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Title: Understanding Used Oil Analysis

Applies To: MaxxForce 5, 7, DT, 9, 10, 11, 13,15 engine models

DESCRIPTION

The engine service manual identifies the proper oil drain interval for your engine and should be followed, whether oil miles or accumulated hours, depending on the application. Applications such as school buses, urban buses, and garbage packers may reach oil drain interval in hours before miles. Many owners use the drain as an opportunity to obtain oil samples. Oil analysis is a tool that can be used to assess an engine's health and maximize its life. This document communicates the abnormal and critical levels for pertinent oil characteristics. A normally operating engine will end a drain interval at or below the abnormal levels. An occasional excursion above abnormal levels may occur. In the instance that oil analysis characteristics exceed the critical level during a regular oil drain interval, reconfirm the maintenance interval per the criteria (fuel economy, average speed, etc.) in the service manual, and adjust if necessary.

- The engine oil guidelines below should not be treated as a sole reason for disassembly of the engine. Excursions past the critical levels can be justification for further investigation into engine performance and maintenance practices of the engine or vehicle. In these instances consult your local International® Truck or IC Bus® dealer for further guidance. In most cases servicing of the oil and filter is recommended.
- Sodium (Na) and potassium (K) content above abnormal and critical levels is a potential indicator of coolant contamination. If either reaches critical levels, consult your local International® Truck or IC Bus® dealer.
- Due to testing inaccuracy in fuel dilution measurement, viscosity, not fuel dilution, should be the primary indicator for additional engine diagnosis, beyond servicing of oil, for excursions of either parameter. Fuel dilution should only be used as a means of determining the cause of low viscosity levels. Abnormal and critical minimum viscosity limits differ by oil viscosity grade so that both unacceptably low viscosity levels and unacceptably high fuel dilution levels are identified.
- Total Base Number (TBN) is a measure of the oil's ability to neutralize acids. As acids are formed in the engine, the TBN is depleted when neutralizing these acids. When TBN falls below the minimum recommended level, internal corrosion may occur. If TBN falls below the minimum over the course of a drain interval, consult the product data sheet for your oil to obtain the TBN level of new oil. MaxxForce® Diesel Engines are developed for operation with new oil at a TBN level of 10 or higher. In the case where TBN falls below the criteria, a shortened oil drain or a minimum 10 TBN level for new oil is highly recommended.
- Included in this document are guidelines for assessing engine oil condition. Used oil wear metals limits have been omitted due to the fact that these are highly dependent on application, service, time/mileage

on oil, etc. See your local International® Truck or IC Bus® dealer if assistance in interpretation of oil analysis is needed.

ABNORMAL & CRITICAL LEVELS FOR 10W-30, 5W-30 OILS

Abnormal Levels

Make	Models	Max Si ^b (ppm)	Max Na ^b (ppm)	Max K ^b (ppm)	Min Vis ^c (cSt)	Max Vis ^c (cSt)	Max H ₂ O ^d (%)	Max Soot ^e (%)	Min TBN ^f (mgKOH/g)
Navistar	All Others - Pre 2007	20	40	50	10 ^g	14	0.2	4	3.5
Navistar	MaxxForce 7	20	40	50	10	15	0.2	4	3.5
Navistar	MxF 5, MxF DT, 9, & 10	20	40	50	10 ^g	14	0.2	4	3.5
Navistar	MxF11, 13, & 15	20	40	50	11	15	0.2	3	3.5

Critical Levels

Make	Models	Max Si ^b (ppm)	Max Na ^b (ppm)	Max K ^b (ppm)	Min Vis ^c (cSt)	Max Vis ^c (cSt)	Max H ₂ O ^d (%)	Max Soot ^e (%)	Min TBN ^f (mgKOH/g)
Navistar	All Others - Pre 2007	30	100	150	9 ^g	15	0.5	5	3
Navistar	MaxxForce 7	30	100	150	9	16	0.5	5	3
Navistar	MxF 5, MxF DT, 9, & 10	30	100	150	9 ^g	15	0.5	5	3
Navistar	MxF11, 13, & 15	30	100	150	10	16	0.5	5	3

ABNORMAL & CRITICAL LEVELS FOR 15W-40, 5W-40 OILS

Abnormal Levels

Make	Models	Max Si ^b (ppm)	Max Na ^b (ppm)	Max K ^b (ppm)	Min Vis ^c (cSt)	Max Vis ^c (cSt)	Max H ₂ O ^d (%)	Max Soot ^e (%)	Min TBN ^f (mgKOH/g)
Navistar	All Others - Pre 2007	20	40	50	12 ^g	16.5	0.2	4	3.5
Navistar	MaxxForce 7	20	40	50	12.5	18.5	0.2	4	3.5
Navistar	MxF 5, MxF DT, 9, & 10	20	40	50	11 ^g	17	0.2	4	3.5
Navistar	MxF11, 13, & 15	20	40	50	12.5	18.5	0.2	3	3.5

Critical Levels

Max Si^b Max Na^b Max K^b Min Vis^c Max Vis^c Max H₂O^d Max Soot^e Min TBN^f

Make	Models	(ppm)	Na ^b (ppm)	(ppm)	Vis ^c (cSt)	Vis ^c (cSt)	H ₂ O ^d (%)	Soot ^e (%)	(mgKOH/g)
Navistar	All Others - Pre 2007	30	100	150	11 ^g	17.5	0.5	5	3
Navistar	MaxxForce 7	30	100	150	11.5	19.5	0.5	5	3
Navistar	MxF 5, MxF DT, 9, & 10	30	100	150	10 ^g	18	0.5	5	3
Navistar	MxF11, 13, & 15	30	100	150	11.5	19.5	0.5	5	3

Oil Characteristic Key

Si	Maximum Silicon for Level
Na	Maximum Sodium for Level
K	Maximum Potassium for Level
Vis L	Minimum Viscosity for Level
Vis H	Maximum Viscosity for Level
H ₂ O	Maximum Water for Level
Soot	Maximum Soot for Level
TBN	Minimum Total Base Number for Level

^aPer ASTM D2896

^bPer ASTM D5185

^cKinematic Viscosity at 100°C per ASTM D445

^dPer ASTM D1744

^ePer FTIR or TGA

^fPer ASTM D4739

^gOil in engines with oil activated fuel systems experience shear induced viscosity loss independent of fuel dilution

RESOLUTION

Contact Engine Technical support if you have any questions.



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