CO AND CO$_2$ MEASUREMENTS

§ 1065.250 Nondispersive infra-red analyzer.

(a) *Application.* Use a nondispersive infra-red (NDIR) analyzer to measure CO and CO$_2$ concentrations in raw or diluted exhaust for either batch or continuous sampling.

(b) *Component requirements.* We recommend that you use an NDIR analyzer that meets the specifications in Table 1 of § 1065.205. Note that your NDIR-based system must meet the calibration and verifications in § 1065.350 and § 1065.355 and it must also meet the linearity verification in § 1065.307. You may use an NDIR analyzer that has compensation algorithms that are functions of other gaseous measurements and the engine's known or assumed fuel properties. The target value for any compensation algorithm is 0.0% (that is, no bias high and no bias low), regardless of the uncompensated signal's bias.

HYDROCARBON MEASUREMENTS

§ 1065.260 Flame-ionization detector.

(a) *Application.* Use a flame-ionization detector (FID) analyzer to measure hydrocarbon concentrations in raw or diluted exhaust for either batch or continuous sampling. Determine hydrocarbon concentrations on a carbon number basis of one, C$_1$. Determine methane and nonmethane hydrocarbon values as described in paragraph (e) of this section. See subpart I of this part for special provisions that apply to measuring hydrocarbons when testing with oxygenated fuels.

(b) *Component requirements.* We recommend that you use a FID analyzer that meets the specifications in Table 1 of § 1065.205. Note that your FID-based system for measuring THC, THCE, or CH$_4$ must meet all of the verifications for hydrocarbon measurement in subpart D of this part, and it must also meet the linearity verification in § 1065.307. You may use a FID that has compensation algorithms that are functions of other gaseous measurements and the engine's known or assumed fuel properties. The target value for any compensation algorithm is 0.0% (that is, no bias high and no bias low),

regardless of the uncompensated signal's bias.

(c) *Heated FID analyzers.* For compression-ignition engines, two-stroke spark-ignition engines, and four-stroke spark-ignition engines below 19 kW, you must use heated FID analyzers that maintain all surfaces that are exposed to emissions at a temperature of (191 ± 11) °C.

(d) *FID fuel and burner air.* Use FID fuel and burner air that meet the specifications of § 1065.750. Do not allow the FID fuel and burner air to mix before entering the FID analyzer to ensure that the FID analyzer operates with a diffusion flame and not a premixed flame.

(e) *Methane.* FID analyzers measure total hydrocarbons (THC). To determine nonmethane hydrocarbons (NMHC), quantify methane, CH$_4$, either with a nonmethane cutter and a FID analyzer as described in § 1065.265, or with a gas chromatograph as described in § 1065.267. Instead of measuring methane, you may assume that 2% of measured total hydrocarbon is methane, as described in § 1065.650(c)(1)(vi). For a FID analyzer used to determine NMHC, determine its response factor to methane, RF_{CH4}, as described in § 1065.360. Note that NMHC-related calculations are described in § 1065.660.

[70 FR 40516, July 13, 2005, as amended at 75 FR 23035, Apr. 30, 2010; 75 FR 68462, Nov. 8, 2010]

§ 1065.265 Nonmethane cutter.

(a) *Application.* You may use a nonmethane cutter to measure CH$_4$ with a FID analyzer. A nonmethane cutter oxidizes all nonmethane hydrocarbons to CO$_2$ and H$_2$O. You may use a nonmethane cutter for raw or diluted exhaust for batch or continuous sampling.

(b) *System performance.* Determine nonmethane-cutter performance as described in § 1065.365 and use the results to calculate NMHC emission in § 1065.660.

(c) *Configuration.* Configure the nonmethane cutter with a bypass line if it is needed for the verification described in § 1065.365.

(d) *Optimization.* You may optimize a nonmethane cutter to maximize the penetration of CH$_4$ and the oxidation of