SURFACE VEHICLE RECOMMENDED PRACTICE

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Superseding J1699-3 JUL2015

Vehicle OBD II Compliance Test Cases

RATIONALE

CARB regulation references to SAE Standards in the text were updated to reflect their recent revisions. Editorial changes were also made.

FOREWORD

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

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1. SCOPE

The main purpose of this SAE 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, or the equivalent document ISO 15031-5.

Any software meeting these specifications will utilize the vehicle interface that is defined in SAE J2534.

SAE J1699-3 tests shall be run using an SAE J2534-1 (API Version 04.04) Interface. However, the use of an SAE J2534-2 (API Version 04.04) Interface shall be permitted if the following conditions are met:

- The number of 29-bit ISO 15765 OBD ECUs exceeds the capability of the SAE J2534-1 Interface.
- The SAE J2534-2 Interface meets or exceeds all of the SAE J2534-1 requirements and also supports the SAE J2534-2 feature “Mixed Format Frames on a CAN Network.”

2. REFERENCES

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

2.1 Applicable Documents

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

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1850	Class B DATA_Communications Network Interface
SAE J1930	Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms - Equivalent to ISO/TR 15031-2 NOTE: Equivalent to ISO/DIS 15031-2.
SAE J1930DA	Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet
SAE J1962	Diagnostic Connector NOTE: Equivalent to ISO/DIS 15031-3.
SAE J1978	OBD II Scan Tool - Equivalent to ISO/DIS 15031-4:December 14, 2001 NOTE: Equivalent to ISO/DIS 15031-4.
SAE J1979	E/E Diagnostic Test Modes NOTE: Equivalent to ISO/DIS 15031-5.
SAE J1979DA	Digital Annex of E/E Diagnostic Test Modes
SAE J2012	Diagnostic Trouble Code Definitions NOTE: Equivalent to ISO/DIS 15031-6.
SAE J2012DA	Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions
SAE J2284/3	High-Speed CAN (HSC) for Vehicle Applications at 500 KBPS
SAE J2534-1	Recommended Practice for Pass-Thru Vehicle Programming

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2.1.2 ISO Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ISO 9141-2:1994 Road Vehicles - Diagnostic Systems - CARB Requirements for Interchange of Digital Information

ISO 14230-4:2000 Road Vehicles - Diagnostic Systems - KWP 2000 Requirements for Emission-Related Systems

ISO 15031-1:2010 (Ed. 2) Road Vehicles - Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics - Part 1: General Information and Use Case Definition

ISO 15031-2:2010 (Ed. 1) Road Vehicles - Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics - Part 2: Guidance on Terms, Definitions, Abbreviations and Acronyms

ISO 15031-3:2016 (Ed. 2) Road Vehicles - Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics - Part 3: Diagnostic Connector and Related Electrical Circuits: Specification and Use

ISO 15031-4:2014 (Ed. 2) Road Vehicles - Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics - Part 4: External Test Equipment

ISO 15031-5:2015 (Ed. 3) Road Vehicles - Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics - Part 5: Emissions-Related Diagnostic Services

ISO 15031-6:2015 (Ed. 3) Road Vehicles - Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics - Part 6: Diagnostic Trouble Code Definitions

ISO 15031-7:2013 (Ed. 2) Road Vehicles - Communication Between Vehicle and External Equipment for Emissions-Related Diagnostics - Part 7: Data Link Security

ISO 15765-4 Road Vehicles - Diagnostic Communication over Controller Area Network (DoCAN) - Part 4: Requirements for Emissions-Related Systems - Amendment 1

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1699-1 SAE J1850 Verification Test Procedures

SAE J1699-2 Test Cases for OBD-II Scan Tools and I/M Test Equipment

2.2.2 ISO Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ISO 11898 Road Vehicles - Interchange of Digital information, Controller Area Network (CAN) for High Speed Communication

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2.2.3 Other Publications

2.2.3.1 CARB OBD Regulations and Rulemaking

OBD II and associated enforcement regulations, sections 1968.2 and 1968.5, title 13, California Code of Regulations. Web address: http://www.arb.ca.gov/msprog/obdprog/obdregs.htm.

HD OBD and associated enforcement regulations, sections 1971.1 and 1971.5, title 13, California Code of Regulations. Web address: http://www.arb.ca.gov/msprog/obdprog/hdobdreg.htm.

2.2.3.2 European OBD Regulation

European OBD and emission legislation is available at the following website: http://eur-lex.europa.eu/homepage.html.

2.3 Definitions

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

2.3.1 Definition of Terms

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

2.4 Acronyms

The following are common acronyms used in this document:

A/C Air Conditioning

CAN Controller Area Network

CALID Calibration Identification

CID Component ID

CNOBD China OBD

CVN Calibration Verification Number

D Diesel/Compression Ignition

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

EOBD European On Board Diagnostics

G Gasoline/Spark ignition

HD Heavy Duty (U.S. vehicles >14000 pound GVWR, European vehicles >2610 kg RW in M_1, M_2, N_1, and N_2 categories, or all vehicles in M_3 and N_3 categories)

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HEV	Hybrid Electric Vehicle
HSC	High Speed CAN
ID	Identification (number)
IOBD	India OBD-II
I/M	Inspection and Maintenance
ISO	International Standards Organization
kbps	Kilobits per Second
KWP	Key Word Protocol
LD	Light Duty (U.S. passenger cars, light-duty trucks, and medium-duty engines ≤14000 pound GVWR, or European vehicles ≤2610 kg RW in M_1, M_2, N_1, and N_2 categories)
MD	Medium Duty (medium-duty engines ≤14000 pound GVWR, engine dyno certified)
MIL	Malfunction Indicator Lamp
OBD-II	On Board Diagnostics (level 2) (U.S. OBD-II for LD and MD)
OBDBr	On Board Diagnostics for Brazil
OBDM	On Board Diagnostic Monitor
PCM	Powertrain Control ECU
PHEV	Plug In Hybrid Electric Vehicle
PWM	Pulse Width Modulation
PID	Parameter Identification (number)
rpm	Revolutions per Minute (engine speed)
SID	Service ID
S/S	Stop/Start
TID	Test ID
VIN	Vehicle Identification Number
VPW	Variable Pulse Width (modulation)

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3. OVERVIEW

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

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

- Section 3 provides an overview and specifies general conditions for testing.
- Section 4 defines the required message structure and required timing for each protocol.
- Sections 5 through 9 are known as the static test. Most of the static test can be run in approximately 15 minutes without driving the vehicle. A complete test of permanent codes required running the CARB drive cycle.
- Sections 10 through 11 are known as the dynamic test. The dynamic tests must be run over several driving cycles and requires the vehicle to be driven.

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

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

Section	Condition	Services	Purpose
5	No malfunctions	$01, $02, $03, $04, $05, $06, $07, $08, $09, $0A	Basic test service support
6	Pending trouble codes	$07, $02, $03	DTC and status properly reported
7	Confirmed DTC	$07, $02, $03	DTC and status properly reported
8	Fault repaired	$07, $02, $03, $04	DTC and status properly reported
9	After three driving cycles	$07, $02, $03, $04, $0A	DTC and status properly reported
10	No malfunctions	$03, $04, $01, $06, 07, $09	Check in-use performance counters
11	No malfunctions	$03, $04, $01, $06, $07, $09	Check I/M readiness bits

Figure 1 - Conditions and services tested

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3.1 Select Static Test or Dynamic Test Sequence

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

- Sections 5 through 9 (static test) are run as a group to assess basic vehicle communication functionality.
- Sections 10 through 11 (dynamic test) are run as a group to assess proper function of the I/M Readiness bits and to assess proper function of the in-use performance counters. Because the dynamic tests require driving a vehicle for as long as several days, the dynamic test has provisions to resume testing after the requisite monitoring cycles have been performed.

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

- Run static tests contained in Sections 5 through 9.
- Run dynamic tests contained in Sections 10 though 11.
- Resume dynamic tests contained in Sections 10 though 11.

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

Prompt 1:

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

Prompt 2:

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

Prompt 3:

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

Prompt 4:

Prompt user for the type of engine (spark ignition, compression ignition) and type of powertrain (conventional, stop-start hybrid [HEV] or plug-in hybrid [PHEV]) for the vehicle being tested. (Determine what PIDs and value ranges must be supported in Service $01 and Service $02.) Note that HEV, PHEV, and stop-start vehicles will typically turn off the engine at idle. This creates eight categories of engines: spark ignition/gasoline (G) for conventional, S/S, HEV, and PHEV, and compression ignition/diesel (D) for conventional, S/S, HEV and PHEV. If PHEV is chosen, inform the user not to plug in charge during the static test.

Prompt 5:

Prompt user whether to perform a U.S. OBD test, a European OBD with IUMPR test, a European OBD without IUMPR test, an India OBD test without IUMPR, a Brazil OBD test without IUMPR or, a China 6OBD test without IUMPR.

Prompt 6:

Prompt user whether to perform the static test or the dynamic test.

Prompt 7:

Prompt user for the type of vehicle—light-duty passenger car, light-/medium-duty truck <14000 pound GVWR, or heavy-duty truck > 14000 pound GVW—and, if light-/medium-duty truck, whether the vehicle was certified on an engine dyno or a chassis dyno. (Note that all heavy-duty trucks are dyno certified, so there is no need to ask the question.) This creates the following categories of vehicles:

- U.S. OBD for light-duty passenger cars (LD OBD).
- U.S. OBD for light-duty or medium-duty truck, chassis certified (LD OBD).
- U.S. OBD for medium-duty truck engine dyno certified ≤14000 GVWR (MD OBD).
- U.S. OBD for heavy-duty truck >14000 pound GVWR (HD OBD).
- EOBD for light-duty passenger car (LD EOBD).
- EOBD for light-duty truck (LD EOBD).
- EOBD for heavy-duty truck (HD EOBD).
- India OBD for passenger cars and trucks below 3.5T GVW (tested as LD EOBD without IUMPR).

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- India OBD for trucks above 3.5T GVW (tested as HD EOBD without IUMPR).
- Brazil OBD for light-duty passenger cars and and trucks.
- China OBD for light-duty passenger cars.

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

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

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

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

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

1. Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V (i.e., nominal 12-V system with the engine off and the engine running). Any software meeting these specifications will check voltage to ensure that it is within the specified range each time the software executes the protocol determination routine. If battery voltage falls outside the specified range, the software will flag a warning and prompt the operator to determine if testing is to continue.
2. All data specified within messages are hex unless otherwise specified.
3. Multiple ECUs can respond to SAE J1979 (ISO 15031-5) request messages.
4. XX = valid reported hex data (data not checked/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 4.2.
8. OBD messages on ISO 15765-4 protocol shall only be received from the CAN identifiers shown in Figures 4 and 5. The maximum number of legislated OBD ECUs in an OBD compliant vehicle shall not exceed eight using 11 bit CAN IDs. The maximum number of legislated OBD ECUs in an OBD compliant vehicle shall not exceed 239 using 29 bit CAN IDs. For a given vehicle, each OBD identifier must be unique. The SAE J2534 device will ignore OBD responses from CAN identifiers not shown in Figures 4 and 5. 29 bit CAN IDs are only allowed to use addresses in the range 0x00 to 0x32 and 0x34 to 0xEF.
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.

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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:

    For all protocols except ISO 15765-4, at least every 2.0 seconds ± 0.5 second, 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. For ISO 15765-4, the message shall be selectable by a user prompt; however, it will eventually be removed.

    Waiting for user input:

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

    After the user input has been gathered, the periodic message should be stopped and any response messages from the periodic Service $01 PID $00 messages should be read and discarded from the SAE J2534 device before the next test is executed. Special care should be exercised to be sure that the last periodic message has been sent and any replies generated are discarded. This can be accomplished by attempting to receive responses for 2 seconds after the periodic message has been stopped.

11. It is assumed that all OBD emission or diagnostic-critical ECUs support Mode $01, PID $00.

12. Procedure to determine when the link drops out: Send Service $01 PID $00. The proper response from all OBD ECUs will be verified or the diagnostic link will be flagged as being "down" and the test aborted.

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

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

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

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

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

18. Inability to meet OBD communication protocols specified in the document (e.g., Message Format, Message Timing, Data Not Available) shall be logged as a failure.

19. Fail on NRC $78 responses for Service $09 INFOTYPE $02 (VIN), CALID (INFOTYPE $04), IPT (INFOTYPE $08 or INFOTYPE $0B), ECUNAME (INFOTYPE $0A), ESN (INFOTYPE $0D), EROTAN (INFOTYPE $0F). NRC $78 is allowed for CVN for EOBD/IOBD/OBDBr.

20. The software will validate the desired engine running state during the test (engine on/engine off) to ensure the actual state (as determined by SID $01, PID $0C) matches the state desired in each section of the test. If the states do not match, this will be logged as a warning.

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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 (ISO 14230-4)											
10LL LLLLb	F1	addr	Maximum 7 data bytes							Yes	No
Diagnostic request at 41.6 kbit/s (SAE J1850)											
61	6A	F1	Maximum 7 data bytes							Yes	Yes
Diagnostic response at 41.6 kbit/s (SAE J1850)											
41	6B	addr	Maximum 7 data bytes							Yes	Yes
LL LLLL = Length of data bytes											

Figure 2 - Diagnostic message format for ISO 9141-2, ISO 14230-4, and SAE J1850

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

Figure 3 - Diagnostic message format for ISO 15765-4

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

CAN communication is required to be 500 kbps to meet OBD II requirements. EOBD India and Brazil OBD allow 250 or 500 kbps.

CAN identifiers are defined in Figures 4 and 5.

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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

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4.2 Message Timing

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

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

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

ISO 9141-2	ISO 14230-4	SAE J1850	ISO 15765-4
25 to 50 ms for key word $0808 0 to 50 ms for key word $9494	25 to 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 emission-related OBD servers (ECUs). The client requests a CVN, which is only supported by server #1 (ECU #1) with two response messages. Server #2 (ECU #2) is not flash programmable. Figure 7 graphically depicts the timing handling in the client and two 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.

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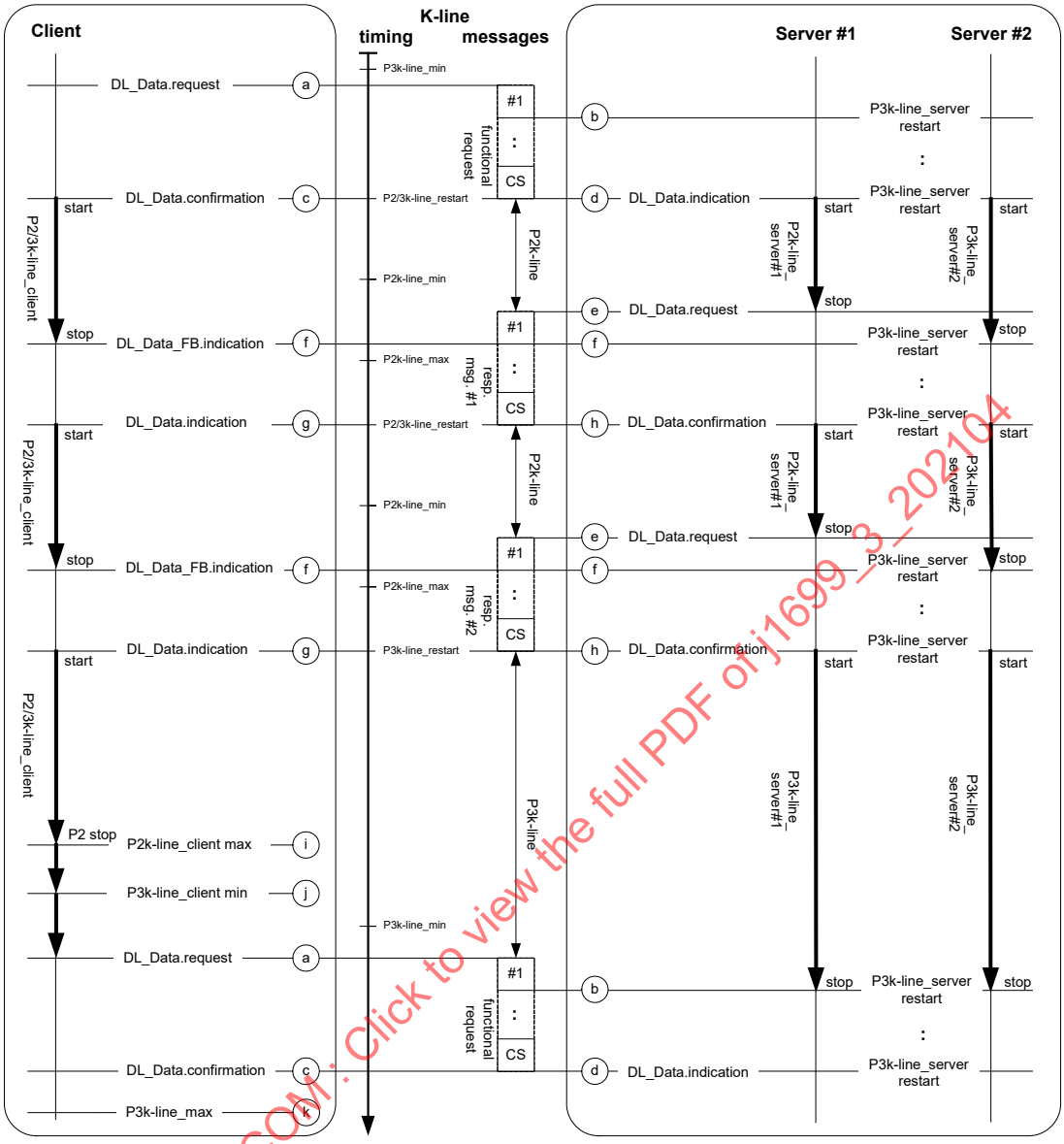

Figure 7 - ISO 9141-2 and ISO 14230-4 protocol client and server timing behavior

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.

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Figure 7 shows the client and two 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 P2K-line/P3K-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 P2K-line and P3K-line timer, using the default reload values P2K-line_max and P3K-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 P3K-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 P2K-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 P2K-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 P2K-line/P3K-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 P2K-line and P3K-line timer, using the default reload values P2K-line_max and P3K-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 P2K-line/P3K-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 P3K-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 P2K-line_max timeout, which indicates that all response messages from all servers are received.

j. The client application indicates that P3K-line_min is reached and that the P3K-line timing window is now open to send a new request message (see item a.).

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4.2.2 ISO 15765-4 Functional OBD Communication During Default Session

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

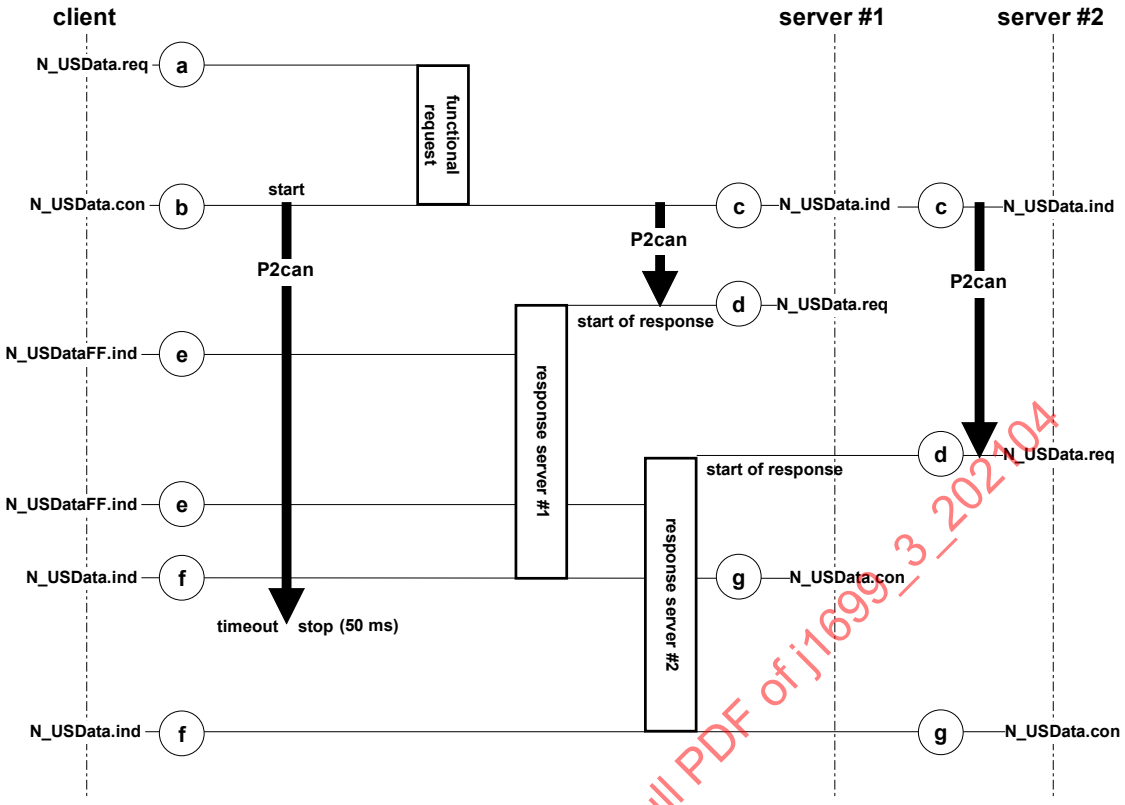

Figure 8 - Functional OBD communication - default response timing

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 P2CAN timer, using the default reload value P2CAN. 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 P2CAN after the reception of N_USData.ind. This means that in case of a multi-frame response messages the FirstFrame shall be sent within P2CAN and for single frame response messages that the SingleFrame shall be sent within P2CAN.

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 P2CAN in case it knows the servers to be expected to respond and all servers have responded, or keeps the P2CAN 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 P2CAN timer.

g. The completion of the transmission of the response message will also be indicated in the servers via N_USData.con.

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4.2.3 Functional OBD Communication During Default Session with Enhanced Response Timing

Figure 9 graphically depicts the timing handling in the client and two 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.

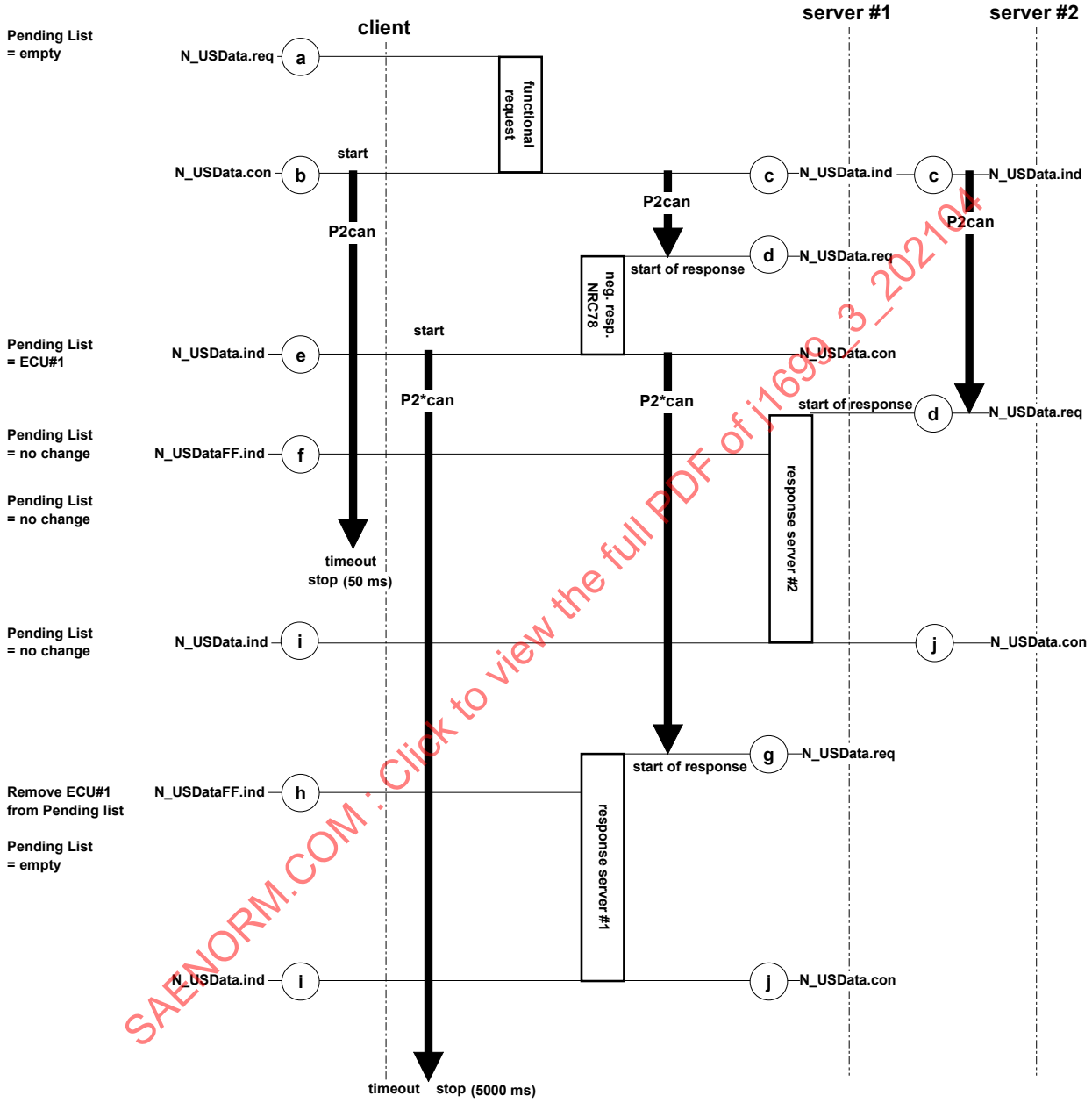

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Figure 9 - Functional OBD communication - enhanced response timing

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 P2CAN timer, using the default reload value P2CAN. For the response message, the value of the P2CAN 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 P2CAN after the reception of N_USData.ind. This means that in case of a multi-frame response messages, the FirstFrame shall be sent within P2CAN and for single frame response messages that the SingleFrame shall be sent within P2CAN. In case any of the addressed servers cannot provide the requested information within the P2CAN 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 P2CAN timer in order to observe other servers to respond within P2CAN. 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 P2CAN. 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 still cannot 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 effect 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.

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4.3 Data Not Available

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

There are two conditions for which data is not available:

1. Service is not supported.

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

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

Table A - Proper response from ECU

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
a) Service $01 not supported	All ECUs must respond to Service $01 PID $00 if Service $01 is supported. If Service $01 is not supported, no response is allowed. All emissions-related OBD II compliant ECUs must respond to Service $01 PID $00.	All ECUs must respond to Service $01 PID $00 if Service $01 is supported. If Service $01 is not supported, no response is allowed. All emissions-related OBD II compliant ECUs must respond to Service $01 PID $00.	All ECUs must respond to Service $01 PID $00 if Service $01 is supported. If Service $01 is not supported, ECU can either not respond or send a negative response ($7F, $01, $11) All emissions-related OBD II compliant ECUs must respond to Service $01 PID $00.
b) Service $01 unsupported, PID requested	No response preferred, positive response is allowed.	No response preferred, positive response is allowed.	ECU can either not respond or send a negative response ($7F, $01, $12).
c) Service $01 supported, PID requested	Respond within P2 timing.	Respond within P2 timing.	Respond within P2 timing.
d) Service $02 not supported	The ECU shall not respond.	The ECU shall not respond.	ECU can either not respond or send a negative response ($7F, $02, $11).
e) Service $02 supported, PID requested, no freeze frame stored	PID $02 indicates $0000, but if PIDs are requested, ECU can either not respond or send invalid data, except if supported PIDs ($00, $20, ...) have been requested, then the ECU shall send a response with the supported PID and data bytes.	PID $02 indicates $0000, but if PIDs are requested, ECU can either not respond or send invalid data, except if supported PIDs ($00, $20, ...) have been requested, then the ECU shall send a response with the supported PID and data bytes.	PID $02 indicates $0000, but if PIDs are requested, ECU can either not respond or send a negative response ($7F, $02, $12), except if supported PIDs ($00, $20, ...) have been requested, then the ECU shall send a response with the supported PID and data bytes.
f) Service $02 unsupported PID requested, no freeze frame stored	No response preferred, positive response is allowed.	No response preferred, positive response is allowed.	ECU can either not respond or send a negative response ($7F, $02, $12).
g) Service $02 supported PID requested, freeze frame stored	Respond within P2 timing.	Respond within P2 timing.	Respond within P2 timing.
h) Service $02 unsupported PID requested, freeze frame stored	No response preferred, positive response is allowed.	No response preferred, positive response is allowed.	ECU can either not respond or send a negative response ($7F, $02, $12).
i) Service $03/$07 not supported	The ECU shall not respond.	The ECU shall not respond.	ECU can either not respond or send a negative response ($7F, $03/$07/$0A, $11).
j) Service $03/$07 supported, no DTCs stored	No response preferred, positive response indicating no DTCs is allowed.	No response preferred, positive response indicating no DTCs is allowed.	Positive response indicating no DTCs is required.
k) Service $03/$07 supported, DTCs stored	Positive response is required.	Positive response is required.	Positive response is required.

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Condition	ISO 9141-2	SAE J1850	ISO 14230-4
l) Service $04 not supported	The ECU shall not respond.	The ECU shall not respond.	ECU can either not respond or send a negative response ($7F, $04, $11).
m) Service $04 supported, conditions not correct	The ECU shall not respond.	The ECU shall not respond.	Negative response is required ($7F, $04, $22).
n) Service $04 supported, conditions correct	Positive response is required.	Positive response is required.	Positive response is required.
o) Service $05/$06 not supported	The ECU shall not respond.	The ECU shall not respond.	ECU can either not respond or send a negative response ($7F, $05/$06, $11).
p) Service $05/$06 supported TID requested, no stored data available	If TIDs are requested, ECU can either not respond or send invalid data.	If TIDs are requested, ECU can either not respond or send invalid data.	If TIDs are requested, ECU can either not respond or send invalid data or send negative response ($7F, $05/$06, $12).
q) Service $05/$06 unsupported TID requested, no stored data available	No response preferred, positive response is allowed.	No response preferred, positive response is allowed.	ECU can either not respond or send a negative response ($7F, $05/$06, $12).
r) Service $05/$06 supported TID requested, stored data available	Respond within P2 timing.	Respond within P2 timing.	Respond within P2 timing.
s) Service $05/$06 unsupported TID requested, stored data available	No response preferred, positive response is allowed.	No response preferred, positive response is allowed.	ECU can either not respond or send a negative response ($7F, $05/$06, $12).
t) Service $08 not supported	The ECU shall not respond.	The ECU shall not respond.	ECU can either not respond or send a negative response ($7F, $08, $11).
u) Service $08 supported TID requested, conditions correct	Respond within P2 timing.	Respond within P2 timing.	Respond within P2 timing.
v) Service $08 supported TID requested, conditions not correct	The ECU shall not respond or may respond with a manufacturer-specified value as DATA_A, which corresponds to the reason the test cannot be run.	The ECU shall not respond or may respond with a manufacturer-specified value as DATA_A, which corresponds to the reason the test cannot be run.	Negative response is required ($7F $08, $22) or may respond with a manufacturer-specified value as DATA_A which corresponds to the reason the test cannot be run.
w) Service $08 unsupported TID requested	No response preferred, positive response is allowed.	No response preferred, positive response is allowed.	ECU can either not respond or send a negative response ($7F, $08 $12).
x) Service $09 not supported	The ECU shall not respond.	The ECU shall not respond.	ECU can either not respond or send a negative response ($7F, $09, $11).
y) Service $09 supported INFOTYPE requested, data available (VIN, CVN, CALID)	Respond within P2 timing.	Respond within P2 timing.	Respond within P2 timing.
z) Service $09 supported INFOTYPE requested, data not available, conditions correct (CVN)	Respond within 1 m; do not restart CVN calculation. Test tool sends retry message every 0.055 to 4.0 seconds.	Respond within 1 m; do not restart CVN calculation. Test tool sends retry message after 30 seconds.	One or multiple negative response message(s) ($7F, $09, $78) required within P2max (25 - 50 ms) until positive response is sent.
aa) Service $09 supported INFOTYPE requested, data not available, conditions not correct (CVN), prior to 2005 MY only	The ECU shall not respond.	The ECU shall not respond.	Negative response is required ($7F, $09, $22).

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Condition	ISO 9141-2	SAE J1850	ISO 14230-4
bb) Service $09 unsupported INFOTYPE requested	No response preferred, positive response is allowed.	No response preferred, positive response is allowed.	ECU can either not respond or send a negative response ($7F, $09, $12).
cc) Service $00 or $0A through $0F	The ECU shall not respond.	The ECU shall not respond.	ECU can either not respond or send a negative response ($7F, $0X, $11).

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

4.3.2 ISO 15765-4: Diagnostics on CAN

There are four conditions for which data is not available:

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

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

Table B - Proper response from ECU for ISO 15765-4

Condition	ISO 15765-4
a) Service $01 not supported	All ECUs shall respond to Service $01 PID $00 if Service $01 is supported. All emissions-related OBD II compliant ECUs must respond to Service $01 PID $00. If Service $01 is not supported, no response is allowed.
b) Service $01 unsupported PID requested	The ECU shall not respond.
c) Service $01 supported PID requested	Respond within P2 timing (no negative response message with response code $78 allowed).
Service $01 supported PID requested during initialization	Positive response is required. — or — Negative response for max of five times.
d) Service $02 not supported	The ECU shall not respond.
e) Service $02 supported PID, frame xx requested, no freeze frame stored	1) The ECU shall respond to PID $02 frame xx within P2 timing; PID $02 frame xx must indicate $0000. 2) The ECU shall respond with supported PIDs for frame xx ($00, $20, …) within P2 timing. 3) If PIDs other than support PIDs or PID $02 are requested, the ECU shall not respond. 4) If a PID frame xx, with xx greater than 00, is requested and ECU only supports frame 00, the ECU shall not respond.
f) Service $02 unsupported PID, frame xx requested, no freeze frame stored	PID $02 frame xx indicates $0000, but if PIDs are requested, ECU shall not respond.
g) Service $02 supported PID, frame xx requested, freeze frame stored	1) The ECU shall respond to PID $02 frame xx within P2 timing. 2) The ECU shall respond with supported PIDs for frame xx ($00, $20 ...) within P2 timing and shall respond to PIDs frame xx indicated as supported within P2 timing.
h) Service $02 unsupported PID, frame xx requested, freeze frame stored	The ECU shall not respond.
i) Service $03/$07/$0A not supported	The ECU shall not respond.
j) Service $03/$07/$0A supported, no DTCs stored	Positive response indicating no DTCs is required.

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Condition	ISO 15765-4
k) Service $03/$07/$0A supported, DTCs stored	Positive response including the stored DTCs is required.
l) Service $04 not supported	The ECU shall not respond.
m) Service $04 supported, conditions not correct	Negative response is required ($7F, $04, $22).
n) Service $04 supported, conditions correct	Positive response message required. Multiple negative response messages (NRC $78) allowed within a maximum time of 5000 ms after request until positive response is required.
o) Service $06 not supported	The ECU shall not respond.
p) Service $06 supported TID requested, no stored data available	Positive response required, test values, min, and max limits must be set to $00.
q) Service $06 unsupported TID requested, no stored data available	The ECU shall not respond.
r) Service $06 supported TID requested, stored data available	Respond within P2 timing.
s) Service $06 unsupported TID requested, stored data available	The ECU shall not respond.
t) Service $08 not supported	The ECU shall not respond.
u) Service $08 supported TID requested, conditions correct	Respond within P2 timing.
v) Service $08 supported TID requested, conditions not correct	Negative response required ($7F, $08, $22).
w) Service $08 unsupported TID requested	The ECU shall not respond.
x) Service $09 not supported	The ECU shall not respond.
y) Service $09 supported INFOTYPE requested, data available (VIN, CVN, CALID)	Respond within P2 timing.
z) Service $09 supported INFOTYPE requested, data not available, conditions correct (CVN)	Initial negative response message ($7F, $09, $78) required within P2max (50 ms) and consecutive negative response message(s) ($7F, $09, $78) is (are) required within P2max (5.0 s) until positive response is sent. See Note A below.
aa) Service $09 supported INFOTYPE requested, data not available, conditions not correct (CVN), prior to 2005 MY only	Negative response required ($7F, $09, $22).
bb) Service $09 unsupported INFOTYPE requested	The ECU shall not respond.
cc) Service $00, $05 or $0B through $0F	The ECU shall not respond.

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

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

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

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

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

5. TEST VEHICLE WITH NO MALFUNCTIONS, NO DTCS SET

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

5.1 Perform MIL Bulb Check, Engine Off

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

Procedure:

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

5.1.2 Turn ignition on. Do not crank engine.

Evaluation Procedure:

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

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

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

Protocol determination procedure:

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

SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 15765-4 - 11-bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBD-Br test)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBD-Br test)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 1 - Request current powertrain diagnostic data request message for all protocols

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

Table 2 - ECU# x response: Request current powertrain diagnostic data response message

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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.

ISO 15765-4 500 kbps must be utilized for OBD-II for 2008 MY and beyond.

ISO 15765-4 250 or 500 kbps must be utilized for EOBD for 2014 MY and beyond.

ISO 15765-4 500 kbps must be utilized for China OBD.

India OBD <3.5T allows for all protocols tested during protocol determination.

India OBD >3.5T allows for all ISO 15765-4 protocols tested during protocol determination.

Brazil OBD (OBDBr-1/OBDBr-2/OBDBr-3) allows for all protocols tested during protocol determination.

Use of a protocol that is not specified above shall be flagged as a failure.

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

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

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

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Table 4 - Clear/reset emission-related diagnostic information response message

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

Evaluation criteria:

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

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

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

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

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

Procedure:

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

Table 5 - Request current powertrain diagnostic data request message for all protocols

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

Table 6 - ECU#1 response: Request current powertrain diagnostic data response message

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

Evaluation criteria:

Each OBD ECU that responds with Service $01, PID $01 must respond with messages as shown in the response table above, where DATA_A bits 0 through 6 must be 0 (number of DTCs must be 0 because of previously sent engine-off Service $04 request) and DATA_A bit 7 must be 0, indicating MIL off.

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

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

Procedure:

5.4.2 [For ISO 15765-4 protocol only] Transmit a Service $0A request message. Verify that a proper response is received with DTC count set to zero and no DTCs.

Table 7 - Request emission-related diagnostic trouble codes with permanent status

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

Table 8 - Request emission-related diagnostic trouble codes with permanent status response message for ISO 15765-4

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

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response is received. The #OFDTC (DTC count) must be $00 and the message shall contain no DTCs for all the responses.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message containing no DTCs and indicating no DTCs are stored by setting the parameter # of DTC to $00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported for OBD-II by all emission-related ECUs that also support Service $03 or Service $07 for the 2010 MY and beyond or this shall be flagged as a failure; however, if the vehicle is a 2010 to 2012 MY vehicle that does not support permanent codes or permanent codes for all emission-related ECUs, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

If an OBD-II vehicle fails but it is supposed to have permanent DTCs, prompt the user whether to continue testing or abort the test.

Permanent codes are not required for EOBD, India or Brazil OBD. If an EOBD, India, or Brazil OBD vehicle does not support permanent codes, do not log a failure. If an EOBD, India, or Brazil OBD vehicle does support permanent codes, they will be tested for correct behavior.

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5.5 Verify That All Service $06 - Request On-Board Monitoring Test Results, Engine Off

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

Procedure:

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

Table 9 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read supported OBDMIDs) for all protocols

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

Table 10 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs) for ISO 9141-2, SAE J1850, and ISO 14230-4 protocols

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

Table 11 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs) for ISO 15765-4 protocol

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
	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. If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested then this shall be flagged as a failure.

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

Table 12 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read supported OBDMIDs) for ISO 15765-4 protocol

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

Table 13 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
	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)				

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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, and $E1-$FF as determined in 5.5.1, send the corresponding Service $06 request message and note the response.

Table 14 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 15765-4 protocol

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

Table 15 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
	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 for OBD-II only.

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

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

Some manufacturers have engine-off monitors, e.g., O_2 sensors that run as soon as the ignition is on. These monitors may report test results on Service $06. If a Service $06 Test ID reports a test value and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

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

Table 16 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 9141-2, SAE J1850, and ISO 14230-4 protocols

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

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Table 17 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for non-continuously monitored systems response SID	M	46	SIDPR
#2	Test ID (report test results)	M	XX	TID
#3	Test Limit Type & Component ID	M	XX	TLTCID
	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, and component ID value (bit 7)				

Evaluation criteria:

The test value(s) must be greater than or equal to the minimum test limit(s) and less than or equal to the maximum test limit(s).

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

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

Evaluation criteria:

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

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

NOTE: Hybrid Electric Vehicles (HEVs/PHEVs) and stop-start vehicles have engine controls that can start and stop the engine without regard to ignition key position.

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

Procedure:

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

Table 18 - Request current powertrain diagnostic data request message for all protocols

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

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Table 19 - Request current powertrain diagnostic data response message (report supported PIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
	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:

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

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

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

Table 20 - Request current powertrain diagnostic data request message for ISO 15765-4 protocol

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

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Table 21 - Request current powertrain diagnostic data response message (report supported PIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
	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 22 - Request current powertrain diagnostic datarequest message for all protocols

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

Table 23 - Request current powertrain diagnostic data response message

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
	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, as determined in 5.6.1, must be supported.

For all the PIDs that are indicated as supported by each ECU, a response with valid data and with the PID length as noted must be received as shown in Table 24. Note: Scaling PID $4F may be utilized in some PID responses and must be referenced if so utilized.

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

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

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

Evaluation criteria:

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

Table 24 - Engine off service $01 PID validation

Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
01, DATA_A, bit 7	ALL - Fail	Bit 7 must be 0.	0 = MIL off.
01, DATA_A, bits 0-6	ALL - Fail	Bits 0-6 must be 0.	No DTCs.
01, DATA_B, bit 0	ALL - Fail if OBD-II, G - Fail if EOBD, IOBD, or OBDBr	Bit 0 must be 1 for at least one ECU.	All spark and compression ignition engines must support misfire monitoring.
01, DATA_B, bit 1	ALL - Fail	Bit 1 must be 1 for at least one ECU.	All spark and compression ignition engines must support fuel system monitoring.
01, DATA_B, bit 2	ALL - Fail	Bit 2 must be 1 for all ECUs.	An OBD ECU that supports Service $01 PID $01 must support comprehensive component monitoring.
01, DATA_B, bit 3		Bit 3 can be 0 or 1. For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements (Service $01, PID $01, DATA_B, bit 2 = 1), the status of Service $01, PID $01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine, 1 = compression ignition engine.
01, DATA_B, bit 4	G- Fail	Bit 4 must be 0 for spark ignition engines, compression ignition engines that support full range misfire, and ECUs, which do not support misfire monitoring, or must be 1 before the misfire evaluation is complete for compression ignition engines that utilize idle misfire monitor. Bit 4 must be 0 for any unsupported monitor in DATA_B bit 1.	Misfire monitoring shall always indicate complete for spark ignition engines or compression ignition engines that utilize full range misfire monitoring. For compression ignition engine that utilize the idle monitor through the 2019 MY, misfire monitoring shall indicate complete after the misfire evaluation is complete (1000 engine revs at idle, approx 60 seconds). Unsupported monitors must indicate “ready.”
01, DATA_B, bit 5		Bit 5 can be 0 or 1. Bit 5 must be 0 for any unsupported monitor in DATA_B bit 0.	Fuel system may indicate incomplete for spark ignition and compression ignition engines If non-continuous monitors are employed. Unsupported monitors must indicate “ready.”
01, DATA_B, bit 6	ALL - Fail	Bit 6 must be 0.	CCM must always be complete.
01, DATA_B, bit 7	ALL - Fail	Bit 7 must be 0.	Reserved bits must be 0.
01, DATA_C, bit 0	G - Fail	Bit 0 must be 1 for at least one ECU for spark ignition engines. Bit 0 may be 0 or 1 for compression ignition engines.	All spark ignition engines must support catalyst monitoring. Compression ignition engines may or may not support NMHC catalyst monitoring.

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Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
01, DATA_C, bit 2	ALL - Fail if not 1 for OBD-II/CNOBD only	Bit 2 must be 1 for at least one ECU for OBD-II/C NOBD spark ignition engines, 0 or 1 for EOBD/IOBD/OBDBr spark ignition engines, depending if they support an evap leak check. Bit 2 must be 0 for compression ignition engines (reserved).	All OBD-II/CNOBD spark ignition engines must support evap system monitoring. EOBD/IOBD/OBDBr must not support evap unless a leak check is present. Bit 2 is reserved for compression ignition engines. Note: This check will erroneously fail a dedicated CNG vehicle with no evap monitor.
01, DATA_C, bit 3	D - Fail for OBD-II only	Bit 3 may be 0 or 1 for spark ignition engines. Bit 3 must be 1 for at least one ECU for compression ignition engines.	Spark ignition engines may or may not support SAIR monitoring. Compression ignition engines must support boost pressure monitoring.
01, DATA_C, bit 4	ALL - Fail	Bit 4 must be 0.	Reserved bits must be 0.
01, DATA_C, bit 5	ALL - Fail if OBD-II, G - Fail if EOBD, IOBD, or OBDBr	Bit 5 must be 1 for at least one ECU.	All spark ignition engines must support O_2 sensor monitoring. Compression ignition engines must support exhaust gas sensor monitoring.
01, DATA_C, bit 6	ALL - Fail	Bit 6 must be 1 for at least one ECU.	All spark ignition engines must support O_2 sensor heater monitoring. Compression ignition engines must support PM filter monitoring.
01, DATA_C, bit 7	D - Fail for OBD-II only	Bit 7 may be 0 or 1 for spark ignition engines. Bit 7 must be 1 for at least one ECU for compression ignition engines.	Spark ignition engines may or may not support EGR/VVT monitoring. Compression ignition engines must at least support EGR monitoring.
01, DATA_D, bits 0-7	ALL -Fail	Bits 0-7 must all be 0 for any unsupported monitor indicated in DATA_C.	Unsupported monitors must indicate “ready.”
01, DATA_D, bits 2	D - Fail	Bit 2 must be 0 for compression ignition engines.	Reserved bits must be 0.
01, DATA_D, bits 4	ALL - Fail	Bit 4 must be 0 for all engines.	Reserved bits must be 0.
01, DATA_D, bits 0-7	All - Fail	Bits 0-7 must be 1 for any supported monitor indicated in DATA_C, except for bit 6 which may be 0 on some spark ignition vehicles.	No supported monitors complete. O_2 heater monitor (bit 6) may complete (0) on some spark ignition vehicles.
02		2 bytes long, value must be 0000.	No freeze frame available.
03	G - Fail	2 bytes long, value must be 0000.	FUELSYSA and B.
04	ALL - Fail	1 byte long, value must be 0%.	LOAD_PCT = 0 with the engine off and key on.
05	ALL - Fail unless $67 supported	1 byte long, value must be -20 to 120 °C. Either $05 or $67 must be supported.	ECT in normal range.
06	G - Warn, not required for OBDBr	1 byte value or 2 byte value, as determined in Figure 10.	Short fuel trim bank 1/3.
07	G - Warn, not required for OBDBr	1 byte value or 2 byte value, as determined in Figure 10.	Long fuel trim bank 1/3.
08	Not required for OBDBr	1 byte value or 2 byte value, as determined in Figure 10.	Short fuel trim bank 2/4.
09	Not required for OBDBr	1 byte value or 2 byte value, as determined in Figure 10.	Long fuel trim bank 2/4.
0A		1 byte long.	FRP.
0B	G - Warn unless $87, $10, or $66 supported	1 byte long. Either ($0B or $87) or ($10 or $66) must be supported.	MAP.
0C	ALL - Fail	2 bytes long, value must be 0.	rpm is 0 with engine off.
0D	ALL LD - Fail ALL MD, HD - warn	1 byte long, value must be 0.	VSS is 0 with engine off. MD,HD does not have to support vehicle speed.
0E	G - Fail	1 byte long.	SPARKADV.

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Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
0F	G - Warn unless $68 is supported	1 byte long, value must be -20 to 120 °C. Either $0F or $68 may be supported.	IAT in normal range.
10	G - Warn unless $66, $0B, or 87 supported	2 bytes long, value must be less than or equal to 5 g/s. Either ($0B or $87) or ($10 or $66) must be supported.	MAF ≤5 g/s with engine off.
11	G - Fail	1 byte long, value is 0 to 40% for spark ignition engines, value can be 0 to 100% for compression ignition engines.	TP in normal range.
12		1 byte long.	AIR_STAT.
13 or 1D, bits 0-7	G - Warn	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engines. (Note: Either $13 or $1D must be supported for spark ignition engine. Both PIDs shall not be supported on spark ignition or compression ignition engines. Neither PID is required to be supported for compression ignition engines.)	At least 2 O_2S needed for OBD-II for spark ignition engines, compression ignition engines may or may not use O_2 sensors. Both PIDs $13 and $1D cannot be supported at the same time for either spark or compression ignition engines.
14, 15, 16, 17, 18, 19, 1A, 1B		2 bytes long.	
1C	ALL - Fail	1 byte long, value must be 01, 03, 07, 09, 0B, 0D, 0F, 22 for LD OBD-II or 13, 14, 22 for HD OBD. Value must be 06, 07, 08, 09, 0C, 0D, 0E, 0F for LD EOBD or 17, 18, 19, 1A, 21 for HD EOBD. Value must be $20 for IOBD-II. Value must be $1C, $1D, $23, or $2A for OBDBr. Value must be $29 for CNOBD.	Must be California OBD-II or EOBD, LD, MD or HD, IOBD-II, CNOBD, or OBDBr Note: SAE defined values are: $01-$0F, $11-$15, $17-$1A, $1C-$2B.
1E		1 byte long.	
1F	ISO 15765-4 ALL - Fail	2 bytes long, value must be 0.	RUNTM is 0 with engine off.
21	ISO 15765-4 ALL - Fail unless $4D supported	2 bytes long, value must be 0.	MIL_DIST is 0 after Service $04.
22, 23		2 bytes long.	FRP.
24, 25, 26, 27, 28, 29, 2A, 2B		4 bytes long.	Check for usage of PID 4F.
2C	D - Fail unless $69 is supported for OBD-II, CNOBD, and HD OBD	1 byte long, value must be ≤10%.	EGR_PCT is ≤10% with engine off.
2D		1 byte long.	EGR_ERR.
2E	ISO 15765-4 G - Warn	1 byte long.	EVAP_PCT.
2F	ISO 15765-4 G, D - Warn	1 byte long, value must be 1 to 100%.	FLI.
30	ISO 15765-4 ALL - Fail	1 byte long, value must be 0.	WARM_UPS must be 0 after Service $04.
31	ISO 15765-4 ALL - Fail unless $4E supported	2 bytes long, value must be 0.	CLR_DIST is 0 after Service $04.
32		2 bytes long.	EVAP_VP.
33	ISO 15765-4 ALL - Fail	1 byte long, value must be 71 to 110 kPa.	BARO within normal range.
34, 35, 36, 37, 38, 39, 3A, 3B		4 bytes long.	Check for usage of PID 4F.
3C, 3D, 3E, 3F		2 bytes long.	

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Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
41	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	4 bytes long.	
41, DATA_B, bit 3	ISO 15765-4 ALL - Fail if OBD-II, Fail for EOBD/IOBD/OBDBr if supported (data must be correct if PID $41 is supported for EOBD/IOBD/OBDBr)	Bit 3 can be 0 or 1. For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements (Service $01, PID $01, DATA_B, bit 2 = 1), the status of Service $01, PID $01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine. 1 = compression ignition engine.
41, DATA_B, bits 0-2	ISO 15765-4 ALL - Fail if OBD, Warn if EOBD/IOBD/OBDBr	If Bit 0 or 1 or 2 = 1, corresponding bit in $01 DATA_B must = 1.	If monitor enabled, it must show supported in PID $01.
41, DATA_B, bits 4-6	ISO 15765-4 ALL - Fail if OBD, Warn if EOBD/IOBD/OBDBr	If Bit 4 = 1, then PID $01 DATA_B Bit 0 must be = 1; if Bit 5 = 1, then PID $01 DATA_B Bit 1 must be = 1; if Bit 6 = 1, then PID $01 DATA_B Bit 2 must be = 1.	If monitor not complete, it must show supported in PID $01.
41, DATA_C, bits 0-7	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	If Bit 0, 1, 2, 3, 4, 5, 6, or 7 = 1, corresponding bit in $01 DATA_C must = 1.	If monitor enabled, it must show supported in PID $01.
41, DATA_D, bits 0-7	ISO 15765-4 ALL - Fail if OBD-II, Fail for EOBD/IOBD/OBDBr if supported (data must be correct if PID $41 is supported for EOBD/IOBD/OBDBr)	Bits 0 to 5 and bit 7 must be 1 for any supported monitor indicated in PID $01 DATA_C for spark ignition; Bits 0 to 7 must be 1 for any supported monitor indicated in PID $01 DATA_C for compression ignition.	No supported monitors complete except O_2 heater monitor (bit 6) may complete (0) on some spark ignition vehicles.
41, DATA_D, bits 0-7	ISO 15765-4 ALL - Fail if OBD-II, Fail for EOBD/IOBD/OBDBr if supported (data must be correct if PID $41 is supported for EOBD/IOBD/OBDBr)	Bits 0 to 7 must be 0 for any unsupported monitor indicated in PID $01 DATA_C.	Unsupported monitors must indicate “ready.”
41, DATA_D, bits 0-7	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	If Bit 0, 1, 2, 3, 4, 5, 6 or 7 = 1, corresponding bit in $01 DATA_C must = 1.	If monitor not complete, it must show supported in PID $01.
42	ISO 15765-4 G, D - Fail	2 bytes long.	VPWR.
43	ISO 15765-4 G, D - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	2 bytes long, value must be 0%.	LOAD_ABS is 0% with engine off.
44	ISO 15765-4 G - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	2 bytes long.	EQ_RAT. Check for usage of PID 4F.
45	ISO 15765-4 G - Fail unless $6C is supported if OBD-II, Warn if EOBD/IOBD/OBDBr	1 byte long, value must be 0 to 50% for spark ignition engines, value can be 0 to 100% for compression ignition engines. Either $45 or $6C must be supported for spark ignition engines.	TP_R in normal range.

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Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
46	OBD-II or HD OBD - Warn unless $46 is supported	1 byte long, value must be -20 to 85 °C.	AAT in normal range.
47		1 byte long, value must be 0 to 60% for spark ignition engines, value can be 0 to 100% for compression ignition engines.	TP_B in normal range.
48		1 byte long, value must be 0 to 60% for spark ignition engines, value can be 0 to 100% for compression ignition engines.	TP_C in normal range.
49	ISO 15765-4 D - Fail	1 byte long, value must be 0 to 40%.	APP_D in normal range.
4A		1 byte long, value must be 0 to 40%.	APP_E in normal range.
4B		1 byte long, value must be 0 to 40%.	APP_F in normal range.
4C		1 byte long.	
4D	2010 MY and beyond ALL - Fail unless $21 supported	2 bytes long, value must be 0 m.	MIL_TIME is 0 minute (59 seconds or less) after Service $04.
4E	2010 MY and beyond ALL - Fail unless $31 supported	2 bytes long, value must be 0 m.	CLR_TIME is 0 minute (59 seconds or less) after Service $04.
4F		4 bytes.	These four values, if not $00, shall be used to calculate scaling factors for data reported with PIDs $24 to $2B, PIDs $34 to $3B, PID $44, and PID $0B.
50		4 bytes.	This value, if available, shall be used to calculate scaling factors for MAF sensor.
51	2015 MY and beyond Fail if OBD-II or HD OBD (not required for EOBD/IOBD/OBDBr)	1 byte, value must be $01 to $0E or $18 to $1C.	FUEL_TYPE in SAE assigned range.
52		1 byte.	ALCH_PCT.
53		2 bytes.	EVAP_VPA.
54		2 bytes.	EVAP_VP.
55		1 byte value or 2 byte value, as determined in Figure 10.	Short term secondary O_2 fuel trim bank 1/3.
56		1 byte value or 2 byte value, as determined in Figure 10.	Long term secondary O_2 fuel trim bank 1/3.
57		1 byte value or 2 byte value, as determined in Figure 10.	Short term secondary O_2 fuel trim bank 2/4.
58		1 byte value or 2 byte value, as determined in Figure 10.	Long term secondary O_2 fuel trim bank 2/4.
59		2 bytes long.	FRP.
5A		1 byte long, value must be 0 to 40%.	APP_R in normal range.
5B	2013 MY and beyond HEV and PHEV - Fail if OBD-II or HD OBD	1 byte.	BAT_PWR.
5C	2010 MY and beyond D - Warn if OBD-II or HD OBD	1 byte long, value must be -20 to 150 °C.	EOT.
5D	2010 MY and beyond D - Warn if OBD-II or HD OBD	2 bytes long.	FUEL_TIMING.
5E	2010 MY and beyond D - Warn if OBD-II or HD OBD	2 bytes long, value must be 0 when engine is not running.	FUEL_RATE.
5F		1 byte, value must be $0E to $10.	EMIS_SUP in SAE assigned range.

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Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
61	2010 MY and beyond D - Fail if OBD-II or HD OBD	1 byte.	TQ_DD.
62	2010 MY and beyond D - Fail if OBD-II or HD OBD 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	1 byte, value must be ≥0%.	TQ_ACT (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II.
63	2010 MY and beyond D - Fail if HD OBD 2019 MY and beyond D - Fail if MD OBD 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	2 bytes long, value must be ≥0.	TQ_REF(PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II.
64		5 bytes long.	TQ_MAX.
65	2010 MY and beyond D - Warn if OBD-II or HD OBD and PID $65 not supported D - Warn if OBD-II or HD OBD and bit 3 not supported	2 bytes, DATA_A, at least one device must be supported in bits 0-4, bits 5-7 must be 0. Diesel normally supports DATA_A bit 3 (glow plug lamp status). This check will erroneously warn a diesel with no glow plugs.	Auxiliary I/O, may support PTO or recommended gear, diesel normally supports wait to start lamp.
66	G - Warn unless $10, $0B, or $87 supported	5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0. If supported, MAFA and MAFB values must be less than or equal to 5 g/s. Either ($0B or $87) or ($10 or $66) must be supported.	Mass air flow sensor. MAFx ≤5 g/s with engine off.
67	ALL - Fail unless $05 is supported	3 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0. If supported, ECT 1 and ECT 2 values must be -20 to 120 °C. Either $05 or $67 must be supported.	Engine coolant temperature. ECT x in normal range.
68	G - Warn unless $0F is supported	7 bytes long, DATA_A, at least one sensor must be supported in bits 0-5, bits 6-7 must be 0. If supported, any IAT values must be -20 to 120 °C. Either $0F or $68 may be supported.	Intake air temperature sensor. IAT xy in normal range.
69	2010 MY and beyond D - Fail unless $2C is supported for OBD-II, CNOBD, or HD OBD	7 bytes long, DATA_A, at least one PID must be supported in bits 0-5, bits 6-7 must be 0. If supported, any EGR_x_CMD values must be ≤10%.	Commanded EGR and EGR error. EGR_x_CMD is ≤10% with engine off. If EGR_x_CMD = 0.0%, and EGR_x_ACT = 0.0%, EGR_x_ERR must be 0.0%. If EGR_x_CMD = 0.0%, and EGR_x_ACT > 0.0%, EGR_x_ERR must be 99.2%.
6A		5 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0.	Commanded diesel intake air flow. Control and relative intake air flow position.

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Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
6B		5 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0. If supported, any EGRT values must be -20 to 200 °C for either 1 °C or 4 °C scaling.	Exhaust gas recirculation temperature. EGRT xy in normal range.
6C	ISO 15765-4 G - Fail unless $45 is supported if OBD-II or HD OBD, Warn if EOBD/IOBD/OBDBr or HD EOBD	5 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0. If supported, any TP_x_REL values must be 0 to 50% for spark ignition engines. Either $45 or $6C must be supported for spark ignition engines.	Commanded throttle actuator control and relative throttle position. TP_x_REL in normal range.
6D		11 bytes long, DATA_A, at least one PID must be supported in bits 0-5, bits 6-7 must be 0. If supported, any FRT_x values must be -20 to 120 °C.	Fuel pressure control system. FRT_x in normal range.
6E		9 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0.	Injection pressure control system.
6F		3 bytes long, DATA_A, at least one sensor must be supported in bits 0-1 or for wide range sensors bits 2-3, bits 4-7 must be 0.	Turbocharger compressor inlet pressure or turbocharger compressor inlet pressure wide range.
70		10 bytes long, DATA_A, at least one PID must be supported in bits 0-5, bits 6-7 must be 0. DATA_J, bits 4-7 must be 0.	Boost pressure control.
71		6 bytes long, DATA_A, at least one PID must be supported in bits 0-5, bits 6-7 must be 0. DATA_F, bits 4-7 must be 0.	Variable geometry turbo (VGT) control.
72		5 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0.	Wastegate control.
73		5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0.	Exhaust pressure.
74		5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0.	Turbocharger rpm.
75		7 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0. If supported, any TCA_Cxxx values must be -20 to 120 °C, any TCA_Txxx values must be -20 to 1000 °C.	Turbocharger A temperature. TCA_Cxxx in normal range. TCA_Txxx in normal range.
76		7 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0. If supported, any TCB_Cxxx values must be -20 to 120 °C, any TCB_Txxx values must be -20 to 1000 °C.	Turbocharger B temperature. TCB_Cxxx in normal range. TCB_Txxx in normal range.
77		5 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0. If supported, any CACT xy values must be -20 to 120 °C.	Charge air cooler temperature (CACT) CACT xy in normal range.

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Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
78		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	Exhaust gas temperature (EGT) bank 1.
79		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	Exhaust gas temperature (EGT) bank 2.
7A		7 bytes long, DATA_A, at least one PID must be supported in bits 0-2, bits 3-7 must be 0.	Diesel particulate filter (DPF) bank 1.
7B		7 bytes long, DATA_A, at least one PID must be supported in bits 0-2, bits 3-7 must be 0.	Diesel particulate filter (DPF) bank 2.
7C		9 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0.	Diesel particulate filter (DPF) temperature.
7D	2010 MY and beyond D - Fail if MD, HD OBD	1 byte long, DATA_A, bits 4-7 must be 0.	NOx NTE control area status.
7E	2010 MY and beyond D - Fail if MD, HD OBD	1 byte long, DATA_A, bits 4-7 must be 0.	PM NTE control area status.
7F	2010 MY and beyond ALL - Fail if HD OBD D - Fail if MD OBD	13 bytes long, DATA_A, at least one PID must be supported in bits 0-2, bits 3-7 must be 0.	Engine run time.
81	2010 MY and beyond D - Fail if MD, HD OBD	41 bytes long, DATA_A, at least one PID must be supported in bits 0-4, bits 5-7 must be 0.	Engine run time for AECD #1-#5.
82		41 bytes long, DATA_A, at least one PID must be supported in bits 0-4, bits 5-7 must be 0.	Engine run time for AECD #6-#10.
83		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3. If any bits 4-7 are set to 1, then sensor data value must be $FFFF.	NOx sensor.
84		1 byte.	Manifold surface temperature.
85	2013 MY and beyond D - Fail if OBD-II or HD OBD Warn unless $9B is supported	10 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0. Either $85 or $9B may be supported. Note: This check will erroneously fail a compression ignition vehicle not equipped with a NOx Reagent System.	NOx control system including DEF level.
86		5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0.	Particulate matter (PM) sensor.
87	G - Warn unless $0B, $10, or $66 supported	5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0. Either ($0B or $87) or ($10 or $66) must be supported.	Intake manifold absolute pressure (MAP).
88	2013 MY and beyond D - Fail if MD, HD OBD	13 bytes.	SCR inducement system.
89		41 bytes long, DATA_A, at least one PID must be supported in bits 0-4, bits 5-7 must be 0.	Engine run time for AECD #11-#15.
8A		41 bytes long, DATA_A, at least one PID must be supported in bits 0-4, bits 5-7 must be 0.	Engine run time for AECD #16-#20.

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PID	**Required Support**	**Required Value**	**Comment**
8B	2013 MY and beyond D - Fail if OBD-II or HD OBD	7 bytes.	Diesel aftertreatment status.
8C		17 bytes.	Wide range O_2.
8D		1 byte.	TP_G.
8E	2010 MY and beyond D - Warn if HD OBD 2019 MY and beyond D - Fail if MD OBD-II 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	1 byte long.	Engine friction percent torque (PEMS) 30/60/100% phase-in starting in 2019 MY for OBD-II.
8F		7 bytes long, DATA_A, at least one sensor must be supported in bits 0-3. DATA_C and D (PM sensor normalized output) must be >-100%. DATA_F and G, if supported, must be >-100%.	PM sensor output. Check to see if PM data is using signed scaling as required.
90		3 bytes long.	WWH-OBD vehicle OBD system Info.
91		5 bytes long.	WWH-OBD ECU OBD system Info.
92		2 bytes long.	Fuel system control status (Compr Ign).
93		3 bytes long.	WWH-OBD vehicle OBD counters.
94		12 bytes long.	NOx inducement.
98		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	Exhaust gas temperature (EGT) bank 1.
99		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	Exhaust gas temperature (EGT) bank 2.
9A	2019 MY and beyond PHEV - Fail if OBD-II	6 bytes long, DATA_C, D (HV_BATT_V) must be > 0 V.	Hybrid/EV vehicle system data.
9B	Warn unless $85 is supported	4 bytes long, DATA_A, at least one sensor value must be supported in bits 0-3. Either $85 or $9B may be supported.	Diesel exhaust fluid sensor output.
9C		17 bytes long, DATA_A, at least one sensor must be supported in bits 0-7.	O_2 sensor (wide range).
9D	2016 MY and beyond D - Fail if HD OBD 2019 MY and beyond D - Fail if MD OBD 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	4 bytes long, DATA_A, B and DATA_C, D values must be 0 g/s when engine is not running.	Fuel Rate (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II.
9E	2016 MY and beyond D - Fail if HD OBD 2019 MY and beyond D - Fail if MD OBD 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	2 bytes long, DATA_A, B value must be 0 kg/h when engine is not running.	Engine exhaust flow rate (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II.
9F		9 bytes long, DATA_A, at least one bank must be supported in bits 0-7, i.e., bits 0 and 1, or bits 2 and 3, or bits 4 and 5, or bits 6 and 7. Any DATA_B-I values which are supported must be 0% when engine is not running.	Fuel system percentage use.

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Engine Off Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
A1		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3. If bits 4-7 are set to 1, then sensor data value must be $FFFF.	NOx sensor corrected.
A2	2016 MY and beyond D - Fail if HD OBD 2019 MY and beyond D - Fail if MD OBD, OBD-II	2 bytes, DATA_A, B value must be 0 mg/stroke when engine is not running.	Cylinder fuel rate.
A3		9 bytes long.	Evap vapor pressure. EVAP_A/B_VP.
A4		4 bytes long.	GEAR_ACT, GEAR_RAT.
A5	2019 MY and beyond D - Fail if OBD-II	4 bytes long.	Diesel exhaust fluid. DEF_CMD, DEF_UCDC.
A6	2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	4 bytes long, value must be >0 km.	Odometer. ODO (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II.

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

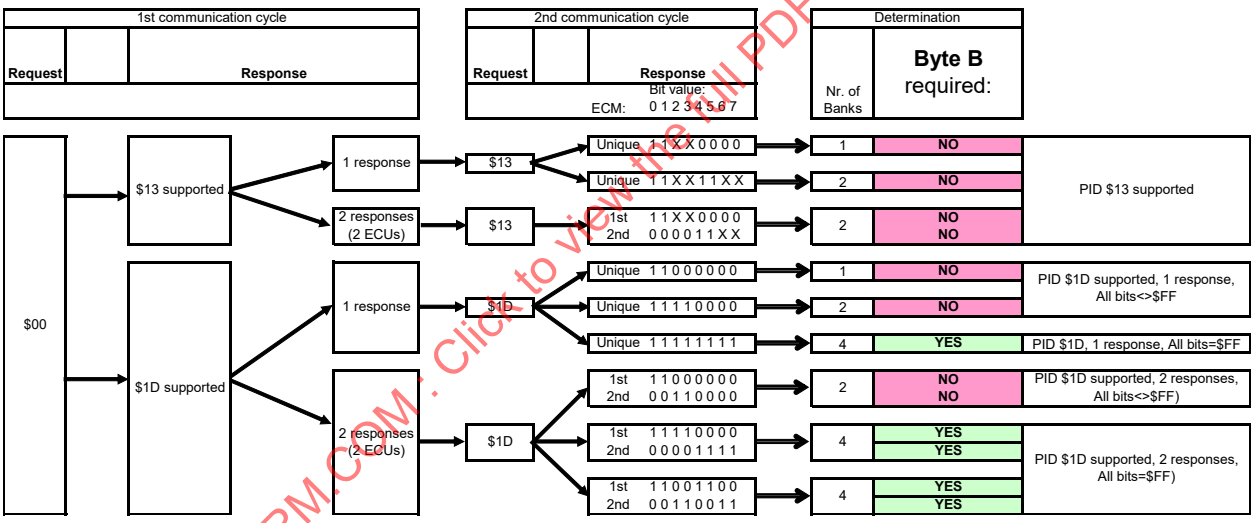

Figure 10 - Determination of usage of byte B in addition to byte A for Service $01 PIDs $06 to $09 and PIDs $55 to $58

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5.7 Verify Service $08 - Control of On-Board System, Test or Component, Engine Off

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

Procedure:

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

Table 25 - Request control of on-board device request message (read supported TIDs) for all protocols

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

Table 26 - Request control of on-board device response message (report supported TIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
	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 SAE J1850, ISO9141-2 and ISO 14230-4, DATA_A-E shall be filled with $00 if unused.

Evaluation criteria:

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

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

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

There is no legislative requirement to support Service $08. If not supported, it shall not be flagged as a warning for U.S. OBD/EOBD/IOBD/OBDBr/CNOBD vehicles. If an ECU indicates that a PID/TID/OBDMID/INFOTYPE Supported PID/TID/OBDMID/INFOTYPE is supported, but that ECU does NOT actually support the PID/TID/OBDMID/INFOTYPE when it is requested, then this shall be flagged as a failure.

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

Table 27 - Request control of on-board device request message (read supported TIDs) for ISO 15765-4 protocol

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

U = User Optional

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Table 28 - Request control of on-board device response message (report supported TIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
	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 SAE J1850, ISO 9141-2 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 [For all protocols] Request next unsupported TID support TID ($20, $40, $60, $80, $A0, $C0, $E0) for all ECUs to ensure that the ECU can respond properly to an unsupported TID and does not terminate communication (single request).

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

Evaluation criteria:

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

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

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

Protocol determination procedure:

5.8.1 Move ignition to crank position and start engine or propulsion system active for Hybrid/PHEV. 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.

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

SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 11 bit 500 kbps
ISO 15765-4 - 11 bit 250 kbps (only if EOBD/IOBD/OBDBr test)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 29 - Request current powertrain diagnostic data request message for all protocols

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

Table 30 - ECU#x response: Request current powertrain diagnostic data response message

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (All PID values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID requested	00	PID
#3	Data byte A, representing support for PIDs 01	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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

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5.9 Clear DTCs (Service $04), Engine Running

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

Procedure:

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

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

Table 31 - Clear/reset emission-related diagnostic information request message for all protocols

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

Table 32 - Clear/reset emission-related diagnostic information response message

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

Table 33 - Clear/reset emission-related diagnostic information response message

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

Evaluation criteria:

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

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

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

For all protocols, determine which OBD ECUs have I/M readiness flags in them using Service $01 PID $01 (excluding comprehensive components). If any OBD ECUs accept the Service $04 request, all OBD ECUs with I/M readiness must accept the Service $04 request. Any OBD ECUs that don't support I/M readiness may reject a Service $04 request and respond with a negative response of $22 (Conditions not Correct).

If any OBD ECU containing I/M readiness rejects the Service $04 request, all OBD ECUs must reject the Service $04 request regardless if they support I/M readiness or not.

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

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

Procedure:

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

Table 34 - Request current powertrain diagnostic data request message for all protocols

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

Table 35 - Request current powertrain diagnostic data response message (report supported PIDs)

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
	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:

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

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

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

Table 36 - Request current powertrain diagnostic data request message for ISO 15765-4 protocol

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

Table 37 - Request current powertrain diagnostic data response message (report supported PIDs)

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
	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, as determined in 5.10.1, send the corresponding Service $01 PID request message and note the response.

Table 38 - Request current powertrain diagnostic data request message for all protocols

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

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Table 39 - Request current powertrain diagnostic data response message

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
	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 40. Note: Scaling PID $4F may be utilized in some PID responses and must be referenced if so utilized.

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

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

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

Evaluation criteria:

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

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Table 40 - Engine idle service $01 PID validation

Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
01, DATA_A, bit 7	ALL - Fail	Bit 7 must be 0.	0 is MIL off.
01, DATA_A, bits 0-6	ALL - Fail	Bits 0-6 must all be 0.	No DTCs.
01, DATA_B, bit 0	ALL - Fail if OBD-II, G - Fail if EOBD/IOBD/OBDBr	Bit 0 must be 1 for at least one ECU.	All spark and compression ignition engines must support misfire monitoring.
01, DATA_B, bit 1	ALL - Fail	Bit 1 must be 1 for at least one ECU.	All spark and compression ignition engines must support fuel system monitoring.
01, DATA_B, bit 2	ALL - Fail	Bit 2 must be 1 for all ECUs.	An OBD ECU that supports Service $01 PID $01 must support comprehensive component monitoring.
01, DATA_B, bit 3		Bit 3 can be 0 or 1. For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements (Service $01, PID $01, DATA_B, bit 2 = 1), the status of Service $01, PID $01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine. 1 = compression ignition engine.
01, DATA_B, bit 4	G -Fail	Bit 4 must be 0 for spark ignition engines, compression ignition engines that support full range misfire, and ECUs, which do not support misfire monitoring, or must be 1 before the misfire evaluation is complete for compression ignition engines that utilize idle misfire monitor. Bit 4 must be 0 for any unsupported monitor in DATA_B bit 1.	Misfire monitoring shall always indicate complete for spark ignition engines or compression ignition engines that utilize full range misfire monitoring. For compression ignition engine that utilize the idle monitor through the 2019 MY, misfire monitoring shall indicate complete after the misfire evaluation is complete (1000 engine revs at idle, approx 60 seconds). Unsupported monitors must indicate “ready.”
01, DATA_B, bit 5		Bit 5 can be 0 or 1. Bit 5 must be 0 for any unsupported monitor in DATA_B bit 0.	Fuel system may indicate incomplete for spark ignition and compression ignition engines if non-continuous monitors are employed. Unsupported monitors must indicate “ready.”
01, DATA_B, bit 6	ALL - Fail	Bit 6 must be 0.	CCM must always be complete.
01, DATA_B, bit 7	ALL -Fail	Bit 7 must be 0.	Reserved bits must be 0.
01, DATA_C, bit 0	G - Fail	Bit 0 must be 1 for at least one ECU for spark ignition engines. Bit 0 may be 0 or 1 for compression ignition engines.	All spark ignition engines must support catalyst monitoring. Compression ignition engines may or may not support NMHC catalyst monitoring.
01, DATA_C, bit 2	ALL - Fail if not 1 for OBD-II/CNOBD only	Bit 2 must be 1 for at least one ECU for OBD-II/CNOBD spark ignition engines, 0 or 1 for EOBD/IOBD/OBDBr spark ignition engines, depending if they support an evap leak check. Bit 2 must be 0 for compression ignition engines (reserved).	All OBD-II/CNOBD spark ignition engines must support evap system monitoring. EOBD/IOBD/OBDBr must not support evap unless a leak check is present. Bit 2 is reserved for compression ignition engines. Note: This check will erroneously fail a dedicated CNG vehicle with no evap monitor.
01, DATA_C, bit 3	D - Fail for OBD-II only	Bit 3 may be 0 or 1 for spark ignition engines. Bit 3 must be 1 for at least one ECU for compression ignition engines.	Spark ignition engines may or may not support SAIR monitoring. Compression ignition engines must support boost pressure monitoring.
01, DATA_C, bit 4	ALL - Fail	Bit 4 must be 0.	Reserved bits must be 0.

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
01, DATA_C, bit 5	ALL - Fail if OBD-II, G - Fail if EOBD/IOBD/OBDBr	Bit 5 must be 1 for at least one ECU.	All spark ignition engines must support O_2 sensor monitoring. Compression ignition engines must support exhaust gas sensor monitoring.
01, DATA_C, bit 6	ALL - Fail	Bit 6 must be 1 for at least one ECU.	All spark ignition engines must support O_2 sensor heater monitoring. Compression ignition engines must support PM filter monitoring.
01, DATA_C, bit 7	D - Fail for OBD-II only	Bit 7 may be 0 or 1 for spark ignition engines. Bit 7 must be 1 for at least one ECU for compression ignition engines.	Spark ignition engines may or may not support EGR/VVT monitoring. Compression ignition engines must at least support EGR monitoring.
01, DATA_D, bits 2	D - Fail	Bit 2 must be 0 for compression ignition engines.	Reserved bits must be 0.
01, DATA_D, bits 4	ALL - Fail	Bit 4 must be 0 for all engines.	Reserved bits must be 0.
01, DATA_D, bits 0-7	ALL -Fail	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	G - Fail	2 bytes long.	FUELSYSA and B.
04	ALL - Fail	1 byte long, value must be >0% and ≤60%. For HEV, PHEV, S/S, must be 0 to 100%.	LOAD_PCT less than or equal to 60% at idle. S/S engine may be off, HEV, PHEV may be off or at full load.
05	ALL - Fail unless $67 supported	1 byte long, value must be -20 to 120 °C. Either $05 or $67 must be supported.	ECT in reasonable range.
06	G - Warn, not required for OBDBr	1 byte value or 2 byte value, as determined in Figure 10.	Short fuel trim bank 1/3.
07	G - Warn, not required for OBDBr	1 byte value or 2 byte value, as determined in Figure 10.	Long fuel trim bank 1/3.
08	Not required for OBDBr	1 byte value or 2 byte value, as determined in Figure 10.	Short fuel trim bank 2/4.
09	Not required for OBDBr	1 byte value or 2 byte value, as determined in Figure 10.	Long fuel trim bank 2/4.
0A		1 byte long, value must be greater than 0 kPa, may be = 0 for HEV, PHEV, S/S.	FRP not zero, HEV, PHEVhybrid, S/S engine may be off.
0B	G - Warn unless $87, $10 or $66 supported	1 byte long, value must be greater than 0 kPa. Either ($0B or $87) or ($10 or $66) must be supported, may be = 0 for HEV, PHEV, S/S.	MAP not zero, HEV, PHEV, S/S engine may be off.
0C	ALL - Fail	2 bytes long, value must be between 300 rpm and 2000 rpm. HEV, PHEV, S/S value may be 1 to 299 and set as a warning.	rpm between 300 and 2000 at idle, HEV, PHEV, S/S engine may be off.
0D	ALL LD - Fail ALL MD, HD - warn	1 byte long, value must be 0.	VSS is 0 at engine idle. HD does not have to support vehicle speed.
0E	G - Fail	1 byte long.	SPARKADV.
0F	G - Warn unless $68 is supported	1 byte long, value must be -20 to 120 °C. Either $0F or $68 may be supported.	IAT in normal range.
10	G - Warn unless $66, $0B or $87 supported	2 bytes long, value must be greater than 0 g/s. Either ($0B or $87) or ($10 or $66) must be supported, may be = 0 for HEV, PHEV, S/S.	MAF not zero, HEV, PHEV, S/S engine may be off.
11	G - Fail	1 byte long, value must be 0 to 40% for spark ignition engines, value can be 0 to 100% for compression ignition engines.	TP in normal range.
12		1 byte long.	AIR_STAT.

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
13 or 1D, bits 0-7	G - Warn	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engines. (Note: Either $13 or $1D must be supported for spark ignition engine. Both PIDs shall not be supported on spark ignition or compression engines. Neither PID is required to be supported for compression ignition engines.)	At least 2 O2S needed for OBD-II for spark ignition engines, compression ignition engines may or may not use any O_2 sensors. Both PIDs $13 and $1D cannot be supported at the same time for either spark or compression ignition engines.
14, 15, 16, 17, 18, 19, 1A, 1B		2 bytes long.	
1C	ALL - Fail	1 byte long, value must be 01, 03, 07, 09, 0B, 0D, 0F, 22 for LD OBD-II or 13, 14, 22 for HD OBD. Value must be 06, 07, 08, 09, 0C, 0D, 0E, 0F for LD EOBD or 17, 18, 19, 1A, 21 for HD EOBD. Value must be $20 for IOBD-II Value must be $1C, $1D, $23, or $2A for OBDBr. Value must be $29 for CNOBD.	Must be California OBD-II or EOBD, CNOBDor IOBD-II Note: SAE defined values are: $01-$0F, $11-$15, $17-$1A, $1C-$2B.
1D, 1E		1 byte long.	
1F	ISO 15765-4 ALL - Fail	2 bytes long, value must be greater than 0, may be = 0 for HEV, PHEV, S/S.	RUNTM not zero, HEV, PHEV, S/S engine may be off.
21	ISO 15765-4 ALL - Fail unless $4D supported	2 bytes long, value must be 0.	MIL_DIST = 0 after Service $04.
22		2 bytes long, value must be greater than 0 kPa, may be = 0 for HEV, PHEV, S/S.	FRP not zero, HEV, PHEV, S/S engine may be off.
23		2 bytes long, value must be greater than 0 kPa, may be = 0 for HEV, PHEV, S/S.	FRP not zero, HEV, PHEV, S/S engine may be off.
24, 25, 26, 27, 28, 29, 2A, 2B		4 bytes long.	Check for usage of PID 4F.
2C	D - Fail unless $69 is supported for OBD-II, CNOBD, and HD OBD	1 byte long, value must be ≤10% for spark ignition engines, ≤50% for spark ignition hybrid engines, ≤100% for compression ignition engines.	EGR_PCT is ≤10% at idle for spark ignition engine, EGR rates may be much higher for compression ignition engines, spark ignition HEV and PHEV engines.
2D		1 byte long.	EGR_ERR.
2E	ISO 15765-4 G - Warn	1 byte long.	EVAP_PCT.
2F	ISO 15765-4 G - Warn	1 byte long, value must be 1 to 100%.	FLI.
30	ISO 15765-4 ALL - Fail	1 byte long, value must be 0 or 1 shortly after Service $04.	WARM_UPS is 0 or 1 after Service $04.
31	ISO 15765-4 ALL - Fail unless $4E supported	2 bytes long, value must be 0.	CLR_DIST is 0 after Service $04.
32		2 bytes long.	EVAP_VP.
33	ISO 15765-4 ALL - Fail	1 byte long, value must be 71 to 110 kPa.	BARO within normal range.
34, 35, 36, 37, 38, 39, 3A, 3B		4 bytes long.	Check for usage of PID 4F.
3C, 3D, 3E, 3F		2 bytes long.	
41	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	4 bytes long.	

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
41, DATA_B, bit 3	ISO 15765-4 ALL - Fail if OBD-II, Fail for EOBD/IOBD/OBDBr if supported (data must be correct if PID $41 is supported for EOBD/IOBD/OBDBr)	Bit 3 can be 0 or 1. For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements (Service $01, PID $01, DATA_B, bit 2 = 1), the status of Service $01, PID $01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine. 1 = compression ignition engine.
41, DATA_B, bits 0-2	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	If Bit 0 or 1 or 2 = 1, corresponding bit in $01 DATA_B must = 1.	If monitor enabled, it must show supported in PID $01.
41, DATA_B, bits 4-6	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	If Bit 4 = 1, then PID $01 DATA_B Bit 0 must be = 1; if Bit 5 = 1, then PID $01 DATA_B Bit 1 must be = 1; if Bit 6 = 1, then PID $01 DATA_B Bit 2 must be = 1.	If monitor not complete, it must show supported in PID $01.
41, DATA_C, bits 0-7	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	If Bit 0, 1, 2, 3, 4, 5, 6, or 7 = 1, corresponding bit in $01 DATA_D must = 1.	If monitor enabled, it must show supported in PID $01.
41, DATA_D, bits 0-7	ISO 15765-4 ALL - Fail if OBD-II, Fail for EOBD/IOBD/OBDBr if supported (data must be correct if PID $41 is supported for EOBD/IOBD/OBDBr)	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	ISO 15765-4 ALL - Fail if OBD-II, Fail for EOBD/IOBD/OBDBr if supported.(data must be correct if PID $41 is supported for EOBD/IOBD/OBDBr)	Bits 0-7 must all be 0 for any unsupported monitor indicated in PID $01 DATA_C.	Unsupported monitors must indicate “ready.”
41, DATA_D, bits 0-7	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	If Bit 0, 1, 2, 3, 4, 5, 6, or 7 = 1, corresponding bit in $01 DATA_D must = 1.	If monitor not complete, it must show supported in PID $01.
42	ISO 15765-4 G, D - Fail	2 bytes long.	VPWR.
43	ISO 15765-4 G, D - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	2 bytes long, value must be >0%. For HEV, PHEV S/S, must be 0 to 100%.	LOAD_ABS >0% at idle. S/S engine may be off, HEV, PHEV may be off or at full load (0 to 100%).
44	ISO 15765-4 G - Fail if OBD-II, Warn if EOBD/IOBD/OBDBr	2 bytes long.	EQ_RAT. Check for usage of PID 4F.
45	ISO 15765-4 G - Fail unless $6C is supported if OBD-II, Warn if EOBD/IOBD/OBDBr	1 byte long, value must be 0 to 50% for spark ignition engines, value can be 0 to 100% for compression ignition engines and for HEV, PHEV, S/S. Either $45 or $6C must be supported for spark ignition engines.	TP_R in normal range.
46	OBD-II or HD OBD - Warn unless $46 is supported	1 byte long, value must be -20 to 85 °C.	AAT in normal range.

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
47		1 byte long, value must be 0 to 60% for spark ignition engines, value can be 0 to 100% for compression ignition engines and for HEV, PHEV, S/S.	TP_B in normal range.
48		1 byte long, value must be 0 to 60% for spark ignition engines, value can be 0 to 100% for compression ignition engines and for HEV, PHEV, S/S.	TP_C in normal range.
49	ISO 15765-4 D - Fail	1 byte long, value must be 0 to 40%.	APP_D in normal range.
4A		1 byte long, value must be 0 to 40%.	APP_E in normal range.
4B		1 byte long, value must be 0 to 40%.	APP_F in normal range.
4C		1 byte long.	
4D	2010 MY and beyond ALL - Fail unless $21 supported	2 bytes long, value must be 0 m.	MIL_TIME is 0 minute (59 seconds or less) after Service $04.
4E	2010 MY and beyond ALL - Fail unless $31 supported	2 bytes long, value must be 0 m.	CLR_TIME is 0 minute (59 seconds or less) after Service $04.
4F		4 bytes.	These four values, if not $00, shall be used to calculate scaling factors for data reported with PIDs $24 to $2B, PIDs $34 to $3B, PID $44, and PID $0B.
50		4 bytes.	This value, if available, shall be used to calculate scaling factors for MAF sensor.
51	2015 MY and beyond Fail if OBD-II or HD OBD (not required for EOBD/IOBD/OBDBr)	1 byte, value must be $01 to $0E or $18 to $1C.	FUEL_TYPE in SAE assigned range.
52		1 byte.	ALCH_PCT.
53		2 bytes.	EVAP_VPA.
54		2 bytes.	EVAP_VP.
55		1 byte value or 2 byte value, as determined in Figure 10.	Short term secondary O_2 fuel trim bank 1/3.
56		1 byte value or 2 byte value, as determined in Figure 10.	Long term secondary O_2 fuel trim bank 1/3.
57		1 byte value or 2 byte value, as determined in Figure 10.	Short term secondary O_2 fuel trim bank 2/4.
58		1 byte value or 2 byte value, as determined in Figure 10.	Long term secondary O_2 fuel trim bank 2/4.
59		2 bytes long, value must be greater than 0 kPa, may be = 0 for HEV, PHEV, S/S.	FRP not zero, HEV, PHEV, S/S engine may be off.
5A		1 byte long, value must be 0 to 40%.	APP_R in normal range.
5B	2013 MY and beyond HEV and PHEV - Fail if OBD-II or HD OBD	1 byte, value must be greater than 0%.	BAT_PWR.
5C	2010 MY and beyond D - Warn if OBD-II or HD OBD	1 byte long, value must be -20 to 150 °C.	EOT.
5D	2010 MY and beyond D - Warn if OBD-II or HD OBD	2 bytes long.	FUEL_TIMING.

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
5E	2010 MY and beyond D - Warn if OBD-II or HD OBD	2 bytes long, value must be greater than 0 L/h, may be = 0 for HEV, PHEV, S/S.	FUEL_RATE not zero, HEV, PHEV, S/S engine may be off.
5F		1 byte, value must be $0E to $10.	EMIS_SUP in SAE assigned range.
61	2010 MY and beyond D - Fail if OBD-II or HD OBD	1 byte.	TQ_DD.
62	2010 MY and beyond D - Fail if OBD-II or HD OBD 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	1 byte, value must be greater than zero percent, may be = 0 for HEV, PHEV, S/S.	TQ_ACT (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II. TQ_ACT not zero, HEV, PHEV, S/S engine may be off.
63	2010 MY and beyond D - Fail if HD OBD 2019 MY and beyond D - Fail if MD OBD 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	2 bytes long, value must be greater than zero Nm, may be = 0 for HEV, PHEV, S/S.	TQ_REF(PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II. TQ_REF not zero, HEV, PHEV, S/S engine may be off.
64		5 bytes long, all values must greater than 0%, may be = 0 for HEV, PHEV, S/S.	TQ_MAX not zero, HEV, PHEV, S/S engine may be off.
65	2010 MY and beyond D - Warn if OBD-II or HD OBD D - Warn if OBD-II or HD OBD and bit 3 not supported	2 bytes, DATA_A, at least one device must be supported in bits 0-4, bits 5-7 must be 0. Diesel normally supports DATA_A bit 3 (glow plug lamp status) This check will erroneously warn a diesel with no glow plugs.	Auxiliary I/O, may support PTO or recommended gear, diesel normally supports wait to start lamp.
66	G - Warn unless $10, $0B, or $87 supported	5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0. If supported, MAFA and MAFB values must be greater than 0 g/s, may be = 0 for HEV, PHEV, S/S. Either ($0B or $87) or ($10 or $66) must be supported.	Mass air flow sensor MAFx not zero, hyHEV, PHEVbrid, S/S engine may be off.
67	ALL - Fail unless $05 is supported	3 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0. If supported, ECT 1 and ECT 2 values must be -20 to 120 °C. Either $05 or $67 must be supported.	Engine coolant temperature ECT x in reasonable range.
68	G - Warn unless $0F is supported	7 bytes long, DATA_A, at least one sensor must be supported in bits 0-5, bits 6-7 must be 0. If supported, any IAT values must be -20 to 120 °C. Either $0F or $68 may be supported.	Intake air temperature sensor IAT xy in normal range.

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
69	2010 MY and beyond D - Fail unless $2C is supported for OBD-II, CNOBD, or HD OBD	7 bytes long, DATA_A, at least one PID must be supported in bits 0-5, bits 6-7 must be 0. If supported, any EGR_x_CMD values must be ≤10% for spark ignition engines, ≤50% for spark ignition hybrid engines, ≤100% for compression ignition engines.	Commanded EGR and EGR Error. EGR_x_CMD is ≤10% at idle for spark ignition engines. EGR rates may be much higher for compression ignition, spark ignition HEV and PHEV engines. If EGR_x_CMD = 0.0%, and EGR_x_ACT = 0.0%, EGR_x_ERR must be 0.0%. If EGR_x_CMD = 0.0%, and EGR_x_ACT > 0.0%, EGR_x_ERR must be 99.2%
6A		5 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0.	Commanded diesel intake air flow control and relative intake air flow position.
6B		5 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0. If supported, any EGRT values must be -20 to 215 °C for 1 °C scaling or -20 to 500 °C for 4 °C scaling.	Exhaust gas recirculation temperature. EGRT xy in normal range.
6C	ISO 15765-4 G - Fail unless $45 is supported if OBD-II or HD OBD, Warn if EOBD/IOBD/OBDBr or HD EOBD	5 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0. If supported, any TP_x_REL values must be 0 to 50% for spark ignition engines, value can be 0 to 100% for compression ignition engines and for HEV, PHEV, S/S. Either $45 or $6C must be supported for spark ignition engines.	Commanded throttle actuator control and relative throttle position. TP_x_REL in normal range.
6D		11 bytes long, DATA_A, at least one PID must be supported in bits 0-5, bits 6-7 must be 0. If supported, any FRT_x values must be -20 to 120 °C.	Fuel pressure control system. FRT_x in reasonable range.
6E		9 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0.	Injection pressure control system.
6F		3 bytes long, DATA_A, at least one sensor must be supported in bits 0-1 or for wide range sensors bits 2-3, bits 4-7 must be 0.	Turbocharger compressor inlet pressure or turbocharger compressor inlet pressure wide range.
70		10 bytes long, DATA_A, at least one PID must be supported in bits 0-5, bits 6-7 must be 0. DATA_J, bits 4-7 must be 0.	Boost pressure control.
71		6 bytes long, DATA_A, at least one PID must be supported in bits 0-5, bits 6-7 must be 0. DATA_F, bits 4-7 must be 0.	Variable geometry turbo (VGT) control.
72		5 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0.	Wastegate control.
73		5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0.	Exhaust pressure.
74		5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0.	Turbocharger rpm.

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
75		7 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0. If supported, any TCA_Cxxx values must be -20 to 120 °C, any TCA_Txxx values must be -20 to 1000 °C.	Turbocharger A temperature. TCA_Cxxx in normal range. TCA_Txxx in normal range.
76		7 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0. If supported, any TCB_Cxxx values must be -20 to 120 °C, any TCB_Txxx values must be -20 to 1000 °C.	Turbocharger B temperature. TCB_Cxxx in normal range. TCB_Txxx in normal range.
77		5 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0. If supported, any CACT xy values must be -20 to 120 °C.	Charge air cooler temperature (CACT) CACT xy in normal range.
78		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	Exhaust gas temperature (EGT) bank 1.
79		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	Exhaust gas temperature (EGT) bank 2.
7A		7 bytes long, DATA_A, at least one PID must be supported in bits 0-2, bits 3-7 must be 0.	Diesel particulate filter (DPF) bank 1.
7B		7 bytes long, DATA_A, at least one PID must be supported in bits 0-2, bits 3-7 must be 0.	Diesel particulate filter (DPF) bank 2.
7C		9 bytes long, DATA_A, at least one PID must be supported in bits 0-3, bits 4-7 must be 0.	Diesel Particulate Filter (DPF) Temperature.
7D	2010 MY and beyond D - Fail if MD, HD OBD	1 byte long, DATA_A, bits 4-7 must be 0.	NOx NTE control area status.
7E	2010 MY and beyond D - Fail if MD, HD OBD	1 byte long, DATA_A, bits 4-7 must be 0.	PM NTE control area status.
7F	2010 MY and beyond ALL - Fail if HD OBD D - Fail if MD OBD	13 bytes long, DATA_A, at least one PID must be supported in bits 0-2, bits 3-7 must be 0.	Engine run time.
81	2010 MY and beyond D - Fail if MD, HD OBD	41 bytes long, DATA_A, at least one PID must be supported in bits 0-4, bits 5-7 must be 0.	Engine run time for AECD #1-#5.
82		41 bytes long, DATA_A, at least one PID must be supported in bits 0-4, bits 5-7 must be 0.	Engine run time for AECD #6-#10.
83		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3. If any bits 4-7 are set to 1, then sensor data value must be $FFFF.	NOx sensor.
84		1 byte.	Manifold surface temperature.

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
85	2013 MY and beyond D - Fail if OBD-II or HD OBD unless $9B is supported	10 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0. Either $85 or $9B may be supported. Note: This check will erroneously fail a compression ignition vehicle not equipped with a NOx Reagent System.	NOx control system including DEF level.
86		5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0.	Particulate matter (PM) sensor.
87	G - Warn unless $0B, $10, or $66 supported	5 bytes long, DATA_A, at least one sensor must be supported in bits 0-1, bits 2-7 must be 0. If supported, values must be greater than 0 kPa, may be = 0 for HEV, PHEV, S/S. Either ($0B or $87) or ($10 or $66) must be supported.	Intake manifold absolute pressure (MAP) not zero, HEV, PHEV, S/S engine may be off.
88	2013 MY and beyond D - Fail if MD, HD OBD	13 bytes.	SCR inducement system.
89		41 bytes long, DATA_A, at least one PID must be supported in bits 0-4, bits 5-7 must be 0.	Engine run time for AECD #11-#15.
8A		41 bytes long, DATA_A, at least one PID must be supported in bits 0-4, bits 5-7 must be 0.	Engine run time for AECD #16-#20.
8B	2013 MY and beyond D - Fail if OBD-II or HD OBD	7 bytes.	Diesel aftertreatment status.
8C		17 bytes.	Wide range O_2.
8D		1 byte.	TP_G.
8E	2010 MY and beyond D - Warn if HD OBD 2019 MY and beyond D - Fail if MD OBD-II. 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	1 byte long.	Engine friction percent torque (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II.
8F		7 bytes long, DATA_A, at least one sensor must be supported in bits 0-3. DATA_C and D (PM sensor normalized output) must be >-100%. DATA_F and G, if supported, must be >-100%.	PM sensor output. Check to see if PM data is using signed scaling as required.
90		3 bytes long.	WWH-OBD vehicle OBD system info.
91		5 bytes long.	WWH-OBD ECU OBD system info.
92		2 bytes long.	Fuel system control status (Compr Ign).
93		3 bytes long.	WWH-OBD vehicle OBD counters.
94		12 bytes long.	NOx inducement.
98		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	Exhaust gas temperature (EGT) bank 1.
99		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	Exhaust gas temperature (EGT) bank 2.
9A	2019 MY and beyond PHEV - Fail if OBD-II	6 bytes long, DATA_C, D (HV_BATT_V) must be >0 V	Hybrid/EV vehicle system data.

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Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
9B	Warn unless $85 is supported	4 bytes long, DATA_A, at least one sensor value must be supported in bits 0-3. Either $85 or $9B may be supported.	Diesel exhaust fluid sensor output.
9C		17 bytes long, DATA_A, at least one sensor must be supported in bits 0-7.	O_2 sensor (wide range).
9D	2016 MY and beyond D - Fail if HD OBD 2019 MY and beyond D - Fail if MD OBD 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond	4 bytes long, DATA_A, B and DATA_C, D values must be >0 g/s when engine is running or = 0 g/s when engine is not running.	Fuel rate (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II. Note: S/S engine may be off; HEV/PHEV engine may be off.
9E	2016 MY and beyond D - Fail if HD OBD 2019 MY and beyond D - Fail if MD OBD 2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	2 bytes long, DATA_A, B value must be >0 kg/h when engine is running or = 0 kg/h when engine is not running.	Engine exhaust flow rate (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II. Note: S/S engine may be off; HEV/PHEV engine may be off.
9F		9 bytes long, DATA_A, at least one bank must be supported in bits 0-7, i.e., bits 0 and 1, or bits 2 and 3, or bits 4 and 5, or bits 6 and 7. At least one DATA_B-I value which is supported must be >0% when engine is running	Fuel system percentage use. Note: S/S engine may be off; HEV/PHEV engine may be off.
A1		9 bytes long, DATA_A, at least one sensor must be supported in bits 0-3, bits 4-7 must be 0.	NOx sensor corrected.
A2	2016 MY and beyond D - Fail if HD OBD 2019 MY and beyond D - Fail if MD OBD, OBD-II	2 bytes, DATA_A, B value must be >0 mg/stroke when engine is running or = 0 mg/stroke when engine is not running.	Cylinder fuel rate. Note: S/S engine may be off; HEV/PHEV engine may be off.
A3		9 bytes long.	Evap vapor pressure EVAP_A/B_VP.
A4		4 bytes long.	GEAR_ACT, GEAR_RAT.
A5	2019 MY and beyond D - Fail if OBD-II	4 bytes long.	Diesel exhaust fluid DEF_CMD, DEF_UCDC.
A6	2019 MY and beyond ALL - Warn if OBD-II 2021 MY and beyond ALL - Fail if OBD-II	4 bytes long, value must be >0 km.	Odometer. ODO (PEMS). 30/60/100% phase-in starting in 2019 MY for OBD-II.

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

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

Procedure:

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

Table 41 - Request powertrain freeze frame data response message for all protocols

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

Table 42 - Request powertrain freeze frame data response message

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

Evaluation criteria:

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

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

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

Procedure:

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

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Table 43 - Request powertrain freeze frame data request message (read supported PIDs) for all protocols

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

Table 44 - Request powertrain freeze frame data response message (report freeze frame PID values)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	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 an ECU has a freeze frame DTC, but does not support Service $02, PID $00, Frame $00, this shall be flagged as a failure.

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

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

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

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

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

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

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

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Table 45 - Request powertrain freeze frame data request message (read supported PIDs) for ISO 15765-4 protocol

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

Table 46 - Request powertrain freeze frame data response message (report freeze frame PID values)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDPR
#2	1st supported PID	M	00	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	xxxxxxxx	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				

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Evaluation criteria:

Each ECU that has a freeze frame DTC must report the same supported PIDs for single and group request messages.

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

Table 47 - Request powertrain freeze frame data response message for all protocols

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

Table 48 - Request powertrain freeze frame data response message

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

Evaluation criteria:

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

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

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

5.12 Verify Service $03 - Request Emission-Related DTCs, Engine Running

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

Procedure:

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

Table 49 - Request current powertrain diagnostic data request message for all protocols

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

Table 50 - ECU# x response: Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

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

Table 51 - Request emission-related diagnostic trouble codes request message for all protocols

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

Table 52 - Request emission-related diagnostic trouble codes response message for ISO 15765-4

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

Table 53 - Request emission-related diagnostic trouble codes response message for ISO 14230-4

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

Evaluation criteria:

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

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

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

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

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

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

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

Procedure:

5.13.1 [For all protocols] Transmit Service $05, Test ID $00, HO2S12 ($02) and note response. (All vehicles that support Service $05 should have at least one O_2 sensor [HO2S12]; TID $00 is not defined.)

Table 54 - Request oxygen sensor monitoring test results request message for all protocols

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

Evaluation criteria:

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

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

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

5.14 Verify Service $06 - Request On-Board Monitoring Test Results, Engine Running

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

Procedure:

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

Table 55 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read supported OBDMIDs) for all protocols

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

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Table 56 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs) for ISO 9141-2, SAE J1850, and ISO 14230-4 protocols

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

Table 57 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs) for ISO 15765-4 protocol

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
	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.

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

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

Table 58 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read supported OBDMIDs) for ISO 15765-4 protocol

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

U = User Optional.

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Table 59 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
	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 60 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 15765-4 protocol

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

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Table 61 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
	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.

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Evaluation criteria:

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

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

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

OBDMID support is not allowed in the followed, prohibited ranges: $15-$1F, $25-$30, $3F, $55-$5F, $65-$70, $75-$7F, $87-$8F, $92-$97, $9A-$9F, $B4-$BF, $C1-$DF, $E1-$FF. Vehicles which do not comply shall flagged as a failure. The range $E1-$FF is allowed for EOBD/IOBD/OBDBr only.

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

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

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

Some manufacturers have engine-off monitors, e.g., O_2 sensors that run as soon as the ignition is turned on. These monitors may report test results on Service $06 immediately after DTCs are cleared. If a Service $06 Test ID reports a test value, and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

Table 62 - OBDMID validation

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

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

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Table 63 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 9141-2, SAE J1850, and ISO 14230-4 protocols only

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

Table 64 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for non-continuously monitored systems response SID	M	46	SIDPR
#2	Test ID (report test results)	M	XX	TID
#3	Test Limit Type & Component ID	M	XX	TLTCID
	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., O_2 sensors that run as soon as the ignition is turned on. These monitors may report test results on Service $06. If a Service $06 Test ID reports a test value and test limits, it shall not be considered a failure.

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

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

Evaluation criteria:

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

5.15 Verify Service $07 - Request Pending Emission-Related DTCs, Engine Running

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

Procedure:

5.15.1 [For all protocols] Transmit a Service $07 request message. Verify that a proper response is received with DTC count set to zero and no DTCs.

Table 65 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols

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

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Table 66 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 15765-4

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

Table 67 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4

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

Evaluation criteria:

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

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

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

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

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

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

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

Procedure:

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

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Table 68 - Request control of on-board device request message (read supported TIDs) for all protocols

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

Table 69 - Request control of on-board device response message (report supported TIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
	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 SAE J1850, ISO9141-2 and ISO 14230-4, DATA_A-E shall be filled with $00 if unused.				

Evaluation criteria:

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

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

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

There is no legislative requirement to support Service $08. If not supported, it shall not be flagged as a warning for USOBD/EOBD/IOBD/OBDBr/CNOBD vehicles.

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

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

Table 70 - Request control of on-board device request message (read supported TIDs) for ISO 15765-4 protocol

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

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Table 71 - Request control of on-board device response message (report supported TIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
	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 SAE J1850, ISO9141-2 and ISO 14230-4, DATA_A-E shall be filled with $00 if unused.

Evaluation criteria:

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

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

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

Evaluation criteria:

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

5.17 Verify Service $09 - Request Vehicle Information, Engine Running

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

Procedure:

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

Table 72 - Request vehicle information request message (request supported InfoType) for all protocols

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

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Table 73 - Request vehicle information response message (request supported InfoType) for ISO 9141-2, SAE J1850, and ISO 14230-4 protocols only

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	XX	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 74 - Request vehicle information response message (request supported InfoType) for ISO 15765-4 protocol

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
	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) for light-duty and heavy-duty OBD-II and heavy-duty EOBD, no ECUs or no more than one ECU on the vehicles supports VIN for light-duty EOBD/IOBD/OBDBr/CNOBD. (EOBD/IOBD/OBDBr does not require VIN support; however, if VIN is not supported, this shall be flagged as a warning.) Verify that one and only one ECU on the vehicle supports INFOTYPE $0D (ESN) for 2013 MY and beyond heavy-duty OBD-II.

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. (EOBD/IOBD/OBDBr/CNOBD requires CALID support.)

Operator Prompt 2 asks for the number of emission-related reprogrammable ECUs in the vehicle. For OBD-II, CNOBD, and HD OBD, the number of ECUs that report CVNs must match or exceed the number of ECUs input by the operator at Prompt 2. (Non-reprogrammable ECUs are not prohibited from outputting CVNs.) (EOBD/IOBD/OBDBr does not require CVN support.)

Verify that IPT (INFOTYPE $08 or INFOTYPE $0B) is supported by at least one ECU for OBD-II. In-use Performance Indicator (INFOTYPE $08 or INFOTYPE $0B) must be supported for the 2007 MY and beyond or this shall be flagged as a failure for OBD-II. Verify that IPT (INFOTYPE $08 or INFOTYPE $0B) is supported by at least one ECU for EOBD/IOBD/OBDBr/CNOBD if IPT support is indicated by Operator Prompt 5 or this shall be flagged as a failure.

If IPT is supported for either OBD-II, CNOBD, or EOBD, verify that either INFOTYPE $08 or $0B is supported. If both are supported, this shall be flagged as a failure.

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

For OBD-II and CNOBD, verify that INFOTYPE $0A is supported for 2010 MY and beyond vehicles. If the vehicle does not support ECU name, this shall be flagged as failure; however, if the vehicle is a 2010 to 2012 MY vehicle that does not support ECU name, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply. (EOBD/IOBD does not require ECU name support.)

For OBD-II and CNOBD, verify that INFOTYPE $12 is supported for 2014 MY and beyond PHEV vehicles. If a PHEV vehicle does not support Fueled Engine Operation Ignition Cycle Counter, this shall be flagged as failure.

For OBD-II only, verify that INFOTYPE $14 is supported for 2017 MY and beyond vehicles. Miles since evap monitoring decision is required for Federal Tier III Evap vehicles as part of a phase in starting in the 2017 MY. Warn if not supported on spark ignition engines. Warnings require additional analysis by the vehicle manufacturer to determine if support is required or not.

For OBD-II only, verify that required INFOTYPEs $13, $16, $17, $18, $19 are supported. Warn if not supported for 2019 MY and 2020 MY and fail if not supported for 2021 MY and beyond.

For EOBD only, verify that required INFOTYPE $17 is supported. Warn if not supported for 2020 MY and fail if not supported for 2021 MY and beyond.

For OBD-II only, verify that required INFOTYPEs $1A, $1B, $1C are supported for PHEV only. Warn if not supported for 2019 MY and 2020 MY and fail if not supported for 2021 MY and beyond.

For EOBD only, verify that required INFOTYPEs $1A, $1B, $1C are supported for PHEV only. Warn if not supported for 2020 MY and fail if not supported for 2021 MY and beyond.

For OBD-II only, $1D, $1E, $1F, $21, $22, $23, $24, $25, $26, $27, $28, and $29 may be supported for 2019 and beyond vehicles. The OEM will need to determine which to support. These InfoTypes cannot be evaluated for support.

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

If an INFOTYPE higher than $29 is supported, this shall be flagged as a failure.

For ISO 15765-4 protocol only, if INFOTYPE $01, $03, $05 or $07, $09, $0C, $0E are supported, this shall be flagged as a warning.

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

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

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Table 75 - Request vehicle information request message (request supported InfoType) for ISO 156765-4 protocol

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information request SID	M	09	SIDRQ
#2	InfoType#1 (InfoTypes supported: $01-$20)	M	00	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 76 - Request vehicle information response message (request supported InfoType)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
	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)				

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Evaluation criteria:

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

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

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

Evaluation criteria:

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

Procedure:

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

Table 77 - Request vehicle information request message for all protocols

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

Table 78 - Request vehicle information response message

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request vehicle information request SID	49	SIDRQ
#2	InfoType: 01 - MessageCount VIN	01	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 SAE J1850, ISO 9141-2, and ISO 14230-4.

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

Table 79 - Request vehicle information request message for all protocols

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

Table 80 - Request vehicle information response message for ISO 15765-4

Message direction:	ECU #1 → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: 02 - VIN (Vehicle Information Number)	02	INFTYP
#3	Number of data items: 01	01	NODI
#4	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

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Table 81 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	02	INFTYP_
#3	MessageCount	M	01 - 05	MC_
#4	data record of InfoType = [DATA_A,	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 SAE J1850, ISO 9141-2, and ISO 14230-4. The response consists of the following messages:

Message #1 shall contain three pad bytes of $00, followed by VIN character #1.
Message #2 shall contain VIN characters #2 through #5, inclusive.
Message #3 shall contain VIN characters #6 through #9, inclusive.
Message #4 shall contain VIN characters #10 through #13, inclusive.
Message #5 shall contain VIN characters #14 through #17, inclusive.

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

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

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

The VIN year character (position 10) must correspond to the model year entered by the operator in Prompt 3 for OBD-II only. (EOBD/IOBD/OBDBr VIN does not require model year in position 10.)

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Table 82 - VIN year character

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

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Procedure:

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

Table 83 - Request vehicle information request message for all protocols

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

Table 84 - Request vehicle information response message

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

Evaluation criteria:

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

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

Table 85 - Request vehicle information request message for all protocols

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

Table 86 - Request vehicle information response message (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: 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

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Table 87 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	04	INFTYP_
#3	MessageCount	M	01 - XX	MC_
#4	data record of InfoType = [DATA_A,	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 four must match the number of 16 character CALIDs returned for SAE J1850, ISO 14230-4, and ISO 9141-2.

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

All CALIDs must contain 1 to 16 printable ASCII characters $20 through $7E.

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

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

Procedure:

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

Table 88 - Request vehicle information request message for all protocols

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

Table 89 - Request vehicle information response message

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

Evaluation criteria:

Note message count for evaluation in 5.17.10.

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

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

Table 90 - Request vehicle information request message for all protocols

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

Table 91 - Request vehicle information response message for ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: Calibration Verification Number	06	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 92 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	06	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				

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Evaluation criteria:

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

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

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

All CVNs must contain 4 bytes of hex data.

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

Procedure:

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

Table 93 - Request vehicle information request message for all protocols

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

Table 94 - Request vehicle information response message

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

Evaluation criteria:

Response message for INFOTYPE $07 should return a value of $08, $09, or $0A for all protocols except ISO 15765-4.

5.17.12 [For all protocols] Transmit Service $09, INFOTYPE = $08 if IPT is supported.

Table 95 - Request vehicle information request message for all protocols

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

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Table 96 - Request vehicle information response message (1) for ISO 15765-4

Message direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request vehicle information response SID	49	SIDPR
#2	InfoType: In-use Performance Tracking	08	INFTYP
#3	Number of data items: 16 or 20 or 28 (shown as 28 in this example)	10 or 14 or 1C	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B
#44	AFRICOMP1_A: X counts	XX	AFRICOMP1_A
#45	AFRICOMP1_B: X counts	XX	AFRICOMP1_B
#46	AFRICOND1_A: X counts	XX	AFRICOND1_A
#47	AFRICOND1_B: X counts	XX	AFRICOND1_B
#48	AFRICOMP2_A: X counts	XX	AFRICOMP2_A
#49	AFRICOMP2_B: X counts	XX	AFRICOMP2_B
#50	AFRICOND2_A: X counts	XX	AFRICOND2_A
#51	AFRICOND2_B: X counts	XX	AFRICOND2_B
#52	PFCOMP1_A: X counts	XX	PFCOMP1_A
#53	PFCOMP1_B: X counts	XX	PFCOMP1_B
#54	PFCOND1_A: X counts	XX	PFCOND1_A
#55	PFCOND1_B: X counts	XX	PFCOND1_B
#56	PFCOMP2_A: X counts	XX	PFCOMP2_A
#57	PFCOMP2_B: X counts	XX	PFCOMP2_B
#58	PFCOND2_A: X counts	XX	PFCOND2_A
#59	PFCOND2_B: X counts	XX	PFCOND2_B

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Table 97 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFTYP_
#3	MessageCount	M	01 - 10	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:

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

All In-use Performance data must contain either 32 bytes or 40 bytes or 56 bytes of data.

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

For ISO 15765-4, NODI in the response message must be $10 or $14 or $1C.

For OBD-II only, starting with the 2010 MY, spark ignition engines must support data for secondary oxygen sensor. NODI must be $14 and the response message must report back 40 bytes of data or this shall be flagged as a failure. Starting with the 2019 MY, spark ignition engines must support data for Air Fuel Imbalance monitor and Gasoline Particulate Filter monitor (30/60/100% phase-in starting in 2019 MY). NODI must be $1C and the response message must report back 56 bytes of data or this shall be flagged as a warning.

For OBD-II only, INFOTYPE $08 (In-use performance data) must be supported for the 2005 MY and beyond. If the vehicle does not support in-use performance data, this shall be flagged as a failure; however, if the vehicle is a 2005 or 2006 MY, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply. (For EOBD/IOBD/OBDBr, IPT support is required based on Operator Prompt 5.)

For CNOBD only, INFOTYPE $08 (In-use performance data), spark ignition engines must support data for Gasoline Particulate Filter monitor starting in 2020 MY. NODI must be $1C and the response message must report back 56 bytes of data or this shall be reported as a warning for 2020 calendar year. It will be up to the OEM to determine if support is required.

5.17.13 [For all protocols] Transmit Service $09, INFOTYPE = $0B if IPT is supported.

Table 98 - 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	0B	INFTYP

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Table 99 - Request vehicle information response message (1) for ISO 15765-4

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

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Table 100 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	0B	INFTYP_
#3	MessageCount	M	01 - 09	MC_
#4 #5 #6 #7	data record of InfoType = [DATA_A, DATA_B, DATA_C, Data D]	M M M M	XX XX XX XX	DATA_A DATA_B DATA_C DATA_D

Evaluation criteria:

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

All In-use Performance data must contain 32 or 36 bytes of data.

If an ECU does not support INFOTYPE $0B, no response is allowed for ISO 15765-4, SAE J1850, and ISO 9141-2. For ISO 14230-4, the ECU can either not respond or send a negative response ($7F, $12).

For ISO 15765-4, NODI in the response message must be $10 or $12.

For OBD-II, INFOTYPE $0B (In-use performance data) must be supported by compression ignition engines for the 2010 MY and beyond or this shall be flagged as a failure. For EOBD/IOBD/OBDBr, IPT support is required based on Operator Prompt 5.

Procedure:

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

Table 101 - 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 ECU Name	09	INFTYP

Table 102 - 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 ECU Name	09	INFTYP
#3	Message Count ECU Name = 5 response messages	05	MC_ECUN

Evaluation criteria:

Response message for INFOTYPE $09 should return a value of $05 for SAE J1850, ISO 9141-2, and ISO 14230-4.

[For all protocols] Transmit Service $09, INFOTYPE = $0A. if ECU name is supported.

Table 103 - Request vehicle information request message for ISO 15765-4

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

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Table 104 - Request vehicle information response message (1) for ISO 15765-4

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

Table 105 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	0A	INFTYP_
#3	MessageCount	M	01 - 05	MC_
#4 #5 #6 #7	data record of InfoType = [DATA_A, DATA_B, DATA_C, Data D]	M M M M	XX XX XX XX	DATA_A DATA_B DATA_C DATA_D

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Evaluation criteria:

If an ECU does not support INFOTYPE $0A, no response is allowed for ISO 15765-4, SAE J1850, and ISO 9141-2. For ISO 14230-4, the ECU can either not respond or send a negative response ($7F, $12).

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

For response to INFOTYPE $0A, five response messages should be received for SAE J1850, ISO 9141-2, and ISO 14230-4. The response consists of the following messages:

Message #1 shall contain data bytes 1 through 4.
Message #2 shall contain data bytes 5 through 8.
Message #3 shall contain data bytes 9 through 12.
Message #4 shall contain data bytes 13 through 16.
Message #5 shall contain data bytes 17 through 20.

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

Defined field assignment:

- Data bytes 1-4, “XXXX,” contains ECU acronym and ECU number if the vehicle is equipped with more than one ECU of that type as specified in Table 106.
- Data byte 5, “-,” ($2D) contains delimiter.
- Data bytes 6-20, “YYYYYYYYYYYYYYY,” contains text name (no blanks between words) and ECU number if the vehicle is equipped with more than one ECU of that type as specified in Table 106.

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

Any data field that does not match the specification in Table 106 (ECU name and number must match corresponding ECU Acronym and number; ECU name and ECU Acronym must match table value including characters, case, spelling, and include no spaces) shall be flagged as a warning prior to 2010 MY and a failure for 2010 MY and beyond.

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

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

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Table 106 - ECU name data byte description

Acronym (max 1 to 4 chars)	Full name of Control Module/ECU	ECU name and number (max 14 chars + 1 opt. digit)
ABS, ABS1, ABS2	Anti-Lock Brake System (ABS) Control Module	**AntiLockBrake**
AFCM, AFC1, AFC2	Alternative Fuel Control Module	**AltFuelCtrl**
AHCM, AHC1, AHC2	Auxiliary Heater Control Module	**AuxHeatCtrl**
APCM, APC1, APC2	Air Pump Control Module	**AirPumpCtrl**
AWDC, AWD1, AWD2	All Wheel Drive Control Module	**AllWhlDrvCtrl**
BCCM, BCC1, BCC2	Battery Charger Control Module	**B+ChargerCtrl**
BECM, BEC1, BEC2	Battery Energy Control Module	**B+EnergyCtrl**
BMCM, BMC1, BMC2	Battery Management Control Module	**B+ManageCtrl**
BCM, BCM1, BCM2	Body Control Module	**BodyControl**
BSCM,BSC1, BSC2	Brake System Control Module	**BrakeSystem**
CATM, CAT1, CAT2	Catalyst Heater Control Module	**CatHeaterCtrl**
CMPM, CMP1, CMP2	Camshaft Position Control Module	**CamPosCtrl**
CHCM, CHC1, CHC2	Chassis Control Module	**ChassisCtrl**
CRCM, CRC1, CRC2	Cruise Control Module	**CruiseControl**
CTCM, CTC1, CTC2	Coolant Temperature Control Module	**CoolTempCtrl**
DCDC, DCD1, DCD2	DC/DC Converter Control Module	**DCDCConvCtrl**
DMCM, DMC1, DMC2	Drive Motor Control Module	**DriveMotorCtrl**
EACC, EAC1, EAC2	Electric A/C Compressor Control Module	**ElecACCompCtrl**
EACM, EAM1, EAM2	Exhaust Aftertreatment Control Module	**ExhaustAftCtrl**
EBBC, EBB1, EBB2	Electronic Brake Boost Control Module	**ElecBrkBstCtrl**
ECCI, ECC1, ECC2	Emissions Critical Control Information	**EmisCritInfo**
ECM, ECM1, ECM2	Engine Control Module	**EngineControl**
FACM. FAC1, FAC2	Fuel Additive Control Module	**FuelAddCtrl**
FCCM, FCC1, FCC2	Fuel Cell Control Module	**FuelCellCtrl**
FICM, FIC1, FIC2	Fuel Injector Control Module	**FuelInjCtrl**
FPCM, FPC1, FPC2	Fuel Pump Control Module	**FuelPumpCtrl**
4WDC, 4WD1, 4WD2	Four-Wheel Drive Clutch Control Module	**4WhlDrvClCtrl**
GWM, GWM1, GWM2	Gateway Module	**Gateway**
GPCM, GPC1, GPC2	Glow Plug Control Module	**GlowPlugCtrl**
GSM, GSM1, GSM2	Gear Shift Control Module	**GearShiftCtrl**
HVAC, HVA1, HVA2	HVAC Control Module	**HVACCtrl**
HPCM, HPC1, HPC2	Hybrid Powertrain Control Module	**HybridPtCtrl**
IPC, IPC1, IPC2	Instrument Panel Cluster (IPC) Control Module	**InstPanelClust**
OBCC, OBC1, OBC2	Off-Board Charger Control Module	**OBChargerCtrl**
PCM, PCM1, PCM2	Powertrain Control Module	**PowertrainCtrl**
RDCM, RDC1, RDC2	Reductant Control Module	**ReductantCtrl**
SGCM, SGC1, SGC2	Starter/Generator Control Module	**Start/GenCtrl**
TACM, TAC1, TAC2	Throttle Actuator Control Module	**ThrotActCtrl**
TCCM, TCC1, TCC2	Transfer Case Control Module	**TransfCaseCtrl**
TCM, TCM1, TCM2	Transmission Control Module	**TransmisCtrl**
VTMC, VTM1, VTM2	Vehicle Thermal Management Control Module	**ThermalMgmt**

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5.17.15 [For SAE J1850, ISO 9141-2, and ISO 14230-4 protocols] Transmit Service $09, INFOTYPE = $0C if ESN is supported.

Table 107 - 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: 0C - MessageCount ESN	0C	INFTYP

Table 108 - 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: 0C - MessageCount ESN	0C	INFTYP
#3	Message Count ESN = 5 response messages	05	MC_ESN

Evaluation criteria:

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

Procedure:

5.17.16 [For all protocols] Transmit Service $09, INFOTYPE = $0D (ESN) if ESN is supported.

Table 109 - 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: 0D - ESN (Engine Serial Number)	0D	INFTYP

Table 110 - 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: 0D - ESN (Engine Serial Number)	0D	INFTYP
#3	Number of data items: 01	01	NODI
#4	1st ASCII character of ESN	XX	ESN
#5	2nd ASCII character of ESN	XX	ESN
#6	3rd ASCII character of ESN	XX	ESN
#7	4th ASCII character of ESN	XX	ESN
#8	5th ASCII character of ESN	XX	ESN
#9	6th ASCII character of ESN	XX	ESN
#10	7th ASCII character of ESN	XX	ESN
#11	8th ASCII character of ESN	XX	ESN
#12	9th ASCII character of ESN	XX	ESN
#13	10th ASCII character of ESN	XX	ESN
#14	11th ASCII character of ESN	XX	ESN
#15	12th ASCII character of ESN	XX	ESN
#16	13th ASCII character of ESN	XX	ESN
#17	14th ASCII character of ESN	XX	ESN
#18	15th ASCII character of ESN	XX	ESN
#19	16th ASCII character of ESN	XX	ESN
#20	17th ASCII character of ESN	XX	ESN

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Table 111 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	0D	INFTYP_
#3	MessageCount	M	01 - 05	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:

For response to INFOTYPE $0D, five response messages should be received for SAE J1850, ISO 9141-2, and ISO 14230-4. Messages 1 to 5 shall contain up to 17 printable ASCII characters starting with any fill bytes of $00, followed by the ESN characters. The response consists of the following messages:

Message #1 shall contain up to four filling bytes of $00 or ESN characters.
Message #2 shall contain up to four filling bytes of $00 or ESN characters.
Message #3 shall contain up to four filling bytes of $00 or ESN characters.
Message #4 shall contain up to four filling bytes of $00 or ESN characters.
Message #5 shall contain up to three filling bytes of $00, followed by any ESN characters.

For ISO 15765-4, there is only one response message, which contains up to 17 ASCII characters starting with any fill bytes of $00, followed by the ESN characters. NODI in the response message must be $01.

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

Procedure:

5.17.17 [For SAE J1850, ISO 9141-2, and ISO 14230-4 protocols] Transmit Service $09, INFOTYPE = $0E if EROTAN is supported.

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Table 112 - 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: 0E - MessageCount EROTAN	0E	INFTYP

Table 113 - 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: 0E - MessageCount EROTAN	0E	INFTYP
#3	Message Count EROTAN = 5 response messages	05	MC_EROTAN

Evaluation criteria:

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

5.17.18 [For all protocols] Transmit Service $09, INFOTYPE = $0F (EROTAN) if EROTAN is supported.

Table 114 - 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: 0F - EROTAN (Exhaust Reg or Type Approval Number)	0F	INFTYP

Table 115 - 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: 0F - EROTAN (Exhaust Reg or Type Approval Number)	0F	INFTYP
#3	Number of data items: 01	01	NODI
#4	1st ASCII character of EROTAN	XX	EROTAN
#5	2nd ASCII character of EROTAN	XX	EROTAN
#6	3rd ASCII character of EROTAN	XX	EROTAN
#7	4th ASCII character of EROTAN	XX	EROTAN
#8	5th ASCII character of EROTAN	XX	EROTAN
#9	6th ASCII character of EROTAN	XX	EROTAN
#10	7th ASCII character of EROTAN	XX	EROTAN
#11	8th ASCII character of EROTAN	XX	EROTAN
#12	9th ASCII character of EROTAN	XX	EROTAN
#13	10th ASCII character of EROTAN	XX	EROTAN
#14	11th ASCII character of EROTAN	XX	EROTAN
#15	12th ASCII character of EROTAN	XX	EROTAN
#16	13th ASCII character of EROTAN	XX	EROTAN
#17	14th ASCII character of EROTAN	XX	EROTAN
#18	15th ASCII character of EROTAN	XX	EROTAN
#19	16th ASCII character of EROTAN	XX	EROTAN
#20	17th ASCII character of EROTAN	XX	EROTAN

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Table 116 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	0F	INFTYP_
#3	MessageCount	M	01 - 05	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:

For response to INFOTYPE $0F, five response messages should be received for SAE J1850, ISO 9141-2, and ISO 14230-4. Messages 1 to 5 shall contain up to 17 printable ASCII characters starting with any fill bytes of $00, followed by the EROTAN characters. The response consists of the following messages:

Message #1 shall contain up to four filling bytes of $00 or EROTAN characters.
Message #2 shall contain up to four filling bytes of $00 or EROTAN characters.
Message #3 shall contain up to four filling bytes of $00 or EROTAN characters.
Message #4 shall contain up to four filling bytes of $00 or EROTAN characters.
Message #5 shall contain up to three filling bytes of $00, followed by any EROTAN characters.

For ISO 15765-4, there is only one response message, which contains up to 17 ASCII characters starting with any fill bytes of $00, followed by the EROTAN characters. NODI in the response message must be $01.

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

Procedure:

5.17.19 [For ISO 15765-4 protocol] Transmit Service $09, INFOTYPE = $12 if INFOTYPE $12 if supported..

Table 117 - Request vehicle information request message for ISO 15765-4

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: 12 - Fueled Engine Operation Ignition Cycle Counter	12	INFTYP

Table 118 - Request vehicle information 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 vehicle information request SID	49	SIDRQ
#2	InfoType: 12 - Fueled Engine Operation Ignition Cycle Counter	12	INFTYP
#3	Number of data items: 01	01	NODI
#4	FEOCNTR_A: X counts	XX	FEOCNTR_A
#5	FEOCNTR_B: X counts	XX	FEOCNTR_B

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Evaluation criteria:

Response message for INFOTYPE $12 should be returned.

Procedure:

5.17.20 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $13 (TG/EFN) if TG/EFN is supported.

Table 119 - 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: 13 - TG/EFN (Test Group/Engine Family Number)	13	INFTYP

Table 120 - 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: 13 - TG/EFN (Test Group/Engine Family Number)	13	INFTYP
#3	Number of data items: 01	01	NODI
#4	1st ASCII character of TG/EFN	XX	TG/EFN
#5	2nd ASCII character of TG/EFN	XX	TG/EFN
#6	3rd ASCII character of TG/EFN	XX	TG/EFN
#7	4th ASCII character of TG/EFN	XX	TG/EFN
#8	5th ASCII character of TG/EFN	XX	TG/EFN
#9	6th ASCII character of TG/EFN	XX	TG/EFN
#10	7th ASCII character of TG/EFN	XX	TG/EFN
#11	8th ASCII character of TG/EFN	XX	TG/EFN
#12	9th ASCII character of TG/EFN	XX	TG/EFN
#13	10th ASCII character of TG/EFN	XX	TG/EFN
#14	11th ASCII character of TG/EFN	XX	TG/EFN
#15	12th ASCII character of TG/EFN	XX	TG/EFN

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles must support test group/engine family number using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

For ISO 15765-4, there is only one response message, which contains up to 12 ASCII characters. NODI in the response message must be $01.The test group/engine family number can contain only printable ASCII characters $20 through $7E. Any unused data shall be reported as $00. (Invalid characters shall be flagged as a failure.)

The test group/engine family number first character (position 1) must correspond to the model year entered by the operator in Prompt 3 for OBD-II only. (EOBD/IOBD/OBDBr does not require test group/engine family number). The model year character in the test group/engine family number must be the same as in VIN as described in Table 82.

Procedure:

5.17.21 [For ISO 15765-4 protocol] Transmit Service $09, INFOTYPE = $14 if INFOTYPE $14 if supported.

Table 121 - Request vehicle information request message for ISO 15765-4

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: 14 - Distance Traveled Since Evap Monitoring Decision	14	INFTYP

Table 122 - Request vehicle information 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 vehicle information request SID	49	SIDRQ
#2	InfoType: 14 - Distance Traveled Since Evap Monitoring Decision	14	INFTYP
#3	Number of data items: 01	01	NODI
#4	EVAP_DIST_A: xx counts	xx	EVAP_DIST_A
#5	EVAP_DIST_B: xx counts	xx	EVAP_DIST_B

Evaluation criteria:

Response message for INFOTYPE $14 should return a value of $FFFF after a Service $04 code clear.

Procedure:

5.17.22 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $16 (Engine Run/Idle Time) if Engine Run/Idle Time is supported.

Table 123 - 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: 16 - Engine Run/Idle Time	16	INFTYP

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Table 124 - 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: 16 - Engine Run/Idle Time	16	INFTYP
#3	Number of data items: 1	01	NODI
#4	IGNCNTR-R_A: X counts	XX	IGNCNTR-R_A
#5	IGNCNTR-R_B: X counts	XX	IGNCNTR-R_B
#6	IGNCNTR-R_C: X counts	XX	IGNCNTR-R_C
#7	IGNCNTR-R_D: X counts	XX	IGNCNTR-R_D
#8	IGNCNTR-L_A: X counts	XX	IGNCNTR-L_A
#9	IGNCNTR-L_B: X counts	XX	IGNCNTR-L_B
#10	IGNCNTR-L_C: X counts	XX	IGNCNTR-L_C
#11	IGNCNTR-L_D: X counts	XX	IGNCNTR-L_D
#12	FEOCNTR-R_A: X counts	XX	FEOCNTR-R_A
#13	FEOCNTR-R_B: X counts	XX	FEOCNTR-R_B
#14	FEOCNTR-R_C: X counts	XX	FEOCNTR-R_C
#15	FEOCNTR-R_D: X counts	XX	FEOCNTR-R_D
#16	FEOCNTR-L_A: X counts	XX	FEOCNTR-L_A
#17	FEOCNTR-L_B: X counts	XX	FEOCNTR-L_B
#18	FEOCNTR-L_C: X counts	XX	FEOCNTR-L_C
#19	FEOCNTR-L_D: X counts	XX	FEOCNTR-L_D
#20	ERT-R_A: X sec	XX	ERT-R_A
#21	ERT-R_B: X sec	XX	ERT-R_B
#22	ERT-R_C: X sec	XX	ERT-R_C
#23	ERT-R_D: X sec	XX	ERT-R_D
#24	ERT-L_A: X sec	XX	ERT-L_A
#25	ERT-L_B: X sec	XX	ERT-L_B
#26	ERT-L_C: X sec	XX	ERT-L_C
#27	ERT-L_D: X sec	XX	ERT-L_D
#28	IERT-R_A: X sec	XX	IERT-R_A
#29	IERT-R_B: X sec	XX	IERT-R_B
#30	IERT-R_C: X sec	XX	IERT-R_C
#31	IERT-R_D: X sec	XX	IERT-R_D
#32	IERT-L_A: X sec	XX	IERT-L_A
#33	IERT-L_B: X sec	XX	IERT-L_B
#34	IERT-L_C: X sec	XX	IERT-L_C
#35	IERT-L_D: X sec	XX	IERT-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles must support engine run/idle time data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 32 bytes of data.

If an ECU does not support INFOTYPE $16, no response is allowed for ISO 15765-4.

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

IGNCNTR-R and FEOCNTR-R must contain a value of 0 or 1 count after a Service $04 command to clear codes.

IGNCNTR-L must contain a value greater than or equal to 1 count and greater than the value of IGNCNTR-R.

FEOCNTR-L must contain a value greater than or equal to 1 count and greater than the value of FEOCNTR-R unless the vehicle is a hybrid or PHEV then 0 is allowed.

ERT-R and IERT-R must contain a value greater than 1 sec unless the vehicle is a hybrid or PHEV, then a value of 0 is allowed.

ERT-L and IERT-L must contain a value greater than 1 sec unless the vehicle is a hybrid or PHEV, then a value of 0 is allowed.

Procedure:

5.17.23 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $17 (Distance/Fuel Used) if Distance/Fuel Used is supported.

Table 125 - 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: 17 - Distance/Fuel Used	17	INFTYP

Table 126 - 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: 17 - Distance/Fuel Used	17	INFTYP
#3	Number of data items: 1	01	NODI
#4	DT-R_A: X km	XX	DT-R_A
#5	DT-R_B: X km	XX	DT-R_B
#6	DT-R_C: X km	XX	DT-R_C
#7	DT-R_D: X km	XX	DT-R_D
#8	DT-L_A: X km	XX	DT-L_A
#9	DT-L_B: X km	XX	DT-L_B
#10	DT-L_C: X km	XX	DT-L_C
#11	DT-L_D: X km	XX	DT-L_D
#12	FC-R_A: X l	XX	FC-R_A
#13	FC-R_B: X l	XX	FC-R_B
#14	FC-R_C: X l	XX	FC-R_C
#15	FC-R_D: X l	XX	FC-R_D
#16	FC-L_A: X l	XX	FC-L_A
#17	FC-L_B: X l	XX	FC-L_B
#18	FC-L_C: X l	XX	FC-L_C
#19	FC-L_D: X l	XX	FC-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles must support distance/fuel used data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $17, no response is allowed for ISO 15765-4.

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

DT-R must contain a value of 0 km after a Service $04 command to clear codes.

Log the value of FC-R and FC-L to be used in 9.22.2.

Log the value of DT-R and DT-L to be used in 9.22.2.

Procedure:

5.17.24 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $18 (PKE/EOE) if PKE/EOE is supported.

Table 127 - 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: 18 - PKE/EOE	18	INFTYP

Table 128 - 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: 18 - PKE/EOE	18	INFTYP
#3	Number of data items: 1	01	NODI
#4	PKE-R_A: X km/hr2	XX	PKE-R_A
#5	PKE-R_B: X km/hr2	XX	PKE-R_B
#6	PKE-R_C: X km/hr2	XX	PKE-R_C
#7	PKE-R_D: X km/hr2	XX	PKE-R_D
#8	PKE-L_A: X km/hr2	XX	PKE-L_A
#9	PKE-L_B: X km/hr2	XX	PKE-L_B
#10	PKE-L_C: X km/hr2	XX	PKE-L_C
#11	PKE-L_D: X km/hr2	XX	PKE-L_D
#12	EOE-R_A: X kWh	XX	EOE-R_A
#13	EOE-R_B: X kWh	XX	EOE-R_B
#14	EOE-R_C: X kWh	XX	EOE-R_C
#15	EOE-R_D: X kWh	XX	EOE-R_D
#16	EOE-L_A: X kWh	XX	EOE-L_A
#17	EOE-L_B: X kWh	XX	EOE-L_B
#18	EOE-L_C: X kWh	XX	EOE-L_C
#19	EOE-L_D: X kWh	XX	EOE-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles must support PKE/EOE data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $18, no response is allowed for ISO 15765-4.

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

PKE-R must contain a value of 0 km/hr^2 after a Service $04 command to clear codes.

Log the value of PKE-R, PKE-L, EOE-R and EOE-L to be used in 9.22.3.

Procedure:

5.17.25 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $19 (PSA) if Propulsion System Active is supported.

Table 129 - 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: 19 - PSA	19	INFTYP

Table 130 - 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: 19 - PSA	19	INFTYP
#3	Number of data items: 1	01	NODI
#4	PSA-R_A: X sec	XX	PSA-R_A
#5	PSA-R_B: X sec	XX	PSA-R_B
#6	PSA-R_C: X sec	XX	PSA-R_C
#7	PSA-R_D: X sec	XX	PSA-R_D
#8	PSA-L_A: X sec	XX	PSA-L_A
#9	PSA-L_B: X sec	XX	PSA-L_B
#10	PSA-L_C: X sec	XX	PSA-L_C
#11	PSA-L_D: X sec	XX	PSA-L_D
#12	IPSA-R_A: X sec	XX	IPSA-R_A
#13	IPSA-R_B: X sec	XX	IPSA-R_B
#14	IPSA-R_C: X sec	XX	IPSA-R_C
#15	IPSA-R_D: X sec	XX	IPSA-R_D
#16	IPSA-L_A: X sec	XX	IPSA-L_A
#17	IPSA-L_B: X sec	XX	IPSA-L_B
#18	IPSA-L_C: X sec	XX	IPSA-L_C
#19	IPSA-L_D: X sec	XX	IPSA-L_D
#20	CPSA-R_A: X sec	XX	CPSA-R_A
#21	CPSA-R_B: X sec	XX	CPSA-R_B
#22	CPSA-R_C: X sec	XX	CPSA-R_C
#23	CPSA-R_D: X sec	XX	CPSA-R_D
#24	CPSA-L_A: X sec	XX	CPSA-L_A
#25	CPSA-L_B: X sec	XX	CPSA-L_B
#26	CPSA-L_C: X sec	XX	CPSA-L_C
#27	CPSA-L_D: X sec	XX	CPSA-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles must support PSA data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 24 bytes of data.

If an ECU does not support INFOTYPE $19, no response is allowed for ISO 15765-4.

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

Log the value of PSA-R and IPSA-R to be used in 9.22.4.

Log the value of PSA-L and IPSA-L to be used in 9.22.4.

CPSA-R must contain a value of 0 seconds after a Service $04 command to clear codes.Log the value of CPSA-L to be used in 9.22.4.

Procedure:

5.17.26 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $1A (PHEVDD) if PHEV Distance Data is supported.

Table 131 - 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: 1A - PHEVDD	1A	INFTYP

Table 132 - 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: 1A - PHEVDD	1A	INFTYP
#3	Number of data items: 1	01	NODI
#4	CDEODT-R_A: X km	XX	CDEODT-R_A
#5	CDEODT-R_B: X km	XX	CDEODT-R_B
#6	CDEODT-R_C: X km	XX	CDEODT-R_C
#7	CDEODT-R_D: X km	XX	CDEODT-R_D
#8	CDEODT-L_A: X km	XX	CDEODT-L_A
#9	CDEODT-L_B: X km	XX	CDEODT-L_B
#10	CDEODT-L_C: X km	XX	CDEODT-L_C
#11	CDEODT-L_D: X km	XX	CDEODT-L_D
#12	CDERDT-R_A: X km	XX	CDERDT-R_A
#13	CDERDT-R_B: X km	XX	CDERDT-R_B
#14	CDERDT-R_C: X km	XX	CDERDT-R_C
#15	CDERDT-R_D: X km	XX	CDERDT-R_D
#16	CDERDT-L_A: X km	XX	CDERDT-L_A
#17	CDERDT-L_B: X km	XX	CDERDT-L_B
#18	CDERDT-L_C: X km	XX	CDERDT-L_C
#19	CDERDT-L_D: X km	XX	CDERDT-L_D
#20	CIDT-R_A: X km	XX	CIDT-R_A
#21	CIDT-R_B: X km	XX	CIDT-R_B
#22	CIDT-R_C: X km	XX	CIDT-R_C
#23	CIDT-R_D: X km	XX	CIDT-R_D
#24	CIDT-L_A: X km	XX	CIDT-L_A
#25	CIDT-L_B: X km	XX	CIDT-L_B
#26	CIDT-L_C: X km	XX	CIDT-L_C
#27	CIDT-L_D: X km	XX	CIDT-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty PHEV vehicles must support PHEV distance data using a (25/50/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 24 bytes of data.

If an ECU does not support INFOTYPE $1A, no response is allowed for ISO 15765-4.

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

CDEODT-R, CDERDT-R and CIDT-R must contain a value of 0 km after a Service $04 command to clear codes.

Procedure:

5.17.27 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $1B (CDFC/CIFC) if CDFC/CIFC is supported.

Table 133 - 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: 1B - CDFC/CIFC	1B	INFTYP

Table 134 - 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: 1B - CDFC/CIFC	1B	INFTYP
#3	Number of data items: 1	01	NODI
#4	CDFC-R_A: X liters	XX	CDFC-R_A
#5	CDFC-R_B: X liters	XX	CDFC-R_B
#6	CDFC-R_C: X liters	XX	CDFC-R_C
#7	CDFC-R_D: X liters	XX	CDFC-R_D
#8	CDFC-L_A: X liters	XX	CDFC-L_A
#9	CDFC-L_B: X liters	XX	CDFC-L_B
#10	CDFC-L_C: X liters	XX	CDFC-L_C
#11	CDFC-L_D: X liters	XX	CDFC-L_D
#12	CIFC-R_A: X liters	XX	CIFC-R_A
#13	CIFC-R_B: X liters	XX	CIFC-R_B
#14	CIFC-R_C: X liters	XX	CIFC-R_C
#15	CIFC-R_D: X liters	XX	CIFC-R_D
#16	CIFC-L_A: X liters	XX	CIFC-L_A
#17	CIFC-L_B: X liters	XX	CIFC-L_B
#18	CIFC-L_C: X liters	XX	CIFC-L_C
#19	CIFC-L_D: X liters	XX	CIFC-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty PHEV vehicles must support CDFC/CIFC data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $1B, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.28 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $1C (CDEOGE/CDERGE/GE) if CDEOGE/CDERGE/GE is supported.

Table 135 - 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: 1C - CDEOGE/CDERGE/GE	1C	INFTYP

Table 136 - 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: 1C - CDEOGE/CDERGE/GE	1C	INFTYP
#3	Number of data items: 1	01	NODI
#4	CDEOGE-R_A: X kWh	XX	CDEOGE-R_A
#5	CDEOGE-R_B: X kWh	XX	CDEOGE-R_B
#6	CDEOGE-R_C: X kWh	XX	CDEOGE-R_C
#7	CDEOGE-R_D: X kWh	XX	CDEOGE-R_D
#8	CDEOGE-L_A: X kWh	XX	CDEOGE-L_A
#9	CDEOGE-L_B: X kWh	XX	CDEOGE-L_B
#10	CDEOGE-L_C: X kWh	XX	CDEOGE-L_C
#11	CDEOGE-L_D: X kWh	XX	CDEOGE-L_D
#12	CDERGE-R_A: X kWh	XX	CDERGE-R_A
#13	CDERGE-R_B: X kWh	XX	CDERGE-R_B
#14	CDERGE-R_C: X kWh	XX	CDERGE-R_C
#15	CDERGE-R_D: X kWh	XX	CDERGE-R_D
#16	CDERGE-L_A: X kWh	XX	CDERGE-L_A
#17	CDERGE-L_B: X kWh	XX	CDERGE-L_B
#18	CDERGE-L_C: X kWh	XX	CDERGE-L_C
#19	CDERGE-L_D: X kWh	XX	CDERGE-L_D
#20	GE-R_A: X kWh	XX	GE-R_A
#21	GE-R_B: X kWh	XX	GE-R_B
#22	GE-R_C: X kWh	XX	GE-R_C
#23	GE-R_D: X kWh	XX	GE-R_D
#24	GE-L_A: X kWh	XX	GE-L_A
#25	GE-L_B: X kWh	XX	GE-L_B
#26	GE-L_C: X kWh	XX	GE-L_B
#27	GE-L_D: X kWh	XX	GE-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty PHEV vehicles must support CDEOGE/CDERGE/GE data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 24 bytes of data.

If an ECU does not support INFOTYPE $1C, no response is allowed for ISO 15765-4.

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

GE-R must contain a value equal to 0 kWh after a Service $04 command to clear codes. The Electrical Vehicle Supply Equipment (EVSE) shall not be attached to the vehicle during the J1699 test execution.

Procedure:

5.17.29 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $1D (AGSA_TIME1/AGSA_TIME2/AGSB_TIME1/AGSB_TIME2) if AGSA_TIME1/AGSA_TIME2/AGSB_TIME1/AGSB_TIME2 is supported.

Table 137 - 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: 1D - AGSA_TIME1/AGSA_TIME2/AGSB_TIME1/AGSB_TIME2	1D	INFTYP

Table 138 - 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: 1D - AGSA_TIME1/AGSA_TIME2/AGSB_TIME1/AGSB_TIME2	1D	INFTYP
#3	Number of data items: 1	01	NODI
#4	AGSA_TIME1-R_A: X sec	XX	AGSA_TIME1-R_A
#5	AGSA_TIME1-R_B: X sec	XX	AGSA_TIME1-R_B
#6	AGSA_TIME1-R_C: X sec	XX	AGSA_TIME1-R_C
#7	AGSA_TIME1-R_D: X sec	XX	AGSA_TIME1-R_D
#8	AGSA_TIME1-L_A: X sec	XX	AGSA_TIME1-L_A
#9	AGSA_TIME1-L_B: X sec	XX	AGSA_TIME1-L_B
#10	AGSA_TIME1-L_C: X sec	XX	AGSA_TIME1-L_C
#11	AGSA_TIME1-L_D: X sec	XX	AGSA_TIME1-L_D
#12	AGSA_TIME2-R_A: X sec	XX	AGSA_TIME2-R_A
#13	AGSA_TIME2-R_B: X sec	XX	AGSA_TIME2-R_B
#14	AGSA_TIME2-R_C: X sec	XX	AGSA_TIME2-R_C
#15	AGSA_TIME2-R_D: X sec	XX	AGSA_TIME2-R_D
#16	AGSA_TIME2-L_A: X sec	XX	AGSA_TIME2-L_A
#17	AGSA_TIME2-L_B: X sec	XX	AGSA_TIME2-L_B
#18	AGSA_TIME2-L_C: X sec	XX	AGSA_TIME2-L_C
#19	AGSA_TIME2-L_D: X sec	XX	AGSA_TIME2-L_D
#20	AGSB_TIME1-R_A: X sec	XX	AGSB_TIME1-R_A
#21	AGSB_TIME1-R_B: X sec	XX	AGSB_TIME1-R_B
#22	AGSB_TIME1-R_C: X sec	XX	AGSB_TIME1-R_C
#23	AGSB_TIME1-R_D: X sec	XX	AGSB_TIME1-R_D
#24	AGSB_TIME1-L_A: X sec	XX	AGSB_TIME1-L_A
#25	AGSB_TIME1-L_B: X sec	XX	AGSB_TIME1-L_B
#26	AGSB_TIME1-L_C: X sec	XX	AGSB_TIME1-L_C
#27	AGSB_TIME1-L_D: X sec	XX	AGSB_TIME1-L_D
#28	AGSB_TIME2-R_A: X sec	XX	AGSB_TIME2-R_A
#29	AGSB_TIME2-R_B: X sec	XX	AGSB_TIME2-R_B
#30	AGSB_TIME2-R_C: X sec	XX	AGSB_TIME2-R_C
#31	AGSB_TIME2-R_D: X sec	XX	AGSB_TIME2-R_D
#32	AGSB_TIME2-L_A: X sec	XX	AGSB_TIME2-L_A
#33	AGSB_TIME2-L_B: X sec	XX	AGSB_TIME2-L_B
#34	AGSB_TIME2-L_C: X sec	XX	AGSB_TIME2-L_C
#35	AGSB_TIME2-L_D: X sec	XX	AGSB_TIME2-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support AGSA_TIME1/AGSA_TIME2/AGSB_TIME1/AGSB_TIME2 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 32 bytes of data.

If an ECU does not support INFOTYPE $1D, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.30 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $1E (VRHC_TIME1/VRHC_TIME2) if VRHC_TIME1/VRHC_TIME2 is supported.

Table 139 - 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: 1E - VRHC_TIME1/VRHC_TIME2	1E	INFTYP

Table 140 - 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: 1E - VRHC_TIME1/VRHC_TIME2	1E	INFTYP
#3	Number of data items: 1	01	NODI
#4	VRHC_TIME1-R_A: X sec	XX	VRHC_TIME1-R_A
#5	VRHC_TIME1-R_B: X sec	XX	VRHC_TIME1-R_B
#6	VRHC_TIME1-R_C: X sec	XX	VRHC_TIME1-R_C
#7	VRHC_TIME1-R_D: X sec	XX	VRHC_TIME1-R_D
#8	VRHC_TIME2-R_A: X sec	XX	VRHC_TIME2-R_A
#9	VRHC_TIME2-R_B: X sec	XX	VRHC_TIME2-R_B
#10	VRHC_TIME2-R_C: X sec	XX	VRHC_TIME2-R_C
#11	VRHC_TIME2-R_D: X sec	XX	VRHC_TIME2-R_D
#12	VRHC_TIME1-L_A: X sec	XX	VRHC_TIME1-L_A
#13	VRHC_TIME1-L_B: X sec	XX	VRHC_TIME1-L_B
#14	VRHC_TIME1-L_C: X sec	XX	VRHC_TIME1-L_C
#15	VRHC_TIME1-L_D: X sec	XX	VRHC_TIME1-L_D
#16	VRHC_TIME2-L_A: X sec	XX	VRHC_TIME2-L_A
#17	VRHC_TIME2-L_B: X sec	XX	VRHC_TIME2-L_B
#18	VRHC_TIME2-L_C: X sec	XX	VRHC_TIME2-L_C
#19	VRHC_TIME2-L_D: X sec	XX	VRHC_TIME2-L_D

Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support VRHC_TIME1/VRHC_TIME2 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $1E, no response is allowed for ISO 15765-4.

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

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Procedure:

5.17.31 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $1F (AAF1_TIME1/AAF1_TIME2/AAF2_TIME1/AAF2_TIME2) if Active Aerodynamic Feature #1 Timer 1 or Active Aerodynamic Feature #1 Timer 2 or Active Aerodynamic Feature #2 Timer 1 or Active Aerodynamic Feature #2 Timer 2 is supported.

Table 141 - 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: 1F - AAF1_TIME1/AAF1_TIME2/AAF2_TIME1/AAF2_TIME2	1F	INFTYP

Table 142 - 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: 1F - AAF1_TIME1/AAF1_TIME2/AAF2_TIME1/AAF2_TIME2	1F	INFTYP
#3	Number of data items: 1	01	NODI
#4	AAF1_TIME1-R_A: X sec	XX	AAF1_TIME1-R_A
#5	AAF1_TIME1-R_B: X sec	XX	AAF1_TIME1-R_B
#6	AAF1_TIME1-R_C: X sec	XX	AAF1_TIME1-R_C
#7	AAF1_TIME1-R_D: X sec	XX	AAF1_TIME1-R_D
#8	AAF1_TIME2-R_A: X sec	XX	AAF1_TIME2-R_A
#9	AAF1_TIME2-R_B: X sec	XX	AAF1_TIME2-R_B
#10	AAF1_TIME2-R_C: X sec	XX	AAF1_TIME2-R_C
#11	AAF1_TIME2-R_D: X sec	XX	AAF1_TIME2-R_D
#12	AAF1_TIME1-L_A: X sec	XX	AAF1_TIME1-L_A
#13	AAF1_TIME1-L_B: X sec	XX	AAF1_TIME1-L_B
#14	AAF1_TIME1-L_C: X sec	XX	AAF1_TIME1-L_C
#15	AAF1_TIME1-L_D: X sec	XX	AAF1_TIME1-L_D
#16	AAF1_TIME2-L_A: X sec	XX	AAF1_TIME2-L_A
#17	AAF1_TIME2-L_B: X sec	XX	AAF1_TIME2-L_B
#18	AAF1_TIME2-L_C: X sec	XX	AAF1_TIME2-L_C
#19	AAF1_TIME2-L_D: X sec	XX	AAF1_TIME2-L_D
#20	AAF2_TIME1-R_A: X sec	XX	AAF2_TIME1-R_A
#21	AAF2_TIME1-R_B: X sec	XX	AAF2_TIME1-R_B
#22	AAF2_TIME1-R_C: X sec	XX	AAF2_TIME1-R_C
#23	AAF2_TIME1-R_D: X sec	XX	AAF2_TIME1-R_D
#24	AAF2_TIME2-R_A: X sec	XX	AAF2_TIME2-R_A
#25	AAF2_TIME2-R_B: X sec	XX	AAF2_TIME2-R_B
#26	AAF2_TIME2-R_C: X sec	XX	AAF2_TIME2-R_C
#27	AAF2_TIME2-R_D: X sec	XX	AAF2_TIME2-R_D
#28	AAF2_TIME1-L_A: X sec	XX	AAF2_TIME1-L_A
#29	AAF2_TIME1-L_B: X sec	XX	AAF2_TIME1-L_B
#30	AAF2_TIME1-L_C: X sec	XX	AAF2_TIME1-L_C
#31	AAF2_TIME1-L_D: X sec	XX	AAF2_TIME1-L_D
#32	AAF2_TIME2-L_A: X sec	XX	AAF2_TIME2-L_A
#33	AAF2_TIME2-L_B: X sec	XX	AAF2_TIME2-L_B
#34	AAF2_TIME2-L_C: X sec	XX	AAF2_TIME2-L_C
#35	AAF2_TIME2-L_D: X sec	XX	AAF2_TIME2-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support AAF1_TIME1/AAF1_TIME2/AAF2_TIME1/AAF2_TIME2 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 32 bytes of data.

If an ECU does not support INFOTYPE $1F, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.32 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $21 (EDSM_TIME1/DSM1_TIME1/DSM2_TIME1/DSM3_TIME1/DSM4_TIME1) if "Eco" Driver-Selectable Mode Timer/Driver-Selectable Mode Timer 1/Driver-Selectable Mode Timer 2/Driver-Selectable Mode Timer 3/Driver-Selectable Mode Timer 4 is supported.

Table 143 - 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: 21 - EDSM_TIME1/DSM1_TIME1/DSM2_TIME1/DSM3_TIME1/DSM4_TIME1	21	INFTYP

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Table 144 - 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: 21 - EDSM_TIME1/DSM1_TIME1/DSM2_TIME1/DSM3_TIME1/DSM4_TIME1	21	INFTYP
#3	Number of data items: 1	01	NODI
#4	EDSM_TIME1-R_A: X sec	XX	EDSM_TIME1-R_A
#5	EDSM_TIME1-R_B: X sec	XX	EDSM_TIME1-R_B
#6	EDSM_TIME1-R_C: X sec	XX	EDSM_TIME1-R_C
#7	EDSM_TIME1-R_D: X sec	XX	EDSM_TIME1-R_D
#8	EDSM_TIME1-L_A: X sec	XX	EDSM_TIME1-L_A
#9	EDSM_TIME1-L_B: X sec	XX	EDSM_TIME1-L_B
#10	EDSM_TIME1-L_C: X sec	XX	EDSM_TIME1-L_C
#11	EDSM_TIME1-L_D: X sec	XX	EDSM_TIME1-L_D
#12	DSM1_TIME1-R_A: X sec	XX	DSM1_TIME1-R_A
#13	DSM1_TIME1-R_B: X sec	XX	DSM1_TIME1-R_B
#14	DSM1_TIME1-R_C: X sec	XX	DSM1_TIME1-R_C
#15	DSM1_TIME1-R_D: X sec	XX	DSM1_TIME1-R_D
#16	DSM1_TIME1-L_A: X sec	XX	DSM1_TIME1-R_A
#17	DSM1_TIME1-L_B: X sec	XX	DSM1_TIME1-R_B
#18	DSM1_TIME1-L_C: X sec	XX	DSM1_TIME1-R_C
#19	DSM1_TIME1-L_D: X sec	XX	DSM1_TIME1-R_D
#20	DSM2_TIME1-R_A: X sec	XX	DSM2_TIME1-R_A
#21	DSM2_TIME1-R_B: X sec	XX	DSM2_TIME1-R_B
#22	DSM2_TIME1-R_C: X sec	XX	DSM2_TIME1-R_C
#23	DSM2_TIME1-R_D: X sec	XX	DSM2_TIME1-R_D
#24	DSM2_TIME1-L_A: X sec	XX	DSM2_TIME1-L_A
#25	DSM2_TIME1-L_B: X sec	XX	DSM2_TIME1-L_B
#26	DSM2_TIME1-L_C: X sec	XX	DSM2_TIME1-L_C
#27	DSM2_TIME1-L_D: X sec	XX	DSM2_TIME1-L_D
#28	DSM3_TIME1-R_A: X sec	XX	DSM3_TIME1-R_A
#29	DSM3_TIME1-R_B: X sec	XX	DSM3_TIME1-R_B
#30	DSM3_TIME1-R_C: X sec	XX	DSM3_TIME1-R_C
#31	DSM3_TIME1-R_D: X sec	XX	DSM3_TIME1-R_D
#32	DSM3_TIME1-L_A: X sec	XX	DSM3_TIME1-L_A
#33	DSM3_TIME1-L_B: X sec	XX	DSM3_TIME1-L_B
#34	DSM3_TIME1-L_C: X sec	XX	DSM3_TIME1-L_C
#35	DSM3_TIME1-L_D: X sec	XX	DSM3_TIME1-L_D
#36	DSM4_TIME1-R_A: X sec	XX	DSM4_TIME1-R_A
#37	DSM4_TIME1-R_B: X sec	XX	DSM4_TIME1-R_B
#38	DSM4_TIME1-R_C: X sec	XX	DSM4_TIME1-R_C
#39	DSM4_TIME1-R_D: X sec	XX	DSM4_TIME1-R_D
#40	DSM4_TIME1-L_A: X sec	XX	DSM4_TIME1-L_A
#41	DSM4_TIME1-L_B: X sec	XX	DSM4_TIME1-L_B
#42	DSM4_TIME1-L_C: X sec	XX	DSM4_TIME1-L_C
#43	DSM4_TIME1-L_D: X sec	XX	DSM4_TIME1-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support EDSM_TIME1/DSM1_TIME1/DSM2_TIME1/DSM3_TIME1/DSM4_TIME1 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 40 bytes of data.

If an ECU does not support INFOTYPE $21, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.33 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $22 (ISS_TIME1/ERC_TIME1/EOC_TIME1) if Idle Stop-Start Timer/Engine Running Coasting Timer/Engine Off Coasting Timer is supported.

Table 145 - 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: 22 - ISS_TIME1/ERC_TIME1/EOC_TIME1	22	INFTYP

Table 146 - 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: 22 - ISS_TIME1/ERC_TIME1/EOC_TIME1	22	INFTYP
#3	Number of data items: 1	01	NODI
#4	ISS_TIME1-R_A: X sec	XX	ISS_TIME1-R_A
#5	ISS_TIME1-R_B: X sec	XX	ISS_TIME1-R_B
#6	ISS_TIME1-R_C: X sec	XX	ISS_TIME1-R_C
#7	ISS_TIME1-R_D: X sec	XX	ISS_TIME1-R_D
#8	ISS_TIME1-L_A: X sec	XX	ISS_TIME1-L_A
#9	ISS_TIME1-L_B: X sec	XX	ISS_TIME1-L_B
#10	ISS_TIME1-L_C: X sec	XX	ISS_TIME1-L_C
#11	ISS_TIME1-L_D: X sec	XX	ISS_TIME1-L_D
#12	ERC_TIME1-R_A: X sec	XX	ERC_TIME1-R_A
#13	ERC_TIME1-R_B: X sec	XX	ERC_TIME1-R_B
#14	ERC_TIME1-R_C: X sec	XX	ERC_TIME1-R_C
#15	ERC_TIME1-R_D: X sec	XX	ERC_TIME1-R_D
#16	ERC_TIME1-L_A: X sec	XX	ERC_TIME1-L_A
#17	ERC_TIME1-L_B: X sec	XX	ERC_TIME1-L_B
#18	ERC_TIME1-L_C: X sec	XX	ERC_TIME1-L_C
#19	ERC_TIME1-L_D: X sec	XX	ERC_TIME1-L_D
#20	EOC_TIME1-R_A: X sec	XX	EOC_TIME1-R_A
#21	EOC_TIME1-R_B: X sec	XX	EOC_TIME1-R_B
#22	EOC_TIME1-R_C: X sec	XX	EOC_TIME1-R_C
#23	EOC_TIME1-R_D: X sec	XX	EOC_TIME1-R_D
#24	EOC_TIME1-L_A: X sec	XX	EOC_TIME1-L_A
#25	EOC_TIME1-L_B: X sec	XX	EOC_TIME1-L_B
#26	EOC_TIME1-L_C: X sec	XX	EOC_TIME1-L_C
#27	EOC_TIME1-L_D: X sec	XX	EOC_TIME1-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support ISS_TIME1/ERC_TIME1/EOC_TIME1 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 24 bytes of data.

If an ECU does not support INFOTYPE $22, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.34 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $23 (DCTE1_CNTS/DCTU1_CNTS/DCTE2_CNTS/DCTU2_CNTS/DCTE3_CNTS/DCTU3_CNTS) if Driver Coaching Technology 1 Enabled Counter/Driver Coaching Technology 1 Utilized Counter/Driver Coaching Technology 2 Enabled Counter/Driver Coaching Technology 2 Utilized Counter/Driver Coaching Technology 3 Enabled Counter /Driver Coaching Technology 3 Utilized Counter is supported.

Table 147 - 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: 23 - DCTE1_CNTS/DCTU1_CNTS/DCTE2_CNTS/DCTU2_CNTS/DCTE3_CNTS/DCTU3_CNTS	23	INFTYP

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Table 148 - 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: 23 - DCTE1_CNTS/DCTU1_CNTS/DCTE2_CNTS/DCTU2_CNTS/ DCTE3_CNTS/DCTU3_CNTS	23	INFTYP
#3	Number of data items: 1	01	NODI
#4	DCTE1_CNTS-R_A: X counts	XX	DCTE1_CNTS-R_A
#5	DCTE1_CNTS-R_B: X counts	XX	DCTE1_CNTS-R_B
#6	DCTE1_CNTS-R_C: X counts	XX	DCTE1_CNTS-R_C
#7	DCTE1_CNTS-R_D: X counts	XX	DCTE1_CNTS-R_D
#8	DCTU1_CNTS-R_A: X counts	XX	DCTU1_CNTS-R_A
#9	DCTU1_CNTS-R_B: X counts	XX	DCTU1_CNTS-R_B
#10	DCTU1_CNTS-R_C: X counts	XX	DCTU1_CNTS-R_C
#11	DCTU1_CNTS-R_D: X counts	XX	DCTU1_CNTS-R_D
#12	DCTE1_CNTS-L_A: X counts	XX	DCTE1_CNTS-L_A
#13	DCTE1_CNTS-L_B: X counts	XX	DCTE1_CNTS-L_B
#14	DCTE1_CNTS-L_C: X counts	XX	DCTE1_CNTS-L_C
#15	DCTE1_CNTS-L_D: X counts	XX	DCTE1_CNTS-L_D
#16	DCTU1_CNTS-L_A: X counts	XX	DCTU1_CNTS-L_A
#17	DCTU1_CNTS-L_B: X counts	XX	DCTU1_CNTS-L_B
#18	DCTU1_CNTS-L_C: X counts	XX	DCTU1_CNTS-L_C
#19	DCTU1_CNTS-L_D: X counts	XX	DCTU1_CNTS-L_D
#20	DCTE2_CNTS-R_A: X sec	XX	DCTE2_CNTS-R_A
#21	DCTE2_CNTS-R_B: X sec	XX	DCTE2_CNTS-R_B
#22	DCTE2_CNTS-R_C: X sec	XX	DCTE2_CNTS-R_C
#23	DCTE2_CNTS-R_D: X sec	XX	DCTE2_CNTS-R_D
#24	DCTU2_CNTS-R_A: X sec	XX	DCTU2_CNTS-R_A
#25	DCTU2_CNTS-R_B: X sec	XX	DCTU2_CNTS-R_B
#26	DCTU2_CNTS-R_C: X sec	XX	DCTU2_CNTS-R_C
#27	DCTU2_CNTS-R_D: X sec	XX	DCTU2_CNTS-R_D
#28	DCTE2_CNTS-L_A: X sec	XX	DCTE2_CNTS-L_A
#29	DCTE2_CNTS-L_B: X sec	XX	DCTE2_CNTS-L_B
#30	DCTE2_CNTS-L_C: X sec	XX	DCTE2_CNTS-L_C
#31	DCTE2_CNTS-L_D: X sec	XX	DCTE2_CNTS-L_D
#32	DCTU2_CNTS-L_A: X sec	XX	DCTU2_CNTS-L_A
#33	DCTU2_CNTS-L_B: X sec	XX	DCTU2_CNTS-L_B
#34	DCTU2_CNTS-L_C: X sec	XX	DCTU2_CNTS-L_C
#35	DCTU2_CNTS-L_D: X sec	XX	DCTU2_CNTS-L_D
#36	DCTE3_CNTS-R_A: X sec	XX	DCTE3_CNTS-R_A
#37	DCTE3_CNTS-R_B: X sec	XX	DCTE3_CNTS-R_B
#38	DCTE3_CNTS-R_C: X sec	XX	DCTE3_CNTS-R_C
#39	DCTE3_CNTS-R_D: X sec	XX	DCTE3_CNTS-R_D
#40	DCTU3_CNTS-R_A: X sec	XX	DCTU3_CNTS-R_A
#41	DCTU3_CNTS-R_B: X sec	XX	DCTU3_CNTS-R_B
#42	DCTU3_CNTS-R_C: X sec	XX	DCTU3_CNTS-R_C
#43	DCTU3_CNTS-R_D: X sec	XX	DCTU3_CNTS-R_D
#44	DCTE3_CNTS-L_A: X sec	XX	DCTE3_CNTS-L_A
#45	DCTE3_CNTS-L_B: X sec	XX	DCTE3_CNTS-L_B
#46	DCTE3_CNTS-L_C: X sec	XX	DCTE3_CNTS-L_C
#47	DCTE3_CNTS-L_D: X sec	XX	DCTE3_CNTS-L_D
#48	DCTU3_CNTS-L_A: X sec	XX	DCTU3_CNTS-L_A
#49	DCTU3_CNTS-L_B: X sec	XX	DCTU3_CNTS-L_B
#50	DCTU3_CNTS-L_C: X sec	XX	DCTU3_CNTS-L_C
#51	DCTU3_CNTS-L_D: X sec	XX	DCTU3_CNTS-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support DCTE1_CNTS/DCTU1_CNTS/DCTE2_CNTS/DCTU2_CNTS/DCTE3_CNTS/DCTU3_CNTS data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 48 bytes of data.

If an ECU does not support INFOTYPE $23, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.35 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $24 (EWU_TIME/TWU_TIME) if Active Engine Warm-up Timer/Active Transmission Warm-up Timer is supported.

Table 149 - 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: 24 - EWU_TIME/TWU_TIME	24	INFTYP

Table 150 - 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: 24 - EWU_TIME/TWU_TIME	24	INFTYP
#3	Number of data items: 1	01	NODI
#4	EWU_TIME-R_A: X sec	XX	EWU_TIME-R_A
#5	EWU_TIME-R_B: X sec	XX	EWU_TIME-R_B
#6	EWU_TIME-R_C: X sec	XX	EWU_TIME-R_C
#7	EWU_TIME-R_D: X sec	XX	EWU_TIME-R_D
#8	EWU_TIME-L_A: X sec	XX	EWU_TIME-L_A
#9	EWU_TIME-L_B: X sec	XX	EWU_TIME-L_B
#10	EWU_TIME-L_C: X sec	XX	EWU_TIME-L_C
#11	EWU_TIME-L_D: X sec	XX	EWU_TIME-L_D
#12	TWU_TIME-R_A: X sec	XX	TWU_TIME-R_A
#13	TWU_TIME-R_B: X sec	XX	TWU_TIME-R_B
#14	TWU_TIME-R_C: X sec	XX	TWU_TIME-R_C
#15	TWU_TIME-R_D: X sec	XX	TWU_TIME-R_D
#16	TWU_TIME-L_A: X sec	XX	TWU_TIME-L_A
#17	TWU_TIME-L_B: X sec	XX	TWU_TIME-L_B
#18	TWU_TIME-L_C: X sec	XX	TWU_TIME-L_C
#19	TWU_TIME-L_D: X sec	XX	TWU_TIME-L_D

Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support EWU_TIME/TWU_TIME data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $24, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.36 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $25 (OCCT1_TIME1/OCCT1_TIME2) if Active Off-Cycle Credit Technology #1 Timer 1/Active Off-Cycle Credit Technology #1 Timer 2 is supported.

Table 151 - 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: 25 - OCCT1_TIME1/OCCT1_TIME2	25	INFTYP

Table 152 - 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: 25 - OCCT1_TIME1/OCCT1_TIME2	25	INFTYP
#3	Number of data items: 1	01	NODI
#4	OCCT1_TIME1-R_A: X sec	XX	OCCT1_TIME1-R_A
#5	OCCT1_TIME1-R_B: X sec	XX	OCCT1_TIME1-R_B
#6	OCCT1_TIME1-R_C: X sec	XX	OCCT1_TIME1-R_C
#7	OCCT1_TIME1-R_D: X sec	XX	OCCT1_TIME1-R_D
#8	OCCT1_TIME2-R_A: X sec	XX	OCCT1_TIME2-R_A
#9	OCCT1_TIME2-R_B: X sec	XX	OCCT1_TIME2-R_B
#10	OCCT1_TIME2-R_C: X sec	XX	OCCT1_TIME2-R_C
#11	OCCT1_TIME2-R_D: X sec	XX	OCCT1_TIME2-R_D
#12	OCCT1_TIME1-L_A: X sec	XX	OCCT1_TIME1-L_A
#13	OCCT1_TIME1-L_B: X sec	XX	OCCT1_TIME1-L_B
#14	OCCT1_TIME1-L_C: X sec	XX	OCCT1_TIME1-L_C
#15	OCCT1_TIME1-L_D: X sec	XX	OCCT1_TIME1-L_D
#16	OCCT1_TIME2-L_A: X sec	XX	OCCT1_TIME2-L_A
#17	OCCT1_TIME2-L_B: X sec	XX	OCCT1_TIME2-L_B
#18	OCCT1_TIME2-L_C: X sec	XX	OCCT1_TIME2-L_C
#19	OCCT1_TIME2-L_D: X sec	XX	OCCT1_TIME2-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support OCCT1_TIME1/OCCT1_TIME2 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $25, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.37 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $26 (OCCT2_TIME1/OCCT2_TIME2) if Active Off-Cycle Credit Technology #2 Timer 1/Active Off-Cycle Credit Technology #2 Timer 2 is supported.

Table 153 - 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: 26 - OCCT2_TIME1/OCCT2_TIME2	26	INFTYP

Table 154 - 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: 26 - OCCT2_TIME1/OCCT2_TIME2	26	INFTYP
#3	Number of data items: 1	01	NODI
#4	OCCT2_TIME1-R_A: X sec	XX	OCCT2_TIME1-R_A
#5	OCCT2_TIME1-R_B: X sec	XX	OCCT2_TIME1-R_B
#6	OCCT2_TIME1-R_C: X sec	XX	OCCT2_TIME1-R_C
#7	OCCT2_TIME1-R_D: X sec	XX	OCCT2_TIME1-R_D
#8	OCCT2_TIME2-R_A: X sec	XX	OCCT2_TIME2-R_A
#9	OCCT2_TIME2-R_B: X sec	XX	OCCT2_TIME2-R_B
#10	OCCT2_TIME2-R_C: X sec	XX	OCCT2_TIME2-R_C
#11	OCCT2_TIME2-R_D: X sec	XX	OCCT2_TIME2-R_D
#12	OCCT2_TIME1-L_A: X sec	XX	OCCT2_TIME1-L_A
#13	OCCT2_TIME1-L_B: X sec	XX	OCCT2_TIME1-L_B
#14	OCCT2_TIME1-L_C: X sec	XX	OCCT2_TIME1-L_C
#15	OCCT2_TIME1-L_D: X sec	XX	OCCT2_TIME1-L_D
#16	OCCT2_TIME2-L_A: X sec	XX	OCCT2_TIME2-L_A
#17	OCCT2_TIME2-L_B: X sec	XX	OCCT2_TIME2-L_B
#18	OCCT2_TIME2-L_C: X sec	XX	OCCT2_TIME2-L_C
#19	OCCT2_TIME2-L_D: X sec	XX	OCCT2_TIME2-L_D

Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support OCCT2_TIME1/OCCT2_TIME2 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $26, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.38 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $27 (OCCT3_TIME1/OCCT3_TIME2) if Active Off-Cycle Credit Technology #3 Timer 1/Active Off-Cycle Credit Technology #3 Timer 2 is supported.

Table 155 - 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: 27 - OCCT3_TIME1/OCCT3_TIME2	27	INFTYP

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Table 156 - 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: 27 - OCCT3_TIME1/OCCT3_TIME2	27	INFTYP
#3	Number of data items: 1	01	NODI
#4	OCCT3_TIME1-R_A: X sec	XX	OCCT3_TIME1-R_A
#5	OCCT3_TIME1-R_B: X sec	XX	OCCT3_TIME1-R_B
#6	OCCT3_TIME1-R_C: X sec	XX	OCCT3_TIME1-R_C
#7	OCCT3_TIME1-R_D: X sec	XX	OCCT3_TIME1-R_D
#8	OCCT3_TIME2-R_A: X sec	XX	OCCT3_TIME2-R_A
#9	OCCT3_TIME2-R_B: X sec	XX	OCCT3_TIME2-R_B
#10	OCCT3_TIME2-R_C: X sec	XX	OCCT3_TIME2-R_C
#11	OCCT3_TIME2-R_D: X sec	XX	OCCT3_TIME2-R_D
#12	OCCT3_TIME1-L_A: X sec	XX	OCCT3_TIME1-L_A
#13	OCCT3_TIME1-L_B: X sec	XX	OCCT3_TIME1-L_B
#14	OCCT3_TIME1-L_C: X sec	XX	OCCT3_TIME1-L_C
#15	OCCT3_TIME1-L_D: X sec	XX	OCCT3_TIME1-L_D
#16	OCCT3_TIME2-L_A: X sec	XX	OCCT3_TIME2-L_A
#17	OCCT3_TIME2-L_B: X sec	XX	OCCT3_TIME2-L_B
#18	OCCT3_TIME2-L_C: X sec	XX	OCCT3_TIME2-L_C
#19	OCCT3_TIME2-L_D: X sec	XX	OCCT3_TIME2-L_D

Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support OCCT3_TIME1/OCCT3_TIME2 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $27, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.39 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $28 (OCCT4_TIME1/OCCT4_TIME2) if Active Off-Cycle Credit Technology #4 Timer 1/Active Off-Cycle Credit Technology #4 Timer 2 is supported.

Table 157 - 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: 28 - OCCT4_TIME1/OCCT4_TIME2	28	INFTYP

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Table 158 - 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: 28 - OCCT4_TIME1/OCCT4_TIME2	28	INFTYP
#3	Number of data items: 1	01	NODI
#4	OCCT4_TIME1-R_A: X sec	XX	OCCT4_TIME1-R_A
#5	OCCT4_TIME1-R_B: X sec	XX	OCCT4_TIME1-R_B
#6	OCCT4_TIME1-R_C: X sec	XX	OCCT4_TIME1-R_C
#7	OCCT4_TIME1-R_D: X sec	XX	OCCT4_TIME1-R_D
#8	OCCT4_TIME2-R_A: X sec	XX	OCCT4_TIME2-R_A
#9	OCCT4_TIME2-R_B: X sec	XX	OCCT4_TIME2-R_B
#10	OCCT4_TIME2-R_C: X sec	XX	OCCT4_TIME2-R_C
#11	OCCT4_TIME2-R_D: X sec	XX	OCCT4_TIME2-R_D
#12	OCCT4_TIME1-L_A: X sec	XX	OCCT4_TIME1-L_A
#13	OCCT4_TIME1-L_B: X sec	XX	OCCT4_TIME1-L_B
#14	OCCT4_TIME1-L_C: X sec	XX	OCCT4_TIME1-L_C
#15	OCCT4_TIME1-L_D: X sec	XX	OCCT4_TIME1-L_D
#16	OCCT4_TIME2-L_A: X sec	XX	OCCT4_TIME2-L_A
#17	OCCT4_TIME2-L_B: X sec	XX	OCCT4_TIME2-L_B
#18	OCCT4_TIME2-L_C: X sec	XX	OCCT4_TIME2-L_C
#19	OCCT4_TIME2-L_D: X sec	XX	OCCT4_TIME2-L_D

Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support OCCT4_TIME1/OCCT4_TIME2 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $28, no response is allowed for ISO 15765-4.

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

Procedure:

5.17.40 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $29 (OCCT5_TIME1/OCCT5_TIME2) if Active Off-Cycle Credit Technology #5 Timer 1/Active Off-Cycle Credit Technology #5 Timer 2 is supported.

Table 159 - 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: 29 - OCCT5_TIME1/OCCT5_TIME2	29	INFTYP

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Table 160 - 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: 29 - OCCT5_TIME1/OCCT5_TIME2	29	INFTYP
#3	Number of data items: 1	01	NODI
#4	OCCT5_TIME1-R_A: X sec	XX	OCCT5_TIME1-R_A
#5	OCCT5_TIME1-R_B: X sec	XX	OCCT5_TIME1-R_B
#6	OCCT5_TIME1-R_C: X sec	XX	OCCT5_TIME1-R_C
#7	OCCT5_TIME1-R_D: X sec	XX	OCCT5_TIME1-R_D
#8	OCCT5_TIME2-R_A: X sec	XX	OCCT5_TIME2-R_A
#9	OCCT5_TIME2-R_B: X sec	XX	OCCT5_TIME2-R_B
#10	OCCT5_TIME2-R_C: X sec	XX	OCCT5_TIME2-R_C
#11	OCCT5_TIME2-R_D: X sec	XX	OCCT5_TIME2-R_D
#12	OCCT5_TIME1-L_A: X sec	XX	OCCT5_TIME1-L_A
#13	OCCT5_TIME1-L_B: X sec	XX	OCCT5_TIME1-L_B
#14	OCCT5_TIME1-L_C: X sec	XX	OCCT5_TIME1-L_C
#15	OCCT5_TIME1-L_D: X sec	XX	OCCT5_TIME1-L_D
#16	OCCT5_TIME2-L_A: X sec	XX	OCCT5_TIME2-L_A
#17	OCCT5_TIME2-L_B: X sec	XX	OCCT5_TIME2-L_B
#18	OCCT5_TIME2-L_C: X sec	XX	OCCT5_TIME2-L_C
#19	OCCT5_TIME2-L_D: X sec	XX	OCCT5_TIME2-L_D

Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles may support OCCT5_TIME1/OCCT5_TIME2 data using a 30/60/100% phase-in. Lack of support shall not be flagged as a warning or failure.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $29, no response is allowed for ISO 15765-4.

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

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 161 - 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

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Table 162 - 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 5.10.1.

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

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

Table 163 - 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

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Table 164 - 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 except PID support PIDs in reverse order ($FF through $01), even if not supported, to ensure ECU can respond properly to unsupported PIDs and does not terminate communication. For ISO 15765-4 protocol only, request the last 6 supported PIDs in reverse order as a group using a single message. At least one PID from each ECU shall be selected.

Table 165 - 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 166 - 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 5.10.1 must be supported.

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

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

Evaluation criteria:

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

5.19 Verify Service $01 Idle Message Timing

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

Procedure:

5.19.1 [ISO 9141-2, SAE J1850, and ISO 14230-4 protocols only] Transmit the Service $01 PID $00 request at the maximum allowed time interval (4900 ms) for 15 seconds (three requests).

Table 167 - Request current powertrain diagnostic data request message for all protocols

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

Table 168 - 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 from every emission-related ECU for every request. If all responses are not received, this will be flagged as a failure.

5.20 Verify Service $01 Burst Message Timing

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

Procedure:

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

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

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

Table 169 - 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 170 - 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 and that the data link remains initialized.

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

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

5.21 Verify Reserved/Unused Services, Engine Running

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

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

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

Table 171 - Request emission-related diagnostic trouble codes with permanent status

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

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Evaluation criteria:

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

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

Evaluation criteria:

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

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

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

6.1 Induce Circuit Fault

Procedure:

6.1.1 With ignition off and engine off, disconnect a sensor that is tested continuously (e.g., ECT, TP, IAT, MAF, etc.) but will not prevent the engine from starting; 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. If disconnecting the sensor causes starting issues, the engine can be started and then the sensor can be disconnected. The selected fault must illuminate the MIL using two (for OBD-II) or three (for EOBD/IOBD/OBDBr) 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 or propulsion system active for Hybrid/PHEV, 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.

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

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

Protocol determination procedure:

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

SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 15765-4 - 11-bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)

Check battery voltage at the SAE J1962 connector pin 16.

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

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Table 172 - 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 173 - 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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

6.3 Verify Service $07 - Request Pending Emission-Related DTCs, Engine Off

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 second, 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 174 - 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

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Table 175 - 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 176 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for SAE J1850, ISO 9141-2, and ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2 #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			

Evaluation criteria:

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

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

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

- For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.
- For ISO 14230-4 interfaces, the ECU shall respond with a report containing no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).
- For ISO 15765-4 interfaces, the ECU will respond with a message containing no DTCs and indicating no DTCs by setting the parameter # of DTC to $00.

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

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6.4 Verify Service $03 - Request Emission-Related DTCs, Engine Running

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

Procedure:

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

Table 177 - 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 178 - 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 179 - Request emission-related diagnostic trouble codes response message for ISO 14230-4

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

Evaluation criteria:

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

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

- For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.
- For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).
- For ISO 15765-4 interfaces, the ECU will respond with a message containing no DTCs and indicating no DTCs by setting the parameter # of DTC to $00.

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

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Procedure:

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

Table 180 - 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 181 - ECU# x response: Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

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

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

Procedure:

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

Table 182 - 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

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Table 183 - Request powertrain freeze frame data response message

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

Evaluation criteria:

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

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

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

Procedure:

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

Table 184 - 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 185 - 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 an ECU has a freeze frame DTC, but does not support Service $02, PID $00, Frame $00, this shall be flagged as a failure.

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

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

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

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

Procedure:

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

Table 186 - 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 187 - 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 #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

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Evaluation criteria:

Each ECU that has a freeze frame DTC must report the same supported PIDs for single and group request messages.

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

Table 188 - 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 189 - 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.

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

Table 190 - 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 191 - 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 that has a freeze frame DTC must respond with the same data value for each PID for single PID requests and group PID requests.

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

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

Evaluation criteria:

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

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6.6 Continue to Induce Circuit Fault (EOBD/IOBD/OBDBr Only)

Purpose: EOBD/IOBD/OBDBr allows three driving cycles to set a confirmed DTC versus two driving cycles for OBD-II.

Procedure:

6.6.1 For OBD-II, skip to Section 7. For EOBD/IOBD/OBDBr, continue to 6.6.2 for second driving cycle. Go to Section 7 for third driving cycle.

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

6.6.3 Start engine or propulsion system active for Hybrid/PHEV, let idle for one minute or whatever time it takes to set a pending. Note: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position.

6.6.4 Continue to Section 7.

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

7.1 Continue to Induce Circuit Fault

Procedure:

7.1.1 Turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU. Keep sensor disconnected. If disconnecting the sensor causes starting issues, the engine can be started and then the sensor can be disconnected.

7.1.2 Start engine or propulsion system active for Hybrid/PHEV, 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.

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

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

Protocol determination procedure:

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

SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 11 bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)

Check battery voltage at the SAE J1962 connector pin 16.

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

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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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

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 second, 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).

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Table 194 - 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 195 - 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 #4	DTC High Byte of PXXXX DTC Low Byte of PXXXX	XX XX	DTC1HI DTC1LO

Table 196 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for SAE J1850, ISO 9141-2, and ISO 14230-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2 #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 197 - 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

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Evaluation criteria:

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

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

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

- For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.
- For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).
- For ISO 15765-4 interfaces, the ECU will respond with a message containing no DTCs and indicating no DTCs by setting the parameter # of DTC to $00.

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

7.4 Verify Service $03 - Request Emission-Related DTCs, Engine Running

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

Procedure:

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

Table 198 - 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 199 - 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 200 - Request emission-related diagnostic trouble codes response message for SAE J1850, ISO 9141-2, and ISO 14230-4

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

Table 201 - 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

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Table 202 - Request emission-related diagnostic trouble codes response message for ISO 14230-4

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

Evaluation criteria:

Verify that at least one Service $03 DTC response with a non-zero DTC is received (all protocols).

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

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

- For SAE J1850 and ISO 9141-2 interfaces, no response is preferred, but a positive response message indicating no DTCs is allowed, but not required.
- For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs. (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).
- For ISO 15765-4 interfaces, the ECU will respond with a message containing no DTCs and indicating no DTCs by setting the parameter # of DTC to $00.

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

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

Table 203 - 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 204 - 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	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

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Evaluation criteria:

DATA_A, bits 0-6 must be greater than or equal to one (at least one DTC) and DATA_A bit 7 must be 1 (MIL is on) for at least one ECU.

7.5 Verify Service $02 - Request Powertrain Freeze Frame Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service $02 requests and that at least one ECU contains freeze frame data for a confirmed DTC.

Procedure:

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

Table 205 - 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 206 - Request powertrain freeze frame data response message

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

Evaluation criteria:

Verify that Frame $00, PID $02 is the same as one of the DTCs reported in Service $03 in Section 7 for the vehicle (the set of ECUs) and is the same freeze frame DTC as reported in 6.5.1. There should be at least one DTC stored.

NOTE: The OBD-II regulations allow overwriting an exiting freeze frame with a misfire DTC (P0300 - P0312) or a fuel system DTC (P0170 - P0175); however, it is assumed that this testing will not be performed on a vehicle that will set these faults. A different freeze frame DTC between 6.5.1 and 7.5.1 shall, therefore, be flagged as a failure.

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

Procedure:

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

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Table 207 - 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 208 - 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 an ECU has a freeze frame DTC, but does not support Service $02, PID $00, Frame $00, this shall be flagged as a failure.

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

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

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

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

Procedure:

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

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Table 209 - 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 210 - 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 #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				

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Evaluation criteria:

Each ECU that has a freeze frame DTC must report the same supported PIDs for single and group request messages.

[For all protocols] For all PIDs supported by the vehicle (PIDs $01-$1F, $21-$3F, $41-$5F, $61-$7F, $81-$9F, $A1-$BF, $C1-$DF, $E1-$FF), as determined in 7.5.2, send the corresponding Service $02 Frame $00 PID request message and note the response for each ECU.

Table 211 - 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 212 - 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
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.

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

Table 213 - 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				

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Table 214 - 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 that has a freeze frame DTC must respond with the same data value for each PID for single PID requests and group PID requests.

7.5.5 [For all protocols] Request next unsupported PID-support PID ($20, $40, $60, $80, $A0, $C0, or $E0) for all ECUs (if available as determined in 7.5.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

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

Evaluation criteria:

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

8. TEST VEHICLE WITH FAULT REPAIRED

8.1 Repair Circuit Fault and Complete One Driving Cycle, MIL Illuminated

Procedure:

8.1.1 Turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU, connect sensor.

8.1.2 Start engine or propulsion system active for Hybrid/PHEV, 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.

8.1.3 Turn ignition off (engine off) for 30 seconds. (This completes one driving cycle with no fault.)

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8.1.4 Start engine or propulsion system active for Hybrid/PHEV, 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. (This starts the second driving cycle; however, second driving cycle will not be complete until key is turned off.)

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

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

Protocol determination procedure:

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

SAE J1850 10.4 kbps VPW
SAE J1850 41.6 kbps PWM
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 11 bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 215 - Request current powertrain diagnostic data request message for all protocols

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

Table 216 - 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.

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

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 second, 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 217 - 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 218 - 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 219 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4

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

Evaluation criteria:

Verify that no Service $07 pending DTC is set.

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

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

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

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

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

8.4 Verify Service $03 - Request Emission-Related DTCs, Engine Running

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

Procedure:

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

Table 220 - 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 221 - 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 222 - Request emission-related diagnostic trouble codes response message for SAE J1850, ISO 9141-2, and ISO 14230-4

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

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Table 223 - 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 224 - Request emission-related diagnostic trouble codes response message for ISO 14230-4

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

Evaluation criteria:

Verify that at least one Service $03 DTC response with a non-zero DTC is received.

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

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

- For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.
- For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).
- For ISO 15765-4 interfaces, the ECU will respond with a message containing no DTCs and indicating no DTCs by setting the parameter # of DTC to $00.

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

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

Table 225 - 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

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Table 226 - ECU# x response: Request current powertrain diagnostic data response message

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

Evaluation criteria:

DATA_A, bits 0-6 must be greater than or equal to one (at least one DTC) and DATA_A bit 7 must be 1 (MIL is on) for at least one ECU.

8.5 Verify Service $02 - Request Powertrain Freeze Frame Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service $02 requests when there is no DTC stored, that freeze frame data is retained in the ECU while a confirmed DTC is present.

Procedure:

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

Table 227 - 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 228 - Request powertrain freeze frame data response message

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

Evaluation criteria:

Verify that Frame $00, PID $02 is the same as one of the DTCs reported in Service $03 in Section 7 for the vehicle (the set of ECUs). There should be at least one DTC stored.

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

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Procedure:

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

Table 229 - 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 230 - 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 #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
C1 = Conditional — “DATA_B - D” depend on selected PID				

8.5.3 Evaluation Criteria

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

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

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

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

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

Procedure:

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

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Table 231 - 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 232 - 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 #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				

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Evaluation criteria:

Each ECU that has a freeze frame DTC must report the same supported PIDs for single and group request messages.

8.5.5 [For all protocols] For all PIDs supported by the vehicle (PIDs $01-$1F, $21-$3F, $41-$5F, $61-$7F, $81-$9F, $A1-$BF, $C1-$DF, $E1-$FF), as determined in 8.5.2, send the corresponding Service $02 Frame $00 PID request message and note the response for each ECU.

Table 233 - 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 234 - 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
C1 = Conditional — “DATA_B - D” depend on selected PID				

Evaluation criteria:

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

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

- For SAE J1850 and ISO 9141-2, no response is preferred, but a positive response is allowed.
- For ISO 15765-4, the ECU shall not respond.
- For ISO 14230-4, no response is preferred, but a negative response message ($7F, $12) is allowed.

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

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

Table 235 - 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				

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Table 236 - 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 that has a freeze frame DTC must respond with the same data value for each PID for single PID requests and group PID requests.

8.5.7 [For all protocols] Request next unsupported PID-support PID ($20, $40, $60, $80, $A0, $C0, or $E0) for all ECUs (if available as determined in 8.4.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

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

Evaluation criteria:

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

8.6 Verify Service $0A - Request Permanent Emission-Related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service $0A request and to verify that there is at least one permanent DTCs stored during the previous driving cycle.

Procedure:

8.6.1 [For ISO 15765-4 protocol only] Transmit a Service $0A request message.

Table 237 - Request emission-related diagnostic trouble codes with permanent status

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

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Table 238 - Request emission-related diagnostic trouble codes with permanent status response message for ISO 15765-4

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

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message containing no DTCs and indicating no DTCs are stored by setting the parameter # of DTC to $00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported for OBD-II by all emission-related ECUs that also support Service $03 or Service $07 for the 2010 MY and beyond or this shall be flagged as a failure; however, if the vehicle is a 2010 to 2012 MY vehicle that does not support permanent codes, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

Permanent codes are not required for EOBD/IOBD/OBDBr. If an EOBD/IOBD/OBDBr vehicle does not support permanent codes, do not log a failure. If an EOBD/IOBD/OBDBr vehicle does support permanent codes, they will be tested for correct behavior.

For OBD-II ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match. For 2009 MY and earlier, if all responses are received with #OFDTC set to $00, this shall be flagged as a warning, for 2010 MY and beyond, this shall be flagged as a failure (e.g., TCM supports Service $0A, but ECM with the induced fault does not support Service $0A). If the vehicle is a 2010 to 2012 MY vehicle where all emission-related ECUs do not support permanent codes, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

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9. TEST VEHICLE WITH NO FAULTS AFTER THREE OR FOUR DRIVING CYCLES COMPLETED

9.1 Complete Two or More Additional Driving Cycles

Procedure:

9.1.1 Turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU. (This completes two driving cycles with no fault.)

9.1.2 Start engine or propulsion system active for Hybrid/PHEV, 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. (This starts third driving cycle; however, third driving cycle will not be completed until key is turned off.)

9.1.3 Turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU. (This completes three driving cycles with no fault.)

9.1.4 Start engine or propulsion system active for Hybrid/PHEV, 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. (This starts third driving cycle; however, third driving cycle will not be completed until key is turned off. (This initiates the fourth driving cycle, MIL may now be off, but it is not a failure if MIL stays illuminated. Additional driving cycles for EOBD/IOBD/OBDBr may be performed until the MIL is off.)

9.1.5 If the MIL is off, continue to 9.2; otherwise, turn ignition off (engine off) for 30 seconds or longer, as appropriate for the ECU. (This completes an additional driving cycles with no fault.)

9.1.6 Start engine or propulsion system active for Hybrid/PHEV, let idle for 1 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 MIL should now be off. Additional driving cycles may be performed until the MIL is off.)

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

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

Protocol determination procedure:

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

ISO 15765-4 - 11-bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)
SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2(wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 239 - 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

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Table 240 - 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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

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 241 - 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 242 - 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

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Table 243 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4

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

Evaluation criteria:

Verify that no Service $07 pending DTC is set.

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

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

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

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

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

9.4 Verify Service $03 - Request Emission-Related DTCs, Engine Running

Purpose: To verify that a proper response indicated at least one stored DTCs is received and to verify that the MIL is now off.

Procedure:

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

Table 244 - 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

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Table 245 - 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 246 - Request emission-related diagnostic trouble codes response message for SAE J1850, ISO 9141-2, and ISO 14230-4

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

Table 247 - 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 248 - 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.

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

- For SAE J1850 and ISO 9141-2 interfaces, if an ECU has no DTCs to report, a positive response message indicating no DTCs is allowed, but not required.
- For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).
- For ISO 15765-4 interfaces, the ECU will respond with a message containing no DTCs and indicating no DTCs by setting the parameter # of DTC to $00.

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

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

Table 249 - 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 250 - ECU# x response: Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

Procedure:

9.4.3 Record MIL status (DATA_A bit 7) in vehicle log file - MIL must not be illuminated or this will be flagged as a failure.

9.5 Verify Service $02 - Request Powertrain Freeze Frame Data, Engine Running

Purpose: To verify that all ECUs respond correctly to Service $02 requests and that freeze frame data is retained in the ECU after the MIL is extinguished and the confirmed DTC is still present for 40 warm-up cycles.

Procedure:

9.5.1 [For all protocols] Transmit Service $02 PID $02 Frame $00 to read freeze frame DTCs. Freeze frame must be retained in at least one ECU after MIL is extinguished.

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Table 251 - 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 252 - Request powertrain freeze frame data response message

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

Evaluation criteria:

Verify that Frame $00, PID $02 is the same as one of the DTCs reported in Service $03 from Section 7 for the vehicle (the set of ECUs). There should be at least one DTC stored.

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

Procedure:

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

Table 253 - 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 254 - 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				

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Evaluation criteria:

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

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

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

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

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

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

Table 255 - 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				

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Table 256 - 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 that has a freeze frame DTC must report the same supported PIDs for single and group request messages.

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

Table 257 - 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 258 - 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

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Evaluation criteria:

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

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

- For SAE J1850 and ISO 9141-2, no response is preferred, but a positive response is allowed.
- For ISO 15765-4, the ECU shall not respond.
- For ISO 14230-4, no response is preferred, but a negative response message ($7F, $12) is allowed.

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

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

Table 259 - 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 260 - 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				

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Evaluation criteria:

Each ECU that has a freeze frame DTC must respond with the same data value for each PID for single PID requests and group PID requests.

9.5.6 [For all protocols] Request next unsupported PID-support PID ($20, $40, $60, $80, $A0, $C0, or $E0) for all ECUs (if available as determined in 9.5.2) to ensure ECU can respond properly to unsupported PID and does not terminate communication (single request).

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

Evaluation criteria:

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

9.6 Verify Service $0A - Request Permanent Emission-Related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service $0A request and to verify that the permanent code was erased on the same driving cycle as the MIL was extinguished.

Procedure:

9.6.1 [For ISO 15765-4 protocol only] Transmit a Service $0A request message. Verify that a proper response is received with DTC count set to zero and no DTCs.

Table 261 - Request emission-related diagnostic trouble codes with permanent status

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

Table 262 - Request emission-related diagnostic trouble codes with permanent status response message for ISO 15765-4

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

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message containing no DTCs and indicating no DTCs are stored by setting the parameter # of DTC to $00.

ECUs that do not support permanent codes shall not respond.

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Permanent codes must be supported for OBD-II by all emission-related ECUs that also support Service $03 or Service $07 for the 2010 MY and beyond or this shall be flagged as a failure; however, if the vehicle is a 2010 to 2012 MY vehicle that does not support permanent codes, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

Permanent codes are not required for EOBD/IOBD/OBDBr. If an EOBD/IOBD/OBDBr vehicle does not support permanent codes, do not log a failure. If an EOBD/IOBD/OBDBr vehicle does support permanent codes, they will be tested for correct behavior.

9.7 Complete Static Test or Continue to Permanent Code Drive Cycle

Purpose: To allow bypass of additional permanent DTC tests and Permanent Code drive cycle.

Procedure:

9.7.1 If Service $0A was supported by at least one ECU in prior tests 5.21, 8.6, and 9.6, prompt the user to run the CARB drive cycle Portion for Permanent DTCs. If the answer is "Yes," then continue to 9.8. If the answer is "No," then skip to 9.22.2. If Service $0A is supported and the user decides to bypass the CARB drive cycle, this shall be flagged as a warning that the Permanent Code Drive Cycle was not tested.

9.7.2 If Service $0A was not supported by at least one ECU in prior tests 5.21, 8.6, and 9.6, prompt user whether to clear codes or exit Section 9. If the user wants to exit, continue to 9.23.6. If the user wants to clear codes with the engine off, continue to 9.23.1. If the user wants to clear codes with the engine running continue to 9.23.5. If no ECUs support Service $0A, this shall be flagged as a warning that the Permanent Code Drive Cycle could not be run because there were no Service $0A responses during static test.

9.8 Induce Circuit Fault to Set Pending, and Confirmed DTC

Procedure:

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

9.8.2 Start engine or propulsion system active for Hybrid/PHEV, let idle for 1 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.

9.8.3 Turn ignition off (engine off) for 30 seconds. Keep sensor disconnected.

9.8.4 Start engine or propulsion system active for Hybrid/PHEV, 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.

9.8.5 Turn ignition off (engine off) for 30 seconds. Keep sensor disconnected.

9.8.6 (For EOBD/IOBD/OBDBr only; EOBD/IOBD/OBDBr may require an additional driving cycle to set confirmed DTC.) If required, start engine or propulsion system active for Hybrid/PHEV, 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.

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9.8.7 Turn ignition off (engine off) for 30 seconds. Keep sensor disconnected.

9.8.8 This completes the driving cycle and allows the permanent code to be set. Connect scan tool to the SAE J1962 connector.

9.8.9 Turn ignition on. Do not crank engine.

9.9 Establish Communication (SAE J1978/ISO 15031-4), Engine Off

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

Protocol determination procedure:

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

ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 11 bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)
SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 263 - 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 264 - 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

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Evaluation criteria:

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

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

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

9.10 Verify Service $03 - Request Emission-Related DTCs, Engine Off

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

Procedure:

9.10.1 [For ISO 15765-4 and ISO 14320-4 protocols] Transmit Service $03 request message. Verify that a proper response is received.

Table 265 - 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 266 - Request emission-related diagnostic trouble codes response message for ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

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

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

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

- For ISO 14230-4 interfaces, the ECU shall respond with a message indicating no DTCs (DTC#1, DTC#2, and DTC#3 shall be all set to $0000).
- For ISO 15765-4 interfaces, the ECU will respond with a message containing no DTCs and indicating no DTCs by setting the parameter # of DTC to $00.

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

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9.11 Verify Service $0A - Request Permanent Emission-Related DTCs, Engine Off

Purpose: To verify that all ECUs respond correctly to a Service $0A request and to verify that there is at least one permanent DTCs stored during the previous driving cycle.

Procedure:

9.11.1 [For ISO 15765-4 protocol only] Transmit a Service $0A request message.

Table 267 - Request emission-related diagnostic trouble codes with permanent status

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

Table 268 - Request emission-related diagnostic trouble codes with permanent status response message for ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message containing no DTCs and indicating no DTCs are stored by setting the parameter # of DTC to $00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported for OBD-II by all emission-related ECUs that also support Service $03 or Service $07 for the 2010 MY and beyond or this shall be flagged as a failure; however, if the vehicle is a 2010 to 2012 MY vehicle that does not support permanent codes or permanent codes for all emission-related ECUs, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

Permanent codes are not required for EOBD/IOBD/OBDBr. If an EOBD/IOBD/OBDBr vehicle does not support permanent codes, do not log a failure. If an EOBD/IOBD/OBDBr vehicle does support permanent codes, they will be tested for correct behavior.

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9.12 Repair Circuit Fault

Purpose: To verify that, with the ignition on and engine off, all ECUs provide the correct response to a Service $04 request and that DTCs and the MIL status bit are cleared and permanent DTCs do not clear.

Procedure:

9.12.1 Turn ignition off (engine off) for 30 seconds.

9.12.2 Connect sensor.

9.12.3 Turn ignition on. Do not crank engine.

9.13 Establish Communication (SAE J1978/ISO 15031-4), and Clear DTCs, Engine Off

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

Protocol determination procedure:

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

SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 11 bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)

Check battery voltage at the SAE J1962 connector pin 16.

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

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Table 269 - 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 270 - 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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

9.13.2 [ISO 15765-4 protocol] Transmit Service $04 request message and observe response message.

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

Table 271 - 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 272 - Clear/reset emission-related diagnostic information response message

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

Evaluation criteria:

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

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

9.14 Verify MIL Status Bit, Engine Off

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

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

Procedure:

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

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Table 273 - 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 274 - ECU#1 response: Request current powertrain diagnostic data response message

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

Evaluation criteria:

Each OBD ECU that responds with Service $01, PID $01 must respond with messages as shown in the response table above, where DATA_A bits 0 through 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.

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

9.15 Verify Service $0A - Request Permanent Emission-Related DTCs, Engine Off

Purpose: To verify that all ECUs respond correctly to a Service $0A request and to verify that there is at least one permanent DTC still stored after DTCs were cleared.

Procedure:

9.15.1 [For ISO 15765-4 protocol only] Transmit a Service $0A request message.

Table 275 - Request emission-related diagnostic trouble codes with permanent status

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

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Table 276 - Request emission-related diagnostic trouble codes with permanent status response message for ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message containing no DTCs and indicating no DTCs are stored by setting the parameter # of DTC to $00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported for OBD-II by all emission-related ECUs that also support Service $03 or Service $07 for the 2010 MY and beyond or this shall be flagged as a failure; however, if the vehicle is a 2010 to 2012 MY vehicle that does not support permanent codes or permanent codes for all emission-related ECUs, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

Permanent codes are not required for EOBD/IOBD/OBDBr. If an EOBD/IOBD/OBDBr vehicle does not support permanent codes, do not log a failure. If an EOBD/IOBD/OBDBr vehicle does support permanent codes, they will be tested for correct behavior.

9.16 Complete One Driving Cycle with Fault Repaired

Procedure:

9.16.1 Start engine or propulsion system active for Hybrid/PHEV, let idle for one minute or whatever time it takes to run monitor and detect that there is no malfunction. (Monitor may have already run with engine off.) Note: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position.

9.16.2 Turn ignition off (engine off) for 30 seconds. (This completes one driving cycle with no fault.)

9.16.3 Start engine or propulsion system active for Hybrid/PHEV. Prompt operator to remain at idle until prompted to start permanent code drive cycle in 9.19.

9.16.4 Continue to idle for 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. (This starts the second driving cycle; however, second driving cycle will not be complete until key is turned off.)

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9.17 Establish Communication (SAE J1978/ISO 15031-4) and Request Vehicle Information, Engine Running

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

Protocol determination procedure:

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

ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 11 bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)
SAE J1850 10.4 kbps VPW
SAE J1850 41.6 kbps PWM
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 277 - 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 278 - 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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

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9.18 Verify Service $0A - Request Permanent Emission-Related DTCs, Engine Running

Purpose: To verify that all ECUs respond correctly to a Service $0A request and to verify that there is at least one permanent DTC stored after DTCs were cleared and a short driving cycle was completed.

Procedure:

9.18.1 [For ISO 15765-4 protocol only] Transmit a Service $0A request message.

Table 279 - Request emission-related diagnostic trouble codes with permanent status

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

Table 280 - Request emission-related diagnostic trouble codes with permanent status response message for ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message containing no DTCs and indicating no DTCs are stored by setting the parameter # of DTC to $00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported for OBD-II by all emission-related ECUs that also support Service $03 or Service $07 for the 2010 MY and beyond or this shall be flagged as a failure; however, if the vehicle is a 2010 to 2012 MY vehicle that does not support permanent codes, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

Permanent codes are not required for EOBD/IOBD/OBDBr. If an EOBD/IOBD/OBDBr vehicle does not support permanent codes, do not log a failure. If an EOBD/IOBD/OBDBr vehicle does support permanent codes, they will be tested for correct behavior.

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9.19 Complete Permanent Code Drive Cycle

Purpose: To allow permanent DTCs to be erased after DTCs are cleared and permanent code driving cycle is complete. Permanent code must be retained until start of next driving cycle.

Procedure:

9.19.1 Drive vehicle according to the following conditions. (The OBD Condition Counter may increment but is not required to increment):

- Continuous idle time ≥30 seconds with vehicle speed ≤1 mph and accelerator pedal released.
- Cumulative time ≥300 seconds with vehicle speed ≥25 mph (40 km/h), or ≥1150 rpm.
- Cumulative time since engine start ≥600 seconds.
- Cumulative fueled engine operation for ≥10 seconds for PHEV vehicles only.

Prompt user to idle for 30 seconds, drive the vehicle at ≥25 mph (40 km/h) for 300 seconds, and continue driving the vehicle in any manner for an additional 270 seconds. Display the status of the OBDCOND counter, the IGNCTR counter, the 30 second “Idle Timer,” the 300 second “25 mph/40 km/h Driving Timer,” and the 600 second “Total Drive Timer.”

NOTE: The software will monitor the following PIDs, if available: $0C (rpm), $0D (VSS), $1F (RUNTM) every 1.0 second to determine vehicle conditions. The software will monitor OBDCOND every 1.0 second. The software will inform user as soon as the drive cycle conditions have been completed and OBDCOND counter has incremented.

NOTE: The software assumes that the engine has been idling for 30 continuous seconds since test 9.16.3 and that this time counts as idle time if the vehicle is currently at idle. If the vehicle is currently moving, the time will be attributed to time spent below 25 mph (engine run time).

The specific denominator requirements vary for light-duty gas and diesel, medium-duty diesel (dyno cert), heavy-duty, EOBD light-duty, and EOBD heavy-duty. They are summarized in Table 360. The vehicle shall be tested according to the type of vehicle as determined by the operator prompts.

9.19.2 Every 1.0 seconds, tool will request permanent DTCs. If the DTC is erased, tool will prompt user that DTC has been erased prematurely and continue to 9.22. Premature erasure of the permanent code shall be logged as a failure.

9.19.3 [For ISO 15765-4 protocol only] Transmit a Service $0A request message.

Table 281 - Request emission-related diagnostic trouble codes with permanent status

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

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Table 282 - Request emission-related diagnostic trouble codes with permanent status response message for ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match. Premature erasure of the permanent code shall be logged as a failure.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message containing no DTCs and indicating no DTCs are stored by setting the parameter # of DTC to $00.

ECUs that do not support permanent codes shall not respond.

9.19.4 [For all protocols] For all supported PIDs $0C, $0D, $1F, send the corresponding Service $01 PID request message and monitor the responses only from the modules that support Service $01, PID $01 (I/M Readiness).

Table 283 - Request current powertrain diagnostic data request message for all protocols

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

Table 284 - 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

Note: If multiple modules support I/M Readiness functionality, utilize only the responses from module that supports Service $09, INFOTYPE $08 or $0B to perform this test. Based on the responses in 5.17.1, utilise INFOTYPE $08 or $0B to get OBDCOND counter data.

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9.19.5 [For all protocols] Transmit Service $09, INFOTYPE = $08 if IPT supported.

Table 285 - 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 286 - 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 or 20 (20 in this example)	10 or 14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B

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Table 287 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFTYP_
#3	MessageCount	M	01 - 10	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				

9.19.6 [For all protocols] Transmit Service $09, INFOTYPE = $0B if IPT supported.

Table 288 - Request vehicle information request message for all protocols

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

Table 289 - Request vehicle information response message (1) for ISO 15765-4

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

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Table 290 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	0B	INFTYP_
#3	MessageCount	M	01 - 09	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 engine has been started. Monitor for RUNTM >0 seconds. If RUNTM is not available, monitor for rpm >450 rpm.

Cumulative engine run time is ≥600 seconds. Monitor for RUNTM >600 seconds. If RUNTM is not available, montor for rpm >450 rpm for >600 seconds.

Cumulative engine run time ≥25 mph (40 km/h) is ≥300 seconds. Monitor for RUNTM increase ≥300 seconds when VSS ≥25 mph (40 km/h). If RUNTM is not available, monitor for rpm >450 rpm and VSS ≥25 mph (40 km/h) for ≥300 seconds.

Continuous time at vehicle speed ≤1 mph is ≥30 seconds. Monitor for RUNTM increase >30 seconds when VSS ≤1 mph. If RUNTM is not available, monitor for rpm >450 rpm and VSS ≤1 mph for ≥30 seconds. (While idle timer is accumulating idle time, reset idle timer to zero if idle conditions are no longer being met and accumulate idle time once again if idle conditions are being met later in the driving cycle.)

The above conditions require that the accelerator pedal is released when the vehicle is stopped.

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

Procedure:

9.19.7 When the software has determined that the driving condition specified above have been met within a time tolerance of ± 20 seconds, the software should stop sending Service $01 and Service $09 requests, prompt the operator to stop the vehicle in a safe location and turn off the ignition, then prompt the operator to continue with the test. This completes the end of the driving cycle.

9.20 Key on, see if permanent DTCs have been erased

Procedure:

9.20.1 Turn ignition on. Start engine or propulsion system active for Hybrid/PHEV.

9.21 Establish Communication (SAE J1978/ISO 15031-4), Engine On

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.

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Protocol determination procedure:

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

ISO 15765-4 - 11 bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)
SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 291 - 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 292 - 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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

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9.22 Verify Service $0A - Request Permanent Emission-Related DTCs, Engine On

Purpose: To verify that all ECUs respond correctly to a Service $0A request and to verify that there are no permanent DTCs stored after completing the CARB driving cycle with no malfunctions present.

Procedure:

9.22.1 [For ISO 15765-4 protocol only] Transmit a Service $0A request message. Verify that a proper response is received with DTC count set to zero and no DTCs.

Table 293 - Request emission-related diagnostic trouble codes with permanent status

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

Table 294 - Request emission-related diagnostic trouble codes with permanent status response message for ISO 15765-4

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

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service $0A permanent DTC response is received. The #OFDTC (DTC count) must be $00 and the message shall contain no DTCs for all the responses.

If an ECU that supports permanent codes has no DTCs to report, the ECU will respond with a message containing no DTCs and indicating no DTCs are stored by setting the parameter # of DTC to $00.

ECUs that do not support permanent codes shall not respond.

Permanent codes must be supported for OBD-II by all emission-related ECUs that also support Service $03 or Service $07 for the 2010 MY and beyond or this shall be flagged as a failure; however, if the vehicle is a 2010 to 2012 MY vehicle that does not support permanent codes or permanent codes for all emission-related ECUs, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply.

Permanent codes are not required for EOBD/IOBD/OBDBr. If an EOBD/IOBD/OBDBr vehicle does not support permanent codes, do not log a failure. If an EOBD/IOBD/OBDBr vehicle does support permanent codes, they will be tested for correct behavior.

Procedure:

9.22.2 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $16 (Engine Run/Idle Time) if Engine Run/Idle Time is supported per test 5.17.1.

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Table 295 - 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: 16 - Engine Run/Idle Time	16	INFTYP

Table 296 - 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: 16 - Engine Run/Idle Time	16	INFTYP
#3	Number of data items: 1	01	NODI
#4	IGNCNTR-R_A: X counts	XX	IGNCNTR-R_A
#5	IGNCNTR-R_B: X counts	XX	IGNCNTR-R_B
#6	IGNCNTR-R_C: X counts	XX	IGNCNTR-R_C
#7	IGNCNTR-R_D: X counts	XX	IGNCNTR-R_D
#8	IGNCNTR-L_A: X counts	XX	IGNCNTR-L_A
#9	IGNCNTR-L_B: X counts	XX	IGNCNTR-L_B
#10	IGNCNTR-L_C: X counts	XX	IGNCNTR-L_C
#11	IGNCNTR-L_D: X counts	XX	IGNCNTR-L_D
#12	FEOCNTR-R_A: X counts	XX	FEOCNTR-R_A
#13	FEOCNTR-R_B: X counts	XX	FEOCNTR-R_B
#14	FEOCNTR-R_C: X counts	XX	FEOCNTR-R_C
#15	FEOCNTR-R_D: X counts	XX	FEOCNTR-R_D
#16	FEOCNTR-L_A: X counts	XX	FEOCNTR-L_A
#17	FEOCNTR-L_B: X counts	XX	FEOCNTR-L_B
#18	FEOCNTR-L_C: X counts	XX	FEOCNTR-L_C
#19	FEOCNTR-L_D: X counts	XX	FEOCNTR-L_D
#20	ERT-R_A: X sec	XX	ERT-R_A
#21	ERT-R_B: X sec	XX	ERT-R_B
#22	ERT-R_C: X sec	XX	ERT-R_C
#23	ERT-R_D: X sec	XX	ERT-R_D
#24	ERT-L_A: X sec	XX	ERT-L_A
#25	ERT-L_B: X sec	XX	ERT-L_B
#26	ERT-L_C: X sec	XX	ERT-L_C
#27	ERT-L_D: X sec	XX	ERT-L_D
#28	IERT-R_A: X sec	XX	IERT-R_A
#29	IERT-R_B: X sec	XX	IERT-R_B
#30	IERT-R_C: X sec	XX	IERT-R_C
#31	IERT-R_D: X sec	XX	IERT-R_D
#32	IERT-L_A: X sec	XX	IERT-L_A
#33	IERT-L_B: X sec	XX	IERT-L_B
#34	IERT-L_C: X sec	XX	IERT-L_C
#35	IERT-L_D: X sec	XX	IERT-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles must support engine run/idle time data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 32 bytes of data.

If an ECU does not support INFOTYPE $16, no response is allowed for ISO 15765-4.

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

IGNCNTR-R and L must contain a value greater than that in 5.17.22.

FEOCNTR-R, ERT-R, FEOCNTR-L, ERT-L and IERT-L must contain a value greater than that in 5.17.22 unless the vehicle is a hybrid or PHEV, then the value may also be greater than or equal to the value in 5.17.22.

Procedure:

9.22.3 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $17 (Distance/Fuel Used) if Distance/Fuel Used is supported per test 5.17.1.

Table 297 - 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: 17 - Distance/Fuel Used	17	INFTYP

Table 298 - 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: 17 - Distance/Fuel Used	17	INFTYP
#3	Number of data items: 1	01	NODI
#4	DT-R_A: X km	XX	DT-R_A
#5	DT-R_B: X km	XX	DT-R_B
#6	DT-R_C: X km	XX	DT-R_C
#7	DT-R_D: X km	XX	DT-R_D
#8	DT-L_A: X km	XX	DT-L_A
#9	DT-L_B: X km	XX	DT-L_B
#10	DT-L_C: X km	XX	DT-L_C
#11	DT-L_D: X km	XX	DT-L_D
#12	FC-R_A: X l	XX	FC-R_A
#13	FC-R_B: X l	XX	FC-R_B
#14	FC-R_C: X l	XX	FC-R_C
#15	FC-R_D: X l	XX	FC-R_D
#16	FC-L_A: X l	XX	FC-L_A
#17	FC-L_B: X l	XX	FC-L_B
#18	FC-L_C: X l	XX	FC-L_C
#19	FC-L_D: X l	XX	FC-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles must support distance/fuel used data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $17, no response is allowed for ISO 15765-4.

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

DT-R and DT-L must contain a value greater than that in 5.17.23.

FC-R and FC-L must contain a value greater than that in 5.17.23 unless the vehicle is a hybrid or PHEV, then the value may also be greater than or equal to the value in 5.17.23.

Procedure:

9.22.4 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $18 (PKE/EOE) if PKE/EOE is supported per test 5.17.1.

Table 299 - 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: 18 - PKE/EOE	18	INFTYP

Table 300 - 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: 18 - PKE/EOE	18	INFTYP
#3	Number of data items: 1	01	NODI
#4	PKE-R_A: X km/hr2	XX	PKE-R_A
#5	PKE-R_B: X km/hr2	XX	PKE-R_B
#6	PKE-R_C: X km/hr2	XX	PKE-R_C
#7	PKE-R_D: X km/hr2	XX	PKE-R_D
#8	PKE-L_A: X km/hr2	XX	PKE-L_A
#9	PKE-L_B: X km/hr2	XX	PKE-L_B
#10	PKE-L_C: X km/hr2	XX	PKE-L_C
#11	PKE-L_D: X km/hr2	XX	PKE-L_D
#12	EOE-R_A: X kWh	XX	EOE-R_A
#13	EOE-R_B: X kWh	XX	EOE-R_B
#14	EOE-R_C: X kWh	XX	EOE-R_C
#15	EOE-R_D: X kWh	XX	EOE-R_D
#16	EOE-L_A: X kWh	XX	EOE-L_A
#17	EOE-L_B: X kWh	XX	EOE-L_B
#18	EOE-L_C: X kWh	XX	EOE-L_C
#19	EOE-L_D: X kWh	XX	EOE-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty vehicles must support PKE/EOE data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 16 bytes of data.

If an ECU does not support INFOTYPE $18, no response is allowed for ISO 15765-4.

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

PKE-R and PKE-L must contain a value of greater than 0.

EOE-R and EOE-L must contain a value of greater than that in 5.17.24 unless the vehicle is a hybrid or PHEV, then the value may also be greater than or equal to the value in 5.17.24.

Procedure:

9.22.5 [For ISO 15765-4 protocol only] Transmit Service $09, INFOTYPE = $19 (PSA) if PSA is supported per test 5.17.1.

Table 301 - 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: 19 - PSA	19	INFTYP

Table 302 - 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: 19 - PSA	19	INFTYP
#3	Number of data items: 1	01	NODI
#4	PSA-R_A: X sec	XX	PSA-R_A
#5	PSA-R_B: X sec	XX	PSA-R_B
#6	PSA-R_C: X sec	XX	PSA-R_C
#7	PSA-R_D: X sec	XX	PSA-R_D
#8	PSA-L_A: X sec	XX	PSA-L_A
#9	PSA-L_B: X sec	XX	PSA-L_B
#10	PSA-L_C: X sec	XX	PSA-L_C
#11	PSA-L_D: X sec	XX	PSA-L_D
#12	IPSA-R_A: X sec	XX	IPSA-R_A
#13	IPSA-R_B: X sec	XX	IPSA-R_B
#14	IPSA-R_C: X sec	XX	IPSA-R_C
#15	IPSA-R_D: X sec	XX	IPSA-R_D
#16	IPSA-L_A: X sec	XX	IPSA-L_A
#17	IPSA-L_B: X sec	XX	IPSA-L_B
#18	IPSA-L_C: X sec	XX	IPSA-L_C
#19	IPSA-L_D: X sec	XX	IPSA-L_D
#20	CPSA-R_A: X sec	XX	CPSA-R_A
#21	CPSA-R_B: X sec	XX	CPSA-R_B
#22	CPSA-R_C: X sec	XX	CPSA-R_C
#23	CPSA-R_D: X sec	XX	CPSA-R_D
#24	CPSA-L_A: X sec	XX	CPSA-L_A
#25	CPSA-L_B: X sec	XX	CPSA-L_B
#26	CPSA-L_C: X sec	XX	CPSA-L_C
#27	CPSA-L_D: X sec	XX	CPSA-L_D

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Evaluation criteria:

Starting with the 2019 MY, all light-duty PHEV vehicles must support PSA data using a 30/60/100% phase-in. Lack of support shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARD Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

Response must contain 24 bytes of data.

If an ECU does not support INFOTYPE $19, no response is allowed for ISO 15765-4.

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

PSA-Rand CPSA-R must contain a value of greater than that in 5.17.25.

PSA-L, IPSA-L and CPSA-L must contain a value greater than that in 5.17.25.

9.23 Clear DTCs (Service $04)

Purpose: To clear DTCs after completing Sections 5 through 9 and this is required to verify the Service $9 InfoTypes supported $16-$29 recent values all equal 0 after the code clear message is sent.

Procedure:

9.23.1 Turn ignition off for 30 seconds or longer, as appropriate for the ECU. Connect scan tool to the SAE J1962 connector.

9.23.2 Turn ignition on. Do not crank engine.

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

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

Protocol determination procedure:

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

SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 15765-4 - 11-bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)

Check battery voltage at the SAE J1962 connector pin 16.

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

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Table 303 - 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 304 - 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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

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

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

Table 305 - 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 306 - 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 307 - 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.

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

9.23.6 [For ISO 15765-4 protocol only] Using Service $9 Request all InfoTypes supported $16-$29 in 5.17.1. This is to verify that all of the recent values report a value of 0 after a code clear. These values shall not increment past 0 as the engine has not been started/the propulsion has not been active after the clear codes message has been sent.

Procedure:

The tool sends Service $9 and request all InfoTypes supported $16-$29 in test 5.17.1.

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Evaluation criteria:

Verify all applicable recent values are equal to 0 for all of the supported InfoTypes. If a recent value is reported as “not available” by displaying the maximum value, it shall not be evaluated. If any applicable recent value is not equal to 0, the test shall report a fail.

9.23.7 Prompt user whether to end Static Test or to continue to Dynamic Test. If requested by operator, continue testing and go to Section 10, otherwise prompt the operator to turn ignition off (engine off) to complete Section 9.

It is a suggested software implementation that the Static Test logfile be closed at this time because the Static Test is complete.

10. TEST VEHICLE WITH NO FAULTS TO VERIFY IUMPR COUNTERS, SERVICES $06 AND $01

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

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

Ensure that ignition is on, engine is off.

Protocol determination procedure:

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

SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 15765-4 - 11-bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 308 - 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

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Table 309 - 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 SAE J1962 connector pin 16 must be between 11.0 V and 18.0 V.

10.2 Verify Service $01 Data - Request Current Powertrain Diagnostic Data, Engine Off

NOTE: Hybrid Electric Vehicles (HEVs/PHEVs) and stop-start vehicles have engine controls that can start and stop the engine without regard to ignition key position.

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:

10.2.1 [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.

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Table 310 - 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 311 - 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:

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

10.2.2 [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 312 - 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 313 - 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, as determined in 10.2, must be supported.

For all the PIDs that are indicated as supported by each ECU, a response with the PID length as noted must be received as shown in Table 24. Note: Scaling PID $4F may be utilized in some PID responses and must be referenced if so utilized.

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

10.3 Verify Service $09 - Request VIN Information, Engine Off

Purpose: To obtain VIN from the vehicle and create a new, VIN-specific log file or continue testing with a existing VIN-specific log file. Obtain CALIDs and CVNs so they can be recorded in the logfile.

Procedure:

10.3.1 [For all protocols] Transmit Service $09 request, INFOTYPE $00 request message to determine which INFOTYPEs are supported. Note the INFOTYPEs reported by each ECU as supported.

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Table 314 - Request vehicle information request message (request supported InfoType) for all protocols

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information request SID	M	09	SIDRQ
#2	InfoType#1 (InfoType s supported)	M	00	INFTYP

Table 315 - Request vehicle information response message (request supported InfoType) for ISO 9141-2, SAE J1850, and ISO 14230-4 protocols only

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	XX	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 316 - Request vehicle information response message (request supported InfoType) for ISO 15765-4 protocol only

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
	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) for OBD-II, no ECUs or no more than one ECU on the vehicles supports VIN for EOBD/IOBD/OBDBr. (EOBD/IOBD/OBDBr does not require VIN support; however, if VIN is not supported, this shall be flagged as a warning.).

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

Table 317 - 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

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Table 318 - 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 319 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	02	INFTYP_
#3	MessageCount	M	01 - 05	MC_
#4	data record of InfoType = [DATA_A,	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 SAE J1850, ISO 9141-2, and ISO 14230-4. The response consists of the following messages:

Message #1 shall contain three pad bytes of $00, followed by VIN character #1.
Message #2 shall contain VIN characters #2 through #5, inclusive.
Message #3 shall contain VIN characters #6 through #9, inclusive.
Message #4 shall contain VIN characters #10 through #13, inclusive.
Message #5 shall contain VIN characters #14 through #17, inclusive.

For ISO 15765-4, there is only one response message that consists of all VIN characters without any pad bytes.

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

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

If VIN is not supported, prompt the operator to enter a VIN number in 10.3.3.

Procedure:

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

Table 320 - Request vehicle information request message for all protocols

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

Table 321 - Request vehicle information response message

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

Evaluation criteria:

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

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

Table 322 - 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

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Table 323 - 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: 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

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Table 324 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	04	INFTYP_
#3	MessageCount	M	01 - XX	MC_
#4	data record of InfoType = [DATA_A,	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 SAE J1850, ISO 14230-4, ISO 9141-2.

All CALIDs must contain 1 to 16 printable ASCII characters.

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

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

Procedure:

10.3.5 [For SAE J1850, ISO 9141-2, and ISO 14230-4 protocols] Transmit Service $09, INFOTYPE = $05 if CVN is supported.

Table 325 - Request vehicle information request message for all protocols

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

Table 326 - Request vehicle information response message

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

Evaluation criteria:

Note message count for evaluation in 10.3.6

10.3.6 [For all protocols] Transmit Service $09, INFOTYPE = $06 (CVN) if CVN is supported.

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

Table 327 - 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

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Table 328 - 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 329 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	06	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 eight character CVNs returned for ISO 9141-2, SAE J1850, and ISO 14230-4.

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

All CVNs must contain 4 bytes of hex data.

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

Procedure:

If the VIN is invalid or not supported (i.e., development vehicle with no valid VIN), prompt operator for an operator-specified file name or VIN in order to create a new log file, then continue vehicle testing in 10.4 or, if the operator-specified log file exists, continue to append to the existing operator-specified log file and resume testing in Section 11.

If the VIN is valid and has a corresponding VIN-specific log file, continue to append to the exiting VIN-specific log file and resume vehicle testing in Section 11.

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If the VIN is valid and does not have a corresponding VIN-specific log file, create a new VIN-specific log file, then continue vehicle testing in 10.4.

NOTE: It is a suggested software implementation that a warning be generated if the current software version does not match the software version used to create the original log file.

10.4 Verify Service $01 - Request Current Powertrain Diagnostic Data, Engine Off

Purpose: To determine which ECUs support I/M Readiness bits (Mode $01, PID $01) and to determine what PIDs can be used to verify proper function of the general denominator.

Procedure:

10.4.1 [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 330 - 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 331 - Request current powertrain diagnostic data response message (report supported PIDs)

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [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:

Determine and record which ECUs support PID $01 (I/M Readiness). For the ECUs that support PID $01, determine which of the following PIDs are supported for each ECU: PIDs $0C (rpm), $0D (VSS), $1F (RUNTM).

10.5 Clear DTCs (Service $04), Engine Off

Purpose: To reset the I/M Readiness bits to a “not ready” condition.

Procedure:

10.5.1 [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.

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Table 332 - 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 333 - Clear/reset emission-related diagnostic information response message

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

Evaluation criteria:

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

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

10.6 Verify Service $01 - Request Current Powertrain I/M Readiness Data, Engine Off

Purpose: To determine the returned I/M Readiness data indicates “not ready” after a code clear.

Procedure:

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

Table 334 - 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 335 - 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 336.

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Table 336 - Engine off service $01 PID $01 validation

Engine Off Service $01 PID $01 Validation		
PID	**Required Value**	**Comment**
01, DATA_A, bit 7	Bit 7 must be 0.	0 = MIL off.
01, DATA_A, bits 0-6	Bits 0-6 must be 0.	No DTCs.
01, DATA_B, bit 3	Bit 3 can be 0 or 1. For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements (Service $01, PID $01, DATA_B, bit 2 = 1), the status of Service $01, PID $01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine. 1 = compression ignition engine.
01, DATA_B, bit 4	Bit 4 must be 0 for spark ignition engines and ECUs which do not support misfire monitoring or may be 0 or 1 for compression ignition engines.	Misfire monitoring is always complete for spark ignition engines or compression ignition engines that utilize full range misfire monitoring and incomplete for compression ignition engines that utilize the idle monitor through the 2019 MY.
01, DATA_B, bit 5	Bit 5 can be 0 or 1.	Fuel system may indicate incomplete for spark ignition and compression ignition engines if non-continuous monitors are employed. Unsupported monitors must indicate “ready.”
01, DATA_B, bit 6	Bit 6 must be 0.	CCM always complete. Unsupported monitors must indicate “ready.”
01, DATA_B, bits 3 and 7	Bit 3 and 7 must be 0.	Reserved bits must be 0.
01 DATA_B bits 0-2 and 01 DATA_C bit 0-7	At least one bit must be 1.	An OBD ECU that supports Service $01 PID $01 must support at least one monitor.
01, DATA_D, bits 0-7	Bits 0-7 must be 1 for any supported monitor indicated in DATA_C, except for bit 6 which may be 0 on some spark ignition vehicles.	No supported monitors complete. O_2 heater monitor (bit 6) may complete (0) on some spark ignition 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.”

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10.7 Verify Service $06 - Request Emission-Related DTCs, Engine Off

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

Procedure:

10.7.1 [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 337 - 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 338 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs) for ISO 9141-2, SAE J1850, and ISO 14230-4 protocols

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

Table 339 - 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.

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

10.7.2 [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 340 - 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

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Table 341 - 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 for OBD-II only.

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

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

Some manufacturers have engine-off monitors, e.g., O_2 sensors that run as soon as the ignition is on. These monitors may report test results on Service $06. If a Service $06 Test ID reports a test value and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

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

Table 342 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 9141-2, SAE J1850, and ISO 14230-4 protocols

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

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Table 343 - 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).

10.8 Verify Service $07 - Request Pending Emission-Related DTCs, Engine Off

Purpose: To verify that there are no pending emission-related DTCs reported after a code clear.

Procedure:

10.8.1 [For all protocols] Transmit a Service $07 request message. Verify that a proper response is received with DTC count set to zero and no DTCs.

Table 344 - 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 345 - 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

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Table 346 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4

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

Evaluation criteria:

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

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

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

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

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

10.9 Verify Service $03 - Request Emission-Related DTCs, Engine Off

Purpose: To verify that there are no confirmed DTCs reported after a code clear.

Procedure:

10.9.1 [For all protocols] Transmit Service $03 request. Verify that a proper response indicating no DTCs is received.

Table 347 - 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 348 - 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

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Table 349 - Request emission-related diagnostic trouble codes response message for ISO 14230-4

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

Evaluation criteria:

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

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

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

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

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

10.10 Verify Service $09 - Request Vehicle Information, Engine Off

Purpose: To record the values of the OBD general denominator (OBDCOND), the ignition counter (IGNCTR), and the OBD in-use performance numerators and denominators prior to driving the vehicle.

Procedure:

If IUMPR is not supported and the compliance type, based on operator input, is EOBD/IOBD/OBDBr without IUMPR or U.S. OBD-II with MY prior to 2005 MY, then skip to Section 11.

10.10.1 [For all protocols] Transmit Service $09, INFOTYPE = $08 if IPT supported.

Table 350 - Request vehicle information request message for all protocols

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

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Table 351 - 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 or 20 or 28 (shown as 28 in this example)	14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: XX counts	XX	IGNCNTR_A
#7	IGNCNTR_B: XX counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B
#44	AFRICOMP1_A: X counts	XX	AFRICOMP1_A
#45	AFRICOMP1_B: X counts	XX	AFRICOMP1_B
#46	AFRICOND1_A: X counts	XX	AFRICOND1_A
#47	AFRICOND1_B: X counts	XX	AFRICOND1_B
#48	AFRICOMP2_A: X counts	XX	AFRICOMP2_A
#49	AFRICOMP2_B: X counts	XX	AFRICOMP2_B
#50	AFRICOND2_A: X counts	XX	AFRICOND2_A
#51	AFRICOND2_B: X counts	XX	AFRICOND2_B
#52	PFCOMP1_A: X counts	XX	PFCOMP1_A
#53	PFCOMP1_B: X counts	XX	PFCOMP1_B
#54	PFCOND1_A: X counts	XX	PFCOND1_A
#55	PFCOND1_B: X counts	XX	PFCOND1_B
#56	PFCOMP2_A: X counts	XX	PFCOMP2_A
#57	PFCOMP2_B: X counts	XX	PFCOMP2_B
#58	PFCOND2_A: X counts	XX	PFCOND2_A
#59	PFCOND2_B: X counts	XX	PFCOND2_B

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Table 352 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFTYP_
#3	MessageCount	M	01 - 10	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				

10.10.2 Record the values of the OBD Condition Counter (OBDCOND), Ignition Counter (IGNCTR) and all OBD monitor condition and completion counters prior to completing the standard CARB OBD drive cycle. If IPT not supported for EOBD/IOBD/OBDBr based on operator prompt, set all IPT values to 0.

Evaluation criteria:

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

All In-use Performance data must contain either 32 bytes or 40 or 56 bytes of data.

Ignition counter must be greater than or equal to OBD Condition Counter.

OBD Condition Counter must be greater than or equal to any monitor condition counters.

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

For ISO 15765-4, NODI in the response message must be $10 or $14 or $1C.

For OBD-II only, starting with the 2010 MY, spark ignition engines must support data for secondary oxygen sensor. NODI must be $14 and the response message must report back 40 bytes of data or this shall be flagged as a failure. Starting with the 2019 MY, spark ignition engines must support data for Air Fuel Imbalance monitor and Gasoline Particulate Filter monitor 30/60/100% phase-in starting in 2019 MY. NODI must be $1C and the response message must report back 56 bytes of data or this shall be flagged as a warning for 2019 MY and 2020 MY and a failure for 2021 MY unless the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply for the 2021 or beyond model year.

10.10.3 [For all protocols] Transmit Service $09, INFOTYPE = $0B if IPT supported.

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Table 353 - Request vehicle information request message for ISO 15765-4

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

Table 354 - Request vehicle information response message (1) for ISO 15765-4

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

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Table 355 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	0B	INFTYP_
#3	MessageCount	M	01 - 09	MC_
#4 #5 #6 #7	data record of InfoType = [DATA_A, DATA_B, DATA_C, Data D]	M M M M	XX XX XX XX	DATA_A DATA_B DATA_C DATA_D

Evaluation criteria:

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

All In-use Performance data must contain 32 or 36 bytes of data.

If an ECU does not support INFOTYPE $0B, no response is allowed for ISO 15765-4, SAE J1850, and ISO 9141-2. For ISO 14230-4, the ECU can either not respond or send a negative response ($7F, $12).

For ISO 15765-4, NODI in the response message must be $10 or $12.

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

If no ECU supports INFOTYPE $08 or $0B, any software conforming to these specifications shall assume that all returned data was $00. This will allow the remainder of the test to complete although all INFOTYPE $08 tests will ultimately fail.

10.10.4 [For ISO 15765-4] Transmit Service $09, INFOTYPE = $12 if Plug In Hybrid Vehicle (PHEV) vehicle only.

Table 356 - Request vehicle information request message for ISO 15765-4

Message direction:	External test equipment → All ECUs		
Message Type:	Request		
Data Byte	**Description (all values are in hexadecimal)**	**Byte Value (Hex)**	**Mnemonic**
#1	Request vehicle information request SID	09	SIDRQ
#2	InfoType: Fueled Engine Operation Ignition Cycle Counter	12	INFTYP

Table 357 - 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: Fueled Engine Operation Ignition Cycle Counter	12	INFTYP
#3	Number of data items: 1	1	NODI
#4 #5	FEOCNTR_A: X counts FEOCNTR_B: X counts	XX XX	FEOCNTR_A FEOCNTR_B

Evaluation criteria:

If a PHEV vehicle (based on Operator prompt) does not support INFOTYPE $12 for 2014 MY and beyond, this shall be flagged as a failure.

Procedure:

10.10.5 Turn ignition off (engine off) for 60 seconds. This will allow ignition counter to increment on the following ignition on cycle.

10.10.6 Turn ignition to crank position and start engine. (Prompt operator to initiate the drive cycle as quickly as possible.)

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

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10.11 Re-Establish Communication (SAE J1978/ISO 15031-4), Engine Running (If Required)

Purpose: To re-establish communication with the vehicle when the ignition key was turned off.

Protocol determination procedure:

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

SAE J1850 41.6 kbps PWM
SAE J1850 10.4 kbps VPW
ISO 9141-2 (wait 5 seconds before trying next protocol)
ISO 14230-4 (fast baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 14230-4 (slow baud rate initialization) (wait 5 seconds before trying next protocol)
ISO 15765-4 - 11-bit 500 kbps
ISO 15765-4 - 11-bit 250 kbps (only if EOBD/IOBD/OBDBr test)
ISO 15765-4 - 29 bit 500 kbps
ISO 15765-4 - 29 bit 250 kbps (only if EOBD/IOBD/OBDBr test)

Check battery voltage at the SAE J1962 connector pin 16.

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

Table 358 - 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 359 - 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

Procedure:

10.12 Complete CARB Drive Cycle to Increment In-Use Performance Denominator

Purpose: To verify that the OBD general denominator and ignition counters increment properly and to warm up engine.

Procedure:

10.12.1 Drive vehicle according to the following conditions so that the OBD Condition Counter may increment:

Continuous idle time ≥30 seconds with vehicle speed ≤1 mph or rpm <1150 rpm and accelerator pedal released, at an altitude <8000 feet (BARO >22 in Hg) and ambient temperature ≥20 °F.

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Cumulative time ≥300 seconds with vehicle speed ≥25 mph (40 km/h), or ≥1150 rpm at an altitude <8000 feet (BARO >22 in Hg) and ambient temperature ≥20 °F.

Cumulative time since engine start ≥600 seconds, at an altitude <8000 feet (BARO >22 in Hg) and ambient temperature ≥20 °F.

Cumulative (does not have to be continuous) fueled engine operation for ≥10 seconds,at an altitude <8000 feet (BARO >22 in Hg) and ambient temperature ≥20 °F for PHEV vehicles only.

NOTE: The software will monitor the following PIDs, if available: $0C (rpm), $0D (VSS), $1F (RUNTM) every 1.0 second to determine vehicle conditions. The software will monitor OBDCOND every 1.0 second. The software will inform user as soon as the drive cycle conditions have been completed and OBDCOND counter has incremented. See Table 360 for details.

The specific denominator requirements vary for light-duty gas and diesel, medium-duty diesel (dyno cert), heavy-duty, EOBD light-duty and EOBD heavy-duty. They are summarized in Table 360. The vehicle shall be tested according to the type of vehicle as determined by the operator prompts.

Table 360 - Engine idle service $01 PID validation

IUMPR Requirements by Region and Vehicle Type						
Criteria	**OBD-II LD Gas + Diesel**	**OBD-II MD Diesel (Dyno Cert)**	**OBD HD Gas**	**OBD HD Diesel**	**EOBD LD Gas + Diesel**	**EOBD HD Gas + Diesel**
Time since start ≥600 seconds	RUNTM ≥600 seconds	RUNTM ≥600 seconds	RUNTM ≥600 seconds	RUNTM ≥600 seconds	RUNTM ≥600 seconds	RUNTM ≥600 seconds
Drive time above 25 mph ≥300 seconds	VSS ≥25 mph	VSS ≥25 mph — OR — rpm ≥1150	VSS ≥25 mph	rpm ≥1150	VSS ≥40 km/h	VSS ≥40 km/h — OR — rpm ≥1150
Idle time ≥30 seconds	VSS ≤1 mph	VSS ≤1 mph — OR — rpm <1150	VSS ≤1 mph	rpm <1150	VSS ≤1.6 km/h	VSS ≤1.6 km/h — OR — rpm <1150
PHEV fueled engine operation ≥10 seconds	rpm ≥450 rpm	rpm ≥450 rpm				

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Prompt user to idle for 30 seconds, drive the vehicle at ≥25 mph (40 km/h) (or ≥1150 rpm) for 300 seconds, and continue driving the vehicle in any manner for an additional 270 seconds. Display the status of the OBDCOND counter, the IGNCTR counter, the 30 seconds “Idle Timer,” the 300 seconds “25 mph/40 km/h Driving Timer” and the 600 seconds “Total Drive Timer.” The user should be reminded to perform the test at altitudes less than 8000 feet and ambient temperatures greater than 20 °F.

NOTE 1: If the VSS PID is present, the software will use the VSS criteria rather than the rpm criteria for the Drive time and Idle time evaluation for light-duty, medium-duty vehicles and heavy-duty gas vehicles. Heavy-duty diesel vehicles will use the rpm criteria for drive time and Idle time evaluation. If PID $1C is calibrated to $22 for a diesel vehicle (meets light-duty and heavy-duty OBD), the rpm criteria will be used for the drive time and Idle time evaluation.

NOTE 2: The rpm criteria for idle time is defined as ≤200 rpm above normal warmed up idle speed (in drive for an auto trans); however, the software has no way to determine the normal idle speed of the vehicle. The criteria is evaluated as <1150 rpm as a surrogate.

10.12.2 [For all protocols] For all supported PIDs $0C, $0D, $1F, send the corresponding Service $01 PID request message and monitor the responses only from the modules that support Service $01, PID $01 (I/M Readiness).

Table 361 - Request current powertrain diagnostic data request message for all protocols

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

Table 362 - 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

NOTE: If multiple modules support I/M Readiness functionality, utilize only the responses from module that supports Service $09, INFOTYPE $08 or $0B to perform this test. Based on the responses in 10.9, utilise INFOTYPE $08 or $0B to get OBDCOND counter data.

10.12.3 [For all protocols] Transmit Service $09, INFOTYPE = $08 if IPT supported.

Table 363 - Request vehicle information request message for all protocols

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

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Table 364 - 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 or 20 (shown as 20 in this example)	14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B

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Table 365 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFTYP_
#3	MessageCount	M	01 - 10	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				

10.12.4 [For all protocols] Transmit Service $09, INFOTYPE = $0B if IPT supported.

Table 366 - 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	0B	INFTYP

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Table 367 - Request vehicle information response message (1) for ISO 15765-4

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

Table 368 - Request vehicle information response message for SAE J1850, ISO 14230-4, and ISO 9141-2

Data Byte	**Parameter Name**	**Cvt**	**Hex Value**	**Mnemonic**
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFTYP_
#3	MessageCount	M	01 - 09	MC_
#4 #5 #6 #7	data record of InfoType = [DATA_A, DATA_B, DATA_C, Data D]	C C C C	XX XX XX XX	DATA_A DATA_B DATA_C DATA_D
C = Conditional — data A - D is only present if the requested InfoType = $02, $04, and $06				

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Evaluation criteria:

For OBD-II, CNOBD, and EOBD with IPT (based on user prompt):

The OBDCOND counter must increment within ± 20 seconds of the tool determination that the CARB drive cycle conditions have been met using the criteria listed below in conjunction with Table 360 and vehicle type based on operator prompts:

- The engine has been started. Monitor for RUNTM >0 seconds. If RUNTM is not available, monitor for rpm >450 rpm. For HEV fueled engine operation, monitor for rpm >450 for 10 seconds.
- Cumulative engine run time is ≥600 seconds. Monitor for RUNTM >600 seconds. If RUNTM is not available, montor for rpm >450 rpm for >600 seconds.
- Cumulative engine run time ≥25 mph (40 km/h) is ≥300 seconds. Monitor for RUNTM increase ≥300 seconds when VSS ≥25 mph (40 km/h). If RUNTM is not available, monitor for rpm >450 rpm and VSS ≥25 mph (40 km/h) for ≥300 seconds or rpm >1150 indicated in Table 358.
- Continuous idle time at vehicle speed ≤1 mph is ≥30 seconds. Monitor for RUNTM increase >30 seconds when VSS ≤1 mph. If RUNTM is not available, monitor for rpm >450 rpm and VSS ≤1 mph for ≥30 seconds. (While idle timer is accumulating idle time, reset idle timer to zero if idle conditions are no longer being met and accumulate idle time once again if idle conditions are being met later in the driving cycle.)

The above conditions require that the user is driving the vehicle within the stated altitude and ambient air temperature conditions and that the accelerator pedal is released when the vehicle is stopped. Note: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position.

For EOBD/IOBD/OBDBr without IPT (based on user prompt):

The OBDCOND counter is not supported. Assume the OBDCOND counter has incremented after the four conditions specified above (engine start, run time >600 seconds, time >40 km/h, and idle time >30 seconds) has been satisfied. This will ensure that the engine is warmed up for 10.12.

Procedure:

10.12.5 When the software has determined that the OBDCOND counter has incremented and the driving conditions have been met, the software should stop sending Service $01 and Service $09 requests, prompt the operator to stop the vehicle in a safe location without turning off the ignition, then prompt the operator to continue with the test.

10.13 Verify Service $01 - Request Current Powertrain Diagnostic Data, Engine Running

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

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

Procedure:

10.13.1 [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.

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Table 369 - 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 370 - 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:

Required PIDs must be supported for all vehicles (ALL), gasoline engines (G), or diesel engines (D) as specified in Table 375. At least one ECU must support the required data. If more than one ECU supports the PID, then each ECU must meet the requirements specified under “Required Value.” The table specifies whether lack of support will generate a Failure or a Warning. A failure is defined as lack of support as required in the OBD-II regulations. A warning is defined as lack of support for a PID that is highly likely to be required to be supported by most vehicle manufacturers. Warnings require additional analysis by the vehicle manufacturer. For 2010 MY and beyond, use PID $01, DATA_B, bit 3 to determine gasoline or diesel PID support rather than Operator Prompt 4.

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

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

Table 371 - 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			

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Table 372 - 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.

10.13.3 [For all protocols] For all supported PIDs $01-$1F, $21-$3F, $41-$5F, $61-$7F, $81-$9F, $A1-$BF, $C1-$DF, $E1-$FF, as determined in 10.12.1, send the corresponding Service $01 PID request message and note the response.

Table 373 - Request current powertrain diagnostic data request message for all protocols

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

Table 374 - 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 375. Note: Scaling PID $4F may be utilized in some PID responses and must be referenced if so utilized.

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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.

Table 375 - Engine warm idle service $01 PID validation

Engine Idle Service $01 PID Validation			
PID	**Required Support**	**Required Value**	**Comment**
01, DATA_A, bit 7	G - Warn	Bit 7 must be 0.	0 is MIL off.
01, DATA_A, bits 0-6	G - Warn	Bits 0-6 must be 0.	No DTCs.
01, DATA_B, bit 0	ALL - Fail if OBD-II, G - Fail if EOBD/IOBD/OBDBr	Bit 0 must be 1 for at least one ECU.	All spark and compression ignition engines must support misfire monitoring.
01, DATA_B, bit 1	ALL - Fail	Bit 1 must be 1 for at least one ECU.	All spark and compression ignition engines must support fuel system monitoring.
01, DATA_B, bit 2	ALL - Fail	Bit 2 must be 1 for all ECUs.	An OBD ECU that supports Service $01 PID $01 must support comprehensive component monitoring.
01, DATA_B, bit 3		Bit 3 can be 0 or 1 For 2010 MY and beyond, data must match Prompt 4. Note that for ECUs that only support CCM requirements (Service $01, PID $01, DATA_B, bit 2 = 1), the status of Service $01, PID $01, DATA_B bit 3 is irrelevant and may be set to either gasoline or diesel.	0 = spark ignition engine. 1 = compression ignition engine.
01, DATA_B, bit 4	G - Fail	Bit 4 must be 0 for spark ignition engines, compression ignition engines that support full range misfire, and ECUs, which do not support misfire monitoring, or must be 1 before the misfire evaluation is complete for compression ignition engines that utilize idle misfire monitor. Bit 4 must be 0 for any unsupported monitor in DATA_B bit 1.	Misfire monitoring shall always indicate complete for spark ignition engines or compression ignition engines that utilize full range misfire monitoring. For compression ignition engine that utilize the idle monitor through the 2019 MY, misfire monitoring shall indicate complete after the misfire evaluation is complete (1000 engine revs at idle, approx 60 seconds). Unsupported monitors must indicate “ready.”
01, DATA_B, bit 5		Bit 5 can be 0 or 1. Bit 5 must be 0 for any unsupported monitor in DATA_B bit 0.	Fuel system may indicate incomplete for spark ignition and compression ignition engines If non-continuous monitors are employed. Unsupported monitors must indicate “ready.”
01, DATA_B, bit 6	ALL - Fail	Bit 6 must be 0.	CCM must always be complete.
01, DATA_B, bits 7	ALL - Fail	Bit 7 must be 0.	Reserved bits must be 0.
01, DATA_C, bit 0	G - Fail	Bit 0 must be 1 for at least one ECU for spark ignition engines. Bit 0 may be 0 or 1 for compression ignition engines.	All spark ignition engines must support catalyst monitoring. Compression ignition engines may or may not support NMHC catalyst monitoring.

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