

**APPENDIX D**

**PROPOSED PRE-CONDITIONING REQUIREMENTS**

## Appendix D. Proposed Pre-Conditioning Requirements

One of the issues raised by members of the NO<sub>2</sub> working group is that NO<sub>2</sub> emissions from a catalyzed emission control system can be very sensitive to the amount of soot and ash present in the system at the time of testing. For instance, if a filter has a substantial bed of soot present, the NO<sub>2</sub> that forms during an emissions test would have ample opportunities to be reduced to NO. If it had a substantial amount of ash, and the catalyst was on the filter itself, the ash could cover active sites, thereby reducing the amount of NO<sub>2</sub> formed (see Appendix E for additional discussion).

To ensure some control over the state of a system prior to emissions testing, staff proposes various additional pre-conditioning requirements. Staff's proposal covers pre-conditioning for the new and aged devices for the original verification as well as the units involved in the first phase of in-use compliance testing. The additional requirements would apply to any system for which the Executive Officer determines that NO<sub>2</sub> emissions could be affected by the presence of PM or ash.

At present, the Procedure only specifies a pre-conditioning requirement of 25 to 125 hours of operation on an engine. Nothing further is specified. To control the amount of PM and ash in the new device, staff proposes a more specific pre-conditioning procedure. The device must be operated on a diesel engine for between 25 and 30 hours using standard, repeated test cycles appropriate for the application. For on-road applications, the Federal Test Procedure (FTP) heavy-duty transient cycle, Urban Dynamometer Driving Schedule (UDDS), or 13-mode Supplemental Emissions Test (SET) cycle may be used. For off-road applications, the 8-mode certification test cycle or the Non-Road Transient Cycle (NRTC) may be used. For stationary applications, the appropriate modal stationary test cycle may be used.

During discussions with manufacturers, staff learned that repeating standard test cycles may be insufficient to stabilize the performance of a catalyst. Manufacturers indicated that standard practice involves ten hours of engine operation with temperatures higher than those generated by the standard test cycles. The engine could undergo constant, high-load operation and cyclic operation between low and high loads. For the purposes of stabilizing catalyst performance, staff proposes that an applicant may choose, as part of the 25 to 30 hour period, to run the engine for up to ten hours either (1) at high load such that the exhaust temperature is between 350 and 450 degrees Celsius, or (2) by alternating back and forth between high and low loads such that the exhaust temperature never exceeds 525 degrees Celsius, and low load operation does not result in significant soot accumulation following the stabilization period.

After the 25 to 30 hour pre-conditioning period, the device must be run on the emissions test engine for three repetitions of the emissions test cycle, and the backpressure must be recorded. The device would then be ready for testing.

The proposed pre-conditioning for the aged device consists of running the device on the emissions test engine for three repetitions of the emissions test cycle. If the average

backpressure is within 30 percent of the average backpressure recorded for the new device, it is ready to be tested. The 30 percent criterion was recommended by MECA as an intermediate backpressure between a new filter and a filter that needs to be cleaned. If the backpressure is too high, the applicant may burn off excess soot and clean out excess ash as necessary until the backpressure requirement is met.

The proposed pre-conditioning for devices undergoing the first phase of in-use compliance testing is similar. For reference, the backpressure of a cleaned or pre-conditioned unit is recorded over the required test cycle with the unit installed on the test engine. This reference unit must be identical to the test units. The backpressure of the test units retrieved from the field must be measured and recorded using the same engine and test cycle as used with the reference unit. If the backpressure of the test units is within 30 percent of the average backpressure recorded for the reference unit, they do not require pre-conditioning. Otherwise, the test units must be pre-conditioned in the same manner as the aged unit described above. A unit other than one of the selected test units that appears to meet the backpressure requirement without any pre-conditioning may not be substituted for a selected test unit that does not meet the requirement.

There is no backpressure limit for the second phase of testing which involves units at 60 to 80 percent of their minimum warranty period (e.g., between 90,000 and 120,000 miles or 3 and 4 years for heavy-heavy duty vehicles). At that point, the unit would likely have accumulated substantial ash, resulting in elevated backpressure. Staff proposes that these units be tested purely "as is."