القرار MEPC.272(69)
(المعتمد في 22 نيسان/إبريل 2016)

تعديلات على المدونة التقنية بشأن مكافحة انبعاث أكاسيد النتروجين
من محركات الديزل البحرية لعام 2008

(اختبار المحركات التي تعمل بالغاز والمحركات المختلطة الوقود)

第 MEPC.272(69)号决议
（2016 年 4 月 22 日通过）

船用柴油发动机氮氧化物
2008 年氮氧化物技术规则修正案

（气体燃料和双燃料发动机检测）

RESOLUTION MEPC.272(69)
(Adopted on 22 April 2016)

AMENDMENTS TO THE NO_X TECHNICAL CODE 2008
NITROGEN OXIDES FROM MARINE DIESEL ENGINES

(Testing of gas-fuelled and dual fuel engines)

RÉSOLUTION MEPC.272(69)
(adoptée le 22 avril 2016)

AMENDEMENTS AU CODE TECHNIQUE SUR LE CONTRÔLE DES ÉMISSIONS D'OXYDES
D'AZOTE PROVENANT DES MOTEURS DIESEL MARINS

(Mise à l'essai des moteurs à gaz et moteurs à combustible mixte)

РЕЗОЛЮЦИЯ MEPC.272(69)
(Принята 22 апреля 2016 года)

ПОПРАВКИ К ТЕХНИЧЕСКОМУ КОДЕКСУ ПО КОНТРОЛЮ ЗА ВЫБРОСАМИ
ОКИСЛОВ АЗОТА ИЗ СУДОВЫХ ДИЗЕЛЬНЫХ ДВИГАТЕЛЕЙ 2008 ГОДА

(Испытания работающих на газе и двухтопливных двигателей)

RESOLUCIÓN MEPC.272(69)
(adoptada el 22 de abril de 2016)

ENMIENDAS AL CÓDIGO TÉCNICO RELATIVO AL CONTROL DE LAS EMISIONES
DE ÓXIDOS DE NITRÓGENO DE LOS MOTORES DIÉSEL MARINOS

(Prueba de los motores de gas y los motores de combustible mixto)

RESOLUTION MEPC.272(69)
(Adopted on 22 April 2016)

AMENDMENTS TO THE NO_X TECHNICAL CODE 2008
NITROGEN OXIDES FROM MARINE DIESEL ENGINES

(Testing of gas-fuelled and dual fuel engines)

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,

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocols of 1978 and 1997 relating thereto (MARPOL), which specifies the amendment procedure and confers upon the appropriate body of the Organization the function of considering and adopting amendments thereto,

NOTING FURTHER regulation 13 of MARPOL Annex VI which makes the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (NO_X Technical Code 2008) mandatory under that Annex,

HAVING CONSIDERED, at its sixty-ninth session, draft amendments to the NO_X Technical Code 2008 related to the testing of gas-fuelled and dual fuel engines,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to the NO_X Technical Code 2008, as set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 16(2)(f)(iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 March 2017, unless prior to that date not less than one-third of the Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objection to the amendments;

3 INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of MARPOL, the said amendments shall enter into force on 1 September 2017 upon their acceptance in accordance with paragraph 2 above;

4 AGREES that these amendments apply to each marine diesel engine with a power output of more than 130 kW installed, or designed and intended for installation, on a ship subject to regulation 13 of MARPOL Annex VI, on or after 1 September 2017;

5 REQUESTS the Secretary-General, for the purposes of article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to MARPOL;

6 REQUESTS FURTHER the Secretary-General to transmit copies of the present resolution and its annex to the Members of the Organization which are not Parties to MARPOL.

ANNEX

AMENDMENTS TO THE NO_X TECHNICAL CODE 2008
(Testing of gas-fuelled and dual fuel engines)

Abbreviations, subscripts and symbols

1 In subparagraphs .1 and .2 and in the title of table 2, the word "marine" is added before the word "diesel".

2 In table 2, row 4 is replaced with the following:

"

(H)FID	(Heated) flame ionization detector

"

Chapter 1 – General

3 In paragraph 1.3.10, the following new sentence is inserted after the first sentence:

"In addition, a gas-fuelled engine installed on a ship constructed on or after 1 March 2016 or a gas-fuelled additional or non-identical replacement engine installed on or after that date is also considered as a marine diesel engine."

Chapter 4 – Approval for serially manufactured engines: engine family and engine group concepts

4 In paragraph 4.3.8.2.6, after the existing bullet point "– dual fuel", a new bullet point is added as follows:

"– gas fuel"

5 After existing paragraph 4.3.8.2.10, a new paragraph 4.3.8.2.11 is added as follows:

".11 ignition methods:

– compression ignition
– ignition by pilot injection
– ignition by spark plug or other external ignition device"

6 In paragraph 4.4.6.2.5, after the words "injection cam", the words "or gas valve" are inserted.

7 In the first and second bullet points under paragraph 4.4.7.2.1, after the word "injection", the words "or ignition" are inserted, respectively.

8 In paragraph 4.4.7.2.2, after the existing bullet point "– combustion chamber", a new bullet point is added as follows:

"– gas valve specification."

Chapter 5 – Procedures for NO_x emission measurements on a test bed

9 In paragraph 5.2.1.2, after the word "engines", the words "operating on liquid or dual fuel" are inserted.

10 The existing paragraph 5.2.1.3 is renumbered as 5.2.1.3.1 and in the renumbered paragraph 5.2.1.3.1, after the word "engines", the words "operating on liquid or dual fuel" are inserted.

11 A new paragraph 5.2.1.3.2 is added after the renumbered paragraph 5.2.1.3.1 as follows:

"5.2.1.3.2 For engines to be tested with gas fuel only with or without cooling of the intake air the parameter f_a shall be determined according to the following:

$$f_a = \left(\frac{99}{p_s}\right)^{1.2} \cdot \left(\frac{T_a}{298}\right)^{0.6} \qquad (2a)"$$

12 In the second sentence of paragraph 5.3.3, the words "fuel injection pump" are replaced with the word "engine".

13 In the first sentence of paragraph 5.3.4, the words "for dual fuel" are deleted.

14 In the second sentence of paragraph 5.4.2, before the word "diesel", the word "marine" is inserted.

15 A new paragraph 5.12.3.2.3 is added as follows:

".3 The calculation shall be in accordance with paragraphs 5.12.3.1 to 5.12.3.2. However, q_{mf}, W_{ALF}, W_{BET}, W_{DEL}, W_{EPS} values shall be calculated in accordance with the following table:

Factors in the formula (6) (7) (8)		**Formula for factors**
q_{mf}	=	$q_{mf\_G} + q_{mf\_L}$
W_{ALF}	=	$\frac{q_{mf\_G} \times w_{ALF\_G} + q_{mf\_L} \times w_{ALF\_L}}{q_{mf\_G} + q_{mf\_L}}$
W_{BET}	=	$\frac{q_{mf\_G} \times w_{BET\_G} + q_{mf\_L} \times w_{BET\_L}}{q_{mf\_G} + q_{mf\_L}}$
W_{DEL}	=	$\frac{q_{mf\_G} \times w_{DEL\_G} + q_{mf\_L} \times w_{DEL\_L}}{q_{mf\_G} + q_{mf\_L}}$
W_{EPS}	=	$\frac{q_{mf\_G} \times w_{EPS\_G} + q_{mf\_L} \times w_{EPS\_L}}{q_{mf\_G} + q_{mf\_L}}$

"

16 Paragraph 5.12.3.3 is replaced with the following:

"5.12.3.3 For the intake air:

$$k_{wa} = 1 - k_{w2} \quad (15)"$$

17 Paragraph 5.12.4.1 is replaced with the following:

"5.12.4.1 As the NO_X emission depends on ambient air conditions, the NO_X concentration shall be corrected for ambient air temperature and humidity with the factors in accordance with 5.12.4.5, 5.12.4.6 or 5.12.4.7 as applicable."

18 In paragraph 5.12.4.6, the last sentence is replaced with the following:

"However if $H_a \geq H_{SC}$, then H_{SC} shall be used in place of H_a in formula (17) or (17a)."

19 A new paragraph 5.12.4.7 is added after existing paragraph 5.12.4.6 as follows:

"5.12.4.7 For engines to be tested with gas fuel only:

$$k_{\mathrm{hd}} = 0.6272 + 44.030 \times 10^{-3} \times H_{\mathrm{a}} - 0.862 \times 10^{-3} \times {H_{\mathrm{a}}}^2 \quad (17a)$$

where:

H_a is the humidity of the intake air at the inlet to the air filter in g water per kg dry air."

Chapter 6 – Procedures for demonstrating compliance with NO_X emission limits on board

20 In the first sentence of paragraph 6.2.1.2, before the word "diesel", the word "marine" is inserted.

21 Subparagraph 6.2.2.3.1 is replaced with the following:

".1 injection or ignition timing,"

22 In subparagraph 6.2.2.3.14, the word "or" is deleted.

23 At the end of subparagraph 6.2.2.3.15, the word "or" is added.

24 A new subparagraph 6.2.2.3.16 is added as follows:

".16 gas valve."

25 In the third sentence of paragraph 6.3.1.4, the word "dual" is replaced with the word "gas".

26 The footnote of table 6 is replaced with the following:

"* Only for engines to be tested with gas fuel."

27 Paragraph 6.3.4.1 is replaced with the following:

"6.3.4.1 Generally all emission measurements with liquid fuel shall be carried out with the engine running on marine diesel fuel oil of an ISO 8217:2005, DM grade. Generally all emission measurements with gas fuel shall be carried out with the engine running on gas fuel equivalent to ISO 8178-5:2008."

28 In paragraph 6.3.4.3, before the word "engine", the words "or gas-fuelled" are inserted.

Appendix III – Specifications for analysers to be used in the determination of gaseous components of marine diesel engine emissions

29 Subparagraph 1.2.12 is replaced with the following:

".12 O_2 – Oxygen analyser

Paramagnetic detector (PMD), zirconium dioxide (ZRDO) or electrochemical sensor (ECS). ZRDO shall not be used for dual fuel or gas-fuelled engines."

30 At the end of paragraph 3.3, a new sentence is added as follows:

"Optionally, for gas-fuelled engines (without liquid pilot injection), the hydrocarbon analyser may be of the non-heated flame ionization detector (FID) type."

31 At the end of paragraph 3.5, a new sentence is added as follows:

"ZRDO shall not be used for dual fuel or gas-fuelled engines."

Appendix IV – Calibration of the analytical and measurement instruments

32 In paragraph 2.2.4, the word "bleeding" is replaced with the word "blending".

33 In paragraphs 5.3, 5.4.2, 8, 8.1.1, 8.2.2 and 8.3.2.10, the symbol "FID" is replaced with the symbol "(H)FID", respectively.

Appendix V – Parent engine test report and test data

Section 1 – Parent engine test report

34 Rows 10, 11 and 12 of sheet 1/5 are replaced with the following:

"

Static injection or ignition timing		deg CA BTDC
Electronic injection or ignition control	No:	Yes:
Variable injection or ignition control	No:	Yes:

"

35 Rows 6 and 27 of sheet 2/5 are replaced, respectively, as follows:

Row 6:

"

Fuel type to be used on board	Distillate/distillate or heavy fuel/dual fuel/ gas fuel

"

Row 27:

"

Injection or ignition timing (range)					

"

36 A new row is inserted after row 6 of sheet 2/5 as follows:

"

Ignition methods	Compression ignition/ignition by pilot injection/ignition by spark plug or other external ignition device

"

37 The title of the table "Fuel characteristics" under sheet 3/5 is replaced with the following:

"Liquid fuel characteristics"

38 A new table is added after the table of fuel characteristics under sheet 3/5 as follows:

"**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/m³	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%
			C6+	mol%
			CO_2	mol%

39 Row 11 of sheet 5/5 is replaced and a footnote is added as follows:

"

Fuel rack/gas admission duration**	mm/sec										

** Only for engines to be tested with gas fuel"

Section 2 – Parent engine test data to be included in the technical file

40 In the second table, currently entitled "Parent engine test fuel oil", the title is replaced by:

"Parent engine test liquid fuel"

The following table is inserted after the aforementioned table:

"

Parent engine test gas fuel		
ISO 8178-5:2008		
Carbon	% m/m	
Hydrogen	% m/m	
Sulphur	% m/m	
Nitrogen	% m/m	
Oxygen	% 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%	
C6+	mol%	
CO_2	mol%	

"

Appendix VI – Calculation of exhaust gas mass flow (carbon balance method)

41 In paragraph 2.5, the words "in case of gas mode operation of dual-fuel engine," are deleted.

Appendix VII – Checklist for an engine parameter check method

42 The chapeau of paragraph 1.1 is replaced with the following:

".1 parameter 'injection timing and ignition timing':"

43 At the end of subparagraph 1.1.4, the word "and" is added.

44 A new subparagraph 1.1.5 is added as follows:

".5 timing indicator or timing light."

Appendix VIII – Implementation of the direct measurement and monitoring method

45 At the end of paragraph 2.1.1.4, a new sentence is added as follows:

"Optionally, for gas-fuelled engines (without liquid pilot injection), the hydrocarbon analyser may be of the non-heated flame ionization detector (FID) type."

46 At the end of paragraph 2.1.1.5, a new sentence is added as follows:

"ZRDO shall not be used for dual fuel or gas-fuelled engines."

نسخة صادقة مصدّقة من نصّ التعديلات على المدونة التقنية بشأن أكاسيد النتروجين لعام 2008 ، الذي اعتمدته لجنة حماية البيئة البحرية التابعة للمنظمة البحرية الدولية في دورتها التاسعة والستين ، في 22 نيسان/أبريل 2016 ، بموجب المادة 16(2)(د) من اتفاقية ماربول ، على النحو الوارد في مرفق القرار MEPC.272(69) ، وقد أودع النصّ الأصلي لدى الأمين العام للمنظمة البحرية الدولية .

此件系国际海事组织海上环境保护委员会第六十九届会议，按照防污公约第 16(2)(d)条，于 2016 年 4 月 22 日通过并载于第 MEPC.272(69) 号决议附件中的《2008 年氮氧化物技术规则》修正案文本的核证无误副本，其正本交国际海事组织秘书长保存。

CERTIFIED TRUE COPY of the text of the amendments to the NO_x Technical Code 2008, adopted on 22 April 2016 by the Marine Environment Protection Committee of the International Maritime Organization at its sixty-ninth session, in accordance with article 16(2)(d) of MARPOL and set out in the annex to resolution MEPC.272(69), the original of which is deposited with the Secretary-General of the International Maritime Organization.

COPIE CERTIFIÉE CONFORME du texte des amendements au Code technique sur le contrôle des émissions d'oxydes d'azote provenant des moteurs diesel marins, adoptés le 22 avril 2016 par le Comité de la protection du milieu marin de l'Organisation maritime internationale, à sa soixante-neuvième session, conformément à l'article 16 2) d) de MARPOL, tel qu'il figure en annexe à la résolution MEPC.272(69) et dont l'original est déposé auprès du Secrétaire général de l'Organisation maritime internationale.

ЗАВЕРЕННАЯ КОПИЯ текста поправок к Техническому кодексу по NO_x 2008 года, одобренных 22 апреля 2016 года Комитетом по защите морской среды Международной морской организации на его шестьдесят девятой сессии в соответствии со статьей 16 2) d) Конвенции МАРПОЛ и изложенных в приложении к резолюции MEPC.272(69), подлинник которых сдан на хранение Генеральному секретарю Международной морской организации.

COPIA AUTÉNTICA CERTIFICADA de las enmiendas al Código técnico sobre los NO_x 2008, adoptadas el 22 de abril de 2016 por el Comité de protección del medio marino de la Organización Marítima Internacional en su 69º periodo de sesiones, de conformidad con lo dispuesto en el artículo 16 2) d) del Convenio MARPOL, las cuales figuran en el anexo de la resolución MEPC.272(69), y cuyo original ha sido depositado ante el Secretario General de la Organización Marítima Internacional.

عن الأمين العام للمنظمة البحرية الدولية :

代表国际海事组织秘书长：
For the Secretary-General of the International Maritime Organization:
Pour le Secrétaire général de l'Organisation maritime internationale :
За Генерального секретаря Международной морской организации:
Por el Secretario General de la Organización Marítima Internacional:

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伦敦，
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05 JAN 2017