Tier 4 Maintenance & Troubleshooting Workshop

The Rental Show

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Tier 4 Workshop

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Electronic Sensors

- DPF inlet exhaust temperature sensor
- DPF inside exhaust temperature sensor
- DPF differential pressure sensor
- Exhaust temperature sensor
- EGR pressure sensor
- Cooling water temperature sensor
- Cam speed sensor
- Pump discharge control valve
- Fuel temperature sensor
- Crank rotation sensor
- New air temperature sensor
- EGR temperature sensor
- Intake temperature sensor
- Rail pressure sensor

Sensor Layout Naturally Aspirated

- NA engine
- Intake pressure
- Intake temperature sensor
- EGR pressure sensor
- Intake air temperature sensor
- EGR\%/V
- Air Cleaner
- DPF inside temperature sensor
- DPF inlet temperature sensor
- DPF differential pressure sensor
- EGR gas temperature sensor
- EGRVC
- DOC
- SF
Sensor Layout Turbocharged

Crank Speed Sensor

Part No. 129A00-21710
Sensor installation tightening torque 8 ± 2 N-m
Electromagnetic Sensor

Pulsar ring has 58 teeth with a gap missing at Top Dead Center

Pulsar ring is pressed onto the flywheel

Cam Position Sensor

Part No. 129A00-14710
Sensor installation tightening torque 8 ± 0.5 N-m
Camshaft Pulsar ring

New Air Temperature Sensor

Part No. 129A00-12711
Sensor installation tightening torque: With turbocharger 7.0 ± 1.4 N·m
Without turbocharger 3.5 ± 0.5 N·m
EGR Temperature Sensor

Part No. 129A00-13751
Sensor installation tightening torque: 14 ± 3 N·m

Intake Manifold Temperature Sensor

Part No. 129A00-12720
Sensor installation tightening torque: 14 ± 3 N·m
Fuel Temperature Sensor

Part No. 129A00-51200
Sensor installation tightening torque 28 ± 2 N·m

(Suction) Pressure Control Valve (MPROP)
**Coolant Temperature Sensor**

Part No. 129927-44900  
Sensor installation tightening torque  22 ± 2 N·m

**DPF Temperature Sensor**

Part No.  
DPF Inside 129C00-13950  
DPF Inlet  129C00-13940  
Sensor installation tightening torque  40 ± 7.5 N·m
Exhaust Temperature Sensor

Part No. 129A00-13760 (Main)
Sensor installation tightening torque 32.5 ± 7.5 N·m

Rail Pressure Sensor

Part No. 129A00-57100
Sensor installation tightening torque 95 ± 5 N·m
EGR Pressure Sensor

Part No. 129A00-12703
Sensor installation tightening torque 7 ± 1.4 N·m

DPF Differential Pressure Sensor

Part No. 129A00-17702
Sensor installation tightening torque 7 ± 1.4 N·m
Accelerator (Throttle) Position Sensor

The only block grounded sensor

Oil Pressure Sensor (Switch)
Atmospheric Sensor

DPF Diesel Particulate Filter
Diesel Oxidation Catalyst (DOC)
Convert hydrocarbons and carbon-monoxide into hydrogen dioxide and carbon dioxide

\[
2CO + O_2 \rightarrow 2CO_2 \\
(HC) + O_2 \rightarrow CO_2 + H_2O 
\]

Trap particulate matter (PM) – Soot Filter (SF)

DPF = DOC + SF

DPF Regeneration

Five methods of DPF Regeneration
1. Self Regeneration
2. Assist Regeneration
3. Reset Regeneration
4. Stationary Regeneration
5. Recovery Regeneration (Option)
### Self Regeneration

- **Self Regeneration**
  - **Regeneration without ECU intervention**
    - The engine is operated at high speed and/or high load, the exhaust temperature rises and PM is continuously combusted and eliminated.

### Assist Regeneration

- **Assist Regeneration**
  - **Regeneration with the use of assistance device (e.g. Intake Throttle)**
    - When the differential pressure in the SF inlet/outlet in the DPF rises, the differential pressure sensor installed in the DPF detects the increase.
    - ECU commands the intake throttle to close the throttle to allow the minimum amount of intake air necessary to run the engine.
    - The ECU also controls the regeneration by performing after-injection to increase the exhaust temperature.
    - EGR is commanded to closed.
  - **No operator input is required and no indicator lights will come on.**
## Reset Regeneration

- **Reset Regeneration**
  - Regeneration with the combined use of Assist Regeneration and Post-Injection (fueling on the exhaust stroke)
    - 50 hours after the initial operation and every 100 hours thereafter, reset regeneration will be performed to increase exhaust temperature and burn off particulate matter
    - If ECU detects high levels of particulate matter that is not reduced by assist regeneration, the ECU will command Reset Regeneration
  - No special operation is required from the operator
  - High Exhaust Temperature lamp will be illuminated
  - May notice change in exhaust tone and smell

## Stationary Regeneration

- **Stationary Regeneration**
  - Regeneration that requires the machine to be parked so the ECU can control the engine speed and fuel injection
    - If ECU detects high levels of particulate matter that is not being reduced by other regeneration methods, it will request a stationary regeneration
    - May be requested if engine is operated at low speeds or loads continuously
    - Is required when replacing certain sensors or components
  - Requires the following conditions to be met to begin:
    - Engine speed at low idle
    - Interlock in correct state (i.e. parking brake)
    - Engine temperature above 60°C or 15 min. of engine operation
Recovery Regeneration

- Recovery Regeneration (option)
  - Longer regeneration process than Stationary Regeneration and lower temperature
    - The DPF can not be regenerated by Reset or Stationary regeneration when excessive particulate matter is accumulated
    - Engine has entered Limp-Home (backup) mode
    - Can last up to 4 hours

Example – Control Panel Indicators

[Diagram showing control panel indicators for engine status, including preheat, oil pressure, engine coolant temperature, and regeneration request.]
DPF Maintenance:

- **DOC:**
  - No maintenance required – Replace at 9000 hours
- **Soot Filter**
  - With DPF Cleaning Alarm – Clean when alarm notification occurs
  - Without DPF Cleaning Alarm – Clean at 6000 hours

### DTC related to Regeneration Request

<table>
<thead>
<tr>
<th>DTC</th>
<th>Speed Limit</th>
<th>Power Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1421</td>
<td>None</td>
<td>85% then 50% after 2 hours</td>
</tr>
<tr>
<td>P1424</td>
<td>Max Torque Speed + 200 RPM</td>
<td>85% then 50% after 15 min</td>
</tr>
<tr>
<td>P1463</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2463</td>
<td></td>
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</tbody>
</table>

**Stationary Regeneration Required:**
- **Causes:**
  - 3 hours with Reset in standby (inhibit switch on or DOC<250°C)
  - PM level too high

**Back-up mode, Recovery Regeneration or Soot filter exchange by SA-D required:**
- **Causes:**
  - 10 hours without performing stationary regeneration
  - PM level greater than or equal to threshold level

**P method reached threshold level**

**C method reached threshold level**