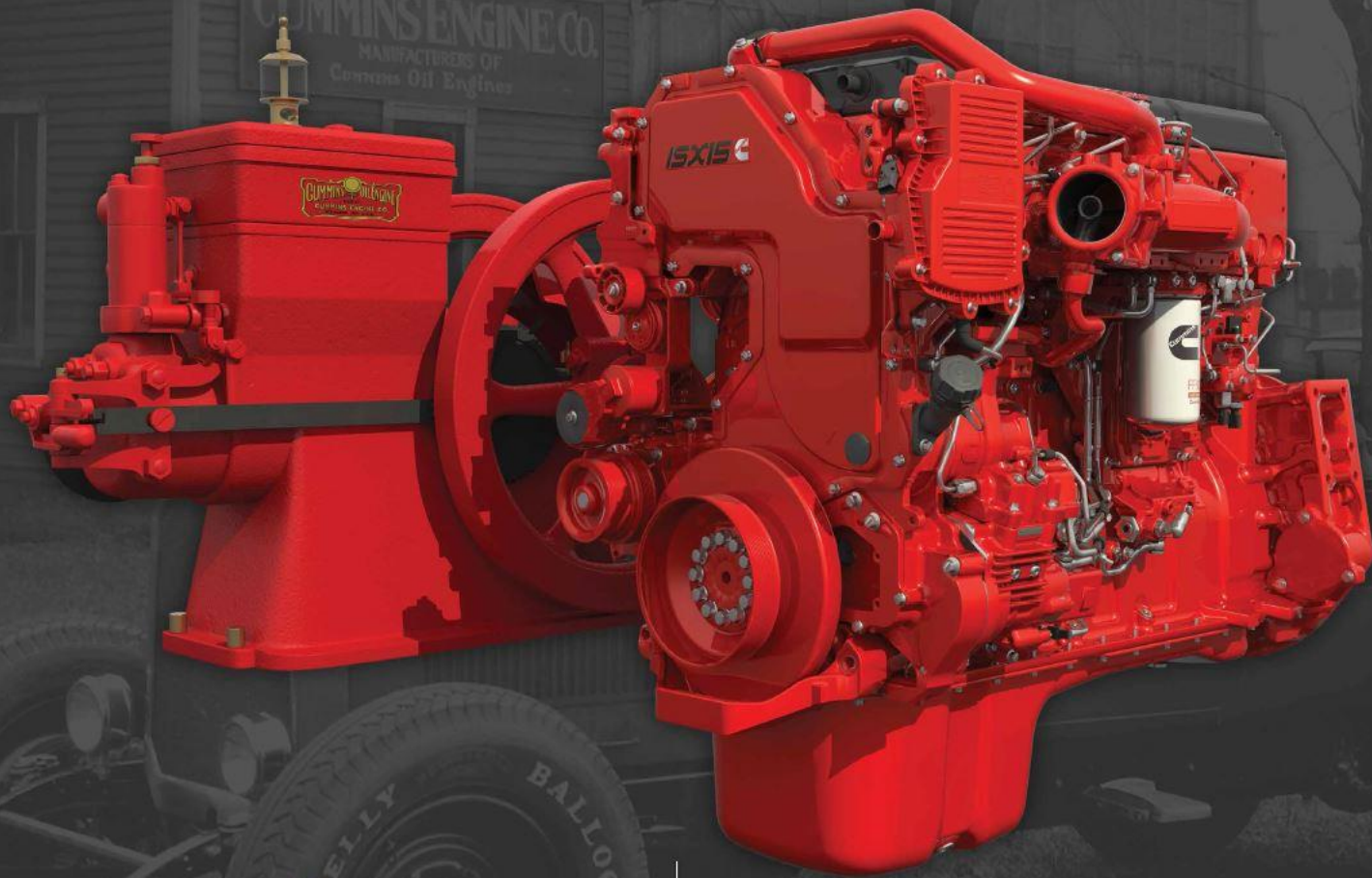


We Have A History Of Building The Future.



Legendary

Performance

Dependable

Partner

Loyal

Customers



Vision.

1919-1944



Innovation.

1945-1952



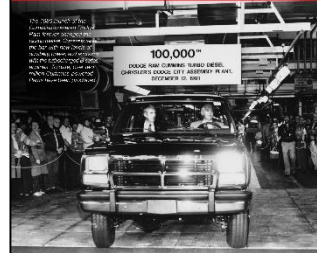
Scale.

1953-1974



Durability.

1975-2005



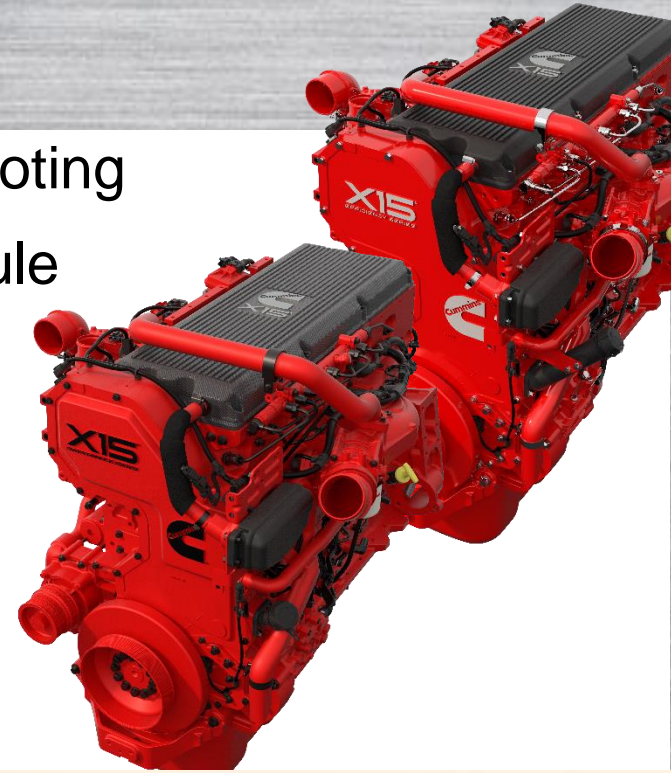
Environment.

2006-2015



Agenda

1. Aftertreatment Review & Troubleshooting
2. **R**edefining the Future – Single Module
3. Diagnostic Tools
4. Expert Diagnostics System
5. Connected Diagnostics
6. Protecting Your Investment
7. Oil Drain Intervals – CK-4



FLEET MAINTENANCE COUNCIL OF
SOUTHEASTERN WISCONSIN

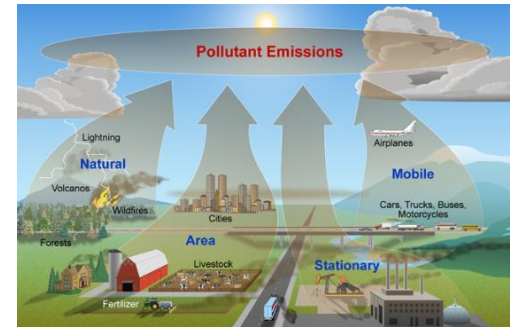
Clean Air – Is Better Air



Cleaning Your Air - Emission Regulations



- 1988 Ignition Timing – Step Timing Control
- 1991 Full Authority Electronic Controls
- 1994 Re-entrant Piston Combustion Bowl
- 1998 Advanced Elect. & Combustion Tech.
- 2002 Exhaust Gas Recirculation (EGR)
- 2007 Exhaust Aftertreatment
- 2010 Selective Catalytic Reduction
- 2013 OBD On-board Emission Diagnostics



- **2017-2027 Phase 2 CO₂ – Reduce Fuel Consumption**

Clean Power Leader

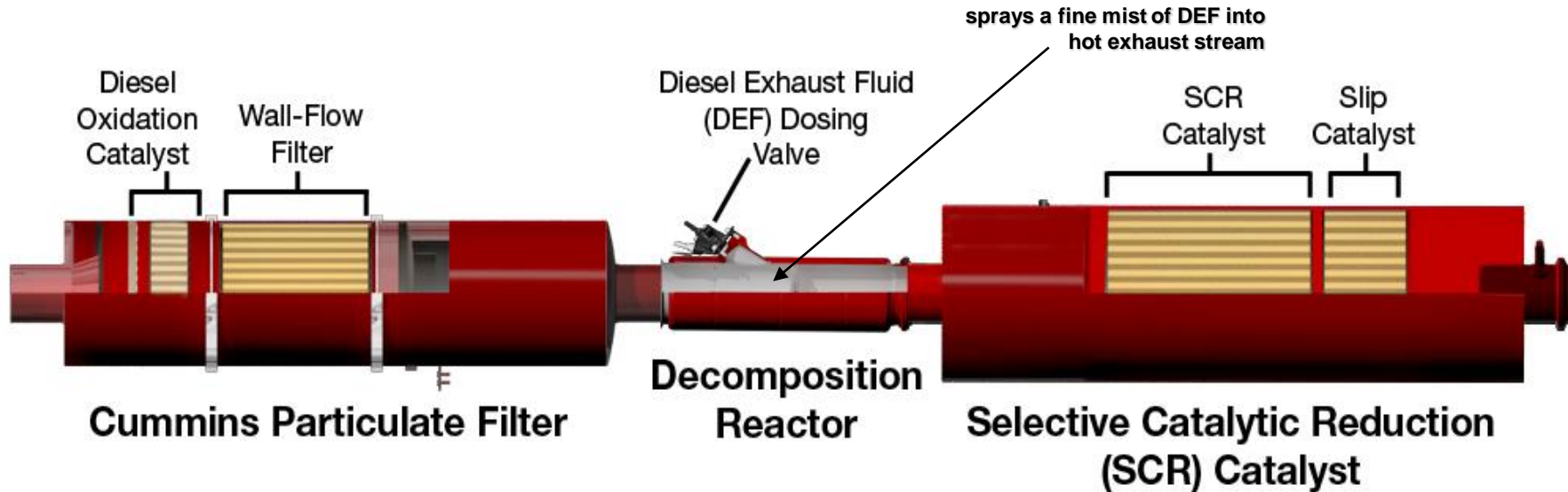


1988

2017

The Right Technology Matters

Cummins Aftertreatment System
I heard SCR is going away ?



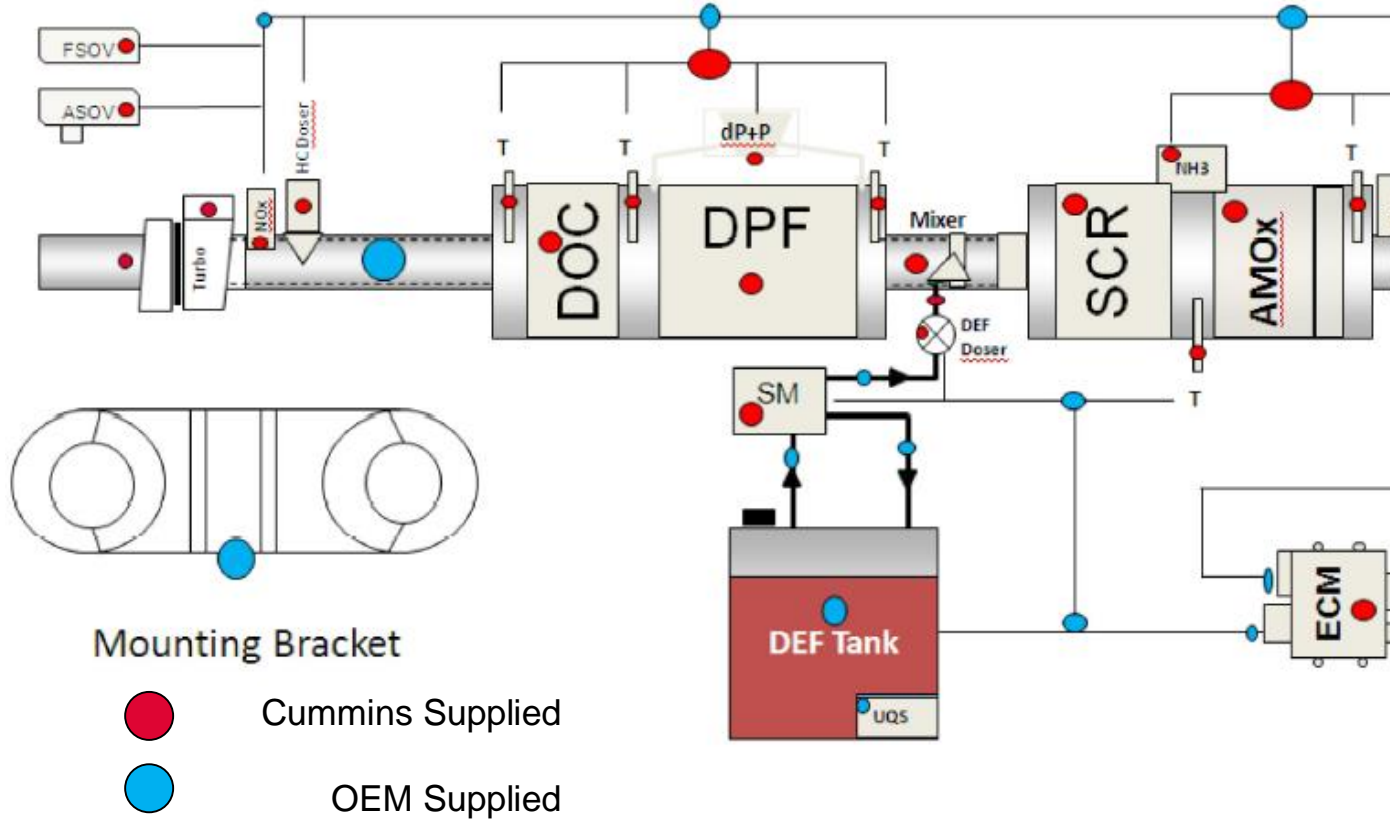
Cummins On-Highway Product Plan

- **SCR is the foundation for the future**
 - Reduces NOx to near-zero levels required
 - Enables greater fuel efficiency
 - Allows for Simple engine design
 - Easy Engine access for servicing
 - Cost Effective.
- No major engine changes, or hardware additions, to meet future EPA Greenhouse Gas Standards; it's all about reducing fuel consumption.

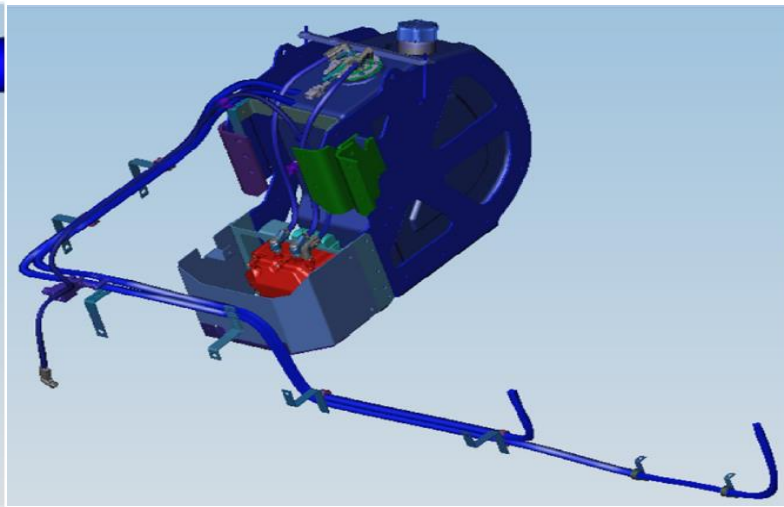
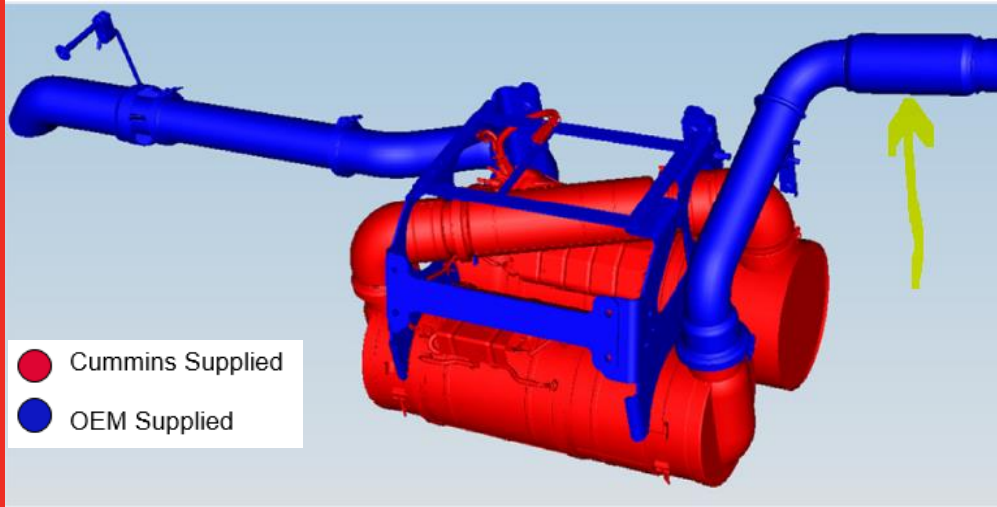




OEM vs. Engine Components



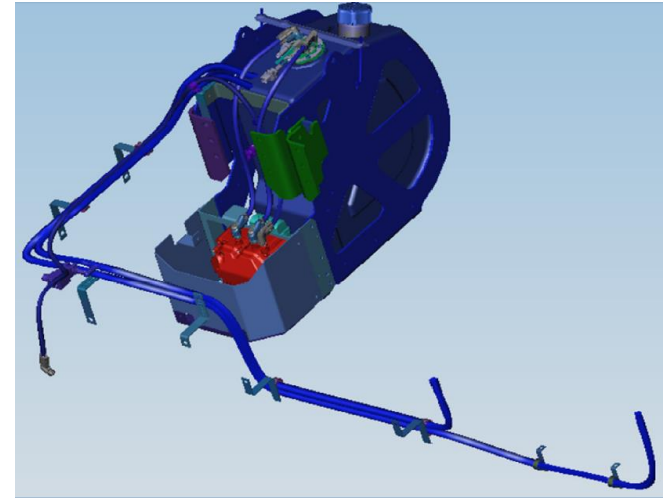
OEM DEF Tank, Supply Lines, Wiring Harnesses, Exhaust Piping & Mounting



DEF System Inspections



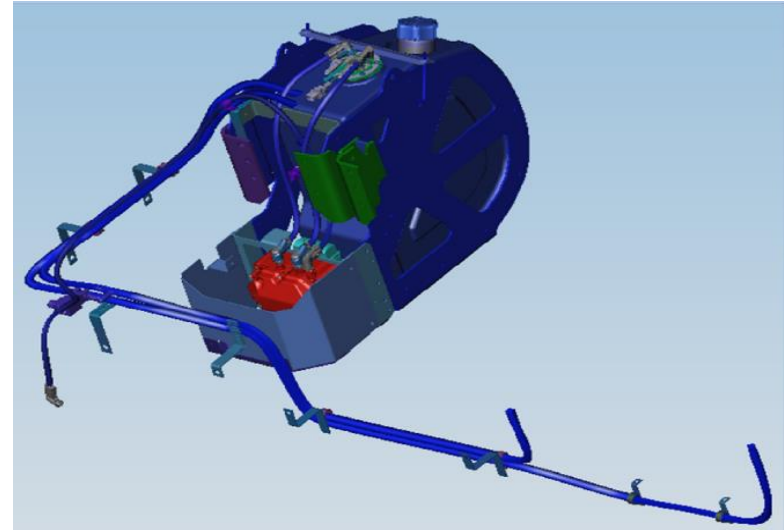
- Visually inspect SCR Aftertreatment DEF Supply lines and Connections for signs of leakage (look for white powder residue build-up).
- Visually inspect SCR aftertreatment wiring harnesses and Connectors for signs of chaffing and damaged Connectors.
- For best practice, fill the Diesel Exhaust Fluid (DEF) tank before it gets below 25% of full.



OEM DEF Tank and Supply Lines



- F/C 3574 F/C 3596
- Erratic, Low, DEF Fluid Pressure
- DEF Pump Filter Replace
- DEF Tank Filter Inspect/Replace
- Blockage in the Lines or Fittings
- Debris in the Tank
- Debris in the Sending Unit
- Sucking Air
 - Hole in DEF tank pick-up tube
 - Air Suction from the Sending Unit
 - Air Suction at Quick Connect Fitting
 - Air Suction at Lines
- Run Regen monitoring pump pressure & speed
- Isolate DEF Tank & Supply Lines



Diesel Exhaust Fluid (DEF) Properties



- **DEF is a non-toxic, non-polluting, and a non-flammable substance.**

- **May have slightly pungent odor similar to ammonia.**

- **Does DEF Freeze?**
 - DEF freezes at 11 degrees F.
 - SCR system is designed to provide heating for the DEF tank and supply lines.
 - If DEF freezes, it can be thawed and used.
 - DEF is not damaged or destroyed because it is frozen.
 - System has timed delay while small amount of DEF is thawed for use.



DEF Additives – NO. NO. NO.














- DO NOT be adding anything to the DEF Tank – but DEF !
- No Anti-Freeze Agents
- No *HEET*
- No Diesel Fuel
- **NOTHING but DEF**



Low DEF Warning & Inducement



DEF (Urea) Tank Level	Notification*		Inducement
	Lamp	- or - Message	
>10% full 	None	None	None
Stage 1 <10% full 	DEF lamp solid 	Warning message Increasing message duration and/or frequency	None
Stage 2 <5% full 	DEF lamp flashing 		None
Stage 3 <2.5% full 	DEF lamp flashing Amber warning lamp solid  	Inducement message -Idle 1-HR -Shut-off Engine -Fill Fuel Tank w/o refilling DEF Tank -Operate for 24-HR	Maintenance derate (25% torque derate)
Stage 4 Empty, after the engine has been shut down 	DEF lamp flashing Red lamp solid  		Maintenance derate (40% torque derate) Vehicle speed limited to 5 mph

Single Module Aftertreatment System

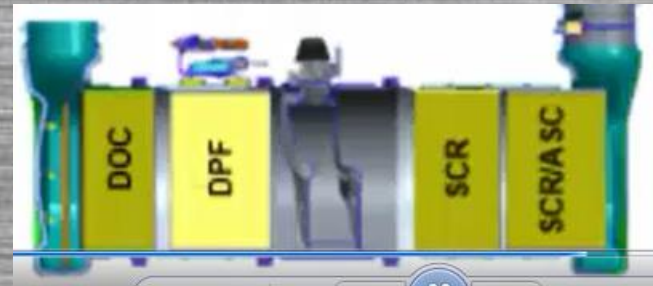
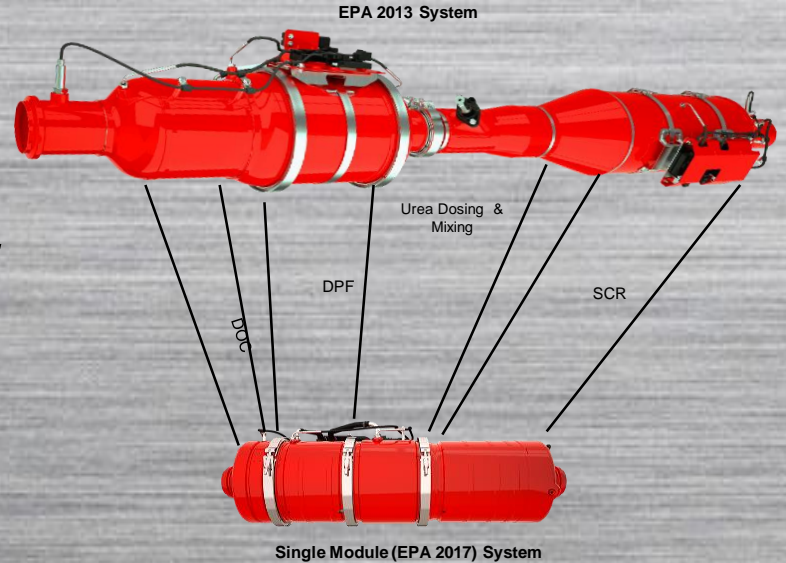
Cummins Emission Solutions has developed an ultra high efficiency aftertreatment system that takes up less space, is easier to install, and simpler to maintain.

This is the *'Differentiator'*



Single Module Aftertreatment Architecture

- Only TRUE Single Module
- Five sizes to cover engine platforms B6.7 through X15
- Flexible system
 - Inlets and outlets from end or the side
 - Orientation of inlet and sensor table positions



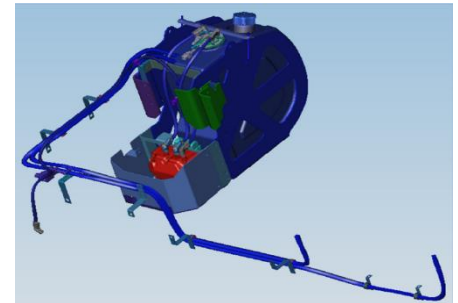
Simple & Optimized DEF Dosing for 2017



Components Supplied by Cummins	Components Supplied by OEM
DEF Dosing Valve	DEF Tank
DEF Dosing Unit	DEF Tank Heater
	DEF Tank Level Sensor
	DEF Tank Temperature Sensor
	DEF Tank Quality Sensor
	DEF Tank Vent
	DEF Tank Fill Connection
	DEF Tank Filter
	DEF Tank Drain
	Heated DEF Suction Line
	Heated DEF Return Line
	Heated DEF Pressure Line
	DEF Heater Control Relay (DEF Lines)
	Coolant Flow Valve
	DEF Tank Heater Coolant Lines
	Coolant Supply Line Tee
	Wiring Harness

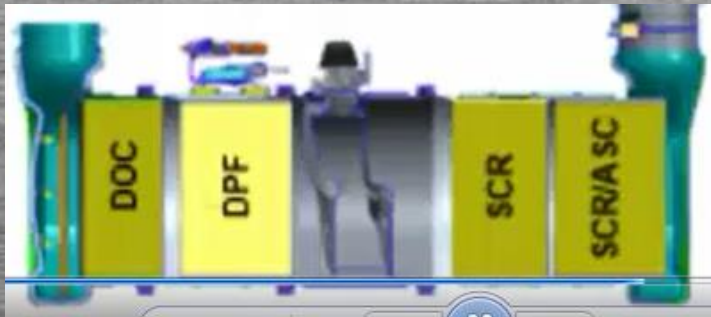


- The UL2 system **does not require engine coolant lines** to and from the diesel exhaust fluid (DEF) injector, **reducing installation complexity.**
- The system provides a **more efficient atomization and minimizes deposit formation.**
- This **results in fewer regeneration** events while optimizing the use of DEF throughout the system.



2017 Heavy-duty Single Module Aftertreatment

- Customer voice-driven design
- MidRange System features:
 - Up to 60% reduction in size
 - Up to 40% reduction in weight
- Enhanced thermal efficiency



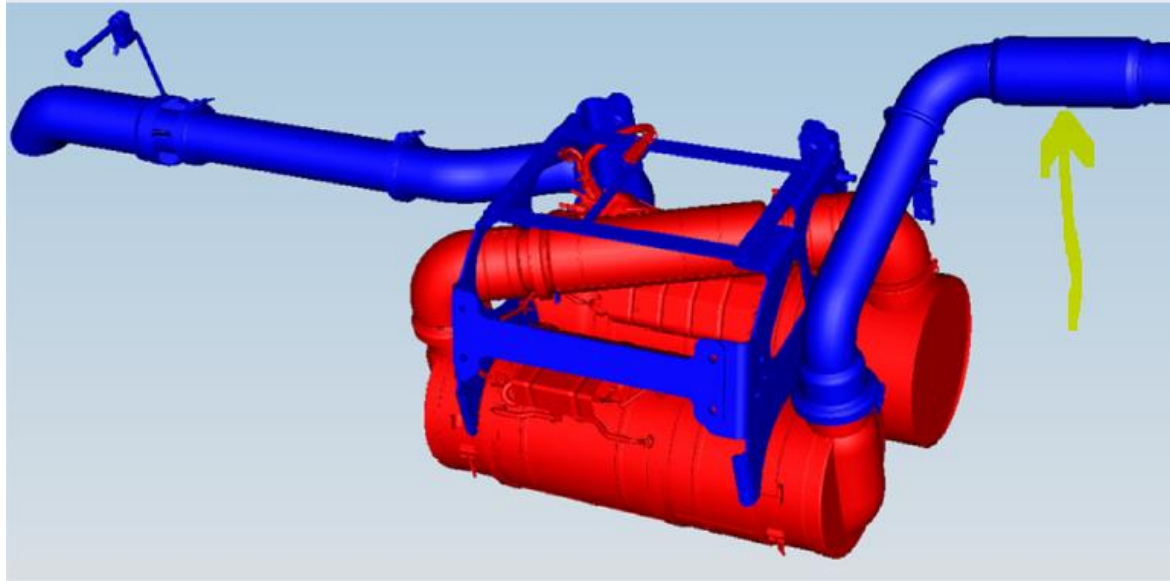
Aftertreatment Problems



Aftertreatment problems, i.e. DOC face plugging, have progressed from upstream exhaust or engine problems:

1.) Leaky Exhaust Connections

- can't maintain heat in system for passive regeneration
- can't build the heat with dosing during active regeneration
- Inspect OEM Piping, Flexpipe, Connection Clamps, Mounting Brackets



Aftertreatment Problems



Aftertreatment problems, i.e. DOC face plugging, have progressed from upstream exhaust or engine problems:

- 1.) Leaky Exhaust Connections
 - can't maintain heat in system for passive regeneration
 - can't build the heat with dosing during active regeneration
- 2.) Plugged or faulty Dosing Injector (HD engines)
- 3.) Operating Engine with Active Fault Codes
- 4.) **BLACK SMOKE**
 - Whatever causes excess black smoke, the aftertreatment cannot keep up with it, resulting in a plugged DPF.
 - Dirty air cleaner, Cracked Charged-Air-Cooler, Intake Leaks
 - Worn/Defective Turbocharger, EGR Valve, Fuel Injectors
 - Test by disconnecting exhaust behind turbo and perform snap-rail test for excess black smoke
- 5.) Worn DOC from Excess Regens (resulting from idling)
- 6.) **Excess Idle Time – SHUT IT OFF !**



DPF Cleaning



ISB, ISC, ISL, PX7, PX9 Mid-range

Maintenance Procedures at 321,500 Kilometers [200,000 Miles], 6,500 Hours (Section 10)

- Aftertreatment Diesel Particulate Filter - Clean⁴
- Aftertreatment Diesel Exhaust Fluid Dosing Unit Filter - Change

ISX, ISM Heavy-duty

**Maintenance Procedures at 320,000 Kilometers [200,000 Miles] or 4500 Hours⁽⁴⁾
(Section 8)**

- Aftertreatment Diesel Particulate Filter – replace or clean

Diesel Particulate Filter Cleaning

- Inspect EXHAUST CONNECTIONS between turbocharger and Aftertreatment assembly (muffler) for LEAKS EVERY CHANCE.
- Proactively clean DPF's at:
 - Vocational; Urban; Light-duty; Short-haul; High Idle: **3,000 hours**
 - **Requires “Maintenance Reset” in ECM using Insite Software** ALWAYS use new exhaust gaskets in DPF and exhaust connections
 - Remove old gasket materials completely from connections
 - Inspect Aftertreatment Inlet for Oil, Coolant, Fuel Contamination
 - Apply High-Temp rated Anti-seize to innerside of v-bands and all bolts



ReCon DPF Exchange Program



- During normal operation, ash builds up in the Diesel Particulate Filter, eventually the DPF needs to be cleaned or replaced.
- Faster than Cleaning
 - Simply remove the DPF and install the Cummins ReCon DPF
 - No need for DPF regeneration after installation
- Dependable
 - Cummins four-step remanufacturing process restores the DPF to original condition
- Better Value
 - 1 year, unlimited mileage warranty
 - Cummins gives full credit for undamaged cores
- Available for 2010 & 2013 ISX15, ISL engines; Releasing ISB ReCon
- 'New' High Efficiency for 2007 ISX



Aftertreatment Diesel Exhaust Fluid Dosing Pump Unit & Filter



**DEF Filter Cartridge
Under cap**

Install

TOC

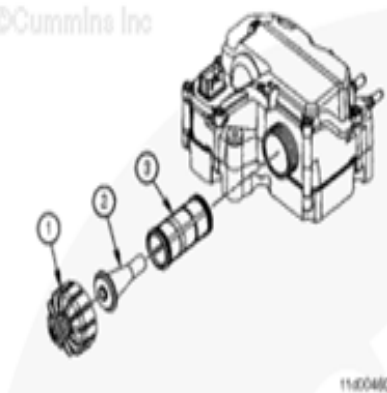
NOTE: Lubrication of the DEF filter o-rings is not required.

1. Slide the DEF filter equalizing element into the DEF filter cartridge.
2. Insert the assembly into the aftertreatment DEF dosing unit.
3. Install and tighten the cap.

Torque Value: 20 n.m [177 in-lb]



©Cummins Inc



SMALL | MEDIUM | LARGE

[↑ Previous](#)[↓ Next](#)

Diagnostic Tools

Fix-it-right – The First Time



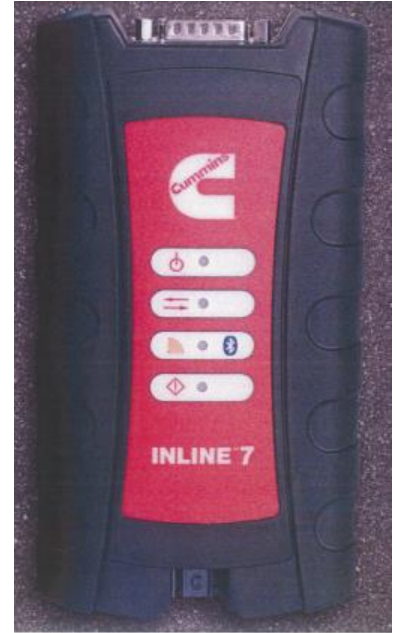
InLine 7 DataLink



- Universally Compatible with Engines & Components
- Only WI-FI & Bluetooth
- *Industrial Strength*
- \$1,135 Fleet
- Kit Part #5299899
- 1-Year Warranty



Cummins INLINE™ 7 Data Link Adapter.





GUIDANZ

- SmartPhone/Tablet Mobile App
- BlueTooth using InLine-Mini or InLine 7
- InLine Mini, #5299909, \$312.16
- Fault Code Analysis
- Immediate Assessment
- Integrate and Streamline Repair
- Easy to use !
- It's FREE !



Internal Use Only

Insite.Cummins.Com



- Computer Based Diagnostics Software
- Requires In-Line DataLink Translator
- Sold on Annual Subscription, \$550/YR
- Required for 'Tests'
- Required for 'Reset' Aftertreatment & Doser
- Required to perform 'forced' regeneration
- www.insite.cummins.com

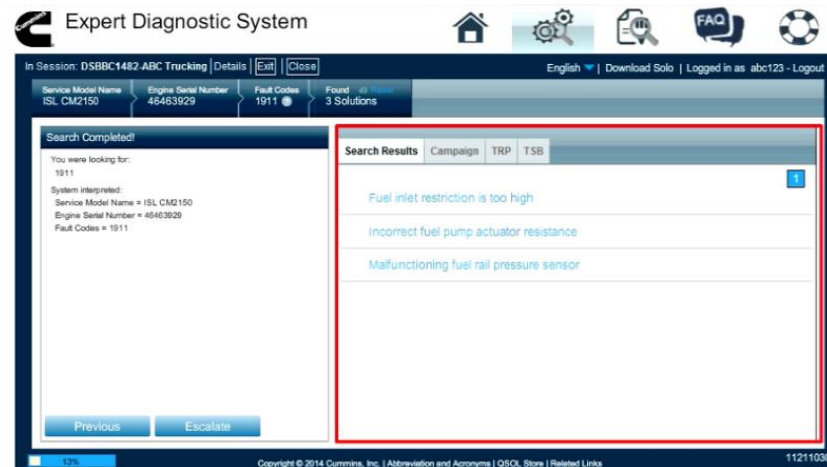




Insite.Cummins.Com

DO NOT USE
INSITE FOR
TROUBLESHOOTING
STEPS !
USE EDS.

Cummins Expert Diagnostic System



Insite Functionality



- Viewing Fault Codes
- Run Diagnostic Tests
- 'Reset' Aftertreatment Maintenance
- Engine Data Monitor/Logger
- Change/Adjust Engine Feature & Parameters
- Read/Reset Engine Faults & Trip Information
- **NOT TO BE USED FOR DIAGNOSTIC FAULT TREES**
- Use **QuickServe OnLine** for Diagnostic Fault Trees
 - Annual Subscription \$50/month (billed \$600 annually)
 - Identify Engine Campaigns and Temporary Repair Practices

PowerSpec



- Engine Interface Software
- Computer Based Read/Reset Tool
- Requires In-Line DataLink Translator
- Read/Reset Fault Codes
- Read/Reset Trip Information
- Adjust Electronic Feature Parameter Settings
- Downloadable Free www.powerspec.cummins.com

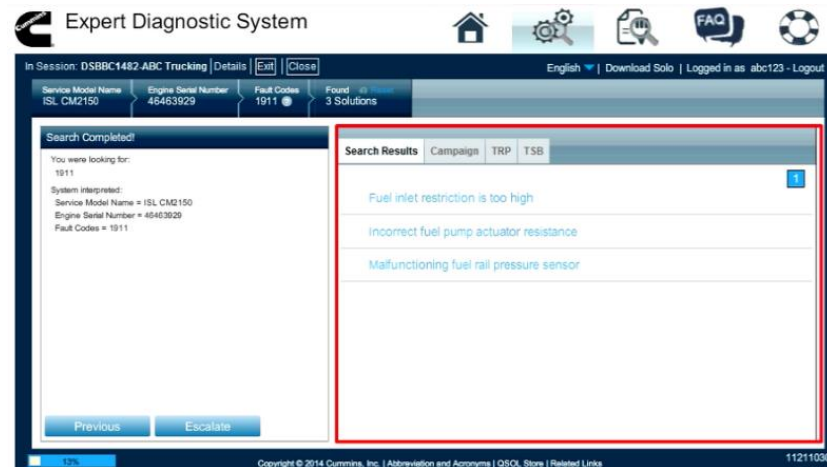




Insite.Cummins.Com

DO NOT USE
INSITE FOR
TROUBLESHOOTING
STEPS !
USE EDS.

Cummins Expert Diagnostic System



EDS - Expert Diagnostic System



Expert Diagnostic System Training



English | Advanced_User_FieldService | Logged in as jf953 - Logout

Diagnostic Session: DSBBN0546 - Tri State Truck...

Details Exit Close

Engine Performance Symptom
Runs Rough or Misfires

Fault Codes
No Fault Codes

Reset
12 Solutions

Search completed!

- You were looking for:**
runs rough
- System interpreted:**
Fault Codes = No Fault Codes
Engine Performance Symptom = Runs Rough or Misfires
Service Model Name = ISL9 CM2350 L101
Engine Serial Number = 73499722

Troubleshooting the
highest likely cause
FIRST.

Previous

Escalate

Results Campaigns 1 TRP 1 TSB 24

Verify performance complaint
Modification Date: 2015-03-13 16:58 Status: Released

Fuel injector malfunctioning- Injector Performance Test
Modification Date: 2015-01-30 14:17 Status: Released

Air in-fuel due to loose or damaged fuel line fittings
Modification Date: 2015-03-31 09:04 Status: Released

Malfunctioning high pressure fuel system component
Modification Date: 2015-03-18 09:06 Status: Released

Malfunctioning low pressure fuel system component
Modification Date: 2015-03-13 16:29 Status: Released

Malfunctioning intake manifold pressure sensor
Modification Date: 2015-03-13 17:02 Status: Released

High exhaust restriction
Modification Date: 2015-03-13 17:03 Status: Released

High fuel drain line restriction
Modification Date: 2015-03-13 16:56 Status: Released

CVC
COURSE
#1122

QuickServe.Cummins.com



Browser address bar: <https://quickserve.cummins.com> qs3/portal/servic... Cummins QuickServe Online x ISB6.7 CM2350 Calibration Imp... QuickServe Online | (2883567) ...

File Edit View Favorites Tools Help

Home RSS Mail Print Page Safety Tools ?

Cummins NPower **QuickServe Online** Search All En... am544 (Di

Parts Service Settings Products Pro

Engine Content

Content For Engine:
ISB6.7 CM2350 B101

ESN: >

How do I locate my ESN?
Engine Model Search
Part Number Supersessions
VIN To ESN Reference
TSB Smart Filter

Generator Set / Alternator Content

Content for Serial Number (SN):
 >

OR

Current Plant: None
Current Model: None
Current Spec: None

Search by Plant, Model, or Spec

Literature Search
CPG Smart Filter
Bill of Material - By Serial Number
Bill of Material - By Part Number
SRT User Tool
Campaign Status Tool

As part of a...
the survey.

...sting your feedback on Technical Service Bulletins (TSBs). Please click [HERE](#) to participate in

Service... (ISB6.7 CM2350 B101)

Manuals Campaigns TRPs ATCs Service Bulletins TSBs **What's New** Service Tools

Fault Code Search Symptom Search Related Information

Engine Fault Code Analyzer Engine Fault Code Search SPN/FMI To Fault Codes

Enter all active fault codes. Also enter all inactive fault codes with more than one count logged in the last 25 engine hours. [Help](#)

	FAULT CODE	DESCRIPTION
Remove	1. <input type="text"/>	
Remove	2. <input type="text"/>	
Remove	3. <input type="text"/>	
Remove	4. <input type="text"/>	
Remove	5. <input type="text"/>	

Notification
Campaign
Updates



Fault Code Analyzer

Service Information (ISB6.7 CM2350 B101)

Manuals Campaigns TRPs ATCs Service Bulletins TSBs **What's New** Service Tools

Fault Code Search Symptom Search Related Information

Engine Fault Code Analyzer Engine Fault Code Search SPN/FMI To Fault Codes

Enter all active fault codes. Also enter all inactive fault codes with more than one count [Help](#)

FAULT CODE		DESCRIPTION
Remove	1 <input type="text" value="4769"/>	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Abnormal Rate of Change
Remove	2 <input type="text" value="4261"/>	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Root Cause Not Known
Remove	3 <input type="text" value="3232"/>	Aftertreatment 1 Intake NOx Sensor - Abnormal Update Rate
Remove	4 <input type="text" value="2556"/>	Engine Intake Air Heater 1 Circuit - Voltage Below Normal or Shorted to Low Source
Remove	5 <input type="text" value="2555"/>	Engine Intake Air Heater 1 Circuit - Voltage Above Normal or Shorted to High Source
Remove	6 <input type="text" value="559"/>	Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
Remove	7 <input type="text" value="2638"/>	Aftertreatment Diesel Oxidation Catalyst Conversion Efficiency - Data Valid But Below Normal Operating Range - Least Severe Level
Remove	8 <input type="text"/>	
Remove	9 <input type="text"/>	
Remove	10 <input type="text"/>	

Add More Fault Codes Analyze



Fault Code Analyzer

Service Information (ISB6.7 CM2350 B101)

Manuals Campaigns TRPs ATCs Service Bulletins TSBs **What's New** Service Tools

Fault Code Search Symptom Search Related Information

Engine Fault Code Analyzer Engine Fault Code Search SPN/FMI To Fault Codes

Enter all active fault codes. Also enter all inactive fault codes with more than one count logged in the last 25 engine hours. [Help ?](#)

ORDER	PRIMARY FAULT CODES	RELATED FAULT CODES
1	2556	2555
2	3232	
3	4769	
4	4261	
5	559	
6	2638	

Go Back Start Over

If any additional fault codes are still active after validating the first three primary fault codes, then re-enter the remaining fault codes.

Cummins Virtual College ProMotion Training



- Computer Based
- Access Thru QSOL
- Self-studies by Course or Engine Model
- Assessment Testing Available
- Same training used by Cummins Dealers & Dist.
- Start with EDS #1122



Cummins QuickServe Training		Technician Role
Home page	Gerdin, Jeff(A340152): Current Technician	
What training have I completed?	TECH = Milwaukee Branch (A04896)[BRANCH] = Cummins Npower (DIST03520)[DIST] = US AND CANADA[ABO] = Cummins Factory	
By product or program	FAIR PROCESSING NOTICE	
% of qualification program	CUMMINS QUICKSERVE ONLINE --TECHNICIAN TRAINING RECORDS	
By course	Introduction -- Cummins Technician Training Records	
By test with scores	The Cummins Service Training and Information Department will implement a change to how Service Managers will training records in QuickServe Online. The change will allow the Service Managers to access records for individual organization. This will allow the Service Manager to better understand the product qualifications of each technician Pro Motion IDs to assist in warranty filing, and provide guidance on courses a technician may still require to become on a Cummins product.	
What do I need to become qualified?	In order for this change to be implemented and operated successfully, the Cummins QuickServe Online Sys Columbus, Indiana will hold certain personal data of the technicians and the Service Training and Information Columbus, Indiana will process certain personal data of the technicians as described below.	
Get a Smart Program Guide		
View tests that I've started		
View available tests		
Cummins Virtual College On Line		
Send my test results to Cummins		
Virtual College upload		



ProMotion Training

All Training Courses > search ESD



am544 (Technician)

Welcome to ProMotion - Jeff Gerdin (A340152) - CUMMINS NPOWER, LLC (04896)

NEEDS UPDATING ■ NOT QUALIFIED ■ ALREADY QUALIFIED ■ **ALL TRAINING COURSES** ■ UPLOAD SCORES

Show entries

Search: x



Course ID	Course Name	Course Time	Delivery Method		Color	Passed?	Date Passed
			Course Type	ROM EXT-ID			
1122	EDS Technician Training	0.7 hours	Online		Green	Yes	04/01/2013
1121	EDS Introduction	0.3 hours	Online		Green	Yes	07/11/2012
1181	Expert Diagnostics System (EDS) Hands-On Assessment Course	0.0 hours	Instructor-led		Red	No	
1352	EDS 2015 New Features Update 1	0.2 hours	Online		Red	No	
1368	EDS 2015 New Features Update 2	0.1 hours	Online		Red	No	

Showing 1 to 5 of 5 entries (filtered from 456 total entries)



ProMotion Training

Not Qualified > search ISL > ISL G CM2180 Qualification



Welcome to ProMotion - Jeff Gerdin (A340152) - CUMMINS SALES AND SERVICE - MILWAUKEE (04896)

NEEDS UPDATING ■

NOT QUALIFIED ■

ALREADY QUALIFIED ■

ALL TRAINING COURSES

UPLOAD SCORES

Show entries

Program ID	Color	Program Name	Completed Date	Expiration Date	% Completed
2003-23Q	Red	ISC8.3 CM554, ISC8.3 CM850, ISL8.9 CM554, ISL8.9 CM850 Qualification			0
2005-15Q	Red	ISC CM554, ISC CM850, ISL CM554, ISL CM850, ISB CM554, ISB CM850 NOW LEO			0
2006-39Q	Red	ISC/ISL CM2150 Qualification			3
2007-28Q	Red	ISL G CM2180 Qualification			2
2009-31Q	Red	ISC8.3 & ISL9 CM2250 Qualification (EPA 2010)			3
2010-31Q	Red	ISL G CM2180 NOW LEO			2
2010-32Q	Red	ISC CM2150, ISL CM2150, ISB CM2150 NOW LEO			3
2012-25Q	Red	ISL9 CM2350 L101 Qualification (EPA 2013)			5
2015-37Q	Red	ISC8.3 CM2250, ISL9 CM2250, ISB6.7 CM2250 NOW LEO			3

Showing 1 to 8 of 8 entries (filtered from 113 total entries)

How do I get signed up?

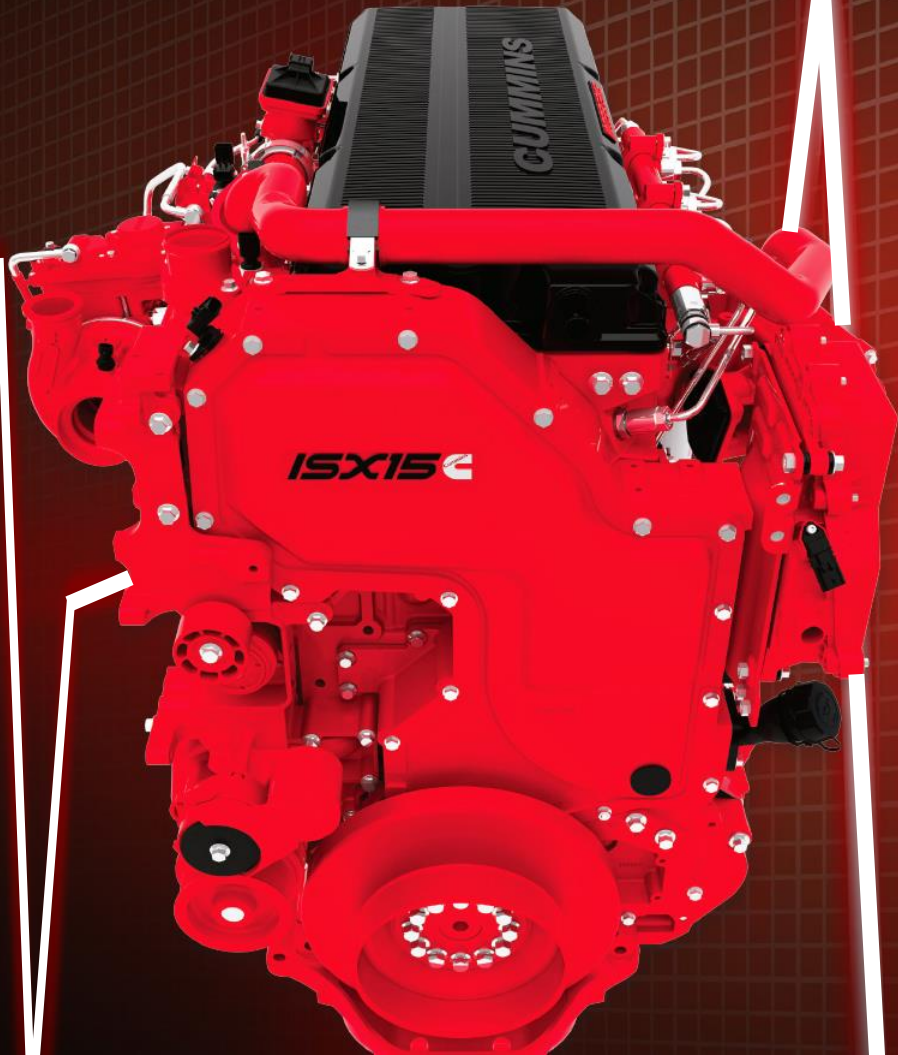


Contact Cummins NPower
Customer Assistance Center
At 1866-831-7620 > #3

For Insite, QSOL, PowerSpec,
and all Software Support.

Request a ProMotion Training ID.

Shelly Johnson, Software Administrator



The Lifeline For Your Engine.

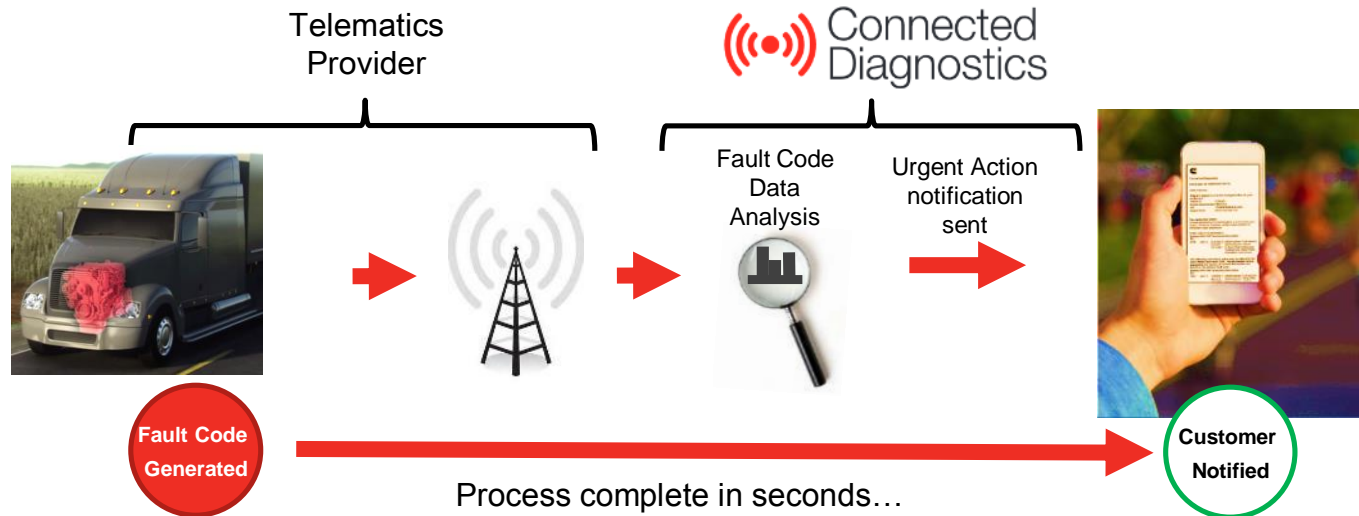


Connected
Diagnostics™

Over 200,000 trucks Connected!

Connected Diagnostics

- Previously, the operator relied on lamps and gauges to make operating decisions during an engine system fault
- Now, Connected Diagnostics provides immediate, expert recommendations in response to urgent faults





Customer Notification – Email Example

Connected Diagnostics Notification ID

Vehicle and Engine information

Recommended customer action


Fault code details

Suggested root cause

Awareness of possible impact on performance

Link to nearest certified repair locations

Cummins Care contact information



Connected Diagnostics
Notification ID: QS123456789012
Dear Customer,

This is in regard to a recent fault generated on your equipment:

Vehicle ID 12345
Engine Serial Number 12345678
VIN 1A2BC93DE4FG5678
Engine Model ISX15 CM2350

Recommended Action:
Ensure equipment is in a safe location and shut down your engine. Contact a Cummins certified repair location for immediate repair assistance.

Fault Code (FC) Information:

Primary FC	SPN	FMI	Timestamp	Description
175	3464	3	2014-01-01 22:33:10 UTC/GMT	(Air Handling) Electronic Throttle Control Actuator Driver Circuit - Voltage Above Normal or Shorted to High Source

The following active fault codes may be related to the new primary fault code 175. Recommended action, suggested root cause, and derate information are based on the primary fault code.

Related FC	SPN	FMI	Timestamp	Description
177	3464	7	2014-01-01 13:41:45 UTC/GMT	(Air Handling) Electronic Throttle Control Actuator - Mechanical System Not Responding or Out of Adjustment

Suggested Root Causes:

Component or System	Probability
Intake Throttle Actuator	98%

This fault code indicates that your engine has entered a situation where performance on road speed will be limited, and you may experience the following:
25% torque derate in 8 operating hours

Equipment and Service Locations:
[Click to see map of nearby Cummins certified service locations](#)

At the time of service, a Cummins certified service technician will perform standard diagnostics to determine a more detailed root cause and the repairs required.
If you require further assistance, please contact Cummins Care at 1-800-DIESELS (1-800-343-7357) and we will be happy to assist you.

Thank you for being a Cummins customer.

Cummins Care
Connected Diagnostics
cumminsengines.com

Uptime



Benefits of Connected Diagnostics



- Instant Notification
 - Proactive vs. Reactive
 - Allows for alternative optional planning – ‘Plan B’
 - Details on the fault code sent to fleet management allows faults to be addressed before mission is impacted
 - Cummins provides recommendation based upon the primary fault code and probable root cause
- Saves time - Saves money
 - Reduces Tow Charges
- Reduces Late Deliveries and Late Pick-ups
- No Fee Charged from Cummins



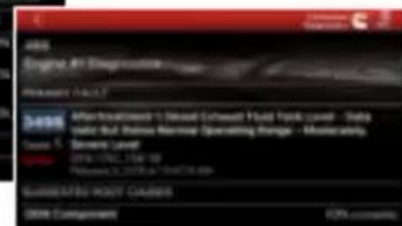
Let's Get Started

- Geotab
 - GO7 Device features an integrated cellular antenna and GPS
 - Customer installed "Plug and play" connection to an in-cab 9-pin connector
 - Great for currently unconnected customers



Connected Diagnostics Mobile App

- Brings Connected Diagnostics™ information to the field
 - Full functionality – more than an email
 - Complete information
 - Instant notification
 - Expert recommendations
- Scaled for phones today with tablet version coming soon
- Displays in portrait and landscape



Extended Coverages

- **Fixes Your cost-of-operation** – Customer has peace-of-mind knowing unexpected costly repairs are covered.
- **Repairs follows prescribed troubleshooting** and SRT labor hours - results in less downtime = **UPTIME !**
- **Nationwide Support at 3,500 Authorized Cummins Dealers.**
- Helps plan and maintain Service Department budgets.
- Easy to understand coverages with customized terms based on application and mileage.
- Includes Fuel Pump, Turbo, Injectors, Water Pump, Engine Sensors & HARNESSSES, Air Compressor, ECM, EGR Valve, EGR Cooler, and Internally lubricated components.
- **Adds Resale Value in Secondary Market.**
- Extended Warranties **Preserve Relationships.**



Realizing

Our Vision

As **One Cummins network**

we can deliver seamless, consistent and excellent customer support.

To get there we need to:

- ▶ Be a **growth business**
- ▶ **Support** all customers
- ▶ Be a **Great Place to Work**

Cummins Authorized Service Locations

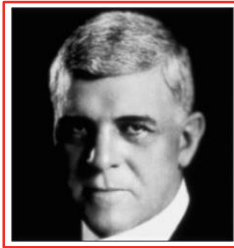


3500 Cummins
authorized
service locations



A Rich History Rooted in

Innovation



Incorporated in 1919 by Clessie Cummins and W.G. Irwin

Pioneered the development of diesel engines

Promoted diesels as a reliable source of power

Earned its first profit in 1937



A Common Engine Across Truck Market

1

One Solution for an Entire Fleet

One Platform for Efficiency or Performance

One Vast Support Network (The Largest in N.A.)

One-Stop-Shop for Engine Subsystems

One 'Power-of-Choice'

One-800-CUMMINS Dealer Locator

One Phone Call Away....



THE BAHAMAS

Short-Course in Engine Oil



What is Engine Oil?

- Engine oil is made up of 2 main components
 - Base Stock (70-80%)
 - Petroleum based or fully synthesized
 - Group I, II and III are all petroleum based (Marketing → III = “synthetic”)
 - Group IV and V are fully synthesized
 - Additive Package (20-30%)
 - Chemical compounds that improve the lubricant performance of base stock



What is the Function of Engine Oil?


- Separate moving parts
- Absorb heat
- Prevent corrosion
- Control combustion byproducts
- Clean and remove sludge/soot

A blue circular graphic containing the text 'CK-4' in white, bold, sans-serif font.

CK-4



What is Engine Oil Viscosity?

- Engine oil is referred to by its viscosity or “weight”
 - Viscosity is a measure of the fluid’s resistance to flow and shear
 - Low viscosity example: water
 - High viscosity example: maple syrup
- Viscosity can be measured in two different ways
 - Kinematic viscosity: a measure of the fluid’s resistance to flow and shear under the forces of gravity
 - Dynamic viscosity: a measure of the fluid’s resistance to flow in the narrow confines between fast moving parts 

How Does Engine Oil Degrade?

- Combination of factors → Primary factor is combustion
- HOT Temperatures = Combustion Flame
 - Hot temperatures, combined with Oxygen degrade all components of the oil in a process called Oxidation
 - Base stock → changes the chemical and physical properties
 - Additives → Anti-oxidants are designed to absorb oxygen, others lose function
- Acidic/corrosive gases = NO_x & Sulfur (fuel and oil)
 - Acidic/corrosive gases can attack soft metal parts
- Incomplete Combustion = Soot



Why a New Proposed Category (PC-11) for Oils?

Current CJ-4 oils were defined in PC-10.

However, a new oil category was created due to several new requirements:

- 2017 EPA Greenhouse Gas (GHG) standards drove lower CO₂ emissions resulting in an increase in fuel economy. This can be accomplished by reducing friction with lower viscosity oils.
- The EMA (Engine Manufacturers Association) requested improved oil oxidation resistance due to:
 - Engines running hotter and higher pressures causing quicker oxidation of current oils.
 - Oil oxidation can lead to shorter oil drain intervals.
- Off-highway markets needed a backward compatible oil for high horsepower type applications.



CK-4



BEST



BETTER



GOOD



Oil Analysis Tools

Oil Analysis Tools

Although multiple oil parameters should be considered when making critical oil decisions, oxidation is the most sensitive and repeatable measure available for oil degradation.

Labs analyze used engine oil based on several parameters including:

- Oxidation
- Nitration
- TBN (Total Base Number)
- TAN (Total Acid Number)

These parameters monitor chemical changes to oil that can **precede** failures (corrosion, wear, deposits, viscosity increase). All can be useful, **but oxidation is key.**

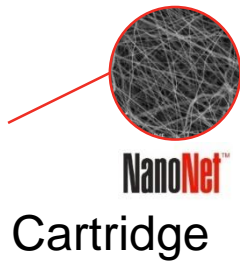
- Additive metals/elements such as magnesium, calcium, zinc, and phosphorus
- Viscosity
- Oil contamination, such as:
 - Certain metals/elements like sodium and potassium, as these may indicate a coolant leak
 - Fuel dilution, which can decrease viscosity and cause more metal to metal contact
 - Water contamination
- Wear metals, such as iron, copper, and lead

These parameters are more **reactionary** toward wear, deposits, or contamination.

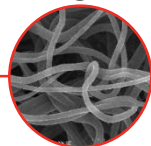
NanoNet Lubricating Oil Filter LF14000NN Contamination Filter vs. Debris Filter



LF14000NN



NanoNet™
Cartridge



StrataPore™
Cartridge



Stacked-Disc
Cartridge

LF9080

Venturi Nozzle



* Note there is not a venturi Nozzle in LF14000 NN

* LF14000 NN design does not require the venture to pull lube through the NanoNet combo section

Oil – The Life-blood of the Engine

<u>Item</u>	<u>Severe</u> < 5.5mpg	<u>Normal</u> 5.5 – 6.5mpg	<u>Light</u> > 6.5mpg
Oil Drain	15,000	25,000	35,000
Fuel St 1	15,000	25,000	35,000
Fuel St 2	15,000	25,000	35,000
Ash Clean	250,000 – 400,000	400,000 – 600,000	600,000 – 800,000
DEF	250,000	280,000	300,000
Valvetrain	500,000	500,000	500,000
Drive Belts	500,000	500,000	500,000
CCV Filter	NA	NA	NA
HC Doser	NA	NA	NA



²Maintenance Light will illuminate when DPF cleaning is required.

Realistic ISX Oil Drain Intervals



<u>SEVERE-Duty</u>		<u>NORMAL-Duty</u>		<u>LIGHT-Duty</u>	
Heavy-Haul over 80,000lbs					
High Idle Time over 40%					
Dusty Environment					
MPG	Interval/Miles	MPG	Interval/Miles	MPG	Interval/Miles
4.5	5,000	5.6	16,000	6.6	26,000
4.6	6,000	5.7	17,000	6.7	27,000
4.7	7,000	5.8	18,000	6.8	28,000
4.8	8,000	5.9	19,000	6.9	29,000
4.9	9,000	6.0	20,000	7.0	30,000
5.0	10,000	6.1	21,000	7.1	31,000
5.1	11,000	6.2	22,000	7.2	32,000
5.2	12,000	6.3	23,000	7.3	33,000
5.3	13,000	6.4	24,000	7.4	34,000
5.4	14,000	6.5	25,000	7.5	35,000
5.5	15,000				
* Valvoline 5,000 Mile 'extension' only applies to Normal or Light-Duty Applications					





Maintenance Intervals



Maintenance Item	Miles	Kilometers	Hours
Oil and Filter	15,000	24,000	500
Fuel Filter	15,000	24,000	500
Coolant Filter	15,000	24,000	500
Standard Coolant	60,000	96,000	2,000
Overhead Adjustment	150,000	240,000	5,000
Coalescing Filter	Every 3 rd to 4 th Oil Change Interval		
DEF Filter	200,000	320,000	6,500
Particulate Filter Cleaning	200,000	320,000	6,500

Consult your Operation and Maintenance Manual for more information.

MidRange Engine Vocational Intervals



Maintenance Item	Miles	Hours
Oil Change CK-4 Oil	9,000	300
Fuel Filter		300
Coolant Filter		300
Overhead		
DEF		4,000
Particulate Filter		1,000
Coalescing Filter	Every 4th oil change	Interval

**Extended Oil Drains
Short-term Gain for
Long-term Pain**

Under 7 MPG
High Idle 40%
Heavy CGWR
Weight
Dusty
Environment



* Refer to Operation & Maintenance Manual that is provided with every vehicle

CK-4 category oils were released for 2017, coinciding with higher engine temperatures, to improve oxidation resistance, shear stability, and aeration control



EGR Cooler Failures



EGR Cooler Failures

What causes them?



1. Coolant Leaks
2. Defective Radiator Cap
3. Improper Coolant Fill Procedures



Resulting In Progressive Damage?

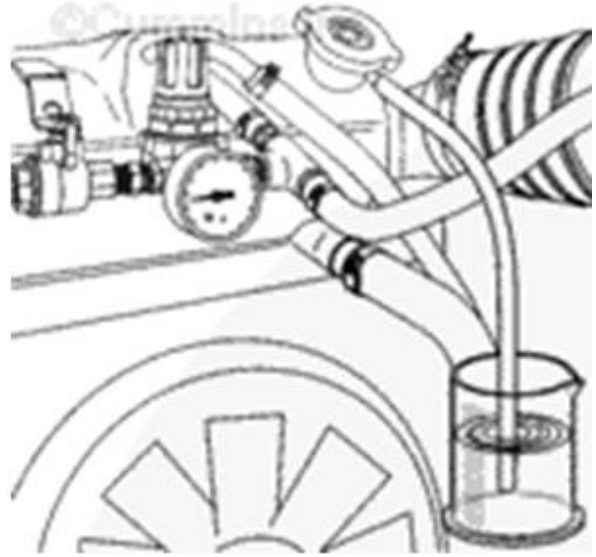
- Plugs every sensor in the intake and exhaust
- Seizes the EGR Valve
- Takes out the Turbocharger
- Can Damage Aftertreatment



Defective Radiator Caps



- **Procedure 008-047 Radiator Pressure Cap Test**
 - Test with Cap on Radiator, DO NOT REMOVE:
 - Remove Vent Line to top-tank.
 - Install T-fitting and a pressure regulator between the engine and the top tank.
 - Run hose from cap vent to container of water



Defective Radiator Caps

Working harder than ever, reducing life.



- Radiator Caps increase the cooling system pressure raising the boiling point to maximum effectiveness and thermo capacity.
- Protects against air entrainment and component cavitation.
- **008-047 Radiator Pressure Cap**
 - Test with Cap on Radiator, DO NOT REMOVE:
 - Remove Vent Line to top-tank.
 - Install T-fitting and a pressure regulator between the engine and the top tank.
 - Apply 20 psi air pressure to the cooling system. (NO MORE THEN 20psi)
 - Pressurize the cooling system slowly to the value printed on the radiator pressure cap or until bubbles can be seen in the overflow bottle.
 - Bubbles should start to form at a pressure within $-1/+2$ psi of the value printed on the radiator pressure cap, or it **must** be replaced.
 - Refer to Operation & Maintenance Manual for min. cap requirements.
 - This method allows you to check the sealing area on the top tank.



EGR Cooler Failures

What causes them?



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2. Defective Radiator Cap
3. Improper Coolant Fill Procedures

Resulting In Progressive Damage?

- Plugs every sensor in the intake and exhaust
- Seizes the EGR Valve
- Takes out the Turbocharger
- Requires cleaning the Doser Injector, 7th Injector (EcoFit)
- Can Damage Aftertreatment
- Replace CCV Filter





Radiator Caps



pressure raising the boiling point to
y.

ment cavitation.

OVE:

- Remove Vent Line to top-tank.
- Install T-fitting and a pressure regulator between the engine and the top tank.
- Apply 20 psi air pressure to the cooling system. (NO MORE THEN 20psi)
- Pressurize the cooling system slowly to the value printed on the radiator pressure cap or until bubbles can be seen in the overflow bottle.
- Bubbles should start to form at a pressure within 2 psi of the value printed on the radiator pressure cap, or it **must** be replaced.
- Refer to Operation & Maintenance Manual for min. cap requirements.
- This method allows you to check the sealing area on the top tank.

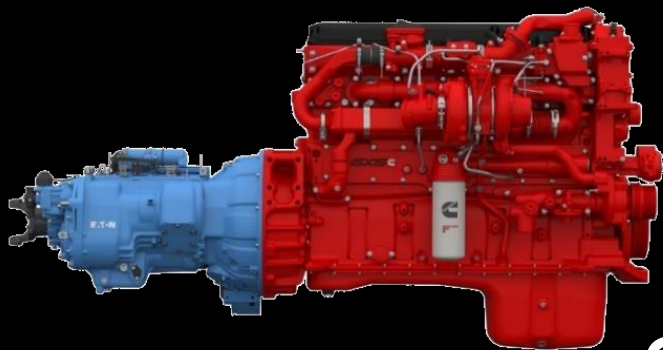
A New Era of Trucking

X15™

- Reliability – UPTIME - Top Priority
- Single Module Aftertreatment saving 100 lbs
- Fuel Economy Gains
 - Reduced Internal Parasitic Loads
- *Efficiency Series* Engines up to 500hp/1850tq
- Engine Braking Improved 50% at low rpm's
- Maintenance Cost Reduction by 25%
- Removed 7th Dosing Injector
- All Supported by 3,500 Service Dealers throughout North America.



Redefining Efficiency.



SMARTADVANTAGE
REVOLUTION

ADEPT – Advanced Dynamic Electronic Features

- Enhances vehicle efficiency by managing torque and leveraging momentum
 - SmartTorque2 (Eaton Neutral Coast)
 - SmartCoast
 - Predictive Cruise
 - Dynamic Torque
- Ordered as ‘OPTIONAL’ Equipment
- Overview Video: <https://www.youtube.com/watch?v=hoOFEHi7YIA>

ADEPT™



The American Workhorse

B6.7™

- 30+ years of North American Legacy
- 12-million engines working in-service
- Stable In-line 6 Cylinder Architecture
- Single VGT Turbocharger for all ratings
- 200-325 HP, 520-750 lb-ft Torque
- Proven in various duty cycles and across diverse applications
- New STOP-START Feature to save even more fuel
- American designed and globally embraced

The American Workhorse

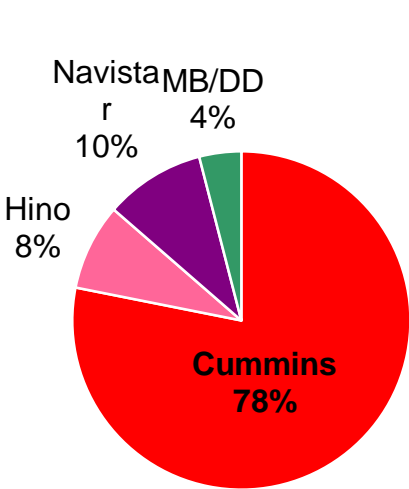


- Robust platform with over 5 million units sold
- In-line 6 Cylinder Wet-liner Inframe rebuildable
- Heavy-duty design features
- 260-380 HP, 720-1250 lb-ft Torque
- Class-leading power-to-weight ratio
- Proven in various duty cycles and across diverse applications

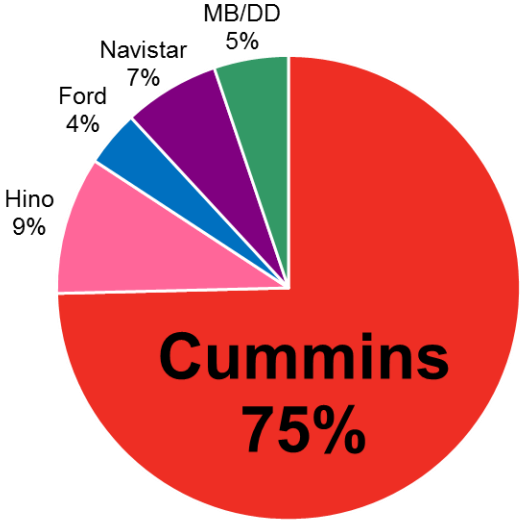
Engine Manufacturers Class 6,7, and 8 Group 1 Market Share* *(November, 2016 YTD)*



2015 Market Share (EOY)



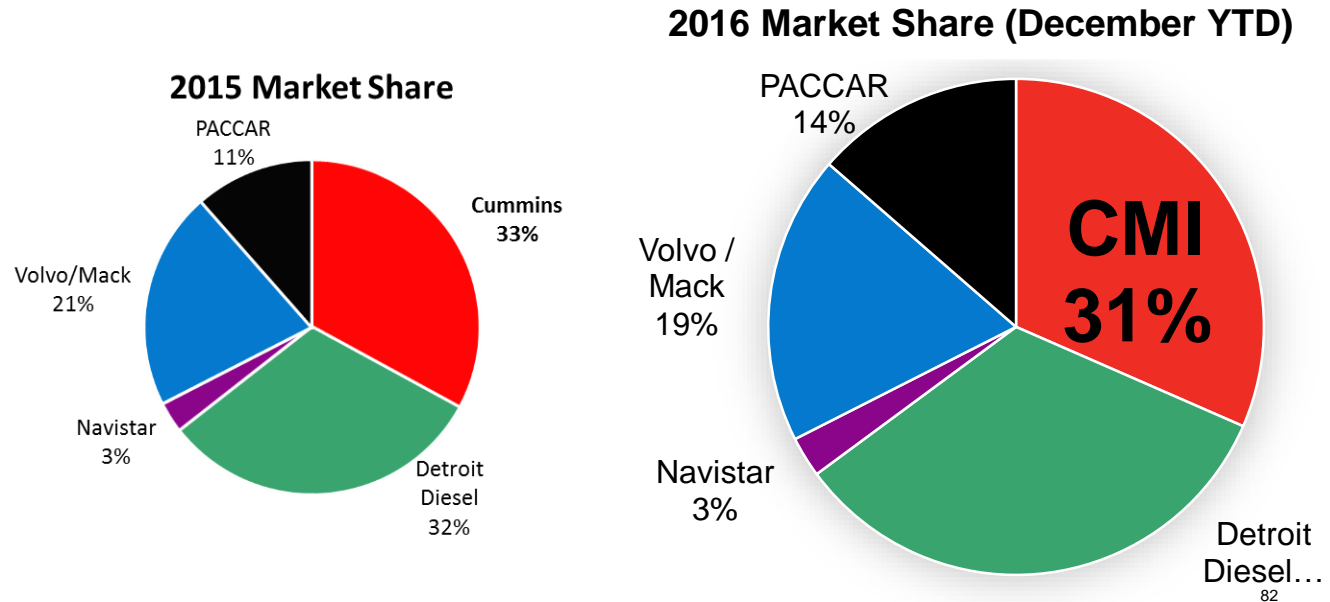
2016 Market Share November (YTD)



* Wards NA Medium Duty Market Share data (Class 6,7,8 Group 1 data) includes natural gas and diesel products, ACT historic build data and Cummins account teams data

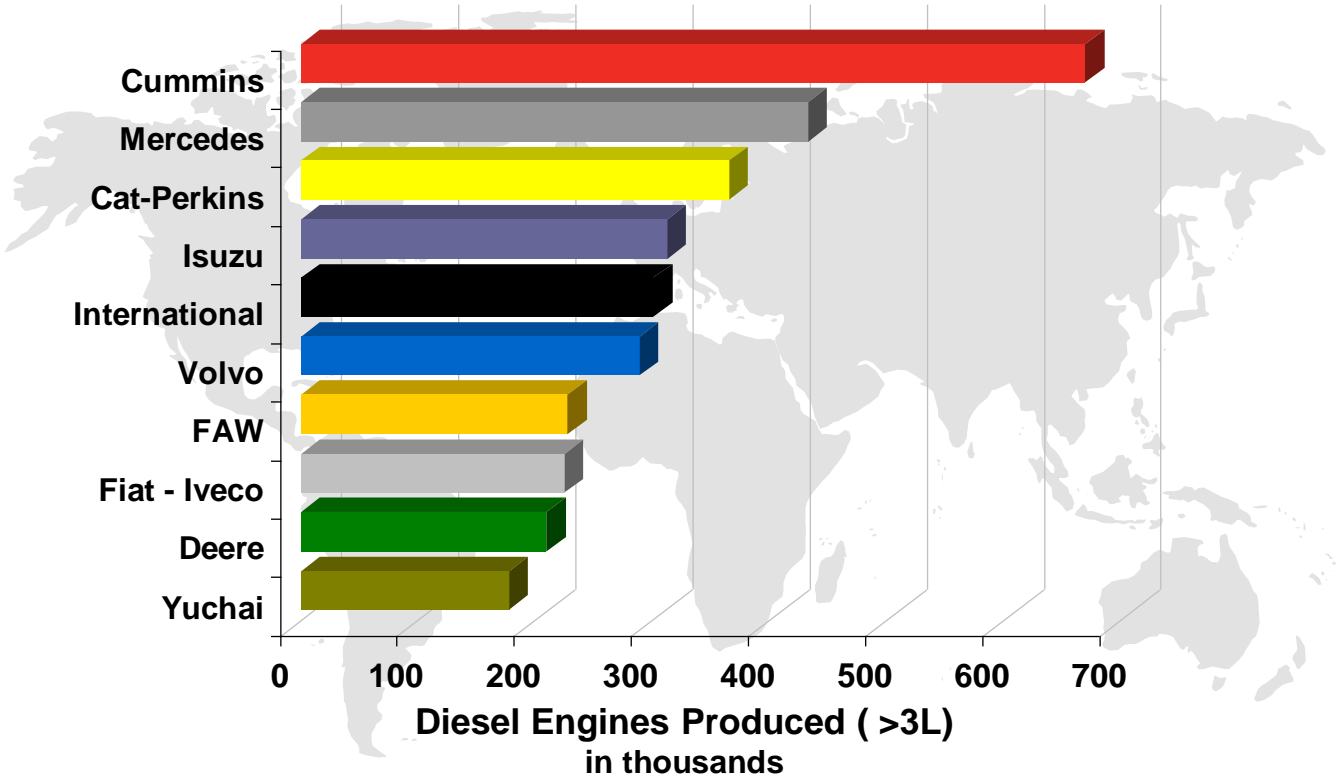


Engine Manufacturers Class 8 Market Share* *(December, 2016 YTD)*



* Wards NAFTA Class 8 Truck Shipments include diesel and natural gas products

Global Diesel Engine Production Volume Leader



4/18/2017

Source: Power Systems Research,
Cummins Confidential 2008