SERVICE BULLETIN

Language Code	Group	Product	No.	Version	Date	Page
GB	160	EXC	8 K	2	2009-12-03	1/5

Applies to models

EC135B LC, EC140B LC, EC140B LCM, EC140C L, EC140C LM, EC160B LC, EC160B NLC, EC160C L, EC160C NL, EC180B LC, EC180C L, EC210B F, EC210B LC, EC210B LR, EC210B NC, EC210B NLC, EC210C L, EC210C LR, EC210C N, EC210C NL, EC235C NL, EC240B LC, EC240B LR, EC240B NLC, EC240C L, EC240C LR, EC240C NL, EC290B F, EC290B LC, EC290B LR, EC290B NLC, EC290C L, EC290C LR, EC290C NL, EC330B LC, EC360B LC, EC360B LR, EC360B NLC, EC360C L, EC360C NL, EC460B LC, EC460B LR, EC460C L, EC700B LC, EC700C L, ECR145C L, ECR235C L, ECR305C L, EW140B, EW140C, EW145B, EW160B, EW160C, EW180B, EW180C, EW200B, EW210C, EW230C, FC2121C, FC2421C, FC2924C, FC3329C

Supersedes SB 160 EXC 8 K Version 1 dated 2007-08-06. Changes are marked with lines in the margin.

ONLY FOR DISTRIBUTORS / DEALERS

Oil analyses

WARNING!

Please pay attention to the safety instructions in the Operator's and Service Manuals concerned.

This Service Bulletin is to be considered as technical information only and is not subject to any reimbursement programs outside normal warranty.

Cause and action

Many oil analysis companies perform fluid analysis programs on Volvo Excavators. There is a risk that the monitoring limits they use may differ from Volvo Excavator's limits in many cases. This means that dealers and customers often receive false alarm reports. The reason is that these analysis companies may be using different monitoring limits versus Volvo Excavators based upon their experience with other competitors monitoring limit guidelines. On Volvo Excavators, please use the monitoring limits according to tables 1, 2, and 3 in this service bulletin.

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Table 1. Monitoring limits for Engine 4-16 liters

Parameter	Possible origin/cause	Normal level
Iron (Fe)	Crankshaft, cylinder liner, camshaft, cam follower, valve guides	≤ 100 ppm
Lead (Pb)	Big-end and main bearing shells	≤ 20 ppm
Copper (Cu)	Big-end and main bearing shells, gudgeon pin bushes, oil cooler	≤ 15 ppm **(1)(2)**
Tin (Sn)	Outer surface of sliding bearings	≤ 10 ppm **(1)**
Chrome (Cr)	Piston rings, valve stems	≤ 10 ppm
Aluminium (Al)	Pistons, charge air cooler, dirt	≤ 10 ppm **(1)**
Nickel (Ni)	Layer between surface and copper layer on sliding bearings, rocker arm bushes	≤ 10 ppm **(1)**
Molybdenum (Mo)	Piston ring	≤ 15 ppm **(3)**
Silicon (Si)	Sand, dirt, etc.	≤ 20 ppm
Viscosity	Reduction: Fuel dilution, oil shearing Increase: Oxidation, contamination by soot	Min: 9 cSt Max: 8 cSt higher than fresh oil value. Applies at 100 C
Soot	Incomplete combustion	≤ 2% weight **(4)**
Water	Coolant, condensation	≤ 0.1%
Fuel	Incomplete combustion, internal leak on fuel system, etc.	≤ 6% **(5)**
Sodium (Na), potassium (K) and/or boron (B)	High concentrations of sodium (Na), potassium (K) and/or boron (B) can indicate a coolant leak. Charge air cooler **(6)**	≤ 5ppm **(6)**
TBN	TBN indicates remaining alkalinity after acid neutralisation	≥ 4 (ASTM D2896) ≥ 2 (ASTM D4739)

1 Can be considerably higher during running-in.
2 Several 100 ppm copper can be found during the first 1000h of the vehicle life (sometimes even longer). This is copper flushed out from the oil cooler and is not harmful to the engine.
3 Certain oils contain molybdenum, which can cause an increased value.
4 When using VDS-3 oil, ≤3%.
5 If fuel dilution is > 6% AND viscosity is > 9 cSt then engine is OK. If fuel dilution is > 6% AND viscosity is <9 cSt continue with “Fuel system and used oil analysis, fault tracing” at group 23, information type “Diagnostic”.
6 Boron (B) can be found as an additive and thus and up in the sample. Potassium (K) can originate from the charge air cooler. Potassium and aluminium (Al) are then found at a ratio of between 3:1 and 2:1. Over 100 ppm K can be found but with no harm to the engine (soft particles).

NOTE! The values are to be regarded as monitoring limits and not as absolute values. It is important to establish a trend and not to make judgements based on isolated samples.

Generally the engine oil should be able to carry up to 2% of soot for up to 500 operating hours. The engine oil should meet the requirements according to Operator's manual. If oil of a lower specification is used, the levels of soot will rise earlier.

Different oils have a varying ability of carrying soot depending on compounding and additives. The ability of oil to carry soot means that the soot particles stick to components in the oil and are carried around in the system, whereas in an oil that cannot carry soot the soot particles stick together and clog up the oil filter.

Higher levels of soot may arise because of lower fuel quality or poor operating conditions. Engines which are run at idling speed for long periods generate more soot in the oil.

Table 2. Monitoring limits for hydraulic systems of Volvo.

Particle		Hydraulic system (EC- model)	Hydraulic system (EW-model)	Note
Aluminium	Al	20	20	PPM
Lead	Pb	20	20	PPM
Iron	Fe	25	25	PPM
Silicon	Si	50	50	PPM
Copper	Cu	150	150	PPM
Chromium	Cr	10	10	PPM
Nickel	Ni	10	10	PPM
Water		0.10%	0.10%	
ISO code	ISO4406	22/20/18	22/20/17	

NOTE! The values are to be regarded as monitoring limits and not as absolute values. It is important to establish a trend and not to make judgements based on isolated samples.

Table 3. Monitoring limits for power transmission system of Volvo.

Particle		Swing or Travel gearbox (EC- model)	Travel gearbox (EW-model)	Front axle (EW- model)		Rear axle (EW-model)	Note
				Hub	Differ-ential		
Aluminium	Al		100	100	100	100	PPM
Lead	Pb	50					PPM
Iron	Fe	500	1200	1200	500	1200	PPM
Silicon	Si	100					PPM
Copper	Cu	50	500	200	200	200	PPM
Water		0.25%	0.10%	0.10%	0.10%	0.10%	

NOTE! The values are to be regarded as monitoring limits and not as absolute values. It is important to establish a trend and not to make judgements based on isolated samples.

In cases where oil analysis shows a high PPM content, carry out :
1 Oil change and filter replacement.
2 Further oil analyses :
– at first directly after the oil change and filter replacement.
– and then three oil analyses at intervals of 100 hours.

These oil analyses provide an answer to the tendency, which may turn out as follows :
1 PPM content drops. Wear is normal.
2 PPM content remains at a high but stable level. Wear is normal.
3 PPM content continues to rise. This indicates abnormal wear and the customer should be informed.
4 PPM content varies greatly up and down. This indicates presence of foreign particles caused by working environment, storage of oil etc.

It is important to note that the iron content increases with a defective air cleaner system before one can note a rising silicon content. That is, in the case of rising iron content, the air cleaner system must be checked.

Oil sampling should be carried out as follows :
1 The oil should be at normal operating temperature.
2 The engine should be running at low idling and a draining hose should be connected to a pressure outlet for the transmission.
3 Regarding engines where there is no pressure outlet, the oil should be sucked up with the aid of a "hand pump".

The sample bottle must not be filled directly from the drain plug, as the oil at the bottom of the sump may have a higher concentration of contaminants and this will lead to a misleading analysis. The possible origin of the different particles is shown in table 4.

NOTE! An oil analysis does not provide an absolute guarantee of entirely avoiding a future breakdown. It can only provide an indication of the condition of the machine.

Certain breakdowns can develop fairly quickly, that is, an oil analysis at x hours may show normal PPM contents and a breakdown may occur prior to the next oil sample. When in doubt as to what action should be taken as a result of the oil analysis, contact Volvo CE Service Department.

Other aspects of oil analyses

All oils contain a varying degree of different additives in order to achieve required quality and performance requirements.
These additives also contain the metals which show up in the analysis. Various amounts of metals occur depending on :

1 Which type of oil is being produced (engine, transmission, axle oil).
2 Which company is making the oil.
3 On which market the oil will be sold (price, quality, competition).
4 Which requirements the customer demands.

The following metals occur:

Barium	Ba
Calcium	Ca
Magnesium	Mg
Boron	B
Phosphorus	P
Zinc	Zn
Sodium	Na

Table 4. Probable origin of particles in engine oil.

Particle		Engine
Aluminium	Al	Pistons.
Lead	Pb	Big-end and main crankshaft bearings (all types of plain bearings). Oil cooler.
Iron	Fe	Cylinder liners, camshaft, valve tappets, valve, guides and crankshaft.
Silicon	Si	Dust, dirt etc.
Copper	Cu	Big-end and main crankshaft bearings (all types of plain bearings). Water and oil coolers
Chromium	Cr	Piston rings and valves.
Tin	Sn	Slide bearings.
Water		Cooling and condensation water.