Air Resources Board

Robert F. Sawyer, Ph.D., Chair
9480 Telstar Avenue, Suite 4
El Monte, California 91731 www.arb.ca.gov

Linda S. Adams
Secretary for
Environmental Protection

Arnold Schwarzenegger
Governor

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.

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

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/

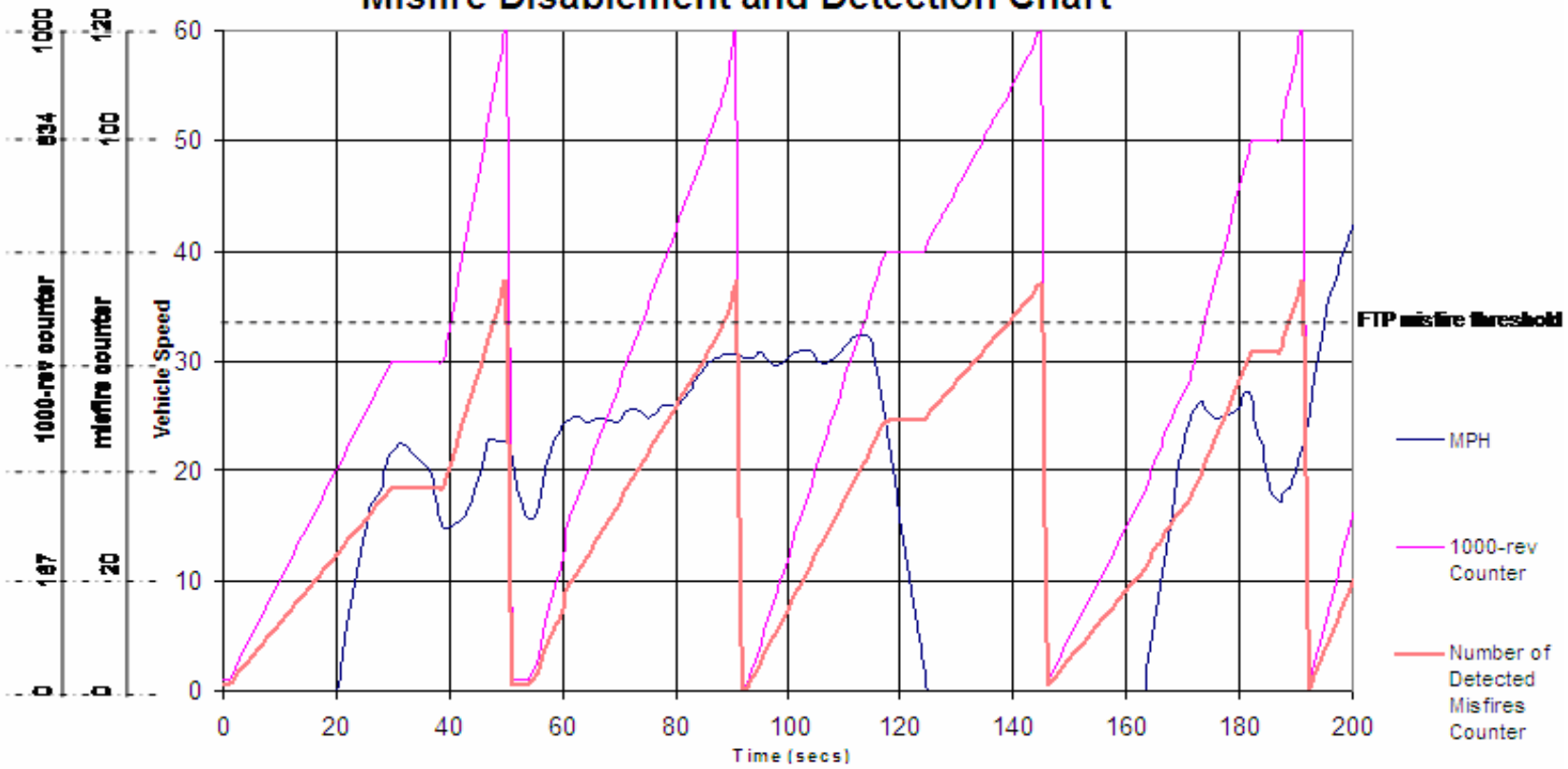
Robert H. Cross, Chief
Mobile Source Control Division

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

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)

Calculated Load (%)	Idle	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	Redline
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	NR
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

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

Attachment C:
Summary Table

Test Group		**Certification Standard**						
7ARBV05.0XYZ		(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	EgrVVTRa	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

Attachment F

Diesel	List DTC of monitor that detects the following malfunction:											
COMPONENT/SYSTEM	MONITORING REQUIREMENTS											
NMHC Catalyst	(f)(1.2.2)	(f)(1.2.3)(A)	(f)(1.2.3)(B)	(f)(1.2.3)(C)	(f)(1.2.3)(D)							
	Conversion Efficiency	After treatment assistance DPF regen	After treatment assitance SCR feedgas	After treatment assistance HC Clean up	After treatment assistance Ammonia clean up							
	(e.g., P0xxx)											
NOx Catalyst	(f)(2.2.2)	(f)(2.2.3)(A)	(f)(2.2.3)(B)	(f)(2.2.3)(C)	(f)(2.2.3)(D)(i)	(f)(2.2.3)(D)(ii)	(f)(2.2.3)(D)(iii)					
	Conversion Efficiency	Reductant delivery	Reductant tank level	Proper Reductant	Feedback: time to CL	Feedback: default/OL	Feedback: CL limits					
Misfire	(f)(3.2.1)	(f)(3.2.2)										
	Continuous Misfire	Threshold misfire										
Fuel System Monitoring	(f)(4.2.1)(A)	(f)(4.2.1)(B)	(f)(4.2.2)(A)	(f)(4.2.2)(B)	(f)(4.2.3)(A)	(f)(4.2.3)(B)	(f)(4.2.4)(A)(i)	(f)(4.2.4)(A)(ii)	(f)(4.2.4)(A)(iii)			
	Pressure Threshold	Pressure Functional	Quantity Threshold	Quantity Functional	Timing Threshold	Timing Functional	Feedback: time to CL	Feedback: default/OL	Feedback: CL limits			
Upstream Exhaust Gas Sensor Monitoring	(f)(5.2.1)(A)(i)	(f)(5.2.1)(A)(ii)	(f)(5.2.1)(A)(iii)	(f)(5.2.1)(A)(iv)	(f)(5.2.4)(A)	(f)(5.2.4)(B)						
	Emissions threshold	Circuit Faults	Feedback: default/OL	Sufficient for other diagnostics	Heater Performance	Heater Circuit Continuity						
Downstream Exhaust Gas Sensor Monitoring	(f)(5.2.1)(B)(i)	(f)(5.2.1)(B)(ii)	(f)(5.2.1)(B)(iii)	(f)(5.2.1)(B)(iv)	(f)(5.2.4)(A)	(f)(5.2.4)(B)						
	Emissions threshold	Circuit Faults	Feedback: default/OL	Sufficient for other diagnostics	Heater Performance	Heater Circuit Continuity						
NOx and/or PM Sensors	(f)(5.2.2)(A)	(f)(5.2.2)(B)	(f)(5.2.2)(C)	(f)(5.2.2)(D)	(f)(5.2.4)(A)	(f)(5.2.4)(B)						
	Emissions threshold	Circuit Faults	Feedback: default/OL	Sufficient for other diagnostics	Heater Performance	Heater Circuit Continuity						
Other Exhaust Gas Sensors	(f)(5.2.3)(A)	(f)(5.2.4)(A)	(f)(5.2.4)(B)									
	Per approved plan	Heater Performance	Heater Circuit Continuity									
EGR	(f)(6.2.1)(A)	(f)(6.2.1)(B)	(f)(6.2.2)(A)	(f)(6.2.2)(B)	(f)(6.2.3)(A)	(f)(6.2.3)(B)	(f)(6.2.4)(A)(i)	(f)(6.2.4)(A)(ii)	(f)(6.2.4)(A)(iii)			
	Low Flow Threshold	Low Flow Functional	Low Flow Threshold	Low Flow Functional	Slow Response Threshold	Slow Response Increasing and Decreasing	Feedback: time to CL	Feedback: default/OL	Feedback: CL limits			
EGR Cooler	(f)(6.2.5)(A)	(f)(6.2.5)(B)										
	Cooler Threshold	Cooler Functional										
Boost Pressure	(f)(7.2.1)(A)	(f)(7.2.1)(B)	(f)(7.2.2)(A)	(f)(7.2.2)(B)	(f)(7.2.3)(A)	(f)(7.2.3)(B)	(f)(7.2.4)(A)	(f)(7.2.4)(B)	(f)(7.2.5)(A)(i)	(f)(7.2.5)(A)(ii)	(f)(7.2.5)(A)(iii)	
	Underboost Threshold	Underboost Functional	Overboost Threshold	Overboost Functional	VGT Response Threshold	VGT Response Functional	Charge Air Cooling Threshold	Charge Air Cooling Functional	Feedback: time to CL	Feedback: default/OL	Feedback: CL limits	
NOx Adsorber	(f)(8.2.1)(A)	(f)(8.2.1)(B)	(f)(8.2.1)(A)	(f)(8.2.2)	(f)(8.2.3)(A)(i)	(f)(8.2.3)(A)(ii)	(f)(8.2.3)(A)(ii)					
	Threshold	Functional	Missing Substrate	Failure to achieve desorption	Feedback: time to CL	Feedback: default/OL	Feedback: CL limits					
PM Filter	(f)(9.2.1)(A)	(f)(9.2.1)(B)	(f)(9.2.2)(A)	(f)(9.2.2)(B)	(f)(9.2.2)(C)	(f)(9.2.3)	(f)(9.2.4)	(f)(9.2.5)	(f)(9.2.6)	(f)(9.2.7)(A)(i)	(f)(9.2.7)(A)(ii)	(f)(9.2.7)(A)(iii)
	Threshold	Functional	Regen frequency: Mfr spec	Regen frequency: Threshold	Regen frequency: Functional	Incomplete Regen	NMHC Conversion	Missing Substrate	Failure to achieve regeneration	Feedback: time to CL	Feedback: default/OL	Feedback: CL limits
Crankcase Ventilation	(f)(10.2.2)											
	Disconnection											
Engine Cooling System	(f)(11.2.1)(A)	(f)(11.2.2)(A)	(f)(11.2.2)(A)	(f)(11.2.2)(A)	(f)(11.2.1)(B)	(f)(11.2.1)(C)	(f)(11.2.1)(D)					
	Threshold temperature	OOR high	OOR low	Circuit continuity	Time to reach closed loop	Stuck below the highest minimum enable temp	Stuck above the lowest maximum enable temp					
Cold start strategy	(f)(12.2.1)	(f)(12.2.2)										
	Single element functional fail	Threshold monitor										
VVT system	(f)(13.2.1)	(f)(13.2.2)	(f)(13.2.3)									
	Target error threshold monitor	Slow Response threshold monitor	Target error or slow response functional monitor in lieu of threshold									

	List DTC of monitor used that detects the following failure mode:											
Monitor/System	OOR-low	Circuit low	OOR- high	Circuit high	open circuit	Rationality-low	Rationality-high	Other Rationality	Functional #1	Functional #2	Other Functional	
[Insert name of Comprehensive Component #1] *(e.g., exhaust temp sensor #1, barometric pressure sensor, MAF sensor, etc.)*												
[Insert name of Comprehensive Component #n]												

Attachment G

Gasoline	List DTC of monitor that detects the following malfunction:											
COMPONENT/SYSTEM	MONITORING REQUIREMENTS											
Catalyst	(e)(1.2.2) Conversion Efficiency *(e.g., P0xxx)*											
Heated Catalyst	(e)(2.2) Heating Performance											
Misfire	(e)(3.2.1) Catalyst damage misfire	(e)(3.2.2) FTP level misfire -First 1000 revs	(e)(3.2.2) FTP level misfire- 4 x 1000 revs									
Evaporative System	(e)(4.2.2)(A) No purge flow	(e)(4.2.2)(B) 0.040" leak	(e)(4.2.2)(C) 0.020" leak	(e)(4.2.5) 0.090" leak in lieu of 0.040"								
Secondary Air	(e)(5.2.3) Insufficient flow threshold	(e)(5.2.4) Insufficient flow functional in lieu of threshold										
Fuel System	(e)(6.2.1)(A) FTP emission threshold	(e)(6.2.1)(B) Secondary fuel trim FTP emission threshold	(e)(6.2.1)(C) Air-fuel ratio cylinder imbalance	(e)(6.2.2) Adaptive limits reached	(e)(6.2.3) Secondary fuel trim adaptive limits	(e)(6.2.4) Fails to enter closed loop						
Upstream O2/Exhaust Gas Sensor Monitoring	(e)(7.2.1)(A) FTP emission threshold-slow response	(e)(7.2.1)(A) FTP emission threshold-other characteristic	(e)(7.2.1)(B) open circuit	(e)(7.2.1)(B) out-of-range high	(e)(7.2.1)(B) shorted high	(e)(7.2.1)(B) out-of-range low	(e)(7.2.1)(B) shorted low	(e)(7.2.1)(C) Feedback: fails to enter, defaults out	(e)(7.2.1)(D) Sufficient for other diagnostics	(e)(7.2.3)(A) Heater Performance	(e)(7.2.3)(B) Heater Circuit Continuity	
Downstream O2/Exhaust Gas Sensor Monitoring	(e)(7.2.2)(A) Emissions threshold	(e)(7.2.2)(B) open circuit	(e)(7.2.2)(D) out-of-range high	(e)(7.2.2)(B) shorted high	(e)(7.2.2)(D) out-of-range low	(e)(7.2.2)(B) shorted low	(e)(7.2.2)(C) Sufficient for other diagnostics	(e)(7.2.3)(A) Heater Performance	(e)(7.2.3)(B) Heater Circuit Continuity	(d)(2.2.3) & (e)(6.2.4) Feedback: fails to enter, defaults out		
EGR	(e)(8.2.1) Low Flow Threshold	(e)(8.2.1) High Flow Threshold	(e)(8.2.2) Low Flow Functional in lieu of Threshold	(e)(8.2.2) High Flow Functional in lieu of Threshold								
Crankcase Ventilation	(e)(9.2.2) Disconnection											
Engine Cooling System	(e)(10.2.1) Time to reach threshold temp	(e)(10.2.2)(A) open circuit	(e)(10.2.2)(A) out-of-range high	(e)(10.2.2)(A) shorted high	(e)(10.2.2)(A) out-of-range low	(e)(10.2.2)(A) shorted low	(e)(10.2.2)(B) Time to reach closed loop	(e)(10.2.2)(C) Stuck below the highest minimum enable temp	(e)(10.2.2)(D) Stuck above the lowest maximum enable temp			
Cold start strategy	(e)(11.2.1)(A) Threshold monitor	(e)(11.2.1)(B) Functional monitor in lieu of threshold	(e)(11.2.2)(A) Single element functional fail	(e)(11.2.2)(B) Threshold monitor								
VVT system	(e)(13.2.1) Target error threshold monitor	(e)(13.2.2) Slow Response threshold monitor	(e)(13.2.3) Target error or slow response functional monitor in lieu of threshold									
Direct Ozone Reduction (DOR) System	(e)(14.2.1) Functional monitor for <50% std credit DOR systems	(e)(14.2.2) Threshold monitor for >50% std credit DOR systems										

	List DTC of monitor used that detects the following failure mode:										
Monitor/System	OOR-low	Circuit low	OOR- high	Circuit high	open circuit	Rationality-low	Rationality-high	Other Rationality	Functional #1	Functional #2	Other Functional
[Insert name of Comprehensive Component #1] *(e.g., barometric pressure sensor, MAF sensor, etc.)*											
[Insert name of Comprehensive Component #n]											