

Environmental Protection Agency

§ 600.510–12

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(iii) The net heating value and density of gasoline are to be determined by the manufacturer in accordance with § 600.113(f).

(2) [Reserved]

(3) Alcohol dual fuel passenger automobiles and natural gas dual fuel passenger automobiles manufactured during model years 1993 through 2019 must meet the minimum driving range requirements established by the Secretary of Transportation (49 CFR part 538) to obtain the CAFE credit determined in paragraphs (c)(2)(v) and (vi) of this section.

(h) For model years 1993 and later, and for each category of automobile identified in paragraph (a) of this section, the maximum increase in average fuel economy determined in paragraph (c) of this section attributable to alcohol dual fuel automobiles and natural gas dual fuel automobiles shall be as follows:

Model year	Maximum Increase (mpg)
1993–2014	1.2
2015	1.0
2016	0.8
2017	0.6
2018	0.4
2019	0.2
2020 and later	0

(1) The Administrator shall calculate the increase in average fuel economy to determine if the maximum increase provided in paragraph (h) of this section has been reached. The Administrator shall calculate the average fuel economy for each category of automobiles specified in paragraph (a) of this section by subtracting the average

fuel economy values calculated in accordance with this section by assuming all alcohol dual fuel and natural gas dual fuel automobiles are operated exclusively on gasoline (or diesel) fuel from the average fuel economy values determined in paragraphs (b)(2)(vi), (b)(2)(vii), and (c) of this section. The difference is limited to the maximum increase specified in paragraph (h) of this section.

(2) [Reserved]

(i) [Reserved]

[71 FR 77955, Dec. 27, 2006, as amended at 74 FR 61554, Nov. 25, 2009]

§ 600.510–12 Calculation of average fuel economy and average carbon-related exhaust emissions.

(a)(1) Average fuel economy will be calculated to the nearest 0.1 mpg for the categories of automobiles identified in this section, and the results of such calculations will be reported to the Secretary of Transportation for use in determining compliance with the applicable fuel economy standards.

(i) An average fuel economy calculation will be made for the category of passenger automobiles as determined by the Secretary of Transportation. For example, categories may include, but are not limited to domestically manufactured and/or non-domestically manufactured passenger automobiles as determined by the Secretary of Transportation.

(ii) [Reserved]

(iii) An average fuel economy calculation will be made for the category of trucks as determined by the Secretary of Transportation. For example, categories may include, but are not limited to domestically manufactured trucks, non-domestically manufactured trucks, light-duty trucks, medium-duty passenger vehicles, and/or heavy-duty trucks as determined by the Secretary of Transportation.

(iv) [Reserved]

(2) Average carbon-related exhaust emissions will be calculated to the nearest one gram per mile for the categories of automobiles identified in this section, and the results of such calculations will be reported to the Administrator for use in determining compliance with the applicable CO₂ emission standards.

(i) An average carbon-related exhaust emissions calculation will be made for passenger automobiles.

(ii) An average carbon-related exhaust emissions calculation will be made for light trucks.

(b) For the purpose of calculating average fuel economy under paragraph (c) of this section and for the purpose of calculating average carbon-related exhaust emissions under paragraph (j) of this section:

(1) All fuel economy and carbon-related exhaust emissions data submitted in accordance with § 600.006(e) or § 600.512(c) shall be used.

(2) The combined city/highway fuel economy and carbon-related exhaust emission values will be calculated for each model type in accordance with § 600.208-12 of this section except that:

(i) Separate fuel economy values will be calculated for model types and base levels associated with car lines for each category of passenger automobiles and light trucks as determined by the Secretary of Transportation pursuant to paragraph (a)(1) of this section.

(ii) Total model year production data, as required by this subpart, will be used instead of sales projections;

(iii) [Reserved]

(iv) The fuel economy value will be rounded to the nearest 0.1 mpg;

(v) The carbon-related exhaust emission value will be rounded to the nearest gram per mile; and

(vi) At the manufacturer's option, those vehicle configurations that are self-compensating to altitude changes may be separated by sales into high-altitude sales categories and low-altitude sales categories. These separate sales categories may then be treated (only for the purpose of this section) as separate configurations in accordance with the procedure of § 600.208-12(a)(4)(ii).

(3) The fuel economy and carbon-related exhaust emission values for each vehicle configuration are the combined fuel economy and carbon-related exhaust emissions calculated according to § 600.206-08(a)(3) except that:

(i) Separate fuel economy values will be calculated for vehicle configurations associated with car lines for each category of passenger automobiles and light trucks as determined by the Sec-

retary of Transportation pursuant to paragraph (a)(1) of this section.

(ii) Total model year production data, as required by this subpart will be used instead of sales projections; and

(iii) The fuel economy value of diesel-powered model types will be multiplied by the factor 1.0 to convert gallons of diesel fuel to equivalent gallons of gasoline.

(c) Except as permitted in paragraph (d) of this section, the average fuel economy will be calculated individually for each category identified in paragraph (a)(1) of this section as follows:

(1) Divide the total production volume of that category of automobiles; by

(2) A sum of terms, each of which corresponds to a model type within that category of automobiles and is a fraction determined by dividing the number of automobiles of that model type produced by the manufacturer in the model year; by

(i) For gasoline-fueled and diesel-fueled model types, the fuel economy calculated for that model type in accordance with paragraph (b)(2) of this section; or

(ii) For alcohol-fueled model types, the fuel economy value calculated for that model type in accordance with paragraph (b)(2) of this section divided by 0.15 and rounded to the nearest 0.1 mpg; or

(iii) For natural gas-fueled model types, the fuel economy value calculated for that model type in accordance with paragraph (b)(2) of this section divided by 0.15 and rounded to the nearest 0.1 mpg; or

(iv) For alcohol dual fuel model types, for model years 1993 through 2019, the harmonic average of the following two terms; the result rounded to the nearest 0.1 mpg:

(A) The combined model type fuel economy value for operation on gasoline or diesel fuel as determined in § 600.208-12(b)(5)(i); and

(B) The combined model type fuel economy value for operation on alcohol fuel as determined in § 600.208-12(b)(5)(ii) divided by 0.15 provided the requirements of § 600.510(g) are met; or

(v) For natural gas dual fuel model types, for model years 1993 through 2019, the harmonic average of the following two terms; the result rounded to the nearest 0.1 mpg:

(A) The combined model type fuel economy value for operation on gasoline or diesel as determined in § 600.208-12(b)(5)(i); and

(B) The combined model type fuel economy value for operation on natural gas as determined in § 600.208-12(b)(5)(ii) divided by 0.15 provided the requirements of paragraph (g) of this section are met.

(d) The Administrator may approve alternative calculation methods if they are part of an approved credit plan under the provisions of 15 U.S.C. 2003.

(e) For passenger automobile categories identified in paragraph (a)(1) of this section, the average fuel economy calculated in accordance with paragraph (c) of this section shall be adjusted using the following equation:

$$\text{AFE}_{\text{adj}} = \text{AFE}[(0.55 \times a \times c) + (0.45 \times c) + (0.5556 \times a) + 0.4487] / [(0.55 \times a) + 0.45] + \text{IW}$$

Where:

AFE_{adj} = Adjusted average combined fuel economy, rounded to the nearest 0.1 mpg;

AFE = Average combined fuel economy as calculated in paragraph (c) of this section, rounded to the nearest 0.0001 mpg;

a = Sales-weight average (rounded to the nearest 0.0001 mpg) of all model type highway fuel economy values (rounded to the nearest 0.1 mpg) divided by the sales-weighted average (rounded to the nearest 0.0001 mpg) of all model type city fuel economy values (rounded to the nearest 0.1 mpg). The quotient shall be rounded to 4 decimal places. These average fuel economies shall be determined using the methodology of paragraph (c) of this section.

$c = 0.0014$;

$$\text{IW} = (9.2917 \times 10^{-3} \times \text{SF}_{3\text{IWC}} \times \text{FE}_{3\text{IWC}}) - (3.5123 \times 10^{-3} \times \text{SF}_{4\text{ETW}} \times \text{FE}_{4\text{IWC}}).$$

NOTE: Any calculated value of IW less than zero shall be set equal to zero.

$\text{SF}_{3\text{IWC}}$ = The 3000 lb. inertia weight class sales divided by total sales. The quotient shall be rounded to 4 decimal places.

$\text{SF}_{4\text{ETW}}$ = The 4000 lb. equivalent test weight category sales divided by total sales. The quotient shall be rounded to 4 decimal places.

$\text{FE}_{4\text{IWC}}$ = The sales-weighted average combined fuel economy of all 3000 lb. inertia weight class base levels in the compli-

ance category. Round the result to the nearest 0.0001 mpg.

$\text{FE}_{4\text{IWC}}$ = The sales-weighted average combined fuel economy of all 4000 lb. inertia weight class base levels in the compliance category. Round the result to the nearest 0.0001 mpg.

(f) The Administrator shall calculate and apply additional average fuel economy adjustments if, after notice and opportunity for comment, the Administrator determines that, as a result of test procedure changes not previously considered, such correction is necessary to yield fuel economy test results that are comparable to those obtained under the 1975 test procedures. In making such determinations, the Administrator must find that:

(1) A directional change in measured fuel economy of an average vehicle can be predicted from a revision to the test procedures;

(2) The magnitude of the change in measured fuel economy for any vehicle or fleet of vehicles caused by a revision to the test procedures is quantifiable from theoretical calculations or best available test data;

(3) The impact of a change on average fuel economy is not due to eliminating the ability of manufacturers to take advantage of flexibility within the existing test procedures to gain measured improvements in fuel economy which are not the result of actual improvements in the fuel economy of production vehicles;

(4) The impact of a change on average fuel economy is not solely due to a greater ability of manufacturers to reflect in average fuel economy those design changes expected to have comparable effects on in-use fuel economy;

(5) The test procedure change is required by EPA or is a change initiated by EPA in its laboratory and is not a change implemented solely by a manufacturer in its own laboratory.

(g)(1) Alcohol dual fuel automobiles and natural gas dual fuel automobiles must provide equal or greater energy efficiency while operating on alcohol or natural gas as while operating on gasoline or diesel fuel to obtain the CAFE credit determined in paragraphs (c)(2)(iv) and (v) of this section or to obtain the carbon-related exhaust

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emissions credit determined in paragraphs (j)(2)(ii) and (iii). The following equation must hold true:

$$E_{alt}/E_{pet} > \text{or} = 1$$

Where:

E_{alt} = $[FE_{alt}/(NHV_{alt} \times D_{alt})] \times 10^6$ = energy efficiency while operating on alternative fuel rounded to the nearest 0.01 miles/million BTU.

E_{pet} = $[FE_{pet}/(NHV_{pet} \times D_{pet})] \times 10^6$ = energy efficiency while operating on gasoline or diesel (petroleum) fuel rounded to the nearest 0.01 miles/million BTU.

FE_{alt} is the fuel economy [miles/gallon for liquid fuels or miles/100 standard cubic feet for gaseous fuels] while operated on the alternative fuel as determined in § 600.113-08(a) and (b);

FE_{pet} is the fuel economy [miles/gallon] while operated on petroleum fuel (gasoline or diesel) as determined in § 600.113(a) and (b);

NHV_{alt} is the net (lower) heating value [BTU/lb] of the alternative fuel;

NHV_{pet} is the net (lower) heating value [BTU/lb] of the petroleum fuel;

D_{alt} is the density [lb/gallon for liquid fuels or lb/100 standard cubic feet for gaseous fuels] of the alternative fuel;

D_{pet} is the density [lb/gallon] of the petroleum fuel.

(i) The equation must hold true for both the FTP city and HFET highway fuel economy values for each test of each test vehicle.

(ii)(A) The net heating value for alcohol fuels shall be premeasured using a test method which has been approved in advance by the Administrator.

(B) The density for alcohol fuels shall be premeasured using ASTM D 1298-85 (Reapproved 1990) "Standard Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method" (incorporated by reference at § 600.011-93).

(iii) The net heating value and density of gasoline are to be determined by the manufacturer in accordance with § 600.113(f).

(2) [Reserved]

(3) Alcohol dual fuel passenger automobiles and natural gas dual fuel passenger automobiles manufactured during model years 1993 through 2019 must meet the minimum driving range requirements established by the Secretary of Transportation (49 CFR part

538) to obtain the CAFE credit determined in paragraphs (c)(2)(iv) and (v) of this section.

(h) For model years 1993 and later, and for each category of automobile identified in paragraph (a)(1) of this section, the maximum increase in average fuel economy determined in paragraph (c) of this section attributable to alcohol dual fuel automobiles and natural gas dual fuel automobiles shall be as follows:

Model year	Maximum increase (mpg)
1993-2014	1.2
2015	1.0
2016	0.8
2017	0.6
2018	0.4
2019	0.2
2020 and later	0.0

(1) The Administrator shall calculate the increase in average fuel economy to determine if the maximum increase provided in paragraph (h) of this section has been reached. The Administrator shall calculate the average fuel economy for each category of automobiles specified in paragraph (a)(1) of this section by subtracting the average fuel economy values calculated in accordance with this section by assuming all alcohol dual fuel and natural gas dual fuel automobiles are operated exclusively on gasoline (or diesel) fuel from the average fuel economy values determined in paragraph (c) of this section. The difference is limited to the maximum increase specified in paragraph (h) of this section.

(2) [Reserved]

(i) For model years 2012 through 2015, and for each category of automobile identified in paragraph (a)(1) of this section, the maximum decrease in average carbon-related exhaust emissions determined in paragraph (j) of this section attributable to alcohol dual fuel automobiles and natural gas dual fuel automobiles shall be calculated using the following formula, and rounded to the nearest tenth of a gram per mile:

$$\text{Maximum Decrease} = \frac{8887}{\left[\frac{8887}{FltAvg} - MPG_{MAX} \right]} - FltAvg$$

Where:

FltAvg = The fleet average CREE value for passenger automobiles or light trucks determined for the applicable model year according to paragraph (j) of this section, except by assuming all alcohol dual fuel and natural gas dual fuel automobiles are operated exclusively on gasoline (or diesel) fuel.

MPG_{MAX} = The maximum increase in miles per gallon determined for the appropriate model year in paragraph (h) of this section.

(1) The Administrator shall calculate the decrease in average carbon-related exhaust emissions to determine if the maximum decrease provided in this paragraph (i) has been reached. The Administrator shall calculate the average carbon-related exhaust emissions for each category of automobiles specified in paragraph (a) of this section by subtracting the average carbon-related exhaust emission values determined in paragraph (j) of this section from the average carbon-related exhaust emission values calculated in accordance with this section by assuming all alcohol dual fuel and natural gas dual fuel automobiles are operated exclusively on gasoline (or diesel) fuel. The difference is limited to the maximum decrease specified in paragraph (i) of this section.

(2) [Reserved]

(j) The average carbon-related exhaust emissions will be calculated individually for each category identified in paragraph (a)(1) of this section as follows:

(1) Divide the total production volume of that category of automobiles into:

(2) A sum of terms, each of which corresponds to a model type within that category of automobiles and is a product determined by multiplying the number of automobiles of that model type produced by the manufacturer in the model year by:

(i) For gasoline-fueled and diesel-fueled model types, the carbon-related

exhaust emissions value calculated for that model type in accordance with paragraph (b)(2) of this section; or

(ii)(A) For alcohol-fueled model types, for model years 2012 through 2015, the carbon-related exhaust emissions value calculated for that model type in accordance with paragraph (b)(2) of this section multiplied by 0.15 and rounded to the nearest gram per mile, except that manufacturers complying with the fleet averaging option for N₂O and CH₄ as allowed under §86.1818-12(f)(2) of this chapter must perform this calculation such that N₂O and CH₄ values are not multiplied by 0.15; or

(B) For alcohol-fueled model types, for model years 2016 and later, the carbon-related exhaust emissions value calculated for that model type in accordance with paragraph (b)(2) of this section; or

(iii)(A) For natural gas-fueled model types, for model years 2012 through 2015, the carbon-related exhaust emissions value calculated for that model type in accordance with paragraph (b)(2) of this section multiplied by 0.15 and rounded to the nearest gram per mile, except that manufacturers complying with the fleet averaging option for N₂O and CH₄ as allowed under §86.1818-12(f)(2) of this chapter must perform this calculation such that N₂O and CH₄ values are not multiplied by 0.15; or

(B) For natural gas-fueled model types, for model years 2016 and later, the carbon-related exhaust emissions value calculated for that model type in accordance with paragraph (b)(2) of this section; or

(iv) For alcohol dual fuel model types, for model years 2012 through 2015, the arithmetic average of the following two terms, the result rounded to the nearest gram per mile:

(A) The combined model type carbon-related exhaust emissions value for operation on gasoline or diesel fuel as determined in § 600.208-12(b)(5)(i); and

(B) The combined model type carbon-related exhaust emissions value for operation on alcohol fuel as determined in § 600.208-12(b)(5)(ii) multiplied by 0.15 provided the requirements of paragraph (g) of this section are met, except that manufacturers complying with the fleet averaging option for N₂O and CH₄ as allowed under § 86.1818-12(f)(2) of this chapter must perform this calculation such that N₂O and CH₄ values are not multiplied by 0.15; or

(v) For natural gas dual fuel model types, for model years 2012 through 2015, the arithmetic average of the following two terms; the result rounded to the nearest gram per mile:

(A) The combined model type carbon-related exhaust emissions value for operation on gasoline or diesel as determined in § 600.208-12(b)(5)(i); and

(B) The combined model type carbon-related exhaust emissions value for operation on natural gas as determined in § 600.208-12(b)(5)(ii) multiplied by 0.15 provided the requirements of paragraph (g) of this section are met, except that manufacturers complying with the fleet averaging option for N₂O and CH₄ as allowed under § 86.1818-12(f)(2) of this chapter must perform this calculation such that N₂O and CH₄ values are not multiplied by 0.15.

(vi) For alcohol dual fuel model types, for model years 2016 and later, the combined model type carbon-related exhaust emissions value determined according to the following formula and rounded to the nearest gram per mile:

$$CREE = (F \times CREE_{alt}) + ((1-F) \times CREE_{gas})$$

Where:

F = 0.00 unless otherwise approved by the Administrator according to the provisions of paragraph (k) of this section;

CREE_{alt} = The combined model type carbon-related exhaust emissions value for operation on alcohol fuel as determined in § 600.208-12(b)(5)(ii); and

CREE_{gas} = The combined model type carbon-related exhaust emissions value for operation on gasoline or diesel fuel as determined in § 600.208-12(b)(5)(i).

(vii) For natural gas dual fuel model types, for model years 2016 and later, the combined model type carbon-related exhaust emissions value determined according to the following formula and rounded to the nearest gram per mile:

$$CREE = (F \times CREE_{alt}) + ((1-F) \times CREE_{gas})$$

Where:

F = 0.00 unless otherwise approved by the Administrator according to the provisions of paragraph (k) of this section;

CREE_{alt} = The combined model type carbon-related exhaust emissions value for operation on natural gas as determined in § 600.208-12(b)(5)(ii); and

CREE_{gas} = The combined model type carbon-related exhaust emissions value for operation on gasoline or diesel fuel as determined in § 600.208-12(b)(5)(i).

(k) *Alternative in-use weighting factors for dual fuel model types.* Using one of the methods in either paragraph (k)(1) or (2) of this section, manufacturers may request the use of alternative values for the weighting factor F in the equations in paragraphs (j)(2)(vi) and (vii) of this section. Unless otherwise approved by the Administrator, the manufacturer must use the value of F that is in effect in paragraphs (j)(2)(vi) and (vii) of this section.

(1) Upon written request from a manufacturer, the Administrator will determine and publish by written guidance an appropriate value of F for each requested alternative fuel based on the Administrator's assessment of real-world use of the alternative fuel. Such published values would be available for any manufacturer to use. The Administrator will periodically update these values upon written request from a manufacturer.

(2) The manufacturer may optionally submit to the Administrator its own demonstration regarding the real-world use of the alternative fuel in their vehicles and its own estimate of the appropriate value of F in the equations in paragraphs (j)(2)(vi) and (vii) of this section. Depending on the nature of the analytical approach, the manufacturer could provide estimates of F that are model type specific or that are generally applicable to the manufacturer's dual fuel fleet. The manufacturer's

analysis could include use of data gathered from on-board sensors and computers, from dual fuel vehicles in fleets that are centrally fueled, or from other sources. The analysis must be based on sound statistical methodology and must account for analytical uncertainty. Any approval by the Administrator will pertain to the use of values of F for the model types specified by the manufacturer.

[75 FR 25714, May 7, 2010]

EFFECTIVE DATE NOTE: At 75 FR 25714, May 7, 2010, § 600.510-12 was added, effective July 6, 2010.

§ 600.510-86 Calculation of average fuel economy.

(a) Average fuel economy will be calculated to the nearest 0.1 mpg for the classes of automobiles identified herein, and the results of such calculations will be reported to the Secretary of Transportation for use in determining compliance with the applicable fuel economy standards.

(1) An average fuel economy calculation will be made for the category of passenger automobiles that is domestically manufactured as defined in § 600.511(d)(1).

(2) An average fuel economy calculation will be made for the category of passenger automobiles that is not domestically manufactured as defined in § 600.511(d)(2).

(3) An average fuel economy calculation will be made for the category of light trucks which is defined in § 600.511(e)(1) and has two-wheel drive.

(4) An average fuel economy calculation will be made for the category of light trucks which is defined in § 600.511(e)(1) and has four-wheel drive.

(5) An average fuel economy calculation will be made for the category of light trucks which is defined in § 600.511(e)(2) and has two-wheel drive.

(6) An average fuel economy calculation will be made for the category of light trucks which is defined in § 600.511(e)(2) and has four-wheel drive.

(b) For the purpose of calculating average fuel economy under paragraph (c), of this section:

(1) All fuel economy data submitted in accordance with § 600.006(e) or § 600.512(c) shall be used.

(2) The combined city/highway fuel economy will be calculated for each model type in accordance with § 600.207 of this section except that:

(i) Separate fuel economy values will be calculated for model types and base levels associated with car lines that are:

(A) Domestically produced, and
(B) Nondomestically produced and imported;

(ii) Total model year production data, as required by this subpart, will be used instead of sales projections;

(iii) The fuel economy value of diesel-powered model types will be multiplied by the factor 1.0 to correct gallons of diesel fuel to equivalent gallons of gasoline;

(iv) The fuel economy value will be rounded to the nearest 0.1 mpg;

(v) At the manufacturer's option, those vehicle configurations that are selfcompensating to altitude changes may be separated by sales into high-altitude sales categories and low-altitude sales categories. These separate sales categories may then be treated (only for the purpose of this section) as separate configurations in accordance with the procedure of paragraph § 600.207(a)(4)(ii), and

(3) The fuel economy value for each vehicle configuration is the combined fuel economy calculated according to § 600.206 except that:

(i) Separate fuel economy values will be calculated for vehicle configurations associated with car lines that are:

(A) Domestically produced, and
(B) Nondomestically produced and imported;

(ii) Total model year production data, as required by this subpart will be used instead of sales projections; and

(iii) The fuel economy value of diesel-powered model types will be multiplied by the factor 1.0 to convert gallons of diesel fuel to equivalent gallons of gasoline.

(c) Except as permitted in paragraph (d) of this section, the average fuel economy will be calculated individually for each category identified in § 600.510(a) as follows:

(1) Divide the total production volume of that category of automobiles by