



RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER

No. 313-69-1221c

dated 13.05.2019

Re:

amendments to the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, ND No. 2-020101-040-E, 2018

Item(s) of supervision:

Internal Combustion Engines

Entry-into-force date:

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Appendices:

Appendix 1: information on amendments introduced by the Circular Letter

Appendix 2: text of amendments to Part IV "Technical Supervision During Manufacture of Products"

Director General

Konstantin G. Palnikov

Text of CL:

We hereby inform that the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, shall be amended as specified in the Appendix to the Circular Letter considering the requirements of IACS UR M78 (July 2018).

It is necessary to do the following:

1. Apply the provisions of the Circular Letter during review and approval of technical documentation on machinery and during technical supervision at its manufacture.
 2. Bring the content of the Circular Letter to the notice of the RS surveyors and interested persons in the area of RS Branch Offices' activity.
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List of the amended and/or introduced paras/chapters/sections:

Part IV, Section 5: paras 5.1.4, 5.12.20, 5.14, 5.14.5, 5.14.5.2, 5.14.5.3, 5.14.5.6 and 5.14.6.1; Appendix 6: paras 3.3, 4.5, 5.6, 6.2, 7.3, 8.4, 8.7, 8.8 and 9.3; Appendix 7: paras 1.4, 3.2.2, 3.3.1, 3.5 and 4.4.2

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**Information on amendments introduced by the Circular Letter
(for inclusion in the Revision History to the RS Publication)**

Nos.	Amended paras/chapters/sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
1	Part IV, Section 5, para 5.1.4	The reference to the applicable definitions has been introduced	313-69-1221c of 13.05.2019	01.07.2019
2	Part IV, Section 5, para 5.12.20	The reference has been specified	313-69-1221c of 13.05.2019	01.07.2019
3	Part IV, Section 5, para 5.14.5	The reference to the type approval procedure has been specified; the reference to the scope of the required documents has been replaced	313-69-1221c of 13.05.2019	01.07.2019
4	Part IV, Section 5, para 5.14.5.2	The reference to the scope of the required documents has been replaced	313-69-1221c of 13.05.2019	01.07.2019
5	Part IV, Section 5, para 5.14.5.3	The reference has been specified	313-69-1221c of 13.05.2019	01.07.2019
6	Part IV, Section 5, para 5.14.5.6	The reference to the scope of the required documents has been replaced	313-69-1221c of 13.05.2019	01.07.2019
7	Part IV, Section 5, para 5.14.6.1	The reference to the scope of the required documents has been replaced	313-69-1221c of 13.05.2019	01.07.2019
8	Part IV, Section 5, Appendix 6, para 3.3	The list of properties of the ICE type has been specified	313-69-1221c of 13.05.2019	01.07.2019
9	Part IV, Section 5, Appendix 6, para 4.5	Measures to verify that gas engine system is gastight have been specified	313-69-1221c of 13.05.2019	01.07.2019
10	Part IV, Section 5, Appendix 6, para 5.6	The test program of the engines has been specified	313-69-1221c of 13.05.2019	01.07.2019
11	Part IV, Section 5, Appendix 6, para 6.2	The scope of the checked engine parameters during tests has been specified	313-69-1221c of 13.05.2019	01.07.2019
12	Part IV, Section 5, Appendix 6, para 7.3	The scope of the engine tests has been specified	313-69-1221c of 13.05.2019	01.07.2019
13	Part IV, Section 5, Appendix 6, para 8.4	The scope of the engine tests has been specified	313-69-1221c of 13.05.2019	01.07.2019
14	Part IV, Section 5, Appendix 6, para 8.7	The scope of the engine tests has been specified	313-69-1221c of 13.05.2019	01.07.2019
15	Part IV, Section 5, Appendix 6, para 8.8	The scope of the engine tests has been specified	313-69-1221c of 13.05.2019	01.07.2019

16	Part IV, Section 5, Appendix 6, para 9.3	The scope of surveys of the engine components after the test has been specified.	313-69-1221c of 13.05.2019	01.07.2019
17	Part IV, Section 5, Appendix 7, para 1.4	Measures to verify that gas engine system is gastight have been specified	313-69-1221c of 13.05.2019	01.07.2019
18	Part IV, Section 5, Appendix 7, para 3.2.2	The scope of the checked engine parameters during tests has been specified	313-69-1221c of 13.05.2019	01.07.2019
19	Part IV, Section 5, Appendix 7, para 3.3.1	The scope of the engine tests has been specified	313-69-1221c of 13.05.2019	01.07.2019
20	Part IV, Section 5, Appendix 7, para 3.5	The scope of the engine tests has been specified	313-69-1221c of 13.05.2019	01.07.2019
21	Part IV, Section 5, Appendix 7, para 4.4.2	The scope of the engine tests has been specified	313-69-1221c of 13.05.2019	01.07.2019

**RULES FOR TECHNICAL SUPERVISION DURING CONSTRUCTION OF SHIPS AND
MANUFACTURE OF MATERIALS AND PRODUCTS FOR SHIPS, 2018,
ND No. 2-020101-040-E**

PART IV. TECHNICAL SUPERVISION DURING MANUFACTURE OF PRODUCTS

5 MACHINERY

5.1 GENERAL

1 **Para 5.1.4** is replaced by the following text:

5.1.4 The following definitions and abbreviations are used for the purposes of this Section.
"External examination means examination of a component, material, equipment; verification of accompanying documents issued in accordance with the accepted form of supervision during manufacture, and other documentation defining the compliance of the items of supervision with the approved technical documentation, e.g. measurement results, presence of brands (if envisaged), flaw detection results, etc.

Based on the results of external examination, the possibility of continuing manufacturing (machining), installation, hydraulic testing, etc. process shall be explored.

ICE — internal combustion engine.

MGTI — main geared turbine installation.

GTI — gas turbine installation.

GT — gas turbine.

QCV — quick closing valve.

RAC — remote automatic control.

RC — remote control.

HPC — high-pressure compressor.

LPC — low-pressure compressor.

HPT — high-pressure turbine.

LPT — low-pressure turbine.

AT — astern turbine.

FSAH — full speed ahead.

FSAS — full speed astern.

MTB — main thrust bearing.

MODU — mobile offshore drilling unit.

For gas engines the definitions given in 9.2 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships, are used."

5.12 BENCH TESTS

2 In **Para 5.12.20** the reference to "1.2.3.1.1" is replaced by the reference to "1.2.3.1".

**5.14 REGISTER DOCUMENTS FOR TECHNICAL SUPERVISION DURING CONSTRUCTION
AND APPROVAL OF ICE**

3 In **Para 5.14.5** the reference to "5.14.4.1 to 5.14.4.4" is replaced by the reference to "5.14.4"; the reference to "Tables 1.2.3.1-1 and 1.2.3.1-2 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships" is replaced by the references to "Tables 1.2.3.1-1 – 1.2.3.1-3 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships".

4 In Para **5.14.5.2** the reference to "Table 1.2.3.1-2 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships" is replaced by the reference to "Tables 1.2.3.1-2 and 1.2.3.1-3 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships".

5 In **Para 5.14.5.3** the reference to "15.4.5.6" is replaced by the reference to "5.14.5.6".

6 In **Para 5.14.5.6** the reference to "Tables 1.2.3.1-1 and 1.2.3.1-2 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships" is replaced by the reference to "Tables 1.2.3.1-1 – 1.2.3.1-3 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships".

7 In Para **5.14.6.1** the reference to "Tables 1.2.3.1-1 and 1.2.3.1-2 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships" is replaced by the reference to "Tables 1.2.3.1-1 – 1.2.3.1-3 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships".

APPENDIX 6

TYPE TESTING APPROVAL OF INTERNAL COMBUSTION ENGINES (ICE) AND RECOMMENDED CONTENT OF TYPE APPROVAL CERTIFICATE (CTO)

8 **Para 3.3** is replaced by the following text:

"3.3 Type of ICE is defined by:

bore and stroke;

injection method (direct or indirect);

valve and injection operation (by cams or electronically controlled);

kind of fuel (liquid, gaseous, dual-fuel ICE);

working cycle (4-stroke, 2-stroke);

turbo-charging system (pulsating or constant pressure);

the charging air cooling system (e.g. with or without intercooler);

cylinder arrangement (in-line or V)¹;

cylinder power, speed and cylinder pressures².

gas admission method (direct cylinder injection, charge air space or pre-mixed) for gas engine;

gas supply valve operation (mechanical or electronically controlled) for gas engine;

ignition system (pilot injection, spark ignition, glow plug or gas self-ignition) for gas engine;

ignition system (mechanical or electronically controlled).

Provided documentary evidence of successful service experience with the classified rating of 100 % is submitted, an increase (if design approved³) may be permitted without a new type test if the increase from the type tested engine is within:

5 % of the maximum combustion pressure, or

5 % of the mean effective pressure, or

5 % of the rpm.

Providing maximum power is not increased by more than 10 %, an increase of maximum approved power may be permitted without a new type test provided engineering analysis and evidence of successful service experience in similar field applications (even if the application is not classified) or documentation of internal testing are submitted if the increase from the type tested engine is within:

10 % of the maximum combustion pressure, or

10 % of the mean effective pressure, or

10 % of the rpm.

¹ One type test shall be considered adequate for the one-type ICE to cover a range of different numbers of cylinders. However, a type test of an in-line ICE may not always cover the V-version. Subject to the individual Societies' discretion, separate type tests may be required for the V-version. On the other hand, a type test of a V-engine covers the in-line engines, unless the bmep is higher. Items such as axial crankshaft vibration, torsional vibration in camshaft drives, and crankshafts, etc. may vary considerably with the number of cylinders and may influence the choice of engine to be selected for type testing.

² The engine is type approved up to the tested ratings and pressures (100 % corresponding to MCR).

³ Only crankshaft calculation and crankshaft drawings, if modified. "

9 New **Para 4.5** is introduced reading as follows:

"4.5 Measures to verify that gas fuel piping on engine is gas tight shall be carried out prior to start-up of the engine."

10 **Para 5.6** is replaced by the following text:

"5.6 High speed engines for marine use shall normally be subjected to an endurance test of 100 hours at full load. Omission or simplification of the type test may be considered for the type approval of engines with long service experience from non-marine fields or for the extension of type approval of engines of a well-known type, in excess of the limits given in Section 3.

Propulsion ICE for high speed craft that may be used for frequent load changes from idle to full shall normally be tested with at least 500 cycles (idle – full load – idle) using the steepest load ramp that the control system (or operation manual if not automatically controlled) permits. The duration at each end shall be sufficient for reaching stable temperatures of the hot parts.

For DF engines, the load tests required for in 7.2 и 8.4 shall be carried out in gas mode at the different percentages of the maximum power available in gas mode (refer to 9.13 of Part IX "Machinery", the Rules for the Classification and Construction of Sea-Going Ships).

The 110 % load tests are not required in the gas mode.

The influence of the methane number and LHV of the fuel gas is not required to be verified during the Stage B type tests. It shall however be justified by the engine designer through internal tests or calculations and documented in the type approval test report."

11 **Para 6.2** is replaced by the following text:

"6.2 As a minimum, the following engine data shall be measured and recorded:

engine rpm;

torque;

maximum combustion pressure for each cylinder¹; mean indicated pressure for each cylinder¹;

charging air pressure and temperature; exhaust gas temperature;

fuel rack position or similar parameter related to engine load;

turbocharger speed;

all engine parameters that are required for control and monitoring for the intended use (propulsion, auxiliary, emergency);

each fuel index for gas and diesel as applicable (or equivalent reading) for gas engine;

gas pressure and temperature at the inlet of the gas manifold for gas engine;

gas concentration in the crankcase for gas engine.

Calibration records for the instrumentation used to collect data as listed above shall be presented to — and reviewed by the attending Surveyor.

Additional measurements may be required in connection with the design assessment.

¹ For engines where the standard production cylinder heads are not designed for such measurements, a special cylinder head made for this purpose may be used. In such a case, the measurements may be carried out as part of Stage A and shall be properly documented. Where deemed necessary e.g. for dual fuel engines, the measurement of maximum combustion pressure and mean indicated pressure may be carried out by indirect means, provided the reliability of the method is documented."

12 New **Para 7.3** is introduced reading as follows:

"7.3 DF engines shall run the load points defined in 7.2 in both gas and diesel modes (with and without pilot injection in service) as found applicable for the engine type.

For DF engines with variable liquid / gas ratio, the load tests shall be carried out at different ratios between the minimum and the maximum allowable values.

For DF engines, switch over between gas and diesel modes shall be tested at different loads."

13 **Para 8.4** is replaced by the following text:

"8.4 The load points (refer to Fig. 8.5) are:

rated power (MCR), i.e. 100 % output at 100 % torque and 100 % speed corresponding to load point 1, normally for 2 hours with data collection with an interval of 1 hour. If operation of the engine at limits as defined by its specified alarm system (e.g. at alarm levels of lub oil pressure and inlet temperature) is required, the test shall be made here;

100 % power at maximum permissible speed corresponding to load point 2;

maximum permissible torque (at least and normally 110 %) at 100 % speed corresponding to load at point 3, or maximum permissible power (at least and normally 110 %) and 103,2 % speed according to the nominal propeller curve corresponding to load point 3a. Load point 3a applies to engines only driving fixed pitch propellers or water jets. Load point 3 applies to all other purposes; part loads e.g. 75 %, 50 % and 25 % of rated power and speed according to nominal propeller curve (i.e. 90,8 %, 79,3 % and 62,9 % speed) corresponding to points 6, 7 and 8 or at constant rated speed setting corresponding to points 9, 10 and 11, depending on the intended application of the engine;

crosshead engines not restricted for use with C.R propellers shall be tested with no load at the associated maximum permissible engine speed.

DF engines shall undergo the tests both in gas and diesel modes that apply for the engine type as defined by the engine designer (refer to 5.6), including the overspeed test.

In case of DF engines with variable liquid / gas ratio, the load tests shall be carried out at different ratios between the minimum and the maximum allowable values."

14 **Para 8.7** is replaced by the following text:

"8.7 Functional tests:

verification of the lowest specified propulsion engine speed according to the nominal propeller curve as specified by the engine designer (even though it works on a water-brake);

starting tests, for non-reversible engines and/or starting and reversing tests, for reversible engines, for the purpose of determining the minimum air pressure and the consumption for a start;

for DF engines, the lowest specified speed is to be verified in diesel mode and gas mode;

for DF engines, switch over between gas and diesel modes are to be tested at different loads;

the efficiency of the ventilation arrangement of the double walled gas piping system is to be verified for gas engine;

simulation of a gas leakage in way of a cylinder gas supply valve for gas engine;

governor tests (refer to 2.11, Part IX "Machinery" of the Rules for the Classification and Construction of Sea-Going Ships) be carried out.

Thus, gas engines intended to produce electrical power in addition shall be tested in compliance with 2.11.3.2, Part IX "Machinery" of the Rules for the Classification and Construction of Sea-Going Ships considering the requirements of 2.11.3.5 — 2.11.3.6 of Part IX "Machinery", of the Rules for the Classification and Construction of Sea-Going Ships and that for DF engines, switchover to oil fuel during the test is acceptable. For GF and premixed engines, the influences of LHV, methane number and ambient conditions on the dynamic load response test results are to be theoretically determined and specified in the test report. Referring to the limitations as specified in 9.12.1.2, Part IX "Machinery", of the Rules for the Classification and Construction of Sea-Going Ships, the margin for satisfying dynamic load response shall be determined for GF and premixed engines."

15 **Para 8.8** is replaced by the following text:

"8.8 Integration test.

For electronically controlled diesel engines, integration tests shall verify that the response of the complete mechanical, hydraulic and electronic system shall be as predicted for all intended operational modes. The scope of these tests shall be agreed with the Register for selected cases based on the risk review, FMEA required in 1.2.3.1, Part IX "Machinery" of the Rules for the Classification and Construction of Sea-Going Ships.

Thus, gas engines shall at least include the following incidents:

failure of ignition (spark ignition or pilot injection systems), both for one cylinder unit and common system failure;

failure of a cylinder gas supply valve;

failure of the combustion (to be detected by e.g. misfiring, knocking, exhaust temperature deviation, etc.);
abnormal gas pressure;
abnormal gas temperature (this test may be carried out using a simulation signal of the temperature).".

16 **Para 9.3** is replaced by the following text:

"9.3 For all the other engines, after the test run the components of one cylinder for in-line ICE and two cylinders for V-ICE shall be presented for inspection as follows (ICE with long service experience from non-marine fields can have a reduced extent of opening):
piston removed and dismantled; crosshead bearing dismantled; guide planes;
connecting rod bearings (big and small end) dismantled (special attention to serrations and fretting on contact surfaces with the bearing backsides);
main bearing dismantled;
cylinder liner in the installed condition;
cylinder head, valves disassembled;
cam drive gear or chain, camshaft and crankcase with opened covers. (the engine shall be turnable by turning gear for this inspection);
gas supply valve including pre-chamber as found applicable (for gas engine);
spark igniter (for GF engines);
pilot fuel injection valve (for DF engines).".

APPENDIX 7

BENCH TESTS (FACTORY ACCEPTANCE TESTS (FAT)) AND ICE TESTS AFTER INSTALLATION ONBOARD

17 New **Para 1.4** is introduced reading as follows:

"1.4 Measures to verify that gas fuel piping on engine is gas tight shall be carried out prior to start-up of the engine.".

18 **Para 3.2.2** is replaced by the following text:

"3.2.2 For each required load point, the following parameters are normally to be recorded:
power and speed;
fuel index (or equivalent reading);
maximum combustion pressures (only when the cylinder heads installed are designed for such measurement);
exhaust gas temperature before turbine and from each cylinder (to the extent that monitoring is required in Appendix 9 and Chapter 4.2, Part XV "Automation" of the Rules for Classification and Construction of Sea-Going Ships);
charge air temperature;
charge air pressure;
turbocharger speed (to the extent that monitoring is required in Appendix 9);
fuel index, both gas and diesel as applicable (or equivalent reading) for gas engine;
gas pressure and temperature for gas engine.

19 **Para 3.3.1** is replaced by the following text:

"3.3.1 Test loads for various engine applications are given below. In addition, the scope of the trials may be expanded depending on the engine application, service experience, or other relevant reasons.

DF engines shall be tested in both diesel and gas mode as found applicable. Thus, for DF engines when operating on gas fuel, the parameters of the load conditions required in 3.3.2 — 3.3.6 shall be determined taking into account the maximum continuous power available in gas mode (refer

to 9.13, Part IX "Machinery" of the Rules for the Classification and Construction of Sea-Going Ships).

The 110 % load test is not required in the gas mode.

Note. Alternatives to the detailed tests may be agreed between the manufacturer and the Register when the overall scope of tests is found to be equivalent the requirements of 3.3."

20 **Para 3.5** is replaced by the following text:

"3.5 Integration tests.

For electronically controlled engines, integration tests shall be made to verify that the response of the complete mechanical, hydraulic and electronic system is as predicted for all intended operational modes and the tests considered as a system shall be carried out at the works. If such tests are technically unfeasible at the works, however, these tests may be conducted during sea trial. The scope of these tests shall be agreed with the Register for selected cases based on the FMEA, 1.2.3.1, Part IX "Machinery" of the Rules for the Classification and Construction of Sea-Going Ships.

For gas engines the tests shall at least include the following incidents (failures may be checked by simulation or other alternative methods agreed with the Register):

failure of ignition (spark ignition or pilot injection systems), for one cylinder unit;

failure of a cylinder gas supply valve;

failure of the combustion (to be detected by e.g. misfiring, knocking, exhaust temperature deviation, etc.);

abnormal gas pressure;

abnormal gas temperature."

21 **Para 4.4.2** is replaced by the following text:

"4.4.2 The suitability of the engine to operate on fuels intended for use shall be demonstrated.

For DF engines, the test loads required to be carried out in all operating modes (gas mode, diesel mode)."