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A New Portable Test Instrument for the Reliable Measurement of Particle Number Emissions from Combustion Engines During Periodic Technical Inspection

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Experience has shown that emission after-treatment systems can fail due to aging, poor maintenance, poisoning or manipulation. In addition, the recent awareness about discrepancies between laboratory testing of emissions over a drive cycle and real-world in-use measurements are furthering the need for a periodic technical inspection (PTI). While PTI is mandatory in many European countries, current PTI test procedures as specified in UNECE Regulation 24 for the free acceleration smoke emission test for LD and HD diesel vehicles are too insensitive to detect DPF failures in the latest generations of vehicles. Recently, Switzerland pioneered using portable PN instruments for periodic control of off-road construction machinery.

Building on the experience with the NPET instrument developed for the Swiss Ordinance SR 941.242, TSI Inc. developed a battery-operated PN emission tester capable of rapidly assessing the performance of DPFs during periodic inspection. The PTI-PN tester is a light-weight, mobile device that incorporates a catalytic stripper and true single particle counting using the same proven CPC technology already adopted for UNECE Regulation No. 83 emission testing. The device's measurement probe can be directly attached to the tailpipe and the operator is guided through the measurement process step-by-step by a graphical touch screen interface. The measurement test cycle and threshold is currently user-configurable to support the development of the PTI-PN test procedure

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Counting particles with a CPC is the only direct and highly accurate method to measure PN emissions. In fact this technique requires no assumptions and is supported by a traceable calibration as outlined in ISO 27891:2015. While other technologies estimate PN values, CPC measurements are the only method that has been used for type approval testing around the world for more than 5 years as well as for field emissions tests in Switzerland. We will report on recent advances towards a unified PTI test procedure, introduce further details of TSI's PTI-PN instrument, and present data of recent measurement campaigns.