

## July's Edition of Natural Gas Engine Tech Talk

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Bauer lives in Indiana, has a bachelor's degree in Mechanical Engineering from the University of Michigan, has and continues to be involved in the development, optimization, and support of natural gas engine technology for the last 15 years.

### **This month's topic: How to avoid unnecessary downtime and expensive repairs, Engine Oil Oxidation**

This month, I decided to focus on an issue we see as the root cause of avoidable damage on natural gas engines: oil oxidation. To get a few facts around oxidation, its cause, how to avoid it, and its consequences, I interviewed Cummins' Chemical Technology Manager and Cummins oil expert, Ryan Denton, who has a Ph.D. in Chemistry.

Below are his responses to my questions:

#### **What is oxidation?**

Oxidation is an indirect measurement of the amount of oxygen incorporated into petroleum and other components in engine oil. Oil oxidation is measured with an infrared spectrometer.

#### **How does oxidation occur?**

Chemical compounds exposed to air and extreme temperatures naturally undergo oxidation reactions. In the engine, extreme heat from hot metal surfaces and gases in the power cylinder is the primary source of oil oxidation.

#### **How can oxidation be avoided?**

Oxidation of the engine oil can be impacted in three different categories: 1. Maintenance 2. Engine oil quality 3. Engine duty cycles (when possible).

1. **Maintenance:** Following the recommended oil drain interval in the owner's manual ensures that oxidation levels remain within acceptable levels to protect engine components.
2. **Engine Oil Quality:** Cummins recently released **Cummins Engineering Standard (CES) 20092**, which represents a significant increase in natural gas engine oil quality and performance from previous specifications (CES 20074 and CES 20085). Using a high-quality CES 20092 oil (such as Valvoline Premium Blue One Solution 9200) provides the best technology to prevent oxidation in natural gas engines from occurring in the first place.
3. **Engine Duty Cycle:** As oxidation is essentially a function of time and temperature, **accurately defining oil drain cycles by hours vs miles** and reducing unnecessary fuel burn (e.g. excessive idling) not only improves fuel economy but also keeps oxidation values lower.

#### **What are the consequences?**

Oxidation of engine oil can lead to an increase in corrosivity which can attack soft metals like lead and copper. Also, oxidized compounds are more likely to lead to polymerization which increases engine oil viscosity. Finally, in extreme heat areas, oxidation can lead to the formation of solid deposits that could eventually lead to excessive oil consumption, wear or other negative impacts.

#### **If you miss one oil drain interval on a natural gas engine, how is the engine affected?**

Increased oil corrosivity puts bearings, bushings and other components containing soft metals at risk. There is also a potential increased risk for wear due to deposit formation (especially in the power

cylinder) and viscosity increase. Each engine is unique but, in some cases, **even missing a single oil drain** can lead to irreversible damage to key components.

Some of the damages mentioned above are cracked or burned pistons, crankshaft seal leaks, camshaft, and follower failures. While less common, other issues resulting from oil oxidation on both the ISL G and ISX12 G include damage to crankshaft and connecting rods bearings.

### Maintenance Best Practices

- Based upon your fleet's average speed, calculate when to perform your maintenance based upon the engine hours run.
  - Average speed includes **all idle time**
  - Best obtained through Insite (no calculation needed)
  - (500hr interval) X (Ave MPH from Insite) = miles driven in 500 hrs.
- Only use **CES 20092** oil for best additive package
- Do all required maintenance **on time** (see Cummins recommended maintenance schedule below)
  - Natural Gas engines do not tolerate engine oil breaking down
  - Oxidized or depleted natural gas engine oil appears to be clean; oxidation is not visible to the naked eye.
- Change spark plug before you experience engine skipping:
  - Prevents unburnt fuel from reaching the catalyst
  - Prevents Check Engine Lights on the dash

### Resources:

ISB6.7 G & B6.7N Maintenance Intervals	
	Hours
Oil & Filter* - CES 20085	500
Oil & Filter* - CES 20092	750
Spark Plugs	750
Fuel Filter	1,000
Valve Adjustment	1,500
Crankcase Breather	2,000
Ignition Coil Extension	5,000

ISB6.7 G & B6.7N Maintenance Part Numbers		
Component	Cummins Part #	Fleetguard Part #
Oil Filter	3937736	LF3970
Fuel Filter	3607140	NG5900
Crankcase Filter	5288839	x
Spark Plug Kit**	4376564	x
Ignition Coil Extension	5402163	x

\*\*Kit includes spark plug and pregreased boot

ISL G & L9N Maintenance Intervals	
	Hours
Oil & Filter* - CES 20085	500
Coolant Filter	500
Oil & Filter* - CES 20092	1,000
Fuel Filter	1,000
Valve Adjustment	1,000
Spark Plugs	1,500
Crankcase Breather Filter - L9N	2,000
Standard Coolant	2,000
Ignition Coil Extension	10,000

ISL G & L9N Maintenance Part Numbers		
Component	Cummins Part #	Fleetguard Part #
Oil Filter	3401544	LF9009
Fuel Filter	3607140	NG5900
Crankcase Filter*	5288839	x
Spark Plug Kit**	5473009	x
Ignition Coil Extension	5265337	x

\*If equipped

\*\*Kit includes spark plug and pregreased boot

ISX12 G & ISX12 N Maintenance Intervals	
	Hours
Oil & Filter* - CES 20085	500
Oil & Filter* - CES 20092	1,000
Spark Plugs	1,000
Coolant Filter	1,500
Standard Coolant	6,000
Valve Adjustment	1,000 / 3,000
Ignition Coil Extension	10,000
Crankcase Breather Filter - ISX12N	10,000

\*Per Cummins QSOL

ISX12 G & ISX12 N Maintenance Part Numbers		
Component	Cummins Part #	Fleetguard Part #
Oil Filter	4367100	LF14000NN
Fuel Filter*	3607140	NG5900
Crankcase Filter*	4389517	CV53009
Spark Plug Kit**	4309391	x
Ignition Coil Extension	4387015	x

\*If equipped

\*\*Kit includes spark plug and pregreased boot

## CES 20092 Oil Provider Recommendations

Company Name	Product Name	Vis Grade
Valvoline	Premium Blue 9200 - One Solution 10W-30	10W-30
Valvoline	Premium Blue 9200 - One Solution 15W-40	15W-40

### Alternatives

Company Name	Product Name	Vis Grade
Association of Independent Oil Distributors	Purus TFO Synthetic Blend CK-4/SN	15W-40
Association of Independent Oil Distributors	Purus TFO Synthetic Blend CK-4/SN	10W-30
Castrol Ltd.	Castrol Duratec ES 15W-40	15W-40
Castrol Ltd.	Castrol Vecton Long Drain NG 15W-40	15W-40
CITGO Petroleum Corporation	Citgard® CNG/LNG Engine Oil 10W-30	10W-30
CITGO Petroleum Corporation	Citgard® CNG/LNG Engine Oil 15W-40	15W-40
Petro-Canada Lubricants Inc	Duron GEO LD 10W-30	10W-30
Petro-Canada Lubricants Inc	Duron GEO LD 15W-40	15W-40
SINOPEC LUBRICANT CO. LTD.	Sinopec Tulux G600 CNG/LNG/LPG 15W-40	15W-40
TongYi Petroleum Chemical Co.	TongYi Long Range Gas Engine Oil LPG/CNG	10W-30
TongYi Petroleum Chemical Co.	TongYi Long Range Gas Engine Oil LPG/CNG	15W-40
TongYi Petroleum Chemical Co.	TongYi Long Range Gas Engine Oil LPG/CNG/LNG 15W-40	15W-40
TOTAL LUBRIFIANTS	Total Rubia Gas 9M 15W-40	15W-40
TOTAL LUBRIFIANTS	Total Rubia Gas 9M FE 10W-30	10W-30