



SURFACE VEHICLE RECOMMENDED PRACTICE



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(R) Vehicle OBD II Compliance Test Cases

RATIONALE

Corrections have been made to this document in order to keep pace with and agree with changes made to the California Air Resources Board legislation: Title 13, California Code Regulations, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II), particularly with regards to permanent DTCs and new diesel engine requirements. Many functional enhancements have also been included in this document.

FOREWORD

At the request of the California Air Resources Board (CARB), SAE members have generated this document to serve as a guide for testing vehicles for compliance with U. S. Federal and CARB requirements for emission-related on-board diagnostic functions (OBD II).

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1. SCOPE

The main purpose of this Recommended Practice is to verify that vehicles are capable of communicating a minimum subset of information, in accordance with the diagnostic test services specified in SAE J1979: *E/E Diagnostic Test Modes*, or the equivalent document ISO 15031-5: *Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics – Part 5: Emissions-related diagnostic services*.

Any software meeting these specifications will utilize the vehicle interface that is defined in SAE J2534, *Recommended Practice for Pass-Thru Vehicle Programming*.

2. REFERENCES

This specification takes precedence over all conflicts in the documents cited in this section.

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

1) SAE J1850 (May 2001) Class B Data Communications Network Interface

2) SAE J1930 Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms

NOTE: Equivalent to ISO/DIS 15031-2—Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics—Part 2: Terms, definitions, abbreviations and acronyms.

3) SAE J1962 Diagnostic Connector

NOTE: Equivalent to ISO/DIS 15031-3—Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics—Part 3: Diagnostic connector and related electrical circuits, specification and use

4) SAE J1978 (April 2002) OBD II Scan Tool

NOTE: Equivalent to ISO/DIS 15031-4—Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics—Part 4: External test equipment

5) SAE J1979 (May 2007) E/E Diagnostic Test Modes

NOTE: Equivalent to ISO/DIS 15031-5 (April 30, 2002)—Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics—Part 5: Emissions-related diagnostic services

6) SAE J2012 (April 2002) Diagnostic Trouble Code Definitions

NOTE: Equivalent to ISO/DIS 15031-6 (April 30, 2002)—Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics—Part 6: Diagnostic trouble code definitions

7) SAE J2284-3 (March 2002) High-Speed CAN (HSC) for Vehicle Applications at 500 KBPS

8) SAE J2534 (April 2004) Recommended Practice for Pass-Thru Vehicle Programming

2.1.2 ISO Publications

Available from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

- 1) ISO 9141-2 Road vehicles—Diagnostic systems—Part 2: CARB requirements for interchange of digital information
- 2) ISO 14230-4 Road vehicles—Diagnostic systems—Part 4: KWP 2000 requirements for emission related systems
- 3) ISO/DIS 15031-2 Communication between vehicle and external equipment for emissions-related diagnostics—Part 2: Terms, definitions, abbreviations and acronyms (Equivalent to SAE J1930)
- 4) ISO/DIS 15031-3 Communication between vehicle and external equipment for emissions-related diagnostics—Part 3: Diagnostic connector and related electrical circuits, specification and use (Equivalent to SAE J1962)
- 5) ISO/DIS 15031-4 Communication between vehicle and external equipment for emissions-related diagnostics (Equivalent to SAE J1978)
- 6) ISO/DIS 15031-5 Communication between vehicle and external equipment for emissions-related diagnostics—Part 5: Emissions-related diagnostic services (Equivalent to SAE J1979)
- 7) ISO/DIS 15031-6 Communication between vehicle and external equipment for emissions-related diagnostics—Part 6: Diagnostic trouble code definitions (Equivalent to SAE J2012)
- 8) ISO 15765-4 Road vehicles—Diagnostics on controller area network (CAN)—Part 4: Requirements for emissions-related systems

2.2 Related Publications

The following publications are for information purposes only and are not a required part of this document.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

- 1) SAE J1699®-1 SAE J1850 Verification Test Procedures
- 2) SAE J1699®-2 OBD II Related SAE Specification Verification Test Procedures

2.2.2 ISO Publications

Available from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

- 1) ISO 11898 Road vehicles, Interchange of Digital information, Controller Area Network (CAN) for High Speed Communication
- 2) ISO 14229 Road Vehicles, Diagnostic Systems, Specification of Diagnostic Services

2.2.3 Other Publications

CARB Regulation – title:

Modifications to Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II), Section 1968.2, Title 13, California Code Regulations

NOTE: Public comment on proposed changes ended November 1, 2002.

Web address: <<http://www.arb.ca.gov/msprog/obdprog/obdregs.htm>>

2.3 Definitions

The definitions provided in SAE J1930 apply to this document as applicable.

2.3.1 Definition of Terms

The definitions of terms that are related to the use of this document may be found in the publications listed under 2.1, Applicable Publications.

2.3.2 Acronyms

The following are common acronyms used in this document:

- A/C Air Conditioning
- CAN Controller Area Network
- CALID Calibration Identification
- CID Component ID
- CVN Calibration Verification Number
- DLC Data Length Code (also Data Link Connector, e.g., SAE J1962 connector)
- DTC Diagnostic Trouble Code
- DTM Diagnostic Test Mode
- ECU Electronic Control Unit
- HEV Hybrid Electric Vehicle
- HSC High Speed CAN
- ID Identification (number)
- I/M Inspection and Maintenance
- ISO International Standards Organization
- Kbps Kilobits per second
- KWP Key Word Protocol
- MIL Malfunction Indicator Lamp
- OBD-II On Board Diagnostics (level 2)
- OBDM On Board Diagnostic Monitor
- PCM Powertrain Control ECU
- PWM Pulse Width Modulation
- PID Parameter Identification (number)
- RPM Revolutions Per Minute (engine speed)
- SAE SAE International
- SID Service ID
- TID Test ID
- VIN Vehicle Identification Number
- VPW Variable Pulse Width (modulation)

3. OVERVIEW

The purpose of the testing is to gain confidence that communications with the vehicle can be established and maintained according to the protocols allowed in SAE J1979 (ISO 15031-5), and further, that the test modes (diagnostic services) defined in SAE J1979 and implemented on the vehicle adhere to the defined structure and return data which can be interpreted using the information contained in this SAE J1979 document.

This SAE J1699®-3 document is structured in the following manner:

Section 3 – Provides an overview and specifies general conditions for testing.

Section 4 – Defines the required message structure and required timing for each protocol.

Sections 5 through 9 – These sections are known as the Static Test. Most of the Static Test can be run in approximately 15 minutes without driving the vehicle. A complete test of permanent codes required running the CARB drive cycle.

Sections 10 through 11 – These sections are known as the Dynamic Test. The Dynamic Tests must be run over several driving cycles and requires the vehicle to be driven.

Within each subsection, the Request and Response message data for each of the allowed protocols and test mode (service) that need to be conducted are defined. Evaluation criteria to judge success or failure are defined.

Figure 1 shows which services are tested under each operating condition.

Section	Condition	Services	Purpose
5	No Malfunctions	\$01, \$02, \$03, \$04, \$05, \$06, \$07, \$08, \$09, \$0A	Basic test Service support
6	Pending Trouble Codes	\$07, \$02, \$03	DTC and status properly reported
7	Confirmed DTC	\$07, \$02, \$03	DTC and status properly reported
8	Fault Repaired	\$07, \$02, \$03, \$04	DTC and status properly reported
9	After 3 Driving Cycles	\$07, \$02, \$03, \$04, \$0A	DTC and status properly reported
10	No Malfunctions	\$03, \$04, \$01, \$06, \$07, \$09	Check in-use performance counters
11	No Malfunctions	\$03, \$04, \$01, \$06, \$07, \$09	Check I/M readiness bits

FIGURE 1 - CONDITIONS AND SERVICES TESTED

3.1 Select Static Test or Dynamic Test Sequence

Purpose: Each group of tests will establish that under normal operating conditions, communication can be established and that all supported test services behave correctly. The following tests can be run in three major groups.

Sections 5 through 9 (Static Test) are run as a group to assess basic vehicle communication functionality.

Sections 10 through 11 (Dynamic Test) are run as a group to assess proper function of the I/M Readiness bits and to assess proper function of the in-use performance counters. Because the Dynamic Tests require driving a vehicle for as long as several days, the Dynamic Test has provisions to resume testing after the requisite monitoring cycles have been performed.

Any software meeting these specifications shall contain the following provisions for the user:

Run Static Tests contained in Sections 5 through 9

Run Dynamic Tests contained in Sections 10 though 11

Resume Dynamic Tests contained in Sections 10 though 11

NOTE: The following text contains suggested prompts for the user of any software meeting these specifications:

Prompt 1:

Prompt user for how many diagnostic critical or emission critical ECUs are present in the vehicle. (Determine how many ECUs will respond to Service \$01, PID \$00 and Service \$09, CALID requests.)

Prompt 2:

Prompt user for how many reprogrammable, diagnostic-critical or emission-critical ECUs are present in the vehicle. (Determine how many ECUs will respond to Service \$09 CVN.)

Prompt 3:

Prompt user for the Model Year (model year as indicated by VIN) of the vehicle being tested. (Determine what info types must be supported in Service \$09.) The format should be 20XX. If the vehicle VIN model year in Service \$09 does not match the user data, assume that the user is engaged in development work and use the model year input by the user to determine test criteria within this document.

Prompt 4:

Prompt user for the type of engine (spark ignition, compression ignition or hybrid) in the vehicle being tested. (Determine what PIDs must be supported in Service \$01 and Service \$02.)

Prompt 5:

Prompt user whether to perform the Static Test or the Dynamic Test.

It is expected that formal testing will be conducted on a production vehicle containing no faults with the test equipment connected via the SAE J1962 diagnostic connector. Formal testing will follow the order defined in this document.

It is assumed that these tests will also be conducted during vehicle development. If the tests are to be run off vehicle, out of order, or the initial conditions have not been controlled, then care needs to be taken when interpreting the results.

It is a suggested software implementation that a logfile with test results be retained to support manufacturers' OBD-II certification efforts. There should be a separate logfile retained for the static test and for the dynamic test. In addition to recording the test results and timestamping data, the logfile should record the vehicle VIN, as well as the CALID and the CVN of all ECUs that respond with that data to help identify the specific vehicle that was tested and the level of software in each ECU.

Note that some items that are tested in one section are tested again in another section. Although this is redundant from a testing standpoint, it was anticipated that software that meets these specifications would be reusing large portions of modular code. This document was structured to allow for maximum reuse of modular software.

The following notes are applicable to the vehicle testing described in this document:

1. Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts (i.e., nominal 12-volt system with the engine off and the engine running). Any software meeting these specifications will check voltage to ensure that it is within the specified range each time the software executes the protocol determination routine. If battery voltage falls outside the specified range, the software will flag a warning and prompt the operator to determine if testing is to continue.
2. All data specified within messages are hex unless otherwise specified.
3. Multiple ECUs can respond to SAE J1979 (ISO 15031-5) request messages.
4. XX = valid reported hex data (data not checked/specify in this document).
5. x = valid reported bit data (data not checked/specify in this document).
6. Vehicles utilizing the ISO 9141-2 Protocol, especially when supplemented with the use of ISO 14230-4 (KWP 2000), may deviate from the vehicle response to diagnostic messages specified in these documents. In these instances, the instructions contained in SAE J1979 (ISO 15031-5) shall take precedence.
7. Each OBD ECU will respond within the time defined in 4.2.
8. OBD messages on ISO 15765-4 protocol shall only be received from the CAN identifiers shown in Figures 4 and 5 below. The maximum number of legislated OBD ECUs in an OBD compliant vehicle shall not exceed eight (8). For a given vehicle, each OBD identifier must be unique. The SAE J2534 device will ignore OBD responses from CAN identifiers not shown in Figures 4 and 5.
9. It is assumed that any software meeting these specifications will follow the testing sequence specified in this document. Failure to do so may result in incorrect results.
10. Tester Present / Keep Alive Strategy - For protocols that require periodic messages to maintain diagnostic operation after link initialization, the following strategies shall be implemented.

During test case execution, except the burst mode test and idle message timing test:

At least every 2.0 ± 0.5 seconds, a Service \$01 PID \$00 request will be sent out. The proper response from all OBD ECUs will be verified or the diagnostic link will be flagged as being "down" and the test aborted.

Waiting for user input:

When the link must be maintained during periods where the program is stalled waiting for user input, the SAE J2534 interface's periodic message capability should be used to maintain the diagnostic link. The Service \$01 PID \$00 request should be scheduled at a 1.0 second interval. At no other time should the periodic message capability be used.

After the user input has been gathered, the periodic message should be stopped and any response messages from the periodic Service \$01 PID \$00 messages should be read and discarded from the SAE J2534 device before the next test is executed. Special care should be exercised to be sure that the last periodic message has been sent and any replies generated are discarded. This can be accomplished by attempting to receive responses for two seconds after the periodic message has been stopped.

11. It is assumed that all OBD emission or diagnostic-critical ECUs support Mode \$01, PID \$00.
12. Procedure to determine when the link drops out - Send Service \$01 PID \$00. The proper response from all OBD ECUs will be verified or the diagnostic link will be flagged as being "down" and the test aborted.

13. Repeated/identical responses from a given ECU for a given request message shall be flagged as a warning. Any software meeting these specifications will use the last response.

14. Windows 95, Windows 98, and Windows ME shall not be used as the operating system for vehicle testing due to inadequate timer resolution. If one of these operating systems is identified, the software will flag a warning.

15. When performing protocol initialization for ISO 9141-2 and ISO 14230-4 protocols, ensure that K and L Line is initialized at idle (logic 1) for greater than 300 milliseconds after the 5 second wait time between communication attempts has expired.

16. A failure is defined as an ECU response that does not meet the evaluation criteria described in this document and does not meet the requirements specified in the OBD-II regulations or another SAE/ISO document referenced by the OBD-II regulations. A warning is defined as an ECU response that does not meet the evaluation criteria described in this document and may or may not meet the requirements specified in the OBD-II regulations or another SAE/ISO document referenced by the OBD-II regulations. Warnings require the operator to evaluate whether the ECU response is correct for the particular vehicle and software application. The operator, therefore, must determine whether the vehicle meets the appropriate OBD-II requirements.

17. A "single request" refers using ISO 15765-4 to request only a single data item, e.g. a single PID, even though ISO 15765-4 allows requests for multiple data items in a single message, e.g. six PIDs.

4. DIAGNOSTIC MESSAGE FORMAT AND TIMING

4.1 Message Format

The diagnostic message formats used for diagnostic protocols ISO 9141-2, including Keyword 2000, and SAE J1850 are shown in Figure 2. The message format for CAN, including SAE J2284-3 (500 Kbps), and defined in ISO 15765-4 is shown in Figure 3.

Diagnostic Message Formats

Header bytes (Hex)			Data bytes								
Priority/Type	Target address (hex)	Source address (hex)	#1	#2	#3	#4	#5	#6	#7	ERR	RESP
Diagnostic request at 10.4 kbit/s: SAE J1850 and ISO 9141-2											
68	6A	F1	Maximum 7 data bytes					Yes	No		
Diagnostic response at 10.4 kbit/s: SAE J1850 and ISO 9141-2											
48	6B	ECU addr	Maximum 7 data bytes					Yes	No		
Diagnostic request at 10.4 kbit/s (ISO 14230-4)											
11LL LLLLb	33	F1	Maximum 7 data bytes					Yes	No		
Diagnostic response at 10.4 kbit/s (ISO14230-4)											
10LL LLLLb	F1	addr	Maximum 7 data bytes					Yes	No		
Diagnostic request at 41.6 kbit/s (SAE J1850)											
61	6A	F1	Maximum 7 data bytes					Yes	Yes		
Diagnostic response at 41.6 kbit/s (SAE J1850)											
41	6B	addr	Maximum 7 data bytes					Yes	Yes		
LL LLLL = Length of data bytes											

FIGURE 2 - DIAGNOSTIC MESSAGE FORMAT FOR ISO 9141-2, ISO 14230-4 AND SAE J1850

Header bytes		CAN frame data field							
CAN Identifier (11 or 29 bit)		#1	#2	#3	#4	#5	#6	#7	#8

FIGURE 3 - DIAGNOSTIC MESSAGE FORMAT FOR ISO 15765-4

ECU responses will be verified to be properly padded per ISO 15765-4. Per ISO 15765-4, pad bytes from the ECU to the tool are not specified. Incorrect padding (i.e., lack of pad bytes) for messages from the ECU to the tool shall be flagged as a one-time failure. Within this document, pad bytes from the tool to the ECU will be set to \$00.

CAN communication is required to be 500 kbps to meet OBD II requirements.

CAN identifiers are defined in Figures 4 and 5 below.

CAN Identifier	Description
\$7DF	CAN Identifier for functionally addressed request messages sent by the external test equipment.
\$7E0	Physical request CAN Identifier from the external test equipment to ECU #1
\$7E8	Physical response CAN Identifier from ECU #1 to the external test equipment
\$7E1	Physical request CAN Identifier from the external test equipment to ECU #2
\$7E9	Physical response CAN Identifier from ECU #2 to the external test equipment
\$7E2	Physical request CAN Identifier from the external test equipment to ECU #3
\$7EA	Physical response CAN Identifier from ECU #3 to the external test equipment
\$7E3	Physical request CAN Identifier from the external test equipment to ECU #4
\$7EB	Physical response CAN Identifier from ECU #4 to the external test equipment
\$7E4	Physical request CAN Identifier from the external test equipment to ECU #5
\$7EC	Physical response CAN Identifier from ECU #5 to the external test equipment
\$7E5	Physical request CAN Identifier from the external test equipment to ECU #6
\$7ED	Physical response CAN Identifier from ECU #6 to the external test equipment
\$7E6	Physical request CAN Identifier from the external test equipment to ECU #7
\$7EE	Physical response CAN Identifier from ECU #7 to the external test equipment
\$7E7	Physical request CAN Identifier from the external test equipment to ECU #8
\$7EF	Physical response CAN Identifier from ECU #8 to the external test equipment

FIGURE 4 - CAN 11 BIT IDENTIFIERS

CAN Identifier	Description
\$18DB 33 F1	CAN Identifier for functionally address request messages sent by the external test equipment.
\$18DA xx F1	Physical request CAN Identifier from the external test equipment to ECU #xx
\$18DA F1 xx	Physical response CAN Identifier from ECU #xx to the external test equipment

FIGURE 5 - CAN 29 BIT IDENTIFIERS

4.2 Message Timing

It is not the purpose of this document to test the low level timing of each of the protocols, however, the response time to the request messages is important.

The test equipment must be capable of measuring the response time to an accuracy of at least 1 ms.

The times defined in Figure 6 below are from the end of the request message to the start of the first response for ISO 9141-2, ISO 14230-4 and SAE J1850 protocols. In the case where multiple ECUs respond to the same request, it is the time between responses. Note that ISO 9141-2 and ISO 14230-4 responses that occur before the minimum P2 timing will be flagged as a failure.

ISO 9141-2	ISO 14230-4	SAE J1850	ISO 15765-4
25 to 50 ms for key word \$0808 0 to 50 ms for key word \$9494	25 - 50 ms for key words: \$8FE9 (2025 dec), \$8F6B (2027 dec), \$8F6D (2029 dec), \$8FEF (2031 dec) NOTE: Only functionality of key byte 2025 dec is allowed!	100 ms	50 ms

FIGURE 6 - MESSAGE RESPONSE TIMES

Responses received after the times indicated will be ignored. In some cases, a failure to respond may mean that a test will fail, or it may simply mean that the request is not supported.

4.2.1 ISO 9141-2 and ISO 14230-4 implementation example

This section provides an implementation example for client/external test equipment and server/ECU. It is assumed that the client (external test equipment) communicates to a vehicle with two (2) emission-related OBD servers (ECUs). The client requests a CVN, which is only supported by server #1 (ECU #1) with two (2) response messages. Server #2 (ECU #2) is not flash programmable. Figure 7 graphically depicts the timing handling in the client and two (2) servers for a functionally addressed request message. A description follows the figure that references the points marked in Figure 7. Note that the term server refers to the ECU, while the term client refers to the test tool.

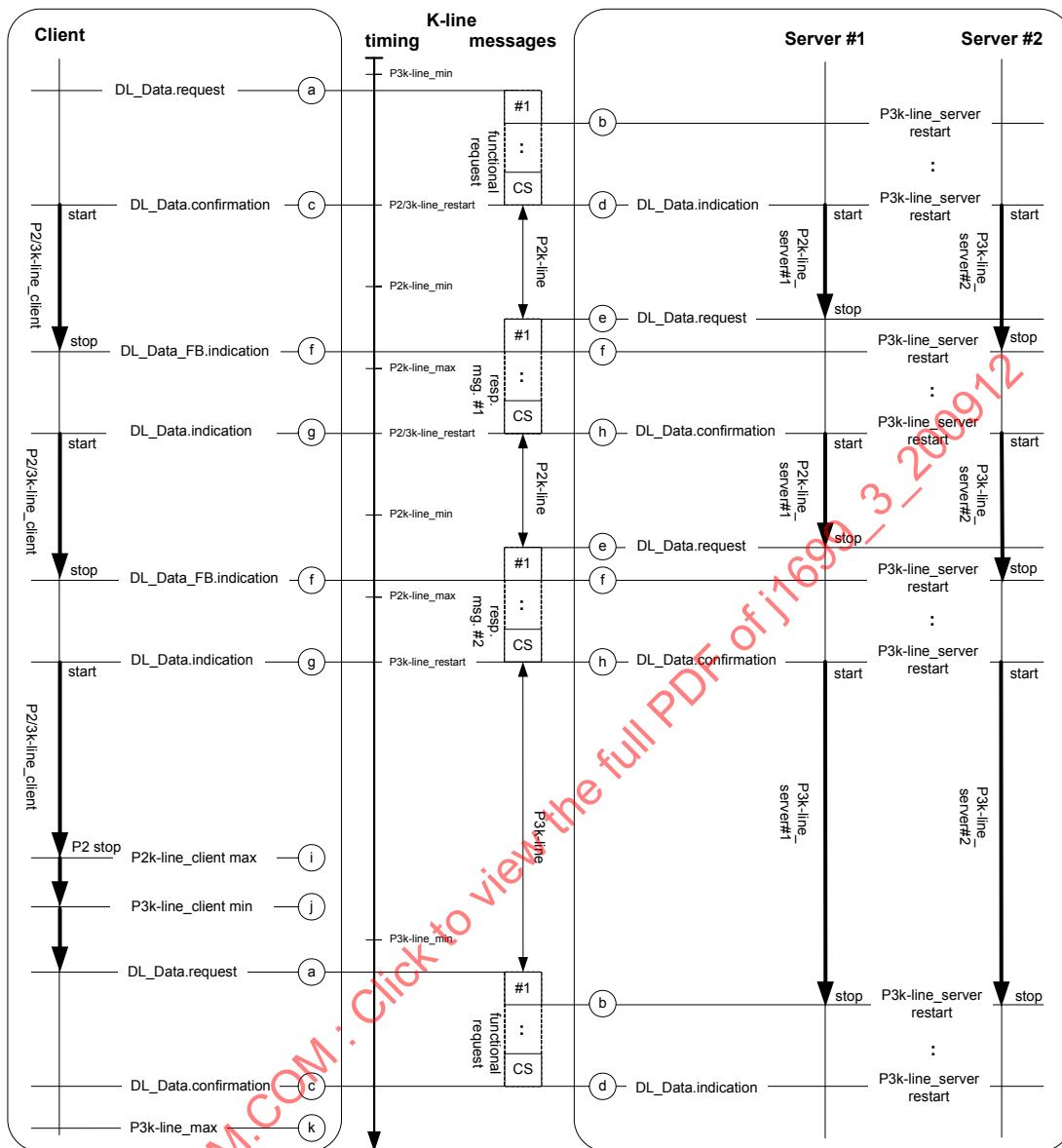


FIGURE 7 - ISO 9141-2 AND ISO 14230-4 PROTOCOL CLIENT AND SERVER TIMING BEHAVIOR

From a server point of view there is no difference in the timing handling compared to a physically addressed request message. The server shall reset the $P3_{k\text{-line}}$ timer value on each received byte regardless of whether the byte is part of a request message or a response message from another server or an echo from its transmit line. There are several methods of how a server could implement the timing handling. The implementation of timing parameters is not part of this specification but an important system supplier responsibility. Some general server timing parameter implementation guidelines are described in this section. The server time stamps each receiver interrupt event and restarts/resets the $P3_{k\text{-line}}$ timer or timing value e.g. ISR time stamps received byte and processing of the received information is performed outside the ISR. For simplification of the diagram the Figure 7 only shows a $P3_{k\text{-line}}$ restart after the reception of the first byte and last byte (checksum) of a received message. The $P3_{k\text{-line}}$ restart is required on each received byte. The received message can be either a request message from the client or a response message from any other server connected and initialized by the 33 hex address. If the server has received a complete message it compares the target address with the 33 hex address.

Figure 7 shows the client and two (2) initialized servers connected via K-line (either ISO 9141-2 or ISO 14230-4 protocol. The relevant events for the client and both servers are marked and described.

- a) The diagnostic application of the client starts the transmission of a functionally addressed request message by issuing a DL_Data.request to its data link layer. The data link layer transmits the request message to the servers.
- b) Both servers and the client receive a byte of a message via a receive interrupt by the UART. The ISR (Interrupt Service Routine) either restarts the P2_{K-line} / P3_{K-line} timers or time stamps the received byte.
- c) The completion of the request message is indicated in the client with DL_Data.confirmation. When receiving the DL_Data.confirmation the client starts its P2_{K-line}_and P3_{K-line} timer, using the default reload values P2_{K-line_max} and P3_{K-line_max}.
- d) If the last message byte is received, each server checks whether the received message includes a target address which matches the 33 hex address. If the result is a match (server#1 and #2) then the completion of the request message is indicated in the servers via DL_Data.indication and each server needs to determine whether it supports the request and has a message available to respond with. If a server determines that the address in the received message is different than 33 hex, or if the address is a match but no response has to be sent (server#2), the P2 timer is stopped. Since the P3_{K-line} timer has already been restarted no further action is required. If a response message is available and has to be sent (server#1, but not server#2) then the transmission of the response message shall be started after P2_{K-line_min} timing is expired.
- e) Server#1 starts the response message by indicating a DL_Data.request from the application to the data link layer and at the same time stops its P2_{K-line} timer.
- f) Both servers and the client receive a byte of a message via a receive interrupt by the UART. The ISR (Interrupt Service Routine) restarts the P2_{K-line} / P3_{K-line} timers or time stamps the received byte and the client issues a DL_Data_FB.indication to the application layer.
- g) The completion of the response message is indicated in the client with DL_Data.indication. When receiving the DL_Data.indication the client starts its P2_{K-line} and P3_{K-line} timer, using the default reload values P2_{K-line_max} and P3_{K-line_max}.
- h) Both servers have received the last byte of a message via a receive interrupt by the UART. The ISR (Interrupt Service Routine) either resets the P2_{K-line} / P3_{K-line} timers or time stamps the received byte. The completion of the response message (e.g. length and checksum check) is indicated in server#1 via DL_Data.confirmation. If server#1 does not want to send further response messages, it stops its P2 timer. In server#2 the message is received and the P3_{K-line} timer is restarted, but no DL_Data.indication is forwarded to the application because the target address does not match the 33 hex (target address of this message is the tester address F1 hex).
- i) The client application detects a P2_{K-line_max} timeout, which indicates that all response messages from all servers are received.
- j) The client application indicates that P3_{K-line_min} is reached and that the P3_{K-line} timing window is now open to send a new request message (see a)).

4.2.2 ISO 15765-4 functional OBD communication during defaultSession

Figure 8 graphically depicts the timing handling in the client and two (2) servers for a functionally addressed request message during the default session. A description follows the figure that references the points marked in Figure 8.

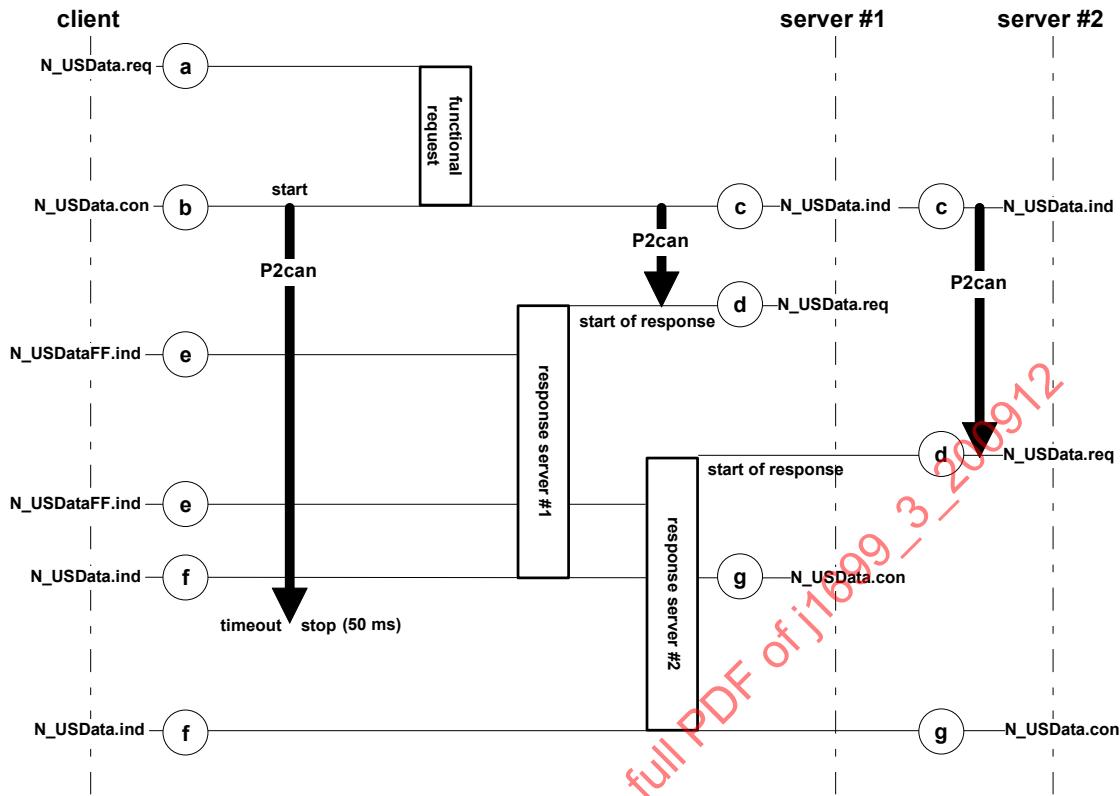


FIGURE 8 - FUNCTIONAL OBD COMMUNICATION - DEFAULT RESPONSE TIMING

From a server point of view there is no difference in the timing handling compared to a physically addressed request message, but the client shall handle the timing different compared to physical communication.

- The diagnostic application of the client starts the transmission of a functionally addressed request message by issuing an N_USData.req to its network layer. The network layer transmits the request message to the servers. A functionally addressed request message shall only be a single frame message.
- The completion of the request message is indicated in the client via N_USData.con. When receiving the N_USData.con the client starts its P2_{CAN} timer, using the default reload value P2_{CAN}. For simplicity Figure 8 assumes that the client and the server are located on the same network.
- The completion of the request message is indicated in the servers via N_USData.ind.
- The functionally addressed servers are required to start with their response messages within P2_{CAN} after the reception of N_USData.ind. This means that in case of a multi-frame response messages the FirstFrame shall be sent within P2_{CAN} and for single frame response messages that the SingleFrame shall be sent within P2_{CAN}.
- In case of a multi-frame response message the reception of the FirstFrame from any server is indicated in the client via the N_USDataFF.ind of the network layer. A single frame response message is indicated via N_USData.ind.
- When receiving the FirstFrame/SingleFrame indication of an incoming response message the client either stops its P2_{CAN} in case it knows the servers to be expected to respond and all servers have responded or keeps the P2_{CAN} running if the client does not know the servers to be expected to respond (client awaits the start of further response messages). The network layer of the client will generate a final N_USData.ind in case the complete message is received or an error occurred during the reception. The reception of a final N_USData.ind of a multi-frame message in the client will not have any influence on the P2_{CAN} timer.
- The completion of the transmission of the response message will also be indicated in the servers via N_USData.con.

4.2.3 Functional OBD communication during defaultSession with enhanced response timing

Figure 9 graphically depicts the timing handling in the client and two (2) servers for a functionally addressed request message during the default session, where one server requests an enhanced response timing via a negative response message including response code 78 hex. A description follows the figure that references the points marked in Figure 9.

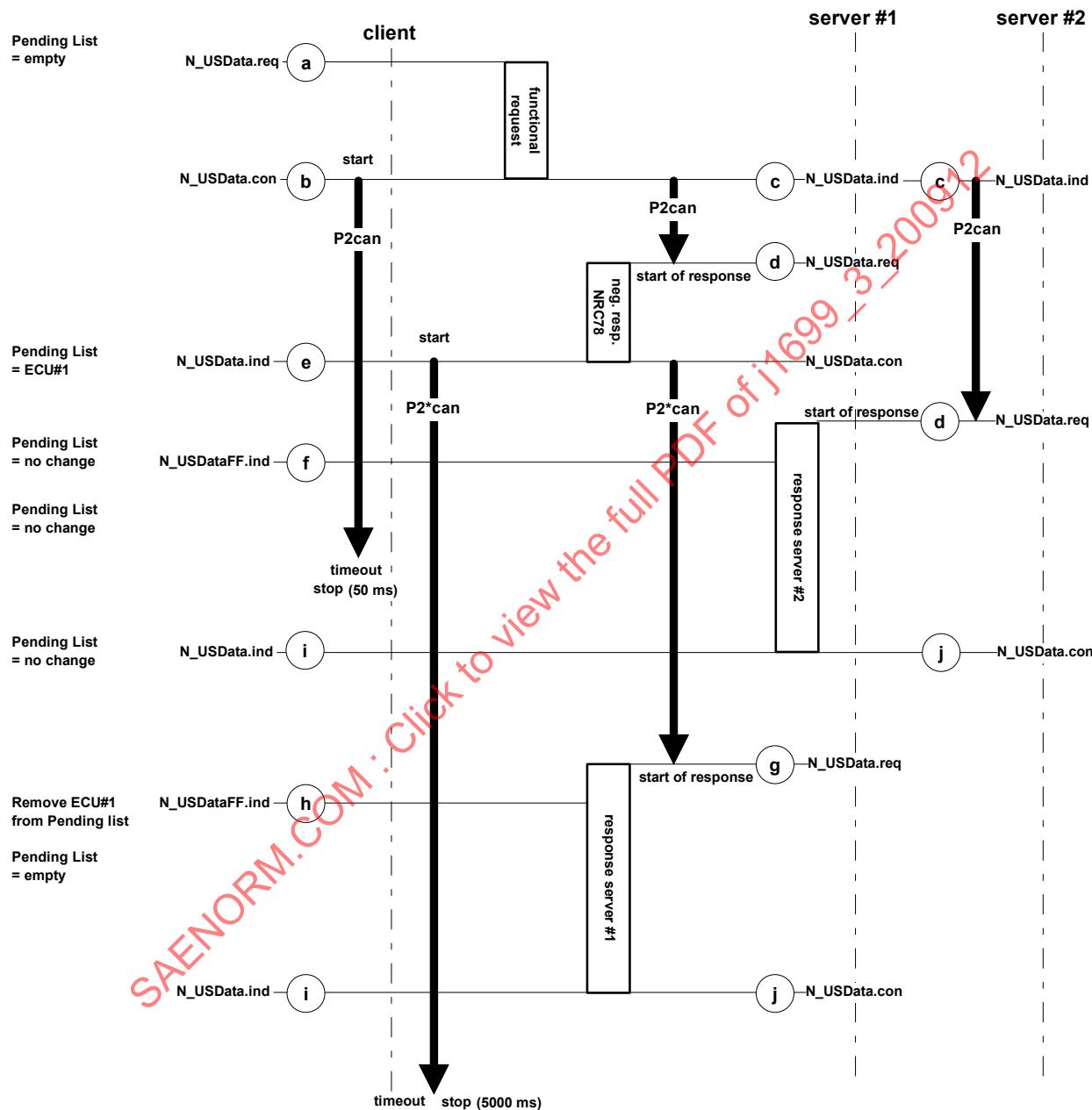


FIGURE 9 - FUNCTIONAL OBD COMMUNICATION - ENHANCED RESPONSE TIMING

From a server point of view there is no difference in the timing handling compared to a physically addressed request message that requires enhanced response timing, but the client shall handle the timing differently compared to physical communication.

- a) The diagnostic application of the client starts the transmission of the functionally addressed request message by issuing a N_USData.req to its network layer. The network layer transmits the request message to the servers. A functionally addressed request message shall only be a single frame message.
- b) The completion of the request message is indicated in the client via N_USData.con. When receiving N_USData.con the client starts its $P_{2\text{CAN}}$ timer, using the default reload value $P_{2\text{CAN}}$. For the response message the value of the $P_{2\text{CAN}}$ timer shall consider any latency that is involved based on the vehicle network design (e.g. communication over gateways, bus bandwidth, etc.). For simplicity the figure assumes that the client and the server are located on the same network.
- c) The completion of the request message is indicated in the servers via N_USData.ind.
- d) The functionally addressed servers are required to start with their response messages within $P_{2\text{CAN}}$ after the reception of N_USData.ind. This means that in case of a multi-frame response messages the FirstFrame shall be sent within $P_{2\text{CAN}}$ and for single frame response messages that the SingleFrame shall be sent within $P_{2\text{CAN}}$. In case any of the addressed servers cannot provide the requested information within the $P_{2\text{CAN}}$ response timing it can request an enhanced response timing window by sending a negative response message including response code 78 hex (this is not allowed for service \$01).
- e) Upon the reception of the negative response message within the client, the client network layer generates a N_USData.ind. The reception of a negative response message with response code 78 hex causes the client to continue its $P_{2\text{CAN}}$ timer in order to observe other servers to respond within $P_{2\text{CAN}}$. In addition, the client establishes an enhanced $P_{2^*\text{CAN}}$ timer for observation of further server #1 response(s). The client shall store a server identification in a list of pending response messages. Once a server that is stored as pending in the client starts with its final response message (positive response message or negative response message including a response code other than 78 hex) it is deleted from the list of pending response messages. For simplicity Figure 9 only shows a single negative response message including response code 78 hex from server #1.
- f) Server #2 transmits a FirstFrame of a multi-frame response message within $P_{2\text{CAN}}$. The reception of the FirstFrame is indicated in the client network layer by a N_USDataFF.ind. Figure 9 shows when the client receives the start of the response message of the second server.
- g) Server #1 previously indicated to the client (e) enhanced response timing. Once server #1 can provide the requested information it starts with its final response message by issuing a N_USData.req to its network layer. If the server #1 can still not provide the requested information within the enhanced $P_{2^*\text{CAN}}$ then a further negative response message including response code 78 hex can be sent. This will cause the client to reload its $P_{2^*\text{CAN}}$ timer value again. A negative response message including response code 78 hex from a server that is already stored in the list of pending response messages has no affect to the client internal list of pending response messages.
- h) Server #1 transmits a FirstFrame of a multi-frame response message within $P_{2^*\text{CAN}}$. The reception of the FirstFrame is indicated in the client network layer by a N_USDataFF.ind. Figure 9 shows when the client receives the start of the response message of the server #1. The client removes server #1 from the internal list of pending response messages.
- i) The client network layer will generate a N_USData.ind.
- j) The server network layer will generate a N_USData.con based on the completion of the transmission.

4.3 Data Not Available

4.3.1 Protocols: ISO 9141-2, ISO 14230-4 and SAE J1850

There are two conditions for which data is not available:

1. Service is not supported.
2. Service is supported but data is not available at the time that the request is made.

Table A indicates the proper ECU response for each protocol as detailed in SAE J1979 (ISO 15031-5).

TABLE A - PROPER RESPONSE FROM ECU

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
a) Service \$01 not supported	All ECUs must respond to Service \$01 PID \$00 if Service \$01 is supported. If Service \$01 is not supported, no response is allowed. All emissions-related OBD II compliant ECUs must respond to Service \$01 PID \$00.	All ECUs must respond to Service \$01 PID \$00 if Service \$01 is supported. If Service \$01 is not supported, no response is allowed. All emissions-related OBD II compliant ECUs must respond to Service \$01 PID \$00.	All ECUs must respond to Service \$01 PID \$00 if Service \$01 is supported. If Service \$01 is not supported, ECU can either not respond or send a negative response (\$7F, \$01, \$11) All emissions-related OBD II compliant ECUs must respond to Service \$01 PID \$00.
b) Service \$01 unsupported PID requested	No response preferred, positive response is allowed	No response preferred, positive response is allowed	ECU can either not respond or send a negative response (\$7F, \$01, \$12)
c) Service \$01 supported PID requested	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing
d) Service \$02 not supported	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response (\$7F, \$02, \$11)
e) Service \$02 supported PID requested, no Freeze Frame stored	PID \$02 indicates \$0000, but if PIDs are requested, ECU can either not respond or send invalid data, except if supported PIDs (\$00, \$20, ...) have been requested, then the ECU shall send a response with the supported PID and data bytes	PID \$02 indicates \$0000, but if PIDs are requested, ECU can either not respond or send invalid data, except if supported PIDs (\$00, \$20, ...) have been requested, then the ECU shall send a response with the supported PID and data bytes	PID \$02 indicates \$0000, but if PIDs are requested, ECU can either not respond or send a negative response (\$7F, \$02, \$12), except if supported PIDs (\$00, \$20, ...) have been requested, then the ECU shall send a response with the supported PID and data bytes
f) Service \$02 unsupported PID requested, no Freeze Frame stored	No response preferred, positive response is allowed	No response preferred, positive response is allowed	ECU can either not respond or send a negative response (\$7F, \$02, \$12)
g) Service \$02 supported PID requested, Freeze Frame stored	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing

TABLE A - PROPER RESPONSE FROM ECU (CONTINUED)

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
h) Service \$02 unsupported PID requested, Freeze Frame stored	No response preferred, positive response is allowed	No response preferred, positive response is allowed	ECU can either not respond or send a negative response (\$7F, \$02, \$12)
i) Service \$03/\$07/\$0A not supported	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response (\$7F, \$03/\$07/\$0A, \$11)
j) Service \$03/\$07 supported, no DTCs stored	No response preferred, positive response indicating no DTCs is allowed	No response preferred, positive response indicating no DTCs is allowed	Positive response indicating no DTCs is required.
k) Service \$03/\$07 supported, DTCs stored	Positive response is required	Positive response is required	Positive response is required
l) Service \$04 not supported	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response (\$7F, \$04, \$11)
m) Service \$04 supported, conditions not correct	The ECU shall not respond	The ECU shall not respond	Negative response is required (\$7F, \$04, \$22)
n) Service \$04 supported, conditions correct	Positive response is required	Positive response is required	Positive response is required
o) Service \$05/\$06 not supported	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response (\$7F, \$05/\$06, \$11)
p) Service \$05/\$06 supported TID requested, no stored data available	If TIDs are requested, ECU can either not respond or send invalid data.	If TIDs are requested, ECU can either not respond or send invalid data.	If TIDs are requested, ECU can either not respond or send invalid data or send negative response (\$7F, \$05/\$06, \$12).
q) Service \$05/\$06 unsupported TID requested, no stored data available	No response preferred, positive response is allowed	No response preferred, positive response is allowed	ECU can either not respond or send a negative response (\$7F, \$05/\$06, \$12)
r) Service \$05/\$06 supported TID requested, stored data available	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing
s) Service \$05/\$06 unsupported TID requested, stored data available	No response preferred, positive response is allowed	No response preferred, positive response is allowed	ECU can either not respond or send a negative response (\$7F, \$05/\$06, \$12)
t) Service \$08 not supported	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response (\$7F, \$08, \$11)
u) Service \$08 supported TID requested, conditions correct	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing

TABLE A - PROPER RESPONSE FROM ECU (CONTINUED)

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
v) Service \$08 supported TID requested, conditions not correct	The ECU shall not respond or may respond with a manufacturer-specified value as DATA A, which corresponds to the reason the test cannot be run.	The ECU shall not respond or may respond with a manufacturer-specified value as DATA A, which corresponds to the reason the test cannot be run.	Negative response is required (\$7F \$08, \$22) or may respond with a manufacturer-specified value as DATA A which corresponds to the reason the test cannot be run.
w) Service \$08 unsupported TID requested	No response preferred, positive response is allowed	No response preferred, positive response is allowed	ECU can either not respond or send a negative response (\$7F, \$08, \$12)
x) Service \$09 not supported	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response (\$7F, \$09, \$11)
y) Service \$09 supported INFOTYPE requested, data available (VIN, CVN, CALID)	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing
z) Service \$09 supported INFOTYPE requested, data not available, conditions correct (CVN)	Respond within 1 minute; do not restart CVN calculation. Test tool sends retry message every 0.055 to 4.0 seconds	Respond within 1 minute; do not restart CVN calculation. Test tool sends retry message after 30 seconds	One or multiple negative response message(s) (\$7F, \$09, \$78) required within P2max (25 – 50 ms) until positive response is sent
aa) Service \$09 supported INFOTYPE requested, data not available, conditions not correct (CVN), prior to 2005 MY only	The ECU shall not respond	The ECU shall not respond	Negative response is required (\$7F, \$09, \$22)
bb) Service \$09 unsupported INFOTYPE requested	No response preferred, positive response is allowed	No response preferred, positive response is allowed	ECU can either not respond or send a negative response (\$7F, \$09, \$12)
cc) Service \$00 or \$0B through \$0F not supported	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response (\$7F, \$0X, \$11)

NOTE: OBD-II regulations require a response to a Service \$09 CVN request within P2 timing (except for 30 seconds after reprogramming). For CVN requests within this document, a \$78 negative response is not allowed.

4.3.2 ISO 15765-4: Diagnostics on CAN

There are four conditions for which data is not available:

1. Service is not supported.
2. Service is supported but data is not supported.
3. Service is supported but data is not available at the time that the request is made.
4. Service is supported but data is not available within P2 timing.

Table B indicates the proper ECU response as detailed in SAE J1979 (ISO 15031-5).

TABLE B - PROPER RESPONSE FROM ECU FOR ISO 15765-4

Condition	ISO 15765-4
a) Service \$01 not supported	All ECUs shall respond to Service \$01 PID \$00 if Service \$01 is supported. All emissions-related OBD II compliant ECUs must respond to Service \$01 PID \$00. Negative response message \$21 (busyRepeatRequest) is allowed only during initialization per ISO 15765-4. (\$7F, \$02, \$21) is required within P2max (50 ms) and consecutive negative response message(s) are required within P2max until positive response is sent. See Note B below. If Service \$01 is not supported, no response is allowed.
b) Service \$01 unsupported PID requested	The ECU shall not respond
c) Service \$01 supported PID requested	Respond within P2 timing (no negative response message with response code \$78 allowed)
d) Service \$02 not supported	The ECU shall not respond
e) Service \$02 supported PID, frame xx requested, no Freeze Frame stored	1) The ECU shall respond to PID \$02 frame xx within P2 timing; PID \$02 frame xx must indicate \$0000. 2) The ECU shall respond with supported PIDs for frame xx (\$00, \$20, ...) within P2 timing. 3) If PIDs other than support PIDs or PID \$02 are requested, the ECU shall not respond.
f) Service \$02 unsupported PID, frame xx requested, no Freeze Frame stored	PID \$02 frame xx indicates \$0000, but if PIDs are requested, ECU shall not respond.
g) Service \$02 supported PID, frame xx requested, Freeze Frame stored	1) The ECU shall respond to PID \$02 frame xx within P2 timing. 2) The ECU shall respond with supported PIDs for frame xx (\$00, \$20 ...) within P2 timing and shall respond to PIDs frame xx indicated as supported within P2 timing.
h) Service \$02 unsupported PID, frame xx requested, Freeze Frame stored	The ECU shall not respond
i) Service \$03/\$07/\$0A not supported	The ECU shall not respond
j) Service \$03/\$07/\$0A supported, no DTCs stored	Positive response indicating no DTCs is required.
k) Service \$03/\$07/\$0A supported, DTCs stored	Positive response including the stored DTCs is required
l) Service \$04 not supported	The ECU shall not respond

TABLE B - PROPER RESPONSE FROM ECU FOR ISO 15765-4

Condition	ISO 15765-4
m) Service \$04 supported, conditions not correct	Negative response is required (\$7F, \$04, \$22)
n) Service \$04 supported, conditions correct	Positive response message required. Negative response message(s) (\$7F, \$04, \$78) allowed until positive response message available.
o) Service \$06 not supported	The ECU shall not respond
p) Service \$06 supported TID requested, no stored data available	Positive response required, test values, min and max limits must be set to \$00
q) Service \$06 unsupported TID requested, no stored data available	The ECU shall not respond
r) Service \$06 supported TID requested, stored data available	Respond within P2 timing
s) Service \$06 unsupported TID requested, stored data available	The ECU shall not respond
t) Service \$08 not supported	The ECU shall not respond
u) Service \$08 supported TID requested, conditions correct	Respond within P2 timing
v) Service \$08 supported TID requested, conditions not correct	Negative response required (\$7F, \$08, \$22)
w) Service \$08 unsupported TID requested	The ECU shall not respond
x) Service \$09 not supported	The ECU shall not respond
y) Service \$09 supported INFOTYPE requested, data available (VIN, CVN, CALID)	Respond within P2 timing
z) Service \$09 supported INFOTYPE requested, data not available, conditions correct (CVN)	Initial negative response message (\$7F, \$09, \$78) required within P2max (50 ms) and consecutive negative response message(s) (\$7F, \$09, \$78) is (are) required within P2max (5.0 seconds) until positive response is sent. See Note A below.
aa) Service \$09 supported INFOTYPE requested, data not available, conditions not correct (CVN), prior to 2005 MY only	Negative response required (\$7F, \$09, \$22)
bb) Service \$09 unsupported INFOTYPE requested	The ECU shall not respond
cc) Service \$00 or \$0B through \$0F not supported	The ECU shall not respond

NOTE A: OBD-II regulations require a response to a Service \$09 CVN request within P2 timing (except for 30 seconds after reprogramming). For CVN requests within this document, a \$78 negative response is not allowed.

NOTE B: Per ISO 15765-4, the following applies to initialization only.

When all started response messages are completely received (positive and negative responses) and the P2CAN_Client application timer has elapsed, the external test equipment shall analyze whether negative responses have been received.

If one or more of the received response messages are negative responses to the previously transmitted request with response code 0x21 (busyRepeatRequest), the external test equipment shall restart the response validation procedure at after a minimum delay of 200 ms. If the negative response(s) appear(s) on six (6) subsequent sequences, the external test equipment shall assume that the vehicle is not compliant with ISO 15031-5. This implies that a legislated-OBD compliant system shall provide a positive response within a maximum of 5 retries (1000 ms) (Assuming that the each negative response with NRC 0x21 is received shortly before P2 elapses the total time available for the vehicle to correctly respond results in 1250 ms.)

If a legislated-OBD ECU responds with any other negative response code or a legislated-OBD ECU responds with a response which cannot be interpreted according to ISO 15031-5, the external test equipment shall assume that the vehicle is not compliant with ISO 15031-5 (i.e. NOT OK).

5. TEST VEHICLE WITH NO MALFUNCTIONS, NO DTCS SET

Purpose: This group of tests will establish that under normal operating conditions communication can be established and that all supported test services behave correctly.

5.1 Perform MIL Bulb Check, Engine Off

Purpose: This test determines that the MIL behaves as required by OBD legislation.

Procedure:

5.1.1 Ignition off for 30 seconds or longer, as appropriate for the ECU. Connect scan tool to the SAE J1962 connector.

5.1.2 Turn ignition on. Do not crank engine.

Evaluation: Procedure:

5.1.3 Visually verify that the MIL is on for a minimum of 15 seconds. (MIL can stay on until engine cranking, or it is allowed to turn off after a minimum of 15 seconds.)

5.2 Establish Communication (SAE J1978 / ISO 15031-4), Ignition On, Engine Off

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

5.2.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 15765-4 – 11-bit

ISO 15765-4 – 29 bit

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 1 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 2 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

5.3 Clear DTCs (Service \$04), Engine Off

Purpose: To verify that, with the ignition on and engine off, all ECUs provide the correct response to a Service \$04 request and that DTCs and the MIL status bit are cleared.

Procedure:

5.3.1 [For all protocols] Transmit Service \$04 request message and observe response message.

Any software meeting these specifications must wait 2 seconds before proceeding to next step to allow for NVRAM read/write times.

TABLE 3 - CLEAR/RHESET EMISSION-RELATED DIAGNOSTIC INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information request SID	04	SIDRQ

TABLE 4 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information response SID	44	SIDPR

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. At least one OBD ECU must respond with message as shown in the response table above. If more than the specified number of emission-related ECUs respond to this diagnostic message, this shall be flagged as a failure.

For ISO 15765-4, a positive response message is required. Negative response message(s) (\$7F, \$04, \$78) are allowed for up to 30 seconds maximum, until a positive response message is available. All other negative responses shall be flagged as a failure. For ISO 9141-2, SAE J1850 and ISO 14230-4, a positive response is required.

5.4 Verify MIL Status Bit, Engine Off, Verify No Permanent DTCs

Purpose: To verify the correct response to a Service \$01, PID \$01 request for those ECUs that support it, and that DTCs and the MIL status bit were cleared by the previous Service \$04 request.

Note to manufacturers: During bulb prove out, MIL status bit must indicate whether the MIL will be illuminated after engine is started. It should not reflect the status of the MIL bulb driver circuit, which will be turning the bulb on for the bulb prove out.

Procedure:

5.4.1 [For all protocols] Send Service \$01, PID \$01 request message.

TABLE 5 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID: Number of emission-related DTCs and MIL status	01	PID

TABLE 6 - ECU#1 RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: Number of emission-related DTCs and MIL status	01	PID
#3	MIL: status, Number of emission-related DTCs	00000000 b = \$00	DATA_A
#4	Misfire -, Fuel system -, Comprehensive monitoring	xxxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxxx b = \$XX	DATA_D

Evaluation criteria:

Each OBD ECU that responds with Service \$01, PID \$01 must respond with messages as shown in the response table above where:

DATA A bits 0 thru 6 must be 0. (Number of DTCs must be 0, because of previously sent engine-off Service \$04 request.) and DATA A bit 7 must be 0, indicating MIL off.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. At least one OBD ECU must respond with message as shown in the response table above. If more than the specified number of emission-related ECUs respond to this diagnostic message, this shall be flagged as a failure.

Purpose: To verify that all ECUs respond correctly to a Service \$0A request and to verify that there are no permanent DTCs stored before proceeding through the next test sequence.

Procedure:

5.4.2 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message. Verify that a proper response is received with DTC count set to zero.

TABLE 7 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

TABLE 8 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS
RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	00	#OFDTC

Evaluation criteria:

For ISO 15765-4 interfaces, the ECU that support permanent codes will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00. ECUs that do not support permanent codes shall not respond. If vehicle fails because it has permanent DTCs, prompt the user whether to continue testing or abort the test.

5.5 Verify that All Service \$06 – Request On-board Monitoring Test Results, Engine Off

Purpose: To verify that each ECU responds correctly to a Service \$06 request, and that the data in the responses are correct. Verify that all Service \$06 data and limits are set to zero for ISO 15765-4. For all other protocols, the data must be greater than or equal to the minimum test limit or less than or equal to the maximum test limit.

Procedure:

5.5.1 [For all protocols] Transmit Service \$06, OBDMID support OBDMIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported OBDMID to determine which OBDMIDs are supported. Note the OBDMIDs reported by each ECU as being supported.

TABLE 9 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ SUPPORTED OBDMIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID (OBDMIDs supported)	M	xx	OBDMID

TABLE 10 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT SUPPORTED OBDMIDS) FOR ISO 9141-2, SAE J1850 AND ISO 14230-4 PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	Test ID	M	xx	TID
#3	FillerByte	M	FF	FB
#4	data record of supported Test IDs = [Data A: supported Test IDs, Data B: supported Test IDs, Data C: supported Test IDs, Data D: supported Test IDs]	M	xx	DATAREC_-DATA_A
#5		M	xx	DATA_B
#6		M	xx	DATA_C
#7		M	xx	DATA_D

TABLE 11 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT SUPPORTED OBDMIDS) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic	
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR	
#2	data record of supported OBDMID = [1 st supported OBDMID Data A: supported OBDMIDs, Data B: supported OBDMIDs, Data C: supported OBDMIDs, Data D: supported OBDMIDs]	M	xxxxxxxx	OBDMIDREC	
#3		M	xxxxxxxx	OBDMID	
#4		M	xxxxxxxx	DATA_A	
#5		M	xxxxxxxx	DATA_B	
#6		M	xxxxxxxx	DATA_C	
		M	xxxxxxxx	DATA_D	
C1 = Conditional — OBDMID value shall be the same value as included in the request message if supported by the ECU					
C2 = Conditional — value indicates OBDMIDs supported; range of supported OBDMIDs depends on selected OBDMID value (see C1)					

Evaluation criteria:

If all OBDMID support OBDMIDs for an ECU indicate that no OBDMIDs are supported, this shall be flagged as a failure. If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

5.5.2 [For ISO 15765-4 protocol only] Transmit request for all OBDMID support OBDMIDs as two messages (OBDMIDs \$00, \$20, \$40, \$60, \$80, \$A0), and (OBDMIDs \$C0, \$E0) and again note results.

TABLE 12 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ SUPPORTED OBDMIDS) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID (OBDMIDs supported)	M	00	OBDMID
#3	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	20	OBDMID
#4	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	40	OBDMID
#5	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	60	OBDMID
#6	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	80	OBDMID
#7	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	A0	OBDMID

U = User Optional

TABLE 13 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT SUPPORTED OBDMIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	data record of supported OBDMID = [1 st supported OBDMID Data A: supported OBDMIDs, Data B: supported OBDMIDs, Data C: supported OBDMIDs, Data D: supported OBDMIDs]	M	xxxxxxxx	OBDMIDREC
#3		M	xxxxxxxx	OBDMID
#4		M	xxxxxxxx	DATA_A
#5		M	xxxxxxxx	DATA_B
#6		M	xxxxxxxx	DATA_C
:		:	xxxxxxxx	DATA_D
	:	:	:	:
#n-4	data record of supported OBDMID = [m th supported OBDMID Data A: supported OBDMIDs, Data B: supported OBDMIDs, Data C: supported OBDMIDs, Data D: supported OBDMIDs]	C1	xxxxxxxx	OBDMIDREC
#n-3		C2	xxxxxxxx	OBDMID
#n-2		C2	xxxxxxxx	DATA_A
#n-1		C2	xxxxxxxx	DATA_B
#n		C2	xxxxxxxx	DATA_C
				DATA_D

C1 = Conditional — OBDMD value shall be the same value as included in the request message if supported by the ECU

~~C2 = Conditional — value indicates OBDMIDs supported; range of supported OBDMIDs depends on selected OBDMID value (see C1)~~

Evaluation criteria:

Each ECU must report the same supported OBDMIDs for single and group request messages.

5.5.3 [For ISO 15765-4 protocol only] For all supported OBDMIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF as determined in 5.5.1, send the corresponding Service \$06 request message and note the response.

TABLE 14 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ OBDMID TEST VALUES) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID	M	XX	OBDMID

TABLE 15 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT OBDMID TEST VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	data record of supported OBDMID = [On-Board Diagnostic Monitor ID	M	XX	OBDMID
#3	Std./Manuf. Defined TID#1	M	XX	S/MDTID
#4	Unit And Scaling ID#1	M	XX	UASID
#5	Test Value (High Byte)#1	M	00	TVHI
#6	Test Value (Low Byte)#1	M	00	TVLO
#7	Min. Test Limit (High Byte)#1	M	00	MINTLHI
#8	Min. Test Limit (Low Byte)#1	M	00	MINTLLO
#9	Max. Test Limit (High Byte)#1	M	00	MAXTLHI
#10	Max. Test Limit (Low Byte)#1]	M	00	MAXTLLO
:	:	:	:	:
#n-8	data record of supported OBDMID = [On-Board Diagnostic Monitor ID	C1	XX	OBDMID
#n-7	Std./Manuf. Defined TID#m	C2	XX	S/MDTID
#n-6	Unit And Scaling ID#m	C2	XX	UASID
#n-5	Test Value (High Byte)#m	C2	00	TVHI
#n-4	Test Value (Low Byte)#m	C2	00	TVLO
#n-3	Min. Test Limit (High Byte)#m	C2	00	MINTLHI
#n-2	Min. Test Limit (Low Byte)#m	C2	00	MINTLLO
#n-1	Max. Test Limit (High Byte)#m	C2	00	MAXTLHI
#n	Max. Test Limit (Low Byte)#m]	C2	00	MAXTLLO
C1 = Conditional — parameter is only present if more than one (1) Manufacturer Defined TID is supported by the ECU for the requested Monitor ID.				
C2 = Conditional — parameter and value depends on selected Manufacturer Defined TID number and are only included if the Manufacturer Defined TID is supported by the ECU. The value shall be zero (\$00) in case the On-Board Diagnostic Monitor has not been completed at least once since Clear/reset emission-related diagnostic information or battery disconnect.				

Evaluation criteria:

Misfire OBDMID A2 + SDTID 0B (Cylinder #1 misfire count EWMA) and OBDMID A2 + SDTID 0C (Cylinder #1 misfire counts) must be supported for at least one ECU.

Except as described below, for all OBDMIDs, TVHI, TVLO, MINTLHI, MINTLLO, MAXTLHI, and MAXTLLO must report \$00.

OBDMIDs \$00 -\$10, Test IDs \$01, \$02, \$03, and \$04 are constants and are not required to be reset to zero. For these Test IDs, TVHI and TVLO may be equal to MINTLHI and MINTLLO and MAXTVHI and MAXTVLO.

Some manufacturers have engine-off monitors, e.g., O2 sensors that run as soon as the ignition is on. These monitors may report test results on Service \$06. If a Service \$06 Test ID reports a test value and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

5.5.4 [ISO 9141-2, SAE J1850 and ISO 14230-4 protocols only] For all supported OBDMIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, send the corresponding Service \$06 request message and note the response.

TABLE 16 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ OBDMID TEST VALUES) FOR ISO 9141-2, SAE J1850 AND ISO 14230-4 PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID	M	XX	OBDMID

TABLE 17 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT OBDMID TEST VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for non-continuously monitored systems response SID	M	46	SIDPR
#2	Test ID (report test results)	M	XX	TID
#3	Test Limit Type & Component ID	M	XX	TLTCID
#4	data record of Test ID = [Test Value (High Byte) Test Value (Low Byte) Test Limit (High Byte) Test Limit (Low Byte)]	M	XX	TIDREC_TVHI
#5		M	XX	TVLO
#6		C	XX	TLHI
#7		C	XX	TLLO
C	= Conditional — if Test Limit is either a Minimum or a Maximum Limit depends on the parameter Test Limit Type & Component ID value (bit 7)			

Evaluation criteria:

The test value(s) must be greater than or equal to the Min Test Limit(s) and less than or equal to the Max Test Limit(s).

5.5.5 [For all protocols] Request next unsupported OBDMID-support OBDMID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs to ensure ECU can respond properly to an unsupported OBDMID and does not terminate communication (single request).

5.5.6 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

5.6 Verify Service \$01 Data – Request Current Powertrain Diagnostic Data, Engine Off

NOTE: Hybrid Electric Vehicles (HEVs) have engine controls that can start and stop the engine without regard to ignition setting. The operator must ensure that the engine is off when performing the test.

Purpose: To verify that all ECUs respond correctly to Service \$01 requests, to determine which PIDs are supported by each ECU and to check that the returned data is valid for engine-off conditions.

Procedure:

5.6.1 [For all protocols] Transmit Service \$01, PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported PID to determine which PIDs are supported. Note the PIDs reported by each ECU as being supported.

TABLE 18 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support	XX	PID

TABLE 19 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE (REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [1 st supported PID	M	xxxxxxxx	PIDREC_
#3	Data A: supported PIDs,	M	xxxxxxxx	PID
#4	Data B: supported PIDs,	M	xxxxxxxx	DATA_A
#5	Data C: supported PIDs,	M	xxxxxxxx	DATA_B
#6	Data D: supported PIDs]	M	xxxxxxxx	DATA_C
				DATA_D
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

Required PIDs must be supported for all vehicles (ALL), gasoline engines (G), diesel engines (D), and hybrid vehicles (treated the same as gasoline) as specified in Table 24. At least one ECU must support the required data. If more than one ECU supports the PID, then each ECU must meet the requirements specified under "Required Value". The table specifies whether lack of support will generate a Failure or a Warning. A failure is defined as lack of support as required in the OBD-II regulations. A warning is defined as lack of support for a PID that is highly likely to be required to be supported by most vehicle manufacturers. Warnings require additional analysis by the vehicle manufacturer.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure. Except for PID \$00, if a PID Supported PID for an ECU indicates that no PIDs are supported, this shall be flagged as a failure.

5.6.2 [For ISO 15765-4 protocol only] Transmit request for all PID support PIDs as two messages (PIDs \$00, \$20, \$40, \$60, \$80, \$A0), and -(PIDs \$C0, \$E0) and again note results.

TABLE 20 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ISO 15765-4 PROTOCOL

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID
#3	PID used to determine PID support for PIDs 21-40	20	PID
#4	PID used to determine PID support for PIDs 41-60	40	PID
#5	PID used to determine PID support for PIDs 61-80	60	PID
#6	PID used to determine PID support for PIDs 81-A0	80	PID
#7	PID used to determine PID support for PIDs A1-E0	A0	PID

TABLE 21 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [1 st supported PID, Data A: supported PIDs, Data B: supported PIDs, Data C: supported PIDs, Data D: supported PIDs]	M	xxxxxxxx	PIDREC_- PID
#3		M	xxxxxxxx	DATA_A
#4		M	xxxxxxxx	DATA_B
#5		M	xxxxxxxx	DATA_C
#6		M	xxxxxxxx	DATA_D
:	:	:	:	:
#n-4	data record of supported PIDs = [m th supported PID, Data A: supported PIDs, Data B: supported PIDs, Data C: supported PIDs, Data D: supported PIDs]	C1	xxxxxxxx	PIDREC_- PID
#n-3		C2	xxxxxxxx	DATA_A
#n-2		C2	xxxxxxxx	DATA_B
#n-1		C2	xxxxxxxx	DATA_C
#n		C2	xxxxxxxx	DATA_D
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

Each ECU must report the same supported PIDs for single and group request messages.

5.6.3 [For all protocols] For all supported PIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, send the corresponding Service \$01 PID request message and note the response.

TABLE 22 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data request SID	M	01	SIDRQ
#2	PID#1	M	XX	PID

TABLE 23 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of 1 st supported PID = [PID#1 data A, data B, data C, data D]	M	XX	PIDREC – PID
#3		M	xxxxxxxx	DATA_A
#4		C1	xxxxxxxx	DATA_B
#5		C1	xxxxxxxx	DATA_C
#6		C1	xxxxxxxx	DATA_D
C1 = Conditional — “data B - D” depend on selected PID value C2 = Conditional — parameter is only present if supported by the ECU C3 = Conditional — parameters and values for “data B - D” depend on selected PID number and are only included if PID is supported by the ECU				

Evaluation criteria:

All PIDs that are indicated as supported, as determined in 5.6.1, must be supported.

For all the PIDs that are indicated as supported by each ECU, a response with valid data and with the PID length as noted must be received as shown in Table 24.

NOTE: Scaling PID \$4F may be utilized in some PID responses and must be referenced if so utilized.

It is not an error to return a PID that was not supported on SAE J1850, and ISO 9141-2. On ISO 15765-4, the ECU shall not respond to an unsupported PID. On ISO 14230-4, the ECU can either respond with a negative response message (\$7F, \$12) or not respond to a request for an unsupported PID.

5.6.4 Request the next unsupported PID-support PID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs to ensure ECU can respond properly to an unsupported PID and does not terminate communication (single request).

5.6.5 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION

Engine Off Service \$01 PID Validation			
PID	Req'd Support	Required Value	Comment
01	ALL - Fail		
01, DATA_A, bit 7		Bit 7 must be 0	0 = MIL off
01, DATA_A, bits 0-6		Bits 0-6 must be 0	No DTCs
01, DATA_B, bit 3		<p>Bit 3 can be 0 or 1 For 2010 MY and beyond, data must match Prompt 4.</p> <p>Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01 DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.</p>	0 = spark ignition engine, 1 = compression ignition engine.
01, DATA_B, bit 4		Bit 4 must be 0 for spark ignition engines and ECUs, which do not support misfire monitoring, or must be 1 for compression ignition engines.	Unsupported monitors must indicate "ready". Misfire monitoring shall always indicate complete for spark ignition engines. Misfire monitoring shall indicate complete for compression ignition engines after the misfire evaluation is complete (1000 engine revs at idle, approx. 60 sec.).
01, DATA_B, bit 5		Bit 5 can be 0 or 1	Fuel system may indicate incomplete for spark ignition and compression ignition engines If non-continuous monitors are employed. Unsupported monitors must indicate "ready"
01, DATA_B, bit 6		Bit 6 must be 0	CCM always complete. Unsupported monitors must indicate "ready"
01, DATA_B, bit 7		Bit 7 must be 0	Reserved bits must be 0

TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
01 DATA_B bits 0-2 and 01 DATA_C bit 0-7		At least one bit must be 1	An OBD ECU that supports Service \$01 PID \$01 must support at least one monitor
01, DATA_D, bits 0-7		Bits 0 - 7 must be 1 for any supported monitor indicated in DATA_C	No supported monitors complete. O2 heater monitor (bit 6) may complete (0) on some vehicles
01, DATA_D, bits 0-7		Bits 0 - 7 must be 0 for any unsupported monitor indicated in DATA_C	Unsupported monitors must indicate "ready"
02		2 bytes long, value must be 0000	No freeze frame available
03, DATA_A, bits 5-7, DATA_B 5-7,	G – Warn	2 bytes long, Data A and Data B bits 5-7 must all be 0	Some FUELSYSx bits are reserved
04	ALL – Fail	1 byte long, value must be 0%	LOAD_PCT is 0 at zero airflow
05	ALL – Fail	1 byte long, value must be -20 to 120 deg C. Either \$05 or \$67 must be supported.	ECT in normal range
06	G – Warn	1 byte value or 2 byte value, as determined in Figure 10	Short Fuel Trim Bank 1/3
07	G – Warn	1 byte value or 2 byte value, as determined in Figure 10	Long Fuel Trim Bank 1/3
08		1 byte value or 2 byte value, as determined in Figure 10	Short Fuel Trim Bank 2/4
09		1 byte value or 2 byte value, as determined in Figure 10	Long Fuel Trim Bank 2/4
0A		1 byte long	FRP
0B	G – Warn	1 byte long. Either (\$0B or \$87) or (\$10 or \$66) must be supported	MAP
0C	ALL – Fail	2 bytes long, value must be 0	RPM is 0 with engine off
0D	ALL – Fail	1 byte long, value must be 0	VSS is 0 with engine off
0E	G – Warn	1 byte long	SPARKADV

TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
0F	G – Warn	1 byte long, value must be -20 to 120 deg C Either \$0F or \$68 may be supported.	IAT in normal range
10	G – Warn	2 bytes long, value must be less than or equal to 5 g/sec. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	MAF< = 5 g/sec with engine off
11	G – Fail	1 byte long, value is 0% to 40% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP in normal range
12		1 byte long	AIR_STAT
13 or 1D, bits 0-7	G – Warn	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engines; (NOTE: Either \$13 or \$1D must be supported for spark ignition engine. Both PIDs shall not be supported on spark ignition or compression ignition engines. Neither PID is required to be supported for compression ignition engines)	At least 2 O2S needed for OBD-II for spark ignition engines, compression ignition engines may or may not use O2 sensors. Both PIDs \$13 and \$1D cannot be supported at the same time for either spark or compression ignition engines.
14, 15, 16, 17, 18, 19, 1A, 1B		2 bytes long	
1C	ALL – Fail	1 byte long, value must be 01, 03, 07, 09, 0B or 0D	Must be California OBD-II
1D, 1E		1 byte long	
1F	ISO 15765-4 ALL - Fail	2 bytes long, value must be 0	RUNTM is 0 with engine off
21	ISO 15765-4 ALL – Fail unless \$4D supported	2 bytes long, value must be 0	MIL_DIST is 0 after Service \$04
22, 23		2 bytes long	FRP

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TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
24, 25, 26, 27, 28, 29, 2A, 2B		4 bytes long	Check for usage of PID 4F
2C		1 byte long, value must be < or = 10%	EGR_PCT is < or = 10% with engine off
2D		1 byte long	EGR_ERR
2E	ISO 15765-4 G – Warn	1 byte long	EVAP_PCT
2F	ISO 15765-4 G, D – Warn	1 byte long	FLI
30	ISO 15765-4 ALL – Fail	1 byte long, value must be 0	WARM_UPS must be 0 after Service \$04
31	ISO 15765-4 ALL – Fail unless \$4E supported	2 bytes long, value must be 0	CLR_DIST is 0 after Service \$04
32		2 bytes long	EVAP_VP
33	ISO 15765-4 ALL - Fail	1 byte long, value must be 71 to 110 kPa	BARO within normal range
34, 35, 36, 37, 38, 39, 3A, 3B		4 bytes long	Check for usage of PID 4F
3C, 3D, 3E, 3F		2 bytes long	
41	ISO 15765-4 ALL - Fail		
41, DATA_B, bit 3	ISO 15765-4 ALL - Fail	Bit 3 can be 0 or 1 For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine, 1 = compression ignition engine.

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TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
41, DATA_D, bit 0-7		Bits 0 to 7 must be 1 for any supported monitor indicated in PID \$01 DATA_C	No supported monitors complete. O2 heater monitor (bit 6) may complete (0) on some vehicles.
41, DATA_D, bits 0-7		Bits 0 to 7 must be 0 for any unsupported monitor indicated in PID \$01 DATA_C	Unsupported monitors must indicate "ready"
42	ISO 15765-4 G, D- Fail	2 bytes long	VPWR
43	ISO 15765-4 G- Fail	2 bytes long, value must be 0%	LOAD_ABS is 0% with engine off
44	ISO 15765-4 G- Fail	2 bytes long	EQ_RAT Check for usage of PID 4F
45	ISO 15765-4 G- Fail	1 byte long, value must be 0% to 50% for spark ignition engines, value can be 0% to 100% for compression ignition engines. Either \$45 or \$6C must be supported for spark ignition engines.	TP_R in normal range
46		1 byte long, value must be -20 to 85 deg C	AAT in normal range
47		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP_B in normal range
48		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP_C in normal range

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TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
49		1 byte long, value must be 0% to 40%	APP_D in normal range
4A		1 byte long, value must be 0% to 40%	APP_E in normal range
4B		1 byte long, value must be 0% to 40%	APP_F in normal range
4C		1 byte long	
4D	2010 MY and beyond A – Fail unless \$21 supported	2 bytes long, value must be 0 minutes	MIL_TIME is 0 minutes (59 seconds or less) after Service \$04
4E	2010 MY and beyond All - Fail unless \$31 supported	2 bytes long, value must be 0 minutes	CLR_TIME is 0 minutes (59 seconds or less) after Service \$04
4F		4 bytes	These four values, if not \$00, shall be used to calculate scaling factors for data reported with PIDs \$24 to \$2B, PIDs \$34 to \$3B, PID \$44 and PID \$0B.
50		4 bytes	This value, if available, shall be used to calculate scaling factors for MAF sensor.
51		1 byte, value must be \$01 to \$16	FUEL_TYPE in SAE assigned range
52		1 byte	ALCH_PCT
53		2 bytes	EVAP_VPA
54		2 bytes	EVAP_VP
55		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 1/3
56		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 1/3

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TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
57		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 2/4
58		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 2/4
59		2 bytes long	FRP
5A		1 byte long, value must be 0% to 40%	APP_R in normal range
5B		1 byte	BAT_PWR
5C	2010 MY and beyond D - Warn	1 byte long, value must be -20 to 150 deg C	EOT
5D		2 bytes long	FUEL_TIMING
5E		2 bytes long, value must be 0 when engine is not running	FUEL_RATE
5F		1 byte, value must be \$0E to \$10	EMIS_SUP in SAE assigned range
61	2010 MY and beyond D - Fail	1 byte	TQ_DD
62	2010 MY and beyond D - Fail	1 byte, value must be > or = 0%	TQ_ACT
63		2 bytes long, value must be > or = 0	TQ_REF
64		5 bytes long	TQ_MAX

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TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
65		2 bytes, Data A, at least one device must be supported in bits 0 – 3, bits 4 – 7 must be 0, Data B, bits 4 – 7 must be 0.	Auxiliary I/O
66	G - Warn	5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0. If supported, MAFA and MAFB values must be less than or equal to 5 g/sec. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	Mass Air Flow Sensor MAFx < = 5 g/sec with engine off SAENORM.COM : Click to view full J1699-3-200912
67	ALL - Fail	3 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0. If supported, ECT 1 and ECT 2 values must be -20 to 120 deg C. Either \$05 or \$67 must be supported.	Engine Coolant Temperature ECT x in normal range
68	G - Warn	7 bytes long, Data A, at least one sensor must be supported in bits 0 – 5, bits 6 – 7 must be 0. If supported, any IAT values must be -20 to 120 deg C. Either \$0F or \$68 may be supported.	Intake Air Temperature Sensor IAT xy in normal range
69		7 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. If supported, any EGR_x_CMD values must be < or = 10%.	Commanded EGR and EGR Error EGR_x_CMD is < or = 10% with engine off If EGR_x_CMD = 0.0%, and EGR_x_ACT = 0.0%, EGR_x_ERR must be 0.0%, If EGR_x_CMD = 0.0%, and EGR_x_ACT > 0.0%, EGR_x_ERR must be 99.2%,

TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
6A		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Commanded Diesel Intake Air Flow Control and Relative Intake Air Flow Position
6B		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any EGRT values must be -20 to 120 deg C.	Exhaust Gas Recirculation Temperature EGRT xy in normal range
6C	ISO 15765-4 G- Fail	5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any TP_x_REL values must be 0% to 50% for spark ignition engines. Either \$45 or \$6C must be supported for spark ignition engines.	Commanded Throttle Actuator Control and Relative Throttle Position TP_x_REL in normal range
6D		11 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. If supported, any FRT_x values must be -20 to 120 deg C.	Fuel pressure Control System FRT_x in normal range
6E		9 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Injection Pressure Control System
6F		3 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Turbocharger Compressor Inlet Pressure

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TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
70		10 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. Data J, bits 4 – 7 must be 0.	Boost Pressure Control
71		6 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. Data F, bits 4 – 7 must be 0.	Variable Geometry Turbo (VGT) Control
72		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Wastegate Control
73		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Exhaust Pressure
74		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Turbocharger RPM
75		7 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any TCA_Cxxx values must be -20 to 120 deg C, any TCA_Txxx values must be -20 to 1000 deg C.	Turbocharger A Temperature TCA_Cxxx in normal range TCA_Txxx in normal range
76		7 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any TCB_Cxxx values must be -20 to 120 deg C, any TCB_Txxx values must be -20 to 1000 deg C.	Turbocharger B Temperature TCB_Cxxx in normal range TCB_Txxx in normal range

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TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
77		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any CACT xy values must be -20 to 120 deg C.	Charge Air Cooler Temperature (CACT) CACT xy in normal range
78		9 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Exhaust Gas Temperature (EGT) Bank 1
79		9 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Exhaust Gas Temperature (EGT) Bank 2
7A		7 bytes long, Data A, at least one PID must be supported in bits 0 – 2, bits 3 – 7 must be 0.	Diesel Particulate Filter (DPF) Bank 1
7B		7 bytes long, Data A, at least one PID must be supported in bits 0 – 2, bits 3 – 7 must be 0.	Diesel Particulate Filter (DPF) Bank 2
7C		9 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Diesel Particulate Filter (DPF) Temperature
7D		1 byte long, Data A, bits 4 – 7 must be 0.	NOx NTE control area status
7E		1 byte long, Data A, bits 4 – 7 must be 0.	PM NTE control area status

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TABLE 24 - ENGINE OFF SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
7F		13 bytes long, Data A, at least one PID must be supported in bits 0 – 2, bits 3 – 7 must be 0.	Engine Run Time
81		41 bytes long, Data A, at least one PID must be supported in bits 0 – 4, bits 5 – 7 must be 0.	Engine Run Time for AECD #1 - #5
82		41 bytes long, Data A, at least one PID must be supported in bits 0 – 4, bits 5 – 7 must be 0.	Engine Run Time for AECD #6 - #10
83		9 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0.	NOx Sensor
84		1 byte	Manifold Surface Temperature
85		10 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0.	NOx Control System
86		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0,	Particulate Matter (PM) Sensor
87	G – Warn	5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	Intake Manifold Absolute Pressure (MAP)
88		13 bytes	SCR Inducement System
89		41 bytes long, Data A, at least one PID must be supported in bits 0 – 4, bits 5 – 7 must be 0.	Engine Run Time for AECD #11 - #15
8A		41 bytes long, Data A, at least one PID must be supported in bits 0 – 4, bits 5 – 7 must be 0.	Engine Run Time for AECD #16 - #20

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**Determination of usage of Byte B in addition to Byte A
for Service \$01 PIDs \$06 to \$09 and PIDs \$55 to \$58**

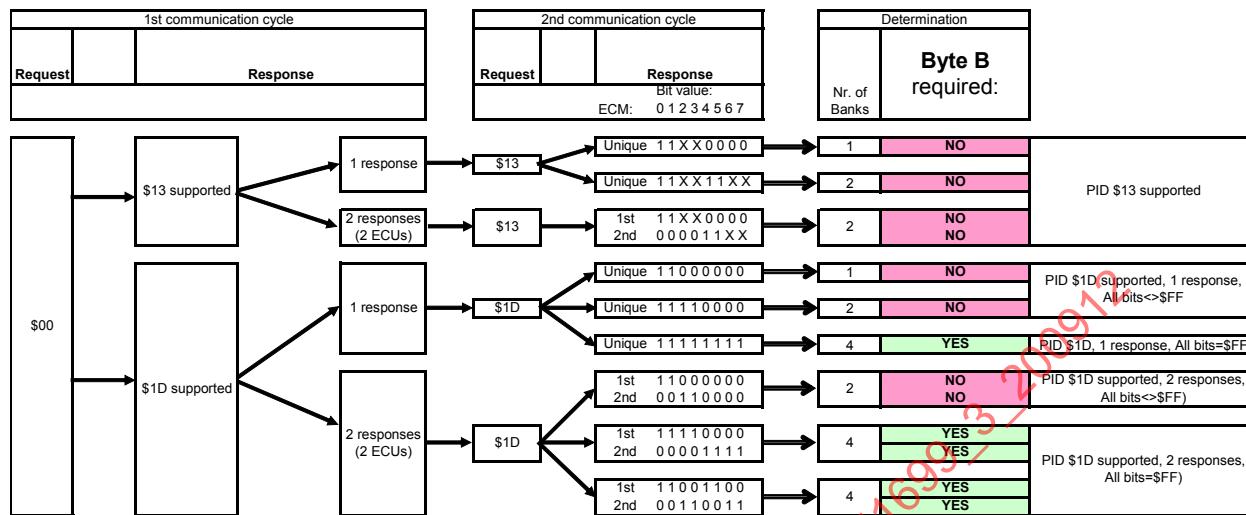


FIGURE 10 - DETERMINATION OF USAGE OF BYTE B IN ADDITION TO BYTE A FOR SERVICE \$01 PIDS \$06 TO \$09 AND PIDS \$55 TO \$58

5.7 Verify Service \$08 – Request Control of On-board System, Test or Component, Engine Off

Purpose: To verify that all ECUs respond correctly to Service \$08 requests during engine-off conditions, and to determine which TIDs are supported by each ECU. To verify the correct response to unsupported TIDs.

Procedure:

5.7.1 [For all protocols] Transmit Service \$08, TID support TIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported TID to determine which TIDs are supported. Note the TIDs reported by each ECU as being supported.

TABLE 25 - REQUEST CONTROL OF ON-BOARD DEVICE REQUEST MESSAGE (READ SUPPORTED TIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device request SID	M	08	SIDRQ
#2	TID#1 (Test IDs supported)	M	XX	TID

TABLE 26 - REQUEST CONTROL OF ON-BOARD DEVICE RESPONSE MESSAGE (REPORT SUPPORTED TIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
#2	data record of supported TIDs = [1 st supported TID Data A: supported TIDs, Data B: supported TIDs, Data C: supported TIDs, Data D: supported TIDs]	M	XX	TIDREC_
#3		M	xxxxxxxx	DATA_A
#4		M	xxxxxxxx	DATA_B
#5		M	xxxxxxxx	DATA_C
#6		M	xxxxxxxx	DATA_D

C1 = Conditional — TID value shall be the same value as included in the request message if supported by the ECU

C2 = Conditional — value indicates TIDs supported; range of supported TIDs depends on selected TID value (see C1) for ISO 15765-4. For SAE J1850, ISO9141-2 and ISO 14230-4, Data A-E shall be filled with \$00 if unused.

Evaluation criteria:

If the service is not supported by an ECU, no response is allowed for SAE J1850, ISO 9141-2 and ISO 15765-4.

If the service is not supported for ISO 14230-4, the ECU will either not respond, or respond with a negative response message (\$7F, \$08, \$11).

If all TID support TIDs for an ECU indicate that no TIDs are supported, this shall be flagged as a failure.

There is no legislative requirement to support Service \$08. If Service \$08 is not supported, it shall be flagged as a warning that each manufacturer will need to analyze.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

5.7.2 [For ISO 15765-4 protocol only] Transmit request for all TID support TIDs as two messages (TIDs \$00, \$20, \$40, \$60, \$80, \$A0), and (TIDs \$C0, \$E0) and again note results.

TABLE 27 - REQUEST CONTROL OF ON-BOARD DEVICE REQUEST MESSAGE (READ SUPPORTED TIDS)
FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device request SID	M	08	SIDRQ
#2	TID#1 (Test IDs supported: \$01 - \$20)	M	00	TID
#3	TID#2 (Test IDs supported: \$21 - \$40)	U	20	TID
#4	TID#3 (Test IDs supported: \$41 - \$60)	U	40	TID
#5	TID#4 (Test IDs supported: \$61 - \$80)	U	60	TID
#6	TID#5 (Test IDs supported: \$81 - \$A0)	U	80	TID
#7	TID#6 (Test IDs supported: \$A1 - \$C0)	U	A0	TID

TABLE 28 - REQUEST CONTROL OF ON-BOARD DEVICE RESPONSE MESSAGE (REPORT SUPPORTED TIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
#2	data record of supported TIDs = [1 st supported TID Data A: supported TIDs, Data B: supported TIDs, Data C: supported TIDs, Data D: supported TIDs]	M	XX	TIDREC_ TID
#3		M	xxxxxxx	DATA_A
#4		M	xxxxxxx	DATA_B
#5		M	xxxxxxx	DATA_C
#6		M	xxxxxxx	DATA_D
:	:	:	:	:
#n-4	data record of supported TIDs = [m th supported TID Data A: supported TIDs, Data B: supported TIDs, Data C: supported TIDs, Data D: supported TIDs]	C1	XX	TIDREC_ TID
#n-3		C2	xxxxxxx	DATA_A
#n-2		C2	xxxxxxx	DATA_B
#n-1		C2	xxxxxxx	DATA_C
#n		C2	xxxxxxx	DATA_D

Evaluation criteria:

Each ECU must report the same supported TIDs for single and group request messages.

5.7.3 [For all protocols] Request next unsupported TID support TID (\$20, \$40, \$60, \$80, \$A0, \$C0, \$E0) for all ECUs to ensure that the ECU can respond properly to an unsupported TID and does not terminate communication (single request).

5.7.4 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

5.8 Establish Communication (SAE J1978 / ISO 15031-4), Engine Running

Purpose: Verify that one, and only one, of the allowed protocols is supported and that a response message of the correct format is sent by the vehicle with engine running.

Protocol Determination Procedure:

5.8.1 Move ignition to crank position and start engine. Let engine idle for 1 minute.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position or setting. The operator must ensure that the engine is running when performing the test, e.g., turn on A/C.

5.8.2 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 15765-4 – 29 bit

ISO 15765-4 – 11 bit

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 29 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 30 - ECU#X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

5.9 Clear DTCs (Service \$04), Engine Running

Purpose: To verify that with the engine running all ECUs provide a consistent and correct response to a Service \$04 request.

Procedure:

5.9.1 [For all protocols] Send Service \$04 to clear codes and verify that correct response is received.

Any software meeting these specifications must wait 2 seconds before proceeding to next step to allow for NVRAM read/write times.

TABLE 31 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information request SID	04	SIDRQ

TABLE 32 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information response SID	44	SIDPR

TABLE 33 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION RESPONSE MESSAGE

Message direction:	ECU#2 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Negative Response Service identifier	7F	SIDNR
#2	Clear/reset emission-related diagnostic information request SID	04	SIDRQ
#3	Negative Response Code: conditionNotCorrect	22	NR_CNC

Evaluation criteria:

There is no legislative requirement to clear codes with the engine running.

ECUs that cannot clear codes with the engine running, will ignore the request for SAE J1850 and ISO 9141-2 interfaces, or will send a negative response message (\$7F, \$22) for ISO 14230-4 and ISO 15765-4 interfaces.

For ISO 15765-4, negative response message(s) (\$7F, \$04, \$78) are allowed for up to 30 seconds maximum, until a positive response message is available.

For all protocols, all OBD ECUs must respond in the same manner to an engine-running Service \$04 request, i.e. all ECUs provide a positive response or all ECUs provide a negative response. If all OBD ECUs do not provide the same response, this shall be flagged as a failure.

5.10 Verify Service \$01 – Request Current Powertrain Diagnostic Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service \$01 requests, to determine which PIDs are supported by each ECU and to check that the returned data is valid for engine-running conditions.

Procedure:

5.10.1 [For all protocols] Transmit Service \$01, PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported PID to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 34 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support	XX	PID

TABLE 35 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [
#3	1 st supported PID	M	XX	PIDREC_-
#4	Data A: supported PIDs,	M	xxxxxxx	PID
#5	Data B: supported PIDs,	M	xxxxxxx	DATA_A
#6	Data C: supported PIDs,	M	xxxxxxx	DATA_B
	Data D: supported PIDs]	M	xxxxxxx	DATA_C
		M	xxxxxxx	DATA_D
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

Required PIDs must be supported for all vehicles (ALL), gasoline engines (G), diesel engines (D), and hybrid vehicles (treated the same as gasoline) as specified in Table 40. At least one ECU must support the required data. If more than one ECU supports the PID, then each ECU must meet the requirements specified under "Required Value". The table specifies whether lack of support will generate a Failure or a Warning. A failure is defined as lack of support as required in the OBD-II regulations. A warning is defined as lack of support for a PID that is highly likely to be required to be supported by most vehicle manufacturers. Warnings require additional analysis by the vehicle manufacturer.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure. Except for PID \$00, if a PID Supported PID for an ECU indicates that no PIDs are supported, this shall be flagged as a failure.

5.10.2 [For ISO 15765-4 protocol only] Transmit request for all PID support PIDs as two messages (PIDs \$00, \$20, \$40, \$60, \$80, \$A0), and (PIDs \$C0, \$E0) and again note results.

TABLE 36 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR
ISO 15765-4 PROTOCOL

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID
#3	PID used to determine PID support for PIDs 21-40	20	PID
#4	PID used to determine PID support for PIDs 41-60	40	PID
#5	PID used to determine PID support for PIDs 61-80	60	PID
#6	PID used to determine PID support for PIDs 81-A0	80	PID
#7	PID used to determine PID support for PIDs A1-E0	A0	PID
U = User Optional			

TABLE 37 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [
#3	1 st supported PID	M	XX	PIDREC_-
#4	Data A: supported PIDs,	M	xxxxxxx	PID
#5	Data B: supported PIDs,	M	xxxxxxx	DATA_A
#6	Data C: supported PIDs,	M	xxxxxxx	DATA_B
	Data D: supported PIDs]	M	xxxxxxx	DATA_C
:	:	:	:	DATA_D
#n-4	data record of supported PIDs = [	C1	XX	PIDREC_-
#n-3	m th supported PID	C2	xxxxxxx	PID
#n-2	Data A: supported PIDs,	C2	xxxxxxx	DATA_A
#n-1	Data B: supported PIDs,	C2	xxxxxxx	DATA_B
#n	Data C: supported PIDs,	C2	xxxxxxx	DATA_C
	Data D: supported PIDs]	C2	xxxxxxx	DATA_D
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

For ISO 15765-4 protocol, each ECU must report the same supported PIDs for single and group request messages.

5.10.3 [For all protocols] For all supported PIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, as determined in 5.10.1, send the corresponding Service \$01 PID request message and note the response.

TABLE 38 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data request SID	M	01	SIDRQ
#2	PID#1	M	XX	PID

TABLE 39 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of 1 st supported PID = [
#3	PID#1	M	XX	PIDREC_-
#4	data A,	M	XX	PID
#5	data B,	C1	XX	DATA_A
#6	data C,	C1	XX	DATA_B
	data D]	C1	XX	DATA_C
				DATA_D
C1 = Conditional — “data B - D” depend on selected PID value				
C2 = Conditional — parameter is only present if supported by the ECU				
C3 = Conditional — parameters and values for “data B - D” depend on selected PID number and are only included if PID is supported by the ECU				

Evaluation criteria:

All PIDs that are indicated as supported must be supported.

For all the PIDs that are indicated as supported by each ECU, a response with valid data and with the PID length as noted must be received as shown in Table 40.

NOTE: Scaling PID \$4F may be utilized in some PID responses and must be referenced if so utilized.

It is not an error to return a PID that was not supported on SAE J1850, and ISO 9141-2. On ISO 15765-4, the ECU shall not respond to an unsupported PID. On ISO 14230-4, the ECU can either respond with a negative response message (\$7F, \$12) or not respond to a request for an unsupported PID.

5.10.4 [For all protocols] Request the next unsupported PID-support PID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

5.10.5 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION

Engine Idle Service \$01 PID Validation			
PID	Req'd Support	Required Value	Comment
01	ALL - Fail		
01, DATA_A, bit 7		Bit 7 must be 0	0 is MIL off
01, DATA_A, bits 0-6		Bits 0 – 6 must all be 0	No DTCs
01, DATA_B, bit 3		Bit 3 can be 0 or 1 For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine, 1 = compression ignition engine.
01, DATA_B, bit 4		Bit 4 must be 0 for spark ignition engines and ECUs, which do not support misfire monitoring, or may be 0 or 1 for compression ignition engines.	Unsupported monitors must indicate “ready”. Misfire monitoring shall always indicate complete for spark ignition engines. Misfire monitoring shall indicate complete for compression ignition engines after the misfire evaluation is complete (1000 engine revs at idle, approx. 60 sec.).
01, DATA_B, bit 5		Bit 5 can be 0 or 1	Fuel system may indicate incomplete for spark ignition and compression ignition engines if non-continuous monitors are employed. Unsupported monitors must indicate “ready”
01, DATA_B, bit 6		Bit 6 must be 0	CCM always complete. Unsupported monitors must indicate “ready”
01, DATA_B, bits 4-6		Bits 4 – 6 must all be 0 for any unsupported monitor in DATA B bits 0-2	Unsupported monitors must indicate “ready”
01, DATA_B, bit 7		Bit 7 must be 0	Reserved bits must be 0

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support:	Required Value	Comment
01 DATA_B bits 0-2 and 01 DATA_C bits 0-7		At least one bit must be 1	An OBD ECU that supports Service \$01 PID \$01 must support at least one monitor
01, DATA_D, bits 0-7		Bits 0 – 7 may be 0 or 1 for any supported monitor indicated in DATA_C	Some supported monitors may be complete.
01, DATA_D, bits 0-7		Bits 0 – 7 must all be 0 for any unsupported monitor indicated in DATA_C	Unsupported monitors must indicate "ready"
02		2 bytes long, value must be 0000	No freeze frame available
03, DATA_A, bits 5-7, DATA_B 5-7	G – Warn	2 bytes long, Data A and Data B bits 5 – 7 must all be 0	Some FUELSYSx bits are reserved
04	ALL – Fail	1 byte long, value must be 0 to 60%	LOAD_PCT less than or equal to 60% at idle
05	ALL – Fail	1 byte long, value must be -20 to 120 deg C. Either \$05 or \$67 must be supported.	ECT in normal range
06	G – Warn	1 byte value or 2 byte value, as determined in Figure 10	Short Fuel Trim Bank 1/3
07	G – Warn	1 byte value or 2 byte value, as determined in Figure 10	Long Fuel Trim Bank 1/3
08		1 byte value or 2 byte value, as determined in Figure 10	Short Fuel Trim Bank 2/4
09		1 byte value or 2 byte value, as determined in Figure 10	Long Fuel Trim Bank 2/4
0A		1 byte long, value must be greater than 0 kPa	FRP not zero
0B	G – Warn	1 byte long, value must be greater than 0 kPa. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	MAP not zero
0C	ALL – Fail	2 bytes long, value must be between 300 and 2000 rpm	RPM between 300 and 2000 at idle
0D	ALL – Fail	1 byte long, value must be 0	VSS is 0 at engine idle
0E	G – Warn	1 byte long	SPARKADV

TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support:	Required Value	Comment
0F	G – Warn	1 byte long, value must be between -20 and 120 deg C Either \$0F or \$68 may be supported.	IAT in normal range
10	G – Warn	2 bytes long, value must be greater than 0 g/sec. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	MAF not zero
11	G - Fail	1 byte long, value must be 0% to 40% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP in normal range
12		1 byte long	AIR_STAT
13 or 1D, bits 0-7	G – Warn	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engines, (NOTE: Either \$13 or \$1D must be supported for spark ignition engine. Both PIDs shall not be supported on spark ignition or compression engines. Neither PID is required to be supported for compression ignition engines)	At least 2 O2S needed for OBD-II for spark ignition engines, compression ignition engines may or may not use any O2 sensors. Both PIDs \$13 and \$1D cannot be supported at the same time for either spark or compression ignition engines.
14, 15, 16, 17, 18, 19, 1A, 1B		2 bytes long	
1C	ALL - Fail	1 byte long, value must be 01, 03, 07, 09, 0B or 0D	Must be California OBD-II
1D, 1E		1 byte long	
1F	ISO 15765-4 ALL – Fail	2 bytes long, value must be greater than 0	RUNTM not zero
21	ISO 15765-4 ALL – Fail unless \$4D supported	2 bytes long, value must be 0	MIL_DIST=0 after Service \$04
22		2 bytes long, value must be greater than 0 kPa	FRP not zero
23		2 bytes long, value must be greater than 0 kPa	FRP not zero

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support:	Required Value	Comment
24, 25, 26, 27, 28, 29, 2A, 2B		4 bytes long	Check for usage of PID 4F
2C		1 byte long, value must be < or = 10% for spark ignition engines, < or = 100% for compression ignition or hybrid engines	EGR_PCT is < or = 10% at idle for spark ignition engine, EGR rates may be much higher for compression ignition and hybrid engines.
2D		1 byte long	EGR_ERR
2E	ISO 15765-4 G – Warn	1 byte long	EVAP_PCT
2F	ISO 15765-4 G – Warn	1 byte long	FLD
30	ISO 15765-4 ALL – Fail	1 byte long, value must be 0 or 1 shortly after Service \$04	WARM_UPS is 0 or 1 after Service \$04
31	ISO 15765-4 ALL – Fail unless \$4E supported	2 bytes long, value must be 0	CLR_DIST is 0 after Service \$04
32		2 bytes long	EVAP_VP
33	ISO 15765-4 ALL – Fail	1 byte long, value must be 71 to 110 kPa	BARO within normal range
34, 35, 36, 37, 38, 39, 3A, 3B		4 bytes long	Check for usage of PID 4F
3C, 3D, 3E, 3F		2 bytes long	
41	ISO 15765-4 ALL - Fail	4 bytes long	
41, DATA_B, bit 3	ISO 15765-4 ALL - Fail	Bit 3 can be 0 or 1 For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine, 1 = compression ignition engine.

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support:	Required Value	Comment
41, DATA_D, bit 0-7		Bits 0 – 7 may be 0 or 1 for any supported monitor indicated in PID \$01 DATA_C	Some supported monitors may be complete.
41, DATA_D, bits 0-7		Bits 0 – 7 must all be 0 for any unsupported monitor indicated in PID \$01 DATA_C	Unsupported monitors must indicate “ready”
42	ISO 15765-4 G, D - Fail	2 bytes long	VPWR
43	ISO 15765-4 G- Fail	2 bytes long, value must be greater than 0%	LOAD_ABS greater than 0 at idle
44	ISO 15765-4 G- Fail	2 bytes long	EQ_RAT Check for usage of PID 4F
45	ISO 15765-4 G- Fail	1 byte long, value must be 0% to 50% for spark ignition engines, value can be 0% to 100% for compression ignition engines. Either \$45 or \$6C must be supported for spark ignition engines.	TP_R in normal range
46		1 byte long, value must be -20 to 85 deg C	AAT in normal range
47		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP_B in normal range
48		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP_C in normal range

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support:	Required Value	Comment
49		1 byte long, value must be 0% to 40%	APP_D in normal range
4A		1 byte long, value must be 0% to 40%	APP_E in normal range
4B		1 byte long, value must be 0% to 40%	APP_F in normal range
4C		1 byte long	
4D	2010 MY and beyond All – Fail unless \$21 supported	2 bytes long, value must be 0 minutes	MIL_TIME is 0 minutes (59 seconds or less) after Service \$04
4E	2010 MY and beyond All – Fail unless \$31 supported	2 bytes long, value must be 0 minutes	CLR_TIME is 0 minutes (59 seconds or less) after Service \$04
4F		4 bytes	These four values, if not \$00, shall be used to calculate scaling factors for data reported with PIDs \$24 to \$2B, PIDs \$34 to \$3B, PID \$44 and PID \$0B.
50		4 bytes	This value, if available, shall be used to calculate scaling factors for MAF sensor.
51		1 byte, value must be \$01 to \$16	FUEL_TYPE in SAE assigned range
52		1 byte	ALCH_PCT
53		2 bytes	EVAP_VPA
54		2 bytes	EVAP_VP
55		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 1/3
56		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 1/3

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
57		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 2/4
58		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 2/4
59		2 bytes long, value must be greater than 0 kPa	FRP not zero
5A		1 byte long, value must be 0% to 40%	APP_R in normal range
5B		1 byte, value must be greater than zero percent	BAT_PWR
5C	2010 MY and beyond D - Warn	1 byte long, value must be -20 to 150 deg C	EOT
5D		2 bytes long	FUEL_TIMING
5E		2 bytes long, value must be greater than zero L/h	FUEL_RATE not zero
5F		1 byte, value must be \$0E to \$10	EMIS_SUP in SAE assigned range
61	2010 MY and beyond D - Fail	1 byte	TQ_DD
62	2010 MY and beyond D - Fail	1 byte, value must be greater than zero percent	TQ_ACT not zero
63		2 bytes long, value must be greater than zero Nm	TQ_REF not zero
64		5 bytes long, all values must greater than zero percent	TQ_MAX not zero

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
65		2 bytes, Data A, at least one device must be supported in bits 0 – 3, bits 4 – 7 must be 0, Data B, bits 4 – 7 must be 0.	Auxiliary I/O
66	G - Warn	5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0, If supported, MAFA and MAFB values must be greater than 0 g/sec. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	Mass Air Flow Sensor MAFx not zero
67	ALL - Fail	3 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0. If supported, ECT 1 and ECT 2 values must be -20 to 120 deg C. Either \$05 or \$67 must be supported.	Engine Coolant Temperature ECT x in normal range
68	G - Warn	7 bytes long, Data A, at least one sensor must be supported in bits 0 – 5, bits 6 – 7 must be 0. If supported, any IAT values must be -20 to 120 deg C. Either \$0F or \$68 may be supported.	Intake Air Temperature Sensor IAT xy in normal range
69		7 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. If supported, any EGR_x_CMD values must be < or = 10% for spark ignition engines, < or = 100% for compression ignition or hybrid engines.	Commanded EGR and EGR Error EGR_x_CMD is < or = 10% with engine off If EGR_x_CMD = 0.0%, and EGR_x_ACT = 0.0%, EGR_x_ERR must be 0.0%, If EGR_x_CMD = 0.0%, and EGR_x_ACT > 0.0%, EGR_x_ERR must be 99.2%,

TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
6A		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Commanded Diesel Intake Air Flow Control and Relative Intake Air Flow Position
6B		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any EGRT values must be -20 to 215 deg C.	Exhaust Gas Recirculation Temperature EGRT xy in normal range
6C	ISO 15765-4 G- Fail	5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any TP_x_REL values must be 0% to 50% for spark ignition engines, value can be 0% to 100% for compression ignition engines. Either \$45 or \$6C must be supported for spark ignition engines.	Commanded Throttle Actuator Control and Relative Throttle Position TP_x_REL in normal range
6D		11 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. If supported, any FRT_x values must be -20 to 120 deg C.	Fuel pressure Control System FRT_x in normal range
6E		9 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Injection Pressure Control System
6F		3 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Turbocharger Compressor Inlet Pressure

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
70		10 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. Data J, bits 4 – 7 must be 0.	Boost Pressure Control
71		6 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. Data F, bits 4 – 7 must be 0.	Variable Geometry Turbo (VGT) Control
72		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Wastegate Control
73		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Exhaust Pressure
74		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Turbocharger RPM
75		7 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any TCA_Cxxx values must be -20 to 120 deg C, any TCA_Txxx values must be -20 to 1000 deg C.	Turbocharger A Temperature TCA_Cxxx in normal range TCA_Txxx in normal range
76		7 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any TCB_Cxxx values must be -20 to 120 deg C, any TCB_Txxx values must be -20 to 1000 deg C.	Turbocharger B Temperature TCB_Cxxx in normal range TCB_Txxx in normal range

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TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
77		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any CACT xy values must be -20 to 120 deg C.	Charge Air Cooler Temperature (CACT) CACT xy in normal range
78		9 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Exhaust Gas Temperature (EGT) Bank 1
79		9 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Exhaust Gas Temperature (EGT) Bank 2
7A		7 bytes long, Data A, at least one PID must be supported in bits 0 – 2, bits 3 – 7 must be 0.	Diesel Particulate Filter (DPF) Bank 1
7B		7 bytes long, Data A, at least one PID must be supported in bits 0 – 2, bits 3 – 7 must be 0.	Diesel Particulate Filter (DPF) Bank 2
7C		9 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Diesel Particulate Filter (DPF) Temperature
7D		1 byte long, Data A, bits 4 – 7 must be 0.	NOx NTE control area status
7E		1 byte long, Data A, bits 4 – 7 must be 0.	PM NTE control area status

TABLE 40 - ENGINE IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
7F		13 bytes long, Data A, at least one PID must be supported in bits 0 – 2, bits 3 – 7 must be 0.	Engine Run Time
81		41 bytes long, Data A, at least one PID must be supported in bits 0 – 4, bits 5 – 7 must be 0.	Engine Run Time for AECD #1 - #5
82		41 bytes long, Data A, at least one PID must be supported in bits 0 – 4, bits 5 – 7 must be 0.	Engine Run Time for AECD #6 - #10
83		9 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0.	NOx Sensor
84		1 byte	Manifold Surface Temperature
85		10 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0.	NOx Control System
86		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0,	Particulate Matter (PM) Sensor
87	G – Warn	5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0. If supported, values must be greater than 0 kPa. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	Intake Manifold Absolute Pressure (MAP) not zero
88		13 bytes	SCR Inducement System
89		41 bytes long, Data A, at least one PID must be supported in bits 0 – 4, bits 5 – 7 must be 0.	Engine Run Time for AECD #11 - #15
8A		41 bytes long, Data A, at least one PID must be supported in bits 0 – 4, bits 5 – 7 must be 0.	Engine Run Time for AECD #16 - #20

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5.11 Verify Service \$02 – Request Powertrain Freeze Frame Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service \$02 requests when there is no DTC stored, that at least one ECU supports Service \$02 PID \$02 and that PID \$02 Frame \$00 contains \$0000.

Procedure:

5.11.1 [For all protocols] Transmit Service \$02 Frame \$00 PID \$02 to read freeze frame DTCs.

TABLE 41 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	02	SIDRQ
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO

TABLE 42 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	42	SIDPR
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO
#4	DTC High Byte of PXXXX	00	DATA_A
#5	DTC Low Byte of PXXXX	00	DATA_B

Evaluation criteria:

If an ECU does not support Service \$02, it shall not respond to a Service \$02 request for SAE J1850, ISO 9191-2, or ISO 15765-4 protocols. The ECU can either not respond or send a negative response (\$7F, \$11) for ISO 14230-4 protocol.

Each ECU that supports Service \$02 and has no freeze frame data stored shall respond with a positive response for PID \$02 indicating \$0000:

At least one ECU shall report that no freeze frame DTCs are stored (PID \$02 is \$0000) in the vehicle or this shall be flagged as a failure.

Procedure:

5.11.2 [For all protocols] Transmit Service \$02, PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0, Frame \$00 request messages through the highest supported PID to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 43 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE (READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 44 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	1 st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M C1 C1 C1	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D
C1 = Conditional — “data B - D” depend on selected PID				

Evaluation criteria:

If an ECU has a freeze frame DTC, but does not support Service \$02, PID \$00, Frame \$00, this shall be flagged as a failure.

If only one ECU supports Service \$02, Frame \$00, PID \$02, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by the vehicle that has a freeze frame DTC.

When more than one ECU supports Service \$02, Frame \$00, PID \$02, then, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by each corresponding ECU that has a freeze frame DTC.

If all PID support PIDs for an ECU that has a freeze frame DTC indicates that no PIDs are supported, this shall be flagged as a failure.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

5.11.3 [For all protocols] Request next unsupported PID-support PID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

5.11.4 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

5.11.5 [For ISO 15765-4 protocol only] Transmit request for all supported PID support PIDs, up to three messages (PIDs \$00, \$20, \$40), (PIDs \$60, \$80, \$A0), and (PIDs \$C0, \$E0) and again note results.

TABLE 45 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE (READ SUPPORTED PIDS)
FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	M	00	PID
#3	frame #00	M	00	FRNO_
#4	PID used to determine PID support for PIDs 21-40	U	20	PID
#5	frame #00	U/C	00	FRNO_
#6	PID used to determine PID support for PIDs 41-60	U	40	PID
#7	frame #00	U/C	00	FRNO_
U = User Optional				
C = Conditional — parameter is only included if preceding PID# is included				

TABLE 46 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	1 st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxxx	DATA_A
#5		C1	xxxxxxxx	DATA_B
#6		C1	xxxxxxxx	DATA_C
#7		C1	xxxxxxxx	DATA_D
:	:	:		:
#2	m th supported PID	C2	xxxxxxxx	PID_
#3	frame #	C2	XX	FRNO_
#4	data record of m th supported PID = [data A, data B, data C, data D]	C3 C4 C4 C4	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D
C1 = Conditional — “data B - D” depend on selected PID C2 = Conditional — parameter shall be the same value as included in the request message if supported C3 = Conditional — data A shall be included if preceding PID is supported C4 = Conditional — parameters and values for “data B - D” depend on selected PID number				

Evaluation criteria:

Each ECU must report the same supported PIDs for single and group request messages.

5.11.6 [For ISO 15765-4 protocol only] For all supported PIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, send the corresponding Service \$02, Frame \$00 PID request messages and note the response.

TABLE 47 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	02	SIDRQ
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO

TABLE 48 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE

Message direction:	ECU #1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	42	SIDPR
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO
#4	DTC High Byte of \$0000	00	DATA_A
#5	DTC Low Byte of \$0000	00	DATA_B

Evaluation criteria:

For all the Service \$02, PID \$02, Frame \$00 responses, the reported data must be equal to \$0000. This corresponds to no fault codes being recorded.

If an ECU does not support Service \$02, it shall not respond to a Service \$02 request for ISO 15765-4 protocol.

For ISO 15765-4 protocol, if PID \$02 indicates \$0000, the ECU shall not respond to a Service \$02 request for PID \$01, PID \$03-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF.

5.12 Verify Service \$03 – Request Emission-related DTCs, Engine Running

Purpose: To verify that no DTCs are stored before proceeding through the next test sequence and that there are correct and consistent responses for Service \$01 PID \$01 requests and Service \$03 requests.

Procedure:

5.12.1 [For all protocols] Transmit Service \$01, PID \$01 request message and note results.

TABLE 49 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID: Number of emission-related DTCs and MIL status	01	PID(01)

TABLE 50 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: Number of emission-related DTCs and MIL status	01	PID_01
#3	MIL: status, Number of emission-related DTCs	00000000 b = \$00	DATA_A
#4	Misfire -, Fuel system - Comprehensive monitoring	xxxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxxx b = \$XX	DATA_D

Evaluation criteria:

DATA A, bits 0-6 must be zero (no DTCs) and DATA A bit 7 must be zero (MIL is off).

5.12.2 [For all protocols] Transmit Service \$03 request. Verify that a proper response is received

TABLE 51 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs request SID	03	SIDRQ

TABLE 52 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE
FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 53 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE
FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

For ISO 15765-4 and ISO 14230-4 protocols, verify that at least one Service \$03 DTC response with zero DTCs is received.

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU will respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$03 request will generate a warning. This can be used to determine if this is the correct behavior for the vehicle.

5.13 Verify Service \$05 – Request Oxygen Sensor Monitoring Test Results, Engine Running

Purpose: To verify the correct response to Service \$05 request messages, and to verify that the ECU responds properly to a request for an unsupported Service \$05 TID.

Procedure:

5.13.1 [For all protocols] Transmit Service \$05, Test ID \$00, HO2S12 (\$02) and note response. (All vehicles that support Service \$05 should have at least one O2 sensor [HO2S12]; TID \$00 is not defined.)

TABLE 54 - REQUEST OXYGEN SENSOR MONITORING TEST RESULTS REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request oxygen sensor monitoring test results request SID	05	SIDRQ
#2	Test ID	00	TID
#3	O2 Sensor #	02	O2SNO

Evaluation criteria:

Each OBD ECU that supports this test Service can either not respond to an unsupported TID or respond within the time defined in 4.2. A positive response is allowed, but not required, if Service \$05 is supported by the SAE J1850, ISO 9141-2 and ISO 14230-4 protocols.

If Service \$05 is not supported, no response is allowed for SAE J1850 and ISO 9141-2. For ISO 14230-4 protocol, either a no response or a negative response message (\$7F, \$11) is allowed.

No response to any Service \$05 request is allowed for the ISO 15765-4 protocol.

5.14 Verify Service \$06 – Request On-board Monitoring Test Results, Engine Running

Purpose: To verify that each ECU responds correctly to a Service \$06 request, that for ISO 15765-4 protocol, the OBDMID support data in the responses is in the expected ranges for monitors indicated as supported in Service \$01, PID \$01t, and verify that the minimum set of specified OBDMIDs are supported. Verify that all Service \$06 data and limits are set to zero for ISO 15765-4. For all other protocols, the data must be greater than or equal to the minimum test limit or less than or equal to the maximum test limit.

Procedure:

5.14.1 [For all protocols] Transmit Service \$06 OBDMID support OBDMIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported OBDMID to determine which OBDMIDs are supported. Note the OBDMIDs reported by each ECU as supported.

TABLE 55 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ SUPPORTED OBDMIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID (OBDMIDs supported)	M	XX	OBDMID

TABLE 56 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT SUPPORTED OBDMIDS) FOR ISO 9141-2, SAE J1850 AND ISO 14230-4 PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	Test ID	M	xx	TID
#3	FillerByte	M	FF	FB
#4	data record of supported Test IDs = [Data A: supported Test IDs, Data B: supported Test IDs, Data C: supported Test IDs, Data D: supported Test IDs]	M	xx	DATAREC_
#5		M	xx	DATA_A
#6		M	xx	DATA_B
#7		M	xx	DATA_C
				DATA_D

TABLE 57 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT SUPPORTED OBDMIDS) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	data record of supported OBDMID = [1 st supported OBDMID Data A: supported OBDMIDs, Data B: supported OBDMIDs, Data C: supported OBDMIDs, Data D: supported OBDMIDs]	M	XX	OBDMIDREC
#3		M	xxxxxxxx	OBDMID
#4		M	xxxxxxxx	DATA_A
#5		M	xxxxxxxx	DATA_B
#6		M	xxxxxxxx	DATA_C
				DATA_D
C1 = Conditional — OBDMID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates OBDMIDs supported; range of supported OBDMIDs depends on selected OBDMID value (see C1)				

Evaluation criteria:

If all OBDMID support OBDMIDs for an ECU indicate that no OBDMIDs are supported, this shall be flagged as a failure.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

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5.14.2 [For ISO 15765-4 protocol only] Transmit request for all OBDMID support OBDMIDs as two messages (OBDMID \$00, \$20, \$40, \$60, \$80, \$A0), and (OBDMIDs \$C0, \$E0) and again note results.

TABLE 58 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ SUPPORTED OBDMIDS) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID (OBDMIDs supported)	M	00	OBDMID
#3	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	20	OBDMID
#4	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	40	OBDMID
#5	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	60	OBDMID
#6	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	80	OBDMID
#7	On-Board Diagnostic Monitor ID (OBDMIDs supported)	U	A0	OBDMID
U = User Optional.				

TABLE 59 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT SUPPORTED OBDMIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	data record of supported OBDMID = [1 st supported OBDMID	M	XX	OBDMIDREC
#3	Data A: supported OBDMIDs,	M	xxxxxxxx	OBDMID
#4	Data B: supported OBDMIDs,	M	xxxxxxxx	DATA_A
#5	Data C: supported OBDMIDs,	M	xxxxxxxx	DATA_B
#6	Data D: supported OBDMIDs]	M	xxxxxxxx	DATA_C
:	:	:	:	DATA_D
#n-4	data record of supported OBDMID = [m th supported OBDMID	C1	XX	OBDMIDREC
#n-3	Data A: supported OBDMIDs,	C2	xxxxxxxx	OBDMID
#n-2	Data B: supported OBDMIDs,	C2	xxxxxxxx	DATA_A
#n-1	Data C: supported OBDMIDs,	C2	xxxxxxxx	DATA_B
#n	Data D: supported OBDMIDs]	C2	xxxxxxxx	DATA_C
				DATA_D
C1 = Conditional — OBDMID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates OBDMIDs supported; range of supported OBDMIDs depends on selected OBDMID value (see C1)				

Evaluation criteria: *SAE16993-1-2009r2*

Each ECU must report the same supported OBDMIDs for single and group request messages.

5.14.3 [ISO 15765-4 protocols only] For all supported OBDMIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, send the corresponding Service \$06 request message and note the response.

TABLE 60 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ OBDMID TEST VALUES) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID	M	XX	OBDMID

TABLE 61 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT OBDMID TEST VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	data record of supported OBDMID = [			OBDMIDREC
#3	On-Board Diagnostic Monitor ID	M	XX	OBDMID
#4	Std./Manuf. Defined TID#1	M	XX	S/MDTID
#5	Unit And Scaling ID#1	M	XX	UASID
#6	Test Value (High Byte)#1	M	00	TVHI
#7	Test Value (Low Byte)#1	M	00	TVLO
#8	Min. Test Limit (High Byte)#1	M	00	MINTLHI
#9	Min. Test Limit (Low Byte)#1	M	00	MINTLLO
#10	Max. Test Limit (High Byte)#1	M	00	MAXTLHI
#10	Max. Test Limit (Low Byte)#1]	M	00	MAXTLLO
:	:	:	:	:
#n-8	data record of supported OBDMID = [			OBDMIDREC
#n-7	On-Board Diagnostic Monitor ID	C1	XX	OBDMID
#n-6	Std./Manuf. Defined TID#m	C2	XX	S/MDTID
#n-5	Unit And Scaling ID#m	C2	XX	UASID
#n-4	Test Value (High Byte)#m	C2	00	TVHI
#n-3	Test Value (Low Byte)#m	C2	00	TVLO
#n-2	Min. Test Limit (High Byte)#m	C2	00	MINTLHI
#n-1	Min. Test Limit (Low Byte)#m	C2	00	MINTLLO
#n	Max. Test Limit (High Byte)#m	C2	00	MAXTLHI
#n	Max. Test Limit (Low Byte)#m]	C2	00	MAXTLLO
C1 = Conditional — parameter is only present if more than one (1) Manufacturer Defined TID is supported by the ECU for the requested Monitor ID.				
C2 = Conditional — parameter and value depends on selected Manufacturer Defined TID number and are only included if the Manufacturer Defined TID is supported by the ECU. The value shall be zero (\$00) in case the On-Board Diagnostic Monitor has not been completed at least once since Clear/reset emission-related diagnostic information or battery disconnect.				

Evaluation criteria:

Based on OBD monitor support data from Service \$01, PID \$01, verify that all OBDMIDs that are reported as supported in 5.14.1 by each ECU respond with the required data and within the expected range as shown in Table 60. Lack of OBDMID support for supported monitors or support outside the defined expected OBDMID ranges for each supported monitor shall be flagged as a failure.

For 2010 MY and beyond, the support bit status shall match the data reported from Operator Prompt 4. Inconsistent support between DATA_B bit 3, and Operator Prompt 4 shall be flagged as a failure. Prior to the 2010 MY, this shall be a warning for compression ignition engines only (i.e. bit 3 = 0 but Operator Prompt indicates diesel. Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.

If Service \$01 PID \$1 indicates support for a monitor, at least one OBDMID shall be supported in the "Allowed OBDMID Range" for at least one ECU as shown in Table 62 unless otherwise indicated in the "Required OBDMIDs" section of the table. Vehicles which do not comply shall flagged as a failure.

OBDMID support is not allowed in the followed, prohibited ranges: \$11 - \$1F, \$25 - \$30, \$3E - \$3F, \$51 - \$5F, \$65 - \$70, \$75 - \$7F, \$87 - \$8F, \$92 - \$97, \$9A - \$9F, \$B4 - \$BF, \$C1 - \$DF, \$E1 - \$FF. Vehicles which do not comply shall flagged as a failure.

Except as described below, for all OBDMIDs, TVHI, TVLO, MINTLHI, MINTLLO, MAXTLHI, and MAXTLLO must report \$00.

OBDMIDs \$00 -\$10, Test IDs \$01, \$02, \$03, and \$04 are constants and are not required to be reset to zero. For these Test IDs, TVHI and TVLO may be equal to MINTLHI and MINTLLO and MAXTVHI and MAXTVLO.

Misfire OBDMIDs \$A1, \$A2, \$A3, \$A4, \$A5, \$A6, \$A7, \$A8, \$A9, \$AA, \$AB, \$AC, \$AD, \$AE, \$AF, \$B0, and \$B1 may report misfire data after the engine has been started, therefore, TVHI, TVLO, MINTLHI, MINTLLO, MAXTLHI, and MAXTLLO and are not required to be \$00.

Some manufacturers have engine-off monitors, e.g., O2 sensors that run as soon as the ignition is turned on. These monitors may report test results on Service \$06 immediately after DTCs are cleared. If a Service \$06 Test ID reports a test value, and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

TABLE 62 - OBDMID VALIDATION

Monitor Supported	PID \$01	Required OBDMIDs	Allowed OBDMID Range
Spark Ignition Monitors Supported	Data B bit 3 = 0		
Misfire	Data B bit 0 = 1	\$A2 SDTID \$0B, \$A2 SDTID \$0C (Cyl #1)	\$A1 - \$B1
Fuel System	Data B bit 1 = 1	No OBDMIDs required	\$81 - \$84
CCM	Data B bit 2 = 1	No OBDMIDs required	
Catalyst	Data C bit 0 = 1	\$21 (Bank 1)	\$21 - \$24
Heated Catalyst	Data C bit 1 = 1	At least one OBDMID in the allowed range	\$61 - \$64
Evap System	Data C bit 2 = 1	At least one OBDMID in the allowed range	\$39 - \$3D
Secondary Air	Data C bit 3 = 1	At least one OBDMID in the allowed range	\$71 - \$74
Reserved, must be 0	Data C bit 4 = 0		
O2 Sensor	Data C bit 5 = 1	\$01 (Bank 1 Sensor 1)	\$01 - \$10
O2 Heater	Data C bit 6 = 1	No OBDMIDs required	\$41 - \$50
EGR and/or VVT	Data C bit 7 = 1	At least one OBDMID in the allowed range	\$31 - \$38
Compression Ignitions Monitors Supported	Data B bit 3 = 1		
Misfire	Data B bit 0 = 1	\$A2 SDTID \$0B, \$A2 SDTID \$0C (Cyl #1)	\$A1 - \$B1
Fuel System	Data B bit 1 = 1	No OBDMIDs required	\$81 - \$84
CCM	Data B bit 2 = 1		
HMHC Catalyst	Data C bit 0 = 1	At least one OBDMID in the allow range	\$21 - \$24
NOx Aftertreatment	Data C bit 1 = 1	At least one OBDMID in the allow range	\$90 - \$91, \$98 - \$99
Reserved, must be 0	Data C bit 2 = 1		
Boost Pressure	Data C bit 3 = 1	At least one OBDMID in the allow range	\$85 - \$86
Reserved, must be 0	Data C bit 4 = 0		
Exhaust Gas Sensor	Data C bit 5 = 1	\$01 (Bank 1 Sensor 1)	\$01 - \$10
PM Filter	Data C bit 6 = 1	\$B2 (Bank 1 Sensor 1)	\$B2 - \$B3
EGR and/or VVT	Data C bit 7 = 1	At least one OBDMID in the allowed range	\$31 - \$38

5.14.4 [ISO 9141-2, SAE J1850 and ISO 14230-4 protocols only] For all supported OBDMIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, send the corresponding Service \$06 request message and note the response.

TABLE 63 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ OBDMID TEST VALUES) FOR ISO 9141-2, SAE J1850 AND ISO 14230-4 PROTOCOLS ONLY

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID	M	XX	OBDMID

TABLE 64 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT OBDMID TEST VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for non-continuously monitored systems response SID	M	46	SIDPR
#2	Test ID (report test results)	M	XX	TID
#3	Test Limit Type & Component ID	M	XX	TLTCID
#4	data record of Test ID = [			TIDREC_
#5	Test Value (High Byte)	M	XX	TVHI
#6	Test Value (Low Byte)	M	XX	TVLO
#7	Test Limit (High Byte)	C	XX	TLHI
	Test Limit (Low Byte)]	C	XX	TLLO

C =Conditional — if Test Limit is either a Minimum or a Maximum Limit depends on the parameter Test Limit Type & Component ID value (bit 7)

Evaluation criteria:

The test value(s) must be greater than or equal to the Min Test Limit(s) and less than or equal to the Max Test Limit(s).

Some manufacturers have engine-off monitors, e.g., O2 sensors that run as soon as the ignition is turned on. These monitors may report test results on Service \$06. If a Service \$06 Test ID reports a test value, and test limits, it shall not be considered a failure.

5.14.5 [For all protocols] Request next unsupported OBDMID-support OBDMID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs to ensure ECU can respond properly to an unsupported OBDID and does not terminate communication (single request).

5.14.6 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to a diagnostic message, this shall be flagged as a failure.

5.15 Verify Service \$07 – Request Pending Emission-related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service \$07 request and there are no pending emission-related DTCs reported.

Procedure:

5.15.1 [For all protocols] Transmit a Service \$07 request message. Verify that a proper response is received with DTC count set to zero.

TABLE 65 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request SID	07	SIDRQ

TABLE 66 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 67 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	47	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

For ISO 15765-4 and ISO 14230-4 protocols, verify that at least one Service \$07 DTC response with zero DTCs is received.

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$07 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

5.16 Verify Service \$08 – Request Control of On-board System, Test or Component, Engine Running

Purpose: To verify that each ECU responds correctly to a Service \$08 requests during engine-running conditions and to determine which TIDs are supported by each ECU. To verify the correct response to unsupported TIDs.

Procedure:

5.16.1 [For all protocols] Transmit Service \$08, TID support TIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request message through the highest supported TID TO DETERMINE WHICH TIDS ARE SUPPORTED. Note TIDs reported by each ECU as being supported.

TABLE 68 - REQUEST CONTROL OF ON-BOARD DEVICE REQUEST MESSAGE (READ SUPPORTED TIDS)
FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device request SID	M	08	SIDRQ
#2	TID#1 (Test IDs supported)	M	XX	TID

TABLE 69 - REQUEST CONTROL OF ON-BOARD DEVICE RESPONSE MESSAGE (REPORT SUPPORTED TIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
#2	data record of supported TIDs = [1 st supported TID Data A: supported TIDs, Data B: supported TIDs, Data C: supported TIDs, Data D: supported TIDs]	M	XX	TIDREC_
#3		M	xxxxxxxx	TID
#4		M	xxxxxxxx	DATA_A
#5		M	xxxxxxxx	DATA_B
#6		M	xxxxxxxx	DATA_C
		M	xxxxxxxx	DATA_D

C1 = Conditional — TID value shall be the same value as included in the request message if supported by the ECU
C2 = Conditional — value indicates TIDs supported; range of supported TIDs depends on selected TID value (see C1) for ISO 15765-4. For SAE J1850, ISO9141-2 and ISO 14230-4, Data A-E shall be filled with \$00 if unused.

Evaluation criteria:

If the service is not supported by an ECU, no response is allowed for SAE J1850, ISO 9141-2 and ISO 15765-4.

If the service is not supported for ISO 14230-4, the ECU will either not respond, or respond with a negative response message (\$7F, \$08, \$11).

If all TID support TIDs for an ECU indicate that no TIDs are supported, this shall be flagged as a failure.

There is no legislative requirement to support Service \$08. If Service \$08 is not supported, it shall be flagged as a warning that each manufacturer will need to analyze.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

5.16.2 [For ISO 15765-4 protocol only] Transmit request for all TID support TIDs as two messages (TIDs \$00, \$20, \$40, \$60, \$80, \$A0), and (TIDs \$C0, \$E0) and again note results.

TABLE 70 - REQUEST CONTROL OF ON-BOARD DEVICE REQUEST MESSAGE (READ SUPPORTED TIDS)
FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device request SID	M	08	SIDRQ
#2	TID#1 (Test IDs supported: \$01 - \$20)	M	00	TID
#3	TID#2 (Test IDs supported: \$21 - \$40)	U	20	TID
#4	TID#3 (Test IDs supported: \$41 - \$60)	U	40	TID
#5	TID#4 (Test IDs supported: \$61 - \$80)	U	60	TID
#6	TID#5 (Test IDs supported: \$81 - \$A0)	U	80	TID
#7	TID#6 (Test IDs supported: \$A1 - \$C0)	U	A0	TID

U = User Optional

TABLE 71 - REQUEST CONTROL OF ON-BOARD DEVICE RESPONSE MESSAGE (REPORT SUPPORTED TIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
#2	data record of supported TIDs = [1 st supported TID, Data A: supported TIDs, Data B: supported TIDs, Data C: supported TIDs, Data D: supported TIDs]	M	XX	TIDREC_TID
#3		M	xxxxxxx	DATA_A
#4		M	xxxxxxx	DATA_B
#5		M	xxxxxxx	DATA_C
#6		M	xxxxxxx	DATA_D
:	:	:	:	:
#n-4	data record of supported TIDs = [m th supported TID, Data A: supported TIDs, Data B: supported TIDs, Data C: supported TIDs, Data D: supported TIDs]	C1	XX	TIDREC_TID
#n-3		C2	xxxxxxx	DATA_A
#n-2		C2	xxxxxxx	DATA_B
#n-1		C2	xxxxxxx	DATA_C
#n		C2	xxxxxxx	DATA_D

C1 = Conditional — TID value shall be the same value as included in the request message if supported by the ECU
C2 = Conditional — value indicates TIDs supported; range of supported TIDs depends on selected TID value (see C1) for ISO 15765-4. For SAE J1850, ISO9141-2 and ISO 14230-4, Data A-E shall be filled with \$00 if unused.

Evaluation criteria:

Each ECU must report the same supported TIDs for single and group request messages.

5.16.3 [For all protocols] Request next unsupported TID support TID (\$00, \$20, \$40, \$60, \$80, \$A0, \$C0, \$E0) for all ECUs to ensure that the ECU can respond properly to an unsupported TID and does not terminate communication (single request).

5.16.4 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

5.17 Verify Service \$09 – Request Vehicle Information, Engine Running

Purpose: To verify that all ECUs respond correctly to Service \$09 requests with the engine running and to verify that VIN, CALIDs, and CVNs for reprogrammable ECUs are supported in the returned responses.

Procedure:

5.17.1 [For all protocols] Transmit Service \$09 request, INFOTYPEs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported INFOTYPE to determine which INFOTYPEs are supported. Note the INFOTYPEs reported by each ECU as being supported.

TABLE 72 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE (REQUEST SUPPORTED INFOTYPE) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information request SID	M	09	SIDRQ
#2	InfoType#1 (InfoType s supported)	M	XX	INF_TYP

TABLE 73 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (REQUEST SUPPORTED INFOTYPE) FOR ISO 9141-2, SAE J1850 AND ISO 14230-4 PROTOCOLS ONLY

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	XX	INF_TYP_
#3	MessageCount	M	XX	MC_
#4	data record of InfoType = [Data A: supported InfoTypes, Data B: supported InfoTypes, Data C: supported InfoTypes, Data D: supported InfoTypes]	M	xxxxxxxx	DATA_REC_- DATA_A
#5		M	xxxxxxxx	DATA_B
#6		M	xxxxxxxx	DATA_C
#7		M	xxxxxxxx	DATA_D

TABLE 74 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (REQUEST SUPPORTED INFOTYPE) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	data record of supported InfoTypes = [1 st supported InfoType Data A: supported InfoTypes, Data B: supported InfoTypes, Data C: supported InfoTypes, Data D: supported InfoTypes]	M	XX	INF_TYPREC
#3		M	xxxxxxxx	DATA_A
#4		M	xxxxxxxx	DATA_B
#5		M	xxxxxxxx	DATA_C
#6		M	xxxxxxxx	DATA_D

C1 = Conditional — INFOTYPE value shall be the same value as included in the request message if supported by the ECU
 C2 = Conditional — value indicates INFOTYPES supported; range of supported INFOTYPES depends on selected INFOTYPE value (see C1)

Evaluation criteria:

Verify that one and only one ECU on the vehicle supports INFOTYPE \$02 (VIN).

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. Verify that CALID (INFOTYPE \$04) is supported by the expected number of ECUs, as indicated by the operator prompt.

Operator prompt 2 asks for the number of emission-related reprogrammable ECUs in the vehicle. The number of ECUs that report CVNs must match or exceed the number of ECUs input by the operator at prompt 2. (Non-reprogrammable ECUs are not prohibited from outputting CVNs.)

Verify that IPT (INFOTYPE \$08 or INFOTYPE \$0B) is supported by at least one ECU. In-use Performance Indicator (INFOTYPE \$08 or INFOTYPE \$0B) must be supported for the 2007 MY and beyond or this shall be flagged as a failure.

Verify that both INFOTYPE \$08 and \$0B are not supported. If they are, this shall be flagged as a failure.

For ECUs that support IPT (INFOTYPE \$08 or \$0B), verify that IPT support for ECU matches Service \$01, PID \$01, DATA_B bit 3. If bit 3 = 0 (spark ignition), then INFOTYPE \$08 shall be supported, if bit 3 = 1 (compression ignition), then INFOTYPE \$0B shall be supported. For 2010 MY and beyond, the support bit status shall match the data reported from Operator Prompt 4. Inconsistent support between DATA_B bit 3, INFOTYPES \$08 and \$0B and Operator Prompt 4 shall be flagged as a failure. Prior to the 2010 MY, this shall be a warning for compression ignition engines only (i.e. bit 3 = 0 but Operator Prompt indicates diesel). Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.

Verify that INFOTYPE \$0A is supported for 2010 MY and beyond vehicles. If the vehicle does not support ECU name, this shall be flagged as failure, however, if the vehicle is a 2010 – 2012 MY vehicle that does not support ECU name, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

If all INFOTYPE support PIDs for an ECU indicate that no INFOTYPES are supported, this shall be flagged as a failure.

If an INFOTYPE higher than \$0B is supported, this shall be flagged as a failure.

For ISO 15764-4 protocol only, if INFOTYPE \$01, \$03, \$05 or \$07 is supported, this shall be flagged as a warning.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

5.17.2 [For ISO 15765-4 protocol only] Transmit request for all INFOTYPES as two messages (INFOTYPES \$00, \$20, \$40, \$60, \$80, \$A0), and (INFOTYPES \$C0, \$E0) and again note results.

TABLE 75 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE (REQUEST SUPPORTED INFOTYPE)
FOR ISO 156765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information request SID	M	09	SIDRQ
#2	InfoType#1 (InfoTypes supported: \$01 - \$20)	M	00	INF_TYP
#3	InfoType#2 (InfoTypes supported: \$21 – \$40)	U	20	INF_TYP
#4	InfoType#3 (InfoTypes supported: \$41 - \$60)	U	40	INF_TYP
#5	InfoType#4 (InfoTypes supported: \$61 - \$80)	U	60	INF_TYP
#6	InfoType#5 (InfoTypes supported: \$81 - \$A0)	U	80	INF_TYP
#7	InfoType#6 (InfoTypes supported: \$A0 - \$C0)	U	A0	INF_TYP

U = User Optional.

TABLE 76 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (REQUEST SUPPORTED INFOTYPE)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	data record of supported InfoTypes = [1 st supported InfoType	M	XX	INFYPREC
#3	Data A: supported InfoTypes,	M	xxxxxxxx	INFYP
#4	Data B: supported InfoTypes,	M	xxxxxxxx	DATA_A
#5	Data C: supported InfoTypes,	M	xxxxxxxx	DATA_B
#6	Data D: supported InfoTypes]	M	xxxxxxxx	DATA_C
:	:	:	:	DATA_D
#n-4	data record of supported InfoTypes = [m th supported InfoType	C1	XX	INFYPREC
#n-3	Data A: supported InfoTypes,	C2	xxxxxxxx	INFYP
#n-2	Data B: supported InfoTypes,	C2	xxxxxxxx	DATA_A
#n-1	Data C: supported InfoTypes,	C2	xxxxxxxx	DATA_B
#n	Data D: supported InfoTypes]	C2	xxxxxxxx	DATA_C
				DATA_D
C1 = Conditional — INFOTYPE value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates INFOTYPES supported; range of supported INFOTYPES depends on selected INFOTYPE value (see C1)				

Evaluation criteria:

For ISO 15765-4 protocol, each ECU must report the same supported OBDMIDs for single and group request messages.

5.17.3 [For all protocols] Request next unsupported INFOTYPE support INFOTYPE (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs to ensure ECU can respond properly to an unsupported INFOYTPE and does not terminate communication (single request).

5.17.4 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Procedure:

5.17.5 [For SAE J1850, ISO 9141-2 and ISO 14230-4 protocols] Transmit Service \$09, INFOTYPE = \$01.

TABLE 77 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: 01 – MessageCount VIN	01	INFYP

TABLE 78 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	49	SIDRQ
#2	InfoType: 01 – MessageCount VIN	01	INFYP
#3	Message Count VIN = 5 response messages	05	MC_VIN

Evaluation criteria:

Response message for INFOTYPE \$01 should return a value of \$05 for SAE J1850, ISO 9141-2 and ISO 14230-4.

5.17.6 [For all protocols] Transmit Service \$09, INFOTYPE = \$02 (VIN).

TABLE 79 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: 02 - VIN (Vehicle Identification Number)	02	INFTYP

TABLE 80 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	ECU #1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: 02 - VIN (Vehicle Information Number)	02	INFTYP
#3	Number of data items: 01	01	NODI
#4	1 st ASCII character of VIN	XX	VIN
#5	2 nd ASCII character of VIN	XX	VIN
#6	3 rd ASCII character of VIN	XX	VIN
#7	4 th ASCII character of VIN	XX	VIN
#8	5 th ASCII character of VIN	XX	VIN
#9	6 th ASCII character of VIN	XX	VIN
#10	7 th ASCII character of VIN	XX	VIN
#11	8 th ASCII character of VIN	XX	VIN
#12	9 th ASCII character of VIN	XX	VIN
#13	10 th ASCII character of VIN	XX	VIN
#14	11 th ASCII character of VIN	XX	VIN
#15	12 th ASCII character of VIN	XX	VIN
#16	13 th ASCII character of VIN	XX	VIN
#17	14 th ASCII character of VIN	XX	VIN
#18	15 th ASCII character of VIN	XX	VIN
#19	16 th ASCII character of VIN	XX	VIN
#20	17 th ASCII character of VIN	XX	VIN

TABLE 81 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850, ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	02	INFTYP_
#3	MessageCount	M	01 - 05	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D

C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06

Evaluation criteria:

For response to INFOTYPE \$02, five response messages should be received for SAE J1850, ISO 9141-2 and ISO 14230-4. The response consists of the following messages:

Message # 1 shall contain three pad bytes of \$00, followed by VIN character # 1.

Message # 2 shall contain VIN characters # 2 through # 5 inclusive.

Message # 3 shall contain VIN characters # 6 through # 9 inclusive.

Message # 4 shall contain VIN characters # 10 through # 13 inclusive.

Message # 5 shall contain VIN characters # 14 through # 17 inclusive.

For ISO 15765-4, there is only one response message that consists of all VIN characters without any pad bytes. NODI in the response message must be \$01.

Only one ECU on the vehicle shall support INFOTYPE \$02 (VIN).

All Model Year characters must be printable ASCII characters 1 through 9 and A through Z except I, O and Q. (Invalid characters shall be flagged as a failure.) All remaining characters must be printable ASCII characters 0 through 9 and A through Z except I, O and Q. (Invalid characters shall be flagged as a failure.)

The VIN year character (position 10) must correspond to the model year entered by the operator in Prompt 3.

TABLE 82 - VIN YEAR CHARACTER

VIN Character	Model Year	Model Year
A		2010
B	1981	2011
C	1982	2012
D	1983	2013
E	1984	2014
F	1985	2015
G	1986	2016
H	1987	2017
J	1988	2018
K	1989	2019
L	1990	2020
M	1991	2021
N	1992	2022
P	1993	2023
R	1994	2024
S	1995	2025
T	1996	
V	1997	
W	1998	
X	1999	
Y	2000	
1	2001	
2	2002	
3	2003	
4	2004	
5	2005	
6	2006	
7	2007	
8	2008	
9	2009	

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Procedure:

5.17.7 [For SAE J1850, ISO 9141-2 and ISO 14230-4 protocols] Transmit Service \$09, INFOTYPE = \$03.

TABLE 83 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: MessageCount Calibration ID	03	INFTYP

TABLE 84 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	49	SIDRQ
#2	InfoType: MessageCount CALID	03	INFTYP
#3	Message Count Calibration ID = x response messages	XX	MC_CALID

Evaluation criteria:

Response message for INFOTYPE \$03 should return a value that is a multiple of 4 for all protocols except ISO 15765-4.

5.17.8 [For all protocols] Transmit Service \$09, INFOTYPE = \$04 (CALID).

TABLE 85 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: Calibration ID	04	INFTYP

TABLE 86 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1ST) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: Calibration ID	04	INFTYP
#3	Number of data items: 02 for this example	02	NODI
#4	Data A	XX	DATA_A
#5	Data B	XX	DATA_B
#6	Data C	XX	DATA_C
#7	Data D	XX	DATA_D
#8	Data E	XX	DATA_E
#9	Data F	XX	DATA_F
#10	Data G	XX	DATA_G
#11	Data H	XX	DATA_H
#12	Data I	XX	DATA_I
#13	Data J	XX	DATA_J
#14	Data K	XX	DATA_K
#15	Data L	XX	DATA_L
#16	Data M	XX	DATA_M
#17	Data N	XX	DATA_N
#18	Data O	XX	DATA_O
#19	Data P	XX	DATA_P
#20	Data A	XX	DATA_A
#21	Data B	XX	DATA_B
#22	Data C	XX	DATA_C
#23	Data D	XX	DATA_D
#24	Data E	XX	DATA_E
#25	Data F	XX	DATA_F
#26	Data G	XX	DATA_G
#27	Data H	XX	DATA_H
#28	Data I	XX	DATA_I
#29	Data J	XX	DATA_J
#30	Data K	XX	DATA_K
#31	Data L	XX	DATA_L
#32	Data M	XX	DATA_M
#33	Data N	XX	DATA_N
#34	Data O	XX	DATA_O
#35	Data P	XX	DATA_P

TABLE 87 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850, ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	04	INFTYP_
#3	MessageCount	M	01 – XX	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D

C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06

Evaluation criteria:

The value of INFOTYPE \$03 divided by 4 must match the number of 16 character CALIDs returned for SAE J1850, ISO 14230-4, ISO 9141-2.

For ISO 15765-4, NODI in the response message must match the number of 16 character CALIDs returned.

All CALIDs must contain 1 to 16 printable ASCII characters.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. Each emission-related ECU shall output one or more CALIDs. (Every OBD ECU must report its own CALID; however, some ECUs may report multiple CALIDs). For the 2009 MY and beyond, if any emission-related ECU reports more than one CALID, this shall be flagged as a warning. Manufacturers may request EO approval to respond with more than one CALID per ECU.

Any unused CALID bytes must be reported as \$00 and reported at the end on the CALID.

Procedure:

5.17.9 [For SAE J1850, ISO 9141-2 and ISO 14230-4 protocols] Transmit Service \$09, INFOTYPE = \$05.

TABLE 88 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: MessageCount CVN	05	INFTYP

TABLE 89 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	49	SIDRQ
#2	InfoType: MessageCount CVN	05	INFTYP
#3	Message Count CVN = x response messages	XX	MC_CVN

Evaluation criteria:

Note message count for evaluation in 5.17.10.

5.17.10 [For all protocols] Transmit Service \$09, INFOTYPE = \$06 (CVN).

It is assumed that the ECU has been running for at least 30 seconds and all CVNs have been calculated.

TABLE 90 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: Calibration Verification Number	06	INFTYP

TABLE 91 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: Calibration Verification Number	06	INF_TYP
#3	Number of data items: 02 for this example	02	NODI
#4	Data A	XX	DATA_A
#5	Data B	XX	DATA_B
#6	Data C	XX	DATA_C
#7	Data D	XX	DATA_D
#8	Data E	XX	DATA_E
#9	Data F	XX	DATA_F
#10	Data G	XX	DATA_G
#11	Data H	XX	DATA_H

TABLE 92 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850, ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	06	INF_TYP_
#3	MessageCount	M	01 – XX	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D

C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06

Evaluation criteria:

The value of INFOTYPE \$05 must match the number of 4 byte CVNs returned for ISO 9141-2, SAE J1850 and ISO 14230-4.

For ISO 15765-4, NODI in the response message must match the number of 4 byte CVNs returned.

If an ECU does not support INFOTYPE \$06, no response is allowed for ISO 15765-4, SAE J1850 and ISO 9141-2. For ISO 14230-4, the ECU can either not respond or send a negative response (\$7F, \$12).

All CVNs must contain 4 bytes of hex data.

Operator prompt 2 asks for the number of emission-related reprogrammable ECUs in the vehicle. The number of ECUs that report CVNs must match or exceed the number of ECUs input by the operator at prompt 2. (Non-reprogrammable ECUs are not prohibited from outputting CVNs.) For the 2009 MY and beyond, if any emission-related ECU reports more than one CVN, this shall be flagged as a warning. Manufacturers may request EO approval to respond with more than one CVN per ECU.

Procedure:

5.17.11 [For SAE J1850, ISO 9141-2 and ISO 14230-4 protocols] Transmit Service \$09, INFOTYPE = \$07.

TABLE 93 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: 07 – MessageCount IPT	07	INFTYP

TABLE 94 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	49	SIDRQ
#2	InfoType: 07 – MessageCount IPT	07	INFTYP
#3	Message Count IPT = x response messages	XX	MC_IPT

Evaluation criteria:

Response message for INFOTYPE \$07 should return a value of 08 for all protocols except ISO 15765-4.

5.17.12 [For all protocols] Transmit Service \$09, INFOTYPE = \$08.

TABLE 95 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: In-use Performance Tracking	08	INFTYP

TABLE 96 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	08	INF_TYP
#3	Number of data items: 16 or 20 (shown as 20 in this example)	10 or 14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B

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TABLE 97 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850, ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INF_TYP_
#3	MessageCount	M	01 - 08	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	M	XX	DATA_A
#5		M	XX	DATA_B
#6		M	XX	DATA_C
#7		M	XX	DATA_D

Evaluation criteria:

For SAE J1850, ISO 9141-2 and ISO 14230-4 protocols, the value of INFOTYPE \$07 must match the number of returned response messages.

All In-use Performance data must contain either 32 bytes or 40 bytes of data.

If an ECU does not support INFOTYPE \$08, no response is allowed for ISO 15765-4, SAE J1850 and ISO 9141-2. For ISO 14230-4, the ECU can either not respond or send a negative response (\$7F, \$12).

For ISO 15765-4, NODI in the response message must be \$10 or \$14.

Starting with the 2010 MY, spark ignition engines must support data for secondary oxygen sensor. NODI must be \$14 and the response message must report back 40 bytes of data or this shall be flagged as a failure.

INFOTYPE \$08 (In-use performance data) must be supported for the 2005 MY and beyond. If the vehicle does not support in-use performance data, this shall be flagged as a failure, however, if the vehicle is a 2005 or 2006 MY, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

5.17.13 [For ISO 15765-4] Transmit Service \$09, INFOTYPE = \$0B.

TABLE 98 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ISO 15765-4

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: In-use Performance Tracking	0B	INF_TYP_

TABLE 99 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	0B	INFOTYP
#3	Number of data items: 16	10	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	HCCATCOMP_A: X counts	XX	HCCATCOMP_A
#9	HCCATCOMP_B: X counts	XX	HCCATCOMP_B
#10	HCCATCOND_A: X counts	XX	HCCATCOND_A
#11	HCCATCOND_B: X counts	XX	HCCATCOND_B
#12	NCATCOMP_A: X counts	XX	NCATCOMP_A
#13	NCATCOMP_B: X counts	XX	NCATCOMP_B
#14	NCATCOND_A: X counts	XX	NCATCOND_A
#15	NCATCOND_B: X counts	XX	NCATCOND_B
#16	NADSCOMP_A: X counts	XX	NADSCOMP_A
#17	NADSCOMP_B: X counts	XX	NADSCOMP_B
#18	NADSCOND_A: X counts	XX	NADSCOND_A
#19	NADSCOND_B: X counts	XX	NADSCOND_B
#20	PMCOMP_A: X counts	XX	PMCOMP_A
#21	PMCOMP_B: X counts	XX	PMCOMP_B
#22	PMCOND_A: X counts	XX	PMCOND_A
#23	PMCOND_B: X counts	XX	PMCOND_B
#24	EGSCOMP_A: X counts	XX	EGSCOMP_A
#25	EGSCOMP_B: X counts	XX	EGSCOMP_B
#26	EGSCOND_A: X counts	XX	EGSCOND_A
#27	EGSCOND_B: X counts	XX	EGSCOND_B
#28	EGRCOMP_A: X counts	XX	EGRCOMP_A
#29	EGRCOMP_B: X counts	XX	EGRCOMP_B
#30	EGRCOND_A: X counts	XX	EGRCOND_A
#31	EGRCOND_B: X counts	XX	EGRCOND_B
#32	BPCOMP_A: X counts	XX	BPCOMP_A
#33	BPCOMP_B: X counts	XX	BPCOMP_B
#34	BPCOND_A: X counts	XX	BPCOND_A
#35	BPCOND_B: X counts	XX	BPCOND_B

Evaluation criteria:

All In-use Performance data must contain 32 bytes of data.

If an ECU does not support INFOTYPE \$0B, no response is allowed for ISO 15765-4.

For ISO 15765-4, NODI in the response message must be \$01.

INFOTYPE \$0B (In-use performance data) must be supported by compression ignition engines for the 2010 MY and beyond or this shall be flagged as a failure.

5.17.14 [For ISO 15765-4] Transmit Service \$09, INFOTYPE = \$0A.

TABLE 100 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ISO 15765-4

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: ECU's/module's acronym and text name	0A	INFOTYP

TABLE 101 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: ECU's/module's acronym and text name	0A	INFOTYP
#3	Number of data items: 01	01	NODI
#4	Data A	XX	ECUNAME_A
#5	Data B	XX	ECUNAME_B
#6	Data C	XX	ECUNAME_C
#7	Data D	XX	ECUNAME_D
#8	Data E: '-' delimiter	2D	ECUNAME_E
#9	Data F	XX	ECUNAME_F
#10	Data G	XX	ECUNAME_G
#11	Data H	XX	ECUNAME_H
#12	Data I	XX	ECUNAME_I
#13	Data J	XX	ECUNAME_J
#14	Data K	XX	ECUNAME_K
#15	Data L	XX	ECUNAME_L
#16	Data M	XX	ECUNAME_M
#17	Data N	XX	ECUNAME_N
#18	Data O	XX	ECUNAME_O
#19	Data P	XX	ECUNAME_P
#20	Data Q	XX	ECUNAME_Q
#21	Data R	XX	ECUNAME_R
#22	Data S	XX	ECUNAME_S
#23	Data T	XX	ECUNAME_T

Evaluation criteria:

If an ECU does not support INFOTYPE \$0A, no response is allowed for ISO 15765-4.

For ISO 15765-4, NODI in the response message must be \$01.

All ECU Name data must contain 20 bytes of data. All characters must be printable ASCII characters 1 through 9 and A through Z, + and / except for the delimiter (\$2D) and filler bytes (\$00). Invalid characters shall be flagged as a failure for 2010 MY and beyond.

Defined field assignment:

- Data bytes 1-4, “XXXX”, contains ECU acronym and ECU number if the vehicle is equipped with more than one ECU of that type as specified in Table 102 below;
- Data byte 5, “-”, (\$2D) contains delimiter;
- Data bytes 6-20, “YYYYYYYYYYYYYYYY”, contains text name (no blanks between words) and ECU number if the vehicle is equipped with more than one ECU of that type as specified in Table 101 below.

Any unused bytes shall be filled with \$00 at the end of the field.

Any data field that does not match the specification in Table 102 (ECU name and number must match corresponding ECU Acronym and number. ECU name and ECU Acronym must match table value including characters, case, spelling and include no spaces.) shall be flagged as a warning prior to 2010 MY and a failure for 2010 MY and beyond

If more than one ECU responds with the same ECU name, this shall be flagged as a failure.

INFOTYPE \$0A (ECU Name data) must be supported by all emission-related ECUs (as indicated by Operator prompt 1) for the 2010 MY and beyond or this shall be flagged as a failure, however, if the vehicle is a 2010 - 2012 MY vehicle that does not support ECU name, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

TABLE 102 - ECU NAME DATA BYTE DESCRIPTION

Acronym (max 1 – 4 chars)	Full name of Control Module/ECU	ECU name and number (max 14 chars + 1 opt. digit)
ABS, ABS1, ABS2	Anti-Lock Brake System (ABS) Control Module	AntiLockBrake
AFCM, AFC1, AFC2	Alternative Fuel Control Module	AltFuelCtrl
AHCM, AHC1, AHC2	Auxiliary Heater Control Module	AuxHeatCtrl
AWDC, AWD1, AWD2	All Wheel Drive Control Module	AllWhlDrvCtrl
BECM, BEC1, BEC2	Battery Energy Control Module	B+EnergyCtrl
BSCM, BSC1, BSC2	Brake System Control Module	BrakeSystem
CRCM, CRC1, CRC2	Cruise Control Module	CruiseControl
CTCM, CTC1, CTC2	Coolant Temperature Control Module	CoolTempCtrl
DMCM, DMC1, DMC2	Drive Motor Control Module	DriveMotorCtrl
ECCI, ECC1, ECC2	Emissions Critical Control Information	EmisCritInfo
ECM, ECM1, ECM2	Engine Control Module	EngineControl
FACM, FAC1, FAC2	Fuel Additive Control Module	FuelAddCtrl
FICM, FIC1, FIC2	Fuel Injector Control Module	FuelInjCtrl
FPCM, FPC1, FPC2	Fuel Pump Control Module	FuelPumpCtrl
4WDC, 4WD1, 4WD2	Four-Wheel Drive Clutch Control Module	4WhlDrvCICtrl
GPCM, GPC1, GPC2	Glow Plug Control Module	GlowPlugCtrl
GSM, GSM1, GSM2	Gear Shift Control Module	GearShiftCtrl
HPCM, HPC1, HPC2	Hybrid Powertrain Control Module	HybridPtCtrl
IPC, IPC1, IPC2	Instrument Panel Cluster (IPC) Control Module	InstPanelClust
PCM, PCM1, PCM2	Powertrain Control Module	PowertrainCtrl
RDCM, RDC1, RDC2	Reducant Control Module	ReducantCtrl
SGCM, SGC1, SGC2	Starter / Generator Control Module	Start/GenCtrl
TACM, TAC1, TAC2	Throttle Actuator Control Module	ThrotActCtrl
TCCM, TCC1, TCC2	Transfer Case Control Module	TransfCaseCtrl
TCM, TCM1, TCM2	Transmission Control Module	TransmisCtrl

5.18 Verify Service \$01 Data in Reverse Order

Purpose: To verify that all ECUs respond correctly to Service \$01 requests, even in reverse order, to determine which PIDs are supported by each ECU, both indicated as supported and indicated as unsupported.

Procedure:

5.18.1 [For all protocols] Transmit Service \$01, PID support PIDs \$E0, \$C0, \$A0, \$80, \$60, \$40, \$20, and \$00 request messages (in reverse order) to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 103 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE,
REVERSE ORDER FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs	XX	PID

TABLE 104 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [1 st supported PID Data A: supported PIDs, Data B: supported PIDs, Data C: supported PIDs, Data D: supported PIDs]	M	XX	PIDREC_PID
#3		M	xxxxxxxx	DATA_A
#4		M	xxxxxxxx	DATA_B
#5		M	xxxxxxxx	DATA_C
#6		M	xxxxxxxx	DATA_D

C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)

Evaluation criteria:

Each ECU must report the same set of supported PIDs as was reported in 5.10.1

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure. Except for PID \$00, if a PID Supported PID for an ECU indicates that no PIDs are supported, this shall be flagged as a failure.

5.18.2 [For ISO 15765-4 protocol only] Transmit request for all PID support PIDs as two messages (in reverse order) (PIDs \$E0, \$C0) and (PIDs \$A0, \$80, \$60, \$40, \$20, \$00) and again note results.

TABLE 105 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE,
REVERSE ORDER FOR ISO 15765-4 PROTOCOL

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs A1-E0	A0	PID
#3	PID used to determine PID support for PIDs 81-A0	80	PID
#4	PID used to determine PID support for PIDs 61-80	60	PID
#5	PID used to determine PID support for PIDs 41-60	40	PID
#6	PID used to determine PID support for PIDs 21-40	20	PID
#7	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 106 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [1 st supported PID, Data A: supported PIDs, Data B: supported PIDs, Data C: supported PIDs, Data D: supported PIDs]	M	XX	PIDREC_- PID
#3		M	xxxxxxxx	DATA_A
#4		M	xxxxxxxx	DATA_B
#5		M	xxxxxxxx	DATA_C
#6		M	xxxxxxxx	DATA_D
:	:	:	:	:
#n-4	data record of supported PIDs = [m th supported PID, Data A: supported PIDs, Data B: supported PIDs, Data C: supported PIDs, Data D: supported PIDs]	C1	XX	PIDREC_- PID
#n-3		C2	xxxxxxxx	DATA_A
#n-2		C2	xxxxxxxx	DATA_B
#n-1		C2	xxxxxxxx	DATA_C
#n		C2	xxxxxxxx	DATA_D
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

Each ECU must report the same supported PIDs for single and group request messages.

5.18.3 [For all protocols] Request all PIDs except PID support PIDs in reverse order (\$FF through \$01), even if not supported, to ensure ECU can respond properly to unsupported PIDs and does not terminate communication. For ISO 15765-4 protocol only, request the last 6 supported PIDs in reverse order as a group using a single message.

TABLE 107 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data request SID	M	01	SIDRQ
#2	PID#1	M	XX	PID

TABLE 108 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of 1 st supported PID = [
#3	PID#1	M	XX	PIDREC_
#4	data A,	M	XX	PID
#5	data B,	C1	XX	DATA_A
#6	data C,	C1	XX	DATA_B
	data D]	C1	XX	DATA_C
				DATA_D
C1 = Conditional — “data B - D” depend on selected PID value				

Evaluation criteria:

All PIDs that are indicated as supported by the forward-order PID support map in 5.10.1 must be supported.

NOTE: It is not an error to return a PID that was not supported on SAE J1850, and ISO 9141-2. On ISO 15765-4, the ECU shall not respond to an unsupported PID. On ISO 14230-4, the ECU can either respond with a negative response message (\$7F, \$12) or not respond to a request for an unsupported PID.

5.18.4 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

5.19 Verify Service \$01 Idle Message Timing

Purpose: To verify that all ECUs continue to remain initialized and in a diagnostic session even if the test tool at sends diagnostic messages the maximum allowed interval.

Procedure:

5.19.1 [For all protocols] Transmit the Service \$01 PID \$00 request at the maximum allowed time interval (4900 ms) for 15 seconds (3 requests).

TABLE 109 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 110 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [
#3	1 st supported PID	M	XX	PIDREC_PID
#4	Data A: supported PIDs,	M	xxxxxxx	DATA_A
#5	Data B: supported PIDs,	M	xxxxxxx	DATA_B
#6	Data C: supported PIDs,	M	xxxxxxx	DATA_C
	Data D: supported PIDs]	M	xxxxxxx	DATA_D
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

Verify that a response is received from every emission-related ECU for every request. If all responses are not received, this will be flagged as a failure.

5.20 Verify Service \$01 Burst Message Timing

Purpose: To verify that all ECUs continue to remain initialized and in a diagnostic session even if the test tool sends diagnostic messages at the maximum allowed rate.

Procedure:

5.20.1 [For all protocols] Transmit the Service \$01 PID \$00 request at the maximum allowed rate. Alternate between Service \$01 PID \$00 and PID \$01.

Request PID \$00 and \$01 for 5 seconds at the maximum rate defined by ISO 15031-5 P3 timing. (P3 K-Line = 55 ms for ISO 9141-2 and ISO 14230-4. There is no P3 definition for SAE J1850 and ISO 15765-4 which means that the test tool can send another request immediately after all expected responses have been received.)

Test tool should expect to receive Service \$01 PID \$00 responses from all OBD ECUs. Test tool should only expect to receive responses from OBD ECUs that support Service \$01, PID \$01.

TABLE 111 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00 or 01	PID

TABLE 112 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [
#3	1 st supported PID	M	XX	PIDREC_-
#4	Data A: supported PIDs,	M	xxxxxxx	PID
#5	Data B: supported PIDs,	M	xxxxxxx	DATA_A
#6	Data C: supported PIDs,	M	xxxxxxx	DATA_B
	Data D: supported PIDs]	M	xxxxxxx	DATA_C
				DATA_D
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

Verify that a response is received for every request and that the data link remains initialized.

Verify that at least 100 responses are received for ISO 15765-4, at least 50 responses are received for SAE J1850, and at least 4 responses are received for ISO 14230-4 and ISO 9141-2. Fewer than the minimum number of responses may indicate a throughput problem between the SAE J2534 interface and the ECU.

A correct burst test response is defined as receiving the correct number of responses from all ECUs expected to respond to a Service \$01 PID \$00 request or receiving the correct number of responses from all ECUs expected to respond to a Service \$01 PID \$01 request.

5.21 Verify Reserved/Unused Services, Engine Running

Purpose: To verify that all ECUs respond correctly to reserved/unused services.

Procedure: [For ISO 15765-4 protocol only] Request all reserved services \$00 and from \$0B through \$0F to ensure all ECUs can respond properly to unsupported services and do not terminate communication,

5.21.1 [For ISO 15765-4 protocol only] Transmit a Service \$00 and \$0B through Service \$0F request messages. Wait for approximately 2.0 seconds for a response and continue.

TABLE 113 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	00, 0B - 0F	SIDRQ

Evaluation criteria:

Verify that no response is received from any ECU. Any response message including a negative response shall be considered a failure.

5.21.2 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

6. TEST VEHICLE AND SET A PENDING CODE BY INDUCING A FAULT

Purpose: This group of tests will establish that under normal operating conditions communication can be established and that all supported test services behave correctly in the presence of an induced fault.

6.1 Induce Circuit Fault

Procedure:

- 6.1.1 With ignition off and engine off, disconnect a sensor that is tested continuously (e.g., ECT, TP, IAT, MAF, etc.); a fault that will generate a MIL light and a single DTC with the engine idling in a short period of time (i.e. < 10 seconds) for only one ECU. The selected fault must illuminate the MIL using two driving cycles, not one driving cycle (like GM "Type A" DTC) to allow proper testing of Service 07 and freeze frame. If a DTC that sets in two driving cycles cannot be tested, it is acceptable to use a fault that sets in one driving cycle. If this is the case, a pending DTC, a confirmed DTC, and MIL will be set on the first driving cycle.
- 6.1.2 Start engine, let idle for one minute or whatever time it takes to set a pending DTC.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster.

6.2 Establish Communication (SAE J1978 / ISO 15031-4), Engine Running

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

- 6.2.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 15765-4 – 11-bit

ISO 15765-4 – 29 bit

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 114 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 115 - ECU#X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

6.3 Verify Service \$07 – Request Pending Emission-related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service \$07 request and there is at least one pending emission-related DTC reported.

Procedure:

6.3.1 Every 0.500 seconds, tool will request pending DTCs. If DTC is set, tool will prompt user that DTC has been set and to continue. If no pending DTC is set, after 30 seconds the tool will prompt the user to continue without a pending DTC (logged as a failure).

6.3.2 [For all protocols] Transmit a Service \$07 request message.

TABLE 116 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request SID	07	SIDRQ

TABLE 117 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	01	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

TABLE 118 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR SAE J1850, ISO 9141-2 AND ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	DTC#1 (High Byte)	XX	DTC1HI
#3	DTC#1 (Low Byte)	XX	DTC1LO
#4	DTC#2 (High Byte)	XX	DTC2HI
#5	DTC#2 (Low Byte)	XX	DTC2LO
#6	DTC#3 (High Byte)	XX	DTC2HI
#7	DTC#3 (Low Byte)	XX	DTC2LO
C =Conditional — DTC#1, DTC#2, and DTC#3 are always present. If no valid DTC number is included the DTC values shall contain \$00			

Evaluation criteria:

Verify that at least one Service \$07 pending DTC response with a non-zero DTC is received. (all protocols)

For ISO 15765-4 only, the #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU has no DTCs to report, it shall respond in the following manner:

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a report containing no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$07 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

6.4 Verify Service \$03 – Request Emission-related DTCs, Engine Running

Purpose: To verify that a proper response indicating no stored DTCs is received and to verify that the MIL is off.

Procedure:

6.4.1 [For all protocols] Transmit Service \$03. Verify that a proper response is received.

TABLE 119 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs request SID	03	SIDRQ

TABLE 120 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE
FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 121 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE
FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

If a “Type A – one driving cycle” fault was induced, a confirmed DTC will be set and the MIL will be illuminated on the first driving cycle. If 6.4.1 results in at least one confirmed DTC, skip to Section 7 and continue.

Each ECU that has no DTCs to report shall respond in the following manner:

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$03 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

Procedure:

6.4.2 [For all protocols] Transmit Service \$01, PID \$01 request message and note results.

TABLE 122 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID: Number of emission-related DTCs and MIL status	01	PID

TABLE 123 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: Number of emission-related DTCs and MIL status	01	PID
#3	MIL: status, Number of emission-related DTCs	00000000 b = \$00	DATA_A
#4	Misfire -, Fuel system -, Comprehensive monitoring	xxxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxxx b = \$XX	DATA_D

Evaluation criteria:

DATA_A, bits 0-6 must be zero (no DTCs) and DATA_A bit 7 must be zero (MIL is off).

6.5 Verify Service \$02 – Request Powertrain Freeze Frame Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service \$02 requests if a freeze frame is stored.

Procedure:

6.5.1 [For all protocols] Transmit Service \$02 Frame \$00 PID \$02 to read freeze frame DTCs.

TABLE 124 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	02	SIDRQ
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO

TABLE 125 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	42	SIDPR
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO
#4	DTC High Byte of PXXXX	XX	DATA_A
#5	DTC Low Byte of PXXXX	XX	DATA_B

Evaluation criteria:

If an ECU does not support Service \$02, it shall not respond to a Service \$02 request for SAE J1850, ISO 9191-2, or ISO 15765-4 protocols. The ECU can either not respond or send a negative response (\$7F, \$11) for ISO 14230-4 protocol.

Freeze frame may be stored when pending DTC is set; however, it is not required. If freeze frame is not stored for pending codes, PID \$02 is reported as \$0000 for that ECU.

If freeze frame is supported for pending codes in some ECUs, verify that Frame \$00, PID \$02 is the same as any one of the DTCs reported in Service \$07 for the vehicle (the set of ECUs).

Procedure:

6.5.2 [For all protocols] If freeze frame is supported for pending codes (i.e. an ECU responded with a PID \$02 Freeze Frame DTC), Transmit Service \$02, Frame \$00, PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0, Frame \$00 request messages through the highest supported PID to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 126 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 127 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	1 st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, #5 data B, #6 data C, #7 data D]	M C1 C1 C1	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D

C1 = Conditional — “data B - D” depend on selected PID

Evaluation criteria:

If an ECU has a freeze frame DTC, but does not support Service \$02, PID \$00, Frame \$00, this shall be flagged as a failure.

If only one ECU supports Service \$02, Frame \$00, PID \$02, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by the vehicle.

When more than one ECU supports Service \$02, Frame \$00, PID \$02, then, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by each corresponding ECU that has a freeze frame DTC.

If all PID support PIDs for an ECU that has a freeze frame DTC indicates that no PIDs are supported, this shall be flagged as a failure.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

Procedure:

6.5.3 [For ISO 15765-4 protocol only] Transmit request for all supported PID support PIDs up to three messages (PIDs \$00, \$20, \$40), (PIDs \$60, \$80, \$A0), and (PIDs \$C0, \$E0) and again note results.

TABLE 128 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ISO 15765-4

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	M	00	PID
#3	frame #00	M	00	FRNO_
#4	PID used to determine PID support for PIDs 21-40	U	20	PID
#5	frame #00	U/C	00	FRNO_
#6	PID used to determine PID support for PIDs 41-60	U/C	40	PID
#7	frame #00	U/C	00	FRNO_

U = User Optional
C = Conditional — parameter is only included if preceding PID# is included

TABLE 129 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	1 st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxxx	DATA_A
#5		C1	xxxxxxxx	DATA_B
#6		C1	xxxxxxxx	DATA_C
#7		C1	xxxxxxxx	DATA_D
:		:	:	:
#2	m th supported PID	C2	XX	PID_
#3	frame #	C2	XX	FRNO_
#4	data record of m th supported PID = [data A, data B, data C, data D]	C3	xxxxxxxx	DATA_A
#5		C4	xxxxxxxx	DATA_B
#6		C4	xxxxxxxx	DATA_C
#7		C4	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID
C2 = Conditional — parameter shall be the same value as included in the request message if supported
C3 = Conditional — data A shall be included if preceding PID is supported
C4 = Conditional — parameters and values for “data B - D” depend on selected PID number

Evaluation criteria:

Each ECU must report the same supported PIDs for single and group request messages.

6.5.4 [For all protocols] For all PIDs supported by the vehicle, (PIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF), as determined in 6.4.2, send the corresponding Service \$02 Frame \$00 PID request message and evaluate the response for each ECU.

TABLE 130 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 131 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	PID	M	XX	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxxx	DATA_A
#5		C1	xxxxxxxx	DATA_B
#6		C1	xxxxxxxx	DATA_C
#7		C1	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID

Evaluation criteria:

Each ECU that indicated support for a PID and has a freeze frame DTC stored in Frame \$00, PID \$02, must send a positive response.

Each ECU that 1) did not indicate support for a PID or 2) indicated support for a PID but has no freeze frame DTC stored in Frame \$00, PID \$02, shall respond in the following manner:

For SAE J1850 and ISO 9141-2, no response is preferred, but a positive response is allowed.

For ISO 15765-4, the ECU shall not respond.

For ISO 14230-4, no response is preferred, but a negative response message (\$7F, \$12) is allowed.

For ISO 15765-4 protocols, if PID \$02 indicates \$0000, the ECU shall not respond to a Service \$02 request for PID \$01, PID \$03-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF.

6.5.5 [For ISO 15765-4 protocol only] Request up to the first three supported PIDs for each ECU that has a freeze frame DTC as a group and note the response.

TABLE 132 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_
#4	PID	U	XX	PID
#5	frame #00	U/C	00	FRNO_
#6	PID	U	XX	PID
#7	frame #00	U/C	00	FRNO_

U = User Optional
C = Conditional — parameter is only included if preceding PID# is included

TABLE 133 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	PID	M	XX	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, #5 data B, #6 data C, #7 data D]	M	xxxxxxxx	DATA_A
		C1	xxxxxxxx	DATA_B
		C1	xxxxxxxx	DATA_C
		C1	xxxxxxxx	DATA_D
:	:	:	:	:
#2	m th supported PID	C2	XX	PID_
#3	frame #	C2	XX	FRNO_
#4	data record of m th supported PID = [data A, #5 data B, #6 data C, #7 data D]	C3	xxxxxxxx	DATA_A
		C4	xxxxxxxx	DATA_B
		C4	xxxxxxxx	DATA_C
		C4	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID
C2 = Conditional — parameter shall be the same value as included in the request message if supported
C3 = Conditional — data A shall be included if preceding PID is supported
C4 = Conditional — parameters and values for “data B - D” depend on selected PID number

Evaluation criteria:

Each ECU must respond with the same data value for each PID for single PID requests and group PID requests.

6.5.6 [For all protocols] Request next unsupported PID-support PID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs (if available as determined in 6.4.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

6.5.7 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

7. TEST VEHICLE AND SET A CONFIRMED CODE AND MIL BY RETAINING FAULT

7.1 Continue to Induce Circuit Fault

Procedure:

7.1.1 Turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU. Keep sensor disconnected.

7.1.2 Start engine, let idle for one minute or whatever time it takes to set a confirmed DTC and illuminate the MIL.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster.

7.2 Establish Communication (SAE J1978 / ISO 15031-4), Engine Running

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

7.2.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 15765-4 – 29 bit

ISO 15765-4 – 11 bit

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 134 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 135 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

7.3 Verify Service \$07 – Request Pending Emission-related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service \$07 request and there is at least one pending emission-related DTC set even though the DTC is now a confirmed DTC as well.

Procedure:

7.3.1 [For all protocols] Every 0.500 seconds, tool will request pending DTCs by transmitting a Service \$07 request message. If DTC is set, tool will inform the user that DTC has been set and continue. If after 30 seconds, no pending DTC is set, the tool will continue to wait for a DTC to be set, but will allow the user the option to continue without a pending DTC (flagged as a failure).

TABLE 136 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request SID	07	SIDRQ

TABLE 137 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	01	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

TABLE 138 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR SAE J1850, ISO 9141-2 AND ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	DTC#1 (High Byte)	XX	DTC1HI
#3	DTC#1 (Low Byte)	XX	DTC1LO
#4	DTC#2 (High Byte)	XX	DTC2HI
#5	DTC#2 (Low Byte)	XX	DTC2LO
#6	DTC#3 (High Byte)	XX	DTC2HI
#7	DTC#3 (Low Byte)	XX	DTC2LO
C =Conditional — DTC#1, DTC#2, and DTC#3 are always present. If no valid DTC number is included the DTC values shall contain \$00			

TABLE 139 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

Evaluation criteria:

Verify that at least one Service \$07 pending DTC response with a non-zero DTC is received. (all protocols)

For ISO 15765-4 only, the #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU has no DTCs to report, it shall respond in the following manner:

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$07 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

7.4 Verify Service \$03 – Request Emission-related DTCs, Engine Running

Purpose: To verify that a proper response indicating at least one stored DTC is received and to verify that the MIL is still on.

Procedure:

7.4.1 [For all protocols] Transmit Service \$03 request message. Verify that a proper response is received.

TABLE 140 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs request SID	03	SIDRQ

TABLE 141 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	01	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

TABLE 142 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR SAE J1850, ISO 9141-2 AND ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: xx	XX	DTC1HI
#3	DTC#1 Low Byte: xx	XX	DTC1LO
#4	DTC#2 High Byte: xx	XX	DTC2HI
#5	DTC#2 Low Byte: xx	XX	DTC2LO
#6	DTC#3 High Byte: xx	XX	DTC3HI
#7	DTC#3 Low Byte: xx	XX	DTC3LO

TABLE 143 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 144 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE
FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

Verify that at least one Service \$03 DTC response with a non-zero DTC is received. (All protocols)

For ISO 15765-4 only, the #OFDTC (DTC count) and the number of reported DTCs must match.

Each ECU that has no DTCs to report shall respond in the following manner:

For SAE J1850 and ISO 9141-2 interfaces, no response is preferred, but a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs. (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$03 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

7.4.2 [For all protocols] Transmit Service \$01, PID \$01 request message and note results.

TABLE 145 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID: Number of emission-related DTCs and MIL status	01	PID

TABLE 146 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: Number of emission-related DTCs and MIL status	01	PID
#3	MIL: status, Number of emission-related DTCs	1xxxxxx b = \$XX	DATA_A
#4	Misfire -, Fuel system -, Comprehensive monitoring	xxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxx b = \$XX	DATA_D

Evaluation criteria:

DATA_A, bits 0-6 must be greater than or equal to one (at least one DTC) and DATA_A bit 7 must be 1 (MIL is on) for at least one ECU.

7.5 Verify Service \$02 – Request Powertrain Freeze Frame Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service \$02 requests and that at least one ECU contains freeze frame data for a confirmed DTC.

Procedure:

7.5.1 [For all protocols] Transmit Service \$02 Frame \$00 PID \$02 to read freeze frame DTCs. Freeze frame must be present in at least one ECU while a confirmed DTC is present.

TABLE 147 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	02	SIDRQ
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO

TABLE 148 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	42	SIDPR
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO
#4	DTC High Byte of PXXXX	XX	DATA_A
#5	DTC Low Byte of PXXXX	XX	DATA_B

Evaluation criteria:

Verify that Frame \$00, PID \$02 is the same as one of the DTCs reported in Service \$03 in Section 7 for the vehicle (the set of ECUs) and is the same Freeze Frame DTC as reported in 6.5.1. There should be at least one DTC stored.

NOTE: The OBD-II regulations allow overwriting an exiting Freeze Frame with a misfire DTC (P0300 - P0312) or a fuel system DTC (P0170 - P0175), however, it is assumed that this testing will not be performed on a vehicle that will set these faults. A different Freeze Frame DTC between 6.5.1 and 7.5.1 shall, therefore, be flagged as a failure.

If an ECU does not support Service \$02, it shall not respond to a Service \$02 request for SAE J1850, ISO 9191-2, or ISO 15765-4 protocols. The ECU can either not respond or send a negative response (\$7F, \$11) for ISO 14230-4 protocol.

Procedure:

7.5.2 [For all protocols] Transmit Service \$02, Frame \$00 PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0, Frame \$00 request messages through the highest supported PID to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 149 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 150 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDRQ
#2	1 st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, #5 data B, #6 data C, #7 data D]	M	xxxxxxxx	DATA_A
		C1	xxxxxxxx	DATA_B
		C1	xxxxxxxx	DATA_C
		C1	xxxxxxxx	DATA_D
C1 = Conditional — “data B - D” depend on selected PID				

Evaluation criteria:

If an ECU has a freeze frame DTC, but does not support Service \$02, PID \$00, Frame \$00, this shall be flagged as a failure.

If only one ECU supports Service \$02, Frame \$00, PID \$02, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by the vehicle that has a freeze frame DTC.

When more than one ECU supports Service \$02, Frame \$00, PID \$02, then, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by each corresponding ECU that has a freeze frame DTC.

If all PID support PIDs for an ECU that has a freeze frame DTC indicates that no PIDs are supported, this shall be flagged as a failure.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

Procedure:

7.5.3 [For ISO 15765-4 protocol only] Transmit request for all supported PID support PIDs up to three messages (PIDs \$00, \$20, \$40), (PIDs \$60, \$80, \$A0), and (PIDs \$C0, \$E0) and again note results.

TABLE 151 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ISO 15765-4

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	M	00	PID
#3	Frame #00	M	00	FRNO_
#4	PID used to determine PID support for PIDs 21-40	U	20	PID
#5	Frame #00	U/C	00	FRNO_
#6	PID used to determine PID support for PIDs 41-60	U/C	40	PID
#7	Frame #00	U/C	00	FRNO_

U = User Optional
C = Conditional — parameter is only included if preceding PID# is included

TABLE 152 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDRQ
#2	1 st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M C1 C1 C1	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D
:		:	:	:
#2	m th supported PID	C2	XX	PID_
#3	Frame #	C2	XX	FRNO_
#4	data record of m th supported PID = [data A, data B, data C, data D]	C3 C4 C4 C4	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D

C1 = Conditional — “data B - D” depend on selected PID
C2 = Conditional — parameter shall be the same value as included in the request message if supported
C3 = Conditional — data A shall be included if preceding PID is supported
C4 = Conditional — parameters and values for “data B - D” depend on selected PID number

Evaluation criteria:

Each ECU must report the same supported PIDs for single and group request messages.

7.5.4 [For all protocols] For all PIDs supported by the vehicle, (PIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF), as determined in 7.5.2, send the corresponding Service \$02 Frame \$00 PID request message and note the response for each ECU.

TABLE 153 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 154 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	PID	M	XX	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A,	M	xxxxxxxx	DATA_A
#5	data B,	C1	xxxxxxxx	DATA_B
#6	data C,	C1	xxxxxxxx	DATA_C
#7	data D]	C1	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID

Evaluation criteria:

Each ECU that indicated support for a PID and has a freeze frame DTC stored in Frame \$00, PID \$02, must send a positive response.

Each ECU that 1) did not indicate support for a PID or 2) indicated support for a PID but has no freeze frame DTC stored in Frame \$00, PID \$02, shall respond in the following manner:

For SAE J1850 and ISO 9141-2, no response is preferred, but a positive response is allowed.

For ISO 15765-4, the ECU shall not respond.

For ISO 14230-4, no response is preferred, but a negative response message (\$7F, \$12) is allowed.

For ISO 15765-4 protocols, if PID \$02 indicates \$0000, the ECU shall not respond to a Service \$02 request for PID \$01, PID \$03-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF.

7.5.5 [For ISO 15765-4 protocol only] Request up to the first three supported PIDs for each ECU that has a freeze frame DTC as a group and note the response.

TABLE 155 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_
#4	PID	U	XX	PID
#5	frame #00	U/C	00	FRNO_
#6	PID	U	XX	PID
#7	frame #00	U/C	00	FRNO_

U = User Optional
C = Conditional — parameter is only included if preceding PID# is included

TABLE 156 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	PID	M	XX	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxxx	DATA_A
#5		C1	xxxxxxxx	DATA_B
#6		C1	xxxxxxxx	DATA_C
#7		C1	xxxxxxxx	DATA_D
:	:	:	:	:
#2	m th supported PID	C2	XX	PID_
#3	frame #	C2	00	FRNO_
#4	data record of m th supported PID = [data A, data B, data C, data D]	C3	xxxxxxxx	DATA_A
#5		C4	xxxxxxxx	DATA_B
#6		C4	xxxxxxxx	DATA_C
#7		C4	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID
C2 = Conditional — parameter shall be the same value as included in the request message if supported
C3 = Conditional — data A shall be included if preceding PID is supported
C4 = Conditional — parameters and values for “data B - D” depend on selected PID number

Evaluation criteria:

Each ECU must respond with the same data value for each PID for single PID requests and group PID requests.

7.5.6 [For all protocols] Request next unsupported PID-support PID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs (if available as determined in 7.5.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

7.5.7 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

8. TEST VEHICLE WITH FAULT REPAIRED**8.1 Repair Circuit Fault and Complete One Driving Cycle, MIL Illuminated****Procedure:**

- 8.1.1 Turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU, connect sensor.
- 8.1.2 Start engine, let idle for one minute or whatever time it takes to run monitor and detect that there is no malfunction.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster.

- 8.1.3 Turn ignition off (engine off) for 30 seconds. (This completes one driving cycle with no fault.)
- 8.1.4 Start engine, let idle for one minute or whatever time it takes to detect that there is no malfunction.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster. (This starts the second driving cycle; however, second driving cycle will not be complete until key is turned off.)

8.2 Establish Communication (SAE J1978 / ISO 15031-4), Engine Running

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

- 8.2.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

SAE J1850 10.4 Kbps VPW

SAE J1850 41.6 Kbps PWM

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 15765-4 - 29 bit

ISO 15765-4 – 11 bit

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 157 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 158 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

8.3 Verify Service \$07 – Request Pending Emission-related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service \$07 request and there are no pending emission-related DTC set even though the DTC is still a confirmed DTC.

Procedure:

- 8.3.1 [For all protocols] Every 0.500 seconds, tool will request pending DTCs. If DTCs is no longer set, tool will prompt user that DTC has been cleared and to continue. If pending DTC continues to stay set, every 30 seconds the tool will prompt the user to continue with a pending DTC (logged as a failure).
- 8.3.2 Transmit a Service \$07 request message.

TABLE 159 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request SID	07	SIDRQ

TABLE 160 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 161 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	47	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

Verify that no Service \$07 pending DTC is set.

For ISO 15765-4 and ISO 14230-4 protocols, verify that at least one Service \$03 DTC response with zero DTCs is received.

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a report containing no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$07 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

8.4 Verify Service \$03 – Request Emission-related DTCs, Engine Running

Purpose: To verify that a proper response indicated at least one stored DTCs is received and to verify that the MIL is still on.

Procedure:

8.4.1 [For all protocols] Transmit Service \$03 request message. Verify that a proper response is received.

TABLE 162 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs request SID	03	SIDRQ

TABLE 163 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	> or = 01	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

TABLE 164 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR SAE J1850, ISO 9141-2 AND ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: xx	XX	DTC1HI
#3	DTC#1 Low Byte: xx	XX	DTC1LO
#4	DTC#2 High Byte: xx	XX	DTC2HI
#5	DTC#2 Low Byte: xx	XX	DTC2LO
#6	DTC#3 High Byte: xx	XX	DTC3HI
#7	DTC#3 Low Byte: xx	XX	DTC3LO

TABLE 165 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 166- REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE
FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

Verify that at least one Service \$03 DTC response with a non-zero DTC is received.

For ISO 15765-4 only, the #OFDTC (DTC count) and the number of reported DTCs must match.

Each ECU that has no DTCs to report shall respond in the following manner:

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$03 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

8.4.2 [For all protocols] Transmit Service \$01, PID \$01 request message and note the results.

TABLE 167 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID: Number of emission-related DTCs and MIL status	01	PID

TABLE 168 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: Number of emission-related DTCs and MIL status	01	PID
#3	MIL: status, Number of emission-related DTCs	1xxxxxx b	DATA_A
#4	Misfire -, Fuel system -, Comprehensive monitoring	xxxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxxx b = \$XX	DATA_D

Evaluation criteria:

DATA_A, bits 0-6 must be greater than or equal to one (at least one DTC) and DATA_A bit 7 must be 1 (MIL is on) for at least one ECU.

8.5 Verify Service \$02 – Request Powertrain Freeze Frame Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service \$02 requests when there is no DTC stored, that freeze frame data is retained in the ECU while a confirmed DTC is present.

Procedure:

8.5.1 [For all protocols] Transmit Service \$02 PID \$02 Frame \$00 to read freeze frame DTCs. Freeze frame must be retained in at least one ECU while a confirmed DTC is present.

TABLE 169 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	02	SIDRQ
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO

TABLE 170 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	42	SIDPR
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO
#4	DTC High Byte of PXXXX	XX	DATA_A
#5	DTC Low Byte of PXXXX	XX	DATA_B

Evaluation criteria:

Verify that Frame \$00, PID \$02 is the same as one of the DTCs reported in Service \$03 in Section 7 for the vehicle (the set of ECUs). There should be at least one DTC stored.

If an ECU does not support Service \$02, it shall not respond to a Service \$02 request for SAE J1850, ISO 9191-2, or ISO 15765-4 protocols. The ECU can either not respond or send a negative response (\$7F, \$11) for ISO 14230-4 protocol.

Procedure:

8.5.2 [For all protocols] Transmit Service \$02, Frame \$00 PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0, Frame \$00 request messages through the highest supported PID to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 171 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 172 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	1 st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, #5 data B, #6 data C, #7 data D]	M C1 C1 C1	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D

C1 = Conditional — “data B - D” depend on selected PID

Evaluation criteria:

If an ECU has a freeze frame DTC, but does not support Service \$02, PID \$00, Frame \$00, this shall be flagged as a failure.

If only one ECU supports Service \$02, Frame \$00, PID \$02, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by the vehicle that has a freeze frame DTC.

When more than one ECU supports Service \$02, Frame \$00, PID \$02, then, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by each corresponding ECU that has a freeze frame DTC.

If all PID support PIDs for an ECU that has a freeze frame DTC indicates that no PIDs are supported, this shall be flagged as a failure.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

Procedure:

8.5.3 [For ISO 15765-4 protocol only] Transmit request for all supported PID support PIDs up to three messages (PIDs \$00, \$20, \$40), (PIDs \$60, \$80, \$A0), and (PIDs \$C0, \$E0) and again note results.

TABLE 173 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	M	00	PID
#3	frame #00	M	00	FRNO_
#4	PID used to determine PID support for PIDs 21-40	U	20	PID
#5	frame #00	U/C	00	FRNO_
#6	PID used to determine PID support for PIDs 41-60	U/C	40	PID
#7	frame #00	U/C	00	FRNO_

U = User Optional
C = Conditional — parameter is only included if preceding PID# is included

TABLE 174 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDRQ
#2	1 st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M C1 C1 C1	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D
:		:	:	:
#2	m th supported PID	C2	XX	PID_
#3	Frame #	C2	XX	FRNO_
#4	data record of m th supported PID = [data A, data B, data C, data D]	C3 C4 C4 C4	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D

C1 = Conditional — “data B - D” depend on selected PID
C2 = Conditional — parameter shall be the same value as included in the request message if supported
C3 = Conditional — data A shall be included if preceding PID is supported
C4 = Conditional — parameters and values for “data B - D” depend on selected PID number

Evaluation criteria:

Each ECU must report the same supported PIDs for single and group request messages.

8.5.4 [For all protocols] For all PIDs supported by the vehicle, (PIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF), as determined in 8.5.2, send the corresponding Service \$02 Frame \$00 PID request message and note the response for each ECU.

TABLE 175 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 176 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	PID	M	XX	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxxx	DATA_A
#5		C1	xxxxxxxx	DATA_B
#6		C1	xxxxxxxx	DATA_C
#7		C1	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID

Evaluation criteria:

Each ECU that indicated support for a PID and has a freeze frame DTC stored in Frame \$00, PID \$02, must send a positive response.

Each ECU that 1) did not indicate support for a PID or 2) indicated support for a PID but has no freeze frame DTC stored in Frame \$00, PID \$02, shall respond in the following manner:

For SAE J1850 and ISO 9141-2, no response is preferred, but a positive response is allowed.

For ISO 15765-4, the ECU shall not respond.

For ISO 14230-4, no response is preferred, but a negative response message (\$7F, \$12) is allowed.

For ISO 15765-4 protocols, if PID \$02 indicates \$0000, the ECU shall not respond to a Service \$02 request for PID \$01, PID \$03-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF.

8.5.5 [For ISO 15765-4 protocol only] Request up to the first three supported PIDs for each ECU that has a freeze frame DTC as a group and note the response.

TABLE 177 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_
#4	PID	U	XX	PID
#5	frame #00	U/C	00	FRNO_
#6	PID	U	XX	PID
#7	frame #00	U/C	00	FRNO_

U = User Optional
C = Conditional — parameter is only included if preceding PID# is included

TABLE 178 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	PID	M	XX	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, #5 data B, #6 data C, #7 data D]	M	xxxxxxxx	DATA_A
		C1	xxxxxxxx	DATA_B
		C1	xxxxxxxx	DATA_C
		C1	xxxxxxxx	DATA_D
:	:	:	:	:
#2	m th supported PID	C2	XX	PID_
#3	frame #	C2	00	FRNO_
#4	data record of m th supported PID = [data A, #5 data B, #6 data C, #7 data D]	C3	xxxxxxxx	DATA_A
		C4	xxxxxxxx	DATA_B
		C4	xxxxxxxx	DATA_C
		C4	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID
C2 = Conditional — parameter shall be the same value as included in the request message if supported
C3 = Conditional — data A shall be included if preceding PID is supported
C4 = Conditional — parameters and values for “data B - D” depend on selected PID number

Evaluation criteria:

Each ECU must respond with the same data value for each PID for single PID requests and group PID requests.

8.5.6 [For all protocols] Request next unsupported PID-support PID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs (if available as determined in 8.4.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

8.5.7 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

8.6 Verify Service \$0A – Request Permanent Emission-related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service \$0A request and to verify that there is at least one permanent DTCs stored during the previous driving cycle.

Procedure:

8.6.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

TABLE 179 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

TABLE 180 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS
RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	01	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00. ECUs that do not support permanent codes shall not respond.

For 2009 MY and earlier, if no ECU responds to a Service \$0A request, this shall be considered a pass. Permanent codes must be supported by all emission-related ECUs that also support Service \$03 or Service \$07 for 2010 MY and beyond or this shall be flagged as a failure however, if the vehicle is a 2010 - 2012 MY vehicle that does not support permanent codes, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

For ISO 15765-4 interfaces, verify that at least one Service \$0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match. For 2009 MY and earlier, if all responses are received with #OFDTC set to \$00, this shall be flagged as a warning, for 2010 MY and beyond, this shall be flagged as a failure. (e.g. TCM supports Service \$0A, but ECM with the induced fault does not support Service \$0A). If the vehicle is a 2010 - 2012 MY vehicle where all emission-related ECUs do not support permanent codes, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

9. TEST VEHICLE WITH NO FAULTS AFTER 3 DRIVING CYCLES COMPLETED

9.1 Complete Two or More Additional Driving Cycles

Procedure:

9.1.1 Turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU. (This completes two driving cycles with no fault.)

9.1.2 Start engine, let idle for one minute or whatever time it takes to detect that there is no malfunction.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster. (This starts third driving cycle; however, third driving cycle will not be completed until key is turned off.)

9.1.3 Turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU. (This completes three driving cycles with no fault.)

9.1.4 Start engine, let idle for one minute or whatever time it takes to detect that there is no malfunction.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster. (This starts third driving cycle; however, third driving cycle will not be completed until key is turned off. (This initiates the fourth driving cycle, MIL may now be off, but it is not a failure if MIL stays illuminated. Additional driving cycles may be performed until the MIL is off.)

9.1.5 If the MIL is off, continue to 9.2, otherwise, turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU. (This completes an additional driving cycles with no fault.)

9.1.6 Start engine, let idle for one minute or whatever time it takes to detect that there is no malfunction.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster. (The MIL should now be off. Additional driving cycles may be performed until the MIL is off.)

9.2 Establish Communication (SAE J1978 / ISO 15031-4), Engine Running

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

9.2.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

ISO 15765-4 – 11-bit

ISO 15765-4 – 29 bit

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 9141-2(wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization)

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 181 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 182 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

9.3 Verify Service \$07 – Request Pending Emission-related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service \$07 request and there are no pending emission-related DTCs set.

Procedure:

9.3.1 [For all protocols] Transmit a Service \$07 request message.

TABLE 183 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request SID	07	SIDRQ

TABLE 184 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 185 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	47	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

Verify that no Service \$07 pending DTC is set.

For ISO 15765-4 and ISO 14230-4 protocols, verify that at least one Service \$07 DTC response with zero DTCs is received.

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$07 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

9.4 Verify Service \$03 – Request Emission-related DTCs, Engine Running

Purpose: To verify that a proper response indicated at least one stored DTCs is received and to verify that the MIL is now off.

Procedure:

9.4.1 [For all protocols] Transmit Service \$03 request message. Verify that a proper response is received.

TABLE 186 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs request SID	03	SIDRQ

TABLE 187 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	01	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

TABLE 188 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR SAE J1850, ISO 9141-2, AND ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: xx	XX	DTC1HI
#3	DTC#1 Low Byte: xx	XX	DTC1LO
#4	DTC#2 High Byte: xx	XX	DTC2HI
#5	DTC#2 Low Byte: xx	XX	DTC2LO
#6	DTC#3 High Byte: xx	XX	DTC3HI
#7	DTC#3 Low Byte: xx	XX	DTC3LO

TABLE 189 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 190 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE
FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

Verify that at least one Service \$03 DTC response with a non-zero DTC is received. (All protocols)

For ISO 15765-4 only, the #OFDTC (DTC count) and the number of reported DTCs must match.

Each ECU that has no DTCs to report shall respond in the following manner:

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$03 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

9.4.2 [For all protocols] Transmit Service \$01, PID \$01 request message and note the results.

TABLE 191 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID: Number of emission-related DTCs and MIL status	01	PID(01)

TABLE 192 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: Number of emission-related DTCs and MIL status	01	PID
#3	MIL: status, Number of emission-related DTCs	\$XX	DATA_A
#4	Misfire -, Fuel system -, Comprehensive monitoring	\$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	\$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	\$XX	DATA_D

Evaluation criteria:

DATA_A, bits 0-6 must be greater than or equal to one (at least one DTC).

Procedure:

9.4.3 Record MIL status (DATA_A bit 7) in vehicle log file – MIL must not be illuminated or this will be flagged as a failure.

9.5 Verify Service \$02 – Request Powertrain Freeze Frame Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service \$02 requests and that freeze frame data is retained in the ECU after the MIL is extinguished and the confirmed DTC is still present for 40 warm-up cycles.

Procedure:

9.5.1 [For all protocols] Transmit Service \$02 PID \$02 Frame \$00 to read freeze frame DTCs. Freeze frame must be retained in at least one ECU after MIL is extinguished.

TABLE 193 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	02	SIDRQ
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO

TABLE 194 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request powertrain freeze frame data response SID	42	SIDPR
#2	PID: DTC that caused required freeze frame data storage	02	PID
#3	Frame #	00	FRNO
#4	DTC High Byte of PXXXX	XX	DATA_A
#5	DTC Low Byte of PXXXX	XX	DATA_B

Evaluation criteria:

Verify that Frame \$00, PID \$02 is the same as one of the DTCs reported in Service \$03 from Section 7 for the vehicle (the set of ECUs). There should be at least one DTC stored.

If an ECU does not support Service \$02, it shall not respond to a Service \$02 request for SAE J1850, ISO 9191-2, or ISO 15765-4 protocols. The ECU can either not respond or send a negative response (\$7F, \$11) for ISO 14230-4 protocol.

Procedure:

9.5.2 [For all protocols] Transmit Service \$02, Frame \$00 PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0, Frame \$00 request messages through the highest supported PID to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 195 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 196 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	1 st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4 #5 #6 #7	data record of 1 st supported PID = [data A, data B, data C, data D]	M C1 C1 C1	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D

C1 = Conditional — “data B - D” depend on selected PID

Evaluation criteria:

If an ECU has a freeze frame DTC, but does not support Service \$02, PID \$00, Frame \$00, this shall be flagged as a failure.

If only one ECU supports Service \$02, Frame \$00, PID \$02, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by the vehicle that has a freeze frame DTC.

When more than one ECU supports Service \$02, Frame \$00, PID \$02, then, at a minimum, PIDs \$02, \$04, either \$05 or \$67, \$0C, \$0D, and either \$11, \$45 or \$49 must be supported by each corresponding ECU that has a freeze frame DTC.

If all PID support PIDs for an ECU that has a freeze frame DTC indicates that no PIDs are supported, this shall be flagged as a failure.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

9.5.3 [For ISO 15765-4 protocol only] Transmit request for all supported PIDs up to three messages (PIDs \$00, \$20, \$40, \$60), (PIDs \$80, \$A0), and (PIDs \$C0, \$E0) and again note results.

TABLE 197 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	M	00	PID
#3	frame #00	M	00	FRNO_
#4	PID used to determine PID support for PIDs 21-40	U	20	PID
#5	frame #00	U/C	00	FRNO_
#6	PID used to determine PID support for PIDs 41-60	U	40	PID
#7	frame #00	U/C	00	FRNO_

U = User Optional
C = Conditional — parameter is only included if preceding PID# is included

TABLE 198 - REQUEST POWERTRAIN FREEZE FRAME DATA RESPONSE MESSAGE
(REPORT FREEZE FRAME PID VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDRQ
#2	1 st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxxx	DATA_A
#5		C1	xxxxxxxx	DATA_B
#6		C1	xxxxxxxx	DATA_C
#7		C1	xxxxxxxx	DATA_D
:	:	:	:	:
#2	m th supported PID	C2	XX	PID_
#3	Frame #	C2	XX	FRNO_
#4	data record of m th supported PID = [data A, data B, data C, data D]	C3	xxxxxxxx	DATA_A
#5		C4	xxxxxxxx	DATA_B
#6		C4	xxxxxxxx	DATA_C
#7		C4	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID
C2 = Conditional — parameter shall be the same value as included in the request message if supported
C3 = Conditional — data A shall be included if preceding PID is supported
C4 = Conditional — parameters and values for “data B - D” depend on selected PID number

Evaluation criteria:

Each ECU must report the same supported PIDs for single and group request messages.

9.5.4 [For all protocols] For all PIDs supported by the vehicle, (PIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF), send the corresponding Service \$02 Frame \$00 PID request message and note the response for each ECU.

TABLE 199 - REQUEST POWERTRAIN FREEZE FRAME DATA REQUEST MESSAGE
(READ SUPPORTED PIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_

TABLE 200 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	PID	M	XX	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, #5 data B, #6 data C, #7 data D]	M C1 C1 C1	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	DATA_A DATA_B DATA_C DATA_D

C1 = Conditional — “data B - D” depend on selected PID

Evaluation criteria:

Each ECU that indicated support for a PID and has a freeze frame DTC stored in Frame \$00, PID \$02, must send a positive response.

Each ECU that 1) did not indicate support for a PID or 2) indicated support for a PID but has no freeze frame DTC stored in Frame \$00, PID \$02, shall respond in the following manner:

For SAE J1850 and ISO 9141-2, no response is preferred, but a positive response is allowed.

For ISO 15765-4, the ECU shall not respond.

For ISO 14230-4, no response is preferred, but a negative response message (\$7F, \$12) is allowed.

For ISO 15765-4 protocols, if PID \$02 indicates \$0000, the ECU shall not respond to a Service \$02 request for PID \$01, PID \$03-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF.

9.5.5 [For ISO 15765-4 protocol only] Request up to the first three supported PIDs for each ECU that has a freeze frame DTC as a group and note the response.

TABLE 201 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_
#4	PID	U	XX	PID
#5	frame #00	U/C	00	FRNO_
#6	PID	U	XX	PID
#7	frame #00	U/C	00	FRNO_

U = User Optional
C = Conditional — parameter is only included if preceding PID# is included

TABLE 202 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	PID	M	XX	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, #5 data B, #6 data C, #7 data D]	M	xxxxxxxx	DATA_A
		C1	xxxxxxxx	DATA_B
		C1	xxxxxxxx	DATA_C
		C1	xxxxxxxx	DATA_D
:	:	:	:	:
#2	m th supported PID	C2	XX	PID_
#3	frame #	C2	00	FRNO_
#4	data record of m th supported PID = [data A, #5 data B, #6 data C, #7 data D]	C3	xxxxxxxx	DATA_A
		C4	xxxxxxxx	DATA_B
		C4	xxxxxxxx	DATA_C
		C4	xxxxxxxx	DATA_D

C1 = Conditional — “data B - D” depend on selected PID
C2 = Conditional — parameter shall be the same value as included in the request message if supported
C3 = Conditional — data A shall be included if preceding PID is supported
C4 = Conditional — parameters and values for “data B - D” depend on selected PID number

Evaluation criteria:

Each ECU must respond with the same data value for each PID for single PID requests and group PID requests.

9.5.6 [For all protocols] Request next unsupported PID-support PID (\$20, \$40, \$60, \$80, \$A0, \$C0, or \$E0) for all ECUs (if available as determined in 9.5.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

9.5.7 Transmit Service \$01, PID \$00 request message to determine if any emission-related ECUs have dropped out of communication.

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

9.6 Verify Service \$0A – Request Permanent Emission-related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service \$0A request and to verify that the permanent code was erased on the same driving cycle as the MIL was extinguished.

Procedure:

9.6.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message. Verify that a proper response is received with DTC count set to zero.

TABLE 203 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

TABLE 204 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	00	#OFDTC

Evaluation criteria:

For ISO 15765-4 interfaces, the ECU that support permanent codes will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00. ECUs that do not support permanent codes shall not respond.

For 2009 MY and earlier, if no ECU responds to a Service \$0A request, this shall be considered a pass. Permanent codes must be supported by all emission-related ECUs that also support Service \$03 or Service \$07 for the 2010 MY and beyond or this shall be flagged as a failure, however, if the vehicle is a 2010 - 2012 MY vehicle that does not support permanent codes or permanent codes for all emission-related ECUs, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

9.7 Complete Static Test or Continue to Permanent Code Drive Cycle

Purpose: To allow bypass of additional permanent DTC tests and Permanent Code drive cycle.

Procedure:

9.7.1 If Service \$0A was supported by at least one ECU in prior tests 5.21, 8.6, and 9.6, prompt the user to run the CARB drive cycle Portion for Permanent DTCs. If the answer is "Yes" then continue to 9.8. If the answer is "No" then skip to 9.22.2. If Service \$0A is supported and the user decides to bypass the CARB drive cycle, this shall be flagged as a warning that the Permanent Code Drive Cycle was not tested.

9.7.2 If Service \$0A was not supported by at least one ECU in prior tests 5.21, 8.6, and 9.6, skip to 9.22.2. If no ECUs support Service \$0A, this shall be flagged as a warning that the Permanent Code Drive Cycle could not be run because there were no Service \$0A responses during static test.

9.8 Induce Circuit Fault to Set Pending, and Confirmed DTC

Procedure:

9.8.1 With ignition off and engine off, disconnect a sensor that is tested continuously (e.g., ECT, TP, IAT, MAF, etc.); a fault that will generate a MIL light and a single DTC with the engine idling in a short period of time (i.e. < 10 seconds) for only one ECU. The selected fault must illuminate the MIL using two driving cycles, not one driving cycle (like GM “Type A” DTC) to allow proper testing of Service 07 and freeze frame. If a DTC that sets in two driving cycles cannot be tested, it is acceptable to use a fault that sets in one driving cycle. If this is the case, a pending DTC, a confirmed DTC, and MIL will be set on the first driving cycle.

9.8.2 Start engine, let idle for one minute or whatever time it takes to set a pending DTC.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster.

9.8.3 Turn ignition off (engine off) for 30 seconds. Keep sensor disconnected.

9.8.4 Start engine, let idle for one minute or whatever time it takes to set a confirmed DTC and illuminate the MIL.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster.

9.8.5 Turn ignition off (engine off) for 30 seconds. Keep sensor disconnected. This completes the driving cycle and allows the permanent code to be set. Connect scan tool to the SAE J1962 connector.

9.8.6 Turn ignition on. Do not crank engine.

9.9 Establish Communication (SAE J1978 / ISO 15031-4), Engine Off

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

9.9.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

ISO 15765-4 – 29 bit

ISO 15765-4 – 11 bit

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 205 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 206.- ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

9.10 Verify Service \$03 – Request Emission-related DTCs, Engine Off

Purpose: To verify that a proper response indicating at least one stored DTC is received and to verify that the MIL is still on.

Procedure:

9.10.1 [For ISO 15765-4 and ISO 14320-4 protocols] Transmit Service \$03 request message. Verify that a proper response is received.

TABLE 207 REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs request SID	03	SIDRQ

TABLE 208 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE
FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 and ISO 14230-4 protocols, verify that at least one Service \$03 DTC response with a non-zero DTC is received.

For ISO 15765-4 only, the #OFDTC (DTC count) and the number of reported DTCs must match.

Each ECU that has no DTCs to report shall respond in the following manner:

For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$03 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

9.11 Verify Service \$0A – Request Permanent Emission-related DTCs, Engine Off

Purpose: To verify that all ECUs respond correctly to a Service \$0A request and to verify that there is at least one permanent DTCs stored during the previous driving cycle.

Procedure:

9.11.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

TABLE 209 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

TABLE 210 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service \$0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported by all emission-related ECUs that also support Service \$03 or Service \$07 for the 2010 MY and beyond or this shall be flagged as a failure, however, if the vehicle is a 2010 - 2012 MY vehicle that does not support permanent codes or permanent codes for all emission-related ECUs, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

9.12 Repair Circuit Fault

Purpose: To verify that, with the ignition on and engine off, all ECUs provide the correct response to a Service \$04 request and that DTCs and the MIL status bit are cleared and permanent DTCs do not clear.

Procedure:

9.12.1 Turn ignition off (engine off) for 30 seconds.

9.12.2 Connect sensor.

9.12.3 Turn ignition on. Do not crank engine.

9.13 Establish Communication (SAE J1978 / ISO 15031-4), and Clear DTCs, Engine Off

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

9.13.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 15765-4 – 29 bit

ISO 15765-4 – 11 bit

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 211 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 212 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

9.13.2 [ISO 15765-4 protocol] Transmit Service \$04 request message and observe response message.

Any software meeting these specifications must wait 2 seconds before proceeding to next step to allow for NVRAM read/write times.

TABLE 213 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information request SID	04	SIDRQ

TABLE 214 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information response SID	44	SIDPR

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. At least one OBD ECU must respond with message as shown in the response table above. If more than the specified number of emission-related ECUs respond to this diagnostic message, this shall be flagged as a failure.

For ISO 15765-4, negative response message(s) (\$7F, \$04, \$78) are allowed for up to 30 seconds maximum, until a positive response message is available. All other negative responses shall be flagged as a failure.

9.14 Verify MIL Status Bit, Engine Off

Purpose: To verify the correct response to a Service \$01, PID \$01 request for those ECUs that support it, and that DTCs and the MIL status bit were cleared by the previous Service \$04 request.

Note to manufacturers: During bulb prove out, MIL status bit must indicate whether the MIL will be illuminated after engine is started. It should not reflect the status of the MIL bulb driver circuit, which will be turning the bulb on for the bulb prove out.

Procedure:

9.14.1 [For all protocols] Send Service \$01, PID \$01 request message.

TABLE 215 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID: Number of emission-related DTCs and MIL status	01	PID

TABLE 216 - ECU#1 RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: Number of emission-related DTCs and MIL status	01	PID
#3	MIL: status, Number of emission-related DTCs	00000000 b = \$00	DATA_A
#4	Misfire -, Fuel system -, Comprehensive monitoring	xxxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxxx b = \$XX	DATA_D

Evaluation criteria:

Each OBD ECU that responds with Service \$01, PID \$01 must respond with messages as shown in the response table above where:

DATA A bits 0 thru 6 must be 0. (Number of DTCs must be 0, because of previously sent engine-off Service \$04 request.) and DATA A bit 7 must be 0, indicating MIL off.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. At least one OBD ECU must respond with message as shown in the response table above. If more than the specified number of emission-related ECUs respond to this diagnostic message, this shall be flagged as a failure.

9.15 Verify Service \$0A – Request Permanent Emission-related DTCs, Engine Off

Purpose: To verify that all ECUs respond correctly to a Service \$0A request and to verify that there is at least one permanent DTC still stored after DTCs were cleared.

Procedure:

9.15.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

TABLE 217 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

TABLE 21. - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service \$0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported by all emission-related ECUs that also support Service \$03 or Service \$07 for the 2010 MY and beyond or this shall be flagged as a failure, however, if the vehicle is a 2010 - 2012 MY vehicle that does not support permanent codes or permanent codes for all emission-related ECUs, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

9.16 Complete One Driving Cycle with Fault Repaired**Procedure:**

9.16.1 Start engine, let idle for one minute or whatever time it takes to run monitor and detect that there is no malfunction. (Monitor may have already run with engine off.)

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster.

9.16.2 Turn ignition off (engine off) for 30 seconds. (This completes one driving cycle with no fault.)

9.16.3 Start engine, let idle for one minute or whatever time it takes to detect that there is no malfunction.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster. (This starts the second driving cycle; however, second driving cycle will not be complete until key is turned off.)

9.17 Establish Communication (SAE J1978 / ISO 15031-4), Engine Running

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

9.17.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

ISO 15765-4 - 29 bit

ISO 15765-4 – 11 bit

SAE J1850 10.4 Kbps VPW

SAE J1850 41.6 Kbps PWM

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 219 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 220 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

9.18 Verify Service \$0A – Request Permanent Emission-related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service \$0A request and to verify that there is at least one permanent DTC stored after DTCs were cleared and a short driving cycle was completed.

Procedure:

9.18.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

TABLE 221 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

TABLE 222 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service \$0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported by all emission-related ECUs ECUs that also support Service \$03 or Service \$07 for the 2010 MY and beyond or this shall be flagged as a failure, however, if the vehicle is a 2010 - 2012 MY vehicle that does not support permanent codes, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

9.19 Complete Permanent Code Drive Cycle

Purpose: To allow permanent DTCs to be erased after DTCs are cleared and permanent code driving cycle is complete. Permanent code must be retained until start of next driving cycle.

Procedure:

9.19.1 Drive vehicle according to the following conditions so that the OBD Condition Counter may increment:

- Continuous time > or = 30 seconds with vehicle speed < or = 1 mph and accelerator pedal released
- Cumulative time > or = 300 seconds with vehicle speed > or = 25 mph
- Cumulative time since engine start > or = 600 seconds

Prompt user to idle for 30 seconds, drive the vehicle at > or = 25 mph for 300 seconds, and continue driving the vehicle in any manner for an additional 270 seconds. Display the status of the OBDCOND counter, the IGNCTR counter, the 30 second "Idle Timer", the 300 second "25 MPH Driving Timer" and the 600 second "Total Drive Timer".

NOTE: The software will monitor the following PIDs, if available: \$0C (RPM), \$0D (VSS), \$1F (RUNTM) every 1.0 seconds to determine vehicle conditions. The software will monitor OBDCOND every 1.0 seconds. The software will inform user as soon as the drive cycle conditions have been completed and OBDCOND counter has incremented.

9.19.2 Every 1.0 seconds, tool will request permanent DTCs. If the DTC is erased, tool will prompt user that DTC has been erased prematurely and continue to 9.22. Premature erasure of the permanent code shall be logged as a failure.

9.19.3 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

TABLE 223 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

TABLE 224 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service \$0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match. Premature erasure of the permanent code shall be logged as a failure.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

ECUs that do not support permanent codes shall not respond.

9.19.4 [For all protocols] For all supported PIDs \$0C, \$0D, \$1F, send the corresponding Service \$01 PID request message and monitor the responses only from the modules that support Service \$01, PID \$01 (I/M Readiness).

TABLE 225 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data request SID	M	01	SIDRQ
#2	PID#1	M	X	PID

TABLE 226 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of 1 st supported PID = [
#3	PID#1	M	XX	PIDREC_
#4	data A,	M	XX	PID
#5	data B,	C1	XX	DATA_A
#6	data C,	C1	XX	DATA_B
	data D]	C1	XX	DATA_C
				DATA_D
C1 = Conditional — “data B - D” depend on selected PID value				
C2 = Conditional — parameter is only present if supported by the ECU				
C3 = Conditional — parameters and values for “data B - D” depend on selected PID number and are only included if PID is supported by the ECU				

NOTE: If multiple modules support I/M Readiness functionality, utilize only the responses from module that supports Service \$09, INFOTYPE \$08 or \$0B to perform this test. Based on the responses in 5.17.1, utilize INFOTYPE \$08 or \$0B to get OBDCOND counter data.

9.19.5 [For all protocols] Transmit Service \$09, INFOTYPE = \$08.

TABLE 227 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: In-use Performance Tracking	08	INF_TYP

TABLE 228 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	08	INF_TYP
#3	Number of data items: 16 or 20 (20 in this example)	14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B

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TABLE 229 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850, ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INF_TYP_
#3	MessageCount	M	01 - 08	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

9.19.6 [For ISO 15765-4] Transmit Service \$09, INFOTYPE = \$0B.

TABLE 230 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ISO 15765-4

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: In-use Performance Tracking	0B	INF_TYP

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TABLE 231 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	0B	INF_TYP
#3	Number of data items: 16	10	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	HCCATCOMP_A: X counts	XX	HCCATCOMP_A
#9	HCCATCOMP_B: X counts	XX	HCCATCOMP_B
#10	HCCATCOND_A: X counts	XX	HCCATCOND_A
#11	HCCATCOND_B: X counts	XX	HCCATCOND_B
#12	NCATCOMP_A: X counts	XX	NCATCOMP_A
#13	NCATCOMP_B: X counts	XX	NCATCOMP_B
#14	NCATCOND_A: X counts	XX	NCATCOND_A
#15	NCATCOND_B: X counts	XX	NCATCOND_B
#16	NADSCOMP_A: X counts	XX	NADSCOMP_A
#17	NADSCOMP_B: X counts	XX	NADSCOMP_B
#18	NADSCOND_A: X counts	XX	NADSCOND_A
#19	NADSCOND_B: X counts	XX	NADSCOND_B
#20	PMCOMP_A: X counts	XX	PMCOMP_A
#21	PMCOMP_B: X counts	XX	PMCOMP_B
#22	PMCOND_A: X counts	XX	PMCOND_A
#23	PMCOND_B: X counts	XX	PMCOND_B
#24	EGSCOMP_A: X counts	XX	EGSCOMP_A
#25	EGSCOMP_B: X counts	XX	EGSCOMP_B
#26	EGSCOND_A: X counts	XX	EGSCOND_A
#27	EGSCOND_B: X counts	XX	EGSCOND_B
#28	EGRCOMP_A: X counts	XX	EGRCOMP_A
#29	EGRCOMP_B: X counts	XX	EGRCOMP_B
#30	EGRCOND_A: X counts	XX	EGRCOND_A
#31	EGRCOND_B: X counts	XX	EGRCOND_B
#32	BPCOMP_A: X counts	XX	BPCOMP_A
#33	BPCOMP_B: X counts	XX	BPCOMP_B
#34	BPCOND_A: X counts	XX	BPCOND_A
#35	BPCOND_B: X counts	XX	BPCOND_B

Evaluation criteria:

The OBDCOND counter must increment within ± 20 seconds of the tool determination that the CARB drive cycle conditions have been met using the criteria listed below:

The engine has been started. Monitor for RUNTM > 0 seconds. If RUNTM is not available, monitor for RPM > 450 rpm.

Cumulative engine run time is > or = 600 seconds. Monitor for RUNTM > 600 seconds. If RUNTM is not available, monitor for RPM > 450 rpm for > 600 seconds.

Cumulative engine run time > or = 25 mph is > or = 300 seconds. Monitor for RUNTM increase > or = 300 seconds when VSS > or = 25 mph. If RUNTM is not available, monitor for RPM > 450 rpm and VSS > or = 25 mph for > or = 300 seconds.

Continuous time at vehicle speed < or = 1 mph is > or = 30 seconds. Monitor for RUNTM increase > 30 seconds when VSS < or = 1 mph. If RUNTM is not available, monitor for RPM > 450 rpm and VSS < or = 1 mph for > or = 30 seconds. (While idle timer is accumulating idle time, reset idle timer to zero if idle conditions are no longer being met and accumulate idle time once again if idle conditions are being met later in the driving cycle.)

The above conditions require that the user is driving the vehicle within the stated altitude and ambient air temperature conditions and that the accelerator pedal is released when the vehicle is stopped.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster.

Procedure:

9.19.7 When the software has determined that the OBDCOND counter has incremented and the driving conditions have been met, the software should stop sending Service \$01 and Service \$09 requests, prompt the operator to stop the vehicle in a safe location and turn off the ignition, then prompt the operator to continue with the test. This completes the end of the driving cycle.

9.20 Key On, See if Permanent DTCs have been Erased

Procedure:

9.20.1 Turn ignition on. Do not crank engine.

9.21 Establish Communication (SAE J1978 / ISO 15031-4), Engine Off

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

9.21.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

ISO 15765-4 – 11 bit

ISO 15765-4 – 29 bit

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 232 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 233 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

9.22 Verify Service \$0A – Request Permanent Emission-related DTCs, Engine Off

Purpose: To verify that all ECUs respond correctly to a Service \$0A request and to verify that there are no permanent DTCs stored after completing the CARB driving cycle with no malfunctions present.

Procedure:

9.22.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message. Verify that a proper response is received with DTC count set to zero.

TABLE 234 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

TABLE 235 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES WITH PERMANENT STATUS RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	00	#OFDTC

Evaluation criteria:

For ISO 15765-4 interfaces, the ECU that support permanent codes will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00. ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported by all emission-related ECUs that also support Service \$03 or Service \$07 for the 2010 MY and beyond or this shall be flagged as a failure, however, if the vehicle is a 2010 - 2012 MY vehicle that does not support permanent codes or permanent codes for all emission-related ECUs, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

Purpose:

Ask whether the user wants to clear codes at end of Section 9.

Procedure:

9.22.2 Prompt user whether to clear codes or exit Section 9. If the user wants to exit, continue to 9.22.3. If the user wants to clear codes with the engine off, continue to 9.23. If the user wants to clear codes with the engine running continue to 9.23.5.

Procedure:

9.22.3 Turn ignition off (engine off). Section 9 is complete.

It is a suggested software implementation that the Static Test logfile be closed at this time because the Static Test is complete.

9.23 Clear DTCs (Service \$04)

Purpose: To clear DTCs after completing Sections 5 through 9.

Procedure:

9.23.1 Turn ignition off for 30 seconds or longer, as appropriate for the ECU. Connect scan tool to the SAE J1962 connector.

9.23.2 Turn ignition on. Do not crank engine.

9.23.3 Establish communication (SAE J1978 / ISO 15031-4), ignition on, engine off

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Protocol Determination Procedure:

9.23.4 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 15765-4 – 11-bit

ISO 15765-4 – 29 bit

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 236 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 237 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

9.23.5 [For all protocols] Send Service \$04 to clear codes and verify that correct response is received.

Any software meeting these specifications must wait 2 seconds before proceeding to next step to allow for NVRAM read/write times.

TABLE 238 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information request SID	04	SIDRQ

TABLE 239 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information response SID	44	SIDPR

TABLE 240 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs→ External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Negative Response Service identifier	7F	SIDNR
#2	Clear/reset emission-related diagnostic information request SID	04	SIDRQ
#3	Negative Response Code: conditionNotCorrect	22	NR_CNC

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. At least one OBD ECU must respond with message as shown in the response table above. If more than the specified number of emission-related ECUs respond to this diagnostic message, this shall be flagged as a failure.

If an engine off Service \$04 request was made, for ISO 15765-4, a positive response message is required. Negative response message(s) (\$7F, \$04, \$78) are allowed for up to 30 seconds maximum, until a positive response message is available. All other negative responses shall be flagged as a failure. For ISO 9141-2, SAE J1850 and ISO 14230-4, a positive response is required.

If an engine running Service \$04 request was made, for all protocols, all OBD ECUs must respond in the same manner to an engine-running Service \$04 request, i.e. all ECUs provide a positive response or all ECUs provide a negative response. If all OBD ECUs do not provide the same response, this shall be flagged as a failure.

Procedure:

9.23.6 Prompt user whether to end Static Test or to continue to Dynamic Test. If requested by operator, continue testing and go to Section 10, otherwise prompt the operator to turn ignition off (engine off) to complete Section 9.

It is a suggested software implementation that the Static Test logfile be closed at this time because the Static Test is complete.

10. TEST VEHICLE WITH NO FAULTS TO VERIFY IN-USE PERFORMANCE COUNTERS, SERVICE \$06, AND SERVICE \$01

10.1 Establish Communication (SAE J1978 / ISO 15031-4), Ignition On, Engine Off

Purpose: To verify that one, and only one, of the allowed protocols is supported and that the vehicle sends a response message of the correct format.

Ensure that ignition is on, engine is off.

Protocol Determination Procedure:

10.1.1 Test tool sends Service \$01 PID \$00 request message for each of the protocols below per (SAE J1978 / ISO 15031-4) in the following sequence:

SAE J1850 41.6 Kbps PWM

SAE J1850 10.4 Kbps VPW

ISO 9141-2 (wait 5 seconds before trying next protocol)

ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

ISO 15765-4 – 11-bit

ISO 15765-4 – 29 bit

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below shall be run using this protocol. Continue with cycling thru the remainder of the protocols.

TABLE 241 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 242 - ECU# X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. If the specified number of emission-related ECUs do not positively respond to an OBD diagnostic message, this shall be flagged as a failure.

Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 volts.

10.2 Verify Service \$09 – Request VIN Information, Engine Off

Purpose: To obtain VIN from the vehicle and create a new, VIN-specific log file or continue testing with a existing VIN-specific log file. Obtain CALIDs and CVNs so they can be recorded in the logfile.

Procedure:

10.2.1 [For all protocols] Transmit Service \$09 request, INFOTYPE \$00 request message to determine which INFOTYPES are supported. Note the INFOTYPES reported by each ECU as supported.

TABLE 243 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE
(REQUEST SUPPORTED INFOTYPE) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information request SID	M	09	SIDRQ
#2	InfoType#1 (InfoType s supported)	M	00	INFTYP

TABLE 244 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE
(REQUEST SUPPORTED INFOTYPE) FOR ISO 9141-2, SAE J1850 AND ISO 14230-4 PROTOCOLS ONLY

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	XX	INF_TYP_
#3	MessageCount	M	XX	MC_
#4	data record of InfoType = [Data A: supported InfoTypes, Data B: supported InfoTypes, Data C: supported InfoTypes, Data D: supported InfoTypes]	M	xxxxxxxx	DATAREC_
#5		M	xxxxxxxx	DATA_A
#6		M	xxxxxxxx	DATA_B
#7		M	xxxxxxxx	DATA_C
				DATA_D

TABLE 245 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE
(REQUEST SUPPORTED INFOTYPE) FOR ISO 15765-4 PROTOCOL ONLY

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic	
#1	Request vehicle information response SID	M	49	SIDPR	
#2	data record of supported InfoTypes = [1 st supported InfoType Data A: supported InfoTypes, Data B: supported InfoTypes, Data C: supported InfoTypes, Data D: supported InfoTypes]	M	XX	INF_TYPREC	
#3		M	xxxxxxxx	INF_TYP	
#4		M	xxxxxxxx	DATA_A	
#5		M	xxxxxxxx	DATA_B	
#6		M	xxxxxxxx	DATA_C	
		M	xxxxxxxx	DATA_D	
C1 = Conditional — INFOTYPE value shall be the same value as included in the request message if supported by the ECU					
C2 = Conditional — value indicates INFOTYPES supported; range of supported INFOTYPES depends on selected INFOTYPE value (see C1)					

Evaluation criteria:

Verify that one and only one ECU on the vehicle supports INFOTYPE \$02 (VIN).

10.2.2 [For all protocols] Transmit Service \$09, INFOTYPE = \$02 (VIN).

TABLE 246 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: 02 - VIN (Vehicle Identification Number)	02	INF_TYP

TABLE 247 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	ECU #1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: 02 - VIN (Vehicle Information Number)	02	INF_TYP
#3	Number of data items: 01	01	NODI
#4	1 st ASCII character of VIN	XX	VIN
#5	2 nd ASCII character of VIN	XX	VIN
#6	3 rd ASCII character of VIN	XX	VIN
#7	4 th ASCII character of VIN	XX	VIN
#8	5 th ASCII character of VIN	XX	VIN
#9	6 th ASCII character of VIN	XX	VIN
#10	7 th ASCII character of VIN	XX	VIN
#11	8 th ASCII character of VIN	XX	VIN
#12	9 th ASCII character of VIN	XX	VIN
#13	10 th ASCII character of VIN	XX	VIN
#14	11 th ASCII character of VIN	XX	VIN
#15	12 th ASCII character of VIN	XX	VIN
#16	13 th ASCII character of VIN	XX	VIN
#17	14 th ASCII character of VIN	XX	VIN
#18	15 th ASCII character of VIN	XX	VIN
#19	16 th ASCII character of VIN	XX	VIN
#20	17 th ASCII character of VIN	XX	VIN

TABLE 248 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850,
ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	02	INF_TYP_
#3	MessageCount	M	01 - 05	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D

C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06

Evaluation criteria:

For response to INFOTYPE \$02, five response messages should be received for SAE J1850, ISO 9141-2 and ISO 14230-4. The response consists of the following messages:

Message # 1 shall contain three pad bytes of \$00, followed by VIN character # 1.

Message # 2 shall contain VIN characters # 2 through # 5 inclusive.

Message # 3 shall contain VIN characters # 6 through # 9 inclusive.

Message # 4 shall contain VIN characters # 10 through # 13 inclusive.

Message # 5 shall contain VIN characters # 14 through # 17 inclusive.

For ISO 15765-4, there is only one response message that consists of all VIN characters without any pad bytes.

Only one ECU on the vehicle shall support INFOTYPE \$02 (VIN).

All Model Year characters must be printable ASCII characters 1 through 9 and A through Z except I, O and Q. (Invalid characters shall be flagged as a failure.). All remaining characters must be printable ASCII characters 0 through 9 and A through Z except I, O and Q. (Invalid characters shall be flagged as a failure.).

Procedure:

10.2.3 [For SAE J1850, ISO 9141-2 and ISO 14230-4 protocols] Transmit Service \$09, INFOTYPE = \$03.

TABLE 249 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: MessageCount Calibration ID	03	INFTYP

TABLE 250 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	49	SIDRQ
#2	InfoType: MessageCount CALID	03	INFTYP
#3	Message Count Calibration ID = x response messages	XX	MC_CALID

Evaluation criteria:

Response message for INFOTYPE \$03 should return a value that is a multiple of 4 for all protocols except ISO 15765-4.

10.2.4 [For all protocols] Transmit Service \$09, INFOTYPE = \$04 (CALID).

TABLE 251 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: Calibration ID	04	INFTYP

TABLE 252.- REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1ST) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: Calibration ID	04	INFTYP
#3	Number of data items: 02 for this example	02	NODI
#4	Data A	XX	DATA_A
#5	Data B	XX	DATA_B
#6	Data C	XX	DATA_C
#7	Data D	XX	DATA_D
#8	Data E	XX	DATA_E
#9	Data F	XX	DATA_F
#10	Data G	XX	DATA_G
#11	Data H	XX	DATA_H
#12	Data I	XX	DATA_I
#13	Data J	XX	DATA_J
#14	Data K	XX	DATA_K
#15	Data L	XX	DATA_L
#16	Data M	XX	DATA_M
#17	Data N	XX	DATA_N
#18	Data O	XX	DATA_O
#19	Data P	XX	DATA_P
#20	Data A	XX	DATA_A
#21	Data B	XX	DATA_B
#22	Data C	XX	DATA_C
#23	Data D	XX	DATA_D
#24	Data E	XX	DATA_E
#25	Data F	XX	DATA_F
#26	Data G	XX	DATA_G
#27	Data H	XX	DATA_H
#28	Data I	XX	DATA_I
#29	Data J	XX	DATA_J
#30	Data K	XX	DATA_K
#31	Data L	XX	DATA_L
#32	Data M	XX	DATA_M
#33	Data N	XX	DATA_N
#34	Data O	XX	DATA_O
#35	Data P	XX	DATA_P

TABLE 253 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850,
ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	04	INFTYP_
#3	MessageCount	M	01 – XX	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D

C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06

Evaluation criteria:

The value of INFOTYPE \$03 divided by 4 must match the number of 16 character CALIDs returned for SAE J1850, ISO 14230-4, ISO 9141-2.

All CALIDs must contain 1 to 16 printable ASCII characters.

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. Each emission-related ECU shall output one or more CALIDs. (Every OBD ECU must report its own CALID; however, some ECUs may report multiple CALIDs). For the 2009 MY and beyond, if any emission-related ECU reports more than one CALID, this shall be flagged as a warning. Manufacturers may request EO approval to respond with more than one CALID per ECU.

Any unused CALID bytes must be reported as \$00 and reported at the end on the CALID.

Procedure:

10.2.5 [For SAE J1850, ISO 9141-2 and ISO 14230-4 protocols] Transmit Service \$09, INFOTYPE = \$05.

TABLE 254 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: MessageCount CVN	05	INFTYP

TABLE 255 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	49	SIDRQ
#2	InfoType: MessageCount CVN	05	INFTYP
#3	Message Count CVN = x response messages	XX	MC_CVN

Evaluation criteria:

Note message count for evaluation in 5.17.10

10.2.6 [For all protocols] Transmit Service \$09, INFOTYPE = \$06 (CVN).

It is assumed that the ECU has been running for at least 30 seconds and all CVNs have been calculated.

TABLE 256 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: Calibration Verification Number	06	INFTYP

TABLE 257 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: Calibration Verification Number	06	INF_TYP
#3	Number of data items: 02 for this example	02	NODI
#4	Data A	XX	DATA_A
#5	Data B	XX	DATA_B
#6	Data C	XX	DATA_C
#7	Data D	XX	DATA_D
#8	Data E	XX	DATA_E
#9	Data F	XX	DATA_F
#10	Data G	XX	DATA_G
#11	Data H	XX	DATA_H

TABLE 258 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850,
ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	06	INF_TYP_
#3	MessageCount	M	01 – XX	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D

C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06

Evaluation criteria:

The value of INFOTYPE \$05 must match the number of 8 character CVNs returned for ISO 9141-2, SAE J1850 and ISO 14230-4.

If an ECU does not support INFOTYPE \$06, no response is allowed for ISO 15765-4, SAE J1850 and ISO 9141-2. For ISO 14230-4, the ECU can either not respond or send a negative response (\$7F, \$12).

All CVNs must contain 4 bytes of hex data.

Operator prompt 2 asks for the number of emission-related reprogrammable ECUs in the vehicle. The number of ECUs that report CVNs must match or exceed the number of ECUs input by the operator at prompt 2. (Non-reprogrammable ECUs are not prohibited from outputting CVNs.) (Non-reprogrammable ECUs are not prohibited from outputting CVNs.) For the 2009 MY and beyond, if any emission-related ECU reports more than one CVN, this shall be flagged as a warning. Manufacturers may request EO approval to respond with more than one CVN per ECU.

Procedure:

If the VIN is invalid (i.e. development vehicle wth no valid VIN), prompt operator for an operator-specified file name or VIN in order to create a new log file, then continue vehicle testing in 10.3 or, if the operator-specified log file exists, continue to append to the existing operator-specified log file and resume testing in Section 11.

If the VIN is valid and has a corresponding VIN-specific log file, continue to append to the exiting VIN-specific log file and resume vehicle testing in Section 11.

If the VIN is valid and does not have a corresponding VIN-specific log file, create a new VIN-specific log file, then continue vehicle testing in 10.3.

10.3 Verify Service \$01 – Request Current Powertrain I/M Readiness Data, Engine Off

Purpose: To determine which ECUs support I/M Readiness bits (Mode \$01, PID \$01) and to determine what PIDs can be used to verify proper function of the general denominator.

Procedure:

10.3.1 [For all protocols] Transmit Service \$01, PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported PID to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 259 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support	XX	PID

TABLE 260 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [1 st supported PID	M	XX	PIDREC_PID
#3	Data A: supported PIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported PIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported PIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported PIDs]	M	xxxxxxxx	DATA_D
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

Determine and record which ECUs support PID \$01 (I/M Readiness). For the ECUs that support PID \$01, determine which of the following PIDs are supported for each ECU: PIDs \$0C (RPM), \$0D (VSS), \$1F (RUNTM).

10.4 Clear DTCs (Service \$04), Engine Off

Purpose: To reset the I/M Readiness bits to a "not ready" condition.

Procedure:

10.4.1 [For all protocols] Transmit Service \$04 request message and observe response message.

Any software meeting these specifications must wait 2 seconds before proceeding to next step to allow for NVRAM read/write times.

TABLE 261 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information request SID	04	SIDRQ

TABLE 262 - CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information response SID	44	SIDPR

Evaluation criteria:

Operator prompt 1 asks for the number of emission-related ECUs in the vehicle. At least one OBD ECU must respond with message as shown in the response table above. If more than the specified number of emission-related ECUs respond to this diagnostic message, this shall be flagged as a failure.

For ISO 15765-4, a positive response message is required. Negative response message(s) (\$7F, \$04, \$78) are allowed for up to 30 seconds maximum, until a positive response message is available. All other negative responses shall be flagged as a failure. For ISO 9141-2, SAE J1850 and ISO 14230-4, a positive response is required.

10.5 Verify Service \$01 – Request Current Powertrain I/M Readiness Data, Engine Off

Purpose: To determine the returned I/M Readiness data indicates "not ready" after a code clear.

Procedure:

10.5.1 [For all protocols] Send Service \$01 PID \$01 request message and note the response.

TABLE 263 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data request SID	M	01	SIDRQ
#2	PID#1	M	01	PID

TABLE 264 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of 1 st supported PID = [	PID#1	XX	PIDREC_PID
#3		data A,	xxxxxxx	DATA_A
#4		data B,	xxxxxxx	DATA_B
#5		data C,	xxxxxxx	DATA_C
#6		data D]	xxxxxxx	DATA_D

Evaluation criteria:

For all ECUs that support PID \$01, a response with valid data and with the PID length as noted must be received and meet the criteria defined in Table 265.

TABLE 265 - ENGINE OFF SERVICE \$01 PID \$01 VALIDATION

Engine Off Service \$01 PID \$01 Validation		
PID	Required Value	Comment
01, DATA_A, bit 7	Bit 7 must be 0	0 = MIL off
01, DATA_A, bits 0-6	Bits 0-6 must be 0	No DTCs
01, DATA_B, bit 3	Bit 3 can be 0 or 1 For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine, 1 = compression ignition engine.
01, DATA_B, bit 4	Bit 4 must be 0 for spark ignition engines and ECUs, which do not support misfire monitoring, and 1 for compression ignition engines.	Misfire monitoring is always complete for spark ignition engines and incomplete for compression ignition engines.
01, DATA_B, bit 5	Bit 5 can be 0 or 1	Fuel system may indicate incomplete for spark ignition and compression ignition engines if non-continuous monitors are employed. Unsupported monitors must indicate "ready"
01, DATA_B, bit 6	Bit 6 must be 0	CCM always complete. Unsupported monitors must indicate "ready"
01, DATA_B, bits 3 and 7	Bit 3 and 7 must be 0	Reserved bits must be 0
01 DATA_B bits 0-2 and 01 DATA_C bit 0-7	At least one bit must be 1	An OBD ECU that supports Service \$01 PID \$01 must support at least one monitor
01, DATA_D, bits 0-7	Bits 0 - 7 must be 1 for any supported monitor indicated in DATA_C	No supported monitors complete. O2 heater monitor (bit 6) may complete (0) on some vehicles.
01, DATA_D, bits 0-7	Bits 0 - 7 must be 0 for any unsupported monitor indicated in DATA_C	Unsupported monitors must indicate "ready"

10.6 Verify Service \$06 – Request On-board Monitoring Test Results, Engine Off

Purpose: To verify that each ECU responds correctly to a Service \$06 request, and that the data in the responses are correct, that the misfire OBDMIDs are supported for ISO 15765-4, and verify correct response to unsupported OBDMIDs. Verify that all Service \$06 data and limits are set to zero for ISO 15765-4. For all other protocols, the data must be greater than or equal to the minimum test limit or less than or equal to the maximum test limit.

Procedure:

10.6.1 [For all protocols] Transmit Service \$06, OBDMID support OBDMIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported OBDMID to determine which OBDMIDs are supported. Note the OBDMIDs reported by each ECU as being supported.

TABLE 266 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ SUPPORTED OBDMIDS) FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID (OBDMIDs supported)	M	XX	OBDMID

TABLE 267 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT SUPPORTED OBDMIDS) FOR ISO 9141-2, SAE J1850 AND ISO 14230-4 PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	Test ID	M	XX	TID
#3	FillerByte	M	FF	FB
#4	data record of supported Test IDs = [Data A: supported Test IDs, Data B: supported Test IDs, Data C: supported Test IDs, Data D: supported Test IDs]	M	XX	DATAREC_ DATA_A
#5		M	XX	DATA_B
#6		M	XX	DATA_C
#7		M	XX	DATA_D

TABLE 268 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT SUPPORTED OBDMIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	data record of supported OBDMID = [1 st supported OBDMID Data A: supported OBDMIDs, Data B: supported OBDMIDs, Data C: supported OBDMIDs, Data D: supported OBDMIDs]	M	xxxxxxxx	OBDMIDREC
#3		M	xxxxxxxx	OBDMID
#4		M	xxxxxxxx	DATA_A
#5		M	xxxxxxxx	DATA_B
#6		M	xxxxxxxx	DATA_C
		M	xxxxxxxx	DATA_D

C1 = Conditional — OBDMID value shall be the same value as included in the request message if supported by the ECU

C2 = Conditional — value indicates OBDMIDs supported; range of supported OBDMIDs depends on selected OBDMID value (see C1)

Evaluation criteria:

If all OBDMIDs support OBDMIDs for an ECU indicate that no OBDMIDs are supported, this shall be flagged as a failure.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

10.6.2 [For ISO 15765-4 protocol only] For all supported OBDMIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, send the corresponding Service \$06 request message and note the response.

TABLE 269 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ OBDMID TEST VALUES) FOR ISO 15765-4 PROTOCOL

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID	M	XX	OBDMID

TABLE 270 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT OBDMID TEST VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	data record of supported OBDMID = [			OBDMIDREC
#3	On-Board Diagnostic Monitor ID	M	XX	OBDMID
#4	Std./Manuf. Defined TID#1	M	XX	S/MDTID
#5	Unit And Scaling ID#1	M	XX	UASID
#6	Test Value (High Byte)#1	M	00	TVHI
#7	Test Value (Low Byte)#1	M	00	TVLO
#8	Min. Test Limit (High Byte)#1	M	00	MINTLHI
#9	Min. Test Limit (Low Byte)#1	M	00	MINTLLO
#10	Max. Test Limit (High Byte)#1	M	00	MAXTLHI
	Max. Test Limit (Low Byte)#1]	M	00	MAXTLLO
:	:	:	:	:
#n-8	data record of supported OBDMID = [			OBDMIDREC
#n-7	On-Board Diagnostic Monitor ID	C1	XX	OBDMID
#n-6	Std./Manuf. Defined TID#m	C2	XX	S/MDTID
#n-5	Unit And Scaling ID#m	C2	XX	UASID
#n-4	Test Value (High Byte)#m	C2	00	TVHI
#n-3	Test Value (Low Byte)#m	C2	00	TVLO
#n-2	Min. Test Limit (High Byte)#m	C2	00	MINTLHI
#n-1	Min. Test Limit (Low Byte)#m	C2	00	MINTLLO
#n	Max. Test Limit (High Byte)#m	C2	00	MAXTLHI
	Max. Test Limit (Low Byte)#m]	C2	00	MAXTLLO
C1 = Conditional — parameter is only present if more than one (1) Manufacturer Defined TID is supported by the ECU for the requested Monitor ID.				
C2 = Conditional — parameter and value depends on selected Manufacturer Defined TID number and are only included if the Manufacturer Defined TID is supported by the ECU. The value shall be zero (\$00) in case the On-Board Diagnostic Monitor has not been completed at least once since Clear/reset emission-related diagnostic information or battery disconnect.				

Evaluation criteria:

Misfire OBDMID A2 + SDTID 0B (Cylinder #1 misfire count EWMA) and OBDMID A2 + SDTID 0C (Cylinder #1 misfire counts) must be supported for at least one ECU.

Except as described below, for all OBDMIDs, TVHI, TVLO, MINTLHI, MINTLLO, MAXTLHI, and MAXTLLO must report \$00.

OBDMIDs \$00 -\$10, Test IDs \$01, \$02, \$03, and \$04 are constants and are not required to be reset to zero. For these Test IDs, TVHI and TVLO may be equal to MINTLHI and MINTLLO and MAXTVHI and MAXTVLO.

Some manufacturers have engine-off monitors, e.g., O2 sensors that run as soon as the ignition is on. These monitors may report test results on Service \$06. If a Service \$06 Test ID reports a test value and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

10.6.3 [ISO 9141-2, SAE J1850 and ISO 14230-4 protocols only] For all supported OBDMIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, send the corresponding Service \$06 request message and note the response.

TABLE 271 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS REQUEST MESSAGE (READ OBDMID TEST VALUES) FOR ISO 9141-2, SAE J1850 AND ISO 14230-4 PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems request SID	M	06	SIDRQ
#2	On-Board Diagnostic Monitor ID	M	XX	OBDMID

TABLE 272 - REQUEST ON-BOARD MONITORING TEST RESULTS FOR CONTINUOUS AND NON-CONTINUOUSLY MONITORED SYSTEMS RESPONSE MESSAGE (REPORT OBDMID TEST VALUES)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for non-continuously monitored systems response SID	M	46	SIDPR
#2	Test ID (report test results)	M	XX	TID
#3	Test Limit Type & Component ID	M	XX	TLTCID
#4	data record of Test ID = [Test Value (High Byte) Test Value (Low Byte) Test Limit (High Byte) Test Limit (Low Byte)]	M	XX	TIDREC_TVHI
#5		M	XX	TVLO
#6		C	XX	TLHI
#7		C	XX	TLLO

C = Conditional — if Test Limit is either a Minimum or a Maximum Limit depends on the parameter Test Limit Type & Component ID value (bit 7)

Evaluation criteria:

The test value(s) must be greater than or equal to the Min Test Limit(s) and less than or equal to the Max Test Limit(s).

10.7 Verify Service \$07 – Request Pending Emission-related DTCs, Engine Off

Purpose: To verify that there are no pending emission-related DTCs reported after a code clear.

Procedure:

10.7.1 [For all protocols] Transmit a Service \$07 request message. Verify that a proper response is received with DTC count set to zero.

TABLE 273 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request SID	07	SIDRQ

TABLE 274 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO-15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 275 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES DETECTED DURING CURRENT OR LAST COMPLETED DRIVING CYCLE RESPONSE MESSAGE FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	47	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

For ISO 15765-4 and ISO 14230-4 protocols, verify that at least one Service \$07 DTC response with zero DTCs is received.

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU shall respond with a report containing no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$07 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

10.8 Verify Service \$03 – Request Emission-related DTCs, Engine Off

Purpose: To verify that there are no confirmed DTCs reported after a code clear.

Procedure:

10.8.1 [For all protocols] Transmit Service \$03 request. Verify that a proper response indicating no DTCs is received

TABLE 276 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs request SID	03	SIDRQ

TABLE 277 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	00	#OFDTC

TABLE 278 - REQUEST EMISSION-RELATED DIAGNOSTIC TROUBLE CODES RESPONSE MESSAGE FOR ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTC response SID	43	SIDPR
#2	DTC#1 High Byte: 00	00	DTC1HI
#3	DTC#1 Low Byte: 00	00	DTC1LO
#4	DTC#2 High Byte: 00	00	DTC2HI
#5	DTC#2 Low Byte: 00	00	DTC2LO
#6	DTC#3 High Byte: 00	00	DTC3HI
#7	DTC#3 Low Byte: 00	00	DTC3LO

Evaluation criteria:

For ISO 15765-4 and ISO 14230-4 protocols, verify that at least one Service \$03 DTC response with zero DTCs is received.

For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.

For ISO 14230-4 interfaces, the ECU will respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to \$0000).

For ISO 15765-4 interfaces, the ECU will respond with a message indicating no DTCs are stored by setting the parameter # of DTC to \$00.

For all protocols, as an aid to ECU engineers, any OBD ECU that does not respond to a Service \$03 request will generate a warning. This information can be used to determine if this is the correct behavior for the vehicle.

10.9 Verify Service \$09 – Request Vehicle Information, Engine Off

Purpose: To record the values of the OBD general denominator (OBDCOND), the ignition counter (IGNCTR), and the OBD in-use performance numerators and denominators prior to driving the vehicle.

Procedure:

10.9.1 [For all protocols] Transmit Service \$09, INFOTYPE = \$08.

TABLE 279 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: In-use Performance Tracking	08	INFTYP

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TABLE 280 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	08	INF_TYP
#3	Number of data items: 16 or 20 (shown as 20 in this example)	14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: XX counts	XX	IGNCNTR_A
#7	IGNCNTR_B: XX counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B

TABLE 281 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850, ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INF_TYP_
#3	MessageCount	M	01 - 08	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

10.9.2 Record the values of the OBD Condition Counter (OBDCOND), Ignition Counter (IGNCTR) and all OBD monitor condition and completion counters prior to completing the standard CARB OBD drive cycle.

Evaluation criteria:

For SAE J1850, ISO 9141-2 and ISO 14230-4 protocols, the value of INFOTYPE \$07 must match the number of returned response messages.

All In-use Performance data must contain either 32 bytes or 40 bytes of data.

Ignition counter must be greater than or equal to OBD Condition Counter.

OBD Condition Counter must be greater than or equal to any monitor condition counters.

If an ECU does not support INFOTYPE \$08, no response is allowed for ISO 15765-4, SAE J1850 and ISO 9141-2. For ISO 14230-4, the ECU can either not respond or send a negative response (\$7F, \$12)

For ISO 15765-4, NODI in the response message must be \$10 or \$14.

Starting with the 2010 MY, spark ignition engines must support data for secondary oxygen sensor. NODI must be \$14 and the response message must report back 40 bytes of data or this shall be flagged as a failure.

10.9.3 [For ISO 15765-4] Transmit Service \$09, INFOTYPE = \$0B.

TABLE 282 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ISO 15765-4

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: In-use Performance Tracking	0B	INF_TYP_

TABLE 283 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	0B	INFOTYP
#3	Number of data items: 16	10	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	HCCATCOMP_A: X counts	XX	HCCATCOMP_A
#9	HCCATCOMP_B: X counts	XX	HCCATCOMP_B
#10	HCCATCOND_A: X counts	XX	HCCATCOND_A
#11	HCCATCOND_B: X counts	XX	HCCATCOND_B
#12	NCATCOMP_A: X counts	XX	NCATCOMP_A
#13	NCATCOMP_B: X counts	XX	NCATCOMP_B
#14	NCATCOND_A: X counts	XX	NCATCOND_A
#15	NCATCOND_B: X counts	XX	NCATCOND_B
#16	NADSCOMP_A: X counts	XX	NADSCOMP_A
#17	NADSCOMP_B: X counts	XX	NADSCOMP_B
#18	NADSCOND_A: X counts	XX	NADSCOND_A
#19	NADSCOND_B: X counts	XX	NADSCOND_B
#20	PMCOMP_A: X counts	XX	PMCOMP_A
#21	PMCOMP_B: X counts	XX	PMCOMP_B
#22	PMCOND_A: X counts	XX	PMCOND_A
#23	PMCOND_B: X counts	XX	PMCOND_B
#24	EGSCOMP_A: X counts	XX	EGSCOMP_A
#25	EGSCOMP_B: X counts	XX	EGSCOMP_B
#26	EGSCOND_A: X counts	XX	EGSCOND_A
#27	EGSCOND_B: X counts	XX	EGSCOND_B
#28	EGRCOMP_A: X counts	XX	EGRCOMP_A
#29	EGRCOMP_B: X counts	XX	EGRCOMP_B
#30	EGRCOND_A: X counts	XX	EGRCOND_A
#31	EGRCOND_B: X counts	XX	EGRCOND_B
#32	BPCOMP_A: X counts	XX	BPCOMP_A
#33	BPCOMP_B: X counts	XX	BPCOMP_B
#34	BPCOND_A: X counts	XX	BPCOND_A
#35	BPCOND_B: X counts	XX	BPCOND_B

Evaluation criteria:

All In-use Performance data must contain 32 bytes of data.

If an ECU does not support INFOTYPE \$0B, no response is allowed for ISO 15765-4.

For ISO 15765-4, NODI in the response message must be \$10.

For ECUs that support IPT (INFOTYPE \$08 or \$0B), verify that IPT support for ECU matches Service \$01, PID \$01, DATA_B bit 3. If bit 3 = 0 (spark ignition), then INFOTYPE \$08 shall be supported, if bit 3 = 1 (compression ignition), then INFOTYPE \$0B shall be supported. For 2010 MY and beyond, the support bit status shall match the data reported from Operator Prompt 4. Inconsistent support between DATA_B bit 3, INFOTYPES \$08 and \$0B and Operator Prompt 4 shall be flagged as a failure. Prior to the 2010 MY, this shall be a warning for compression ignition engines only (i.e. bit 3 = 0 but Operator Prompt indicates diesel. Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.

If no ECU supports INFOTYPE \$08 or \$0B, any software conforming to these specifications shall assume that all returned data was \$00. This will allow the remainder of the test starting with Section 11 to complete although all INFOYTPE \$08 tests will ultimately fail.

Procedure:

10.9.4 Turn ignition off (engine off) for 60 seconds. This will allow ignition counter to increment on the following ignition on cycle.

10.9.5 Turn ignition to crank position and start engine. (Prompt operator to initiate the drive cycle as quickly as possible.)

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C.

10.10 Re-establish Communication (SAE J1978 / ISO 15031-4), Engine Running (if required)

Purpose: To re-establish communication with the vehicle when the ignition key was turned off.

Protocol Determination Procedure:

10.10.1 Test tool sends Service \$01 PID \$00 request message for the same protocol that was established in the previous step.

TABLE 284 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

TABLE 285 - ECU#X RESPONSE: REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxxx b	DATA_D

Procedure:

10.11 Complete CARB Drive Cycle to Increment In-use Performance Denominator

Purpose: To verify that the OBD general denominator and ignition counters increment properly.

Procedure:

10.11.1 Drive vehicle according to the following conditions so that the OBD Condition Counter may increment:

- Continuous time > or = 30 seconds with vehicle speed < or = 1 mph and accelerator pedal released, at an altitude < 8000 ft (BARO < 22 in Hg) and ambient temperature > or = 20 deg F
- Cumulative time > or = 300 seconds with vehicle speed > or = 25 mph, at an altitude < 8000 ft (BARO < 22 in Hg) and ambient temperature > or = 20 deg F
- Cumulative time since engine start > or = 600 seconds, at an altitude < 8000 ft (BARO < 22 in Hg) and ambient temperature > or = 20 deg F

Prompt user to idle for 30 seconds, drive the vehicle at > or = 25 mph for 300 seconds, and continue driving the vehicle in any manner for an additional 270 seconds. Display the status of the OBDCOND counter, the IGNCTR counter, the 30 second "Idle Timer", the 300 second "25 MPH Driving Timer" and the 600 second "Total Drive Timer". The user should be reminded to perform the test at altitudes less than 8000 feet and ambient temperatures greater than 20 deg F.

NOTE: The software will monitor the following PIDs, if available: \$0C (RPM), \$0D (VSS), \$1F (RUNTM) every 1.0 seconds to determine vehicle conditions. The software will monitor OBDCOND every 1.0 seconds. The software will inform user as soon as the drive cycle conditions have been completed and OBDCOND counter has incremented.

10.11.2 [For all protocols] For all supported PIDs \$0C, \$0D, \$1F, send the corresponding Service \$01 PID request message and monitor the responses only from the modules that support Service \$01, PID \$01 (I/M Readiness).

TABLE 286 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data request SID	M	01	SIDRQ
#2	PID#1	M	X	PID

TABLE 287 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of 1 st supported PID = [			PIDREC_
#3	PID#1	M	XX	PID
#4	data A,	M	XX	DATA_A
#5	data B,	C1	XX	DATA_B
#6	data C,	C1	XX	DATA_C
	data D]	C1	XX	DATA_D
C1 = Conditional — "data B - D" depend on selected PID value				
C2 = Conditional — parameter is only present if supported by the ECU				
C3 = Conditional — parameters and values for "data B - D" depend on selected PID number and are only included if PID is supported by the ECU				

NOTE: If multiple modules support I/M Readiness functionality, utilize only the responses from module that supports Service \$09, INFOTYPE \$08 or \$0B to perform this test. Based on the responses in 10.9, utilize INFOTYPE \$08 or \$0B to get OBDCOND counter data.

10.11.3 [For all protocols] Transmit Service \$09, INFOTYPE = \$08.

TABLE 288 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: In-use Performance Tracking	08	INFTYP

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TABLE 289 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	08	INF_TYP
#3	Number of data items: 16 or 20 (shown as 20 in this example)	14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B

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TABLE 290 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE FOR SAE J1850, ISO 14230-4 AND ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INF_TYP_
#3	MessageCount	M	01 - 08	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

10.11.4 [For ISO 15765-4] Transmit Service \$09, INFOTYPE = \$0B.

TABLE 291 - REQUEST VEHICLE INFORMATION REQUEST MESSAGE FOR ISO 15765-4

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: In-use Performance Tracking	0B	INF_TYP

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TABLE 292 - REQUEST VEHICLE INFORMATION RESPONSE MESSAGE (1) FOR ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	0B	INF_TYP
#3	Number of data items: 16	10	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	HCCATCOMP_A: X counts	XX	HCCATCOMP_A
#9	HCCATCOMP_B: X counts	XX	HCCATCOMP_B
#10	HCCATCOND_A: X counts	XX	HCCATCOND_A
#11	HCCATCOND_B: X counts	XX	HCCATCOND_B
#12	NCATCOMP_A: X counts	XX	NCATCOMP_A
#13	NCATCOMP_B: X counts	XX	NCATCOMP_B
#14	NCATCOND_A: X counts	XX	NCATCOND_A
#15	NCATCOND_B: X counts	XX	NCATCOND_B
#16	NADSCOMP_A: X counts	XX	NADSCOMP_A
#17	NADSCOMP_B: X counts	XX	NADSCOMP_B
#18	NADSCOND_A: X counts	XX	NADSCOND_A
#19	NADSCOND_B: X counts	XX	NADSCOND_B
#20	PMCOMP_A: X counts	XX	PMCOMP_A
#21	PMCOMP_B: X counts	XX	PMCOMP_B
#22	PMCOND_A: X counts	XX	PMCOND_A
#23	PMCOND_B: X counts	XX	PMCOND_B
#24	EGSCOMP_A: X counts	XX	EGSCOMP_A
#25	EGSCOMP_B: X counts	XX	EGSCOMP_B
#26	EGSCOND_A: X counts	XX	EGSCOND_A
#27	EGSCOND_B: X counts	XX	EGSCOND_B
#28	EGRCOMP_A: X counts	XX	EGRCOMP_A
#29	EGRCOMP_B: X counts	XX	EGRCOMP_B
#30	EGRCOND_A: X counts	XX	EGRCOND_A
#31	EGRCOND_B: X counts	XX	EGRCOND_B
#32	BPCOMP_A: X counts	XX	BPCOMP_A
#33	BPCOMP_B: X counts	XX	BPCOMP_B
#34	BPCOND_A: X counts	XX	BPCOND_A
#35	BPCOND_B: X counts	XX	BPCOND_B

Evaluation criteria:

The OBDCOND counter must increment within ± 20 seconds of the tool determination that the CARB drive cycle conditions have been met using the criteria listed below:

The engine has been started. Monitor for RUNTM > 0 seconds. If RUNTM is not available, monitor for RPM > 450 rpm.

Cumulative engine run time is > or = 600 seconds. Monitor for RUNTM > 600 seconds. If RUNTM is not available, monitor for RPM > 450 rpm for > 600 seconds.

Cumulative engine run time > or = 25 mph is > or = 300 seconds. Monitor for RUNTM increase > or = 300 seconds when VSS > or = 25 mph. If RUNTM is not available, monitor for RPM > 450 rpm and VSS > or = 25 mph for > or = 300 seconds.

Continuous time at vehicle speed < or = 1 mph is > or = 30 seconds. Monitor for RUNTM increase > 30 seconds when VSS < or = 1 mph. If RUNTM is not available, monitor for RPM > 450 rpm and VSS < or = 1 mph for > or = 30 seconds. (While idle timer is accumulating idle time, reset idle timer to zero if idle conditions are no longer being met and accumulate idle time once again if idle conditions are being met later in the driving cycle.)

The above conditions require that the user is driving the vehicle within the stated altitude and ambient air temperature conditions and that the accelerator pedal is released when the vehicle is stopped.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C or defroster.

Procedure:

10.11.5 When the software has determined that the OBDCOND counter has incremented and the driving conditions have been met, the software should stop sending Service \$01 and Service \$09 requests, prompt the operator to stop the vehicle in a safe location without turning off the ignition, then prompt the operator to continue with the test.

10.12 Verify Service \$01 – Request Current Powertrain Diagnostic Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service \$01 requests, to determine which PIDs are supported by each ECU and to check that the returned data is valid for a warm, engine-idle condition.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. The operator must ensure that the engine is on when performing the test, e.g. turn on A/C.

Procedure:

10.12.1 [For all protocols] Transmit Service \$01, PID support PIDs \$00, \$20, \$40, \$60, \$80, \$A0, \$C0, and \$E0 request messages through the highest supported PID to determine which PIDs are supported. Note PIDs reported by each ECU as being supported.

TABLE 293 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support	XX	PID

TABLE 294- REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [1 st supported PID Data A: supported PIDs, Data B: supported PIDs, Data C: supported PIDs, Data D: supported PIDs]	M	XX	PIDREC_- PID
#3		M	xxxxxxxx	DATA_A
#4		M	xxxxxxxx	DATA_B
#5		M	xxxxxxxx	DATA_C
#6		M	xxxxxxxx	DATA_D

C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)

Evaluation criteria:

Required PIDs must be supported for all vehicles (ALL), gasoline engines (G), diesel engines (D), and hybrid vehicles (treated the same as gasoline) as specified in Table 249. At least one ECU must support the required data. If more than one ECU supports the PID, then each ECU must meet the requirements specified under "Required Value". The table specifies whether lack of support will generate a Failure or a Warning. A failure is defined as lack of support as required in the OBD-II regulations. A warning is defined as lack of support for a PID that is highly likely to be required to be supported by most vehicle manufacturers. Warnings require additional analysis by the vehicle manufacturer. For 2010 MY and beyond, use PID \$01, DATA_B, bit 3 to determine gasoline or diesel PID support rather than Operator Prompt 4.

If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure. Except for PID \$00, if a PID Supported PID for an ECU indicates that no PIDs are supported, this shall be flagged as a failure.

10.12.2 [For ISO 15765-4 protocol only] Transmit request for all PIDs as two messages (PIDs \$00, \$20, \$40, \$60, \$80, \$A0), and (PIDs \$C0, \$E0) and again note results.

TABLE 295 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ISO 15765-4 PROTOCOL

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID
#3	PID used to determine PID support for PIDs 21-40	20	PID
#4	PID used to determine PID support for PIDs 41-60	40	PID
#5	PID used to determine PID support for PIDs 61-80	60	PID
#6	PID used to determine PID support for PIDs 81-A0	80	PID
#7	PID used to determine PID support for PIDs A1-E0	A0	PID

TABLE 296 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE
(REPORT SUPPORTED PIDS)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [1 st supported PID Data A: supported PIDs, Data B: supported PIDs, Data C: supported PIDs, Data D: supported PIDs]	M	XX	PIDREC_PID
#3		M	xxxxxxx	DATA_A
#4		M	xxxxxxx	DATA_B
#5		M	xxxxxxx	DATA_C
#6		M	xxxxxxx	DATA_D
:	:	:	:	:
#n-4	data record of supported PIDs = [m th supported PID Data A: supported PIDs, Data B: supported PIDs, Data C: supported PIDs, Data D: supported PIDs]	C1	XX	PIDREC_PID
#n-3		C2	xxxxxxx	DATA_A
#n-2		C2	xxxxxxx	DATA_B
#n-1		C2	xxxxxxx	DATA_C
#n		C2	xxxxxxx	DATA_D

Evaluation criteria:

For ISO 15765-4 protocol, each ECU must report the same supported PIDs for single and group request messages.

10.12.3 [For all protocols] For all supported PIDs \$01-\$1F, \$21-\$3F, \$41-\$5F, \$61-\$7F, \$81-\$9F, \$A1-\$BF, \$C1-\$DF \$E1-\$FF, as determined in 10.12.1, send the corresponding Service \$01 PID request message and note the response.

TABLE 297 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA REQUEST MESSAGE
FOR ALL PROTOCOLS

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data request SID	M	01	SIDRQ
#2	PID#1	M	X	PID

TABLE 298 - REQUEST CURRENT POWERTRAIN DIAGNOSTIC DATA RESPONSE MESSAGE

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of 1 st supported PID = [			PIDREC_
#3	PID#1	M	XX	PID
#4	data A,	M	XX	DATA_A
#5	data B,	C1	XX	DATA_B
#6	data C,	C1	XX	DATA_C
	data D]	C1	XX	DATA_D
C1 = Conditional — “data B - D” depend on selected PID value				
C2 = Conditional — parameter is only present if supported by the ECU				
C3 = Conditional — parameters and values for “data B - D” depend on selected PID number and are only included if PID is supported by the ECU				

Evaluation criteria:

All PIDs that are indicated as supported must be supported.

For all the PIDs that are indicated as supported by each ECU, a response with valid data and with the PID length as noted must be received as shown in Table 299.

NOTE: Scaling PID \$4F may be utilized in some PID responses and must be referenced if so utilized.

It is not an error to return a PID that was not supported on SAE J1850, and ISO 9141-2. On ISO 15765-4, the ECU shall not respond to an unsupported PID. On ISO 14230-4, the ECU can either respond with a negative response message (\$7F, \$12) or not respond to a request for an unsupported PID.

TABLE 299 - ENGINE WARM IDLE SERVICE \$01 PID VALIDATION

Engine Idle Service \$01 PID Validation			
PID	Req'd Support:	Required Value	Comment
01	ALL – Fail		
01, DATA_A, bit 7	G – Warn	Bit 7 must be 0	0 is MIL off
01, DATA_A, bits 0-6	G – Warn	Bits 0-6 must be 0	No DTCs
01, DATA_B, bit 3		Bit 3 can be 0 or 1 For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01 DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine, 1 = compression ignition engine.
01, DATA_B, bit 4		Bit 4 must be 0 for spark ignition engines and ECUs, which do not support misfire monitoring, and 0 or 1 for compression ignition engines.	Misfire monitoring is always complete for spark ignition engines. Misfire monitoring may be complete or incomplete for compression ignition engines.
01, DATA_B, bit 5		Bit 5 can be 0 or 1	Fuel system may indicate incomplete for spark ignition and compression ignition engines If non-continuous monitors are employed. Unsupported monitors must indicate “ready”
01, DATA_B, bit 6		Bit 6 must be 0	CCM always complete. Unsupported monitors must indicate “ready”
01, DATA_B, bits 7		Bit 7 must be 0	Reserved bits must be 0
01, DATA_B, bits 4-6		All 0 for any unsupported monitor in DATA_B bits 0-2	Unsupported monitors must indicate “ready”

TABLE 299 - ENGINE WARM IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support:	Required Value	Comment
01 DATA_B bits 0-2 and 01 DATA_C bits 0-7		At least one bit must be 1	An OBD ECU that supports Service \$01 PID \$01 must support at least one monitor
01, DATA_D, bits 0-7		All 0 for any unsupported monitor indicated in DATA_C	Unsupported monitors must indicate "ready"
02		2 bytes long	
03, DATA_A, bits 5-7, DATA_B bits 5-7	G – Warn	2 bytes long, Data A and B bits 5 – 7 must be 0	Some FUELSYSx bits are reserved
04	ALL – Fail	1 byte long, value must be 0 to 60%	LOAD_PCT less than or equal to 60% at idle
05	ALL – Fail	1 byte long, value must be -20 to 120 deg C. Either \$05 or \$67 must be supported.	ECT warmed up, in normal range
06	G – Warn	1 byte value or 2 byte value, as determined in Figure 10. Value must be between + 50% and – 50%	SHRTFT1/3 in normal range
07	G – Warn	1 byte value or 2 byte value, as determined in Figure 10. Value must be between + 50% and – 50%	LONGFT1/3 in normal range
08		1 byte value or 2 byte value, as determined in Figure 10. Value must be between + 50% and – 50%	SHRTFT2/4 in normal range
09		1 byte value or 2 byte value, as determined in Figure 10. Value must be between + 50% and – 50%	LONGFT2/4 in normal range
0A		1 byte long, value must be greater than 0 kPa	FRP not zero
0B	G – Warn	1 byte long, value must be greater than 0 kPa. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	MAP not zero
0C	ALL – Fail	2 bytes long, value must be between 300 and 2000 rpm	RPM < 2000 and > 300 at idle
0D	ALL – Fail	1 byte long, value must be 0	VSS is 0 at engine idle

TABLE 299 - ENGINE WARM IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support:	Required Value	Comment
0E	G – Warn	1 byte long, value must be -25 deg to +40 deg	SPARKADV normal
0F	G – Warn	1 byte long, value must be -20 to 120 deg C. Either \$0F or \$68 may be supported.	IAT in normal range
10	G – Warn	2 bytes long, value must be greater than 0 g/sec. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	MAF not zero
11	G - Fail	1 byte long, value must be 0% to 40% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP in normal range
12		1 byte long	
13 or 1D, bits 0-7	G – Warn	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engines; (NOTE: Either \$13 or \$1D must be supported for spark ignition engine. Both PIDs shall not be supported on spark or compression ignition engines. Neither PID is required to be supported for compression ignition engines)	At least 2 O2S needed for OBD-II for spark ignition engines, compression ignition engines may or may not use any O2 sensors. Both PIDs \$13 and \$1D cannot be supported at the same time for either spark or compression ignition engines.
14, 15, 16, 17, 18, 19, 1A, 1B		2 bytes long	
1C	ALL - Fail	1 byte long, value must be 01, 03, 07, 09, 0B or 0D	Must be California OBD-II
1D, 1E		1 byte long	
1F	ISO 15765-4 ALL – Fail	2 bytes long, value must be greater than 300	RUNTM greater than 300 sec
21	ISO 15765-4 ALL – Fail unless \$4D supported	2 bytes long, value must be 0 km	MIL_DIST is zero
22		2 bytes long, value must be greater than 0 kPa	FRP not zero

TABLE 299 - ENGINE WARM IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support:	Required Value	Comment
23		2 bytes long, value must be greater than 0 kPa	FRP not zero
24, 25, 26, 27, 28, 29, 2A, 2B		4 bytes long. Disregard range check when scaling byte is utilized.	Check for usage of PID 4F
2C		1 byte long, value must be < or = 10% for spark ignition engines, < or = 100% for compression ignition or hybrid engines	EGR_PCT is < or = 10% at idle for spark ignition engine, EGR rates may be much higher for compression ignition and hybrid engines.
2D		1 byte long	EGR_ERR
2E	ISO 15765-4 G – Warn	1 byte long	EVAP_PCT
2F	ISO 15765-4 G – Warn	1 byte long, value = 1 byte long, value must be 1 to 100%	FLI in normal range
30	ISO 15765-4 ALL – Fail	1 byte long, value must be 0 to 4	WARM_UPS near zero
31	ISO 15765-4 ALL – Fail unless \$4E supported	2 bytes long, value must be less than 50 km	CLR_DIST less than 50 km
32		2 bytes long	EVAP_VP
33	ISO 15765-4 ALL - Fail	1 byte long, value must be between 71 and 110 kPa	BARO within normal range
34, 35, 36, 37, 38, 39, 3A, 3B		4 bytes long. Disregard range check when scaling byte is utilized.	Check for usage of PID 4F
3C, 3D, 3E, 3F		2 bytes long	
41	ISO 15765-4 ALL - Fail	4 bytes long	

TABLE 299 - ENGINE WARM IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID		Required Value	Comment
41, DATA_B, bit 3	ISO 15765-4 ALL - Fail	<p>Bit 3 can be 0 or 1 For 2010 MY and beyond, data must match Prompt 4.</p> <p>Note that for ECUs that only support CCM requirements, (Service \$01, PID \$01, Data_B, bit 2 = 1), the status of Service \$01, PID \$01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.</p>	0 = spark ignition engine, 1 = compression ignition engine.
42	ISO 15765-4 G, D - Fail	2 bytes long	VPWR
43	ISO 15765-4 G- Fail	2 bytes long, value must be greater than 0%	LOAD_ABS greater than 0 at idle
44	ISO 15765-4 G- Fail	2 bytes long, value must be 0.5 to 1.5 for spark ignition engines and 0 to 1.99 for compression ignition engines. Disregard range check when scaling byte is utilized.	EQ_RAT in normal range Check for usage of PID 4F
45	ISO 15765-4 G- Fail	<p>1 byte long, value must be 0% to 50% for spark ignition engines, value can be 0% to 100% for compression ignition engines.</p> <p>Either \$45 or \$6C must be supported for spark ignition engines.</p>	TP_R in normal range
46		1 byte long, value must be -20 to 85 deg C	AAT in normal range
47		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP_B in normal range

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TABLE 299 - ENGINE WARM IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID		Required Value	Comment
48		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP_C in normal range
49		1 byte long, value must be 0% to 40%	APP_D in normal range
4A		1 byte long, value must be 0% to 40%	APP_E in normal range
4B		1 byte long, value must be 0% to 40%	APP_F in normal range
4C		1 byte long	
4D	2010 MY and beyond All – Fail unless \$21 supported	2 bytes long, value must be 0 minutes	MIL_TIME is 0 minutes (59 seconds or less) after Service \$04
4E	2010 MY and beyond All – Fail unless \$31 supported	2 bytes long, value must be greater than 5 minutes	CLR_TIME is greater than 5 minutes
4F		4 bytes	These four values, if not \$00, shall be used to calculate scaling factors for data reported with PIDs \$24 to \$2B, PIDs \$34 to \$3B, PID \$44 and PID \$0B.
50		4 bytes	This value, if available, shall be used to calculate scaling factors for MAF sensor.
51		1 byte, value must be \$01 to \$16	FUEL_TYPE in SAE assigned range
52		1 byte	ALCH_PCT

TABLE 299 - ENGINE WARM IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
53		2 bytes	EVAP_VPA
54		2 bytes	EVAP_VP
55		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 1/3
56		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 1/3
57		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 2/4
58		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 2/4
59		2 bytes long, value must be greater than 0 kPa	FRP not zero
5A		1 byte long, value must be 0% to 40%	APP_R in normal range
5B		1 byte, value must be greater than zero percent	BAT_PWR
5C	2010 MY and beyond D - Warn	1 byte long, value must be -20 to 150 deg C	EOT
5D		2 bytes long	FUEL_TIMING
5E		2 bytes long, value must be greater than zero L/h	FUEL_RATE not zero
5F		1 byte, value must be \$0E to \$10	EMIS_SUP in SAE assigned range
61	2010 MY and beyond D - Fail	1 byte	TQ_DD
62	2010 MY and beyond D - Fail	1 byte, value must be greater than zero percent	TQ_ACT not zero
63		2 bytes long, value must be greater than zero Nm	TQ_REF not zero
64		5 bytes long, all values must greater than zero percent	TQ_MAX not zero

TABLE 299 - ENGINE WARM IDLE SERVICE \$01 PID VALIDATION (CONTINUED)

PID	Req'd Support	Required Value	Comment
65		2 bytes, Data A, at least one device must be supported in bits 0 – 3, bits 4 – 7 must be 0, Data B, bits 4 – 7 must be 0.	Auxiliary I/O
66	G - Warn	5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0. If supported, MAFA and MAFB values must be greater than 0 g/sec. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	Mass Air Flow Sensor MAFx not zero
67	ALL - Fail	3 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0. If supported, ECT 1 and ECT 2 values must be -20 to 120 deg C. Either \$05 or \$67 must be supported.	Engine Coolant Temperature ECT x in normal range
68	G - Warn	7 bytes long, Data A, at least one sensor must be supported in bits 0 – 5, bits 6 – 7 must be 0. If supported, any IAT values must be -20 to 120 deg C. Either \$0F or \$68 may be supported.	Intake Air Temperature Sensor IAT xy in normal range
69		7 bytes long, Data A, at least one PID must be supported in bits 0 – 5, bits 6 – 7 must be 0. If supported, any EGR_x_CMD values must be < or = 10% for spark ignition engines, < or = 100% for compression ignition or hybrid engines.	Commanded EGR and EGR Error EGR_x_CMD is < or = 10% with engine off If EGR_x_CMD = 0.0%, and EGR_x_ACT = 0.0%, EGR_x_ERR must be 0.0%, If EGR_x_CMD = 0.0%, and EGR_x_ACT > 0.0%, EGR_x_ERR must be 99.2%,