

# REGULATORY DEBRIEF FOR NOx TIER III COMPLIANCE FOR YACHTS

DECEMBER 2019

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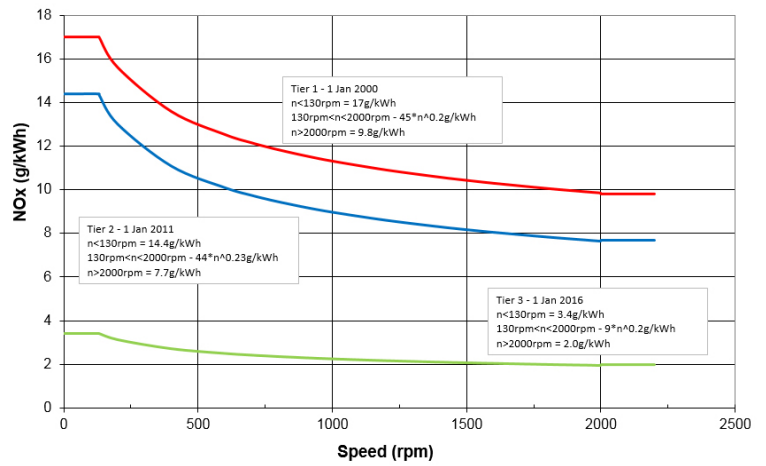
## TABLE OF CONTENTS

Standards And Implementation Schedule .....	1
Engine Compliance Requirements .....	1
Exceptions .....	2
United States Waters .....	2
Options For Compliance .....	4
Selective Catalytic Reduction (SCR) .....	4
NOx Tier III Challenges For Large Yachts .....	4
ABS Support .....	5



## STANDARDS AND IMPLEMENTATION SCHEDULE

Nitrogen Oxides (NOx) are one of the 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 NOx 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 NOx emission to a specific value in accordance with the rated engine speed as indicated on the table to the right.



## ENGINE COMPLIANCE REQUIREMENTS

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

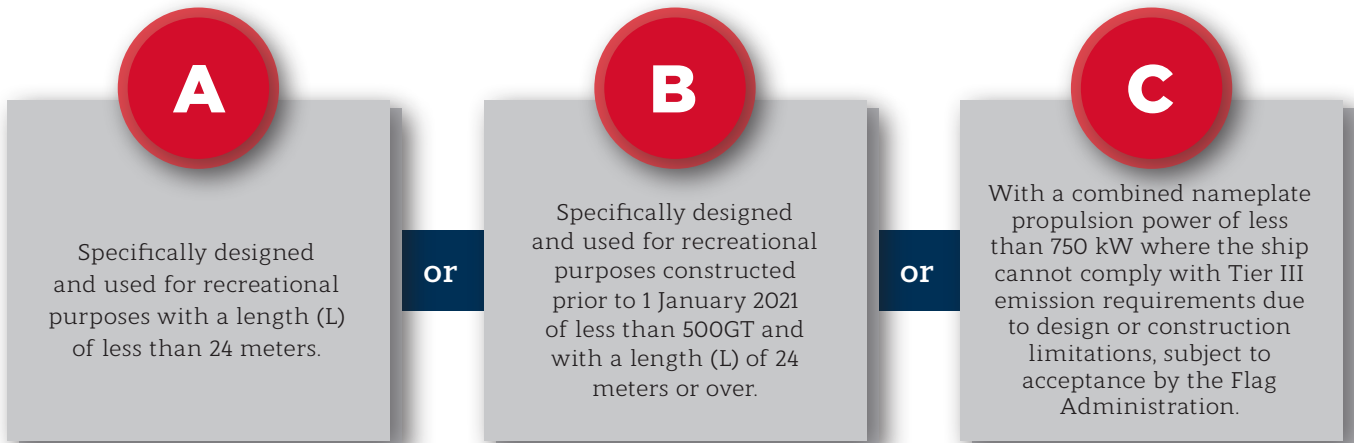
Currently the North American area and the United States Caribbean Sea area are the only designated NOx ECAs which entered into force from 1 January 2016.

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



## 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 rated at less than 750kW if the ship construction limitations 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.

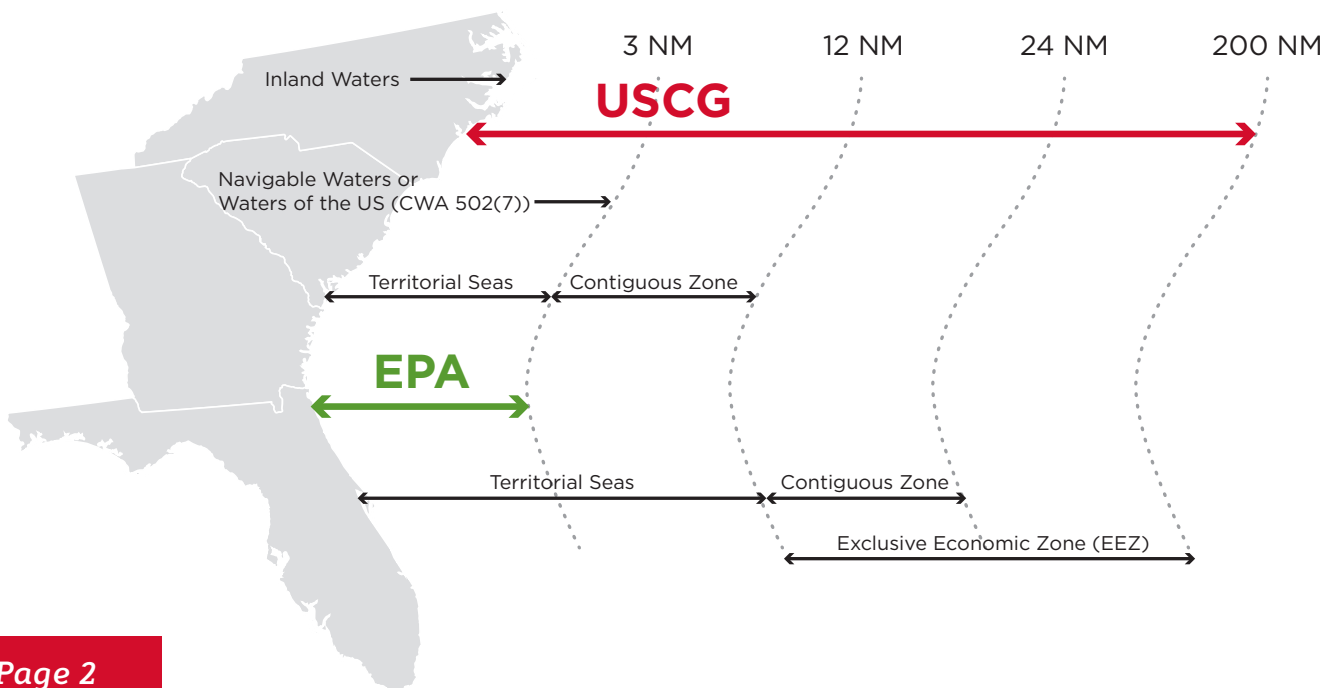


*Note: At MEPC 74, the Committee rejected a proposal submitted by Turkey and ICOMIA that sought a further delay for 5 years of the application date to 1 January 2026 on large yachts, greater than 24m in length and less than 500GT. The conclusion was that all marine engines installed on such yachts constructed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

## UNITED STATES WATERS

The United States (U.S.) Environmental Protection Agency (EPA) has additional requirements besides the IMO requirements for engines which are to be installed onboard any U.S. flagged yacht. The EPA categorizes marine engines as follows:

- Category 1:** Displacement < 7 liter/cylinder
- Category 2:** Displacement from 7 < 30 liter/cylinder
- Category 3:** Displacement ≥ 30 liter/cylinder







Courtesy of Mangusta Yachts

Engines intended to be installed onboard U.S. flagged yachts are to comply with the emission requirements laid down in 40 CFR (Code of Federal Regulations) Part 1042 and 40 CFR Part 1043.

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

For Category 3 engines the EPA NOx limits are equivalent to IMO Tiers, except that the EPA also sets a hydrocarbon (HC) limit of 2.0 g/kWh, a CO limit of 5.0 g/kWh and mandates additional Particulate Matter (PM) measurements and reporting during engine certification testing.

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 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; only engines with ratings of 130kW to 1400kW qualify under this WI. 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 certified by the EPA as meeting Clean Air Act Tier 3 requirements under 40 CFR part 1042. Such certified engines are available and will be accepted in the short-term until engines of the required size certified to meet MARPOL Annex VI Tier III become available. This WI is applicable to U.S.-flagged and foreign-flagged vessels.

The emission limits values are tabulated in EPA emission standard EPA-420-B-16-025 of March 2016, "Marine Compression-Ignition (CI) Engines: Exhaust Standards", which is accessible via [www.epa.gov/emission-standards-reference-guide/epa-emission-standards-nonroad-engines-and-vehicles](http://www.epa.gov/emission-standards-reference-guide/epa-emission-standards-nonroad-engines-and-vehicles).



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## OPTIONS FOR COMPLIANCE

Thermal NOx 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 NOx emission.

Exhaust Gas Recirculation (EGR) and use of gas fuel, e.g. LNG, in lean burning (Otto) engines are proven effective methods.

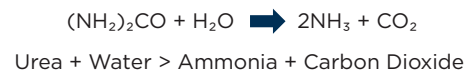
Abatement technology, like Selective Catalytic Reduction (SCR) is another measure that can be applied to reduce NOx emissions by treating the exhaust gas.

For Yachts to meet the Tier III requirements SCR systems are the current suitable technology.

## SELECTIVE CATALYTIC REDUCTION (SCR)

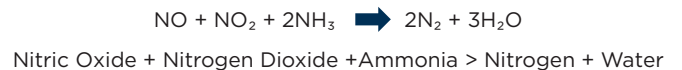
Selective Catalytic Reduction is an abatement technology that uses reductant to treat the exhaust gas from a diesel engine to reduce the amount of NOx emitted.

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 NOx across the SCR chamber to emit nitrogen and water.



## NOx TIER III CHALLENGES FOR LARGE YACHTS

As previously mentioned, during 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 main auxiliary components necessary for this 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 concern.

The engine-room will require additional space to accommodate the equipment and the associated cooling arrangements required for the proper storage of urea under specific 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.



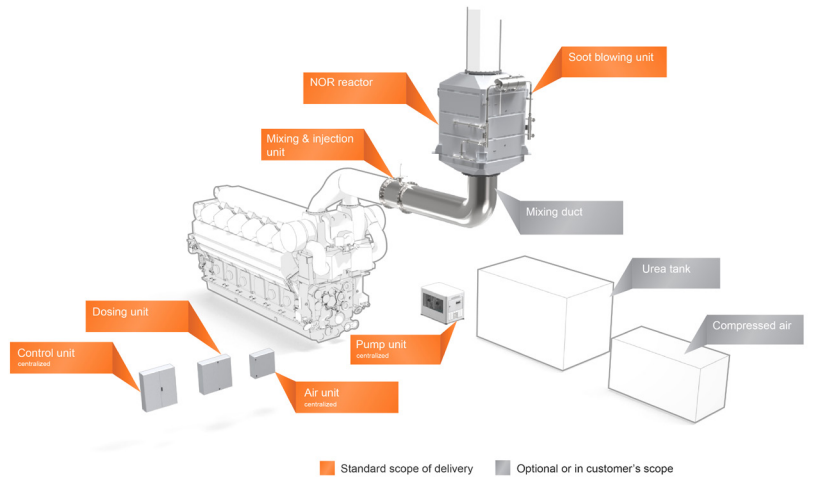
## ABS SUPPORT

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

Whether it is a new building project or a retrofit project ABS provides 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](mailto:yachts@eagle.org).



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