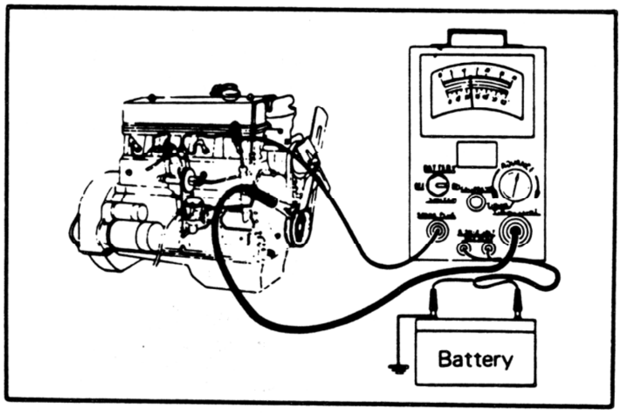


Fig. 9-191 Ignition Timing Inspection

(1) Ignition timing inspection procedures.
This tester is to determine whether the ignition timing adjustment is within the manufacturer's standard or whether the ignition timing matches with the operator's operating conditions.

1) Connect the tester red lead wire onto the battery positive terminal and the black lead wire onto the battery negative terminal.
2) Connect the "pick-up" onto the No. 1 cylinder plug.
3) Connect the tachometer's leader to the terminals of distributor.
4) Start the engine, and set at specified idle revolution.
   Specified idle revolution: 550 $^{+50}_{-0}$ rpm
5) Turn on the battery switch, and set the advancer to "TIMING" position.
6) Focuss the timing light onto the slot in the crankshaft pulley and pointer on the timing gear cover, and compare the timing difference with the manufacturer's standard.

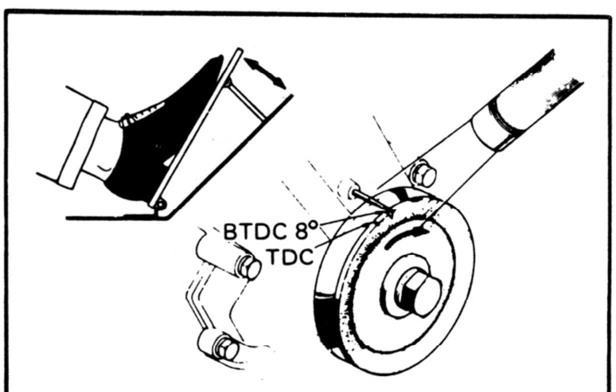


Fig. 9-192 Ignition Timing Inspection

7) It is satisfactory if the timing is within the standard ignition timing at specified revolution.
   If the timing is incorrect, loosen the distributor clamp, and adjust by turning the distributor assembly counterclockwise or clockwise.

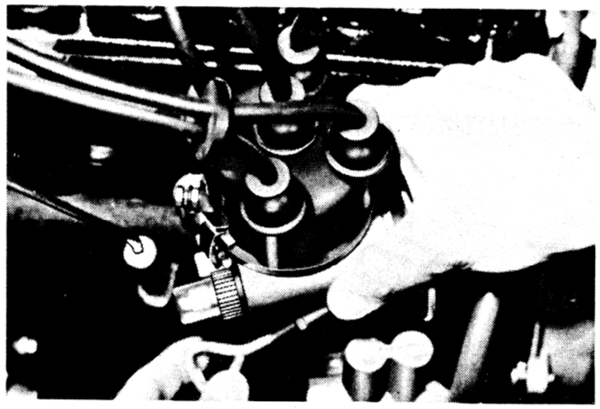


Fig. 9-193 Timing Adjustment

Caution:

(1) Set the distributor octane selector at standard position.
(2) If the timing is incorrect, loosen the distributor clamp, and adjust by turning the distributor assembly.
When the housing is turned counterclockwise, the timing will advance, and it will retard when turned clockwise.
(3) If the ball or slot is ahead in the rotational direction of the pulley in relation with the timing point, the timing is retarded, thus, turn the distributor counterclockwise.
(4) If the ball or slot is before the rotational direction of the pulley in relation with the timing pointer, the timing is advanced, thus, turn the distributor clockwise.

(2) Octane selector adjustment
For adjustment, drive the vehicle in top gear, and if a slight "ping" disappears gradually when the accelerator pedal is suddenly depressed, the adjustment is satisfactory.
If the "ping" is excessive:
. . . . . turn toward "R" direction.
If there is no "ping":
. . . . . turn toward "A" direction.

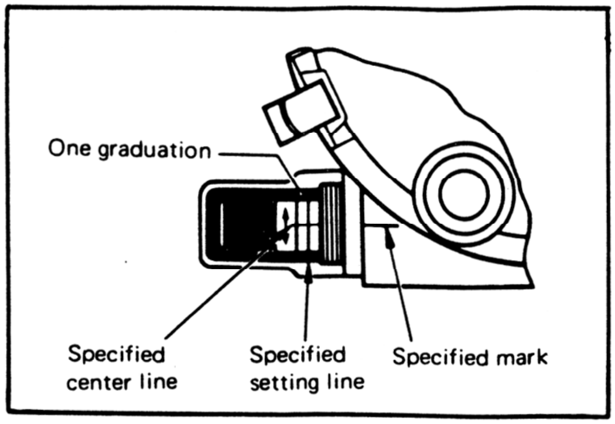


Fig. 9-194 Octane Selector Standard Position

7. Distributor governor operation inspection. (during engine stalled condition)
   (1) Turn the rotor clockwise, and it is satisfactory if it returns lightly when the fingers are released.
   (2) It is satisfactory if there is no excessive play toward the counterclock wise direction after the rotor returns when the fingers are released.
8. Distributor vacuum advancer operation inspection. (during engine stalled condition)
   Disconnect the vacuum advancer hose from the carburetor, and it is satisfactory, if the breaker arm moves smoothly when the hose is sucked with the mouth.
9. Advance characteristics (with the tester)
   Measure the governor and vacuum advancer characteristics with the distributor tester, and it is satisfactory if both are within the ranges.
   (1) Governor advance characteristics.
      Excessive advance angle:
         Governor spring weakened
      Insufficient advance angle:
         Inoperative governor weights & cam
   (2) Vacuum advance characteristics
      Excessive advance angle:
         Vacuum advancer spring weakened
      Insufficient advance angle:
         Diaphragm damaged and breaker plate sticky

Caution:

(1) Remove the vacuum hose and measure the governor advance angle.
(2) Vacuum advance angle refers to deducting of governor advance angle from the measurement.

Advance characteristics:

	Distributor revolution (rpm)	Advance angle
Governor advance:	450 ~ 650	Starting
	1,400	7.5° ~ 9.5°
	2,300	13° ~ 15°
	Vacuum (mmHg)	Advance angle
Vacuum advance:	70 ~ 90 (2.8 ~ 3.6 in.)	Starting
	120 (4.8 in.)	2.3° ~ 4.3°
	200 (8 in.)	7° ~ 9°
	260 (10.4 in.)	9.3° ~ 11.3°
	350 (14 in.)	12° ~ 14°

10. Distributor gap inspection
    It is satisfactory if following defects are not present.
    (1) If the distributor cap and rubber caps are not cracked or damaged.
    (2) If the spark plug cords, coil cord terminals and cap cord insertions are not rusted or burnt.
    (3) If the segment terminals are not burnt.

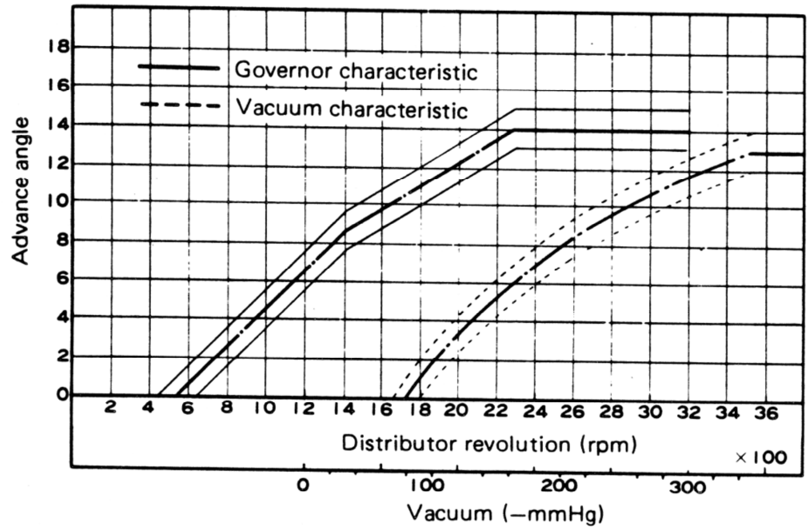


Fig. 9-195 Distributor Advance Characteristics

11. Rotor inspection
    It is satisfactory if the rotor is not cracked, damaged or if the electrode is not dirty or burnt.
    (1) Replace if the rotor is cracked or damaged.
    (2) Clean if the electrode is dirty or burnt.

12. Resistive cord inspection
    Measure the resistance of the resistive cord with the circuit tester.
    Specified resistance: 16 kΩ (per meter)
    Resistance limit: 25 kΩ (per meter)

DISTRIBUTOR (Transistor type)

CIRCUIT DIAGRAM

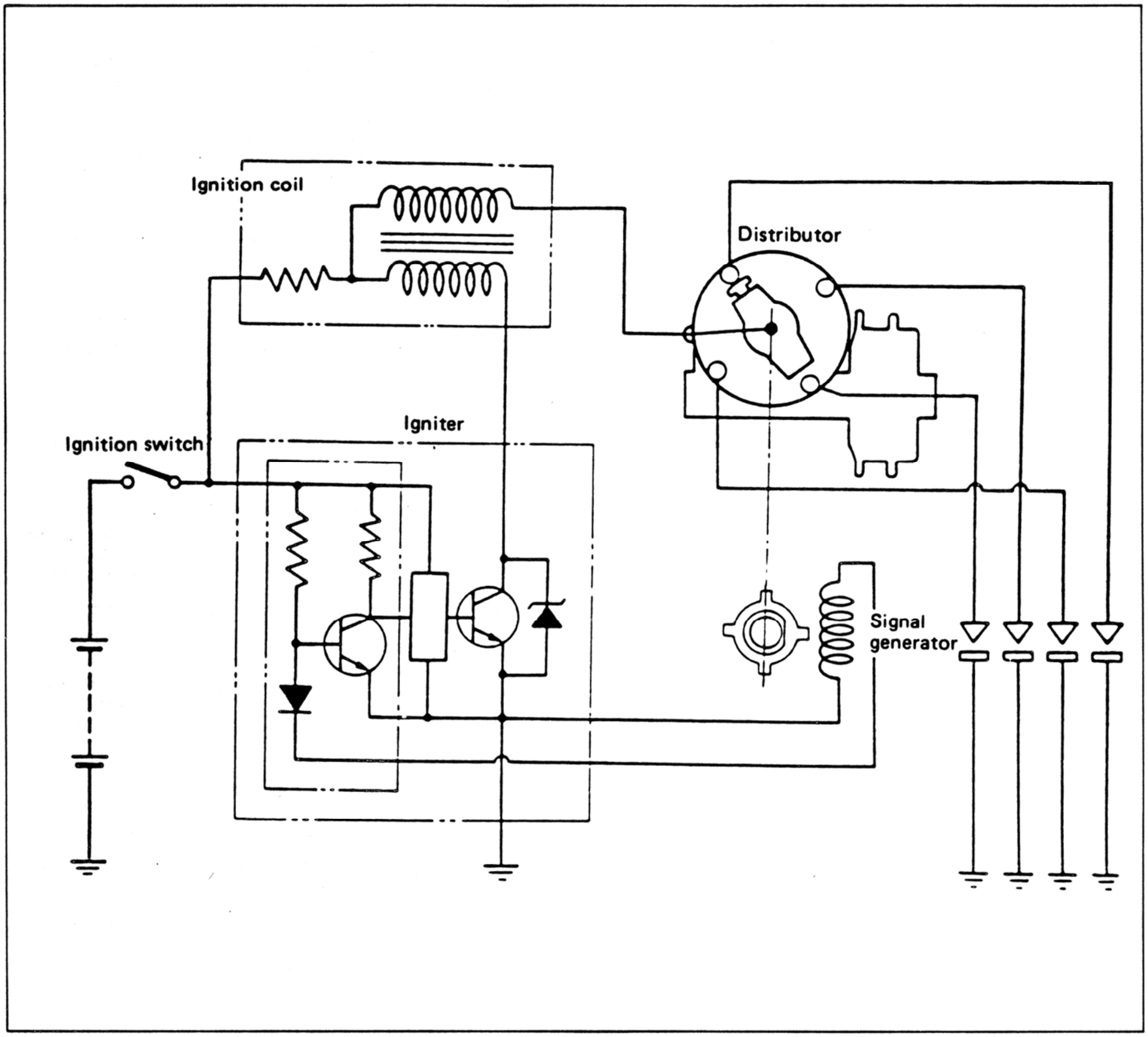


Fig. 9-196 Ignition System Circuit Diagram

SPECIFICATIONS AND SERVICE STANDARDS

Ignition method	Contactless transistorized ignition
Rated voltage (V)	12
Operating voltage range (V)	6 ~ 16
Polarity	(–) ground
Allowable operating ambient temperature (°C)	–30 ~ +100

ADVANTAGE

The fully transistorized igniter eliminates contact points, and troubles such as power failure, fuel inefficiency or starting problems associated with contact point ignition systems. Moreover, distributor contact point adjustment, replacement or other maintenance is no longer needed.

OPERATIONAL DESCRIPTION

PRINCIPLE OF FULLY TRANSISTORIZED IGNITION

(1) Fig. 9–197 shows the principle of fully transistorized ignition. When the signal rotor is inoperative, since potential at point P which is determined by partial pressure caused by resistance R and resistance in the pickup coil, is set higher than the operating potential of the transistor (approximately 0.6 V), the transistor is turned ON. As a result, primary current flows in the ignition coil.

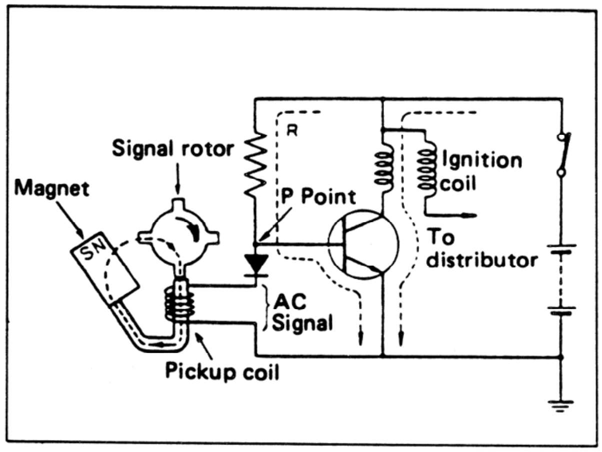


Fig. 9-197 Principle of Fully Transistorized Ignition

(2) When the engine is started, the signal rotor begins rotating and the amount of magnetic flux passing the pickup coil fluctuates. Alternating current signal is caused in the pickup coil by the fluctuation of magnetic flux. The voltage waveform of the signal is such that the projected part, as shown in Fig. 9–164, sharply changes from (+) to (–) across the symmetricalcenter.

When the current signal is in the (+) direction to point P, potential at point P does not change (due to diode), and the transistor remains in ON position.

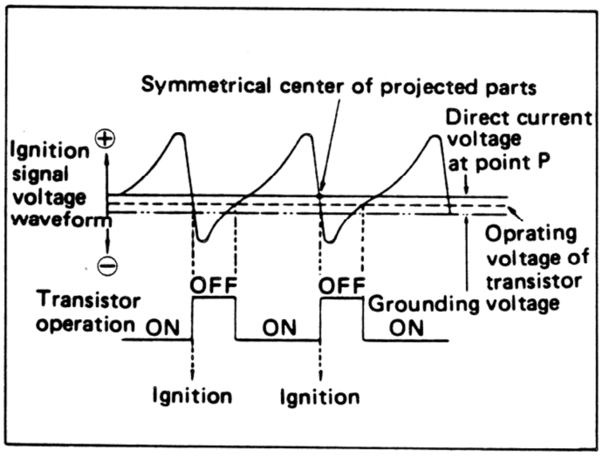


Fig. 9-198 Ignition Signal Waveform and Transistor Operation

In contrast, when voltage is in the (–) direction to point P, potential at point P becomes lower than the operating potential of the transistor (approximately 0.6 V), changing the transistor position to OFF.

When this occurs, current in the primary coil is prevented, and high voltage is generated in the secondary coil and ignites the plug via the distributor. When alternating current signal generates in the (+) direction to point P again, transistor it turned ON, and current runs through the primary coil as before. As the signal rotor rotates once (so does the distributor), the transistor is turned ON and OFF four times, igniting the plug each time to keep the engine running.

In reality, such a cycle cannot be completed by a single transistor. Consequently, the ignition system incorporates an igniter comprising transistor circuits.

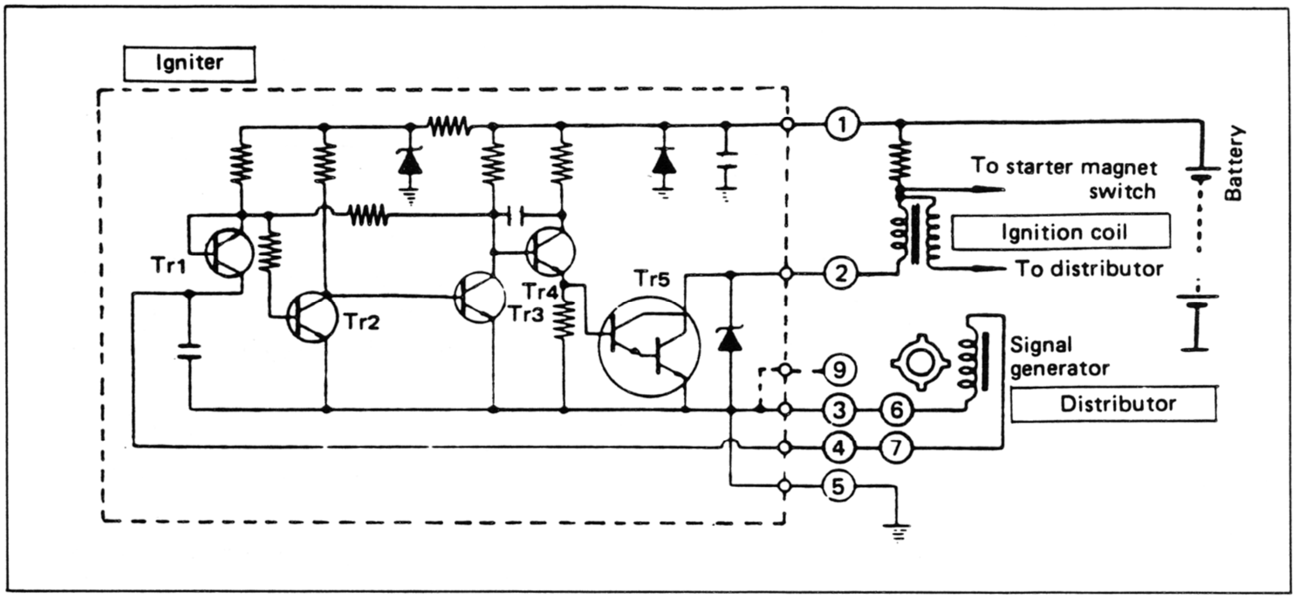


Fig. 9-199 Full Transistorized Igniter Circuit Diagram

CONSTRUCTION OF THE FULLY TRANSISTORIZED IGNITER

The fully transistorized igniter consists of the following four components;

(1) Distributor (contactless ignition signal generator)
(2) Igniter
(3) Ignition coil
(4) Spark plug

Ignition coil and spark plug are of the conventional type.

DISTRIBUTOR

In the conventional distributor, points were used to intermittently supply the primary current in the ignition coil. In the fully transistorized igniter, such an intermittent supply of primary current in the ignition coil is controlled by the igniter, and the distributor is used to generate signal for actuating the igniter. See "Distributor pickup mechanism" for details of the signal generating mechanism.

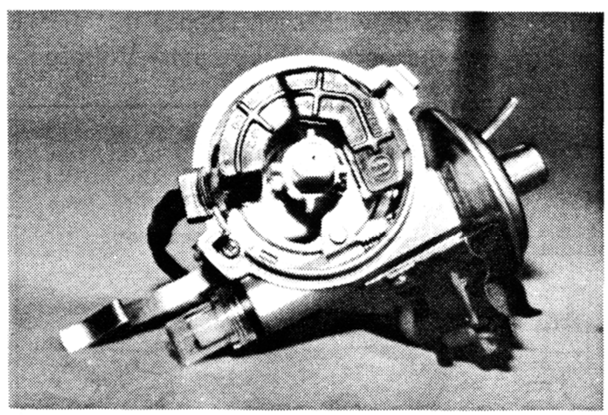


Fig. 9-200 Distributor

The distributor comprises a signal rotor having four teeth, assembled on the distributor shaft, and a signal generator comprising a magnet and a coil is assembled on the breaker plate. The timing is controlled by the governor weight and vacuum advancer, as before.

The output lead of the pickup coil is connected to the igniter, and a shielded wire is used to prevent noise.

DISTRIBUTOR PICKUP MECHANISM (IGNITION SIGNAL GENERATOR)

The ignition signal generator consists of the signal rotor, secured on the distributor shaft, rotating at 1/2 of the engine speed, and the signal generator (pickup coil, magnet and bracket) that is attached to the breaker plate.
Magnetic flux from the magnet passes through the pickup coil as routed below, and it does not change when the signal rotor is inoperative (when the engine is stopped). Consequently, no change occurs in the pickup coil.

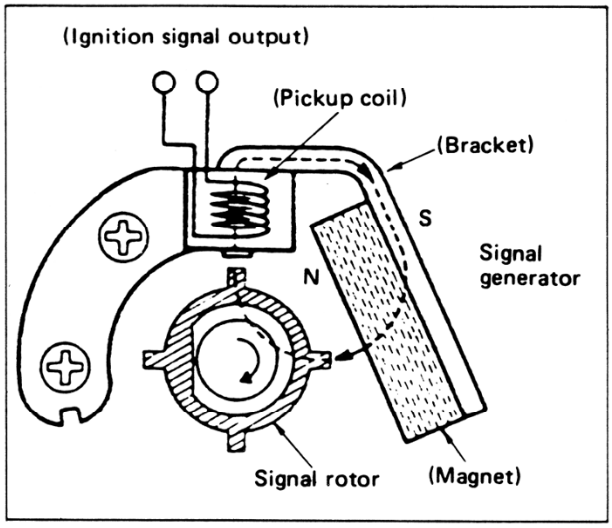
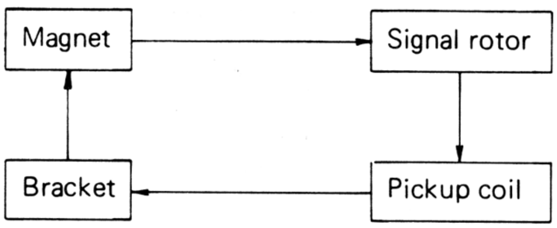


Fig. 9-201 Ignition Signal Generator Mechanism



When the engine is started and the signal rotor begins to rotate, the air gap at the projected part of the signal rotor changes, as shown in (A), (B) and (C) in Fig. 9–202. The amount of magnetic flux that passes through the pickup coil changes accordingly. Voltage is generated at the both ends of the pickup coil in accordance with such change in the magnetic flux. The generated voltage is higher when the change in the magnetic flux is greater. Voltage is much less when the flux change is less.

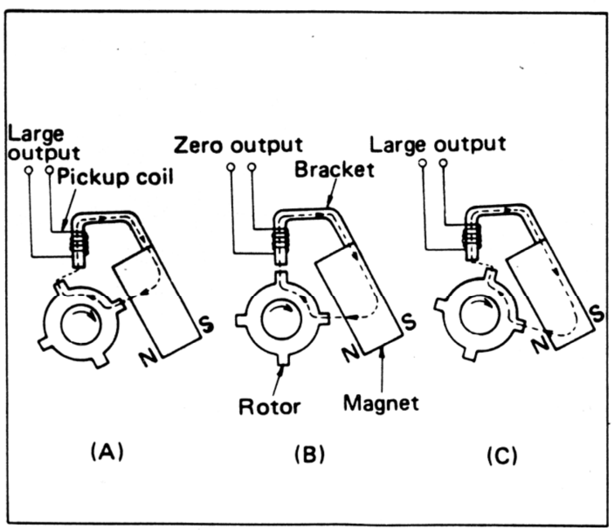


Fig. 9-202 Ignition Signal Generator Mechanism

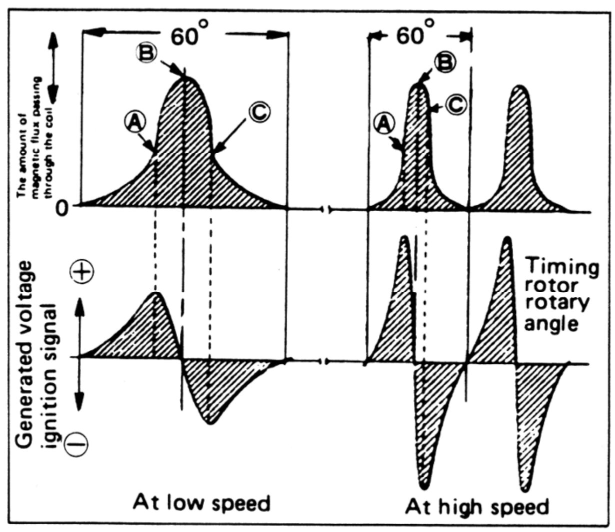


Fig. 9-203 Relation between Magnetic Flux Change in the Pickup Coil and Generated Voltage

The voltage generation is maximized when the projected portion of the signal rotor is approaching the center of the pickup coil (when air gap is decreasing and the magnetic flux increases, as in (A) in Fig. 9–202), and when it leaves the center (air gap is increasing and magnetic flux decreases, as in (C) in Fig. 9–202. Polarity is reversed.

IGNITER

The igniter consists of an ignition signal detector, amplifying circuit, and power switching circuit. It detects ignition signal from the distributor, and determines the ignition timing and current carrying time of the ignition coil.

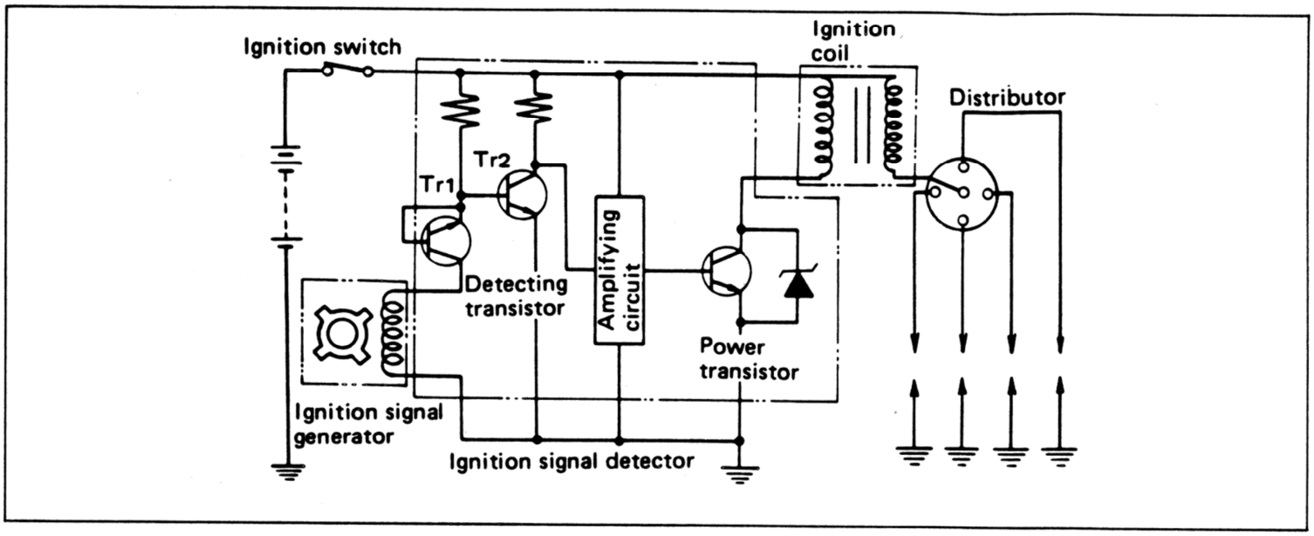


Fig. 9-204 Igniter Operating Principle

Transistor Tr1 which is connected in parallel to transistor Tr2 has a short-circuited connection between the emitter and the base, and is used as diode.

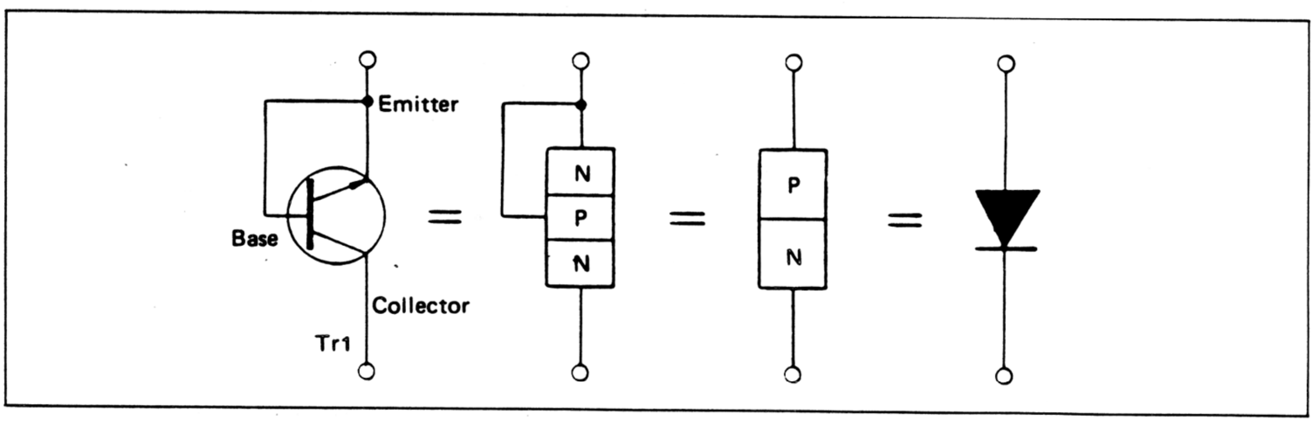


Fig. 9-205 Diodized NPN Transistor

(1) Ignition ON with engine stopped
When the engine is not running, pickup coil output is zero, and potential level at point P is determined by partial pressure caused by resistance R1 and pickup coil resistance. The potential level is set higher than the operating potential of transistor Tr2 which is used for detecting ignition signal. Consequently, Tr2 is ON.
Under such a condition, current runs through the amplifying circuit to turn ON the power transistor Tr5, and current flows to the primary side of the ignition coil.

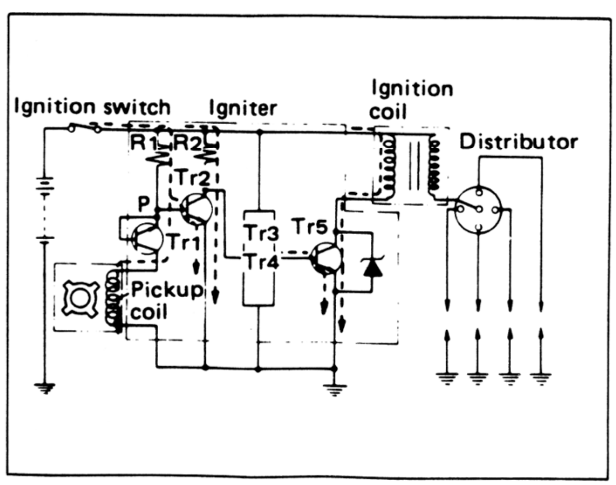


Fig. 9-206 Igniter Circuit Diagram (With Engine Stopped)

(2) At engine starting

When the engine is started, voltage is generated in the pickup coil, and changes potential at point P.

When voltage generating in the coil is working to increase potential at point P, Tr2 is turned ON, and so is Tr5. If voltage generating in the coil is working to decrease potential at point P, it becomes lower than the operating potential of Tr2, and Tr2 and Tr5 are turned OFF. As a result, high voltage is generated in the secondary side of the ignition coil and sparks the spark plug. Thus, the transistor Tr2 is turned ON and OFF repeatedly to supply current to the ignition coil intermittently. Fig. 9–208 shows the relation between voltages generating in the pickup coil and the ignition coil with respect to the operation of the igniter.

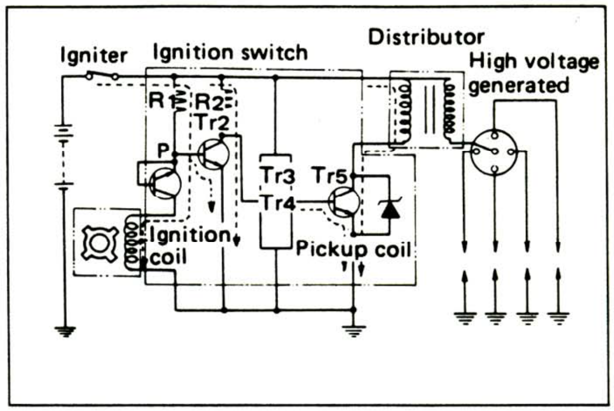


Fig. 9-207 Igniter Circuit Diagram (At Engine Starting)

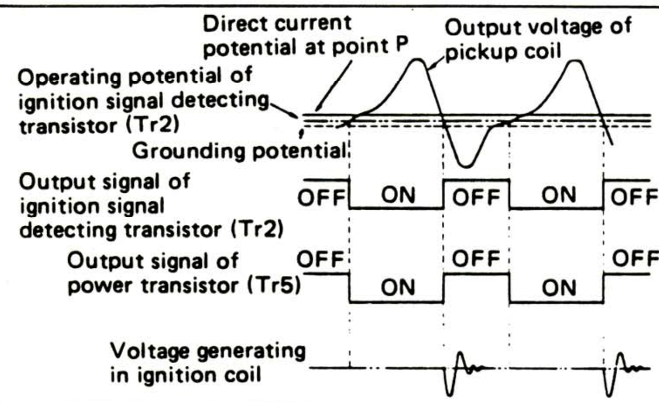


Fig. 9-208 Transistor Interaction at Starting

DISTRIBUTOR ASSEMBLY

SPECIFICATIONS AND SERVICE STANDARD

Air gap	(mm) (in.)	0.2 ~ 0.4 (0.008 ~ 0.016)	
Pickup coil resistance	(Ω)	140 ~ 180	
Timing characteristics			
Governor advance angle	4P	Distributor rpm	Advance angle
		400 rpm	0°
		640 rpm	2.4°
		1000 rpm	7.0°
		1800 rpm	11.0°
Vacuum advance angle	4P	Vacuum	Advance angle
		– 90 mmHg (–3.543 inHg)	0°
		–130 mmHg (–5.118 inHg)	2.9°
		–234 mmHg (–9.213 inHg)	8.2°
		–300 mmHg (–11.811 inHg)	10.5°

TIMING CHARACTERISTICS

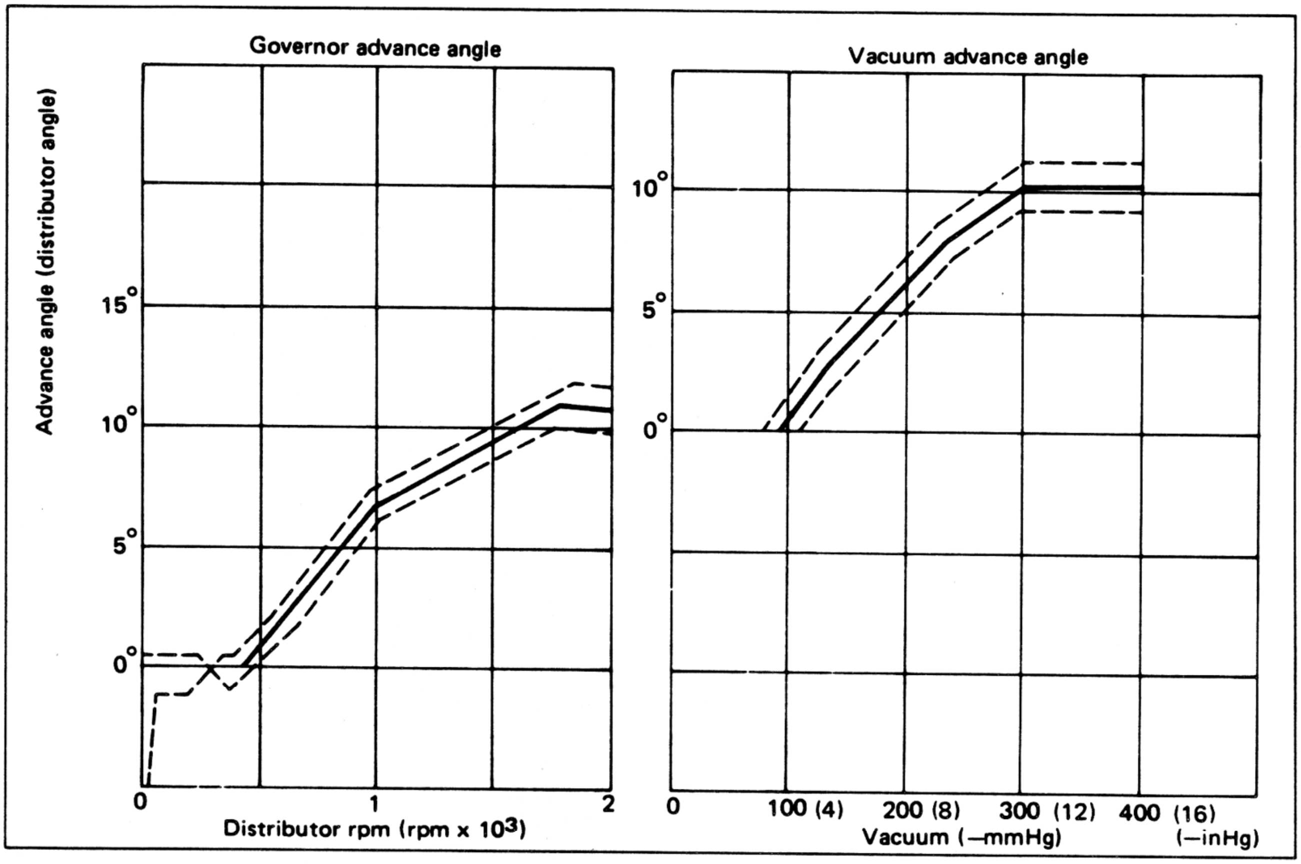


Fig. 9-209 Timing Characteristics (4P Engines)