STATE OF CALIFORNIA

DEPARTMENT OF CONSUMER AFFAIRS

State and Consumer Services Agency

DEPARTMENT OF CONSUMER AFFAIRS

Bureau of Automotive Repair

BAR OBD Inspection System

Data Acquisition Device Specification

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<Version 1.07>

August, 2011

Revision History:

Revision Number	Revision Date	Revision Purpose
Version 1.00	June 01, 2011	Internal Release
Version 1.01	June 17, 2011	Internal Review Clean-up and Ready for Industry Comment
Version 1.02	July 15, 2011	Extended time for Industry Comment
Version 1.03	July 29, 2011	Incorporated comments from Industry
Version 1.04	August 4, 2011	Incorporated comments from Industry and internally
Version 1.05	August 4, 2011	Minor wording changes
Version 1.06	August 9, 2011	Changes from Mike McCarthy
Version 1.07	August 11, 2011	Changes from Mike McCarthy

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1. Introduction

The objective of this specification is to lay the foundation for the final BAR OBD Inspection System (OIS) Data Acquisition Device (DAD) Specification. BAR's intent is to document all of BAR's Hardware, Firmware and Software requirements for the DAD, used to support California's Smog Check Inspection Program, within this document.

1.1. Purpose

The intended audience for this specification is the OBD Community that will develop the DAD Hardware, Firmware and Software. It is expected that BAR and the OBD Community will use this specification as a baseline for the elaboration of more detailed and refined requirements. BAR has not specified each and every requirement needed to successfully communicate with vehicles and their OBDII systems. The OBD Community is expected to be seasoned and experienced providers of OBDII devices with extensive knowledge of the challenges of communicating with vehicles and the knowledge of how to overcome these challenges. Where this document is specific, it is because these are areas where BAR and/or stakeholders in the Smog Check Program are aware of shortcomings in other OBDII implementations.

1.2. Scope

The BAR OIS will consist of a computer with attached bar code scanner, printer and DAD device. The BAR OIS shall run "Windows 7, 32 bit" with a minimum of Service Pack 1 (SP1) as an operating system, and using a minimum of Internet Explorer version 8 as the Web Browser. The BAR OIS will access BAR's Next Generation Electronic Transmission Web Application (NWA) to conduct Smog Check Inspections. The BAR OIS will reside in various Smog Check stations across the State, and other locations such as Fleet, Referee, BAR Roadside, and BAR Headquarter sites. The BAR OIS will be used by licensed technicians performing Smog Check Inspections, other station personnel and BAR Field Office Representatives configuring the equipment and/or performing audits and reviews of the system and completed inspections.

The primary function of the BAR OIS is to perform Smog Check Inspections.

1.3. Definitions, Acronyms, and Abbreviations

The definitions of all terms, acronyms, abbreviations, and references required to properly interpret this BAR OBD Inspection System Data Acquisition Device Specification are included within the text of this document.

2. On Board Diagnostic (OBD) Data Acquisition Device (DAD) Overview

The On Board Diagnostic (OBD) Data Acquisition Device (DAD) connects to the BAR OBD Inspection System (OIS) computer for the purpose of retrieving OBD second generation (OBDII) information from a vehicle. The BAR OIS shall run "Windows 7, 32 bit" with a minimum of Service Pack 1 (SP1) as an operating system, and using a minimum of Internet Explorer version 8 as the Web Browser. The BAR OIS will connect to a BAR authorized website to access and run BAR's Next Generation Electronic Transmission (NGET) Web Application (NWA). The NWA will determine and control the Smog Check Inspection. The DAD must be functional in a standard automotive repair environment and thus be

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resistant to shock, vibration, and environmental exposure in order to ensure reliability and accuracy. The BAR OIS will have standard connections and interfaces to allow interchangeability of different brands of bar code scanners, and printers, while working with the BAR certified DAD. The DAD is comprised of the Hardware, Firmware and Software Drivers necessary to meet the requirements of this specification. The DAD is intended to receive instructions from the NWA. The DAD will collect OBD data from the vehicle and carry out all tasks in accordance with this specification and report it to the NWA.

This specification does not apply to the computer, bar code scanner, or printer, which are not part of this specification, and are not to be included as a part of this specification. This specification is to cover the DAD which is comprised of the hardware, firmware, and software (drivers, etc.) to receive instructions from the NWA and carry out all tasks to obtain data from the vehicle and report it back to the NWA in accordance with this specification. Portions of the DAD are expected to be software (e.g., drivers) that will be installed on the BAR OIS computer.

3. Requirements

3.1. General Requirements

3.1.1. The DAD shall be compatible with typical automotive service operating environments.

3.1.2. The DAD hardware and raw materials, including fasteners and enclosures, shall be corrosion resistant under conditions normally encountered in the automotive repair environment for the period of the warranty.

3.1.3. The DAD Provider shall supply the Hardware, Firmware and Software Drivers necessary to meet the requirements of this specification.

3.1.4. The DAD Provider shall supply the DAD in a hardwired configuration to all customers before offering alternative configurations.

3.1.5. The DAD shall be compatible with the BAR OIS operating system

3.1.6. The DAD shall be compatible with the Web Browser.

3.1.7. The DAD Provider shall be responsible to update the hardware and/or firmware and/or software as needed to conform to this specification at no cost.

3.1.8. The DAD shall utilize a mechanism to update the DAD hardware, firmware and software as needed to meet this specification.

3.1.8.1 The DAD Provider shall develop a plan for the update of the DAD hardware/firmware/software that is agreed to by BAR.

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3.1.9. The DAD Provider shall supply a programming interface compatible with the BAR OIS operating system (e.g., APIs, development drivers) for development of applications that use the DAD.

3.1.10. All communication between the DAD software and the BAR NWA shall follow the interface specification created by the DAD Provider, BAR's NWA Contractor and BAR.

3.1.10.1. The DAD software and BAR NWA interface specification shall address the situation where there is no communication with vehicle.

3.1.10.2. The DAD software and BAR NWA interface specification shall address the situation where the communication between the DAD and the vehicle has been dropped and shall include the last data request in the error response

3.1.10.3. The DAD software and BAR NWA interface specification shall address the situation where the DAD has been disconnected and shall include the last data request in the error response.

3.1.10.4. The DAD software and BAR NWA interface specification shall address the requesting of data by the NWA to the DAD.

3.1.10.5. The DAD software and BAR NWA interface specification shall address the responding of the DAD to the NWA for all data requests.

3.1.10.6. The DAD software and BAR NWA interface specification shall address how the NWA and DAD will determine that the DAD has completed communication with the vehicle and that all data files are complete.

3.2. Specific Requirements

Standards

3.2.1. If a conflict exists between what this specification requires and what the SAE/ISO standard requires, this specification overrides the SAE/ISO specification.

3.2.1.1. To the extent the DAD Provider knows or has reason to believe that an element of this specification conflicts with an SAE or ISO requirement and that implementation in accordance with this specification will adversely impact the ability of the DAD to properly interface with vehicles, the DAD Provider shall identify the conflict and the known or suspected associated adverse impact to BAR to request clarification as to how the specification shall be implemented.

3.2.2. The DAD shall meet all SAE J1978, (OBD II Scan Tool) requirements, as detailed in SAE J1978 "OBD II Scan Tool -- Equivalent to ISO/DIS 15031-4: December 14, 2001", published 2002-04-30.

3.2.3. All DAD hardware components shall meet or exceed EN60529:1992, IP43, water and dust resistance.

3.2.4. If wireless communication is used for any portion of the communication between the OIS Computer and the vehicle's OBDII port, the DAD shall be FCC Part 15 Class B, approved.

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3.2.5. The DAD shall be compliant with SAE J1979, “E/E Diagnostic Test Modes”, published 2010-09-28.

3.2.6. The DAD shall be compliant with SAE J1962, APR 2002.

Data Files

3.2.7. The DAD shall create three Static Data Files to be sent to the NWA.

3.2.8. If OBDII Dynamic Data is requested, the DAD shall create the Dynamic Data File to be sent to the NWA.

3.2.9. The data files shall be in a Comma Separated Variable (CSV) format that is compatible with Microsoft Excel 2003/2007/2010.

3.2.10. No data within the files shall contain commas (“,”). Commas shall only be used as delimiters.

3.2.11. No data within the files shall contain a “space” (Hex value 20) unless that data is a string value per the SAE J1979 specification and that data contains a space character. i.e. a CAL ID with a space in it.

3.2.11.1. A vertical bar (|) (ASCII character for Hex value 7C) shall be used to delimit diagnostic trouble code (DTC)s in mode $03, $07, and $0A.

3.2.12. The file name extension shall be “.CSV”.

3.2.13. The **first Static Data File** shall be the **Raw Static Data File**.

3.2.13.1. The file name of the Raw Static Data File shall contain the 16 character globally unique identifier (GUID) supplied by the calling function. (all characters are ASCII 48-57 and 97-122) and have the text “_RAW” appended at the end of the GUID.

Examples:

c7a93487b68d6d10_RAW.csv

4018204dbd519d20_RAW.csv

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3.2.13.2. The first line of the Raw Static Data File shall contain the column names as specified in “DAD Raw Static Data Format Specification Draft 1_0.xls” column A “Column Name”.

3.2.13.3. Each subsequent line of the Raw Static Data File shall be a complete data record for an individual vehicle Electronic Control Unit (ECU) and shall be formatted as outlined in “DAD Raw Static Data Format Specification Draft 1_0.xls” columns B through G.

3.2.13.4. The lines of data in the Raw Static Data File shall be ordered and reported in descending order from the ECU with the highest Parameter ID (PID) count to the ECU with the lowest PID count.

3.2.13.4.1. If two or more ECUs have the same PID Count, they shall be reported in numeric order of the address from lowest to highest (e.g., for a vehicle with ECUs $07E8 and $07E9, both with a PID Count of 15, ECU $07E8 shall be reported before $07E9).

3.2.14. The **second Static Data File** shall be the **Translated Static Data File**.

3.2.14.1. The file name of the Translated Static Data File shall contain the 16 character GUID supplied by the calling function. (all characters are ASCII 48-57 and 97-122) and have the text “_TRANS” appended at the end of the GUID.

Examples:

c7a93487b68d6d10_TRANS.csv

4018204dbd519d20_TRANS.csv

3.2.14.2. The first line of the file shall contain the column names as specified in “DAD Translated Static Data Format Specification Draft 1_0.xls” column A “Column Name”. The line shall NOT contain any spaces or commas in the field names. The line shall be comma delimited between column names.

3.2.14.3. Each subsequent line of the file shall be a complete data record for an individual vehicle ECU as received from the vehicle and shall be formatted as specified in “DAD Translated Static Data Format Specification Draft 1_0.xls” columns B through G.

3.2.14.4. The lines of data in the Translated Static Data File shall be ordered and reported in descending order from the ECU with the highest PID count to the ECU with the lowest PID count.

3.2.15. The **third Static Data File** shall be the **Summary Static Data File**.

3.2.15.1. The file name of the Summary Static Data File shall contain the 16 character GUID supplied by the calling function. (all characters are ASCII 48-57 and 97-122) and have the text “_SUM” appended at the end of the GUID.

Examples:

c7a93487b68d6d10_SUM.csv

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4018204dbd519d20_SUM.csv

3.2.15.2. The first line of the file shall contain the column names as specified in “DAD Summary Static Data Format Specification Draft 1_0.xls” column A “Column Name”. The line shall NOT contain any spaces or commas in the field names. The line shall be comma delimited between column names.

3.2.15.3. The second line of the file shall be a summary of some of the data retrieved from the vehicle's ECUs. The OBDII summary data shall be formatted as specified in “DAD Summary Static Data Format Specification Draft 1_0.xls” columns B through G.

3.2.16. After the three Static Data Files are sent to the NWA, the DAD shall encrypt the files using a minimum of 128 bit encryption.

3.2.16.1 The encrypted files shall not be able to be decrypted on the client. (For example: 1) The Windows Encryption File System (EFS) cannot decrypt the files. 2) The public key on the client is only able to encrypt files and the private key shall not be on the client.)

3.2.17. The **Dynamic Data File** shall be the **Raw Dynamic Data File.**

3.2.18. The file name of the Raw Dynamic Data File shall contain the 16 character GUID supplied by calling function. (all characters are ASCII 48-57 and 97-122) and have the text “_DYNA” appended at the end of the GUID.

Examples:

c7a93487b68d6d10_DYNA.csv

4018204dbd519d20_DYNA.csv

3.2.19. The first line of the file shall contain twelve field names. The first field name shall be TIME and the second field name shall be ADDRESS. The remaining 10 field names shall be the names of the PIDs that were requested by the NWA. The naming convention is specified in column A "Column Name". The line shall NOT contain any spaces or commas in the field names. The line shall be comma delimited between column names, as specified in “DAD Raw Dynamic Data Format Specification Draft 1_0.xls”.

3.2.20. The remaining lines of the file shall be the communication data as sent and received from the vehicle's OBDII system and shall be formatted as outlined in "Data Layout" columns B through D. Comma delimiting shall be used

3.2.21. After the Dynamic Data File is sent to the NWA, the DAD shall encrypt the file using a minimum of 128 bit encryption.

3.2.22. The encrypted files shall be stored on the local computer hard drive in a directory as agreed to between BAR, BAR’s NWA Contractor, and the DAD Provider.

3.2.23. The DAD Provider shall supply BAR with a methodology to unencrypt files.

Log Files

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3.2.24. In addition to the three Static Data Files, the DAD shall create a DAD-Vehicle Communications Log File to be sent to the NWA.

3.2.25. The file name extension shall be three characters only and shall be ".log".

3.2.26. The file name of the DAD-Vehicle Communications Log File shall contain the 16 character GUID supplied by the calling function. (all characters are ASCII 48-57 and 97-122) and have the text "_VEH" appended at the end of the GUID.

Examples:

c7a93487b68d6d10_VEH.log

4018204dbd519d20_VEH.log

3.2.27. The DAD-Vehicle Communications Log File shall be a standard ASCII "TXT" file with a ".log" extension that is compatible with Microsoft Excel/Word 2003/2007/2010.

3.2.27.1. The first line of the DAD-Vehicle Communications Log File shall contain the version of the software creating the log file. Example: "DAD_DLL_VERSION_1.0".

3.2.27.2. The remaining lines of the DAD-Vehicle Communications Log File shall be the communication data as sent and received from the vehicles OBDII system and shall be formatted as specified in "DAD-Vehicle Communication Log File Specification Draft V1_0.xlsx" on the Data Layout" tab, columns B through D.

3.2.27.3. Since this is a log file, the data may be separated by spaces.

3.2.27.4. Delimiting is not required, but may be done.

3.2.28. The DAD-Vehicle Communications Log File shall be encrypted using the same encryption as the three required Static Data Files.

3.2.29. The DAD-Vehicle Communications Log File shall be stored in the same local computer directory as the three required Static Data Files.

3.2.30. The DAD Provider may choose to collect additional log files from the DAD if needed for diagnostic purposes.

3.2.31. Any additional log files shall be sent to the NWA.

3.2.32. Any additional log files shall be encrypted using the same encryption as the three required data files.

3.2.33. Any additional log files shall be stored in the same local computer directory as the three required data files.

3.2.34. Upon request to BAR from the DAD Provider, BAR will supply the additional log files.

Testable Vehicles

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3.2.35. The DAD shall access the OBDII SAE J1979 defined data from all gasoline fueled vehicles required to have OBDII systems, including passenger, light and medium duty trucks and shall report the data to the BAR NWA.

3.2.36. The DAD shall access the OBDII SAE J1979 defined data from all diesel fueled vehicles required to have OBDII systems, including passenger, light and medium duty trucks – 1998 and newer up to and including 14,000 Gross Vehicle Weight Rating (GVWR), and shall report the data to the BAR NWA.

3.2.37. The DAD shall access the OBDII SAE J1979 defined data from all alternate fueled (e.g., LPG, CNG, Hydrogen, Methanol, any ratio of ethanol / gasoline including E85) vehicles required to have OBDII systems, including passenger, light and medium duty trucks and shall report the data to the BAR NWA.

3.2.38. The DAD shall access the OBDII SAE J1979 defined data from all hybrid vehicles required to have OBDII systems and shall report the data to the BAR NWA.

Connectivity Rate

Regarding the following Connectivity Rate requirements, BAR understands and acknowledges that on a per car basis, successful communication may not be technically possible. This may be due to physically broken components required for communications such as diagnostic connectors or wiring. For the purposes of determining the connectivity rate and to the extent identifiable, BAR intends to exclude these vehicles from the calculation. However, to the extent technically feasible, BAR does not intend to exclude vehicles from the calculation that, by design, are not necessarily within applicable SAE/ISO specifications. The DAD Provider will be expected to provide a solution that can accommodate noncompliant vehicles to the extent feasible and BAR will exclude specific vehicles only upon request by the DAD Provider and approval by BAR with data supporting that the specific vehicles are noncompliant and there is no technically feasible solution (e.g., there is no change possible in the DAD software or hardware that would allow communication to successfully occur, necessary hardware or software changes to accommodate the vehicle can be shown to cause communication problems with other compliant vehicles, etc.).

3.2.39. The DAD Provider shall provide the necessary Hardware, Firmware and Software to ensure the Model Year (MY) 1996 – 1999 non-diesel fueled vehicles maintain a connectivity rate of 99.9%, which includes vehicles noncompliant with the required SAE and ISO standards as specified by the ARB OBDII regulation (title 13, California Code of Regulations, sections 1968.1 and 1968.2).

3.2.40. The DAD Provider shall provide the necessary Hardware, Firmware and Software to ensure the MY 1998 – 2003 diesel fueled vehicles maintain a connectivity rate of 99.9%, which includes vehicles noncompliant with the required SAE and ISO standards as specified by the ARB OBDII regulation (title 13, California Code of Regulations, sections 1968.1 and 1968.2).

3.2.41. The DAD Provider shall provide the necessary Hardware, Firmware and Software to ensure the MY 2000 and later non-diesel fueled vehicles maintain a connectivity rate of 99.9%, which includes vehicles noncompliant with the required SAE and ISO standards as specified by the ARB OBDII regulation (title 13, California Code of Regulations, sections 1968.1 and 1968.2).

3.2.42. The DAD Provider shall provide the necessary Hardware, Firmware and Software to ensure the MY 2004 and later diesel fueled vehicles maintain a connectivity rate of 99.9%, which includes providing the necessary accommodations for vehicles noncompliant with the

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required SAE and ISO standards as specified by the ARB OBDII regulation (title 13, California Code of Regulations, sections 1968.1 and 1968.2).

3.2.43. The DAD connectivity rates shall be based on OBDII certified vehicles subject to the California Smog Check Program.

3.2.44. The DAD shall not exclude an entire vehicle make, model or manufacturer, even though the overall connectivity rate is satisfied (e.g., Toyota Camry or Ferrari).

3.2.45 The BAR must agree to any vehicle exemption that the DAD Provider requests.

Successful Communication
A successful communication, for purposes of this document (i.e., for determining a successful event in calculating the Connectivity Rate per the previous sections), shall be defined as when:

3.2.45. The DAD shall retrieve and consolidate (where applicable) per SAE/ISO specifications and this document, all the data supported on a vehicle and shown in the Referenced Excel Files in the "Data Files" Section of this document from all OBD-related electronic control units (ECU)s on the vehicle.

3.2.45.1. For the purposes of this requirement, 'supported on a vehicle' shall be defined as data/parameters indicated as supported by one or more ECUs on the vehicle and sent by each applicable ECU to the DAD upon receiving a request per the SAE/ISO standards and this document.

3.2.46. The DAD shall properly translate/transform the data shown in the Referenced Excel Files in the "Data Files" Section of this document per SAE/ISO specifications and this document.

3.2.47. The DAD shall accurately transmit the data shown in the Referenced Excel Files in the "Data Files" Section of this document to the NWA per this document and any additional specifications established between the DAD Provider, BAR's NWA Contractor and BAR.

Communication Protocols

3.2.48. The DAD shall be capable of communicating with vehicles using ISO 9141-2:1994 amended 1:1996, (5 baud initialization, 10.4 kbaud compatible) communication protocol.

3.2.48.1. The DAD shall perform initialization in a manner compliant with the document "Volkswagen Group of America K-Line Communication Description", available at http://www.obdclearinghouse.com/index.php?body=get_file&id=1343 or available from BAR upon request.

3.2.48.2. Regardless of whether the received keywords from the vehicle are $08 08 (indicating P2 min = 25msec) or $94 94 (indicating P2 min = 0 msec), the DAD must use a P2min of 0 msec (e.g., must be prepared to accept responses from a vehicle using keywords $08 08 that are received before 25 msecs).

3.2.49. The DAD shall be capable of communicating with vehicles using SAE J1850, June 2006, Variable Pulse Width (10.4 kbaud compatible) communication protocol.

3.2.49.1. Vehicles that respond to SAE J1850 requests from the DAD with either the correct header bytes of $48 6B addr where 'addr' is the address of the responding

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ECU or the incorrect header bytes of $68 6B addr shall be considered J1850 compliant by the DAD and vehicle ECU responses with either header bytes shall be accepted as valid vehicle responses.

3.2.50. The DAD shall be capable of communicating with vehicles using SAE J1850, June 2006, Pulse Width Modulation (41.6 kbaud compatible) communication protocol.

3.2.50.1. Vehicles that respond to SAE J1850 requests from the DAD with either the correct header bytes of $41 6B addr where 'addr' is the address of the responding ECU or the incorrect header bytes of $61 6B addr shall be considered J1850 compliant by the DAD and vehicle ECU responses with either header bytes shall be accepted as valid vehicle responses.

3.2.51. The DAD shall be capable of communicating with vehicles using ISO 14230-4: 2000 Keyword protocol 2000 (both 5-baud 'slow' initialization and 10.4 kbaud 'fast' initialization) communication protocol.

3.2.51.1. The DAD shall perform initialization in a manner compliant with the document "Volkswagen Group of America K-Line Communication Description" referenced above.

3.2.51.2. The DAD shall perform initialization in a manner compliant with the document "Keyword Protocol 2000 Data Link Layer Recommended Practice", Version 1.5, dated October 1, 1997 and available from BAR upon request.

3.2.51.3. With respect to 'fast' initialization, regardless of keywords received from the vehicle (i.e., compliant keywords per ISO 14230-4 section 4.4 StartCommunication service, noncompliant keywords, or even missing keywords), if the DAD receives a positive StartCommunication response from the vehicle, the DAD shall use the functionality of keyword $8FE9 (decimal 2025) for messages sent to the vehicle and attempt further communications as if compliant keywords were received.

3.2.52. The DAD shall be capable of communicating with vehicles using ISO 15765-4: 2005 Controller Area Network (CAN) (11 bit header, 500 kbaud compatible) communication protocol.

3.2.52.1. The DAD shall implement CAN in a manner consistent with the document "A summary of the most common mistakes when implementing the OBD on CAN (ISO15765-4) initialization sequence" written by DaimlerChrysler AG, Mercedes Car Group Vehicle Diagnostic Engineering and available from BAR upon request.

3.2.53. The DAD shall be capable of communicating with vehicles using ISO 15765-4: 2005 CAN (29 bit header, 500 kbaud compatible) communication protocol.

3.2.54. The DAD determination of the communication protocol with the vehicle shall be automatic and fully integrated into the DAD Hardware, Firmware and Software.

Initialization Sequence:

3.2.55. [Reserved]

3.2.56. The DAD shall have a default sequence for the order in which the various communication protocols are attempted when establishing communication with the vehicle.

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3.2.56.1. The DAD Provider shall select the default sequence because it has been demonstrated in-use to have high success.

3.2.56.2 The default sequence shall be provided to BAR.

3.2.57. Prior to initialization, the DAD may be sent the preferred communication protocol by the NWA. If the DAD is sent the preferred communication protocol, the DAD shall first attempt to establish communication with the vehicle using this preferred communication protocol rather than with the first protocol in the default sequence.

3.2.57.1. If the DAD is not sent a preferred communication protocol, the DAD shall use the default sequence.

3.2.57.2. If the DAD is sent a preferred communication protocol, and the vehicle fails to communicate with the DAD, the DAD shall use the default sequence.

3.2.58. The DAD, in coordination with the NWA, shall conduct initialization in a manner that maximizes the successful communication with vehicles. Measure to be considered to achieve this include, but are not limited to:

3.2.58.1. Altering the sequence for initialization after unsuccessful first attempts such as changing the order that protocols are attempted if the vehicle failed to communicate on the first go around or 'relaxing' tolerances/specifications on repeat requests to try and be more tolerant of non-compliant vehicles, etc.

3.2.58.2. Having the ability to simultaneously attempt initialization on different protocols (where allowed by SAE and ISO specifications) to facilitate faster initialization.

3.2.58.3. Repeating initialization attempts on the same protocol consecutively before moving on to the next protocol if such an approach is advantageous.

3.2.59. If the DAD establishes communication (e.g., positive response to a Mode $01 PID $00 request or a positive StartCommunication response received) with one or more ECUs on the vehicle:

3.2.59.1. The DAD shall request and translate all received responses to a Mode $01 PID $00 request and if no vehicle ECU supports any Mode $01 PIDs from $00-$20 (e.g., all received responses are all zeros indicating no supported PIDs):

3.2.59.1.1. The DAD shall again request Mode $01 PID $00 to see if any non-zero responses are received. If at least one ECU responds with support for some Mode $01 PIDs, the DAD shall proceed with the inspection/data collection. If all the received responses still indicate no supported PIDs, the DAD shall terminate communication (e.g., use of a StopCommunication message or allow P3 to expire on ISO 9141 and ISO 14230 protocols) and then attempt to initialize communication with the vehicle beginning with the next protocol in the default sequence (e.g., if communication was established in ISO 14230 but all ECU responses indicated no Mode $01 PIDs were supported, ISO 14230 communication shall be terminated and then the DAD shall attempt to initialize

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with the next protocol (e.g., J1850 PWM, etc.) such that initialization on ISO 14230 will be attempted again only after all other protocols have been tried.

3.2.59.1.2. The DAD shall repeat the step in requirement 3.2.59.1.1 three times if the conditions of requirement 3.2.59.1 are satisfied before proceeding with the inspection/data collection.

3.2.59.2. The DAD shall request and translate and consolidate all received responses to a Mode $01 PID $01 request to determine vehicle readiness status in accordance with 3.2.98 through 3.2.100 and if the only monitor indicated as supported on the vehicle is comprehensive components (i.e., Data B bit 2 is 1 (supported) while Data B bits 0-1 and Data C bits 0-7 are all 0 (unsupported)):

3.2.59.2.1. The DAD shall again request Mode $01 PID $01 to see if additional ECUs respond and/or newly received responses now indicate support for some monitors in addition to comprehensive components. If the consolidated vehicle readiness now indicates support for more than comprehensive components, the DAD shall proceed with the inspection/data collection. If all the received responses still indicate support only for comprehensive components, the DAD shall terminate communication (e.g., use of a StopCommunication message or allow P3 to expire on ISO 9141 and ISO 14230 protocols) and then attempt to initialize communication with the vehicle beginning with the next protocol in the default sequence (e.g., if communication was established in ISO 14230 but all ECU responses indicated only comprehensive components were supported, ISO 14230 communication shall be terminated and then the DAD shall attempt to initialize with the next protocol (e.g., J1850 PWM, etc.) such that initialization on ISO 14230 will be attempted again only after all other protocols have been tried.

3.2.59.2.2. The DAD shall repeat step 3.2.59.2.1 three times if the conditions of 3.1.59.2 are satisfied before proceeding with the inspection/data collection.

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3.2.60. Upon request by the NWA by ECU Address, specifying the PID(s) and duration of data reporting, the DAD shall continually output/report ('broadcast') the requested PID(s) to the NWA as fast as the protocol allows for the data to be requested from the vehicle for the duration requested.

3.2.60.1. The DAD shall use PID support information and/or previous requests for the required PID(s) to identify the number of responses expected for each requested PID so that the DAD may make a subsequent request for that PID (or the next PID) as soon as the DAD has identified that all expected responses have been received, rather than waiting for the P2 time to expire.

3.2.60.2. For vehicles using the ISO 15765-4 protocol, the DAD shall use the multi-/bulk PID request function (allowing the request of up to six PIDs with a single request message) when more than one PID is requested by the NWA unless the DAD has determined that the vehicle will not properly respond to the multi-PID request and that the DAD must use single PID request messages instead.

3.2.60.3. The DAD shall be able to transmit a subsequent request (for the same or next PID) within 10 msecs of the vehicle being ready to accept such a request per the applicable SAE and ISO specifications.

3.2.61. The DAD Provider shall be responsible for the creation and display of appropriate user information screens on the BAR OIS during OBDII Dynamic Data Collection.

3.2.61.1. The DAD Provider shall work with BAR and BAR's NWA Contractor to determine what the appropriate user information shall be.

3.2.61.2. The DAD Provider shall work with BAR and BAR's NWA Contractor to determine the method for displaying the user information.

OBDII Static Data Collection

3.2.62. The DAD shall collect OBDII data from the vehicle in a BAR specified order.

Negative Response Codes

3.2.63. For ISO 15675-4 protocol:

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3.2.63.1. The DAD shall be designed to handle negative response codes per Table 11 of SAE J1979.

3.2.63.2. Additionally, for response code $78-Request correctly received-response pending, upon receipt of a $78 for any request made by the DAD (i.e., any mode, any PID, InfoType, etc…, regardless of whether SAE J1979 allows that response code for that request), the DAD shall reset to 5000 msecs and wait for the response from the vehicle.

3.2.63.3. The DAD shall be designed to accept up to three consecutive $78 response messages (each one resulting in a reset of P2 and waiting an additional P2max of 5000 msecs) before giving up and moving on to collect other data.

3.2.63.4. Where specified elsewhere in this document (requirement 3.2.132 regarding calibration verification number), the DAD shall return the negative response code to the NWA as the result for the requested item in cases where it resorted to giving up after three consecutive attempts to wait for the valid data to be sent from the vehicle.

3.2.63.5. For response code $22- Conditions not correct, the DAD shall be designed to give up on collecting that data item and move on to collecting other data.

3.2.63.6. Where specified elsewhere in this document (requirement 3.2.133 regarding calibration verification number), the DAD shall return the negative response code to the NWA as the result for the requested item in cases where it received a $22 instead of a valid response with actual data.

3.2.64. For all other protocols:

3.2.64.1. The DAD shall be designed to handle negative response codes per Table 10 of SAE J1979.

Not Supported, Not Available, Not Valid Items:

3.2.65. Whenever data requested by the NWA is not supported by any ECU on the vehicle (e.g., Mode $01 PID $1C is required by the NWA but none of the vehicle ECUs indicate support in Mode $01 PID $00 for PID $1C), the DAD shall return “NS” (not supported) to the NWA for that data.

3.2.66. Whenever data requested by the NWA is indicated as supported by one or more ECUs on the vehicle but then only some or none of the vehicle ECUs that indicated support respond to a request from the DAD for that data (e.g., Mode $01 PID $1C is required by the NWA and one or more of the vehicle ECUs indicates support in Mode $01 PID $00 for PID $1C but only some or none of the ECUs that indicated support for PID $1C respond to a Mode $01 PID $1C request from the DAD), the DAD shall return “NA” (not available) to the NWA for that data item.

3.2.66.1. In cases where one or more ECUs indicated an item of data was supported but none of those ECUs responded when the data was requested, the DAD shall be designed to use “Verification of Responses” before determining it is “NA” and moving on to the next data.

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3.2.66.2. In cases where one or more ECUs indicated an item of data was supported but not all of those ECUs responded when the data was requested, the DAD shall be designed to use "Verification of Responses" before determining it is "NA" for the ECUs that did not respond and moving on to the next data.

3.2.67. Whenever data requested by the NWA is indicated as supported by one or more ECUs on the vehicle and the only responses received from ECUs that indicated support are invalid responses (e.g., the data does not have the expected number of data bytes, error checking indications indicate the data was not properly received, data collisions that cannot be reconciled with data collision handling specified in the applicable protocol specifications, etc.) for that data (e.g., Mode $01 PID $1C is required by the NWA and one or more of the vehicle ECUs indicates support in Mode $01 PID $00 for PID $1C but only invalid responses or data are sent from the ECUs that indicated support to a Mode $01 PID $1C request from the DAD), the DAD shall return "NV" (not valid) to the NWA for that data.

3.2.68. Whenever data is specifically indicated by the NWA to be excluded/not requested from a vehicle, the DAD, if necessary (e.g., to send a complete data record if required by the NWA interface), shall return "NR" (not requested) to the NWA interface for that data.

3.2.69. Unless specifically directed otherwise in this specification, the DAD shall not send requests to the vehicle for data the vehicle has indicated is not supported (e.g., if none of the vehicle ECUs indicate that Mode $01 PID $1C is supported, the DAD shall not request Mode $01 PID $1C).

Verification of Responses:

3.2.70. Where explicitly directed to by this specification (e.g., section 3.2.66.1, etc.), the DAD shall be designed to repeat a request message sent to the vehicle and confirm the responses agree with the previous responses in accordance with the following sections.

3.2.70.1. In cases where one or more vehicle ECU responses to the repeated request differ from its previous (initial) response to the same DAD request message, the DAD shall resend the request message a third time.

3.2.70.1.1. If the first and third responses agree, the DAD shall use either of those responses.

3.2.70.1.2. If the second and third responses agree, the DAD shall use either of those responses.

3.2.70.1.3. If none of the three responses agree, the DAD shall use the third response.

ECU Address Format:

3.2.71. The DAD shall identify the ECU address for each data item it transmits to the NWA per the Referenced Excel Files in the "Data Files" Section of this document.

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3.2.71.1. For the ISO 15765-4 11-bit header protocol, the ECU Address shall be reported as Hex represented as ASCII with a value between 07E8 and 07EF (i.e., vehicle ECU using CAN identifier of $07E8 shall reported as 07E8 to the NWA).

3.2.71.2. For all other protocols, the ECU Address shall be reported as Hex represented as ASCII with a value between 00 and FF (i.e., vehicle ECU with an address of $0A shall be reported as 0A to the NWA).

Protocol Name Format:

3.2.72. The DAD shall report the protocol name to the NWA per the following definitions:

3.2.72.1. SAE J1850 PWM, report as “JPWM1850”

3.2.72.2. SAE J1850 VPW, report as “JVPW1850”

3.2.72.3. ISO 9141, report as “I914” followed by the Hex keywords received from the vehicle during initialization (i.e., “I9140808” or “I9149494”)

3.2.72.4. ISO 14230 slow (5 baud) initialization, report as “KWPS” followed by the Hex keywords (key byte 2 then key byte 1) received from the vehicle during initialization without a space (e.g., “KWPS8FE9”)

3.2.72.5. ISO 14230 fast (10,400 baud) initialization, report as “KWPF” followed by the Hex keywords (key byte 2 then key byte 1) received from the vehicle during initialization without a space (e.g., “KWPF8F6B”). The asterisk character (*) shall be used as a filler character in vehicles that do not properly report two full keybytes.

3.2.72.6. ISO 15765 11 bit header 500 kBit/s, report as “ICAN11bt”

3.2.72.7. ISO 15765 29 bit header 500 kBit/s, report as “ICAN29bt”

3.2.73. If the DAD Provider uses a non-standard protocol or a permutation of a standard protocol to communicate with ‘Problem Vehicles’, the DAD Provider shall define each unique non-standard protocol name in conjunction with BAR’s NWA Contractor and BAR.

Acquiring Mode $01, PID Count and Support List Information:
When acquiring Mode $01 PID Count and Support List information, the DAD shall be designed to use the procedure outlined in the “Verification of Responses” section (3.2.70) to confirm the data before reporting it.

PID Count:

3.2.74. The DAD shall calculate the PID Count based on the vehicle responses, on a per ECU basis, to Mode $01 PID Support indicators ($00 and $20, $40, etc. up to $E0 when applicable)

3.2.75. The DAD shall report the PID Count in a decimal number as text string format.

3.2.76. The DAD shall not request PID $20 (or other subsequent PID support) unless the vehicle has indicated support for such PIDs (e.g., only if PID $00 indicates PID $20 is supported shall PID $20 be requested by the DAD).

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3.2.76.1. For the ISO 15765-4 protocol, the DAD shall not use the multi-/block PID request message to ask for PID support of $00, $20, and subsequent with a single request message.

3.2.77. On a per ECU basis, for each PID indicated as supported by the ECU PID support indicators, the DAD shall increment the PID Count for that ECU by one.

3.2.78. Support of PID $00 itself shall not be included in the count (e.g., a vehicle ECU reporting in PID $00 that PIDs $01 and $03 are supported would have a decimal PID Count of 2, not 3).

3.2.79. Support of subsequent PID support indicators shall be included in the count (e.g., a vehicle ECU reporting in PID $00 that PIDs $10, $1C, and $20 are supported and reporting in PID $20 that PIDs $2E and $2F are supported would have a decimal PID count of 5, because $20 would be counted as a supported PID).

3.2.80. For the Summary Static Data File, if the vehicle has more than three vehicle ECUs that support Mode $01 PID $00, the DAD shall report the PID Counts for the three vehicle ECUs with the highest PID Counts.

3.2.81. For the Summary Static Data File, if the vehicle has multiple ECUs, the DAD shall report the PID Count to the NWA in the order from highest PID count to lowest.

3.2.82. For the Translated Static Data and Summary Static Data Files, if two or more ECUs have the same PID Count, they shall be reported in numeric order of the address from lowest to highest (e.g., for a vehicle with ECUs $E8 and $E9, both with a PI D Count of 15, ECU $E8 shall be reported before $E9).

3.2.83. For the Summary Static Data File, the highest PID count ECU shall be reported to the NWA as “ECU1_PID_COUNT”, the second highest PID count ECU shall be reported as “ECU2_PID_COUNT”, and the third highest PID count ECU shall be reported as “ECU3_PID_COUNT” (and the source address of each corresponding ECU shall be reported as “ECU1_ADDR”, “ECU2_ADDR”, and “ECU3_ADDR”).

3.2.84. For the Summary Static Data File, if there are fewer than three ECUs to report, the DAD shall report “NS” for the unused ECU#n_PID_COUNT and ECU#n_ADDR fields.

PID Support List:

3.2.85. The DAD shall identify a list of the supported PIDs on a per ECU basis.

3.2.86. The DAD shall report the Hex designation of the first supported PID, followed by a delimiter of a vertical bar “|” (ASCII character for Hex 7C), followed by the next supported PID, and so on (e.g., “01|03|04|09|1F” for a vehicle ECU only supporting PIDs $01, $03, $04, $09, and $1F).

3.2.87. If PID $00 indicates PID $20 is supported, the DAD shall include PID $20 in the list and the DAD shall request PID $20 from the vehicle and any supported PIDs from $21 through $3F shall be added to the list.

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3.2.87.1. The DAD shall follow the same procedure for PID $40, $60, etc. as indicated as supported by the vehicle.

3.2.88. PID $00 shall not be included in the list.

3.2.89. For the Summary Static Data File, the PID support list shall be reported to the NWA in the order from highest PID count to lowest PID count.

3.2.90. For the Summary Static Data File, vehicles with more than three ECUs, the PID support list for the three ECUs with the highest PID count shall be reported.

3.2.91. For the Summary Static Data File, the PID Support list for the highest PID count ECU shall be reported to the NWA as ”ECU1_PID_LIST”, the PID Support list for the second highest PID count ECU shall be reported as ”ECU2_PID_LIST”, and the PID Support list for the third highest PID count ECU shall be reported as ”ECU3_PID_LIST”.

3.2.92. For the Summary Static Data File, if there are fewer than three ECUs to report, the DAD shall report “NS” for the unused ”ECU#n_PID_LIST”.

3.2.93. For the Summary Static Data File, if any of the ECUs required to report a PID Support list as one of the ”ECU#n_PID_LIST” has zero PIDs supported, a zero (‘0’) shall be reported as the PID support list for that ECU.

Acquiring Mode $01, PID $01 Information:
When acquiring any Mode $01 PID $01 information, the DAD shall be designed to use the procedure outlined in the “Verification of Responses” section (3.2.70) to confirm the data before reporting it.

Malfunction Indicator Light (MIL) Command Status (Mode $01 PID $01 Data A bit 7):

3.2.94. For the Summary Static Data File, the DAD shall consolidate the MIL command status reported from every vehicle ECU (if more than one) that supports Mode $01 PID $01.

3.2.95. For the Summary Static Data File, if one or more ECUs report the MIL commanded on (bit 7 = 1), the DAD shall report the MIL command status as commanded ON to the NWA.

3.2.96. For the Translated Static Data and Summary Static Data Files, the format of the reported value shall be “MIL_ON” if the MIL is commanded on and “MIL_OFF” if the MIL is commanded off.

3.2.97. For the Summary Static Data File, the DAD shall not ignore or otherwise exclude some of the vehicle ECU PID $01 responses when determining the MIL command status (e.g., it is not acceptable to only use the MIL command status of the first ECU that responds or the one with the highest PID count).

Readiness Status (Mode $01 PID $01 Data B-D):

3.2.98. For the Summary Static Data File, the DAD shall consolidate the monitor readiness status reported from every vehicle ECU (if more than one) that supports Mode $01 PID $01 into a single field named “SID01_P1_SUPPORT”.

3.2.99. For the Summary Static Data File, the DAD shall create a Readiness Status for the vehicle and report it to the NWA.

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3.2.99.1. The Readiness Status shall use bits 0-7 of Data B, C and D per SAE J1979.

3.2.99.2. The DAD shall report a “C” for a monitor that is both supported and complete.

3.2.99.3. The DAD shall report a “U” for a monitor that is unsupported (regardless of whether it is also complete or not complete).

3.2.99.4. The DAD shall report an “I” for a monitor that is both supported and not complete.

3.2.99.5. The DAD shall report the Readiness Status in the order listed: (Example ONLY! Refer to SAE J1979 SEP2010 for specifics for gasoline and Diesel)

- Position 1 is Misfire monitor status
- Position 2 is Fuel System monitor status
- Position 3 is Comprehensive Component monitor status
- Position 4 is Gasoline or Compression-Ignition readiness labels
- Position 5 is Catalyst monitor status
- Position 6 is Heated Catalyst monitor status
- Position 7 is Evaporative System monitor status
- Position 8 is Secondary Air System monitor status
- Position 9 is ISO/SAE Reserved or A/C System monitor status
- Position 10 is Oxygen Sensor monitor status
- Position 11 is Oxygen Sensor Heater monitor status
- Position 12 is EGR and/or VVT System monitor status

For example, “CCCCIUUUUCCI”.

3.2.99.6. The DAD shall consolidate the Readiness Status based on the PID $01 responses from all vehicle ECUs that support PID $01.

3.2.99.7. For each monitor (individual bit), the Readiness Status shall indicate supported and complete if all of the ECUs that report that monitor as supported also report it as complete.

3.2.99.8. The Readiness Status shall indicate supported and not complete if one or more of the ECUs that reports that monitor as supported also reports it as not complete.

3.2.99.9. The Readiness Status shall indicate unsupported if all ECUs report that monitor as unsupported.

3.2.100. For the Summary Static Data File, the DAD shall not ignore or otherwise exclude some of the vehicle ECU PID $01 responses when determining the Readiness Status (e.g., it is not acceptable to only use the data of the first ECU that responds or the one with the highest PID count).

Number of Stored DTCs (Mode $01 PID $01 Data A bits 0-6):

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3.2.101. For the Summary Static Data File, the DAD shall sum up the number of stored DTCs reported from every vehicle ECU (if more than one) that supports Mode $01 PID $01 and report the number in the "SID01_P1_DTCS" column.

3.2.101.1. For the Summary Static Data File, if one or more ECUs report a non-zero number for the number of stored DTCs, the DAD shall add the values together and report the cumulative total of stored DTCs to the NWA.

3.2.101.2. For the Summary Static Data File, the DAD shall report the value as a decimal number as text string (e.g., if one ECU reports 2 stored DTCs and another ECU reports 1 stored DTC, the DAD shall report '3' for the cumulative total of stored DTCs.

3.2.102. For the Summary Static Data File, the DAD shall not ignore or otherwise exclude some of the vehicle ECU PID $01 responses when determining the number of stored DTCs (e.g., it is not acceptable to only use the data reported by the first ECU that responds or the one with the highest PID count).

Acquiring Mode $01 PID $1C (OBD Compliance) and PID $0C (Engine Speed) Data:

OBD Compliance (Mode $01 PID $1C):

3.2.103. If indicated as required by the NWA and one or more ECUs on the vehicle indicated support for Mode $01 PID $1C, the DAD shall request Mode $01, PID $1C

3.2.104. For the Summary Static Data File, the DAD shall report the value from the ECU with the highest PID Count that supports PID $1C in the "SID01_PID1C" column.

3.2.105. The DAD shall report the value Hex represented as ASCII per SAE J1979 (e.g., "01" for a vehicle reporting $01 – "OBD II (California ARB)").

Engine Speed (Mode $01 PID $0C):

3.2.106. If indicated as required by the NWA and one or more of the ECUs on the vehicle indicated PID $0C was supported, the DAD shall continuously request the engine speed from the ECU with the highest PID Count for five seconds, in accordance with the applicable communication protocol.

3.2.106.1. For the Summary Static Data File, the DAD shall record the minimum rpm value observed during the five seconds in the "SID01_PID0C_MIN" column.

3.2.106.2. For the Summary Static Data File, the DAD shall record the maximum rpm value observed during the five seconds in the "SID01_PID0C_MAX" column.

3.2.106.3. The DAD shall calculate and record the median rpm value over the five seconds in the "SID01_PID0C" column.

3.2.106.4. The DAD shall report the minimum, maximum and median rpms, translated to rpm units per SAE J1979, to the NWA.

Acquiring Mode $03 Confirmed Emission-Related Diagnostic Trouble Codes (DTCs):

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3.2.107. If indicated, as required by the NWA, the DAD shall retrieve the confirmed DTCs (Mode $03) from the vehicle in accordance with this section and SAE J1979.

3.2.108. For vehicles using the ISO 15765-4 protocol:

3.2.108.1. The DAD shall request confirmed DTCs from the vehicle.

3.2.108.2. If the number of confirmed DTCs reported in the Mode $03 response (databyte #2) from any responding ECU disagrees with the number of confirmed DTCs received from that ECU, the DAD shall repeat the Mode $03 request.

3.2.108.2.1. If there is still a disagreement, the DAD shall ignore the disagreement and report all received DTCs.

3.2.109. For vehicles using all other protocols:

3.2.109.1. The DAD shall request confirmed DTCs from the vehicle.

3.2.109.2. If the number of received DTCs from any ECU disagrees with the number of DTCs reported in Mode $01 PID $01 databyte A bits 0-6 from that ECU, the DAD shall repeat the request for Mode $01 PID $01 and Mode $03.

3.2.109.2.1. If disagreement still exists, the DAD shall ignore the disagreement and report all received DTCs.

3.2.110. For the Translated Static Data and Summary Static Data Files, the DAD shall translate all confirmed DTCs received from all ECUs in accordance with SAE J1979 and report the DTCs to the NWA in the J2012 format (i.e., first two digits are ASCII alphanumeric designator (e.g. P0, U0, B1, or C2), Hex represented as ASCII for next three digits, each code is delimited by "Vertical Bar" (ASCII character 0x7C)).

3.2.111. The DAD shall not report unused bytes (filler bytes of $00) as a DTC (e.g., a Mode $03 response of all $00 for databytes 2-6 on a non-ISO 15765-4 protocol vehicle shall not be reported as DTC P0000).

Acquiring Mode $09, InfoTypes $01 and $02 Vehicle Identification Number (VIN) Data:
When acquiring any Mode $09 InfoType $02 information, the DAD shall be designed to use the procedure outlined in the “Verification of Responses” section (3.2.70) to confirm the data before reporting it.

3.2.112. If indicated, as required by the NWA, the DAD shall retrieve the VIN (Mode $09 InfoType $02) from the vehicle in accordance with this section and SAE J1979.

3.2.113. If one or more of the ECUs on a vehicle indicates Mode $09 InfoType $02 is supported in the Mode $09 InfoType $00 response:

3.2.113.1. For the ISO 15765-4 protocol, the DAD shall request the VIN from the vehicle and report it to the NWA.

3.2.113.1.1. The DAD shall not request InfoType $01 (number of messages to report VIN) nor require InfoType $01 to be supported before requesting InfoType $02 (VIN).

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3.2.113.2. For all other protocols, the DAD shall request InfoType $01 (if reported as supported) before requesting InfoType $02.

3.2.113.2.1. Regardless of the response (or lack of) to InfoType $01, the DAD shall assume a response of $05 for InfoType $01 and request InfoType $02 and report it to the NWA.

3.2.114. If one or more ECUs on a vehicle respond positively to Mode $09 InfoType $00 but no ECUs indicate that InfoType $02 is supported:

3.2.114.1. The DAD shall still request InfoType $02 and attempt to retrieve the VIN per requirement 3.2.113 and subordinate requirements.

3.2.114.2. If one or more ECUs respond with data, the DAD shall translate the data per requirement 3.2.115 and subordinate requirements.

3.2.115. The DAD shall translate the VIN data received from the vehicle to printable ASCII characters in accordance with this section and J1979 before being transmitted to the NWA as follows:

3.2.115.1. Per extended Hex to ASCII, in accordance with ISO 8859-1 and Microsoft® Windows Latin-1 increased characters available at: **http://www.ascii-code.com**.

3.2.115.2. Hex values from $01 through $1F and $7F shall be considered non-printable ASCII characters and a "*" (Hex value 2A) shall be used to in place of any non-printable ASCII character.

3.2.115.2.1. Excluding the first 3 filler bytes of $00 used for all protocols except ISO 15765-4, a Hex value of $00 shall also be considered non-printable and replaced with a "*" (Hex value 2A).

3.2.115.3. Hex values from $80 through $FE (extended ASCII codes) shall be replaced with a "?" (Hex value 3F).

3.2.115.4. Hex value of $FF (extended ASCII codes) shall be replaced with a "#" (Hex value 23).

3.2.115.5. If the InfoType $02 response message from the vehicle contains less than 17 data bytes (ISO 15765-4 protocol) or less than 20 data bytes (all other protocols), the DAD shall repeat the request for InfoType $02 to the vehicle.

3.2.115.5.1. If the response still indicates too few characters, the DAD shall convert (in accordance with requirements 3.2.115.1, 3.2.115.2, 3.2.115.3, and 3.2.115.4) and transmit all of the data bytes (for the ISO 15765-4 protocol) or the last 17 (if more than 17) or all the data bytes (if 17 or less) (for all other protocols) to the NWA.

3.2.115.5.2. The DAD shall not add filler or padding characters before reporting the partial VIN to the NWA in cases where fewer than 17 characters were received.

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3.2.115.6. If the VIN data was received pursuant to requirement 3.2.114 above (was reported as unsupported in InfoType $00 but data requested and received anyway), the DAD shall add a lowercase 'u' (Hex value 75) as the first character in front of the VIN data (17 characters or less) before reporting it to the NWA (e.g., a vehicle with at least one ECU that responds to Mode $09 InfoType $00 but no ECUs that indicate InfoType $02 is supported reports a VIN to an InfoType $02 request that is translated per J1979 to "1ABCDEFGH12345678" shall be reported as "u1ABCDEFGH12345678"

3.2.116. For the Summary Static Data File, if more than one vehicle ECU sends an InfoType $02 response, the response from the ECU with the highest PID count shall be reported to the NWA.

3.2.117. For all protocols except ISO 15675-4, if the first three databytes of Message #1 in the response to InfoType $02 are not $00 and the last three databytes of Message #5 are $00 (i.e., VIN padded at the wrong end), the DAD shall translate and transmit the first 17 databytes of the InfoType $02 response to the NWA as the VIN instead of the last 17 databytes.

Acquiring Mode $09, InfoTypes $03 and $04 Calibration Identification (CAL ID) Data:

3.2.118. If indicated, as required by the NWA, the DAD shall retrieve the CAL ID (Mode $09 InfoType $04) from the vehicle in accordance with this section and SAE J1979.

3.2.119. If one or more of the ECUs on a vehicle indicates Mode $09 InfoType $04 is supported in the Mode $09 InfoType $00 response:

3.2.119.1. For the ISO 15765-4 protocol, the DAD shall request the CAL ID from the vehicle and report it to the NWA.

3.2.119.1.1. The DAD shall not request InfoType $03 (number of messages to report CAL ID) nor require InfoType $03 to be supported before requesting InfoType $04 (CAL ID).

3.2.119.2. For all other protocols, the DAD shall request InfoType $03 (if reported as supported) before requesting InfoType $04.

3.2.119.2.1. The DAD shall use the information reported in InfoType $03 to determine how many CAL IDs will be reported in InfoType $04.

3.2.119.2.2. If a vehicle ECU responds with more messages than were indicated in InfoType $03 from that ECU, the DAD shall ignore the extra messages and not include them in the CAL ID (e.g., an ECU indicated in InfoType $03 that 8 messages would be sent and then 9 messages were actually received from that ECU in response to an InfoType $04 request, the 9th message shall not be included in the CAL ID reported to the NWA for this ECU).

3.2.119.2.3. If a vehicle ECU responds to InfoType $03 with a number that is not a multiple of 4 (i.e., 1, 2, 3, 5, etc.), the DAD shall assume the InfoType $03 data is a mistake and expect a number of messages that is a multiple of 4 when requesting InfoType $04 from that ECU. The DAD shall use the Message Count

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information (in Data byte #3 per SAE J1979 specifications) to construct the full CAL IDs (in multiples of 4 messages) and use P2 time-outs to determine no further messages will be sent from that ECU.

3.2.120. For the Summary Static Data File, CAL IDs shall be reported to the NWA for a maximum of three vehicle ECUs.

3.2.120.1. For the Summary Static Data File, if more than three vehicle ECUs support and report CAL ID(s), the DAD shall report the CAL ID(s) for the three ECUs with the highest PID Count.

3.2.120.2. For the Summary Static Data File, the CAL ID(s) for the highest PID count ECU shall be reported to the NWA as “ECU1_SID09_IT04”, the CAL ID(s) for the second highest PID count ECU shall be reported as ” ECU2_SID09_IT04”, and the CAL ID(s) for the third highest PID count ECU shall be reported as “ECU3_SID09_IT04”.

3.2.120.3. For the Summary Static Data File, if there are fewer than three ECUs to report, the DAD shall report “NS” for the unused “ECU#n_SID09_IT04”.

3.2.121. If an ECU reports more than one CAL ID, the DAD shall report the received CAL IDs to the NWA for that ECU in the same order received from the vehicle (i.e., for each ECU that responds with multiple CAL IDs, the DAD shall use the same order as received to report the CAL IDs for that vehicle ECU to the NWA).

3.2.121.1. Multiple CAL IDs from the same ECU shall be separated by a "Vertical Bar" (Hex value 7C) between CAL IDs when reported to the NWA.

3.2.122. Any unused databytes at the end of the CAL ID and reported as $00 (filler bytes) shall be removed/filtered by the DAD before reporting the CAL ID to the NWA.

3.2.123. The data shall be converted to printable ASCII characters by the DAD before being transmitted to the NWA.

3.2.123.1. Per extended Hex to ASCII, in accordance with ISO 8859-1 and Microsoft® Windows Latin-1 increased characters available at: http://www.ascii-code.com.

Acquiring Mode $09, InfoTypes $05 and $06 Calibration Verification Number (CVN) Data:

3.2.124. If indicated, as required by the NWA, the DAD shall retrieve the CVN (Mode $09 InfoType $06) from the vehicle in accordance with this section and SAE J1979.

3.2.125. If one or more of the ECUs on a vehicle indicates Mode $09 InfoType $06 is supported in the Mode $09 InfoType $00 response:

3.2.125.1. For the ISO 15765-4 protocol, the DAD shall request the CVN(s) from the vehicle and report it to the NWA.

3.2.125.1.1. The DAD shall not request InfoType $05 (number of messages to report CVN) or require InfoType $05 to be supported before requesting InfoType $06 (CVN).

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3.2.125.2. For all other protocols, the DAD shall request InfoType $05 (if reported as supported) before requesting InfoType $06.

3.2.125.2.1. The DAD shall use the information reported in InfoType $05 to determine how many CVNs will be reported in InfoType $06.

3.2.126. For the Summary Static Data File, CVNs shall be reported to the NWA for a maximum of three vehicle ECUs.

3.2.126.1. If more than three vehicle ECUs support and report CVN(s), the DAD shall report the CVN(s) for the three ECUs with the highest PID Count.

3.2.126.2. The CVN(s) for the highest PID count ECU shall be reported to the NWA as “ECU1_SID09_IT06”, the CVN(s) for the second highest PID count ECU shall be reported as “ECU2_SID09_IT06” and the CVN(s) for the third highest PID count ECU shall be reported as “ECU3_SID09_IT06”.

3.2.126.3. If there are fewer than three ECUs to report, the DAD shall report “NS” for the unused “ECU#n_SID09_IT06”.

3.2.127. If an ECU reports more than one CVN, the DAD shall report the received CVNs to the NWA for that ECU in the same order received from the vehicle (i.e., for each ECU that responds with multiple CVNs, the DAD shall use the same order as received to report the CVNs for that vehicle ECU to the NWA). Multiple CVNs from the same ECU shall be separated by a "Vertical Bar" (Hex value 7C) between CVNs when reported to the NWA.

3.2.128. CVNs shall be reported to the NWA for the same ECU(s) that CAL ID was reported for and in the same order.

3.2.129. Any unused databytes at the start of the CVN and reported as $00 (filler bytes) shall be removed/filtered by the DAD before reporting the CVN(s) to the NWA.

3.2.130. The data shall be converted to Hex represented as ASCII characters in accordance with SAE J1979 by the DAD before being transmitted to the NWA.

3.2.131. For all protocols, the DAD shall comply with SAE J1979 section 6.2.4.3 “Data Not Available within P2 Timing” for InfoType $06.

3.2.132. In accordance with requirement 3.2.63.4, if a request for CVN has resulted in three consecutive $78 negative response code messages (and corresponding extension and reset of P2 each time) and a valid response has still not been received, the DAD shall report “78” as the CVN for that ECU in the Summary Static Data File.

3.2.133. In accordance with requirement 3.1.63.6, if a request for CVN has resulted in a $22-conditions not correct negative response code message, the DAD shall report “22” as the CVN for that ECU in the Summary Static Data File.

Acquiring Mode $01, PIDs $30 (Number of Warm-ups Since Codes Cleared), $31 (Distance Traveled Since Codes Cleared), $4E (Engine Run Time Since Codes Cleared), $21 (Distance Traveled With MIL On) and $4D (Engine Run Time With MIL On), Data:

Number of Warm-ups Since Codes Cleared (Mode $01 PID $30):

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3.2.134. If indicated as required by the NWA, the DAD shall retrieve the number of warm-ups since codes cleared from the vehicle in accordance with this section and SAE J1979.

3.2.135. If one or more of the ECUs on a vehicle indicates Mode $01 PID $30 is supported, the DAD shall request the number of warm-ups since codes cleared from the vehicle and report it in the “SID01_PID30” column.

3.2.136. For the Summary Static Data File, the DAD shall convert the number of warm-ups since codes cleared data to the decimal number as text string format in accordance with SAE J1979 before being reported to the NWA.

3.2.137. For the Summary Static Data File, if more than one ECU on a vehicle responds with number of warm-ups since codes cleared data, the DAD shall report the value from the ECU with the highest PID Count.

Distance Traveled Since Codes Cleared (Mode $01 PID $31) and Engine Run Time Since Codes Cleared (Mode $01 PID $4E):

3.2.138. If indicated as required by the NWA, the DAD shall retrieve the Distance Traveled Since Codes Cleared from the vehicle in accordance with this section and SAE J1979.

3.2.139. If one or more of the ECUs on a vehicle indicates Mode $01 PID $31 is supported, the DAD shall request the Distance Traveled Since Codes Cleared from the vehicle and report it in the “SID01_PID31” column.

3.2.140. For the Summary Static Data File, the DAD shall convert the Distance Traveled Since Codes Cleared data to the decimal number as text string format (in kilometers) in accordance with SAE J1979 before being reported to the NWA.

3.2.141. For the Summary Static Data File, if more than one ECU on a vehicle responds with Distance Traveled Since Codes Cleared data, the DAD shall report the value from the ECU with the highest PID Count.

3.2.142. If indicated as required by the NWA, the DAD shall retrieve the Engine Run Time Since Codes Cleared from the vehicle in accordance with this section and SAE J1979.

3.2.143. If one or more of the ECUs on a vehicle indicates Mode $01 PID $4E is supported, the DAD shall request the Engine Run Time Since Codes Cleared from the vehicle and report it in the “SID01_PID4E” column.

3.2.144. For the Summary Static Data File, the DAD shall convert the Engine Run Time Since Codes Cleared data to the decimal number as text string format (in minutes) in accordance with SAE J1979 before being reported to the NWA.

3.2.145. For the Summary Static Data File, if more than one ECU on a vehicle responds with Engine Run Time Since Codes Cleared data, the DAD shall report the value from the ECU with the highest PID Count.

Distance Traveled With MIL On (Mode $01 PID $21) and Engine Run Time With MIL On (Mode $01 PID $4D):

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3.2.146. If indicated as required by the NWA, the DAD shall retrieve the Distance Traveled With MIL On from the vehicle in accordance with this section and SAE J1979.

3.2.147. If one or more of the ECUs on a vehicle indicates Mode $01 PID $21 is supported, the DAD shall request the Distance Traveled With MIL On from the vehicle and report it in the “SID01_PID21” column.

3.2.148. For the Summary Static Data File, the DAD shall convert the Distance Traveled With MIL On data to the decimal number as text string format (in kilometers) in accordance with SAE J1979 before being reported to the NWA.

3.2.149. For the Summary Static Data File, if more than one ECU on a vehicle responds with non-zero data, the DAD shall report the value from the ECU with the highest PID Count.

3.2.150. If indicated as required by the NWA, the DAD shall retrieve the Engine Run Time With MIL On from the vehicle in accordance with this section and SAE J1979.

3.2.151. If one or more of the ECUs on a vehicle indicates Mode $01 PID $4D is supported, the DAD shall request the Engine Run Time With MIL On from the vehicle and report it in the “SID01_PID4D” column.

3.2.152. For the Summary Static Data File, the DAD shall convert the Engine Run Time With MIL On data to the decimal number as text string format (in minutes) in accordance with SAE J1979 before being reported to the NWA.

3.2.153. For the Summary Static Data File, if more than one ECU on a vehicle responds with non-zero data, the DAD shall report the value from the ECU with the highest PID Count.

Acquiring Mode $07 (Pending Emission-Related DTCs) and Mode $0A (Permanent Emission-Related DTCs) Data:

3.2.154. If indicated, as required by the NWA, the DAD shall retrieve the Pending Emission-Related DTCs (Mode $07) and Permanent Emission-Related DTCs (Mode $0A) from the vehicle in accordance with this section and SAE J1979.

3.2.155. The DAD shall request Pending Emission-Related DTCs from the vehicle,

3.2.155.1. The DAD shall translate all Pending Emission-Related DTCs received from all ECUs in accordance with SAE J1979.

3.2.155.2. The DAD shall report the Pending Emission-Related DTCs to the NWA in the J2012 format (i.e., first two digits are ASCII alphanumeric designator (e.g. P0, U0, B1, or C2), the next three digits are Hex represented as ASCII, each code is delimited by "Vertical Bar" (ASCII character 0x7C)).

3.2.156. The DAD shall not report unused bytes (filler bytes of $00) as a Pending Emission-Related DTC (e.g., a Mode $07 response of all $00 for databytes 2-6 on a non-ISO 15765-4 protocol vehicle shall not be reported as Pending Emission-Related DTC P0000).

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3.2.157. For vehicles using the ISO 15765-4 protocol, the DAD shall request Permanent Emission-Related DTCs from the vehicle

3.2.157.1. The DAD shall translate all Permanent Emission-Related DTCs received from all ECUs in accordance with SAE J1979.

3.2.157.2. The DAD shall report the Permanent Emission-Related DTCs to the NWA in the J2012 format (i.e., first two digits are ASCII alphanumeric designator (e.g. P0, U0, B1, or C2), the next three digits are Hex represented as ASCII, each code is delimited by "Vertical Bar" (ASCII character 0x7C)).

Acquiring Mode $06 Test ID (TID) Support and Test Limit Type and Component ID (TLTCID) Support/Mode $06 OBD Monitor ID (OBDMID) Support and Test ID (TID) Support Data:

3.2.158. If indicated, as required by the NWA, the DAD shall retrieve the test results (Mode $06) from the vehicle in accordance with this section and SAE J1979.

3.2.159. For non-ISO 15765-4 protocol vehicles:

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3.2.159.1. TID support shall be determined based on the vehicle responses, on a per ECU basis, to Mode $06 TID Support indicators ($00 and $20, $40, etc. up to $E0 when applicable).

3.2.159.2. The DAD shall not request TID $20 (or other subsequent TID support) unless one or more ECUs on the vehicle indicates support for such TIDs (e.g., only if TID $00 indicates TID $20 is supported shall TID $20 be requested by the DAD).

3.2.159.3. After identifying what TIDs are supported, the DAD shall request the test results for each supported TID and identify which TLTCIDs are reported for each TID requested. The TLTCID[1] is defined per SAE J1979 as data byte #2 of the response message to a requested TID.

3.2.159.4. For the Summary Static Data File, if more than one vehicle ECU supports Mode $06 TIDs, the TID and TLTCID support shall be reported for the ECU with the highest PID Count.

3.2.159.5. The DAD shall report the Hex designation of the first supported TID, followed by a “Forward Slash” (Hex value 2F), then the first TLTCID reported for that TID, followed by a "Vertical Bar" (Hex value 7C), then the next reported TID and TLTCID combination, and so on (e.g., “02/84|02/16|03/01|1F/10” for a vehicle ECU only supporting TIDs $02, $03, and $1F and reporting TLTCIDs $84 and $16 for TID $02, TLTCID $01 for TID $03, and TLTCID $10 for TID $1F).

3.2.159.6. The DAD shall not include support TIDS (e.g., $00, $20, $40, etc.) in the list reported to the NWA.

3.2.159.6.1. The DAD shall report the supported TID/TLTCID combinations in numeric order from the lowest TID to the highest TID and from the lowest TLTCID to the highest TLTCID within each TID.

3.2.160. For ISO 15765-4 protocol vehicles:

[1] Note that this document requests the TLTCID which, per SAE J1979, represents both the test limit type and the component ID (CID). It is not just bits 0-6 of data byte #2 which represent only the CID and are commonly displayed by scan tools as the CID.

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3.2.160.1. OBDMID support shall be determined based on the vehicle responses, on a per ECU basis, to Mode $06 OBDMID Support indicators ($00 and $20, $40, etc. up to $E0 when applicable).

3.2.160.2. The DAD shall not request OBDMID $20 (or other subsequent OBDMID support) unless one or more ECUs on the vehicle indicates support for such OBDMIDs (e.g., only if OBDMID $00 indicates OBDMID $20 is supported shall OBDMID $20 be requested by the DAD).

3.2.160.3. After identifying what OBDMIDs are supported, the DAD shall request the test results for each supported OBDMID and identify which TIDs are reported for each OBDMID requested. The TID is defined per SAE J1979 as data byte #3 of the response message to a requested OBDMID.

3.2.160.4. The DAD shall translate the supported OBDMIDs and reported TIDs on a per ECU basis and report the list of supported OBDMIDs and TIDs to the NWA.

3.2.160.4.1. For the Summary Static Data File, if more than one vehicle ECU supports Mode $06 OBDMIDs, the DAD shall report the supported OBDMIDs and reported TIDs for the ECU with the highest PID Count.

3.2.160.5. The DAD shall report the Hex designation of the first supported OBDMID, followed by a “Forward Slash” (Hex value 2F), then the first TID reported for that OBMID, followed by a "Vertical Bar" (Hex value 7C), then the next reported OBDMID and TID combination, and so on (e.g., “01/01|01/05|01/85|1F/10” for a vehicle ECU only supporting OBDMIDs $01 and $1F and reporting TIDs $01, $05, and $85 for OBDMID $01 and TID $10 for OBDMID $1F).

3.2.160.6. The DAD shall not include support OBDMIDS (e.g., $00, $20, $40, etc.) in the list reported to the NWA.

3.2.160.7. The DAD shall report the supported OBDMID/TID combinations in numeric order from the lowest OBDMID to the highest OBDMID and from the lowest TID to the highest TID within each OBDMID.

Acquiring Mode $09, InfoTypes $0A (ECU Name):

3.2.161. If indicated, as required by the NWA, the DAD shall retrieve the ECU Name (Mode $09 InfoType $0A) from the vehicle in accordance with this section and SAE J1979.

3.2.162. If one or more of the ECUs on a vehicle indicates Mode $09 InfoType $0A is supported in the Mode $09 InfoType $00 response:

3.2.162.1. For the ISO 15765-4 protocol, the DAD shall request the ECU Name from the vehicle and report it to the NWA.

3.2.162.1.1. The DAD shall not request InfoType $09 (number of messages to report ECU Name) nor require InfoType $09 to be supported before requesting InfoType $0A (ECU Name).

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3.2.162.2. For all other protocols, the DAD shall not request ECU Name.

3.2.163. For the Summary Static Data File, ECU Name shall be reported to the NWA for a maximum of three vehicle ECUs. If more than three vehicle ECUs support and report ECU Name(s), the DAD shall report the ECU Name(s) for the three ECUs with the highest PID Count. The ECU Name(s) for the highest PID count ECU shall be reported as ”ECU1_SID09_IT0A”, the ECU Name(s) for the second highest PID count ECU shall be reported as ”ECU2_SID09_IT0A”, and the ECU Name(s) for the third highest PID count ECU shall be reported as ”ECU3_SID09_IT0A”. If there are fewer than three ECUs to report, the DAD shall report “NS” for the unused “ECU#n_SID09_IT0A”.

3.2.164. Any unused databytes at the end of the ECU Name and reported as $00 (filler bytes) shall be removed/filtered by the DAD before reporting the ECU Name to the NWA.

3.2.165. The data shall be converted to ASCII text by the DAD, per SAE J1979, before being transmitted to the NWA using the same requirements detailed in the “Acquiring Mode $09, InfoTypes $01 and $02 (VIN) Data” requirements 3.2.115.1, 3.2.115.2, 3.2.115.3, and 3.2.115.4.

Acquiring Mode $09, InfoTypes $07 and $08/$0B In-Use Monitor Performance Ratio (IUMPR) Data:

3.2.166. If indicated, as required by the NWA, the DAD shall retrieve the IUMPR data (Mode $09 InfoType $08/$0B) from the vehicle in accordance with this section and SAE J1979.

3.2.167. If one or more of the ECUs on a vehicle indicates Mode $09 InfoType $08 or $0B is supported in the Mode $09 InfoType $00 response:

3.2.167.1. For the ISO 15765-4 protocol, the DAD shall request the IUMPR data from the vehicle and report it to the NWA.

3.2.167.2. The DAD shall not request InfoType $07 (number of messages to report IUMPR data) or require InfoType $07 to be supported before requesting InfoType $08 or $0B (IUMPR data).

3.2.167.3. For all other protocols, the DAD shall request InfoType $07 (if reported as supported) before requesting InfoType $08.

3.2.167.4. The DAD shall use the information reported in InfoType $07 to determine how many messages will be reported in InfoType $08 or $0B.

3.2.168. For the Summary Static Data File, if more than one ECU supports and reports IUMPR data, the DAD shall report the IUMPR data from the ECU with the highest PID Count.

3.2.169. The DAD shall report the IUMPR data to the NWA as a consolidated raw Hex message.

3.2.169.1. For the ISO 15765-4 protocol, a consolidated raw Hex message shall be defined as the CAN identifier per ISO 15765-4 (e.g., 07 E8 for 11-bit CAN, 18 DA F1 xx where xx is the module (ECU) address for 29-bit CAN), followed by the valid data bytes (e.g., 49 08 xx yy yy yy where xx is the number of data items and yy yy yy is the 32 to 40

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data bytes expected for an IUMPR Mode $09 InfoType $0B response from a vehicle ECU).

3.2.169.2. For the ISO 15765-4 protocol, the consolidated raw Hex message shall not include the N_PCI byte(s). These bytes shall be used by the DAD to properly receive the message and consolidate the frames into one message but then not be included as part of the consolidated raw Hex message reported to the NWA. For example, a response from ECU $07EE (shortened to three frames for brevity):

07 EE <u>10 14</u> 49 08 14 04 00 0D first frame from ECU $07EE
07 EE <u>21</u> 09 03 38 03 B1 02 C7 second frame from ECU $07EE
07 EE <u>22</u> 03 B1 02 E1 03 9C 02 third frame from ECU $07EE

shall be reported as '07EE49081404000D09033803B102C703B102E1039C02' when removing the N_PCI bytes and consolidating the multiple frames into a single message.

3.2.169.3. For all other protocols, a consolidated raw Hex message shall be defined as the data bytes #4 through #7 of the 8, 9, or 10 messages that make up the $0A/$0B response. Header bytes and databytes #1 through #3 including message count number shall be omitted from the message. For example, an ISO 9141 response from ECU $10 (shortened to only the first three messages for brevity):

48 6B 10 49 08 01 04 00 0D 09 first message
48 6B 10 49 08 02 03 38 03 B1 second message
48 6B 10 49 08 03 02 C7 03 B1 third message

shall be reported as '04000D09033803B102C703B1' when removing the header bytes and databytes #1 through #3 and consolidating the multiple messages into a single message.

Hardware:

Cabling:

3.2.170. The DAD cable(s) shall remain functional when a vehicle up to 14,000 GVWR is driven over it while the cable is lying on a concrete floor.

3.2.171. The DAD cable sheathing shall be of a material that will not leave markings on vehicle paint.

3.2.172. The DAD cable connectors shall be equipped with strain reliefs.

3.2.173. If hardwired DAD configuration, (originally supplied cable) shall be 15 feet ± 6 inches, between the SAE J1962 type A vehicle connector and the BAR OIS Computer.

3.2.174. The vendor may optionally offer various cable lengths (original 15 feet cable must still be provided) between the SAE J1962 type A vehicle connector and the BAR OIS Computer. All optional cable lengths shall be subject to, and must meet, all the Functional Validation Tests.

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Electrical Problems:

3.2.175. The DAD shall be designed to protect its circuitry from electrical damage caused by vehicles in compliance with the SAE J1978 specification.

Identification:

3.2.176. The DAD shall be equipped with an identification label that displays the Media Access Control (MAC) address or electronic serial number.

3.2.177. The DAD hardware/firmware shall be equipped with an electronic MAC address or electronic serial number.

3.2.178. Each DAD shall include an MAC or electronic serial number at the hardware level that is unique to the DAD.

3.2.179. The DAD MAC or electronic serial number shall be sent to the NWA upon request.

3.2.180. The DAD Provider shall submit to BAR for review and approval a list or numbering methodology for the MAC(s) or electronic serial number(s) used.

3.2.181. The DAD Provider shall submit to BAR for review and approval, a methodology for the assigning of MAC(s) or serial number(s) for refurbished DADs and for maintenance replacement units.

Durability:

3.2.182. The DAD shall withstand three consecutive drops onto a concrete floor from a height of 48” and continue to meet all requirements.

3.2.183. The DAD’s J1962 type A connector, which includes, the housing, pins, wiring, and strain reliefs shall remain functional under the following condition for a total of 5000 cycles (1 cycle = 1 connection + 1 disconnection): mating of the connectors with a 10° (+/- 2°) offset between centerlines of each, keeping two surfaces parallel.

3.2.184. The DAD’s connectors, which include, the housing, pins, wiring, and strain reliefs shall remain functional under the following condition for a total of 5000 cycles (1 cycle = 1 connection + 1 disconnection): disconnection, by pulling the cable with a 20 lb. force offset of the mating connector by 20° (+/- 4°).

Connectors:

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3.2.185. The DAD's connection to the vehicle's OBDII port shall conform to SAE J1962, April 2002, "External Test Equipment Connector Type A" and "Vehicle Connector Type A"

3.2.186. The DAD's connection to the vehicle's OBDII port shall be designed to prevent connection to a J1962 Type B Vehicle Connector.

3.2.187. The DAD's connection to the vehicle's OBDII port shall not use the optional spring clip identified in section 5.6 of J1962.

3.2.188. The pins used in the DAD's connectors shall have all edges "broken" (chamfered or rolled edges), in such that, the mating vehicle connector is not damaged. Reference: EN 22768-1:1993 (equivalent ISO 2768-1: 1989) and SAE J1962 revised APR2002.

3.2.189. For hardwired DAD devices, the connector between the DAD and the BAR OIS Computer shall be USB 2.0.

DAD Functionality Check;

3.2.190. The DAD shall include a mechanism to ensure that the DAD is functional during a Smog Check Inspection. [The intent of this functionality check is to verify that the DAD is functional and that the hardware has not been damaged since the previous inspection].

3.2.191. Two options of the device/mechanism for checking functionality shall be developed. BAR will decide which option will be deployed to the stations prior to implementation.

3.2.191.1. A simple functional checker; the DAD shall include a device/mechanism to verify the circuit integrity (e.g., continuity, open, short) of the cable from the DAD SAE J1962 connector to the OIS computer.

3.2.191.2. An OBD-II protocol device/simulator; the DAD shall include a device/mechanism capable of simulating each communication protocol.

3.2.191.2.1. The OBD-II protocol device/simulator shall verify the integrity of the DAD cable from the DAD SAE J1962 connector up to the DAD device/processor.

3.2.191.2.2. The OBD-II protocol device/simulator shall verify the integrity of the DAD device/processor itself to communicate on each protocol.

3.2.191.2.3. The OBD-II protocol device/simulator shall, by design, ensure that it cannot be used to simulate a successful inspection in lieu of an actual vehicle.

3.2.192. The DAD shall perform the functionality check when requested by the NWA.

3.2.193. The DAD functionality check results shall be reported to the OIS computer.

3.2.194. The DAD Functionality Check shall be further defined between the DAD Provider, BAR's NWA Contractor and BAR.

DAD General Electrical:

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3.2.195. The DAD shall not require power to be present on pin 16 in order to communicate with the vehicle.

3.2.195.1. The DAD may be designed to use power if it is present on pin 16 but shall not require it to be present.

3.2.195.2. If power is not present on pin 16, the DAD shall be supplied with an alternate means of powering.

3.2.196. The DAD shall not require pin 4 (chassis ground) to be connected to ground in order to communicate with the vehicle.

3.2.196.1. The DAD may be designed to use pin 4 if it is present but shall not require it to be present.

3.2.196.2. If ground is not present on pin 4, the DAD shall be supplied with an alternate means of grounding.

3.2.197. The DAD shall utilize pin 5 (signal ground) for the signal ground to establish and maintain communication with the vehicle if pin 5 is connected to ground.

3.2.197.1. If pin 5 is determined to not be connected to ground (e.g., via an electrical check for continuity, failure to establish communication, etc.), the DAD shall utilize pin 4 (chassis ground) for the signal ground if pin 4 is connected to ground.

3.2.198. The DAD shall retrieve data from an OBDII system while being subjected to Radio Frequency Interference (RFI) or Electromagnetic Interference (EMI) caused by vehicles under test, and/or other service station EMI/RFI generators, such as air compressors.

3.2.199. If wireless technology is used, there shall be no loss of communication between the transmitter and receiver when they are within 30’ (thirty feet) of each other.

3.2.199.1. There shall be no loss of communication between the DAD transmitter and receiver while either the DAD transmitter and/or receiver is within 3’ (three feet) of a BAR-97 Certified chassis dynamometer’s Power Absorption Unit (PAU) during loaded operation.

3.2.199.2. There shall be no loss of communication between the DAD transmitter and receiver while either the DAD transmitter and/or receiver is within 2’ (two feet) of a vehicle engine’s Original Equipment Manufacturer (OEM) (not modified) electronic engine controls, while the vehicle’s engine is running.

3.2.199.3. There shall be no loss of communication between the DAD transmitter and receiver, while either the DAD transmitter and/or receiver are within 5’ (five feet) of a five-hp. Alternating Current (AC) electric motor.

Future OBD Data:

3.2.200. For the ISO 15765-4 CAN protocol only, the DAD shall be capable of receiving a specific data request(s) from the NWA in the form of a Mode $xx PID $xx request message, be able to successfully format and transmit that message to the vehicle, retrieve the

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response from the vehicle, and process and transmit the response to the BAR NWA in a format determined by BAR (e.g., to allow capture of future data that is not included in the data files and/or defined by SAE yet). Such request messages will be restricted to SAE J1979 defined messages (i.e., Modes $01 through $0F including messages or data not currently identified in this specification and/or after being defined by SAE J1979 at a future time).

4. Functional Validation Tests

BAR will verify that each requirement of this specification has been met. The following is a sampling of the testing that will be done.

4.1. Testing:

4.1.1. The following item shall be subject to visual inspection and conducted at the discretion of BAR at standard ambient conditions (or simulated ambient conditions) ranging from 35 to 110 °F (2º to 43º C): Inspection of materials and fasteners: Pass = Verify that the materials used in construction are resistant to corrosion and abrasion.

4.1.2. The following item shall be subject to visual inspection and conducted at the discretion of BAR at standard ambient conditions (or simulated ambient conditions) ranging from 35 to 110 °F (2º to 43º C): Inspection of electrical connectors: Pass = Verify that the electrical connectors utilized coincide with connectors specified in the document.

4.1.3. The following item shall be subject to visual inspection and conducted at the discretion of BAR at standard ambient conditions (or simulated ambient conditions) ranging from 35 to 110 °F (2º to 43º C): Inspection of strain reliefs: Pass = Verify that strain reliefs are used on all connections.

4.1.4. All tests shall be performed both while the DAD is powered on and off and at standard ambient conditions (or simulated ambient conditions) ranging from 35 to 110 °, F, (2º to 43º C).

4.1.4.1. The DAD shall pass the following functional test performed by BAR: Drop test onto concrete floor three times from a height of 48”. Pass = Verify that the DAD is fully functional after the final drop.

4.1.4.2. The DAD shall pass the following functional test performed by BAR: Drive a vehicle up to 14,000 GVWR (+/- 500 lbs.) traveling at 5 ft/s (+/- 0.5 ft/s) over each cable. Repeat 10 times. Pass = Verify that the DAD is fully functional after the final drive-over.

4.1.4.3. The DAD shall pass the following functional test performed by BAR: Drive a vehicle up to 14,000 GVWR (+/- 500 lbs.) directly on top of each cable and let stand for a period of 10 minutes. Pass = Verify that the DAD is fully functional after the end of the test.

4.1.4.4. The DAD shall pass the following functional test performed by BAR: Apply battery voltage up to 24.0 V DC (+/- 1 volt) for a minimum of 10 minutes as a positive voltage applied to pin 16 and ground applied at pin 4 (chassis ground) and 5 (signal ground),

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of the J1962 external test connector. Pass = Verify that the DAD is fully functional after the end of the test.

4.1.4.5. The DAD shall pass the following functional test performed by BAR: Simulate a reverse vehicle battery voltage of up to 24.0 V DC for at least 10 minutes with ground applied to pin 16 and the positive battery voltage applied at pin 4 (chassis ground) and 5 (signal ground), of the J1962 external test connector. (The DAD will not be powered on due to the reversed polarity). Pass = Verify that the DAD is fully functional after the end of the test.

4.1.4.6. The DAD shall pass the following functional test performed by BAR: Apply battery voltage ranging from 8.0 to 15.0 V DC (+/- 1 volt) for a minimum of 5 minutes, positive voltage applied at pins 7 and 15 and ground applied at pin 4 (chassis ground) and 5 (signal ground), of the J1962 external test connector. Pass = Verify that the DAD is fully functional after the end of the test

4.1.4.7. The DAD shall pass the following functional test performed by BAR: Connector cyclic testing. The J1962 Type A, OBD connector, which includes, the housing, pins, wiring, and strain reliefs shall remain functional (defined as the ability to successfully retrieve the OBD data, detailed in this specification, upon completion of the following test for a total of 5000 cycles (1 cycle = 1 connection + 1 disconnection): Mating of the connectors with a 10° (+/- 2°) offset between centerlines of each, keeping two surfaces parallel.

4.1.4.8. The DAD shall pass the following functional test performed by BAR: Connector cyclic testing. The J1962 Type A, OBD connector, which includes, the housing, pins, wiring, and strain reliefs shall remain functional (defined as the ability to successfully retrieve the OBD data, detailed in this specification, upon completion of the following test for a total of 5000 cycles (1 cycle = 1 connection + 1 disconnection): Disconnection, by pulling the cable with a 20 lb. force offset of the mating connector by 20° (+/- 4°).

4.1.5. The DAD shall pass the following functional test performed by BAR: Automatic (without user intervention) DAD boot up upon PC start.

4.1.6. The DAD shall pass the following functional test performed by BAR: Successfully initialize / communicate with all OBDII relevant ECUs and retrieve all of the OBDII data specified in requirements for 99.9% of the OBDII equipped vehicles tested by BAR.

4.1.7. The DAD shall pass the following functional test performed by BAR: Successful transmission of all OBDII data, detailed in this specification, from all OBDII relevant ECUs, to the NWA for 99.9% of the OBDII equipped vehicles tested by BAR.

4.1.8. The DAD shall pass the following functional test performed by BAR: Successful update of the DAD firmware and software using the DAD Provider's proposed mechanism.

4.1.9. The DAD shall pass the following functional test performed by BAR: If wireless technology is used, there shall be no loss of communication between the transmitter and receiver when they are within 30' (thirty feet) of each other.

4.1.10. The DAD shall pass the following functional test performed by BAR: If wireless technology is used, there shall be no loss of communication between the transmitter and

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receiver while either the DAD transmitter and/or receiver is within 3' (three feet) of the chassis dynamometer's PAU during loaded operation.

4.1.11. The DAD shall pass the following functional test performed by BAR: If wireless technology is used, there shall be no loss of communication between the transmitter and receiver while either the DAD transmitter and/or receiver is within 2' (two feet) of a vehicle engine's OEM (not modified) electronic engine controls, while the vehicle's engine is running.

4.1.12. The DAD shall pass the following functional test performed by BAR: If wireless technology is used, there shall be no loss of communication between the transmitter and receiver while either the DAD transmitter and/or receiver is within 5' (five feet) of a five-hp. AC electric motor.

4.1.13. The DAD shall pass the following functional test performed by BAR: Successful creation of all data files, detailed in this specification, for each and every communication protocol identified in the "Communication Protocols" section, a successful communication event as well as for an unsuccessful communication event (which may be simulated by disabling communication on an OBDII equipped vehicle or other method approved by BAR)

4.1.14. A connectivity rate, as required in this document, determined from manufacturer selected and BAR approved Beta sites. The vehicles subject to testing during Beta shall follow a model year distribution proportionate to that of the CA Smog Check fleet.

4.1.15. The DAD Provider shall provide proof to BAR of successful testing of requirement 4.1.4.7.

4.1.16. The DAD Provider shall provide proof to BAR of successful testing of requirement 4.1.4.8.

5. DAD Certification

5.1. Certification:

The BAR will certify a single DAD Provider's device. If the DAD Provider cannot fulfill the requirements of this specification, BAR at its sole discretion may certify additional devices and/or decertify the original device.

BAR will certify the DAD Provider's device after verification that all of the requirements in this specification have been met.

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