§ 1065.360  FID optimization and verification.

(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 CH₄ 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 CH₄ 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.

(c) THC FID response optimization. This procedure is only for FID analyzers that measure THC. Use good engineering judgment for initial instrument start-up and basic operating adjustment using FID fuel and zero air. Heated FIDs must be within their required operating temperature ranges. Optimize FID response at the most common analyzer range expected during emission testing. Optimization involves adjusting flows and pressures of FID fuel, burner air, and sample to
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minimize response variations to various hydrocarbon species in the exhaust. Use good engineering judgment to trade off peak FID response to propane calibration gases to achieve minimal response variations to different hydrocarbon species. For an example of trading off response to propane for relative responses to other hydrocarbon species, see SAE 770141 (incorporated by reference in §1065.1010). Determine the optimum flow rates and/or pressures for FID fuel, burner air, and sample and record them for future reference.

(d) THC FID CH₄ response factor determination. This procedure is only for FID analyzers that measure THC. Since FID analyzers generally have a different response to CH₄ versus C_H₃, determine each THC FID analyzer’s CH₄ response factor, \( RF_{CH₄[THC-FID]} \), after FID optimization. Use the most recent \( RF_{CH₄[THC-FID]} \) measured according to this section in the calculations for HC determination described in §1065.660 to compensate for CH₄ response. Determine \( RF_{CH₄[THC-FID]} \) as follows, noting that you do not determine \( RF_{CH₄[THC-FID]} \) for FIDs that are calibrated and spanned using CH₄ with a nonmethane cutter:

(1) Select a C_H₄ span gas concentration that you use to span your analyzers before emission testing. Use only span gases that meet the specifications of §1065.750. Record the C_H₄ concentration of the gas.

(2) Select a CH₄ span gas concentration that you use to span your analyzers before emission testing. Use only span gases that meet the specifications of §1065.750. Record the CH₄ concentration of the gas.

(3) Start and operate the FID analyzer according to the manufacturer’s instructions.

(4) Confirm that the FID analyzer has been calibrated using C_H₄. Calibrate on a carbon number basis of one (C₁). For example, if you use a C_H₄ span gas of concentration 200 μmol/mol, span the FID to respond with a value of 600 μmol/mol.

(5) Zero the FID with a zero gas that you use for emission testing.

(6) Span the FID with the C_H₄ span gas that you selected under paragraph (d)(1) of this section.

(7) Introduce at the sample port of the FID analyzer, the CH₄ span gas that you selected under paragraph (d)(2) of this section.

(8) Allow time for the analyzer response to stabilize. Stabilization time may include time to purge the analyzer and to account for its response.

(9) While the analyzer measures the CH₄ concentration, record 30 seconds of sampled data. Calculate the arithmetic mean of these values.

(10) Divide the mean measured concentration by the recorded span concentration of the CH₄ calibration gas. The result is the FID analyzer’s response factor for CH₄, \( RF_{CH₄[THC-FID]} \).

(e) THC FID methane (CH₄) response verification. This procedure is only for FID analyzers that measure THC. If the value of \( RF_{CH₄[THC-FID]} \) from paragraph (d) of this section is within ±5.0% of its most recent previously determined value, the THC FID passes the methane response verification. For example, if the most recent previous value for \( RF_{CH₄[THC-FID]} \) was 1.05 and it changed by ±0.05 to become 1.10 or it changed by −0.05 to become 1.00, either case would be acceptable because ±4.8% is less than ±5.0%. Verify \( RF_{CH₄[THC-FID]} \) as follows:

(1) First verify that the flow rates and/or pressures of FID fuel, burner air, and sample are each within ±0.5% of their most recent previously recorded values, as described in paragraph (c) of this section. You may adjust these flow rates as necessary. Then determine the \( RF_{CH₄[THC-FID]} \) as described in paragraph (d) of this section and verify that it is within the tolerance specified in this paragraph (e).

(2) If \( RF_{CH₄[THC-FID]} \) is not within the tolerance specified in this paragraph (e), re-optimize the FID response as described in paragraph (c) of this section.

(3) Determine a new \( RF_{CH₄[THC-FID]} \) as described in paragraph (d) of this section. Use this new value of \( RF_{CH₄[THC-FID]} \) in the calculations for HC determination, as described in §1065.660.