

Hug Engineering AG

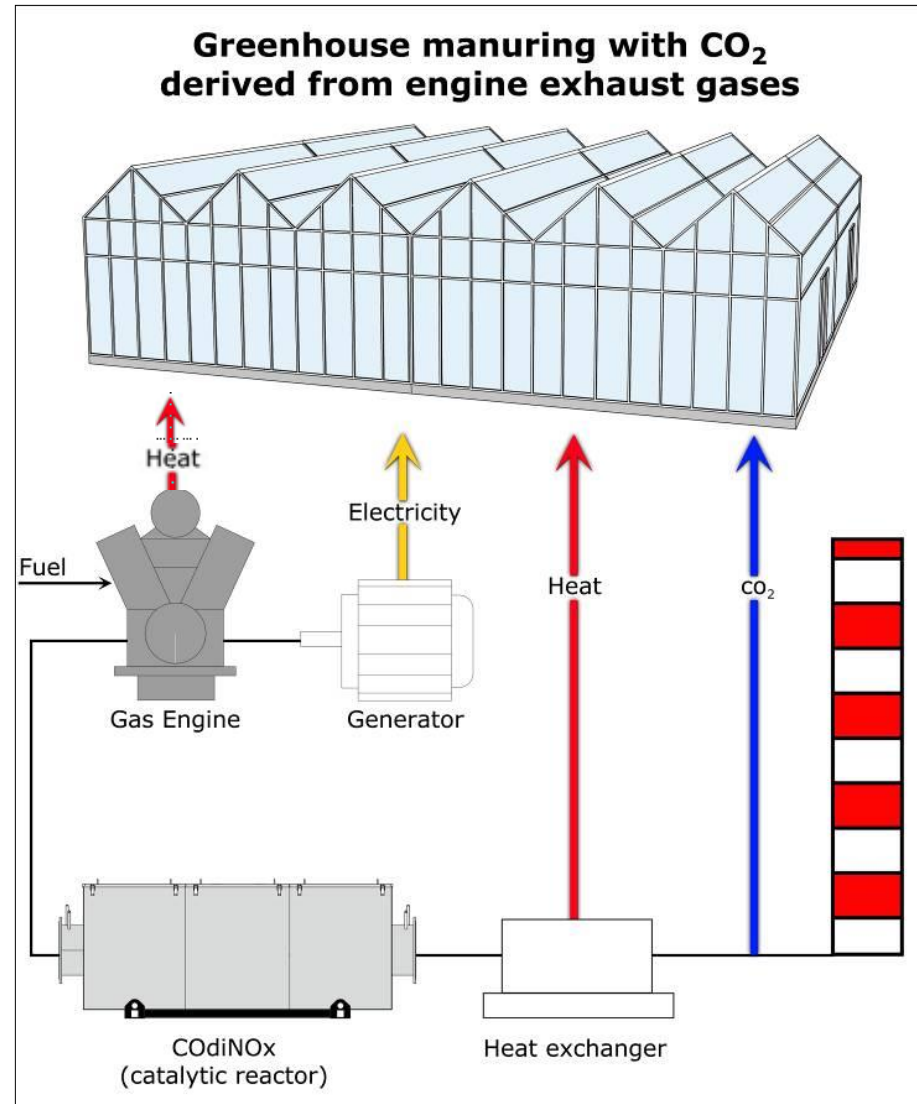
The one-stop-shop for DPF-Technology



Thomas Walter, PU OEM/Retrofit
Conference PPP Elimination of Ultrafine Particle Emissions in Iran
Tehran April 15th/16th, 2015

Starting Point of Hug Engineering AG

Turning Engine Exhaust Gas into Flowers ...



Greenhouse Application, CO₂ Fertilisation COdiNOx System 200 - 6`000 kW



Hug Engineering AG Company Presentation

hugengineering.
A Company of the ElringKlinger Group

We reduce emissions



Milestones and History of Hug Engineering AG

- 1983** Company foundation by Hans-Thomas Hug
- 1988** First urea operated DeNOx plant, EW Schaffhausen
- 1991** First SCR ship application, Aurora of Helsingborg
- 1992** First patent for exhaust gas purification
- 1993** First COdiNOx installation, Zuurbier NL
- 2002** Relocation from Weisslingen to Elsau
- 2003** First serial order for DPF on locomotives, Am843
- 2005** First DPF installation on megayacht, White Rose of Drachs
- 2011**  Group takes over majority of Hug Engineering AG
- 2013** Hug USA becomes market leader in onroad DPF retrofit in the U.S.

30 years of innovation

30 years entrepreneurial spirit

30 years reliable systems

PRODUCT DEVELOPMENT



1988: First urea operated DeNOx plant, 4.4 MW, EW Schaffhausen



1991: First SCR ship application, Aurora of Helsingborg



1993: First COdiNOx installation, Zuurbier NL



2003: First serial order for DPF on locomotives Am843



2005: First DPF installation on megayacht, White Rose of Drachs



2012: DPF-SCR emission control system with CleanCoat for construction machinery

DEVELOPMENT OF THE COMPANY



1983: Founding of Hug Engineering by Hans-Thomas Hug



1984: Reorganisation into stock corporation (AG)



1991: H+S Metallbau founded (metal construction company)



1992: First patent for exhaust gas purification



1999: Founding of Hug Engineering GmbH, Germany



2002: Relocation from Weisslingen to Elsau



2006: Stock holding COdiNOx Beheer B.V., The Netherlands



2007: Founding of Hug Engineering SPA, Italy



2008: More than 230 employees



2009: Founding of Hug Engineering Inc. USA



2011: ElringKlinger Group acquires 2/3 of the shares of Hug Engineering

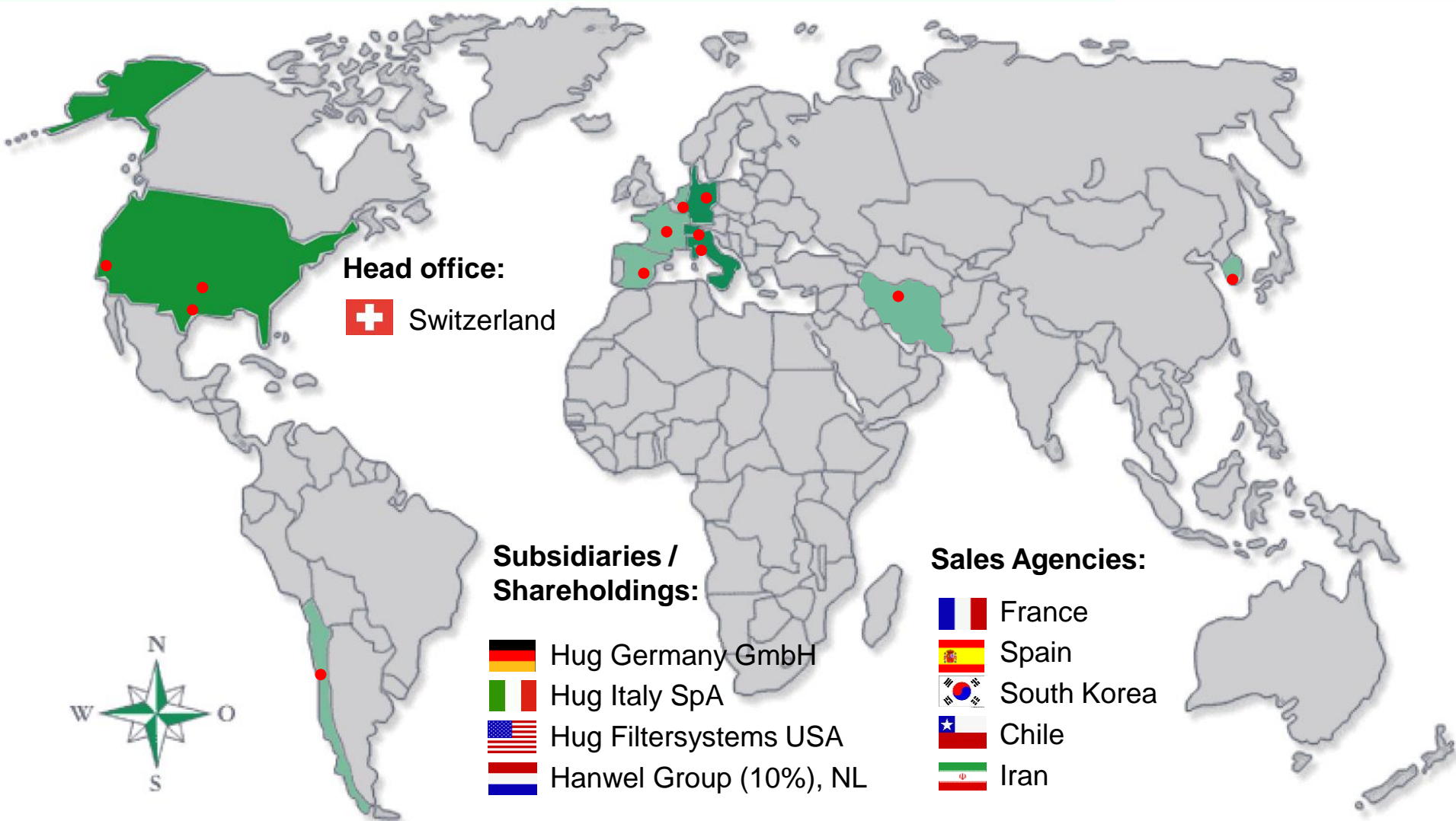


2013: Hug USA is on the way to become market leader in Onroad DPF retrofit

Key figures Hug Group 2014 (2013)

■ Sales ElringKlinger Group	€ 1'325 Mio. (€ 1'176 Mio.)
■ Employees ElringKlinger (31.12.14)	7'255 (6'716)
■ Sales Hug Gruppe	€ 82.6 Mio. (€ 67.4 Mio.)
■ Employees Hug Group (31.12.14)	216 (202)
thereof in Switzerland	176 (166)
■ Investments	€ 2,0 Mio. (€ 1.6 Mio.)
■ R&D expenditure	€ 4,4 Mio (€ 3,5 Mio.)
■ Equity Ratio	72,5 % (53,9%)
■ Shareholder Structure	93,7 % ElringKlinger 6,3 % M. Hug

Hug Engineering AG worldwide



One-Stop-Shop in Exhaust Gas Aftertreatment

R&D

development,
ceramics, catalytics,
apparatus, software (e.g.
regeneration strategy),
design engineering



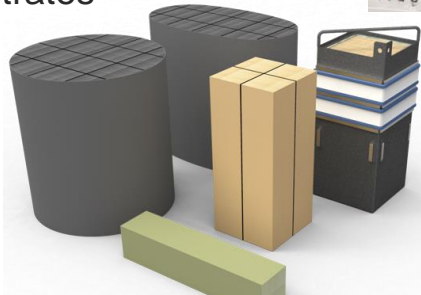
Sales

Sales,
marketing,
consulting



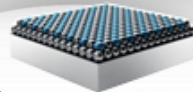
Ceramic Production

production
filter and catalysis /
substrates



Coating

catalytic coating of filters and
catalysts



CSS + COM

installation,
customer service,
spare parts
worldwide



Canning

canning,
filter housings,
converter assembly



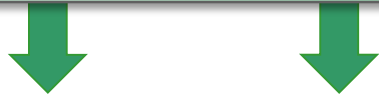
Equipment Production

software, components for steering,
dosing and regeneration



Product Units and Applications

Product Unit Stationary



combikat™

Electrical power plants
Combined heat- and power plants



COdiNOx™

Greenhouses
(CO₂- Fertilisation)

Product Unit Mobile



mobiclean™

Rail applications
Locomotives
Track construction
Railcars



nauticlean™

Yachts
Inland water vessels
Other ships



marine

Vessels
Cruise liners
Cargo ships

Product Unit OEM/Retrofit



OEM



mobicleanR™

On-/Off-Road Applications
Construction Machinery
Agricultural Machinery
GPU's

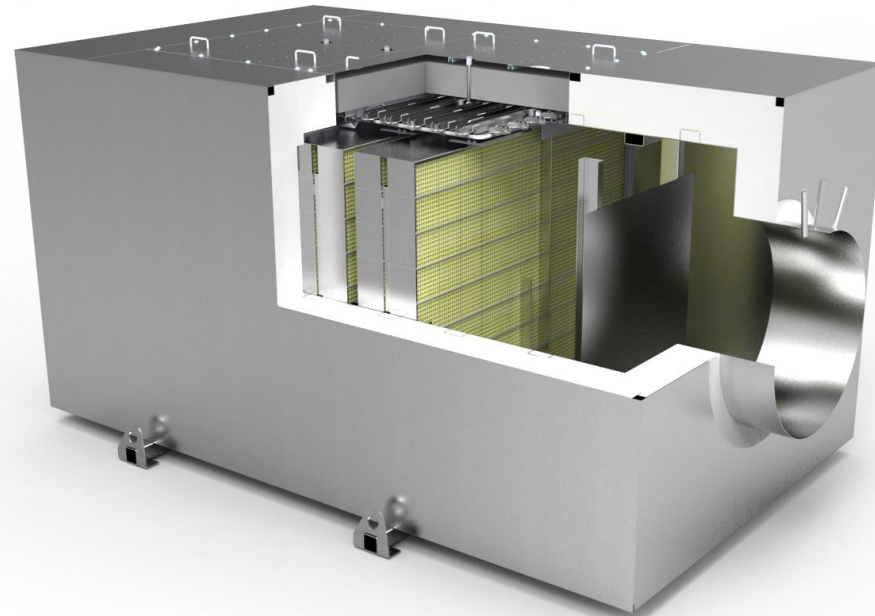
Retrofit



mobicleanR™

Trucks
Busses
Construction Machinery
Agricultural Machinery

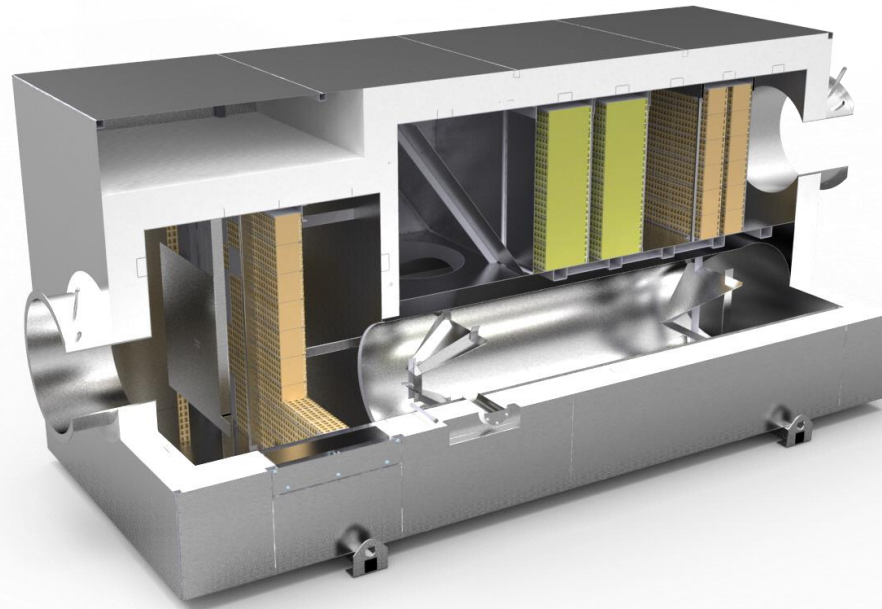
combikat for Stationary Applications



CODiNOx

For Greenhouse Applications

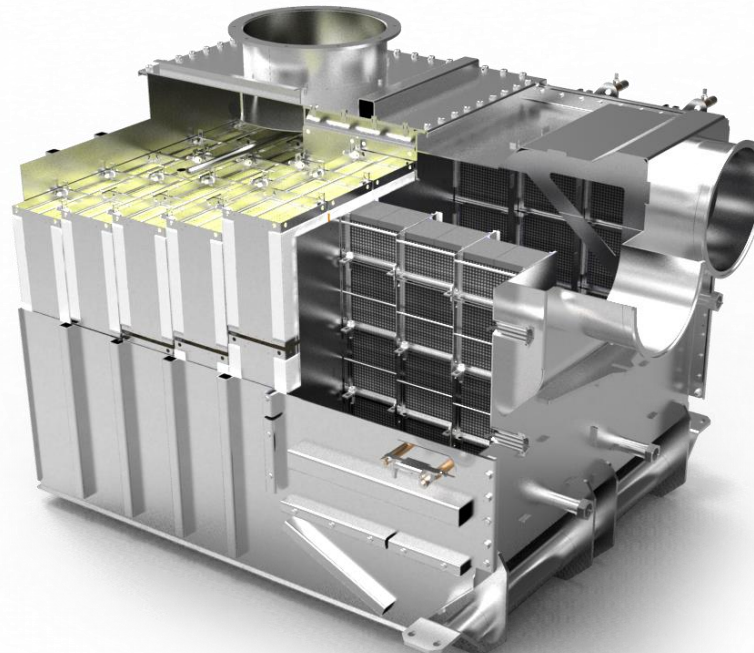
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CODiNOx™

mobiclean For Rail Applications

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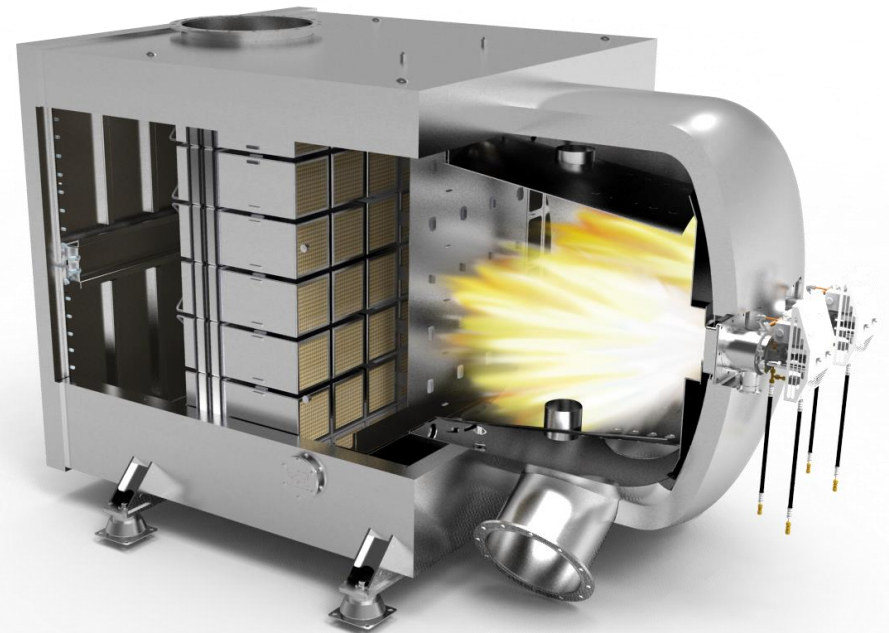


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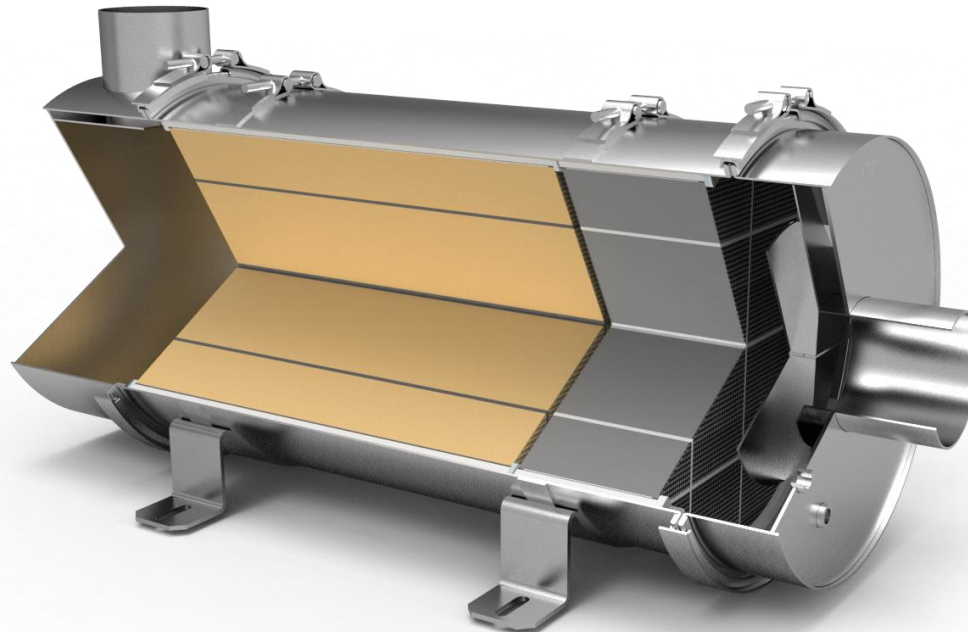
Facts:

- DPF with active regeneration
- fuel up to 5'000 ppm Sulphur
- temperature control exh.gas 550°C
- certification from Lloyds Register



mobiclean R

DPF for On- and Offroad Applications

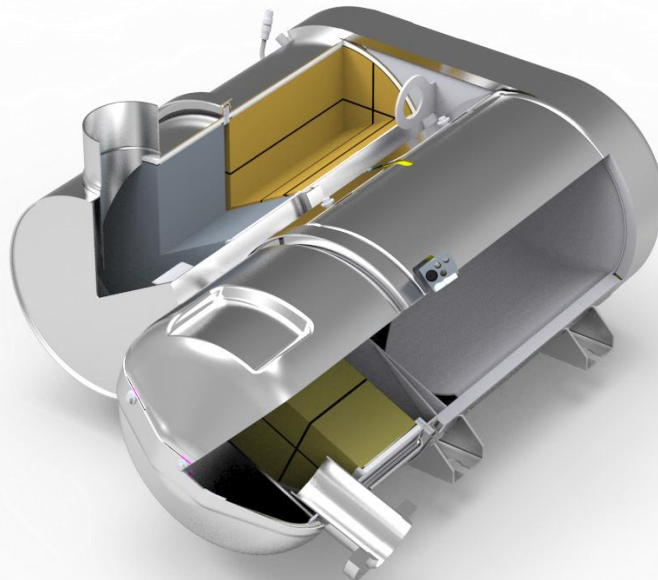


mobiclean R™

mobiclean ASCR

DPF and SCR for On- and Offroad Applications

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mobiclean R™

Certifications



**DIN ISO 9001 und ISO 14001:
Quality Management and Environmental Management**



Suitability certificate for welding of rail vehicles and rail vehicle parts as per EN 15085, CL 4



Certification about the filtration efficiency of our filters

*VERT (Verminderung der Emissionen von Real-Dieselmotoren im Tunnelbau)



German Lloyds and Lloyds Register „Marine Design Appraisal Document“



General type approval (ABE, Allg. Betriebserlaubnis) as per annex XXVII § 48 Abs.2 and annex XIV Nr.3.4 StVZO, Germany



CARB (USA), Californian Air Resources Board



Omologati per l'Italia (DM 39 del 25.01.2008)



RPC = Reduced Pollution Certificate

History of DPF-Systems for Construction Machinery

'Historic' Project on Construction Machinery

First Application of Diesel Particulate Filter (fabric) on Bulldozer (1994):

Facts:

- passive regeneration
- fuel ~1'500 ppm Sulphur



Current DPF-Retrofit Applications

DPF-Retrofit for Public Buses in Italy

- Retrofit Project in 2010-2012
- Retrofit for Buses in Lombardia (Milano, Brescia, ...)
- DPF (CRT) with Vanadia-Coating on (SIC)
- Totally ~1'500 filters installed, 95% still in operation



DPF-Retrofit for Trucks in US

- Retrofit for Trucks MY 1991-2006 in CA, NY, TX
- Diesel Particulate Filters (CRT) with CleanCoat on SIC
- Totally > 12'000 filters sold so far
- Market share 2014 of Hug in CA 43% (market leader)



DPF-Retrofit for GPU's at Zürich Airport

- Protection of ground personnel working around GPU
- Diesel Particulate Filter with active regeneration
- Regeneration with electrically operated heater

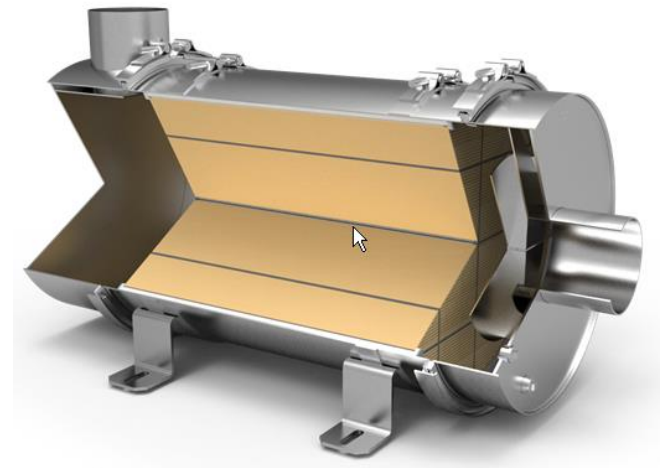


DPF-Solutions for First-Fit and Retrofit in Iran

mobiclean R Filter System

Basic Characteristics of Filter:

- Substrate material is Silicon Carbide (SiC), Mullite in preparation
- Catalytically coated
- Cell density 100 or 200 cpsi
- Soot filtration rate > 99%
- Available as
 - [- CRT-System (passive regeneration)]*
 - with burner (active regeneration)



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* for longterm durability max. Sulphur content of fuel is 50 ppm

Proposal for Iran

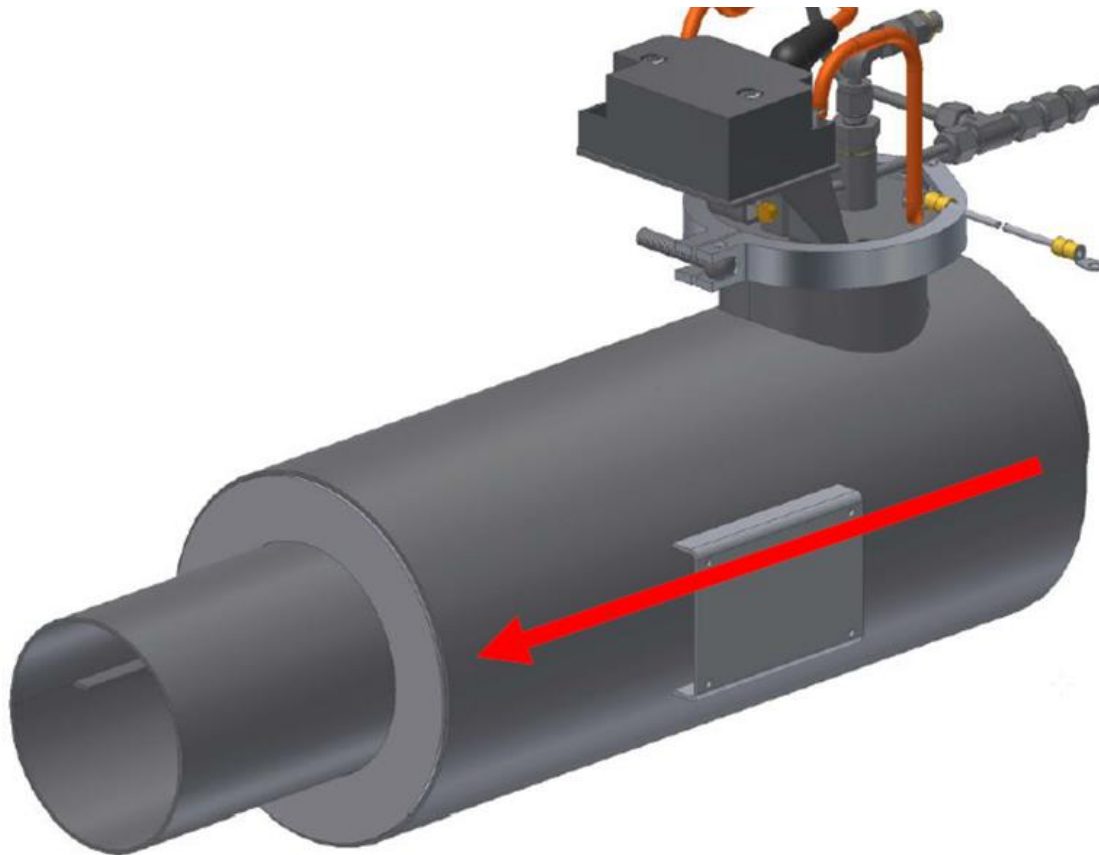
Active DPF-Regeneration with Full Flow Burner

Specifications/Procedure:

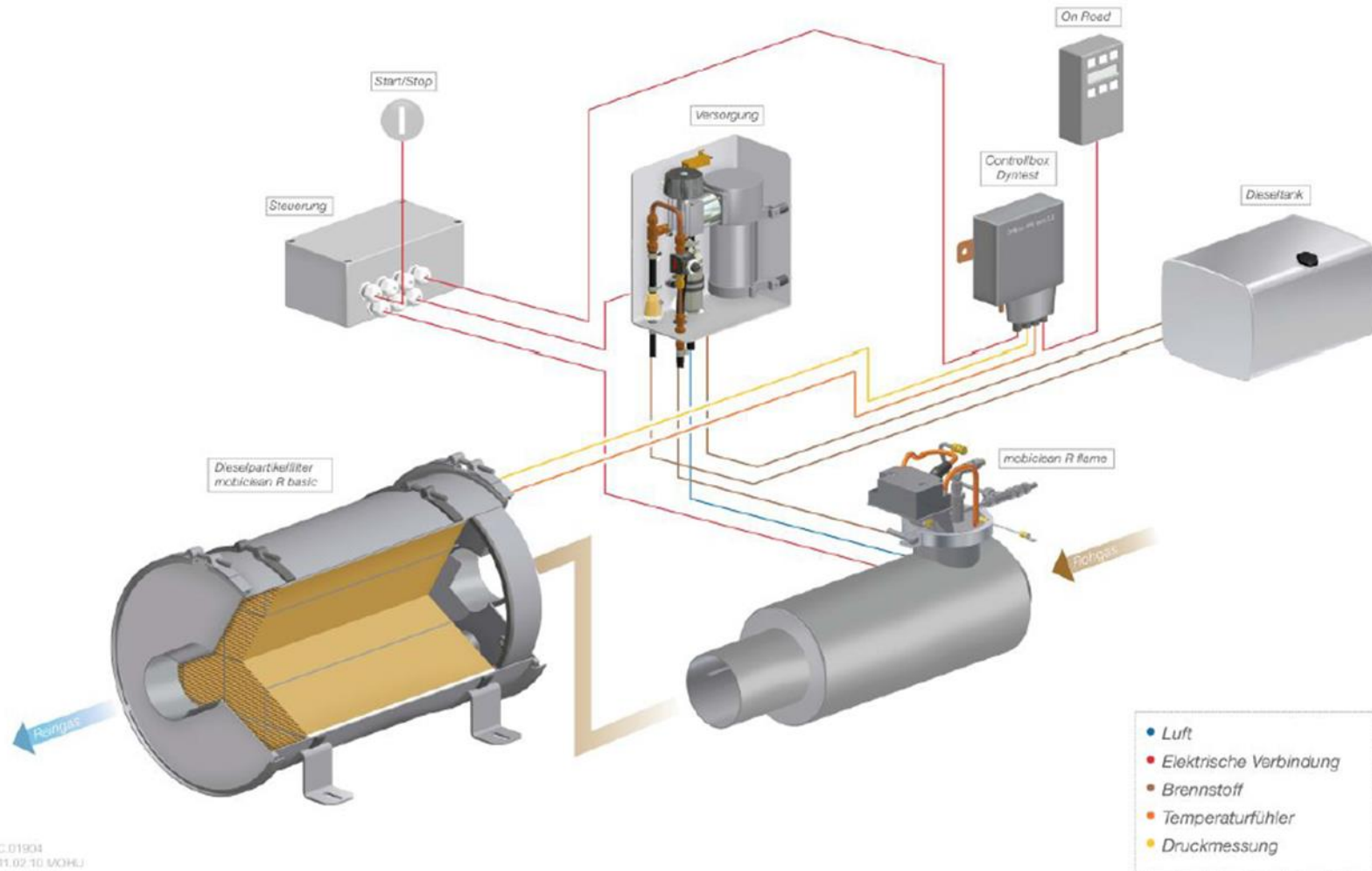
- For engine power range of 50 to 400 kW
- For fuel sulphur content < 10'000 ppm
- Automatic activation of regeneration
- Normal operation of engine (no derating) under regeneration
- Active regeneration takes about 10-15 min.
- Increase fuel consumption of vehicle by about 1 - 2 %

Active DPF-Regeneration with Full Flow Burner

Full Flow Burner for Truck-Applications (schematic):
(available Q4/'15)



Active DPF-Regeneration with Full Flow Burner



Hug Representative in Iran TMC



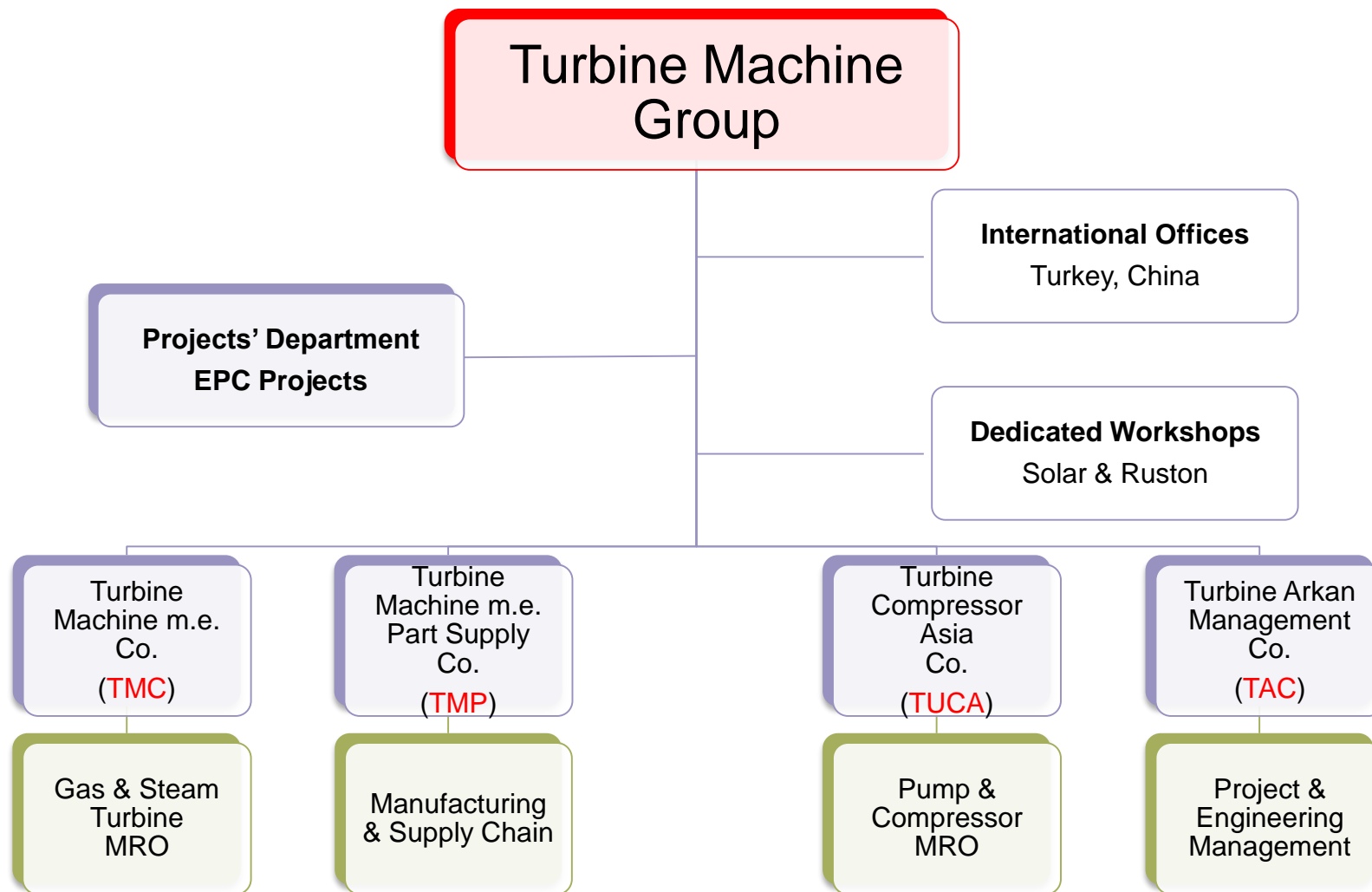
Turbine Machine m.e. Co

- Privately Owned & Established in 2002
- Employee: 143 (PhD:17, MS: 31, BS: 58, Technicians: 37)
- Integrated total solution for gas&steam turbines, pumps, compressors
 - ✓ MRO of Rotating Equipment in Iran
 - ✓ Reverse Engineering, Re-Engineering & Consulting
 - ✓ Packaging and Retrofit
 - ✓ Manufacture & Networked Supply Chain
 - ✓ Design, Analysis, & Engineering
 - ✓ Dedicated Workshops





Hug Representative in Iran



Thank you very much for your attention!



Hug Engineering AG
Environmental technology &
Exhaust Gas Purification Systems

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