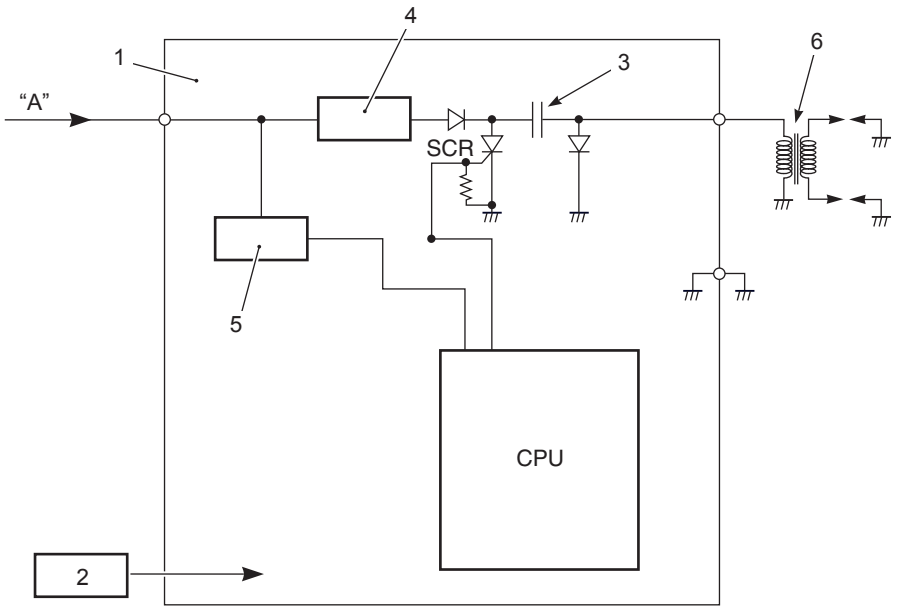
Ignition System

General Description

Ignition System Description

CENDK1111801001

A digital CDI (condenser discharged ignition) system is employed on the DF15A/20A.
A condenser built in the ECM stores an electrical energy supplied from the ECM power source.
The electrical energy stored in the condenser is released to the ignition coil primary windings by the ignition timing signal calculated by the ECM, then a high surge voltage is generated in the ignition coil secondary windings and wakes ignition spark.



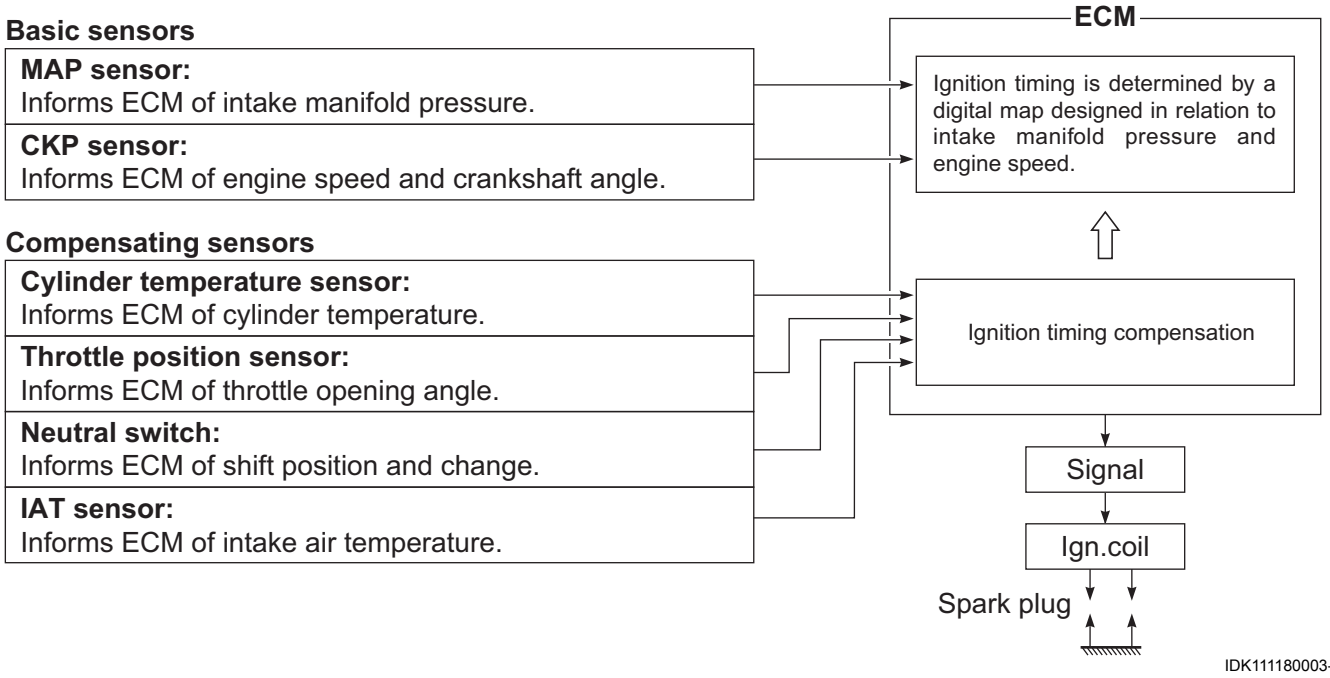
IDK111180002-04

1. ECM	4. Power circuit-1	"A": ECM power source (from power source coil)
2. Sensor/switch signal input	5. Power circuit-2	
3. Condenser	6. Ignition coil	

Ignition Control Description

CENDK1111801002

Sensors at specific points on the engine monitor current engine conditions and send signals to the ECM.
Based on these signals, the ECM determines the optimum ignition timing and releases voltage to the primary winding of the ignition coil.



IDK111180003-01

Ignition Specification

Ignition type	Digital CDI
Advance	Electronic microcomputer control
Ignition timing	5° BTDC – 10° BTDC (DF15A) 5° BTDC – 20° BTDC (DF20A)
Firing order	Simultaneous ignition

Ignition Timing Control Mode

- **When cranking**
  The ignition timing is fixed at 5° BTDC until the engine starts.
- **When operating (normal operation)**
  The ignition timing ranges between BTDC 5° – 10° (DF15A) or BTDC 5° – 20° (DF20A), depending on current engine operating conditions.

NOTE

The ignition timing remains at BTDC 5° when the shift lever is in neutral.

Component Location

Ignition System Components Location

CENDK1111803001

Refer to “Wiring Harness Routing Diagram” in Section 4A (Page 4A-3).

Diagnostic Information and Procedures

Ignition System Symptom Diagnosis

CENDK1111804001

Condition	Possible cause	Correction / Reference item
Engine cranks, but will not start or weak spark. (No spark)	Loose connection or disconnection of lead wire.	*Connect securely.*
	Faulty spark plug(s).	*Replace.*
	Faulty ignition coil.	*Replace.*
	Faulty CKP sensor.	*Replace.*
	Faulty CMP sensor.	*Replace.*
	Faulty power source coil.	*Replace.*
	Faulty ECM.	*Replace.*
	Faulty emergency stop switch.	*Replace.*
	Faulty neutral switch.	*Replace.*
Spark plug is wet or quickly becomes fouled with carbon.	Incorrect gasoline.	*Change.*
	Incorrect spark plug.	*Replace.*
Spark plug quickly become fouled with oil or carbon.	Worn piston ring.	*Replace.*
	Worn piston.	*Replace.*
	Worn cylinder.	*Replace.*
	Excessive valve stem to valve guide clearance.	*Replace.*
	Worn valve stem seal.	*Replace.*
Spark plug electrodes overheat or burn.	Incorrect spark plug.	*Change.*
	Overheated engine.	*Tune-up.*
	Loose spark plug.	*Tighten.*

Ignition System Troubleshooting

CENDK1111804002

Perform the following ignition system tests when the engine is hard to start in order to determine if the cause is in the ignition or another system.

Step 1

Check the ignition system connector for poor connections.

Is there connection in the ignition system connectors?

Yes Go to step 2.

No Poor connection of connectors.

Step 2

Check spark condition.

Is result OK?

Yes Go to step 13.

No No or weak sparks. Go to step 3.

Step 3

Check if the spark plug is in good condition.

Is result OK?

Yes Go to step 4.

No Replace spark plug with a new one.

Step 4

- Disconnect the emergency stop switch lead wire connector.
- Check spark condition at engine cranking.

Is result OK?

Yes Check and/or replace emergency stop switch.

No Go to step 5.

Step 5
Check neutral switch condition.
Refer to “Neutral Switch Inspection” in Section 1I (Page 1I-15).

Is result OK?

Yes — Go to step 6.

No — Faulty Neutral switch.

Step 6
Measure the ignition coil primary peak voltage.
Refer to “Ignition Coil Primary Peak Voltage Inspection” (Page 1H-7).

Is the peak voltage OK?

Yes — Poor connection of the spark plug.

No — Go to step 7.

Step 7
Check ignition coil resistance.
Refer to “Ignition Coil Inspection” (Page 1H-6).

Is result OK?

Yes — Go to step 8.

No — Faulty ignition coil.

Step 8
- Check the spark plug cap for any evidence of the high-tension leak.
- Check spark plug cap resistance.

Are result OK?

Yes — Go to step 9.

No — Faulty spark plug cap.

Step 9
Check CKP sensor resistance.
Refer to “CKP Sensor Inspection” (Page 1H-7).

Is result OK?

Yes — Go to step 10.

No
- Check air gap between CKP sensor and flywheel reluctor bars.
- Adjust CKP sensor air gap.
- Replace CKP sensor or flywheel.

Step 10
Check CMP sensor.
Refer to “CMP Sensor Inspection” in Section 1C (Page 1C-9).

Is result OK?

Yes — Go to step 11.

No
- Faulty CMP sensor.
- Check CMP sensor trigger vane.
- Replace CMP sensor or camshaft pulley.

Step 11
Check ECM power source.
- Manual starter model:
  a. Check ECM power source coil resistance.
  Refer to “ECM Power Source Coil Inspection” (Page 1H-7).
- Electric starter model:
  a. Check battery charge coil resistance.
  Refer to “Battery Charge Coil Inspection” in Section 1K (Page 1K-15).
  b. Check rectifier / regulator.
  Refer to “Rectifier / Regulator Inspection” in Section 1K (Page 1K-16).

Is result OK?

Yes — Go to step 12.

No
- Faulty power source coil.
- Faulty battery charge coil.
- Faulty rectifier / regulator.

Step 12
Substitute a known-good ECM then repeat step 2.

Is check result of step 2 satisfactory?

Yes
- Faulty ECM.
- Replace ECM.

No — Open or short circuit in wire harness.

Step 13
Check the ignition timing by using timing light. (BTDC 5° at 1 000 r/min)

Is result OK?

Yes — System is in good condition.

No — Faulty ECM.

Service Instructions

Spark Plug Removal and Installation

CENDK1111806001

Refer to “Spark Plug Removal and Installation” in Section 0B (Page 0B-7).

Spark Plug Inspection

CENDK1111806002

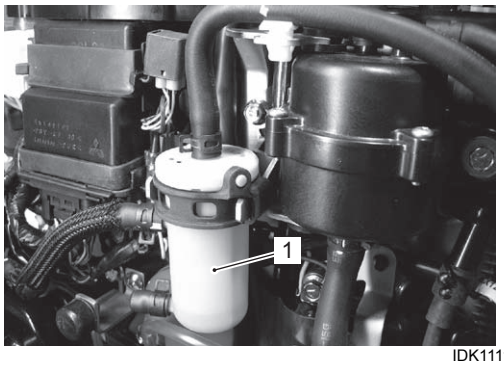
Refer to “Spark Plug Inspection and Cleaning” in Section 0B (Page 0B-7).

Ignition Coil Removal and Installation

CENDK1111806003

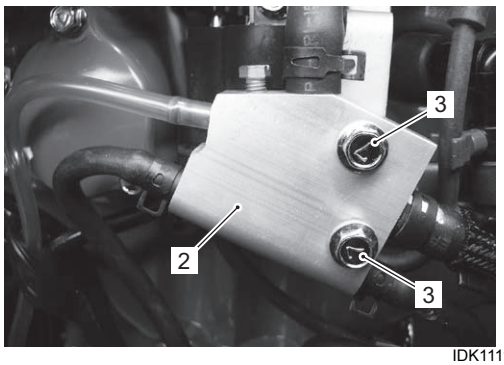
Removal

1) Remove PORT lower side cover.
   Refer to “Lower Side Cover Removal and Installation” in Section 2A (Page 2A-2).
2) Remove the fuel filter (1) from filter bracket.



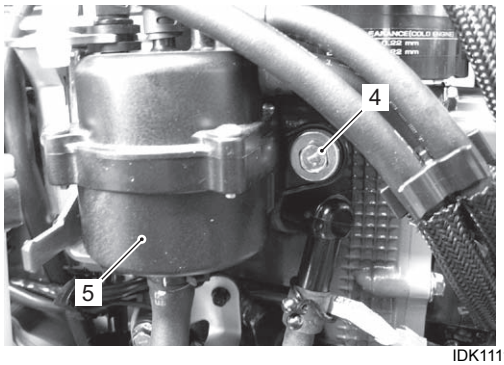
IDK111180004-01

3) Remove the bolts (3) securing fuel cooler (2).



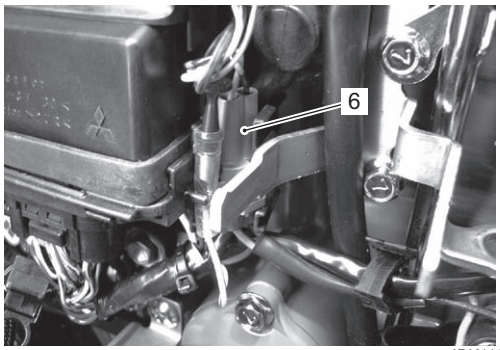
IDK111180005-01

4) Remove the bolt (4) securing fuel vapor separator (5), then remove separator from bracket.

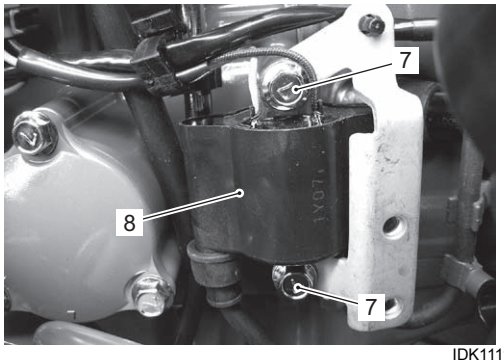


IDK111180006-01

5) Disconnect the ignition coil lead wire connector (6).
6) Remove the bolts (7) and ignition coil (8).



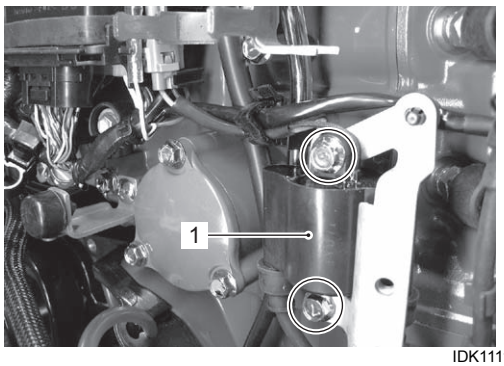
IDK111180008-01



IDK111180007-02

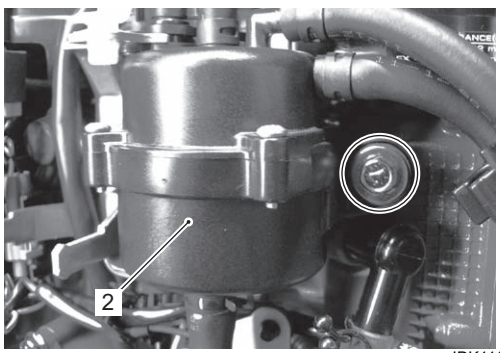
Installation

1) Install the ignition coil (1), then secure the ignition coil with its mounting bolts.
2) Connect ignition coil lead wire connector.



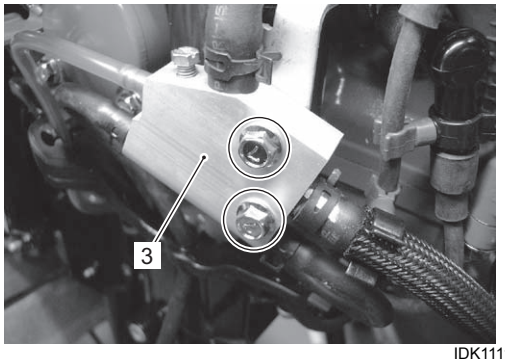
IDK111180009-01

3) Install the fuel vapor separator (2), then secure separator with its mounting bolt.



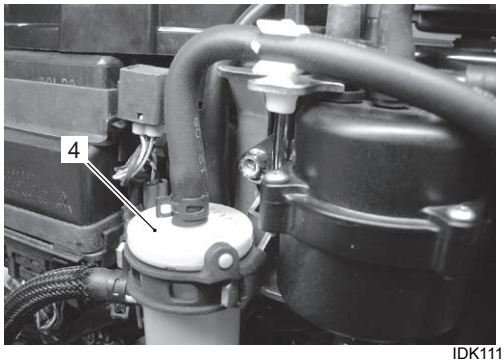
IDK111180010-01

4) Install the fuel cooler (3), then secure fuel cooler with its mounting bolts.



IDK111180011-01

5) Install fuel filter (4) to filter bracket.



IDK111180012-01

6) Install PORT lower side cover.
Refer to “Lower Side Cover Removal and Installation” in Section 2A (Page 2A-2).

Ignition Coil Inspection

CENDK1111806004

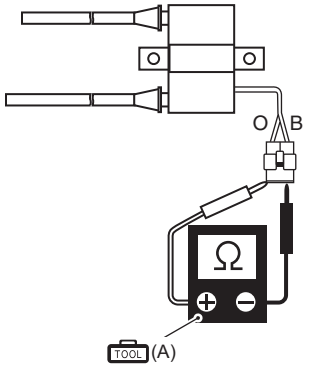
Special tool
TOOL (A): 09930–99320 (Digital tester)

Tester knob indication
Resistance (Ω)

Primary Coil Side

1) Remove PORT lower side cover.
Refer to “Lower Side Cover Removal and Installation” in Section 2A (Page 2A-2).
2) Disconnect the ignition coil lead wire connector.
3) Connect the tester probe to the coil lead wires as shown.

Primary coil resistance
Standard: 0.08 – 0.11 Ω



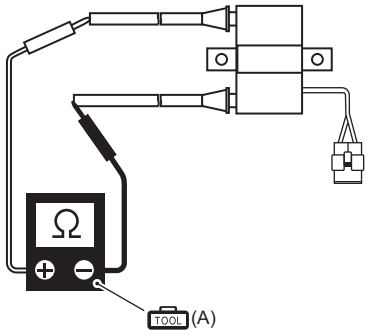
IAJ311180003-02

4) If measurement is out of specification, replace the ignition coil.
5) Install PORT lower side cover.
Refer to “Lower Side Cover Removal and Installation” in Section 2A (Page 2A-2).

Secondary Coil Side

1) Remove the spark plug caps from the high-tension cord.
2) Connect the tester probe to the high-tension cords as shown.

Secondary coil resistance
Standard: 3.5 – 4.7 kΩ



IAJ311180004-02

If measurement is out of specification, replace the ignition coil.

Spark Plug Cap Inspection

CENDK1111806005

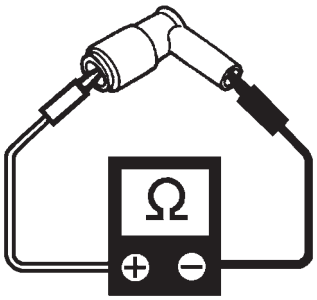
Measure the spark plug cap resistance in the following procedure.

Special tool
TOOL (A): 09930–99320 (Digital tester)

Tester knob indication
Resistance (Ω)

1) Remove the spark plug cap from high-tension cord.
2) Connect the tester probe to spark plug cap as shown.

Spark plug cap resistance
Standard: 4 – 6 kΩ



IAJ311180005-01

3) If measurement is out of specification, replace the spark plug cap.
4) Connect the spark plug cap to high-tension cord.

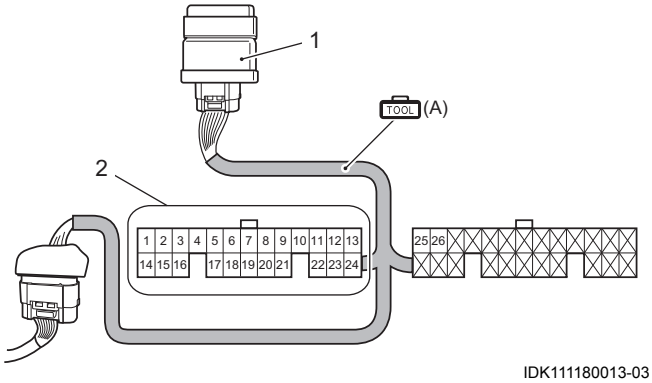
Ignition Coil Primary Peak Voltage Inspection

CENDK1111806006

Special tool
TOOL (A): 09930–88940 (26-pin test cord)
CD-77: Stevens peak reading voltmeter CD-77

Tester knob indication
NEG 500

1) Disconnect wire harness connector from ECM.
2) Connect the 26 pin test cord between ECM and wire harness as shown in figure.



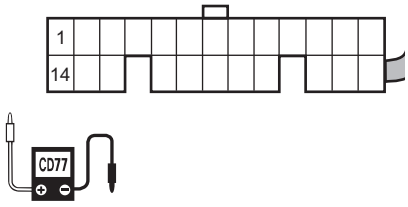
IDK111180013-03

1. ECM	2. White connector

3) Connect the tester probe to the test cord lead wires as shown.

Tester probe connection	
Red (+)	**Black (–)**
No.1 terminal	No.14 terminal (or engine body ground)

26-pin test cord (White connector)



IDK111180001-04

4) Remove all spark plugs.
5) Crank with the recoil starter, then measure voltage.

Ignition coil primary peak voltage (for electric starter models)
Standard: 110 V or over

Ignition coil primary peak voltage (for manual starter models)
Standard: 100 V or over

6) If measurement is out of specification, inspect the related parts.
Refer to “Ignition System Symptom Diagnosis” (Page 1H-3) and “Ignition System Troubleshooting” (Page 1H-3).

CKP Sensor Inspection

CENDK1111806011

Refer to “CKP Sensor Peak Voltage Inspection” in Section 1C (Page 1C-6) and “Resistance Check” in Section 1C (Page 1C-5).

ECM Power Source Coil Inspection

CENDK1111806008

Refer to “ECM Power Source Coil Peak Voltage Inspection” in Section 1C (Page 1C-6) and “Resistance Check” in Section 1C (Page 1C-5).

Emergency and Engine Stop Switch Inspection

CENDK1111806009

Refer to “Emergency and Engine Stop Switch Inspection” in Section 1C (Page 1C-13).