LR NOx EMISSIONS CERTIFICATION
OF
MARINE DIESEL ENGINES

Procedure NOx10

April 2010
FOREWORD

This procedure outlines Lloyd’s Register’s provisions for verifying and issue of certification for the Emissions of Nitrogen Oxides from Marine Diesel Engines for compliance with the requirements as specified in MARPOL 73/78, Annex VI Regulation 13 for the Prevention of Air Pollution from Ships.

MARPOL 73/78 Annex VI is applicable to all ships of 400 tonnes gross and above and to fixed and floating platforms and drilling rigs with respect to:

- the prohibition of the use of ozone depleting substances, Regulation 12;
- nitrogen oxide (NOx) emissions from diesel engines, Regulation 13;
- sulphur oxide (SOx) emissions from ships, Regulation 14;
- volatile organic compound emission from cargo tanks of oil tankers (vapour control systems), Regulation 15;
- shipboard incineration of waste, Regulation 16;
- fuel oil quality, Regulation 18.

Annex VI was ratified by the required number of Administrations on 19 May 2004, and entered into force on 19 May 2005. It should be noted that notwithstanding the above diesel engines, which undergo a major conversion or are installed on a ship constructed on or after 1 January 2000 must comply with the NOx Technical Code.

MARPOL Annex VI has since been revised, with the revised Annex VI entering into force on 1 July 2010, together with a revised NOx Technical Code.

IMO    International Maritime Organisation

MARPOL The International Convention for the Prevention of Pollution from Ships

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1. INTRODUCTION

1.1 This procedure relates to the Lloyd's Register requirements for testing and certifying Marine Diesel Engines for compliance with NOx emission limits. It must be read in conjunction with MARPOL 73/78 Annex VI and the NOx Technical Code.

1.2 LR NOx emission certification is an impartial certification system based on the requirements of MARPOL 73/78, Annex VI and the Technical Code on Control of Emissions of Nitrogen Oxides from Marine Diesel Engines.

1.3 LR is a entirely independent international organisation which provides impartial technical and advisory services. Its income is derived principally from the fees charged for its services and any surplus is used for the improvement of those service. LR is a registered charity and is recognised under the laws of the United Kingdom as a whole body whose business is conducted for the benefit of the community.

1.4 As a certification body LR retains a permanent, full-time staff responsible for the operation of its certification systems and ensuring that its activities are free from any external commercial interest.

1.5 It is strongly recommended that clients make early contact with LR to discuss their particular requirements to develop a mutually acceptable route for obtaining NOx emission certification.

2 GENERAL

2.1 MARPOL 73/78, Annex VI was adopted by a sufficient number of countries with the required combined tonnage for it to become mandatory on 19 May 2005.

2.2 The Technical Code on Control of Emissions of Nitrogen Oxides from Marine Diesel Engines (NOx Technical Code) contains requirements for the testing and certification of marine diesel engines.

2.3 Notwithstanding the above, diesel engines with a power output of more than 130kW installed or designed and intended to be installed on board a ship on or after January 1, 2000 must comply with the NOx Technical Code, unless used exclusively for emergency purposes.

2.4 The revised Annex VI has introduced a reduction in permissible NOx emissions for ships built after 1 January 2011, and a further reduction for ships built after 1 January 2016 when operating in designated Emission Control Areas.

2.5 The original NOX emission limits applicable to ships built after 1 January 2000 are now referred to as Tier I limits, the limits for ships built after 1 January 2011 are referred to as Tier II limits, and the limits for ships built after 1 January 2016 operating in Emission Control Areas are referred to as Tier III limits.

2.6 Diesel engines on or after the January 1, 2000 meeting one of the following criteria must be certified for compliance with the NOx Technical Code.

2.6.1 Diesel engines installed on a new ship.

2.6.2 Diesel engines which undergo a major conversion.

2.6.3 Diesel engines whose maximum continuous rating is increased by more than 10%.

2.7 The following exemptions are permitted under Regulations 13 of Annex VI:

2.7.1 emergency diesel engines,

2.7.2 engines installed in lifeboats,

2.7.3 any device or equipment intended to be solely used in case of emergency,

2.7.4 where emission is necessary for the purpose of securing the safety of a ship or saving life at sea.

2.7.5 any emission resulting from damage to a ship or its equipment.
2.7.6 engines installed on ships solely engaged in voyages within territorial waters provided they are subject to an alternative NOx control established by the Administration.

3 DEFINITIONS

3.1 The following definitions are extracts from Annex VI and the code for ease of reference and the understanding of these procedures.

3.2 “Emissions” means any release of substances, subject to control by Annex VI from ships into the atmosphere or sea.

3.3 “NOx Technical Code” means the Technical Code on Control of Emissions of Nitrogen Oxides from Marine Diesel Engines adopted by Conference resolution 2, as may be amended by the IMO.


3.5 “Nitrogen Oxide (NOx) Emissions” means the total emission of nitrogen oxides, calculated as the total weighted emissions of NO\(_2\) and determined using the relevant test cycles and measurement methods specified in the NOx Technical Code.

3.6 “Major conversion” means a modification of an engine where:-

3.6.1 the engine is replaced by a new engine built on or after 1 January 2000 or

3.6.2 any substantial modification, as defined in the NOx Technical Code, is made to the engine, or

3.6.3 the maximum continuous rating of the engine is increased by more than 10%.

3.7 “Substantial Modifications” means any modification\(^1\) to an engine that could potentially cause the engine to exceed the emission standards.

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\(^1\) Note: Routine wear and tear replacements which do not affect the NOx emission characteristics are not classed as substantial modifications under the NOx Technical Code.
3.8 “Installed” means a marine diesel engine that is or is intended to be fitted on a ship, including a portable auxiliary marine diesel engine, only if its fuelling, cooling or exhaust system is an integral part of the ship. A fuelling system is considered integral to the ship only if it is permanently affixed to the ship. This definition includes a marine diesel engine that is used to supplement the installed power capacity of the ship and is intended to be an integral part of the ship.

3.9 “Components” are those interchangeable parts which influence the NOx emissions performance, identified by their design/parts number.

3.10 “Setting” means adjustment of an adjustable feature influencing the NOx emission performance.

3.11 “Operating values” are engine data, like cylinder peak pressure, exhaust gas temperature, etc., and are load-dependent.

3.12 “Rated Power” means the maximum continuous rated power output as specified on the nameplate and in the Technical File of the marine diesel engine.

3.13 “Rated Speed” is the crankshaft revolutions per minute at which the rated power occurs as specified on the nameplate and in the Technical File.

3.14 “Brake power” is the observed power measured at the crankshaft or its equivalent, the engine being equipped only with the standard auxiliaries necessary for its operation on the test bed.

3.15 “Technical File” is a record containing all details of parameters, including components and settings of an engine, which may influence the NOx emissions of the engine.

3.16 “A record book of engine parameters” is the document for recording all parameter changes, including components and engine settings, which may influence NOx emissions of the engine.

3.17 “EAPP Certificate” (also referred to as a Statement of Compliance) is the Certificate of Compliance for Engine Air Pollution Prevention which relates to marine diesel engine NOx emissions measured on a test bed meeting the requirements of the NOx Technical Code.

3.18 “EIAPP Certificate” is the Engine International Air Pollution Prevention Certificate which relates to marine diesel engine NOx emissions meeting the requirements of the NOx Technical Code, and on satisfactory survey after installation on board ship.

3.19 “IAPP Certificate” is the International Air Pollution Prevention Certificate. This is issued to a ship after survey to confirm full compliance with the requirements of MARPOL 73/78 Annex VI.

3.20 NOx Emission Limits, Regulation 13

3.20.1 Tier I limits

<table>
<thead>
<tr>
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<th>RPM</th>
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<tr>
<td>17.0</td>
<td>n &lt; 130</td>
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<td>45.0n (^{-0.2})</td>
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n = rated engine speed (crankshaft rpm)

3.20.2 Tier II limits

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<td>n &lt; 130</td>
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<tr>
<td>44.0n (^{-0.23})</td>
<td>n ≥ 130 but &lt;2000</td>
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<tr>
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<td>n ≥ 2000</td>
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</table>

n = rated engine speed (crankshaft rpm)

3.20.3 Tier III limits

<table>
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<th>RPM</th>
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<tbody>
<tr>
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<td>n &lt; 130</td>
</tr>
<tr>
<td>9.0n (^{-0.2})</td>
<td>n ≥ 130 but &lt;2000</td>
</tr>
<tr>
<td>2.0</td>
<td>n ≥ 2000</td>
</tr>
</tbody>
</table>

n = rated engine speed (crankshaft rpm)
4. SCOPE

4.1 This procedure covers the test requirements for all marine diesel engines above 130 kW which are installed or intended to be installed on board any ship subject to Annex VI, unless exempted.

4.2 This procedure covers the survey and issue of certification for the following:

4.2.1 Pre-Certification survey (EAPP Certificate)

- This is undertaken at the engine manufacturer’s test bed site and is to ensure that the engine is designed and equipped complies with the NOx emission limits. (Reference Annex VI, regulation 13)
- Under certain circumstances, this may be conducted on board the ship after installation and prior to entering service.
- On completion of above LR will issue a Certificate or Statement of Compliance (EAPP), and this will need to be exchanged for an EIAPP Certificate on satisfactory completion of an on-board survey (see Section 11). LR may issue such EIAPP Certificates where authorised by the Flag State Administration.

4.2.2 Conformity of Production Procedure

- The series production of family or group member engines of a certified parent engines is to be manufactured in accordance with an approved Conformity of Production procedure.
- This is a process which allows each member engine’s components, settings and operating values during manufacture and assembly to be verified as being in accordance with the approved parent engine’s Technical File. This is an alternative to testing each individual engine.

4.3 After installation on board a ship, an engine verification survey is required before the issue of a MARPOL Annex VI, IAPP certificate.

4.3.1 This survey is to confirm the engine remains in compliance with the requirements stated in the Technical File and hence the NOx emission limits.

4.3.2 The ship owner may choose one of the following on-board verification survey methods. Details of these are specified in the NOx Technical Code.

- An engine parameter check where the components, setting and operating values are verified to confirm they remain in accordance with those specified in the Technical File.
- Simplified measurement in accordance with the NOx Technical Code, section 6.3.
- Direct measurement and monitoring of the NOx emissions from permanently installed measurement equipment in accordance with the NOx Technical Code, section 6.4.

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2 Note: The on-board engine NOx emission verification survey requirements are not addressed by these Procedures.
5 PARENT, FAMILY and GROUP ENGINES CONCEPT

5.1 General

5.1.1 Engines may be individually tested to demonstrate their compliance with the NOx Emission limits and technical code.

5.1.2 Alternatively, engines may be manufactured as members of a certified engine (Parent) in accordance with an approved conformity of production procedure.

5.2 Parent Engine

5.2.1 A manufacturer may nominate an engine, termed a Parent engine, for testing to represent an engine family or engine group. Details of which must be submitted for agreement and approval.

5.2.2 The parent engine is the family or group member engine whose features and characteristics are known to provide the highest NOx emissions.

5.2.3 Acceptance of the Parent engine as representing a family or group of engines provides the basis for certifying series manufactured engines without individual NOx emission testing.

5.2.4 Where a family or group concept is agreed, the engine manufacturer must submit the following for acceptance and approval either by the Administration or their nominated body.

- A Technical File providing details and data of the Parent engine's components, settings and operating values. The Technical File should include all allowable alternative components and settings for the other family or group member engines.

- Documentation supporting the family or group choice including all terms and conditions, and replacement spare parts.

- The quality procedure to ensure effective control of the components, settings and operating values during manufacture and assembly of the series produced engines.

5.3 Family Engine Concept

5.3.1 Family engines are:

- series produced engines with similar NOx emission characteristics,

- defined by their common basic design characteristics,

- not intended to be modified or adjusted during installation on board or in service.

5.3.2 All engine models covered by the family designation are to be listed in the Parent engine Technical File. The information should include their specifications, operating condition limits and any allowable engine adjustments.

5.4 Engine group concept

5.4.1 Group engine are:

- engines with common parameters, specifications and characteristics. These are specified in sections 4.3.8 and 4.4.5 of the Technical Code.

- similar type of engines which may require minor adjustment or modification during installation or in service on board a ship,

- engines where such adjustments maintain the NOx emissions within the limit for the engine.

- normally series produced in low numbers such as generators and some of the larger powered propulsion engines.

5.4.2 All group designated engine models are to be listed in the Parent engine Technical File. The information should include their specifications, operating condition limits and any allowable engine adjustments.

Note: Allowable adjustments are those which maintain compliance with the NOx emission limit requirements.
6. **APPROVAL PROCEDURE**

6.1. **General**

6.1.1. The initial review of the Technical File and the consideration of test reports and existing certification will be co-ordinated by the authorised LR office.

6.1.2. LR in consultation with the Flag Administration may recognise certificates and reports issued by another Administration or on their behalf, provided such certifications and reports are considered by LR and/or the Administration to fulfil the NOx emission certification requirements.

6.1.3. A LR representative shall inspect and witness the NOx emission testing of marine diesel engines unless agreed otherwise in writing.

6.1.4. All test and measuring equipment shall be of proven accuracy, where appropriate in accordance with the NOx Technical Code, and traceable to a national or international standard of measurement.

6.1.5. The engine builder is responsible for selecting the parent engine, family or group, the preparation and submission of the supporting documentation.

6.2. **Application for the Issue of a NOx Emission Certificate.**

6.2.1. An application for the Issue of a NOx Emission Certificate should be made on a Lloyd’s Register Request for Marine Services form (2502) obtainable from LR.

6.2.2. A separate LR Request for Services should be completed for each engine model parent, family or group series and each place of production for which application is being made with supporting documentation.

6.2.3. The completed request for service form(s) and Technical File(s) should contain sufficient information to allow the engine to be assessed against the requirements of the NOx Technical Code.

6.2.4. Typical minimum information to be contained in the technical file documentation is listed below.

- General drawings of the engine and major components affecting the NOx emission levels.
- Details of the engine(s), such as model number, power rating, number and cylinder configuration, crankshaft revolutions, stroke, etc.
- Identification of components, settings and operating values of the engine(s) which affect its NOx emissions.
- Identification of the full range of allowable adjustments and components and the acceptable alternative for the engines.
- Full record of the relevant engine’s performance data and engine application.
- Procedure for the engine on-board NOx emission verification survey after installation.
- Copy of the final test report.
- Details of the designation and restrictions for group or family engines, where applicable.
- Specification of acceptable replacement spare parts and components which will result in continued compliance of the engine with the NOx emission limits.
- Details of the identification markings for the engine components and spare parts.
- Details of any system employed to assist with the reduction of NOx emissions from the engine, e.g. water injection, steam, exhaust circulation, selective catalytic reduction (SCR), etc.
- Copy of the NOx Certificate (once issued).

6.2.5. Where series manufactured engines are to be certified under the family or group concept, the
Conformity of Production procedure, detailing the implemented quality system to ensure conformity of components and settings during manufacture and assembly is to be submitted for approval.

6.2.6. The following supporting documentation should also be submitted for information and review.

- Intended ship and / or shipyard and Flag Administration, where available.
- Proposed test dates and location.
- Details of the proposed contents of the test bed report. (Initial application only)
- Details of the NOx emission test bed measurement equipment, span gases and calibration records.
- Details of the proposed test procedure.

6.3. **Initial Review**

6.3.1. The information should be submitted to LR for review and verification of whether:

- The engine is acceptable for certifying as an individual, parent, family or group member engine.
- The information satisfies the requirements of the NOx Technical Code for the proposed engine test and certification.
- Details are provided of all components and settings, which may affect the NOx emissions including their identification system and acceptable adjustments. *(Reference Appendix 1 for a guide on parameters affecting NOx emissions.)*
- The engine operating values are listed.
- The proposed test equipment and test procedure are acceptable and appropriate for the demonstration of compliance with the NOx Technical Code.
- The proposed test cycle(s) {C1, D2, E1 or E3} is acceptable for the proposed application.

6.3.2. Existing certificates and reports witnessed and issued by an independent authorised certifier, may be considered for acceptance in whole or in part.

6.3.3. If the initial review is acceptable, Lloyd's Register will liaise with the applicant to finalised the inspection and testing dates.

6.3.4. Lloyd's Register will advise the client of the areas not considered to meet the requirements of the NOx Technical Code.

6.3.5. The Technical File should have an identification number with revision status and a contents page listing the contained information to assist with future submissions and approvals.

6.4. **Inspection and Testing**

6.4.1. The engine test will be conducted in accordance with the appropriate test cycle(s) and the NOx Technical Code.

6.4.2. Where a deviation from the test cycle is proposed, full details of the proposal with justifications are to be submitted for approval.

6.4.3. The attending surveyor will verify and witness the following at the time of carrying out the engine NOx emission test.

- Verify the components, settings and operating values are correct for the designated test engine as provided in the Technical File.
- Verify the installation and calibration records of the NOx measuring equipment.
- Review and record the reference gases composition, concentration, filling and/or expiry dates and calibration records.
- Witness the NOx measuring equipment zero and span check before and after the NOx emission test and verify the drift is less than 2%.
• Witness the engine test and the NOx measurement records.

• Witness the drawing of the test fuel oil sample for analysis.

• Forward the final test results and NOx emission calculations for review.

6.4.4 On satisfactory completion of the document review and test report assessment, a NOx emission certificate is issued. (Appendix 6 shows an example of the certificate format.)

6.4.5 Where it is agreed to carry out the NOx emission pre-certification test on-board the ship, the test measuring equipment, the calibration records and test procedures are to be submitted for review and acceptance prior to the test proceeding.

7. CERTIFICATE

7.1. The EIAPP Certificate

7.1.1. EIAPP (Engine International Air Pollution Prevention) Certificates are issued by or on behalf of the respective Flag Administration. The EIAPP certificate is available in Forms2. Refer to the Country Files to establish whether LR is authorised to issue EIAPP certificates on behalf of the respective Flag Administration.

7.1.2 An EIAPP certificate has no expiry date and is valid for the life of the engine, as long as the engine is maintained within its NOx limits.

7.1.3 It's emission limit remains valid for all engines verified as manufactured in accordance with the approved Technical File and Conformity of Production procedures for the authorised Administration.

7.1.4 Each engine requires its own EIAPP certificate.

7.1.5. Certificates or Statements of Compliance (EAPP Certificates) will require to be replaced with an EIAPP Certificate (see 4.2.1) by an attending Surveyor.

4 NOTE: Measurements are to be taken after steady state conditions are established at each test stage.
8. CONFORMITY OF PRODUCTION

8.1. The Lloyd's Register publication, "NOx Conformity of Production Procedure", documents the requirements for certification of serially manufactured family or group member engines.

8.2. In general the following criteria requires to be taken into consideration.

8.2.1. An approved conformity of production procedure should be in place prior to series production.

8.2.2. The conformity of production procedure is to ensure the components, tolerances and settings of each series produced engine are the same as the certified parent engine and its approved Technical File.

8.2.3. The conformity of production procedure should document the system methodology, including controls, inspections and tests for compliance with the engine specification and approved technical file, covering for example.

- Design and drawing control.
- Verification of the NOx sensitive components during manufacture and engine assembly.
- Verification of the settings and operating parameters.
- Manufacturing inspections and tests.
- Engine assembly inspections and tests.
- Procedure for dealing with non-compliant items.
- Preparation, control, obtaining approval and issue of the engine's Technical File.

8.2.4. The attending surveyor will ensure through inspection and testing that:
- the engine components are manufactured and assembled in accordance with the approved procedures and corresponding data in the approved parent engine Technical File,
- the components are correctly marked with the unique identifier,
- the correct components are assembled in the engine being certified,
- the settings and operating parameters are in accordance with the approved parent Technical File data for the engine.

8.2.5. The surveyor on completion of the inspections issues a Verification of Conformity Report for the engine(s).

8.2.6. Provision should be made to uniquely identify approved NOx sensitive components modified due to technical development or design changes.

8.2.7. For mass produced engines having a bore not exceeding 300 mm, where individual inspection is not viable, a suitable Lloyd's Register approved quality scheme may be considered for the Conformity of Production verification.
9. **FEES**

9.1. Lloyd’s Register services associated with NOx emissions certification of Marine Diesel Engines will be charged on the basis of; a Technical File review, a test report(s) assessment, the associated inspection and survey, witnessing of NOx emission testing and issue of a NOx certification, as applicable.

9.2. Fee quotations are based on the submitted documentation being complete, and being submitted in the English language, or a language acceptable to Lloyd’s Register.

9.2.1. The fee covers the original submission and one amendment. Where further submissions are required then an additional fee will be charged commensurate with the volume of work involved.

9.2.2. Where translation costs are incurred for documentation submitted in other languages, such additional charges will be invoiced at cost.

9.3. For initial, periodical and renewal surveys, a fee quotation will be made upon acceptance of an application.

9.4. Should a client withdraw his application for certification, for whatever reason, Lloyd’s Register reserves the right to charge fees for costs already incurred.

10. **CLIENT’S RESPONSIBILITY**

10.1 **The Engine Manufacturer**

10.1.1 The engine manufacturer is responsible for:

- preparing the facilities necessary for measuring the engine NOx emissions,
- the maintenance of the calibration and accuracy of the measurement equipment in accordance with code requirements,
- demonstrating each engine supplied is in compliance with the NOx Technical Code,
- applying for the issue of a pre-certification certificate (EIAPP) for each engine supplied,
- submitting data substantiating any claim that an engine is part of a family or group of a parent engine for approval,
- applying for the approval of the Technical File for each engine supplied,
- preparing and submitting for approval an engine on-board verification procedure,
- submitting modifications to the approved engine Technical File for approval,
- applying for the approval of the Control of Production procedures for series manufactured engines,

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5 **Note:** This may be the responsibility of the Test House where they carry out the testing.
10.2. **The Ship Owner**

10.2.1. The Ship Owner is responsible for:

- installing engines which are certified as being in compliance with the NOx Technical Code.
- maintaining the installed engine(s) to ensure they remain compliant with the NOx Technical code,
- maintaining a record book of engine parameter in which changes to engine settings, modifications, maintenance and any other parameters which could affect the NOx emissions from the engine(s) are recorded,
- arranging the periodical surveys in accordance with MARPOL 73/78, Annex VI requirements to cover the on-board NOx emission verification surveys of the engine(s),
- arranging an on-board verification survey where major changes are effected to the engines or systems,
- providing advance notice to Lloyd's Register of the proposed date and location of these surveys,
- the calibration of any measurement equipment used on-board during these surveys.
- obtaining and maintaining the IAPP (International Air Pollution Prevention) certificate.

11. **ON-BOARD VERIFICATION SURVEY AFTER INSTALLATION**

11.1. **General**

11.1.1. After a pre-certified (EAPP) engine is installed on board a ship, an initial installation survey is carried out to confirm the engine remains in compliance with the NOx emission limits as part of the Annex VI survey for issue of an EIAPP certificate. This may be verified in accordance with one of the following approved procedures:

- engine parameter method, or
- simplified measurement method, or
- direct measurement and monitoring method

11.1.2. The chosen on-board verification survey system is required to be approved and forms part of the engine Technical File documentation.
12. DECLARATION

12.1 Precise terms of reference contained in the LR Group Management Procedures MS-02-00 relate to the organisation and staff of LR and the requirements for the quality of service provided by Lloyd's Register.

12.2 Lloyd's Register undertakes to ensure that current issues of the LR NOx Emissions Certification of Marine Diesel Engines Procedure NOx04 and other appropriate documentation are available to all its representatives, located in exclusive and non-exclusive offices world-wide.

12.3 Lloyd's Register undertakes to maintain records of relevant documentation, such as Technical Files and test reports, for the duration of the certification validity. Lloyd's Register retains the right to hold this documentation and data in an electronic format.

12.4 Lloyd's Register undertakes to protect the confidentiality of information received in the course of its services.

12.5 The affairs of Lloyd's Register are under the overall direction of the General committee, which is composed of persons nominated or elected to represent the world community and the industry which Lloyd's Register serves.

12.6 Any appeal to Lloyd's Register from decisions or recommendations made with respect to LR NOx emission certification may be referred to the General committee, who may direct a special examination to be held.
APPENDIX I

GUIDE OF TYPICAL NOx - SENSITIVE PARAMETERS

The following are provided as a guide of typical parameters which may have an effect on the NOx emissions from an engine. Note: This is not an exhaustive list.

1. Oil fuel injection timing
2. Injection nozzles, operating setting
3. Fuel injection pump operational setting, cams & injection settings
4. Fuel cam
5. Common rail system injection pressure
6. Configuration of combustion chamber
7. Compression ratio
8. Turbocharger type
9. Turbocharger air or turbine impeller
10. Charge air cooler, charge air heater
11. Valve timing
12. Additives to fuel, such as water, steam, etc.
13. Air inlet and exhaust valves
14. Cooling medium temperature
15. Oil fuel specification
16. Engine speed
17. (SCR) selective catalytic reduction unit in exhaust
18. Exhaust gas re-circulation
19. Water and steam injection systems
20. Variations in the climatic conditions
APPENDIX 2
RELATIONSHIP BETWEEN EAPP, EIAPP & IAPP CERTIFICATION
(MARPOL 73/78 ANNEX VI)

- NOx Emission Test of Marine Diesel Engine on Test Bed (EAPP) (NOx Technical Code)
- Incineration of Waste (MEPC40) IMO Type Examination Certificate
- Control of Emissions:
  - Volatile Organic Compounds from Cargo Tanks of Oil Tankers
  - Sulphur Oxide
  - Fuel Oil Quality
  - Ozone Depleting Substances

On-Board Verification Survey of Diesel Engine for compliance with Marpol 73/78 Annex VI and issue of EIAPP.

On-Board Verification Survey for Compliance with Marpol 73/78 Annex VI

LR Authorisation from Flag State Administration

IAPP Certificate Issued Valid for 5 Years (maximum)

Periodical Surveys to Maintain IAPP Certificate which is Endorsed at Each Survey

IAPP Certificate Renewal Survey for Re-issue for Further 5 Years
APPENDIX 3

PRE-CERTIFICATION (EAPP) OF PARENT ENGINE

Engine Manufacturer (EM), on basis of in-house test(s), selects engine with highest NOx emission as Parent Engine for a particular NOx Test Cycle.

EM Prepares and Submits Documentation for Approval

LR reviews Technical File and confirms Family or Group of Parent Engine

LR Reviews Documentation for Compliance with NOx Emission Technical Code

Agrees and Witness Engine NOx Testing (Ref. Appendix 5)

EM Prepares Test Report and submits with Technical File

Test Report and Technical File Reviewed, Approved and Stamped

NOx Certification Issued on Completion (EAPP)
PRE-CERTIFICATION (EAPP) OF FAMILY OR GROUP MEMBER ENGINES

Engine Manufacturer (EM) manufactures member engines related to selected Parent Engine of the same NOx Test Cycle as per Appendix 3.

EM Prepares Conformity of Production Procedure Submit for Approval

Member Engine(s) in Family or Group Technical File Submitted by EM

LR Review

LR Accepts and EM Implements Procedure

LR Surveyor Verifies Engine Components during Manufacture and Engine Assembly

LR Surveyor Submits Verification of Conformity Report for Engine

LR Reviews Verification Report and Confirms Family or Group Member Engine Technical File against the Parent Engine Technical File

NOx Certification Issued (EAPP)
APPENDIX 5

PRE-CERTIFICATION TEST

Engine Manufacturer (EM) Advises Date and Location of Test

LR Verifies Test Installation and Equipment Calibration

Verify Gas Composition and Expiry Dates
Witness Zero and Span Calibration before Test.

Witness NOx Testing in Accordance with Appropriate Test Cycle. Steady State Condition to Exist Prior to Recording Data

Witness Zero and Span Calibration after Test and Confirm any Deviation is within 2% Limit

Witness Drawing of Fuel Sample for Analysis
Completion of Pre-Certification NOx Emission Testing Check List and Report

EM Submits Technical File with Test Report for Review

LR Issues NOx Certification (EAPP)
Certificate of Compliance for Engine Air Pollution Prevention (EAPP)

This shall be supplemented by the attached Record of Construction

Issued to indicate compliance with the provision of the Protocol of 1997 to amend the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 related thereto (hereinafter referred to as ‘the Convention’) pending ratification of the Convention and issue of an International Convention Certificate under the authority of the Government of by Error! Reference source not found.

Name and address of engine manufacturer

Model number
Serial number
Test cycle(s)
Rated power (kW) and speed (RPM)
Engine approval number

Survey date(s)

This is to certify
1. that the above mentioned marine diesel engine has been surveyed for pre-certification in accordance with the requirements of the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines; and
2. that the pre-certification survey shows that the engine, its components, adjustable features, and technical file, prior to the engine’s installation and/or service on board a ship, fully comply with the applicable regulation 13 of Annex VI of the Convention.

This shall be valid for the life of the engine subject to surveys in accordance with regulation 5 of Annex VI of the Convention in ships under the authority of this Government.

Issued at

Surveyor to Lloyd’s Register EMEA

A member of the Lloyd’s Register Group

IMO Number

* Provided for LR internal use.

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Supplement to the Error! Reference source not found. of Compliance for Engine Air Pollution Prevention
Record of Construction, Technical File and Means of Verification

In respect of the provisions of Annex VI of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocols of 1978 and 1997 relating thereto (hereinafter referred to as 'the Convention') and of the Technical Code on Emissions on Control of Nitrogen Oxides from Marine Diesel Engines (hereinafter referred to as the ‘NOx Technical Code’).

This record and its attachments shall be permanently attached to the Error! Reference source not found. of Compliance for EAPP.

The Error! Reference source not found. of Compliance for EAPP shall accompany the engine throughout its life and shall be available on board the ship at all times.

Unless otherwise stated regulations mentioned in this record refer to regulations of Annex VI of the Convention and the requirements for an engine's Technical File and Means of Verification refer to mandatory requirements from the NOx Technical Code.

1. Particulars of the engine

1.1 Name and address of engine manufacturer

1.2 Place of engine build

1.3 Date(s) of engine build

1.4 Place of pre-certification survey

1.5 Date(s) of pre-certification survey

1.6 Engine type and model number

1.7 Engine serial number

1.8 The engine is a parent engine and/or The engine is a member engine of an engine family or The engine is a member engine of an engine group or

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© Lloyd’s Register
The engine is an individual
1.9 Test cycle(s) (see chapter 3 of the NOx Technical Code)  

1.10 Rated power (kW) and speed (RPM)  

1.11 Engine approval number  

1.12 Specification(s) of test fuel  

1.13 NOx reducing device designated approval number (if installed)  

1.14 Applicable NOx emission limit (regulation 13 of Annex VI) (g/kWh)  

| Tier II limits | apply to engines installed on ships built after 1 January 2011  |

1.15 Engine’s actual NOx emission value (g/kW h)  

2. Particulars of the Technical File  

2.1 Technical File identification/approval number  

2.2 Technical File approval date  

2.3 The Technical File, as required by chapter 2 of the NOx Technical Code, is an essential part of the **Error! Reference source not found.** of Compliance for EAPP and must always accompany an engine throughout its life and always be available on board a ship.
3. Specifications for the On-board NOx Verification Procedure for the Engine Parameter Survey

3.1 On-board NOx verification procedure identification/approval number(s)

3.2 On-board NOx verification procedures approval date

3.3 The specification for the on-board NOx verification procedures, as required by chapter 6 of the NOx Technical Code, are an essential part of the Error! Reference source not found. of Compliance for EAPP and must always accompany an engine through its life and always be board a ship.

This is to certify that this record is correct in all respects.

Issued at

Surveyor to
A member of the Lloyd’s Register Group

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Engine International Air Pollution Prevention (EIAPP) Certificate

This certificate shall be supplemented by the attached Record of Construction

Issued under the provisions of the Protocol of 1997 to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 related thereto (hereinafter referred to as the “Convention”) under the authority of the Government of...

Name and address of engine manufacturer

Model number
Serial number
Test cycle(s)
Rated power (kW) and speed (RPM)
Engine approval number
Survey date(s)

This is to certify
1. that the above mentioned marine diesel engine has been surveyed for pre-certification in accordance with the requirements of the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines made mandatory by Annex VI of the Convention; and
2. that the pre-certification survey shows that the engine, its components, adjustable features, and technical file, prior to the engine’s installation and/or service on board a ship, fully comply with the applicable regulation 13 of Annex VI of the Convention.

This certificate is valid for the life of the engine subject to surveys in accordance with regulation 5 of Annex VI of the Convention in ships under the authority of this Government.

Issued at

Surveyor to Lloyd’s Register EMEA

A member of the Lloyd’s Register Group

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Provided for LR internal use.
Supplement to the
Engine International Air Pollution Prevention Certificate

Record of Construction, Technical File and Means of Verification

In respect of the provisions of Annex VI of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocols of 1978 and 1997 relating thereto (hereinafter referred to as ‘the Convention’) and of the Technical Code on Emissions on Control of Nitrogen Oxides from Marine Diesel Engines (hereinafter referred to as the 'NOx Technical Code').

This record and its attachments shall be permanently attached to the EIAPP Certificate.

The EIAPP Certificate shall accompany the engine throughout its life and shall be available on board the ship at all times.

Unless otherwise stated regulations mentioned in this record refer to regulations of Annex VI of the Convention and the requirements for an engine’s Technical File and Means of Verification refer to mandatory requirements from the NOx Technical Code.

1. Particulars of the engine

1.1 Name and address of engine manufacturer

1.2 Place of engine build

1.3 Date(s) of engine build

1.4 Place of pre-certification survey

1.5 Date(s) of pre-certification survey

1.6 Engine type and model number

1.7 Engine serial number

1.8 The engine is a parent engine and/or
The engine is a member engine of an engine family or
The engine is a member engine of an engine group or
The engine is an individual
1.9 Test cycle(s) (see chapter 3 of the NOx Technical Code)

1.10 Rated power (kW) and speed (RPM)

1.11 Engine approval number

1.12 Specification(s) of test fuel

1.13 NOx reducing device designated approval number
   (if installed)

1.14 Applicable NOx emission limit (regulation 13 of Annex VI) (g/kWh)

1.15 Engine’s actual NOx emission value (g/kW h)

2. Particulars of the Technical File

2.1 Technical File identification/approval number

2.2 Technical File approval date

2.3 The Technical File, as required by chapter 2 of the NOx Technical Code, is an essential part of the EIAPP Certificate and must always accompany an engine throughout its life and always be available on board a ship.
3. Specifications for the On-board NOx Verification Procedure for the Engine Parameter Survey

3.1 On-board NOx verification procedure identification/approval number(s)

3.2 On-board NOx verification procedures approval date

3.3 The specification for the on-board NOx verification procedures, as required by chapter 9 of the NOx Technical Code, are an essential part of the EIAPP Certificate and must always accompany an engine through its life and always be available on board a ship.

This is to certify that this record is correct in all respects.

Issued at

__________

Surveyor to

A member of the Lloyd’s Register Group
This contract is between the Client and Lloyd’s Register EMEA (hereinafter referred to as LR) for Marine services and is subject to the terms and conditions on this document.

TERMS AND CONDITIONS

1. In these terms and conditions: (i) “Services” means any and all services provided by any entity that is part of the LR Group, as hereinafter defined, including any classification of the Client’s vessel, equipment or machinery; (ii) the “Contract” means this agreement for supply of the Services; (iii) the “LR Group” means LR, its affiliates and subsidiaries and the directors, employees, representatives and agents of any of them, individually or collectively; and (iv), the “Client” means the legal entity for whom the person accepting these terms and conditions, its affiliates and subsidiaries and the officers, directors, employees, representatives and agents of any of them, individually or collectively.

2. The Client agrees to pay all undisputed portions of invoices for the Services within 30 days of the invoice date. LR reserves the right to charge interest at an annual rate of a 1% above the London Interbank Offered Rate (LIBOR) or the equivalent in the country where the Client maintains its business, except as may be required by law or as may be authorised by the Client. The Client agrees to pay all undisputed portions of invoices for the Services within 30 days, and may withhold any or all Services until the arrears, including interest, are paid.

3. LR reserves the right to charge for any work that is additional to that originally quoted.

4. LR will keep confidential and not use or disclose to any third party outside the LR Group any data, plan or other technical information received from the Client except as may be required by law or as may be authorised by the Client. (The inclusion of data and plans on www.cdlive.lr.org does not in any way breach the duty of confidentiality.) LR Group undertakes to not to use the Client’s data for any purpose other than to perform the Services. The Client agrees to the release of the Client’s data to any independent source if the LR Group is required to do so by law or a court order.

5. The Client shall indemnify and hold LR and its officers, directors, employees, representatives and agents harmless from all claims, costs, proceedings, damages and expenses, (including legal and other professional fees and expenses), made against, incurred or paid by any member of the LR Group as a result of or in connection with any breach by the Client of this Contract or any alleged or actual infringement, whether or not under English law, or any third party’s intellectual property rights (including copyright) or other rights arising out of the use or supply of the information by or on behalf of the Client to any member of the LR Group.

6. This Contract continues in force until terminated by LR or the Client, after giving the other party 30 days’ written notice.

7. If the Contract is terminated by LR or the Client before the Services under the Contract are completed, LR’s fees will be calculated on a pro rata basis up to the date of termination. Any reasonable costs directly attributed to early termination and any amounts then due to LR will immediately become payable.

8. LR’s Services do not assess compliance with any standard other than the applicable classification rules, international conventions, or any other standards that are expressly agreed in writing by LR and the Client. Without limiting the generality of the foregoing, the issuance of a class certificate does not relieve the owner or operator of the vessel of its non-delegable duty to maintain the vessel in a seaworthy condition.

9. If the Client requires classification Services relating to vessels, machinery, or equipment classified by LR in a jurisdiction in which LR itself does not do business the Client hereby acknowledges and agrees that these Services will be performed by a LR affiliate of LR that is part of the LR Group and that is authorised to conduct classification surveys and issue certificates on the vessel, machinery, or equipment.

10. In providing Services, information, or advice, the LR Group does not warrant the accuracy of any information or advice supplied. Except as set out in these Terms and Conditions, LR will not be liable for any loss, damage, or expense sustained by any person and caused by any act, omission, error, negligence, or strict liability of any of the LR Group or caused by any inaccuracy in any information or advice given in any way by or on behalf of the LR Group even if held to amount to a breach of warranty. Nevertheless, if the Client uses the Services or relies on any information or advice given by or on behalf of the LR Group and as a result suffers loss, damage, or expense that is proved to have been caused by any negligent act, omission, or errors of the LR Group or any negligent inaccuracy in information or advice given by or on behalf of the LR Group, then LR will pay compensation to the Client for its proved loss up to the fee (if any) charged by LR for that particular service, information, or advice.

11. Notwithstanding the previous clause, the LR Group will not be liable for any loss of profit, loss of contract, loss of use, or any indirect or consequential loss, damage, or expense sustained by any person caused by any act, omission, or error or caused by any inaccuracy in any information or advice given in any way by or on behalf of the LR Group.

12. No LR Group entity will be liable or responsible in negligence or otherwise to any person not being a party to the agreement pursuant to which any certificate, statement, data, or report is issued by an LR Group entity for (i) any information or advice expressly or impliedly given by an LR Group entity, (ii) any omission of accuracy in any information or advice given, or (iii) any act or omission that caused or contributed to the issuance of any certificate, statement data, or report containing the information or advice. Nothing in these Terms and Conditions creates rights in favour of any person who is not a party to the Contract with an LR Group entity.

13. No omission or failure to carry out or observe any stipulation, condition or obligation to be performed under the Contract will give rise to any claim against LR or any other LR Group entity, or be deemed to be a breach of contract, if the failure or omission arises from causes beyond that entity’s reasonable control.

14. This Agreement and any dispute or claim between any member of the LR Group and the Client arising from or in connection with it, or the Services provided hereunder, will be governed by English law. Except as provided below, LR and the Client irrevocably agree that the English courts will have exclusive jurisdiction over any dispute or claim arising from or in connection with this Agreement or the Services provided hereunder. Nothing in this clause limits the right of LR to take debt collection proceedings against the Client in any other court of competent jurisdiction.

15. No addition, alteration or substitution of these Terms and Conditions will bind any LR Group entity, or form part of this Contract unless it is expressly accepted in writing by LR.

16. The Client has a duty to provide a safe place of work for LR’s surveyors. This duty relates to places of work which are under the control of the Client which can include ships, shipyards, offshore platforms, factories, foundries, refineries and offices.

17. Any vessel, machinery, equipment or part of machinery, or equipment must be operated only in a manner consistent with the proposed design criteria and any limits agreed at the time of classification. If any vessel or equipment operates outside these limits, such facts must be reported to LR without delay.

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18. Any damage, defect, breakdown, or grounding that could invalidate the conditions for which a class has been assigned, must be reported to LR without delay.

19. All repairs to hull, equipment and machinery that may be required for a ship to retain class are to be carried out to the satisfaction of LR. When repairs are effected at a port, terminal, or location where the services of an LR surveyor are not available, the repairs are to be surveyed by one of the LR Group’s surveyors at the earliest opportunity thereafter.

20. Plans and particulars of any proposed alterations to the approved scantlings and arrangements of hull, equipment, or machinery are to be submitted to LR for approval, and the alterations are to be carried out to the satisfaction of the LR Group’s surveyors.

21. It is the responsibility of the Client to ensure that all surveys necessary for the maintenance of class are carried out at the proper time and in accordance with LR’s instructions.

22. LR may give timely notice to the Client about forthcoming surveys. The omission of notice, however, does not absolve the Client from responsibility to comply with requirements for maintenance of class.

23. When the Regulations with regard to surveys on the hull, equipment, or machinery have not been complied with and the ship is thereby not entitled to retain class, the class may be suspended or withdrawn.

24. When reported defects in the hull, equipment, or machinery are found and the Client fails to repair these defects in accordance with LR’s requirements, the class may be suspended or withdrawn.

25. LR in its discretion may withhold or, if already granted, may suspend or withdraw any class (or withhold any certificate or report in any other case) if a Client fails to comply with the conditions set forth in Paragraphs 15 through 22 or in the event of non-payment of any fee including fees of the LR Group incurred by the previous owner(s) of the vessel, if applicable.