DEKATI

Excellence in Particle Measurements

Dekati®
Brake Wear Emission Measurement Solutions

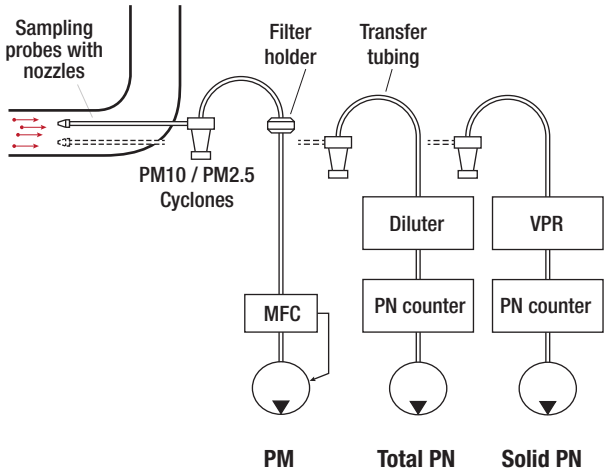
- Complete setups for regulatory and R&D testing
- Solutions for PM and PN measurements
- Compliant with UN GTR-24 Regulation requirements

Dekati®
Measurement solutions for regulatory brake wear emission testing

Brake wear measurements setups compliant with UN GTR-24

The UN Global Technical Regulation No. 24 (UN GTR No. 24) establishes a standardized framework for measuring brake particulate emissions from light-duty vehicles. It addresses the growing environmental concerns related to non-exhaust emissions, which significantly contribute to airborne particulate matter.

UN GTR No. 24 specifies laboratory-based testing procedures using brake dynamometers to replicate real-world braking scenarios. A standardized test cycle, the WLTP-Brake cycle, simulates typical driving conditions to ensure consistency and comparability of results. The regulation focuses on measuring both particulate mass (PM) and particle number (PN) emissions, with a defined size range to capture the relevant pollutants accurately. The complete setup for GTR-24 compliant brake wear particle number & mass measurements is available from Dekati.



Setup principle for brake wear PM and PN measurements according GTR-24

Dekati setups for brake wear particle mass (PM) measurements

Dekati offers a GTR-24 compliant measurement setup for brake wear particle mass emission measurements. The setup includes:

- PM2.5 cyclone
- PM10 cyclone
- 2 gravimetric filter holders
- 2 sampling tubes
- 2 sets of isokinetic sampling nozzles
- Transfer tubing

Dekati PM2.5 and PM10 cyclones, filter holder, sampling tubes and nozzles for GTR-24 compliant PM measurements

Optionally, the gravimetric filter holder can be replaced by a Dekati® eFilter™, which combines a compliant filter holder with a real-time measurement module, enabling monitoring of the emission levels during the entire measurement cycle. The measurement module samples the concentrations at a 1Hz sampling interval.

Dekati® eFilter™

Dekati setups for brake wear particle number (PN) measurements

The PN setup includes a PM2.5 cyclone to remove coarse particles, connected to a Dekati® eDiluter™ Pro. The Dekati® eDiluter™ Pro is a two-stage dilution system that fulfills all the GTR-24 requirements for a VPR (Volatile Particle Remover) including volatile particle removal efficiency, particle penetration and the PCRF (Particle Concentration Reduction Factor). For the solid particle number measurement, the sample first passes through the first dilution stage of the eDiluter™ Pro which is heated to 350 °C and next through an integrated catalytic stripper to evaporate all volatile species. For the total particle number measurement, both dilution stages are operated at ambient temperature.

Dekati® eDiluter™Pro, PM2.5 cyclone, sampling tube and nozzle set

The Dekati® eDiluter™ Pro is available with a PMP compliant Airmodus A20 bCPC particle number counter with a 10nm cut-off point.

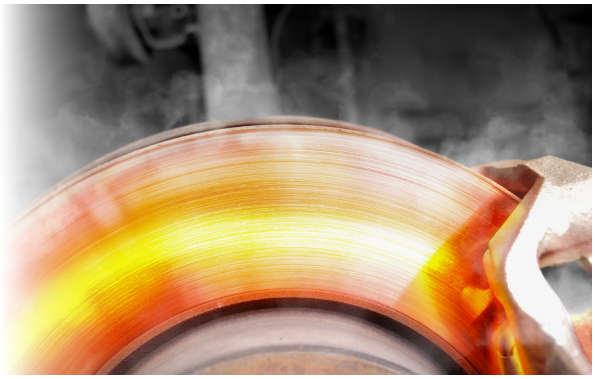
Airmodus A20 bCPC

Dekati®
Advanced R&D solutions for brake wear emission characterization

Catching the complexity of brake wear particle emissions

The characterization of brake wear emissions presents a complex challenge as their formation involves multiple mechanisms, influenced by factors such as braking intensity and frequency. Brake wear particles also vary widely in size. Mechanical abrasion mainly produces larger, micron-sized particles (>1 µm), while high-energy braking and frequent deceleration generate smaller nucleation particles (10–200 nm) due to rapid, high-temperature processes.

Accurately measuring brake wear emissions is essential for assessing their environmental impact and developing effective emission reduction strategies, and requires advanced instrumentation that can measure in real-time, with high precision and over a broad particle size range.



Real-time brake wear emission characterization with the Dekati® HR-ELPI®+

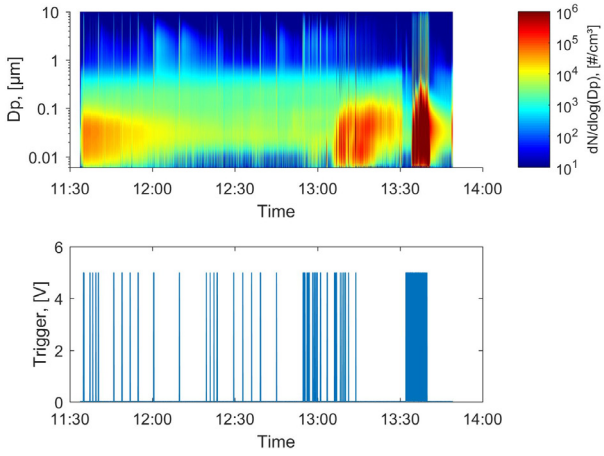
The Dekati® High-Resolution HR-ELPI®+ system simplifies brake wear particle measurements by using a single instrument and method, eliminating the need for complex merging of data from multiple devices.

Dekati® HR-ELPI®+

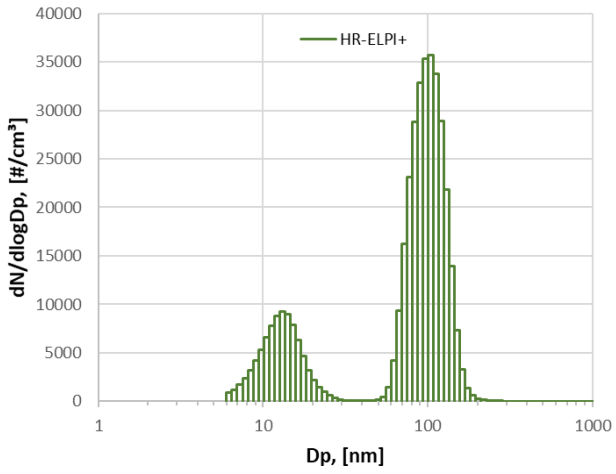
The HR-ELPI®+ provides real-time measurement of particle concentration and size distribution across a range of 6 nm to 10 µm, with size classification into 14 to 500 size classes at a 10 Hz time resolution.

The system also collects physical brake wear particles in 14 size fractions during the measurements. As such, the particles can be further analyzed using chemical or physical methods to define the particle composition and sources. The Dekati® HR-ELPI®+ is widely used in both dynamometer and on-road brake wear testing, showcasing its reliability and durability.

Brake wear particles are collected in the impactor of the HR-ELPI®+ in 14 separate size fractions for later microscopical or chemical analysis



Particle size and concentration measured with the High Resolution HR-ELPI®+, for the braking pattern shown in the picture below



Particle size distribution measured with the HR-ELPI®+, classified into 500 size fractions

Specifications

Dekati® eDiluter™Pro

- GTR-24 compliant dilution system
- Integrated catalytic stripper for solid PN sampling

Dilution factor	1:25 – 1:900, adjustable
Sample inlet/outlet pressure ratio	0.90–2.15
Max. sample inlet temperature	600 ºC
Inlet sample flow	4-10 lpm, depending on dilution factor
Diluted outlet sample flow	50- 80 lpm
Dilution air	Clean and dry dilution air, 5-7 bar abs., max 200 lpm
Dimensions	H205 x W168 x D520 mm
Weight	7.3 kg

Dekati® HR-ELPI®+

- Real-time particle number and mass distribution
- Wide size range

Particle size range	0.006 – 10 µm
Number of size classes	100 or 500 (30 or 150 per decade)
Sample flow rate	10 lpm
Collection plate diameter	Ø25 mm
Sample temperature	10 – 50 ºC (optional 10 – 180 °C with the High Temperature HR-ELPI®+ upgrade)
Sampling rate	10 Hz
Weight	22 kg
Dimensions	H407 x W454 x D242 mm
Pump requirements	20 m^3/h @ 40 mbars

Dekati® eFilter™

- GTR-24 compliant filter holder combined with real-time concentration measurment sensor

Min. particle size	>5 nm nominal Adjustable between 4 – 15 nm
Primary flow rate (gravimetric filter)	10 – 100 lpm
Sampling rate	1 Hz
Dimensions	H225 x W85 x L90 mm
Weight	1.5 kg

Airmodus A20 bCPC

- Accurate PN measurement, even at high concentrations
- User-friendly interface

PN measurement range	0-100 000#/cm^3 0-30 000#/cm^3 in single count mode
Particle size range	5 nm – 2.5 µm
Inlet sample flow	1 lpm, controlled via critical orifice
Working fluid	n-Butanol (>99.5%)
Dimensions	H260 x W230x D400 mm
Weight	7.5 kg

For more information, please contact: sales@dekati.com

DEKATI Since 1993

Dekati Ltd. is a world leader in designing and manufacturing innovative fine particle measurement solutions. We have over 30 years of experience in providing measurement instruments and complete measurement solutions to a wide variety of environments and sample conditions. All Dekati® Products are developed and manufactured in Finland and are available with up to five-year warranty.

CERTIFIED ISO 9001 BUREAU VERITAS

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