

EPA Greenhouse Gas Provisions Applicable to Clean Alternative Fuel Conversions of Heavy Duty Class 2b and 3 Vehicles: Frequently Asked Questions

This information is intended to assist manufacturers that convert Heavy duty Class 2b and 3 vehicles to operate on alternative fuels such as compressed natural gas fuel, liquified natural gas fuel, propane gas fuel and even electric fuel for automotive use, in understanding the Heavy Duty (HD) class 2b and 3 vehicle Greenhouse Gas (GHG) regulations. It is not a substitute for compliance with GHG emission requirements in 40 CFR part 1037, subpart B, sections 1037.104, 1037.115 and 1037.150 and referenced sections in 40 CFR part 86, subpart S.

Note: As explained in Section XII of 80 FR 40137 July 13, 2015, Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Phase 2; Proposed Rule, footnote #41 states, "EPA is proposing to recodify the Phase 1 requirements for pickups and vans from 40 CFR 1037.104 into 40 CFR part 86, which is also the regulatory part that applies for light-duty vehicles." If accepted as proposed, the regulatory cites that appear in this FAQ document will be updated when the final rule is published.

These questions and answers present compliance information that is generally applicable to HD class 2b and 3 vehicle conversions. The Appendix provides additional information applicable to certain special conversion circumstances, such as conversion to dual-fuel vehicles and Original Equipment Manufacturer (OEM) protocol-dependent conversion options.

What are the OEM Class 2b & 3 HD GHG Rule Requirements?

To provide perspective, this section is a general discussion of the GHG regulations as they apply to OEMs. A subsequent section of this document will address the special provisions that apply specifically to Class 2b & 3 Alternative Fuel Conversion (AFC) manufacturers.

Q1. What GHG emissions does the HD vehicle GHG rule regulate?

GHG exhaust emissions include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Under the HD GHG rule, CO₂ in-use and fleet average GHG compliance is based solely on CO₂ emissions (different from Light-Duty Vehicle (LDV) GHG where the compliance is based on all carbon related exhaust emissions – called “CREE”). Compliance with the HD CO₂ standards is based on a CO₂ emissions weighting of 55% of the city test results and 45% of the highway test results.

The HD GHG regulations also include individual standards for CH₄ and N₂O. Compliance for CH₄ and N₂O is again based on emissions weighting of 55% of the city test results and 45% of the highway test results (again, different from LDVs where only the city test results are used to determine compliance to the N₂O and CH₄ standards).

The HD GHG rule also regulates GHG emissions caused by leakage from the air conditioning (A/C) system (A/C refrigerants can be potent GHGs). OEMs must comply with A/C system refrigerant leakage requirements. An AFC manufacturer that modifies the OEM A/C system may require additional refrigerant leak compliance testing. Please check with an EPA Certification Representative if you think this requirement applies to you.

Q2. When do the OEM Class 2b & 3 HD vehicle GHG regulations take effect?

The GHG Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles Rule (HD GHG rule) is codified in 40 CFR 1037. Part 1037 established GHG emission standards starting with model year (MY) 2014. OEMs may also elect to optionally comply with the GHG standards in MY 2013.

Q3. What are the OEM Class 2b & 3 HD vehicle GHG exhaust emission compliance requirements?

OEMs are required to meet in-use CO₂ standards. The same standards are applicable to HD GHG AFC manufacturers:

Compliance is demonstrated by meeting a standard equal to the vehicle subconfiguration CO₂ emissions multiplied by 1.10. Unlike conventional emission standards, CO₂ in-use standards may not be available when needed by the AFC manufacturer that intends to convert one or more specific OEM vehicle test group(s), shortly after the OEM vehicle test group(s) is/are released into commerce. In that case, use the method described in Q8, Paragraph C.

OEMs are also required to meet CH₄ and N₂O emission standards. Again, these same standards are also applicable to HD GHG AFC manufacturers:

The CH₄ and N₂O standards are 0.05 g/mi and 0.05 g/mi, respectively.¹ Compliance with the standards is based on a 55% weighted city test result with a corresponding 45% weighted highway test result. The OEM may elect a higher alternate standard for CH₄ and/or N₂O (See Q8 Paragraph A). Standards apply at the EPA defined full useful life, meaning that deterioration factors (DFs) need to be applied to low mileage test results (unless the OEM used fully aged components).

Typically, DFs do not apply to CO₂ emissions. However, Plug-In Electric Hybrid vehicles will likely experience higher In-Use CO₂ as the battery-pack performance deteriorates over its useful life. In this particular case, the battery deterioration should be accounted for.

OEM fleet average CO₂ emission standards do not apply to most HD GHG AFC manufacturers: OEMs are required to meet fleet average CO₂ standards using the vehicle specific CO₂ measured emissions. Given that compliance with CO₂ standards is a fleet averaging compliance program, OEMs may exercise considerable flexibilities in achieving compliance through averaging, banking, and trading of GHG credits. OEM compliance with fleet average CO₂ standards is based on each OEM's GHG report submitted to EPA. This report must be submitted to EPA within 90 days of the end of the calendar year in which the certificate of compliance expired. Most HD GHG Class 2b and 3 AFC manufacturers are currently Small Business exempt manufacturers. However, currently only 1 or 2 AFC manufacturers are not GHG exempt and are thus required to comply with the same requirements as the OEM manufacturers.

Q4. How do HD GHG Class 2b & 3 Rules differ for AFC manufacturers?

With the exception that AFC manufacturers do not have to comply with a fleet average CO₂ emission standard, the GHG standards generally apply in the same way to a converted vehicle as they do to the OEM vehicle. That means that class 2b and 3 AFC manufacturers comply by demonstrating that the converted vehicle meets the same GHG emission standards that the OEM certified to. If an OEM elected to early comply with GHG standards in MY 2013, the AFC manufacturer of that vehicle would also have to comply with the GHG standards of MY 2013.

Q5. Does the 'small business' status described in 40 CFR Part 1037, subpart B regulations also apply to AFC manufacturers? Describe the requirements to demonstrate GHG compliance for the different exemption status categories?

Yes. The exemption categories described in 40 CFR 1037.150 (c), subpart B, also apply to AFC manufacturers.

¹40 CFR part 1037.104(c).

Small Business Administration (SBA) Exclusion:

If an AFC manufacturer employs less than 1,000 employees worldwide and is engaged in manufacturing, it is not subject to the GHG standards in §§1037.104 through 1037.106. Note that qualification for this exclusion under the SBA regulation is determined by the aggregate number of employees of all affiliate companies. Although the AFC manufacturer does not need EPA approval to qualify as excluded, it must submit to EPA a written notification describing its SBA qualification justification. Labels must also be affixed to its AFC vehicles stating that “This vehicle is excluded under 40 CFR 1037.150 (c)”. If an OEM is exempt as an SBA exclusion, the AFC manufacturer would be exempt as well under 40 CFR 1037.150 (c).

Conditional Exemption:

The GHG conditional exemption does not apply to HD vehicles (unlike light-duty vehicles).

Not Exempt:

If the AFC manufacturer does not qualify for SBA exclusion, it must meet the GHG requirements described in Q1-3 [above] and presented in 40 CFR 85.525(a)(2)(iii). This includes meeting the in-use exhaust CO₂, the CH₄ and the N₂O emission standards. The AFC manufacturer may exercise any of the compliance options described in Q8, paragraphs A, B or C to meet the standards.

Q6. How do HD GHG requirements differ between OEMs and AFC manufacturers?

The GHG compliance requirements that exist for AFC manufacturers differ from the requirements for OEMs in a number of ways. AFC manufacturers:

1. Do not comply with a fleet average CO₂ standard
2. Do not have the option to earn, bank, average, or trade credits
3. Do not submit pre- or final model year GHG compliance reports
4. Do not participate in any special credit programs available to the OEMs, such as early credits, fleet average credits, or advanced technology vehicle credits.

Q7. Where are the HD GHG requirements for AFC manufacturers codified?

The GHG compliance requirements for AFC manufacturers are presented in 40 CFR Part 85.525, as amended. The April 8, 2011 AFC regulations were amended as part of the Heavy-Duty GHG final rule and the Light-Duty GHG 2017 final rule. The Heavy-Duty GHG final rule amendments were published in the Federal Register Vol. 76, FR 57106, September 15, 2011. The Light-Duty GHG 2017 final rule amendments were published in the Federal Register Vol. 77, FR 62624, October 15, 2012.

In addition EPA published a direct final rule (technical amendments) on June 17, 2013. The heavy duty technical amendments were published in the Federal Register Vol. 78, FR 36370, June 17, 2013.

Q8. What Class 2b and 3 HD GHG provisions apply to AFC manufacturers?

Provisions applicable to HD class 2b and 3 conversions are set forth in 40 CFR part 85.525(a)(2)(iii). AFC manufacturer compliance with GHG emission standards requires compliance with the OEM in-use CO₂ exhaust standard for the vehicle “subconfiguration” that is identical to the AFC manufacturer’s emission data vehicle.

Subconfiguration, as defined in 40 CFR part 1037.104 (d)(12) means a unique combination within a vehicle configuration of equivalent test weight, road-load horsepower, and any other operational characteristics or parameters which the EPA determines may significantly affect CO₂ emissions within a vehicle configuration. The terms **equivalent test weight**, and **road-load horsepower** are further defined in 40 CFR part 600.002-93. The term **vehicle configuration** is further defined in 40 CFR part 1037.104 (d)(12).

40 CFR part 85.525(a)(2)(iii) also requires that the AFC manufacturer meet standards for CH₄ of 0.050 g/mi, and for N₂O of 0.050 g/mi. The CH₄ and N₂O standards apply at full useful life, or 120K miles.

40 CFR part 85.525(a)(2)(iii), paragraphs A-C, describe three options in lieu of meeting the standards presented in Q5 above.

Paragraph A:

If the OEM used an “alternative” higher standard for CH₄ and/or N₂O, the AFC manufacturer may demonstrate compliance by meeting the OEM alternative higher standard. For example, an OEM may select a CH₄ standard of 0.080 g/mi. The AFC manufacturer would then demonstrate compliance against this 0.080 g/mi standard.

Paragraph B:

Some types of alternative fuel converted vehicles will emit less CO₂ than the OEM vehicle. This option takes the difference between the manufacturer’s “in-use CO₂ exhaust emission standard” and the measured CO₂ value for the converted configuration and calculates equivalents of CH₄ and/or N₂O g/mi emissions. These equivalents are then used to reduce the CH₄ and/or N₂O emissions from the alternative fuel converted vehicle and thereby show compliance to the CH₄ and/or N₂O cap standards. This option is also available to AFC manufacturers using an OEM’s alternative higher standard. For GHG purposes, the method assumes 25 g/mi of CO₂ equates to 1 g/mi of CH₄, and 298 g/mi of CO₂ equates to 1 g/mi of N₂O.

Example of compliance with CH₄ standard: Assume an OEM’s in-use CO₂ standard for the equivalent fuel conversion test vehicle equals 400 g/mi CO₂. Assume the fuel conversion test vehicle produces the following CO₂ and CH₄ emission results when tested on the alternative fuel:

CO₂ = 325 g/mi
 CH₄ = 0.070 g/mi

Using the difference in CO₂ test results and equating 25 g/mi CO₂ to 1 g/mi CH₄:

$$400 - 325 = 75 \text{ g/mi CO}_2$$
$$(75 \text{ g/mi CO}_2)/(25 \text{ g/mi CO}_2) \text{ yields a } 3.000 \text{ g/mi CH}_4 \text{ "equivalent"}$$

Reducing the fuel conversion CH₄ test results by the GHG equivalent:

$$0.070 \text{ g/mi CH}_4 - 3.000 \text{ g/mi CH}_4 = \text{a negative CH}_4 \text{ result}$$

In this example, the negative adjusted fuel conversion CH₄ result would be reported as 0.000 g/mi CH₄, thus easily demonstrating compliance with the CH₄ standard of 0.050 g/mi.

Paragraph C:

AFC manufacturers may also comply with the GHG standards by comparing emission test results from the vehicle before and after the alternative fuel conversion. This option is called the back-to-back testing option. Because CO₂ emissions may be lower when the vehicle is operating on the alternative fuel, it may be possible to demonstrate that higher CH₄ emissions when operating on CNG, for example, are more than offset with lower CO₂ emissions. The sum of in-use CO₂ emissions, and CH₄ and N₂O emissions shall be calculated for pre- and post-conversion FTP test results, where CH₄ and N₂O are weighted by their global warming potential of 25 and 298, respectively. The post-conversion sum of these emissions must be lower than the sum of the pre-conversion emissions. If the OEM used a compliance statement in lieu of generating N₂O emissions (which is allowed through MY 2014), then the AFC manufacturer may also disregard the N₂O emissions in the calculations.

The OEM in-use CO₂ standards based on vehicle subconfiguration data may not be available at the time the AFC manufacturer needs it. For example, some MY 2014 OEM in-use CO₂ values may not be available until April of 2015. If the OEM in-use CO₂ standard is not available when the AFC manufacturer plans to conduct emission compliance testing, the only option available to demonstrate compliance to the GHG standards is the back-to-back testing option provided in this Paragraph C.

EPA will make the in-use CO₂ emissions data available as it is received on the following EPA website: <http://www.epa.gov/oms/consumer/fuels/altfuels/altfuels.htm> under the heading, "Other Information".

Q9. How do the heavy-duty GHG regulations impact OBD compliance for AFC manufacturers?

There are no OBD GHG compliance requirements for OEMs or AFC manufacturers.

Q10. What are the requirements for entering GHG data into the Verify data system?

General data entry requirements:

A) Compliance is demonstrated against the GHG standards

Enter in the Verify Test Information dataset the AFC manufacturer's test results for CO₂, N₂O, and CH₄. AFC manufacturers will need to enter DFs for their N₂O, and CH₄ emission results using EPA assigned DFs if necessary. A "Pass" determination will be displayed in the Certification summary Information (CSI) report if the CH₄ result meets the CH₄ standard, or the higher CH₄ standard in the OEM application. A "Pass" determination will be displayed in the Certification summary Information (CSI) report if the N₂O result meets the N₂O standard, or the higher N₂O standard in the OEM application. Even though in-use CO₂ standards and test results were entered, Verify will not return a pass/fail determination. EPA staff will examine the CO₂ standards and the AFC manufacturer's CO₂ test results to confirm that GHG emissions pass the standards.

If the OEM in-use CO₂ standard is available, enter that CO₂ value in the Verify Test Group dataset as the AFC manufacturer's test vehicle CO₂ standard. Enter the CH₄ standard if the AFC manufacturer's CH₄ result will meet the CH₄ standard or the optional higher CH₄ standard in the OEM application. Enter the N₂O standard if the AFC manufacturer's N₂O result will meet the N₂O standard or the optional higher N₂O standard in the OEM application. Through MY 2014, the AFC manufacturer may use a compliance statement instead of an actual N₂O standard. If the compliance statement is used in lieu of a N₂O standard, do not enter a N₂O standard. After MY 2014, the AFC manufacturer must meet either the N₂O emission standard or the higher N₂O standard in the OEM application, and that value shall be entered in the Verify Test Group dataset.

If the AFC manufacturer's CH₄ test result does not meet the CH₄ standard or the optional higher OEM CH₄ standard, and the OEM has reported an in-use CO₂ standard, do not enter a CH₄ standard. In this case, compliance with the CH₄ standard may be determined using the CO₂ equivalence approach described in Paragraph C in Q8 above. Demonstrating that the CH₄ result passes the CH₄ standard using the approach in Paragraph C should be shown in Manufacturer Test Comments so they will appear on the CSI document. EPA will examine the results to determine that the CH₄ standard, or the higher OEM alternative CH₄ standard has been met.

If the AFC manufacturer's N₂O test result does not meet the N₂O standard or the optional higher OEM N₂O standard, and the OEM has reported an in-use CO₂ standard, do not enter a N₂O standard. In this case, compliance with the N₂O standard may be determined using the CO₂ equivalence approach described in Paragraph C in Q8 above. Demonstrating that the N₂O result passes the N₂O standard using the approach in Paragraph C should be shown in Manufacturer Test Comments so they will appear on the CSI document. Alternatively, through MY 2014, the AFC manufacturer may use a N₂O compliance statement in lieu of the N₂O standard. EPA staff will examine the results to determine that the N₂O standard, or the higher OEM alternative N₂O standard has been met, or that a N₂O compliance statement has been submitted (which is only allowed through MY 2014).

B) Compliance is demonstrated using the back-to-back testing option

Enter in the Verify Test Information dataset the CH₄, N₂O and CO₂ test results for the AFC manufacturer's vehicle operating on the alternative fuel. Enter the pre-conversion CO₂ results, for example, based on testing with the OEM fuel, in Manufacturer Test Comments so they appear on the CSI document. DFs need not be applied to the pre and post conversion CO₂ test results.

Do not enter standards or DFs for CH₄, N₂O or CO₂ in the Verify Test Group dataset. Do not enter an N₂O standard if meeting the standard is based on a compliance statement. A compliance demonstration using the back-to-back testing option is based on showing that the GHG emissions from the AFC manufacturer's test vehicle have not been increased.

If an AFC manufacturer qualifies for a Small Business Administration exclusion:

In addition to the other criteria pollutant emission test results, enter the city and highway CH₄ test results in the Verify Test Information dataset. It must enter a CO₂ value of 0.0 g/mile (Verify requires data entry into this field) so that Verify will be able to issue a certificate to the AFC manufacturer.

Do not enter standards or DFs for CH₄, N₂O or CO₂ in the Verify Test Group dataset.

No pass/fail determinations will be displayed as part of the Test Group Information dataset for CH₄, N₂O or CO₂ because no standards were entered for these GHG emissions.

Conditional Exemption Data Entry:

Does not apply to HD vehicles.

Q11. How will GHG compliance reporting be handled for AFC manufacturers submitting notification applications under the Intermediate Age Vehicle/Engine and/or the Outside Useful Life Vehicle/Engine program(s)?

All but 1 or 2 AFC manufacturers are currently SBA excluded. SBA excluded manufacturers are exempt from GHG compliance requirements. However, they must notify their Designated Compliance Officer each model year before introducing these excluded vehicles into U.S. commerce. The notification should include a description of the manufacturer's qualification as a small business under 13 CFR 121.201. Excluded vehicles must be labeled with the following statement: "This vehicle is excluded under 40 CFR 1037.150(c)". This exclusion statement may be added the existing conversion label. GHG excluded AFC manufacturers must comply with the reporting and recordkeeping requirements specified in §85.535(e) and (f).

Any AFC manufacturers that are not excluded from GHG demonstration will have to show compliance with the in-use CO₂, CH₄ and N₂O GHG emission standards, using any of the Options in Q8 (above). These AFC manufacturers must comply with the recordkeeping requirements in 40 CFR 1037.150(b) through (d), and they must label each vehicle that they convert and keep VIN #'s for up to 8 years.

AFC manufacturers that market conversion systems for use on vehicles/ engines other than the test group/engine families and evaporative/refueling families covered by the compliance demonstration and notification may be liable for a tampering violation.

APPENDIX

Dual-fuel vehicle conversions:

The GHG compliance information in this document applies if the OEM’s original emissions calibration is unaltered in the conversion to a dual-fuel configuration.

If the conversion involves any changes to the OEM’s calibration strategies, the AFC manufacturer must provide test results demonstrating that the converted vehicles/engines meet all applicable emission standards and a good engineering judgment analysis explaining why the changes are necessary and why they will not increase in-use emissions deterioration.

Testing options for HD 2b and 3 conversion compliance demonstrations:

AFC manufacturers must generally use the same test procedure to demonstrate compliance with the HD GHG regulations that the OEM used to certify. The information in this Q/A document is applicable to chassis test procedures. The table below summarizes applicability to various vehicle types, based on certification testing options available to the OEM.

	Vehicle Type	Test Procedure		Q/A Applicable?
		OEM	AFC Manufacturer	
Complete	SI	chassis	chassis	yes
	CI MY2017 & earlier	chassis or engine	same as OEM	maybe*
	CI MY2018 & later	chassis	chassis	yes
Incomplete	SI and CI	chassis or engine	same as OEM	maybe
Class 4 +	SI	chassis or engine	same as OEM	maybe

Complete HD Compression Ignition Vehicle Certification Election:

OEM’s must certify spark ignition HD 2b and 3 vehicles using the chassis certification process. For model years prior to 2018, OEM’s may also optionally elect to certify complete compression ignition HD Class 2b and 3 vehicles using the chassis certification process (instead of engine dynamometer certification). As adopted, beginning in model year 2018, the Tier 3 Motor Vehicle Emission and Fuel Standards final rule requires that OEM’s certify complete HD compression ignition class 2b and 3 vehicles using the chassis certification process.

Prior to model year 2018, if the OEM elected to certify compression ignition HD complete vehicles using the chassis process, the Q&A’s contained in this document also apply to those compression ignition fuel conversion complete vehicles. For model years 2018 and later the Q&A’s contained in this document apply to compression ignition fuel conversion HD 2b and 3 complete vehicles.

Incomplete HD Spark and Compression Ignition Vehicle Certification Election:

OEM’s may also optionally elect to certify incomplete spark ignition and/or compression ignition HD Class 2b and 3 vehicles using the chassis certification process. If the OEM certified these

vehicles using the chassis process, the Q&A's contained in this document also apply to those incomplete spark and compression ignition fuel conversion vehicles.

Spark Ignition HD Vehicle Class 4 and Above Optional Chassis Test GHG Election:

OEM's may also optionally elect to chassis test complete and/or incomplete spark ignition HD Class 4 and above vehicles to demonstrate compliance to the greenhouse gas requirements. Chassis vehicle testing is conducted on a similar "sister vehicle". If the OEM elected to comply with the GHG requirements using the chassis test process, the Q&A's contained in this document also apply to those classes of HD fuel conversion vehicles.

Further Information

For further information, please contact:

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