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Particulate Measurement - Dilution Tunnel Stablization

by

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NOTICE

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Summary

Particulate testing was conducted to determine the number of hot-start UDDS (LA-4) cycles that must be driven to stabilize a clean 18-inch diameter dilution tunnel. The results of this investigation indicate that valid particulate measurments can be obtained with a clean dilution tunnel; i.e., essentially no LA-4 cycles are required to stabilize the dilution tunnel with respect to particulate material. This conclusion is based on the observation that slightly higher than average particulate levels (taken with stabilized tunnel) were measured during the first (actually first two) LA-4 test after tunnel cleaning. If particulate material is being lost to the dilution tunnel walls it is minimal and not significant compared to normal test variability.

Test Procedure

This test program was designed to quantify the number of hot-start UDDS cycles required to stabilize a clean 18-inch dilution tunnel with respect to particulate material. A 1975 EPA owned Mercedes 300 D was selected for this evaluation primarily because: (1) this vehicle had a well established UDDS baseline (standard deviation of + 5.1 %) from which particulate stabiliation could be measured; and (2) its level of particulate production is representative of the majority of light-duty diesel vehicles currently being manufactured.

Initial preparation of the study required that the dilution tunnel be cleaned. This was accomplished by disassembling the tunnel and washing each section. After cleaning and reassembling the tunnel, particulate measurements began.

The procedure used to measure the particulate emissions was similar to the procedure specified in the "Draft Recommended Practice for Measurement of Gaseous and Particulate Emissions from Light-Duty Diesel Vehicles" March 1978. Therefore, only highlights of this procedure will be indicated.

Particulate measurements were made by isokinetically removing a sample of dilute exhaust from the 18-inch diameter dilution tunnel, and then passing the sample flow through a 47 mm fluorocarbon coated glass fiber filter. The weight of particulate material collected is considered to be the net weight difference between the clean filter (stabilized with respect to humidity) and the loaded filter (also stabilized).

Discussion of Results

The attached graph, Figure 1, presents the individual UDDS particulate measurement results of this study (presented in the order taken) along with a summary of the baseline level of particulate emissions (measured with a stabilized tunnel). Theoretically, if substantial tunnel deposition were taking place during the stabilization process, each successive particulate measurement taken after tunnel cleaning would be slightly higher than the previous measurement, with the limiting value being equal to the stabilized tunnel average. However, a comparison of the individual data points to the previously established hot-start UDDS particulate baseline indicates that the level of measured particulate material for the first hot-start test was slightly higher than the baseline. Further testing did not indicate any trend toward substantial increases in measured particulates.

Although the average particulate level from the seven tests performed after the tunnel was cleaned was 4.8 percent higher than the previous baseline, the increased level was within the normal test variation experienced with this vehicle. No significant difference in measured hydrocarbon was observed after the tunnel was cleaned.

It is concluded from these data that no preconditioning is necessary to stabilize the dilution tunnel with respect to particulate material. Hence, as stated in the Summary, it is also concluded that the amount of particulate material lost to dilution tunnel walls is very small (i.e., within measurement capabilities), and therefore valid particulate measurements can be made with a clean dilution tunnel.

Figure 1 - Dilution Tunnel Stabilization
18-Inch Tunnel
CVS Flow Rate 535 SCFM
Mercedes 300D, 4000 #