# Component Procedures: Ignition System

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## Parts and Labor (itype_189)

### Labor

| Operation | Qualifier Path | Skill | Std Hrs | Wty Hrs |
|---|---|---|---|---|
| Remove & Replace | Ignition System > Ignition Coil, R&R > Left B? | B | 0.3 | 0.2 |
| Remove & Replace | Ignition System > Ignition Coil, R&R > Left B? | B | 1.6 | 0.0 |
| Remove & Replace | Ignition System > Ignition Coil, R&R > Left B? | B | 0.3 | 0.2 |
| Remove & Replace | Ignition System > Ignition Coil, R&R > Left B? | B | 0.2 | 0.2 |
| Remove & Replace | Ignition System > Ignition Coil, R&R > Left B? | B | 1.9 | 0.0 |
| Remove & Replace | Ignition System > Ignition Coil, R&R > Right ? | B | 0.3 | 0.2 |
| Remove & Replace | Ignition System > Ignition Coil, R&R > Right ? | B | 0.2 | 0.2 |
| Remove & Replace | Ignition System > Ignition Coil, R&R > Right ? | B | 0.6 | 0.0 |
| Remove & Replace | Ignition System > Ignition Coil, R&R > Both B? | B | 2.3 | 0.0 |
| Remove & Replace | Ignition System > Spark Plugs, R&R | B | 2.8 | 0.0 |
| Remove & Install | Ignition System > Spark Plugs, R&I | B | 2.8 | 0.0 |
| Diagnosis | Ignition System > System, Diagnosis | B | 0.6 | 0.0 |

## Specifications Quick Reference (itype_439)

Quick Specifications
- item

## Ignition System Specifications (Article 11470)

Application Specification
Ignition System Type T8 Ignition Coil — 1–6
Firing Order 1–2–3–4–5–6
Spark Plug Torque Refer to: Fastener Specifications
Spark Plug Gap Refer to: Engine Mechanical Specifications
Spark Plug Type Refer to: Electronic Parts Catalog

## Electronic Ignition System Description (Article 11085)

The electronic ignition system produces and controls a high-energy secondary spark. This spark is used to ignite the compressed air/fuel mixture at precisely the correct time. This provides optimal performance, fuel economy, and control of exhaust emissions. This ignition system uses an individual coil for each cylinder. The ignition coils are mounted near each cylinder with short integrated boots or high tension wires connecting the coils to the spark plugs . The driver modules within each ignition coil are commanded ON/OFF by the Engine Control Module ( ECM ). The ECM uses engine speed, the mass air flow ( MAF ) sensor signal, and position information from the crankshaft position and the camshaft position sensor s to control the sequence, dwell, and timing of the spark.

The electronic ignition system consists of the following components:

Crankshaft Position Sensor

The crankshaft position sensor works in conjunction with a reluctor wheel on the crankshaft (front mounted crankshaft position sensor) or a reluctor wheel that is part of the flywheel (rear mounted crankshaft position sensor). The ECM monitors the voltage frequency on the crankshaft position sensor signal circuit. As each reluctor wheel tooth rotates past the sensor, the sensor creates a digital ON/OFF pulse. This digital signal is processed by the ECM. This creates a signature pattern that enables the ECM to determine the crankshaft position. The ECM uses the signal to determine which pair of cylinders is approaching top dead center based on the crankshaft position signal alone. The camshaft position sensor signals are used in order to determine which of these 2 cylinders is on a firing stroke, and which is on the exhaust stroke. The ECM uses this to properly synchronize the ignition system, the fuel injectors , and the knock control. This sensor is also used in order to detect misfire.

The ECM also has a dedicated replicated crankshaft position sensor signal output circuit that may be used as an input signal to other modules for monitoring engine RPM.

Camshaft Position Sensor

This engine uses a camshaft position sensor for each camshaft. The camshaft position sensor is a three wire hall effect type sensor. The ECM supplies the camshaft position sensor with a 5 V reference circuit, a signal circuit and a low reference circuit. The camshaft position sensor signals are an input to the ECM. These signals are also used to detect camshaft alignment with the crankshaft. The camshaft position sensor does not

directly affect the operation of the ignition system. The camshaft position sensor information is used by the ECM to determine the position of the camshaft relative to the crankshaft position. By monitoring the camshaft position and crankshaft position signals the ECM can accurately time the operation of the fuel injector s.
The ECM also has a dedicated replicated camshaft position sensor signal output circuit that may be used as an input signal to other modules for monitoring engine RPM.

Knock Sensor

The knock sensor system enables the ECM to control the ignition timing for the best possible performance while protecting the engine from potentially damaging levels of detonation, also known as spark knock. The knock sensor system uses 1 or 2 flat response 2-wire sensors. The sensor uses piezo-electric crystal technology that produces an AC voltage signal of varying amplitude and frequency based on the engine vibration or noise level. The amplitude and frequency depend upon the level of knock that the knock sensor detects. The ECM receives the knock sensor signal through the high and low signal circuits.
The ECM learns a minimum noise level, or background noise, at idle from the knock sensor and uses calibrated values for the rest of the RPM range. The ECM uses the minimum noise level to calculate a noise channel. A normal knock sensor signal will ride within the noise channel. As engine speed and load change, the noise channel upper and lower parameters will change to accommodate the normal knock sensor signal, keeping the signal within the channel. In order to determine which cylinders are knocking, the ECM only uses knock sensor signal information when each cylinder is near top dead center (TDC) of the firing stroke. If knock is present, the signal will range outside of the noise channel.
If the ECM has determined that knock is present, it will retard the ignition timing to attempt to eliminate the knock. The ECM will always try to work back to a zero compensation level, or no spark retard. An abnormal knock sensor signal will stay outside of the noise channel or will not be present. Knock sensor diagnostics are calibrated to detect faults with the knock sensor circuitry inside the ECM, the knock sensor wiring, or the knock sensor voltage output. Some diagnostics are also calibrated to detect constant noise from an outside influence such as a loose/damaged component or excessive engine mechanical noise.

Ignition Coils

Each ignition coil has an ignition voltage feed and a ground circuit. The engine control module (ECM) supplies a low reference and an ignition control (IC) circuit. Each ignition coil contains a solid state driver module.
The ECM will command the IC circuit ON, which allows the current to flow through the primary coil windings. When the ECM commands the IC circuit OFF, this will interrupt current flow through the primary coil windings. The magnetic field created by the primary coil windings will collapse across the secondary coil windings, which induces a high voltage across the spark plug electrodes.

Engine Control Module (ECM)

The ECM controls all ignition system functions and constantly corrects the spark timing. The ECM monitors information from various sensor inputs that may include the following components, if applicable:
- Ambient pressure sensor s (BARO)
- Engine coolant temperature ( ECT ) sensor
- Engine knock sensors
- Intake air temperature ( IAT ) sensors
- Mass air flow (MAF) sensors
- Throttle position sensor
- Transmission gear position or range information sensors
- Vehicle speed sensor ( VSS )

## Engine Controls - Fastener Specifications (Article 11469)

Application Specification
Metric English
Accelerator Pedal Position (APP) Sensor to Body Retaining Bolt 9 Nm 80 lb in
Air Cleaner Lower Housing to Body Retaining Bolt 10 Nm 89 lb in
Air Cleaner Outlet Duct Hose Clamp 4 Nm 35 lb in
Camshaft Position ( CMP ) Actuator Solenoid Valve to Engine Front Cover Retaining Bolt 9 Nm 80 lb in
Camshaft Position (CMP) Sensor to Engine Front Cover Retaining Bolt 10 Nm 89 lb in
Crankshaft Position ( CKP ) Sensor to Engine Block Retaining Bolt 10 Nm 89 lb in
Engine Coolant Temperature ( ECT ) Sensor 20 Nm 15 lb ft
Evaporative Emission ( EVAP ) Canister Purge Solenoid Valve bolt 10 Nm 89 lb in
Evaporative Emission (EVAP) Canister to Underbody Retaining Bolt 6 Nm 53 lb in
Fuel Feed Intermediate Pipe Fitting 28 Nm 21 lb ft
Fuel Feed Pipe Bolt 50 Nm 37 lb ft
Fuel Feed Pipe Fitting 28 Nm 21 lb ft
Fuel Pipe Shield 10 Nm 89 lb in

Fuel Pipe Stone Guard to Underbody Retaining Nut 5 Nm 44 lb in
Fuel Pressure Sensor 33 Nm 24 lb ft
Fuel Rail Assembly Bolt
First pass 12 Nm 106 lb in
- First pass
Final pass 23 Nm 17 lb ft
- Final pass
Fuel Rail to Lower Inlet Manifold Retaining Bolt 10 Nm 89 lb in
Fuel Tank Heat Shield 5.5 Nm 49 lb in
Fuel Tank Hose to Filler Tube Clamp 4 Nm 35 lb in
Fuel Tank Strap to Underbody Retaining Bolt 30 Nm 22 lb ft
Filler Tube Support Bracket to Body Retaining Bolt 9 Nm 80 lb in
Heated Oxygen Sensor ( HO2S ) 42 Nm 31 lb ft
Ignition Coil to Camshaft Cover Retaining Bolt 10 Nm 89 lb in
Intake Manifold Runner Control Solenoid to Upper Intake Manifold Retaining Bolt 10 Nm 89 lb in
Knock Sensor to Engine Block Retaining Bolt 23 Nm 17 lb ft
Manifold Absolute Pressure Sensor 4 Nm 35 lb in
Mass Airflow Sensor with Intake Air Temperature ( MAF ) Sensor to Air Cleaner Upper Housing Retaining Screw 4 Nm 35 lb in
Rear Frame to Underbody Retaining Bolt
First pass 65 Nm 48 lb ft
Final pass + 120 Degrees
Spark Plug
Fit New Spark Plug 20 Nm 15 lb ft
- Fit New Spark Plug
Refit Existing Spark Plug 18 Nm 13 lb ft
- Refit Existing Spark Plug
Throttle Body to Upper Intake Manifold Retaining Bolt 10 Nm 89 lb in

## All New Technical Service Bulletins (itype_432)

Tsbs
- Fluid in Spark Plug Tubes, Coolant and/or Oil Leak, Malfunction Indicator Lamp (MIL) Illuminated (21-NA-147, 2025/07/25)

## All Technical Service Bulletins (itype_100)

Tsbs
- Fluid in Spark Plug Tubes, Coolant and/or Oil Leak, Malfunction Indicator Lamp (MIL) Illuminated (21-NA-147, 2025/07/25)
- Engine Controls - Single Cylinder Misfire Diagnostics (PIP5062C, 2014/05/02)

## Repair Tips (itype_110)

Tsbs
- Engine Controls - Single Cylinder Misfire Diagnostics (PIP5062C, 2014/05/02)

## Electronic Ignition (EI) System Diagnosis) (Article 11374)

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
This ignition system uses an individual ignition coil for each cylinder. The Engine Control Module ( ECM ) controls the spark events by transmitting the timing pulses on the ignition control circuits to the individual ignition coil in firing order sequence.

Diagnostic Aids
- This engine application may use 2 fuses, one for each bank, to supply ignition voltage to the ignition module/coil assemblies. A good indication that a fuse is open is that all misfire counters are incrementing on one side of the engine.
- An open/high resistance on the low reference circuit to the ignition coil may cause a misfire.
- An erratic or weak spark is considered a no spark condition.

Reference Information
Schematic Reference
Engine Controls Schematics
Connector End View Reference
Master Electrical Component List
Description and Operation
Electronic Ignition System Description
Electrical Information Reference
- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs
Scan Tool Reference
Control Module References
Special Tools
EL 26792 - HEI Spark Tester
For equivalent regional tools, refer to Special Tools .
Circuit/System Testing
- Ignition OFF and all vehicle systems OFF. Disconnect the harness connector at the appropriate T8 Ignition Coil. It may take up to 2 min for all vehicle systems to power down.
- Test for less than 5 Ω between the ground circuit terminal 1/A and ground.
- If 5 Ω or greater
- Ignition OFF.
- Test for less than 2 Ω in the ground circuit end to end.
- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω, repair the open/high resistance in the ground connection.
- If less than 5 Ω
- Test for less than 5 Ω between the low reference circuit terminal 2/B and ground.
- Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module .
- Test for less than 2 Ω in the low reference circuit end to end.
- If less than 2 Ω, replace the K20 Engine Control Module.
- Ignition ON.
- Verify a test lamp illuminates between the ignition circuit terminal 4/D and ground.
- If the test lamp does not illuminate
- Test for less than 2 Ω in the ignition circuit end to end.
- If less than 2 Ω, verify the fuse is not open and there is voltage at the fuse.
- If the test lamp illuminates
- Ignition OFF, exchange the suspect T8 Ignition Coil with the T8 Ignition Coil of a known functioning cylinder.
- Engine Running.
- Verify the scan tool Cylinder 1–6 Current Misfire Counter does not increment for the same cylinder that the suspect T8 Ignition Coil was removed from.
- If increments Replace the K20 Engine Control Module.
- If does not increment
- Test or replace the T8 Ignition Coil.
Component Testing
- Ignition OFF, connect the EL 26792 to the appropriate T8 Ignition Coil.
- Verify the spark output of the T8 Ignition Coil.
- If no output or the output is weak Replace the T8 Ignition Coil
- If the output is good
- All OK.
Repair Instructions
Perform the Diagnostic Repair Verification after completing the repair.
- Ignition Coil Replacement - Bank 1
- Ignition Coil Replacement - Bank 2
- Control Module References for engine control module replacement, programming, and setup.