALLATIONS

Chapter 1 GENERAL

1.3 General Requirements for Machinery Installations of Tugs and Pushers

Paragraph 1.3.8 has been added as follows.

1.3.8 Rating Plates for *A.C.* Generating Sets

Rating plates which comply with the requirements in **1.3.10 of Part D** are to be installed on *A.C.* generating sets.

1.4 General Requirements for Machinery Installations of Barges

Paragraph 1.4.2 has been added as follows.

1.4.2 Rating Plates for *A.C.* Generating Sets

Rating plates which comply with the requirements in **1.3.10 of Part D** are to be installed on *A.C.* generating sets.

Chapter 6 TORSIONAL VIBRATION OF SHAFTINGS

6.1 General

6.1.2 Data to be Submited

Sub-paragraph -2 has been amended as follows.

2 Notwithstanding the requirements specified in **-1**, submission of torsional vibration calculation sheets may be omitted in the following cases provided that approval of the Society is obtained:

(1) In cases where the shafting system is of the same type as previously approved one.

(2) In cases where there is a slight alternation in the specifications of the vibration system, and the frequency and torsional vibration stress can be deduced with satisfactory accuracy on the basis of the previous results of calculations or measurements.

(3) In cases where the shafting system is for a generating set which has an engine power of less than 110 *kW.*

Part 8 ELECTRICAL INSTLATIONS

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.4 Rotating Machines

2.4.14 *A.C.* Generators

Sub-paragraph -6 has been added as follows.

6 Rating plates which comply with the requirements in **1.3.10 of Part D** are to be installed on *A.C.* generating sets.

EFFECTIVE DATE AND APPLICATION (Amendment 1-7)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to *A.C.* generating sets whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.

Amendment 1-8

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.1 General

2.1.1 General*

Sub-paragraph -2 has been amended as follows.

2 For each type of ~~diesel~~ reciprocating internal combustion engines, an approval of use is to be obtained by the engine designer (hereinafter referred to "licensor" in this Chapter) as specified separately by the Society.

2.1.3 Drawings and Data*

Sub-paragraph -1 has been amended as follows.

1 Drawings and data to be submitted are generally as follows:
((1) and (2) are omitted.)
(3) Drawings and data for the purpose of inspection and testing of ~~diesel~~ reciprocating internal combustion engines
  (a) A list containing all drawings and data submitted (including relevant drawing numbers and revision status)
  ((b) to (m) are omitted.)
  (n) Schematic layout or other equivalent drawings and data on the ~~diesel~~ reciprocating internal combustion engine of the following **i)** to **vii)** (Details of the system so far as supplied by the licensee such as~~:~~ main dimensions, operating media and maximum working pressures).
    (i) to vii) are omitted.)
  ((o) to (ao) are omitted.)

Paragraph 2.1.4 has been amended as follows.

2.1.4 Approval of ~~Diesel~~ Reciprocating Internal Combustion Engines*

1 ~~Diesel~~ Reciprocating internal combustion engines are to be approved in accordance with the following **(1)** to **(6)**:
(1) Development of documents and data for engine production
  (a) Prior to the start of the ~~diesel~~ reciprocating internal combustion engine approval process in accordance with the following **(3)** and subsequent sub-paragraphs of this paragraph, a design approval is to be obtained as specified separately by the Society.
  (b) Each type of ~~diesel~~ reciprocating internal combustion engine is to be provided with a certificate of approval of use obtained by the licensor in accordance with **2.1.1-2**. For the first engine of a type or for those with no service records, the process of an approval of use and the approval process for production by the licensee may be performed

simultaneously.

(c) The licensor is to review the drawings and data of the ~~diesel~~ reciprocating internal combustion engine whose approval of use has been obtained for the application and develop, if necessary, application specific drawings and data for production of ~~diesel~~ reciprocating internal combustion engines for the use of the licensee in developing the ~~diesel~~ reciprocating internal combustion engine specific production drawings and data listed in **2.1.3-1(3)**.

(d) If substantive modifications to the drawings and data of the ~~diesel~~ reciprocating internal combustion engine whose approval of use has been obtained have been made in the drawings and data of ~~diesel~~ reciprocating internal combustion engines to be produced, the affected drawings and data are to be resubmitted to the Society as specified separately by the Society.

(2) Drawings and data for the purpose of inspection and testing of ~~diesel~~ reciprocating internal combustion engines

(a) The licensee is to develop the drawings and data listed in **2.1.3-1(3)** and a comparison list of these drawings and data to the drawings and data of the ~~diesel~~ reciprocating internal combustion engine whose approval of use has been obtained by the licensor and submit these drawings and the comparison list to the Society.

(b) In applying **2.1.3-1(3)**, if there are differences in the technical content on the licensee's production drawings and data of the ~~diesel~~ reciprocating internal combustion engine compared to the drawings and data of the ~~diesel~~ reciprocating internal combustion engine whose approval of use has been obtained by the licensor, the licensee is to submit "Confirmation of the licensor's acceptance of licensee's modifications" approved by the licensor and signed by the licensee and licensor. If the licensor acceptance is not confirmed, the ~~diesel~~ reciprocating internal combustion engine manufactured by the licensee is to be regarded as a different engine type and is **2.1.1-2** is to apply to the ~~diesel~~ reciprocating internal combustion engine.

((c) and (d) are omitted.)

(e) The licensee or its subcontractors are to prepare to be able to provide the drawings and data specified in **(a)** and **(b)** above so that the Surveyor can use the information for inspection purposes during manufacture and testing of the ~~diesel~~ reciprocating internal combustion engine and its components.

((3) and (4) are omitted.)

(5) Engine assembly and testing

The licensee is to assemble and test the ~~diesel~~ reciprocating internal combustion engine according to the Society's technical rules each of the ~~diesel~~ reciprocating internal combustion engine assembly and testing procedure is to be witnessed by the Surveyor unless the manufacturer of the ~~diesel~~ reciprocating internal combustion engine is one approved in accordance with **the Rules for Approval of Manufacturers and Service Suppliers** and use of a mass production system is agreed between the manufacturer and the Society.

(6) Issue of certificates of ~~diesel~~ reciprocating internal combustion engines and components

((a) and (b) are omitted.)

2 In applying **-1** above, for those cases when a licensor - licensee agreement does not apply, a "licensor" is to be understood as the following **(1)** or **(2)**:

(1) The entity that has the design rights for the ~~diesel~~ reciprocating internal combustion engine type; or

(2) The entity that is delegated by the entity having the design rights of **(1)** above to modify the design.

3 Components of licensor's design which are covered by the certificate of approval of use of the

relevant engine type are regarded as approved whether manufactured by the ~~diesel~~ reciprocating internal combustion engine manufacturer or sub-supplied.

4 (Omitted)

EFFECTIVE DATE AND APPLICATION (Amendment 1-8)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Rules, the current requirements apply to reciprocating internal combustion engines whose type is the same type of those for which the application for approval is submitted to the Society before the effective date.

Amendment 1-9

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.1 General

2.1.1 General*

Sub-paragraph -3 has been amended as follows.

3 Electronically-controlled ~~diesel~~ reciprocating internal combustion engines which are used as the main propulsion machinery are to be in accordance with the requirements specified otherwise by the Society in addition to those in this Chapter.

EFFECTIVE DATE AND APPLICATION (Amendment 1-9)

1. The effective date of the amendments is 1 July 2020.

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

Amendment 1-10

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.1 General

2.1.1 General*

Sub-paragraph -4 has been amended as follows.

4 ~~Diesel~~ Reciprocating internal combustion engines fitted with exhaust gas recirculation (EGR) systems are to be in accordance with requirements specified ~~otherwise by the Society~~ in **Chapter 23, Part D of the Rules for the Survey and Construction of Steel Ships** in addition to those in this Chapter.

EFFECTIVE DATE AND APPLICATION (Amendment 1-11)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Rules, the current requirements apply to EGR systems whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.

Amendment 1-11

Part 7 MACHINERY INSTALLATIONS

Chapter 2 DIESEL ENGINES

2.1 General

2.1.1 General*

Sub-paragraphs -4 and -5 have been renumbered to Sub-paragraphs -5 and -6, and Sub-paragraph -4 has been added as follows.

4 The requirements of exhaust driven turbochargers specified in this chapter also apply, in principle, to engine driven chargers.
~~4~~5 (Omitted)
~~5~~6 (Omitted)

2.1.3 Drawings and Data*

Sub-paragraph -1 has been amended as follows.

1 Drawings and data to be submitted are generally as follows:
(1) Drawings and data for approval
((a) to (f) are omitted.)
(g) The following drawings and data for exhaust driven turbochargers:
i) Category *A* turbochargers (upon request)
1) Sectional assembly (including principal dimensions and names of components)
2) Containment test report
3) Test procedures
ii) Category *B* turbochargers
1) Sectional assembly (including principal dimensions and materials of housing components for containment evaluation)
~~iii)~~2) Documentation of containment in the event of the disc fracture specified in **2.5.1-4~~6~~** ~~(only for category *B* or *C* turbochargers with novel design features or no service records)~~
~~ii)~~3) Documentation of the following operational data and limitations ~~Particulars (only for category *B* or *C* turbochargers)~~
・Maximum permissible operating speed (*rpm*)
・Maximum permissible exhaust gas temperature at the turbine inlet
・Minimum lubrication oil inlet pressure
・Maximum lubrication oil outlet temperature
・Maximum permissible vibration levels (self- and externally generated vibration)
・Alarm level for overspeed (levels are also to be indicated on engine control system diagrams)
・Alarm level for exhaust gas temperature at the turbine inlet (levels are also to

be indicated on engine control system diagrams)
・Lubrication oil inlet pressure low alarm set point (levels are to also be indicated on engine control system diagrams)
・Lubrication oil outlet temperature high alarm set point (levels are to also be indicated on engine control system diagrams)

4) Diagram of lubrication oil systems (diagrams included in piping arrangements fitted to engines may be accepted instead)
5) Test report of type test (only for type tests)
6) Test procedure (only for type tests)

iii) Category *C* turbochargers
1) Drawings listed in **ii)** above
~~iv~~2) Drawings of the housing and rotating parts (~~only for category *C* turbochargers~~including details of blade fixing)
~~v~~3) Material specifications of the parts mentioned in **~~iv~~2)** above (~~only for category *C* turbochargers.~~ Mechanical property and chemical composition are to be provided.)
~~vi~~4) Welding details and welding procedures for the parts mentioned in **~~iv~~2)** above, if made of welded construction ~~(only for category *C* turbochargers with novel design features or no service records)~~

(2) Drawings and data for reference
((a) to (h) are omitted.)
(i) The following drawings and data for exhaust driven turbochargers (only for category *C* turbochargers):
i) Documentation of the safe torque transmission specified in **2.5.1-~~5~~6** when the disc is connected to the shaft by an interference fit ~~(only for category *C* turbochargers with novel design features or no service records)~~
ii) Information on expected lifespan (~~only for category *C* turbochargers with novel design features or no service records~~ Creep, low cycle fatigue and high cycle fatigue are to be considered.)
iii) Operation and service maintenance manuals ~~(only for category *C* turbochargers with novel design features or no service records)~~
(j) Other drawings and data deemed necessary by the Society

(3) (Omitted)

2.5 Associated Installations

Paragraph 2.5.1 has been amended as follows.

2.5.1 Exhaust Driven Turbochargers*

1 Manufacturers are to adhere to a quality system designed to ensure that designer specifications are met, and that manufacturing is in accordance with the approved drawings.

~~1~~2 For main propulsion engine equipped with exhaust driven turbochargers, means are to be provided to ensure that the engine can be operated with sufficient power to give the ship a navigable speed in case of failure of one of the turbochargers.

~~2~~3 Where the main propulsion engine cannot be operable only with the exhaust driven turbochargers in case of starting or low speed range, an auxiliary of scavenging air system is to be provided. For the event of failure of such an auxiliary system, proper means are to be provided so that the main propulsion engine can be brought into the condition that its output increases enough as the exhaust driven turbochargers show their function.

4 Exhaust driven turbochargers are to be designed to operate under conditions given in **1.3.1-4** and **2.2.2-7**. Component lifetime and the alarm level for speed are to be based upon an air inlet temperature of 45 °C.

~~3~~5 The air inlets of exhaust driven turbochargers ~~with novel design features or no service records~~ are to be fitted with filters.

~~4~~6 Exhaust driven turbochargers ~~with novel design features or no service records~~ are to be capable of containment in the event of a rotor burst. This means that no parts are to penetrate the casing of exhaust driven turbochargers or escape through the air intake in the case of a rotor burst. It is to be assumed that the discs disintegrate in the worst possible way.

~~5~~7 In the case of category *C* turbochargers ~~with novel design features or no service records~~ where the disc is connected to the shaft by an interference fit, calculations are to substantiate safe torque transmission during all relevant operating conditions such as maximum speed, maximum torque and maximum temperature gradient combined with minimum shrinkage amount.

~~6~~8 For categories *B* and *C* turbochargers ~~with novel design features or no service records~~, the indications and alarms listed in the **Table 7.2.5** are to be provided. Indications may be provided at local locations, monitoring stations or control stations. Alarm levels may be equal to permissible limits, but are not to be reached when operating the engine at 110% power, or at any approved intermittent overload beyond 110% in cases where the turbochargers are fitted to engines for which intermittent overload power is approved.

~~7~~9 Turbochargers are to have compressor characteristics that allow the engines, for which they are intended, to operate without any audible high pitch vibrations or explosion-like noises from the scavenger area of the engine (hereinafter referred to as "surging" in this Part) during all operating conditions and also after extended periods of operation. For abnormal, but permissible, operation conditions such as misfiring and sudden load reduction, repeated surging (hereinafter referred to as "continuous surging") is not to occur.

10 Certificates for categories *B* and *C* turbochargers issued by the Society will, at a minimum, cite the applicable type approval.

11 Certification and test requirements specified in this chapter apply to the replacement of rotating parts and casings.

Paragraph 2.5.7 has been deleted.

~~**2.5.7 Engine Driven Chargers**~~

~~Engine driven chargers are, in principle, to be in accordance with the requirements of exhaust driven turbochargers specified in this chapter.~~

2.6 Tests

2.6.1 Shop Tests*

Sub-paragraph -6 has been amended as follows.

6 For categories *B* and *C* turbochargers ~~with novel design features or for those with no service records~~, tests are to be carried out to verify durability according to procedures deemed appropriate by the Society.

EFFECTIVE DATE AND APPLICATION (Amendment 1-10)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Rules, the current requirements apply to turbochargers with novel design features or no service records for which the application for approval is submitted to the Society before the effective date.

Amendment 1-12

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.2 Materials, Construction and Strength

2.2.1 Materials

Sub-paragraph -1 has been amended as follows.

1 Materials intended for the principal components of ~~diesel~~ reciprocating internal combustion engines and their non-destructive tests as well as surface inspections and dimension inspections are to conform to the requirements given in **Table 7.2.1**. However, with respect to ultrasonic testing as well as surface inspections and dimension inspections, submission or presentation of test results to the Surveyor may be considered sufficient. In cases where deemed necessary by the Society, tests or inspections may also be required for any parts not specified in **Table 7.2.1**.

2.2.2 Construction, Installation and General*

Sub-paragraph -2 has been amended as follows.

2 Where the principal components of a ~~diesel~~ reciprocating internal combustion engine are of welded construction, they are to comply with the requirements of **Chapter 9**.

Sub-paragraph -6 has been amended as follows.

6 Ventilation of crankcase, and any arrangement which could produce a flow of external air into the crankcase, is not permitted except in cases **(1)** to **(3)** below.
((1) and (2) are omitted.)
(3) In cases where trunk piston type dual fuel ~~diesel~~ reciprocating internal combustion engines are provided with crankcase ventilation for preventing the accumulation of leaked gas.

Sub-paragraph -7 has been amended as follows.

7 The ambient reference conditions for the purpose of determining the power of ~~diesel~~ reciprocating internal combustion engines are to be as follows:
Total barometric pressure: 0.1 *MPa*
Air temperature: 45 °C
Relative humidity: 60 %
Seawater temperature (charge air intercooler-inlet): 32 °C

Table 7.2.1 has been amended as follows.

Table 7.2.1 Application of Materials and Non-destructive Tests as well as Surface Inspections and Dimension Inspections to Principal Components of ~~Diesel~~ Reciprocating Internal Combustion Engines

(Table is omitted.)

Notes:

((1) to (4) are omitted.)

(5) Only for crosshead ~~diesel~~ reciprocating internal combustion engines.

((6) to (17) are omitted.)

2.4 Safety Devices

2.4.1 Speed Governors and Overspeed Protective Devices

Sub-paragraphs -1 to -4 have been amended as follows.

1 For ships in which ~~Each diesel~~ reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships), ~~in diesel ships~~ each of such reciprocating internal combustion engines is to be provided with a speed governor so adjusted to prevent the engine speed from exceeding the number of maximum continuous revolutions by more than 15%.

2 In addition to this speed governor, each ~~diesel~~ reciprocating internal combustion engine as specified **-1** above ~~used as main propulsion machinery in diesel ships~~ that has a continuous maximum output of 220 *kW* or above, and which can be declutched or which drives a controllable pitch propeller, is to be provided with a separate overspeed protective device. The overspeed protective device, including its driving gear, are to be independent from the governor required by **-1**, and be so adjusted that the engine speed may not exceed the number of maximum continuous revolutions by more than 20 %.

3 ~~Diesel~~ Reciprocating internal combustion engines used to drive generators are to be provided with the governors specified in the requirements in **2.4.2, Part 8**. However, if a ~~diesel~~ reciprocating internal combustion engine which is used as main propulsion machinery ~~for~~ of an electric propulsion ship drives a generator used to supply electrical power exclusively to propulsion motors, the requirements specified in **5.1.2-2, Part 8** are to be applied.

4 In addition to the speed governor, each ~~diesel~~ reciprocating internal combustion engine used as main propulsion machinery of electric propulsion ships and those ~~diesel~~ reciprocating internal combustion engines used to drive generators that have a maximum continuous output of 220 *kW* or above are to be provided with a separate overspeed protective device. The overspeed protective device, including its driving gear, are to be independent from the governor required by **-3**, and be so adjusted that the engine speed may not exceed the number of maximum continuous revolutions by more than 15 %.

Paragraph 2.4.2 has been amended as follows.

2.4.2 Sentinel Valve for Overpressure in the Cylinders

Each cylinder of a ~~diesel~~ reciprocating internal combustion engine having a bore exceeding 230 *mm* is to be provided with an effective sentinel valve for overpressure. This valve is to be adjusted so that it can operate at a maximum of 1.4 *times* the maximum pressure in the cylinder at maximum continuous power and does not pose a threat to crew members. However, in cases where another effective alarm for cylinder overpressure is provided, this sentinel valve may be omitted.

2.4.3 Protection against Crankcase Explosion*

Sub-paragraph -1 has been amended as follows.

1 ~~For diesel~~ 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:

2.4.5 Crankcase Oil Mist Detection Arrangements*

Sub-paragraph -1 has been amended as follows.

1 Crankcase oil mist detection arrangements are required for ~~diesel~~ reciprocating internal combustion engines of 2,250 *kW* maximum continuous power and above or having cylinders of more than 300 *mm* bore, and in cases of engine failure, the following means are to automatically be employed. However, in cases where alternative devices deemed appropriate by the Society are provided, such devices may be used instead of crankcase oil mist detection arrangements. In this case, the following means are also to be automatically employed.

(1) In the case of low speed ~~diesel~~ engines (a rated speed of less than 300 *rpm*), alarms are to activate and speeds be reduced. (However, in cases where alternative measures such as activating alarms to request such speed reductions are taken, the manual reduction of speeds may be accepted).

(2) In the case of medium speed ~~diesel~~ engines (a rated speed of 300 *rpm* and above, but less than 1,400 *rpm*) and high speed ~~diesel~~ engines (a rated speed of 1,400 *rpm* and above), alarms are to activate and diesel engines are to be stopped or have their fuel supply shut off.

2.5.3 Starting Arrangements

Sub-paragraph -4 has been amended as follows.

4 The starting arrangements of ~~diesel~~ reciprocating internal combustion engines which drive generators or auxiliaries are to be as deemed appropriate by the Society.

Paragraph 2.5.4 has been amended as follows.

2.5.4 Fuel Oil Arrangements

1 Where a ~~diesel~~ reciprocating internal combustion engine is mounted on an elastic support, flexible joints approved by the Society are to be provided at the connections between the engine and the fuel oil supply pipe.

2 The fuel oil arrangements for ~~diesel~~ reciprocating internal combustion engines are additionally to comply with the requirements in **11.9** in this Part and **3.2.2, Part 9**.

2.5.5 Lubricating Oil Arrangements

Sub-paragraph -1 has been amended as follows.

1 The lubricating oil arrangements of ~~diesel~~ reciprocating internal combustion engines with a maximum continuous output exceeding 37 *kW* are to be provided with alarm devices which give visible and audible alarming in the event of failure of the supply of lubricating oil or an appreciable

reduction in lubricating oil pressure. Also, devices to stop the operation of the engine automatically by lower pressure after such alarms are to be provided.

2.6 Tests

2.6.1 Shop Tests*

Sub-paragraphs -2 and -3 have been amended as follows.

2 For ~~diesel~~ reciprocating internal combustion engines, shop trials are to be carried out according to the test procedure deemed appropriate by the Society.
3 For ~~diesel~~ 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 a procedure deemed appropriate by the Society.

Table 7.2.6 has been amended as follows.

Table 7.2.6 Hydrostatic Test Pressure
(Table is omitted.)

Notes:
((1) to (7) are omitted.)
(8) Only for crosshead ~~diesel~~ reciprocating internal combustion engines.
((9) and (10) are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-12)

1. The effective date of the amendments is 1 July 2020.
2. Notwithstanding the amendments to the Rules, the current requirements apply to reciprocating internal combustion engines for which the application for approval is submitted to the Society before the effective date.

Amendment 1-13

Part 7 MACHINERY INSTALLATIONS

Chapter 2 DIESEL ENGINES

2.2 Materials, Construction and Strength

2.2.1 Materials

1 Materials intended for the principal components of diesel engines and their non-destructive tests as well as surface inspections and dimension inspections are to conform to the requirements given in **Table 7.2.1**. However, with respect to ultrasonic testing as well as surface inspections and dimension inspections, submission or presentation of test results to the Surveyor may be considered sufficient. In cases where deemed necessary by the Society, tests or inspections may also be required for any parts not specified in **Table 7.2.1**.

Table 7.2.1 has been amended as follows.

Table 7.2.1 Application of Materials and Non-destructive Tests as well as Surface Inspections and Dimension Inspections to Principal Components of Diesel Engines

Principal components			Cylinder bore D (*mm*)								
			$D \leq 300$			$300 < D \leq 400$			$400 < D$		
			I	II	III	I	II	III	I	II	III
1	Welded bedplate		○	○		○	○		○	○	
2	Bearing transverse girders (cast steel)		○	○		○	○		○	○	
3	Welded frame box		○	○		○	○		○	○	
4	Welded cylinder frames (5)		○	○		○	○		○	○	
5	Engine block (spheroidal graphite cast iron)(6)		○			○			○		
6	Cylinder liner					○(7)			○(7)		
7	Cylinder head (cast steel or forged steel)					○	○		○	○	
8	Piston crown (cast steel or forged steel)								○	○	
9	Crankshaft	made in one piece	○	○	○	○	○	○	○	○	○
		Web, pin and journal for all built-up and semi-built-up types	○	○	○	○	○	○	○	○	○
		Others (including coupling bolts)	○	○	○	○	○	○	○	○	○
10	Piston rod (5)								○	○	
11	Cross head (5)		○	○		○	○		○	○	
12	Connecting rods together with connecting rod bearing caps		○	○	○	○	○	○	○	○	○
13	Bolts and studs (for cylinder heads, connecting rods, main bearings)					○	○	*TR*(8)	○	○	*TR*(8)
14	Tie rod (5)		○	○	*TR*(8)	○	○	*TR*(8)	○	○	*TR*(8)
15	Fuel injection pump body		○(9)			○(9)			○(9)		
16	High pressure fuel injection pipes including common fuel rail		○			○			○		
17	High pressure common servo oil system		○			○			○		
18	Heat exchanger, both sides (10)					△			△		
19	Accumulator(11)		○			○			○		
20	Piping, pumps, actuators, etc. for hydraulic drive of valves (12)		○(13)			○(13)			○(13)		
21	Pipes, valves and fittings attached to engines classified in **Chapter 12** as either Group I or Group II. (excluding items listed in this table)		○			○			○		
22	Bearings for main, crosshead, and crankpin (12)		*TR*(14)	*TR*(15)	○	*TR*(14)	*TR*(15)	○	*TR*(14)	*TR*(15)	○
23	Turbine discs, blades, blower impellers and rotor shafts of exhaust driven turbochargers (16)	Category *A*	○(9)	~~⊖~~		○(9)	~~⊖~~		○(9)	~~⊖~~	
		Category *B*	○	○	○(17)	○	○	○(17)	○	○	○(17)
		Category *C*	○	○	○(17)	○	○	○(17)	○	○	○(17)
24	Casings of exhaust driven turbochargers (16)(18)	Category *A*	○(~~17~~9)			○(~~17~~9)			○(~~17~~9)		
		Category *B*	○			○			○		
		Category *C*	○			○			○		

Notes:

(1) Materials intended for the components marked by "○" or "*TR*" in Column I are to comply with the requirements in **Part K of the Rules for the Survey and Construction of Steel Ships**. However, the components marked by "*TR*" in

Column I may be in accordance with Note (9). In addition, materials intended for the components marked by "△" in Column I are to comply with the requirements in **Chapter 8**.

(2) Materials intended for the components marked by "○"or "*TR*" in Column II are to be tested by a magnetic particle test or a liquid penetrant test as well as an ultrasonic test.

(3) Materials intended for the components marked by "○"or "*TR*" in Column III are to be tested by a surface inspection and a dimension inspection.

(4) For items marked by "*TR*", submission of a test report which compiles all test and inspection results in an acceptance protocol issued by the manufacturer may be accepted. The test report is to include the following. Tests or inspections may be carried out on samples from the current production.
(a) Signature of the manufacturer
(b) Statement that components comply with specifications stipulated by the manufacturer

(5) Only for crosshead diesel engines.

(6) Only when engine power exceeds 400 *kW*/*cyl*. Chemical composition analysis may be omitted.

(7) Materials may be in accordance with Note (9) except when used for steel parts.

(8) Only for threaded bolts and studs used for connecting rods or tie rods.

(9) Materials which comply with the requirements of national or international standards such as *ISO*, *JIS*, etc. may be used.

(10) Charge air coolers need only be tested on the water side.

(11) Only when capacity exceeds 0.5*l*.

(12) Only when engine power exceeds 800 *kW*/*cyl*.

(13) Materials intended for pumps and actuators may be in accordance with Note (9).

(14) Mechanical property test may be omitted.

(15) Magnetic particle tests and liquid penetrant tests may be omitted. An ultrasonic test is to be carried out for full contact between the base material and bearing metal

(16) In cases where the manufacturer has a quality system deemed appropriate by the Society, materials and non-destructive tests as well as a surface inspection and a dimension inspection for categories *A* and *B* turbochargers may not require the presence of a Society surveyor. In such cases, the submission or presentation of test records may be required by the Society.

(17) Surface inspection may be omitted.

(1~~7~~8) Chemical composition analysis may be omitted.

2.6 Tests

Paragraph 2.6.1 has been amended as follows.

2.6.1 Shop Tests*

1 For components or accessories specified in **Table 7.2.6**, hydrostatic tests are to be carried out on the water or oil side of the component at the pressures shown in the Table. In cases deemed necessary by the Society, tests may also be required for any components not specified in **Table 7.2.6**.

2 (Omitted)

3 (Omitted)

4 For rotating assemblies of exhaust driven turbochargers of categories *B* and *C*, dynamic balancing tests are to be carried out.

5 For the impellers and inducers of exhaust driven turbochargers of categories *B* and *C*, overspeed tests for a duration of 3 *minutes* at either of the following **(1)** or **(2)** are to be carried out ~~according to test procedures deemed appropriate by the Society~~. For forged impellers and inducers subject to quality control through an approved non-destructive test method, overspeed tests may be dispensed with.

(1) 120 % of the alarm level speed at room temperature; or

(2) 110 % of the alarm level speed at an inlet temperature of 45° C when tested in the actual housing with the corresponding pressure ratio.

Table 7.2.6 has been amended as follows.

Table 7.2.6 Hydrostatic Test Pressure

Part		Cylinder bore D (mm)		Test Pressure[2](MPa)
		$D \leq 300$	$300<D$	
Cylinder block (gray cast iron or spheroidal graphite cast iron) [3] [4]		○	○	1.5P
Engine block (gray cast iron or spheroidal graphite cast iron) [3] [4]		○	○	1.5P
Cylinder liner [4]			○	1.5P
Cylinder head (gray cast iron, spheroidal graphite cast iron, cast steel or forged steel)			○	1.5P
High pressure fuel line	Fuel injection pump body	TR[6]	○	1.5P or P +30, whichever is smaller
	fuel injection valves [5]			
	fuel injection pipes including common fuel rail [5]	TR[6]	○	
High pressure common servo oil system		TR[6]	○	1.5P
Turbocharger, cooling space [7]	Category A	~~○~~	~~○~~	0.4 or 1.5P, whichever is greater
	Category B	○	○	
	Category C	○	○	
Heat exchanger, both sides			○	1.5P
Exhaust gas valve cage [8]		○	○	1.5P
Accumulator [9]		○	○	1.5P
Piping, pumps, actuators, etc. for hydraulic drive of valves [10]		○	○	1.5P
Engine driven pumps (oil, water, fuel, bilge) [10]		○	○	1.5P
Piping system other than those listed in this Table		○	○	Apply the requirements in **10.6**

Notes:

(1) Materials intended for the components marked by "○"or "*TR*" are to be tested by hydrostatic test.

(2) P is the maximum working pressure (MPa).

(3) Only when engine power exceeds 400 kW/cyl.

(4) Hydrostatic tests are also required for those parts filled with cooling water that have the ability to contain water which is in contact with the cylinder or cylinder liner.

(5) Only when not autofretted.

(6) For items marked by "*TR*", submission of a test report which compiles all test and inspection results in an acceptance protocol issued by the manufacturer may be accepted. The test report is to include the following. Tests or inspections may be carried out on samples from the current production.

(a) Signature of the manufacturer

(b) Statement that components comply with specifications stipulated by the manufacturer

(7) In cases where the manufacturer has a quality system deemed appropriate by the Society, hydrostatic tests for categories ~~A and~~ 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.

(8) Only for crosshead diesel engines.

(9) Only when capacity exceeds 0.5l.

(10) Only when engine power exceeds 800 kW/cyl.

EFFECTIVE DATE AND APPLICATION (Amendment 1-13)

1. The effective date of the amendments is 1 July 2020.

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

Amendment 1-14

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.3 Crankshafts

2.3.1 Solid Crankshafts

Sub-paragraph -1 had been amended as follows.

1 The diameters of crankpins and journals are to be not less than the value given by the following formula:
(Omitted)

A and *B*:Coefficients given in **Table 7.2.2** and **Table 7.2.3** for engines having equal firing intervals (in the case of Vee engines, those with equal firing intervals on each bank.). Special consideration will be given to values *A* and *B* for ~~diesel~~ reciprocating internal combustion engines having unequal firing intervals or for those not covered by the Tables.

(Omitted)

EFFECTIVE DATE AND APPLICATION (Amendment 1-14)

1. The effective date of the amendments is 1 July 2020.
2. Notwithstanding the amendments to the Rules, the current requirements apply to crankshafts for which the application for approval is submitted to the Society before the effective date.

Amendment 1-15

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.5 Associated Installations

Table 7.2.5 has been amended as follows.

Table 7.2.5 Alarms and Indications of Turbochargers
(Table is omitted.)

Notes:

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

(4) Separate sensors are to be provided when the lubrication oil system of the turbocharger is not integrated with the lubrication oil system of the ~~diesel~~ reciprocating internal combustion engine, or when it is separated from the ~~diesel~~ reciprocating internal combustion engine lubrication oil system by a throttle or pressure reduction valve.

(5) "H" and "L" mean "high" and "low", respectively.

EFFECTIVE DATE AND APPLICATION (Amendment 1-15)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Rules, the current requirements apply to turbochargers whose type is the same type of those for which the application for approval is submitted to the Society before the effective date.

Amendment 1-16

Part 7 MACHINERY INSTALLATIONS

Chapter 5 PROPELLERS

5.3 Force Fitting of Propellers

5.3.1 Pull-up Length*

Sub-paragraph -1 has been amended as follows.

1 In cases where a propeller is force fitted onto a propeller shaft without the use of a key, the lower and upper limits of pull-up length are to be as given by the following formulae. For a taper of more than 1/15, these limits of pull-up length are to be subject to the satisfaction of the Society:
(Omitted)

c: ~~1.0 for turbine ships;~~
~~For diesel ships,~~ 1.2 or the value given by the following formula, whichever is greater. However, where a detailed report on the maximum torque acting on the fitted portion of the propeller under all operating conditions including transient conditions has been submitted to the satisfaction of the Society, it may comply with the provisions specified otherwise.

(Omitted)

EFFECTIVE DATE AND APPLICATION (Amendment 1-16)

1. The effective date of the amendments is 1 July 2020.
2. Notwithstanding the amendments to the Rules, the current requirements apply to propellers for which the application for approval is submitted to the Society before the effective date.

Amendment 1-17

Part 7 MACHINERY INSTALLATIONS

Chapter 6 TORSIONAL VIBRATION OF SHAFTINGS

6.1 General

6.1.3 Measurements

Sub-paragraph -2 has been amended as follows.

2 In cases where the barred speed ranges specified in **6.3.1** are marked for ~~main diesel engines~~ reciprocating internal combustion engine used as main propulsion machinery, the following **(1)** and **(2)** are to be confirmed and recorded.
((1) and (2) are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-17)

1. The effective date of the amendments is 1 July 2020.
2. Notwithstanding the amendments to the Rules, the current requirements apply to reciprocating internal combustion engines whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.

Amendment 1-18

Part 7 MACHINERY INSTALLATIONS

Chapter 9 WELDING FOR MACHINERY INSTALLATIONS

9.3 Post Weld Heat Treatment

9.3.1 Procedure of Post Weld Heat Treatment*

Table 7.9.1 has been amended as follows.

Table 7.9.1 Post Weld Heat Treatment Temperature

~~Category~~	Kind of steel	Minimum holding temperature (°C)
~~1~~	Carbon steel Carbon manganese steel $0.3M_0$ steel $0.5M_0$ steel $0.5Cr$-$0.5M_0$ steel $1Cr$-$0.5M_0$ steel $1\frac{1}{4}Cr$-$0.5M_0$ steel	600
~~2~~	$2\frac{1}{4}Cr$-$1M_0$ steel $5Cr$-$0.5M_0$ steel $0.5Cr$-$0.5M_0$-$0.5M_0$ steel	680

9.6 Welding of Piping

Paragraph 9.6.1 has been amended as follows.

9.6.1 ~~Scope~~General

1 The requirements in **9.6** apply to the welding of pipes.

2 The requirements in **9.6.2**, **9.6.3** and **9.6.4** ~~**9.6**~~ apply to the welding of pipes~~, valves and pipe fittings~~ belonging to Group I and II specified in **Chapter 10,** and the valves and pipe fittings used for these pipes.

Paragraph 9.6.2 has been amended as follows.

9.6.2 ~~Alignment~~Assembling, etc. of Joints*

1 Edge preparation is to be in accordance with recognized standards and/or approved drawings. The preparation of the edges is to be preferably carried out by mechanical means. When flame cutting is used, care is to be taken to remove any oxide scales and notches due to irregular cutting by matching, grinding or chipping back to sound metal.

2 Joint preparations are to be appropriate to the welding process.

3 The maximum offset of joints between pipes is to be appropriate for the welding process and is not to exceed ~~1/4 of the pipe thickness~~the maximum offset specified in **Table 7.9.6**.

4 Assembling for welding is to be appropriate and within prescribed tolerances. Tack welds are to be made with an electrode suitable for the base metal. Tack welds which form part of the finished

weld are to be made using approved procedures. When welding materials require preheating, the same preheating is to be applied during tack welding.

Table 7.9.6 has been renumbered to Table 7.9.8, and Table 7.9.6 has been added as follows.

Table 7.9.6 Maximum offset of joints between pipes

		Diameter (inside diameter) and thickness of pipes during welding		
		Inside diameter less than 150 *mm*, and thickness up to 6 *mm*	Inside diameter less than 300 *mm*, and thickness up to 9.5 *mm* (excluding the left column.)	Inside diameter 300 *mm* and over, or thickness over 9.5 *mm*
Maximum offset	Without backing ring	1.0 *mm* or 1/4 of thickness of pipe, whichever is less.	1.5 *mm* or 1/4 of thickness of pipe, whichever is less.	2.0 *mm* or 1/4 of thickness of pipe, whichever is less.
	With backing ring	0.5 *mm*		

Paragraph 9.6.3 has been amended as follows.

9.6.3 Preheating of Welds*

1 When welding pipes, dryness is to be ensured in all cases using suitable preheating if necessary.

2 ~~m~~Materials are to be ~~suitably~~ preheated to minimum preheating temperature specified in **Table 7.9.7** in accordance with the kind of material and thickness of the ~~material~~welds. However, consideration is to be given to using a higher preheating temperature when a low hydrogen process is not used.

3 The preheating of materials not specified in **Table 7.9.7** is to be as deemed appropriate by the Society in accordance with the kind of material, welding consumable used and welding method.

Table 7.9.7 has been added as follows.

Table 7.9.7 Minimum Preheating Temperature

Kind of material	Thickness of weld (1) (t) (*mm*)	Minimum preheating temperature (°C)
$C + \frac{Mn}{6} \leq 0.4$ (2)	$t \geq 20$ (7)	50
$C + \frac{Mn}{6} > 0.4$ (2)	$t \geq 20$ (7)	100
0.3*Mo* steel 0.5*Mo* steel (3)	$t \geq 13$ (7)	100
1*Cr*-0.5M_0 steel (4) 1.25*Cr*-0.5M_0-0.75*Si* steel (5)	$t < 13$	100
	$t \geq 13$	150
2.25*Cr*-1M_0 steel (6) (8) 0.5*Cr*-0.5M_0-0.25*V* steel (8)	$t < 13$	150
	$t \geq 13$	200

Notes:

1. Excludes the thickness of any excess weld metal.
2. Corresponds to Grade 1, Grade 2 and Grade 3 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
3. Corresponds to Grade 4, No.12 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
4. Corresponds to Grade 4, No.22 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
5. Corresponds to Grade 4, No.23 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
6. Corresponds to Grade 4, No.24 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
7. For welding at ambient temperatures below 0 °C, the minimum preheating temperature required is to be independent of thickness unless specially approved by the Society.

8. For these materials, preheating may be omitted for thicknesses up to 6 *mm* if the results of hardness tests carried out on welding procedure qualifications are considered acceptable by the Society.

Paragraph 9.6.4 has been amended as follows.

9.6.4 Post Weld Heat Treatment

1 After any welding, pipes of a thickness specified in **Table 7.9.~~6~~8** are to be subject to ~~post weld~~stress relieving heat treatment ~~for relieving any residual stress according to~~in accordance with the ~~grade~~kind of ~~the~~ material ~~used~~. The heat treatments are not to impair the specified properties of the materials, and verification may be required to this effect as necessary.

2 Stress relieving heat treatment after welding for other than the oxy-acetylene welding process is required as specified in **Table 7.9.8** according to the kind of material and thickness. In cases where oxy-acetylene welding is applied, the heat treatment specified in **Table 7.9.9** according to the kind of the material is required.

3 The heat treatment temperature is to be 20 °C lower than the temperature of the final tempering treatment of the material or below.

~~2~~4 Regarding the post weld heat treatment of pipes and piping systems that are made of materials other than those given in ~~**1 above**~~ **Table 7.9.8**, treatment is to be made in accordance to the ~~grade~~kind of base metal, the weld material, the welding procedure, etc. as deemed appropriate by the Society.

Table 7.9.8 has been amended as follows.

Table 7.9.~~6~~8 ~~Pipes Requiring Post Weld~~Stress Relieving Heat Treatment

~~Grade (Note 1)~~		~~Category in **Table 7.9.1**~~	~~Thickness of weld (t) (*mm*)~~
~~Grade 1, Grade 2 and Grade 3~~		~~1~~	~~$t \geq 15$~~
~~Grade 4~~	~~No.12~~	~~1~~	~~$t \geq 15$~~
	~~No.22 No.23~~	~~1~~	~~$t > 8$~~
	~~No.24~~	~~2~~	~~All (Note 2)~~

~~Notes:~~

~~(1) Grades are as specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships.**~~

~~(2) This treatment may be omitted if the thickness is 8 *mm* or less, the outside diameter is 100 *mm* or less and the design temperature is 450 °C or less.~~

Kind of material	Maximum thickness of weld [1] (t) (*mm*)	Minimum holding temperature (°C)
Carbon steel Carbon manganese steel[2]	$t \geq 15$[7][8]	600
0.3*Mo* steel 0.5*Mo* steel[3]	$t \geq 15$[7]	
1*Cr*-0.5M_0 steel[4] 1.25*Cr*-0.5M_0-0.75*Si* steel[5]	$t > 8$	
2.25*Cr*-1M_0 steel[6] 0.5*Cr*-0.5M_0-0.25*V* steel	Any [9]	680

Notes:

1. Excludes the thickness of any excess weld metal.
2. Corresponds to Grade 1, Grade 2 and Grade 3 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
3. Corresponds to Grade 4, No.12 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.

4. Corresponds to Grade 4, No.22 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
5. Corresponds to Grade 4, No.23 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
6. Corresponds to Grade 4, No.24 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
7. When steels with specified Charpy V notch impact properties at low temperature are used, the thickness above which post weld heat treatment is to be applied may be increased by special agreement with the Society.
8. Stress relieving heat treatment may be omitted up to 30 *mm* thickness by special agreement with the Society.
9. Heat treatment may be omitted for pipes having thicknesses not greater than 8 *mm*, diameters not greater than 100 *mm* and minimum service temperatures of 450 ºC.

Table 7.9.9 has been added as follows.

Table 7.9.9 Heat Treatment

Kind of material	Type and temperature of heat treatment (°C)
Carbon steel Carbon manganese steel(1)	Normalizing: from 880 to 940
0.3*Mo* steel 0.5*Mo* steel(2)	Normalizing: from 900 to 940
1*Cr*-0.5M_0 steel(3) 1.25*Cr*-0.5M_0-0.75*Si* steel(4)	Normalizing: from 900 to 960 Tempering: from 640 to 720
2.25*Cr*-1M_0 steel(5)	Normalizing: from 900 to 960 Tempering: from 650 to 780
0.5*Cr*-0.5M_0-0.25*V* steel	Normalizing: from 930 to 980 Tempering: from 670 to 720

Notes:

1. Corresponds to Grade 2, No.4 and Grade 3, No.4 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
2. Corresponds to Grade 4, No.12 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
3. Corresponds to Grade 4, No.22 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
4. Corresponds to Grade 4, No.23 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.
5. Corresponds to Grade 4, No.24 specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.

Chapter 10 PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES

10.4 Connection and Forming of Piping Systems

Paragraph 10.4.4 has been amended as follows.

10.4.4 Forming of Pipes and Heat Treatment after Forming*

1 Hot forming of pipes of Group I and Group II is to conform to the following requirements:

(1) Hot forming is to be generally carried out in a temperature range of 1000 °C – 850 °C. However, the temperature may be decreased to 750 °C during the forming process.

(2) For ~~steel pipes of Grade 4 in **Table 7.9.6**~~ chromium-molybdenum steel and chromium-molybdenum-vanadium steel, stress relieving heat treatment is to be carried out ~~according to the requirements regarding the holding temperature and holding time for the pipes specified in **9.3.1.**~~ as specified in **Table 7.9.8** in accordance with the kind of material. For carbon steel, carbon-manganese steel and carbon-molybdenum steel, no subsequent heat treatment is required.

(3) In cases where the hot forming is carried outside the temperature range of **(1)** above, a subsequent new heat treatment as specified in **Table 7.9.9** is required.

2 When pipes of Group I and Group II are subjected to cold-forming, a suitable heat treatment is to be carried out ~~according to the pipe material, service environment, etc.~~ as specified in the following **(1)** and **(2)** in accordance with the kind of material with consideration given to any harmful plastic deformation due to cold-forming and development of residual stresses that may occur. For carbon steel and carbon-manganese steel with minimum tensile strengths of 320, 360 and 410 N/mm^2 (including Grade 1; Grade 2, No.2; Grade 2, No.3; Grade 3, No.2; and Grade 3, No.3 as specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**), the heat treatment may be omitted.

(1) In cases where pipes are subjected to bending processes in such a manner that the bending radius of the pipe centreline is 4 times or less the outside diameter of the pipe, heat treatment as specified in **Table 7.9.9** is required.

(2) Stress relieving heat treatment as specified in **Table 7.9.8** is required for all materials except in the case of **(1)** above.

3 Regarding the forming and after-forming heat treatment for ~~steel~~ pipes other than those specified in ~~**-1 and -2**~~**Table 7.9.8** ~~above as well as pipes of materials other than steel~~, they are to be approved by the Society.

EFFECTIVE DATE AND APPLICATION (Amendment 1-18)

1. The effective date of the amendments is 1 July 2020.

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

Amendment 1-19

Part 7 MACHINERY INSTALLATIONS

Chapter 11 PIPING SYSTEMS

11.10 Lubricating Oil Systems and Hydraulic Oil Systems

11.10.2 Lubricating Oil Pumps

Sub-paragraph -2 has been amended as follows.

2 Two lubricating fuel oil pumps of the same capacity are to be provided for both ~~diesel~~ reciprocating internal combustion engines used to drive electrical generators and auxiliary machinery for which redundancy is required. The total capacity of the two pumps is to be enough to ensure a sufficient supply of oil at maximum continuous output of the engine, and the capacity of each pump is to be sufficient enough to ensure the navigable speed of the ship in cases where the other pump fails. The above requirement, however, does not apply to cases where each engine is provided with a dedicated lubricating oil pump that has the capacity to ensure a sufficient supply of oil at maximum continuous output.

Sub-paragraph -3 has been added as follows.

3 Number and capacity of lubricating oil pumps for waterjet propulsion systems and azimuth thrusters

Lubricating oil pumps for waterjet propulsion systems and azimuth thrusters are to comply with the requirements in **-1**. In this case, the term "main propulsion machinery, propulsion shafting systems, and their associated power transmission systems" is to be read as "waterjet propulsion systems" or "azimuth thrusters" respectively.

Paragraph 11.10.3 has been amended as follows.

11.10.3 Lubricating Oil Filters*

1 In cases where a forced lubrication system (including gravity tanks) is adopted for the lubrication of machinery installations, lubricating oil filters are to be provided. Additionally, it is recommended to use strainers with magnets for waterjet propulsion systems and azimuth thrusters.

2 Filters used for the lubricating oil systems of the main propulsion machinery, power transmissions of propulsion shafting, ~~and~~ controllable pitch propeller systems, waterjet propulsion systems, and azimuth thrusters are to be capable of being cleaned without stopping the supply of filtered oil.

EFFECTIVE DATE AND APPLICATION (Amendment 1-19)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Rules, the current requirements apply to waterjet propulsion systems or azimuth thrusters whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.

Amendment 1-20

Part 7 MACHINERY INSTALLATIONS

Chapter 11 PIPING SYSTEMS

11.15 Exhaust Gas Piping Arrangements

Paragraph 11.15.1 has been amended as follows.

11.15.1 Exhaust Gas Pipes from ~~Diesel~~ Reciprocating Internal Combustion Engines*

1 In principle, the exhaust gas pipes of two or more ~~diesel~~ reciprocating internal combustion engines are not to be connected together except in the following **(1)** and **(2)** cases:

(1) In cases where exhaust gas pipes of two or more ~~diesel~~ reciprocating internal combustion engines are connected to common silencers and effective means are provided to prevent any exhaust gas from returning into the cylinders of non-operating engines.

(2) In cases where exhaust gas pipes of two or more ~~diesel~~ reciprocating internal combustion engines are connected to common exhaust gas cleaning systems ~~deemed appropriate by the Society~~ which comply with the requirements of **Chapter 22**, **Part D of the Rules for the Survey and Construction of Steel Ships**.

2 (Omitted)

3 Boiler uptakes and exhaust piping lines from ~~diesel~~ reciprocating internal combustion engines are not to be connected together except in the following **(1)** and **(2)** cases:

(1) In cases where boilers are arranged to utilize waste heat from ~~diesel~~ reciprocating internal combustion engines.

(2) In cases where boiler uptakes and exhaust piping lines from diesel engines are connected to common exhaust gas cleaning systems ~~deemed appropriate by the Society~~ which comply with the requirements of **Chapter 22**, **Part D of the Rules for the Survey and Construction of Steel Ships**.

EFFECTIVE DATE AND APPLICATION (Amendment 1-20)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Rules, the current requirements apply to EGCS whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF INLAND WATERWAY SHIPS

GUIDANCE

2020 AMENDMENT NO.1

Notice No.36 30 June 2020

Resolved by Technical Committee on 22 January 2020

Notice No.36 30 June 2020
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF INLAND WATERWAY SHIPS

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

Amendment 1-1

Part 2 CLASS SURVEYS

Chapter 2 CLASSIFICATION SURVEYS

2.3 River Trials and Stability Experiments

2.3.1 River Trials

Sub-paragraph -3 has been amended as follows.

3 The performance tests of machinery installations required by **2.3.1-1(3), Part 2 of the Rules** are to include the following **(1)** to **(7)** in order to verify that the machinery installations have sufficient normal functions and reliability and are free from detrimental vibration within the numbers of revolutions used. However, these tests may be dispensed with where such tests have been conducted while the ship was anchored or at dockside. The details of these tests may be found in *JIS F* 0801 "Test Code of Propelling Machinery at Sea Trials" or other documents considered equivalent thereto. The preparations specified in **1.4.2-8~~, Part 2 of the Guidance~~** are to be made before tests are carried out.
((1) to (4) are omitted.)
(5) Governor tests
For engines for main sources of electrical power (including engines driving generator for both propulsion and main power supply), the characteristics for governors specified in ~~**2.4.2-1**~~**2.4.1-5(1), Part ~~H~~7 of the Rules** are to be confirmed.
((6) and (7) are omitted.)

Part 7 MACHINERY INSTALLATIONS

Chapter 2 DIESEL ENGINES

2.4 Safety Devices

Paragraph 2.4.1 has been added as follows.

2.4.1 Speed Governors and Overspeed Protective Devices

In applying **2.4.1-5(1)(c), Part 7 of the Rules**, the following throwing-on methods are considered acceptable.

(1) Four-stroke diesel engines with mean effective pressures of 1.35 *MPa* or more (Refer to **Fig. 7.2.4.1**)

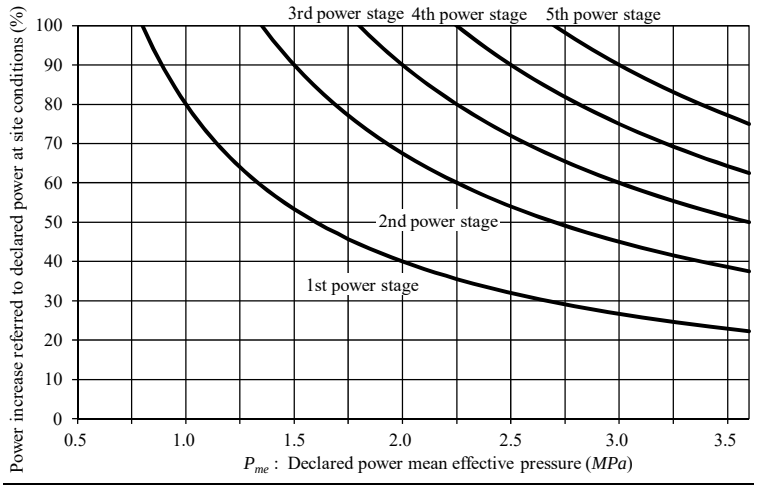
Total throw-on loads at the 1st power stage (%) = $80/P_{me}$
Total throw-on loads at the 2nd power stage (%) = $135/P_{me}$
Total throw-on loads at the 3rd power stage (%) = $180/P_{me}$
Total throw-on loads at the 4th power stage (%) = $225/P_{me}$
Total throw-on loads at the 5th power stage (%) = $270/P_{me}$
Total throw-on loads at the 6th power stage (%) = 100

(2) Gas-fuelled engines

Methods of throwing-on in steps decided by mutual agreement between manufacturer and user.

Fig 7.2.4.1 has been added as follows.

Fig. 7.2.4.1 Reference values for maximum possible sudden power increases as a function of brake mean effective pressure (P_{me}) at declared power (four-stroke diesel engines)



EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 30 June 2020.

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

Amendment 1-2

Part 2 CLASS SURVEYS

Chapter 3 ANNUAL SURVEYS

3.3 Annual Surveys for Machinery

3.3.1 General Examinations

Sub-paragraph -3 has been amended as follows.

3 In general examinations specified in **3.3.1, Part 2 of the Rules**, for ships where harmonic filters are installed on the main busbars of electrical distribution systems, except in cases where the filters are installed for single application frequency drives such as pump motors, it is to be ascertained that the harmonic filters are placed in good order and either of the following **(1)** or **(2)** is to be verified.

(1) For ships fitted with facilities to continuously monitor the Total Harmonic Distortion (THD) values experienced by the main busbars as specified in **2.~~12.4-1~~3.12-1, Part 8 of the Rules**, records of THD values are to be verified.

(2) (Omitted)

Part 7 MACHINERY INSTALLATIONS

Chapter 1 GENERAL

1.3 General Requirements for Machinery Installations of Tugs and Pushers

1.3.1 General

Sub-paragraph -4 has been added as follows.

4 When designing and constructing machinery installations that are adequate for the service for which they are intended in accordance with **1.3.1-1**, **Part 7 of the Rules**, the properties (e.g. viscosity, cold flow property) of the fuel oils intended to be used by the machinery installations are to be taken into account, and fuel oil heaters and fuel oil coolers are to be provided when deemed necessary.

Part 8 ELECTRICAL INSTALLATIONS

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.12 Semiconductor Converters for Power

Paragraph 2.12.5 has been deleted.

~~**2.12.5 Shop Tests**~~

~~**1** Regarding the temperature rise tests for semiconductor element connections mentioned in **2.12.5-2, Part 8 of the Rules**, measurements of the temperature rise of individual element parts such as cooling fins, cases and coolant parts, etc. may be accepted. However, such temperature rise tests may be preformed on the aforementioned element parts only in cases where manufactures specify in advance that the temperature rise of semiconductor element connections will not exceed their maximum allowable temperature if the temperature rise of their parts is within allowable limits.~~

~~**2** With respect to **2.12.5-3, Part 8 of the Rules**, tests which may inadvertently inflict serious damage on the protective devices of semiconductor elements may be omitted in cases where the proper operation of semiconductor element protective fuses, etc. can be confirmed.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 30 June 2020.

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.

Amendment 1-3

Part 2 CLASS SURVEYS

Chapter 1 GENERAL

1.1 Surveys

1.1.3 Intervals of Class Maintenance Surveys

Sub-paragraph -11 has been added as follows.

11 With respect to the wording "whenever the survey is considered necessary by the Society" in **1.1.3-3(6), Part 2 of the Rules** means, for example, a case where abnormal conditions are observed from the measurement data of vibration measurement system or Fe-density measurement system used instead of the temperature sensors and the temperature recorder of the azimuth thrusters which adopts roller bearings for propeller shafts bearings. In this case, abnormal conditions are to be reported to the Society immediately. Upon review of the reports, the Society may request an occasional survey when considered necessary.

1.1.5 Postponement of Surveys

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

The procedure and approval of the postponement of Periodical Surveys specified in **1.1.5, Part 2 of the Rules** are to be handled in accordance with **(1)** and **(2)** below;

((1) is omitted.)

(2) Approval of postponement of Surveys

The Society will verify the items specified in **(a)** and **(b)** below, and upon approval, will return one copy of the application to the applicant as proof of approval. The applicant is to take suitable action, such as to keep the approval letter on board the ship, in order to show the Surveyor that the ship is accepted to extend the Survey by the Society.

(a) The ship is maintained in good order. Verification may be made by reviewing the description of the current condition of the ship on the application and the report file of the Class Surveys.

(b) There are no ~~outstanding recommendations~~ critical Conditions in the survey reports. ~~Outstanding recommendations~~ Critical Conditions (used hereafter in this Part) refer to matters that affect or may affect the seaworthiness of the ship.

((c) is omitted.)

Section 1.2 has been deleted.

~~**1.2 Specialized Ships, Installations, and Apparatus**~~

~~**1.2.3 Surveys of Water Jet Propulsion Systems, etc.**~~

~~With respect to the wording "specified separately by the Society" in **1.2.3, Part 2 of the**~~

~~**Rules**, reference is to be made to **Annex D1.1.3-1 "Guidance for the Survey and Construction of Waterjet Propulsion Systems", Part D of the Guidance for the Survey and Construction of Steel Ships** for water jet propulsion systems and **Annex D1.1.3-3 "Guidance for the Survey and Construction of Azimuth Thrusters", Part D of the Guidance for the Survey and Construction of Steel Ships** for azimuth thrusters.~~

Chapter 2 CLASSIFICATION SURVEYS

2.4 Alterations

2.4.1 Examinations of Altered Parts

Sub-paragraph -4 has been added as follows.

4 With respect to the provisions of **2.4.1, Part 2 of the Rules**, for ships where selective catalytic reduction systems, exhaust gas cleaning systems or exhaust gas recirculation systems are newly installed, applicable surveys to the relevant systems are to be carried out in accordance with **2.1, Part 2 of the Rules**.

Chapter 9 PLANNED MACHINERY SURVEYS

9.1 Planned Machinery Surveys

9.1.1 Application

Sub-paragraph (5) has been amended as follows.

The Planned Machinery Survey generally applies to surveys of machinery and equipment that have had much use. However, it does not apply to the following machinery, equipment and survey items.

((1) to (4) are omitted.)

(5) Measurement of crankshaft deflections of ~~main diesel~~ reciprocating internal combustion engines used as main propulsion machinery and clearances of stern tubes or shaft bracket bearings at their aft ends

((6) and (7) are omitted.)

9.1.2 Continuous Machinery Survey

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

1 Application of CMS

((1) is omitted.)

(2) Auxiliaries prescribed in item ~~4~~6 of **Table 2.9.1, Part 2 of the Rules** are as follows:

((a) to (m) are omitted.)

Sub-paragraph -5(4) has been amended as follows.

5 Substitution for open-up examinations

The machinery and equipment listed below may be exempt from open-up examinations if they are found to be in satisfactory condition by carrying out the examinations listed and examining records such as the logbooks. However, when defects are found during the examinations, or if the maintenance condition is judged to be questionable as a result of examining the logbooks or other records, open-up examinations may be required.

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

(4) Auxiliary ~~diesel~~ reciprocating internal combustion engines that are not normally used at sea and those that have a total running time of less than 7,000 hrs counting from the last open-up examination

Visual examinations under their operating conditions (However, an open-up examination is required when the total running time reaches 7,000 hrs counting from the last open-up examination)

Sub-paragraphs -6(1) and (2) have been amended as follows.

6 Confirmatory Survey

In ships deemed by the Society as maintaining their machinery and equipment well, overhaul inspections according to the CMS Program specified in **-3** by the shipowner (or the ship management company) may forgo the open-up examination performed in the presence of Surveyors by conducting the following confirmatory surveys, provided that the machinery and equipment are overhauled as part of the ship's maintenance practices and the records from such overhauls are kept in good order. In this case, the due date of the next open-up examination is 6 *years* from the date of its last overhaul and inspection.

(1) Procedure of the confirmatory survey

((a) to (c) are omitted.)

(d) Visual examinations of lubricating oil conditions are to be carried out through open-up inspections, etc. of the lubricating oil filters of crankshafts, main bearings, crankpin bearings, crankpin bolts, as well as ~~main diesel engines~~ camshafts and ~~main diesel engine~~ camshaft driving devices of reciprocating internal combustion engines used as main propulsion machinery.

((e) to (g) are omitted.)

(2) Items applicable to the confirmatory survey

Items of machinery and equipment applicable to the confirmatory surveys are as follows.

(a) ~~Main diesel~~ Reciprocating internal combustion engines used as main propulsion machinery

(b) ~~Diesel~~ Reciprocating internal combustion engines used for driving generators, auxiliary machinery essential for main propulsion or auxiliary machinery for the manoeuvring and the safety of the ship

((c) and (d) are omitted.)

((3) is omitted.)

9.1.3 Planned Machinery Maintenance Scheme

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

4 Approval of PMS

Conditions for approval of PMS are as follows:

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

(4) Machinery Maintenance Records

Machinery maintenance records are to include at least the following items. These records are to be retained on board the ship at all times.

((a) to (g) are omitted.)

(h) Results of visual examinations of lubricating oil conditions carried out through open-up examinations of the lubricating oil filters, etc. of crankpins, crank journals, thrust shafts and bearings of ~~main diesel~~ reciprocating internal combustion engines used as main propulsion machinery (in cases where the principle components of such engines were inspected through independent open-up surveys conducted by chief engineers)

((5) to (7) are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 1 July 2020.

Amendment 1-4

Part 2 CLASS SURVEYS

Chapter 2 CLASSIFICATION SURVEYS

2.3 River Trials and Stability Experiments

2.3.1 River Trials

Sub-paragraph -3 has been amended as follows.

3 The performance tests of machinery installations required by **2.3.1-1(3), Part 2 of the Rules** are to include the following **(1)** to **(7)** in order to verify that the machinery installations have sufficient normal functions and reliability and are free from detrimental vibration within the numbers of revolutions used. However, these tests may be dispensed with where such tests have been conducted while the ship was anchored or at dockside. The details of these tests may be found in *JIS F* 0801 "Test Code of Propelling Machinery at Sea Trials" or other documents considered equivalent thereto. The preparations specified in **1.4.2-8, Part 2 of the Guidance** are to be made before tests are carried out.

(1) For ~~diesel~~ reciprocating internal combustion engines, the output test shown in **Table 2.2.3.1-5**, is to be used as the standard. For ~~diesel~~ reciprocating internal combustion engines driving generators or auxiliary machinery (excluding auxiliary machinery for specific uses), operating tests may be carried out at the appropriate time after installation on board.

((2) and (4) are omitted.)

(5) Governor tests
For reciprocating internal combustion engines ~~for~~ driving main sources of electrical power (including reciprocating internal combustion engines driving generators for both propulsion and main power supply), the characteristics for governors specified in **2.4.2-1, Part ~~H~~ 8 of the Rules** are to be confirmed.

((6) and (7) are omitted.)

(8) Low pressure (i.e. pressure less than 1 *MPa*) gas-fuelled engines are to comply with the requirements specified in **(1)** and **(5)**. For low pressure gas-fuelled dual-fuel engines, the output tests and governor tests are to be carried out for all operating modes (i.e. the gas mode, diesel mode, etc. specified in **1.4-3 of Annex 4, Part GF** or **1.4-3 of Annex 4, Part N of the Guidance for the Survey and Construction of the Steel Ships**). The 110% load test is not required for the gas mode.

(9) For high pressure gas-fuelled dual fuel engines, the requirements for low pressure gas-fuelled dual fuel engines specified in **(8)** apply mutatis mutandis.

Sub-paragraph -7 has been amended as follows.

7 The measurements of the torsional vibration for shafting systems required by **2.3.1-1(7), Part 2 of the Rules** are to be carried out in accordance with the following requirements

(1) Measurement is to be in accordance with the requirement specified in ~~of~~ **6.1.3, Part 7 of the Rules**. In cases where the confirmation of engine running conditions specified in **6.1.3-2, Part 7 of the Rules** is performed at the estimated upper and lower borders by calculation, it is recommended that the fuel index around estimated borders also be confirmed with

consideration given to possible differences between estimated borders and actual borders confirmed through measurements.

(2) For low pressure (i.e. pressure less than 1 *MPa*) gas-fuelled dual fuel engines, the measurements specified in **(1)** are to be carried out for both the diesel and gas mode. However, measurements in either diesel mode or in the gas mode (but not both modes) may be omitted where considered appropriate by the Society based upon relevant torsional vibration calculation sheets of diesel and gas mode.

(3) For high pressure gas-fuelled dual fuel engines, the requirements for low pressure gas-fuelled dual fuel engines specified in **(2)** apply mutatis mutandis.

Table 2.2.3.1-5 has been amended as follows.

Table 2.2.3.1-5 Trials of ~~Diesel~~ Reciprocating Internal Combustion Engines

Test items	Use of engines		
	Main engines of ~~diesel~~ ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships) (1)	Reciprocating internal combustion ~~E~~engines driving generators (including main engines of electric propulsion ships) (2)	Reciprocating internal combustion ~~E~~engines driving auxiliaries (excluding auxiliary machinery for specific use etc.)
(Omitted)			

Notes:

((1) to (10) are omitted.)

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.1 General

2.1.1 General

Sub-paragraph -2 has been amended as follows.

2 The wording "the requirements specified otherwise by the Society" in **2.1.1-3**, **Part 7 of the Rules** means "**GUIDANCE FOR THE ADDITIONAL REQUIREMENTS ON ELECTRONICALLY-CONTROLLED ~~DIESEL~~ ENGINES**" in **Annex D2.1.1**, **Part D of the Guidance for the Survey and Construction of Steel Ships**.

Sub-paragraph -4 has been amended as follows.

4 The wording "the requirements specified otherwise by the Society" in **2.1.1-5, Part 7 of the Rules** means **Annex 3** "**GUIDANCE FOR HIGH PRESSURE DUAL FUEL ~~DIESEL~~ ENGINES**" or **Annex 4** "**GUIDANCE FOR LOW PRESSURE DUAL FUEL ~~DIESEL~~ 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).

2.5 Associated Installations

2.5.3 Starting Arrangements

Sub-paragraph -2 has been amended as follows.

2 For ~~diesel~~ reciprocating internal combustion engine starting arrangements operated by batteries, the following requirements, in addition to **2.5.3-3**, **Part 7 of the Rules**, are to be complied with:

((1) is omitted.)

(2) The starting arrangements for reciprocating internal combustion engines driving main generators ~~engines~~ are to be such that either they are provided with two sets of separate batteries; or a single battery set in cases where power for starting can also be fed through a separate circuit from those batteries used for the starting of main propulsion machinery. However, a single battery set may only be accepted in cases where only one main generator engine is provided. The capacity of this single battery set is to be such that it is sufficient for starting the engine at least three times.

(3) Batteries for starting are to be used only for starting and for monitoring ~~diesel~~ reciprocating internal combustion engines. Arrangements are to be made so that the energy stored in the batteries can be maintained at all times.

2.6 Tests

2.6.1 Shop Tests

Sub-paragraph -1(5) has been amended as follows.

1 The purpose of the shop trials specified in **2.6.1-2**, **Part 7 of the Rules** is to verify design premises such as 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) to (4) are omitted.)

(5) The programme shown in **Table 7.2.6.1-1** is to be used for the shop trials of ~~diesel~~ 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) ~~For the main engines of diesel ships or electrical propulsion ships~~ In the case of reciprocating internal combustion engines used as main propulsion machinery (including those used as main propulsion machinery for electrical propulsion ships);
JIS F 4304 “Shipbuilding - Internal combustion engines for propelling use-shop test code”

(b) ~~For diesel~~ 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) and (7) are omitted.)

Table 7.2.6.1-1 has been amended as follows.

Table 7.2.6.1-1 Programme for Shop Trials of ~~Diesel~~ Reciprocating Internal Combustion Engines

Test items	Use of engines		
	Reciprocating internal combustion engines used as ~~M~~main propulsion machinery ~~diesel engines~~ (1)	Reciprocating internal combustion ~~E~~engines driving generators (including those used as main ~~engines~~ propulsion machinery of electric propulsion ships) (2)	Reciprocating internal combustion ~~E~~engines driving auxiliaries (excluding auxiliary machinery for specific use etc.) (1)
(Omitted)			

(Notes are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to reciprocating internal combustion engines for which the application for approval is submitted to the Society before the effective date.

Amendment 1-5

Part 2 CLASS SURVEYS

Chapter 2 CLASSIFICATION SURVEYS

2.3 River Trials and Stability Experiments

2.3.1 River Trials

Sub-paragraph -9 has been amended as follows.

9 "Tests where deemed necessary by the Society" in **2.3.1-1(9), Part 2 of the Rules**, refers to the tests and examinations mentioned in the following **(1)** to **(~~6~~7)**.
((1) to (6) are omitted.)
(7) For ships having exhaust gas recirculation systems, running tests of engines are to be carried out with exhaust gas recirculation systems in operation, and the satisfactory operation of the engine and exhaust gas recirculation system is to be confirmed.

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.1 General

2.1.1 General

Sub-paragraph -3 has been deleted.

~~**3** The wording "requirements specified otherwise by the Society" referred to in **2.1.1-4, Part 7 of the Rules** means **Annex D2.1.1-5** "Guidance for the Survey and Construction of Exhaust Gas Recirculation Systems and Associated Equipment", **Part D of the Guidance for the Survey and Construction of Steel Ships**.~~
~~4~~3 (Omitted)

EFFECTIVE DATE AND APPLICATION (Amendment 1-5)

1. The effective date of the amendments is 1 July 2020.
2. Notwithstanding the amendments to the Guidance, the current requirements apply to EGR systems whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.

Amendment 1-6

Part 2 CLASS SURVEYS

Chapter 8 PROPELLER SHAFT AND STERN TUBE SHAFT SURVEYS

8.1 Propeller Shaft and Stern Tube Shaft Surveys

Paragraph 8.1.2 has been amended as follows.

8.1.2 Partial Surveys

1 The "reference standards deemed appropriate by the Society" referred to in **8.1.2(2)(b)i), Part 2 of the Rules** means the reference standards specified in the following **(1)** and **(2)**:

(1) The following **(a)** to **(d)** upper limits for ~~M~~metal particles ~~(upper limits)~~; however, if the test results of the oil analysis suggest that the sample oil does not represent the lubricating oil in the stern tube and is suspected to be invalid (e.g., when only iron (Fe) exceeds the upper limit of **(a)** below, it is suspected that rust in the lubricating oil tank is the cause.), the Surveyor instruct the shipowner (or the ship management company) to promptly re-perform the oil analysis and to be verified the test results of the oil analysis by the time of the first periodical survey (excluding those specified in **1.1.3-1(5), Part 2 of the Rules**) on or after the day 3 *months* after the day of receiving the said instruction. In order to avoid the need to receive such instructions, the Society recommends that periodic oil analysis be performed at intervals shorter than those specified in **1.3.1(9)(k)i), Part 2 of the Rules** so that the oil analysis to be re-performed by the shipowner (or the ship management company) in preparation for the above cases is performed at intervals not exceeding 6 *months* from the date of the last valid oil analysis. In either case, the re-performed lubricant analysis is considered to comply with the requirements of this paragraph if the test results for metal particles satisfy the following upper limits.

(a) Iron (Fe): 50 *ppm*
(b) Tin (Sn): 20 *ppm*
(c) Lead (Pb): 20 *ppm*
(d) Sodium (Na): 80 *ppm*

(2) The following **(a)** and **(b)** upper limits for IR Oxidation and separated water ~~(upper limits)~~; however, in the case of environmentally acceptable lubricants (EAL), regardless of the following **(a)**, observation of any trends (such as TAN (total acid number), viscosity and change in colour etc.) based on periodical oil analysis can be made.

(a) IR oxidation @ 5.85μm: 10 ($Abs.unit/cm$)
(b) Separated water: 1.0 %

2 The "reference standards deemed appropriate by the Society" referred to in **8.1.2(2)(b)ii), Part 2 of the Rules** means the reference standards specified in the following **(1)** ~~and~~ to ~~(2)~~**(3)**:

(1) The following **(a)** and **(b)** upper limits for ~~C~~chloride content and sodium content ~~(upper limits)~~

((a) and (b) are omitted.)

(2) pH

Lower limit values determined based upon characteristics of the corrosion inhibitors used, but not to be less than 11

(3) Bearing particles and other particles

(a) The following **i)** and **v)** upper limits for ~~M~~metal particles ~~(upper limits)~~

i) Iron (Fe): 25 *ppm*
ii) Chromium (Cr): 5 *ppm*
iii) Nickel (Ni): 5 *ppm*
iv) Copper (Cu): 40 *ppm*
v) Silicon (Si): 30 *ppm*

((b) is omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-6)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships other than ships the delivery of which is on or after 1 January 2016 until the first propeller shaft and stern tube shaft surveys scheduled on or after 1 January 2016 are completed.

3. Notwithstanding the provision of preceding **2.**, the amendments to the Guidance may apply, upon request of the owner, to ships other than ships the delivery of which is on or after 1 January 2016 before the first propeller shaft and stern tube shaft surveys scheduled on or after 1 January 2016 are completed.

Amendment 1-7

Part 7 MACHINERY INSTALLATIONS

Chapter 1 GENERAL

1.1 General

1.1.1 Scope

Sub-paragraph -1 has been amended as follows.

1 In **Part 7 of the Rules**, "main propulsion machinery" means the following machinery which generates or converts motive power capable of propelling a ship at the speed specified in **2.1.9**, **Part 1 of the Rules**:
(1) ~~Diesel~~ Reciprocating internal combustion engines (including superchargers)
(2) Generating plants for propulsion and motors for propulsion (excluding **Chapter 14**)

Chapter 4 SHAFTINGS

4.2 Materials, Construction and Strength

4.2.4 Propeller Shafts and Stern Tube Shafts

Sub-paragraph -4 has been amended as follows.

4 The diameters of propeller shafts of vessels whose main propulsion machinery falls under one of the classes of high speed ~~diesel~~ engines which are reciprocating internal combustion may be in accordance with **(1)** to **(3)** below. However, the requirements in **-3** are not to be applied in such cases.
(1) The definition of "high speed ~~diesel~~ engine"
The term "high speed ~~diesel~~ engine" in this sub-paragraph is defined as those engines simultaneously complying with the following conditions:
((2) and (3) are omitted.)

Chapter 5 PROPELLERS

5.2 Construction and Strength

Paragraph 5.2.1 has been amended as follows.

5.2.1 Thickness of Blade

1 With respect to the wording "deemed appropriate by the Society" specified in **Note (1) for Table 7.5.2 of the Rules**, the value is to be 0.6 ~~I~~in cases where the materials used for propellers ~~are either~~ is grey cast iron ~~or steel castings~~, and the values ~~specified in **Table 7.5.2.1-1** are to be used for K in the formulae given in **5.2.1-1, Part 7 of the Rules**.~~ are to be determined on a case by case basis by the Society in cases where the material is some other specific material.

~~**2** The thickness of highly skewed propeller blades, depending on the skew angle (the angle, on the expanded blade drawing, between the line connecting the centre of the propeller shaft with the point at the blade tip on the centre line of blade width and the tangential line drawn from the centre of the propeller shaft to the centre line of blade width (*See* **Fig. 7.5.2.1-1**.)) is to comply with the following requirements:~~

~~(1) In cases where the skew angle exceeds 25 *degrees* but is 60 *degrees* or less~~

~~(a) The blade thicknesses at radii $0.25R$ ($0.35R$ for controllable pitch propellers) and $0.6R$ are not to be less than the values obtained from multiplying those values calculated by the formula in **5.2.1-1, Part 7 of the Rules**, by the coefficient A given in the formula below;~~

~~$$A = 1 + B\frac{\theta - 25^{\circ}}{60^{\circ}}$$~~

~~Where:~~

~~θ: skew angle (*degree*)~~

~~B: 0.2 at radii $0.25R$ (or $0.35R$ for controllable pitch propeller)~~
~~0.6 at radii $0.6R$~~

~~(b) Blade thickness t_x at any radius between $0.6R$ and $0.9R$ is not to be less than the value determined by the following formula. Moreover, this thickness is provide sufficient strength against loads imparted during reversing manoeuvres, etc.~~

~~$$t_x = 0.003D + \frac{(1-x)(t_{0.6} - 0.003D)}{0.4} \ (mm)$$~~

~~Where:~~

~~D: diameter of propeller (*mm*)~~

~~x: ratio of the radius ($= 2r/D$, r is the radius (*mm*))~~

~~$t_{0.6}$: blade thickness at $0.6R$ as required in **(a)** above (*mm*)~~

~~(2) In cases where the skew angle exceeds 60°~~

~~Based on the precise calculation sheet of propeller strength submitted by the manufacturer or designer, blade thickness is to be determined by the Society on a case by case basis.~~

~~**3**~~**2** In accordance of **5.2.1-1, Part 7 of the Rules**, the following **(1)** to **(3)** are to be applied to Δw and w when using experimental data taken from model ships which are 6 m or more in length.

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

~~**4**~~**3** When applying **5.2.1-4, Part 7 of the Rules**, ~~T~~the standard method of detailed calculation of a propeller blade thickness is shown as follows:

(1) The hydraulic forces on a propeller blade during a propeller rotation are calculated by the lifting-surface theory, and the stresses on the propeller blade are calculated by structural analysis using the hydraulic forces. The wake distribution used for the calculation of the

hydraulic forces is to be experimental data taken from a sister vessel or a model ship (data is to be corrected appropriately to the actual ship's scale). In cases where such data is not known, the data shown in **Fig.7.5.2.1-~~2~~1** or **Table 7.5.2.1-~~3~~1** may be used for high speed craft ($C_b \leq 0.6$), excluding those with unconventional stern constructions (such as multi-shafting arrangements), instead.

((2) to (6) are omitted.)

Table 7.5.2.1-1 has been deleted.

~~Table7.5.2.1-1 Values of *K*~~

~~Material~~		~~*K*~~
~~Steel castings~~	~~*KSC*, Tensile strength is greater than or equal to 480 *N/mm*^{2}~~	~~1.0~~
	~~*KSC*, Tensile strength is less than 480 *N/mm*^{2}~~	~~0.9~~
~~Grey cast iron~~		~~0.6~~

Fig. 7.5.2.1-1 has been deleted.

~~Fig. 7.5.2.1-1 Definition of Skew Angle~~

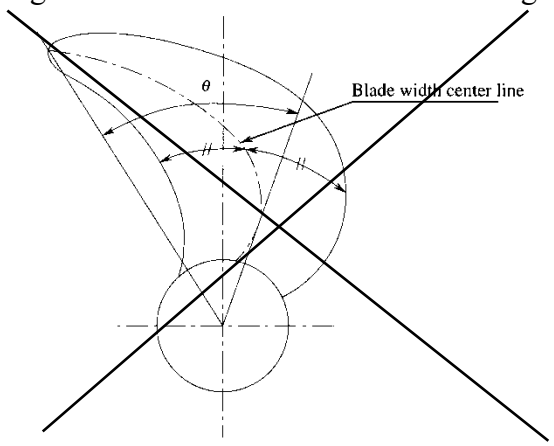


Fig. 7.5.2.1-2 has been renumbered to Fig. 7.5.2.1-1.

Fig. 7.5.2.1-~~2~~1 Standard Wake Distribution for High Speed Craft
(Figure is omitted.)

Table 7.5.2.1-3 has been renumbered to Table 7.5.2.1-1.

Table 7.5.2.1-~~3~~1 Standard Wake Distribution for High Speed Craft (V_a/V_s)
(Table and Note are omitted.)

Paragraph 5.2.2 has been amended as follows.

5.2.2 Controllable Pitch Propellers

~~2~~1 ~~The Society may specially approve fixing bolts that satisfy the strength requirements specified in the Rules upon consideration of~~ The wording "documents deemed appropriate by the Society" specified in **5.2.2-2, Part 7 of the Rules** means the following documents (**(~~a~~1)** to **(~~e~~5)**).

(~~a~~1) Calculation sheet for the load sharing factor *k* of the bolt

where

$$k = \frac{k_b}{k_b + k_f}$$

k_b : Rigidity of bolt tension

k_f : Rigidity of flange compression

(~~b~~2) Static stress and dynamic stress acting on the bolt

(~~c~~3) Specifications of bolt material (including the manufacturing process)

(~~d~~4) Endurance limit curve of the bolt (both in air and in sea water)

(~~e~~5) Securing method of the bolt

~~1~~2 When fitting blade fixing bolts according to the requirements of **5.2.2-5, Part 7 of the Rules**, ~~B~~blades are to be fitted securely to pitch control gears by giving all of the fixing bolts an adequate initial fitting force. It is to be regarded as standard practice that the initial fitting force complies with the following condition;

$$\frac{1.3}{n}\left(\frac{AK_3}{L} + F_c\right) < T_0 < 0.55\sigma_0 d^2$$

where

T_0: Initial fitting force (N)

σ_0: Yield strength or 0.2 % proof strength of bolt material (N/mm^2)

Other symbols are the same as in the formula shown in **5.2.2-2, Part 7 of the Rules**.

3 (Omitted)

5.3 Force Fitting of Propellers

Paragraph 5.3.1 has been amended as follows.

5.3.1 Pull-up Length

~~**1** Special consideration is required in cases where propellers are force fitted onto propeller shafts through sleeves, because the formulae of pull-up length in **5.3.1-1, Part 7 of the Rules** are not able to be applied.~~

~~**2** In cases where the material of a propeller shaft is something other than forged steel or the material of a propeller boss is something other than that specified in **5.3.1-1, Part 7 of the Rules**, the values of K_B, K_C and K_W are to be determined by following formula:~~

$$K_B = \frac{P_B}{\tan\alpha}\left\{\left(\frac{K_{B1}^2 + 1}{K_{B1}^2 - 1} + m_B\right)\frac{1}{E_B} + \left(\frac{1 + K_{B2}^2}{1 - K_{B2}^2} - m_S\right)\frac{1}{E_S}\right\}$$

$$K_C = \left\{(\lambda_B - \lambda_S) + \frac{(C_B - C_S)}{(C_B - C_0)}\lambda_S\right\}\left(l_B - \frac{P_B}{\tan\alpha}\right)$$

$$K_W = 0.7\sigma_{0.2}$$

~~m_B: Poisson's number of the propeller boss material~~

~~m_S: Poisson's number of the propeller shaft material~~

~~E_B: Modulus of elasticity of the propeller boss material (N/mm^2)~~

~~E_S: Modulus of elasticity of the propeller shaft material (N/mm^2)~~

~~λ_B: Coefficient of linear thermal expansion of the propeller boss material ($mm/mm\ °C$)~~

~~λ_S: Coefficient of linear thermal expansion of the propeller shaft material ($mm/mm\ °C$)~~

~~$\sigma_{0.2}$: 0.2% proof stress of the propeller boss material (N/mm^2)~~

~~Other symbols are to be in accordance with those shown in **5.3.1, Part 7 of the Rules**.~~

~~**3**~~ In the provision of coefficient "c" used in the calculation of tangential force F_v, specified in **5.3.1-1, Part 7 of the Rules**, the wording "the satisfaction of the Society", means determining "c" in accordance with **(2)** below using maximum torque Q_{max} as derived from **(1)** below:

(1) (Omitted)
(2) (Omitted)

Chapter 6 TORSIONAL VIBRATION OF SHAFTINGS

6.2 Allowable Limit

6.2.2 Intermediate Shafts, Thrust Shafts, Propeller Shafts and Stern Tube Shafts

Sub-paragraph -2 has been amended as follows.

2 For ships ~~powered by steam turbines, or gas turbines; diesel engines having slip couplings such as electro-magnetic couplings or fluid couplings between engine and propulsion shafting; and, ships with electric propulsion systems~~ that fall under any of the following, the allowable limits of torsional vibration stress on the intermediate shafts, thrust shafts, propeller shafts and stern tube shafts are to be calculated by applying the values of C_K given in the following **Table 7.6.2.2-2** to the formula specified in **6.2.2-1(1), Part 7 of the Rules**.

(1) Ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships), having slip couplings such as electro-magnetic couplings or fluid couplings between engine and propulsion shafting; or
(2) Electric propulsion ships

6.2.4 Power Transmission Systems

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

The wording “the provisions specified elsewhere” in **6.2.4-3, Part 7 of the Rules** means the following with respect to rubber couplings.

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

(3) In cases where rubber couplings, whose torque is transmitted in the direction of shearing rubber elements, are used in main propulsion shafting ~~powered~~ driven by ~~diesel~~ reciprocating internal combustion engines having outputs of 3,500 *kW* or more, the main propulsion shafting is to comply with the following **(a)** and **(b)**:
((a) and (b) are omitted.)

Chapter 7 BOILERS, ETC. AND INCINERATORS

7.3 Construction of Thermal Oil Heaters

Paragraph 7.3.3 has been amended as follows.

7.3.3 Safety Devices, etc. for Thermal Oil Heaters Directly Heated by the Exhaust Gas of Engines

The wording "Fixed fire extinguishing and cooling systems as deemed appropriate by the Society" in **7.3.3-7, Part 7 of the Rules** means combinations of fixed gas fire-extinguishing systems and systems for cooling heating coils, headers, casings, etc., and heater themselves such as water-spray. Fixed fire extinguishing cooling systems can be water-drenching systems able to discharge copious amounts of water. In such cases, the suitable means for collection and drainage, to prevent any water from flowing into ~~diesel~~ reciprocating internal combustion engines, are to be provided on exhaust ducting below heaters, and such drainage is to be led to suitable places.

Chapter 11 PIPING SYSTEMS

11.9 Fuel Oil Systems

Paragraph 11.9.6 has been amended as follows.

11.9.6 Fuel Oil Systems for ~~Diesel~~ Reciprocating Internal Combustion Engines

One self-cleaning filter will also be accepted as a filter of reciprocating internal combustion engines capable of being cleaned without stopping the supply of filtered oil required by **11.9.6-3, Part 7 of the Rules**.

11.12 Cooling Systems

Title of Paragraph 11.12.3 has been amended as follows.

11.12.3 Cooling Systems for ~~Diesel~~ Reciprocating Internal Combustion Engines

In cases where oil tanks are heated by cooling fresh water from main propulsion machinery, adequate means are to be provided to detect any oil contamination in the cooling fresh water piping system.

EFFECTIVE DATE AND APPLICATION (Amendment 1-7)

1. The effective date of the amendments is 1 July 2020.
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.

Amendment 1-8

Part 7 MACHINERY INSTALLATIONS

Chapter 1 GENERAL

1.1 General

Paragraph 1.1.3 has been amended as follows.

1.1.3 Machinery Installations with Novel Design Features

~~**1** For the waterjet propulsion systems, **Annex D1.1.3-1** "Guidance for the Survey and Construction of Waterjet Propulsion Systems", **Part D of the Guidance for the Survey and Construction of Steel Ships** is to apply.~~

~~**2**~~ For installations in ships having main and essential auxiliary boilers that burn coal as fuel, the requirements specified in **Annex D1.1.3~~-2~~** "Guidance for the Survey and Construction of Coal Burning Installations in Ships", **Part D of the Guidance for the Survey and Construction of Steel Ships** are to apply; however, these requirements (excluding in **1.1.3**, **1.1.5** and **1.1.6**) may be regarded as reference for considering plans.

~~**3** For azimuth thrusters, **Annex D1.1.3-3 "GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF AZIMUTH THRUSTERS", Part D of the Guidance for the Survey and Construction of Steel Ships** is to apply.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-8)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to waterjet propulsion systems or azimuth thrusters whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.

Amendment 1-9

Part 7 MACHINERY INSTALLATIONS

Chapter 1 GENERAL

1.3 General Requirements for Machinery Installations of Tugs and Pushers

1.3.1 General

Sub-paragraph -3 has been deleted.

~~**3 With respect to the wording "the satisfaction of the Society" specified in 1.3.1-8, Part 7 of the Rules**, the following **(1)** and **(2)** apply:~~

~~(1) Selective catalytic reduction (SCR) systems are to comply with **Annex D1.3.1-5(1)** "GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF SELECTIVE CATALYTIC REDUCTION SYSTEMS AND ASSOCIATED EQUIPMENT", **Part D of the Guidance for the Survey and Construction of Steel Ships**.~~

~~(2) Exhaust gas cleaning systems (EGCS) are to comply with **Annex D1.3.1-5(2)** "GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF EXHAUST GAS CLEANING SYSTEMS AND ASSOCIATED EQUIPMENT", **Part D of the Guidance for the Survey and Construction of Steel Ships**.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-9)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to SCR systems or EGCS whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.

Amendment 1-10

Part 7 MACHINERY INSTALLATIONS

Chapter 2 DIESEL ENGINES

2.1 General

2.1.1 General

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

3 The wording "requirements specified otherwise by the Society" referred to in **2.1.1-~~4~~5, Part 7 of the Rules** means **Annex D2.1.1-5** "Guidance for the Survey and Construction of Exhaust Gas Recirculation Systems and Associated Equipment", **Part D of the Guidance for the Survey and Construction of Steel Ships**.

4 The wording "the requirements specified otherwise by the Society" in **2.1.1-~~5~~6, Part 7 of the Rules** means **Annex 3** "**GUIDANCE FOR HIGH PRESSURE DUAL FUEL DIESEL ENGINES**" or **Annex 4** "**GUIDANCE FOR LOW PRESSURE DUAL FUEL DIESEL 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 2.1.3 has been amended as follows.

2.1.3 Drawings and Data

For ~~engines equipped with exhaust driven turbochargers,~~ the following ~~drawings and~~ data ~~specified in **2.1.3, Part 7 of the Rules** are to~~ ,those represented by two sizes in a generic range of turbochargers (i.e. the same components, materials, etc., with the only difference being the size) are acceptable. ~~include the following items according to the category of turbocharger specified in **2.1.2, Part 7 of the Rules**. However, this applies only to turbochargers with novel design features or no service records.~~

~~(1) Category *A* turbochargers~~

~~(a) The sectional assembly listed in **2.1.3-1(1)(g)i), Part 7 of the Rules** is to include principal dimensions and names of components. The submission of the drawings may be omitted where deemed appropriate by the Society.~~

~~(2) Category *B* turbochargers~~

~~(a) The sectional assembly listed in **2.1.3-1(1)(g)i), Part 7 of the Rules** is to include principal dimensions and materials of housing components for containment evaluation.~~

~~(b) The turbocharger particulars listed in **2.1.3-1(1)(g)ii), Part 7 of the Rules** are to include the following items:~~

~~i) Maximum permissible operating speed (rpm);~~

~~ii) Maximum permissible exhaust gas temperature at the turbine inlet;~~

~~iii) Minimum lubrication oil inlet pressure;~~

~~iv) Maximum lubrication oil outlet temperature; and~~

~~v) Maximum permissible vibration levels (self- and externally generated vibration).~~

~~(c) The engine control system diagram listed in **2.1.3-1(2)(f), Part 7 of the Rules** is to include the following items:~~

~~i) Alarm level for overspeed;~~

~~ii) Alarm level for exhaust gas temperature at the turbine inlet;~~

~~iii) Lubrication oil inlet pressure low alarm set point; and~~

~~iv) Lubrication oil outlet temperature high alarm set point.~~

~~(3) Category *C* turbochargers~~

~~(a) The items as listed in **(2)** above are to be included.~~

(~~b~~1) The documentation for safe torque transmission specified in **2.1.3-1(2)(i)i), Part 7 of the Rules** ~~may be for any two sizes within a series of turbocharger which is of the same design, but scaled to each other.~~

~~(c) The information on expected lifespan listed in **2.1.3-1(2)(i)ii), Part 7 of the Rules** is to consider creep, low cycle fatigue and high cycle fatigue.~~

(~~d~~2) The operation and ~~service~~ maintenance manuals listed in **2.1.3-1(2)(i)iii), Part 7 of the Rules** ~~are to include guidance for the operation and maintenance of exhaust driven turbochargers. This guidance may be for any two sizes within a series of turbocharger which is of the same design, but scaled to each other.~~

2.5 Associated Installations

Paragraph 2.5.1 has been deleted.

~~**2.5.1 Exhaust Driven Turbochargers**~~

~~The safe torque transmission specified in **2.5.1-5, Part 7 of the Rules** is to be substantiated by calculations.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-10)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to turbochargers with novel design features or no service records for which the application for approval is submitted to the Society before the effective date.

Amendment 1-11

Part 7 MACHINERY INSTALLATIONS

Title of Chapter 2 has been amended as follows.

Chapter 2 ~~DIESEL~~ RECIPROCATING INTERNAL COMBUSTION ENGINES

2.1 General

Title of Paragraph 2.1.4 has been amended as follows.

2.1.4 Approval of ~~Diesel~~ Reciprocating Internal Combustion Engines

Sub-paragraph -3 has been amended as follows.

3 The wording "the drawings and data of the ~~diesel~~ reciprocating internal combustion engine whose approval of use has been obtained" specified in **(1)(c)**, **(1)(d)**, **(2)(a)** and **(2)(b)** of **2.1.4-1, Part 7 of the Rules** means those listed in **8.2.2, Part 6 of Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

Title of Fig. 7.2.1.4-1 has been amended as follows.

Fig. 7.2.1.4-1 Flow of Approval of ~~Diesel~~ Reciprocating Internal Combustion Engines

EFFECTIVE DATE AND APPLICATION (Amendment 1-11)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to reciprocating internal combustion engines whose type is the same type of those for which the application for approval is submitted to the Society before the effective date.

Amendment 1-12

Part 7 MACHINERY INSTALLATIONS

Chapter 2 DIESEL ENGINES

2.6 Tests

2.6.1 Shop Tests

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

3 In cases where the manufacturer has a quality system deemed appropriate by the Society, the dynamic balancing tests specified in **2.6.1-4, Part 7 of the Rules** for categor~~ies~~y ~~*A* and *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.

4 ~~The programme for the overspeed tests required by **2.6.1-5, Part 7 of the Rules** is to be in accordance with the following:~~

~~(1) Overspeed test for a duration of 3 *minutes* at either of the following speeds:~~

~~(a) 120% of the alarm level speed at room temperature; or~~

~~(b) 110% of the alarm level speed at an inlet temperature of 45°C when tested in the actual housing with the corresponding pressure ratio.~~

~~(2) For forged impellers and inducers subject to quality control through an approved non-destructive test method, overspeed tests may be dispensed with.~~

~~(3)~~ In cases where the manufacturer has a quality system deemed appropriate by the Society, the overspeed tests specified in **2.6.1-5, Part 7 of the Rules** for category ~~*A* and~~ *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.

EFFECTIVE DATE AND APPLICATION (Amendment 1-12)

1. The effective date of the amendments is 1 July 2020.

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

Amendment 1-13

Part 7 MACHINERY INSTALLATIONS

Chapter 9 WELDING FOR MACHINERY INSTALLATIONS

9.3 Post Weld Heat Treatment

Paragraph 9.3.1 has been amended as follows.

9.3.1 Procedure of Post Weld Heat Treatment

~~Procedures of post weld heat treatments for alloy steels other than those~~The wording "specially considered by the Society" specified in **9.3.1-~~1~~2, Part 7 of the Rules** means as follows:

(1) The temperature to be maintained in the post weld heat treatment is to be as given in **Table 7.9.3.1-1**.

(2) The requirements in **9.3.1-1, Part 7 of the Rules** apply to procedures of heat treatments other than post weld heat treatments for alloy steel referred to above.

9.6 Welding of Piping

Paragraph 9.6.2 has been deleted.

~~**9.6.2 Alignment of Joints**~~

~~The following values are to be taken as standard values for the allowable limits of the offset of joints referred to in paragraph **9.6.2, Part 7 of the Rules** in cases where a pipe and pipe fitting as well as pipe and pipe are butt welded:~~

~~(1) In cases where a backing strip is used; 0.5 *mm*~~

~~(2) In cases where no backing strip is used~~

~~(a) In cases where the nominal diameter is less than 150*A*, and the thickness is 6 *mm* or less; 1 *mm* or 25% of the thickness, whichever is smaller.~~

~~(b) In cases where the nominal diameter is less than 300*A*, and the thickness is 9.5 *mm* or less; 1.5 *mm* or 25% of the thickness, whichever is smaller (excluding those cases that correspond to **(a)** above).~~

~~(c) In cases where the nominal diameter is not less than 300*A* or the thickness exceeds 9.5 *mm*; 2 *mm* or 25% of the thickness, whichever is smaller.~~

Paragraph 9.6.3 has been deleted.

~~**9.6.3 Preheating of Welds**~~

~~Preheating for pipes referred to in paragraph **9.6.3, Part 7 of the Rules** is to be carried out at the minimum preheating temperature specified in **Table 7.9.6.3-1** according to the grade of the materials and their thickness.~~

Table 7.9.6.3-1 has been deleted.

~~Table 7.9.6.3-1 Minimum Preheating Temperature~~

~~Grade~~[1]		~~Thickness of weld (t) (mm)~~	~~Minimum preheating temperature(°C)~~
~~Grade 1~~ ~~Grade 2~~ ~~Grade 3~~	~~$C + \frac{Mn}{6} \leq 0.4$~~	~~$t \geq 20$~~[2]	~~50~~
	~~$C + \frac{Mn}{6} > 0.4$~~	~~$t \geq 20$~~[2]	~~100~~
~~Grade 4~~	~~No.12~~	~~$t \geq 13$~~[2]	~~100~~
	~~No.22~~ ~~No.23~~	~~$t < 13$~~[3]	~~100~~
		~~$t \geq 13$~~	~~150~~
	~~No.24~~	~~$t < 13$~~[3]	~~150~~
		~~$t \geq 13$~~	~~200~~

~~Notes:~~

~~(1) Grades are as specified in Section **4.2, Part K of the Rules** **for the Survey and Construction of Steel Ships**. Materials not specified in this table are to be as deemed appropriate by the Society.~~

~~(2) In cases where welding is carried out at an ambient temperature less than 0°C, it is necessary to preheat the welding object to at least the minimum preheating temperature irrespective of the thickness, excluding those cases where sufficient consideration has been given to any possible moisture.~~

~~(3) Preheating may be omitted for thickness of 6 mm or less depending on the results of hardness tests in cases where sufficient consideration has been given to any possible moisture.~~

Chapter 10 PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES

10.4 Connection and Forming of Piping Systems

Paragraph 10.4.4 has been deleted.

~~**10.4.4 Forming of Pipes and Heat Treatment after Forming**~~

~~The wording "a suitable heat treatment" specified in **10.4.4-2, Part 7 of the Rules** means, as a rule, the following:~~

~~(1) For steel pipes of Grade 2, No. 4, Grade 3, No. 4 and Grade 4 that are specified in **Table 7.9.6, Part 7 of the Rules**, stress-relieving heat treatments are to be carried out in accordance with the requirements relative to the holding temperature and holding period specified in **9.3.1, Part 7 of the Rules**.~~

~~(2) In cases where steel pipes of Grade 2, No. 4, Grade 3, No. 4 and Grade 4 that are specified in **Table 7.9.6, Part 7 of the Rules** are subjected to bending processes in such a manner that the bending radius of the pipe centre line is 4 times or less the outside diameter of the pipe, they are to be subjected to annealing or annealing and tempering according to the type of pipe materials. The type and temperature of this heat treatment are to be as shown in **Table 7.10.4.4-1**.~~

Table 7.10.4.4-1 has been deleted.

~~Table 7.10.4.4-1 Type and Temperature of Heat Treatment~~

~~Grade (Note 1)~~		~~Type and temperature of heat-treatment (°C)~~
~~Grade 2, No.4 and Grade 3, No.4~~		~~Normalizing: from 880 to 940~~
~~Grade 4~~	~~No.12~~	~~Normalizing: from 900 to 940~~
	~~No.22 No.23~~	~~Normalizing: from 900 to 960 Tempering: from 640 to 720~~
	~~No.24~~	~~Normalizing: from 900 to 960 Tempering: from 640 to 780~~

~~Note~~

~~1. Grades are as specified in **4.2, Part K of the Rules for the Survey and Construction of Steel Ships**.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-13)

1. The effective date of the amendments is 1 July 2020.

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

Amendment 1-14

Part 7 MACHINERY INSTALLATIONS

Chapter 11 PIPING SYSTEMS

Section 11.15 has been deleted.

~~**11.15 Exhaust Gas Piping Arrangements**~~

~~**11.15.1 Exhaust Gas Pipes from Diesel Engines**~~

~~**1** The wording "common exhaust gas cleaning systems deemed appropriate by the Society" specified in **11.15.1-1(2)** and **11.15.1-3(2), Part 11 of the Rules** means systems complying with **1.4.1-6** of **Annex D1.3.1-5(2)** "GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF EXHAUST GAS CLEANING SYSTEMS AND ASSOCIATED EQUIPMENT", **Part D of the Guidance for the Survey and Construction of Steel Ships**.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-14)

1. The effective date of the amendments is 1 July 2020.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to EGCS whose applications for approval are submitted to the Society before the effective date installed on ships for which the date of contract for construction is before the effective date.