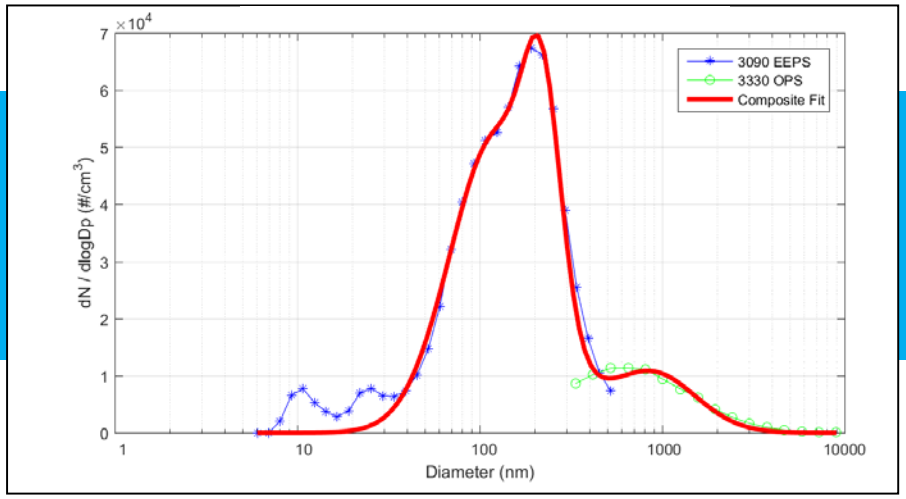
BREMSE:
BRAKE WEAR ***E***MISSION ***M***EASUREMENT ***S***YSTEM

THE ONLY INSTRUMENTAL SYSTEM TAILORED TO THE NEEDS OF BRAKE WEAR PARTICLE EMISSION MEASUREMENT



The TSI BREMSE system is the most comprehensive way to characterize particle emissions from braking. Its size range spans over three orders of magnitude of particle diameter (from 5.6 nm to 10 um), and its time response captures the fast-changing nature of braking events. Integrating two of TSI's time-tested instruments – the 3330 Optical Particle Sizer (OPS) and 3090 Engine Emission Particle Sizer (EEPS) – into a single measurement solution, the BREMSE system offers you the ability to accurately capture rapidly changing particle emissions from dynamic braking events. BREMSE's all-in-one, continuous measurement solution will help you collect the data you need to stay ahead in a fast-paced regulatory and market environment.

Features

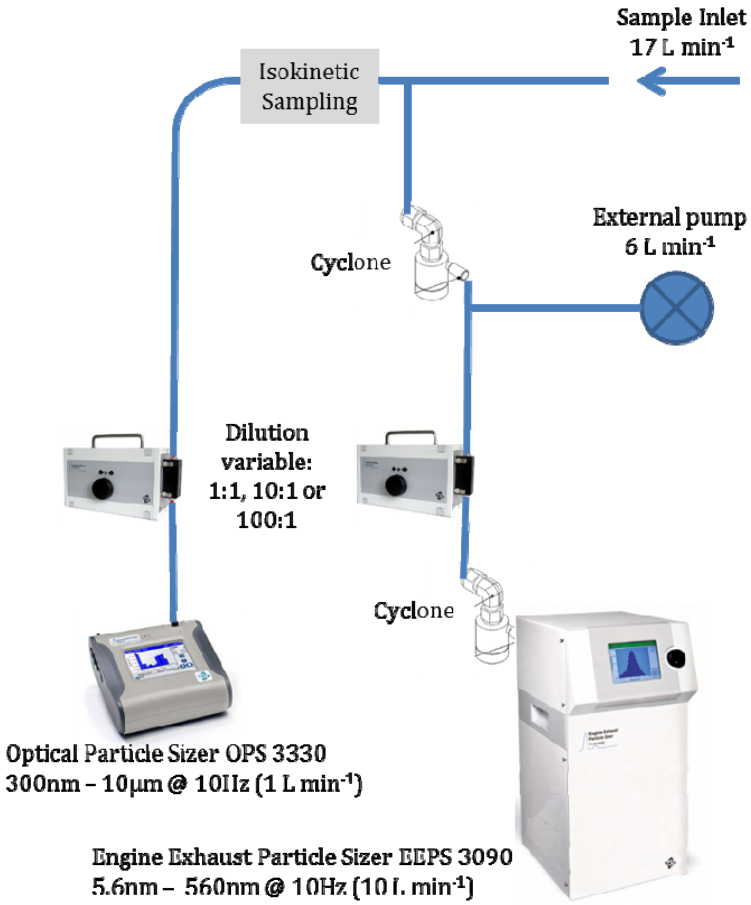
+ Only commercial system that measures particle size range from 5.6 nanometer to 10 microns
+ 10 Hz data acquisition

UNDERSTANDING, ACCELERATED

Operation

The BREMSE system consists of two particle sizers – the 3330 Optical Particle Sizer (OPS) and the 3090 Engine Emission Particle Sizer (EEPS) – along with a diluter for each instrument, and an additional cyclone to improve particle sizing accuracy within the EEPS. The optional low-maintenance diluters (3332-10 / 3332-100) are calibrated according to the instrument's sampling flow. The indicator lights on the diluter indicate if the pressure drop across the capillary is in accordance with the calibration. If one of the red arrows is illuminated, an adjustment of the knob will restore the proper flow balance. Engineered to provide very low particle loss in the 0.5- to 10-µm size range, the diluter is totally self-contained and requires no compressed gas.

Both particle sizers in the BREMSE system operate at ambient pressure (eliminating concerns about particle volatilization), and both draw the sample stream into the instrument continuously. The inlet of each instrument is designed to maximize measurement accuracy of particles within the designated size range. In order to minimize transport losses of larger particles in bends and corners, the OPS inlet is oriented such that the particle stream travels in a straight line toward the measurement zone. The EEPS, on the other hand, intentionally removes large particles from its sample stream using an inlet cyclone, as the larger particles can compromise the sizing accuracy of the instrument.



Sheath air then surrounds the particle stream in both instruments to enhance size resolution. Within the EEPS, particles are charged to a predictable degree by a corona charger. This is a critical step for sizing smaller particles, but is not necessary for the OPS. The particle streams then enter the measurement zone of each instrument.

Within the OPS, particle measurement occurs when the particles cross a laser beam and create a light pulse. The intensity of the light pulse is measured, and is used to determine particle size and count.

The data processing algorithms used in the OPS were developed to optimize accuracy over the OPS size range from 0.3 – 10 um.

Within the EEPS, the measurement zone consists of a column with a central high-voltage rod and an outer cylindrical wall consisting of 22 stacked electrometer rings. The charged particles impact on these rings depending upon their size – smaller particles will impact on rings nearer the top of the stack, while larger particles will travel further down the stack before reaching a ring. As a particle impacts upon a ring, it transfers its charge to the ring. The currents resulting from these charge transfers are recorded, and algorithms are applied to translate these currents into particle counts and sizes. With 22 electrometer rings collecting data simultaneously at 10 Hz, rapid changes in particle size distribution can be captured.

Following the measurement zone, a portion of the air flow in each instrument is directed through HEPA filters in order to serve as sheath air for incoming particles, and remaining air flow is exhausted out the back of the instrument.

SPECIFICATIONS

	3090 EEPS	3330 OPS	BREMSE system
Operating Features			
Particle size range	5.6 – 560 nm	0.3 – 10 µm	6 nm – 10 µm
Particle size resolution	16 channels per decade	10-32 channels, depending on selected size range	≥ 16 channels per decade
Time resolution	10 Hz		
Particle Concentration Range	$3x10^3$ #/cm³ minimum; $6x10^6$ (5.6 nm) – $6x10^4$ (560 nm) #/cm³ maximum	$3x10^3$ #/cm³ maximum	$3x10^3$ #/cm³ minimum; $6x10^6$ (5.6 nm) – $6x10^4$ (560 nm) #/cm³ maximum
Mass Concentration Range	3×10^{-4} – 5×10^4 µg/m³	0.001 – 2.75×10^5 µg / m³	3×10^{-4} – 2.75×10^5 µg/m³
Sample Flow	10 L / min	1.0 L / min	11 L / min
Environmental Conditions			
Operating Temperature	0 – 40 °C	0 – 45 °C	0 – 40 °C
Physical Features			
Weight	32 kg (70 lbs)	2.1 kg (4.5 lbs) with battery	Approx. 85 lbs
Dimensions	70.4 x 34.3 x 43.9 cm (27.7 x 13.5 x 17.3 in)	13.5 x 21.6 x 22.4 cm (5.3 x 8.5 x 8.8 in.)	Approx. 112 x 59 x 46 cm (44 x 23 x 18 in)
Sample inlet	3/8 in OD	1/4 in OD	Defined by user
Exhaust / outlet			
Voltage Requirements	100 – 240 VAC, 50/60 Hz		
Power Requirements	250 W	15 W	265 W

To Order
BREMSE: BRake Emission Measurement SystEm

Specify	Description
3090	Engine Emission Particle Sizer
3330	Optical Particle Sizer
3332-100	Diluter for Optical Particle Sizer (*order Qty. 2)
3032	External pump
3001789	3/8" tubing

UNDERSTANDING, ACCELERATED

TSI Incorporated - Visit our website **www.tsi.com** for more information.

USA	**Tel:** +1 800 874 2811	**India**	**Tel:** +91 80 67877200
UK	**Tel:** +44 149 4 459200	**China**	**Tel:** +86 10 8219 7688
France	**Tel:** +33 4 91 11 87 64	**Singapore**	**Tel:** +65 6595 6388
Germany	**Tel:** +49 241 523030		

P/N 5001387 Rev B Printed in U.S.A