Welcome to Dinex
Dinex presentation

- Company structure
  - Products
  - Technology
  - World class manufacturing
  - Medium Duty/Heavy Duty
  - Large Engines/Industrial
  - Summary
Dinex Scope of Supply

Insulation techniques
Keeping heat inside or outside. 800 degrees inside and 250 outside.

Flex pipes & bellows
Well known 2-S flex pipes are in production. In addition, we have developed a low-leakage flex hose for emission applications.

Clamps
A complete new range of low-leakage clamps “tight-fit”.

Silencers
Lock seamed, stamped or welded units. We supply alu. or stainless steel in 125 different sizes today with own tooling shop.

Emission technologies
Particle filters and SCR cats can be installed into our silencer systems.

Exhaust fittings
All fittings are made in-house for complete systems supply.

Pipes
Bending from 22 mm to 152.4 mm in alu or stainless steel.
Going the extra mile

Leading OEM supplier of exhaust and emission systems for the heavy duty industry and industrial equipment.

Act as global and local production, logistic and development partner.

- Trucks – CNG Trucks
- Buses – CNG Buses
- Construction
- Agricultural
- Marine
- Trains & locomotives
- Large stationary
Dinex Group 2013

Employees 1100
Companies 20
Turnover 200 MEUR
Global, but local

- **Dinex A/S, Middelfart, Denmark**
  - 110 employees, 20.000 m²

- **Dinex Deutschland GmbH, Hassloch, Germany**
  - 110 employees, 6.500 m²

- **Dinex Latvia, Jelgava, Latvia**
  - 285 employees, 16.000 m²

- **Dinex Turkey, Çerkezköy, Turkey**
  - 250 employees, 10.000 m²

- **Dinex Inc., Dublin GA, U.S.A.**
  - 30 employees, 5.600 m²

- **Dinex Clamps, Stonyhurst, UK**
  - 20 employees, 1.000 m²

- **Dinex Ecocat OY, Vihtavuorie, Finland**
  - 100 employees, 6.000 m²

- **Dinex RUS, Gatchina, Russia**
  - 100 employees, 3.500 m²

- **Dinex, Changzhou, China**
  - 90 employees, 10.000 m²
Aiming for the best

Advanced production methods reduce the risk of the human factor and ensure high levels of repeatable output.

Quality is an attitude
Dinex holds a number of certifications, amongst which ISO 9001, 14001 & TS16949 are the most prominent.
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Complete technology provider

Tail pipe
Flow plates
Mixers
Pipe bending

Diesel Oxidation Catalysts (DOC)
Diesel Particulate filters (DPF)

Decoupling
Insulation techniques
Urea injections
SCR Catalysts
Clamps & brackets
DiNLOG ECU

Diesel injection modules

PTS – Pipe Treatment System

- Flex & Bellows
- Straps & Clamps
- Pipe bending with integration of mixer and dosing
- Insulation
ATS – After Treatment System

Cordierite

SiC

Metal substrates

Canning

Coatings

Electronics & ECU

System integration

Coatings
Product innovations 2013-2015

- Flex hoses D3S 2013
- Bellows 2014
- Urea doser 2013/2014
- Cordierite substrate and coating SCR, DPF and DOC 2013/2014
- HP-SIC (Dinex SCR) 2015 – one brick

DOC, DPF and SCR systems as one-box solution & modular systems

95% in-house production
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Exhaust Engineering

- **Insulation**
  - Optimised by FEA, CFD & thermal IR testing

- **Canning**
  - Optimised by FEA, hot shake & pull out testing

- **Mixing**
  - Injection, spray, mixer & distribution optimized by multiphase CFD and distribution measurements

- **Clamping & decoupling**
  - Optimised by FEA, hot shake & leakage testing

- **Materials**
  - Optimised by FEA, hot shake & salt spray testing
CFD, FEA & Acoustics

**CFD**
- Flow uniformity index
- Flow distribution
- Backpressure
- Ammonia (NH₃) uniformity index
  
The CFD software is correlated with the FTIR measurements

**FEA**
- Stress distribution
- Natural frequencies
- Mode shapes
  
The FEA software is to be correlated with the hot shake test

**Acoustics**
- Transfer matrix
- Transmission loss
- Insertion loss
  
The NVH software is correlated with the flow rig
Dinex Technology Center

Unique position
Built to meet Dinex’s position as the World’s leading exhaust engineering technology provider.

- CFD – Backpressure @ the substrate boundary
- CFD – Urea injection and ammonia distribution
- CFD – Velocity streamlines
R&D Centre

Engine cells
- Two Horiba engine test stands for engines up to 600 kW.
- Full transient and stationary test capability - ETC, FTP, ESC, ISO8178, Dinex 5-mode.
- Installation of customer engines.
- Development and test of silencers and emission technologies.

Chassis dyno
- MAHA 72” roller chassis dyno for vehicles up to 30 tonnes and 470 kW.
- Simulation of stationary cycles or transient real world driving cycles, such as: FTP, ETC, Braunschweig etc.
- One of only a handful 72” dyno’s in operation in Europe.
Advanced test center

**Reverberation chamber**
- 920m³ and 156 m²
- 9° between opposite surfaces

**Test objects up to 20m³ volume**
**Brüel & Kjær measuring equipment**
- 6 microphone array, Ø 6.57m
- Frequency analysis: 1/3 octave, 50Hz - 8kHz
- Sound power measurements, ISO 3743
- Sound attenuation, ISO 11820
- Near-field measurements
- Spark arrestor testing

**Hot shake test cell**
- 60 kN shaker with slip table
- Up to 200 kg in all three directions while hot gas is passed through the test object
- Cycles will include random, sine, SoR, shock and bump tests
Competitors
- From 8 suppliers to 1 (Dinex)

Canning & Acoustics
- Donaldson
- Nelson Global
- Eberspächer
- Tenneco
- Faurecia
- Cornaglia
- RTA
- CES

Substrates / Ceramics
- Corning
- NGK
- Emitec
- EcoCat
- Haldor Topsøe
- Ibiden

Coatings
- BASF
- Johnson Matthey
- Umicore
- Ecocat

Dosing
- Bosch
- Emitec
- Albonair
- Cummins

Insulation
- Thermamax
- GH Isolite
- Wenth SIT

ATS solutions
- PTS components
- Pipe bending
  - Fomego
  - VDL
  - Sarzi
  - Cortubi
  - ATZ
  - Nelson Global
- Bellow / Flexible hose
  - Witzenmann
  - BOA
  - TruFlex
  - Westfalia
  - Senior
- DOC
- DPF
- Injection
- Hydro. CAT
- SCR
- SCR SLIP-CAT
- Sound-attenuation
- Urea
- Dosing / ECU
- Ejector
Cost Optimization

- Decoupling (new patent 2014)
  - New designs – direct flaring
  - Leaktight and less weight
  - Thermal management

- Insulation
  - Optimized process and design

- Thinner pipe and 1D bending

- Clamp
  - Better designs than competitors
  - Leaktight

- Improved system integration
- Assembly, less space requirement
- Less substrates
Dinex EcoCat acquisition

<table>
<thead>
<tr>
<th>Metallic Substrates</th>
<th>Products</th>
<th>Application Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>EcoCat® substrate</td>
<td>Metallic Substrates</td>
<td>P&amp;LCV</td>
</tr>
<tr>
<td>EcoXcell® substrate</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>POC® (Particle Oxidation Catalyst substrate)</td>
<td>Particle Oxidation Catalyst (POC)</td>
<td>✔</td>
</tr>
<tr>
<td>Open Foil Coated (OFC) substrate</td>
<td>Open Foil Coated (OFC)</td>
<td>✔</td>
</tr>
</tbody>
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Applications

- Diesel Oxidation Catalyst (DOC)
- EcoFilter – Diesel Particulate Filter (DPF)
- Selective Catalytic Reduction (SCR)
- Three-way catalyst for gasoline
- Natural gas engine catalyst

- Balanced product portfolio for complete after-treatment of diesel, gasoline and alternative fuel applications
- In-house metallic substrates and outsourced ceramic substrates
- Key benefits
  - Metallic substrates: mechanical durability, ease of forming, cost-efficiency
  - Ceramic substrates: thermal properties, cost-efficiency
- Combination of substrate and coating key to achieve optimal operating performance

**Diagram:**

- Urea injection
- DOC
- H-Cat
- SCR
- ASC
- DPF / POC

**Standards:**

- EURO IV
- EURO V
- EURO VI
Product portfolio - Ecocat

- EcoXcell
- EcoCat®
- HydroXcell
- POC®
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We do it ourselves

- PTS
  - Pipes
  - Decoupling
  - Insulation
  - Clamps

- ATS
  - Substrates (Metal, Cordierite & SiC)
  - Coating
  - Canning
  - System integration
Innovative production PTS

Bending & Sawing cell
Low mix – high volume.
Low volume – high mix
also performed

Decoupling elements
2D+ & D3S traditional flex
technologies.
Low leakage COAX and
bellows

Robotic insulation cell
Several insulation
technologies and thickness
in low & high volume

Joints & connections
Low leakage clamps with
and without gaskets.
Range covers all pipe and
emission sizes
Innovative production ATS

Substrates
Silicon Carbide, Cordierite,
HP SIC dual coating,
Metallic.
For DOC, DPF & SCR

Robotic coating
Fast, precise, repeatable.
Coating on all substrate
technologies for DOC, POC,
DPF, SCR, ASC, CNG, Dual
Fuel

Robotic canning cell
High volume cells with
precision welding and
leakage requirements

Full system integration
1 Stop Solution from A - Z
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Dinex EURO VI cleantech

- **Dinex cleantech technology** - *all solutions in one box*

- **DOC** - Pt/Pd coating on a metallic or ceramic substrate

- **DPF** - Base metal- or Pt-coating on a ceramic SiC or Cordierite substrate

- **SCR** - Vanadium or Zeolite based coating on metallic or ceramic substrate

- *SCR Slip-coating in the end*
Dinex EURO V based on EURO VI
Scania EURO IV

35,000 units / year

- EcoCat metallic DOC substrate in mantle sleeving OEM for Scania 9 Ltr. / 11 Ltr. & 12 Ltr. EURO IV EGR engines
- Approved coating formular
EURO V Hydrolizer cat

Complete system cat and canning – 35,000 units yearly volume MAN TG-X series
Kamaz, Russia SCR EU 4 & 5
EURO IV MAZ Belarus

Dinex DOC/POC solution used by Yaroslav Motors in newest high-tech factory built for EURO IV engines in Russia
SCR TIER 4 I – 20,000 units
CNG & Dual fuel systems

Leading CNG EURO V & VI technology with MAN, Scania, Volvo & Daimler.

Complete systems of substrates, coating, pipework and insulation for converting Diesel into Diesel+CNG and Diesel+LPG.
EURO VI Insulation
80% market share EU on pipes and manifolds - vehicle manufacturers & engine companies. Several approved profiles, thicknesses and materials.
Ford EURO VI System

Full system with clamps, pipes, insulation, decoupling & silencer system integration
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Large Stationary (Power Plants)

- Power plants and other large stationary gas- and diesel-powered engines
- A significant source of NOx pollution

World Bank Group - EHS-guidelines:
- Finances construction of power plants in less developed member countries.
- Defines guidelines of NOx-emissions, if none stricter is applicable where the plant is built.

Local legislation applicable in:
- US: Tight NOx & CO limits since 2000
- EU: Tightening NOx & CO in from 7/1-2013
- Also legislation in: India, Japan, Russia
Large Stationary (Power Plants)

- **SCR-systems**
  - ~400 ltr. catalyst volume per MW
  - Modular, ceramic bricks
  - Ammonia Slip-cat (ASC) needed
  - 1 system needed per engine

- **Oxidation catalysts**
  - ~10 ltr./MW
  - Reduces CO & can be engineered to remove CH4
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Summary
Dinex at a glance

All technologies in-house

Long experience track record

Global, but local

Quality is an attitude

The courage, passion & will to win
Thank you for your attention