

Department of Consumer Affairs
Bureau of Automotive Repair

Permanent Diagnostic Trouble Codes

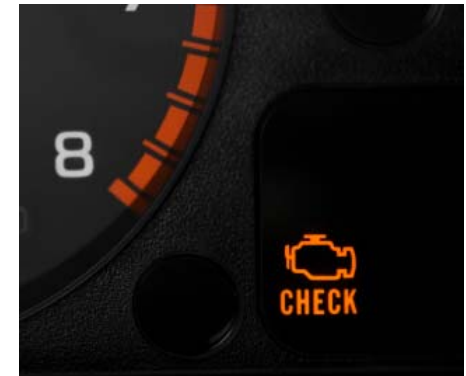
Greg Coburn, Engineering and Research Branch
Workshop Meeting
April 19, 2018



OBD Inspection Failure Criteria

CCR 3340.42.2(c): On or after January 1, 2013, OBD equipped vehicles shall fail the OBD inspection if any one of the following conditions occurs as applicable to the vehicle:

- (1) The vehicle's MIL does not illuminate when the ignition is on and the engine is off (under prior version of regulation)
- (2) The vehicle's MIL illuminates continuously or flashes with the engine running (under prior version of regulation)
- (3) The vehicle's OBD system reports the MIL commanded 'ON' (under prior version of regulation)
- (4) The vehicle's OBD system reports a Diagnostic Trouble Code (DTC) (under prior version of regulation)



OBD Inspection Failure Criteria (cont'd)

- (5) The vehicle's OBD system data indicates the system has not yet been sufficiently operated to determine the presence or absence of a DTC (TBD)
- (6) The vehicle's OBD system does not communicate with the EIS or OIS (under prior version of regulation)
- (7) The vehicle's OBD system data is inappropriate for the vehicle being tested (February 2017)
- (8) The vehicle's OBD system data does not match the original equipment manufacturer (OEM) or an Air Resources Board (ARB) exempted OBD software configuration (TBD)

OBD Inspection Failure Criteria (cont'd)

- (9) The vehicle's OBD system reports incomplete readiness monitor(s) for the following groups (May 2015):
- (A) Gasoline-powered vehicles, model-years 1996 - 1999, with more than one (1) incomplete monitor
 - (B) Gasoline-powered vehicles, model-years 2000+, with any incomplete monitors, excluding the evaporative system monitor
 - (C) Diesel-powered vehicles model-years 1998 through 2006 with any incomplete monitors
 - (D) Diesel-powered vehicles model-years 2007 and newer with any incomplete monitors, excluding the particulate filter system monitor

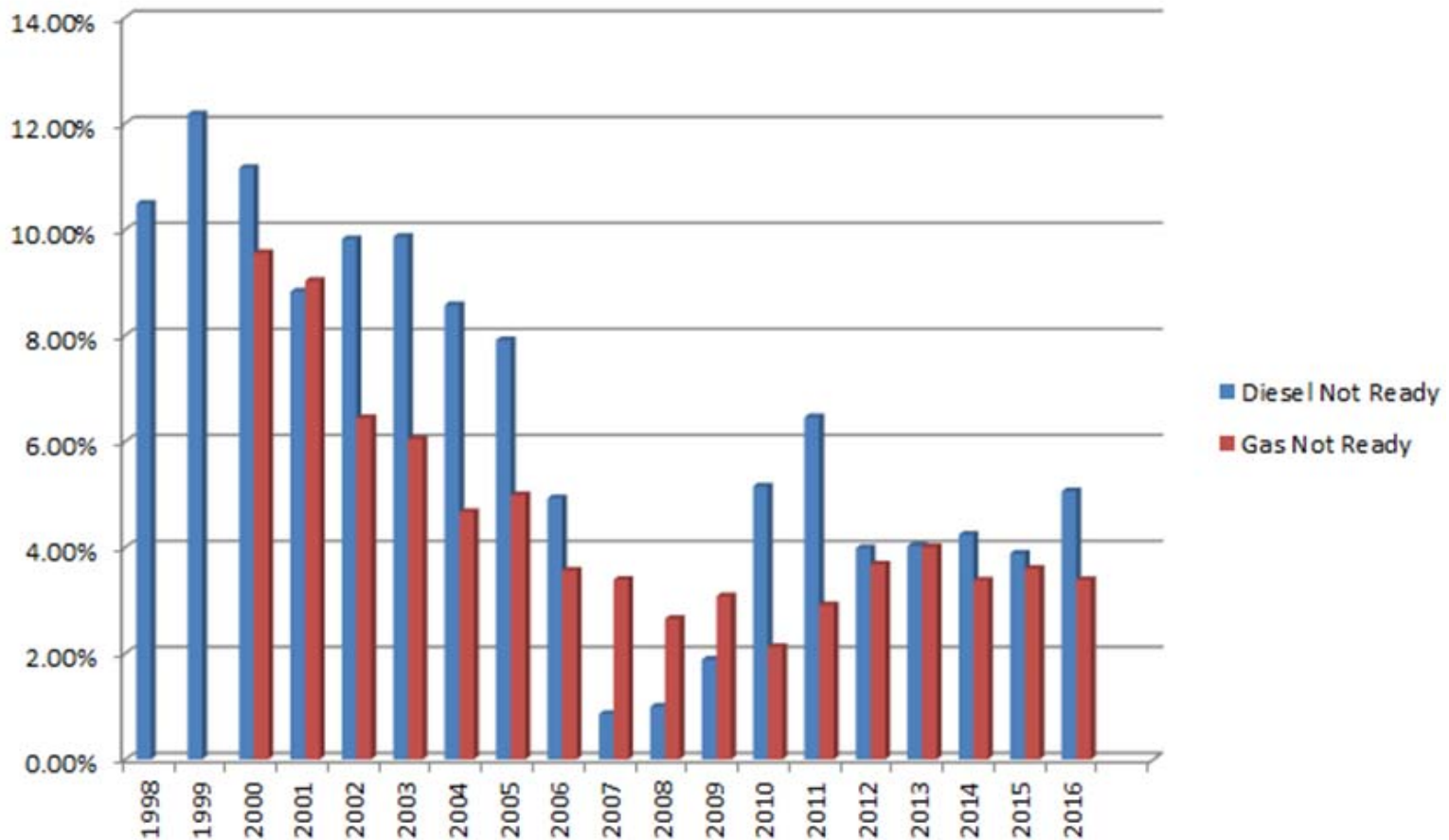
Current Readiness Standards

Table 1: OBD Test Monitor Readiness Standards
(Implemented May 4, 2015)

Model Years	Fuel Type	Number of Incomplete Monitors Allowed to Pass OBD Test
1996-1999	Gas ¹	Any one
2000 and newer	Gas ¹	Evaporative system
1998-2006	Diesel	Zero
2007 and newer	Diesel	Any two

⁽¹⁾ Includes gasoline, compressed natural gas (CNG), liquid natural gas (LNG) and liquid propane gas (LPG)

Not Ready by Model Year & Fuel



Monitor Readiness Decisions

- Monitor Readiness decisions can be aided by considering:
 - Number of warmup cycles since DTCs cleared
 - Distance traveled since DTCs cleared
 - Presence of a PDTC

Warm-up Counts and Distance Traveled

- **Mode \$01 PID \$30:** Number of warm-up cycles conducted since DTCs were cleared
- **Mode \$01 PID \$31:** Distance traveled since DTCs cleared
- Supported by most 2006+ diesel and most 2008+ gasoline vehicles
- Can be used with PDTCs to determine vehicle readiness to test per CCR 3340.42.2(c)(5)

Permanent DTCs

- OEM phase-in 2010 – 2012 model years
- Same codes as regular OBD II fault codes (DTCs)
- Stored in Non-Volatile Random Access Memory (NVRAM)
- Cannot be erased by DTC code clearing or battery disconnect
- Stated purpose is to prevent DTC clearing to obtain a passing test⁽¹⁾
- Only the OBD II system itself can clear the PDTC when:
 - The OBD II system's MIL (not dashboard MIL) is commanded off.
 - The related readiness monitor(s) ran to completion with no malfunction detected.

(1) SAE J-1979

PDTC and PID Support by Model Year & Fuel

PDTCs

Majority coverage by 2010 (gas and diesel)

PID \$30

Number of warm up cycles since codes cleared

Majority coverage by 2006 (diesel) and 2007 (gas)

PID \$31

Distance traveled since codes cleared

Majority coverage by 2006 (diesel) and 2007 (gas)

MODEL YEAR	DIESEL			GASOLINE				
	TESTS	PID30 SUPPORT	PID31 SUPPORT	PERMDTC SUPPORT	TESTS	PID30 SUPPORT	PID31 SUPPORT	PERMDTC SUPPORT
1998	361	0.00%	0.00%	0.00%				
1999	1,388	0.07%	0.07%	0.00%				
2000	1,334	0.15%	0.15%	0.00%	72,030	0.06%	0.06%	0.00%
2001	1,877	0.32%	0.32%	0.00%	116,784	0.05%	0.05%	0.00%
2002	1,933	0.00%	0.00%	0.00%	76,224	0.02%	0.02%	0.00%
2003	2,398	0.17%	0.17%	0.00%	134,925	0.29%	0.29%	0.00%
2004	2,669	38.29%	38.29%	0.00%	80,975	6.05%	6.05%	0.00%
2005	2,921	46.32%	46.32%	0.00%	150,768	27.21%	27.21%	0.00%
2006	3,322	93.71%	93.71%	0.00%	79,289	49.42%	49.42%	0.00%
2007	2,057	99.42%	99.42%	0.00%	158,892	73.63%	73.63%	0.00%
2008	1,999	99.60%	99.60%	0.00%	68,022	98.70%	98.70%	0.00%
2009	722	99.86%	99.86%	0.00%	98,013	99.93%	99.93%	0.00%
2010	700	99.86%	99.86%	73.71%	39,700	99.93%	99.93%	73.03%
2011	2,220	99.91%	99.91%	99.59%	144,465	99.95%	99.95%	93.93%
2012	1,638	99.82%	99.82%	99.45%	22,886	99.93%	99.92%	98.46%
2013	1,990	99.95%	99.95%	99.65%	31,882	99.97%	99.97%	99.14%
2014	1,935	99.90%	99.90%	99.53%	19,600	99.91%	99.91%	99.63%
2015	4,826	99.90%	99.90%	99.21%	17,211	99.95%	99.95%	99.80%
2016	939	99.89%	99.89%	99.36%	17,240	99.90%	99.90%	99.78%
2017	279	1.00%	1.00%	98.92%	2,967	99.87%	99.87%	99.53%

Evaporative Emissions (Gasoline)

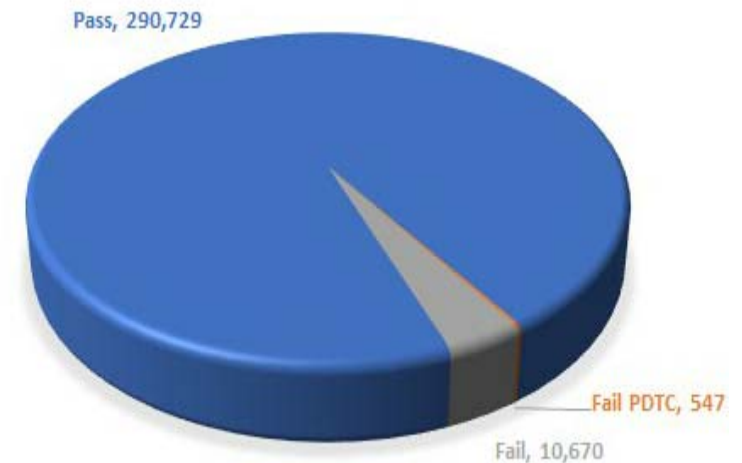
- Evaporated fuel (EVAP) emissions are a significant source of pollution in gasoline vehicles.
- OBD II EVAP monitors can be difficult to set due to:
 - Required warmup cycle, ambient temperature, fuel level, elevation
- Current regulation does not require EVAP monitor readiness for MY2000+ gas vehicles⁽¹⁾
- Clearing EVAP related DTCs still possible since the EVAP monitor is not required to complete in order for the vehicle to pass smog
- This creates a loophole where vehicles with EVAP defects can still pass their Smog Check.

Evaporative Emissions (Gasoline)

- PDTCs can assist in identifying EVAP system problems:
 - Proposal: When the EVAP monitor is incomplete, and an EVAP related PDTC is present, then
 - The vehicle would fail Smog Check unless:
 - The EVAP monitor runs to completion, or
 - 15 warm-up cycles have been completed since code clearing, and
 - 200 miles have been driven since code clearing
 - Sufficient operation of the vehicle would increase the ability for a DTC to reset.
 - Addresses situations where the vehicle has difficulty clearing the PDTC, with the intent not to unduly inconvenience affected motorists.

Analysis of Gasoline Tests

- Examined initial test records from Jan-Feb 2018 on model year 2010 and newer gas vehicles
 - 301,399 initial tests
 - 10,670 initial test failures (3.5%)
- Of the 290,729 passing initial tests, 547 have:
 - Incomplete EVAP monitor, and
 - EVAP related PDTC present, and
 - Less than 15 warm-up cycles, or less than 200 miles driven since DTC cleared



Analysis of Gasoline Tests

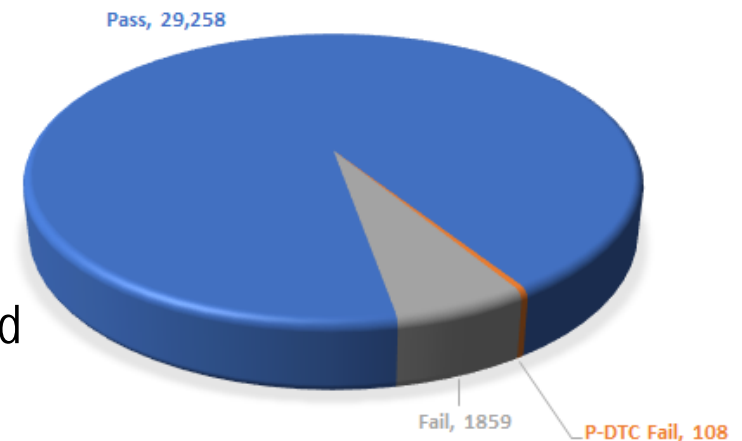
- Using the proposed PDTC criteria would result in about 275 additional failures per month
- Initial test fail rate would rise from 3.5% to 3.7%
- Effect of this change would increase as:
 - Newer vehicles age and deteriorate
 - Vehicles come off the model year biennial exemption (only 2010-2012 currently get biennial renewal Smog Checks)
- Top 4 EVAP Related PDTCs
 - EVAP system leak detected (very small leak)
 - EVAP system leak detected (large leak)
 - EVAP system incorrect purge flow
 - EVAP system leak detected (fuel cap loose/off)

Diesel Readiness Monitors

- New Diesel Readiness Monitors
 - NMHC CAT (Non-Methane Hydrocarbon Catalyst)
 - NOx/SCR (NOx Selective Catalytic Reduction)
 - PM Filter (Diesel Particulate Matter Filter)
 - Exhaust Gas Sensor
 - Boost Pressure
- Diesels after-treatment monitors often take longer to run
- Several monitors linked to PM filter regeneration
- Cannot be treated the same as gasoline monitors
- May be treated in similar fashion to the gasoline EVAP monitor

Analysis of Diesel Tests

- Examined initial test records from Jan-March 2018 on model year 2010 and newer diesel vehicles
 - 31,117 initial tests
 - 1,859 initial test failures (6.0%)
- Of the 29,258 passing initial tests, 108 have:
 - Incomplete After-treatment related monitor, and
 - After-treatment related PDTC present, and
 - Less than 15 warm-up cycles, or less than 200 miles driven since DTC cleared
- Using the proposed PDTC criteria would result in about 55 additional failures per month
- Initial test fail rate would rise from 6.0% to 6.3%



PERMANENT DIAGNOSTIC TROUBLE CODES

BUREAU OF AUTOMOTIVE REPAIR

Smog Check Vehicle Inspection Report (VIR)

Vehicle Information

Test Date/Time: 07/05/2017 @ 2:56 PM

Model Year: 2012	Vehicle Make: NISSAN	Vehicle Model: VERSA S
VIN (scanned from vehicle):		
VIN (manually entered or from DMV document):		
License Plate:	License State: CA	Fuel Type: Gasoline
Certification Type: California	Odometer: 33333	

Overall Test Result

FAIL

Your vehicle failed the Smog Check inspection. Check your Owner's Manual to determine if the emission failure is repairable under the vehicle manufacturer warranty. Vehicles purchased new in California have an emission performance warranty for a minimum of 3 years or 50,000 miles that guarantees your vehicle passes the inspection. An emission parts warranty of 7 years or 70,000 miles covers certain high cost parts listed in the Owner's Manual. If your vehicle is a Partial Zero Emissions Vehicle (PZEV), the emission warranty extends to 15 years or 150,000 miles. The warranty for PZEV hybrid battery systems is 10 years or 150,000 miles. These warranties require the vehicle has not failed due to lack of scheduled maintenance, and other conditions specified in the vehicle's Owner's Manual. Warranty information by vehicle manufacturer is provided by the Bureau of Automotive Repair at www.bar.ca.gov.

BAR's Consumer Assistance Program (CAP) offers financial assistance with emission repairs and a monetary incentive to retire a vehicle from operation. If a warranty service or coverage problem arises, you may file a complaint with BAR. To learn more about CAP or to file a complaint, visit www.bar.ca.gov.

Visual Inspection: PASS Functional Inspection: FAIL

Comments: 2012 Nissan Versa with permanent DTC present; warnups = 29; distance travelled = 804 km; permanent DTCs ON; fails

Visual Inspection Result Information

Result	Inspection Category	Result	Inspection Category
PASS	Air Injection System	PASS	Catalyst
PASS	Computers, Sensors, Switches, and Wiring	PASS	Crankcase Emission Controls
PASS	Exhaust Gas Recirculation (EGR)	PASS	Fuel Evaporative System (EVAP)
PASS	Fuel Metering System	PASS	Other Emission Related Components/Systems
NOTAPPLICABLE	Turbocharger/Supercharger	PASS	Vacuum Lines to Sensors/Switches

Emission Control Systems Functional Check Results

Result	Inspection Category	Result	Inspection Category
PASS	Liquid Fuel Leak Check	FAIL	OBDII
PASS	Smoke Check		

Permanent Fault Codes

P0171 - System Too Lean Bank 1

Smog Check Inspection Station Information

Station ID: RC999562
 WONDERFUL WORLD OF SMOG
 10949 NORTH MATHER BOULEVARD
 EUREKA, CA 95501
 (916) 555-1212

Inspector Name/ID:
 Software Version/OIS ID: 6.8.996.4/CV003596

Implementation Constraints

- VID must be updated to distinguish between EVAP and non-EVAP PDTCs in gasoline vehicles
- VID must be updated to distinguish between after-treatment and non after-treatment PDTCs in diesel vehicles
- Problematic vehicle issues:
 - PDTCs not clearing on time
 - PDTCs never clearing

Implementation Plan

- Update VID
- Develop FAQs
- Change DMV registration renewal notice
- Send ET Blasts
- Provide training to industry
- Update CAP failure criteria
- Develop Referee policies
- Update BAR website
- Work with OEM and ARB to fix problematic vehicles

Questions and Comments

Submit additional questions and/or comments to:

Greg Coburn

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