



ELECTRICAL

Section 2A - Ignition

Table of Contents

**2
A**

Specifications	2A-2	Troubleshooting Tips	2A-25
Special Tools	2A-4	Ignition Test Procedures	2A-26
Flywheel/Starter Motor	2A-6	Direct Voltage Adaptor (DVA) Test	2A-26
CDM Mounting	2A-8	Resistance Tests	2A-30
Solenoid Mounting	2A-10	Bias Circuit	2A-30
Theory of Operation	2A-12	Shift Stabilizer Circuit	2A-31
V-6 2.0/2.5L CDM Ignition	2A-13	Idle Stabilizer Description	2A-31
Capacitor Charging #1, #2, & #3 CDMs ..	2A-14	Rev-Limit Circuit	2A-31
Capacitor Charging #4, #5 & #6 CDMs ..	2A-14	EFI Injector Timing Signal Test	2A-32
#1 Cylinder Trigger Circuit	2A-14	EFI Detonation Control System	2A-32
Ignition Coil Circuit	2A-14	Detonation Circuit Test	2A-32
Stop Circuit	2A-14	Ignition Component Removal	2A-33
Ignition Component Description	2A-15	Flywheel Removal	2A-33
Capacitor Discharge Module (CDM)	2A-15	Flywheel Installation	2A-33
Trigger Coil	2A-15	Stator Removal	2A-34
Control Module	2A-15	Stator Installation	2A-35
Ignition Component Description	2A-16	Trigger Removal	2A-36
Stator Assembly	2A-16	Trigger Installation	2A-37
Flywheel	2A-16	CDM Removal	2A-38
CDM (P/N 827509) Trouble Shooting		CDM Installation	2A-38
Flowchart	2A-17	Control Module Removal	2A-38
CDM (P/N 827509)	2A-17	Control Module Installation	2A-38
CDM Stop Diode Trouble Shooting	2A-18	Detonation Module Removal	2A-39
CDM Trouble Shooting Flowchart	2A-20	Detonation Module Installation	2A-39
Direct Voltage Adaptor (DVA)	2A-25		



Specifications

IGNITION SYSTEM	Type Spark Plug Type Spark Plug Gap	Capacitor Discharge NGK BPZ8HS-10 0.040 in. (1.0 mm)
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CAPACITOR DISCHARGE MODULE				
Circuit Test	Connect Negative (-) Meter Lead To:	Connect Positive (+) Meter Lead To:	Ohms Scale	Results:
Stop Diode Forward Bias	Green (D) / or Green test harness lead	Black/Yellow (B) / or Black/Yellow test harness lead	R x 100 Diode Reading*	Continuity
Stop Diode Reverse Bias	Black/Yellow (B) / or Black/Yellow test harness lead	Green (D) / or Green test harness lead	R x 100 Diode Reading*	No Continuity
Return Ground Path Diode, Reverse Bias	Green (D) / or Green test harness lead	Ground Pin (A) or Black test harness lead	R x 100 Diode Reading*	No Continuity
Return Ground Path Diode, Forward Bias	Ground Pin (A) / or Black test harness lead	Green (D) / or Green test harness lead	R x 100 Diode Reading*	Continuity
CDM Trigger Input Resistance	Ground Pin (A) / or Black test harness lead	White (C) / or White test harness lead	R x 100	1000 - 1250 Ohms
Coil Secondary Impedance	Ground Pin (A) or Black test harness lead	Spark Plug Terminal (At Spark Plug Boot)	R x 100	900 - 1200 Ohms

*Diode Readings: Due to the differences in test meters, results other than specified may be obtained. In such a case, reverse meter leads and re-test. If test results then read as specified CDM is O.K. The diode measurements above will be opposite if using a Fluke equivalent multimeter.



Stator Output Test		400 DVA Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading @ Cranking to 2500 RPM
Connect to Green Test Harness Lead	Connect to Black Test Harness Lead	160 - 320

CDM Trigger Input Test		2 DVA Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading @ Cranking
White Test Harness Lead	Black Test Harness Lead	0.2 - 2.0

CDM Trigger Input Test		20 DVA Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading @ Idle to 2500 RPM
White Test Harness Lead	Black Test Harness Lead	2 - 8 Volts

Bias Circuit Test (All Models Except 200 EFI)		40 DVA Scale @2500 RPM
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading
Engine Ground	Black/White Shift Switch Wire	25 - 40 Volts

Bias Circuit Test (200 EFI)		40 DVA Scale @ 2500 RPM
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading
Engine Ground	Disconnect 4 wire Detonation Control Module connector. Insert bent paper clip into Black/White terminal.	25 - 40 Volts

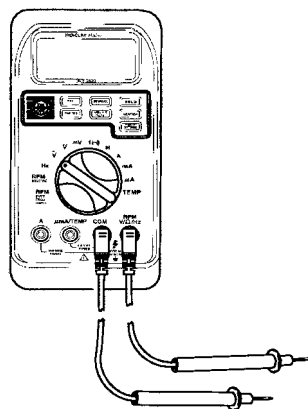
Trigger Assembly Test		
Test Leads to	Resistance Ohms	Scale Reading
Between Brown Trigger Lead and Yellow Trigger Lead	1100-1400	R x 100
Between White Trigger Lead and Red Trigger Lead	1100-1400	R x 100
Between Purple Trigger Lead and Blue Trigger Lead	1100-1400	R x 100

Stator Resistance Test		R x 1 Ohms Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	
Connect to White/Green stator lead	Connect to Green/White stator lead	380-430
Connect to White/Green stator lead	Connect to engine ground	No continuity
Connect to Green/White stator lead	Connect to engine ground	No continuity

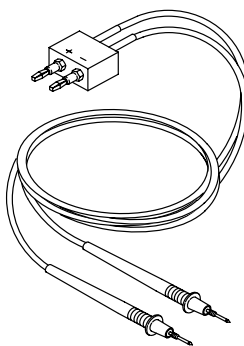


Special Tools

1. DMT 2000 Digital Tachometer Multimeter 91-854009A1



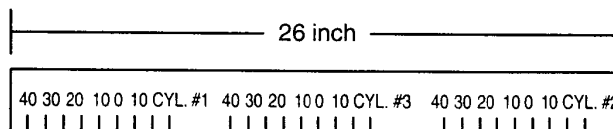
2. DVA Adaptor 91-89045



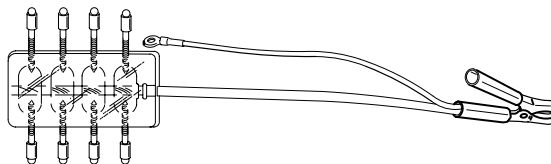
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3. Cylinder Timing Decal 91-853883-1

NOTE: Decal can be used to help troubleshoot ignition timing by determining the timing of individual cylinders.

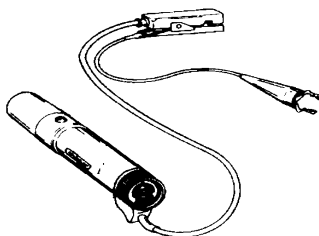


4. Spark Gap Tester 91-850439



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5. Timing Light 91-99379





6. Crank Shaft Protector Cap 91-24161

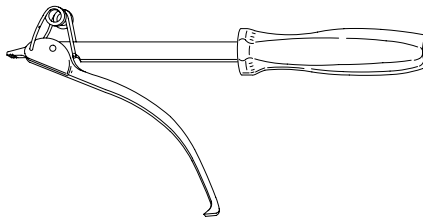


7. Flywheel Puller 91-849154T1

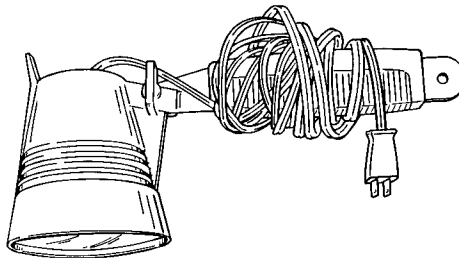


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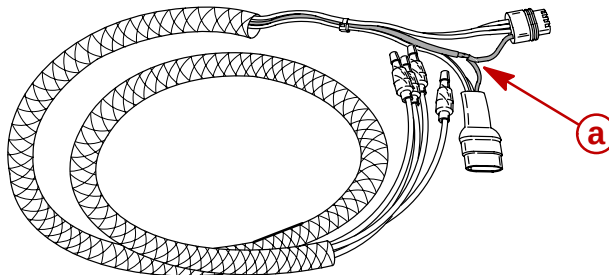
8. Flywheel Holder 91-52344



9. Heat Lamp 91-63209



10. CDM Test Harness 84-825207A2



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a - BLACK Ground Wires – Solder together. Prevents electrical interference while performing CDM checks with engine running.

[illegible]

 25 Liquid Neoprene (92-25711--2)

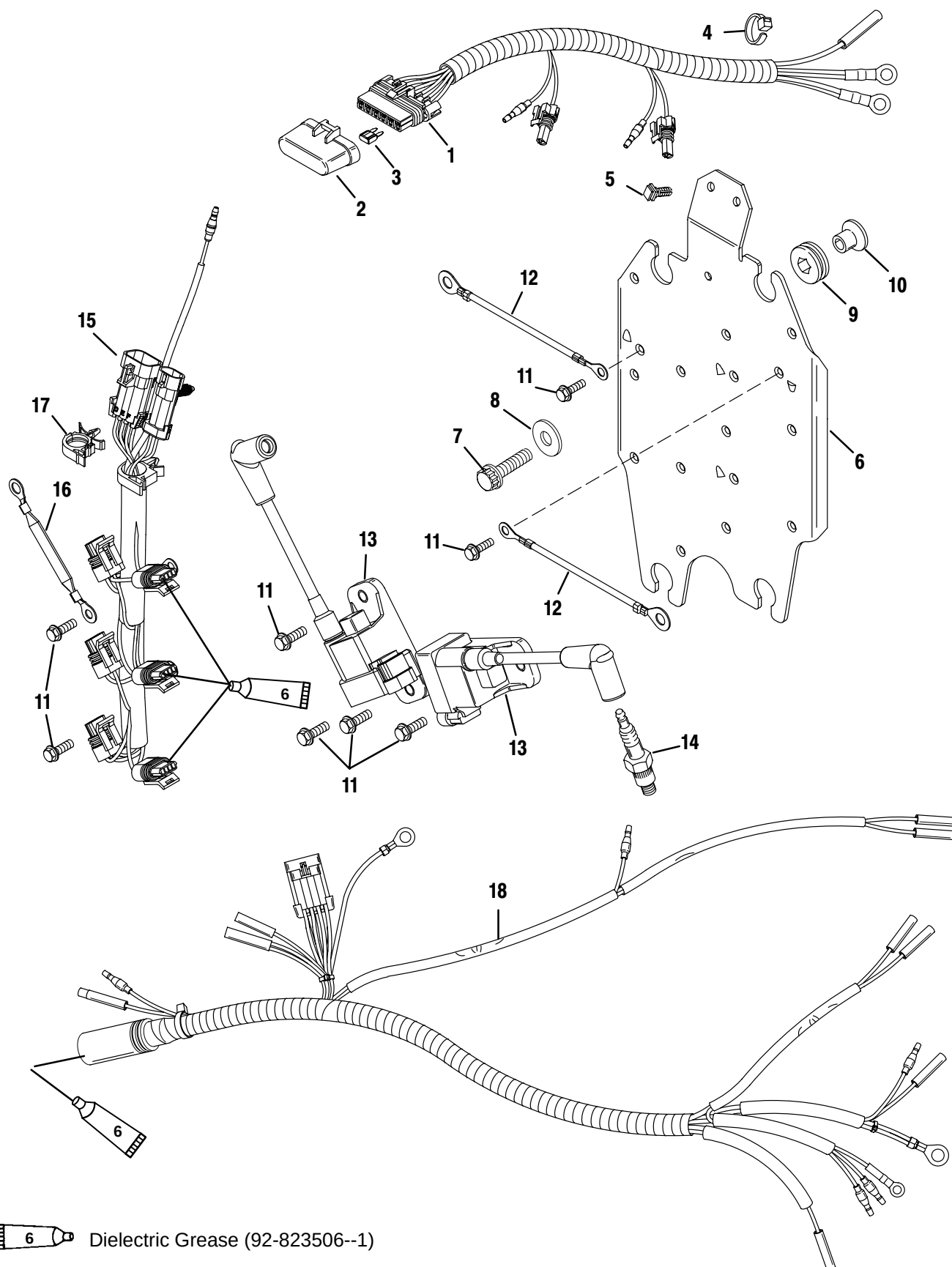


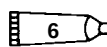
Flywheel/Starter Motor

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in	lb-ft	Nm.
1	1	FLYWHEEL COVER ASSEMBLY			
2	1	MARKER			
3	2	SCREW (3/16-32 x 3/8)			
4	2	WASHER			
5	1	PLUG			
6	1	NUT		120	163
7	1	WASHER			
8	1	FLYWHEEL			
9	1	STATOR			
10	5	SCREW (10-32 x 1-3/8)	50		5.5
11	5	WASHER			
12	1	TRIGGER PLATE ASSEMBLY			
13	1	PIVOT			
14	1	NUT			
15	1	LINK ROD			
16	1	BALL JOINT			
17	1	STARTER MOTOR (See breakdown on Starter Motor)			
18	2	COLLAR			
19	2	RUBBER STOP			
20	1	SCREW (1/4-20 x 5/8)	60		7
21	1	WIRE ASSEMBLY (BLACK)			
22	1	LOCKWASHER			
23	1	NUT	60		7
24	1	DECAL-In Gear Idle			
25	1	DECAL-Warning-High Voltage			
26	1	DECAL-Start in Gear			



CDM Mounting



 6 Dielectric Grease (92-823506--1)

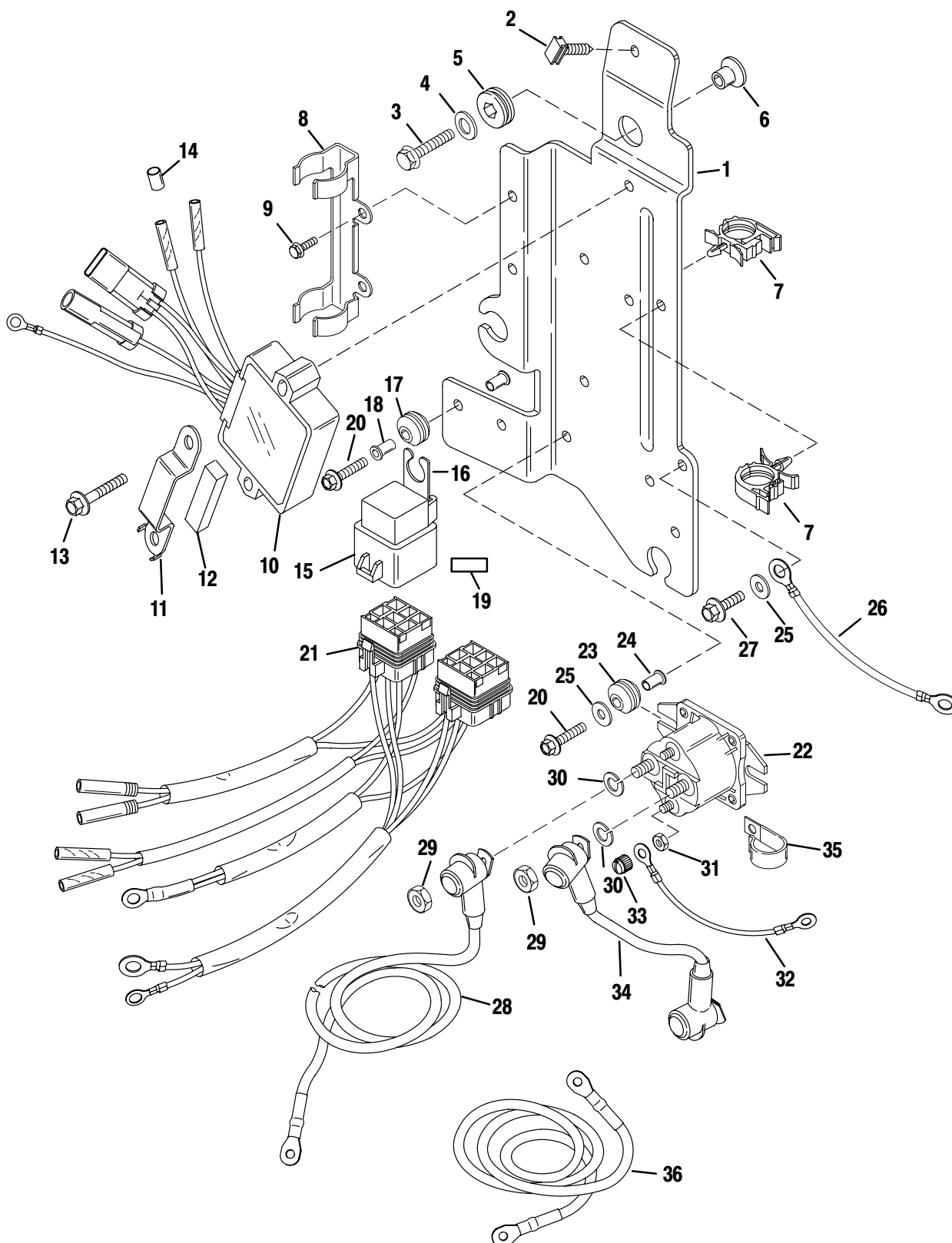


CDM Mounting

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in	lb-ft	Nm.
1	1	POWER HARNESS			
2	1	COVER			
3	3	FUSE			
4	3	STA STRAP			
5	2	CLIP			
6	1	CDM MOUNTING PLATE			
7	4	SCREW (.312-18 x 1-1/4)		20	27
8	4	WASHER			
9	4	GROMMET			
10	4	BUSHING			
11	15	SCREW (M6 x 16)	70		8
12	2	CABLE			
13	6	CDM			
14	6	SPARK PLUG (NGK#BPZ8HS10)		20	27
15	1	CDM HARNESS			
16	1	CABLE			
17	1	CLIP			
18	1	ENGINE HARNESS			



Solenoid Mounting





Solenoid Mounting

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in	lb-ft	Nm.
1	1	SOLENOID PLATE			
2	1	CLIP			
3	3	SCREW (.312-18 x 1-1/4)		20	27
4	3	WASHER			
5	3	GROMMET			
6	3	BUSHING			
7	4	CLIP			
8	1	CLAMP			
9	2	SCREW (M5 x 12)	40		4.5
10	2	VOLTAGE REGULATOR			
11	2	BRACKET			
12	2	FOAM PAD			
13	4	SCREW (M6 x 35)	70		8
14	1	PLUG (GRAY LEAD)			
15	2	TRIM RELAY			
16	2	BRACKET			
17	2	GROMMET			
18	2	BUSHING			
19	2	DECAL			
20	4	SCREW (M6 x 25)	70		8
21	1	WIRING HARNESS			
22	1	STARTER SOLENOID			
23	2	GROMMET			
24	2	BUSHING			
25	2	WASHER			
26	1	CABLE			
27	1	SCREW (M6 x 14)	70		8
28	1	BATTERY CABLE (POSITIVE)			
29	2	NUT	60		7
30	2	LOCKWASHER			
31	2	NUT	30		3.5
32	1	CABLE			
33	2	CAP NUT	Drive Tight		
34	1	CABLE			
35	1	CLIP			
36	1	BATTERY CABLE (NEGATIVE)			



Theory of Operation

The V-6 outboard CDM ignition system is alternator-driven with distributor-less capacitor discharge. Major components of the system are the flywheel, stator assembly, trigger assembly, control module, 6 CDM assemblies and 6 spark plugs.

The stator assembly is mounted below the flywheel and has 3 capacitor charging coils. The flywheel is fitted with permanent magnets inside the outer rim. As the flywheel rotates, the permanent magnets pass the capacitor charging coils producing AC voltage. The AC voltage is conducted to the CDMs where it is rectified, regulated to 300 volts, and stored in capacitors.

The trigger assembly (also mounted under the flywheel) has 3 coils. Each coil controls the spark to 2 cylinders - one on each bank. The flywheel also has a second set of permanent magnets located around the center hub. As the flywheel rotates, the magnets pass the trigger coils producing AC voltage. The AC voltage is conducted to the control module, which shapes the signal before sending it to the electronic switch (SCR) inside the appropriate CDM. The switch discharges the capacitor voltage into the primary side of the ignition coil (inside the CDM).

As this voltage goes to ground through the primary circuit of the coil, it induces a voltage rise in the secondary side of the ignition coil. This voltage can increase to approximately 40000 volts before bridging the spark plug gap and returning to ground.

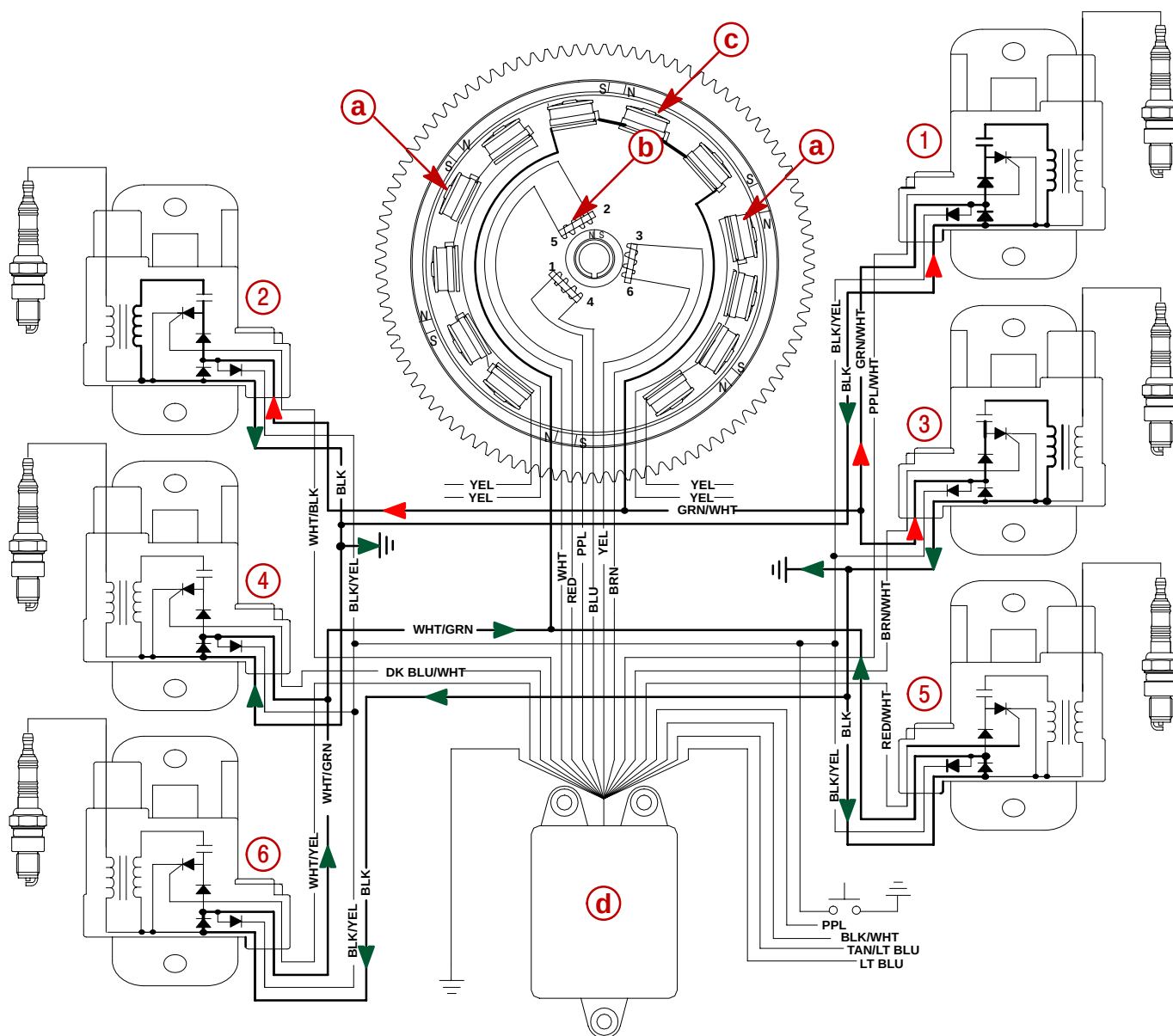
The preceding sequence occurs once per engine revolution for each cylinder.

Spark timing is advanced or retarded by the movement of the trigger assembly attached to the throttle/spark arm.

The control module provides rev-limit (carb models), bias control, shift stabilizer, idle stabilizer, injector timing signal (EFI models), and low oil warning.



V-6 2.0/2.5L CDM Ignition



- a** - Battery Charging Coils
- b** - Trigger Coils
- c** - Capacitor Charging Coils
- d** - Control Module



Capacitor Charging #1, #2, & #3 CDMs

The STATOR assembly is mounted to the block below the flywheel and has 3 CAPACITOR CHARGING COILS connected in series. The FLYWHEEL is fitted with 6 permanent magnets inside the outer rim. The flywheel rotates the permanent magnets past the capacitor charging coils causing the coils to produce AC voltage (260-320 volts). The AC voltage is then conducted to the CAPACITOR DISCHARGE MODULES (CDM), where it is rectified (DC) and stored in a capacitor. The stator voltage return path is through the ground wire of one of the other CDMs and back through that CDM's charging coil wire to the capacitor charging coils.

NOTE: The CDM contains a zener diode (not shown for clarity). The zener diode regulates the capacitor voltage to 300 volts, preventing overcharging of the capacitor (and possible failure) if the SCR does not receive a trigger pulse.

Capacitor Charging #4, #5 & #6 CDMs

The flywheel rotates the permanent magnets past the capacitor charging coils causing the coils to produce AC voltage (260-320 volts). The opposite voltage pulse is then conducted to the CAPACITOR DISCHARGE MODULES (CDM), where it is rectified (DC) and stored in a capacitor. The stator voltage return path is through the ground wire of one of the other CDMs and back through that CDM's charging coil wire to the capacitor charging coils.

NOTE: The CDM contains a zener diode (not shown for clarity). The zener diode regulates the capacitor voltage to 300 volts, preventing overcharging of the capacitor (and possible failure) if the SCR does not receive a trigger pulse.

#1 Cylinder Trigger Circuit

The TRIGGER assembly (also mounted under the flywheel) has three coils, one for two cylinders - one on each bank. These coils are mounted adjacent to the flywheel center hub. The center hub of the flywheel contains a permanent magnet with two north-south transitions.

As the flywheel rotates, the magnet north-south transitions pass the trigger coils. This causes the trigger coils to produce a voltage pulse which is sent to the control module. The control module shapes the signal before sending it onto the capacitor discharge module (CDM). A positive voltage pulse will activate the electronic switch (SCR) inside the capacitor discharge module (CDM). The switch discharges the capacitor voltage through the coil primary windings. The return voltage pulse exits the CDM through the ground wire and returns through the control module.

Spark timing is advanced or retarded by the movement of the trigger assembly attached to the throttle/spark arm.

Ignition Coil Circuit

As the capacitor voltage flows through the primary windings of the ignition coil, a voltage is induced into the ignition coil secondary windings. This secondary voltage rises to the level required to jump the spark plug gap and return to ground. This secondary voltage can, if necessary, reach approximately 40,000 volts. To complete the secondary voltage path, the released voltage enters the ground circuit of CDM module.

Stop Circuit

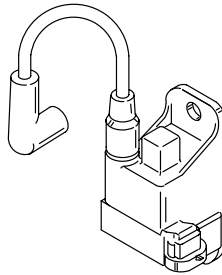
To stop the engine, the stop switch is closed allowing the capacitor charge current from the stator to drain directly to ground.



Ignition Component Description

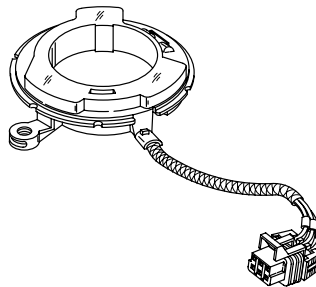
Capacitor Discharge Module (CDM)

Each module contains an ignition coil and amplifier circuitry which produces approximately 40,000 volts at the spark plugs.



Trigger Coil

Located under flywheel. Is charged by single magnet on flywheel hub. Trigger pulses are sent to CDM.

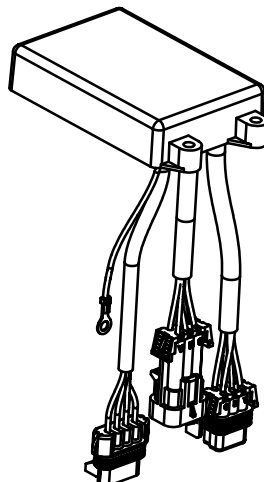


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Control Module

The control module provides rev-limit (carb models), bias control, shift stabilizer, idle stabilizer, injector timing signal (EFI models), and low oil warning.

On carburetor models, the rev-limiter affects the cylinders in the following sequence 2-3-4-5-6-1. As the engine rpm exceeds the maximum specification (5900 ± 100), the control module will retard the timing on cylinder #2. The controller will retard the timing a maximum of 30 degrees and then, if necessary, stop spark on the cylinder. If the engine rpm is still above the maximum specification, the controller will begin to retard timing on the next cylinder, then stop spark, continuing in sequence until the engine rpm drops below the maximum specification.

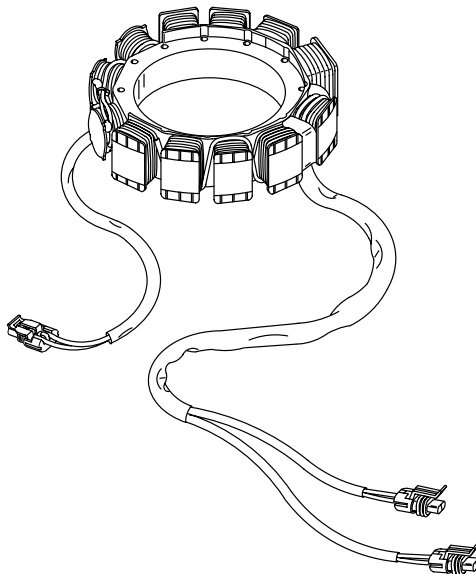




Ignition Component Description

Stator Assembly

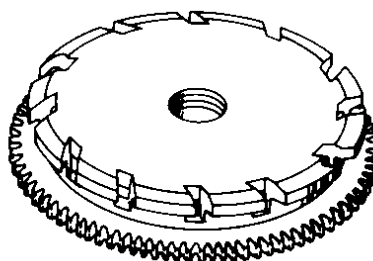
Located under the flywheel in the stator assembly are 12 coils; 3 ignition charge coils and 9 auxiliary power coils wound in series that provide voltage to the CDM's and battery/auxiliary circuits respectively.



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Flywheel

Contains 6 magnets (12 pole) around circumference. Flywheel has 2 magnets on inner hub for trigger. Outer magnets are for battery charge coils and ignition charge coils. These outer magnets are covered by a thin stainless steel retaining ring bonded onto the inside diameter.



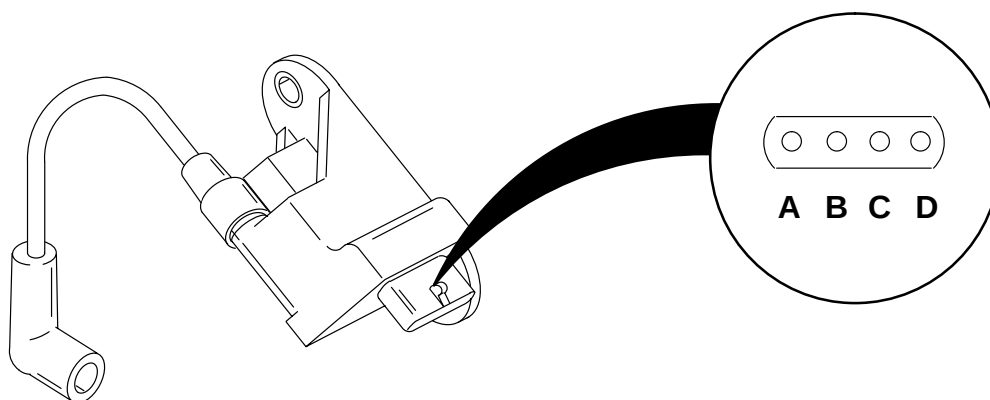


CDM (P/N 827509) Trouble Shooting Flowchart

CHART 1

Step	Action	Value	Yes	No	Tools
1	Verify High Tension Leads, Spark Plug and Spark Boots are in good condition. Inspect wires for chafing. Visual Inspection	—	Step 2	Replace Failed Component Step 2	High Tension lead pin P/N 84-813706A56
2	Verify 4 Pin Connector Integrity Visual Inspection	—	Step 3	Repair/Replace Connector Components Step 3	—
3	Verify Ground from CDM connector to block	0.2 Ohms and below	Step 4	Correct Ground Path Step 4	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045
4	Test all CDMs at Cranking with Spark Gap Tester Spark on All CDMs? Will spark jump a 7/16 in. (11.11 mm) gap?	7/16 in. (11.11 mm) gap	If at least one CDM has spark, continue with Chart #3	Continue with Chart #2	Spark Gap Tester P/N 91-850439

CDM (P/N 827509)



- a** - Ground
- b** - Black/Yellow
- c** - Trigger Connection
- d** - Stator Connection



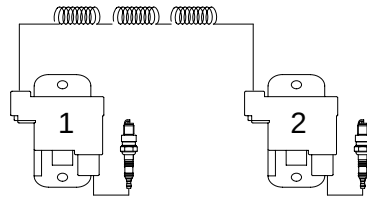
CDM Stop Diode Trouble Shooting

2 Cyl.:

CDM #1 gets its charging ground path through CDM #2

CDM #2 gets its charging ground path through CDM #1

A shorted Stop Diode in either CDM would prevent the opposite one from sparking.



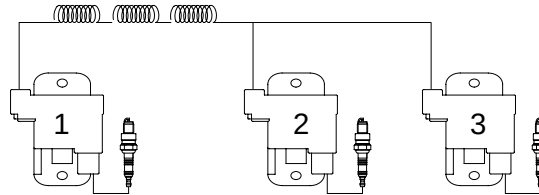
3 Cyl.:

CDM #1 gets its charging ground path through CDM #2 or #3

CDM #2 and #3 get their charging ground path through CDM #1

A shorted Stop Diode in CDM #1 would prevent CDMs #2 and #3 from sparking.

A shorted Stop Diode in CDM #2 or #3 would prevent CDM #1 from sparking.



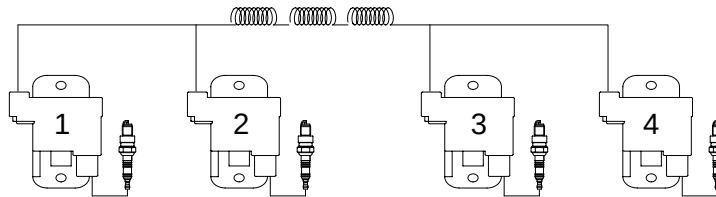
4 Cyl.:

CDM #1 and #2 get their charging ground path through CDM #3 or #4

CDM #3 and #4 get their charging ground path through CDM #1 or #2

A shorted Stop Diode in CDM #1 or #2 would prevent CDMs #3 and #4 from sparking.

A shorted Stop Diode in CDM #3 or #4 would prevent CDMs #1 and #2 from sparking.





CDM Stop Diode Trouble Shooting (Con't)

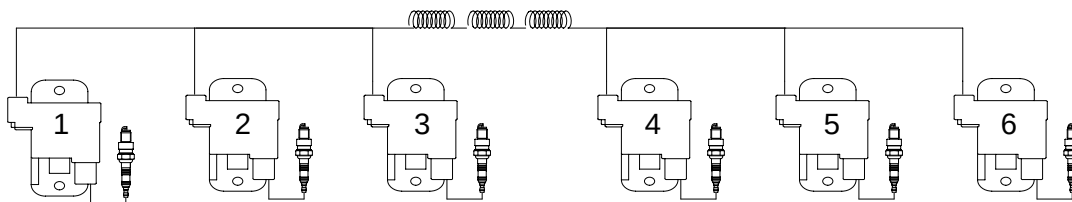
2.0/2.5 Litre 6 Cyl.:

CDM #1, #2 and #3 get their charging ground path through CDM #4, #5 or #6

CDM #4, #5 and #6 get their charging ground path through CDM #1, #2 or #3

A shorted Stop Diode in CDM #1, #2 or #3 would prevent CDMs #4, #5 and #6 from sparking.

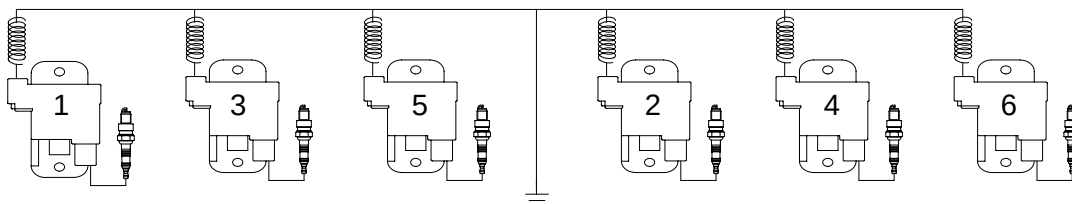
A shorted Stop Diode in CDM #4, #5 or #6 would prevent CDMs #1, #2 and #3 from sparking.



3.0 Litre 6 Cyl.:

All CDMs get their charging ground path independently through the stator's white leads.

A shorted Stop Diode in any one CDM will prevent at least 2 other CDMs from sparking.



**CDM Trouble Shooting Flowchart****CHART #2 (NO SPARK ON ANY CDM)**

Step	Action	Value	Yes	No	Tools
1	With the key switch ON: Verify continuity between disconnected BLK/YEL harness wire and ground. This Test Checks: Lanyard Switch Key Switch Rev Limiter (external) Chafed BLK/YEL wire	NO continuity	Step 2	Repair or Replace Component Run Engine Verify Repair Step 9	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045
2	Un-plug all CDMs and verify continuity between disconnected BLK/YEL harness wire and ground. This Test Checks: CDM Harness	NO continuity	Step 3	Repair or Replace Component Run Engine Verify Repair Step 9	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045
3	Connect CDM one at a time This Test Checks: Individual CDM Stop Circuits	Resistance will rise with each CDM connected, full continuity indicates shorted CDM stop circuit.*	Step 4	Repair or Replace Component Run Engine Verify Repair Step 9	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045 TPI/CDM Test Harness 84-825207A2
4	Check Stator Open circuit voltage at cranking should be no less than 100 Volts on the DVA Resistance between GRN/WHT and WHT/GRN	660-710 Ohms 2, 3 & 4 Cyl. Models 380-430 Ohms 2.0/2.5L 990 - 1210 Ohms 3.0L	Step 5	Replace Stator Run Engine Verify Repair Step 9	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045

*Diode Readings: Due to the differences in test meters, results other than specified may be obtained. In such a case, reverse meter leads and re-test. If test results then read as specified CDM is O.K. The diode measurements above will be opposite if using a Fluke equivalent multimeter.

**CHART #2 (NO SPARK ON ANY CDM) (CON'T)**

Step	Action	Value	Yes	No	Tools
5	Check CDM Trigger Input/Crank Shaft Position Sensor Output: Cranking with CDM disconnected. Cranking with CDM connected.	1 Volt and above - CDM disconnected. 0.2 - 5 Volts- CDM connected.	Step 6	2, 3, & 4 Cyl Replace Trigger Run Engine Verify Repair Step 9 2.0/2.5L 6 Cyl. - Step 6 3.0L 6 Cyl. - Step 7	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045 TPI/CDM Test Harness P/N 84-825207A2
6	2.0/2.5L V-6 Models Resistance between Trigger wires. Red - White Blue - Purple Brown - Yellow	1100 - 1400 Ohms	Step 8	Replace Control Module Run Engine Verify Repair Step 9	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1
7	3.0 L V-6 Models Resistance Check Crank Position Sensor	900 - 1300 Ohms	Step 8	Replace Crank Position Sensor Run Engine Verify Repair Step 9	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045
8	Test all CDMs at Cranking with Spark Gap Tester Spark on All CDMs? Will spark jump a 7/16 in. (11.11 mm) gap?	7/16 in. (11.11 mm) gap	Step 9	Verify All Preceding Steps	Spark Gap Tester P/N 91-850439
9	If mis-firing is in a repeatable range: Perform DVA readings on stator and trigger at all running speeds.* 2.0/2.5L V-6 Models Preform Bias circuit tests 200 HP EFI - Disconnect Detonation Module. Check Black/White to ground All other models - Disconnect Black/White to shift switch. Check Black/White to Ground	Stator: 200 Volts and above Trigger: 2 Volts and above -25 to -40 Volts @2500 rpm	Run Engine Verify Repair END	Refer to *Note Below Replace Control Module Run Engine Verify Repair	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045 TPI/CDM Test Harness P/N 84-825207A2

* Note: Stator tests will only isolate problem down to a charging pair. Further testing is necessary to determine faulty CDM. Disconnecting one CDM of the charging pair is recommended.

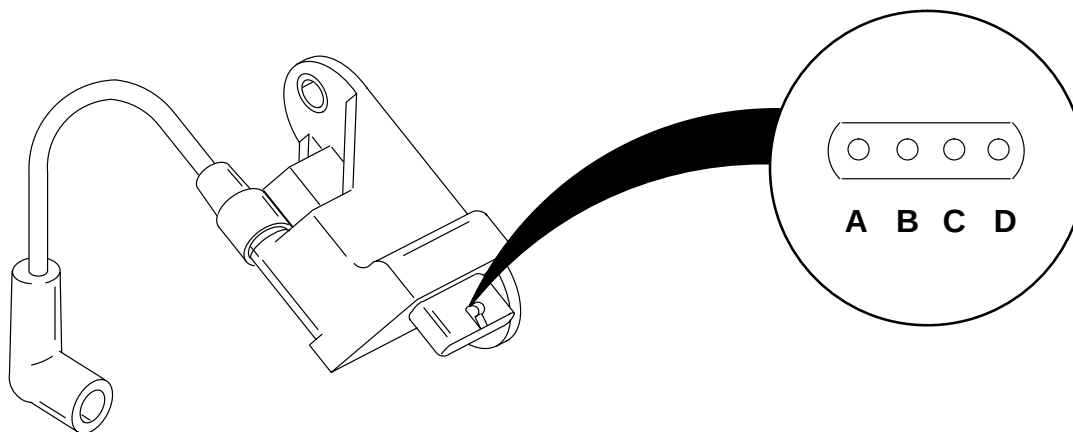
**CDM Trouble Shooting Flowchart****CHART #3 (AT LEAST ONE CDM HAS SPARK)**

Step	Action	Value	Yes	No	Tools
1	Resistance Check ALL CDMs	Refer to chart	Step 3	Replace any CDMs that do not pass specifications even if they fire Step 2	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045
2	Test all CDMs at Cranking with Spark Gap Tester Spark on All CDMs Will spark jump a 7/16 in. (11.11 mm) gap?	7/16 in. (11.11 mm) gap	Run Engine Verify Repair Step 7	Step 3	Spark Gap Tester P/N 91-850439
3	Check CDM Trigger Input: Cranking with CDM disconnected Cranking with CDM connected	1 Volt and above - CDM disconnected. 0.2 - 5 Volts - CDM connected.	Step 6	2, 3, & 4 Cyl - Replace Trigger Run Engine Verify Repair Step 7 2.0/2.5L 6 Cyl. - Step 4 3.0L 6 Cyl. - Step 4	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045 TPI/CDM Test Harness 84-825207A2
4	2.0/2.5L V-6 Models Resistance between Trigger wires Red - White Blue - Purple Brown - Yellow	1100 - 1400 Ohms	Replace Control Module Step 6	Replace Trigger Step 6	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1
5	3.0 V6 Models Resistance Check Crank Position Sensor	900 - 1300 Ohms	Step 6	Replace Crank Position Sensor Run Engine Verify Repair Step 7	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045

**CHART #3 (AT LEAST ONE CDM HAS SPARK) (CON'T)**

Step	Action	Value	Yes	No	Tools
6	Test all CDMs at Cranking with Spark Gap Tester Spark on All CDMs? Will spark jump a 7/16 in. (11.11 mm) gap?	7/16 in. (11.11 mm) gap	Run Engine Verify Repair Step 7	Replace any non-firing CDMs Step 7	Spark Gap Tester P/N 91-850439
7	If mis-firing is in a repeatable range: Perform DVA readings on stator and trigger at all running speeds.* 2.0/2.5L V-6 Models Preform Bias circuit tests 200 HP EFI - Disconnect Detonation Module. Check Black/White to ground All other models - Disconnect Black/White to shift switch. Check Black/White to Ground	Stator: 200 Volts and above Trigger: 2 Volts and above -25 to -40 Volts @2500 rpm	Run Engine Verify Repair END	Refer to *Note Below Replace Control Module Run Engine Verify Repair	DMT 2000 Digital Tachometer/ Multi-meter P/N 91-854009A1 & DVA Adaptor P/N 91-89045 TPI/CDM Test Harness 84-825207A2 6 Pin Connector

* Note: Stator tests will only isolate problem down to a charging pair. Further testing is necessary to determine faulty CDM. Disconnecting one CDM of the charging pair is recommended.

**CAPACITOR DISCHARGE MODULE****IMPORTANT:** Spark plug wires are screwed into CDM.

- a** - Ground
- b** - Black/Yellow
- c** - Trigger Connection
- d** - Stator Connection

A resistance check is required and can be performed on the CDM as follows:**NOTE:** This test can be performed using the test harness (P/N 84-825207A2). Do Not connect the test harness plug to the stator/trigger engine wire harness.

CAPACITOR DISCHARGE MODULE				
Circuit Test	Connect Negative (-) Meter Lead To:	Connect Positive (+) Meter Lead To:	Ohms Scale	Results:
Stop Diode Forward Bias	Green (D) / or Green test harness lead	Black/Yellow (B) / or Black/Yellow test harness lead	R x 100 Diode Reading*	Continuity
Stop Diode Reverse Bias	Black/Yellow (B) / or Black/Yellow test harness lead	Green (D) / or Green test harness lead	R x 100 Diode Reading*	No Continuity
Return Ground Path Diode, Reverse Bias	Green (D) / or Green test harness lead	Ground Pin (A) or Black test harness lead	R x 100 Diode Reading*	No Continuity
Return Ground Path Diode, Forward Bias	Ground Pin (A) / or Black test harness lead	Green (D) / or Green test harness lead	R x 100 Diode Reading*	Continuity
CDM Trigger Input Resistance	Ground Pin (A) / or Black test harness lead	White (C) / or White test harness lead	R x 100	1000 - 1250 Ohms
Coil Secondary Impedance	Ground Pin (A) or Black test harness lead	Spark Plug Terminal (At Spark Plug Boot)	R x 100	900 - 1200 Ohms

*Diode Readings: Due to the differences in test meters, results other than specified may be obtained. In such a case, reverse meter leads and re-test. If test results then read as specified CDM is O.K. The diode measurements above will be opposite if using a Fluke equivalent multimeter.



Direct Voltage Adaptor (DVA)

The DVA can be used with Quicksilver DMT 854009A1, VOA Meter 91-99750A1, Quicksilver Volt/Ohm meter 91-93572, or an equivalent volt meter (capable of measuring 400 volts DC or higher) to check primary ignition voltage on Alternator Driven Ignition (ADI) systems. (Models are specified in Test Charts, following.)

⚠ CAUTION

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

- **MAKE CERTAIN** that Positive (+) lead/terminal of DVA is connected to Positive (+) receptacle of meter.
- **400 VDC test position (or higher) MUST BE** used for all tests, except "Trigger Ohms" test.
- **DO NOT CHANGE** meter selector switch position while engine is running and/or "cranked."

⚠ WARNING

DANGER - HIGH VOLTAGE/SHOCK HAZARD! Do Not touch ignition components and/or metal test probes while engine is running and/or "cranked."

Test procedures and specifications are provided for checking primary ignition voltage while the engine is running and/or being "cranked."

Troubleshooting Tips

1. Intermittent, weak or no spark output at any one spark plug (single cylinder) usually is a bad CDM or control module.
2. Intermittent, weak or no spark output at two spark plugs (one plug from each bank of three cylinders) usually is caused by a bad TRIGGER.
3. Intermittent, weak or no spark output at three spark plugs (1,2, & 3 or 4, 5, & 6) usually is caused by a bad CDM.
4. No spark output on any spark plug (six cylinders) usually is a bad stop circuit, stator or control module.
5. Erratic timing or an engine that will not idle down usually has a failure in the bias circuit inside the control module.



Ignition Test Procedures

Direct Voltage Adaptor (DVA) Test

⚠ CAUTION

DVA checks can be made while cranking engine with starter motor. To prevent engine from starting while being cranked, all spark plugs must be removed.

⚠ CAUTION

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

- **INSURE** that the Positive (+) meter lead is connected to the DVA receptacle on the meter.
- **DO NOT CHANGE** meter selector switch position while engine is running and/or being “cranked”.
- **DO NOT** reverse battery cable connections. The battery negative cable is (–) ground.
- **DO NOT** “spark” battery terminals with battery cable connections to check polarity.
- **DO NOT** disconnect battery cables while engine is running.

A process of elimination must be used when checking the ignition system without a voltmeter (capable of measuring 400 volts DC, or higher) and Direct Voltage Adaptor (91-89045), as the control module cannot be thoroughly checked with conventional test equipment.

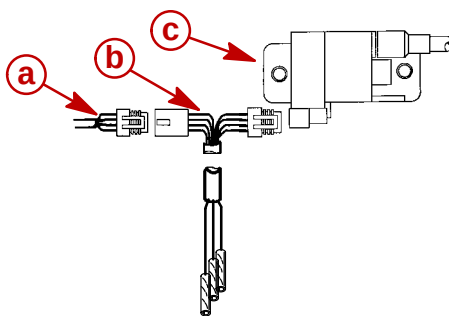
All other components can be tested with an ohmmeter. Before troubleshooting the ignition system, check the following:

1. Make sure that electrical harness and ignition switch are not the source of the problem.
2. Check that plug-in connectors are fully engaged and terminals are free of corrosion.
3. Make sure that wire connections are tight and free of corrosion.
4. Check all electrical components, that are grounded directly to engine, and all ground wires to see that they are grounded to engine.
5. Check for disconnected wires and short and open circuits.



NOTE: Each CDM is grounded through the engine wiring harness via the connector plug. It is not necessary to have the CDM mounted on the ignition plate for testing.

1. Remove all spark plugs.
2. Insert spark gap tool (P/N 91-63998A1) into each spark plug boot and attach alligator clips to a good engine ground.
3. Disconnect remote fuel line from engine.
4. Make sure all CDMs are plugged in.
5. Test Stator and Trigger voltage to CDM:
 - a. Install test harness (84-825207A2) between ignition harness and CDM.

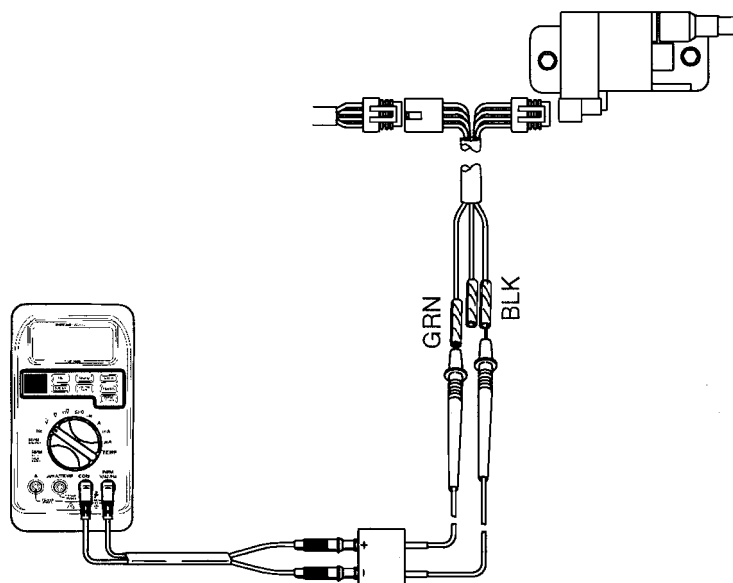


- a** - Stator/Trigger Harness
b - Test Harness (84-825207A2)
c - Capacitor Discharge Module

- b. Test each CDM.

Stator Output Test		400 DVA Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading
Connect to Green Test Harness Lead	Connect to Black Test Harness Lead	160 - 320

If only one CDM stator reading is below specifications, replace that CDM. If all CDM stator voltage readings are low, go to "Testing Stator Resistance".



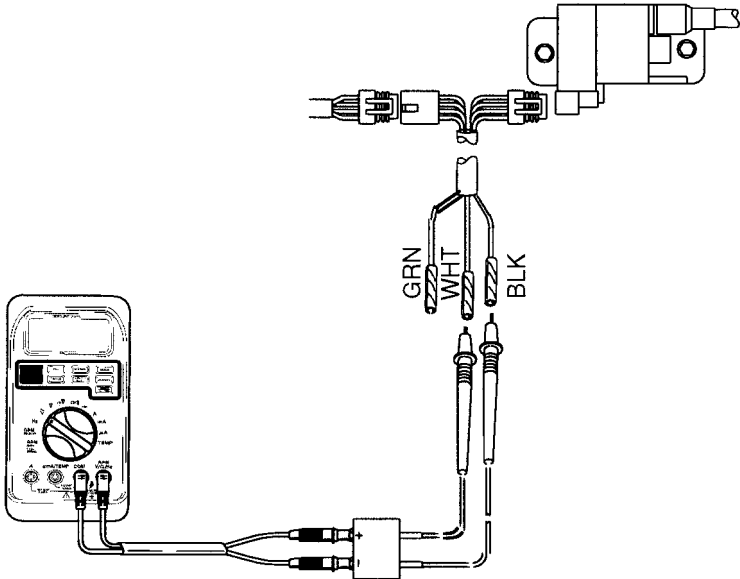
58049

Test each CDM.



CDM Trigger Input Test		2 DVA Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading @ Cranking
White Test Harness Lead	Black Test Harness Lead	0.2 - 2.0

If reading is below specifications, test trigger resistance. If reading is above specifications, check CDM and ground connections.



58049

**ENGINE RUNNING AT 2500 RPM**

It is not necessary to perform this test if the voltage output was tested in the previous step.

Stator Output Test		400 DVA Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading
Connect to Green Test Harness Lead	Connect to Black Test Harness Lead	160 - 320

If stator output is low, go to "Testing Stator Resistance".

CDM Trigger Input Test		20 DVA Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading @ Idle to 2500 RPM
White Test Harness Lead	Black Test Harness Lead	2 - 8 Volts

If reading is below specifications, go to "Testing Trigger Resistance". If reading is above specifications, check CDM and ground connections.

2.0/2.5L V-6 Models Only - Check control module bias circuit

Bias Circuit Test (All Models Except 200 EFI)		40 DVA Scale @2500 RPM
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading
Engine Ground	Black/White Shift Switch Wire	25 - 40 Volts

Bias Circuit Test (200 EFI)		40 DVA Scale @2500 RPM
Positive Meter Lead (+)	Negative Meter Lead (-)	DVA Reading
Engine Ground	Disconnect 4 wire Detonation Control Module connector. Insert bent paper clip into Black/White terminal.	25 - 40 Volts

If reading is below specifications, replace control module.



Resistance Tests

TRIGGER ASSEMBLY TEST

1. Disconnect all trigger leads from control module.
2. Use an ohmmeter and perform the following checks:

Test Leads to	Resistance Ohms	Scale Reading
Between BROWN Trigger Lead and YELLOW Trigger Lead	1100-1400	R x 100
Between WHITE Trigger Lead and RED Trigger Lead	1100-1400	R x 100
Between PURPLE Trigger Lead and BLUE Trigger Lead	1100-1400	R x 100

3. If meter readings are not as specified, replace trigger assembly.

STATOR

1. Disconnect stator leads.

NOTE: Resistance varies greatly with temperature. Measurements should be taken with the stator temperature range of 65° to 85° F. The ignition bobbin resistance may rise to 1.5 times the room temperature resistance value after the engine has been running and engine block temperature has stabilized.

Stator Resistance Test		R x 1 Ohms Scale
Positive Meter Lead (+)	Negative Meter Lead (-)	
Connect to White/Green stator lead	Connect to Green/White stator lead	380-430
Connect to White/Green stator lead	Connect to engine ground	No continuity
Connect to Green/White stator lead	Connect to engine ground	No continuity

IMPORTANT: If all CDM stator output voltage is low and stator resistance tests are within specifications, then each CDM (one at a time) must be replaced with a CDM known to be good until stator output voltage returns to proper levels. This process of elimination will reveal a defective CDM.

Bias Circuit

Bias voltage is NEGATIVE (-) voltage applied to the ignition system to raise the trigger firing threshold as engine rpm is increased, thus stabilizing ignition timing and preventing random ignition firing.

Refer to Bias Circuit Test page 2A-29 to check bias circuit on carburetor and EFI model outboards.



Shift Stabilizer Circuit

The shift stabilizer circuit (not used on all models) is designed to increase the idle to timing approximately 2 degrees when the engine is shifted into gear.

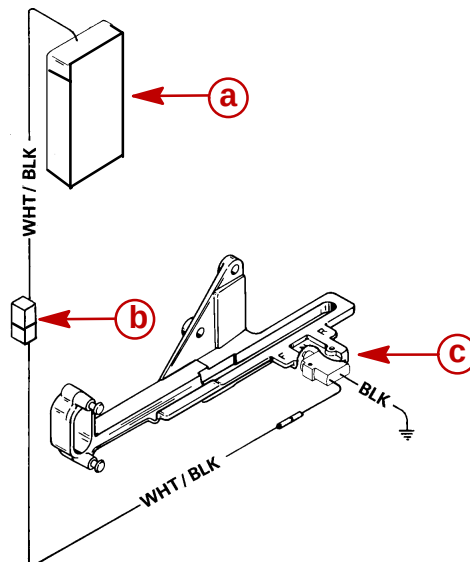
1. Check idle timing with engine out-of-gear, activate the switch, timing should increase approximately 2 degrees.
2. Shift switch may be tested with a resistance test. CONTINUITY between the BLACK wires (disconnected) with the engine in gear and NO CONTINUITY with the engine in NEUTRAL.

Idle Stabilizer

The idle stabilizer will electronically advance the ignition timing by as much as 3° if the engine idle speed falls below approximately 550 rpm. This timing advance raises the idle rpm to an acceptable level (550 rpm). When the idle stabilizer senses the idle rpm has reached the acceptable level, it returns the timing to the normal idle timing.

Note: retarding the timing with the spark arm is not an effective method of checking idle stabilizer.

1. Check idle timing with engine in-gear, slight movements of timing indicates idle stabilizer operation.



- a** - Control Module (Contains Idle Stabilizer and Shift Interrupt Circuitry)
- b** - Harness Connector
- c** - Shift Interrupt Switch

Rev-Limit Circuit

1. Install Flywheel Timing Tape (P/N 91-853883 3) onto flywheel.
2. With the engine under load and at maximum rpm the timing on #2 cylinder should be within specifications. As the engine rpm reaches approximately 5900 ± 100 rpm, timing on #2 cylinder will retard, as needed, to a maximum of 30 degrees and then spark to the cylinder will stop.



EFI Injector Timing Signal Test

Use DDT to monitor injector timing signals. (Press Keys1, 3, 1)

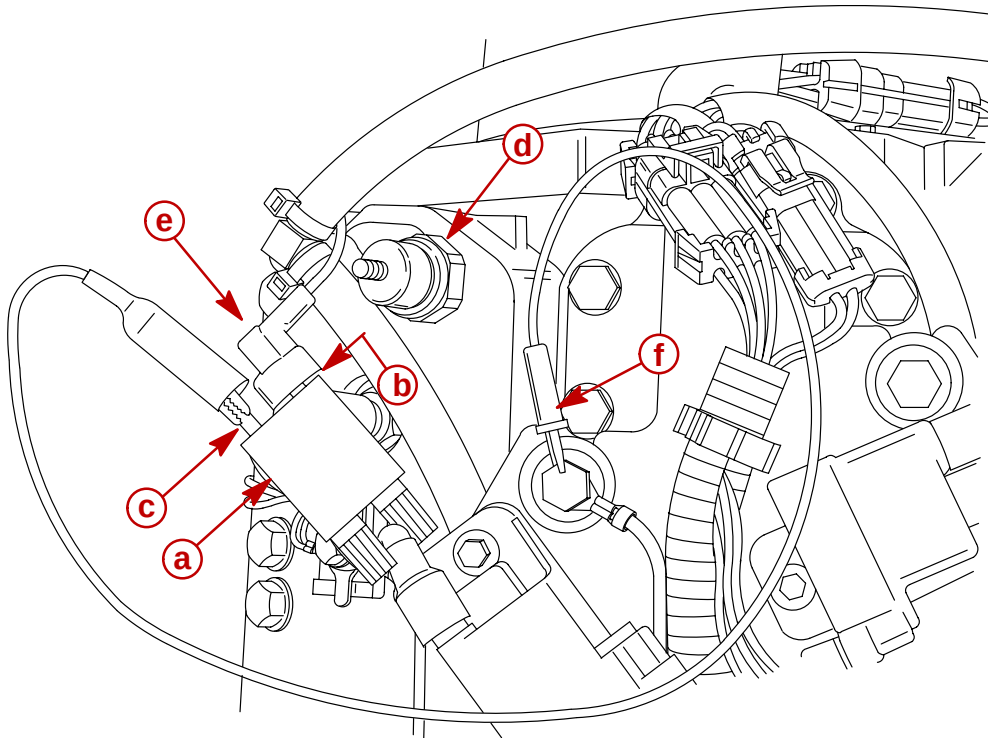
EFI Detonation Control System

The Detonation control system will only retard the timing approximately 1-2 degrees (uses same system as shift stabilizer on carburetor models).

Use DDT to monitor Knock Volts (Press Keys1, 3, 1)

Detonation Circuit Test

1. Disconnect WHITE/BLUE lead from knock sensor and connect to RED male connector of Interface Module 91-854013 (contained in DMT 2000 Multimeter Kit 91854009A1).
2. Connect jumper lead from BLACK male connector on Interface Module to engine ground.



58066

- a** - Interface Module (91-854013)
- b** - RED Connector
- c** - BLACK Connector
- d** - Knock Sensor
- e** - Knock Sensor Lead
- f** - BLACK Lead (to engine ground)

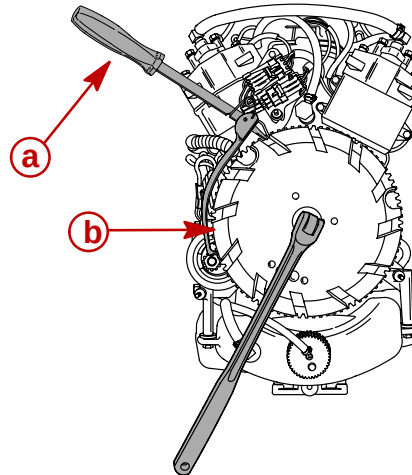
3. Turn key switch to RUN position (do not start engine). With Digital Diagnostic Terminal connected to engine, DDT should indicate over 6 volts for knock voltage output.
4. Start engine and run at idle. DDT indicated knock voltage output should drop below 1.0 volt. If voltage does not drop below 1.0 volt, knock circuit within detonation module is defective.



Ignition Component Removal

Flywheel Removal

1. Remove 3 wing nuts and lift flywheel cover off engine.
2. While holding flywheel with Flywheel Holder (91-52344), remove flywheel nut and washer.



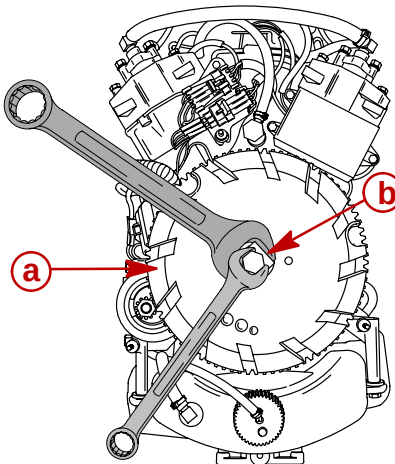
58035

- a** - Flywheel Holder (91-52344)
b - Flywheel

3. Install Flywheel Puller (91-849154T1) into flywheel.

⚠ CAUTION

Do not hammer on end of puller center bolt to remove flywheel, or damage may result to crankshaft or bearings. Do not use heat to aid flywheel removal as flywheel and electrical components under flywheel may be damaged.



58036

- a** - Flywheel
b - Flywheel Puller (91-849154T1)

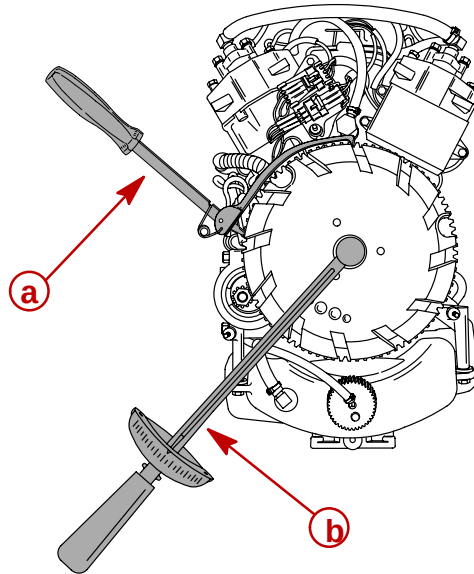
Flywheel Installation

IMPORTANT: Do not apply oil to crankshaft taper or flywheel taper as flywheel will not seat properly against crankshaft when torqued.



NOTE: Inspect flywheel magnets for clinging debris before installing flywheel. Failure to remove debris from magnets may result in damage to electrical components under flywheel when outboard is initially started.

1. Reinstall flywheel on crankshaft. Secure flywheel with flat washer and locknut. While holding flywheel with Flywheel Holder (91-52344), torque flywheel nut to 120 lb. ft. (163.0 N m).



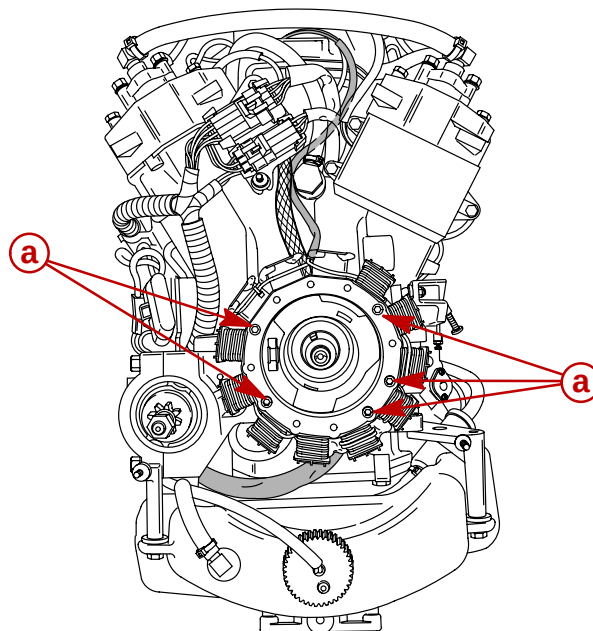
a - Flywheel Holder
(91-52344)

58037
b - Torque Nut to 120 lb.
ft. (163 Nm)

2. Reinstall flywheel cover on engine.

Stator Removal

1. Remove flywheel, as outlined in “Flywheel Removal,” preceding.
2. Remove 4 screws which secure stator to the upper end cap.



a - Stator Attaching Screws

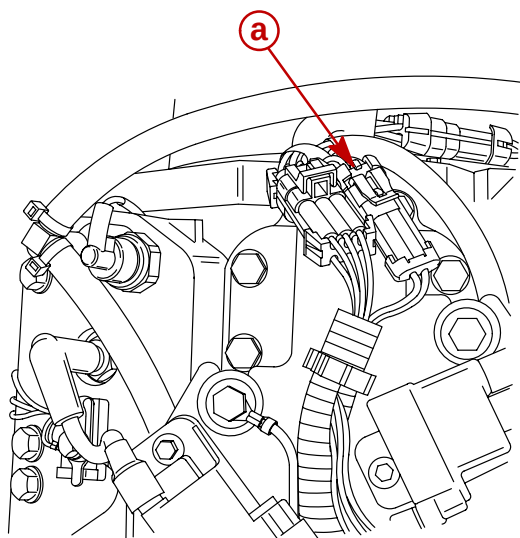
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3. Disconnect all stator harnesses from their respective connectors and remove stator.

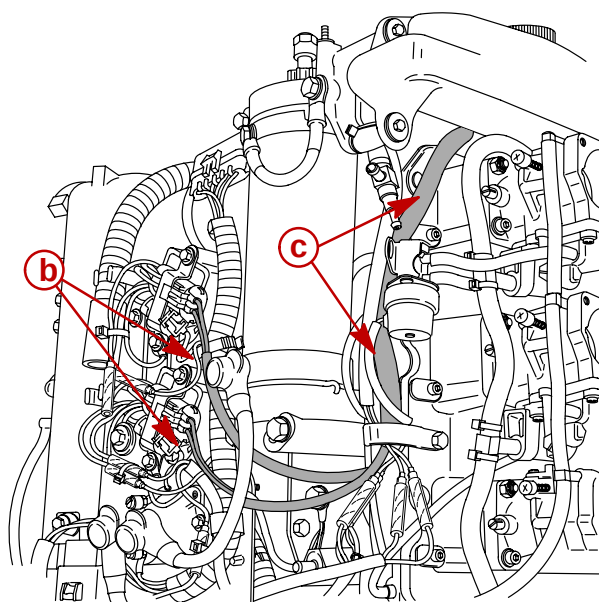


Stator Installation

1. Clean stator attaching screw threads with Loctite 7649 Primer (92-809824) and apply Loctite 271 (92-809820). Install stator assembly in position on upper end cap and secure with attaching screws. Torque screws to 50 lb. in. (5.5 N m).
2. Route stator harnesses as shown and reconnect to appropriate connectors.



58051

a - Stator CDM Connectors

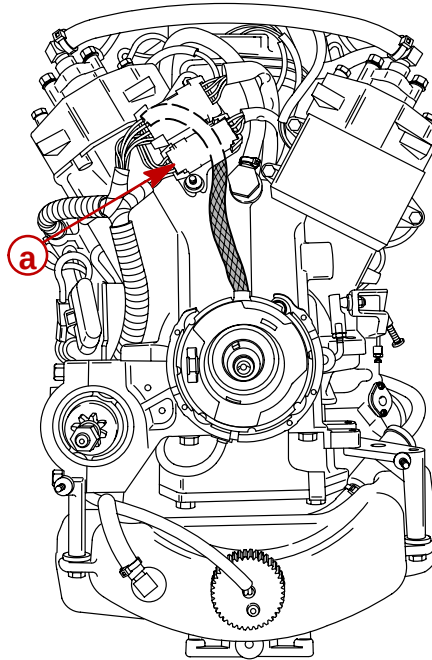
58038

b - Stator Voltage Regulator Connectors
c - Stator Harness Routing



Trigger Removal

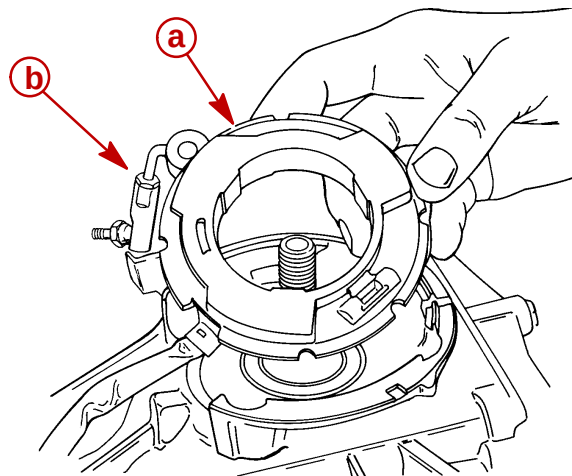
1. Remove flywheel, as outlined in **“Flywheel Removal,”** preceding.
2. Remove 5 screws which secure stator assembly to upper end cap. Lift stator off end cap and move to the side.
3. Remove locknut that secures link rod swivel into spark advance lever. Pull link rod out of lever.
4. Disconnect trigger harness from its respective connector.



58040

a - Trigger Connector

5. If trigger assembly is faulty, remove and retain link rod swivel from trigger.



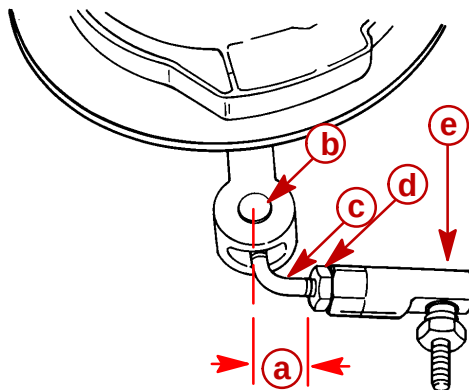
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a - Trigger
b - Link Rod Swivel



Trigger Installation

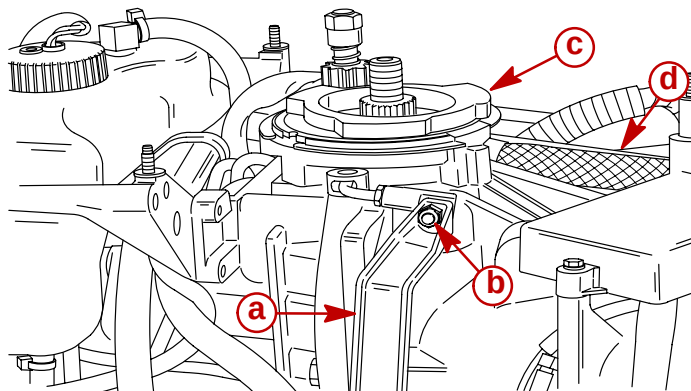
1. If link rod swivel was disassembled or removed, reassemble to trigger as shown.



51840

- a** - Retain This [11/16 in. (17.5 mm)] Dimension
- b** - Pivot
- c** - Link Rod
- d** - Hex Nut
- e** - Ball Joint

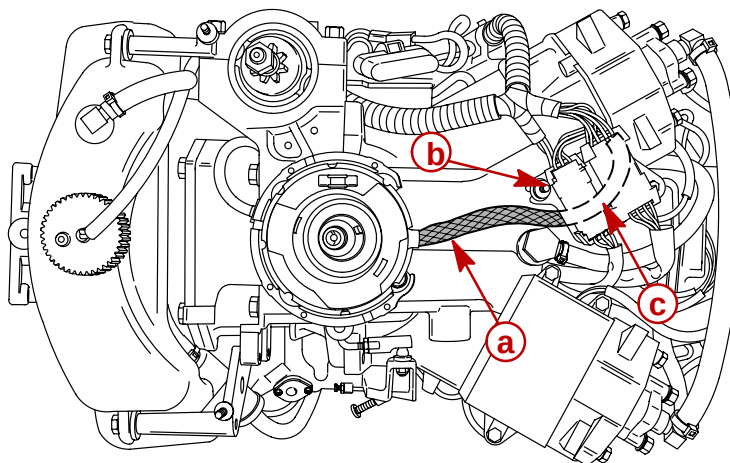
2. Place trigger assembly in upper end cap. Fasten link rod swivel to spark advance lever with locknut.



58203

- a** - Spark Advance Lever
- b** - Locknut
- c** - Trigger
- d** - Trigger Harness

3. Route trigger harness as shown and reconnect trigger harness connector.



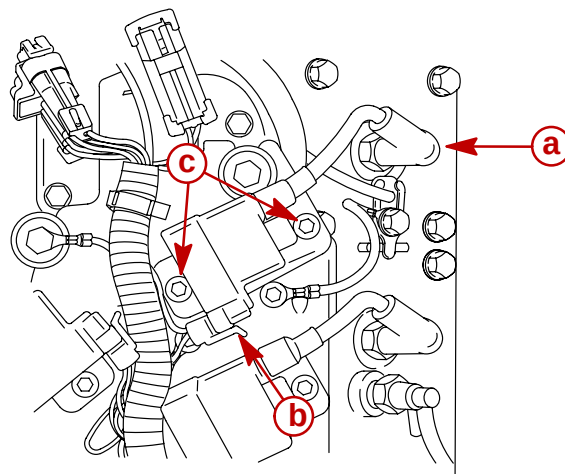
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- a** - Harness
- b** - Connector
- c** - Route Trigger Harness Under Harness Connectors



CDM Removal

1. Disconnect spark plug lead from spark plug.
2. Disconnect CDM harness connector.
3. Remove 2 bolts securing CDM and remove CDM.



a - Spark Plug Lead
b - Harness Connector

c - Bolts

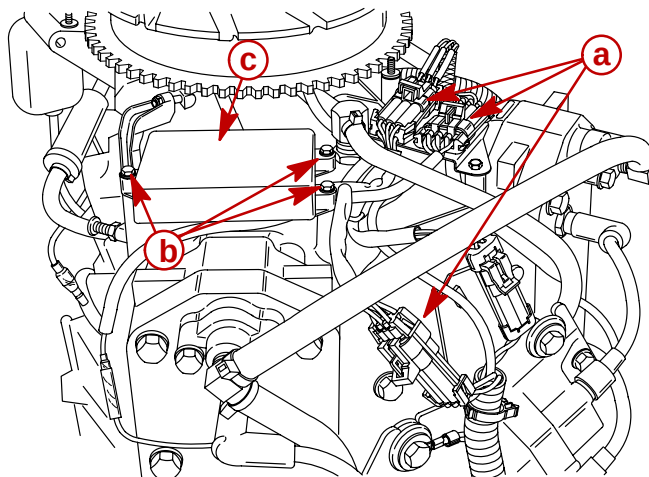
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CDM Installation

1. Secure CDM with 2 bolts. Torque bolts to 70 lb. in. (8 Nm).
2. Reconnect CDM harness.
3. Reconnect spark plug lead to spark plug.

Control Module Removal

1. Disconnect 3 Control Module harness connectors.
2. Remove 3 bolts securing module and remove module.



a - Harness Connectors
b - Bolts (3)

c - Control Module

58034

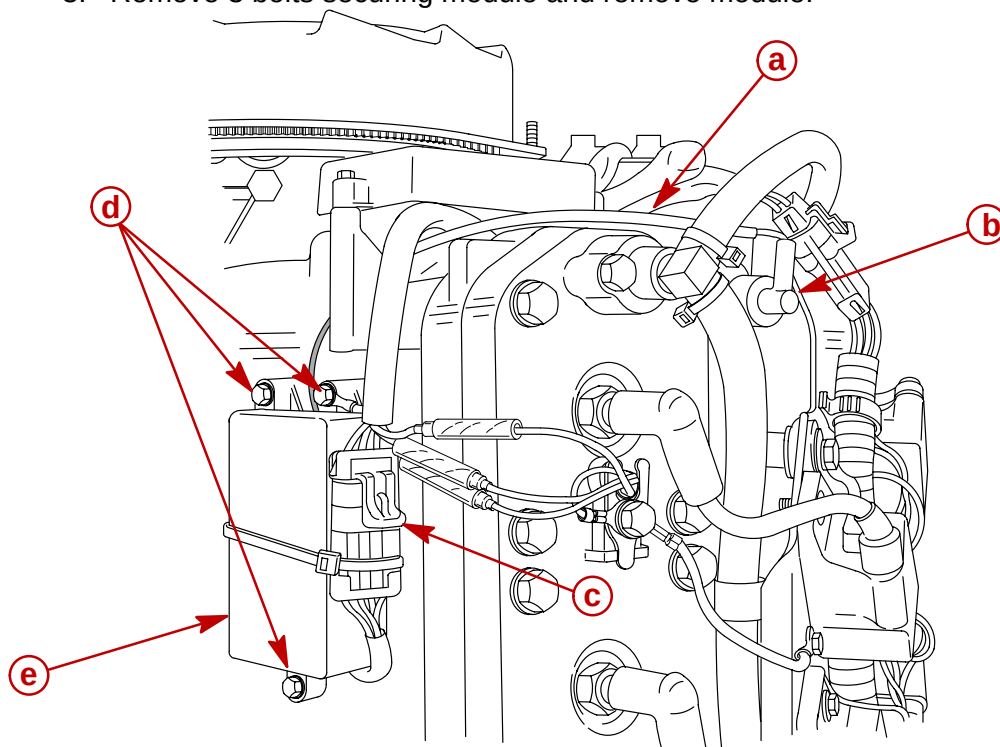
Control Module Installation

1. Secure module with 3 bolts. Torque bolts to 30 lb. in. (3.5 Nm).
2. Reconnect 3 module harness connectors.



Detonation Module Removal (200 XRI only)

1. Remove detonation sensor lead from sensor.
2. Disconnect detonation module harness connector.
3. Remove 3 bolts securing module and remove module.



58052

a - Sensor Lead
b - Sensor
c - Harness Connector

d - Bolts (3)
e - Detonation Module

Detonation Module Installation

1. Secure module with 3 bolts. Torque bolts to 30 lb. in. (3.4 Nm).
2. Reconnect 3 harness connectors.
3. Reconnect sensor lead to sensor.