



Cummins

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Agenda

- General Points of Interest
 - General Operating & Maintenance Tips
 - Fluids - Lube Oil & Fuels
 - Biodiesel
 - Fuel Economy Tips
- SCR & Diesel Exhaust Fluid (DEF)
- Q & A



Engine Maintenance

- Use a good name brand multi-grade oil:
 - Consult Owner's Manual for specifications
 - Synthetic oils can be used
 - Provided they meet the performance requirement
 - Should not be used to extend change interval
- Consult Owner's Manual for specific oil and filter change intervals
- Don't under-estimate the value of good filters
- Do not overlook Coolant System requirements!
 - SCA (Supplemental Coolant Additives)
 - Anti-freeze & water quality



Coolant System Maintenance

- The chassis manufacturer provides cooling system and coolant (initial fill)
 - Follow their recommendations
 - Some do not require routine SCA maintenance
- Quality of water used for make-up can affect the coolant's performance (protection & life)
- Test Strips available for testing SCA level, water quality, and antifreeze performance
 - Can extend coolant life
 - Cannot test for SCA level in some OEM coolants (follow OEM recommendations)



RV Maintenance and Operation

ISL Electronic Diesel



Quick Reference Guide

Cooling

Routine Maintenance Recommendations

The ISL was designed to utilize supplemental coolant additive (SCA) and heavy-duty coolant. Check SCA concentration annually or when make-up coolant is added to the system.

Coolant level should be checked routinely. A good practice is to be observant of liquids that may have leaked on the ground while the motorhome is stopped.

Check coolant concentration annually or whenever coolant is added to the system. A refractometer such as a Fleetguard #C2806 is recommended to test coolant concentration versus a floating ball device due to accuracy.

Definition of Heavy-Duty Coolant

A combination of 50/50 water and low silicate antifreeze (ethylene glycol or propylene glycol are acceptable) protects to -34°F. Freeze protection decreases above 68% antifreeze. In addition to freeze protection, antifreeze is essential for overheat and corrosion protection.

Antifreeze must meet ASTM D4985 (GM6038M) specs.

Water Quality Requirements

Calcium/Magnesium	Max. 170 ppm as CaCO ₃ +MgCO ₃
Chloride	Max. 40 ppm as Cl
Sulfur	Max. 100 ppm as SO ₄

A conservative approach to cooling system maintenance would include an analysis of your home-base tap water supply. Your Cummins distributor can provide this service as well as sample bottles and other coolant test devices. Consider using pre-formulated antifreeze when on the road or when water quality is unknown. The use of distilled water is also acceptable.

Fully Formulated Coolant

Fully formulated coolant, such as Fleetguard Compleat, is recommended by Cummins and offers a vehicle owner the convenience of a pre-mixed antifreeze solution containing high quality water and antifreeze.

Ether

Ether MUST NOT be used for ISL engines. The ISL comes equipped from the factory with an integrated grid heater for cold starting.

Information

Cummins 1-800-DIESELS (1-800-343-7357)
Cummins Website everytime.cummins.com

Consult Owners Manual or a Cummins Distributor for additional details.

Lubricating Oil

Routine Maintenance Recommendations

A good general practice is to check oil level as part of the daily pre-trip procedure.

Oil Drain Interval

High-Pressure Common Rail Fuel System: 20,000 mile or 1 year, whichever comes first

CAP Fuel System: 18,000 mile or 1 year, whichever comes first

Lube Oil Filter	Fleetguard	Cummins
ISL (all models)	LF9009	3401544

Lube Oil Specifications

The primary Cummins recommendation is to use SAE 15W-40 oil for normal operation at ambient temperatures above 5 °F (-15 °C). Consult the Owners Manual or a Cummins Distributor for recommendations concerning colder operating temperatures.

ISL CM2150 ... Use high quality SAE 15W-40 heavy duty oil which meets or exceeds CES 20081 (API CJ-4/SL). Note an oil may meet API CJ-4/SL and not Cummins Engineering Standard (CES) 20081. CES 20081 represents a low ash oil that will maximize the efficiency of the Cummins Particulate Filter (CPF) and extend the CPF service interval. A non-low ash oil meeting CES 20078 (CI-4/SK) can be used with no change to the oil change interval, but will reduce the service interval of the CPF.

High-Pressure Common Rail Fuel System (Pre ISL CM2150) ... Use high quality SAE 15W-40 heavy duty oil which meets or exceeds CES 20078 (API CI-4/SK).

ISL CAP Fuel System ... Use high quality SAE 15W-40 heavy duty oil which meets or exceeds CH-4/CI-4 oil.

Synthetic Oils

Use of synthetic engine oil made with API group 3 or 4 base stocks is permitted subject to the same performance and viscosity limitations of petroleum (mineral) based engine oils. The same oil change intervals as petroleum based engine oil must be applied.

Supplemental Oil Additives

Cummins does not recommend the use of aftermarket oil additives. Current high quality engine oils are very sophisticated, with precise amounts of additives blended into the lubricating oil to meet stringent requirements. Aftermarket oil additives are not necessary to enhance engine oil performance and in some cases can reduce the engine oil's capability to protect the engine.

Oil Analysis

Oil analysis, as a method to extend drain intervals, is NOT recommended. Different methods of measuring soot, lack of correlation among testing labs, and differing driving patterns and idle time are the basis of right recommendation.



Engine Idling

- At Startup
 - Idling for engine warm-up is not required
 - Once oil pressure is seen, put motorhome in motion
 - Don't operate at full "throttle/power" until engine temp reaches approximately 150 deg.F.
- At Shutdown ... Idle (3-5 min) required only after full throttle / high power operation.
- Idling is not necessary after normal operation such as exiting highway, driving into rest stop, campground, etc.



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Lube Oil Changes... EPA 2007 Engine



Ultra-Low
Sulfur Fuel (ULSD)



Diesel Particulate Filter



Latest Lube Oil Specification

- CJ-4 (CES 20081) ... '07 release
 - Lower ash content to extend DPF service interval
 - ULSD reduces requirement for ash
 - Backward compatible with pre-EPA'07 engines when ULSD is utilized
 - Same requirement for EPA 2010 engines



Cummins Fuel Additive Policy

- Additives are **NOT** required with commercially available #2, #1, or #1-2 blends.
- When parking your vehicle for an extended period of time, the best defense against fungus growth is to top-off fuel tank.
- If you are in an area where you have a strong concern about fungal growth, biocide treatment wouldn't hurt.
- Purchase fuel at well respected truck stops that move a lot of fuel daily.



Ultra-Low Sulfur Diesel (ULSD)

- ULSD availability:
 - Available in US and Canada as of Oct 06
 - 500 ppm (LSD) becoming difficult to locate in US
 - Major suppliers only offer 15 ppm (ULSD)
 - Latest EPA pump audit shows 97.8% ULSD
 - Limited availability in Mexico ... improving
- Backward compatible with pre-2007 engines
 - No change in lubricity performance
 - No fuel additives required



Fuel Specifications

Diesel Fuel Lubricity

Property	No. 1-D S15	No. 1-D S500	No. 1-D S5000	No. 2-D S15	No. 2-D S500	No. 2-D S5000	No. 4-D
Flash Point (°C min.)	38	38	38	52	52	52	55
Distillation Temperature	288 max	288 max	288 max	282 min 338 max	282 min 338 max	282 min 338 max	--
Kinematic Viscosity	1.3 – 2.4	1.3 – 2.4	1.3 – 2.4	1.9 – 4.1	1.9 – 4.1	1.9 – 4.1	5.5 – 24.0
Sulfur, max.	15 ppm	0.05%	0.5%	15 ppm	0.05%	0.5%	2.0%
Cetane Number	40	40	40	40	40	40	30
Lubricity (HFRR) micron, max	520	520	520	520	520	520	--



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Biodiesel ... Cummins Position

- B5 approved for all engines.
- B20 blends are acceptable for engines certified to EPA'02 and later emissions standards
 - Fuel to be provided by BQ-9000 Accredited Producer
 - Certified Producers can be found at:
www.bq-9000.org
- Additional information available:
 - http://cumminsengines.com/every/customer/biodiesel_faq.page?
 - Brochure in Cummins booth



Biodiesel

- Fuel at the pump is a blend of petrodiesel and B100 (100%) biodiesel:
B20 = 80% petrodiesel + 20% B100.
- Biodiesels are *manufactured* ... not raw vegetable oil, SVO (Straight Vegetable Oil), or refined/filtered used cooking oil.
- Challenges of Biodiesel
 - Filter plugging ... shorter shelf life.
 - Low temp. performance ... waxing at 20-32 deg.F.
 - Less energy content = lower fuel economy



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MPG ... Driver Influence

- Driver influences MPG by determining:
 - Operating speed (engine) ... our engines are most efficient at lower RPMs
 - Vehicle speed ... No.1 factor in MPG
- To achieve maximum MPG ... maximize use of 'Top Gear' (transmission)
 - Allow engine to lug-back (RPM) while climbing grades ... limit unnecessary down-shifts
 - Utilize Allison 'Economy' mode ... lowers the shift point (RPM)
 - "Manage" engine speed ... limit high RPM



Fuel Economy ... Power Demand

- Simple equation: The more power used, the more fuel required
 - Aerodynamic (air drag)
 - Largest component of power demand
 - Cubic function of speed (2x speed = 8x hp)
 - Rolling Resistance ... Tires/pressure, road surface, weight
 - Accessory Losses (cooling fan, engine parasitics)



Aerodynamic Loss ... Effect of Road Speed

@ 65 = 168 hp

Aero = 95 hp

Tire = 44 hp

Misc = 29 hp

@ 75 = 238 hp

Aero = 146 hp

Tire = 53 hp

Misc = 39 hp

70 hp

51 hp

9 hp

10 hp

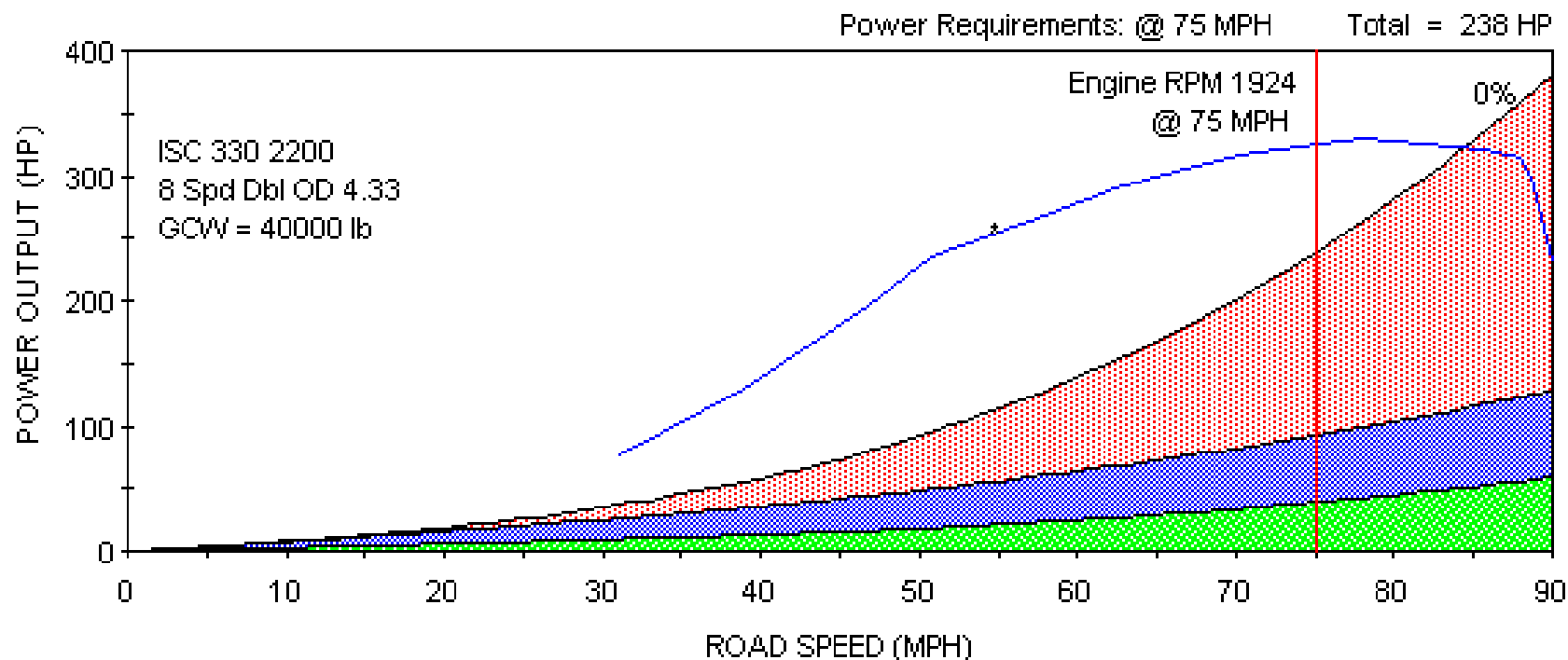
42%

54%

20%

34%

LEVEL ROAD POWER
REQUIREMENTS



Power Demand ...

Tips for limiting power demand

- Reduce vehicle speed ... #1 factor affecting MPG is speed ... 'Rule of Thumb' **1 mpg per 10 mph above 55 mph**
- Maintain proper tire pressure (manufacturer's req.)
 - Rolling resistance increases as pressure drops
 - Low pressure results in approximately 1% loss in MPG per 5-10 PSI
- Avoid excessive manual fan usage ... cooling fans draw 20-40 hp.
- Limit unnecessary engine idling



Fuel Economy ... Winter Losses

- Why does MPG go south for the winter?
 - Loss of energy content (winter fuel)
 - #2 Diesel = 142,000 BTU
 - #1 Diesel = 134,000 BTU
 - Increased air and rolling resistance
 - Cold air more dense
 - Snow, slush, or wet road surfaces
 - Lower operating temps of tires
 - Transmission and axles fluids operate below optimum temperature



Fuel Economy ... Additional Detail

- Cummins White Paper ...
'Secrets of Better Fuel Economy'
 - The Physics of MPG
 - http://cumminsengines.com/assets/pdf/MPG_Secrets_Whitepaper.pdf



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EPA 2010 Engine Changes

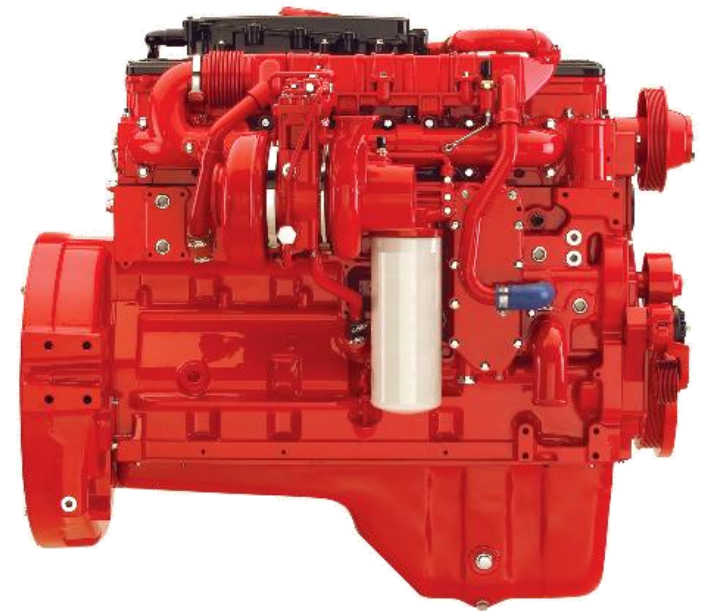
**Selective
Catalytic
Reduction**



**Diesel Exhaust
Fluid (DEF)**



**Cummins
Particulate
Filter**



EPA 2007



Diesel Exhaust Fluid (DEF)

- DEF is:
 - The reactant for the SCR System
 - A solution of automotive grade Urea (32%) & water (68%)
 - User Friendly ... non-toxic, non-polluting & non-flammable
- 10-13 gallon tank size for motorhomes
- DEF consumption approximately 2% of diesel fuel consumed
 - 2 gal DEF for every 100 gal of Diesel
 - Typical motorhome will use less than 30 gals. of DEF annually



Diesel Exhaust Fluid (DEF) ... Simplicity

- “Operating with DEF is as simple as maintaining the windshield washer solution.”
 - Approximately 2800-3150 miles per tank of DEF
 - Driver gets a ‘low fluid level’ light (350-700) miles before tank is empty
 - DEF can be purchased at:
 - Truck Stops (on the fuel inland or jugs)
 - Many auto supply retailers (NAPA, etc)
 - Any Cummins Distributor and most Truck Dealers
 - No special tools or protective wear required



Aftertreatment Dash Lamps



- HEST Lamp
 - High Exhaust Temperature
 - Alert ... not a call to action



- DPF Lamp
 - Diesel Particulate Filter
 - Status ... can be a call to action



- Diesel Exhaust Fluid Lamp
 - Low level warning

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