



SURFACE VEHICLE RECOMMENDED PRACTICE

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(R) Vehicle OBD II Compliance Test Cases

RATIONALE

Changes have been made to this document in order to keep pace with changes made to the California Air Resources Board legislation: Title 13, California Code Regulations, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines, 1971.1. On-Board Diagnostic System Requirements--2010 and Subsequent Model-Year Heavy-Duty Engines, and Regulation (EC) No 715/2007 of the European Parliament and of the Council of June 20, 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information as amended by Commission Regulation (EC) 692/2008.

Some clarifications and functional enhancements have also been included in this document.

FOREWORD

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

TABLE OF CONTENTS

1.	SCOPE.....	11
2.	REFERENCES.....	12
2.1	Applicable Documents	12
2.2	Related Publications	13
3.	DEFINITIONS	14
3.1	Definition of terms	14
3.2	Acronyms	14
4.	OVERVIEW.....	15
4.1	Select Static Test or Dynamic Test Sequence.....	16
5.	DIAGNOSTIC MESSAGE FORMAT AND TIMING	19
5.1	Message format	19
5.2	Message timing	20
5.3	Data not available	27

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6.	TEST VEHICLE WITH NO MALFUNCTIONS, NO DTCS SET	32
6.1	Perform MIL bulb check, engine off	32
6.2	Establish communication (J1978 / ISO 15031-4), ignition on, engine off	33
6.3	Clear DTCs (Service \$04), engine off	34
6.4	Verify MIL status bit, engine off, verify no Permanent DTCs	34
6.5	Verify that all Service \$06 - Request on-board monitoring test results, engine off	36
6.6	Verify Service \$01 Data - Request current powertrain diagnostic data, engine off	40
6.7	Verify Service \$08 - Request control of on-board system, test or component, engine off	58
6.8	Establish communication (J1978 / ISO 15031-4), engine running	60
6.9	Clear DTCs (Service \$04), engine running	61
6.10	Verify Service \$01 - Request current powertrain diagnostic data, engine running	62
6.11	Verify Service \$02 – Request powertrain freeze frame data, engine running	79
6.12	Verify Service \$03 – Request emission-related DTCs, engine running	82
6.13	Verify Service \$05 - Request oxygen sensor monitoring test results, engine running	84
6.14	Verify Service \$06 - Request on-board monitoring test results, engine running	84
6.15	Verify Service \$07 - Request pending emission-related DTCs, engine running	89
6.16	Verify Service \$08 - Request control of on-board system, test or component, engine running	91
6.17	Verify Service \$09 - Request vehicle information, engine running	93
6.18	Verify Service \$01 data in reverse order	113
6.19	Verify Service \$01 idle message timing	115
6.20	Verify Service \$01 burst message timing	116
6.21	Verify Reserved/Unused Services, engine running	117
7.	TEST VEHICLE AND SET A PENDING CODE BY INDUCING A FAULT	118
7.1	Induce Circuit Fault	118
7.2	Establish communication (J1978 / ISO 15031-4), engine running	118
7.3	Verify Service \$07 – Request pending emission-related DTCs, engine running	119
7.4	Verify Service \$03 – Request emission-related DTCs, engine running	120
7.5	Verify Service \$02 – Request powertrain freeze frame data, engine running	122
7.6	Continue to induce circuit fault (EOBD only)	126
8.	TEST VEHICLE AND SET A CONFIRMED CODE AND MIL BY RETAINING FAULT	127
8.1	Continue to induce circuit fault	127
8.2	Establish communication (J1978 / ISO 15031-4), engine running	127
8.3	Verify Service \$07 - Request pending emission-related DTCs, engine running	128
8.4	Verify Service \$03 – Request emission-related DTCs, engine running	130
8.5	Verify Service \$02 – Request powertrain freeze frame data, engine running	132
9.	TEST VEHICLE WITH FAULT REPAIRED	136
9.1	Repair circuit fault and complete one driving cycle, MIL illuminated	136
9.2	Establish communication (J1978 / ISO 15031-4), engine running	137
9.3	Verify Service \$07 - Request pending emission-related DTCs, engine running	138
9.4	Verify Service \$03 – Request emission-related DTCs, engine running	139
9.5	Verify Service \$02 – Request powertrain freeze frame data, engine running	141
9.6	Verify Service \$0A - Request permanent emission-related DTCs, engine running	146
10.	TEST VEHICLE WITH NO FAULTS AFTER 3 OR 4 DRIVING CYCLES COMPLETED	147
10.1	Complete two or more additional driving cycles	147
10.2	Establish communication (J1978 / ISO 15031-4), engine running	147
10.3	Verify Service \$07 - Request pending emission-related DTCs, engine running	148
10.4	Verify Service \$03 – Request emission-related DTCs, engine running	149
10.5	Verify Service \$02 – Request powertrain freeze frame data, engine running	152
10.6	Verify Service \$0A - Request permanent emission-related DTCs, engine running	156
10.7	Complete static test or continue to permanent code drive cycle	157
10.8	Induce circuit fault to set pending, and confirmed DTC	157
10.9	Establish communication (J1978 / ISO 15031-4), engine off	158
10.10	Verify Service \$03 – Request emission-related DTCs, engine off	159
10.11	Verify Service \$0A - Request permanent emission-related DTCs, engine off	160
10.12	Repair circuit fault	161
10.13	Verify MIL status bit, engine off	163

10.14	Verify Service \$0A - Request permanent emission-related DTCs, engine off.....	164
10.15	Complete one driving cycle with fault repaired	165
10.16	Establish communication (J1978 / ISO 15031-4), engine running	165
10.17	Verify Service \$0A - Request permanent emission-related DTCs, engine running.....	166
10.18	Complete permanent code drive cycle.....	167
10.19	Key on, see if permanent DTCs have been erased	173
10.20	Establish communication (J1978 / ISO 15031-4), engine on.....	173
10.21	Verify Service \$0A - Request permanent emission-related DTCs, engine on.....	174
10.22	Clear DTCs (Service \$04)	175
11.	TEST VEHICLE WITH NO FAULTS TO VERIFY IUMPR COUNTERS, SERVICES \$06 AND \$01.....	177
11.1	Establish communication (J1978 / ISO 15031-4), ignition on, engine off	177
11.2	Verify Service \$01 Data - Request current powertrain diagnostic data, engine off	178
11.3	Verify Service \$09 – Request VIN Information, engine off	180
11.4	Verify Service \$01 - Request current powertrain diagnostic data, engine off.....	186
11.5	Clear DTCs (Service \$04), engine off.....	186
11.6	Verify Service \$01 - Request current powertrain I/M readiness data, engine off	187
11.7	Verify Service \$06 – Request on-board monitoring test results, engine off.....	188
11.8	Verify Service \$07 - Request pending emission-related DTCs, engine off.....	192
11.9	Verify Service \$03 – Request emission-related DTCs, engine off.....	193
11.10	Verify Service \$09 – Request Vehicle Information, engine off	194
11.11	Re-establish communication (J1978 / ISO 15031-4), engine running (if required).....	199
11.12	Complete CARB drive cycle to increment in-use performance denominator	200
11.13	Verify Service \$01 - Request current powertrain diagnostic data, engine running	206
11.14	Verify Service \$09 - Request vehicle information, engine running	224
12.	TEST VEHICLE WITH NO FAULTS TO VERIFY IUMPR COUNTERS, SERVICE \$06, I/M READINESS	228
12.1	Re-establish communication (J1978 / ISO 15031-4), engine running (if required).....	228
12.2	Complete manufacturer drive cycle and clear I/M Readiness bits.....	234
12.3	Turn engine off to allow drive cycle data to be collected.	239
12.4	Re-establish communication (J1978 / ISO 15031-4), ignition on, engine off (if required)	239
12.5	Verify Service \$01 - Request current powertrain diagnostic data, engine off.....	240
12.6	Verify Service \$06 – Request on-board monitoring test results, engine off.....	241
12.7	Verify Service \$09 – Request vehicle information, engine off	244
12.8	Verify Service \$01 - Request current powertrain I/M readiness data, engine off	249
12.9	Verify Service \$03 – Request emission-related DTCs, engine off.....	250
12.10	Verify Service \$07 - Request pending emission-related DTCs, engine off.....	251
12.11	Clear DTCs (Service \$04), engine off.....	252
12.12	Verify Service \$09 – Request vehicle information, engine off	253
13.	NOTES	257
13.1	Marginal Indicia	257
Figure 1	Conditions and services tested	15
Figure 2	Diagnostic message format for ISO 9141-2, ISO 14230-4 and SAE J1850	19
Figure 3	Diagnostic message format for ISO 15765-4.....	19
Figure 4	CAN 11 BIT identifiers.....	20
Figure 5	CAN 29 BIT identifiers.....	20
Figure 6	Message response times	21
Figure 7	ISO 9141-2 and ISO 14230-4 protocol client and server timing behavior	22
Figure 8	Functional OBD communication - default response timing	24
Figure 9	Functional OBD communication - enhanced response timing.....	25
Table A	Proper response from ECU	27
Table B	Proper response from ECU for ISO 15765-4.....	31
Table 1	Request current powertrain diagnostic data request message for all protocols	33
Table 2	ECU# X response: request current powertrain diagnostic data response message	33
Table 3	Clear/reset emission-related diagnostic information request message for all protocols	34
Table 4	Clear/reset emission-related diagnostic information response message	34
Table 5	Request current powertrain diagnostic data request message for all protocols	35

Table 6	ECU#1 response: request current powertrain diagnostic data response message	35
Table 7	Request emission-related diagnostic trouble codes with permanent status	35
Table 8	Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4	36
Table 9	Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read supported obdmids) for all protocols	36
Table 10	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported obdmids) for ISO 9141-2, J1850 and ISO 14230-4 protocols	37
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	37
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	37
Table 13	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported obdmids)	38
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	38
Table 15	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)	39
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, J1850 and ISO 14230-4 protocols	40
Table 17	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)	40
Table 18	Request current powertrain diagnostic data request message for all protocols	41
Table 19	Request current powertrain diagnostic data response message (report supported pids)	41
Table 20	Request current powertrain diagnostic data request message for ISO 15765-4 protocol	42
Table 21	Request current powertrain diagnostic data response message (report supported PIDS)	42
Table 23	Request current powertrain diagnostic data response message	43
Table 24	Engine off service \$01 PID validation	44
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	58
Table 25	Request control of on-board device request message (read supported TIDS) for all protocols	58
Table 26	Request control of on-board device response message (report supported TIDS)	58
Table 27	Request control of on-board device request message (read supported TIDS) for ISO 15765-4 protocol	59
Table 28	Request control of on-board device response message (report supported TIDS)	59
Table 29	Request current powertrain diagnostic data request message for all protocols	60
Table 30	ECU#X Response: request current powertrain diagnostic data response message	61
Table 31	Clear/reset emission-related diagnostic information request message for all protocols	61
Table 32	Clear/reset emission-related diagnostic information response message	61
Table 33	Clear/reset emission-related diagnostic information response message	62
Table 34	Request current powertrain diagnostic data request message for all protocols	62
Table 35	Request current powertrain diagnostic data response message (report supported PIDS)	62
Table 36	Request current powertrain diagnostic data request message for ISO 15765-4 protocol	63
Table 37	Request current powertrain diagnostic data response message (report supported PIDS)	63
Table 38	Request current powertrain diagnostic data request message for all protocols	64
Table 39	Request current powertrain diagnostic data response message	64
Table 40	Engine idle service \$01 PID validation	65
Table 41	Request powertrain freeze frame data response message for all protocols	79
Table 42	Request powertrain freeze frame data response message	79
Table 43	Request powertrain freeze frame data request message (read supported PIDS) for all protocols	79
Table 44	Request powertrain freeze frame data response message (report freeze frame PID values)	80
Table 45	Request powertrain freeze frame data request message (read supported PIDS) for ISO 15765-4 protocol	81
Table 46	Request powertrain freeze frame data response message (report freeze frame PID values)	81
Table 47	Request powertrain freeze frame data response message for all protocols	82
Table 48	Request powertrain freeze frame data response message	82
Table 49	Request current powertrain diagnostic data request message for all protocols	82
Table 50	ECU# X response: request current powertrain diagnostic data response message	83
Table 51	Request emission-related diagnostic trouble codes request message for all protocols	83
Table 52	Request emission-related diagnostic trouble codes response message for ISO 15765-4	83
Table 53	Request emission-related diagnostic trouble codes response message for ISO 14230-4	83

Table 54	Request oxygen sensor monitoring test results request message for all protocols	84
Table 55	Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read supported OBDMIDS) for all protocols	85
Table 56	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDS) for ISO 9141-2, J1850 and ISO 14230-4 protocols	85
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	85
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	86
Table 59	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDS)	86
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	86
Table 61	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)	87
Table 62	OBDMID validation	88
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, J1850 and ISO 14230-4 protocols only ...	89
Table 64	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)	89
Table 65	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols	90
Table 66	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO-15765-4	90
Table 67	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4	90
Table 68	Request control of on-board device request message (read supported TIDS) for all protocols	91
Table 69	Request control of on-board device response message (report supported TIDS)	91
Table 70	Request control of on-board device request message (read supported TIDS) for ISO 15765-4 protocol	92
Table 71	Request control of on-board device response message (report supported TIDS)	92
Table 73	Request vehicle information response message (request supported INFOTYPE) for ISO 9141-2, J1850 and ISO 14230-4 protocols only	93
Table 74	Request vehicle information response message (request supported INFOTYPE) for ISO 15765-4 protocol	93
Table 75	Request vehicle information request message (request supported INFOTYPE) for ISO 156765-4 protocol	94
Table 76	Request vehicle information response message (request supported INFOTYPE)	95
Table 77	Request vehicle information request message for all protocols	95
Table 78	Request vehicle information response message	96
Table 79	Request vehicle information request message for all protocols	96
Table 80	Request vehicle information response message for ISO 15765-4	96
Table 81	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	97
Table 82	VIN year character	98
Table 83	Request vehicle information request message for all protocols	98
Table 84	Request vehicle information response message	98
Table 85	Request vehicle information request message for all protocols	99
Table 86	Request vehicle information response message (1 ST) for ISO 15765-4	99
Table 87	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	100
Table 88	Request vehicle information request message for all protocols	100
Table 89	Request vehicle information response message	100
Table 90	Request vehicle information request message for all protocols	101
Table 91	Request vehicle information response message for ISO 15765-4	101
Table 92	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	101
Table 93	Request vehicle information request message for all protocols	102
Table 95	Request vehicle information request message for all protocols	102
Table 96	Request vehicle information response message (1) for ISO 15765-4	103
Table 97	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	104
Table 98	Request vehicle information request message for all protocols	104
Table 99	Request vehicle information response message (1) for ISO 15765-4	105
Table 100	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	105

Table 101	Request vehicle information request message for all protocols	106
Table 102	Request vehicle information response message	106
Table 103	Request vehicle information request message for ISO 15765-4	106
Table 104	Request vehicle information response message (1) for ISO 15765-4	107
Table 105	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	107
Table 106	ECU name data BYTE description	109
Table 107	Request vehicle information request message for all protocols	109
Table 108	Request vehicle information response message	109
Table 109	Request vehicle information request message for all protocols	110
Table 110	Request vehicle information response message for ISO 15765-4	110
Table 111	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	110
Table 112	Request vehicle information request message for all protocols	111
Table 113	Request vehicle information response message	111
Table 114	Request vehicle information request message for all protocols	111
Table 115	Request vehicle information response message for ISO 15765-4	112
Table 116	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	112
Table 117	Request current powertrain diagnostic data request message, reverse order for all protocols	113
Table 118	Request current powertrain diagnostic data response message (report supported PIDS)	113
Table 119	Request current powertrain diagnostic data request message, reverse order for ISO 15765-4 protocol	114
Table 120	Request current powertrain diagnostic data response message (report supported pids)	114
Table 121	Request current powertrain diagnostic data request message for all protocols	115
Table 122	Request current powertrain diagnostic data response message	115
Table 123	Request current powertrain diagnostic data request message for all protocols	115
Table 124	Request current powertrain diagnostic data response message (report supported pids)	116
Table 125	Request current powertrain diagnostic data request message for all protocols	116
Table 126	Request current powertrain diagnostic data response message (report supported pids)	117
Table 127	Request emission-related diagnostic trouble codes with permanent status	117
Table 128	Request current powertrain diagnostic data request message for all protocols	118
Table 129	ECU#x Response: Request current powertrain diagnostic data response message	119
Table 130	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols	119
Table 131	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 15765-4	119
Table 132	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for J1850, ISO 9141-2 and ISO 14230-4	120
Table 133	Request emission-related diagnostic trouble codes request message for all protocols	120
Table 134	Request emission-related diagnostic trouble codes response message for ISO 15765-4	121
Table 135	Request emission-related diagnostic trouble codes response message for ISO 14230-4	121
Table 136	Request current powertrain diagnostic data request message for all protocols	121
Table 137	ECU# X response: request current powertrain diagnostic data response message	122
Table 138	Request powertrain freeze frame data response message for all protocols	122
Table 139	Request powertrain freeze frame data response message	122
Table 140	Request powertrain freeze frame data request message (read supported PIDS) for all protocols	123
Table 141	Request powertrain freeze frame data response message (report freeze frame PID values)	123
Table 142	Request powertrain freeze frame data request message (read supported pids) for ISO 15765-4	124
Table 143	Request powertrain freeze frame data response message (report freeze frame PID values)	124
Table 144	Request powertrain freeze frame data request message (read supported pids) for all protocols	125
Table 145	Request current powertrain diagnostic data response message	125
Table 146	Request current powertrain diagnostic data request message for ISO 15765-4 protocol	125
Table 147	Request current powertrain diagnostic data response message	126
Table 148	Request current powertrain diagnostic data request message for all protocols	127
Table 149	ECU# X response: request current powertrain diagnostic data response message	128
Table 150	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols	128
Table 151	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 15765-4	128
Table 152	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for J1850, ISO 9141-2 and ISO 14230-4	129
Table 153	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 15765-4	129

Table 154	request emission-related diagnostic trouble codes request message for all protocols	130
Table 155	request emission-related diagnostic trouble codes response message for iso 15765-4	130
Table 156	request emission-related diagnostic trouble codes response message for j1850, iso 9141-2 and iso 14230-4	130
Table 157	request emission-related diagnostic trouble codes response message for iso 15765-4	130
Table 158	request emission-related diagnostic trouble codes response message for iso 14230-4	131
Table 159	request current powertrain diagnostic data request message for all protocols	131
Table 160	ecu# x response: request current powertrain diagnostic data response message	131
Table 161	request powertrain freeze frame data response message for all protocols	132
Table 162	request powertrain freeze frame data response message	132
Table 163	request powertrain freeze frame data request message (read supported pids) for all protocols	133
Table 164	request powertrain freeze frame data response message (report freeze frame pid values)	133
Table 165	request powertrain freeze frame data request message (read supported pids) for iso 15765-4	134
Table 166	request powertrain freeze frame data response message (report freeze frame pid values)	134
Table 167	Request powertrain freeze frame data request message (read supported pids) for all protocols	134
Table 168	Request current powertrain diagnostic data response message	135
Table 169	Request current powertrain diagnostic data request message for iso 15765-4 protocol	135
Table 170	Request current powertrain diagnostic data response message	136
Table 171	Request current powertrain diagnostic data request message for all protocols	137
Table 172	ECU# X response: request current powertrain diagnostic data response message	137
Table 173	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols	138
Table 174	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 15765-4	138
Table 175	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4	138
Table 176	Request emission-related diagnostic trouble codes request message for all protocols	139
Table 177	Request emission-related diagnostic trouble codes response message for ISO 15765-4	139
Table 178	Request emission-related diagnostic trouble codes response message for J1850, ISO 9141-2 and ISO 14230-4	140
Table 179	Request emission-related diagnostic trouble codes response message for ISO 15765-4	140
Table 180	Request emission-related diagnostic trouble codes response message for ISO 14230-4	140
Table 181	Request current powertrain diagnostic data request message for all protocols	141
Table 182	Response: request current powertrain diagnostic data response message	141
Table 184	Request powertrain freeze frame data response message	142
Table 185	Request powertrain freeze frame data request message (read supported pids) for all protocols	142
Table 186	Request powertrain freeze frame data response message (report freeze frame PID values)	142
Table 187	Request powertrain freeze frame data request message (read supported pids) for ISO 15765-4 protocol	143
Table 188	Request powertrain freeze frame data response message (report freeze frame PID values)	143
Table 189	Request powertrain freeze frame data request message (read supported pids) for all protocols	144
Table 190	Request current powertrain diagnostic data response message	144
Table 191	Request current powertrain diagnostic data request message for ISO 15765-4 protocol	145
Table 192	Request current powertrain diagnostic data response message	145
Table 193	Request emission-related diagnostic trouble codes with permanent status	146
Table 194	Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4	146
Table 195	Request current powertrain diagnostic data request message for all protocols	148
Table 196	ECU# X response: request current powertrain diagnostic data response message	148
Table 197	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols	148
Table 198	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 15765-4	149
Table 199	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4	149
Table 200	Request emission-related diagnostic trouble codes request message for all protocols	150
Table 201	Request emission-related diagnostic trouble codes response message for ISO 15765-4	150
Table 202	Request emission-related diagnostic trouble codes response message for J1850, ISO 9141-2, and ISO 14230-4	150
Table 203	Request emission-related diagnostic trouble codes response message for ISO 15765-4	150

Table 204	Request emission-related diagnostic trouble codes response message for ISO 14230-4	151
Table 205	Request current powertrain diagnostic data request message for all protocols	151
Table 206	ECU# X response: request current powertrain diagnostic data response message	151
Table 207	Request powertrain freeze frame data response message for all protocols	152
Table 208	Request powertrain freeze frame data response message	152
Table 209	Request powertrain freeze frame data request message (read supported PIDS) for all protocols	153
Table 210	Request powertrain freeze frame data response message (report freeze frame PID values)	153
Table 211	Request powertrain freeze frame data request message (read supported PIDS) for ISO 15765-4 protocol	154
Table 212	Request powertrain freeze frame data response message (report freeze frame PID values)	154
Table 213	Request powertrain freeze frame data request message (read supported PIDS) for all protocols	155
Table 214	Request current powertrain diagnostic data response message	155
Table 215	Request current powertrain diagnostic data request message for ISO 15765-4 protocol	155
Table 216	Request current powertrain diagnostic data response message	156
Table 217	Request emission-related diagnostic trouble codes with permanent status	157
Table 218	Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4	157
Table 219	Request current powertrain diagnostic data request message for all protocols	159
Table 220	ECU# X response: request current powertrain diagnostic data response message	159
Table 221	Request emission-related diagnostic trouble codes request message for all protocols	159
Table 222	Request emission-related diagnostic trouble codes response message for ISO 15765-4	160
Table 223	Request emission-related diagnostic trouble codes with permanent status	160
Table 224	Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4	161
Table 225	Request current powertrain diagnostic data request message for all protocols	162
Table 226	ECU# X response: request current powertrain diagnostic data response message	162
Table 227	Clear/reset emission-related diagnostic information request message for all protocols	163
Table 228	Clear/reset emission-related diagnostic information response message	163
Table 229	Request current powertrain diagnostic data request message for all protocols	163
Table 230	ECU#1 response: request current powertrain diagnostic data response message	164
Table 231	Request emission-related diagnostic trouble codes with permanent status	164
Table 232	Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4	164
Table 233	Request current powertrain diagnostic data request message for all protocols	166
Table 234	ECU# X response: request current powertrain diagnostic data response message	166
Table 235	Request emission-related diagnostic trouble codes with permanent status	166
Table 236	Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4	167
Table 237	Request emission-related diagnostic trouble codes with permanent status	168
Table 238	Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4	168
Table 239	Request current powertrain diagnostic data request message for all protocols	169
Table 240	Request current powertrain diagnostic data response message	169
Table 241	Request vehicle information request message for all protocols	169
Table 242	Request vehicle information response message (1) for ISO 15765-4	170
Table 243	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	171
Table 244	Request vehicle information request message for all protocols	171
Table 245	Request vehicle information response message (1) for ISO 15765-4	172
Table 246	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	172
Table 247	Request current powertrain diagnostic data request message for all protocols	173
Table 248	ECU# X response: request current powertrain diagnostic data response message	174
Table 249	Request emission-related diagnostic trouble codes with permanent status	174
Table 250	Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4	174
Table 251	Request current powertrain diagnostic data request message for all protocols	176
Table 252	ECU# X response: request current powertrain diagnostic data response message	176
Table 253	Clear/reset emission-related diagnostic information request message for all protocols	176
Table 254	Clear/reset emission-related diagnostic information response message	176
Table 255	Clear/reset emission-related diagnostic information response message	177
Table 256	Request current powertrain diagnostic data request message for all protocols	178

Table 257	ECU# X response: request current powertrain diagnostic data response message	178
Table 258	Request current powertrain diagnostic data request message for all protocols	178
Table 259	Request current powertrain diagnostic data response message (report supported pids)	179
Table 260	Request current powertrain diagnostic data request message for all protocols	179
Table 261	Request current powertrain diagnostic data response message	179
Table 262	Request vehicle information request message (request supported infotype) for all protocols	180
Table 263	Request vehicle information response message (request supported infotype) for ISO 9141-2, J1850 and ISO 14230-4 protocols only	180
Table 264 only	Request vehicle information response message (request supported infotype) for ISO 15765-4 protocol	180
Table 265	Request vehicle information request message for all protocols	180
Table 266	Request vehicle information response message for ISO 15765-4	181
Table 267	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	181
Table 268	Request vehicle information request message for all protocols	182
Table 269	Request vehicle information response message	182
Table 270	Request vehicle information request message for all protocols	182
Table 271	Request vehicle information response message (1 st) for ISO 15765-4	183
Table 272	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	183
Table 273	Request vehicle information request message for all protocols	184
Table 274	Request vehicle information response message	184
Table 275	Request vehicle information request message for all protocols	184
Table 276	Request vehicle information response message for ISO 15765-4	185
Table 277	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	185
Table 278	Request current powertrain diagnostic data request message for all protocols	186
Table 279	Request current powertrain diagnostic data response message (report supported pids)	186
Table 280	Clear/reset emission-related diagnostic information request message for all protocols	187
Table 281	Clear/reset emission-related diagnostic information response message	187
Table 282	Request current powertrain diagnostic data request message for all protocols	187
Table 283	Request current powertrain diagnostic data response message	187
Table 284	Engine off service \$01 pid \$01 validation	188
Table 285	Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read supported obdmids) for all protocols	189
Table 286	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported obdmids) for ISO 9141-2, J1850 and ISO 14230-4 protocols	189
Table 287	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported obdmids)	189
Table 288	Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read obdmid test values) for ISO 15765-4 protocol	190
Table 289	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report obdmid test values)	190
Table 290	Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read obdmid test values) for ISO 9141-2, J1850 and ISO 14230-4 protocols	191
Table 291	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report obdmid test values)	191
Table 292	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols	192
Table 293	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO-15765-4	192
Table 294	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4	192
Table 295	Request emission-related diagnostic trouble codes request message for all protocols	193
Table 296	Request emission-related diagnostic trouble codes response message for ISO 15765-4	193
Table 297	Request emission-related diagnostic trouble codes response message for ISO 14230-4	194
Table 298	Request vehicle information request message for all protocols	194
Table 299	Request vehicle information response message (1) for ISO 15765-4	195
Table 300	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	196
Table 301	Request vehicle information request message for ISO 15765-4	196
Table 302	Request vehicle information response message (1) for ISO 15765-4	197
Table 303	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	197
Table 304	Request vehicle information request message for ISO 15765-4	198

Table 305	Request vehicle information response message for ISO 15765-4	198
Table 306	Request current powertrain diagnostic data request message for all protocols	199
Table 307	ECU# X response: request current powertrain diagnostic data response message	200
Table 308	Engine idle service \$01 PID validation.....	201
Table 309	Request current powertrain diagnostic data request message for all protocols	202
Table 310	Request current powertrain diagnostic data response message.....	202
Table 311	Request vehicle information request message for all protocols	202
Table 312	Request vehicle information response message (1) for ISO 15765-4.....	203
Table 313	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2.....	204
Table 314	Request vehicle information request message for all protocols	204
Table 315	Request vehicle information response message (1) for ISO 15765-4.....	205
Table 316	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2.....	205
Table 317	Request current powertrain diagnostic data request message for all protocols	207
Table 318	Request current powertrain diagnostic data response message (report supported pids)	207
Table 319	Request current powertrain diagnostic data request message for ISO 15765-4 protocol.....	208
Table 320	Request current powertrain diagnostic data response message (report supported pids)	208
Table 321	Request current powertrain diagnostic data request message for all protocols	209
Table 322	Request current powertrain diagnostic data response message.....	209
Table 323	Engine warm idle service \$01 PID validation.....	210
Table 324	Request vehicle information request message for all protocols	224
Table 325	Request vehicle information response message (1) for ISO 15765-4.....	225
Table 326	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2.....	225
Table 327	Request vehicle information request message for all protocols	226
Table 328	Request vehicle information response message (1) for ISO 15765-4.....	226
Table 329	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2.....	227
Table 330	Request vehicle information request message for ISO 15765-4	227
Table 331	Request vehicle information response message for ISO 15765-4	227
Table 332	Request current powertrain diagnostic data request message for all protocols	228
Table 333	ECU# X response: request current powertrain diagnostic data response message	228
Table 334	Request current powertrain diagnostic data request message for all protocols	229
Table 335	Request current powertrain diagnostic data response message.....	229
Table 336	Request vehicle information request message for all protocols	229
Table 337	Request vehicle information response message (1) for ISO 15765-4.....	230
Table 338	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2.....	231
Table 339	Request vehicle information request message for all protocols	231
Table 340	Request vehicle information response message (1) for ISO 15765-4.....	232
Table 341	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2.....	232
Table 342	In-use counter validation	234
Table 343	Request current powertrain diagnostic data request message for all protocols	235
Table 344	Request current powertrain diagnostic data response message.....	235
Table 345	Request vehicle information request message for all protocols	235
Table 346	Request vehicle information response message (1) for ISO 15765-4.....	236
Table 347	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2.....	237
Table 348	Request vehicle information request message for all protocols	237
Table 349	Request vehicle information response message (1) for ISO 15765-4.....	238
Table 350	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2.....	238
Table 351	Request current powertrain diagnostic data request message for all protocols	239
Table 352	ECU# X response: request current powertrain diagnostic data response message	239
Table 353	Request current powertrain i/m readiness data request message	240
Table 354	Request current powertrain diagnostic data response message (report supported pids)	240
Table 355	Request current powertrain diagnostic data request message.....	240
Table 356	Request current powertrain diagnostic data response message.....	240
Table 357	Engine off service \$01 PID validation	241
Table 358	Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read supported obdmids) for all protocols	241
Table 359	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported obdmids) for iso 9141-2, J1850 and ISO 14230-4 protocols.....	242
Table 360	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported obdmids)	242

Table 361	Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read obdmid test values) for ISO 15765-4 protocol	242
Table 362	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report obdmid test values)	243
Table 363	Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read obdmid test values) for ISO 9141-2, J1850 and ISO 14230-4 protocols	243
Table 364	Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report obdmid test values)	244
Table 365	Request vehicle information request message for all protocols	244
Table 366	Request vehicle information response message (1) for ISO 15765-4	245
Table 367	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	246
Table 368	Request vehicle information request message for all protocols	246
Table 369	Request vehicle information response message (1) for ISO 15765-4	247
Table 370	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	247
Table 371	Request current powertrain diagnostic data request message for all protocols	249
Table 372	Request current powertrain diagnostic data response message	249
Table 373	Engine off service \$01 PID validation	250
Table 374	Request emission-related diagnostic trouble codes request message for all protocols	250
Table 375	Request emission-related diagnostic trouble codes response message for ISO 15765-4	251
Table 376	Request emission-related diagnostic trouble codes response message for ISO 14230-4	251
Table 377	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols	252
Table 378	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO-15765-4	252
Table 379	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4	252
Table 380	Clear/reset emission-related diagnostic information request message for all protocols	253
Table 381	Clear/reset emission-related diagnostic information response message	253
Table 382	Request vehicle information request message for all protocols	253
Table 383	Request vehicle information response message (1) for ISO 15765-4	254
Table 384	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	255
Table 385	Request vehicle information request message for all protocols	255
Table 386	Request vehicle information response message (1) for ISO 15765-4	256
Table 387	Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2	256
Table C	Change log	261

1. SCOPE

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

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

2. REFERENCES

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

2.1 Applicable 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 – Communication between Vehicle and External Equipment for Emissions-Related Diagnostics – Part 2: Terms, definitions, abbreviations and acronyms.

SAE J1930DA J1930 Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet

SAE J1962 Diagnostic Connector Equivalent to ISO/DIS 15031-3:December 14, 2001

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

SAE J1978 OBD II Scan Tool - Equivalent to ISO/DIS 15031-4:December 14, 2001

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

SAE J1979 E/E Diagnostic Test Modes

NOTE: Equivalent to ISO/DIS 15031-5 – Communication between Vehicle and External Equipment for Emissions-Related Diagnostics - Part 5: Emissions-related diagnostic services

SAE J1979DA J1979-DA, Digital Annex of E/E Diagnostic Test Modes

SAE J2012 Diagnostic Trouble Code Definitions

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

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

SAE J2534 Recommended Practice for Pass-Thru Vehicle Programming

2.1.2 ISO Publications

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

ISO 9141-2	Road Vehicles – Diagnostic systems – Part 2: CARB requirements for interchange of digital information
ISO 14230-4	Road Vehicles – Diagnostic systems – Part 4: KWP 2000 requirements for emission related systems
ISO/DIS 15031-2	Communication between Vehicle and External Equipment for Emissions-Related Diagnostics – Part 2: Terms, definitions, abbreviations and acronyms (Equivalent to SAE J1930)
ISO/DIS 15031-3	Communication between Vehicle and External Equipment for Emissions-Related Diagnostics – Part 3: Diagnostic connector and related electrical circuits, specification and use (Equivalent to SAE J1962)
ISO/DIS 15031-4	Communication between Vehicle and External Equipment for Emissions-Related Diagnostics (Equivalent to SAE J1978)
ISO/DIS 15031-5	Communication between Vehicle and External Equipment for Emissions-Related Diagnostics – Part 5: Emissions-related diagnostic services (Equivalent to SAE J1979)
ISO/DIS 15031-6	Communication between Vehicle and External Equipment for Emissions-Related Diagnostics – Part 6: Diagnostic trouble code definitions (Equivalent to SAE J2012)
ISO 15765-4	Road vehicles – Diagnostics on Controller Area Network (CAN) – Part 4: Requirements for emissions-related systems

2.2 Related Publications

The following publications are 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 OBD II Related SAE Specification Verification Test Procedures

2.2.2 ISO Publications

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

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

2.2.3 Other Publications

CARB OBD Regulation:

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

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

European OBD Regulation:

REGULATION (EC) No 715/2007 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of June 20, 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information. As amended by Commission Regulation (EC) 692/2008

Web address: <http://europa.eu/legislation_summaries/environment/air_pollution/l28186_en.htm>

3. DEFINITIONS

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

3.1 Definition of terms

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

3.2 Acronyms

The following are common acronyms used in this document:

A/C	Air Conditioning
CAN	Controller Area Network
CALID	Calibration Identification
CID	Component ID
CVN	Calibration Verification Number
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 (US vehicles > 14,000 lb GVWR or 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)
HEV	Hybrid Electric Vehicle
HSC	High Speed CAN
ID	Identification (number)
I/M	Inspection and Maintenance
ISO	International Standards Organization
Kbps	Kilobits per s
KWP	Key Word Protocol
LD	Light Duty (US passenger cars, light duty trucks and medium duty engines <= 14,000 lb GVWR or European vehicles <= 2610 kg RW in M ₁ , M ₂ , N ₁ and N ₂ categories.
MD	Medium Duty (medium duty engines <= 14,000 lb GVWR, engine dyno certified
MIL	Malfunction Indicator Lamp
OBD-II	On Board Diagnostics (level 2) (US OBD-II for LD and MD)
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 M (engine speed)
SAE	Society of Automotive Engineers
SID	Service ID
S/S	Stop/Start
TID	Test ID
VIN	Vehicle Identification Number
VPW	Variable Pulse Width (modulation)

4. OVERVIEW

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

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

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

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

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

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

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

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

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

Figure 1 - Conditions and services tested

4.1 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 through 11

Resume Dynamic Tests contained in Sections 10 through 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 8 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

Prompt 5:

Prompt user whether to perform a US OBD test, a European OBD with IUMPR test or a European OBD without IUMPR test.

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 Duty/Medium Duty truck < 14,000 lb GVWR or Heavy Duty truck > 14,000 lb GVWR and, if Light Duty/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:

- US OBD for Light Duty passenger cars (LD OBD)
- US OBD for Light Duty truck chassis certified (LD OBD)
- US OBD for Medium Duty truck engine dyno certified $\leq 14,000$ GVWR (MD OBD)
- US OBD for Heavy Duty truck > 14,000 lb 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)

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

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

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

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

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

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

9. It is assumed that any software meeting these specifications will follow the testing sequence specified in this document. Failure to do so may result in incorrect results.
10. Tester Present / Keep Alive Strategy - For protocols that require periodic messages to maintain diagnostic operation after link initialization, the following strategies shall be implemented.

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

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

Waiting for user input:

When the link must be maintained during periods where the program is stalled waiting for user input, the J2534 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 s interval. At no other time should the periodic message capability be used.

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

11. It is assumed that all OBD emission or diagnostic-critical ECUs support Mode \$01, PID \$00.
12. Procedure to determine when the link drops out - Send Service \$01 PID \$00. The proper response from all OBD ECUs will be verified or the diagnostic link will be flagged as being "down" and the test aborted.
13. Repeated/identical responses from a given ECU for a given request message shall be flagged as a warning. Any software meeting these specifications will use the last response.
14. Windows 95, Windows 98, and Windows ME shall not be used as the operating system for vehicle testing due to inadequate timer resolution. If one of these operating systems is identified, the software will flag a warning.
15. When performing protocol initialization for ISO 9141-2 and ISO 14230-4 protocols, ensure that K and L Line is initialized at idle (logic 1) for greater than 300 ms after the 5 s 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.
20. The software will validate the desired engine running state during the test (engine on/engine off) to ensure the 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.

5. DIAGNOSTIC MESSAGE FORMAT AND TIMING

5.1 Message format

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

Diagnostic Message Formats

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

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

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

Figure 3 - Diagnostic message format for ISO 15765-4

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

CAN communication is required to be 500 kbps to meet OBD II requirements. EOBD allows 250 or 500 kbps.

CAN identifiers are defined in Figures 4 and 5 below.

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

Figure 4 - CAN 11 bit identifiers

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

Figure 5 - CAN 29 bit identifiers

5.2 Message timing

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

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

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

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

Figure 6 - Message response times

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

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

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

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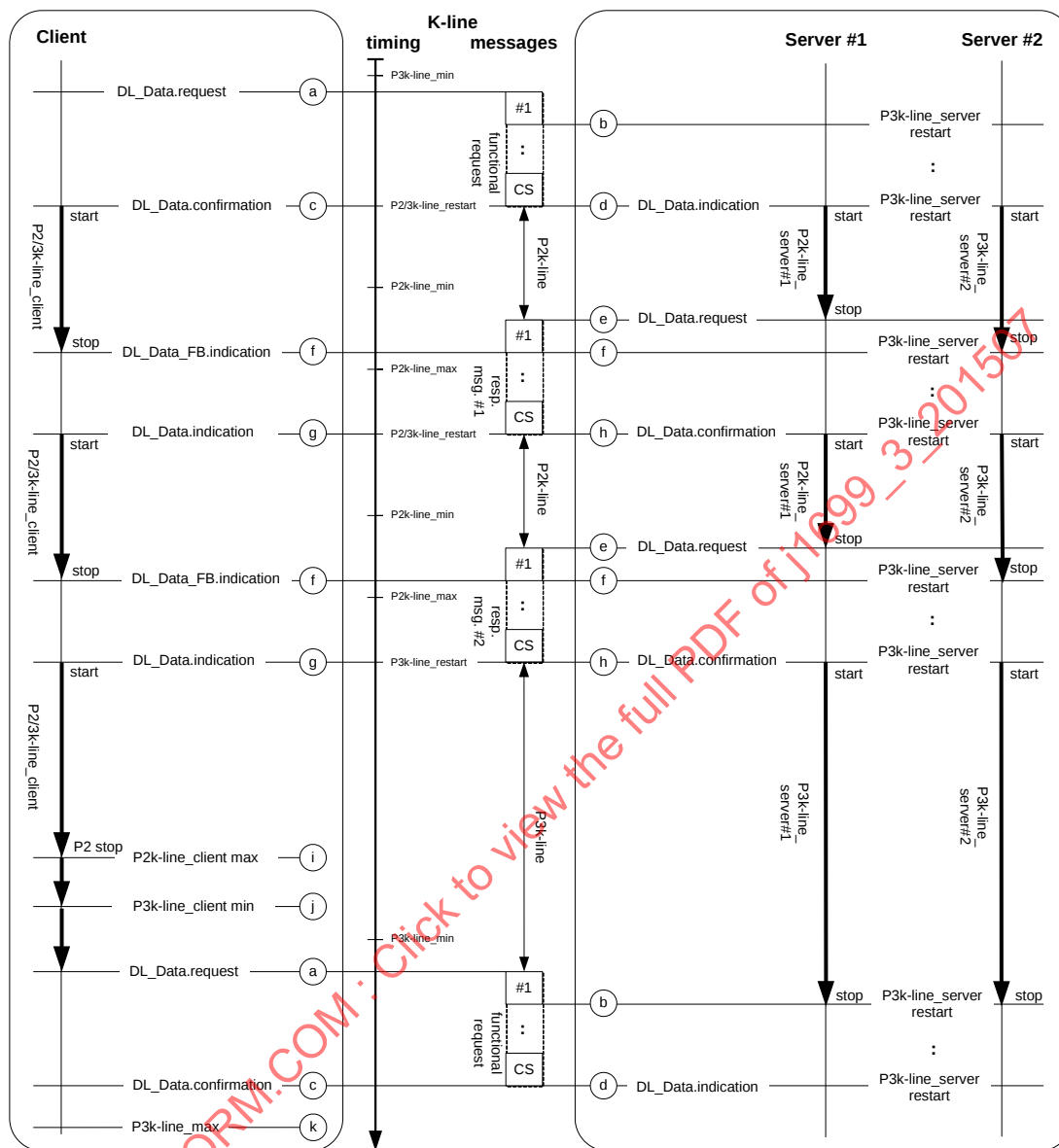


Figure 7- ISO 9141-2 and ISO 14230-4 protocol client and server timing behavior

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-line} timer value on each received byte regardless of whether the byte is part of a request message or a response message from another server or an echo from its transmit line. There are several methods of how a server could implement the timing handling. The implementation of timing parameters is not part of this specification but an important system supplier responsibility. Some general server timing parameter implementation guidelines are described in this section. The server time stamps each receiver interrupt event and restarts/resets the P3_{k-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-line_server} restart after the reception of the first byte and last byte (checksum) of a received message. The P3_{k-line_server} restart is required on each received byte. The received message can be either a request message from the client or a response message from any other server connected and initialized by the 33 hex address. If the server has received a complete message it compares the target address with the 33 hex address.

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

- a. The diagnostic application of the client starts the transmission of a functionally addressed request message by issuing a `DL_Data.request` to its data link layer. The data link layer transmits the request message to the servers.
- b. Both servers and the client receive a byte of a message via a receive interrupt by the UART. The ISR (Interrupt Service Routine) either restarts the 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 a)).

5.2.2 ISO 15765-4 functional OBD communication during defaultSession

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

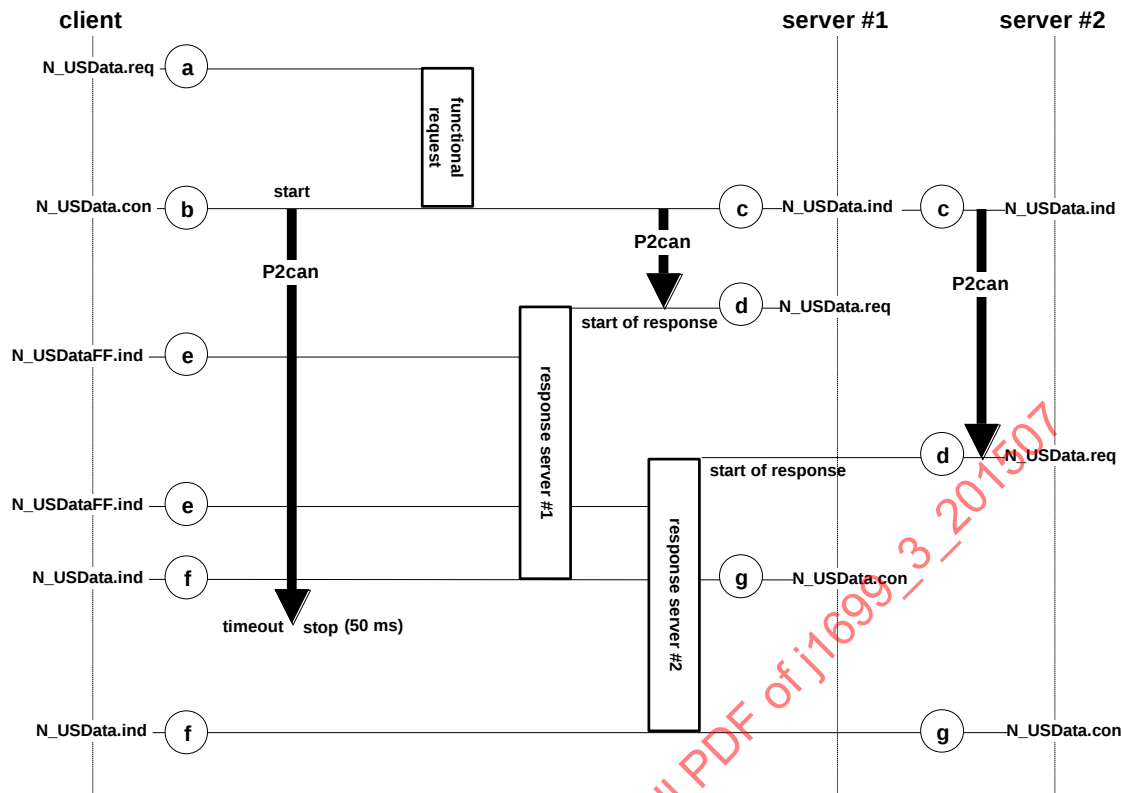


Figure 8 - Functional OBD communication - default response timing

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

- The diagnostic application of the client starts the transmission of a functionally addressed request message by issuing an N_USData.req to its network layer. The network layer transmits the request message to the servers. A functionally addressed request message shall only be a single frame message.
- The completion of the request message is indicated in the client via N_USData.con. When receiving the N_USData.con the client starts its 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.
- The completion of the request message is indicated in the servers via N_USData.ind.
- The functionally addressed servers are required to start with their response messages within 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 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.

5.2.3 Functional OBD communication during defaultSession with enhanced response timing

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

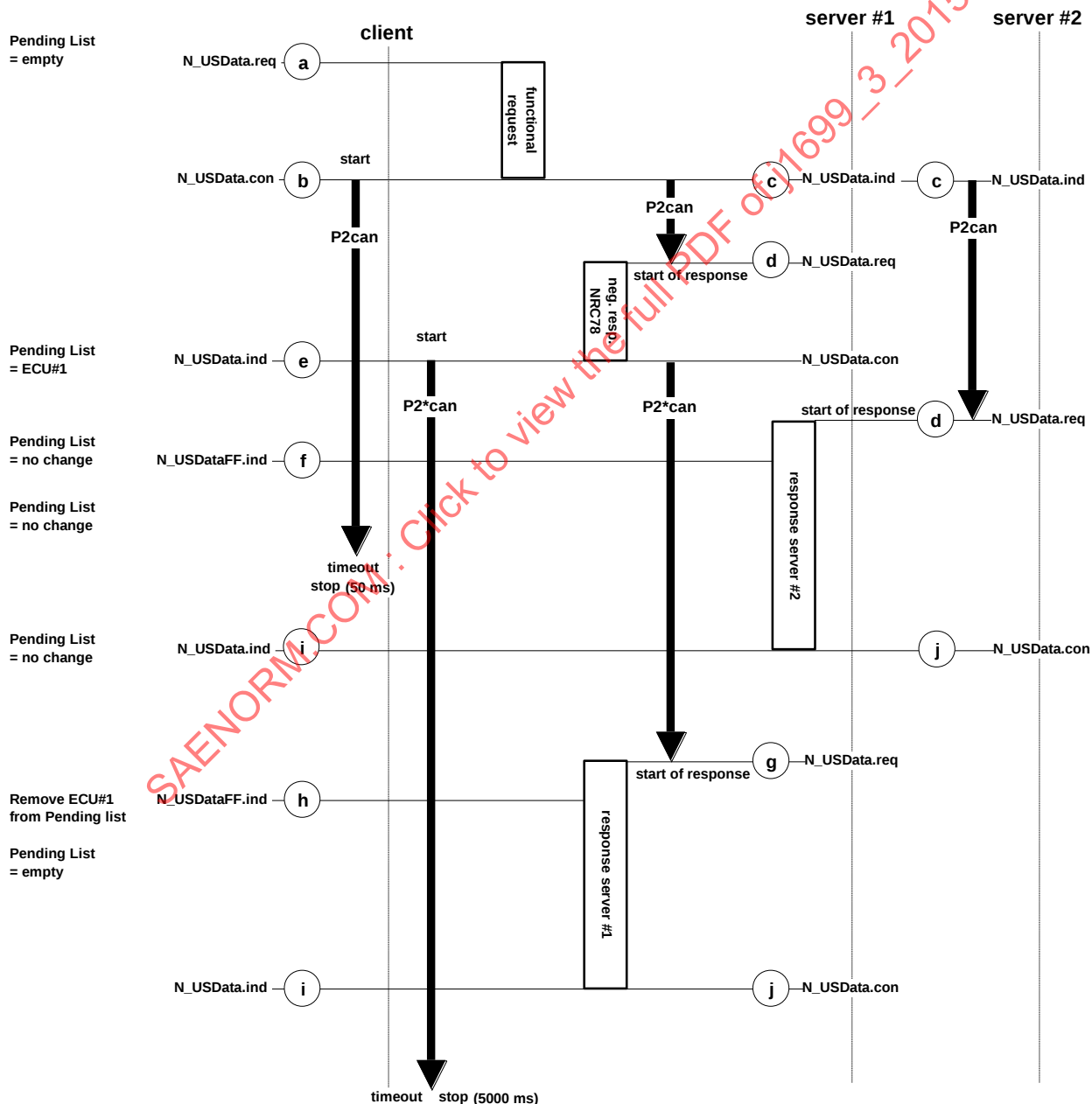


Figure 9 - Functional OBD communication - enhanced response timing

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

- a. The diagnostic application of the client starts the transmission of the functionally addressed request message by issuing a N_USData.req to its network layer. The network layer transmits the request message to the servers. A functionally addressed request message shall only be a single frame message.
- b. The completion of the request message is indicated in the client via N_USData.con. When receiving N_USData.con the client starts its 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 can still not provide the requested information within the enhanced P2*CAN then a further negative response message including response code 78 hex can be sent. This will cause the client to reload its P2*CAN timer value again. A negative response message including response code 78 hex from a server that is already stored in the list of pending response messages has no affect to the client internal list of pending response messages.
- h. Server #1 transmits a FirstFrame of a multi-frame response message within P2*CAN. The reception of the FirstFrame is indicated in the client network layer by a N_USDataFF.ind. Figure 9 shows when the client receives the start of the response message of the server #1. The client removes server #1 from the internal list of pending response messages.
- i. The client network layer will generate a N_USData.ind.
- j. The server network layer will generate a N_USData.con based on the completion of the transmission.

5.3 Data not available

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

There are two conditions for which data is not available:

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

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

Table A - Proper response from ECU

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
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

Table A - Proper response from ECU (continued)

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
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
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).

Table A - Proper response from ECU (continued)

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
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

Table A - Proper response from ECU (continued)

Condition	ISO 9141-2	SAE J1850	ISO 14230-4
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 s	Respond within 1 m; do not restart CVN calculation. Test tool sends retry message after 30 s	One or multiple negative response message(s) (\$7F, \$09, \$78) required within P2max (25 – 50 ms) until positive response is sent
aa) Service \$09 supported INFOTYPE requested, data not available, conditions not correct (CVN), prior to 2005 MY only	The ECU shall not respond	The ECU shall not respond	Negative response is required (\$7F, \$09, \$22)
bb) Service \$09 unsupported INFOTYPE requested	No response preferred, positive response is allowed	No response preferred, positive response is allowed	ECU can either not respond or send a negative response (\$7F, \$09, \$12)
cc) Service \$00 or \$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 s after reprogramming). For CVN requests within this document, a \$78 negative response is not allowed.

5.3.2 ISO 15765-4: Diagnostics on CAN

There are four conditions for which data is not available:

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

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

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

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

Condition	ISO 15765-4
conditions correct	
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

NOTE A: OBD-II regulations require a response to a Service \$09 CVN request within P2 timing (except for 30 s 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 analyse whether negative responses have been received.

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

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

6. 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.

6.1 Perform MIL bulb check, engine off

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

Procedure:

6.1.1 Ignition off for 30 s or longer, as appropriate for the ECU. Connect scan tool to the J1962 connector.

6.1.2 Turn ignition on. Do not crank engine.

Evaluation: Procedure:

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

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

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

Protocol Determination Procedure:

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

J1850 41.6 Kbps PWM

J1850 10.4 Kbps VPW

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

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

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

ISO 15765-4 – 11-bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

ISO 15765-4 – 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD test)

Check battery voltage at the J1962 connector pin 16.

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

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

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

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

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

Evaluation criteria:

If a positive response is generated on more than one protocol, this shall be flagged as a failure. ISO 15765-4 500 kbps must be utilized for OBD-II for 2008 MY and beyond and ISO 15765-4 250 or 500 kbps must be utilized for EOBD for 2014 MY and beyond, otherwise, this shall be flagged as a failure.

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

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

6.3 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:

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

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

**Table 3 - Clear/reset emission-related diagnostic information request message
for all protocols**

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

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

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

Evaluation criteria:

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

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

6.4 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:

6.4.1 [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	xxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxx b = \$XX	DATA_D

Evaluation criteria:

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

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

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

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

Procedure:

6.4.2 [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 - 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. If an EOBD vehicle does not support permanent codes, do not log a failure. If an EOBD vehicle does support permanent codes, they will be tested for correct behavior.

6.5 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:

6.5.1 [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, J1850 and ISO 14230-4 protocols

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

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

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

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

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

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

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

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

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

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

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

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

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request on-board monitoring test results for continuous and non-continuously monitored systems response SID	M	46	SIDPR
#2	data record of supported OBDMID = [On-Board Diagnostic Monitor ID Std./Manuf. Defined TID#1 Unit And Scaling ID#1 Test Value (High Byte)#1 Test Value (Low Byte)#1 Min. Test Limit (High Byte)#1 Min. Test Limit (Low Byte)#1 Max. Test Limit (High Byte)#1 Max. Test Limit (Low Byte)#1]	M	XX	OBDMIDREC
#3		M	XX	OBDMID
#4		M	XX	S/MDTID
#5		M	00	UASID
#6		M	00	TVHI
#7		M	00	TVLO
#8		M	00	MINTLHI
#9		M	00	MINTLLO
#10		M	00	MAXTLHI
:	:	:	:	:
#n-8	data record of supported OBDMID = [On-Board Diagnostic Monitor ID Std./Manuf. Defined TID#m Unit And Scaling ID#m Test Value (High Byte)#m Test Value (Low Byte)#m Min. Test Limit (High Byte)#m Min. Test Limit (Low Byte)#m Max. Test Limit (High Byte)#m Max. Test Limit (Low Byte)#m]	C1	XX	OBDMIDREC
#n-7		C2	XX	OBDMID
#n-6		C2	XX	S/MDTID
#n-5		C2	00	UASID
#n-4		C2	00	TVHI
#n-3		C2	00	TVLO
#n-2		C2	00	MINTLHI
#n-1		C2	00	MINTLLO
#n		C2	00	MAXTLHI
				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., O2 sensors that run as soon as the ignition is on. These monitors may report test results on Service \$06. If a Service \$06 Test ID reports a test value and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

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

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

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

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

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

- 6.5.5 [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).

- 6.5.6 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.

- 6.6 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:

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

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

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

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

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

Evaluation criteria:

Required PIDs must be supported for all vehicles (ALL), gasoline engines (G), 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.

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

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

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

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

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

Evaluation criteria:

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

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

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

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

Table 23 - Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

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

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

6.6.4 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).

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

Evaluation criteria:

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

Table 24 - Engine off service \$01 PID validation

Engine Off Service \$01 PID Validation			
PID	Req'd Support	Required Value	Comment
01, 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	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 and ECUs, which do not support misfire monitoring, or must be 1 for compression ignition engines. Bit 4 must be 0 for any unsupported monitor in DATA B bit 1.	Misfire monitoring shall always indicate complete for spark ignition engines. Misfire monitoring shall indicate complete for compression ignition engines after the misfire evaluation is complete (1000 engine revs at idle, approx. 60 sec.). 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

Table 24 - Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
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 only.	Bit 2 must be 1 for at least one ECU for OBD-II spark ignition engines, 0 for EOBD spark ignition engines. Bit 2 must be 0 for compression ignition engines (reserved).	All OBD-II spark ignition engines must support evap system monitoring. EOBD 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	Bit 5 must be 1 for at least one ECU	All spark ignition engines must support O2 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 O2 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. O2 heater monitor (bit 6) may complete (0) on some spark ignition vehicles.

Table 24 - Engine off service \$01 PID validation (continued)

02		2 bytes long, value must be 0000	No freeze frame available
03, DATA_A, bits 5-7, DATA_B 5-7,	G – Warn	2 bytes long, Data A and Data B bits 5-7 must all be 0	Some FUELSYSx bits are reserved
04	ALL – Fail	1 byte long, value must be 0%	LOAD_PCT = 0 with the engine off and key on.
05	ALL – Fail unless \$67 supported	1 byte long, value must be -20 to 120 deg C. Either \$05 or \$67 must be supported.	ECT in normal range
06	G – Warn	1 byte value or 2 byte value, as determined in Figure 10	Short Fuel Trim Bank 1/3
07	G – Warn	1 byte value or 2 byte value, as determined in Figure 10	Long Fuel Trim Bank 1/3
08		1 byte value or 2 byte value, as determined in Figure 10	Short Fuel Trim Bank 2/4
09		1 byte value or 2 byte value, as determined in Figure 10	Long Fuel Trim Bank 2/4
0A		1 byte long	FRP
0B	G – Warn 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

Table 24 - Engine off service \$01 PID validation (continued)

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

Table 24 - Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
24, 25, 26, 27, 28, 29, 2A, 2B		4 bytes long	Check for usage of PID 4F
2C	D – Fail unless \$69 is supported for OBD-II and HD OBD	1 byte long, value must be < or = 10%	EGR_PCT is < or = 10% with engine off
2D		1 byte long	EGR_ERR
2E	ISO 15765-4 G – Warn	1 byte long	EVAP_PCT
2F	ISO 15765-4 G, D – Warn	1 byte long, 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	
41	ISO 15765-4 ALL – Fail if OBD-II, Warn if EOBD	4 bytes long	
41, DATA_B, bit 3	ISO 15765-4 ALL – Fail if OBD-II, Fail for EOBD if supported. (data must be correct if PID \$41 is supported for EOBD)	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	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	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

Table 24 - Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
41, DATA_C, bits 0-7	ISO 15765-4 ALL – Fail if OBD-II, Warn if EOBD	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 if supported. (data must be correct if PID \$41 is supported for EOBD)	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 O2 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 if supported. (data must be correct if PID \$41 is supported for EOBD)	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	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- Fail if OBD-II, Warn if EOBD	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	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	1 byte long, value must be 0% to 50% for spark ignition engines, value can be 0% to 100% for compression ignition engines. Either \$45 or \$6C must be supported for spark ignition engines.	TP_R in normal range
46	OBD-II or HD OBD – Warn unless \$46 is supported	1 byte long, value must be -20 to 85 deg C	AAT in normal range
47		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP_B in normal range
48		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines	TP_C in normal range

Table 24 - Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
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 m (59 s 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 m (59 s 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).	1 byte, value must be \$00 to \$17.	FUEL_TYPE in SAE assigned range.
52		1 byte	ALCH_PCT
53		2 bytes	EVAP_VPA
54		2 bytes	EVAP_VP
55		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 1/3
56		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 1/3

Table 24 - Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
57		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 2/4
58		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 2/4
59		2 bytes long	FRP
5A		1 byte long, value must be 0% to 40%	APP_R in normal range
5B	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 deg 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
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	1 byte, value must be > or = 0%	TQ_ACT
63	2010 MY and beyond D – Fail if OBD-II or HD OBD	2 bytes long, value must be > or = 0	TQ_REF
64		5 bytes long	TQ_MAX

Table 24 - Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
65	2010 MY and beyond D – Fail if OBD-II or HD OBD	2 bytes, Data A, at least one device must be supported in bits 0 – 3, bits 4 – 7 must be 0, Data B, bits 4 – 7 must be 0.	Auxiliary I/O, may support PTO, diesel must support 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/sec. Either (\$0B or \$87) or (\$10 or \$66) must be supported.	Mass Air Flow Sensor MAFx <= 5 g/sec 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 deg 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 deg 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 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 < or = 10%.	Commanded EGR and EGR Error EGR_x_CMD is < or = 10% with engine off If EGR_x_CMD = 0.0%, and EGR_x_ACT = 0.0%, EGR_x_ERR must be 0.0%, If EGR_x_CMD = 0.0%, and EGR_x_ACT > 0.0%, EGR_x_ERR must be 99.2%

Table 24 - Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
6A		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Commanded Diesel Intake Air Flow Control and Relative Intake Air Flow Position
6B		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any EGRT values must be -20 to 200 deg C for either 1deg or 4 deg 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 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 deg C.	Fuel pressure Control System FRT_x in normal range
6E		9 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Injection Pressure Control System
6F		3 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Turbocharger Compressor Inlet Pressure

Table 24 - Engine off service \$01 PID validation (continued)

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

Table 24 - Engine off service \$01 PID validation (continued)

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

Table 24 - Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
7F	2010 MY and beyond ALL – Fail if MD, HD 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, bits 4 – 7 must be 0.	NOx Sensor
84		1 byte	Manifold Surface Temperature
85	2013 MY and beyond D – Fail if OBD-II or HD OBD	10 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0. Note: This check will erroneously fail a compression ignition vehicle not equipped with a NOx Reagent System.	NOx Control System
86		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Particulate Matter (PM) Sensor
87	G – Warn 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
8B	2013 MY and beyond D – Fail if OBD-II or HD OBD	7 bytes	Diesel Aftertreatment status
8C		17 bytes	Wide Range O2
8D		1 byte	TP_G

Table 24 – Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
8E	2010 MY and beyond D – Warn if OBD-II or HD OBD	1 byte long	Engine Friction Percent Torque
8F		7 bytes long, Data A, at least one sensor must be supported in bits 0 – 3.	PM Sensor Output
90		3 byte long	WWH-OBD System Info Vehicle OBD
91		5 bytes long	WWH-OBD System Info ECU OBD
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
9C		17 bytes long, Data A, at least one sensor must be supported in bits 0 – 7.	O2 Sensor (wide range)

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

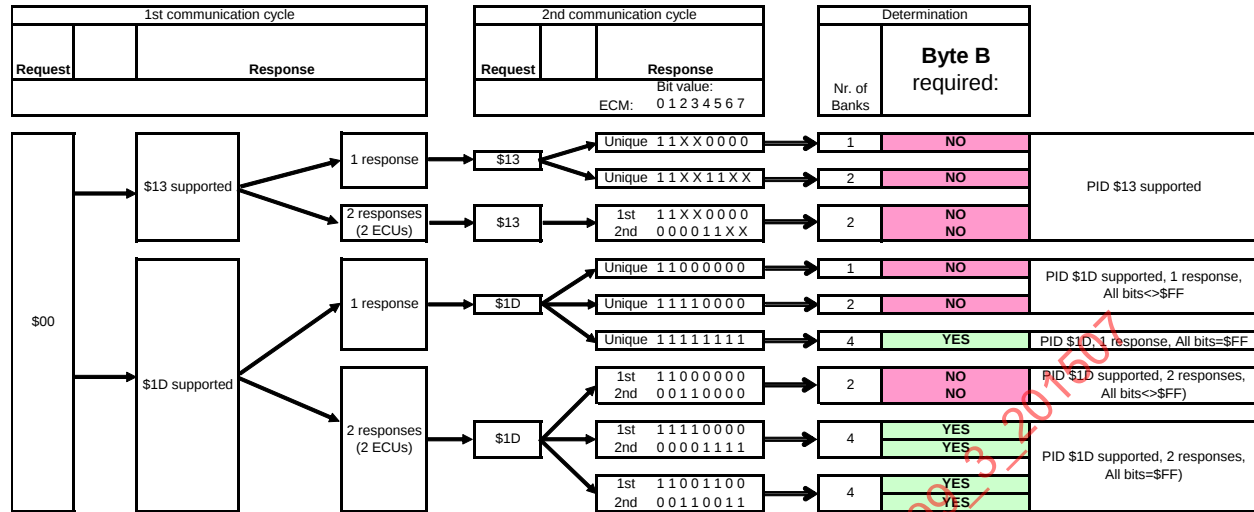


Figure 10 - Determination of usage of Byte B in addition to Byte A for Service \$01 PIDs \$06 to \$09 and PIDs \$55 to \$58

6.7 Verify Service \$08 - Request control of on-board system, test or component, engine off

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

Procedure:

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

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

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

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

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

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

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

Evaluation criteria:

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

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

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

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

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

6.7.1 [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				

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

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
#2	data record of supported TIDs = [1 st supported TID	M	XX	TIDREC_ 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
:	:	:	:	:
#n-4	data record of supported TIDs = [m th supported TID	C1	XX	TIDREC_ TID
#n-3	Data A: supported TIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported TIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported TIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported TIDs]	C2	xxxxxxxx	DATA_D
C1 = Conditional — TID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates TIDs supported; range of supported TIDs depends on selected TID value (see C1) for ISO 15765-4. For J1850, ISO9141-2 and ISO 14230-4, Data A-E shall be filled with \$00 if unused.				

Evaluation criteria:

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

- 6.7.2 [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).
- 6.7.3 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.

- 6.8 Establish communication (J1978 / ISO 15031-4), engine running

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

Protocol Determination Procedure:

- 6.8.1 Move ignition to crank position and start engine. Let engine idle for 1 m.

NOTE: Some powertrain control systems have engine controls that can start and stop the engine without regard to ignition position or setting.

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

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

Check battery voltage at the J1962 connector pin 16.

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

Table 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

6.9 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:

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

Any software meeting these specifications must wait 2 s 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 s maximum, until a positive response message is available.

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

6.10 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:

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

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

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

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

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

Evaluation criteria:

Required PIDs must be supported for all vehicles (ALL), gasoline engines (G), 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.

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

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

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

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

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

Evaluation criteria:

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

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

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

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

Table 39 - Request current powertrain diagnostic data response message

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

6.10.4 [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).

6.10.5 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.

Table 40 - Engine Idle Service \$01 PID Validation

Engine Idle Service \$01 PID Validation			
PID	Req'd 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	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 and ECUs, which do not support misfire monitoring, or may be 0 or 1 for compression ignition engines. Bit 4 must be 0 for any unsupported monitor in DATA B bit 1.	Misfire monitoring shall always indicate complete for spark ignition engines. Misfire monitoring shall indicate complete for compression ignition engines after the misfire evaluation is complete (1000 engine revs at idle, approx. 60 sec.). 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

Table 40 - Engine Idle Service \$01 PID Validation (continued)

PID	Req'd Support:	Required Value	Comment
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 only.	Bit 2 must be 1 for at least one ECU for OBD-II spark ignition engines, 0 for EOBD spark ignition engines. Bit 2 must be 0 for compression ignition engines (reserved).	All OBD-II spark ignition engines must support evap system monitoring. EOBD 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	Bit 5 must be 1 for at least one ECU	All spark ignition engines must support O2 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 O2 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”

Table 40 - Engine idle service \$01 PID validation (continued)

02		2 bytes long, value must be 0000	No freeze frame available
03, DATA_A, bits 5-7, DATA_B 5-7	G – Warn	2 bytes long, Data A and Data B bits 5 – 7 must all be 0	Some FUELSYSx bits are reserved
04	ALL – Fail	1 byte long, value must be > 0 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 deg C. Either \$05 or \$67 must be supported.	ECT in reasonable range
06	G – Warn	1 byte value or 2 byte value, as determined in Figure 10	Short Fuel Trim Bank 1/3
07	G – Warn	1 byte value or 2 byte value, as determined in Figure 10	Long Fuel Trim Bank 1/3
08		1 byte value or 2 byte value, as determined in Figure 10	Short Fuel Trim Bank 2/4
09		1 byte value or 2 byte value, as determined in Figure 10	Long Fuel Trim Bank 2/4
0A		1 byte long, value must be greater than 0 kPa, 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 and 2000 rpm, may be = 0 for HEV, PHEV, S/S.	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

Table 40 - Engine idle service \$01 PID validation (continued)

PID	Req'd Support:	Required Value	Comment
0F	G – Warn unless \$68 is supported	1 byte long, value must be between -20 and 120 deg C. Either \$0F or \$68 may be supported.	IAT in normal range
10	G – Warn unless \$66, \$0B or \$87 supported	2 bytes long, value must be greater than 0 g/sec. 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
13 or 1D, bits 0-7	G – Warn	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engines; (Note: Either \$13 or \$1D must be supported for spark ignition engine. Both PIDs shall not be supported on spark ignition or compression engines. Neither PID is required to be supported for compression ignition engines)	At least 2 O2S needed for OBD-II for spark ignition engines, compression ignition engines may or may not use any O2 sensors. Both PIDs \$13 and \$1D cannot be supported at the same time for either spark or compression ignition engines.
14, 15, 16, 17, 18, 19, 1A, 1B		2 bytes long	
1C	ALL - Fail	1 byte long, value must be 01, 03, 07, 09, 0B, 0D, 0F 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	Must be California OBD-II or EOBD
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.

Table 40 - Engine idle service \$01 PID validation (continued)

PID	Req'd Support:	Required Value	Comment
24, 25, 26, 27, 28, 29, 2A, 2B		4 bytes long	Check for usage of PID 4F
2C	D – Fail unless \$69 is supported for OBD-II and HD OBD	1 byte long, value must be < or = 10% for spark ignition engines, < or = 100% for compression ignition engines	EGR_PCT is < or = 10% at idle for spark ignition engine, EGR rates may be much higher for compression ignition 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%	FLU
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	4 bytes long	
41, DATA_B, bit 3	ISO 15765-4 ALL - Fail if OBD-II, Fail for EOBD if supported. (data must be correct if PID \$41 is supported for EOBD)	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	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	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

Table 40 - Engine idle service \$01 PID validation (continued)

PID	Req'd Support:	Required Value	Comment
41, DATA_C, bits 0-7	ISO 15765-4 ALL – Fail if OBD-II, Warn if EOBD	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 if supported. (data must be correct if PID \$41 is supported for EOBD)	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 if supported. (data must be correct if PID \$41 is supported for EOBD)	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	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- Fail if OBD-II, Warn if EOBD	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	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	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 deg C	AAT in normal range
47		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines 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

Table 40 - Engine idle service \$01 PID validation (continued)

PID	Req'd Support:	Required Value	Comment
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 m (59 s 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 m (59 s 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)	1 byte, value must be \$00 to \$17	FUEL_TYPE in SAE assigned range.
52		1 byte	ALCH_PCT
53		2 bytes	EVAP_VPA
54		2 bytes	EVAP_VP
55		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 1/3
56		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 1/3

Table 40 - Engine idle service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
57		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 2/4
58		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 2/4
59		2 bytes long, value must be greater than 0 kPa, 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 zero percent	BAT_PWR
5C	2010 MY and beyond D – Warn if OBD-II or HD OBD	1 byte long, value must be -20 to 150 deg 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 greater than zero 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	1 byte, value must be greater than zero percent, may be = 0 for HEV, PHEV, S/S.	TQ_ACT not zero, HEV, PHEV, S/S engine may be off.
63	2010 MY and beyond D – Fail if OBD-II or HD OBD	2 bytes long, value must be greater than zero Nm, may be = 0 for HEV, PHEV, S/S.	TQ_REF not zero, HEV, PHEV, S/S engine may be off.
64		5 bytes long, all values must greater than zero percent, may be = 0 for HEV, PHEV, S/S.	TQ_MAX not zero, HEV, PHEV, S/S engine may be off.

Table 40 - Engine idle service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
65	2010 MY and beyond D – Fail if OBD-II or HD OBD	2 bytes, Data A, at least one device must be supported in bits 0 – 3, bits 4 – 7 must be 0, Data B, bits 4 – 7 must be 0.	Auxilliary I/O, may support PTO, diesel must support wait ti 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/sec, 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 deg 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 deg 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 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 < or = 10% for spark ignition engines, < or = 100% for compression ignition engines.	Commanded EGR and EGR Error EGR_x_CMD is < or = 10% at idle for spark ignition engines. EGR rates may be much higher for compression 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%

Table 40 - Engine idle service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
6A		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0.	Commanded Diesel Intake Air Flow Control and Relative Intake Air Flow Position
6B		5 bytes long, Data A, at least one PID must be supported in bits 0 – 3, bits 4 – 7 must be 0. If supported, any EGRT values must be -20 to 215 deg C for 1 deg scaling or -20 to 500 deg C for 4 deg 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 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 deg 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, bits 2 – 7 must be 0.	Turbocharger Compressor Inlet Pressure

Table 40 - Engine idle service \$01 PID validation (continued)

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

Table 40 - Engine idle service \$01 PID validation (continued)

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

Table 40 - Engine idle service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
7F	2010 MY and beyond ALL – Fail if MD, HD 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, bits 4 – 7 must be 0.	NOx Sensor
84		1 byte	Manifold Surface Temperature
85	2013 MY and beyond D – Fail if OBD-II or HD OBD	10 bytes long, Data A, at least one sensor must be supported in bits 0 – 3, bits 4 – 7 must be 0. Note: This check will erroneously fail a compression ignition vehicle not equipped with a NOx Reagent System.	NOx Control System
86		5 bytes long, Data A, at least one sensor must be supported in bits 0 – 1, bits 2 – 7 must be 0.	Particulate Matter (PM) Sensor
87	G – Warn 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 O2
8D		1 byte	TP_G

Table 40 – Engine off service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
8E	2010 MY and beyond D – Warn if OBD-II or HD OBD	1 byte long	Engine Friction Percent Torque
8F		7 bytes long, Data A, at least one sensor must be supported in bits 0 – 3.	PM Sensor Output
90		3 byte long	WWH-OBD System Info Vehicle OBD
91		5 bytes long	WWH-OBD System Info ECU OBD
92		2 bytes long	Fuel System Control Status (Compr Ign)
93		3 bytes long	WWH-OBD Counters Vehicle OBD
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
9C		17 bytes long, Data A, at least one sensor must be supported in bits 0 – 7.	O2 Sensor (wide range)

6.11 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:

6.11.1 [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:

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

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

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

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

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

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

Evaluation criteria:

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

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

6.11.3 [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).

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

6.11.5 [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.

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

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

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

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

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

6.11.6 [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.

6.12 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:

6.12.1 [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	xxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxx b = \$XX	DATA_D

Evaluation criteria:

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

6.12.2 [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.

6.13 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:

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

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

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

Evaluation criteria:

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

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

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

6.14 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:

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 60 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 15765-4 protocol

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

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

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

Evaluation criteria:

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

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

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

OBDMID support is not allowed in the followed, prohibited ranges: \$11 - \$1F, \$25 - \$30, \$3E - \$3F, \$51 - \$5F, \$65 - \$70, \$75 - \$7F, \$87 - \$8F, \$92 - \$97, \$9A - \$9F, \$B4 - \$BF, \$C1 - \$DF, \$E1 - \$FF. Vehicles which do not comply shall be flagged as a failure. The range \$E1 - \$FF is allowed for EOBD 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., O2 sensors that run as soon as the ignition is turned on. These monitors may report test results on Service \$06 immediately after DTCs are cleared. If a Service \$06 Test ID reports a test value, and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

Table 62 - OBDMID Validation

Monitor Supported	PID \$01	Required OBDMIDs	Allowed OBDMID Range
Spark Ignition Monitors Supported	Data B bit 3 = 0		
Misfire	Data B bit 0 = 1	\$A2 SDTID \$0B, \$A2 SDTID \$0C (Cyl #1) 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

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

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

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

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

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

Evaluation criteria:

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

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

6.14.5 [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).

6.14.6 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.

6.15 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:

6.15.1 [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

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.

6.16 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:

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

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

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

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

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
#2	data record of supported TIDs = [1 st supported TID	M	XX	TIDREC_ TID
#3	Data A: supported TIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported TIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported TIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported TIDs]	M	xxxxxxxx	DATA_D
C1 = Conditional — TID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates TIDs supported; range of supported TIDs depends on selected TID value (see C1) for ISO 15765-4. For J1850, ISO9141-2 and ISO 14230-4, Data A-E shall be filled with \$00 if unused.				

Evaluation criteria:

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

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

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

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

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

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

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

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

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

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request control of on-board device response message SID	M	48	SIDPR
#2	data record of supported TIDs = [1 st supported TID	M	XX	TIDREC_ 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
:	:	:	:	:
#n-4	data record of supported TIDs = [m th supported TID	C1	XX	TIDREC_ TID
#n-3	Data A: supported TIDs,	C2	xxxxxxxx	DATA_A
#n-2	Data B: supported TIDs,	C2	xxxxxxxx	DATA_B
#n-1	Data C: supported TIDs,	C2	xxxxxxxx	DATA_C
#n	Data D: supported TIDs]	C2	xxxxxxxx	DATA_D
C1 = Conditional — TID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates TIDs supported; range of supported TIDs depends on selected TID value (see C1) for ISO 15765-4. For J1850, ISO9141-2 and ISO 14230-4, Data A-E shall be filled with \$00 if unused.				

Evaluation criteria:

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

6.16.3 [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).

6.16.4 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.

6.17 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:

6.17.1 [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	INFotyp

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

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

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 = [			INFATYPEC
#2	1 st supported InfoType	M	XX	INFATYPE
#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. (EOBD 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 requires CALID support.)

Operator prompt 2 asks for the number of emission-related reprogrammable ECUs in the vehicle. For OBD-II 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 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 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 or EOBD, verify that both INFOTYPE \$08 and \$0B are not supported. If they are, this shall be flagged as a failure.

For OBD-II and 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 only, verify that INFOTYPE \$0A is supported for 2010 MY and beyond vehicles. If the vehicle does not support ECU name, this shall be flagged as failure, however, if the vehicle is a 2010–2012 MY vehicle that does not support ECU name, the manufacturer can present the CARB Executive Officer with the manufacturer's proposed phase-in plan and an explanation as to why the vehicle is not required to comply. (EOBD does not require ECU name 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 \$12 is supported, this shall be flagged as a failure.

For ISO 15764-4 protocol only, if INFOTYPE \$01, \$03, \$05 or \$07, \$09, \$0C, \$0E is supported, this shall be flagged as a warning.

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

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

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

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information request SID	M	09	SIDRQ
#2	InfoType#1 (InfoTypes supported: \$01 - \$20)	M	00	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
#2	data record of supported InfoTypes = [1 st supported InfoType	M	XX	INFTYPEPREC
#3	Data A: supported InfoTypes,	M	xxxxxxxx	INFTYPE
#4	Data B: supported InfoTypes,	M	xxxxxxxx	DATA_A
#5	Data C: supported InfoTypes,	M	xxxxxxxx	DATA_B
#6	Data D: supported InfoTypes]	M	xxxxxxxx	DATA_C
:	:	:	:	:
#n-4	data record of supported InfoTypes = [m th supported InfoType	C1	XX	INFTYPEPREC
#n-3	Data A: supported InfoTypes,	C2	xxxxxxxx	INFTYPE
#n-2	Data B: supported InfoTypes,	C2	xxxxxxxx	DATA_A
#n-1	Data C: supported InfoTypes,	C2	xxxxxxxx	DATA_B
#n	Data D: supported InfoTypes]	C2	xxxxxxxx	DATA_C
C1 = Conditional — INFOTYPE value shall be the same value as included in the request message if supported by the ECU C2 = Conditional — value indicates INFOTYPEs supported; range of supported INFOTYPEs depends on selected INFOTYPE value (see C1)				

Evaluation criteria:

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

6.17.3 [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).

6.17.4 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:

6.17.5 [For 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	INFTYPE	

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 J1850, ISO 9141-2 and ISO 14230-4.

6.17.6 [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	1 st ASCII character of VIN	XX	VIN
#5	2 nd ASCII character of VIN	XX	VIN
#6	3 rd ASCII character of VIN	XX	VIN
#7	4 th ASCII character of VIN	XX	VIN
#8	5 th ASCII character of VIN	XX	VIN
#9	6 th ASCII character of VIN	XX	VIN
#10	7 th ASCII character of VIN	XX	VIN
#11	8 th ASCII character of VIN	XX	VIN
#12	9 th ASCII character of VIN	XX	VIN
#13	10 th ASCII character of VIN	XX	VIN
#14	11 th ASCII character of VIN	XX	VIN
#15	12 th ASCII character of VIN	XX	VIN
#16	13 th ASCII character of VIN	XX	VIN
#17	14 th ASCII character of VIN	XX	VIN
#18	15 th ASCII character of VIN	XX	VIN
#19	16 th ASCII character of VIN	XX	VIN
#20	17 th ASCII character of VIN	XX	VIN

Table 81 - Request vehicle information response message for 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	INFOTYP_
#3	MessageCount	M	01 - 05	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

Evaluation criteria:

For response to INFOTYPE \$02, five response messages should be received for 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 VIN does not require model year in position 10.)

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	

Procedure:

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

Table 83 - Request vehicle information request message for all protocols

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

Table 84 - Request vehicle information response message

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

Evaluation criteria:

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

6.17.8 [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	INFOTP

Table 86 - Request vehicle information response message (1st) for ISO 15765-4

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

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

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	04	INFTYP_
#3	MessageCount	M	01 – XX	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

Evaluation criteria:

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

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

All CALIDs must contain 1 to 16 printable ASCII characters \$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:

6.17.9 [For 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

6.17.10 [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 s 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 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, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D

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

Evaluation criteria:

The value of INFOTYPE \$05 must match the number of 4 byte CVNs returned for ISO 9141-2, 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, 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:

6.17.11 [For 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.

6.17.12 [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

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 (shown as 20 in this example)	10 or 14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B

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

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFOTYP_
#3	MessageCount	M	01 - 10	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	M	XX	DATA_A
#5		M	XX	DATA_B
#6		M	XX	DATA_C
#7		M	XX	DATA_D

Evaluation criteria:

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

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

If an ECU does not support INFOTYPE \$08, no response is allowed for ISO 15765-4, 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.

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.

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, IPT support is required based on Operator Prompt 5).

6.17.13 [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	INFOTYP	

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	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

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

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

Evaluation criteria:

For 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, 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, IPT support is required based on Operator Prompt 5.

Procedure:

6.17.14 [For 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 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

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	INFOTYP
#3	Number of data items: 01	01	NODI
#4	Data A	XX	ECUNAME_A
#5	Data B	XX	ECUNAME_B
#6	Data C	XX	ECUNAME_C
#7	Data D	XX	ECUNAME_D
#8	Data E: '-' delimiter	2D	ECUNAME_E
#9	Data F	XX	ECUNAME_F
#10	Data G	XX	ECUNAME_G
#11	Data H	XX	ECUNAME_H
#12	Data I	XX	ECUNAME_I
#13	Data J	XX	ECUNAME_J
#14	Data K	XX	ECUNAME_K
#15	Data L	XX	ECUNAME_L
#16	Data M	XX	ECUNAME_M
#17	Data N	XX	ECUNAME_N
#18	Data O	XX	ECUNAME_O
#19	Data P	XX	ECUNAME_P
#20	Data Q	XX	ECUNAME_Q
#21	Data R	XX	ECUNAME_R
#22	Data S	XX	ECUNAME_S
#23	Data T	XX	ECUNAME_T

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

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

Evaluation criteria:

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

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

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

- Message # 1 shall contain 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 104 below;
- Data byte 5, "-", (\$2D) contains delimiter;
- Data bytes 6-20, "YYYYYYYYYYYYYYYY", contains text name (no blanks between words) and ECU number if the vehicle is equipped with more than one ECU of that type as specified in Table 101 below.

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

Any data field that does not match the specification in Table 104 (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 - 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 support for ECU name not required.)

Table 106 - ECU name data byte description

Acronym (max 1 – 4 chars)	Full name of Control Module/ECU	ECU name and number (max 14 chars + 1 opt. digit)
ABS, ABS1, ABS2	Anti-Lock Brake System (ABS) Control Module	AntiLockBrake
AFCM, AFC1, AFC2	Alternative Fuel Control Module	AltFuelCtrl
AHCM, AHC1, AHC2	Auxiliary Heater Control Module	AuxHeatCtrl
Air Pump Control Module	AirPumpCtrl	APCM, APC1, APC2
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
BSCM, BSC1, BSC2	Brake System Control Module	BrakeSystem
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
ECCI, ECC1, ECC2	Emissions Critical Control Information	EmissCritInfo
ECM, ECM1, ECM2	Engine Control Module	EngineControl
FACM, FAC1, FAC2	Fuel Additive Control Module	FuelAddCtrl
FICM, FIC1, FIC2	Fuel Injector Control Module	FuelInjCtrl
FPCM, FPC1, FPC2	Fuel Pump Control Module	FuelPumpCtrl
4WDC, 4WD1, 4WD2	Four-Wheel Drive Clutch Control Module	4WHLDrvClCtrl
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
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

6.17.15 [For 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	INFOTYP

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	INFOTYP
#3	Message Count ESN = 5 response messages	05	MC_ESN

Evaluation criteria:

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

6.17.16 [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	INFOTYP

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	INFOTYP
#3	Number of data items: 01	01	NODI
#4	1 st ASCII character of ESN	XX	ESN
#5	2 nd ASCII character of ESN	XX	ESN
#6	3 rd ASCII character of ESN	XX	ESN
#7	4 th ASCII character of ESN	XX	ESN
#8	5 th ASCII character of ESN	XX	ESN
#9	6 th ASCII character of ESN	XX	ESN
#10	7 th ASCII character of ESN	XX	ESN
#11	8 th ASCII character of ESN	XX	ESN
#12	9 th ASCII character of ESN	XX	ESN
#13	10 th ASCII character of ESN	XX	ESN
#14	11 th ASCII character of ESN	XX	ESN
#15	12 th ASCII character of ESN	XX	ESN
#16	13 th ASCII character of ESN	XX	ESN
#17	14 th ASCII character of ESN	XX	ESN
#18	15 th ASCII character of ESN	XX	ESN
#19	16 th ASCII character of ESN	XX	ESN
#20	17 th ASCII character of ESN	XX	ESN

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

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

Evaluation criteria:

For response to INFOTYPE \$0D, five response messages should be received for 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.)

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

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 J1850, ISO 9141-2 and ISO 14230-4.

6.17.18 [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	1 st ASCII character of EROTAN	XX	EROTAN
#5	2 nd ASCII character of EROTAN	XX	EROTAN
#6	3 rd ASCII character of EROTAN	XX	EROTAN
#7	4 th ASCII character of EROTAN	XX	EROTAN
#8	5 th ASCII character of EROTAN	XX	EROTAN
#9	6 th ASCII character of EROTAN	XX	EROTAN
#10	7 th ASCII character of EROTAN	XX	EROTAN
#11	8 th ASCII character of EROTAN	XX	EROTAN
#12	9 th ASCII character of EROTAN	XX	EROTAN
#13	10 th ASCII character of EROTAN	XX	EROTAN
#14	11 th ASCII character of EROTAN	XX	EROTAN
#15	12 th ASCII character of EROTAN	XX	EROTAN
#16	13 th ASCII character of EROTAN	XX	EROTAN
#17	14 th ASCII character of EROTAN	XX	EROTAN
#18	15 th ASCII character of EROTAN	XX	EROTAN
#19	16 th ASCII character of EROTAN	XX	EROTAN
#20	17 th ASCII character of EROTAN	XX	EROTAN

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

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

Evaluation criteria:

For response to INFOTYPE \$0F, five response messages should be received for 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.)

6.18 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:

- 6.18.1 [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 117 - Request current powertrain diagnostic data request message, reverse order for all protocols

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

Table 118 - 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 = [	M	XX	PIDREC_ PID
#3	1 st supported PID	M	xxxxxxx	DATA_A
#4	Data A: supported PIDs,	M	xxxxxxx	DATA_B
#5	Data B: supported PIDs,	M	xxxxxxx	DATA_C
#6	Data C: supported PIDs,	M	xxxxxxx	DATA_D
	Data D: supported PIDs]	M	xxxxxxx	
C1 = Conditional — PID value shall be the same value as included in the request message if supported by the ECU				
C2 = Conditional — value indicates PIDs supported; range of supported PIDs depends on selected PID value (see C1)				

Evaluation criteria:

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

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.

6.18.2 [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 119 - Request current powertrain diagnostic data request message, reverse order for ISO 15765-4 protocol

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

Table 120 - Request current powertrain diagnostic data response message (report supported PIDs)

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

Evaluation criteria:

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

6.18.3 [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 121 - 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 122 - Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

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

6.18.4 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.

6.19 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:

6.19.1 [For all protocols] Transmit the Service \$01 PID \$00 request at the maximum allowed time interval (4,900 ms) for 15 s (3 requests).

Table 123 - Request current powertrain diagnostic data request message for all protocols

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

**Table 124 - Request current powertrain diagnostic data response message
(report supported PIDs)**

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

6.20 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:

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

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 125 - Request current powertrain diagnostic data request message for all protocols

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

**Table 126 - Request current powertrain diagnostic data response message
(report supported PIDs)**

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

Evaluation criteria:

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

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

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.

6.21 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,

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

Table 127 - Request emission-related diagnostic trouble codes with permanent status

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

Evaluation criteria:

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

6.21.2 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.

7. 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.

7.1 Induce Circuit Fault**Procedure:**

7.1.1 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 s) for only one ECU. The selected fault must illuminate the MIL using two (for OBD-II) or three (for EOBD) 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.

7.1.2 Start engine, let idle for one m 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.

7.2 Establish communication (J1978 / ISO 15031-4), engine running

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

Protocol Determination Procedure:

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

J1850 41.6 Kbps PWM

J1850 10.4 Kbps VPW

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

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

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

ISO 15765-4 – 11-bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

ISO 15765-4 – 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD 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 128 - 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 129 - 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

7.3 Verify Service \$07 – Request pending emission-related DTCs, engine running

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

Procedure:

7.3.1 Every 0.500 s, 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 s the tool will prompt the user to continue without a pending DTC (logged as a failure).

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

Table 130 - 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 131 - 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 132 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for J1850, ISO 9141-2 and ISO 14230-4

Message direction:		All ECUs → External test equipment	
Message Type:		Response	
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	DTC#1 (High Byte)	XX	DTC1HI
#3	DTC#1 (Low Byte)	XX	DTC1LO
#4	DTC#2 (High Byte)	XX	DTC2HI
#5	DTC#2 (Low Byte)	XX	DTC2LO
#6	DTC#3 (High Byte)	XX	DTC3HI
#7	DTC#3 (Low Byte)	XX	DTC3LO
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.

7.4 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:

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

Table 133 - 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 134 - Request emission-related diagnostic trouble codes response message for ISO 15765-4

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

Table 135 - Request emission-related diagnostic trouble codes response message for ISO 14230-4

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

Evaluation criteria:

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.

Procedure:

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

Table 136 - Request current powertrain diagnostic data request message for all protocols

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

Table 137 - ECU# x response: Request current powertrain diagnostic data response message

Message direction:		All ECUs → External test equipment	
Message Type:		Response	
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: 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	xxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxx b = \$XX	DATA_D

Evaluation criteria:

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

7.5 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:

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

Table 138 - Request powertrain freeze frame data response message for all protocols

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

Table 139 - Request powertrain freeze frame data response message

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

Evaluation criteria:

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:

- 7.5.2 [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 140 - Request powertrain freeze frame data request message (read supported PIDs) for all protocols

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

Table 141 - Request powertrain freeze frame data response message (report freeze frame PID values)

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

Evaluation criteria:

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

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

Table 142 - Request powertrain freeze frame data request message (read supported PIDs) for ISO 15765-4

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

Table 143 - Request powertrain freeze frame data response message (report freeze frame PID values)

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

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

Table 144 - Request powertrain freeze frame data request message (read supported PIDs) for all protocols

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

Table 145 - Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

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

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

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

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

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

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

Table 146 - Request current powertrain diagnostic data request message for ISO 15765-4 protocol

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data request SID	M	02	SIDRQ
#2	PID	M	XX	PID
#3	frame #00	M	00	FRNO_
#4	PID	U	XX	PID
#5	frame #00	U/C	00	FRNO_
#6	PID	U	XX	PID
#7	frame #00	U/C	00	FRNO_
U = User Optional C = Conditional — parameter is only included if preceding PID# is included				

Table 147 - Request current powertrain diagnostic data response message

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

7.5.6 [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).

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

Evaluation criteria:

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

7.6 Continue to induce circuit fault (EOBD only)

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

Procedure:

- 7.6.1 For OBD-II, skip to Section 7. For EOBD, continue to 6.6.2 for second driving cycle. Go to Section 7 for third driving cycle.
- 7.6.2 Turn ignition off (engine off) for 30 s or longer, as appropriate for the ECU. Keep sensor disconnected.
- 7.6.3 Start engine, let idle for one m 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.
- 7.6.4 Continue to Section 7

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

- 8.1 Continue to induce circuit fault

Procedure:

- 8.1.1 Turn ignition off (engine off) for 30 s or longer, as appropriate for the ECU. Keep sensor disconnected.
- 8.1.2 Start engine, let idle for one m 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.
- 8.2 Establish communication (J1978 / ISO 15031-4), engine running

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

Protocol Determination Procedure:

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

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

Check battery voltage at the J1962 connector pin 16.

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

Table 148 - Request current powertrain diagnostic data request message for all protocols

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

Table 149 - ECU# x response: Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

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

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

8.3 Verify Service \$07 - Request pending emission-related DTCs, engine running

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

Procedure:

8.3.1 [For all protocols] Every 0.500 s, 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 s, no pending DTC is set, the tool will continue to wait for a DTC to be set, but will allow the user the option to continue without a pending DTC (flagged as a failure).

Table 150 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle request message for all protocols

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

Table 151 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 15765-4

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

Table 152 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for J1850, ISO 9141-2 and ISO 14230-4

Message direction:		All ECUs → External test equipment	
Message Type:		Response	
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response SID	47	SIDPR
#2	DTC#1 (High Byte)	XX	DTC1HI
#3	DTC#1 (Low Byte)	XX	DTC1LO
#4	DTC#2 (High Byte)	XX	DTC2HI
#5	DTC#2 (Low Byte)	XX	DTC2LO
#6	DTC#3 (High Byte)	XX	DTC3HI
#7	DTC#3 (Low Byte)	XX	DTC3LO
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 153 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 15765-4

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

Evaluation criteria:

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

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

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

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

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

For ISO 15765-4 interfaces, the ECU will respond with a message 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.

8.4 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:

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

Table 154 - 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 155 - 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 156 - Request emission-related diagnostic trouble codes response message for J1850, ISO 9141-2 and ISO 14230-4

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

Table 157 - 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 158 - Request emission-related diagnostic trouble codes response message for ISO 14230-4

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

Evaluation criteria:

Verify that at least one Service \$03 DTC response with a non-zero DTC is received. (All protocols)

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

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

For J1850 and ISO 9141-2 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.

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

Table 159 - 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 160 - 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	xxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxx b = \$XX	DATA_D

Evaluation criteria:

DATA_A, bits 0-6 must be greater than or equal to one (at least one DTC) and DATA_A bit 7 must be 1 (MIL is on) for at least one ECU.

8.5 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:

8.5.1 [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 161 - 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 162 - 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:

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 163 - 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 164 - Request powertrain freeze frame data response message (report freeze frame PID values)

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

Evaluation criteria:

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

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

- 8.5.3 [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 165 - 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 166 - Request powertrain freeze frame data response message (report freeze frame PID values)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request powertrain freeze frame data response SID	M	42	SIDRQ
#2	1 st supported PID	M	00	PID_
#3	Frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxx	DATA_A
#5		C1	xxxxxxx	DATA_B
#6		C1	xxxxxxx	DATA_C
#7		C1	xxxxxxx	DATA_D
:	:	:	:	:
#2	m th supported PID	C2	XX	PID_
#3	Frame #	C2	XX	FRNO_
#4	data record of m th supported PID = [data A, data B, data C, data D]	C3	xxxxxxx	DATA_A
#5		C4	xxxxxxx	DATA_B
#6		C4	xxxxxxx	DATA_C
#7		C4	xxxxxxx	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. [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 167 - 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 168 - Request current powertrain diagnostic data response message

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

8.5.4 [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 169 - 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 170 - Request current powertrain diagnostic data response message

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

8.5.5 [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).

8.5.6 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.

9. TEST VEHICLE WITH FAULT REPAIRED

9.1 Repair circuit fault and complete one driving cycle, MIL illuminated

Procedure:

9.1.1 Turn ignition off (engine off) for 30 s or longer, as appropriate for the ECU, connect sensor.

9.1.2 Start engine, let idle for one m 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.

9.1.3 Turn ignition off (engine off) for 30 s. (This completes one driving cycle with no fault.)

9.1.4 Start engine, let idle for one m 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.)

9.2 Establish communication (J1978 / ISO 15031-4), engine running

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

Protocol Determination Procedure:

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

J1850 10.4 Kbps VPW

J1850 41.6 Kbps PWM

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

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

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

ISO 15765-4 - 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD test)

ISO 15765-4 – 11 bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

Check battery voltage at the J1962 connector pin 16.

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

Table 171 - 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 172 - 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

9.3 Verify Service \$07 - Request pending emission-related DTCs, engine running

Purpose: To verify that all ECUs respond correctly to a Service \$07 request and there are no pending emission-related DTC set even though the DTC is still a confirmed DTC.

Procedure:

9.3.1 [For all protocols] Every 0.500 s, 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 s the tool will prompt the user to continue with a pending DTC (logged as a failure).

9.3.2 Transmit a Service \$07 request message.

Table 173 - 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 174 - 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 175 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4

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

Evaluation criteria:

Verify that no Service \$07 pending DTC is set.

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

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

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

For ISO 15765-4 interfaces, the ECU will respond with a message 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 still on.

Procedure:

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

Table 176 - 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 177 - Request emission-related diagnostic trouble codes response message for ISO 15765-4

Message direction:	All ECUs → External test equipment		
Message Type:	Response		
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related DTCs response SID	43	SIDPR
#2	# of DTC {number of emission-related DTCs stored in this ECU}	> or = 01	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Table 178 - Request emission-related diagnostic trouble codes response message for J1850, ISO 9141-2 and ISO 14230-4

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

Table 179 - 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 180 - 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 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 181 - Request current powertrain diagnostic data request message for all protocols

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

Table 182 - ECU# x response: Request current powertrain diagnostic data response message

Message direction:		All ECUs → External test equipment	
Message Type:		Response	
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: 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	xxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxx b = \$XX	DATA_D

Evaluation criteria:

DATA_A, bits 0-6 must be greater than or equal to one (at least one DTC) and DATA_A bit 7 must be 1 (MIL is on) for at least one ECU.

9.5 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:

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 while a confirmed DTC is present.

TABLE 183 - 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 184 - Request powertrain freeze frame data response message

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

Evaluation criteria:

Verify that Frame \$00, PID \$02 is the same as one of the DTCs reported in Service \$03 in Section 7 for the vehicle (the set of ECUs). There should be at least one DTC stored.

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

Procedure:

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 185 - 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 186 - Request powertrain freeze frame data response message (report freeze frame PID values)

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

9.5.3 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, and either \$11, \$45 or \$49 must be supported by the vehicle that has a freeze frame DTC. For EOBD, 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, and either \$11, \$45 or \$49 must be supported by each corresponding ECU that has a freeze frame DTC. For EOBD, 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:

- 9.5.4 [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.

Table 187 - 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 188 - Request powertrain freeze frame data response message (report freeze frame PID values)

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

- 9.5.5 [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 189 - 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 190 - Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

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

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

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

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

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

- 9.5.6 [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 191 - 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 192 - Request current powertrain diagnostic data response message

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

9.5.7 [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).

9.5.8 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.

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 there is at least one permanent DTCs stored during the previous driving cycle.

Procedure:

9.6.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

Table 193 - 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 194 - 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 - 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. If an EOBD vehicle does not support permanent codes, do not log a failure. If an EOBD 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 - 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.

10. TEST VEHICLE WITH NO FAULTS AFTER 3 OR 4 DRIVING CYCLES COMPLETED

10.1 Complete two or more additional driving cycles

Procedure:

- 10.1.1 Turn ignition off (engine off) for 30 s or longer, as appropriate for the ECU. (This completes two driving cycles with no fault.)
- 10.1.2 Start engine, let idle for one m 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.)
- 10.1.3 Turn ignition off (engine off) for 30 s or longer, as appropriate for the ECU. (This completes three driving cycles with no fault.)
- 10.1.4 Start engine, let idle for one m 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 may be performed until the MIL is off.)
- 10.1.5 If the MIL is off, continue to 9.2, otherwise, turn ignition off (engine off) for 30 s or longer, as appropriate for the ECU. (This completes an additional driving cycles with no fault.)
- 10.1.6 Start engine, let idle for one m 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.)

10.2 Establish communication (J1978 / ISO 15031-4), engine running

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

Protocol Determination Procedure:

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

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

Check battery voltage at the J1962 connector pin 16.

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

Table 195 - 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 196 - 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

10.3 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:

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

Table 197 - 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 198 - 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 199 - 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.

10.4 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:

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

**Table 200 - 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 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}	01	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

**Table 202 - Request emission-related diagnostic trouble codes response message
for J1850, ISO 9141-2, and ISO 14230-4**

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

**Table 203 - 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 204 - Request emission-related diagnostic trouble codes response message for ISO 14230-4

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

Evaluation criteria:

Verify that at least one Service \$03 DTC response with a non-zero DTC is received. (All protocols)

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

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

For J1850 and ISO 9141-2 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.

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

Table 205 - Request current powertrain diagnostic data request message for all protocols

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

Table 206 - ECU# x response: Request current powertrain diagnostic data response message

Message direction:		All ECUs → External test equipment	
Message Type:		Response	
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data response SID	41	SIDPR
#2	PID: 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:

10.4.3 Record MIL status (DATA_A bit 7) in vehicle log file – MIL must not be illuminated or this will be flagged as a failure.

10.5 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:

10.5.1 [For all protocols] Transmit Service \$02 PID \$02 Frame \$00 to read freeze frame DTCs. Freeze frame must be retained in at least one ECU after MIL is extinguished.

Table 207 - 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 208 - 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:

10.5.2 [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 209 - 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 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	SIDPR
#2	1 st supported PID	M	00	PID_
#3	frame #	M	00	FRNO_
#4	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxx	DATA_A
#5		C1	xxxxxxx	DATA_B
#6		C1	xxxxxxx	DATA_C
#7		C1	xxxxxxx	DATA_D
C1 = Conditional — “data B - D” depend on selected PID				

Evaluation criteria:

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

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

10.5.3 [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 211 - 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 212 - Request powertrain freeze frame data response message (report freeze frame PID values)

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

10.5.4 [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 213 - 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 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	data record of 1 st supported PID = [data A, data B, data C, data D]	M	xxxxxxx	DATA_A
#5		C1	xxxxxxx	DATA_B
#6		C1	xxxxxxx	DATA_C
#7		C1	xxxxxxx	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.

10.5.5 [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 215 - 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 216 - Request current powertrain diagnostic data response message

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

10.5.6 [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).

10.5.7 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.

10.6 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:

10.6.1 [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 217 - Request emission-related diagnostic trouble codes with permanent status

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

Table 218 - 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.

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 - 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. If an EOBD vehicle does not support permanent codes, do not log a failure. If an EOBD vehicle does support permanent codes, they will be tested for correct behavior.

10.7 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:

10.7.1 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 section 9.8, If the answer is "No" then skip to section 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.

10.7.2 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.

10.8 Induce circuit fault to set pending, and confirmed DTC

Procedure:

- 10.8.1 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 s) for only one ECU. The selected fault must illuminate the MIL using two (for OBD-II or three (for EOBD) 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.
- 10.8.2 Start engine, let idle for one m 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.
- 10.8.3 Turn ignition off (engine off) for 30 s. Keep sensor disconnected.
- 10.8.4 Start engine, let idle for one m 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.
- 10.8.5 Turn ignition off (engine off) for 30 s. Keep sensor disconnected.
- 10.8.6 (For EOBD only – EOBD may require an additional driving cycle to set confirmed DTC.) If required, start engine, let idle for one m 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.
- 10.8.7 Turn ignition off (engine off) for 30 s. Keep sensor disconnected.
- 10.8.8 This completes the driving cycle and allows the permanent code to be set. Connect scan tool to the J1962 connector.
- 10.8.9 Turn ignition on. Do not crank engine.
- 10.9 Establish communication (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:

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

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

Check battery voltage at the J1962 connector pin 16.

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

Table 219 - Request current powertrain diagnostic data request message for all protocols

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

Table 220 - ECU# x response: Request current powertrain diagnostic data response message

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

Evaluation criteria:

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

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

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

10.10 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:

10.10.1 [For ISO 15765-4 and ISO 14320-4 protocols] Transmit Service \$03 request message. Verify that a proper response is received.

Table 221 - 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 222 - 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.

10.11 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:

10.11.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

Table 223 - Request emission-related diagnostic trouble codes with permanent status

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

Table 224 - Request emission-related diagnostic trouble codes with permanent status response message for ISO-15765-4

Message direction:		All ECUs → External test equipment	
Message Type:		Response	
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status response SID	4A	SIDPR
#2	# of DTC {number of emission-related DTCs with permanent status stored in this ECU}	XX	#OFDTC
#3	DTC High Byte of PXXXX	XX	DTC1HI
#4	DTC Low Byte of PXXXX	XX	DTC1LO

Evaluation criteria:

For ISO 15765-4 interfaces, verify that at least one Service \$0A permanent DTC response with a non-zero DTC is received. The #OFDTC (DTC count) and the number of reported DTCs must match.

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 - 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. If an EOBD vehicle does not support permanent codes, do not log a failure. If an EOBD vehicle does support permanent codes, they will be tested for correct behavior.

10.12 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:

10.12.1 Turn ignition off (engine off) for 30 s.

10.12.2 Connect sensor.

10.12.3 Turn ignition on. Do not crank engine.

10.12.4 Establish communication (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:

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

J1850 41.6 Kbps PWM

J1850 10.4 Kbps VPW

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

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

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

ISO 15765-4 – 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD test)

ISO 15765-4 – 11 bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

Check battery voltage at the J1962 connector pin 16.

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

Table 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 used to determine PID support for PIDs 01-20	00	PID

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 requested	00	PID
#3	Data byte A, representing support for PIDs 01	1xxxxxxx b	DATA_A
#4	Data byte B, representing support for PIDs	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

10.12.6 [ISO 15765-4 protocol] Transmit Service \$04 request message and observe response message.

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

Table 227 - 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 228 - 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 s maximum, until a positive response message is available. All other negative responses shall be flagged as a failure.

10.13 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:

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

Table 229 - 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 230 - 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	xxxxxxx b = \$XX	DATA_B
#5	Catalyst -, Heated catalyst -, ..., monitoring supported	xxxxxxx b = \$XX	DATA_C
#6	Catalyst -, Heated catalyst -, ..., monitoring test complete/not complete	xxxxxxx b = \$XX	DATA_D

Evaluation criteria:

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

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

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

10.14 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:

10.14.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

Table 231 - 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 232 - 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 - 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. If an EOBD vehicle does not support permanent codes, do not log a failure. If an EOBD vehicle does support permanent codes, they will be tested for correct behavior.

10.15 Complete one driving cycle with fault repaired**Procedure:**

10.15.1 Start engine, let idle for one m 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.

10.15.2 Turn ignition off (engine off) for 30 s. (This completes one driving cycle with no fault.)

10.15.3 Start engine. Prompt operator to remain at idle until prompted to start permanent code drive cycle in 9.19.

10.15.4 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.)

10.16 Establish communication (J1978 / ISO.15031-4), engine running

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

Protocol Determination Procedure:

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

ISO 15765-4 - 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD test)

ISO 15765-4 – 11 bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

J1850 10.4 Kbps VPW

J1850 41.6 Kbps PWM

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

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

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

Check battery voltage at the J1962 connector pin 16.

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

Table 233 - 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 234 - 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

10.17 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:

10.17.1 [For ISO 15765-4 protocol only] Transmit a Service \$0A request message.

Table 235 - 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 236 - 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 - 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. If an EOBD vehicle does not support permanent codes, do not log a failure. If an EOBD vehicle does support permanent codes, they will be tested for correct behavior.

10.18 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:

10.18.1 Drive vehicle according to the following conditions. (The OBD Condition Counter may increment but is not required to increment):

- Continuous idle time $\geq$ 30 s with vehicle speed $\leq$ 1 mph and accelerator pedal released
- Cumulative time $\geq$ 300 s with vehicle speed $\geq$ 25 mph (40 kph), or $\geq$ 1150 rpm
- Cumulative time since engine start $\geq$ 600 s
- Cumulative fueled engine operation for $\geq$ or = to 10 s for PHEV vehicles only

Prompt user to idle for 30 s, drive the vehicle at $\geq$ or = 25 mph (40 kph) for 300 s, and continue driving the vehicle in any manner for an additional 270 s. Display the status of the OBDCON counter, the IGNCTR counter, the 30 second "Idle Timer", the 300 second "25 MPH/40 KPH 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 s to determine vehicle conditions. The software will monitor OBDCOND every 1.0 s. 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 s 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 306. The vehicle shall be tested according to the type of vehicle as determined by the operator prompts.

10.18.2 Every 1.0 s, tool will request permanent DTCs. If the DTC is erased, tool will prompt user that DTC has been erased prematurely and continue to section 9.22. Premature erasure of the permanent code shall be logged as a failure.

10.18.3 [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

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}	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.

10.18.4 [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 239 - 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 240 - Request current powertrain diagnostic data response message

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

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

Table 241 - 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	INFOTYP

Table 242 - 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

Table 243 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFTYP_
#3	MessageCount	M	01 - 10	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

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

Table 244 - 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 245 - 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

Table 246 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

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

Evaluation criteria:

The engine has been started. Monitor for RUNTM > 0 s. If RUNTM is not available, monitor for RPM > 450 rpm.

Cumulative engine run time is > or = 600 s. Monitor for RUNTM > 600 s. If RUNTM is not available, monitor for RPM > 450 rpm for > 600 s.

Cumulative engine run time > or = 25 mph (40 kph) is > or = 300 s. Monitor for RUNTM increase > or = 300 s when VSS > or = 25 mph (40 kph). If RUNTM is not available, monitor for RPM > 450 rpm and VSS > or = 25 mph (40 kph) for > or = 300 s.

Continuous time at vehicle speed < or = 1 mph is > or = 30 s. Monitor for RUNTM increase > 30 s when VSS < or = 1 mph. If RUNTM is not available, monitor for RPM > 450 rpm and VSS < or = 1 mph for > or = 30 s. (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:

10.18.6 When the software has determined that the driving condition specified above have been met within a time tolerance of ± 20 s, 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.

10.19 Key on, see if permanent DTCs have been erased

Procedure:

10.19.1 Turn ignition on. Start engine.

10.20 Establish communication (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.

Protocol Determination Procedure:

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

ISO 15765-4 – 11 bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

ISO 15765-4 – 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD test)

J1850 41.6 Kbps PWM

J1850 10.4 Kbps VPW

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

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

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

Check battery voltage at the J1962 connector pin 16.

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

Table 247 - 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 248 - 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

10.21 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:

10.21.1 [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 249 - 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 250 - 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 - 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. If an EOBD vehicle does not support permanent codes, do not log a failure. If an EOBD vehicle does support permanent codes, they will be tested for correct behavior.

Purpose:

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

Procedure:

10.21.2 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 running, continue to 9.23.5, otherwise continue to 9.23.1.

10.22 Clear DTCs (Service \$04)

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

Procedure:

10.22.1 Turn ignition off for 30 s or longer, as appropriate for the ECU. Connect scan tool to the J1962 connector.

10.22.2 Turn ignition on. Do not crank engine.

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

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

Protocol Determination Procedure:

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

J1850 41.6 Kbps PWM

J1850 10.4 Kbps VPW

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

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

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

ISO 15765-4 – 11-bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

ISO 15765-4 – 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD test)

Check battery voltage at the J1962 connector pin 16.

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

Table 251 - 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 252 - 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

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

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

Table 253 - 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 254 - 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 255 - Clear/reset emission-related diagnostic information response message

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

Evaluation criteria:

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

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

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

Procedure:

10.22.6 Prompt user whether to end Static Test or to continue to Dynamic Test. If requested by operator, continue testing and go to Section 10, otherwise prompt the operator to turn ignition off (engine off) to complete Section 9

It is a suggested software implementation that the Static Test logfile be closed at this time because the Static Test is complete.

11. TEST VEHICLE WITH NO FAULTS TO VERIFY IUMPR COUNTERS, SERVICES \$06 AND \$01

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

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

Ensure that ignition is on, engine is off.

Protocol Determination Procedure:

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

J1850 41.6 Kbps PWM

J1850 10.4 Kbps VPW

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

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

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

ISO 15765-4 – 11-bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

ISO 15765-4 – 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD test)

Check battery voltage at the J1962 connector pin 16.

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

Table 256 - 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 257 - 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Evaluation criteria:

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

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

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

11.2 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:

11.2.1 [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.

Table 258 - 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 259 - Request current powertrain diagnostic data response message
(report supported PIDs)**

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

11.2.2 [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 260 - 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 261 - Request current powertrain diagnostic data response message

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

Evaluation criteria:

All PIDs that are indicated as supported, as determined in 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 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.

11.3 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:

11.3.1 [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.

Table 262 - 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	INFOTYP

Table 263 - Request vehicle information response message (request supported InfoType) for ISO 9141-2, J1850 and ISO 14230-4 protocols only

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

Table 264 - Request vehicle information response message (request supported InfoType) for ISO 15765-4 protocol only

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	data record of supported InfoTypes = [	M	XX	INFOTYPREC
#3	1 st supported InfoType	M	XX	INFOTYP
#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
	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. (EOBD does not require VIN support, however, if VIN is not supported, this shall be flagged as a warning.).

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

Table 265 - 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 266 - Request vehicle information response message for ISO 15765-4

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

Table 267 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	02	INFTYP_
#3	MessageCount	M	01 - 05	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

Evaluation criteria:

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

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

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

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

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

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

For ISO 15765-4, there is only one response message that consists of all VIN characters without any pad bytes.

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

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

If VIN is not supported, prompt the operator to enter a VIN number in 10.3.3.

Procedure:

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

Table 268 - 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	INFOTYP

Table 269 - 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	INFOTYP
#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.

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

Table 270 - 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	INFOTYP

Table 271 - Request vehicle information response message (1st) for ISO 15765-4

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

Table 272 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	04	INFTYP_
#3	MessageCount	M	01 – XX	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

Evaluation criteria:

The value of INFOTYPE \$03 divided by 4 must match the number of 16 character CALIDs returned for 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:

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

Table 273 - 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 274 - 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

11.3.6 [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 s and all CVNs have been calculated.

Table 275 - 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 276 - 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 277 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	06	INFTYP_
#3	MessageCount	M	01 – XX	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

Evaluation criteria:

The value of INFOTYPE \$05 must match the number of 8 character CVNs returned for ISO 9141-2, J1850 and ISO 14230-4.

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

All CVNs must contain 4 bytes of hex data.

Operator prompt 2 asks for the number of emission-related reprogrammable ECUs in the vehicle. The number of ECUs that report CVNs 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 Section 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 existing VIN-specific log file and resume vehicle testing in Section 11.

If the VIN is valid and does not have a corresponding VIN-specific log file, create a new VIN-specific log file, then continue vehicle testing in Section 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.

11.4 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:

11.4.1 [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 278 - 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 279 - Request current powertrain diagnostic data response message (report supported PIDs)

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

Evaluation criteria:

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).

11.5 Clear DTCs (Service \$04), engine off

Purpose: To reset the I/M Readiness bits to a "not ready" condition.

Procedure:

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

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

Table 280 - 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 281 - 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 s maximum, until a positive response message is available. All other negative responses shall be flagged as a failure. For ISO 9141-2, J1850 and ISO 14230-4, a positive response is required.

11.6 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:

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

Table 282 - 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 283 - Request current powertrain diagnostic data response message

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

Evaluation criteria:

For all ECUs that support PID \$01, a response with valid data and with the PID length as noted must be received and meet the criteria defined in Table 284.

Table 284 - 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 for OBD-II and EOBD, and 1 for compression ignition engines for OBD-II and 0 for EOBD.	Misfire monitoring is always complete for spark ignition engines and incomplete for compression ignition engines.
01, DATA_B, bit 5	Bit 5 can be 0 or 1	Fuel system may indicate incomplete for spark ignition and compression ignition engines if non-continuous monitors are employed. Unsupported monitors must indicate "ready"
01, DATA_B, bit 6	Bit 6 must be 0	CCM always complete. Unsupported monitors must indicate "ready"
01, DATA_B, bits 3 and 7	Bit 3 and 7 must be 0	Reserved bits must be 0
01 DATA_B bits 0-2 and 01 DATA_C bit 0-7	At least one bit must be 1	An OBD ECU that supports Service \$01 PID \$01 must support at least one monitor
01, DATA_D, bits 0-7	Bits 0 - 7 must be 1 for any supported monitor indicated in DATA_C, except for bit 6 which may be 0 on some spark ignition vehicles.	No supported monitors complete. O2 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"

11.7 Verify Service \$06 – Request on-board monitoring test results, engine off

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

Procedure:

11.7.1 [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 285 - 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 286 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs) for ISO 9141-2, J1850 and ISO 14230-4 protocols

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

Table 287 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report supported OBDMIDs)

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

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.

11.7.2 [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 288 - 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 289 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)

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

Evaluation criteria:

Misfire OBDMID A2 + SDTID 0B (Cylinder #1 misfire count EWMA) and OBDMID A2 + SDTID 0C (Cylinder #1 misfire counts) must be supported for at least one ECU 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., O2 sensors that run as soon as the ignition is on. These monitors may report test results on Service \$06. If a Service \$06 Test ID reports a test value and test limits that are not zero, it shall not be considered a failure, but a warning that each manufacturer will need to analyze.

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

Table 290 - Request on-board monitoring test results for continuous and non-continuously monitored systems request message (read OBDMID test values) for ISO 9141-2, J1850 and ISO 14230-4 protocols

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

Table 291 - Request on-board monitoring test results for continuous and non-continuously monitored systems response message (report OBDMID test values)

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

Evaluation criteria:

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

11.8 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:

11.8.1 [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 292 - 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 293 - 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 294 - Request emission-related diagnostic trouble codes detected during current or last completed driving cycle response message for ISO 14230-4

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

Evaluation criteria:

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

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

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

For ISO 15765-4 interfaces, the ECU will respond with a message 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.

11.9 Verify Service \$03 – Request emission-related DTCs, engine off

Purpose: To verify that there are no confirmed DTCs reported after a code clear.

Procedure:

11.9.1 [For all protocols] Transmit Service \$03 request. Verify that a proper response indicating no DTCs is received

Table 295 - 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 296 - 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 297 - 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.

11.10 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 without IUMPR or US OBD-II with MY prior to 2005 MY, then skip to Section 11.

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

Table 298 - 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	INFOTYP

Table 299 - 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 (shown as 20 in this example)	14	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: XX counts	XX	IGNCNTR_A
#7	IGNCNTR_B: XX counts	XX	IGNCNTR_B
#8	CATCOMP1_A: X counts	XX	CATCOMP1_A
#9	CATCOMP1_B: X counts	XX	CATCOMP1_B
#10	CATCOND1_A: X counts	XX	CATCOND1_A
#11	CATCOND1_B: X counts	XX	CATCOND1_B
#12	CATCOMP2_A: X counts	XX	CATCOMP2_A
#13	CATCOMP2_B: X counts	XX	CATCOMP2_B
#14	CATCOND2_A: X counts	XX	CATCOND2_A
#15	CATCOND2_B: X counts	XX	CATCOND2_B
#16	O2SCOMP1_A: X counts	XX	O2SCOMP1_A
#17	O2SCOMP1_B: X counts	XX	O2SCOMP1_B
#18	O2SCOND1_A: X counts	XX	O2SCOND1_A
#19	O2SCOND1_B: X counts	XX	O2SCOND1_B
#20	O2SCOMP2_A: X counts	XX	O2SCOMP2_A
#21	O2SCOMP2_B: X counts	XX	O2SCOMP2_B
#22	O2SCOND2_A: X counts	XX	O2SCOND2_A
#23	O2SCOND2_B: X counts	XX	O2SCOND2_B
#24	EGRCOMP_A: X counts	XX	EGRCOMP_A
#25	EGRCOMP_B: X counts	XX	EGRCOMP_B
#26	EGRCOND_A: X counts	XX	EGRCOND_A
#27	EGRCOND_B: X counts	XX	EGRCOND_B
#28	AIRCOMP_A: X counts	XX	AIRCOMP_A
#29	AIRCOMP_B: X counts	XX	AIRCOMP_B
#30	AIRCOND_A: X counts	XX	AIRCOND_A
#31	AIRCOND_B: X counts	XX	AIRCOND_B
#32	EVAPCOMP_A: X counts	XX	EVAPCOMP_A
#33	EVAPCOMP_B: X counts	XX	EVAPCOMP_B
#34	EVAPCOND_A: X counts	XX	EVAPCOND_A
#35	EVAPCOND_B: X counts	XX	EVAPCOND_B
#36	SO2SCOMP1_A: X counts	XX	SO2SCOMP1_A
#37	SO2SCOMP1_B: X counts	XX	SO2SCOMP1_B
#38	SO2SCOND1_A: X counts	XX	SO2SCOND1_A
#39	SO2SCOND1_B: X counts	XX	SO2SCOND1_B
#40	SO2SCOMP2_A: X counts	XX	SO2SCOMP2_A
#41	SO2SCOMP2_B: X counts	XX	SO2SCOMP2_B
#42	SO2SCOND2_A: X counts	XX	SO2SCOND2_A
#43	SO2SCOND2_B: X counts	XX	SO2SCOND2_B

Table 300 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFTYP_
#3	MessageCount	M	01 - 10	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

11.10.2 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 based on operator prompt, set all IPT values to 0.

Evaluation criteria:

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

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

Ignition counter must be greater than or equal to OBD Condition Counter.

OBD Condition Counter must be greater than or equal to any monitor condition counters.

If an ECU does not support INFOTYPE \$08, no response is allowed for ISO 15765-4, 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.

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.

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

Table 301 - 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 302 - 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	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

Table 303 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

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

Evaluation criteria:

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

All In-use Performance data must contain 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 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.

11.10.4 [For ISO 15765-4] Transmit Service \$09, INFOTYPE = \$12 if Plug-In Hybrid Vehicle (PHEV) vehicle only.

Table 304 - 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	INFOTYP

Table 305 - 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	INFOTYP
#3	Number of data items: 1	1	NODI
#4	FEOCNTR_A: X counts	XX	FEOCNTR_A
#5	FEOCNTR_B: X counts	XX	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:

11.10.5 Turn ignition off (engine off) for 60 s. This will allow ignition counter to increment on the following ignition on cycle.

11.10.6 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.

11.11 Re-establish communication (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:

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

J1850 41.6 Kbps PWM

J1850 10.4 Kbps VPW

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

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

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

ISO 15765-4 – 11-bit 500 kbps

ISO 15765-4 – 11-bit 250 kbps (only if EOBD test)

ISO 15765-4 – 29 bit 500 kbps

ISO 15765-4 – 29 bit 250 kbps (only if EOBD test)

Check battery voltage at the J1962 connector pin 16.

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

Table 306 - 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 307 - 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	xxxxxxx b	DATA_B
#5	Data byte C, representing support for PIDs	xxxxxxx b	DATA_C
#6	Data byte D, representing support for PIDs	xxxxxxx b	DATA_D

Procedure:

11.12 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:

11.12.1 Drive vehicle according to the following conditions so that the OBD Condition Counter may increment:

Continuous idle time > or = 30 s with vehicle speed < or = 1 mph and accelerator pedal released, at an altitude < 8000 ft (BARO < 22 in Hg) and ambient temperature > or = 20 deg F

Cumulative time > or = 300 s with vehicle speed > or = 25 mph (40 kph), or >= 1150 rpm at an altitude < 8000 ft (BARO < 22 in Hg) and ambient temperature > or = 20 deg F

Cumulative time since engine start > or = 600 s, at an altitude < 8000 ft (BARO < 22 in Hg) and ambient temperature > or = 20 deg F

Cumulative (does not have to be continuous) fueled engine operation for > or = to 10 s, at an altitude < 8000 ft (BARO < 22 in Hg) and ambient temperature > or = 20 deg F for PHEV vehicles only

NOTE: The software will monitor the following PIDs, if available: \$0C (RPM), \$0D (VSS), \$1F (RUNTM) every 1.0 s to determine vehicle conditions. The software will monitor OBDCOND every 1.0 s. The software will inform user as soon as the drive cycle conditions have been completed and OBDCOND counter has incremented.

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 the table below. The vehicle shall be tested according to the type of vehicle as determined by the operator prompts.

Table 308 - 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 s	RUNTM ≥ 600 s	RUNTM ≥ 600 s	RUNTM ≥ 600 s	RUNTM ≥ 600 s	RUNTM ≥ 600 s	RUNTM ≥ 600 s
Drive time above 25 mph ≥ 300 s	VSS ≥ 25 mph	VSS ≥ 25 mph	VSS ≥ 25 mph	RPM > 1150	VSS ≥ 40 kph	VSS ≥ 40 kph
Idle time ≥ 30 s	VSS ≤ 1 mph	VSS ≤ 1 mph --- OR --- RPM ≥ 1150	VSS ≤ 1 mph	VSS ≤ 1 mph --- OR --- RPM ≥ 1150	VSS ≤ 1.6 kph	VSS ≤ 1.6 kph --- OR --- RPM ≥ 1150
PHEV Fueled Engine Operation ≥ 10 s	RPM ≥ 450 rpm	RPM ≥ 450 rpm				

Prompt user to idle for 30 s, drive the vehicle at $> \text{ or } = 25$ mph (40 kph) for 300 s, and continue driving the vehicle in any manner for an additional 270 s. Display the status of the OBDCOND counter, the IGNCTR counter, the 30 s "Idle Timer", the 300 s "25 MPH/40 KPH Driving Timer" and the 600 s "Total Drive Timer". The user should be reminded to perform the test at altitudes less than 8000 feet and ambient temperatures greater than 20 deg F.

11.12.2 [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 309 - 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 310 - Request current powertrain diagnostic data response message

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

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

Table 311 - 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 312 - 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

Table 313 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFTYP_
#3	MessageCount	M	01 - 10	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

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

Table 314 - 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 315 - 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	INFITYP
#3	Number of data items: 16 or 18 (16 in this example)	10	NODI
#4	OBDCOND_A: X counts	XX	OBDCOND_A
#5	OBDCOND_B: X counts	XX	OBDCOND_B
#6	IGNCNTR_A: X counts	XX	IGNCNTR_A
#7	IGNCNTR_B: X counts	XX	IGNCNTR_B
#8	HCCATCOMP_A: X counts	XX	HCCATCOMP_A
#9	HCCATCOMP_B: X counts	XX	HCCATCOMP_B
#10	HCCATCOND_A: X counts	XX	HCCATCOND_A
#11	HCCATCOND_B: X counts	XX	HCCATCOND_B
#12	NCATCOMP_A: X counts	XX	NCATCOMP_A
#13	NCATCOMP_B: X counts	XX	NCATCOMP_B
#14	NCATCOND_A: X counts	XX	NCATCOND_A
#15	NCATCOND_B: X counts	XX	NCATCOND_B
#16	NADSCOMP_A: X counts	XX	NADSCOMP_A
#17	NADSCOMP_B: X counts	XX	NADSCOMP_B
#18	NADSCOND_A: X counts	XX	NADSCOND_A
#19	NADSCOND_B: X counts	XX	NADSCOND_B
#20	PMCOMP_A: X counts	XX	PMCOMP_A
#21	PMCOMP_B: X counts	XX	PMCOMP_B
#22	PMCOND_A: X counts	XX	PMCOND_A
#23	PMCOND_B: X counts	XX	PMCOND_B
#24	EGSCOMP_A: X counts	XX	EGSCOMP_A
#25	EGSCOMP_B: X counts	XX	EGSCOMP_B
#26	EGSCOND_A: X counts	XX	EGSCOND_A
#27	EGSCOND_B: X counts	XX	EGSCOND_B
#28	EGRCOMP_A: X counts	XX	EGRCOMP_A
#29	EGRCOMP_B: X counts	XX	EGRCOMP_B
#30	EGRCOND_A: X counts	XX	EGRCOND_A
#31	EGRCOND_B: X counts	XX	EGRCOND_B
#32	BPCOMP_A: X counts	XX	BPCOMP_A
#33	BPCOMP_B: X counts	XX	BPCOMP_B
#34	BPCOND_A: X counts	XX	BPCOND_A
#35	BPCOND_B: X counts	XX	BPCOND_B

Table 316 - Request vehicle information response message for J1850, ISO 14230-4 and ISO 9141-2

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request vehicle information response SID	M	49	SIDPR
#2	InfoType	M	08	INFITYP_
#3	MessageCount	M	01 - 09	MC_
#4	data record of InfoType = [Data A, Data B, Data C, Data D]	C	XX	DATA_A
#5		C	XX	DATA_B
#6		C	XX	DATA_C
#7		C	XX	DATA_D
C = Conditional — data A - D is only present if the requested InfoType = \$02, \$04, and \$06				

Evaluation criteria:

For OBD-II and EOBD with IPT (based on user prompt):

The OBDCOND counter must increment within +/- 20 s of the tool determination that the CARB drive cycle conditions have been met using the criteria listed below in conjunction with Table 308 and vehicle type based on operator prompts:

The engine has been started. Monitor for RUNTM > 0 s. If RUNTM is not available, monitor for RPM > 450 rpm. For HEV fueled engine operation, monitor for RPM > 450 for 10 s.

Cumulative engine run time is > or = 600 s. Monitor for RUNTM > 600 s. If RUNTM is not available, monitor for RPM > 450 rpm for > 600 s.

Cumulative engine run time > or = 25 mph (40 kph) is > or = 300 s. Monitor for RUNTM increase > or = 300 s when VSS > or = 25 mph (40 kph). If RUNTM is not available, monitor for RPM > 450 rpm and VSS > or = 25 mph (40 kph) for > or = 300 s or RPM > 1150 indicated in Table 306

Continuous idle time at vehicle speed < or = 1 mph is > or = 30 s. Monitor for RUNTM increase > 30 s when VSS < or = 1 mph. If RUNTM is not available, monitor for RPM > 450 rpm and VSS < or = 1 mph for > or = 30 s. (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 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 sec, time > 40 kph and idle time > 30 sec) has been satisfied. This will ensure that the engine is warmed up for Section 10.12.

Procedure:

11.12.4 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.

11.13 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:

11.13.1 [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.

Table 317- 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 318 - Request current powertrain diagnostic data response message
(report supported PIDs)**

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

Evaluation criteria:

Required PIDs must be supported for all vehicles (ALL), gasoline engines (G), or diesel engines (D) as specified in Table 320. 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.

11.13.2 [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 319 - 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 320 - Request current powertrain diagnostic data response message (report supported PIDs)

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of supported PIDs = [1 st supported PID	M	XX	PIDREC_ PID
#3	Data A: supported PIDs,	M	xxxxxxxx	DATA_A
#4	Data B: supported PIDs,	M	xxxxxxxx	DATA_B
#5	Data C: supported PIDs,	M	xxxxxxxx	DATA_C
#6	Data D: supported PIDs]	M	xxxxxxxx	DATA_D
:	:	:	:	:
#n-4	data record of supported PIDs = [m th supported PID	C1	XX	PIDREC_ 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.

11.13.3 [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 321 - 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 322 - Request current powertrain diagnostic data response message

Data Byte	Parameter Name	Cvt	Hex Value	Mnemonic
#1	Request current powertrain diagnostic data response SID	M	41	SIDPR
#2	data record of 1 st supported PID = [			PIDREC_
	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 323. 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 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 323 - Engine warm idle service \$01 PID validation

Engine Idle Service \$01 PID Validation			
PID	Req'd 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	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 and ECUs, which do not support misfire monitoring, and 0 or 1 for compression ignition engines. Bit 4 must be 0 for any unsupported monitor in DATA B bit 1.	Misfire monitoring shall always indicate complete for spark ignition engines. Misfire monitoring shall indicate complete for compression ignition engines after the misfire evaluation is complete (1000 engine revs at idle, approx. 60 sec.). 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

Table 323 - Engine warm idle service \$01 PID validation (continued)

PID	Req'd Support:	Required Value	Comment
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 only.	Bit 2 must be 1 for at least one ECU for OBD-II spark ignition engines, 0 for EOBD spark ignition engines. Bit 2 must be 0 for compression ignition engines (reserved).	All OBD-II spark ignition engines must support evap system monitoring. EOBD 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	Bit 5 must be 1 for at least one ECU	All spark ignition engines must support O2 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 O2 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 be 0 for any unsupported monitor indicated in DATA_C	Unsupported monitors must indicate “ready”

Table 323 - Engine warm idle service \$01 PID validation (continued)

02		2 bytes long	
03, DATA_A, bits 5-7, DATA_B bits 5-7	G – Warn	2 bytes long, Data A and B bits 5 – 7 must be 0	Some FUELSYSx bits are reserved
04	ALL – Fail	1 byte long, value must be > 0 and <= 60%. For HEV, PHEV, S/S, must be 0 to 100%.	LOAD_PCT > 0 and <= 60% at idle. S/S engine may be off, HEV, PHEV may be off or at full load (0 to 100%).
05	ALL – Fail unless \$67 supported	1 byte long, value must be -20 to 120 deg C. Either \$05 or \$67 must be supported.	ECT warmed up, in reasonable range
06	G – Warn	1 byte value or 2 byte value, as determined in Figure 10. Value must be between + 50% and – 50%	SHRTFT1/3 in normal range
07	G – Warn	1 byte value or 2 byte value, as determined in Figure 10. Value must be between + 50% and – 50%	LONGFT1/3 in normal range
08		1 byte value or 2 byte value, as determined in Figure 10. Value must be between + 50% and – 50%	SHRTFT2/4 in normal range
09		1 byte value or 2 byte value, as determined in Figure 10. Value must be between + 50% and – 50%	LONGFT2/4 in normal range
0A		1 byte long, value must be greater than 0 kPa, may be = 0 for HEV, PHEV, S/S.	FRP not zero, hyHEV, PHEVbrid, 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 hHEV, PHEVbrid, S/S.	MAP not zero, hyHEV, PHEVbrid, S/S engine may be off.
0C	ALL – Fail	2 bytes long, value must be between 300 and 2000 rpm, may be = 0 for HEV, PHEV, S/S	RPM < 2000 and > 300 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

Table 323 - Engine warm idle service \$01 PID validation (continued)

PID	Req'd Support:	Required Value	Comment
0E	G – Fail	1 byte long, value must be -30 deg to +55 deg	SPARKADV normal
0F	G – Warn unless \$68 is supported	1 byte long, value must be -20 to 120 deg C. Either \$0F or \$68 may be supported.	IAT in normal range
10	G – Warn unless \$66, \$0B or \$87 supported	2 bytes long, value must be greater than 0 g/sec. Either (\$0B or \$87) or (\$10 or \$66) must be supported, may be = 0 for HEV, PHEV, S/S.	MAF not zero, hHEV, 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	
13 or 1D, bits 0-7	G – Warn	1 byte long. For PID 13 or 1D, 2 or more bits must be 1 for spark ignition engines; (Note: Either \$13 or \$1D must be supported for spark ignition engine. Both PIDs shall not be supported on spark or compression ignition engines. Neither PID is required to be supported for compression ignition engines)	At least 2 O2S needed for OBD-II for spark ignition engines, compression ignition engines may or may not use any O2 sensors. Both PIDs \$13 and \$1D cannot be supported at the same time for either spark or compression ignition engines.
14, 15, 16, 17, 18, 19, 1A, 1B		2 bytes long	
1C	ALL - Fail	1 byte long, value must be 01, 03, 07, 09, 0B, 0D, 0F 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	Must be California OBD-II or EOBD
1D, 1E		1 byte long	
1F	ISO 15765-4 ALL – Fail	2 bytes long, value must be greater than 300	RUNTM greater than 300 sec
21	ISO 15765-4 ALL – Fail unless \$4D supported	2 bytes long, value must be 0 km	MIL_DIST is zero

Table 323 - Engine warm idle service \$01 PID validation (continued)

PID	Req'd Support:	Required Value	Comment
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. Disregard range check when scaling byte is utilized.	Check for usage of PID 4F
2C	D – Fail unless \$69 is supported for OBD-II and HD OBD	1 byte long, value must be < or = 10% for spark ignition engines, < or = 100% for compression ignition engines	EGR_PCT is < or = 10% at idle for spark ignition engine, EGR rates may be much higher for compression ignition engines.
2D		1 byte long	EGR_ERR
2E	ISO 15765-4 G – Warn	1 byte long	EVAP_PCT
2F	ISO 15765-4 G – Warn	1 byte long, value = 1 byte long, value must be 1 to 100%	FLI in normal range
30	ISO 15765-4 ALL – Fail	1 byte long, value must be 0 to 4	WARM_UPS near zero
31	ISO 15765-4 ALL – Fail unless \$4E supported	2 bytes long, value must be less than 50 km	CLR_DIST less than 50 km
32		2 bytes long	EVAP_VP
33	ISO 15765-4 ALL - Fail	1 byte long, value must be between 71 and 110 kPa	BARO within normal range
34, 35, 36, 37, 38, 39, 3A, 3B		4 bytes long. Disregard range check when scaling byte is utilized.	Check for usage of PID 4F
3C, 3D, 3E, 3F		2 bytes long	
41	ISO 15765-4 ALL - Fail if OBD-II, Warn if EOBD	4 bytes long	
41, DATA_B, bits 0-2	ISO 15765-4 ALL – Fail if OBD-II, Warn if EOBD	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	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

Table 323 - Engine warm idle service \$01 PID validation (continued)

PID		Required Value	Comment
41, DATA_B, bit 3	ISO 15765-4 ALL - Fail if OBD-II, Fail for EOBD if supported. (data must be correct if PID \$41 is supported for EOBD)	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_C, bits 0-7	ISO 15765-4 ALL – Fail if OBD-II, Warn if EOBD	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 if supported. (data must be correct if PID \$41 is supported for EOBD)	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	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- Fail if OBD-II, Warn if EOBD	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	2 bytes long, value must be 0.5 to 1.5 for spark ignition engines and 0 to 1.999 for compression ignition engines or HEV, PHEV, S/S engines. Disregard range check when scaling byte is utilized.	EQ_RAT in reasonable range Check for usage of PID 4F
45	ISO 15765-4 G- Fail unless \$6C is supported if OBD-II, Warn if EOBD	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 deg C	AAT in normal range
47		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines and for HEV, PHEV, S/S.	TP_B in normal range

Table 323 - Engine warm idle service \$01 PID validation (continued)

PID		Required Value	Comment
48		1 byte long, value must be 0% to 60% for spark ignition engines, value can be 0% to 100% for compression ignition engines 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 m (59 s or less) after Service \$04
4E	2010 MY and beyond All – Fail unless \$31 supported	2 bytes long, value must be greater than 5 m	CLR_TIME is greater than 5 m
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).	1 byte, value must be \$00 to \$17	FUEL_TYPE in SAE assigned range.
52		1 byte	ALCH_PCT

Table 323 - Engine warm idle service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
53		2 bytes	EVAP_VPA
54		2 bytes	EVAP_VP
55		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 1/3
56		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 1/3
57		1 byte value or 2 byte value, as determined in Figure 10	Short Term Secondary O2 Fuel Trim Bank 2/4
58		1 byte value or 2 byte value, as determined in Figure 10	Long Term Secondary O2 Fuel Trim Bank 2/4
59		2 bytes long, value must be greater than 0 kPa, may be = 0 for hHEV, PHEV, S/S.	FRP not zero, hybHEV, 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 zero percent	BAT_PWR
5C	2010 MY and beyond D – Warn if OBD-II or HD OBD	1 byte long, value must be -20 to 150 deg 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 greater than zero 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 II or HD OBD	1 byte	TQ_DD
62	2010 MY and beyond D – Fail if OBD-II II or HD OBD	1 byte, value must be greater than zero percent, may be = 0 for HEV, PHEV, S/S.	TQ_ACT not zero, HEV, PHEV, S/S engine may be off.
63	2010 MY and beyond D – Fail if OBD-II or HD OBD	2 bytes long, value must be greater than zero Nm, may be = 0 for HEV, PHEV, S/S.	TQ_REF not zero, HEV, PHEV, S/S engine may be off.
64		5 bytes long, all values must greater than zero percent, may be = 0 for HEV, PHEV, S/S.	TQ_MAX not zero, HEV, PHEV, S/S engine may be off.

Table 323 - Engine warm idle service \$01 PID validation (continued)

PID	Req'd Support	Required Value	Comment
65	2010 MY and beyond D – Fail if OBD-II or HD OBD	2 bytes, Data A, at least one device must be supported in bits 0 – 3, bits 4 – 7 must be 0, Data B, bits 4 – 7 must be 0.	Auxilliary I/O, may support PTO, diesel must support wait ti 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/sec, 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 deg 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 deg 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 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 < or = 10% for spark ignition engines, < or = 100% for compression ignition engines.	Commanded EGR and EGR Error EGR_x_CMD is < or = 10% at idle for spark ignition engines. EGR rates may be much higher for compression 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%