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December 21, 2006

Mail-Out #MSC 06-23

**TO: ALL PASSENGER CAR MANUFACTURERS
ALL LIGHT-DUTY/MEDIUM-DUTY VEHICLE MANUFACTURERS
ALL OTHER INTERESTED PARTIES**

SUBJECT: Guidelines for On-Board Diagnostic II (OBD II) Certification Data

In order to expedite the OBD II certification review process, staff has developed guidelines and templates for reporting various elements of the certification documentation. Where applicable, all OBD II certification information shall be submitted in accordance with these templates. Templates provided in previous Mail-Outs (MO #95-20 and MO #96-05) have been updated and included in this document. Except as discussed further in the calibration identification (CAL ID) and calibration verification number (CVN) information section, the formats and reporting requirements defined herein shall apply to all 2008 and newer model year OBD II certification documentation.

Misfire Detection and Disablement Chart

Section (i)(2.5.3) of title 13, California Code of Regulations, section 1968.2 (i.e., the OBD II regulation) requires the certification application to include documentation of misfire monitor disablement during the federal test procedure (FTP) and US06 test cycles. For this documentation, a template is provided as Attachment A, "Misfire Detection and Disablement Chart". Data for these charts shall be collected from a vehicle with random misfire present at the FTP emission threshold level over both the FTP and US06 drive cycles. These charts shall be printed as full pages in landscape format with time in seconds plotted on the x-axis and no more than 200 seconds of data on each page. The y-axis scaling shall be unique to each parameter to allow clear identification and observation of each trace. The parameters plotted on the chart shall include vehicle speed, a misfire counter (indicating the number of actual detected misfires for the current 1000-revolution evaluation interval), and a 1000-revolution counter (indicating the number of crankshaft revolutions accumulated while the misfire monitor is enabled for the current 1000-revolution evaluation interval). The FTP misfire threshold (i.e., number of detected misfires per 1000 revolution increment needed to detect a fault as defined in section (e)(3.2.2)(B)) shall be plotted as a horizontal line on the same y-axis scale as that used for the misfire counter.

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website: <http://www.arb.ca.gov>.

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A status bit indication shall be located immediately below the x-axis of the chart and shall indicate the individual status of all applicable disablements during the test cycle. The status bits shall be aligned with the x-axis of the chart to facilitate correlation of a status bit indicating disablement and the corresponding point on the chart where the disablement is active. One status bit shall indicate the overall status of the misfire monitor (enabled/disabled), a separate status bit shall indicate the point at which a fault is detected by the misfire monitor, and additional status bits shall be provided for each individual disablement that occurs during the test cycle such as fuel cut, negative torque, manual transmission (M/T) gear shifts, and any other criterion that disables the misfire monitor.

Misfire Probability of Detection Chart

Section (i)(2.5.2) of the OBD II regulation requires the certification application to include documentation of misfire monitor probability of detection (Pd) in various engine speeds and loads. For this documentation, a template is provided as Attachment B, "Probability of Detection Chart". This template was originally issued with Mail-Out #96-05 and is included in this Mail-Out with a few modifications to provide additional clarification in the data. Manufacturers are required to submit data for the following misfire patterns: any one cylinder out, random misfire at the FTP threshold, and paired cylinders. Additionally, manufacturers are required to submit Pd data for misfire patterns causing misfire rates equal to or greater than two cylinders out that could be caused by the malfunction of a single component (e.g., shared coils).

The chart shall include engine speed in revolutions per minute (rpm), on the x-axis and calculated load in percent, on the y-axis. Engine speed shall start at idle and continue up to redline in increments of 500 rpm. The calculated load axis shall include the following: zero torque, 15%, 30%, 50%, 65%, 80%, and wide-open-throttle (WOT). Calculated load is defined as PID \$04 Calculated Load Value in Society of Automobile Engineers (SAE) J1979 (ISO 15031-5), April 2002. For reference, the calculation is:

$$\frac{(current_airflow)}{\left[(peak_airflow_at_WOT @ STP _as_a_function_of_RPM) \times \frac{BARO}{29.92} \times \sqrt{\frac{298}{(AAT + 278)}} \right]}$$

For a given misfire pattern, Pd is calculated by dividing the total number of detected misfires by the total number of induced misfires. Pd shall be reported in decimal form with two significant digits. Manufacturers may not average different cylinder Pd values together and then report this average on a single chart. For example, on a four-cylinder engine, manufacturers may not report the single cylinder out misfire pattern by

measuring the Pd for each of the four cylinders and then averaging these Pd values into one chart; instead, the Pd values shall be reported separately on four different charts. In lieu of separately reporting the Pd values for each cylinder, a manufacturer may submit a chart with the worst case (lowest from all cylinders) Pd value for each speed and load point. However, a demonstration must be made by the manufacturer to show that the data submitted are representative of the worst case.

Manufacturers shall fill in all cells with data or notation as follows: manufacturers shall use the abbreviation NA for engine speed/load cells that are not achievable and shall provide reasons for not reporting data in those cells; manufacturers shall use the abbreviation NR for engine speed/load cells that do not require misfire monitoring as defined in section (e)(3.3.1)(C) of the OBD II regulation.

OBD II Summary Tables

Section (i)(2.2) of the OBD II regulation requires manufacturers to submit OBD II calibration data in a standardized format. This format was originally specified in Mail-Out #95-20 and is included in this Mail-Out as Attachment C, "Summary Table" with minor changes. Manufacturers are reminded to use the engineering units specified in section (i)(2.2.2) of the OBD II regulation and to ensure that monitors are separated clearly in the summary tables by a horizontal line above and below each different monitor. Additionally, manufacturers shall use SAE J1930 terms in the summary table where applicable.

Moreover, many delays in OBD II certification are due to manufacturers using vague definitions and values in the summary tables. For example, manufacturers should avoid including a general secondary parameter such as "no fault present", "not defective", or "no fault codes present". Instead, manufacturers should indicate precisely which fault code(s) is required to disable the monitor and whether this fault code disablement is applicable to pending fault codes, confirmed fault codes commanding the malfunction indicator light (MIL) on, confirmed fault codes not commanding the MIL on, or other fault status. In lieu of listing every applicable disablement fault code in the summary table with each monitor, manufacturers may use notation to reference a separate table listing the applicable disablement fault code(s) for the given monitor.

As another example of vague secondary parameters, manufacturers frequently use general language in monitoring descriptions such as "front oxygen sensor status: OK". Such a description does not provide staff with enough detail to review the monitor. From this definition, staff does not know what criteria the manufacturer is relying on to verify whether the sensor is "OK" or not and accordingly, cannot ensure that the OBD system is properly designed.

Other commonly used terms that are not sufficient for use in expeditious review of certification applications include qualitative, non-engineering terms such as “stable,” “noisy,” “ready,” “active”, “valid”, or “steady.” Such terms should be replaced with the actual parameters and quantitative conditions necessary to execute the monitor (e.g., instead of “oxygen sensor ready” use “oxygen sensor voltage > 0.55 volts”). Similarly, terms relating to internal flags such as “engine speed: Idle” or “idle conditions: true” should be replaced with the actual specifications using engineering units.

To avoid listing duplicate information in the summary tables, manufacturers may group fault codes together for monitors that share identical monitoring strategies and calibrations (e.g., monitors for bank 1 and bank 2 sensors). The monitoring strategy, thresholds, and secondary parameter calibrations can then be listed once and all applicable fault codes identified and grouped under the Fault Code column in the summary table.

Rate-Based Data Reporting

Section (j)(3) of the OBD II regulation requires manufacturers to collect and report in-use rate-based data. A template titled “Rate-Based Data” is provided in this Mail-Out as Attachment D. Manufacturers are required to use the Microsoft Excel electronic template provided on the Air Resources Board (ARB) website <http://www.arb.ca.gov/msprog/obdprog/obdprog.htm> for reporting rate-based data. These data shall be reported to ARB in both hard copy and electronic format. For the electronic submittal, manufacturers may email the data to ARB staff. Manufacturers are required to fill in all fields in this template; the abbreviation NA shall not be used in this template. Manufacturers may insert additional rows in the template to report rate-based data as needed. For the calculated ratio for each monitor, the ratio shall be reported with a minimum of three decimal places. Below are additional details for each field in the rate-based table:

| | |
|---------------|---|
| No.: | Number data sets starting from the number 1. |
| Model Year: | Report the model year for the vehicle in this field. |
| Manufacturer: | Report manufacturer name in this field. Manufacturer name shall be consistent for all data submitted. |
| Model: | Report the vehicle model name in this field. Manufacturers shall report the selling model name, not the internal manufacturer model name. |
| Test Group: | Report the CA test group name for the certified vehicle. |
| Date: | Report the date that the data was taken in this field. |
| ODO: | Report the odometer reading on the vehicle in miles. |

CAL ID: Report the CAL ID in this field. For vehicles with more than one CAL ID, the CAL ID field should be filled with the CAL ID that best represents the OBD II software in the electronic controller unit (ECU); i.e., the CAL ID with the highest priority as defined in section (g)(4.6.3).

Gen Den: Report the general denominator in this field as defined in section (d)(4.3).

Ign Cycle: Report the number of ignition cycles in this field.

B1CatNum: Report the numerator for the Bank 1 catalyst in this field.

B1CatDen: Report the denominator for the Bank 1 catalyst in this field.

B1CatRat: Report the ratio for the Bank 1 catalyst in this field.

B2CatNum: Report the numerator for the Bank 2 catalyst in this field.

B2CatDen: Report the denominator for the Bank 2 catalyst in this field.

B2CatRat: Report the ratio for the Bank 2 catalyst in this field.

B1O2Num: Report the numerator for Bank 1 front oxygen or air/fuel ratio sensor in this field.

B1O2Den: Report the denominator for Bank 1 front oxygen or air/fuel ratio sensor in this field.

B1O2Rat: Report the ratio for Bank 1 front oxygen or air/fuel ratio sensor in this field.

B2O2Num: Report the numerator for Bank 2 front oxygen or air/fuel ratio sensor in this field.

B2O2Den: Report the denominator for Bank 2 front oxygen or air/fuel ratio sensor in this field.

B2O2Rat: Report the ratio for Bank 2 front oxygen or air/fuel ratio sensor in this field.

EGRVVTNum: Report the numerator for exhaust gas recirculation/variable valve timing (EGR/VVT) in this field.

EGRVVTDen: Report the denominator for EGR/VVT in this field.

EGRVVTRat: Report the ratio for EGR/VVT in this field.

SAIRNum: Report the numerator for Secondary Air in this field.

SAIRDen: Report the denominator for Secondary Air in this field.

SAIRRat: Report the ratio for Secondary Air in this field.

20Num: Report the numerator for 0.020" evaporative system leak in this field.

20Den: Report the denominator for 0.020" evaporative system leak in this field.

20Rat: Report the ratio for 0.020" evaporative system leak in this field.

B1SO2Num: Report the numerator for Bank 1 secondary oxygen or air/fuel ratio sensor in this field.

B1SO2Den: Report the denominator for Bank 1 secondary oxygen or air/fuel ratio sensor in this field.
B1SO2Rat: Report the ratio for Bank 1 secondary oxygen or air/fuel ratio sensor in this field.
B2SO2Num: Report the numerator for Bank 2 secondary oxygen or air/fuel ratio sensor in this field.
B2SO2Den: Report the denominator for Bank 2 secondary oxygen or air/fuel ratio sensor in this field.
B2SO2Rat: Report the ratio for Bank 2 secondary oxygen or air/fuel ratio sensor in this field.

CAL ID & CVN

Section (g)(4.7.4) of the OBD II regulation requires manufacturers to submit CAL ID and CVN information. A template titled "CAL ID and CVN Data" is provided in this Mail-Out as Attachment E. For 2008 and subsequent model years, manufacturers are required to use the Microsoft Excel electronic template provided on the ARB website <http://www.arb.ca.gov/msprog/obdprog/obdprog.htm> for reporting and electronically submitting CAL ID and CVN data to ARB. For the electronic submittal, manufacturers may email the data to ARB staff. CAL ID and CVN data shall be submitted on a quarterly basis for each test group, including new data associated with running change and field fix calibrations. Successive reports should only include new CAL ID and CVN data not included in previous submitted reports. In cases where more than one CAL ID and CVN pair are available for a given test group (e.g., a single set of software in one ECU has multiple CAL IDs and CVNs, a running change software set has been released with a new CAL ID and CVN for an ECU), manufacturers shall use additional rows to report all CAL ID and CVN pairs. No distinction is required in the table between multiple CAL ID and CVN pairs for a single set of software in an ECU versus multiple sets of software available for an ECU that each have a unique CAL ID and CVN. Below are additional details for the CAL ID and CVN table:

Model Year: Report the model year for the vehicle in this field.
Manufacturer: Report manufacturer name in this field. Manufacturer name shall be consistent for all data submitted.
Model: Report the vehicle model name in this field. Manufacturers shall report the selling model name, not the internal manufacturer model name.
Engine Size: Report the engine size (in liters) in this field.
Transmission: Report A/T for automatic transmission or M/T for manual transmission vehicles in this field. Only A/T and M/T are accepted data for this field. For other non-conventional transmissions such

as continuously variable transmission (CVT), semi-automatic, automated manual, etc., the manufacturer shall report A/T in this field.

Test Group: Report the CA test group name for the certified vehicle in this field
Module ID: Report the module ID (source address in the header bytes as defined in SAE J1979) in HEX format in this field.
CAL ID: Report the CAL ID in ASCII format in this field.
CVN: Report the CVN in HEX format in this field.

For 2005 through 2007 model year vehicles, manufacturers are not required to submit CAL ID and CVN information in the standardized format provided above. However, to the extent that a manufacturer has kept information for CAL ID and CVN, staff is requesting that each manufacturer submit all 2005 through 2007 model year vehicle CAL ID and CVN information in any format available to the manufacturer.

OBD II Checklists

To facilitate the OBD II review and certification process, ARB staff has provided two checklists: one for diesel vehicles and one for gasoline vehicles. These checklists are included in this Mail-Out as Attachment F and Attachment G and are available electronically at: <http://www.arb.ca.gov/msprog/obdprog/obdprog.htm> . They are intended to assist manufacturers and staff in making sure that pertinent information has been provided in the application. Attachment F lists malfunction criteria that are required to be detected for diesel vehicles, and requires manufacturers to identify the specific fault code(s) for the diagnostic(s) used to satisfy each criterion. Where components or systems are not supported by the vehicle, manufacturers shall use the abbreviation NA in the applicable field. Attachment G is similarly structured with the specific requirements for gasoline vehicles. While intended to be comprehensive, these checklists do not alter or supersede the regulatory requirements of the OBD II regulation. These checklists focus on areas where the requirements are complex or where specific malfunction criteria are satisfied with multiple diagnostics, and are helpful to staff to quickly identify the relevant diagnostics when reviewing a system for compliance.

Summary

Staff has provided these templates and guidelines to help expedite the OBD II certification process. Any variation on these templates by a manufacturer must be approved by ARB before certification material is submitted. Staff may periodically modify these templates to further facilitate certification. Staff will send out an email informing manufacturers of modifications and provide appropriate leadtime, where

All Interested Parties
December 21, 2006
Page 8

relevant, to incorporate the modifications. Manufacturers interested in receiving future emails should follow the instructions to subscribe to the On-Board Diagnostics Program list at the following website: <http://www.arb.ca.gov/listserv/obdprog.htm> . By signing up for this list serve, subscribers will also receive a notice whenever changes are made to the ARB On-Board Diagnostics Program website. Should you have questions or comments regarding this Mail-Out, please have your staff contact Mr. Mike McCarthy, Manager, at (626) 771-3614.

Sincerely,

/s/

Robert H. Cross, Chief
Mobile Source Control Division

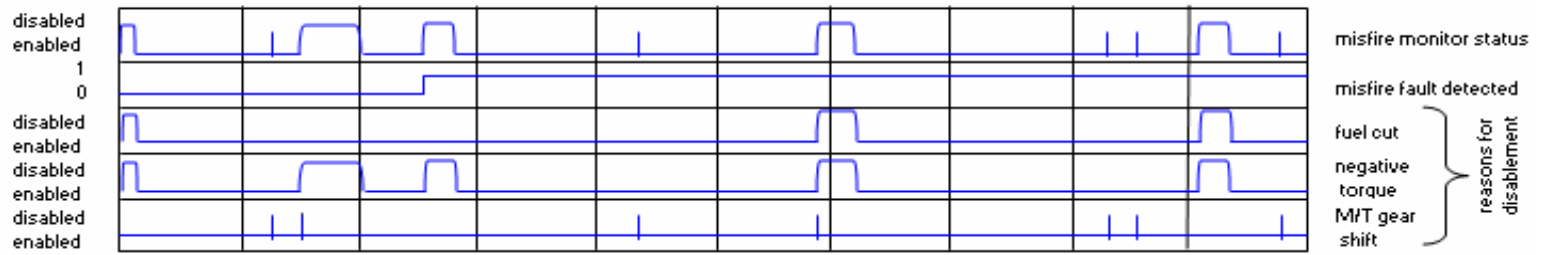
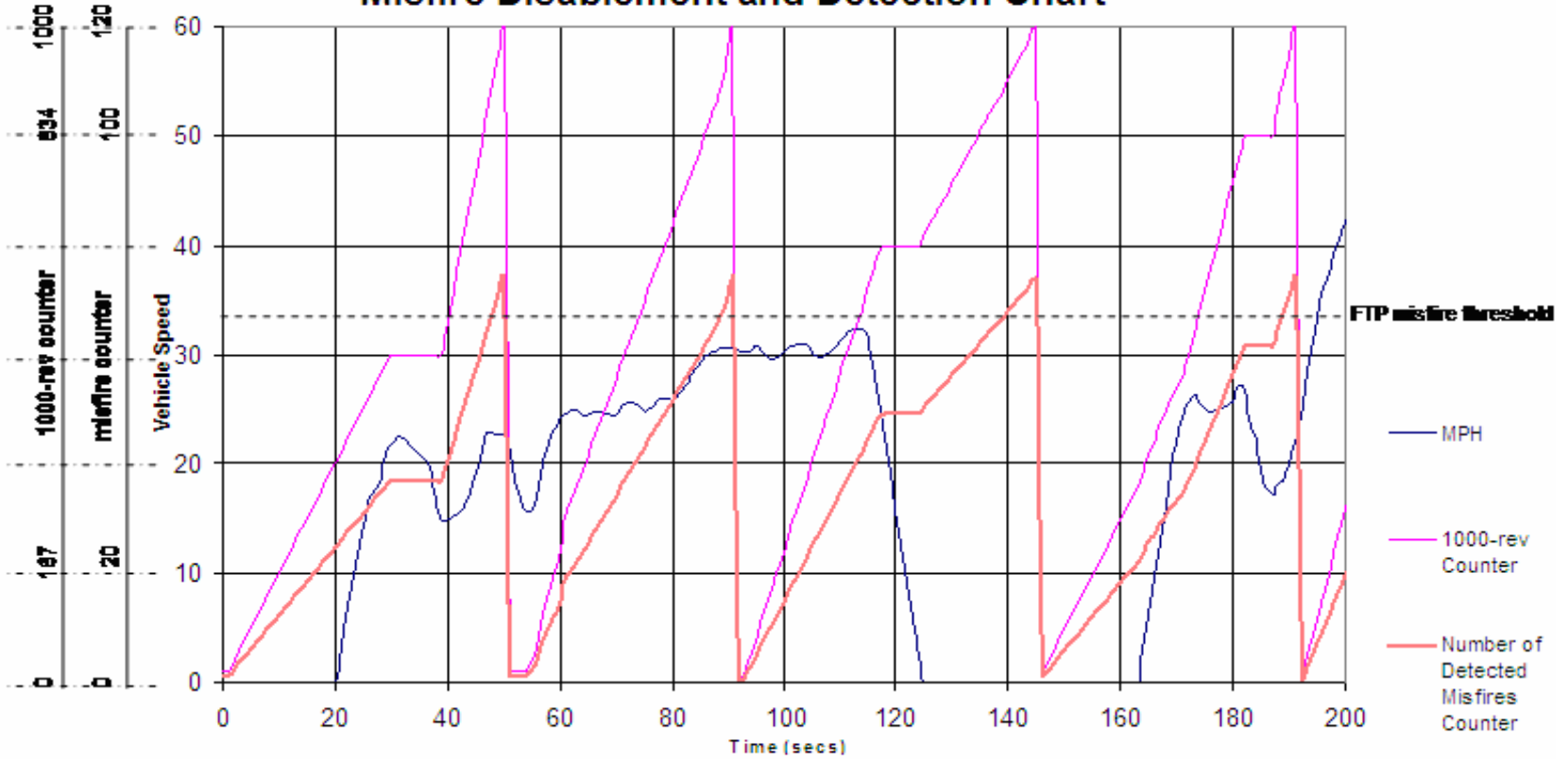
Attachment A: Misfire Disablement and Detection Chart
B: Probability of Detection Chart
C: Summary Table
D: Rate-Based Data
E: CAL ID and CVN Data
F: Monitoring Requirements
G: Monitoring Requirements

cc: Mr. Mike McCarthy, Manager
Advanced Engineering Section

All Interested Parties
December 21, 2006
Page 9

bcc: Steve Albu, MSCD
Thomas Montes, MSCD

Attachment A: Misfire Disablement and Detection Chart



Attachment B: Probability of Detection Chart

Misfire Pattern: One Cylinder Out

| | | Engine Speed (rpm) | | | | | | | | | | | Redline | |
|---------------------|-------------|--------------------|------|------|------|------|------|------|------|------|------|------|---------|------|
| | | Idle | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | | 6000 |
| Calculated Load (%) | Zero Torque | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | NR | NR | NR | NR | NR | NR | NR |
| | 15 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | NR | NR | NR | NR | NR | NR |
| | 30 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | 50 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | 65 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | 80 | NA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | WOT | NA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | | | | | | | | | | | | | NR |
| | | | | | | | | | | | | | | NR |
| | | | | | | | | | | | | | | NR |
| | | | | | | | | | | | | | | 1.00 |
| | | | | | | | | | | | | | | 1.00 |
| | | | | | | | | | | | | | | 1.00 |

NA Not Achievable
 NR Not Required per 1968.2 Section (e)(3.3.1)(C)

Attachment C: Summary Table

| Test Group 7ARBV05.0XYZ | | Certification Standard (ULEVII, SULEV, etc...) | | | | | | |
|--|---------------|--|--|--|---|---|---|---------------|
| Component/ System | Fault Code | Monitor Strategy Description | Malfunction Criteria | Threshold Value | Secondary Parameters | Enable Conditions | Time Required | MIL illum. |
| (example) Catalyst | P0420 | oxygen storage | rear oxygen sensor period vs. front oxygen sensor period | > .75 disable conditions: | engine speed engine load ECT MAP fuel system status MIL not illuminated for DTCs: | 1000<rpm<4000 >20% >70C > 25 kPa closed loop P0139 P0105 P0133 | 20 seconds once per trip | two trips |
| EGR System | P0401 | difference in MAP readings | delta MAP | < 10 kPa disable conditions: | vehicle speed ECT fuel system status battery voltage MIL not illuminated for DTCs: | > 35 mph > 70C fuel-cut > 11.0 volts P0105 | 3 seconds | two trips |
| Manifold Absolute Pressure (MAP) Sensor: | | | | | | | | |
| MAP High | P0108 | Out of Range High | MAP Voltage | > 4.0 V (110 kPa) | Engine Speed | > 300 rpm | Continuous | one trip |
| MAP Low | P0107 | Out of Range Low | MAP Voltage | < 0.15 V (15 kPa) | Engine Speed | > 300 rpm | Continuous | one trip |
| MAP Rationality | P0106 | Comparison of modeled MAP to actual MAP signal | High Rationality MAP Voltage: | < 3.1 (65 kPa) | Engine Speed Vehicle Speed calculated load | 1000 to 5000 > 10 mph > 50% | 2 seconds Monitor runs whenever enable conditions are met | two trips |
| | | | Low Rationality MAP Voltage: | > 1.0 (25 kPa) | Engine Speed Vehicle Speed Fuel System Status | > 1500 > 10 mph Fuel Cut | | |

Attachment D: Rate-Based Data

| No. | Model Year | Manufacturer | Model | Test Group | VIN | Date | ODO | Cal ID | Gen Den | Ign Cycle | B1CatNum | B1CatDen | B1CatRat | B2CatNum | B2CatDen | B2CatRat | B1O2Num | B1O2Den | B1O2Rat |
|-----|------------|--------------|----------|---------------|-------------------|-----------|-------|---------------|---------|-----------|----------|----------|----------|----------|----------|----------|---------|---------|---------|
| 1 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748121 | 12-Jun-06 | 5000 | 12345-xyz-678 | 100 | 300 | 10 | 20 | 0.50 | 10 | 20 | 0.50 | 15 | 44 | 0.34 |
| 2 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748122 | 12-Jun-06 | 5001 | 12345-xyz-678 | 101 | 301 | 20 | 40 | 0.50 | 20 | 40 | 0.50 | 30 | 88 | 0.34 |
| 3 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748123 | 12-Jun-06 | 7000 | 12345-xyz-678 | 50 | 400 | 30 | 60 | 0.50 | 30 | 60 | 0.50 | 45 | 132 | 0.34 |
| 4 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748124 | 12-Jun-06 | 8000 | 12345-xyz-678 | 60 | 500 | 40 | 80 | 0.50 | 40 | 80 | 0.50 | 60 | 176 | 0.34 |
| 5 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748125 | 12-Jun-06 | 9000 | 12345-xyz-678 | 70 | 600 | 50 | 100 | 0.50 | 50 | 100 | 0.50 | 75 | 220 | 0.34 |
| 6 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748126 | 12-Jun-06 | 10000 | 12345-xyz-678 | 80 | 700 | 60 | 120 | 0.50 | 60 | 120 | 0.50 | 90 | 264 | 0.34 |
| 7 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748127 | 12-Jun-06 | 11000 | 12345-xyz-678 | 90 | 800 | 70 | 140 | 0.50 | 70 | 140 | 0.50 | 105 | 308 | 0.34 |
| 8 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748128 | 12-Jun-06 | 12000 | 12345-xyz-678 | 100 | 900 | 80 | 160 | 0.50 | 80 | 160 | 0.50 | 120 | 352 | 0.34 |
| 9 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748129 | 12-Jun-06 | 13000 | 12345-xyz-678 | 110 | 1000 | 90 | 180 | 0.50 | 90 | 180 | 0.50 | 135 | 396 | 0.34 |
| 10 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748130 | 12-Jun-06 | 14000 | 12345-xyz-678 | 120 | 1100 | 100 | 200 | 0.50 | 100 | 200 | 0.50 | 150 | 440 | 0.34 |
| 11 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748131 | 12-Jun-06 | 15000 | 12345-xyz-678 | 130 | 1200 | 110 | 220 | 0.50 | 110 | 220 | 0.50 | 165 | 484 | 0.34 |
| 12 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748132 | 12-Jun-06 | 16000 | 12345-xyz-678 | 140 | 1300 | 120 | 240 | 0.50 | 120 | 240 | 0.50 | 180 | 528 | 0.34 |
| 13 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748133 | 12-Jun-06 | 17000 | 12345-xyz-678 | 150 | 1400 | 130 | 260 | 0.50 | 130 | 260 | 0.50 | 195 | 572 | 0.34 |
| 14 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748134 | 12-Jun-06 | 17000 | 12345-xyz-678 | 160 | 1500 | 140 | 280 | 0.50 | 140 | 280 | 0.50 | 210 | 616 | 0.34 |
| 15 | 2007 | ABC Motors | cleanCar | 7CARBV3.50XYZ | XX1XX6356XX748135 | 12-Jun-06 | 5002 | 12345-xyz-678 | 102 | 302 | 21 | 42 | 1.50 | 21 | 42 | 1.50 | 31 | 89 | 1.34 |

| B2O2Num | B2O2Den | B2O2Rat | EgrVVTNum | EgrVVTDen | EgrVVTRat | SAIRNum | SAIRDen | SAIRRat | 20Num | 20Den | 20Rat | B1SO2Num | B1SO2Den | B1SO2Rat | B2SO2Num | B2SO2Den | B2SO2Rat |
|---------|---------|---------|-----------|-----------|-----------|---------|---------|---------|-------|-------|-------|----------|----------|----------|----------|----------|----------|
| 15 | 44 | 0.34 | 15 | 44 | 0.34 | 0 | 0 | 0 | 5 | 5 | 1.00 | 22.5 | 96.8 | 0.23 | 15 | 44 | 0.34 |
| 30 | 88 | 0.34 | 30 | 88 | 0.34 | 0 | 0 | 0 | 7 | 10 | 0.70 | 45.0 | 193.6 | 0.23 | 30 | 88 | 0.34 |
| 45 | 132 | 0.34 | 45 | 132 | 0.34 | 0 | 0 | 0 | 9 | 15 | 0.60 | 67.5 | 290.4 | 0.23 | 45 | 132 | 0.34 |
| 60 | 176 | 0.34 | 60 | 176 | 0.34 | 0 | 0 | 0 | 11 | 20 | 0.55 | 90.0 | 387.2 | 0.23 | 60 | 176 | 0.34 |
| 75 | 220 | 0.34 | 75 | 220 | 0.34 | 0 | 0 | 0 | 13 | 25 | 0.52 | 112.5 | 484.0 | 0.23 | 75 | 220 | 0.34 |
| 90 | 264 | 0.34 | 90 | 264 | 0.34 | 0 | 0 | 0 | 15 | 30 | 0.50 | 135.0 | 580.8 | 0.23 | 90 | 264 | 0.34 |
| 105 | 308 | 0.34 | 105 | 308 | 0.34 | 0 | 0 | 0 | 17 | 35 | 0.49 | 157.5 | 677.6 | 0.23 | 105 | 308 | 0.34 |
| 120 | 352 | 0.34 | 120 | 352 | 0.34 | 0 | 0 | 0 | 19 | 40 | 0.48 | 180.0 | 774.4 | 0.23 | 120 | 352 | 0.34 |
| 135 | 396 | 0.34 | 135 | 396 | 0.34 | 0 | 0 | 0 | 21 | 45 | 0.47 | 202.5 | 871.2 | 0.23 | 135 | 396 | 0.34 |
| 150 | 440 | 0.34 | 150 | 440 | 0.34 | 0 | 0 | 0 | 23 | 50 | 0.46 | 225.0 | 968.0 | 0.23 | 150 | 440 | 0.34 |
| 165 | 484 | 0.34 | 165 | 484 | 0.34 | 0 | 0 | 0 | 25 | 55 | 0.45 | 247.5 | 1064.8 | 0.23 | 165 | 484 | 0.34 |
| 180 | 528 | 0.34 | 180 | 528 | 0.34 | 0 | 0 | 0 | 27 | 60 | 0.45 | 270.0 | 1161.6 | 0.23 | 180 | 528 | 0.34 |
| 195 | 572 | 0.34 | 195 | 572 | 0.34 | 0 | 0 | 0 | 29 | 65 | 0.45 | 292.5 | 1258.4 | 0.23 | 195 | 572 | 0.34 |
| 210 | 616 | 0.34 | 210 | 616 | 0.34 | 0 | 0 | 0 | 31 | 70 | 0.44 | 315.0 | 1355.2 | 0.23 | 210 | 616 | 0.34 |
| 31 | 89 | 1.34 | 31 | 89 | 1.34 | 0 | 0 | 0 | 8 | 11 | 1.70 | 46.0 | 194.6 | 1.23 | 31 | 89 | 1.34 |

Attachment E: CAL ID and CVN Data

| Model Year | Manufacturer | Model | Engine Size | Transmission | Test Group | Module ID | CAL ID | CVN |
|------------|--------------|------------|-------------|--------------|---------------|-----------|---------------|-----------------|
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-670 | ABCDEF123456780 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-671 | ABCDEF123456781 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-672 | ABCDEF123456782 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-673 | ABCDEF123456783 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-674 | ABCDEF123456784 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-675 | ABCDEF123456785 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-676 | ABCDEF123456786 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-678 | ABCDEF123456789 |
| 2006 | ABC Motors | cleanTruck | 5.0 | A/T | 7CARBV5.00XYZ | \$07E8 | 12345-xyz-870 | ABCDEF123456720 |
| 2006 | ABC Motors | cleanTruck | 5.0 | A/T | 7CARBV5.00XYZ | \$07EA | 12345-xyz-871 | ABCDEF123456721 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-770 | ABCDEF123456720 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-771 | ABCDEF123456721 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-772 | ABCDEF123456722 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-773 | ABCDEF123456723 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-774 | ABCDEF123456724 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-775 | ABCDEF123456725 |
| 2006 | ABC Motors | cleanCar | 3.5 | M/T | 7CARBV3.50XYZ | \$07E8 | 12345-xyz-776 | ABCDEF123456726 |

