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Subject **Page**

GENERAL INFORMATION

Color Abbreviations

BL	**Blue**	**N**	**Natural**
BK	**Black**	**O**	**Orange**
BR	**Brown**	**PK**	**Pink**
DB	**Dark Blue**	**P**	**Purple**
DG	**Dark Green**	**R**	**Red**
GN	**Green**	**T**	**Tan**
GY	**Gray**	**W**	**White**
LB	**Light Blue**	**Y**	**Yellow**
LG	**Light Green**		

NOTE: Whenever a wire is labeled with two colors, the first color listed is the basic color of the wire, and the second color listed is the stripe marking of the wire.

How to Find Electrical Concerns

Troubleshooting Steps

These six steps present an orderly method of troubleshooting.

Step 1: Verify the concern.

- Operate the complete system to check the accuracy and completeness of the customer's complaint.

Step 2: Narrow the concern.

- Using a DVOM, narrow down the possible causes and locations of the concern to pinpoint the exact cause.

- Read the description about the components and study the wiring schematic. You should then know enough about the circuit operation to determine where to check for the trouble.

Step 3: Test the cause.

- Use electrical test procedures to find the specific cause of the symptoms.

Step 4: Verify the cause.

- Confirm that you have found the correct cause by connecting jumper wires and/or temporarily installing a known good component and operating the circuit.

Step 5: Make the repair.

- Repair or replace the inoperative component.

Step 6: Verify the repair.

- Operate the system as in Step 1 and check that your repair has removed all symptoms without creating any new symptoms.

Troubleshooting Tools

Jumper Wire

This is a test lead used to connect two points of a circuit. A Jumper Wire can bypass an open in a wire to complete a circuit.

WARNING: NEVER USE A JUMPER WIRE ACROSS LOADS (MOTORS, ETC.) CONNECTED BETWEEN HOT AND GROUND. THIS DIRECT BATTERY SHORT MAY CAUSE INJURY OR FIRE.

Voltmeter

A DC Voltmeter measures circuit voltage. Connect negative (- or black) lead to ground, and positive (+ or red) lead to voltage measuring point.

Ohmmeter

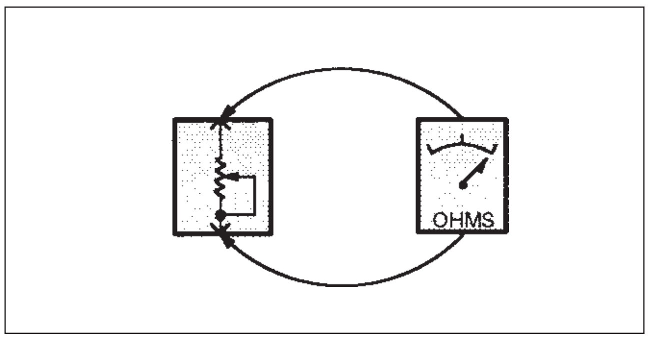


Figure 1 – Resistance Check

An Ohmmeter shows the resistance between two connected points (Figure 1).

Test Lamp

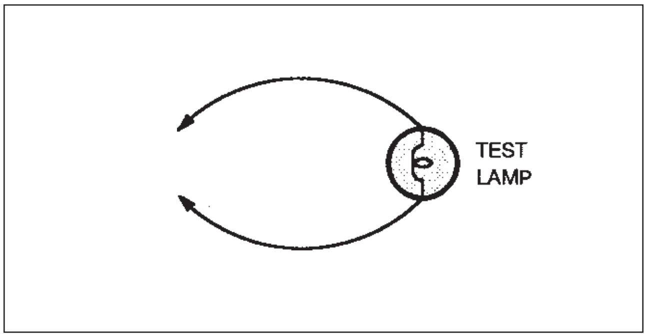


Figure 2 – Test Lamp

A Test Light is a 12-volt bulb with two test leads (Figure 2).

Uses: Voltage Check, Short Check.

Self-Powered Test Lamp

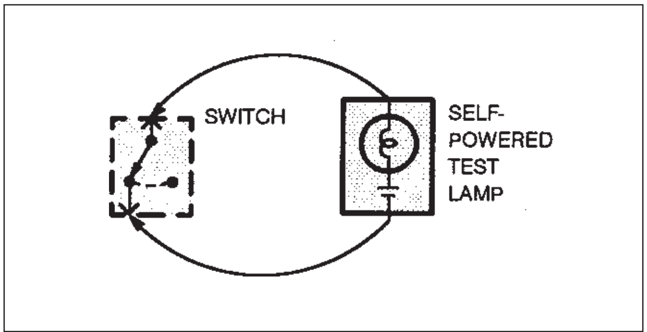


Figure 3 – Continuity Check

The Self-Powered Test Lamp is a bulb, battery and set of test leads wired in series (Figure 3). When connected to two points of a continuous circuit, the bulb glows.

Uses: Continuity Check, Ground Check.

CAUTION: When using a self-powered test lamp or ohmmeter, be sure power is off in circuit during testing. Hot circuits can cause equipment damage and false readings.

Switch Circuit Check & Voltage Check

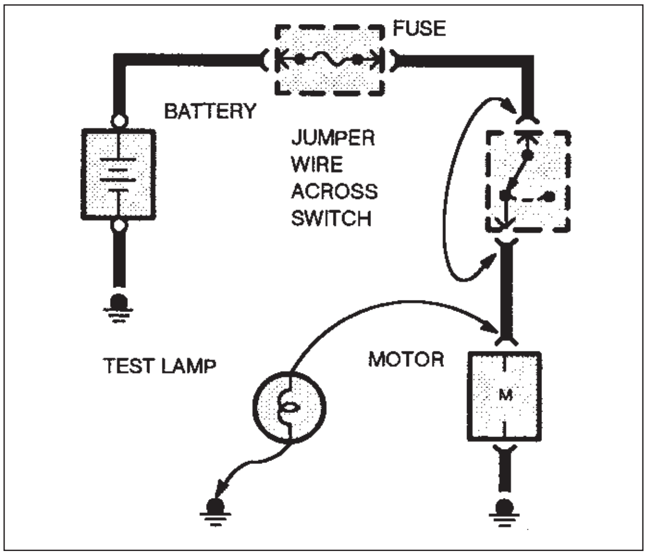


Figure 4 – Switch Circuit Check and Voltage Check

In an inoperative circuit with a switch in series with the load, jumper the terminals of the switch to power the load. If jumpering the terminals powers the circuit, the switch is inoperative (Figure 4).

Continuity Check (Locating open circuits)

Connect one lead of test lamp to a known good ground or the negative (-) battery terminal. Test for voltage by touching the other lead to the test point. The bulb goes on when the test point has voltage (Figure 4).

Short Check

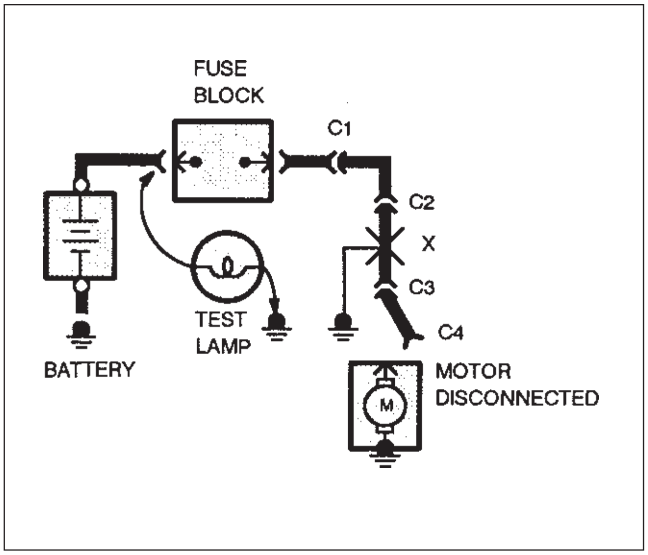


Figure 5 – Short Check

A fuse that repeatedly blows is usually caused by a short to ground. It's important to be able to locate such a short quickly (Figure 5).

1. Turn off everything powered through the fuse.

2. Disconnect other loads powered through the fuse:

   • Motors: disconnect motor connector (Connector C4 in Figure 5).

   • Lights; remove bulbs.

3. Turn the Ignition Switch to RUN (if necessary) to power fuse.

4. Connect one Test Lamp lead to the hot end of the blown fuse. Connect the other lead to ground. The bulb should glow, showing power to fuse. *(This step is just a check to be sure you have power to the circuit).*

5. Disconnect the test lamp lead that is connected to ground, and reconnect it to the load side of the fuse at the connector of the disconnected component. (In Figure 5, connect the test lamp lead to connector C4).

   • If the Test Lamp is off, the short is in the disconnected component.

   • If the Test Lamp goes on, the short is in the wiring. You must find the short by disconnecting the circuit connectors, one at a time, until the Test Lamp goes out. For example, in Figure 5 with a ground at X, the bulb goes out when C1 or C2 is disconnected, but not after disconnecting C3. This means the short is between C2 and C3.

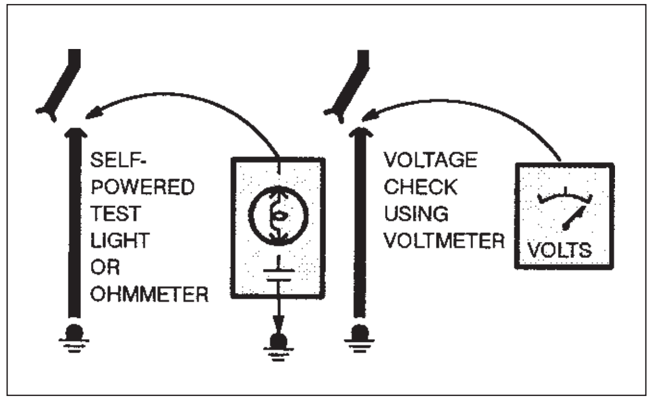


Figure 6 – Ground Check

Ground Check

Turn on power to the circuit. Perform a Voltage Check between the suspected inoperative ground and the frame. Any indicated voltage means that the ground is inoperative (Figure 6).

Turn off power to the circuit. Connect one lead of a Self-Powered Test Lamp or Ohmmeter to the wire in question and the other lead to a known ground. If the bulb glows, the circuit ground is OK (Figure 6).

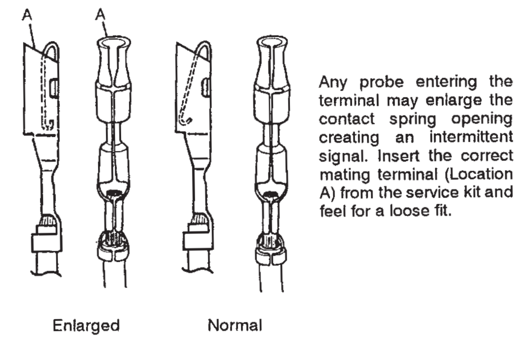
The circuit schematics in this manual make it easy to identify common points in circuits. This knowledge can help narrow the concern to a specific area. For example, if several circuits fail at the same time, check for a common power or ground connection. If part of a circuit fails, check the connections between the part that works and the part that doesn't work.

For example, if the low beam headlamps work, but the high beams and the indicator lamp don't work, then the power and ground paths must be good. Since the dimmer switch is the component that switches this power to the high beam lights and the indicator, it is most likely the cause of failure.

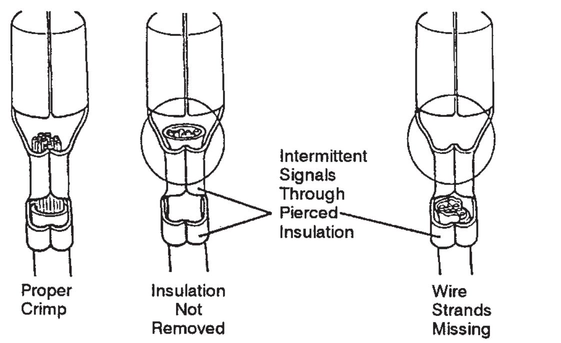
Troubleshooting Wiring Harness and Connector Hidden Concerns

The following illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

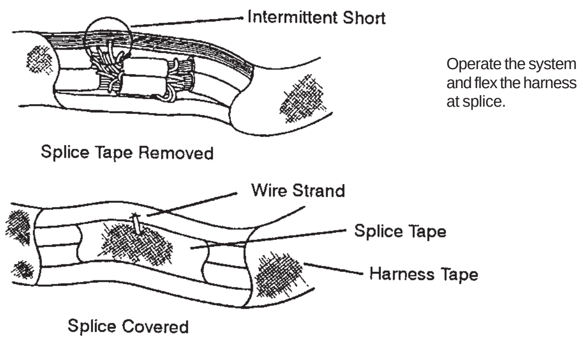
NOTE: When servicing gold plated terminals in a connector, only replace with gold plated terminals designed for that connector.



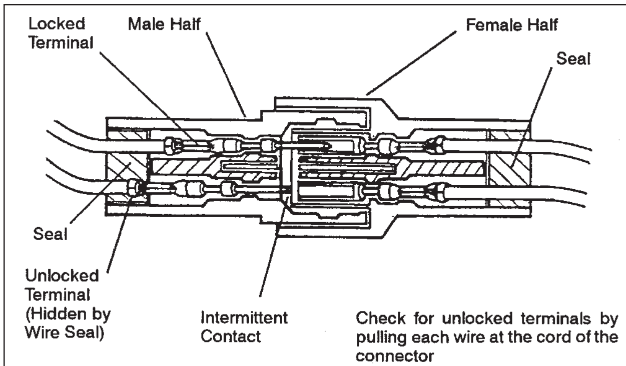
DEFORMED (ENLARGED) FEMALE TERMINALS



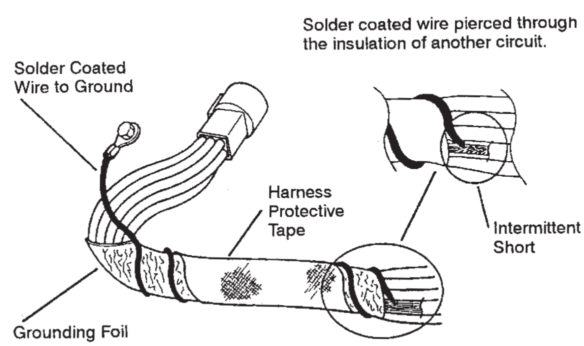
DEFECTIVE INSULATION STRIPPING



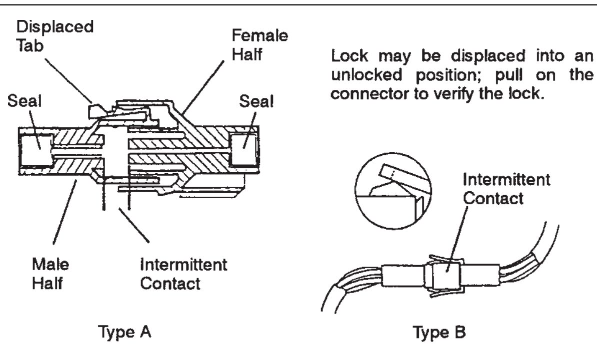
ELECTRICAL SHORT WITHIN THE HARNESS



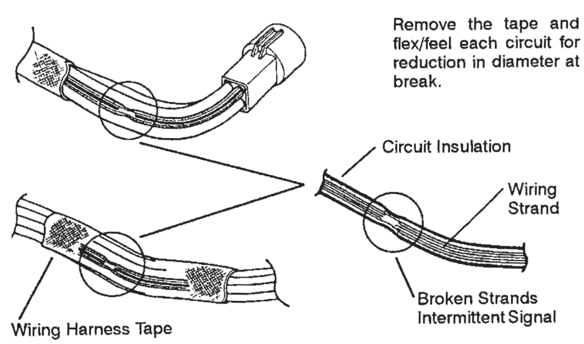
TERMINAL NOT PROPERLY SEATED



ELECTRICAL SHORT INSIDE THE HARNESS

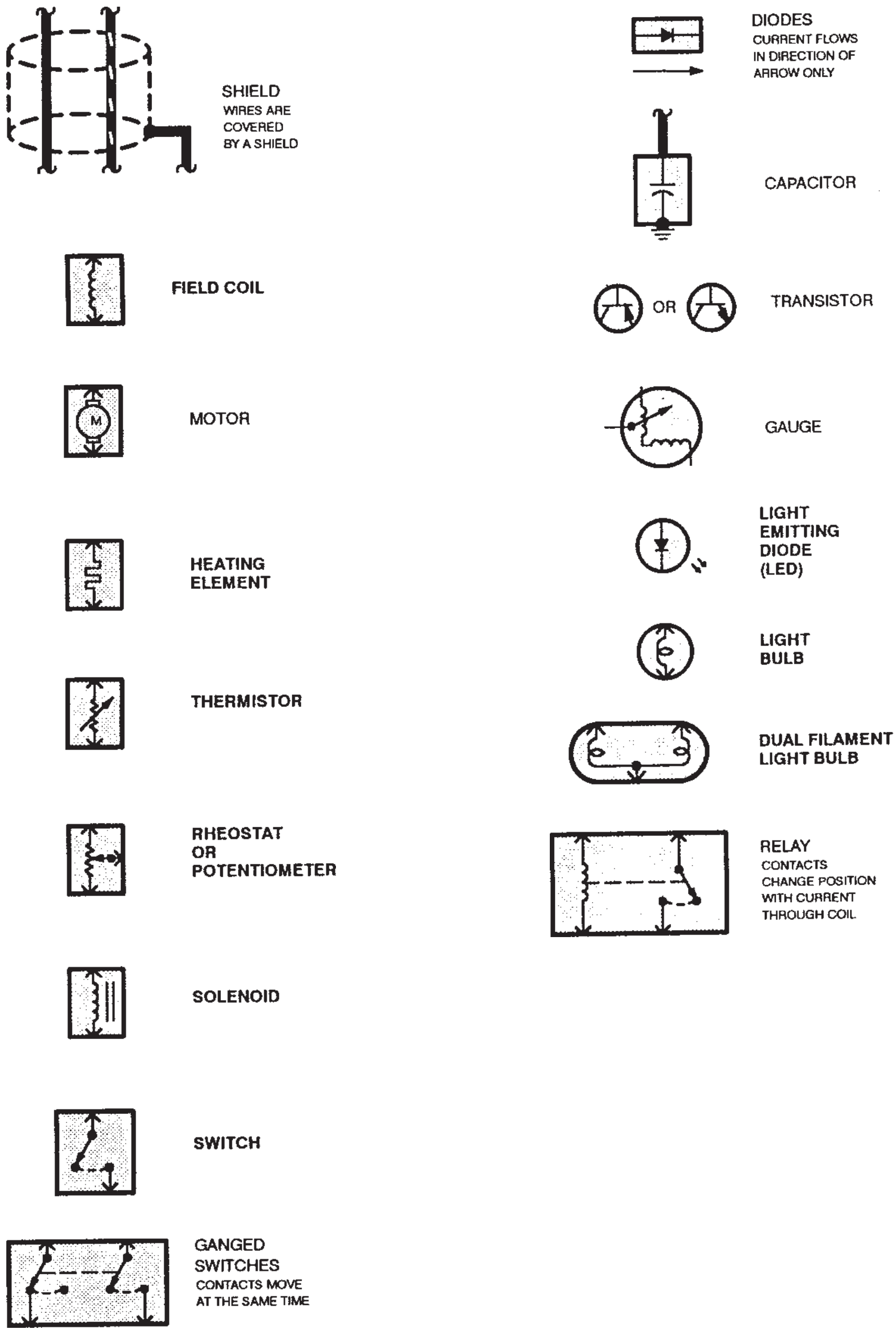


PARTIALLY MATED CONNECTORS



BROKEN WIRE STRANDS IN HARNESS

Electrical Symbols



WARNING: WHEN CARRYING OUT SERVICE OPERATIONS ON AN ENGINE EQUIPPED WITH DISTRIBUTORLESS IGNITION. FOLLOW ALL THE USUAL SAFETY MEASURES TO PREVENT THE POSSIBILITY OF ELECTRIC SHOCKS SHOULD BE FOLLOWED.

NOTE: High tension voltage produced by a distributorless ignition system is higher than for a conventional ignition system. It is in excess of 55,000 Volts.

Description

The WSG-1068 engine uses a Coil On Plug Ignition System to ignite the fuel/air mixture at the correct time and sequence based upon the input it receives. The brain of this system is an Ignition Control Module (ICM). The ICM has the capability at the OEM option to protect the engine from over heating and low oil pressure. Inputs are sensors or switches that feed the ICM information.

- Engine Cylinder Head Temperature Sensor (CHT) Input.
- Camshaft Position Sensor (CMP) Input.
- Crankshaft Position Sensor (CKP) Input.
- Fuel Select Switch.

From these inputs, the ICM computes spark strategy (spark advance) and fuel mixture (air/fuel) to obtain optimum engine performance for correct load conditions.

Operation

The ignition control module needs the following information to calibrate the engine properly:

- Crankshaft position.
- Engine RPM.
- Engine temperature.
- Engine load and altitude.
- Fuel select switch.

The camshaft position sensor (CMP sensor):

- Sends the Ignition Control Module a signal indicating camshaft position used for fuel synchronization.

The crankshaft position sensor (CKP sensor):

- Sends the Ignition Control Module a signal indicating crankshaft position.
- Is essential for calculating spark timing.

The intake air temperature sensor (IAT sensor):

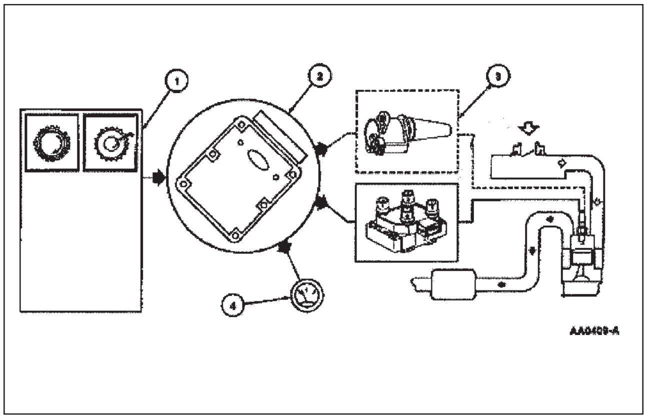
- Sends the ignition control module a signal indicating the temperature of the air entering the engine, but is not used on this engine.
- Resistance decreases as temperature increases.

The cylinder heat temperature (CHT sensor):

- Sends a signal to the Ignition Control Module indicating the cylinder head temperature.

Overview

The Ignition System is designed to ignite the compressed air/fuel mixture in an internal combustion engine by a high voltage spark from an ignition coil. The ignition system also provides engine timing information to the ignition control module (ICM) for proper engine operation and misfire detection.



Electronic Ignition System

The Coil On Plug (COP) EI System uses a separate coil per spark plug and each coil is mounted directly onto the plug. The COP EI System eliminates the need for spark plug wires but does require input from the camshaft position (CMP) sensor. Operation of the components are as follows:

1. **Note:** Electronic Ignition engine timing is entirely controlled by the ICM. Electronic Ignition engine timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

2. The ICM uses the CMP sensor not shown on COP EI Systems to identify top dead center of compression of cylinder 1 to synchronize the firing of the individual coils.

3. The ICM acts as an electronic switch to ground in the coil primary circuit. When the switch is closed, battery positive voltage (B+) applied to the coil primary circuit builds a magnetic field around the primary coil. When the switch opens, the power is interrupted and the primary field collapses inducing the high voltage in the secondary coil windings and the spark plug is fired. A kickback voltage spike occurs when the primary field collapses.

4. The ICM processes the CKP signal and uses it to drive the tachometer as the Clean Tach Out (CTO) signal.

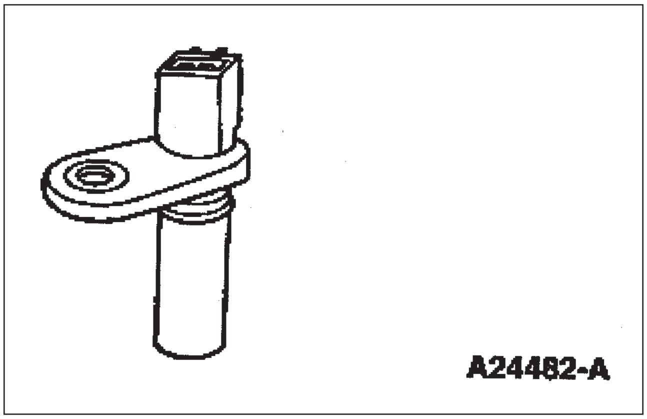
Starting RPM

The program strategy requires the engine to obtain a minimum of 100-140 RPM before the ICM will allow ignition spark to be generated. Any failure with an auxiliary system can cause excessive engine crank (load) force, which may cause the engine too not reach the required starting RPM. Perform a through inspection of all auxiliary systems and components, inspect for binding hydraulic pumps and misalignment of drive systems.

Camshaft Position Sensor

The Camshaft Position (CMP) Sensor detects the position of the camshaft. The CMP Sensor identifies when piston #1 is on its compression stroke.

The CMP Sensor is a magnetic transducer mounted on the engine front cover adjacent to the camshaft. By monitoring a target on the camshaft sprocket, the CMP sensor identifies cylinder one to the ICM. The COP EI system uses this information to synchronize the firing of the individual coils.



The Fuel Select Switch

In the event that the engine is operated on alternate fuels such as natural gas, compressed natural gas (CNG), or liquefied petroleum gas (LPG), timing can be modified with a Fuel Select Switch.

NOTE: Fuel select switch is supplied by the customer.

- Sends a signal to the ICM to adjust base timing for alternate fuel
- Is manually controlled.

With this system, the ICM monitors the engine load, speed, operating temperature, air intake temperature and decides what degree of spark advance is correct for all of the operating conditions. Because timing is set for life inherently in the design of the engine, and there are no moving parts in the ignition system itself, no maintenance is required except for periodic spark plug checks. The system provides for fixed spark advance at start-up, for cold weather starting, and for “average value” default settings in case of component failure. Particular attention has been given to spark optimization for excellent fuel economy and power in the warm-up mode.

The spark plugs are paired so that one plug fires during the compression stroke and its companion plug fires during the exhaust stroke. The next time that coil is fired, the plug that was on exhaust will be on compression, and the one that was on compression will be on exhaust. The spark in the exhaust cylinder is wasted but little of the coil energy is lost.

Run Mode

The ICM interprets engine speed above100 RPM as Run Mode.

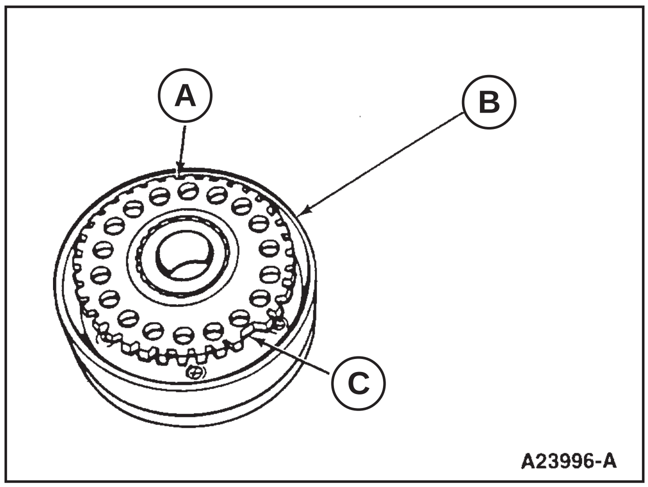
The Base Spark Advance (BSA) is calculated by the (ICM) module processing the engine speed and load plus sensors mentioned in operation of this section and Fuel Select Switch.

Inputs to the ICM Effecting the Ignition

The spark strategy is based on sensors and manifold vacuum input to the ICM module, which include the following inputs:

Crankshaft Position Sensor (CKP Sensor)

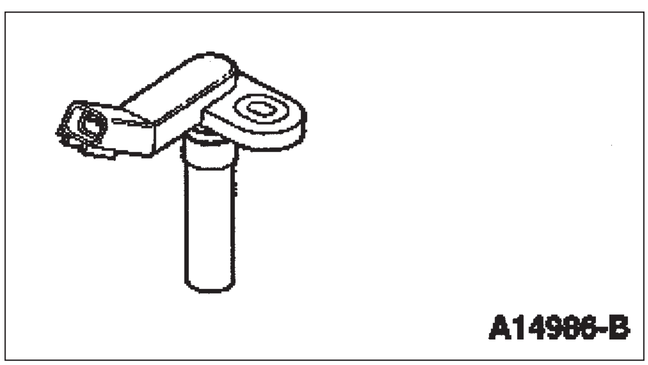
The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel **A**, the CKP is the primary sensor for ignition information to the ICM. The pulse wheel located behind the crankshaft pulley **B**, has a total of 39 teeth spaced 9 degrees apart with one empty space **C** for a missing tooth. An A/C voltage signal is generated which increases with engine rpm and provides engine speed and crankshaft position information to the ICM. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the ICM. The CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. ICM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



A **Pulse Wheel (Part Crankshaft Pulley).**

B **Crankshaft Damper (Face Down) 6312.**

C **Gap in Teeth (Provides position reference for number one piston**



Coil On Plug

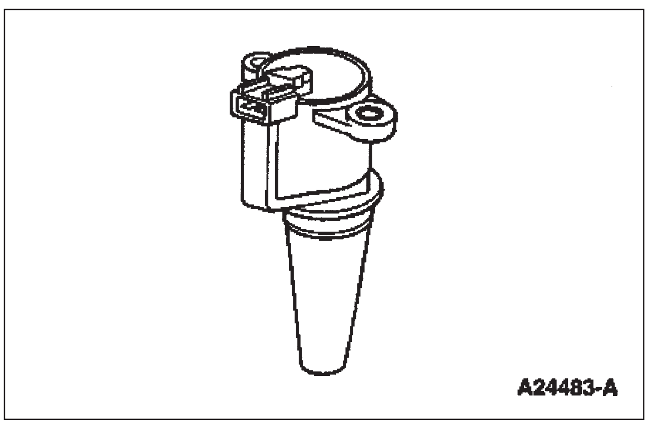
The coil on plug (COP) ignition operates similar to standard coil pack ignition except each plug has one coil per plug. COP has three different modes of operation: engine crank, engine running and CMP Failure Mode Effects Management (FMEM).

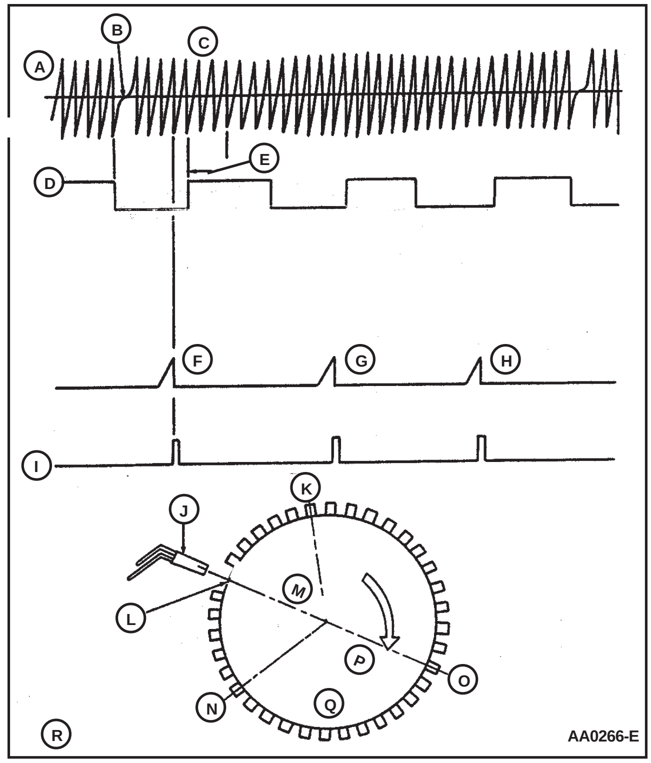
Engine Crank/Engine Running

During engine crank the ICM will fire two spark plugs simultaneously. Of the two plugs simultaneously fired one will be under compression the other will be on the exhaust stroke. Both plugs will fire until camshaft position is identified by a successful camshaft position sensor signal. Once camshaft position is identified only the cylinder under compression will be fired.

CMP FMEM

During CMP FMEM the COP ignition works the same as during engine crank. This allows the engine to operate without the ICM knowing if cylinder one is under compression or exhaust.





- (A) CKP Sensor
- (B) Missing Tooth 60° BTDC
- (C) TDC
- (D) Spark
- (E) 10° BTDC
- (F) Coil 1
- (G) Coil 2
- (H) Coil 3
- (I) IDM
- (J) CKP Sensor
- (K) TDC 2 and 6
- (L) Missing Tooth
- (M) 60° BTDC
- (N) TDC 1 and 5
- (O) TDC 3 and 4
- (P) 1 and 5
- (Q) Crankshaft Wheel
- (R) **Note:** This diagram does not correlate to any timing marks that may be on the engine front cover or dampener.

Cranking Mode

Cranking mode is the area of engine operating speed within which the ignition timing is at a static position. The static spark advance is fixed at 10 degrees BTDC up to 250 RPM.

Transient Mode

This function is to provide a limp in mode whenever certain components fail. The engine will run but at a set timing and batch fuel delivery. This mode will stay in effect until problem is corrected or ignition turned off and back on if an intermittent problem.

Overspeed Mode

Over-speed protection is available on certain ICM modules that have set RPM limits. Refer to the ICM Replacement chart. When the module senses the engine RPM is at the preset limit, grounding of the Coil on Plugs is removed stalling the engine. The ignition must cycle from on to off and to start in order to restart the engine. Note: this strategy must be compatible with governor controllers.

Electronic Engine Controls

Refer to Section 08 of this manual.

ICM Replacement

Make sure the correct ICM part number is being installed for the appropriate engine application.

PART NUMBER	APPLICATION
1U1L-12A297-AA or YU1L-12A297-AA	Turbocharged with 2400 Overspeed Shutdown
XU1L-12A297-AB	Naturally Aspirated with 2250 Overspeed Shutdown
Y U1L-12A297-CA	Naturally Aspirated with 4000 Overspeed Shutdown

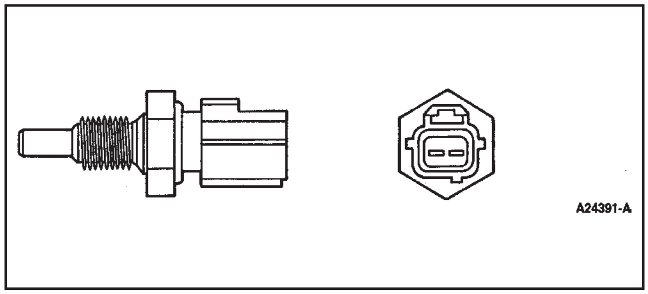
Cylinder Head Temperature Sensor (CHT Sensor)

The cylinder head temperature (CHT) sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as temperature increases, and increases as temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the ICM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow.

Voltage that is dropped across a fixed resistor in series with the sensor resistor determines the voltage signal at the ICM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The CHT sensor is installed in the aluminum cylinder head and measures the metal temperature. The CHT sensor communicates an overheating condition to the ICM. The ICM would then initiate a cooling strategy based on information from the CHT sensor. A cooling system failure such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using a CHT sensor and cooling strategy would prevent damage by allowing air cooling of the engine and limp home capability.



Cylinder Head Temperature (CHT) Sensor.

Starting Mode

Module enters start mode at first application of power. No spark is applied for first turn of crankshaft. Timing is fixed at 10 degrees BTDC. Dwell is fixed at 10 degrees of crankshaft rotation. Start mode remains in effect until 10 turns of the crankshaft @ 500 rpm. If drops below 500 rpm at any time, turn counter is reset. Once 10 turns are made @ 100 rpm or greater, module is set to run mode. In transitioning to run mode, calculated timing values are ramped into system during approximately 3.5 revolutions to ensure transition. Dwell is determined with a base value plus a correction factor based on system voltage.

CHT Effects

Cylinder Head Temperature (CHT) is monitored and a correction factor is applied to engine timing based on one of three 1 X 8 tables. OCT1 selects which timing table will be used for correction.

IAT Effects (Not Used)

Intake Air Temperature (IAT) is monitored and a correction factor is applied to engine timing based on one of three 1 X 8 tables. OCT1 selects which timing table will be used for correction.

Overspeed Protection

The ICM module contains an RPM limit that is set at 4000 RPM. Reaction is the module will be shut off, stalling the engine. Key must cycle from run to off to start in order to restart engine. Note: this strategy must be compatible with governor controllers.

Engine Protection

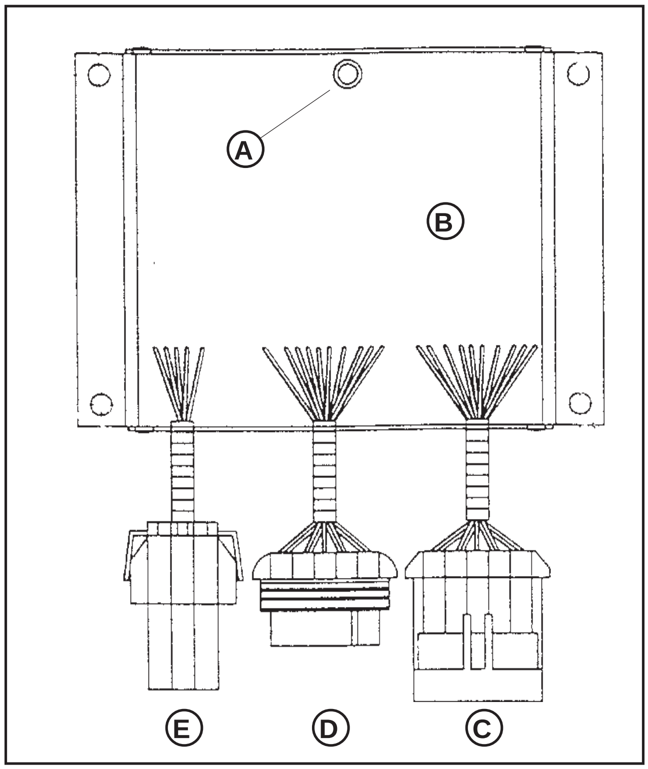
Reaction for overtemp (based on CHT input) and low oil pressure (based on oil pressure switch input) the module will be shut off, stalling the engine. Key must cycle from run to off to start in order to restart engine. Engine protection becomes active after 240 crankshaft revolutions and when 800 rpm is exceeded. The purpose of having to meet these conditions provides an opportunity for the engine to restart if the failure still exists which caused the engine to stall. Over temperature reaction is experienced when temperature reaches 250°F. Low oil pressure reaction is experienced when oil pressure drops below 6 psi +/- 1.5 psi. Oil pressure switch position is normally open when engine is off.

Starter Lockout

Starter lockout relay control open drain (ICM switch to ground). Activated once engine is in the run mode and has reached 600 RPM. Will not allow start until ignition voltage to ICM module is switched off and back on.

Tachometer Output

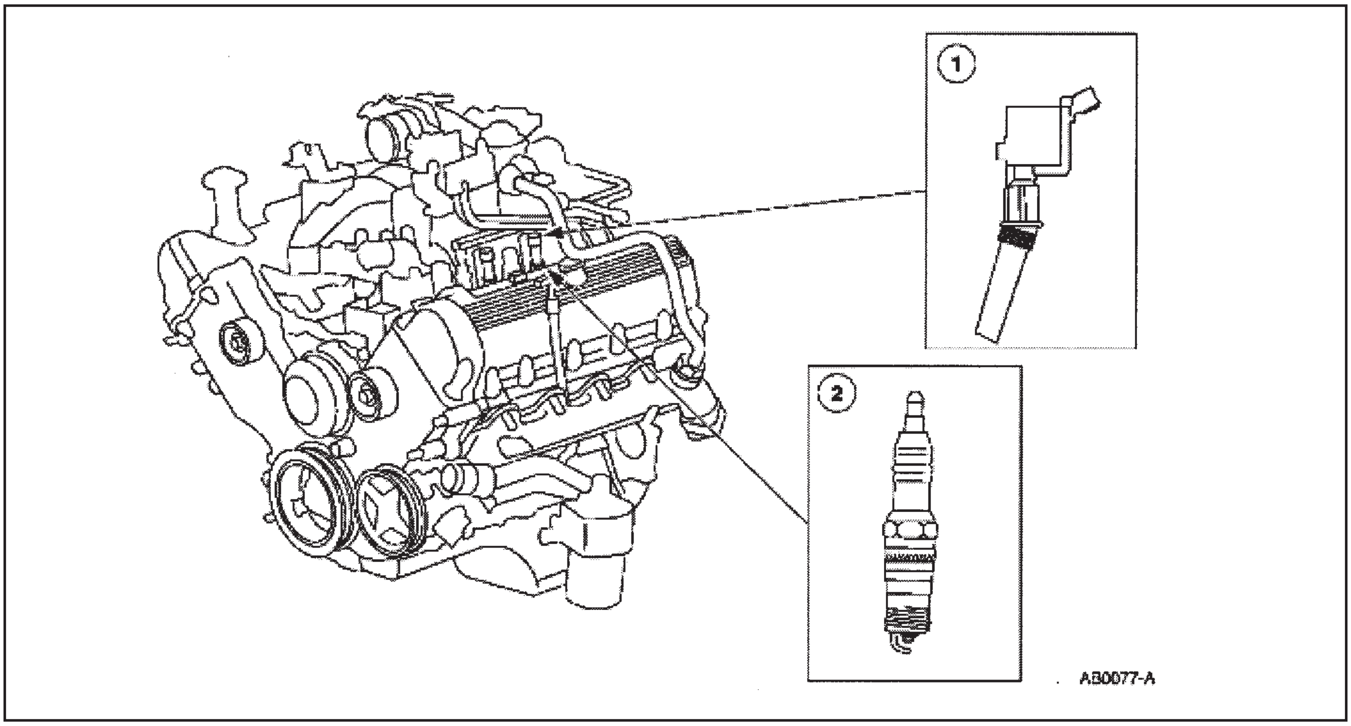
Tachometer output will be from auxiliary output #2, which is accessed through the five pin connector terminal E. The pulses per revolution will be determined by the number of cylinders the ICM will control. The four cylinder ICM will output 2 pulses per revolution, the six cylinder ICM output 3 pulses per revolution, the eight cylinder output 4 pulses per revolution, and the ten cylinder 5 pulses per revolution. The intention of this is to allow for use of a conventional tachometer from this output.



Ignition Control Module (ICM):

- A Vacuum port (5/32" I.D.) MAP Sensor
- B Ignition Control Module (ICM)
- C Connector C4 (10 pin connector)
- D Connector C2 (10 pin connector)
- E Connector C3 (5 pin connector)

Ignition System - Components Location



1 **Ignition Coil (12029)** 2 **Spark Plug (12405)**

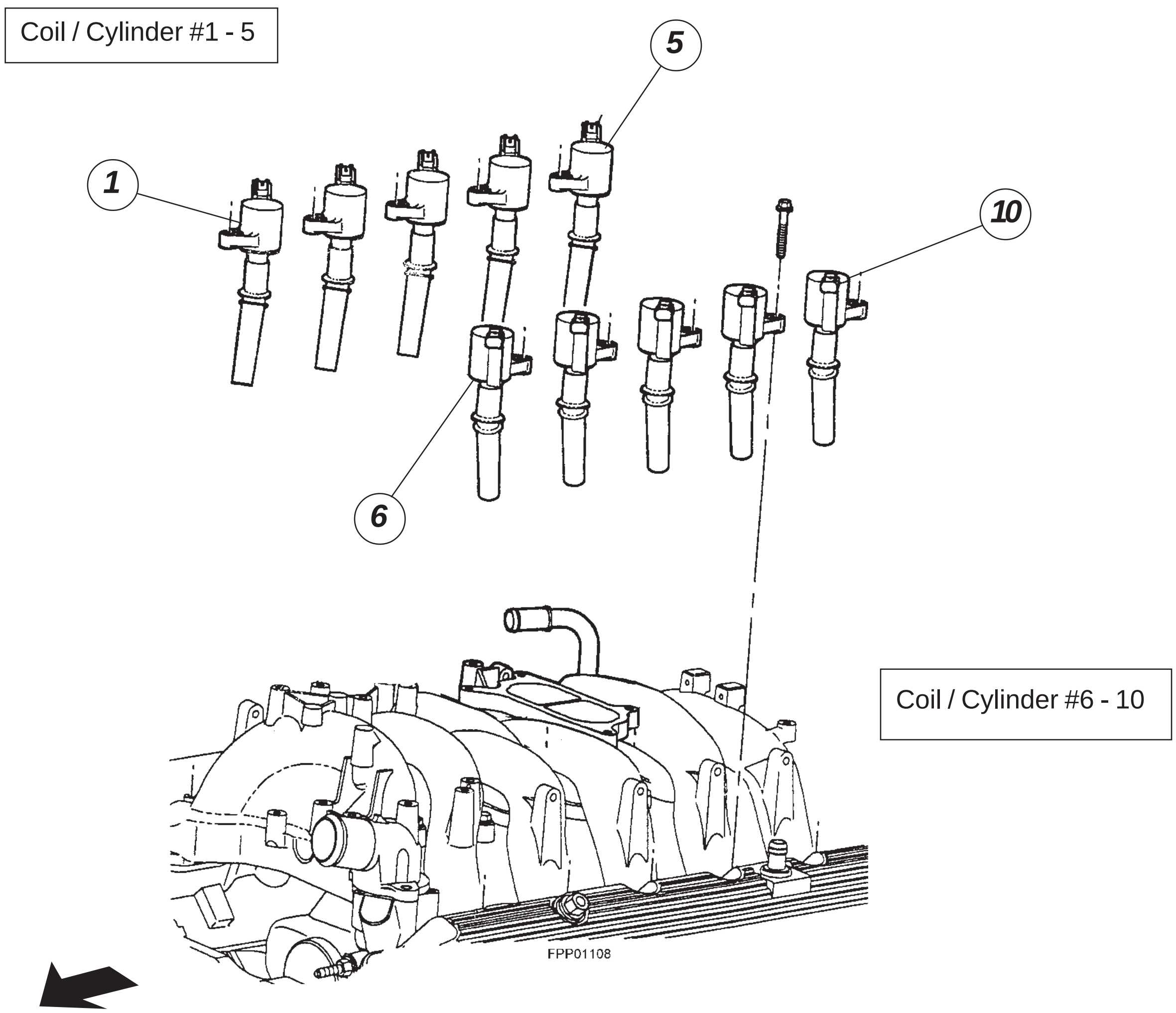
The 6.8L engine is equipped with a coil on plug ignition system. This system has a separate ignition coil mounted on each spark plug. Operation of the coils is controlled by ignition control module (ICM), which computes ignition timing based on inputs from the electronic engine control system sensors. For additional information on sensor inputs related to ignition control; refer to Section 08.

The ignition coils change a supplied low voltage signal into high voltage pulses to the spark plugs. The ignition control module controls the low side of each coil.

The ignition system is set for base timing at 10 degrees before top dead center (BTDC) and is not adjustable.

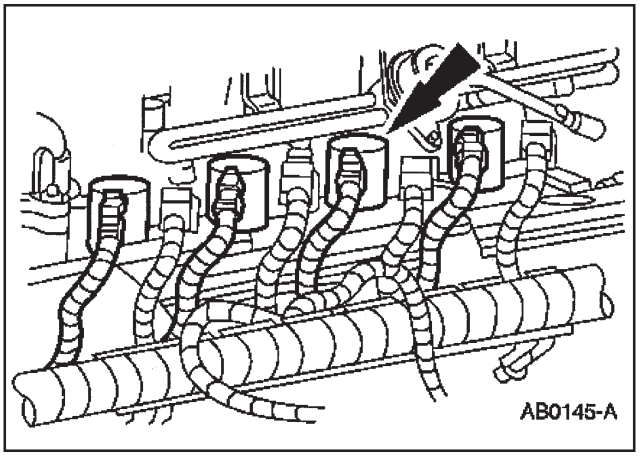
Refer to Specifications for firing order.

Firing Order



Ignition Coil-On Plug - Removal

1. Disconnect the wiring at the coil.



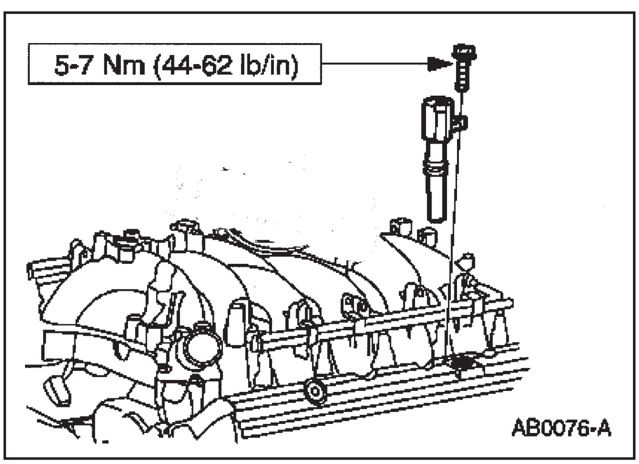
2. Remove the bolt and the coil.

Ignition Coil-On Plug - Installation

WARNING: ALWAYS WEAR SAFETY GLASSES TO PROTECT EYES FROM FLYING FOREIGN MATERIAL.

1. NOTE: Remove any foreign material from spark plug wells with compressed air.

2. Insert a small amount of dielectric grease into each boot using Motorcraft Silicone Brake Caliper Grease and Dielectric Compound XG-3 or equivalent meeting Ford specification ESE-M1C171-A.



To install, reverse the removal procedure.

Harness Connector Pinout Description

ICM Connector C4 (10 Pin) Terminals			
I/O	***Conn***	***Pin***	***Description***
I	*Main*	*A*	*Coil #1*
I	*Main*	*B*	*Coil #7*
I	*Main*	*C*	*Coil #6*
I	*Main*	*D*	*Coil #3*
I	*Main*	*E*	*Coil #5*
I	*Main*	*F*	*Coil #8*
I	*Main*	*G*	*Coil #10*
I	*Main*	*H*	*Coil #4*
I	*Main*	*J*	*Coil #2*
I	*Main*	*K*	*Coil #9*

I / O = Input / Output

Octane Select Operation

OCT1: Used to select ignition table for fuel type. Input can be B+. Fuel choices are LPG or Natural Gas.

OCT2: Used to choose constant to add or subtract from selected timing table.

TABLE 3: Operation of ICM

Full Select Operation		
Fuel	***OCT1 Circuit 674 (BR-W)***	***Timing Effect***
LPG	*Ground*	*Base LPG*
NG	*12V*	*Base NG*
NG	*Open*	*Base NG*

DIAGN0SIS AND TESTING

Service Adjustments And Checks

1. Each 400 hours of engine operation remove the spark plugs and clean and adjust the electrode.

2. Clean and visually check each coil-on plug connectors, check for secure fit.

Diagnostic Equipment

To accurately diagnose Coil on Plug (COP), certain diagnostic equipment and tools are required. In addition, the
suggested diagnostic equipment may make the job easier and more convenient.

Prior to diagnosing COP, obtain the following test equipment or equivalent.

• Spark tester, neon bulb type (Champion CT-436).

• Spark tester, gap type (special service tool D81P-6666-A).

Connect this gap type spark tester between any COP and engine ground to instantly determine if spark is being provided to the plug. A spark plug with a broken side electrode is not sufficient to check for spark and may lead to incorrect results.

• Volt-ohmmeter (Rotunda 73111 Automotive Meter 105-R005 7 or equivalent).

A volt-ohmmeter is essential for gathering system operating data during diagnosis, testing, and engine servicing procedures. This digital volt ohmmeter (DVOM) can also be used for general purpose electrical troubleshooting on conventional starting and charging systems.

CAUTION: There should be no wires spliced to the main wire harness for source of power or RPM signal unless pre-approved by Ford Power Products. Otherwise, any alteration will void the warranty. Altering of wire harness may cause lack of power, no start, or erratic running.

NOTE: When using the spark plug firing indicator, place the grooved end as close as possible to the plug boot. Very weak or no flashing may be caused by a fouled plug.

NOTE: Do not use an incandescent test lamp to check CKPS- or CKPS+ circuits. The lamp will prevent the circuit from operating.

Preliminary Checks

Before using this section verify the customer complaint and refer to the appropriate symptom chart. Perform the procedure included in the symptom chart.

Basic Circuit Checks

Basic circuit checks help to minimize pinpoint test steps by providing a procedure to diagnose harness faults associated with the Electronic Engine Control (EC) System. The following techniques provide helpful reminders for diagnosing open circuits (continuity), shorts to ground and shorts to power.

NOTE:

- The suspect circuit must be isolated before testing.
- When disconnecting any harness connector, always inspect for damaged or pushed out pins, corrosion and loose wires. Repair as necessary.
- The digital multimeter must be set to the correct scale.
- The techniques do not apply in all situations, therefore, it is necessary to follow each pinpoint test step accurately and completely.
- General resistance and voltage values are specified below. Always use the pinpoint test values if they differ.
- Always turn the key to the OFF position unless directed otherwise by the pinpoint test.

Each of the following procedures will require the Ignition Control Module (ICM) and component to be disconnected to isolate the harness.

Open Circuit (Continuity)

Disconnect ICM. Measure the harness resistance between the suspect circuit at the harness connector and the appropriate ICM harness connector pin. The resistance must be less than 5.0 ohms.

Shorts to Ground

Measure the harness resistance between the suspect circuit at the harness connector and a reliable ground (B+, chassis ground or PWR GND). The resistance must be greater than 10,000 ohms.

Shorts to Power

Key ON to power up circuit. Measure voltage between the suspect circuit at the harness connector and a reliable ground. The voltage must be less than 1.0 volt.

Visual/Physical Check

Several of the symptom procedures call for a careful visual/physical check. This can often lead to repairing a problem without performing unnecessary steps. Use the following guidelines when performing a visual/physical check:

Inspect unit for modifications or aftermarket equipment that can contribute to symptom, verify that all electrical and mechanical loads or accessory equipment is “OFF’’ or disconnected before performing diagnosis.

- Inspect engine fluids for correct levels and evidence of leaks.
- Inspect vacuum hoses for damage, leaks, cracks, kinks and improper routing, inspect intake manifold sealing surface for a possible vacuum leak.
- Inspect all wires and harnesses for proper connections and routing, bent or broken connector pins, burned, chafed, or pinched wires, corrosion, and verify harness grounds are clean and tight.
- Inspect ignition control module (ICM), sensors and actuators for physical damage.
- Inspect fuel system for adequate fuel level, and fuel quality (concerns such as proper fuel pressure and contamination).
- Inspect intake air system and air filter for restrictions.

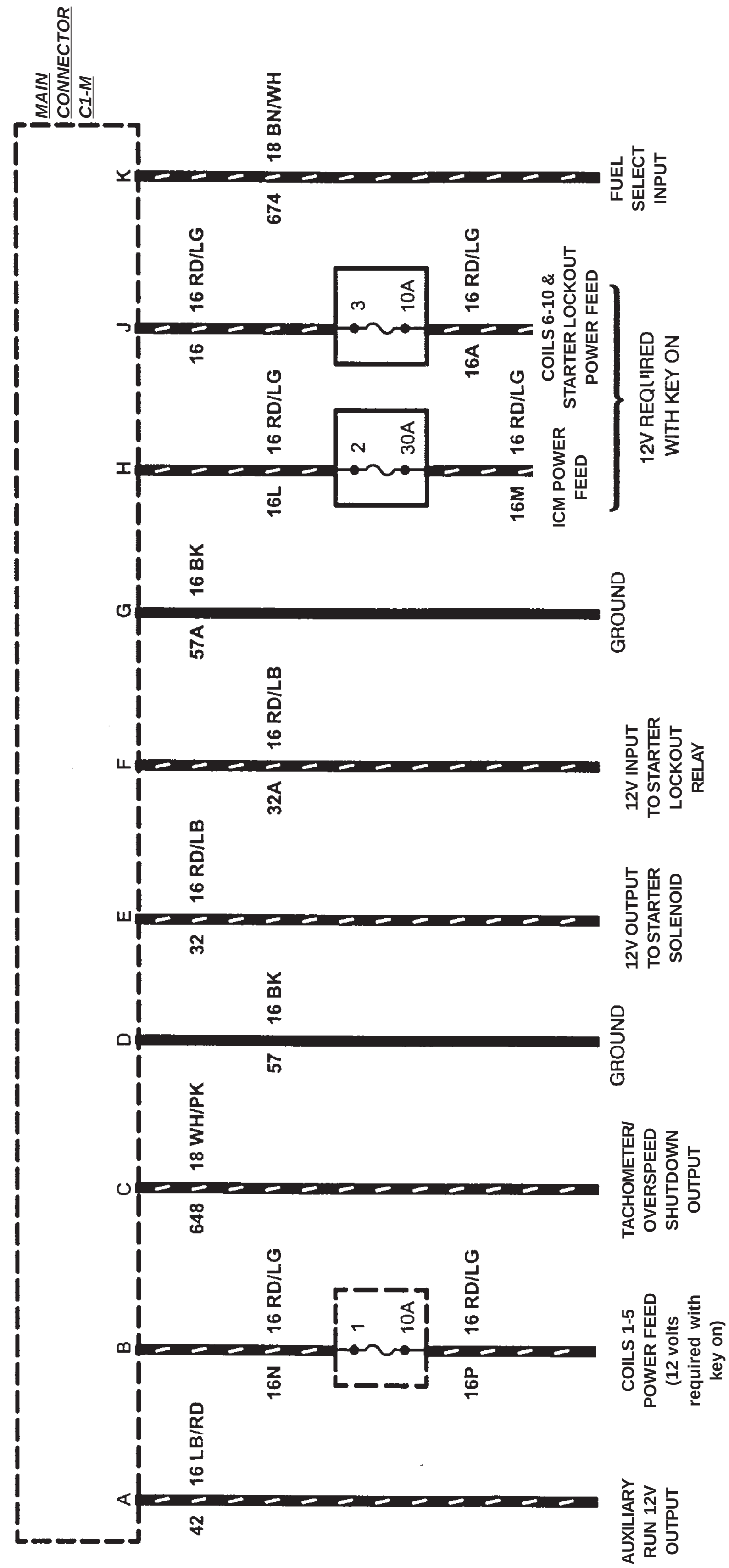
Intermittent Problems

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

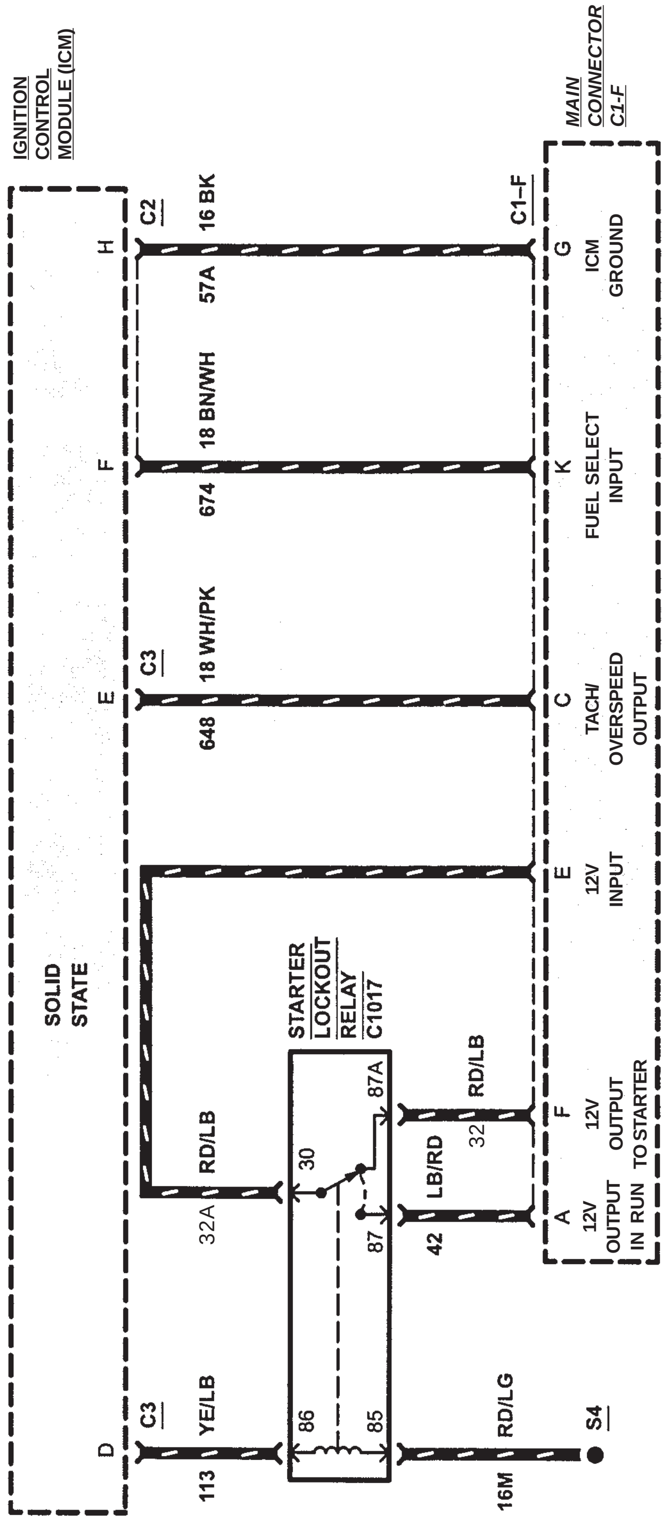
- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminals.
- Improper contact tension. All connector terminals in the problem circuit should be carefully checked.
- Poor terminal-to-wire connections. This requires removing the terminal from the connector body to check.
- Improperly installed aftermarket equipment or accessories.

Operate the engine with accessories “OFF’’ and a suitable multimeter connected to the suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

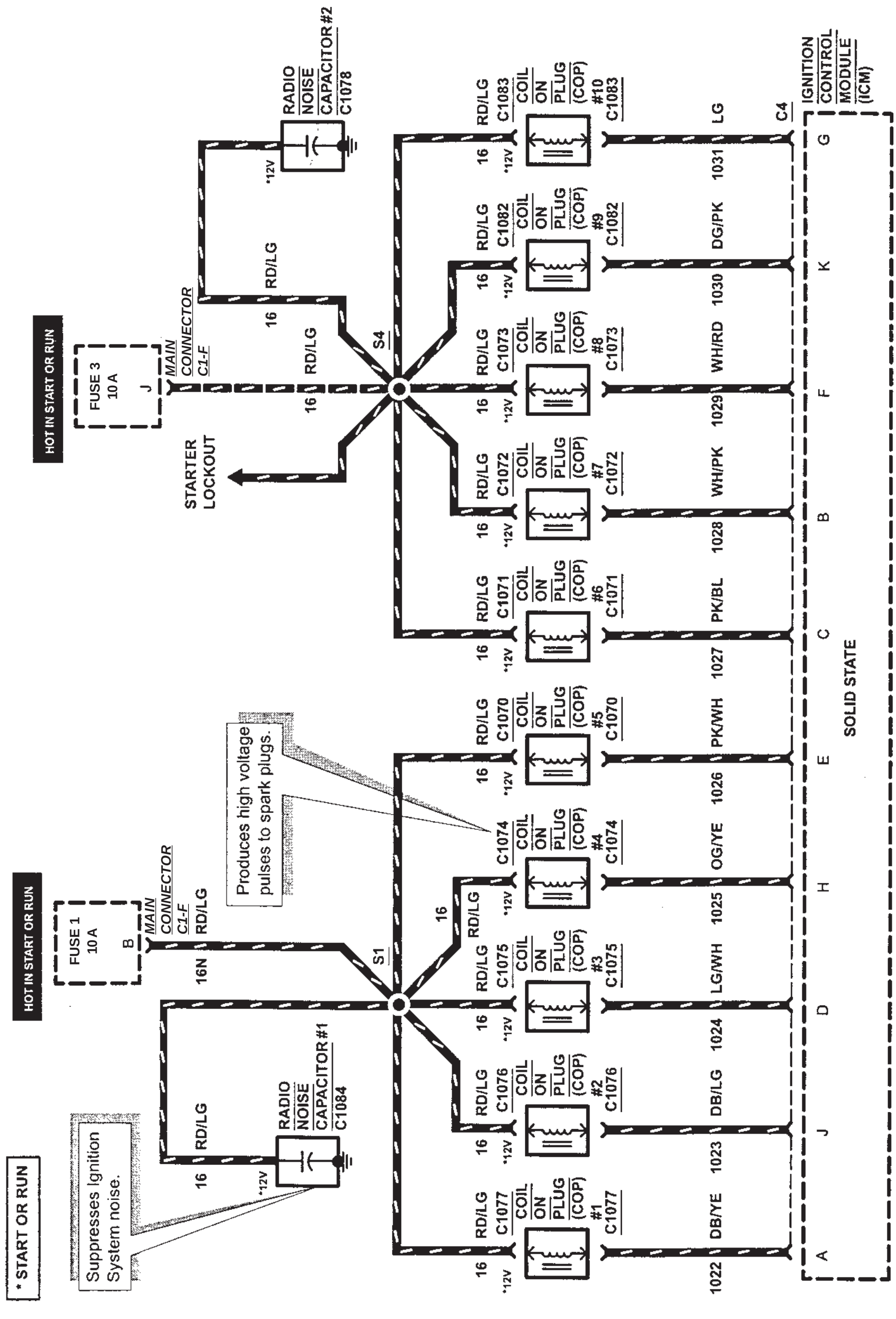
Main Jumper Connector C1-M (XU1L-14324-BB)



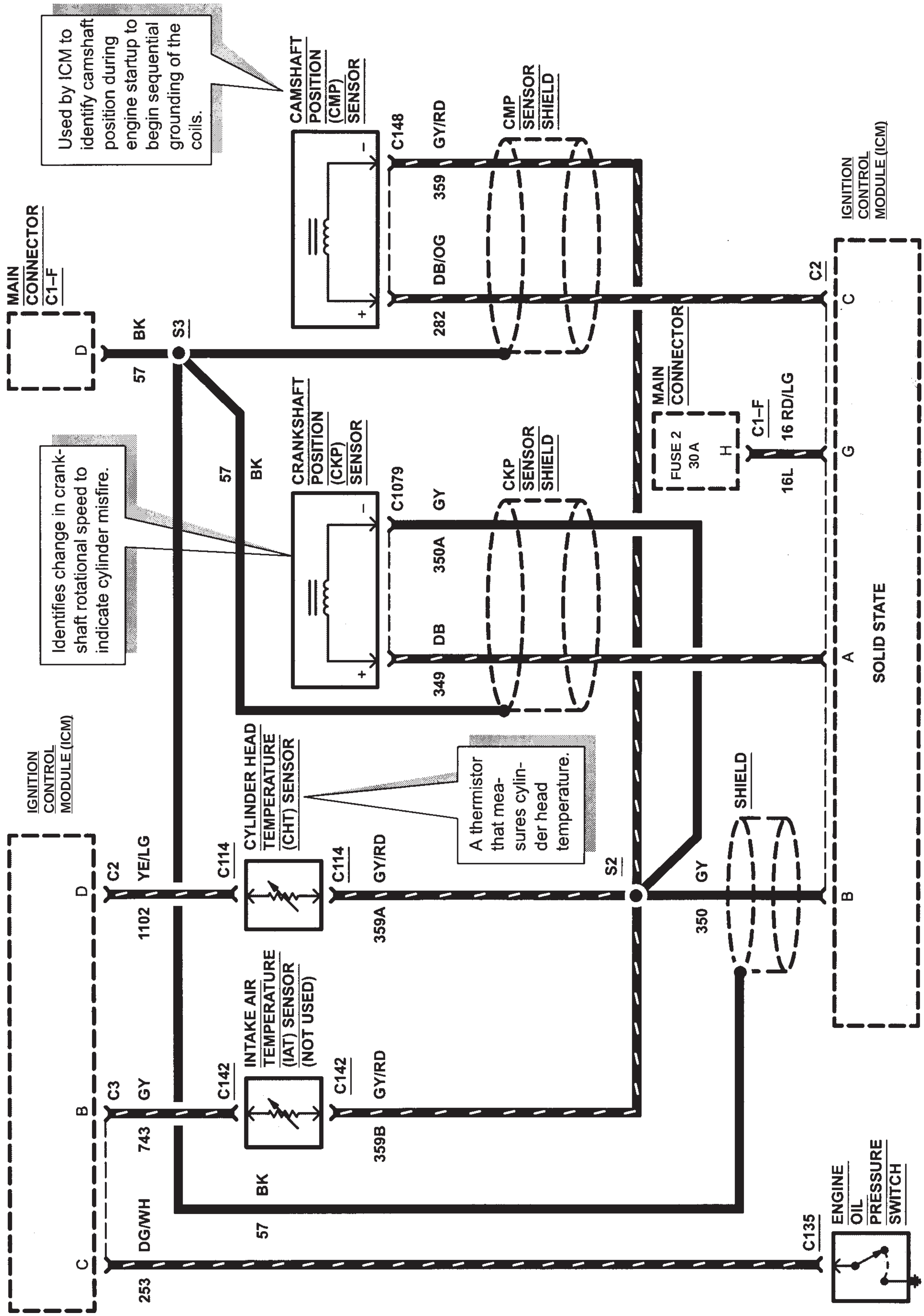
Ignition/Starter Lockout (part of SK2U1L-12A200-BA)



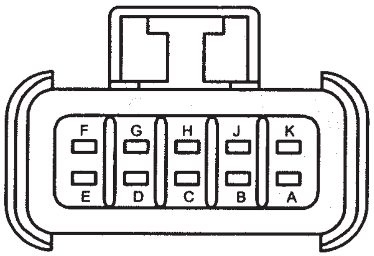
Engine Controls (part of SK2U1L-12A200-BA)



Engine Sensors (part of SK2U1L-12A200-BA)

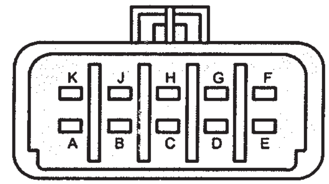


Engine Harness Connectors



C1-F
Engine Harness 10 Pin Connector
12A200-CG

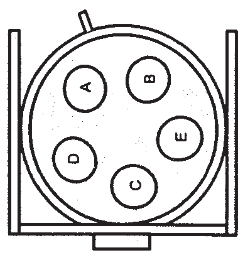
PIN	CIRCUIT	CIRCUIT FUNCTION
A	42 (LB/RD)	12V Run Output (above 600 RPM)
B	16N (RD/LG)	Coils 6 - 10 and Starter Lockout Power
C	648 (WH/PK)	Tachometer/Overspeed Shutdown Output
D	57 (BK)	Ground
E	32 (RD/LB)	Lockout Relay Power to Starter
F	32A (RD/LB)	12V in Start Position
G	57A (BK)	Ground
H	16L (RD/LG)	12V ICM Power with Key On
J	16 (RD/LG)	12V Coils 1 - 5 Power with Key On
K	674 (BR/WH)	Fuel Select Input



C1-M
Jumper Harness 10 Pin Connector
14324-BB

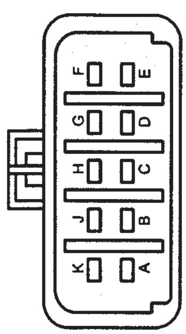
PIN	CIRCUIT	CIRCUIT FUNCTION
A	42 (LB/RD)	12V Run Output (above 600 RPM)
B	16N (RD/LG)	12V Required with Key On
C	648 (WH/PK)	Tachometer/Shutdown Output
D	57 (BK)	Ground
E	32 (RD/LB)	12V Output to Starter
F	32A (RD/LB)	12V in Start Position
G	57A (BK)	Ground
H	16L (RD/LG)	12V Required with Key On
J	16 (RD/LG)	12V Required with Key On
K	674 (BR/WH)	Fuel Select Input

ICM Connectors



C3
ICM 5 PIN CONNECTOR

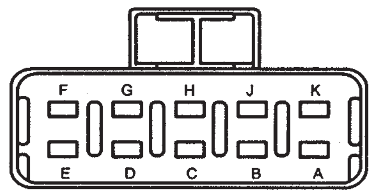
PIN	CIRCUIT	CIRCUIT FUNCTION
A	–	NOT USED
B	743 (GY)	IAT Sensor (NOT USED)
C	253 (DG/WH)	Oil Pressure Switch Input
D	113 (YE/LB)	Starter Lockout
E	648 (WH/PK)	Aux. Out 2/ Overspeed Ground



C2
ICM 10 PIN CONNECTOR

PIN	CIRCUIT	CIRCUIT FUNCTION
A	349 (DB)	Crank Position Sensor Input
B	350 (GY)	Signal Return (-)
C	282 (DB/OG)	Cam Sensor (+) 5V
D	1102 (YE/LG)	Cylinder Head Temp Sensor (+) 5V
E	–	NOT USED
F	674 (BN/WH)	Fuel Select Input
G	16L (RD/LG)	Power (+) 12V Input
H	57A (BK)	Ground
J	–	NOT USED
K	–	NOT USED

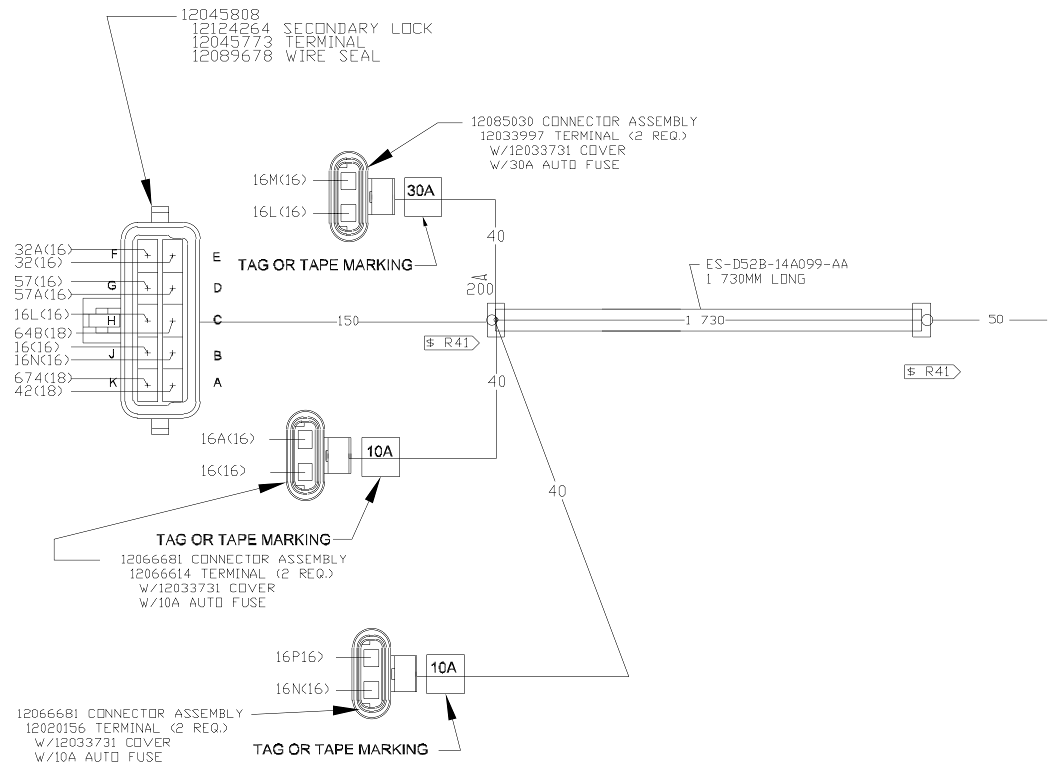
ICM Connectors



C4
ICM 10 PIN CONNECTOR

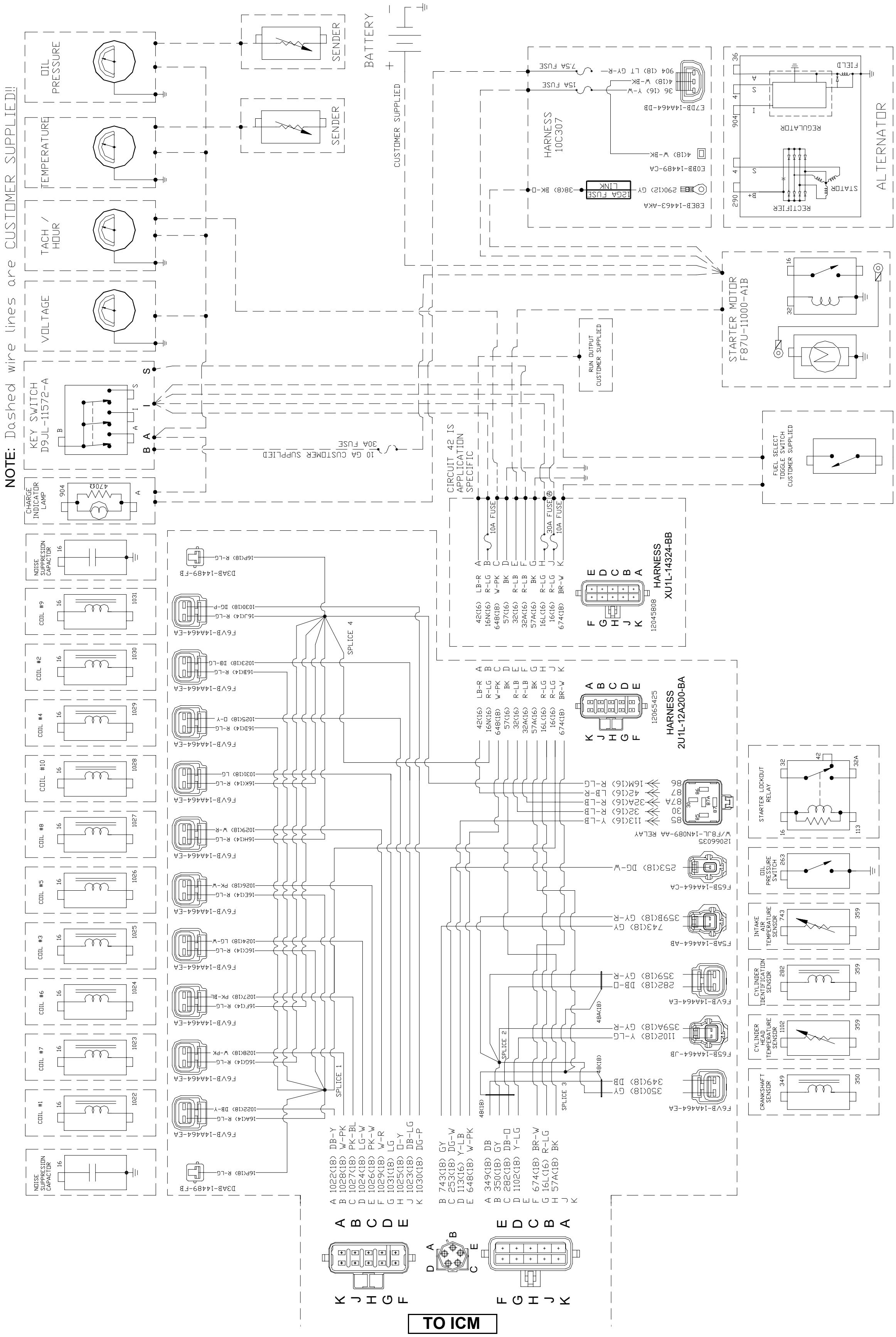
PIN	CIRCUIT	CIRCUIT FUNCTION
A	1022 (DB/YE)	Coil #1 Grounding
B	1028 (WH/PK)	Coil #7 Grounding
C	1027 (PK/BU)	Coil #6 Grounding
D	1024 (LG/WH)	Coil #3 Grounding
E	1026 (PK/WH)	Coil #5 Grounding
F	1029 (WH/RD)	Coil #8 Grounding
G	1031 (LG)	Coil #10 Grounding
H	1025 (OG/YE)	Coil #4 Grounding
J	1023 (DB/LG)	Coil #2 Grounding
K	1030 (DG/P)	Coil #9 Grounding

Wiring Schematic - Jumper Harness (XU1L-14324-BB)



CIRCUIT NUMBER	WIRE SIZE	COLOR	MAT	CIRCUIT DESCRIPTION	CIRCUIT LENGTH
674	18	BR-W	AZ	OCTANE SELECT	1 930
648	18	W-PK	AZ	TECH.	1 930
57A	16	BK	AZ	GROUND	1 930
57	16	BK	AZ	GROUND	1 930
42	18	LB-R	AZ	STATOR LOCKOUT AUXILIARY OUT	1 930
32A	16	R-LB	AZ	STARTER IN FROM SWITCH	1 930
32	16	R-LB	AZ	STARTER LOCKOUT TO RELAY	1 930
16P	16	R-LG	AZ	POWER (KEY ON)	1 820
16N	16	R-LG	AZ	POWER (KEY ON)	190
16M	16	R-LG	AZ	POWER (KEY ON)	1 820
16L	16	R-LG	AZ	POWER (KEY ON)	190
16A	16	R-LG	AZ	POWER (KEY ON)	1 820
16	16	R-LG	AZ	POWER (KEY ON)	190

Recommended Wiring - MS-2U1L-3458-BA



Pinpoint Test A - Ignition Check

The ignition system check will verify the required inputs and outputs recommended by Ford Power Products. Always locate and inspect all power, ground and terminal connections prior to the start of this test, as failures and corrosion associated with these areas can adversely affect the engine to start properly.

Inspection and Verification

1. Visually inspect for obvious signs of mechanical and electrical damage.
2. Visually inspect for and note auxiliary system connections not shown on the **recommended wiring schematic**.

Step	Action	Values	Yes	No
1	1. Key Off, Engine Off. 2. Inspect the battery for clean and tight battery positive and negative connections. 3. Using an ohmmeter, measure the voltage across the battery posts. Is the voltage within the specified value?	12.53 Volts	GO to Step 2	Recharge the battery. TEST the system for normal operation.
2	1. Disconnect the Battery Positive cable from the battery and the starter B+ post. 2. Using an ohmmeter, measure the resistance between the terminal ends of the cable. Is the resistance within the specified value?	Less than 5 Ohms	GO to Step 3	Replace the Battery Positive Cable and RETEST
3	1. Disconnect the Battery Negative cable from the battery. 2. Using an ohmmeter, measure the resistance between the terminal ends of the cable. Is the resistance within the specified value?	Less than 5 Ohms	GO to Step 4	Replace the Battery Negative Cable and RETEST
4	1. Key Off, Engine Off. 2. Inspect the starter B+ terminal for a clean and tight connection. 3. Using an ohmmeter, measure the voltage at the starter B+ terminal Is the voltage within the specified value?	Battery Voltage	GO to Step 5	REPAIR the circuit(s) in question. TEST the system for normal operation.
5	1. KOEO. 2. Using an ohmmeter, measure the voltage at the ignition switch B terminal. Is the voltage within the specified value?	Battery Voltage	GO to Step 6	Inspect or Replace the 30A fuse. REPAIR the circuit(s) in question. TEST the system for normal operation.
6	1. KOEO. 2. Using an ohmmeter, measure the voltage at the ignition switch I terminal. Is the voltage within the specified value?	Battery Voltage	GO to Step 7	Remove and Replace the Ignition Switch And Retest
7	1. KOEO. 2. Using an ohmmeter, measure the voltage at the ignition switch S terminal. Is the voltage within the specified value?	Battery Voltage	System OK If the engine will not crank, GO to Section 07 Pin Point Test A	Remove and Replace the Ignition Switch And Retest