

point where $x_{\text{H}_2\text{O}}$ is measured to the analyzer are at least 5 °C above the local sample gas dewpoint.

(6) Allow time for the analyzer response to stabilize. Stabilization time may include time to purge the transfer line and to account for analyzer response.

(7) While the analyzer measures the sample's concentration, record 30 seconds of sampled data. Calculate the arithmetic mean of this data. The analyzer meets the interference verification if this value is within (0.0 ±0.4) mmol/mol.

[70 FR 40516, July 13, 2005, as amended at 73 FR 37308, June 30, 2008; 73 FR 59328, Oct. 8, 2008; 75 FR 23040, Apr. 30, 2010; 76 FR 57447, Sept. 15, 2011]

§ 1065.355 H₂O and CO₂ interference verification for CO NDIR analyzers.

(a) *Scope and frequency.* If you measure CO using an NDIR analyzer, verify the amount of H₂O and CO₂ interference after initial analyzer installation and after major maintenance.

(b) *Measurement principles.* H₂O and CO₂ can positively interfere with an NDIR analyzer by causing a response similar to CO. If the NDIR analyzer uses compensation algorithms that utilize measurements of other gases to meet this interference verification, simultaneously conduct these other measurements to test the compensation algorithms during the analyzer interference verification.

(c) *System requirements.* A CO NDIR analyzer must have combined H₂O and CO₂ interference that is within ±2 % of the flow-weighted mean concentration of CO expected at the standard, though we strongly recommend a lower interference that is within ±1%.

(d) *Procedure.* Perform the interference verification as follows:

(1) Start, operate, zero, and span the CO NDIR analyzer as you would before an emission test. If the sample is passed through a dryer during emission testing, you may run this verification test with the dryer if it meets the requirements of §1065.342. Operate the dryer at the same conditions as you will for an emission test. You may also run this verification test without the sample dryer.

(2) Create a humidified CO₂ test gas by bubbling a CO₂ span gas that meets the specifications in §1065.750 through distilled water in a sealed vessel. If the sample is not passed through a dryer during emission testing, control the vessel temperature to generate an H₂O level at least as high as the maximum expected during emission testing. If the sample is passed through a dryer during emission testing, control the vessel temperature to generate an H₂O level at least as high as the level determined in §1065.145(e)(2) for that dryer. Use a CO₂ span gas concentration at least as high as the maximum expected during testing.

(3) Introduce the humidified CO₂ test gas into the sample system. You may introduce it downstream of any sample dryer, if one is used during testing.

(4) If the sample is not passed through a dryer during this verification test, measure the water mole fraction, $x_{\text{H}_2\text{O}}$, of the humidified CO₂ test gas as close as possible to the inlet of the analyzer. For example, measure dewpoint, T_{dew} , and absolute pressure, p_{total} , to calculate $x_{\text{H}_2\text{O}}$. Verify that the water content meets the requirement in paragraph (d)(2) of this section. If the sample is passed through a dryer during this verification test, you must verify that the water content of the humidified test gas downstream of the vessel meets the requirement in paragraph (d)(2) of this section based on either direct measurement of the water content (*e.g.*, dewpoint and pressure) or an estimate based on the vessel pressure and temperature. Use good engineering judgment to estimate the water content. For example, you may use previous direct measurements of water content to verify the vessel's level of saturation.

(5) If a sample dryer is not used in this verification test, use good engineering judgment to prevent condensation in the transfer lines, fittings, or valves from the point where $x_{\text{H}_2\text{O}}$ is measured to the analyzer. We recommend that you design your system so that the wall temperatures in the transfer lines, fittings, and valves from the point where $x_{\text{H}_2\text{O}}$ is measured to the analyzer are at least 5 °C above the local sample gas dewpoint.

§ 1065.360

40 CFR Ch. I (7–1–13 Edition)

HYDROCARBON MEASUREMENTS

§ 1065.360 FID optimization and verification.

(6) Allow time for the analyzer response to stabilize. Stabilization time may include time to purge the transfer line and to account for analyzer response.

(7) While the analyzer measures the sample's concentration, record its output for 30 seconds. Calculate the arithmetic mean of this data.

(8) The analyzer meets the interference verification if the result of paragraph (d)(7) of this section meets the tolerance in paragraph (c) of this section.

(9) You may also run interference procedures for CO₂ and H₂O separately. If the CO₂ and H₂O levels used are higher than the maximum levels expected during testing, you may scale down each observed interference value by multiplying the observed interference by the ratio of the maximum expected concentration value to the actual value used during this procedure. You may run separate interference concentrations of H₂O (down to 0.025 mol/mol H₂O content) that are lower than the maximum levels expected during testing, but you must scale up the observed H₂O interference by multiplying the observed interference by the ratio of the maximum expected H₂O concentration value to the actual value used during this procedure. The sum of the two scaled interference values must meet the tolerance in paragraph (c) of this section.

(e) *Exceptions.* The following exceptions apply:

(1) You may omit this verification if you can show by engineering analysis that for your CO sampling system and your emission-calculation procedures, the combined CO₂ and H₂O interference for your CO NDIR analyzer always affects your brake-specific CO emission results within ±0.5% of the applicable CO standard.

(2) You may use a CO NDIR analyzer that you determine does not meet this verification, as long as you try to correct the problem and the measurement deficiency does not adversely affect your ability to show that engines comply with all applicable emission standards.

[70 FR 40516, July 13, 2005, as amended at 73 FR 37308, June 30, 2008; 73 FR 59328, Oct. 8, 2008; 75 FR 23041, Apr. 30, 2010]

(a) *Scope and frequency.* For all FID analyzers, calibrate the FID upon initial installation. Repeat the calibration as needed using good engineering judgment. For a FID that measures THC, perform the following steps:

(1) Optimize the response to various hydrocarbons after initial analyzer installation and after major maintenance as described in paragraph (c) of this section.

(2) Determine the methane (CH₄) response factor after initial analyzer installation and after major maintenance as described in paragraph (d) of this section.

(3) Verify the methane (CH₄) response within 185 days before testing as described in paragraph (e) of this section.

(b) *Calibration.* Use good engineering judgment to develop a calibration procedure, such as one based on the FID-analyzer manufacturer's instructions and recommended frequency for calibrating the FID. Alternately, you may remove system components for off-site calibration. For a FID that measures THC, calibrate using C₃H₈ calibration gases that meet the specifications of §1065.750. For a FID that measures CH₄, calibrate using CH₄ calibration gases that meet the specifications of §1065.750. We recommend FID analyzer zero and span gases that contain approximately the flow-weighted mean concentration of O₂ expected during testing. If you use a FID to measure methane (CH₄) downstream of a non-methane cutter, you may calibrate that FID using CH₄ calibration gases with the cutter. Regardless of the calibration gas composition, calibrate on a carbon number basis of one (C₁). For example, if you use a C₃H₈ span gas of concentration 200 µmol/mol, span the FID to respond with a value of 600 µmol/mol. As another example, if you use a CH₄ span gas with a concentration of 200 µmol/mol, span the FID to respond with a value of 200 µmol/mol.