

Cummins Westport
The Natural Choice



Cummins Westport, Inc. Engine Overview

March 2015



Cummins Westport Inc. (CWI)

A Cummins JV Company

- CWI was established in 2001 as a 50/50 joint venture company between Cummins Inc and Westport Innovations.
 - Cummins Inc. - world's largest independent manufacturer of commercial diesel and natural gas engines.
 - Westport Innovations Inc. - world leader in gaseous fuel engine technology
- CWI offers 8.9 and 12 liter spark ignited alternative fuel automotive engines.
- Engines are manufactured by Cummins in Rocky Mount, North Carolina, and Jamestown, New York.
- Local parts and service support through Cummins Distributor network.

Cummins Westport

Heavy Duty Engines Designed Specifically for Alternative Fuels

- Based on Reliable Cummins Engine Platforms
- Common parts and design provide heavy duty performance
- Engineered and Optimized Specifically for Alternative Fuel
- Continued improvement in reliability and cost of ownership
- Service, Parts and Training Support through the Cummins Distributor network

2014/16 Cummins Westport Products.



ISB6.7G

6.7 Litre

Spark Ignited
SEGR

Three Way Catalyst



ISL G

8.9 Litre

Spark Ignited
SEGR

Three Way Catalyst

Up to 60,000 miles/year
66,000 lb. GVW



ISX12 G

11.9 Litre

Spark Ignited
SEGR

Three Way Catalyst

Up to 80,000 lb. GVW



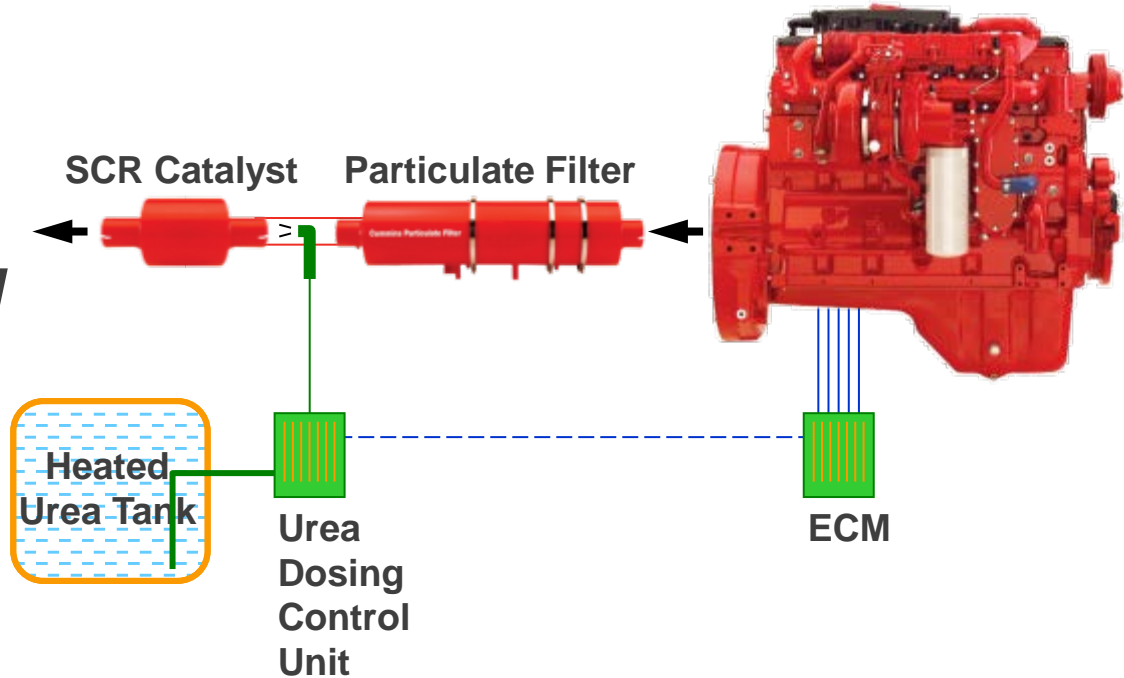
Natural Gas Engines: Features

- ISX12 G : 12 Liters, 80,000 lb GVW
- ISL G : 9 Liters, 66,000 lb GVW
- Use 100% Natural Gas
 - Stored as CNG, LNG
- Spark Ignited, In-line 6 cylinder
- Wastegate Turbocharger
- Charge-Air Cooled (CAC)
- Stoichiometric EGR Combustion
- Three Way Catalyst Aftertreatment
 - Maintenance Free
- Base Warranty: 2 yr/250,000 miles
- Extended Coverage Available

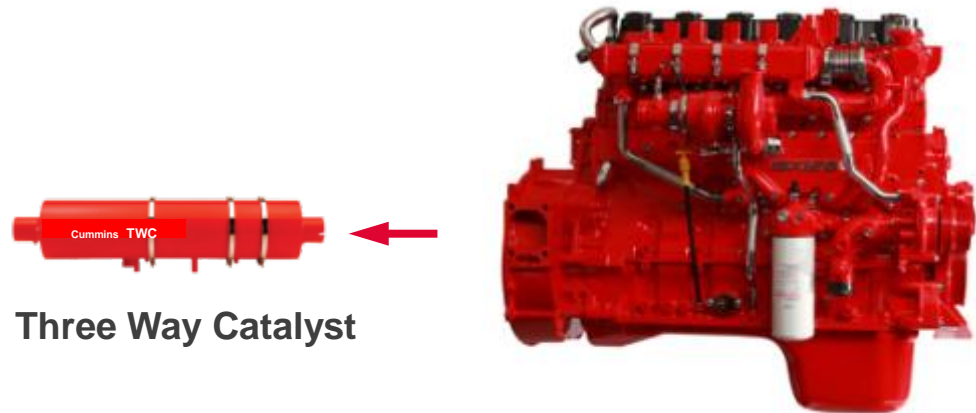


2015 Engines Aftertreatment Comparison

2015 Diesel



ISL G
ISX12G



ISX12G

Natural Gas Engine Introduction

■ Target Markets

- Regional haul truck / tractor
- Vocational
- Refuse

■ Platform & Technology

- Cummins 11.9 litre ISX12 diesel is base engine
- Utilizing spark-ignition with cooled EGR & three way catalyst (TWC)
 - Same combustion technology as ISL G



ISX12G

Natural Gas Engine

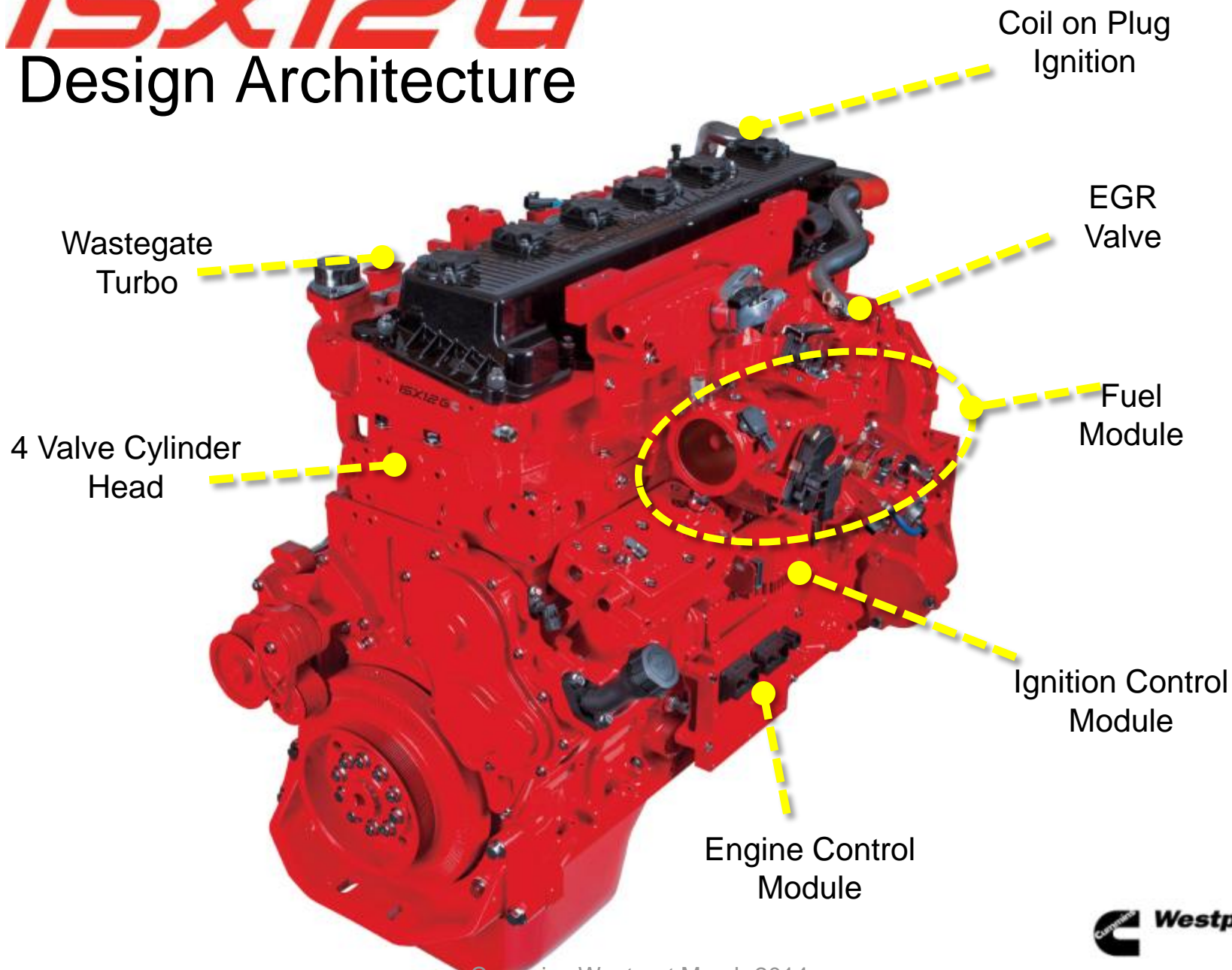
■ Key Product Attributes

- 4 cycle, spark ignited, in-line 6 cylinder, turbocharged, CAC
- Displacement – 11.9 litres (726.2 cu in)
- Peak rating: 400 hp, 1450 lb-ft
- 2013 EPA/CARB certified
- Meets 2014 EPA GHG requirements
- Dedicated 100% natural gas engine
 - Will operate on CNG or LNG
- Three Way Catalyst after-treatment
- Engine braking
- Manual/Automatic Transmission capable
 - AMT Available Now.



ISX12G

Design Architecture



Differences

ISX12 diesel and ISX12 G natural gas

	ISX12		ISX12 G	
Horsepower	310-425 HP	231-317 kW	320-400 HP	239-298 kW
Peak Torque	1150-1650 lb-ft	1559-2237 N-m	1150-1450 lb-ft	1559-1966 N-m
Torque at Idle	800 lb-ft	1085 N-m	700 lb-ft	949 N-m
Aftertreatment	DPF + SCR		Three Way Catalyst	
Engine Brake Performance	Optional 380 HP @ 2100 RPM		Optional 240 HP @ 2100 RPM	



ISX12 G Features

Coil on Plug Ignition

ISX12 G Coil and Extension



ISX12 G Spark Plug



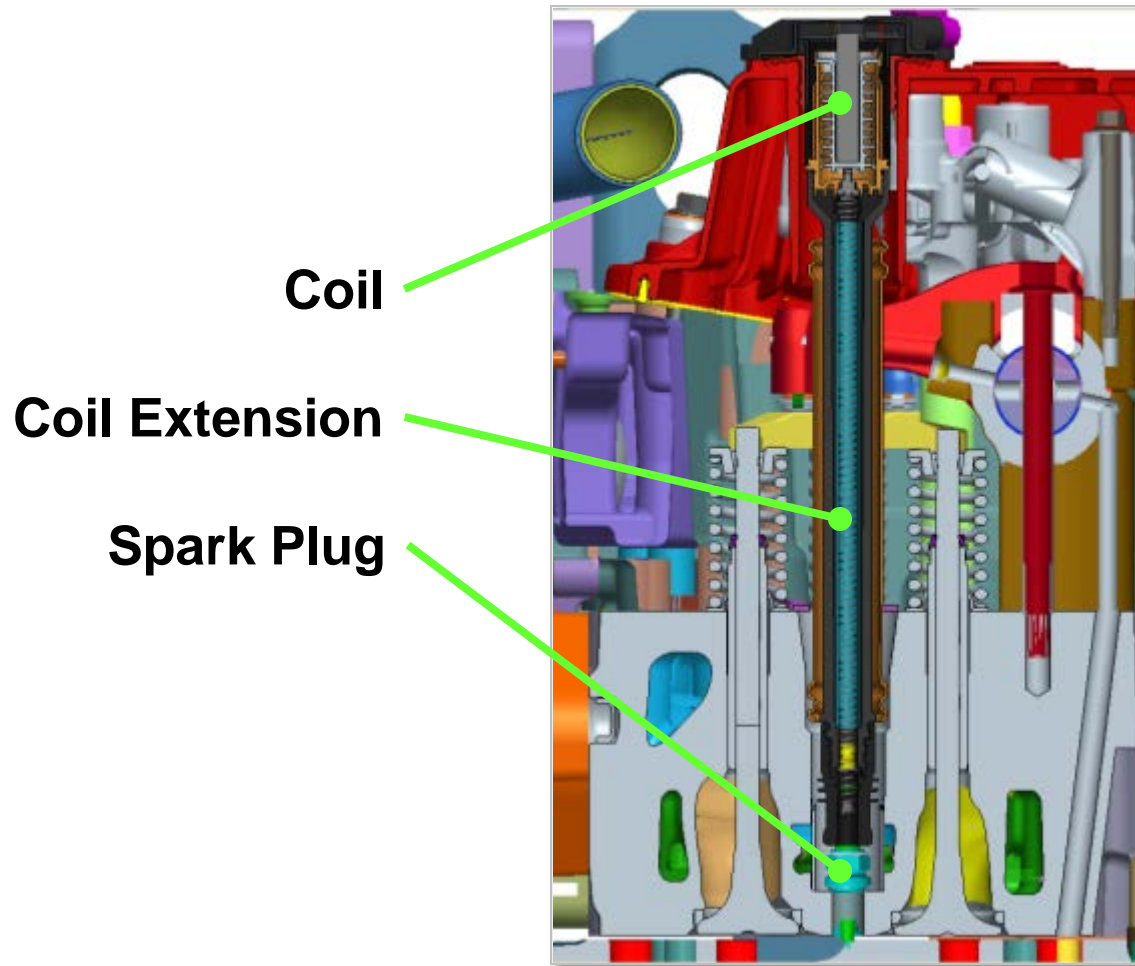
Three Way Catalyst



Fuel Flexibility



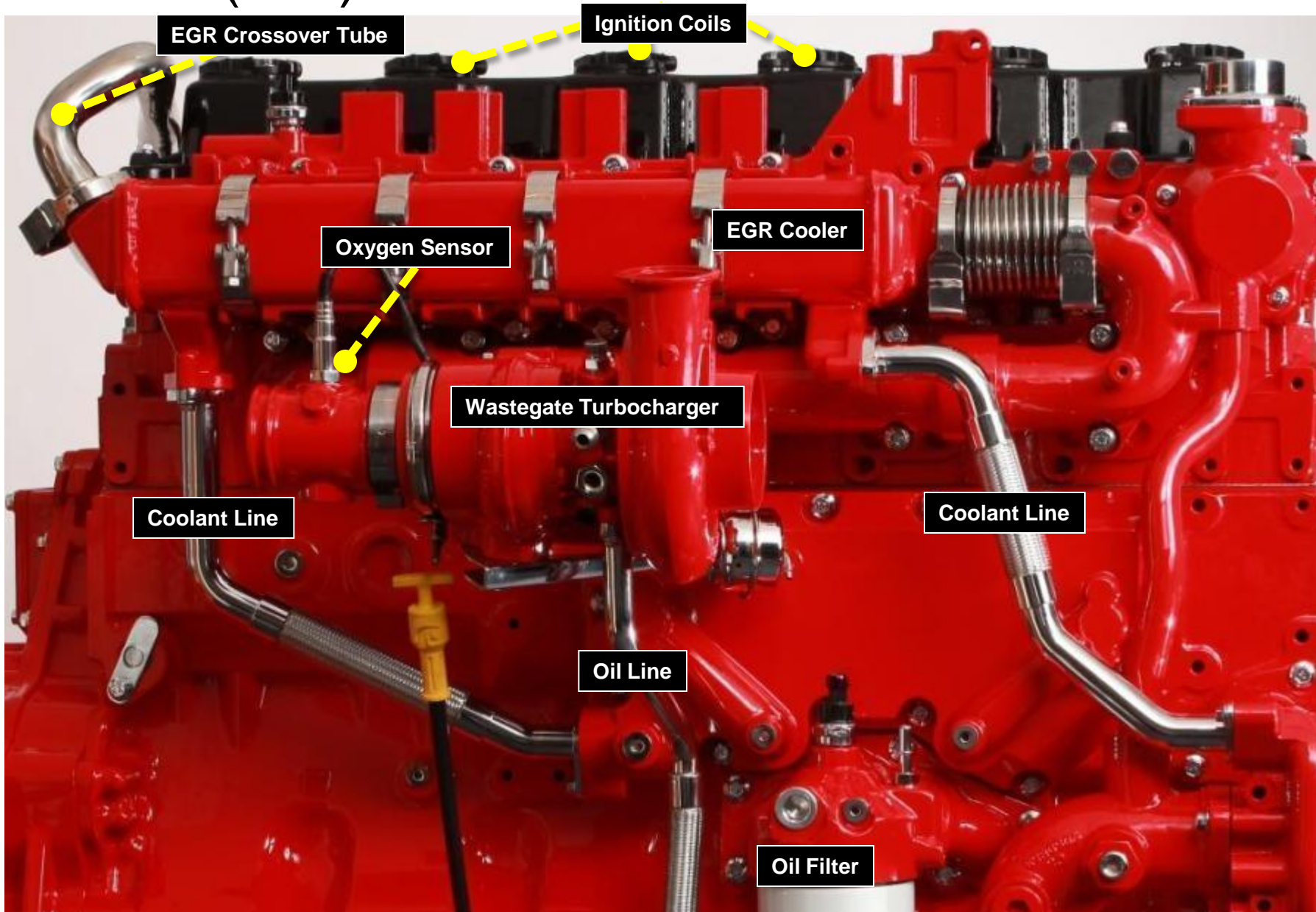
ISX12 G Cylinder Head, Coil, Spark Plug



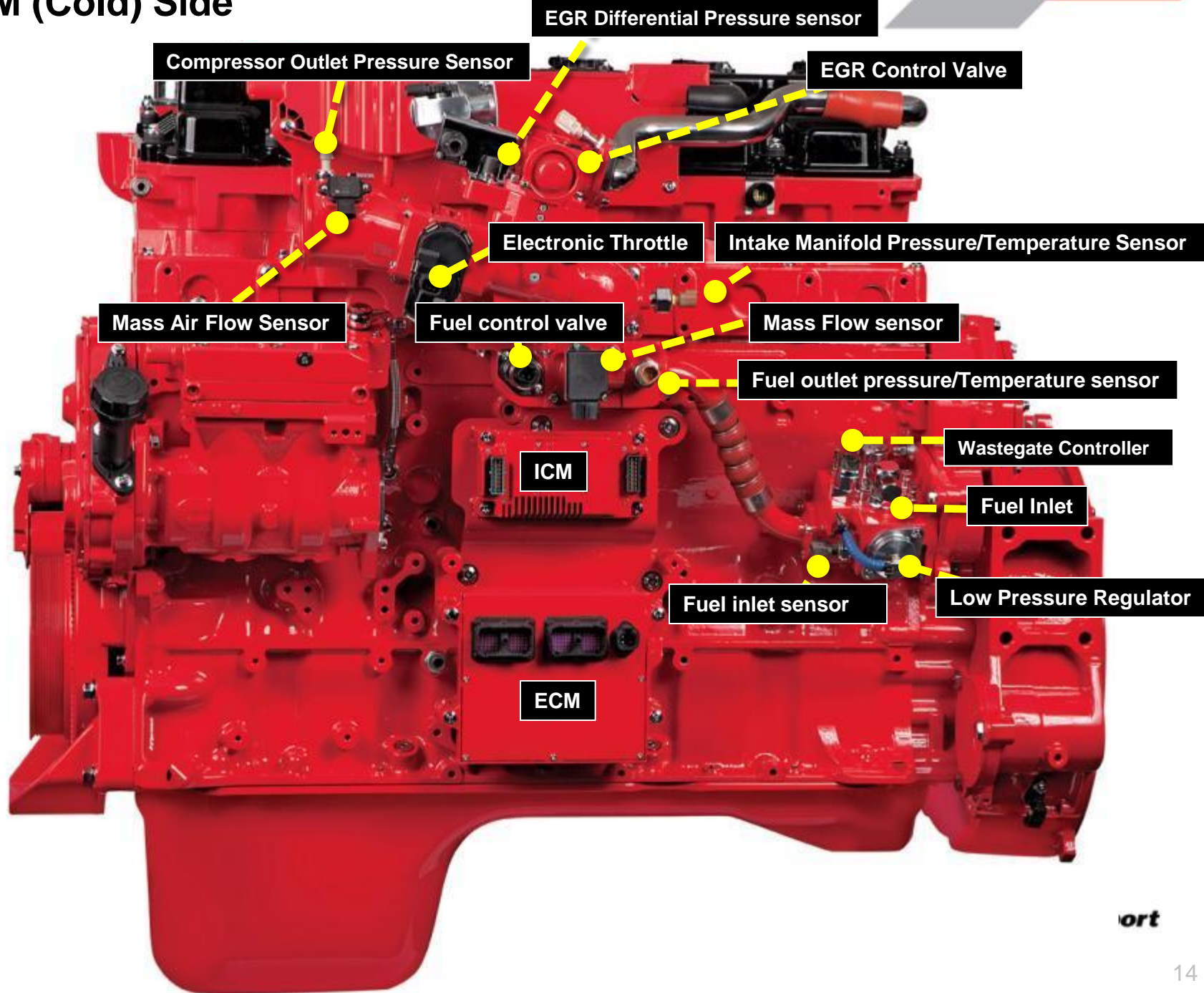
Flexible coil extension
for serviceability

Cylinder head cross section

Turbo (Hot) Side



ECM (Cold) Side



ISX12 G Maintenance Intervals - Revised Aug 2014

Note: 50 mph (80 kph) Average Speed	Hours	Miles	Kilometers	Months
Spin-on Fuel Filter	Daily Check			
Oil & Filter*	500	25,000	40,000	6
Coolant Filter*	1,500	75,000	120,000	12
Spin-on Fuel Filter*	1,000	50,000	80,000	9
Spark Plugs*	1,500	75,000	120,000	12
Overhead Adjustment*	1,500	75,000	120,000	12
Engine Brake (Adjust)	6,000	300,000	480,000	24
Standard Coolant	6,000	300,000	480,000	24
Air Cleaner/Element	Follow vehicle manufacturers published recommendations			

- Default interval is the hours stated. Interval is whichever comes first – hours, miles or time.
- Use CES20074 engine oil
- Refer to Owners Manual or QSOL for complete details on Maintenance Intervals.

* Assuming normal line haul duty cycle based on 50 mph average speed.
Maintenance Intervals must be reduced for slower average speed applications.



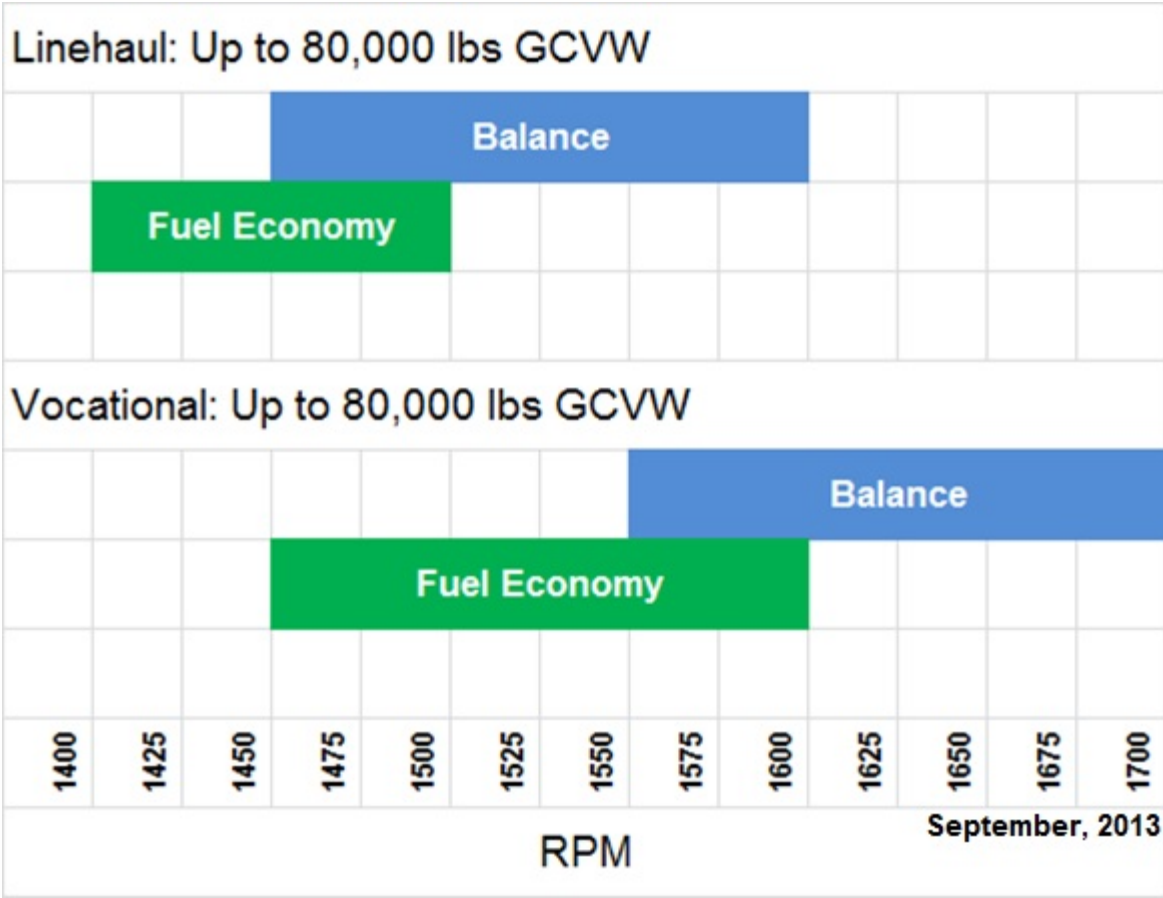
Cold Weather Operation

- Cold weather requirements for Cummins diesel and natural gas engines are the same
 - Guidelines are published in ISX12 G CM2180 owners manual and operation and maintenance manuals
 - Important to pay particular attention to protecting natural gas engines from freezing intake temperatures by using winter fronts and/or warm underhood air
- AEB 174.04 Provides further guidelines for Cold Weather Engine operation for All Automotive and Industrial Engines.
- Also refer to Customer Service Bulletin 4332709 – Operation of Natural Gas Engines in Cold Climates.

2014 Gearing Recommendations

ISX12G

320-400 HP



Powerspec 5.4

- Software Application
 - Gearing calculator
 - Electronic features- settings and descriptions
 - Customized engine ‘specs’
 - “Easy Spec” available for fleets
 - Collects valuable trip information
 - Reporting feature



For more information or to download PowerSpec, visit:

<http://www.powerspec.cummins.com>



Cummins Westport
The Natural Choice



Fuel System



Fuel Systems

- Cummins Westport natural gas engines fuel requirements enable the use of both CNG or LNG.
- Customers may choose CNG or LNG depending on duty cycle, application, and/or fuel availability.
- Natural gas fuel (CNG or LNG) must meet fuel quality requirements per AEB 79.05 (CES14624)
- Regardless of how the fuel is stored on the vehicle, the at engine fuel inlet pressure at rated conditions requirement is the same
 - ISL G - minimum 70 psi, maximum 150 psi
 - ISX12 G – minimum 60 psi, maximum 150 psi

Fuel Quality

- Natural gas fuel must not contain water, dust, sand, dirt, oils or any other substance detrimental to the operation of the engine
- For CWI ISL G and ISX12 G engines Cummins Engineering Standard (CES) 14624 applies.
 - For these engines the methane number based on the SAE922359 must be **75 or higher**, and the Lower Heating Value must equal or exceed 37448.6 kJ/kg (**16100 BTU/lbm**)
 - Four constituents that must also meet requirements

CES 14608 and CES 14624 Maximum Allowable Hydrogen, Hydrogen Sulfide, Sulfur, and Siloxanes		
Constituents	Requirements	Test Method
Hydrogen (H ₂)	0.03 percent volume maximum	ASTM D2650
Hydrogen Sulfide (H ₂ S)	0.0006 percent volume maximum	ASTM D4084
Siloxanes	0.0003 percent volume maximum	Environmental Protection Agency (EPA) TO-14, 15 GC/ELCD, GC/AED, GC/MS
Sulfur (S)	0.001 percent weight maximum	Title 17 CCR Section 94112 Method 16

On Line Fuel Quality Calculator

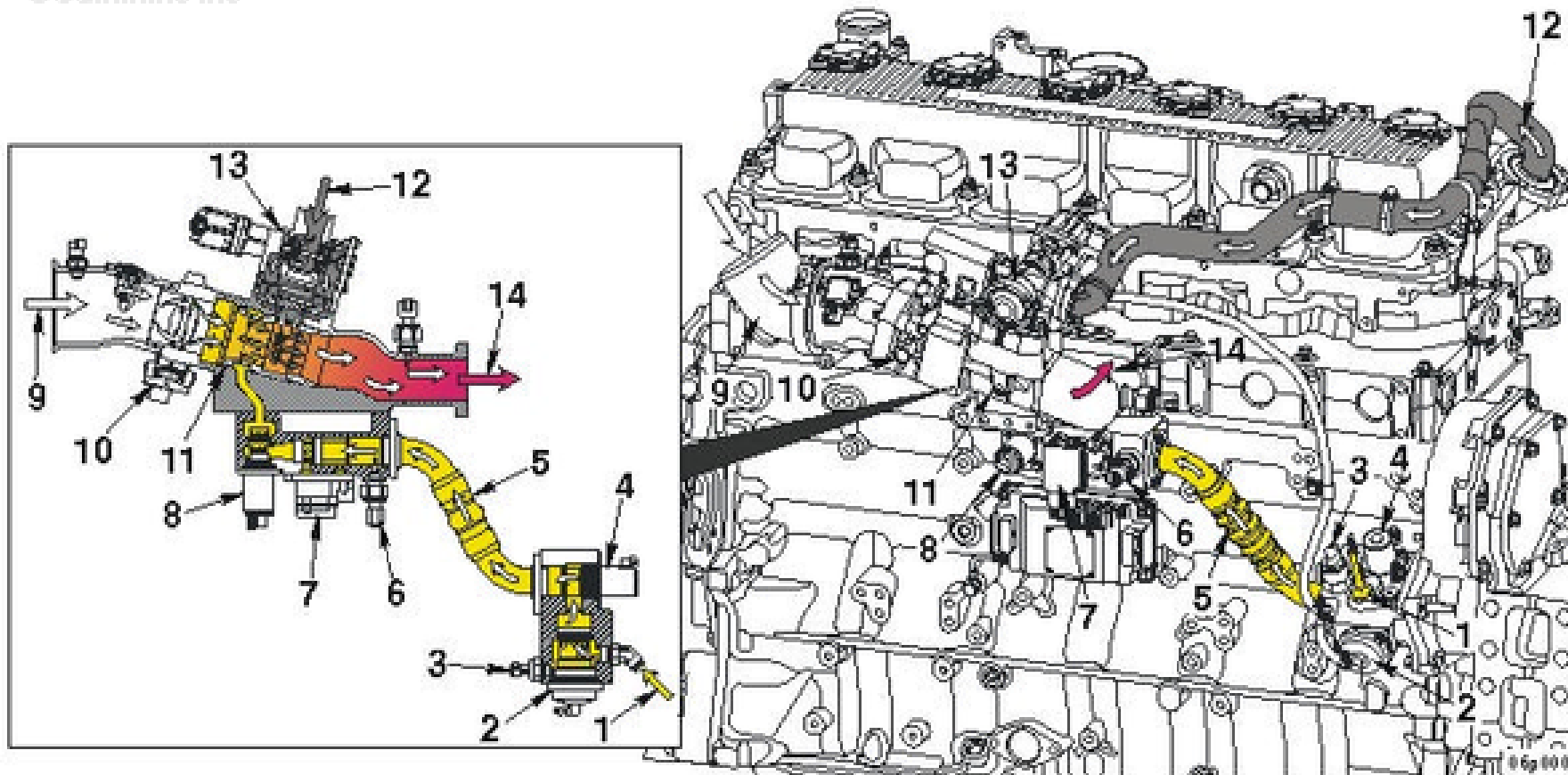
Fuel Composition			Results for ISX12 G/SL G	Results for B/C Gas
Methane	CH ₄	<input type="text" value="88.99"/> %	Methane Number <input type="text" value="87.0"/>	Methane Number <input type="text" value="87.0"/>
Ethane	C ₂ H ₆	<input type="text" value="5"/> %		
Propane	C ₃ H ₈	<input type="text" value="2"/> %		
Butane	C ₄ H ₁₀	<input type="text" value=".01"/> %		
Pentane	C ₅ H ₁₂	<input type="text" value="0"/> %		
Hexane	C ₆ H ₁₄	<input type="text" value="0"/> %		
Heptane	C ₇ H ₁₆	<input type="text" value="0"/> %		
Octane	C ₈ H ₁₈	<input type="text" value="0"/> %		
Carbon Dioxide	CO ₂	<input type="text" value="0"/> %		
Nitrogen	N ₂	<input type="text" value="4"/> %		
Oxygen	O ₂	<input type="text" value="0"/> %		
Sulfur	S ₂	<input type="text" value="0"/> %	Additional Results	
Hydrogen	H ₂	<input type="text" value="0"/> %	Lower Heating Value: (min. 16,100 BTU/lbm)	<input type="text" value="19991"/> PASS
Hydrogen Sulfide H ₂ S		<input type="text" value="0"/> %	Sulfur % Weight: (max. 0.001% weight)	<input type="text" value="0.000"/> PASS
Siloxanes	Si	<input type="text" value="0"/> %	Hydrogen % Volume: (max. 0.03% volume)	<input type="text" value="0"/> PASS
Total (must be 100%)		<input type="text" value="100.00"/> %	Hydrogen Sulfide % Volume: (max. 0.0006% volume)	<input type="text" value="0"/> PASS
			Siloxanes % Volume: (max. 0.0003% volume)	<input type="text" value="0"/> PASS

<http://www.cumminswestport.com/fuel-quality-calculator>

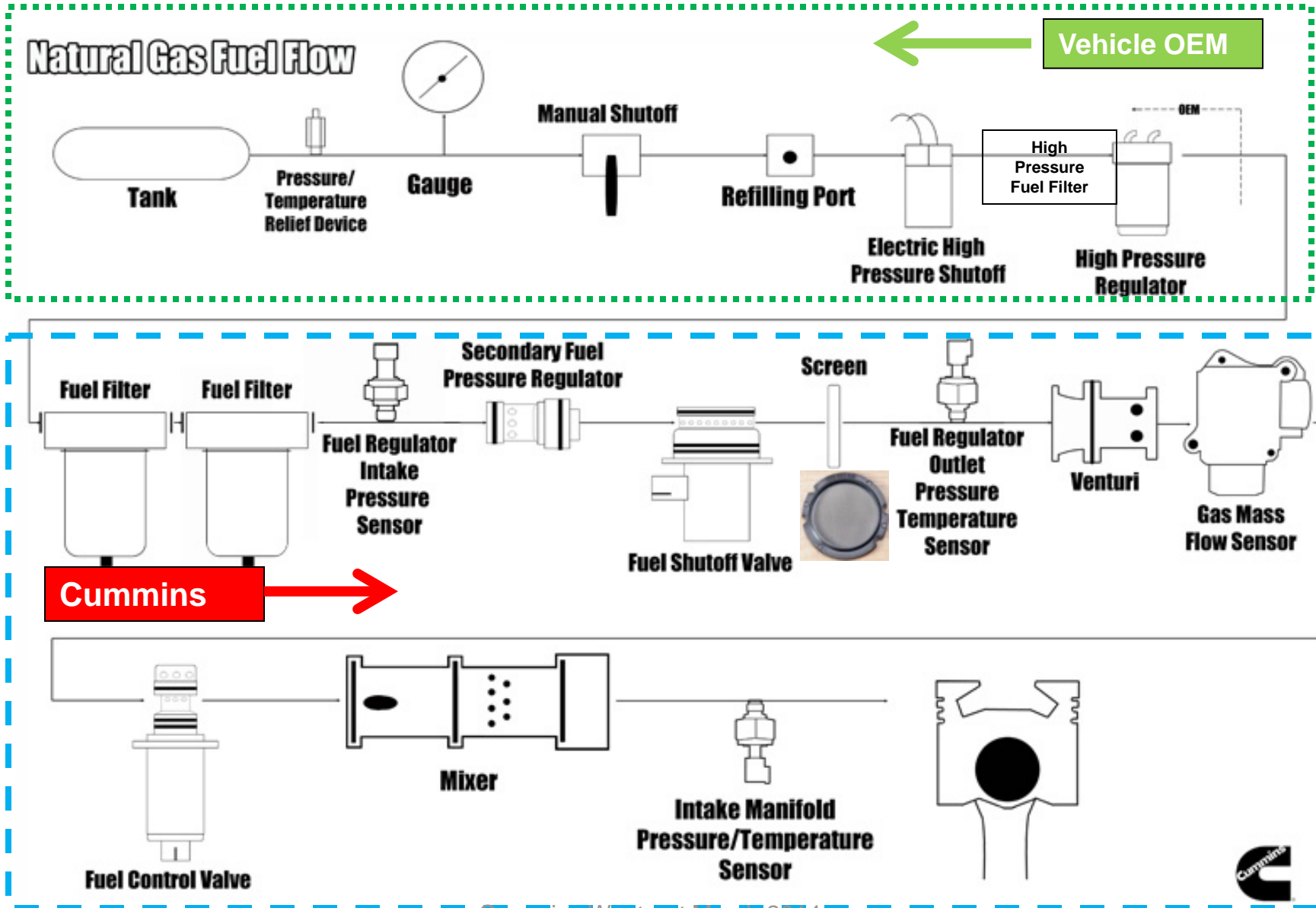
Fuel System Flow - Engine

1. Fuel inlet from remote mounted gas filter
2. Low-pressure regulator
3. Fuel inlet pressure sensor
4. Fuel shutoff valve
5. Fuel transfer tube
6. Fuel outlet pressure/temperature sensor
7. Gas mass flow sensor
8. Fuel control valve
9. Air inlet
10. Throttle actuator
11. Air/fuel mixer
12. Exhaust gas to exhaust gas recirculation (EGR) valve
13. EGR valve
14. Intake manifold.

©Cummins Inc

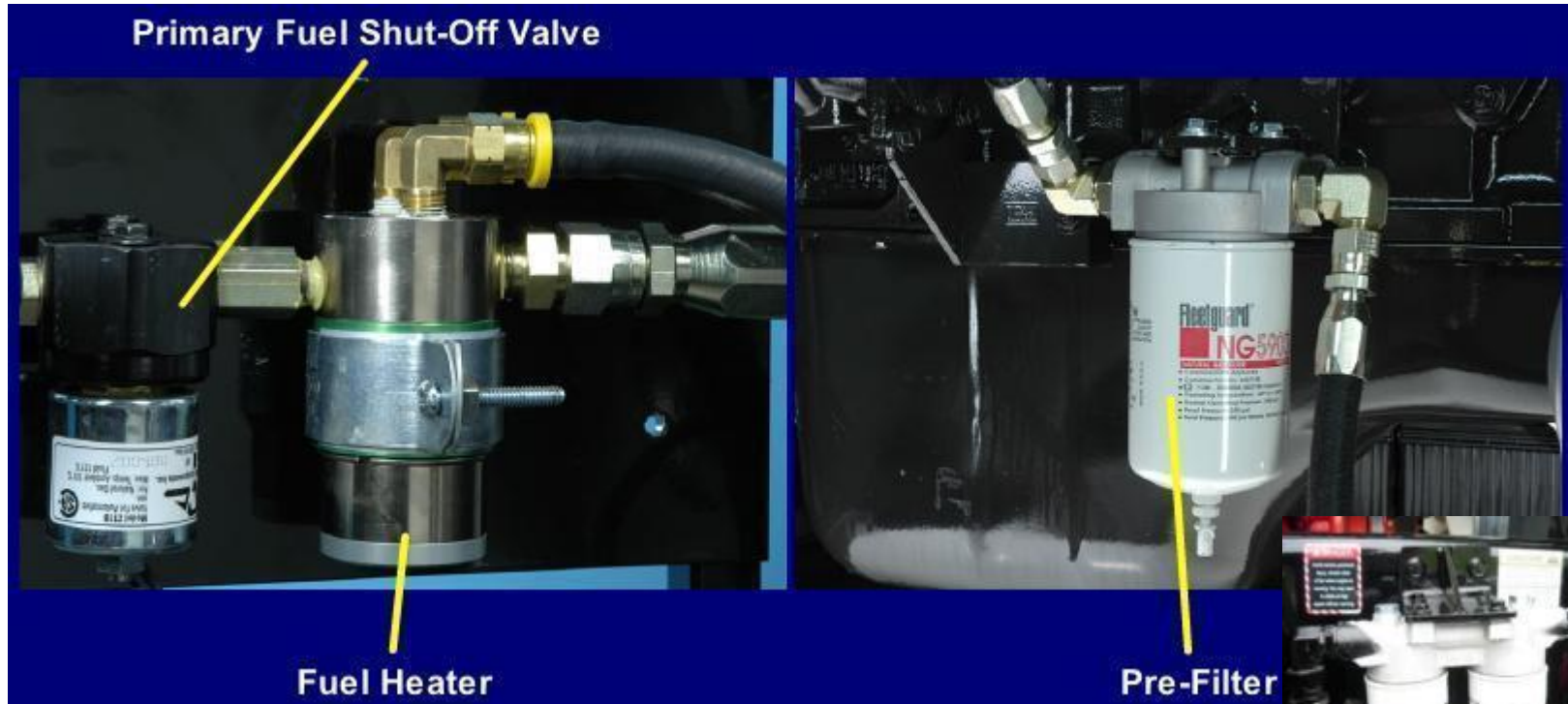


Fuel System Flow – Total System Diagram



OEM Supplied Fuel System Components

(Both CNG and LNG Systems)

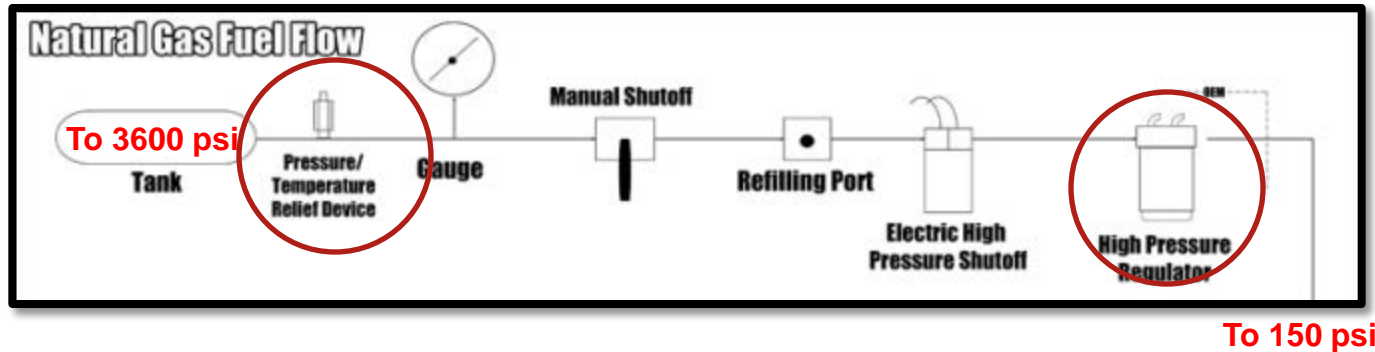


- Mounted on the vehicle
- Primary fuel shut off valve opens in key on position
- Regulates fuel storage pressure to engine pressure (60-150 psi)
- Fuel heater supplied with warm engine coolant to prevent freezing
- Fuel pre-filter(s) mounted near engine has a daily drain requirement

Compressed Natural Gas Filling

- During CNG refueling, gas heats up (expands) as it compresses in the tanks
- Two CNG refueling strategies exist:
 1. Time fill
 - Tanks can be slowly filled to 3,600 psi to allow heat to dissipate during refueling.
 - Full fill (i.e. 3,600 psi @ 70F ambient temperature) is possible with time fill stations.
 2. Fast fill
 - End up with 3,600 psi at some elevated temperature in the tanks. As gas cools to ambient temperature, pressure of gas decreases - no loss of gas. End result is less than 3600 psi fill
 - Results vary by station, but 15-20% under fill is not uncommon for temperature-compensated fast fill stations
- Usable fuel pressure limited to approx 400+ psi tank pressure (10%)
 - Avoid low pressure faults at engine
- Recommended net vs. gross fuel capacity assumptions:
 - Time fill CNG: Net capacity 10% lower
 - Fast fill CNG: Net capacity 25-30% lower

CNG Fuel System – Off Engine



- Normal North American fill cycle will exert pressures up to 4500 psi under some ambient conditions.
- CNG system container valves, PRD's, regulators and other system components should be rated for 3600 psi service pressure/4500 psi working pressure.
- Unlike traditional temperature activated PRD's (Pressure Relief Device), new rupture disc PRDs may vent gas if working pressure is exceeded.

Source: CVEF Safety Alert Improper Use of Underrated European CNG Valves and Rupture Disc PRDs on US Vehicles

<http://www.cleanvehicle.org/index.shtml>

Two Types of LNG Systems

Tank Pressure System

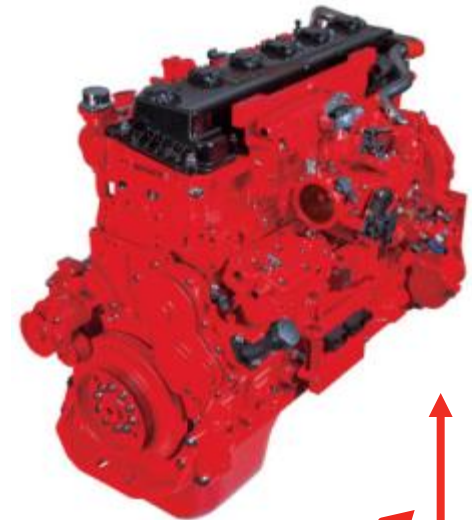
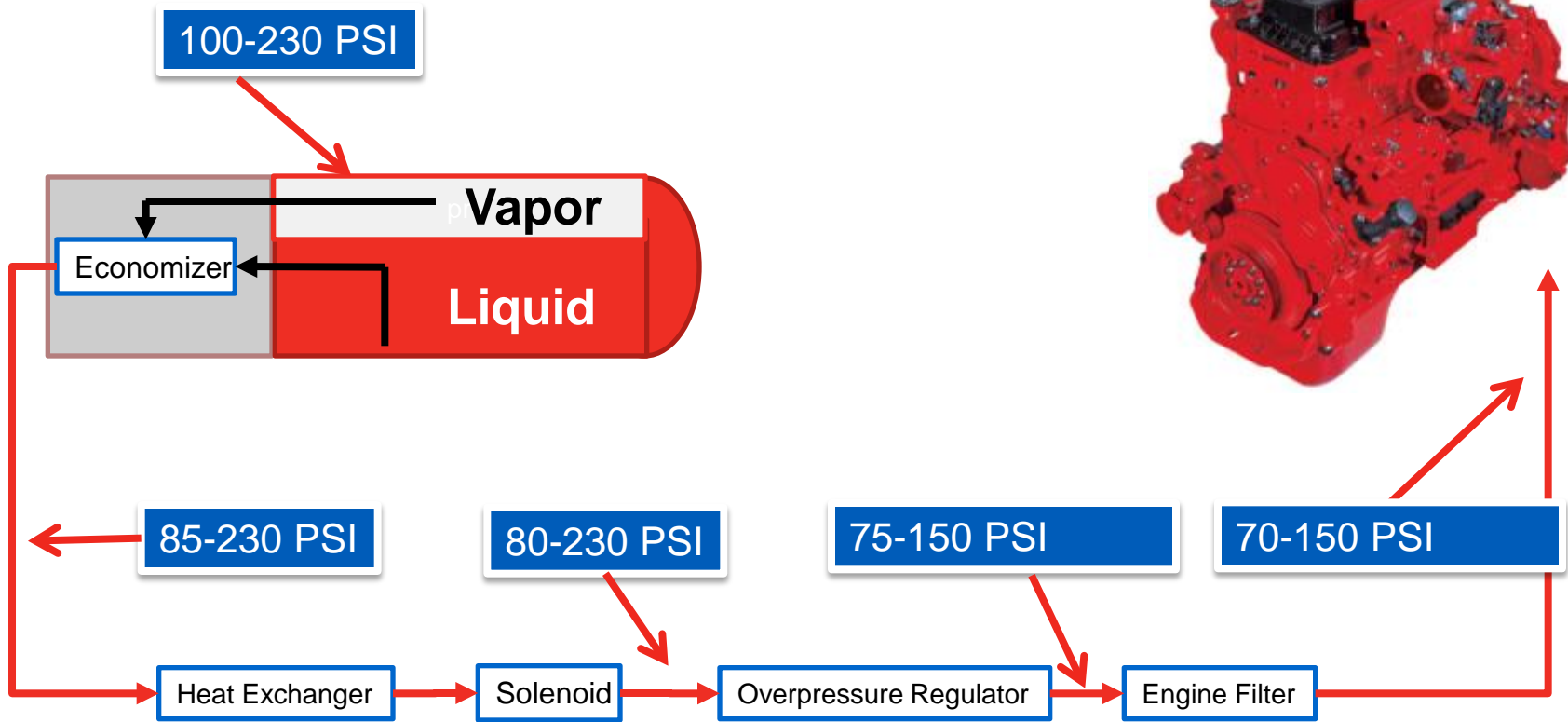
- Relies on vapor pressure in the tank to push fuel to the engine
- Fuel delivered from LNG station must be “warm” or saturated to maintain adequate tank pressure *
- Has a tank pressure management system to reduce excess tank pressure as fuel is used, this minimizes need for venting unless the vehicle is stored for long periods.
- Hold time is maximized if tank pressure is set low and tank relief pressure is high.

* New system

LNG Pump System

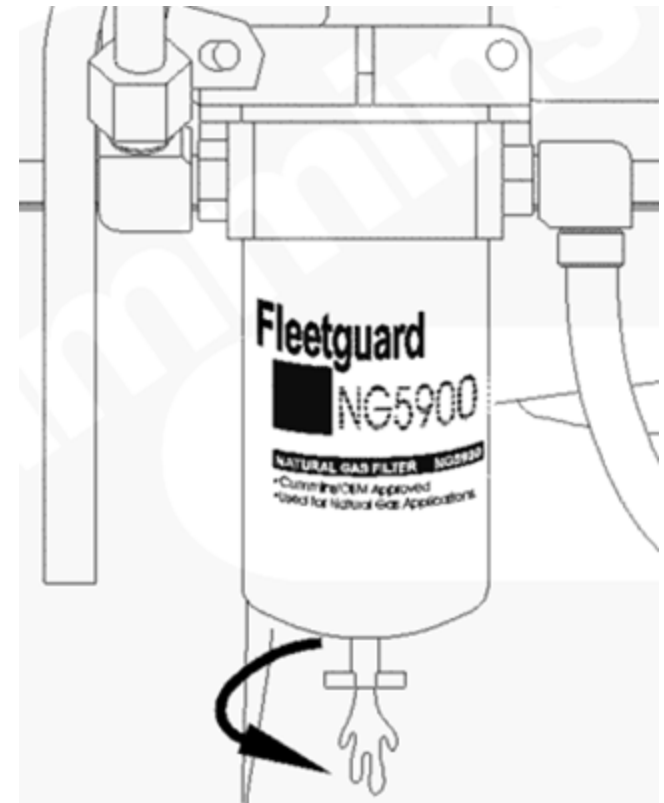
- Utilizes Westport “iCE Pack” Pump Technology to keep tank pressures low (and LNG cold) and provide consistent fuel pressure to match engine requirements
- Compatible with unsaturated (Cold) and saturated (Warm) LNG.
- Increases fuel storage time to up to 10 days,
- Provides for faster fill times, and eliminates the need to equalize truck tank pressures with the fuel station.

Typical LNG System Pressures



Fuel Filter (Spin-on Type) - Drain

- Shut off the engine. Use your hand to open the drain valve. Turn the valve **counterclockwise** approximately 1-1/2 to 2 turns until draining occurs.
- Drain the oil from the fuel filter.
- When closing the drain valve, do **not** over tighten the valve. Over tightening can damage the threads. Turn the valve **clockwise** to close the drain valve.



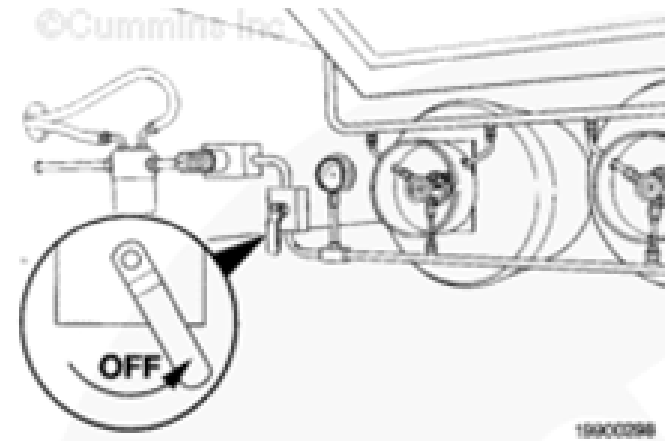
- **no more than one ounce of oil in the fuel filter.**

Fuel Filter Draining Oil



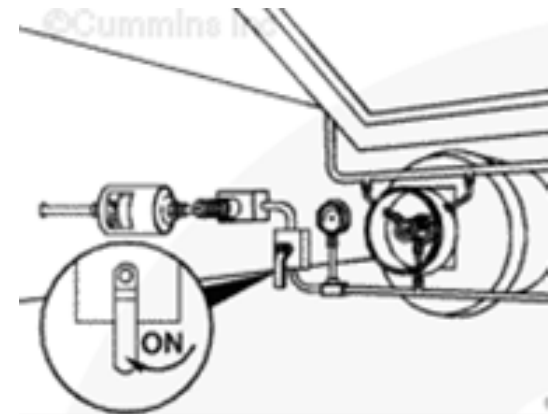
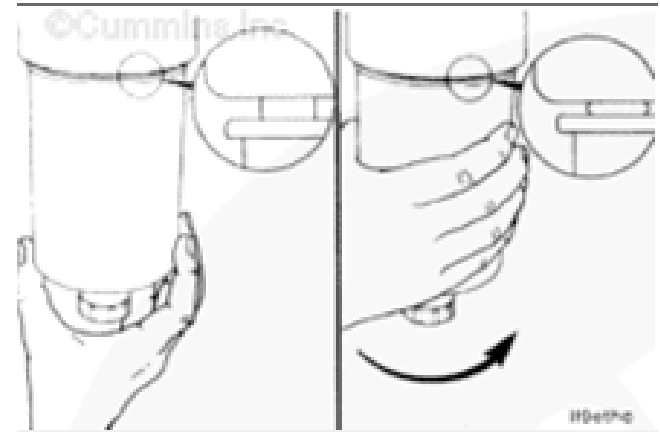
Fuel Filter (Spin-on Type) - Change

- Before removing the filter, **turn off the fuel supply** at the vehicle's main fuel shutoff valve.
- Start the engine and allow it to run at idle. **Allow the engine to run until it dies.**
- Remove the fuel filter and clean the gasket surface of the fuel filter head.
- Lubricate the seal with clean gas engine lubricating oil.



Fuel Filter (Spin-on Type) - Change

- Install the fuel filter on the fuel filter head. Turn the filter until the gasket contacts the filter head surface.
- Tighten the fuel filter, by hand, an additional $\frac{1}{2}$ to $\frac{3}{4}$ of a turn after the gasket contacts the fuel filter head surface
- Turn on the vehicle's main fuel shutoff valve.
- Use a gas detector, Part Number 3823984, or soap solution to check for leaks.
- If leaks are found, close the valve, turn the key to the OFF position, and repair leaks immediately.



Use 15W-40 Natural Gas Engine Oil



- Cummins Westport natural gas engines require special engine oil that is available from major oil suppliers.
- Careful attention must be paid to engine oil specifications because natural gas engine oil has different properties than diesel engine oil. A sulfated ash limit of 0.6 percent has been placed on all engine lubricating oil recommended for use in Cummins Westport engines.
- Higher ash oils can cause valve and/or piston damage and lead to excessive oil consumption and degradation of the catalyst.

**Do not use diesel engine oil in a natural gas engine.
If diesel engine oil is used, valve torching, piston scuffing,
and reduction in spark plug life will occur.**

CES20074 Gas Engine Only (GEO) engine oil is available from most major oil companies

Valvoline

International Sites | FAQs | My Subscriptions

FIND A SERVICE CENTER
Enter ZIP

Products Service Centers Car Care Racing Heritage Trade Partners Our Business
Enter Keyword

PRODUCTS

Consumer Products

Commercial & Industrial Products

OEM Endorsed Products

- Valvoline Premium Blue® Extreme Engine Oil
- Valvoline Premium Blue® Engine Oil
- Valvoline Premium Blue® Classic Engine Oil
- Valvoline Premium Blue® GEO Engine Oil**
- Valvoline Premium Blue® GEO Engine Oil LA
- Valvoline® and Estor's Premium Hydraulic Fluid

Heavy Duty Diesel Engine Oils

Natural Gas Engine Oils

Transmission Fluids and Gear Oils

Grease

Hydraulic and Industrial Oils

Valvoline Professional Series

Valvoline / Products / Commercial & Industrial Products / OEM Endorsed Products / Valvoline Premium Blue® GEO Engine Oil

Valvoline Premium Blue® GEO Engine Oil

A low-ash oil for fleets fueled by CNG, LNG or propane

- Reduced ash content
- Valve recession protection
- Low oil consumption and piston deposit control
- Excellent shear stability
- Enhanced valve train wear protection
- Good catalyst compatibility
- Advanced oxidation control

Download Product Info PDF

MSDS

Valvoline Racing
The teams, winners, photos and more
[Go to Racing](#)

Over a Century of Quality
The Oldest Trademark in the Industry
[Learn more](#)

Overview How To Use Sizes and Grades Specs Testimonials

Specs

Recommended for Cummins B5C, Detroit Diesel, John Deere and Caterpillar dedicated natural gas engines for vehicular applications. It is a Cummins 20074 approved engine oil.

Intended Use Guidelines

AEB 140.26
Published April 2013

		ISLG		ISX12 G	
General Recommendations (Powerspec)		< 66,000 lb <60,000miles/yr		< 80000 lb	
Intended Use	Minimum Startability (%)	GVW (lbs)	GCW (lbs)	GVW (lbs)	GCW (lbs)
Tractor configurations					
• Line haul	14	66000	66000	80000	80000
• Local pickup& delivery	20	66000	66000	80000	80000
• Refuse hauler	28	66000	66000	80000	80000
• Regional haul	20	66000	66000	80000	80000
Concrete ready mix	28	80000	n/a	80000	n/a
Snowplow	28	66000	n/a	80000	n/a
Mining service	28	66000	66000	80000	80000
Utility/Dump Truck	28	66000	80000*	80000	80000
Refuse packer	28	80000	n/a	80000	n/a
Oil field well servicing	28	66000	66000	80000	80000
Wrecker service	28	66000	66000	80000	80000
Fire truck service	not rec	not rec	not rec	not rec	not rec
EMT/rescue service	not rec	not rec	not rec	not rec	not rec
Crane/cherry picker	28	80000	n/a	80000	n/a
Construction	28	66000	80000*	80000	80000
Agriculture	28	66000	80000*	80000	80000
Motorhome, RV	20	not rec	not rec	not rec	not rec
Transit/Shuttle Bus	20	60000	n/a	80000	n/a
Highway Coach	20	66000	n/a	80000	n/a
School Bus	20	37000	n/a	not rec	not rec
Logger	not rec	not rec	not rec	not rec	not rec
Mining haulers	not rec	not rec	not rec	not rec	not rec
Heavy equipment transport	not rec	not rec	not rec	not rec	not rec
Oil field rig move	not rec	not rec	not rec	not rec	not rec

Note: No waivers or exceptions will be granted for operation outside these guidelines. Customers should be advised that applications outside these boundaries will result in some negative consequences or degraded performance and/or reduced engine life.



ISLG and ISX12 G Warranty Coverage

- *Base Warranty for ISL G and ISX12 G Engines are similar to Cummins diesel engines*
- *Extended Coverage options are available for ISX 12 G Truck*
 - *3 to 5 yr. 100,000 to 500,000 mile - Protection Plan 1 - Truck*
 - *3 to 5 yr. 100,000 to 500,000 mile – Protection Plan 2 –Truck*
 - *5 yr. 500,000, 6 yr. 600,000, 7 yr. 700,000 mile Major Component*
- *All Extended Coverage warranty programs posted on Cummins CIRCUIT*



Learn more @ cumminswestport.com

Featuring the Natural Gas Academy videos covering:

- What is Natural Gas?
- Natural Gas Engines
- Natural Gas Fuel Systems
- How to Fuel a Vehicle
- ISL G Engine Walk-Around
- ISX12 G Engine Walk-Around
- ISX12 G Driver Familiarization
- Natural Gas Engine Maintenance
- Upgrading Your Facility for NGVs



Links & Resources

[Natural Gas Academy](#)

[Natural Gas Academy Videos](#)

■ [Learn About Natural Gas](#)

[Compressed Natural Gas](#)

[Liquefied Natural Gas](#)

[Biomethane](#)

[Fuel Quality Calculator](#)

[Vehicle Fuel Systems and Onboard Fuel Storage](#)

[Fuel Providers](#)

[Fuel Stations](#)

[Incentives & Grants](#)

[Links to More Information](#)

