

# Component Procedures: Fuel Injector

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# Component Procedures: Fuel Injector

## Parts and Labor (itype\_189)

### Parts

Qualifier	Part #	Name	Price	Note
Injector	12634126	Injector	208.76	

### Labor

Operation	Qualifier Path	Skill	Std Hrs	Wty Hrs
Remove & Replace	Fuel Injection > Crossover Pipe, R&R	B	1.5	1.1
Remove & Replace	Fuel Injection > Injector, R&R > Left Bank > ?	B	2.8	0.0
Remove & Replace	Fuel Injection > Injector, R&R > Left Bank > ?	B	0.1	0.0
Remove & Replace	Fuel Injection > Injector, R&R > Left Bank > ?	B	3.3	0.0
Remove & Replace	Fuel Injection > Injector, R&R > Right Bank > ?	B	2.8	0.0
Remove & Replace	Fuel Injection > Injector, R&R > Right Bank > ?	B	0.1	0.0
Remove & Replace	Fuel Injection > Injector, R&R > Right Bank > ?	B	3.3	0.0
Remove & Replace	Fuel Injection > Injector, R&R > Both Sides > ?	B	3.8	0.0
Clean	Fuel Injection > Injector, Clean > All Inject?	B	0.5	0.0

## Fuel Injector Replacement (Article 11427)

Single Use Fasteners and Components

Fuel Feed Intermediate Pipe

Removal Procedure

- Relieve the high side fuel system pressure. Fuel Pressure Relief
- Remove the fuel injection fuel rail assembly.
- Fuel Injection Fuel Rail Assembly Replacement - Bank 1
- Fuel Injection Fuel Rail Assembly Replacement - Bank 2
- For removal of the fuel injector s, refer to Fuel Rail and Injectors Cleaning and Inspection .

Installation Procedure

- Prepare the fuel injectors for assembly, refer to Fuel Rail and Injectors Cleaning and Inspection .
- Install the fuel injection fuel rail assembly.
- Pressure up the fuel system and check for leaks.

## All New Technical Service Bulletins (itype\_432)

Tsbs

- SES Light With A P2097 Or P2099 (PIP4964F, 2025/04/29)

## All Technical Service Bulletins (itype\_100)

Tsbs

- Fuel System - MIL ON, Misfire, Injector DTC's Set (PIP4924D, 2014/01/21)
- Fuel System - Cold Start Misfire After Engine/Fuel Sys Repair (PI1296, 2014/08/19)
- SES Light With A P2097 Or P2099 (PIP4964F, 2025/04/29)
- Engine Controls - Single Cylinder Misfire Diagnostics (PIP5062C, 2014/05/02)

## Repair Tips (itype\_110)

Tsbs

- Fuel System - MIL ON, Misfire, Injector DTC's Set (PIP4924D, 2014/01/21)
- Fuel System - Cold Start Misfire After Engine/Fuel Sys Repair (PI1296, 2014/08/19)
- Engine Controls - Single Cylinder Misfire Diagnostics (PIP5062C, 2014/05/02)

## Fuel Injector Solenoid Coil Test (Article 11383)

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

Circuit/System Description

The engine control module ( ECM ) supplies a separate high voltage supply circuit and a high voltage control

circuit for each fuel injector . The fuel injector high voltage supply circuit and the high voltage control circuit are both controlled by the ECM. The ECM energizes each fuel injector by grounding the control circuit. The ECM controls each fuel injector with 65 V. This is controlled by a boost capacitor in the ECM. During the 65 V boost phase, the capacitor is discharged through a fuel injector, allowing for initial injector opening. The fuel injector is then held open with 12 V. A fuel injector coil winding resistance that is too high or too low will affect the engine driveability. The fuel injector coil windings are affected by temperature. The resistance of the fuel injector coil windings will increase as the temperature of the fuel injector increases.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Component Testing

- The resistance test must be performed at the fuel injector or mis-diagnosis will occur.
- The DMM and test leads must be calibrated to 0  $\Omega$  in order to prevent mis-diagnosis.
- Ignition OFF, all vehicle system OFF, Disconnect the harness connector at the appropriate Q17 Fuel Injector. It may take up to 2 m for all vehicle systems to power down.
- Test for 1–3  $\Omega$  at 18-23°C (65-75°F) between the high voltage supply circuit terminal 2 and the high voltage control circuit terminal 1 at the Q17 fuel injector.
- If not within the specified range Replace the Q17 Fuel Injector.
- If within the specified range
- Test for infinite resistance between each terminal at the Q17 Fuel Injector and the Q17 Fuel Injector housing/case.
- If less than infinite resistance Replace the Q17 Fuel Injector.
- If infinite resistance
- All OK, perform the Fuel Injector Balance Test .

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

Fuel Injector Replacement

## **Fuel Injector Balance Test (Article 11379)**

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

Circuit/System Description

Two methods of testing fuel injector balance are available, the Active Fuel Injector Tester (AFIT) or a scan tool. The Active Fuel Injector Tester and SIDI adaptor connects to the engine control module harness connectors to test the high pressure fuel pump performance, fuel injector wiring, and fuel injector operation. The AFIT displays step by step instructions to precisely determine pressure drop of each fuel injector. The scan tool fuel injector balance test is performed while the engine is running at idle. The scan tool pressurizes the fuel rail to a predetermined pressure before each fuel injector is pulsed for a precise amount of time allowing a measured amount of the fuel to be injected. This causes a drop in the system fuel pressure that is recorded and used to compare each fuel injector.

Diagnostic Aids

- Monitoring the Current Misfire Counters may help to isolate the fuel injector that is causing the condition.
- Operating the vehicle over a wide temperature range may help isolate the fuel injector that is causing the condition.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Fuel System Description

## Scan Tool Reference

Control Module References for scan tool information

## Special Tools

- CH-47976 - Active Fuel Injector Tester
- CH-47976-500A - Active Fuel Injection Tester (AFIT) SIDI Adapter Kit

For equivalent regional tools, refer to Special Tools

## Circuit/System Verification

- Ignition ON.
- Verify the scan tool Fuel Remaining parameter is greater than 10%.
- If the Fuel Remaining parameter is less than 10% , add fuel to the fuel tank .
- If the Fuel Remaining parameter is 10% or greater
- Verify the scan tool ECT Sensor parameter is less than 60°C (140°F).
- If the ECT Sensor parameter is greater than 60°C (140°F) , allow the engine temperature to cool.
- If the ECT Sensor parameter is 60°C (140°F) or less
- Verify the battery is fully charged and all accessories are Off.
- If the battery is not fully charged , charge or repair battery as necessary.
- If the battery is fully charged
- Perform the appropriate Fuel Injector Balance Test in Circuit System Testing.

## Circuit System Testing

### Fuel Injector Balance Test with Active Fuel Injector Tester

- Ignition OFF, all vehicle systems OFF. Install the CH-47976 - Active Fuel Injector Tester and the CH-47976-500A - Active Fuel Injection Tester (AFIT) SIDI Adapter Kit , refer to the Active Fuel Injector Tester User Guide. It may take up to 2 minutes for all vehicle systems to power down.
- Turn ON the Active Fuel Injector Tester and select the vehicle.
- Ignition ON, perform the Injector Test with the Active Fuel Injector Tester.
- If the Active Fuel Injector Tester aborts testing due to fuel pressure or fuel leak down Refer to Fuel System Diagnosis .
- If the Active Fuel Injector Tester does not abort testing
- Compare the test results with the appropriate recommended tolerance.
- If any fuel injector exceeds the recommended tolerance Replace the appropriate Q17 Fuel Injector(s).
- If all fuel injectors are within the recommended tolerance
- Perform Fuel Injector Circuit Diagnosis .

### Fuel Injector Balance Test with Scan Tool

- Command the Fuel Pump Enable ON with a scan tool.
- Verify the fuel pressure is between 345–690 kPa (50–100 PSI) with the fuel pump running.
- If not within 345–690 kPa (50–100 PSI) Refer to Fuel System Diagnosis .
- If within 345–690 kPa (50–100 PSI)
- Verify the fuel pressure does not decrease greater than 34 kPa (5 PSI) within 1 minute.
- If greater than the specified value Refer to Fuel System Diagnosis .
- If less than the specified value
- Engine idling.
- Verify the scan tool Fuel Rail Pressure Sensor 1 parameter is between 1.9–5.0 MPa (276–725 PSI).
- If not between 1.9–5.0 MPa (276–725 PSI) Refer to Fuel System Diagnosis .
- If between 1.9–5.0 MPa (276–725 PSI)
- Select the Fuel Injector Balance function within the Control Functions menu of a scan tool.
- Select and test a Q17 Fuel Injector. Repeat for each Q17 Fuel Injector.
- Obtain and record a pressure drop value for each Q17 Fuel Injector.
- Add all of the individual pressure drop values except for the fuel injector suspected of being faulty. This is the total pressure drop.
- Divide the total pressure drop by the number of fuel injectors that were added together. This is the average pressure drop.
- Multiply the average pressure drop by 0.20. This is the acceptable variance from the average pressure drop, 20%.
- Verify the difference between any individual pressure drop and the average pressure drop is not greater than the acceptable variance.
- If greater than the acceptable variance Replace the Q17 Fuel Injector.
- If within the acceptable variance

## Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Fuel Injection Fuel Rail Assembly Replacement - Bank 1

- Fuel Injection Fuel Rail Assembly Replacement - Bank 2

## Fuel Injector Circuit Diagnosis (Article 11381)

### Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

### Diagnostic Fault Information

Circuit Short to Ground Open/High Resistance Short to Voltage Signal Performance

Fuel Injector 1 Control + P2147 P0201 P2148 P1248

Fuel Injector 1 Control – P0261 P0201 P0262 P1248

Fuel Injector 2 Control + P2150 P0202 P2151 P1249

Fuel Injector 2 Control – P0264 P0202 P0265 P1249

Fuel Injector 3 Control + P2153 P0203 P2154 P124A

Fuel Injector 3 Control – P0267 P0203 P0268 P124A

Fuel Injector 4 Control + P2156 P0204 P2157 P124B

Fuel Injector 4 Control – P0270 P0204 P0271 P124B

Fuel Injector 5 Control + P216B P0205 P216C P124C

Fuel Injector 5 Control – P0273 P0205 P0274 P124C

Fuel Injector 6 Control + P216E P0206 P216F P124D

Fuel Injector 6 Control – P0276 P0206 P0277 P124D

### Circuit/System Description

The engine control module ( ECM ) supplies voltage to each fuel injector on the injector high voltage supply circuits. The ECM energizes each fuel injector by grounding the high voltage control circuit of the fuel injector. The ECM monitors the status of the injector high voltage supply circuits and the injector high voltage control circuits. When a fuel injector circuit condition is detected by the ECM, the affected fuel injector(s) is disabled.

### Diagnostic Aids

- Performing the fuel injector coil test may help isolate an intermittent condition. Refer to Fuel Injector Solenoid Coil Test .
- If the condition is intermittent, move the related harnesses and connectors, with the engine operating, while monitoring the scan tool Injector Control Circuit Status parameters. An Injector Control Circuit Status parameter will change from OK or Not Run to Malfunction if there is a condition with the circuit or a connection.

### Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Fuel System Description

Scan Tool Reference

Control Module References for scan tool information

### Circuit/System Verification

- Engine idling.
- Verify the scan tool Cylinder 1–6 Current Misfire Counter parameters do not increment.
- If the Cylinder 1–6 Current Misfire Counters increment Refer to Circuit/System Testing.
- If the Cylinder 1–6 Current Misfire Counters do not increment
- Verify the scan tool Cylinder 1–6 Injector Control Circuit Status parameters display OK.
- If the Cylinder 1–6 Injector Control Circuit Status parameters do not display OK Refer to Circuit/System Testing.
- If the Cylinder 1–6 Injector Control Circuit Status parameters display OK
- All OK.

### Circuit/System Testing

- Ignition OFF, all vehicle systems OFF. Disconnect the X3 harness connector at the K20 Engine Control Module . It may take up to 2 min for all vehicle systems to power down.
- Test for infinite resistance between the appropriate Q17 Fuel Injector control + circuit and ground.
- If less than infinite resistance
- Disconnect the harness connector of the Q17 Fuel Injector.
- Test for infinite resistance between the Q17 Fuel Injector control + circuit and ground.

- If infinite resistance
- Test for infinite resistance between the Q17 Fuel Injector control – circuit and ground.
- If less than infinite, repair the short to ground in the circuit.
- If infinite, replace the Q17 Fuel Injector.
- Ignition ON.
- Test for less than 1 V between the Q17 Fuel Injector control + circuit and ground.
- If 1 V or greater
- Disconnect the harness connector of the Q17 Fuel Injector, ignition ON.
- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, repair the short to voltage on the control – circuit.
- If less than 1 V
- Ignition OFF.
- Test for less than 3  $\Omega$  between the Q17 Fuel Injector control + circuit and control – circuit.
- If 3  $\Omega$  or greater
- Test for less than 2  $\Omega$  on the control + circuit end to end.
- If 2  $\Omega$  or greater, repair the open/high resistance in the circuit.
- If less than 2  $\Omega$
- Test for less than 2  $\Omega$  on the control – circuit end to end.
- If less than 2  $\Omega$ , replace the Q17 Fuel Injector.
- If less than 3  $\Omega$
- Replace the K20 Engine Control Module.

#### Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Fuel Injector Replacement
- Control Module References for K20 Engine Control Module replacement, programming, and setup