五、委任唐海誼擔任澳門科學館股份有限公司董事會董事。

5. É nomeado Tong Hoi Yee como membro do Conselho de Administração do Centro de Ciência de Macau, S.A..

六、續任關可穎擔任澳門科學館股份有限公司監事會主席。

6. É renovada a nomeação de Kuan Ho Weng como presidente do Conselho Fiscal do Centro de Ciência de Macau, S.A..

七、續任孔兆偉擔任澳門科學館股份有限公司監事會監事。

7. É renovada a nomeação de Kong Zhaowei como membro do Conselho Fiscal do Centro de Ciência de Macau, S.A..

八、續任秦斌以兼任方式擔任澳門科學館股份有限公司監事會監事。

8. É renovada a nomeação, em regime de acumulação de funções, de Qin Bin como membro do Conselho Fiscal do Centro de Ciência de Macau, S.A..

九、擔任本批示第一款及第四款所指職務的報酬由澳門科學館股份有限公司的股東會訂定及由該公司承擔。

9. A remuneração pelo exercício das funções referidas nos n.os 1 e 4 do presente despacho é a que se encontra fixada pela Assembleia Geral do Centro de Ciência de Macau, S.A. e é por este suportada.

十、本批示第一款及第四款所指人員繼續為醫療福利及退休及撫卹制度作出的扣除，以原薪俸為計算基礎；屬僱主實體負擔的部分，由澳門科學館股份有限公司承擔。

10. Os descontos que os trabalhadores referidos nos n.os 1 e 4 do presente despacho continuam a proceder para efeitos de assistência na doença e do regime de aposentação e sobrevivência são calculados com base no vencimento de origem, sendo os encargos relativos à entidade patronal suportados pelo Centro de Ciência de Macau, S.A..

十一、本批示第一款至第八款所指的成員任期為一年，自二零二六年四月一日起產生效力。

11. O mandato dos membros referidos nos n.os 1 a 8 do presente despacho tem a duração de um ano e produz efeitos a partir de 1 de Abril de 2026.

二零二六年二月六日

6 de Fevereiro de 2026.

行政長官　岑浩輝

O Chefe do Executivo, *Sam Hou Fai.*

第 10/2026 號行政長官公告

國際海事組織海上環境保護委員會於二零一六年四月二十二日，分別透過第MEPC.271（69）號和第MEPC.272（69）號決議，通過了《修正〈經1978年議定書修訂的1973年國際防止船舶造成污染公約〉的1997年議定書》（《防污公約》1997年議定書）附則修正案和《船用柴油發動機氮氧化物排放控制技術規則》（《2008年氮氧化物技術規則》）修正案，該等修正案於二零一七年九月一日在國際法律秩序上生效，包括對澳門特別行政區生效；

基於此，行政長官根據第3/1999號法律《法規的公佈與格式》第五條（一）項和第六條第一款的規定，命令公佈：

Aviso do Chefe do Executivo n.º 10/2026

Considerando que, em 22 de Abril de 2016, o Comité de Protecção do Meio Marinho da Organização Marítima Internacional (OMI), através das resoluções MEPC.271(69) e MEPC272(69), respectivamente, adoptou emendas ao Anexo do Protocolo de 1997 que altera a Convenção Internacional para a Prevenção da Poluição por Navios, 1973, tal como modificada pelo Protocolo de 1978 a ela relativo (MARPOL PROT 1997) e ao Código Técnico sobre o Controlo de Emissões de Óxidos de Azoto Provenientes de Motores Diesel Marítimos (Código Técnico NO_x 2008), e que tais emendas entraram em vigor na ordem jurídica internacional, incluindo a Região Administrativa Especial de Macau, em 1 de Setembro de 2017;

O Chefe do Executivo manda publicar, nos termos da alínea 1) do artigo 5.º e do n.º 1 do artigo 6.º da Lei n.º 3/1999 (Publicação e formulário dos diplomas):

—國際海事組織海上環境保護委員會第MEPC.271（69）號決議通過的《防污公約》1997年議定書附則修正案的中文和英文正式文本；

- as emendas ao Anexo da MARPOL PROT 1997 adoptadas pelo Comité de Protecção do Meio Marinho da OMI através da resolução MEPC.271(69), nos seus textos autênticos em línguas chinesa e inglesa;

—國際海事組織海上環境保護委員會第MEPC.272（69）號決議通過的《2008年氮氧化物技術規則》修正案的中文和英文正式文本。

- as emendas ao Código Técnico NO_x 2008 adoptadas pelo Comité de Protecção do Meio Marinho da OMI através da resolução MEPC.272(69), nos seus textos autênticos em línguas chinesa e inglesa.

二零二六年二月九日發佈。

Promulgado em 9 de Fevereiro de 2026.

行政長官　岑浩輝

O Chefe do Executivo, *Sam Hou Fai.*

第 MEPC.271（69）號決議

（2016 年 4 月 22 日通過）

經 1978 年議定書修訂的 1973 年國際防止船舶造成污染公約 1997 年修正議定書附則修正案

防污公約附件 VI 規則第 13 條修正案

（氮氧化物第 III 層排放控制區操作性遵行記錄要求）

海上環境保護委員會，

憶及國際海事組織公約關於防止和控制船舶造成海洋污染國際公約賦予海上環境保護委員會的職能的第 38（a）條，

注意到經 1978 年議定書和 1997 年議定書修訂的 1973 年國際防止船舶造成污染公約（防污公約）第 16 條，該條規定出修正程序並授予本組織適當機構審議和通過其修正案的職能，

在其第六十九屆會議上，**審議了**關於氮氧化物第 III 層排放控制區操作性遵行記錄要求的防污公約附則 VI 修正草案，

1 **按照**防污公約第 16（2）（d）條，通過防污公約附件 VI 規則第 13 條修正案，其文本載於本決議附件中；

2 **決定**，按照防污公約第 16（2）（f）（iii）條，該修正案將於 2017 年 3 月 1 日被視為獲得接受，除非在該日之前，不少於三分之一的締約方

或其總計商船隊構成不少於世界商船隊總噸位 50%的締約方，已通知本組織反對該修正案；

3 **邀請**各締約方注意，按照防污公約第 16（2）（g）（ii）條，上述修正案在按照以上第 2 段獲接受後，將於 2017 年 9 月 1 日生效；

4 **要求**秘書長，為防污公約第 16（2）（e）條之目的，向所有防污公約的締約方發送本決議及其附件中所含修正案文本的核證無誤副本；

5 **進一步要求**秘書長向本組織並非防污公約締約方的會員國發送本決議及其附件的副本。

附件

防污公約附則 VI 修正案

（氮氧化物第 III 層排放控制區操作性遵行記錄要求）

附則 VI

防止船舶造成空氣污染規則

第 3 章

控制船舶排放要求

規則 13－氮氧化物（NOx）

1 在現有第 5.2 段之後增加一個新的第 5.3 段如下：

“5.3 本規則第 5.1 段所適用並按第 II 和第 III 層發證或僅按第 II 層發證的船舶，其船上安裝的船用柴油發動機的層級和開/閉狀態須在進入和離開在本規則第 6 段之下劃定的排放控制區時，或在此等區域中改變開/閉狀態時，連同日期、事件和船位，記錄於主管機關所規定的記錄簿中。”

2 在第 5.1.1 段中，將符號“NO_x”改為“NO_2”。

RESOLUTION MEPC.271(69)
(Adopted on 22 April 2016)

AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1997 TO AMEND THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO

Amendments to regulation 13 of MARPOL Annex VI

(Record requirements for operational compliance with NO_x Tier III emission control areas)

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,

HAVING CONSIDERED, at its sixty-ninth session, draft amendments to MARPOL Annex VI, related to record requirements for operational compliance with NO_X Tier III emission control areas,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to regulation 13 of MARPOL Annex VI, the text of which is 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 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;

5 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 MARPOL ANNEX VI
(Record requirements for operational compliance with NO_x Tier III emission control areas)

ANNEX VI

REGULATION FOR THE PREVENTION OF AIR POLLUTION FROM SHIPS

Chapter 3
Requirements for control of emissions from ships

Regulation 13 – Nitrogen oxides (NO_x)

1 A new paragraph 5.3 is added after existing paragraph 5.2, as follows:

"5.3 The tier and on/off status of marine diesel engines installed on board a ship to which paragraph 5.1 of this regulation applies which are certified to both Tier II and Tier III or which are certified to Tier II only shall be recorded in such logbook as prescribed by the Administration at entry into and exit from an emission control area designated under paragraph 6 of this regulation, or when the on/off status changes within such an area, together with the date, time and position of the ship."

2 In paragraph 5.1.1, the symbol "NO_x" is replaced with the symbol "NO_2".

第 MEPC.272（69）號決議

（2016 年 4 月 22 日通過）

船用柴油發動機氮氧化物
2008 年氮氧化物技術規則修正案

（氣體燃料和雙燃料發動機檢測）

海上環境保護委員會，

憶及國際海事組織公約關於防止和控制船舶造成海洋污染國際公約賦予海上環境保護委員會的職能的第 38（a）條，

注意到經 1978 年議定書和 1997 年議定書修訂的 1973 年國際防止船舶造成污染公約（防污公約）第 16 條，該條規定出修正程序並授予本組織適當機構審議和通過其修正案的職能，

進一步注意到，防污公約附件 VI 規則第 13 條，該條使控制船用柴油發電機氮氧化物排放技術規則（2008 年氮氧化物技術規則）在該附則下成為強制性，

在其第六十九屆會議上，**審議了**有關氣體燃料和雙燃料發動機檢測的《2008 年氮氧化物技術規則》修正草案，

1 **按照**防污公約第 16（2）（d）條，通過本決議附件中所載《2008 年氮氧化物技術規則》修正案；

2 **按照**防污公約第 16（2）（f）（iii）條，決定，該修正案將於 2017

年 3 月 1 日被視為獲得接受，除非在該日之前，不少於三分之一的締約方或其總計商船隊構成不少於世界商船隊總噸位 50%的締約方，已通知本組織反對該修正案；

3 **邀請**各締約方注意，上述修正案在按照以上第 2 段獲接受後，將於 2017 年 9 月 1 日生效；

4 **同意**，本修正案適用於安裝在、或設計為並擬安裝於在 2017 年 9 月 1 日或之後受防污公約附則 VI 規則第 13 條管轄的船舶上，輸出功率大於 130kW 的船用柴油發動機；

5 **要求**秘書長，為防污公約第 16（2）（e）條之目的，向所有防污公約的締約方發送本決議及其附件中所含修正案文本的核證無誤副本；

6 **進一步要求**秘書長向本組織並非防污公約締約方的會員國發送本決議及其附件的副本。

附件

2008 年氮氧化物技術規則修正案

（氣體燃料和雙燃料發動機檢測）

縮寫、下標和符號

1 在.1 和.2 分段及表 2 標題中，在“柴油”之前加入“船用”。

2 表 2，第 4 行，修改如下：

“

（H）FID	（加熱式）火焰電離探測器

”

第 1 章－總則

3 1.3.10 段，將下列新句插入第一句之後：

“另外，2016 年 3 月 1 日或之後建造的船舶上安裝的氣體燃料發動機或在該日或之後安裝的氣體燃料的附加或非同型替換發動機，也被視為船用柴油發動機。”

第 4 章－系列生產發動機認可：發動機族和發動機組概念

4 4.3.8.2.6 段，在現有要點“－雙燃料”之後，加上一個新的要點如下：

“－ 氣體燃料”

5 在現有 4.3.8.2.10 段之後，加上一個新的 4.3.8.2.11 段如下：

“.11 點燃方法；

— 壓燃

— 引火點燃

— 火花塞或其他外部點燃裝置點燃”

6 4.4.6.2.5 段，在“噴射凸輪”一詞之後插入“或氣體閥門”字樣。

7 在 4.4.7.2.1 段之下的第一和第二要點中，在“噴射”一詞之後插入“或點燃”。

8 4.4.7.2.2 段，在現有要點“— 燃燒室”之後，加入一個新的要點如下：

“— 氣體閥門規範。”

第 5 章 — 試驗台氮氧化物排放測量程序

9 5.2.1.2 中，在“發動機”一詞之前，插入“液體或雙燃料運作的”。

10 原 5.2.1.3 段重新編號為 5.2.1.3.1 段及在重新編號的 5.2.1.3.1 段中，在“發動機”一詞之前，插入“液體或雙燃料運作的”。

11 在重新編號的 5.2.1.3.1 段之後，加入一個新的 5.2.1.3.2 段如下：

“5.2.1.3.2 對於僅使用氣體燃料測試的、有或無進氣冷卻的發動機，參數f_a須按照下列公式確定：

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

12 在 5.3.3 段第二句中，將“燃料噴射泵“改為”發動機”。

13 在 5.3.4 段第一句中，刪除“雙燃料”一詞。

14 在 5.4.2 段第二句中，在“柴油”一詞之前插入“船用”一詞。

15 增加一個新的 5.12.3.2.3 段如下：

“.3 須按照 5.12.3.1 至 5.12.3.2 段進行計算。但是，q_{mf}, W_{ALF}, W_{BET}, W_{DEL}, W_{EPS}的值須按照下表計算：

公式（6）（7）（8）中的因數		因數公式
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 5.12.3.3 段修改如下：

“5.12.3.3 對於進氣：

$$k_{wa} = 1 - k_{w2} \qquad (15)$$”

17 5.12.4.1 段修改如下：

“5.12.4.1 由於氮氧化物的排放取決於環境空氣狀況，所以氮氧化

物的濃度須酌情按照 5.12.4.5、5.12.4.6 或 5.12.4.7 中的係數就空氣溫度和濕度進行修正。”

18 在 5.12.4.6 段中，末句修改如下：

“但是，如果 f $H_a \geq Hsc$，在公式（17）或（17a）中，須使用Hsc替代的H_a。”

19 在現有 5.12.4.6 段之後，增加一個新的 5.12.4.7 段如下：

“5.12.4.7 對於僅用氣體燃料測試的發動機：

$$k_{hd} = 0.6272+44.030\times10^{-3}\times H_a-0.862\times10^{-3}\times H_a^2 \qquad (17a)$$

式中：

H_a 係進氣在進氣口空氣過濾器處的濕度，以每千克乾氣體中有多少克的水計。”

第 6 章－船上驗證符合氮氧化物排放限值的程序

20 在 6.2.1.2 段的第一句中，在“柴油”之前插入“船用”。

21 6.2.2.3.1 分段改為：

“.1 噴射或點火時機，”

22 在 6.2.2.3.14 分段中，刪除“或”。

23 在 6.2.2.3.15 分段末尾，加上“或”。

24 增加一個新的 6.2.2.3.16 分段如下：

“.16 氣體閥門。”

25 在 6.3.1.4 段第三句中，將“雙”字改為“氣體”。

26 表 6 的腳註改為：

“* 僅用氣體燃料測試的發動機。”

27 6.3.4.1 段改為：

“6.3.4.1 總之，所有使用液體燃料的排放測量須在發動機使用 ISO 8217:2005，DM 級船用柴油燃料運轉下進行。總之，所有使用氣體燃料的排放測量須在發動機使用等效於 ISO 8178-5:2008 的氣體燃料運轉下進行。”

28 6.3.4.3 段，在“發動機”一詞之前插入，“或氣體燃料”。

附錄 III－用於確定船用柴油發動機排放氣體成分的分析儀技術規範

29 1.2.12 分段改為：

“.12 O_2－氧氣分析儀

順磁探測器（PMD），二氧化鋯（ZRDO）或電化傳感器（ECS）。二氧化鋯不得用於雙燃料或氣體燃料發動機。”

30 在 3.3 段末尾，增加一個新句如下：

“或者，對於氣體燃料發動機（無液體點火噴射），碳氫分析儀可為非加熱型火焰電離檢測器（FID）類型。”

31 在 3.5 段末尾，增加一個新句如下：

“二氧化鋯不得用於雙燃料或氣體燃料發動機。”

附錄 IV – 分析和測量儀器的校準

32 在 2.2.4 中，“排氣”一詞改為“混合”。

33 在 5.3、5.4.2、8、8.1.1、8.2.2 和 8.3.2.10 段中，符號“FID”分別改為“（H）FID”。

附錄 V－母型機試驗報告和試驗數據

第 1 節－母型機實驗報告

34 表 1/5 第 10、11 和 12 行修改如下：

“

靜態噴射定時		deg CA BTDC
電子噴射或點火控制	否：	是：
可變噴射或點火控制	否：	是：

”

35 表 2/5 第 6 和 27 行，分別修改如下：

第 6 行：

“

船上使用燃料類型	蒸餾/蒸餾或重燃料/雙燃料/氣體燃料

”

第 27 行：

“

噴射或點火定時（範圍					

”

36 表 2/5 第 6 行之後，插入新的一行如下：

“

點火方法	壓燃/引火點燃/火花塞或其他外部點火裝置點燃

”

37 表 3/5 之下的表“燃料特性”的標題修改如下：

“液體燃料特性”

38 表 3/5 之下的表“燃料特性”之後，增加一個新表如下：

“氣體燃料特性

燃料類型：				
燃料性能			**燃料成分分析**	
甲烷號	EN16726：2015		碳	% m/m
低熱值		MJ/kg	氫	% m/m
沸點		°C	氮	% m/m
沸點密度		kg/m³	氧	% m/m
沸點壓力		bar（abs）	硫	% m/m
			甲烷, CH_4	mol%
			乙烷, C_2H_6	mol%
			丙烷, C_3H_8	mol%
			異丁烷,i C_4H_{10}	mol%
			正丁烷,n C_4H_{10}	mol%
			戊烷, C_5H_{12}	mol%
			C6+	mol%
			二氧化碳	mol%

39 表 5/5 第 11 行修改及增加一個腳註如下：

“

燃料齒條/氣體進入時長**mm/sec										

** 僅使用氣體燃料測試的發動機”

第 2 節－納入技術檔案中的母型機試驗數據

40 在目前題為“母型機試驗燃油”的第二個表中，將標題改為：

“母型機試驗液體燃料”

在上述表後插入下表：

“

母型機試驗氣體燃料		
ISO 8178-5:2008		
碳	% m/m	
氫	% m/m	
硫	% m/m	
氮	% m/m	
氧	% m/m	
甲烷, CH_4	mol%	
乙烷, C_2H_6	mol%	
丙烷, C_3H_8	mol%	
異丁烷, i C_4H_{10}	mol%	
正丁烷, n C_4H_{10}	mol%	
戊烷, C_5H_{12}	mol%	
C6+	mol%	
二氧化碳	mol%	

”

附錄 VI－廢氣質量流量計算（碳平衡法）

41 在 2.5 中，刪除“在雙燃料發動機的氣體運轉模式下，”。

附錄 VII－發動機參數檢查法的檢查清單

42 1.1 段的帽段修改如下：

“.1 ‘噴射定時和點火定時’參數：”

43 在 1.1.4 分段末尾，加上“及”一字。

44 增加一個新的 1.1.5 分段如下：

“.5 定時指示器或定時燈。”

附錄 VIII－直接測量和監測法的實施

45 在 2.1.1.4 段末尾，增加新句如下：

“或者，對於氣體燃料發動機（無液體點火噴射），碳氫分析儀可為非加熱型火焰電離檢測器（FID）類型。”

46 在 2.1.1.5 段末尾，增加新句如下：

“二氧化鋯不得用於雙燃料或氣體燃料發動機。”

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:

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

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."