19-410

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 2019 AMENDMENT NO.2
Guidance for the Survey and Construction of Steel Ships
Part D 2019 AMENDMENT NO.2

Rule No.103 / Notice No.70 27 December 2019
Resolved by Technical Committee on 22 July 2019

ClassNK
NIPPON KAIJI KYOKAI

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

RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part D Machinery Installations

2019 AMENDMENT NO.2

Rule No.103 27 December 2019

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Rule No.103 27 December 2019
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 1 GENERAL

1.3 General Requirements for Machinery Installations

1.3.1 General*

(-1 to -5 are omitted.)

6 Main propulsion machinery and prime movers for driving generators, and auxiliary machinery (excluding auxiliary machinery for specific use etc.) and their prime movers that are installed in the ships are to be designed to operate under the conditions given in **Table D1.1**. However, deviation from the angles given in **Table D1.1** may be permitted after taking into consideration the type, size and service conditions of the ship.

(-7 to -10 are omitted.)

Table D1.1 has been amended as follows.

Table D1.1 Angle of Inclination

Type of machinery installation	Athwartships(2)		~~Bow~~Fore-and-~~stern~~aft (2)	
	Static inclination (List)	Dynamic inclination (Rolling)	Static inclination (Trim)	Dynamic inclination (Pitching)
Main propulsion machinery Main boilers and essential auxiliary boilers Prime movers driving generators (excluding those for emergency) ~~a~~Auxiliary machinery (excluding auxiliary machinery for specific use, etc.) and their driving units	15°	22.5°	5° (4)	7.5°
Emergency installation (emergency generators, emergency fire pumps and prime movers to drive them) Switchgears(1)(Circuit breakers, etc.) Automatic or remote operated equipment	22.5° (3)	22.5° (3)	10°	10°

Notes:

(1) ~~Up to an angle of inclination of 45 degrees,~~No undesired switching operations or operational changes are ~~not~~ to ~~be caused~~occur.

(2) Athwartships and ~~bow~~fore-and-~~stern~~aft inclinations may occur simultaneously.

(3) In ships intended for the ~~carrying~~carriage of ~~either~~ liquefied gases ~~or~~and of dangerous chemicals ~~in bulk, the arrangement is to be such that~~ the emergency power supply ~~must~~is to also remain operable with the ship flooded to a final athwartships inclination up to ~~a~~ maximum of 30°. ~~degrees~~

(4) Where the length of the ship exceeds 100 *m*, the fore-and-aft static angle of inclination may be taken as follows:
$\theta = 500/L$
θ : The static angle of inclination (°)
L : Length of the ship specified in **2.1.2, Part A** (*m*)

Chapter 11 WELDING FOR MACHINERY INSTALLATIONS

11.6 Welding of Piping

Paragraph 11.6.1 has been amended as follows.

11.6.1 Scope

1 The requirements in **11.6** apply to the welding of pipes.

2 The requirements in ~~**11.6**~~ **11.6.2**, **11.6.3** and **11.6.4** apply to the welding of pipes~~, valves and pipe fittings~~ belonging to Group I and II specified in **Chapter 12** and valves and pipe fittings used for these pipes.

Paragraph 11.6.5 has been amended as follows.

11.6.5 Non-destructive Testing*

~~**1** Butt weld joints of Group I pipes having nominal diameters exceeding 65 *A* are to be subjected to full radiographic testing.~~

~~**2** Butt weld joints of Group I pipes having nominal diameters not more than 65 *A* and Group II pipes having nominal diameters exceeding 90 *A* are to be subjected to a radiographic testing by sampling in accordance with the instructions of the Surveyor.~~

~~**3** The Society may approve other appropriate non-destructive testing in lieu of a radiographic testing.~~

1 In general, the welded joints including the inside wherever possible are to be visually examined and the following **(1)** to **(3)** non-destructive tests are required depending on the class of pipes and type of joint.

(1) The following **(a)** to **(d)** apply to butt-welded joints.
- (a) Butt-weld joints of Group I pipes whose nominal diameters are greater than 65 *A* are to be subjected to full radiographic testing.
- (b) Butt-weld joints of Group II pipes whose nominal diameters are greater than are greater than 90 *A* are be subjected to at least 10% random radiographic testing.
- (c) The Society may additionally require butt-weld joints other than those specified in **(a)** and **(b)** to be subjected to random radiographic testing, depending on the kind of materials, welding procedure and controls during the fabrication.
- (d) Subject to approval by the Society, an ultrasonic testing procedure may be accepted, in lieu of the radiographic testing specified in **(a)** to **(c)** above when the conditions are such that a comparable level of weld quality is assured.

~~**5**~~(2) ~~With respect to the fillet welding of Group I or Group II pipes~~ Fillet welds of flange pipe connections in the case of Group I pipes are to be examined by the magnetic particle method or by other appropriate non-destructive methods. In other cases (e.g. fillet welds of flange pipe connections in the case of Group II or Group III pipes and sleeve welded joints), the

~~Society~~ Surveyor, in consideration of the material, dimensions and service conditions of the pipes, etc., may require a magnetic particle examination or ~~other suitable examination~~ equivalent non-destructive testing.

~~6~~(3) The Society, in consideration of the ~~welding materials or the welding procedure~~ material, dimensions and service conditions of the pipes, etc., may require ~~a special examination~~, additional ultrasonic examinations, in addition to the non-destructive tests specified in **(1)** and **(2)** above.

2 Radiographic and ultrasonic examination is to be performed with an appropriate technique by trained operators.

3 Magnetic particle examinations are to be performed with suitable equipment and procedures, and with a magnetic flux output sufficient for defect detection. The Society may require the equipment to be checked against standard samples.

4 The requirements in **11.4.5-2** to **-7** are to be applied to radiographic testing. The radiographic testing, however, may be conducted in another appropriate method in lieu of the radiographic testing using a radiograph film in cases where the Society specifically grants approval.

Chapter 12 PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES

12.2 Thickness of Pipes

12.2.2 Minimum Thickness of Pipes*

Sub-paragraph -5 has been added as follows.

1 The thickness of steel pipes is to comply with the requirements in **12.2.1** and is not to be less than the value shown in **Table D12.6** depending on the service and location of the pipes. However, where corrosion resistant alloy steel pipes are used in lieu of steel pipes, the minimum thickness of these pipes will be considered by the Society in each case.

2 For pipes efficiently protected against corrosion, the minimum thickness specified in **Table D12.6(2)** may be reduced by an amount up to but not more than 1 *mm* except for steel pipes for CO_2 fire extinguishing.

3 In determining the thickness of pipes from **Table D12.6(2)**, no allowance need be made for any negative tolerance and reduction in thickness due to bending. However, for threaded pipes their minimum thickness is to be measured at the bottom of the thread, with the exception of the threaded portions for fitting the pipe head of air pipes, overflow pipes and sounding pipes as well as the threaded portions of pipes used for CO_2 fire extinguishing from the distribution station to the nozzles.

4 The minimum thickness of copper and copper alloy pipes is to be as shown in **Table D12.7**.

5 Minimum wall thickness of pipes for which mechanical joints are used is also to comply with the requirements in **12.3.3-3**, in addition to **-1** to **-4**.

12.3 Construction of Valves and Pipe Fittings

Paragraph 12.3.3 has been amended as follows.

12.3.3 Mechanical Joints*

1 Mechanical joints are to be ~~of a Society approved type as well as be adequate for their intended service conditions and application. Their~~ of construction and type ~~are to~~ according to the examples of mechanical joints shown in **Fig. D12.1**. Similar joints certified by the Society to comply with the requirements in this **12.3.3** and **13.2.4** may be acceptable.

2 ~~conform to the examples in **Fig. D12.1**, according to their respective application classifications shown in **Table D12.8** and **Table D12.9**~~ Pipe unions, compression couplings, slip-on joints and similar joints are to be of type approved by the Society for the service conditions, the intended application and pressure ratings in accordance with standards separately specified by the Society.

~~**5**~~**3** In cases where the application of mechanical joints results in ~~any~~ reduction in pipe wall thickness due to the use of bite type rings or other structural elements, this is to be taken into account in determining the minimum wall thickness of the pipe to withstand the design pressure.

~~**7**~~**4** The material of mechanical joints is to be compatible with the piping material and internal and external media.

5 Mechanical joints are to be tested to a burst pressure of 4 times the design pressure. For design pressures above 20 *MPa* the required burst pressure will be specially considered by the Society.

6 Where required by **Table D12.8**, mechanical joints are to be of fire resistant type approved by the Society.

7 Mechanical joints are to be tested in accordance with a program approved by the Society in accordance with standards separately specified by the Society; such a programme is to include at least the following **(1)** to **(8)**:

(1) leakage test;
(2) vacuum test (where deemed necessary by the Society);
(3) vibration (fatigue) test;
(4) fire endurance test (where deemed necessary by the Society);
(5) burst pressure test;
(6) pressure pulsation test (where deemed necessary by the Society);
(7) assembly test (where deemed necessary by the Society); and
(8) pull out test (where deemed necessary by the Society).

~~**2** Mechanical joints which in the event of damage could cause a fire or flooding are not to be used in piping sections directly connected to the ship's side below the freeboard deck or tanks containing flammable fluids.~~

~~**3** Piping which has been fitted with a mechanical joint is to be adequately adjusted, aligned and supported. Supports or hangers are not to be used to force the alignment of piping at the point of connection.~~

~~**4** Slip-on joints are not to be used inside tanks except for those used for pipes for the same medium as in the tank. Usage of slip type slip-on joints as the main means of pipe connection is not permitted except in cases where compensation of axial pipe deformation is necessary.~~

~~**6** Mechanical joints are to be constructed so that any possibility of tightness failure due to pressure pulsation, piping vibration, temperature variation and other similar adverse effects occurring during operation on board is prevented.~~

~~**8** Mechanical joints are to be designed to withstand internal and external pressure as applicable~~

~~and in cases where they are used in suction lines; the joints are to be capable of operating under a vacuum.~~

~~**9** The installation of mechanical joints is to be in accordance with the manufacturer's assembly instructions. In cases where special tools and gauges are required for installation of these joints, these are to be supplied by the manufacturer.~~

12.6 Tests

Paragraphs 12.6.1 and 12.6.2 have been amended as follows.

12.6.1 Shop Tests*

1 Tests of welds in piping systems and auxiliaries are to comply with the requirements in **Chapter 11** ~~of this Part~~.

2 ~~Pipes~~ All pipes in Group I and Group II and integral fittings as well as, in all cases, all steam pipes, feed ~~water~~ pipes such as feed water pipes, compressed air pipes and fuel oil pipes ~~with the~~ having a design pressure ~~exceeding~~ greater than 0.35 *MPa* are to be subjected to hydrostatic tests together with the ~~welded fittings~~ relative integral fittings, after completion of ~~all the fabrication process~~ manufacture but before insulation and coating at a pressure equal to 1.5 times the design pressure. ~~This test may be carried out after installation on board.~~ For steel pipes and integral fittings having design temperatures above 300 °*C*, the requirements specified in **-3** below apply to the test pressure of hydrostatic tests.

3 The value pressure of hydrostatic tests for ~~S~~steel pipes and integral fittings ~~with~~ having a design temperature ~~exceeding~~ above 300 °*C* ~~are~~ is to ~~be subjected to a hydrostatic test at the pressure~~ that determined by the formula below. However, in cases where the pressure determined by ~~this~~ said formula is greater than 2 times the design pressure ~~value~~, the pressure of hydrostatic tests may be reduced to a ~~value of~~ pressure equal to 2 times the design pressure ~~value may be used~~. In addition, ~~when there is a fear of~~ in order to avoid ~~any~~ excessive stress in way of bends, T-pieces, etc., the value of test pressure may be reduced to 1.5 times the design pressure, subject to the approval by the Society. ~~This test may be carried out after installation on board.~~

$$P_t = 1.5\frac{K_{100}}{K_t}P$$

where

P_t : Test pressure (*MPa*)

K_{100} : ~~Allowable~~ Permissive stress of pipe material at 100 °*C* (N/mm^2)

K_t : ~~Allowable~~ Permissive stress of pipe material at the design temperature (N/mm^2)

P : Design pressure (*MPa*)

4 In cases where primary general membrane stress in the pipe wall is expected to exceed 90 % of the specified yield stress or proof stress, at the test pressure specified in **-2** and **-3**, the test pressure is to be ~~lowered to decrease~~ reduced so that such stress does not exceed the stress to 90% of the specified yield stress or proof stress at the testing temperature.

5 Valves and pipe fittings non-integral with the piping system ~~used~~ intended for pipes in Group I and Group II are to be subjected to hydrostatic tests in accordance with standards recognized by the Society, but at a pressure equal to 1.5 times the design pressure.

6 Valves and distance pieces fitted to the ship's side below the load line are to be subjected to hydrostatic tests at a pressure of 1.5 times the design pressure or 0.5 *MPa*, whichever is greater.

7 The pressure parts of auxiliaries (excluding auxiliary machinery for specific use etc.) are to be subjected to hydrostatic tests at a pressure equal to 1.5 times the design pressure or 0.2 *MPa*, whichever is greater.

8 Free standing fuel oil storage tanks are to be subjected to hydrostatic tests at a pressure corresponding to a water head of 2.5 *m* above the top plate.
9 Auxiliaries (excluding auxiliary machinery for specific use etc.) are to be subjected to running tests as deemed appropriate by the Society.
10 When, for technical reasons, it is not possible to carry out complete hydrostatic testing specified in **-2** and **-3** above before assembly on board, for all sections of piping, the testing may be carried out in conjunction with the checking required by **13.17.2-3** or **14.6.2-2** provided that the test plans referred to in **2.1.4-5, Part B** containing the closing lengths of piping, particularly in respect to the closing seams, are submitted to the Society and approved.

12.6.2 Tests after Installation On Board~~.~~*

~~In cases where joints between pipes or between pipes and valves are welded aboard ship, such piping systems are to be subjected to hydrostatic tests as deemed appropriate by the Society.~~ The applicable requirements in **13.17.2-3** or **14.6.2-2**, apply to tests of piping systems after assembly on board.

Chapter 13 PIPING SYSTEMS

13.2 Piping

13.2.1 General*

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

5 Protection of piping systems and fittings
(1) All pipes, including seawater pipes, valves, cocks, pipe fittings, valve operating rods, handles, etc. ~~located at positions~~ are to be protected from mechanical damage in cases where they are located in cargo holds or ~~on weather decks~~ other spaces where they ~~are liable to be damaged are to be adequately protected~~ may be subject to impacts (e.g. fish holds, chain lockers). Where a casing is provided for protection, ~~it~~ the casing is to be ~~so~~ constructed ~~that it can be~~ so as to facilitate ~~easily removed~~ easy removal for inspection.
((2) is omitted.)

Paragraph 13.2.4 has been amended as follows.

13.2.4 ~~Slip-on Joints~~ Mechanical Joints*

1 The requirements of this **13.2.4** applies to pipelines where the pipe unions, compression couplings and slip-on joints specified in **12.3.3** are used and also correspondingly apply to pipelines where similar joints are used.
2 Application of mechanical joints and their acceptable use is to be in accordance with the following **-3** to **-7**, in addition to the requirements in **Table D12.8** for each service and the requirements in **Table D12.9** depending upon the class of pipes and pipe dimensions. In particular cases, sizes of mechanical joints in excess of those specified in **Table D12.9** may be accepted by the Society in cases where such mechanical joints comply with a national and/or international standard

recognized by the Society.

3 Mechanical joints, which in the event of damage could cause fire or flooding, are not to be used in piping sections directly connected to the ship's side below the freeboard deck of cargo ships or tanks containing flammable fluids.

4 The number of mechanical joints in the flammable fluid systems specified in **Table D12.8** is to be kept to a minimum. In general, flanged joints conforming to standards recognized by the Society are to be used.

5 Piping in which a mechanical joint is fitted is to be adequately adjusted, aligned and supported. Supports or hangers are not to be used to force alignment of piping at the point of connection.

6 The following **(1)** to **(3)** limitations apply to use of slip-on joints, in addition to **-2** to **-5** above.

(1) Slip-on joints are not to be used on pipe-lines in cargo holds, ~~deep~~ tanks and other spaces which are not easily accessible, unless approved by the Society.

(2) Application of slip-on joints inside tanks may be permitted only for the same media that is in the tanks; this includes those tanks specified in **(1)** above.

(3) Usage of slip type slip-on joints as the main means of pipe connection is not permitted except in cases where compensation of axial pipe deformation is necessary.

7 The installation of mechanical joints is to be in accordance with the manufacturer's assembly instructions. Where special tools and gauges are required for installation of the joints, these are to be supplied by the manufacturer.

13.17 Tests

Paragraph 13.17.2 has been amended as follows.

13.17.2 Tests On Board

(-1 is omitted.)

2 For piping systems for which welding between pipes or between pipes and pipe fittings is carried out on board the ship, all joints welded on board the ship are to be subjected to the non-destructive testing specified in **11.6**.

~~2~~**3** In general, all the piping systems are, after assembly on board, to be checked for leakage under operational conditions and, if necessary, using special techniques other than hydrostatic testing. In particular, ~~F~~fuel oil piping systems, thermal oil piping systems and heating coils in tanks are, after installed on board, to be subjected to a leak test at a pressure of 1.5 times the design pressure or 0.4 *MPa*, whichever is greater.

Chapter 14 PIPING SYSTEMS FOR TANKERS

14.6 Tests

Paragraph 14.6.2 has been amended as follows.

14.6.2 Tests after Installation On Board

1 For piping systems for which welding between pipes or between pipes and pipe fittings is carried out on board the ship, all joints welded on the board ship are to be subjected to the non-destructive testing specified in **11.6**.

~~**1**~~**2** Cargo oil pipes, after the completion of their installation, are to be subjected to leak tests at a pressure~~s of~~ not less than 1.25 *times* ~~or greater their~~ the design pressure~~s~~.

~~**2**~~**3** Heating pipes inside cargo oil tanks are, after assembly on board, to be subjected to leak tests at a pressure~~s of~~ not less than 1.5 *times* ~~or greater their~~ the design pressure~~s~~ or 0.4 *MPa*, whichever is greater. ~~However, the test pressure is to be at least 0.4 *MPa* or more.~~

~~**3**~~**4** After installation on board, auxiliaries and piping systems are to be subjected to the following tests:

(1) Function tests of cargo oil pumps.

(2) Function tests of various systems concerning the safety measures specified in this Chapter.

EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

1. The effective date of the amendments is 1 January 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.

* "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 2-2

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 D2.1**. 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 D2.1**.

2 (Omitted)

Table D2.1 has been amended as follows.

Table D2.1 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)								○	○(~~8~~)	
11	Cross head (5)		○	○(~~8~~)		○	○(~~8~~)		○	○(~~8~~)	
12	Connecting rods together with connecting rod bearing caps		○	○	○	○	○	○	○	○	○
13	Bolts and studs (for cylinder heads, connecting rods, main bearings)					○	○	*TR*(~~9~~8)	○	○	*TR*(~~9~~8)
14	Tie rod (5)		○	○	*TR*(~~9~~8)	○	○	*TR*(~~9~~8)	○	○	*TR*(~~9~~8)
15	Fuel injection pump body		○(9)			○(9)			○(9)		
~~15~~ 16	High pressure fuel injection pipes including common fuel rail		○			○			○		
~~16~~ 17	High pressure common servo oil system		○			○			○		
~~17~~ 18	Heat exchanger, both sides (~~9~~10)					△			△		
~~18~~ 19	Accumulator ~~of common rail fuel or servo oil system~~ (11)		○			○			○		
~~19~~ 20	Piping, pumps, actuators, etc. for hydraulic drive of valves (12)		○(13)			○(13)			○(13)		
~~20~~ 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)		○			○			○		
~~21~~ 22	Bearings for main, crosshead, and crankpin (12)		*TR*(14)	*TR*(15)	○	*TR*(14)	*TR*(15)	○	*TR*(14)	*TR*(15)	○
~~22~~ 23	Turbine discs, blades, blower impellers and rotor shafts of exhaust driven turbochargers (16)		○	○		○	○		○	○	
~~23~~ 24	Casings of exhaust driven turbochargers (16)		○(17)			○(17)			○(17)		

Notes:

(1) Materials intended for the components marked by "○" or "*TR*" in Column I are to comply with the requirements in **Part K**. 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 10**.

(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. ~~be signed by the manufacturer and state that components comply with specifications stipulated by the manufacturer. Such specifications are to be submitted to the Society in advance.~~ 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) ~~which comply with the requirements of national or international standards such as *ISO*, *JIS*, etc. may be used~~, except when used for steel parts.

~~(8) After final machining, a magnetic particle test or a liquid penetrant test is to be carried out again.~~

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

2.6 Tests

2.6.1 Shop Tests*

1 For components or accessories specified in **Table D2.6**, 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 D2.6**.

Table D2.6 has been amended as follows.

Table D2.6 Hydrostatic Test Pressure

Part		Cylinder bore D (mm)		Test Pressure[~~1~~2] (MPa)
		$D \leq 300$	$300<D$	
Cylinder block (gray cast iron or spheroidal graphite cast iron) ~~(2)~~ (3) (4)		○	○	1.5P
Engine block (gray cast iron or spheroidal graphite cast iron) (3) (4)		○	○	1.5P
Cylinder liner [~~3~~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)		○	○	0.4 or 1.5P, whichever is greater
Heat exchanger, both sides			○	1.5P
Exhaust gas valve cage [~~2~~8]		○	○	1.5P
Accumulator ~~of common rail fuel or servo oil system~~ [~~8~~9]		○	○	1.5P
Piping, pumps, actuators, etc. for hydraulic drive of valves [~~9~~10]		○	○	1.5P
Engine driven pumps (oil, water, fuel, bilge) [~~9~~10]		○	○	1.5P
Piping system other than those listed in this Table		○	○	Apply the requirements in **12.6**

Notes:

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

(~~1~~2) P is the maximum working pressure (MPa).

(~~4~~3) Only when engine power exceeds 400 kW/cyl.

(~~3~~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. ~~be signed by the manufacturer and state that components comply with specifications stipulated by the manufacturer. Such specifications are to be submitted to the Society in advance.~~ 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.

(~~2~~8) Only for crosshead diesel engines.

(~~8~~9) Only when capacity exceeds 0.5l.

(~~9~~10) Only when engine power exceeds 800 kW/cyl.

EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

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

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

Amendment 2-3

Chapter 2 DIESEL ENGINES

2.4 Safety Devices

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 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.

EFFECTIVE DATE AND APPLICATION (Amendment 2-3)

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

2. Notwithstanding the amendments to the Rules, the current requirements apply to diesel engines other than those which fall under the following:

(1) diesel engines for which the application for approval is submitted to the Society on or after the effective date; or

(2) diesel engines installed 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.

Amendment 2-4

Chapter 6 SHAFTINGS

6.2 Materials, Construction and Strength

6.2.10 Stern Tube Bearings and Shaft Bracket Bearings*

Sub-paragraph -1 has been amended as follows.

1 The aftermost stern tube bearing or shaft bracket bearing which supports the weight of propeller is to comply with the following requirements **(1)**~~,~~ and **(2)**~~ and (3)~~:

(1) In the case of ~~water~~ oil lubricated bearings~~ of lignumvitae~~.

~~(a) The bearing length is not to be less than 4 times the required diameter of the propeller shaft given by the formula in **6.2.4-1** or **-2**, or 3 times the actual shaft diameter, whichever is greater.~~

~~(b) Adequate means are to be provided to supply ample amount of clean water for lubrication and cooling.~~

(~~2~~a) In the case of ~~oil lubricated bearings of~~ white metal.

~~(a)~~i) The length of the bearing is not to be less than twice the required diameter of the propeller shaft given by the formulae in either **6.2.4-1** or **-2**~~, or 1.5 times the actual diameter, whichever is greater~~. However, where the nominal bearing pressure (determined by the static bearing reaction calculation taking into account shaft and propeller weight which is deemed to be exerted solely on the aft bearing divided by the projected area of the shaft in way of the bearing, hereinafter defined the same way in this chapter) is not more than 0.8 *MPa* and special consideration is given on the construction and arrangement in accordance with provisions specified elsewhere and specially approved by the Society, the length of the bearing may be fairly shorter than that specified above. However, the minimum length is to be not less than 1.5 times the actual diameter of the propeller shaft.

~~(b)~~ii) The stern tube is to be always filled with oil. Adequate means are to be provided to measure the temperature of oil in the stern tube.

~~(c)~~iii) In cases where a gravity tank supplying lubricating oil to the stern tube bearing is fitted, it is to be located above the load water line and provided with a low level alarm device. However, in cases where the lubricating system is designed to be used under the condition that the static oil pressure of the gravity tank is lower than the water pressure, the tank is not required to be above the load water line.

~~(d)~~iv) The lubricating oil is to be cooled by submerging the stern tube in the water of the after peak tank or by some other suitable means.

~~(3) In cases where bearing materials other than **(1)** and **(2)** above are intended to be used, the materials, construction and arrangement are to be approved by the Society. The length of these bearings is to comply with the following requirements in **(a)** and **(b)**:~~

(~~a~~b) In the case of ~~oil lubricated bearing of synthetic~~ materials other than white metal~~;~~.

i) The materials, construction and arrangement are to be approved by the Society.

ii) For bearings of synthetic rubber, reinforced resin or plastics materials which are approved for use as oil lubricated stern tube bearings, the length of the bearing is to be not less than twice the required diameter of the propeller shaft given by the

formulae in either **6.2.4-1** or **-2**~~, or 1.5 times the actual diameter, whichever is greater~~. However, ~~for~~ where nominal bearing pressure is not more than 0.6 *MPa* and bearings have~~ing~~ a construction and arrangement specially approved by the Society, the length of the bearing may be fairly shorter than that specified above. However, the minimum length is to be not less than 1.5 times the actual diameter of the propeller shaft.

iii) Notwithstanding the requirement given in **ii)**, the Society may allow use of bearings whose nominal bearing pressure is more than 0.6 *MPa* where the material has proven satisfactory testing and operating experience

(~~b~~2) In the case of water lubricated bearings~~ of synthetic materials;~~.

(a) The materials, construction and arrangement are to be approved by the Society.

(b) ~~For bearings of synthetic materials which are approved for use as water lubricated stern tube bearings such as rubber or plasties, t~~The length of the bearing is to be not less than 4 times the required diameter of the propeller shaft given by the formulae in either **6.2.4-1** or **-2**, or 3 times the actual diameter, whichever is greater. However, ~~for bearings having a construction and arrangement specially approved by the Society, the length of the bearing may be fairly shorter than that specified above~~ for bearings of synthetic materials, such as rubber or plastics, that are approved for use as water lubricated stern tube bearings and where special consideration is given to their construction and arrangement in accordance with provisions specified elsewhere, the length of the bearing may be fairly shorter than that specified above. However, minimum length is to be not less than twice the required diameter of the propeller shaft given by the formulae in either **6.2.4-1** or **-2**, or 1.5 times the actual diameter, whichever is greater.

2 Sealing devices, other than gland packing type water sealing devices, are to be approved by the Society with regards to materials, construction and arrangement.

EFFECTIVE DATE AND APPLICATION (Amendment 2-4)

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

Amendment 2-5

Chapter 12 PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES

12.3 Construction of Valves and Pipe Fittings

12.3.3 Mechanical Joints*

Fig. D12.1 has been amended as follows.

Fig D12.1 Examples of Mechanical Joints

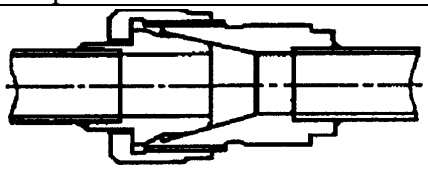
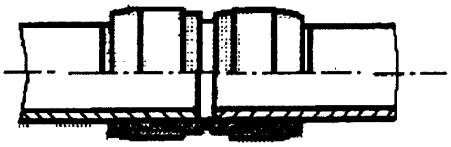
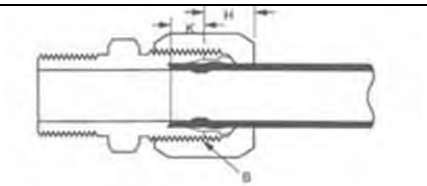
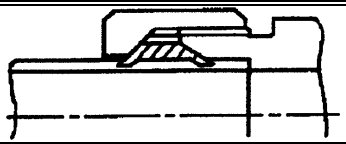
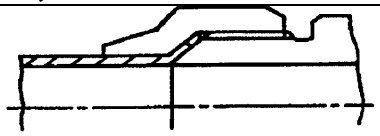
Pipe Unions	
Welded and Brazed Types	
Compression Couplings	
Swage Type	
Press Type	
Typical Compression Type	
Bite Type	
Flared Type	

Fig D12.1 Examples of Mechanical Joints (Continued)

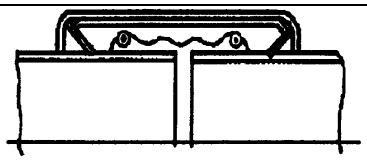
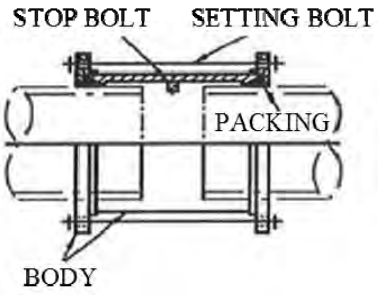
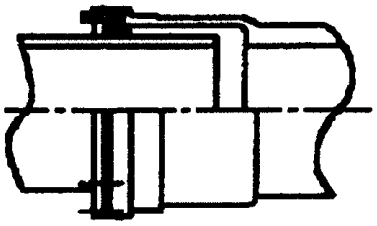
<table>
<tr><td colspan="3">Slip-on Joints</td></tr>
<tr><td>Grip Type</td><td colspan="2">  </td></tr>
<tr><td>Machine Grooved Type</td><td colspan="2"> 
Roll Groove
 
Cut Groove</td></tr>
<tr><td>Slip Type</td><td>  </td><td>  </td></tr>
</table>

Table D12.8 has been amended as follows.

Table D12.8 Application Classifications of Mechanical Joints[1]

Application Purpose	System	Kind of Connections[2]		
		Pipe Union	Compression Coupling	Slip-on Joint[10]
Flammable fluids[~~8~~9] (Flash point □60 Material ˚C)	Cargo oil lines[6]	+	+	+
	Crude oil washing lines[6]	+	+	+
	Vent lines[5]	+	+	+
Inert gases	Water seal effluent lines	+	+	+
	Scrubber effluent lines	+	+	+
	Main lines[4][6]	+	+	+
	Distributions lines[6]	+	+	+
Flammable fluids[~~8~~9] (Flash point > 60 ˚C)	Cargo oil lines[6]	+	+	+
	Fuel oil lines[4][5]	+	+	+
	Lubricating oil lines[4][5]	+	+	+
	Hydraulic oil[4][5]	+	+	+
	Thermal oil[4][5]	+	+	+
Sea Water	Bilge lines[3]	+	+	+
	Water filled fire extinguishing systems, e.g. sprinkler systems[5]	+	+	+
	Non water filled fire extinguishing systems, e.g. foam, drencher systems[5]	+	+	+
	Fire main[5]	+	+	+
	Ballast systems[3]	+	+	+
	Cooling water systems[3]	+	+	+
	Tank cleaning services	+	+	+
	Non-essential systems	+	+	+
Fresh water	Cooling water systems[3]	+	+	+
	Condensate returns[3]	+	+	+
	Non-essential systems	+	+	+
Sanitary/ Drains/ Scuppers	Deck drains (internal)[7]	+	+	+
	Sanitary drains	+	+	+
	Scuppers and discharges (overboard)	+	+	-
Sounding/Vents	Water tanks/Dry spaces	+	+	+
	Oil tanks (f.p.> 60 ˚C)[4][5]	+	+	+
Miscellaneous	Starting/Control air[3]	+	+	-
	Service air (non-essential)	+	+	+
	Brine	+	+	+
	CO_2 systems[3]	+	+	-
	Steam	+	+	-[~~9~~8]

Notes:

(1) +: Application is allowed; -: Application is not allowed

(2) If mechanical joints include any components which readily deteriorate in case of fire, ~~they are to be of a Society approved fire resistant type under consideration of~~ the following **(3)** to **(6)**~~:~~ apply.

(3) ~~Only Society approved fire resistant types may be used~~ ~~:~~Inside machinery spaces of category *A*~~.~~, fire resistant types approved by the Society.

(4) ~~May not be used~~ Slip-on joints are not accepted inside machinery spaces of category *A* or accommodation spaces. May be ~~used~~ accepted in machinery spaces other than those of category *A* ~~ones~~ provided that the joints are located in easily visible and accessible positions.

(5) ~~Only Society approved~~ ~~:~~Fire resistant types ~~may be used~~ approved by the Society except in cases where such mechanical joints are installed on ~~exposed~~ open decks~~,~~ as defined in **9.2.3-2(10), Part R of the Rules~~.~~; ~~except for~~ this excludes spaces in the cargo areas of tankers, ships carrying liquefied gases in bulk and ships carrying dangerous

chemicals in bulk (as defined in **3.2.6, Part R**, **1.1.4(6), Part N** and **1.3.1(4), Part S**), ~~and are~~ but not used for fuel oil lines, fire extinguishing systems and fire mains.

(6) ~~Only Society~~ In pump rooms and open decks, ~~approved~~ fire resistant types approved by the Society ~~may be used in pump rooms and on open decks~~.

(7) ~~May only be used~~ Only above the free~~-~~board deck.

(~~9~~8) Slip type slip-on joints as shown in **Fig. D12.1** may be used for pipes on deck with a design pressure of 1.0 *MPa* or less.

(~~8~~9) ~~The number of~~ Piping where mechanical joints are used ~~in flammable fluid systems is to be kept to a minimum. In general, flanged joints which conform to recognized standards are to be used~~ is also to comply with the requirements specified in **13.2.4-4**.

(10) ~~The use of~~ Piping where slip joints are used is also to comply with the requirements specified in **13.2.4-6**.

Table D12.9 has been amended as follows.

Table D12.9 Application Classifications of Mechanical Joints Depending upon the Class of ~~Piping~~ Pipes to which the Mechanical Joints are Fitted (1)

Types of Joints		Classes of ~~Piping Systems~~ Pipes		
		Group I	Group II	Group III
Pipe Unions	Welded and brazed type	+(2)	+(2)	+
Compression Couplings	Swage type	+	+	+
	Bite type	+(2)	+(2)	+
	Typical compression type	+(2)	+(2)	+
	Flared type	+(2)	+(2)	+
	Press type	-	-	+
Slip-on joints	Machine grooved type	+	+	+
	Grip type	-	+	+
	Slip type	-	+	+

Notes:

(1) + Application is allowed, - Application is not allowed.

(2) May be used for pipes ~~of a~~ whose nominal diameter ~~of~~ is 50*A* or ~~below~~ less.

EFFECTIVE DATE AND APPLICATION (Amendment 2-5)

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

2. Notwithstanding the amendments to the Rules, the current requirements apply to mechanical joints other than those which fall under the following:

(1) mechanical joints for which the application for approval of use is submitted to the Society on or after the effective date;

(2) mechanical joints for which the date of renewal of approval of use is on or after the effective date; or

(3) mechanical joints 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.

Amendment 2-6

Chapter 13 PIPING SYSTEMS

13.2 Piping

13.2.5 Bulkhead Valves*

Sub-paragraph -2 has been amended as follows.

1 Valves or cocks, such as drain valves, which do not constitute any part of a piping system is not to be fitted on collision bulkheads.
2 Pipes passing through collision bulkheads are to be fitted with suitable screw-down valves or butterfly valves suitably supported by a seat or flanges that are operable from above the ~~bulkhead~~ freeboard deck and valve chests are to be secured to a bulkhead located inside the forepeak. However, these valves may be fitted on the aft side of the collision bulkhead in question provided that the valves are readily accessible under all service conditions, and that the space in which they are located is not a cargo space. Remote control devices for these valves may be omitted.
3 Valves and cocks, such as drain valves, which do not constitute any part of a piping system, may be fitted on watertight bulkheads other than collision bulkheads, provided that they are readily accessible at any time for inspection. Such valves and cocks are to be operable from above the bulkhead deck and are to be provided with an indicator to show whether they are open or closed, except in cases where the valves or cocks are secured to a fore or aft bulkhead located inside the engine room.
4 Means for controlling valves or cocks from above freeboard decks or bulkhead decks are to be constructed so that the weights thereof are not supported by the valves or the cocks.

13.4 Scuppers, Sanitary Discharges, etc.

13.4.1 General*

Sub-paragraph -1 has been amended as follows.

1 Scupper pipes, sufficient in number and size, to provide effective drainage are to be provided for all decks. However, the Society may permit this means of drainage to be dispensed with in any particular compartment of any ship or class of ship, if it is satisfied that, due to the size or internal subdivision of those spaces, the safety of the ship is not thereby impaired. For the special hazards associated with loss of stability when fitted with fixed pressure water-spraying fire-extinguishing systems refer to **20.5.1-4, Part R**.

EFFECTIVE DATE AND APPLICATION (Amendment 2-6)

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

2. Notwithstanding the amendments to the Rules, the current requirements apply to ships other than ships that fall under the following:

(1) for which the contract for construction is placed on or after the effective date;

(2) in the absence of a contract for construction, the keels of which are laid or which are at *a similar stage of construction* on or after 1 July 2020; or

(3) the delivery of which is on or after 1 January 2024.

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.

Amendment 2-7

Chapter 17 REFRIGERATING MACHINERY AND CONTROLLED ATMOSPHERE SYSTEMS

17.1 General

17.1.1 Scope*

Sub-paragraph -1 has been amended as follows.

1 The requirements in this chapter apply to refrigerating machinery using the primary refrigerants listed below and those forming refrigerating cycles used for refrigeration, air conditioning, etc., as well as any controlled atmosphere systems for cargo holds. However, any refrigerating machinery with compressors of 7.5 *kW* or less and any refrigerating machinery using primary refrigerants other than those listed below are to be as deemed appropriate by the Society.

~~*R22 : $CHClF_2$*~~
*R*134*a* : CH_2FCF_3
*R*404*A* : *R*125/*R*143*a*/R134*a* (44/52/4 *wt*%) CHF_2CF_3 / CH_3CF_3 / CH_2FCF_3
*R*407*C* : *R*32/*R*125/*R*134*a* (23/25/52 *wt*%) CH_2F_2 / CHF_2CF_3 / CH_2FCF_3
*R*407*H* : *R*32/*R*125/*R*134*a* (32.5/15/52.5 *wt*%) CH_2F_2 / CHF_2CF_3 / CH_2FCF_3
*R*410*A* : *R*32/*R*125 (50/50 *wt*%) CH_2F_2 / CHF_2CF_3
*R*449*A* : *R*32/*R*125/*R*1234*yf*/*R*134*a* (24.3/24.7/25.7/25.3 *wt*%)
CH_2F_2 / CHF_2CF_3 / $CF_3CF=CH_2$/CH_2FCF_3
*R*507*A* : *R*125/*R*143*a* (50/50 *wt*%) CHF_2CF_3 / CH_3CF_3

17.2 Design of Refrigerating Machinery

17.2.1 General

The design pressure of pressure vessels and piping systems and the class of pipes used for refrigerating machinery are to be as follows:

(1) The design pressure of the pressure vessels and piping systems used for the refrigerating machinery and exposed to the pressure of the refrigerant is not to be less than the pressure in **Table D17.1** depending on the kind of refrigerant.

((2) is omitted.)

Table D17.1 has been amended as follows.

Table D17.1 Design Pressure of Pressure Vessels and Piping Systems for Refrigerating Machinery

Refrigerants	High Pressure Side[(1)] (*MPa*)	Low Pressure Side[(2)] (*MPa*)
~~*R22*~~	~~1.9~~	~~1.5~~
*R*134*a*	1.4	1.1
*R*404*A*	2.5	2.0
*R*407*C*	2.4	1.9
*R*407*H*	2.5	2.0
*R*410*A*	3.3	2.6
*R*449*A*	2.6	2.0
*R*507*A*	2.5	2.0

Notes:
(Omitted)

EFFECTIVE DATE AND APPLICATION (Amendment 2-7)

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

2. Notwithstanding the amendments to the Rules, the current requirements apply to refrigerating machinery, refrigerating installations or controlled atmosphere systems other than refrigerating machinery, refrigerating installations or controlled atmosphere systems that fall under the following:

(1) that intended for installation on ships the keels of which are laid or which are at a similar stage of construction on or after 1 January 2020; or

(2) that intended for installation on ships the keels of which are laid or which are at a similar stage of construction before 1 January 2020 that fall under the following:

(a) that for which the contractual delivery date of the equipment to the ship is on or after 1 January 2020; or

(b) that for which, in the absence of a contractual delivery date, the actual delivery of the equipment to the ship is on or after 1 January 2020.

3. Notwithstanding the provision of preceding **2.**, the amendment to the Rules may apply, upon request of the owner, to refrigerating machinery, refrigerating installations or controlled atmosphere systems other than those specified in **2.**(1) or (2) above.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part D Machinery Installations

2019 AMENDMENT NO.2

Notice No.70 27 December 2019

Resolved by Technical Committee on 22 July 2019

Notice No.70 27 December 2019
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

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

Part D MACHINERY INSTALLATIONS

Amendment 2-1

Annex D1.3.1-5(2) GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF EXHAUST GAS CLEANING SYSTEMS AND ASSOCIATED EQUIPMENT

1.1 General

1.1.1 Application

Sub-paragraphs -3 has been amended as follows.

3 In cases where exhaust gas cleaning systems which do not use chemical agents are used, the term "liquids containing sodium hydroxide solutions" is to be read as "liquids which have passed through scrubber chambers" ~~(excluding~~; this, however, does not apply to **-4**, **-9** and **-10** of **1.5.1**~~)~~.

EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

1. The effective date of the amendments is 27 December 2019.

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.

3. Notwithstanding the provision of preceding **2.**, the amendments to the Guidance may 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 upon request of the owner.

Amendment 2-2

D6 SHAFTINGS

D6.2 Materials, Construction and Strength

Paragraph D6.2.10 has been amended as follows.

D6.2.10 Stern Tube Bearings and Shaft Bracket Bearings

1 The wording "provisions specified elsewhere ~~and specially approved by the Society~~" in **6.2.10-1(~~2~~1)(a)i)**, **Part D of the Rules** means the following:

When ~~T~~the length of a bearing ~~may be~~ is less than twice the required diameter ~~that required~~ in accordance with ~~by~~ **6.2.10-1(~~2~~1)(a)i)**, **Part D of the Rules~~;~~**, the following **(1)** and **(2)** are, in principle, to be satisfied.~~ however, the minimum length of the bearing is not to be less than 1.5 times the actual diameter of the propeller shaft.~~

(1) Shaft alignment calculations are to be carried out in accordance with the requirements in **Annex D6.2.13** "**GUIDANCE FOR CALCULATION OF SHSFT ALIGNMENT**".

(2) For improving the lubricating condition of the bearing, the following measures are to be taken:

(a) A lubricating oil inlet is to be provided at the aft end of the bearing to ensure the forced circulation of the lubricating oil.

(b) Either of the following devices to measure stern tube bearing metal temperature at the aft end bottom along with high temperature alarms (with a preset value of 60℃ or below) is to be provided:

i) Two or more temperature sensors embedded in the metal; or

ii) An embedded temperature sensor, replaceable from inboard the ship, and a spare temperature sensor.

In this case, the replacement of such sensors according to procedures submitted beforehand is to be demonstrated.

(c) Low level alarms are to be provided for lubricating oil sump tanks.

2 The wording "construction and arrangement specially approved by the Society" in **6.2.10-1(~~3~~1)(~~a~~b)ii)**, **Part D of the Rules** means the following:

When ~~T~~the length of a bearing ~~may be~~ is less than twice the required diameter ~~that required~~ in accordance with ~~by~~ **6.2.10-1(~~3~~1)(~~a~~b)ii)**, **Part D of the Rules~~;~~**, the following **(1)** and **(2)** are, in principle, to be satisfied.~~however, the minimum length of a bearing is not to be less than 1.5 times the actual diameter of the propeller shaft.~~

(1) Nominal bearing pressure ~~(determined by the static bearing reaction divided by the projected area of the shaft in way of the bearing, hereinafter defined the same way in this Chapter)~~, etc. calculated in accordance with **Annex D6.2.13** "**GUIDANCE FOR CALCULATION OF SHAFT ALIGNMENT**" are to be within the allowable limits specified in the Type Approval Certificate.

(2) The measures for lubricating condition specified in **-1(2)** are to be taken.

3 The wording "~~construction and arrangement~~ provisions specified elsewhere ~~specially approved by the Society~~" in **6.2.10-1(~~3~~2)(b)**, **Part D of the Rules** means the following:

When ~~T~~the length of a bearing ~~may be~~ is less than 4 times the required diameter of the propeller shaft or less than 3 times the actual diameter, whichever is greater,~~that required~~ in accordance with ~~by~~ **6.2.10-1(~~3~~2)(b)**, **Part D of the Rules~~;~~**, the following **(1)** and **(2)** are, in principle, to be satisfied.~~however, the minimum length of a bearing is not to be less than twice the required~~

~~diameter of the propeller shaft given by the formula in **6.2.4-1**, **Part D of the Rules** or 1.5 times the actual diameter, whichever is greater.~~

(1) Nominal bearing pressure~~, under the assumption that the weight of shaft and propeller are loaded solely on the aftermost bearing,~~ is to be within the allowable limit specified in the Type Approval Certificate.

(2) Forced lubrication using water pumps is to be adopted and a non-flow alarm is to be provided at the lubricating water inlet.

EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

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

Amendment 2-3

D11 WELDING FOR MACHINERY INSTALLATIONS

D11.6 Welding of Piping

Paragraph D11.6.5 has been amended.

D11.6.5 Non-destructive Testing

1 When the non-destructive testing specified in **11.6.5, Part D of the Rules** is carried out, test plans are to be submitted to the Society for approval prior to testing in accordance with **2.1.4-5, Part B of the Rules**.

~~**1**~~**2** The criteria for acceptable defects detected by the radiographic testing are to be in accordance with **D11.4.5-1**.

~~**2**~~**3** The ultrasonic testing is to be in accordance with **D11.4.6-2**.

~~**3**~~**4** The magnetic particle testing and liquid penetrant testing are to be in accordance with **D11.4.6-3** and **D11.4.6-4** respectively.

5 The "when the conditions are such that a comparable level of weld quality is assured" referred to **11.6.5-1(1)(d), Part D of the Rules** means, for example, such case wheres well-documented quality assurance procedures and records are available to enable the Society to assess the ability of the manufacturer to produce satisfactory automatic welds consistently.

~~**4**~~**6** The wording "another appropriate method" referred to in **11.6.5-4, Part D of the Rules** means those specified in **D11.4.5-2(1)**.

D12 PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES

D12.3 Construction of Valves and Pipe Fittings

Paragraph D12.3.3 has been amended as follows.

D12.3.3 Mechanical Joints

1 The wording "~~mechanical joints are to be of a Society approved type~~ type approved by the Society" ~~stipulated~~ referred to in **12.3.3-~~1~~2, Part D of the Rules** ~~refers to those mechanical joints approved~~ means one whose approval of use is obtained in accordance with **Chapter 9, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

2 Details of the pressure referred to in **12.3.3-5, Part D of the Rules** are specified in **9.3.2(4)** of **Chapter 9, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

3 The wording "standards separately specified by the Society" referred to in **12.3.3-7, Part D of the Rules** refers to **Chapter 9, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

4 The wording "where deemed necessary by the Society" referred to in **(2)** and **(4)** as well as **(6)** to **(8)** of **12.3.3-7, Part D of the Rules** is in accordance with **Table 6.9-1** of **Chapter 9, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

Paragraph D12.3.4 has been amended as follows.

D12.3.4 Flexible Hose Assemblies

1 The wording "~~to be~~ approved by the Society" referred to in **12.3.4-2, Part D of the Rules** means ~~that approval is to be made~~ one whose approval is obtained in accordance with **2.4.2-11, Chapter 2, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

2 The wording "exposed open decks" in **12.3.4-3, Part D of the Rules** means "open decks" as defined in **9.2.3-2(10), Part R of the Rules** ~~except for~~ , excluding spaces in the cargo areas of tankers, ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk defined in **3.2.6, Part R**, **1.1.4(6), Part N** and **1.3.1(4), Part S of the Rules**.

3 The wording "~~W~~where specially approved by the Society" ~~stipulated~~ referred to in **12.3.4-3(3)(a) of the Rules** refers to the use of materials such as Teflon ~~or~~ and nylon which are unable to be reinforced. ~~However, t~~The hoses, however, are to have external wire braid protection as practicable.

D12.6 Tests

Paragraph D12.6.1 has been amended as follows.

D12.6.1 Shop Tests

(-1 is omitted.)

2 The Society may waive the presence of the Surveyor at the hydrostatic tests required by in **-2** and **-3** of **12.6.1, Part D of the Rules** for small bore pipes (less than about 15 *mm*), depending on the application.

3 The term "integral" referred to in **-2** and **-3** of **12.6.1, Part D of the Rules** means, for example, welded fittings.

4 The "non-integral" referred to in **12.6.1-5, Part D of the Rules** means one which does not fall under that specified in **-3** above.

5 The wording "standards recognized by the Society" referred to in **12.6.1-5, Part D of the Rules** means national standards such as Japanese Industrial Standards or standards of an authorized body as well as other standards proven to be appropriate. For valves, however, *JIS B* 2003 or *ISO* 5208, or other equivalent standards are to be applied.

~~2~~**6** The wording ~~of~~ "free standing fuel oil storage tanks" referred to in **12.6.1-8, Part D of the Rules** means those free standing tanks storing the following liquids:

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

Paragraph D12.6.2 has been deleted.

~~**D12.6.2 Tests after Installation On Board**~~

~~The hydrostatic tests for piping systems, after installation on board, specified in **12.6.2, Part D of the Rules** may be omitted in cases where adequate nondestructive tests have been carried out on welded joints with results free from defects.~~

D13 PIPING SYSTEMS

D13.2 Piping

Paragraph D13.2.1 has been amended as follows.

D13.2.1 General

1 The term "cargo holds" referred to in **13.2.1-5, Part D of the Rules** does not include spaces within the cargo area specified in **3.2.6, Part R of the Rules**, **1.1.4(6), Part N of the Rules** and **1.3.1(4), Part S of the Rules** for tankers, ships carrying liquefied gases in bulk or ships carrying dangerous chemicals in bulk where cargoes are not carried (e.g. hold spaces).

2 ~~The m~~Marking of ~~piping~~ pipes with "distinctive colours" ~~as required by~~ referred to in **13.2.1-8(1), Part D of the Rules** is, in principle, to be carried out in accordance with *JIS F 7005* "Identification of Piping Systems ~~o~~On Board Ships".

Paragraph D13.2.4 has been amended as follows.

D13.2.4 ~~Slip-on Joints~~ Mechanical Joints

1 The wording "standard recognized by the Society" referred to in **13.2.4-4, Part D of the Rules** means, for example, Japanese Industrial Standards.

2 The term "cargo holds" referred to in **13.2.4-6(1), Part D of the Rules** includes hold spaces, defined in **1.3.1(13), Part S of the Rules** for tankers and ships carrying dangerous chemicals in bulk and **1.1.4(25), Part N of the Rules** for ships carrying liquefied gases in bulk.

3 The wording "approved by the Society" referred to in **13.2.4-6(1), Part D of the Rules** means, for example, the following **(1)** to **(4)**:

~~1~~(1) ~~The joints of bilge suction piping and ballast piping led into cargo holds may be fitted with~~ ~~s~~Slip-on joints of the type approved by the Society are used for joints of bilge suction piping and ballast piping led into cargo holds.

~~2~~(2) Slip-on joints ~~may be~~ are used for joints of suction pipes for double bottoms ~~within tanks containing the same liquid as that passing through the piping~~.

~~3~~(3) Slip-on joints ~~may be~~ are used for cargo oil pipes, except for those within ballast tanks through which the pipes ~~are passing~~ penetrate. (*See* **14.2.4-5, Part D of the Rules**)

~~4~~(4) ~~For ballast pipes in ballast tanks adjacent to cargo oil tanks,~~ ~~s~~Slip-on joints ~~may be~~ are used for ballast pipes in ballast tanks adjacent to cargo oil tanks~~.~~, ~~However, for ballast pipes~~ except for those within cargo oil tanks through which ~~such~~ the pipes penetrate~~, slip-on joints are not to be used~~. (*See* **14.2.7-4, Part D of the Rules**)

EFFECTIVE DATE AND APPLICATION (Amendment 2-3)

1. The effective date of the amendments is 1 January 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.

* "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 2-4

D13 PIPING SYSTEMS

D13.2 Piping

Paragraph D13.2.5 has been amended as follows.

D13.2.5 Bulkhead Valves

1 With respect to the provisions of **13.5.10, Part D of the Rules**, bulkhead valves capable of being brought into operation from a readily accessible enclosed space, the location of which is accessible from the navigation bridge or continuously manned propulsion machinery control rooms without traversing exposed decks, may be accepted as an alternative to valves operable from above the ~~bulkhead~~ freeboard deck required by the provisions of **13.2.5-2, Part D of the Rules**.

2 Pipes penetrating stern tanks are to be fitted with stop valves at the fore side of the bulkhead.

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

4 The number of pipes piercing the collision bulkhead specified in **13.2.5-2, Part D of the Rules**, is to be in principle just one. Where the forepeak is divided to hold two different kinds of liquids, the Society may allow the collision bulkhead to be pierced below the ~~bulkhead~~ freeboard deck by two pipes. However, the Society is satisfied that there is no practical alternative to the fitting of such a second pipe and, that having regard to the additional subdivision provided in the forepeak, the safety of the ship is maintained. In addition, ~~screw-down~~ valves~~,~~ complied with the requirements in **13.2.5-2, Part D of the Rules**, are to be fitted.

EFFECTIVE DATE AND APPLICATION (Amendment 2-4)

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

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships other than ships that fall under the following:

(1) for which the contract for construction is placed on or after the effective date;

(2) in the absence of a contract for construction, the keels of which are laid or which are at *a similar stage of construction* on or after 1 July 2020; or

(3) the delivery of which is on or after 1 January 2024.

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.

Amendment 2-5

D17 REFRIGERATING MACHINERY AND CONTROLLED ATMOSPHERE SYSTEMS

D17.1 General

D17.1.1 Scope

Sub-paragraph -2 has been amended as follows.

2 Refrigerating machinery with compressors of 7.5 *kW* or less using ~~*R22,*~~ *R*134*a*, *R*404*A*, *R*407*C*, *R*407*H*, *R*410*A*, *R*449*A* or *R*507*A* as their primary refrigerant are to be suitable for use, their service conditions and the surrounding environment on board.

EFFECTIVE DATE AND APPLICATION (Amendment 2-5)

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

2. Notwithstanding the amendments to the Guidance, the current requirements apply to refrigerating machinery, refrigerating installations or controlled atmosphere systems other than refrigerating machinery, refrigerating installations or controlled atmosphere systems that fall under the following:

(1) that intended for installation on ships the keels of which are laid or which are at a similar stage of construction on or after 1 January 2020; or

(2) that intended for installation on ships the keels of which are laid or which are at a similar stage of construction before 1 January 2020 that fall under the following:

(a) that for which the contractual delivery date of the equipment to the ship is on or after 1 January 2020; or

(b) that for which, in the absence of a contractual delivery date, the actual delivery of the equipment to the ship is on or after 1 January 2020.

3. Notwithstanding the provision of preceding **2.**, the amendment to the Guidance may apply, upon request of the owner, to refrigerating machinery, refrigerating installations or controlled atmosphere systems other than those specified in **2.**(1) or (2) above.

Amendment 2-6

Annex D1.1.3-1 GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF WATERJET PROPULSION SYSTEMS

1.1 General

1.1.1 Application

Sub-paragraph -1 has been amended as follows.

1 The requirements in this Guidance apply to waterjet propulsion systems intended for main propulsion and steering ~~driven~~ by high speed engines (hereinafter referred to as "propulsion systems").

Paragraph 1.1.3 has been amended as follows.

1.1.3 Number of Propulsion Systems

1 In general, a minimum of two propulsion systems are to be provided for ships. ~~Propulsion systems are to be designed so that the failure of any one system does not result in the failure of all of the other systems.~~

2 Each steering system for a propulsion system is to be provided with a main steering gear and an auxiliary steering gear. The main steering gear and the auxiliary steering gear are to be so arranged that the failure of one of them will not render the other one inoperative.

3 Notwithstanding the requirements of **-2** above, in cases where each main steering system comprises two or more identical steering actuating systems, an auxiliary steering gear need not be fitted provided that each steering gear: ~~As a result, the requirements for auxiliary steering gear specified in **Chapter 15**, **Part D of the Rules** do not apply to propulsion systems.~~

(1) is capable of satisfying the requirements in **1.5.1-1(2)** while operating with all steering gear steering actuating systems;

(2) is arranged so that after a single failure in its piping or in one of the steering actuating systems, steering capability can be maintained or speedily regained;

(3) The above capacity requirements apply regardless whether the steering systems are arranged with common or dedicated power units.

~~2~~**4** In ~~certain~~ special cases, a single propulsion system installation may be considered, notwithstanding the requirements specified in **-1** to **-3**, provided that the ship in question is not engaged in international voyages. In this case, the functions of propulsion~~,~~ and steering ~~and reversing~~ are to be designed with redundancy in the following arrangements:

(1) A minimum of two prime movers are to be provided.

(2) A minimum of two ~~hydraulic power~~steering actuating systems ~~for steering and reversing~~ are to be provided.

(3) Electric supply is to be maintained or restored immediately in cases where there is a loss of any one of the main generators in service so that the functioning of at least one of the ~~propulsion systems, including their~~ prime mover~~s~~ and steering system, is maintained by the arrangements specified in **1.6.2-1(1)** and **(2)**.

Paragraph 1.1.4 has been amended as follows.

1.1.4 Terminology

The terms used in this Guidance are defined as follows:

(1) ~~Waterjet p~~"Propulsion systems" are systems, including the following components **(a)** through **(d)**, which receives water through inlet ducts and discharges it through nozzles at an increased velocity to produce propulsive thrust and steering.
   (a) Shaftings (main shafts, bearings, shaft couplings, coupling bolts and sealing devices)
   (b) Water intake ducts
   (c) Waterjet pump units
   (d) Steering ~~and reversing~~ system~~s~~

(2) ~~Waterjet p~~"Pump units" are made up of impellers, impeller casings, stators, stator casings, nozzles, bearings, bearing housing and sealing devices.

(3) "Impellers" are a rotating assemblies provided with blades to give energy to the water.

(4) "Main shafts" are shafts that impellers are connected to.

(5) "Water intake ducts" are portions that lead water drawn from water intakes to impeller inlets.

(6) "Nozzles" are portions that inject rectified water from impellers.

(7) "Deflectors" are devices serving as rudders by leading water injected from nozzles either to port or to starboard.

(8) "Reversers" are devices to thrust ships to go astern by reversing flow directions of water injected from nozzles.

(9) "Stators" are assemblies composed of rows of stationary vanes that reduce any swirl added to water by impellers.

(10) "Steering ~~and reversing~~ system~~s~~" is a ship's directional control system, including the steering gear, steering gear control system and rudder (including the rudder stock) if any, or any equivalent system (including deflectors, reversers and steering actuating system driving defectors and/or reversers) for applying force on the ship hull to cause a change of heading or course. (*See* **Fig. 1** and **Fig.2**)~~are those systems consisting of deflectors, reversers and hydraulic power system driving defectors and/or reversers.~~

(11) ~~Hydraulic power~~"Steering actuating system~~s~~" consists of a steering gear power unit, a steering actuator and, for hydraulic or electrohydraulic steering gear, hydraulic piping. ~~are systems composed of hydraulic pumps and electric motors or engines for driving such pumps, and hydraulic piping systems and hydraulic actuators.~~

(12) "Steering actuator" is a component which converts power into mechanical action to control the propulsion system as follows.
   (a) In the case of electric steering: electric motor and driving pinion.
   (b) In the case of electro hydraulic steering: hydraulic motor and driving pinion.

(1~~2~~3) "High speed engines" are diesel engines complying with the following condition or gas turbines:

$$\left(S \cdot n^2\right) / \left(1.8 \times 10^6\right) \geq 90$$

$$\left(\pi \cdot d_j \cdot n\right) / \left(6 \times 10^4\right) \geq 6$$

S : Length of stroke (*mm*)

n : Number of revolutions of an engine at maximum continuous output (*rpm*)

d_j : Diameter of journal (*mm*)

(14) "Declared steering angle limits" are the operational limits in terms of maximum steering angle or equivalent, that are to be declared by the manufacturer / ship designer, also taking into account vessel speed or propeller torque/speed, or other limitations.

Fig. 1 and Fig. 2 have been added as follows.

Fig. 1 Definition of steering system (in cases where two or more identical steering actuating systems are provided)

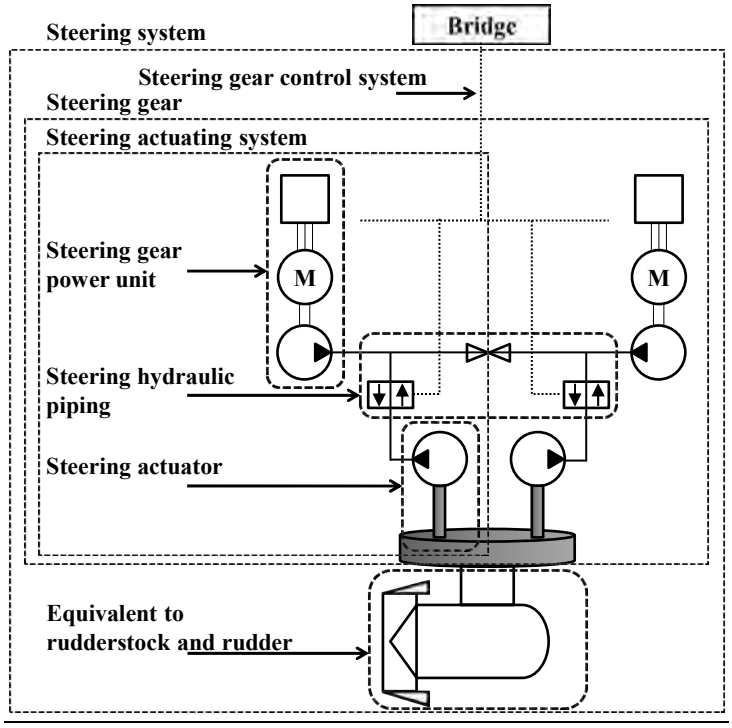
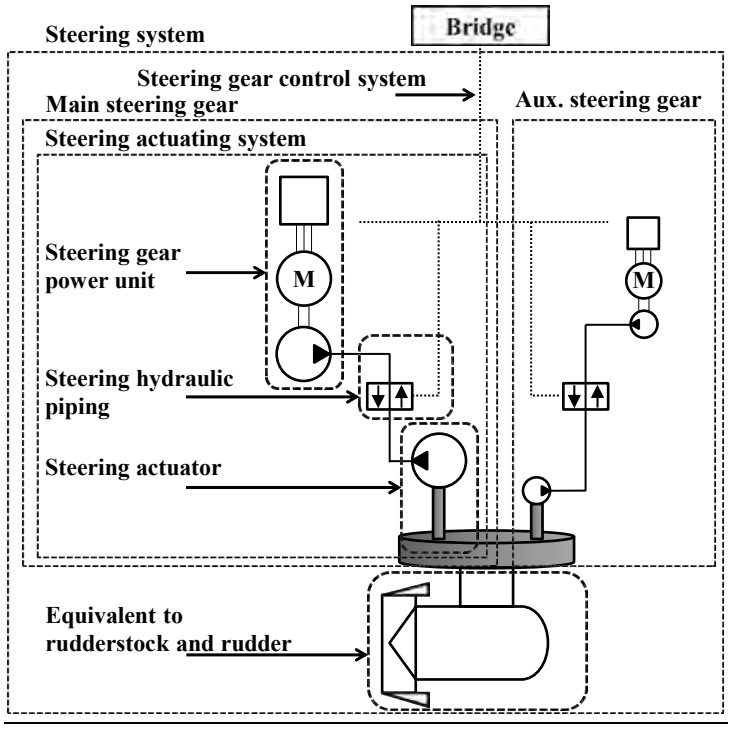


Fig. 2 Definition of steering system (in cases where a main steering gear and an auxiliary steering gear are provided)



1.2 Class Surveys

1.2.1 Classification Survey

Sub-paragraphs -1 and -3 have been amended as follows.

1 Classification Surveys during Construction
(1) Plans and documents
Plans and documents to be submitted are generally as follows:
((a) to (l) are omitted.)
(m) Details of ~~hydraulic~~steering actuators
((n) to (u) are omitted.)
(2) Shop tests
The following tests and inspections are to be carried out at manufacturing plants of propulsion systems.
((a) to (c) are omitted.)
(d) The tests specified in **15.5.1**, **Part D of the Rules** for ~~hydraulic power~~steering actuating systems
(e) (Omitted)
(3) (Omitted)
2 (Omitted)
3 Sea Trials
(1) In the Classification Survey of ships, the following tests are to be carried out during sea trials, in substitution for those tests specified in **2.3.1-1(3)**, **Part B of the Rules**. However, those tests required in **(c)~~, (d), (e), (f)~~** ~~and~~to **(g)** may be carried out either at dockside or in dry dock.
(a) Tests on steering capabilities specified in **1.5.1**
(b) Tests on operation of controls for steering ~~and reversing~~ 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) to (e) are omitted.)
(f) 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 ~~hydraulic power~~ steering actuating systems
(g) (Omitted)
(2) In the case of Classification Survey of ships not built under the Society's survey, the above tests may be dispensed with, provided that sufficient data on the previous tests are available and no alteration affecting the tests specified in **(1)** have been made after the previous tests.

1.2.2 Periodical Surveys

Sub-paragraphs -1 and -5 have been amended as follows.

1 Annual Surveys
(1) (Omitted)
(2) Performance tests
The following tests are to be carried out:
(a) Performance tests of steering~~ and reversing~~ systems
(b) (Omitted)
(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 ~~hydraulic power~~steering actuating systems

(d) Test for supply of the alternative source of power specified in **1.6.2-2**.

(-2 to -4 are omitted.)

5 Planned Machinery Surveys

The following examinations are to be carried out according to the survey programs specified in **Chapter 9**, **Part B of the Rules**:

(1) Open-up examinations of hydraulic pumps for ~~hydraulic power~~steering actuating systems

((2) to (4) are omitted.)

1.3 Materials and Welding

1.3.1 Materials

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

1 (Omitted)

2 The materials used for the following components are also to comply with the requirements below:

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

(3) Hydraulic pumps, hydraulic piping and ~~hydraulic~~steering actuators: **10.2.1**, **12.1.4** and **15.4.1**, **Part D of the Rules**

Title of Section 1.5 has been amended as follows.

1.5 Steering ~~and Reversing~~ Systems

Paragraph 1.5.1 has been amended as follows.

1.5.1 Capability of Steering ~~and Reversing~~Gears

1 The main steering gear is to be:

(1) of adequate strength and capable of steering the ship at the maximum ahead service speed specified in **2.1.8**, **Part A of the Rules** which is to be demonstrated;

~~1~~(2) ~~Deflectors are, in principle, to be~~ capable of changing direction of the ~~ship's directional control~~ propulsion system from one side to the other at declared steering angle limits at an average ~~rotational~~turning speed of not less than 2.3°/s with the ship running ahead at speed~~s~~ specified in **2.1.8**, **Part A of the Rules**.; ~~In addition, ships are to have sufficient steering capability according to their ship type. The wording "declared steering angle limits" refers to the operational limits of deflectors in terms of maximum steering angle according to manufacturer guidelines for safe operation.~~

(3) for all ships, operated by power; and

(4) so designed that they will not be damaged at maximum astern speed; this design requirement need not be proved by trials at maximum astern speed and declared steering angle limits.

2 The auxiliary steering gear is to be:

(1) of adequate strength and capable of steering the ship at navigable speed and of being brought speedily into action in an emergency;

(2) capable of changing direction of the propulsion system from one side to the other at declared steering angle limits at an average turning speed of not less than 0.5°/s with the ship running ahead at one half of the maximum ahead service speed specified in **2.1.8**, **Part A of the Rules**

or 7 *knots*, whichever is the greater; and

(3) for all ships, operated by power where necessary to meet the requirements of Regulation 29.4.2, Chapter II-1, *SOLAS* and in any ship having power of more than 2,500 *kW* propulsion power per propulsion system.

~~2~~3 Reversers are to be such that they enable the ship to ~~provide sufficient power for~~ go~~ing~~ astern with sufficient steering ~~to secure proper control of the ship~~ under ~~all~~ normal circumstances, and ~~when transferred from ahead to astern runs,~~ they are to have astern power to provide effective braking for ships when changing from ahead to astern runs.

1.5.2 General Construction ~~of Steering and Reversing Systems~~

Sub-paragraph -1 has been amended as follows.

1 Design pressures of the scantlings of piping and other components of ~~hydraulic power~~steering actuating systems subject to internal hydraulic pressure are to be at least 125% of the maximum working pressure expected under the worst permissible operating condition, taking into account any pressure which may exist in the low pressure side of systems. Design pressures are not to be less than relief valve setting pressures.
(-2 to -4 are omitted.)

Paragraph 1.5.3 has been amended as follows.

1.5.3 ~~Hydraulie~~Steering Actuators

1 The strength of ~~hydraulie~~steering actuators is to comply with the requirements specified in **15.4.4**, **Part D of the Rules**.

2 The construction of oil seals in ~~hydraulie~~steering actuators is to comply with the requirements specified in **15.4.5**, **Part D of the Rules**.

Paragraph 1.5.4 has been amended as follows.

1.5.4 ~~Hydraulic Power~~Steering Actuating Systems

1 Suitable arrangements to maintain the cleanliness of hydraulic fluid are to be provided after taking into consideration the types and designs of ~~hydraulic power~~steering actuating systems.

2 Arrangements for bleeding air from ~~hydraulic power~~steering actuating systems are to be provided where necessary.

3 Relief valves are to be fitted to any parts of ~~hydraulic power~~steering actuating systems which can be isolated and in which pressure can be generated from power sources or from external forces. Setting pressures of relief valves are not to be less than 125% of the maximum working pressure expected in the protected part. Minimum discharge capacities of relief valves are not to be less than 110% of the total capacity of pumps which provide power for ~~hydraulie~~steering actuators. Under such conditions, any rise in pressure is not to exceed 10% of the setting pressure. In this regard, due consideration is to be given to any anticipated extreme ambient conditions in respect of oil viscosity.

4 Low level alarms are to be provided for hydraulic fluid tanks to give the earliest practicable indication of ~~any hydraulic~~ fluid leakage from steering actuating system. These alarms are to be audible and visual and to be given on navigation bridges and at positions from which main engines are normally controlled.

5 In cases where flexible hoses are used for ~~hydraulic power~~steering actuating systems, the construction and strength of such flexible hoses are to comply with the requirements specified in **15.4.6**, **Part D of the Rules**.

1.6 Electric Installations

Paragraph 1.6.2 has been amended as follows.

1.6.2 Maintenance of Electric Supply

1 Main sources of electric power are to be so arranged that electric supplies to relevant equipment are maintained, or restored immediately in the case of a loss of any one of the generators in service, to ensure the functions of propulsion~~,~~ and steering ~~and reversing~~ of at least one of the propulsion systems, its associated control systems and its indication devices ~~for deflector positions~~ of steering gear by the following arrangements:

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

2 In cases where the propulsion power exceeds 2,500 *kW* per thruster unit, an alternative source of power is to be provided in accordance with the following:

(1) (Omitted)

(2) Any alternative source of power is to be capable of automatically supplying alternative power within 45 *seconds* to the ~~deflector~~steering gear and its associated control system and its indication devices for ~~deflector positions~~steering gear. In this case, the alternative source of power is to be capable of changing direction of the ship's directional control system from one side to the other at declared steering angle limits at an average ~~rotational~~turning speed of not less than 0.5°/*s* with the ship running ahead at one half of the speeds specified in **2.1.8**, **Part A of the Rules** or 7 ~~knots~~*knots*, whichever is greater. Alternative sources of power are to have enough capacity for the continuous operation of such systems for at least 30 *minutes* in every ship of 10,000 *gross tonnage* or more, and for at least 10 *minutes* in every other ship.

(3) (Omitted)

Paragraph 1.6.3 has been amended as follows.

1.6.3 Electrical Installations for Steering ~~and Reversing~~ Systems

In cases where hydraulic pumps for ~~hydraulic power~~steering actuating systems are driven by electric motors, electrical installations for steering and reversing systems are to comply with the following requirements in **(1)** through **(7)**:

(1) Each ~~propulsion system~~steering system is to be served ~~separately~~ by at leaset two exclusive circuits fed directly from main switchboards. ~~In cases where three or more propulsion systems are provided, at least two those exclusive circuits are required.~~ One of these circuits, however, may be supplied through the emergency switchboard.

((2) to (7) are omitted.)

1.12 Special Requirements for Propulsion Systems Installed in Ships with Restricted Area of Service and Small Ships

1.12.1 Ships with Class Notation "*Coasting Service*", "*Smooth Water Service*" or Equivalent

Sub-paragraph -3 has been added as follows.

1 For ships with the Class Notation "*Coasting Service*", "*Smooth Water Service*" or equivalent, the requirements specified in **1.11** are not necessary.

2 For ships with the Class Notation "*Coasting Service*", "*Smooth Water Service*" or equivalent, which are not engaged in international voyages, or whose gross tonnage is less than 500 *tons*, the following requirements are not necessary in addition to the requirement in **-1**.

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

3 For the ships specified in **-2**, the following requirements may be applied:

(1) Notwithstanding the requirements of **1.6.3(1)**, each steering system may be served separately by exclusive circuits fed directly from main switchboards. In cases where three or more propulsion systems are provided, these exclusive circuits for steering systems may be composed of at least two systems. In addition, one of these circuits may be supplied through the emergency switchboard.

Annex D1.1.3-3 GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF AZIMUTH THRUSTERS

1.1 General

Paragraph 1.1.3 has been amended as follows.

1.1.3 Number of Thrusters

1 In general, a minimum of two thrusters is to be provided for ships. ~~Thrusters are to be designed so that the failure of one thruster does not result in the failure of any other thrusters.~~

2 Each of the steering systems of thrusters are to be provided with a main steering gear and an auxiliary steering gear. The main steering gear and the auxiliary steering gear are to be so arranged that the failure of one of them will not render the other one inoperative.

3 Notwithstanding the requirements of **-2** above, in cases where each main steering system comprises two or more identical steering actuating systems, an auxiliary steering gear need not be fitted provided that each steering gear: ~~As a result, the requirements for auxiliary steering gear as specified in **Chapter 15, Part D of the Rules** do not apply to thrusters.~~

(1) is capable of satisfying the requirements in **1.5.1-1(2)** while operating with all steering gear steering actuating systems;

(2) is arranged so that after a single failure in its piping or in one of the steering actuating systems, steering capability can be maintained or speedily regained;

(3) The above capacity requirements apply regardless whether the steering systems are arranged with common or dedicated power units.

~~2~~**4** In special cases, a single thruster installation may be subject to consideration and deemed acceptable, notwithstanding the requirements specified in **-1** to **-3**. In such cases, the functions of propulsion and steering are to be designed with redundancy as in the following arrangements:

(1) A minimum of two prime movers ~~is~~are to be provided.

(2) (Omitted)

(3) Electric suppl~~ies~~y ~~are~~is to be maintained or restored immediately in the cases where there is a ~~of~~ loss of any one of the main generators in service so that the function~~s~~ing of at least one of the prime mover and ~~thrusters~~steering system, ~~including its prime movers, are~~is maintained by the arrangements specified in **1.6.2-1(1)** and **(2)**.

Paragraph 1.1.4 has been amended as follows.

1.1.4 Terminology

The terms used in this Guidance are defined as follows:

(1) "Thrusters" are propulsion units which control ship direction through ~~with~~ steering functions enabled by their own capability of azimuthing. Thrusters include the following components:
  (a) Propellers
  (b) Propeller shafts
  (c) Gears, clutches and gear shafts for transmission of propulsion torque (when integrated in thrusters)
  (d) Azimuth thruster casings
  (e) ~~Azimuth steering gears~~Steering system
  ~~(f) Control systems~~

(2) "Azimuth thruster casings" are watertight structures that include steering columns (or struts), propeller pods, propeller nozzles and nozzle supports.

(3) "Azimuth steering gears" are devices for applying steering torque to thrusters, and include electric motors, hydraulic pumps, hydraulic systems, hydraulic motors and gear assemblies for azimuth steering gears.

(4) "Steering system" is a ship's directional control system, including the steering gear, steering gear control system and rudder (including the rudder stock) if any, or any equivalent system (including azimuth steering gears) for applying force on the ship hull to cause a change of heading or course.(*See* **Fig. 1** and **Fig.2**)

(5) "Steering actuating system" consists of a steering gear power unit, a steering actuator and, for hydraulic or electrohydraulic steering gear, hydraulic piping.

(6) "Steering actuator" is a component which converts power into mechanical action to control the propulsion system as follows.

(a) In the case of electric steering: electric motor and driving pinion.

(b) In the case of electro hydraulic steering: hydraulic motor and driving pinion.

(7) "Declared steering angle limits" are the operational limits in terms of maximum steering angle or equivalent, that are to be declared by the manufacturer / ship designer, also taking into account vessel speed or propeller torque/speed, or other limitations.

Fig. 1 has been added as follows.

Fig. 1 Definition of steering system (in cases where two or more identical steering actuating systems are provided)

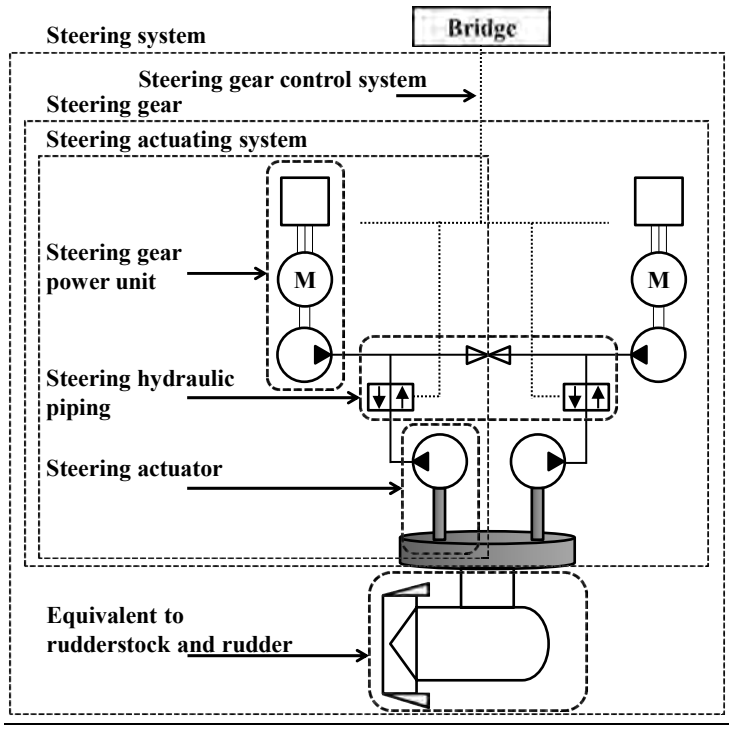
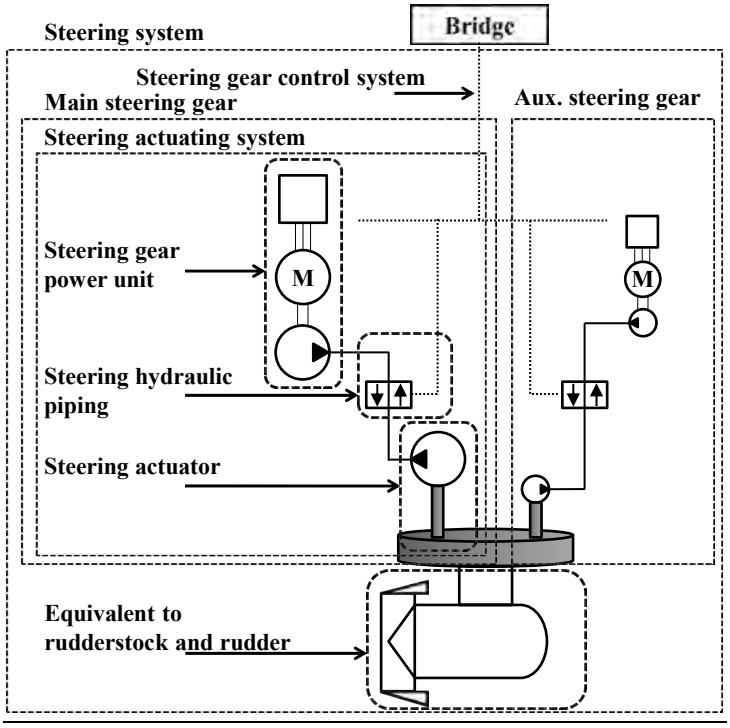


Fig. 2 has been added as follows.

Fig. 2 Definition of steering system (in cases where a main steering gear and an auxiliary steering gear are provided)



1.2 Class Surveys

1.2.1 Classification Surveys

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

3 Sea Trials

(1) In Classification Surveys of ships, the following tests are to be carried out during sea trials, as substitutes for those tests given in **2.3.1-1(3)**, **Part B of the Rules**. However, those tests required in **(c)**~~**, (d), (e) and**~~to **(f)** may be carried out either at dockside or in dry dock. Also, when it is difficult to carry out tests on the functioning of relief valves mentioned in **(e)** after installation on board, these tests may be carried out as shop tests.
((a) to (f) are omitted.)

(2) (Omitted)

Title of Section 1.5 has been amended as follows.

1.5 ~~**Azimuth**~~ Steering ~~**Gears**~~Systems

Paragraph 1.5.1 has been amended as follows.

1.5.1 Capability of ~~**Azimuth**~~ Steering Gears

1 The main steering gear is to be:

(1) of adequate strength and capable of steering the ship at the maximum ahead service speed specified in **2.1.8**, **Part A of the Rules** which is to be demonstrated;

~~**1**~~(2) ~~The steering arrangements of thruster are to be~~ capable of changing direction of the ~~ship's directional control system~~thruster from one side to the other at declared steering angle limits at an average ~~rotational~~turning speed of not less than 2.3°/*s* with the ship running ahead at speed~~s~~ specified in **2.1.8**, **Part A of the Rules**~~.~~; ~~The wording "declared steering angle limits" refers to the operational limits in terms of maximum steering angle according to manufacturer guidelines for safe operation.~~

~~**2**~~(3) In addition to the requirements specified in ~~**1**~~**(2)** above, the rate of turning for azimuth steering gears is to be not less than 1.0 *rpm* in static conditions of ships if astern power is obtained by turning thrusters.

(4) for all ships, operated by power; and

(5) so designed that they will not be damaged at maximum astern speed; this design requirement need not be proved by trials at maximum astern speed and declared steering angle limits.

2 The auxiliary steering gear is to be:

(1) of adequate strength and capable of steering the ship at navigable speed and of being brought speedily into action in an emergency;

(2) capable of changing direction of the thruster from one side to the other at declared steering angle limits at an average turning speed of not less than 0.5°/*s* with the ship running ahead at one half of the maximum ahead service speed specified in **2.1.8**, **Part A of the Rules** or 7 *knots*, whichever is the greater; and

(3) for all ships, operated by power where necessary to meet the requirements of Regulation 29.4.2, Chapter II-1, *SOLAS* and in any ship having power of more than 2,500 *kW* propulsion power per thruster.

Paragraph 1.5.2 has been amended as follows.

1.5.2 Construction ~~of Azimuth Steering Gear~~

1 Design pressures for calculations to determine the scantlings of piping and other components of ~~hydraulic power~~steering actuating systems of azimuth steering gears subject to internal hydraulic pressure are to be at least 125% of the maximum working pressure expected under the worst permissible operation conditions after taking into account any pressure which may exist in low pressure sides of such systems. Design pressures are not to be less than relief valve setting pressures.

2 (Omitted)

3 The installation of piping and arrangements of relief valves as well as measuring devices for hydraulic systems and the construction of liquid level indicators are to comply with the requirements in **13.2.1** and **13.8.4**, **Part D of the Rules**.

1.6 Electric Installations

1.6.1 General

Sub-paragraph -1 has been amended as follows.

1 Each ~~thruster~~steering system is to be served ~~separately~~ by at leaset two exclusive circuits fed directly from main switchboards. ~~In cases where three or more thrusters are provided, at least two those exclusive circuits are required.~~ One of these circuits, however, may be supplied through the emergency switchboard.

Paragraph 1.6.2 has been amended as follows.

1.6.2 Maintenance of Electric Suppl~~ies~~y

1 (Omitted)

2 In cases where propulsion power exceeds 2,500 *kW* per thruster ~~unit~~, an alternative source of power is to be provided in accordance with the following:

(1) (Omitted)

(2) Any alternative source of power is to be capable of automatically supplying alternative power within 45 *seconds* to the steering ~~arrangement~~gear and its associated control system and its indication devices for ~~azimuth angles~~steering gear. In this case, the alternative source of power is to be capable of changing direction of the ship's directional control system from one side to the other at declared steering angle limits at an average ~~rotational~~turning speed of not less than 0.5°/*s* with the ship running ahead at one half of the speeds specified in **2.1.8**, **Part A of the Rules** or 7 ~~knots~~*knots*, whichever is greater. Alternative sources of power are to have enough capacity for the continuous operation of such systems for at least 30 *minutes* in every ship of 10,000 *gross tonnage* or more, and for at least 10 *minutes* in every other ship.

(3) (Omitted)

1.13 Special Requirements for Thrusters Installed in Ships with Restricted Areas of Service and Small Ships

1.13.1 Ships with Class Notation "*Coasting Service*", "*Smooth Water Service*" or the Equivalent

Sub-paragraph -3 has been added as follows.

1 For ships with the Class Notation "*Coasting Service*", "*Smooth Water Service*" or the equivalent, the following requirements are not necessary and may be omitted.

(1) Those requirements for auxiliary fans specified in **1.10.1-3**

(2) **1.12.1**

2 For those ships with the Class Notation "*Coasting Service*", "*Smooth Water Service*" or the equivalent which are not engaged in international voyages or whose gross tonnage is less than 500 *tons*, in addition to those requirements specified in **-1,** the following requirements are not necessary and may be omitted.

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

3 For the ships specified in **-2**, the following requirements may be applied:

(1) Notwithstanding the requirements of **1.6.1-1**, each steering system may be served separately by exclusive circuits fed directly from main switchboards. In cases where three or more thrusters are provided, these exclusive circuits for steering systems may be composed of at least two systems. In addition, one of these circuits may be supplied through the emergency switchboard.

EFFECTIVE DATE AND APPLICATION (Amendment 2-6)

1. The effective date of the amendments is 1 January 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.

* "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 2-7

Annex D12.1.6-2 has been amended as follows.

Annex D12.1.6-2 GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF PLASTIC PIPES

1.1 Scope

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

2 The guidance is not applicable to use of mechanical joints and flexible couplings ~~used~~ which are accepted for use in accordance with **12.3.3-1** or **12.3.4-2, Part D of the Rules** in metallic piping systems.

3 The specification of the pipes is to be in accordance with a recognized 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**) may not apply to the pipes specified in **1.3-2**.

1.2 Terminology

Terms used in this Guidance 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 guidance.

~~(2)~~(3) "Joint" means ~~joining pipes~~ 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.

(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.

~~(3)~~(8) "*FTP* Code" means as defined in **3.2.23, Part R of the Rules**.

1.3 Materials

1 Plastic pipes are to be those approved by the Society and adequate for their service conditions.

2 Notwithstanding the requirement in **-1**, those pipes which ~~are made of thermoplastic materials~~

~~such as polyethylene (PE), polypropylene (PP), polybutylene (PB), etc.,~~ comply with recognized standards such as *JIS* or *JWWA*, comply with **1.4.1-2(2)**, **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 auxiliary machinery excluding "auxiliary machinery essential for main propulsion", "auxiliary machinery for the manoeuvring and the safety" and "auxiliary machinery for cargo handling" in **Table D1.1.6-1** (except for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems and exhaust gas cleaning systems (EGCS) etc.).

1.4 Design Requirements

1.4.1 Strength

1 The strength of fittings and joints is to be not less than that of the pipes.

2 The nominal pressure is to be determined from the following **(1)** to **(3)**:

(1) Internal Pressure

In the case of internal pressure, the smaller of the following is to be taken:

$$P_{n\,int} \le \frac{P_{sth}}{4} \text{ or } P_{n\,int} \le \frac{P_{lth}}{2.5}$$

where

P_{sth} : Short-term hydrostatic test failure pressure

P_{lth} : Long-term hydrostatic test failure pressure (>100,000h)

(2) External Pressure (for any installation which may be subject to vacuum conditions inside the pipe or a head of liquid acting on the outside of the pipe or for any pipes that would allow progressive flooding to other compartments through damaged piping or through open ended pipes in the compartments)

External pressure is to comply with the following formula. Maximum working external pressure is the sum of the vacuum inside pipes and heads of liquid acting on the outside of pipes.

$$P_{n\,ext} \le \frac{P_{col}}{3}$$

where

P_{col} : Pipe collapse pressure (However, in no instance is the pipe collapse pressure to be less than 0.3 MPa)

(3) Wall Thickness

Notwithstanding the requirements of the preceding **(1)** or **(2)** above as applicable, the pipe or pipe layer minimum wall thickness is to follow recognized standards. In the absence of standards for pipes not subject to external pressure, the requirements of **(2)** above are to be met.

~~(3)~~(4) Temperature

~~Maximum permissible working~~ Nominal pressure is to be specified in accordance with the manufacturer recommendations with due regard being given to the maximum possible working temperature.

3 Design temperature

(1) In this Guidance, design temperatures are to be the highest and lowest working temperatures

of any liquid inside such pipes and atmospheric temperatures of the area where such pipes are arranged at the designed conditions. The design temperatures of ballast pipes are not to be less than 50℃ for high temperature sides and are not to be more than 0℃ for low temperature sides.

(2) The permissible working temperature depending on the working pressure is to be in accordance with manufacturer's recommendations, but in each case it is to be at least 20ºC lower than the minimum heat distortion/deflection temperature of the pipe material, determined according to *ISO* 75 method A, or equivalent e.g. *ASTM D648*. The minimum heat distortion/deflection temperature is to be not less than 80ºC.

4 The sum of the longitudinal stresses due to pressure, weight and other loads is not to exceed the allowable stress in the longitudinal direction.

5 In the case of fibre reinforced plastic pipes, the sum of the longitudinal stresses is not to exceed half of the nominal circumferential stress derived from the nominal internal pressure condition according to the preceding **-2(1)**.

6 Plastic pipes and joints are to have a minimum resistance to impact in accordance with recognized national or international standards, e.g. *ISO* 9854, *ISO* 9653, *ISO* 15493, *ASTM D2444* or their equivalent.

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

1.5.1 Fire Endurance

1 Pipes and their associated 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 Permitted use of piping depending on fire endurance, location and piping system is given in **Table 1**.

1.5.2 Flame Spread

1 All pipes, except those fitted on open decks and within tanks, cofferdams, pipe tunnels and ducts, if separated from accommodation, permanent manned areas and escape ways by means of an *A* class bulkhead, are to have low surface flame spread characteristics as determined by the test procedures given in *Appendix* 3 of *IMO Res. A.*753(18) (including any amendments due to *IMO Res. MSC.*313(88) and *IMO Res. MSC.*399(95)). Pipings with both the total heat release (Q_t) of not more than 0.2 *MJ* and the peak heat release rate (Q_p) of not more than 1.0*kW* (both values determined in accordance with the requirements of "Test for Surface Flammability" specified in the *FTP* Code, *ANNEX* 1, *Part* 5) are considered to comply with the above requirements and may be exempted from testing in accordance to standard *ISO* 1716:2010 about calorific value.

2 Surface flame spread characteristics are to be determined using the procedure given in the *FTP* Code, *ANNEX* 1, *Part* 5 with regard to the modifications due to the curvilinear pipe surfaces as also listed in *Appendix* 3 of *IMO Res. A.*753(18), as amended by *IMO Res. MSC.*313(88) and *IMO Res. MSC.* 399(95).

3 Surface flame spread characteristics may also be determined using the test procedures given in *ASTM D635*, or in other national equivalent standards. Under the procedure of *ASTM D635* a maximum burning rate of 60 *mm/min* applies. In case of adoption of other national equivalent standards, the relevant acceptance criteria are to be defined.

1.5.3 Fire Protection Coatings

In cases where the fire protective coating of pipes and fittings is necessary for achieving

required fire endurance levels, such coating is to meet the requirements in the following **(1)** to **(4)**:

(1) Pipes are generally to be delivered from the manufacturer with the protective coating already applied.

(2) The fire protection properties of such coatings are not to be diminished when exposed to salt water, oil or bilge slops. It is to be demonstrated that such coatings are resistant to those products that are likely to come into contact with the piping.

(3) When considering fire protection coatings, characteristics such as thermal expansion, resistance against vibrations, and elasticity are to be taken into account.

(4) Fire protection coatings are to have sufficient resistance to impacts and be able to retain their integrity.

1.5.4 Electrical Conductivity

1 In cases where the piping systems for fluids with conductivity of less than 1,000 *pS/m* (*pico siemens per meter*), such as refined products and distillates, conductive pipes are to be used.

2 Regardless of the fluid being conveyed, plastic piping is to be electrically conductive if such piping passes through those hazardous areas specified in **4.3**, **Part H of the Rules**.

3 Pipes and fittings having conductive layers are to be protected against any possibility of spark damage to pipe walls.

4 In cases where electrical conductivity is to be ensured, the resistance of pipes and fittings is not to exceed $0.1\ M\Omega/m$.

1.5.5 Durability against Chemicals

The pipes are to be resistant to any chemical substances they might possibly come it to contact with during service.

1.5.6 Smoke Generation and Toxicity

Piping materials within the accommodation, service, and control spaces are to fulfill the requirements of *Appendix* 3 of *IMO Res. A.*753(18) (including any amendments due to *IMO Res. MSC.*313(88) and *IMO Res. MSC.*399(95)), on smoke and toxicity test. Procedure modifications are necessary due to the curvilinear pipe surfaces listed in **Chapter 6, Part R of the Rules**.

Table 1 Fire Endurance Requirements Matrix

N	Piping Systems	Location										
		A	B	C	D	E	F	G	H	I	J	K
CARGO (FLAMMABLE CARGO f.p.[11] ≤ 60 C°)												
1	Cargo lines	—	—	L1	—	—	○	—	○[10]	○	—	L1[2]
2	Crude oil washing lines	—	—	L1	—	—	○	—	○[10]	○	—	L1[2]
3	Vent lines	—	—	—	—	—	○	—	○[10]	○	—	×
INERT GAS												
4	Water seal effluent lines	—	—	○[1]	—	—	○[1]	○[1]	○[1]	○[1]	—	○
5	Scrubber effluent lines	○[1]	○[1]	—	—	—	—	—	○[1]	○[1]	—	○
6	Main lines	○	○	L1	—	—	—	—	—	○	—	L1[6]
7	Distribution lines	—	—	L1	—	—	○	—	—	○	—	L1[2]
FLAMMABLE LIQUIDS (f.p.[11] > 60 C°)												
8	Cargo lines	×	×	L1	×	×	—[3]	○	○[10]	○	—	L1
9	Fuel oil	×	×	L1	×	×	—[3]	○	○	○	L1	L1
10	Lubricating	×	×	L1	×	×	—	—	—	○	L1	L1
11	Hydraulic oil	×	×	L1	×	×	○	○	○	○	L1	L1
SEAWATER[1]												
12	Bilge mains & branches	L1[7]	L1[7]	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	×	○[10]	○	○	○	L2W	L2W
17	Cooling water, essential services[12]	L3	L3	—	—	—	—	—	○	○	—	L2W
18	Tank cleaning services fixed machines	—	—	L3	—	—	○	—	○	○	—	L3[2]
19	Non-essential systems[13]	○	○	○	○	○	—	○	○	○	○	○
FRESHWATER												
20	Cooling water essential services[12]	L3	L3	—	—	—	—	○	○	○	L3	L3
21	Condensate returns	L3	L3	L3	○	○	—	—	—	○	○	○
22	Non-essential systems[13]	○	○	○	○	○	—	○	○	○	○	○
SANITARY/DRAINS/SCUPPERS												
23	Deck drains (internal)	L1W[4]	L1W[4]	—	L1W[4]	○	—	○	○	○	○	○
24	Sanitary drains (internal)	○	○	—	○	○	—	○	○	○	○	○
25	Scuppers and discharges (overboard)	○[1,8]	○[1,8]	○[1,8]	○[1,8]	○[1,8]	—○	○	○	○	○[1,8]	○
SOUNDING/AIR												
26	Water tanks/dry spaces	○	○	○	○	○	○[10]	○	○	○	○	○
27	Oil tanks (f.p.[11] > 60 C°)	×	×	×	×	×	×[3]	○	○[10]	○	×	×
MISCELLANEOUS												
28	Control air	L1[5]	L1[5]	L1[5]	L1[5]	L1[5]	—	○	○	○	L1[5]	L1[5]
29	Service air (non-essential)[13]	○	○	○	○	○	—	○	○	○	○	○
30	Brine	○	○	—	○	○	—	—	—	○	○	○
31	Auxiliary low pressure steam ($\leq 0.7MPa$)	L2W	L2W	○[9]	○[9]	○[9]	○	○	○	○	○[9]	○[9]
32	Central vacuum cleaners	—	—	—	○	—	—	—	—	○	○	○
33	Exhaust gas cleaning system / Exhaust gas recirculation system effluent line	L3[1]	L3[1]	—	—	—	—	—	—	—	L3[1, 14] —	—
34	Reductant agent transfer / supply system (SCR installations)	L1[15]	L1[15]	—	—	—	—	—	—	○	L3[14] —	○

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℃

(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℃, "○" may replace "－" or "×".

4 : In the case of drains serving only the space concerned, "○" may replace "L1W".

5 : When controlling functions are not required by statutory requirements or guidelines, "○" may replace "L1".

6 : In the case of pipes between machinery spaces and deck water seals, "○" may replace "L1".

7 : In the case of passenger vessels, "×" 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 be "×" throughout unless fitted at the upper end with the means of closing capable of being operated from a position above the freeboard deck in order to prevent downflooding.

9 : In the case of essential services, such as fuel oil tank heating and the ship's whistle, "×" is to replace "○".

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 "○".

11 : To be determined by an approved closed cup method.

12 : Pipe lines used for "auxiliary machinery essential for main propulsion", "auxiliary machinery for the manoeuvring and safety" and "auxiliary machinery for cargo handling" in **Table D1.1.6-1**.

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 (○) 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.

1.6 Installation

1.6.1 Supports

1 Selection and spacing of pipe supports in shipboard systems are to be determined as a function of allowable stresses and maximum deflection criteria. Support spacing is not to be greater than that recommended the pipe manufacturer. The selection and spacing of pipe supports are to take into account pipe dimensions, length of the piping, mechanical and physical properties of pipe materials, mass of pipes and contained fluids, external pressures, operating temperatures, thermal expansion effects, loads due to external forces, thrust forces, water hammers, vibrations, fatigue and maximum accelerations to which such systems may be subjected. Combination of loads is to be considered.

2 Each support is to evenly distribute the load of the pipe and its contents over the full width of the support. Measures are to be taken to minimise any wearing down of such pipes in the places where they come in contact with their supports.

3 Heavy components in piping systems, such as valves and expansion joints, are to be independently supported.

1.6.2 Expansion

1 Suitable provisions are to be made in pipelines to allow for relative movement between pipes made of plastic and steel structures, paying due regard to:

(1) The difference in the coefficients of thermal expansion

(2) Deformations of the ship's hull and its structure

2 When calculating the thermal expansions, system working temperatures as well as those temperatures at which assembly is performed are to be taken into account.

1.6.3 External Loads

1 When installing piping, allowances are to be made for temporary point loads in cases where applicable. Such allowances are to include at least the force exerted by a load (person) of 100 *kg* at mid-span on any pipe of more than 100 *mm* nominal outside diameter.

2 Besides for providing adequate robustness for all piping including open-ended piping a minimum wall thickness, complying with **1.4.1-2**, may be increased taking into account the conditions encountered during service on board ships.

~~**2**~~**3** Pipes are to be protected from mechanical damage in cases where necessary.

1.6.4 Strength of Connections

1 The strength of connections is to be not less than that of the piping system in which they are installed.

2 Pipes may be assembled using adhesive-bonded, welded, flanged or other joints.

3 Adhesives, when used for joint assembly, are to be suitable for providing permanent seals between pipes and fittings throughout the temperature and pressure ranges of their intended

application.

4 All tightening of joints is to be performed in accordance with manufacturer instructions.

1.6.5 Installation of Conductive Pipes

1 In cases where pipes are required to be electrically conductive as specified in **1.5.4**, sufficient consideration is to be given to electrical continuity.

2 Any resistance to earth from any points in such piping systems are not to exceed $1\ M\Omega$.

3 Earthing wires are to be accessible for inspection.

1.6.6 Application of Fire Protection Coatings

1 Fire protection coatings are to be applied on joints, in cases where such coatings are necessary for meeting the required fire endurance in accordance with **1.5.3**, after performing hydrostatic pressure tests of such piping systems.

2 Such fire protection coatings are to be applied in accordance with manufacturer recommendations, using procedures approved for each particular case.

3 Pipes are to be electrically conductive, even after being coated with fire protective coatings, in cases where it is necessary to coat conductive pipes.

1.6.7 Penetration of Divisions

1 Where plastic pipes pass through "A" or "B" class divisions, arrangements are to be made to ensure that their fire endurance is not impaired in accordance with **9.3, Part R of the Rules**.

~~**1**~~**2** When plastic pipes pass through oiltight and watertight bulkheads or decks, the watertight integrity of the bulkhead or deck is to be maintained. Such p~~P~~enetrations ~~of oiltight and watertight divisions~~ are to be of steel. Steel penetration may be required, in cases where deemed necessary, for other steel divisions. For pipes not able to satisfy the requirements in **1.4.1-2(2)**, a metallic shut-off valve operable from above the freeboard deck is to be fitted at the bulkhead or deck.

~~**2**~~**3** If bulkheads or decks are also fire divisions and destruction by fire of any plastic pipes may cause the inflow of liquid from tanks, metallic shut-off valves operable from above freeboard decks should be fitted at such bulkheads or decks.

1.6.8 Control during Installation

1 Pipes are to be properly protected from any damage caused by sparks from things such as welding and cutting as well as from any mechanical impacts with heavy objects during assembling.

2 Installation is to be in accordance with manufacturer guidelines.

3 Sufficient consideration is to be given to fire protection and safety of life in cases where adhesives are being used as well as in cases of cutting or grinding pipes.

4 Methods for connecting pipes~~, except for those piping systems specified in **1.3-2**~~, are to be approved by the Society before such work is actually started.

5 The tests and explanations specified in this guidance are to be completed before shipboard piping installation commences.

~~**5**~~**6** All personnel involved in either connecting or bonding plastic pipes ~~as specified in **1.3-2**~~ by welding, lamination or similar methods are to be properly qualified. Records for each person, including the bonding procedure with dates as well as the results of any qualification testing are to be shown to the Surveyor if necessary.

1.6.9 Bonding Procedure Quality Testing

1 Procedures for making bonds are to include:

(1) Materials used
(2) Tools and fixtures
(3) Joint preparation requirements
(4) Cure temperatures
(5) Dimensional requirements and tolerances

(6) Test acceptance criteria upon completion of assembly

2 Test assemblies are to be fabricated in accordance with procedures in order to be qualified and such assemblies are to consist of at least one pipe-to-pipe joint and one pipe-to-fitting joint.

3 In cases where such test assemblies have been cured, they are to be subjected to hydrostatic test pressures at safety factors 2.5 times design pressures of such test assemblies for not less than one hour. No leakages or separation of joints are allowed. Such tests are to be conducted so that joints are loaded in both longitudinal and circumferential directions.

4 Selection of pipes used for test assemblies are to be in accordance with the following:

(1) In cases where the largest size to be joined has a nominal outside diameter that is 200 *mm* or smaller, test assemblies are to be the largest piping size to be joined.

(2) In cases where the largest size to be joined has a nominal outside diameter that is greater than 200 *mm*, the size of the test assembly is to be either 200 *mm* or 25% of the largest piping size to be joined, whichever is greater.

5 When conducting performance qualifications, each bonder and each bonding operator are to make up test assemblies, the size and number of which are to be as required in **-4**.

~~**5**~~**6** When conducting performance qualifications, each bonder and each bonding operator are to make up test assemblies, the size and number of which are to be as required above.

1.6.10 Miscellaneous

1 Sufficient consideration is to be given for any wearing down caused by materials such as sand and sludge.

2 In cases where *GRP* pipes are used as drain pipes from scrubbers and blower casings of inert gas systems, the requirements in Guidelines for Inert Gas Systems of *IMO* are to be complied with.

3 In cases where plastic pipes are to be installed in external areas, such pipes shall either be specifically approved for external use or be protected against ultraviolet radiation.

4 After installation on board, plastic pipes are to be easily distinguishable from pipes made of other materials.

1.7 Shop Tests

1 Plastic pipes, except for those piping systems specified in **1.3-2**, are to be subjected to the following tests and measurements of dimension after they have been manufactured. The number of test specimens, testing procedures, results, procedures of measurement of dimension and tolerance are to comply with the internal standards of manufacturers that have been approved by the Society.

(1) Tensile tests

(2) Hydrostatic tests (~~h~~Hydrostatic pressures are not to be less than 1.5 times nominal pressure. Alternatively, for pipes and fittings not employing hand lay up techniques, the hydrostatic pressure test may be carried out in accordance with the hydrostatic testing requirements stipulated in the recognized national or international standard to which the pipe or fittings are manufactured, provided that there is an effective quality system in place.) ~~or hydrostatic tests stipulated in standards considered equivalent by the Society~~

(3) Outside diameter and wall thickness measurements

(4) Ascertainment of uniform quality and the presence of no harmful defects

(5) Electric conductivity test (only for those pipes which require electric conductivity in accordance with **1.5.4**)

2 For tests and measurements specified in **-1**, in cases where the manufacture has been assessed in accordance with "**Rules for Approval of Manufacturers and Service Suppliers**", the requirements that items be tested in the presence of the Surveyor may be reduced. In such cases, the Society's Surveyor may require submission of all relevant test results instead.

3 The plastic pipes specified in **1.3-2** are to be subjected to the tests specified in **-1(2)** and **1.5.2** for every batch of pipes. Those tests are to be conducted in the presence of the Surveyor. In cases where the manufacturer has been assessed in accordance with the **Rules for Approval of Manufacturers and Service Suppliers** or the manufacturer has a quality system that meets *ISO* 9000 series standards or their equivalent, the tests are to be conducted by the manufacturer at the frequency specified in the quality system. In such cases, the Society may require submission of all relevant test results instead. The quality system is to consist of elements necessary to ensure that pipes and fittings are produced with consistent and uniform mechanical and physical properties.

~~**3**~~**4** Plastic pipes which have been connected by adhesive bonding, laminating, welding, etc. are to be subjected to hydrostatic tests after completion of all fabrication processes at pressures of 1.5 times design pressures. (See **D1.1.4(6)**) These tests may be carried out after installation on board.

~~**4**~~**5** Notwithstanding the requirements specified in **-1**, the Society may request hydrostatic tests for all plastic pipes at a hydrostatic pressure not less than 1.5 times the nominal pressure taking into consideration the pipe service conditions.

1.8 On-board Tests and Inspection

After installed on board, in addition to those tests and inspections specified in **B2.1.4-2(4)**, 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" in **Table D1.1.6-1** and for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems and exhaust gas cleaning systems (EGCS), 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**.

(4) Safe support of pipes and no harmful defects on their external surface.

EFFECTIVE DATE AND APPLICATION (Amendment 2-7)

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

2. Notwithstanding the amendments to the Guidance, 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 1 July 2021.

* "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.