

give us information as required under this part or the Act. Note that these are also violations of 40 CFR 1068.101(a)(2).

(e) We may void your certificate if we find that you intentionally submitted false or incomplete information. This includes rendering submitted information false or incomplete after submission.

(f) If we deny your application or suspend, revoke, or void your certificate, you may ask for a hearing (see § 1036.820).

Subpart D [Reserved]

Subpart E—In-use Testing

§ 1036.401 In-use testing.

We may perform in-use testing of any engine family subject to the standards of this part, consistent with the provisions of § 1036.235. Note that this provision does not affect your obligation to test your in-use engines as described in 40 CFR part 86, subpart T.

Subpart F—Test Procedures

§ 1036.501 How do I run a valid emission test?

(a) Use the equipment and procedures specified in 40 CFR 86.1305 to determine whether engines meet the emission standards in § 1036.108.

(b) You may use special or alternate procedures to the extent we allow them under 40 CFR 1065.10.

(c) This subpart is addressed to you as a manufacturer, but it applies equally to anyone who does testing for you, and to us when we perform testing to determine if your engines meet emission standards.

(d) For engines that use aftertreatment technology with infrequent regeneration events, invalidate any test interval in which such a regeneration event occurs with respect to CO₂, N₂O, and CH₄ measurements.

(e) Test hybrid engines as described in 40 CFR part 1065 and § 1036.525.

(f) [Reserved]

(g) If your engine requires special components for proper testing, you must provide any such components to us if we ask for them.

§ 1036.525 Hybrid engines.

(a) If your engine system includes features that recover and store energy during engine motoring operation test the engine as described in paragraph (d) of this section. See § 1036.615(a)(2) for engine systems intended to include features that recover and store energy from braking unrelated to engine motoring operation. For purposes of this section, features that recover energy between the engine and transmission are considered “related to engine motoring”.

(b) If you produce a hybrid engine designed with power take-off capability and sell the engine coupled with a transmission, you may calculate a reduction in CO₂ emissions resulting from the power take-off operation as described in 40 CFR 1037.525. Use good engineering judgment to use the vehicle-based procedures to quantify the CO₂ reduction for your engines.

(c) The hardware that must be included in these tests is the engine, the hybrid electric motor, the rechargeable energy storage system (RESS) and the power electronics between the hybrid electric motor and the RESS. You may ask us to modify the provisions of this section to allow testing non-electric hybrid vehicles, consistent with good engineering judgment.

(d) Measure emissions using the same procedures that apply for testing non-hybrid engines under this part, except as specified otherwise in this part and/or 40 CFR part 1065. If you test hybrid engines using the SET, deactivate the hybrid features unless we have specified otherwise. The five differences that apply under this section are related to engine mapping, engine shutdown during the test cycle, calculating work, limits on braking energy, and state of charge constraints.

(1) Map the engine as specified in 40 CFR 1065.510. This requires separate torque maps for the engine with and without the hybrid features active. For transient testing, denormalize the test cycle using the map generated with the hybrid feature active. For steady-state testing, denormalize the test cycle using the map generated with the hybrid feature inactive.

(2) If the engine will be configured in actual use to shut down automatically

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during idle operation, you may let the engine shut down during the idle portions of the test cycle.

(3) Follow 40 CFR 1065.650(d) to calculate the work done over the cycle except as specified in this paragraph (d)(3). For the positive work over the cycle set negative power from hybrid to zero. For the negative work over the cycle set the positive power to zero and set the non-hybrid power to zero.

(4)(i) Calculate brake energy fraction, x_b , as the integrated negative work over the cycle divided by the integrated positive work over the cycle

according to Equation 1036.525–1. Calculate the brake energy limit for the engine, x_{bl} , according to Equation 1036.525–2. If x_b is less than x_{bl} , use the integrated positive work for your emission calculations. If the x_b is greater than x_{bl} use Equation 1036.525–3 to calculate the positive work done over the cycle. Use W_{cycle} as the integrated positive work when calculating brake-specific emissions. To avoid the need to delete extra brake work from positive work you may set an instantaneous brake target that will prevent x_b from being larger than x_{bl} .

$$x_b = \left| \frac{W_{neg}}{W_{pos}} \right|$$

Eq. 1036.525-1

$$x_{bl} = 4.158 \cdot 10^{-4} \cdot P_{max} + 0.2247$$

Eq. 1036.525-2

$$W_{cycle} = W_{pos} - \left(\left| W_{neg} \right| - x_{bl} \cdot W_{pos} \right)$$

Eq. 1036.525-3

(ii) The following definitions of terms apply for this paragraph (d)(4):

x_b = the brake energy fraction.

W_{neg} = the negative work over the cycle.

W_{pos} = the positive work over the cycle.

x_{bl} = the brake energy fraction limit.

P_{max} = the maximum power of the engine with the hybrid system engaged (kW).

W_{cycle} = the work over the cycle when x_b is greater than x_{bl} .

(iii) Note that these calculations are specified with SI units (such as kW), consistent with 40 CFR part 1065. Emission

results are converted to g/hp-hr at the end of the calculations.

(5) Correct for the net energy change of the energy storage device as described in 40 CFR 1066.501.

EFFECTIVE DATE NOTE: At 78 FR 36389, June 17, 2013, §1036.525 was amended by revising paragraph (a), effective Aug. 16, 2013. For the convenience of the user, the revised text is set forth as follows:

§ 1036.525 Hybrid engines.

(a) If your engine system includes features that recover and store energy during engine motoring operation test the engine as described in paragraph (d) of this section. For

purposes of this section, features that recover energy between the engine and transmission are considered related to engine motoring.

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§ 1036.530 Calculating greenhouse gas emission rates.

This section describes how to calculate official emission results for CO₂, CH₄, and N₂O.

(a) Calculate brake-specific emission rates for each applicable duty cycle as specified in 40 CFR 1065.650. Do not apply infrequent regeneration adjustment factors to your results.

(b) Adjust CO₂ emission rates calculated under paragraph (a) of this section for measured test fuel properties as specified in this paragraph (b) to obtain the official emission results. You are not required to apply this adjustment for fuels containing at least 75 percent pure alcohol, such as E85. The purpose of this adjustment is to make official emission results independent of differences in test fuels within a fuel type. Use good engineering judgment to develop and apply testing protocols to minimize the impact of variations in test fuels.

(1) For liquid fuels, determine the net energy content (Btu per pound of fuel) according to ASTM D4809 or ASTM D240 (both incorporated by reference in §1036.810) and carbon weight fraction (dimensionless) of your test fuel according to ASTM D5291 (incorporated by reference in §1036.810). (Note that we recommend using ASTM D4809.) For gaseous fuels, use good engineering judgment to determine the fuel's net energy content and carbon weight fraction. (Note: Net energy content is also sometimes known as lower heating value.) Calculate the test fuel's carbon-specific net energy content (Btu/lbC) by dividing the net energy content by the carbon fraction, expressed to at least five significant figures. You may perform these calculations using SI units with the following conversion factors: one Btu equals 1055.06 Joules and one Btu/lb equals 0.0023260 MJ/kg.

(2) If you control test fuel properties so that variations in the actual carbon-specific energy content are the same as or smaller than the repeatability of

measuring carbon-specific energy content, you may use a constant value equal to the average carbon-specific energy content of your test fuel. Otherwise, use the measured value for the specific test fuel used for a given test. If you use a constant value, you must update or verify the value at least once per year, or after changes in test fuel suppliers or specifications.

(3) Calculate the adjustment factor for carbon-specific net energy content by dividing the carbon-specific net energy content of your test fuel by the reference level in the following table, expressed to at least five decimal places. Note that as used in this section, the unit lbC means pound of carbon and kgC means kilogram of carbon.

Fuel type	Reference carbon-specific net energy content (Btu/lbC)	Reference carbon-specific net energy content (MJ/kgC)
Diesel fuel	21,200	49.3112
Gasoline	21,700	50.4742
Natural Gas	28,500	66.2910
LPG	24,300	56.5218

(4) Your official emission result equals your calculated brake-specific emission rate multiplied by the adjustment factor specified in paragraph (b)(2) of this section. For example, if the net energy content and carbon fraction of your diesel test fuel are 18,400 Btu/lb and 0.870, the carbon-specific net energy content of the test fuel would be 21,149 Btu/lbC. The adjustment factor in the example above would be 0.99759 (21,149/21,200). If your brake-specific CO₂ emission rate was 630.0 g/hp-hr, your official emission result would be 628.5 g/hp-hr.

Subpart G—Special Compliance Provisions

§ 1036.601 What compliance provisions apply to these engines?

(a) Engine and equipment manufacturers, as well as owners, operators, and rebuilders of engines subject to the requirements of this part, and all other persons, must observe the provisions of this part, the provisions of the Clean Air Act, and the following provisions of 40 CFR part 1068:

(1) The exemption and importation provisions of 40 CFR part 1068, subparts