8- Connect one test lead of an ohmmeter to the red wire of the coil and the other test lead to the blue wire. Observe the reading. Move the test lead on the blue wire to the white wire and again observe the reading. Both readings should be 400 ohms.

9- Connect one test lead to the blue wire and the other to the white. The reading should be 10 ohms.

10- Connect one test lead to a good ground on the distributor case. Test the red, blue, and white wires, one at a time. There should be **NO** continuity.

CLEANING AND INSPECTING

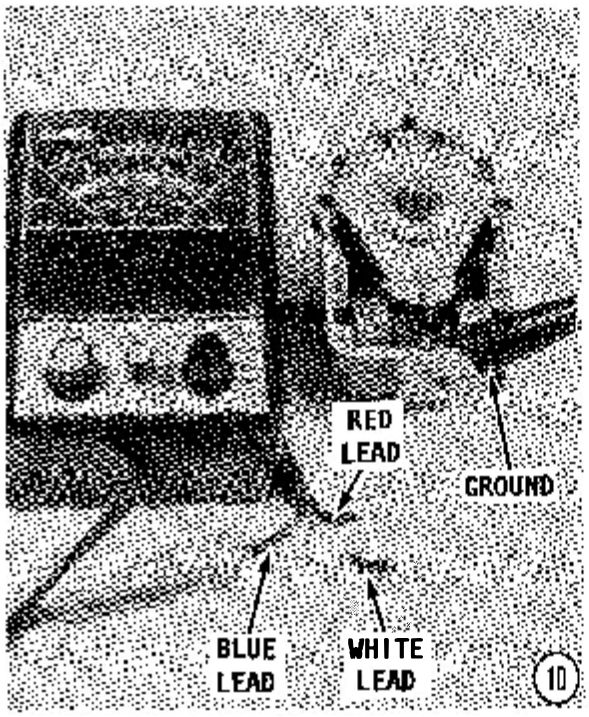
Check the ignition driver frame housing for dirt, rust, or corrosion. Remove rust or corrosion with No. 320 carborundum paper, and then be sure to wipe the housing clean.

Inspect the rotating magnet and shaft assembly for rust or corrosion. Clean them thoroughly with No. 320 carborundum paper, and then wipe them clean. **DO NOT** use a wire brush.

Check the condition of the high tension leads.

Inspect and replace the bearings if there is any indication of wear or roughness. **NEVER** use solvent to clean bearings.

Check the condition of the distributor cap assembly. Inspect the distributor cap for leakage paths caused by broken leads, poor connections, moisture, dirt, carbon, or corrosion.

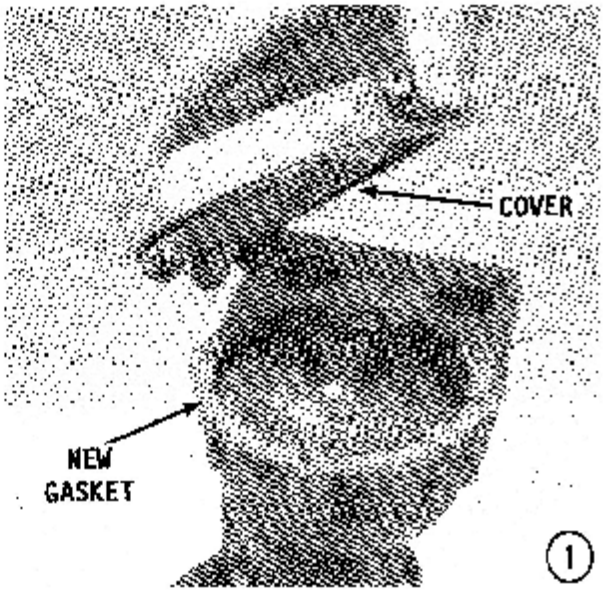


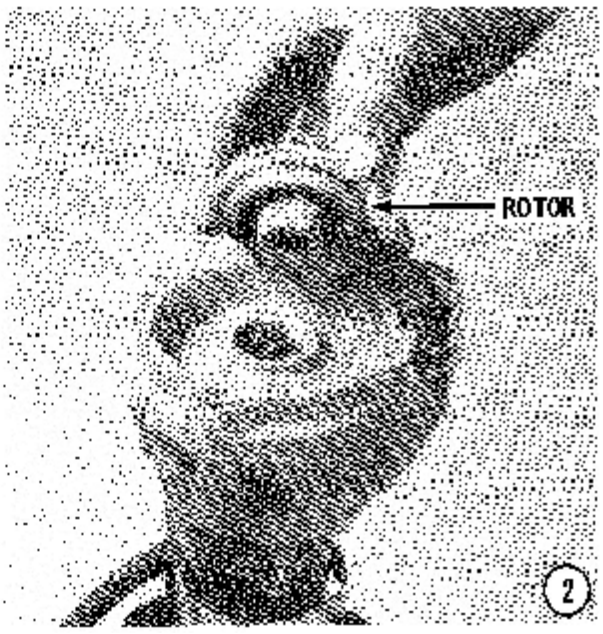
Before assembling the ignition driver, verify all parts have been properly cleaned and tested. Discard and replace any parts which are questionable. This is the only way to guarantee satisfactory engine performance after the work has been completed.

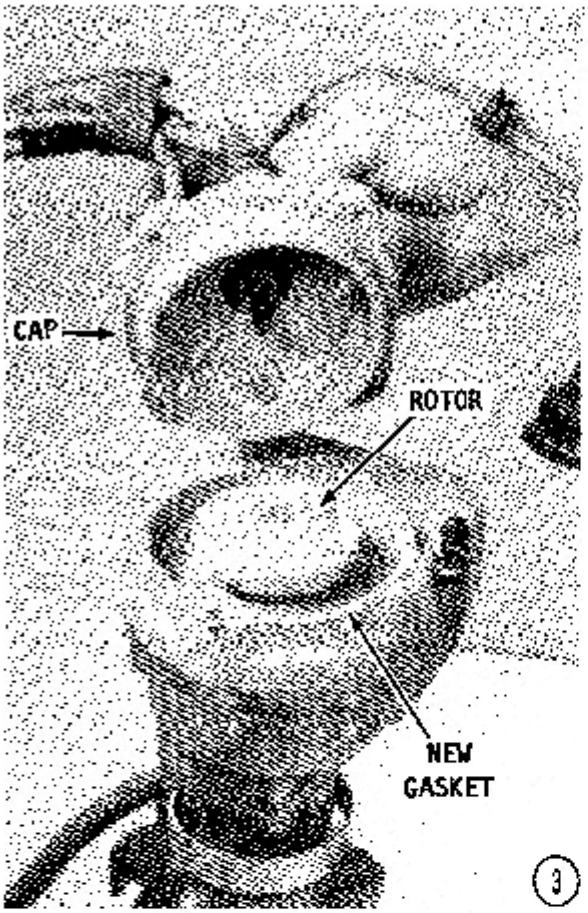
TYPE II ASSEMBLING

1- Place a **NEW** gasket in position, and then install the ignition driver housing cover. Clean the splines inside the rotor and the distributor shaft.

2- Check to be sure the spring is pressed into the bottom of the splined hole of the rotor. Apply a couple drops of "Blue" Loctite, or equivalent, into the bottom of the splined hole in the rotor, and then install the rotor.







3- Install a **NEW** distributor cap gasket and then the cap.

DISTRIBUTOR INSTALLATION

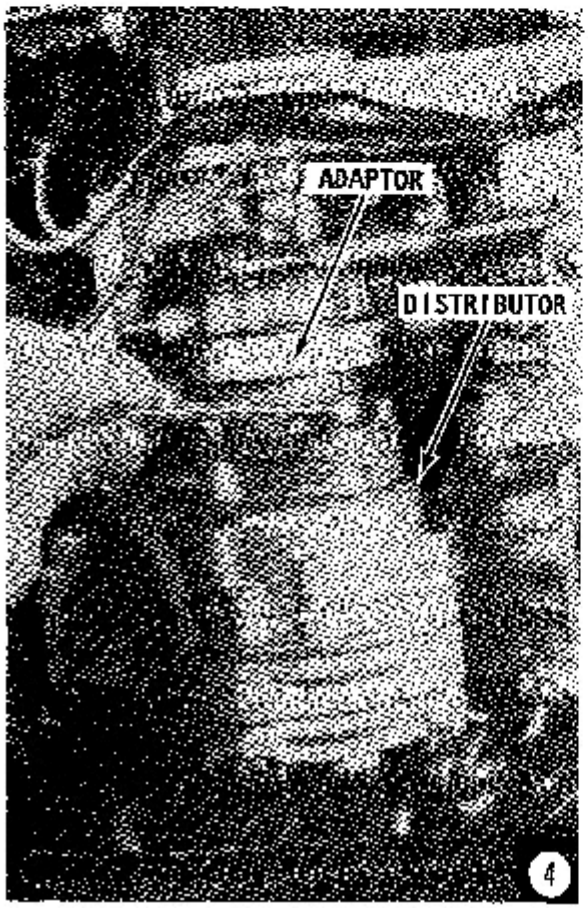
First, some good words: The distributor is installed into an adaptor on the engine and secured with capscrews. The distributor drive coupling has a flat-sided tang. This tang indexes with a similar tang on the distributor shaft. This arrangement guarantees the distributor can only be installed one way, and therefore, accurate timing is maintained. Late models have a blanked tooth and missing spline to maintain timing.

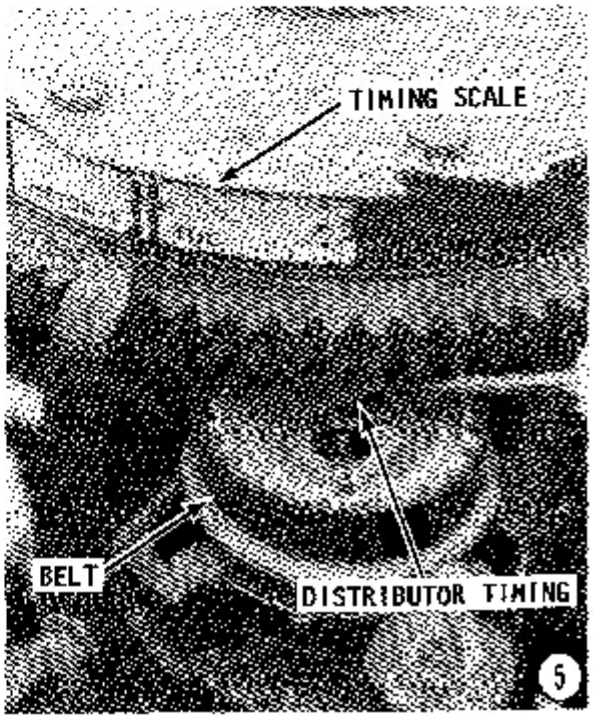
4- Slide the distributor into the adaptor with tang on the distributor drive coupling indexed with the tang on the distributor shaft, or, on late models, with the blanked tooth and missing spline indexed. Secure the distributor in place with the capscrews.

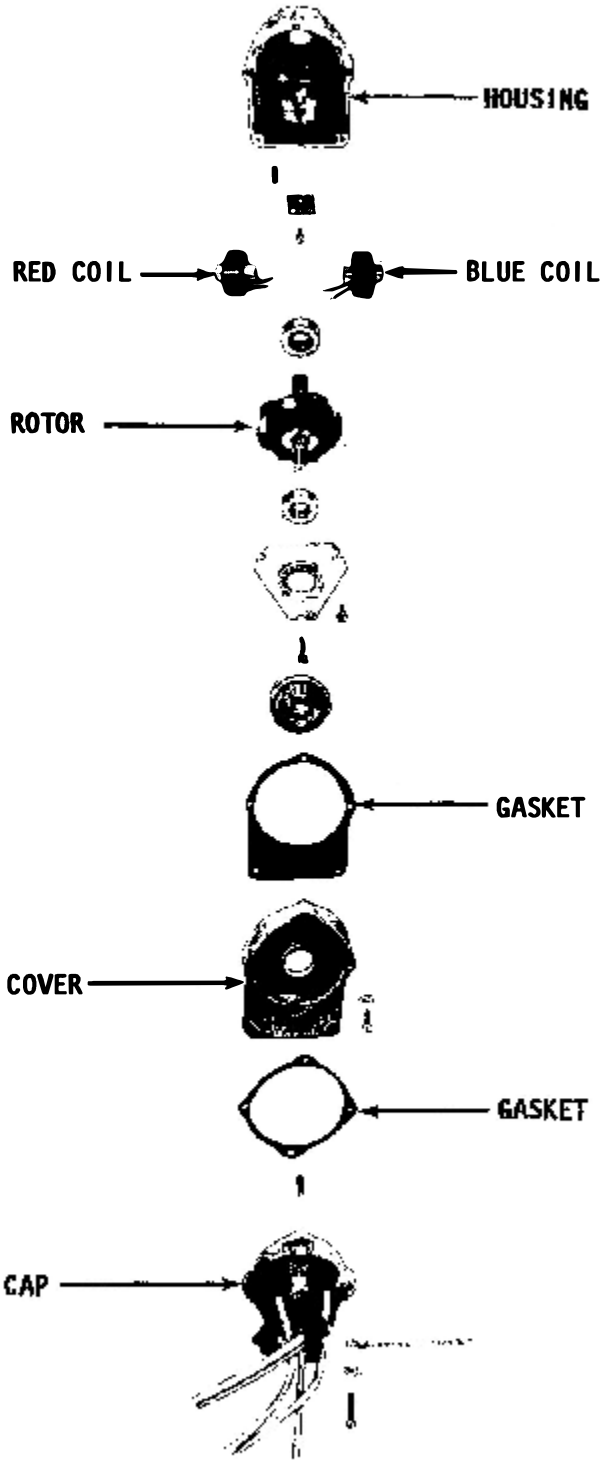
For timing and synchronization instructions, see Chapter 6.

Drive Belt Installation

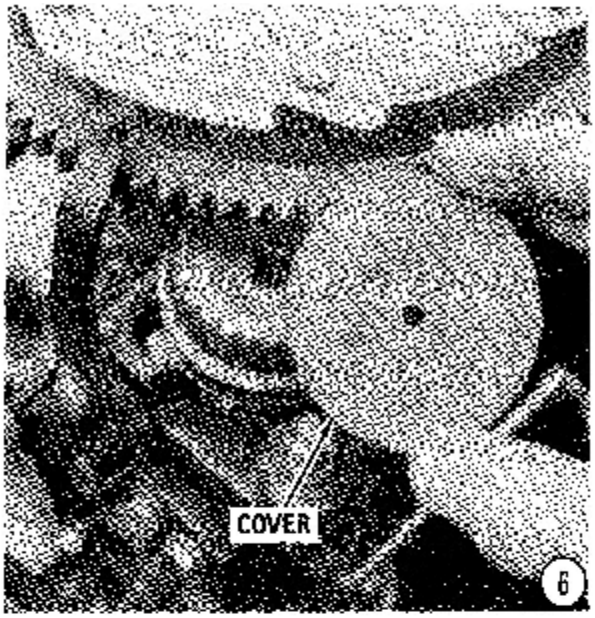
5- If the adaptor has been removed or if the drive belt timing has been disturbed, it will be necessary to time the adaptor pulley to the timing mark on the flywheel. This is accomplished by rotating the flywheel until the timing mark on the rim is aligned with the center of the crankshaft and the center of the driven pulley. Now, position the arrow on the pulley to point to the timing mark.







Exploded drawing of a belt-driven distributor for the Lightning Energizer Ignition system, with major parts identified.



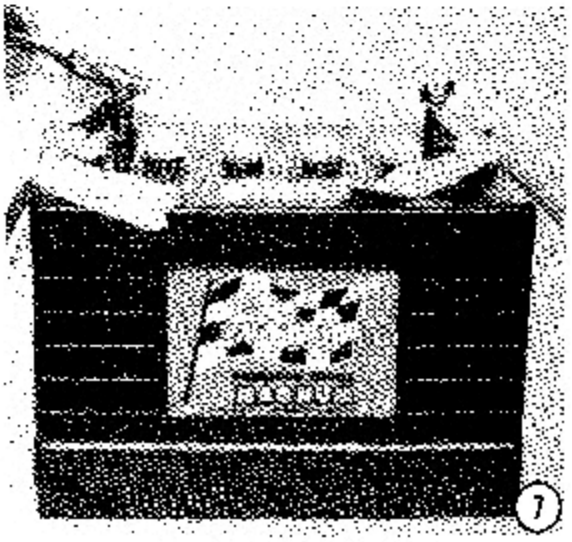
6- Install the timing belt around the distributor pulley. Position the cap on the end of distributor shaft. Secure the cap with the washer and capscrew. Tighten the capscrew to a torque value of 60 in.-lbs (0.68Nm).

7- Install the engine cowl. If a battery is used with the engine, install the leads to the battery terminals.

For timing and synchronization procedures, see Chapter 6.

SWITCH BOX

Marine dealers will not allow the return of an electrical part after it leaves their store. Therefore, the switch box should be removed and tested by an authorized Marine Dealer, if there is reason to believe it is defective. If it is not defective, the expense of a new unit is saved.



5-7 TYPE III IGNITION SYSTEM THUNDERBOLT — DISTRIBUTOR C.D. IGNITION -- POINTLESS

Description

This ignition system is identified in the Specifications in the Appendix as Type III. C.D. is an abbreviation for "capacitor discharge".

CRITICAL WORDS: These next two paragraphs may well be the most important words in this chapter. Probably the No. 1 cause of electrical problems with outboard power plants is misuse of the wiring harness.

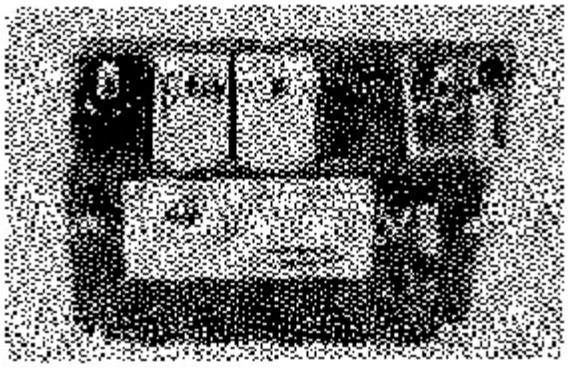
A wiring harness is used between the key switch and the engine. This harness seldom contains wire of sufficient size to allow connecting accessories. Therefore, anytime a new accessory is installed, **NEW** wiring should be used between the battery and the accessory. A separate fuse panel **MUST** be installed on the dash. To connect the fuse panel, use two red and black No. 10 gauge wires from the battery. C.D. ignition systems require a full 12-volts for proper operation. Therefore, again let it be said, **NEVER** connect accessories through the key switch.

Key Switch

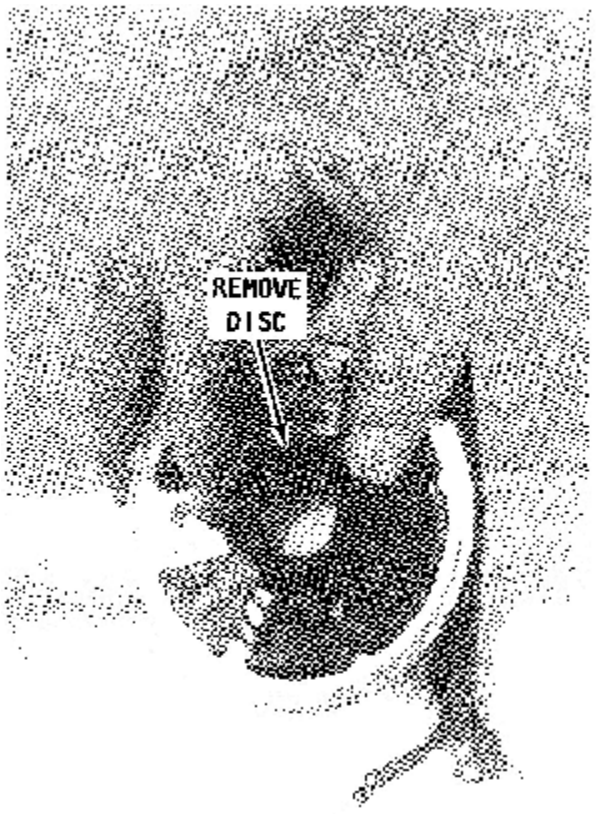
A marine-type key switch **MUST** be installed as a replacement item. An automotive-type switch installation may cause damage to the system.

Principles of Operation

The flow of current from the battery to the spark plug is as follows: Battery voltage is supplied to the switch box at all times via the red wire. At the switch box, the battery voltage is inverted to create AC voltage.



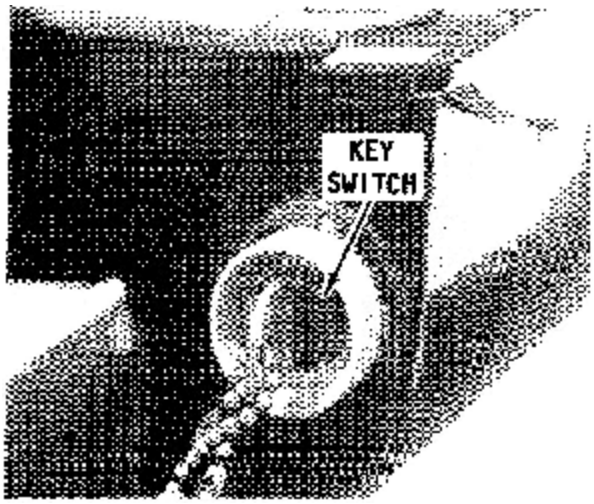
*Switch box used with the Thunderbolt Lightning Energizer ignition system. This box **MUST** be tested using special equipment available only at professional shops.*



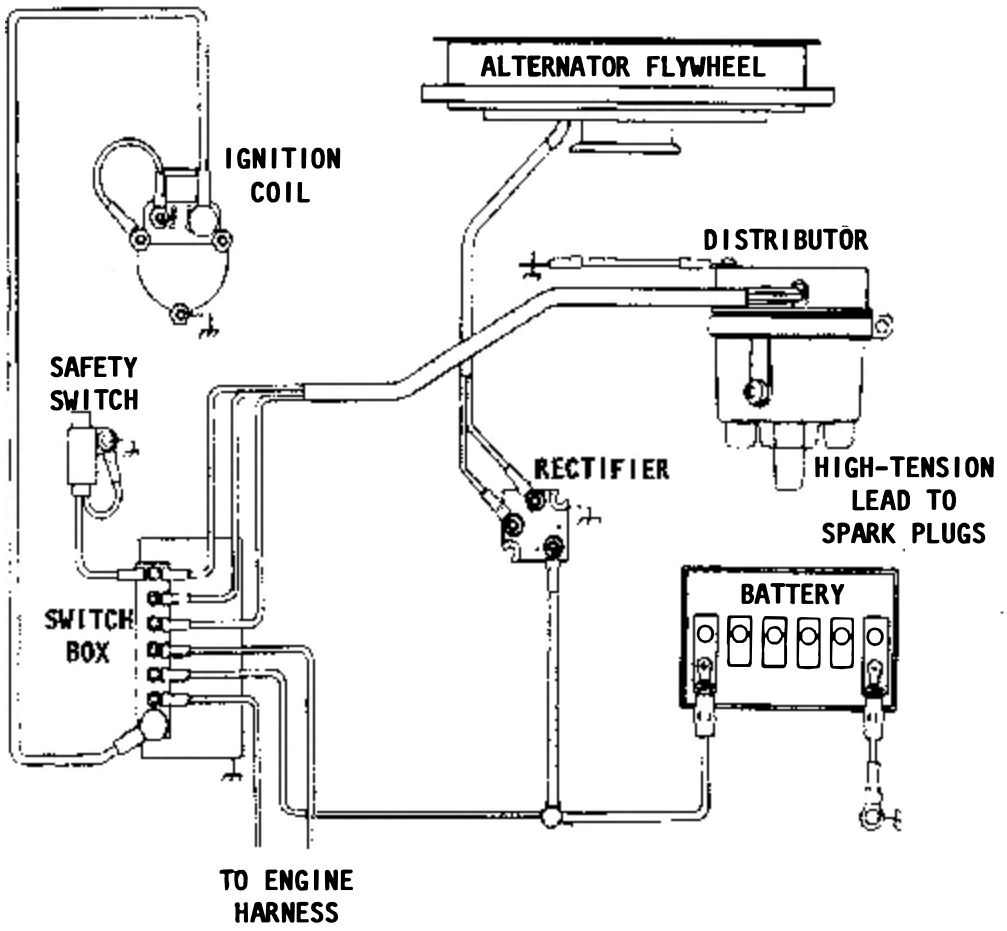
*A disc is used to protect the trigger assembly from damage during shipment. This disc **MUST** be removed before the unit is installed for service.*

This AC voltage is stepped up to a higher AC voltage and is rectified and stored in a capacitor in the switch box. Here the current awaits a trigger signal.

When the key switch is turned to the **ON** position, a reduced voltage is conducted to the trigger. This trigger is located in the distributor housing and consists of two opposite faced coils. One coil produces a magnetic field and is considered the **SENDER.** The opposite coil produces a trigger

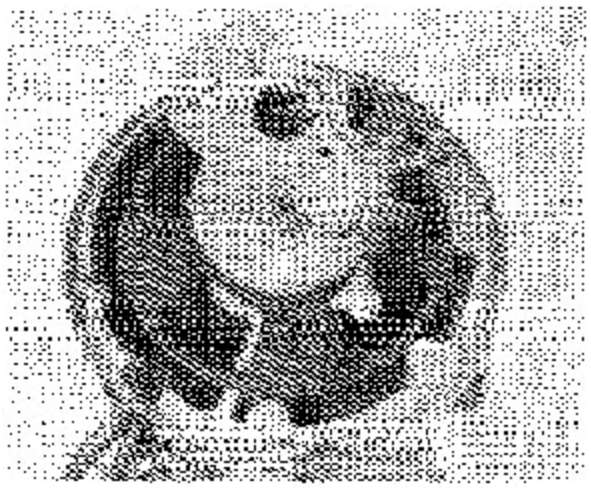


Key switch located in the shift box. The box must be disassembled to service the key switch.



Functional diagram of the Type III ignition system covered in this section for a 3-cylinder powerhead.

signal when a slot (window) in the rotor disc passes between these coils. Therefore, this second coil is considered the **RECEIVER.**



*Distributor and rotor used with the Capacitor Discharge (CD) ignition system. The rotor is a part of the shaft and **CANNOT** be removed.*

The rotor disc has one slot (window) for each cylinder in the engine. The disc is driven at crankshaft speed by the flywheel pulley, timing belt and distributor pulley. This trigger signal operates a SCR (switch control rectifier) which discharges the switch box capacitor into the primary winding of the ignition coil. A high strength magnetic field is built around the coil core. As the SCR turns off, there is no voltage to sustain this magnetic field, thus it collapses very rapidly, inducing a higher voltage in the secondary winding of the coil. This voltage is applied to the spark plugs by the distributor rotor, cap, and high-tension lead wires.

Advance or retard is accomplished by rotating the trigger coils in relation to the rotor disc openings.

The engine is shut down by turning the key switch to the **OFF** position. This action interrupts the battery voltage to the white terminal of the switch box.

TROUBLESHOOTING
TYPE III IGNITION SYSTEM

Always attempt to proceed with the troubleshooting in an orderly manner. The "shot-in-the-dark" approach will only result in wasted time, incorrect diagnosis, replacement of unnecessary parts, and frustration.

Begin the ignition system troubleshooting with the spark plugs and continue through the system until the source of trouble is located.

Spark Plugs

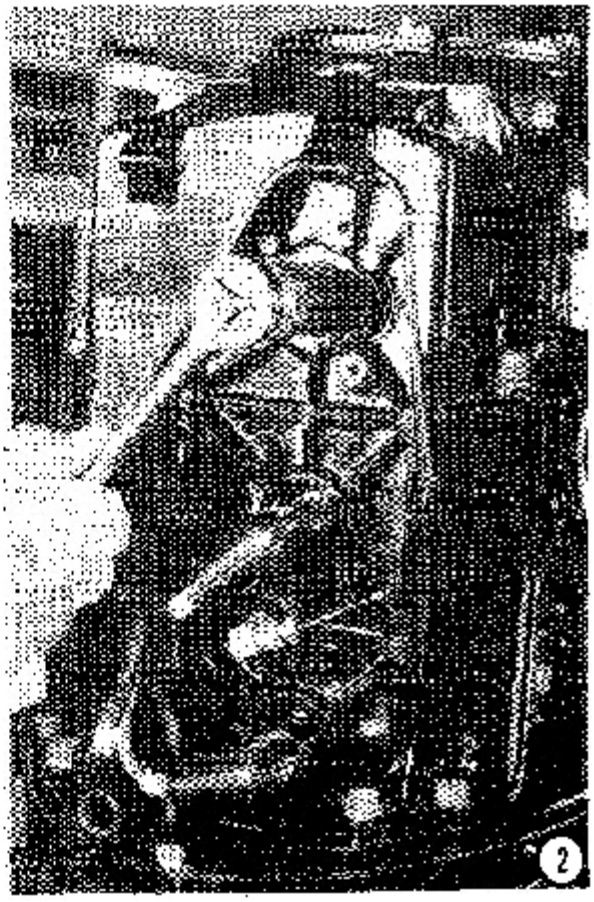
1- Check the plug wires to be sure they are properly connected. Check the entire length of the wires from the plugs to the distributor. If the wire is to be removed from the spark plug, **ALWAYS** use a pulling and twisting motion as a precaution against damaging the connection.

2- Attempt to remove the spark plugs by hand. This is a rough test to determine if the plug is tightened properly. You should not be able to remove the plug without using the proper socket size tool. Remove the spark plugs and keep them in order. Examine each plug and evaluate its condition as described in Section 5-2.

3- Use a spark tester and check for spark at each cylinder. If a spark tester is not available, hold the plug wire about 3/8" to 1/2" (9.53 to 12.7 mm) from the engine. Turn the flywheel with a pull starter or electrical starter and check for spark. A strong spark over a wide gap must be observed when testing in this manner, because under compression a strong spark is necessary in order to ignite the air/fuel mixture in the cylinder. This means it is possible to think you have a strong spark, when in reality the spark will be too weak when the plug is installed. If there is no spark, or if the spark is weak, the trouble is most likely in the distributor or in the switch box.

Compression

Before spending too much time and money attempting to trace a problem to the ignition system, a compression check of each cylinder should be made. If the cylinder does not have adequate compression, troubleshooting and attempted service of the ignition or fuel system will fail to give the desired results of satisfactory engine performance.



Remove the spark plug wires by pulling and twisting **ONLY** on the molded cap. **NEVER** pull on the wire because the connection inside the cap may be separated or the boot be damaged. Remove the spark plugs. Insert a compression gauge into the cylinder spark plug hole. Crank the engine for several revolutions and note the final compression reading. Repeat the procedure for each cylinder.

A variation in reading between the cylinders is far more important than the actual individual readings. If a particular cylinder varies more than 20 psi from the others, the cylinder may be scored, the rings frozen, or the piston burned. In-line outboard powerheads covered in this manual do not use a cylinder head. Therefore, low compression in one cylinder **CANNOT** be attributed to a blown head gasket.

DISTRIBUTOR OR SWITCH BOX TESTING

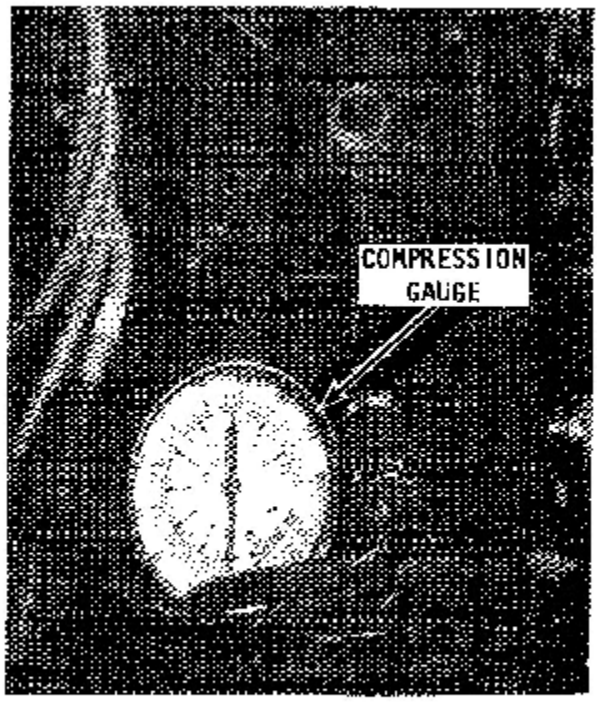
An ignition analyzer **MUST** be used to properly test the distributor or switch box.

The specifications listed in the Appendix must be carefully met in all areas in order to obtain maximum engine efficiency. Actually, the best advice that can be given is to remove the distributor and switch box, and then take them to your favorite marine dealer for testing and check.

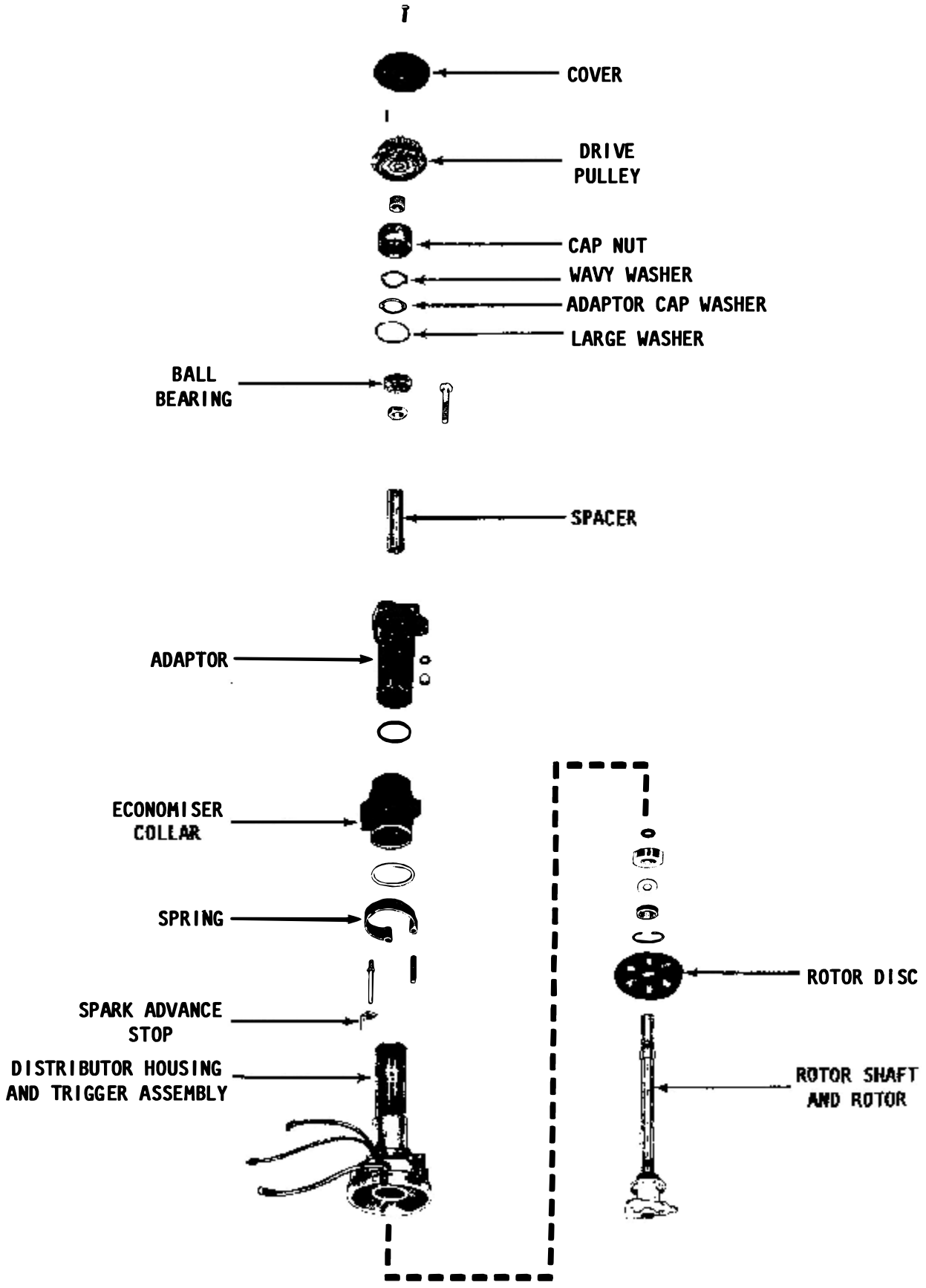
By taking them to the dealer two things will be accomplished. First, the dealer is equipped with trained personnel and adequate equipment to do the job properly. Secondly, electrical parts, in almost all cases, cannot be returned once the item leaves the store. Therefore, the cost of purchasing unnecessary electrical components is avoided. In short, you save time, money, and frustration by having the testing done right the **FIRST** time.

SERVICING TYPE III IGNITION SYSTEM

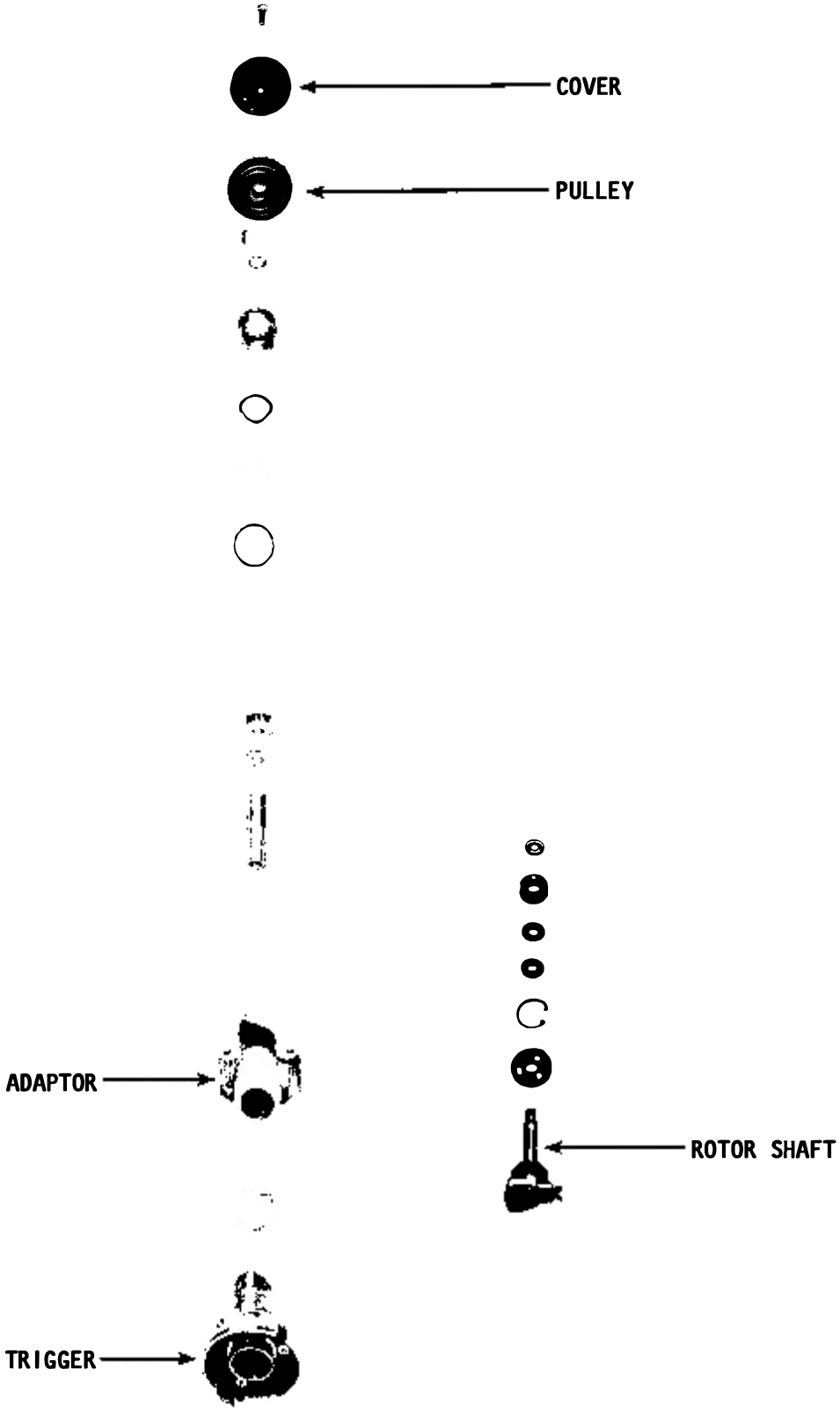
Ignition overhaul procedures may differ slightly on various outboard models, but the following general basic instructions will apply to all outboard engines covered in this manual and equipped with the Type III ignition system -- Thunderbolt -- C.D. Ignition -- pointless -- with a distributor.



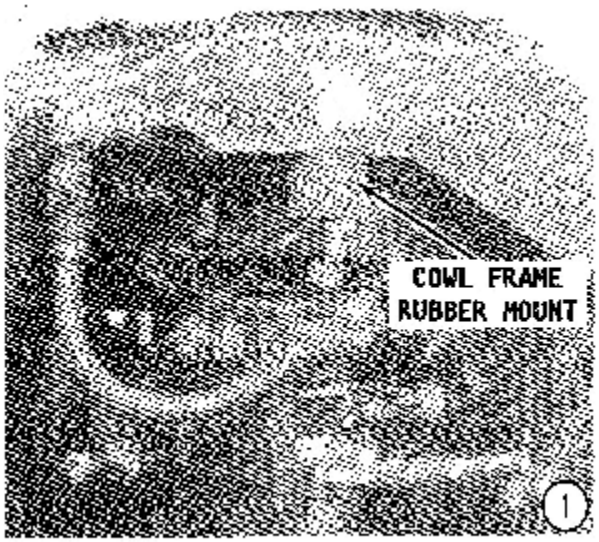
*When a compression check is performed, the spark plug leads **MUST** be grounded to the powerhead to prevent excessive strain on the coil. If the leads are not grounded, and simply left hanging, the coil will attempt to match the demand created by the spark trying to jump from the plug shell to nearest ground.*



Exploded drawing of belt-driven distributor for the Capacitor Discharge (CD) ignition system used on a 4-cylinder in-line powerhead, with major parts identified.



Exploded drawing of a belt-driven distributor for the Capacitor Discharge (CD) ignition system used on a 3-cylinder powerhead, with major parts identified.

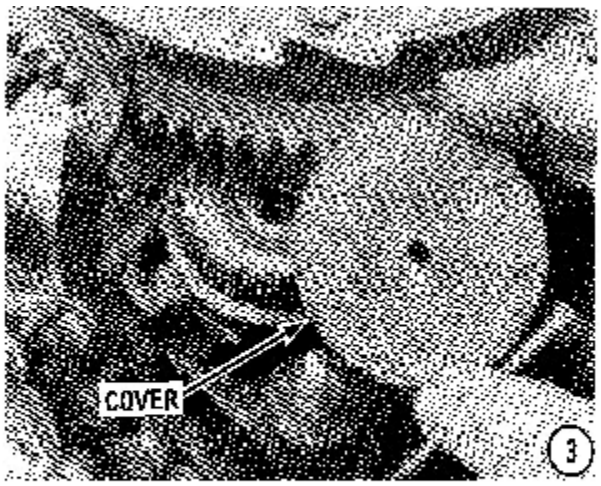


SPECIAL WORDS

The photographs used in this section were taken with the Type III system installed on a 6-cylinder unit. The procedures for removal and installation are identical for a 4-cylinder powerhead and may be followed with complete confidence.

REMOVAL

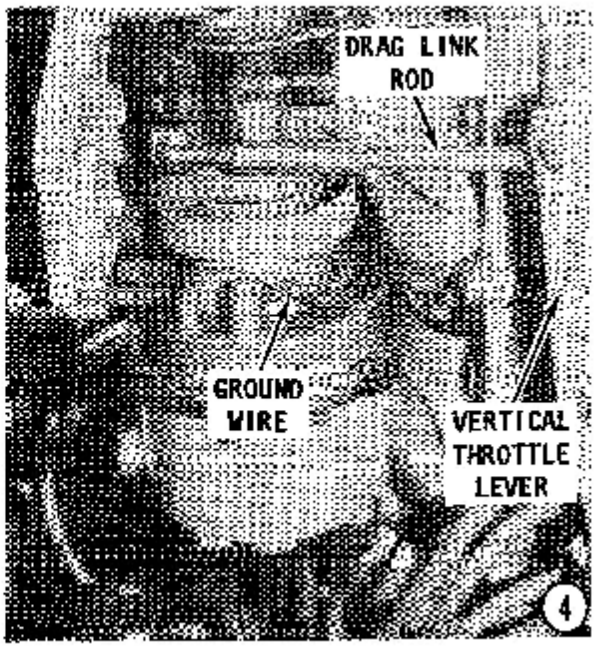
1- Remove the electrical harness and the battery leads from the engine. Remove the wrap-around cowling. Remove the support frame and rear support by removing the three nuts from the top of the cowl frame rubber mount.

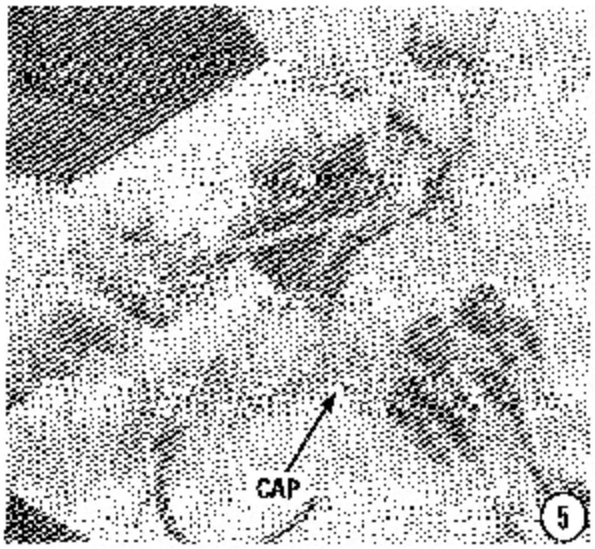


2- Remove the two bolts and lockwashers at the front top of the support frame. Remove the four bolts and lockwashers at the bottom of the rear support bracket. Disconnect the choke solenoid wire at the solenoid, and then lift the top cowl support frame from the engine. At the switch box, disconnect the three wires from the distributor.

3- Remove the attaching bolt, and then remove the distributor pulley cover. Slip the timing belt off the pulley. Now, work the pulley, key, and spacer from the distributor shaft.

4- Remove the distributor drag link rod from the vertical throttle lever. Remove the ground wire screw from the distributor. Remove the three nuts, washer, and bolts securing the distributor to the engine, and then remove the distributor.





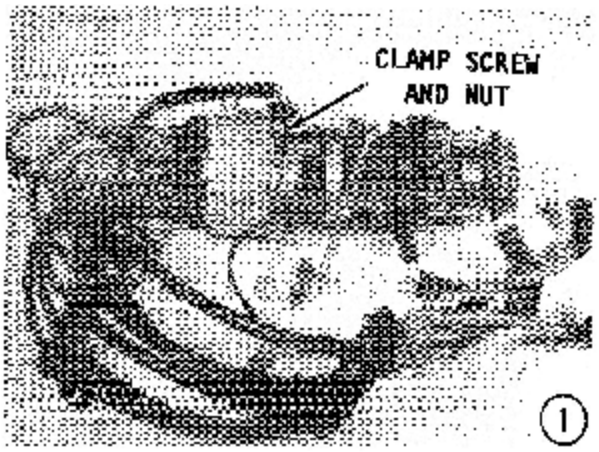
Distributor Cap

5- Remove the distributor cap retainer clamp screw and nut.

6- Lift the cap and clamp from the distributor. Further disassembly of the distributor is not necessary, unless the rotor is no longer serviceable. If the rotor requires replacement, the distributor shaft must be removed and replaced with a new rotor and shaft assembly. The rotor **CANNOT** be removed from the shaft and replaced separately. Bend the tabs of the adaptor cap washer open, and then remove the washer. Lift out the larger washer and **CAREFULLY** press the bearing out of the housing by working through the two holes provided for this purpose. Remove the nut and **GENTLY** tap the distributor shaft free.

CLEANING AND INSPECTING

Inspect the ball bearings and the distributor housing for wear, dirt, or corrosion. Replace any defective parts. Carefully check the condition of the high-tension leads. Check the distributor cap for leakage paths. Such paths may be caused by broken leads, poor connections, moisture, dirt, carbon, or corrosion inside the distributor.



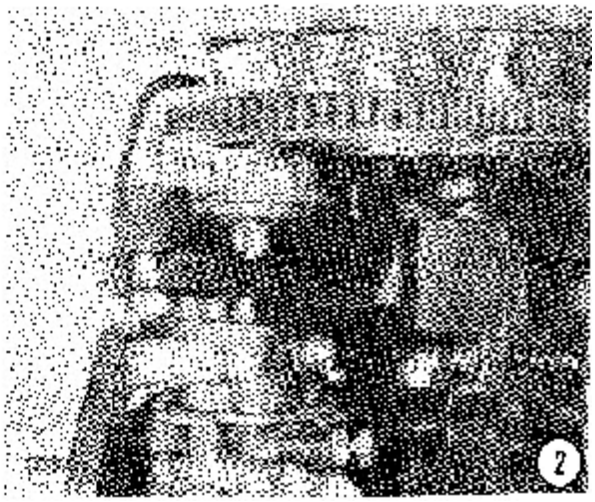
ASSEMBLING TYPE III DISTRIBUTOR

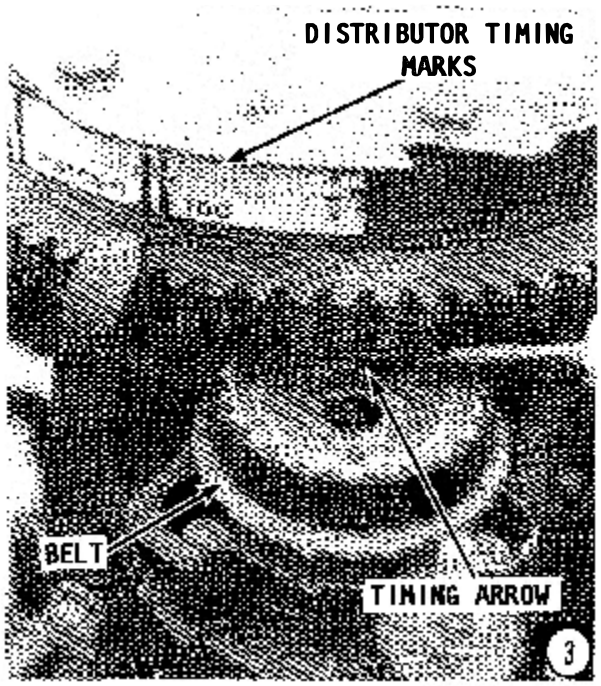
GOOD WORDS

If the distributor shaft and rotor were disassembled perform the tasks in the next three paragraphs. If the shaft and rotor were not disassembled, proceed directly to Step 1.

Insert the distributor shaft through the rotor disc. Support the distributor housing between two blocks of wood in a vise. **CAREFULLY,** yes, very **CAREFULLY** tap the end of the distributor shaft. The shaft will pass through the bearing and associated parts as shown in the exploded drawing. Continue working the shaft in until the collar on the shaft seats into the recess of the distributor.

Thread the nut onto the distributor shaft. Slide the bearing onto the shaft.

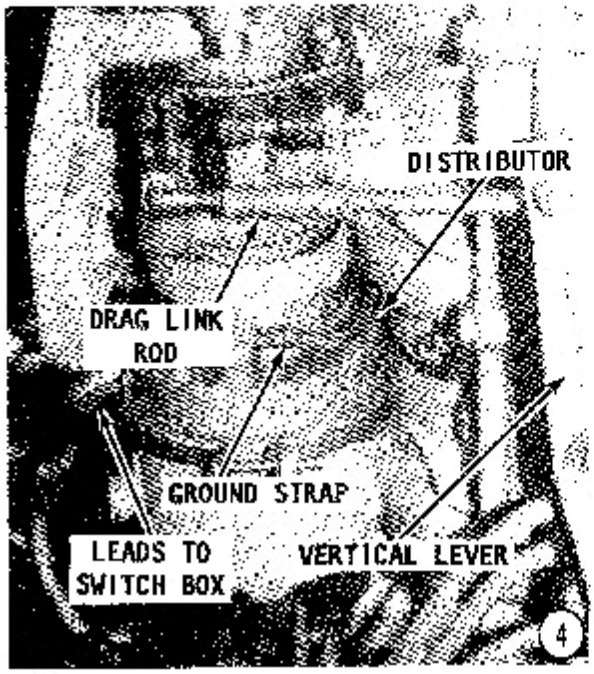




Continue to slide the bearing further onto the shaft by working through the two holes provided for this purpose, until the bearing makes contact with the backside of the nut.

Replace the large washer. Slide the adaptor cap washer onto the shaft, then bend the tabs downward to secure it in place.

1- Place the distributor cap assembly onto the distributor housing. **TAKE CARE** not to damage the brush or spring. Install the distributor cap clamp and retainer with the screw and nut. Position the clamp screw and nut as shown.

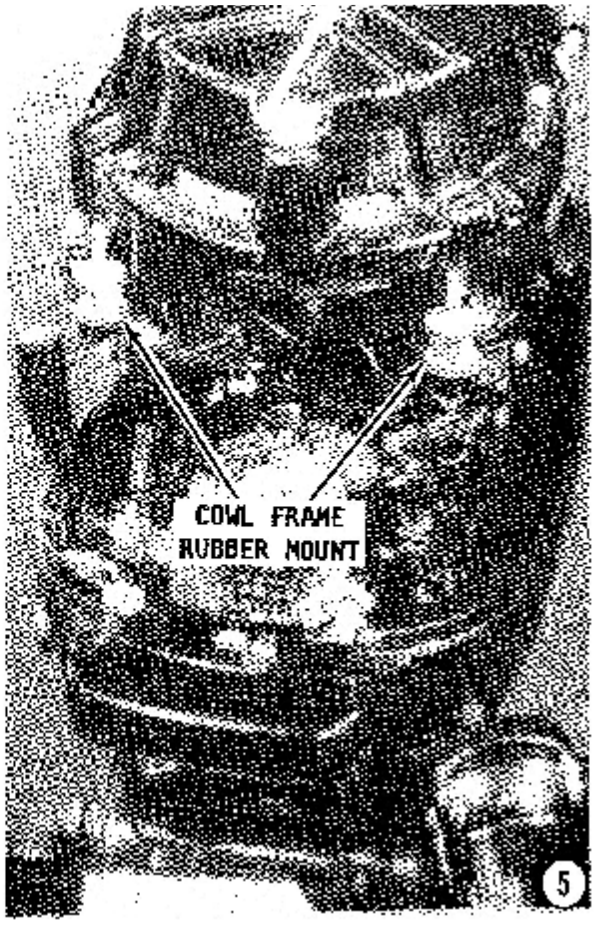


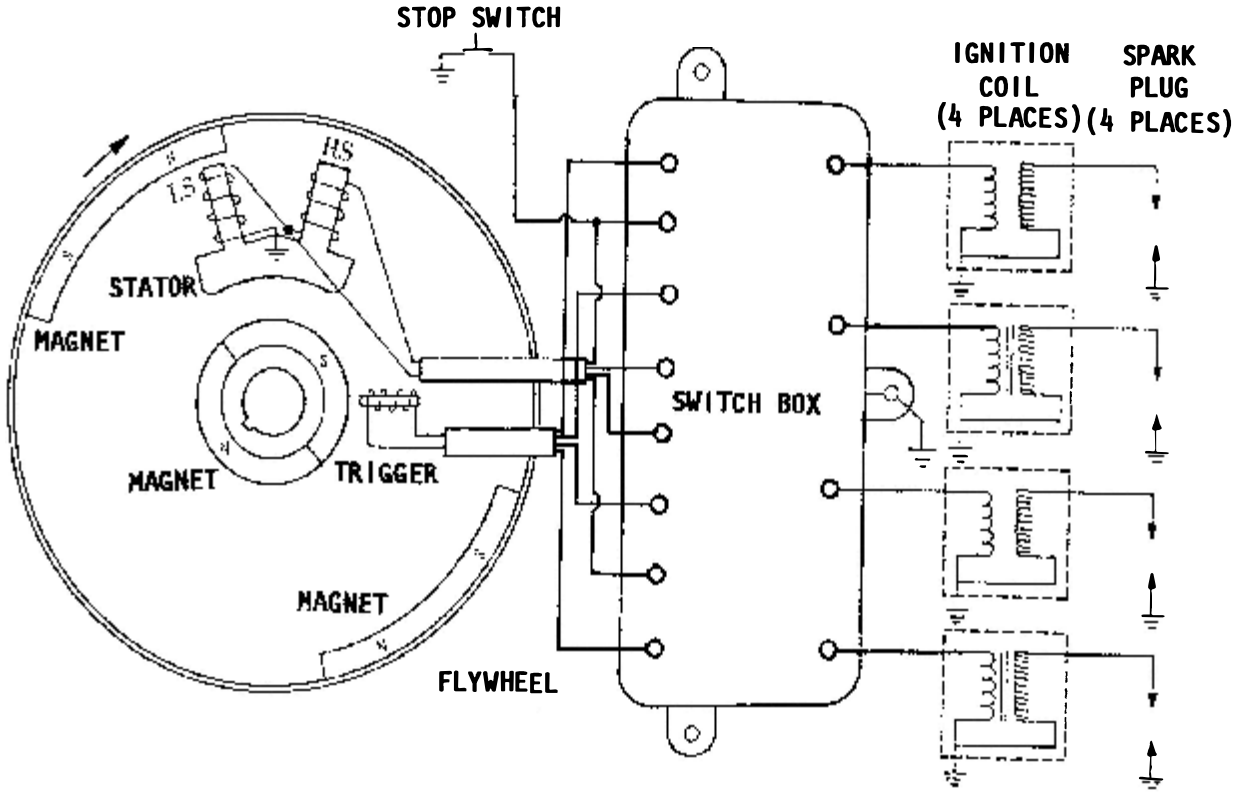
2- Position the distributor and distributor adaptor assembly onto the engine block mounting flange. Check to be sure the driven pulley spacer and the distributor drive key are in position. Install the three screws securing the distributor to the engine block.

3- Align the arrow on the pulley with the timing mark on the flywheel, and then install the timing belt. Install the distributor pulley cover and secure it in place with the screw. Tighten the screw to a torque value of 60 in.-lbs (0.68Nm).

4- Install the ground strap and connect the link rod to the vertical lever. Connect the high-tension lead to the coil and the high-tension wires to the spark plugs. Install the vent tubes. Connect the three trigger lead wires to the switch box matching the color code on the wires. Cover the terminals with a coating of neoprene.

5- Install the cowl mounting brackets. Connect the electrical leads to the battery. For timing and synchronization instructions, see Chapter 6. Install the wrap-around cowl.





Functional diagram of the Type IV ignition system covered in this section for a 4-cylinder powerhead. This system was used only on the Model 500EL, 1975.

5-8 TYPE IV IGNITION SYSTEM THUNDERBOLT — FLYWHEEL — CD POINTLESS

SPECIAL WORDS

On all powerheads equipped with a flywheel magneto, the rectifier will be damaged if the battery leads are disconnected from the battery while the engine is running or if the leads should accidently be reversed. This is a safety feature designed by the manufacturer because the cost of replacing a rectifier is a fraction of the cost for a new switch box.

Description

This ignition system is identified in the Specifications in the Appendix as Type IV. C.D. is an abbreviation for "capacitor discharge".

The Type IV ignition system consists of a stator mounted around the crankshaft under the flywheel; a generating coil for each cylinder attached to the stator; permanent magnets fastened to the inside rim of the flywheel; a second set of magnets installed within the flywheel hub; a trigger coil mounted under the flywheel; a rectifier; a capacitor; and a switch box along with associated wiring.

Operation
Type IV Ignition System

As the crankshaft and flywheel rotate, the magnets pass the generating coils. As they pass the coils, an AC voltage is generated at the coil terminals. This AC voltage is conducted to the switch box, where it is rectified and stored in a capacitor.

The trigger coil is also mounted under the flywheel, and a second set of magnets is installed in the flywheel hub. This second set of magnets causes the trigger coil to produce AC voltage as the flywheel rotates. This voltage is conducted to the switch box, where it is connected to a switch (SCR).

Polarity of the AC trigger signal determines into which ignition coil the capacitor will be discharged. An ignition coil is installed for each cylinder. The capacitor voltage is conducted to the primary winding of the ignition coil where a high strength magnetic field is built around the coil core.

As the switch (SCR) turns off, there is no voltage to sustain this magnetic field, and it collapses rapidly. This rapid collapse induces a very high voltage in the secondary winding of the coil. This voltage is applied to the spark plug by a high-tension lead.

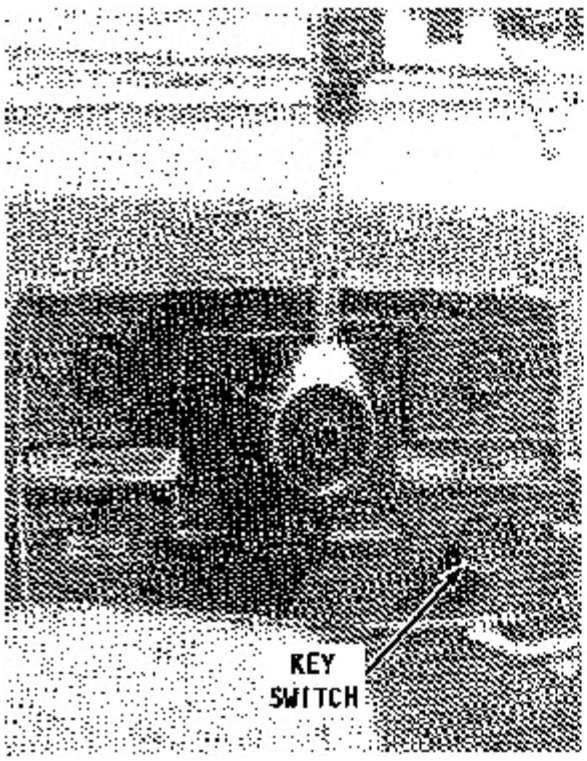
The preceding sequence occurs once per engine revolution for each cylinder.

Change in spark timing, advance or retard, is accomplished by rotating the trigger coil in relationship to the magnets on the flywheel hub.

The engine is shut down by shorting the orange wire switch box terminal or the charging coil terminal block under the edge of the flywheel to ground with the key switch, the stop button, or the ignition safety stop switch.

CRITICAL WORDS: These next two paragraphs may well be the most important words in this chapter. Probably the No. 1 cause of electrical problems with outboard power plants is misuse of the wiring harness.

A wiring harness is used between the key switch and the engine. This harness seldom contains wire of sufficient size to allow connecting accessories. Therefore, anytime a new accessory is installed, **NEW** wiring should be used between the battery and the accessory. A separate fuse panel **MUST** be installed on the control panel. To connect the fuse panel, use two red and black No. 10 gauge wires from the battery. C.D. ignition systems require a full 12-volts for proper operation. Therefore, again let it be said, **NEVER** connect accessories through the key switch.



Key switch located in the shift box. The box must be disassembled to service the key switch.

Key Switch

A marine-type key switch **MUST** be installed as a replacement item. An automotive-type switch installation may cause damage to the system.

TROUBLESHOOTING TYPE IV IGNITION SYSTEM

Always attempt to proceed with the troubleshooting in an orderly manner. The "shot-in-the-dark" approach will only result in wasted time, incorrect diagnosis, replacement of unnecessary parts, and frustration.

Begin the ignition system troubleshooting with the spark plugs and continue through the system until the source of trouble is located.

Spark Plugs

1- Check the plug wires to be sure they are properly connected. Check the entire length of the wires from the plugs to the coils. If the wire is to be removed from the spark plug, **ALWAYS** use a pulling and twisting motion as a precaution against damaging the connection.

2- Attempt to remove the spark plugs by hand. This is a rough test to determine if the plug is tightened properly. You should not be able to remove the plug without using the proper socket size tool. Remove the spark plugs and keep them in order. Examine each plug and evaluate its condition as described in Section 5-2.

3- Use a spark tester and check for spark at each cylinder. If a spark tester is not available, hold the plug wire about 1/4" (6.35mm) from the engine. Turn the flywheel with a pull starter or electrical starter and check for spark. A strong spark over a wide gap must be observed when testing in this manner, because under compression a strong spark is necessary in order to ignite the air/fuel mixture in the cylinder. This means it is possible to think you have a strong spark, when in reality the spark will be too weak when the plug is installed. If there is no spark, or if the spark is weak, the trouble is most likely under the flywheel in the CD system.

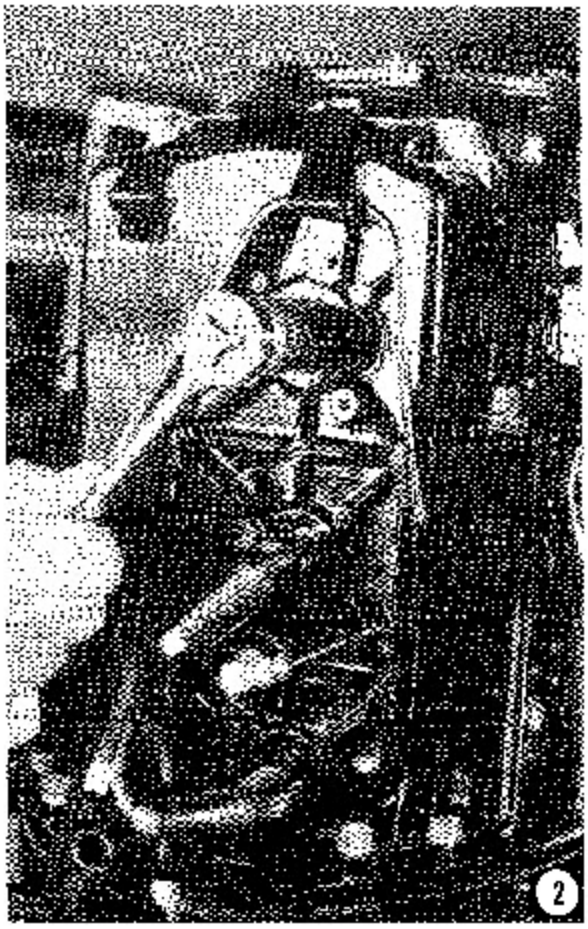
ONE MORE WORD: Each cylinder has its own ignition system in a flywheel-type ignition system. This means if a strong spark is observed on any one cylinder and not at another, only the weak system is at fault. However, it is always a good idea to check and service all systems while the flywheel is removed.

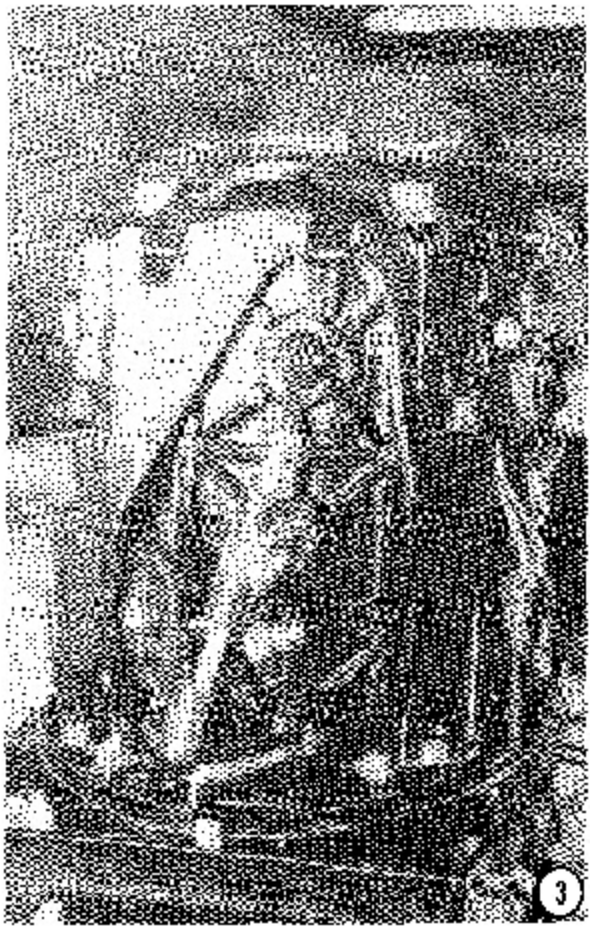
On four-cylinder engines, failure of the trigger coil will affect two cylinders.

Compression

Before spending too much time and money attempting to trace a problem to the ignition system, a compression check of each cylinder should be made. If the cylinder does not have adequate compression, troubleshooting and attempted service of the ignition or fuel system will fail to give the desired results of satisfactory engine performance.

Remove the spark plug wires by pulling and twisting **ONLY** on the molded cap. **NEVER** pull on the wire because the connection inside the cap may be separated or the boot be damaged. Remove the spark plugs. Insert a compression gauge into the cylinder spark plug hole. Crank the engine for several revolutions and note the final compression reading. Repeat the procedure for each cylinder.



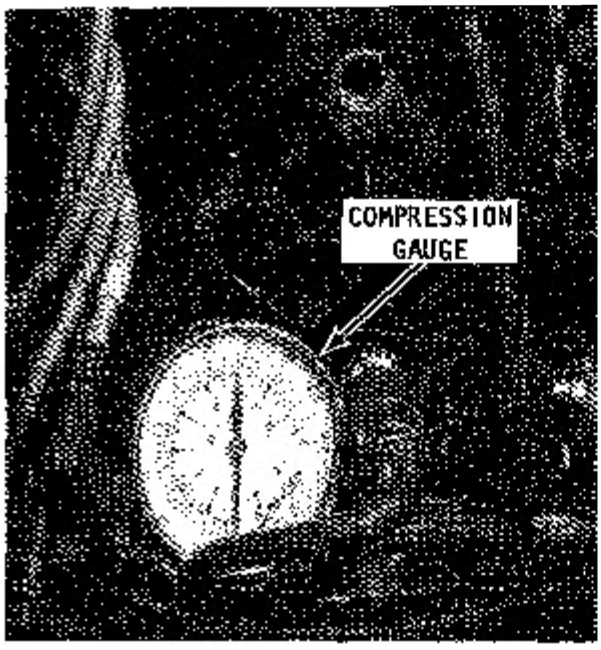


A variation in reading between the cylinders is far more important than the actual individual readings. If a particular cylinder varies more than 20 psi from the others, the cylinder may be scored, the rings frozen, or the piston burned. In-line outboard engines covered in this manual do not use a cylinder head. Therefore, low compression in one cylinder **CANNOT** be attributed to a blown head gasket.

Testing

The thunderbolt ignition stator assembly and stator coil tests may be made without removing the flywheel. Refer to the tables given on pages 5-50 thru 5-53. Be sure to use the correct table for the unit being serviced. The test will indicate if the switch box or the flywheel components are defective. The flywheel does not have to be removed in order to replace the switch box. Naturally, if any parts under the flywheel are defective, the flywheel must be removed in order to replace them.

All of the tests may be performed with a VOA (Volt/Ohm/Ampere) meter or with an ignition analyzer. The general procedure is to disconnect the leads from the switch box terminals, and then to make the test with the meter. Compare the results with the Specifications given on Pages 5-50 thru 5-53.



*When a compression check is performed, the spark plug leads **MUST** be grounded to the powerhead to prevent excessive strain on the coil. If the leads are not grounded, and simply left hanging, the coil will attempt to match the demand created by the spark trying to jump from the plug shell to nearest ground.*

Replace any part that fails to meet the specifications. These tests are difficult to perform without the proper test equipment. Your local marine shop is equipped to make an accurate determination of serviceable or faulty components.

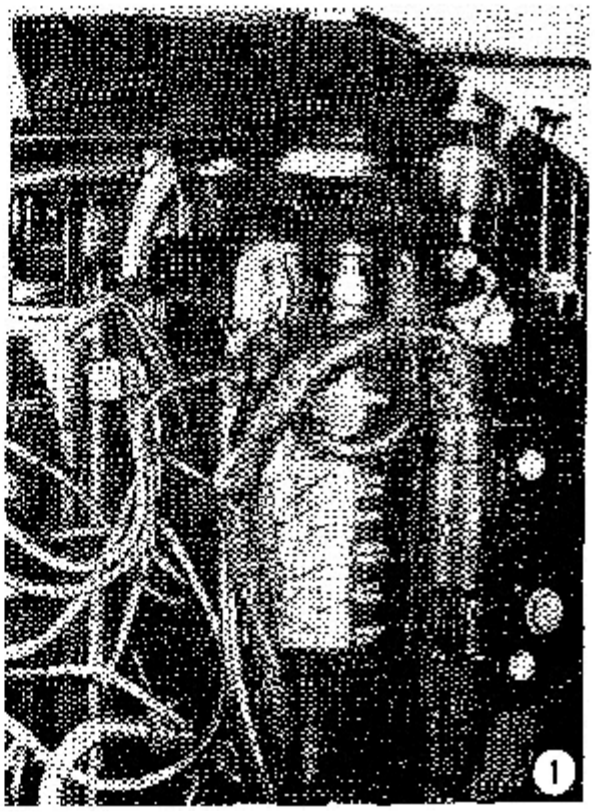
SERVICING
TYPE IV IGNITION SYSTEM

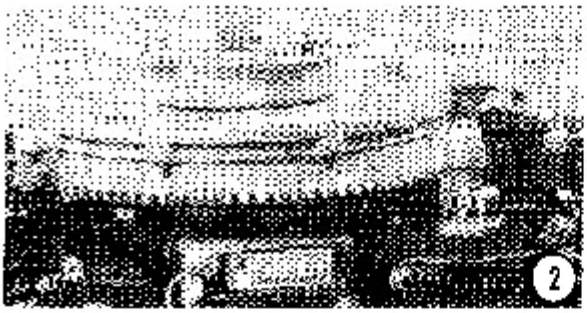
The Type IV ignition system installed on the outboard engines covered in this manual will usually operate over extremely long periods of time without requiring adjustment or repair. However, if ignition system problems are encountered, and the usual corrective actions such as replacement of spark plugs and timing check does not correct the problem, the CD output should be checked to determine if the unit is functioning properly.

Ignition overhaul procedures may differ slightly on various outboard models, but the following general basic instructions will apply to all high-speed flywheel CD ignition systems.

REMOVAL

1- Remove enough of the engine cowl or cover to expose the flywheel. Disconnect the leads from the battery terminals.





2- Remove the crankshaft nut in the center of the flywheel. A flywheel strap may be required to hold the flywheel securely while the nut is loosened.

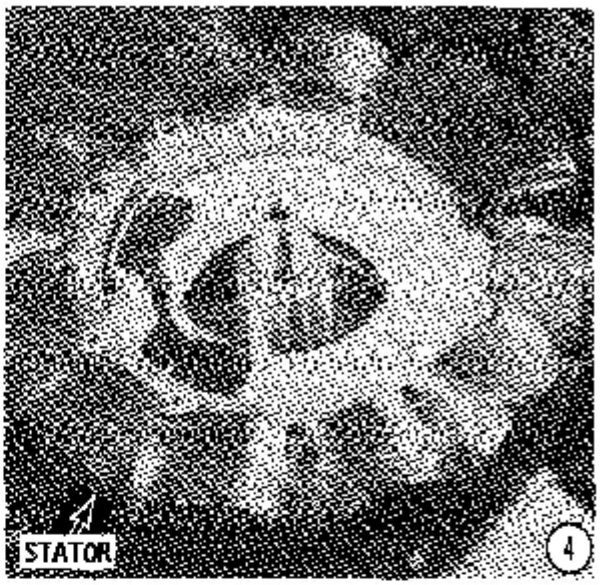
3- Obtain the proper type flywheel puller. **NEVER** attempt to use a puller which pulls on the outside edge of the flywheel or the flywheel may be damaged. After the puller is installed, tighten the center screw onto the end of the crankshaft. Continue tightening the screw until the flywheel is released from the crankshaft. Remove the flywheel.

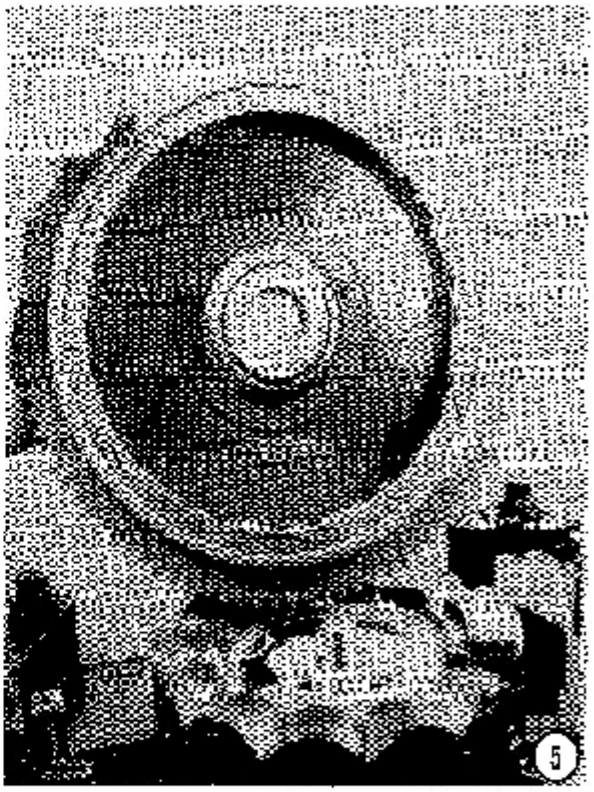
4- Determine the faulty part, if this has not been done, according to the Troubleshooting and Testing procedures in this Section. Remove the faulty part paying particular attention to wiring connections. Take time to either make a drawing or take a polaroid picture of the area to **ENSURE**, without a doubt, the wiring will be connected in proper sequence.

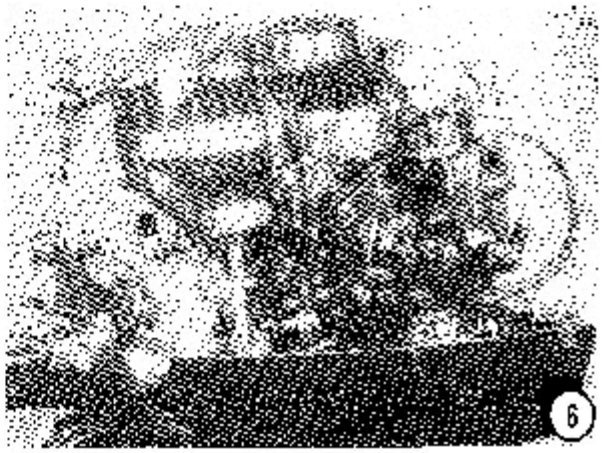
5- Check the inside of the flywheel for any indication of metal particles adhering to the magnets. Insert the key into the crankshaft keyway, and then slide the flywheel onto the crankshaft, with the slot in the flywheel aligned with the key on the crankshaft. Install and tighten the flywheel nut to a torque value of 100ft lb (136Nm).

6- Install the hand starter, if one is used. Install the cowl or engine cover. Connect the battery leads to the battery terminals.

For timing and synchronizing, see Chapter 6.







5-9 TYPE V IGNITION SYSTEM THUNDERBOLT — FLYWHEEL — C.D. COIL PER CYLINDER

Description

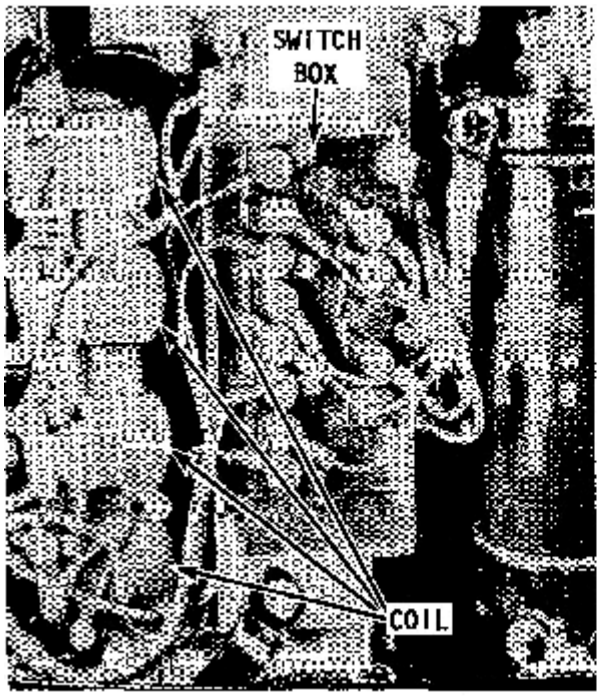
This ignition system is identified in the Specifications in the Appendix as Type V. C.D. is an abbreviation for "capacitor discharge".

This system has been used on Mercury Outboard engines since 1973 and on Mariner Outboard units since 1976. The Specifications lists the models with the Type V system installed.

The system consists of two sets of permanent magnets, a stator assembly, trigger assembly, switchbox, rectifier, capacitor, one ignition coil per cylinder, one spark plug per cylinder.

One set of permanent magnets is installed on the inside outer rim of the flywheel. The second set of magnets is mounted around the flywheel hub. The ignition rectifier and capacitor are housed within the switch box. The stator assembly is mounted below the flywheel and contains the four ignition coils.

Two or three more coils, in addition to the four ignition coils, are used with the trigger assembly. The trigger assembly on a 3-cylinder powerhead has three coils and 4-cylinder units have only two coils. None of the coils rotate -- they remain stationery.



Single switch box installation on a 4-cylinder in-line powerhead. Notice the coil for each cylinder.

When the second set of magnets passes the trigger coils, AC voltage is produced and conducted to an electronic switch (SCR) in the switchbox.

Theory of Operation

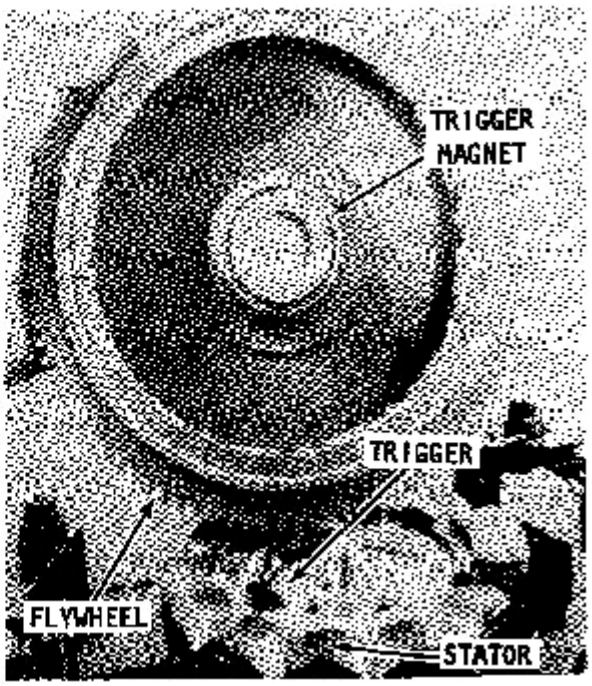
To begin a complete cycle: when the permanent magnets in the flywheel rim pass the stator ignition coils, AC voltage is produced. This voltage is conducted to the switch box where it is rectified and stored in the capacitor. When the second set of magnets pass the trigger coils, another AC voltage is produced and conducted to an electronic switch (SCR) in the switch box.

The switch discharges the capacitor voltage into the ignition coil at a precise time and in the proper firing order sequence.

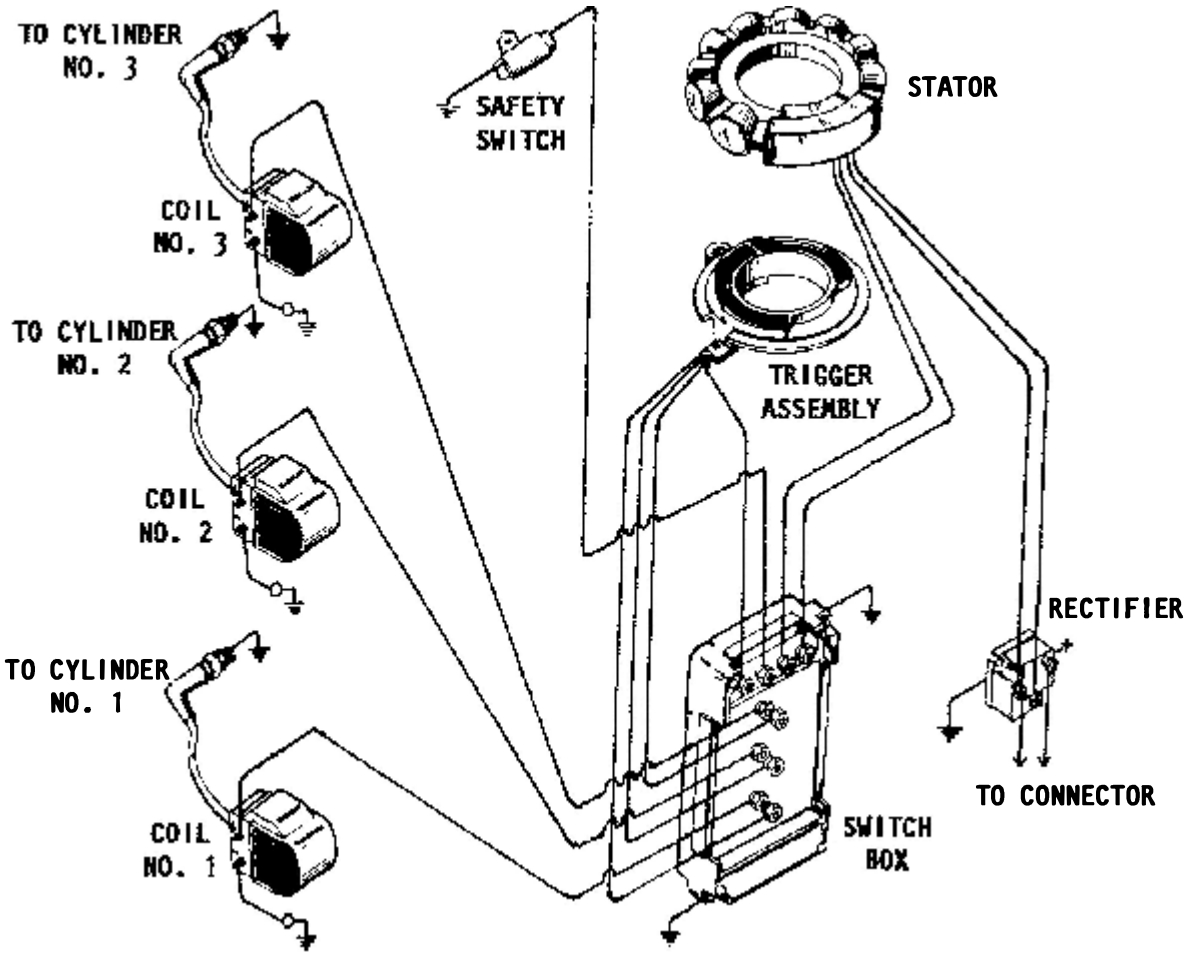
The capacitor voltage is conducted to the primary windings of the ignition coil. When the field generated by the coil (actually an electrical pulse) collapses, a high AC voltage charge is generated in the secondary windings and then conducted through the high-tension leads to the spark plugs. This high-voltage jumps the gap between the electrodes of the spark plug and ignites the air/fuel mixture in the cylinder.

This sequence occurs once for each cylinder per crankshaft revolution.

Advance or retard is accomplished by rotating the trigger coil position in relation to the permanent magnets on the flywheel hub.



Flywheel removed exposing the stator, trigger assembly and other ignition parts for testing and service.



Functional diagram of the Type V ignition system for a 3-cylinder powerhead, with major parts identified.

CRITICAL WORDS: These next two paragraphs may well be the most important words in this chapter. Probably the No. 1 cause of electrical problems with outboard power plants is misuse of the wiring harness.

A wiring harness is used between the key switch and the engine. This harness seldom contains wire of sufficient size to allow connecting accessories. Therefore, anytime a new accessory is installed, **NEW** wiring should be used between the battery and the accessory. A separate fuse panel **MUST** be installed on the dash. To connect the fuse panel, use two red and black No. 10 gauge wires from the battery. C.D. ignition systems require a full 12-volts for proper operation. Therefore, again let it be said, **NEVER** connect accessories through the key switch.

Key Switch

A marine-type key switch **MUST** be installed as a replacement item. An automotive-type switch installation may cause damage to the system.

TROUBLESHOOTING TYPE V IGNITION SYSTEM

READ, BELIEVE, & OBEY: Never touch or disconnect any ignition part on an engine equipped with the Type V ignition system while the engine is running; while the key switch is **ON;** or while the battery cables are connected, because high voltage is present.

The following safety precautions are listed for your personal safety and to prevent damage to expensive parts.

NEVER reverse battery cable connections. The battery negative (-) is ground. The black cable must always be connected to this terminal. The red cable must always be connected to the positive (+) terminal.

NEVER check polarity by "sparking" the battery terminals with the battery cable connections.

NEVER disconnect the battery cables while the engine is running.

NEVER crank the engine if the switch boxes are not properly grounded to the engine.

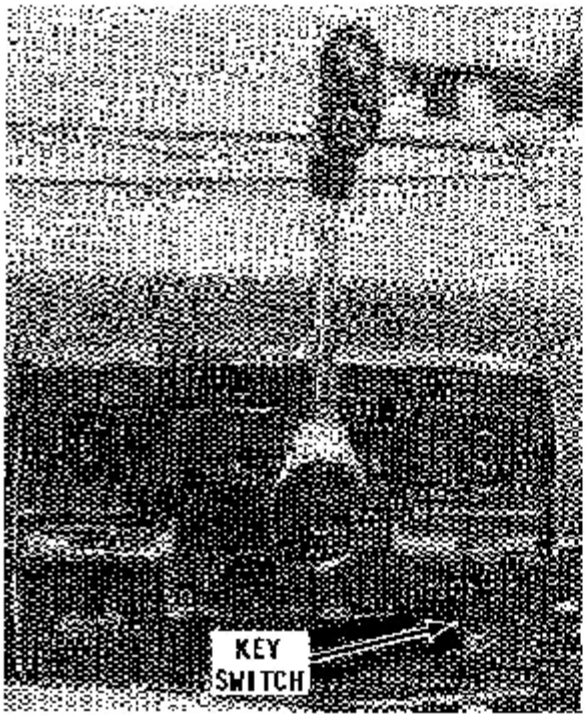
The switchbox and ignition coils cannot be thoroughly checked with conventional test equipment. A Quicksilver Thunderbolt Ignition Analyzer is required to properly check these items.

All other components can be tested with a VOA (Volt/Ohm/Ampere) meter.

ALWAYS check the following areas for sources of trouble **BEFORE** opening the ignition system.

Check to be sure the electrical harness, ignition switch, and safety cutoff switch are not the source of the problem.

Verify that the plug-in connectors are fully engaged and the terminals are free of corrosion.



If the key switch requires replacement or service, the shift box must be disassembled.

Check to be sure all electrical components and/or ground wires are properly grounded to the engine. Inspect visible wire connections to be sure they are tight and free of corrosion.

Observe the entire electrical system for disconnected wires, and for short or open circuits.

Ready For Troubleshooting

Always attempt to proceed with the troubleshooting in an orderly manner. The "shot-in-the-dark" approach will only result in wasted time, incorrect diagnosis, replacement of unnecessary parts, and frustration.

Begin the ignition system troubleshooting with the spark plugs and continue through the system until the source of trouble is located.

Spark Plugs

1- Check the plug wires to be sure they are properly connected. Check the entire length of the wires from the plugs to the coil. If the wire is to be removed from the spark plug, **ALWAYS** use a pulling and twisting motion as a precaution against damaging the connection.