

(iv) Demonstrate that the deficiency does not adversely affect your ability to demonstrate compliance with the applicable emission standards.

**§ 1065.365 Nonmethane cutter penetration fractions.**

(a) *Scope and frequency.* If you use a FID analyzer and a nonmethane cutter (NMC) to measure methane ( $\text{CH}_4$ ), determine the nonmethane cutter's penetration fractions of methane,  $PF_{\text{CH}_4}$ , and ethane,  $PF_{\text{C}_2\text{H}_6}$ . Perform this verification after installing the nonmethane cutter. Repeat this verification within 185 days of testing to verify that the catalytic activity of the cutter has not deteriorated. Note that because nonmethane cutters can deteriorate rapidly and without warning if they are operated outside of certain ranges of gas concentrations and outside of certain temperature ranges, good engineering judgment may dictate that you determine a nonmethane cutter's penetration fractions more frequently.

(b) *Measurement principles.* A nonmethane cutter is a heated catalyst that removes nonmethane hydrocarbons from the exhaust stream before the FID analyzer measures the remaining hydrocarbon concentration. An ideal nonmethane cutter would have  $PF_{\text{CH}_4}$  of 1.000, and the penetration fraction for all other hydrocarbons would be 0.000, as represented by  $PF_{\text{C}_2\text{H}_6}$ . The emission calculations in § 1065.660 use this section's measured values of  $PF_{\text{CH}_4}$  and  $PF_{\text{C}_2\text{H}_6}$  to account for less than ideal NMC performance.

(c) *System requirements.* We do not limit NMC penetration fractions to a certain range. However, we recommend that you optimize a nonmethane cutter by adjusting its temperature to achieve  $PF_{\text{CH}_4} > 0.95$  and  $PF_{\text{C}_2\text{H}_6} < 0.02$  as determined by paragraphs (d) and (e) of this section, as applicable. If we use a nonmethane cutter for testing, it will meet this recommendation. If adjusting NMC temperature does not result in achieving both of these specifications simultaneously, we recommend that you replace the catalyst material.

Use the most recently determined penetration values from this section to calculate HC emissions according to § 1065.660 and § 1065.665 as applicable.

(d) *Procedure for a FID calibrated with the NMC.* If your FID arrangement is such that a FID is always calibrated to measure  $\text{CH}_4$  with the NMC, then span that FID with the NMC cutter using a  $\text{CH}_4$  span gas, set that FID's  $\text{CH}_4$  penetration fraction,  $PF_{\text{CH}_4}$ , equal to 1.0 for all emission calculations, and determine its ethane ( $\text{C}_2\text{H}_6$ ) penetration fraction,  $PF_{\text{C}_2\text{H}_6}$ , as follows:

(1) Select a  $\text{CH}_4$  gas mixture and a  $\text{C}_2\text{H}_6$  analytical gas mixture and ensure that both mixtures meet the specifications of § 1065.750. Select a  $\text{CH}_4$  concentration that you would use for spanning the FID during emission testing and select a  $\text{C}_2\text{H}_6$  concentration that is typical of the peak NMHC concentration expected at the hydrocarbon standard or equal to THC analyzer's span value.

(2) Start, operate, and optimize the nonmethane cutter according to the manufacturer's instructions, including any temperature optimization.

(3) Confirm that the FID analyzer meets all the specifications of § 1065.360.

(4) Start and operate the FID analyzer according to the manufacturer's instructions.

(5) Zero and span the FID with the cutter and use  $\text{CH}_4$  span gas to span the FID with the cutter. Note that you must span the FID on a  $\text{C}_1$  basis. For example, if your span gas has a  $\text{CH}_4$  reference value of  $100 \mu\text{mol}$ , the correct FID response to that span gas is  $100 \mu\text{mol}$  because there is one carbon atom per  $\text{CH}_4$  molecule.

(6) Introduce the  $\text{C}_2\text{H}_6$  analytical gas mixture upstream of the nonmethane cutter.

(7) Allow time for the analyzer response to stabilize. Stabilization time may include time to purge the nonmethane cutter and to account for the analyzer's response.

(8) While the analyzer measures a stable concentration, record 30 seconds of sampled data. Calculate the arithmetic mean of these data points.

(9) Divide the mean by the reference value of  $\text{C}_2\text{H}_6$ , converted to a  $\text{C}_1$  basis. The result is the  $\text{C}_2\text{H}_6$  penetration fraction,  $PF_{\text{C}_2\text{H}_6}$ . Use this penetration fraction and the  $\text{CH}_4$  penetration fraction, which is set equal to 1.0, in emission calculations according to § 1065.660 or § 1065.665, as applicable.

(e) *Procedure for a FID calibrated by bypassing the NMC.* If you use a FID with an NMC that is calibrated by bypassing the NMC, determine penetration fractions as follows:

(1) Select CH<sub>4</sub> and C<sub>2</sub>H<sub>6</sub> analytical gas mixtures that meet the specifications of § 1065.750 with the CH<sub>4</sub> concentration typical of its peak concentration expected at the hydrocarbon standard and the C<sub>2</sub>H<sub>6</sub> concentration typical of the peak total hydrocarbon (THC) concentration expected at the hydrocarbon standard or the THC analyzer span value.

(2) Start and operate the nonmethane cutter according to the manufacturer's instructions, including any temperature optimization.

(3) Confirm that the FID analyzer meets all the specifications of § 1065.360.

(4) Start and operate the FID analyzer according to the manufacturer's instructions.

(5) Zero and span the FID as you would during emission testing. Span the FID by bypassing the cutter and by using C<sub>3</sub>H<sub>8</sub> span gas to span the FID. Note that you must span the FID on a C<sub>1</sub> basis. For example, if your span gas has a propane reference value of 100 μ/mol, the correct FID response to that span gas is 300 μ/mol because there are three carbon atoms per C<sub>3</sub>H<sub>8</sub> molecule.

(6) Introduce the C<sub>2</sub>H<sub>6</sub> analytical gas mixture upstream of the nonmethane cutter.

(7) Allow time for the analyzer response to stabilize. Stabilization time may include time to purge the nonmethane cutter and to account for the analyzer's response.

(8) While the analyzer measures a stable concentration, record 30 seconds of sampled data. Calculate the arithmetic mean of these data points.

(9) Reroute the flow path to bypass the nonmethane cutter, introduce the C<sub>2</sub>H<sub>6</sub> analytical gas mixture to the bypass, and repeat the steps in paragraphs (e)(7) through (8) of this section.

(10) Divide the mean C<sub>2</sub>H<sub>6</sub> concentration measured through the nonmethane cutter by the mean concentration measured after bypassing the nonmethane cutter. The result is the C<sub>2</sub>H<sub>6</sub> penetration fraction,  $PF_{C_2H_6}$ . Use this penetration fraction according to § 1065.660 or § 1065.665, as applicable.

(11) Repeat the steps in paragraphs (e)(6) through (10) of this section, but with the CH<sub>4</sub> analytical gas mixture instead of C<sub>2</sub>H<sub>6</sub>. The result will be the CH<sub>4</sub> penetration fraction,  $PF_{CH_4}$ . Use this penetration fraction according to § 1065.660 or § 1065.665, as applicable.

#### NO<sub>x</sub> MEASUREMENTS

##### § 1065.370 CLD CO<sub>2</sub> and H<sub>2</sub>O quench verification.

(a) *Scope and frequency.* If you use a CLD analyzer to measure NO<sub>x</sub>, verify the amount of H<sub>2</sub>O and CO<sub>2</sub> quench after installing the CLD analyzer and after major maintenance.

(b) *Measurement principles.* H<sub>2</sub>O and CO<sub>2</sub> can negatively interfere with a CLD's NO<sub>x</sub> response by collisional quenching, which inhibits the chemiluminescent reaction that a CLD utilizes to detect NO<sub>x</sub>. The calculations in § 1065.672 for H<sub>2</sub>O quench account for the water vapor in humidified NO span gas. The procedure and the calculations scale the quench results to the water vapor and CO<sub>2</sub> concentrations expected during testing. If the CLD analyzer uses quench compensation algorithms that utilize H<sub>2</sub>O and/or CO<sub>2</sub> measurement instruments, use these instruments to measure H<sub>2</sub>O and/or CO<sub>2</sub> and evaluate quench with the compensation algorithms applied.

(c) *System requirements.* A CLD analyzer must have a combined H<sub>2</sub>O and CO<sub>2</sub> quench of ±2% or less, though we strongly recommend a quench of ±1% or less. Combined quench is the sum of the CO<sub>2</sub> quench determined as described in paragraph (d) of this section, plus the H<sub>2</sub>O quench determined in paragraph (e) of this section.

(d) *CO<sub>2</sub> quench verification procedure.* Use the following method to determine CO<sub>2</sub> quench, or use good engineering judgment to develop a different protocol:

(1) Use PTFE tubing to make necessary connections.

(2) Connect a pressure-regulated CO<sub>2</sub> span gas to one of the inlets of a three-way valve made of 300 series stainless steel. Use a CO<sub>2</sub> span gas that meets the specifications of § 1065.750 and attempt to use a concentration that is approximately twice the maximum CO<sub>2</sub> concentration expected to enter the