RESOLUTION MEPC.402(83) (adopted on 11 April 2025)
GUIDELINES FOR TEST-BED AND ONBOARD MEASUREMENTS OF METHANE (CH4) AND/OR NITROUS OXIDE (N2O) EMISSIONS FROM MARINE DIESEL ENGINES

ANNEX 7

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(adopted on 11 April 2025)

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THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO that, at its eightieth session, it adopted, by resolution MEPC.377(80), the *2023 IMO Strategy on Reduction of GHG Emissions from Ships* (2023 IMO GHG Strategy) setting out the levels of ambition for the international shipping sector in reducing GHG emissions,
NOTING that the 2023 IMO GHG Strategy provides that in order to support the global availability and uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources, the Organization may consider and analyse measures to address emissions of methane (CH_4) and nitrous oxide (N_2O),

HAVING CONSIDERED, at its eighty-third session, draft guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines,

1 ADOPTS the *Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines*, as set out in the annex to the present resolution;

2 INVITES Member States to encourage shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested groups to voluntarily apply these Guidelines when undertaking measurements, calculation and reporting of CH_4 and/or N_2O emission values from marine diesel engines;

3 ALSO INVITES Member States to share data gathered in applying these Guidelines to future sessions of the Committee;

4 AGREES to keep these Guidelines under review in light of the experience gained with their implementation.

ANNEX

GUIDELINES FOR TEST-BED AND ONBOARD MEASUREMENTS OF METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O) EMISSIONS FROM MARINE DIESEL ENGINES

1 Introduction

1.1 The purpose of these Guidelines is to specify the protocol for test-bed and onboard measurements, calculation and reporting of methane (CH_4) and/or nitrous oxide (N_2O) emission values from marine diesel engines, as well as documentation and verification of CH_4 and/or N_2O emission values.

1.2 The measurements, calculations and reporting for CH_4 and/or N_2O emission values should be carried out in accordance with the NO_x Technical Code 2008 as amended, (NTC 2008) other than as specifically provided for in the protocol set out in appendix 1 of these Guidelines. All references in appendix 1 are to NTC 2008.

1.3 For onboard measurements, the protocol set out in appendix 1 may be accepted for an Individual Engine or for an Engine Group represented by the Parent Engine. It should not be accepted for an Engine Family without further justifications. For test-bed measurements, the protocol may also be accepted for an Engine Family.[1]

2 Information to be included in the CH_4 and/or N_2O file

2.1 The applicant for the establishment of the emission values should prepare a CH_4 and/or N_2O file that should contain the following information:

.1 details of the engine as tested should include but are not limited to:

.1 model and designation;

.2 rated power and rated speed;

.3 listing of NO_x critical components as fitted and settings / operating values as applied including, for CH_4, NO_x certified maximum liquid-to-gas fuel ratios across load range; and

.4 other components and settings / operating values which affect CH_4 and/or N_2O emissions;

.2 details, including drawings of exhaust system, showing sampling position(s);

.3 where C_{slip} is reported, including crankcase emissions, details of how that was determined should be provided;

.4 a copy of the relevant engine test data, as given in appendix 2 of these Guidelines and any additional data to fully define the engine performance and enable calculation of the gaseous emissions of CH_4 and/or N_2O. For test-bed measurements, this information can also be provided in the test report as referred to in section 5.10 of the NTC 2008;

1 The composition of an Engine Family or an Engine Group as defined in NTC 2008 is set solely by factors affecting NO_x emissions; those cannot be assumed to be equally applicable to CH_4 and/or N_2O emissions. In some instances, such as liquid-to-gas fuel ratio, the requirements for highest NO_x will tend to result in lowest CH_4.

.5 where a CH_4 and/or N_2O reducing device or system is used, the CH_4 and/or N_2O file should contain documentation on the emission abatement device, giving details of its intended purpose, manner of operation, critical components and settings / operating values together with information on any consumables necessary for its operation. Where exhaust gas samples are to be drawn from both before and after the device, details of analyser changeover arrangements and sequencing should be given if only one set of analysers is to be used.

3 Verification of the CH_4 and/or N_2O emission values

3.1 In order to confirm that the emission values have been established in accordance with these Guidelines, the CH_4 and/or N_2O file should be submitted to the Administration for verification.

3.2 On receipt of the CH_4 and/or N_2O file from the applicant and satisfactory completion of the verification, a Statement of emission values for CH_4 and/or N_2O should be issued by the Administration. The form of Statement of emission values for CH_4 and/or N_2O is set out in appendix 3 of these Guidelines.

APPENDIX 1

PROTOCOL FOR TEST-BED AND ONBOARD MEASUREMENTS OF CH_4 AND/OR N_2O EMISSIONS FROM MARINE DIESEL ENGINES BASED ON THE NO_x TECHNICAL CODE 2008

Explanatory note:
This protocol does not amend mandatory provisions in NTC 2008. Measurements, calculations and reporting of CH_4 and/or N_2O emission values should be carried out in accordance with NTC 2008, other than as specifically provided for in the protocol.

<table>
<tr><th>Paragraph of NO_x Technical Code 2008</th><th>Addition to NTC 2008</th></tr>
<tr><td>Abbreviations, subscripts and symbols</td><td></td></tr>
<tr><td></td><td>In table 1, the definitions of N_2O and NMHC are added as follows:
<table><tr><th>Symbol</th><th>Definition</th></tr><tr><td>N_2O</td><td>Nitrous oxide</td></tr><tr><td>NMHC</td><td>Non-methane hydrocarbons</td></tr></table></td></tr>
<tr><td></td><td>In table 2, abbreviations for FTIR, NDUV, NMC are added as follows:
<table><tr><th>Symbol</th><th>Definition</th></tr><tr><td>FTIR</td><td>Fourier transform infrared (analyser)</td></tr><tr><td>NDUV</td><td>Non-dispersive ultraviolet (analyser)</td></tr><tr><td>NMC</td><td>Non-methane cutter</td></tr></table>
Note: NMC = FID with non-methane cutter</td></tr>
<tr><td></td><td>In table 3, symbols and terms for C_{fCH4}, C_{fN2O} and $C_{slip\text{-}CH4}$ are added as follows:
<table><tr><th>Symbol</th><th>Term</th></tr><tr><td>C_{fCH4}</td><td>g CH_4 / g fuel[2]</td></tr><tr><td>C_{fN2O}</td><td>g N_2O / g total fuel (applies to both gas and liquid fuels)</td></tr><tr><td>$C_{slip\text{-}CH4}$</td><td>% (of the mass of the methane containing fuel used by the energy converter)</td></tr></table>
Note: $C_{slip\text{-}CH4}$ is a factor accounting for CH_4 (expressed in % of mass of methane containing fuel consumed in the energy converter) which is emitted from the energy converter (including fuel from combustion chamber/oxidation process and from crankcase, as appropriate).</td></tr>
</table>

[2] For methane containing fuels, the $C_{slip\text{-}CH4}$ is covering the role of C_{fCH4}, so C_{fCH4} is set to zero for these fuels. For the purpose of these Guidelines, non-methane gas fuels should be regarded as liquid fuels.

Chapter 3	
3.2 Test cycles and weighting factors to be applied	For the test cycles E2 and E3, the specific emission at the 10% mode point or the lowest mode point at which gas fuel would be used should be measured and reported in addition to the existing mode points. **For onboard measurements only**: In setting the load points of the test cycle to be followed the provisions of 6.4.6.7 should apply. In the case of the 100% load point this should, subject to the engine emission test plan, be allowed to be no lower than 85% of rated power. If that value cannot be achieved, then the test should be deferred to such time that at least that power level can be achieved. The test cycle 100% power weighting factor under 3.2 should be applied irrespective of the actual power developed at that load point.
Chapter 5	
5.2.5.3 Positioning of abatement device or system	Requirements do not necessarily apply to CH_4 and/or N_2O abatement device or system. The installation requirements of the device should be respected and provided in the CH_4 and/or N_2O file.
5.6.1 Permissible deviations of instruments for engine-related parameters and other essential parameters	**For onboard measurements only**: Engine performance and ambient condition monitoring equipment requirements should be in accordance with the requirements of 6.4.5.1.
5.9.2	CH_4 and/or N_2O should be added to the list of main exhaust components. In the case of CH_4, this means CH_4 as reported by the measurement device before correction for NMC efficiency.
5.9.3.2 Exhaust gas temperature at sample probe for HC	For the measurement of CH_4 and/or N_2O, there are no minimum temperature requirements.
5.9.6.2 Test sequence	**For onboard measurements only**: At each load point of a test cycle the provisions of 6.4.6.8 should apply rather than those of 5.9.6.2. In the case of the E3 test cycle, if the actual propeller curve differs from the E3 curve, the load point used should be set using the measured engine power.
5.11 Data evaluation for gaseous emissions	In addition to the concentrations for the species to be determined as specified by 5.11 of NTC 2008, the concentrations of CH_4 and/or N_2O are to be determined. The averaged results are to be given in ppm.
	Where the NMC methane efficiency is not 0% and/or the NMC ethane efficiency is not 100% the CH_4 concentration to be used in equation 18a is calculated as follows: $c_{NMHC} = \frac{c_{HC}\ (w/oCutter) \cdot (1 - Em) - c_{HC}\ (wCutter)}{Ee - Em}$

	Where: c_{HC} *(wCutter)* HC concentration with sample gas through NMC (ppmC1) c_{HC} *(w/oCutter)* HC concentration with NMC bypassed – i.e. usual HC reading (c_{HC}) (ppmC1) *Em* NMC methane efficiency – appendix IV, 8.5.1 *Ee* NMC ethane efficiency – appendix IV, 8.5.2 CH_4 concentration: $c_{CH4} = c_{HC} - c_{NMHC}$
5.12.5.1 Calculation of the emission mass flow rates	For the calculation of the emission mass flow rates in 5.12.5.1, u_{gas} values for N_2O and/or CH_4 should be calculated using table 5 as extended:

Gas		HC	CH_4	N_2O
ρ_{gas} kg/m^3		*	0.716	1.9631
	ρ_e†	Coefficient u_{gas}‡		
Liquid fuel**	1.2943	0.000479	0.000553	0.001517
Rapeseed Methyl Ester	1.2950	0.000536	0.000553	0.001516
Methanol	1.2610	0.001133	0.000568	0.001557
Ethanol	1.2757	0.000805	0.000561	0.001539
Natural gas	1.2661	0.000558*	0.000565	0.001551
Propane	1.2805	0.000512	0.000559	0.001533
Butane	1.2832	0.000505	0.000558	0.001530

* In the case of HC emissions when using natural gas as the fuel, the given u_{gas} value of 0.000558 should be used for NMHC on the basis of CH2.93. For total HC, the u_{gas} of CH_4 should be used.

5.12.5.2	The CH_4 and/or N_2O concentration to be entered into equation 18a is the value from 5.11 on a wet basis.

<table>
<tr><td>5.12.6 Calculation of the specific emission</td><td>Calculate C_{fCH4} (g/kg fuel and g/kWh), C_{fN2O} (g/kg fuel and g/kWh) and $C_{slip\text{-}CH4}$ (% of the mass of the methane containing fuel used by the engine) for each load point where emissions are measured.

$C_{fgas} = q_{mgas} / fuel\ flow$

$C_{slip\text{-}CH4} = (q_{mCH4} / fuel\ flow) \cdot 100$

Calculate the average weighed emissions

$C_{fgas} = \sum\_i{=}1...n\ (q_{mgas} \cdot W_{Fi})\ /\ sum\_i{=}1..n\ (q_{fuel,i} \cdot W_{Fi})$

With $q_{fuel,i}$ being the fuel flow at each mode point.

$C_{slip\text{-}CH4} = \sum\_i{=}1...n\ (\ q_{mCH4} \cdot W_{Fi})\ /\ 10\ /\ sum\_i{=}1..n\ (q_{fuel,i} \cdot W_{Fi})$

q_{mgas} (g/h): see section 5.12.5.2 of the NTC 2008, equation 18a

Fuel flow (kg/h) as measured.</td></tr>
<tr><td>Appendix III</td><td></td></tr>
<tr><td></td><td>Section 1.1
CH_4 and/or N_2O are added to the list of components included in the exhaust gas analysis system.</td></tr>
<tr><td></td><td>Figure 1
• For arrangements of exhaust gas analysis measurement systems for the measurement of CH_4, refer to ISO 8178-1 section 7.4.4.
• NMC and N_2O analyser should be arranged, installed and operated in accordance with the respective manufacturer's recommendations.</td></tr>
<tr><td></td><td>Section 1.2
Analysers for CH_4 and N_2O: see section 3</td></tr>
<tr><td></td><td>Section 3

3.6 Methane (CH_4) analysis

The reference method for CH_4 should be FID + NMC.
Other principles / systems should be accepted if proven against FID+NMC with exhaust gases of the compositions to be measured.
It should be ensured that the HC / CH_4 analyser(s) to be used have duly calibrated ranges for the respective concentrations to be measured.
The NMC should have the capacity to handle the expected CH_4 and NMHC concentrations.</td></tr>
</table>

	3.7 Nitrous oxide (N_2O) analysis An FTIR analyser, an NDIR (non-dispersive infrared) analyser, laser infrared analyser or NDUV analyser may be used in accordance with the instrument supplier's instructions. Note: According to sections 5.4.2 and 5.4.3 of the NTC 2008, other systems or analysers may, subject to the approval of the Administration, be accepted if they yield equivalent results to that of the equipment referenced.
Appendix IV	**Calibration of the analytical and measurement instruments**
	Requirements of table 1 or table 3 regarding fuel measurement device apply separately to both liquid fuel meter and gas fuel meter.
	In addition to the calibration procedures of appendix IV of the NTC 2008, relevant parts of ISO 8178-1 for calibration of CH_4 and/or N_2O measurement instruments should be applied. FID should be calibrated with NMC bypassed with NMC efficiencies E_e and E_m determined separately.
	Section 2 "C_2H_6 and purified synthetic air" is added to 2.2.1.5. A new sub-paragraph "2.2.1.6 N_2O and purified nitrogen" is added after the existing 2.2.1.5.
	Section 5 N_2O is added to the list of analysers in the first sentence of 5.4.2.
8.4	For measurement of N_2O, a new section 8.4 applies
8.4.1	The interference should be checked prior to first use of an analyser and after major servicing or updating of software.
8.4.2	In those cases where the analyser applies compensation algorithms which use as inputs the concentrations of other measured gases those measurements should be undertaken concurrently with this verification check.
8.4.3	For NDIR - The potential for cross interferences effects of CO, CO_2, H_2O, CH_4 and SO_2 as applicable should be checked.
8.4.3.1	Apart from H_2O the interference species are dependent on the selected N_2O absorption band used by the device which should be known. From that knowledge good engineering judgement should be used to determine the interference gases to be used based on those which may be expected to be present in the exhaust gases to be measured.

8.4.4	For FTIR or Laser Infrared – The inference gases depend on the selected N_2O absorption band used by the device which should be known. Based on that knowledge good engineering judgement should be used to determine the interference gases to be used.
8.4.5	The combined effect of the interference gases should not be more 1.0 µmol/mol.
8.4.6	Verification procedure: .1 The concentrations of the interference span gases as identified from 8.4.3 or 8.4.4 should be at least as high as the maximum values to be encountered in service. Those interference gases may be presented in the form of a multi-component span gas. .2 The N_2O analyser is started, operated, zeroed and spanned as in service. .3 Humified interference test gas should be fed into the analyser. That test gas should be generated by bubbling the multi-component span gas through distilled H_2O in a sealed container. If the sample is not treated by a dryer the container temperature should be controlled to generate a H_2O concentration at least as high as the expected maximum when in service. If the sample is treated by a dryer the container temperature should be controlled to generate a H_2O concentration at least as high as the expected maximum based on the dryer outlet temperature when in service. .4 The water mole fraction of the test gas should be determined from measurements taken as close as possible to the analyser inlet. Those measurements may be dew point and absolute pressure. .5 Condensation in the piping leading from the container generating the humidified test gas to the analyser should be minimized by maintaining an adequate minimum temperature. .6 Following stabilization, the analyser output should be recorded for 30 s. The arithmetic mean response over that period should be compared with the limit in 8.4.5.
8.4.6.1	As an alternative to the multi-component span gas in 8.4.6 individual span gases may be run separately. Where an interference gas concentration is higher than that to be measured in service the determined interference value should be scaled down by the ratio of in-service maximum / span concentration. Where the H_2O concentration is below that to be measured in service, but not below 0.025 mol/mol H_2O content, the determined

	interference may be scaled up by the ratio of maximum in-service value / the value used. The sum of the individual interferences should be compared with the limit in 8.4.5.
8.4.7	An interference verification check report documenting the procedure as followed, including the rational for the interference gases used and their concentrations, and the outcomes of that procedure is to be prepared and should be available as may be required.
8.4.8	Alternative approaches to the verification of N_2O analyser interference may be acceptable. Where so used the justification for the approach taken should be included in the report as required by 8.4.7. Irrespective of the procedure followed the limit given by 8.4.5 remains applicable.
8.5	**Efficiency of the non-methane cutter (NMC)**
	The NMC is used for the removal of the non-methane hydrocarbons from the sample gas by oxidizing all hydrocarbons except CH_4. Ideally, the conversion rate for CH_4 is 0% and for the other hydrocarbons, as represented by ethane, is 100%. Since the performance of NMC can deteriorate rapidly and without warning if operated outside certain ranges of gas concentrations and temperature ranges, the efficiency of the NMC should be checked as part of the pretest verification procedures under 6.1 and again on completion of the measurement exercise (at the time of rechecking the analysers in accordance with 5.9.9 of NTC 2008) with the average of the two *Em* and *Ee* values so obtained being used to correct the measured CH_4 concentrations. For onboard measurement, the efficiency of the NMC may be assessed in a laboratory before and after the measurement exercise. With the agreement of the Administration, alternative approaches to the assessment of NMC efficiency may be accepted. Methane efficiency < 15% Ethane efficiency > 98%
8.5.1	**NMC methane efficiency**
	Methane calibration gas at a concentration typical of that to be measured is flowed through the FID analyser with and without the NMC bypassed. The methane efficiency, *Em*, is determined as: $Em = 1 - \frac{C_M\,(wCutter)}{C_M\,(w/oCutter)}$

	Where: $C_M\,(wCutter)$ HC concentration with CH_4 flowing through the NMC (ppmC1) $C_M\,(w/oCutter)$ HC concentration with CH_4 bypassing NMC (ppmC1)
8.5.2	**NMC ethane efficiency**
	Ethane calibration gas at a concentration typical of the expected non-methane hydrocarbon concentration to be measured is flowed through the FID analyser with and without the NMC bypassed. The ethane efficiency, *Ee*, is determined as: $Ee = 1 - \frac{C_E\,(wCutter)}{C_E\,(w/oCutter)}$ Where: $C_E\,(wCutter)$ HC concentration with C_2H_6 flowing through the NMC (ppmC1) $C_E\,(w/oCutter)$ HC concentration with C_2H_6 bypassing NMC (ppmC1)

APPENDIX 2

ENGINE TEST REPORT AND TEST DATA – CH_4 AND/OR N_2O CALCULATIONS

Engine	
Manufacturer	
Engine type	
Emission abatement device	
Engine family or Engine group identification	
Serial number	
Rated power	
Rated speed	

Emissions test results:					
Test cycle					
C_{fCH4} weighted					g/kg fuel
$C_{slip\text{-}CH4}$ weighted					% (of the mass of the methane containing fuel used by the engine)
N_2O (weighted)					g/kg total fuel
Test identification					
Date/time					
Test site					
Test number					
Company					
Date and place of report					
Signature					

Measurement equipment					
	Manufacturer	Model	Measurement ranges	Calibration	
				Span gas conc.	Deviation of calibration
Analyser					
HC / CH_4 Analyser*			ppm		%
N_2O Analyser			ppm		%
CO Analyser			ppm		%
CO_2 Analyser			%		%
O_2 Analyser			%		%
Speed			rpm		%

Torque			Nm		%
Power, if applicable			kW		%
Fuel flow-liquid					%
Fuel flow-gas					%
Air flow					%
Exhaust flow					%
Temperatures					
Charge air coolant inlet			°C		°C
Exhaust gas			°C		°C
Inlet air			°C		°C
Charge air			°C		°C
Fuel-liquid			°C		°C
Fuel-gas			°C		°C
Pressures					
Exhaust gas			kPa		kPa
Charge air			kPa		kPa
Atmospheric			kPa		kPa
Vapour pressure					
Intake air			kPa		%
Humidity					
Intake air			%		%

* For FID+NMC

Make and model of NMC		
	Before measurement	After measurement
NMC CH_4 gas concentration	ppmC	ppmC
HC with CH_4 through NMC	ppmC	ppmC
HC with CH_4 bypassing NMC	ppmC	ppmC
NMC methane efficiency *Em*		
NMC C_2H_6 gas concentration	ppmC	ppmC
HC with C_2H_6 through NMC	ppmC	ppmC
HC with C_2H_6 bypassing NMC	ppmC	ppmC
NMC ethane efficiency *Ee*		

Liquid fuel characteristics

Fuel type				
Fuel properties:			**Fuel elemental analysis:**	
Density	ISO 3675	kg/m^3	Carbon	% m/m
Viscosity	ISO 3104	mm^2/s	Hydrogen	% m/m
Water	ISO 3733	% V/V	Nitrogen	% m/m
Lower heating value/Hu		MJ/kg	Oxygen	% m/m
			Sulphur	% m/m

Gas fuel characteristics

Fuel type:				
Fuel properties			**Fuel elemental analysis**	
Methane number	EN16726:2015		Carbon	% m/m
Lower heating value		MJ/kg	Hydrogen	% m/m
Boiling point		°C	Nitrogen	% m/m
Density at boiling point		kg/m^3	Oxygen	% m/m
Pressure at boiling point		Bar (abs)	Sulphur	% m/m
			Methane, CH_4	mol%
			Ethane, C_2H_6	mol%
			Propane, C_3H_8	mol%
			Isobutane, i C_4H_{10}	mol%
			N-Butane, n C_4H_{10}	mol%
			Pentane, C_5H_{12}	mol%
			C_6+	mol%
			CO_2	mol%

Gaseous emissions data

Mode	1	2	3	4	5	6	7	8	9	10
Power/Torque (%)										
Speed (%)										
Time at beginning of mode										

Gaseous emissions data:										
Sampling position										
HC concentration (ppmC)										
CH_4 concentration (ppmC)* recorded#										
CH_4 concentration (ppmC)* - corrected#										
N_2O concentration (ppm)*										
CO concentration (ppm)										
CO_2 concentration (%)										
O_2 concentration (%)										
CH_4 mass flow (kg/h)*#										
N_2O mass flow (kg/h)*										
CO mass flow (kg/h)										
CO_2 mass flow (kg/h)										
O_2 mass flow (kg/h)										
CH_4 (g/kg)*#										
CH_4 (g/kWh)* #										
N_2O (g/kg)*										
N_2O (g/kWh)*										

* As applicable.
\# As applicable to either liquid or gas fuel.

Engine parameters to be measured and recorded

Mode	1	2	3	4	5	6	7	8	9	10
Power/Torque (%)										
Speed (%)										
Time at beginning of mode										

Engine data										
Speed (rpm)										
Power (kW)										
Mean effective pressure (kPa)										
Fuel rack/gas admission duration** (mm/sec)										
Liquid-to-gas fuel ratio (on mass basis)										
Liquid Fuel flow (kg/h or m^3/h*)										
Gas Fuel flow (kg/h)										
Exhaust flow (q_{mew}) (kg/h)										
Exhaust temperature at the sampling point (°C)										
Charge air coolant temperature in (°C)										
Charge air coolant temperature out (°C)										
Charge air temperature (°C)										
Charge air reference temperature (°C)										
Charge air pressure (kPa)										
Fuel-liquid temperature before the engine (°C)										
Fuel-gas temperature before the engine (°C)										

Ambient data										
Atmospheric pressure (kPa)										
Intake air temperature (°C)										
Intake air humidity (g/kg)										
Relative humidity (RH) of intake air* %										
Air temperature at RH sensor* (°C)										
Dry bulb temperature of intake air* (°C)										
Wet bulb temperature of intake air* (°C)										

* As applicable.
** Only for engines to be tested with gas fuel.

Abatement device:

The report should state whether reported data before or after device- hence the gaseous emission data page will need to be repeated, if both are to be given.

Additionally, if both before and after data given, the analyser data should, if relevant, be repeated to cover all analysers used.

For each Mode Point, the following device data should additionally be recorded: Settings, Operating values and Consumption (specified rates).

APPENDIX 3

FORM OF STATEMENT OF EMISSION VALUES FOR METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O)

Issued in accordance with the *Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines* (resolution MEPC.402(83)) under the authority of the Government of:

……………………………………………………………………………………………………
(full designation of the country)

by...
(full designation of the competent person or organization authorized)

Particulars of applicant

Name of applicant…………………………………………………………………………………

THIS IS TO DECLARE THAT:

1 the applicant has submitted to this Administration the information recommended by the Guidelines for test-bed and onboard measurements of CH_4 and/or N_2O emissions from marine diesel engines (resolution MEPC.402(83));

2 the emission value(s) have been established in accordance with the Guidelines for test-bed and onboard measurements of CH_4 and/or N_2O emissions from marine diesel engines (resolution MEPC.402(83));

3 the engine weighted verified emissions value(s) are as follows:

1	Engine manufacturer and model	
2	Engine serial number	
3	Abatement device manufacturer and model	
4	Device serial number	
5	Use (applicable test cycle(s) – NTC 3.2)	
6	C_{fCH4} (g/kg fuel)*	
7	$C_{slip\text{-}CH4}$ % (of the mass of the methane containing fuel used by the engine)*	
8	C_{fN2O} (g/kg fuel)*	

* Include as appropriate

Issued at………………………………………………………………………………...
(place of issue of the Statement)

(dd/mm/yyyy): ....
(date of issue) *(signature of duly authorized official issuing the Statement)*

(seal or stamp of the authority, as appropriate)

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ANNEX 8

WORK PLAN FOR THE DEVELOPMENT OF A REGULATORY FRAMEWORK FOR THE USE OF ONBOARD CARBON CAPTURE AND STORAGE (OCCS)

Goal: The goal of this work is to develop a regulatory framework for the use of onboard carbon capture and storage (OCCS), in order to reduce net GHG emissions from ships without negatively affecting the environment

Objectives: The work has the following objectives:

.1 avoiding emissions to air and discharges to sea that are harmful to the environment and ensuring traceability of the captured carbon;

.2 consider legal barriers that may hinder the use of OCCS and transportation and transfer of the captured carbon to safe permanent storage or utilization;

.3 facilitate access to certified reception facilities for the value chain for permanent storage or utilization of captured carbon;

.4 enable recording and reporting of relevant data; and

.5 develop options that take into account GHG emission reductions from onboard carbon capture in the IMO GHG regulatory framework.

Boundaries (freedoms and constraints):

.1 issues related to health, safety and the human element will be addressed by the Maritime Safety Committee (MSC) and its sub-committees. MSC and MEPC should liaise to ensure alignment of the overall regulatory framework for onboard carbon capture;

.2 issues related to accounting of emissions from ships using OCCS will be addressed by the workstreams on further development of the LCA framework, and decisions made in this process will affect the regulatory framework for OCCS;

.3 the regulatory framework should take a technology-neutral approach and needs to consider the diverse types of technology for OCCS;

.4 the regulatory framework needs to consider the environmental risks associated with the use of OCCS, and the transfer and discharge to shore; and

.5 decisions and developments in other workstreams related to the short-term and mid-term GHG reduction measures may impact the work and should be considered.

Tasks:

.1 avoiding emissions to air and discharges to sea that are harmful to the environment and ensuring traceability of the captured carbon;

.1 understand and identify the environmental risks of the different onboard carbon capture technologies;

.2 develop measures to minimize the negative impact on the environment:

.1 develop guidelines on testing, survey, and certification of OCCS, including development of provisions to minimize emissions/discharge of substances that are harmful to the environment and ensure the availability of the data needed for LCA calculations;

.2 review the existing IMO regulatory framework in a structured manner to identify existing instruments that should be amended, and potential additional guidelines or regulations that may be needed; and

.3 consider the need to define the acceptable means of disposal or use of captured carbon;

.3 develop provisions for enforcement to ensure that the OCCS on ships comply with environment regulations and standards, including consideration of what existing regulations and guidelines need to be updated; and

.4 review the status of technological development of onboard carbon capture applications, including their potential in reducing GHG emissions from ships;

.2 consider legal barriers that may hinder the use of OCCS and transportation and transfer of the captured carbon to safe permanent storage or utilization:

.1 identify and understand the impact of any legal barriers; and

.2 decide on further actions as appropriate;

.3 facilitate access to certified reception facilities for the value chain for permanent storage or utilization of captured carbon:

.1 consider monitoring the development of relevant regulations applicable to facilities for permanent storage or utilization of captured carbon, carbon capture facilities, national regulations, and installation of OCCS on ships;

.2 consider if and how to address compatibility between ships and reception facilities ashore; and

.3 engage in a principal discussion on how to address the quality and concentration of the captured carbon delivered ashore;

.4 enable recording and reporting of relevant data:

.1 consider and identify what data should be recorded and reported and how;

.2 consider how to enable the traceability of the captured carbon; and

.3 update relevant guidelines and provisions as appropriate;

.5 develop options that take into account GHG emission reductions from onboard carbon capture in the IMO GHG regulatory framework:

.1 consider how GHG emission reductions achieved through OCCS could be reflected in the IMO regulatory framework; and

.2 update relevant guidelines as needed.

Timing: Aim to complete the work in 2028, and priority tasks as soon as possible. The tasks associated with objective 1 (tasks 1.1 to 1.4) should be prioritized.

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