SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1699®-3

ISSUED AUG2004

Issued 2004-08

OBD II Compliance Test Cases

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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).

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, 400 Commonwealth Drive, Warrendale, PA 15096 <http://store.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 (April 2002): 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 (February 2002): 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 <http://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, 400 Commonwealth Drive, Warrendale, PA 15096 <http://store.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 <http://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 Section 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 Society of Automotive Engineers
- 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 J1979 and implemented on the vehicle adhere to the defined structure and return data which can be interpreted using the information contained in this J1979 document.

This 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 11 – These sections are divided according to the conditions that are applied to the vehicle.

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	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	DTC and status properly reported
10	No Malfunctions	$04, $01, $06, $09	Check in-use counters
11	No Malfunctions	$04, $01, $06, $09	Check in-use performance counters

Figure 1 – Conditions and services tested

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.

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

1. Battery voltage at the 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 J1979 (ISO 15031-5) request messages.

4. XX = valid reported hex data (data not checked/specified in this document).

5. x = valid reported bit data (data not checked/specified 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 Section 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 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 J2534 interfaces 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 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 and Windows 98 shall not be used as the operating system for vehicle testing due to inadequate timer resolution.

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.

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

Per ISO 15765-4 8.2, CAN DLC must be set to 8. Unused bytes are not specified. Within this document, unused bytes from the tool to the ECU (pad bytes) will be set to $00. ECU responses will be verified to have a DLC of 8.

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 1ms.

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 - 50 ms for key word $0808 0 – 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.

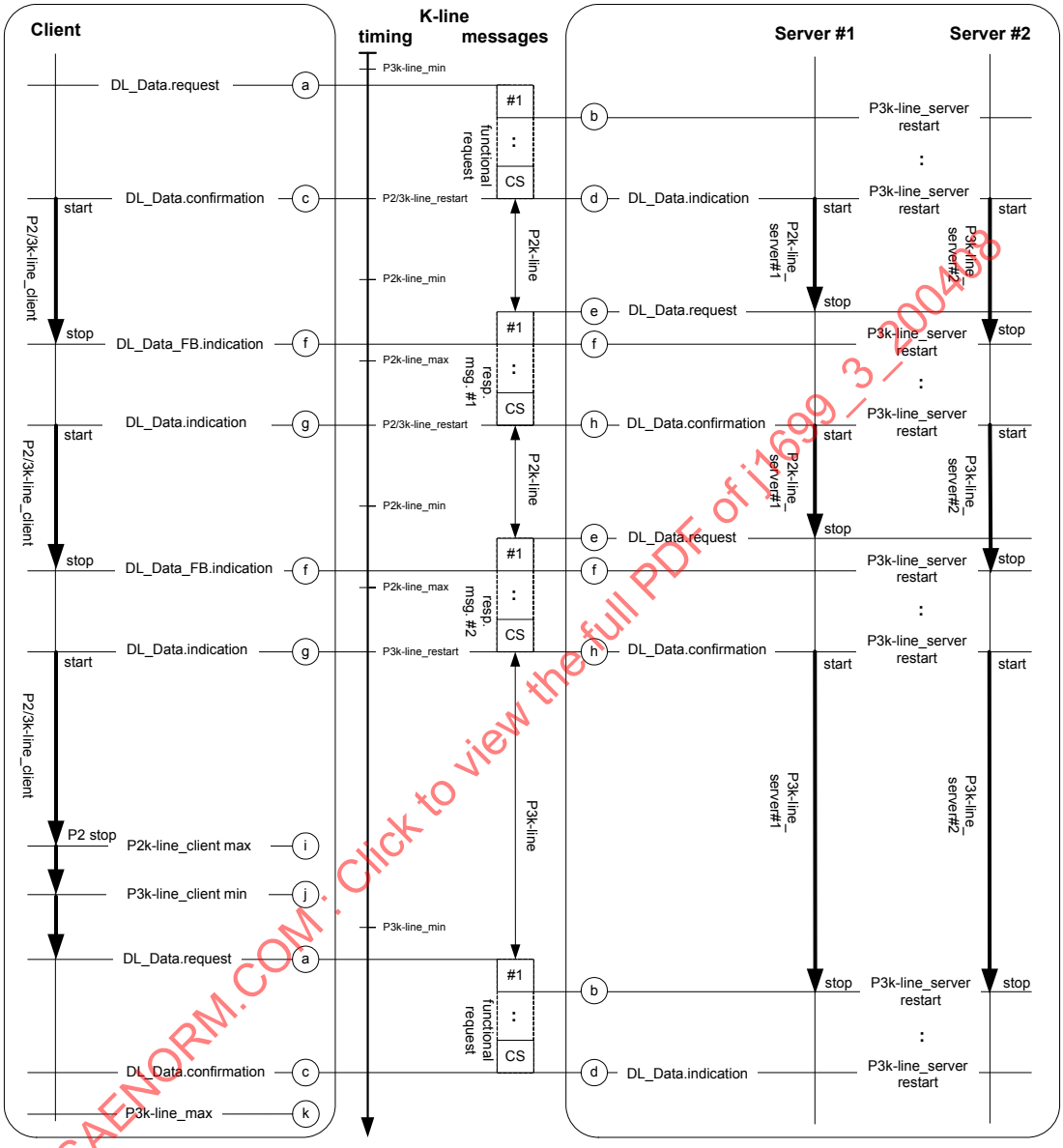

Figure 7 — ISO 9141-2 and ISO 14230-4 protocol client and server timing behavior

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 it's 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 $P3_{k\text{-}line\_server}$ 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 $P3_{k\text{-}line\_server}$ restart after the reception of the first byte and last byte (checksum) of a received message. The $P3_{k\text{-}line\_server}$ 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 $P2_{k\text{-}line}$ / $P3_{k\text{-}line}$ 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 $P2_{K\text{-}line}$—and $P3_{K\text{-}line}$ timer, using the default reload values $P2_{K\text{-}line\_max}$ and $P3_{K\text{-}line\_max}$.

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 $P3_{k\text{-}line}$ 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 $P2_{k\text{-}line\_min}$ 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 $P2_{k\text{-}line}$ 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 $P2_{k\text{-}line}$ / $P3_{k\text{-}line}$ 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 $P2_{K\text{-}line}$ and $P3_{K\text{-}line}$ timer, using the default reload values $P2_{K\text{-}line\_max}$ and $P3_{K\text{-}line\_max}$.

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 $P2_{k\text{-}line}$ / $P3_{k\text{-}line}$ 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 $P3_{k\text{-}line}$ 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 $P2_{k\text{-}line\_max}$ timeout, which indicates that all response messages from all servers are received.

j) The client application indicates that $P3_{k\text{-}line\_min}$ is reached and that the $P3_{k\text{-}line}$ 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.

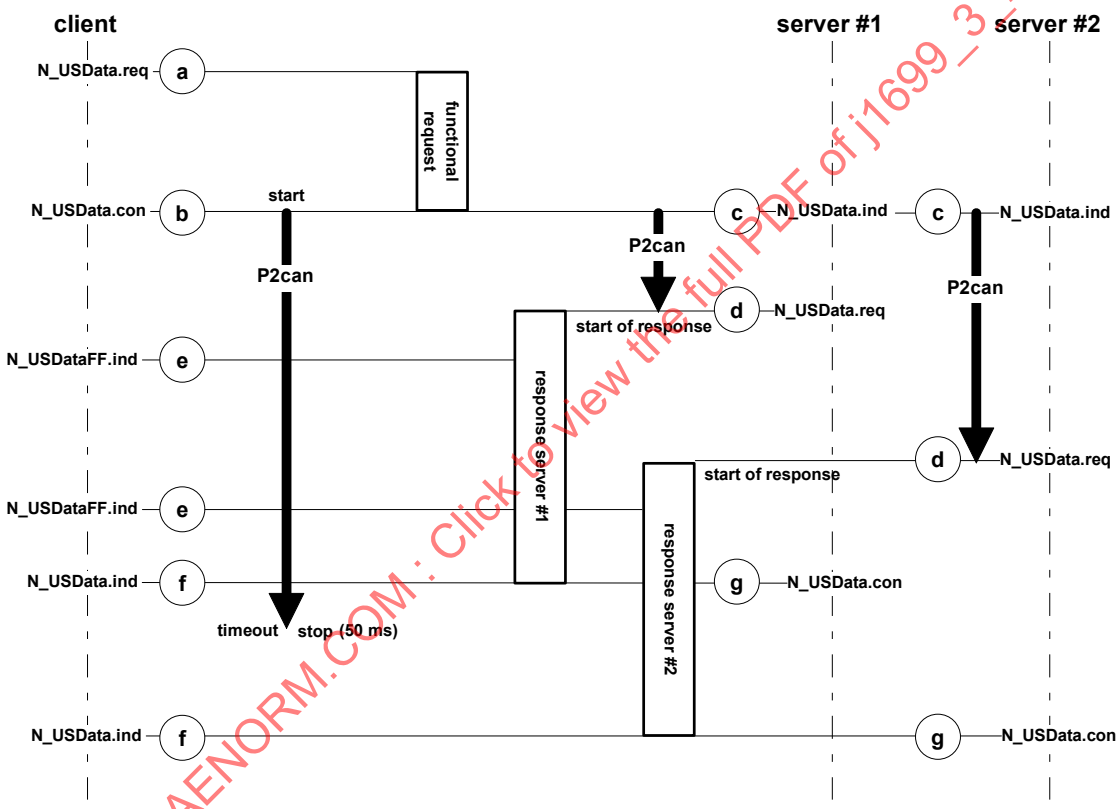

Figure 8 – Functional OBD communication - default response timing

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.

a) 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.

b) 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.

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 $P2_{CAN}$ 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 $P2_{CAN}$.

e) 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.

f) 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.

g) 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.

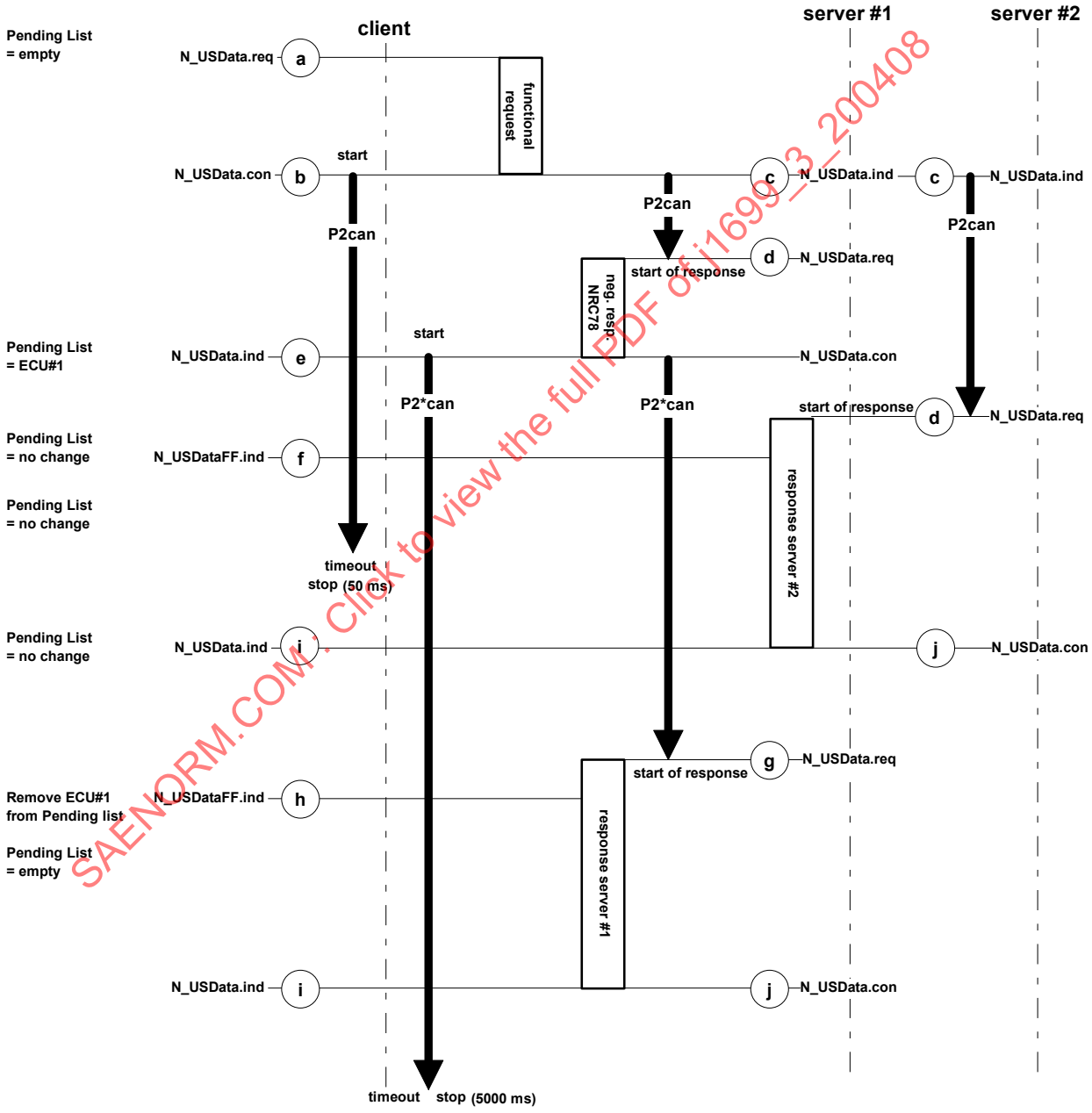

Figure 9 — Functional OBD communication – enhanced response timing

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 $P2_{CAN}$ timer, using the default reload value $P2_{CAN}$. For the response message the value of the $P2_{CAN}$ 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 $P2_{CAN}$ 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 any of the addressed servers cannot provide the requested information within the $P2_{CAN}$ 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 $P2_{CAN}$ timer in order to observe other servers to respond within $P2_{CAN}$. In addition, the client establishes an enhanced $P2^*_{CAN}$ 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 $P2_{CAN}$. 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 $P2^*_{CAN}$ then a further negative response message including response code 78 hex can be sent. This will cause the client to reload its $P2^*_{CAN}$ 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 $P2^*_{CAN}$. 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 J1979 (ISO 15031-5).

Table A – Proper Response From ECU

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
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.
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)
Service $01 supported PID requested	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing
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)
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

Table A – Proper Response From ECU (continued)

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
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)
Service $02 supported PID requested, Freeze Frame stored	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing
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)
Service $03/$07 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, $11)
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.
Service $03/$07 supported, DTCs stored	Positive response is required	Positive response is required	Positive response is required
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)
Service $04 supported, conditions not correct	The ECU shall not respond	The ECU shall not respond	Negative response is required ($7F, $04, $22)
Service $04 supported, conditions correct	Positive response is required	Positive response is required	Positive response is required
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)
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).

Table A – Proper Response From ECU (continued)

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
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)
Service $05/$06 supported TID requested, stored data available	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing
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)
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)
Service $08 supported TID requested, conditions correct	Respond within P2 timing	Respond within P2 timing	Respond within P2 timing
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.
Service $08 unsupported TID requested	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response ($7F, $08 $12)
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)
Service $09 supported INFOTYPE requested, data available (VIN, CVN, CALID)	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
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
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)
Service $09 unsupported INFOTYPE requested	The ECU shall not respond	The ECU shall not respond	ECU can either not respond or send a negative response ($7F, $09, $12)

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 J1979 (ISO 15031-5).

Table B – Proper Response From ECU For ISO 15765-4

Condition	ISO 15765-4
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.
Service $01 unsupported PID requested	The ECU shall not respond
Service $01 supported PID requested	Respond within P2 timing (no negative response message with response code $78 allowed)
Service $02 not supported	The ECU shall not respond
Service $02 supported PID requested, no Freeze Frame stored	PID $02 indicates $0000, but if PIDs are requested, ECU must not respond except if supported PIDs ($00, $20, …) have been requested, then the ECU shall send a response with the supported PID and data bytes
Service $02 unsupported PID requested, no Freeze Frame stored	PID $02 indicates $0000, but if PIDs are requested, ECU must not respond except for support PIDs $00, $20, etc.
Service $02 supported PID requested, Freeze Frame stored	Respond within P2 timing
Service $02 unsupported PID requested, Freeze Frame stored	The ECU shall not respond
Service $03/$07 not supported	The ECU shall not respond
Service $03/$07 supported, no DTCs stored	Positive response indicating no DTCs is required.
Service $03/$07 supported, DTCs stored	Positive response including the stored DTCs is required
Service $04 not supported	The ECU shall not respond

Table B – Proper Response From ECU For ISO 15765-4 (continued)

Condition	ISO 15765-4
Service $04 supported, conditions not correct	Negative response is required ($7F, $04, $22)
Service $04 supported, conditions correct	Positive response message required. Negative response messages(s) ($7F, $04, $78) allowed until positive response message available.
Service $06 not supported	The ECU shall not respond
Service $06 supported TID requested, no stored data available	Positive response required, test values, min and max limits must be set to $00
Service $06 unsupported TID requested, no stored data available	The ECU shall not respond
Service $06 supported TID requested, stored data available	Respond within P2 timing
Service $06 unsupported TID requested, stored data available	The ECU shall not respond
Service $08 not supported	The ECU shall not respond
Service $08 supported TID requested, conditions correct	Respond within P2 timing
Service $08 supported TID requested, conditions not correct	Negative response required ($7F, $08, $22)
Service $08 unsupported TID requested	The ECU shall not respond
Service $09 not supported	The ECU shall not respond
Service $09 supported INFOTYPE requested, data available (VIN, CVN, CALID)	Respond within P2 timing
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
Service $09 supported INFOTYPE requested, data not available, conditions not correct (CVN), prior to 2005 MY only	Negative response required ($7F, $09, $22)
Service $09 unsupported INFOTYPE requested	The ECU shall not respond

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. The following tests can be run in three major groups.

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

Section 10 can be run as a standalone test to assess proper function of the I/M Readiness bits. Because Section 10 requires driving a vehicle for as long as several days, Section 10 has provisions to resume testing after the requisite monitoring cycles have been performed.

Section 11 can also be run as a standalone test to assess proper function of the in-use performance counters.

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

Run tests contained in Sections 5 through 9

Run test contained in Section 10

Resume tests contained in Section 10

Run tests contained in Section 11

NOTE: The following text contains 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.

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.)

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 at least 30 seconds. Connect scan tool to the J1962 connector.

5.1.2 Turn ignition on. Do not crank engine.

Evaluation:

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 (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 (J1978 / ISO 15031-4) in the following sequence:

J1850 41.6 Kbps PWM
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 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	1xxxxxxx 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 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/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 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.

5.4 Verify MIL status bit, engine off

Purpose: To verify the correct response to a Service $01, PID $01 request, 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 indicated support for Mode $04 during engine-off must respond with messages as shown in the response table above.

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

DATA A bit 7 must be 0, indicating MIL off.

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 7. — 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 8. — 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**
	data record of supported OBDMID = [			OBDMIDREC
#2	1st supported OBDMID	M	xxxxxxxx	OBDMID
#3	Data A: supported OBDMIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported OBDMIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported OBDMIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported OBDMIDs]	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.

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 9. — 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 10. — 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**
	data record of supported OBDMID = [			OBDMIDREC
#2	1st supported OBDMID	M	xxxxxxxx	OBDMID
#3	Data A: supported OBDMIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported OBDMIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported OBDMIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported OBDMIDs]	M	xxxxxxxx	DATA_D
:	:	:	:	:
	data record of supported OBDMID = [			OBDMIDREC
#n-4	mth supported OBDMID	C1	xxxxxxxx	OBDMID
#n-3	Data A: supported OBDMIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported OBDMIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported OBDMIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported OBDMIDs]	C2	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:

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, send the corresponding Service $06 request message and note the response.

Table 11. — 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 12. — 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**
	data record of supported OBDMID = [			OBDMIDREC
#2	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
:	:	:	:	:
	data record of supported OBDMID = [			OBDMIDREC
#n-8	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.

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, 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 13. — Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 9141-2, 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 14. — 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
	data record of Test ID = [			TIDREC_
#4	Test Value (High Byte)	M	XX	TVHI
#5	Test Value (Low Byte)	M	XX	TVLO
#6	Test Limit (High Byte)	C	XX	TLHI
#7	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).

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

Evaluation criteria:

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

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 15. — 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 16. — 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**
	data record of supported PIDs = [			PIDREC_
#2	1st supported PID	M	xxxxxxxx	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:

At a minimum, PIDs $01, $04, $05, $0C, $0D, and $11 must be supported by the vehicle for spark ignition engines. At a minimum, PIDs $01, $04, $05, $0C, and $0D must be supported by the vehicle for compression ignition engines.

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 17. — 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 18. — 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**
	data record of supported PIDs = [			PIDREC_
#2	1st supported PID	M	xxxxxxxx	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
:	:	:	:	:
	data record of supported PIDs = [			PIDREC_
#n-4	mth supported PID	C1	xxxxxxxx	PID
#n-3	Data A: supported PIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported PIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported PIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported PIDs]	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 19. — 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 20.— 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**
	data record of 1st supported PID = [			PIDREC_
#2	PID#1	M	XX	PID
#3	data A,	M	xxxxxxxx	DATA_A
#4	data B,	C1	xxxxxxxx	DATA_B
#5	data C,	C1	xxxxxxxx	DATA_C
#6	data D]	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 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 23.

It is not an error to return a PID that was not supported on 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 [For ISO 15765-4 protocol only] Request up to the first six supported PIDs for each ECU as a group and note the response.

Table 21. — Request current powertrain diagnostic data request message for ISO 15765-4 protocol

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
#3	PID#2	U	XX	PID
#4	PID#3	U	XX	PID
#5	PID#4	U	XX	PID
#6	PID#5	U	XX	PID
#7	PID#6	U	XX	PID
U = User Optional				

Table 22.— 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**
	data record of 1st supported PID = [			PIDREC_
#2	PID#1	M	XX	PID
#3	data A,	M	XX	DATA_A
#4	data B,	C1	XX	DATA_B
#5	data C,	C1	XX	DATA_C
#6	data D]	C1	XX	DATA_D
:	:	:	:	:
	data record of mth supported PID = [			PIDREC_
#n-4	PID#m	C2	XX	PID
#n-3	data A,	C2	XX	DATA_A
#n-2	data B,	C3	XX	DATA_B
#n-1	data C,	C3	XX	DATA_C
#n	data D]	C3	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:

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

If the PID values do not match, this shall be flagged as a warning for additional analysis by the engineer. (Values may not match exactly because of A/D jitter, sampling issues, etc.).

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

Evaluation criteria:

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

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 23. – Engine Off Service $01 PID Validation

Engine Off Service $01 PID 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 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.
01, DATA_B, bit 5	Bit 5 must be 0	Fuel system is always complete. 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	Bit 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,	2 bytes long, bits 5-7 must be 0	Bits are reserved
04	1 byte long, value must be 0%	LOAD_PCT is 0 at zero airflow
05	1 byte long, value must be -20 to 120 deg C	ECT in normal range

Table 23 – Engine Off Service $01 PID Validation (continued)

PID	Required Value	Comment
06, 07, 08, 09	1 byte value unless PID $1D indicates that 4 banks are supported, in which case, 2 byte values must be returned.	
0A, 0B	1 byte long	
0C	2 bytes long, value must be 0	RPM is 0 with engine off
0D	1 byte long, value must be 0	VSS is 0 with engine off
0E	1 byte long	
0F	1 byte long, value must be -20 to 120 deg C	IAT in normal range
10	2 bytes long, value must be less than or equal to 5 g/sec	MAF< = 5 g/sec with engine off
11	1 byte long, value is 0% to 40%	TP in normal range
12	1 byte long	
13 or 1D, bits 0-7	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engine; (Note: both PIDs may not be supported on spark 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
14, 15, 16, 17, 18, 19, 1A, 1B	2 bytes long	
1C	1 byte long, value must be 01, 02, 03, 07, 08, 09, 0B or 0D	Must be Federal OBD and/or California OBD-II
1D, 1E	1 byte long	
1F	2 bytes long, value must be 0	RUNTM is 0 with engine off
21	2 bytes long, value must be 0	MIL_DIST is 0 after Service $04
22, 23	2 bytes long	
24, 25, 26, 27, 28, 29, 2A, 2B	4 bytes long	

Table 23 – Engine Off Service $01 PID Validation (continued)

PID	Required Value	Comment
2C	1 byte long, value must be 0	EGR_PCT is 0 with engine off
2D, 2E, 2F	1 byte long	
30	1 byte long, value must be 0 or 1	WARM_UPS is 0 or 1 after Service $04
31	2 bytes long, value must be 0	CLR_DIST is 0 after Service $04
32	2 bytes long	
33	1 byte long, value must be 81 to 110 kPa	BARO within normal range
34, 35, 36, 37, 38, 39, 3A, 3B	4 bytes long	
3C, 3D, 3E, 3F	2 bytes long	
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	2 bytes long	
43	2 bytes long, value must be 0%	LOAD_ABS is with engine off
44	2 bytes long	
45	1 byte long, value must be 0% to 50%	TP_R in normal range
46	1 byte long, value must be -20 to 60 deg C	AAT in normal range
47	1 byte long, value must be 0% to 60%	TP_B in normal range
48	1 byte long, value must be 0% to 60%	TP_C in normal range
49	1 byte long, value must be 0% to 40%	APP_D in normal range

Table 23 – Engine Off Service $01 PID Validation (continued)

PID	Required Value	Comment
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	2 bytes long, value must be 0	MIL_TIME is 0 after Service $04
4E	2 bytes long, value must be 0	CLR_TIME is 0 after Service $04

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 24.— 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 25. — 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**
	data record of supported TIDs = [			TIDREC_
#2	1st supported TID	M	XX	TID
#3	Data A: supported TIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported TIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported TIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported TIDs]	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 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.

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 26.— 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 27. — 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**
	data record of supported TIDs = [			TIDREC_
#2	1st supported TID	M	XX	TID
#3	Data A: supported TIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported TIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported TIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported TIDs]	M	xxxxxxxx	DATA_D
:	:	:	:	:
	data record of supported TIDs = [			TIDREC_
#n-4	mth supported TID	C1	XX	TID
#n-3	Data A: supported TIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported TIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported TIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported TIDs]	C2	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 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.

5.7.3 Request next unsupported TID support TID ($20, $40, $60, $80, $A0, $C0, $E0) to ensure that the ECU can respond properly to an unsupported TID and does not terminate communication.

Evaluation criteria:

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

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 (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 (J1978 / ISO 15031-4) in the following sequence:

J1850 41.6 Kbps PWM
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 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 28. — 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 29. — 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	1xxxxxxx 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 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 the 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 30. — 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 31.— 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 32.— 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.

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 33. — 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 34. — 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**
	data record of supported PIDs = [			PIDREC_
#2	1st supported PID	M	XX	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:

At a minimum, PIDs $01, $04, $05, $0C, $0D, and $11 must be supported by the vehicle for spark ignition engines. At a minimum, PIDs $01, $04, $05, $0C, and $0D must be supported by the vehicle for compression ignition engines.

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 35. — 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 36. — 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**
	data record of supported PIDs = [			PIDREC_
#2	1st supported PID	M	XX	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
:	:	:	:	:
	data record of supported PIDs = [			PIDREC_
#n-4	mth supported PID	C1	XX	PID
#n-3	Data A: supported PIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported PIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported PIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported PIDs]	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:

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, send the corresponding Service $01 PID request message and note the response.

Table 37. — 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 38. — 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**
	data record of 1st supported PID = [			PIDREC_
#2	PID#1	M	XX	PID
#3	data A,	M	XX	DATA_A
#4	data B,	C1	XX	DATA_B
#5	data C,	C1	XX	DATA_C
#6	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 41.

It is not an error to return a PID that was not supported on 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 ISO 15765-4 protocol only] Request up to the first six supported PIDs for each ECU as a group and note the response.

Table 39. — Request current powertrain diagnostic data request message for ISO 15765-4 protocol

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
#3	PID#2	U	XX	PID
#4	PID#3	U	XX	PID
#5	PID#4	U	XX	PID
#6	PID#5	U	XX	PID
#7	PID#6	U	XX	PID
U = User Optional				

Table 40. — 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**
	data record of 1st supported PID = [			PIDREC_
#2	PID#1	M	XX	PID
#3	data A,	M	XX	DATA_A
#4	data B,	C1	XX	DATA_B
#5	data C,	C1	XX	DATA_C
#6	data D]	C1	XX	DATA_D
:	:	:	:	:
	data record of mth supported PID = [			PIDREC_
#n-4	PID#m	C2	XX	PID
#n-3	data A,	C2	XX	DATA_A
#n-2	data B,	C3	XX	DATA_B
#n-1	data C,	C3	XX	DATA_C
#n	data D]	C3	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:

For ISO15765-4 protocol, each ECU must respond with the same data value for each PID for single PID requests and group PID requests.

If the PID values do not match, this shall be flagged as a warning for additional analysis by the engineer. (Values may not match exactly because of A/D jitter, sampling issues, etc.).

5.10.5 Request the next unsupported PID-support PID ($20, $40, $60, $80, $A0, $C0, or $E0) to ensure ECU can respond properly to unsupported PID and does not terminate communication.

Evaluation criteria:

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

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 41. – Engine Idle Service $01 PID Validation

Engine Idle Service $01 PID Validation		
PID	**Required Value**	**Comment**
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 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.
01, DATA_B, bit 5	Bit 5 must be 0	Fuel system is always complete. 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, bits 3 and 7	Bits 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 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	2 bytes long, bits 5 – 7 must all be 0	Bits are reserved
04	1 byte long, value must be 0 to 60%	LOAD_PCT less than or equal to 60% at idle

Table 41 – Engine Idle Service $01 PID Validation (continued)

PID	Required Value	Comment
05	1 byte long, value must be -20 to 120 deg C	ECT in normal range
06, 07, 08, 09	1 byte value unless PID $1D indicates that 4 banks are supported, in which case, 2 byte values must be returned.	
0A	1 byte long, value must be greater than 0 kPa	FRP not zero
0B	1 byte long, value must be greater than 0 kPa	MAP not zero
0C	2 bytes long, value must be 300 and 2000 rpm	RPM between 300 and 2000 at idle
0D	1 byte long, value must be 0	VSS is 0 at engine idle
0E	1 byte long	
0F	1 byte long, value must be -20 and 120 deg C	IAT in normal range
10	2 bytes long, value must be greater than 0	MAF not zero
11	1 byte long, value must be 0% to 40%	TP in normal range
12	1 byte long	
13 or 1D, bits 0-7	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engine; (Note: both PIDs may not be supported on spark 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
14, 15, 16, 17, 18, 19, 1A, 1B	2 bytes long	
1C	1 byte long, value must be 01, 02, 03, 07, 08, 09, 0B or 0D	Must be Federal OBD or California OBD-II
1D, 1E	1 byte long	
1F	2 bytes long, value must be greater than 0	RUNTM not zero
21	2 bytes long, value must be 0	MIL_DIST=0 after Service $04

Table 41 – Engine Idle Service $01 PID Validation (continued)

PID	Required Value	Comment
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
24, 25, 26, 27, 28, 29, 2A, 2B	4 bytes long	
2C	1 byte long, value must be 0	EGR_PCT is 0 at idle
2D, 2E, 2F	1 byte long	
30	1 byte long, value must be 0	WARM_UPS is 0 after Service $04
31	2 bytes long, value must be 0	CLR_DIST is 0 after Service $04
32	2 bytes long	
33	1 byte long, value must be 81 to 110 kPa	BARO within normal range
34, 35, 36, 37, 38, 39, 3A, 3B	4 bytes long	
3C, 3D, 3E, 3F	2 bytes long	
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	2 bytes long	
43	2 bytes long, value must be greater than 0%	LOAD_ABS greater than 0 at idle
44	2 bytes long	
45	1 byte long, value must be 0% to 50%	TP_R in normal range
46	1 byte long, value must be -20 to 60 deg C	AAT in normal range
47	1 byte long, value must be 0% to 60%	TP_B in normal range
48	1 byte long, value must be 0% to 60%	TP_C in normal range

Table 41 – Engine Idle Service $01 PID Validation (continued)

PID	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	2 bytes long, value must be 0	MIL_TIME is 0 after Service $04
4E	2 bytes long, value must be 0	CLR_TIME is 0 after Service $04

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 $00 and that PID $02 Frame $00 contains $0000.

Procedure:

5.11.1 [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 42. — 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 43. — 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	1st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1st 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:

If at least one ECU 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, $05, $0C, $0D, and $11 must be supported by the vehicle for spark ignition engines. If only one ECU supports Service $02, Frame $00, PID $02, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by the vehicle for compression ignition engines.

When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, $0D, and $11 must be supported by each corresponding ECU for spark ignition engines. When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by each corresponding ECU for compression ignition engines.

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

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

Table 44. — 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 45. — 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	1st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1st 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
:	:	:	:	:
#2	mth supported PID	C2	xxxxxxxx	PID_
#3	frame #	C2	XX	FRNO_
#4	data record of mth supported PID = [data A,	C3	xxxxxxxx	DATA_A
#5	data B,	C4	xxxxxxxx	DATA_B
#6	data C,	C4	xxxxxxxx	DATA_C
#7	data D]	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.

5.11.3 [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 $02, Frame $00 PID request messages and note the response.

Table 46. — 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 47. — 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 SAE J1850, ISO 9141-2, or ISO 15765-4 protocols. For ISO 14230-4 protocol, the ECU can either not respond or send a negative response message ($7F, $11).

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.

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 48. — 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 49.— 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 50. — 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 51. — 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 52.— 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 an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required, for SAE J1850 and ISO 9141-2 interfaces.

For ISO 14230-4 interfaces, the ECU will respond with a positive response 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.

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, O2S11 ($01) and note response. (All vehicles that support Service $05 should have at least one O2 sensor [HO2S11]; TID $00 is not defined.)

Table 53. — 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 #	01	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 Section 4.2. A positive response is allowed, but not required, if Service $05 is supported by the J1850, ISO 9141-2 and ISO 14230-4 protocols.

If Service $05 is not supported, no response is allowed for 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 the data in the responses are correct, and verify that misfire OBDMIDs are supported for ISO 15765-4. 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 54. — 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 55. — 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**
	data record of supported OBDMID = [			OBDMIDREC
#2	1st supported OBDMID	M	XX	OBDMID
#3	Data A: supported OBDMIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported OBDMIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported OBDMIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported OBDMIDs]	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.

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 56. — 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 57. — 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**
	data record of supported OBDMID = [			OBDMIDREC
#2	1st supported OBDMID	M	XX	OBDMID
#3	Data A: supported OBDMIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported OBDMIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported OBDMIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported OBDMIDs]	M	xxxxxxxx	DATA_D
:	:	:	:	:
	data record of supported OBDMID = [			OBDMIDREC
#n-4	mth supported OBDMID	C1	XX	OBDMID
#n-3	Data A: supported OBDMIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported OBDMIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported OBDMIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported OBDMIDs]	C2	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:

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 58. — 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 59. — 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**
	data record of supported OBDMID = [			OBDMIDREC
#2	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
:	:	:	:	:
	data record of supported OBDMID = [			OBDMIDREC
#n-8	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.

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

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, and $AD 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.

5.14.4 [ISO 9141-2, 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 60. — Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 9141-2, 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 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 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
	data record of Test ID = [			TIDREC_
#4	Test Value (High Byte)	M	XX	TVHI
#5	Test Value (Low Byte)	M	XX	TVLO
#6	Test Limit (High Byte)	C	XX	TLHI
#7	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 Request next unsupported OBDMID-support OBDMID ($20, $40, $60, $80, $A0, $C0, or $E0) to ensure ECU can respond properly to an unsupported OBDID and does not terminate communication.

Evaluation criteria:

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

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 62. — 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 63. — 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 64.— 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:

If an ECU has no DTCs to report, it 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 (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 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).

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 65.— 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 66. — 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**
	data record of supported TIDs = [			TIDREC_
#2	1st supported TID	M	XX	TID
#3	Data A: supported TIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported TIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported TIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported TIDs]	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 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.

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 67.— 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 68. — 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**
	data record of supported TIDs = [			TIDREC_
#2	1st supported TID	M	XX	TID
#3	Data A: supported TIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported TIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported TIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported TIDs]	M	xxxxxxxx	DATA_D
:	:	:	:	:
	data record of supported TIDs = [			TIDREC_
#n-4	mth supported TID	C1	XX	TID
#n-3	Data A: supported TIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported TIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported TIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported TIDs]	C2	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 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 Request next unsupported TID support TID ($00, $20, $40, $60, $80, $A0, $C0, $E0) to ensure that the ECU can respond properly to an unsupported TID and does not terminate communication.

Evaluation criteria:

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

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 69. — 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	INFTYP

Table 70. — Request vehicle information response message (request supported InfoType) for ISO 9141-2, 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	INFTYP_
#3	MessageCount	M	XX	MC_
	data record of InfoType = [			DATAREC_
#4	Data A: supported InfoTypes,	M	xxxxxxxx	DATA_A
#5	Data B: supported InfoTypes,	M	xxxxxxxx	DATA_B
#6	Data C: supported InfoTypes,	M	xxxxxxxx	DATA_C
#7	Data D: supported InfoTypes]	M	xxxxxxxx	DATA_D

Table 71. — 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**
	data record of supported InfoTypes = [			INFTYPREC
#2	1st supported InfoType	M	XX	INFTYP
#3	Data A: supported InfoTypes,	M	xxxxxxxx	DATA_A
#4	Data B: supported InfoTypes,	M	xxxxxxxx	DATA_B
#5	Data C: supported InfoTypes,	M	xxxxxxxx	DATA_C
#6	Data D: supported InfoTypes]	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 should match or exceed the number of ECUs input by the operator. (Non-reprogrammable ECUs are not prohibited from outputting CVNs.)

Verify that IPT (INFOTYPE $08) is supported by at least one ECU. In-use Performance Indicator (INFOTYPE $08) must be supported for the 2007 MY. If the vehicle is a 2005 or 2006 MY vehicle that does not support in-use performance data, this shall be flagged as failure, however, 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.

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 72. — 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	INFTYP
#3	InfoType#2 (InfoTypes supported: $21 – $40)	U	20	INFTYP
#4	InfoType#3 (InfoTypes supported: $41 - $60)	U	40	INFTYP
#5	InfoType#4 (InfoTypes supported: $61 - $80)	U	60	INFTYP
#6	InfoType#5 (InfoTypes supported: $81 - $A0)	U	80	INFTYP
#7	InfoType#6 (InfoTypes supported: $A0 - $C0)	U	A0	INFTYP
U = User Optional.				

Table 73. — 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**
	data record of supported InfoTypes = [			INFTYPREC
#2	1st supported InfoType	M	XX	INFTYP
#3	Data A: supported InfoTypes,	M	xxxxxxxx	DATA_A
#4	Data B: supported InfoTypes,	M	xxxxxxxx	DATA_B
#5	Data C: supported InfoTypes,	M	xxxxxxxx	DATA_C
#6	Data D: supported InfoTypes]	M	xxxxxxxx	DATA_D
:	:	:	:	:
	data record of supported InfoTypes = [			INFTYPREC
#n-4	mth supported InfoType	C1	XX	INFTYP
#n-3	Data A: supported InfoTypes,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported InfoTypes,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported InfoTypes,	C2	xxxxxxxx	DATA_C
#n	Data D: supported InfoTypes]	C2	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:

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

5.17.3 Request next unsupported INFOTYPE-support INFOTYPE ($20, $40, $60, $80, $A0, $C0, or $E0) to ensure ECU can respond properly to an unsupported INFOYTPE and does not terminate communication.

Evaluation criteria:

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

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:

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

Table 74. — 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	INFTYP

Table 75. — 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	INFTYP
#3	Message Count VIN = 5 response messages	05	MC_VIN

Evaluation criteria:

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

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

Table 76. — 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 77. — 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	1st ASCII character of VIN	XX	VIN
#5	2nd ASCII character of VIN	XX	VIN
#6	3rd ASCII character of VIN	XX	VIN
#7	4th ASCII character of VIN	XX	VIN
#8	5th ASCII character of VIN	XX	VIN
#9	6th ASCII character of VIN	XX	VIN
#10	7th ASCII character of VIN	XX	VIN
#11	8th ASCII character of VIN	XX	VIN
#12	9th ASCII character of VIN	XX	VIN
#13	10th ASCII character of VIN	XX	VIN
#14	11th ASCII character of VIN	XX	VIN
#15	12th ASCII character of VIN	XX	VIN
#16	13th ASCII character of VIN	XX	VIN
#17	14th ASCII character of VIN	XX	VIN
#18	15th ASCII character of VIN	XX	VIN
#19	16th ASCII character of VIN	XX	VIN
#20	17th ASCII character of VIN	XX	VIN

Table 78. — Request vehicle information response message for 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,	C	XX	DATA_A
#5	Data B,	C	XX	DATA_B
#6	Data C,	C	XX	DATA_C
#7	Data D]	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 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 characters must be printable ASCII.

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

Table 79. — 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	

Procedure:

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

Table 80. — 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 Calibration ID	03	INFTYP

Table 81. — 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 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.

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

Table 82. — 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 83. — 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 84. — Request vehicle information response message for 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,	C	XX	DATA_A
#5	Data B,	C	XX	DATA_B
#6	Data C,	C	XX	DATA_C
#7	Data D]	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 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).

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

Procedure:

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

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: 01 – MessageCount CVN	05	INFTYP

Table 86. — 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 CVN	05	INFTYP
#3	Message Count CVN = x response messages	XX	MC_CVN

Evaluation criteria:

5.17.9 [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 87. — 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 88. — 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	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

Table 89. — Request vehicle information response message for 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	INFTYP_
#3	MessageCount	M	01 – XX	MC_
#4	data record of InfoType = [Data A,	C	XX	DATA_A
#5	Data B,	C	XX	DATA_B
#6	Data C,	C	XX	DATA_C
#7	Data D]	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, J1850 and ISO 14230-4.

If an ECU does not support INFOTYPE $06, no response is allowed for ISO 15765-4, 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 should match or exceed the number of ECUs input by the operator. (Non-reprogrammable ECUs are not prohibited from outputting CVNs.)

Procedure:

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

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: 01 – MessageCount IPT	07	INFTYP

Table 91. — 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 IPT	01	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.

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

Table 92. — 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 93. — 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	INFTYP
#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	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

Table 94. — Request vehicle information response message for 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	INFTYP_
#3	MessageCount	M	01 - 08	MC_
#4	data record of InfoType = [Data A,	M	XX	DATA_A
#5	Data B,	M	XX	DATA_B
#6	Data C,	M	XX	DATA_C
#7	Data D]	M	XX	DATA_D

Evaluation criteria:

The value of INFOTYPE $07 must match the number of returned response messages.

All In-use Performance data must be 32 bytes data.

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

INFOTYPE $08 (In-use performance data) must be supported for the 2007 MY. If the vehicle is a 2005 or 2006 MY vehicle that does not support in-use performance data, this shall be flagged as failure, however, 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. .

5.18 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 95. — 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 96. — 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**
	data record of supported PIDs = [			PIDREC_
#2	1st supported PID	M	XX	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:

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

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 97. — 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 98. — 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**
	data record of supported PIDs = [			PIDREC_
#2	1st supported PID	M	XX	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
:	:	:	:	:
	data record of supported PIDs = [			PIDREC_
#n-4	mth supported PID	C1	XX	PID
#n-3	Data A: supported PIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported PIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported PIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported PIDs]	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 in reverse order ($FF through $01), even if not supported, to ensure ECU can respond properly to unsupported PIDs and does not terminate communication.

Table 99. — 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 100.— 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**
	data record of 1st supported PID = [			PIDREC_
#2	PID#1	M	XX	PID
#3	data A,	M	XX	DATA_A
#4	data B,	C1	XX	DATA_B
#5	data C,	C1	XX	DATA_C
#6	data D]	C1	XX	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 Section 5.10.1 must be supported.

Note: It is not an error to return a PID that was not supported on 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.

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

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 (4,900 ms) for 15 seconds (3 requests).

Table 101. — 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 102. — 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**
	data record of supported PIDs = [			PIDREC_
#2	1st supported PID	M	XX	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:

Verify that a response is received 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 at sends diagnostic messages 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 J1850 and ISO 15765-4 which means that the test tool can send another request immediately after all expected responses have been received.)

Table 103. — 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 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**
	data record of supported PIDs = [			
#2	1st 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:

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 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 J2534 interface and the ECU.

6. Test vehicle with 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 (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 (J1978 / ISO 15031-4) in the following sequence:

J1850 41.6 Kbps PWM
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 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 105. — 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 106. — 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	1xxxxxxx 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 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 107. — 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 108. — 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 109. — Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for 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, no response is preferred, but a positive response message indicating no DTCs is allowed (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 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).

6.4 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:

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

Table 110. — 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 111. — 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 all ECUs. If this is the case, skip the remainder of section 6.4.

If freeze frame is supported for pending codes, verify that Frame $00, PID $02 is the same as any one of the DTCs reported in Service $07 for every ECU.

Procedure:

6.4.2 [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 112. — 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 113. — 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	1st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1st 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:

If at least one ECU 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, $05, $0C, $0D, and $11 must be supported by the vehicle for spark ignition engines. If only one ECU supports Service $02, Frame $00, PID $02, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by the vehicle for compression ignition engines.

When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, $0D, and $11 must be supported by each corresponding ECU for spark ignition engines. When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by each corresponding ECU for compression ignition engines.

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

Procedure:

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

Table 114. — 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	40	PID
#7	frame #00	U/C	00	FRNO_

U = User Optional

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

Table 115. — 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	1st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1st 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
:	:	:	:	:
#2	mth supported PID	C2	XX	PID_
#3	frame #	C2	XX	FRNO_
#4	data record of mth supported PID = [data A,	C3	xxxxxxxx	DATA_A
#5	data B,	C4	xxxxxxxx	DATA_B
#6	data C,	C4	xxxxxxxx	DATA_C
#7	data D]	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.

6.4.4 [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 evaluate the response for each ECU.

Table 116. — 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 117.— 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 1st 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.

6.4.5 [For ISO 15765-4 protocol only] Request up to the first three supported PIDs for each ECU as a group and note the response.

Table 118. — 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 119.— 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 #5 #6 #7	data record of 1st 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	mth supported PID	C2	XX	PID_
#3	frame #	C2	XX	FRNO_
#4 #5 #6 #7	data record of mth 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 respond with the same data value for each PID for single PID requests and group PID requests.

6.4.6 Request next unsupported PID-support PID ($20, $40, $60, $80, $A0, $C0, or $E0) (if available as determined in 6.4.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication.

Evaluation criteria:

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

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.

6.5 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:

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

Table 120. — 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 121. — 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 122.— 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 6.5.1 results in at least one confirmed DTC, skip to section 7.4.2 and continue.

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

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

For ISO 14230-4, a positive response containing no DTCs is required. (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).

For ISO 15765-4, a positive response message indicating no DTCs is required (Number of DTCs parameter is set to $00)

Procedure:

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

Table 123. — 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 124.— 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).

7. Test vehicle with a confirmed code by retaining fault

7.1 Continue to induce circuit fault

Procedure:

7.1.1 Turn ignition off (engine off) for 30 seconds. 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 (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 (J1978 / ISO 15031-4) in the following sequence:

J1850 41.6 Kbps PWM
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 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 125. — 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 126. — 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	1xxxxxxx 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 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 127. — 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 128. — 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 129. — Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for 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 #3	DTC#1 (High Byte) DTC#1 (Low Byte)	XX XX	DTC1HI DTC1LO
#4 #5	DTC#2 (High Byte) DTC#2 (Low Byte)	XX XX	DTC2HI DTC2LO
#6 #7	DTC#3 (High Byte) DTC#3 (Low Byte)	XX XX	DTC2HI 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 130.— 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, no response is preferred, but a positive response message indicating no DTCs is allowed (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 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).

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 131. — 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 132. — 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 133.— Request emission-related diagnostic trouble codes response message for 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 134. — 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 135.— 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 J1850 and ISO 9141-2, no response is preferred, but a positive response message indicating no DTCs is allowed.

For ISO 14230-4, a positive response containing no DTCs is required. (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).

For ISO 15765-4, a positive response message indicating no DTCs is required (Number of DTCs parameter is set to $00)

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

Table 136. — 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 137.— 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: Monitor status since DTCs cleared	01	PID
#3	MIL: status, Number of emission-related DTCs	1xxxxxxx b = $XX	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.

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. (All protocols)

Table 138. — 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 139. — 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 $07 or Service $03 for every ECU. There should be at least one DTC stored. (All protocols)

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 140. — 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 141. — 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	1st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1st 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:

If at least one ECU 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, $05, $0C, $0D, and $11 must be supported by the vehicle for spark ignition engines. If only one ECU supports Service $02, Frame $00, PID $02, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by the vehicle for compression ignition engines.

When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, $0D, and $11 must be supported by each corresponding ECU for spark ignition engines. When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by each corresponding ECU for compression ignition engines.

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

Procedure:

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

Table 142. — 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	40	PID
#7	Frame #00	U/C	00	FRNO_

U = User Optional

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

Table 143. — 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	1st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1st 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
:	:	:	:	:
#2	mth supported PID	C2	XX	PID_
#3	Frame #	C2	XX	FRNO_
#4	data record of mth supported PID = [data A,	C3	xxxxxxxx	DATA_A
#5	data B,	C4	xxxxxxxx	DATA_B
#6	data C,	C4	xxxxxxxx	DATA_C
#7	data D]	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.

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), send the corresponding Service $02 Frame $00 PID request message and note the response for each ECU.

Table 144. — 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 145.— 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 1st 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 as a group and note the response.

Table 146. — 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 147.— 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 1st 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
:	:	:	:	:
#2	mth supported PID	C2	XX	PID_
#3	frame #	C2	00	FRNO_
#4	data record of mth supported PID = [data A,	C3	xxxxxxxx	DATA_A
#5	data B,	C4	xxxxxxxx	DATA_B
#6	data C,	C4	xxxxxxxx	DATA_C
#7	data D]	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 Request next unsupported PID-support PID ($20, $40, $60, $80, $A0, $C0, or $E0) (if available as determined in 7.5.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication.

Evaluation criteria:

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

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 cycles, MIL illuminated

Procedure:

8.1.1 Turn ignition off (engine off) for 30 seconds, 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 (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 (J1978 / ISO 15031-4) in the following sequence:

J1850 10.4 Kbps VPW
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 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 148. — 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 149. — 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	1xxxxxxx 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 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 150. — 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 151. — 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 152.— 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.

If an ECU has no DTCs to report, it 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 (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 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).

8.4 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:

8.4.1 [For all protocols] Transmit Service $02 PID $02Frame $00 to read freeze frame DTCs. Freeze frame must be retained in at least one ECU while a confirmed DTC is present.

Table 153. — 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 154. — 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 $07 or Service $03 for every ECU. 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:

8.4.2 [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 155. — 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 156. — 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	1st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1st 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:

If at least one ECU 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, $05, $0C, $0D, and $11 must be supported by the vehicle for spark ignition engines. If only one ECU supports Service $02, Frame $00, PID $02, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by the vehicle for compression ignition engines.

When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, $0D, and $11 must be supported by each corresponding ECU for spark ignition engines. When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by each corresponding ECU for compression ignition engines.

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

Procedure:

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

Table 157. — 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 158. — 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	1st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1st 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
:	:	:	:	:
#2	mth supported PID	C2	XX	PID_
#3	Frame #	C2	XX	FRNO_
#4	data record of mth supported PID = [data A,	C3	xxxxxxxx	DATA_A
#5	data B,	C4	xxxxxxxx	DATA_B
#6	data C,	C4	xxxxxxxx	DATA_C
#7	data D]	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.

8.4.4 [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 159. — 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 160.— 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 1st 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.

8.4.5 [For ISO 15765-4 protocol only] Request up to the first three supported PIDs for each ECU as a group and note the response.

Table 161. — 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 162.— 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 1st 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
:	:	:	:	:
#2	mth supported PID	C2	XX	PID_
#3	frame #	C2	00	FRNO_
#4	data record of mth supported PID = [data A,	C3	xxxxxxxx	DATA_A
#5	data B,	C4	xxxxxxxx	DATA_B
#6	data C,	C4	xxxxxxxx	DATA_C
#7	data D]	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.

8.4.6 Request next unsupported PID-support PID ($20, $40, $60, $80, $A0, $C0, or $E0) (if available as determined in 8.4.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication.

Evaluation criteria:

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

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.

8.5 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:

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

Table 163. — 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 164. — 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 165.— Request emission-related diagnostic trouble codes response message for 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 166. — 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 167.— 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 J1850 and ISO 9141-2, no response is preferred, but a positive response message indicating no DTCs is allowed.

For ISO 14230-4, a positive response containing no DTCs is required. (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).

For ISO 15765-4, a positive response message indicating no DTCs is required (Number of DTCs parameter is set to $00)

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

Table 168. — 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 169.— 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: Monitor status since DTCs cleared	01	PID
#3	MIL: status, Number of emission-related DTCs	1xxxxxx b = $XX	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.

9. Test vehicle with no faults after 3 driving cycles completed

9.1 Complete two additional driving cycles

Procedure:

9.1.1 Turn ignition off (engine off) for 30 seconds. (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. (This completes three driving cycles with no fault.)

9.1.4 Start engine, let idle for one minute. (This initiates the fourth driving cycle, MIL may now be off, but it is not a failure if MIL stays illuminated.)

9.2 Establish communication (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 (J1978 / ISO 15031-4) in the following sequence:

ISO 15765-4 – 11-bit
ISO 15765-4 – 29 bit
J1850 41.6 Kbps PWM
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 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 170. — 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 171. — 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	1xxxxxxx 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 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 172. — 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 173. — 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 174.— 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.

If an ECU has no DTCs to report, it 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 (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 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).

9.4 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:

9.4.1 [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 175. — 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 176. — 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 $07 or Service $03 for every ECU. 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:

9.4.2 [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 177. — 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 178. — 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	1st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1st 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:

If at least one ECU 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, $05, $0C, $0D, and $11 must be supported by the vehicle for spark ignition engines. If only one ECU supports Service $02, Frame $00, PID $02, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by the vehicle for compression ignition engines.

When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, $0D, and $11 must be supported by each corresponding ECU for spark ignition engines. When more than one ECU supports Service $02, Frame $00, PID $02, then, at a minimum, PIDs $02, $04, $05, $0C, and $0D must be supported by each corresponding ECU for compression ignition engines.

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

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

Table 179. — 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 180. — 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	1st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1st 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
:	:	:	:	:
#2	mth supported PID	C2	XX	PID_
#3	Frame #	C2	XX	FRNO_
#4	data record of mth supported PID = [data A,	C3	xxxxxxxx	DATA_A
#5	data B,	C4	xxxxxxxx	DATA_B
#6	data C,	C4	xxxxxxxx	DATA_C
#7	data D]	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.

9.4.4 [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 181. — 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 182.— 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 1st 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.

9.4.5 [For ISO 15765-4 protocol only] Request up to the first three supported PIDs for each ECU as a group and note the response.

Table 183. — 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 184.— 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 #5 #6 #7	data record of 1st 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	mth supported PID	C2	XX	PID_
#3	frame #	C2	00	FRNO_
#4 #5 #6 #7	data record of mth 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 respond with the same data value for each PID for single PID requests and group PID requests.

9.4.6 Request next unsupported PID-support PID ($20, $40, $60, $80, $A0, $C0, or $E0) (if available as determined in 9.4.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication.

Evaluation criteria:

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

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.

9.5 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:

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

Table 185. — 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 186. — 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 187.— Request emission-related diagnostic trouble codes response message for 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 188. — 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 189.— 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 J1850 and ISO 9141-2, no response is preferred, but a positive response message indicating no DTCs is allowed.

For ISO 14230-4, a positive response containing no DTCs is required. (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).

For ISO 15765-4, a positive response message indicating no DTCs is required (Number of DTCs parameter is set to $00)

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

Table 190. — 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 191.— 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: Monitor status since DTCs cleared	01	PID
#3	MIL: status, Number of emission-related DTCs	?xxxxxxx	DATA_A
#4	Misfire -, Fuel system -, Comprehensive monitoring	xxxxxxxx	DATA_B
#5	Catalyst -, Heated catalyst -, …, monitoring supported	xxxxxxxx	DATA_C
#6	Catalyst -, Heated catalyst -, …, monitoring test complete/not complete	xxxxxxxx	DATA_D

Evaluation criteria:

DATA _A, bits 0-6 must be greater than or equal to one (at least one DTC).

Procedure:

9.5.3 Record MIL status (DATA_A bit 7) in vehicle log file – MIL can be illuminated or not illuminated.

Procedure:

9.5.4 Prompt user whether to clear codes or exit section 9. If the user wants to clear codes, continue to 9.6

Purpose:

Ask whether the user wants to clear codes at end of section 9.

9.6 Clear DTCs (Service $04), engine off

Purpose: To clear DTCs after completing Sections 5 through 9.

Procedure:

9.6.1 Turn ignition off for at least 30 seconds. Connect scan tool to the J1962 connector.

9.6.2 Turn ignition on. Do not crank engine.

9.6.3 Establish communication (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:

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

J1850 41.6 Kbps PWM
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 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 192. — 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 193. — 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	1xxxxxxx 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 J1962 connector pin 16 must be between 11.0 and 18.0 volts

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

Software must wait 2 seconds before proceeding to next step to allow for NVRAM read/write times.

Table 194. — 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 195.— 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 196.— 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.

10. Test vehicle with no faults to verify in-use counters, Service $06, and I/M Readiness

Purpose: To verify that I/M Readiness bit get set to "Ready" after the manufacturer drive cycle is complete, Service $06 data is not out of limits on a vehicle with no faults, and the OBD condition and ignition counters increment properly.

10.1 Establish communication (J1978 / ISO 15031-4), ignition on, engine off

Procedure:

10.1.1 Ensure that the engine is 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:

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

J1850 41.6 Kbps PWM
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 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 197. — 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 198. — 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	1xxxxxxx 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 J1962 connector pin 16 must be between 11.0 and 18.0 volts

10.2 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.

Procedure:

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

Software must wait 2 seconds before proceeding to next step to allow for NVRAM read/write times.

Table 199. — 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 200.— 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.

10.3 Verify Service $09 – Request vehicle information, engine off

Purpose: To verify that all ECUs respond correctly to Service $09 requests and to record the initial status of the IPT counters.

Procedure:

10.3.1 [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 supported.

Table 201. — 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	INFTYP

Table 202. — Request vehicle information response message (request supported InfoType) for ISO 9141-2, 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	INFTYP_
#3	MessageCount	M	XX	MC_
	data record of InfoType = [			DATAREC_
#4	Data A: supported InfoTypes,	M	xxxxxxxx	DATA_A
#5	Data B: supported InfoTypes,	M	xxxxxxxx	DATA_B
#6	Data C: supported InfoTypes,	M	xxxxxxxx	DATA_C
#7	Data D: supported InfoTypes]	M	xxxxxxxx	DATA_D

Table 203. — Request vehicle information response message (request supported InfoType) for ISO 15765-4 only

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

Verify that IPT (INFOTYPE $08) is supported by at least one ECU. In-use Performance Indicator (INFOTYPE $08) must be supported for the 2007 MY. If the vehicle is a 2005 or 2006 MY vehicle that does not support in-use performance data, this shall be flagged as failure, however, 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.

Procedure:

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

Table 204. — 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	INFTYP

Table 205. — 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	INFTYP
#3	Message Count VIN = 5 response messages	05	MC_VIN

Evaluation criteria:

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

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

Table 206. — 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 207. — 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	1st ASCII character of VIN	XX	VIN
#5	2nd ASCII character of VIN	XX	VIN
#6	3rd ASCII character of VIN	XX	VIN
#7	4th ASCII character of VIN	XX	VIN
#8	5th ASCII character of VIN	XX	VIN
#9	6th ASCII character of VIN	XX	VIN
#10	7th ASCII character of VIN	XX	VIN
#11	8th ASCII character of VIN	XX	VIN
#12	9th ASCII character of VIN	XX	VIN
#13	10th ASCII character of VIN	XX	VIN
#14	11th ASCII character of VIN	XX	VIN
#15	12th ASCII character of VIN	XX	VIN
#16	13th ASCII character of VIN	XX	VIN
#17	14th ASCII character of VIN	XX	VIN
#18	15th ASCII character of VIN	XX	VIN
#19	16th ASCII character of VIN	XX	VIN
#20	17th ASCII character of VIN	XX	VIN

Table 208. — Request vehicle information response message for 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,	C	XX	DATA_A
#5	Data B,	C	XX	DATA_B
#6	Data C,	C	XX	DATA_C
#7	Data D]	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 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 characters must be printable ASCII.

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

Table 209. — 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	

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

Table 210. — 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 211. — 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	INFTYP
#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	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

Table 212. — Request vehicle information response message for 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	INFTYP_
#3	MessageCount	M	01 - 08	MC_
#4	data record of InfoType = [Data A,	C	XX	DATA_A
#5	Data B,	C	XX	DATA_B
#6	Data C,	C	XX	DATA_C
#7	Data D]	C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = $02, $04, and $06				

Evaluation criteria:

All In-use Performance data must be 32 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, J1850 and ISO 9141-2. For ISO 14230-4, the ECU can either not respond or send a negative response ($7F, $12).

INFOTYPE $08 (In-use performance data) must be supported for the 2007 MY. If the vehicle is a 2005 or 2006 MY vehicle that does not support in-use performance data, this shall be flagged as failure, however, 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.

10.3.5 Record the values of the OBD Condition Counter (OBDCOND), Ignition Counter (IGNCNTR) and all monitor condition and completion counters.

10.4 Complete manufacturer drive cycle to clear I/M Readiness bits.

Procedure:

10.4.1 Stop vehicle in a safe location. Turn ignition off (engine off). Allow vehicle to soak according to the manufacturer-specified conditions in order to run any engine-off diagnostics and/or prepare the vehicle for any engine-running diagnostics on the next driving cycle that require an engine-off soak period.

10.4.2 Turn ignition to crank position and start engine. Note: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position. Drive vehicle according to the manufacturer-specified driving cycle.

10.4.3 Stop vehicle in a safe location. Turn ignition off (engine off). Allow vehicle to soak according to the manufacturer-specified conditions in order to run any engine-off diagnostics

Note: At this point, the user may disconnect the J1699-3 tool and proceed to run the vehicle through various monitoring cycles. After completing the requisite monitoring cycles, the user can choose to continue running Section 10 tests from this point on. When continuing this test, the user needs to ensure that the correct log file has been selected for continuation.

10.5 Establish communication (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.

10.5.1 Turn ignition to crank position and start engine. Note: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position.

Protocol Determination Procedure:

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

J1850 41.6 Kbps PWM
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 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 213. — 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 214. — 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	1xxxxxxx 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 J1962 connector pin 16 must be between 11.0 and 18.0 volts

10.6 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 I/M Readiness data is valid for the circumstances.

Procedure:

10.6.1 [For all protocols] Transmit Service $01, PID support PID $00.

Table 215. — Request current powertrain diagnostic data request message

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	00	PID

Table 216. — 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**
	data record of supported PIDs = [			PIDREC_
#2	1st supported PID	M	XX	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

Evaluation criteria:

At least one ECU must support Service $01, PID $01.

10.6.2 [For all protocols] Send Service $01 PID $01 request message and note the response.

Table 217. — 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 218. — 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**
	data record of 1st supported PID = [			PIDREC_
#2	PID#1	M	XX	PID
#3	data A,	M	xxxxxxxx	DATA_A
#4	data B,	M	xxxxxxxx	DATA_B
#5	data C,	M	xxxxxxxx	DATA_C
#6	data D]	M	xxxxxxxx	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 217.

Table 219. – Engine Idle Service $01 PID Validation

Engine Idle Service $01 PID 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 4	Bit 4 must be 0	Misfire should be complete. Unsupported monitors must indicate “ready”.
01, DATA_B, bit 5	Bit 5 must be 0	Fuel system is always complete. 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 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 0	All I/M Readiness bits zero. Unsupported monitors must indicate “ready”

10.7 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 the data in the response 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 are greater than or equal to the minimum test limit or less than or equal to the maximum test limit, i.e., “passing.”

Procedure:

10.7.1 [For all protocols] Transmit Service $06 OBDMID support OBDMID $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 220. — 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 221. — 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**
	data record of supported OBDMID = [			OBDMIDREC
#2	1st supported OBDMID	M	XX	OBDMID
#3	Data A: supported OBDMIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported OBDMIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported OBDMIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported OBDMIDs]	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.

10.7.2 [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 222. — 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