Troubleshooting Guide

for DOCs, DPFs and SCRs

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going the extra mile

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Troubleshooting Guide

for DOCs, DPFs and SCRs

This technical leaflet should be used as a guide for the correct service of vehicles equipped with Dinex DOC, DPF or SCR/ASC (substrate) systems, but it will never substitute the use of the service manual of the vehicle. The directions and instructions of the vehicle manufacturer must be strictly adhered to.

General information

- Before the substrate is replaced, you must test and diagnose the problem with a Scan tool to exclude all possible sources of errors.
- The use of a Scan tool to read and reset diagnostic error codes is mandatory.
- The tests listed in this manual should be performed before and after replacing any emission system parts. This ensures that the substrates will work correctly when replaced.
- Failure to do this may cause an ATS malfunction after a short period of time. In some cases, this malfunction can cause permanent damage to the new substrate and consequently is not covered by our warranty. It can also damage other parts of the engine such as the turbo, EGR valves, sensors, etc.
- If the diagnosis concludes that the substrate should be replaced, prior to proceeding with the replacement, it is critical to determine and repair the problem that caused the failure of the substrate before the vehicle leaves the garage.
- If the substrate fails due to other problems such as insufficient temperature to perform the regeneration (in case of DPF), low level of additive, incorrect selection of engine oil, etc. and the substrate is damaged before the end of its expected working life (~200,000 km), the causes of those failures must be corrected prior to any replacement procedure. If the causes are not corrected they will inevitably lead to failure of the new substrate that will not be covered by our warranty, as the cause of the failure is not linked to the substrate manufacturing process.

What is a DOC?

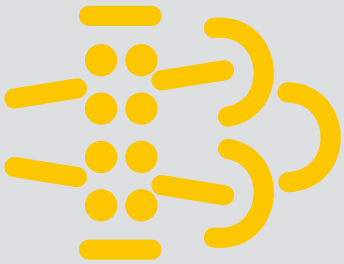
DOC stands for Diesel Oxidation Catalyst.

The DOC oxidizes carbon monoxide (CO) and hydrocarbons (HC) which creates an exothermic reaction that works in conjunction with the DPF by heating the exhaust going into the DPF. This ensures that the exhaust is hot enough to burn the soot into ash in the DPF.

Reactions

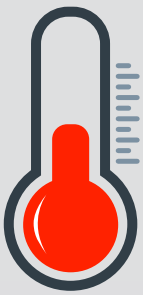
$$2CO + O_2 \rightarrow 2CO_2$$
$$C_xH_{2x+2} + [(3x+1)/2]\ O_2 \rightarrow x\ CO_2 + (x+1)$$
$$2NO_2 + C \rightarrow 2NO + CO_2$$

How Does a DOC Work?



When an active or manual regen is required, the HC (hydrocarbon) injector adds a bit of fuel into the exhaust system.

The HC injector is also called the fuel doser or after treatment injector.



The dosed diesel goes onto the DOC, which, by catalytic reaction heats up the DPF.

When Do You See Failures in the DOC?

Typically, it is not the DOC that fails, but a failure happens upstream. This causes the DOC to stop working and you get cool regen.

Common Upstream Failures

The HC injector clogged. Fuel can mix with soot to clog the injector.

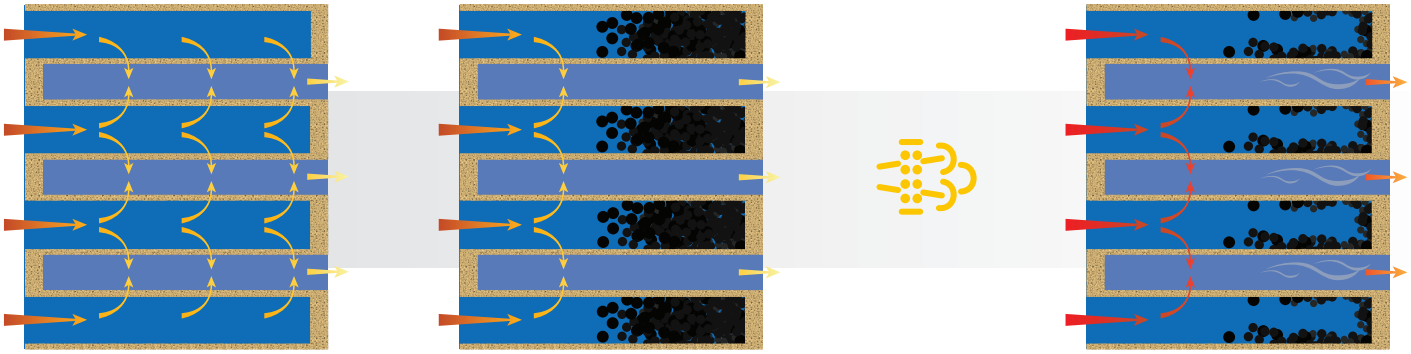
The air filter is full. The DOC needs air when it ramps up to go through regen. If the air filter is full or clogged, the DOC can't get air.

What is a DPF?

DPF stands for Diesel Particulate Filter.

Its purpose is to filter Diesel Particulate Matter (PM), also known as soot, out of exhaust gasses.

How Does a DPF Work?

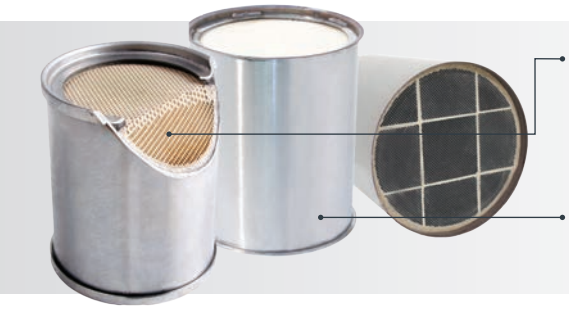


Exhaust gasses containing soot enter the DPF. The filter traps any matter larger than one micron, allowing gasses through.

Over time, soot builds up in the DPF. Eventually, this causes backpressure detected by the Engine Control Unit (ECU) necessitating regeneration.

Regeneration (regen) requires high exhaust temperatures of 570°-750°C. Combining high temperatures and a unique mix of precious metals washcoat the substrate turns soot into ash. The DPF is now regenerated and ready for use.

Primary Components of a DPF



Filter

Cordierite or Silicon Carbide (SIC) wall flow filter traps matter larger than one micron.

Metal Case

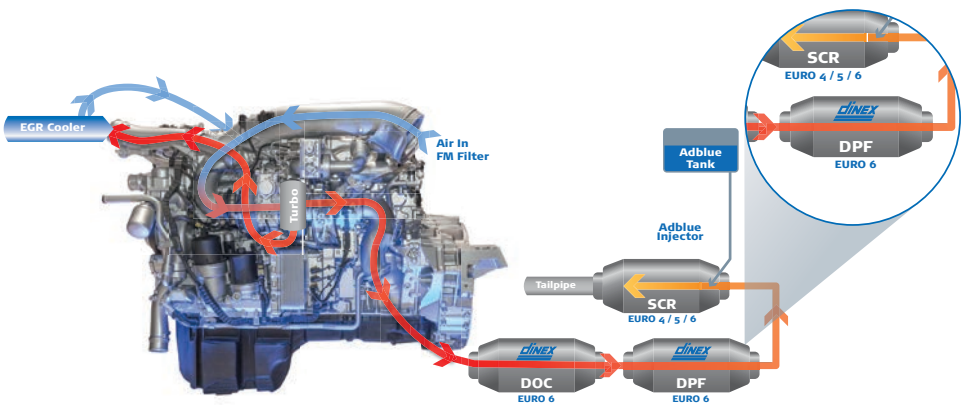
Stainless steel metal casing designed to withstand extreme temperatures.

Types of Regen

Passive: Automatic regen that occurs when the DPF reaches the correct exhaust temperatures.

Active: If a regen doesn't complete a cycle, but sensors indicate DPF has reached capacity, an active regen occurs. The DPF dashboard light indicator will come on and the vehicle must continue to move to finish the cycle.

Manual: If an active regen can't complete, typically due to short drive times, then a manual regen will be required in a shop.



What is an SCR?

SCR stands for Selective Catalytic Reduction

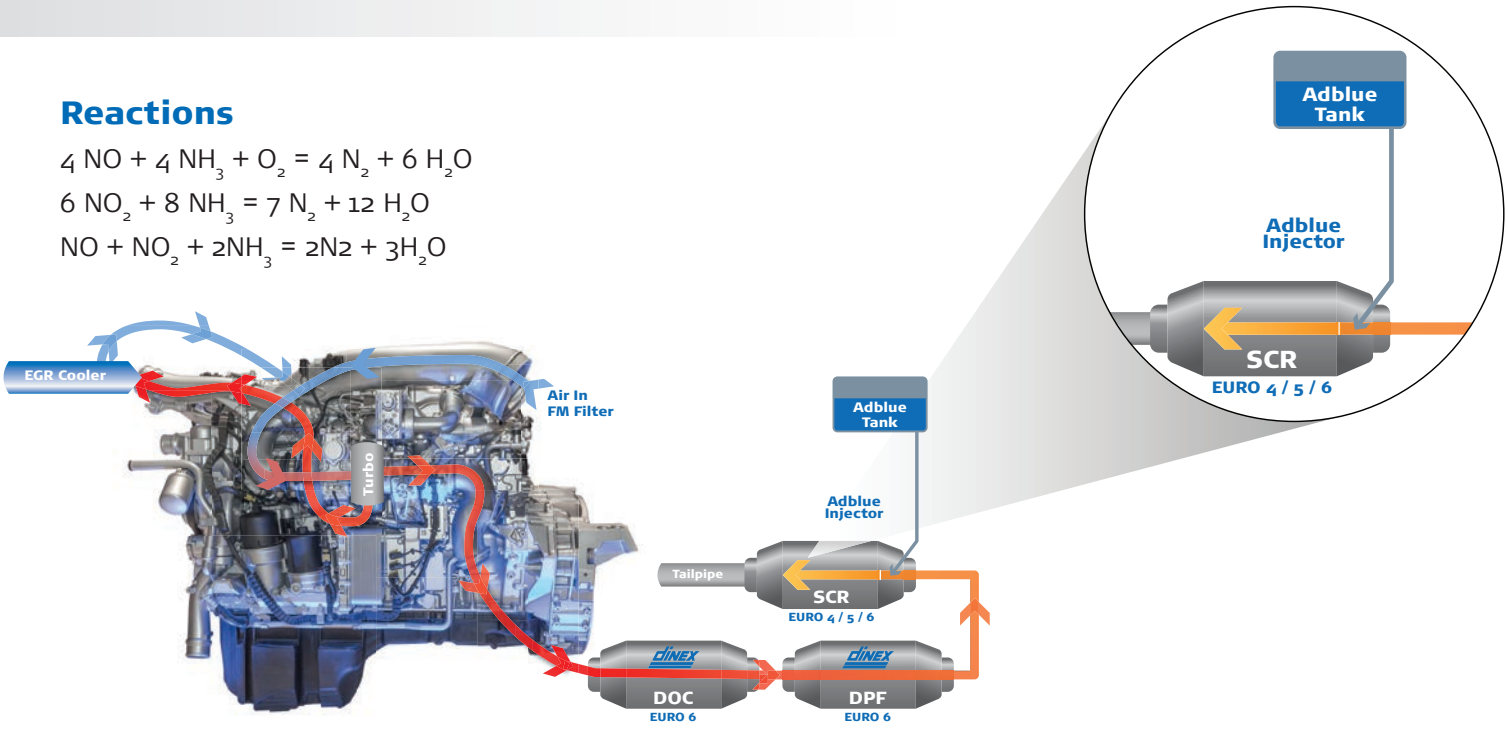
The SCR uses a water-based urea solution (AdBlue) that is first converted into ammonia via hydrolysis at 200+°C and pushed through the substrate removing NOx.

Reactions

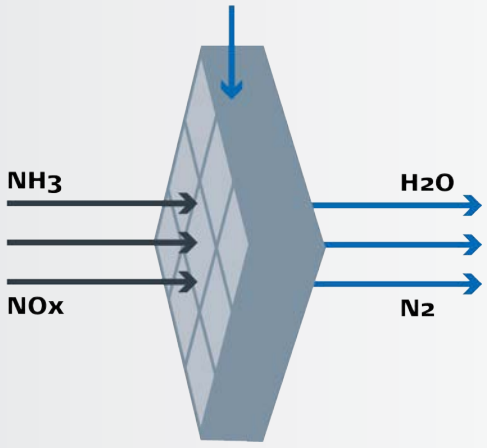
$4\ NO + 4\ NH_3 + O_2 = 4\ N_2 + 6\ H_2O$

$6\ NO_2 + 8\ NH_3 = 7\ N_2 + 12\ H_2O$

$NO + NO_2 + 2NH_3 = 2N2 + 3H_2O$



The SCR substrate is coated with a solution of copper, iron or zeolites. The ASC zone also contains platinum group metals (PGM).



Diagnosing the substrate

Before replacing the substrate, a complete diagnostic test should be carried out with the Scan Tool (code reader) to detect all possible diagnostic error codes and repair the causes prior to any replacement.
A visual inspection of the components listed below is highly recommended as well, as an error involving any of these components separately or in conjunction with others can lead to a failure of the DOC, DPF or SCR. Only if the vehicle shows none of these possible failures can you proceed with the substrate replacement under cover of the warranty.

Pre-replacement diagnosis checklist

- **Onboard diagnostics (OBD) test**
- **Visual inspection of systems listed below**
  - **Intake, Exhaust systems and sensors**
    - Air does not leak at the intake manifold or gasket
    - Exhaust gas does not leak at the exhaust manifold or upstream of the ATS system
    - Sensors are working normally (lambda, NOx, temperature, pressure differential, mass air flow)
- **Exhaust Gas Recirculation System**
  - EGR valve is free to operate
  - EGR pipe is free to move
- **Other factors**
  - Fuel Additive (Fuel Born Catalyst) level is OK, if applies
  - Engine and turbo wear is within tolerance
  - Fuel injector spray pattern is acceptable
  - Glow plugs are functioning normally
  - Air filter is not clogged
  - ECU is not producing any engine-related errors
  - Engine oil according to OE specification
  - Engine oil level within tolerance zone

Substrate maintenance

The engine is losing power and will not allow to rev

- Is there any AdBlue in the tank?
- Is the AdBlue injector operating properly?
- Is the NOx sensor functioning normally?
- Is the DPF light on?

The DPF light comes back on within a few miles after replacement of the DPF

- Has the ECU been reset during the DPF service procedure?
- Are the pressure pipes/sensors connected correctly?
- Are the pressure pipes blocked? Were they cleaned using pressurized air during the DPF service procedure?
- Did you check for air leakage upstream of the DPF (cracked pipes, exhaust manifold gasket, loose connections, etc.)?
- Did you check the status of the lambda sensor?
- If regen temperature cannot be reached, then the DOC may need to be replaced.
- Check the condition of DOC. If the substrate shows signs of contamination, it may need to be replaced

The DPF keeps blocking up

- Was the vehicle driven on enough journeys to regenerate?
- Has the fuel additive tank been filled?
- Was the right Fuel Born Catalyst (FBC) used for this model?

If the vehicle was serviced recently or the oil was replaced

- Oil Specification - Check if the correct low-ash oil was used.
- If the oil level is too high the oil can be contaminated with fuel during failed regeneration attempts. The additional fuel which is required for an increase in exhaust gas temperature passes into the sump tank mixing with the oil, contaminating it. This can lead to a breakdown. In this case the oil needs to be replaced.
- Likewise, if the oil level is too high, the excess oil will be forced into the combustion chambers and partially burn, possibly contaminating the ATS components.

The EGR System (Exhaust Gas Recirculation)

- Is the EGR (Exhaust Gas Recirculation valve) performing well? When this valve doesn't perform well it can stick, modifying the Air/fuel mixture that enters the combustion chambers, leading to an increased level of solid particles that continually travel through the exhaust system, causing the DPF to clog much faster.

Substrate maintenance

SCR system failure

- Are there any OBD errors? OBD diagnostics should be carried out prior to any intervention in the exhaust system.
- Is AdBlue level normal? Low (almost empty) AdBlue level can hinder normal SCR operation under some conditions.
- Are NOx sensors working properly? Check and replace NOx sensors if suspect.
- Is AdBlue injection nozzle damaged or clogged? SCR cannot function without AdBlue. Clean or replace the nozzle if suspect.
- Is SCR substrate free of damage or foreign substances?

The substrate can be clogged or poisoned losing its efficiency and allowing pollutants to escape. Excessive NOx will be picked up by NOx sensors and OBD code will be generated.

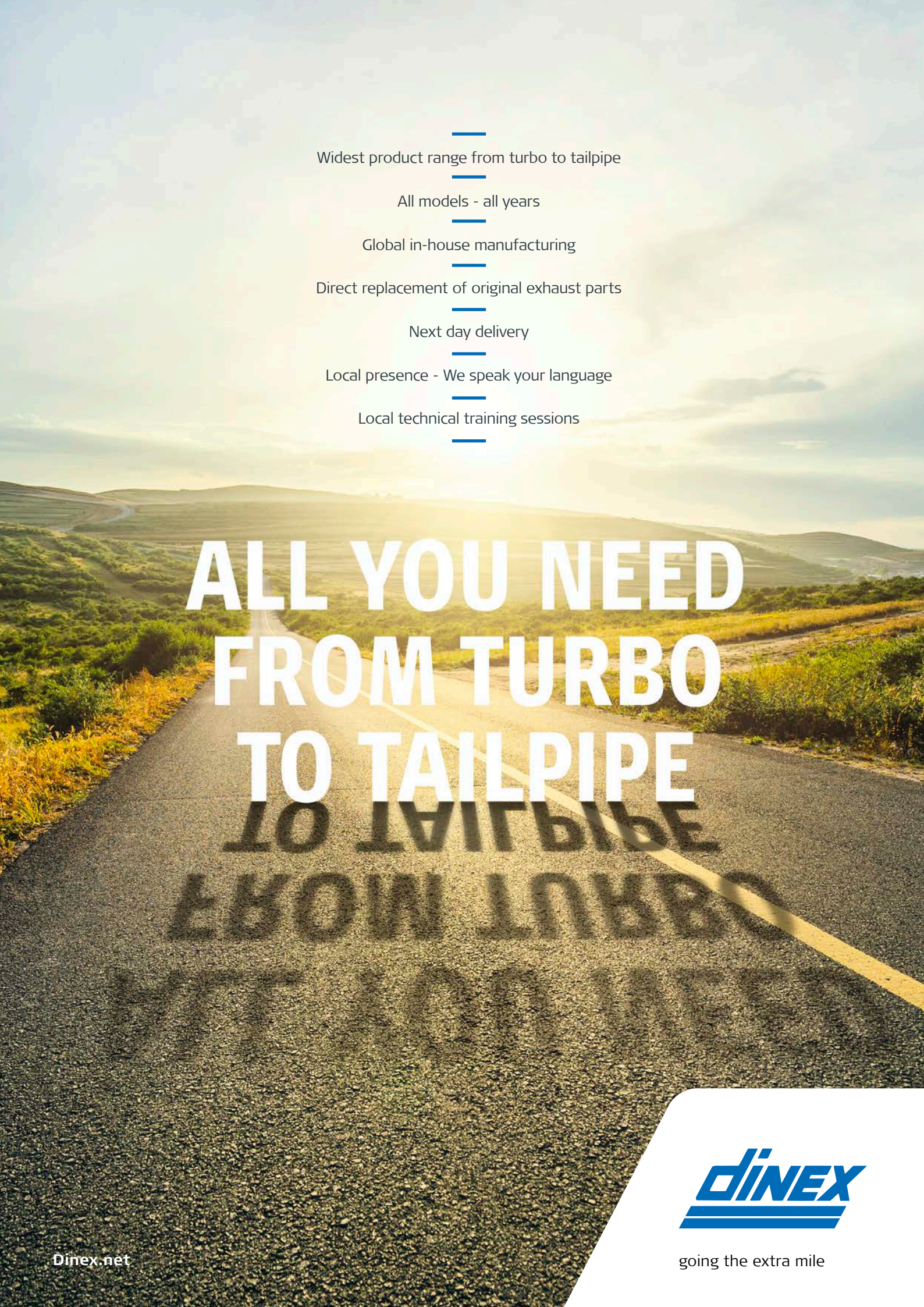
Injection System

- Is the injection system working correctly? Poor maintenance of the injectors produces faulty spray pattern or overly rich mixture, leading to an increased level of solid particles that continually travel through the exhaust system, causing the DPF to clog much faster.

Air Intake System

- Is the air intake system properly sealed? A leak at the intake area will lead to an improper mixture in one or several cylinders which will lead to an increased level of solid particles that continually travel through the exhaust system, causing the DPF to clog much faster. Mixture in one or several cylinders which will lead to an increased level of solid particles that continually travel through the exhaust system, causing the DPF to clog much faster.

Broken Substrates


Widest product range from turbo to tailpipe
All models - all years
Global in-house manufacturing
Direct replacement of original exhaust parts
Next day delivery
Local presence - We speak your language
Local technical training sessions
ALL YOU NEED
FROM TURBO
TO TAILPIPE
Dinex.net
going the extra mile

Quality from Turbo to Tailpipe

Emission Technologies

Diesel Particulate Filters (DPFs), Diesel Oxidation Catalysts (DOCs) and Selective Catalyst Reduction (SCRs) for exact OE replacement.

Insulation Techniques

Keeping heat where it should be. Hot inside and cool outside.

Flex Pipes & Bellows

Dinex offers our well-known 3S Flex pipe as well as OE grade bellows.

Clamps

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

Exhaust Fittings

Several different aftertreatment sensor fittings available (Temperature fittings, pressure fittings, etc.).

Pipes

Bends from Ø22-152,4 mm in stainless steel.

Advanced Production

Advanced production techniques ensure our parts work over long distances and times.

We produce our ceramics, coatings, and formed metal in-house to ensure every part going out the door meets our standards.

Dinex employs processes to reduce the number of welds and joints to create longer lasting products.

Certified and approved

Probably needless to say, but Dinex is certified according to a number of international standards, including:

ISO 9001, ISO 14001, ISO 18001, ISO 50001, IATF 16949.

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- (S) Sales
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