



# ELECTRICAL

## Section 2A - Ignition

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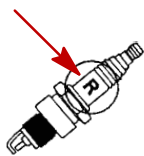
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# Specifications

<p><b>IGNITION SYSTEM</b> Readings taken @ 68°F (20°C).</p>	<p><b>Type</b> <b>Spark Plug:</b> Type Gap Hex Size Torque Hole Size <b>Firing Order</b> <b>Ignition Timing:</b> @ Idle @ 1500-1800 @ WOT (6000 rpm) <b>Stator Resistance</b> <b>Crank Position Sensor (CPS) Resistance</b> <b>Ignition Coil Resistance:</b> Internal Shielding Electronic Spark Trigger (EST) Secondary High Tension Lead/Boot Resistance <b>ECM Engine Speed Limiter</b> <b>Fuel/Spark Cut-out on Cylinders #2 and #3</b> <b>Fuel/Spark Cut-out on All Cylinders</b> <b>ECM Overheat Speed Control</b>  <b>ECM Low Oil Pressure Speed Control</b>  <b>MAT/ECT Temperature Sensor</b> <b>Manifold Absolute Pressure (MAP) Sensor Resistance</b> <b>Fuel Injector Resistance</b>  <b>Main Power Relay</b> <b>Idle Air Control (IAC)</b> <b>Throttle Position Sensor Typical Range</b> Output Voltage @ Idle Output Voltage @ WOT (6000)</p>	<p>Capacitor Discharge Ignition  Champion RA8HC 0.040 in. (1.0 mm) 5/8 in. (16 mm) 150 lb-in. (17 Nm) 12 mm 1-3-4-2  Controlled by ECM 14° B.T.D.C 28° B.T.D.C 0.20 - 0.30 Ω (YEL-YEL)  300 - 350 Ω (RED - WHT)  0 - 10.0 KΩ (Pin A - Mounting Bracket) 8.5 - 12KΩ (Pin B - Pin C) 3.0 - 7.0 kΩ (Pin A - Coil Tower)  0.600 - 1.100 KΩ  6225 rpm  6350 rpm Guardian System is activated. Power limit will vary with level of overheat.  Guardian System is activated. Engine power is limited to 10% of maximum (Approximately 2000 RPM) See Graph Section 3B - EFI  See Table Section 3B - EFI 10.0 - 13.5Ω  81-99 Ω (Pin 85 - Pin 86) 24-30 Ω (Between Pins)  0.39-1.00 Volts 3.66-4.80 Volts</p>
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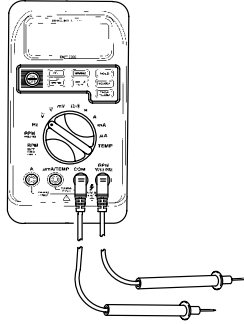
**IMPORTANT: Use resistive spark plugs only.**





# Special Tools

1. DMT 2000 Digital Tachometer Multi-meter P/N 91-854009A1

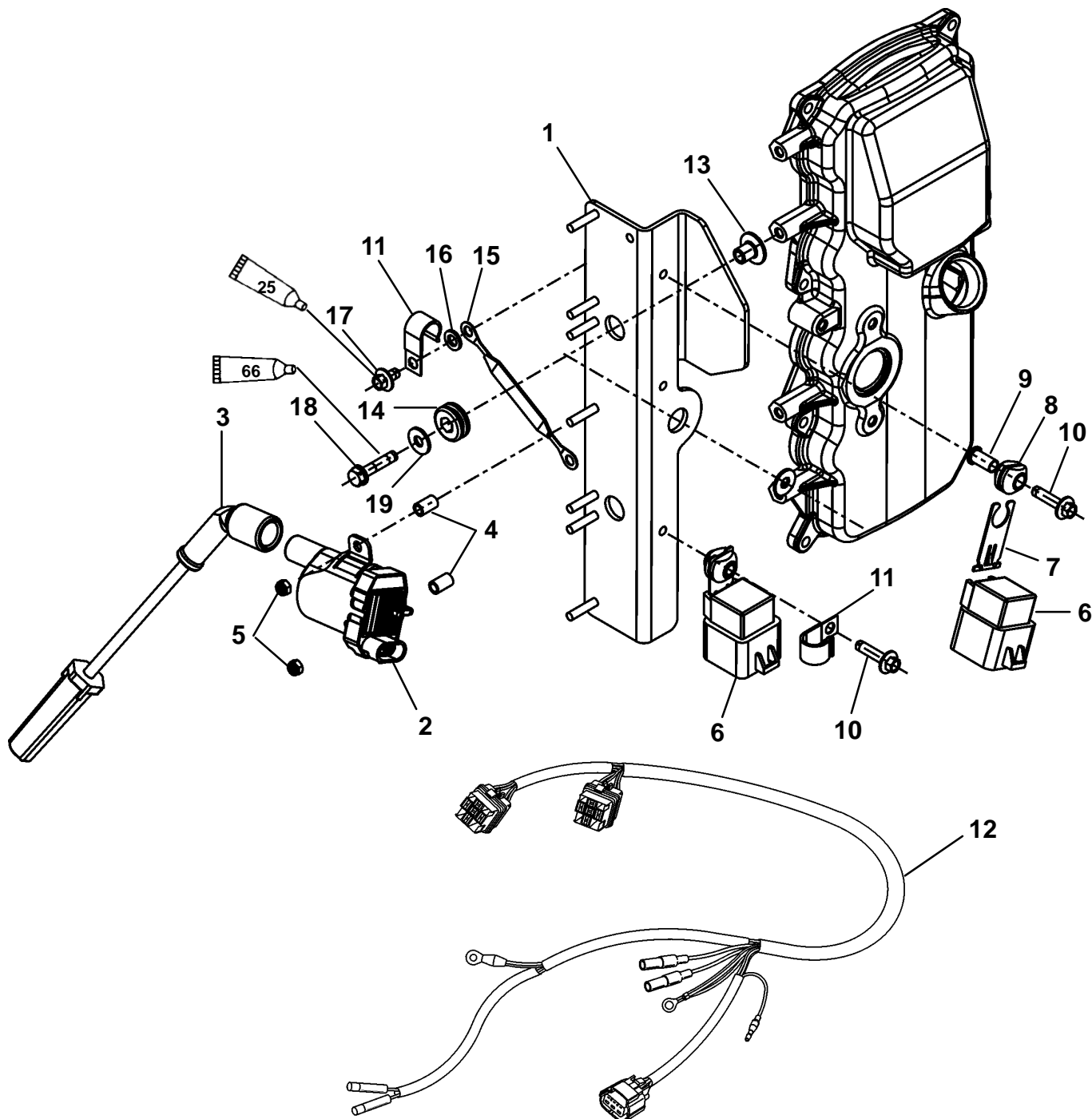




# IGNITION COIL MOUNTING

25 Liquid Neoprene (92-25711--3)

66 Loctite 242 (92-809821)





# IGNITION COIL MOUNTING

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in	lb-ft	Nm.
1	1	COIL PLATE			
2	4	IGNITION COIL			
3	4	HIGH TENSION CABLE			
4	7	SPACER			
5	7	NUT	30		3.4
6	3	TRIM RELAY			
7	3	BRACKET			
8	3	GROMMET			
9	3	BUSHING			
10	3	SCREW (M6 X 25)	60		6.8
11	2	J CLIP			
12	1	TRIM HARNESS			
13	3	BUSHING			
14	3	GROMMET			
15	1	CABLE			
16	1	WASHER			
17	1	SCREW (M6 X 10)	45		5.1
18	3	SCREW (M6 X 30)	75		8.5
19	3	WASHER			



## Ignition Description

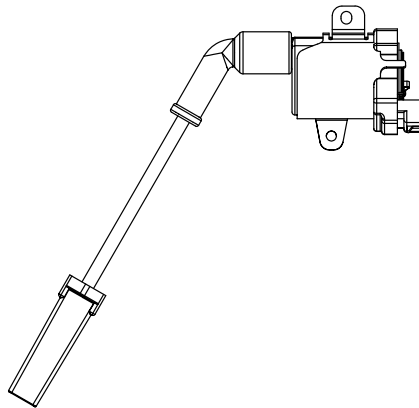
When the ignition key switch is turned to the “RUN” position battery voltage is applied to both the Electronic Control Module (ECM) through the purple wire, and the main power relay through the red/purple wire. As the ECM receives the “RUN” signal it internally completes the ground circuit of the main relay for a period of two seconds, energizing the ignition/injection systems for start-up. As the engine is cranked with the starter motor, the ECM receives the run signal from the Crank Position Sensor (CPS) and completes the ground circuit to the main relay for engine operation.

With the main relay closed (completed circuit) D.C. current from the battery/charging system is transferred through the 20 ampere main relay fuse to the positive terminal of all ignition coil primary windings. The negative terminals of the ignition coil primaries are connected to the engine ground through the coils internal driver, which is triggered by the ECM. With the coil drivers closed, an electric magnetic field is allowed to build up within the ignition coil.

As the flywheel rotates, the CPS senses the location of the 54 teeth on the flywheel and supplies the trigger signal information to the ECM. The ECM utilizes the CPS information and determines when to remove the trigger signal from the coil driver of each ignition coil. The coil driver then opens the coil primary ground circuit which allows it's magnetic field to rapidly collapse across the coil secondary winding which induces a high voltage charge (50,000 volts) that fires the spark plug.

## Ignition Component Description

### Ignition Coils (EST)



The negative terminals of the ignition coil primaries are connected to the engine ground through the coils internal driver, which is triggered by the ECM. With the coil drivers closed, an electric magnetic field is allowed to build up within the ignition coil.

As the flywheel rotates, the CPS senses the location of the 54 teeth on the flywheel and supplies the trigger signal information to the ECM. The ECM utilizes the CPS information and determines when to remove the trigger signal from the coil driver of each ignition coil. The coil driver then opens the coil primary ground circuit which allows it's magnetic field to rapidly collapse across the coil secondary winding which induces a high voltage charge (50,000 volts) that fires the spark plug.



## Ignition Test Procedures

### **⚠ WARNING**

**DANGER – HIGH VOLTAGE/SHOCK HAZARD!** Do not touch ignition components and/or metal test probes while engine is running and/or being “cranked”. **STAY CLEAR OF SPARK PLUG LEADS.** To assure personal safety, each individual spark plug lead should be grounded to engine.

### **⚠ WARNING**

When testing or servicing the ignition system, high voltage is present. **DO NOT TOUCH OR DISCONNECT** any ignition parts while engine is running, while key switch is on or while battery cables are connected.

### **⚠ CAUTION**

Failure to comply with the following items may result in damage to the ignition system.

1. DO NOT reverse battery cable connections. The battery negative cable is (–) ground.
2. DO NOT “spark” battery terminals with battery cable connections to check polarity.
3. DO NOT disconnect battery cables while engine is running.
4. DO NOT crank engine with Ignition Coils/Coil Mounting Plate not grounded.

### **⚠ CAUTION**

To protect against meter and/or component damage, observe the following precautions:

**IMPORTANT:** The metal housing of the ECM is isolation mounted and **MUST NOT** be externally grounded. Should the housing become externally grounded, the engine will not run until the ground is removed and battery cables are momentarily disconnected from the battery to re-set the ECM.

- ALL COMPONENTS MUST BE GROUNDED during tests. Running or “cranking” engine with Ignition Coils/Coil Mounting Plate ungrounded may damage components.



# Ignition Troubleshooting

Refer to Section 3B “Electronic Fuel Injection” - “Troubleshooting and Diagnostics” for complete system troubleshooting/diagnostics procedures.

## Ignition Diagnostic Procedures

**TROUBLESHOOTING TIP:** With engine running, use inductive timing light to check spark advance of each cylinder as throttle is opened and closed. If timing advances and retards on each cylinder, ignition system is MOST LIKELY functioning properly.

**IMPORTANT:** If outboard appears to have an ignition system failure, it is recommended that before beginning in-depth troubleshooting:

- a. Ensure that the engine is mechanically sound condition. (Fuel System, Cylinder Compression etc.).
- b. Check all engine ground leads for loose or corroded connections.
- c. Disconnect and reconnect ignition harness connectors to verify proper continuity.





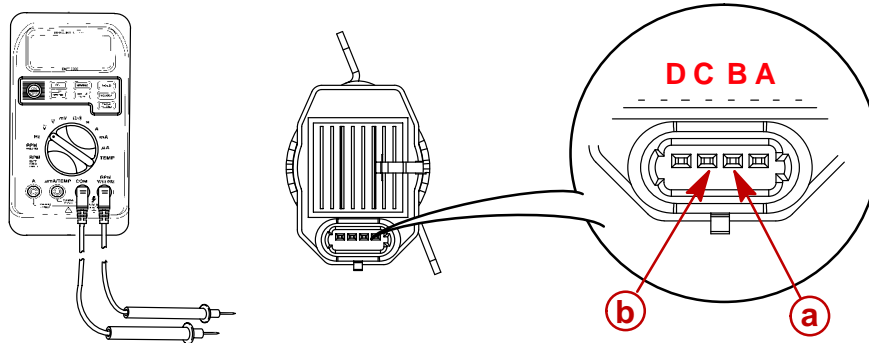
# Testing Ignition Coil

## Resistance Tests

Readings may vary slightly due to temperature changes. Readings listed taken at 68° F (20° C).

**NOTE:** If using DMT 2000 turn the selector switch to  $\Omega$ . Allow the meter to auto-range.

### ELECTRONIC SPARK TRIGGER (EST) TO EST GROUND



**a** - Red Meter Test Lead  
**b** - Black Meter Test Lead

METER TEST LEADS		METER SCALE (ANALOG)	READING ( $\Omega$ )
RED	BLACK	RX1K	8.5 - 12.0K
PIN B	PIN C		

**NOTE:** Ohm readings may not be in range specified because of sensitivity of your multi-meter. Meter should show almost full continuity or near zero resistance condition.

## High Tension Lead Removal/Installation

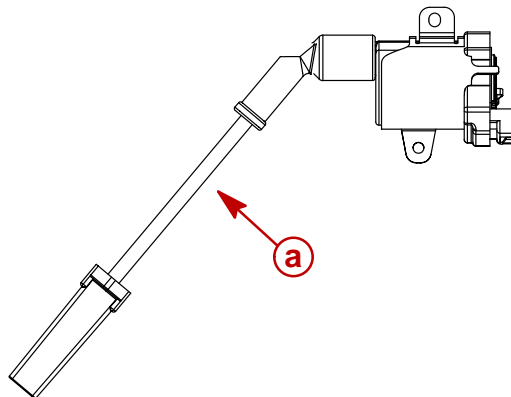
### REMOVAL

1. Slightly twist high tension lead while removing.

### INSTALLATION

1. Push high tension lead on until it snaps in place.

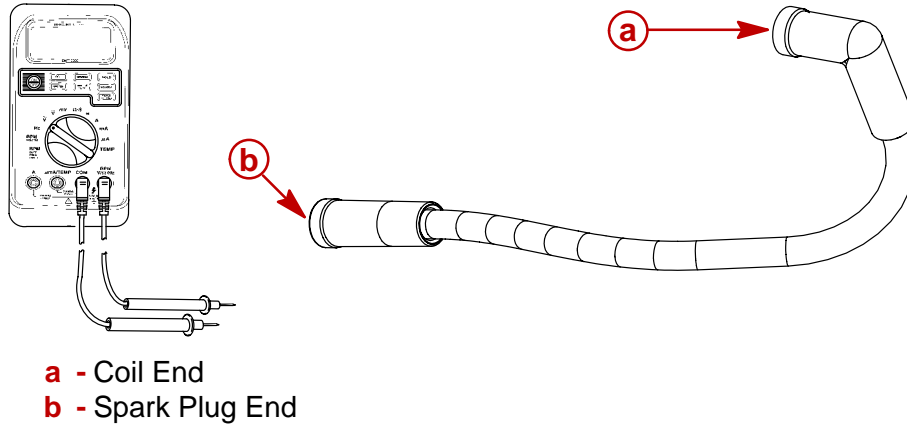
**NOTE:** High tension leads must be removed before testing. Leads contain 5k ohm resistor.



**a** - High Tension Lead

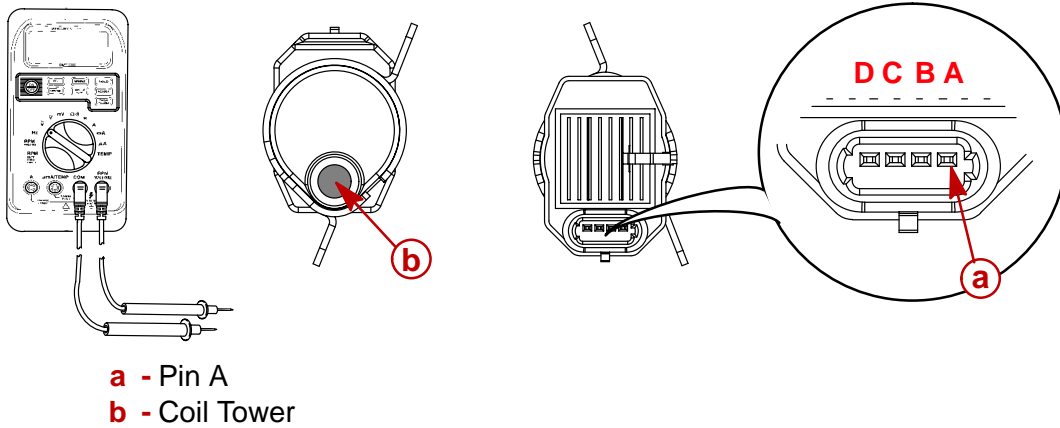


# High Tension Lead Resistance



METER TEST LEADS		METER SCALE (ANALOG)	READING (Ω)
RED	BLACK	RX100	0.600 - 1.100K
COIL END	PLUG END		

# IGNITION COIL (SECONDARY)



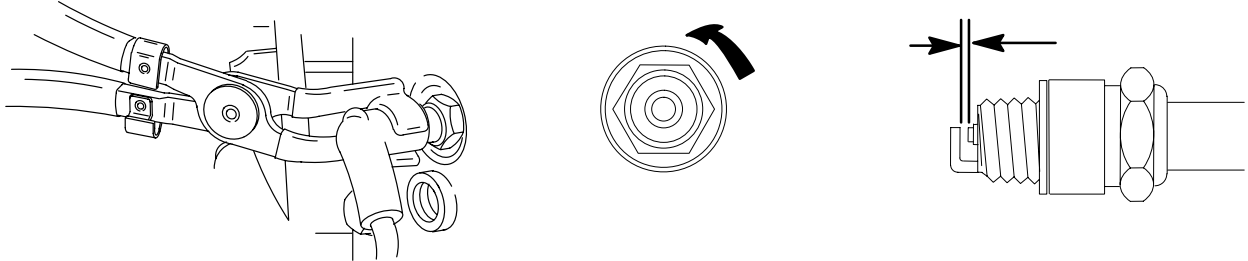
METER TEST LEADS		METER SCALE (ANALOG)	READING (Ω)
RED	BLACK	RX1K	3.0 - 7.0
COIL TOWER	PIN A		



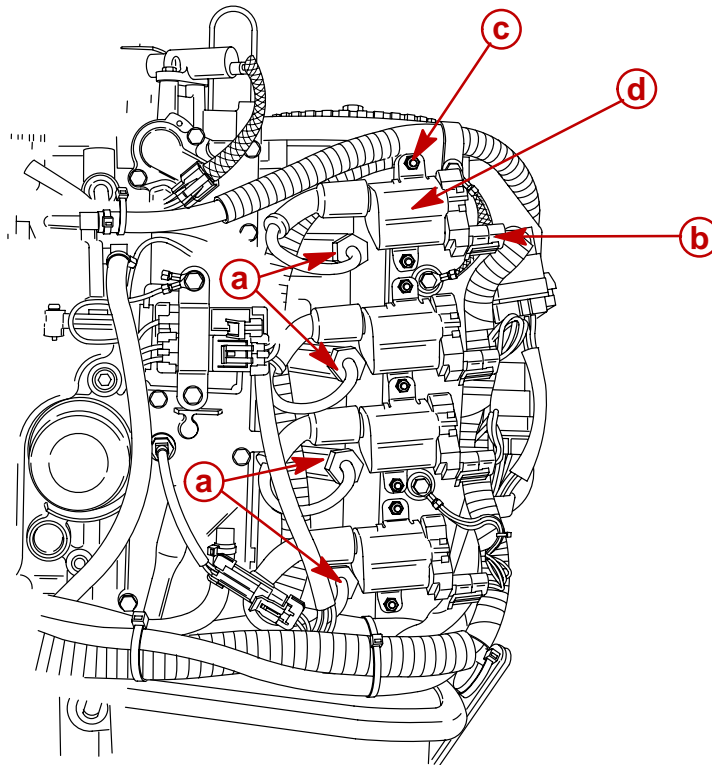
# Ignition Coil Removal and Installation

## ⚠ WARNING

Avoid serious injury or death from fire or explosion caused by damaged spark plug boots. Damaged spark plug boots can emit sparks. Sparks can ignite fuel vapors under the engine cowl. To avoid damaging spark plug boots, do not use any sharp object or metal tool such as pliers, screwdriver, etc. to remove spark plug boots.



1. Disconnect spark plug leads from spark plugs.
2. Disconnect ignition coil harness connectors.
3. Remove ignition coil mounting screws.
4. Reverse steps for installation.



- a** - Spark Plug Lead (4)
- b** - Ignition Coil Harness Connector (4)
- c** - Ignition Coil Mounting Nut (7)
- d** - Ignition Coil (4)

### Ignition Coil Mounting Nut Torque

30 lb. in. (3.4 N·m)