The stator assembly is mounted beneath the flywheel. Permanent magnets are installed on the inside outer rim of the flywheel. The ignition coils produce AC voltage as the permanent magnets in the flywheel pass the stationary stator ignition coils. The AC voltage is conducted to the switchbox where it is rectified and stored in a capacitor (condenser).

The trigger assembly has two coils and is also mounted under the flywheel. A second set of magnets is mounted around the flywheel hub. When the second set of magnets passes the trigger coils, AC voltage is produced and conducted to an electronic switch (SCR) in the switchbox.

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 ignition coil primary. The ignition coil increases this voltage enough to jump the gap at the spark plug.

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.

CRITICAL WORDS

These next two paragraphs may well be the most important words in this chapter. Misuse of the wiring harness is the most single cause of electrical problems with outboard power plants.

A wiring harness is used between the key switch and the powerhead. 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. CD 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 IV IGNITION SYSTEM

READ, BELIEVE, & OBEY

Because high voltage is present, **NEVER** ever touch or disconnect any ignition part on a powerhead equipped with a Type IV ignition system while:

a- The powerhead is running
b- The key switch is **ON.**
c- The battery cables are connected.

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.

Components of the Type IV ignition system installed on the powerheads covered in this manual may be tested with a VOA (Volt/Ohm/Ampere) meter.

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

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

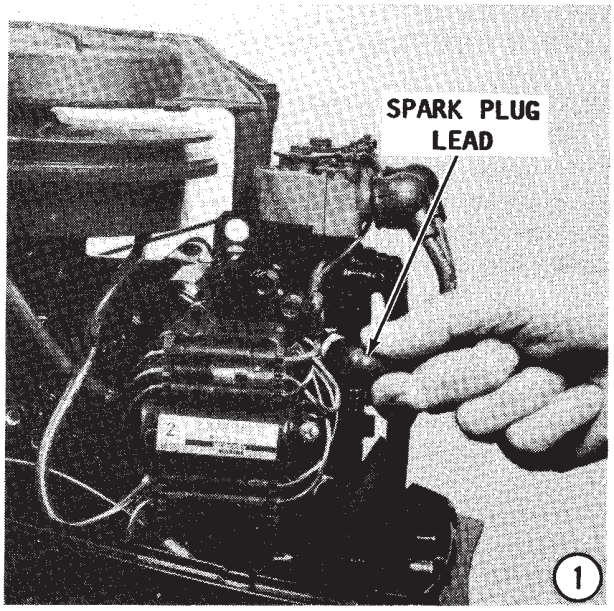
Verify the plug-in connectors are fully engaged and the terminals are free of corrosion.

Check to be sure all electrical components and 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 plug/s and continue through the system until the source of trouble is located.

Spark Plugs

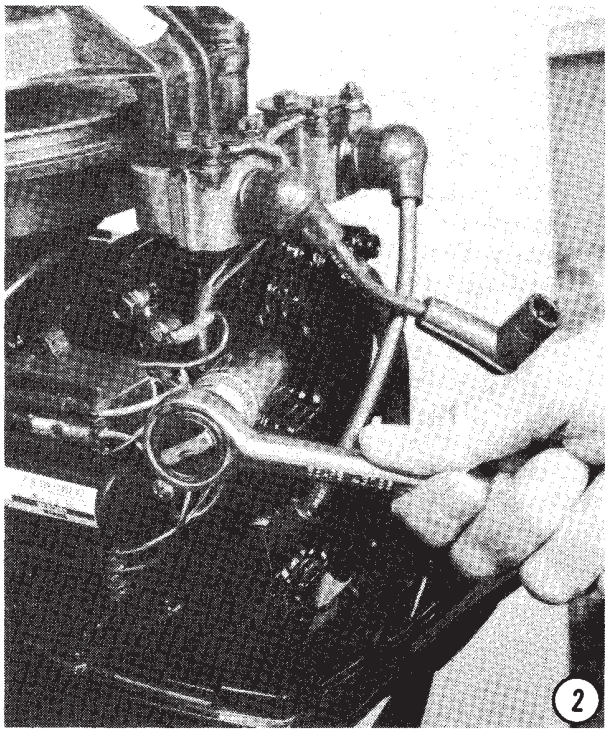
1- Check the plug wires to be sure they are properly connected. Check the entire length of the wire/s from the plug/s to the coil. If the wire is to be removed from the spark plug, **ALWAYS** use a pulling and twisting motion as a precaution against damaging the connection.

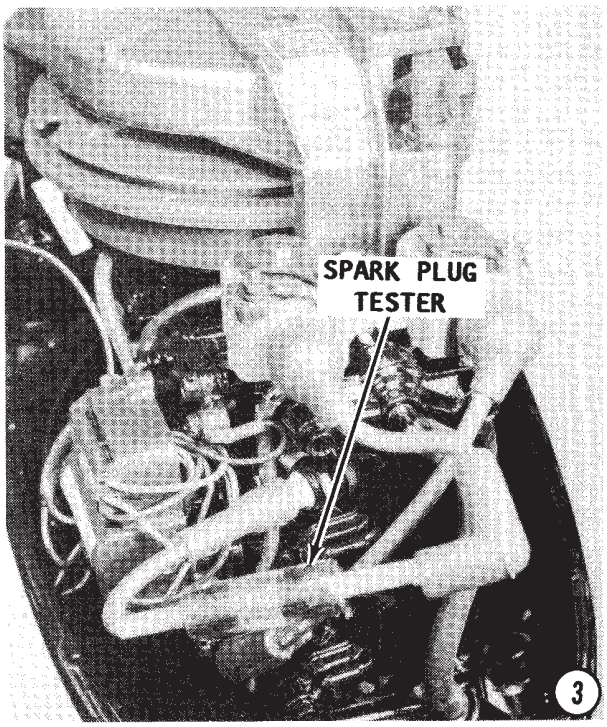
2- Attempt to remove the spark plug/s by hand. This is a rough test to determine if the plug is tightened properly. You should not be able to remove the plug without using the proper socket size tool. Remove the spark plug/s and keep them in order. Examine each plug and evaluate its condition as described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

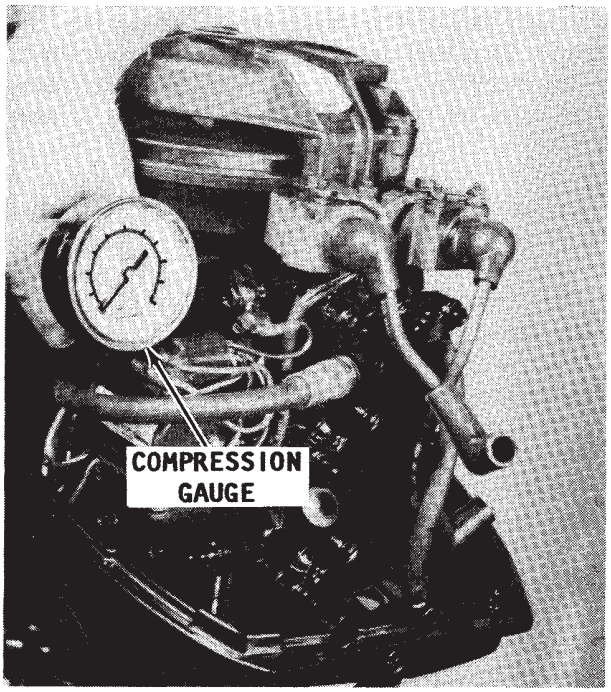
3- Use a spark tester and check for spark at each cylinder. If a spark tester is not available, hold the plug wire about 1/4" (6.4mm) from the powerhead. Turn the flywheel with a pull starter or electrical starter and check for spark. A strong spark over a wide gap must be observed when testing in this 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 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 for one cylinder and not at the other, only the weak







Making a compression check should become standard procedure before any major work or tune-up is performed. Without adequate compression in each cylinder, any other work will have little affect on performance.

system is at fault. However, it is always a good idea to check and service both systems while the flywheel is removed.

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 satisfactory engine performance.

Remove the spark plug wire/s 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 plug/s. Insert a compression gauge into one cylinder spark plug hole. Crank the engine for several revolutions and note the compression reading. Repeat the procedure for the other cylinder.

A variation in reading between the two cylinders is far more important than the actual individual readings. If one cylinder varies more than 20 psi (138 kPa) from the other, the cylinder may be scored, the rings frozen, or the piston burned. With the exception of Type "C" powerheads which do not use a cylinder head. Therefore, low compression in one cylinder **CANNOT** be attributed to a blown head gasket. A one-cylinder powerhead should have a compression reading of approximately 110 psi (760 kPa).

RESISTANCE TESTS
SINGLE-CYLINDER UNITS

Capacitor Charging Coil Resistance Tests

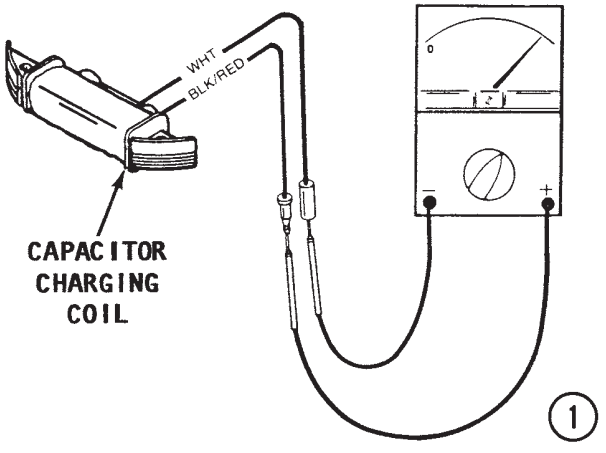
1- Disconnect the White and Black/Red leads leading from the capacitor charging coil under the flywheel at their quick disconnect fittings. Obtain and ohmmeter. Set the meter to the Rx10 scale. Make contact with the Red meter lead to the Black/Red lead from the coil. Make contact with the Black meter lead to the White coil lead. The meter should register between 9.3 and 14.2 ohms.

If the resistance is not within the limits given and the powerhead does not operate, the capacitor charging coil must be replaced.

To replace the coil, the hand rewind starter must be removed first, see Chapter 12, and then the flywheel "pulled". Use a strap wrench to secure the flywheel, while the flywheel nut is being loosened, and then use a flywheel puller, to "pull" the flywheel from the taper of the crankshaft.

Trigger Coil Resistance Test

2- Disconnect the Red/White lead leading from the trigger coil, mounted next to the flywheel, at its quick disconnect fitting. Remove the forward screw retaining the coil to the housing, and remove the Black lead from this retaining screw. Select the Rx10 scale on the ohmmeter. Make contact with the Red meter lead to the Black lead from the trigger coil. Make contact with



the Black meter lead to the Red/White lead from the trigger. The meter should register between 8.0 and 11.5 ohms.

If the resistance is not within the limits given and the powerhead does not operate, the trigger coil must be replaced.

To replace the trigger coil, remove the two securing screws and pull the coil up and out of the housing. Pass the two leads through the grommet in the housing.

Ignition Coil Resistance Tests

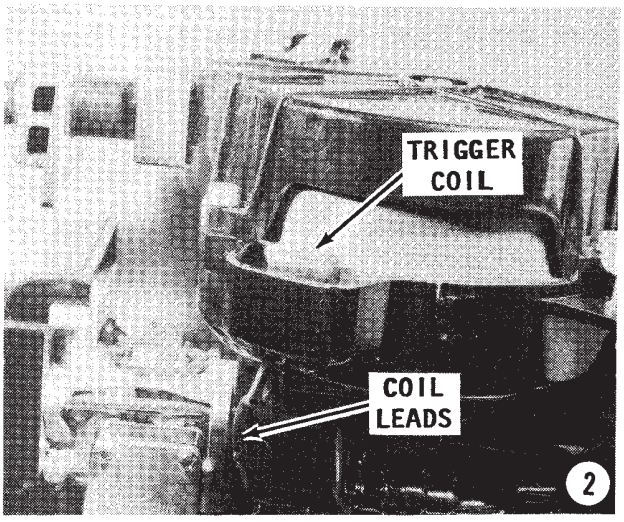
FIRST, THESE WORDS

The following two tests are best performed with the ignition coil removed from the powerhead. Therefore, the next step begins with instructions for removal.

3- Slide the Yellow/Black lead from the ignition coil at the spade fitting on the coil. Disconnect the high tension lead at the spark plug. Remove the two securing bolts and lift the coil free of the powerhead. Three small black leads will remain, which were secured by the two bolts to the coil. Make a note of the original locations of these three leads, to ensure installation back into the same location from which they were removed.

To test the primary windings: select the Rx1 scale on the ohmmeter. Make contact with the Black meter lead to the spade terminal on the coil. Make contact with the Red meter lead to the laminated core of the coil on the **SAME SIDE** as the spade terminal. The meter should register between 0.02 and 0.38 ohms.

To test the secondary windings: select the Rx1000 scale on the ohmmeter. Make contact with the Red meter lead to the spade terminal on the coil. Make contact with the Black meter lead to the high tension lead terminal. The meter should reister between 3.0 and 4.4 ohms.



If the reading is questionable but the powerhead operates, install a spark plug tester and check the strength of the spark.

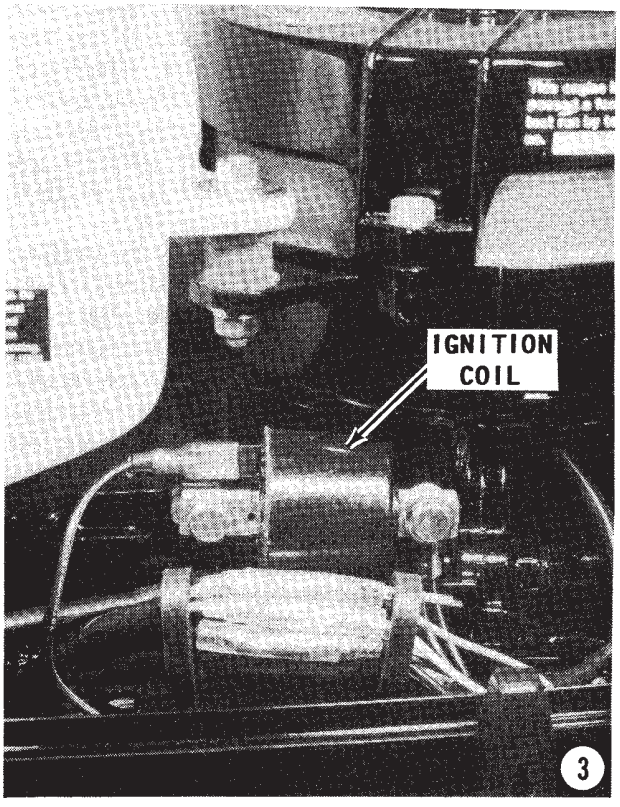
If the spark is acceptable, it is not necessary to replace the ignition coil. However, keep this area in mind for possible future trouble.

If the spark is weak, it will get weaker. Therefore, replace the coil.

Position the ignition coil against the powerhead. Install the forward securing bolt through the laminated core, slide the eyelet connectors of the three small Black leads onto the bolt and thread the bolt into the powerhead. Install the other securing bolt. Tighten both bolts to a torque valve of 5.9ft lbs (8Nm). Connect the Yellow/Black lead from the CDI unit to the spade terminal on the coil. Install the high tension lead to the spark plug.

Other Electrical Components

The CDI unit is located under the ignition coil. At press time, resistance specifications to test this unit were not available



from the manufacturer. Systematic resistance tests of the capacitor charging coil, trigger coil, and ignition coil, as well as inspection of quick disconnect fittings, "kill" switch action and spark plug condition may serve to eliminate ignition problems. If all areas are tested and inspected and the powerhead still does not operate in a satisfactory manner, then the CDI unit must be removed and replaced.

Some models may be equipped with a lighting coil under the flywheel. This coil may be identified by its clean laminated copper windings. The lighting coil, so named because it may be used to power the lights on the boat when used together with a voltage regulator, allows the powerhead to generate additional current to charge the battery. Manual start models may be equipped with a lighting coil, but the coil leads will be taped off and not used. Again, at press time, no resistance specifications were available for testing this coil.

RESISTANCE TESTS
TWO-CYLINDER UNITS

Stator Types

Two types of stator assemblies are installed on powerheads with the Type IV ignition system. One type has a black ground wire. The stator is grounded to the powerhead through this black ground wire.

The other type does not have the black ground wire. The stator is grounded directly to the powerhead through the stator mounting plate.

Stator Tests

FIRST, THESE WORDS

The stator **MUST** be grounded to the powerhead before making the following tests. If satisfactory meter readings are not obtained, the stator is defective and must be replaced.

1- Ground the stator to the powerhead. Refer to the appropriate table in the Appendix. Identify the leads listed under the column "Tester Leads To:". Select the appropriate scale on the VOA meter. Disconnect the lead/s at their quick disconnect fittings. Make contact with the VOA leads to the disconnected lead/s. The meter reading should be as indicated in the Appendix for the model being serviced.

If the resistance is not within the limits listed in the table and the powerhead does not operate, the stator must be replaced. Service or adjustment is not possible.

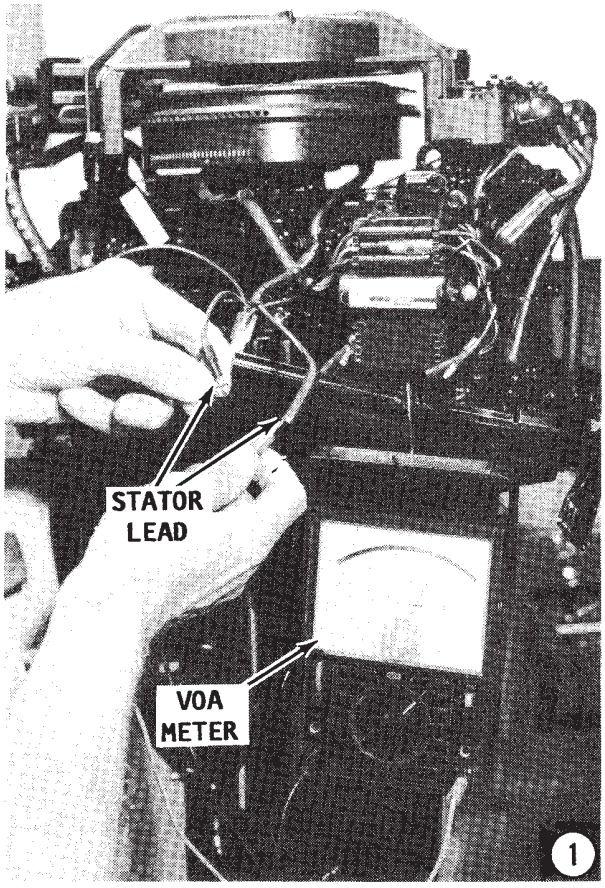
To replace the stator, the hand starter or electric cranking motor must be removed and the flywheel must be "pulled", refer to the procedures begining on Page 5-43.

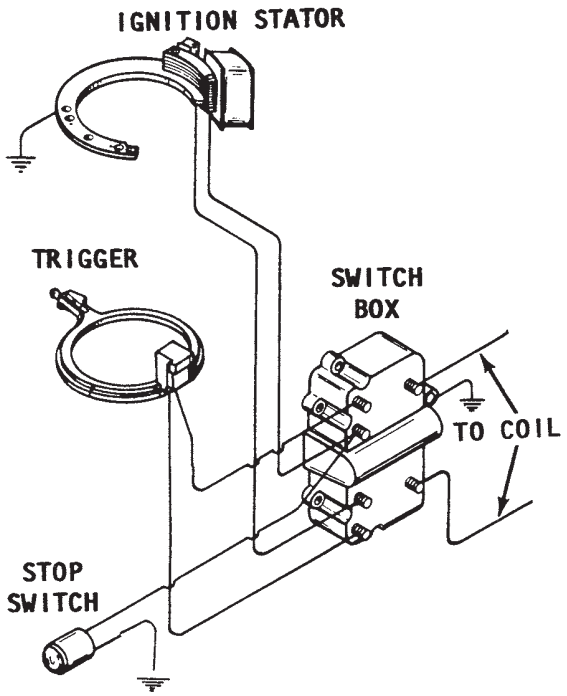
Trigger Assembly Test

First, These Words

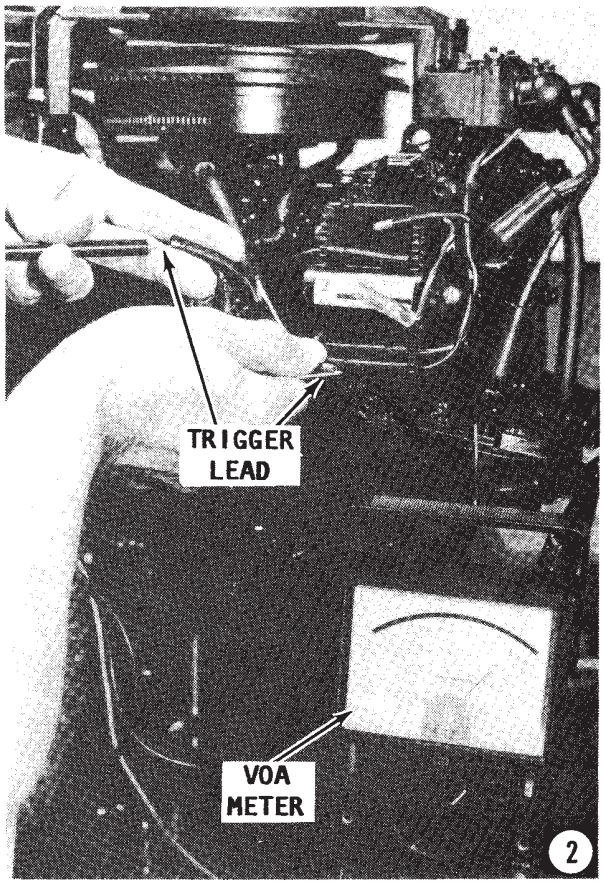
The switch box **MUST** be properly grounded to the powerhead before making this series of tests.

2- Check the small black lead from the switchbox is grounded securely to the powerhead. Refer to the appropriate table in the Appendix. Identify the leads listed under the column "Tester Leads To:" If the colors of the leads are not specified for the model being serviced, refer to the wiring diagram in the Appendix. Select the appropriate scale on the VOA meter. Disconnect the lead/s at their quick disconnect fittings. Make contact with the VOA leads to the disconnected lead/s. The meter read-





Functional diagram of the Type IV ignition system used on 2-cylinder powerheads to show the physical relationship of the stator, trigger, switch box, and stop switch. The color code differs for various models. Therefore, check the listings in the Appendix.



ing should be as indicated in the Appendix for the model being serviced.

If the resistance is not within the limits listed in the table and the powerhead does not operate, the trigger assembly must be replaced. Service or adjustment is not possible.

To replace the assembly the hand starter or electric cranking motor must be removed and the flywheel must be "pulled", refer to the procedures begining on Page 5-43.

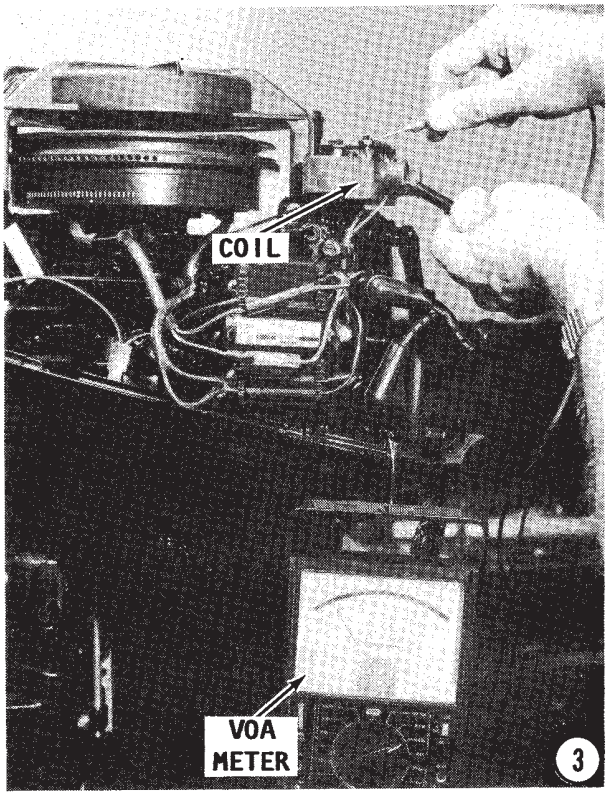
Ignition Coil Test

First, These Words

A VOA meter is only capable of detecting certain faults in an ignition coil. Replace the coil, if the meter readings are not as specified in the chart in the Appendix. If the coil tests are satisfactory, but the coil is still suspected, an Ignition Analyzer must be used to check the coil further. If an analyzer is not available the coil should be replaced or checked at your favorite marine dealer.

Coil terminals are often painted. Therefore, **BE SURE** to obtain good metal to metal contact when making tests.

Disconnect both small leads from the coil terminals. Remove the high-tension lead from the coil tower.



Primary Resistance Test

3- Refer to appropriate table in the Appendix. Identify the leads listed under the column "Tester Leads To:". Select the appropriate scale on the VOA meter. Make contact with the VOA leads to the disconnected lead/s. The meter reading should be as indicated in the Appendix for the model being serviced.

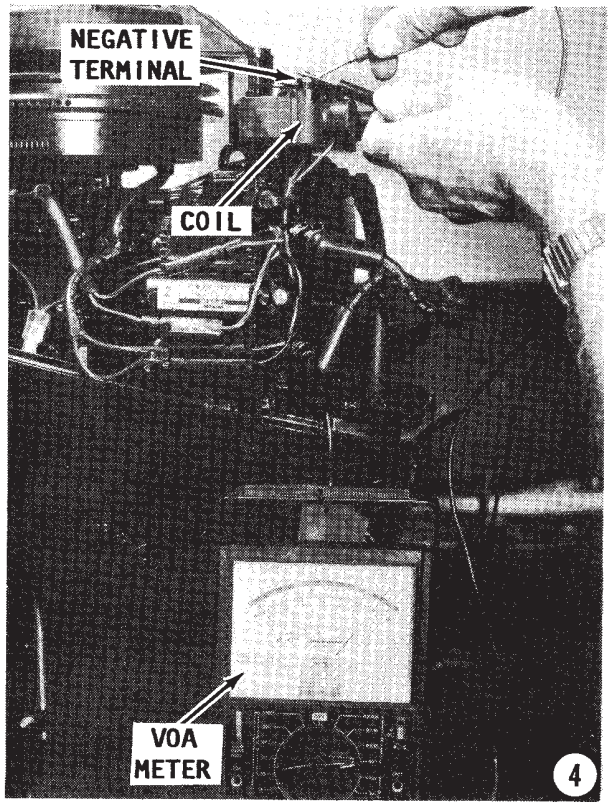
Secondary Resistance Test

4- Refer to appropriate table in the Appendix. Identify the leads listed under the column "Tester Leads To:". Select the appropriate scale on the VOA meter. Make contact with the VOA leads to coil tower and the appropriate testing point given in the table. The meter reading should be as indicated in the Appendix for the model being serviced.

If the reading is questionable but the powerhead still operates, install a spark plug tester and check the strength of the spark.

If the spark is acceptable, it is not necessary to replace the coil. However, keep this area in mind for possible future trouble.

If the spark is weak it will get weaker, therefore, replace the coil.



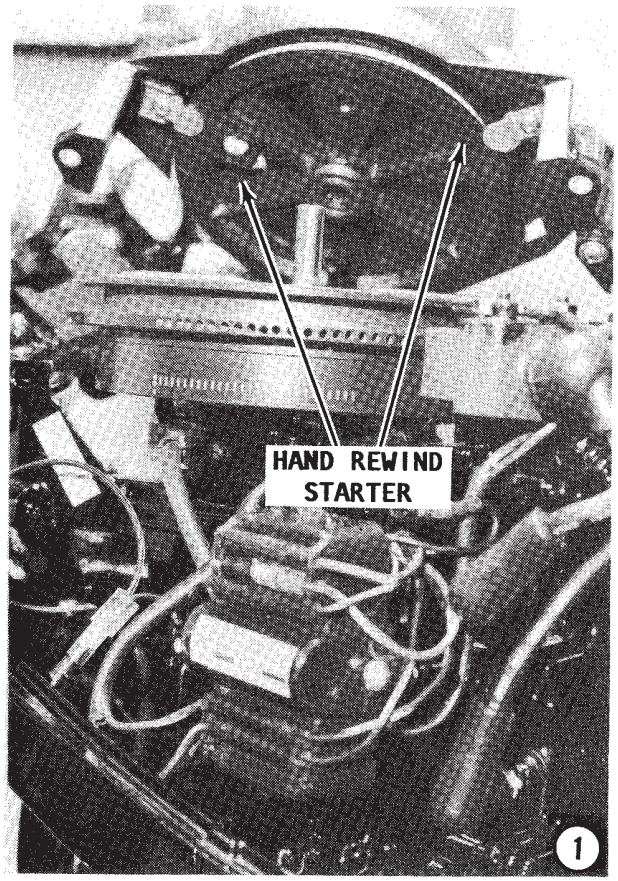
FLYWHEEL COMPONENT SERVICE TYPE IV IGNITION SYSTEM

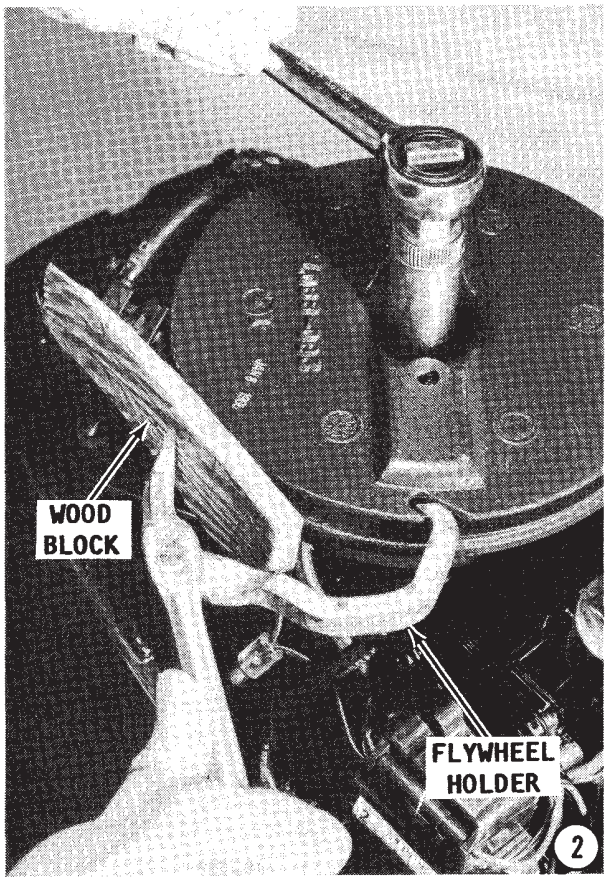
The Type IV CD ignition system installed on the powerheads covered in this manual will usually operate over extremely long periods of time without requiring adjustment or repair. However, if ignition system problems are encountered, and the usual corrective actions such as replacement of spark plugs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

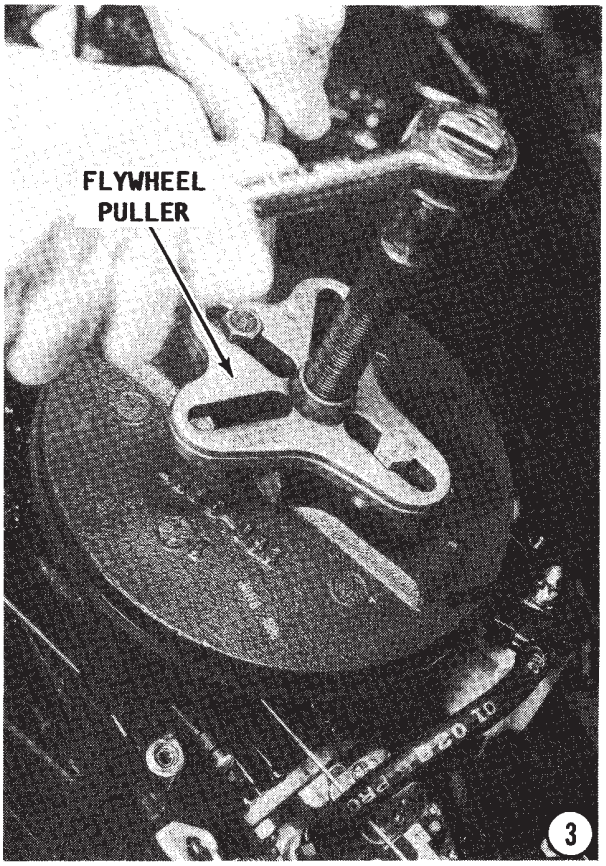
Overhaul procedures may differ slightly on various outboard models, but the following general basic instructions will apply to all Type IV high-speed flywheel CD ignition systems.

Flywheel Removal

1- Remove enough of the cowling to expose the hand starter. Remove the hand starter attaching hardware, and then lift the hand starter free of the crankshaft. Disconnect the leads from the battery terminals.







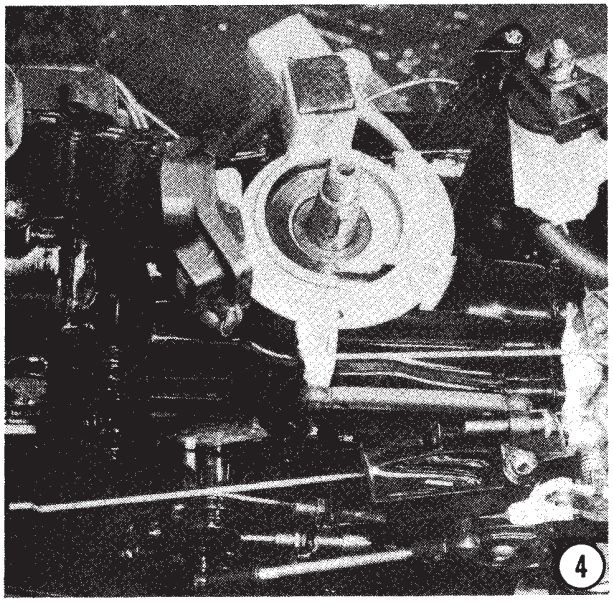
2- Remove the crankshaft nut in the center of the flywheel. A flywheel strap or other device will be required to hold the flywheel securely while the nut is loosened.

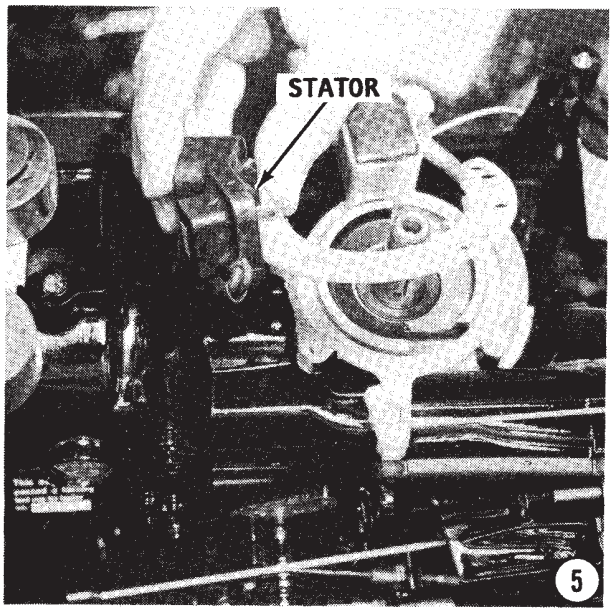
3- Obtain the proper type flywheel puller. **NEVER** attempt to use a puller which pulls on the outside edge of the flywheel or the flywheel may be damaged. After the puller is installed, tighten the center screw onto the end of the crankshaft. Continue tightening the screw until the flywheel is released from the crankshaft. Remove the flywheel. **NEVER** hammer on or heat the end of the puller center bolt in an effort to remove the flywheel. Such action will damage the crankshaft or the bearings.

SPECIAL WORDS

A slight "pull" will be felt as the flywheel is lifted, due to the magnets installed on the inside rim of the flywheel.

4- **STOP,** and carefully observe the layout of the electrical system and associated wiring. Study how the CD system is assembled. Because there are so many different CD installation arrangements, it is not possible to illustrate all of them, and even if they were shown, you would not be able to identify the circuitry for the engine you are servicing. **TAKE TIME** to make notes of the wire routing. You may elect to follow the practice of many professional mechanics by taking a series of photographs of the engine with the flywheel removed, one from the top, and a couple from the sides showing the wiring and arrangement of parts.



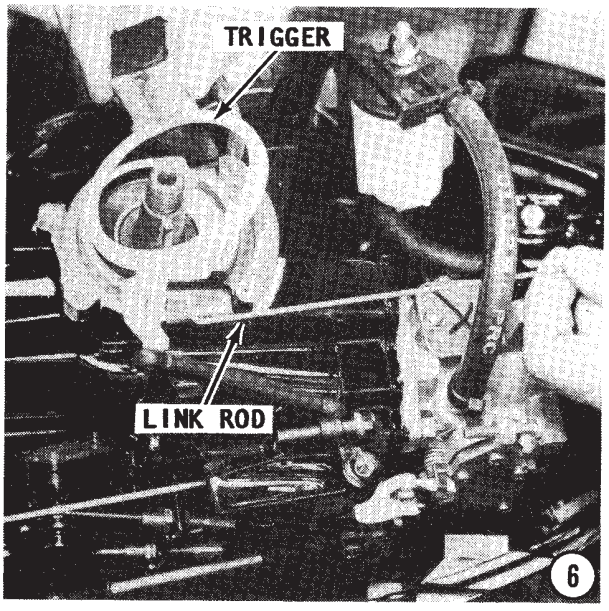


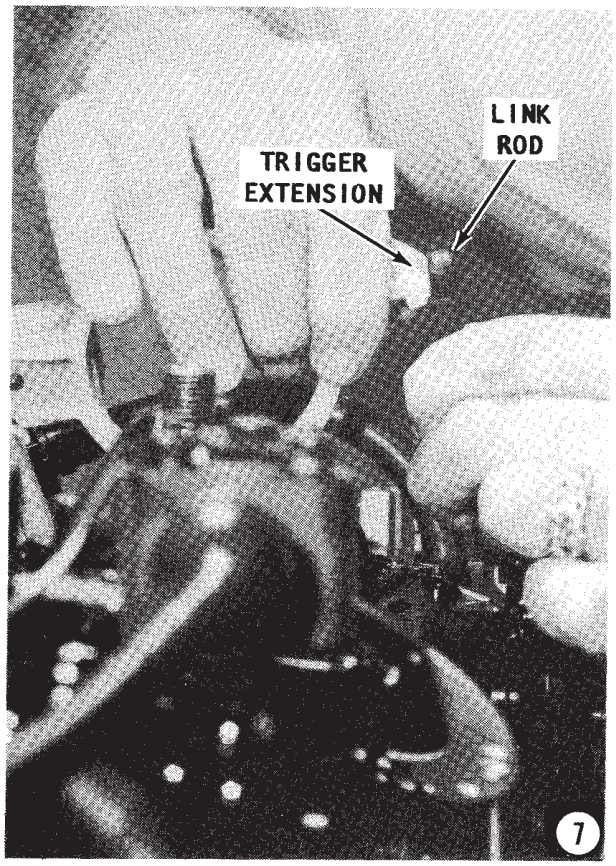
5- Remove the stator attaching hardware, and then lift the stator and set it aside. It is not necessary to disconnect the wiring to the stator. See earlier instructions in this section to test the stator. On models equipped with an electric cranking motor, remove the alternator.

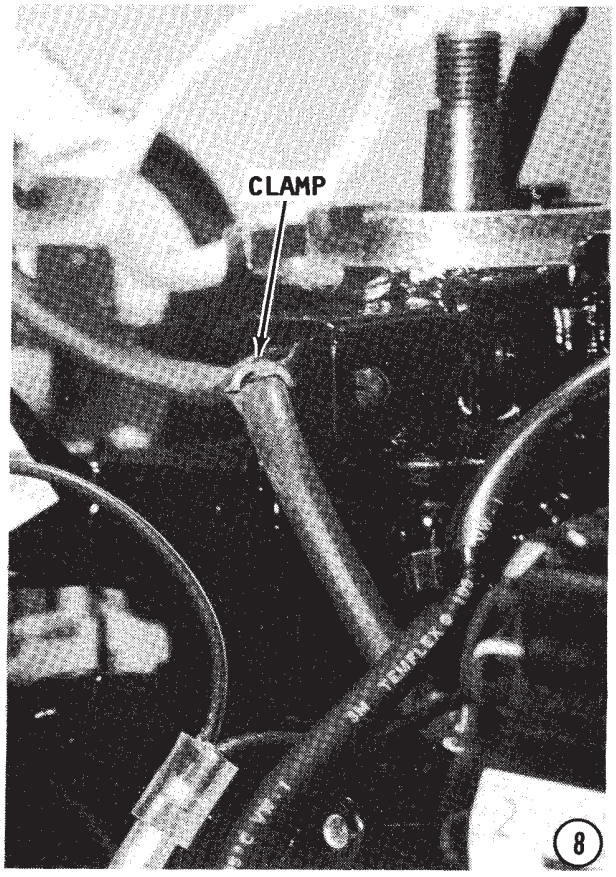
6- Lift the trigger assembly, and then disconnect the spark advance rod.

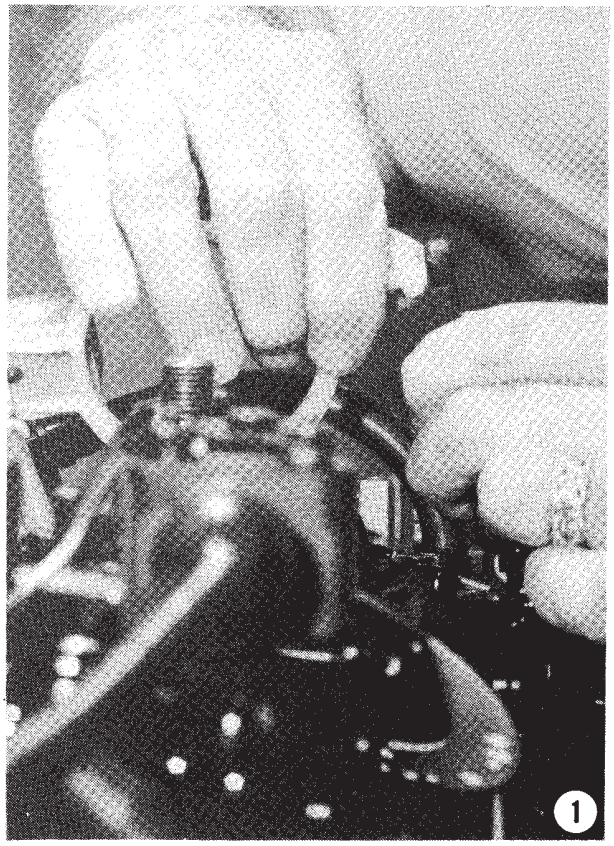
7- Unsnap the link rod from the trigger extension.

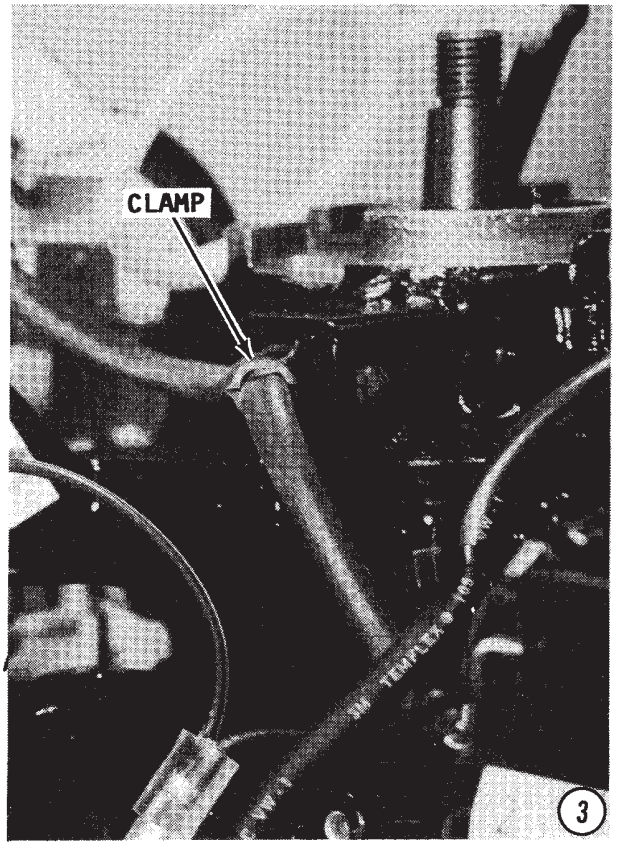
8- Disconnect all trigger assembly leads from the switch box, including the clamp on the wire harness. Lift the trigger assembly from the powerhead. See instructions in the Appendix to test the trigger assembly.











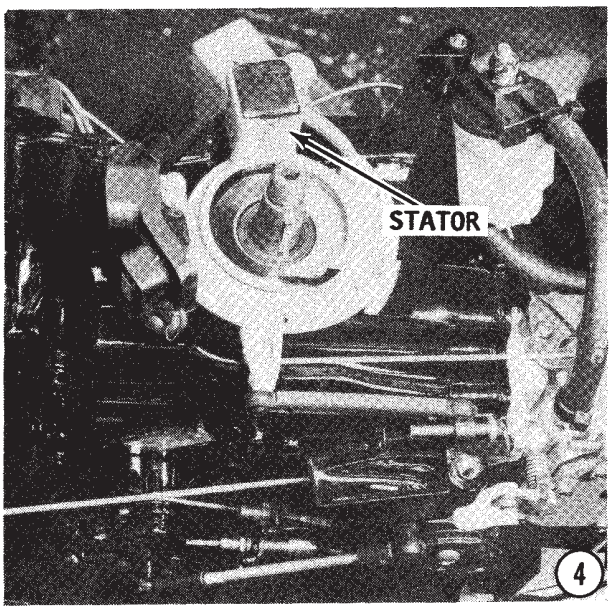
ASSEMBLING FLYWHEEL PARTS

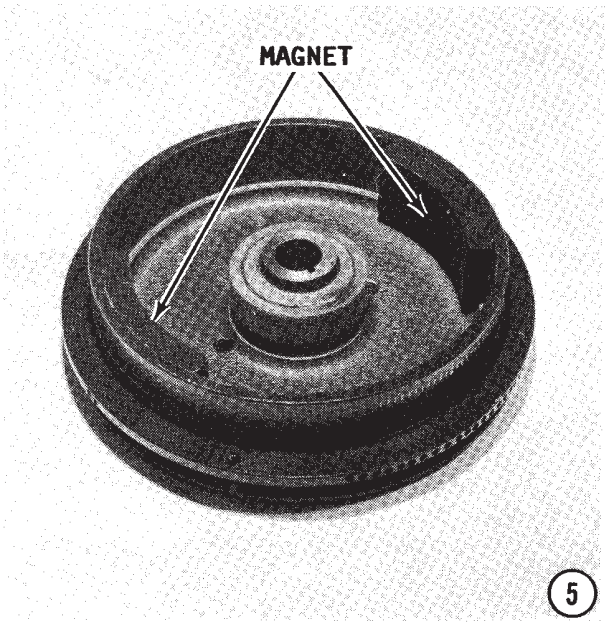
1- Connect the link rod to the trigger assembly extension. Hook the spark advance rod onto the trigger extension. Snap the rod into place. On earlier model units the rod is held in place with a locknut.

2- Slide the trigger assembly over the end cap into place.

3- Install the clamp on the wire harness. Route the trigger wiring harness along the side of the powerhead, and then connect the wires to the proper terminals in the switch box. Refer to the diagram or photographs made before removal. If this was not done, check the wiring diagrams in the Appendix.

4- Place the stator in position over the trigger assembly. Apply a drop of Loctite





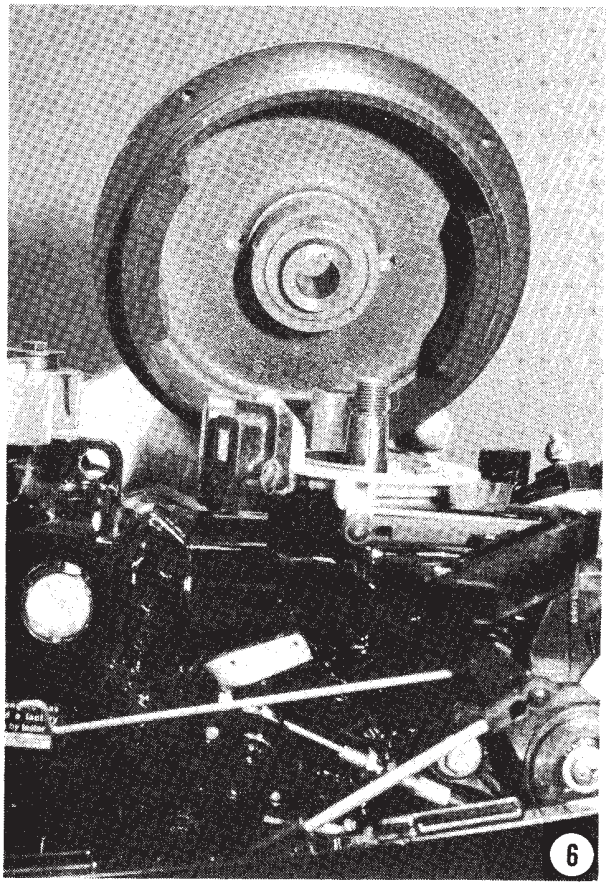
A, or equivalent, to the threads of the stator attaching screws. Install and tighten the attaching screws to a torque value of 30 in lbs (3.4 Nm). On models equipped with an electric cranking motor, position the alternator on the opposite side from the stator, and then secure it in place with the attaching hardware. Connect the wires to the alternator. Connect the stator leads to the proper terminals of the rectifier and switch box. Refer to the wiring diagrams in the Appendix.

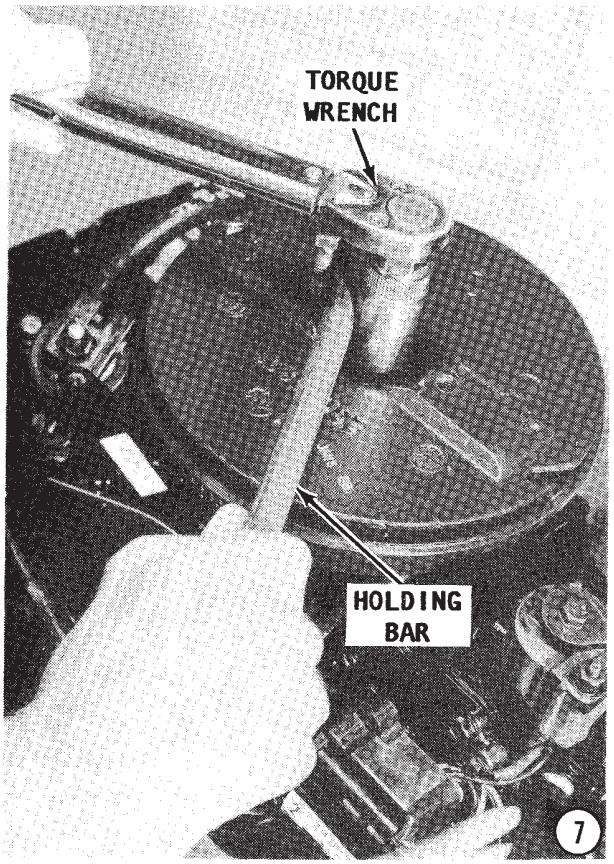
Flywheel Installation

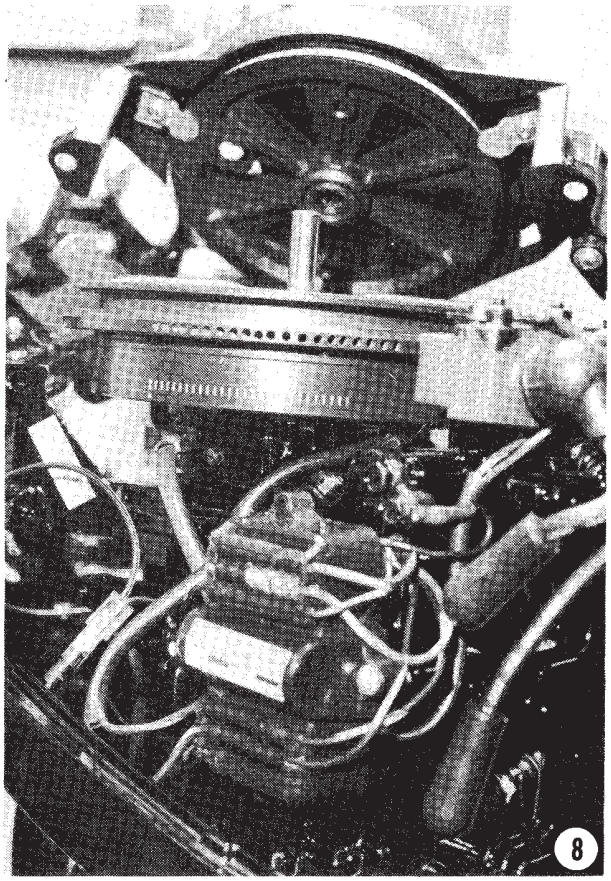
5- Place the key in the crankshaft keyway. Check the flywheel magnets to be sure they are free of any metal parts. Double check the taper in the flywheel hub and the taper on the crankshaft to verify they are clean and contain no oil, as a precaution against the flywheel "walking" on the crankshaft during operation.

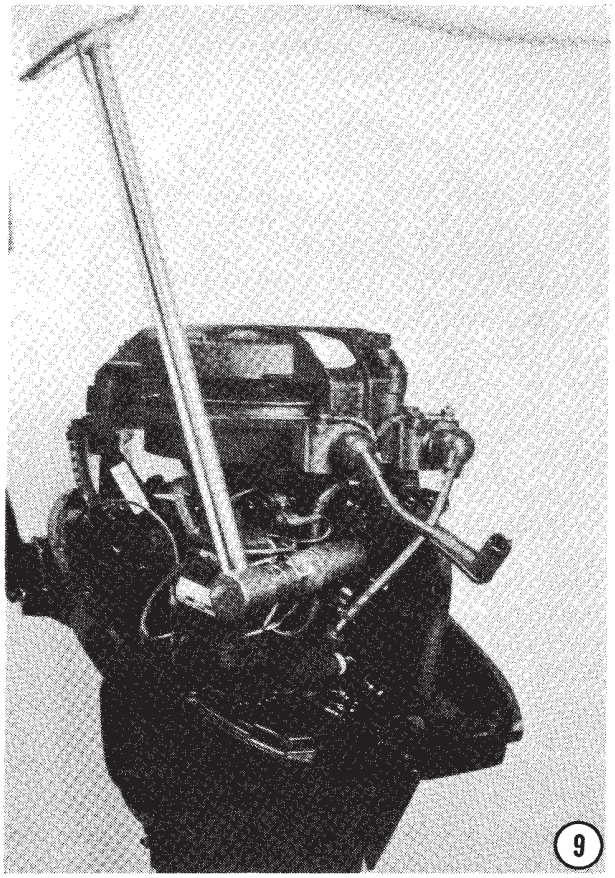
6- Slide the flywheel down over the crankshaft with the keyway in the flywheel aligned with the key on the crankshaft. Rotate the flywheel clockwise and check to be sure the flywheel does not contact any part of the magneto or the wiring.

7- Thread the flywheel nut onto the crankshaft and tighten it to the torque value given in the Appendix.









8- Install the hand starter and secure it in place with the attaching hardware.

9- Install the spark plugs and tighten them to a torque value of 20-1/2 ft lbs (27.8 Nm). Install the electrical leads to the battery terminals.

For detailed timing and synchronizing procedures, see Chapter 6.

6
TIMING AND SYNCHRONIZING

6-1 INTRODUCTION AND PREPARATION

Timing and the synchronization on an outboard engine is extremely important to obtain maximum efficiency. The engine cannot perform properly and produce its designed horsepower output if the fuel carburetion and ignition systems have not been precisely adjusted.

Synchronization

In simple terms, synchronization is timing the carburetion to the ignition. This means, as the throttle is advanced to increase engine rpm, the carburetor and the ignition systems are both advanced equally and at the same rate.

Therefore, anytime the fuel system or the ignition system on an engine is serviced to replace a faulty part, or any adjustments are made for any reason, engine timing and synchronization **MUST** be carefully checked and verified.

For this reason the timing and synchronizing procedures have been separated from all others and presented alone in this chapter.

Before making adjustments with the timing or synchronizing, the ignition system should be thoroughly checked according to the procedures outlined in Chapter 5, and the fuel system in good working order per Chapter 4.

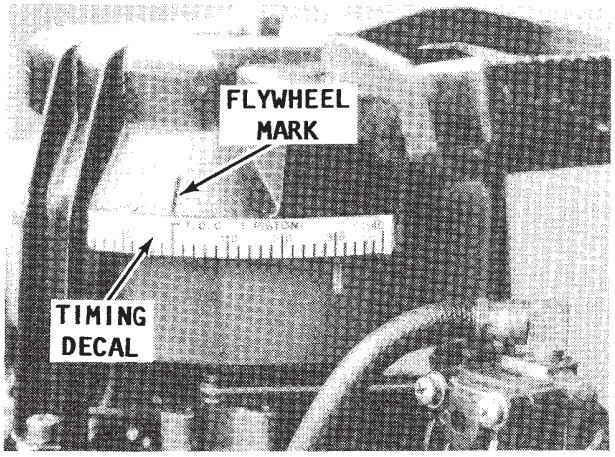
Timing

The timing on many models is set at the factory and there is no way in heaven, or on earth, to make an adjustment. However, on some powerheads, the timing may be adjusted. All outboard engines have some type of synchronization between the carburetion and ignition systems.

Many models do not have timing marks on the flywheel and a dial indicator must be used to properly time the engine. On later models the flywheel does have a timing mark and the engine may be properly timed using a timing light. This method has its disadvantages, because the engine must be run at full throttle in forward gear in a test tank, or at full throttle on the boat in a waterway. The problems of roaring across a lake or down the river at full throttle and attempting to check the timing with a light can easily be imagined.

Therefore, the timing light is not too practical a method of timing and synchronizing a large horsepower engine if a test tank is not available.

On some late model powerheads, the timing is checked using a timing light while cranking the engine. Using this procedure it is not necessary to mount the engine in a test tank or to move the boat into a body of water. **HOWEVER,** a flush device **MUST** be used and the engine **NEVER** operated above 1000 rpm.



Typical flywheel mark and timing decal used on smaller powerheads covered in this manual.

PREPARATION

Timing and synchronizing the ignition and fuel systems on an outboard motor are critical adjustments. Therefore, the following equipment is essential and is called out repeatedly in this section. This equipment must be used as described, unless otherwise instructed. Naturally, they are removed following completion of the adjustments.

Dial Indicator

Top dead center (TDC) of the No. 1 (top) piston must be precisely known before the timing adjustment can be made. TDC can only be determined through installation of a dial indicator into the No. 1 spark plug opening.

Timing Light

During many procedures in this section, the timing mark on the flywheel must be aligned with a stationary timing mark on the engine while the engine is being cranked, or is running. Only through use of a timing light connected to the No. 1 spark plug, can the timing mark on the flywheel be observed while the engine is operating.

Tachometer

A tachometer connected to the engine must be used to accurately determine engine speed during idle and high-speed adjustment.

The meter readings range from 0 to 6,000 rpm in increments of 100 rpm. Tachometers have solid state electronic circuits which eliminates the need for relays or batteries and contributes to their accuracy.

Most marine outboard units have a female plug at the forward end of the shift box as a convenience for installation of a tachometer. Therefore, when purchasing a tachometer for the boat, check to be sure the adaptor plug will mate with the fitting on the shift box.

If the boat is not equipped with a tachometer, connect one lead to the primary (negative (-)) terminal of any one coil. Connect the other lead of the tachometer to a good ground on the powerhead.

Test Tank

The engine must be operated at various times during the procedures. Therefore, a test tank, flush device, or moving the boat into a body of water, is necessary.

CAUTION: Water must circulate through the lower unit to the engine any time the engine is run to prevent damage to the water pump in the lower unit. Just five seconds without water will damage the water pump.

NEVER, AGAIN, NEVER operate the engine at high speed with a flush device attached. The engine, operating at high speed with such a device attached, would **RUNAWAY** from lack of a load on the propeller, causing extensive damage.

6-2 MODEL 39, 40, 60, 75, AND 110 -- 1965-1969

Primary Pickup Synchronization

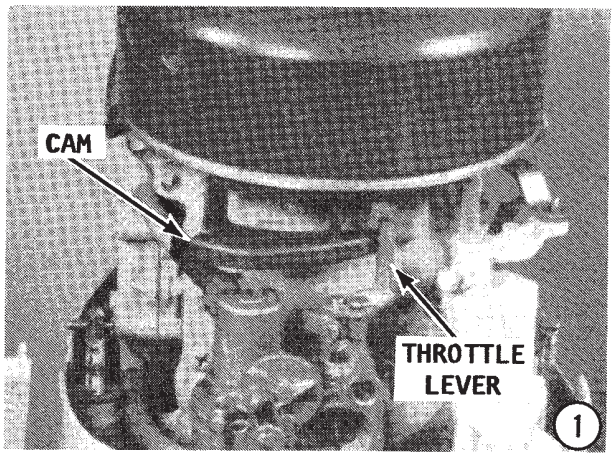
1- Mount the engine in a test tank. Connect a tachometer to the engine. Start the engine and allow it to warm to operating temperature.

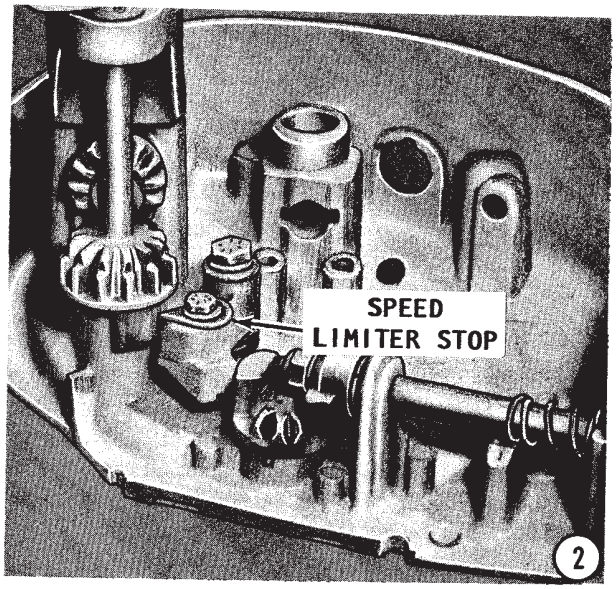
CAUTION: Water must circulate through the lower unit to the engine any time the engine is run to prevent damage to the water pump in the lower unit. Just five seconds without water will damage the water pump.

Shift the engine into **FORWARD** gear. Advance the throttle by turning the twist grip until the engine is operating between 1000 and 1100 rpm. At this speed, the magneto cam should just touch the throttle lever on the carburetor. If 1000 to 1100 rpm cannot be obtained, loosen the screw on the top of the carburetor securing the throttle lever to the carburetor. Slowly move the arm inward or outward until the engine is operating at the recommended rpm.

Model 110, Serial No. 1492282 to 1580202

2- Shift the engine into **NEUTRAL**, and then adjust the neutral speed limiter stop to obtain a maximum speed of 2400 to 2700 rpm.





Model 60, Serial No. 1610265 and Above

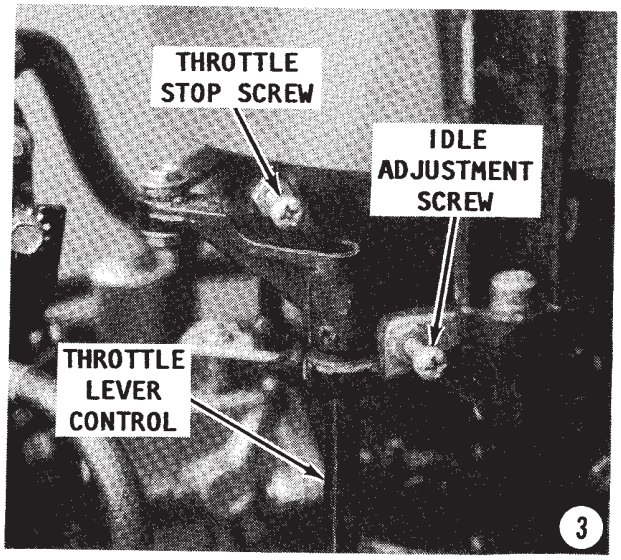
3- Adjust the throttle stop screw until the threaded end of the screw extends 5/16" (8mm) thru the throttle lever control.

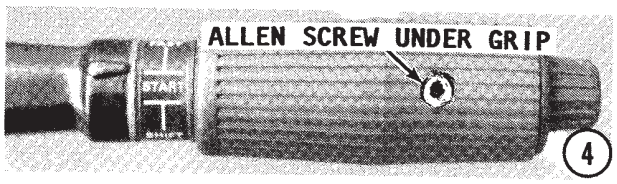
Model 110, Serial No. 1580203 and above

Adjust the throttle stop screw until the threaded end of the screw extends 1/4" (6mm) thru the throttle lever control.

Tiller Handle Adjustment

4- With the engine running and the shift lever in the **NEUTRAL** position, advance the throttle until the engine is operating at 2400 to 2700 rpm. When the engine is operating at this speed, the **START** position on the twist grip should align with the indicator arrow on the tiller handle. If the twist grip is not properly aligned as stated in the previous step, loosen the Allen screw at the bottom of the twist grip and align the twist grip. Tighten the Allen screw, and then check the adjustment by backing off the throttle to normal idle, and then advancing the throttle to the **START** position. The engine should be operating at 2400 to 2700 rpm. This procedure will eliminate any error caused by "play" in the throttle. An accurate adjustment at this time will ensure easy start of a cold engine. Disconnect the tachometer and remove the engine from the test tank.

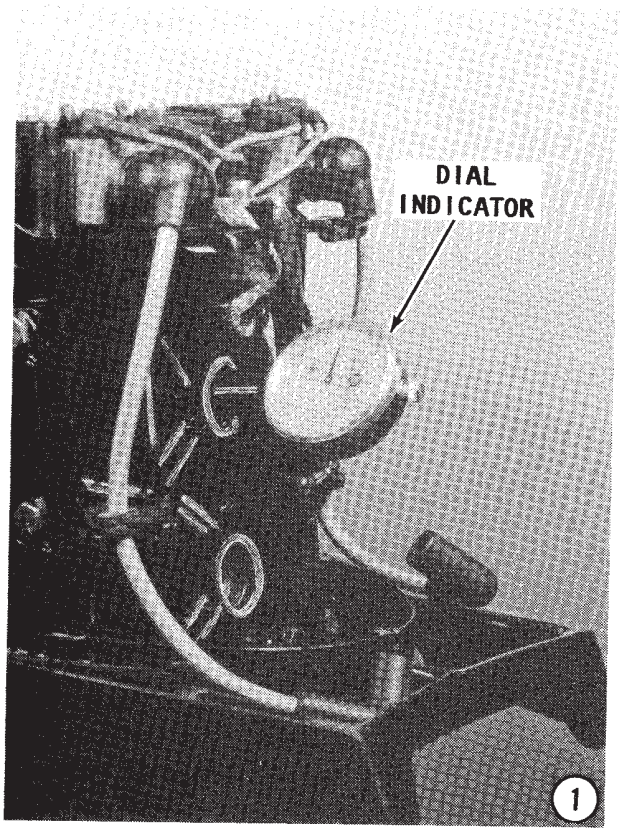




6-3 MODEL 200 1965 - 1966

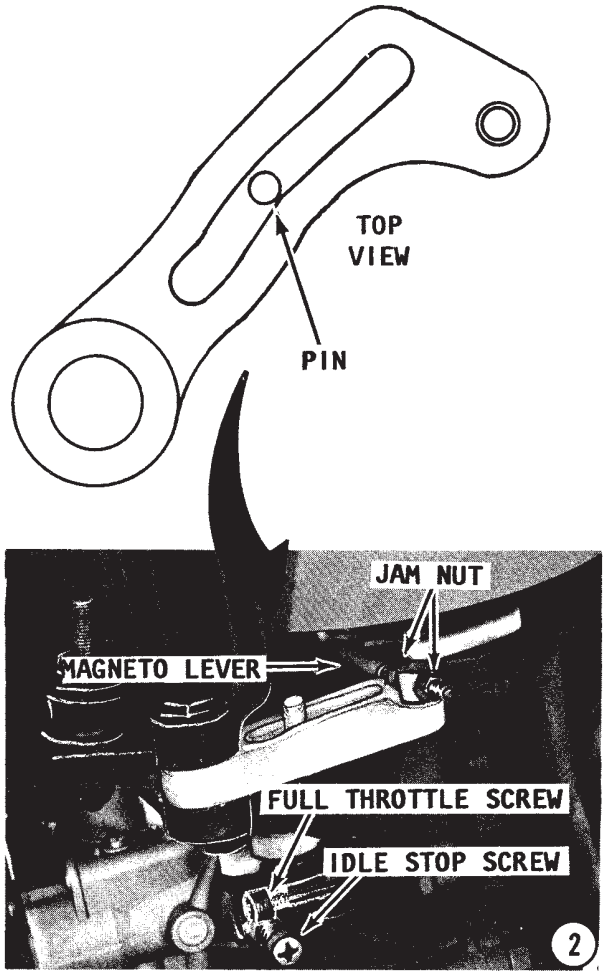
Maximum Advance Adjustment

1- Remove the engine cowling. Remove the No. 1 (top) spark plug and install a dial indicator in the opening. Rotate the flywheel **CLOCKWISE** until TDC of the piston stroke is reached. At that point, adjust the dial indicator to 0^{o}.



Connect one lead of an ohmmeter to the No. 1 (top) cylinder of the breaker points. Connect the other meter lead to a good ground on the engine. Rotate the flywheel **COUNTERCLOCKWISE** until the correct BTDC reading on the dial indicator is reached, according to the Specifications in the Appendix.

2- Shift the engine into **FORWARD** gear. Advance the throttle until the pin on the intermediate magneto lever is positioned as shown in the accompanying illustration. The breaker points should open at this time. If they fail to open, loosen the jam nut on the magneto lever and adjust the lever until the points just open. Tighten the jam nuts. Advance the magneto slowly until the points just open. Hold the magneto at this position and adjust the magneto advance stop screw until it just makes contact with the magneto stop. Tighten the jam nuts. Remove the dial indicator. Install the spark plugs.



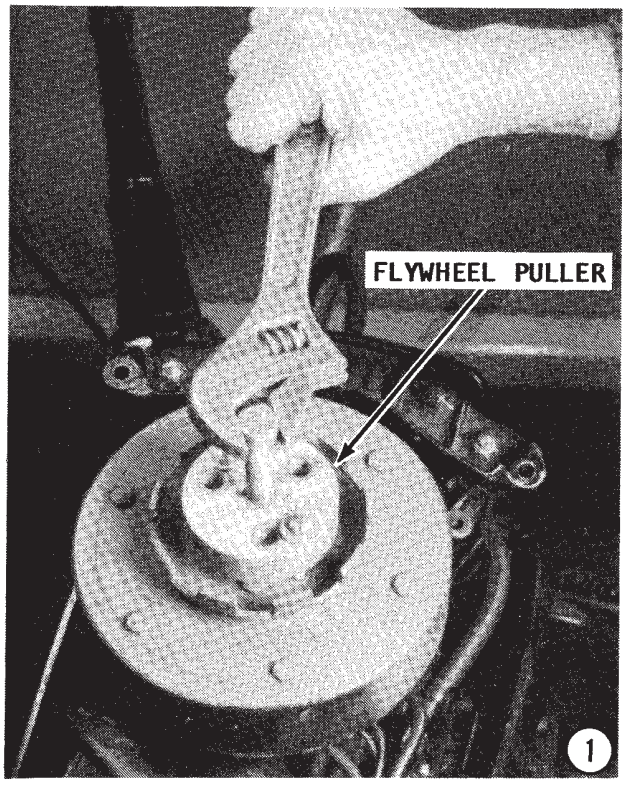
6-4 MODEL 350 1965 - 1969

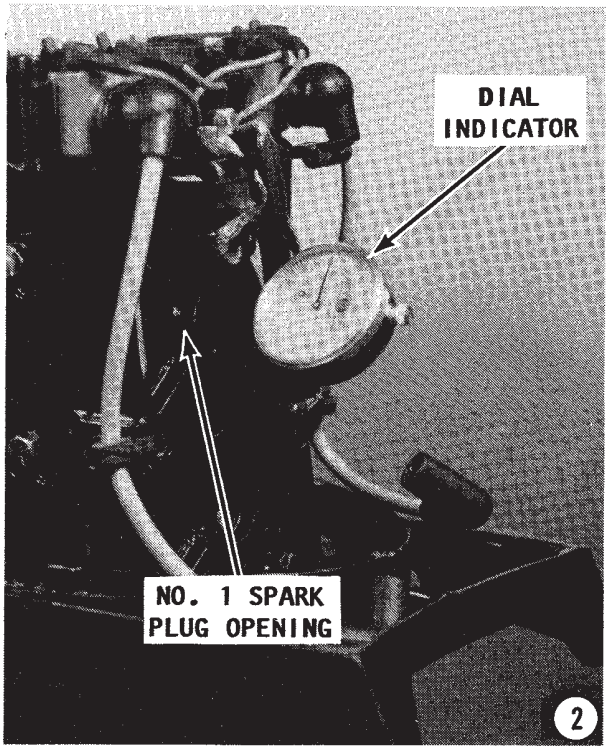
1- Remove the engine cowling or enough of the engine cover to expose the flywheel. The flywheel must be removed in order to adjust the maximum advance. Remove the nut securing the flywheel to the crankshaft. It may be necessary to use some type of flywheel strap to prevent the flywheel from turning as the nut is loosened.

Install the proper 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.

2- Shift the engine into **FORWARD** gear. Install the flywheel nut onto the bare crankshaft. Tighten the nut only until the crankshaft begins to rotate against the compression in the cylinders.

Remove all the spark plugs to relieve compression in the cylinders. Install a dial indicator into the No. 1 (top) spark plug opening. Connect one lead of an ohmmeter to the No. 1 (top) cylinder ignition point terminal. Connect the other meter lead to a good ground on the engine.

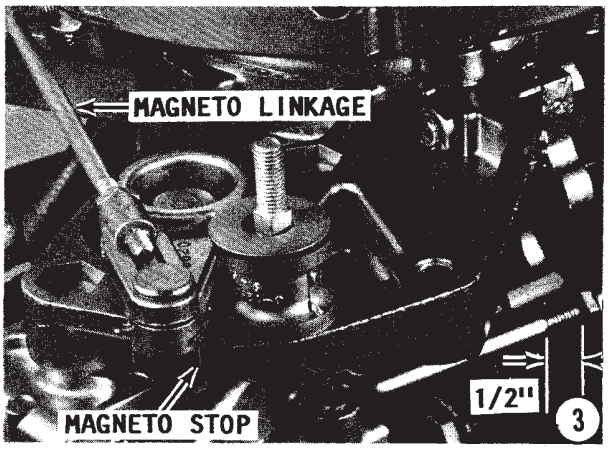


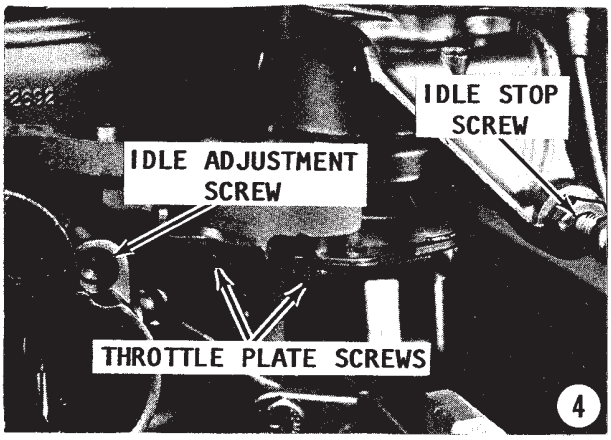


With a wrench on the flywheel nut, slowly rotate the crankshaft **CLOCKWISE** until the No. 1 piston is at TDC of the stroke. At this point adjust the dial indicator to 0^{o}.

With a wrench on the flywheel nut, slowly rotate the crankshaft **COUNTERCLOCKWISE** until the required setting BTDC, as determined from the Specifications in the Appendix, is obtained.

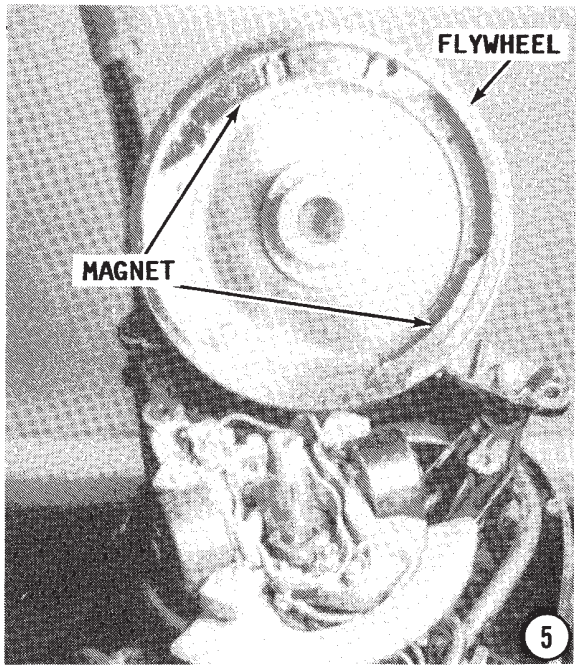
3- Now, slowly advance the magneto against the magneto stop. The breaker points should **OPEN,** as indicated by the ohmmeter. If the breaker points did not open or if they opened before the magneto contacted the stop, loosen the locknut and adjust the linkage until the points just open as the magneto contacts the stop. Tighten the locknut.

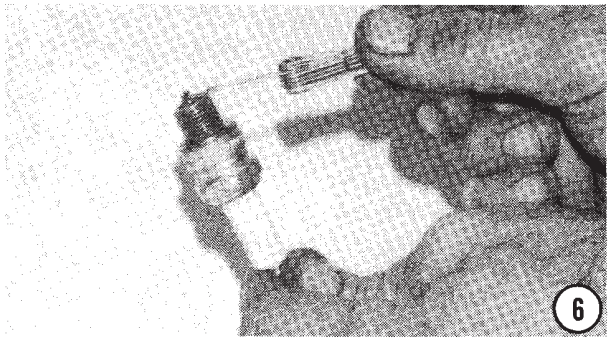




4- With the throttle still at full advance (the magneto just contacting the stop), loosen the two screws on the carburetor pickup plate and adjust the plate until the carburetor is at full throttle (the butterfly is wide open). Check for 0.010 - 0.015" (.25-.38mm) "play" in the carburetor shaft. This amount of "play" will prevent a strain on the linkage. **NEVER** bend the pickup with the nylon sleeve to make this adjustment. Linkage adjustment on the port side of the engine should not be necessary. However, if the setting has been disturbed, adjust the linkage until 1/2" (13mm) of threads remain exposed. Remove the dial indicator and install the spark plug.

5- Remove the flywheel nut from the crankshaft. This can be accomplished by placing the wrench on the nut and then striking the end of the wrench handle a





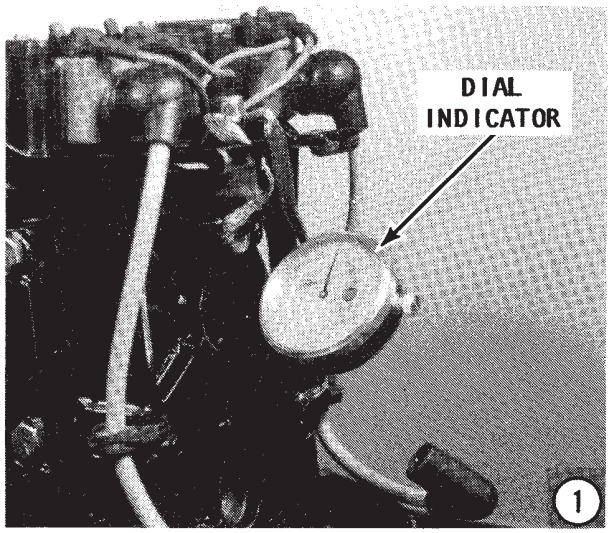
quick blow with the heel of your hand to jar it loose. Check to be sure there are no metal parts stuck to the magnets inside the flywheel. Place the key in the crankshaft keyway. Check to be sure the inside taper of the flywheel and the taper on the crankshaft is clean of dirt or oil, to prevent the flywheel from "walking" on the crankshaft during operation. Slide the flywheel on the crankshaft with the keyway in the flywheel aligned with the key. Thread the nut onto the flywheel and tighten it to the torque value given in the Specifications in the Appendix.

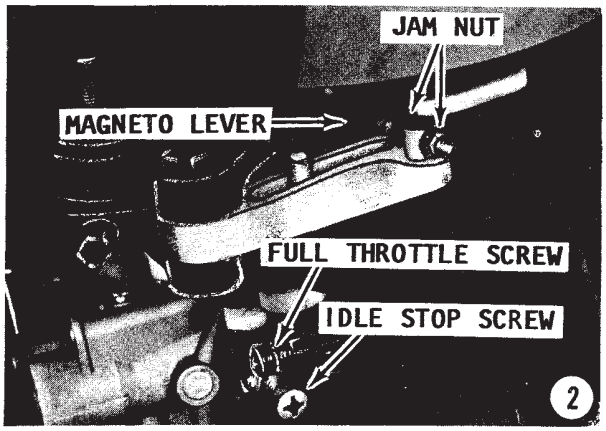
6- Check the gap on each spark plug according to the Specificatons in the Appendix. Install the spark plugs. Install the engine cowling.

6-5 MODEL 200 1967 - 1969

Maximum Advance Adjustment

1- Remove the engine cowling. Remove the No. 1 (top) spark plug and install a dial indicator in the opening. Rotate the flywheel **CLOCKWISE** until TDC of the piston stroke is reached. At that point, adjust the dial indicator to 0^{o}. Connect one lead





of an ohmmeter to the No. 1 (top) cylinder of the breaker points. Connect the other meter lead to a good ground on the engine.

Rotate the flywheel **COUNTERCLOCKWISE** until the correct BTDC reading on the dial indicator is reached, according to the Specifications in the Appendix.

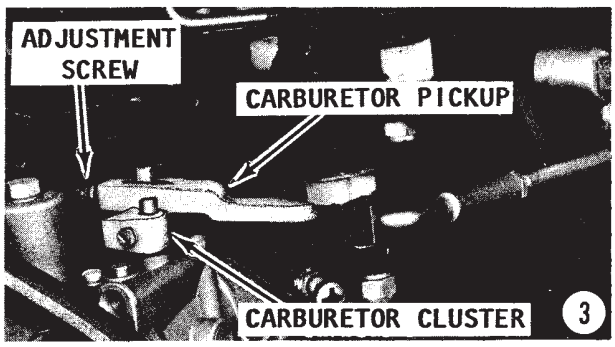
2- Back off the full throttle screw. Advance the throttle to the full advance position. Hold a slight pressure on the twist grip handle and at the same time, turn the full throttle screw inward until the points just begin to open, as evidenced by the ohmmeter.

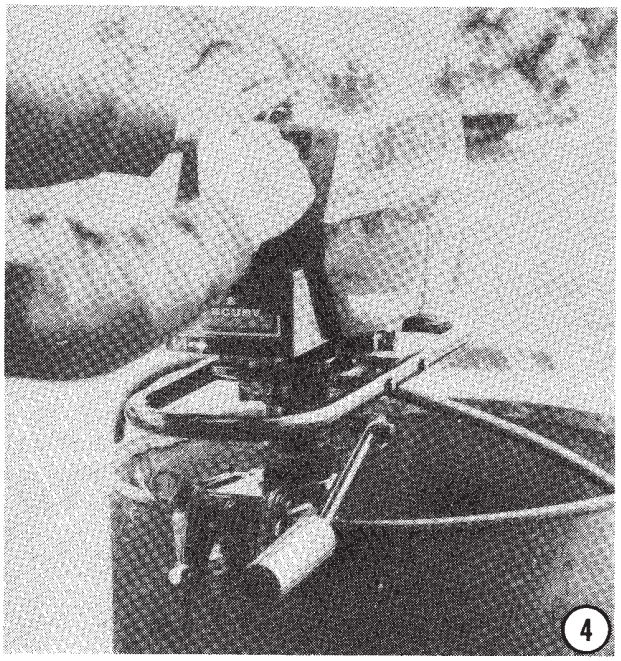
3- With the throttle at the full advance position, check the carburetor shutter. The shutter **MUST** be in the full open position. Check the clearance in the carburetor cluster. The clearance must be 0.005 -0.015" (.25-.38mm). Correct the clearance, as required, by turning the adjusting screw inward or outward. The proper clearance will prevent a strain on the linkage. Remove the dial indicator. Install the spark plugs.

Tiller Handle Adjustment

4- Mount the engine in a test tank. **NEVER** use a flush device for this test.

Remove the engine cowling and connect the fuel line to a fuel source. Install a tachometer to the engine.



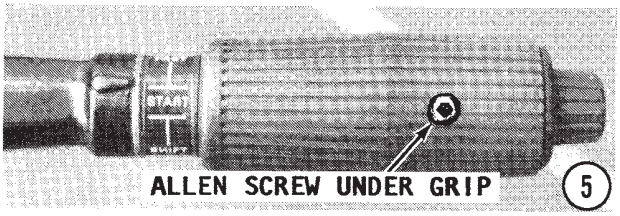


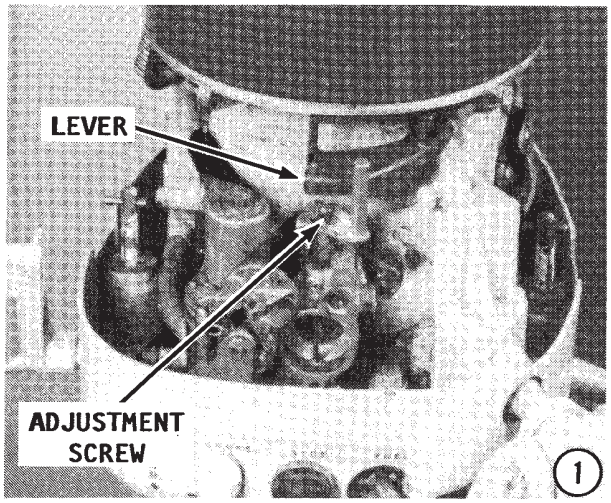
CAUTION: Water must circulate through the lower unit to the engine any time the engine is run to prevent damage to the water pump in the lower unit. Just five seconds without water will damage the water pump.

Start the engine and allow it to warm to operating temperature.

5- With the engine in **NEUTRAL,** rotate the twist grip throttle until the engine is operating at 2400 - 2700 rpm. At this engine speed, the word **START** on the twist grip should be aligned with the indicator arrow on the handle. If **START** and the arrow are not aligned, loosen the Allen screw at the bottom of the twist grip and align the word **START** with the arrow.

Tighten the Allen screw to hold the adjustment. Check the adjustment by backing off the throttle to idle speed and then advance it to **START.** Proper adjustment will assist in starting a cold engine and will eliminate any possible error caused by "play" in the linkage. Remove the tachometer. Remove the engine from the test tank.





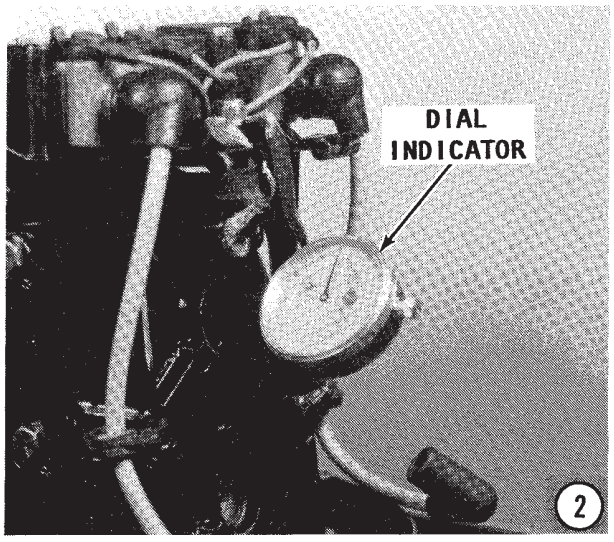
6-6 MODEL 40 1970

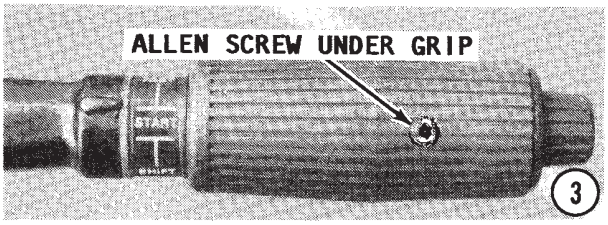
Maximum Advance Adjustment

1- Shift the engine into **FORWARD** gear. With the engine **NOT** running, advance the twist grip to obtain full throttle. No adjustment is possible at full throttle. However, check for 0.050" (1.3mm) clearance between the cam and the throttle lever. If an adjustment is required, loosen the screw on top of the carburetor and adjust the carburetor lever to obtain the 0.050" (1.3mm) clearance. Tighten the screw securely to hold the adjustment. Back-off the throttle to idle speed position.

Primary Pickup Synchronization

2- Remove all spark plugs to relieve compression in the cylinders. Install a dial indicator in the No. 1 (top) spark plug opening. Now, slowly rotate the flywheel clock-





wise and determine TDC for the No. 1 piston stroke. Once TDC is reached, reset the dial indicator to 0°.

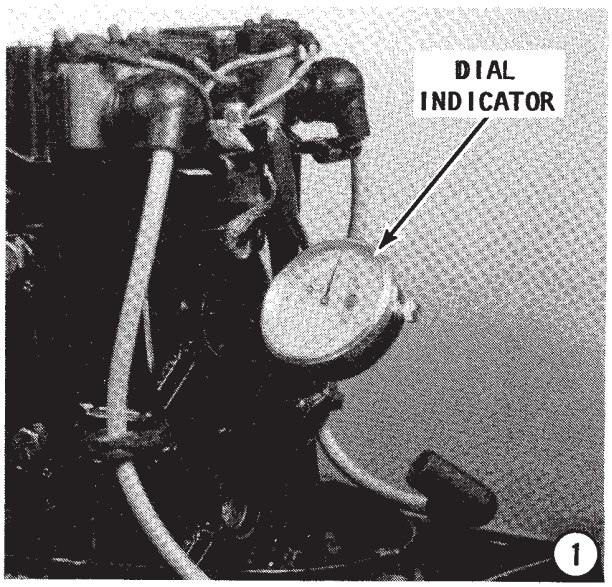
Connect one lead of an ohmmeter to the white contact lead of the point set for the No. 1 cylinder. Connect the other meter lead to a good ground on the engine. Slowly rotate the flywheel clockwise until 0.005" (.13mm) is reached on the dial indicator.

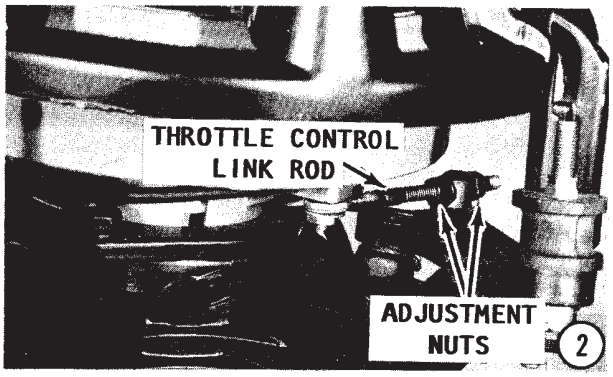
3- Rotate the twist grip to close the throttle until the ohmmeter indicates the ignition points just open. At this point, adjust the throttle lever, by loosening the screw on top of the carburetor and shifting the lever inward or outward, until the cam follower on the carburetor just makes contact with the armature plate cam. Tighten the screw securely to hold the adjustment. Remove the dial indicator. Install the spark plugs. Install the engine cowling and test the engine by operating it in a test tank.

6-7 MODEL 200 WITH MAGNETO IGNTION SYSTEM 1970 -- 1977

Maximum Advance Adjustment

1- Remove the engine cowling. Remove the No. 1 (top) spark plug and install a dial indicator in the opening. Rotate the flywheel **CLOCKWISE** until TDC of the piston





stroke is reached. At that point, adjust the dial indicator to 0°. Connect one lead of an ohmmeter to the No. 1 (top) cylinder of the maker points. Connect the other meter lead to a good ground on the engine.

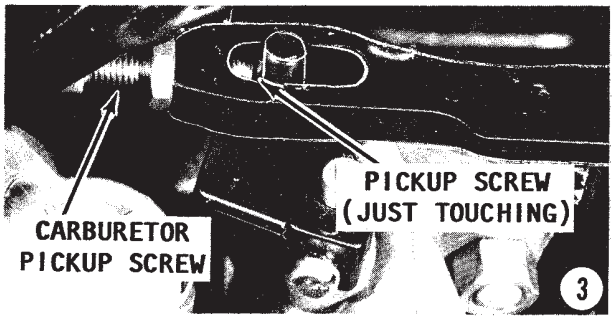
Rotate the flywheel **COUNTERCLOCKWISE** until the correct BTDC reading on the dial indicator is reached, according to the Specifications in the Appendix.

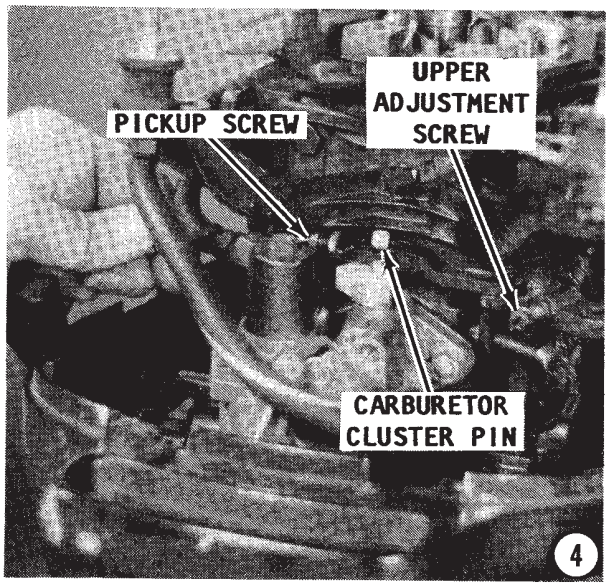
2- Adjust the two elastic stop nuts on the throttle control link until the ohmmeter indicates the points just **CLOSE** at BTDC. Refer to the Specifications in the Appendix for the exact setting.

Primary Pickup Synchronization

3- Rotate the flywheel **COUNTERCLOCKWISE** until the dial indicator reads 0.002 BTDC. Close the throttle with the twist grip until the ohmmeter indicates the points just **OPEN.** At this point adjust the carburetor pickup screw until it just makes contact with the cluster actuating rod on the carburetor.

4- Rotate the twist grip to the full throttle position. Now, adjust the upper screw in the vertical shaft while vibrating the carburetor cluster until there is 0.035-0.048" (.9-1.2mm) play between the pickup screw and the cluster actuating rod on the carburetor. Remove the ohmmeter and dial indicator. Install the No. 1 spark plug.





Maximum Advance Timing

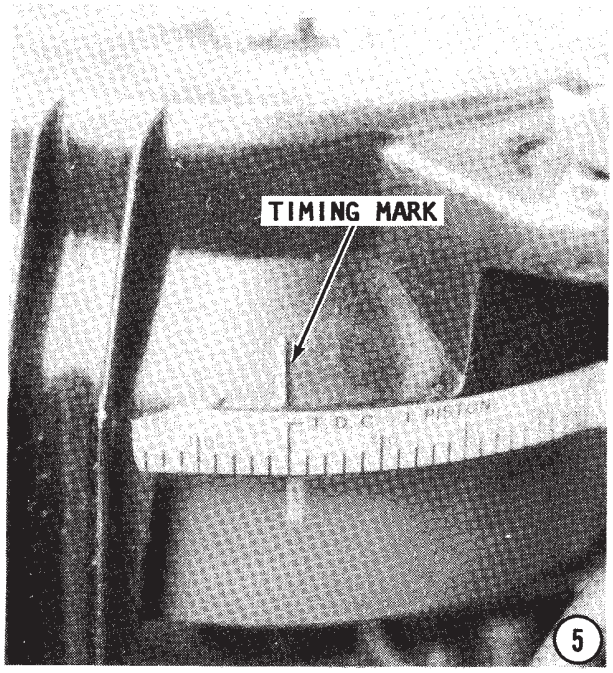
5- Mount the engine in a test tank. **NEVER** use a flush device for this test.

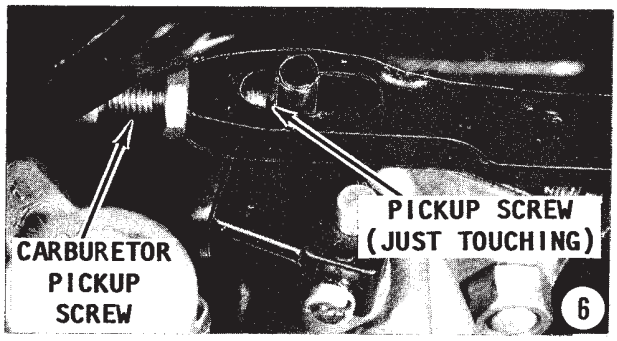
Connect the fuel line to a fuel source. Install a timing light to the No. 1 (top) spark plug.

CAUTION: Water must circulate through the lower unit to the engine any time the engine is run to prevent damage to the water pump in the lower unit. Just five seconds without water will damage the water pump.

Start the engine and allow it to warm to operating temperature.

Aim the timing light at the degree markings on the top of the cowling support frame. Rotate the twist grip throttle to the wide open position. Check the BTDC degree indication with the Specifications in the Appendix. If adjustment is required: Loosen the two elastic stop nuts on the throttle control link rod.





Primary Pickup Synchronizing Timing

6- Return the throttle to the idle position and check the timing against the Specifications in the Appendix. Adjust the carburetor pickup screws until the specifications are met. Shut down the engine, remove the timing light.

Tiller Handle Adjustment

7- Install a tachometer to the engine. Start the engine and allow it to warm to operating temperature. With the engine in **NEUTRAL,** rotate the twist grip throttle until the engine is operating at 2400 - 2700 rpm. At this engine speed, the word **START** on the twist grip should be aligned with the indicator arrow on the handle. If **START** and the arrow are not aligned, loosen the Allen screw at the bottom of the twist grip and align the word **START** with the arrow. Tighten the Allen screw to hold the adjustment. Check the adjustment by backing off the throttle to idle speed and then advance it to **START.** Proper adjustment will assist in starting a cold engine and will eliminate any possible error caused by "play" in the linkage. Remove the tachometer. Disconnect the fuel line. Remove the engine from the test tank.