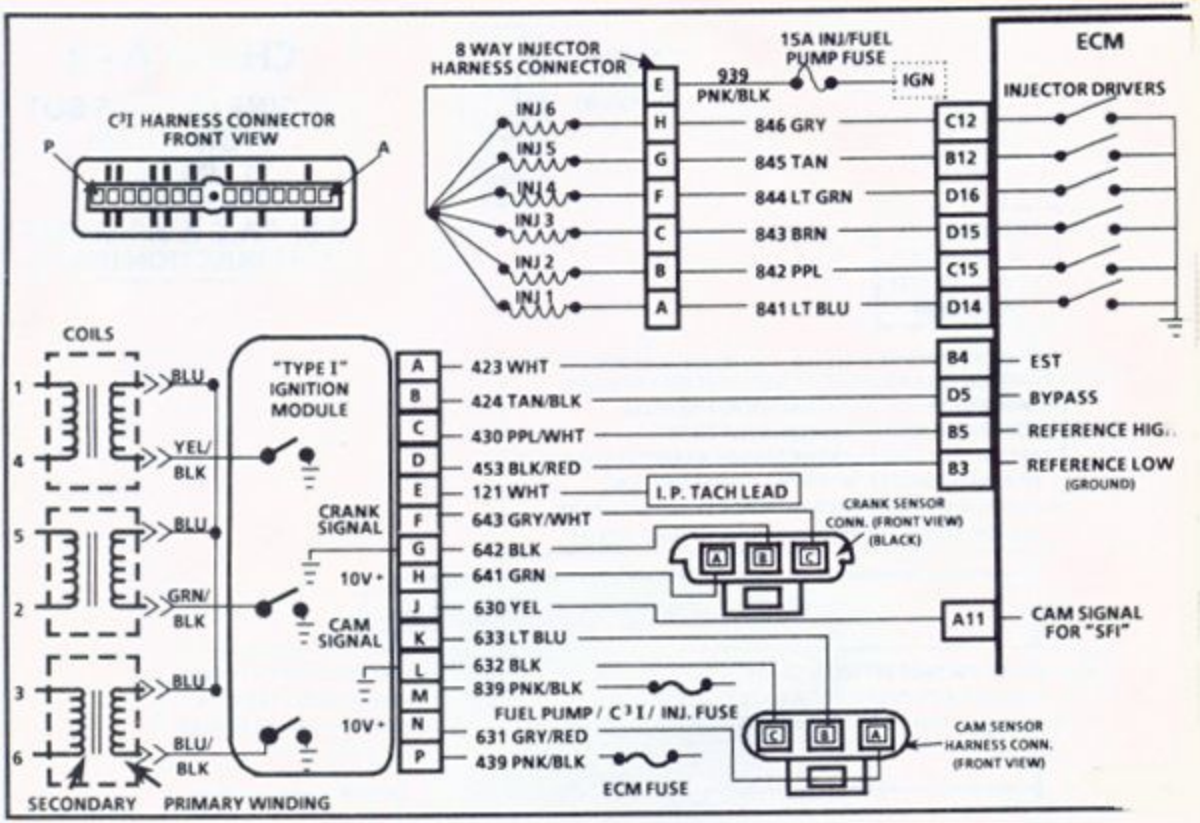

Page 1

Circuit Description: The C³I uses a waste spark method of spark distribution. In this type of ignition system the ignition module triggers the #1/4 coil pair resulting in both #1 and #4 spark plugs firing at the same time. #1 cylinder is on the compression stroke at the same time #4 is on the exhaust stroke, resulting in a lower energy requirement to fire #4 spark plug. This leaves the remainding high voltage to fire #1 spark plug.

This Sequential Fuel Injection type of fuel delivery system utilizes 6 seperate injector driver circuits to activate the 6 fuel injectors. While cranking, the ECM activates all 6 injectors simultaneously (all at one time). After a calibrated engine rpm is reached and a good Cam signal has been received by the ECM, the injection mode of operation is changed to Sequential (timed seperately).

Test Description: Step numbers refer to step numbers on diagnostic chart.

1. Identification of "TYPE I" or "TYPE II" ignition system is very important, because the "TYPE I" diagnostics will not work on "TYPE II" systems. Identification can be made by comparing the position of the coil towers with the drawing at the top of the chart. This step verifies that "SES" light operation, TPS and Coolant Sensor signals are normal. A blinking injector test light verifies that the ECM is monitoring the C³I reference signal and atempting to activate the injectors.
2. Both the Cam and Crank Sensors have been verified as functioning properly as is evidenced by the blinking injector test light. A fuel pressure test at this point will seperate the diagnostic path into either a fuel related fault or ighnition system malfunction.
3. The 8 terminal injector harness connector must be disconnected to avoid flooding of the engine and fouling of the spark plugs. By testing for spark or plug leads 1, 3 and 5, each ignition coil's ability to produce at least 25,000 volts is verified.
4. By testing the problem coil's control circuit with a test light, a determination can be made as to the problem coil being faulty or the module's internal driver for that coil being the source of the complaint.
5. An injector with a resistance value of less than 10 ohms (shorted) could cause repeat ECM failures.
6. Tests for battery voltage on CKT 939. If voltage was present, the "light off" test result was caused by no activation pulse reaching the injector connector from the ECM.

NOTICE; FUEL SYSTEM IS UNDER PRESSURE. TO AVOID FUEL SPILLAGE, REFER TO FIELD SERVICE PROCEDURES FOR TESTING OR REPAIRS REQUIRING DISASSEMBLY OF FUEL LINES OR FITTINGS.

1

- VERIFY TYPE OF IGNITION SYSTEM (TYPE I OR TYPE II)
- FUEL QUANTITY OK.
- IGNITION ON, THROTTLE CLOSED.
- "SERVICE ENGINE SOON LIGHT" SHOULD BE ON. (IF NOT SEE CHART A-1.
- IF CODE 41 IS DISPLAYED, DISCONNECT 14 PIN C³I MODULE CONNECTOR AND START TEST AT STEP # 9 ON PAGE 2 OF THIS CHART.
- TPS SHOULD "SCAN" LESS THAN 2.5V. (IF NOT SEE CODE CHART 21)
- COOLANT TEMPERATURE SHOULD "SCAN" BETWEEN -30°C & 130°C. (IF NOT SEE CHART 14 OR 15)
- DISCONNECT ANY INJECTOR CONNECTOR AND INSTALL INJECTOR TEST LIGH" .NJECTOR HARNESS CONNECTOR.
- CRANK ENGINE AND OBSERVE TEST LIGHT. IT SHOULD BLINK. DOES IT?

MODULE &COIL ASSEMBLY (TOP VIEW)

TYPE I

YES

NO

2

- IGNITION OFF, INSTALL FUEL PRESS. GAGE AND NOTE PRESS. AFTER IGNITION IS TURNED ON FOR 2 SECONDS, PRESSURE SHOULD BE 253-297 kPa (37-43 PSI). IS IT?

YES

NO

NO PRESSURE

INCORRECT PRESSURE

SEE CHART A-5

SEE CHART A-7

3

- DISCONNECT 8 TERM. INJ. HARNESS CONN.
- CHECK FOR SPARK WITH SPARK TESTER ON PLUG WIRES 1,3 & 5 ,(ONE AT A TIME) WHILE CRANKING, WITH REMAINING PLUG WIRES STILL CONNECTED.

NO SPARK ON ONE OR TWO WIRES

SPARK ON ALL

NO SPARK ON ALL

4

- VERIFY THAT PLUG WIRE RESISTANCE IS LESS THAN 30K OHMS. (IF NOT, REPLACE)
- REMOVE 6 COIL SCREWS AND TILT COIL ASSEMBLY BACK.
- DISCONNECT THE AFFECTED COIL'S CONTROL WIRE FROM THE MODULE.
- CONNECT A TEST LIGHT BETWEEN THE COMMON FEED (BLUE) AND CONTROL WIRE FOR THE COIL BEING TESTED.
- THE TEST LIGHT SHOULD BLINK WHILE CRANKING ENGINE. DOES IT?

CHECK FOR FUEL WET SPARK PLUGS. IF OK, SEE "DIAGNOSTIC AIDS" ON FACING PAGE.

CHECK CKT 839 TO C³I TERM. "M" FOR OPEN. IF CKT IS OK, IT'S FAULTY C³I MODULE CONNECTION OR MODULE.

NO

YES

THE C³I MODULE IS FAULTY. ALSO CHECK PRIMARY COIL RESISTANCE. IF RTESISTANCE IS NOT BETWEEN .5 AND .9 OHMS, REPLACE THE COIL AND THE C³I MODULE.

FAULTY IGNITION COIL CONNECTION OR COIL.

STEADY LIGHT

LIGHT OFF

6

- REMOVE TEST LIGHT.
- PROBE INJECTOR HARNESS POWER TERMINAL AT INJ. WITH A TEST LIGHT TO GROUND.
- TEST LIGHT SHOULD BE ON. IS IT?

NO

YES

CKT. 939 FROM IGN. FEED IS OPEN OR SHORTED TO GND.

SEE PAGE 2 OF THIS CHART

5

- CHECK INJECTOR DRIVER CIRCUIT FOR A SHORT TO GROUND.
- IF CKT. IS NOT SHORTED, CHECK RESISTANCE ACROSS INJECTOR.
- RESISTANCE SHOULD BE OVER 10 OHMS. IS IT?

YES

NO

FAULTY ECM

FAULTY ECM AND INJECTOR

* INSPECT CRANK SENSOR FOR PROPER GAP (APPROX. .025"), OR SIGNS OF RUBBING. IF RUBBING IS EVIDENT, DETERMINE CAUSE AND REPLACE SENSOR.

Circuit Description:

For timing of spark plug firing, a cam sensor "hall effect" switch is used. The cam sensor sends a signal (Sync-Pulse) to the ignition module when cylinder #1 is 25° after top dead center on the compression stroke. This signal is used to start the correct sequence of coil firing and to enable sequential fuel injection. The engine will continue to run if the cam signal is lost while running, however, will not restart after shut down and a Code 41 will be stored.

The crank sensor sends a signal to the ignition module and then to the ECM for reference rpm and crankshaft position. There are three windows in a disc (interruptor) which is mounted to the harmonic balancer. These windows pass by the sensor and as each window passes, the next coil is triggered.

Test Description: Step numbers refer to step numbers on diagnostic chart.

7. Verifies ignition feed voltage at terminal "P" of the C³I module. Less than battery voltage would be an indication of a CKT 439 fault.
8. The test light to 12 volts simulates a reference signal to the ECM which will result in an injector test light blink if the CKT 430, the ECM and the injector driver circuit are all OK.
9. If the Cam Sensor signal circuit terminal "B" is momentarily jumpered to the ground circuit terminal "C" and then the engoine is cranked without turning the ignition switch "OFF", the response should be an injector test light blink. This is a result of this artificial "Cam Signal" being transmitted through the C³I module to ECM terminal "A11" and the ECM activating the injector driver circuit.
10. Verifies a proper Cam signal circuit voltage of 6 to 9 volts and a good ground from the C³I module to terminal "C" of the sensor connector.
11. Determines if reason for incorrect voltage reading was due to a fault in CKT 633, an open in CKT 632 or a faulty C³I module.

FROM PAGE 1 TEST LIGHT ON

MODULE &COIL ASSEMBLY (TOP VIEW)

TYPE I

7. • DISCONNECT C³I MODULE 14 PIN CONNECTOR.
• IGNITION ON, CHECK VOLTAGE AT HARNESS TERMINAL "P".
• READING SHOULD BE APPROX. BATTERY VOLTAGE. IS IT?

YES

NO — OPEN IN IGNITION FEED CKT 439.

8. • IGNITION ON, CONNECT A TEST LIGHT TO 12 VOLTS AND REPEATEDLY TOUCH TO C³I MODULE HARN. TERM. "C".
• INJECTOR TEST LIGHT INSTALLED IN ANY INJ. HARN. CONNECTOR SHOULD BLINK WITH EACH TOUCH. DOES IT?

YES

FROM STEP #1 FOR CODE 41

9. • RECONNECT 14 PIN C³I MODULE CONNECTOR.
• DISCONNECT CRANK AND CAM SENSOR CONNECTORS.
• IGNITION ON. SEE CAUTION★
• MOMENTARILY JUMPER CAM SENSOR HARN. TERMS. "B" TO "C".
• IGN. STILL ON, CRANK ENGINE. INJ. TEST LIGHT SHOULD BLINK. DOES IT?

NO

NO — • CHECK INJECTOR DRIVER CIRCUIT FROM ECM FOR OPEN OR SHORT TO VOLTAGE.
• IS CIRCUIT OK?

YES — CHECK CKT. 430 FOR OPEN OR SHORT TO GROUND OR TO VOLTAGE. IF CKT. 430 IS OK, IT'S POOR CONNECTION AT ECM TERM. "B5" OR FAULTY ECM.

NO — REPAIR INJECTOR DRIVER CIRCUIT

YES

10. • CHECK VOLTAGE BETWEEN CAM SENSOR HARN. TERMS. "B" AND "C".
• VOLTAGE SHOULD BE 6-9 VOLTS. IS IT?

NO

YES — • CHECK VOLTAGE AT CAM SENSOR HARN. TERM. "A".
• SHOULD BE OVER 10 VOLTS. IS IT?

NO — CHECK FOR OPEN POWER FEED CKT. 631. IF CKT. IS OK, IT'S FAULTY C³I MODULE CONNECTION OR MODULE.

YES — VERIFY THAT CAM SENSOR INTERRUPTOR IS TURNING WHILE CRANKING ENGINE. IF OK, IT'S FAULTY CAM SENSOR CONNECTION OR SENSOR.*

NO

YES — SEE PAGE 3 OF THIS CHART

11. • CHECK VOLTAGE FROM CAM SENSOR HARNESS TERM. "B" TO GROUND.
• READING SHOULD BE 6 TO 9 VOLTS. IS IT?

NO — CHECK CKT 633 FOR OPEN OR SHORT TO GROUND (IF VOLTAGE WAS ABOVE 9 VOLTS, CHECK FOR A SHORT TO VOLTAGE AND THE POSSIBILITY OF A DAMAGED SENSOR. IF CKT IS OK, IT'S C³I MODULE CONNECTION OR MODULE.

YES — CHECK CKT 632 FOR OPEN. IF CKT IS OK, IT'S FAULTY C³I MODULE CONNECTION OR MODULE.

★CAUTION: When jumpering sensor terminals, be sure to keep fingers clear of pulleys and belts as a slight movement of belt may occur, resulting in possible injury.

* INSPECT CRANK SENSOR FOR PROPER GAP (APPROX. .025"), OR SIGNS OF RUBBING. IF RUBBING IS EVIDENT, DETERMINE CAUSE AND REPLACE SENSOR.

Circuit Description:

For timing of spark plug firing, a cam sensor "hall effect" switch is used. The cam sensor sends a signal (Sync-Pulse) to the ignition module when cylinder #1 is 25° after top dead center on the compression stroke. This signal is used to start the correct sequence of coil firing and to enable sequential fuel injection. The engine will continue to run if the cam signal is lost while running, however, will not restart after shut down and a Code 41 will be stored.

The crank sensor sends a signal to the ignition module and then to the ECM for reference rpm and crankshaft position. There are three windows in a disc (interruptor) which is mounted to the harmonic balancer. These windows pass by the sensor and as each window passes, the next coil is triggered.

Test Description: Step numbers refer to step numbers on diagnostic chart.

12. Jumpering the Crank Sensor harness terminals "B" and "C" together simulates a Cam signal to the C³I module. Then, by repeatedly jumpering the Crank sensor harness terminals "B" and "C" together a Crank signal is simulated which should result in the injector test light blinking.
13. Verifies a proper Crank signal circuit voltage of 6 to 9 volts and a good ground from the C³I module to terminal "B" of the sensor connector.
14. Determines if reason for incorrect voltage reading was due to a fault in CKT 643, an open in CKT 642 or a faulty C³I module.

MODULE &COIL ASSEMBLY (TOP VIEW)

TYPE I

FROM PAGE 2
NO INJECTOR TEST LIGHT FLASH

(12) • IGNITION ON AND INJECTOR TEST LIGHT STILL IN PLACE.
• MOMENTARILY JUMPER CAM SENSOR HARNESS CONNECTOR (GRAY) TERMINALS "B" TO "C".
• REPEATEDLY JUMPER CRANK SENSOR HARNESS CONNECTOR (BLACK) TERMINALS "B" TO "C". ★ SEE CAUTION.
• INJECTOR TEST LIGHT SHOULD FLASH EACH TIME CRANK SENSOR HARNESS TERMINALS ARE JUMPERED. DID IT?

NO

(13) • CHECK VOLTAGE BETWEEN CRANK SENSOR HARN. TERMS. "B" AND "C".
• VOLTAGE SHOULD BE 6-9 VOLTS. IS IT?

NO

(14) • CHECK VOLTAGE FROM CRANK SENSOR HARN. TERM. "C" TO GROUND.
• READING SHOULD BE 6 TO 9 VOLTS. IS IT?

NO

CHECK CKT 643 FOR OPEN OR SHORT TO GROUND (IF VOLTAGE WAS ABOVE 9 VOLTS, CHECK FOR A SHORT TO VOLTAGE AND THE POSSIBILITY OF A DAMAGED SENSOR. IF CKT IS OK, IT'S C^3I MODULE CONNECTION OR MODULE.

YES

CHECK FOR OPEN IN GROUND CKT 642. IF CKT IS OK, IT'S C^3I MODULE CONNECTION OR MODULE.

YES

IT'S FAULTY C^3I MODULE CONNECTION OR MODULE.

YES

• CHECK VOLTAGE AT CRANK SENSOR HARN. TERM. "A".
• READING SHOULD BE OVER 10 VOLTS. IS IT?

NO

CHECK POWER FEED CKT 641 FOR OPEN OR SHORT TO GROUND. IF CKT. IS OK, IT'S C^3I MODULE CONNECTION OR MODULE.

YES

IT'S CRANK SENSOR CONNECTION OR SENSOR.*

★CAUTION: When jumpering sensor terminals, be sure to keep fingers clear of pulleys and belts as a slight movement of belt may occur, resulting in possible injury.

* INSPECT CRANK SENSOR FOR PROPER GAP (APPROX. .025"), OR SIGNS OF RUBBING. IF RUBBING IS EVIDENT, DETERMINE CAUSE AND REPLACE SENSOR.