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, CO$_2$ Fertilisation
COdiNOx System 200 - 6`000 kW
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.

**PRODUCT DEVELOPMENT**
- 1983: First urea operated DeNOx plant, 4.4 MW, CW Weisslingen
- 1991: First SCR ship application, Aurora of Helsingborg
- 1992: 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 CleanCost for construction machinery

**DEVELOPMENT OF THE COMPANY**
- 1983: Founding of Hug Engineering by Hans Thomas Hug
- 1984: Reorganisation into stock corporation (AG)
- 1986: hi-S Metaltech founded (metal construction company)
- 1990: First patent for urea SCR gas purification
- 1996: Founding of CodiNOx, Dillingen, Germany
- 2002: Relocation from Weisslingen to Elsau
- 2006: Stock holding CodiNOx Industrial B.V., The Netherlands
- 2008: More than 300 employees
- 2010: Founding of Hug Engineering Inc., USA
- 2011: ElringKlinger Group acquires 51% 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

Head office: Switzerland

Subsidiaries / Shareholdings:
- Hug Germany GmbH
- Hug Italy SpA
- Hug Filtersystems USA
- Hanwel Group (10%), NL

Sales Agencies:
- France
- Spain
- South Korea
- Chile
- Iran
One-Stop-Shop in Exhaust Gas Aftertreatment

**R&D**
do development, ceramics, catalytics, apparatus, software (e.g. regeneration strategy), design engineering

**Sales**
Sales, marketing, consulting

**Ceramic Production**
production filter and catalysts / 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**
- Electrical power plants
- Combined heat-and-power plants
- Greenhouses (CO₂- Fertilisation)

**Product Unit Mobile**
- Rail applications
- Locomotives
- Track construction
- Railcars
- Yachts
- Inland water vessels
- Other ships

**Product Unit OEM/Retrofit**
- Vessels
- Cruise liners
- Cargo ships
- On-/Off-Road Applications
- Construction Machinery
- Agricultural Machinery
- GPU’s

**OEM**
- mobiclean™
- mobicleanR

**Retrofit**
- Trucks
- Busses
- Construction Machinery
- Agricultural Machinery
combikat
for Stationary Applications
COdiNOx
For Greenhouse Applications
mobiclean
For Rail Applications
nauticlean
DPF for Ship Applications

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 ASCR
DPF and SCR for On- and Offroad Applications
## Certifications

<table>
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<tr>
<th>Certification</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>ISO</strong></td>
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<tr>
<td>SVS X ASS</td>
<td>Suitability certificate for welding of rail vehicles and rail vehicle parts as per EN 15085, CL 4</td>
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<tr>
<td><strong>VERT</strong></td>
<td>Certification about the filtration efficiency of our filters</td>
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<tr>
<td>German Lloyds and Lloyds Register „Marine Design Appraisal Document“</td>
<td></td>
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<td><strong>Lloyd's Register</strong></td>
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<td><strong>GL Group</strong></td>
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<tr>
<td>KBA</td>
<td>General type approval (ABE, Allg. Betriebserlaubnis) as per annex XXVII § 48 Abs.2 and annex XIV Nr.3.4 StVZO, Germany</td>
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<td><strong>CA.gov</strong></td>
<td>CARB (USA), Californian Air Resources Board</td>
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<td><strong>Italy</strong></td>
<td>Omologati per l'Italia (DM 39 del 25.01.2008)</td>
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<tr>
<td><strong>United Kingdom</strong></td>
<td>RPC = Reduced Pollution Certificate</td>
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History of DPF-Systems for Construction Machinery
‘Historic’ Project on Construction Machinery


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, Brecia, ...)
- 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)

* 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
Hug Representative in Iran

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

Turbine Machine Group

Projects’ Department
EPC Projects

International Offices
Turkey, China

Dedicated Workshops
Solar & Ruston

Turbine Machine m.e. Co. (TMC)
Gas & Steam Turbine MRO

Turbine Machine m.e. Part Supply Co. (TMP)
Manufacturing & Supply Chain

Turbine Compressor Asia Co. (TUCA)
Pump & Compressor MRO

Turbine Arkan Management Co. (TAC)
Project & Engineering Management

International Offices
Turkey, China

Dedicated Workshops
Solar & Ruston

Turbine Machine m.e. Co. (TMC)
Gas & Steam Turbine MRO

Turbine Machine m.e. Part Supply Co. (TMP)
Manufacturing & Supply Chain

Turbine Compressor Asia Co. (TUCA)
Pump & Compressor MRO

Turbine Arkan Management Co. (TAC)
Project & Engineering Management
Thank you very much for your attention!