

REGULATORY DEBRIEF FOR NOx TIER III COMPLIANCE FOR YACHTS

JULY 2020





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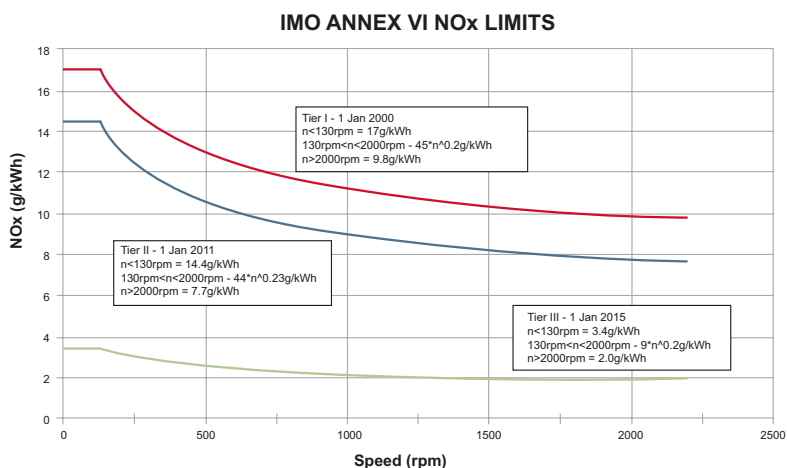
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STANDARDS AND IMPLEMENTATION SCHEDULE

Nitrogen Oxides (NO_x) are one of the gaseous air pollutants from ships regulated by Annex VI of the International Maritime Organization (IMO) Marine Pollution (MARPOL) Convention. Under Regulation 13 of MARPOL Annex VI, the NO_x emission limits have been progressively set at three Tiers for installed diesel engines with a power output of more than 130kW (other than those used solely for emergency), i.e. IMO Tier I, Tier II and Tier III. Each Tier limits the NO_x emission to a specific value based on the rated engine speed as indicated on the table to the right.



ENGINE COMPLIANCE REQUIREMENTS

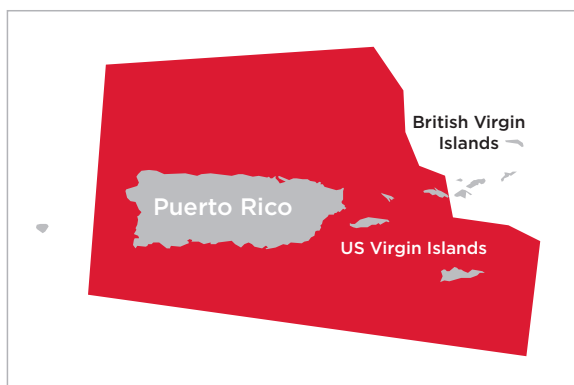
The application date of the Regulation 13 NO_x emission limits is tied to the ship construction date and the Tier III limit is only applicable when operating within a designated NO_x Tier III Emission Control Area (NO_x ECA).

Currently the North American area and the United States Caribbean Sea area are the only designated NO_x ECAs and which entered into force from 1 January 2016.

The existing Baltic and North Sea SO_x ECAs have been designated as NO_x ECAs under IMO Resolution MEPC. 286(71), with the IMO NO_x Tier III requirements to be applicable from 1 January 2021.



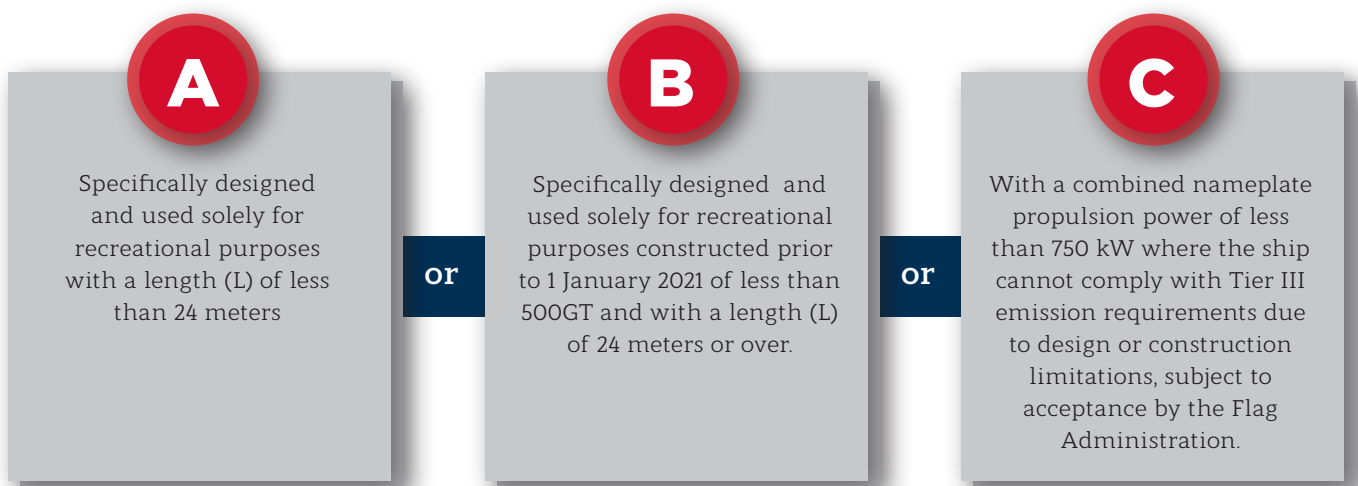
North American ECA, United States Caribbean Sea ECA, Baltic Sea ECA and North Sea ECA.



EXCEPTIONS

With the adoption of the first Tier III NOx ECA regulations at MEPC 66, the Committee by Resolution MEPC.251(66) approved three exemption criteria that are generally applicable to small recreational crafts such as yachts. These exemptions were applied to ships of less than 24m in length if specifically designed and used solely for recreational purposes and to an engine installed on a ship with a combined nameplate propulsion power of less than 750kW if the ship construction limitations (demonstrated to the satisfaction of the Administration) prevented compliance with Tier III. A five-year delay in the application of the Tier III limits until 1 January 2021 was also applied to engines installed on a ship of less than 500 gross tonnage, with a length of 24m or over, specifically designed and used solely for recreational purposes.

Note: At MEPC 74, the Committee rejected a proposal submitted by Turkey and ICOMIA that sought a further delay for 5 years of the application date to 1 January 2026 on the previously exempted large yachts, greater than 24m in length, less than 500GT and used solely for recreational purposes. The conclusion was that the regulated marine engines installed on such yachts constructed on or after 1 January 2021 are to comply with the NOx Tier III emission limits when operating in a NOx ECA.



UNITED STATES FLAGGED YACHTS

The U.S. Environmental Protection Agency (EPA) and U.S. Coast Guard are authorized to administer MARPOL Annex VI by the Act to Prevent Pollution from Ships. U.S. EPA regulations implementing Annex VI are codified at 40 CFR Part 1043. The NOx emission limits in Regulation 13 of MARPOL Annex VI are applicable to U.S. flagged ships trading in international waters and foreign flag ships while operating in the U.S. ECA areas. US flagged vessels are also subject to engine requirements under the Clean Air Act. The U.S. EPA categorizes marine engines as follows under Clean Air Act regulations in 40 CFR part 1042:

Category 1: Displacement < 7 liter/cylinder. Commercial or recreational.

Note: Recreational marine engine means a Category 1 propulsion marine engine that is intended by the manufacturer to be installed on a recreational vessel and may not be installed on a commercial vessel. Commercial engines may be for propulsion or auxiliary use and may be installed on commercial vessels.

Category 2: Displacement from 7 < 30 liter/cylinder

Category 3: Displacement ≥ 30 liter/cylinder



Engines intended to be installed onboard U.S. flagged yachts are to comply with the emission requirements laid down in 40 CFR Part 1042 and 40 CFR Part 1043. Category 1 and 2 engines are to comply with the emission Tiers in accordance with Tables 1, 2, 3, 4 of 40 CFR Part 1042.101. Category 3 engines are to comply with Table 1 of 40 CFR Part 1042.104, which is equivalent to the IMO NO_x emission levels, except that the CFR also sets a HC limit of 2.0g/kWh and a CO limit of 5.0 g/kWh under Tier 2/II and Tier 3/III.

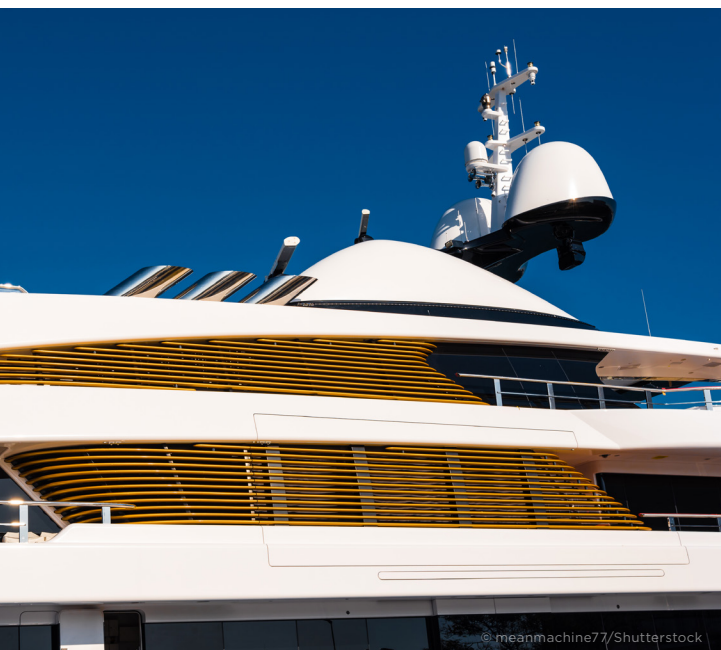
Such engines needing an Engine International Air Pollution Prevention (EIAPP) Certificate must be covered by an EIAPP Certificate that is issued by the U.S. EPA. Engines on U.S. flagged vessels that do not operate in waters subject to the jurisdiction of another country may comply with the EPA's domestic emission standards in lieu of compliance with Annex VI.

Note: The EPA has four NO_x emission Tiers written in Arabic numerals (e.g. Tier 1, 2, 3 & 4) compared to IMO MARPOL which has three NO_x emission Tiers written in Roman numerals (e.g. Tier I, II & III).

On October 17th, 2018 the United States Coast Guard (USCG) released a Work Instruction (WI) to clarify how it will enforce Regulation 13.5.1.2 of Annex VI due to the unavailability of Tier III engines of the size required to comply with this regulation. The USCG will defer enforcement of this regulation on qualified yachts and engines; In lieu of meeting MARPOL Annex VI Tier III performance standards, engines with rating of 130 kW to 600 kW installed on yachts with keel-laying date on or after January 1st, 2016 may instead be accepted by the US Government provided they meet the Clean Air Act Tier 3 requirements under 40 CFR part 1042.

Such certified engines are available and will be accepted in the short-term if available engines of the required size certified to meet MARPOL Annex VI Tier III are demonstrated to be unsuitable. This WI is applicable to U.S.-flagged and foreign- flagged vessels.

For further information on EPA emission standards for nonroad engines and vehicles please refer to:
<https://www.epa.gov/emission-standards-reference-guide/epa-emission-standards-nonroad-engines-and-vehicles>



OPTIONS FOR COMPLIANCE

Thermal NO_x is formed through high temperature oxidation of nitrogen in combustion air during the combustion process, usually above 1300°C. The formation rate is primarily related to temperature and the residence time of nitrogen at that temperature.

Therefore, modification of the combustion process for lowering the temperature in the cylinders of diesel engines and shortening the residence time of nitrogen at the high temperature is one of the approaches for the reduction of NO_x emissions.

There are three main routes to achieve IMO NO_x Tier III compliance, and these involve the use of Selective Catalytic Reduction (SCR), Exhaust Gas Recirculation (EGR) and gas fuel, e.g. LNG, in lean burning (Otto) engines.

For Yachts to meet the Tier III requirements SCR systems are the typically applied technology.

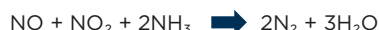
SELECTIVE CATALYTIC REDUCTION (SCR)

Selective Catalytic Reduction is an abatement technology that uses reductant to treat the exhaust gas from a diesel engine to reduce the amount of NO_x emitted.

In the treatment process, a reductant, typically ammonia in urea solution, is mixed with the exhaust stream prior to the blocks of catalyst elements in the SCR unit. The ammonia, decomposed from urea, reacts with NO_x across the SCR chamber to emit nitrogen and water.



Urea + Water > Ammonia + Carbon Dioxide



Nitric Oxide + Nitrogen Dioxide + Ammonia > Nitrogen + Water

NO_x TIER III CHALLENGES FOR LARGE YACHTS

The main auxiliary components necessary for the SCR process are:

Reductant solution tank
(urea solution or ammonia
solution, depending on the
design option)

Reductant solution
supply unit

Reductant solution
injection unit

Soot blower
system

The additional required space to accommodate the SCR and associated auxiliary components is the primary challenge for yacht applications.

The engine-room may require additional space to accommodate the equipment and the associated cooling arrangements that may be required for the correct storage of urea under certain ambient conditions.

Other challenges may be represented by the availability of the urea at the ports where yachts berth together with the general complexity of its handling.

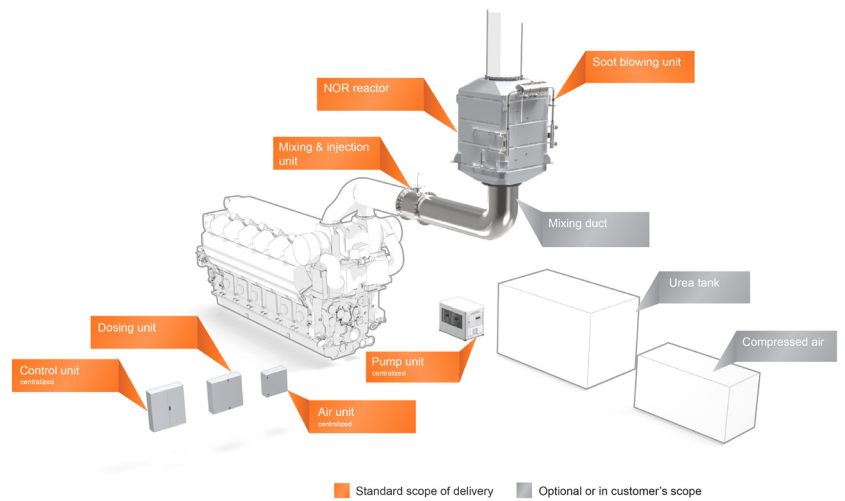
ABS SUPPORT

ABS leads the way in helping the yacht industry understand and comply with IMO and U.S. NOx Tier III requirements and can support yacht designers and builders to reach an informed NOx Tier III compliance path.

ABS can provide decision support on technical matters and design challenges associated with the different solutions on the market.

Our Yachts Center of Excellence will carry out thorough design assessments and our experienced surveyors will be available through every step of the installation process to ensure compliance.

Contact us today at yachts@eagle.org.



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