

<b>Technical Service Bulletin Number</b>
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TSB140168
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## Technical Service Bulletin

### Subject

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New Cummins® Service Tool Fuel Return Hose and Updated Procedure for ISX and QSX Engines with Common Rail Fuel Systems

### Warranty Statement

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The information in this document has no effect on present warranty coverage or repair practices, nor does it authorize TRP or Campaign actions.

### Contents

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This document announces a new Cummins® service tool fuel return hose and updated service manual procedure.

#### Product Affected

- ISX12/ISX11.9 CM2250
- ISX12 CM2350 X102
- ISX15 CM2250
- ISX15 CM2250 SN
- ISX15 CM2350 X101
- QSX11.9 CM2250 ECF
- QSX15 CM2350 X105
- QSX15 CM2250 ECF
- QSX15 CM2350 X106
- PowerGen QSX15 CM2250
- PowerGen QSX15 CM2250 ECF

#### Reason for Change

To decrease the occurrence of falsely identifying leaking fuel pressure relief valves.

### Service Tools Available

To complete the fuel pressure relief valve return flow measurement at the fuel rail, a new Cummins® service tool has been released. Cummins® service tool, fuel return hose, Part Number 5299319, **must** be used to perform the fuel pressure relief valve return flow measurement.

### Publications Affected

The fuel pressure relief valve return flow test has been revised to state that the fuel pressure relief valve return flow should be measured at the fuel rail and **not** at the fuel drain manifold.

Measurement of the fuel pressure relief valve return flow at the fuel drain manifold is acceptable if there are accessibility issues. If the fuel pressure relief valve return flow is measured at the fuel drain manifold and the fuel flow is found out of specification, the fuel pressure relief valve return flow measurement **must** be repeated at the fuel rail.

The following procedures have been revised:

- For ISX12/ISX11.9 CM2250 Service Manual, Bulletin 2883445. [Refer to Procedure 005-236 in Section 5.](#)
- For ISX12 CM2350 X102 Service Manual, Bulletin 4310646. [Refer to Procedure 005-236 in Section 5.](#)
- For ISX15 CM2250 Service Manual, Bulletin 4022250. [Refer to Procedure 005-236 in Section 5.](#)
- For ISX15 CM2250 SN Service Manual, Bulletin 4310736. [Refer to Procedure 005-236 in Section 5.](#)
- For ISX15 CM2350 X101 Service Manual, Bulletin 4310641. [Refer to Procedure 005-236 in Section 5.](#)
- For QSX11.9 CM2250 ECF Service Manual, Bulletin 2883561. [Refer to Procedure 005-236 in Section 5.](#)
- For QSX15 CM2350 X105 Service Manual, Bulletin 4332667. [Refer to Procedure 005-236 in Section 5.](#)
- For QSX15 CM2250 ECF Service Manual, Bulletin 2883557. [Refer to Procedure 005-236 in Section 5.](#)
- For QSX15 CM2350 X106 Service Manual, Bulletin 4332712. [Refer to Procedure 005-236 in Section 5.](#)
- For PowerGen QSX15 CM2250 Service Manual, Bulletin 4310664. [Refer to Procedure 005-236 in Section 5.](#)
- For PowerGen QSX15 CM2250 ECF Service Manual, Bulletin 4310661. [Refer to Procedure 005-236 in Section 5.](#)

## Document History

Date	Details
2014-12-1	Module Created
2015-9-25	Non-Product Problem Solving (PPS)

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**Last Modified: 01-Oct-2015**

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## 005-236 Fuel System Diagnostics

### General Information

#### **WARNING**

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

#### **WARNING**

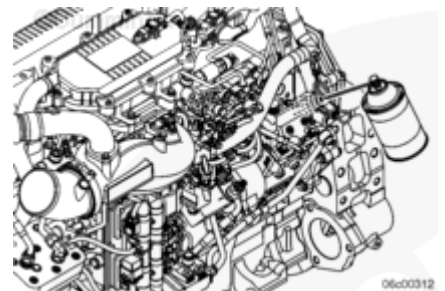
When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

#### **CAUTION**

Clean all fittings before disassembly. Dirt or contaminants can damage the fuel system.

#### **CAUTION**

Hold banjo fittings while tightening the banjo bolt to prevent fitting rotation. Allowing the banjo fitting to rotate may damage the fuel line.



Before servicing **any** fuel system components, (such as fuel lines, fuel pump, injectors, etc.) which would expose the fuel system or internal engine component to potential contaminants prior to disassembly, clean the fittings, mounting hardware, and the area around the component to be removed. Dirt or contaminants can be introduced into the fuel system and engine if the surrounding areas are **not** cleaned, resulting in damage to the fuel system and engine.

[Refer to Procedure 000-009 in Section 0.](#)

To prevent engine damage from debris or contamination, cover, cap, or plug any openings as soon as possible when servicing the fuel system. Caps and plugs can be found in Clean Care Kit, Part Number 4919073.

The following procedures are used to diagnose fuel system issues. These checks and measurements are referenced throughout the applicable troubleshooting and fault code trees as needed.

This procedure is not intended to take the place of the troubleshooting tree repair direction.

Refer to the appropriate troubleshooting symptom tree for repair direction.

**NOTE: The fuel line from the engine control module (ECM) cooling plate to the high-pressure fuel pump contains a filter screen at the high-pressure fuel pump banjo fitting. The screen must be examined and cleaned, or the banjo bolt replaced, if the screen is damaged.**

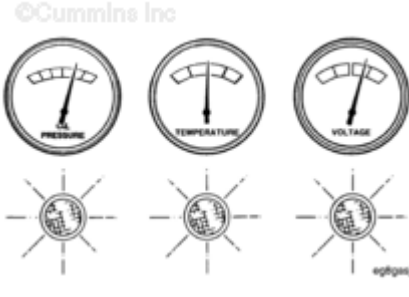


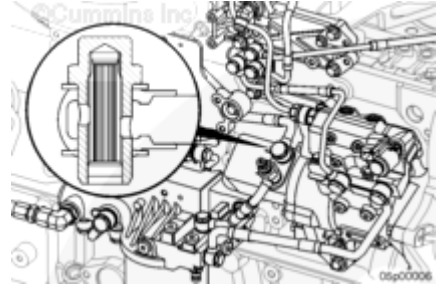
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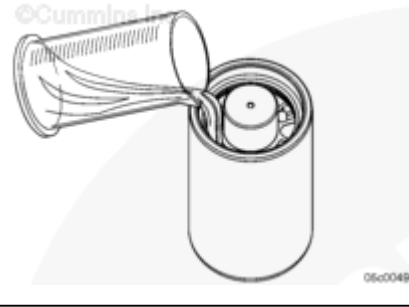
ca800wa


## Low-Pressure System Check



<p>The low-pressure system check consists of a number of measurements and checks to make sure that the low pressure fuel system is functioning properly. These checks will vary, depending on whether or not the engine will start.</p>	 <p>©Cummins Inc</p>
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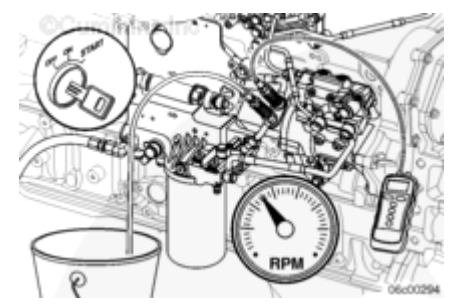
<p>The fuel line from the ECM cooling plate to the high-pressure fuel pump contains a filter screen at the high-pressure fuel pump banjo fitting. The screen <b>must</b> be examined and cleaned, or the banjo bolt replaced, if the screen is damaged.</p>	 <p>©Cummins Inc</p>
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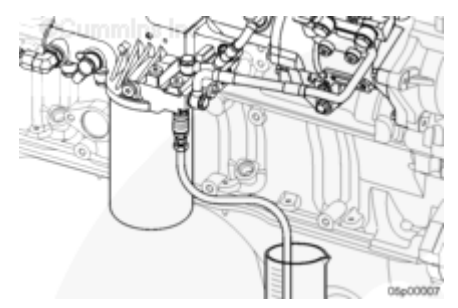
### Measurement - Engine Will Start



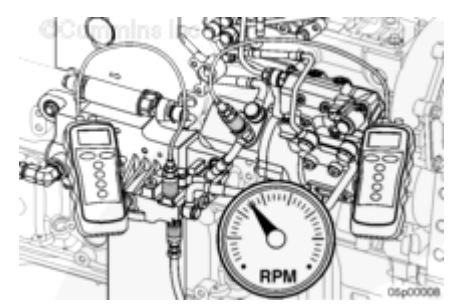
<p>Verify the fuel system has been primed. Refer to Procedure 005-234 in Section 5.</p>		 <p>©Cummins Inc</p>
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<p>Check for air in the fuel. Refer to Procedure 006-003 in Section 6.</p>		
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<p>Measure the fuel inlet restriction. Refer to Procedure 006-020 in Section 6.</p>	 	
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<p><b>Measure Fuel Pressure</b></p> <ul style="list-style-type: none"> <li>Remove the threaded plug from the outlet side of the fuel filter head and install a Compuchek™ fitting, Part Number 3100221, or equivalent.</li> <li>Install the orificed diagnostic fuel line, Part Number 3164621, at the Compuchek™ fitting.</li> </ul>	 	
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<ul style="list-style-type: none"> <li>Install a 0 to 2068 kPa [0 to 300 psi] pressure gauge at the Compuchek™ fitting at the inlet to the fuel filter head.</li> <li>Install a 0 to 2068 kPa [0 to 300 psi] pressure gauge at the Compuchek™ fitting at the outlet to the fuel filter head.</li> <li>Wait for the lift pump cycle to</li> </ul>	 	
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- complete (approximately 60 seconds).
- Operate the engine at high idle and observe the filter inlet pressure.
  - Operate the engine at high idle and observe the filter outlet pressure.

Measurements		
	kpa	psi
Fuel Filter Restriction (max)	69	10

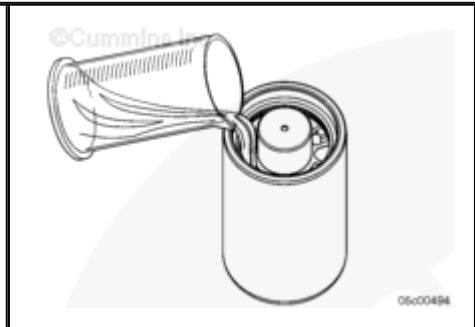
If the difference between the filter inlet pressure and filter outlet pressure is greater than the specification, replace the fuel filter.

Operate the engine at high idle and observe the fuel gear pump pressure at the fuel filter inlet.

Measurements		
	kpa	psi
Gear Pump Pressure at High Idle (min)	1000	145

**Measurement - Engine Will Not Start**

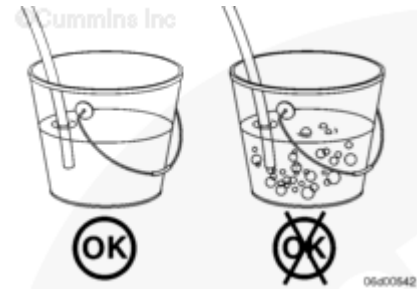
Verify the fuel system has been primed. Refer to Procedure 005-234 in Section 5.



Check for air in the fuel. Refer to



Procedure 006-003 in Section 6.

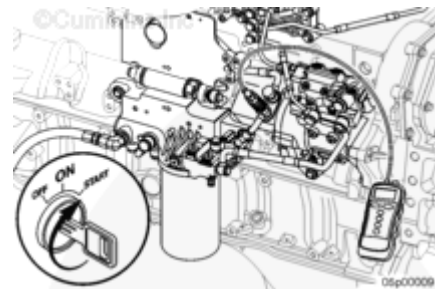


Install a 0 to 207 kPa [0 to 30 psi] pressure gauge at the Compuchek™ fitting at the inlet to the fuel filter head.

Turn the keyswitch to the ON position to active the lift pump. Repeat this action, if necessary.

Measure the fuel lift pump pressure

Measurements		
	kpa	psi
Fuel Lift Pump Pressure (min)	69	10

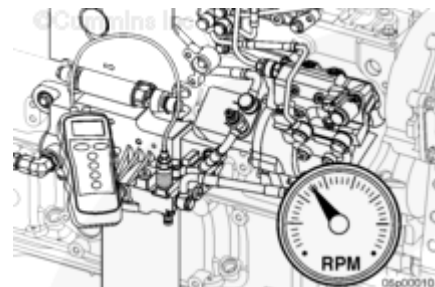


Install a 0 to 207 kPa [0 to 30 psi] pressure gauge at the Compuchek™ fitting at the inlet to the fuel filter head.

Disconnect the lift pump electrical connector, if equipped.

Crank the engine and observe the fuel gear pressure.

Measurements		
	kpa	psi
Gear Pump Pressure While Cranking at a	69	10



Minimum of 150 rpm  
for 10 seconds (min)

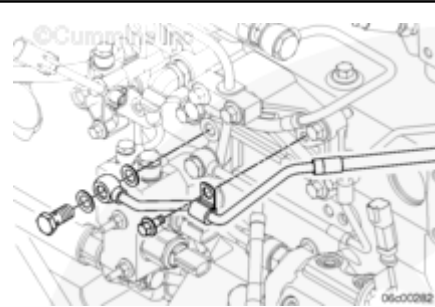
### Fuel Drain Line Restriction

#### CAUTION

Hold banjo fittings while tightening the banjo bolt to prevent fitting rotation. Allowing the banjo fitting to rotate may damage the fuel line.

Measure the fuel drain line restriction. Refer to Procedure 006-012 in Section 6.

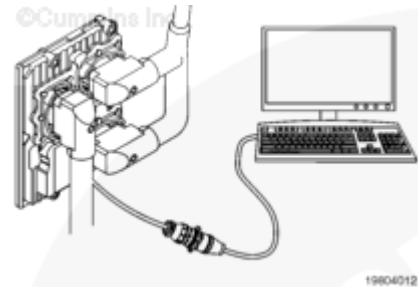
**NOTE:** Engines with excessive return restriction in the high-pressure fuel pump return circuit may also display Fault Code 1911. This fault code is a result of the fuel pressure relief valve coming open.



### High-Pressure System Leak Down Test

**NOTE:** This test can not be performed if the engine will not start.

- Connect INSITE™ electronic service tool.
- Operate the engine.
- Perform INSITE™ electronic service tool Fuel System Leakage Test.
- Monitor the fuel rail pressure. Fuel rail pressure will rise and stabilize. This could take up to 5 minutes.
- Shut the engine OFF and wait for it to completely stop.



- Turn the keyswitch ON quickly.
- Record the Fuel Rail Pressure Measured value.
- Monitor for 30 seconds.
- Record the Fuel Rail Pressure Measured value again.
- Subtract the second measured value from the first measured value.
- A decay in fuel pressure greater than 1500 bar [21776 psi] in 30 seconds is an indication of a high-pressure fuel system leak.
- Reference the appropriate troubleshooting symptom tree for repair direction.

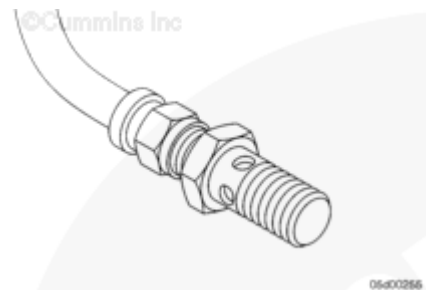
## High-Pressure Fuel Pump Return Flow Test

### Initial Setup



Hold banjo fittings while tightening the banjo bolt to prevent fitting rotation. Allowing the banjo fitting to rotate may damage the fuel line.

**NOTE:** If the unit is equipped with an air bleed fuel transfer tube, it must be removed from the engine prior to performing the High-Pressure Fuel Pump Return Flow Test. Use the following procedure to identify the air bleed fuel transfer tube. Refer to Procedure 200-001 in Section F. Use Part Number 3678921 from the fuel system service tools kit to plug the outlet of the fuel filter head. Attach the

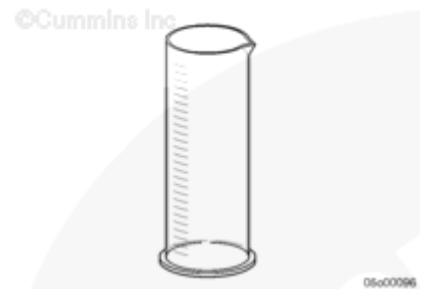


**banjo flow adapter fitting to the high-pressure fuel pump return line. Use the following procedure for the torque value during installation of the air bleed fuel transfer tube. Refer to Procedure 006-013 in Section 6.**

Return fuel is routed from the injectors, the fuel rail pressure relief valve, and the fuel pump head through three different drain lines. Measurement of fuel injector leakage requires the use of a fuel return hose, Part Number 3164618. The fitting has a closed end, four holes in the smooth section near the hex, and a male threaded section that attaches to the flexible hose.

The tool is used to isolate the leakage from just the fuel pump, so it can be measured with a graduated cylinder.

Obtain a graduated cylinder that is marked in cubic centimeters. Use graduated cylinder, Part Number 4919139, or equivalent.

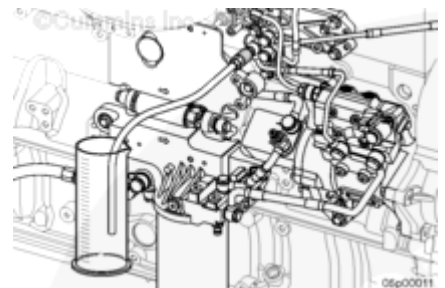


Remove the banjo bolt from the fuel pump head drain line at the fuel drain manifold.

Install the banjo flow adapter fitting, Part Number 3164618, at the fuel drain manifold.

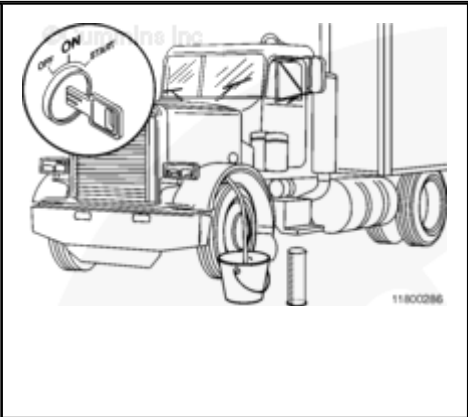
Route the hose into a collection device.

Use graduated cylinder, Part Number 4919139, for measurement when directed.

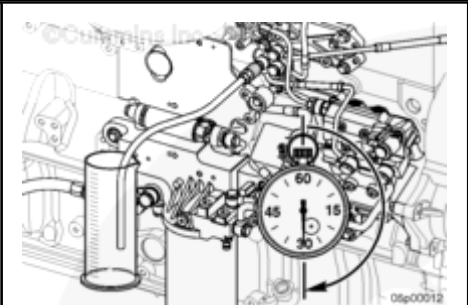


**Measurement - Engine Will Start**

- Close the engine cover while performing this measurement.
- Operate the engine until it is at operating temperature.
- Allow the engine to idle with fuel flowing into a collection device (bucket).
- Perform INSITE™ electronic service tool Fuel System Leakage Test.
- Monitor the fuel pressure rise on the screen.
- Allow the pressure to stabilize and create a steady stream of flow. This could take up to 5 minutes.



- Move the banjo flow adapter line from the collection device (bucket) to the graduated cylinder, Part Number 4919139.
- Allow fuel to flow into the graduated cylinder for exactly 30 seconds.
- Immediately return the banjo flow adapter line back to the collection device (bucket).
- Record the volume of fuel collected in the graduated cylinder. Compare it to the specification below.



Maximum Fuel Volume Measurement During High Pressure Leakage Test	
Time	ml/cc
30 seconds	450

If 450 ml/cc pump head drain flow is collected in less than 30 seconds, the fuel pump head has malfunctioned and **must** be replaced.

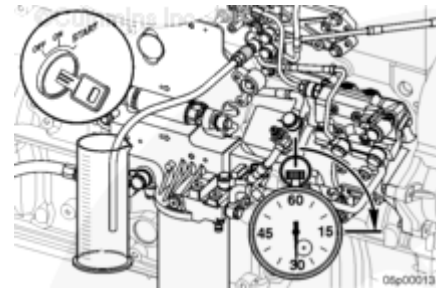
**NOTE:** This specification is valid for engines operating on diesel fuels. Low fuel viscosity will increase the leakage rate; for example, kerosene or aviation fuels will result in excessive leakage.

**Verify the fuel type being measured before replacing a fuel pump head for excessive leakage.**

**Measurement - Engine Will Not Start**

**NOTE: Do not crank the engine for 30 seconds continuously. Crank the engine in 15 second intervals with a 15 second pause between intervals. This reduces the possibility of overheating the starting motor.**

- Fuel pump diagnostic line connected at the fuel drain manifold.
- Lift pump disconnected.
- Route the hose into a collection device (bucket)
- Use graduated cylinder, Part Number 4919139, for measurement when directed.
- Close the engine cover while performing this measurement.
- Begin cranking the engine.
- Obtain a steady stream of fuel flow from the drain line.
- Move the drain line to the graduated cylinder for 15 seconds then back to the bucket.
- Stop cranking and allow the engine to rest for 15 seconds.
- Repeat the three steps above a total of two times.
- Record the amount of fuel flow from the injector drain line in 30 seconds while the engine is cranking.
- Record the volume of fuel collected in the graduated cylinder. Compare it to the specification below.



Maximum Fuel Volume Measurement During High Pressure Leakage Test	
Time	ml/cc
30 seconds	320

If 320 ml/cc pump head drain flow is collected in less than 30 seconds, the fuel pump head has malfunctioned and must be replaced.

**NOTE: This specification is valid for engines operating on diesel fuels. Low fuel viscosity will increase the leakage rate; for example, kerosene or aviation fuels will result in excessive leakage. Verify the fuel type being measured before replacing a fuel pump head for excessive leakage.**

## High-Pressure Injector Return Flow Test

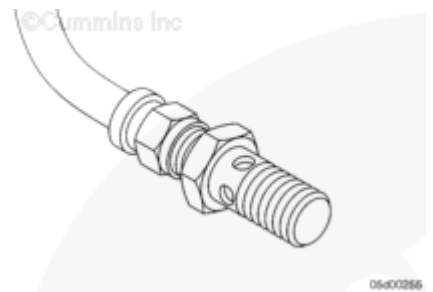
### Initial Setup


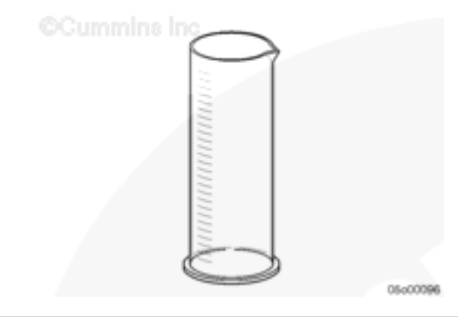




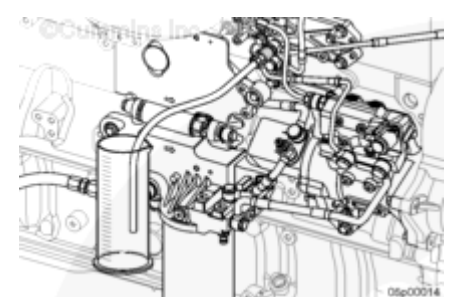
Installation of the banjo flow adapter at any place other than the fuel drain manifold can cause damage to high pressure fuel system components.

Return fuel is routed from the injectors, the fuel rail pressure relief valve, and the fuel pump head through three different drain lines. Measurement of fuel injector leakage requires the use of a fuel return hose, Part Number 3164618. The fitting has a closed end, four holes in the smooth section near the hex, and a male threaded section that attaches to the flexible hose.

The tool is used to isolate the leakage from just the injectors, so it can be measured with a graduated cylinder.



<p>Obtain a graduated cylinder that is marked in cubic centimeters. Use graduated cylinder, Part Number 4919139, or equivalent.</p>		
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<div style="border: 2px solid blue; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><b>CAUTION</b></p> </div> <p>Hold the banjo fittings while tightening the banjo bolt to prevent the fitting from rotating. Allowing the banjo fitting to rotate may damage the fuel line.</p> <p><b>NOTE: Make sure the engine is at operating temperature before beginning this test.</b></p> <ul style="list-style-type: none"> <li>• Remove the banjo bolt from the injector drain line at the fuel drain manifold.</li> <li>• Install banjo flow adapter fitting, Part Number 3164618, at the fuel drain manifold.</li> <li>• Route the hose into a collection device (bucket).</li> <li>• Use graduated cylinder, Part Number 4919139, for measurement when directed.</li> </ul>	 	
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**Measurement - Engine Will Start**

<ul style="list-style-type: none"> <li>• Close the engine cover while performing this measurement.</li> <li>• Perform INSITE™ electronic service tool High-Pressure Leakage Test.</li> <li>• Connect INSITE™ electronic service</li> </ul>		
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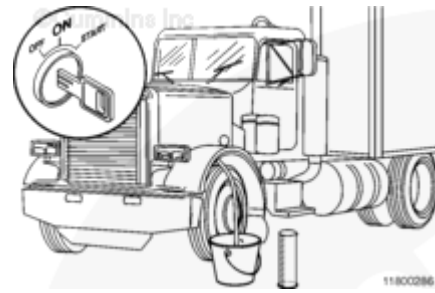


tool.

- Start the engine and allow it to idle with fuel flowing into a collection device.
- Wait for the lift pump cycle to complete (approximately 60 seconds).
- Operate engine until it is at operating temperature.
- Begin the High-Pressure Leakage Test.

**NOTE:** Make sure a steady flow of fuel is present at the drain line before beginning the measurement. Air in the line and movement of the hose during measurement can result in inaccurate measurements.

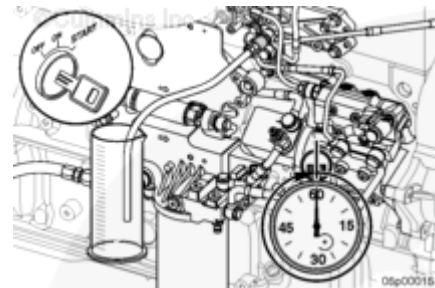
- Monitor the fuel pressure rise on the screen.
- Allow the pressure to stabilize and create a steady stream of flow. This could take up to 5 minutes.
- When fuel pressure stabilizes, allow fuel to flow into the collection device for 60 seconds.



- Move the banjo flow adapter line from the bucket to the graduated cylinder, Part Number 4919139.
- Allow fuel to flow into the graduated cylinder for exactly 60 seconds.
- Immediately return the banjo flow adapter line back to the collection device (bucket).
- Record the volume of fuel collected in the graduated cylinder. Compare it to the specification below.

Maximum Injector Return Flow Measurement	
Time	ml/cc
60 seconds	120

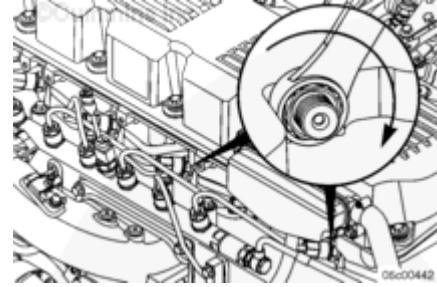
**NOTE:** Fuel temperature and fuel type will influence this measurement. For example as the engine is warmed up



and the injectors become hot, the leakage rate will increase. Also, low viscosity fuels, such as kerosene or aviation fuels, will cause the leakage rate to increase. The above specification is correct for on-highway diesel fuels, where the diesel fuel inlet temperature is less than 49°C [120°F].

- After recording the fuel leakage quantity, record the Fuel Rail Pressure Measured value.
- Stop INSITE™ electronic service tool High-Pressure Leak Test and turn the keyswitch to OFF.

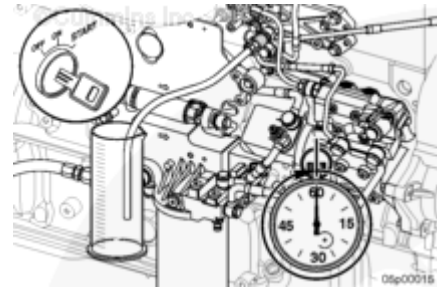
If injector drain flow is excessive, it will be necessary to isolate the injector(s) or fuel connector(s) that are damaged or worn.



### Measurement - Engine Will Not Start

**NOTE:** Do not crank the engine for 30 seconds continuously. Crank the engine in 15 second intervals with a 15 second pause between intervals. This reduces the possibility of overheating the starting motor.

- Injector drain line connected at the fuel drain manifold.
- Lift pump disconnected.
- Route the hose into a collection device (bucket)
- Use graduated cylinder, Part Number 4919139, for measurement when directed.



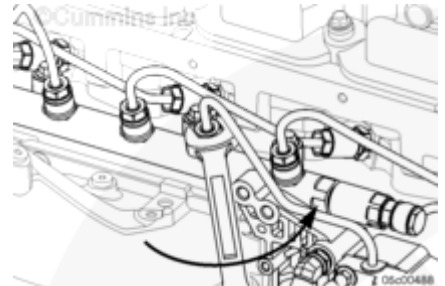
- Close the engine cover while performing this measurement.
- Begin cranking the engine.
- Begin cranking the engine until fuel exits the drain line.
- Move the drain line to the graduated cylinder for 15 seconds then back to the bucket.
- Stop cranking and allow the engine to rest for 15 seconds.
- Repeat the three steps above one more time.
- Record the amount of fuel flow from the injector drain line in 30 seconds while the engine is cranking.
- The leakage should only be a few drops.
- If injector drain flow is excessive, it will be necessary to isolate the injector(s) or fuel connector(s) that are damaged or worn.

## High-Pressure Injector Return Flow Isolation Test

### Initial Setup

#### **WARNING**

Normal engine operation creates highly pressurized fuel in the fuel line which will remain in the fuel line after engine shutdown. Never open the fuel system when the engine is operating. Before servicing the fuel system, always loosen the pump-to-rail fuel line at the rail to vent the pressure. Keep hands clear of the line when loosening. High-pressure fuel spray can penetrate the



skin, resulting in serious personal injury or death.

**NOTE:** Make sure the engine is at operating temperature before beginning this test.

Before servicing the high-pressure fuel system, loosen the pump-to-rail line at the rail, to vent the pressure.

Keep hands clear of the line when loosening the rail line.

Tighten the fuel rail nut.

**Torque Value:**

1. 47 n.m [35 ft-lb]
2. Rotate 60 degrees.

**NOTE:** A machined slot in this fitting directs the fuel spray toward the engine.

**CAUTION**

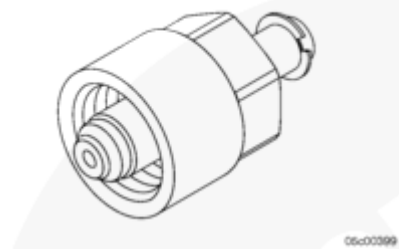
Do not install the isolation tool at the high pressure pump outlet fitting. Severe engine damage will result. This tool must only be installed at the fuel rail for the purpose of isolating the high-pressure fuel supply from individual injectors.

**CAUTION**

Make sure the keyswitch is in the OFF position (engine not operating) when loosening or tightening high-pressure fuel lines.



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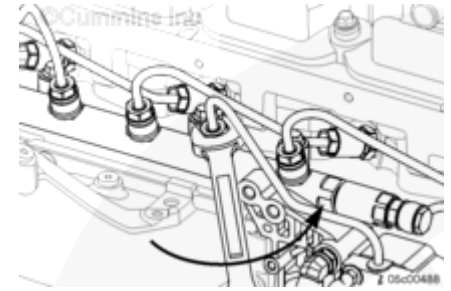
Use leak test isolation tool, Part Number 4918563, to isolate excessive fuel drain from injectors or fuel connectors.

Follow the pressure relief step (shown in the previous step) prior to every installation of the isolation tool.

Isolate the injector and fuel connector for each cylinder by installing the isolation tool at the fuel rail in place of the high-pressure fuel line that supplies the fuel connector.

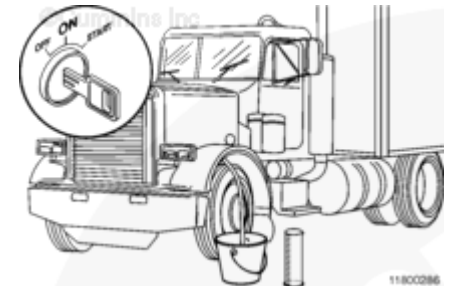
**Torque Value:**

1. 10 n.m [89 in-lb]
2. Rotate 60 degrees.



**Measurement - Engine Will Start**

- Engine at operating temperature.
- Lift pump disconnected.
- Injector drain line connected at the fuel drain manifold.
- Route the hose into a collection device (bucket).
- Use graduated cylinder, Part Number 4919139, for measurement when directed.
- Close the engine cover while performing this measurement.
- Connect INSITE™ electronic service tool.
- Start the engine and allow it to idle with fuel flowing into a collection device (bucket).
- Begin the High-Pressure Leakage Test.
- Monitor the fuel pressure rise on the screen.
- Allow the pressure to stabilize and create a steady stream of flow. This could take up to 5 minutes.



- Record the fuel rail pressure Measure Value.
- Move the banjo flow adapter line from the bucket to the graduated cylinder, Part Number 4919139.
- Allow fuel to flow into the graduated cylinder for exactly 60 seconds. Immediately return the banjo flow adapter line back to the collection device (bucket).
- Record the quantity of fuel collected in the graduated cylinder. Compare it to the specification below.

Do this up to six times; once while each injector is isolated.

**NOTE: Make sure a steady flow of fuel is present at the drain line before beginning the measurement. Air in the line and movement of the hose during measurement can result in inaccurate measurements.**

Maximum Injector Return Flow Measurement	
Time	ml/cc
60 seconds	120

- If isolating any single injector results in a significant Increase in fuel rail pressure measured or a reduction in the maximum injector return flow measurement, check or tighten that fuel connector. [Refer to Procedure 006-052 in Section 6.](#)
- Remove the isolation tool.
- Run the High-Pressure Injector Return Flow Test.
- If there is a significant increase in fuel rail pressure measured or maximum injector return flow measurement is now within specification, the leak was caused by a leaking fuel connector.



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Cylinder	Pressure	Quantity
1		
2		
3		
4		
5		
6		

05p0016

- If the leak remains, the fuel injector should be replaced.

Do this up to six times; once while each injector is isolated.

**NOTE: Make sure a steady flow of fuel is present at the drain line before beginning the measurement. Air in the line and movement of the hose during measurement can result in inaccurate measurements.**

**Measurement - Engine Will Not Start**

**NOTE: Do not crank the engine for 30 seconds continuously. Crank the engine in 15 second intervals with a 15 second pause between intervals. This reduces the possibility of overheating the starting motor.**

- Injector drain line connected at the fuel drain manifold.
- Lift pump disconnected.
- Route the hose into a collection device (bucket)
- Use graduated cylinder, Part Number 4919139, for measurement when directed.
- Close the engine cover while performing this measurement.
- Begin cranking the engine.
- Obtain a steady stream of fuel flow from the drain line.
- Move the drain line to the graduated cylinder for 15 seconds then back to the bucket.
- Stop cranking and allow the engine to rest for 15 seconds.
- Repeat the three steps above a total of four times.
- Record the amount of fuel flow from the injector drain line in 1 minute while the engine is cranking.



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Cylinder	Pressure	Quantity
1		
2		
3		
4		
5		
6		

05p00016

If isolating a single injector results in a significant decrease in the injector return flow measurement or the engine starts, check or tighten that fuel connector. Refer to Procedure 006-052 in Section 6.

Perform the High Pressure Injector Return Flow Test again. If a significant Increase in Fuel Rail pressure measured, or the leakage is now **only** a few drops, the leak was caused by a leaking fuel connector.

If the leak remains, the fuel injector should be replaced.

Do this up to six times; once while each injector is isolated.

**NOTE: Make sure a steady flow of fuel is present at the drain line before beginning the measurement. Air in the line and movement of the hose during measurement can result in inaccurate measurements.**

## Fuel Pressure Relief Valve Return Flow Test

### Initial Setup



Installation of the banjo flow adapter at any place other than the fuel drain manifold can cause damage to high pressure fuel system components.

Return fuel is routed from the injectors, the fuel rail pressure relief valve, and the fuel



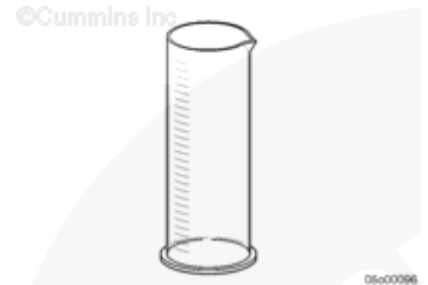
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pump head through three different drain lines. Measurement of fuel injector leakage requires the use of a fuel return hose, Part Number 5299319.

The tool is used to isolate the leakage from just the fuel pressure relief valve, so it can be measured with a graduated cylinder.

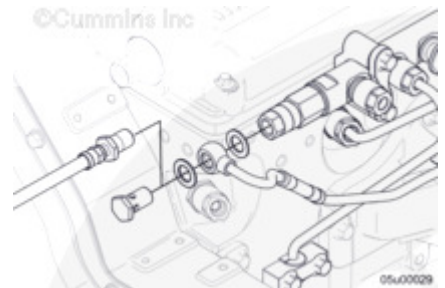
Obtain a graduated cylinder that is marked in cubic centimeters; example: graduated cylinder, Part Number 4919139, or equivalent.



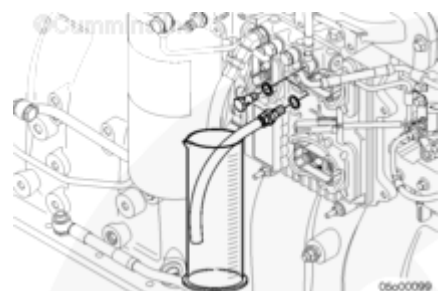
Remove the banjo bolt from the drain line at the fuel pressure relief valve.

Install banjo flow adapter fitting, Part Number 5299319, at the fuel pressure relief valve.

Route the hose from this adapter to a collection device.



- Alternatively, fuel return hose Part Number 3164618, can be installed at the fuel drain manifold.
- If the fuel rail return flow does **not** meet the specification when checking at the fuel drain manifold, then measure the fuel rail return flow at the fuel rail pressure relief valve, **not** at the fuel drain manifold.
- If the fuel rail return flow does **not** meet specification at the fuel rail pressure

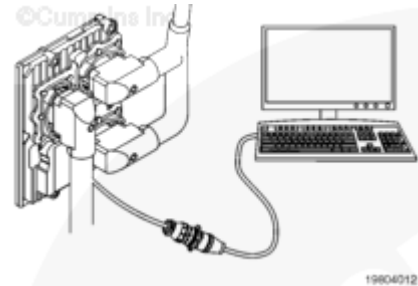


relief valve, then a malfunctioning fuel rail relief valve has been detected.

### Measurement - Engine Will Start

- Engine at operating temperature.
- Fuel Pressure Relief valve line connected at the fuel pressure relief valve.
- Route the hose into a collection device (bucket).
- Use graduated cylinder, Part Number 4919139, for measurement when directed.
- Close the engine cover while performing this measurement.
- Connect INSITE™ electronic service tool.
- Start the engine and allow it to idle with Fuel Pressure Relief valve line in a collection device (bucket).
- Perform INSITE™ electronic service tool High-Pressure Leakage Test.
- Monitor the fuel pressure rise on the screen.
- Allow the pressure to stabilize. This could take up to 5 minutes.
- Move the Fuel Pressure Relief valve line to a graduated cylinder, Part Number 4919139,
- Allow fuel to flow into the graduated cylinder for 60 seconds.
- The leakage must be less than 10 drops per minute.
- Replace the Fuel Pressure Relief Valve if leakage is greater than 10 drops in 60 seconds.

**NOTE: If Fault Code 449 or 2311 is active, do not replace the fuel pressure relief valve without first determining the cause of the fault condition. Use the appropriate fault code troubleshooting tree in Section TF, in the Fault Code Troubleshooting Manual, Bulletin 4022225.**



**NOTE:** A steady leak from the fuel pressure relief valve can be an indication that the valve seat is worn. This condition will often coincide with Fault Code 1911 and/or Fault Code 3727.

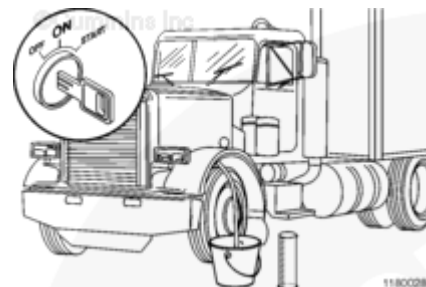
Use the appropriate fault code troubleshooting tree in Section TF in the following manuals:

- PowerGen QSX15 CM2250 Fault Code Troubleshooting Manual, Bulletin 4310740.
- PowerGen QSX15 CM2250 ECF Fault Code Troubleshooting Manual, Bulletin 4310739.
- ISB6.7 CM2250, ISC8.3 CM2250, ISL9 CM2250, ISX12/ISX11.9 CM2250, and ISX15 CM2250 Fault Code Troubleshooting Manual, Bulletin 4022225.
- QSB6.7 CM2250, QSL9 CM2250, QSX11.9 CM2250 ECF, QSX15 CM2250 ECF Fault Code Troubleshooting Manual, Bulletin 2883477.

### Measurement - Engine Will Not Start

**NOTE:** Do not crank the engine for 30 seconds continuously. Crank the engine in 15 second intervals with a 15 second pause between intervals. This reduces the possibility of overheating the starting motor.

- Fuel Pressure Relief valve line connected at the fuel pressure relief valve.
- Lift pump disconnected.
- Route the hose into a collection device (bucket).
- Use graduated cylinder, Part Number 4919139, for measurement when directed.
- Close the engine cover while



performing this measurement.

- Begin cranking the engine.
- Move the drain line to the graduated cylinder for 15 seconds then back to the bucket.
- Stop cranking and allow the engine to rest for 15 seconds.
- Repeat the three steps above a total of four times.
- Record the amount of fuel flow from the Fuel Pressure Relief valve line in 1 minute while the engine is cranking.
- The leakage should be less than 10 drops per minute.
- Replace the Fuel Pressure Relief Valve if leakage is greater than 10 drops in 60 seconds.

**NOTE: If Fault Code 449 or 2311 is active, do not replace the fuel pressure relief valve without first determining the cause of the fault condition**

Use the appropriate fault code troubleshooting tree in Section TF in the following manuals:

- PowerGen QSX15 CM2250 Fault Code Troubleshooting Manual, Bulletin 4310740.
- PowerGen QSX15 CM2250 ECF Fault Code Troubleshooting Manual, Bulletin 4310739.
- ISX15 CM2250 Fault Code Troubleshooting Manual, Bulletin 4022225.
- QSB6.7 CM2250, QSB6.7 CM2250 EC, QSL9 CM2250, QSX11.9 CM2250 ECF, and QSX15 CM2250 ECF Fault Code Troubleshooting Manual, Bulletin 2883477.

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