Environmental Protection Agency

Pt. 600, App. III

(2) Assume that the same vehicle was tested by the Federal Highway Fuel Economy Test Procedure and calculation similar to that shown in paragraph (a) by this appendix resulted in a highway fuel economy or MPG<sub>h</sub> of 36.9. According to the procedure in §600.113, the combined fuel economy (called MPG<sub>comb</sub>) for the vehicle may be calculated by substituting the city and highway fuel economy values into the following equation:

\[
\text{MPG}_{c/h} = \frac{1}{\frac{0.55}{\text{MPG}_c} + \frac{0.45}{\text{MPG}_h}}
\]

\[
\text{MPG}_{c/h} = \frac{1}{\frac{0.55}{27.7} + \frac{0.45}{36.9}} = 31.2
\]

(b) This sample fuel economy calculation is applicable to 1988 and later model year automobiles.

(1) Assume that a gasoline-fueled vehicle was tested by the Federal Emission Test Procedure and the following results were calculated:

HC = .139 grams/mile.
CO = 1.59 grams/mile.
CO<sub>2</sub> = 317 grams/mile.

(2) Assume that the test fuel used for this test had the following properties:

SG = 0.745.
CWF = 0.868.
NHV = 18,478 Btu/lb.

(3) According to the procedure in §600.113-08, the city fuel economy or MPG<sub>c</sub>, for the vehicle may be calculated by substituting the HC, CO, and CO<sub>2</sub> gram/mile values and the SG, CWF, and NHV values into the following equation:

\[
\text{MPG}_c = \frac{(5174 \times 10^4 \times \text{CWF} \times \text{SG})}{((\text{CWF} \times \text{HC}) + (0.429 \times \text{CO} + (0.273 \times \text{CO}_2)) \times (0.6 \times \text{SG} \times \text{NHV} + 5471)}
\]

Example:

\[
\text{MPG}_c = \frac{(5174 \times 10^4 \times 0.868 \times 0.745)}{((0.868 \times 0.139 + 0.429 \times 1.59 + 0.273 \times 317) \times (0.6 \times 0.745 \times 18478 + 5471))}
\]

\[
\text{MPG}_c = 27.9
\]

(4) Assume that the same vehicle was tested by the Federal Highway Fuel Economy Test Procedure and a calculation similar to that shown in (b)(3) of this section resulted in a highway fuel economy of MPG<sub>h</sub> of 36.9. According to the procedure in §600.210-08(c) or §600.210-12(c), the combined fuel economy (called MPG<sub>comb</sub>) for the vehicle may be calculated by substituting the city and highway fuel economy values into the following equation:

\[
\text{MPG}_{comb} = \frac{1}{\frac{0.55}{\text{MPG}_c} + \frac{0.45}{\text{MPG}_h}}
\]

\[
\text{MPG}_{comb} = \frac{1}{\frac{0.55}{27.9} + \frac{0.45}{36.9}} = 31.3
\]

APPENDIX III TO PART 600—SAMPLE FUEL ECONOMY LABEL CALCULATION

Suppose that a manufacturer called Mizer Motors has a product line composed of eight car lines. Of these eight, four are available with the 3.0 liter, 6 cylinder, sequential multi-point fuel injection, 4-valve per cylinder, and 3-way catalyst engine. These four car lines are:

- Ajax
- Boredom III
- Dodo
- Castor (Station Wagon)
A car line is defined in subpart A (with additional guidance provided in EPA Advisory Circular 89) as a group of vehicles within a make or division which has a degree of commonality in construction. Car line does not consider any level of decor or opulence and is not generally distinguished by such characteristics as roofline, number of doors, seats, or windows. Station wagons and light duty trucks are, however, identified separately from the remainder of each car line. In other words, a Castor station wagon would be considered a different car line than the normal Castor car line made up of sedans, coupes, etc.

The engine considered here is defined as a basic engine in subpart A of this part (with additional guidance provided in EPA Advisory Circular 83A). A basic engine is a unique combination of manufacturer, engine displacement, number of cylinders, fuel system, catalyst usage and other engine and emission control system characteristics specified by the Administrator. A model type is a unique combination of car line, basic engine, and transmission class. Thus Ajax is a car line but Ajax 3.0 liter, 6 cylinder manual four-speed transmission is a model type whereas Ajax 3.0 liter, 6 cylinder automatic three-speed transmission is a different model type.

The following calculations provide an example of the procedures described in subpart C of this part for the calculation of vehicle configuration and model type fuel economy values. In order to simplify the presentation, only city fuel economy values are included (as determined by either the derived 5-cycle method or vehicle-specific 5-cycle based method). The procedure is identical for highway and combined fuel economy values.

Step I. Input data as supplied by the manufacturer or as determined from testing conducted by the Administrator.

Manufacturer—Mizer Motors
Basic Engine: (3.0 liter, 6 cylinder, sequential multi-point fuel injection, 4-valve per cylinder, 3-way catalyst).

<table>
<thead>
<tr>
<th>Test vehicle carline</th>
<th>Engine code</th>
<th>Trans</th>
<th>Inertia weight</th>
<th>Axle ratio</th>
<th>Harmonically averaged city MPG</th>
<th>Specific label MPG</th>
<th>Vehicle config. sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajax</td>
<td>1</td>
<td>M-4</td>
<td>3500</td>
<td>2.73</td>
<td>16.1001</td>
<td>16</td>
<td>15,000</td>
</tr>
<tr>
<td>Ajax</td>
<td>2</td>
<td>A-3</td>
<td>3500</td>
<td>2.56</td>
<td>15.9020</td>
<td>16</td>
<td>35,000</td>
</tr>
<tr>
<td>Boredom III</td>
<td>4</td>
<td>M-4</td>
<td>4000</td>
<td>3.08</td>
<td>14.2343</td>
<td>14</td>
<td>10,000</td>
</tr>
<tr>
<td>Ajax</td>
<td>3</td>
<td>M-4</td>
<td>4000</td>
<td>3.36</td>
<td>15.0000</td>
<td>15</td>
<td>15,000</td>
</tr>
<tr>
<td>Boredom III</td>
<td>8</td>
<td>A-3</td>
<td>4000</td>
<td>2.56</td>
<td>13.8138</td>
<td>14</td>
<td>25,000</td>
</tr>
<tr>
<td>Boredom III</td>
<td>5</td>
<td>A-3</td>
<td>4500</td>
<td>3.08</td>
<td>13.2203</td>
<td>13</td>
<td>20,000</td>
</tr>
<tr>
<td>Castor</td>
<td>5</td>
<td>A-3</td>
<td>5000</td>
<td>3.08</td>
<td>10.6006</td>
<td>11</td>
<td>40,000</td>
</tr>
</tbody>
</table>

1. The vehicle configuration fuel economy values, rounded to the nearest mile per gallon, are the fuel economy values that would be used on specific labels for that vehicle configuration.

Step II. Group vehicle fuel economy and sales data according to base level combinations within this basic engine.

<table>
<thead>
<tr>
<th>Base level</th>
<th>Transmission class</th>
<th>Inertia weight</th>
<th>Miles per gallon</th>
<th>Projected vehicle configuration sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Manual-4</td>
<td>3.500</td>
<td>16.1001</td>
<td>15,000</td>
</tr>
<tr>
<td>B</td>
<td>Automatic-3</td>
<td>3.500</td>
<td>15.9020</td>
<td>35,000</td>
</tr>
<tr>
<td>C</td>
<td>Manual-4</td>
<td>4.000</td>
<td>14.2343</td>
<td>10,000</td>
</tr>
<tr>
<td>D</td>
<td>Automatic-3</td>
<td>4.000</td>
<td>15.8138</td>
<td>15,000</td>
</tr>
<tr>
<td>E</td>
<td>Automatic-3</td>
<td>4.000</td>
<td>13.2203</td>
<td>20,000</td>
</tr>
<tr>
<td>F</td>
<td>Automatic-3</td>
<td>5.000</td>
<td>10.6006</td>
<td>40,000</td>
</tr>
</tbody>
</table>

Step III. Determine base level fuel economy values.
A. For all the base levels except the base level which includes 4,000 pound, manual four-speed transmission data, the base level fuel economy is as noted in Step II since only one vehicle configuration was tested within each of these base levels.

3,500 lbs/M4 transmission. 3,500 lbs/A3 transmission. 4,000 lbs/A3 transmission.
16.1001 mpg. 15.9020 mpg. 13.8138 mpg.
B. Since data from more than one vehicle configuration are included in the 4,000-pound, manual four-speed transmission base level, this fuel economy is harmonically averaged in proportion to the percentage of total sales of all vehicle configurations tested within that base level represented by each vehicle configuration tested within that base level.

Base level fuel economy =

\[
\frac{\text{Fraction of total sales of configurations tested represented by configuration No. 1 sales}}{\text{No. 1 fuel economy}} \times \frac{\text{Fraction of total sales of configurations tested represented by configuration No. 2 sales}}{\text{No. 2 fuel economy}} = \frac{1}{14.2343 + \frac{1}{15.0000}}
\]

Therefore, the 4000 pound, M4 transmission fuel economy is 14.6840 miles per gallon.

Therefore, the 4000 pound, M4 transmission fuel economy is 14.6840 miles per gallon.

Note that the car line of the test vehicle using a given engine makes no difference—only the weight and transmission do.

<table>
<thead>
<tr>
<th>Model Type</th>
<th>Base Level</th>
<th>Fuel Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajax</td>
<td>M4</td>
<td>16.1001</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>14.6840</td>
</tr>
<tr>
<td>Dodo</td>
<td>M4</td>
<td>16.1001</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>14.6840</td>
</tr>
<tr>
<td>Boredom III</td>
<td>M4</td>
<td>14.6840</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>13.8138</td>
</tr>
<tr>
<td>Castor</td>
<td>A3</td>
<td>13.2203</td>
</tr>
</tbody>
</table>

Step IV. For each model type offered by the manufacturer with that basic engine, determine the sales fraction represented by each inertia weight/transmission class combination and the corresponding fuel economy.

Step V. Determine fuel economy for each model type (that is, car line/basic engine/transmission class combination).
The model type fuel economy values rounded to the nearest mile per gallon, are the fuel economy values listed in the EPA Fuel Economy Guide and used on the general labels (window stickers) for production vehicles for that model year.

Similarly, Ajax and Dodo 3.0 liter, 6 cylinder, M4 model type MPG is calculated as follows:

\[
\frac{1}{\begin{bmatrix} 0.4000 \\ 16.1001 \end{bmatrix}} + \frac{0.6000}{14.6840} = 15.2185, \text{ which rounds to 15 MPG}^{1}
\]

Dodo 3.0 liter, 6 cylinder, A3 model type MPG is calculated as follows:

\[
\frac{1}{\begin{bmatrix} 0.3000 \\ 15.9020 \end{bmatrix}} + \frac{0.7000}{13.8138} = 14.3803 \text{ mpg, which rounds to 14 MPG}^{1}
\]

Boredom III 3.0 liter 6 cylinder M4 model type MPG = 14.6840 mpg, which rounds to 15 mi./gal\(^1\)

Boredom III 3.0 liter, 6 cylinder, A3 model type MPG is calculated as follows:

\[
\frac{1}{\begin{bmatrix} 0.2500 \\ 13.8138 \end{bmatrix}} + \frac{0.7500}{13.2203} = 13.3638, \text{ which rounds to 13 MPG}^{1}
\]

Castor 3.0 liter, 6 cylinder, A3 model type MPG is calculated as follows:

\[
\frac{1}{\begin{bmatrix} 0.3000 \\ 15.9020 \end{bmatrix}} + \frac{0.7000}{13.8138} = 14.3803 \text{ mpg, which rounds to 14 MPG}^{1}
\]
\[
\frac{1}{\begin{bmatrix} 0.2000 \\ 13.2203 \end{bmatrix}} + \frac{0.8000}{10.6006} = 11.0381, \text{ which rounds to 11 MPG}^1
\]

Note that even though no Dodo was actually tested, this approach permits its fuel economy figure to be estimated, based on the inertia weight distribution of projected Dodo sales within a specific engine and transmission grouping.

[71 FR 77958, Dec. 27, 2006]

APPENDIX IV TO PART 600—SAMPLE FUEL ECONOMY LABELS FOR 2008 THROUGH 2012 MODEL YEAR VEHICLES

A. Gasoline (or diesel)-fueled vehicle label

B. Gasoline (or diesel)-fueled vehicle label (with transitional text statement for MY 2008 and 2009 vehicles only)