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.1
Guidance for the Survey and Construction of Steel Ships
Part D 2019 AMENDMENT NO.1

Rule No.39 / Notice No.26 14 June 2019
Resolved by Technical Committee on 1 August 2018 / 30 January 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.1

Rule No.39 14 June 2019

Resolved by Technical Committee on 30 January 2019

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

Rule No.39 14 June 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 1-1

Chapter 2 DIESEL ENGINES

2.1 General

2.1.1 General*

Sub-paragraph -6 has been added as follows.

6 Gas-fuelled engines are to be in accordance with the requirements specified otherwise by the Society in addition to those in this chapter.

Chapter 11 WELDING FOR MACHINERY INSTALLATIONS

Title of Section 11.2 has been amended as follows.

11.2 Welding Procedure and Related Specifications ~~Qualification Tests~~

Paragraph 11.2.1 has been amended as follows.

11.2.1 ~~Requirements for Tests~~ Approval of Welding Procedure and Related Specifications*

1 ~~Manufacturers are to conduct welding procedure qualification tests, if they plan to carry out for the first time the following welding work:~~ The manufacturer is to obtain the approval of the welding procedures in the following cases:

(1) Where the welding procedures are first adopted for the welding work specified below.

(a) Welding work for windlasses to which approved welding procedures and related specifications are to be applied in accordance with **16.2.3**

(~~1~~b) Welding work for boilers, pressure vessels of Group I and Group II

(~~2~~c) Welding work for the principal components of prime movers, etc. (these principal components are specified in **Table D2.1**, **3.2.1-1**, **4.2.1-1** and **5.2.1-1**; hereinafter, this definition applies throughout this Chapter)

(~~3~~d) Welding work using special materials

(~~4~~e) Welding work using special welding procedures

(2) Where the items described in the approved welding procedure specifications are altered.

(3) Where considered necessary by the Surveyor.

~~**2** Except for minor changes in welding conditions, in cases where any part of a welding procedure approved by an approval test as specified in **-1** is modified, a welding procedure qualification test is to be carried out.~~

2 The specifications which correspond to the welding procedure referred to in the preceding **-1** are to be treated collectively as the welding procedure specification and to be approved by the Society. The specifications are to include the items specified in **2.2.2-2** and **-3, Part M**.

3 Whenever manufacturers conduct an approval test for a welding procedure and related specifications applied to a welding work specified in any of **-1(1)(b)** to **(e)**, they are to submit detailed data in connection with this welding work to the Society for approval.

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 14 June 2019.

Amendment 1-2

Chapter 2 DIESEL ENGINES

2.1 General

2.1.4 Approval of Diesel Engines

Sub-paragraph -1(4) has been amended as follows.

1 Diesel engines are to be approved in accordance with the following **(1)** to **(6)**:
((1) to (3) are omitted.)
(4) Licens~~or~~ce approval
((a) and (b) are omitted.)
((5) and (6) are omitted.)

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								○	○(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)	○	○	*TR*(9)
14	Tie rod (5)		○	○	*TR*(9)	○	○	*TR*(9)	○	○	*TR*(9)
15	High pressure fuel injection pipes including common fuel rail					○			○		
16	High pressure common servo oil system					○			○		
17	Heat exchanger, both sides (9)10)					⊖△			⊖△		
18	Accumulator of common rail fuel or servo oil system (11)10)		○			○			○		
19	Piping, pumps, actuators, etc. for hydraulic drive of valves (12)4)		○(13)			○(13)			○(13)		
20	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	Bearings for main, crosshead, and crankpin (12)4)		*TR*(14)2)	*TR*(15)3)	○	*TR*(14)2)	*TR*(15)3)	○	*TR*(14)2)	*TR*(15)3)	○
22	Turbine discs, blades, blower impellers and rotor shafts of exhaust driven turbochargers (16)4)		○	○		○	○		○	○	
23	Casings of exhaust driven turbochargers (16)4)		○(17)5)			○(17)5)			○(17)5)		

Notes:

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

(5) Only for crosshead diesel engines.

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

(7) Materials 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~~7~~) 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.

(10~~9~~) Charge air coolers need only be tested on the water side.

(11~~0~~) Only when capacity exceeds 0.5*l*.

(12~~1~~) 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 for pumps and actuators.

(14~~2~~) Mechanical property test may be omitted.

(15~~3~~) 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~~4~~) In cases where the manufacturer has a quality system deemed appropriate by the Society, materials and non-destructive tests ~~as well as surface inspections and dimension inspections~~ for categories *A* and *B* turbochargers may not require the presence of a Society surveyor ~~be substituted for by tests deemed necessary by the manufacturer~~. In such cases, the submission or presentation of test records may be required by the Society.

(17~~5~~) Chemical composition analysis may be omitted.

Chapter 10 PRESSURE VESSELS

10.2 Materials and Welding

10.2.1 Materials*

Sub-paragraph -3 has been deleted.

1 The materials used for the construction of the pressure parts of pressure vessels are to be adequate for their service conditions and are to comply with the requirements in the following **(1)** to **(3)**. However, when special materials are intended to be used, sufficient information related to the design and usage of these materials is to be submitted to the Society for approval.

(1) Pressure vessels, Group I (*PV*-1)
All materials are to comply with the requirements in **Chapter 3** to **Chapter 7, Part K** and they are to be tested in accordance with the requirements in **Chapter 1** and **Chapter 2** of the said Part.

(2) Pressure vessels, Group II (*PV*-2)
Same as those for Group I. However, for those pressure vessels which conform to either one of the following conditions, materials may be in accordance with the requirements in **(3)**.
(a) Design pressure below 0.7 *MPa*.
(b) Design pressure not exceeding 2 *MPa*, a maximum working temperature not exceeding 150℃ and an internal capacity not exceeding 500 *litres*.

(3) Pressure vessels, Group III (*PV*-3)
Materials complying with the requirements on the recognized standards are to be used.

2 Notwithstanding the requirements in **-1(1)** and **(2)**, the materials used for fittings such as valves, nozzles, etc. that are to be fitted to pressure vessels of Group I and Group II may be in accordance with the requirements in **-1(3)**, where approved by the Society with consideration given to their dimensions and service conditions.

~~**3 Notwithstanding the requirements in -1 and -2 above, the materials used for heat exchangers fitted to diesel engines are to be in accordance with the requirements of 2.2.1.**~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 14 June 2019.

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

3. Notwithstanding the provision of preceding **2.**, the amendments to the Rules may apply to the principal components of diesel engines for which the application for survey is submitted to the Society before the effective date upon request of the owner or the engine manufacturer.

Amendment 1-3

Chapter 4 has been amended as follows.

Chapter 4 GAS TURBINES

4.1 General

4.1.1 Scope

1 The requirements in this Chapter apply to ~~gas turbines of the~~ open cycle ~~type~~ gas turbines (i.e., thermodynamic cycle in which the working fluid enters the gas turbine from the atmosphere and is discharged into the atmosphere) used as main propulsion machinery, or used to drive generators and auxiliaries (hereinafter referred to in this Chapter as all auxiliaries excluding auxiliary machinery for specific use, etc.). The requirements of this Chapter apply mutatis mutandis to other cycle types gas turbines.

2 Gas turbines for driving emergency generators are to ~~conform to~~ comply with the requirements in **3.3** and **3.4, Part H**, in addition to the requirements ~~in this Chapter~~ (excluding **4.2.1-1**, **4.2.1-2**, **4.3.1-1**, **4.3.2** and **4.3.3**~~.~~) in this Chapter.

4.1.2 Terminology

The terminology used in this Chapter is as specified in the following **(1)** to **(5)**:

(1) "Gas generator" is an assembly of gas turbine components that produces heated pressurized gas to a process or to a power turbine.

(2) "Power turbine" is a turbine which is driven by the gases from a gas generator, producing power output from the gas turbine through an independent shaft.

(3) "Combustion chamber" is a component of a gas turbine in which fuel (heat source) reacts with the working fluid to increase its temperature.

(4) "Enclosure" is barriers, used to protect personnel, protect equipment from the environment, contain fires and possibly provide sound attenuation.

(5) "Principal components" of gas turbines are those listed in the following **(a)** to **(h)**:

- (a) Discs (or rotors), stationary blades and moving blades of the turbine
- (b) Discs, stationary blades and moving blades of the compressor
- (c) Turbine and compressor casings
- (d) Combustion chambers
- (e) Turbine output shafts
- (f) Connecting bolts for main turbine components
- (g) Shaft couplings and bolts
- (h) Pipes, valves and fittings attached to a gas turbine classified in **Chapter 12** as either Group I or II

4.1.~~2~~3 Drawings and Data*

Drawings and data to be submitted are as follows:

(1) Drawings and data for approval

- (a) Discs (and/or rotors) of the turbine and compressor
- (b) Combustion chambers
- (c) Details of the fixing of moving and stationary blades
- (d) Shaft couplings and bolts
- (e) Piping arrangements fitted to the turbine (including fuel ~~oil~~, lubricating oil, cooling water,

pneumatic and hydraulic systems~~,~~ and ~~indicating pipe~~ information on materials, ~~pipe~~ sizes and ~~service~~ working pressures of pipes)

(f) Pressure vessels and heat exchangers (classified ~~in~~ as Group I and Group II as defined in **10.1.3**) attached to the turbine

(g) Details of turbine installation

(h) Particulars (type and product number of the turbine, power and number of revolutions per minute of the turbine and compressors at maximum continuous rating, ~~gas pressure and~~ temperatures and pressure at turbine inlet and outlet, pressure losses in inlet air and exhaust ~~ducts~~ gas arrangements, ambient condition intended for operation, ~~service~~ fuel oil and lubricating oil to be used)

(i) Material specifications of principal components

(~~i~~j) Critical speeds of turbine rotors and compressors

(~~m~~k) Number of moving blades in each stage

(~~n~~l) Number and arrangements of stationary blades

(~~o~~m) Lists of safety devices, including those specified in **4.3.5** ~~based on the failure mode and effect analysis.~~

(n) In the case of a gas turbine without service records for Society-classed ships or the modification of specifications of a gas turbine with such service records, the following **i)** and **ii)**:

(~~j~~i) Welding details of principal components

(~~k~~ii) Maintenance instructions

(2) Drawings and data for reference

(a) A list containing all drawings and data submitted (with relevant drawing numbers and revision status)

(~~a~~b) Sectional assembly

(~~b~~c) Moving blades and stationary blades

(~~c~~d) General arrangement

(~~d~~e) Starting arrangement ~~(attached to turbine)~~

(~~e~~f) Inlet air and exhaust gas arrangements

(~~f~~g) Diagram of engine control systems

(~~g~~h) ~~Calculation sheets for~~ Documents containing strength ~~of~~ considerations made for principal components

(~~h~~i) Calculation sheets for vibration of turbine blades

(j) Documentation on the failure mode and effect analysis

(k) In the case of a gas turbine without service records for Society-classed ships or modification specifications of a gas turbine with such service records, the following **i)** and **ii)**:

(~~i~~i) Operation instructions for fuel oil control systems

(~~j~~ii) Illustrative drawing of cooling method for each part of turbine

(~~k~~l) Other drawings and data deemed necessary by the Society

4.2 Materials, Construction and Strength

4.2.1 Materials

1 Materials intended for ~~of the components of gas turbine specified below (hereinafter referred to as "~~the principal components of gas turbines~~")~~ are to comply with the requirements in **Part K**.

~~(1) Discs (or rotor), stationary blades and moving blades of turbine~~

~~(2) Discs, stationary blades and moving blades of compressor~~

~~(3) Turbine and compressor casings~~
~~(4) Combustion chambers~~
~~(5) Turbine output shaft~~
~~(6) Connecting bolts for main components of turbine~~
~~(7) Shaft coupling and bolts~~
~~(8) Pipes, valves and fittings attached to gas turbine classified as either Group I or II in **Chapter 12**~~

2 The principal components of gas turbines (excluding bolts, pipes, valves and fittings) are to ~~have been~~ be subjected to the non-destructive tests specified in **5.1.10** and **6.1.10, Part K**.

3 ~~The~~ ~~m~~Materials used ~~in~~ for high temperature parts are to have properties suitable ~~for the design, performance and service life~~ against corrosion~~s~~, thermal stress~~es~~, creep~~s~~ and relaxation~~s~~ in order to maintain intended performance and achieve the intended service life. In cases where the base material is coated, for example, with corrosion-resistant surfacing, the coating material is to have ~~such~~ properties such that it is hard to detach from the base material ~~as well as not to impair~~ the strength of the base material is not impaired.

4.2.2 Construction and Installations

1 Gas turbines are to be so designed that no excessive vibration and surging, etc. are induced within the operating speed range.

2 Each part of ~~a~~ gas turbine~~s~~ is to be so constructed that no detrimental deformations are caused by ~~their~~ its thermal expansions.

3 Where the principal components of gas turbines are of welded construction, they are to comply with the requirements in **Chapter 11**.

4 ~~In the event of failure of the main source of electrical power, the~~ ~~g~~Gas turbines ~~for~~ used as main propulsion machinery are to be so designed ~~as not to cause the gas generator to stop, or to enable to~~ that they can restart immediately when the electrical power supply is resumed after ~~the gas generator has stopped~~ any stoppage resulting from a temporary failure of the main source of electrical power.

5 Gas turbines are to be installed ~~on the seatings~~ so that no excessive structural constraints are caused by thermal expansion~~s~~.

6 Gas turbines are to be ~~designed and~~ installed so that any ~~possible shedding of~~ ~~the~~ turbine or compressor ~~or turbine~~ blade~~s~~ loss or any failure of other principal components ~~will~~ does not endanger ~~the ship, any other machinery and any~~ persons and machinery ~~on board~~ in the vicinity of the gas turbine. In addition, gas turbines are to be constructed to contain, as far as possible, turbine or compressor blades and any blade debris in the event of blade loss.

4.3 Safety Devices

4.3.1 Governors and Overspeed Protective Devices

1 Gas turbines are to be provided with an overspeed protective device. ~~The overspeed protective~~ This device is to be so adjusted that the output shaft speed may not exceed the maximum continuous speed by more than 15 % ~~as well as~~ and is to have the functions ~~that are~~ specified in **4.3.2-2**.

2 Gas turbines are to be provided with a speed governor independent of the overspeed protective device specified in **-1** above. The speed governor is to be capable of controlling the speed of the unloaded gas turbine without bringing the overspeed protective device into action.

3 The governors of gas turbines used to drive generators are to ~~conform to~~ comply with the requirements in **2.4.2-1** and **-2, Part H**. However, when gas turbines used ~~for~~ as main propulsion machinery in electric propulsion ships are used to drive generators to supply electric power

exclusively to propulsion motors, the requirements in **5.1.2-2, Part H** are to be applied.

4.3.2 ~~Emergency Stopping~~ Shut-down Devices

1 Gas turbines are to be provided with ~~emergency stopping devices operated by suitable manually operated gears installed~~ hand trip gear for shutting off the fuel in an emergency which is to be provided at the control station.

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

(1) Over speed

(2) ~~Low~~ Unacceptable lubricating oil pressure drop (for gas turbines other than the main gas turbines, only in the case where forced lubrication is adopted.)

(3) Failure of the lubricating oil system

(~~3~~4) Failure in automatic starting

(~~4~~5) ~~Flame-out~~ Loss of flame during operation

(~~5~~6) Excessive vibrations

(7) Excessive high temperature of gas at the turbine inlet or outlet

3 In addition to the requirements specified in **-2** above, gas turbines ~~for~~ used as main propulsion machinery are to be provided with a quick closing device (shut-down device~~s~~) which automatically shuts off the fuel supply to the turbines ~~under~~ in at least the following ~~conditions~~ **(1)** to **(3)** cases. ~~as well as to be provided with such~~ In addition, means are to be provided so that ~~alarm devices that give~~ alarms are operated at the control station ~~when any~~ by the activation of these shut-down devices ~~come into action~~.

(1) Excessive axial displacement of each rotor (except for gas turbines with roller bearings)

~~(2) Abnormal rise of turbine inlet or outlet gas temperature~~

(~~3~~2) Unacceptable lubricating oil pressure drop of reduction gear

(~~4~~3) Excessive high vacuum pressure at the compressor inlet ~~(except for gas turbines with automatic by-pass doors etc.)~~

4.3.3 Alarms

~~**1**~~ Gas turbines are to be provided with alarm devices as required by **Table D4.1** ~~which come into action under the following conditions. In cases where shut-down devices specified in **4.3.2** are also required, the alarm is to work before any shut-down devices come into action~~.

~~(1) Abnormal rise of turbine inlet or outlet gas temperature~~

~~(2) Drop of lubricating oil pressure~~

~~(3) Drop of fuel oil supply pressure~~

~~(4) Excessive vibration~~

~~**2** In addition to the requirements specified in -1 above, gas turbines for main propulsion are to be provided with alarm devices which come into action under the following conditions. In cases where shut-down devices specified in **4.3.2** are also required, the alarm is to work before any shut-down devices come into action.~~

~~(1) Abnormal rise of differential pressure across lubricating oil filter~~

~~(2) Abnormal rise of lubricating oil inlet temperature~~

~~(3) Abnormal rise of cooling medium temperature in case where an intercooling cycle is adopted~~

~~(4) Abnormal rise of bearing temperature or lubricating oil outlet temperature~~

~~(5) Excessive high vacuum pressure at the compressor inlet~~

Table D4.1 Emergency Shutdown and Alarm Settings(1)

Monitoring parameter	Alarm	Emergency Shutdown	
		Gas turbines used as main propulsion machinery	Gas turbines other than those used as main propulsion machinery
Turbine speed	H	X	X
Lubricating oil pressure	L(2)	X	X(3)
Failure of the lubricating oil system	○(4)	X	X
Lubricating oil pressure of reduction gear	L(2)	X	
Differential pressure across lubricating oil filter	H		
Lubricating oil temperature	H		
Oil fuel supply pressure	L		
Oil fuel temperature	H		
Cooling medium temperature	H		
Bearing temperature	H		
Flame and ignition failure	○	X	X
Automatic starting failure	○	X	X
Vibration	H(2)	X	X
Axial displacement of rotor	H	X	
Exhaust gas temperature at the turbine inlet	H(2)	X	X
Exhaust gas temperature at the turbine outlet	H(2)	X	X
Vacuum pressure at the compressor inlet	H(2)	X	
Loss of control system	○		

Notes:

(1) "H" and "L" mean "high" and "low". "○" means abnormal condition occurred.

(2) Alarms are to be activated at the suitable setting points prior to arriving the critical condition for the activation of shut-down devices in the case where such shutdown is required.

(3) Only in the case where forced lubrication is adopted.

(4) Alarms are to be audible and visual.

4.3.4 Fire Detection and Extinction Systems in Enclosures

Where ~~an acoustic enclosure is fitted which completely surrounds the~~ gas generators and the high pressure oil pipes of gas turbines are surrounded by an enclosure, the enclosure is to be provided with fire detection systems and a fire extinguishing system~~s~~ which complies with the requirements of **Part R** ~~are to be provided for the enclosure~~.

4.3.5 Additional Safety Devices

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

4.4 Associated Installations

4.4.1 Air Inlet Systems

~~The a~~Air inlet systems ~~is~~ are to ~~have such construction~~ be so constructed and arrange~~ment~~d ~~so~~ that any intrusion of harmful particles and water into ~~the~~ compressors can be minimized. ~~Additionally~~ In addition, means are to be provided to minimize the detrimental effects caused by any salt deposits in the suction air, and if necessary, by any icing of the air intake.

4.4.2 Exhaust Gas Arrangement, etc.*

1 The open ends of exhaust gas pipes are to be located so as to prevent exhaust gas from entering into the air inlet system.

2 Boilers and heat exchangers utilizing the exhaust heat of gas turbines are also to comply with the requirements specified in **Chapter 9** and **Chapter 10**.

3 Exhaust gas arrangements and other hot surfaces ~~is also to comply with the requirements specified in **2.5.2**~~ are to be water-cooled or sufficiently covered with thermal insulation so that surface temperature does not exceed 220℃. However, in cases where no fire is likely to occur, this requirement may be dispensed with.

4 Exhaust gas arrangements are also to comply with the requirements specified in **13.16**.

4.4.3 Starting Arrangements*

1 Starting devices are to be so arranged that the firing operation is discontinued and the main fuel valve is closed within a pre-determined time in cases where ignition fails. In addition, ~~G~~gas turbines are to be provided with ~~suitable~~ automatic or interlocked means for the following **(1)** or **(2)** before ignition commences (on starting) or recommences ~~after failure to start that are effective in preventing~~ so as to prevent abnormal combustion or ignition trouble ~~at the time of starting or restarting after starting failure~~.

(1) Clearing all parts of the main gas turbine of the accumulation of liquid fuel; or

(2) Purging gaseous fuel

2 Where compressed air ~~or batteries are~~ is used for starting, the starting arrangement is ~~also~~ to comply with the requirements specified in ~~**2.5.3**~~**13.13**, in addition to the following **(1)** to **(5)**~~.~~:

(1) In order to protect starting air mains against the effects of backfiring and internal explosion in the starting air pipes (including explosion arising from improper functioning of starting valves), means are to be provided in accordance with the following **(a)** to **(e)**:

(a) An isolation non-return valve or equivalent is to be fitted at the starting air supply connection to each gas turbine.

(b) A rupture disc or flame arrester is to be fitted in way of the supply inlet to the starting air manifold.

(c) In cases where an flame arrester is provided in accordance with **(b)** above, a rupture disc is to be fitted at an appropriate position on the starting air manifold as an emergency means for pressure relief.

(d) For rupture discs which cannot be readily replaced, a mechanism of blocking up the exhaust way is to be provided for the purpose of quick restart of the gas turbine. This blocking mechanism is to be fitted with a means of indicating whether it is blocking or not.

(e) An effective arrangement to prevent the accumulation of oils in the starting air manifold or to prevent the excessive temperature rise in the starting air manifold is to be provided.

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

(a) Ships other than electric propulsion ships

$Z = 6C$

where

Z: Total number of starts of gas turbines

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

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

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

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

(b) Electric propulsion ships

$Z = 6 + 3\ (k\text{-}1)$

where

Z: Total number of starts of gas turbines

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

(3) The capacity of the reservoirs specified in **(2)** above is to be about equal.

(4) The compressor to which **13.13.3-2** applies is to have a capacity not less than 50% of the total capacity specified in **13.13.3-3**.

(5) The capacity of starting air compressors fitted for main propulsion machinery (excluding an emergency compressor which is installed to satisfy **1.3.1-5**) is to be approximately equally divided between the number of said compressors.

3 Gas turbines which are arranged for electrical starting are to comply with the requirements specified in **Part H**, in addition to the following **(1)** to **(3)**:

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

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

(3) The starting batteries are to be used for starting and the gas turbine's own monitoring purposes only. Provisions are to be made to continuously maintain the stored energy at all times.

4 Gas turbines which are arranged for hydraulic starting are to comply with the requirements specified in **13.10**, in addition to the following **(1)** and **(2)**:

(1) Starting arrangements for main propulsion machinery are to be provided with two sets of hydraulic systems.

(2) The capacity of the hydraulic power pack is to be sufficient (without recharging) to provide the number of consecutive starts specified in **-2** above within 30 *minutes*.

4.4.4 Ignition Arrangements

1 Each ~~device in~~ ignition arrangement~~s~~ is to ~~be composed~~ consist of two or more systems ~~that~~ independent of each other.

2 ~~The c~~Cables of an electric ignition device ~~is~~ are to be arranged so that ~~have good~~ satisfactory electrical insulation is ensured and ~~to be laid in such a way that it is not easily~~ the cables are not likely to be damaged.

3 Ignition distributors are to be of an explosion-proof construction or are to be provided with proper shielding. No coils for any ignition device are to be situated in areas where explosive gases may accumulate.

4.4.5 Fuel Oil Arrangements

1 Sufficient consideration is to be given to the prevention of any clogging of ~~the~~ fuel manifolds and fuel nozzles due to solids ~~particles~~ contained in the fuel~~,~~ and ~~also for~~ to the prevention of any corrosion of turbine blades and other parts due to corrosive substances such as salts ~~and similar corrosive substances~~.

2 The fuel control system is to comply with the following requirements:

(1) The fuel control system is to be capable of adjusting the fuel supply to the burners so as to maintain the exhaust gas temperature within the pre-determined range throughout the normal operation.

(2) The fuel control system is to be capable of ensuring stable combustion throughout the operation range where the fuel supply is adjustable.

(3) ~~At a sudden load fluctuation, t~~The fuel control system is to be capable of maintaining the minimum speed of the turbines without stopping the gas generator in the case of sudden load fluctuations.

(4) In dual-fuel applications, provision is to be made for automatic isolation of both primary and standby fuel supplies in the event of a fire.

3 The fuel oil arrangements are also to comply with the requirements in **13.9**, **Part D** and **4.2.2**, **Part R**.

4.4.6 Lubricating Oil Arrangements

1 Gas turbines ~~for~~ used as main propulsion machinery are to be provided with an effective emergency supply of lubricating oil which comes into service automatically and has sufficient amount ~~of oil~~ to ensure adequate lubrication until the turbine is brought to rest after a shutdown of the fuel oil supply~~,~~ in ~~case~~ the event of a failure of the lubricating oil supplying system. ~~The emergency supply may be obtained from~~ For this purpose, a gravity tank or from an auxiliary lubricating oil pump driven by the turbine may be used.

~~**2** The lubricating oil arrangements for main gas turbines are to be provided with the automatic temperature controlling devices.~~

~~**3**~~**2** An oil sampling ~~connection~~ valve is to be provided at a proper location.

~~**4**~~**4** Lubricating oil arrangements are also to comply with the requirements in **13.10**, **Part D** and **4.2.3**, **Part R**.

4.4.7 Automatic Temperature Controls

The gas turbine services specified in the following **(1)** to **(3)** are to be fitted with automatic temperature controls so as to maintain steady state conditions throughout the normal operating range of the main gas turbine.

(1) Lubricating oil supply

(2) Oil fuel supply (or automatic control of oil fuel viscosity as alternative)

(3) Exhaust gas

4.4.8 Cooling Arrangements

Gas turbines are to be provided with cooling arrangements as required, and arrangements are to be provided so that the design temperature is not exceeded.

4.5 Tests

4.5.1 Shop Tests*

1 For gas turbines and their accessories hydrostatic tests are to be carried out at pressures specified below.

(1) Casing: 1.5 times the maximum design pressure.

(2) Piping system: Pressures specified in section **12.6**.

2 For rotating assemblies of turbines and compressors, dynamic balancing tests are to be carried out after their assembly.

3 For turbine rotors, excess speed tests are to be carried out at 115% or greater of the maximum continuous rotational speed for at least 2 *minutes* after completion of manufacture. When the Society recognizes that the rotational speed does not exceed 115% of the maximum continuous rotational speed, tests may be carried out at 115%.

4 For gas turbines, shop trials are to be carried out, including the test of safety devices specified in **4.3** above, by procedures deemed appropriate by the Society. In this case, the Society may request tests regarding the starting characteristics and critical speeds of rotor shafts.

Chapter 11 WELDING FOR MACHINERY INSTALLATIONS

11.2 Welding Procedure Qualification Tests

11.2.1 Requirements for Tests*

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

1 Manufacturers are to conduct welding procedure qualification tests, if they plan to carry out for the first time the following welding work:

((1) is omitted.)

(2) Welding work for the principal components of prime movers, etc. (these principal components are specified in **Table D2.1**, **3.2.1-1**, ~~**4.2.1-1**~~**4.1.2(5)** and **5.2.1-1**; hereinafter, this definition applies throughout this Chapter)

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

Chapter 13 PIPING SYSTEMS

13.12 Cooling Systems

13.12.1 Cooling Pumps*

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

1 Number and capacity of cooling pumps for main propulsion machinery.

(1) Main propulsion machinery is to be provided with a main cooling pump of sufficient capacity to maintain the supply of water (oil) at the maximum continuous output of the machinery as well as a stand-by cooling pump of sufficient capacity to supply cooling water (oil) under the normal navigating conditions. However, the capacity of the stand-by circulating pumps of ships having steam turbines as main propulsion machinery ~~will be~~ is considered ~~in each case~~ by the Society on a case-by-case basis. These pumps are to be connected and ready for use.

(2) In steam turbine ships, an adequately installed scoop arrangement may be used as the main cooling water pump. In ~~this~~ such cases, the main condenser is to be so arranged as to be sufficiently cooled by other cooling systems~~,~~ while the ship runs at low speed, in addition to any cooling system performed by the stand-by cooling water pumps ~~prescribed~~ specified in **(1)** above.

(3) In cases where two or more main propulsion machinery are provided~~,~~, each of which has a built-in main cooling pump as well as cases where it is possible to obtain navigable speed in case of the failure of one of the main propulsion machinery, stand-by cooling pumps may be dispensed with on the condition that one complete spare pump is carried on board.

2 Number and capacity of cooling pumps for auxiliaries, electrical generators and their prime movers.

(1) Electrical generators and auxiliaries for which duplication is required and their prime movers are to be provided with main and stand-by cooling pumps of sufficient capacity to maintain the supply of water (oil) at the maximum continuous output of the machinery. These pumps are to be connected and ready for use.

(2) In cases where each of prime mover ~~prescribed~~ specified in **(1)** above is provided with an exclusive main cooling pump, the stand-by cooling pump may be omitted.

3 Drive system of stand by cooling pumps and use of other pumps.

(1) Stand-by cooling pumps are to be driven by an independent power source.

(2) In cases where a suitable pump driven by an independent power source and intended for other purposes is available for use, this pump may be used as a stand-by cooling pump.

13.13 Pneumatic Piping Systems

13.13.3 Number and Total Capacity of Air Compressors

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

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

valves will be considered to be equivalent to any air compressors driven by the main propulsion machinery.

2 One of the air compressors ~~prescribed~~ specified in **-1** above is to be driven by a prime mover that is not the main propulsion machinery.

3 The total capacity of air compressors is to be sufficient to supply air into the air reservoirs from atmospheric pressure to the pressure required for the consecutive starts prescribed in **2.5.3-2** or **4.4.3-2**, corresponding to the type of prime mover, within one *hour*.

13.16 Exhaust Gas Piping Arrangements

Paragraph 13.16.1 has been amended as follows.

13.16.1 Exhaust Gas Pipes from Diesel Engines and Gas Turbines*

1 In principle, the exhaust gas pipes ~~of~~ from two or more diesel engines are not to be connected together except in the following **(1)** and **(2)** cases~~:~~. In addition, the exhaust gas pipes from diesel engines and gas turbines as well as the exhaust gas pipes from two or more gas turbines are, in principle, not to be connected together.

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

(2) In cases where exhaust gas pipes of two or more diesel engines are connected to common exhaust gas cleaning systems deemed appropriate by the Society.

2 Exhaust gas piping lines ~~that are led overboard near the water line~~ are to be ~~so~~ arranged ~~as to prevent~~ so that water does not enter ~~from being siphoned back into~~ the cylinders of diesel engines or gas turbines. In particular, exhaust gas piping lines that are led overboard near the water line are to be so arranged to prevent water from being siphoned into the line.

3 Boiler uptakes and exhaust piping lines from diesel engines are not to be connected together except in the following **(1)** and **(2)** cases~~:~~. In addition, boiler uptakes and the exhaust gas pipes from gas turbines are not to be connected together except in case **(1)**.

(1) In cases where boilers or gas turbines are arranged to utilize waste heat from diesel engines.

(2) In cases where boiler uptakes and exhaust piping lines from diesel engines are connected to common exhaust gas cleaning systems deemed appropriate by the Society.

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 14 June 2019.

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

Amendment 1-4

Chapter 11 WELDING FOR MACHINERY INSTALLATIONS

Title of Section 11.2 has been amended as follows.

11.2 Welding Procedure and Related Specifications ~~Qualification Tests~~

Paragraphs 11.2.2 and 11.2.3 have been amended as follows.

11.2.2 Execution ~~Kinds~~ of Tests*

The requirements in **4.1.3 of Part M** are to be applied. However, approval tests for the following welding procedures and related specifications are to be in accordance with requirements otherwise specified.

(1) Welding procedures and related specifications applicable to the welding work specified in **11.2.1-1(1)(a)** for which the approval test is carried out using a material not specified in **Part K** as a base metal

(2) Welding procedures and related specifications applicable to the welding work for boilers, pressure vessels or principal components of prime movers, etc.

(3) Welding procedures and related specifications applicable to the welding work specified in **11.2.1-1(1)(d)** or **(e)**

~~**1** The types of tests are as follows:~~

~~(1) Mechanical tests~~

~~(a) Butt welding~~

~~i) Tensile test for joints~~

~~ii) Guided bend test or rolled bend test~~

~~iii) Impact test (the middle welded part, the boundary between the base metal and the welded part as well as the heat affected zone)~~

~~(b) Fillet weldings~~

~~Fracture test~~

~~(2) Visual inspection and hardness test~~

~~(3) Macroscopic and microscopic examinations (the middle part of weld metal, the boundary between the base metal and the welded part as well as the heat affected zone)~~

~~(4) Radiographic examination~~

~~**2** In cases where welding is made to a base metal which has no impact value requirement, the impact test may be omitted subject to Society approval.~~

~~**3** In the case of fillet weldings, microscopic examinations and radiographic examinations may be omitted.~~

~~**4** For welding procedure qualification tests on materials used at high temperatures, the Society may require a creep test or a high temperature tensile test.~~

~~**5** In cases where special materials are used, or special welding procedures are employed, the Society may require other tests matching the specific requirements of such special materials or special welding procedures.~~

11.2.3 ~~Welding of Test Assemblies~~Range of Approval

The requirements in **4.1.4 of Part M** are to be correspondingly applied. However, the ranges of approval for the following welding procedures and related specifications are to be in accordance with the requirements otherwise specified.

(1) Welding procedures and related specifications applicable to the welding work specified in

11.2.1-1(1)(a)

(2) Welding procedures and related specifications applicable to the welding work for boilers, pressure vessels or principal components of prime movers, etc. and the welding work specified in **11.2.1-1(1)(d)** or **(e)**

~~**1** The shape and dimensions of test assemblies are to be as specified in **Fig. D11.1.**~~

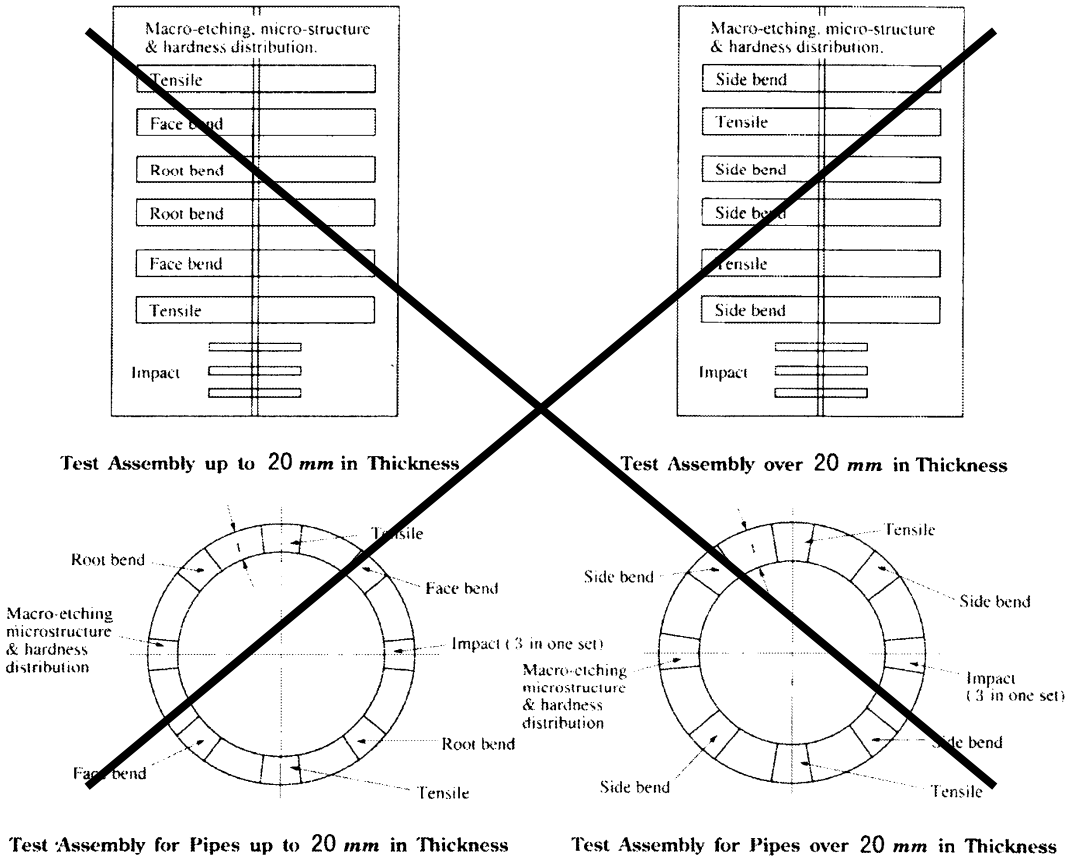
~~**2** Test assemblies are to be of the same or equivalent material used in actual welding work.~~

~~**3** In cases where the test assemblies of rolled steel plates for low-temperature service are butt welded, the direction of the welding generally is to be in parallel with the direction of the rolling.~~

~~**4** In general, the thickness of the test assemblies for welding procedure qualification tests is to be equal to the maximum thickness of the materials to be used in the actual welding work.~~

~~**5** The welding of test assemblies is to be carried out under the same or similar conditions experienced in the actual work.~~

~~Fig. D11.1 Welding Procedure Qualification Test Assemblies~~



Paragraphs 11.2.4 to 11.2.7 have been deleted.

~~**11.2.4 Test Specimens and Test Procedures**~~

~~The shape and dimensions of test specimens and test procedures are to comply with the requirements in **Chapter 3, Part M**. However, the requirements of other appropriate Codes or Standards may be applied subject to Society approval.~~

~~**11.2.5 Retests**~~

~~**1** In cases where a tested part fails to meet the requirements, a retest may be performed by testing multiple test specimens of the same part. If all these additional tests are satisfactory, the part is considered to have passed the test. However, when impact tests for cargo tanks in ships carrying liquefied gases in bulk are performed again, the retests are to be carried out in accordance with the~~

~~requirements in **4.2.11-3, Part M.**~~

~~**2** Test specimens for retests are to be taken from either the same test assembly as the first test or from a test assembly newly welded under the same welding conditions as the first test assembly.~~

~~**3** In cases where a retested part also fails to meet the requirements, tests may be performed over again after changing the welding conditions. In this case, where all of the tests specified for the test assembly have been carried out and their results are in compliance with the requirements, the tests are to be accepted as successful.~~

~~**11.2.6 Test Records**~~

~~Test results are to be summarized and be submitted to the Society as the test records.~~

~~**11.2.7 Omission of Tests**~~

~~In cases where test records, deemed appropriate by the Society, are available and the test results are considered to be satisfactory, a part or all of the tests may be omitted.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 14 June 2019.

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

Amendment 1-5

Chapter 12 PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES

12.4 Connection and Forming of Piping Systems

Paragraphs 12.4.1 and 12.4.2 have been amended as follows.

12.4.1 Welding of Piping Systems

The welding for piping systems is also to comply with the requirements in **Chapter 11**.

12.4.2 Direct Connection of Pipe Lengths*

1 Butt welded joints of pipe lengths are to comply with the following **(1)** and **(2)**. ~~Direct connection of pipe lengths belonging to Group I or II is to be of a butt welded type. However, for steel pipes having a nominal diameter of not more than 80*A*, slip-on sleeve welded joints may be used.~~

(1) Butt welded joints are generally to be of a full penetration type.

(2) Except for pipes belonging to Group II and III, welding is to be as follows:

(a) double welded,

(b) use of a backing ring or inert gas back-up on first pass, or

(c) other equivalent methods recognized by the Society.

2 Slip-on sleeve welded joints are to comply with the following **(1)** and **(2)**.

(1) Slip-on sleeve welded joints are to have sleeves, sockets and weldments of adequate dimensions conforming to standards recognized by the Society.

(2) Except for pipes belonging to Group III, slip-on sleeve welded joints are not to be used for pipes specified in any of the following **(a)** to **(c)**.

(a) Pipes having a nominal diameter of more than 80*A*

(b) Pipes conveying toxic media

(c) Pipes servicing where fatigue, severe erosion or crevice corrosion is expected to occur

3 Threaded joints are to comply with the following **(1)** to **(3)**.

(1) Threaded joints are to comply with the requirements of standards recognized by the Society.

~~2~~(2) Threaded pipe joints ~~(only tapered threads where used for pipes in Group I and Group II)~~ are not to be used for the following pipes. However, the Society may allow use for pipes specified in **(~~3~~e)** ~~and~~ or **(~~4~~f)** after considering the service of the pipes.

(~~1~~a) (Omitted)

(b) Pipes conveying toxic media

(c) Pipes servicing where fatigue, severe erosion or crevice corrosion is expected to occur

(~~2~~d) Pipes for CO_2 systems, except inside protected spaces and in CO_2 cylinder rooms.

(~~3~~e) Pipes belonging to Group I with a nominal diameter exceeding 25*A*.

(~~4~~f) Pipes belonging to Group II and Group III with a nominal diameter exceeding 50*A*.

(3) For pipes belonging to Group I or Group II, threaded joints with tapered threads are to be used.

EFFECTIVE DATE AND APPLICATION (Amendment 1-5)

1. The effective date of the amendments is 14 June 2019.

2. Notwithstanding the amendments to the Rules, the current requirements apply to piping systems of ships for which the date of contract for construction* is before the effective date and that for which the application for examinations of altered parts related to the welding of the piping system or the direct connections of pipe lengths is not submitted to the Society 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 1-6

Chapter 14 PIPING SYSTEMS FOR TANKERS

14.2 Cargo Oil Pumps, Cargo Oil Piping Systems, Piping in Cargo Oil Tanks, etc.

14.2.2 Arrangement of Cargo Oil Piping Systems*

Sub-paragraph -7 has been amended as follows.

7 All cargo oil tanks and cargo piping systems are to be electrically bonded to hull structures by suitable methods such as metal-to-metal contact using welding or bolts, or bonding straps, etc. The following tanks and piping systems which are not permanently connected to the hull of the ship are to be connected to the hull of the ship by bonding straps:

(1) Cargo tanks which are electrically separated from the hull of the ship (e.g., independent cargo oil tanks);

(2) Pipe connections which can be removed (e.g., spool pieces); and

(3) Wafer-style valves with non-conductive (e.g., PTFE) gaskets or seals.

EFFECTIVE DATE AND APPLICATION (Amendment 1-6)

1. The effective date of the amendments is 14 June 2019.

2. Notwithstanding the amendments to the Rules, the current requirements apply to ships other than ships for which the application for Classification Survey during Construction is submitted to the Society on or after the effective date.

Amendment 1-7

Chapter 16 WINDLASSES AND MOORING WINCHES

16.2 Windlasses

16.2.3 Materials and Fabrication*

Sub-paragraph -2 has been amended as follows.

1 Materials

Materials used in the construction of torque-transmitting and load-bearing components of windlasses are to comply with the following requirements:

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

2 Welded fabrication

Welded fabrication is to comply with the following requirements:

(1) (Omitted)

(2) Welding procedures and related specifications ~~welders~~ are to be qualified in accordance with requirements of~~in~~ standards recognized by the Society or the requirements of **Chapter 11**.

(3) Each welder to be engaged in the welding work is to pass the qualification tests specified in **Part M** (including initial and renewal tests) with respect to each required welder qualification depending on the applicable welding process and materials to be welded. In addition, each welder is to obtain a qualification certificate issued by the Society.

(~~3~~4) Welding consumables are to be type-approved by the Society in accordance with the requirements in **Part M ~~of the Rules~~**.

EFFECTIVE DATE AND APPLICATION (Amendment 1-7)

1. The effective date of the amendments is 14 June 2019.

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

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

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

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

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

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

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

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

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

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

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

Note:
This Procedural Requirement applies from 1 July 2009.

Amendment 1-8

Chapter 2 DIESEL ENGINES

2.1 General

2.1.2 Terminology

Sub-paragraph -3 has been added as follows.

3 For low pressure gas-fuelled engines, the terminology is in accordance with the requirements specified otherwise by the Society.

EFFECTIVE DATE AND APPLICATION (Amendment 1-8)

1. The effective date of the amendments is 1 July 2019.

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

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part D Machinery Installations

2019 AMENDMENT NO.1

Notice No.26 14 June 2019

Resolved by Technical Committee on 1 August 2018 / 30 January 2019

Notice No.26 14 June 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 1-1

D1 GENERAL

Table D1.1.6-1 has been amended as follows.

Table D1.1.6-1 Kinds of Auxiliaries

Kind of auxiliary		Auxiliary machinery items
Auxiliary Machinery essential for main propulsion	Auxiliary machinery for cooling systems	Jacket cooling water pumps, Piston cooling water (oil) pumps, Fuel valve cooling water (oil) pumps, Turbocharger cooling water pumps, Circulating water pumps, Cooler cooling water pumps, Generator engine cooling water (oil) pumps, Air compressors cooling water pumps
	Auxiliary machinery for feed water, condensate and draining systems	Boiler water circulating pumps, Condensate pumps, Exhaust gas economizer feed pumps, Drain pumps, Feed water pumps
	Auxiliary machinery for fuel oil systems	F.O. supply (service) pumps, F.O. transfer pumps, Boiler burning pumps, F.O. purifiers
	Auxiliary machinery for lubricating oil systems	Cam shaft L.O. pumps, Turbocharger L.O. pumps, Crosshead L.O. pumps, Reduction gear L.O. pumps, Stern tube L.O. pumps (not applicable for gravitational circulation systems), L.O. purifiers
	Auxiliary machinery for hydraulic systems	Hydraulic oil pumps (pumps to supply hydraulic oil to hydraulic circuits for driving or controlling equipment relevant to main propulsion, e.g., controllable pitch propeller oil pumps)
	Other auxiliary machinery	Vacuum pumps for condensers, Gland steam exhaust fans, Boiler draught fans, Air compressors (excluding air compressors for emergency use), Distilling plants (when distillate is used for main boilers or other essential auxiliary boilers), Others as deemed essential by the Society.
Auxiliary machinery for manoeuvring and safety	Pumps	Bilge pumps (including pumps for oil-water separators*), Ballast pumps, Fire pumps* (including emergency fire pumps), Fuel oil supply pumps for gas combustion units (*GCU*s) of gas-fuelled ships
	Steering-related auxiliary machinery	Steering engines, Side thrusters*, Stabilizers
	Deck machinery	Windlasses, Mooring winches*, Hydraulic pumps used for windlasses, Hydraulic pumps used for mooring winches*
	Ventilating fans, blowers, etc.	Ventilating fans (installed in hazardous areas due to flammable gases or gases harmful to the health of personnel in engine room*, boiler room*, cargo oil pump room of oil tanker), Ventilating fans for cargo oil tanks, Gas-free fans and inert gas blowers of oil tanker, Blower fans for gas combustion units (*GCU*s) of gas-fuelled ships, Others as deemed essential by the Society.
Auxiliary machinery for cargo handling	Cargo handling machinery and gear	Hydraulic pumps used for Cargo handling appliances (items subject to "Rules for the Survey and Construction of Cargo Handling Appliances of Ships"), Hoisting machinery, Operating equipment
	Auxiliary machinery for specific use of oil tanker, ships carrying liquefied gages in bulk and ships carrying dangerous chemicals in bulk	Cargo pumps, Stripping pumps, Tank cleaning pumps, Gas compressors, Pumps used for gas cooling system, Gas refrigerating compressors, Fuel oil supply pumps and blower fans for gas combustion units (*GCU*s) of ships carrying liquefied gases in bulk

	Auxiliary machinery for cargo refrigerating installation	Compressors, Liquid pumps and Condenser cooling pumps used for cargo refrigerating machinery (including items subject to "Rules for the Survey and Construction of Cargo Refrigerating Installation of Ships")
	Other auxiliary machinery	Others as deemed essential by the Society
Auxiliary machinery for specific use	Cargo handling equipment for specific Use	Unloaders (Shipborne units), Refrigerating machines for heat insulated containers, etc.
	Public working equipment	Dredging equipment, Drilling machines, Pile-driving equipment, etc.
	Fishing equipment	Winches, etc.
	Marine-products processing equipment	Canning/packing equipment, Conveyors, Ice-making machines, etc.
	Equipment for specific operations	Equipment specifically designated by the Society

Remarks:
For those items of auxiliary machinery marked by an asterisk, see **D1.1.4(4)**

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 14 June 2019.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships the keels of which were laid or which were at *a similar stage of construction* before the effective date.
(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.
* For high speed craft, "1%" is to be read as "3%".

Amendment 1-2

D2 DIESEL ENGINES

D2.1 General

D2.1.1 General

Sub-paragraph -4 has been added as follows.

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

D11 WELDING FOR MACHINERY INSTALLATIONS

Title of Section D11.2 has been amended as follows.

D11.2 Welding Procedure and Related Specifications ~~Qualification Tests~~

Paragraph D11.2.1 has been amended as follows.

D11.2.1 ~~Requirements for Tests~~ Approval of Welding Procedure and Related Specifications

The "detailed data ~~and information~~" refered to in **11.2.1-3, Part D of the Rules** ~~to be submitted in connection with the welding procedure qualification tests~~ are, in general, to be as follows:

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

(6) Maximum plate thickness and maximum pipe wall thickness of products referred to above, kind and specification of material

(7) (Omitted)

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 14 June 2019.

Amendment 1-3

Chapter D4 has been amended as follows.

D4 GAS TURBINES

D4.1 General

D4.1.~~2~~3 Drawings and Data

~~**1** For gas turbine manufacturers (hereinafter such a manufacturer is referred to as "licensee") producing turbines based on drawings and data of a turbine designer (hereinafter such a designer is referred to as "licenser") which have been already approved by the Society, a list of identification numbers, including the revision status of such drawings and data, may be accepted as a substitution for the drawings and data specified in **4.1.2, Part D of the Rules**.~~

~~**2** In cases where the licensee proposes design modifications on components relevant to the drawings and data mentioned in **-1** above, all associated documents are to be submitted by the licensee for approval or for reference. In addition, in cases where significant modifications are made, a statement confirming the licenser's acceptance of these modifications is also to be submitted.~~

~~**3** In all cases, including those according to **-1** and **-2 above**, a complete set of documents are to be kept in the manufacturing workshop and to be available for review by the attending Surveyor.~~

"Documents containing strength considerations made for principal components" referred to in **4.1.3(2)(h), Part D of the Rules** are to include the following **(1)** and **(2)** documents:

(1) documents showing that mechanical stresses acting on principal components are clear based upon the results of stress analysis or from experimental values, etc. and it is ensured that there is an adequate safety factor for such stresses against the fatigue limit.

(2) documents showing that it has been verified for principle components on which mechanical stresses, thermal stresses, creeps, relaxations, etc. or any combination thereof is applied and that stresses corresponding to differential stresses between those in the static condition of the gas turbine at ambient temperature and those in the condition in which the gas turbine is operating at the maximum continuous output.

D4.2 Materials, Construction and Strength

D4.2.2 Construction and Installations

1 The restart of gas turbines used as main propulsion machinery specified in **4.2.2-4, Part D of the Rules** does not require an automatic restarting function.

2 The phrase "installed so that (...) does not endanger persons and machinery in the vicinity of the gas turbine" specified in **4.2.2-6, Part D of the Rules** means that the following **(1)** to **(3)** are, as far as possible, to be located outside of the plane of high speed rotating parts of the gas turbine, taking into account those cases where the casing is unable to contain a blade or another principal component, or any debris in the event of the loss of a blade or the failure of such a principle component.

(1) Fuel oil, lubricating oil and other systems having a fire risk

(2) Fire detection and alarm systems as well as fire extinguishing systems

(3) Areas normally manned in the compartment where the gas turbine is installed

D4.4 Associated Installations

D4.4.2 Exhaust Gas Arrangement, etc.

The "other hot surfaces" referred to in **4.4.2-3, Part D of the Rules** means, for example, surfaces of piping systems supplying compressed air extracted from a part between compressors or the compressor outlet, or high temperature gas extracted from the turbine inlet or a part between turbines; to the outside.

D4.4.3 Starting Arrangements

1 In cases where the "means" specified in **4.4.3-1, Part D of the Rules** is automatic, ~~F~~fuel oil systems, lubricating oil systems and cooling systems, etc. are to be designed so that ~~they are provided with appropriate interlocks, or~~ they can be operated sequentially according to a pre-determined programme ~~for~~ when the engine ~~the starting-up~~ starts or stops ~~and the stopping of the engine~~. Regarding the sequence and operation related to these systems, attention is to be paid to the following **(1)** to **(7)**:

(1) Lubricating oil pumps are to be in operation before the starting-up and after the stopping of any engine. However, this requirement may be dispensed with in cases where the engine is equipped with roller bearings and the lubricating oil pumps are being driven by the engine.
(2) Combustion chambers are to be pre-purged by a sufficient volume of air before ignition.
(3) The opening of the main fuel valve is not to precede the ignition spark.
(4) The ignition period of each burner (after the main fuel valve has been opened, in the event of ignition failure, the amount of time until the valve is closed.) is not to exceed a pre-determined length of time. The engine starting trial is to be halted in cases where the engine does not start within such a pre-determined time period.
(5) Excessive fuel is not to be supplied to combustion chambers during ignition.
(6) After shutting off the fuel valves, a suitable measure is to be taken to prevent any abnormal combustion or ignition trouble at times of restarting. For example, this could be achieved by opening the drain valves located at positions between the fuel oil shut off valve and the fuel nozzle.
(7) Starting devices are to be disconnected from gas generators after their running becomes self-sustaining.

2 In cases where the "reservoirs" specified in **4.4.3-2(2), Part D of the Rules** are utilized for the "purging" specified in **4.4.3-1(2), Part D of the Rules**, the total capacity of the reservoirs is to be such that a capacity necessary for the purging is added.

D4.4.5 Fuel Oil Arrangements

The "sufficient consideration" referred to in **4.4.5-1, Part D of the Rules** means that provisions such as those in accordance with the following **(1)** and **(2)** are made.

(1) At least two filters are to be fitted in the fuel oil supply lines to the gas turbine and be so arranged that any filter may be cleaned without interrupting the supply of filtered fuel oil to the gas turbine.
(2) Fuel treatment systems, including filtration and centrifuging devices, are to be provided so as to control the level of water and particulate contamination within the limits specified by the manufacturer of the gas turbine.

D4.5 Tests

D4.5.1 Shop Tests

Manufacturers of gas turbines are to submit shop trial plans, according to *JIS B* 8041 or *ISO*

2314 as a standard, for Society approval and all shop trials are to be carried out in accordance with such approved plans.

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 14 June 2019.

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

Amendment 1-4

D11 WELDING FOR MACHINERY INSTALLATIONS

D11.2 Welding Procedure Qualification Tests

Paragraphs D11.2.2 and D11.2.3 have been added as follows.

D11.2.2 Execution of Tsets

1 Approval tests for welding procedures and related specifications that fall under **11.2.2(1), Part D of the Rules** are to comply with the following requirements. For items not specified in the following requirements, **4.1.3** and **4.2** to **4.5, Part M of the Rules** are to be applied correspondingly. In cases where it is difficult to meet the above requirements, approval tests are to be as deemed appropriate by the Society.

(1) Selection of welding consumables

In general, a welding consumable for which the requirements related to strength (i.e. yield point or proof stress and tensile strength) of deposited weld metal is higher than strength of base metals and which resembele to base metals in the chemical composition is to be selected.

(2) Tests for butt welded joints

(a) The kinds of tests, the areas subjected to tests and the number of specimens are to be in accordance with the requirements specified in **Table D11.2.2-1**.

(b) The testing temperatures during impact tests and the values of minimum mean absorbed energy are to comply with the requirements of base metals.

(c) The Vickers hardness measured by hardness tests is, as a standard, to comply with the values specified in **Table D11.2.2-2** depending on the requirements related to the yield point or proof stress of base metals.

(3) Tests for fillet weld joints, T-joints with full penetration and T-joints with partial penetration

(a) For the number of specimens for hardness tests, the requirements specified in **Table D11.2.2-1** are to be applied correspondingly.

(b) The Vickers hardness measured by hardness tests is to be in accordance with **(2)(c)**.

2 Approval tests for welding procedures and related specifications that fall under **11.2.2(2), Part D of the Rules** are to be comply with the following requirements. For the approval tests for welding procedures and related specifications applied to the welding work for materials used at high temperatures, the Society may require a creep test or a high temperature tensile test where demmed necessary. For items not specified in the following requirements, **4.1.3** and **4.2** to **4.5, Part M of the Rules** are to be applied correspondingly.

(1) Test assemblies

Test assemblies are to be of the same or equivalent material used in the actual welding work. Additionally, the thickness of the test assemblies is, in principle, to be equal to the maximum thickness of the materials to be used in the actual welding work.

(2) Tests for butt welded joints

(a) The kinds of tests, areas subjected to tests and the number of specimens are to be in accordance with the requirements specified in **Table D11.2.2-3**.

(b) Test specimens are to be collected in accordance with **Fig. D11.2.2-1**.

(3) Tests for fillet weld joints

The kinds of tests to be conducted are finished inspections, macro-structure inspections, hardness tests and fracture tests.

3 Approval tests for welding procedures and related specifications that fall under **11.2.2(3),**

Part D of the Rules are to be comply with **-2**. However, the Society may require other test conditions or other kinds of tests where deemed necessary.

Table D11.2.2-1 Kinds of Tests, Areas Subjected to Tests and Number of Specimens (Approval Tests for Welding Procedures and Related Specifications Applicable to Welding Work for Windlasses)

Kind of test	Areas subjected to tests or number of specimens
Visual inspection	Whole length of welding joints
Non-destructive inspection	Whole length of welding joints (1)
Tensile test	2
Bend test	4(2)
Impact test (sets)	3–8(3)(4)
Macro-Structure inspection	1
Hardness test	1(5)

Notes:

(1) Internal inspections by radiographic examination or ultrasonic examination, and surface inspections by magnetic particle examination or liquid penetrant examination are to be carried out.

(2) Two specimens are to be taken from the root bend and face bend respectively. However, the root and face bends may be substituted for by four side bends for plates with a thickness of 12 *mm* or more, and pipes with a wall thickness of 20 *mm* or more.

(3) Impact tests may be omitted when welding base metals which have no requirements related to testing temperature during impact tests and minimum mean absorbed energy.

(4) **Fig 4.2** and **Fig. M4.3, Part M of the Rules** are to be applied correspondingly to the position of the notch of the impact test specimen.

(5) Hardness tests may be omitted when welding austenitic stainless steels or materials for which requirements related to yield point or proof stress is less than 355 N/mm^2.

Table D11.2.2-2 Requirements of Hardness Test

Requirements related to yield point or proof stress of a base metal(1) (N/mm^2)	Vickers hardness (*HV*10)
420 or less	350 max
more than 420 but 690 or less	420 max

Note:

(1) In cases where the value is more than 690 N/mm^2, Vickers hardness is to be a value deemed necessary by the Society.

Table D11.2.2-3 Kinds of Tests, Areas Subjected to Tests and Number of Specimens (Approval Tests for Welding Procedures and Related Specifications Applied to Welding Work for Boilers, Pressure Vessels, Principal Components of Prime Movers, etc.)

Kinds of test	Areas subjected to tests or number of specimens
Visual inspection	Whole length of welding joints
Radiographic examination	Whole length of welding joints
Tensile test	2
Bend test	4(1)
Impact test (sets)	3(2) (3)
Macro-Structure inspection	1(4)
Microscopic examinations	-(4)
Hardness test	1

Notes:

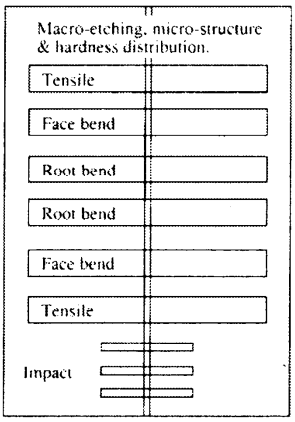
(1) In cases where it is difficult to collect a specified number of test specimens due to tube diameter, the number of each bend test specimen may be reduced by half.

(2) Impact tests may be omitted when welding base metals which have no requirements related to testing temperature during impact tests or minimum mean absorbed energy.

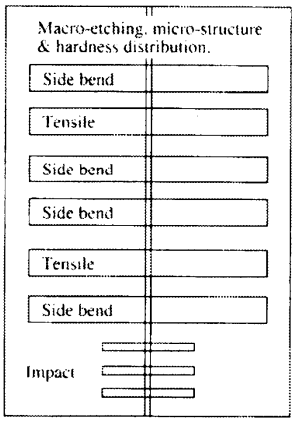
(3) Impact test specimen notch position is to be at the center of weld, on the fusion line and in the heat affected zone.

(4) To be conducted at the center of weld, on the fusion line and in the heat affected zone.

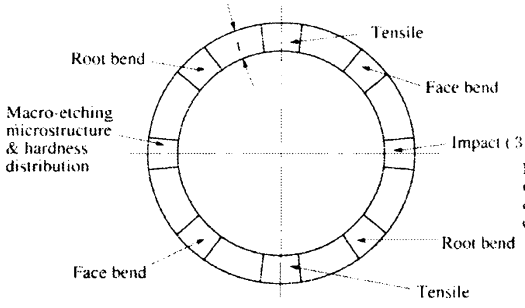
Fig. D11.2.2-1 Welding Procedure Qualification Test Assemblies



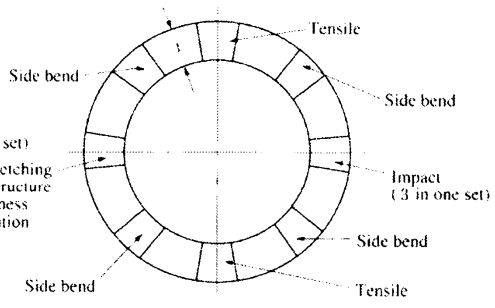
Test Assembly up to 20 *mm* in Thickness



Test Assembly over 20 *mm* in Thickness



Test Assembly for Pipes up to 20 *mm* in Thickness



Test Assembly for Pipes over 20 *mm* in Thickness

D11.2.3 Range of Approval

1 For welding procedures and related specifications that fall under **11.2.3(1), Part D of the Rules**, the range of approval related to the kind of base metal is to be in accordance with the following requirements; however, **4.1.4, Part M of the Rules** is to be correspondingly applied for ranges of approval other than that for the kind of base metal. In cases where it is difficult to meet the above requirements, the ranges of approval are to be as deemed appropriate by the Society.

(1) In cases where the approval test is conducted using the materials specified in **Part K of the Rules** as base metals

(a) Where approved by the Society, the welding procedures may be considered applicable to materials not specified in **Part K of the Rules** in accordance with the group and the subgroup of base metals during approval tests as well as the range of approval related to the kind of base metals specified in *ISO*15614-1.
(The group and the subgroup of materials are to be in accordance with *ISO/TR*15608. This also applies throughout the rest of requirement **-1**.)

(b) With respect to **(a)**, in cases where a welding heat input is greater than 50 *kJ/cm*, the welding procedures may be considered applicable only to materials in the same group and the same subgroup as the materials to which the welding procedures are considered applicable in **4.1.4, Part M of the Rules**.

(2) In cases where the approval test is conducted using materials not specified in **Part K of the Rules** as a base metal

(a) Where approved by the Society, the welding procedures may be considered applicable to materials not used as the test assembly in accordance with the group and the subgroup of base metals during approval tests as well as the range of approval related to kind of base metals specified in *ISO*15614-1.

(b) With respect to **(a)**, in cases where a welding heat input is greater than 50 *kJ/cm*, the welding procedures may be considered applicable only to materials in the same group and in the same or one subgroup below that of the test assembly.

2 For the welding procedures and related specifications that fall under **11.2.3(2), Part D of the Rules**, the upper limit of the range of approval related to thickness is, in principle, to be a value same as the thickness of test assembly; however, **4.1.4, Part M of the Rules** is to be correspondingly applied for the range of approval for the thickness.

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 14 June 2019.

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

Amendment 1-5

D12 PIPES, VALVES, PIPE FITTINGS AND AUXILIARIES

D12.4 Connection and Forming of Piping Systems

Paragraph D12.4.2 has been amended as follows.

D12.4.2 Direct Connection of Pipe Lengths

1 The "standards recognized by the Society" specified in **12.4.2-2(1), Part D of the Rules** refers to, for example, *JIS B*2316.

2 The "toxic media" specified in **12.4.2-2(2)(b)** and **-3(2)(b), Part D of the Rules** refers to, for example, media categorized as toxic gases or toxic substances by the *IMDG* code, as defined in Chapter VII, Regulation 1.1 of the *SOLAS*.

3 The "standards recognized by the Society" specified in **12.4.2-3(1), Part D of the Rules** refers to, for example, *JIS B*2301, *JIS B*2302 and *JIS B*2308.

4 An example of "the Society may allow use for pipes specified in **(e)** or **(f)** after considering the service" specified in **12.4.2-3(2)~~2~~, Part D of the Rules** is that of the fixed local application fire-fighting system specified in **10.5.5, Part R of the Rules**. In cases such as this, all of the relevant joints are to be in compliance with recognized national and/or international standards.

EFFECTIVE DATE AND APPLICATION (Amendment 1-5)

1. The effective date of the amendments is 14 June 2019.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to piping systems of ships for which the date of contract for construction* is before the effective date and that for which the application for examinations of altered parts related to the welding of the piping system or the direct connections of pipe lengths is not submitted to the Society 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 1-6

D14 PIPING SYSTEMS FOR TANKERS

D14.2 Cargo Oil Pumps, Cargo Oil Piping Systems, Piping in Cargo Oil Tanks, etc.

D14.2.2 Arrangement of Cargo Oil Piping Systems

Sub-paragraph -1 has been amended as follows.

1 "~~All cargo oil tanks and~~ C~~c~~argo piping systems" in **14.2.2-7, Part D of the Rules** includes cargo oil pipes, vent pipes, tank washing pipes, etc. ~~the following tanks and cargo oil piping systems:~~

~~(1) Cargo oil pipes, vent pipes, tank washing pipes, etc.;~~

~~(2) Cargo tanks which are electrically separated from the hull of the ship (e.g., independent cargo oil tanks);~~

~~(3) Pipe connections arranged for the removal (e.g., spool pieces); and~~

~~(4) Wafer-style valves with non-conductive (e.g., PTFE) gaskets or seals.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-6)

1. The effective date of the amendments is 14 June 2019.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships other than ships for which the application for Classification Survey during Construction is submitted to the Society on or after the effective date.

Amendment 1-7

Annex D2.1.1 GUIDANCE FOR THE ADDITIONAL REQUIREMENTS ON ELECTRONICALLY-CONTROLLED DIESEL ENGINES

2.1 Construction and Associated Installations

Paragraphs 2.1.2 and 2.1.3 have been amended as follows.

2.1.2 Control Valves

1 Control valves are to be capable of retaining their expected ability to function properly for a period of time set by manufacturers. ~~In principle, this period is to be at least 3 *years.*~~

2 (Omitted)

2.1.3 Accumulators and Common Accumulators

1 (Omitted)

2 Accumulators are to be capable of retaining their expected ability to function properly for a period of time set by manufacturers. ~~In principle, this period is to be at least 3 *years.*~~

3 (Omitted)

EFFECTIVE DATE AND APPLICATION (Amendment 1-7)

1. The effective date of the amendments is 14 June 2019.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to the principal components of diesel engines for which the application for survey is submitted to the Society before the effective date.

3. Notwithstanding the provision of preceding **2.**, the amendments to the Guidance may apply to the principal components of diesel engines for which the application for survey is submitted to the Society before the effective date upon request of the owner or the engine manufacturer.

Amendment 1-8

D2 DIESEL ENGINES

D2.1 General

Paragraph D2.1.2 has been added as follows.

D2.1.2 Terminology

The wording "the requirements specified otherwise by the Society" in **2.1.2-3, Part D of the Rules** means **1.4 of Annex 4 , Part GF** or **1.4 of Annex 4 , Part N**.

D2.6 Tests

Paragraph D2.6.1 has been amended as follows.

D2.6.1 Shop Tests

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

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

(2) For all stages of testing, the following **(a)** to **(c)** ambient conditions are to be recorded and the pertaining operation values (normally the following **(d)** to **(k)** items) for each load point are to be measured and recorded by the engine manufacturer. All results are to be compiled in an acceptance protocol to be issued by the manufacturer. Calibration records for the instrumentation are to be presented to the attending surveyor. In addition, crankshaft deflection is to be checked and recorded in the results in cases where such a check is required by the manufacturer during the operating life of the engine.
   (a) Ambient air temperature
   (b) Ambient air pressure
   (c) Atmospheric humidity
   (d) Power
   (e) Speed
   (f) Fuel index (or equivalent reading)
   (g) Maximum combustion pressures (only when the cylinder heads installed are designed for such measurement)
   (h) Exhaust gas temperature at the turbine inlet and from each cylinder
   (i) Charge air temperature
   (j) Charge air pressure
   (k) Turbocharger speed

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

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

(5) The programme shown in **Table D2.6.1-1** is to be used for the shop trials of diesel engines. In

this case, refer to the *JIS* specified below or those considered equivalent thereto for more details on each respective testing procedure. However, additional tests may be requested by the Society depending on the engine application, service experience, or other relevant reasons. In addition, alternatives to the detailed tests may be agreed between the manufacturer and the Society when the overall scope of tests is found to be equivalent.

(a) ~~For the main~~ In case of diesel engines ~~of diesel ships~~ for main propulsion or driving generators for electrical propulsion ~~ships~~;
JIS F 4304 "Shipbuilding - Internal combustion engines for propelling use-shop test code"

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

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

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

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

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

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

(a) For 4-stroke engines, the operations given in the following **i)** and **ii)** are to be performed without any indication of surging.
i) While at maximum continuous rating (maximum continuous power and speed), speed is to be reduced with the constant torque (fuel index) down to 90% power.
ii) While at 50% power and 80% speed, speed is to be reduced to 72% while keeping constant torque (fuel index).

(b) For 2-stroke engines, the surge margin is to be demonstrated by at least one of the following **i)** to **iii)**:
i) The engine working characteristics established at shop tests of the engine is to be plotted into the compressor chart of the turbocharger (established in a test rig). There is to be at least a 10% surge margin in the full load range, i.e., working flow is to be 10% above the theoretical mass flow at the surge limit where there are no pressure fluctuations.
ii) A sudden fuel cut-off to at least one cylinder at the following **1)** and **2)** loads is not to result in continuous surging and the turbocharger is to be stabilised at the new loads within 20 seconds. For applications with more than one turbocharger, the fuel supply to the cylinders closest upstream to each turbocharger is to be cut off.
1) The maximum power permitted for one cylinder misfiring.
2) The engine load corresponding to a charge air pressure of about 0.06 *MPa*, but

without auxiliary blowers running.

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

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

(1) The requirements specified in **-1(1)** to **(7)** apply mutatis mutandis (in this case the term "diesel engines" is to be read as "gas-fuelled engines").

(2) The engines are to comply with the following **(a)** to **(d)**.

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

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

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

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

ii) Gas pressure and temperature

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

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

ii) Failure of a cylinder gas supply valve

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

iv) Abnormal gas pressure

v) Abnormal gas temperature

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

~~**2**~~**4** (Omitted)

~~**3**~~**5** (Omitted)

~~**4**~~**6** (Omitted)

~~**5**~~**7** (Omitted)

EFFECTIVE DATE AND APPLICATION (Amendment 1-8)

1. The effective date of the amendments is 1 July 2019.

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