

# **RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS**

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

**Part D**

**Machinery Installations**

**Rules for the Survey and Construction of Steel Ships**  
**Part D** **2022 AMENDMENT NO.2**  
**Guidance for the Survey and Construction of Steel Ships**  
**Part D** **2022 AMENDMENT NO.2**

Rule No.89 / Notice No.64 27 December 2022

Resolved by Technical Committee on 27 July 2022

**ClassNK**  
NIPPON KAIJI KYOKAI

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

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# **RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS**

**RULES**

**Part D**

**Machinery Installations**

**2022 AMENDMENT NO.2**

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AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

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

**Part D MACHINERY INSTALLATIONS**

**Amendment 2-1**

**Chapter 2 RECIPROCATING INTERNAL COMBUSTION ENGINES**

**2.5 Associated Installations**

Paragraph 2.5.3 has been amended as follows.

**2.5.3 Starting Arrangements\***

**1** The starting air mains are to be protected against explosion caused by back-fire from the cylinders or excessive temperature rise in the starting air manifold at the time of starting by the following ~~arrangements (1) through (5) arrangements~~:

- (1) An isolating non-return valve or equivalent thereto is to be provided at the starting air supply connection to each engine.
- (2) An adequate rupture disc device or a flame arrester is to be fitted at the starting valve on each cylinder for direct reversing engines having a starting air manifold. At least one such device is to be fitted at the supply inlet to the starting air manifold for each non-reversing engine. However, the above mentioned device may be omitted for engines having cylinder bore not exceeding 230 mm.
- (3) An adequate rupture disc device is to be fitted at an appropriate position on the starting air manifold as an emergency means of relieving a pressure caused by explosion for direct reversing engines fitted with flame arresters in accordance with (2) above.
- (4) For rupture disc devices of which ruptured discs cannot be easily replaced, a mechanism of blocking up the exhaust way is to be provided for the purpose of quick restart of the engine. This blocking mechanism is to be fitted with a means of indicating whether it is blocking or not.
- (5) An effective arrangement to prevent the accumulation of combustibles (fuel oil, lubrication oil, system oil, etc.) in the starting air manifold or to prevent the excessive temperature rise in the starting air manifold is to be provided for direct reversing engines.

**2** Where main propulsion engines are arranged for starting by compressed air, at least two starting air reservoirs are to be provided. These reservoirs are to be connected so that usage can be readily switched from one to the other. In this case, the total capacity of the starting air reservoirs is to be sufficient to provide, without replenishment, the number of consecutive starts not less than that specified in (1), (2) and (3) below. Where the arrangements of the main propulsion engines and shafting systems are other than shown below, the required number of starts is to be as deemed appropriate by the Society. When other consumers such as auxiliary machinery starting systems, control systems, whistles, etc. are to be connected to starting air reservoirs, their air consumption is also to be taken into account.

- (1) For direct reversible engines

$$Z = 12C$$

where

Z : Total number of starts of engine

C : Constant determined by the arrangement of main propulsion engines and shafting systems, where the following values are to be referred to as the standard;

C = 1.0 For single screw ships, where one engine is either coupled with the shaft directly or through reduction gears.

C = 1.5 For twin screw ships, where two engines are either coupled with the shafts directly or through reduction gear. Or, for single screw ships, where two engines are coupled with the shaft through declutchable coupling provided between engine and reduction gear.

C = 2.0 For single screw ships, where two engines are coupled with one shaft without any declutchable coupling between engine and reduction gear.

(2) For non-reversible type engines using a separate reversing gear or controllable pitch propeller, 1/2 of the total number of starts specified in (1) above may be accepted.

(3) For electric propulsion ships:

$$Z = 6 + 3(k - 1)$$

where

Z : Total number of starts of engine

k : Number of engines (In the case of more than 3 engines, the value of k to be used is 3.)

**3** The capacities of the reservoirs specified in -2 above are to be about the same.

~~54~~ ~~The Starting air reservoirs and starting air systems are also to comply with the requirements in 13.13.~~

~~35~~ Internal combustion engines which are arranged for electrical starting are to comply with the requirements specified in Part H, in addition to the following (1) to (3):

(1) Two separate batteries are to be fitted to starting arrangements for main propulsion machinery. Arrangements are to be such that the batteries cannot be connected in parallel, and each battery is to be capable of starting the main propulsion machinery under the cold and ready-to-start condition. The combined capacity of the batteries is to be sufficient (without recharging) to provide the number of consecutive starts specified in -2 above within 30 minutes.

(2) Electric starting arrangements for internal combustion engines driving generators and auxiliary machinery are to have two separate batteries but may be supplied by separate circuits from the batteries for main propulsion machinery. In the case of single auxiliary engines, only one battery needs to be fitted. The capacity of each set of batteries is to be sufficient for at least three starts for each engine.

(3) Starting batteries are to be used for starting and engine self-monitoring purposes only. Provisions are to be made to continuously maintain stored energy at all times.

~~Where main propulsion engines are arranged for starting by battery, 2 sets of batteries are to be provided. The total capacity of the batteries is to be sufficient, without recharging, to provide the number of starts of the main propulsion engine required in -2 within 30 minutes.~~

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

## Chapter 4 GAS TURBINES

### 4.3 Safety Devices

Paragraph 4.3.2 has been amended as follows.

#### 4.3.2 Shut-down Devices

**1** Gas turbines are to be provided with hand trip gear for shutting off the fuel in an emergency which is to be provided at the control station.

**2** Unless the FMEA proves that the adverse effects due to failures occurring are within acceptable ranges, the shut-down functions for gas turbines are to be provided in accordance with Table D4.1.

~~**3**~~ Gas turbines are to be provided with a quick closing device (shut-down device) which automatically shuts off the fuel supply to the turbines at least in the cases of the following **(1)** to **(7)**. In addition, means are to be provided so that alarms are operated at the control station by the activation of these shut-down devices.

((1) to (7) are omitted.)

~~**4**~~ In addition to the requirements specified in ~~**3**~~ above, gas turbines used as main propulsion machinery are to be provided with a quick closing device (shut-down device) which automatically shuts off the fuel supply to the turbines in at least the following **(1)** to **(3)** cases. In addition, means are to be provided so that alarms are operated at the control station by the activation of these shut-down devices.

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

Paragraph 4.3.3 has been amended as follows.

#### 4.3.3 Alarms

Gas turbines are to be provided with alarm devices as required by **Table D4.1**. The addition or omission of alarm devices, however, may be accepted taking into account the results of failure mode and effects analysis (FMEA).

Paragraph 4.3.5 has been amended as follows.

#### 4.3.5 Additional Safety Devices

Gas turbines may be required to be provided with additional safety devices as required in order to safeguard against hazardous conditions arising in the event of malfunctions in the gas turbine installation. Such hazardous conditions are to be verified by the manufacturer in accordance with the failure mode and effects analysis (FMEA).

### 4.4 Associated Installations

#### 4.4.3 Starting Arrangements\*

Sub-paragraph -2 has been amended as follows.

**2** Where compressed air is used for starting, the starting arrangement is to comply with ~~the requirements specified in 13.13~~, in addition to the following **(1)** to **(5)**:

((1) is omitted.)

**(2)** The arrangement for the air starting of main propulsion machinery is to be provided with at least two starting air reservoirs which may be used independently. The total capacity of the air

reservoirs is to be sufficient to provide, without their being replenished, the number of consecutive starts of main propulsion machinery ~~under cold and ready to start conditions~~ not less than the following (a) and (b). Where the arrangements of the main propulsion machinery and shafting systems are other than those shown below, the required number of starts is to be as deemed appropriate by the Society. ~~In any case, an additional number of starts may be required when the gas turbine is in the warm running condition.~~ When other consumers such as auxiliary machinery starting systems, control systems, whistles, etc. are to be connected to ~~the~~ starting air reservoirs, their air consumption is also to be taken into account.

(a) Ships other than electric propulsion ships

$$Z = 6C$$

where

Z: Total number of starts of gas turbines

C: Constant determined by the arrangement of gas turbines and shafting systems, where the following values are to be referred to as the standard

C = 1.0: Single screw ships, where one gas turbine is either coupled with the shaft directly or through reduction gears.

C = 1.5: Twin screw ships, where two gas turbines are either coupled with the shafts directly or through reduction gear, and for single screw ships, where two gas turbines are coupled with the shaft through declutchable coupling provided between gas turbines and reduction gear.

C = 2.0: Single screw ships, where two gas turbines are coupled with one shaft without any declutchable coupling between gas turbines and reduction gear.

(b) Electric propulsion ships

$$Z = 6 + 3(k-1)$$

where

Z: Total number of starts of gas turbines

k: Number of engines (In the case of more than three gas turbines, the value of  $k$  to be used need not exceed three.)

(3) The capacities of the reservoirs specified in (2) above ~~is~~ are to be about equal ~~the same~~.

~~(4) The compressor to which 13.13.3.2 applies is to have a capacity not less than 50 % of the total capacity specified in 13.13.3.3.~~

~~(5) The capacity of starting air compressors fitted for main propulsion machinery (excluding an emergency compressor which is installed to satisfy 1.3.1.5) is to be approximately equally divided between the number of said compressors.~~

## Chapter 13 PIPING SYSTEMS

### 13.13 Pneumatic Piping Systems

Paragraph 13.13.3 has been amended as follows.

#### 13.13.3 Number and Total Capacity of Air Compressors

**1** In cases where the main propulsion machinery is designed for starting by compressed air, two or more starting air compressors are to be provided and arranged so as to be able to charge each air reservoir. However, in cases where cylinders are provided with air charging valves, these charging valves will be considered to be equivalent to any air compressors driven by the main propulsion machinery.

**2** One of the air compressors specified in -1 above is to be driven by a prime mover that is not the main propulsion machinery. Such compressor is to have a capacity not less than 50 % of the total capacity specified in -3.

**3** The total capacity of air compressors is to be sufficient to supply air into the air reservoirs from atmospheric pressure to the pressure required for the consecutive starts prescribed in **2.5.3-2** or **4.4.3-2**, corresponding to the type of prime mover, within one *hour*. The capacity is to be approximately equally divided between the number of starting air compressors (excluding emergency compressors installed to satisfy **1.3.1-5**) fitted for main propulsion machinery.

#### EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

1. The effective date of the amendments is 1 January 2023.
2. Notwithstanding the amendments to the Rules, the current requirements apply to ships for which the date of contract for construction\* is before the effective date.  
\* “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.

## Chapter 15 STEERING GEARS

### 15.1 General

Paragraph 15.1.2 has been amended as follows.

#### 15.1.2 Terminology

The terms used in this Chapter are defined as follows:

- (1) A “main steering gear” is defined as the machinery, rudder actuators, steering gear power units, if any, and ancillary equipment and the means of applying torque to the rudder stock (tiller, etc) necessary for effecting movement of the rudder for the purpose of steering the ship under normal service conditions.
- (2) An “auxiliary steering gear” is defined as the equipment other than any part of the main steering gear necessary to steer the ship in the event of failure of the main steering gear but not including tiller, etc.
- (3) A “steering gear power unit” (hereinafter referred to as “power unit”) is:
  - (a) in the case of electric gear: an electric motor and its associated electrical equipment;
  - (b) in the case of electrohydraulic steering gear: a hydraulic pump, electric motor and its associated electrical equipment; and
  - (c) in the case of hydraulic steering gear other than those in (b): a hydraulic pump and its driving engine.
- (4) A “power actuating system” is defined as the hydraulic equipment provided for supplying power to turn the rudder stock, comprising a power unit or units, together with the associated hydraulic pipes and fittings, and a rudder actuator. The power actuating systems may share common mechanical components, i.e., tiller, etc.
- (5) A “rudder actuator” is defined as the component which converts directly hydraulic pressure into mechanical action to move the rudder.
- (6) A “control system” is defined as the equipment by which orders are transmitted from the navigating bridge to the power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables. Steering gear control systems are also understood to cover “equipment required to control steering gear power actuating systems”.
- (7) “Maximum working pressure” means the maximum expected pressure in the system when the steering gear is operated under the conditions specified in 15.2.2(1).
- (8) “Hydraulic locking” means all situations where two hydraulic systems (usually identical) oppose each other in such a way that may lead to loss of steering. Such a loss of steering can either be caused by pressure in the two hydraulic systems working against each other or by hydraulic “by-pass” (i.e. the systems puncture each other and cause pressure drop on both sides or make it impossible to build up pressure).

### 15.3 Controls

Paragraph 15.3.1 has been amended as follows.

#### 15.3.1 General\*

(-1 and -2 are omitted.)

**3** For the control systems specified in the requirements of **-1(2)** above, at least the following most probable failures that may cause reduced or erroneous system performance are to be

automatically detected and individual visible and audible alarms are to be given on the navigation bridge:

- (1) Power supply failure
- (2) Earth fault on AC and DC circuits
- (3) Loop failure in closed loop systems, both command and feedback loops (normally short circuit, broken connections and earth faults)
- (4) Data communication errors
- (5) Programmable system failures (Hardware and software failures)

~~(6) Hydraulic locking~~

(7) In the case of closed loop systems, deviation between rudder order and feedback Individual visible and audible deviation alarms are to be initiated on the navigation bridge when the rudder's actual position does not reach its set point within acceptable time limits (e.g. follow-up control and autopilot). The deviation alarm may be caused by mechanical, hydraulic or electrical failures.

4 For the control systems specified in the requirements of 1(2) above, the failures (as defined but not limited to those in 3 above) likely to cause uncontrolled movement of the rudder are to be clearly identified. In the event of such a failure, the following response is to be implemented:

- (1) the rudder is to stop in the angle when failure occurs without manual intervention, or
- (2) the rudder is to return to the midship/neutral position.

For mechanical failures such as sticking valves and failure of static components (pipes, cylinders), system response without manual intervention is not mandatory, and operators may instead follow instructions permanently displayed in accordance with 15.1.4-2 in the case of such failures.

(-5 and -6 are omitted.)

## EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

1. The effective date of the amendments is 1 July 2023.
2. Notwithstanding the amendments to the Rules, the current requirements apply to ships for which the date of contract for construction\* is before the effective date.
3. Notwithstanding the provision of preceding 2., the amendments to the Rules may apply to the surveys for which the application is submitted to the Society before the effective date upon request by the owner.  
\* “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.

## Annex 12.1.6 PLASTIC PIPES

Section 1.1 has been amended as follows.

### 1.1 Scope

1 This annex is to apply to the materials, construction, strength, application, assembly and tests of piping systems on ships, including pipe joints and fittings, made predominately of materials other than metal.

2 ~~The annex is not applicable to use of mechanical joints and flexible couplings only approved for the use in metallic piping systems which are accepted for use in accordance with 12.3.3.1 or 12.3.4.2, Part D of the Rules is not permitted.~~

3 The specification of the pipes is to be in accordance with a recognised national or international standard acceptable to the Society and the following requirements. However, the requirements in 1.4 (except 1.4.1-2(2)) and 1.5 (except 1.5.2) need not apply to the pipes specified in 1.3-2.

Section 1.2 has been amended as follows.

### 1.2 Terminology

Terms used in this annex are defined as follows:

- (1) "Plastic" means both thermoplastic and thermosetting plastic materials with or without reinforcement, such as *PVC* and fibre reinforced plastics - FRP. Plastic includes synthetic rubber and materials of similar thermo/mechanical properties.
- (2) "Pipe/piping Systems" means those made of plastic(s) and include pipes, fittings, system joints, methods of joining and any internal or external liners, coverings and coatings required to comply with this annex.
- (3) "Joint" means the location at which two pieces of pipe or a pipe and a fitting are connected together. The joint may be made by adhesive bonding, laminating, welding, flanges ~~etc~~ and mechanical joints according to Fig. D12.1 in 12.3.3, Part D of the Rules.
- (4) "Fittings" means bends, elbows, fabricated branch pieces, etc. of plastic materials.
- (5) "Nominal pressure" means the maximum permissible working pressure which is to be determined in accordance with 1.4.1-2.
- (6) "Design pressure" means the maximum working pressure which is expected under operation conditions or the highest set pressure of any safety valve or pressure relief device on the system, if fitted.
- (7) "Fire endurance" means the capability of piping to maintain its strength and integrity (i.e. capable of performing its intended function) for some predetermined period of time while exposed to fire.
- (8) "Pipes and their associated fittings whose integrity is essential to the safety of ship" means piping systems specified in Table 1 and includes piping systems deemed by the Society that in event of failure will pose a threat to personnel and the ship.
- (9) "Essential services" are those services essential for propulsion and steering and safety of the ship as specified in 3.2.1-2, Part H of the Rules.
- (§10) "FTP Code" means as defined in 3.2.23, Part R of the Rules.

Section 1.3 has been amended as follows.

### 1.3 Materials

1 Plastic pipes are to be those approved by the Society in accordance with **12.1.6, Part D of the Rules** and adequate for their service conditions.

2 Notwithstanding the requirement in -1 above, pipes which comply with recognised standards such as *JIS* or *JWWA*, comply with **1.4.1-2(2)** and **1.5.2** and are adequate for their service conditions may be used for the following (1) and (2):

- (1) Drinking water pipes, domestic water pipes (including hot water pipes) and sanitary pipes located within accommodation spaces and engine rooms as well as deck scuppers located within spaces.
- (2) ~~Pipes used for the “Auxiliary machinery for specific use” and “Other auxiliary machinery” (except for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems, exhaust gas cleaning systems (EGCS), etc.) specified in 1.1.1-6, Part D of the Rules~~  
Other pipes not used for essential services.

### 1.5 Requirements for Pipe/Piping Systems Depending On Service and/or Locations

Paragraph 1.5.1 has been amended as follows.

#### 1.5.1 Fire Endurance

1 Pipes and their associated joints and fittings whose integrity is essential to the safety of ships are required to meet the minimum fire endurance requirements of *Appendix 1* or *2*, as applicable, of *IMO Res. A.753(18)* (including any amendments due to *IMO Res. MSC.313(88)* and *IMO Res. MSC.399(95)*).

2 Unless instructed otherwise by the Administration, fire endurance tests are to be carried out with representative specimens for pipes, joints and fittings in accordance with the following (1) and (2). A test specimen incorporating several components of a piping system may be tested in a single test:

#### (1) Pipes

(a) For sizes with outer diameter less than 200 mm, the pipe with the minimum outer diameter and wall thickness is used.

(b) For sizes with outer diameter of 200 mm or more, the pipe with the minimum outer diameter is used for each category of t/D ratio (where “D” is the outer diameter and “t” is the structural wall thickness). A scattering of ±10 % for t/D is regarded as the same group.

If fire protective coatings, etc. are included in the pipe used in the fire test, the pipe with the minimum fire protective coatings, etc. are used regardless of the (t/D) ratio.

#### (2) Joints

Each type of joint applicable for applied fire endurance level on pipe to pipe specimen is to be tested.

3 Means are to be provided to ensure a constant media pressure inside the test specimen during the fire test as specified in *Appendix 1* or *2* of *IMO Res.A.753(18)*, as amended by *IMO Res. MSC.313(88)* and *MSC.399(95)*. During the test, it is not permitted to replace media drained by fresh water or nitrogen.

~~24~~ Permitted use of piping depending on fire endurance, location and piping system is given in **Table 1**.

## 1.7 Tests

Paragraph 1.7.2 has been amended as follows.

### 1.7.2 On-board Tests and Inspection

After installation~~ed~~ on board, in addition to those tests and inspections specified in **2.1.4-1(8), Part B of the Rules**, the following tests and inspections are to be carried out.

- (1) Hydrostatic tests at pressures 1.5 *times* design pressure or 0.4 MPa, whichever is greater, used for ~~“auxiliary machinery essential for main propulsion”, “auxiliary machinery for the manoeuvring and the safety” and “auxiliary machinery for cargo handling” specified in 1.1.6-1, Part D of the Rules~~ and for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems and exhaust gas cleaning systems (EGCS), etc essential services. Notwithstanding the requirement above, the following (2) may be applied to open ended pipes (drains, effluents, etc.).
- (2) Leakage tests at service conditions, used for other than auxiliary machinery specified in (1) above.
- (3) Sufficient earthing to hulls for those pipes required to be electrically conductive in accordance with **1.5.4** above.
- (4) Safe support of pipes and no harmful defects on their external surface.

Table 1 has been amended as follows.

Table 1 Fire Endurance Requirements Matrix

N	Piping Systems	Location										
		A	B	C	D	E	F	G	H	I	J	K
<b>CARGO (FLAMMABLE CARGO f.p.<sup>11</sup> ≤ 60°C)</b>												
1	Cargo lines	—	—	L1	—	—	○	—	○ <sup>10</sup>	○	—	L1 <sup>2</sup>
2	Crude oil washing lines	—	—	L1	—	—	○	—	○ <sup>10</sup>	○	—	L1 <sup>2</sup>
3	Vent lines	—	—	—	—	—	○	—	○ <sup>10</sup>	○	—	×
<b>INERT GAS</b>												
4	Water seal effluent lines	—	—	○ <sup>1</sup>	—	—	○ <sup>1</sup>	○ <sup>1</sup>	○ <sup>1</sup>	○ <sup>1</sup>	—	○
5	Scrubber effluent lines	○ <sup>1</sup>	○ <sup>1</sup>	—	—	—	—	—	○ <sup>1</sup>	○ <sup>1</sup>	—	○
6	Main lines	○	○	L1	—	—	—	—	—	○	—	L1 <sup>6</sup>
7	Distribution lines	—	—	L1	—	—	○	—	—	○	—	L1 <sup>2</sup>
<b>FLAMMABLE LIQUIDS (f.p.<sup>11</sup> &gt; 60°C)</b>												
8	Cargo lines	×	×	L1	×	×	— <sup>3</sup>	○	○ <sup>10</sup>	○	—	L1
9	Fuel oil	×	×	L1	×	×	— <sup>3</sup>	○	○	○	L1	L1
10	Lubricating	×	×	L1	×	×	—	—	—	○	L1	L1
11	Hydraulic oil	×	×	L1	×	×	○	○	○	○	L1	L1
<b>SEAWATER<sup>1</sup></b>												
12	Bilge mains & branches	L1 <sup>7</sup>	L1 <sup>7</sup>	L1	×	×	—	○	○	○	—	L1
13	Fire mains & water sprays	L1	L1	L1	×	—	—	—	○	○	×	L1
14	Foam systems	L1W	L1W	L1W	—	—	—	—	—	○	L1W	L1W
15	Sprinkler systems	L1W	L1W	L3	×	—	—	—	○	○	L3	L3
16	Ballast	L3	L3	L3	L3	×	○ <sup>10</sup>	○	○	○	L2W	L2W
17	Cooling water, essential services <sup>12</sup>	L3	L3	—	—	—	—	—	○	○	—	L2W
18	Tank cleaning services fixed machines	—	—	L3	—	—	○	—	○	○	—	L3 <sup>2</sup>
19	Non-essential systems <sup>13</sup>	○	○	○	○	○	—	○	○	○	○	○
<b>FRESHWATER</b>												
20	Cooling water essential services <sup>12</sup>	L3	L3	—	—	—	—	○	○	○	L3	L3
21	Condensate returns	L3	L3	L3	○	○	—	—	—	○	○	○
22	Non-essential systems <sup>13</sup>	○	○	○	○	○	—	○	○	○	○	○
<b>SANITARY/DRAINS/SCUPPERS</b>												
23	Deck drains (internal)	L1W <sup>4</sup>	L1W <sup>4</sup>	—	L1W <sup>4</sup>	○	—	○	○	○	○	○
24	Sanitary drains (internal)	○	○	—	○	○	—	○	○	○	○	○
25	Scuppers and discharges (overboard)	○ <sup>1,8</sup>	○	○	○	○	○ <sup>1,8</sup>	○				
<b>SOUNDING/AIR</b>												
26	Water tanks/dry spaces	○	○	○	○	○	○ <sup>10</sup>	○	○	○	○	○
27	Oil tanks (f.p. <sup>11</sup> > 60_°C)	×	×	×	×	×	× <sup>3</sup>	○	○ <sup>10</sup>	○	×	×

Table 1 Fire Endurance Requirements Matrix (continued)

N	Piping Systems*	Location										
		A	B	C	D	E	F	G	H	I	J	K
MISCELLANEOUS												
28	Control air	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	—	○	○	○	L1 <sup>5</sup>	L1 <sup>5</sup>
29	Service air (non-essential) <sup>13</sup>	○	○	○	○	○	—	○	○	○	○	○
30	Brine	○	○	—	○	○	—	—	—	○	○	○
31	Auxiliary low pressure steam (≤ 0.7MPa)	L2W	L2W	○ <sup>9</sup>	○ <sup>9</sup>	○ <sup>9</sup>	○	○	○	○	○ <sup>9</sup>	○ <sup>9</sup>
32	Central vacuum cleaners	—	—	—	○	—	—	—	—	○	○	○
33	Exhaust gas cleaning system / Exhaust gas recirculation system effluent line	L3 <sup>1</sup>	L3 <sup>1</sup>	—	—	—	—	—	—	—	L3 <sup>1, 14</sup>	—
34	Reductant agent transfer / supply system (SCR installations)	L1 <sup>15</sup>	L1 <sup>15</sup>	—	—	—	—	—	—	○	L3 <sup>14</sup>	○

Notes:

(1) LOCATION

- A : “Machinery spaces of category A”: Machinery spaces of category A as defined in **2.1.32, Part A of the Rules**
- B : “Other machinery spaces and pump rooms”: Spaces, other than category A machinery spaces and cargo pump rooms, containing: propulsion machinery; boilers; fuel oil units; steam and internal combustion engines; generators and major electrical machinery; oil filling stations; refrigerating, stabilising, ventilation and air-conditioning machinery as well as similar spaces and trunks to such spaces.
- C : “Cargo pump rooms”: Spaces containing cargo pumps and entrances and trunks to such spaces.
- D : “Ro-ro cargo holds”: Ro-ro cargo holds are ro-ro cargo spaces and special category spaces as defined in **3.2.41, Part R of the Rules** and **2.1.38, Rules for High Speed Craft**
- E : “Other dry cargo holds”: All spaces other than ro-ro cargo holds used for non-liquid cargo and trunks to such spaces.
- F : “Cargo tanks”: All spaces used for liquid cargo and trunks to such spaces.
- G : “Fuel oil tanks”: All spaces used for fuel oil (excluding cargo tanks) and trunks to such spaces.
- H : “Ballast water tanks”: All spaces used for ballast water and trunks to such spaces.
- I : “Cofferdams, voids, etc.”: Cofferdams and voids are those empty spaces between two bulkheads separating two adjacent compartments.
- J : “Accommodation, service”: Accommodation spaces, service spaces and control stations as defined in **2.1.36, 2.1.37, Part A of the Rules** and **9.2.3-2(1), Part R of the Rules**
- K : “Open decks”: Open deck spaces as defined in **9.2.4-2(10), Part R of the Rules** (excluding lifeboat and liferaft embarkation and lowering stations)

(2) ABBREVIATIONS

- L1 : Pipes without leakage during pressure tests as a result of fire endurance tests (for more than one hour) and pressure tests (for more than 15 minutes) in dry conditions in accordance with *IMO Res. A.753(18) Appendix 1* (including any amendments due to *IMO Res. MSC.313(88)* and *IMO Res. MSC.399(95)*)
- L1W : For piping systems which do not carry flammable fluid or any gas, pipes with negligible leakage (i.e. not exceeding 5 % flow loss) during pressure tests as a result of fire endurance tests (for more than one hour) and pressure tests (for more than 15 minutes) in dry conditions in accordance with *IMO Res. A.753(18) Appendix 1* (including any amendments due to *IMO Res. MSC.313(88)* and *IMO Res. MSC.399(95)*)
- L2 : Pipes without leakage during pressure tests as a result of fire endurance tests (for more than 30 minutes) and pressure tests (for more than 15 minutes) in dry conditions in accordance with *IMO Res. A.753(18) Appendix 1* (including any amendments due to *IMO Res. MSC.313(88)* and *IMO Res. MSC.399(95)*)
- L2W : Pipes with negligible leakage (i.e. not exceeding 5 % flow loss) during pressure tests as a result of fire endurance tests (for more than 30 minutes) and pressure tests (for more than 15 minutes) in dry conditions in accordance with *IMO Res. A.753(18) Appendix 1* (including any amendments due to *IMO Res. MSC.313(88)* and *IMO Res. MSC.399(95)*)
- L3 : Pipes without significant leakage (i.e. not exceeding 0.2 l/min) during pressure tests as a result of fire endurance tests (for more than 30 minutes) and pressure tests (for more than 15 minutes) in wet conditions in accordance with *IMO Res. A.753(18) Appendix 1* (including any amendments due to *IMO Res. MSC.313(88)* and *IMO Res. MSC.399(95)*)
- : No fire endurance test required

- : Not applicable
- × : Metallic materials having a melting point greater than 925 °C

(3) FOOTNOTES

- 1 : In cases where non-metallic piping is used, remotely controlled valves are to be provided at ship's side (such valves are to be controlled from outside spaces).
- 2 : Remote closing valves are to be provided at cargo tanks.
- 3 : When cargo tanks contain flammable liquids with a f.p. (to be determined by an approved closed cup method) > 60 °C, "o" may replace "-" or "x".
- 4 : In the case of drains serving only the space concerned, "o" may replace "L1W".
- 5 : When controlling functions are not required by statutory requirements or guidelines, "o" may replace "L1".
- 6 : In the case of pipes between machinery spaces and deck water seals, "o" may replace "L1".
- 7 : In the case of passenger vessels, "x" is to replace "L1".
- 8 : Scuppers serving open decks in positions I and II, as defined in **20.1.2, Part C of the Rules**, ~~should~~ are to be "x" throughout unless fitted at the upper end with the means of closing capable of being operated from a position above the freeboard deck in order to prevent downflooding.
- 9 : In the case of essential services, such as fuel oil tank heating and the ship's whistle, "x" is to replace "o".
- 10 : In the case of tankers where compliance with **3.2.4(1)(a)vi, Part 3 of the Rules for Marine Pollution Prevention Systems** is required, "-" is to replace "o".
- 11 : To be determined by an approved closed cup method.
- 12 : Pipe-lines used for ~~the "auxiliary machinery essential for main propulsion", "auxiliary machinery for the manoeuvring and safety" and "auxiliary machinery for cargo handling" specified in 1.1.1 6, Part D of the Rules essential services.~~
- 13 : Pipes specified in **1.3-2(1) and (2)**
- 14 : L3 in service spaces, NA in accommodation and control spaces.
- 15 : Type approved plastic piping without fire endurance test (o) is acceptable downstream of the tank valve, provided this valve is metal seated and arranged as fail-to-closed or with quick closing from a safe position outside the space in the event of fire.

## EFFECTIVE DATE AND APPLICATION (Amendment 2-3)

1. The effective date of the amendments is 1 July 2023.
2. Notwithstanding the amendments to the Rules, the current requirements apply to plastic piping systems other than those which fall under the following:
  - (1) plastic piping systems for which the application for approval of use is submitted to the Society on or after the effective date;
  - (2) plastic piping systems for which the date of renewal of approval of use is on or after the effective date; or
  - (3) plastic piping systems used on ships for which the date of contract for construction\* is on or after 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.

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# **GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS**

**Part D**

**Machinery Installations**

**GUIDANCE**

**2022 AMENDMENT NO.2**

Notice No.64      27 December 2022

Resolved by Technical Committee on 27 July 2022

AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

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

## Part D MACHINERY INSTALLATIONS

### D2 RECIPROCATING INTERNAL COMBUSTION ENGINES

#### D2.5 Associated Installations

Paragraph D2.5.3 has been amended as follows.

##### D2.5.3 Starting Arrangements

~~1~~ The wording “effective arrangement to prevent the accumulation of combustibles” specified in **2.5.3-1(5), Part D of the Rules** means a construction of the starting air manifold from which combustibles can be easily (e.g. the starting air manifold has a gentle slope and a well at the lowermost position) discharged through a drain pipe which is normally open.

~~2~~ For main propulsion machinery starting arrangements operated by compressed air, the following requirements, in addition to those in **2.5.3, Part D of the Rules**, are to be complied with:

~~(1) Starting air reservoirs for main propulsion machinery are to be of approximately the same capacity.~~

~~(2) For ships designed to use the compressed air stored in starting air reservoirs for main propulsion machinery for purposes other than starting, the capacity of such air reservoirs is to take into account total compressed air consumption.~~

~~(3) For main propulsion machinery starting arrangements operated by compressed air, at least one of the starting air compressors is to be driven by power source other than the main propulsion machinery, and its capacity is to be 50 % or more of the total capacity specified in the requirements of **2.5.3-2, Part D of the Rules**.~~

~~(4) Starting air compressors for main propulsion machinery are to be of approximately the same capacity.~~

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

~~(1) Two sets of batteries provided for starting main propulsion machinery are to be arranged so that no parallel connections can be made, and so that each battery is capable of starting main propulsion machinery in a cold state after all of the starting preparations have been completed.~~

~~(2) The starting arrangements for reciprocating internal combustion engines driving main generators 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 reciprocating internal combustion engines. Arrangements are to be made so that the energy stored in the batteries can be maintained at all times.~~

## EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 January 2023.
2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships for which the date of contract for construction\* is before the effective date.  
\* “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.