E :rical current produced directly by the battery or A.C. generator will not jump the spark plug gap because the electrical pressure (voltage) is too low to overcome such resistance. Thousands of volts are required to make an electrical current jump the spark plug gap. This voltage requirement varies according to spark plug design, gap width, spark plug condition, and operating factors, but for dependable performance, the ignition coil should be capable of producing at least 15,000 volts.

Low voltage current, produced by the battery or A.C. generator, flows to the ignition coil at intervals determined by the contact points (or electronic switch) and is transformed by the ignition coil into high voltage current which jumps the spark plug gap.

Ignition systems in use on various motorcycles differ primarily in regard to the voltage source, battery or A.C. generator, which in turn affects the specific design of other ignition components. Other differences concern the method chosen for inducing high voltage and whether the system incorporates electronic circuitry.

As we have seen in preceding sections of this manual, motorcycle batteries produce a nominal 6 or 12 volts of *direct current,* while A.C. generators produce *alternating current.* A.C. generator voltage is determined by the number of windings, strength of magnetic field, and engine rpm (see page 8), though for ignition purposes, generator voltage is in a relatively low range and must be transformed into high voltage before it goes to the spark plug.

An A.C. generator that serves as the voltage source for ignition is commonly called a *magneto,* and ignition s ms are normally classified as being either "battery" or "magneto". In motorcycles without lighting equipment or batteries, the A.C. generator may function solely as a magneto. In other models one A.C. generator coil may be used for magneto functions, while another coil, or coils, within the same A.C. generator may provide lighting and battery charging current.

Magnetos can be classified as being "high tension", "low tension", or "energy transfer".

A *high tension magneto* (page 29) incorporates the function of an ignition coil within the magneto windings. High voltage is induced in the magneto secondary windings by a rapid *collapse* of the magnetic field surrounding the magneto primary windings. The high voltage so induced is sent directly to the spark plug. No separate ignition coil is used.

A *low tension magneto* (page 30) is essentially a high tension magneto without integral secondary windings. The contact points are connected in series with the primary windings of a separate ignition coil.

An *energy transfer* system (page 31) is similar to a low tension magneto system, except that the contact points are connected in parallel with the A.C. generator windings. High voltage is induced in the secondary windings of a separate ignition coil upon the rapid *build-up* of the magnetic field surrounding the ignition coil primary windings.

Some technical publications treat the energy transfer system as a separate category apart from battery or magneto systems. Some publications, including the one you are now reading, classify the energy transfer system as another kind of magneto, since it obviously isn't a battery system. Still other publications, including manuals by the U.S. Department of Transportation, do not use the term "energy transfer" at all, considering it to be merely a variant of the low tension magneto system. Different usage of the term "magneto" and different categorization of the term "energy transfer" create much confusion. It is unusual for any two technical publications to use these terms in the same way.

Honda motorcycles are equipped with either battery ignition systems or energy transfer systems. The high tension magneto system and the low tension magneto system are sometimes encountered on motorcycles of other manufacture, but not Honda. Therefore, if you hear or read the term "magneto" used in reference to Honda motorcycles, it necessarily refers to the energy transfer system. All types of ignition systems; battery, high tension magneto, low tension magneto, and energy transfer, may be encountered on Honda Power Products.

Battery Ignition:

The battery ignition system used in Honda motorcycles is illustrated in Fig. 44. This illustration is simplified to clearly show how the basic system functions. Actual connections and circuit paths for specific models may not conform exactly to Fig. 44 but are shown in shop manuals for the individual models.

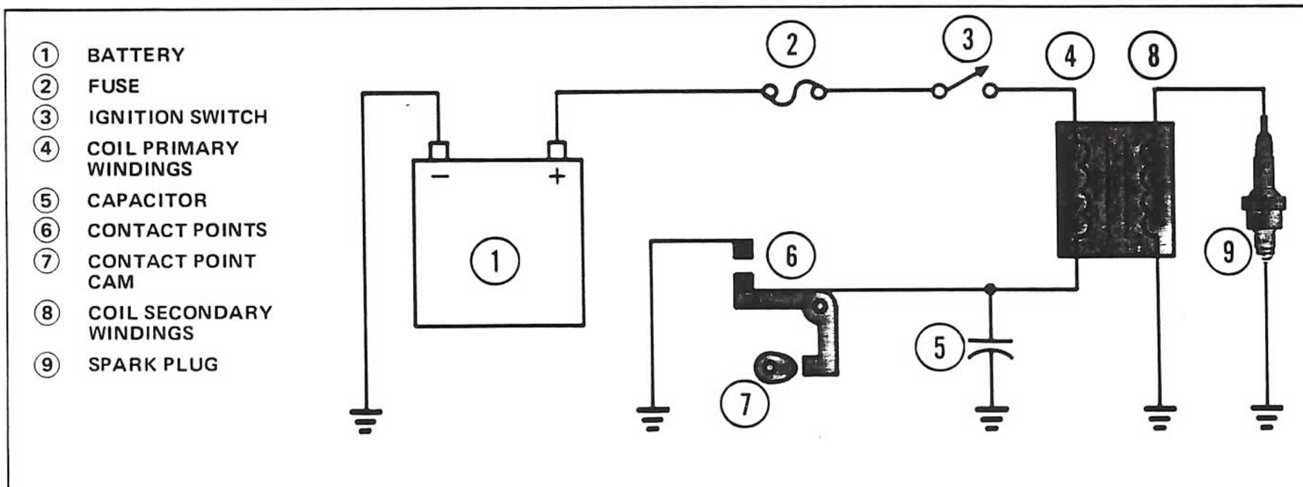


Fig. 44 Battery Ignition System

The *primary* ignition circuit starts at the battery ① and runs through fuse ② , ignition switch ③ coil primary windings ④ , contact points ⑥ , and to ground, completing the primary circuit. A capacitor ⑤ (also called a condenser) is connected at a point between the coil primary windings and the contact points. The other end of the capacitor is grounded.

The *secondary* ignition circuit starts in the ignition coil secondary windings ⑧ and runs through the spark plug ⑨ to ground, completing the secondary circuit.

The contact points ⑥ (page 27) are connected in series with the primary circuit. When the ignition switch ③ is turned on, the contact points open and close the primary circuit as the contact point cam ⑦ rotates. While the contact points are closed, current flows through the primary windings ④ of the ignition coil, establishing a magnetic field. When the contact points open, the circuit is broken, and the magnetic field rapidly collapses, inducing current in the secondary coil windings ⑧ (see Induction, page 8).

The induced secondary current jumps the spark plug gap, creating the spark to ignite the air-fuel mixture in the cylinder. Secondary voltage is far greater than voltage through the primary circuit because there is a far greater number of secondary coil windings than primary windings. One of the principles of induction, stated on page 8, is that the strength of induced voltage is partly determined by the number of windings which cut the magnetic field.

As the contact points open, the effect of the collapsing magnetic field in the ignition coil also creates some voltage surge in the primary circuit. The capacitor ⑤ (page 27) absorbs this voltage surge and thus helps to prevent the contact points from arcing as they separate.

The contact points must be prevented from arcing for two reasons. Firstly, arcing causes the contact points to become pitted and burnt, greatly reducing their service life. Secondly, arcing allows the primary current to continue to flow for an instant after the points start to open, thus decreasing the speed with which the coil's magnetic field collapses and decreasing the induced voltage in the secondary windings. The use of a capacitor allows the primary circuit to be broken with a minimum of arcing to extend contact point service life and hasten the collapse of the coil's magnetic field.

Incidentally, the ignition coil steps down amperage by the same ratio that it steps up voltage. High voltage (electrical pressure) is required to jump the spark plug gap, but amperage is of little consequence in this application. If you inadvertently touch an uninsulated spark plug terminal while the engine is running, the high voltage shock will make you flinch, but unless you have a heart condition, the amperage (current flow) is too low to really harm you.

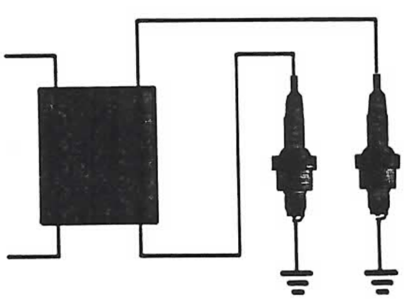


Fig. 45 Single Ignition Coil Firing Two Spark Plugs

There are several models of Honda motorcycle in which a single ignition coil is used to fire two spark plugs. This is achieved by connecting a spark plug to each end of the ignition coil's secondary windings, as shown in Fig. 45. In this hook-up, both spark plugs are wired in series with the secondary coil windings, and both plugs fire simultaneously.

Where two spark plugs are fired by a single coil, the plugs are used in cylinders whose firing order is 360° apart. Thus, one spark plug will fire while its cylinder is near the top of its compression stroke, and the other spark plug will fire simultaneously while its cylinder is near the top of its exhaust stroke. Spark plugs connected in this manner fire twice as often as necessary (no purpose is served by firing on the exhaust stroke), but this design greatly simplifies the ignition system, eliminating the need for a distributor, or for additional sets of contact points, capacitors, and coils for each cylinder.

High Tension Magneto Ignition:

The high tension magneto system does not use a separate ignition coil. High voltage is induced in the magneto secondary windings by the collapsing magnetic field that surrounds the magneto primary windings.

All magneto systems operate without a battery, or independent of the battery if one is provided for other electrical functions.

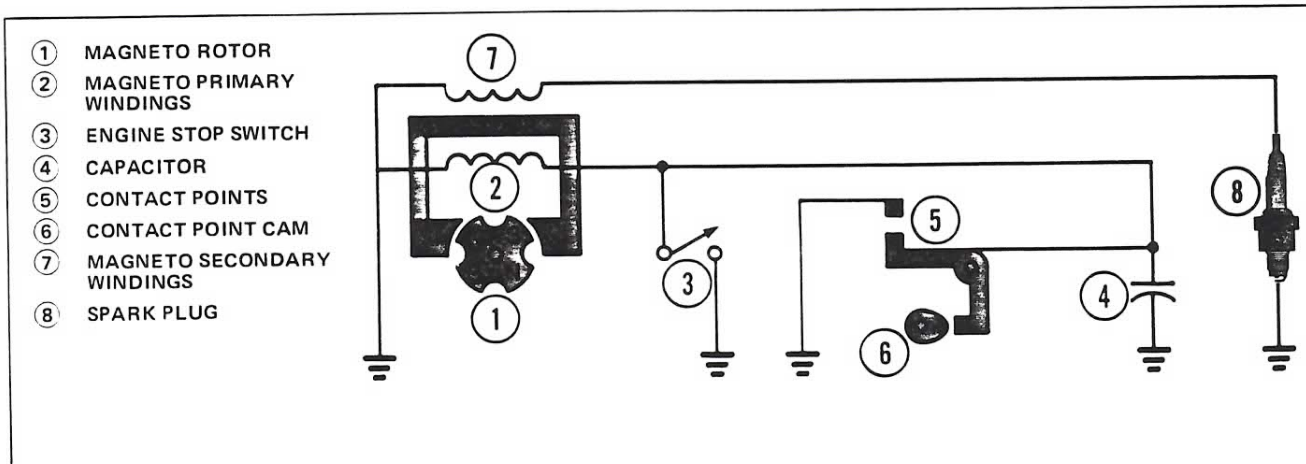


Fig. 46 High Tension Magneto Ignition System

Between firing impulses, the contact points ⑤ remain closed, completing the primary circuit. As the magneto rotor ① spins, alternating current is induced in the magneto primary windings ② , the same as in any A.C. generator (see A.C. Generator Operation, page 8). Magnetic lines of force are built up, collapsed, and then built up again in the opposite direction.

As the magnetic field in the primary circuit collapses, current is induced in the magneto secondary windings. However, if the primary circuit were operated as a simple A.C. generator, the collapse would not be sufficiently rapid to induce usable ignition voltage, so the contact point cam ⑥ is timed to open the contact points ⑤ just as the magnetic field collapses. Opening the contact points breaks the primary circuit, hastening the collapse of the magnetic field. *Rapid* collapse of the magnetic field induces high voltage in the magneto secondary windings ⑦ which flows through the spark plug ⑧ . The capacitor ④ protects the contact points and helps to hasten the collapse of the magnetic field, as in other ignition systems.

When the engine stop switch ③ is closed, the contact points have no effect. The primary circuit remains unbroken, and the magnetic field will not collapse rapidly enough to induce ignition voltage.

w Tension Magneto Ignition:

The low tension magneto system uses a separate ignition coil to induce high voltage. Operation is otherwise similar to the high tension magneto system described on page 29. Note that the contact points in both high and low tension magneto systems are connected in series with the primary circuit, as opposed to the energy transfer system (page 31) in which the contact points are connected in parallel with the primary circuit.

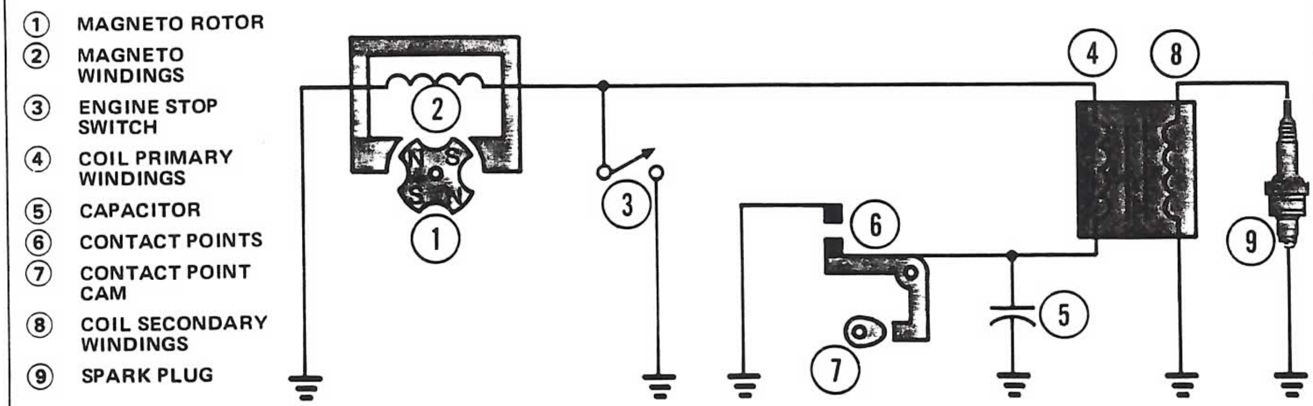


Fig. 47 Low Tension Magneto Ignition System

The contact points ⑥ close to complete the primary circuit. The magneto rotor ① spins, inducing current in the magneto windings ② which flows through the ignition coil primary windings ④ , establishing a magnetic field in the ignition coil.

Because the magneto is an A.C. generator, current flow will reverse direction as the rotor ① spins. Reversal of current flow collapses the magnetic field in the ignition coil, but does not collapse it rapidly enough to induce usable ignition voltage. The contact point cam ⑦ is synchronized with the magneto rotor ① to open the contact points ⑥ at this time, breaking the primary circuit and hastening the collapse of the magnetic field in the ignition coil. *Rapid* collapse of the magnetic field induces high voltage in the coil secondary windings ⑧ which flows through the spark plug ⑨ . The capacitor ⑤ protects the contact points and helps to hasten the collapse of the magnetic field.

The engine stop switch ③ can be closed to short circuit the magneto, stopping the engine.

Energy Transfer Ignition:

Operation of the energy transfer system differs from the low tension magneto system by having contact points connected in parallel with the primary circuit and contact point timing which results in secondary voltage being induced by the rapid *build-up* of a magnetic field. Note that battery ignition systems, high tension magneto ignition systems, and low tension magneto systems all induce secondary voltage by the rapid *collapse* of a magnetic field, while the energy transfer system induces secondary voltage by the rapid *build-up* of a magnetic field.

The term "energy transfer" is a misnomer for the circuit shown in Fig. 48. However, application of the term to this circuit is justified by common use and serves to distinguish this circuit from other magneto ignition circuits.

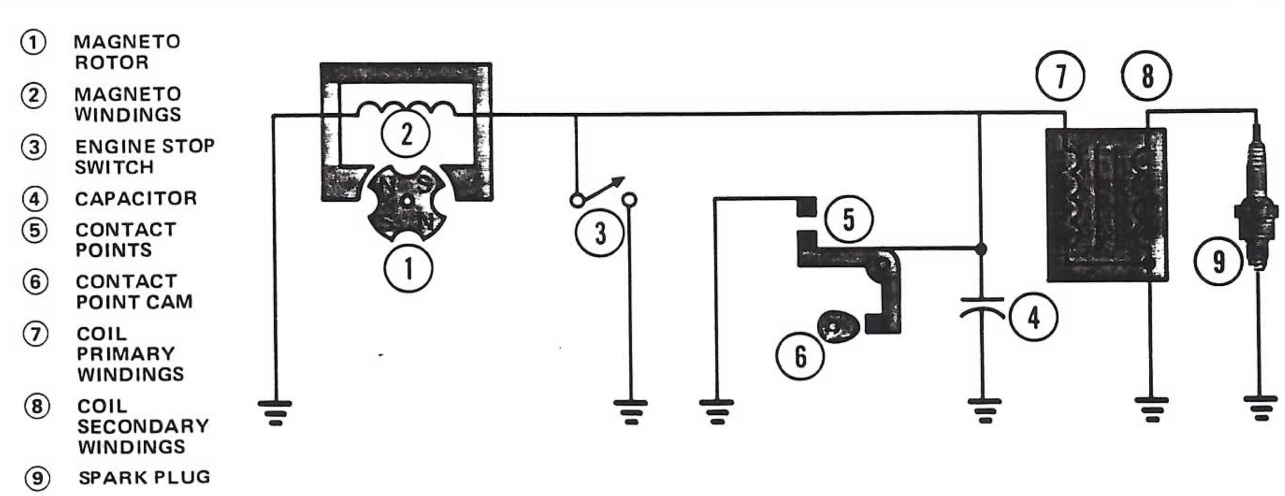


Fig. 48 Energy Transfer Ignition System

Primary voltage is supplied by the magneto or A.C. generator (whichever term you prefer). Between firing impulses, the contact points (5) remain closed, short circuiting all current produced by the magneto. Thus, no current energizes the ignition coil primary windings (7) . The same effect can be obtained manually by closing the engine stop switch (3) .

The contact point cam (6) is synchronized with the magneto rotor (1) to open the contact points (5) when the magneto's output wave (see Fig. 23, page 10) is at or near its peak. When magneto output reaches its peak and the contact points (5) open, a surge of current flows through the ignition coil primary windings (7) , causing rapid *build-up* of a magnetic field which induces high voltage in the ignition coil secondary windings (8) . The high voltage so induced then flows through the spark plug (9) . The capacitor (4) protects the contact points and enables them to break the circuit quickly with a minimum of arcing.

Capacitor Discharge Ignition (CDI):

A capacitor has the ability to temporarily store and quickly discharge electrical energy. Any ignition system which discharges a capacitor into the primary windings of the ignition coil for the purpose of inducing secondary voltage is, by definition, *capacitor discharge ignition.* Capacitor discharge ignition comes in many forms and may be incorporated in either battery or magneto systems.

Some systems use a battery as the primary voltage source, but send battery voltage through a converter before it reaches the capacitor, the idea being to produce higher voltage than would otherwise be possible. Some systems use a magneto as the primary voltage source to charge the capacitor, and the capacitor discharges whatever magneto voltage it received.

In any case, capacitor discharge ignition customarily uses an electronic switch to trigger the capacitor instead of contact points. Tune-ups are greatly simplified when there are no contact points to adjust or replace. Fig. 49 is a simplified illustration of the capacitor discharge ignition system used on the Honda CR-125M.

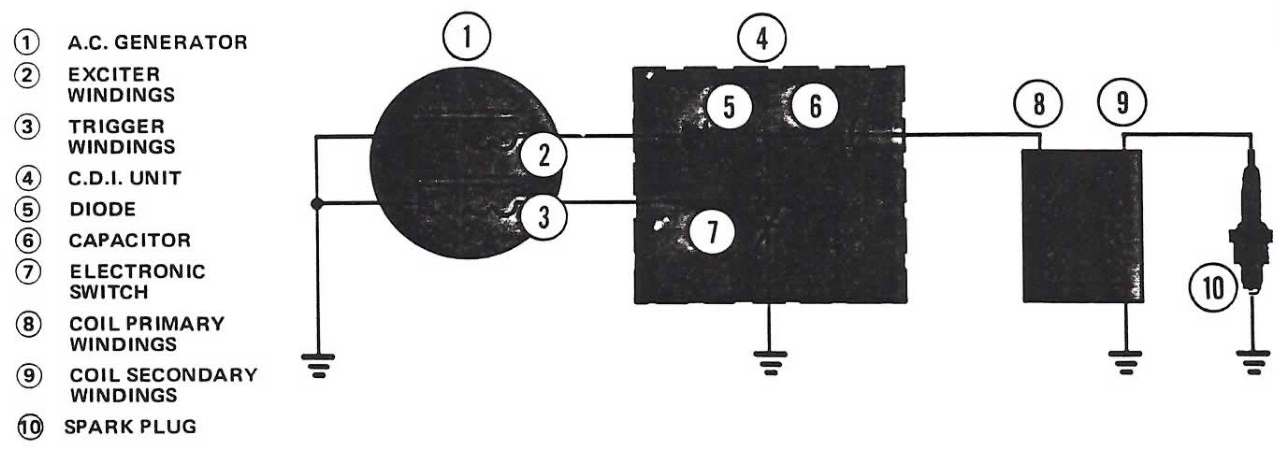


Fig. 49 Capacitor Discharge Ignition System (Honda CR-125M)

Exciter windings (2) in the generator (1) produce alternating current. The positive half of the A.C. wave (see Alternating Current Wave Form, page 10, Fig. 23) passes through the diode (5) in the C.D.I. unit (4) to charge the capacitor (6) . Because the diode allows current to pass in only one direction, the capacitor is prevented from discharging through the magneto during the negative half of the magneto's A.C. wave.

Alternating current induced in the trigger windings (3) of the generator (1) are used to open and close the electronic switch (7) in the C.D.I. unit (4) (the electronic switch circuit is considerably more complicated than is shown in Fig. 49).

The electronic switch (7) (page 32) is opened while the magneto charges the capacitor. When the electronic switch closes, this completes a circuit, grounding one end of the capacitor through the switch, while the other end is grounded through the ignition coil primary windings (8) . The capacitor then discharges through the ignition coil primary windings, causing the rapid build-up of a magnetic field which induces high voltage in the ignition coil secondary windings (9) . High voltage induced in the secondary windings flows through the spark plug (10)

Ignition Advance:

The ignition spark must be timed to ignite the air-fuel mixture in the cylinder as the piston nears the end of its compression stroke. Timing must be precise in order to obtain maximum power and fuel economy. Optimum ignition timing is determined mainly by such factors as engine rpm, fuel quality, air-fuel mixture ratio, and combustion chamber design. Engine speed determines the time available to complete combustion in relation to piston position. Fuel quality, air-fuel mixture ratio, and combustion chamber design affect the speed with which combustion can occur.

Combustion in the engine cylinder is not instantaneous. Ignition must occur before the end of the compression stroke in order for combustion to be completed in time to drive the piston downward on the power stroke.

At idling speed, ignition can be timed to occur quite late in the compression stroke, because there is ample time for combustion to be completed as the piston starts its power stroke. At high speeds, ignition must occur earlier during the compression stroke.

If ignition occurs too early during the compression stroke, combustion will be completed before the piston reaches its top dead center position. The piston is then forced to move upward against extremely high pressure. If flywheel momentum cannot overcome the pressure against the piston, the engine will stall, or kick backward when being started. Excessive ignition advance will result in overheating and loss of power. The air-fuel mixture may also detonate with an audible knock. The piston may become damaged by overheating and detonation.

If ignition occurs too late, combustion will not be completed until the piston has travelled downward on its power stroke. This reduces the pressure which propels the piston and power is lost.

If ignition is retarded still farther, combustion may not be completed at the start of the exhaust stroke, and the air-fuel mixture will be discharged into the exhaust port while still burning intensely. This will cause overheating, and in four-stroke engines may burn the exhaust valve.

Most motorcycles are equipped with a device which automatically advances ignition timing as engine rpm increases. An automatic ignition advance (Fig. 50 & 51) is used on Honda motorcycles equipped with battery ignition systems and on some Honda models equipped with energy transfer systems.

Some motorcycles, especially mini-bikes and dirt bikes using the energy transfer system, have fixed ignition timing; no automatic advance mechanism is provided. These motorcycles have their ignition timing set permanently in an advanced position, so that timing will be most nearly correct when the engine is running at medium or high speeds.

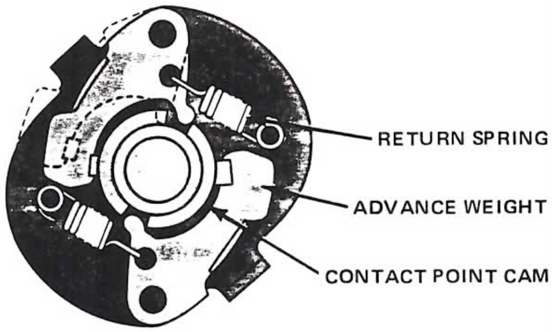


Fig. 50 Ignition Advance Unit

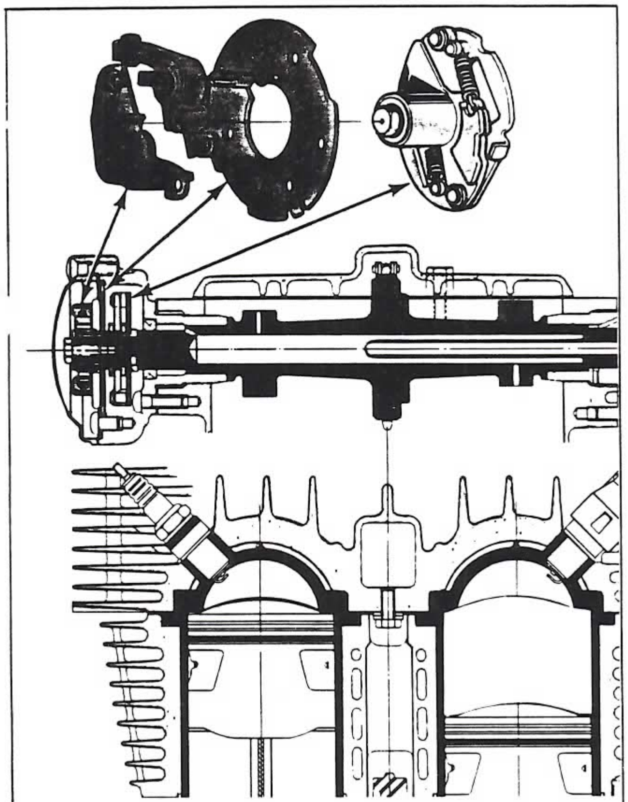


Fig. 51 Engine Cross Section (Honda CB-450) Showing Ignition Advance Unit Installed

Centrifugal Ignition Advance Operation:

The centrifugal ignition advance unit (Fig. 50) rotates with the contact point cam and is driven by the engine camshaft or crankshaft. Fig. 51 shows an ignition advance unit installed on the end of the camshaft. Centrifugally controlled weights in the advance unit regulate the position of the contact point cam relative to the camshaft and crankshaft.

At idle speed, the weights are held inward by spring tension, and the cam is positioned to open the contact points near the end of the compression stroke (usually 5° to 15° before top dead center, depending on model design). At idle speed, there is ample time for combustion to be well underway before the piston moves down on its power stroke, and a minimal advance promotes smooth idling and prevents kick-back during starting.

As engine speed increases, the advance weights fly outward by centrifugal force, rotating the contact point cam ahead. In the advanced position, the cam opens the contact points earlier during the compression stroke (usually 25° to 45° before top dead center, depending on model design).

Capacitor discharge ignition systems do not have contact points and therefore cannot use a mechanical advance unit. Electronic ignition advance can be provided by taking advantage of the fact that increased rpm induces greater voltage in the trigger windings, which in turn controls the electronic switch that discharge the capacitor.

Dwell Angle and Contact Point Gap Adjustment:

Dwell angle (4) is the distance (measured in degrees or in percent of one full revolution) which the contact point cam (3) rotates while the contact points (1) are closed. Increasing dwell angle causes the contact points to be closed for a longer duration and open for a shorter duration. Decreasing dwell angle has the opposite result. For every ignition system design, there is a specific dwell angle range in which the system operates most effectively.

(1) CONTACT POINTS
(2) CONTACT POINT GAP
(3) CONTACT POINT CAM
(4) CAM ROTATION WHILE CONTACT POINTS ARE CLOSED (DWELL ANGLE)
(5) POSITION OF CAM LOBE APEX WHEN CONTACT POINTS START TO OPEN
(6) CAM ROTATION WHILE CONTACT POINTS ARE OPEN
(7) POSITION OF CAM LOBE APEX WHEN CONTACT POINTS FULLY CLOSE

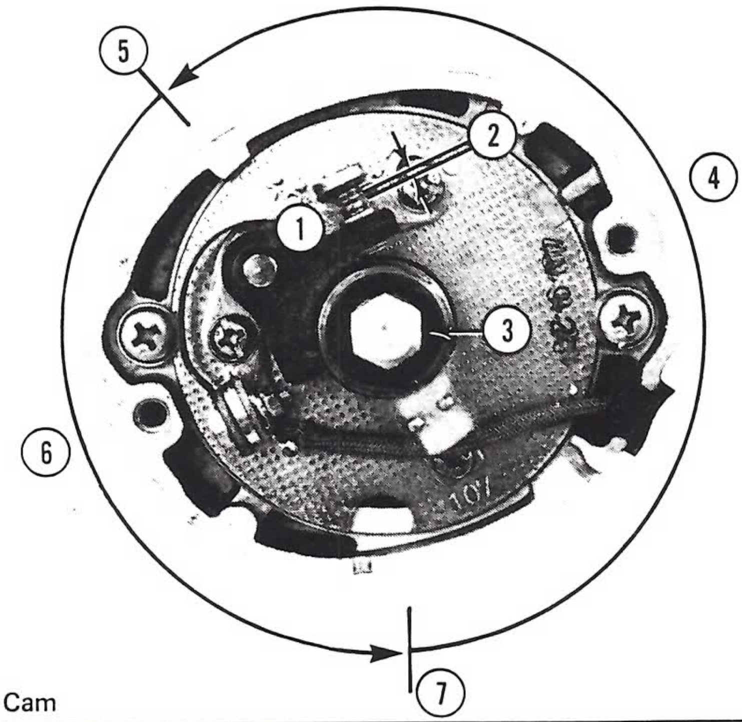


Fig. 52 Contact Points and Single Lobed Cam

Contact point gap adjustment controls dwell angle. Increasing contact point gap (2) (measured with contact points in the fully opened position) decreases dwell angle. Decreasing the gap increases dwell angle.

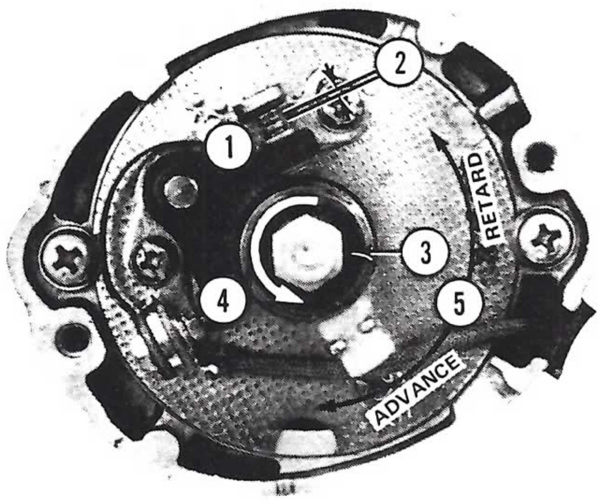
If possible, adjust contact point gap using a dwell meter. If you do not have a dwell meter, or if no dwell specification is available, then adjust contact point gap using a wire clearance gauge.

A wire gauge will measure contact point gap more accurately than a flat gauge, if the contact point surfaces have any irregularities due to wear or pitting. Slight wear, corrosion, or pitting can be corrected by dressing the contact points with a contact point file. Badly worn or pitted contact points should be replaced. Severe pitting indicates a faulty capacitor (condenser) which should also be replaced. While servicing the contact points, also lubricate the contact point cam with a thin film of grease.

The recommended contact point gap for Honda motorcycles is 0.3 - 0.4mm (0.012 - 0.016 in.), measured with contact points in the fully opened position. If the contact points are in good condition, this clearance will usually produce an acceptable dwell angle.

..ition Timing Adjustment:

Ignition timing can be adjusted by widening or narrowing the contact point gap (2), or by repositioning the contact points (1) relative to the contact point cam (3). With Honda motorcycles using capacitor discharge ignition, timing is adjusted by repositioning the magneto stator relative to the rotor.



(1) CONTACT POINTS
(2) CONTACT POINT GAP
(3) CONTACT POINT CAM
(4) CONTACT POINT RUBBING BLOCK
(5) CONTACT POINT BASE PLATE

Fig. 53 Ignition Advance Adjustment

When the contact point gap (2) is widened, the cam lobe (3) contacts the rubbing block (4) earlier in its rotation (timing is advanced), and the cam lobe stays in contact with the rubbing block longer (dwell angle is decreased). Conversely, narrowing the contact point gap retards timing and increases dwell angle.

When the contact point base plate (5) is moved in the *opposite direction* of contact point cam rotation, the cam lobe (3) contacts the rubbing block (4) earlier in its rotation, and timing is advanced. Conversely, moving the contact point base plate in the *same direction* as contact point cam rotation will retard timing.

Ignition timing adjustment for some motorcycle models is accomplished solely by varying the contact point gap. For some models, adjustment is accomplished solely by moving the contact point base plate. Some other models require a combination of both procedures to adjust ignition timing.

When altering the ignition point gap for the purpose of adjusting ignition timing, do not exceed the recommended dwell angle range. If you measure contact point gap instead of dwell angle, then do not set the gap narrower than 0.3mm (0.012 in.) or wider than 0.4mm (0.016 in.). If correct ignition timing cannot be achieved within the specified dwell angle or gap range, then replace the contact points.

For greatest accuracy, use a stroboscopic timing light, so you can adjust ignition timing with the engine running (Fig. 54). On models equipped with automatic ignition advance, a stroboscopic timing light is essential for checking full advance timing.

If you do not have a stroboscopic timing light, it will be necessary to check ignition timing with the engine stopped, using a continuity light or similar device. This method is called *static timing.*

If the motorcycle has a *battery ignition system,* a simple continuity light can be connected in parallel with the contact points to check static timing. (Fig. 55). With the ignition switch and engine switch on, turn the crankshaft slowly, and the bulb will light when the contact points *open.* A continuity light can be easily constructed, using a 6 or 12 volt (depending on the motorcycle's battery voltage), 3 watt bulb or one of the bulbs from the motorcycle's instrument lights.

If the motorcycle has an *energy transfer system,* the simple continuity light shown in Fig. 55 will not work, no matter whether the motorcycle is battery equipped or not. For static timing with an energy transfer system, it is necessary to disconnect the contact point lead from the motorcycle's electrical system and connect a self-powered continuity light in series with the contact points (Fig. 56). With this hook-up, the bulb will light when the contact points *close.* A self-powered continuity light can also be used to check *battery ignition system* timing, if the contact point leads are disconnected.

Some mechanics prefer to use a buzzer rather than a light. Self-powered "buzz boxes" are commercially available for this purpose. As an inexpensive alternative, a child's toy telegraph set can be hooked-up to light, buzz, or click when the contact points close. A VOM or ohmmeter can also be used to determine when the contact points open and close.

① STROBOSCOPIC TIMING LIGHT

② DWELL METER

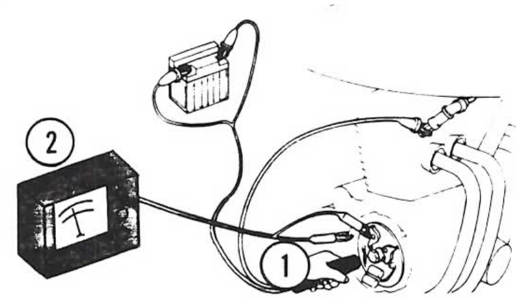


Fig. 54 Checking Ignition Timing and Dwell Angle, Using a Stroboscopic Timing Light and Dwell Meter with Engine Running

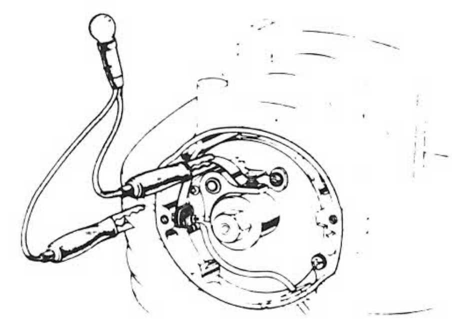


Fig. 55 Checking Static Ignition Timing with a Simple Continuity Light (for battery ignition systems only)

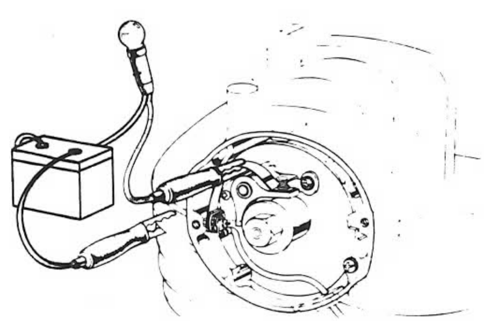


Fig. 56 Checking Static Ignition Timing with a Self-Powered Continuity Light

ıition Timing Marks:

Honda single cylinder and twin cylinder models have timing marks stamped on the generator rotor (see Fig. 57, 59, 61 on following pages). Honda four cylinder air-cooled models have timing marks on the ignition advance assembly (see Fig. 63, page 41). The Honda GL-1000 has timing marks on the edge of the flywheel (see Fig. 65, page 42).

Timing marks are lettered "T" for *top* dead center piston position and "F" for ignition *firing* position at idle speed. The "F" mark is also used to indicate the static timing position. All Honda motorcycle engines equipped with automatic ignition advance have additional marks which indicate ignition full advance position (see Fig. 57, 59, 61, 63, 65 on following pages).

Twin cylinder engines with 180° crankshafts (e.g. CB-360T, CB-500T) have two sets of timing marks. Timing marks for the right cylinder (as viewed from the rider's position) are designated "T" and "F", while timing marks for the left cylinder are designated "LT" and "LF".

Four cylinder air-cooled engines have two sets of timing marks, "T, F, 1•4" and "T, F, 2•3", which are referenced to cylinder numbers and contact point assemblies. The GL-1000 has two sets of timing marks, "1-T-F" and "2-T-F", which are referenced to contact point assemblies only and not to cylinder numbers.

Procedure for Adjusting Contact Point Gap and Ignition Timing on Honda Single Cylinder Engines Without Adjustable Contact Point Base Plate:

① CONTACT POINT LOCKING SCREW
② TIMING INDEX MARK
③ "F" MARK
④ FULL ADVANCE MARKS

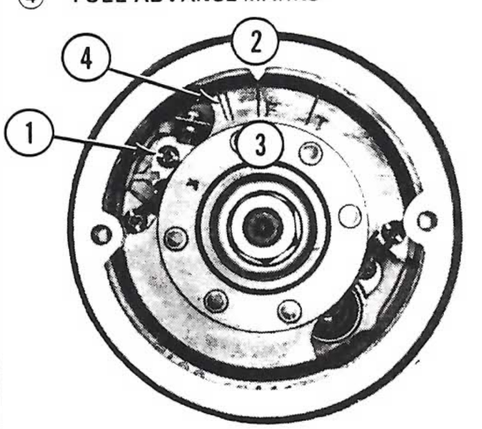


Fig. 57 Contact Points and Ignition Timing Marks — Honda Single Cylinder Engine Without Adjustable Base Plate

1. Check ignition timing. If adjustment is required, loosen contact point locking screw ① (Fig. 57). Adjust contact point gap to achieve correct timing. Retighten locking screw. Recheck timing after locking screw is tightened.

Idle or static timing is correct if contact points open when index mark ② aligns with rotor "F" mark ③ . Most Honda models without an adjustable base plate also have no automatic ignition advance mechanism, and the "F" mark is used for timing at any rpm. If the motorcycle *does* have an automatic ignition advance mechanism, high rpm timing is correct if contact points open when index mark ② is between full advance marks ④ .

NOTE: Full advance timing is more important to performance than idle timing. If the motorcycle is equipped with an automatic ignition advance, adjust contact point gap to achieve correct full advance timing for best results. If correct full advance timing causes idle timing to be substantially incorrect, then replace the ignition advance mechanism.

2. Check dwell angle or contact point gap (see page 35). If dwell angle is not within limits specified in the shop manual, or if contact point gap is not within a range or 0.3 - 0.4mm (0.012 - 0.016 in.), then replace the contact points and repeat step one.

Procedure for Adjusting Contact Point Gap and Ignition Timing on Honda Single and Twin Cylinder Engines Having One Set of Contact Points and an Adjustable Contact Point Base Plate:

1. Check dwell angle or contact point gap. If adjustment is required, loosen contact point locking screws (1) (Fig. 58). Adjust contact point gap to achieve the dwell angle specified in the shop manual, or adjust gap to 0.3 - 0.4mm (0.012 - 0.016 in.). Tighten locking screws. Recheck dwell angle or gap after locking screws are tightened.

2. Check ignition timing. If adjustment is required, loosen base plate locking screws (2). Rotate base plate to achieve correct ignition timing. Tighten locking screws. Recheck dwell angle or gap, and timing, after locking screws are tightened.

   Idle or static timing is correct if contact points open when index mark (3) (Fig. 59) aligns with rotor "F" mark (4). High rpm timing is correct if contact points open when index mark (3) is between full advance marks (5).

(1) CONTACT POINT LOCKING SCREWS
(2) BASE PLATE LOCKING SCREWS

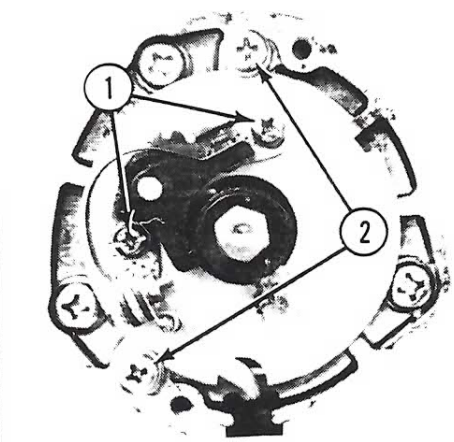


Fig. 58 Contact Point Assembly — Honda Single Cylinder Engine With Adjustable Base Plate

(3) TIMING INDEX MARK
(4) "F" MARK
(5) FULL ADVANCE MARKS

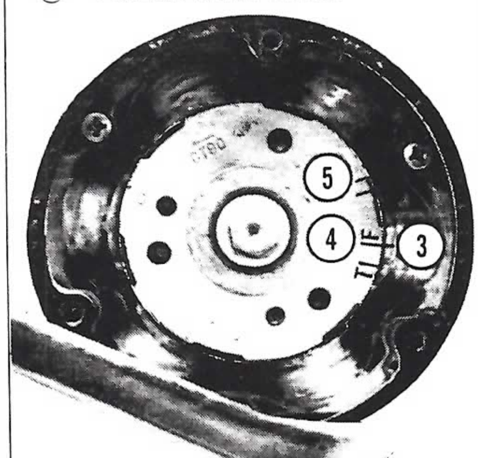


Fig. 59 Ignition Timing Marks (Honda CT-90 shown here)

Procedure for Adjusting Contact Point Gap and Ignition Timing on Honda Twin Cylinder Engines Having Two Sets of Contact Points:

(1) CONTACT POINT LOCKING SCREWS
(2) BASE PLATE LOCKING SCREWS

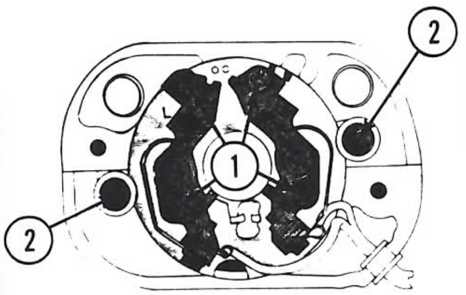


Fig. 60 Contact Point Assembly — Honda Twin Cylinder Engine Having Two Sets of Contact Points

(3) TIMING INDEX MARK
(4) "LF" MARK
(5) "F" MARK
(6) FULL ADVANCE MARKS

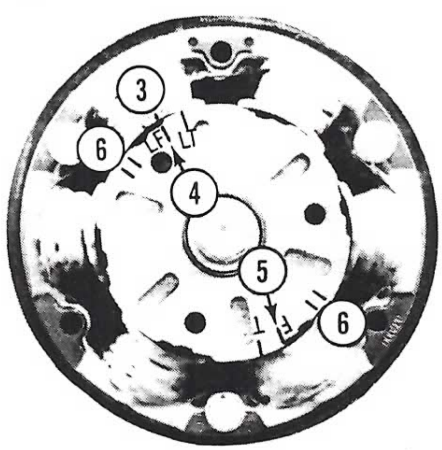


Fig. 61 Ignition Timing Marks (Honda CB-360T shown here)

1. Check dwell angle or contact point gap. If adjustment is required, loosen contact point locking screws (1), (Fig. 60). Adjust both left and right contact point gaps to achieve the dwell angle specified in the shop manual, or adjust gap to 0.3 - 0.4mm (0.012 - 0.016 in.). Tighten locking screws. Recheck dwell angle or gap after locking screws are tightened.

2. Check both left and right cylinder ignition timing. Left cylinder idle or static timing is correct if the left contact points open when index mark (3) (Fig. 61) aligns with rotor "LF" mark (4). Right cylinder timing is correct if the right contact points open when index mark (3) aligns with rotor "F" mark (5). High rpm timing is correct if left and right contact points open when index mark (3) is between the full advance marks (6).

3. If *both* left and right contact points open before or after the timing marks align, loosen the base plate locking screws (2) (Fig. 60), and rotate the base plate to achieve correct timing. Retighten the base plate locking screws. Recheck dwell angle or gap, and timing, after locking screws are tightened.

4. If *only one* set of contact points is not correctly timed, readjust contact point gap to synchronize the timing for both cylinders. Increase gap to advance timing or decrease gap to retard timing. Contact point gap must not exceed the specified dwell angle or gap range. If correct ignition timing cannot be achieved within the specified dwell angle or gap range, replace the contact points.

Procedure for Adjusting Contact Point Gap and Ignition Timing on Honda Four Cylinder Air-Cooled Engines:

1. Check dwell angle or contact point gap. If adjustment is required, loosen contact point locking screws (1) (Fig. 62). Adjust both #1/#4 and #2/#3 contact point gaps to achieve the dwell angle specified in the shop manual, or adjust gap to 0.3 - 0.4mm (0.012 - 0.016 in.). Tighten locking screws. Recheck dwell angle or gap after locking screws are tightened.

2. Check ignition timing for #1/#4 cylinders (cylinders are numbered from left to right as viewed from the rider's position). If adjustment is required, loosen main base plate locking screws (2) . Rotate main base plate to achieve correct timing. Tighten locking screws. Recheck dwell angle or gap, and timing, after locking screws are tightened.

   Idle or static timing for #1/#4 cylinders is correct if #1/#4 (left) contact points open when index mark (4) (Fig. 64) aligns with "F 1•4" mark (5) . High rpm timing is correct if left contact points open when index mark (4) is between #1/#4 full advance marks (6) .

3. Check ignition timing for #2/#3 cylinders. If adjustment is required, loosen #2/#3 base plate locking screws (3) . Rotate #2/#3 base plate to achieve correct ignition timing. Tighten locking screws. Recheck #2/#3 dwell angle or gap, and timing, after locking screws are tightened.

   Idle or static timing for #2/#3 cylinders is correct if #2/#3 (right) contact points open when index mark (4) aligns with "F 2•3" mark (not illustrated). High rpm timing is correct if right contact points open when index mark (4) is between #2/#3 full advance marks.

(1) CONTACT POINT LOCKING SCREWS
(2) MAIN BASE PLATE LOCKING SCREWS
(3) #2/#3 BASE PLATE LOCKING SCREWS

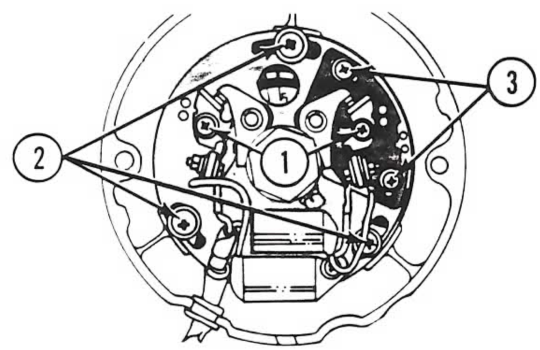


Fig. 62 Contact Point Assembly — Honda Four Cylinder Air-Cooled Engine

(4) TIMING INDEX MARK
(5) "F" 1•4" MARK
(6) #1/#4 FULL ADVANCE MARK

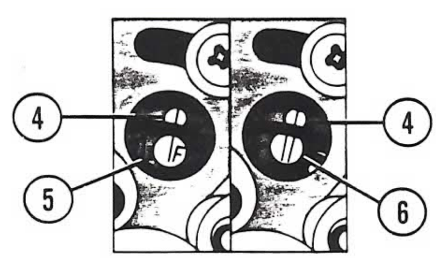


Fig. 63 Ignition Timing Marks (Honda CB-550 shown here)

Procedure for Adjusting Contact Point Gap and Ignition Timing on the Honda GL-1000:

① CONTACT POINT LOCKING SCREWS
② MAIN BASE PLATE LOCKING SCREWS
③ #3/#4 BASE PLATE LOCKING SCREWS

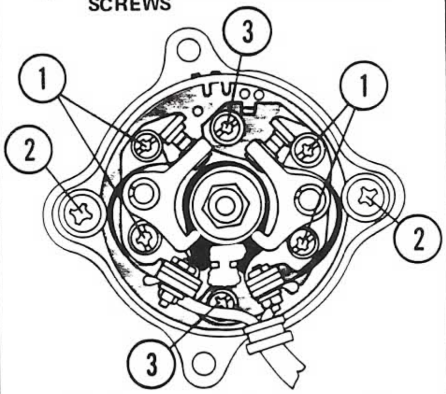


Fig. 64 Contact Point Assembly — Honda GL-1000

④ TIMING INDEX MARK
⑤ "F" MARK*
⑥ FULL ADVANCE MARK*

* Numeral "1" or "2" (not visible in illustration) follows "F" and "T" marks to distinguish #1/#2 cylinder timing marks from #3/#4 cylinder timing marks.

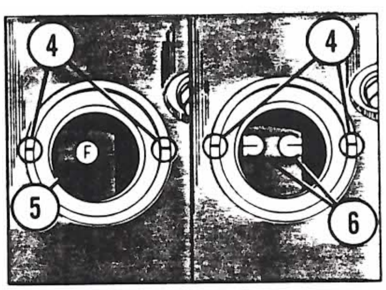


Fig. 65 Ignition Timing Marks — Honda GL-1000

1. Check dwell angle or contact point gap. If adjustment is required, loosen contact point locking screws ① (Fig. 64). Adjust both contact point gaps to achieve the dwell angle specified in the shop manual, or adjust gap to 0.3 - 0.4mm (0.012 - 0.016 in.). Tighten locking screws. Recheck dwell angle or gap after locking screws are tightened.

2. Check ignition timing for #1/#2 cylinders (cylinders are numbered as follows: #1 = right front; #2 = left front; #3 = right rear; #4 = left rear). If adjustment is required, loosen main base plate locking screws ② . Rotate main base plate to achieve correct ignition timing. Tighten locking screws. Recheck dwell angle or gap, and timing, after locking screws are tightened.

   Idle or static timing for #1/#2 cylinders is correct if #1/#2 (left) contact points open when index mark ④ (Fig. 65) aligns with "1-F" mark ⑤ . High rpm timing is correct if left contact points open when index mark ④ aligns with full advance mark ⑥ .

3. Check ignition timing for #3/#4 cylinders. If adjustment is required, loosen #3/#4 base plate locking screws ③ . Rotate #3/#4 base plate to achieve correct ignition timing. Tighten locking screws. Recheck #3/#4 dwell angle or gap, and timing, after locking screws are tightened.

   Idle or static timing for #3/#4 cylinders is correct if #3/#4 (right) contact points open when index mark ④ aligns with "2-F" mark ⑤ . High rpm timing is correct if right contact points open when index mark ④ aligns with full advance mark ⑥ .

Spark Plugs:

Fig. 66 shows the cross section of a typical spark plug. The spark plug provides an electrode gap inside the combustion chamber where a spark will ignite the air-fuel mixture. The insulator (2) is sealed to the center electrode (3) and shell (4) to prevent the escape of combustion gases through the spark plug. A gasket (5) under the shoulder of the shell prevents the escape of combustion gases between the spark plug and cylinder head.

Spark plugs are manufactured in standard sizes which are classified in terms of thread diameter (9) and reach (6) (Fig. 66 & 67). *Reach* is the distance from the shoulder of the shell to its threaded end. Gasket thickness is not included in the reach measurement. These spark plug dimensions must match the corresponding cylinder head dimensions of the motorcycle. For example, a Honda CB-750 requires spark plugs with a 12mm thread diameter and 19mm (¾ in.) reach. Various Honda models use spark plugs of 10mm, 12mm, or 14mm thread diameter and 12.7mm (½ in.) or 19mm (¾ in.) reach.

If the spark plug does not have the correct thread diameter, then obviously it cannot be installed. If the reach is too long, the spark plug will protrude into the combustion chamber where it may overheat, possibly interfere with piston or valve movement, and carbon deposits will accumulate on spark plug threads making removal difficult. If the reach is too short, the spark will occur in the cavity of the spark plug well where it will be less effective, and carbon deposits will accumulate on cylinder head threads impeding installation of the correct reach.

The service life of a sprak plug varies with factors of operating conditions, type and grade of fuel, compression ratio, etc. Spark plugs should be inspected, cleaned and regapped, or replaced, in accordance with the maintenance schedule in the owner's manual.

(1) TERMINAL
(2) INSULATOR
(3) CENTER ELECTRODE
(4) SHELL
(5) GASKET
(6) REACH (THREAD LENGTH)
(7) ELECTRODE GAP
(8) SIDE ELECTRODE
(9) THREAD DIAMETER

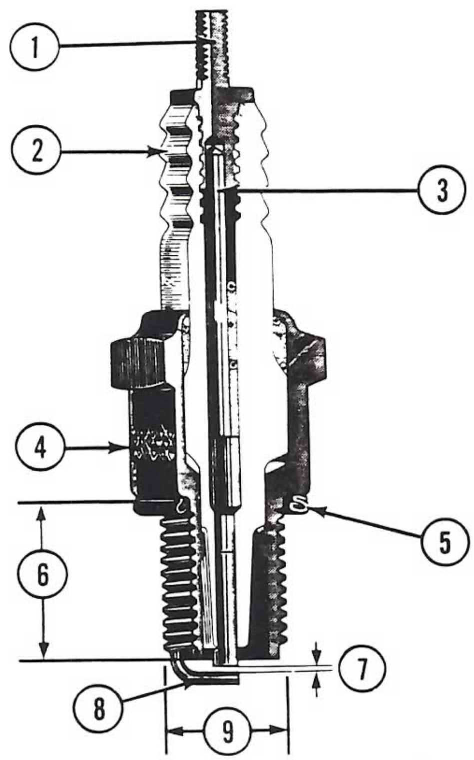


Fig. 66 Spark Plug Cross Section

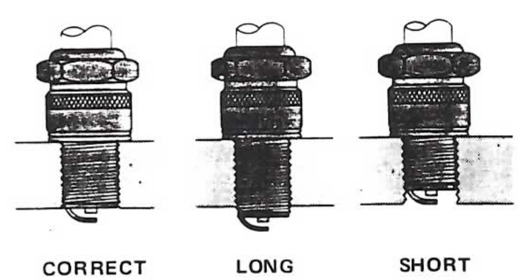


Fig. 67 Spark Plug Reach

The gap ⑦ between center electrode ③ and side electrode ⑧ (Fig. 66, page 43) must be wide enough to produce a good spark, but not so wide that the ignition coil cannot produce enough voltage to jump the gap. The gap widens with use due to electrode erosion from heat and chemical action. Spark plug voltage requirements increase as the gap widens.

Carbon and chemical deposits on the insulator nose also increase voltage requirements. These deposits conduct electricity and allow some of the current to leak across the insulator nose instead of jumping the electrode gap. Electrode wear and deposits on the insulator nose eventually raise voltage requirements to a point where the ignition coil has an insufficient voltage reserve, resulting in loss of spark intensity, and ultimately causing misfiring.

Spark plugs with high mileage may also develop insulator cracks or gas leakage between the insulator and shell. Regapping and cleaning will help to extend spark plug service life, but the plugs must eventually be replaced.

Before removing a spark plug, clean the area around the base of the plug to prevent dirt or debris from falling into the combustion chamber through the open spark plug well. Inspect the spark plug for excessive electrode wear, insulator cracks, or signs of gas leakage (gray stains on the outside of the insulator near the top of the shell). If these conditions are found to exist, discard the spark plug. Inspect the insulator nose and electrodes for signs of fouling or overheating (see Spark Plug Heat Range, page 45). If the spark plug appears to be reusable, clean and regap the plug.

Commercial sandblast spark plug cleaners remove fouling deposits quite well. If you do not have access to such a device, it is possible to achieve some improvement by picking off encrusted deposits and cleaning the spark plug with solvent and a rag. Also wipe clean the exterior of the spark plug insulator and interior of the spark plug cap to reduce the possibility of electrical flashover.

Use a wire gauge to measure spark plug electrode gap. Where there are any surface irregularities, a wire gauge will measure more accurately than a flat gauge. Electrode gap specifications are given in the owner's manuals and shop manuals for each Honda model. All spark plugs, whether new or used, should be accurately gapped before installation. Electrode gap is adjusted by carefully bending the side electrode.

Install spark plugs finger-tight, then use a spark plug wrench for final tightening. The initial placement of the spark plug is done without using the force of a wrench in order to prevent the possibility of cross-threading and damaging the cylinder head threads.

Optimum spark plug tightening torque varies with such factors as cylinder head thread material (iron or aluminum), the condition of the cylinder head threads, and whether they are clean or dirty, dry or oily. Spark plug tightening torque specifications may be found in some Honda shop manuals and in some literature published by spark plug manufacturers, though specifications from different sources will not necessarily coincide. Few people use a torque wrench to install spark plugs anyway.

Spark plugs must be tightened firmly enough to compress the gasket and form a gastight seal, but over-tightening may cause cylinder head thread damage. The spark plug gasket can be reused several times, provided it remains with the same spark plug and cylinder with which it was originally used.

Spark Plug Heat Range:

Heat range refers to the spark plug's ability to transfer heat from the center electrode's firing tip, through the insulator, through the spark plug shell, to the cylinder head where heat is dissipated (Fig. 68). The ability of the spark plug to transfer heat is controlled by the exposed length of the insulator nose (Fig. 69). When the exposed insulator nose is relatively long, heat from the center electrode's firing tip must travel a relatively long path to reach the spark plug shell and cylinder head. Conversely, when the exposed insulator nose is shorter, heat has a shorter path to follow and is dissipated more easily.

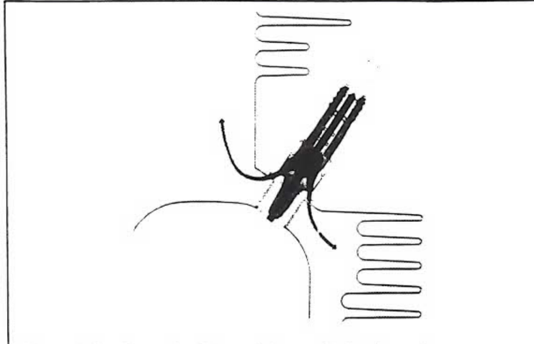


Fig. 68 Spark Plug Heat Dissipation

Spark plug manufacturers produce each spark plug size and model in many heat ranges, using carefully graduated differences in the length of the exposed insulator nose.

The operating temperature of a spark plug varies in relation to exposed insulator nose length and also with all factors which affect combustion chamber temperature, such as engine design, engine rpm and load, riding conditions, air-fuel mixture ratios, ignition timing, etc. Fouling is likely to occur when the temperature of the center electrode's firing tip is less than approximately 450°C (842°F). Preignition is likely to occur when the temperature of the center electrode's firing tip exceeds approximately 950°C (1742°F).

(1) LONG INSULATOR NOSE EXPOSURE RAISES OPERATING TEMPERATURE
(2) MEDIUM INSULATOR NOSE EXPOSURE
(3) SHORT INSULATOR NOSE EXPOSURE LOWERS OPERATING TEMPERATURE

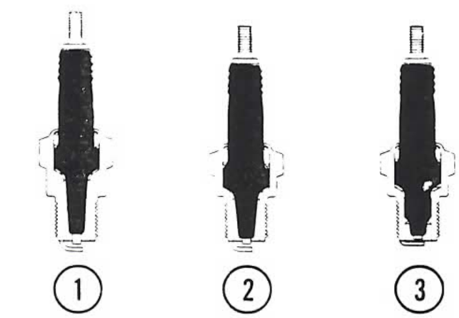


Fig. 69 Spark Plug Insulator Nose Length and Heat Range

The objective of spark plug heat range selection is to equip the engine with spark plugs which will maintain electrode and insulator tip temperatures hot enough to burn off carbon and chemical deposits that cause fouling, yet cool enough to prevent preignition.

Preignition takes place when a hot spot in the combustion chamber (such as a glowing hot spark plug electrode) ignites the air-fuel mixture before the ignition spark occurs. Preignition greatly increases combustion chamber heat and pressure which may burn or melt the spark plug firing tip. Worse yet, preignition may cause serious engine damage, such as seized or holed pistons. Therefore, it is safest to select the coldest spark plug (shortest exposed insulator nose length) that will function without fouling.

Whenever spark plugs are removed from the engine, note the appearance of the insulator tip and electrodes. An abnormal appearance may indicate the need for engine service or spark plugs of a different heat range. Most spark plug manufacturers publish literature with full color photographic illustrations of various spark

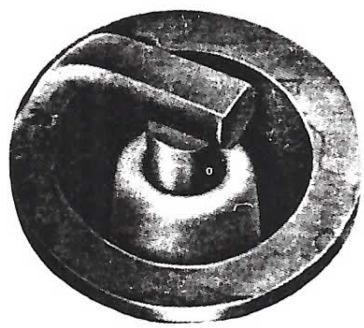


Fig. 70 Normal Spark Plug Firing Tip

Fig. 71 Overheated Spark Plug Firing Tip

Fig. 72 Fouled Spark Plug Firing Tip

plug conditions. Obtain a copy of such literature, if available. Full color photographic illustrations are a far better diagnostic guide than Fig. 70, 71, 72 of this manual.

The insulator color of a normal spark plug (Fig. 70) will be brown, tan, or yellow (shades of gray if unleaded fuel is used). Electrode wear will be proportionate to the mileage the spark plug has been used. Normal coloration and wear indicate that the engine is functioning properly and the spark plug is of suitable heat range.

Insulator color will become chalk white as the spark plug starts to overheat. Extreme overheating (Fig. 71) will produce a blistered insulator appearance with melted deposits, and the electrodes will become abnormally eroded or even melted.

A spark plug may become overheated from any of the following conditions:

- Excessively advanced ignition timing.
- Lean air-fuel mixture ratio or intake air leak.
- Detonation (inadequate fuel octane rating or lugging the engine).
- Preignition (hot spots in the combustion chamber).
- Insufficient engine cooling (no air flow over cooling fins or loss of liquid coolant).
- Spark plug heat range too high for operating conditions.

The insulator nose and electrodes will become black and fouled (Fig. 72) if spark plug operating temperature is too low to burn off carbon deposits, or if fuel or oil in the combustion chamber cause excessive carbon deposits.

Dry, sooty fouling may be caused by any of the following conditions:

- Excessive use of the choke.
- Prolonged idling or low rpm operation.
- Excessively rich air-fuel mixture ratio.
- Ignition malfunction (insufficient firing voltage).
- Spark plug heat range too low for operating conditions.

Wet, oily black fouling indicates engine wear or damage (worn valve guides, worn piston rings, damaged pistons), or excessive oil in the fuel-oil mixture of two-stroke engines.