



11L, 13L, And 16L Engine Oil Analysis Specifications - US10 And Newer Emissions



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If oil dilution is suspected refer to the applicable CBR solution below:

- **CBR-569** Mack Chassis - Oil Diluted With Fuel; Fuel In Oil, Diagnostic Information - All Emissions, All Model Years
- **CBR-982** Volvo Chassis - Oil Diluted With Fuel; Fuel In Oil, Diagnostic Information - All Emissions Prior To US17+OBD16 (Common Rail Fuel System), Model Year 2017 And Older
- **CBR-406** Dye Test Procedure; Fuel System Leak Check - Common Rail Fuel System - US17+OBD16 And Newer Emissions, Common Model Year 2018 And Newer

Oil Analysis Specifications

The chart below contains three ranges of values:

- **Green** The value is within permissible limits and oil is in good condition.
- **Alert** The value indicates necessity for an oil change/service at the earliest convenience.
- **Warning** The value indicates the engine is already at risk. Urgent oil change/service required.

	Property	Method	Requirement		
			Green	Alert	Warning
Wear and contaminant elements	Fe	ASTM D5185 ¹	< 100 ppm ²	100 - 150 ppm ²	> 150 ppm ²
	Pb		< 20 ppm	20 - 35 ppm	> 35 ppm
	Cu		< 15 ppm ³	15 - 30 ppm ³	> 30 ppm ³
	Sn		< 10 ppm	10 - 15 ppm	> 15 ppm
	Cr		< 5 ppm	5 - 10 ppm	> 10 ppm
	10 - 15	..

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	Al		< 10 ppm ⁴	ppm ⁴	> 15 ppm ⁴
	Ni		< 15 ppm	15 - 20 ppm	> 20 ppm
	Si		< 20 ppm ²	20 - 40 ppm ²	> 40 ppm ²
	Mo		< 5 ppm ⁵	5 - 10 ppm ⁵	> 10 ppm ⁵
	K		< 10 ppm ⁴	10 - 20 ppm ⁴	> 20 ppm ⁴
	Na		< 10 ppm	10 - 20 ppm	> 20 ppm
	B		< 5 ppm ⁵	5 - 10 ppm ⁵	> 10 ppm ⁵
Contaminants	Water	ASTM D6304 ¹	< 0.05%	0.05 - 0.1%	> 0.1%
	Fuel	ASTM D3524 ¹	< 4% ⁶	4 - 6% ⁶	> 6% ⁶
	Soot	DIN 51452 ¹ or TGA	< 2%	2 - 3%	> 3%
Oil Condition	Viscosity at 100°C	ASTM D445	Stay in grade ⁶	Stay in grade ⁶	Stay in grade ⁶
	TBN	ASTM D4739	≥ 3	2.0 - 2.9	< 2
	Oxidation (net)	DIN 51453 ¹	< 30	30 - 40	> 40
	Nitration (net)	DIN 51453 ¹	< 25	25 - 30	> 30

¹ Or equivalent.

² May be higher during running in (first few drain intervals).

³ Very high copper (Cu) levels, more than 500 ppm, are sometimes found during the first 60,000 miles (100,000 km) of the vehicle life. The source is the oil cooler and the copper levels normally drop in consecutive drain intervals.

⁴ AL and K may be simultaneously high during the first few intervals. The source is then likely the charge air cooler and particles are soft and harmless. The K:Al ratio is then typically 2-3:1.

⁵ Some oils may contain Mo and/or B. Check fresh oil values.

⁶ If fuel dilution exceeds 6%, contact our dealer network and/or follow the instructions in Notification Letter NL-2014-001.

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Dye Test Procedure; Fuel System Leak Check - Common Rail Fuel System - US17+OBD16 And Newer Emissions, Common Model Year 2018 And Newer



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****READ FIRST:** The presence of any of the DTCs listed below in active status will cause an exception in PTT and not allow the test to run. **This article is not a diagnostic procedure for electrical codes.**

DTC	Description
P0259	Injection Pump Fuel Metering Control "B" High
P0256	Injection Pump Fuel Metering Control B
P2A16	Injection Pump Fuel Metering Control "D" (Cam/Rotor/Injector)
P2A19	Injection Pump Fuel Metering Control "D" High (Cam/Rotor/Injector)
P2A1E	Injection Pump Fuel Metering Control "F" (Cam/Rotor/Injector)
P2A21	Injection Pump Fuel Metering Control "F" High (Cam/Rotor/Injector)
P009D	Fuel Pressure Relief Control Circuit High
P009C	Fuel Pressure Relief Control Circuit Low
P009B	Fuel Pressure Relief Control
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance Bank 1
P0192	Fuel Rail Pressure Sensor Circuit Low Bank 1
P0190	Fuel Rail Pressure Sensor Bank 1

For the Common Rail, Fuel Leak Test and Fuel Leak Test Valve Cover Removed, test procedures refer to [Impact](#) under function group 237.

Tags

- k12213022 p0256-14 p0259-00 p2a16-14
- p2a19-00 p2a1e-14 p2a21-00 leak check
- p025614 p025900 p2a1614 p2a1900
- p2a1e14 p2a2100 dye test common rail
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Volvo Chassis - Oil Diluted With Fuel; Fuel In Oil, Diagnostic Information - All Emissions Prior To US17+OBD16 (Common Rail Fuel System), Model Year 2017 And Older



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For any vehicle with symptoms of oil contamination or dilution, including oil level above full (overfilled, making oil), low oil pressure codes, odors, etc.:

A. Oil analysis should be requested before proceeding with any repair. There are two types of analysis:

- GC (Gas Chromatograph) ASTM D3524 is the recommended method.
- FTIR (Fourier Transform Infrared Spectroscopy) is **not** an accurate method for fuel dilution measurements.

B. The following information should be included on the analysis sheet and considered as possible contributing factors when reviewing the report:

- Mileage
- Engine hours
- Mileage/hours since last oil service
- Oil manufacturer
- Oil product name/code
- Oil viscosity (weight)
- Oil grade

C. If the above data indicates a high percentage of fuel dilution and the oil life does not exceed recommended service intervals, perform the following dye test:

1. Put dye in the fuel filter on the engine.
2. Pressurize/prime the system with the hand pump
3. Remove the valve cover
4. Ensure there is shielding in place to prevent oil sling from the geartrain.
5. Run the engine for no longer than 10-15 seconds.
4. Inspect the following areas with a black light during and after operation:

- Injector plunger, solenoid, and side body

- Fuel gallery plugs at the front and back of the cylinder head

NOTE: A small amount of fuel observed around the injector plungers is normal.

D. Repair as needed.

E. Resecure the valve cover and run the truck for a short period of time. Check to see if oil level has increased.



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