

Reducing NOx emissions from marine engines

Ships are one of the biggest NOx sources in the world. NOx emissions from ships cause pollution over land and cause eutrophication of the seas. It leads to oxygen depletion and reduce fish and shellfish populations.

NOx tax & IMO Tier 3

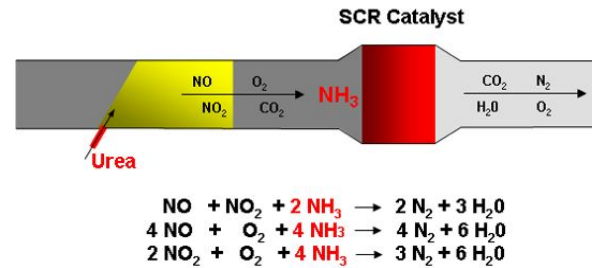
The legislation for the marine sector is tightening in 2011 and 2016. Norway has a goal to reduce NOx emissions by 30,000 tons before 2011. A special NOx tax is introduced. The International Maritime Organization's (IMO) Tier 3 directive means installation of SCR technology for ships to fulfil the 2016 legislation.

How airless SCR technology works

A mixture of urea and deionised water known as AdBlue is sprayed into the exhaust gases. The heat of the exhaust system transforms urea into ammonia which reacts with the nitrogen oxides in a catalytic converter, converting them into harmless nitrogen gas and water vapour.



Selective Catalytic Reduction (SCR)



Airless SCR from DANSK TEKNOLOGI

The airless technology was originally developed for use on heavy trucks, and is a preferred and proven technology within the truck industry. The heart of the system is derived from the innovative Digital Dosing pump technology that we have developed for Grundfos. We have used this knowledge to develop a SCR system suited especially for marine engines.

The first installation is already running at the Danish Navy test yard in Korsøer, and the first installation on a patrol ship was finished October 2009.

Installation on Danish Navy patrol vessels

- 4 stroke MTU engine 2040 kW (2 engines on each ship)
- NOx reduction up to 90%
- Vessel fulfils IMO2016
- Catalyst volume 1744 l (16 elements)
- Urea consumption max 42 l/h
- Dosing temperature 315-520°C
- Fuel: Marine Gasoil S<0,035-0,2% (350-2000 ppm)



DANSK TEKNOLOGI is both consultant and contractor in the field of engineering and new technology.

Our skills span the initial generation of ideas and insights all the way through to detailed implementation.

DANSK TEKNOLOGI focuses on creating benefits for clients rather than merely proposing them, and this focus is supported by an outstanding implementation track record. Our client base includes some of the most professional organisations - many of them world leaders in their field.

The range of projects DANSK TEKNOLOGI has been involved in include:

- Product Development
- Business Development
- Assembly Technology
- Robot Technology
- Manufacturing Technology
- Production Systems

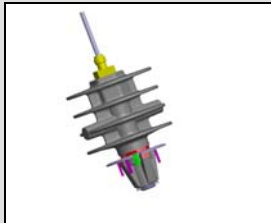
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Key components in the airless SCR system for marine engines



Digital dosing pump for urea (UDS)

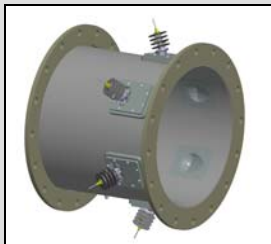
Based on a Grundfos DME 60-10 pump developed by DANSK TEKNOLOGI, modified to fit marine environment. Membrane pump, Max dosing: 60 l/h at 10 bar, Stainless steel pump head, 0 → 60 l/h less than 330 ms



Nozzle (urea dosing)

Airless Urea nozzle 7 l/h at 8 bar

6 nozzles placed in exhaust system



Modular design:

1 nozzle: 75 ml/h - 7 l/h

6 nozzles: 75 ml/h - 42 l/h



Catalyst

Titanium oxide catalyst designed for the temperature profile of the MTU motor used on the ships

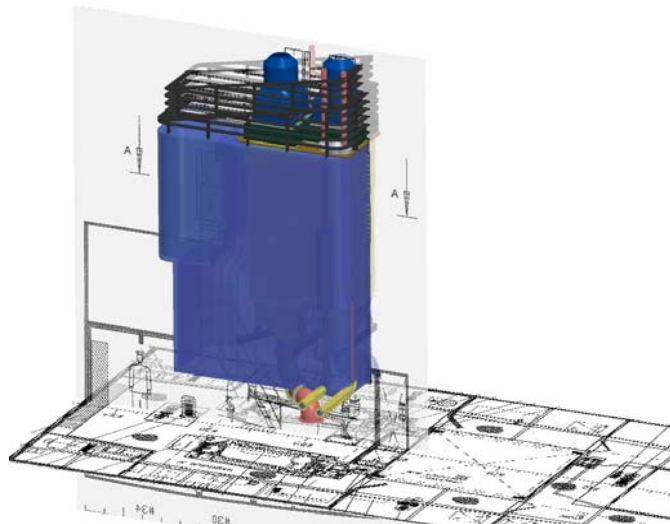
Total volume 1744 l (16 elements)

Installation on Danish Navy test yard

Installation of catalyst elements:



Catalyst, planed installation on ships



Case: Airless SCR from DANSK TEKNOLOGI installed on 100T truck



MAN 353 kW Euro 3 engine

3,9 → 1,2 gNO_x / kWh → 70% reduction

Catalyst volume 25 l single element

Urea consumption max 1,8 l/h

Dosing temperature 200-450°C

Fuel; On-road diesel S<0,001% (10ppm)



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