Exhaustaftertreatment for inland waterway vessels

UNECE Geneve 19.06.2019

TEHAG
Diesel Emission Management

Tehag Group

- Tehag Engineering AG founded in 1991 in Switzerland
- Since 1993 specialisation on exhaust aftertreatment for Diesel engines
- Starting with SCR for stationary applications
- Since 2005 production of the own DPF and SCR-Systems
- Ceritfied by Swiss VERT and German TÜV
- Since 2010 business unit for Muffler

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Our markets

- Stationary Engines (Emergency, CHP)
- Buses
- Agriculture vehicles
- Construction vehicles
- Material Transportation
- Trucks
- Railway vehicles
- Ships

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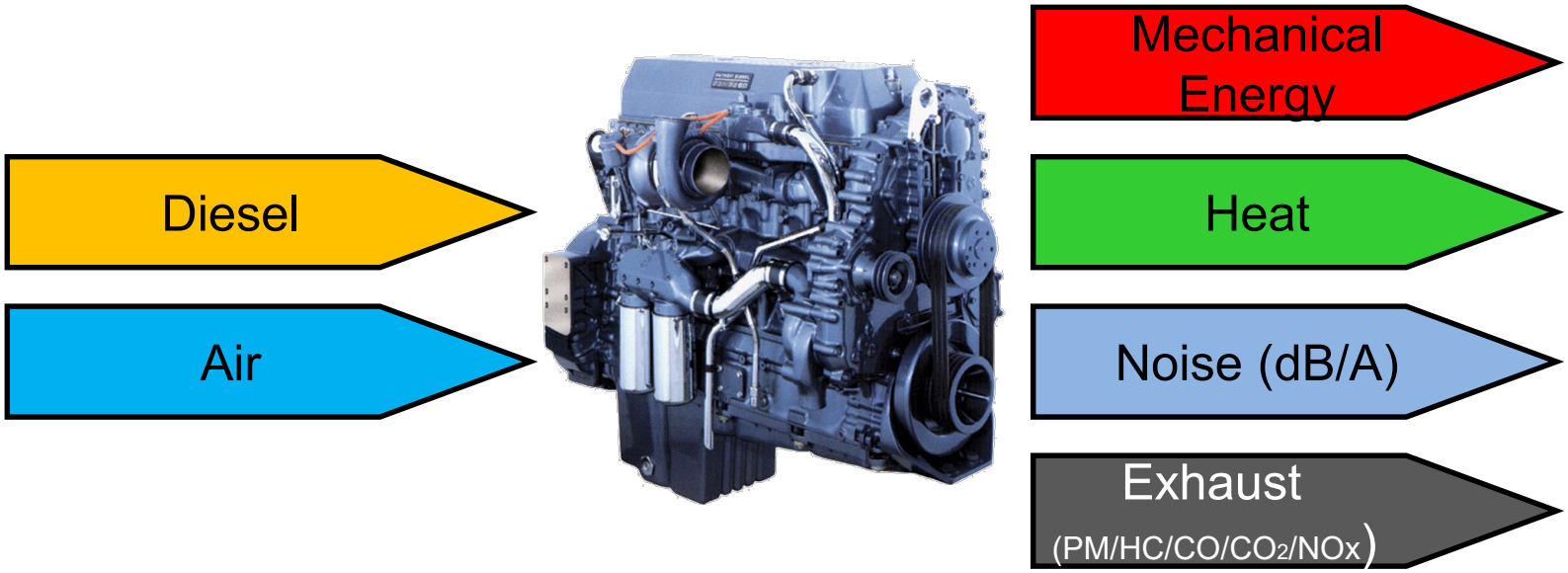
Why exhaust aftertreatment



Harmfull Engine Emissions

Noise (dB/A)

- Muffler

Exhaust
(PM/HC/CO/CO_2/NOx)

- PM/PN/particles

  - Wall-Flow Filter

- Gaseous pollutant

  - Carbon monoxide (CO) → Oxidationcatalyst
  - Hydrocarbons (HC) → Oxidationcatalyst
  - Nitrogen oxide (NO/NO_2) → SCR-system

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Harmfull Engine Emissions

- Composition of Diesel soot

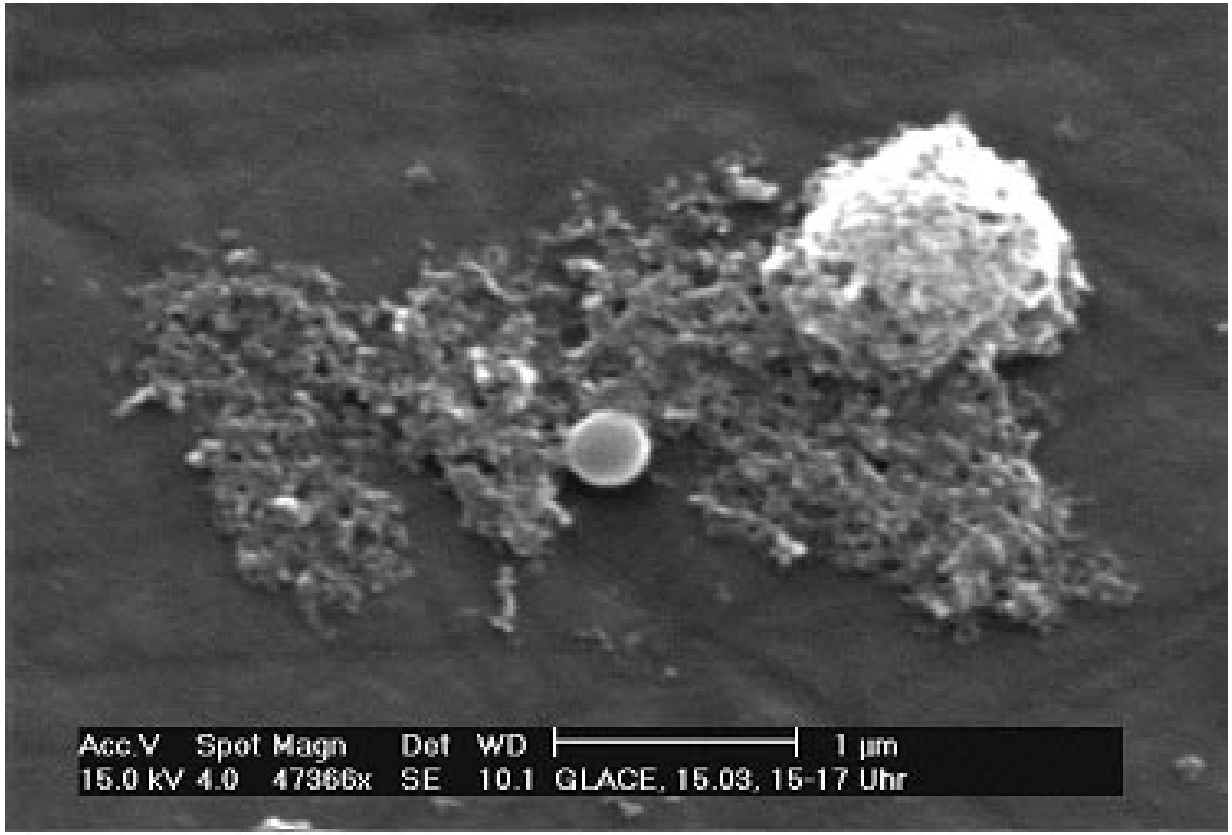
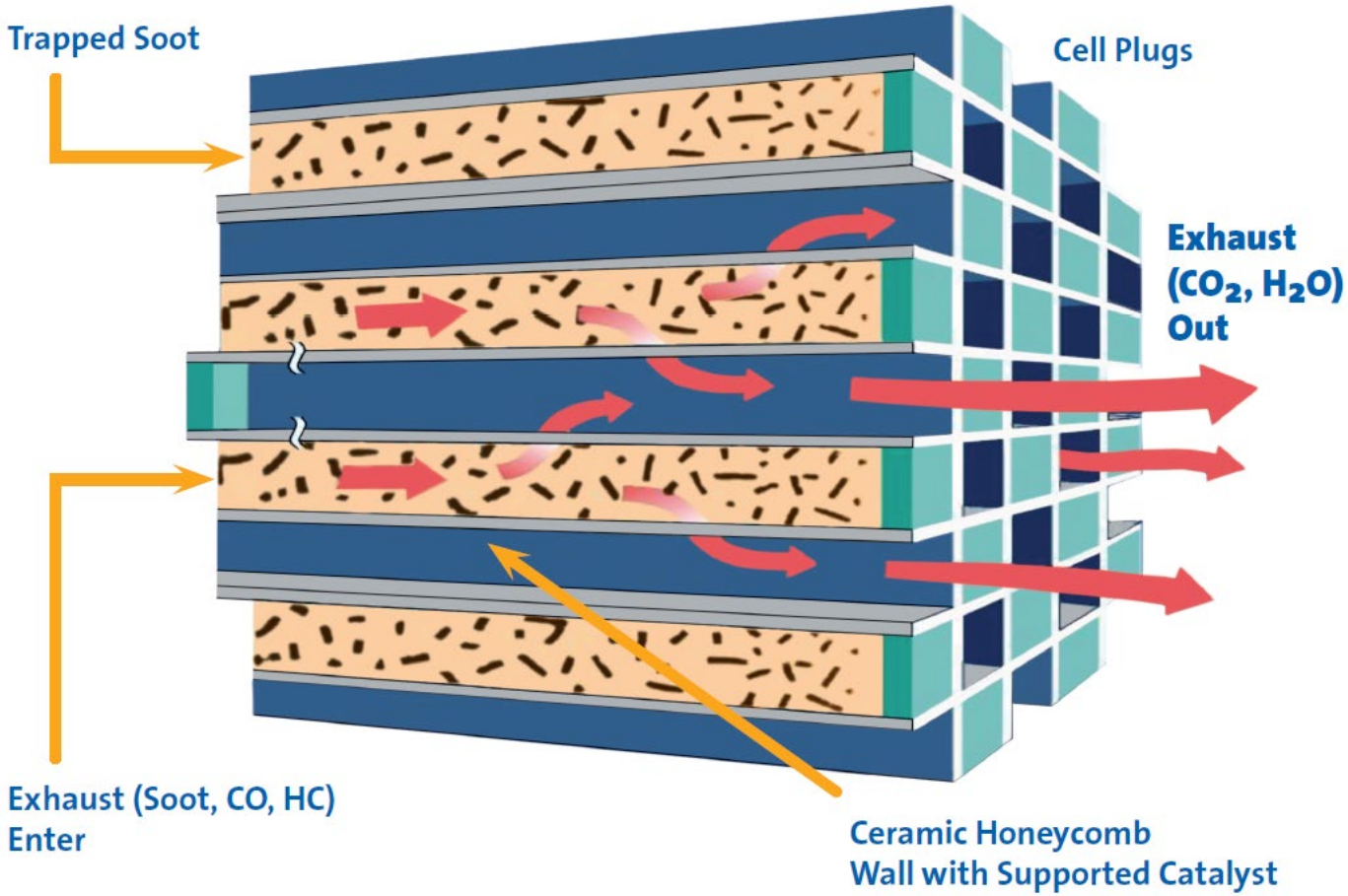


Figure 2: Secondary electron image of a typical soot agglomerate.

DPF-Technology

- The wall-flow concept



Regenartion methods

- DPF with passive regeneration
  - CRT System
- DPF with active regeneration
  - fuel burner
  - HC-dosing
  - electric heating
  - fuel additive
- DPF with no regeneration
  - only for short time opperation

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passive regeneration

- CRT-concept
  - continuously regeneration technology
  - catalytic coating with platinum
  - oxidation of carbon to CO_2
  - side effect oxidation of HC and CO aswell to CO_2 ans H_20
  - automatic regeneration starting at 250° C
  - Tehag product CWF-particlefilter

passive regeneration

- Requirements for a propper function:
  - app. 30% of the engine duty exhaust temeratures higher than 250° C
  - Fuelquality DIN EN 590, sulfurcontent max. 350 ppm
  - Use of lubeoil with less ash
  - Maintenance of the engine
  - slight oil consumption
  - propper maintenance of the DPF
  - permanent filter function controll

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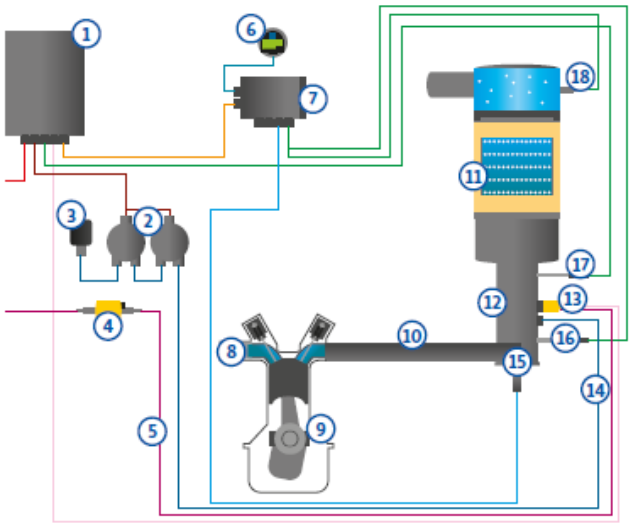
active regeneration

- Fuel burner
  - Injection of Diesel in the Exhaust
  - Ignition by a glow plug
  - Increasing the exhausttemperature up to 650 ° C
  - Burning process of the soot (Carbon)



1 AWF-b CPU
2 Luftverdichter
3 Luftfilter
4 Kraftstoffpumpe
5 Dieselleitung
6 Digitalanzeige – Temperatur/Gegendruck
7 Filterüberwachung
8 Ansaugleitung
9 Motor
10 Abgasleitung
11 Partikelfilter
12 Brennkammer
13 Glühkerze
14 Luftzufuhr
15 Gegendruckmessung
16 Temperaturmessung 1
17 Temperaturmessung 2
18 Temperaturmessung 3

active regeneration

- Requirements for a propper function:
  - Fuelquality DIN EN 590, sulfurcontent max. 350 ppm
  - Use of lubeoil with less ash
  - Maintenance of the engine
  - slight oil consumption
  - propper maintenance of the DPF
  - permanent filter function controll
  - heat insulation

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NOx-reduction

- SCR-technology
  - Selective catalytic reduction
  - longterm proven solution to reduce NO & NO_2
  - Urea (Ad-blue) as reactant
  - Catalyst with special coating
  - Automatic control for the injection of Urea
  - Retrofitsolution without connection to the engine control
  - Working temerature approx. 220° C

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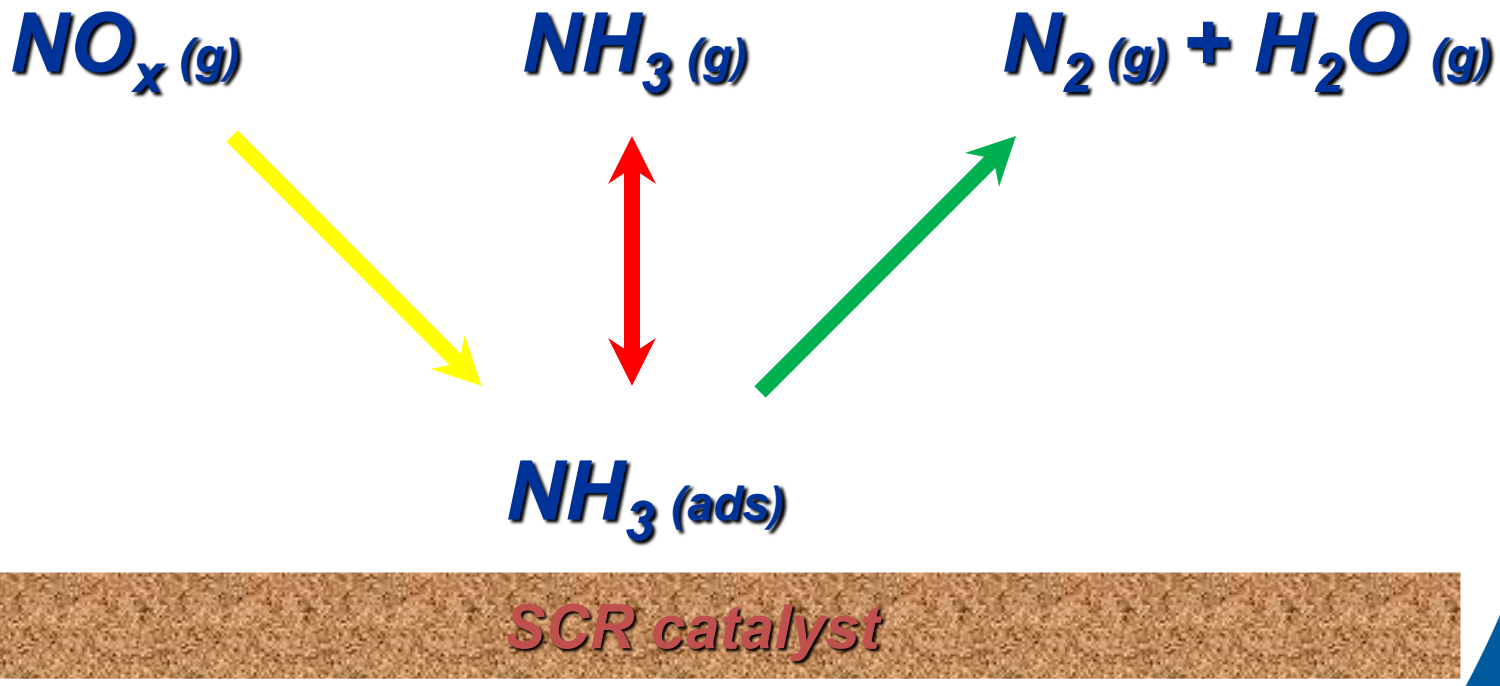
NOx-reduction

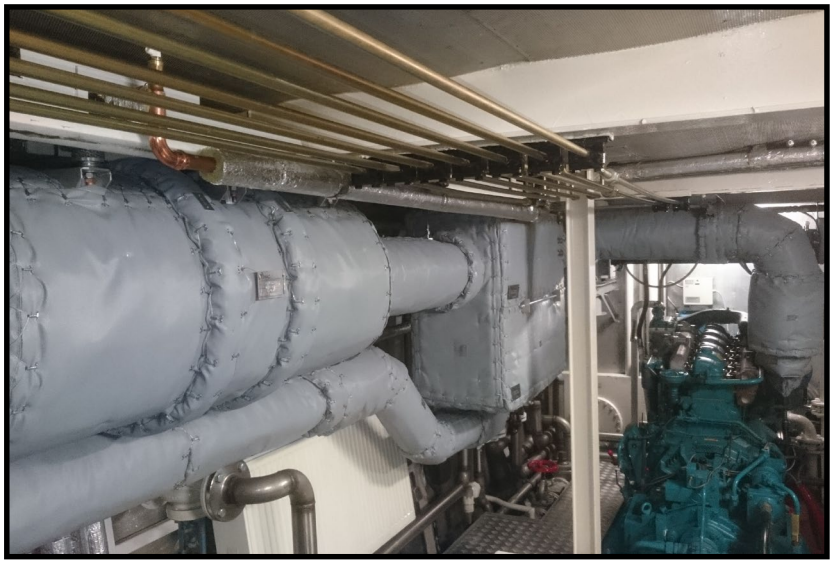
- Principal of operation:



- $4\ NH_3 + 4\ NO + O_2 \rightarrow 4\ N_2 + 6\ H_2O$
- $4\ NO_2 + 8NH_3 \rightarrow 7N_2 + 12H_2O$

Examples

- MS Max Prüss



- Engines 2x MAN D2876 / 250 kW each
- Systems installed 2015

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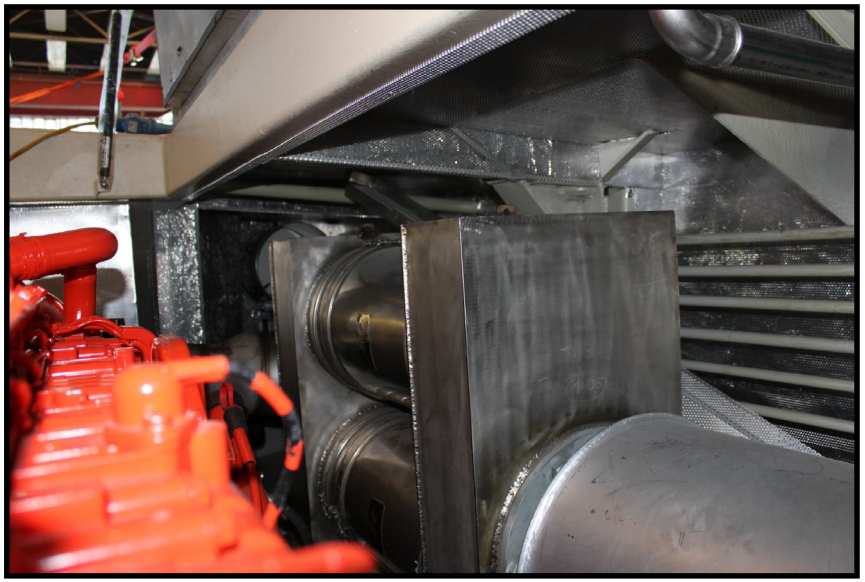
Examples

- MS Linz



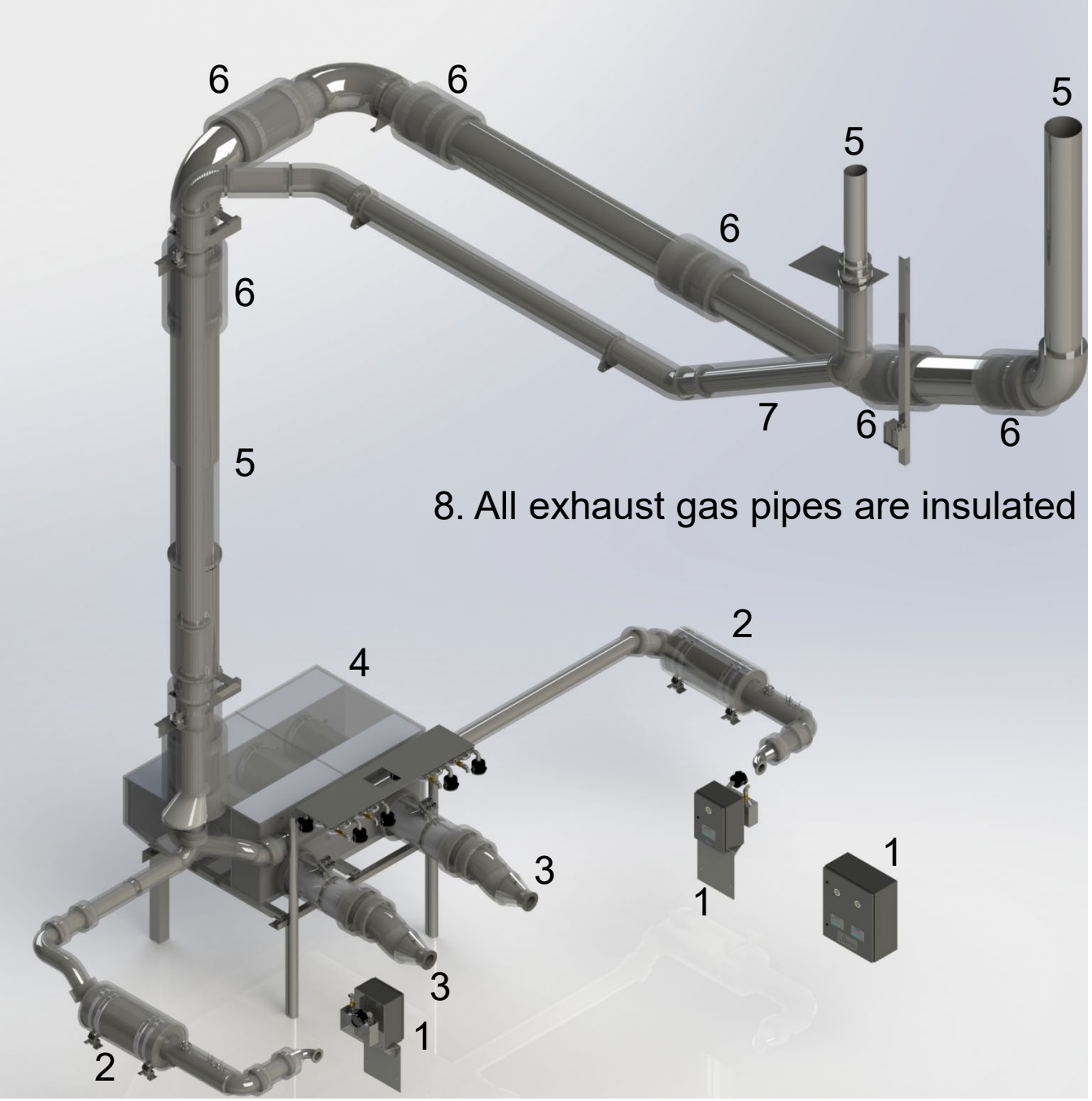
- Engines 2x Scania DI 13 / 331 kW each
- Systems installed in 2012
- In total 6 boats were made

Examples

Examples

- LS Fritz

- Engine Scania DI 13 331 kW
- System installed 2016



1. Control Cabinet
2. Sootfilter for Auxilliary engines
3. Active Diesel Burn
4. Sootfilter for Main Engines
5. Exhaus Gas Piping Main Engines and Auxilliary engines
6. Compensator(s)
7. Silencer (planned)
8. Insulation

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conclusion

- Every engine produces harmfull emissions
- There is long term proven aftertreatment technology availble today to reduce soot, NOx, HC & CO very effective
- Selection of the technology depending of the operating conditions
- Propper function also depending on the maintenence of the engine
- **Fuel and lubeoil quality very important**

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Thanks a lot for your attention!

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