Diesel Aftertreatment Systems
Moderator

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Presenters

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Objectives

At the completion of this webinar, you can expect to come away with:

1. Knowledge of system operation
2. Preventive maintenance practices
3. System troubleshooting and diagnosis tips
Cummins Inc
Your Trusted Partner in Transit
Agenda

01 Cummins Transit Market Overview

02 The Power Of Choice

03 Innovation: Our Electrification Story

04 Questions
Where We’ve Come From

Particulate

- 10.7g/HP-hr
- 6.0g/HP-hr
- 4.0g/HP-hr
- 2.5g/HP-hr
- 1.2g/HP-hr
- 0.2g/HP-hr

NOx

- 5.0g/HP-hr
- 4.0g/HP-hr
- 2.5g/HP-hr
- 1.2g/HP-hr
- 0.2g/HP-hr

- 500 PPM Sulfur Diesel Fuel
- 15 PPM ULSD Diesel Fuel

- Charge Air Cooling
- Electronic Fuel System
- HPI Fuel System
- EGR & VG Turbo
- Particulate Filter
- SCR & XPI Fuel System
- OBD
Coming in 2019

Cummins Portfolio:

- B6.7™ Hybrid
- L9N™
- L9™
- BP74E

Brands: NovaBus, New Flyer, ElDorado National, Gillig
Cummins Aftertreatment System Review
2013 Multi-Module Aftertreatment

- Reduces oxides of nitrogen (NOx) and particulate matter (PM)
- Achieves near-zero emissions; maintains industry-leading fuel economy
- Diesel Exhaust Fluid (DEF) usage approximately 3-4% of fuel usage

- Cummins Selective Catalytic Reduction (SCR) Catalyst Converts NOx into harmless nitrogen gas and water vapor.
- Decomposition Reactor converts DEF into ammonia (NH₃) through hydrolysis.
- Diesel Exhaust Fluid (DEF) Dosing Valve Allows a fine mist of DEF to be sprayed into the exhaust stream of the Decomposition Reactor.
- Cummins Particulate Filter Collects and oxidizes carbon to remove PM from the exhaust.

- Electronic Controls Single Electronic Control Module (ECM) constantly adjusts engine and aftertreatment operations for peak performance and emissions control.
System Component Responsibilities

**Cummins Supplied**
- Standard Cummins Particulate Filter assembly
- Catalyzed filter, DOC elements
- V-band clamps on 3 modular sections
- ¼" insulated housing
- Standard SCR Catalyst Assembly
- SCR, AMOX catalyst elements
- ¼" insulated housing
- Inlet / Outlet Subassembly
- Decomposition Pipe w/ 2 Gasketed Marmon Flanges
- Aftertreatment DEF Controller and Line Heater Controls (CES to integrate w/ OEM)
- Aftertreatment DEF Dosing Valve
- Delta Pressure Sensor, Mounting, Tube
- NOx Sensor
- Temperature Sensors (DPF and SCR)
- Wiring harness with Common Vehicle Connectit
- Insulated Platform for Sensor Mounting
- Aftertreatment DEF Dosing Unit

**OEM Supplied**
- Turbo to CPF Assembly Downpipe
- DEF Tank
- DEF Tank Filter
- DEF Level Sensor
- DEF Temperature Sensor
- DEF Tank Heater (CES to integrate w/OEM)
- DEF Tank Heater Relay/Valve
- DEF Line Heaters
- DEF Lines to/from DEF tank to Aftertreatment DEF Dosing Unit
- DEF Line from Aftertreatment DEF Dosing Unit to Aftertreatment DEF Dosing Valve
- Coolant Lines to/from DEF Tank
- Coolant Lines to/from Doser Nozzle
- Vehicle to Aftertreatment Wiring
- Tailpipe Assembly
- Mounting Brackets/Fasteners
2013 MR System Architecture

- DEF Doser
- EGR-COOLER
- CHARGE AIR COOLER
- CM 2350 with AT Controls + DEF Doser Controls
- Air Throttle
- DEF Tank
- DEF
- SCR Catalyst
- SCR 1
- SCR 2
- AMOX
- SCR
- DOC
- DPF
- Cyclone Mixer (end inlet SCR)
- Mix
- dP+P
- NOx
- NOx
- NOx
- NOx
- = Change from 2010
2016 MR System Architecture

- New component added to the DEF Tank Header Assembly
- Supplied by OEM
- Smart component (datalink)

DEF Quality Sensor
- New component added to the DEF Tank Header Assembly
- Supplied by OEM
- Smart component (datalink)

Particulate Matter Sensor
- Supplied by Cummins
- SCR sensor table changes as part of this additional component

CM 2350 with AT Controls + DEF Doser Controls

Additional Diagnostics: DPF Feedgas

TSB150203 & TSB150152 for reference

= Change from 2015
2010 - 2016 DEF System Architecture
2010 - 2016 Bosch DEF Dosing Unit

Inlet Port (From Tank)
1. Fitting, Connector
2. O-ring (serviceable)

DEF Filter Kit
1. O-ring
2. Filter
3. O-ring
4. Equalizing Element

Electrical Connector

Return Port (To Tank)
1. Fitting, Connector
2. O-ring (serviceable)

Supply Port (to DEF Dosing Valve)
1. Fitting, Connector
2. O-ring (serviceable)
Filtration Points in DEF Circuit

- Tank Filter: 40 or 100 micron depending on equipment year
- Supply Module Main Filter: 10 micron
- Injector Inlet Filter: 40 micron
- Supply Module Inlet Filter: 100 micron
- Supply Module Backflow Filter: 100 micron
Troubleshooting Steps

DO NOT use INSITE for troubleshooting steps

• Troubleshooting steps within INSITE are not updated as regularly as other sources

DO use QSOL for troubleshooting steps

• Campaign notifications
• Fault Code Analyzer
• Updated regularly
Service and Support
Unmatched Service & Support Network

With 24/7 support in over 225 locations across North America, the Cummins service network is the most extensive in the industry.
Cummins Care

We are here to make the lives of our customers easier by providing a seamless support experience.

We help prevent issues, answer quickly, provide solutions

Cumminsengines.com is your one stop-shop for high level service, product, literature and support information. The On-Highway, Urban Bus & Shuttle section provides more specific information for transit and shuttle bus applications.

Email

Text

Phone

Text

Cummins Care is not a typical call center. We are a solutions center helping to prevent issues and provide answers quickly.
The Cummins difference

| ONE CENTURY OF POWERTRAIN FOCUS | POWERTRAIN OF CHOICE | CAPABILITIES ACROSS APPLICATIONS |
Houston Metro
Metro Facts

Houston METRO currently operates 1,236 buses. METRO is currently purchasing compressed natural gas (CNG) and clean diesel buses.

Currently, Houston METRO operates 930 Clean Diesel buses.
System Preventive Maintenance

Cummins Clean Diesel Preventive Maintenance:

**ISB**
- DPF replacement with swing unit – 5000 hours
- EGR components and port cleaning – 5000 hours
- Replace Differential Pressure Sensor – 5000 hours
- Minor Tune Up – 5000 hours / Major Tune Up – 10000 hours (turbo/SCR inspection, & injector replacement)

**ISL**
- DPF replacement with swing unit – 5000 hours
- EGR components and port cleaning – 5000 hours
- Replace Differential Pressure Sensor – 5000 hours
- Minor Tune Up – 5000 hours / Major Tune Up – 10000 hours (turbo/SCR inspection, & injector replacement)

**ISX**
- DPF replacement with swing unit – 5000 hours
- EGR components and port cleaning – 5000 hours
- Replace Differential Pressure Sensor – 5000 hours
- Minor Tune Up – 5000 hours / Major Tune Up – 10000 hours (turbo/SCR inspection, & injector replacement)
Current Common Issues

Dosing valve plugging when battery switch is turned off too quickly

Picture of plugged dosing valve
Resolved Common Issues

Dirty EGR components and ports have been remedied with 5k hour cleaning.
Frequent DPF soot loading has been remedied with 5k hour replacement of DPF with cleaned swing units.
Frequent DPF soot loading has been addressed with programmed “0” mph regens on non-SCR aftertreatment systems.
Service Procedures

5k hour DPF replacement
5K hour EGR component / port cleaning
5k hour dosing unit filter replacement
5k / 10K hour Tune Up
Service Procedures

DPF Cleaning Procedures:

Steps of the DPF pneumatic cleaning, vacuum testing, and/or baking and retesting (with pictures)
RTD Denver
RTD Facts

- Cold Side EGR Valve
- Very poor duty cycle
- Frequent Plugging of EGR and DPF
- 96000 mile EGR CCO

- Hot Side EGR valve
- Highway duty cycle
- Less plugging of EGR & DPF, causes intermittent problems
- 150000 mile EGR CCO
Common Failures

EGR related components on both a ISL9 and ISX12
Typical Repairs

ISL9 Intake Horn

ISX12 EGR Valve
Logical Troubleshooting Steps

ISL 9 EGR Valve and Intake Horn Bottom View
Summary