European Commission

Technical guidance

for the monitoring, certification and verification of engine power in EU fisheries control

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October – 2024
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EUROPEAN COMMISSION

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Technical guidance for the monitoring, certification and verification of engine power in EU fisheries control

Developed by the Technical Working Group on Engine Power, subgroup of the Expert Group on Fisheries Control

This guidance document is legally non-binding, intended to provide guidance to Member States and stakeholders about how EU law in the field of engine power certification and verification should be applied, on the basis of the views of the Commission's Directorate-General for Maritime Affairs and Fisheries and the majority of Member States in the Expert Group on Fisheries Control, who endorsed this guidance on 7 March 2025. The binding interpretation of EU legislation is the exclusive competence of the Court of Justice of the European Union. The views expressed in this guidance are without prejudice to the position that the Commission might take before the Court of Justice.

Directorate-General for Maritime Affairs and Fisheries

2025

ABSTRACT (EN)

Fisheries management depends on matching the intensity of fishing to the reproductive capacity of the fish stocks. Engine power of catching vessels is one of the capacity indicators regulated through the Entry/Exit scheme for which the Common Fisheries Policy (CFP) sets ceilings. Member States are required to put in place measures to adjust the fishing capacity of their fleet to their fishing opportunities over time. Engine power is also used as a determinant and restrictive parameter to manage fishing effort, aimed to protect specific areas and fish stocks and to manage fisheries sustainably. Accurate declaration and registration of catching vessels' engine power are essential elements of fleet management and fisheries management, to ensure that the capacity ceilings of Member States' fleets are not exceeded, that the capacity of the EU fleet is maintained at a level to avoid increased fishing effort and possible overfishing of stocks, and to ensure a level playing field between operators.

Council Regulation (EC) No 1224/2009 and the Commission Implementing Regulation (EU) No 404/2011 set out the main responsibilities of Member States with regard to the monitoring, certification and verification of engine power of catching vessels. The objective of the Technical guidance for the monitoring, certification and verification of engine power in EU fisheries control is to support the Member State authorities with the full and harmonised implementation of an adequate monitoring, certification and verification system of the engine power of catching vessels in accordance with these regulations, including relevant elements of enforcement with regard to the identification of engine power related infringements and the regularisation thereof, as well as reporting requirements to the European Commission.

The guidance also contains considerations and recommendations for possible (future) measures to contribute to the further improvement and harmonisation among Member States of engine power certification and verification related measures.

The guidance has been developed within the framework of the Technical Working Group on Engine Power which is managed by the European Commission (DG MARE) with support of the external contractor Roos Diesel Analysis BV, and is composed of experts from the Member States' competent authorities in the field of engine power certification and verification, the European Fisheries Control Agency (EFCA) and other external experts that were invited or consulted on an ad-hoc basis.

The guidance is based on identified best practice verification and certification practices in all relevant Member States and input from Member States' and external experts in the Technical Working Group.

Representatives of the Classification Societies Bureau Veritas (BV) and Registro Italiano Navale (RINA) attended Working Group meetings and contributed to the development of the guidance. Gearbox manufacturers Hundested, Reintjes and ZF were consulted and contributed to part of the guidance dealing with gearbox energy losses.

Directorate-General for Maritime Affairs and Fisheries

2025

Manuscript completed in October 2024

Luxembourg: Publications Office of the European Union, 2025

PDF ISBN 978-92-68-29119-1 doi:10.2771/0220138 KL-01-25-039-EN-N

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Executive summary

Engine power is one of the capacity indicators of catching vessels regulated through the Entry/Exit scheme for which the Common Fisheries Policy (CFP) sets ceilings. Member States are required to put in place measures to adjust the fishing capacity of their fleet to their fishing opportunities over time. Engine power is also used as a determinant and restrictive parameter to manage fishing effort, aimed to protect specific areas and fish stocks and to manage fisheries sustainably. The declared and certified maximum continuous engine power of catching vessels must reflect the actual maximum power of propulsion engines installed on board, which is essential for sustainable fisheries management and to realise a level playing field among competing fishermen in the European Union. In accordance with Council Regulation (EC) No 1224/2009 (hereafter: the Control Regulation), Member States must certify and verify the engine power of certain catching vessels to ensure the correct declaration and registration of engine power. At the end of 2023, Council Regulation (EC) No 1224/2009 has been amended by Regulation (EU) 2023/2842 (hereafter: the new Control Regulation)[1].

The guidance has been developed within the framework of the Technical Working Group on Engine Power, to support full and adequate implementation by Member States of the regulatory requirements to certify and verify engine power, as laid down in the (new) Control Regulation. The working group is managed by the European Commission (DG MARE) with support of the external contractor Roos Diesel Analysis BV, and is composed of experts from the Member States' competent authorities in the field of engine power certification and verification, the European Fisheries Control Agency (EFCA) and other external experts that were invited or consulted on an ad-hoc basis.

The guidance explains certain essential concepts and definitions related to engine power, to ensure a common understanding and harmonised implementation of the (new) Control Regulation. Paramount concepts covered by the guidance are:

> **Engine power** is defined in accordance with ISO 3046-1:2002, which means that the amount of power attributed to the engine is the amount available at the output flange of the engine (brake power), and that the fitting of auxiliary equipment, fuel specifications and ambient conditions need to be considered when determining engine power. Furthermore,

[1] Any use of "(new) Control Regulation" refers to both the Control Regulation and the new Control Regulation.

when power is measured at any other location than the output shaft or flange of the engine, for instance at the propeller shaft, corrections need to be applied to approximate the engine's brake power.

Derating is defined as reducing the maximum continuous power that can be obtained from the engine through (a) technical modification(s) made to the engine such as the change of its configuration (parts) or mechanical or electronic settings that affect power such as the fuel injection timing, maximum quantity of fuel being injected per cycle, maximum engine speed, or a combination of these, provided that there is no possibility to increase the performance of the engine above the derated power after the deration is completed.

Certification of engine power

In accordance with the (new) Control Regulation, the engine power can only be certified if the engine is not capable of developing more than the stated maximum continuous engine power, which implies that Member States have a responsibility to implement measures that aim to ensure that the declared and / or certified engine power cannot be exceeded.

The concepts recommended in the guidance to be applied during the engine power certification process, to ensure that the declared engine power can indeed not be exceeded, are:

Designating a single, suitable, document as the **engine power certificate** in the meaning of the (new) Control Regulation, and application of an unambiguous definition of the **engine power** stated on that certificate.

Critical evaluation of the intrinsic (power) capacity of newly installed engines, during the **engine selection** process, to ensure that new engines are actually **suitable** for the vessel they are installed in, and to mitigate the risks associated with excessively powerful engines.

Conducting **physical tests** before the engine is installed on board a vessel (pre-installation physical verification), to verify whether the engine is indeed not more powerful than declared.

Application of **ongoing compliance measures**, such as seals or electronic protection, to prevent unnoticed and / or unauthorised tampering with engine settings after the engine power has been verified. This is particularly important in case of derated engines.

Conducting a **sea trial** before commissioning of the vessel and / or its engine, to ensure whether settings and parameters have not changed since the pre-installation physical verification, or in case such verification has not been conducted, to conduct a shaft power measurement.

Verification of engine power

In accordance with the (new) Control Regulation, Member States have a duty to verify the engine power of catching vessels in their fleet. The procedure laid down in the (new) Control Regulation and Commission Implementing Regulation (EU) No 404/2011, is that Member States draw a risk based sample of vessels that will undergo a data verification. If a data verification yields indications of non-compliance, the Member State must proceed to a physical engine power verification.

As from 10 January 2028, a catching vessel equipped with a permanently installed system that measures and records engine power, that meets all requirements laid down in Article 39(a) of the new Control Regulation and all detailed rules concerning such systems laid down in the Commission implementing acts, is not required to undergo a data verification or physical engine power verification, other than the assessment of recorded engine power data of the permanently installed system by the competent authorities.

Drawing a sample of vessels to undergo a data verification

In accordance with the regulations, operation of a catching vessel under an individual fishing effort regime (kW*days), operation of a catching vessel subject to power limitations and a catching vessel having a relatively high power-to-tonnage ratio compared to similar vessels in the same fleet, must be considered risk factors to be accounted for in the sampling process. It is recommended to consider the amount of declared auxiliary power as an additional risk factor.

The guidance contains a practical example on how to determine the sample size, and recommend to select vessels on a recurring basis.

Data verification

Selected vessels must undergo a data verification, which consist of analysis and cross checking of engine power values and engine power related parameters, to identify vessels at risk of non-compliance. In accordance with the (new) Control Regulation, as a minimum, the following data sources must be considered: vessel position data, fishing logbook data, the EIAPP certificate, Class certificates, the sea trial report and the Union fleet register.

The guidance contains extensive recommendations on how to assess data from these sources and recommend to document these assessments in a **data verification report**, to substantiate the consequential decision whether or not to proceed to a physical engine power verification.

Physical verification

A physical engine power verification is conducted when a data verification as described above yields indications of non-compliance, or when a Member State has other suspicions of non-compliance against a vessel. A shaft power measurement, based on shaft torque and revolutionary speed measurement, must be part of a physical verification. The principles recommended in the guidance concerning physical engine power verifications are:

Physical power verifications should be conducted on an **unannounced** basis.

Member States must ensure that physical power verifications are conducted in a **safe** manner. The guidance contains detailed recommendations that aim to contribute to safe working practices.

Physical power verifications must be adequately **prepared**. The guidance contains detailed recommendations on how to prepare a physical power verification.

The power measurement (and other, if applicable) **equipment** must be accurate and calibrated, and must be installed in accordance with the manufacturer’s instructions.

Physical power verifications must be conducted by skilled and trained **personnel**.

Engine power data must be **logged** and retained to remain available for further analysis in case verification results are questioned or disputed or are part of an infringement procedure.

The amount of propulsive power required by the vessel is affected by, among other factors, the deployment and position of **fishing gear** in case the vessel is equipped with towed gear, and the **propeller pitch** position in case the vessel is equipped with a controllable pitch propeller. The guidance contains detailed recommendations on how to account for these two factors during a physical engine power verification.

The amount of propulsive power required by the vessel is affected by, among other factors, **external factors**: wind, waves, water depth, current and steering. The guidance contains detailed recommendations on how to account for these factors, and if possible how to mitigate their effect, during a physical engine power verification.

The **engine** must be observed and its performance must be assessed during the physical power verification, to determine whether the measured power is the actual maximum amount of power the engine can produce. Which settings and / or parameters must be assessed is engine (type) specific and elaborated on in the guidance.

The power measured during a physical engine power verification is typically obtained at the propeller shaft of a vessel under site ambient conditions, which may differ from the declared engine power which is specified as break power under reference ambient conditions in accordance with ISO 3046-1:2002. The following factors, which may cause a discrepancy between measured power and declared power, are considered in the guidance:

Energy efficiency of the **gearbox**, which is typically incorporated in the driveline between the engine and the propeller shaft. The guidance contains recommendations and calculation examples for gearboxes of which no official efficiency data are known. The recommended efficiency to assume depends on the gearbox direction of rotation, the incorporation of a clutch, the number of pre-stages, and the incorporation of auxiliary drives.

Energy consumed by **non-essential driven auxiliaries** such as hydraulic pumps and shaft generators. It is recommended to either disengage the auxiliary or, if this is not possible, to let it run freely. If this is also not possible, the nominal power of the auxiliary must be applied as correction to the measured amount of power.

The site **ambient conditions** on board may differ from the reference conditions under which the declared engine power has been determined. In specific cases, it is recommended to apply the correction methods provided in ISO 3046-1:2002 to account for these differences.

It is recommended to report the measurement results and the consequential compliance assessment in a physical power verification report. The guidance contains examples for calculations of the correction factors referred to above, an example how to apply them in an overall compliance assessment, and a checklist for the information and data to be included in the physical engine power report.

Infringements

The guidance summarises the regulatory context concerning infringements. The criteria for serious infringements related to engine power under the (new) Control Regulation are presented, including a calculation example on how to establish a serious infringement from a physical engine power verification result.

Reference is made to manipulation of a continuous engine power monitoring device, which will become more relevant once these devices will be installed on a large scale.

Regularisation

Regularisation is the process of verifying that the engine can no longer exceed the declared amount of power after an infringement has previously been established. The following methods of regularisation are covered in the guidance: reducing the maximum engine power and (re)securing the derated settings, declaring a higher amount of engine power than before, equipping the vessel with a continuous monitoring device, and replacing the engine.

Which method or combination of methods is recommended or permitted for a specific vessel depends on national legislation in the Member State which may restrict permitted derating, European and / or national legislation that may prohibit registration of an engine the power of which exceeds a certain threshold, and the technical characteristics of the engine such as its control system that determines whether the engine can be adequately derated.

The guidance contains detailed recommendations on regularisation in different scenarios, considering the aspects referred to above. The guidance also elaborates on the conditions under which the power measured during a physical engine power verification may be declared the actual maximum power of the vessel.

Reporting to the Commission

In accordance with Article 118(1) of the (new) Control Regulation, Member States are required to transmit, every five years, a report on the application of the Control Regulation to the Commission. In accordance with Article 39(2) of the Control Regulation, as part of this report, Member States need to inform the Commission on the control measures they have undertaken to ensure that the certified engine power is not exceeded. A detailed list of aspects to be covered in this report is presented in the guidance. The guidance also highlights Member States' responsibilities for the quality and accurate reporting of engine power in the national fishing fleet register and the Union fleet register, which is essential to monitor whether the Member States' fishing capacity ceilings are respected in accordance with the CFP requirements.

Considerations

Several aspects are presented in the guidance that need to be followed up further to enable full implementation of the engine power regulations and the recommendations documented in the guidance to all vessels concerned:

It may be impossible to conduct a shaft power measurement on board vessels with certain **design characteristics**. Therefore it is recommended to ensure during the design and construction of new vessels that a temporary engine power verification can reasonably be conducted and a continuous shaft power measurement system can reasonably be installed.

For the effective application of the certification and verification procedures to electronically controlled engines under the (new) Control Regulation**, access to the ECU(s)** that govern(s) the engine is required at various occasions. In practice, the limited harmonisation and availability of IT tools and scarcity of (independent) operators of these tools may jeopardise the effective implementation of parts of the engine power certification and verification guidance.

Conducting a physical engine power verification based on (propeller) shaft torque measurement (and / or the installation of a continuous shaft power measurement system) is **not possible** on board certain vessels within the existing fleet of Union catching vessels. It may be considered reasonable that certifying authorities demand structural modifications to be made to vessels where a physical engine power verification cannot be conducted.

Several **candidate methodologies** to substitute shaft torque and revolutionary speed as method to determine or approximate the maximum engine power of a catching vessel in the context of the (new) Control Regulation are presented in the guidance, but none of these alternative methods are considered suitable for engine power certification purposes at this point.

The guidance identifies the following aspects where Member States may benefit from **harmonisation** and **cooperation**: the suitability assessment (of newly installed engines), the development of ongoing compliance measures and physical engine power verification capacity building.

The guidance in this document is based on the technical insights at the time of writing. Future amendments of the (new) Control Regulation, the development of a new Commission Implementing Regulation, **new technical insight** in the field of engine power determination, including but not limited to alternative methods that could be considered, may need to be reflected in (a) revised version(s) of this guidance.

1. Introduction and regulatory context

1.1. Engine power of catching vessels in the Common Fisheries Policy

Engine power and gross tonnage are used to define the fishing capacity of the EU fishing fleets within the framework of the Common Fisheries Policy[2] (hereafter: CFP). In accordance with Article 22(1) of the CFP, Member States of the European Union are required to put in place measures to adjust the fishing capacity of their fleet to their fishing opportunities over time, taking into account trends, and based on scientific advice, with the objective of achieving a stable and enduring balance between them. The entry-exit regime laid down in Article 23 of the CFP aims to prevent the fishing capacity of European fishing fleets from growing. Engine power is also one of the determinants of fishing effort in most fishing effort regimes, that are established to protect specific areas and fish stocks.

Taking the important role of engine power in the European fishing policy context into consideration, it is obvious that declared and certified maximum continuous engine power of catching vessels must reflect the actual maximum power of propulsion engines installed on board. Full and adequate implementation by Member States of the regulatory requirements to certify and verify engine power, as laid down in Council Regulation (EC) No 1224/2009[3] (hereafter: the Control Regulation), is essential for sustainable fisheries management and to realise a level playing field among competing fishermen in the European Union.

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2 REGULATION (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.

3 Council Regulation (EC) No 1224/2009 of 20 November 2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy, amending Regulations (EC) No 847/96, (EC) No 2371/2002, (EC) No 811/2004, (EC) No 768/2005, (EC) No 2115/2005, (EC) No 2166/2005, (EC) No 388/2006, (EC) No 509/2007, (EC) No 676/2007, (EC) No 1098/2007, (EC) No 1300/2008, (EC) No 1342/2008 and repealing Regulations (EEC) No 2847/93, (EC) No 1627/94 and (EC) No 1966/2006. (OJ L 343, 22.12.2009, p. 1.).

Council Regulation (EC) No 1224/2009 has been amended by Regulation (EU) 2023/2842[4] (hereafter: the new Control Regulation). Any use of “new Control Regulation” hereafter refers to the amended Control Regulation.

Any use of “Commission Implementing Regulation” in this guidance refers to Commission Implementing Regulation (EU) No 404/2011 of 8 April 2011[5].

Any use of “(new) Control Regulation” refers to both the Control Regulation and the new Control Regulation.

1.2. Scope of the guidance

The objective of the Technical guidance for the monitoring, certification and verification of engine power in EU fisheries control (hereafter: the guidance) is to support Member State authorities with the full and harmonised implementation of an adequate monitoring, certification and verification system of engine power of catching vessels, as required in accordance with Articles 38 to 41 of the (new) Control Regulation. It also provides some indication concerning the implementation of the newly introduced provisions of the new Control Regulation, notably Article 39a on the continuous monitoring of the engine power.

1.3. Development of the guidance

This guidance have been developed within the framework of the Technical sub Working Group on Engine Power (hereafter: the Working Group) of the Expert Group on Fisheries Control. The Working Group, managed by the European Commission (DG MARE) and supported by the external contractor Roos Diesel Analysis BV, is composed of experts from the Member States’ competent authorities in the field of engine power certification and verification, the European Fisheries Control Agency (EFCA), and other external experts that were invited or consulted on an ad-hoc basis.

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4 Regulation (EU) 2023/2842 of the European Parliament and of the Council of 22 November 2023 amending Council Regulation (EC) No 1224/2009, and amending Council Regulations (EC) No 1967/2006 and (EC) No 1005/2008 and Regulations (EU) 2016/1139, (EU) 2017/2403 and (EU) 2019/473 of the European Parliament and of the Council as regards fisheries control PE/38/2023/REV/1 (OJ L, 2023/2842, 20.12.2023).

5 Commission Implementing Regulation (EU) No 404/2011 of 8 April 2011 laying down detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy.(OJ L 112, 30.4.2011, p. 1).

The guidance is based on a compilation of the current implementation of sampling plans, data verifications and certification practices in all relevant Member States[6], the best practices identified from this compilation, relevant output of the Working Group meetings, written exchanges within the framework of the Working Group, and input from Member States' and external experts.

The conclusions and recommendations of the *Study on engine power verification by Member States*[7] were taken into account when developing the guidance, and incorporated in the result;

The document *Relevant regulatory framework and initial (non-exhaustive) reflections for need on guidance and recommendations*[8], compiled and distributed by the European Commission, has been taken into account when developing the guidance.

1.3.1. Consultation of external experts

1.3.1.1. Gearbox manufacturers

Section 4.6.1 about the correction of power for energy losses in the gearbox has been developed in close cooperation between the Working Group and the gearbox manufacturers Hundested, Reintjes and ZF.

1.3.1.2. Classification societies

Multiple Member State authorities, as described in section 3.1 and permitted in accordance with Article 40(3) of the Control Regulation, have assigned (part of) their engine power certification task(s) to one or more Classification Societies. Representatives of DG MOVE and the International Association of Classification Societies (IACS) were consulted to liaise between the Working Group and relevant classification societies. Representatives of Bureau Veritas (BV) and Registro Italiano Navale (RINA) attended Working Group meetings and contributed to the development of the guidance.

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6 22 Member States: BE, BG, HR, CY, DK, EE, FI, FR, DE, EL, IE, IT, LV, LT, MT, NL, PL, PT, RO, SL, ES, SE.

7 Directorate-General for Maritime Affairs and Fisheries (European Commission), Roos Diesel Analysis B.V., Study on engine power verification by Member States, final report, ISBN 978-92-76-08327-6, DOI 10.2771/945320, Luxembourg, Publications Office of the European Union, 2019 (https://data.europa.eu/doi/10.2771/945320).

8 Presented to the Expert Group on Fisheries control in December 2021, updated September 2022 - Ares(2023)928455.

1.3.1.3. Other experts

Representatives of two other organisations (Centre for Research and Technology Hellas (CERTH) and Danish Technology Institute (DTI)) contributed to the discussion about the verification of engine power on board vessels where strain gauge based shaft power measurement cannot be performed (section 8.3).

1.4. The application of the provisions on Engine Power of the Control Regulation, the Commission Implementing Regulation and the new Control Regulation

The provisions concerning engine power can be found in in Articles 38, 39, 40 and 41 of the Control Regulation and Articles 38, 39, 39a, 40 and 41 of the new Control Regulation. The provisions concerning engine power in the new Control Regulation will become applicable as from 10 January 2028. Until that date the provisions of the Control Regulation concerning the monitoring, certification and verification of engine power remain applicable together with the provisions of the Commission Implementing Regulation. The main change in the new Control Regulation concerns the continuous monitoring of engine power (Article 39a).

The Commission Implementing Regulation contains detailed rules concerning the certification and verification of engine power in articles 61, 62 and 63. These provisions of the Commission Implementing Regulation will remain applicable until they are amended to take into account the provisions of the new Control Regulation. The Commission may, by means of implementing acts, lay down detailed rules concerning the certification and verification of engine power in accordance with the new Control Regulation. Also, the Commission is required to adopt detailed rules on the installation, technical requirements and characteristics of the continuous monitoring systems. Those implementing acts will be adopted in accordance with the examination procedure referred to in article 119(2) of the new Control Regulation.

The guidance provides Member States and operators guidance for the implementation of the provisions on monitoring, certification and verification system of engine power of catching vessels in accordance with the Control Regulation, the Commission Implementing Regulation and the new Control Regulation.

1.5. The new Control Regulation in relation to ISO 15016:2015

As from 10 January 2028, in accordance with Article 41(3) of the new Control Regulation, Member States are required to apply the requirements adopted by the International Organisation for Standardisation in its recommended International Standard ISO 15016:2015[9], or equivalent European or national recognised methods, when conducting a physical engine power verification. ISO 15016:2015 has been considered in detail when developing the guidance.

The purpose of ISO 15016:2015 is to provide procedures and requirements for the performance of speed and power performance trials of ships, and for the evaluation and correction of obtained speed and power measurement results. The primary purpose of speed and power trials of ships is to determine the performance of a ship under prescribed conditions, to ultimately verify whether the attained vessel speed is, considering the vessel's propulsion power, satisfactory in relation to the Energy Efficiency Design Index (EEDI) attained by the vessel and / or the (construction) contract to which the vessel is subject.

ISO 15016:2015 contains requirements for the below listed (sub)domains of speed and power trials:

1. Responsibilities;
2. Trial preparations;
3. Installation and calibration;
4. Trial agenda and pre-trial meeting;
5. Ship's condition;
6. Trial boundary conditions;
7. Trial procedures;
8. Conduct of the trial;
9. Data acquisition;
10. Analysis procedure;
11. Processing of the results;
12. Reporting.

Because the purpose of ISO 15016:2015 is to provide requirements for speed and power performance trials, and since there are substantial differences

[9] ISO 15016:2015, Ships and marine technology — Guidelines for the assessment of speed and power performance by analysis of speed trial data.

between these trials and physical engine power verifications of catching vessels, not all procedures and requirements from ISO 15016:2015 can be applied during physical engine power verifications of catching vessels. In addition, not all elements that are necessary to determine the maximum engine power of a catching vessel are accounted for in ISO 15016:2015.

1.6. The (new) Control Regulation in relation to ISO 3046-1:2002

In accordance with article 5 of Regulation (EU) 2017/1130[10], the maximum engine power of a catching vessel is determined in accordance with ISO 3046-1:2002[11]. This maximum engine power value, determined in accordance with ISO 3046-1:2002, is the value to be certified and verified in accordance with the (new) Control Regulation. In accordance with ISO 3046-1:2002, the (maximum) engine power referred to in the (new) Control Regulation is brake power, which in accordance with the same standard is related to specified engine operating and ambient conditions.

The power measured during a verification trial, in accordance with the relevant provisions of ISO 15016:2015, is in most cases propeller shaft power under ambient conditions. Both ISO standards (3046-1:2002 and 15016:2015) are complementary to each other, and the power values obtained using both standards cannot be used interchangeably. Instead, correction factors shall be applied to the power value obtained following the procedures defined in ISO 15016:2015, to arrive at the maximum engine power value determined in accordance with ISO 3046-1:2002, which remains the value to verify under both the Control Regulation and the new Control Regulation[12].

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[10] REGULATION (EU) 2017/1130 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 June 2017 defining characteristics for fishing vessels (recast of Council Regulation (EEC) No 2930/86).

[11] ISO 3046-1:2002, Reciprocating internal combustion engines - Performance - Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods.

[12] Section 11.1.2 Power and torque of ISO 3046-1:2002 provides that “For engines delivering power through a shaft or shafts, any power in accordance with the requirements of this part of ISO 3046 is proportional to the mean torque, calculated or measured, and to the mean rotational speed of the shaft or shafts transmitting this torque”.

The relation between shaft power, shaft speed and shaft torque, determined at one position can be described as: $P_x = T_x \times \frac{Vx \times 2\pi}{60}$

Where $P_x = \textit{shaft power } (kW) \textit{ at position } x$

$T_x = \textit{shaft torque } (kNm) \textit{ at position } x$

$V_x = \textit{shaft speed } (rpm) \textit{ at position } x$

2. Terms and definitions

2.1. Automatic Identification System (AIS)

Automatic Identification System which meets the performance standards drawn up by the International Maritime Organisation according to chapter V, Regulation 19, section 2.4.5 of the 1974 SOLAS Convention.

[Source: Control Regulation, Article 10(1), Directive 2002/59/EC[13]]

2.2. Auxiliary engine

Engine on board a vessel whose power is primarily used for purposes other than vessel propulsion (e.g. powering on-board electrical or hydraulic systems). The registered amount of auxiliary power should equal all engine power installed on board a vessel not registered as main power.

2.3. Auxiliary propulsion system

System aimed at contributing to vessel propulsion, not based on a revolving propeller (e.g. wind assistance).

2.4. Booster (power) arrangement

Booster arrangements are systems of special forms of PTI arrangements (2.64), that attribute incremental propulsion power to the propeller shaft, while the propulsion engine is operating at its maximum power.

2.5. Brake power

Power or the sum of the powers delivered at the end of the crankshaft or its equivalent, with the equipment and auxiliaries fitted as required by the relevant satellite ISO standard.

[Source ISO 15550:2016[14], clause 3.3.3]

[13] DIRECTIVE 2002/59/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 June 2002 establishing a Community vessel traffic monitoring and information system and repealing Council Directive 93/75/EEC (OJ L 208 5.8.2002, p. 10).

[14] ISO 15550:2016, Internal combustion engines — Determination and method for the measurement of engine power — General requirements.

2.6. Catching vessel

A vessel equipped or used for the capture of marine biological resources for commercial purposes.

[Source: new Control Regulation Article 4(33)]

2.7. Certificate of Classification

The document issued by a recognised organisation certifying the fitness of a ship for a particular use or service in accordance with the rules and procedures laid down and made public by that recognised organisation.

[Source: Directive 2009/15/EC[15] (recast) Article 2(k)]

2.8. Certifying authority

As used in this guidance: any organisation that actually issues the engine power certificate referred to in Article 40(1) of the (new) Control Regulation, which may be the Member State's competent authorities and / or one or more classification societies or other operator(s) to which the certification of engine power has been assigned.

2.9. Classification Society

Technical organisation to which certification of compliance with IMO conventions to a certain extent has been delegated, which develop and apply technical standards for the design, construction and survey of ships and which carry out surveys and inspections on board ships. At present, 11 classification societies are recognised by the European Commission[16].

[Source: Directive 94/57/EC[17] (recast), Directive 2009/15/EC and Regulation (EC) 391/2009[18] and www.emsa.europa.eu]

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[15] DIRECTIVE 2009/15/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on common rules and standards for ship inspection and survey organisations and for the relevant activities of maritime administrations (Recast).

[16] Commission Decision 2022/C 466/07, List of organisations recognised on the basis of Regulation (EC) No 391/2009.

[17] COUNCIL DIRECTIVE 94/57/EC of 22 November 1994 on common rules and standards for ship inspection and survey organizations and for the relevant activities of maritime administrations.

[18] REGULATION (EC) No 391/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on common rules and standards for ship inspection and survey organisations (Recast).

2.10. Continuous (engine power) monitoring device

A permanently installed system that continuously measures and records engine power, in accordance with the requirements laid down in Article 39a of the new Control Regulation.

2.11. Continuous power

Power which an engine is capable of delivering continuously, between the normal maintenance intervals stated by the manufacturer, at the stated speed and under stated ambient conditions, the maintenance prescribed by the manufacturer having been carried out.

[Source: ISO 15550:2016, clause 3.3.4]

2.12. Control Regulation

Council Regulation (EC) No 1224/2009 of 20 November 2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy.

2.13. Controllable pitch propeller (CPP)

Propeller with blades whose position (angle relative to the centreline of the propeller shaft) can be adjusted by hydraulic or mechanical means.

2.14. Co-rotating gearbox

Gearbox where the direction of rotation (clockwise or counter-clockwise) of the input shaft (engine side) is equal to that of the output shaft (propeller side) while operating ahead.

2.15. Counter-rotating gearbox

Gearbox where the direction of rotation (clockwise or counter-clockwise) of the input shaft (engine side) is opposite to that of the output shaft (propeller side) while operating ahead.

2.16. Data verification report

A document produced by the Member State's authorities which describes the conducted data verification procedure of the engine power of a catching vessel including its results. The data verification report is written in such a way that it justifies any consequential decision taken by the Member State's authorities to install a permanent power measuring device, or to carry out a physical engine power verification, in accordance with Article 41(2) of the (new) Control Regulation. The data verification report contains a copy of all documents consulted when the data verification was conducted, and the report clearly indicates which data elements are considered to be an indication of non-compliance. A comprehensive list of data to be included in the data verification report is presented in section 4.4.8.

2.17. Declared engine power

The amount of engine power that is, according to the applicant for certification of a catching vessel's engine power (usually its owner), the maximum continuous engine power, or sum of engine power(s), of the vessel's main propulsion engine(s), as declared in the application. Propulsion system variants shall adequately be accounted for when the engine power is declared, in accordance with section 3.8 of this guidance.

Note that the definition of declared power, as applied in the context of this guidance, differs from the definition of ISO 15550:2016, clause 3.3.1 (value of the power, declared by the manufacturer, which an engine will deliver under a given set of circumstances).

2.18. Dependent auxiliary

Item of equipment, the presence or absence of which affects the final shaft power output of the engine.

[Source: ISO 15550:2016, clause 3.1.1]

2.19. Derating

Reducing the maximum continuous power that can be obtained from the engine through (a) technical modification(s) made to the engine such as the change of its configuration (parts) or mechanical or electronic settings that affect power such as the fuel injection timing, maximum quantity of fuel being injected per cycle, maximum engine speed, or a combination, provided that there is no possibility to increase the performance of the engine above the derated power after the deration is completed.

Derating is considered a technical modification as referred to in Article 61(2) and 61(3) of the Commission Implementing Regulation.

[Source: (modified) ISO 2710-1:2017[19], clause 3.19.8 and Working Group meeting no. 2]

2.20. Diesel-direct propulsion system

Marine propulsion system where (a) diesel engine(s) is / are driving a propeller shaft, either directly coupled or connected through a reduction gearbox or reversal (reduction) gearbox.

19 ISO 2710-1:2017, Reciprocating internal combustion engines — Vocabulary — Part 1: Terms for engine design and operation.

2.21. Diesel-electric propulsion system

Marine propulsion system where (a) diesel engine(s) is / are used as a generator to produce electrical power, and where this electrical power is used to power an electrical motor, which drives a propeller shaft.

2.22. Double run

Two consecutive speed runs (conducted by a vessel) at the same power setting on reciprocal headings on, or parallel to, the trial baseline. The trial runs shall be conducted over the same ground area. The engine throttle setting(s), rpm setting(s) or pitch setting(s) shall not be altered during this period.

[Source: ISO 15016:2015, clause 3.4 and clause 10.2]

2.23. Electric propulsion system

Marine propulsion system where electrical power, that has not been produced by (a) conventional (diesel) engine(s) on board, is used to power an electrical motor, which drives a propeller shaft.

2.24. Electronic Control Unit (ECU)

Computerised control system which is OEM supplied and permanently connected to an electronically controlled engine. The timing and quantity of fuel which is per cycle injected in each cylinder is controlled by the ECU. In addition, the ECU may control other engine systems, contain safety systems, record engine performance data, and may interact with external (motor management) systems. The characteristics of the software (settings) if an ECU are considered engine characteristics, as defined in for example the NOx Technical File (where applicable).

Note that different manufacturers use different names for this device (e.g. Electronic Control Module, Digital Control Unit, etc.).

2.25. Electronically controlled engine

An engine equipped with either electronic unit injectors or a common rail fuel injection system, governed by a computerised control system which, as a minimum, electronically determines the timing of the beginning and the end of each fuel injection.

2.26. Energy Efficiency Design Index (EEDI)

The attained EEDI is specific to each ship and indicates the estimated performance of the ship in terms of energy efficiency, and is accompanied by the EEDI technical file that contains the information necessary for the calculation of the attained EEDI and that shows the process of calculation.

The attained EEDI is verified, based on the EEDI technical file, either by the administration or by any organisation duly authorised by it.

[Source: IMO MARPOL Annex VI[20], Regulation 22(1)]

2.27. Engine International Air Pollution Prevention (EIAPP) Certificate

A certificate issued by, or on behalf of, the flag Administration, following a pre-certification survey to ensure that the engine, as designed and equipped, complies with the NOx emission limit contained in Regulation 13 of IMO MARPOL Annex VI.

[Source: NOx Technical Code (2008), clause 2.1(1)]

2.28. Engine performance map

An aspect of the software embedded in an ECU (2.24) which defines the relation between the engine speed and the maximum torque that can be obtained from the engine at each engine speed.

2.29. Engine power

Engine power (main propulsion) is defined as the total of the maximum continuous engine power of each engine, determined in accordance with ISO 3046-1:2002 at the flywheel of each engine and which can by mechanical, electrical, hydraulic or other means, be applied to vessel propulsion, after the engine has been derated (2.19) if applicable, provided that there is no possibility to increase the engine performance above the stated maximum continuous engine power of each engine. However, when a gearbox is incorporated into the engine, the power shall be measured at the gearbox output flange.

[Source: Control Regulation, Article 40, Commission Implementing Regulation, Article 61, Regulation (EU) 2017/1130, Article 5, and Working Group meeting no. 2]

2.30. Engine power certificate

Any document issued by, or on behalf of, the certifying authority (2.8), which has formally been designated as the engine power certificate in the meaning of Article 40 of the (new) Control Regulation.

2.31. Engine speed

The revolutionary speed of the crankshaft of the engine, expressed in revolutions per minute (rpm or $n\,min^{-1}$).

20 Articles, Protocols, Annexes and Unified Interpretations of the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL Convention), as modified by the 1978 and 1997 Protocols.

2.32. Essential auxiliary

Item of equipment that is essential for the continued or repeated operation of the engine.

[Source: ISO 15550:2016, clause 3.1.3]

2.33. Fisheries authority

Member State authority responsible for the implementation and enforcement of national and European fisheries regulations.

2.34. Fishing vessel

A catching vessel or any other vessel used for commercial exploitation of marine biological resources, including support vessels, fish processing vessels, vessels engaged in transhipment, towing vessels, auxiliary vessels and carrier vessels used for the transportation of fishery products, but excluding container vessels and vessels used exclusively for aquaculture.

[Source: new Control Regulation Article 4(31)]

2.35. Fixed pitch propeller (FPP)

Propeller with blades whose position (angle relative to the centreline of the propeller shaft) cannot be adjusted by any means (except structural deformation, for which the propeller needs to be removed from the shaft and heated).

2.36. Flag state

The state in which a vessel is registered, identifying which state, and thus which authority, is responsible for the implementation of flag state duties, arising from national, Union, and international, legislation, including IMO conventions.

2.37. Fuel rack

A control mechanism to adjust the position of a plunger in a fuel pump which, as a consequence of the helix shape of a section of the plunger, results in adjustment of the injected volume of fuel per cylinder, per engine cycle.

2.38. Fuel stop power

Power which an engine is capable of delivering during a stated period corresponding to its application, and stated speed and under stated ambient conditions, with the quantity of fuel injected per cycle being limited, so that this power cannot be exceeded.

[Source: (modified) ISO 15550:2016, clause 3.3.6]

2.39. Gearbox (marine)

Equipment between the engine and the propeller shaft, which reduces the revolutionary speed of the propeller relative to the speed of the engine crankshaft (reduction gearbox) through gear transmission. Clutches may be incorporated into the gearbox to allow for running in neutral mode or to engage a different number of gears, with the objective to reverse the direction of rotation of the output shaft (reversal gearbox). Additional gear driven (or driving) shafts may be incorporated to consume engine power for auxiliary applications (or to add power to the driven shaft).

2.40. Gross Tonnage (GT)

A definition of the size of a vessel, calculated from the moulded volume of all enclosed spaces of the ship in accordance with the IMO Tonnage Convention[21].

[Source: Regulation (EU) 2017/1130, Article 4 and IMO MARPOL Annex VI, Regulation 2.1(15)]

2.41. High Idle engine Speed

The highest revolutionary engine speed (2.31) that can be achieved by the engine when no load is applied to the engine output flange.

2.42. Independent auxiliary

Item of equipment that uses power supplied from a source other than the engine.

[Source: ISO 15550:2016, clause 3.1.2]

2.43. International Air Pollution Prevention (IAPP) Certificate

A certificate issued by or on behalf of the Flag State (2.36) administration to vessels and platforms that meet the characteristics laid down in IMO MARPOL Annex VI, Regulations 6.1 and 6.2, following the survey procedure defined in IMO MARPOL Annex VI, Regulation 5, if the vessel or platform complied with the requirements of Chapter 3 of IMO MARPOL Annex VI.

[Source: IMO MARPOL Annex VI, Regulations 6.1 and 6.2]

[21] International Convention on tonnage measurement of ships, 1969, concluded at London on 23 June 1969 and registered by the International Maritime Organization on 28 September 1982.

2.44. International Maritime Organization (IMO)

A specialised agency of the United Nations which is responsible for measures to improve the safety and security of international shipping and to prevent pollution from ships. It is also involved in legal matters, including liability and compensation issues and the facilitation of international maritime traffic. It was established by means of a Convention adopted under the auspices of the United Nations in Geneva on 6 March 1948 and met for the first time in January 1959.

[Source: www.imo.org]

2.45. ISO standard power

Continuous brake power (2.5) that the engine manufacturer declares that an engine is capable of delivering with only the essential dependent auxiliaries fitted, between the normal maintenance intervals as stated by the manufacturer, and under the following conditions:

(a) At a stated speed at the operating conditions of the engine manufacturer's test bed;

(b) With the power, declared by the manufacturer, which an engine will deliver under a given set of circumstances, adjusted or corrected as determined by the manufacturer to the standard reference conditions specified in clause 5 of ISO 15550:2016;

(c) With the maintenance prescribed by the engine manufacturer having been carried out.

[Source: ISO 15550:2016, clause 3.3.7.1]

2.46. Low Idle engine speed

The lowest revolutionary engine speed (2.31) that can be achieved by the engine when no load is applied to the engine output flange.

2.47. Lower Calorific Value (LCV)

Thermal energy produced by a combustion of fuel, measured as a unit of energy per unit mass or volume of substance when the products are cooled to 150 °C, expressed as kJ/kg.

2.48. Main engine

Engine on board a vessel whose power is primarily used to propel the vessel.

2.49. Marine service standard power

Continuous brake power (2.5) that the engine manufacturer declares that an engine is capable of delivering with only the essential dependent auxiliaries fitted, between the normal maintenance intervals as stated by the manufacturer, which an engine will deliver under a given set of circumstances, adjusted or corrected as determined by the manufacturer to the nominal ambient conditions required by IACS for ships in unrestricted service.

[Source: ISO 3046-1:2002, clause 11.4]

2.50. MARPOL

International Convention for the Prevention of Pollution from Ships (MARPOL), adopted by the IMO (2.44) in 1973 (Convention), 1978 (1978 Protocol), 1997 (1997 Protocol - Annex VI) and its subsequent amendments.

2.51. Maximum Continuous Engine Power

The highest power which an engine is capable of delivering continuously, between the normal maintenance intervals stated by the manufacturer, at the stated speed and under stated ambient conditions, the maintenance prescribed by the manufacturer having been carried out.

[Source: ISO 15550:2016, clause 3.3.4]

2.52. Mechanically controlled engine

An engine equipped with a mechanical system to govern the quantity of fuel being injected per cycle.

Note that:

1. A mechanical governor with electronic actuator is considered a mechanical control system;
2. An electronic actuator governing a mechanical fuel rack to control (a) conventional fuel pump(s) or unit injectors is considered a mechanical control system.

2.53. Member State

A country that is a member of the European Union.

2.54. New Control Regulation

Council Regulation (EC) No 1224/2009 of 20 November 2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy, amended by Regulation (EU) 2023/2842 of 22 November 2023 and in particular the provisions concerning the engine power in Articles 38 to 41.

2.55. Non-essential auxiliary

Item of equipment that is not essential for the continued or repeated operation of the engine.

[Source: ISO 15550:2016, clause 3.1.4]

2.56. NOx Technical Code (NTC)

Technical code on the control of emission of nitrogen oxides (NOx) from marine diesel engines, of which the purpose is to establish mandatory procedures for the testing, survey and certification of marine diesel engines to enable engine manufacturers, shipowners and Administrations to ensure that all applicable marine diesel engines with a power output of more than 130 kW comply with the relevant limiting emission values of NOx as specified within Regulation 13 of IMO MARPOL Annex VI.

[Source: NOx Technical Code (2008)[22], Introduction]

2.57. NOx Technical File

A record containing all details of parameters, including components and settings of an engine, which may influence the NOx emission of the engine, in accordance with Article 2.4 of the NOx Technical Code.

[Source: NOx Technical Code (2008), Article 1.3.15]

2.58. Original Equipment Manufacturer (OEM)

In the meaning of the guidance, OEM refers to the official manufacturer of engines or gearboxes, and explicitly not to independent service providers or alternative part producers, or (sub)dealers of engines or gearboxes, that operate to a certain extent independent from the OEM.

2.59. Parent engine

For the EIAPP (2.27) pre-certification of serially manufactured engines, depending on the approval of the Administration, the Engine Family or the Engine Group concept may be applied. In such a case, specific emission tests are required only for the Parent Engine(s) that represent the Engine Group or Engine Family for (pre-) certification purposes.

[Source: NOx Technical Code (2008), Article 2.2.2]

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22 NOx Technical Code, Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines.

2.60. Performance specifications (engine)

Collective designation (in this guidance) for the complete set of software and embedded settings that govern electronic engines.

2.61. Performance spec sheet (engine)

A document in which all electronic engine characteristics and settings are documented.

2.62. Personal protective equipment (PPE)

Clothing, helmets, goggles or other equipment designed to reduce the exposure of the wearer to hazards, aiming at protecting the wearer's body from injury and from illnesses that may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.

2.63. Port state

The state that has jurisdiction over the port visited by a vessel , and whose authority is thus responsible for the implementation of port state duties, arising from national, Union, and international, legislation, including IMO conventions.

2.64. Power take-in (PTI)

Power produced by a source other than the main propulsion engine(s), which is attributed to the propulsion system by electrical, hydraulic or other means.

2.65. Power take-off (PTO)

Power that is generated by the main propulsion engine, but is used to drive non-essential dependent auxiliaries (2.18 and 2.55).

2.66. Product guide (of engines)

Document with technical information and specifications of (an) engine type(s), that is usually more detailed than a product leaflet or brochure.

2.67. Propeller (shaft) speed

The revolutionary speed of the propeller shaft, expressed in revolutions per minute (rpm or $n\,min^{-1}$).

2.68. Rated (engine) power

Value of the power, declared by the manufacturer, which an engine will deliver under a given set of Circumstances.

Note that, whereas declared power and rated power may be used interchangeably in ISO 15550:2016, this is not the case in this guidance.

Declared power (2.17) in this guidance refers to the declaration made by the applicant (for certification), not by the engine manufacturer.

[Source: ISO 15550:2016, clause 3.3.1]

2.69. Rated (engine) speed

Engine speed corresponding to the rated power (2.68).

[Source: 15550:2016, clause 3.2.4]

2.70. Recognised Organisation (RO)

Classification society (2.9) which has been assigned by a Flag state (2.36) to act on their behalf to carry out statutory survey and certification work of their ships. EU Member States can only authorise a classification society recognised by the European Commission.

[Source: www.emsa.europa.eu]

2.71. Remapping

Making changes to the engine performance map (2.28) in an ECU (2.24) of an electronically controlled diesel engine.

2.72. Sea trial

A voyage of a vessel, which may take place before the Certificate of Classification (2.7) has been issued, with the objective to conduct specific tests in order verify one or more aspects of the vessel, including, but not limited to: its general seaworthiness, the functioning of safety appliances, its compliance with emission requirements, validation of its attained energy efficiency index, or verification of its certified maximum continuous engine power.

2.73. Seal

A mechanical device or substance that can be installed to prevent the unauthorised and / or unnoticed: removal of equipment, access to certain engine components and connectors, opening of (a) cover(s), or changes to (a) engine setting(s) and / or of its components.

2.74. Data set calibration number

Unique number, used to identify the engine performance specifications (2.60) in an ECU (2.24).

2.75. Steady-state ship's condition

When the measured values of propeller shaft speed, shaft torque and ship's speed are stable, the ship's condition shall be deemed steady.

[Source: ISO 15016:2015, clause 10.6]

2.76. Steaming

A vessel's motion ahead through the water, as a result of propulsion, while no fishing gear or other load increasing equipment is being deployed.

2.77. Still water vessel speed

Vessel speed obtained in water that is deep and not affected by current, wind, waves or other influencing external factors.

2.78. Strain gauge

Gauge used to measure the strain on an object. As the object is deformed it causes a change in electrical resistance. This change in resistance, usually measured using a Wheatstone bridge, is related to the strain by the quantity known as the gauge factor.

[Source: ISO 23048:2018[23], clause 3.1]

2.79. Test bed

A facility, usually located at the engine manufacturer's premises, where the engine performance can be tested under stable and precisely controllable conditions. At a test bed, the engine load, generated by a water brake or a dynamometer, is controllable.

2.80. Type approval certificate (engine)

A document issued by a classification society (2.9) or flag administration which certifies that the engine type design, including drawing appraisal and prototype test performance, is compliant with all applicable classification and statutory requirements.

[Source: IACS Unified Requirement (UR) M44]

[23] ISO 23048:2018, Ships and marine technology — Verification method for portable power measurement using a strain gauge.

2.81. Vessel Monitoring System (VMS)

A satellite-based (or, where possible, a land-based mobile network or other equivalent technology) vessel monitoring system operated by the Member States (2.53) for effective monitoring of position and movement of the fishing vessels flying their flag, wherever those vessels may be, and of fishing vessels in the Member States' waters, based on a device installed on board Union fishing vessels which allows those vessels to be automatically located and identified through the vessel monitoring system by transmitting automatically the vessel position data at regular intervals wherever those vessels may be.

[Source: new Control Regulation, Article 9(1) and 9(2)]

3. Certification of engine power

The requirement to certify engine power of catching vessels is laid down in Article 40(1) of the (new) Control Regulation, and applies to Union catching vessels whose propulsion engine power exceeds 120 kilowatts (kW), except vessels using exclusively static gear or dredge gear, auxiliary vessels and vessels used exclusively in aquaculture.

Since the Commission Implementing Regulation entered into force (7 May 2011), it is required to issue an engine power certificate for every new propulsion engine, replacement propulsion engine and propulsion engine that has been technically modified (to be) installed on board these vessels (Control Regulation Article 40(2)). As from 10 January 2028, when the engine power related amendments of the new Control Regulation will become applicable, vessels with an engine that has been installed, replaced or modified for the last time before 7 May 2011, are no longer exempted from these engine power certification requirements.

The precondition that such a certificate is only issued if the engine is not capable of developing more than the stated maximum continuous engine power ((new) Control Regulation, Art 40(2)) implies that the certified power must be carefully defined, and that Member States have a responsibility to implement measures that aim to ensure that the declared and certified engine power cannot be exceeded.

3.1. Definition of the engine power certifying authority

In accordance with Article 40(2) of the Control Regulation, each engine subject to the certification requirement must be officially certified by the Member States' competent authorities. Member States' competent authorities may assign the certification of engine power to classification societies or to other operators having the necessary expertise for the technical examination of engine power ((new) Control Regulation Article 40(3)).

Any organisation that actually issues the engine power certificate referred to in Article 40(1) of the Control Regulation, which may be the Member State's competent authorities and / or one or more classification societies or other operator(s) to which the certification of engine power has been assigned, will be referred to as the certifying authority hereafter, in accordance with the definition presented in section 2.8.

3.1.1. Assigning engine power certification to Classification societies or other operators

The requirements above imply that Member States officially determine and clearly communicate which governmental organisation is the competent authority for certification of engine power, and to which classification societies or other operators it has assigned the certification of engine power, if any, in the context of Article 40 of the Control Regulation.

In case a Member State's competent authority has assigned the certification of engine power to one or more third parties, it remains responsible for the full implementation of the requirement that such a certificate can only be issued if the engine is not capable of developing more than the stated maximum continuous engine power. Member States' competent authorities and the operator(s) to which the certification of engine power has been assigned are recommended to document in detail how the aspects covered by sections 3.2 to 3.12 are to be implemented.

Member States' competent authorities may consider accreditation by a national accreditation body (Regulation (EC) 765/2008[24] Article 2.11) of the organisation(s) to which the certification of engine power has been assigned, as demonstration of having the necessary expertise for the technical examination of engine power, as required by Article 40(3) of the (new) Control Regulation.

Voluntary or mandatory accreditation by a national accreditation body of the organisation(s) to which the certification of engine power has been assigned, does not discharge the Member State's competent Authority from its responsibility to ensure full implementation of the certification duty in accordance with the requirements of the (new) Control Regulation and the Commission Implementing Regulation. Nor does it empower a national accreditation body to approve at its discretion that the certification of engine power is based on a power determination method that is not (explicitly) prescribed by the (new) Control Regulation and / or the Commission Implementing Regulation.

3.2. Definition of the engine power certificate

A Member State may have reasons to declare an existing type of certificate to be the engine power certificate in the context of Article 40 of the (new) Control Regulation. This practise is not prohibited under the (new) Control Regulation, and may offer advantages, such as a lower administrative burden, a lower chance

[24] REGULATION (EC) No 765/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93.

of administrative errors associated with fewer document to be (cross) checked, etc., relative to establishing a separate single purpose engine power certificate.

However, an engine power certificate can only be issued if the individual engine concerned is not capable of developing more than the stated maximum continuous engine power, and if there is no possibility to increase the performance of the propulsion engine above the certified power ((new) Control Regulation Article 40(3)). Therefore, certificates that are issued following a procedure that insufficiently guarantees compliance with these conditions and / or at a moment in time before the certifying authority has had a realistic opportunity to conduct procedures that can ensure compliance with these conditions, are not suitable to be considered an engine power certificate for the purpose of Article 40 of the (new) Control Regulation. Furthermore, certificates that apply to an engine type or an engine family group instead of an individual engine are not suitable to be considered an engine power certificate.

Examples of certificates that are not compatible with the certification requirements laid down in Article 40 of the (new) Control Regulation include:

- EIAPP certificate;
- Type approval certificate.

Notwithstanding that these certificates are not suitable to be considered the engine power certificate in the meaning of Ar.t 40 of the (new) Control Regulation, they may be considered a useful source of information in the wider engine power certification and verification process (e.g. in the scope of data verification to identify risk vessels (section 4.4)).

The following document could be used as engine power certificate in the context of the (new) Control Regulation:

- The Machinery Particulars (or equivalent) document, linked to the Certificate of Classification (or equivalent).

Considering the Machinery Particulars or the Certificate of Classification to be the engine power certificate in the meaning of Article 40 of the (new) Control Regulation would however require the Member State's certifying authority to formally designate this document as the engine power certificate. Furthermore, it would require all information related to the power rating (section 3.3) and all measures applied to ensure ongoing compliance of the engine (section 3.10) to be stated on the certificate or on a document formally connected to the certificate, with the possibility to adapt or reissue the certificate, or the connected document, in case the engine is modified or replaced, or when engine parameters or ongoing compliance measure (e.g. sealing details) change over time.

A separate, single purpose, engine power certificate may be issued by the competent authorities, instead of merging engine power certification with another application in an existing document.

Whichever document is designated the engine power certificate in the meaning of Article 40 of the (new) Control Regulation, it is recommended that the engine power certificate shall be a single document.

3.3. Declaration of engine power

The maximum continuous engine power of a catching vessel, in accordance with Article 5 of Regulation (EU) 2017/1130, has to be determined in accordance with clause 11 of ISO 3046-1:2002. This standard applies to internal combustion engines and hence does not take into account booster power arrangements and / or diesel-electric propulsion systems, which, if applicable, have to be accounted for when declaring the main propulsion engine power of a catching vessel. The remainder of section 3 applies to vessels with a diesel-direct propulsion configuration. Accounting for booster power and diesel-electric propulsion will be discussed in sections 3.8.2 and 3.8.4, respectively.

3.3.1. The amount of rated engine power

The certifying authority is required to determine the maximum continuous rated engine power, and engine speed at the rated engine power, of every engine, before any potential derating is conducted. The rated power must be stated in kW, and the rated engine speed must be stated in rpm.

3.3.2. The type of statement of engine power

The certifying authority is required to state the type of declared maximum continuous engine power (ISO standard power, service standard power, marine service standard power, or power at engine manufacturer defined ambient conditions). ISO standard power is measured at, or corrected to, the ISO standard reference conditions specified in clause 5 of ISO 15550:2016, whereas marine service standard power is measured at, or corrected to, the ambient conditions specified in clause 11.4 of ISO 3046-1:2002.

3.3.3. The type of power application

The declared power application must be continuous fuel stop engine power. The (new) Control Regulation does not contain any provisions which allow overriding the continuous engine power by any available overload power. Therefore, in case overload power is nevertheless available, the continuous maximum engine power to be declared for the purpose of the Control Regulation must include the available overload power.

3.3.4. The type of engine power

The certifying authority must state that the type of declared rated power is brake power. Other types of power (e.g. indicated power) are not compatible with the (new) Control Regulation.

3.3.5. Auxiliaries fitted to the engine

Auxiliaries are classed in accordance with clause 3.1 of ISO 15550:2016 as:

1. Dependent vs. independent auxiliaries;
2. Essential vs. non-essential auxiliaries;
3. Standard Production Equipment (SPE).

Because dependent auxiliaries consume power, it is necessary for the certifying authority to determine whether the declared rated brake power is produced when only essential auxiliaries are installed, or whether also non-essential auxiliaries are installed, and if so, which non-essential auxiliaries.

At a test bed, the engine is typically tested with only essential dependent auxiliaries and SPE items fitted. On board, there may be non-essential auxiliaries fitted to the engine.

3.3.6. ISO power coding designation

It is recommended that, unless the declared engine power is stated as a type different type than ISO standard power, service standard power, or marine service standard power (section 3.3.2), the coding system in clause 12 of ISO 3046-1:2002 is used to state the declared rated engine power, in accordance with sections 3.3.2 to 3.3.5, on the engine power certificate.

Example 1 – ISO 3046-1:2002 coded designation of engine speed and power rating

Declaration of rated power and rated speed in accordance with the ISO 3046-1:2002 clause 12 power designation with the following specifications:

• Amount of rated power and speed (3.3.1):	221 kW at 1800 rpm
• Type of statement of power (3.3.2):	ISO power
• Type of power application (3.3.3):	Continuous fuel stop power
• Type of power (3.3.4):	Brake power
• Auxiliaries fitted (3.3.5):	The power is available using only the essential dependent auxiliaries

ISO 3046-1:2002 clause 12 power designation: **I C F N 221 kW – 1800** min^{-1}

3.4. Derating

Derating is defined as:

> *reducing the maximum continuous power that can be obtained from the engine through (a) technical modification(s) made to the engine such as the change of its configuration (parts) or mechanical or electronic settings that affect power such as the fuel injection timing, maximum quantity of fuel being injected per cycle, maximum engine speed, or a combination, provided that there is no possibility to increase the performance of the engine above the derated power after the deration is completed.*

Methods to ensure ongoing compliance of derated engines are described in section 3.10.

3.5. Certified maximum continuous engine power

The certified ((new) Control Regulation Article 40) maximum continuous engine power is defined as:

> *the total of the maximum continuous engine power of each engine, determined in accordance with ISO 3046-1:2002 at the flywheel of each engine and which can by mechanical, electrical, hydraulic or other means, be applied to vessel propulsion, after the engine has been derated in accordance with section 3.4 if applicable, provided that there is no possibility to increase the engine performance above the stated maximum continuous engine power of each engine. However, when a gearbox is incorporated into the engine, the power shall be measured at the gearbox output flange.*

3.6. Engine selection

Prior to the intended installation of a new or replacement engine on board a catching vessel, in a diesel-direct propulsion configuration, either on board an existing vessel or a vessel yet to be constructed, the fisheries control authority and the certifying authority are recommended to carry out a joint assessment of the suitability of the proposed engine. The purpose of this suitability assessment is to prevent under-declaration of engine power, and in particular to prevent large discrepancies between the declared engine power and the potential maximum continuous engine power of the proposed engine. The suitability assessment should result in a written notice from the authorities to the applicant, stating the acceptance or rejection decision of the proposed engine.

Alternatively to conducting case-by-case suitability assessments, authorities could publish a database with the lowest permissible engine power to be registered per engine type.

The following guiding principles should be applied when assessing the suitability of an engine:

1. A proposed engine should not be installed if a less powerful engine model, with a maximum continuous engine power equal to or exceeding the registered power of the vessel, is available from the same engine manufacturer.
2. Any limitation to permissible derating resulting from European or national law, expressed in kW or as a percentage of the maximum continuous rated engine power, will be related to the highest available maximum continuous power rating available for the respective engine type when the suitability assessment is conducted.
3. Special attention will be given to engine types for which different ratings are available, in particular if the only difference between the respective ratings originates from electronic control characteristics of the engine. In such cases, the available rating / engine variant with the highest maximum continuous power value should be used to assess the engine suitability and to quantify the applied derating, if applicable.
4. It may occur that an engine will be operated on board a catching vessel at a maximum speed which is lower than the engine speed at the engine’s rated power output, as declared by the engine manufacturer. When assessing the engine suitability, no correction will be made to the maximum continuous engine power assigned to the engine model because of any difference between the declared rated engine speed and the anticipated actual maximum engine speed on board the vessel.

If it is confirmed during the application procedure of the intended installation of a new or replacement engine, either on board an existing vessel or a vessel yet to be constructed, that the catching vessel concerned is, or will be at the date of certification, equipped with a permanently installed system that measures and records engine power[25], that meets all requirements laid down in Article 39(a) of the new Control Regulation and all detailed rules concerning such systems laid down in the Commission Implementing acts, the fisheries control authority and the certifying authority may decide that a joint assessment of the suitability of the proposed engine is not required.

3.7. Suitability assessment

A suitability assessment of an engine in a diesel-direct propulsion arrangement should as a minimum comprise the following steps:

1. The applicant files a request to install a specific engine brand, type, and variant if applicable, as the main propulsion engine to be installed on board a specific catching vessel. This request should also state the engine power the applicant intends to declare for the engine.
2. The certifying authority determines the maximum continuous engine power of the proposed engine. The certifying authority will in no case only refer to the engine documentation submitted by the applicant or the engine (re)seller in relation to the proposed engine. As a minimum, the official brochure and product guide as published by the original equipment manufacturer (OEM) should be consulted to collect all available ratings for the proposed engine type. If the engine is expected to be operated at a lower maximum engine speed than the rated speed corresponding with the highest available power rating according to the official information, no correction can be applied to the highest available power value assigned to the engine.
3. In case the engine is subject to a derating prohibition under national law, the declared engine power should, in line with guiding principles 3.6 (2) and (3), be equal to the highest available continuous power rating. In case the engine is subject to a derating limitation, the lowest permissible registered engine power should likewise be calculated from the highest available continuous engine power rating.
4. In case the applicant proposes to declare less engine power than the highest available power rating of the engine proposed to be installed (i.e. the applicant proposes to derate the engine), the certifying

[25] Either on a voluntary basis or, as a result of the risk analysis of Article 39(a)(1) or Article 39(a)(8), or as a result of the requirements laid down in Article 39(a)(2) of the new Control Regulation.

authority should extensively analyse the existence of less powerful, usually smaller in terms of swept volume, engine models available from the same engine brand, and assess their relative suitability. In case a less powerful engine model is available from the same engine brand, which meets all other applicable requirements (e.g. emission standards), the certifying authority should, in line with guiding principle 3.6 (1), reject the application and may propose that engine model to be installed instead of the proposed engine model.

It must be noted that selecting an engine in accordance with the aforementioned steps does not entirely prevent under declaration of engine power because:

1. When a limited amount of derating is permitted, or when the least powerful alternative principle is applied (section 3.6(1)), a relatively small difference between the declared engine power and the maximum continuous engine power of the approved engine type remains possible;
2. In the context of the engine suitability assessment, derating is calculated from the highest available continuous power rating. However higher power ratings may be available for non-continuous (intermittent) use (also see example 2). If the vessel operates in a cyclical load profile, the operator might have the opportunity to use more engine power, on an intermittent basis, if the operator manages to set the engine to the intermittent rating engine specifications.

Example 2 – Determination of maximum power

Based on the rating categories defined by an engine manufacturer as presented in table 1, only ‘rating 1’ ratings should be considered for the determination of the highest continuous power rating of an engine type. However, some manufacturers may not have rating 1 in their catalogues for a particular engine, in which case rating 2 may be considered.

Table 1. Description of ratings (fictive engine manufacturer).

Rating 1	For commercial vessels with displacement hulls in heavy operation. Load and speed could be constant, and full power can be used without interruption.
Rating 2	For commercial vessels with semi planing or displacement hulls in cyclical operation. Full power could be utilized max 4 h per 12 h operation period. Between full load operation periods, engine speed should be reduced at least 10% from the obtained full load engine speed.
Rating 3	For commercial vessels or craft with high demands on speed and acceleration, planing or semi-planing hulls in cyclical operation. Full power could be utilized maximum 2 h per 12 h operation period. Between full load periods, engine speed should be reduced at least 10% from the obtained full load engine speed.
Rating 4	For light planing craft in commercial operation. Recommended speed at cruising = 25 knots. Full power could be utilized max 1 h per 12 h operation period. Between full load operation periods, engine speed should be reduced at least 10% from the obtained full load engine speed.

In case the official engine manufacturer's product guide specifies available ratings for a proposed fictive engine type 'X' to be as displayed in table 2, the highest maximum continuous power of the engine type should be determined at 368 kW. In case a derating prohibition applies to the vessel, the declared engine power should be no less than 368 kW. In case permissible derating is regulatory maximised at 20%, the declared engine power of any type 'X' engine should not be less than (1 – 0,2) x 368 = 294,4 kW.

Table 2. Available ratings of fictive engine type 'X', according to OEM product guide.

	Rating no.	kW	rpm
Model X-1	1	294	1800
Model X-2	1	331	1800
Model X-3	1	368	1800
Model X-4	2	404	1900
Model X-5	2	441	1900
Model X-6	3	515	2300
Model X-7	4	588	2300

In case no derating prohibition or limitation applies to the engine, the certifying authority should as a minimum consult the official engine manufacturer product guide to determine whether a less powerful engine, with a maximum continuous rated engine power equal to or higher than the vessel's registered engine power, is available from the same engine manufacturer. If this is the case, and the less powerful engine meets all other applicable requirements such as emission standards, the certifying authority should reject the application and may propose the less powerful engine type to be selected.

Consider the case where the previously presented engine type 'X' was proposed as engine to be installed. Consider the intended declared amount of engine power to be 200 kW. If, for example, the same OEM also offers engine type 'Y' with the specifications as listed in table 3, the certifying authority should reject the application and may propose the less powerful type (type 'Y') to be selected for installation in the vessel.

In case documentation is provided by the engine (re)seller, or another party, stating that the specific engine variant of engine type 'X' to be installed in the vessel has a rated output of just 200 kW, this is no reason to reconsider the determined maximum continuous output of engine type 'X' to be 368 kW, and that of type 'Y' to be 261 kW, which implies that engine type 'Y' may still be proposed for installation in the vessel under consideration. Also limiting the maximum engine speed of a type 'X' engine to for example 1200 rpm, is no reason to accept the installation of a type 'X' engine, in accordance with section 3.7(2).

Table 3. Available ratings of fictive engine type 'Y', according to OEM product guide.

	Rating no.	kW	rpm
Model Y-1	1	221	1800
Model Y-2	1	261	1800
Model Y-3	1	261	2200
Model Y-4	2	313	2200
Model Y-5	3	313	2200
Model Y-6	4	368	2600

3.8. Accounting for propulsion system variants

3.8.1. Alternative or multi-fuel engines

In case a multi fuel engine is proposed (e.g. a diesel and gas dual fuel engine) to be installed on board a new or existing catching vessel, the acceptance test needs to be performed, and the engine power needs to be determined, using liquid fuel, in accordance with clause 6.2.5.12 of ISO 15550:2016.

3.8.2. Booster arrangements

Booster arrangements are systems that provide additional power to the propulsion line through hydraulic or electric motors, that are powered by auxiliary engines and / or from battery packs. The maximum engine power of the main engine, when considering its suitability for installation on board a new or existing catching vessel, needs to be the registered engine power minus the highest available booster power.

Example 3 – Correction for booster power

Consider a vessel with a registered main propulsion engine power of 250 kW, and a single main engine and an electric booster motor, which has a maximum power of 50 kW.

The maximum permissible engine power is 250 – 50 = 200 kW. The engine selection and assessment is similar to the process described in sections 3.6. and 3.7, including example 2, for a maximum engine power of 200 kW.

3.8.3. Multiple main engines

In case a vessel is equipped with multiple main engines in a diesel-direct configuration, irrespective of whether these engines are driving one or multiple propeller shafts, the main propulsion power is the sum of the maximum engine power of all propulsive engines combined.

3.8.4. Diesel-electric propulsion systems

In case a catching vessel's propulsion system is diesel-electric, the main engine power is the sum of the maximum power of each electromotor driving the propeller shaft(s).

3.9. Pre-installation physical engine power verification

It is recommended to conduct a physical engine power verification of every engine to be installed on board a catching vessel, with a total main engine power of 120 kW or more, prior to its installation on board (hereafter referred to as the pre-installation physical verification). The purpose of this verification is to ensure that, at the time the verification takes place, the engine is not capable of producing more power than its declared amount. The following principles should be applied to the pre-installation physical verification:

1. The engine power is determined in accordance with ISO 3046-1:2002 during the pre-installation physical verification. This implies that the verification is conducted with the engine running on a test bed, which will normally be at a dedicated test facility at the premises of the engine manufacturer, engine dealer or engine (re)seller.
2. The pre-installation physical engine power verification needs to be witnessed by a representative of the certifying authority. The representative of the certifying authority cannot delegate (part of) the observation, collection, compilation or documentation of the engine speed, power and other performance parameters to any other party (including, but not limited to, the engine supplier that hosts the test bed trial).
3. The pre-installation physical engine power verification may be combined with any other test bed trial, such as the acceptance test in the meaning of clause 3.5.1 of ISO 15550:2016. The test must in any case be conducted on the exact individual engine to be certified, and never on another engine that may be considered to be identical or similar.

3.9.1. Pre-installation physical engine power verification test programme

The purpose of the pre-installation physical verification is to verify the maximum engine power, and to document the engine settings and performance parameters when the maximum power is being produced. Therefore, the pre-installation physical verification cannot be replaced by (part of) any other engine test conducted by, or on request of, the engine manufacturer, the engine buyer, the certifying authority or any other relevant party, which aims to validate the engine quality, the engine’s exhaust gas emissions, its safety, its conformity with the specifications agreed between the engine buyer and the seller or any other aspect.

It is recommended to conduct the pre-installation physical verification of the engine power after all other test bed trials and other tests have been completed satisfactory.

The recommended pre-installation physical engine power verification test programme consists of the following three steps:

1. Determination of the low idle engine speed;

The engine is operated with the speed request signal to the engine at the minimum value without any brake load being induced by the test bed. The observed engine speed must be documented.

2. Determination of the high idle engine speed;

The speed request signal to the engine is gradually increased to the maximum value while the brake load induced by the test bed is maintained at the lowest possible value. The observed high idle engine speed value must be documented.

3. Determination of the engine power.

While the speed request signal to the engine is maintained at the maximum value, the brake load induced by the test bed is gradually increased which will result in an increase of the observed engine power. The increase of the brake load is continued until the point where the engine power does not increase further, just before increasing the induced load further causes the engine power to decrease again. This point marks the maximum power of the engine. The observed maximum engine power and engine speed at maximum engine power must be documented.

In case the engine is electronically controlled, the maximum power should also be determined at multiple other engine speeds, e.g. 200 rpm and 400 rpm below the nominal engine speed, to ensure that the declared engine power is not exceeded at any point within the engine speed range. In case it is anticipated that the engine will be operated after installation on board at a maximum speed lower than the nominal speed, the engine power must also be measured at that engine speed. The representative of the certifying authority verifies that it is not possible to exceed the declared engine power at any engine speed.

3.9.2. Pre-installation physical engine power verification test report

The representative of the certifying authority that attends the pre-installation physical engine power verification documents the low idle engine speed, the high idle engine speed, the maximum engine power and the engine speed at maximum engine power observed during the tests. In addition to the aforementioned parameters, the representative of the certifying authority collects and documents all engine control software identification numbers (data set calibration numbers) and settings and all engine performance parameters that may aide future compliance assessments of the engine, while the engine is producing its maximum power at the test bed.

An example test report form to be completed during the test bed trial by the certifying authority representative is presented in Annex 1. A copy of the test report should be provided to the fisheries control authority without delay.

3.10. Ensuring ongoing compliance

After the certifying authority has confirmed during the pre-installation physical engine power verification (section 3.9) that the maximum engine power of the engine to be certified equals the declared engine power, and all engine characteristics, settings and performance parameters have been documented, the certifying authority needs to apply measures to ensure ongoing compliance of the engine with its declared engine power, unless the engine is certified at the highest available rating for the engine type, considering all variants of the engine type and power ratings for intermittent use.

It is recommended that the Member State's certifying authority, before approval is granted to an applicant to install a specific engine on board a vessel, informs the applicant in writing of the exact ongoing compliance measures that will need to be applied to the engine for which an application has been filed. This implies that when an application for a specific engine type and variant is received for the first time, the certifying authority needs to produce an ongoing compliance measures document for that engine, stating how the ongoing compliance of that engine, and all future engines of the same type and variant for which an application may be received, must be ensured.

Although developing and providing such a document may be considered a natural task and responsibility of the certifying authority, it is recommended that certifying authorities consult internal and external experts, including but not limited to representatives of the relevant engine manufacturer, in order to develop requirements that are both practically implementable and, once implemented, will provide the required certainty of ongoing compliance of the engine with its declared engine power.

An example of an Ongoing Compliance Measures document is provided in Annex 2.

It is recommended that:

1. Ongoing compliance measures are developed and implemented in a harmonised manner across the Member States;
2. Certifying authorities publish their ongoing compliance measures, for all engine types and variants for which such measures have been developed, on a publicly available platform, to facilitate their efficient implementation.

3.10.1. The application of seals

It may be required to apply seals, as one of the measures to ensure ongoing compliance of certified engines with their declared power, for the following purposes:

1. The affixation of a component to an engine;

Seals may be used to prevent entire components, such as fuel pumps, governors or ECU devices, to be exchanged unnoticed, even if the type plate of the component under consideration is replaced or forged.

2. The prevention of access to confined spaces;

Seals may be used to prevent the unnoticed opening of doors of control cabinets where critical connectors or computers are located, or to prevent the unnoticed removal of covers, e.g. from a fuel pump or governor. The set bolt of the maximum speed or fuel rack setting may be located behind such a cover.

3. The prevention of unauthorised changing of settings.

Engine settings (e.g. the maximum engine speed setting) on specific governors can be altered by extending or shortening the limiting side of the set bolt, which is achieved by turning that bolt deeper or less deep into the governor housing. When the application of a seal prevents such bolt from being turned, the set bolt is effectively secured. Note that in case a shorter bolt is associated with more speed and / or power, the length of the bolt may also be manipulated in other ways, e.g. through grinding the limiting end. Therefore, the length of the set bolt should also be documented in cases where that is possible.

Note that producing adequate sealing instructions as an element of the ongoing compliance measures for an engine, requires knowledge of the specific engine and all its speed and power control mechanisms. In certain cases, special bushings or limit blocks may need to be machined in order to effectively limit and seal the maximum fuel rack position. Specific covers may need to be produced to shield ECU connectors.

3.10.1.1. Selecting the correct seal

Seals are produced with a wide variety of characteristics, which makes it important to adequately select seals for the purpose of sealing engine settings. Characteristics to consider when selecting the type of seal to be used include:

1. Size

Sealing wire will need to be applied through bores in relatively small bolts and nuts. The sealing wire thickness should be the virtual balance point between ruggedness (associated with a thicker wire) and applicability (associated with a thinner wire). For most bolts and nuts to be sealed, a wire of 1,5 mm (bores to be drilled at 2,0 mm) suffices, but in specific bolts (e.g. special bolts securing the cover on certain governor types), 2,0 mm bores cannot be drilled and the use of thinner sealing wire may thus be required.

2. Material and design

Suitable seals are typically single-use devices made of metal 'locks' and metal wire to 'close' the lock, which exhibit tell-tale evidence of tampering attempts. It is considered very difficult to manipulate seals of this design unnoticed (e.g. cutting the wire, removing the wire from the lock, and reinstalling an alternative piece of wire in the lock after having manipulated the engine settings).

3. Traceability

Seals need to be uniquely marked, numbered and registered to counter the unauthorised replacement of seals (after engine settings may have been changed unauthorised), and to improve traceability from the Member State's authority that has distributed the seals, to the organisation and individual that has applied the seal and to the moment in time at which the seal has been applied. Meticulous administration of applied seals greatly improves the potential contribution of traceable seals to ensuring ongoing compliance of certified engines with their declared engine power.

It is recommended to apply the identification, quality and tamper-proofing requirements as defined in ISO 17712:2013[26] for freight container seals, to seals used for the purpose of ensuring ongoing compliance with certified engine power of catching vessels, except for the strength requirements (as these are associated with wires of a thickness that cannot be used on engines).

Lead or plastic disc seals, as traditionally applied e.g. by engine manufacturers, are not suitable for the purpose of ensuring ongoing compliance of the engine with its declared engine power, as this type of seal is typically not traceable and easy to manipulate and / or replace.

26 ISO 17712:2013, Freight containers – Mechanical seals.

3.10.1.2. Correct application of seals

Seals need to be applied in a manner which ensures that the purpose of their application as defined in section 3.10.1 is met. When securing bolts or nuts that may not be detached or turned, the sealing wire must be pulled tight and twisted in such a way that direction of rotation corresponding with loosening the bolt or nut corresponds with further tightening the sealing wire, to prevent the power from being increased without breaking the sealing wire.

Applied seals may be exposed to vibrations and chafing for extended periods of time, which may eventually cause the sealing wire to break. Application of special paint at high risk areas reduces this risk.

3.10.1.3. Documentation of applied seals

Once all seals have been applied in accordance with the ongoing compliance measures document provided by the certifying authority, the unique number of each seal need to be registered. In addition, clear pictures should be taken of all seals. Efforts need to be made to visualise the (unique) seal identification (number) in the picture, as well as the details of the sealed item and the wire. The sealing information should be comprehensively documented, registered and shared with the fisheries authorities without delay. Meticulous administration of applied seals enables detection of tampering attempts at a later moment in time.

An example of a sealing plan is included in Annex 3.

3.10.1.4. Verification of applied seals

Member States are required to ensure that the applied seals remain untampered with, through regular inspections of applied seals, during surveys conducted by the certifying authority, and during unannounced onboard inspections conducted by the fisheries control authority.

3.10.1.5. Maintaining effective sealing throughout the service life of the engine

Despite precautionary measures, sealing wire may occasionally break as a result of chafing. In addition, vessel operators may have legitimate reasons to remove some or all seals from the engine, e.g. to conduct scheduled maintenance or repair works. Vessel operators should be required to inform the certifying authority without delay about any broken or removed seals.

The certifying authority should ensure that the engine is resealed at the earliest convenient moment, but at least within four weeks from the moment that the seal break was reported. The ongoing compliance measures document, as produced by the certifying authority, should instruct in detail the resealing conditions, i.e. under which conditions the engine power needs to be physically reverified and / or when a verification of specific engine parameters suffices.

3.10.1.6. Examples of effective sealing of mechanically controlled engines

Figure 1 – Mechanically controlled in-line fuel pump and governor of a Mitsubishi S6A300 diesel engine (overview, sealed).

Figure 2 – Fuel pump shown in Figure 1, affixed by a seal to the engine block.

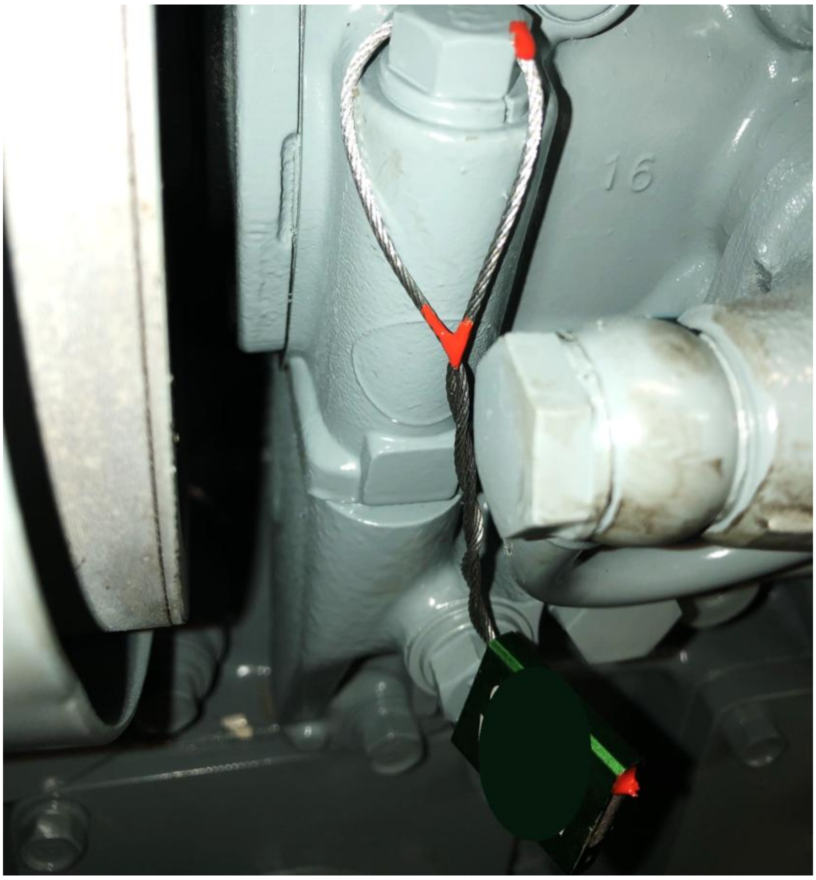


Figure 3 – High idle bolt of governor shown in figure 1 sealed, engine control lever indicated by red arrow. The control end (yellow arrow) must be measured as grinding the control-end of the set bolt would result in an increase of the high-idle engine speed.

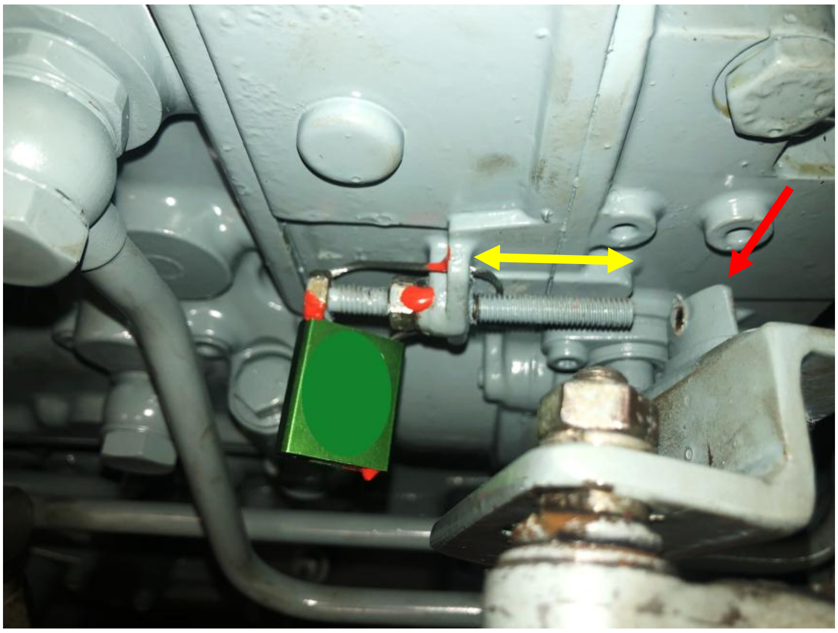


Figure 4 – Mechanical fuel rack limiter of fuel pump shown in Figure 1, fuel rack limiter indicated by yellow arrow (cover removed for setting and measurement).

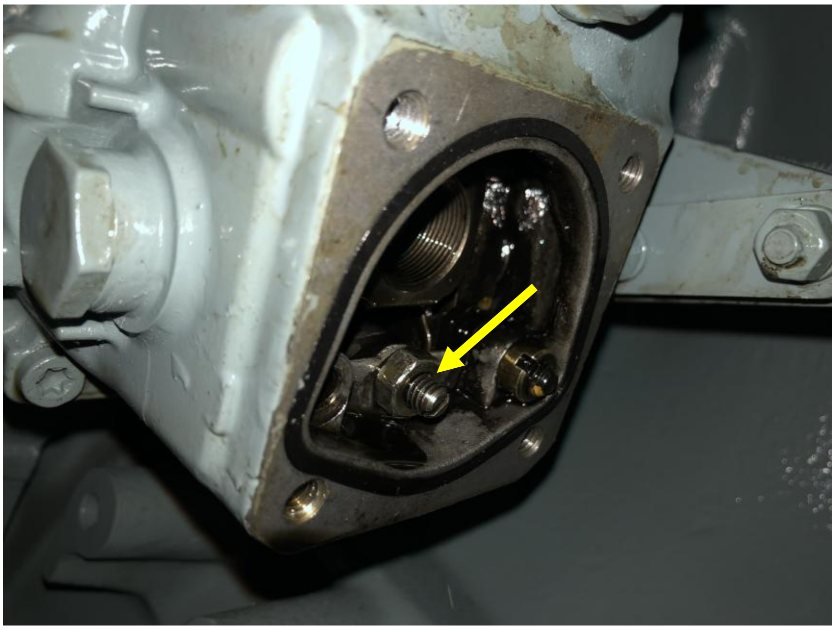


Figure 5 – Fuel rack setting of fuel pump shown in Figure 1, covered and sealed.

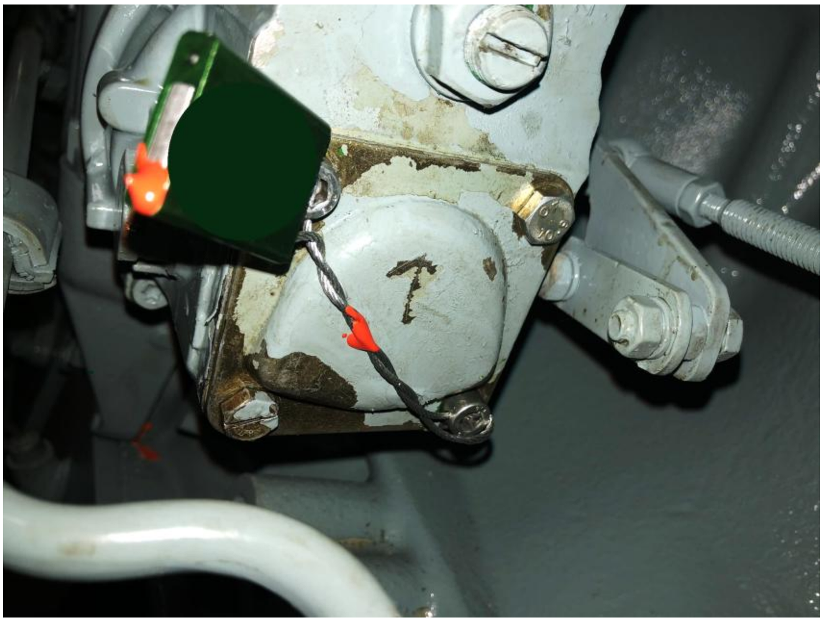


Figure 6 – Mechanically controlled fuel pump of a Stork-Wärtsilä engine. The maximum fuel rack position is restricted by applied and sealed bushing (red arrow) to the indicated stroke (yellow arrow).

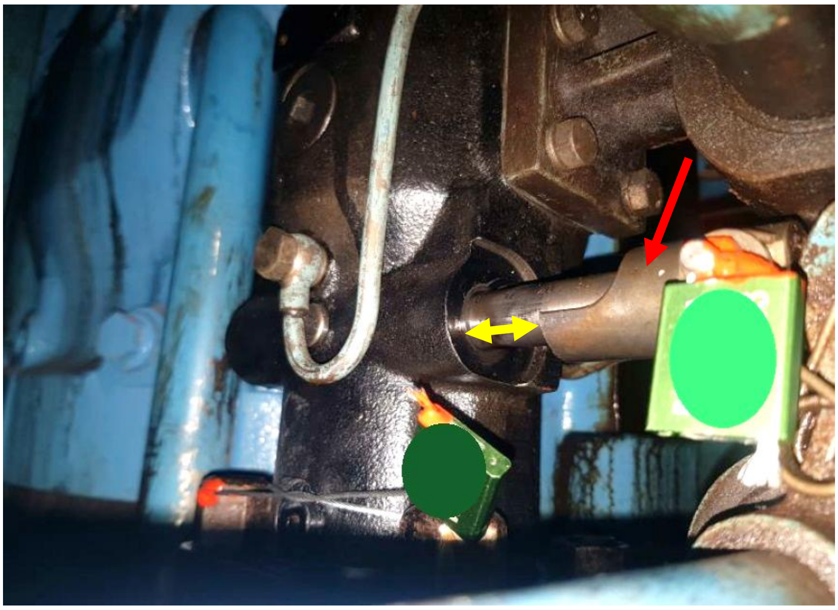


Figure 7 – Typical setting of mechanical governor (Regulateurs Europa 1104 governor on a Deutz TBD 645 L6F engine), front cover removed, low and high idle set bolts indicated by arrows.

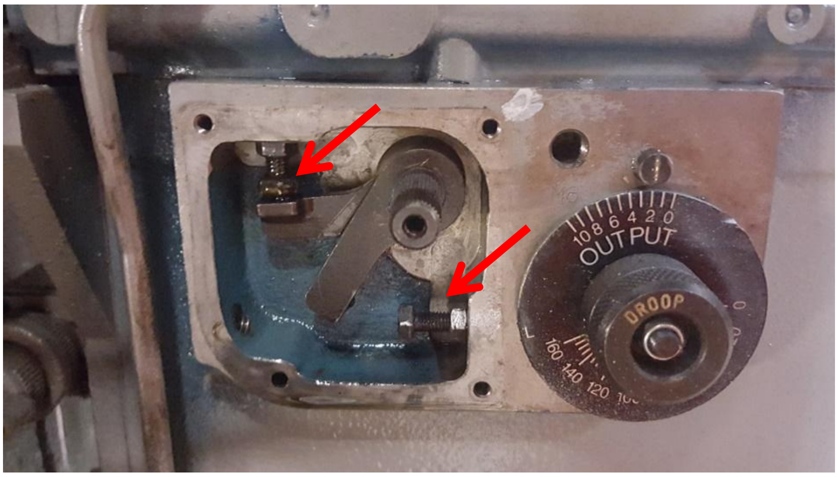
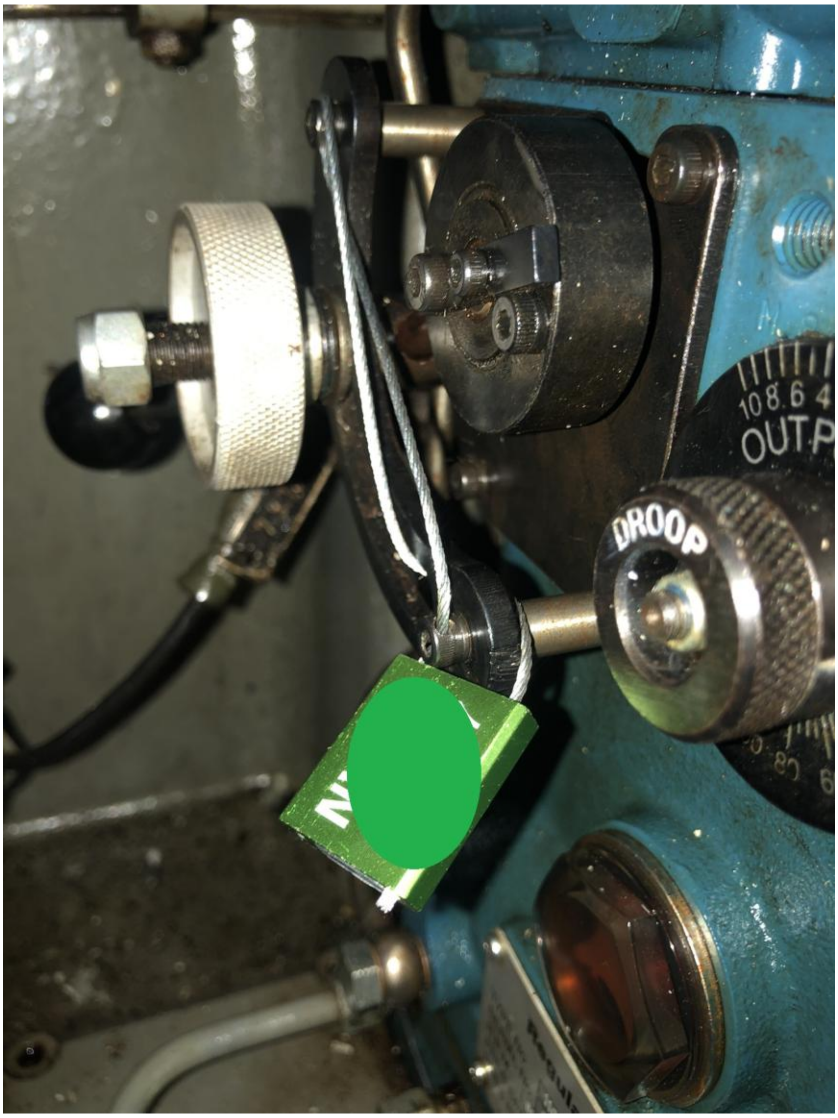


Figure 8 – Regulateurs Europa 1104 governor with front cover reinstalled and sealed to protect high idle and low idle settings.



3.10.2. Electronic derating of engines

Seals may be applied to electronically (ECU) controlled engines to ensure that the original ECU remains affixed to the engine. This does not necessarily prevent that access can be obtained to the ECU, or that a secondary ECU is connected to actually govern the engine.

3.10.2.1. Sealing the ECU connector

It may be attempted to prevent the connection of IT tools to the ECU connector with the objective to prevent tampering with the electronic settings of the engine by sealing this connector. However, blocking the ECU connector also obstructs access to the ECU for legitimate maintenance activities such as the registration of new fuel injectors. Furthermore, it is not overly complicated to circumvent the blocked ECU connector and intervene in the cabling elsewhere. Considering the above, sealing the ECU connector is not considered very effective.

3.10.2.2. Restricting the engine speed or power request externally

The engine power of an electronically controlled engine could be limited when the motor management system is programmed in such a way that the maximum engine speed or power request to the engine is restricted, without limiting the actual engine capacity as defined in the ECU. This can be considered the electronic equivalent of restricting the range of the external engine control lever, without actually limiting the maximum engine speed and / or fuel rack, which is not an acceptable method to ensure ongoing compliance.

3.10.2.3. Restricting the ECU engine performance settings

An electronically controlled engine may be marketed at various capacities in terms of maximum engine power and engine speed (ratings), sometimes available for different load profiles (sections 3.6 and 3.7). If an engine operates in accordance with, and governed by, the original factory settings, it is not derated according to the 'normal' definition of rating and derating (e.g. clause 3.19.8 of ISO 2710:2017). However, if a higher (power) continuous rating exists for the engine type under consideration (section 3.6) it may be considered derated in the context of the implementation of the (new) Control Regulation. Engine manufacturers do not use unified terminology to describe the electronic engine settings of the engines they produce. In this guidance, the term *performance specifications* is used to describe the complete set of software and embedded settings that govern electronically controlled engines. *Performance specifications* are typically identified by a *data set calibration number*, for which an *engine performance spec sheet* can be obtained from the engine manufacturer, in which all electronic engine characteristics and settings are documented.

A special part of the engine performance specification is the *engine performance map,* which defines the relation between the engine speed and the maximum torque that can be obtained from the engine at each engine speed. The engine performance map also defines the relation between the engine speed and the maximum engine power at each speed. Some software versions in ECUs permit changes to the engine performance map (*remapping*) to be made, while other software versions do not.

The certifying authority needs to obtain the exact engine performance specification of the engine it certifies as part of the processes described in sections 3.6 and 3.7. The certifying authority needs to verify whether the declared engine performance specification corresponds with the governing software as installed in all (main and backup, if any) ECUs connected to the engine, and whether the actual output of the engine is, during the physical pre-installation engine power verification described in section 3.9, as expected based on the declared performance specification.

The certifying authority needs to obtain from the engine manufacturer the following information:

1. A list of changes that can be made to the engine performance settings within the applicable engine performance specification;
2. A confirmation whether any remapping can be conducted within the applicable engine performance specification;
3. In case remapping is possible, a confirmation of the remapping limits (e.g. maximum +/- 10% torque at all speeds);
4. In case remapping is possible, confirmation whether a non-overridable password can be applied to the engine mapping after completion of the remapping process.

The information above needs to be provided by the engine manufacturer. This information may be requested and provided *through* a local official engine (sub)dealer, but cannot be a statement *from* this (sub)dealer (but from the original engine manufacturer instead).

<u>Based on the information provided by the engine manufacturer in relation to the declared and verified electronic performance specification of an electronically controlled engine, the following ongoing compliance measures should as a minimum be applied by the certifying authority:</u>

1. If the engine operates at the factory engine settings as documented in the engine performance spec sheet, and remapping is not possible:

   No further ongoing compliance measures need to be applied.

   However, the following shall be verified by the certifying authority, at least during every renewal and intermediate survey of the vessel:

   (a) The data set calibration numbers of the engine control software in every ECU connected to the engine have not changed (no indication of unauthorised change of ECU software);

   (b) The cumulative operating hours of all ECUs are plausible relative to the operating time of the vessel since the installation of the engine/ECU(s) concerned (no indication of unauthorised exchange of the ECU(s)), and the engine has predominantly been governed by the main ECU;

   (c) The historic engine performance data, as far as applicable / available, do not provide indications that the engine has been operating at a higher engine speed or engine power than expected based on its registration and the installed engine performance specification (no recorded indications of non-compliance).

2. If the engine operates at the factory engine settings as documented in the engine performance spec sheet, but remapping is possible, but the remapped settings can be secured by means of a non-overridable password:

Derating through remapping is permitted, up to a final power not lower than the lowest permitted output in accordance with section 3.6, provided that:

(a) The remapped settings are secured by a non-overridable password, to be set by the certifying authority, which cannot be shared with any other party, including the vessel owner and the engine (sub)dealer;

(b) Remapping the engine does not cause non-compliance with any other requirement applicable to the engine, including but not limited to those originating from NOx emission regulations.

In addition, the following needs to be verified by the certifying authority, at least during every renewal and intermediate survey of the vessel:

(a) The data set calibration numbers of the engine control software in every ECU connected to the engine have not changed (no indication of unauthorised change of ECU software);

(b) The adjusted engine performance map (torque vs. speed) has not changed since the initial (verified) remapping;

(c) The cumulative operating hours of all ECUs are plausible relative to the operating time of the vessel since the installation of the engine/ECU(s) concerned (no indication of unauthorised exchange of the ECU(s)), and the engine has predominantly been governed by the main ECU;

(d) The historic engine performance data, as far as applicable / available, do not provide indications that the engine has been operating at a higher engine speed or engine power than expected based on its registration and the installed engine performance specification (no recorded indications of non-compliance).

3. If it is possible to derate the engine through remapping, but not to uprate the engine, and the remapped settings cannot be secured by means of a non-overridable password:

Derating through remapping, relative to the rated power as stated on the engine performance spec sheet, verified in accordance with the procedure described in section 3.9, is not permitted.

In addition, the following needs to be verified by the certifying authority, at least during every renewal and intermediate survey of the vessel:

(a) The data set calibration numbers of the engine control software in every ECU connected to the engine have not changed (no indication of unauthorised change of ECU software);

(b) The cumulative operating hours of all ECUs are plausible relative to the operating time of the vessel since the installation of the engine/ECU(s) concerned (no indication of unauthorised exchange of the ECU(s)), and the engine has predominantly been governed by the main ECU;

(c) The historic engine performance data, as far as applicable / available, do not provide indications that the engine has been operating at a higher engine speed or engine power than expected based on its registration and the installed engine performance specification (no recorded indications of non-compliance).

4. If it is possible to uprate the engine through remapping, or if it is possible to make overload power available:

The declared engine power is the maximum overload power, or the highest attainable uprated power, whichever is higher. No derating from this power can be permitted.

In addition, the following needs to be verified by the certifying authority, at least during every renewal and intermediate survey of the vessel:

(a) The data set calibration numbers of the engine control software in every ECU connected to the engine have not changed (no indication of unauthorised change of ECU software);

The cumulative operating hours of all ECUs are plausible relative to the operating time of the vessel since the installation of the engine/ECU(s) concerned (no indication of unauthorised exchange of the ECU(s)), and the engine has predominantly been governed by the main ECU;

(b) The historic engine performance data, as far as applicable / available, do not provide indications that the engine has been operating at a higher engine speed or engine power than expected based on its registration and the installed engine performance specification (no recorded indications of non-compliance).

3.11. Sea trial

The certifying authority needs to attend a sea trial of the vessel, after an engine has been installed on board, prior to the engine is put into service. A sea trial is normally conducted in the context of vessel certification, among others to verify whether the engine performance is as required and its safety appliances operate normally.

In the context of the engine power certification process, the objectives of the sea trial are:

1. Verification whether engine settings have not changed since the pre-installation physical engine power verification;
2. Verification whether ongoing compliance measures, such as seals, have not been removed or tampered with since the pre-installation physical engine power verification;
3. The engine performance parameters are as expected based on the pre-installation physical engine power verification (section 3.9) results, under all circumstances.

If any aspect above cannot be verified or confirmed during the sea trial, the engine power needs to be measured on board as described in section 3.12.

3.11.1. The verification of engine performance parameters during the sea trial

The engine performance parameters need to be verified under the conditions where the engine may be expected to develop its maximum power (e.g. under fishing and steaming conditions, for a vessel with towed gear). A full description of the verification conditions that should be met and considered is provided in sections 4.5.6 and 4.5.7.

The engine parameters to be verified during the sea trial are all parameters that have been documented in the pre-installation physical engine power test report (section 3.9.2).

In addition to the engine performance parameters, the vessel performance parameters should be observed and documented as described in section 4.5.10.

The certifying authority should produce a sea trial report in which the trial procedure and the exact verification conditions as listed in section 4.5.7 are described, as well as the measured and observed engine and vessel performance parameters.

3.12. Certification of engines already installed on board

As described in sections 3.7 to 3.10, when a new engine is to be installed on board a catching vessel, several steps are recommended to be taken as part of the engine power certification process (suitability assessment of the engine, pre-installation physical engine power verification and the application of ongoing compliance measures).

Situations may occur where an engine, that has not undergone the steps described in sections 3.7 to 3.10, requires engine power certification. Examples of such cases include engines that undergo a *technical modification* on board which results in a change of engine power, and the entry of an existing vessel (previously operating under a different flag) into a Member State's fishing fleet.

Removing these engines from the vessel in order to test these on a test bed in accordance with section 3.9 is permitted, but may be considered excessive. Alternatively, the engine power may be measured by means of a propeller shaft power measurement, in accordance with the procedure described in section 4.5.5, during a sea trail as described in section 3.11. If a physical engine power measurement is to be conducted as part of the certification process, the following conditions need to be met:

1. The engine runs on either reference fuel or commercial fuel specified by the engine manufacturer. It is recommended to measure The Lower Calorific Value of the fuel in accordance with ASTM D 240, or to estimate it in accordance with ASTM D 3338/D 3338M. The measured Lower Calorific Value should not be less than the LCV of the fuel specified by the engine manufacturer. If the engine manufacturer has not specified the LCV of the commercial fuel to be used, a LCV of 42700 kJ/kg must be applied;
2. The engine power measurement should not be conducted on an unannounced basis;
3. An engineer may be present to adjust engine settings (derate, uprate), if permitted by the certifying authority, and if the maximum derating principles as described in section 3.6 are respected;
4. The impact of non-essential dependent auxiliaries need to be minimalised (section 4.6.2);
5. The power needs to be corrected for energy losses in the gearbox (section 4.6.1);
6. The certifying authority must determine whether the engine is self-adjusting for variation of ambient conditions. If this is not the case, the measured engine power should be corrected to ISO standard reference conditions, following the procedure described in

section 4.6.4, or to other reference conditions if specified by the engine manufacturer.

A shaft power measurement may under no circumstance be replaced by another power determination method in order to determine the engine power of an engine that is already installed on board for the purpose of certification of its engine power in the context of the Control Regulation.

When the sea trial is completed, and the engine power has been established, the ongoing compliance measures described in section 3.10 should be applied, documented and shared with the fisheries control authority without delay.

4. Engine power verification

4.1. Vessels equipped with a permanently installed system that measures and records engine power

As from 10 January 2028, a catching vessel equipped with a permanently installed system that measures and records engine power, that meets all requirements laid down in Article 39(a) of the new Control Regulation and all detailed rules concerning such systems laid down in the Commission implementing acts, is not required to undergo a data verification or physical engine power verification, other than the assessment of recorded engine power data of the permanently installed system by the competent authorities.

4.2. Vessels not equipped with a permanently installed system that measures and records engine power

Active catching vessels that are not equipped with a continuous power measurement system as described in section 4.1 must, following a risk analysis and sampling procedure, undergo a data verification. In accordance with Article 41(2) of the new Control Regulation, if there are indications that the engine power of a catching vessel is greater than the power indicated on the fishing license or in the Union or national fleet register (hereafter: indications of non-compliance), Member States are required to proceed with a physical verification of its engine power, or ensure that the catching vessel concerned is equipped with a permanently installed engine power measurement system as referred to in section 4.1.

4.3. Risk analysis and sampling

Member States are required to draw a sample of vessels from those vessels that are not equipped with a permanently installed power monitoring system as described in section 4.1., and which meet one or more of the risk criteria considered in the sampling plan.

In accordance with Article 62(1) of the Commission Implementing Regulation, the sampling plan needs to include at least three risk indicators:

1. The allocation of individual kW*days effort to the vessel;

2. The vessel being subject to power limitations resulting from European or national law;
3. The vessel power-to-tonnage ratio being 50% lower than the average ratio of vessels in the same fleet segment.

A separate random sample must be taken from each group of vessels corresponding to one of the risk criteria of the sampling plan.

The Member State should produce an annual sample report, containing at least the lists of vessels that were considered part of the risk criteria established by the Member States, and the list of vessels that were consequently randomly selected to undergo a data verification as described in section 4.4. This report could, among other purposes, be used to demonstrate effective implementation of the requirements following from Article 62 of the Commission Implementing Regulation.

A sample has to be drawn once per year. If a Member State has (a) legitimate reason(s) why an annual frequency cannot be achieved, it needs to document these reason(s) and aim for the shortest possible interval exceeding one year, between drawing the consecutive samples of vessels to undergo a data verification. The Member State needs to demonstrate, through documentation of actions it has taken, that reasonable efforts have been made to minimize the interval between drawing the consecutive samples of vessels.

4.3.1. Individual kW*days fishing effort

Member States are required to produce a list of all catching vessels, equipped with an inboard engine, that have an individually allocated kW*days capacity ceiling. This list should be included in the sample report. A sample of vessels equal to the square root of all vessels identified as having an allocated individual kW*days effort ceiling has to be randomly selected to undergo a data verification. The list of randomly selected vessels should also be included in the sample report.

4.3.2. Subject to power limitations

Member States are required to produce a list of all catching vessels, equipped with an inboard engine, that have operated at any moment during the year prior to selecting the sample in any geographical area where an engine power limitation resulting from European or national law applies.

Examples of such areas are the Plaice Box (221 kW)[27], the Gulf of Lion (316 kW), Baltic Sea Area 22 (21 kW) and Limfjorden (130 kW). This list should be included in the sample report. A sample of vessels equal to the square root of all vessels identified as having operated in an area where engine power limitations apply has to be randomly selected to undergo a data verification. The list of randomly selected vessels should also be included in the sample report.

4.3.3. Power to tonnage ratio

Member States are required to compare the power-to-tonnage ratio of all individual vessels in the fleet that are equipped with an inboard engine to the average power-to-tonnage ratio of similar vessels. To construct groups of vessels that may be expected to be broadly comparable in terms of power-to-tonnage ratio, the entire fleet of catching vessels equipped with an inboard engines may in accordance with Article 62(1)(c) of the Commission Implementing Regulation be divided by one or more of the following criteria:

1. Fleet segmentation or management units defined in national law;
2. Length categories;
3. Tonnage categories;
4. Gears authorised;
5. Target species.

The criteria used to divide the fleet into groups of similar vessels, as well as the list of all vessels that have a power-to-tonnage ratio of 50% or lower relative to the average power-to-tonnage ratio of similar vessels should be included in the sample report. A sample of vessels equal to the square root of all vessels identified as having a power-to-tonnage ratio of 50% or lower relative to similar vessels has to be randomly selected to undergo a data verification. The list of randomly selected vessels should also be included in the sample report.

4.3.4. Additional risk criteria

In accordance with Article 62(2) of the Commission Implementing Regulation, Member States may add additional risk criteria to select vessels for a data

[27] In accordance with Article 39a(1a) of the Control Regulation, catching vessels using bottom trawls or Danish seines equipped with inboard propulsive engines with a certified engine power between 120kW and 221kW operating in this area shall be equipped with a permanently installed system to measure and record engine power, as of the date of application of this article. Until then, Article 62(1b) of the Implementing Regulation shall apply to the vessels operating in this area, meaning that these vessels are considered as a separate group of high risk vessels for the risk analysis exercise under the sampling plan.

verification. Every applied additional criterion will be described in the sample report. A list of all vessels that meet the Member State’s own, additional, risk criteria should be included in the sample report. A sample of vessels equal to the square root of all vessels that meet the Member State´s own, additional, risk criteria has to be randomly selected to undergo a data verification. The list of randomly selected vessels should also be included in the sample report.

A risk criterion recommended to consider is the incorrect designation of (a) main engine(s) as an auxiliary engine in the National and / or Union fishing fleet register, and the consequential incorrect attribution of the power of this / these engine(s) to the vessel’s amount of registered auxiliary power instead of its main power. Analysis of the ratio of the registered amount of auxiliary power, relative to the registered amount of main power may identify vessels at risk of this type of engine power misregistration, and the consequences thereof on the Member States’ reporting requirements (see section 7.1).

Auxiliary-to-main power ratio: $\left(\frac{Total\ registered\ auxiliary\ engine\ power\ (kW)}{Total\ registeered\ main\ engine\ ppower\ (kW)}\right)$

Two indications of possibly misregistered auxiliary engines are:

1. An extraordinary high auxiliary-to-main power ratio of a vessel, relative to the ratio of similar vessels;
2. An exact integer as auxiliary-to-main power ratio.

4.3.4.1. A high auxiliary-to-main power ratio

To compare the auxiliary-to-main power ratio as describe in section 3.4.3(1), the fleet of catching vessels equipped with (an) inboard engine(s) may be divided into groups of similar vessels by one or more of the following criteria:

1. Fleet segmentation or management units defined in national law;
2. Length categories;
3. Tonnage categories;
4. Gears authorised.

A vessel with an auxiliary-to-main power ratio, exceeding the average ratio of similar vessels by 50% or more, should be considered to be at risk of non-compliance.

The criteria used to divide the fleet into groups of similar vessels, as well as the list of all vessels that have an auxiliary-to-main power ratio that exceeds the average power-to-tonnage ratio of similar vessels by 50% or more should be included in the sample report.

A sample of vessels equal to the square root of all vessels identified as having an auxiliary-to-main power ratio that exceeds the ratio of similar vessels by 50% or more has to be randomly selected to undergo a data verification. The list of randomly selected vessels should also be included in the sample report.

4.3.4.2. An exact integer as auxiliary-to-main power ratio

If a vessel is equipped with a twin (or triple) screw propulsion system, it is relatively common that each shaft of the vessel is driven by an identical engine. A registered amount of auxiliary power being an exact multiple of registered amount of main power (i.e. when the auxiliary-to-main engine power ratio is an exact integer), may be considered a risk indicator.

Authorities may in this case verify the propulsion configuration of the vessel from their records (e.g. survey reports with visual confirmation of the number of propellers and / or the number of engines driving each shaft), or select a sample of the vessels that have an exact integer auxiliary-to-main engine power ratio.

The size of the sample should be equal to the square root of the number of vessels that have an exact integer auxiliary-to-main power ratio, for which the authorities have not confirmed by other means that the installed engines and their respective power have been assigned correctly.

4.3.5. Considerations

1. When drawing the risk based sample of vessels to undergo a data verification, all vessels equipped with inboard engines whose engine power contributes to the Member State fleet size in terms of the kW capacity ceiling, need to be considered eligible for verification. Although the certification requirement as laid down in Article 40 of the Control Regulation does not apply to catching vessels whose propulsion engines power does not exceed 120kW and to vessels exclusively using static gear or dredge gear, auxiliary vessels and vessels used exclusively in aquaculture, not (all of) these catching vessels should be excluded from the sampling process. For example, it should not be ruled out on forehand that catching vessels with a declared engine power lower than 120kW represent a high risk of under declaration of engine power.
2. A catching vessel may meet more than one risk criteria (e.g. it operates in an area where power limitations apply, and it has a power-tot-tonnage ratio of 50% or less relative to similar vessels). In this scenario, the vessel will be part of the random sampling from both groups. This implies that it could theoretically be selected for data verification twice. In forthcoming cases, the selected vessel will be

removed from the sample in one of the groups, and a replacement vessel will be randomly selected from that group to undergo a data verification.

3. Because the sampling in principle takes place on an annual basis, in accordance with section 4.3, it is possible that a vessel is selected for multiple consecutive years. In this case, the vessel will not be removed from the sample on this basis, because the fact that a vessel has been verified once does not result in a guaranteed verification exemption thereafter.

4. In case the sample size, equal to the square root of the group size of vessels that meet certain criteria, is not an integer, the size of the group of vessels to be selected for data verification has to be rounded up to the nearest integer in accordance with Article 62(4) of the Commission Implementing Regulation.

Example 3 – Group size determination

Consider a Member State which has a fleet of 200 catching vessels equipped with inboard engines, of which 105 have operated in an area where power limitations apply at any point during the past 12 months. The square root of 105 is 10,2. Rounding up to the nearest integer gives 11. A random sample of 11 vessels will be drawn from the 105 vessels that have operated in an area where power limitations apply to undergo a data verification in accordance with section 4.4.

The Member State under consideration has a (simplified) homogenous fleet in terms of target species, tonnage etc, but can be divided in 2 length categories: vessels with a length of ≤ 20 m and > 20 m. Both groups consist of 100 vessels. The average power-to-tonnage ratio of the first group is 4,0. Assume that the first group has no vessels with a power-to-tonnage ratio of 2,0 or less. The second group has an average power-to-tonnage ratio of 3,4. Assume that 25 vessels from this group have a power-to-tonnage ratio of 1,7 or less. This implies that 5 vessels (the square root of 25) will be randomly selected from the 25 identified vessels to undergo a data verification in accordance with section 4.4.

Now assume that one vessel is both selected to undergo a data verification because it operates in an area where power limitations apply, and also because it has a low power-to-tonnage ratio. The vessel will be removed from one of both samples, and a replacement vessel will be randomly selected from the respective sample. In total, 11 + 5 = 16 unique vessels need to undergo a data verification.

4.4. Data verification of selected vessels

Following the risk based sampling procedure presented in section 4.3, a sample of vessels has to be selected on an annual basis, to undergo a data verification in accordance with Article 41(1) of the Control Regulation. Member States should conduct as a minimum the analyses presented in sections 4.4.1 to 4.4.7, and produce a data verification report of every data verification conducted. This report should contain a copy of all documents consulted and needs to be sufficiently detailed to enable the reproduction of the analysis at a later moment in time. The report also has to clearly indicate which data elements are considered to be an indication of non-compliance, and the grounds to justify the consequential decision to install a permanent power measuring device or to carry out a physical engine power verification in accordance with Article 41(2) of the Control Regulation. A list of data to be included in the data verification report is presented in section 4.4.8. The nature of the various data to be analysed and the analysis to be conducted imply that cooperation might be required between the fisheries control authority and the certifying authority as defined in section 3.1.

4.4.1. Vessel position data

Vessel position data, and derived thereof vessel speed data, can be obtained from a variety of sources including VMS and AIS systems. The objective of vessel position and speed analysis is to derive a reliable still water maximum vessel speed, while steaming and fishing (in case the vessel is equipped with towed gear).

The still water maximum vessel speed derived from digital vessel position data has to be compared to the reference maximum still water vessel speed values recorded during the sea trial when the maximum engine power was being deployed. Substantial exceedance of the reference maximum vessel speed should be considered an indication of non-compliance.

In order to conduct the analysis described above, the availability of accurate reference still water vessel speed data is required. In case no such information is available, the observed still water vessel speed could be compared to the vessel speed of similar vessels in terms of declared engine power, length, tonnage and fisheries typology. However, it should be noted that individual vessel characteristics not reflected in the aforementioned parameters may cause substantial speed differences between individual vessels, and that this method may not reveal non-compliance in the case of widespread non-compliance within a specific fleet (segment).

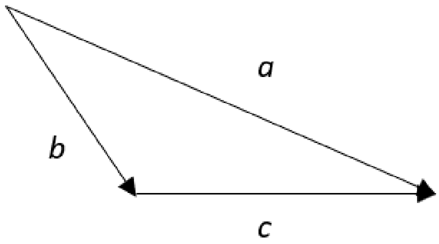
Two methods to approximate still water vessel speed from digital vessel position date are presented hereafter: the vector method and the averaging method.

1. Vector method

The vector method is used to approximate the vessel's still water speed through a combination of the actual current condition (direction, speed) and the recorded vessel speed and course at the same moment. Such analysis is only possible if accurate tidal data are available for the vessel's position, and if other factors affecting the vessel's speed have limited effect (the water shall be deep, the sea state shall be calm and the wind force shall be low). The analysis needs to be conducted for several measuring points, to avoid identification of a vessel as being potentially non-compliant based on a single outlier.

The vector of vessel speed as obtained from digital vessel position data, represented by *a* in figure 9, needs to be combined with the reported current condition at the respective position and time, represented by *b*, to find the resulting still water speed, represented by *c*.

Figure 9 – Vector addition method based on digital vessel position and current data



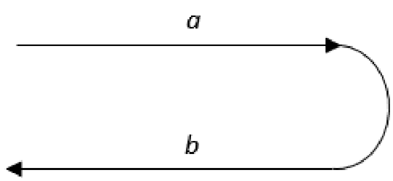
Annex 4 contains an example of application of the vector method.

2. Averaging method

The averaging method is used to approximate the vessel's still water speed through averaging two vessel speed values recorded while the vessel was moving in opposite directions. The time between recording two speed values has to be kept to a minimum, the parallel distance between the two measuring points should be as small as possible and the difference of the vessel heading between the two measuring points has to be as close as possible to 180 degrees, in order to minimise the impact of any difference in sea state, current or wind conditions between both measurement points, and to resemble the 'double run' described in section 4.5.7.4 as closely as possible. The analysis should be repeated several times, to avoid a vessel being identified as potentially non-compliant based on a single outlier.

If a vessel track as presented in figure 10 is considered, the still water speed value would be the average value of speed values collected in direction *a*, averaged with the average of speed values in direction *b*. The available weather, sea state and current conditions at the time and position of data collection have to be documented in the data verification report.

Figure 10 – Averaging method vessel still water speed approximation based on digital vessel position data.



The averaging method is only suitable for catching vessels operating towed gear in a typical ‘zig-zag’ pattern, as the track of other vessels do normally not result in the required data to analyse a double run. The main relative advantage of the averaging method compared to the vector method is its lower dependency on accurate current data and its lower susceptibility to influences of wind and sea state.

Annex 5 contains an example of application of the averaging method.

The vessel speed analysis recommended in this section cannot be performed for catching vessels that do not provide VMS or AIS data. In accordance with Article 9(2) of the (new) Control Regulation, a VMS transponder is mandatory for all Union fishing vessels with a length of 12 metres overall or more[28]. In accordance with Article 10 of the (new) Control Regulation, fishing vessels whose overall length exceeds 15 metres, shall be equipped, and maintain in continuous operation, an AIS system.

4.4.2. Fishing logbook data

The following parameters could be derived from the fishing logbook:

1. Catch volume per unit time per fish species

The catch volume per unit time allows for comparison with peer vessels in terms of length, tonnage, gear type, geographical area of operation and declared engine power. Substantially higher catch volumes reported by a verified vessel could be an indication of non-compliance. Catch volume per unit time per species is a suitable parameter to cross-check indications of non-compliance obtained from vessel speed analysis, to verify whether a relatively fast vessel has also landed relatively large catch volumes.

To enable a meaningful comparison between the catch of a verified vessel and that of peer vessels, Member States should identify vessels of similar characteristics (e.g. similar length, that have operated in the same geographical area, at the same time, preferably for an extended period of time, have operated the same gear type, have landed catches of a comparable composition etc.). Accounting for a larger number of vessels in the analysis provides a more accurate average catch per unit time value, and more information about the variation of catch quantities reported by individual operators. The number of

28 Member States may exempt Union fishing vessels of less than 15 meter of this obligation, under the conditions of Article 9(5) of the Control Regulation. As of the date of application of Article 9(2) of the Control Regulation, each Union fishing vessel shall have installed on board a fully functioning device allowing the vessel to be automatically located and identified by a vessel monitoring system through transmitting automatically the vessel position data at regular intervals. Under the conditions of Article 9(3) of the Control Regulation, catching vessels of less than 9 meter may be exempted of this obligation.

vessels to be included in the analysis of peer vessels depends on the fleet size, the work load associated with conducting this analysis and the variation in the reported catch volume per vessel (a large variation in catch volume per unit time requires more vessels to be evaluated in order to produce reliable averages).

This method is less effective to identify non-compliant vessels in a fleet (segment) where non-compliance with declared engine power is widespread, because non-compliance of peer vessels reduces the observed difference of a verified vessel relative to its peer vessels in terms of catch volume per unit time.

2. The actual operation in effort zones

Plotting catch volumes caught in effort zones by vessels subject to an individual kW*days effort allocation relative to the time the vessel under consideration actually spent in the respective effort zone(s), indicates the effectiveness of (high-risk) vessels in (high-risk) specific zones. Comparative analysis of catch volume per unit time similar to the analysis described above should be conducted. Equally to the analysis of catch volume per unit time per species presented under point 1 of this section, this method is less effective to identify non-compliant vessels in a fleet (segment) where non-compliance with declared engine power is widespread.

In case a vessel is part of the sample of vessels eligible for a data verification because of its operation in a kW*days effort regime (also see section 4.3.1), logbook data will disclose the relative activity of the vessel in areas where this individual effort regime applies.

3. The actual operation in engine power restricted areas

Plotting catch volumes caught by vessels operating in (an) area(s) where engine power restrictions apply, relative to the time actually spent in the engine power restricted area, indicates the effectiveness of vessels in engine power restricted areas. Comparative analysis of the catch volume per unit time, similar to the analysis described above, should be conducted. Equally to the analysis of catch volume per unit time per species presented under points 1 and 2 of this section, this method is less effective to identify non-compliant vessels in a fleet (segment) where non-compliance with declared engine power is widespread.

In case a vessel is part of the sample of vessels eligible for a data verification because of its operation in an area where engine power restrictions apply (also see section 4.3.2), logbook data will disclose the actual activity of the vessel in areas where this engine power restrictions apply.

Other parameters that could be evaluated based on fishing logbook data include the transit time between the port and fishing grounds, but individual vessel characteristics such as hull and propeller design, as well as the exact distance between the fishing grounds and the port make this type of analysis difficult and less meaningful.

4.4.3. The Engine International Air Pollution Prevention (EIAPP) Certificate

The purpose of the EIAPP certificate is to confirm that an engine, as designed and equipped, complies with the maximum relative NOx emission as laid down in the form of Tier levels in IMO MARPOL Annex VI regulation 13. The EIAPP applies to an engine, whereas the International Air Pollution Prevention (IAPP) certificate applies to a vessel. It is required that the propulsion engine installed in a catching vessel which has an IAPP certificate issued, also has (an) EIAPP certificate(s) issued to the engine(s) installed in the vessel. However, vessels with a gross tonnage less than 400 GT and / or vessels engaging exclusively in domestic voyages are exempted from the IAPP certification requirement. Nevertheless, flag state authorities have to establish an alternative NOx control measure to ensure compliance with the NOx emission requirements laid down in regulation 13 of MARPOL Annex VI, for main propulsion diesel engines with a power output of more than 130kW, installed on or after 1 January 2000, on board vessels that are not subject to the IAPP requirement. The documentation related to this alternative NOx control measure may be verified in the context of the engine power data verification instead of the EIAPP certificate, where applicable.

The EIAPP certificate specifies the rated (maximum continuous) engine power and the rated engine speed for which the EIAPP certificate has been issued. It should be noted that an EIAPP certificate may be issued as a pre-certificate under the so-called family concept, if the certified engine has been constructed identically to a parent engine which has been tested on a test bed to demonstrate compliance with the applicable NOx emission limits.

In the context of the engine power data verification, authorities need to verify whether the engine power documented on the EIAPP certificate corresponds to the declared engine power of the vessel. In case these values do not match, the authorities have to determine whether a new EIAPP certificate should have been issued.

In case the engine power documented on the EIAPP certificate exceeds the declared engine power of the engine, the engine may have been derated or its power may have been under-declared, which are both indications of non-compliance.

The EIAPP is directly linked to a so-called Technical File, which documents among others the NOx critical engine components and settings, that may not be changed in order to maintain the validity of the EIAPP certificate and thus to ensure ongoing compliance with the applicable NOx emissions limits. In the context of the engine power data verification, the authorities have to identify those components described in the Technical File that are associated with engine power and speed, and their respective verification methods. A copy of the reviewed EIAPP certificate and the respective Technical File must be included in the data verification report. An example of the standardised EIAPP certification and Technical File is included in Annex 6.

4.4.4. Class certificates

Certificates issued by recognised ship inspection and survey organisations within the meaning of Directive 94/57/EC include one or more certificates that state the main engine power value. The most important certificate is the Certificate of Class, or equivalent document, which certifies that the vessel meets all applicable class rules and requirements. The main engine power of the vessel is documented on the Certificate of Class, or Member State equivalent certificate, or in the connected machinery particulars document, and should in principle be equal to the engine power as found in the register of ships, and the engine power stated on the fishing license(s) of the vessel. Any discrepancy between the certified power and the power as declared on any of the other documents should be considered an indication of non-compliance in the context of the engine power data verification. An example of a Certificate of Class certificate is included in Annex 7.

4.4.5. Sea trial report

A sea trial is typically performed before a vessel enters into service, to verify whether it meets all class and regulatory requirements, and to verify whether the performance of the vessel is in accordance with the contractual requirements as agreed between the shipyard and its client. A sea trial may also be conducted after a major conversion, which may include the replacement of the main engine.

A sea trial report typically contains engine and vessel performance data. Any engine power value or other engine data reported in the sea trial report which suggests the availability of excess power should be considered an indication of non-compliance in the context of the engine power data verification. Where available, the reported vessel speed at the reported engine power should be compared to recent speed data collected through digital vessel position systems, as described in section 4.4.1.

4.4.6. Union Fleet Register

The engine power values collected from the sources and documents discussed in sections 4.4.1 to 4.4.5 have to be compared to the main engine power registered in the EU fleet register and to the main engine power registered in the Member State’s National Fleet Register. Attention must be given to ensure that main and auxiliary engine power are accurately reflected in both registers and correctly derived from the sources and documents referred to in sections 4.4.1 to

4.4.5. Any discrepancy between those values are to be considered as an indication of non-compliance in the context of the engine power data verification.

4.4.7. Other documents

Any other document(s) providing relevant information on vessel power or any related technical characteristics may be considered for evaluation against the engine power values and other vessel performance parameters obtained from the sources and analyses described in sections 4.4.1 to 4.4.6.

4.4.8. Data verification report

As described in section 4.4, the Member State should produce a data verification report. The following elements should, based on the procedures presented in section 4.4.1 to 4.4.7, as a minimum be documented in this report:

1. All data evaluated in the context of the vessel speed analysis (section 4.4.1):
   (a) A list of vessel speed data points: date, time, position and speed over ground of the verified vessel;
   (b) A description of the conditions at each data point: water depth, current, wind and sea state (if available);
   (c) The results of vector or averaging still water speed calculations;
   (d) Similar to the above mentioned data points and corresponding description of condition: list format data for the evaluation of speed of peer vessels (if applicable and available);
   (e) The calculation of peer vessels' still water speed (if applicable and available);
   (f) A comparison between the verified vessel's speed and the peer vessels' speed (if applicable and available).
2. All data required to reproduce the conducted analysis of the fishing logbook, as well as the findings of the respective analysis (section 4.4.2):
   (a) A copy of all raw data used for the catch volume per unit time calculation of the verified vessel;
   (b) A list of vessels included in the peer analysis and all criteria used for their selection;
   (c) A copy of all raw data used for the catch volume per unit time calculation of all peer vessels;

(d) The calculation of catch volume per unit time of the verified vessel and all peer vessels, including a comparative analysis;

(e) The assessment of vessel operation in (an) area(s) where individual kW*days effort allocation applies (if applicable);

(f) The assessment of vessel operation in (an) area(s) where engine power limitations apply (if applicable).

3. A copy of the EIAPP certificate and the respective Technical File (section 4.4.3);

4. Copies of all certificates issued by the recognised ship inspection and survey organisation that were reviewed in the context of the engine power data verification (section 4.4.4);

5. A copy of the sea trial report (section 4.4.5):

   (a) A summary and analysis of all reported data considered relevant in the context of the engine power data verification.

6. The main engine power of the vessel obtained from the union fleet register and from the Member State’s National Fleet Register (section 4.4.6);

7. Copies of all other documents analysed in the context of the engine power data verification (section 4.4.7).

4.5. Physical engine power verification

4.5.1. Selection of vessels for physical engine power verification

A vessel selected to undergo a data verification must thereafter undergo a physical engine power verification, or have a permanent power measuring device installed referred to in Article 39a(1) and Article 39(7) of the new Control Regulation as of the date of application of these articles (10 January 2028), in case at least one of the analyses described in sections 4.4.1 to 4.4.7 yields an indication of non-compliance. The Member State will also proceed to a physical verification, or have a permanent power measuring device installed referred to in Article 39a(1) and Article 39(7) of the new Control Regulation as of the date of application of these articles (10 January 2028), if one or more of the following situations apply:

1. More than one of the analyses described in sections 4.4.2 (fishing logbook), 4.4.4 (Certificate of Class or Member State equivalent certificate), 4.4.5 (sea trial report) and 4.4.6 (Union fleet register) cannot be performed;
2. An active vessel that is legally required to be equipped with a VMS and / or AIS transponder as described in section 4.4.1, but whose vessel position data cannot be analysed, irrespective of the reason why the analysis cannot be conducted;
3. A vessel equipped with an engine that is legally required to be EIAPP certified as described in section 4.4.3, but whose EIAPP certificate cannot be analysed, irrespective of the reason why the analysis cannot be conducted.

In case the sampling and data verification process described in sections 4.3 and 4.4 does not yield any indication that any vessel needs to undergo a physical engine power verification for two consecutive years, it is recommended to select a sample of vessels from all vessels that have undergone a data verification during the most recent verification cycle, to undergo a physical engine power verification. The size of this sample should, as a minimum, be equal to the square root (rounded up to the nearest integer) of the number of vessels that had to undergo a data verification during the most recent verification cycle.

In addition to the risk-based selection described in the previous sections, Member States may select additional vessels for physical verification following their own considerations. These considerations and a list of the consequentially selected vessels should be included in the sample report described in section 4.3.

4.5.2. Principles regarding early notification of vessels selected for physical engine power verification

Member States are recommended to take all possible actions to conduct physical engine power verifications on an unannounced basis. In order to protect the element of surprise to maximise the physical engine power verification effectiveness, the following principles apply:

1. Member States will not inform the vessel operator by any means earlier than strictly necessary about the fact that a vessel has been selected to undergo a physical engine power verification.
2. Member States will not replace a physical engine power verification, following the selection of a vessel to undergo a physical engine power verification in accordance with the procedures described in sections 4.3 and 4.4, by any other form of inspection.
3. Member States will not conduct a pre-inspection, any other form of check or otherwise pre-notify the vessel owner between the moment of selection of the vessel for a physical engine power verification and the moment when the physical engine power verification takes place, as this could serve as warning to the vessel owner about the upcoming physical engine power verification.

4.5.3. Responsibilities

Member States need to ensure that all legal requirements are met and practical preparations are completed to ensure that the selected vessel can undergo all steps of the physical engine power verification as described in this document.

In accordance with Article 104 of the Commission Implementing Regulation, the duration of an inspection should not exceed 4 hours. In accordance with Article 104(4), this limit does not apply where the officials need further information. In those cases where the verification cannot be finalised within the available 4 hours, obtaining an adequate verification result may be considered a need for further information, which justifies the extension of the verification to the shortest duration required to obtain an adequate verification result, to the assessment of the officials.

In case the verification yields indications of non-compliance, this (detection of an apparent infringement) justifies in accordance with Article 104(4) of the Commission Implementing Regulation the (further) extension of the verification duration to enable investigation of these indications and the collection of further evidence.

In case multiple entities are involved in the physical engine power verification, e.g. (an) external contractor(s) for the measurement of shaft power and / or electronic engine diagnostics, it is particularly important to consider that external contractors have no authority to board the vessel unless explicit permission is granted by either the vessel operator or the Member State's authority. In addition, the Member State's authorities are required to inform all involved entities about their duty to contribute to the preservation of the unannounced character of the verification, as described in section 4.5.2.

Above all, it should be clearly communicated by the Member State's authorities, that the physical engine power verification can only be conducted if all parties involved agree that all tasks can be completed in a safe and responsible manner. Every individual involved in the verification process is required to assess whether his task can be performed safely before commencing any task.

In case any individual involved in the verification observes an unsafe situation, the verification works needs to be suspended until the unsafe situation has been resolved or, in case this is not possible, the verification must be aborted.

Prior to the verification, it needs to be verified that it is safe to install the measuring equipment and to conduct a trial voyage with the vessel and all required personnel (crew, Member State(s) official(s) / inspector(s) and external contractor(s)):

1. Prior to approaching the vessel, the Member State's authorities need to ensure that all required personnel and external contractor(s) that will be on board during the verification, are qualified, physically fit and sufficiently inducted to take part in the verification;
2. Prior to commencing the installation works, the escape routes on board need to be observed and verified that these are free of obstacles;
3. Prior to commencing installation works, it needs to be ensured that the engine is switched off and may not be started until the engineer installing the measurement equipment informs the master that all is clear and the engine may be started;
4. Prior to commencing installation works, the surrounding of the (propeller) shaft and the engine need to be inspected for potential hazards. This includes, but is not limited to, slip and trip hazards, hot surfaces, the presence of hazardous substances, electrical installations and the evacuation capability of the engineer that will be working at the shaft. It also needs to be ensured that the working place is well lit to maximise visibility of the working area and potential hazards;

5. Prior to commencing the works, it should be considered that e.g. the absence of communication devices or language barriers will increase the risk. It should be considered that the Member State authority's representatives and the external contractor(s), if applicable, will likely work in high risk areas such as in the engine room and on the deck, while the engine is operating at its maximum capacity and the vessel might perform fishing or bollard pull operations;
6. Prior to commencing the engine power verification voyage, the Member State's authorities are required to observe that the required lifesaving appliances are in place. Since the number of people on board may differ from the crew size during a normal fishing trip, special attention need to be paid to floatation devices such as life jackets and life raft capacity.

During the entire verification, safety aspects to consider include, but are not limited to:

7. The correct use of adequate personal protective equipment (PPE) appropriate and / or required for the task. This may include protective clothing, helmet, protective footwear, protective eyewear, hearing protection, life jacket, protective gloves, breathing apparatus, etc.;
8. The correct use of all equipment used in the context of the verification and in accordance with the manufacturer's specifications and / or recommendations.

In addition, Member States' authorities must be aware and should clearly communicate to vessel operators that neither the authority nor the contractor can be held liable for damage to the engine, gear(s) or any other part of the vessel, or any other vessel or structure, or for injury to or the loss of life of any person as a result of any event related to the physical engine power verification.

4.5.4. Preparation of the verification

As will be discussed further in section 4.5.5, the vessel's main engine power must in principle be measured by means of a strain gauge based torque meter and revolutionary speed meter. Therefore it is assumed throughout the remainder of section 4 that the power measurement is strain gauge based.

In case the length of the available propeller shaft segment on board a vessel to be inspected is known, and information about the accessibility is known, it can to a certain extent be predicted whether such a strain gauge based shaft power measurement can be conducted on board a target vessel. This information is not normally available to fisheries control authorities, and inspecting the vessel shortly before the verification with the sole objective of collecting this information could jeopardise the unannounced character of the verification. It is therefore recommended to collect the following information of *all* vessels that *may* be selected for engine power verification during regular inspections or surveys:

1. **The length of the available propeller shaft segment.** In order to obtain an accurate measurement result, the strain gauge needs to be mounted on a homogeneous portion of the propeller shaft. The length of the shaft must be at least twice the diameter of the shaft in case of a solid shaft, and should offer sufficient space to mount the transmitter, battery and cabling at the shaft or at a nearby flange.

2. **The presence of obstructing equipment near the propeller shaft.** The shaft-mounted equipment (typically the gauge, cabling, battery and transmitter) need to stay clear of all surrounding equipment while the shaft is revolving. It must therefore be verified that there is sufficient clearance between the shaft and nearby equipment. How much clearance is required depends on the dimensions of the equipment used, but 5 cm is sufficient for most common portable torque measurement systems. When assessing the obstruction of nearby equipment, it must be considered whether the surrounding equipment may be expected to vibrate in operation, whether the equipment is a potential source of water or oil leakage, and to what extent the equipment will obstruct the installation of the equipment (e.g. because it is located in the line of sight between the installing engineer and the propeller shaft).

3. **The reachability of the shaft.** Whether or not the measurement equipment can be installed at a certain position depends to a certain extent on the skill, size and flexibility of the installing engineer. It is recommended that, during one of the aforementioned regular inspections or surveys, an inspector checks whether the shaft is reachable by attempting to grab around the shaft with two hands <u>after the shaft has been confirmed to be in standstill</u>. If this is possible, a specialist engineer is as a rule of thumb likely to be able to install the measurement equipment.

When the suitability of a vessel to undergo a physical engine power verification is assessed during a regular inspection or survey, following the steps above, it is recommended to support the findings of this inspection with pictures. When dimensions are verified (e.g. the length of the available shaft segment, or the clearance between the shaft and the nearest obstructing piece of equipment), it is recommended to place an element with known dimensions in the picture, such as a ruler or a tape measure.

Figure 11 – The useful segment on the propeller shaft is indicated by the red arrow. It is recommended to verify whether the shaft segment is safety reachable with two hands, sufficiently long and free of surrounding obstacles.

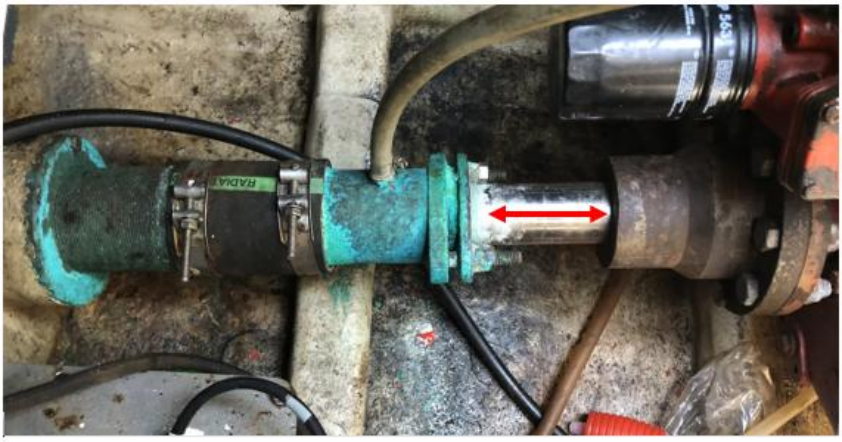
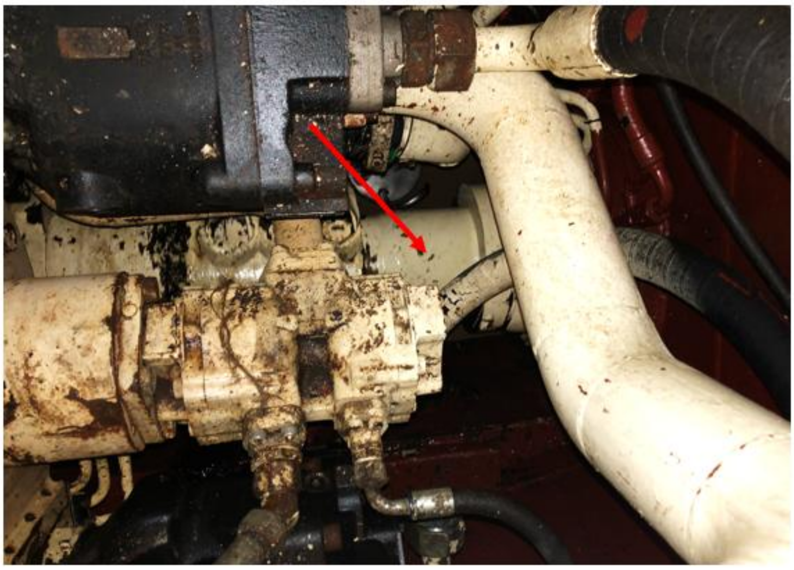


Figure 12 – Example of a propeller shaft segment (red arrow) which is too short to obtain reliable measurement results.

Figure 13 – Example of a propeller shaft (indicated by the red arrow) which cannot be reached to mount power measurement equipment on it, unless a substantial amount of equipment (pumps, piping) is removed.



In addition to information about the suitability of the (propeller) shaft to conduct a physical verification on board the selected vessel, it is recommended to collect the following information in preparation of the verification:

1. Risk indicators observed during the data verification;
2. Main vessel information such as the vessel's dimensions and the fishing gear it operates;
3. Engine information such as the brand and type of the installed engine, the registered and rated engine power and nominal engine speed. Information about the engine installed on board is critical to ensure that the correct (IT) tools can be made available during the verification;
4. Operational data such as the vessel's recent geographical area(s) of operation, the average duration of a fishing trip, typical landing times and ports, but also the speed of the vessel during recent fishing and transit voyages.

In case the Member State's authorities rely on an external contractor for the assessment of the vessel's compliance, the information listed in this section should be shared with the contractor well in advance, to enable selection of the correct IT tools and other equipment and preparation of the verification in detail.

4.5.5. Physical measurement of power

In accordance with ISO 15016:2015, the vessel's main engine power in principle has to be measured by means of a strain gauge based torque meter and revolutionary speed meter. In case there is a suitable segment of clear shaft available and accessible at the immediate output of the engine, the torque measuring equipment should be installed at that position. In case there is no suitable shaft segment available at the immediate output of the engine, the torque measuring equipment has to be installed at the propeller shaft. In case no suitable shaft segment is available either at the immediate output of the engine or at the propeller shaft, the engine power verification as described in this document cannot be conducted. This scenario is discussed in section 8.3 of this document.

4.5.5.1. Equipment

The Member State´s authority need to ensure that the equipment used to measure the vessel's engine power, has been calibrated in accordance with the procedures described in ISO 23048:2018, not longer than 12 months prior to the physical verification. The average error rate of the power, determined in accordance with ISO 23048:2018, must not exceed 2,5%, and a copy of the measurement equipment calibration report has to be included in the engine power verification report.

4.5.5.2. Personnel

The Member State´s authority need to ensure that the shaft power measurement equipment is installed and operated by qualified, skilled and experienced personnel. Engineers responsible for the installation and operation of shaft power measurement equipment need, as a minimum, to have:

1. Followed and successfully completed a training about the installation and correct operation of the equipment used;
2. Demonstrable experience in the performance of strain gauge based shaft power measurements, including experience on board catching vessels.

4.5.5.3. Installation

A strain gauge based system is based on the principle that torque applied to the shaft induces a material deformation which can be measured at the surface of the propeller shaft, known as (micro)strain. A typical (full) Wheatstone bridge strain gauge consists of 4 resistors oriented 45 degrees relative to the centreline of the shaft (schematic full bridge strain gauge layout in figure 14).

The resistance of each resistor will decrease or increase, depending on its relative orientation and the direction of the torque, as a result of extraction or compression of the shaft material. The application of an electrical voltage between positions B and D, will result in a measured voltage between positions A and C. The output of the gauge (mV/V) will, within the working range of the strain gauge, change proportionally to the change of the shaft torque.

The strain gauge is applied to the propeller shaft in accordance with the instructions provided by the manufacturer(s) of the measuring device, the strain gauge and the adhesive used. As a minimum, the following generic steps need to be considered:

1. **Surface preparation**. The area of the propeller shaft where the strain gauge will be mounted must be prepared in accordance with the instructions of the gauge and adhesive manufacturers. In general, the surface needs to be free of scratches and dents, and to be grinded to the correct roughness (not too smooth / too rough), homogeneously over the prepared surface. Subsequently, the surface needs to be rinsed and pH neutralized.
2. **Gauge alignment.** The centre line of the strain gauge needs to be aligned with the propeller shaft.
3. **Adhesive selection.** The selected adhesive needs to be suitable for the application, certified and cannot be past its expiry date. The selection of the adhesive may depend on the expected time the gauge will need to remain usable, the ambient temperature, the ambient humidity and the available installation time. Any adhesive needs to be applied strictly in accordance with the adhesive manufacturer’s instructions.

Figure 14 – Schematic full-bridge strain gauge.

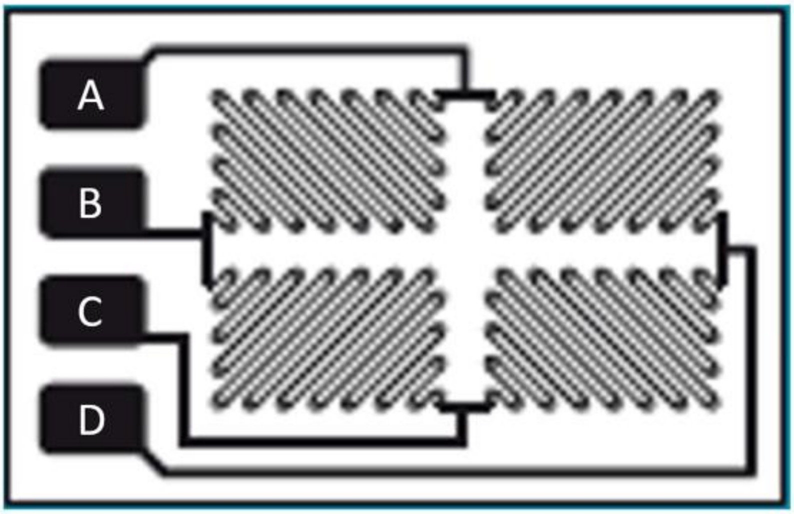


Figure 15 – Example of a strain gauge installed on a propeller shaft.

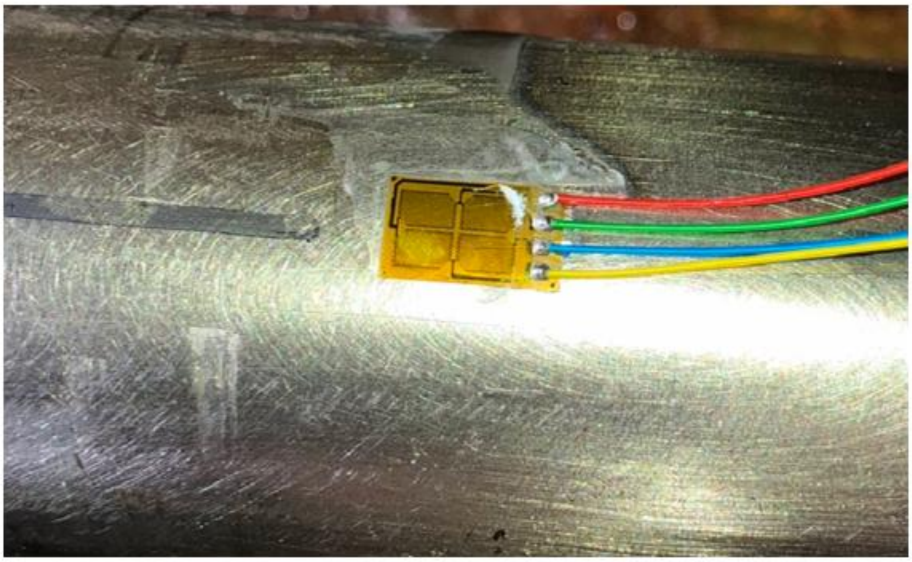
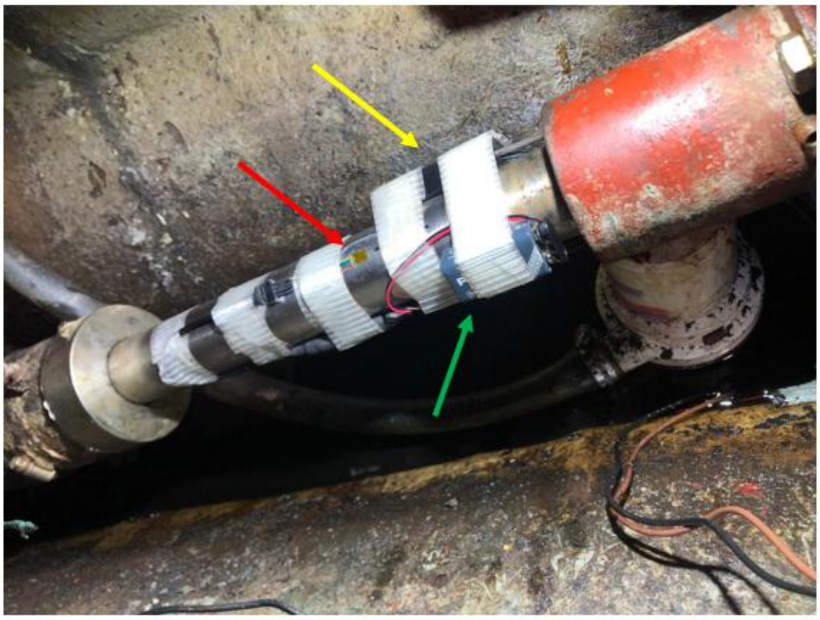


Figure 16 – Example of a strain gauge (red arrow), transmitter (yellow arrow) and battery (green arrow) mounted on a propeller shaft.



In order to arrive from a gauge output (mV/V) at a torque (Nm) value, certain parameters must be known, measured or assumed:

1. The gauge factor quantifies the relation between the measured gauge output and the material (micro)strain. The gauge factor is specified by the strain gauge manufacturer.
2. The below listed shaft properties are required to determine how much torque corresponds with the observed amount of (micro)strain:
   (a) The external shaft diameter;
   (b) The internal shaft diameter;
   (c) The G-Modulus of the shaft steel.

The external diameter of the propeller shaft can be measured, by means of calibrated callipers or another suitable calibrated method.

If the propeller shaft is hollow, for example because the vessel is equipped with a controllable pitch propeller, the internal diameter of the shaft must also be determined. If a drawing of the propeller shaft is available, this could provide the required information. Alternatively, the internal diameter can be determined by measuring the shaft material thickness by means of a calibrated ultrasound thickness gauge. Deducting twice the material thickness from the external diameter gives the internal shaft diameter.

In case the G-modulus of the (magnetic) shaft steel is unknown, a value of 82400 N/mm^2 has to be assumed, in accordance with clause 6.1 of ISO 15016:2015.

All parameters used to convert the strain gauge output into torque have to be documented and reported.

Figure 17 – Example of the use of callipers to measure the external diameter (110 mm) of a propeller shaft.

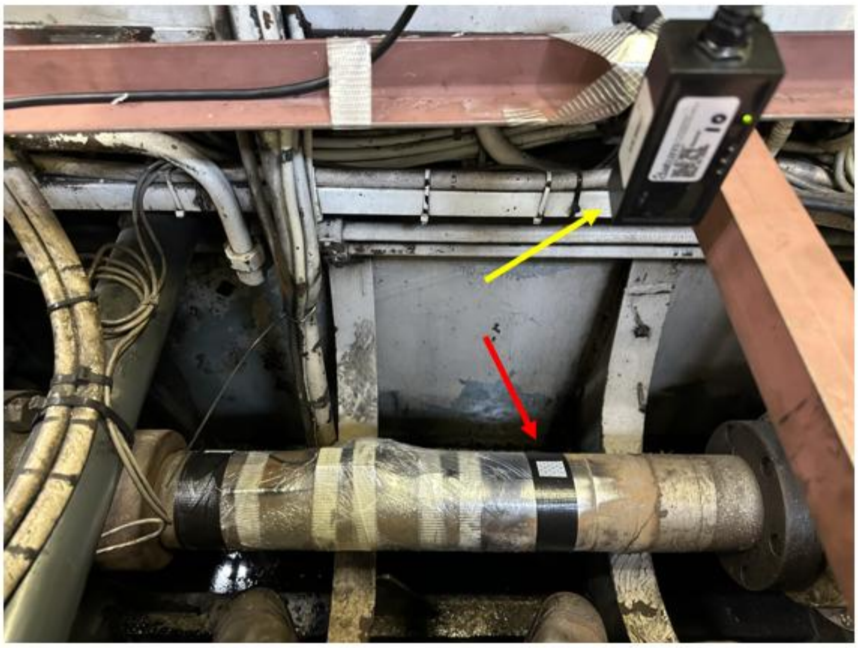
Before starting the engine and commencing the trial, the unloaded output (mV/V) of the applied strain gauge has to be recorded and documented. A too high (absolute) output or varying output of an unloaded strain gauge are indications of a faulty installation. The maximum permissible (absolute) output of an unloaded strain gauge is specified by the strain gauge manufacturer and has to be observed at all times.

The setup of the data acquisition and processing software must associate the unloaded strain gauge output with zero Nm. In the event of a lengthy verification, or when temperature effects on the unloaded strain gauge output may be expected, it is recommended to verify, and if necessary adjust, the zero Nm setting at sea, shortly before the first verification run is commenced. In case the zero Nm setting is adjusted at sea, it must be verified that the shaft is indeed unloaded at that moment.

Before starting the engine and commencing the trial, the accuracy of the signal processing and data acquisition system needs to be verified using either the shunt calibration technique, or by temporarily replacing the strain gauge by resistors with exactly known properties. The results of the on board verification of the signal processing and data acquisition system has to be documented and reported.

In addition to shaft torque, the shaft revolutionary speed must be measured to enable the calculation of power. The most common sensor type for portable power measurement systems is the infrared (reflector) sensor.

Figure 18 – A torque measurement system mountel at a propeller shaft, covered by protective foil. The reflector (red arrow) and strain signal receiver with integrated speed pick-up (yellow arrow) of the infrared shaft speed measurement system are visible.



4.5.5.4. Speed, torque and power data recording

During the physical engine power verification, the measured revolutionary shaft speed, shaft torque and shaft power values need to be recorded and logged at fixed intervals that should not exceed 10 seconds. It is recommended to retain an unprocessed copy of the raw data for at least 5 years, or longer depending on Member State specific national legislation, to remain available for further analysis in case verification results are questioned or disputed or are part of an infringement procedure.

4.5.6. Vessel operating conditions during the verification

The objective of the physical engine power verification is to determine whether the registered engine power of the vessel can be exceeded by the engine installed on board the vessel. The actual engine power is the balance point between the load generated by the vessel, its gear, propeller, loading conditions, hull condition and the load affecting external factors at one side, and the power being produced by the engine at the other side. Both the load generated by the vessel and the power produced by the engine are to a certain extent controllable, and therefore need to be considered.

In order to observe the maximum engine power, it is particularly important to understand the effect of the propeller pitch and the deployment of fishing gear on the power demand generated by the vessel. Whether a vessel is equipped with a controllable pitch propeller, or active fishing gear, determines which trial procedure shall be followed.

In any case, a steady-state ship's condition needs to be pursued throughout each verification run. No fixed time before the ship reaches a steady state can be given. In order to verify that the ship reached the steady ship's condition, the measured values of propeller shaft speed, shaft torque and ship's speed have to be monitored. When all three values are stable the ship's condition can be deemed 'steady'.

4.5.6.1. Passive gear, fixed pitch propeller

The main link between engine power and productivity of catching vessels that exclusively use passive gear, is that more engine power enables the vessel to transit faster between ports and fishing grounds. The engine power of this type of vessel shall be verified when the vessel is steaming. If the pitch position of the vessel's propeller is fixed, i.e. not controllable, the maximum engine power will normally coincide with the highest attainable engine speed. In case there is doubt whether the maximum engine power coincides with the maximum engine speed (e.g. for planning fast craft), the engine speed may be gradually reduced, starting at the highest attainable engine speed, until the maximum engine power is observed.

4.5.6.2. Passive gear, controllable pitch propeller

Similar to a vessel with passive gear and a fixed pitch propeller, the engine power of a vessel with passive gear and a controllable pitch propeller shall be verified while steaming. Since the propeller pitch is controllable, it needs to be set to the position which results in the maximum power being delivered by the engine. This position can be found by first setting the engine speed to maximum, with the pitch in a near-zero position, whereafter the pitch is gradually increased, which will cause the measured power to increase. There may be a point where increasing the pitch beyond that point results in an engine speed drop-off and shaft power drop-off. If this is the case, the maximum engine power can be found at the pitch setting *just* below this drop-off point.

4.5.6.3. Towed gear, fixed pitch propeller

Vessels with towed gear may utilize more power while fishing than while steaming. Measuring the engine power only under steaming conditions is therefore not sufficient to verify the maximum engine power of a vessel equipped with a fixed pitch propeller and towed gear.

The maximum engine power under both steaming and fishing conditions can be observed when the engine speed demand is set to maximum. It should be noted that the highest power could be measured while fishing, but also while steaming. The latter may occur if the engine power under fishing conditions is restricted through limitation of the fuel supply, but the maximum engine speed has not been limited, or limited to a speed substantially higher than the engine speed that is observed when the vessel is fishing.

When a vessel is equipped with beam trawls, the engine power should be measured with the gears positioned just below the water surface. This gear position is generally associated with a slightly higher load relative to the gears positioned at the seabed, and generates a very stable load as well.

4.5.6.4. Towed gear, controllable pitch propeller

Similar to the previous section, vessels with towed gear may utilise more power while fishing than while steaming. However, independent control of the engine speed and propeller pitch offers the possibility to regulate the engine load to a large extent by means of the pitch control. In some cases, the engine power can be verified without deployment of the fishing gear.

It is recommended to first measure the engine power under steaming conditions. Similar to vessels with a controllable pitch propeller and passive gear, the engine speed must be set to maximum, whereafter the propeller pitch is gradually increased, starting from near-zero. If it is observed that increasing the pitch beyond a certain position results in a drop-off of the engine speed, the maximum engine power has already been obtained (at the pitch position just below that drop-off point). Deploying the gear would induce additional load, but this would not result in additional engine power, since it has already been established that the engine cannot produce additional power. Therefore, deploying the gear in this situation is not required to observe the maximum engine power. It could however still be useful to deploy the gear, in order to record the vessel's fishing speed. As described in section 4.5.10 of this document, the vessel speed is a relevant parameter in the broader power verification context.

If no drop-off point is observed within the propeller pitch control range under steaming conditions, i.e. if the power has continued to rise as a result of additional pitch up to 100% pitch under steaming conditions, it is necessary to deploy the gear in order to generate incremental load and to determine the maximum engine power. Once the gear is deployed, the procedure is similar; the engine speed must be set to maximum whereafter the propeller pitch is gradually increased. If a power drop-off is observed from a certain pitch position, the maximum power can be measured with the pitch just below that drop-off point. In case no drop-off is observed, the pitch must be increased to 100%.

Similar to the previous section, when a vessel is equipped with beam trawls, the engine power should be measured with the gears positioned just below the surface.

Figure 19 – Recommended position of beam gear during an engine power verification.

4.5.7. External factors that affect the engine load during the verification

It has been discussed in the previous sections that the produced power is the result of the load induced by the vessel, its fishing gear and its propeller, and the engine capacity. There are also external factors, such as the water depth and sea state, that affect the induced load. The verifier must understand how each of these factors affects the engine load, and account for these factors when conducting the verification and interpreting its results. As a minimum, the following factors should be accounted for:

1. Wind;
2. Waves;
3. Depth;

4. Current;
5. Steering.

4.5.7.1. Wind

During every verification run, the wind force should be observed and documented. In most cases, the effect of a vessel being exposed to wind on the engine load is marginal, but the impact of the consequential waves can be substantial. In addition, there may be an effect of wind on the observed vessel speed. The wind force is recommended to be documented on the Beaufort scale and may be obtained from the most convenient source (e.g. weather report, on board equipment); the use of a special anemometer is not required.

4.5.7.2. Waves

Waves may induce a pattern of increasing and decreasing load on the engine, which makes them relevant to consider in the context of engine power verification. The sea state should be observed and documented during every verification run. It is recommended to use the Douglas sea scale to quantify the sea state. The sea state may be visually observed and estimated, or be obtained from a weather report. A copy of the Douglas sea scale is enclosed in Annex 8.

Waves may cause substantial engine load variations, up to the point where a reliable engine power verification can no longer be conducted. In such cases, the engine power verification must be aborted or postponed. The highest acceptable sea state depends on the characteristics of the vessel, which implies that determining whether the observed sea state is acceptable requires professional judgement.

In case a trial is being conducted when the sea state is substantial, two consecutive runs should be conducted, heading into and following the dominant wave direction, in accordance with clause 10.4 of ISO 15016:2015.

4.5.7.3. Depth

The depth of the water under the vessel, also referred to as Under Keel Clearance (UKC), must be observed and documented during every verification run. When the UKC exceeds three times the vessel’s draught, the effect of the seabed on the engine load can be considered negligible. Operation in shallower waters is associated with higher load. To avoid impact of the verification result by operation in shallow water, efforts must be made to conduct the engine power verification in deep water.

4.5.7.4. Current

Current has an effect on the engine load in relatively shallow waters, which is another reason to make efforts to conduct an engine power verification in deep water. In case fishing gear is being towed over the seabed during the verification, part of the tidal effect on engine power remains also in deep water.

In addition to any effect on engine load, the vessel's Speed Over Ground (SOG) is affected by the current. It is therefore recommended to conduct a double run (two verification runs in opposite directions) under each vessel operating condition (fishing, steaming) when a verification is being conducted on tidal waters. Ideally, these runs shall be conducted with little time between them, over the same ground area, in accordance with the ship's track during the trial described in clause 10.2 of ISO 15016:2015. The average speed of both runs may for data verification purposes (also see section 4.4.1) be considered the still water vessel speed.

4.5.7.5. Steering

Steering causes the engine load to temporarily increase, which affects the engine power verification. Therefore, efforts must be made to conduct the engine power verification where a steady course can be maintained for at least 10 minutes, and substantial steering, due to the characteristics of the fairway or other marine traffic, is not expected. In accordance with clause 10.5 of ISO 15016:2015, rudder amplitudes in excess of 5 degrees should be avoided.

4.5.8. Observation of the engine and the gearbox

Before the verification is commenced, the characteristics and details of the engine should, as far as possible, be determined. The observed specifications should be compared to the details as recorded in the fleet register and on all other relevant documents, such as the EIAPP certificate, if applicable. Only those components for which disassembly of (part of) the engine is not required, have to be inspected at this stage. As a minimum, the following items must be inspected and photographically documented:

1. The engine manufacturer;
2. The main visual characteristics (e.g. the number and arrangement of cylinders, presence of turbocharger(s) and charge air cooling, etc.);
3. The engine identification plate.

Also the specifications of the gearbox have to be determined, as far as possible without (partial) disassembly of the gearbox:

1. The gearbox manufacturer;
2. The main visual characteristics (e.g. the presence of Power Take Off (PTO) shafts and gearbox driven auxiliary equipment, the arrangement of transmission shafts (as far as practically possible), etc.);
3. The presence of Power Take In (PTI) / booster motors;
4. The gearbox identification plate.

4.5.9. Observation of the engine performance during the verification

When the vessel operating conditions are in accordance with one of the conditions described in section 4.5.6, and the external conditions are satisfactory in accordance with section 4.5.7, the engine need to be observed. The objectives of this observation are:

1. To determine which engine control mechanism is responsible for the instantaneous limitation of the observed engine power (e.g. position of bridge control lever, engine speed lever in maximum position, fuel rack in maximum position, etc.);
2. To determine to what extent the setting(s) responsible for the instantaneous limitation of the observed engine power are secured or can be adjusted to increase the engine power;
3. To assess whether mechanisms are in place to circumvent the instantaneous limitation of the engine power (tampering systems).

A certain amount of general knowledge about marine propulsion engines, and understanding of the specific engine type installed on board the verified vessel, is required to draw meaningful conclusions about the engine performance.

4.5.9.1. Observation of the performance of a diesel engine equipped with an electronic control system

Electronically controlled diesel engines in the context of this guidance are engines equipped with either electronic unit injectors or a common rail fuel injections system, governed by a computerised control system which, as a minimum, electronically determines the timing of the beginning and the end of each fuel injection.

Mechanically controlled fuel pumps governed by an electronic governor system are not covered by this section, but by section 4.5.9.3.

An electronically controlled engine is equipped with an Engine Control Unit (ECU). Although different manufacturers use different names for this device (e.g. Electronic Control Module, Digital Control Unit, etc.), ECU will be used throughout this section. When observing an electronically controlled engine, it is important to distinguish between the ECU and the motor management system. The ECU is an OEM supplied control system, which belongs to the individual engine. Without an ECU, an electronically controlled engine cannot operate. Its specification and identification details are usually detailed in among others the NOx Technical file, and the engine specific ECU is already fitted when the engine undergoes an emission or acceptance test.

A motor management system, if present, acts as interface between the vessel's crew and the engine. It may be supplied by a dealer or independent enterprise, and its functionalities as well as the data it displays may be customised or altered after installation on board.

When obtaining engine performance data from an electronically controlled engine, it is recommended to do so directly from the ECU instead of from the motor management system, as data (e.g. load factor, relative torque, etc.) from the latter source have a higher probability of being manipulated.

In order to be able to obtain these data, authorities need to put effort into ensuring that a specialist equipped with the IT tools required to connect to the engine is on board during the physical engine power verification. It should be noted that the hardware required to connect to marine diesel engines of various brands and types is standardised only to a limited extent, and the required software is not standardised at all. It is therefore required to involve a brand and type specific specialist. It is recommended to ensure that the involved expert is fully independent and not related to the vessel subject to verification (e.g. working for the engine dealer that sold the engine to the vessel owner, or working for the enterprise that regularly maintains the engine), to avoid any conflict of interest or jeopardisation of the surprise element of the verification.

Which instantaneous engine performance data and historic engine performance statistics can exactly be obtained from an electronically controlled engine, and how the available data are exactly defined, varies between engine brands and types. It is beyond the scope of this guidance to detail the exact verification steps for all engines.

1. General recommendations:

   (a) When observing instantaneous engine performance data, it is essential to observe and document the engine speed (rpm), torque (Nm or % of maximum) and load (kW or % of maximum – the load factor) and analyse their interrelation.

   (b) When observing historical engine performance data, it is for many ECU systems possible to extract the historical engine speed, load factor, and torque expressed as a range (e.g. 90% - 100% load factor) versus a unit of time (e.g. running hours, or a percentage of the total running hours of the engine). It is essential to extract and document these data during the engine power verification.

2. Observing the ECU particulars:

    (a) Compare the ECU type and serial number, as well as all details, numbers and settings of the installed software programme and mapping that were collected during the acceptance test or documented elsewhere, with the electronic data obtained from the ECU on board.

    (b) Observe the total running hours of the ECU and assess the plausibility of this value considering the operating time of the vessel since the installation of the engine, and its ECU in the vessel.

    (c) In case the engine is equipped with a secondary (back-up) ECU that is permanently affixed to the engine, also collect the data listed above for this ECU.

    (d) In case any difference between the particulars of the ECU(s) on board and the documented data is observed, this should be reported to the certifying authority. Also the OEM (preferably not the engine dealer or other intermediate party) should be consulted to obtain the performance data of the ECU (settings) encountered on board.

3. Observing the instantaneous engine speed:

    (a) The instantaneous engine speed (rpm) has to be compared to the values documented in the files submitted to the authorities in the context of the engine certification process, and the values observed during the engine acceptance test, and / or reported in the pre-installation physical engine power verification test report (see section 3.9.2) if applicable.

    (b) The instantaneous engine speed has to be compared to the historical engine speed data obtained from the ECU.

    (c) In case the instantaneous engine speed is lower than the original value as documented / reported during the certification process, or lower than the highest historical engine speed value stored in the ECU, it should be investigated why the engine speed is (artificially) low during the engine power verification.

4. Observing the instantaneous load factor:

   (a) In case the load factor is below 100%, it needs to be determined why that is the case. There could be a legitimate reason (e.g. when the engine operates at its nominal speed, but not at its maximum torque, under relatively low load conditions) or there could be a system activated that artificially holds back the maximum engine speed or torque.

   (b) In case the load factor is 100%, it needs to be verified whether the instantaneous shaft power measurement value is as expected, compared to the engine specifications and declared amount of power of the engine.

   (c) In case the observed shaft power at 100% load factor is not as expected, whereas the instantaneous engine speed is as expected, all instantaneous engine parameters such as temperatures but in particular charge air pressure, should be compared to the values recorded in the acceptance test report and / or the pre-installation physical engine power verification test report (see section 3.9.2) of the engine.

Figure 20 – Example of a covered and sealed Electronic Control Unit (yellow arrow) and the connector for IT tools (blue arrow).

4.5.9.2. Observation of the performance of a diesel engine equipped with a mechanically controlled in-line fuel pump and a mechanical governor

The mechanically controlled in-line fuel pump with mechanical governor is a system (still) frequently found on relatively small, existing engines. Discussing all variants of pumps and governors in detail is beyond the scope of this guidance.

During a physical engine power verification, it needs to be verified whether positioning the (bridge) control lever in the maximum position results in a maximum engine speed request. On many in-line fuel pump mounted mechanical governors this is relatively easy to determine, as the engine speed control lever and the minimum and maximum speed limiters are mounted externally. This is also the case for some rotating fuel pumps.

To measure the maximum engine power, it is required that the lever reaches the limiter. If this is not the case, the mechanical, pneumatic or electronic system that controls this lever must first be adjusted to ensure that the governor speed control lever actually reaches the limiter.

It may also be possible to temporarily disconnect the mechanical, pneumatic of electronic control from the engine speed control lever at the governor, and manually press the lever to the maximum position. <u>However, this should never be done without prior notice, and everyone involved in the verification should be aware that this induces two substantial incremental risks in the verification:</u>

1. The master has temporarily no control over the engine, and can thus not reduce speed for navigational or manoeuvring purposes.
2. If the setting of the limiter is at an unacceptably high position, there is a risk of engine failure due to overheating / overloading, which may result in an engine failure and all possible consequences.

The general steps listed below should as a minimum be taken when verifying an engine equipped with a mechanically controlled in-line fuel pump and mechanical governor.

1. Observing the maximum engine speed:
    (a) The maximum stabilized engine speed has to be measured during every verification run. It is recommended to obtain the engine speed data from an infrared speed pick-up directly at the flywheel (e.g. a calibrated handheld device), because the meter(s) on board may deviate substantially, and the gearbox reduction ratio (required to calculate back the engine speed from the propeller speed), obtained from the identification plate may not always be correct.

(b) It needs to be verified whether the maximum engine speed setting is adequately secured (e.g. sealed) or appears to have been adjusted recently.

(c) It is recommended to measure and document the length of the maximum engine speed limiter.

(d) It is recommended to compare the maximum engine speed under various operating conditions to the values reported during the engine acceptance test and / or in the pre-installation physical engine power verification test report (see section 3.9.2), and make efforts to explain any observed difference.

2. Observing the fuel rack:

(a) Efforts have to be made to verify whether the engine power is determined during each verification run by the engine speed control, or by the fuel rack limitation, or by a tampering mechanism.

(b) It needs to be verified whether the fuel rack setting is adequately secured (e.g. sealed) or appears to have been adjusted recently.

(c) The verifier must be aware that when the vessel operates under loaded conditions (e.g. fishing), and there is still clearance between the fuel rack and the limiter, the addition of even more load (e.g. through changing the propeller pitch or the gear) could result in the delivery of more engine power.

Figure 21 – In-line mechanical fuel pump with mechanically controlled governor.

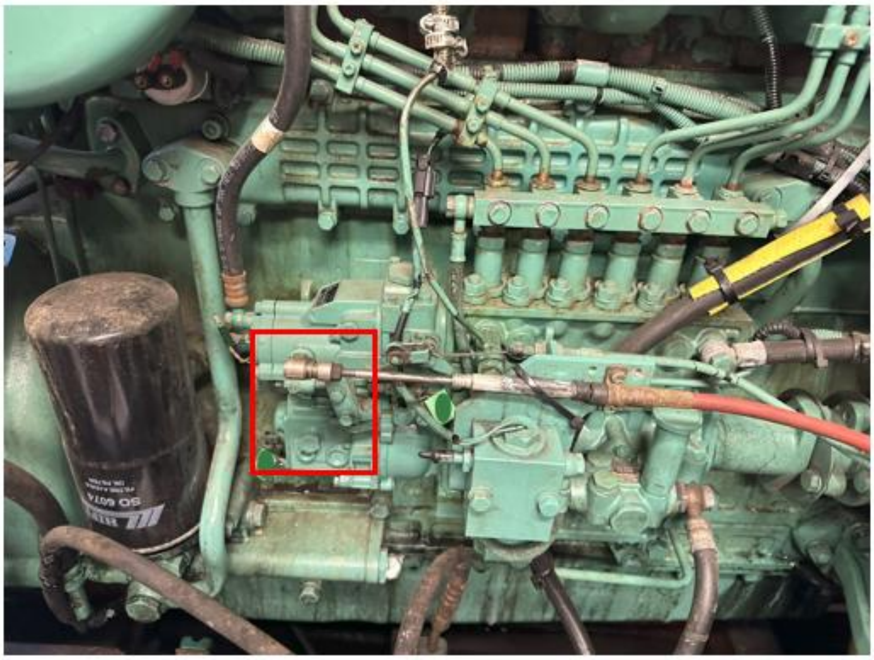
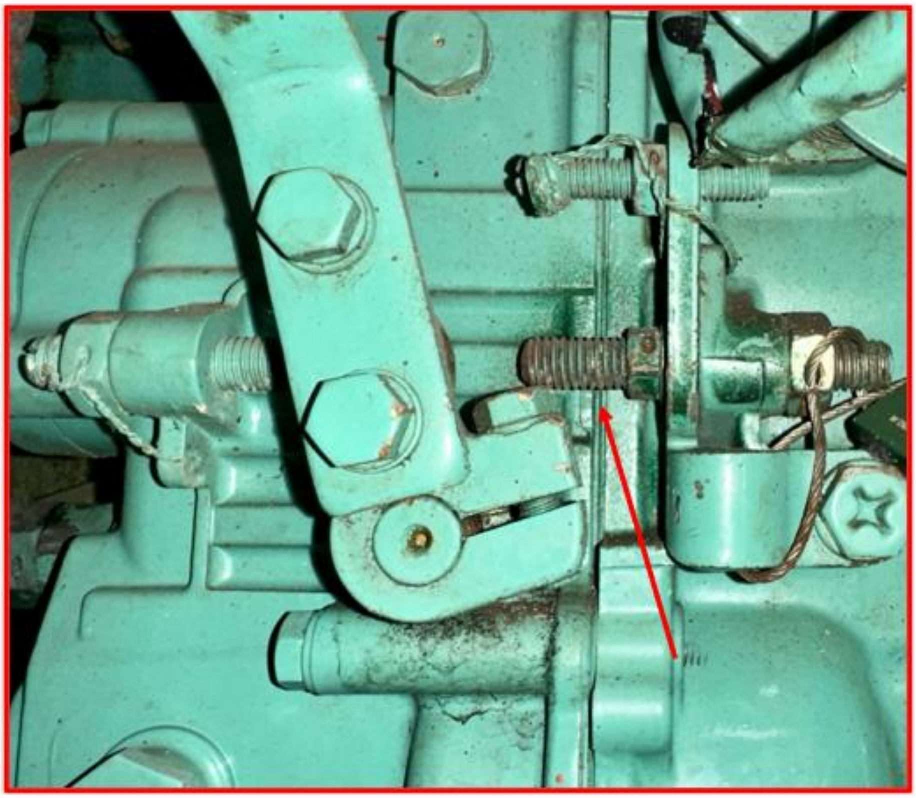


Figure 22 – Close-up of engine speed control lever and minimum / maximum speed setting (area in red square in figure 21). Maximum engine speed setting indicated by red arrow.



4.5.9.3. Observation of the performance of a diesel engine equipped with mechanically controlled one-per-cylinder fuel pumps and a governor

Engines with an individual fuel pump for every cylinder are usually relatively powerful, medium speed engines. These engines have a governor that actuates a common fuel rack, connected through linkages to individual fuel pumps. The output of the governor is among others determined by the pneumatic, mechanical or electronic signal it receives. Some governors are equipped with a possibility to manually control the governor, and / or may have a governor output indicator.

Efforts have to be made to verify, when the bridge control lever is in the maximum position, whether the governor receives the signal that corresponds with the maximum engine speed request.

Discussing all types of governors and fuel pumps in detail is beyond the scope of this guidance, but the general steps listed below should be taken when verifying an engine equipped with one-per-cylinder fuel pumps and a governor.

1. Observing the maximum engine speed:

   (a) The maximum stabilized engine speed has to be measured during every verification run. It is recommended to obtain the engine speed data from an infrared speed pick-up directly at the flywheel (e.g. a calibrated handheld device), because the meter(s) on board may deviate substantially, and the gearbox reduction ratio (required to calculate back the engine speed from the propeller speed) obtained from the identification plate may not always be correct;

   (b) It needs to be verified whether the maximum engine speed setting is adequately secured (e.g. sealed) or appears to have been adjusted recently;

   (c) The governor (output) position has to be observed and documented during every verification run;

   (d) It is recommended to compare the maximum engine speed under various operating conditions to the values reported during the engine acceptance test and / or in the pre-installation physical engine power verification test report (see section 3.9.2), and make effort to explain any observed difference.

2. Observing the fuel rack:

   (a) Efforts have to be made to verify whether the engine power is determined during each verification run by the engine speed control, or by the fuel rack limitation, or by a tampering mechanism;

(b) In case the common fuel rack, or the individual fuel pumps have scales (usually mm), the fuel rack setting of the common fuel rack and the individual fuel pumps have to be observed and documented. The observed fuel rack settings have to be compared to the values documented in the engine acceptance test report and / or in the pre-installation physical engine power verification test report (see section 3.9.2), and efforts have to be made to explain potential differences;

(c) It needs to be verified whether the fuel rack setting is adequately secured (e.g. sealed) or appears to have been adjusted recently;

(d) The verifier must be aware that when the vessel operates under loaded conditions (e.g. fishing), and there is still clearance between the fuel rack and the limiter, the addition of even more load (e.g. through changing the propeller pitch or the gear) could result in the delivery of more engine power.

Figure 23 – Example of the fuel rack to control the fuel delivery per cycle of an individual fuel pump. The mm scale on the fuel rack is clearly visible.

4.5.10. Observation of the vessel performance during the verification

When the vessel operating conditions are in accordance with one of the conditions described in section 4.5.6, and the external conditions are satisfactory in accordance with section 4.5.7, the vessel's stabilized Course Over Ground (COG) has to be observed and documented during each verification run. It is recommended to observe and document the position and time each run is started. COG data may be obtained from GNSS equipment available on board, or alternatively from handheld devices.

4.6. Processing the results of the engine power measurement

4.6.1. Power correction for energy losses in the gearbox

If the engine power is determined by means of a shaft torque and speed measurement at the output flange of the engine, the engine power does not need to be corrected for energy losses in the gearbox. In case the power is determined by means of a shaft torque and shaft speed measurement behind the gearbox, between the gearbox and the propeller, a correction must be applied to the measured shaft power in order to obtain the corresponding brake engine power.

In case an official energy efficiency value of the gearbox at nominal speed and nominal power has been specified by the gearbox manufacturer for the gearbox under consideration, this figure may be used to convert the measured propeller shaft power into brake engine power. The Member State's authorities need to verify the accuracy and authenticity of any document stating the gearbox energy efficiency, in particular when the officially stated energy loss is lower than the energy loss to be assumed in accordance with the generally acceptable gearbox efficiency data from table 4. In such case a copy of the document stating the official energy efficiency of the gearbox must be attached to the physical engine power verification report.

The relation between energy loss and efficiency of the gearbox can be expressed as:

$$\eta_{gbx\,eff} = (1 - \eta_{gbx\,loss})$$

where:

$\eta_{gbx\,eff}$ = gearbox efficiency ratio

$\eta_{gbx\,loss}$ = gearbox loss ratio

In case no official statement regarding the energy efficiency of the gearbox is available, the efficiency values presented in table 4 are applied as follows:

$$P_{propeller\,shaft} = P_{engine} \times \eta_{gbx\,eff}$$

where:

P_{engine} = brake engine power (kW)

$P_{propeller\,shaft}$ = propeller shaft power (kW)

Table 4 – Generally acceptable energy efficiency of gearboxes per configuration

		Reversal gearbox		Reduction gearbox
		co-rotating	counter-rotating	
Clutch	yes	0,970	0,976	0,985
	no			0,986
Additional pre-stage		-0,008	-0,008	-0,008
Additional auxiliary drive		-0,006	-0,006	-0,006

The above percentages may also be applied to gearboxes for which no technical data are available, based on the visually assessed configuration of the gearbox.

4.6.2. Power correction for non-essential dependent auxiliaries

Non-essential auxiliary dependent equipment (section 3.3.5) may be driven directly by the engine or through gear transmission inside the gearbox. Typical auxiliary equipment driven by marine gearboxes are hydraulic pumps and shaft generators.

If non-essential dependent auxiliaries, either directly driven by the engine or through the gearbox, can be disengaged during the verification runs, this should be done. If the auxiliaries cannot be disengaged, but can be demonstrated to run freely (no load applied to the PTOs), this should be done. If the PTOs can be disengaged or run freely, the engine power should not be adjusted for the PTO load.

If a PTO cannot be disengaged, and cannot run freely (remains loaded during the engine power verification run), the nominal PTO power should be added to the engine brake power. This equally applies to PTOs that are not gearbox driven.

The standard oil cooler fitted at the gearbox are not separately be accounted for; heat losses resulting from the gearbox oil cooling process are accounted for in the generally acceptable gearbox efficiency values presented in table 4.

Example 4 – The correction of measured propeller shaft power to brake engine power for gearbox energy efficiency

Consider a vessel with a fixed pitch propeller in combination with a co-rotating reversal gearbox and two hydraulic PTO pumps; one connected to the reversal shaft, and one to an additional auxiliary drive. No official gearbox energy efficiency data are available. The hydraulic PTO pumps cannot be disengaged, but there is no load being applied to the hydraulic pumps during the verification runs. The power measured at the propeller shaft is 200,0 kW.

The total efficiency to be assumed is 0,970 – 0,006 = 0,964

The incremental energy loss due to the connected PTOs may be disregarded, because no load is being applied.

The engine power is determined at $\frac{200}{0{,}964}$ = 207,5 kW.

4.6.3. Correction for Power Take In (PTI) / booster arrangements

Booster arrangements are systems that attribute incremental propulsion power to the propeller shaft, while the propulsion engine is operating at its maximum power. The most common booster arrangement on board catching vessels is the auxiliary engine powered gearbox driving electric motor. Efforts have to be made to determine whether a gearbox mounted shaft generator, if present, can be used as booster motor.

Booster power qualifies as propulsion (engine) power and must therefore be fully deployed during each verification run. In case the booster power cannot be (fully) deployed, or when the verifier doubts whether the full booster power is being deployed during the verification run, either the maximum booster intake power of the gearbox as specified by the gearbox manufacturer, or the nominal power of the booster electric motor must be added to the established brake engine power.

4.6.4. Power correction for ambient conditions

The maximum continuous fuel stop diesel engine brake power is specified at reference ambient conditions, when the engine is running on reference fuel. If the engine manufacturer does not specify reference ambient conditions, the ISO standard reference conditions specified in clause 5 of ISO 15550:2016, or the service ambient reference conditions specified in clause 11.4 of ISO 3046-1:2002 should be applied.

The power adjustment factor $\propto$ should be determined in accordance with the procedure described in clause 10.3 of ISO 3046-1:2002, in order to adjust for ambient conditions that differ from the applicable reference conditions.

To enable calculation of α, and adjustment of the engine power for ambient conditions, the following parameters must be determined during the physical engine power verification run:

t_x	(°C)	=	ambient air temperature on site
$\emptyset_x$	(%)	=	ambient relative humidity on site
p_x	(kPa)	=	ambient total barometric pressure on site
T_x	(K)	=	ambient air thermodynamic temperature on site
T_{ex}	(K)	=	ambient charge air coolant thermodynamic temperature on site
η_m		=	engine mechanical efficiency

If $\emptyset_x$ cannot be determined, 30% has to be assumed, in accordance with ISO 3046-1:2002, clause 10.3.2 note 3.

If p_x cannot be determined, 101,3 kPa has to be assumed (the sea level value listed in ISO 3046-1:2002, table B.2, sea level value.

If η_m cannot be determined, and is not specified otherwise, 0,8 has to be assumed in accordance with clause 10.3.3 of ISO 3046-1:2002.

The formula reference of numerical values for power adjustment defined by the manufacturer, and corresponding exponents, should be used. If the formula reference is not available, the correct formula reference and exponents should be obtained from ISO 3046-1:2002, table 2.

The measured engine power may be adjusted for ambient conditions by application of formula (1) in clause 10.3.1 of ISO 3036-1:2002 if all of the following conditions are met:

1. The engine does not adjust for ambient condition variations;
2. The power adjustment factor α exceeds the value of 1,00;
3. The engine runs on commercial fuel specified by the engine manufacturer, in accordance with clause 6.3.4.14 of ISO 15550:2016 (acceptance test fuel requirements) of which the Lower Calorific Value of the fuel has been measured in accordance with ASTM D 240, or has been estimated in accordance with ASTM D 3338/D 3338M. The measured Lower Calorific Value cannot be less than the LCV of the fuel specified by the engine manufacturer. If the engine manufacturer has not specified the LCV of the commercial fuel to be used, a LCV of 42700 kJ/kg should be applied.

4.7. Compliance assessment based on a physical engine power verification

An engine is considered to be non-compliant during the physical engine power verification in case the brake power, corrected for the losses induced by the gearbox and auxiliary drives, minus the average error rate of the measurement equipment as determined in accordance with section 4.5.5.1, plus the nominal power of auxiliaries that can add power to the propeller shaft in case these auxiliaries were not active during the verification, exceeds the declared and certified engine power of the vessel.

Example 5 – Accounting for gearbox energy efficiency and shaft power measurement equipment accuracy

Consider the physical engine power verification of a vessel with a declared and certified engine power of 221 kW and the verification results listed below.

1. The maximum propeller shaft power was measured at 220 kW
2. The vessel is equipped with a counter-rotating reversal gearbox, without additional PTOs or pre stages, and no manufacturer supplied gearbox efficiency data are available. In this case, a gearbox efficiency of 0,976 must be assumed in accordance with section 4.6.1.
3. The vessel is not equipped with auxiliaries that can attribute power to the propeller shaft.
4. The average error rate of the measurement equipment has been determined at 2,0% in accordance with the procedure described in section 4.5.5.1.
5. The calculated power correction factor for ambient conditions (α) is 0,97, so no adjustment needed in accordance with section 4.6.4.

The brake power after correction for the gearbox efficiency is $\frac{220}{0{,}976}$ = 225,4 kW

The brake power after correction for the gearbox efficiency and the average error rate of the equipment is $(1{,}000 - 0{,}020) \times 225{,}4$ = 220,9 kW

The vessel was compliant during the verification.

Example 6 - Accounting for gearbox energy efficiency, shaft power measurement equipment accuracy and booster power.

Consider the physical engine power verification of a vessel with a declared and certified engine power of 750 kW and the verification results listed below.

1. The maximum propeller shaft power was measured at 650 kW.
2. The vessel is equipped with a reduction gearbox with clutch and one shaft generator that can also be used to provide power to the propeller shaft (booster power). No manufacturer supplied gearbox efficiency data are available. During the verification, it was not possible to engage the electric auxiliary drive with a nominal power of 200 kW.
3. The engine is self-adjusting its brake power for ambient condition variations, so no adjustment needed in accordance with section 4.6.4.
4. In this case, a gearbox efficiency of (0,985 – 0,006) = 0,979 must be assumed in accordance with section 4.6.1.
5. The average error rate of the measurement equipment has been determined at 2,5% in accordance with the procedure described in section 4.5.5.1.

The brake power after correction for the gearbox efficiency is $\frac{650}{0{,}979}$ = 663,9 kW.

The brake power after correction for the gearbox efficiency and the average error rate of the equipment is $(1{,}000 - 0{,}025) \times 663{,}9$ = 647,3 kW.

The nominal power of the auxiliary drive must be added to the power figure calculated above, resulting in a total (engine) power of 647,3 + 200 = 847 kW.

The vessel is non-compliant.

4.8. Reporting a physical engine power verification

It is recommended that the verifying organisation produces an engine power verification report that covers the elements addressed in sections 4.8.1 to 4.8.5 below. In case the verifying organisation is responsible for only a defined element of the engine power verification, e.g. an external contractor responsible for the propeller shaft power measurement, and another organisation (e.g. the Member State fisheries control authority) is responsible for the remaining elements of the verification process, the verifying organisation shall only report on the aspects of the verification that have been carried out under its responsibility. A template physical engine power verification report form is provided in Annex 9.

4.8.1. Reporting the vessel, engine and gearbox characteristics

The engine and gearbox characteristics obtained during the process described in section 4.5.8 should be presented in the verification report. Recommended data to report are included in the physical engine power verification report template in Annex 9.

4.8.2. Reporting the measured engine power

The engine power verification report should present the following data for every conducted verification run:

1. Unadjusted (propeller) shaft power;
2. Brake power under ambient conditions, adjusted for the gearbox efficiency and other energy losses if applicable;

The engine power report may present for every conducted verification run:

3. Brake power at reference conditions, adjusted for site ambient conditions.

The verification results listed above are included in the physical engine power verification report template in Annex 9.

4.8.3. Reporting the ambient conditions

As a minimum, all parameters measured or assumed to calculate the power adjustment factor $\propto$, required to adjust the engine brake power for site ambient conditions, should be reported. These data are listed in section 4.6.4 and are included in the engine power verification report template in Annex 9.

4.8.4. Reporting the vessel performance

The vessel performance data obtained during each verification run in accordance with the procedure described in section 4.5.10 should be presented in the engine power verification report. The data recommended to report are included in the engine power verification report template in Annex 9.

In addition to the data referred to above, the state of external factors that may affect the load during the engine power verification runs (see section 4.5.7) should be reported. The data recommended to report are included in the engine power verification report template in Annex 9.

4.8.5. Reporting the engine performance

All data and information regarding the engine performance, obtained during each verification run in accordance with the procedure described in section 4.5.9, should be presented in the engine power verification report. The data recommended to report are included in the engine power verification report template in Annex 9.

4.9. Considerations with regards to physical engine power verification

4.9.1. Diesel engine arrangements

Section 4.5 (physical engine power verification) of this guidance on engine power verification covers the physical verification of engine power of catching vessels with a diesel-direct propulsion system, with or without booster power arrangements. The diesel engine arrangements discussed in section 4.5.9 cover some general mechanisms found on a selection of diesel engines. Engine types found on board catching vessels may have engine control and fuel systems that deviate from the examples shown, or work according to a principle not covered by this guidance.

In case a physical engine power verification is being prepared, it is essential to study the engine control and fuel system of the engine installed on board the vessel. In-depth understanding of the actual engine installed on board the target vessel helps to conduct the physical engine power verification in a safe and effective manner.

4.9.2. Diesel-electric propulsion

Diesel-electric propulsion systems are systems where electrical power is produced by one or more diesel engines in a generator arrangement, whereafter this power is used to feed an electric motor which is usually directly coupled to the propeller shaft. The maximum power of the electric motor shall in this setup be considered the engine power in the context of a catching vessel's registration, certification and fishing licensing.

A shaft power measurement as described in section 4.5.5 can be conducted on board vessels with a diesel-electric propulsion system, but the engine verification steps described in section 4.5.9 are irrelevant. For an effective power verification, in-depth understanding of the digital control system of the electric motor is required, to determine whether the electric motor is actually producing its maximum power during a verification run. For the purpose of the risk assessment in accordance with Article 39a(1) and Article 39a(7) of the new Control Regulation, it is recommended to consider the risk of non-compliance of all vessels with diesel-electric propulsion as high due to the complexity of the control mechanism of the propulsion system to be verified, and, as a result, it is recommended to install a continuous engine power monitoring device on board of these vessels.

In case there is unclarity about the nominal power of electric motors in a booster power configuration, the same logic should be applied, and installation of a continuous engine power monitoring device on board these vessels is likewise recommended.

4.9.3. Indications of non-compliance

The compliance assessment described in section 4.7 consists of a comparison between a vessel's declared (certified) engine power, and the measured corrected brake engine power. During an actual verification, it may occur that the measured power does not exceed the declared engine power, but indications of non-compliance are observed. Examples of indications of non-compliance are:

1. The measured engine power is low relative to the expected amount of power, based on the engine characteristics or on the engine acceptance test data;
2. The still water vessel speed (SOG) is low relative to the normal vessel speed observed in the context of the data verification process;
3. Abnormal engine performance data (e.g. charge air pressure, temperatures);
4. Historical (digital) engine performance data demonstrates that the engine has been operating at higher engine speeds or has been operating at a higher load (factor) than the engine speed and / or load factor observed during the physical engine power verification;
5. Inability of the vessel to manoeuvre in a normal way;
6. Indications of physical signs of tampering (e.g. broken seals, broken ECU connectors, presence of non-original / additional / unauthorised wiring, visible recent changes to mechanical settings (such as fresh threads in bore / set bolts), absent / damaged / falsified engine identification plates etc.).

In case any of the indications of non-compliance listed above, or any other indication of non-compliance not listed above, have been observed during the verification, these observations have to be elaborated on in the physical engine power verification report. Indications of physical signs of tampering will be photographically documented.

Depending on the strength of the observed indications, further investigation of the engine may be required. Establishing an infringement based on secondary indications alone is considered difficult, but could possibly be viable in case historical digital engine performance data clearly shows a history of non-compliant operation. The decision whether or not to pursue an infringement based on such data requires professional judgement and must be made on a case-by-case basis.

4.9.4. Assigning (physical) engine power verification to an external contractor

The Control Regulation explicitly permits Member State's competent authorities to assign the certification of engine power to classification societies or to other operators having the necessary expertise for the technical examination of engine power ((new) Control Regulation Article 40(3) and section 3.1.1). Although not explicitly addressed in the (new) Control Regulation and / or Commission Implementing Regulation, Member State's competent authorities may also assign (part of) its (physical) engine power verification task to an external contractor.

In case a Member State's competent authority assigns (part of) the verification of engine power to one or more third parties, it remains responsible for the full and qualitative implementation of all engine power verification requirements. Member States' competent authorities and the operator(s) to which (part of) the verification of engine power has been assigned are recommended to document in detail how the assigned engine power verification aspects covered by sections 4.5 to 4.9.3 are to be implemented.

Member States' competent authorities may consider accreditation by a national accreditation body (Regulation (EC) 765/2008[29] Art 2.11), or certification by an accredited organisation of the organisation(s) to which the verification of engine power has been assigned, as demonstration of having the necessary expertise for the verification of engine power in accordance with the requirements of the (new) Control Regulation and the Commission Implementing Regulation.

Voluntary or mandatory accreditation by a national accreditation body of the organisation(s) to which the engine power verification has been assigned, or certification of such organisation(s) by an accredited organisation, does not discharge the Member State's competent authority from its responsibility to ensure the full implementation of the engine power verification duty in accordance with the requirements of the (new) Control Regulation and the Commission Implementing Regulation. Nor does it empower a national accreditation body to approve at its discretion that the verification of engine power is based on a power determination method that is not (explicitly) prescribed by the (new) Control Regulation and / or the Commission Implementing Regulation.

[29] REGULATION (EC) No 765/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93.

5. Infringements

The CFP rules do not provide for any 'tolerance margin' other than related to a margin of error that is associated with the equipment used to measure engine power during the engine power verification procedure (section 4.5.5.1). If having accounted for this margin of error, the verification measurement, corrected for gearbox energy losses and / or other applicable power corrections (section 4.6), confirms a higher engine power than that laid down in the fishing licence and engine power certificate, the vessel in question is in non-compliance of the relevant CFP rules, which requires that the competent authorities of the Member State ensures that "appropriate measures are systematically taken" and that sanctions are systematically applied against those responsible for the offence[30].

In specific cases, the gravity of the non-compliance is such that the act could qualify as a 'serious infringement' under EU law, which requires the competent authorities of Member States to take the necessary action, including immediate enforcement measures, sanctions, and the assignment of points, against those responsible for such conducts.

5.1. Serious infringements under the current legislation (until 9 January 2026)

Until 9 January 2026, non-compliance with the engine power provisions may qualify as a serious infringement of the CFP in the following cases:

(a) Any manipulation of an engine with the aim of increasing its power beyond the maximum continuous engine power according to the engine certificate (Article 90(1)(b) of the Control Regulation);

(b) Fishing without a valid fishing licence (Article 3(1)(a) of Regulation (EC) No 1005/2009 ('the IUU Regulation')).

Assessing the seriousness of these conducts in practice, however, is a task left to the competent authorities of Member States, which are required to determine the gravity of the relevant offence on a case-by-case basis, against the backdrop of certain specific criteria laid down by Article 90(1) of the Control Regulation, and Article 3(2) of the IUU Regulation.

Whenever the competent authorities of a Member State suspect or conclude that a serious infringement of the CFP was committed, they are required to start a full investigation and:

30 Control Regulation, Article 89(1).

(a) take the necessary immediate enforcement action[31], including ordering the immobilisation of the vessel[32],

(b) impose effective, proportionate and dissuasive administrative sanctions to the natural person that committed, or the legal person held liable for the serious infringement[33], and

(c) apply penalty points to the holder of the fishing licence[34].

Finally, Union financial assistance to operators is conditional upon compliance with the CFP rules[35], including those concerning engine power. As such, any application for financial support made under Regulation (EU) 2021/1139 (EMFAF Regulation) is inadmissible in the event of a serious infringement falling under categories (a) or (b) above has been established[36].

5.2. Serious infringements under the new Control Regulation (from 2026 onwards)

As of 10 January 2026, under the new Control Regulation, non-compliance with the engine power provisions may qualify as a serious infringement of the CFP in the following cases:

(a) Fishing without a valid fishing licence (Article 90(2)(a) of the new Control Regulation);

(b) Any manipulation of an engine or continuous engine power monitoring device with the aim of increasing the power of the vessel to exceed the maximum continuous engine power according to the engine certificate (Article 90(2)(o) of the new Control Regulation);

(c) The failure to comply with certain obligations concerning the storage or transmission of continuous monitoring devices data (Article 90(3)(b) of the new Control Regulation);

31 Article 91 of the Control Regulation.

32 Article 43(1) of the IUU Regulation, and Article 91 of the Control Regulation.

33 Articles 90(2) – 90(6) of the Control Regulation.

34 Control Regulation, Article 92.

35 Regulation (EU) No 1380/2013, Article 42(1).

36 EMFAF Regulation, Article 11(1).

(d) The use of an engine power exceeding the maximum continuous engine power certified and recorded in the Member State fishing fleet register (Article 90(3)(k) of the new Control Regulation).

The seriousness of these conducts is not subject anymore to a case-by-case assessment, but it is either objectively pre-identified by the legislation (categories (a) and (b) above), or is to be assessed against the backdrop of specific and harmonised criteria laid down by Annex IV of the new Control Regulation (categories (c) and (d) above). In particular, with regard to Article 90(3)(b), the relevant Annex IV criteria concern interference with a continuous engine power monitoring device, the non-transmission of data, the failure to notify the malfunctioning of such a device or recidivism[37]. As for Article 90(3)(k), the relevant Annex IV criteria concern circumstances when the difference between the verified engine power and the power certified and recorded is higher than 20 % or recidivism.

Example 7 – Application of Annex IV criteria for serious infringements under Article 90(3)(k)

Consider the physical engine power verification of a vessel with a declared and certified engine power of 221 kW and the verification results listed below.

1. The maximum propeller shaft power was measured at 265 kW.
2. The vessel is equipped with a counter-rotating reversal gearbox, without additional PTOs or pre stages, and no manufacturer supplied gearbox efficiency data are available. In this case, a gearbox efficiency of 0,976 must be assumed in accordance with section 4.6.1.
3. The vessel is not equipped with auxiliaries that can attribute power to the propeller shaft.
4. The average error rate of the measurement equipment has been determined at 2,0% in accordance with the procedure described in section 4.5.5.1.
5. The calculated power correction factor for ambient conditions (α) is 0,97, so no adjustment needed in accordance with section 4.6.4.

The brake power after correction for the gearbox efficiency is 271,5 kW.

The brake power after correction for the gearbox efficiency and the average error rate of the equipment is 266,1 kW.

The established brake power after correction for the gearbox efficiency and the average error rate of the equipment exceeds the certified maximum continuous engine power by 20,4%.

The established infringement is a serious infringement in the meaning of the new Control Regulation.

[37] Whenever a non-serious infringement falling under the scope of the provision is committed within 12 months from a confirmed serious infringement of the same provision.

Whenever the competent authorities of a Member State suspect or conclude that a serious infringement of the CFP was committed, they are required to start a full investigation, take the necessary immediate enforcement actions, including ordering the immobilisation of the vessel[38], and applying sanctions[39]. In case of a confirmed serious infringement, falling under categories (a), (b), (c) and (d) above, the competent authorities of a Member State are required to assign the specific number of points indicated in Annex III of the new Control Regulation[40] to both the licence holder and / or the master responsible for the serious infringement[41].

Finally, Union financial assistance to operators is conditional upon compliance with the CFP rules[42], including those concerning engine power. As such, any application for financial support made under the EMFAF Regulation is inadmissible in the event of a serious infringement falling under categories (a), (b), (c) and (d) above has been established[43].

5.3. Manipulation of an engine or continuous engine power monitoring device

In the context of this guidance, manipulation of an engine is deemed to be an action that is characterised by the following elements:

(a) Intentionality: the act of manipulation is performed consciously, not necessarily maliciously including serious negligence.

(b) Conduct: the act of manipulation entails any tampering with mechanical and/or electronic engine settings, including but not limited to:

— technical modifications to the engine and / or its components as referred to in Article 61 of the Commission Implementing Regulation,

38 New Control Regulation, Article 91(1).

39 New Control Regulation, Articles 91a and 91b.

40 Respectively, 7 points for Article 90(2)(a), 6 points for Article 90(2)(o), 5 points for Article 90(3)(k), and 3 points for Article 90(3)(b).

41 New Control Regulation, Article 92(4).

42 Regulation (EU) No 1380/2013, Article 42(1).

43 EMFAF Regulation, Article 11(1).

— tampering with applied seals or any measures to ensure ongoing compliance (section 3.10),

after the engine has been certified for the purpose of Article 40 of the (new) Control Regulation, and without having notified the Member State certifying authority.

(c) Objective: the act of manipulation has the aim to increasing the power of the engine to exceed the maximum continuous engine power according to the engine certificate of the vessel concerned.

Some examples of tampering with mechanical or electronic engine settings are provided in section 6.2 and 6.3.

The criteria for the manipulation of a continuous engine power monitoring device are referred to under section 5.2.

6. Regularisation procedure

In accordance with Article 39(1) of the (new) Control Regulation, it is prohibited to fish with a vessel that is equipped with an engine, the power of which exceeds the engine power established in its fishing licence. The new Control Regulation provides (as from 10 January 2028) for a regularisation procedure for catching vessels exceeding the authorised engine power set out in the fishing licence. Such a regularisation procedure is without prejudice to the effects (e.g., enforcement, sanctions and points) for non-compliance with the CFP rules, including serious infringements, as those examined in section 5, or to the responsibilities of Member States and operators. The regularisation procedure provided for in Article 39(2a) of the new Control Regulation, is subject to the terms and conditions established by each flag Member State under national law.

The following sub-sections (6.1 to 6.5) will examine some of the cases when a regularisation may be necessary.

6.1. Under-declaration of an engine operating at its rated output

If it has previously been declared that an engine is derated, and the engine power has been certified accordingly, but the engine power verification reveals that the actual engine power equals the rated amount of power, and the procedures described in section 3.12 have been followed during the verification, the certifying authority may apply one of the following three regularisation approaches:

1. The engine power is redeclared and re-certified at its actual rated (maximum continuous) power.
2. The engine is derated to the previously underdeclared engine power. If it is decided to derate the engine in order to regularise the vessel, the following aspects shall be considered by the certifying authority:
    (a) The engine can only be derated to the extent derating is permitted by the applicable Member State legislation (see also section 3.6). In case the Member State does not permit derating, or permits derating to an insufficient extent, derating cannot be applied to regularise a non-compliant vessel;

    (b) Derating cannot be applied in case this causes non-compliance with other regulations applicable to the vessel, such as NOx emission regulations;

    (c) Derating can only be permitted in case reliable ongoing compliance measures, as described in section 3.10, can be applied. If for example the engine meets the characteristics described in section 3.10.2.3(4) (electronically controlled engine with the possibility to uprate the engine through remapping, or the possibility to make overload power available), derating is not acceptable as regularisation method.

3. The engine power is redeclared and re-certified at the amount of power measured during the verification, provided that the requirements under point 2 above, and the conditions under section 6.4 below are met.

6.2. Tampering with mechanical engine settings

In case the engine has become non-compliant due to tampering with mechanical engine settings, the procedures described in section 3.12 should be followed to measure the engine power. The engine settings need to be (re)adjusted, during the physical engine power measurement, until the maximum engine power corresponds (again) with the certified amount of maximum continuous engine power. Thereafter, the relevant ongoing compliance measures described in section 3.10 need to be applied or restored.

Examples of tampering with mechanical engine settings are:

1. Removing a seal or seals to adjust the engine settings (i.e. increase the maximum engine speed or increase the maximum fuel rack) without having notified the Member State certifying authorities;
2. Grinding off a limiting bolt to increase the travel of for example the engine speed lever, with the objective to increase the maximum engine speed.

6.3. Tampering with electronic engine settings

If the electronic engine settings have been changed to increase the maximum engine power, derating should no longer be permitted for that engine. In such cases, the only regularisation options are:

1. Declaring the engine power at the highest available continuous rated power for that engine type (also see section 3.6) and recertifying accordingly (without the need to uninstall the engine to test at the test bed again);
2. Replacing the engine;
3. Equipping the vessel with a continuous engine power monitoring device.

Examples of tampering with electronic engine settings are:

1. Altering the engine performance map (that may have been supposed to be password protected) in any of the ECUs connected to the engine;
2. Installing another engine performance specification than declared in any of the ECUs connected to the engine;
3. Installing a hidden additional ECU, potentially equipped with non-compliant engine control software specifications, to actually govern the engine, while the main (and back-up if applicable) ECU(s) may still have compliant engine performance specifications and engine performance maps.

If establishment of the infringement is based on secondary evidence, such as historic engine performance data obtained from the ECU (see also section 4.9.3), the vessel need to be equipped with a continuous engine power monitoring device referred to in Article 39a(1)and Article 39(7) of the new Control Regulation if the infringement is established after 10 January 2028.

6.4. Using the verification result for certification purposes

In case the engine power has been under-declared (section 6.1), the certifying authority may permit to redeclare the engine at a higher maximum continuous power. In such cases, the certifying authority and vessel operator may decide to accept the physical engine power verification as replacement of the physical engine power measurement in the certification context (section 3.12), if all of the following conditions are met:

1. The vessel operating conditions during the verification were as required in accordance with section 4.5.6;
2. External factors that affect the engine load during the verification, as described in section 4.5.7, are adequately accounted for;
3. A reliable measurement of the actual maximum engine power has been conducted (note that an infringement may also be established if the measured power exceeds the certified amount of power during the verification, but the measured amount of power was still not the maximum power of the engine under consideration. This may occur if for example the master refuses to put the engine speed demand lever in the maximum position. In such cases, the verification result cannot be used to recertify the engine power);
4. The engine performance during the physical engine power verification has been observed as described in section 4.5.9, and documented as described in section 4.8.5;

5. The vessel performance during the physical engine power verification has been observed as described in section 4.5.10, and documented as described in section 4.8.4;
6. Appropriate corrections have been applied for the gearbox energy efficiency (section 4.6.1), non-essential dependent auxiliaries (section 4.6.2) and booster power (section 4.6.3) where applicable;
7. The fuel properties and ambient conditions have been recorded in accordance with section 4.6.4, and reported as described in section 4.8.3, to enable correction for site ambient conditions to reference conditions, if required;
8. Ongoing compliance measures have been applied in accordance with section 3.10, where applicable, immediately subsequent to the verification.

6.5. Regularisation of a vessel where the shaft power cannot be measured

An infringement could possibly be established based on secondary evidence such as historic engine performance data obtained from the ECU (see also section 4.9.3), which implies that an infringement may be established concerning a vessel where a physical engine power measurement cannot be conducted.

The regularisation procedures described in sections 6.1 to 6.4 are to a large extent based on the certification procedure described in section 3.12 (certification of engines already installed on board), of which physical measurement of the propeller shaft power is an essential element.

In case a combined shaft torque and shaft revolutionary speed measurement cannot be conducted at the crank shaft or the propeller shaft, after establishment of an infringement concerning an engine already installed on board, the only regularisation options are:

1. Declaring the engine power at the highest available continuous rated power for that engine type (also see section 3.6) and recertifying the engine power accordingly;
2. Replacing the engine.

7. Reporting to the Commission

7.1. Reporting obligation on the Union fishing fleet register

The information contained in the Union fishing fleet register should contain all EU fishing vessels and is reported by the Member States to the Commission under application of the Commission Implementing Regulation (EU) 2017/218. This information is used to monitor whether the Member States' fishing capacity ceilings are respected in accordance with Article 22(7) of the CFP.

Member States are responsible for the accuracy of the information contained in the national fishing fleet register. To this end the Members States should constantly monitor the quality of such information and ensure that it is regularly updated.

In accordance with Article 5, 6(1) and Annex I of Regulation (EU) 2017/218, Member States are required to collect, validate and record without delay in their national fleet register the information concerning fishing vessels, and submit to the Commission any event, including corrections, concerning this data no later than at the end of the working day when the event has been fully registered.

In accordance with Annex I of this regulation, the heading power of main engine in kW is defined in accordance with Article 5 of Regulation (EU) 2017/1130, and the power of auxiliary engine in kW shall include all installed engine power that is not included under the heading power of main engine.

In case a vessel is equipped with multiple main engines, irrespective of whether these engines are driving one or more multiple propellor shafts, the power of main engine to be reported in the national fleet register and the Union fishing fleet register is the sum of the maximum engine power of all propulsive engines combined (section 3.8.3).

7.2. Reporting obligation under the Control Regulation

In accordance with Article 118(1) of the Control Regulation, Member States are required to transmit, every five years, a report on the application of the Control Regulation to the Commission. In accordance with Article 39(2) of the Control Regulation, as part of this report, Member States need to inform the Commission on the control measures they have undertaken to ensure that the certified engine power is not exceeded.

The aforementioned report on the control measures undertaken by Member States to ensure that the certified engine power is not exceeded should, as a minimum, cover the following aspects:

1. Vessel risk analysis and sampling (section 4.3);
2. Data verification of engine power, including results (section 4.4);
3. Physical verification of engine power, including results (section 4.5);
4. Engine power infringements established by alternative evidence (section 4.9.3);
5. Engine power infringements established by continuous power monitoring devices (section 4.1);
6. Sanctioning of established infringements (section 5.4);
7. In case of regularisation, where applicable, updating the certified engine power in the National fishing fleet register and the Union fishing fleet register (section 5.5);
8. In case of incorrect declaration and / or registration of main and auxiliary power (section 4.4.6), the consequential update of the certified engine power in the National fishing fleet register and the Union fishing fleet register.

8. Exceptions, considerations and future developments

8.1. Design requirements for newly built catching vessels

All catching vessels may be selected for a physical engine power verification at some point in time. In addition, a number of catching vessels will be required to have a continuous power monitoring system installed in the near future. Furthermore, additional catching vessels may be identified as being a high risk vessel in terms of compliance with its declared and certified engine power, and therefore also be required to be equipped with a continuous power monitoring system in accordance with the new Control Regulation.

Considering the currently available power measurement systems, both temporary and continuous power measurements should, in accordance with the (new) Control Regulation, be based on a (propeller) shaft power measurement. Therefore, it is strongly recommended that certifying authorities only approve the technical modification of an engine installed on board a catching vessel, the installation of a propulsion system on board a newly constructed catching vessel, or the engine room layout, design and arrangement of a newly constructed catching vessel in general, in case the following requirements are met:

1. A temporary engine power verification can reasonably be conducted;
2. A continuous shaft power measurement system can reasonably be installed.

Practical requirements to conduct a temporary physical shaft power measurement are described in section 4.5.4.

8.2. Access to electronically controlled engines

For the effective application of the certification and verification procedures to electronically controlled engines under the (new) Control Regulation, access to the ECU(s) that govern(s) the engine is required at various occasions:

1. During the pre-installation physical verification (section 3.9.1);

2. During the sea trial after the engine has been installed on board (section 3.11), in particular when the engine needs to be certified after it has been installed on board, e.g. in the event of fleet entry or derating (section 3.12);
3. During a physical engine power verification (section 4.5.9.1).

In the context of engine power certification (events 1 and 2 described above), access to the ECU(s) may be provided by the engine (sub)dealer, distributor or an independent engine maintenance enterprise. However, in the context of an engine power verification, it is recommended that access to the ECU(s) is provided by an actor that is fully independent from the vessel subject to verification (section 4.5.9.1).

The hardware and software (IT tools) to access various brands and types of engines commonly found on board catching vessels, are not (fully) harmonised, and safe and adequate operation of these tools requires specific qualifications. The limited harmonisation of IT tools, the limited availability of IT tools, and the scarcity of – in particular independent – operators of IT tools jeopardise the ability of the Member States' certifying and verifying authorities to effectively implement parts of the engine power certification and verification guidance.

It is therefore recommended that Member States consider the availability of IT tools for fully independent access to ECUs, in the context of certification and verification of engine power, as a condition for approval when assessing the (first) application to install an electronically controlled engine on board a Union catching vessel. An electronically controlled engine whose ECU(s) cannot be independently accessed, and the software of which cannot be read, by the Member States' certifying and verifying competent authorities, could be considered unverifiable in accordance with the (new) Control Regulation and this guidance.

8.3. Verification of engine power on board vessels where a physical engine power verification cannot be conducted

As described in section 4.5.5, and discussed further in section 8.1, conducting a physical engine power verification based on (propeller) shaft torque measurement (and / or the installation of a continuous shaft power measurement system) is not possible on board certain vessels within the existing fleet of Union catching vessels.

Verifying authorities may nevertheless attempt to let the engine produce its maximum power during a verification trial, but no instantaneous engine power can be established on board such vessels. Compelling secondary indications of non-compliance may be obtained from the ECU of specific engine types (section 4.9.5.1), which could possibly also result in the establishment of an infringement (section 4.9.3(4)). However, most engine power verification trials where a physical engine power measurement as described in section 4.5.5 cannot be conducted, are unlikely to produce compelling evidence of non-compliance in case the vessel is actually non-compliant with its certified engine power.

Physical engine power verification has already been an element of the engine power certification and verification process within the framework of the Control Regulation and the Commission Implementing Regulation for a long time since their adoption on 20 November 2009 and 8 April 2011 respectively. Therefore, against this backdrop, design measures similar to those recommended in section 8.1 could have been considered by Member States for newly installed engines and in particular newly constructed catching vessels since that time, to ensure that engine power of catching vessels can be controlled in accordance with the (new) Control Regulation and the Commission Implementing Regulation.

Therefore, it may be considered reasonable that certifying authorities demand structural modifications (e.g. the rearrangement of piping, creating a hatch in a floor overhead of the propeller shaft, or shifting the engine and / or gearbox in the longitudinal direction) to be made to vessels where a physical engine power verification cannot be conducted, in case these vessels are equipped with a main engine installed after the Control Regulation entered into force, and where such structural modifications would enable a physical engine power verification. Demanding structural modifications to be made to a vessel to facilitate physical engine power verification of that vessel may be considered particularly justified in case the installed engine has been derated.

Certain catching vessels will remain where a physical verification based on a (propeller) shaft torque measurement cannot be conducted, for example because no (realistic) structural modification to the vessel will enable such measurement.

Member States are recommended to put efforts into obtaining alternative (to shaft torque and revolutionary speed measurement) power determination methods only for those catching vessels that meet the following conditions:

1. A strain gauge shaft torque measurement can objectively not be conducted (even if structural modifications are made to the vessel);
2. The engine of the catching vessel concerned has been installed prior to the Control Regulation entered into force.

In case a Member State determines that a shaft torque measurement cannot be conducted, and therefore considers the vessel eligible for any alternative power determination method, it should be documented which vessel-specific factors support this decision.

8.3.1. Alternative power determination methods

Several candidate methodologies to substitute shaft torque and revolutionary speed as method to determine or approximate the maximum engine power of a catching vessel in the context of the (new) Control Regulation have been considered, in particular:

1. Evaluation of vessel data (position, speed, etc.) currently transmitted by most fishing vessels;
2. Evaluation of ECU generated data (only applicable to electronically controlled engines);
3. Evaluation of fuel consumption data (obtained from bunker data or via (mass) flow meters on board.

Method 1 (evaluation of vessel data (position, speed, etc.) currently transmitted by most fishing vessels) is considered a useful element in the context of risk assessment and / or data verification (section 4.4.1) to identify indications of potential non-compliance, but too insensitive to confidently identify cases where the exceedance of certified engine power are small, and generally constitutes an insufficient basis to pursue an infringement.

Method 2 (evaluation of ECU generated data (only applicable to electronically controlled engines) is considered a source of potentially compelling evidence of non-compliance in case specific data are generated and appropriate IT tools are available to read out this data (section 4.9.3 and section 8.2). However, it should be realised that the absence of such specific clear indications of non-compliant operation of the vessel cannot currently be considered as sufficient and conclusive evidence of compliance, since (advanced) digital and mechanical methods could potentially be present to impair ECU generated data.

Method 3 (evaluation of fuel consumption data (obtained from bunker data or via (mass) flow meters on board) is acknowledged as a well-established data source for the purpose of monitoring, reporting and verifying carbon dioxide emissions from maritime transport, as required for certain vessels by various regulations (e.g. Regulation (EU) 2015/757[44]). However, the (new) Control Regulation and

[44] Annex I of REGULATION (EU) 2015/757 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 April 2015 on the monitoring, reporting and verification of greenhouse gas emissions from maritime transport, and amending Directive 2009/16/EC (OJ L 123 19.5.2015, p. 55).

Commission Implementing Regulation which regulate the instantaneous maximum engine power of catching vessels that can be obtained from a propulsion engine, differs fundamentally from regulations that concern the average emission of carbon dioxide per unit work (e.g. tonne-mile), unit time or unit distance.

Although evaluation of fuel consumption data obtained from bunker data may provide strong indications or even evidence of non-compliance with the declared amount of engine power (in case of substantial exceedance) in a data verification context, it is not considered possible to quantify the instantaneous maximum engine power based on this method.

Instantaneous fuel mass flow measurement could in principle be used for the approximation of instantaneous maximum engine power, in particular for engines in an as new condition, for which brake specific fuel consumption data are available. However, the suitability of this methodology to determine the instantaneous maximum engine power for the purpose of an engine power verification in the context of the (new) Control Regulation, is considered limited, because of the limited confidence with which an increase of the fuel consumption could be attributed to the use of incremental power, without further investigation of the engine.

In summary, none of the aforementioned alternative power determination methods are currently considered recommendable for engine power verification in the context of the (new) Control Regulation. None of these alternative methods are considered suitable for engine power certification purposes.

8.4. Harmonisation and cooperation beyond the scope of the Working Group

The guidance presented in this document contains elements where Member States may benefit from harmonisation and cooperation. Examples of such elements include:

1. Suitability assessment (of newly installed engines);

There is a substantial overlap in the engine types available to catching vessel operators to choose from between the Union's Member States. Certifying authorities are, in accordance with sections 3.6 and 3.7, recommended to determine the highest maximum continuous power rating for every engine type for which an application to install it in a catching vessel is received. This may be done on a case-by-case basis, or through the development and publication of a database with engine types indicating the highest available maximum continuous power assigned to these types, based on assessments by the certifying authority.

Member States' authorities are recommended to cooperate on the development, maintenance and implementation of such database, to reduce the workload for authorities and to promote harmonisation of the highest maximum continuous engine power values assigned to engine types among Member States.

In addition to assigning the highest maximum continuous engine power to an engine type, information from engine manufacturers is required to determine to what extent, and under which conditions, derating of electronically controlled engines should be permitted (section 3.10.2.3). This information may be obtained from engine manufacturers in the process of developing the aforementioned database. In addition to a reduced workload and better harmonisation, cooperation among Member States in obtaining the ECU characteristics listed in section 3.10.2.3 may result in better cooperation between authorities and engine manufacturers, as the requested information is of a very specific nature.

2. Ongoing compliance measures;

Certifying authorities should, in accordance with section 3.10, develop, document and publish engine type-specific ongoing compliance measures (e.g. sealing instructions). Considering the substantial overlap of available and installed engine types on catching vessels across the EU, Member States' authorities are recommended to cooperate on the development, maintenance and implementation of these measures, to reduce the workload for authorities and to promote the harmonisation of applied ongoing compliance measures among Member States.

3. Physical engine power verification capacity building.

Full implementation of the risk analysis and sampling guidance (section 4.3), and the data verification guidance (section 4.4), may be expected to result in an increased number of catching vessels being selected for a physical engine power verification, or for the installation of a continuous engine power monitoring device.

The availability of Member State officials and external contractors capable of conducting physical engine power verifications is limited, and currently already considered insufficient. No autonomous growth of physical engine power verification capacity among external contractors is foreseen in the short term. Therefore, the shortage of engine power verification capacity within the Union may increase, which could jeopardise the effective implementation of the engine power verification guidance.

Member States' authorities responsible for the physical verification of engine power, the European Commission and other European stakeholders, are therefore recommended to urgently explore options to promote capacity building initiatives in order to bolster the required capacity of physical engine power verification on board catching vessels in the European Union. In this context, full implementation of this guidance may require Member States' authorities to establish a realistic timeframe, as a consequence of limited availability of required resources to implement not only physical engine power verification, but also certain elements related to certification.

8.5. Accounting for technical progress

The guidance in this document is based on the technical insights at the time of writing. Future amendments of the (new) Control Regulation, the development of a new Commission Implementing Regulation, new technical insight in the field of engine power determination, including but not limited to alternative methods that could be considered, may need to be reflected in (a) revised version(s) of this guidance.

Annexes

1. Example test report pre-installation physical engine power verification (section 3.9.2)
2. Example Ongoing Compliance Measures document (section 3.10)
3. Example Sealing Plan (section 3.10.1.3)
4. Example application vector method – using vessel position data (section 4.4.1)
5. Example averaging method – using vessel position data (section 4.4.1)
6. Example standardised EIAPP certificate - Technical File (section 4.4.3)
7. Example Certificate of Class (section 4.4.4)
8. Douglas sea scale (section 4.5.7.2)
9. Template physical engine power verification report form (section 4.8)

Annex 1. Pre-installation physical engine power verification report template

1 – Vessel particulars

1.1	Vessel name		
1.2	IMO number		
1.3	CFR number		
1.4	Main engine power (vessel)	(in EU / MS fleet register)	
1.5	Main engine power (vessel)	(as stated on fishing license)	

2 – Verification particulars

2.1	Verification date	(dd-mm-yyyy)	
2.2	Verification site	(name, address)	
2.3	Authorities represented by	(name(s) of attending inspector(s))	
2.4	Verifier	(name(s), if other than authorities reps)	
2.5	Verifier organisation	(if other than authorities)	

3 – Engine particulars

3.1	Engine manufacturer		
3.2	Engine type		
3.3	Engine serial number		
3.4	Rated power	(engine identification plate)	
3.5	Rated speed	(engine identification plate)	
3.6	Rated power	(EIAPP, if applicable)	
3.7	Rated speed	(EIAPP, if applicable)	
3.8	Number of cylinders		
3.9	Arrangement of cylinders	(in-line, V)	
3.10	Turbocharger	(yes / no)	
3.11	Fuel injection system	(e.g. common rail, EUI, etc.)	
3.12	Control system	(e.g. mechanical, ECU, etc.)	

In case of governor controlled engine:

3.13	Governor manufacturer		
3.14	Governor type		
3.15	Governor serial number		
3.16	Governor droop setting	(%)	

In case of electronically controlled engine:

3.17	ECU serial number	(hardware, main ECU)	
3.18	Software identification	(main ECU, e.g. software version no., Test Spec, as applicable)	
3.19	Rating number / type	(e.g. 'rating 1')	
3.20	Chassis no.	(if applicable)	
3.21	ECU serial number	(hardware, backup ECU, if applicable)	
3.22	Software identification	(backup ECU, ECU, e.g. software version no., Test Spec, as applicable)	
3.23	Rating number / type	(Backup ECU, e.g. 'rating 1', if applicable)	

4 – Measurement setup

4.1	Dyno / water brake manufacturer	
4.2	Dyno / water brake type	
4.3	Dyno / water brake serial number	
4.4	Dyno / water brake last calibration date	

5 – Test fuel specifications

5.1	Fuel type / grade	(in accordance with ISO 8217:2017)	
5.2	Cetane number	(in accordance with ISO 5165)	
5.3	Viscosity	(mm^2/s at 40°C in acc. with ISO 3104)	
5.4	Density	(g/cm^3 at 288 K in acc. with ISO 3675)	
5.5	LCV, measured	(kJ/kg in acc. with ASTM D 240)	
	or		
5.6	LCV, estimated	(kJ/kg in acc. with ASTM D 3338)	

6 – Measurement results

			Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7
6.1	Suggested speed	(% of (de)rated maximum)	Lowest	63	80	91	100	Max	Max
6.2	Suggested power	(% of (de)rated maximum)	0	Max*	Max*	Max*	Max*	Max*	Lowest
6.3	Ambient temperature	(°C, engine room)							
6.4	Ambient air pressure	(mBar, engine room)							
6.5	Relative humidity	(%, engine room)							
6.6	Brake power	(kW)							
6.7	Shaft speed	(rpm)							
6.8	Fuel mass flow	(kg / h)							
6.9	Fuel temperature	(°C)							
	Governor (mechanical engine control system, if applicable):								
6.10	Speed (request) lever	(at max (limited) position): yes / no)							
6.11	Governor output	(position)							
	Fuel system (conventional fuel system, if applicable):								
6.12	Common fuel rack	(position)							
6.13	Fuel pump 1 rack	(position)							
	Fuel pump 2 rack	(position)							
	… all fuel pumps …	(position)							
	Fuel system (common rail fuel system, if applicable):								
6.14	Rail pressure	(bar)							
	Control system readout (electronically controlled engine, if applicable):								
6.15	Speed request	(throttle position (%))							
6.16	Engine speed	(rpm)							

			Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7
6.17	Torque	(nM)							
6.18	Load factor	(%)							
6.19	Fuel rate	(l / h)							

All engines (if applicable):

6.20	Charge air pressure	(Bar)							
6.21	Charge air temp.	(°C)							
6.22	Exhaust gas cylinder 1	(temperature, °C)							
	Exhaust gas cylinder 2	(temperature, °C)							
	… all cylinders …	(temperature, °C)							
6.23	Exhaust gas before TC	(temperature, °C)							
6.24	Exhaust gas after TC	(temperature, °C)							
6.25	HT coolant	(engine inlet temperature, °C)							
6.26	HT coolant	(engine outlet temperature, °C)							

* Maximum power attainable at actual engine speed, through increasing brake load while maintaining (suggested) requested engine speed.

7 – Ongoing compliance measures

In case of derated electronically controlled engine:

7.1	List of derated (electronic) engine settings	
7.2	Description of ongoing compliance measures*	

In case of derated mechanically controlled engine:

7.3	List of derated (mechanical) engine settings	
7.4	Description of ongoing compliance measures*	

* Ongoing compliance measures are methods / appliances to prevent tampering with engine settings aimed at preventing unauthorised uprating of the engine, such as seals, password protection, etc., to be applied after compliance of actual maximum engine power with declared amount has been verified.

8 – Remarks, conclusions and observations

8.1	

Annex 2. Example ongoing compliance measures document

Inspectie Leefomgeving en Transport
Ministerie van Infrastructuur en Waterstaat

Bijlage IV

Instructies verzegeling per motortype –

fabrikant WARTSILA

Versie 1

Datum	30 Juni 2022
Status	Definitief

Colofon

	ILT Vergunningverlening leefomgeving en scheepvaart [redacted]
Contactpersoon	[redacted] *Senior inspecteur* [redacted]
	Visserij@ilent.nl
Versie	1
Auteur	[redacted]
Ingangsdatum	1 juli 2022

Inhoud

Inleiding

Voorliggend document betreft bijlage IV:

Instructies verzegeling per motortype – fabrikant WARTSILA

In dit document wordt per motortype ingegaan op de instructie voor het verzegelen van de motor.

Dit document maakt onderdeel uit van een reeks, namelijk:

- Bijlage I: Voorschriften voor een vermogensmeting voor een vissersvaartuig
- Bijlage II: Voorschriften voor het verzegelen van motoren van vissersvaartuigen
- Bijlage III: Voorschriften verbroken zegels
- Bijlage IV: Instructies verzegeling per motortype

Deze instructies en voorschriften zijn ondersteunend aan het invullen van het Zegelplan en de Vermogensmeting door de betreffende erkende instellingen.

1.3 Wartsila 32

Fabrikant:	Wartsila
Type:	32 def
Min aantal zegels:	Afhankelijk van aantal cilinders

IMO TIER 2 (TIER 3 compliant), HFO, MDO & liquid bio fuels, medium speed motor, 32=bore is beschikbaar van 6-16 cilinders, Variable inlet valve, 3480-9290 kW, 720-750 tpm.

Instructie verzegelen:

Vermogen afstellen met behulp van stelbout voor de centrale regelstang eindblokkering aan bakboord achterzijde van de motor.

De lengte van de stelbout en de dikte van de nok van de heugel opmeten en noteren.

Indien het maximum toerental bijgesteld moet worden dan ook deze stand meten en noteren.

Vooraf controleren of alle nokkenasdeksels voorzien zijn van twee bouten en moeren die verzegeld kunnen worden. Dit geldt ook voor de nokkenas tandwieldeksel.

Verzegelen:
Motor verzegelen op maximum toerental vissend.

5. Bovendeksel regulateur verzegelen.
6. Bij alle cilinders, twee moeren van de brandstofpomp / motorblok verbinding met elkaar verzegelen.
7. Bij alle cilinders, de brandstofpomp stopcilinders volgens foto / tekening (2 zegels) verzegelen.

Tijdens proefvaren wordt bij het af te stellen vermogen, de maat van de heugelstand van de brandstofpompen genoteerd.

De busjes in de stopcilinders moeten dan na de proefvaart op maat gemaakt worden. De stopcilinders worden dan bij terugplaatsing plaatsing verzegeld. Daarbij wordt gecontroleerd of de maximale heugelstand overeenkomt met de stand die bij het af te stellen vermogen hoort.

Vastleggen in protocol in vissende en stomende condities:

- Voorinspuiting brandstof
- Regulator instelling, zowel bij mechanisch als bij elektronisch
- Turbo toerental
- Turbo druk
- Toerental motor
- Regelstand pompen
- Brandstofdruk
- Uitlaatgassen temperatuur (na cilinders en na turbo)
- Motorvermogen

Instructie verbroken zegels:

Indien van de regulateur een of meer zegels ontbreken: Met draaiende motor stationair of vrij varend het maximum toerental meten en met eerste meting vergelijken. Bij afwijking dient dit door een monteur te worden bijgesteld.

Indien alleen de brandstofpompen zonder zegel worden aangetroffen: Mits de racks met de zelfde IJslandse bussen worden terug gemonteerd en de stand per pomp overeenkomt met de eerste meting, dan is geen her meting nodig.

Indien het zegel van de brandstof regelstang heugel met stelbout ontbreekt: Lengte stelbout en dikte nok van de heugel vergelijken met eerste meting. In geval van een afwijking, is een proefvaart nodig met zwevende netten ter verificatie van de drukken, temperaturen en maximum toerental. Daarbij moet dan bekend zijn dat de schroef intussen niet veranderd of gewisseld is. Bij een afwijking kan verzocht worden om bijstelling door een monteur of bij grote afwijkingen dan wel als de eigenaar het wenst, kan een her meting van het vermogen worden verricht. Indien echter alleen deze mankeert en de verzegeling van de brandstofpompen in orde is, dan kan zonder meer een nieuw zegel geplaatst worden.

Indien een of meer zegels van de nokkenasdeksels ontbreken, is een proefvaart nodig met zwevende netten ter verificatie van de drukken, temperaturen en maximum toerental. (Tenzij de nokkenas aantoonbaar niet gewisseld of aangepast is). Daarbij moet dan bekend zijn dat de schroef intussen niet veranderd of gewisseld is. Bij een afwijking kan verzocht worden om bijstelling door een monteur of bij grote afwijkingen dan wel als de eigenaar het wenst, kan een her meting van het vermogen worden verricht.

Translation of page 4

Introduction

This document concerns annex IV:

Instructions sealing per engine type – manufacturer WARTSILA

The sealing instruction per engine type will be addressed in this document.

This document is part of the following series:

- Annex I: Instructions for the measurement of power of a fishing vessel
- Annex II: Instructions for the sealing of engines of fishing vessels
- Annex III: Instructions broken seals
- Annex IV: instructions sealing per engine type

These instructions support the completion of the sealing plan and power measurement by the concerning entities.

Translation of page 9

Manufacturer:	Wartsila
Type:	32 def
Minimum number of seals:	Depends on number of cylinders

IMO TIER 2 (TIER 3 compliant), HFO, MDO & liquid bio fuels, medium speed engine, 32 is the engine bore in cm, the engine is available from 6 to 16 cylinders, Variable inlet valve, 3480-9290 kW, 720 - 750 rpm.

Sealing instructions:

Adjust the engine power using the set bolt of the end stop of the common fuel rack at the port side aft end of the engine.

Measure and note the length of the set bolt and the thickness of the rack.

If the engine revolutionary speed needs to be adjusted, also measure the length of the high idle set bolt.

~~Verify whether the camshaft cover is equipped with two bolts and nuts that can be sealed. This also applies to the camshaft gear cover.~~ [note that crossed out text will be removed from an updated version of the instructions]

Sealing:

Seal the engine at maximum speed (rpm) under fishing conditions.

5. Seal the governor top cover.

6. At every cylinder, seal-connect two nuts at the fuel pump base to affix the pump to the engine block.

7. At every cylinder, seal the fuel pup stop cylinder in accordance with the instruction image / drawing.

The fuel rack position of each fuel pump shall be noted during the sea trial when the engine is producing the desired (maximum compliant) amount of power.

The length of the bushings in the stop cylinders shall be adjusted after the sea trial. The stop cylinders shall be sealed when reinstalled. Thereafter, it shall be verified whether the maximum fuel rack position of each fuel pump corresponds with the position corresponding with the maximum compliant amount of power.

The following shall be noted in the protocol under fishing and steaming conditions:

- Pre-injection of fuel
- Governor settings, both in case of a mechanical and an electronical governor
- Turbocharger speed
- Charge air pressure
- Engine speed (rpm)
- Fuel rack position fuel pumps
- Fuel pressure
- Exhaust gas temperature (after the cylinders and after the turbocharger)
- Engine power

Translation of page 10

Instruction broken seals:

In case one or more seals omit from the governor: Measure the maximum engine speed with the gearbox clutched out or under steaming conditions, and compare the measured speed with the value reported during the initial sea trial. In case any difference is observed, an engineer shall adjust the high idle setting.

In case seals omit from the fuel pumps only: verify whether – after reinstallation – the maximum fuel rack position corresponds with the value reported during the initial sea trial. If this is the case, a remeasurement is not required.

In case seals omit from the common fuel rack limiter: measure the dimensions of the set bolt and the fuel rack, and compare the measured dimensions with the values reported during the initial sea trial. In case any discrepancy is observed, a remeasurement with deployed fishing gear is required to verify pressures, temperatures and the maximum engine speed. A precondition is that the propeller has not been changed or modified in the meantime. In case any discrepancy is observed, adjustment by an engineer may be requested. When large discrepancies are observed and / or when the owner wishes so, a remeasurement may be conducted. If however only this seal omits, and the seals of the fuel pumps are unaffected, a replacement seal can be applied without further conditions.

~~In case one or more seals omit from the camshaft covers, a remeasurement with deployed fishing gear is required to verify pressures, temperatures and the maximum engine speed (unless the camshaft has demonstrably not been changed or modified). A precondition is that the propeller has not been changed or modified in the meantime. In case any discrepancy is observed, adjustment by an engineer may be requested. When large discrepancies are observed and / or when the owner wishes so, a remeasurement may be conducted.~~ [note that crossed out text will be removed from an updated version of the instructions]

Annex 3. Example sealing plan (NL sealing plan)

Numbered translation references in green (translation at end of Annex)

Inspectie Leefomgeving en Transport
Ministerie van Infrastructuur en Waterstaat 1

Aanvraag goedkeuring Zegelplan 2

Aanvraagnummer	xxxxx	3
Ingediend op	xx-xx-xxxx	4

1. Aanvrager 5

Uw organisatiegegevens

KVK-nummer	xxxxx	6
Vestigingsnummer	xxxxx	7
RSIN	xxxxx	8
Statutaire naam	xxxxx	9
Handelsnaam	xxxxx	10
Adres	xxxxx	11
Postcode	xxxxx	12
Plaats	xxxxx	13
Land	Nederland	14

Gegevens contactpersoon 15

Voornaam	xxxxx	16
Achternaam	xxxxx	17
E-mailadres	xxxxx	18

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Telefoonnummer inclusief landcode, bijvoorbeeld +31123456789	xxxxx	19
Uw kenmerk	xxxxx	20
Voor wie vult u dit formulier in?	xxxxx	21

2. Aanvraag

22

Gegevens aanvraag

Naam van de uitvoerende technicus	xxxxx	23

Gegevens vissersvaartuig

24

Vismerk	xxxxx	25
Naam vissersvaartuig	xxxxx	26
Reden vermogensmeting	Meerdere verbroken zegels	27
Datum verzegeling	xxxxx	28
Locatie verzegeling	xxxxx	29

Gegevens hoofdmotor

30

Fabrikant en type	Wartsila 32	31
Serienummer	xxxxx	32
Bouwjaar	2000	33

Gegevens reductiekast/keerkoppeling

34

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Fabrikant	Reintjes	35
Type	xxxxx	36
Serienummer	xxxxx	37
Bouwjaar	2000	38
Beschrijf de ratio op als 1 staat tot [getal], dus begin met 1:	1:4,96	39

Meetresultaten 40

Afgesteld vermogen koers (KW)	xxxxx	41
Toerental hoofdmotor koers (rpm)	xxxxx	42
Toerental schroefas koers (rpm)	xxxxx	43
Vuldruk koers (bar)	xxxxx	44
Spoellucht temperatuur inlaat koers (°C)	xxxxx	45
#1 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	46
#2 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
#3 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
#4 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
#5 Cilinder		

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Temperatuur uitlaatgas koers (°C)	xxxxx	
#6 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
Stand regelstang koers (als dit van toepassing is, in mm)	xxxxx	47
#1 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	48
#2 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	
#3 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	
#4 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	
#5 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	
#6 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	
Afgesteld vermogen koers (KW)	xxxxx	49
Toerental hoofdmotor koers (rpm)	xxxxx	50
Toerental schroefas koers (rpm)	xxxxx	51
Vuldruk koers (bar)	xxxxx	52

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Spoellucht temperatuur inlaat koers (°C)	xxxxx	53
#1 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	54
#2 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
#3 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
#4 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
#5 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
#6 Cilinder		
Temperatuur uitlaatgas koers (°C)	xxxxx	
Stand regelstang koers (als dit van toepassing is, in mm)	xxxxx	55
#1 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	56
#2 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	
#3 Brandstofpomp		
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx	
#4 Brandstofpomp		

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Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx
#5 Brandstofpomp	
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx
#6 Brandstofpomp	
Stand brandstofpomp koers (als dit van toepassing is, in mm)	xxxxx

Aangebrachte zegels 57

Aangebrachte zegel #1		
Locatie	Stopcilinder (eind) 1	58
Nieuw zegelnummer	NVWA xxxxx	59
Aangebrachte zegel #2		
Locatie	Stopcilinder (eind) 2	
Nieuw zegelnummer	NVWA xxxxx	
Aangebrachte zegel #3		
Locatie	NVWA	
Nieuw zegelnummer	NVWA xxxxx	
Aangebrachte zegel #4		
Locatie	Stopcilinder (eind) 4	
Nieuw zegelnummer	NVWA xxxxx	
Aangebrachte zegel #5		
Locatie	Stopcilinder (eind) 5	
Nieuw zegelnummer	NVWA xxxxx	

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Aangebrachte zegel #6

Locatie	Stopcilinder (eind) 6
Nieuw zegelnummer	NVWA xxxxx

Aangebrachte zegel #7

Locatie	Stopcilinder (montage) 1	60
Nieuw zegelnummer	NVWA xxxxx	

Aangebrachte zegel #8

Locatie	Stopcilinder (montage) 2
Nieuw zegelnummer	NVWA xxxxx

Aangebrachte zegel #9

Locatie	Stopcilinder (montage) 3
Nieuw zegelnummer	NVWA xxxxx

Aangebrachte zegel #10

Locatie	Stopcilinder (montage) 4
Nieuw zegelnummer	NVWA xxxxx

Aangebrachte zegel #11

Locatie	Stopcilinder (montage) 5
Nieuw zegelnummer	NVWA xxxxx

Aangebrachte zegel #12

Locatie	Stopcilinder (montage) 6
Nieuw zegelnummer	NVWA xxxxx

Aangebrachte zegel #13

Locatie	Pompvoet 1	61

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Nieuw zegelnummer	NVWA xxxxx
Aangebrachte zegel #14	
Locatie	Pompvoet 2
Nieuw zegelnummer	NVWA xxxxx
Aangebrachte zegel #15	
Locatie	Pompvoet 3
Nieuw zegelnummer	NVWA xxxxx
Aangebrachte zegel #16	
Locatie	Pompvoet 4
Nieuw zegelnummer	NVWA xxxxx
Aangebrachte zegel #17	
Locatie	Pompvoet 5
Nieuw zegelnummer	NVWA xxxxx
Aangebrachte zegel #18	
Locatie	Pompvoet 6
Nieuw zegelnummer	NVWA xxxxx
Aangebrachte zegel #19	
Locatie	Nokkenasdeksel **62**
Nieuw zegelnummer	NVWA xxxxx
Aangebrachte zegel #20	
Locatie	Lever fuel rack **63**
Nieuw zegelnummer	NVWA xxxxx

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Inspectie Leefomgeving en Transport
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Aangebrachte zegel #21

Locatie	Deksel regulateur 64
Nieuw zegelnummer	NVWA xxxxx

Aangebrachte zegel #22

Locatie	Deksel regulateur
Nieuw zegelnummer	NVWA xxxxx

Aangebrachte zegel #23

Locatie	Regulateurvoet 65
Nieuw zegelnummer	NVWA xxxxx

3. Bijlagen 66

Foto van aangebracht zegel 1. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel.jpg 67
Foto van aangebracht zegel 2. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_1.jpg
Foto van aangebracht zegel 3. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_2.jpg
Foto van aangebracht zegel 4. Hierop dient te worden vermeld: locatie, beschrijving zegel en het	afbeelding_zegel_3.jpg

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bijbehorend zegelnummer (maximaal 1 bijlage).	
Foto van aangebracht zegel 5. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_4.jpg
Foto van aangebracht zegel 6. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_5.jpg
Foto van aangebracht zegel 7. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_6.jpg
Foto van aangebracht zegel 8. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_7.jpg
Foto van aangebracht zegel 9. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_8.jpg
Foto van aangebracht zegel 10. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_9.jpg
Foto van aangebracht zegel 11. Hierop dient te worden vermeld: locatie, beschrijving zegel en het	afbeelding_zegel_10.jpg

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bijbehorend zegelnummer (maximaal 1 bijlage).	
Foto van aangebracht zegel 12. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_11.jpg
Foto van aangebracht zegel 13. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_12.jpg
Foto van aangebracht zegel 14. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_13.jpg
Foto van aangebracht zegel 15. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_14.jpg
Foto van aangebracht zegel 16. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_15.jpg
Foto van aangebracht zegel 17. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_16.jpg
Foto van aangebracht zegel 18. Hierop dient te worden vermeld: locatie, beschrijving zegel en het	afbeelding_zegel_17.jpg

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bijbehorend zegelnummer (maximaal 1 bijlage).	
Foto van aangebracht zegel 19. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_18.jpg
Foto van aangebracht zegel 20. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_19.jpg
Foto van aangebracht zegel 21. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_20.jpg
Foto van aangebracht zegel 22. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_21.jpg
Foto van aangebracht zegel 23. Hierop dient te worden vermeld: locatie, beschrijving zegel en het bijbehorend zegelnummer (maximaal 1 bijlage).	afbeelding_zegel_22.jpg
Overzichtsfoto van de aangebrachte zegels (maximaal 5 bijlagen).	Geen
Indien u nog andere foto's wilt toevoegen aan dit zegeplan (maximaal 5 bijlagen).	Geen

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4. Verklaring 69

Verklaring aanvraag	Hierbij verklaar ik dat ik de aanvraag naar waarheid heb ingevuld. En dat ik correspondentie over mijn aanvraag wil ontvangen op het door mij opgegeven e-mailadres. 70
Verklaring eigenaar	Ondergetekende verklaart dat de eigenaar van het vissersvaartuig in dit genoemde zegelplan, kennis heeft genomen van de inhoud van dit document. 71
Plaats van verklaring	xxxxx 72
Datum verklaring	xxxxx 73
Handtekening	xxxxx 74

Contact: Voor contact met de ILT, zie www.ilent.nl/contact of bel met 088 489 00 00 75
Let op: Houd bij telefonisch contact altijd het aanvraagnummer bij de hand.

Pagina 13 van 13

Pictures of seals referred to in sealing plan (illustrative)

Seal no. 1

Seal no. 2

Seal no. 3

Seal no. 4

Seal no. 5

Seal no. 6

Seal no. 7

Seal no. 8

Seal no. 9

Seal no. 10

Seal no. 11

Seal no. 12

Seal no. 13

Seal no. 14

Seal no. 15

Seal no. 16

Seal no. 17

Seal no. 18

Seal no. 19

Seal no. 20

Seal no. 21

Seal no. 22

Seal no. 23

Translation of numbered items in example sealing plan

1	Human Environment and Transport Inspectorate Ministry of Infrastructure and Water Management
2	Application Approval sealing plan
3	Application number
4	Submitted on (date)
5	Applicant Details of your organisation
6	Chamber of commerce number
7	Branch number
8	Legal Entities Partnerships Information Number (abbreviated)
9	Statutory name
10	Trade name
11	Address (street)
12	Postal code
13	Town
14	Country
15	Details contact person
16	First name
17	Surname
18	e-mail address
19	Telephone number, including country code, for example +31123456789
20	Your reference
21	For whom are you completing this form?
22	Application Application details
23	Name of the performing technician
24	Details of fishing vessel
25	External marking
26	Name of fishing vessel
27	Reason (for) power measurement *Multiple broken seals*

28	Date of sealing
29	Location of sealing (geographically)
30	Main engine particulars
31	Manufacturer and type *Wärtsilä 32*
32	Serial number
33	Year of construction
34	Reduction gearbox / reversal gearbox particulars
35	Manufacturer
36	Type
37	Serial number
38	Year of construction
39	Describe the ratio as 1 to [number], so start with 1:
40	Measurement results
41	Adjusted power course (KW)
42	Revolutionary speed main engine course (rpm)
43	Revolutionary speed propeller shaft course (rpm)
44	Charge air pressure (bar)
45	Scavenge air temperature inlet course (°C)
46	Cylinder no. 1 Exhaust gas temperature course (°C)
47	Position of fuel rack course (if applicable, in mm)
48	Fuel pump no. 1 Position fuel pump course (if applicable, in mm)
49	Adjusted power course (KW)
50	Revolutionary speed main engine course (rpm)
51	Revolutionary speed propeller shaft course (rpm)
52	Charge air pressure (bar)
53	Scavenge air temperature inlet course (°C)
54	Cylinder no. 1 Exhaust gas temperature course (°C)
55	Position of fuel rack course (if applicable, in mm)
56	Fuel pump no. 1 Position fuel pump course (if applicable, in mm)

57	Applied seals
58	Applied seal no. 1 Position *Stop cylinder (end) 1*
59	New seal number (seal number removed from this example sealing plan)
60	Applied seal no. 7 Position *Stop cylinder (mounting) 1*
61	Applied seal no. 13 Position *Fuel pump base 1*
62	Applied seal no. 19 Position *Cam shaft cover*
63	Applied seal no. 20 Position *Lever fuel rack*
64	Applied seal no. 21 Position *Governor cover*
65	Applied seal no. 23 Position *Governor base*
66	Attachments
67	Picture of applied seal no. 1. The following shall be reported: position, description of the seal and the corresponding seal number (1 attachment maximum).
68	Overview picture of the applied seals (5 pictures maximum).
69	Declaration
70	Declaration application *I herewith declare to have completed the application truthfully. And that I want to receive correspondence about my application on the e-mail address I submitted.*
71	Declaration owner *The undersigned declares that the owner of the fishing vessel subject of this sealing plan, has taken note of the content of this document.*
72	Place of declaration (geographically)
73	Date of declaration
74	Signature
75	For contact with the Human Environment and Transport Inspectorate (abbreviated), visit www.ilent.nl/contact or call 088 489 00 00. Attention: In case of contact via telephone, please have your application number readily available.

Annex 4 – Vector method example

This example shows how an indicative value for the still water speed of a vessel can be calculated from digitally obtained values for the vessel speed and course over ground (SOG and COG), and the direction and speed of the current vessel speed and course data, using vector subtraction, where:

a = vessel SOG (kts)

b = tidal current speed (kts)

c = vessel still water speed (kts)

α = vessel COG (°)

β = tidal current direction (°)

One way to subtract both vectors is to first factor each vector in its respective x and y component, where a 0° component is considered a positive y value, a 90° component a positive x value, a 180° component a negative y value and a 270° component a negative x value.

Vector components (x, y) may be subtracted as follows to obtain the still water speed:

$$c = \sqrt{(x_{vessel} - x_{current})^2 + (y_{vessel} - y_{current})^2}$$

Assume, for example, a vessel moving at a SOG (a) of 3 knots, a COG (α) of 45°, whereas the instantaneous current is moving at a speed (b) of 5 knots in a direction (β) of 270°.

The *x* component of the vessel movement = $\sin(45) * 3$ = 2,12

The *y* component of the vessel movement = $\cos(45) * 3$ = 2,12

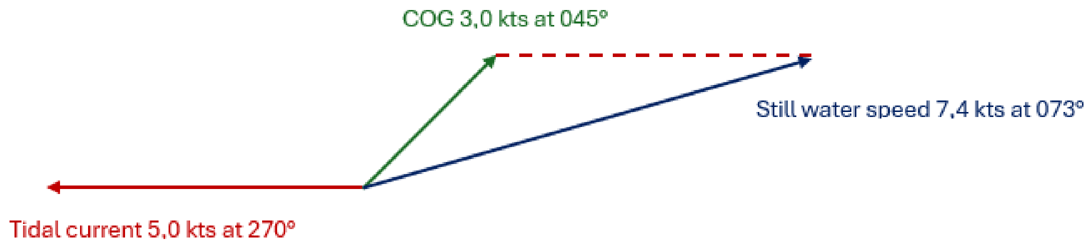
The *x* component of the tidal current = $\sin(270) * 5$ = - 5,00

The *y* component of the tidal current = $\cos(270) * 5$ = 0,00

Application of the formula presented above results in a calculated vessel still water speed of 7,4 knots:

$c = \sqrt{(2{,}12 - (-5{,}00))^2 + (2{,}12 - 0{,}00)^2}$ = 7,4

This example above can graphically be represented by the vectors below, where the vessel still water speed *c* is required to overcome the effects of tidal current *b* to arrive at the vessel speed over the ground *a*.



Caution

The reported current at the time at which the vessel COG and SOG data were obtained, may not be exactly accurate at the vessel's position, as a result of source data quality, interpolation, etc. In addition, other factors than the tidal current alone (e.g. wind and waves) may have affected the reported SOG.

Assume, for example, that the vessel from the example above reached a still water speed of 10,0 knots during its certification sea trial, at a propeller shaft power of 400 kW, and that the operating conditions at the time the vector data were collected (e.g. vessel trim, propeller pitch, hull fouling, fishing gear deployment, etc.) were comparable to the conditions during the sea trial.

The (simplified) propeller law as presented below may be used to approximate the propeller shaft power at the time the vector data were collected:

$$P_{shaft} = xv^3$$

where

P_{shaft} = shaft power (kW)

x = vessel and vessel operating conditions specific factor

v = vessel still water speed (kts)

Application of the propeller law above results in an estimated shaft power of $(\frac{7,4}{10,0})^3 . 400 \approx 162$ kW being used at the time when the vessel speed and tidal current data from this example were collected.

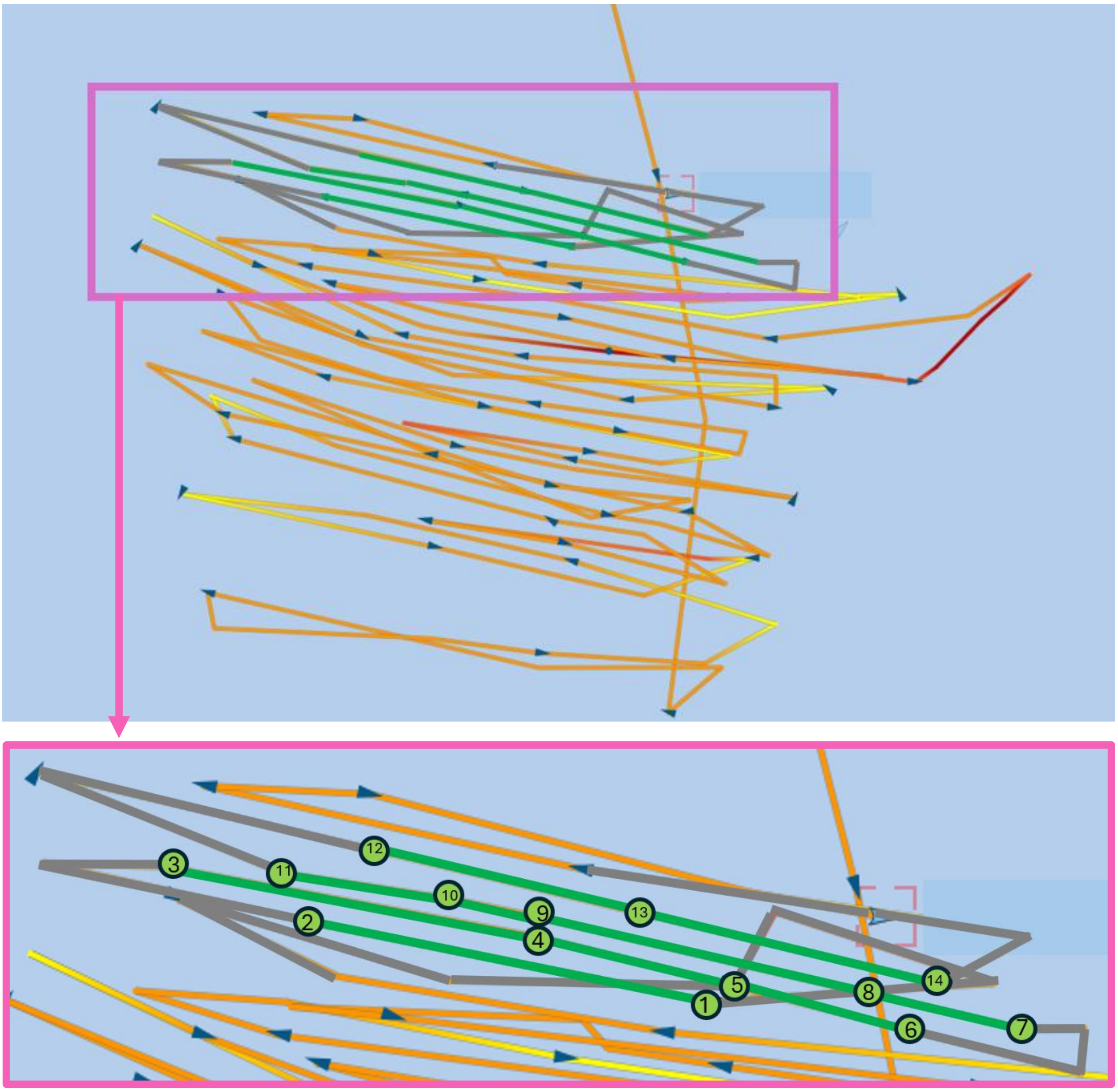
Caution

The exponent in the propeller law formula above may not be exactly 3 for every vessel and / or throughout the entire vessel speed range. The factor x may not be exactly constant throughout the speed range of the vessel, depending on factors such as hull design, propeller slip, fishing gear in-water orientation and position, etc. The instantaneous value of factor x is affected by e.g. hull fouling, trim, sea state, bottom effects, etc. Calculated shaft power values shall therefore be treated as indicative values.

Annex 5. Averaging method example

This example shows how vessel speed and course over ground (SOG and COG) data can be used to approximate a vessel's still water speed, provided that it operates in a typical 'zigzag' pattern, even when no tidal current information is available.

Figure 1 below shows a typical 'zigzag' track of a (beam) trawler conducting fishing operations.



The time, vessel COG and vessel SOG are transmitted regularly (data points). Multiple data points may be collected during one track of fishing. The values corresponding to a small subset of data points, numbered 1 to 12, from the track shown above are presented in table 1. From the figure above, it follows that these 12 data points correspond to 4 subsequent fishing tracks.

Table 1 – Data points of a beam trawler, collected during 01 hour and 26 minutes of fishing

Data point no.	Time (UTC)	Speed (kts)	COG (°)
1	12:36	4,3	286,2
2	12:44	4,2	282,2
3	12:52	6,1	122,8
4	13:00	6,1	099,4
5	13:08	6,2	102,6
6	13:11	6,1	103,4
7	13:18	4,1	264,2
8	13:20	4,2	272,0
9	13:29	4,1	279,8
10	13:31	4,2	284,0
11	13:35	4,1	277,6
12	13:53	6,3	106,6
13	13:56	6,2	104,0
14	14:02	6,3	102,4

These data point correspond with four tracks in more or less opposite directions. A near 180° course change is observed between data points 2 and 3, 6 and 7, and 11 and 12. The properties of each track are summarized in table 2.

Table 2 – Properties of tracks of a beam trawler, obtained from AIS data

Data points	Average speed (kts)	Highest– lowest speed (kts)	Average COG (°)	Highest – lowest COG value (°)
1 – 2 (2)	4,2	0,1	284,2	4,0
3 – 6 (4)	6,1	0,1	107,1	23,4
7 – 11 (5)	4,1	0,1	275,5	19,8
12 – 14 (3)	6,2	0,1	104,3	4,2

Averaged values have consistently been rounded down to arrive at a conservative (average speed) value. Because of the relatively short time between two consecutive data points, tidal conditions will not have changed substantially between data points 2 and 3 (8 minutes), 6 and 7 (7 minutes) or 11 and 12 (18 minutes).

Observing table 1 learns that the last data points before the turn and the first ones thereafter (data points 2 and 3, 6 and 7, and 11 and 12) are no outlier within their respective track, and can therefore safely be averaged. In addition, calm seas (Sea State 1) and low wind force (2 Bft.) were reported in the area.

Assuming that the vessel operates at its maximum power, a still water speed of 5,1 knots may be compared to sea trial data. Since it is not known whether the vessel actually deploys its maximum engine power, comparison of 5,1 knots to the sea trial report is not susceptible to Type I (false positive) errors, but it is to Type II (false negative) errors.

Assume that the vessel from the example above reached a still water speed of 12,0 knots during its certification sea trial at a propeller shaft power of 400 kW under steaming conditions, and a still water speed of 3,6 knots during its certification sea trial at a propeller shaft power of 400 kW under fishing conditions.

Also assume that the operating conditions at the time the AIS data were collected (e.g. vessel trim, propeller pitch, hull fouling, fishing gear deployment, etc.) are identical to the conditions during the fishing run(s) of the certification sea trial.

The (simplified) propeller law as presented below may be used to approximate the propeller shaft power at the time the vector data were collected:

$$P_{shaft} = xv^3$$

where

P_{shaft}	=	shaft power (kW)
x	=	vessel and vessel operating conditions specific factor
v	=	vessel still water speed (kts)

Application of the propeller law above results in an estimated shaft power of $(\frac{5,1}{3,6})^3 . 400$ ≈1137 kW.

Caution

The exponent in the propeller law formula above may not be exactly 3 for every vessel and / or throughout the vessel speed range. The factor x may not be exactly constant throughout the speed range of the vessel, especially under fishing conditions, and depends on factors such as hull design, propeller slip, fishing gear in-water orientation and position, etc. The instantaneous value of factor x is affected by e.g. hull fouling, trim, sea state, bottom effects, etc. Calculated shaft power values shall be treated as indicative values.

Although an (nearly) exact amount of engine power deployed while fishing cannot be provided based on AIS vessel SOG and COG data alone, the vessel speed obtained during actual fishing activities as presented in this example would justify further investigation of the vessel and its propulsion system.

Annex 6. Example standardised EIAPP certificate – Technical File

(standard template Bureau Veritas - anonymised example RINA, including anonymised Technical File and parts verification report)

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Appendix 1

Form of EIAPP Certificate
(Refer to 2.2.10 of the NO_x Technical Code)

ENGINE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE

Issued under the provisions of the Protocol of 1997, as amended by resolution MEPC.xx(58) in 2008, 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:

....
(full designation of the country)

by..
(full designation of the competent person or organization authorized under the provisions of the Convention)

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

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 Revised Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (2008) 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, installed in ships under the authority of this Government.

Issued at:

....
(Place of issue of certificate)

(dd/mm/yyyy) ....
(Date of issue)

....
(Signature of duly authorized official issuing the certificate)

(Seal or stamp of the authority, as appropriate)

SUPPLEMENT TO ENGINE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE (EIAPP CERTIFICATE)

RECORD OF CONSTRUCTION, TECHNICAL FILE AND MEANS OF VERIFICATION

Notes:

1 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.

2 The Record shall be at least in English, French or Spanish. If an official language of the issuing country is also used, this shall prevail in case of a dispute or discrepancy.

3 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 verifications refer to mandatory requirements from the Revised NO_x Technical Code (2008).

1 Particulars of the engine

1.1 Name and address of manufacturer ....
1.2 Place of engine build ....
1.3 Date of engine build ....
1.4 Place of pre-certification survey ....
1.5 Date of pre-certification survey ....
1.6 Engine type and model number ....
1.7 Engine serial number ....
1.8 If applicable, the engine is a Parent Engine ☐ or a Member Engine ☐ of the following Engine Family ☐ or Engine Group☐ ....
1.9 Individual Engine or Engine Family / Engine Group details:
1.9.1 Approval reference ....
1.9.2 Rated power (kW) and rated speed (rpm) values or ranges ....
1.9.3 Test cycle(s) ....
1.9.4 Parent Engine(s) test fuel oil specification ....
1.9.5 Applicable NO_x emission limit (g/kWh), regulation 13.3, 13.4, or 13.5.1 (delete as appropriate) ....
1.9.6 Parent Engine(s) emission value (g/kWh) ....

2 Particulars of the Technical File

The Technical File, as required by chapter 2 of the NO_x 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.

2.1 Technical File identification/approval number ....
2.2 Technical File approval date ....

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3 Specifications for the onboard NO_x verification procedures

The specifications for the onboard NO_x verification procedures, as required by chapter 6 of the NO_x 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.

3.1 Engine Parameter Check method:
3.1.1 Identification/approval number ....
3.1.2 Approval date ....
3.2 Direct Measurement and Monitoring method:
3.2.1 Identification/approval number ....
3.2.2 Approval date ....

Alternatively the Simplified Measurement method in accordance with 6.3 of the NO_x Technical Code may be utilized.

Issued at:

....
(Place of issue of certificate)

(dd/mm/yyyy) ....
(Date of issue)

....
(Signature of duly authorized official issuing the certificate)

(Seal or stamp of the authority, as appropriate)

ENGINE AIR POLLUTION PREVENTION STATEMENT OF COMPLIANCE

No. [redacted]

Issued under the provisions of the Protocol of 1997, as amended by resolution MEPC.176(58) in 2008, 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"),*

by

RINA

Engine Manufacturer	*Model Number*	*Serial Number*	*Tests Cycle(s)*	*Rated Power (kW) and Speed (rpm)*	*Engine Approval number*
[redacted]	[redacted] TIM	[redacted]	E3	232kW @ 2300 rpm	[redacted]

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 Revised Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (2008), 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.

Issued at [redacted]

on [redacted]

RINA Services S.p.A [redacted]

Page 1 of 3

RINA

SUPPLEMENT TO ENGINE AIR POLLUTION PREVENTION STATEMENT OF COMPLIANCE

[redacted]

RECORD OF CONSTRUCTION, TECHNICAL FILE AND MEANS OF VERIFICATION

Notes:

1 This Record and its attachments shall be permanently attached to the EAPP Statement of Compliance. The EAPP Statement of Compliance shall accompany the engine throughout its life and shall be available on board the ship at all times.
2 The Record shall be at least in English, French or Spanish. If an official language of the issuing country is also used, this shall prevail in case of a dispute or discrepancy.
3 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 verifications refer to requirements from the Revised NOx Technical Code (2008).

1	**Particulars of the engine**	
1.1	*Name and address of the manufacturer*	[redacted]
1.2	*Place of engine build*	Same place of Manufacturer
1.3	*Date of engine build*	[redacted]
1.4	*Place of pre-certification survey*	[redacted]
1.5	*Date of pre-certification survey*	[redacted]
1.6	*Engine type and model number*	[redacted]TIM
1.7	*Engine serial number*	[redacted]
1.8	*If applicable, the engine is a parent engine ☐ or a member engine ☒ of the following engine Family ╳ or engine Group*	[redacted]TI
1.9	*Individual Engine or Engine Family/Engine Group details:*	
1.9.1	*Approval reference*	[redacted]
1.9.2	*Rated power (kW) and rated speed (rpm) values or ranges*	210kW @ 2100 rpm
1.9.3	*Test cycle(s)*	E3
1.9.4	*Parent Engine(s) test fuel oil specification*	DMX
1.9.5	*Applicable NOx Emission Limit (g/kWh), regulation 13.4*	7.7
1.9.6	*Parent Engine(s) Emission Value (g/kWh)*	6.6

Page 2 of 3

RINA	SUPPLEMENT TO ENGINE AIR POLLUTION PREVENTION STATEMENT OF COMPLIANCE [redacted]

2 **Particulars of the Technical File**	
The Technical File, as required by chapter 2 of the NOx Technical Code, is an essential part of the EAPP Statement of Compliance and must always accompany an engine throughout its life and always be available on board a ship.	
2.1 Technical File identification/approval number	[redacted]
2.2 Technical File approval date	[redacted]

3 **Specifications of the Onboard NOx Verification Procedures for the Engine Parameter Survey**	
The specifications for the onboard NOx Verification Procedures, as required by chapter 6 of the NOx Technical Code, is an essential part of the EAPP Statement of Compliance and must always accompany an engine throughout its life and always be available on board a ship.	
3.1 Engine Parameter Check method:	
3.1.1 Identification/approval number	[redacted]
3.1.2 Approval date	[redacted]
3.2 Direct Measurement and Monitoring method:	
3.2.1 Identification/approval number	-
3.2.2 Approval date	-

Alternatively, the Simplified Measurement method in accordance with 6.3 of the NOx Technical Code may be utilized.

Issued at [redacted]

on [redacted]

[redacted]

Page 3 of 3

[redacted]

RINA
Approved
Model : [redacted]TIM
[redacted]

TECHNICAL FILE

ON NOx EMISSION FROM EXHAUST GAS

Engine Family : [redacted]TI

1. 일반사항 General
2. **엔진계열목록** Engine Family list
3. 기관 사양 Engine Specification
4. NOx 공장 확인시험 절차 Specifications of the NOx verification procedures at the test bed of shop
5. 선상 주요부품 확인검사 절차사양 Specifications of the on-board NOx verification procedures for the engine parameter survey
6. 대표엔진 시험보고서 Parent Engine test report
7. 대표엔진 시험자료 Parent Engine test data

[redacted]

※. 엔진 일련번호 Engine Serial No. : [redacted]

[redacted]

Model : [redacted]TIM

1. 일반사항 General

This **Technical** File is issued under the provisions of Annex VI of the International convention of air pollution from ships, 1973, as modified by the protocols of 1978, 1997 **and** 2010 relating Nitrogen Oxides from Marine Diesel Engines (NOx Technical Code 2008) for [redacted]TIM (Certified as a "member engine")

2. 엔진계열목록 Engine Family list

No.	Engine Type	No. of Cylinder	Bore [mm]	Stroke [mm]	Rated Power [kW]	Rated Engine Speed [rpm]	Timing [BTDC]	NOx [g/kwh]	NOTE
1	[redacted]TIH	6	111	139	210	2,100	15	6.6 / 7.7	Parent
2	[redacted]TIM	6	111	139	232	2,300	15	6.2 / 7.7	Member

3. 기관 사양 Engine specification

3.1 개요 General

3.1.1 제조사 Manufacture : [redacted]

3.1.2 기관형식 Engine type : 4 cycle, water cooled, Turbocharged & Intercooling

3.1.3 패밀리 (그룹) 식별 Family (Group) identification : Family name: [redacted]TI
Engine model: [redacted]TIH (Parent)
[redacted]TIM (Member)

3.1.4 정격속도 Rated speed [rpm]

3.1.4.1 [redacted]TIH : 2,100

3.1.4.1 [redacted]TIM : 2,300

3.1.5 정격출력 Rated power [kW]

3.1.5.1 [redacted]TIH : 210

3.1.5.2 [redacted]TIM : 232

3.1.6 중간속도 Intermediate speed : -

3.1.7 중간속도에 있어서의 최대 토크 Maximum torque at intermediate speed : -

3.1.8 분사 시기 Static Injection timing : 14±1° BTDC

3.1.9 분사 전자제어 Electronic injection control : No

3.1.10 가변분사 타이밍 Variable injection timing : No

3.1.11 가변의 과급기 배지 Variable turbocharger geometry : No

3.1.12 내경 Bore [mm] [redacted]

2

[redacted]

Model : [redacted]TIM

3.1.13	행정 Stroke [mm]	:	139
3.1.14	공칭 압축비 Nominal compression ratio	:	16.7 ± 0.1 : 1
3.1.15	정격출력에서의 평균유효압력 [kPa] Mean effective pressure at rated power		
3.1.15.1	[redacted]TIH	:	1,484
3.1.15.2	[redacted]TIM	:	1,497
3.1.16	정격출력에서의 최대 실린더의 압력 [kPa] Max. cylinder pressure at rated power		
3.1.16.1	[redacted]TIH	:	12,050
3.1.16.2	[redacted]TIM	:	12,800
3.1.17	실린더 수 및 배치 Cylinder number and configuration	:	Number : 6 In-line
3.1.18	보조기기 Auxiliaries	:	-
3.1.19	흡배기 밸브 및 캠축 Intake & Exhaust Valves and Cam shaft		
3.1.19.1	흡기 밸브 최대 양정 Maximum lift of Intake air valve [mm]	:	7.95
3.1.19.2	배기 밸브 최대 양정 Maximum lift of exhaust gas valve [mm]	:	8.12
3.1.19.3	흡기 밸브 개폐시기 Open/Close timing of intake air valve	:	Open 16° BTDC / close 36° ABDC
3.1.19.4	배기 밸브 개폐시기 Open/Close timing of exhaust gas valve	:	Open 46° BBDC / close 14° ATDC
3.1.19.5	흡기 / 배기 밸브 간극 조정 [mm] In. / Ex. valve clearance in cold condition	:	0.3 / 0.3
3.2	주요부품 Main parts		
3.2.1	분사노즐 Injection nozzle		
3.2.1.1	사양 Specification	:	7 holes x Ø 0.36mm x 150
3.2.1.2	식별 번호 Identification number	:	DELPHI LRC6703709
3.2.2	분사펌프 Injection pump		
3.2.2.1	사양 Specification		
3.2.2.1.1	분사펌프 종류 Injection Pump Type	:	In-line type
3.2.2.1.2	플런저 직경 x 행정 Plunger Dia. x Stroke	:	Ø 12 mm x 12 mm
3.2.2.1.3	조속기 종류 Governor type	:	Mechanical All speed type
3.2.2.1.4	조속기 제어범위 Control range	:	500~2530 rpm of Engine speed
3.2.2.2	식별 번호 Identification number	:	106067-609A
3.2.3	연료캠 Fuel cam	[redacted]	

3

[redacted]

Model : [redacted]TIM

3.2.3.1	식별 번호 Identification number	:	D1146
3.2.4	실린더 헤드 Cylinder head		
3.2.4.1	식별 번호 Identification number	:	3087
3.2.5	피스톤 헤드 Piston head		
3.2.5.1	식별 번호 Identification number	:	0214B
3.2.6	과급기 Turbocharger		
3.2.6.1	사양 Specification	:	Water-cooled type
3.2.6.2	식별 번호 Identification number	:	HX35M / 65.09100-7090
3.2.7	공기 냉각기 Charge air cooler		
3.2.7.1	식별 번호 Identification number	:	65.09500-7005 / DE08-028

[redacted]

4

[redacted]

Model : [redacted]TIM

4. NOx 공장 확인시험 절차
Specifications of the NOx verification procedures at test bed of shop

The specification of the NOx verification procedures at test bed of shop is according to the NOx test code.

4.1. 시험 사이클 Test cycle
Main Engine => E3 test cycle (Propeller Law operated)

Mode no.	1	2	3	4
Engine Speed	100 %	91 %	80 %	63 %
Power	100 %	75 %	50 %	25 %
Weighting Factor	0.2	0.5	0.15	0.15

4.2. 시험용 연료 Test Fuel
: a DM grade marine fuel specified in ISO 8217-2005 : DMX.

Cetane Number	:	Min 45
Sulfur	:	Max. 1.0 % (m/m)
Density at 15 °C	:	Max. 890 kg/m^3

4.3. 측정방법 Measurement method
배기가스 유량측정 방법 (Determination method of exhaust gas flow)

- ☐ 직접계측방법 / Direct measurement method
- ☐ 공기&연료 측정방법 / Air and fuel measurement method
- ■ 연료유량 및 탄소비교방법 / Fuel flow and carbon balance method

[redacted]

5

[redacted]

Model : [redacted]TIM

5. 선상 주요부품 확인검사 절차사양 Specifications of the on-board NOx verification procedures for the engine parameter survey

The specification for the on-board NOx verification procedures, as required by chapter 6 of the NOx technical code, is a essential part of the EIAPP certificate and must always accompany an engine through its life and always be available on board a ship.

5-1. NOx 배출가스 관련 주요부품 목록 List of min parts on NOx emission

검사항목 Parameter	검증절차 Verification Procedure	식별번호 Identification number
엔진번호 Engine serial No.	Check the serial no. marked on the side of engine block.	Engraving of engine
분사노즐 Injection nozzle	1) Draw out the injection nozzle. 2) Check the identification no. of the injection nozzle and holder.	Reference 5 -2. 1) of this technical file
연료분사펌프 Injection pump	Check the identification no. of the injection pump body.	Reference 5 -2. 2) of this technical file
연료캠 Fuel cam	Check the mark on the end side of cam shaft.	Reference 5 -2. 3) of this technical file
실린더헤드 Cylinder Head	Check the mark on the surface of cylinder head block.	Reference 5 -2.4) of this technical file
피스톤 Piston	Check the mark on the surface of Piston.	Reference 5 -2.5) of this technical file
과급기 Turbocharger	Check the identification no. of turbo charger	Reference 5 -2. 6) of this technical file
공기 냉각기 Charger air cooler	Check the identification no. of air intercooler	Reference 5 -2. 7) of this technical file

[redacted]

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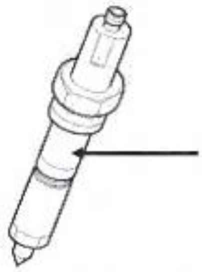
[redacted]

Model : [redacted]TIM

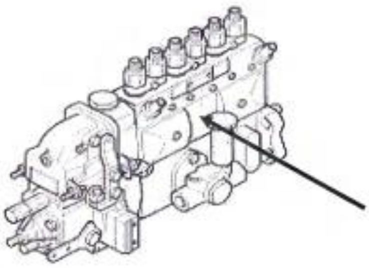
5-2. 주요 부품 인식번호 Identification No. of Main Part

1) Injection nozzle



ID No.	DELPHI LRC 6703709

2) Injection pump



ID No.	106067-609A

3) Fuel cam

ID No.	D1146

[redacted]

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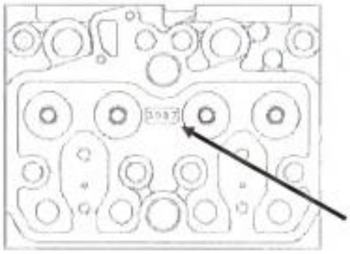
[redacted]

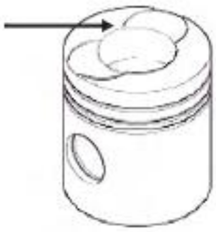
Model : [redacted]TIM

4) Cylinder head



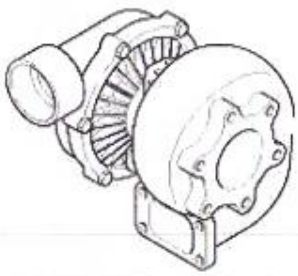
ID No.	3087

5) Piston



ID No.	0214B

6) Turbocharger

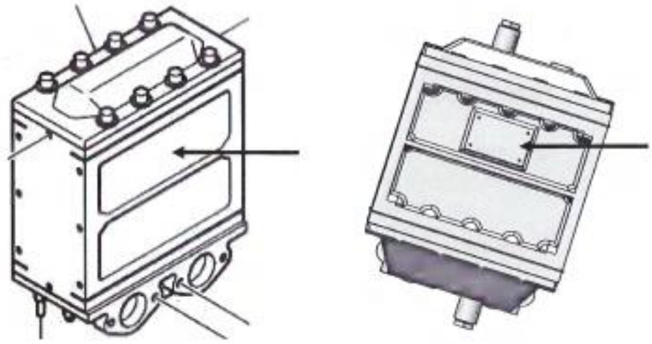


ID No. [redacted] 35M

[redacted]

Model : [redacted] TIM

7) Charger air cooler



ID No.	65.09500-7005	**DE08**-028

[redacted]

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[redacted]

Model : [redacted]TIM

대표엔진 시험보고서 및 시험 자료
Parent Engine test report and test data

6.	대표엔진([redacted]TIH) 시험보고서 Parent Engine test report		
6.1	개요 General		
6.1.1	제조사 Manufacture	:	[redacted]
6.1.2	기관형식 Engine type	:	4 cycle, water cooled, Turbocharged & Intercooling
6.1.3	패밀리 (그룹) 식별 Family (Group) identification	:	Family name: [redacted]II Engine model: [redacted]TIH (Parent) [redacted]TIM (Member)
6.1.4	엔진정보 Engine information		
6.1.4.1	엔진번호 Serial number.	:	[redacted]
6.1.4.2	국가 Flag	:	Stock (not fixed)
6.1.4.3	적용선박 Final application/installation, Ship	:	Stock (not fixed)
6.1.4.4	적용용도 Final application / installation, Engine	:	Main(Propulsion)
6.1.4.5	엔진 제작일 Engine built date	:	[redacted]
6.1.4.6	엔진 장착일 Engine install date	:	Stock (not fixed)
6.1.4.7	선박 용골일 Keel laying date	:	Stock (not fixed)
6.1.5	정격속도 Rated speed [rpm]	:	2,100
6.1.6	정격출력 Rated power [kW]	:	210
6.1.7	중간속도 Intermediate speed	:	-
6.1.8	중간속도에 있어서의 최대 토크 Maximum torque at intermediate speed	:	-
6.1.9	분사 시기 Static injection timing	:	14 ± 1° BTDC
6.1.10	분사 전자제어 Electronic injection control	:	No
6.1.11	가변분사 타이밍 Variable injection timing	:	No
6.1.12	가변의 과급기 배치 Variable turbocharger geometry	:	No
6.1.13	내경 Bore [mm]	:	111
6.1.14	행정 Stroke [mm]	:	139
6.1.15	공칭 압축비 Nominal compression ratio	:	16.7 ± 0.1 : 1
6.1.16	정격출력에서의 평균유효압력 [kPa] Mean effective pressure at rated power	:	1,484
6.1.17	정격출력에서의 최대 실린더의 압력 [kPa] Max. cylinder pressure at rated power	:	12,050

[redacted]

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[redacted]

Model : [redacted]TIM

6.1.18 실린더 수 및 배치 Cylinder number and configuration : Number : 6 In-line

6.1.19 보조기기 Auxiliaries : -

6.2 주위조건의 명세 Specified ambient conditions

6.2.1 최고해수온도 Maximum seawater temperature : 32℃

6.2.2 최고급기온도(해당하는 경우) Maximum charge air temperature : 60℃

6.2.3 냉각 시스템 : 공기 냉각기 Cooling system spec. : Charge air cooler : yes

6.2.4 냉각 시스템 : 급기 단 Cooling system spec. : Charge air stages : 1 stage

6.2.5 냉각계통 설정온도 (저/고) Low/high temperature cooling system set point :

6.2.6 최대입구압력 손실 Maximum inlet depression: 6.2 kPa

6.2.7 최대배기배압 Maximum exhaust back pressure : 8.0 kPa

6.2.8 연료유 사양 Fuel Oil Spec. : DMX (ISO 8217 , DM grade equivalent)

6.2.9 연료유 온도 Fuel oil temperature : 38 ± 5 ℃

6.3 배출량 시험결과 Emission test results

6.3.1

주기 cycle	E-3 : 1 mode	E-3 : 2 mode	E-3 : 3 mode	E-3 : 4 mode	Result
NOx	689.5 ppm	740.5 ppm	803.7 ppm	734.8 ppm	6.6 g/kWh

6.3.2 일시 / 시간 Date / Time : [redacted]

6.3.3 시험장소 / 작업대 Test Site / Bench : 두산인프라코어 군산연구동 1번 동력계 [redacted] Dynamo. #1

6.3.4 검사원 Surveyor : 이탈리아 선급 RINA

6.4 기관패밀리(그룹)의 명세(일반사항) Common specification

6.4.1 연소사이클 Combustion cycle : 4 사이클, 4 stroke cycle

6.4.2 냉각매체 Cooling medium : 물 Water

6.4.3 실린더 배치 Cylinder configuration : 6 기통, In-line

6.4.4 흡기 방법 Method of aspiration : 과급 Pressure charged

6.4.5 선박에서 사용되는 연료형식 Fuel type to be used on board : 정제유 Distillate fuel

6.4.6 연소실 Combustion chambe[redacted] Open chamber

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[redacted]

Model : [redacted]TIM

6.4.7	밸브배기구 배치 Valve port configuration	:	실린더헤드 Cylinder head
6.4.8	밸브배기구 치수 및 수 Valve port size and number	:	INTAKE Φ48.5 x 6, EXHAUST Φ46 x 6
6.4.9	연료 시스템 형식 Fuel system type	:	Pump - Line- Nozzle type
6.5	기타 Miscellaneous features		
6.5.1	배기가스 재순환 Exhaust gas recirculation	:	No
6.5.2	물분사/유화 Water injection / emulsion	:	No
6.5.3	공기분사 Air injection	:	No
6.5.4	급기냉각시스템 Charge air cooling	:	Yes
6.5.5	배기가스 후처리 장치 Exhaust after-treatment	:	No
6.5.6	배기가스 후처리 형식 Exhaust after-treatment type	:	-
6.5.7	이중연료 Dual fuel	:	No
6.6	기관 패밀리/그룹의 정보(시험대에서의 시험용 표본기관의 선택) Engine Family Information (Selection of parent engine for test bed test)		
6.6.1	패밀리/그룹 식별 Family identification	:	[redacted]II
6.6.2	과급방법 Method of pressure charging	:	터보과급 Turbocharged
6.6.3	급기냉각 시스템 Charge air cooling system	:	중간 냉각기식 Intercooling type
6.6.4	대표엔진 선택의 기준 Criteria of the Selection of Parent Engine	:	최대 NOx 배출 값 Highest NOx emission value
6.6.5	실린더 수 Number of cylinder	:	6
6.6.6	실린더 당 정격출력 Max. rated power per cylinder	:	35
6.6.7	정격 속도 Rated speed	:	2,100
6.6.8	분사 타이밍(범위) Injection timing (range)	:	14 ± 1° BTDC
6.6.9	선택된 대표 엔진 Selected Parent Engine	:	[redacted]TIH
6.6.10	시험 주기 Test cycle(s)	:	E-3
6.7	배기관 Exhaust pipe		
6.7.1	직경 Bore [mm]	:	300 mm
6.7.2	길이 Length [mm]		5500 mm
6.7.3	절연제 Insulation		No
6.7.4	배기 채취구 위치 Probe Location [mm]		3,500 mm from the outlet of turbocharger
6.7.5	배기관 형상 Exhaust line		

[redacted]

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[redacted]

Model : [redacted]TIM

6.8 계측장치

6.8.1 분석기 Analyzer

		제조자 Manufacturer	형식 Model	측정범위 Measuring Ranges	교정 Calibration	
					스펜가스 농도 Span gas conc.	교정편차 Deviation of calibration
6.8.1.1	질소산화물분석기 NOx Analyzer)	HORIBA	MEXA 7100DEGR	100 ~ 10,000 ppm	1,917 ppm	±2%
6.8.1.2	일산화탄소분석기 CO Analyzer	HORIBA	MEXA 7100DEGR	1,000 ~ 3,000 ppm	2,811 ppm	±2%
6.8.1.3	이산화탄소분석기 CO2 Analyzer	HORIBA	MEXA 7100DEGR	10 ~ 20 %	18.78 %	±2%
6.8.1.4	산소분석기 O2 Analyzer	HORIBA	MEXA 7100DEGR	25%	23.495 %	±2%
6.8.1.5	탄화수소분석기 HC Analyzer	HORIBA	MEXA 7100DEGR	500 ~ 5,000 ppmC	948.3 ppmC	±2%
6.8.1.6	속도 Speed	HORIBA	DT900-1	-	-	-
6.8.1.7	토크 Torque	HORIBA	DT900-1	-	-	-
6.8.1.8	출력 Power	HORIBA	DT900-1	900kW	-	-
6.8.1.9	연료유량 Fuel flow	AVL	733S.18	120 kg/h	-	± 2 %
6.8.1.10	공기유량 Air flow	ABB	14241-7962638	4,000kg/h	-	± 2 %
6.8.1.11	배기가스유량 Exhaust flow	-			-	-
6.8.2	온도 Temperature					
6.8.2.1	급기 냉각수 입구 온도 Charge air coolant inlet	HORIBA	PT100	0~200°C		± 2%
6.8.2.2	배출가스 Exhaust gas	HORIBA	K type	0 ~ 1200°C		± 1%
6.8.2.3	흡입공기 Inlet air	HORIBA	PT100	0~200°C		± 2%
6.8.2.4	급기 Charge air	HORIBA	PT100	0~200°C		± 2%
6.8.2.5	연료 Fuel	HORIBA	PT100	0~200°C		± 2 %
6.8.3	압력 Pressure					
6.8.3.1	배출가스 Exhaust gas	HORIBA	PTX7517	0~250 kPa		± 0.2 %
6.8.3.2	급기 Charge air	HORIBA	PTX751	0~250 kPa		± 0.3 %
6.8.3.3	대기압 Atmospheric	H[redacted]	[redacted]	[redacted]~250 kPa		± 0.1 %

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[redacted]

Model : [redacted]TIM

6.8.4	증기압 Vapor pressure					
6.8.4.1	흡입공기 Intake air	HORIBA ATS	PTX7517	0~30 kPa		± 0.1 %
6.8.5	습도 Humidity					
6.8.5.1	흡입공기 Intake air	-	-	-		-

6.9 연료특성 Fuel Characteristics

연료성상 Fuel Properties :			연료성분분석 Fuel element analysis	
밀도 Density	ISO 3675	830.2 kg/㎥	탄소 Carbon	85.71 % mass
점도 Viscosity	ISO 3104	2.720 ㎟/s @40°C	수소 Hydrogen	13.75 % mass
물 Water	ISO 3733	- % V/V	질소 Nitrogen	- % mass
			산소 Oxygen	0.53 % mass
			유황 Sulfur	- % mass
			LHV/Hu	43.00 MJ/kg

[redacted]

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[redacted]

Model : [redacted]TIM

6.10 주위환경 및 가스 배출자료 Ambient and Gaseous Emission Data

6.10.1	모드 (Mode)	1	2	3	4
6.10.1.1	출력/토오크 Power / Torque [%]	100	75	50	25
6.10.1.2	속도 Speed [rpm]	2100	1911	1679	1323
6.10.1.3	모드 시험시작 시간 Time at beginning of mode	14:47	15:01	15:15	15:30
6.10.2	가스배출 자료 Gaseous Emissions Data				
6.10.2.1	NOx 농도 건식 [ppm] NOx Concentration dry	689.5	740.5	803.7	734.8
	NOx 농도 습식 [ppm] NOx Concentration wet	633.6	686.9	748.5	688.2
6.10.2.2	CO 농도 건식 [ppm] CO Concentration dry	158.5	97.1	73.9	122.7
	CO 농도 습식 [ppm] CO Concentration wet	145.7	90.1	68.8	114.9
6.10.2.3	CO_2 농도 건식 [%] CO_2 Concentration dry	8.46	7.35	7.04	6.39
	CO_2 농도 습식 [%] CO_2 Concentration wet	7.77	6.82	6.55	5.99
6.10.2.4	O_2 농도 건식 [%] O_2 Concentration dry	9.14	10.70	11.16	12.07
	O_2 농도 습식 [%] O_2 Concentration wet	8.39	9.92	10.40	11.31
6.10.2.5	HC 농도 건식 [ppmC] HC Concentration dry	114.1	161.7	164.9	198.7
	HC 농도 습식 [ppmC] HC Concentration wet	104.9	150.0	153.6	186.1
6.10.2.6	NOx 습보정계수 [Khd] NOx humidity correction factor	0.967	0.968	0.962	0.961
6.10.2.7	건식/습식 보정 계수 [Kwr] Dry / Wet correction factor	0.972	0.976	0.970	0.960
6.10.2.8	NOx 배기질량유량 [kg/h] NOx mass flow	1.216	1.050	0.771	0.400
6.10.2.9	CO 배기질량유량 [kg/h] CO mass flow	0.172	0.084	0.044	0.041
6.10.2.10	CO_2 배기질량유량 [kg/h] CO_2 mass flow	144.6	100.0	65.5	33.8
6.10.2.11	O_2 배기질량유량 [kg/h] O_2 mass flow	[redacted]	105.8	75.6	46.5

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[redacted]

Model : [redacted]TIM

6.10.2.12	HC 배기질량유량 [kg/h] HC mass flow	0.0615	0.0694	0.0484	0.0332
6.10.2.13	NOx 사양 NOx specific [g/kWh]	6.6			
6.10.3	주위환경자료 Ambient Data :				
6.10.3.1	대기압 Atmospheric pressure [kPa]	101.6	101.7	101.7	101.7
6.10.3.2	흡기온도 Intake air temperature [°C]	23.1	22.9	22.6	22.2
6.10.3.3	흡기습도 Intake air humidity [g/kg]	0.0084	0.0084	0.0080	0.0078
6.10.3.4	흡기의 상대습도(RH) [%] Relative humidity (RH) of intake air	49.2	50.4	49.5	50.1
6.10.3.5	RH 센서에서 공기온도 [°C] Air temperature at RH sensor	-	-	-	-
6.10.3.6	흡기의 건구 온도 [°C] Dry bulb temperature of intake air	22.9	22.5	22.0	21.4
6.10.3.7	흡기의 습구 온도 [°C] Wet bulb temperature of intake air	16.1	16.0	15.4	15.1
6.10.3.8	시험조건 파라매터 [fa] Test condition parameter	0.982	0.981	0.979	0.976

[redacted]

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[redacted]

Model : [redacted]TIM

6.11 기관시험사료 Engine test data

6.11.1	모드 (Mode)	1	2	3	4
6.11.1.1	출력/토오크 Power / Torque [%]	100	75	50	25
6.11.1.2	속도 Speed [rpm]	2100	1911	1679	1323
6.11.1.3	모드 시험시작 시간 Time at beginning of mode	14:47	15:01	15:15	15:30
6.11.2	기관자료 Engine data				
6.11.2.1	속도 Speed [rpm]	2100	1911	1679	1323
6.11.2.2	보조출력 Auxiliary power [kW]	-	-	-	-
6.11.2.3	동력계 설정값 [kW] Dynamometer setting	210.0	157.5	105.0	52.5
6.11.2.4	출력 Power [kW]	209.6	157.2	104.7	52.4
6.11.2.5	평균유효압력 Mean Effective pressure [MPa]	1.47	1.21	0.91	0.58
6.11.2.6	연료랙 Fuel Rack [mm]	-	-	-	-
6.11.2.7	**미수정 연료소모량 [g/kWh]** **Uncorrected specific fu** consumption	226.2	210.0	205.2	213.9
6.11.2.8	연료유 유량 Fuel flow [kg/h]	47.4	33.0	21.5	11.2
6.11.2.9	공기 유량 Air flow [kg/h]	1177.6	932.1	636.8	360.9
6.11.2.10	배기 **유량**(qmew) [kg/h] Exhaust flow	1244.6	987.2	669.3	381.7
6.11.2.11	배기가스 온도 [°C] Exhaust temperature	429.4	355.8	326.9	281.6
6.11.2.12	배기가스 배압 [kPa] Exhaust back pressure	8.1	4.5	1.8	0.2
6.11.2.13	급기 냉각수 입구 온도 [°C] **Charge air coolant temperature i**	30.6	30.6	30.3	30.2
6.11.2.**14**	**급기 냉각수 출구 온도 [°C]** **Charge air coolant temperatu** out	32.4	31.6	30.7	30.4
6.11.2.15	급기 온도 Charge air temperature [°C]	56.6	45.0	35.4	30.7
6.11.2.16	급기 참조 온도 [°C] **Charge air reference temperature**	57.9	48.1	38.2	30.9
6.11.2.17	급기 압력 Charge air pressure [kPa]	171	123	67	21
6.11.2.18	연료유 온도 Fuel oil temperature [redacted]	[redacted]	35.2	35.1	34.7

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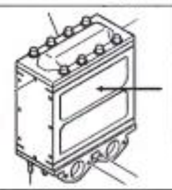
[redacted]

Model :[redacted]TIM

REVISION HISTORY

<table>
<tr><th>REV. DATE</th><th>REV. NO.</th><th>DESCRIPTION</th><th>PAGE NO.</th></tr>
<tr><td>2018.12.14</td><td>01</td><td>*To prevent oxidation, anode applied to th intercooler
<table>
<tr><th>Item</th><th>Previous type</th><th>Anode type</th></tr>
<tr><td>Picture of Intercooler</td><td></td><td></td></tr>
</table>
*Changed the concept of intercooler ID Number
(Heat transfer capacity and/or part number
→ Base Model Name - Heat Transfer Capacity)
<table>
<tr><th>Item</th><th>As-Is</th><th>To-Be</th></tr>
<tr><td>ID Number</td><td>65.09500-7005</td><td>DE08-028</td></tr>
</table>
</td><td>4,9 page</td></tr>
</table>

[redacted]

[redacted]

RINA

STATEMENT N. [redacted]

Verification of main parts on NOx emission(*)

Engine Manufacturer:	[redacted]
Model:	[redacted]TIM
Serial Number	[redacted]

PART	IDENTIFICATION according to Technical File	IDENTIFICATION on engine	Comments
ENGINE SERIAL NO.	[redacted]	[redacted]	Engraved on block and in name plate.
INJECTION NOZZLE	DELPHI LRC 6703709	DELPHI LRC 6703709	Verified on unit #1.
INJECTION PUMP	106067-609A	106067-609A	-
CAMSHAFT	D1146	-	The engine has to be dismounted to check this.
CYLINDER HEAD	3087	3087	Verified on all units (x6)
PISTON	0214B	0214B	Verified on unit #1.
TURBOCHARGER	HX35M	HX35M	-
CHARGER AIR COOLER	65.09500-7005 or DE08-028	DE08-028	-

[redacted] On [redacted]

place and date

[redacted]

stamp and signature

(*) According to Technical File of the engine (Engine Family: [redacted]TI)

Annex 7. Example Certificate of Class

(standard template Bureau Veritas - anonymised example RINA)

BUREAU VERITAS

INTERNATIONAL CLASSIFICATION SOCIETY

CERTIFICATE OF CLASSIFICATION

Nr

Ship's Name

Register Nr

Flag

Port of Registry

Owners

This is to certify that the above named ship has been entered in the Bureau Veritas Register Book with the following classification symbols and notations

This certificate is issued within the scope of Bureau Veritas Marine & Offshore General Conditions.

At

on :

Limit date of validity

BUREAU VERITAS
MARINE & OFFSHORE

This document is electronically signed and does not require a manual signature as defined in IMO guideline FAL.5-Circ.39.
Click here for the verification website

By Order of the Secretary

Conditions and endorsements overleaf.

Any person not a party to the contract pursuant to which this certificate is delivered may not assert a claim against Bureau Veritas Marine & Offshore SAS for any liability arising out of errors or omissions which may be contained in said certificate, or for errors of judgment, fault or negligence committed by personnel of the Society or of its Agents in the establishment or issuance of this certificate, and in connection with any activities which it may provide for.

- Page 1/2

CERTIFICATE OF CLASS

[redacted]

RINA No. [redacted]

IMO number	[redacted]						
Name of ship	[redacted]						
Owner	[redacted]						
Distinctive number or letters		[redacted]		Flag	[redacted]		
Shipyard - place of build		[redacted]					
Date of build		[redacted] 2006		Date of commissioning	[redacted] 2006		
Overall Length	76.25 m	Gross Tonnage	2499	Net Tonnage	750		
Length Between Perpendiculars	67.20 m	Moulded Breadth	14.40 m	Depth	9.50 m		
Number of main engines	1	Total power	4500 kW				

THIS IS TO CERTIFY that the above ship has been surveyed in accordance with the Classification Rules and, on the basis of the survey report submitted, has been assigned the class (*)

C ✠ fishing vessel ; unrestricted

based on the maximum draught of 7700 mm. from Base Line

with additional Class notations:

This certificate is valid until: [redacted] 2026

The validity may be extended at RINA SERVICES S.p.A.'s decision where allowed by the Rules.

This certificate will be invalidated whenever the requirements of the Rules are not complied with.

Issued at: [redacted]

on: [redacted] 2023

This is an electronically signed document in accordance with IMO FAL.5/Circ.39 and does not require a handwritten signature.
Validation and authentication of the paper printout may be obtained from https://ecertificate.rina.org

[redacted]

RINA SERVICES S.p.A.

(*)Service and navigation are described at page 2

[redacted]

This certificate consists of 5 pages

RINA No. [redacted] Name of ship [redacted] Certificate No. [redacted] Page 2 / 5

Former names [redacted]

Service

fishing vessel
Ship specially equipped for catching and storing fish or other living resources of the sea.

Navigation

unrestricted
Unrestricted navigation

The Certificate of Class becomes invalid in the following cases:
1. when the ship's class is suspended in accordance with the provisions indicated in Part A, Ch 2, Sec 3, [1.2] of Rules for the Classification of Ships,
2. when the ship's class is withdrawn in accordance with the provisions indicated in Part A, Ch 2, Sec 3, [1.3] of Rules for the Classification of Ships.

Furthermore, where the ship is assigned with additional class notations or more than one service notations, these notations are suspended and/or withdrawn in accordance with the provisions indicated in Part A, Ch 2, Sec 3, [1.5] of Rules for the Classification of Ships.

The certificate of class is issued on the basis of the requirements and conditions specified in RINA SERVICES S.p.A. Classification Rules of which the interested party has acquired full knowledge, accepting them unconditionally, with particular regard to the following clauses: RINA SERVICES S.p.A. carries out its duties through officers or other persons it considers possess all the requirements of suitability and competence for the tasks which have been assigned to them. In its capacity as expert, RINA SERVICES S.p.A. only expresses opinions and evaluations of compliance with its own rule requirements and does not, in any case whatsoever, (even if its opinions are requested on matters not expressly covered by Rules) assume the liabilities pertaining to the designers, shipowners, builders, test inspectors, shipyards or any person or organization responsible by law or contractually for providing guarantees for all of whom the respective liabilities remain unchanged even in the case of consultative actions by RINA SERVICES S.p.A.. For what concerns the tasks taken on and carried out directly, other than those delegated in the following, RINA SERVICES S.p.A. is answerable in law terms. Within the context of the tasks under the responsibility of RINA SERVICES S.p.A. as delegate of an Administration, liability can only be recognized in the case of fraud or gross negligence by the officers or the persons encharged. In no case shall the liability, regardless of the amount of damage reported, exceed a value equal to 5 times the total of the fees received by RINA SERVICES S.p.A. as consideration of the services rendered from which the damage reported derives.

[redacted]

RINA No. [redacted] Name of ship [redacted] Certificate No. [redacted] Page 3 / 5

REMARKS

The scantlings of the hull structural members have been based on draught amidships not exceeding 7.7 m

The draught marks required by the class have been painted on both sides of the vessel amidships. The upper edges of the marks are to be the following distance below the upper surface of the freeboard deck: 1.75 m

The scantlings of local strength members have been found satisfactory, provided:
- The draught forward in rough sea is not less than 3.4 m.
- Bunker and antirolling tanks are not filled with liquid with a density exceeding that of seawater.

[redacted]

RINA No. [redacted] Name of ship [redacted] Certificate No. [redacted] Page 4 / 5

PERIODICAL CLASS SURVEYS ENDORSEMENTS

ANNUAL SURVEYS

First annual survey Place **XXX - Not Applicable - XXX: related to survey activities carried out before this certificate was issued** Date **XXX - Not Applicable - XXX**	Signature and seal **XXX - Not Applicable - XXX**
Second annual survey Place **XXX - Not Applicable - XXX: related to survey activities carried out before this certificate was issued** Date **XXX - Not Applicable - XXX**	Signature and seal **XXX - Not Applicable - XXX**
Third annual survey Place Date	Signature and seal
Fourth annual survey Place Date	Signature and seal
Fifth annual survey Place Date	Signature and seal

INTERMEDIATE SURVEY

The intermediate survey is applicable at any period of class to oil tankers, chemical tankers, FLS tankers, liquefied gas carriers, combination carriers and at any period of class of other ships which are five years old and over

Place Date	Signature and seal

[redacted]

RINA No. [redacted] Name of ship [redacted] Certificate No. [redacted] Page 5 / 5

EXTENSION TO ALLOW COMPLETION OF CLASS RENEWAL SURVEY (maximum 3 months)

Place Date Class Certificate extended until:	Signature and seal

CLASS RENEWAL SURVEY

Place Date Validity of Class Certificate confirmed until:	Signature and seal

NOTE: for other Class endorsements refer to the "Class survey endorsement sheets" issued by the Offices in charge of the relevant surveys.

[redacted]

Annex 8. Douglas Sea Scale

The Douglas Sea Scale consists of 2 integers; one to quantify the ‘wind waves’ and the other to quantify the ‘swell waves’. Both scales range from 0 (no wave / no swell) to 9 (phenomenal wave / indefinable swell). For example a reported Douglas sea state 3,2 means degree 3 wind waves and degree 2 swell, at the same time. Tables 1 and 2 below present the Douglas wind and swell scales.

Table 1 – Douglas Sea Scale for Wind Waves

Degree	Wave height (m)	Description
0	0,00	Calm (Glassy)
1	0,00 – 0,10	Calm (Rippled)
2	0,10 – 0,50	Smooth
3	0,50 – 1,25	Slight
4	1,25 – 2,50	Moderate
5	2,50 – 4,00	Rough
6	4,00 – 6,00	Very Rough
7	6,00 – 9,00	High
8	9,00 – 14,00	Very High
9	> 14,00	Phenomenal

Table 2 – Douglas Sea Sccale for Swell

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="3">Wave height</th></tr>
<tr><th>Low</th><th>Moderate</th><th>High</th></tr>
<tr><td colspan="2">Wave length</td><td>(< 2 m)</td><td>(2 – 4 m)</td><td>(> 4 m)</td></tr>
<tr><td>Short</td><td>(< 100 m)</td><td rowspan="2">1</td><td>3</td><td>6</td></tr>
<tr><td>Average</td><td>(100 – 200 m)</td><td>4</td><td>7</td></tr>
<tr><td>Long</td><td>(> 200 m)</td><td>2</td><td>5</td><td>8</td></tr>
</table>

- Degree 0 (swell) indicates no swell;
- Degree 9 (swell) indicates an indefinable wavelength and height.

Annex 9. Physical engine power verification report template

1 – Vessel particulars

1.1	Vessel name		
1.2	IMO number		
1.3	CFR number		
1.4	Engine power	(in EU / MS fleet register)	
1.5	Engine power	(as stated on fishing license)	
1.6	Fishing gear	(authorised)	

2 – Verification particulars

2.1	Embarkation date	(dd-mm-yyyy)	
2.2	Embarkation port		
2.3	Embarkation time	(hh:mm)	
2.4	Disembarkation date	(dd-mm-yyyy)	
2.5	Disembarkation port		
2.6	Disembarkation time	(hh:mm)	
2.7	Fishing gear	(on board)	
2.8	Vessel draft	(m, fwd / aft)	
2.9	Verification announcement	(to master, by whom / when / means)	
2.10	Power measured by	(name(s) of contractor(s), if applicable)	
2.11	Authorities represented by	(name(s) of attending inspector(s))	
2.12	Verification trial area	(geographical)	

3 – Engine particulars

3.1	Engine manufacturer		
3.2	Engine type		
3.3	Engine serial number		
3.4	Rated power	(engine identification plate)	
3.5	Rated speed	(engine identification plate)	
3.6	Rated power	(EIAPP, if applicable)	
3.7	Rated speed	(EIAPP, if applicable)	
3.8	Number of cylinders		
3.9	Arrangement of cylinders	(in-line, V)	
3.10	Turbocharger	(yes / no)	
3.11	Fuel injection system	(e.g. common rail, EUI, etc.)	
3.12	Control system	(e.g. mechanical, ECU, etc.)	

In case of governor controlled engine:

3.13	Governor manufacturer		
3.14	Governor type		
3.15	Governor serial number		
3.16	Governor droop setting	(%)	

In case of electronically controlled engine:

3.17	ECU serial number	(hardware, main ECU)	
3.18	Software identification	(main ECU, e.g. software version no., Test Spec, as applicable)	
3.19	Rating number / type	(e.g. 'rating 1')	
3.20	Chassis no.	(if applicable)	

3.21	ECU serial number	(hardware, backup ECU, if applicable)	
3.22	Software identification	(backup ECU, ECU, e.g. software version no., Test Spec, as applicable)	
3.23	Rating number / type	(Backup ECU, e.g. 'rating 1', if applicable)	

In case of derated electronically controlled engine:

3.24	List of derated (electronic) engine settings	
3.25	Description of ongoing compliance measures*	

In case of derated mechanically controlled engine:

3.26	List of derated (mechanical) engine settings	
3.27	Description of ongoing compliance measures*	

* Ongoing compliance measures are methods / appliances to prevent tampering with engine settings aimed at preventing unauthorised uprating of the engine, such as seals, password protection, etc.

4 – Gearbox particulars

4.1	Gearbox manufacturer		
4.2	Gearbox type		
4.3	Gearbox serial number		
4.4	Reduction ratio		
4.5	Rated input power	(kW)	
4.6	Rated input speed	(rpm)	
4.7	Reversal gearbox	(yes / no)	
4.8	Incorporated clutch	(yes / no)	
4.9	Direction of rotation	(co- vs. counter-rotating)	

4.10	Shaft generator(s)	(number, driven by the gearbox)	
4.11	Can shaft gen. (if any) be applied in PTI / booster mode (?)		
4.12	Other non-essential auxiliaries (PTOs)	(driven by gearbox)	
4.13	Gearbox energy efficiency	(official, figure, if available)	

5 – Other non-essential auxiliaries

5.1	List of non-essential auxiliaries	(not driven by gearbox, e.g. (engine) front mounted hydraulic pump or belt drive)	

6 – Measurement setup

			Shaft 1	Shaft 2 (if applicable)
6.1	Strain gauge type			
6.2	Gauge batch number			
6.3	Gauge factor			
6.4	Shaft diameter	(external, mm)		
6.5	Shaft diameter	(internal, mm)		
6.6	Shaft material			
6.7	Shear modulus	(assumed or source)		
	or			
6.8	Young's modulus	(assumed or source)		
	and			
6.9	Poisson ratio	(assumed or source)		
6.10	Shaft speed (rpm) sensor type			
6.11	List of measurement equipment used	(type, serial, etc.)		
6.12	Last calibration	(dd-mm-yyyy)		
6.13	Sampling frequency	(Hz)		

7 – Measurement results

			Run 1	Run 2	Run 3	Run 4	Etc.
7.1	Run start time	(hh:mm)					
7.2	Run end time	(hh:mm)					
7.3	Mode of operation	(fishing, steaming, bollard pull)					
7.4	Vessel COG	(degrees)					
7.5	Vessel SOG	(knots)					
7.6	Vessel UKC	(meter)					
7.7	Sea state	(Douglas Sea Scale)					
7.8	Wind	(Beaufort)					
7.9	Ambient temperature	(°C, engine room)					
7.10	Ambient air pressure	(mBar, engine room)					
7.11	Relative humidity	(%, engine room)					

			Run 1	Run 2	Run 3	Run 4	Etc.
7.12	Shaft power	(kW, propeller shaft)					
7.13	Shaft speed	(rpm, propeller shaft)					
7.14	Engine speed	(calculated, gearbox reduction)					
7.15	Engine speed	(rpm, hand tacho)					
7.16	Engine speed	(engine control panel)					
7.17	Corrected engine power	(after application of correction(s) for gearbox efficiency, PTO losses, ambient conditions, if applicable)					
	Bridge control:						
7.18	Engine speed	(lever position, if applicable)					
7.19	Propeller pitch	(lever position, if applicable)					
7.20	Combinator load	(lever position, if applicable)					
	Propeller:						
7.21	Pitch position actual	(if applicable)					
	Governor (mechanical engine control system, if applicable):						
7.22	Speed (request) lever	(at max (limited) position): yes / no)					
7.23	Governor output	(position)					
	Fuel system (conventional fuel system, if applicable):						
7.24	Common fuel rack	(position)					
7.25	Fuel pump 1 rack	(position)					
	Fuel pump 2 rack	(position)					
	… all fuel pumps …	(position)					
	Fuel system (common rail fuel system, if applicable):						
7.26	Rail pressure	(bar)					
	Control system (electronically controlled engine, if applicable):						
7.27	Speed request	(throttle position (%))					
7.28	Engine speed	(rpm)					
7.29	Torque	(nM)					
7.30	Load factor	(%)					
7.31	Fuel rate	(l / h)					
	All engines (if applicable):						
7.32	Charge air pressure	(Bar)					
7.33	Charge air temp.	(°C)					
7.34	Exhaust gas cylinder 1	(temperature, °C)					
	Exhaust gas cylinder 2	(temperature, °C)					
	… all cylinders …	(temperature, °C)					
7.35	Exhaust gas before TC	(temperature, °C)					
7.36	Exhaust gas after TC	(temperature, °C)					
7.37	HT coolant	(engine inlet temperature, °C)					
7.38	HT coolant	(engine outlet temperature, °C)					

8 – Remarks, conclusions and observations

8.1	

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KL-01-25-039-EN-N

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