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# MX-SCR

PRODUCT DETAILS
AND SPECIFICATIONS

marine
EXHAUST TECHNOLOGY

## Own test facilities

Marine Exhaust Technology is running it's own full scale test facilities in Frederikshavn, Denmark.

Lloyd's Register

## Performance examined by Lloyds Register EMEA

The test has been performed according to agreed protocol in order to prove compliance with the discharge limitation requirements of MARPOL Resolution MEPC. 184 (59), 2009 concerning Exhaust Gas Cleaning Systems. The Measured values for SO2/CO2 ratio, PH, PAH and turbidity are seen to be full compliance with requirements of resolution.

**Developed in our own test center**
**Turn Key Solutions**
**Customized designs for retrofit installations**
**Complete control and monitoring system**
**Compact modular design**
**Low weight**
**Easy installation**
**Cost efficient**
**Integrated with silencer**

**IMO REQUIREMENTS**

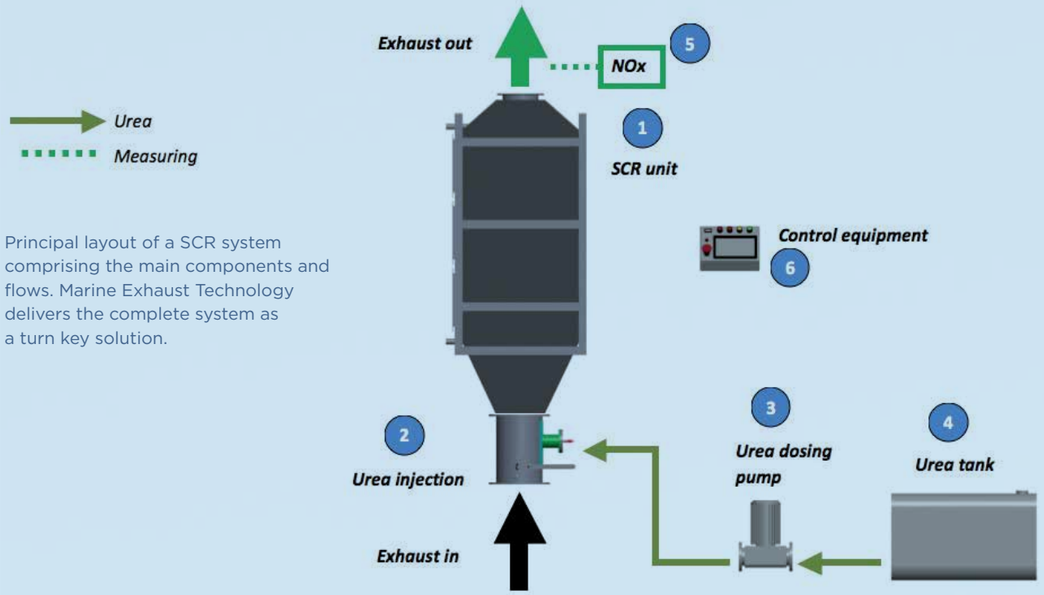
**AIR POLLUTION AND FUEL QUALITY**
The International Maritime Organization (IMO) has adopted mandatory energy efficiency measures to reduce the amount of CO2 emissions from international shipping. The international air pollution and fuel quality requirements are found in MARPOL Annex VI.

**MARPOL ANNEX VI:**
- Sets limits on sulphur oxide (SOx) and nitrogen oxide (NOx) emissions from ship exhausts.
- Prohibits deliberate emissions of ozone depleting substances.
- Limits the sulphur content of fuel oil. The global sulphur cap is reduced initially to 3.50% (from the current 4.50%), effective from 1 January 2012; then progressively to 0.50 %, effective from 1 January 2020.
- Allows special SOx and NOx emission control areas (SECAs and NECAs) to be established. The Baltic Sea, the North Sea, the English Channel, the American and Canadian coasts and inland waters are emission control areas.
- In the SECAs more stringent limits on sulphur emissions apply. The limits are reduced from the original 1.50% to 1.00% beginning on 1 July 2010 and will be even further reduced to 0.10 %, effective from 1 January 2015.
- In the NECAs, all ships are required to drastically reduce their NOx emissions. The Tier II emission limit applies to engines installed on or after 1 January 2011. Tier III emission limit applies to engines installed on or after 1 January 2016 operating in NECAs. Tier III levels are 80% lower than the current levels.

Email: info@maexte.com
Phone: +45 9620 1400
Sandholm 7
DK-9900 Frederikshavn
Denmark

# MX-SCR

## SCR SYSTEM LAYOUT:




Principal layout of a SCR system comprising the main components and flows. Marine Exhaust Technology delivers the complete system as a turn key solution.

## Exhaust gas cleaning systems from Marine Exhaust Technology

At Marine Exhaust Technology it is our goal to provide the most optimal exhaust gas cleaning solutions that offer the highest level of energy efficiency and the lowest environmental impact. Our solutions are always designed in accordance with customers' requirements and specifications. To meet our customers' demands, it is crucial that we identify key operational factors that impact the design of the exhaust gas cleaning solution.

Every Marine Exhaust Technology solution is based on a set of design criteria. With pre-defined design criteria we establish a sound design and engineering basis that ensures optimal quality solutions. Before we set up design criteria for i.e. piping, cables, tanks and crew, we need exhaustive knowledge of the customer's, the ship yard's and the classification society's requirements. Close cooperation with our customers is thus of vital importance.

1. **SCR unit:** The SCR unit contains the catalyst elements. The exhaust gas is mixed with urea and flows through the catalyst elements where the NOx is removed from the gas in a chemical reaction that leaves only harmless N2 and water. The SCR unit design is always customized according to the individual vessel and the available space in each case. Both horizontal and vertical designs are available.
2. **Urea injection:** Urea is injected into the exhaust gas flow through an advanced nozzle. The injection system is important to ensure that urea is mixed homogeneously with the exhaust gas. This way the best NOx removal performance is achieved.
3. **Urea dosing pump:** The correct amount of urea is supplied to the injection nozzle by the urea dosing pump. The urea dosing process is continuously controlled according to the exhaust gas flow and engine load.
4. **Urea tank:** Urea is supplied from the urea tank where a sufficient amount of urea is stored based on the ship's individual needs.
5. **Gas sample NOx measurement:** The NOx reduction rate is continuously monitored and logged directly after the SCR unit.
6. **Control equipment:** The control of the injection of urea is based on the actual engine load temperature, NOx content at the reactor inlet and the NOx content at the reactor outlet. Furthermore, exhaust gas samples are tested and the NOx removal performance logged. The control measures include start up and shut down cleaning procedures.

## DIMENSION TABLE - SCR UNIT:

| Engine size, MW | Height, mm | Width, mm | Depth, mm | Weight, kg | Cat. weight, kg |
|---|---|---|---|---|---|
| 1 MW | 2900 | 466 | 1398 | 550 | 216 |
| 3 MW | 3700 | 932 | 1398 | 850 | 648 |
| 5 MW | 3700 | 1398 | 1398 | 1000 | 864 |
| 7 MW | 4000 | 1398 | 1864 | 1250 | 1296 |
| 9 MW | 4400 | 1398 | 2330 | 1600 | 1728 |
| 11 MW | 5000 | 1398 | 2796 | 2000 | 1944 |
| 13 MW | 5000 | 1864 | 2796 | 2200 | 2592 |
| 15 MW | 4400 | 2330 | 2330 | 2000 | 2700 |

All dimensions are principal and subject to specific design for the individual project.
Both horizontal and vertical designs are available. Dimension include inlet/outlet

## KEY PERFORMANCE DATA:

| | |
|---|---|
| NOx reduction max | 97% |
| Operational temperature in | 300 – 540 °C |
| Back pressure | 800 Pa |
| Urea consumption per MWh | 10 l |
| Pumping power requirement per MW | 0,5 kW |

All performance data are subject to specific calculations on the individual project.

## The diesel engine combustion process

In marine diesel engines the combustion transforms the energy of the fuel to a mechanical energy that provides forward propulsion, keeps the generators running and produces the electricity needed on board the vessel. During this process heat is generated in the form of radiant heat from the engine, heat is transferred from the vessel's cooling water system and into the sea - and from the vessel's exhaust system into the air.
The diesel combustion process is noisy and produces relatively high levels of particles as well as oxides of sulphur and oxides of nitrogen called SOx and NOx. The noise, heat, particulate matter, SOx and NOx are emitted through the vessel's exhaust system.