

Low-Thermal-Mass Stainless-Steel Exhaust Duct Components for Faster Catalyst Activation in BS7 Heavy-Duty After-Treatment Systems

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Dinex Emission Solutions

Dinex.net



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- Dinex Product Portfolio
- BS 7 Thermal Management Challenges
- Low Thermal Mass
- Validation Approach
- System Level Performance
- Durability
- Manufacturability
- Thermal Management as a system

Dinex Product Portfolio

Pipe, Catalyst, Canning technologies with own IP

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CATALYSTS

SCR/ASC

Cu-SCR
Fe/Cu-SCR
V-SCR (LT/MT/HT)

DOC

15-20g/cft



HOC/NSC

20-30g/cft
Development



PF

Cordierite
coating
passive



DPF

HP-SiC (own)
Cordierite
coating



DOC/ASC

Development



TWC

Bi- &
trimetallic
40-130g/cft



Diesel

Natural gas

Hydrogen

ATS SYSTEMS

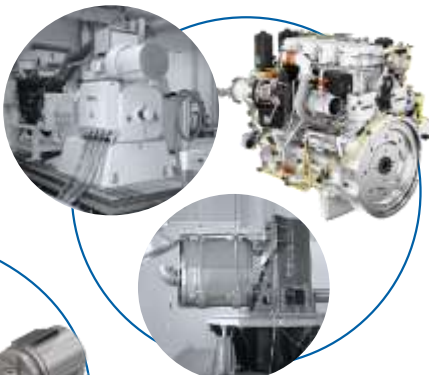
On-Road



Offroad



TESTING & INTEGRATION



H2-ICE



CANNING & PIPES

Mixers



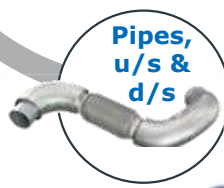
Decoupling & Clamps



Insulation



Pipes, u/s & d/s



BS7 Thermal-Management Challenge

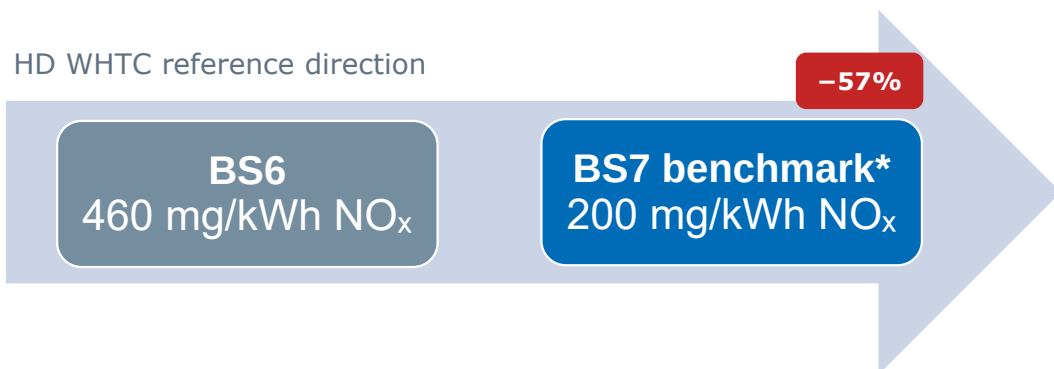
From BS6 to BS7: lower NO_x margin makes catalyst warm-up critical

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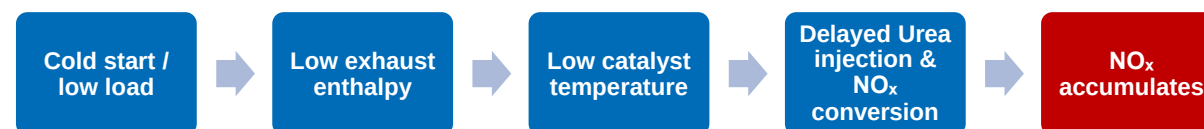


ECT 2025 → thermal-management concept | ECT 2026 → LTM validation

BS7 tightens the NO_x budget



Why it becomes a thermal problem



Additional compliance pressure



Thermal management must raise catalyst temperature before the accumulated NO_x budget is consumed.

BS7 requires effective NO_x conversion earlier during cold-start and low-load operation

Low Thermal Mass [LTM]: Preserve Exhaust Enthalpy

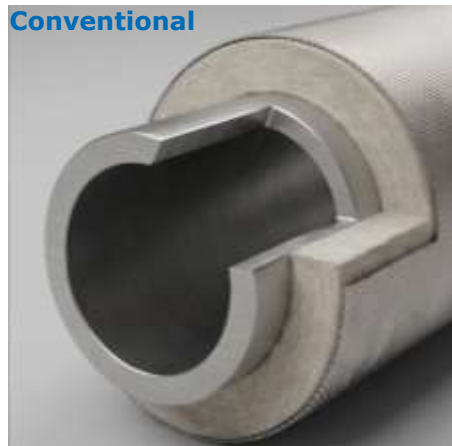
Reduce thermal inertia of components - more available heat reaches the catalyst

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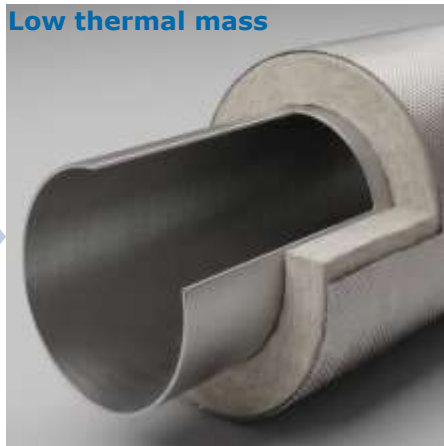


What LTM changes in the exhaust duct

Conventional



Low thermal mass

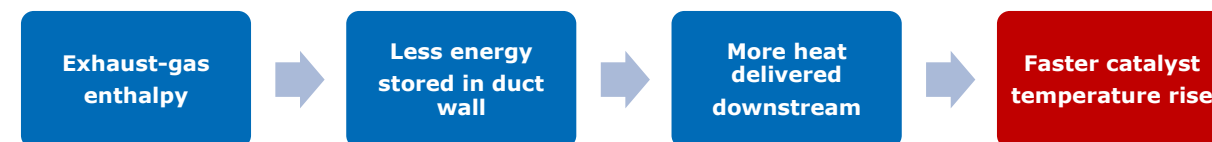


Conventional duct
1.5–2.0 mm SS wall
Higher wall thermal mass
More heat absorbed by wall

Low Thermal Mass duct
0.5-0.8 mm AISI 304
≈67% lower wall thermal mass
Less transient heat storage

Applies to pipes, inlet/outlet cones and duct sections

Mechanism during heat-up



Engineering anchor

Thermal inertia $\approx m \cdot c_p$

Wall thickness ↓ → wall mass ↓ → transient heat absorbed by duct ↓

LTM does not generate heat — it preserves more of the available exhaust enthalpy for catalyst activation

Validation Approach: From Component to Catalyst

Same excitation, different wall thermal mass — measure the effect downstream

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Validation logic

Thermal performance and mechanical robustness are validated in two connected test paths

1 Thermal performance / inertia test



- LTM vs Conventional under equivalent thermal profiles
- Catalyst inlet + centre temperature response

2 Durability validation



- Representative vibration durability loading
- Post-test leak tightness + structural integrity check

Result: earlier catalyst temperature rise demonstrated, while LTM hardware retained leak tightness and structural integrity after durability loading

System-Level Performance: Earlier Catalyst Heat-Up

Measured transient heat-up under equivalent blower excitation

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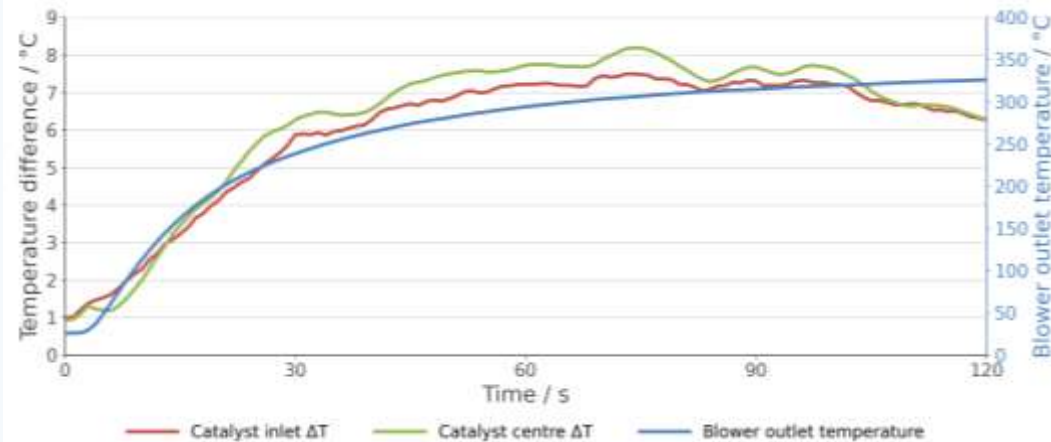


Hot-gas ramp: 380°C / 560 kg·h⁻¹

Comparison: 0.5 mm LTM vs 1.5 mm – 600mm references

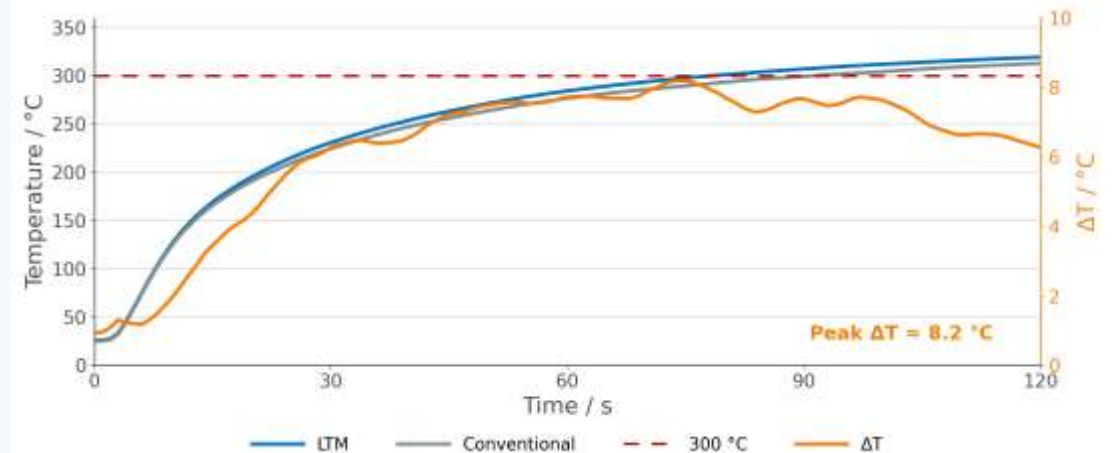
Evaluation window: first 120 s

ΔTemperature



Peak ΔT: +7.5°C inlet | +8.2°C centre

Catalyst center temperature



LTM lead at 200 / 250 / 300°C: 2 / 4 / 13 s

LTM accelerates catalyst heat-up most clearly near the 300 °C reference threshold: 11–13 s earlier, advancing entry into the effective NO_x conversion temperature window

Durability: Tailored Structural Support

The low-mass inner duct is retained; external support is adapted to vibration severity

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1 Validated vibration



- Random vibration: 10–350 Hz
- 24 h @ 2.1 GRMS + 24 h @ 4.1 GRMS
- Post-test inspection + leak-tightness check
- Pre-/post-test sine sweep: 10–500 Hz, 1 g

- ✓ No cracks detected in welds or base material
- ✓ Leak tightness retained after vibration loading
- ✓ No resonance-frequency shift
- ✓ No significant amplitude change

2 Application-specific support concepts

Same low-mass inner gas path — support level to select by duty cycle

A Foil skin only



Minimum added structure

B Foil + support frame



Local stiffness with limited mass

C Thin external shell



Continuous support for demanding duty

Tested LTM hardware retained integrity — structural support can be tailored to application severity

Manufacturability

0.5 mm AISI 304 manufacturing route validated from blank to welded component

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Manufacturing route validated for ultra-thin duct components



Laser cutting of blanks



Stamping / forming

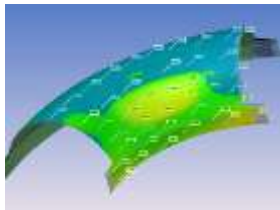


3D laser trimming



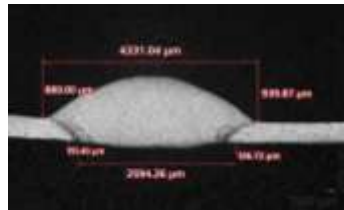
Robotic CMT welding

Geometry / forming



- 0.5 mm AISI 304 successfully formed
- Weld-edge fit-up consistently <1 mm

Joint robustness



- Stable robotic CMT joining achieved
- Leak-tight joints
- Tensile strength comparable to base material

Weld quality



- Defect-free, full-penetration welds
- Smooth internal weld root
- Published process-validation results

Publication: doi.org/10.1016/j.rineng.2026.110300

AISI 304 used as the pilot material for process development; transfer to other exhaust stainless grades requires grade-specific forming and welding re-validation

Validated forming and robotic CMT welding enable manufacturable 0.5 mm LTM components

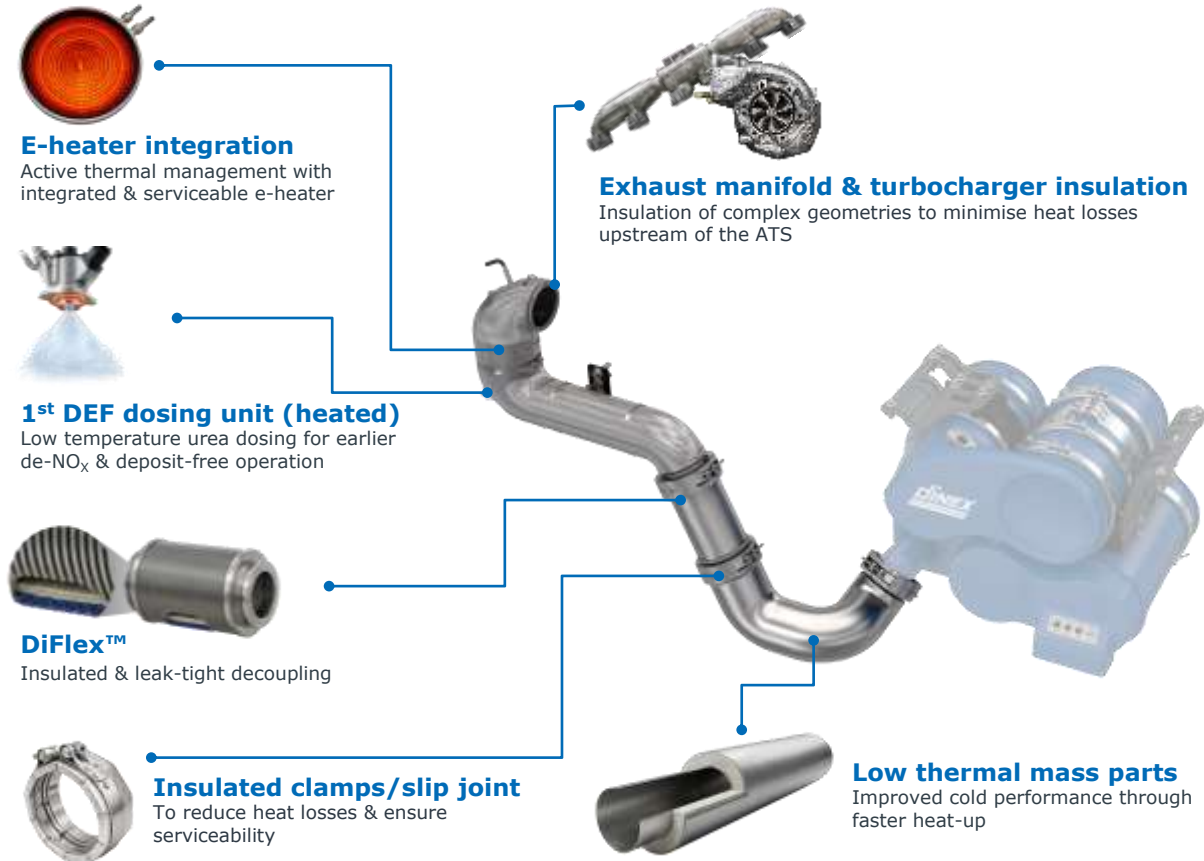
Thermal Management as a System

Preserve exhaust heat to reduce active heating demand

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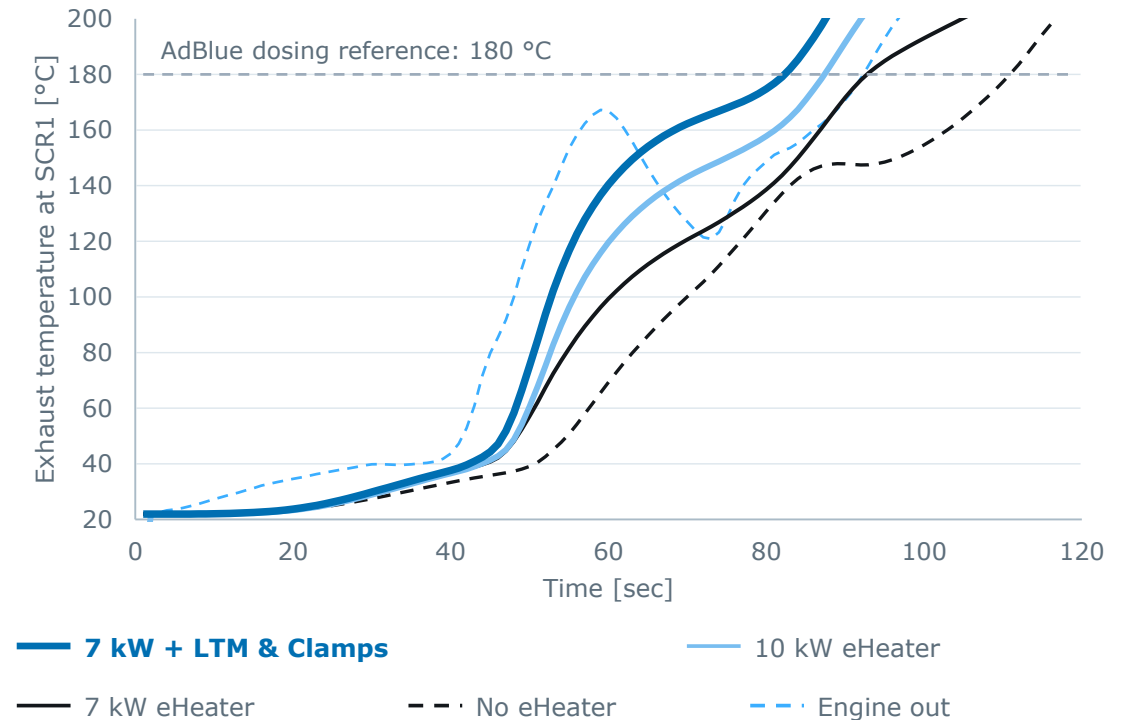


Dinex Thermal Management technologies



Lower active heating demand

System example: 10 kW vs 7 kW + LTM & Clamps



Preserve heat first — add electrical heat only where needed.

**THANK YOU
for your attention!**

