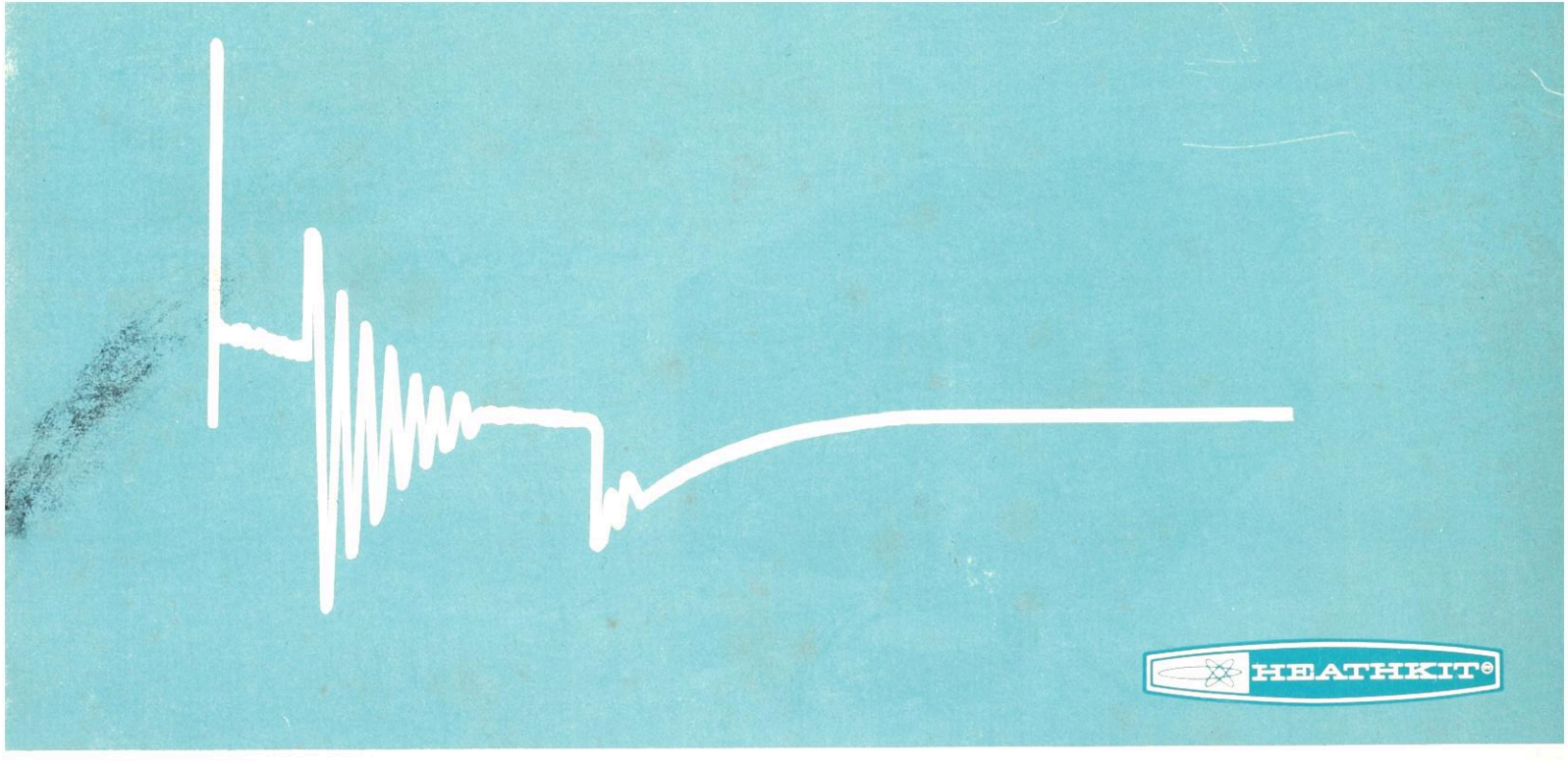


OPERATION HANDBOOK

for the

HEATHKIT SOLID-STATE IGNITION ANALYZER

Model CO-1015

595-1458-04

Operation

of the

HEATHKIT

IGNITION ANALYZER

MODEL CO-1015

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

TABLE OF CONTENTS

INTRODUCTION

This Handbook provides you with the basic information to test and analyze ignition systems with your Heathkit Solid-State Ignition Analyzer. This Analyzer presents a visual display of the ignition system so you can pinpoint electrical problems. A built-in Tachometer indicates engine speed up to 5000 rpm.

With only a few simple connections made to an operating engine, your Analyzer can test for:

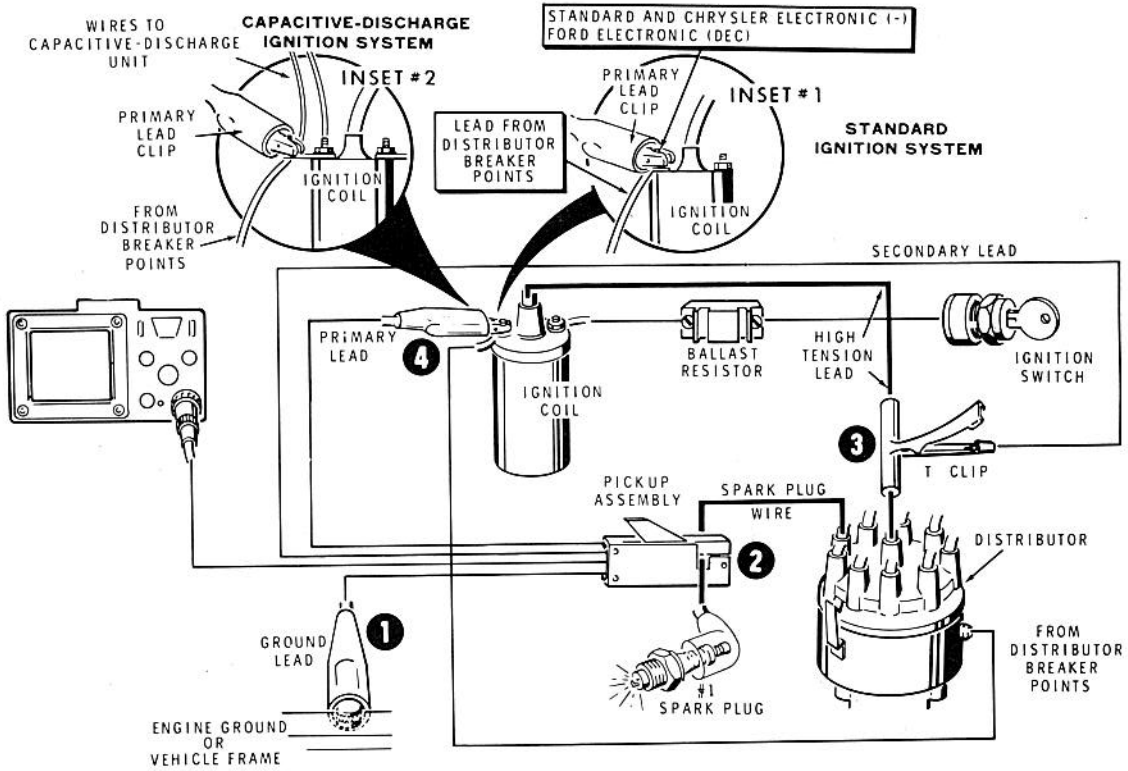
- Shorted or open plugs
- Shorted or open wires
- Close or enlarged gaps
- Fouled plugs
- Resistive plugs or wires
- Defective coils or condensers
- Defective or misadjusted points
- Cam wobble
- Defective distributors

and many, many more problems that are common to ignition systems.

Since this Handbook contains only the basic knowledge that you will need for an analysis, it is most important that you read and understand the information presented in "Introduction to Ignition Analysis," contained in your Assembly Manual.

Keep this Handbook with your Analyzer at all times. It is printed on a grease-resistant material that can be wiped clean, and in a size that will fit under the handle of your Analyzer.

NOTE: Tune-up specifications can be found in your car's Owners Manual, or you can obtain a specification book from your local automotive parts store.


WIRES TO CAPACITIVE-DISCHARGE UNIT
CAPACITIVE-DISCHARGE IGNITION SYSTEM
INSET #2
PRIMARY LEAD CLIP
IGNITION COIL
FROM DISTRIBUTOR BREAKER POINTS
STANDARD AND CHRYSLER ELECTRONIC (-)
FORD ELECTRONIC (DEC)
LEAD FROM DISTRIBUTOR BREAKER POINTS
PRIMARY LEAD CLIP
INSET #1
IGNITION COIL
STANDARD IGNITION SYSTEM
SECONDARY LEAD
PRIMARY LEAD
4
IGNITION COIL
BALLAST RESISTOR
HIGH TENSION LEAD
IGNITION SWITCH
3
T CLIP
PICKUP ASSEMBLY
SPARK PLUG WIRE
2
DISTRIBUTOR
GROUND LEAD
1
#1 SPARK PLUG
FROM DISTRIBUTOR BREAKER POINTS
ENGINE GROUND OR VEHICLE FRAME

PICTORIAL 1

CONNECTION PROCEDURE

Refer to Pictorial 1 for the following steps.

Connect the cable connector to the Analyzer.

1. Clip the ground lead (black) coming from the pickup assembly to chassis ground.

2. Clamp the pickup assembly around the #1*spark plug wire, preferably away from other spark plug wires. CAUTION: Do not allow the pickup trigger to snap shut. In time, this could dislodge the powdered iron core in the clamp end of the trigger.

NOTE: If you are testing a Delco High Energy Ignition (HEI) system, disregard steps 3, 4, and the Note that follows and proceed to "High Energy Ignition (HEI) System."

3. Clip the T clip over the insulation of the high-tension lead.

*This connection starts the "parade" pattern with the #1 cylinder. The remaining cylinder patterns are displayed in their normal firing order. For example, on a 6-cylinder engine with a firing order of 1-5-3-6-2-4, the parade pattern on the CRT screen is displayed in the same order. On this same engine, if the pickup assembly is clamped around the #3 spark plug wire, the "parade" pattern starts with the #3 cylinder, and is displayed on the CRT screen in a 3-6-2-4-1-5 order. Only the display sequence of the firing patterns is changed.

4. The remaining connection (primary lead) depends on the type of ignition system being tested. Use only the instruction that agrees with your system.

NOTE: The primary lead clip should be connected to the distributor breaker points. This may be an external terminal on some distributors, while on others it may be the end of the pig-tail lead from the distributor to the ignition coil. CAUTION: Do not use the insulation piercing feature of the primary lead clip unless it is impossible to make any other connection to the distributor breaker points.

Standard Ignition System: Clip the primary lead clip to the breaker points terminal on the distributor or at the coil end of the connecting wire or pig-tail lead. (See inset drawing #1.)

Ford Electronic Ignition System: Clip the primary lead clip to the "DEC" terminal on the coil.

Chrysler Electronic Ignition System: Clip the primary lead clip to the negative (–) terminal on the coil.

Capacitive-Discharge Ignition System: Clip the primary lead clip to the breaker points terminal on the distributor or to the end of the lead coming from the distributor. Do not connect the primary lead to the ignition coil terminal. (See inset drawing #2.)

High Energy Ignition (HEI) System

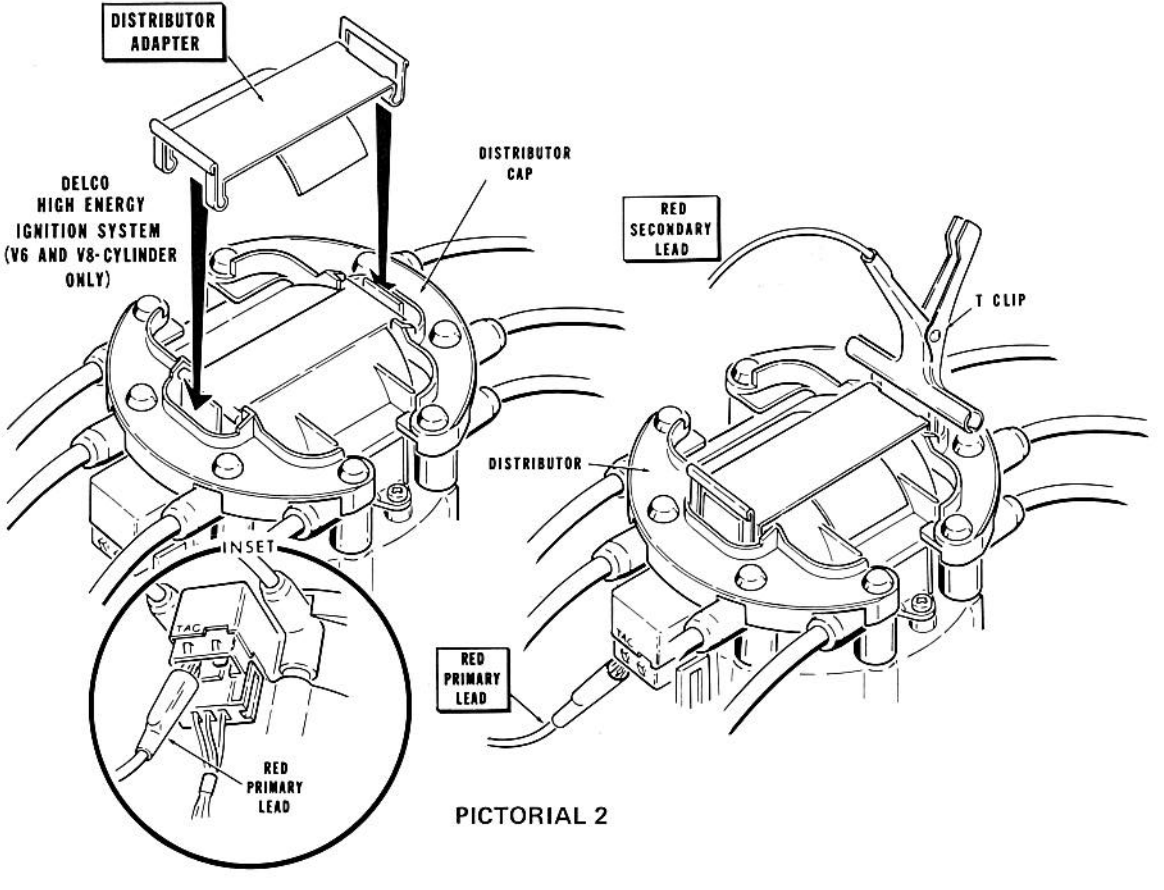
Refer to Pictorial 2 as you perform the following steps.

1. Snap the distributor Adapter into place on top of the distributor cap.

   Clip the black lead coming from the pickup assembly to a good engine ground.

2. Clip the secondary lead T clip to the Distributor Adapter.

3. Clip the primary lead clip to the TACH terminal on the distributor. NOTE: If you have a factory-installed tachometer, it must be disconnected at the distributor before you can connect the primary lead.


DISTRIBUTOR ADAPTER
DELCO HIGH ENERGY IGNITION SYSTEM (V6 AND V8-CYLINDER ONLY)
DISTRIBUTOR CAP
RED SECONDARY LEAD
T CLIP
DISTRIBUTOR
INSET
RED PRIMARY LEAD
RED PRIMARY LEAD

PICTORIAL 2

PREOPERATION ADJUSTMENTS

1. Push the POWER switch to the OFF position.
2. Push the TAC switch to the LO position.
3. Plug the line cord into an ac outlet of the proper voltage, 120 or 240 Vac.
4. Push the POWER switch to the ON position. The POWER light should turn on and the Meter indicator should momentarily read full scale. This is normal.
5. Turn the SELECTOR switch to the CAL position.
6. Allow two to three minutes warmup time.
7. Push the HORIZ POS control to the IN position.
8. Turn the HORIZ POS control until the trace is horizontally centered on the screen.
9. Push the VERT POS control to the IN position.
10. Turn the VERT POS control until the trace is vertically centered on the screen.
11. Pull or push the HORIZ EXP control to match the number of cylinders in the system being tested.
12. Turn the HORIZ EXP and HORIZ POS controls as necessary to adjust the length of the trace to match that of the dwell angle scales.

TACHOMETER

The Tachometer circuit functions in all operating modes except Parade. Setting the TAC switch selects the Tachometer range. In the HI position, readings are from 0 to 5000 rpm; in the LO position, readings are from 0 to 1000 rpm.

With the HORIZ EXP knob pushed in, the Tachometer is calibrated for 4- or 8-cylinder engines; with the knob pulled out, the Tachometer is calibrated for 3- or 6-cylinder engines.

NOTE: For 3- or 4-cylinder engines, the Tachometer meter reading must be doubled to get the correct engine rpm.

IGNITION TEST PROCEDURE

1. Connect Analyzer to ignition system.

2. Make Preoperation adjustments to Analyzer.

WARNING: Before you start the engine in the next step, be sure the pickup cable and its leads and clips are away from the engine cooling fan, drive belts and pulleys, and exhaust manifold.

3. Start engine and adjust to fast idle.

4. Adjust controls to give superimposed secondary pattern.

5. Compare pattern obtained with that of normal pattern.

6. Determine if any difference in patterns is:

   a. Common to all cylinders.
   b. Common to less than all cylinders.

7. Locate trouble zone and possible cause of difficulty by close study of pattern and comparison with pattern interpretation charts on following pages.

8. Make necessary repair (s).

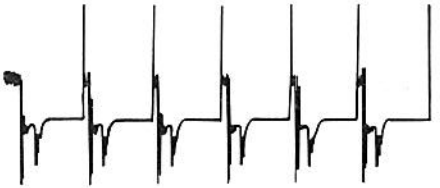
9. Recheck work with Analyzer.

NORMAL PATTERNS

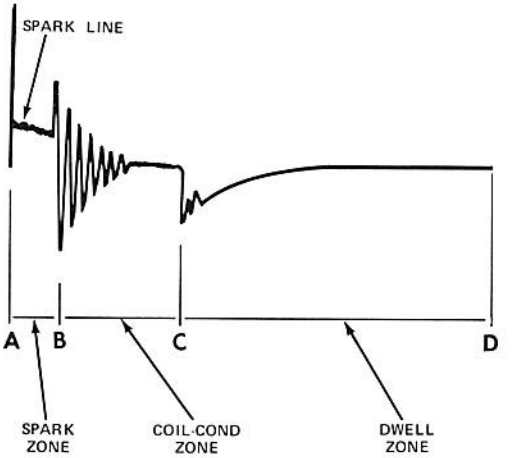
NOTES:

1. The patterns shown on the following pages of this Manual are drawings made from retouched photographs of patterns actually observed on the screen of the CRT.
2. Your Ignition Analyzer will display either the secondary pattern (obtained at the high tension lead) or the primary pattern (obtained at the distributor primary terminal of the coil). However, because the secondary pattern is generally the most informative for showing overall ignition system operation, only secondary patterns will be used in the following pattern displays.

Standard And Ford Electronic Ignition Systems

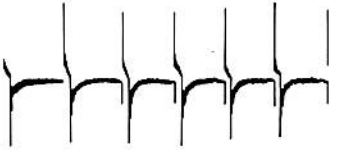


NORMAL PARADE PATTERN

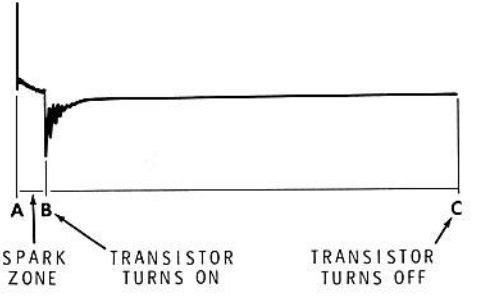


NORMAL SUPERIMPOSE PATTERN

Chrysler Electronic Ignition System



NORMAL PARADE PATTERN

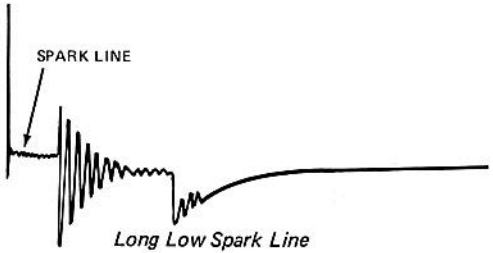


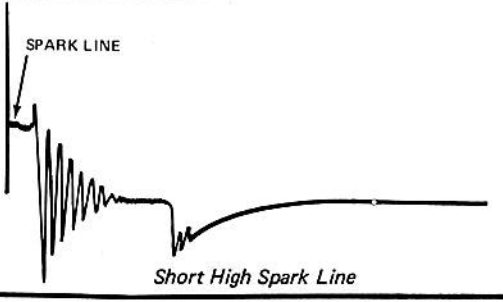
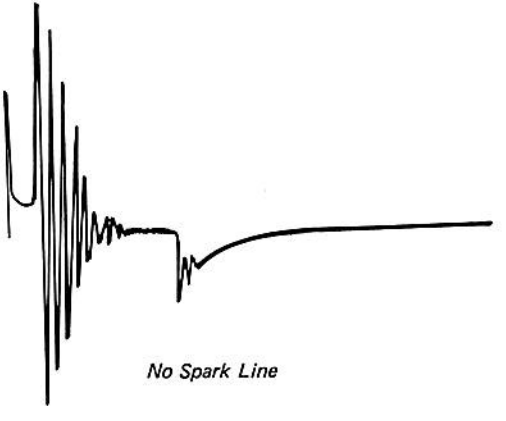
NORMAL SUPERIMPOSE PATTERN

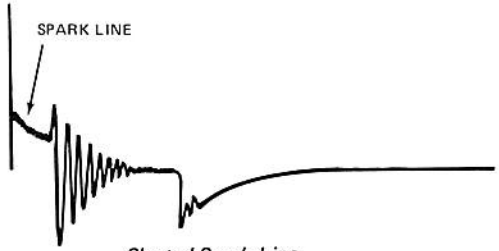
NOTE: The normal patterns for Capacitive Discharge ignition systems are on Page 19 of this Handbook.

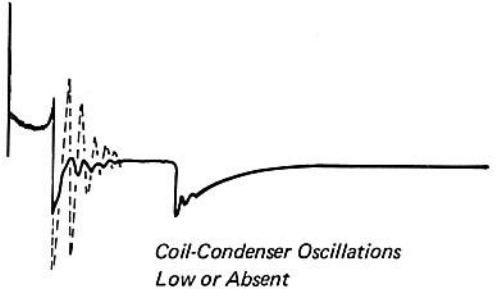
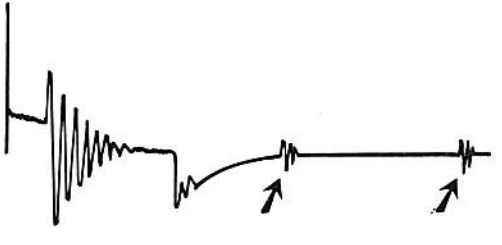
TYPICAL IGNITION PROBLEMS

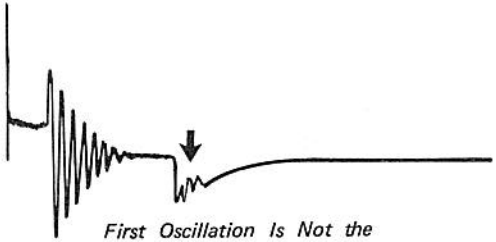
NOTE: Since there are only slight differences between Standard and Chrysler ignition system patterns, only Standard ignition system patterns are shown in the following pattern displays.

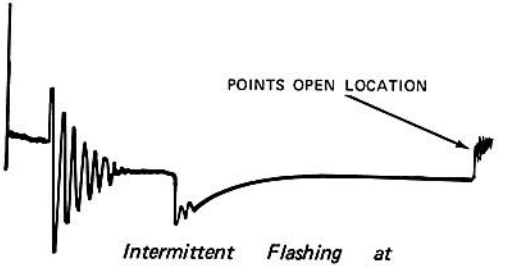
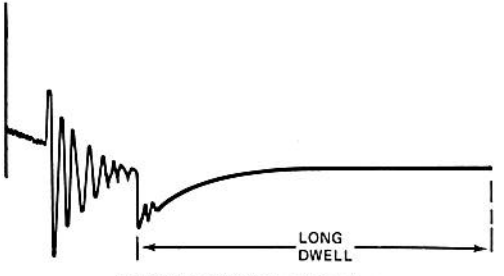
IMPROPER WAVEFORM	POSSIBLE CAUSE
 *Long Low Spark Line*	1. Shorted plug. 2. Fouled plug. 3. Close gap.

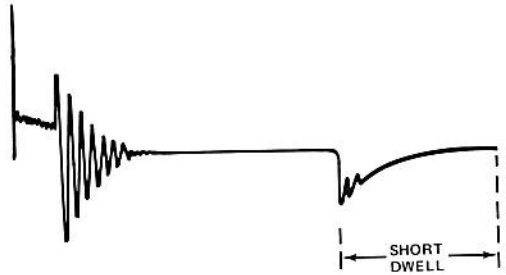
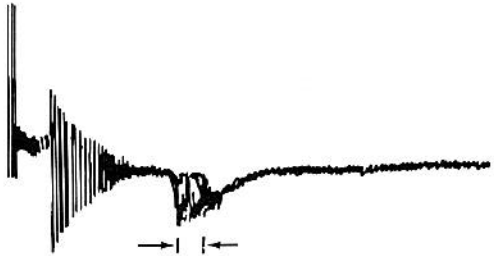
IMPROPER WAVEFORM	POSSIBLE CAUSE
 *Short High Spark Line*	1. Spark plug gapped too wide. 2. Burned open area or broken core in resistance wire to spark plugs. 3. Excessive gap between end of rotor and spark plug wire contact in distributor cap.
 *No Spark Line*	1. Open plug. 2. Open wire. 3. Defective distributor.

IMPROPER WAVEFORM	POSSIBLE CAUSE
 *Slanted Spark Line*	1. Resistive plug. 2. Resistive wire.
 *Broken Spark Line*	1. Defective Distributor Rotor.

IMPROPER WAVEFORM	POSSIBLE CAUSE
 *Coil-Condenser Oscillations Low or Absent*	1. Defective condenser. 2. Defective coil.
 *Random Flashes*	1. Loose connection in primary circuit. May be anywhere between breaker points in distributor and battery.

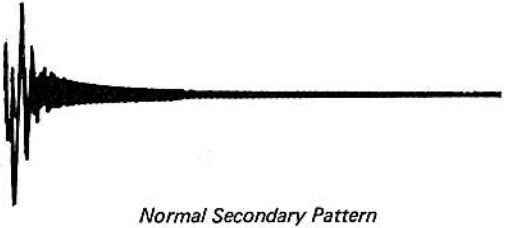
IMPROPER WAVEFORM	POSSIBLE CAUSE
 *Jittery Pattern*	1. Loose or corroded high-tension lead.
 *First Oscillation Is Not the Largest in "Points Close" Signal.*	1. Points not closing properly.

IMPROPER WAVEFORM	POSSIBLE CAUSE
 *Intermittent Flashing at Points Open Location.*	1. Points arcing.
 *Improper Setting of Breaker Points.*	1. Check specifications and set accordingly.

IMPROPER WAVEFORM	POSSIBLE CAUSE
 *Improper Setting of Breaker Points.*	1. Check specifications and set accordingly.
 *Degrees of Variation Greater Than Manufacturer's Specifications.*	1. Excessive cam wobble.

NORMAL PATTERNS FOR CAPACITIVE-DISCHARGE IGNITION SYSTEMS

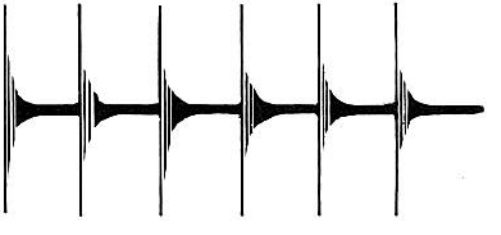
Normal Breaker Points Pattern.



Normal Secondary Pattern

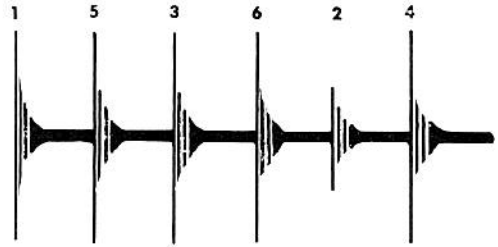
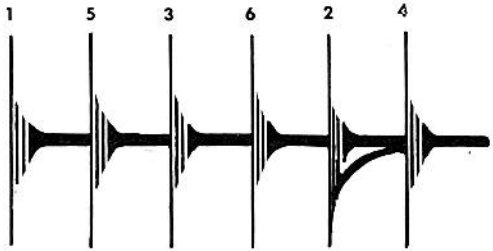
SUPERIMPOSED PATTERNS

Normal Breaker Points Pattern.



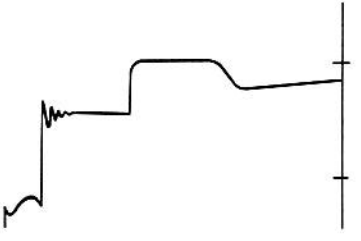
Normal Secondary Pattern

PARADE PATTERNS

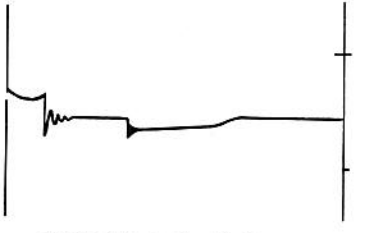
IMPROPER WAVEFORM	POSSIBLE CAUSE
 *Cylinder #2 Pattern Displaced.*	1. Shorted spark plug.
 *Cylinder #2 Pattern Displaced Above or Below Other Patterns.*	1. Spark plug not firing. 2. Open plug. 3. Open spark plug wire.

NORMAL PATTERNS FOR HIGH ENERGY IGNITION SYSTEMS

NOTE: Refer to the Standard Ignition System charts for troubleshooting.

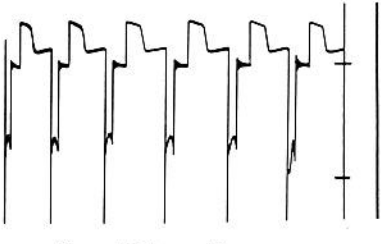


Normal Primary Pattern

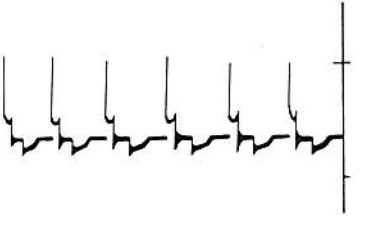


Normal Secondary Pattern

SUPERIMPOSED PATTERNS



Normal Primary Pattern



Normal Secondary Pattern

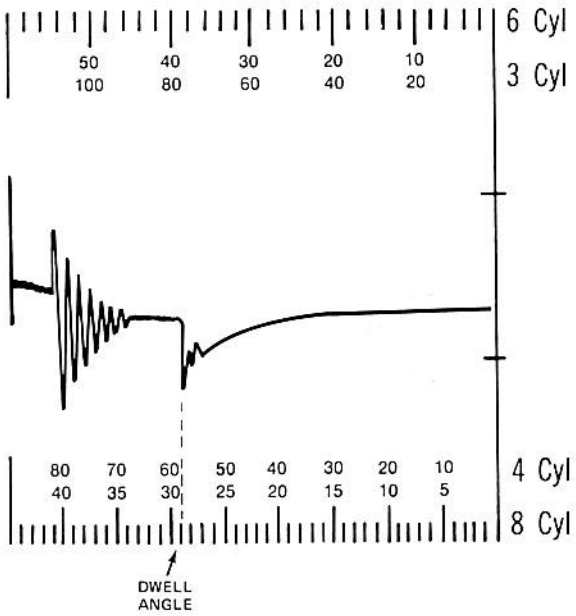
PARADE PATTERNS

DWELL ANGLE

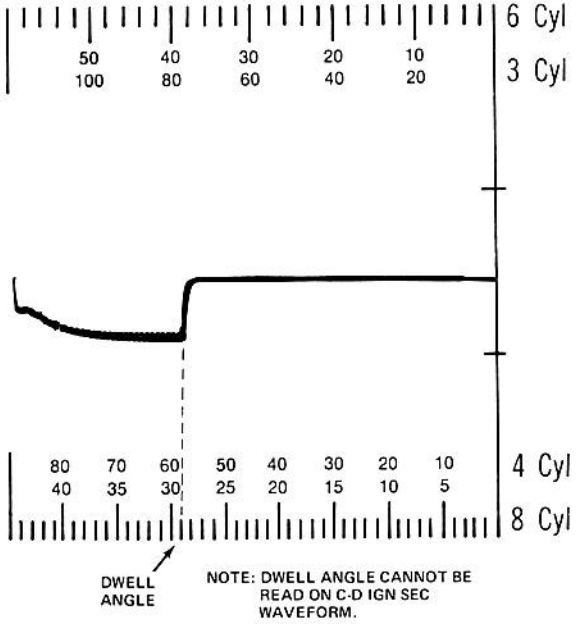
Adjust the VERT POS, HORIZ POS, and HORIZ EXPAND controls so the waveform starts on the left-hand mark and ends on the right-hand mark on the graticule. The Analyzer is now calibrated to read dwell angle directly on the appropriate scale. Read the dwell angle on the scale which corresponds to the number of cylinders of the engine under test.

NOTE: Dwell is nonadjustable on the Ford and Chrysler Electronic Ignition Systems.

Standard Ignition Secondary



Capacitive-Discharge Primary



MAGNETO IGNITION SYSTEMS

MAGNETO IGNITION SYSTEMS

Most two cycle and small four cycle engines use a magneto type ignition system to eliminate using a battery. This type of engine is commonly used on lawn mowers, boats, and chain saws.

The operating principle of a magneto ignition system is primarily the same as the battery supply ignition system. The magneto system uses a coil, condenser, and breaker points. The breaker points are not always accessible; therefore, it is often impractical to obtain primary patterns. As stressed earlier, the secondary pattern is usually used instead of the primary in engine testing since it is more informative.

If the magneto system utilizes a distributor for multicylinder engines, the connections should be made in the same manner as for a standard coil-distributor type system.

In the more common magneto type engine, separate breaker points are used for each cylinder. Therefore, each cylinder spark cycle must be individually viewed for multicylinder engines. Connections to this type system are made by connecting both the pickup assembly and the T clip to the spark plug wire of the cylinder you wish to check. The ground clip is fastened to the engine block, and the insulation piercing clip is not used.

The patterns that you observe will usually correspond to those found in a battery supplied system. Troubles common to both types of systems will give similar deviations and variations of the patterns.

If it is necessary to observe a parade pattern in a multicylinder engine that does not have a distributor, each spark plug wire can be jumpered together with clips similar to the T clip. This effectively connects the T clip to all cylinders so that each spark plug firing will be shown for every ignition cycle.

HEATH COMPANY

BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.