VOLVO CONSTRUCTION EQUIPMENT

SERVICE BULLETIN

Language Code	Group	Product	No.	Version	Date	Page
GB	160	WLO	27 K	4	2009-02-25	1/6

Applies to models

L110E, L110F, L120E, L120F, L150E, L150F, L180E, L180E HL, L180F, L180F HL, L220E, L220F, L350F, L50E, L60E, L60F, L70E, L70F, L90E, L90F

Supersedes SB 160 WLO 27 K Version 3 dated 2006-12-18. 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

The Global Volvo Oil Analysis program is a comprehensive tool for analysing oils in our machines. Volvo Construction Equipment has detailed knowledge about the specific components included in the systems and the monitoring limits are set based on this knowledge.
Various companies carry out oil analysis on Volvo Construction Equipment machines but there is a great risk to do this. Without knowledge about our systems the monitoring limits will in most cases be different than ours. This means that customers receive alarm reports and are worried entirely unnecessarily.
For Volvo Construction Equipment machines the monitoring limits according to tables 1, 2, 3 and 4apply.

For further technical information please see service bulletin 160WLO33 and 160WLO36.

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Table 1

Engine 4 – 16 litre

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).

Table 2

Monitoring limits for components made by Volvo:

Parameter		HT(E) transmission	Note
Aluminium	Al	30	PPM
Lead	Pb	50	PPM
Iron	Fe	100	PPM
Silica	Si	50	PPM
Copper	Cu	50	PPM
Chromium	Cr	20	PPM
Nickel	Ni	10	PPM
Tin	Sn	20	PPM
Water		0.20	%

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 components and hydraulic systems made by Volvo:

Particle		Axles, AWB (axles with wet built-in brakes)	Hydraulic system	Note
Aluminium	Al	30	20	PPM
Lead	Pb	50	20	PPM
Iron	Fe	500	50	PPM
Silica	Si	50	20	PPM
Copper	Cu	120	150	PPM
Chromium	Cr	20	20	PPM
Nickel	Ni	10	10	PPM
Tin	Sn	20	20	PPM
Water		0.20	0.10	%

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 4

Monitoring limits for components made for Volvo L350F:

Table4. Unit: ppm / 500 hours

	Fe: Iron	Cu: Copper	Cr: Chromium	Al: Aluminum	Si: Silicon	Pb: Lead	Na: Sodium (Natrium)	PQ: particle
Transmission	100	400	–	10	30	10	–	21
	200	**800**	–	**30**	**90**	**30**	–	**31**
Axle	1000	30	–	10	30	–	–	91
	2000	**80**	–	**20**	**60**	–	–	**251**

Normal range: Between 0 to value at upper row.
Caution range: Between values, at upper and lower row.
Dangerous: Value at lower row or more.

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 provides 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 iron content rises with faulty air cleaner system before it is possible to note rising silicon content, that is, in the case of rising iron content, the air cleaner system should be checked.

Oil sampling should be carried out as follows:
- The oil should be at normal operating temperature.
- The engine should be running at low idling and a draining hose should be connected to a pressure outlet for the transmission.
- 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 3.

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 Construction Equipment 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
Sulphur	S
Molybdenum	Mo