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OFFICE OF
AIR AND RADIATION

December 3, 2009

CISD-09-19 (LDV/LDT)

SUBJECT: Policy Revisions for Testing Vehicles Equipped with Select-Shift Transmissions, Multimode Transmissions and Shift Indicator Lights (SILs)

Dear Manufacturer:

This letter revises EPA certification and fuel economy testing policy for vehicles equipped with Select-Shift Transmissions, Multimode Transmissions and Shift Indicator Lights (SILs). These revisions are intended to encourage manufacturers to improve in-use fuel economy and reduce testing burden for the Industry (especially for 5-cycle fuel economy labeling requirements,[1] which are optional for 2008-2010 model year vehicles and required for some 2011 and later model year vehicles).

This new policy is optional for 2009 and 2010 model year vehicles and applicable to 2011 and later model year vehicles.

Regulatory Background – The provisions of 40 CFR 86.128-00 provide the basis for shifting certification vehicles equipped with automatic and manual transmissions. The provisions of 40 CFR 600.111-08 provide the basis for shifting fuel economy vehicles (which reference the provisions of 40 CFR 86. 128-00). The provisions of 86.128-00(a) reads as follows:

> "All test conditions, except as noted, shall be run according to the manufacturer's recommendations to the ultimate purchaser, *Provided,* That: Such recommendations are representative of what may reasonably be expected to be followed by the ultimate purchaser under in-use conditions."

Driver-Selectable Devices (includes "Select-Shift" and "Multimode" Transmissions)

Enclosure 1 provides EPA guidance for vehicles equipped with driver-selectable devices. For the purposes of this letter, "Select-Shift" transmissions are defined to be a type of semi-automatic transmission with driver controls which permits the automatic transmission to be shifted like a conventional manual transmission. In the manual mode, select-shift transmissions commonly use buttons or paddles located on the steering wheel or a toggle switch type of floor mounted gear lever to upshift and downshift the vehicle. Also for the purposes of this letter, "multimode" transmissions are defined in Advisory Circular 83A to mean "an automatic, a manual or semi-automatic transmission that has an operator selectable feature that changes

[1] 71 FR 77872, December 27, 2006

transmission parameters such as gear ratios or automatic transmission shift speed calibrations. Electronic overdrive features or variable lockup calibration features are not considered multi-mode transmissions." Unlike select-shift transmissions which allow the driver to make gear changes, multimode transmissions commonly have buttons or switches which allow the driver to select various power, normal, economy and overdrive lockout operating modes, (sometimes called eco, econ, intelligent, sport, sport-sharp, super-sport, tow/haul, and overdrive off modes). This letter supersedes previous select-shift and multimode transmission guidance provided in EPA guidance letters CCD-02-10 dated July 12, 2002; CCD-01-025R, dated December 17, 2001; and CD-87-01, dated January 23, 1987.

Shift Indicator Lights (SILs)

Enclosure 2 provides EPA guidance for vehicles equipped with SILs. For the purposes of this letter, SILs are defined in Advisory Circular 83A as follows: "The SIL is a light that indicates when the driver should shift to the next higher gear. EPA will consider vehicles equipped with a SIL or similar acceptable device and vehicles without a SIL or similar acceptable device as separate transmission classes." The guidance provided in this letter supersedes previous SIL guidance except for carryover SIL shift schedules. Previous SIL guidance was provided in EPA Advisory Circular 72A (pages 3, 4 and 12); EPA guidance letters CD-87-06, dated April 30, 1987; CD-83-10, dated June 22, 1983; and CD-82-10, dated December 22, 1982.

Sample Select Shift Survey Questionnaire

Enclosure 3 provides a sample select shift survey questionnaire that manufacturers may use to conduct their surveys.

If you have questions about this letter, please contact Dave Good by e-mail at good.david@epa.gov or by telephone at 734-214-4430.

Sincerely,

Karl J. Simon, Director
Compliance and Innovative Strategies Division
Office of Transportation and Air Quality

Enclosures

Enclosure 1 to CISD-09-19
Testing Requirements for Vehicles Equipped with Driver-Selectable Devices
(includes "Select-Shift" and "Multimode" Transmissions)

Background

This letter supersedes previous select-shift and multimode transmission guidance provided in EPA guidance letters CCD-02-10 "Errata Correction to Dear Manufacturer Letter CCD-01-25 issued December 17, 2001: Policy Revisions to Fuel Economy Testing of Vehicles Equipped with Select-Shift Automatic Transmissions," dated July 12, 2002; CCD-01-025R, "Policy Revisions to Fuel Economy Testing of Vehicles Equipped with Select-Shift Automatic Transmissions," dated December 17, 2001 and revised July 10, 2002; and CD-87-01, "Current Policy on Driver-Selectable Devices," dated January 23, 1987.

Our basic driver-selectable transmission policy is as follows:

- EPA is handling driver-selectable devices on a case-by-case basis.

- Barring substantial evidence that the vehicle will be driven predominantly in one mode, we will test the vehicle in both modes (or the two extreme modes if more than two modes exist), and harmonically average the results for use in fuel economy calculations. The term "predominant" means "nearly total usage of a given selectable mode" such as the use of "Drive" versus "2" in an automatic transmission.

- Vehicles should comply with emission standards in any mode (i.e., no defeat devices). EPA may perform confirmatory testing and in-use surveillance testing in any of the driver-selectable modes. However, if EPA performs confirmatory testing on a certification or fuel economy vehicle in a mode that is not used for fuel economy, the additional EPA tests should not be used in the fuel economy calculations.

This guidance is provided for vehicles equipped with typical select shift and multimode transmissions. Please contact EPA in advance to request guidance for vehicles equipped with future technologies not covered by this document, unusual default strategies or driver selectable features, e.g., hybrid electric vehicles where the multimode button or switch disables or modifies any fuel saving features of the vehicle (such as the stop-start feature, air conditioning compressor operation, electric-only operation, etc.). Normally, manufacturer requests should include a detailed description of the select shift/multimode operation, a copy of the owner's manual description, expected 5-cycle fuel economy data, and a vehicle supplied to EPA for a short drive evaluation.

Definitions

Advertised Horsepower - Advertised horsepower should be based on SAE surface vehicle standard J2723. For hybrid electric vehicles, the advertised horsepower shall also include the electric power of the vehicle, e.g. the advertised electric motor rating[2] in kilowatts while operating with the battery at the maximum operating state of charge (converted to horsepower using the factor of 1.34 horsepower/kilowatt).

Driver Selectable Transmissions – For purposes of this guidance document, a class of transmissions comprised of select-shift transmissions and multi-mode transmissions.

Equivalent Test Weight (ETW) – For purposes of this guidance document, ETW means the equivalent test weight setting used for FTP testing. See 40 CFR 86.129-94.

Multimode Transmission – For the purposes of this letter, "multimode" transmissions are defined in Advisory Circular 83A to mean "an automatic, a manual or semi-automatic transmission that has an operator selectable feature that changes transmission parameters such as gear ratios or automatic transmission shift speed calibrations. Electronic overdrive features or variable lockup calibration features are not considered multimode transmissions." Unlike select-shift transmissions which allow the driver to make gear changes, multimode transmissions commonly have buttons or switches which allow the driver to select various power, normal economy and overdrive lockout operating modes (sometimes called eco, econ, intelligent, sport, sport-sharp, super-sport, tow/haul, and overdrive off modes).

Predominance Criteria – At least 75% of drivers will have at least 90% of the vehicle shift operation performed in one mode, and on average, 75% of vehicle shift operation is performed in that mode.

Predominant Driver Selectable Mode – The driver selectable mode for which shift survey data meets the predominance criteria.

Select-Shift Transmission - A number of recent model year vehicles have been designed with driver-controllable gear shift capability which permits the automatic transmission to be shifted in a manner similar to a conventional manual transmission. These transmissions are known by a variety of names, but for purposes of this letter, EPA will call these automatic transmissions "select-shift" transmissions. The select-shift transmissions can generally fall into several types: those which permit shifting between gear ranges, for example, a five speed transmission with the gear ranges 1-2, 1-2-3, 1-2-3-4, and 1-2-3-4-5 and those which may use the select-shift transmission to engage specific individual gears. A third type is those which are designed to function with continuously variable transmissions (CVTs).

Weight-to-Horsepower Ratio – ETW/advertised horsepower.

[2] At this time, EPA is unaware of a standard method of determining the rated power of automobile electric propulsion motors, e.g. an SAE recommended practice. Therefore, prior EPA approval is required.

Basic Default Driver-Selectable Transmission Mode Testing Policy

Manufacturers not meeting the predominance requirements set forth below or choosing not to conduct a survey will be required to submit fuel economy data from the vehicle tested in the two extreme modes, and harmonically average the two sets of test results. Vehicle-specific 5-cycle FE labels (if applicable) shall be based on harmonically averaged test results/bag data for FTP, highway, US06, SC03 and Cold temperature FTP tests. Highway FE Label values using the modified 5-cycle method outlined in 40 CFR 600.115-08(b)(2)(iii)(B) (commonly called the 3-cycle method) shall be based on two sets of harmonically averaged test results/bag data for FTP, highway and US06 tests.

Optionally, manufacturers may test in the worst case (fuel economy) mode only.

Predominant Driver-Selectable Transmission Mode Testing Policy

Manufacturers meeting the predominance requirements set forth below have the option to submit fuel economy data from the vehicle tested in the predominant mode only. Vehicle-specific 5-cycle FE labels (if applicable) shall be based on the predominant mode test results/bag data for FTP, highway, US06, SC03 and Cold temperature FTP tests. Highway FE Label values using the modified 5-cycle method outlined in 40 CFR 600.115-08(b)(2)(iii)(B) (commonly called the 3-cycle method) shall be based on the predominant mode test results/bag data for FTP, highway and US06 tests.

Establishing the Predominant Driver-Selectable Mode

Unless manufacturer's previous survey data indicate otherwise, the predominant mode will be the "key-off" (default) mode for vehicles meeting the following criteria:

- A "key-off" (default) mode has been established by the manufacturer.
- The manufacturer provides driver education information regarding all driver-selectable modes to the ultimate purchaser.
- For vehicles with multimode transmissions but without SST, the weight-to-horsepower ratio is greater than or equal to 12.0 to 1
- For SST-equipped vehicles-
    1. Weight-to-horsepower ratio is greater than 15.0 or
    2. Weight-to-horsepower ratio is greater than or equal to 12.0, but less than or equal to 15.0 and the driver must remove a hand from the steering wheel in order to upshift and downshift the SST (regardless of whether or not the driver needs to remove a hand from the steering wheel in order to activate the SST).

Assuming that the requirements listing in the first two bullet items have been met, Table 1 shows the various scenarios described above.

Table 1. Testing Allowance for Default-Equipped Vehicles.

Multimode	SST	ETW/Power	Test in Default Only Allowed?*
Yes	Yes	<12.0	No
		12.0-15.0	Yes, if driver must remove hand from the steering wheel to upshift and downshift SST
		>15.0	Yes
Yes	No	<12.0	No
		≥12.0	Yes
No	Yes	<12.0	No
		12.0-15.0	Yes, if driver must remove hand from the steering wheel to upshift and downshift SST
		>15.0	Yes
*Default-only test allowance may be carried over for products with ETW/Power changes less than 5% from original.			

For vehicles which default to the "best fuel economy" mode on key-off, manufacturers may perform EPA fuel economy testing in the "best fuel economy" mode because this mode would "reasonably be expected to be followed by the ultimate purchaser under in-use conditions;" ref. 40 CFR 86.128-00. In addition to defaulting to the "best fuel economy mode" on key-off, EPA encourages manufacturers to:

- calibrate vehicles with "green" adaptive (block learn) fuel economy strategies;
- calibrate vehicles to minimize the operation of the air conditioning compressor; and
- reset the defroster to the "off" position on key-off;

Fuel economy tips and "driver education" could include brochures provided when purchasing a new vehicle and/or information provided to the operator by the on-board vehicle information system. For example, the on-board vehicle information system could provide messages to the driver that the ambient temperature is sufficiently low so that air-conditioning is not needed; that minimizing defroster operation improves the fuel economy of the vehicle; that moderate braking and coasting techniques provide more battery regeneration for hybrid vehicles than hard braking, etc.

If a predominant mode cannot be established by the criteria above, the manufacturer has the option to conduct a survey to establish the predominant mode. Table 2 provides minimum testing requirements for survey outcomes.

Table 2. Minimum Testing Requirements for Various Survey Outcomes

Survey Outcome	Minimum Testing
SST is predominant*	SST mode only
Full Auto mode is predominant*	Test in predominant mode* only. If no predominant multimode, test worst & best case fuel economy multi-mode settings or (with prior EPA approval) in the two most prevalent multi-mode settings.
Neither SST, nor full Auto mode is predominant*	Worst & best case fuel economy transmission settings or (with prior EPA approval) the two most prevalent transmission settings
** According to EPA predominance criteria*	

Driver-Selectable Mode Survey Design

The following survey design criteria are requirements for determining the usage rate of the driver-selectable modes:

- The survey shall be conducted by telephone or mail and be designed to obtain unbiased quantitative estimates of select-shift and multimode usage. For example, vehicles equipped with select shift and multimode (normal, sport and super sport) modes shall determine the percent of shifting in the SST (normal) mode, the full automatic normal mode, the fully automatic sport mode and the fully automatic super sport mode.

- Preferably, the survey shall be conducted by an independent survey organization.

- The survey respondents shall be the principal drivers of the vehicles and have driven the vehicles for several months.

- The minimum survey sample size is the lesser number of 30 percent of vehicle sales, or 50 respondents.

- Carlines may be combined into a single survey if they are sufficiently similar so as to generate equivalent usage rates. Manufacturers should make these grouping decisions using good engineering judgment. Survey results from these combined carline surveys should be analyzed to assure that respondents from each carline have similar usage rates. If the usage rates significantly vary between carlines initially grouped together for survey purposes, the manufacturer will separate the carlines and collect additional survey responses to meet the minimum 50 responses for each survey.

- If a manufacturer wishes to use its employees as participants, the manufacturer must assure EPA that no bias will be introduced and the method of selecting participants must be approved in advance by EPA.

- With prior EPA approval, properly designed web-based surveys may be used, provided the customer supplies the VIN of their vehicle to authenticate their responses; the vehicle is equipped with the proper engine and transmission; and the principle driver of the vehicle completes the web-based survey questions.

- The shift usage survey should be combined with other questions not related to select-shift transmissions, but the survey should ask the principal driver of a qualifying vehicle "to estimate, the percent of shifting done in the select-shift usage mode."[2]

- Compliance with the predominance criteria shall be calculated from an analysis of the responses and the corresponding usage rates.

Manufacturers should exercise good engineering judgment in making decisions. EPA will not approve the shift survey in advance, except for approving the general design of web-based surveys. EPA reserves the right to examine the survey and the results.

A generic survey is provided in Enclosure 3.

Alternative Methods for Determination of Usage Rates

1. Manufacturers may also determine driver-selectable mode usage rates by instrumenting a vehicle or vehicles and logging driver-selectable mode position shift events using at least 15 representative drivers using either a) a road route similar to the road route outlined in EPA Advisory Circular No. 72A or b) typical in-use driving conditions for a representative period, e.g. a week or more. The instrumented vehicle(s) may be provided by the manufacturer or the vehicle owner, but the driver should be the principal driver of a vehicle equipped with a driver-selectable device which they have driven for several months.
2. Manufacturers may determine driver-selectable mode usage rates by collecting data from the onboard Powertrain and/or Transmission Control Module (PCM and/or TCM), provided that the vehicle is so designed and equipped. Such data may be collected from customer vehicles when brought to the dealership for maintenance. Driver-selectable mode position shift events shall be logged from at least 15 representative drivers determined to have experienced typical in-use driving conditions for a representative period, eg., one week or more.
3. Manufacturers should use good engineering judgment to assure that the vehicle is operated over a mix of city and highway conditions reflective of legal speeds in certification and fuel economy test procedures. Cold temperature operation is not required. Preferably, company drivers should not be used. If a manufacturer wishes to use its employees as participants, the manufacturer must assure EPA that no bias will be introduced and the method of selecting participants must be approved in advance by EPA. The purpose of the survey shall be masked (unknown to the vehicle operators).

[2] Because some select-shift transmissions may access the selection of gears or gear ranges from the "Drive" position, as opposed to a separate shift gate position, some manufacturers will need to use a different metric to determine the correct usage rate of the select-shift mode. An alternative metric should be quantifiable and based on good engineering judgment.

An analysis of the shift events shall be made on an individual driver basis to determine the percentage of driver-selectable mode position shift usage. Driver-selectable mode usage rates for each driver are then compared against the previously described predominance criteria. In addition, for vehicles equipped with a select-shift transmission, the shifting data may be analyzed on an individual vehicle basis to determine an appropriate shift schedule to use for fuel economy tests performed in the manual mode.

Survey Requirements and Fuel Economy Submissions for First Year Vehicles with Driver-Selectable Modes

If the manufacturer is unable to establish a predominant mode prior to production of the first model year of a driver-selectable device design, the manufacturer may submit fuel economy data for one mode, provided they use good engineering judgment in the selection of that mode. However, survey results should be obtained before the end of the model year, and depending on the results, actions may be required under EPA fuel economy regulations. Survey requirement applicability depends on the weight-to-horsepower ratio for tested subconfigurations, as described in "Establishing the Predominant Driver-Selectable Mode" section below.

If the survey results meet the predominance criteria for the tested mode, no additional actions are required. If the survey results fail to meet the predominance criteria for the tested mode, the vehicle manufacturer should comply with the following:

(a) Run fuel economy tests in the two extreme modes or, alternatively, (with prior EPA approval) in the two most prevalent modes.

(b) Recalculate label values under §600.314-08(e)(2) based on harmonically averaged data from paragraph (a) above.

(c) If necessary, under §600.314-08(e)(4)
(i) Re-label all affected vehicles
(ii) Update the entire label, including the Gas Guzzler Tax, under §600.314-08(e)(5).

(d) CAFE will be based on harmonically averaged data.

Overdrive Lockout Policy

Some multimode transmissions contain selectable modes that are designed for non-standard operation and would be deemed not reasonable for normal driving. For example, some multimode transmissions are equipped with an overdrive lockout button/switch (sometimes called a “Tow/Haul” switch). Some are equipped with a “Hold” button which holds the transmission in gear and prevents upshifts, e.g. for mountain driving. Some are equipped with a “Snow” mode for use in snowy (low traction) conditions. For these types of overdrive lockout buttons and switches, fuel economy testing is not necessary in these modes, provided the vehicle defaults to the normal operating mode (with overdrive enabled) on key-off. If the vehicle does not default to the normal operating mode on key-off, fuel economy testing and FE Label

requirements are the same as with any multimode button/switch, provided a vehicle driven in such a mode can follow drive traces for the regulated emissions and fuel economy test cycles.

Driver-Selectable Mode Testing in Support of 2011 and Later Model Year Fuel Economy Labels

Beginning with the 2011 model year, manufacturers are required to determine the FE Labeling methodology (mpg-based derived 5-cycle method, the vehicle-specific 5-cycle method, or for highway values the modified 5-cycle method) based on the 5-cycle tests of the certification vehicle, ref. 40 CFR 600.115-08(a)(3), (b) and (b)(2)(iii)(B). For these 5-cycle certification tests, manufacturers should use good engineering judgment to determine the worst case mode for emissions (in aggregate, considering all regulated emission constituents and all test procedures) and use that mode for all 5-cycle certification tests

Survey Considerations for Small Volume Vehicles

With prior EPA approval, special survey considerations will be allowed on a case-by-case basis for small volume vehicles, e.g. if the manufacturer has difficulty obtaining the minimum response rate. For example, EPA may approve surveys below the minimum sample size (if the results of the survey are statistically corrected to the 95th percent confidence level). EPA may approve manufacturers' requests to survey company employees provided the purpose of the survey is masked from the employee.

Carry-over/Carry-across of Driver-Selectable Mode Shift Survey Results

Vehicle manufacturers wishing to produce driver-selectable device vehicles in subsequent model years may carry-over the survey results for a carline/engine/transmission combination from one model year to another (or carry-across within the same model year) based on good engineering judgment for driver-selectable designs which cover vehicles which have the same or similar criteria:

- Carline, or combined carlines based on good engineering judgment
- Basic mode calibration strategy
- Location and actuation of the select-shift control
- Shift gate pattern

Shift survey results may not be carried over for more than 4 years (5 years total) without prior EPA approval. EPA does not expect to approve carryover requests beyond 10 years (11 years total) except in very rare cases.

Additionally, manufacturers may carryover and carry-across survey results from higher performance to lower performance carline/engine/transmission combinations, as follows:

- **Case 1: Hierarchy for Different Engines:** Surveys may be carried over and carried across from higher horsepower to lower horsepower engines (e.g. from V8s to V6s to 4-cyl engines).

- **Case 2: Hierarchy for Similar Carlines:** Surveys may be carried over and carried across from carlines with higher power/weight ratio to similar carlines with lower power to weight ratio.
- **Case 3: Hierarchy for Different Carlines:** Surveys may be carried over and carried across in the following hierarchy: from two-seaters to 2/4-door sedans, minivans and/or family type SUVs; from 2/4-door sedans to minivans and/or family type SUVs; between minivans and/or family type SUVs; and from high performance SUVs to family type SUVs.
- **Case 4: Flexibility for Different Transmissions:** Surveys may be carried over and carried across to vehicles equipped with different types of transmissions (e.g. from conventional hydraulic automatic transmission to a direct drive clutch-type automatic transmission) and regardless of the number of forward gears, e.g. from S6 to S5 and S4 transmissions and from S4 to S5 and S6 transmissions.

Manufacturers should provide EPA with a summary of the carryover and carry-across decisions which they have made in their annual certification preview meeting.

Carry-over/Carry-across of Driver-Selectable Mode Fuel Economy Data

EPA's carry-over and carry-across policy is outlined in Advisory Circular 17F (Subject: General Criteria for the Carryover and Carry-Across of Certification Data and the Carryover of Fuel Economy Data for Light-Duty Vehicles and Light-Duty Trucks). In general, carryover and carry-across of fuel economy data from vehicles equipped with driver-selectable modes will be allowed if the new vehicle differed from the tested vehicle in ways which the manufacturer's good engineering judgment would indicate that the new vehicle would have equivalent or superior fuel economy characteristics (including the shifting characteristics).

Effective Date of Guidance

Manufacturers may optionally use the select shift guidance provided above in the 2009 and 2010 model years and should use the guidance provided above for the 2011 and subsequent model years.

Enclosure 2 to CISD-09-19
Testing Requirements for Vehicles Equipped with Shift Indicator Lights (SILs)

Background

This letter supersedes previous SIL guidance, except that previous SIL shift schedules may be carried-over until the vehicle platform is phased out. Previous SIL guidance was provided in EPA Advisory Circular (A/C) 72A (pages 3, 4 and 12); EPA guidance letters CD-87-06, dated April 30, 1987; CD-83-10, dated June 22, 1983; and CD-82-10, dated December 22, 1982.

Previous guidance normally resulted in dual testing; test vehicles were shifted with and without the SIL. Previous guidance then weighted the results of the city and highway tests using a SIL usage factor determined by a letter or telephone questionnaire of in-use vehicle owners. The new SIL testing policy outlined in this letter eliminates dual testing requirements and relies on an instrumented vehicle survey (e.g. on a prototype vehicle) to determine the appropriate shift schedule for SIL-equipped vehicles.

SILs are described in A/C 72A as follows: "Shift indicator lights (SILs) are designed to improve fuel economy by encouraging drivers to shift at the lowest practical speed for each gear. A light, usually located in the instrument panel, illuminates to prompt a shift as soon as vehicle operating conditions would allow acceptable performance in the next gear."

SILs determine a separate transmission class, as outlined in A/C 83A, as follows: "The SIL is a light that indicates when the driver should shift to the next higher gear. EPA will consider vehicles equipped with a SIL or similar acceptable device and vehicles without a SIL or similar acceptable device as separate transmission classes."

Testing Policy for Vehicles Equipped with SILs

For reasons discussed in EPA guidance letter CD-87-06, April 30, 1987, and in light of the 5-cycle fuel economy testing requirements (optional for 2008 and later model year vehicles, and required for some 2011 and later vehicles) EPA is revising the previous testing policy for vehicles equipped manual transmissions and SILs. Dual testing will no longer be allowed, except for carryover vehicles which were tested prior to the 2010 model year. EPA will accept shift schedules for manual transmission vehicles equipped with SILs using one of three approaches outlined in A/C 72A, as follows:

- standard shift speeds 15, 25, 40, 45, 50 mph (or higher)
- rpm based percent of rated engine speed, or
- survey-based (using an instrumented vehicle driven over a representative road route).

Alternatively, EPA will accept shift schedules for manual transmission SIL vehicles based on an in-use shift point survey of customer-owned vehicles or company-owned vehicles when driven for a sufficient number of miles over a mix of city and highway conditions (including opportunities for hard accelerations) reflective of legal speeds encountered on regulated fuel economy and emissions tests.

SIL Instrumented Vehicle Shift Point Survey Design

The shift point survey should follow the guidance of A/C 72A, paragraph V, with the following exceptions and reminders:

- Preferably, the survey shall be conducted by an independent survey organization.
- Vehicle instrumentation shall be concealed from the participant.
- Drivers shall not know the purpose of the survey
- **EPA approval is not required.** Manufacturers should use good engineering judgment to assure that the survey route and survey design meets the guidelines of A/C 72A and this guidance letter.
- Sample Size: Minimum sample size is unchanged from A/C 72A (at least 15 drivers).
- Sample Composition: Sample composition is unchanged from A/C 72A.
- Survey Groups: Survey groups are unchanged from A/C 72A, except that manufacturers may use good engineering judgment to combine carlines into a single survey if they are sufficiently similar.
- Test Vehicle Configurations: From the group of test vehicles to be represented, the survey vehicle(s) shall be the worst case in terms of advertised horsepower, transmission characteristics, vehicle weight, N/V ratio, plus Case 2 and 3 carline hierarchies outlined in the carry-over section of Enclosure I. [N/V is the engine speed to vehicle speed ratio. EPA has determined that a lower N/V ratio is worst case for shifting.]
- Road Route: The survey route should include a mix of city, highway & US06 driving. Alternately, the survey may be conducted over typical in-use driving conditions for a representative time period, e.g. two weeks or more.
- Data Analysis: The data shall be analyzed to estimate the shift points used for acceleration and cruise modes using the method provided in A/C 72A (including paragraphs pertaining to data point identification, data rejection, and data analysis) or another Industry-wide method acceptable to EPA.

Other survey designs may be used with prior EPA approval. EPA reserves the right to examine the survey and the results.

SIL Testing in Support of 2011 and Later Model Year Fuel Economy Labels

Manufacturers should use good engineering judgment to assure that surveys are representative of consumer driving over the 5-cycles (FTP, highway, US06, SC03 and Cold temperature FTP), except that cold temperature operation is not required. Shifting for the highway portion of the US06 test may be determined from the survey data (e.g., based on customer shifting during US06 type of accelerations) or delaying shifts in order to follow the US06 cycle as outlined in Advisory Circular 72A, Section IV. B. (page 6).

Beginning with the 2011 model year, manufacturers are required to determine the FE Labeling methodology (mpg-based derived 5-cycle method, the vehicle-specific 5-cycle method, or for highway values the modified 5-cycle method) based on the 5-cycle tests of the certification vehicle, ref. 40 CFR 600.115-08(a)(3), (b) and (b)(2)(iii)(B). For these 5-cycle certification tests,

manufacturers should perform 5-cycle certification tests using shift schedules developed for SIL vehicles using the guidance provided in this letter. For carryover shift schedules based on dual testing approaches, manufacturers should perform certification tests with and without the SIL (for all 5-cycle certification tests) and **harmonically average the SIL and non-SIL fuel economy data** for each of the five cycles to determine the FE Labeling methodology. Please notify EPA if there are problems shifting SIL vehicles on the SC03, US06 and cold temperature FTP tests, e.g. if drivers have difficulty shifting vehicles when the SIL illuminates on the US06 test.

Survey Considerations for Small Volume Vehicles

With prior EPA approval, special survey considerations may be allowed on a case-by-case basis for small volume manufacturers and for small volume vehicles. However, EPA does not expect that special considerations will be needed for SIL vehicles. For example, special survey considerations will likely not be needed to meet the survey minimum sample size requirements because participants can be owners of any SIL-equipped manual transmission vehicle. Additionally, small volume manufacturers are expected to use the standard shift schedule or the rpm-based shift schedules outlined in A/C 72A, sections IV. A. 1 and A. 2 instead of the survey-based shift schedules outlined in A/C 72A section IV. A. 3.

Testing Policy for Vehicles with Select-Shift, Multimode Buttons/Switches and SILs

Vehicles equipped with select shift transmissions, multimode buttons/switches and SILs will be evaluated on a case-by-case basis. Manufacturers may test select shift vehicles equipped with SILs in the manual mode based on one of the shifting methods outlined in Advisory Circular 72A, and this guidance letter. Normally, we expect select shift vehicles to be shifted manually using the standard shift schedule, 15, 25, 40, 45, 50 mph (or higher). However, as discussed in the Instrumented Vehicle Alternative section of Enclosure I, manufacturers may analyze data collected in an instrumented vehicle survey to determine how the select-shift vehicle should be shifted in the manual mode (which would account for the presence of the SIL). Multimode buttons/switches are currently not offered on manual transmission SIL vehicles.

Carry-over/Carry-across of SIL Shift Survey Results

Vehicle manufacturers wishing to produce SIL vehicles in subsequent model years may carry-over the survey results for a carline/engine/transmission combination in one model year to another (or carry-across within the same model year) based on good engineering judgment for SIL designs which cover vehicles with the same or similar criteria:

- Carline, or combined carlines based on good engineering judgment
- Location and visibility of the SIL
- SIL calibration (e.g. vehicle speed, engine rpm when the light activates)

Based on good engineering judgment, manufacturers may carryover/carry across non-SIL survey results to SIL-equipped vehicles for similar carlines provided the SIL illuminates at vehicle speeds lower than or equal to the shift points that resulted from the non-SIL survey.

Previous SIL usage factors (for dual testing) and SIL shift schedules developed using this guidance letter (using one shift pattern) may be carried over and carried across to vehicles and carlines where manufacturers' good engineering judgment indicates that the survey vehicle was worst case in terms of advertised horsepower, transmission characteristics, vehicle weight, N/V ratio, plus Case 2 and 3 carline hierarchies outlined in the carryover section of Enclosure I. Survey results may be carried over until the vehicle platform is redesigned (e.g., until the powertrain is phased out). Manufacturers should document the rationale for carry-over/carry-across in the application for certification. Manufacturers should provide EPA with a summary of the carryover and carry-across decisions which they have made in their annual certification preview meeting.

Previous SIL shift schedules (developed under EPA guidance letters CD-87-06, CD-83-10 and CD-82-10) may be carried-over until the vehicle platform is phased out. As outlined in these guidance letters, appropriate SIL usage factors were determined from responses to customer questionnaires. The usage factor was then used in model type calculations to weight the SIL and non-SIL city and highway tests. SIL usage factors from previous surveys may be carried over provided the model type fuel economy values are based on the weighted **harmonic average of the SIL and non-SIL pairs of city, highway, US06, SC03 and cold FTP tests, as applicable**.

Carry-over/Carry-across of SIL Fuel Economy Data

Same as select-shift carry-over/carry-across policy outlined in Enclosure I.

Survey Requirements and Fuel Economy Submissions for First Year Vehicles with SILs

In order to establish shift schedules for first year SIL vehicles, manufacturers may perform SIL surveys "prior to actual production start-up by using prototype vehicles; ref. CD-87-06, April 30, 1987. However, if a manufacturer is unable to complete a pre-production shift speed survey, with prior EPA approval the manufacturer may establish a shift schedule using good engineering judgment. The underlying assumption will be that the shift points will occur at speeds between the standard shift speeds (15, 25, 40, 45, 50 mph) and the calibrated SIL shift speeds. In this case, the manufacturer would be required to perform a shift speed survey in compliance with the aforementioned survey requirements before the end of the model year. If the good engineering judgment shift schedule differs significantly from the survey-based shift schedule, the manufacturer may have to take remedial action (e.g., relabel as outlined in Enclosure I, in the section titled "Survey Requirements and Fuel Economy Submissions for First Year Vehicles with Driver-Selectable Modes," as applicable). Regardless of the result, the survey-based shift schedule will become the official shift schedule for subsequent model years.

Normally, manufacturer requests to base first year shift schedules on good engineering should include a detailed description of the SIL operation, a copy of the owner's manual description, expected 5-cycle fuel economy data, and a vehicle (equipped with a production SIL) supplied to EPA for a short drive evaluation[1].

[1] The purpose of EPA's drive evaluation is to evaluate the location and visibility of the SIL and to evaluate the overall robustness of the SIL calibration, including drivability of the vehicle at the SIL-indicated shift points. For example, the vehicle should not hesitate, stall or stumble when shifted according to the SIL.

Effective Date of SIL Guidance

Manufacturers may optionally use the SIL guidance provided above in the 2009 and 2010 model years and should use the guidance provided above for the 2011 and subsequent model years.

Enclosure 3 to CISD-09-19
Sample Select Shift Survey Questionnaire

Name:_____ Odometer: _____ Primary Phone Number _____
Address: _____ Alternate Phone Number_____

Please have the person who is the primary operator of the <2010> model year vehicle _____ (enter model type) registered at your address answer the following questions:

1. What is the age of the person who is the primary operator of the vehicle?

Age: 16-20 ____ 21-25 ____ 26-30 ____ 31-38 ____ 39-49 ____ 50-60 ____ 61+ ____

2. How long have you been driving the vehicle? _____Years _____Months

3. How many total hours on average do you drive your vehicle per week? _____ Hours

4. What percentage of your weekly driving time is spent in city type traffic? _____ Percent

5. Are you aware that you can shift your vehicle to simulate a manual transmission using the <steering wheel paddles> or <transmission shift lever>? _____YES _____NO

6. How often do you shift your vehicle using the <paddles to simulate a manual transmission?> or <shift lever to simulate a manual transmission by actuating the shift lever in the plus (+) or minus (-) shift lever positions?>

_____Occasionally _____ Usually _____Very rarely _____Never

7. Please estimate the average percent of time that you use the <paddles> or <shift lever> to simulate a manual transmission compared to the percent of time in the automatic mode.

_____Percent of time in manual mode _____Percent of time in automatic mode

8. **{If applicable}** While in the automatic mode, what percent of the time is spent in the "Normal," mode, the "Sport" mode, and the "Super Sport" mode?

_____Percent of time in the "Normal" mode _____ Percent of time in the "Sport" mode

_____Percent of time in the "Super Sport" mode _____Don't know

9. Are you mostly satisfied with your vehicle fuel efficiency of your vehicle? _____YES _____NO

10. Are you mostly satisfied with your vehicle performance? _____YES _____NO

Comments:
_____

_____

_____

_____