RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part GF Ships Using Low-Flashpoint Fuels

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

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

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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 GF Ships Using Low-Flashpoint Fuels

2019 AMENDMENT NO.1

Rule No.39 14 June 2019

Resolved by Technical Committee on 1 August 2018 / 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:

Amendment 1-1

Part GF SHIPS USING LOW-FLASHPOINT FUELS

Chapter 1 GENERAL

1.1 General (*IGF Code* 2.1)

1.1.3 Approval of Systems and Equipment, etc.*

Sub-paragraph -1 has been amended as follows.

1 For ships using natural gas as fuel, the systems and equipment following **(1)** to **(~~20~~21)** that are provided to use the gas fuel are to be approved as specified separately by the Society.
（(1) to (19) are omitted.)
(20) Gas combustion units (**6.9.4**)
(~~20~~21) Gas-fuelled engines

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

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 that fall under the following:
(1) for which the building contract is placed on or after 1 January 2017; or
(2) in the absence of a building contract, the keels of which are laid or which are at *a similar stage of construction* on or after 1 July 2017; or
(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%".
(3) the delivery of which is on or after 1 January 2021.

3. Notwithstanding the provision of preceding **2**, the amendments to the Rules apply to the ships that fall under the following:
(1) which convert to using low-flashpoint fuels on or after 1 January 2017; or
(2) which, on or after the effective date, undertake to use low-flashpoint fuels different from those which it was originally approved to use before 1 January 2017.

Amendment 1-2

Chapter 16 MANUFACTURE, WORKMANSHIP AND TESTING

16.7 Testing (*IGF Code* 16.7)

Paragraph 16.7.2 has been amended as follows.

16.7.2 Expansion Bellows

The following **(1)** to **(4)** type tests are to be performed on each type of expansion bellows intended for use on fuel piping outside the fuel tank as found acceptable in **7.3.6-4(3)(a)** and **(c)** and where required by the Society, on those installed within the fuel tanks:
((1) to (4) are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

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

2. Notwithstanding the amendments to the Rules, the current requirements apply to ships other than ships that fall under the following:
(1) for which the building contract is placed on or after 1 January 2017; or
(2) in the absence of a building contract, the keels of which are laid or which are at *a similar stage of construction* on or after 1 July 2017; or
(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%".
(3) the delivery of which is on or after 1 January 2021.

3. Notwithstanding the provision of preceding **2.**, the amendments to the Rules apply to the ships that fall under the following:
(1) which convert to using low-flashpoint fuels on or after 1 January 2017; or
(2) which, on or after 1 January 2017, undertake to use low-flashpoint fuels different from those which it was originally approved to use before 1 January 2017.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part GF Ships Using Low-Flashpoint Fuels

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:

Amendment 1-1

Part GF SHIPS USING LOW-FLASHPOINT FUELS

Annex 2 GUIDANCE FOR GAS-FUELLED BOILERS

Chapter 1 GENERAL

Sections 1.1 to 1.3 have been amended as follows.

1.1 Scope

1 This annex applies to gas-only engines and dual fuel engines that are used for main boilers using natural gas (hereinafter referred to as "boiler") ~~and gas fuel supply systems~~ in accordance with the requirements in **1.1.3-1, Part GF of the Rules**.
2 Boilers ~~and gas fuel supply systems~~ are to be in accordance with relevant requirements in **Part D** and **Part GF of the Rules**, in addition to the requirements of this annex.
3 The annex is also to be applied mutatis mutandis to auxiliary boilers for which the use of natural gas fuel has been approved.

1.2 Equivalency

Boilers ~~and gas fuel supply systems~~ not in accordance with the requirements of this annex may be accepted provided that they are deemed to be equivalent by the Society to those approved in accordance with this annex.

1.3 Submission of Plans and Documents

The plans and documents to be submitted are as follows.
(1) Plans and documents for approval
  (a) Items specified in **9.1.3, Part D of the Rules**
  (b) Items specified in **18.1.3(1)(a)**, **(c)**~~and~~, **(e)** and **(f)**, **Part D of the Rules**
  ((c) to (l) are omitted.)
(2) Plans and documents for reference
  ((a) and (b) are omitted.)

Chapter 3 CONTROL SYSTEMS AND SAFETY SYSTEMS

3.2 Safety Systems

3.2.1 Safety Systems and Alarm Systems of Boilers

Sub-paragraph -2 has been amended as follows.

2 Boilers of ships subject to the **1.1.1 of the Rules for Automatic and Remote Control Systems** are to be in accordance with the requirements of **3.2** and ~~**3.6**~~**3.3.3** of said rules as well as **-1** above. In addition, such boilers are to be provided with devices which issue alarms in the event any of the abnormalities specified in the following **(1)** to **(10)** occurs:
((1) to (10) are omitted.)

Chapter 4 TESTS

4.3 Tests after Installation On Board

Sub-paragraph -2 has been amended as follows.

2 Automatic control systems and remote control systems for equipment handling gas fuel of boilers and gas fuel preparation plants are to be tested using gas fuel in normal service conditions before the first ~~fuel loading~~ carrying of gas fuel.

Section 4.4 has been amended as follows.

4.4 Sea Trials

1 ~~Performance of the control systems for~~ For dual fuel boilers ~~of dual-fuel engine type~~ and related equipment installed in ships subject to **1.1.1 of the Rules for Automatic and Remote Control Systems**, performance of the control systems is to be verified during operations using oil fuel in accordance with the requirements in ~~**18.7.4-2, Part D of the Rules** and~~ **2.2.5 of the Rules for Automatic and Remote Control Systems** ~~depending upon their of installation characters~~. In addition, tests are to be carried out using gas fuel to verify the control performance of ~~low-pressure~~ dual fuel ~~engines~~ boilers and gas~~-~~ only ~~engines~~ boilers mutatis mutandis in accordance with the aforementioned requirements.

2 The sea trials specified in **2.3.1, Part B of the Rules** are to be carried out for ~~low-pressure~~ dual~~-~~ fuel ~~engine types~~ boilers operating using oil fuel only. In addition, only the tests in **2.3.1, Part B of the Rules** deemed necessary by the Society are to be carried out during the sea trials for ~~low-pressure~~ dual~~-~~ fuel ~~type engines~~ boilers and the gas~~-~~ only ~~type engines~~ boilers operating by gas burning or oil/gas burning.

Annex 2A has been added as follows.

Annex 2A GUIDANCE FOR GAS COMBUSTION UNITS

Chapter 1 GENERAL

1.1 Scope

1 This annex applies to gas combustion units burning natural gas (hereinafter referred to as "*GCU*") in accordance with the requirements in **1.1.3-1, Part GF of the Rules**.
2 *GCU*s are to be in accordance with relevant requirements in **Part D** and **Part GF of the Rules**, in addition to the requirements of this annex.

1.2 Equivalency

*GCU*s not in accordance with the requirements of this annex may be accepted provided that they are deemed to be equivalent by the Society to those approved in accordance with this annex.

1.3 Submission of Plans and Documents

The plans and documents to be submitted are as follows.

(1) Plans and documents for approval
  (a) General arrangement
  (b) Items specified in **18.1.3(1)**, **(3)** and, **(5)** and **(6)**, **Part D of the Rules**
  (c) Operating instructions for the automatic control devices and remote control devices (including sequential control, combustion control and safety devices).
  (d) Diagrams for automatic combustion control devices of *GCU*
  (e) Gas fuel burning devices
  (f) Gas leak protection devices for connections between *GCU*s and gas fuel supply piping systems
  (g) Gas fuel supply piping systems (including details of valves and pipe fittings) and devices to protect surrounding areas, etc. from gas leakages
  (h) Automatic control and remote control systems for gas fuel supply systems
  (i) Prototype test plans for gas fuel burning devices and test results
  (j) Onboard test plans
  (k) Test plans of gas trials specified in **16.5.1**, **Part GF of the Rules**
  (l) Other drawings and data deemed necessary by the Society depending upon the type of *GCU*
(2) Plans and documents for reference
  (a) Instruction manuals (including guidance for onboard maintenance, inspection and overhaul)
  (b) Other drawings and data deemed necessary by the Society

Chapter 2 CONSTRUCTION AND EQUIPMENT OF *GCU*

2.1 General

1 When the maintaining by disposing as thermal oxidation of vapours specified in **6.9.1-1(2), Part GF of the Rules**, following **(1)** to **(3)** are to be complied with:

(1) *GCU*s are to exhibit no externally visible flame;

(2) the uptake exhaust temperature is to be maintained below 535℃;

(3) if waste gases coming from any other system are to be burnt, *GCU*s are to be designed to accommodate all anticipated feed gas compositions.

2 *GCU* burners are to be capable of ensuring stable igniting and burning under all conditions of combustion including the following **(1)** to **(5)** according to the type of burner. In addition, they are, in principle, to be of the type that has passed the prototype tests specified in **4.1**.

(1) Igniting condition and purging condition the fuel supply systems with inert gas (when supplementary oil burning is continued)

(2) Rapid load fluctuations

(3) Minimum load conditions

(4) Free flow combusting condition (when *GCU* burners are designed to be able to do so)

(5) Other conditions as deemed necessary by the Society depending upon the type of burners

3 *GCU*s are to be capable of quickly gas-burning on the condition of igniting.

4 *GCU*s and its supporting auxiliary services are to be to comply with **6.9.6, Part GF of the Rules**.

2.2 Construction and Arrangement

1 The construction of *GCU*s is to be such that a smooth combustion gas flow is ensured without stagnation of the gas fuel, and neither gas fuel nor combustion gases leak out of the *GCU*s.

2 The construction of *GCU*s is to be capable of effective ventilation by a smooth flow of purge gas and air when the combustion chamber is ventilated. The ventilating system is to be as deemed appropriate by the Society.

3 Uptakes of *GCU*s are to be independent through to the funnel top and the uptakes of other combustion systems or exhaust gas pipes of other equipment are not to be connected thereto.

4 Combustion air intakes of *GCU*s are to be independent and to have a dedicated forced draught system to ensure forced air supply.

2.3 Burners

1 Each burner is to be capable of maintaining of stable combustion under all design firing conditions.

2 Gas fuel supply pipes to burners are to be provided with manually operable shut-off valves. In addition, non-return valves and back-fire prevention devices are to be provided in a series.

3 Gas fuel supply pipes to burners are to be purged automatically with appropriate inert gases if the supply is interrupted or burners are extinguished.

4 Gas fuel burners are to be so arranged that they can be ignited individually only by flames of

oil fuel burners. In such cases, oil fuel burners are to be large enough to instantly ignite the gas fuel at any nozzle of gas fuel burners. In the case of direct ignition type gas fuel burners specified in **3.2**, this requirement may be dispensed with.

5 Burners using both gas fuel and oil fuel are to be provided with at least two flame detectors. If a self-diagnostic function capable of monitoring failures of own system as deemed appropriate by the Society is provided, however, a single detector may be accepted.

6 Gas fuel burners are to be provided with a means to ensure the cutting off of gas fuel supplies before dismounting.

7 Gas fuel burners are to be so arranged as not to be damaged by fire during pilot oil burning.

8 Fuel oil burners are to be so arranged as not to be burn-damaged when *GCU*s are operated under the oil burning mode.

9 Each burner is to have suitable devices and be arranged to ensure that gas flow to the burner is cut off unless satisfactory ignition has been established and maintained.

10 Each oxidation system is to have provision to manually isolate its gas fuel supply from a safely accessible position.

Chapter 3 CONTROL SYSTEMS AND SAFETY SYSTEMS

3.1 Control Systems

3.1.1 Gas Burning Control Systems

Control systems for gas fuel burning are to be in accordance with the requirements specified in the following **(1)** to **(5)**. In addition, the wording "boiler" specified in **18.4.1** and **18.4.2, Part D of the Rules** is to be interpreted to mean "*GCU*", the systems are to be applied the requirements.

(1) It is to be so arranged that gas fuel is not supplied to burners until the flames of pilot burners used for gas fuel ignition are established and secured. In cases where gas fuel supply is initiated manually, it is to be so arranged that the gas fuel supply is cut off automatically when gas fuel supply valves are opened before flame of pilot burners are established, or that the gas fuel supply valves are locked until the pilot burner flames are established.

(2) Control systems regulating oil/gas supply ratios are to be capable of maintaining combustion over the full range of loads approved for oil/gas burning with consideration given to ensuring sufficient supplies of combustion air.

(3) Combustion air supplies for gas burning or oil/gas burning are to be automatically controlled to ensure safe combustion within the possible combustible range.

(4) Combustion chambers of *GCU* are to be capable of automatic purging for the chambers with sufficient air volumes both before igniting base burners and after extinction of all burners. Arrangements deemed appropriate by the Society are to be made to enable *GCU*s to be manually purged.

(5) In the case of gas fuel supply rate control systems, it is to be so arranged that gas fuel supply rates are ensured not to be reduced less than predetermined minimum supply rates verified in advance by tests.

3.2 Safety Systems and Alarm Systems

3.2.1 Safety Systems and Alarm Systems of *GCU*

1 Safety systems and alarm systems of *GCU* are to be in accordance with the following **(1)** and **(2)** requirements.

(1) Safety systems are to be provided so that gas fuel supplies to all burners are cut off to stop the operation of *GCU*s when the following **(a)** to **(i)** occur during gas burning or oil/gas burning. The automatic double block and bleed valves specified in **9.4.4, Part GF of the Rules** may be used as automatic cut off valves for this purpose:
   (a) when automatic ignition fails;
   (b) when all flame detectors specified in **2.3-5** issue flame-fail signals (in such cases, it is to be able to stop the supply within 4 *seconds* after flame-fail);
   (c) when a fan supplying air for either combustion or cooling stops (excluding cases where a standby fan automatically switches on when an operating fan stops);
   (d) when gas fuel supply pressure falls (excluding free flow combusting condition);
   (e) when oil fuel (pilot oil) supply pressure falls;
   (f) when the automatic double block and bleed valves specified in **9.4.4, Part GF of the**

Rules fail;

(g) when the master gas fuel valves specified in **9.4.2, Part GF of the Rules** close;

(h) when the uptake exhaust gas reaches high temperature;

(i) when deemed necessary by the Society.

(2) Means are to be provided to issue alarms in the following **(a)** to **(g)** cases:

(a) when one of the flame detectors specified in **2.3-5** issues a flame-fail signal;

(b) when either the combustion or cooling air supply decreases, or the fan stops;

(c) when gas fuel supply pressure falls (excluding free flow combusting condition);

(d) when the power supply for burner control stops;

(e) when gas detectors for the outer pipes of double wall pipes or ducts fail;

(f) when ventilation fans of the protection ducts for gas fuel supply piping specified in **9.5.1, Part GF of the Rules** stop or inert gas pressure in the space between concentric pipes falls;

(g) when factors causing to activate detecting systems specified in **15.8, Part GF of the Rules** occurs.

2 *GCU*s subject to the **1.1.1 of the Rules for Automatic and Remote Control Systems** are to be in accordance with the requirements **-1** above, following **(1)** and **(2)** requirements.

(1) Such *GCU*s are to be provided with devices which issue alarms in the event any of the abnormalities specified in the following **(a)** to **(e)** occurs:

(a) abnormal gas fuel temperatures;

(b) abnormal gas fuel supply pressures;

(c) low inert gas supply pressures for purging gas fuel piping systems and burners;

(d) low pressures of hydraulic or pneumatic power sources for burning control, or loss of electric power supplies;

(e) others deemed necessary by the Society.

(2) Systems intended for automatic combustion control are to comply with the following **(a)** to **(d)** requirements:

(a) Automatic combustion control systems are to comply with the following requirements:

i) The systems are to be able to obtain planned capacity and be able to secure stable combustion.

ii) Devices to control the fuel supply of *GCU* to adjust according to the load imposed and are to be capable of ensuring stable combustion in the controllable range of fuel supply.

iii) In cases where combustion control is carried out according to the pressure of the *GCU*, the upper limit of this pressure is to be lower than the set pressure of the safety valves.

(b) The combustion control devices for intermittent operation are to comply with the following requirements and they are to operate according to a planned sequence:

i) Before ignition of the pilot burner or before ignition of the main burner if a pilot burner is not fitted, the combustion chamber and the flue are to be prepurged by air of not less than 4 times the volume of the combustion chamber and the flue up to the *GCU* uptake. For small *GCU*s with only one burner, a prepurge for not less than 30 *seconds* will be accepted.

ii) In cases where deemed appropriate by the Society and direct ignition, a method of ignition in which the main burner is fired by ignition spark is used, the opening of the fuel valve is not to precede the ignition spark.

iii) In cases where indirect ignition is used, a method of ignition in which the main

burner is fired by a pilot burner, the opening of the fuel valve for the pilot burner (hereinafter referred to as ignition fuel valve in this part) is not to precede the ignition spark, and the opening of the fuel valve for the main burner (hereinafter referred to as main fuel valve in this part) is not to precede the opening of the ignition fuel valve.

iv) Firing is to definitely be carried out within the planned period. If the firing of the main burner has failed, main fuel valves are to be so designed as to close after being opened within 10 *seconds* in the case of direct ignition and 15 *seconds* in the case of indirect ignition.

v) Firing on the main burners is to be carried out at their low firing position.

vi) After closure of the automatic double block and bleed valves, post-purge is to be sufficiently carried out to completely burn off all remaining fuel oil between the valves and the burner nozzle.

(c) The combustion control devices for controlling the number of firing burners are to comply with the following requirements:

i) Each burner is to be fired and extinguished according to a planned sequence. However, the base burner may be fired by manual operation and other burners may be fired by a flame from burner(s) already lit.

ii) Any remaining fuel in extinguished burners is to be automatically burnt up in order not to interfere with any restarting of the burner. However, while the pilot burner is not ignited, any remaining fuel in the base burner is not to be removed by steam or air when the base burner is placed in *GCU*s.

iii) The burners for *GCU*s are to be capable of being fired and extinguished from main control stations or the main control station on the bridge, except for the firing of base burner.

(d) Other combustion control devices are to be deemed appropriate by the Society. They are also to comply with the relevant requirements in **(a)** to **(c)** above.

Chapter 4 Tests and Inspection

4.1 Prototype Tests

Burners of *GCU*s are to be subjected to prototype tests using gas fuel to demonstrate design performance in accordance with test plans approved by the Society. Such tests, however, may be substituted for by the submission of sufficient records of performance data in cases where deemed appropriate by the Society.

4.2 Shop Tests

1 Tests of welds in piping systems and auxiliaries of *GCU* are to comply with relevant requirements in **Chapter 11, Part D** and **Part GF of the Rules**.
2 Tests of Auxiliaries and piping of *GCU* after manufacture are to comply with the requirements in **12.6, Part D of the Rules**.
3 Operating tests of burners are to be conducted using the gas fuel. Shop tests using only oil fuel, however, may be accepted in cases deemed appropriate by the Society when the burners are of the same or similar type as burners which have passed the prototype tests specified in **4.1**.
4 The tests specified in **-3** above may be substituted for with the tests specified in **4.3** in cases where deemed appropriate by the Society.

4.3 Tests after Installation On Board

1 Function tests for the safety devices and alarm devices of *GCU*s are to be carried out after the *GCU* has been installed on board.
2 Automatic control systems and remote control systems for equipment handling gas fuel of *GCU*s and gas fuel preparation plants are to be tested using gas fuel in normal service conditions before the first fuel loading.
3 Part or all of the tests specified in **-2** above may be conducted during the gas trials specified in **4.4**.

4.4 Gas Trials

1 For Gas trials of the control systems for *GCU*s and related equipment **16.5.1, Part GF of the Rules**, the wording “boiler” and “main boiler” specified in **2.2.5 of the Rules for Automatic and Remote Control Systems** are to be interpreted to mean “*GCU*”, the requirements are to apply depending upon their of installation characters to verify the control performance where only oil fuel is used. In addition, tests are to be carried out to verify the control performance where only gas fuel is used in accordance with the aforementioned requirements.
2 For Gas trials of *GCU*s and related equipment, the wording “Sea Trail” specified in **2.3.1, Part B of the Rules** is to be interpreted to mean “Gas Trail”, the requirements are to apply and the gas trials carried out using oil fuel only.
In addition, only the tests in **2.3.1, Part B of the Rules** deemed necessary by the Society are to be

carried out during the gas trials for dual-fuel type engines and the gas-only type engines operating by gas burning or oil/gas burning.

3 The tests specified in **-1** and **-2** above may be conducted during the sea trials.

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 to ships other than ships that fall under the following:

(1) for which the building contract is placed on or after 1 January 2017; or

(2) in the absence of a building contract, the keels of which are laid or which are at *a similar stage of construction* on or after 1 July 2017; or

(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%".

(3) the delivery of which is on or after 1 January 2021.

3. Notwithstanding the provision of preceding **2**, the amendments to the Guidance apply to the ships that fall under the following:

(1) which convert to using low-flashpoint fuels on or after 1 January 2017; or

(2) which, on or after the effective date, undertake to use low-flashpoint fuels different from those which it was originally approved to use before 1 January 2017.

Amendment 1-2

GF11 FIRE SAFETY

Section GF11.3 has been amended as follows.

GF11.3 Fire Protection ~~(*IGF Code* 11.3)~~

GF11.3.1 General

1 The wording "fire protection" specified in **11.3.1-1, Part GF of the Rules** means structural fire protection, not including means of escape.

2 In applying **11.3.1-1, Part GF of the Rules**, enclosed spaces containing equipment for fuel preparation such as pumps or compressors or other potential ignition sources are to be provided with a fixed fire-extinguishing system complying with any one of the requirements specified in **Chapter 25** to **Chapter 27, Part R of the Rules** and taking into account the necessary concentrations / application rate required for extinguishing gas fires.

~~**1**~~**3** The wording "not deemed necessary by the Society" in **11.3.1-2, Part GF of the Rules** refers to cases where the Administration has decided on the voluntary early implementation of the amendments in resolution *MSC*.422(98) in accordance with *MSC*.1/*Circ*.1568.

~~**2**~~**4** The following "other rooms with high fire risk" (as referred to in **11.3.1-3, Part GF of the Rules**) are as a minimum to be considered, but not be restricted to:

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

GF12 EXPLOSION PREVENTION

GF12.5 Hazardous Area Zones

GF12.5.2 Hazardous Area Zone 1

Sub-paragraph -2 has been amended as follows.

2 Fuel storage hold spaces for type *C* tanks are normally not considered as hazardous area zone 1. The detailed classification of such fuel storage hold spaces are as follows:

(1) Fuel storage hold spaces with all potential leakage sources in a tank connection space and having no access to any hazardous area, are to be considered non-hazardous.

(2) Where the fuel storage hold spaces include bolted access to the tank connection space, they are to be considered hazardous area zone 2.

(3) Where the fuel storage hold spaces include potential leak sources, e.g. tank connections, they are to be considered hazardous area zone 1.

GF15 CONTROL, MONITORING AND SAFETY SYSTEMS

GF15.10 Ventilation

Paragraph GF15.10.1 has been amended as follows.

GF15.10.1 Alarms

In applying **15.10.1, Part GF of the Rules**, ~~means for measuring ventilation flow rate, means capable of detecting mechanical ventilation system stop or other equivalent means are to be provided.~~ acceptable means to confirm that the ventilation system has the "required ventilating capacity" in operation are as specified in the following **(1)** to **(3)**, but not limited to:

(1) Monitoring of the ventilation electric motor or fan operation combined with underpressure indication.

(2) Monitoring of the ventilation electric motor or fan operation combined with ventilation flow indication.

(3) Monitoring of ventilation flow rate to indicate that the required air flow rate is established.

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

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

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

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

(2) which commence conversion to using low-flashpoint fuels on or after the effective date ("commence conversion" date means the date on which the contract is placed for the conversion or in the absence of a contract, the date on which the work identifiable with the specific conversion begins.); or

(3) using low-flashpoint fuels, which commence, on or after the effective date, undertaking to use low-flashpoint fuels different from those which it was originally approved to use before the effective date. ("commence undertaking to use" date is the date of the document accepted by the Classification Society as request for approval for the use of a new fuel.)

* "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 1-3

Annex 3 GUIDANCE FOR HIGH PRESSURE GAS-FUELLED ENGINES

Chapter 1 GENERAL

1.1 Scope

Sub-paragraph -3 has been added as follows.

3 High pressure gas-fuelled engines are to be in accordance with those requirements for low pressure gas-fuelled engines specified in **Annex 4** which the Society deems appropriate.

Chapter 4 TESTS

4.2 Shop Tests

Paragraph 4.2.2 has been amended as follows.

4.2.2 Shop Trials

~~1~~ High pressure gas-fuelled engines are~~, in principle, to be subjected to shop trials using fuel gas before installation on board ship. Shop trials using only oil fuel, however, may be accepted for dual fuel engines which are identical or similar to engines which have passed the prototype tests specified in **4.1**~~ to be tested as specified in **D2.6.1-3, Part D of the Guidance**.

~~**2** Even in cases where shop trials using only oil fuel are approved in accordance with the requirements of **-1** above, the operation of equipment related to the combustion of gas fuel is to be verified by appropriate means to be satisfactory as far as practicable.~~

Annex 4 GUIDANCE FOR LOW PRESSURE GAS-FUELLED ENGINES

Chapter 1 GENERAL

1.1 Scope

Sub-paragraph -1 has been amended as follows.

1 This annex applies to trunk piston reciprocating engines ~~designed to directly inject natural gas not compressed to high pressure into cylinders during suction strokes or into suction piping and ignite for combustion at the termination of compression strokes~~ supplied with low pressure natural gas as fuel (hereinafter referred to as "low pressure gas-fuelled engines"), and gas fuel supply systems in accordance with the requirements of **1.1.3-1, Part GF of the Rules**.

Section 1.4 has been added as follows.

1.4 Terms

1 *Certified safe type* means electrical equipment that is certified in accordance with the recommendation published by the International Electrotechnical Commission (*IEC*), in particular publication *IEC* 60092-502:1999, or with recognized standards at least equivalent. The certification of electrical equipment is to correspond to the category and group for methane gas.

2 *Double block and bleed valves* means a set of two valves in series in a pipe and a third valve enabling the pressure release from the pipe between those two valves, specified in **2.2.1-9, Part GF of the Rules**. The arrangement may also consist of a two-way valve and a closing valve instead of three separate valves. The valves are to be in accordance with **9.4.4** to **9.4.6**.

3 *Dual fuel engine* means an engine that can burn natural gas as fuel simultaneously with liquid fuel, either as pilot oil or bigger amount of liquid fuel (gas mode), and also has the capability of running on liquid diesel fuel oil only (diesel mode).

4 *Engine room* is a machinery space or enclosure containing gas fuelled engine(s).

5 *Gas means* a fluid having a vapour pressure exceeding 0.28 *MPa* absolute at a temperature of 37.8℃.

6 *Gas admission valve* is a valve or injector on the engine, which controls gas supply to the cylinder(s) according to the cylinder(s) actual gas demand.

7 *Gas only engine* means an engine capable of operating on gas fuel only and not able to switch over to oil fuel operation.

8 *Gas piping* means piping containing gas or air / gas mixtures, including venting pipes.

9 *Gas Valve Unit* (*GVU*) is a set of manual shutoff valves, actuated shut-off and venting valves, gas pressure sensors and transmitters, gas temperature sensors and transmitters, gas pressure control valve and gas filter used to control the gas supply to each gas consumer. It also includes a connection for inert gas purging.

10 *Low pressure gas* means gas with a pressure up to 1 *MPa*.

11 *Lower Heating Value* (*LHV*) means the amount of heat produced from the complete combustion of a specific amount of fuel, excluding latent heat of vaporization of water.

12 *Methane Number* is a measure of resistance of a gas fuel to knock, which is assigned to a test fuel based upon operation in knock testing unit at the same standard knock intensity. (Pure methane is used as the knock resistant reference fuel, that is, methane number of pure methane is 100, and pure hydrogen is used as the knock sensitive reference fuel, methane number of pure hydrogen is 0.)

13 *Pilot fuel* means the fuel oil that is injected into the cylinder to ignite the main gas-air mixture on DF engines.

14 *Pre-mixed engine* means an engine where gas is supplied in a mixture with air before the turbocharger.

15 *Safety Concept* is a document describing the safety philosophy with regard to gas as fuel. It describes how risks associated with this type of fuel are controlled under reasonably foreseeable abnormal conditions as well as possible failure scenarios and their control measures. A detailed evaluation regarding the hazard potential of injury from a possible explosion is to be carried out and reflected in the safety concept of the engine.

Chapter 4 TESTS

4.2 Shop Tests

Paragraph 4.2.2 has been amended as follows.

4.2.2 Shop Trials

~~**1**~~ Low pressure gas-fuelled engines are~~, in principle, to be subjected to shop trials using fuel gas before installed on board ship. Shop trials using only oil fuel, however, may be accepted for dual fuel engines which are identical or similar to engines which have passed the prototype tests specified in **4.1**~~ to be tested as specified in **D2.6.1-2, Part D of the Guidance**.

~~**2** Even in cases where shop trials using only oil fuel only are approved in accordance with the requirements of **-1** above, the operation of equipment related to the combustion of gas fuel is to be verified by appropriate means to be satisfactory as far as practicable.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

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.

Amendment 1-4

Annex 3 GUIDANCE FOR HIGH PRESSURE GAS-FUELLED ENGINES

Chapter 1 GENERAL

Section 1.3 has been amended as follows.

1.3 Submission of Plans and Documents

The plans and documents to be submitted are as follows.

(1) Plans and documents for approval
- (a) Drawings and data specified in **2.1.3-1(1), Part D of the Rules**
- (b) Drawings and data specified in **18.1.3(1)(a)**, **(b)** and **(e), Part D of the Rules**
- (c) Gas fuel injection valves
- (d) High pressure oil pipes for actuating gas fuel injection valves and associated protective shielding
- (e) Gas fuel injection pipes and associated protective shielding
- (f) High pressure oil pipes for sealing gas fuel injection valves and associated protective shielding
- (g) Arrangements of gas detectors
- (h) Combustion monitoring devices
- (i) Gas fuel injection valve actuating devices
- (j) Governors
- (k) Engine control system diagrams (including monitor, safety and alarm devices) for gas fuel combustion operations
- (l) Gas leak protective devices at connections between engines and gas fuel supply piping
- (m) Gas fuel supply piping systems (including details of valves and pipe fittings) and protective devices for gas leaks from said systems
- ~~(n) Prototype test plans and test results~~
- ~~(o) Shop test plans~~
- ~~(p) Sea test plans~~
- ~~(q) Sea trial plans~~
- (~~r~~n) Other drawings and data as deemed necessary by the Society according to the type of high pressure gas-fuelled engine

((2) is omitted.)

Chapter 4 TESTS

Section 4.1 has been amended as follows.

4.1 ~~Prototype Tests~~Approval of Use

~~1~~ For each type of ~~H~~high pressure gas-fuelled engines ~~are to be subjected to prototype tests using gas fuel to demonstrate design performance in accordance with prototype test plans approved by the Society. Such tests, however, may be substituted for by verification tests using one or more cylinders of a prototype engine or a similar engine in cases where deemed appropriate by the Society~~, an approval of use is to be obtained by the engine designer (licensor) as specified in **Chapter 8, Part 6 of Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

~~2 Parts and accessory equipment of high pressure gas-fuelled engines related to the supply and combustion of gas fuel may be required to undergo separate tests, in addition to the tests specified in -1 above, to demonstrate individual performance in cases where deemed necessary by the Society.~~

Annex 4 GUIDANCE FOR LOW PRESSURE GAS-FUELLED ENGINES

Chapter 1 GENERAL

1.1 Scope

Sub-paragraph -3 has been added as follows.

3 To low pressure gas-fuelled engines, the requirements specified in **Part GF of the Rules** and **Part GF of the Guidance** referred to in the following requirements in this Annex apply regardless of type, size and trading area of the ship but **1.1.1-2, Part GF of the Rules** does not apply except where explicitly specified otherwise.

(1) **2.1-5(3)**
(2) **2.2.3-1**
(3) **2.2.4**
(4) **2.4.4-5(1)**
(5) **2.4.4-5(2)**
(6) **2.4.4-5(3)(a)** to **(c)**
(7) **2.4.4-5(4)(a)**
(8) **3.1-6**
(9) **8.3(4)(i), Chapter 8, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**

Section 1.3 has been amended as follows.

1.3 Submission of Plans and Documents

The plans and documents to be submitted are as follows.

(1) Plans and documents for approval
  (a) Drawings and data specified in **2.1.3-1(1), Part D of the Rules**
  (b) Drawings and data specified in **18.1.3(1)(a)**, **(b)** and **(e), Part D of the Rules**
  (c) Gas fuel injection valves and associated actuating systems
  (d) Gas fuel injection pipes and associated protective shielding
  (e) Arrangements of gas detectors
  (f) Combustion monitoring devices
  (g) Governors
  (h) Engine control system diagrams (including monitor, safety and alarm systems) for gas fuel combustion operations
  (i) Gas leak protection systems at connections between engines and gas fuel supply piping systems
  (j) Gas fuel supply piping systems (including details of valves and pipe fittings) and protective devices for gas leaks from such systems

~~(k) Prototype test plans and test results~~
~~(l) Shop test plans~~
~~(m) Sea Test plans~~
~~(n) Sea trial plans~~
(~~o~~k) Pilot oil fuel injection devices or ignition systems
(l) Schematic layout or other equivalent documents of gas system on the engine
(m) Gas piping system (including double-walled arrangement where applicable)
(n) Parts for gas admission system
The documentation to contain specifications for pressures, pipe dimensions and materials.
(o) Arrangement of explosion relief valves for crankcase (if required by **2.4.3, Part D of the Rules**), charge air manifold and exhaust gas manifold, as applicable
(p) Schematic layout or other equivalent documents of fuel oil system (main and pilot fuel systems) on the engine (only for dual fuel engines)
(q) Shielding of high pressure fuel pipes for pilot fuel system, assembly (only for dual fuel engines)
(r) Ignition system (only for gas only engines)
(~~p~~s) Other drawings and data deemed necessary by the Society according to the type of low pressure gas-fuelled engine

(2) Plans and documents for reference
(a) Drawings and data specified in **2.1.3-1(2), Part D of the Rules**
~~(b) Instruction manuals (including procedures for onboard maintenance, inspection and overhaul)~~
(~~c~~b) Other drawings and data deemed necessary by the Society

(3) Drawings and data for the purpose of inspection and testing of engines
Items specified in **2.1.3-1(3), Part D of the Rules**

Chapter 2 has been amended as follows.

Chapter 2 CONSTRUCTION AND EQUIPMENT OF LOW PRESSURE GAS-FUELLED ENGINES

2.1 General

1 Low pressure gas-fuelled engines are to be dual fuel system types capable of operating on oil fuel and gas fuel, or gas-only system types.

~~**2** Low pressure gas-fuelled dual fuel engines are to be capable of supplying oil fuel to each cylinder in amounts sufficient for maintaining stable combustion of gas fuel under any conditions.~~

~~**3**~~**2** Low pressure gas-fuelled engines are to be capable of maintaining stable operation even under any of the following **(1)** to **(3)** conditions:

(1) switching from one fuel to another (in the cases of dual fuel engines),

(2) rapid load fluctuations, and

(3) minimum load conditions during gas combustion.

~~**4**~~**3** Gas fuel supply pressures for low pressure gas-fuelled engines are to always be kept higher than suction air pressures at the supply points of gas fuel to combustion chambers or the suction pipes before suction valves in order to prevent any back-flow of air into gas fuel lines.

~~**5** Only oil fuel is, in principle, to be used when operation of low pressure gas-fuelled dual fuel engines are unstable.~~

~~**6** Low pressure gas-fuelled dual fuel engines are to be capable of quickly switching from gas combustion mode to oil fuel only combustion mode.~~

4 The manufacturer is to declare the allowable gas composition limits for the engine and the minimum and (if applicable) maximum methane number.

5 Components containing or likely to contain gas are to be designed in accordance with the following **(1)** to **(5)**.

(1) Minimise the risk of fire and explosion so as to demonstrate an appropriate level of safety commensurate with that of an oil-fuelled engine

(2) Mitigate the consequences of a possible explosion to a level providing a tolerable degree of residual risk, due to the strength of the component(s) or the fitting of suitable pressure relief devices of an approved type

(3) Refer to **10.2** and **10.3, Part GF of the Rules**

(4) Discharge from pressure relief devices is to prevent the passage of flame to the machinery space and be arranged such that the discharge does not endanger personnel or damage other engine components or systems

(5) Relief devices are to be fitted with a flame arrester

2.2 Construction and Strength

2.2.1 Gas Fuel Valves and Actuating Systems

1 Gas fuel valves are to possess satisfactory operating characteristics and durability for the

assumed service period.

2 Gas fuel valves are to be provided with sealing systems to effectively prevent gas fuel from leaking through spaces around valve spindles.

3 Actuating systems of gas fuel valves are to possess satisfactory operating characteristics and reliability.

2.2.2 Cylinder Covers

1 The shapes of combustion chambers and the arrangements of gas fuel valves are to be such that reliable ignition and combustion of gas fuel are ensured.

2 The portions of cylinder covers where gas fuel valves and oil fuel injection valves are fitted are to be so constructed as to prevent the leakages of gas fuels and unburnt gases into cylinders.

2.2.3 Crankcase

1 Crankcase explosion relief valves are to be installed in accordance with **2.4.3, Part D of the Rules**. Refer also to **10.3.1-2, Part GF of the Rules**.

2 For maintenance purposes, a connection, or other means, are to be provided for crankcase inerting and ventilating and gas concentration measuring.

2.2.4 Gas Ignition in Cylinder

For gas ignition in the cylinder, the requirements of **10.3, Part GF of the Rules** are to be applied.

2.3 Safety Systems

~~**2.3.1 Combustion Monitoring Devices**~~

~~**1** When low-pressure gas-fuelled engines are operated on gas fuel, gas fuel supplies are to be automatically cut off in cases where any of the abnormalities specified in the following **(1)** to **(4)** is detected:~~

~~(1) gas fuel valve function,~~

~~(2) pilot oil fuel injection valve (in the cases of dual fuel engines) or ignition system (in the cases of gas-only engines) function,~~

~~(3) suction valve and exhaust valve function, and~~

~~(4) exhaust gas temperatures at cylinder outlets.~~

~~**2** When low-pressure gas-fuelled engines are operated on gas fuel, the following items are, in general, to be monitored:~~

~~(1) abnormalities in cylinder pressure, and~~

~~(2) blow-by through suction valves or exhaust valves.~~

2.3.~~2~~1 Protection Against Explosions

~~**1** Relief valves approved in accordance with **Table D2.4, Part D of the Rules** are to be provided for crankcases.~~

~~**2**~~**1** Suction manifolds and exhaust gas pipes are to be fitted with suitable pressure relief systems unless designed to withstand the worst case overpressure due to ignited gas leaks.

~~**3**~~**2** The pressure relief systems specified in the preceding ~~-2~~**1** are not to continuously discharge exhaust gas into enclosed spaces. Venting due to activation of the system is to be led away from locations where personnel may normally be present.

~~**4**~~**3** Relief valves for cylinders installed in accordance with the requirements of **2.4.2, Part D of the Rules** are to be provided, as far as practicable, with monitoring systems to verify valve closing.

~~5~~4 Gas fuel injection lines are to be provided with non-return valves~~, and rupture disks are to be provided between gas fuel injection lines and non-return valves if necessary to prevent gas fuel injection line failure due to abnormal pressure peaks~~ or devices which have capabilities equivalent to those of the valves.

~~6~~5 Flame arrestors are to be installed before cylinder heads in cases where gas is supplied in mixtures with air through common manifolds.

~~7 Engines having spaces under pistons that directly lead to crankcases are also to be in accordance with **10.3.1-2, Part GF of the Rules**.~~

2.3.~~2~~2 Governors

1 Governors for low pressure gas-fuelled engines are to be capable of being operated during gas fuel combustion mode. In the case of dual fuel engines, the governors are additionally to be capable of being operated either during gas and oil fuel (or pilot oil) combustion mode, and/or oil fuel only combustion mode.

2 The governors of **-1** above are to be in accordance with the requirements in **2.4.1-1, Part D of the Rules** in each mode of operation.

3 Low pressure gas-fuelled dual fuel engines using gas fuel are to be operated in any of the following **(1)** to **(3)** modes:

(1) controllable gas fuel supply and fixed oil fuel (pilot oil) supply,

(2) controllable oil fuel (pilot oil) supply and fixed gas fuel supply, or

(3) controllable gas fuel and oil fuel supplies.

2.4 Accessory Equipment

2.4.1 Charge Air Systems

1 The charge air system on the low pressure gas-fuelled engine is to be designed in accordance with **2.1-5**.

2 In case of a single engine installation, the engine is to be capable of operating at sufficient load to maintain power to essential consumers after opening of the pressure relief devices caused by an explosion event. Sufficient power for propulsion capability is to be maintained.

3 Load reduction is to be considered on a case-by-case basis, depending upon engine configuration (single or multiple) and type of relief mechanism (self-closing valve or bursting disk).

2.4.~~1~~2 Exhaust Gas Systems

1 The exhaust gas system on the low pressure gas-fuelled engine is to be designed in accordance with **2.1-5**.

2 In case of a single engine installation, the engine is to be capable of operating at sufficient load to maintain power to essential consumers after opening of the pressure relief devices caused by an explosion event. Sufficient power for propulsion capability is to be maintained.

3 Continuous relief of exhaust gas (through open rupture disc) into the engine room or other enclosed spaces is not acceptable.

~~Exhaust gas pipes of low pressure gas-fuelled engines are not to be connected to the exhaust gas pipes or the exhaust pipes of other engines or systems.~~

2.4.~~2~~3 Starting Systems

Starting air branch pipes to cylinders are to be provided with effective flame arresters.

2.4.~~3~~4 Gas Fuel Pipes

1 Gas fuel pipes are to be provided with effective protective shielding against gas fuel bursting due to pipe failure, except where deemed appropriate by the Society.

~~**2 Spaces between the gas fuel pipes and protective shielding of low pressure gas-fuelled engines fitted in gas safe machinery spaces are to be in accordance with the requirements in 9.6, Part GF of the Rules: relevant requirements are to be applied mutatis mutandis.**~~

~~**3**~~**2** Only approved type flexible tubes are to be used as protective shielding.

~~**4**~~**3** Gas fuel pipes are to be provided with systems for inerting and gas-freeing.

~~**5**~~**4** Expansion joints provided for gas fuel pipes (only those attached to engines) are to be approved in accordance with the requirements in **Annex 1** "**Guidance for Equipment and Fittings of Ships Using Low-flashpoint Fuels**".

5 For piping attached to low pressure gas-fuelled engines, the following **(1)** to **(5)** also apply.

(1) The piping is to be designed in accordance with the criteria for gas piping (design pressure, wall thickness, materials, piping fabrication and joining details etc.) as given in **Chapter 7, Part GF of the Rules**.

(2) Arrangement of the gas piping system on the engine

Pipes and equipment containing fuel gas are defined as hazardous area zone 0 (refer to **12.5.1, Part GF of the Rules**). The space between the gas fuel piping and the wall of the outer pipe or duct is defined as hazardous area zone 1 (refer to **12.5.2(6), Part GF of the Rules**).

(3) Normal "double wall" arrangement

(a) The gas piping system on the low pressure gas-fuelled engine is to be arranged according to the principles and requirements of **9.6, Part GF of the Rules**.

(b) The design criteria for the double pipe or duct are given in the **9.8** and **7.4.1-4, Part GF of the Rules**.

(c) In case of a ventilated double wall, the ventilation inlet is to be located in accordance with the provisions of **13.8.3, Part GF of the Rules**.

(d) The pipe or duct is to be pressure tested in accordance with **12.6.1-2** to **-4, Part D of the Rules** to ensure gas tight integrity and to show that it can withstand the expected maximum pressure at gas pipe rupture.

(4) Alternative arrangement

(a) Single walled gas piping is only acceptable:

i) for engines installed in *ESD* protected machinery spaces, as defined in **5.4.1(2), Part GF of the Rules** and in compliance with other relevant parts of **Part GF of the Rules** (e.g. **5.6, Part GF of the Rules**);

ii) in the case of conforming to the requirements in **GF9.6.2, Part GF of the Guidance**.

(b) In case of gas leakage in an *ESD*-protected machinery space, which would result in the shutdown of the engine(s) in that space, a sufficient propulsion and manoeuvring capability including essential and safety systems is to be maintained. Therefore the safety concept of the engine is to clearly indicate application of the "double wall" or "alternative" arrangement. The minimum power to be maintained is to be assessed on a case-by-case basis in consideration of the operational characteristics of the ship.

(5) Gas admission valves

Gas admission valves are to be certified safe as follows:

(a) The inside of the valve contains gas and shall therefore be certified for zone 0.

(b) When the valve is located within a pipe or duct in accordance with **(3)**, the outside of the

valve shall be certified for zone 1.

(c) When the valve is arranged without enclosure in accordance with the "*ESD*-protected machinery space" (see **(4)**) concept, no certification is required for the outside of the valve, provided that the valve is de-energized upon gas detection in the space.

(d) However, if they are not rated for the zone they are intended for, it shall be documented that they are suitable for that zone. Documentation and analysis is to be based on *IEC* 60079-10-1 or *IEC* 60092-502.

2.4.4~~5~~5 Cylinder Lubrication

Cylinder lubricating systems for low pressure gas-fuelled dual fuel engines are, in general, to be capable of maintaining adequate alkali values and cylinder oil feeding rates for oil fuel only operation as well as the modes of operation specified in **2.3.~~3~~2-3(1)** to **(3)**.

2.5 Design Requirements for Each Kind of Engines

2.5.1 Dual Fuel Engine

1 General

(1) The maximum continuous power that a dual fuel engine can develop in gas mode may be lower than the approved MCR of the engine (i.e. in oil fuel mode), depending in particular on the gas quality. This maximum power available in gas mode and the corresponding conditions are to be stated by the engine manufacturer and demonstrated during the type test.

(2) Low pressure gas-fuelled dual fuel engines are to be capable of supplying oil fuel to each cylinder in amounts sufficient for maintaining stable combustion of gas fuel under any conditions.

(3) Only oil fuel is, in principle, to be used when operation of low pressure gas-fuelled dual fuel engines are unstable.

2 Starting, changeover and stopping

(1) Dual fuel engines are to be arranged to use either oil fuel or gas fuel for the main fuel charge and with pilot oil fuel for ignition. The engines are to be arranged for rapid changeover from gas use to fuel oil use. In the case of changeover to either fuel supply, the engines are to be capable of continuous operation using the alternative fuel supply without interruption to the power supply.

(2) Changeover to gas fuel operation is to be only possible at a power level and under conditions where it can be done with acceptable reliability and safety as demonstrated through testing.

(3) Changeover from gas fuel operation mode to oil fuel operation mode is to be possible at all situations and power levels.

(4) The changeover process itself from and to gas operation is to be automatic but manual interruption is to be possible in all cases.

(5) In case of shut-off of the gas supply, the engines are to be capable of continuous operation by oil fuel only.

3 Gas supply to the combustion chamber is not to be possible without operation of the pilot oil injection. In addition, pilot injection is to be monitored for example by fuel oil pressure and combustion parameters.

2.5.2 Gas Only Engine

In case of failure of the spark ignition, the engine is to be shut down except when the following **(1)** to **(3)** are satisfied:

(1) the failure is limited to one cylinder;
(2) the gas supply to the failed cylinder is immediately shut off; and
(3) safe operation of the engine is substantiated by risk analysis and tests.

2.5.3 Pre-mixed Engine

Inlet manifold, turbocharger, charge air cooler, etc. are to be regarded as parts of the fuel gas supply system. Failures of those components likely to result in a gas leakage are to be considered in the risk analysis (see **8.3, Chapter 8, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**).

Title of Chapter 3 has been amended as follows.

Chapter 3 CONTROL ~~SYSTEMS~~, ALARM AND SAFETY SYSTEMS

Section 3.1 has been amended as follows.

3.1 General

1 Control systems for operating low pressure gas-fuelled engines using gas fuel are to be in accordance the requirements in **18.1** to **18.3** and **18.7, Part D of the Rules**: relevant requirements are to be applied mutatis mutandis.

2 Temperatures and pressures (or flow rates) of gas fuel supplied to low-pressure gas-fuelled engines are to be automatically controlled. In addition, visual and audible alarm devices which activate when temperatures and pressures exceed preset ranges are to be provided.

3 The engine control system is to be independent and separate from the safety system.

4 The gas supply valves are to be controlled by the engine control system or by the engine gas demand.

5 Combustion is to be monitored on an individual cylinder basis.

6 In the event that poor combustion is detected on an individual cylinder, gas operation may be allowed in the conditions specified in **10.3.1-6, Part GF of the Rules**.

7 Regardless of **-5**, if monitoring of combustion for each individual cylinder is not practicable due to engine size and design, common combustion monitoring may be accepted.

8 Unless the risk analysis required by **8.3, Chapter 8, Part 6 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use** proves that risk is within the acceptable range otherwise, the alarm and safety system functions for dual fuel or gas only engines are to be provided in accordance with **Table 3.1** (for dual fuel engines, **Table 3.1** applies only to the gas mode). However, even in the risk analysis proves that risk is within the acceptable range, the alarm and safety system functions specified in **Part GF of the Rules** are still to be provided.

Table 3.1 Alarm and Safety System Functions for Dual Fuel and Gas Only Engines

Parameter	Alarm	Automatic activation of the double block and bleed valves	Automatic switching over to oil fuel mode[1)]	Engine shutdown
1. Abnormal pressures in the gas fuel supply line	X	X	X	X [5)]
2. Gas fuel supply systems - malfunction	X	X	X	X [5)]
3. Pilot fuel injection or spark ignition systems - malfunction	X	X [2)]	X	X [2)5)]
4. Exhaust gas temperature after each cylinder - high	X	X [2)]	X	X [2)5)]
5. Exhaust gas temperature after each cylinder - low[3)]	X	X [2)]	X	X [2)5)]
6. Cylinder pressure or ignition - failure, including misfiring, knocking and unstable combustion	X	X [2)4)]	X [4)]	X [2)4)5)]
7. Oil mist concentration in crankcase or bearing temperature[6)] - high	X	X	-	X
8. Pressure in the crankcase - high[4)]	X	X	X	-
9. Engine stops - any cause	X	X	-	-
10. Failure of the control-actuating medium of the block and bleed valves	X	X	X	-

Notes:

1) Dual fuel engine only, when running in gas mode

2) For gas only engines, the double block and bleed valves and the engine shutdown may not be activated in case of specific failures affecting only one cylinder, provided that the concerned cylinder can be individually shutoff and the safe operation of the engine in such conditions is demonstrated by the risk analysis.

3) Required only if necessary for the detection of misfiring. In addition, deviation from average is to be used for the operation setting of each function.

4) In the case where the failure can be corrected by an automatic mitigation action, only the alarm may be activated. If the failure persists after a given time, the safety actions are to be activated.

5) Gas only engine only

6) Where required by **2.4.5, Part D of the Rules**

Section 3.2 has been amended as follows.

3.2 Low Pressure Gas-fuelled Engines of Ships Subject to the Rules for Automatic Remote Control Systems

Low pressure gas-fuelled engines of ships subject to the application of the **Rules for Automatic and Remote Control Systems** are to be in accordance with the requirements in **3.2**, **3.5**, **4.1** and **4.2** of said rules. In addition, such engines are to be in accordance with the following **(1)** and **(2)** requirements:

(1) Low pressure gas-fuelled engines are to be provided with safety systems which automatically cut off the gas fuel supplies when **(a)**, **(b)** or **(c)** given below occur. In addition, in the case of dual fuel engines, such systems are to automatically switch the mode of operation to oil fuel only or are to stop the engines. Automatic cut off of the gas fuel supplies with the double

block and bleed valves specified in **9.4.4, Part GF of the Rules**, however, may be accepted.

(a) When operating on gas fuel, ~~the~~ abnormalities ~~specified~~are detected in ~~**2.3.1-1** or **-2** are detected~~the following~~:~~:

i) gas fuel valve function

ii) pilot oil fuel injection valve (in the cases of dual fuel engines) or ignition system (in the cases of gas-only engines) function

iii) suction valve and exhaust valve function,

iv) exhaust gas temperatures at cylinder outlets

v) pressure in cylinder

vi) blow-by through suction valves or exhaust valves

(b) When gas leaks in the ~~double-wall piping systems~~ air space between the gas fuel piping and the wall of the outer pipe or duct specified in **9.6.1, Part GF of the Rules**~~, between inner pipes and outer pipes, or between inner pipes and ducts~~ are detected.

(c) Others deemed necessary by the Society.

((2) is omitted.)

Chapter 4 TESTS

Section 4.1 has been amended as follows.

4.1 ~~Prototype Tests~~ Approval of Use

~~1~~ For each type of ~~L~~low pressure gas-fuelled engines ~~are to be subjected to prototype tests using gas fuel to demonstrate the design performance in accordance with prototype test plans approved by the Society. Such tests, however, may be substituted for by verification tests using one or more cylinders of a prototype engine or a similar engine in cases where deemed appropriate by the Society~~, an approval of use is to be obtained by the engine designer (licensor) as specified in **Chapter 8, Part 6 of Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

~~2 Parts and accessory equipment of low pressure gas-fuelled engines related to the supply and combustion of gas fuel may be required to undergo separate tests, in addition to the tests specified in -1 above, to demonstrate individual performance in cases where deemed necessary by the Society.~~

EFFECTIVE DATE AND APPLICATION (Amendment1-4)

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

2. Notwithstanding the amendments to the Guidance, the current requirements apply to the same type of gas-fuelled engine as that for which the application for approval of use is submitted to the Society before the effective date.

3. Notwithstanding the provision of preceding **2**, the amendments to the Guidance applies to gas-fuelled engines for which the application for renewal of approval of use is submitted on or after the effective date.