

LOCAL VESSELS ADVISORY COMMITTEE

Application of Nitrogen Oxides (NOx) Emission Standard to Marine Diesel Engines Fitted Onboard New Locally Licensed Vessels

Purpose

The purpose of this paper is to seek members' views on the proposed amendments to the Merchant Shipping (Prevention of Air Pollution) Regulation (Cap. 413M) for the implementation of the amendments to the MARPOL Annex VI that are applicable to local vessels¹.

Background

2. On 10 October 2008, the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) adopted the amendments to the MARPOL Annex VI by resolution MEPC.176(58) in response to the public demand worldwide to further reduce air pollution from ships. The amendments entered into force internationally on 1 July 2010.

3. In April 2009, a LVAC Paper No. 6/2009 was circulated to members outlining the relevant requirements that applicable to local vessels and sought members' views regarding the proposed implementation of the amendments to MARPOL Annex VI to local vessels. The proposal was endorsed by LVAC members. A copy of the consultation paper is enclosed for members' reference.

4. With the support of the LVAC members, Marine Department has endeavored to work out a regional implementation plan with the Guangdong maritime authority requiring local vessels to comply with the revised MARPOL VI requirements. The Guangdong maritime authority expressed that, in principle, they supported the Tier II NOx emission standard for diesel engines of output more than 130kW (or 174HP) installed onboard after 1 January 2011. However, they

¹ "local vessel" includes any vessel registered in the Mainland and employed in trading to or from Hong Kong other than ships possessing convention certificates.

considered Mainland river / coastal trade vessels might have difficulties in complying with the latest requirements due to insufficient number of engines meeting the Tier II requirement available in their local market.

5. Improving Hong Kong's air quality to reduce the associated risks to people's health is one of the priorities of the HKSAR Government. The Environmental Protection Department (EPD) study revealed that vessels have become the largest local air pollution sources in Hong Kong in 2011, contributing 33% of the total NOx emissions in Hong Kong. It is noted that the study conducted by Shanghai Maritime Safety Administration proposes to implement the Tier II requirements on Mainland river / coastal vessels in 2015 subject to the approval of China Maritime Safety Administration. Nevertheless, it is considered that Hong Kong should take the initial step requiring locally licensed vessels to apply the Tier II emission standard for marine diesel engines newly installed onboard.

6. Marine diesel engines of output power more than 130kW which in compliance with Tier II NOx emission standard are currently available in the local market.

Proposal

7. It is proposed that the Merchant Shipping (Prevention of Air Pollution) Regulation (Cap. 413M) should be amended requiring all engines installed on board newly licensed local vessels, or replacement of non-identical engines on existing vessels, complying with the Tier II emission standard after the amendment regulation entered into force. Before a regional implementation plan is formulated, the Mainland river/coastal trading vessels should be complied with an emission standard not lower than the current Tier I standard.

Action Requested

8. Members are invited to comment and endorse on the proposal in Paragraph 7 above.

Marine Department
February 2014

Encl. LVAC Paper No. 6/2009 (*with extracts on Nitrogen Oxides (regulation 13) requirements set out in resolution MEPC.176(58) only*)

LOCAL VESSELS ADVISORY COMMITTEE

Implementation of Amendments to MARPOL Annex VI on Local Vessels

Purpose

1. The purpose of this paper is to seek members' views on the proposed amendments to the Merchant Shipping (Prevention of Air Pollution) Regulation (Cap. 413M) to implement the amendments to the MARPOL Annex VI that are applicable to local vessels.

Backgrounds

2. On 10 October 2008, IMO adopted the amendments to the MARPOL Annex VI by resolution MEPC.176(58) in response to the public demand worldwide to further reduce air pollution from ships. The amendments will enter into force internationally on **1 July 2010**. A copy of the resolution MEPC.176(58) is enclosed for members' reference.

3. The main changes of MARPOL Annex VI include:

- .1 Ozone Depleting Substances (ODS) Record Book is required for the ODS rechargeable systems onboard. (Reg. 12)
- .2 Definition of "major conversion" of a marine diesel engine is revised (Reg. 13.1.1 and 13.2)
- .3 Marine diesel engines with power output more than 130 kW (except for engines intended to be used solely for emergencies) installed on ships constructed on or after 1 January 2011 have to comply with NOx "Tier II" emissions standard (14.4 g/kWh). (Reg. 13.3)
- .4 Existing diesel engines with a power output of more than 5,000 kW and a displacement per cylinder at or above 90 litres installed on ships constructed on or after 1 January 1990 but prior to 1 January 2000, will have to comply with the "Tier I" emission limit (17.0 g/kWh) when Approved Methods for the engines are available and certified. (Reg. 13.7)

- .5 The global sulphur cap of fuel will be reduced to 3.5 % from 1 January 2012. (Reg. 14.1.2)
- .6 A VOC Management Plan is required for a tanker carrying crude oil. (Reg. 15.6)

Implementation Measures of the Amendments to MARPOL Annex VI for Local Vessels solely engaged in non-international voyages

4. It is proposed that all the items of the above paragraph will be applicable to local vessels solely engaged in non-international voyages except that the application date “on or after 1 January 2000” (paragraph 3.2 above) for the major conversion of a marine diesel engine under the definition of “major conversion” may be changed to “on or after 1 June 2008” because of the existing requirement under Cap. 413M for local vessels.

Action Requested

5. Members are invited to comment on the above proposal for implementing the amendments to the MARPOL Annex VI on local vessels.

Marine Department
Multi-lateral Policy Division
April 2009

Encl.: MEPC.176(58) – Revised MARPOL Annex VI

7 Entries in the Ozone Depleting Substances Record Book shall be recorded in terms of mass (kg) of substance and shall be completed without delay on each occasion, in respect of the following:

- .1 recharge, full or partial, of equipment containing ozone depleting substances;
- .2 repair or maintenance of equipment containing ozone depleting substances;
- .3 discharge of ozone depleting substances to the atmosphere:
 - .3.1 deliberate; and
 - .3.2 non-deliberate;
- .4 discharge of ozone depleting substances to land-based reception facilities; and
- .5 supply of ozone depleting substances to the ship.

Regulation 13
Nitrogen Oxides (NO_x)

Application

1.1 This regulation shall apply to:

- .1 each marine diesel engine with a power output of more than 130 kW installed on a ship; and
- .2 each marine diesel engine with a power output of more than 130 kW which undergoes a major conversion on or after 1 January 2000 except when demonstrated to the satisfaction of the Administration that such engine is an identical replacement to the engine which it is replacing and is otherwise not covered under paragraph 1.1.1 of this regulation.

1.2 This regulation does not apply to:

- .1 a marine diesel engine intended to be used solely for emergencies, or solely to power any device or equipment intended to be used solely for emergencies on the ship on which it is installed, or a marine diesel engine installed in lifeboats intended to be used solely for emergencies; and
- .2 a marine diesel engine installed on a ship solely engaged in voyages within waters subject to the sovereignty or jurisdiction of the State the flag of which the ship is entitled to fly, provided that such engine is subject to an alternative NO_x control measure established by the Administration.

1.3 Notwithstanding the provisions of subparagraph 1.1 of this paragraph, the Administration may provide an exclusion from the application of this regulation for any marine diesel engine which is installed on a ship constructed, or for any marine diesel engine which undergoes a major conversion, before 19 May 2005, provided that the ship on which the engine is installed is solely engaged in voyages to ports or offshore terminals within the State the flag of which the ship is entitled to fly.

Major Conversion

2.1 For the purpose of this regulation, *major conversion* means a modification on or after 1 January 2000 of a marine diesel engine that has not already been certified to the standards set forth in paragraph 3, 4, or 5.1.1 of this regulation where:

- .1 the engine is replaced by a marine diesel engine or an additional marine diesel engine is installed, or
- .2 any substantial modification, as defined in the revised NO_x Technical Code 2008, is made to the engine, or
- .3 the maximum continuous rating of the engine is increased by more than 10% compared to the maximum continuous rating of the original certification of the engine.

2.2 For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine or the installation of an additional marine diesel engine, the standards in this regulation in force at the time of the replacement or addition of the engine shall apply. On or after 1 January 2016, in the case of replacement engines only, if it is not possible for such a replacement engine to meet the standards set forth in paragraph 5.1.1 of this regulation (Tier III), then that replacement engine shall meet the standards set forth in paragraph 4 of this regulation (Tier II). Guidelines are to be developed by the Organization to set forth the criteria of when it is not possible for a replacement engine to meet the standards in subparagraph 5.1.1 of this regulation.

2.3 A marine diesel engine referred to in paragraph 2.1.2 or 2.1.3 shall meet the following standards:

- .1 for ships constructed prior to 1 January 2000, the standards set forth in paragraph 3 of this regulation shall apply; and
- .2 for ships constructed on or after 1 January 2000, the standards in force at the time the ship was constructed shall apply.

Tier I

3 Subject to regulation 3 of this Annex, the operation of a marine diesel engine which is installed on a ship constructed on or after 1 January 2000 and prior to 1 January 2011 is prohibited, except when the emission of nitrogen oxides (calculated as the total weighted emission of NO₂) from the engine is within the following limits, where n = rated engine speed (crankshaft revolutions per minute):

- .1 17.0 g/kWh when n is less than 130 rpm;
- .2 $45 \cdot n^{(-0.2)}$ g/kWh when n is 130 or more but less than 2,000 rpm;
- .3 9.8 g/kWh when n is 2,000 rpm or more.

Tier II

4 Subject to regulation 3 of this Annex, the operation of a marine diesel engine which is installed on a ship constructed on or after 1 January 2011 is prohibited, except when the emission of nitrogen oxides (calculated as the total weighted emission of NO₂) from the engine is within the following limits, where n = rated engine speed (crankshaft revolutions per minute):

- .1 14.4 g/kWh when n is less than 130 rpm;
- .2 $44 \cdot n^{(-0.23)}$ g/kWh when n is 130 or more but less than 2,000 rpm;
- .3 7.7 g/kWh when n is 2,000 rpm or more.

Tier III

5.1 Subject to regulation 3 of this Annex, the operation of a marine diesel engine which is installed on a ship constructed on or after 1 January 2016:

- .1 is prohibited except when the emission of nitrogen oxides (calculated as the total weighted emission of NO₂) from the engine is within the following limits, where n = rated engine speed (crankshaft revolutions per minute):
 - .1.1 3.4 g/kWh when n is less than 130 rpm;
 - .1.2 $9 \cdot n^{(-0.2)}$ g/kWh when n is 130 or more but less than 2,000 rpm; and
 - .1.3 2.0 g/kWh when n is 2,000 rpm or more;
- .2 is subject to the standards set forth in subparagraph 5.1.1 of this paragraph when the ship is operating in an Emission Control Area designated under paragraph 6 of this regulation; and
- .3 is subject to the standards set forth in paragraph 4 of this regulation when the ship is operating outside of an Emission Control Area designated under paragraph 6 of this regulation.

5.2 Subject to the review set forth in paragraph 10 of this regulation, the standards set forth in paragraph 5.1.1 of this regulation shall not apply to:

- .1 a marine diesel engine installed on a ship with a length (L), as defined in regulation 1.19 of Annex I to the present Convention, less than 24 metres when it has been specifically designed, and is used solely, for recreational purposes; or
- .2 a marine diesel engine installed on a ship with a combined nameplate diesel engine propulsion power of less than 750 kW if it is demonstrated, to the satisfaction of the Administration, that the ship cannot comply with the standards set forth in paragraph 5.1.1 of this regulation because of design or construction limitations of the ship.

Emission Control Area

6 For the purpose of this regulation, an Emission Control Area shall be any sea area, including any port area, designated by the Organization in accordance with the criteria and procedures set forth in appendix III to this Annex.

Marine Diesel Engines Installed on a Ship Constructed Prior to 1 January 2000

7.1 Notwithstanding paragraph 1.1.1 of this regulation, a marine diesel engine with a power output of more than 5,000 kW and a per cylinder displacement at or above 90 litres installed on a ship constructed on or after 1 January 1990 but prior to 1 January 2000 shall comply with the emission limits set forth in subparagraph 7.4 of this paragraph, provided that an Approved Method for that engine has been certified by an Administration of a Party and notification of such certification has been submitted to the Organization by the certifying Administration. Compliance with this paragraph shall be demonstrated through one of the following:

- .1 installation of the certified Approved Method, as confirmed by a survey using the verification procedure specified in the Approved Method File, including appropriate notation on the ship's International Air Pollution Prevention Certificate of the presence of the Approved Method; or
- .2 certification of the engine confirming that it operates within the limits set forth in paragraph 3, 4, or 5.1.1 of this regulation and an appropriate notation of the engine certification on the ship's International Air Pollution Prevention Certificate.

7.2 Subparagraph 7.1 shall apply no later than the first renewal survey that occurs 12 months or more after deposit of the notification in subparagraph 7.1. If a shipowner of a ship on which an Approved Method is to be installed can demonstrate to the satisfaction of the Administration that the Approved Method was not commercially available despite best efforts to obtain it, then that Approved Method shall be installed on the ship no later than the next annual survey of that ship which falls after the Approved Method is commercially available.

7.3 With regard to a ship with a marine diesel engine with a power output of more than 5,000 kW and a per cylinder displacement at or above 90 litres installed on a ship constructed on or after 1 January 1990 but prior to 1 January 2000, the International Air Pollution Prevention Certificate shall, for a marine diesel engine to which paragraph 7.1 of this regulation applies, indicate that either an Approved Method has been applied pursuant to paragraph 7.1.1 of this regulation or the engine has been certified pursuant to paragraph 7.1.2 of this regulation or that an Approved Method does not yet exist or is not yet commercially available as described in subparagraph 7.2 of this regulation.

7.4 Subject to regulation 3 of this Annex, the operation of a marine diesel engine described in subparagraph 7.1 is prohibited, except when the emission of nitrogen oxides (calculated as the total weighted emission of NO₂) from the engine is within the following limits, where n = rated engine speed (crankshaft revolutions per minute):

- .1 17.0 g/kWh when n is less than 130 rpm;
- .2 $45 \cdot n^{(-0.2)}$ g/kWh when n is 130 or more but less than 2,000 rpm; and
- .3 9.8 g/kWh when n is 2,000 rpm or more.

7.5 Certification of an Approved Method shall be in accordance with chapter 7 of the revised NO_x Technical Code 2008 and shall include verification:

- .1 by the designer of the base marine diesel engine to which the Approved Method applies that the calculated effect of the Approved Method will not decrease engine rating by more than 1.0%, increase fuel consumption by more than 2.0% as measured according to the appropriate test cycle set forth in the revised NO_x Technical Code 2008, or adversely affect engine durability or reliability; and
- .2 that the cost of the Approved Method is not excessive, which is determined by a comparison of the amount of NO_x reduced by the Approved Method to achieve the standard set forth in subparagraph 7.4 of this paragraph and the cost of purchasing and installing such Approved Method.³

Certification

8 The revised NO_x Technical Code 2008 shall be applied in the certification, testing, and measurement procedures for the standards set forth in this regulation.

9 The procedures for determining NO_x emissions set out in the revised NO_x Technical Code 2008 are intended to be representative of the normal operation of the engine. Defeat devices and irrational emission control strategies undermine this intention and shall not be allowed. This regulation shall not prevent the use of auxiliary control devices that are used to protect the engine and/or its ancillary equipment against operating conditions that could result in damage or failure or that are used to facilitate the starting of the engine.

Review

10 Beginning in 2012 and completed no later than 2013, the Organization shall review the status of the technological developments to implement the standards set forth in paragraph 5.1.1 of this regulation and shall, if proven necessary, adjust the time periods set forth in that subparagraph.

Regulation 14

Sulphur Oxides (SO_x) and Particulate Matter

General Requirements

1 The sulphur content of any fuel oil used on board ships shall not exceed the following limits:

- .1 4.50% m/m prior to 1 January 2012;

³ The cost of an Approved Method shall not exceed 375 Special Drawing Rights/metric ton NO_x calculated in accordance with the Cost-Effectiveness formula below:

$$C_e = \frac{\text{Cost of Approved Method} \cdot 10^6}{P(\text{kW}) \cdot 0.768 \cdot 6000(\text{hours/year}) \cdot 5 (\text{years}) \cdot \Delta \text{NO}_x(\text{g/kWh})}$$