CALIBRATION OF TSI'S HIGH-CONCENTRATION NANOPARTICLE EMISSIONS TESTER

APPLICATION NOTE NPET-002 (A4)
(8/9/2018) REV A

What does the HC-NPET do?

TSI's High-Concentration NPET, model 3795-HC, allows you to make accurate field measurements of nanoparticle emissions from tailpipes, engines, or any combustion process (waste incinerators, power generators, ship engines, etc.). It dilutes the raw gas and removes volatile compounds to measure total solid particle number concentration. The HC-NPET user-friendly software offers user-defined test cycles and continuous measurements.

How is the HC-NPET calibrated?

Overview

The HC-NPET calibration procedure is summarized in Figure 1. Briefly, the calibration procedure confirms the accuracy of flows within the instrument, and confirms its efficiency of removing volatile compounds and of counting solid particles.

These steps are described in greater detail below.

Calibration Process Description

1. Detector subassembly checkout: for this initial step, the detector (CPC) within the HC-NPET is isolated from the rest of the instrument. The CPC is checked for leaks, its flows are set, and its optics are aligned. Once this is accomplished, the CPC is fully reconnected to the rest of the HC-NPET.

2. Flow calibration: flows within the entire instrument are calibrated. Flows measured in different places have different acceptable accuracies (±5% or 10%), but usually accuracy within 2% is achieved.

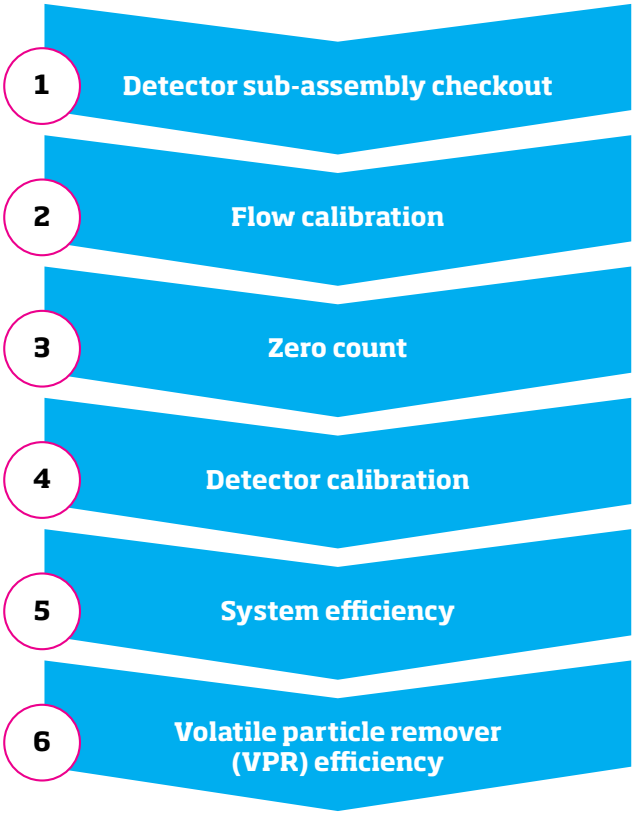

Figure 1: Step-by-step calibration procedure for HC-NPET.

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3. Zero count: in order to ensure the unit does not experience a problematic level of false counts, a zero-check filter is attached to the instrument inlet, and data is logged for a multi-hour period. In order to pass this step, a 3795-HC must average < 0.5 #/cm^3 of false counts over a one-hour period.

4. Detector calibration: this step ensures that the instrument's measured particle concentrations are accurate when compared to a standard particle counter. The instruments are challenged in parallel with a polydisperse soot aerosol; see Figure 2. At least 90% of the particles in this challenge must be at or above 23 nm in size for the test to proceed.

5. System efficiency: The goal of this step is to determine the counting efficiency of the HC-NPET at several specific particle sizes. The instruments are challenged in parallel with classified (i.e. 'size-selected') soot particles. The concentrations measured by the two units are compared to ensure that the ratio meets TSI criteria; see Figure 3.

6. VPR efficiency: when an HC-NPET is sent through service at TSI, the successful removal of volatile aerosol by the catalytic stripper is measured and confirmed. Removal of emery oil aerosol exceeds 99%, while removal of tetracontane aerosol is very close to 100%.

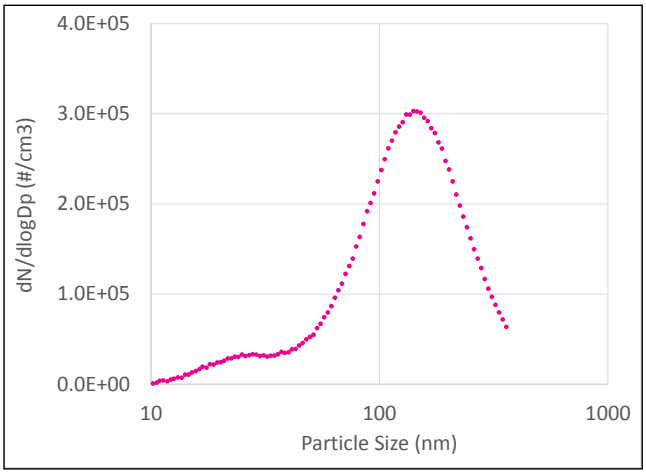

Figure 2: Size distribution of polydisperse soot used as a challenge aerosol in Step #4, Detector Calibration. 90% of the particles must be ≥ 23 nm in size; in this example, ~97% of particles are ≥ 23 nm.

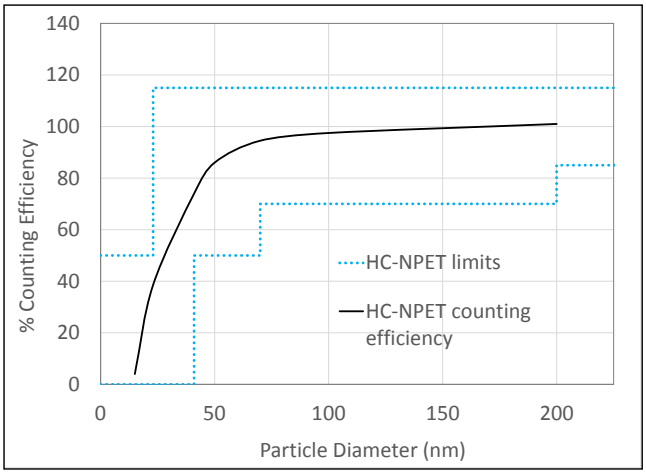

Figure 3: HC-NPET counting efficiency curve and limits.

Contact Us

For more information on TSI's HC-NPET, please don't hesitate to contact TSI using the contact information below. Alternatively, you may email **particle@tsi.com**, or contact your local sales representative.

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