

$$m_{\text{cor}} = m_{\text{uncor}} \cdot \left( \frac{1 - \frac{\rho_{\text{air}}}{\rho_{\text{weight}}}}{1 - \frac{\rho_{\text{air}}}{\rho_{\text{media}}}} \right) \quad \text{Eq. 1065.690-1}$$

Where:

- $m_{\text{cor}}$  = PM mass corrected for buoyancy.
- $m_{\text{uncor}}$  = PM mass uncorrected for buoyancy.
- $\rho_{\text{air}}$  = density of air in balance environment.
- $\rho_{\text{weight}}$  = density of calibration weight used to span balance.
- $\rho_{\text{media}}$  = density of PM sample media, such as a filter.

$$\rho_{\text{air}} = \frac{\rho_{\text{abs}} \cdot M_{\text{mix}}}{R \cdot T_{\text{amb}}} \quad \text{Eq. 1065.690-2}$$

Where:

- $\rho_{\text{abs}}$  = absolute pressure in balance environment.
- $M_{\text{mix}}$  = molar mass of air in balance environment.
- $R$  = molar gas constant.
- $T_{\text{amb}}$  = absolute ambient temperature of balance environment.

Example:

- $\rho_{\text{abs}} = 99.980 \text{ kPa}$
- $T_{\text{sat}} = T_{\text{dew}} = 9.5 \text{ }^\circ\text{C}$
- Using Eq. 1065.645-2,
- $\rho_{\text{H}_2\text{O}} = 1.1866 \text{ kPa}$
- Using Eq. 1065.645-3,
- $x_{\text{H}_2\text{O}} = 0.011868 \text{ mol/mol}$
- Using Eq. 1065.640-8,
- $M_{\text{mix}} = 28.83563 \text{ g/mol}$
- $R = 8.314472 \text{ J/(mol}\cdot\text{K)}$
- $T_{\text{amb}} = 20 \text{ }^\circ\text{C}$

$$\rho_{\text{air}} = \frac{99.980 \cdot 28.83563}{8.314472 \cdot 293.15}$$

- $\rho_{\text{air}} = 1.18282 \text{ kg/m}^3$
- $m_{\text{uncor}} = 100.0000 \text{ mg}$
- $\rho_{\text{weight}} = 8000 \text{ kg/m}^3$
- $\rho_{\text{media}} = 920 \text{ kg/m}^3$

$$m_{\text{cor}} = 100.0000 \cdot \left[ \frac{1 - \frac{1.18282}{8000}}{1 - \frac{1.18282}{920}} \right]$$

$m_{\text{cor}} = 100.1139 \text{ mg}$

**§ 1065.695 Data requirements.**

(a) To determine the information we require from engine tests, refer to the standard-setting part and request from

your Designated Compliance Officer the format used to apply for certification or demonstrate compliance. We may require different information for different purposes, such as for certification applications, approval requests for alternate procedures, selective enforcement audits, laboratory audits, production-line test reports, and field-test reports.

(b) See the standard-setting part and § 1065.25 regarding recordkeeping.

(c) We may ask you the following about your testing, and we may ask you for other information as allowed under the Act:

(1) What approved alternate procedures did you use? For example:

- (i) Partial-flow dilution for proportional PM.
- (ii) CARB test procedures.
- (iii) ISO test procedures.

(2) What laboratory equipment did you use? For example, the make, model, and description of the following:

- (i) Engine dynamometer and operator demand.
- (ii) Probes, dilution, transfer lines, and sample preconditioning components.
- (iii) Batch storage media (such as the bag material or PM filter material).

(3) What measurement instruments did you use? For example, the make, model, and description of the following:

- (i) Speed and torque instruments.
- (ii) Flow meters.
- (iii) Gas analyzers.
- (iv) PM balance.

(4) When did you conduct calibrations and performance checks and what were the results? For example, the dates and results of the following:

- (i) Linearity checks.
- (ii) Interference checks.
- (iii) Response checks.
- (iv) Leak checks.
- (v) Flow meter checks.

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- (5) What engine did you test? For example, the following:
- (i) Manufacturer.
  - (ii) Family name on engine label.
  - (iii) Model.
  - (iv) Model year.
  - (v) Identification number.
- (6) How did you prepare and configure your engine for testing? Consider the following examples:
- (i) Dates, hours, duty cycle and fuel used for service accumulation.
  - (ii) Dates and description of scheduled and unscheduled maintenance.
  - (iii) Allowable pressure range of intake restriction.
  - (iv) Allowable pressure range of exhaust restriction.
  - (v) Charge air cooler volume.
  - (vi) Charge air cooler outlet temperature, specified engine conditions and location of temperature measurement.
  - (vii) Fuel temperature and location of measurement.
  - (viii) Any aftertreatment system configuration and description.
  - (ix) Any crankcase ventilation configuration and description (e.g., open, closed, PCV, crankcase scavenged).
- (7) How did you test your engine? For example:
- (i) Constant speed or variable speed.
  - (ii) Mapping procedure (step or sweep).
  - (iii) Continuous or batch sampling for each emission.
  - (iv) Raw or dilute sampling; any dilution-air background sampling.
  - (v) Duty cycle and test intervals.
  - (vi) Cold-start, hot-start, warmed-up running.
  - (vii) Absolute pressure, temperature, and dewpoint of intake and dilution air.
  - (viii) Simulated engine loads, curb idle transmission torque value.
  - (ix) Warm-idle speed value and any enhanced-idle speed value.
  - (x) Simulated vehicle signals applied during testing.
  - (xi) Bypassed governor controls during testing.
  - (xii) Date, time, and location of test (e.g., dynamometer laboratory identification).
  - (xiii) Cooling medium for engine and charge air.
  - (xiv) Operating temperatures of coolant, head, and block.
  - (xv) Natural or forced cool-down and cool-down time.
  - (xvi) Canister loading.
- (8) How did you validate your testing? For example, results from the following:
- (i) Duty cycle regression statistics for each test interval.
  - (ii) Proportional sampling.
  - (iii) Drift.
  - (iv) Reference PM sample media in PM-stabilization environment.
- (9) How did you calculate results? For example, results from the following:
- (i) Drift correction.
  - (ii) Noise correction.
  - (iii) "Dry-to-wet" correction.
  - (iv) NMHC, CH<sub>4</sub>, and contamination correction.
  - (v) NO<sub>x</sub> humidity correction.
  - (vi) Brake-specific emission formulation—total mass divided by total work, mass rate divided by power, or ratio of mass to work.
  - (vii) Rounding emission results.
- (10) What were the results of your testing? For example:
- (i) Maximum mapped power and speed at maximum power.
  - (ii) Maximum mapped torque and speed at maximum torque.
  - (iii) For constant-speed engines: no-load governed speed.
  - (iv) For constant-speed engines: test torque.
  - (v) For variable-speed engines: maximum test speed.
  - (vi) Speed versus torque map.
  - (vii) Speed versus power map.
  - (viii) Brake-specific emissions over the duty cycle and each test interval.
  - (ix) Brake-specific fuel consumption.
- (11) What fuel did you use? For example:
- (i) Fuel that met specifications of subpart H of this part.
  - (ii) Alternate fuel.
  - (iii) Oxygenated fuel.
- (12) How did you field test your engine? For example:
- (i) Data from paragraphs (c)(1), (3), (4), (5), and (9) of this section.
  - (ii) Probes, dilution, transfer lines, and sample preconditioning components.
  - (iii) Batch storage media (such as the bag material or PM filter material).
  - (iv) Continuous or batch sampling for each emission.

- (v) Raw or dilute sampling; any dilution air background sampling.
- (vi) Cold-start, hot-start, warmed-up running.
- (vii) Intake and dilution air absolute pressure, temperature, dewpoint.
- (viii) Curb idle transmission torque value.
- (ix) Warm idle speed value, any enhanced idle speed value.
- (x) Date, time, and location of test (e.g., identify the testing laboratory).
- (xi) Proportional sampling validation.
- (xii) Drift validation.
- (xiii) Operating temperatures of coolant, head, and block.
- (xiv) Vehicle make, model, model year, identification number.

**Subpart H—Engine Fluids, Test Fuels, Analytical Gases and Other Calibration Standards**

**§ 1065.701 General requirements for test fuels.**

(a) *General.* For all emission measurements, use test fuels that meet the specifications in this subpart, unless the standard-setting part directs otherwise. Section 1065.10(c)(1) does not apply with respect to test fuels. Note that the standard-setting parts generally require that you design your emission controls to function properly when using commercially available fuels, even if they differ from the test fuel.

(b) *Fuels meeting alternate specifications.* We may allow you to use a different test fuel (such as California

Phase 2 gasoline) if you show us that using it does not affect your ability to comply with all applicable emission standards using commercially available fuels.

(c) *Fuels not specified in this subpart.* If you produce engines that run on a type of fuel (or mixture of fuels) that we do not specify in this subpart, you must get our written approval to establish the appropriate test fuel. You must show us all the following things before we can specify a different test fuel for your engines:

- (1) Show that this type of fuel is commercially available.
- (2) Show that your engines will use only the designated fuel in service.
- (3) Show that operating the engines on the fuel we specify would unrepresentatively increase emissions or decrease durability.

(d) *Fuel specifications.* The fuel parameters specified in this subpart depend on measurement procedures that are incorporated by reference. For any of these procedures, you may instead rely upon the procedures identified in 40 CFR part 80 for measuring the same parameter. For example, we may identify different reference procedures for measuring gasoline parameters in 40 CFR 80.46.

(e) *Service accumulation and field testing fuels.* If we do not specify a service-accumulation or field-testing fuel in the standard-setting part, use an appropriate commercially available fuel such as those meeting minimum ASTM specifications from the following table:

TABLE 1 OF § 1065.701—SPECIFICATIONS FOR SERVICE-ACCUMULATION AND FIELD-TESTING FUELS

Fuel type	Subcategory	ASTM specification <sup>1</sup>
Diesel .....	Light distillate and light blends with residual .....	D975-04c
	Middle distillate .....	D6751-03a
	Biodiesel (B100) .....	D6985-04a
Gasoline .....	Motor vehicle and minor oxygenate blends .....	D4814-04b
	Ethanol (Ed75-85) .....	D5798-99
	Methanol (M70-M85) .....	D5797-96
	Aviation gasoline .....	D910-04a
Aviation fuel .....	Gas turbine .....	D1655-04a
	Jet B wide cut .....	D6615-04a
	General .....	D2880-03
Gas turbine fuel .....	General .....	D2880-03

<sup>1</sup> All ASTM specifications are incorporated by reference in § 1065.1010.