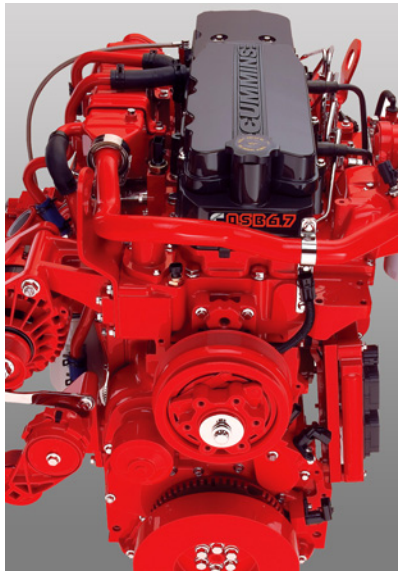
Cummins

Maintenance and Operation

September 2018



Cummins Inc.

- Sales of $20.4 billion in 2017
- Over 1,300,000 engines built in 2017
- 56,000 global employees
- Headquarters in Columbus, Indiana
- 100 year anniversary next year

CMI
LISTED
NYSE

Summary of diesel benefits

- **Premium driving experience with less fatigue**
  - Much lower noise levels, less downshifting in rolling terrain
  - 50% more torque, where you drive
  - Supplemental engine braking for downhill grades
  - Air suspension and air brakes for better ride and handling

- **Cost of ownership**
  - Up to 50% better fuel economy for lower operational cost
  - Longer warranty period

- **Convenience and Support**
  - Longer range for fuel stops
  - Less maintenance visits – annual vs. semi-annual
  - 3500 service locations – engine and generator with 40 RV focused coach care locations
  - 800-CUMMINS, Shows/Rallies, PowerClub

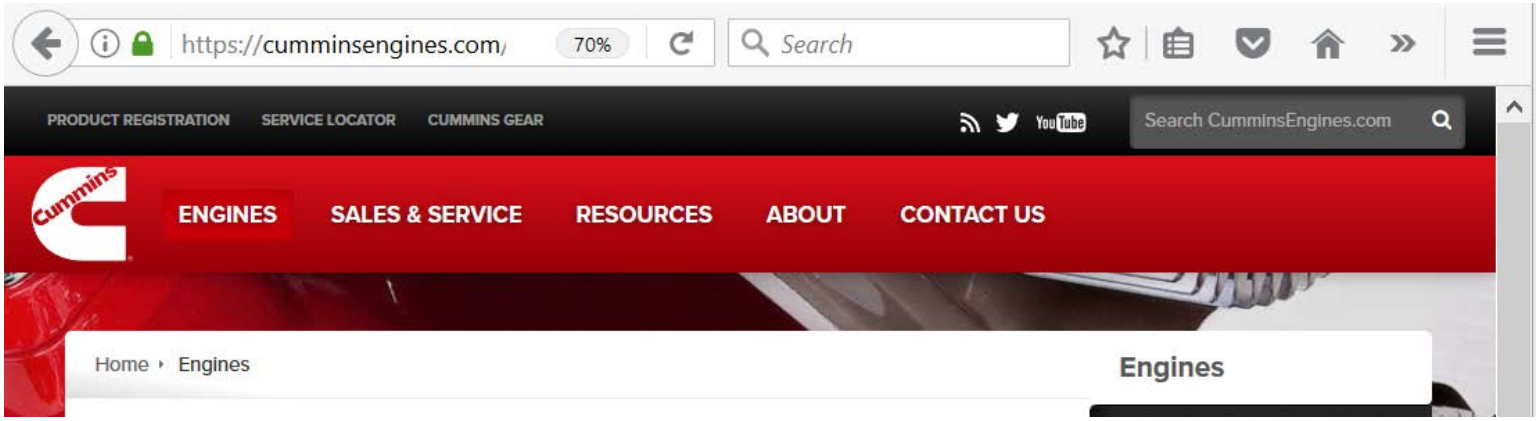
Agenda

- Product Information
  - Emissions history and technology
- Operation
  - Pre-Trip, Dash Lamps, Fuel Economy
- Maintenance
  - Fluids – Fuel, Coolant, Oil, DEF
  - Maintenance intervals
- Support
  - Cummins Care, Cummins Power Club

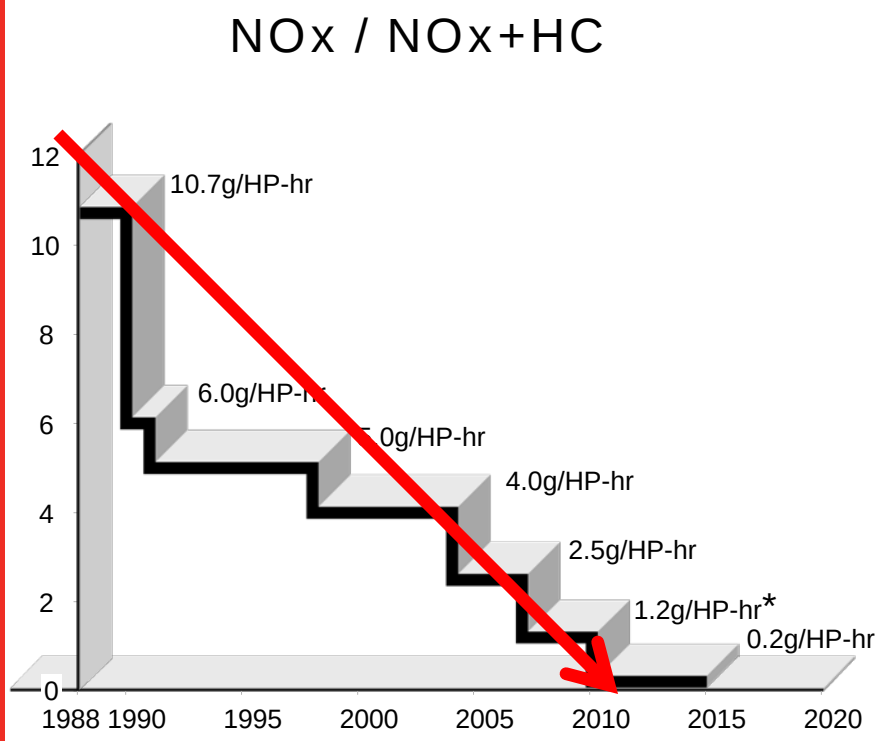
Handouts

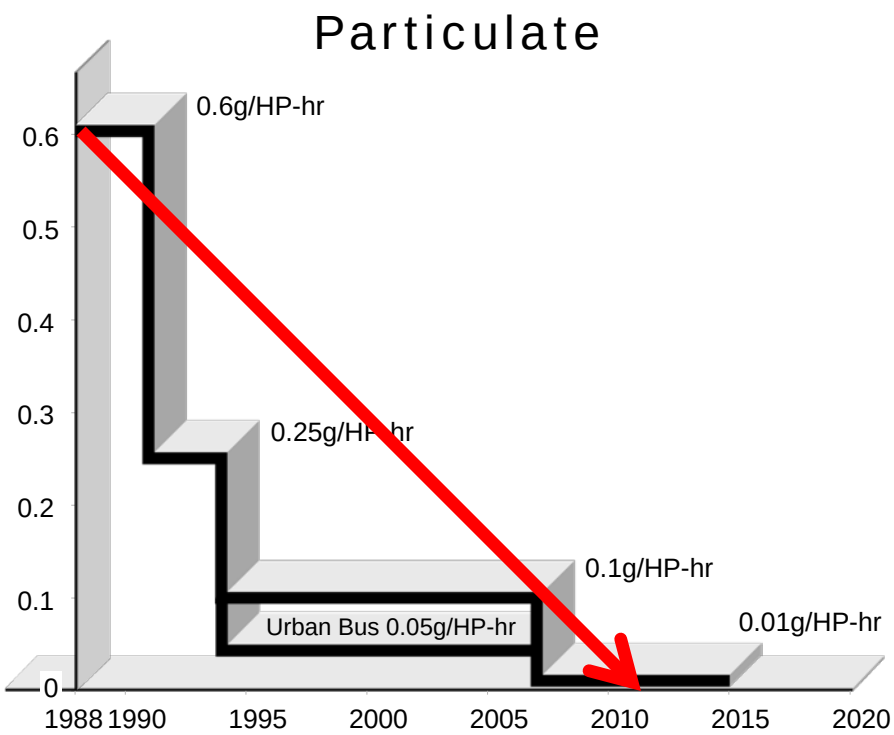
- Presentation is available online

- www.cumminsengines.com
  - Search for FMCA



EPA Emissions – Clean Diesel

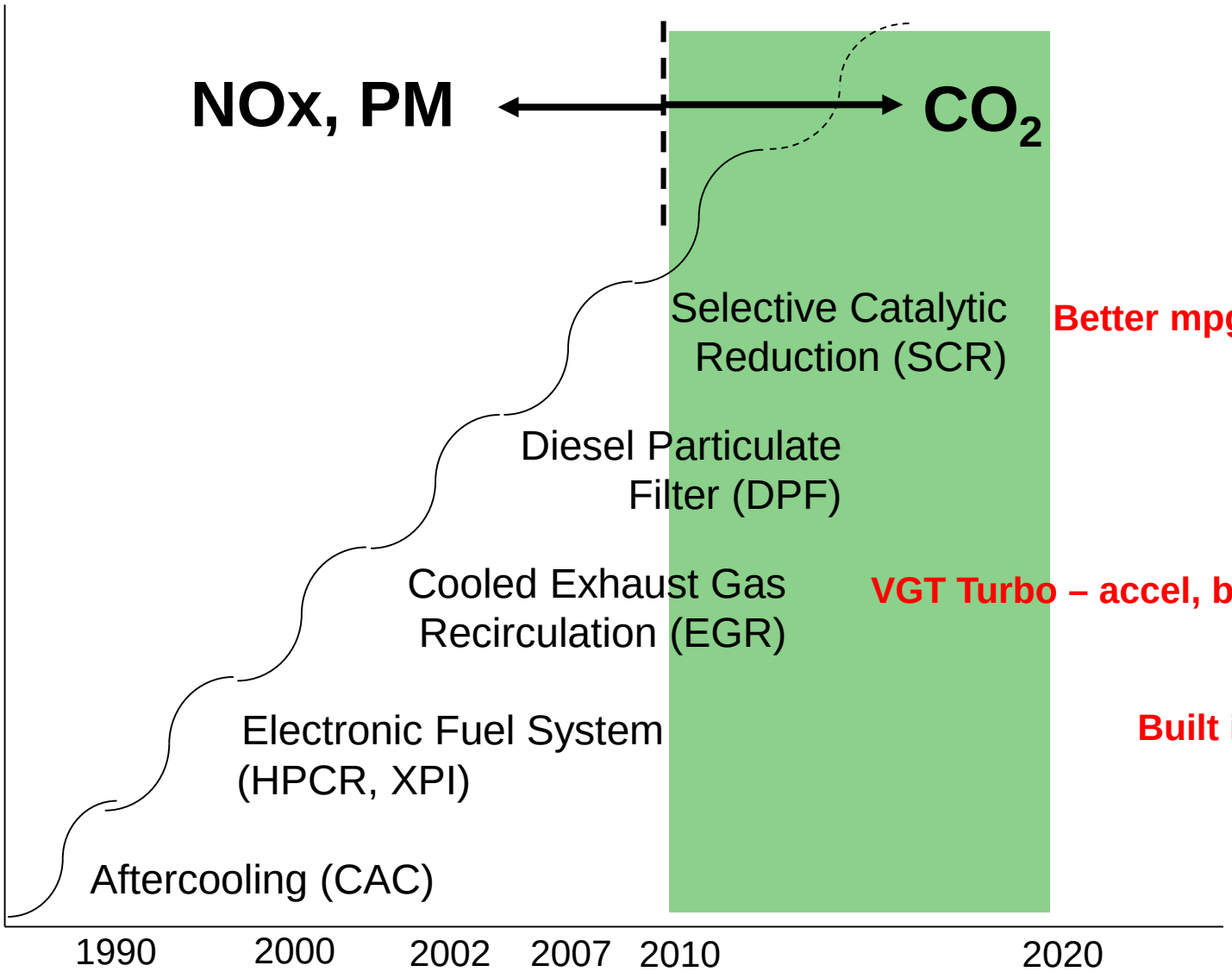




* Phase-In Average

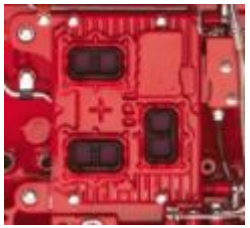
Near Zero Emissions

Technology for Emissions Helps Customers



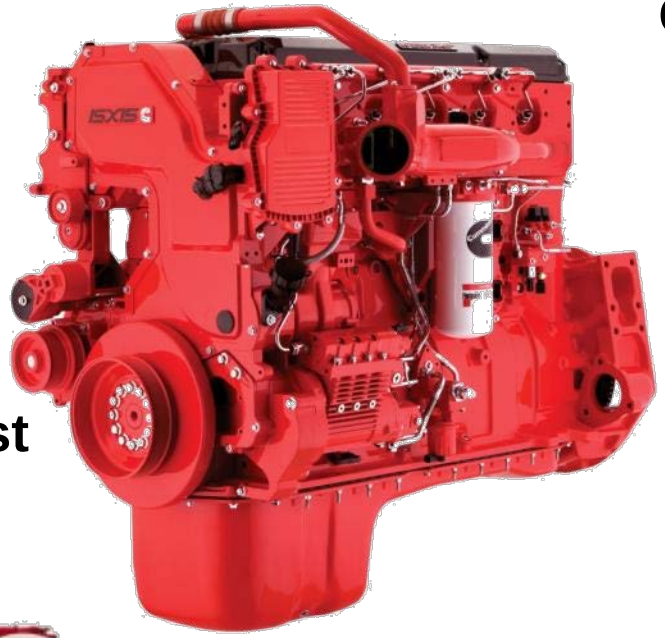
Cummins Owns its Technology

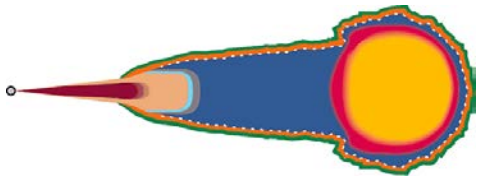
Filters and fluids



Electronic Controls

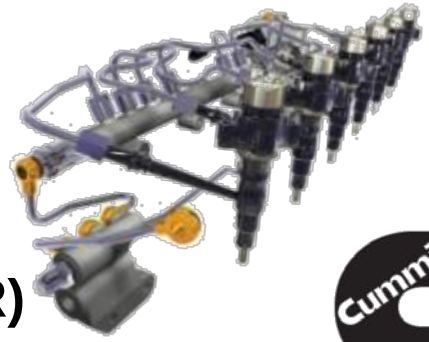
SCR catalyst and DPF





Combustion Technology

Variable Geometry Turbo (VGT)



Fuel Systems (XPI, HPCR)

Operation

Pre Trip Inspection

Before Starting

- **Check fluid levels – Oil, Coolant**
  - Level surface, wait 15 minutes for oil to drain to pan
  - Never remove radiator cap if coolant is hot (>120 degrees)
- **Air Intake**
  - Check Restriction indicator

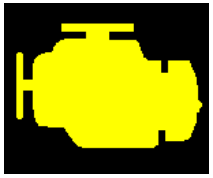
After Starting – walk around coach

- **Check gage levels** (DEF, fuel, air pressure)
- **Water in Fuel lamp?**
- **Check for leaks under coach**
- **Look for smoke**
  - Should be no smoke from exhaust on 2007 and newer
- **Listen for air leaks or other unusual noises**

Operation – Dash Lamps

HEST (High Exhaust System Temperature) lamp
Elevated exhaust temperature. **Don't drive over leaf pile.**

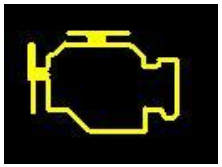
DPF (Diesel Particulate Filter) lamp – soot is present in exhaust filter. **Increase system temperature by doing a highway drive for 30-40 minutes.**



Check Engine Lamp – check fluid levels, gages, sounds, and smells – **make a plan to get service**. Can be coupled with De-Rate

Stop Engine Lamp – **pull over as soon as it is safely possible.** This will require a visit to a Cummins service center.

Diesel Exhaust Fluid (DEF) lamp – indicates when DEF level in tank is low. **Correct with refilling DEF tank.**



Malfunction Indicator Lamp (MIL) – OBD and emissions control system related – **make a plan to get service.**

Do you speak engine?

- Cummins Guidanz – 2007 and newer
  - Read your check engine light from your smart phone
  - App is free

- Inline Mini adapter (part number 5299909)
  - Bluetooth datalink adapter
  - Plugs under dash near steering wheel
  - For you and your travel partners

- Process
  - If CEL comes on, plug in and read code
  - Call local Cummins service location
  - Click “share” to open email to send your ECM data

Fuel Economy

- What consumes horsepower?
  - **Aerodynamics (>50 mph)**
    - Air drag is a function of speed (10 mph = 1 mpg)
    - Customer control – **slow down**
  - **Rolling Resistance (<50 mph)**
    - Function of weight, road surface, and tires
    - Tires (0.3 mpg) and tire pressure (10 psi = 1%)
    - Customer control – **proper inflation and tire selection**
  - **Accessories**
    - cooling fan/alternator/freon compressor (40-60 hp)
    - Customer control - **clean radiator and keep dash a/c system charged**

Engine braking

- Two types of auxiliary brakes
  - Engine brake – restricts exhaust
  - Compression brake – releases compression
- Benefits
  - Longer service brake life
  - Better vehicle control – eliminates brake fade downhill
- More braking horsepower with higher engine rpm
- Transmission controls shifting
- Don’t use when road conditions are slippery

Other operating tips

- **Warm-up** – operate with light throttle until coolant temperature reaches 150 degrees
- **Cooldown** – light load – idle for 3-5 minutes
- **Monthly engine exercise**
  - You are exercising the generator monthly, why not the engine?
  - Good – run engine at high idle (use the cruise set switch) until reaching operating temperature
  - Better – run engine at high idle and move coach forward and back
  - Best – go for a 20-30 minute drive at highway speed
- **Idle Speed** - Engine may automatically increase speed to warm up or reduce soot in DPF

Maintenance

Maintenance Intervals

	ISV5.0 (275hp)	ISB6.7 (200-360hp)	ISC8.3/ISL9 (330-450hp)	ISX15/X15 (550-600hp)
Coolant testing	6 months	6 months	6 months	6 months
Oil and oil filter*	12 months 10,000 miles	12 months 15,000 miles	12 months 20,000 miles	12 months 30,000 miles
Fuel filter*	12 months 10,000 miles	12 months 15,000 miles	12 months 20,000 miles	12 months 30,000 miles
Coolant Filter*	n/a	n/a	n/a (optional)	12 months 50,000 miles
Overhead* Adjustment	n/a	48 months 150,000 miles	48 months 150,000 miles	60 months 500,000 miles
Crankcase Breather Element	70,000 miles	Every 3rd or 4th oil change	Every 3rd or 4th oil change	125,000 miles
DEF filter	n/a	200,000 miles	300,000 miles	300,000 miles
DPF cleaning	150,000 miles	200,000 miles	200,000 miles	200,000 miles

*Whichever occurs first

Belts – 5 year inspection

Air System

- The most expensive mistake you can make
  - Only takes a teaspoon of dust to create major damage
  - Dirt can damage turbo, cylinder head, power cylinder
- Engine needs cool, clean, dry air
- Maintenance
  - Check restriction indicator when fueling
  - Check for loose or broken clamps
  - Follow chassis manufacturer recommendation
    - Generally change every 12-24 months

Fluids – Fuel

- Buy from high volume location (truck stop)
- Cummins does not require fuel additives
  - Two special cases where fuel additives are recommended:
    - Black “slime” in fuel filter
      - Biocide and fuel filters
    - Cold weather operation
      - Fuel can gel at temperatures below 15 degrees
      - Cummins Filtration™ Winter Conditioner Base
      - pint - CC2591, quart - CC2592
- Biodiesel
  - Suggest not storing long term with Biodiesel
  - EPA2002 and later – OK to B20; All OK up to B5

Fluids - Oil

- API Classification
  - Preferred: CJ-4 – Cummins CES 20081
    - Example – Valvoline Premium Blue
  - Optional: CI-4 – Cummins CES20078 – more ash in DPF
  - NEW OILS – **CK-4,** ~~**FA-4**~~ (don't use FA-4)

- Synthetic Oils
  - Do NOT extend oil drain intervals
  - Can be used after first oil drain
  - Main benefit – very low temperatures (-13 deg F)

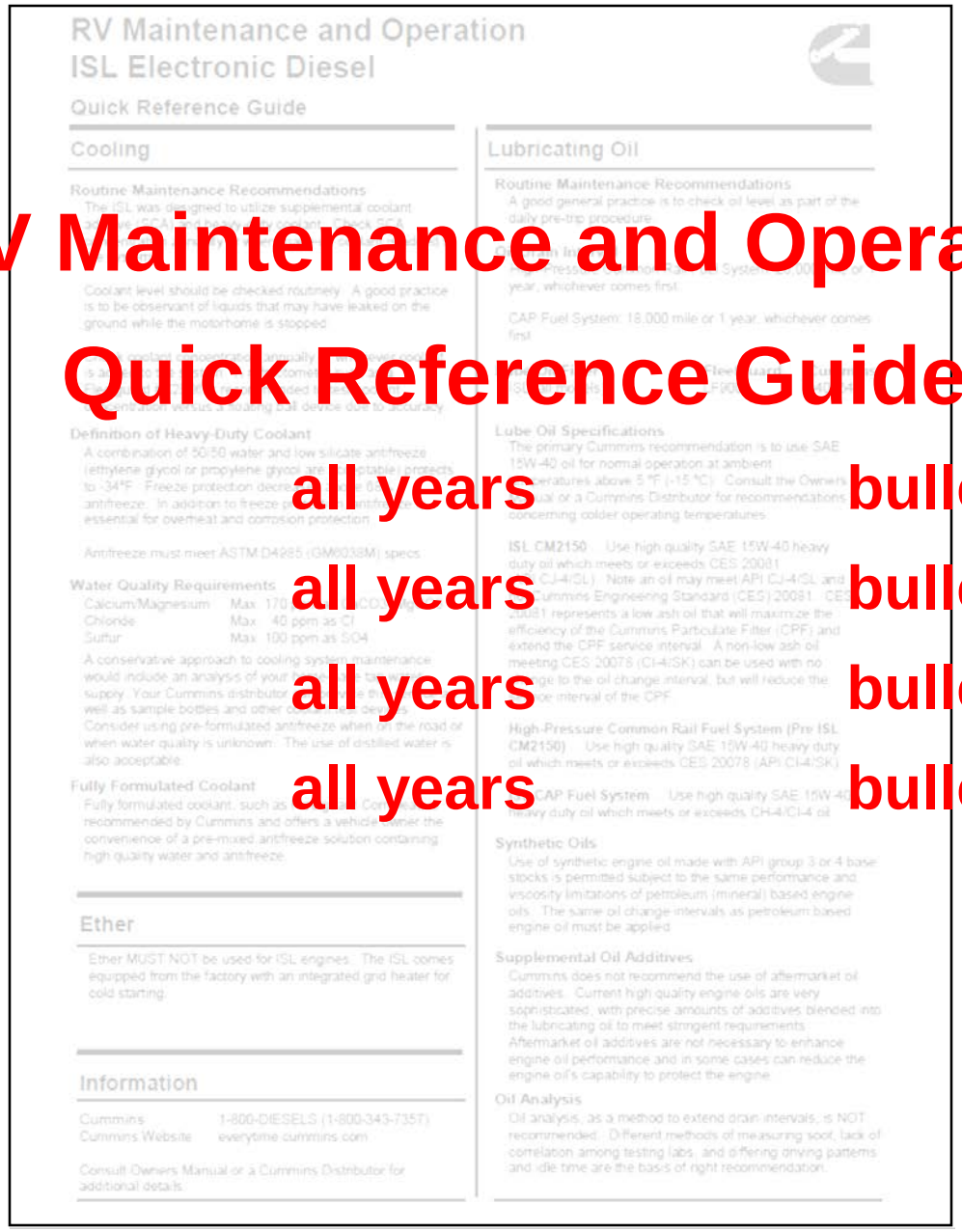
- Oil analysis
  - Can be useful to detect contaminants
  - Should not be used to extend drain intervals

Fluids – Coolant

- Decided by chassis manufacturer – MANY types
- Know what brand you have (don’t just match colors)
- Top off only with the same brand
- Tell your service provider what coolant you want
- Generally drain and refill after 5 years

Long term storage (6 months) suggestions

- Better to change oil/filters before storage than after
- Fill fuel tank (prevent condensation)
- Do NOT store with Biodiesel
- A monthly exercise program is good
  - Operating temperature, lubricate parts, charge batteries
- Tighten DEF cap
- Check coolant freeze protection (northern states)


RV Maintenance and Operation
ISL Electronic Diesel
Quick Reference Guide
Cooling
Routine Maintenance Recommendations
Definition of Heavy-Duty Coolant
Water Quality Requirements
Fully Formulated Coolant
Ether
Information
Lubricating Oil
Routine Maintenance Recommendations
Lube Oil Specifications
Synthetic Oils
Supplemental Oil Additives
Oil Analysis

RV Maintenance and Operation

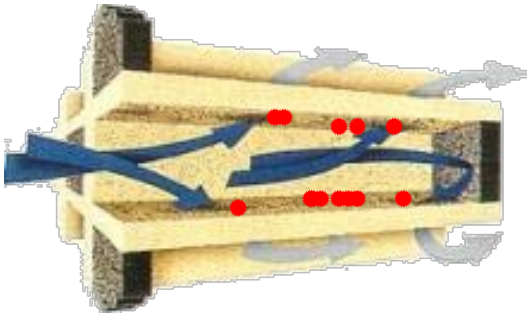
Quick Reference Guides

B6.7	all years	bulletin 4971286
L9	all years	bulletin 4971288
ISX12	all years	bulletin 4971384
X15	all years	bulletin 5410810

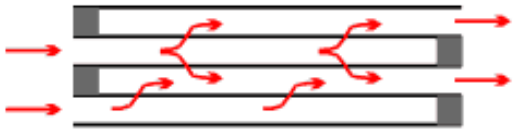
Regeneration Lamp Sequence

Operation: What is Regeneration?

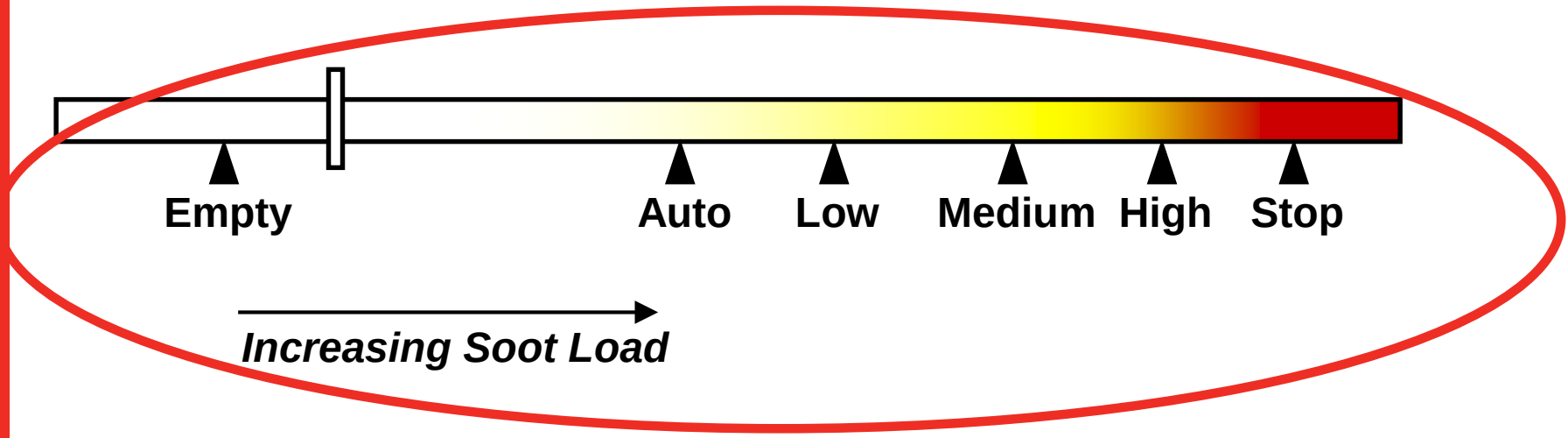
- Soot accumulates in the DPF
- Without regeneration, DPF can plug
- We oxidize the soot by regeneration
  - Passive – any time exhaust system is hot
  - Active – extra fuel creates extra heat
- All that is left is ash (minerals)



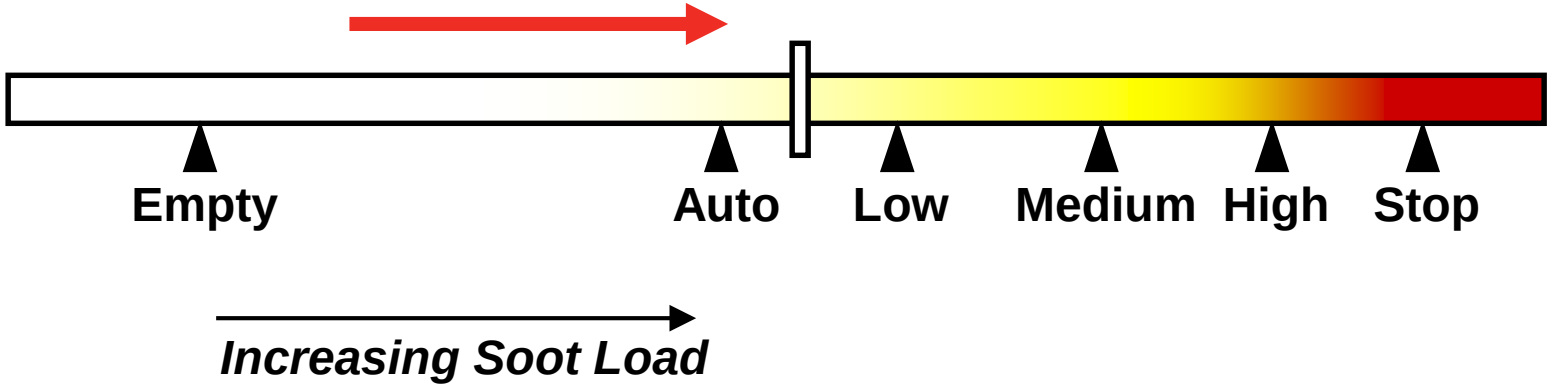
Wall-flow



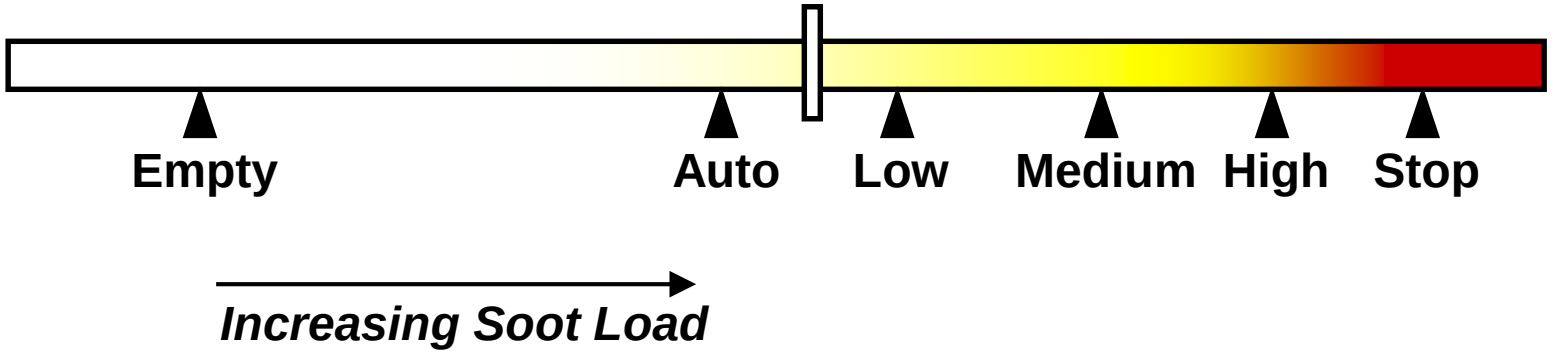
Similar to how your self cleaning oven works



No lamps on
System is filtering exhaust
Soot is collecting in the DPF
Enjoy the ride

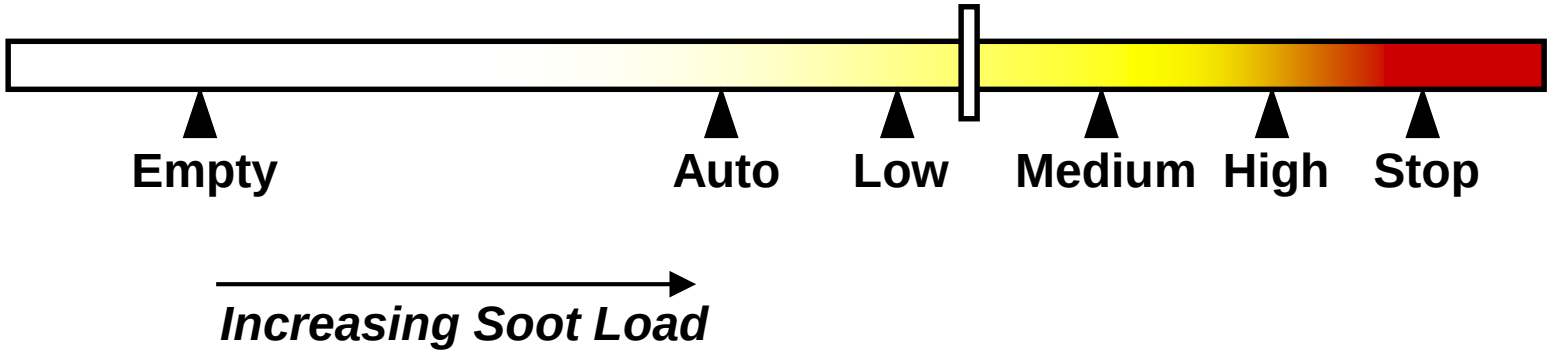


No lamps on
Passive regen is occurring
System may actively regenerate
Might hear different noise from turbo
Enjoy the ride

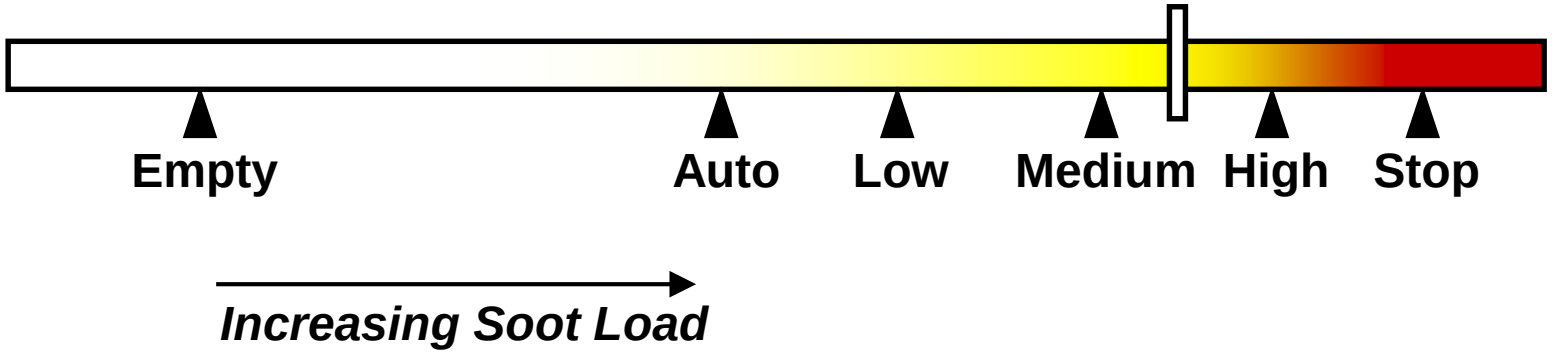


Exhaust temperatures are high

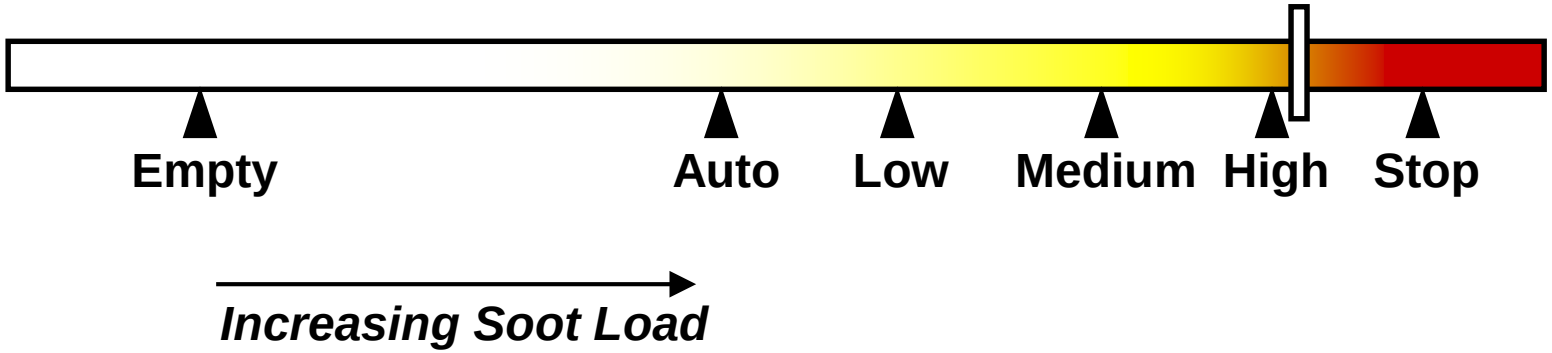
Don’t drive over a dry leaf pile



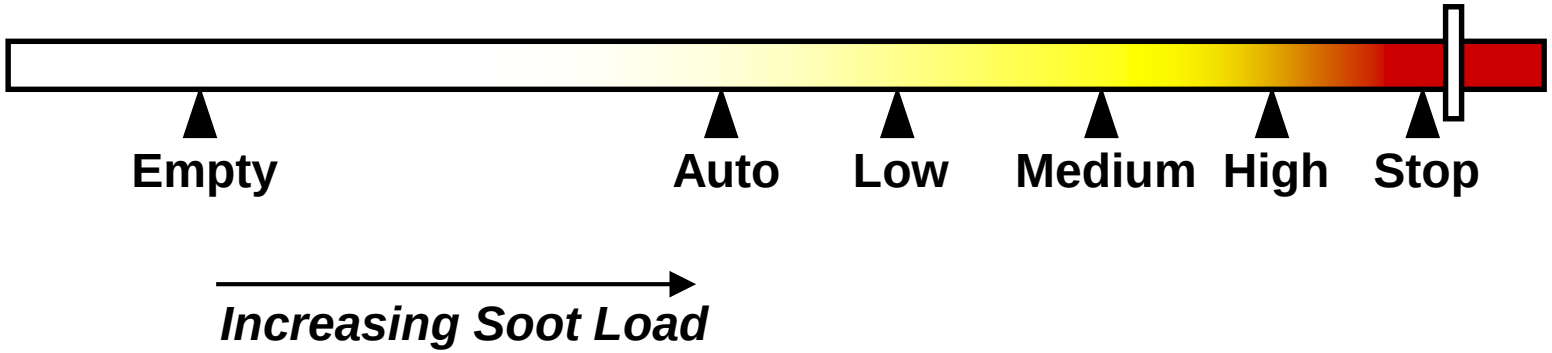
DPF lamp on solid
Low level of soot in DPF
Go for a highway speed drive



DPF lamp flashing
Medium level of soot in DPF
Go for a highway speed drive



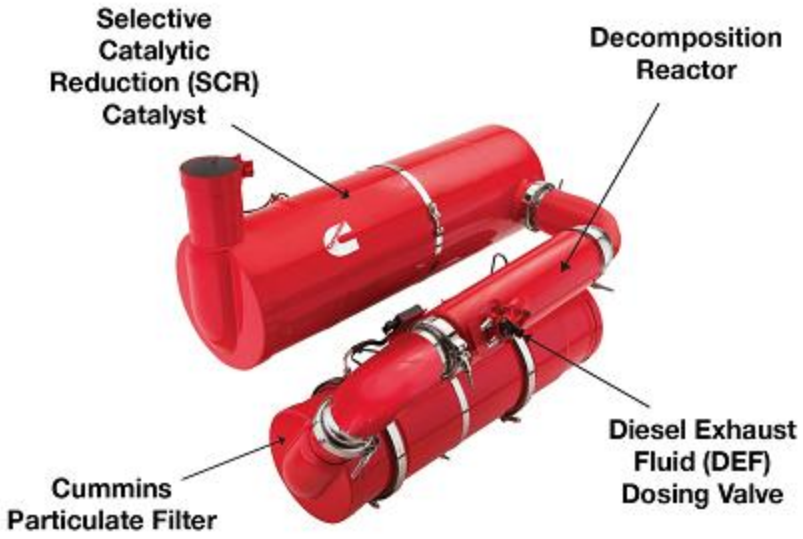
DPF lamp flashing – Check Engine Light on
High level of soot in DPF
Go for a highway speed drive
Or make plans to visit Cummins shop



DPF lamp flashing – STOP Engine Light on
Stop operation as soon as it is safely possible
Will require a visit to Cummins shop

2010 - SCR

- **SCR** – Selective Catalytic Reduction
- DEF (urea) is injected to make ammonia
- Ammonia + NOx react to form nitrogen and water
- Allows better engine tuning – mpg, power, maintenance



Fluids - DEF

- Freezes at 11°F (does not degrade)
- ISO spec 22241-1 – 32% Urea, 68% deionized water
- Shelf life 1 – 2 years depending on temperature
  - Avoid direct sunlight and temperature above 78°F
- Non-toxic, non-polluting, non-flammable
- 2-6 gallons DEF for 100 gallons of diesel
  - Most motorhome DEF tanks are 10-15 gallons
  - Sized for about 2-3 complete fuel tank fill ups

DEF Lamp Sequence

- Just like your car
  - There is a DEF level gage
  - Lamp comes on if you don't pay attention to gage
- Lamp sequence

1. Solid

2. Blinking

3. Blinking and CEL

4. Blinking and Stop Engine

- If you ignore the lamps, there are consequences
  - Torque derate
  - Eventually limited to 5 mph – "inducement"
  - If you run out, don't idle >1 hour, don't fill fuel without DEF, don't key off

Customer Support

Types of Cummins service locations

- Cummins Coach Care locations (40)
  - RV friendly repair locations
  - Meet certain criteria (tools, facilities, amenities)
  - **Top of the line locations**

- Cummins Distributor locations (220)
  - Names start with Cummins (e.g. Cummins Sales & Service, etc)
  - Parts and service for both engines and generators
  - **Specialists**

- Cummins Dealer locations (3500)
  - Have a Cummins sign
  - Typically dealers of a truck OEM (Navistar, Freightliner, etc)
  - Parts and service for chassis and engine
  - **General Practitioners**

Cummins Care

- Customer assistance program

- 1-800-CUMMINS™
  - Assistance in finding Service Location
  - Engines, generators, parts, service – “One Cummins”

- Cummins Care representative
  - Will ask for information (Engine s/n and location)
  - Can help locate closest authorized repair location
  - Can assist you with scheduling the unit into the repair location
  - Can answer questions you might have

Cummins Power Club

- Receive newsletters
- Website access with reference information
  - Online literature
  - Access to QuickServe Online
- Engines and Generators
  - Parts and Service Support
  - Cummins distributor discount – 10%
- Annual Fee
- www.cumminspowerclub.com

Diagnostics

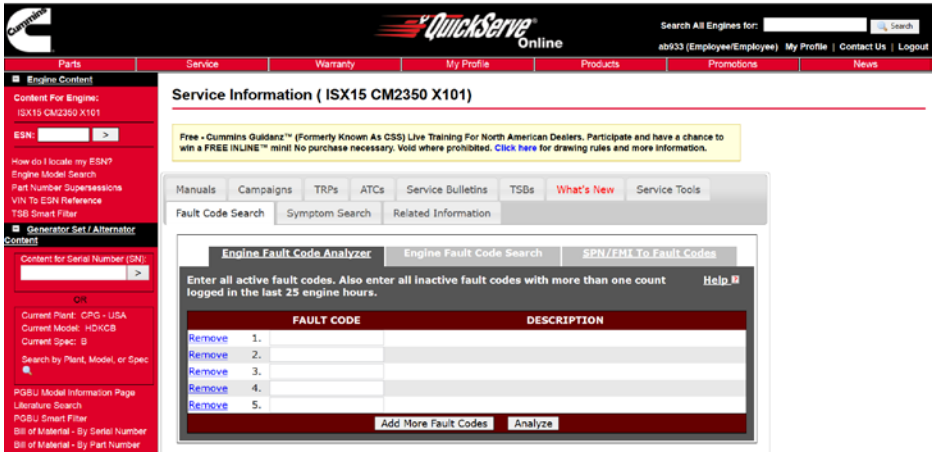
Tools – retrieving fault codes

- Read faults without a lamp
  - Many have SPN/FMI on dash now
  - Pedal Dance: Key On, Throttle Pedal 3x to floor

- New: Cummins Guidanz and Inline Mini
  - App is free; Inline Mini part number 5299909
  - Works on 2007 and newer
  - Also reads public J1939 codes

Service Information

- Cummins QuickServe Online
  - Quickserve.cummins.com
  - Free for up to 5 ESNs (limited owners plan)
  - Fleet version may be best for a non-Cummins sales dealer



- QuickServe Mobile – for your handheld device

Diagnostic Steps

1. Read fault code
2. Quickserve.cummins.com
3. Enter ESN (filters information to that ESN)
4. Service Tab
   - Manuals: Fault Code Troubleshooting Manual
   - Fault Code Search: Fault Code Analyzer
   - (can use SPN/FMI to Fault Code convertor)
5. Click on Fault Code
   - Shop talk is helpful
   - Has wiring diagram and info about fault