MAN Energy Solutions
Future in the making

CIMAC Working Group 5 Exhaust Emission Control

4-Stroke

4 December 2019 in Shanghai

29 November 2019

Timetable
CIMAC WG 5

➢ IMO MEPC 74	13 - 17 May 2019
➢ ESSF Plenary Meeting	24 June 2019
➢ CIMAC WG 5 Meeting	26 June 2019
➢ ESSF Subgroup Air Emissions	13 September 2019
➢ 6th ICCT Workshop on Marine Black Carbon	18 - 19 September 2019
➢ IMO Intersessional WG on GHG-Emissions	11 - 15 November 2019
➢ CIMAC WG 5 Meeting	4 December 2019
➢ ESSF Sub-Groups on Alternative Power and Ship´s Efficiency	17 – 18 December 2019
➢ IMO PPR 7	17 - 21 February 2020
➢ IMO Intersessional WG on GHG-Emissions	23 - 27 March 2020
➢ IMO MEPC 75	30 March - 3 April 2020

Agenda

CIMAC WG 5 Exhaust Emission Control

1	European Sustainable Shipping Forum (ESSF)
2	IMO GHG-Strategy – Preparation to IMO MEPC 75
3	Shaft Power Limitation (SHAPOLI)
4	Mandatory Instruments and Guidance, Outcome of MEPC 74
5	IMO Tier III-requirements for large yachts - ICOMIA
6	Gas Analyzers for IMO OBCT
7	IMO Black Carbon – Outcome of MEPC 74 and 6th ICCT Workshop
8	Unified Interpretation MPC 51 to Engine Test Cycles

European Sustainable Shipping Forum (ESSF)
CIMAC WG 5 Exhaust Emission Control

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1 European Sustainable Shipping Forum (ESSF)
Structure

Please find here the input of EUROMOT: **12 March 2019**

There was a seconded proposal to **unite Sub-Groups Competiveness and Digitalization**. Outcome: standards/guidance for cyber security

There was a seconded proposal to **unite Sub-Groups Air Emissions from Ships and EGCS** and to **remove the topic NOx-emissions from the agenda** (competence of Member States). Outcome: Further improvement of EGCS-guidelines and development of European-consistent wash water discharge criteria; The WP Emission Factors will remain in the Sub-Group; The WP 0.5% Sulphur cap in 2020 with a smooth transition will remain in the Sub-Group

Noise is on the IMO-agenda (IMO Noise-Code exists): This Sub-Group may only be established when a specific outcome can be identified

There was a seconded proposal to **unite Sub-Groups Decarbonization and Alternative Power**. Outcome: Screening of technology and required fuel options with development of an estimated timeline (schema); Screening of efficiency of technologies; Guidelines for transport chain optimization and reducing waiting time of ships

The work of the **R&D Sub-Group could support the work of Sub-Group Decarbonization /Alternative Power** or possibly be integrated

With above into consideration, the number of Sub-Groups could be set to **4 with 1 optional for noise**.

1 European Sustainable Shipping Forum (ESSF)
Review of mandate, Sub-Group Setup

Flash Report and way forward - 8th Meeting of the sub-group Air Emission from Ships operated by ENV under ESSF on **September 13:**

No appointment to the new three Sub-Groups on *Sustainable Alternative Power*, *Ship Energy Efficiency*, *Waste from Ships (PRF)* communicated at that date

…, together with the colleagues in DG MOVE, the SG was informed about the outcome of the discussions of the last meeting of the ESSF Plenary with options on the way forward as regards the **future of the *Air Emission from Ships* under the responsibility of DG ENV and of the new group on *Emission Abatement Methods (EAM)***.
DG MOVE informed about the recommendation by the Plenary on the need to reduce the number of expert groups operating under the ESSF and one option proposed for consideration to merge the above mentioned groups. It is to be noted that some of the SG members (suggested the merging proposal in the potential interest of time) are also part of the Plenary and were present at the meeting. ***DG MOVE also presented the ToR of the EAM group shared already with Plenary.***

1 European Sustainable Shipping Forum (ESSF)
Review of mandate, Sub-Group Setup

ESSF-SubGroups (Status November 2019)

- Sustainable Alternative Power (meeting at December 17)
- Ship Energy Efficiency (meetings at October 21 and December 18)
- Waste from Ships (meeting at December 19)
- Emission Abatement Methods (EAM)

- “Zero” Meeting of the ESSF SubGroup **Ship Energy Efficiency** took place in Brussels at **October 21**
- Why “Zero” Meeting? There was no final appointment of members to the SubGroup at that time
- NGO-participants besides EUROMOT: SEA Europe, VSM, SGMF, Intertanko, Interferry, DFDS, Dreadging Associations, ABS Technology, ESPO (ports), Maersk, (not exhaustive)

IMO GHG-Strategy – Preparation to IMO MEPC 75

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2 IMO GHG-Strategy
Outcome of MEPC 72

Outcome of MEPC 72 (1/2)

- Initial IMO GHG strategy has been adopted with considerable opposition of major industrial and shipping Member States
- 4th Intersessional Working Group on GHG is planned to be convened before MEPC 73
- Vision: Phase out GHG emissions as soon as possible in this century
- Levels of ambition:
  - Carbon intensity of shipping to decline by improving energy efficiency of ships (further development of EEDI)
  - To reduce CO2 emissions per transport work as an average by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008
  - To peak GHG emissions of shipping as soon as possible and to reduce total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts for phasing them out

2 IMO GHG-Strategy
Outcome of MEPC 72

Outcome of MEPC 72 (2/2)

- Candidate measures in short-term (to be agreed between 2018 – 2023), in mid-term (to be agreed between 2023 – 2030) and in long-term (to be agreed beyond 2030)
- Short-term and medium-term: EEDI and SEEMP with technology development related to energy efficiency, speed-optimization and -reduction, control of methane and VOC, shoreside/onshore power supply, low-carbon and zero-carbon fuels, (excerpt)
- Long-term: low-carbon and zero-carbon fuels, new and innovative emission reduction mechanisms, (excerpt)
- Impact on States to be considered, such as to economy, competitiveness, supply security, dependency on transport, remote location, managing of catastrophes
- Review of the strategy in spring 2023

2 IMO GHG-Strategy
Preparation to IMO MEPC 75

Grouping of documents to the IMO ISWG-GHG 6 in November

Operational measures

- ISWG-GHG 6/2/2, ISWG-GHG 6/2/8, ISWG-GHG 6/2/7, ISWG-GHG 6/2/11
- Focus to short-term measures
- Goal-based approach versus prescriptive approach
- Strengthening of SEEMP, audited in accordance with ISM
- Option of voluntary speed limits
- Mandatory speed limits for certain ship types with partly limited time frame
- ISWG-GHG 6/2/11: Goal-based approach without differentiation between technical and operational measures

Technical measures

- ISWG-GHG 6/2/3, ISWG-GHG 6/2/4, ISWG-GHG 6/2/6, ISWG-GHG 6/2/12
- Focus to short-term measures
- Goal-based approach versus prescriptive approach
- Mandatory speed limits for certain ship types, partly limited for application dates
- ISWG-GHG 6/2/3: Goal-based approach with differentiation between technical and operational measures

2 IMO GHG-Strategy
Preparation to IMO MEPC 75

Impact assessments
- ISWG-GHG 6/2, ISWG-GHG 6/2/1, ISWG-GHG 6/2/X
- No discussion due to time constrains

Methane emissions
- ISWG-GHG 6/5/3, The climate impact of Liquefied Natural Gas as a fuel for shipping taking into account methane slip from marine engines and from the supply chain

Views addressed
- To allocate technical measures in the EEDI and operational measures in the SEEMP
- Operational measures like (mandatory) speed limits will hamper technology development
- An approach should be to utilise the EEDI framework, to promote technical measures for GHG-improvement in a level playing field
- Operational measures under the SEEMP will be required in addition to EEDI-measures to achieve the GHG-reduction targets
- Technical measures and operational measures need to be identified, to be allocated to the respective scheme and to be assessed clearly distinct
- Speed limits would penalize more efficient ships, will avoid technology improvement or renewal of the fleet
- Speed limits will worsen the transport work of the ship and in this way the attained EEDI (v_{ref})
- Limitation of power is the preferred option over speed limits
- SHAPOLI is considered as a technical measure

2 IMO GHG-Strategy
Preparation to IMO MEPC 75

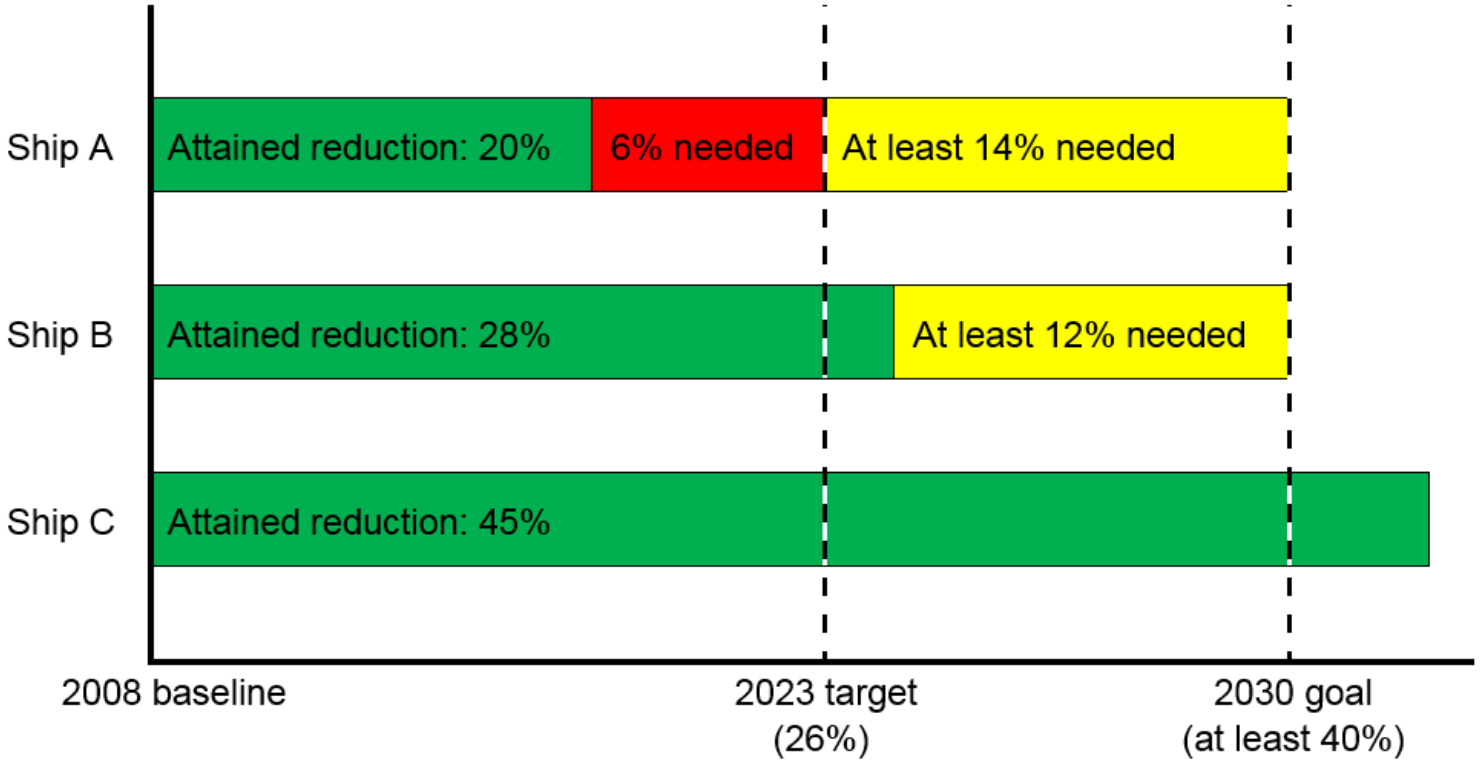

Figure 2: Examples of different ships' attained carbon intensity reductions and needed reductions to reach 2023 target and 2030 goal compared to 2008 baseline

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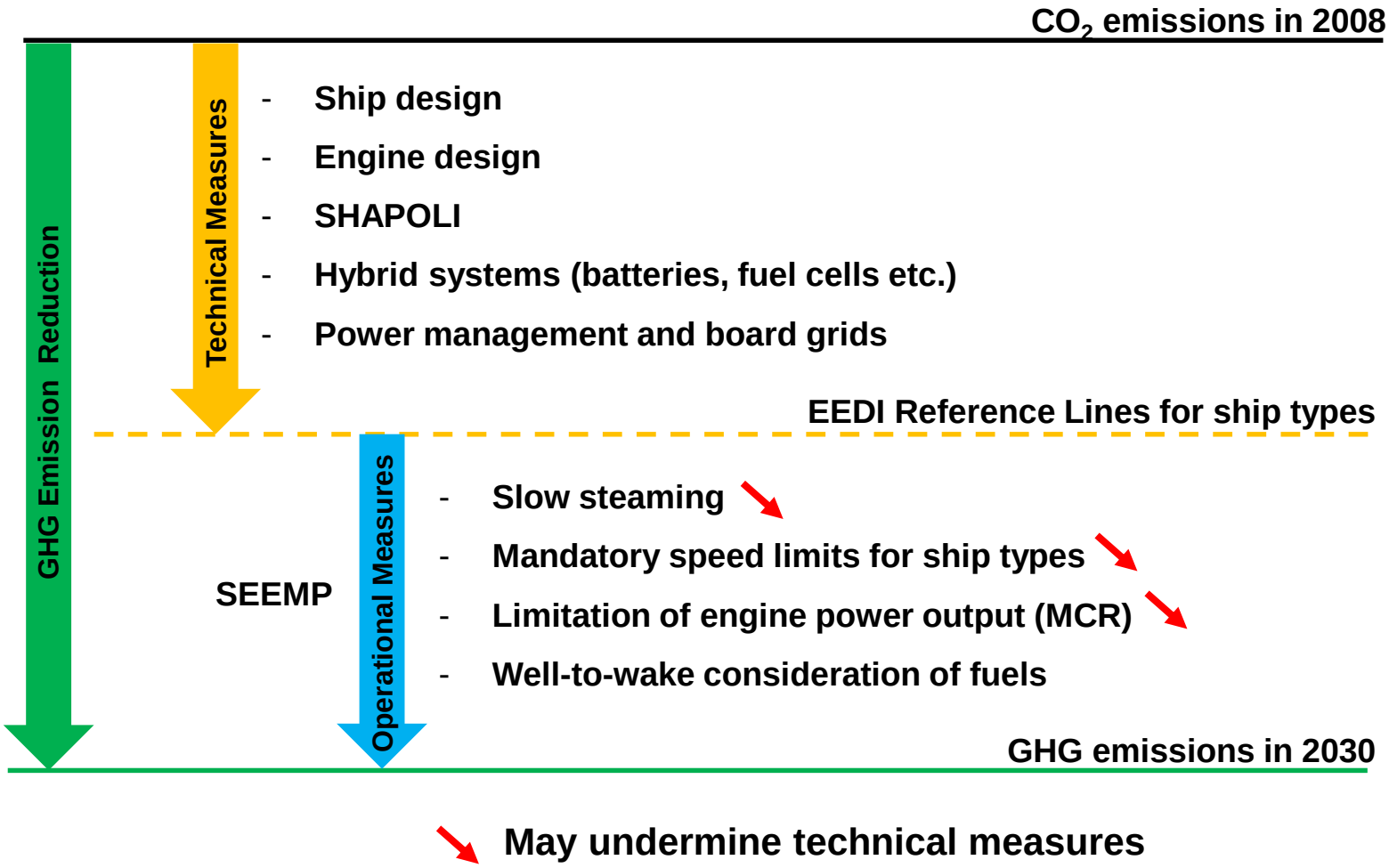
2 IMO GHG-Strategy
Preparation to IMO MEPC 75



2 IMO GHG Strategy - Intersessional Working Groups, MEPC 75
ToR for November 2019 and March 2020

Agenda

1. Adoption of the agenda
2. Further consideration of concrete proposals to improve the operational energy efficiency of existing ships, with a view to developing draft amendments to chapter 4 of MARPOL Annex VI and associated guidelines, as appropriate
3. Further consideration of concrete proposals to reduce methane slip and emissions of Volatile Organic Compounds (VOCs)
4. Consideration of a draft MEPC resolution urging Member States to develop and update a voluntary National Action Plan (NAP) with a view to contributing to reducing GHG emissions from international shipping, and develop associated guidelines, as appropriate
5. Further consideration of concrete proposals to encourage the uptake of alternative low-carbon and zero-carbon fuels, including the development of lifecycle GHG/carbon intensity guidelines for all relevant types of fuels and incentive schemes, as appropriate
6. Consideration of the development of further actions on capacity-building, technical cooperation, research and development, including support for assessment of impacts and support for implementation of measures
7. Consideration of other concrete proposals for candidate measures
8. Any other business

2 IMO GHG Strategy - Intersessional Working Groups, MEPC 75

Outcome of the 6th session

- Focus on short term measures to be implemented until 2023
- Preference for goal based approaches
- Technical and operational measures are still not be finalized and not allocated appropriately
- Measures require mandatory enforcement
- Speed- and/or power limitation as stand-alone measures are not preferred
- Instruments and assessments of their impact on states have to finalized
- IMO will faces difficulties with a well-to-propeller consideration of fuels
- More realistic seems a tank-to-propeller approach
- Development of methane slip regulations in 2020
- LNG/CNG has been a couple of times addressed as transition fuel towards e-fuels

Shaft Power Limitation (SHAPOLI)

CIMAC WG 5 Exhaust Emission Control

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3 Shaft Power Limitation (SHAPOLI)

- Relevant documents for consideration in the further discussion:
  MEPC 74/5/5 Germany et al (follow up of document MEPC 73/5/1 with technical proposal including draft amendments to EEDI guidelines – high complexity)
  MEPC 74/5/17 Denmark (more simple approach – limited application to 2-stroke engines?)
  MEPC 74/5/26 ICS et al (finalization of guidance on minimum propulsion power as precondition)
  MEPC 74/5/31 China (SHAPOLI not less than 85% of MCR; Definition adverse weather condition)

- Relevant document which has been rejected:
  MEPC 74/5/29 USA
- SHAPOLI is a non-mandatory optional feature for ships, with a specific demand to tankers and bulkers
- Several technology approaches (simpler) and controls should be into consideration as well
- Besides performance monitoring on board, certified options described in the NOx Technical File are to be considered as well
- Alignment with MARPOL Annex VI regulation 13 is required
- Link to the discussion about the use of multiple engine maps (PPR 7) is anticipated
- Criteria for activating adverse power reserve to be defined – responsibility and recording
- SHAPOLI has been considered in the ESSF forum as a technical measure

4 Mandatory Instruments and Guidance
Outcome of MEPC 74

1	European Sustainable Shipping Forum (ESSF)
2	IMO GHG-Strategy – Preparation to IMO MEPC 75
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4 Mandatory Instruments and Guidance
Outcome of MEPC 74

- RESOLUTION MEPC.314(74) (adopted on 17 May 2019)
  Amendments to MARPOL Annex VI (Electronic record books and EEDI regulations for ice-strengthened ships)

- RESOLUTION MEPC.315(74) (adopted on 17 May 2019)
  Amendments to THE NOx TECHNICAL CODE 2008 (Electronic record books and certification requirements for SCR-systems)

- RESOLUTION MEPC.318(74) (adopted on 17 May 2019)
  2019 GUIDELINES FOR THE USE OF ELECTRONIC RECORD BOOKS UNDER MARPOL

- RESOLUTION MEPC.319(74) (adopted on 17 May 2019)
  Amendments to The 2017 GUIDELINES ADDRESSING ADDITIOANL ASPECTS OF THE NOx TECHNICAL CODE 2008 WITH REGARD TO PARTICULAR REQUIREMENTS RELATED TO MARINE DIESEL ENGINES FITTED WITH SELECTIV CATALYTIC REDUCTION (SCR) SYSTEMS (resolution MEPC.291(71))

4 Mandatory Instruments and Guidance
Outcome of MEPC 74

- RESOLUTION MEPC.320(74) (adopted on 17 May 2019)
  2019 GUIDELINES FOR CONSISTENT IMPLEMENTATION OF THE 0.50% SULPHUR LIMIT UNDER MARPOL ANNEX VI

- RESOLUTION MEPC.322(74) (adopted on 17 May 2019)
  Amendments to THE 2018 GUIDELINES ON THE METHOD OF CALCULATION OF THE ATTAINED ENERGY EFFICIENCY DESIGN INDEX (EEDI) FOR NEW SHIPS (resolution MEPC.308(73))

4 Mandatory Instruments and Guidance
Outcome of MEPC 74

- MEPC.1/Circ.795/Rev.4
  Unified Interpretations to MARPOL Annex VI regulations
  13.2.2: Time of replacement an engine
  13.5.3: Engine changeover/on-off recording requirements
  14.1: Application of sulphur limit to emergency equipment
  16.9: Shipboard incinerators

- MEPC.1/Circ.864/Rev.1
  2019 GUIDELINES FOR ON BOARD SAMPLING FOR THE VERIFICATION OF THE SULPHUR CONTENT OF THE FUEL OIL USED ON BOARD SHIPS

- MEPC.1/Circ.884
  GUIDANCE ON INDICATION OF ONGOING COMPLIANCE IN THE CASE OF THE FAILURE OF A SINGLE MONITORING INSTRUMENT, AND RECOMMENDED ACTIONS TO TAKE IF THE EXHAUST GAS CLEANING SYSTEM (EGCS) FAILS TO MEET THE PROVISIONS OF THE GUIDELINES

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5 IMO Tier III-requirements for large yachts - ICOMIA

MARINE ENVIRONMENT PROTECTION COMMITTEE **74th session**
Agenda item 5 **MEPC 74/5/15**
7 March 2019

AIR POLLUTION AND ENERGY EFFICIENCY
Effective Implementation of MARPOL Annex VI on large yachts to provide NOx reduction and enable less GHG emissions

Submitted by Turkey and ICOMIA

Executive summary

This document highlights the ongoing issues with Tier III implementation for large yachts over 24m in length and under 500 GT. It goes on to provide possible alternative NOx emission solutions and invites the Committee to decide between two options for addressing the issues raised.

Option 1 – An additional five years postponing of Tier III implementation
Option 2 – A new output to contribute less than Tier III NOx reduction target without SCR

No option is supported by engine manufacturers - rejected in plenary

ICOMIA increases the pressure with a possible new approach to IMO MEPC 75

6 Gas Analyzers for IMO OBCT

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6 Gas Analyzers for IMO OBCT
On Board Confirmation Test (OBCT)

Situation

SCR-Guidelines in Resolution MEPC.291(71)

- 7.1 After installation on board of an engine system fitted with SCR and before entry into service an initial confirmation test should be performed on board. *(parent engine)*
- 7.6 The NOx analyser should meet the requirements of chapter 5 of the NTC 2008.

NTC 2008 Appendix IV 5.4 Calibration

- 5.4.1 Each normally used operating range shall be calibrated. Analyzers shall be calibrated **not more than 3 months** before being used for testing or whenever a system repair or change is made that can influence calibration, or as per provided for by 1.3.2.2.

NTC 2008 Appendix IV 1.3.2.2

- … in accordance with alternative calibration procedures and validity periods subject to such proposals being submitted in advance of the tests and approved by the Administration.

Way forward

The requirements of the SCR-Guidelines comprise zeroing and span check as laid out in section 6 of NTC 2008 “Verification of the calibration” but not the calibration of 5.4 “Calibration” itself. Calibration means “linearization test” which has to be done as stipulated by the gas analyzer manufacturer. The procedure should be laid out to the respective Administration / Recognized Organization for requesting a prior approval.

7 IMO Black Carbon
Outcome of MEPC 74 and 6th ICCT Workshop

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7 IMO Black Carbon
Outcome of MEPC 74

ToR to IMO PPR 7

.1 consider regulating or otherwise directly control Black Carbon emissions from marine diesel engines (exhaust gas) to reduce the impact on the Arctic of Black Carbon emissions from international shipping, taking into account the identified candidate control measures (PPR 6/20/Add.1, annex 9);

.2 further consider the recommended Black Carbon measurement methods (FSN, PAS, LII) to be used in conjunction with regulations to control Black Carbon emissions from marine diesel engines;

.3 develop a standardized sampling, conditioning and measurement protocol, including a traceable reference method and an uncertainty analysis, taking into account the three most appropriate Black Carbon measurement methods (FSN, PAS, LII), to make accurate and traceable (comparable) measurements of Black Carbon emissions. This measurement system should not preclude consideration and agreement on policy options to avoid or otherwise limit Black Carbon emissions from ships, as its development would in fact benefit from guidance on how possible regulations would be applied; and

.4 submit a report to MEPC 77 in 2021.

7 IMO Black Carbon
Outcome of the 6th ICCT Workshop

1st day presentations

- HUG Engineering Switzerland: DPF use and availability for fast speed engines, approaches for medium speed engines and no approach today at low speed engines; HFO use critical
- USUI Co. Japan: ESP with Cyclone achieves 80% reduction rate of Black Carbon
- IVL Sweden: Black Carbon control measures advertising of fuel quality improvement
- Clean Arctic Alliance, Denmark: Black Carbon control measures advertising fuel quality improvement
- Arctic Council, Canada?: Explain the activities of the Arctic Council, emphasizes the expected increase of maritime traffic through the Arctic
- MIT, USA: Opportunities in data acquisition and management for emission monitoring and enforcement measures by digitalization
- AVL, Austria: Correlation of measurement principles and calibration procedures of FSN and PAS
- EUROMOT: Correlation of FSN and PAS
- FMI/VTT, Finland: Traceability of a possible Black Carbon standard – further work to be done
- NRC, Canada: Request of standardizing measurement principle according to aviation and deriving a Black Carbon measurement protocol based on that - no concrete proposal, more time required

7 IMO Black Carbon
Outcome of the 6th ICCT Workshop

2nd day discussion and Black Carbon control measures

- HFO ban
- Alternative fuels
- Black Carbon limit regional (BECA, Arctic according to IMO Polar Code)
- Black Carbon limit globally
- Combination of Black Carbon limit globally and regional

- Not all Black Carbon control measures require Black Carbon standards and measurements
- A combination of fuel-related measures and Black Carbon standards may be an option?
- Industry has been approached for reasonable Black Carbon emission standards

8 Unified Interpretation MPC 51 to Engine Test Cycles

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8 Unified Interpretation MPC 51
Engine Test Cycles

Resolution 2 of the 1997 MARPOL Conference Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (1/4)

Chapter 3.2.1 reads as follows:

For every individual engine or parent engine of an engine group or family, one of the test cycles specified in 3.2.2 to 3.2.6 shall be applied for verification of compliance with the NOx emission limits in accordance with regulation 13 of Annex VI. *(2004)*

For every individual engine or parent engine of an engine family or engine group, one or more of the relevant test cycles specified in 3.2.2 to 3.2.6 shall be applied for verification of compliance with the applicable NOx emission limit contained in regulation 13. *(2017)*

8 Unified Interpretation MPC 51
Engine Test Cycles

Resolution 2 of the 1997 MARPOL Conference Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (2/4)

Interpretation:
(a) One of the test cycles specified in Chapters 3.2.2 to 3.2.6, applicable to the application, shall be applied.
(b) Where more than one test cycle is to be applied the average cycle weighted NOx emission value (in g/kWh) for each cycle is to be stated on the EIAPP Certificate 1.15, together with the corresponding limit value, 1.14.
(c) A Parent Engine test for a particular duty cycle is to follow the appropriate test cycle. A Parent Engine emission value shall not be 'constructed' by, for example, adding data from one test to emission values taken from another test.
(d) In those instances where a constant speed engine as installed can be used either solely for main propulsion or auxiliary purposes, then that engine should be certified to both the E2 and D2 cycles.
(e) Where a generator is also permanently fitted or coupled to main engine propulsion shafting then certification of that main engine using only the E2 or E3 cycle, as appropriate, is required.

8 Unified Interpretation MPC 51
Engine Test Cycles

Resolution 2 of the 1997 MARPOL Conference Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (3/4)

Withdrawn Interpretation in MEPC 71/5/4:
(a) For a parent engine of an engine family or engine group, one or more test cycles maybe applied where an engine family or engine group may contain engine models which can be used solely for one application and engine models which can be used for another application.
(b) Individual engines or member engines of an engine family or engine group intended to be used for more than one application are to be certified for the relevant test cycles.
(c) In those instances where an engine as installed on board may be used simultaneously or separately for supplying energy for auxiliary purposes and for supplying energy to main propulsion that engine is to be certified to the test cycle only which represents the main purpose of the engine application. In such cases main propulsion is considered to be the main purpose and takes precedence. This, for example, means that any-diesel-electric propulsion application only requires E2 certification irrespective of whether energy can be distributed to the switchboard for other (auxiliary) purposes. Similarly, this applies to main engines which e.g. can also drive cargo pumps.

8 Unified Interpretation MPC 51
Engine Test Cycles

Resolution 2 of the 1997 MARPOL Conference Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (4/4)

Description of the issue:

- For diesel-electric main propulsion applications with variable speed sometimes the combination of E2/C1 test cycles is required.
- For the same application sometimes the combination of E2/D2 test cycles is deemed to be appropriate.
- Testing two joint test cycles is burdensome and might require a new set up of the engine.
- Often the combination required by the classification society/Administration is not clear or known during an essential project stage.

Request:

- Against the background that flexible board grids will gain more importance as well for hybrid systems, the revised UI should provide clarity with a view to applicable test cycle for variable speed diesel-electric main propulsion applications.

8 Unified Interpretation MPC 51
Engine Test Cycles

Dear Mr. Aiachini, Dear Madam/Sir, **11 March 2019**

I am writing you on behalf of EUROMOT …

EUROMOT-members, were very interested in the outcome of proposed amendments to IACS UI MPC 51 as provided with attached document to IMO MEPC at its 71st session. The amendments have not been adopted and according to IACS, UI MPC 51 has been retained in the 2004 version.

EUROMOT-members have an interest to develop the UI further in seeking clarification which distinct test cycles in accordance with chapter 3 of NTC 2008 should apply, inter alia to diesel electric propulsion applications. Driven by that interest, the topic has been further discussed, e.g. at meetings of CIMAC WG 5 …

… I would like to ask about the status of the work and any assistance of engine manufacturers, deemed to be helpful in the discussion to develop the issue further to a maturity for an approach at IMO.

Thank you very much for information…

Disclaimer

All data provided in this document is non-binding.
This data serves informational purposes only and is especially not guaranteed in any way.
Depending on the subsequent specific individual projects, the relevant data may be subject to changes and will be assessed and determined individually for each project. This will depend on the particular characteristics of each individual project, especially specific site and operational conditions.

MAN Energy Solutions
Future in the making

Thank you very much!

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29 November 2019