Tasneef®
Life Environmentally Optimized

# Rules for the Certification of Innovative Environmental Technologies (IET)

*Effective from 1 January 2016*

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# GENERAL CONDITIONS

**Definitions:**

"*Administration*" means the Government of the State whose flag the Ship is entitled to fly or under whose authority the Ship is authorized to operate in the specific case.

*"IACS"* means the International Association of Classification Societies.

"*Interested Party*" means the party, other than the Society, having an interest in or responsibility for the Ship, product, plant or system subject to classification or certification (such as the owner of the Ship and his representatives, the ship builder, the engine builder or the supplier of parts to be tested) who requests the Services or on whose behalf the Services are requested.

"*Owner*" means the registered owner, the ship owner, the manager or any other party with the responsibility, legally or contractually, to keep the ship seaworthy or in service, having particular regard to the provisions relating to the maintenance of class laid down in Part A, Chapter 2 of the Rules for the Classification of Ships or in the corresponding rules indicated in the specific Rules.

*"Rules"* in these General Conditions means the documents below issued by the Society:

(i) Rules for the Classification of Ships or other special units;
(ii) Complementary Rules containing the requirements for product, plant, system and other certification or containing the requirements for the assignment of additional class notations;
(iii) Rules for the application of statutory rules, containing the rules to perform the duties delegated by Administrations;
(iv) Guides to carry out particular activities connected with Services;
(v) Any other technical document, as for example rule variations or interpretations.

"*Services*" means the activities described in Article 1 below, rendered by the Society upon request made by or on behalf of the Interested Party.

*"Ship"* means ships, boats, craft and other special units, as for example offshore structures, floating units and underwater craft.

"*Society*" or *"TASNEEF"* means Tasneef and/or all the companies in the Tasneef Group which provide the Services.

"*Surveyor*" means technical staff acting on behalf of the Society in performing the Services.

**Article 1**

**1.1.** The purpose of the Society is, among others, the classification and certification of ships and the certification of their parts and components. In particular, the Society:
(i) sets forth and develops Rules;
(ii) publishes the Register of Ships;
(iii) issues certificates, statements and reports based on its survey activities.

**1.2.** The Society also takes part in the implementation of national and international rules and standards as delegated by various Governments.

**1.3.** The Society carries out technical assistance activities on request and provides special services outside the scope of classification, which are regulated by these general conditions, unless expressly excluded in the particular contract.

**Article 2**

**2.1.** The Rules developed by the Society reflect the level of its technical knowledge at the time they are published. Therefore, the Society, although committed also through its research and development services to continuous updating of the Rules, does not guarantee the Rules meet state-of-the-art science and technology at the time of publication or that they meet the Society's or others' subsequent technical developments.

**2.2.** The Interested Party is required to know the Rules on the basis of which the Services are provided. With particular reference to Classification Services, special attention is to be given to the Rules concerning class suspension, withdrawal and reinstatement. In case of doubt or inaccuracy, the Interested Party is to promptly contact the Society for clarification.
The Rules for Classification of Ships are published on the Society's website: www.tasneef.ae.

**2.3.** The Society exercises due care and skill:
(i) in the selection of its Surveyors
(ii) in the performance of its Services, taking into account the level of its technical knowledge at the time the Services are performed.

**2.4.** Surveys conducted by the Society include, but are not limited to, visual inspection and non-destructive testing. Unless otherwise required, surveys are conducted through sampling techniques and do not consist of comprehensive verification or monitoring of the Ship or of the items subject to certification. The surveys and checks made by the Society on board ship do not necessarily require the constant and continuous presence of the Surveyor. The Society may also commission laboratory testing, underwater inspection and other checks carried out by and under the responsibility of qualified service suppliers. Survey practices and procedures are selected by the Society based on its experience and knowledge and according to generally accepted technical standards in the sector.

**Article 3**

**3.1.** The class assigned to a Ship, like the reports, statements, certificates or any other document or information issued by the Society, reflects the opinion of the Society concerning compliance, at the time the Service is provided, of the Ship or product subject to certification, with the applicable Rules (given the intended use and within the relevant time frame).
The Society is under no obligation to make statements or provide information about elements or facts which are not part of the specific scope of the Service requested by the Interested Party or on its behalf.

**3.2.** No report, statement, notation on a plan, review, Certificate of Classification, document or information issued or given as part of the Services provided by the Society shall have any legal effect or implication other than a representation that, on the basis of the checks made by the Society, the Ship, structure, materials, equipment, machinery or any other item covered by such document or information meet the Rules. Any such document is issued solely for the use of the Society, its committees and clients or other duly authorised bodies and for no other purpose. Therefore, the Society cannot be held liable for any act made or document issued by other parties on the basis of the statements or information given by the Society. The validity, application, meaning and interpretation of a Certificate of Classification, or any other document or information issued by the Society in connection with its Services, is governed by the Rules of the Society, which is the sole subject entitled to make such interpretation. Any disagreement on technical matters between the Interested Party and the Surveyor in the carrying out of his functions shall be raised in writing as soon as possible with the Society, which will settle any divergence of opinion or dispute.

**3.3.** The classification of a Ship, or the issuance of a certificate or other document connected with classification or certificate on and in general with the performance of Services by the Society shall have the validity conferred upon it by the Rules of the Society at the time of the assignment of class or issuance of the certificate; in no case shall it amount to a statement or warranty of seaworthiness,

structural integrity, quality or fitness for a particular purpose or service of any Ship, structure, material, equipment or machinery inspected or tested by the Society.

**3.4.** Any document issued by the Society in relation to its activities reflects the condition of the Ship or the subject of certification or other activity at the time of the check.

**3.5.** The Rules, surveys and activities performed by the Society, reports, certificates and other documents issued by the Society are in no way intended to replace the duties and responsibilities of other parties such as Governments, designers, ship builders, manufacturers, repairers, suppliers, contractors or sub-contractors, Owners, operators, charterers, underwriters, sellers or intended buyers of a Ship or other product or system surveyed.

These documents and activities do not relieve such parties from any fulfilment, warranty, responsibility, duty or obligation (also of a contractual nature) expressed or implied or in any case incumbent on them, nor do they confer on such parties any right, claim or cause of action against the Society. With particular regard to the duties of the ship Owner, the Services undertaken by the Society do not relieve the Owner of his duty to ensure proper maintenance of the Ship and ensure seaworthiness at all times. Likewise, the Rules, surveys performed, reports, certificates and other documents issued by the Society are intended neither to guarantee the buyers of the Ship, its components or any other surveyed or certified item, nor to relieve the seller of the duties arising out of the law or the contract, regarding the quality, commercial value or characteristics of the item which is the subject of transaction.

In no case, therefore, shall the Society assume the obligations incumbent upon the above-mentioned parties, even when it is consulted in connection with matters not covered by its Rules or other documents.

In consideration of the above, the Interested Party undertakes to relieve and hold harmless the Society from any third party claim, as well as from any liability in relation to the latter concerning the Services rendered.

Insofar as they are not expressly provided for in these General Conditions, the duties and responsibilities of the Owner and Interested Parties with respect to the services rendered by the Society are described in the Rules applicable to the specific Service rendered.

**Article 4**

**4.1.** Any request for the Society's Services shall be submitted in writing and signed by or on behalf of the Interested Party. Such a request will be considered irrevocable as soon as received by the Society and shall entail acceptance by the applicant of all relevant requirements of the Rules, including these General Conditions. Upon acceptance of the written request by the Society, a contract between the Society and the Interested Party is entered into, which is regulated by the present General Conditions.

**4.2.** In consideration of the Services rendered by the Society, the Interested Party and the person requesting the service shall be jointly liable for the payment of the relevant fees, even if the service is not concluded for any cause not pertaining to the Society. In the latter case, the Society shall not be held liable for non-fulfilment or partial fulfilment of the Services requested. In the event of late payment, interest at the legal current rate increased by 1.5% may be demanded.

**4.3.** The contract for the classification of a Ship or for other Services may be terminated and any certificates revoked at the request of one of the parties, subject to at least 30 days' notice to be given in writing. Failure to pay, even in part, the fees due for Services carried out by the Society will entitle the Society to immediately terminate the contract and suspend the Services.

For every termination of the contract, the fees for the activities performed until the time of the termination shall be owed to the Society as well as the expenses incurred in view of activities already programmed; this is without prejudice to the right to compensation due to the Society as a consequence of the termination.

With particular reference to Ship classification and certification, unless decided otherwise by the Society, termination of the contract implies that the assignment of class to a Ship is withheld or, if already assigned, that it is suspended or withdrawn; any statutory certificates issued by the Society will be withdrawn in those cases where provided for by agreements between the Society and the flag State.

**Article 5**

**5.1.** In providing the Services, as well as other correlated information or advice, the Society, its Surveyors, servants or agents operate with due diligence for the proper execution of the activity. However, considering the nature of the activities performed (see art. 2.4), it is not possible to guarantee absolute accuracy, correctness and completeness of any information or advice supplied. Express and implied warranties are specifically disclaimed.

Therefore, except as provided for in paragraph 5.2 below, and also in the case of activities carried out by delegation of Governments, neither the Society nor any of its Surveyors will be liable for any loss, damage or expense of whatever nature sustained by any person, in tort or in contract, derived from carrying out the Services.

**5.2.** Notwithstanding the provisions in paragraph 5.1 above, should any user of the Society's Services prove that he has suffered a loss or damage due to any negligent act or omission of the Society, its Surveyors, servants or agents, then the Society will pay compensation to such person for his proved loss, up to, but not exceeding, five times the amount of the fees charged for the specific services, information or opinions from which the loss or damage derives or, if no fee has been charged, a maximum of AED5,000 (Arab Emirates Dirhams Five Thousand only). Where the fees charged are related to a number of Services, the amount of the fees will be apportioned for the purpose of the calculation of the maximum compensation, by reference to the estimated time involved in the performance of the Service from which the damage or loss derives. Any liability for indirect or consequential loss, damage or expense is specifically excluded. In any case, irrespective of the amount of the fees charged, the maximum damages payable by the Society will not be more than AED5,000,000 (Arab Emirates Dirhams Five Millions only). Payment of compensation under this paragraph will not entail any admission of responsibility and/or liability by the Society and will be made without prejudice to the disclaimer clause contained in paragraph 5.1 above.

**5.3.** Any claim for loss or damage of whatever nature by virtue of the provisions set forth herein shall be made to the Society in writing, within the shorter of the following periods: (i) THREE (3) MONTHS from the date on which the Services were performed, or (ii) THREE (3) MONTHS from the date on which the damage was discovered. Failure to comply with the above deadline will constitute an absolute bar to the pursuit of such a claim against the Society.

**Article 6**

**6.1.** These General Conditions shall be governed by and construed in accordance with United Arab Emirates (UAE) law, and any dispute arising from or in connection with the Rules or with the Services of the Society, including any issues concerning responsibility, liability or limitations of liability of the Society, shall be determined in accordance with UAE law. The courts of the Dubai International Financial Centre (DIFC) shall have exclusive jurisdiction in relation to any claim or dispute which may arise out of or in connection with the Rules or with the Services of the Society.

**6.2.** However,

(i) In cases where neither the claim nor any counterclaim exceeds the sum of AED300,000 (Arab Emirates Dirhams Three Hundred Thousand) the dispute shall be referred to the jurisdiction of the DIFC Small Claims Tribunal; and

(ii) for disputes concerning non-payment of the fees and/or expenses due to the Society for services, the Society shall have the

right to submit any claim to the jurisdiction of the Courts of the place where the registered or operating office of the Interested Party or of the applicant who requested the Service is located.
In the case of actions taken against the Society by a third party before a public Court, the Society shall also have the right to summon the Interested Party or the subject who requested the Service before that Court, in order to be relieved and held harmless according to art. 3.5 above.

**Article 7**

**7.1.** All plans, specifications, documents and information provided by, issued by, or made known to the Society, in connection with the performance of its Services, will be treated as confidential and will not be made available to any other party other than the Owner without authorization of the Interested Party, except as provided for or required by any applicable international, European or domestic legislation, Charter or other IACS resolutions, or order from a competent authority. Information about the status and validity of class and statutory certificates, including transfers, changes, suspensions, withdrawals of class, recommendations/conditions of class, operating conditions or restrictions issued against classed ships and other related information, as may be required, may be published on the website or released by other means, without the prior consent of the Interested Party.
Information about the status and validity of other certificates and statements may also be published on the website or released by other means, without the prior consent of the Interested Party.

**7.2.** Notwithstanding the general duty of confidentiality owed by the Society to its clients in clause 7.1 above, the Society's clients hereby accept that the Society may participate in the IACS Early Warning System which requires each Classification Society to provide other involved Classification Societies with relevant technical information on serious hull structural and engineering systems failures, as defined in the IACS Early Warning System (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and used to facilitate the proper working of the IACS Early Warning System. The Society will provide its clients with written details of such information sent to the involved Classification Societies.

**7.3.** In the event of transfer of class, addition of a second class or withdrawal from a double/dual class, the Interested Party undertakes to provide or to permit the Society to provide the other Classification Society with all building plans and drawings, certificates, documents and information relevant to the classed unit, including its history file, as the other Classification Society may require for the purpose of classification in compliance with the applicable legislation and relative IACS Procedure. It is the Owner's duty to ensure that, whenever required, the consent of the builder is obtained with regard to the provision of plans and drawings to the new Society, either by way of appropriate stipulation in the building contract or by other agreement.
In the event that the ownership of the ship, product or system subject to certification is transferred to a new subject, the latter shall have the right to access all pertinent drawings, specifications, documents or information issued by the Society or which has come to the knowledge of the Society while carrying out its Services, even if related to a period prior to transfer of ownership.

**Article 8**

**8.1.** Should any part of these General Conditions be declared invalid, this will not affect the validity of the remaining provisions.

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## 1 SCOPE

These Rules have been developed in order to define advanced marine pollution prevention standards based on innovative technologies applicable to the shipping industry, and to certify ships complying with these standards.

## 2 APPLICATION

These Rules apply, outside the scope of classification, at the request of the Interested Party, where the Interested Party is the ship Owner or the ship management company.

## 3 IET CERTIFICATION

The Innovative Environmental Technologies (IET) certification is a voluntary certification, issued at the request of the Interested Party, which identifies ships complying with these Rules, as applicable.

Each of the technical Annexes (see 4) is relevant to a specific IET certification and defines the requirements to be fulfilled for the issuance of the relevant IET certification.

Subject to compliance with these Rules, the Society provides the Interested Party with an IET Ship Certificate which has a 5-year maximum validity and depends on the outcome of periodical and renewal surveys.

The activities of the Society for the IET certification of ships do not relieve the Interested Parties of their duty to ensure the proper maintenance of the ship at all times.

IET Ship Certificates may also be issued to ships not classed by Tasneef.

## 4 TECHNICAL ANNEXES

Each of the Annexes listed below is relevant to a specific IET certification and defines:

- technical requirements the ship is to comply with;
- operational requirements to be fulfilled by the Interested Party in order to ensure satisfactory environmental performances during the ship life;
- a survey scheme for the surveys to be carried out by the Society in order to maintain the validity of the IET Ship Certificate.

In particular, the Annexes are relevant to:

Annex 1: Technical requirements for grey and black water pollution prevention on ships.

Annex 2: Technical requirements for reduction of exhaust gas emissions from diesel engines installed on ships.

## 5 RELATED CERTIFICATES

Each specific IET Certificate granted to a ship is subject to the validity of the relevant statutory Certificate(s) listed in each specific Annex as “related statutory Certificate”. Should any of the related statutory Certificates be suspended or not be renewed for any reason, by the Administration or by the organisation acting on its behalf, the IET Certificate will be automatically suspended until the ship is granted a new valid related statutory Certificate(s).

## 6 DEFINITIONS

### a) MARPOL 73/78

MARPOL 73/78 is the IMO “International Convention for the Prevention of Pollution from Ships 73/78”, as amended.

### b) IOPP Certificate

“International Oil Pollution Prevention Certificate” (IOPP Certificate) issued by an Administration or by a recognised organisation on behalf of an Administration, in accordance with MARPOL 73/78, Annex I, as applicable.

### c) NLS Certificate

“Noxious Liquid Substances Certificate” (NLS Certificate) issued by an Administration or by a recognised organisation on behalf of an Administration, in accordance with MARPOL 73/78, Annex II, as applicable.

### d) ISPP Certificate

“International Sewage Pollution Prevention Certificate” (ISPP Certificate) issued by an Administration or by a recognised organisation on behalf of an Administration, in accordance with MARPOL 73/78, Annex IV, as applicable.

### e) IAPP Certificate

“International Air Pollution Prevention Certificate” (IAPP Certificate) issued by an Administration or by a recognised organisation on behalf of an Administration, in accordance with MARPOL 73/78, Annex VI, as applicable.

### f) Recognised laboratory

In these Rules, “recognised laboratory” means a laboratory which, according to the national/international certification granted, is considered by the Society to be qualified to perform the requested analysis.

### g) Recognised technician

In these Rules, “recognized technician” means a technician acting on behalf of an Administration or a technician working for a recognised laboratory.

## 1 BLUE-SEA (GREY/BLACK) IET CERTIFICATE FOR SHIPS

The **BLUE-SEA (grey/black)** IET Certificate is assigned, at the request of the Interested Party, to a ship fitted with efficient means to achieve high standards of water quality in discharge effluents.

The requirements of this Annex are intended to ensure the quality of the following discharge effluents:

- grey waters;
- sewage (black waters).

In order for the **BLUE-SEA (grey/black)** IET Certificate to be issued, all the above effluents are to be considered within the relevant application limits.

At the request of the Interested Party, the certification may be relevant only to black waters. In such cases the relevant IET Certificate will be **BLUE-SEA (black)**.

## 2 DEFINITIONS

### 2.1 Definitions in connection with prevention of sea pollution by sewage for the purpose of these Rules

a) Sewage means:

- drainage and other wastes from any form of toilets and urinals;
- drainage from medical premises (dispensary, sick bay, etc) via wash basins, wash tubs and scuppers located in such premises;
- drainage from spaces containing living animals; or
- other waste waters when mixed with the drainage defined above.

b) Holding tank for sewage treatment residues means a tank used for the collection and storage of residues generated by the sewage treatment process.

### 2.2 Definitions in connection with prevention of sea pollution by grey waters for the purpose of these Rules

a) Grey water means:

drainage from showers, baths, wash basins, WC scuppers, hydrotherapy pools, soaking tubs, and swimming pools (when operated with potable water in re-circulation mode); galley and pantry drains; galley and pantry equipment drains; food waste drainage water; and laundry drains.

b) Holding tank for grey water treatment residues means a tank used for the collection and storage of residues generated by the grey water treatment process.

### 2.3 Related statutory Certificates

ISPP Certificate (see item 5 of these Rules)

## 3 TECHNICAL REQUIREMENTS

### 3.1 Documents to be submitted

Table 1 lists the documents to be submitted for the issuance of the **BLUE-SEA (grey/black)** IET Ship Certificate.

### 3.2 Sewage and grey water treatment system

The ship is to be equipped with an automated treatment system for sewage and grey waters which, when installed on board, fulfils the following requirements:

a) The effluent from such treatment system is to meet the water quality standard reported in Table 2.

b) The treatment system is to be provided with adequate instrumentation to control and monitor the functioning parameters, according to the Manufacturer's requirements. Moreover, an alarm is to be given in a suitable station from which waste water operations are controlled, when according to such parameters the system is not working properly.

### 3.3 Sewage and grey water treatment residue holding tanks

a) The ship is to be equipped with a holding tank(s) for sewage treatment residues. The volume of the tank(s) is to be evaluated as 20% of the treatment system influent, calculated for 48 hours and 11 l/person/day, based on the maximum number of persons the ship is certified to carry.

A lower volume may be accepted provided that:

- the sewage treatment system residues are less than 20% of the influent; and
- 48 hours' retention is ensured; and
- technical documentation, including results of shipboard tests, of the system's efficiency and of the effluent volume reduction, is recorded to the satisfaction of the Society.

b) The ship is to be equipped with a holding tank(s) for grey water treatment residues. The volume of the tank(s) is to be evaluated as 10% of the treatment system influent, calculated for 48 hours and 260 l/person/day, based on the maximum number of persons the ship is certified to carry. When swimming pools operated with potable water in re-circulation mode are not fitted on board, 200 l/person/day is to be considered for the evaluation.

A lower volume may be accepted provided that:

- the grey water treatment system residues are less than 10% of the influent; and
- 48 hours' retention is ensured; and
- technical documentation, including results of shipboard tests, of the system's efficiency and of the effluent volume reduction, is recorded to the satisfaction of the Society

.

c) Such holding tanks are to be fitted with an audible high level alarm(s). The high level alarm(s) is(are) to be given in a suitable station.

d) When sewage and grey water treatment residues are stored in the same tank(s), the capacity of such tank(s) is to be at least the sum of the capacities for the sewage and grey water residue holding tanks.

### 3.4 On board re-use of the effluent as technical water

In the event that the treated effluent is re-used on board as technical water, additional design requirements will be evaluated on a case-by-case basis in order to assure that no faecal coliforms are present in the technical water.

If all the effluent is re-used and no treated black or grey waters are discharged by the ship in normal operational conditions, the **BLUE-SEA (grey/black)** IET Certificate will be amended as appropriate.

## 4 OPERATIONAL REQUIREMENTS

### 4.1 Waste water management plan

A waste water management plan is to be available on board. Such plan is to include procedures covering the following:

- sewage and grey water management including discharge criteria (procedures for the observance of national regulations, in case waste waters are discharged in territorial waters, are to be available on board);
- preparation, filling in and maintenance of the sewage and grey water record books;
- periodical analysis, at least every 6 months, of samples of the sewage and grey water effluents to verify compliance with allowable limits;
- disposal of sewage and grey water treatment plant residues ashore or at sea, according to international or national regulations, as applicable;

### 4.2 Sewage and grey water record book

All sewage and grey water discharges (including treatment plant residues), whether to sea or shore-based facilities, are to be recorded in a sewage/grey water record book(s) with indication of the date, location and quantity of sewage/grey water discharged.

If the sewage/grey water is discharged to sea, the records are to include information on the ship speed and distance from the nearest land.

If the ship is not able to dispose at sea of sewage/grey water treatment plant residues in accordance with international or national regulations, such residues are to be disposed of ashore or by incineration.

### 4.3 Periodical analysis

The Interested Party is to arrange for periodical sampling of the effluent to be carried out every 6 months. The sampling is to be taken according to [4.4]. The sample is to be analysed by a recognised laboratory and the effluent quality is to comply with the limits provided in Table 2.

If such limits are not complied with, corrective actions are to be taken as necessary and reported in the sewage/grey water record book(s). The report of the analysis is to be kept on board for at least 36 months and made available during periodical surveys.

### 4.4 Sampling

Sampling is to be carried out in a manner which is representative of effluent quality, and the sample is to be taken at no more than 15 metres from the outboard discharge flange.

Sampling equipment is to be used in accordance with the Manufacturer's instructions/guidelines, as appropriate.

Immediately following collection of the retained sample, a tamper proof security seal with a unique means of identification is to be applied unless the test is carried out in a shipboard laboratory.

A label containing the identification data of the samples is to be secured to the retained sample container.

Sampling and analysis are to be carried out according to the test methods reported in Table 2.

If applicable, any disinfectant residual in samples should be neutralised when the sample is collected to prevent unrealistic bacteria kill or chemical oxidation of organic matter by the disinfectant brought about by artificially extended contact times.

The information provided in Tables 3 and 4 is to be taken into account when preserving samples and performing analysis.

## 5 SURVEY SCHEME

### 5.1 Initial survey

In order to issue the **BLUE-SEA (grey/black)** IET Certificate an initial survey is to be carried out to ascertain that:

- the applicable requirements of this section have been complied with;
- the systems/plant/alarms requested in this section are working properly.

Subject to the satisfactory results of the initial survey, a short-term **BLUE-SEA (grey/black)** IET Certificate is issued.

### 5.2 Initial test campaign

In order to issue the full-term **BLUE-SEA (grey/black)** IET Certificate, a shipboard test campaign is to be carried out to ascertain that the effluent from the sewage and grey water treatment system(s) is in compliance with the allowable limits provided in Table 2.

The duration of the test campaign and the number of samples are based upon the ship configuration and the waste water quantities discharged while the test campaign is carried out.

Sampling is to be witnessed by either a Surveyor of the Society or a recognised technician. Sampling is to be carried out in accordance with [4.4] and in a manner and at a frequency that is representative of average quality of the effluent during the normal ship operational condition.

Samples are to be analysed by a recognised laboratory and the report of the analysis is to contain at least the data requested in Table 2.

Where the tests results of some samples are not in compliance with the requirements of Table 2, the reasons are to be investigated, corrective actions are to be taken as required and a new test campaign is to be carried out, as deemed necessary.

One copy of the analysis carried out on the samples collected during the test campaign is to be provided to the Society, while another is to be kept on board and filed.

On a case-by-case basis, if equivalent samples have been processed under the supervision of a recognised technician, such tests can be accredited for the issuance of the full-term **BLUE-SEA (grey/black)** IET Certificate. Also in such cases, one copy of the tests reports and of the relevant certification is to be provided to the Society and another is to be kept on board and filed.

### 5.3 Periodical surveys

The validity of the **BLUE-SEA (grey/black)** IET Certificate is subject to the execution of:

- annual surveys, to be carried out at the annual due date of the IET Certificate considering its effective date and with a time window of +/- 3 months;
- a renewal survey, to be carried out prior to the IET Certificate expiry date (due date) and with a time window of – 3 months.

Annual and renewal surveys are to be carried out in order to verify compliance with the requirements of this section, ascertaining that:

- requested systems/plant/alarms are in order and in good working condition;
- requested record books are available on board and duly filled in;
- requested documentation is available on board.

Annual surveys are to be duly recorded and endorsed on the IET Certificate.

### 5.4 Intermediate test campaign

During the time period between the second and third annual surveys (time window included), the sampling of the sewage and grey water treatment system effluent requested in 4.1 for periodical analysis is to be witnessed by a Surveyor of the Society or by a recognised technician.

**ANNEX 1 – Ship's Blue-Sea (grey-black)**

**TABLE 1 – DOCUMENTS TO BE SUBMITTED**

| N | A/I | Document |
|---|---|---|
| 1 | A | Schematic drawings of the sewage/grey water treatment system's general arrangements on board (1) |
| 2 | I | Sewage treatment system operating and maintenance manuals |
| 3 | I | Calculation of volume of holding tank(s) for sewage treatment system residues |
| 4 | I | Sewage record book |
| 5 | I | Grey water treatment system operating and maintenance manuals |
| 6 | I | Calculation of volume of holding tank(s) for grey water treatment system residues |
| 7 | I | Grey water record book |
| 8 | I | Waste water management plan |
| 9 | A | Schemes of the sewage and grey water treatment system and/or technical documentation necessary to verify 3.2 (1) |
| 10 | I | Technical documentation necessary to verify 3.4, if applicable |
| 11 | I | Test results of the initial test campaign |

Note: A – to be submitted for approval in four copies
I – to be submitted for information in duplicate
(1) If the ship is not classed by the Society, approved drawings/documents are to be submitted for information.

**TABLE 2 – ALLOWABLE EFFLUENT PARAMETER VALUES**

| No. | PARAMETER DESCRIPTION | MEAS. UNIT | LIMIT | EPA METHOD (1) | ALTERNATIVE SHIPBOARD METHODS (2) |
|---|---|---|---|---|---|
| 1 | **Biological Oxygen Demand ($BOD_5$)** | mg/l | **≤25** | 405.1 | MANOMETRIC DETERMINATION |
| 2 | **Chemical Oxygen Demand (COD)** | mg/l | **≤100** | 410.4 | CNR IRSA 94 |
| 3 | **Total Suspended Solids (TSS)** | mg/l | **≤25** | 160.2 | CNR IRSA 2050 |
| 4 | **Dissolved Oxygen (DO)** | mg/l | **2 to 5** | 360.1 | In field method (4) |
| 5 | **Total Nitrogen (N-total)** | mg/l | **≤20** | 351.1; 351.2; 351.3; 351.4 | CNR IRSA 1994 |
| 6 | **Total Phosphorus (P-total)** | mg/l | **≤1** | 365.2, 365.3 | CNR IRSA 4090 |
| 7 | **pH** | --- | **6 – 8,5** | 150.1 | In field method (4) |
| 8 | **Free Chlorine ($Cl_2$)** | mg/l | **BDL** (3) | DPD1 | In field method (4) |
| 9 | **Total Coliforms (TC)** | colonies/100 ml MPN | **100** | Sm9222b | Colilert18 U.S. E.P.A approved |
| 10 | **Faecal Coliforms (FC)** | colonies/100 ml MPN | **BDL** (3) | Sm9222d | Colilert18 U.S. E.P.A approved |

Note:
(1) Methods of analysis to be used are those listed here; alternative methods may be accepted on a case-by-case basis.
(2) If analysis is carried out in a shipboard laboratory, these methods are accepted as an alternative.
(3) BDL means below detectable limits.
(4) In field method means measurement carried out by portable measurement equipment, to be accepted case-by-case.

**TABLE 3: ADEC (ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION) REQUIREMENTS TO BE TAKEN INTO ACCOUNT WHEN PERFORMING SAMPLES AND ANALYSIS**

| LABORATORY PARAMETERS | CONTAINER | PRESERVATION | MAXIMUM HOLDING TIME (between sampling and analysis) |
|---|---|---|---|
| **Biological Oxygen Demand ($BOD_5$)** | 1 litre HDPE, white label | 4°C | 48 hours |
| **Chemical Oxygen Demand (COD)** | 250 ml HDPE yellow label | H2SO4, pH< 2, 4°C | 28 days |
| **Total Suspended Solids (TSS)** | From BOD bottle | 4°C | 7 days |
| **Dissolved Oxygen (DO)** | Not provided | Not provided | Not provided |
| **Total Nitrogen (N-total)** | From COD bottle | H2SO4, pH< 2, 4°C | 28 days |
| **Total Phosphorus (P-total)** | From COD bottle | H2SO4, pH< 2, 4°C | 28 days |
| **pH** | From BOD bottle | 4°C | In field method (1) |
| **Free Chlorine ($Cl_2$)** | From BOD bottle | 4°C | In field method (1) |
| **Total Coliforms (TC)** | 100 ml sterile plastic | Sodium thiosulfate, 4° | 6 hours |
| **Faecal Coliforms (FC)** | 100 ml sterile plastic | Sodium thiosulfate, 4° | 6 hours |

Note:

(1) In field method means measurement carried out by portable measurement equipment, to be accepted case-by-case.

**TABLE 4: IRSA CNR WITH REFERENCE TO APHA (AMERICAN PUBLIC HEALTH ASSOCIATION), AWWA (AMERICAN WATER WORKS ASSOCIATION), WEF (WATER ENVIRONMENT FEDERATION) (1998): STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTE WATER TO BE TAKEN INTO ACCOUNT WHEN PERFORMING SAMPLES AND ANALYSIS**

| LABORATORY PARAMETERS | CONTAINER | PRESERVATION | MAXIMUM HOLDING TIME (between sampling and analysis) |
|---|---|---|---|
| **Biological Oxygen Demand ($BOD_5$)** | Polyethylene, glass | Refrigeration | 24 hours |
| **Chemical Oxygen Demand (COD)** | Polyethylene, glass | H2SO4, pH< 2, 4°C | 1 week |
| **Chemical Oxygen Demand (COD)** | Polyethylene, glass | Refrigeration | Immediate |
| **Total Suspended Solids (TSS)** | - | - | - |
| **Dissolved Oxygen (DO)** | - | - | In field method (1) |
| **Total Nitrogen (N-total)** | Polyethylene, glass | Refrigeration | 24 hours |
| **Total Phosphorus (P-total)** | Polyethylene, glass | H2SO4, pH< 2, refrigeration | 1 month |
| **pH** | Polyethylene, glass | Refrigeration | Immediate |
| **Free Chlorine ($Cl_2$)** | Polyethylene, glass | Refrigeration | Immediate |
| **Total Coliforms (TC)** | 100 ml sterile plastic | Sodium thiosulfate, 4° | 12 hours |
| **Faecal Coliforms (FC)** | 100 ml sterile plastic | Sodium thiosulfate, 4° | 12 hours |

Note:

(1) In field method means measurement carried out by portable measurement equipment, to be accepted case-by-case.

## 1 BLUE-SKY (ENGINES) IET CERTIFICATE FOR SHIPS

The **BLUE-SKY (engines)** IET Certificate is assigned, at the request of the Interested Party, to a new or existing ship fitted with efficient means to achieve high reduction of polluting emissions in exhaust gases from diesel engines.

The requirements of this Annex are intended to ensure reduction of the following air pollutants, as applicable:

- NOx;
- CO;
- SOx;
- particulate/smoke;
- CO2.

In order for the **BLUE-SKY (engines)** IET Certificate to be issued, all the above pollutants are to be considered within the relevant application limits.

The **BLUE-SKY (engines)** IET certification provides evidence of the percentage improvement of engine emissions, detailing the absolute value of exhaust gas emissions achieved, and listing regulations on exhaust gas emissions that the engine complies with, after the reduction system is installed.

Compliance with these Rules does not mean that the engines do not need to be certified and surveyed according to the requirements of MARPOL 73/78 Annex VI, as applicable.

At the request of the Interested Party, the engines covered by the requirements of these Rules may be only those used for propulsion, or only those used for electrical generation and auxiliaries. In such cases, a **BLUE-SKY (propulsion)** or a **BLUE-SKY (auxiliaries)** Certificate is issued to the ship, as applicable.

## 2 DEFINITIONS

### 2.1 Engines

The engines covered by the requirements of these Rules are those used for propulsion, electrical generation and auxiliaries with the exclusion of:

- engines having a total rated power lower than 500 kW;
- engines used exclusively in case of emergency;
- engines installed on lifeboats.

These Rules also apply to engines certified according to MARPOL 73/78 Annex VI, provided that settings, adjustments and components used comply with the requirements of the engine's approved technical file referred to in the relevant EIAPP Certificate.

### 2.2 Emission reduction system

Emission reduction system refers to any means used, alone or in combination, to reduce the polluting emissions in an engine's exhaust gases, acting as fuel treatment, quality combustion improvement or exhaust gas treatment, such as:

- water in fuel emulsion;
- humidification of charge air;
- water injection;
- exhaust gas recirculation;
- selective catalytic reduction;
- other technologies.

### 2.3 Reduction targets

The reduction target is the minimum % reduction per pollutant that the emission reduction system is to achieve. Such reduction is based on a comparison of emissions before and after the emission reduction system is activated.

### 2.4 Weighted Specific Emission (WSE)

Weighted specific emission means a weighted sum of the specific emission (g/kWh or %/kWh) measured in a test cycle, according to [5.2.2].

### 2.5 Filter Smoke Number (FSN)

Unit of measurement of the smoke, measured according to ISO DP 10054.

### 2.6 Related statutory Certificates

IAPP Certificate, as applicable (see item 5 of these Rules).

## 3 TECHNICAL REQUIREMENTS

### 3.1 Documents to be submitted

Table 2 lists the documents to be submitted for the issuance of the **BLUE-SKY (engines)** IET Ship Certificate.

If the ship is classed by the Society, the documents in Table 2 are additional to those for installations and engine-related systems required by the applicable Rules of the Society.

If the emission reduction system requires the use of a fuel-water emulsion, specific requirements are given in [6]. When other technologies are used, specific requirements concerning their performance may be considered on a case-by-case basis.

### 3.2 Applicable Rules

The system for reducing the emissions and the relevant shipboard arrangements are to comply with all the applicable classification requirements of the Rules of the Society the ship is classed with.

### 3.3 Reduction targets

Percentage reductions achieved by the emission reduction system, based on a comparison of emissions before and after the emission reduction system is activated, are to be not less than those listed in Table 1.

Percentage reductions are to be demonstrated by means of an initial test campaign according to [5.2].

Absolute emission targets may be considered, at the request of the Interested Parties, on a case-by-case basis.

### 3.4 Additional conditions for engines certified for exhaust emissions

In addition to the requirements in [3.3], for engines already certified according to an international or national regulation on exhaust gas emissions, the emissions considered by these Rules and measured after the emission reduction system is activated are to be below the limits fixed by the regulation according to which the engine is certified. If this condition is not satisfied the reduction targets are to be considered not achieved regardless of the % reduction measured.

Considerations in [3.5] on NOx emission-related effects of fuel quality are to be taken into account.

For other pollutants, considerations on emission-related effects of fuel quality may be accepted on a case-by-case basis.

### 3.5 Additional conditions for engines certified for NOx emissions

For engines certified according to MARPOL Annex VI or to other regulations imposing NOx limits, emission-related effects of fuel quality are to be considered.

When heavy fuel oil is used on board, an adjustment to the NOx standard, upward by 1,4 g/kW-hr, is to be applied to the limit the engine was certified for, unless the certification of the engine expressly states that the certification tests were performed burning heavy fuel oil.

**TABLE 1 – REDUCTION TARGETS**

| Pollutant | Reduction Target (RD) |
|---|---|
| **NOx** | ≥ 15% (1) |
| **CO** | ≥ 20% |
| **Particulate** | ≥ 70% (2) |
| **CO2** | ≥ 0%<br>(No increase in CO2 emissions) |
| **SOx** | (3) |

(1) For engines not certified according to MARPOL Annex VI, as an alternative, a % reduction compared to MARPOL Annex VI limits may be accepted, taking into account the fuel quality adjustment in [3.5].

(2) As an alternative to a 70% reduction of particulate/smoke, an absolute FSN ≤ 0,3 may be accepted.

(3) SOx emissions are not to exceed 6 g/kW h, or sulphur content in fuel is not to exceed 1,5% by mass.

## 4 OPERATIONAL REQUIREMENTS

### 4.1 Fuel record book

When, in order to achieve the SOx reduction target, fuel with sulphur content not exceeding 1,5% by mass is used, in order to give evidence of the quality of the fuel used on board, details of the fuel oil delivered to and used on board the ship are to be recorded by means of a bunker record book containing delivery notes and analysis reports. Delivery notes and analysis reports are to be kept on board for at least three years from the date of delivery and made available during periodical surveys.

The bunker delivery notes and relevant analysis report are to be accompanied by a representative sample of the fuel to be kept on board for at least 12 months from the date of delivery and made available during periodical surveys.

Sampling of bunker is to be carried out according to Resolution MEPC.96(47), as amended.

### 4.2 Emission Reduction System (ERS) record book

An Emission Reduction System (ERS) record book is to list those adjustments, components and settings of the emission reduction system which influence the performance of the system and their allowable range of variation according to the Manufacturer.

When maintenance, repair or servicing is carried out on the system, the system's settings, adjustments and components are to be in the allowable range and to be recorded in the Emission Reduction System record book. The record book is to be kept on board and made available during periodical surveys.

### 4.3 Emission Reduction Engine (ERE) record book

The adjustments, components and settings of the engine, at least the engine information contained in Table 4, which influence the engine combustion process, and their allowable range of variation according to the Manufacturer are to be listed in the ERE record book.

For engines certified in compliance with the NOx technical code, if the above-mentioned data are included in the approved technical file referred to in the relevant EIAPP Certificate, then the ERE record book may be replaced by the engine technical file and record book requested by MARPOL 73/78 Annex VI.

When maintenance, repair or servicing of the engine is carried out, the engine's settings, adjustments and components are to be in the allowable range and to be recorded in the ERE record book. The ERE record book is to be kept on board and made available during periodical surveys.

When there are Manufacturer's recommendations concerning specific inspection, control or maintenance of the engine components, in order for the engine to work properly with the emission reduction system, the ERE record book is to address them accordingly.

### 4.4 Periodical emission measurements

Periodical emission measurements are to be carried out at least every 12 months by a recognised technician, in accordance with the procedure set out

in [5.2.1], in order to verify that the engine's emissions are below the maximum Weighted Specific Emission ($WSE_{MAX}$) [5.2.4]. In evaluating compliance, a maximum 5% error in measured values may be considered depending on the instruments used for measurements.

If emissions are above the maximum limits, the reasons are to be investigated and corrective actions are to be taken as appropriate and listed in the emission reduction system (ERS) record book.

The relevant documentation is to be kept on board and made available during periodical surveys.

## 5 SURVEY SCHEME

### 5.1 Initial survey

In order to issue the **BLUE-SKY (engines)** IET Certificate an initial survey is to be carried out to ascertain that:

- the applicable requirements of this section have been complied with;
- the systems/plant requested in this section are working properly.

Subject to the satisfactory results of the initial survey, a short-term **BLUE-SKY (engines)** IET Certificate is issued.

### 5.2 Initial test campaign

#### 5.2.1 General

In order to issue the full-term **BLUE-SKY (engines)** IET Certificate, an initial test campaign is to be carried out to ascertain that the emission targets in Table 1 are complied with.

The initial test campaign may be performed by either shipboard or test bed comparative measurements of the engine's Weighted Specific Emissions (WSE) according to a comparative test based on the test cycles in [5.2.2].

The initial test campaign program and the test procedures are to be agreed in advance with the Society.

The following procedure is specifically designed for diesel engines running to constant speed (diesel-generators for electric propulsion). For other applications and/or propulsion systems the procedure is to be agreed on a case-by-case basis with the Society.

In the case of multi-engine arrangement, the extension of the measurement campaign may be reduced considering the similarity of the engines on board.

When a shipboard test is to be carried out and, due to the kind of reduction system, it is not possible, after the installation of the reduction system, to measure the emissions of the engine with the reduction system not activated, the initial test campaign is to be divided into two parts, before and after the system is installed on board.

#### 5.2.2 Test cycles

Tests cycles with and without the emission reduction system in operation are to be carried out at the load points specified in Table 3.

At each load point, the parameters listed in Table 4 are to be measured after stable conditions for the testing of the engine/s are reached.

Measurements are to be made by a recognised technician and witnessed by a Surveyor of the Society.

For each test cycle, the WSE of each pollutant is to be calculated as follows:

$$WSE = \sum_{i=1}^{N} \frac{\alpha_i SE_i}{\alpha_i P_i}$$

where:

N is the total number of engine load points in the test cycle; N = 4 for the test cycle given in Table 3.

$P_i$ and $\alpha_i$ are, respectively, the engine load and the weighting factor for the i-th load point in the test cycle.

$SE_i$ is the measured specific emission of the pollutant concerned at the i-th load point in the test cycle.

Different test cycles, proposed for the specific operational conditions of the engine, may be agreed with the Society on a case-by-case basis.

#### 5.2.3 Percentage reduction

For each pollutant, the percentage reduction is to be calculated as follows:

$\%\ reduction = 100\ (1 - WSE_w / WSE_o)$

where:

$WSE_w$ is the weighted specific emission measured when the emission reduction system is working.

$WSE_o$ is the weighted specific emission measured when the emission reduction system is not working.

If this situation cannot be achieved, the reference condition is to be agreed with the Society on a case-by-case basis.

Percentage reductions are to comply with the reduction targets in Table 1.

#### 5.2.4 Initial test report

Evidence of the results of the initial test campaign is to be provided in an initial test report that is to contain data recorded during the campaign and listed in the relevant load point emission lists [Table 4].

Moreover, based on the emission targets and on the emissions measured without the reduction system in operation, the report is to contain the maximum Weighted Specific Emission ($WSE_{MAX}$) for each pollutant, where:

$WSE_{MAX} = (1 - RD / 100)\ WSE_o$

RD is the reduction target as in [3.3].

$WSE_o$ is the weighted specific emission measured when the emission reduction system was not working.

The $WSE_{MAX}$ is to be used as the reference value for periodical emission measurements [4.4] (*).

The initial test report is to be kept on board and made available during periodical surveys.

(*) $WSE_{MAX}$ is not applicable for SOx, and for smoke when an absolute limit is fixed.

### 5.3 Periodical surveys

The validity of the **BLUE-SKY (engines)** IET Certificate is subject to the execution of:

- annual surveys, to be carried out at the annual due date of the IET Certificate considering its effective date and with a time window of +/- 3 months;
- a renewal survey, to be carried out prior to the IET Certificate expiry date (due date) and with a time window of – 3 months.

Annual and renewal surveys are to be carried out in order to verify compliance with the requirements of this section, ascertaining that:

- requested systems/plant are in order and in good working condition;
- requested record books are available on board and duly filled in;
- requested documentation is available on board.

Annual surveys are to be duly recorded and endorsed in the IET Certificate.

### 5.4 Intermediate test campaign

During the time period between the second and third annual surveys (time window included), the periodical emission measurements requested in 4.4 are to be performed once, witnessed by a Surveyor of the Society.

### 5.5 Modifications

Should the engines undergo modifications, refitting or repairs, which in the opinion of the Society may affect their emission levels, the maintenance of the **BLUE-SKY (engine)** Certificate is subject to a re-assessment, including shipboard tests, as deemed necessary.

## 6 SPECIFIC REQUIREMENTS FOR USE OF WATER FUEL EMULSION

When a water fuel emulsion system is used on board for producing a stable emulsion (that can be stored in a tank), the following additional requirements are to be complied with.

### 6.1 Stability of the emulsion

The system is to be capable of producing water fuel emulsion which, more than 7 days after its production, does not present separation of water and fuel according to the dynamic separation test method given in Table 5.

### 6.2 Storage of emulsified fuel

In order to assure the good quality of the emulsion, the emulsified fuel is to be used not more than 2 days since the emulsifying process was carried out.

### 6.3 Periodical emulsion analysis

Every 6 months, a sample of the water fuel emulsion, taken from the shipboard production system, is to be collected and sent to a recognised laboratory to perform the test listed in Table 5, according to the indicated standards and methods, in order to verify the characteristics of the emulsified fuel.

### 6.4 Periodical water analysis

Every 6 months, a sample of the water used for producing the emulsion is to be collected and sent to a recognised laboratory to perform the test listed in Table 6, according to the indicated standards and methods, in order to verify compliance with the values given in the table.

### 6.5 Shipboard arrangements

#### 6.5.1 Emulsion system

The water fuel emulsion system is to be designed to assure that the water content in the emulsion is constant.

The water and fuel control devices are to be sealed at the fixed settings which provide an emulsion having the water content equal to the value used during the emission tests carried out during the certification.

The system is to be equipped with indicators or sensors (flow meter or equivalent) to control the actual quantity of water and fuel fed to the emulsifying machine.

A suitable means to prevent the stratification of the emulsion is to be provided in the emulsion system on board.

#### 6.5.2 Fuel oil system

As the addition of water to the fuel oil increases the viscosity, means to heat the emulsion and to keep viscosity within the recommended values indicated by the engine Manufacturer are to be installed in the system.

Particular attention is to be paid to the viscosity control devices installed in the fuel system of the engine, verifying that the emulsion reaches the proper temperature.

The fuel oil filters in the fuel system are to be checked to ensure that they are suitable for the emulsion.

### 6.6 Exhaust gas pipes

Means to collect the water vapour condensation are to be located in the exhaust gas system.

### 6.7 Bypass to integral fuel

When engines operate with water fuel emulsion, a bypass to integral fuel is to be provided in the system. The readiness and capability of the engines to switch from emulsion to integral fuel oil, after having been operated with emulsion, is to be demonstrated during the acceptance test on board.

**TABLE 2 – DOCUMENTS TO BE SUBMITTED**

| N | A/I | Document |
|---|---|---|
| 1 | A | Schematic drawings of the emission reduction system's general arrangements on board (1) |
| 2 | I | Operating and maintenance manual of the emission reduction system (2) |
| 3 | I | Fuel record book (2,3) |
| 4 | I | Emission Reduction System (ERS) record book (2) |
| 5 | I | Emission Reduction Engine (ERE) record book (2,5) |
| 6 | I | Copy of the EIAPP Certificates (2,4) |
| 7 | I | Documentation that the engine can be safely operated with the emission reduction system (2) |
| 8 | A | Initial test campaign procedure including specification of measuring equipment |
| 9 | A | Initial test report (2) |

Note: A – to be submitted for approval in four copies
I – to be submitted for information in duplicate
(1) If the ship is not classed by the Society, approved drawings are to be submitted for information.
(2) Documentation to be kept on board
(3) Only if fuel with maximum 1,5% of sulphur is used
(4) If the engines are certified according to the NOx technical code
(5) For engines certified in compliance with the NOx technical code, the technical file and record book referred to in the EIAPP Certificate are to be provided in lieu of the ERE record book.

**TABLE 3 – TEST CYCLE FOR DIESEL ENGINES AT CONSTANT SPEED**

| Power ($P_i$) | 25% | 50% | 75% | Max (1) |
|---|---|---|---|---|
| Weight ($\alpha_i$) | [0,10] | [0,20] | [0,50] | [0,20] |
| Weight ($\alpha_i$) for smoke density | [0,50] | [0,20] | [0,15] | [0,15] |

Note:
(1): 100% for test bed measurement; maximum operational power for shipboard measurement

**TABLE 4 – LOAD POINT EMISSION LIST**

| **General Data** | |
|---|---|
| Ship Name | - |
| Date | Mm/dd/yy |
| Place | - |
| Fuel type | (Integral fuel – emulsion) |
| Water amount in fuel | % vol |
| Emission reduction system | (emulsion – water injection – air humidification – SCR – EGR – other) |
| **Engine Information** | - |
| Engine Manufacturer | - |
| Engine type | - |
| Serial number | - |
| Rated power | KW |
| Rated speed | Rpm |
| Nominal compression ratio | - |
| Fuel pump | Part number or ID number |
| Injection nozzle | Part number or ID number |

| | |
|---|---|
| Injection timing | ° before TDC |
| Fuel cam | Part number or ID number |
| Piston (head) | Part number or ID number |
| Cylinder head | Part number or ID number |
| Connecting rod | Part number or ID number |
| Shims thickness | mm |
| Turbocharger | (Number-type-serial no. – specification) |
| Exhaust waste gate / Air bypass | - |
| Charge air cooler | (Type – specification) |
| Set point for charge air coolant temperature | ° C |
| **Engine Test Data** | |
| Engine speed | Rpm |
| Alternator power | KW |
| Power factor (cos □ | - |
| Maximum combustion pressure (each cylinder and average) | Bar |
| **Ambient Data** | |
| Total barometric pressure | KPa |
| Intake air temperature (before TC) | ° C |
| Intake air relative humidity | % |
| **Fuel** | |
| Fuel type | - |
| Fuel flow (*) | kg/h |
| Fuel Temperature (before fuel pump) | ° C |
| Fuel Pressure before engine/injection pump | Bar |
| Fuel Rack Position /Fuel Pump Index | - |
| Fuel density at 15° C (ISO 3675) | Kg/l |
| Viscosity at 50° C (ISO 3104) | $mm^2/s$ |
| Carbon | % mass |
| Hydrogen | % mass |
| Nitrogen | % mass |
| Oxygen | % mass |
| Sulphur | % mass |
| LHV/Hu (ISO 8217) | MJ/kg |
| **Charge Air** | |
| Temperature of intercooled charge air | ° C |
| Charge air pressure (relative) | Bar |
| Charge air coolant inlet temperature | ° C |
| **Exhaust Gas** | |
| Exhaust gas temperature (aft each cylinder and average) | ° C |
| Exhaust gas temperature before turbocharger | ° C |
| Exhaust gas temperature after turbocharger | ° C |
| **Gas concentrations** | |
| NOx | Ppm |
| CO | Ppm |
| CO2 | % vol |
| O2 | % vol |
| SOx | g/kW h |
| Smoke density | % or Filter Smoke Number (FSN) |
| Note:<br>(*) In the case of water/fuel emulsion the parameter is to be measured without emulsified water | |

**TABLE 5 – TEST ON WATER FUEL EMULSION**

| Test | Method or Standard | Unit |
|---|---|---|
| Density at 15°C | ISO 3675 | Kg/l |
| Viscosity at 50°C | ISO 3104 | Cst |
| Viscosity at 80°C | ISO 3104 | Cst |
| Water by distillation | ASTM D95/83 | % vol |
| Carbon | ASTM D5291/96 | % wt |
| Separation Test (stability) | M.U. 1548 (diesel oil)<br>M.U.1547 (fuel oil) | pass or not pass |

**TABLE 6 – TEST ON WATER USED FOR EMULSION**

| Test | Method or Standard | Unit | Range |
|---|---|---|---|
| Hardness | IRSA 2040 | ° F | ≤ 7 |
| PH | IRSA 2080 | - | 6 ≤ PH ≤ 7 |