Cummins ISL-G

Webinar
Moderator

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Objectives

Participants on today’s webinar will learn how to:
• Identify Maintenance Procedures
• Examine components to meet specifications
• Perform maintenance practices to OEM specifications
Related APTA Standards

- APTA BTS-BMT-RP-008-16: Training Syllabus to Instruct Bus Technicians on EPA Emissions Standards and Treatment Technologies

For additional resources visit: http://www.apta.com/resources/standards/bus/Pages/default.aspx
Fleet Facts

**Metro**
- 2400+ Buses in service
  - 2300 ISL-G
  - 100 L Gas Plus
- Revenue Miles $\approx 90$ million per year

**Omnitrans**
- 187 Fixed Route Coaches
- 22 Cummins 8.3 C+
- 43 8.1 John Deere HFN04
- 122 8.9 Cummins ISL G
- Service area of 456 sq. miles with just over 9 million miles run per year.
Operating Parameters

• Maximum Horsepower 320 HP
• Peak Torque 1000 LB-FT
• Governed Speed 2200 RPM
• Engine Displacement 540 CU IN 8.9 LITERS
• spark-ignited, in-line 6-cylinder, turbocharged, CAC
• Fuel Type CNG/LNG/RNG Methane number75 or greater
• Aftertreatment Three-Way Catalyst (TW
The control system for the ISL-G engine is a closed loop control system. The electronic control module controls the throttle plate and fuel control valve to provide the correct fueling and spark timing.

The ISL-G engine through the years has been built with several potential sensor configurations and terminology variances.

Ensure that you are using the latest software version to correctly interact with control system.
Control System Components

- Mixer Inlet Pressure
- Throttle Plate
- Wastegate Control Valve
- EGR Pressure Sensor
- EGR Valve
- Ignition Control Module
- Secondary Fuel Pressure Regulator and Intake Manifold Pressure
- Secondary fuel pressure/temp sensor
- Fuel Shut-Off Valve
- Gas Mass Flow Sensor
- Engine Control Module
- Engine Oil Pressure
- Camshaft Speed Sensor
- Knock Sensor #2
- Crankshaft Speed Position
- Fuel Control Valve
Control System Components

- EGR Crossover Tube
- Engine Coolant Temp
- Ignition Coil
- Mass Air Flow Sensor
- EGR Valve
- Crankcase Breather
- Knock Sensor
- EGR Cooler
Ignition System

Capacitive discharge system.

- The ICM (Ignition Control Module) steps 12V input and steps up to 250-300V to the primary side of the coil.
EGR System

- The EGR system is responsible for re-circulating metered exhaust gas back into the combustion chamber.
  - This is done to cool down the chamber temperature by introducing inert gas.
  - Nitric Oxides emissions are formed when engine chamber temperatures rise above 2500° F. Keeping the chamber cool reduces NOx emission.
- System Components: EGR valve, cooler, flow and temperature sensors.
EGR Cooler

• The cooler cools the exhaust gas before it’s recirculated into the intake manifold. This assist in reducing the combustion chamber temperature.

• The cooler circulates engine coolant through the EGR as a heat exchange medium.

• Currently there are two styles in use.
  • Horizontal Plate – square style (illustration 1)
  • Circular style (illustration 2)
Spark Plug R&R Procedure

Removal:
• Do not wiggle coil brackets when removing coils – remove straight up
• Remove spark plug with a magnetic socket
• Blow-Out Spark Plug cavity
Spark Plug R&R Procedure

Installation:

• Check Plug Gap – do not adjust/do not install if out of gap

• Prior to installation spark plug must be cleaned with alcohol pad or swab. Dirt, oil, and fingerprints reduce the seal strength between the spark plug boot and the porcelain causing reduced spark plug life.
Spark Plug R&R Procedure

Installation:

• Remove old boot from coil extension
• Inspect coil for cracks or evidence of arcing
• Clean coil extension
• Install new spark plug boots to coils, new boots come with dielectric grease from the factory. If boots do not have dielectric grease, apply a small amount.
Spark Plug R&R Procedure

Installation:

• Install new spark plugs using clean magnetic spark plug socket.

• Torque spark plug to 28 ft-lb (35 Nm).
  • Failure to torque spark plugs will result in engine misfire and premature spark plug failure.
  • Proper torque aids in heat dissipation.
Acceptable Spark Reuse - Cummins

Consult Cummins Quikserve for latest TSB's
Not-Acceptable Spark Reuse - Cummins

Consult Cummins Quikserve for latest TSB’s
Valve Adjustment Procedures

General Knowledge: valve adjustments are a critical part of the preventive maintenance and the bus repair process. During the procedure; keep in mind:

• Engine should be at 140⁰ F or less.
• Check valve height – valve may recess into head causing performance complaints
• Check the rocker shafts for wear – this may cause the rocker to bind
Valve Adjustment Procedure

Overlap Method:

1. Rotate engine until valve overlap is reached on cylinder #6. Valve overlap is when both the intake and exhaust valves are opened at the same time. You will notice that as the exhaust valve is closing the intake valve starts to open. Valve overlap occurs for about 15° of crankshaft rotation.
Valve Adjustment Procedure

Overlap Method:

2. With valve overlap on #6, cylinder #1 will be on TDC.
   • Both intake and exhaust rockers will be loose indicating valves are closed.

3. Make a reference mark on the crank pulley and timing cover in preparation for next step.
Valve Adjustment Procedure

Overlap Method:
4. Adjust valves as shown below.
Valve Adjustment Procedure

Adjustment Specs:
Intake: .014 in. Exhaust: .030 in.

During the adjustment, keep in mind to:
• Keep medium drag on the feeler gauge to complete adjustment.
• Tight valves will cause performance issues.
• Loose valves will cause noise and performance issues.
• Recheck lash after tightening adjuster screw.
Valve Adjustment Procedure

Overlap Method:

6. After adjusting valves on valve overlap on cylinder #6, rotate the engine a full revolution 360°. Align the previously made reference marks. Cylinder #1 is now in overlap and cylinder #6 at Top Dead Center (TDC).

7. Adjust valves 2E 3l, 4E, 5l, 6l and 6E.
Valve Adjustment Procedure –

Rocker Shafts – it is recommended to perform a rocker assembly inspection. *(requires removal of rocker assemblies)*

- Remove and mark the pedestals and rocker lever assemblies one at a time. Inspect for cracks and excessive wear on the shafts. Check for scoring and or binding. – replace assembly if found. The rocker arm should move freely on the rocker shaft.
- Inspect the rocker lever pedestal and rocker lever shaft for cracks.
Valve Adjustment Procedure

Receded Valves:

A- Inspect the valve stems for height variations. Valves that are sticking out too far indicate the valve has receded into cylinder head.

B- Using a straight edge, look for the valve stems to be NO more than 3/16” higher than others. If valves are found to be high; replace the cylinder head. Recessed valves cause performance issues that may include low power and a CEL.
Steel Piston Conversion

• New piston design for improved durability
• In-frame replacement
  • Cummins sells as complete overhaul kit
• Needs new calibration
• Needs emissions decal
EGR Cooler Carbon

- New EGR Cooler longevity is now showing the typical carbon buildup of EGR coolers
- Causes trouble codes for EGR cooler temperature
- Cummins recommends cleaning the carbon buildup
Maintenance Concerns
Past Issues

• EGR Cooler
  • Leaks
  • 3 Generations

• Aluminum Piston
  • Melting/Cracking
  • Steel Conversion
  • Cummins Quikserve has developed a picture library of damage piston and possible causes.
Past Issues

• Ignition Control Module
  • High failure rate – caused misfire codes
  • Susceptible to voltage and ground fluctuations

• Collateral Damage
  • Turbo, spark plugs, 02 sensor, catalyst
Current Issues

• EGR Cooler-
  • carbon accumulation

• Coolant Level Sensor – OEM
  • Plastic vs. Steel
  • Harness contamination due to coolant leakage
Training
Troubleshooting and Diagnostics

- Insite
  - Quickserve
- EDS
  - Use as backup troubleshooting method
- Work Orders
  - Need technician notes to assist expediting repairs
Troubleshooting and Diagnostics

• Tune-Up Procedures
  • Valve Adjustments
    • Procedures
    • Engine temperature
  • Spark Plug Replacement
    • Cleanliness
    • Proper torque

• Calibrations
  • De-rate Program
    • Minimize piston damage
Summary
The Future of CNG

• ISL-G Near Zero Engine = L9N
  • Omnitrans will be retrofitting its older coaches
    • All new bus buys will have the near zero installed
  • LA Metro current bus orders will have near zero installed
    • 295 El Dorado Buses
  • LA Metro currently installing as replacement engine during midlife
    • 400+ engines on procurement
• LA Metro moving to 100% Electric Vehicle Fleet
  • The Goal is 2030
  • Contracts for 100 Electric buses have been awarded
Any Questions?

Please e-mail the questions to standards@apta.com

The APTA Brake and Chassis Work Group and the APTA Bus Standards Committee would like to thank you for joining our Webinar.

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