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## Application of High-Sulphur Fuels, SO<sub>x</sub> Scrubbers and Tier III Equipment for MAN B&W Two-Stroke Diesel Engines

The IMO global 0.5% fuel sulphur cap coming into force for all ships on 1 January 2020 has raised the interest for installing SO<sub>x</sub> scrubbers in combination with MAN B&W two-stroke marine diesel engines.

### How SO<sub>x</sub> scrubbers influence engine performance

All two-stroke engines in the MAN Diesel & Turbo marine engine programme are compatible with the most commonly applied exhaust gas cleaning systems, such as SO<sub>x</sub> scrubbers. However, a SO<sub>x</sub> scrubber installation will increase the back pressure, thereby affecting engine performance and, consequently, the specific fuel oil consumption (SFOC). Accordingly, MAN Diesel & Turbo has specified some requirements to a SO<sub>x</sub> scrubber installation, which includes the maximum allowable back pressure.

Retrofit solutions are possible for engines in service, and we recommend that MAN Diesel & Turbo is contacted for an evaluation of the scrubber's impact on engine performance, and for recommendation of possible countermeasures to ensure a safe and reliable operation of the engine in combination with the scrubber.

For both newbuilding projects and retrofit projects, MAN Diesel & Turbo strongly recommends that a scrubber installation does not increase the back pressure of an engine by more than 30 mbar at full flow conditions (at SMCR of the engine), and that the additional back pressure from the scrubber decreases more than linearly with the engine load (i.e. the additional back pressure at 50% engine load must be lower than 50% of the additional back pressure at full load).

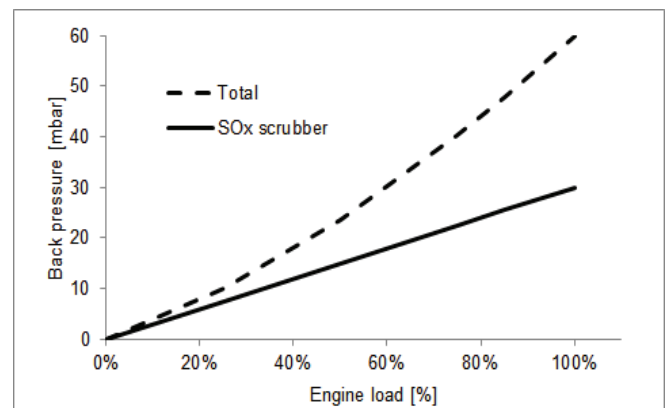


Fig. 1: Back pressure measurements for scrubber and in total

MAN Diesel & Turbo is currently preparing a more detailed scrubber installation guideline with performance prediction tools. Until release of this guideline later this year, requests for SO<sub>x</sub> scrubber installations downstream MAN B&W two-stroke marine diesel engines will be handled on a case-by-case basis.

Questions regarding SO<sub>x</sub> scrubber installations for newbuilding projects should be directed to our Engine & System Application department at [lee@mandieselturbo.com](mailto:lee@mandieselturbo.com). For evaluation of possible SO<sub>x</sub> scrubber retrofit solutions on a vessel in service, please contact our PrimeServ organisation at: [PrimeServ-cph@mandieselturbo.com](mailto:PrimeServ-cph@mandieselturbo.com)



## Tier III in connection with high-sulphur and scrubber application

High-sulphur fuel solutions are available for all Tier III applications, except for low-pressure SCR (selective catalytic reduction). So far, only low-sulphur solutions have been available in the MAN Diesel & Turbo engine calculation tool CEAS (computerised engine application system). In 2017, both low- and high-sulphur Tier III solutions will be available in CEAS.

There will be some differences between the low- and high-sulphur Tier III solutions with regard to engine performance:

- **High-pressure SCR (HPSCR)**

Only minor differences in SFOC and exhaust gas properties, and only when operating at between 20% and 45% load.

- **EGR**

No differences between the low- and high-sulphur solution regarding SFOC and exhaust gas properties.

Regarding high-sulphur EGR solutions, a low-sulphur CEAS EGR report can be used, as there is no difference in engine performance.

## Capacities in the CEAS EGR report

There are no differences in engine performance between low-sulphur and high-sulphur EGR solutions. However, there will be differences in capacities related to the EGR system. If data is needed concerning freshwater consumption, process water bleed-off, sludge accumulation and NaOH consumption, please contact our Marine Project Engineering department at [LEE5@mandieselturbo.com](mailto:LEE5@mandieselturbo.com)

*The new option of calculating engine performance data based on high-sulphur fuel will soon be available in CEAS, however, until then, please contact our Marine Installation department at [lee4@mandieselturbo.com](mailto:lee4@mandieselturbo.com) to request calculations.*

*The CEAS engine calculation tool can be accessed at [www.marine.man.eu](http://www.marine.man.eu) under the headings Two-Stroke and CEAS Engine Calculations.*

Questions regarding the Tier III solutions described in this Market Update Note should be directed to our Process Development department at [ld@mandieselturbo.com](mailto:ld@mandieselturbo.com).

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