

## Chapter 2: Ignition System Service

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Testing of ignition coil, condenser and dwell angle etc.

- 1) Testing of the ignition coil
- 2) Testing of condenser
- 3) Contact breaker testing & Setting
- 4) Distributor testing
- 5) Spark plug testing

Equipments:

- 1) A live test engine with a good battery on a test stand
- 2) Ammeter
- 3) Voltmeter or Multi meter
- 4) ohm-meter or Multi meter
- 5) Hand tools, leads and cables.

Safety precautions:

- 1) H.T. voltage produced by the ignition is not necessarily dangerous but gives unpleasant shocks. Avoid touching high voltage circuit parts, when the systems is in operation.
- 2) Keep hands clear off fan.. fan belt, and other moving parts of engine or machine
- 3) Before starting an engine check to make sure that no petrol is leaking from fuel system.

### **Testing of the ignition coil**

Ignition coil is tested with the special coil test meter. The following are the main tests conducted:

- Resistance of primary winding
- Resistance of secondary winding
- Internal short circuit test
- Coil performance test

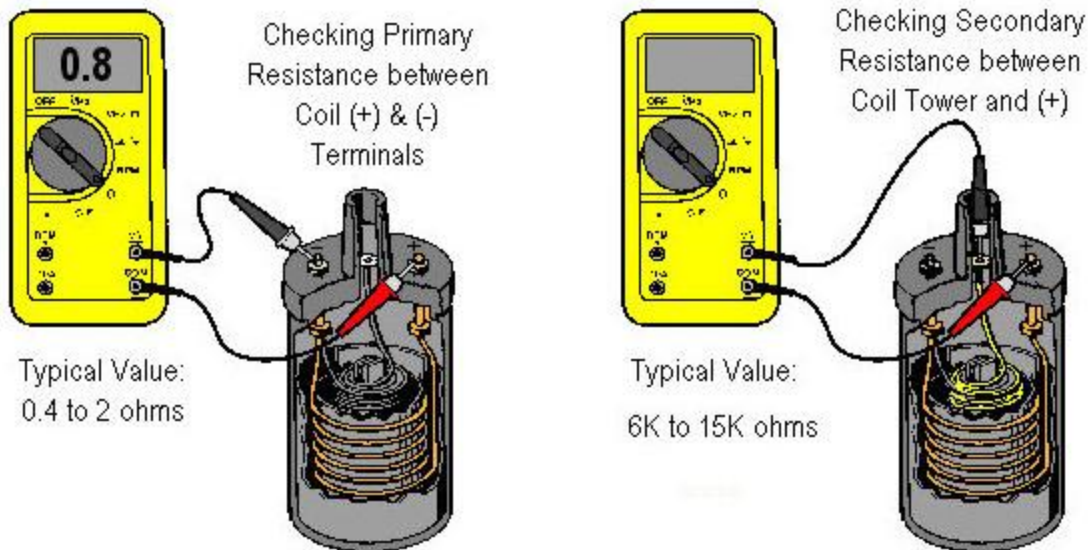


Fig: Testing of Ignition timing

Out of these the first three tests can be performed with the help of a multimeter, while the coil performance may be tested by putting all other new and tested components in the ignition system and observing the spark. A weak spark plug would then indicate the faulty coil.

A special oscilloscope, called ignition scope is also used in modern automobile shops to observe the coil output waveform, which indicates clearly where the fault lies in the ignition system. For example, Uneven firing voltage in various cylinders indicates that either the spark plugs have worn out unevenly or some of the H.T. leads from distributor to sparkplugs may be defective. Similarly absence of oscillations in the ignition surface pattern indicates defective ignition coil.

### 1. Testing of condenser

Following are the tests usually carried out for the condenser:

- 1) Short circuit test. D.C. current is passed through the condenser with a lamp of suitable resistance in series. If the condenser is short circuited, the lamp will light when the switch is closed.
- 2) Open circuit tests. D.C. current of suitable voltage is passed through the condenser which is in series with a neon lamp. If no flashing of the lamp occurs, the open circuit exists in the condenser which must be replaced.
- 3) Capacity test. Test the capacity of the condenser and compare it with the value given by the manufacturer.

### 2. Contact breaker testing & Setting ( Dwell angle testing and setting)

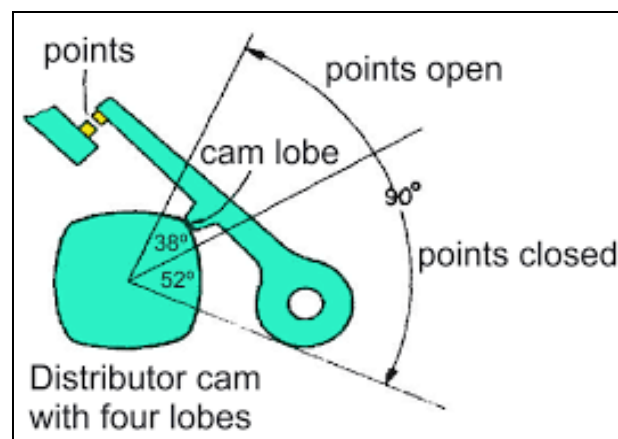
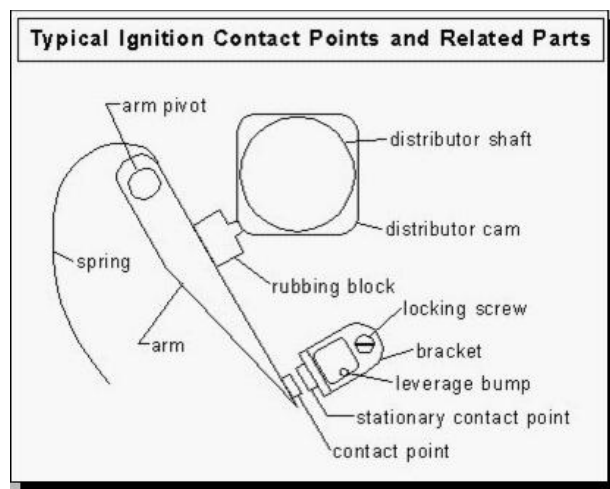
Dwell angle is the amount of time, measured as degrees of rotation, that contact breakers close in a distributor. Unless dwell angle is accurate, ignition timing won't be accurate. The period, measured in degree of cam rotation, during which the contact points remain closed is called the dwell angle.

- 1) Start the engine and run it at idle speed, until it reaches normal operating temperature. ...
- 2) Connect a dwell meter to the ignition coil as described in the tool manufacturer's instructions.
- 3) If dwell is incorrect, stop the engine, remove the distributor cap and rotor, then adjust the point gap as described.

The contact-breaker setting is vital to good running. Ideally, check and set the gap, between every major service, and replace the contact breaker after 6,000 miles or 10,000 km, or twice a year.

Adjust the points by locating the heel of the rubbing block of the contact breaker points so it rides on the cam of the distributor shaft. Using a feeler gauge of the correct manufacturers' specifications, gently adjust the points with a screwdriver until the points gap is in accordance with specifications.

A point gap of **0.016- 0.020 inches** (0.45 - 0.5 mm) is generally kept. The spring tension is measured with the help of a spring balance.



No of cylinders	Cam lobe	Approx. Dwell	Approx. Dwell
3-cylinder engine	120° apart	60% of cam lobe	72+/-5 degree
4-cylinder engine	90° apart	“	54+/-5 degree
6- cylinder engine	60° apart	“	36+/-5 degree
8- cylinder engine	45° apart	“	27+/-5 degree

### 3. Distributor testing

The main test for a distributor is checking of ignition timing which has already been discussed. The detailed testing of distributor, including the condenser and the contact breaker can be carried out on a special tester. The following tests can be performed with the help of these testers:

- Electrical resistance of leads
- Condenser tests
- Contact breaker testing involving
- Centrifugal advance testing
- Vacuum advance test

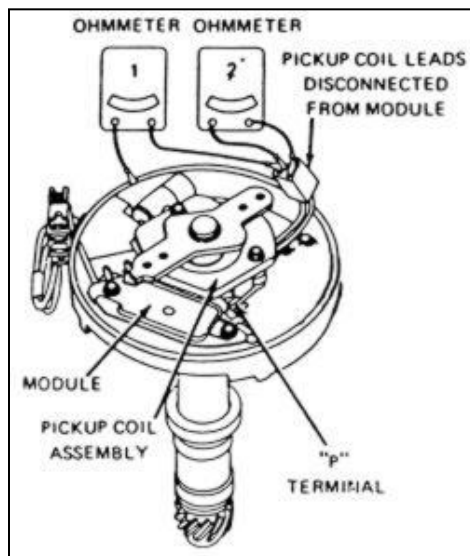


Fig: Distributor Testing

### 4. Spark plug testing

- Visual inspection. If the insulator tip is brownish or light grey in colour, it indicates that the engine conditions have been good, proper fuel has been used. If however, a dry layer of carbon is formed on the insulator tip, electrodes and plug points, it indicates that suitable fuel has not been used, carburetor/fuel quantity adjustment is not correct or/and the ignition system was not correctly tuned. Further, a thick layer of oil on the body and electrodes of the plug means badly

worn out piston rings, excessively rich air fuel mixture and importantly adjusted ignition system. This may also be due to the use of spark plug of higher heat value than required.



Fig: Spark Plug Testing

- 1) Gap checking. This may be done with feeler gauge. A flat will give wrong indication because of uneven wear of the points. So round wire type of feeler gauge should be used for gap checking of spark plugs.
- 2) Testing for current leakage/ breakage in insulator can be tested by putting one lead of multi meter on central electrode and other on threaded portion for continuity.
- 3) Spark quality test is done on a spark cleaner and Tester.

**Ignition Timing** There are various timing devices for timing the engine, the spark `must occur at the spark-plug gap as the piston reaches some definite position in the compression stroke. Adjusting the distributor on the engine so the spark occurs at this correct instant is called *Ignition Timing*. You adjust the distributor by turning it in its mounting. If you rotate the distributor in the direction opposite to normal distributor shaft rotation, you move the timing ahead. That is the contact points will open earlier (or the electrical pulse from the pickup coil will occur earlier). This advances the spark so the sparks will appear at the spark plugs earlier. Turning the distributor in the in the

direction of distributor shaft rotation, will retard the sparks. The sparks appear at the plugs later.

### TIMING WITH A TIMING LIGHT:

1. To time the ignition, check the markings on the crankshaft pulley with the engine running.  
Since the pulley turns rapidly, you cannot see the markings in normal light. But by using a special timing light, you can make the pulley appear to stand still. The timing light is a stroboscopic light.
2. Connect the timing-light lead to the No. 1 spark plug, as shown in (Fig. 1).  
Every time the plug fire, the timing light gives off a flash of light (Fig. 2). The light lasts only a fraction of a second. The repeated flashes of light make the pulley seem to stand still.
3. To connect the timing light, remove the spark-plug nipple from the spark plug.  
Install a metal adapter between the spark-plug clip inside the nipple and the spark plug. The clip on the timing-light lead is then attached to this adapter.

*(However, some timing lights do not require the use of a metal adapter. These timing lights have a type of spark-plug lead connector that clamps around the spark-plug cable). Ice picks, pins, or wires should never be forced through the spark-plug nipple in order to connect the timing light.*

4. To set the ignition timing, loosen the clamp screw that holds the distributor in its mounting. Then turn the distributor one way or the other.
5. As you turn the distributor, the marking on the pulley will move ahead or back , When the ignition timing is correct, the markings will align with a timing pointer, or timing mark, as shown in (Fig. 3).
6. Tighten the distributor clamp

### CHECKING TIMING WITH MAGNETIC TIMING TESTER:

Engines with a magnetic timing probe receptacle can be timed with a magnetic timing tester. This is basically a temporary crankshaft-position sensor.

Connect the tester following the manufacturer's operating instructions. Insert the magnetic probe into the probe hole. As the engine runs, the passage of a slot in the crankshaft vibration damper interrupts a small magnetic field around the probe tip. This signals the position of the number 1 piston to the tester. It then displays the ignition timing. Many computerized engine analyzers and service bay diagnostic computers use the magnetic timing probe.



CHECKING TIMING WITH ELECTRONIC SCAN TOOL OR SCANNER:

Other ignition systems have electronic spark advance. It is used on many electronic distributors and in all distributor less ignition systems.

Electronic ignition systems normally do not require periodic timing adjustments once the timing is set.

Initial timing and spark advance may also be read from a scan tool, computerized engine analyzer, or service-bay diagnostic computer.

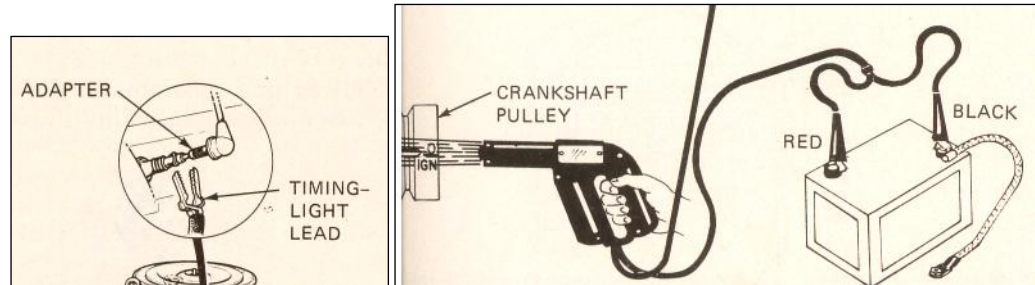


Fig. 1 A timing light is used to check ignition timing

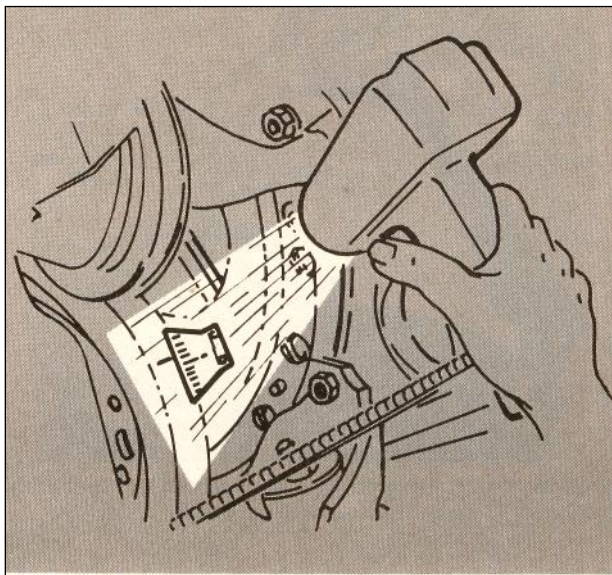


Fig. 2. The timing light flashes every time the No 1 spark plug fires.

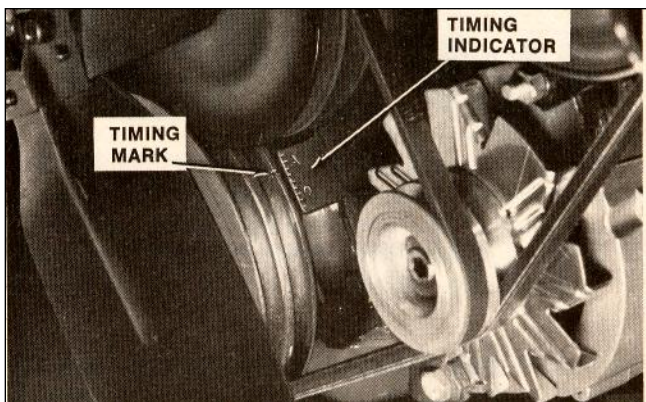


Fig. 3 Ignition timing marks on the crankshaft pulley

TABLE 1 (TYPICAL ENGINE ANALYSIS RESULT) shows a typical values read by ignition analyser. Diagnostic report is a comprehensive vehicle health report that reveals faults or failures detected in the ECU.

DATE : 08/10/2001 TIME : 16:46:29 MECHANIC :								
OWNER :								
VEHICLE: PREMIER 118NE REGN. NO :								
K.M.RUN :								
TEST		MEASURED VALUES		SPECIFICATIONS		RESULT		
BATTERY PARAMETERS								
NORMAL VOLTS		12.9 V (Engine OFF)		> 12.0 V		OK		
CRANKING VOLTS		9.8 V @ 370 RPM		>9.0 V		OK		
CHARGING VOLTS		13.8 V @ 2240 RPM		13.2 - 14.8 V		OK		
CRANKING CURRENT		67 A @ 370 RPM		70 - 130 A		OK		
CHARGING CURRENT (After 15 secs)		32 A @ 2240 RPM 9 A @ 2240 RPM		>5 A <32 A		OK OK		
COIL, SWITCH & C.B								
COIL VOLTS		6.9 V		5.0 - 9.0 V		OK		
SWITCH DROP		N/A		N/A				
C.B VOLTS		0.0 V		0.0 - 1.4 V		OK		
IDLE RPM		1004 RPM		700 - 900 RPM		CHECK		
ADVANCE ANGLE		11.5 Deg @ 1004 RPM		9.0 - 11.0 Deg		CHECK		
	HT FIRING VOLTS (Kv)		DWELL ANGLE (Deg)		DWELL VARI- ATION (Deg)		POWER BALANCE IN (%) DROP	
SPEC	3.0 - 11.0	RESLT	57.0 - 63.0 @ 800 RPM	RESLT	0.0 - 3.0	RESLT	7.0 - 23.0	RESLT
CYL-1	5.6	OK	43.2° @ 1004 RPM	CHECK	0.2°	OK	18.3	OK
CYL-2	5.8	OK	44.2° @ 1004 RPM	CHECK	0.2°	OK	20.0	OK
CYL-3	5.4	OK	43.2° @ 1004 RPM	CHECK	0.2°	OK	23.4	OK
CYL-4	5.1	OK	40.2° @ 1004 RPM	CHECK	0.2°	OK	14.2	OK
CYL-5								
CYL-6								
CYL-7								
CYL-8								
AUTO MASTER, DIESEL Version - 2.10, 23/05/2000 MANATEC AUTOMATIONS PVT. LTD. PONDICHERY - 605 009, INDIA PHONE: 250926,251058 FAX: 91-0413-252634, TELEX: 0469-302 MANA IN								



(6) An engine when tested by Ignition Analyser provided following results. Draw conclusion on the data and give correct range of values.

No of cylinder	HT firing Voltage (Kv)		Conclusion	Correct Values
1	6.5			
2	6.2			
3	5.8			
4	6.1			
	Dwell Angle			
1	46.5			
2	41.5			
3	38.0			
4	42.4			
Ignition Advance				
a	8 Degree at 900 rpm			
b	12 Degree at 2500 rpm			
Idle rpm				
	1300			

#### SETTING OF IGNITION TIMING

- 1) To check the Ignition Timing of a given petrol engine or vehicle.
- 2) To set proper Ignition Timing on a given petrol engine or vehicle.

### Equipments:

- 3) A live test engine with a good battery (on a test stand or a vehicle)
- 4) Timing Light
- 5) Hand tools, leads and cables.
- 6) Scan Tool for distributor less Electronic Ignition engines

### Safety precautions:

- 1) H.T. voltage produced by the ignition is not necessarily dangerous but gives unpleasant shocks. Avoid touching high voltage circuit parts, when the systems is in operation.
- 2) Keep hands clear off fan, fan belt, and other moving parts of engine or machine.
- 3) Before starting an engine check to make sure that no petrol is leaking from fuel system.
- 4) When connecting a timing light, always connect the leads to the battery first. Then make the connection to the No. 1 spark plug.
- 5) When disconnecting the timing light, always disconnect timing light lead from the No. 1 spark plug first. Then disconnect the battery leads, otherwise you are apt to get a high voltage shock when you touch the battery connection.