Environmental Protection Agency

§ 1065.501 Overview.

(a) Use the procedures detailed in this subpart to measure engine emissions over a specified duty cycle. Refer to subpart J of this part for field test procedures that describe how to measure emissions during in-use engine operation. This section describes how to:

1. Map your engine, if applicable, by recording specified speed and torque data, as measured from the engine’s primary output shaft.
2. Transform normalized duty cycles into reference duty cycles for your engine by using an engine map.
3. Prepare your engine, equipment, and measurement instruments for an emission test.
4. Perform pre-test procedures to verify proper operation of certain equipment and analyzers.
5. Record pre-test data.
6. Start or restart the engine and sampling systems.
7. Sample emissions throughout the duty cycle.
8. Record post-test data.
9. Perform post-test procedures to verify proper operation of certain equipment and analyzers.
10. Weigh PM samples.

(b) An emission test generally consists of measuring emissions and other parameters while an engine follows one or more duty cycles that are specified in the standard-setting part. There are two general types of duty cycles:

1. Transient cycles. Transient duty cycles are typically specified in the standard-setting part as a second-by-second sequence of speed commands and normalized torque (or power) commands. Operate an engine over a transient cycle such that the speed and torque of the engine’s primary output shaft follows the target values. Proportionally sample emissions and other parameters and use the calculations in subpart G of this part to calculate emissions. Start a transient test according to the standard-setting part, as follows:
   (i) A cold-start transient cycle where you start to measure emissions just before starting an engine that has not been warmed up.
   (ii) A hot-start transient cycle where you start to measure emissions just before starting a warmed-up engine.
   (iii) A hot running transient cycle where you start to measure emissions after an engine is started, warmed up, and running.

2. Steady-state cycles. Steady-state duty cycles are typically specified in the standard-setting part as a list of discrete operating points (modes or
§ 1065.510 Engine mapping.
(a) Applicability, scope, and frequency.
An engine map is a data set that consists of a series of paired data points that represent the maximum brake torque versus engine speed, measured at the engine’s primary output shaft. Map your engine if the standard-setting part requires engine mapping to generate a duty cycle for your engine configuration. Map your engine while it is connected to a dynamometer or other device that can absorb work output from the engine’s primary output shaft according to §1065.110. Configure any auxiliary work inputs and outputs such as hybrid, turbo-compounding, or thermoelectric systems to represent their in-use configurations, and use the same configuration for emission testing. See Figure 1 of §1065.210. This may involve configuring initial states of charge and rates and times of auxiliary-work inputs and outputs. We recommend that you contact the Designated Compliance Officer before testing to determine how you should configure any auxiliary-work inputs and outputs. Use the most recent engine map to transform a normalized duty cycle from the standard-setting part to a reference duty cycle specific to your engine. Normalized duty cycles are specified in the standard-setting part. You may update an engine map at any time by repeating the engine-mapping procedure. You must map or re-map an engine before a test if any of the following apply:

1. If you have not performed an initial engine map.
2. If the atmospheric pressure near the engine’s air inlet is not within ± 5 kPa of the atmospheric pressure recorded at the time of the last engine map.
3. If the engine or emission-control system has undergone changes that might affect maximum torque performance. This includes changing the configuration of auxiliary work inputs and outputs.
4. If you capture an incomplete map on your first attempt or you do not complete a map within the specified time tolerance. You may repeat mapping as often as necessary to capture a complete map within the specified time.