(e) Attach the sample extension to the exhaust outlet.

(f) Turn on instruments and allow them to warm up as necessary.

(g) Begin sampling. You do not need to begin recording the data at this point.

(h) Begin operating the vehicle or equipment in a normal manner.

NOTE: We may require you to operate the vehicle or equipment in a specific manner.

(i) Begin recording engine speed, engine torque (or surrogate), intake air flow, emissions data (THC, NO_X, CO, air/fuel ratio), and time. This time marks the beginning of the sampling period.

(j) Continue recording data and operating the vehicle or equipment in a normal manner until the end of the sampling period. The length of the sampling period is based on good engineering practice, the precision requirements of §1065.910, and applicable limits in the standard-setting part.

(k) You may measure background concentrations and correct measured emission values accordingly. However, if any background corrections are equivalent to 5 percent or more of the maximum emissions allowed by the applicable standard, the test shall be voided and repeated in an environment with lower background concentrations.

§1065.925 Calculations.

(a) [Reserved]

(b) Convert emission analyzer data to instantaneous concentrations in ppm (ppmC for the FID).

(c) Calculate instantaneous exhaust volumetric flow rates in standard m^3/hr (volume and density values used in these calculations are corrected to standard conditions of 20 °C and 101.3 kPa.). Calculate exhaust volumetric flow rate from the following equation:

Exhaust volumetric flow rate = (intake air mass flow rate)(1+mass fuel/air ratio)/(density of exhaust)

(1) If you do not know the instantaneous density of the exhaust, use the minimum density of the exhaust that occurs over the course of the test, corrected to standard conditions.

(2) For gasoline-fueled engines designed to be operated at stoichiometric fuel/air ratios, you may assume that the density of the exhaust is 1202 g/m^3 at standard conditions of 20 °C and 101.3 kPa.

(3) For LPG-fueled engines designed to be operated at stoichiometric fuel/air ratios, you may assume that the density of the exhaust is 1175 g/m^3 at standard conditions of 20 °C and 101.3 kPa.

(4) For CNG-fueled engines designed to be operated at stoichiometric fuel/air ratios, you may assume that the density of the exhaust is 1149 g/m^3 at standard conditions of 20 °C and 101.3 kPa.

(d) Calculate instantaneous emission rates (g/hr) using the following general equation:

Emission rate = (exhaust volumetric flow rate)(ppm)(density factor)/10^6

Where:

Density factors are 576.8 g/m^3 for THC, 1913 g/m^3 for NO_X, 1164 g/m^3 for CO.

(e) Integrate instantaneous emission rates for the entire specified sample period.

(f) Determine instantaneous brake torque and speed.

(g) Calculate instantaneous brake power.

(h) Integrate instantaneous brake power for the entire specified sample period.

(i) Divide the integrated emission rates by the integrated brake power. These are your final brake-specific emission rates.

§1065.930 Specifications for mass air flow sensors.

(a) Measure the intake air flow using the engine's mass air flow sensor. If the engine is not equipped with a mass air flow sensor, you need to install one.

(b) The sensor design must have an accuracy and precision of ±5 percent under steady-state laboratory conditions.

(c) The sensor must reach at least 90 percent of its final response within 0.3 seconds after any step change to the flow rate greater than or equal 80 percent of full scale.

(d) Calibrate the sensor according to good engineering practice. Verify for each engine before testing that the sensor accurately reads the idle intake air flow rate based on measured manifold

temperature (T_M) and pressure P_M). Use the following equation:

Intake air flow = (displacement)(rpm)(volumetric efficiency)(P_M/101.3 kPa)(293.15 K/T_M)

§ 1065.935 Specifications for THC analyzers.

(a) Use a flame ionization detector (FID).

(b) The analyzer must have an accuracy and precision of ±2 percent of point or better under steady-state laboratory conditions.

(c) The analyzer must reach at least 90 percent of its final response within 1.0 second after any step change to the input concentration greater than or equal 80 percent of full scale.

(d) Zero and span the analyzer daily during testing. Calibrate it according to the analyzer manufacturer's specifications.

§ 1065.940 Specifications for NO_X and air/fuel sensors.

(a) Use stabilized zirconia-based sensors.

(b) The sensors must have an accuracy and precision of ±2 percent of point or better under steady-state laboratory conditions.

(c) The sensors must reach at least 90 percent of its final response within 1.0 second after any step change to the input concentration greater than or equal 80 percent of full scale.

(d) The sensors must be zeroed and spanned daily during testing, and must be calibrated according to the sensor manufacturer's specifications.

§ 1065.945 Specifications for CO analyzers.

(a) Use a non-dispersive infrared (NDIR) detector that is compensated for CO_2 and water interference.

(b) The analyzer must have an accuracy and precision of ±2 percent of point or better under steady-state laboratory conditions.

(c) The analyzer must reach at least 90 percent of its final response within 5.0 second after any step change to the input concentration greater than or equal 80 percent of full scale.

(d) The analyzer must be zeroed and spanned daily during testing, and must be calibrated according to the analyzer manufacturer's specifications.

§ 1065.950 Specifications for speed and torque measurement.

(a) Determine torque from a previously determined relationship of torque and engine speed, throttle position, and/or manifold absolute pressure. Torque estimates must be between 85 percent and 105 percent of the true value. You can demonstrate compliance with this accuracy requirement using steady-state laboratory data.

(b) Measure speed from the engine's electronic control module. Speed estimates must be within ±5 rpm of the true value.

Subpart K—Definitions and Other Reference Information

§ 1065.1001 Definitions.

The following definitions apply to this part. The definitions apply to all subparts unless we note otherwise. All undefined terms have the meaning the Act gives to them. The definitions follow:

Accuracy means the maximum difference between a measured or calculated value and the true value, where the true value is determined by NIST.

Act means the Clean Air Act, as amended, 42 U.S.C. 7401 *et seq.*

Adjustable parameter means any device, system, or element of design that someone can adjust (including those which are difficult to access) and that, if adjusted, may affect emissions or engine performance during emission testing or normal in-use operation.

Aftertreatment means relating to any system, component, or technology mounted downstream of the exhaust valve or exhaust port whose design function is to reduce exhaust emissions.

Auxiliary emission-control device means any element of design that senses temperature, engine speed, motive speed, transmission gear, atmospheric pressure, manifold pressure or vacuum, or any other parameter to activate, modulate, delay, or deactivate the operation of any part of the emission-control system. This also includes any other feature that causes in-use emissions to be higher than those