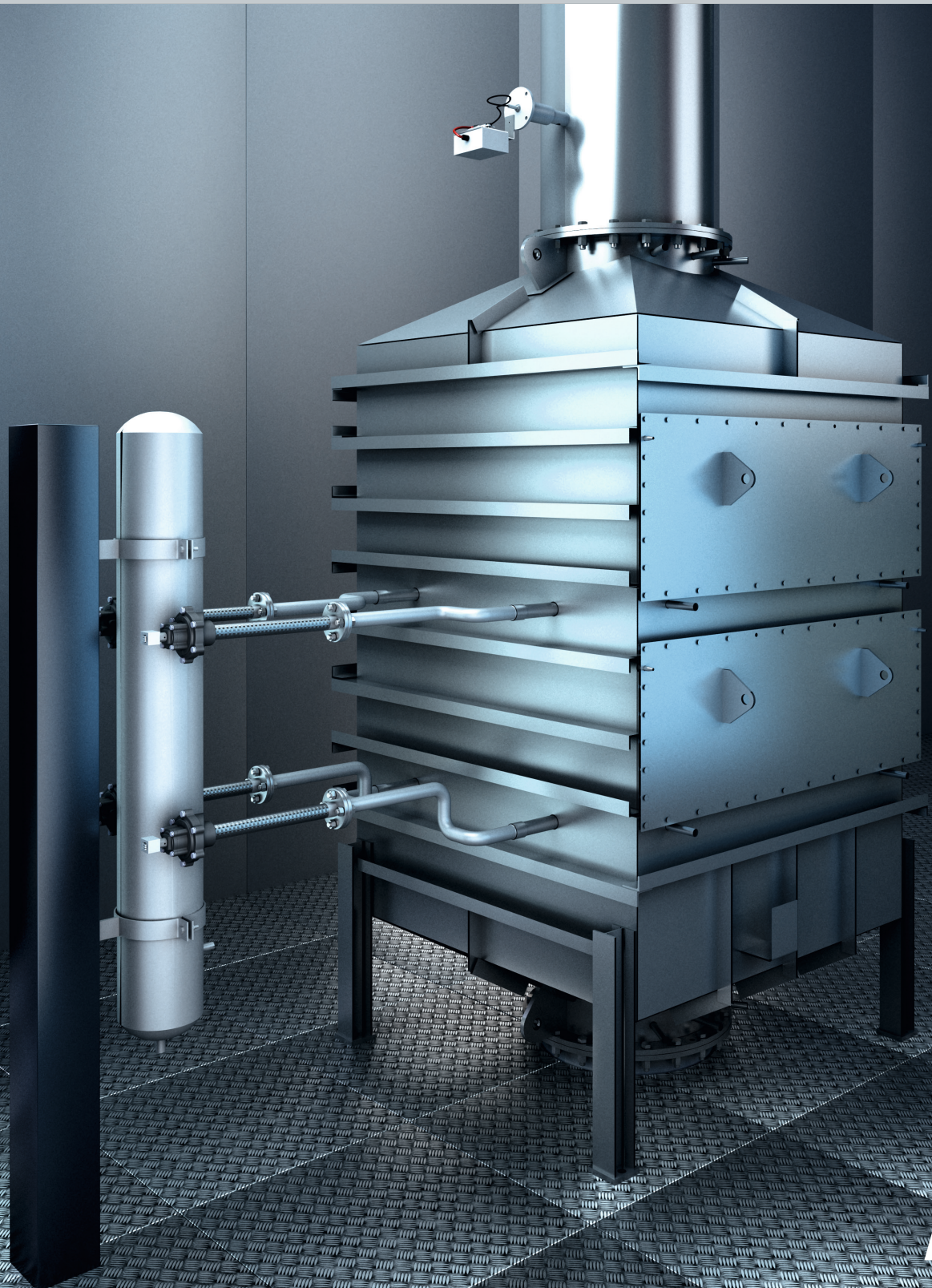


MaK SCR

Selective
Catalytic
Reduction



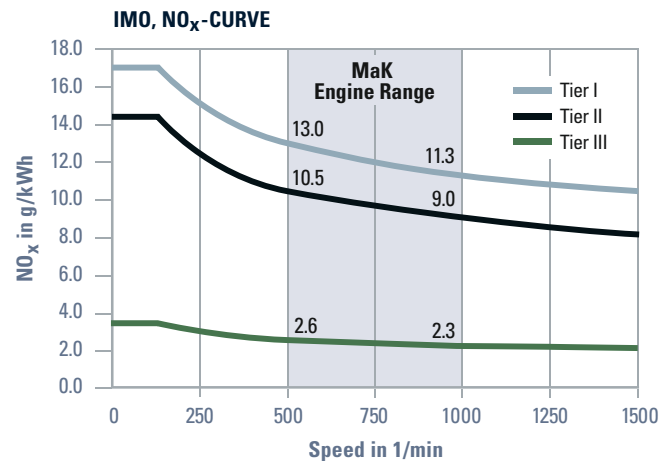
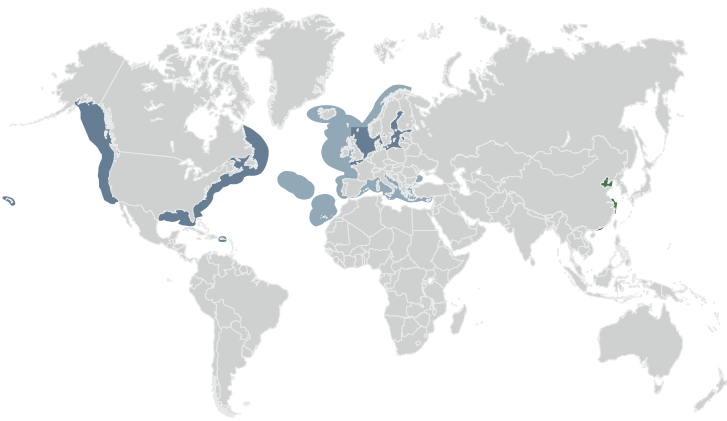
MaK

CLEAN SHIPPING STARTS WITH SCR

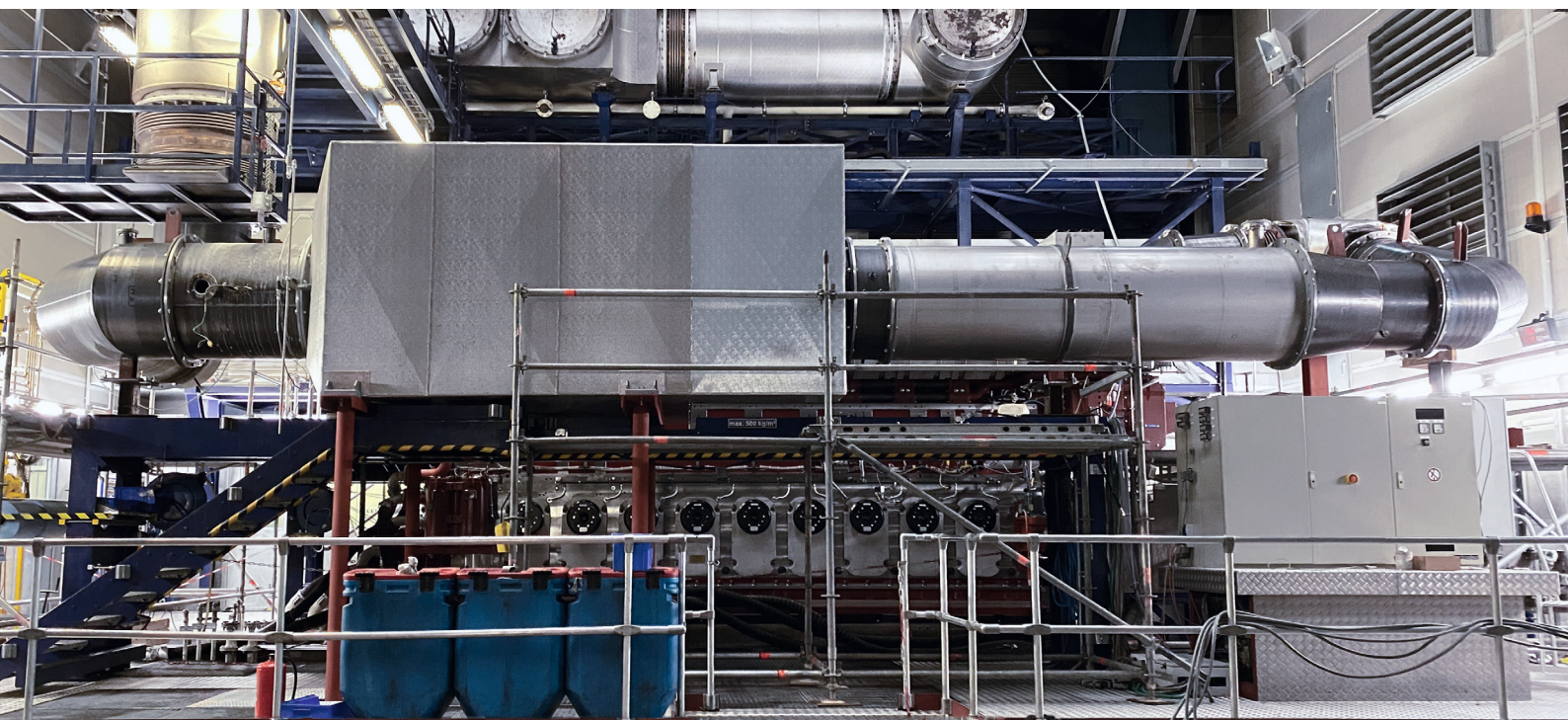
The pressure continues to grow to reduce exhaust gas emissions. Improving air quality requires that certain pollutants, such as nitrogen dioxide and particulate matter, not exceed specific benchmarks. At the same time, vessel operators want to avoid paying high taxes and fees when entering new harbors by ensuring ships meet today's stricter regulatory guidelines.

The solution? The MaK Selective Catalytic Reduction (SCR) system. This advanced, active emission-control technology reduces both NO_x and particulates without sacrificing engine efficiency and reliability – making the modern MaK diesel engine the responsible choice for clean shipping.

Emission Control Areas (ECA)



IMO MARPOL Annex VI, IMO Tier III. IMO III regulations took effect in NO_x Emission Control Areas (NECA) in 2016. Outside NECA zones, IMO II standards apply. The limit for NO_x is about 75% lower in NECA zones than IMO II areas.



Testbed, Caterpillar Motoren, Rostock, Germany

THE RIGHT CHOICE

FOR ENVIRONMENTAL AND ECONOMIC SUCCESS

MaK SCR technology, used for MaK diesel engines and dual-fuel engines in larger vessels, substantially reduces NO_x emissions to meet IMO Tier III standards. At the same time, it reduces particulate matter (PM) and hydrocarbon (HC) emissions, efficiently treating engine-out exhaust without affecting engine performance in any way.

Along with helping the environment, SCR technology saves operators money by lowering taxes and fees when entering emission-controlled areas (ECA) and by maintaining excellent fuel efficiency during vessel operation. Another positive side effect is sound reduction.

In addition, the MaK SCR system requires little space, allows for flexible installation and offers an excellent power-to-weight ratio. During operation, it can switch between the IMO II and IMO III modes to comply with regionally different emissions requirements. The system ensures easy installation and maintenance on board.



The MaK SCR System is available in different sizes for all MaK Marine propulsion and generator sets. It is adaptable for multi-deck, horizontal and vertical installation.

KEY FEATURES AND BENEFITS

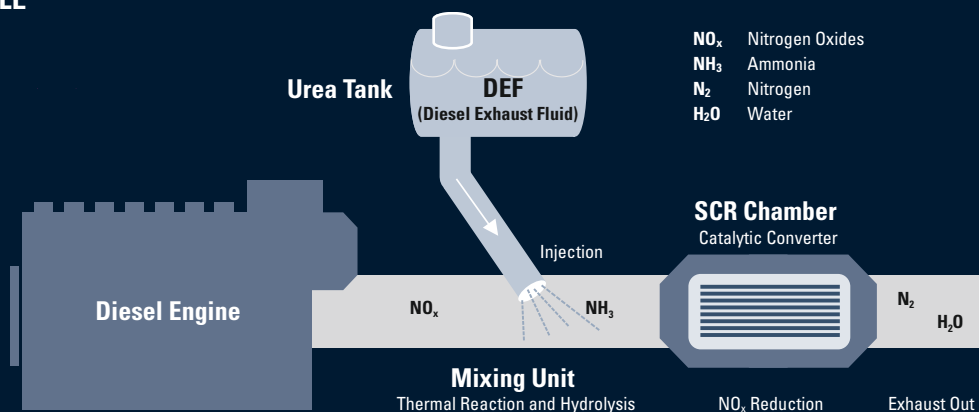
- High engine power and efficiency while reducing diesel emissions
- Excellent fuel economy while maintaining the right level of performance
- Outstanding noise reduction effect
- Compact solution and flexible installation to meet any engine room requirements
- Easy installation and maintenance on board

FROM HARMFUL TO HARMLESS, IN A MATTER OF SECONDS

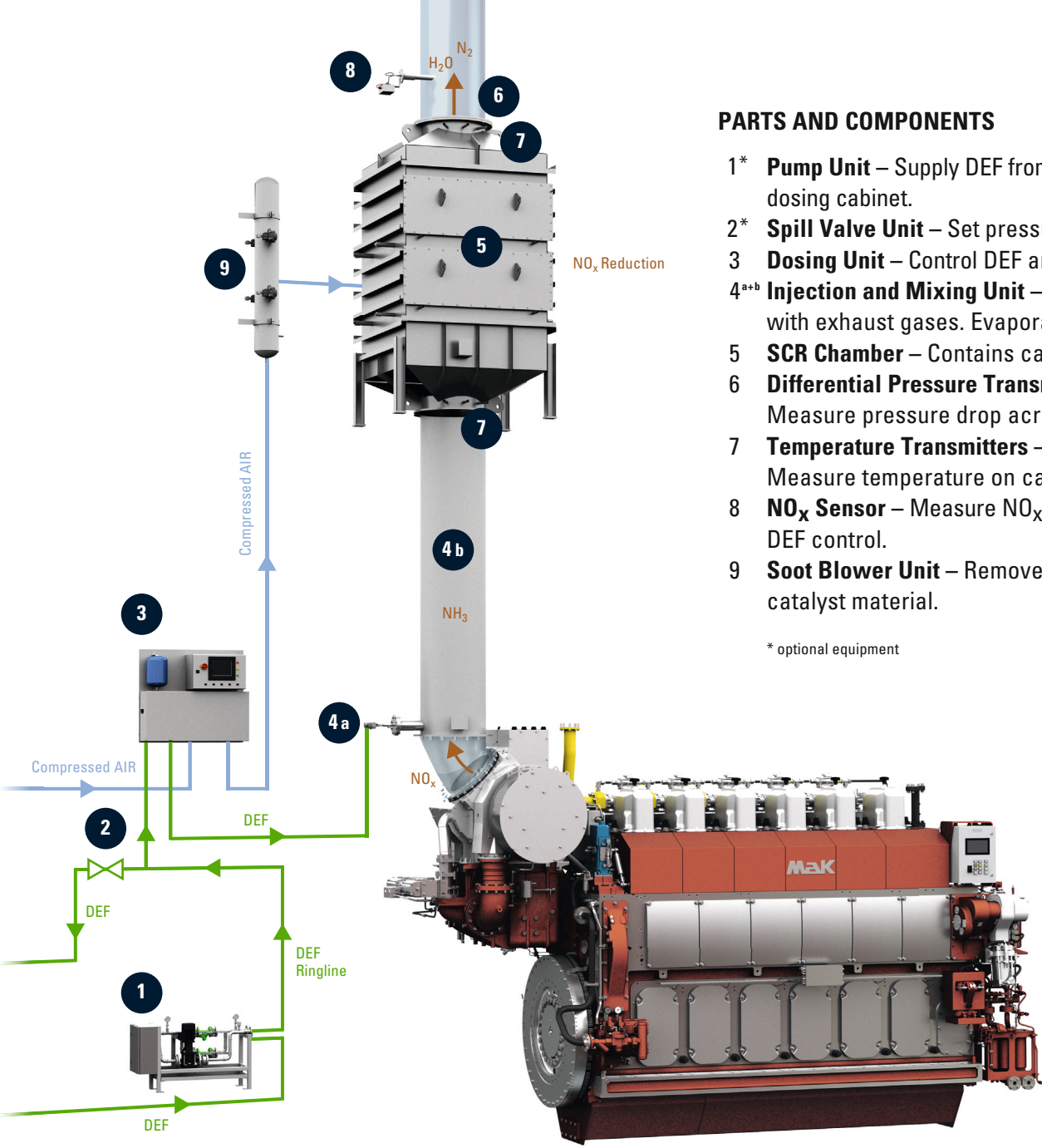
Our SCR system employs simple, highly effective technology to convert damaging NO_x into harmless nitrogen and water. A metering module injects Diesel Exhaust Fluid (DEF), a non-toxic and odorless solution consisting of highly concentrated urea in deionized water, into the exhaust gas system. DEF mixes with the exhaust gases and in just a few seconds initiates the chemical reaction that reduces NO_x emissions.

The amount of DEF supplied to the exhaust gas system depends on the engine load. An electronic controller uses engine parameters (engine load and speed signals) to determine the amount of DEF required while the exhaust gas temperature is set to the optimum range. DEF consumption is approximately 5–10% of fuel consumption

SCR WORKING PRINCIPLE



The primary function of the SCR system is to reduce NO_x . Through this process, compressed air is mixed with DEF drawn from the urea tank and then injected into the exhaust stream. The exhaust heat evaporates water from the DEF, converting it to gaseous ammonia (NH_3). The released NH_3 reacts with NO_x and oxygen in the SCR chamber. The final output is harmless gas particles of nitrogen (N_2) and water steam (H_2O).

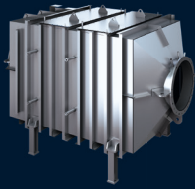


PARTS AND COMPONENTS

- 1* **Pump Unit** – Supply DEF from main tank to dosing cabinet.
- 2* **Spill Valve Unit** – Set pressure of DEF line.
- 3 **Dosing Unit** – Control DEF and air flow.
- 4^{a+b} **Injection and Mixing Unit** – Inject and mix DEF with exhaust gases. Evaporate DEF into ammonia.
- 5 **SCR Chamber** – Contains catalyst material.
- 6 **Differential Pressure Transmitters** – Measure pressure drop across catalyst material.
- 7 **Temperature Transmitters** – Measure temperature on catalyst inlet/outlet.
- 8 **NO_x Sensor** – Measure NO_x concentration for DEF control.
- 9 **Soot Blower Unit** – Remove pollutants from catalyst material.

* optional equipment

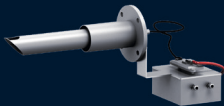
BASIC SCOPE OF SUPPLY



SCR Chamber (vertical or horizontal)



Soot Blow System



NO_x sensor



Mixing Unit



Dosing Unit

The SCR system is available in different sizes for all MaK Marine propulsion and generator sets. It is adaptable for multi-deck, horizontal and vertical installation to meet any engine room requirements. **Please contact your local dealer for more information.**

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