

# **RULES**

PUBLICATION 69/P

## **MARINE DIESEL ENGINES. CONTROL OF NITROGEN OXIDES EMISSION**

October  
2020

Publications P (Additional Rule Requirements) issued by Polski Rejestr Statków complete or extend the Rules and are mandatory where applicable.



**GDAŃSK**

*Publication 69/P – Marine Diesel Engines. Control of Nitrogen Oxides Emission – October 2020* was approved by the PRS Board on 28 September 2020 and enters into force on 1 October 2020.

© Copyright by Polski Rejestr Statków S.A., 2020

PRS/RP, 09/2020

# CONTENTS

	Page
<b>1 General Requirements</b> .....	5
1.1 Application .....	5
1.2 Definitions and Explanations.....	5
<b>2 NO<sub>x</sub> Emission Standards for Marine Diesel Engines</b> .....	8
2.1 Maximum Allowable NO <sub>x</sub> Emission Limits .....	8
2.2 Test Cycles .....	8
<b>3 Procedures for Marine Diesel Engine Testing, Surveys and Certification</b> .....	10
3.1 Marine Diesel Engines Surveys.....	10
3.2 Methods for Determining Engine NO <sub>x</sub> Emissions .....	10
<b>4 Procedures for Pre-Certification of Engine</b> .....	11
<b>5 Procedures for Engine Certification</b> .....	12
<b>6 Engine Family and Engine Group Concepts</b> .....	13
6.1 Parent Engine.....	13
6.2 Engine Family.....	14
6.3 Engine Group.....	14
<b>7 Technical File</b> .....	14
<b>8 On-board NO<sub>x</sub> verification procedures</b> .....	15
<b>Supplement</b> – Flow Charts for Survey and Certification of Marine Diesel Engines .....	21



# 1 GENERAL REQUIREMENTS

## 1.1 Application

**1.1.1** This *Publication* contains technical requirements concerning emission of nitrogen oxides from marine diesel engines resulting from the provisions of Annex VI to *MARPOL 73/78* and the *Technical Code on Control of Emissions of Nitrogen Oxides from Marine Diesel Engines (NO<sub>x</sub> Technical Code – Res. MEPC.177(58) as amended* ) regarding tests, surveys and certification of such engines.

According to testing of gas-fuelled and dual fuel engines additional requirements specified in Resolution MEPC.272(69) apply, which introduces amendments in *NO<sub>x</sub> Technical Code, 2008* as of 1 September 2017.

**1.1.2** This *Publication* applies to:

- each marine diesel engine with a power output of more than 130 kW which is or is intended to be newly fitted on a ship; and
- each marine diesel engine with a power output of more than 130 kW which undergoes a major conversion on or after 1 January 2000 except when demonstrated to the satisfaction of PRS that such engine is an identical replacement for to the engine which it is replacing and is otherwise not covered by the requirements of paragraph 1.1.2.1.

**1.1.3** This *Publication* does not apply to:

- emergency diesel engines, engines installed in lifeboats and any device or equipment intended to be used solely in case of emergency;
- engines installed on ships solely engaged on voyages within waters subject to the sovereignty or jurisdiction of the State whose flag the ship is entitled to fly, provided that such engines are subject to an alternative NO<sub>x</sub> control measure agreed with PRS in each particular case.

**1.1.4** Notwithstanding the provisions of paragraph 1.1.2, PRS may allow exclusion from the application of the present *Publication* requirements to any diesel engine which is installed on a ship constructed, or engine which undergoes a major conversion, on or after 1 January 2000 but before the entry into force of Annex VI, provided that the ship is solely engaged on voyages to ports or offshore terminals within the State the flag of which the ship is entitled to fly.

**1.1.5** The requirements of the present *Publication* apply to normal service conditions; they do not apply to emergency conditions described in Regulation 3 of Annex VI to *MARPOL /73/78*.

**1.1.6** For each ship of less than 400 gross tonnage, the type of survey specified in paragraphs 3.1.2, 3.1.3 and 3.1.4 as well as the scope of survey are subject to PRS consideration in each particular case.

## 1.2 Definitions and Explanations

**1.2.1** *Nitrogen oxide (NO<sub>x</sub>) emissions* – total emission of nitrogen oxides, calculated as the total weighted emission of NO<sub>2</sub> and determined using the relevant test cycles and measurement methods specified in the *No<sub>x</sub> Technical Code*.

**1.2.2** *Major conversion of marine diesel engine* – modification of a marine diesel engine, performed on or after 1 January 2000, which was not certified for compliance with the emissions specified in Regulation 13 in Annex VI to *MARPOL* where:

- .1 the engine is replaced<sup>1</sup> by a new<sup>2</sup> marine diesel engine; or
- .2 any substantial modification, as defined in revised *NO<sub>x</sub> Technical Code, 2008* has been made to the engine; or

---

<sup>1</sup> The term “replaced” is understood to apply to an engine installed either as a replacement for an existing engine or an engine installed as an addition to the original engine complement as at 1 January 2000 to comply with the requirements in force.

<sup>2</sup> The term “new” is understood to apply to engines that left the manufacturer’s works for the first time on 1 January 2000 or after that date.

- .3** the maximum continuous rating of the engine is increased by more than 10% compared to the maximum power rating of the original certification of the engine.

For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine or the installation of an additional marine diesel engine, the NO<sub>x</sub> emission standards in force at the time of the replacement or addition of the engine apply. From 1 January 2016, in the case of replacement engines only, if it is impossible for such a replacement engine to meet the standards for Tier III, then that replacement engine shall meet the standards for Tier II. In that case the requirements specified in IMO Resolution MEPC.230(65) apply.

**Note:** The expression “...*time of replacement*...” refers to a replacement occurring on or after 1 January 2014.

**1.2.3 Substantial modification** – any modification<sup>3</sup> made to an engine installed on board the ship on or after 1 January 2000 that could potentially cause the engine to exceed the emission limit, specified in the *NO<sub>x</sub> Technical Code* in accordance with Regulation 13 of Annex VI to *MARPOL 73/78*. For engines installed on board the ship constructed before 1 January 2000, it means any modification<sup>4</sup> made to an engine which increases its existing emission characteristics established by the simplified measurement method as described in *NO<sub>x</sub> Technical Code, 2008*.

**1.2.4 Components** – those interchangeable parts which influence the NO<sub>x</sub> emissions performance, identified by their design/part number.

**1.2.5 Setting** – adjustment of an adjustable feature influencing the NO<sub>x</sub> emissions performance of an engine.

**1.2.6 Operating values** – engine data, like cylinder peak pressure, exhaust gas temperature, etc. These data are load-dependent.

**1.2.7 EIAPP Certificate** – the *Engine International Air Pollution Prevention Certificate* which is issued to an engine, based on marine diesel engine NO<sub>x</sub> emissions measurements performed on a test bed in accordance with the requirements of the *NO<sub>x</sub> Technical Code*.

**1.2.8 IAPP Certificate** – the *International Air Pollution Prevention Certificate* which is issued to a ship after survey to confirm full compliance with the requirements specified in Annex VI to *MARPOL 73/78*.

**1.2.9 On-board NO<sub>x</sub> verification procedures** – procedures which include an equipment requirement, as specified by the engine manufacturer and approved by PRS, to be used as required at the initial certification survey or periodical surveys to verify compliance of such equipment with any of the requirements of the *NO<sub>x</sub> Technical Code*.

**1.2.10 Rated power** – the maximum continuous rated power output as specified on the nameplate and in the *Technical File* of the marine diesel engine.

**1.2.11 Rated speed** – the crankshaft revolutions per minute at which the rated power occurs as specified on the nameplate and in the *NO<sub>x</sub> Technical File* of the marine diesel engine.

**1.2.12 Marine diesel engine** – any reciprocating internal combustion engine operating on liquid or dual fuel, to which Regulation 13 applies, including booster/compound systems if applied. In addition, a gas-fuelled engine installed on a ship constructed on or after 1 March 2016 or gas-fuelled additional or non-identical replacement engine installed on or after that date is also considered as a marine diesel engine.

---

<sup>3</sup> Routine replacement of engine components by parts specified in the *NO<sub>x</sub> Technical File* that do not alter emission characteristics is not considered a “substantial modification”.

<sup>4</sup> The installation on ships constructed before 1 January 2000 of a certified Approved Method pursuant to regulation 13.7.1.1 of the Annex VI, MARPOL or certification pursuant to regulation 13.7.1.2, is not considered to be a substantial modification for the purpose of the application of regulation 13.2 of the Annex VI, MARPOL. It shall also be interpreted that any modification made on or after 1 January 2000 to such an engine involving alternative duty cycle, rating, components or settings that were available, but not necessarily utilised, prior to 1 January 2000 shall not be considered as representing a substantial modification to that engine.

Where an engine is intended to be operated normally in the gas mode, i.e. with the main fuel gas and only a small amount of liquid pilot fuel, the requirements of Regulation 13 have to be met only for this operation mode. Operating on pure liquid fuel resulting from restricted gas supply in case of failures is exempted for the voyage to the next appropriate port for the repair of the failure.

**1.2.13** *Brake power* – actual power measured at the crankshaft, or its equivalent, of the engine being equipped only with the standard auxiliaries necessary for its operation on the test bed.

**1.2.14** *On-board conditions* mean that an engine is: installed on board and coupled with the actual equipment which is driven by the engine, and under operation to perform the purpose of the equipment.

**1.2.15** *NO<sub>x</sub> Technical File* – record containing all details of parameters, including components and settings of an engine, which may influence the NO<sub>x</sub> emission of the engine.

**1.2.16** *Engine Parameter Record Book* – the document for recording all parameter changes, including components and engine settings, which may influence the NO<sub>x</sub> emission of the engine.

**1.2.17** *Parent engine* – see 6.1.

**1.2.18** *Engine family* – see 6.2.

**1.2.19** *Group of engines* – see 6.3.

**1.2.20** *Identical replacement engine* – new diesel engine that following the major conversion defined in 1.2.2.1, as compared to the engine replaced, (Where the replaced engine is not available to be directly compared with the replacing engine at the time of updating the Supplement to the *IAPP Certificate* reflecting that engine change it is to be ensured that the necessary records in respect of the replaced engine are available in order that it can be confirmed that the replacing engine represents an *identical engine*) is of the same:

- design and model;
  - rated power;
  - rated speed;
  - use;
  - number of cylinders;
  - fuel system type (including, if applicable, injection control software); and
- (a) for engines without *EIAPP Certificate*, have the same NO<sub>x</sub> critical components and settings. For engines without *EIAPP Certificate*, there is no defining NO<sub>x</sub> critical component markings or setting values as usually given in the approved *NO<sub>x</sub> Technical File*. In these instances the assessment of „...the same NO<sub>x</sub> critical components and settings...” shall be established on the basis that the following components and settings are the same:

Fuel system:

- fuel pump model and injection timing
- injection nozzle model

Charge air:

- configuration and, if applicable, turbocharger model and auxiliary blower specification
- cooling medium (sea water / fresh water); or

(b) for engines with *EIAPP Certificate*, belong to the same *engine group / engine family*.

**1.2.21** *Non-identical engine* – engine other than an identical engine.

**1.2.22** *Approved method* – method for a particular engine, or a range of engines, which, when applied to the engine, will ensure that the engine complies with the applicable NO<sub>x</sub> limit.

**1.2.23** *Electronic Record Book* - a device or system, approved by the Administration, used to electronically record the entries required under *NO<sub>x</sub> Technical Code*, in lieu of a hard copy record book.

## 2 NO<sub>x</sub> EMISSION STANDARDS FOR MARINE DIESEL ENGINES

### 2.1 Maximum Allowable NO<sub>x</sub> Emission Limits

Operation of each diesel engine to which the present *Publication* requirements (corresponding to the requirements of Regulation 13, Annex VI to *MARPOL 73/78*) apply is prohibited, except when the emission of nitrogen oxides (calculated as the total weighted emission of NO<sub>x</sub>) from the engine is within the following limits:

**Tier I** – for marine diesel engine installed on a ship constructed on or after 1 January 2000 and before 1 January 2011.

Rated engine speed [rpm]	NO <sub>x</sub> emission [g/kWh]
$n < 130$	17
$130 \leq n < 2000$	$45 \times n^{(-0.2)}$
$n \geq 2000$	9.8

**Tier II** – for marine diesel engine installed on a ship constructed on or after 1 January 2011.

Rated engine speed [rpm]	NO <sub>x</sub> emission [g/kWh]
$n < 130$	14.4
$130 \leq n < 2000$	$44 \times n^{(-0.23)}$
$n \geq 2000$	7.7

**Tier III** – for marine diesel engine installed on a ship constructed on or after 1 January 2016.

Rated engine speed [rpm]	NO <sub>x</sub> emission [g/kWh]
$n < 130$	3.4
$130 \leq n < 2000$	$9 \times n^{(-0.2)}$
$n \geq 2000$	2.0

**Note:** see also MEPC.1/Circ.854 – Guidance on the application of Regulation 13 of MARPOL Annex 6 Tier III requirements to dual fuel and gas-fuelled engines.

The limit and the determined NO<sub>x</sub> values, in g/kWh, shall be given and compared to a precision of one decimal place.

Notwithstanding the above provisions, operation of a diesel engine is permitted where:

- an exhaust gas cleaning system is applied to the engine to reduce on-board NO<sub>x</sub> emissions at least to the limits specified above – approved by PRS on the basis of the complete assembly of engine and NO<sub>x</sub> reduction device in accordance with the NO<sub>x</sub> Technical Code<sup>5</sup>, or
- another equivalent method approved by PRS is applied to reduce on-board NO<sub>x</sub> emissions at least to the limits specified above.

### 2.2 Test Cycles

For every individual engine or parent engine of an engine group or family, one of the test cycles, specified below, shall be applied to verify compliance with the NO<sub>x</sub> emission limits specified in paragraph 2.1:

<sup>5</sup> In item 1.15 of the Supplement to *EIAPP Certificate*, the actual emission value for the engine with the NO<sub>x</sub> reduction device in operation shall be given.



- E2 – for constant speed marine engines for ship main propulsion (including diesel electric drive and variable pitch propeller sets, irrespective of whether the system operates at constant speed or variable speeds) – see Table 2.2-1;
- E3 – for propeller-law-operated main and propeller-law-operated auxiliary engines (Table 2.2-2);
- D2 – for constant speed auxiliary engines (Table 2.2-3);
- C1 – for variable speed, variable load auxiliary engines, not included above (Table 2.2-4).

**Table 2.2-1**

Test cycle type E2	Speed	100%	100%	100%	100%
	Power	100%	75%	50%	25%
	Weighting factor	0.2	0.5	0.15	0.15

**Table 2.2-2**

Test cycle type E3	Speed	100%	91%	80%	63%
	Power	100%	75%	50%	25%
	Weighting factor	0.2	0.5	0.15	0.15

**Table 2.2-3**

Test cycle type D2	Speed	100%	100%	100%	100%	100%
	Power	100%	75%	50%	25%	10%
	Weighting factor	0.05	0.25	0.3	0.3	0.1

**Table 2.2-4**

Test cycle type C1	Speed	Rated				Intermediate			Idle
	Torque %	100%	75%	50%	10%	100%	75%	50%	0%
	Weighting factor	0.15	0.15	0.15	0.1	0.1	0.1	0.1	0.15

**2.2.1** The torque figure specified for test cycle C1 are percentage values which represent for a given test mode the ratio of the required torque to the maximum possible torque at this given speed.

**2.2.2** The intermediate speed for test cycle C1 shall be declared by the manufacturer, taking into account the following requirements:

- .1 for engines which are designed to operate over a speed range on a full load torque curve, the intermediate speed shall be the declared maximum torque speed if it occurs between 60% and 75% of rated speed;
- .2 if the declared maximum torque speed is less than 60% of rated speed, then the intermediate speed shall be 60% of the rated speed;
- .3 if the declared maximum torque speed is greater than 75% of the rated speed, then the intermediate speed shall be 75% of rated speed
- .4 for engines which are not designed to operate over a speed range on the full load torque curve at steady state conditions, the intermediate speed will typically be between 60% and 70% of the maximum rated speed.

**2.2.3** If an engine manufacturer applies for a new test cycle application on an engine already certified under a different test cycle specified in tables 2.2-1 to 2.2-3, then it may not be necessary for that engine to undergo the full certification process for the new application. In this case, the engine manufacturer may demonstrate compliance by recalculation, by applying the measurement results from the specific modes of the first certification test to the calculation of the total weighted emissions for the new test cycle application, using the corresponding weighting factors from the new test cycle.

**2.2.4** Where more than one test cycle is to be applied, on the *EIAPP Certificate* shall be stated: the average cycle weighted NO<sub>x</sub> emission value for each cycle (item 1.15 of the Supplement to *EIAPP Certificate*) together with the corresponding limit values for each cycle (item 1.14 of the Supplement to

*EIAPP Certificate*). Where more than one test cycle is required, each test cycle shall follow a full cycle procedure. It is not permitted to add data from one test to emission values taken from another test.

Where a constant speed engine as installed can be used either solely for main propulsion or auxiliary purposes, then the engine shall be certified to both E2 and D2 test cycles.

Where a generator is permanently fitted or coupled to the main engine propulsion shafting, then certification of the main engine using the E2 or E3, as appropriate, test cycle is required.

### **3 PROCEDURES FOR MARINE DIESEL ENGINE TESTING, SURVEYS AND CERTIFICATION**

Each marine diesel engine is considered to be operated in compliance with the NO<sub>x</sub> limits, specified in paragraph 2.1, if it can be demonstrated that the weighted NO<sub>x</sub> emissions from the engine are within those limits at the Initial Certification Survey, Intermediate Certification Surveys and such other surveys as are required.

#### **3.1 Marine Diesel Engines Surveys**

Each marine diesel engine, specified in 1.1.2, is subject to the following surveys:

##### **.1 Pre-certification Survey**

Pre-certification survey, to be performed on a test bed, in order to confirm that the engine, as designed and equipped, complies with the NO<sub>x</sub> emission limits.

If the survey confirms compliance, the *Engine International Air Pollution Prevention (EIAPP) Certificate* is issued.

##### **.2 Initial Certification Survey**

Initial certification survey is conducted on board a ship after the engine has been installed, but before it is placed in service. This survey shall confirm that the engine, as installed on board the ship, including any modifications and/or adjustments since the pre-certification, if applicable, complies with the *NO<sub>x</sub> Technical Code* and the NO<sub>x</sub> emission limits. This survey, as part of the ship's Initial Survey, may lead to either the issuance of the ship's *International Air Pollution Prevention (IAPP) Certificate* or an amendment of the ship's valid *IAPP Certificate* reflecting the installation of a new engine or its modification.

##### **.3 Periodical and Intermediate Surveys**

Periodical and intermediate surveys are conducted as part of ship's surveys<sup>6</sup> to ensure that the engine continues to fully comply with the provisions of the *NO<sub>x</sub> Technical Code*.

##### **.4 Engine Initial Certification Survey after Substantial Modification**

Engine initial certification survey is conducted every time a substantial modification has been made to an engine to ensure that the modified engine complies with the NO<sub>x</sub> emission limits contained in Chapter 2. This results in the issuance, if applicable, of the *EIAPP Certificate* and the amendment of the *IAPP Certificate*.

#### **3.2 Methods for Determining Engine NO<sub>x</sub> Emissions**

To fulfil the survey and certification requirements specified in paragraph 5.1, the engine manufacturer, ship builder or ship owner can choose one of the following methods:

- .1** test bed testing for the pre-certification survey<sup>7</sup>;
- .2** on-board testing for an engine not pre-certificated for a combined pre-certification survey and initial certification survey in accordance with the full test bed requirements<sup>8</sup>;
- .3** on-board engine parameter check method<sup>9</sup>;
- .4** on-board simplified measurement method<sup>10</sup>; or
- .5** on-board direct measurement and monitoring<sup>11</sup>.

<sup>6</sup> In accordance with the requirements of Regulation 5, Annex VI to *MARPOL 73/78*.

<sup>7</sup> In accordance with the requirements of Chapter 5 of the *NO<sub>x</sub> Technical Code*.

<sup>8</sup> On-board tests shall fulfil the requirements of 4.2.

<sup>9</sup> See 8.2.1.

<sup>10</sup> See 8.2.2.

<sup>11</sup> See 8.2.3.

## 4 PROCEDURES FOR PRE-CERTIFICATION OF ENGINE

4.1 Prior to installation on board, each marine diesel engine, except as allowed in paragraphs 4.2 and 4.4, shall:

- .1 be adjusted to meet the applicable NO<sub>x</sub> emission limits,
- .2 have its NO<sub>x</sub> emissions measured on a test bed<sup>12</sup>, and
- .3 be pre-certified, as documented by the issuance of the *EIAPP Certificate*.

4.2 There are engines which, due to their size, construction and delivery schedule, cannot be pre-certified on a test-bed. In such cases, the engine manufacturer, ship owner or shipbuilder shall make application to PRS requesting an onboard test. The applicant shall demonstrate to PRS that the onboard test fully meets all of the requirements of a test-bed procedure. For engines undergoing an onboard certification test, in order to be issued with the EIAPP Certificate, the same procedures apply as if the engine had been pre-certified on a test bed, **subject to the limitations given in paragraph 4.2.1.**

4.2.1 **This pre-certification survey procedure may be accepted for an individual engine or for engine group represented by the parent engine only, but it shall not be accepted for and engine family certification.**

4.2.2 Engines undergoing an onboard certification test shall have a preliminary approved Technical File, pending the results of the emission test.

If the result of the emission test does not comply with the applicable NO<sub>x</sub> regulation, the engines are to be re-adjusted to the compliance condition originally approved, if any, or the applicant is to apply to the Administration for acceptance of further testing.

In no case shall an allowance be granted for possible deviations of measurements if an initial survey is carried out on board a ship without any valid precertification test.

4.3 **Where a NO<sub>x</sub>-reducing device is to be included within the EIAPP certification, it must be recognized as a component of the engine, and its presence shall be recorded in the engine's Technical File. The applicable test procedure shall be performed and the combined engine/NO<sub>x</sub>-reducing device shall be approved and pre-certified by the Administration taking into account Guidelines developed by the Organization<sup>13</sup>. However, the pre-certification in accordance with the procedure not involving the testing for the combined engine/NO<sub>x</sub>-reducing device on a test bed as given by the Guidelines developed by the Organization is subject to the limitations given in paragraph 4.2.1.**

4.4 For the pre-certification of series manufactured engines, depending on the approval by PRS, the engine family or the engine group concept may be applied. In such a case, the emissions testing is required only for the parent engine(s) of an engine group or engine family.

4.5 With regard to the status of licensees relative to the conformity of production conditions (Control of conformity of production arrangements as required by point 4.3.7 of NO<sub>x</sub> Technical Code 2008) to licensor's requirements, who seeks Engine Family/Group approval in the first instance, it is recommended to adapt the following interpretation:

- An Engine Family / Group approval, as applicable, is granted to the manufacturers requesting to apply the Engine Family or Engine Group concept to serially produced marine diesel engines.
- The conformity of production arrangements as proposed by the entity seeking Engine Family / Group approval and as accepted by the Administration are to cover those marine diesel engines within that particular Engine Family / Group as manufactured by the licensees.
- Additionally, where the licensor has in place arrangements which extend, under his oversight and control, the accepted conformity of production arrangements to other engine manufacturers (i.e licensees ), then candidate marine diesel engines produced by those other manufacturers may be included in the Engine Family / Group as established. In this circumstance the marine diesel engine selected, and accepted by the Administration as the Parent Engine, may be produced either by the licensor who requested the Engine Family / Group certification or by one of the other parties (licensees ) as covered by the agreed conformity of production arrangements.

---

<sup>12</sup> In accordance with Chapter 5 of the *NO<sub>x</sub> Technical Code*.

<sup>13</sup> **Refer to the 2017 Guidelines addressing additional aspects to the NO<sub>x</sub> Technical Code 2008 with regard to particular requirements related to marine diesel engines fitted with selective catalytic reduction (SCR) systems, adopted by resolution MEPC.291(71), as amended (resolution MEPC.313(74))**

- In cases where serially produced marine diesel engines are manufactured outside an accepted conformity of production arrangements, then it is the responsibility of the manufacturer of those marine diesel engines themselves to request certification in accordance with the requirements of the NO<sub>x</sub> Technical Code 2008 from the relevant Administration including the establishment of the relevant Engine Family / Group, selection and testing of the Parent Engine and the development of the particular conformity of the production arrangements which are to cover those marine diesel engines.

**4.6** Each engine requires its own *EIAPP Certificate*. For an engine group or engine family one certificate may be issued, provided that each engine is clearly identified.

**4.7** *EIAPP Certificate* is issued for the life of the engine of a ship entitled to fly the flag of a State which is a Party of Annex VI to *MARPOL 73/78*.

## **5 PROCEDURES FOR ENGINE CERTIFICATION**

**5.1** After installation on board, it shall be determined to what extent an engine has been subjected to further adjustments and/or modifications which could affect the NO<sub>x</sub> emission. Therefore, the engine, after installation on board, but prior to the issuance of *IAPP Certificate*, shall be inspected for modifications and be approved using the onboard NO<sub>x</sub> verification procedures and a respective method of those described in 8.2.

**5.2** For those engines which have not been adjusted or modified relative to the original specification of the manufacturer, the provision of valid *EIAPP Certificate* is sufficient to demonstrate compliance with the applicable NO<sub>x</sub> limits.

**5.3** If all of the engines installed on board are verified to remain within the parameters, components and adjustable features recorded in the *Technical File*, the engines are accepted as complying with NO<sub>x</sub> limits. In that case, *IAPP Certificate* is issued to the ship.

**5.4** Every marine diesel engine installed on board a ship shall have the *Technical File* prepared by the engine manufacturer for engine certification and approved by PRS. The *Technical File* is required to accompany an engine throughout its life on board ships.

**5.5** Where a NO<sub>x</sub> reducing device is installed and needed to comply with the NO<sub>x</sub> limits, one of the options providing a ready means for verifying compliance with regulation 13 is the direct measurement and monitoring method. However, depending on the technical possibilities of the device used, subject to PRS approval, other relevant parameters could be monitored.

**5.6** If any adjustment or modification is made which is outside the approved limits documented in the *Technical File*, the *IAPP Certificate* may be issued only if the overall NO<sub>x</sub> emission performance is verified to be within the required limits by:

- .1** on-board NO<sub>x</sub> simplified measurement; or
- .2** reference to the test-bed testing for the relevant engine group approval showing that the adjustments or modifications do not exceed the NO<sub>x</sub> emission limits.

**At surveys after the initial engine survey, the Direct Measurement and Monitoring method in accordance with 6.4, as approved by the Administration, may alternatively be used.**

The demonstration of compliance in accordance with either direct measurement and monitoring or on-board simplified NO<sub>x</sub> measurement does not establish a new *engine group*<sup>14</sup>, but does define the on-board verification procedure to be used thereafter to verify continuing compliance for that particular engine.

In that case the *parent engine*<sup>15</sup> emission value, as given in the *EIAPP Certificate*, thereafter only relates to the condition of that engine at the pre-certification survey.

**5.7** Provision shall be made for direct measurement of NO<sub>x</sub> emissions<sup>16</sup> during engine operation. Sufficient data shall be collected to calculate the weighted average NO<sub>x</sub> emissions. The data must be current (taken within the last 30 days) and shall be kept on board for three months<sup>17</sup>.

---

<sup>14</sup> See Chapter 6.

<sup>15</sup> See Chapter 6.

<sup>16</sup> The applied method of direct measurement of NO<sub>x</sub> emission shall comply with the provisions of Resolution MEPC.103(49).

**5.8** If any adjustments or modifications are made to any engine after its pre-certification, full record of such adjustments or modifications shall be entered in the *Engine Parameter Record Book*.

**5.9** PRS may, at their own discretion, abbreviate or reduce all parts of the survey on board with respect to an engine which has been issued an *EIAPP Certificate*. The entire survey on board must, however, be completed for at least one cylinder and/or one engine in an engine family or engine group, or spare part, if applicable, and the abbreviation may be made only if all the other cylinders and/or engines or spare parts are expected to perform in the same manner as the surveyed engine and/or cylinder or spare part. Physical verification shall be completed prior to the issue or endorsement of the *IAPP Certificate*. This verification may be performed on a spare part representative (at PRS own discretion in each particular case) of the working component, but such a component must be properly defined in the engine *Technical File* on-board NO<sub>x</sub> verification procedures. PRS may accept engine certification by another classification society or a company authorised by the Administration to perform such certification. Such acceptance is subject to PRS consideration in each particular case. The engine certificates and the *Technical File*, including all supplements, are subject to PRS verification.

## **6 ENGINE FAMILY AND ENGINE GROUP CONCEPTS**

Engines may be certification-tested individually or based on the adopted engine family or engine group concepts. The engine family concept may be applied to any series produced engines which, through their design are proven to have similar NO<sub>x</sub> emission characteristics, are used as produced, and, during installation on board, require no adjustments or modifications which could adversely affect the NO<sub>x</sub> emissions. The engine group concept may be applied to a smaller series of engines produced for similar engine application and which require minor adjustments and modifications during installation or in service on board.

Initially the engine manufacturer may determine whether engines should be covered by the engine family or engine group concept. The type of application depends on whether the engines will be modified, and to what extent, after the pre-certification survey.

### **6.1 Parent Engine**

The manufacturer may select, for testing, an engine (hereinafter referred to as the parent engine) to represent the engine family or the engine group.

The procedure and criteria for selecting the parent engine are subject to PRS review and shall take account of the NO<sub>x</sub> emission level. The selected engine shall have the highest NO<sub>x</sub> emission level among all of the engines in the engine family. PRS has the option of selecting a different engine from that chosen by the manufacturer.

Selection and tests of the parent engine provide the basis for the engine family or engine group certification without the necessity to perform individual NO<sub>x</sub> emission measurement.

Where the measured performance of a member engine of an engine family or an engine group is fundamental to the verification that the member engine is operating within the parameters defined for the approved engine family or group, then that performance data (emission, engine performance, ambient conditions) shall have been obtained in accordance with the requirements of Chapter 5 of the *NO<sub>x</sub> Technical Code*.

When an engine family or group has been agreed, the engine manufacturer shall submit the following for approval:

- Technical File<sup>18</sup>;
- documentation of the engine family or group containing all basic characteristics, conditions relating to the engine and engine selection as well as replacement spare parts;
- quality control procedures regarding the components, settings and operating parameters during manufacture and assembly of the series produced engines<sup>19</sup>;
- the on-board engine survey procedure.

---

<sup>17</sup>In accordance with paragraph 2.3.4 of the *No<sub>x</sub> Technical Code*.

<sup>18</sup>See Chapter 7.

<sup>19</sup>See *Publication 4/P – I.C. Engines and Engine Components – Survey and Certification*.

The determined parent engine NO<sub>x</sub> emission value shall be recorded in item 1.5 of the Supplement to the *EIAPP Certificate* for the parent engine and all subsequent members engines within the engine family or engine group the parent engine represents.

## 6.2 Engine Family

Engine family is understood as:

- series produced engines with similar NO<sub>x</sub> emission characteristics;
- engines whose basic characteristics, but not specifications, must be common; the characteristics are given in paragraph 4.3.8.2 of the NO<sub>x</sub> Technical Code;
- engines to which minor adjustments through adjustable features are allowed.

Engines within an engine family may have different displacement volume within 15% range and this means the possibility of certifying engines with different bore and stroke dimensions within one engine family. If there are engines which incorporate other features which could be considered to affect NO<sub>x</sub> exhaust emissions, these features must be identified and taken into account in the selection of the engines to be included in the engine family.

All engine models in an engine family shall be recorded in the parent engine *Technical File*. The *Technical File* shall also include technical specifications, operating parameters and limits of engine adjustments of all models within an engine family.

## 6.3 Engine Group

Engine group is understood as:

- engines which may require minor adjustment or modification during installation or in service on board a ship, where such adjustments or modification maintain the NO<sub>x</sub> emissions within the limit;
- engines having the same design features as specified in paragraph 4.4.6 of the NO<sub>x</sub> Technical Code.

Engines within an engine group shall have identical piston stroke and bore dimensions. Guidance for allowable adjustment or modification within an engine group is provided in paragraph 4.4.7 of the *NO<sub>x</sub> Technical Code*.

All engine models in an engine group shall be recorded in the parent engine *Technical File*. The *Technical File* shall also include technical specifications, operating parameters and limits of engine adjustments of all models within an engine group.

## 7 TECHNICAL FILE

The *Technical File*, required in paragraph 5.4, shall be prepared by the engine manufacturer or other responsible parties, e.g. ship owner (with/without technical support of the manufacturer) and is subject to approval by PRS for compliance with the *NO<sub>x</sub> Technical Code*. The *Technical File* is required to accompany an engine through its life on board ships.

The *Technical File* shall contain at least the following:

- .1 identification of those components, settings and operating parameters of the engine which influence its NO<sub>x</sub> emissions;
- .2 identification of the full range of allowable adjustments or alternatives for the components of the engine;
- .3 full record of the relevant engine's performance, including the engine's rated speed and rated power;
- .4 a system of on-board NO<sub>x</sub> verification procedures to verify compliance with the NO<sub>x</sub> emission limits during on-board verification surveys in accordance with Chapter 8;
- .5 a copy of the relevant parent engine test data in accordance with section 2 in Appendix 5 to the *NO<sub>x</sub> Technical Code*;
- .6 where applicable, the designation and restrictions for an engine which is a member of an engine group or engine family;
- .7 specifications of those spare parts/components which, when used in the engine, according to those specifications, will result in continued compliance of the engine with the applicable NO<sub>x</sub> emission limits; and
- .8 the *EIAPP Certificate*, as applicable.

When an after treatment device is fitted, it shall be recorded in the *Technical File* as a NO<sub>x</sub> influencing component<sup>20</sup>.

Where, for the purpose of achieving NO<sub>x</sub> compliance, an additional substance is introduced, such as ammonia, urea, steam, water, fuel additives, etc., a means of monitoring the consumption of such substance shall be provided. The *Technical File* shall provide sufficient information to allow a ready means of demonstrating that the consumption of such additional substances is consistent with achieving compliance with the relevant NO<sub>x</sub> limit.

To ensure that the spare parts/components, specified in .7, are used according to the specifications, appropriate identification of a NO<sub>x</sub> influencing component by the manufacturer's part number or specific marking scheme is required. The identification marking shall be related to a particular drawing and other data defining the features of that component with regard to its influence on NO<sub>x</sub> formation in the combustion process. Those drawings and data shall form part of the conformity of production procedures as required in Chapter 4 of the *NO<sub>x</sub> Technical Code* and shall be attached to the *Technical File*.

## 8 ON-BOARD NO<sub>x</sub> VERIFICATION PROCEDURES

**8.1** To ensure that engines are in compliance with Regulation 13, Annex VI to *MARPOL 73/78* after installation on board a ship, each engine with an *EIAPP Certificate* shall be checked at least once prior to the issuance of the *IAPP Certificate*. Such check can be done using the on-board NO<sub>x</sub> verification procedures specified in the engine *Technical File*.

**8.2** On-board NO<sub>x</sub> emission verification procedures shall be conducted using one of the following methods:

- .1 on-board engine parameter check method, to confirm compliance with the NO<sub>x</sub> emission limits during the following surveys: initial certification survey, periodical and intermediate surveys conducted for engines that have been subjected to the pre-certification survey or engines whose components or settings, specified in the *Technical File*, have undergone modifications or adjustments to NO<sub>x</sub> critical components, settings and operating values since they were last surveyed<sup>21</sup>; when conducting engine parameter check method it is required to verify at least the following:
  - all applicable *EIAPP Certificates* of engines on board;
  - approved *Technical Files*, including the on-board NO<sub>x</sub> verification procedures;
  - *Engine Parameter Record Book* of all applicable engines on board;
  - one or all of the identified components, settings and operating parameters specified in the engine *Technical File*;
- .2 on-board simplified measurement method, applied only for on-board confirmation test and to confirm compliance during periodical and intermediate surveys, when required, or during the initial certification survey to confirm compliance for engines that have been subjected to the pre-certification survey<sup>22</sup>; when conducting simplified measurement method it is required to verify at least the following:
  - *EIAPP Certificates* of all applicable engines on board;
  - approved *Technical Files*, including the on-board NO<sub>x</sub> verification procedures;
  - all recommendations issued by the engine manufacturer and approvals issued by PRS concerning the simplified measurement method;
- .3 on-board direct measurement and monitoring method to confirm compliance, applied only at periodical and intermediate surveys<sup>23</sup>; when conducting this method it is required to verify at least the following:
  - *EIAPP Certificates* of all applicable engines on board;
  - approved *Technical Files*, including the on-board NO<sub>x</sub> verification procedures;
  - documentation and approval of the installed measuring equipment;
  - measurement and monitoring<sup>24</sup> results in order to verify that the engines are in compliance with the *NO<sub>x</sub> Technical Code*.

---

<sup>20</sup> See paragraph 7.1.

<sup>21</sup> In accordance with paragraph 6.2 of the *NO<sub>x</sub> Technical Code*.

<sup>22</sup> In accordance with paragraph 6.3 of the *NO<sub>x</sub> Technical Code*.

<sup>23</sup> See chapters 5 and 7 of this *Publication* and sub-chapter 5.5 of the *NO<sub>x</sub> Technical Code*.

**Note:** Applicable UI MPC 112 (Rev.1 Nov 2019), UI MPC 116 (Rev.1 Nov 2019, Corr.1 May 2020) and UI MPC 116 (Rev.1 Nov 2019) are addressed to additional information relevant for on board NO<sub>x</sub> verification procedures for engine systems fitted with SCR which should be included in its *Technical File* in addition to the items in section 2.4 of the *NO<sub>x</sub> Technical Code*.

### SUPPLEMENT

#### Flow Charts for Survey and Certification of Marine Diesel Engines

Guidance for compliance with survey and certification of marine diesel engines is given in the flow charts on the next pages as follows:

Fig. 1 Flow Chart – Pre-certification Survey at the manufacturer’s works.

Fig. 2 Flow Chart – Engine test.

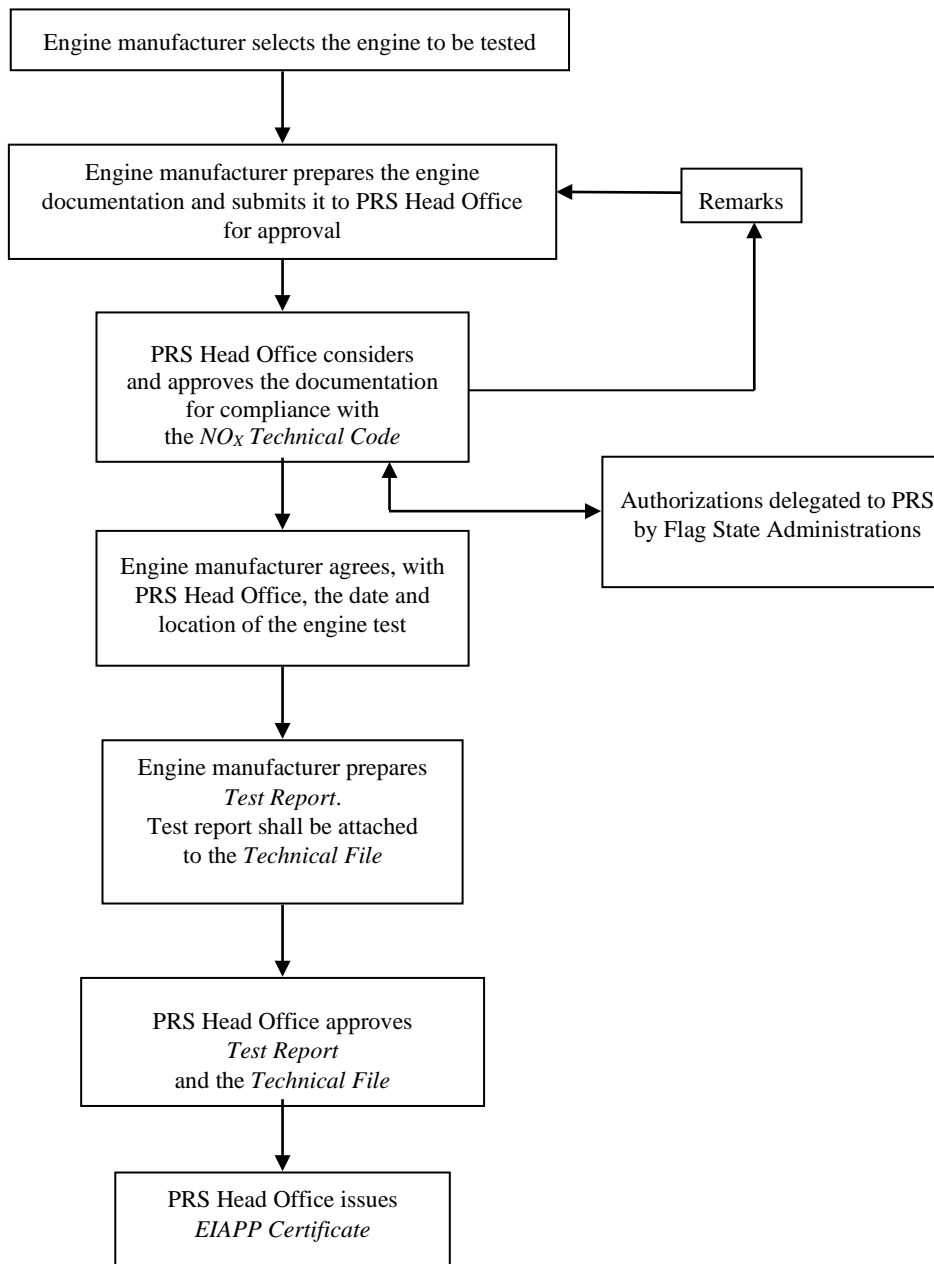


Fig.1 Flow Chart – Pre-certification Survey at the manufacturer’s works

<sup>24</sup>In accordance with paragraph 5.6.



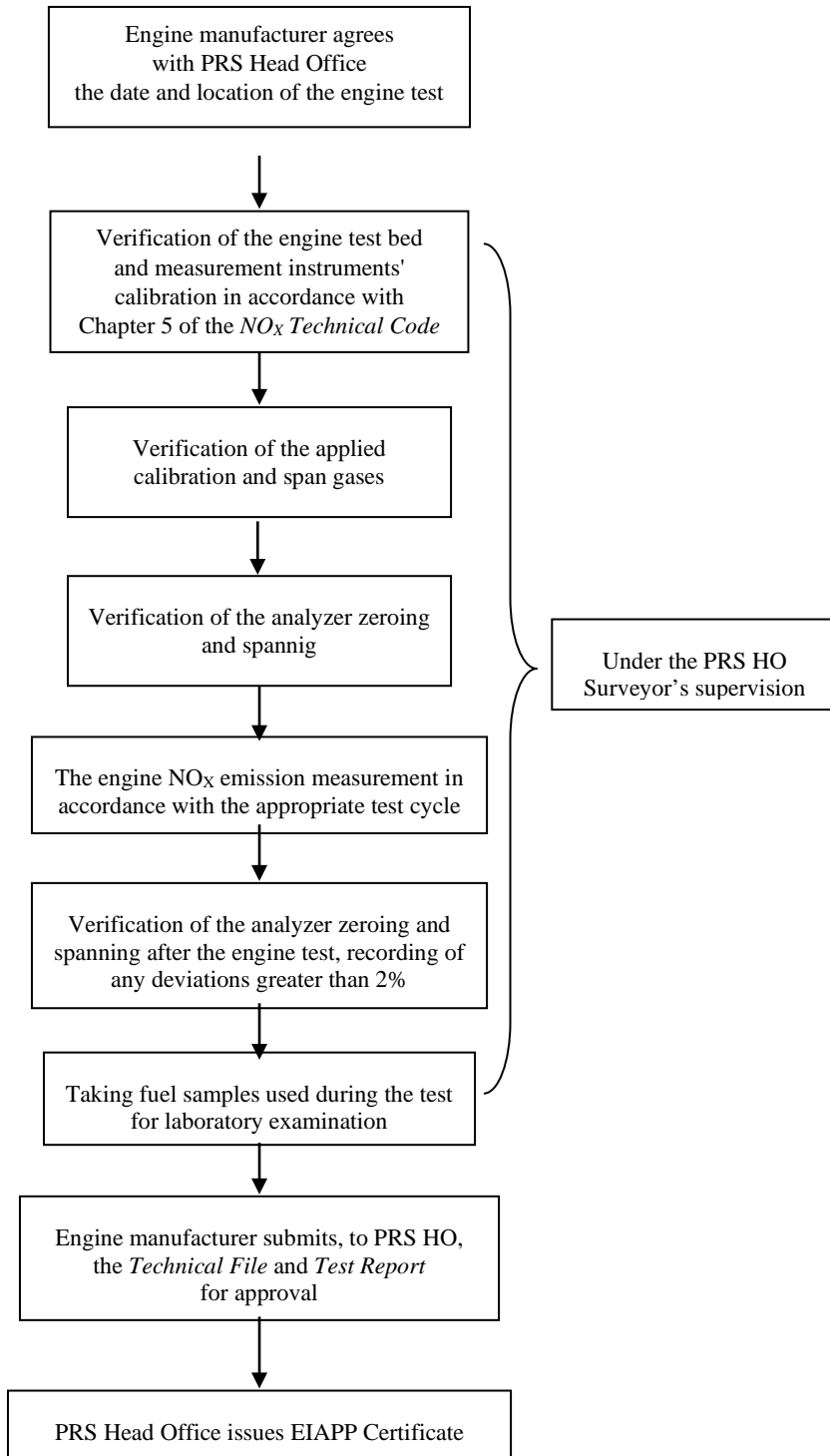


Fig.2 Flow Chart – Engine test

### List of amendments effective as of 1 July 2020

<i>Item</i>	<i>Title/Subject</i>	<i>Source</i>
<a href="#">1.2.3</a>	Footnote	MPC 32 (July 2004) (Rev.1 Jan 2020)
<a href="#">4.2</a>	On-board certification test	MPC 33 (Rev.2 Nov 2019)
<a href="#">4.3</a>	IMO resolution update	MEPC.291(71)
<a href="#">5.6</a>	Direct Measurement and Monitoring method	MPC 40 (Rev.1 Nov 2019)
<a href="#">6.3</a>	Engine Group	MPC 54 (Rev.1 Nov 2019)
<a href="#">8</a>	Note	UI MPC 112 (Rev.1), UI MPC 116 (Rev.1, Corr.1), UI MPC 116 (Rev.1)

### List of amendments effective as of 1 October 2020

<i>Item</i>	<i>Title/Subject</i>	<i>Source</i>
<a href="#">1.2.23</a>	Electronic Record Book	MEPC.317(74)
<a href="#">4</a>	Procedures for pre-certification of engine	MEPC.317(74)

---