CAUTION: READ INSTRUCTIONS CAREFULLY BEFORE STARTING INSTALLATION

INTRODUCTION

The HI-4 ignition system is intended for use with Harley-Davidson® motorcycles. The HI-4 replaces the original equipment (OE) electronic ignition system on 1978 and later models as well as the points and mechanical advance on early models. HI-4 Single Fire Race Ignitions (P/N 8-2100 ignition module only and P/N 8-4100 ignition kit) are true single fire, even at cranking speed. Each cylinder is fired independently and only on the compression stroke. Single fire operation increases engine power at high RPM, improves starting, and reduces the likelihood of backfiring at low RPM.

WARNING: 1996 and later models have a vehicle tilt sensor that shuts off the ignition if the motorcycle rolls on its side. This feature is disabled when the HI-4 ignition is installed.

The HI-4 features state-of-the-art RISC microcontroller technology that allows adjustable advance and rev limit. A timing LED indicates static timing (top dead center) and gives diagnostic information. Two starting modes are provided: electric start and kick start. A tach output gives accurate tach readings even at the rev limit.

NOTE: The HI-4 Single Fire Race Ignition is for off road racing and early OE points applications only.

ADDITIONAL REQUIRED PARTS

FX series Big Twin® and XL series Sportster® models prior to 1984, FL series Big Twin® models prior to 1985, and all models with OE points will require OE timing rotor P/N 32402-83. This part is not included with the HI-4 installation kit and can be purchased from your local dealer.

COIL AND SPARK PLUG CABLE CONSIDERATIONS

We recommend replacing the OE coil. Coils used with the HI-4 must have at least 2 ohms primary resistance. Coils with 4 ohms or higher may be used, but may not produce optimum output. We recommend the following coils for single and dual-plug applications:

HI-4 Ignition With Single Plug Heads. Use Crane 8-3001 coil. This is a “Siamese” coil with two independent sections and will fit in the stock mounting location on most H-D® motorcycles. You can also use two dual spark tower coils and ground one of the towers on each coil to the engine case or frame. You will have to fabricate a bracket to mount the second coil.

HI-4 Ignition With Dual Plug Heads. Use two Crane 8-3006 coils. You will have to fabricate a bracket to mount the second coil.

Crane FireWire spiral core wires are recommended for maximum performance. Do not use solid copper spark plug cables; they may cause interference with your ignition system and accessories.

REMOVAL OF POINTS IGNITION - EARLY MODELS PRIOR TO 1978

1. Turn ignition switch off and disconnect battery ground cable. Disconnect wire going from breaker points to Coil – (negative) terminal.
2. Refer to Figure 1. Remove ignition cover plate, gasket, and hardware (items 1-3). Save these items for later re-use.
3. Note location of breaker plate. There is a V notch in the breaker plate used for alignment. When you install the HI-4, align the V notch in the same location. This should set the timing close enough to start the engine. Remove and save the two stand-offs and washers (items 4-5). Remove the breaker plate assembly, wiring, cam, and advance assembly (items 6-10).
REMOVAL OF OE ELECTRONIC IGNITION SYSTEM - 1978 AND 1979 MODELS

1. Turn ignition switch off and disconnect battery ground cable.

2. Refer to Figure 2. Disconnect wires going from ignition module (item 3) to coil (14).

3. Remove ignition cover plate and hardware (items 1 and 2). Save these items for later re-use. Remove ignition module (3).

4. Note location of timer plate (10). There is a V notch in the timer plate used for alignment. When you install the HI-4, align the V notch in the same location. This should set the timing close enough to start the engine. Remove and save the two standoffs and washers (items 4-5). Remove the sensor, shield, timer plate, trigger rotor, and advance assembly (items 6-12).

HI-4 INSTALLATION

Refer to Figure 4. The HI-4 requires OE timing rotor P/N 32402-83. Check your rotor (9) for correct part number. For models prior to 1980, use the supplied 10-32 x 3/4" bolt and washer to mount the rotor.

1. Install HI-4 system in place of OE breaker or sensor plate. Rotate the HI-4 about 90 degrees to give better access to the cable exit hole in the gear case cover. On some early models it may be necessary to enlarge this hole. Install the HI-4 first, then push the cable through the hole. Align the V notch on the HI-4 same as the OE plate you removed. Use the OE standoffs to secure the HI-4. You must use lock washers under the standoffs for proper clearance between the HI-4 and cover plate. Do not fully tighten the standoffs until the timing has been set.

2. Route the HI-4 harness along the frame rails to the coil. Make sure that harness will not be chafed or burned by exhaust heat. Secure harness with tie wraps. Do not install timing cover.

REMOVAL OF OE ELECTRONIC IGNITION SYSTEM - 1980 AND LATER MODELS

1. Turn ignition switch off and disconnect battery ground cable.

2. Refer to Figure 3. Remove OE ignition module and wire harness (items 1-4). You will disconnect two wires at the coil, wire going to the VOES (Vacuum Operated Electrical Switch), ground wire at the module, and the 3 pin plug (20) that connects to the sensor plate. Refer to shop manual for locations.

3. Remove ignition cover plates and gasket (items 5-9). This will require drilling out two rivets. The rivets will later be replaced with two supplied self threading screws.

4. In order to remove the sensor plate cable, the cable plug (20) must be removed first. Use needle nose pliers to pull the terminals out of the plug. Then pull the cable through the exit hole at the bottom of the timing cover.

5. Note location of sensor plate (11). There is a V notch in the sensor plate used for alignment. When you install the HI-4, you should align the V notch in the same location. This should set the timing close enough to start the engine. Remove and save the two standoffs and washers (10). Remove the sensor plate (item 11).
**HI-4 HOOKUP**

Crimp terminals and hardware are supplied for your convenience. Use the ring terminals for coil hookup. Use male-female quick disconnects for connections to the tach and vacuum switch (VOES). Tape up unused wires.

**NOTE: Damage will result if the brown tach wire comes in contact with +12V.**

1. Identify switched +12 volt wire and tach wire (if equipped) going to the coil. Refer to your service manual, or reconnect the battery and use a test light or voltmeter. The switched +12 volt wire will be hot when the ignition key is turned on.

2. Refer to Figure 5 or 6, depending on your application. Connect the HI-4 red wire and switched +12 volt wire to Coil + (positive).

3. Connect the HI-4 black wire to the Coil – terminal on the coil for the front cylinder.

4. Connect the HI-4 white wire to the Coil – terminal on the coil for the rear cylinder.

5. Connect the HI-4 green wire to the vacuum switch (Figure 3, item 18), if used.

6. Connect the HI-4 brown wire to the tach wire, if equipped with a tachometer. Tape up if unused.

7. The HI-4 is grounded via the timing housing; a separate ground connection is not required.

8. Reconnect battery ground cable. Verify proper ground connections to the frame and engine.

**VOES HOOKUP**

The OE vacuum switch (VOES) is normally an open circuit. Above 3-5 inch-Hg vacuum, the VOES closes and grounds the vacuum input on the OE module. This increases the total advance generated by the OE ignition module. Vacuum advance improves part throttle driveability and fuel economy. Connect the VOES to the HI-4 green wire as shown in Figures 5 and 6.
Figure 3. Harley-Davidson® 1980 and Later OE Electronic System

1. Screws (2)
2. Washers (2)
3. Ignition Module
4. Well Nuts (2)
5. Rivets (2)
6. Outer Cover
7. Inner Cover Screws (2)
8. Inner Cover
9. Gasket
10. Sensor Plate Screws & Washers (2 each)
11. Sensor Plate
12. Rotor Screw & Star Washer
13. Rotor
14. Gear Case Cover
15. Ignition Coil
16. Ignition Coil Terminal
17. Spark Plug Wires (2)
18. Vacuum Operated Electrical Switch (VOES)
19. VOES Connector
20. Sensor Connector

Figure 4. HI-4 Ignition System Installation

1. Buttonhead Screws (2)
2. Outer Cover
3. Inner Cover Screws (2)
4. Inner Cover
5. Gasket
6. Sensor Plate Screws & Washers (2 each)
7. HI-4 Unit
8. Rotor Screw & Star Washer
9. Rotor
10. Gear Case Cover
MODELS WITHOUT OE VACUUM SWITCH (VOES)

This includes most models prior to 1985. Fuel economy and driveability will be improved if you install a VOES and connect it to the HI-4 green wire as shown in Figures 5 and 6. We recommend you use H-D® VOES P/N 26566-91. If the VOES is not used, tape up the green wire.

HI-4 SETUP AND OPERATION

Refer to the label on the HI-4. The unit has two DIP switches that select the advance curve and starting mode. The top switch sets the advance curve. Use the OEM with VOES advance curve for stock and modified engines with OE electronic or points ignition. Use the Race Only advance curve for high compression engines. The bottom switch sets the starting mode. Kick start mode fires the first cylinder for quick starting. Electric start mode delays firing for 2-3 revolutions of the crankshaft for smoother starts and less strain on the starter.

Trimpot setting is indicated by a slot that has two small dots on each side. Do not attempt to turn the trimpots past their limits.

NOTE: Each trimpot can be adjusted over a range of just under one turn. At the ends of the adjustment range, mechanical stops prevent further rotation of the trimpot.

The advance curve is adjustable over a limited range via the advance trimpot (SPK ADV). Advance curves are given in Figures 7 and 8. Each set of advance curves includes minimum and maximum curves. The actua-
al advance curve will be between the minimum and maximum curves depending on advance trimpot setting.

If you have a passenger or are using low octane gasoline, minimum advance will reduce spark knock. Maximum advance will give higher performance, but may require the use of high octane gasoline.

An additional trimpot (REAR CYL) is provided for rear cylinder timing offset over a +/-5 degree range. This feature allows slight offset of rear cylinder timing for critical race applications. Normally, the rear cylinder offset trimpot should be set to zero (midrange).

The RPM limit trimpot (REV LIM) is adjustable from 5,000 to 9,000 RPM. Use a safe RPM limit for your engine.

The HI-4 timing LED should light up when the ignition key is turned on. The timing LED will go off when the crankshaft is rotated past TDC. During cranking, the LED will blink.

**TIMING MARKS**

The TDC and advance timing marks are located on the flywheel and can be observed via an inspection hole (refer to shop manual for details). Refer to Figure 9 for typical timing marks. Early Style includes most 1980 and earlier models. Late Style includes most 1981-95 models. If the shop manual is not available, remove spark plugs, turn engine until front piston is at TDC on compression stroke and identify TDC mark on the flywheel. Refer to Figure 9 and find the diagram with a matching TDC mark. Use the corresponding advance mark shown in the diagram.

**NOTE: 1996 and later models (1995 and later for export models) have a timing mark at 20° BTDC for setting the timing with the OE ignition module. Do not use this mark for setting the timing on the HI-4. In most cases an additional mark will remain at 35° BTDC (see Figure 9). Use this mark to set the timing with a timing light as described below.**

**INITIAL STATIC TIMING PROCEDURE**

In most cases, aligning the V notch on the HI-4 plate to the same location as the OE plate will set the timing close enough to start the engine. If the engine will not start or runs very rough, you can use the following static timing procedure.
Remove spark plugs and turn engine until TDC mark appears in observation hole. Ground spark plugs with an alligator clip so you will not shock yourself. Turn on ignition. Loosen the standoffs holding HI-4 and rotate unit clockwise until timing LED goes out. The point at which LED goes off is TDC. Timing is now set approximately at TDC. Turn off ignition and reinstall spark plugs. Once the engine has been started, you must set the timing with a timing light.

**SETTING ADVANCE TIMING USING STANDARD TIMING LIGHT**

This timing procedure requires that a VOES switch be connected to the HI-4. For racing and early points applications without a VOES switch, you must ground the VOES input (HI-4 green wire) while setting the timing. Connect a timing light to the front cylinder. Set the HI-4 advance trimpot full clockwise for maximum advance. Run the engine at 2,500 RPM. Adjust HI-4 position until TDC timing mark is centered in the observation hole. You will now have the amount of advance you dialed into the timing light. Tighten the standoffs and verify that timing has not shifted. Most dial-back timing lights will be compatible with single fire systems.

**ADVANCE CURVE SETUP**

After you have set the timing as explained above, set the HI-4 advance trimpot to desired position. If you run 93 octane gasoline, you can usually leave the trimpot full clockwise for maximum advance and performance without spark knock. High compression engines may require less advance. You should use the Race Only advance curve for high compression engines.

**COVER PLATE ASSEMBLY**

You can re-use the OE hardware, except use the supplied Crane gasket to provide proper clearance for the HI-4. For models with a riveted outer cover, use the supplied self-threading screws in place of the rivets.

**TROUBLESHOOTING**

Did the engine run properly before installation of the HI-4? If not, remove the HI-4, reinstall the OE ignition or another known good unit and then find and correct the original problem. Did the HI-4 function correctly before the problem occurred? If the answer is yes, did you change anything that may have affected it? Try going back to the last setup that worked OK to help isolate the problem.

If the engine will not start, or runs rough or intermittently, use the following checklist steps:
ENGINE WILL NOT START
1. Check that timing LED lights up when ignition key is first turned on. If not, check for +12 volts on red wire from HI-4.

2. Check that timing LED blinks while engine is cranked. If not, HI-4 may be defective.

3. If the timing LED blinks, but engine will not start, recheck all wire harness connections or replace coil(s).

4. Check for low voltage from a faulty or marginal charging system and battery.

NOTE: The battery ground on most Harley-Davidsons® is connected to the frame behind the seat. In order to provide a dedicated ground for the high starter current, another cable should be installed from the point on the frame that the battery is already grounded to the starter mounting flange. This cable should be the same diameter as the battery ground cable presently on the bike, and will help prevent damage to your electronic components.

CHECKING FOR SPARK
To crank the engine and check for spark, use a KD Tools test plug or H-D® tool HD-26792. These test plugs come with an alligator clip that must be attached to frame or engine ground. Use a length of spark plug wire to connect the test plug to the coil.

WARNING: Never crank the engine with any spark plug wire disconnected.

MISFIRE OR INTERMITTENT OPERATION
Field experience has shown that popping back through the carburetor, misfiring, and intermittent failure (especially after the engine gets hot) are usually not caused by electrical problems within the HI-4. Carburetor problems, fouled spark plugs, coil failure, and loose wire harness connections are the most common culprits. Verify that spiral core or suppression type spark plug wires and resistor spark plugs are being used.

TACH INOPERATIVE
If the tach is inoperative after installation of the HI-4, you may require a tach adapter. The HI-4 tach output is compatible with ground sensing tachs which includes most OE and aftermarket tachs. Some tachs require a high voltage trigger pulse. In this case, install Crane tach adapter P/N 8-2050. Note that the tach will read correctly at the rev limit only if it is connected to the brown wire from the HI-4. Damage to the HI-4 circuitry may have occurred if 12 volts was applied to the brown tach wire at any time.

Figure 9. Top Dead Center (TDC) and Front Cylinder Advance Marks for Various Models