Preview Solution CBR-561-8

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

Published 13 August 2024
Valid for all Mack and Volvo models 2011 to current

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

· **CBR-659** 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-51** V-MAC - E-Tech Fuel Dilution DSM Service Check List

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 at risk. Urgent oil change/service required.

	Property	Method	Requirement		
			Green	Alert	Wa
Wear and contaminant elements	Fe	ASTM D5185[1]	< 100 ppm[2]	100 - 150 ppm[2]	> 15
	Pb		< 20 ppm	20 - 35 ppm	> 3
	Cu		< 15 ppm[3]	15 - 30 ppm[3]	> 3
	Sn		< 10 ppm	10 - 15 ppm	> 1
	Cr		< 5 ppm	5 - 10 ppm	> 1
	Al		< 10 ppm[4]	10 - 15 ppm[4]	> 1
	Ni		< 15 ppm	15 - 20 ppm	> 2
	Si		< 20 ppm[2]	20 - 40 ppm[2]	> 4
	Mo		< 5 ppm[5]	5 - 10 ppm[5]	> 1
	K		< 10 ppm[4]	10 - 20 ppm[4]	> 2
	Na		< 10 ppm	10 - 20 ppm	> 2

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

1 Or equivalent.

2 May be higher during running in. Values above the Green range during the first few drain intervals are expected.

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. During this break-in period, values above the Green range for Cu may be disregarded.

4 AL and K may be simultaneously high during the first few intervals. The source is then likely the charge air cooler. 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 the dealer network.

Related links and attachments

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Preview Solution CBR-51-3

V-MAC - E-Tech Fuel Dilution DSM Service Check List

Published 30 August 2024
Valid for Mack Legacy models

E-Tech Fuel Dilution DSM Service Check List

(Note-proceed only to the point needed to establish cause & correction.)

1.0 Review Oil Analysis Reports

• Because many oil analysis reports provide an inaccurate, estimated, fuel dilution percent, the oil viscosity must be used together with the percent fuel dilution to determine when investigation should be initiated.

• Viscosity must be performed @ 100ºC/212ºF (40ºC/100ºF is not acceptable).

• If two consecutive oil analysis reports have confirmed dilution exceeding 3% and viscosity is 12.4 or less, continue with Sections 2.0 thru 6.0, as applicable.

2.0 Review the Following Known Causes of Dilution

• Reference prior repair history for possible causes.

• A cracked nozzle holder, supply pump seal dislodged or cut EUP o-ring may allow massive amount of fuel into crankcase.

• Any failure in the valve train which produces a non-firing cylinder will put considerable fuel into the crankcase from the nozzle of the non-firing cylinder.

• Removing an EUP prior to draining fuel gallery will put approximately 1 quart of fuel into the crankcase (reference service manual for correct procedure).

3.0 Investigation for Confirmed Gross Dilution

• Gross dilution is detected by a noticeable oil level increase. Gross dilution results in very low oil pressure and poor or no operation of jake brake. False indications of oil increase will result from differences in oil drainback times and oil temperature at the times the levels were checked. For this reason, oil level must be checked after complete drainback and at ambient oil temperature. The optimum time is first thing in the morning.

• With a confirmed oil level increase, review for the known causes in Section 2.0 and if none apply, perform Section 6.0, the System Pressure Test.

4.0 Investigation for Viscosity of 12.5 or Higher

• No action required.

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5.0 Investigation for Viscosity Between 10.0 and 12.4 Inclusive

• Install fuel pressure regulating valve, P/N 691GC225M2. (Available through Parts Depot 10/99)

• New valve provides a 30 psi reduction in fuel pressure.

• Fuel pressure spec. with standard valve is 85-120 psi.

• Fuel pressure spec. with the 691GC225M2 valve is 55-95 psi. (Checked at rated speed-no load)

• If engine already has the 691GC225M2 valve, fax oil analysis report to Service Engineering and consult on next course of action.

6.0 System Pressure Test - Use only for Engine with Gross Dilution (Measurable Increase in Oil Level) or with Viscosity Results of 10.0 or Lower.

6.1 With lines remaining installed, unmount supply pump from engine and inspect for a dislodged shaft seal. If the seal is pushed out of the housing bore, it will be visible in the space between the pump shaft drive gear and the housing. If seal is dislodged, pump must be replaced. If seal is in-place, remove supply pump fuel inlet #10 hose and cap fitting. Disconnect supply pump fuel outlet hose at secondary filter inlet. Ensure hose is full of fuel. To pressure test supply pump, apply 50 psi air pressure, and observe shaft seal area for leakage. If any leakage occurs, replace supply pump.

6.2 Drain oil and remove oil pan, wipe cam lobes and place clean paper under engine.

6.3 Remove regulating valve, install metric M16x1.5 straight-thread plug, P/N 277GC23M with gasket, P/N 57AM5. Keep plug loose, remove secondary fuel filter outlet line, fill with fuel while observing plug. When air stops and fuel begins to flow, tighten plug. Apply 100 psi air pressure to secondary outlet hose and inspect engine bottom end for leaks.

IMPORTANT With air pressure applied, normal plunger leakage will eventually drain the gallery and supply line. The supply line must be periodically refilled with fuel or the possible leak source will not be identified. If gallery is empty or nearly empty, loosen the gallery plug to exhaust air when filling the line.

6.4 A significant leak from the front timing gear area indicates the fuel return gallery front plug is leaking and it is necessary to remove the engine front cover for repair.

6.5 Using the engine turnover tool at the flywheel housing, slowly rotate engine while observing EUP cam lobes and paper under engine for excessive leakage. Normal static leakage from an EUP will result in the formation of a drop and eventual drip.

6.6 If an EUP is dripping rapidly, the cause must be identified. Remove the 100 psi pressure, drain gallery and remove the suspect EUP. Inspect the lower o-ring area for any visible concern which may result in leakage. Also, closely inspect the lower o-ring bore in the cylinder block for damage, score marks, and block surface finish. Note, the EUP bores typically have areas with a polished appearance and other areas without. This has no bearing on surface finish. If no o-ring or bore concern is found, and the

EUP had significant leakage during the pressure test, and the leakage was worse when rotating the engine, switch EUP with a non-leaking EUP from another cylinder and recheck for leakage. Always use new o-rings when installing EUP's. If leakage follows EUP, replace EUP. Retest, and if leakage persists notify Service Engineering.

Related links and attachments

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Preview Solution CBR-659-5

Mack 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

Published 22 May 2024

Valid For

Mack - all models 2017 and older

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)

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- 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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Preview Solution CBR-982-6

Volvo Chassis - Oil Diluted With Fuel; Fuel In Oil, Diagnostic Information - All Emissions Prior To US17+OBD16 (Prior To Common Rail Fuel System)

Valid for all models, model year 2008 to 2017

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

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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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