NO: 500R2

STANADYNE Diesel Systems

SERVICE BULLETIN

LIMITED DISTRIBUTION

DATE: April 9, 1996 **SUPERSEDES: S.B. 500R1 dated 8/7/95**

LIMITED DISTRIBUTION — GENERAL MOTORS

SUBJECT: DS PUMP TROUBLESHOOTING INFORMATION

This bulletin provides troubleshooting information which has been compiled to assist our authorized dealers with their servicing efforts of DS pump models. The information covers only off-engine pump diagnostics. On-engine troubleshooting information is covered in GM publications such as the "6.5L Diesel Electronic Fuel Injection" booklet, publication 16015.15. At the end of this bulletin however, Diagnostic Trouble Code information is attached as well as some miscellaneous information regarding some actual field problems and observations.

We have found that the most efficient method of troubleshooting a DS pump is to first determine whether the problem is electrical or mechanical in nature during the Test As Received For Service, section of the DS service procedure. In cases where the pump is not pumping any fuel or is operating erratically, it is recommended that the electrical tests be performed first. A digital voltmeter will be needed to perform certain procedures outlined herein. If electrical testing leads you to suspect an electrical component has failed, replace that component at this time to see if it will correct the problem, prior to rebuilding.

If a pump is delivering fuel, but the output is low at certain check points during the test as received checks, it is advisable to check and record return oil flow and transfer pump pressure prior to removing the pump from the test bench and performing the rebuild. Recommended procedures to follow if return oil flow is excessive or if transfer pump pressure is low are included in Section 3 under "Additional Test as Received Checks".

Technical Support Group
Product Support Department

Diesel Systems Division, Stanadyne Automotive Corp.
92 Deerfield Road, Windsor, CT 06095, USA Tel: (860) 525-0821; Telex: 99218; Telecopy: (860) 525-4215

SECTION 1

TEST BENCH PROBLEMS

FAULT	POSSIBLE DTC'S *	POSSIBLE CAUSES
Closure Time Too Long or Missing (>1.9 ms)	36	Damaged Calibration Resistor or Pins in PMD connector Defective PMD (See Section 2) Defective Encoder Sensor (See Section 2) Improper Poppet Valve Stroke Setting Debris or Excess Friction in Fuel Control Sol. or Poppet Valve Incorrect Poppet Valve Spring Preload
Closure Time Too Short (<1.5ms)	35	Damaged Calibration Resistor or Pins in PMD connector Defective PMD (See Section 2) Defective Encoder Sensor (See Section 2) Improper Poppet Valve Stroke Setting Incorrect Poppet Valve Spring Preload
Pump Will Not Deliver Fuel	13, 17, 18, 35, 36	Low or No Transfer Pump Pressure (ESO Failure or T.P. Regulator or Transfer Pump problems) Defective Encoder Sensor (See Section 2) Wire Harness or Connector Damage (See Section 2) Improper Poppet Valve Stroke Setting Defective PMD (See Section 2) Fuel Control Solenoid Failure (See Section 2) Pumping Plungers Installed Incorrectly Poppet Valve or Fuel Control Solenoid Armature Binding Shoe/Roller and/or Head and Rotor Failure
Pump Delivers Too Much Fuel @ High Speeds		Fuel set at high end of specification at set point Poppet Valve Stroke Above or Below Specification Poppet Valve Seat Damage Improper Poppet Valve Spring preload - See Section 3 Debris or excess friction in Fuel Control Solenoid or Poppet Valve (Long Closure Time)
No/Low T.P. Pressure, High Return Oil		Damaged O-ring Seals on Head Locking/Locating Screws, T.P. Insert, or T.P. Regulator T.P. Insert not seated completely Misassembled Advance Components Missing or Worn Accumulator Pistons Misassembled Transfer Pump Components Worn Transfer Pump Components
No/Low T.P. Pressure, Return Oil OK		Failed ESO (Ref. Section 2) Internal Transfer Pump leakage - try new T.P. reg. spring to achieve greater adjustment (Ref. S.B. 491R) Defective T.P. Regulator Components Worn Transfer Pump Components

* See Section 4 for an explanation of DTC's and corresponding DTC codes for 1996 and later vehicles which utilize OBD II.

SECTION 1

TEST BENCH PROBLEMS (Cont'd)

FAULT	POSSIBLE DTC'S *	POSSIBLE CAUSES
Return Oil Flow Too High		Encoder Sensor Adjusting Tool still Engaged Preventing Advance Movement Damaged O-ring Seals on Head Locking/Locating Screws, T.P. Insert, or T.P. Regulator Reed Valve Missing from Advance Piston Worn or Defective Head and Rotor/Plungers Excessive Leakage from the Transfer Pump
Low Cranking Fuel		Unstable Test Bench Cranking Speed Reed Valve Missing from Advance Piston Low Transfer Pump Pressure Sticking or Worn Plungers Worn or Defective Head and Rotor Poppet Valve seat area damaged
High Fuel Delivery Throughout RPM Range	17, 18	Improper Poppet Valve Stroke Setting Improper Poppet Valve Spring Preload - check shims Defective PMD (See Section 2) Defective Encoder Sensor (See Section 2) Poppet Valve stuck closed (no spill)
Excessive Variation in Cylinder-to-Cylinder Fuel Delivery at Idle	91 - 98	Worn or Defective Head and Rotor Nicks in T.P. Insert (only when ESO de-energized) Defective or Missing Delivery Valves
Excessive Variation in Cylinder-to-Cylinder Fuel Delivery at 3000 ERPM\70mm/Stroke	91 - 98	Defective or Missing Delivery Valves Missing/improperly assembled Snubber Plates
Low Fuel Throughout RPM Range	17, 18	Low Transfer Pump Pressure Incorrect Poppet Valve Stroke Setting Improper Poppet Valve Spring Preload Poppet Valve not sealing properly or closing completely Defective Encoder Sensor (See Section 2) Defective Data Track Disc (Cylinder Ref. Track) Defective PMD (See Section 2)

* See Section 4 for an explanation of DTC's and corresponding DTC codes for 1996 and later vehicles which utilize OBD II.

SECTION 2

PERFORMING ELECTRICAL TESTS

To perform the tests outlined on the next page, measure voltages at the PMD and Encoder Sensor connectors by inserting probes through the environmental boot on the rear of the connectors as shown below. *NOTE: Some voltages are measured on the 0-10 volt DC scale while others are measured on the AC scale - be sure to change scales accordingly. Notice: AC voltage ranges are for reference only. Your actual readings may differ due to variations in temperature, test equipment and test conditions.*

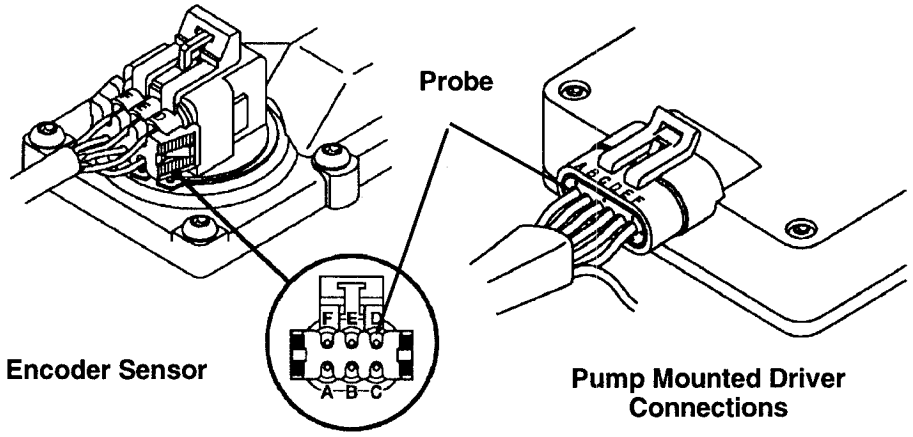


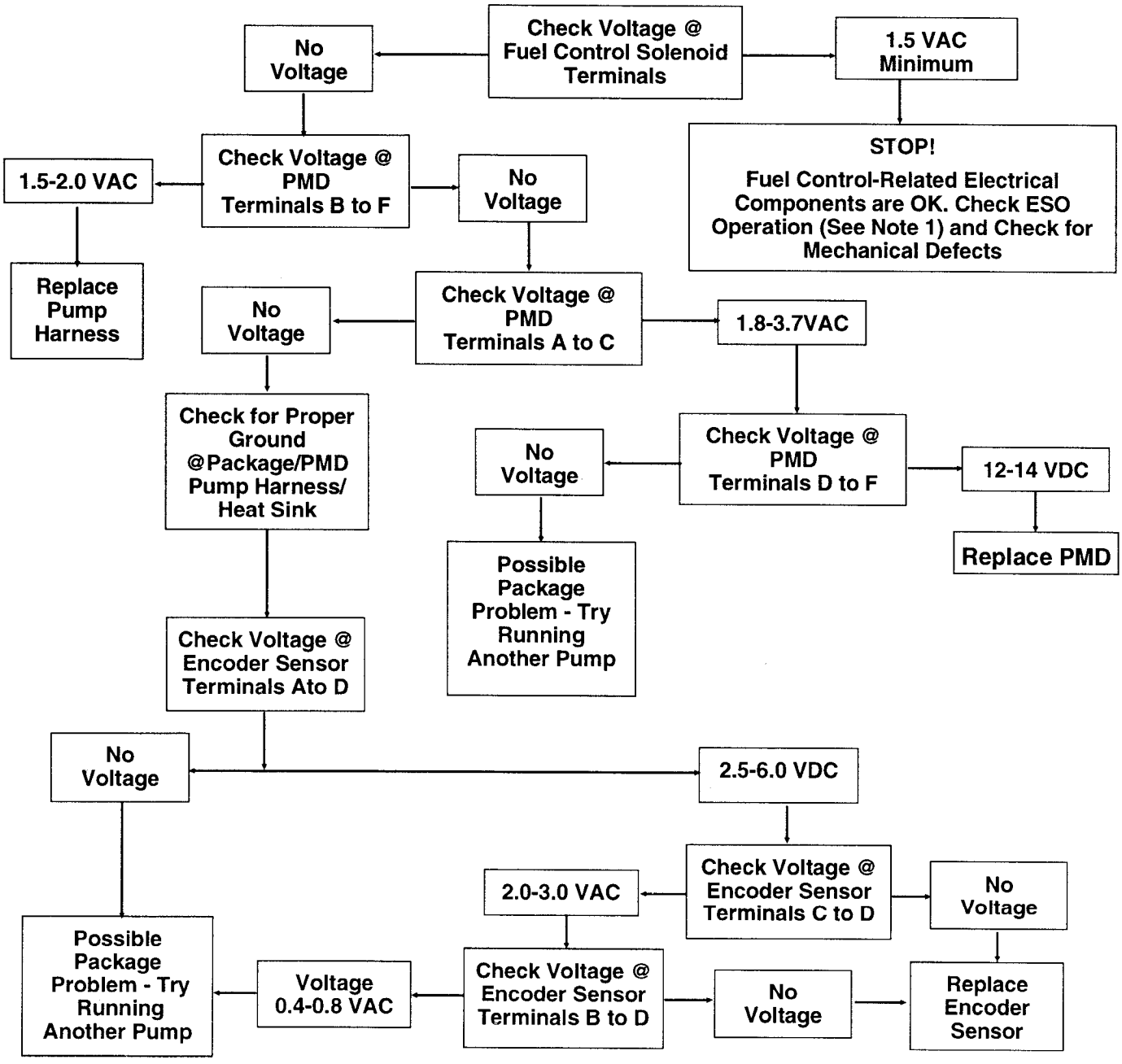
FIGURE 1

CAUTION: Use care when testing DS pump electrical components. Safe electrical practices must be followed at all times to protect both the technician and the component being tested.

SECTION 2

PERFORMING ELECTRICAL TESTS (Cont'd)

These tests are intended to be performed when a pump does not deliver fuel on the test bench. The tests are designed to aid the technician in determining whether an electrical component is faulty, and if so, which one. Operate the pump at 600 ERPM and enter the "Manual Mode". Select test number "0", "Adjust Fuel Delivery" and enter 740 offdelay for DS-5067 models and 622 for DS-5068 models. The chart on the next page identifies the Encoder Sensor and Pump Mounted Driver terminals. *NOTICE: AC Voltage ranges are for reference only. Your actual readings may differ due to variations in temperature, test equipment and test conditions.*



NOTE 1: To check ESO operation, press #3 for ESO test. Open transfer pressure tap valve and de-energize ESO. Transfer pressure should drop to zero with ESO de-energized and increase with ESO energized. If ESO is operational, a mechanical problem may exist within the pump - refer to Section 1 -Test Bench Problems for possible causes.

SECTION 2

PERFORMING ELECTRICAL TESTS (Cont'd)

With the exception of the Ohms resistance test on the Encoder Sensor Fuel Temperature Sensor, these tests are performed at 600 ERPM in "Manual Mode" using 740 offdelay on DS-5067 models or 622 offdelay on DS-5068 models.

FUEL CONTROL SOLENOID AND PUMP MOUNTED DRIVER (PMD)

FUNCTION	TERMINALS	VOLTAGE RANGE	SPEED OR LOAD DEPENDENT*
Fuel Inject Command From Pump Control Module (PCM) to PMD	**A** (Green) to **C** (Black)	1.8-3.7 VAC	S&L
Fuel Inject Command From PMD to Fuel Control Solenoid	**B** (Red) to **F** (Black)	1.5 VAC Min.	S
Ground via Pump Control Module	**C** (Black)		
Power Source	**D** (Pink) to **C** (Black)	12-14 VDC	
Poppet Valve Closure Signal From PMD to PCM	**E** (Dk. Red) to **C** (Black)	2.5-3.5 VAC	L
Return Signal to Fuel Solenoid (Ground)	**F** (Black)		

ENCODER SENSOR

Reference Voltage From Pump Control Module to Encoder Sensor	**A** (Red) to **D** (Black)	2.5-6.0 VDC	
Pump Cam Reference Pulse to PCM	**B** (White) to **D** (Black)	0.4-0.8 VAC	
Pump High-resolution Signal to PCM	**C** (Orange) to **D** (Black)	2.0-3.0 VAC	S
Encoder Sensor Return Signal (Ground)	**D** (Black)		
Fuel Temperature Sensor Signal to PCM	**E** (Yellow)		
Fuel Temperature Sensor Return Signal (Ground)	**F** (Black)	300-7,000 Ohms (See Note 1)	

NOTE 1: Stop bench, power down test equipment. Disconnect Encoder Sensor Connector and measure resistance across Encoder Sensor pins E and F.

*Voltage varies with speed (S) or load (L) (fuel delivery/offdelay) changes.

SECTION 3

CALIBRATION ISSUES AND TEST EQUIPMENT ERROR MESSAGES

Additional Test as Received Checks

By performing a few additional checks during the test as received checks, extra labor and parts replacements can be prevented following pump rebuilding.

For instance, if a pump delivers less than the minimum amount of cranking fuel, it may be due to low transfer pump pressure. If low cranking delivery is encountered it is suggested that prior to removing the pump from the bench that the transfer pump pressure tap be installed and pressure measured at cranking speed. If the pressure is found to be low, it should be elevated by the transfer pressure adjusting tool or by increasing the supply pressure to obtain a minimum of 16 p.s.i. and the cranking delivery rechecked. If the pump now meets specification, the head and rotor assembly should be reusable during the rebuild.

Checking return oil flow at 1500 ERPM during the pump warm-up period can also be beneficial. If it exceeds the specification of 600 cc\min., it could be an indication of an internal leak or wear in the pump. In such cases all seals should be carefully examined for failure during the pump disassembly. If the seals are found to be intact then the transfer pump group, head and rotor assembly and housing should all be examined carefully for possible leakage sources prior to reassembly.

Encoder Sensor Issues

Normally the Encoder Sensor is centered with respect to the hole in the cam ring when the fuel is set to specification on a DS pump. Should you encounter a situation where the Encoder Sensor is at or near the end of its adjusting slot in order to obtain the specified fuel delivery, it could mean the Poppet Valve Stroke setting is outside of its specification. When setting Poppet Valve Stroke be sure that the dial indicator stem remains in contact with the rotor throughout its travel.

If you lose the ability to control both fuel and advance at the same time, check to see if the Encoder Sensor is tight enough to prevent movement relative to the cam ring during pump operation. If tight, try a know good sensor since accurate fuel and advance readings require a good cam reference signal.

Normally, the encoder sensor is considered acceptable if it yields less than 11 errors per 10,000 events. *NOTE: The test routine is designed to count up to a maximum of 254 errors. If the encoder sensor error test repeatedly fails by registering more than 10 errors, check to make sure that no air bubbles are present in the return line. Other possible causes for excess sensor errors are:*

1) *Test Bench Drive Coupling damage or lash* and/or
2) *Faulty Encoder Sensor or a damaged data track disk*, and/or
3) *Poor Ground* - Its been found that some test benches are providing an intermittent ground to the pump. If a pump passes the encoder sensor error routine during the "test as received" checks but yields more than 10 sensor errors when tested following service, try connecting an additional ground wire between the heat sink terminal and the pump cover screw.

Calibration Resistor Error Messages

Near the beginning of either the "Test as Received" or "Test Following Service" test routines, the message "Cal. Resistor not Recognized." may be encountered. If you press (1) to continue, the computer defaults to a #5 (null value) calibrating resistor fuel table and allows the test to continue. However, the problem of reading the resistor may reappear later where you cannot continue. This message may indicate poor connections, a fault with the calibration resistor, the Encoder Sensor, the PMD, or even a test equipment package problem. See Section 2 for electrical troubleshooting information.

SECTION 3

CALIBRATION ISSUES AND TEST EQUIPMENT ERROR MESSAGES (cont'd)

Near the end of "Test Following Service", you may see the message stating "Incorrect Resistor, Check Resistor Value." First check to see if the resistor identification number corresponds to what the calibration equipment specified and if the resistor is installed properly into the PMD connector (Ref. Figure 2). If so, try a different resistor of the same value or check the resistor's resistance as shown below. If the resistor checks properly, check pins and pin sockets on the PMD and harness for damage.

Resistor Part Number	Ohms Resistance Range	Identification Number
30892	4300-4500	1
30893	7200-7400	2
30894	9800-10100	3
30895	13100-13500	4
30896	17500-18000	5
30897	27700-28300	6
30898	43700-44700	7
30899	58400-59600	8
30900	79800-81400	9

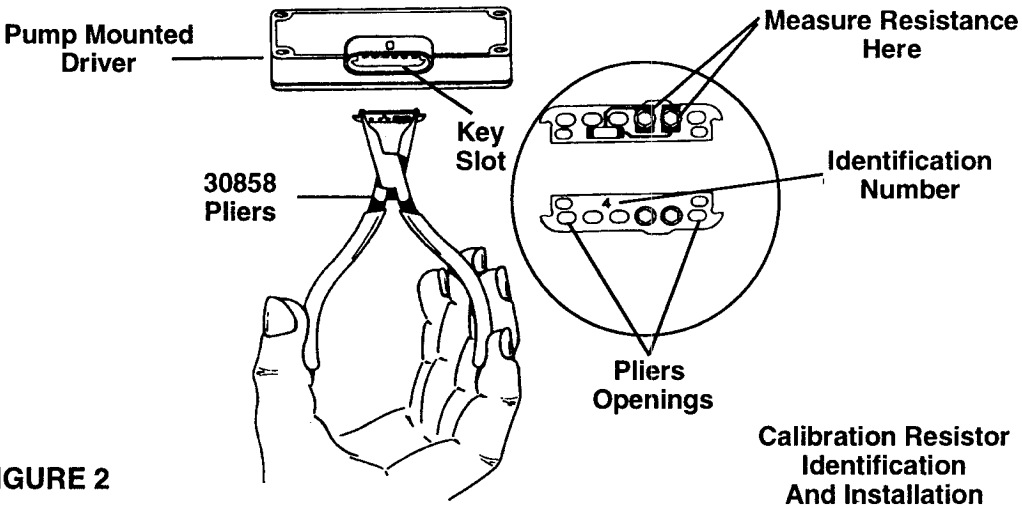


FIGURE 2

Advance Problems

No or incorrect advance operation can be caused by a faulty low resolution track on the Encoder Sensor (See Section 2 for testing) or by an improperly assembled advance piston assembly. (i.e. servo valve or plunger installed backwards or a missing reed valve). If 5 degrees of advance cannot be obtained while checking cranking (particularly on DS-5068 models), this may be caused by the lack of the spring assisted advance feature (S.B. 493), a missing reed valve, a test bench with insufficient flywheel mass or a worn test bench drive. Any or all of these could cause the advance to collapse at low speeds.

Closure Time Error Messages

If a poppet valve closure time error message is encountered at the beginning of the "Test as Received" routine the test equipment will allow the test to be continued or terminated. If the pump is otherwise operable **you must continue the Test as Received checks** so a printout can be obtained. A poppet valve closure time failure at the start of the "Test as Received" or "Test Following Service" routines generally (but not always) means that the poppet valve stroke is set

SECTION 3

CALIBRATION ISSUES AND TEST EQUIPMENT ERROR MESSAGES (cont'd)

incorrectly. If the pump does not deliver any fuel, a faulty harness connector, and/or failed Encoder Sensor or PMD, can also result in closure time failure. Check the voltages as outlined in Section 2 before disassembling the pump to look for mechanical problems. It is also advisable to operate another pump on the stand to determine whether the problem might be related to a malfunction with the test equipment package.

Poppet Valve Spring Preload

As outlined in the DS Operation and Instruction Manual, the poppet valve spring preload is set at the factory through the use of shims beneath the spring. It is also recommended that during disassembly that the shim pack be measured and the total thickness noted so that if one or more of the shmis are misplaced, the same amount of shimming can be installed during reassembly. Should the shims ever be misplaced without their thickness being recorded our experience has been that most rotors require approximately 0.040 inches of shims. If this amount is installed and the pump calibration meets specification it can be assumed that poppet valve spring preload is acceptable.

Miscellaneous Test Equipment Malfunctions

To prevent the loss of the test data (and restesting of the pump) in the event of a printer malfunction, always save the test data prior to attempting to print it. Once the file is printed, it can then be deleted via the "File Activities" menu.

Your data cartridge has a finite amount of storage space and when filled with test data can cause operation problems during the test and/or printing operations. Old data is not automatically deleted from memory as new tests are added to the memory. Saved test files have to be deleted individually (there is no mass deletion operation) in the File Activities Mode as explained on pages 20 through 22 in the Electronic Diesel Fuel Injection Calibration Equipment Instruction Manual, 99650. If you experience printing and/or other test equipment problems, try deleting some of the files from the cartridge to free up additional memory.

If red lights with messages such a "RICH" or "LEAN" appear on the scan tool and the advance readings are outside of the normal 0-10 degrees, another data cartridge should be tried. Central Distributors can usually provide one for this purpose. If the problem persists, the package power supply may be faulty (low current output).

In case of a verified DS test equipment package failure, refer to Service Letter 292 for instructions on how to obtain a replacement.

SECTION 4

DIAGNOSTIC TROUBLE CODES (DTC's) FOR THE 6.5L DIESEL ENGINE

For the 1996 model year, a new set of standardized diagnostic trouble codes has been established as part of the new On Board Diagnostics System known as OBD II. A cross reference listing of the old and the new DTC codes are provided below with the pump related items shown in boldface type to help assist you with your DS pump servicing. Following the cross reference listing is an explanation of the parameters which trigger the pump related DTC's to be set.

Code Description	'96 OBD II DTC	'94/'95 OBD DTC
PROM Error		51
PCM Fuel Circuit Error		54
Intake Air Temperature Sensor Circuit Low (High Temperature)	P0112	47
Intake Air Temperature Sensor Circuit High (Low Temperature)	P0113	48
Engine Coolant Temperature Sensor Circuit Low (High Temperature)	P0117	14
Engine Coolant Temperature Sensor Circuit High (Low Temperature)	P0118	15
Accelerator Pedal Position 1 Circuit Range Fault	P0121	23
Accelerator Pedal Position 1 Circuit Low	P0122	22
Accelerator Pedal Position 1 Circuit High	P0123	21
Fuel Temperature Circuit Low (High Temperature)	**P0182**	**42**
Fuel Temperature Circuit Low (Low Temperature)	**P0183**	**43**
Engine Shutoff Solenoid Circuit Fault	**P0215**	**13**
Injection Timing Stepper Motor Fault	**P0216**	**34**
Engine Overspeed Condition	P0219	
Accelerator Pedal Position 2 (5 Volt Reference Fault)	P0220	99
Accelerator Pedal Position 2 Circuit Range Fault	P0221	27
Accelerator Pedal Position 2 Circuit Low	P0222	26
Accelerator Pedal Position 2 Circuit High	P0223	25
Accelerator Pedal Position 3 (5 Volt Reference Fault)	P0225	
Accelerator Pedal Position 3 Circuit Range Fault	P0226	65
Accelerator Pedal Position 3 Circuit Low	P0227	64
Accelerator Pedal Position 3 Circuit High	P0228	63
Lift Pump Secondary Circuit Low Voltage	P0231	
Wastegate Solenoid Fault	P0236	78
Turbo Boost Sensor Circuit Low	P0237	62
Turbo Boost Sensor Circuit High	P0238	61
Pump Cam Reference Pulse Error	**P0251**	**18**
Cylinder Balance Fault #8 Cylinder	**P0263**	**98**
Cylinder Balance Fault #7 Cylinder	**P0266**	**97**
Cylinder Balance Fault #2 Cylinder	**P0269**	**92**
Cylinder Balance Fault #6 Cylinder	**P0272**	**96**
Cylinder Balance Fault #5 Cylinder	**P0275**	**95**
Cylinder Balance Fault #4 Cylinder	**P0278**	**94**
Cylinder Balance Fault #3 Cylinder	**P0281**	**93**
Cylinder Balance Fault #1 Cylinder	**P0284**	**91**
Crankshaft Position Reference Error	**P0335**	**19**
High Resolution Circuit Fault	**P0370**	**17**
Glow Plug Relay Fault	P0380	29
EGR Circuit Error	P0404	32
EGR Control Pressure/Barometric Sensor Circuit Low (High Vacuum)	P0405	31
EGR Control Pressure/Barometric Sensor CircuitHigh (Low Vacuum)	P0406	33

SECTION 4

DIAGNOSTIC TROUBLE CODES (DTC's) FOR THE 6.5L DIESEL ENGINE (Cont'd)

Code Description	'96 OBD II DTC	'94/'95 OBD DTC
Vehicle Speed Sensor Buffer Fault	P0501	16
Resume/Accel Switch Fault	P0567	76
Set/Coast Switch Fault	P0568	71
PCM Memory	P0601	
PCM Not Programmed	P0602	
PCM Internal Communication Interrupted	P0606	
Accelerator Pedal Position Circuit Fault	P1125	84
TDC Offset Error	**P1214**	**88**
Fuel Solenoid Response Time Too Short	**P1216**	**35**
Fuel Solenoid Response Time Too Long	**P1217**	**36**
Injection Pump Calibration Resistor Error	**P1218**	**56**
A/D Performance	P1627	
PCM 5 Volt Shorted	P1635	57
Malfunction Indicator Lamp Circuit Fault	P1641	46
EGR Vent Error	P1653	45
Service Throttle Soon Lamp Circuit Fault	P1654	49
EGR Pulse Width Error	P1655	44
Wastegate Solenoid Control Circuit	P1656	

NOTE: The following DTC parameters are those used on the engine. Calibration specification parameters may be different - refer to the individual specification.

DTC 13 (P0215) - Electric Shutoff Solenoid Circuit Fault (ESO).

The injection pump fuel supply line has a solenoid controlled shutoff valve. When the solenoid is energized (key in run position), the valve is open and fuel is supplied to the injection pump.

DTC 13 (P0215) becomes active (set) when Powertrain Control Module (PCM) has:

1. Attempted to energize the engine shutoff solenoid (open valve, turn on fuel supply) AND

   voltage at ESO terminal of the PCM connector is greater than zero volts. This indicates the voltage drop across the solenoid, required to energize the coil, did not occur and the solenoid valve is closed.

2. Attempted to de-energize the engine shutoff solenoid (close valve, turn off fuel supply) AND

   voltage at ESO terminal of the PCM connector equals zero volts. This indicates a voltage drop across the solenoid coil did occur, the coil remains energized and the solenoid valve is open.

DTC 17 (P0370) - Encoder Sensor High Resolution Signal Malfunction

This test monitors the number of high resolution pulses which have been missed (not detected). It is based on a comparison between the number of pulses that were detected since the last cam pulse (low resolution) and the number of pulses that should have occurred.

DTC 17 (P0370) becomes active (set) when:

1. Eight cam pulses have occured since the last high resolution pulse was detected.

SECTION 4

DIAGNOSTIC TROUBLE CODES (DTC's) FOR THE 6.5L DIESEL ENGINE (Cont'd)

DTC 18 (P0216) - Encoder Sensor Low Resolution Malfunction (Cam Reference Pulse).

This test monitors the number of cam pulses which have been missed (not detected). It is based on the number of crankshaft position sensor pulses (TDC) that have occurred since the last cam pulse was detected. The physical one to one correspondence between the cam and crankshafts implies if more crank pulses are detected than cam pulses, cam pulses have been missed.

DTC 18 (P0216) becomes active (set) when:

1. Eight crankshaft position sensor pulses have occurred since the last cam pulse was detected. This implies eight cam pulses have been missed.

DTC 34 (P0216) - Fuel Injection Timing Control Circuit Malfunction

Timing of the combustion event is accomplished by delivering a pulse of fuel into the combustion chamber at a desired degree of cylinder travel. This desired degree (desired timing) defines the current position of the cylinder in relationship to Top Dead Center. This test compares desired timing to measured timing when certain conditions have been met.

DTC 34 (P0216) becomes active (set) when:

1. Engine speed has not changed more than 56 RPM for 20.8 seconds AND the absolute value of the timing error exceeds 8 degrees. (The difference between desired timing and measured timing is greater than 5 degrees for both DTC 34 and DTC P0216.)

DTC 35 (P1216) - Fuel Control Solenoid Response Time Too Short (Closure Time).

The injection pump delivers fuel to individual cylinders by opening and closing a solenoid controlled fuel valve. The PCM monitors the amount of time it takes for the fuel solenoid valve to physically close after being commanded to close. Closure time out of range is seen as a fault.

DTC 35 (P1216) becomes active (set) when:

1. Battery voltage is greater than 10 volts but less than 16 volts AND
   engine coolant temperature is greater than 20°C (68°F) AND
   engine speed is greater than 506 RPM AND
   requested fuel is greater than 0.0mm^3 AND
   closure time is less than 1.2 milliseconds for DTC 35 (0.75 milliseconds for DTC P1216).

DTC 36 (P1217) - Fuel Control Solenoid Response Time Too Long (Closure Time).

The injection pump delivers fuel to individual cylinders by opening and closing a solenoid controlled fuel valve. The PCM monitors the amount of time it takes for the fuel solenoid valve to physically close after being commanded to close. Closure time out of range is seen as a fault.

DTC 36 (P1217) becomes active (set) when:

1. Battery voltage is greater than 10 volts but less than 16 volts AND
   engine coolant temperature is greater than -20°C(68°F) AND
   engine speed is greater than 506 RPM AND
   requested fuel is greater than 0.0mm^3 AND
   closure time greater than 2.45 milliseconds.

SECTION 4

DIAGNOSTIC TROUBLE CODES (DTC's) FOR THE 6.5L DIESEL ENGINE (Cont'd)

DTC 42 (P0182) - Fuel Temperature Sensor Circuit Low Input (Unreasonably High Temperature Measured).

The thermistor sensing the fuel temperature is a NTC (negative temperature coefficient), therefore as temperature increases the resistance of the thermistor decreases. The voltage measured across the thermistor is interpreted as a temperature.

DTC 42 (P0182) becomes active (set) when:

1. The fuel temperature is greater than 102°C (215°F).

DTC 43 (P0183) - Fuel Temperature Sensor Circuit High Input (Unreasonably Low Temperature Measured).

The thermistor sensing the fuel temperature is a NTC (negative temperature coefficient), therefore as temperature increases the resistance of the thermistor decreases. The voltage measured across the thermistor is interpreted as a temperature.

DTC 43 (P0183) becomes active (set) when:

1. The engine has been running longer than 2 minutes AND

   the sensor indicates a temperature below -14°C (6°F) for DTC 43 or 8 minutes and 17°C (63°F) for DTC P0183.

DTC 56 (P1218) - Injection Pump Calibration Resistor Fault.

Each injection pump has a calibration resistor installed in the pump mounted driver connector housing. The value of the calibration resistor, measured by the PCM, determines which of eight possible correction tables will be used in providing the correct fuel for injection. This test reports if a valid calibration resistor has been detected.

DTC 56 (P1218) becomes active (set) when:

1. PCM currently does not have a valid resistor value AND

   PCM is unable to read a valid resistor value.

DTC 88 (P1214) - TDC Offset Error

If the PCM is replaced or other components affecting timing are removed or replaced, TDC Offset must be reprogrammed into the PCM. Failure to Program TDC will result in DTC 88 (P1214).

DTC 88 (P1214) becomes active (set) when:

The TDC Offset is greater than ± 2.0° for DTC 88 and ± 2.5° for DTC P1214.

NOTE: DTC 88 (P1214) along with DTC 34 (P0216) may mean that the drive hub has slipped on the pump drive shaft, the advance piston is stuck in its bore or the engine crankshaft key is sheared.

SECTION 5
MISCELLANEOUS ENGINE DIAGNOSTICS

Symptoms: Runs rough (if at all), smokes heavily and sets DTC's 91-98 (Adaptive Cylinder Balance Fault) following rebuilt pump installation. Possible cause: the distributor rotor is installed out of phase (not dot-to-dot) with the pump drive shaft. *NOTE: This condition cannot be recognized during bench testing, and rotor and shaft can be installed 90, 180 or 270 degrees out of phase.*

Symptoms: Engine idles progressively rougher with time, heavy smoke, rattling noise from transmission area and DTC's 91-98. Possible cause: Faulty dual mass flywheel (manual transmission). See GM Bulletin 466102.

Idle Fuel Rate Comparison Chart

The TECH 1 diagnostic tool can display the idle fuel rate of the DS pump equipped GM 6.5L engine. The chart below shows the normal idle fuel range for the engine (8-15 mm^3/stroke), plus some typical ranges that might be displayed when there is a mismatch between the PROM (Programable Read Only Memory Chip). It also shows typical fuel rates that may be displayed with various grades of fuel. It must be noted that fuel rates displayed by TECH 1 are calculated rates only based on OFFDELAY information and not actual measurements. This is why the rates are far from the normal range when a pump and PROM mixup occurs.

We hope that information such as this will help you in assisting GM dealers with their diesel diagnostic efforts.

EFI 6.5L Idle Fuel Rate Comparison

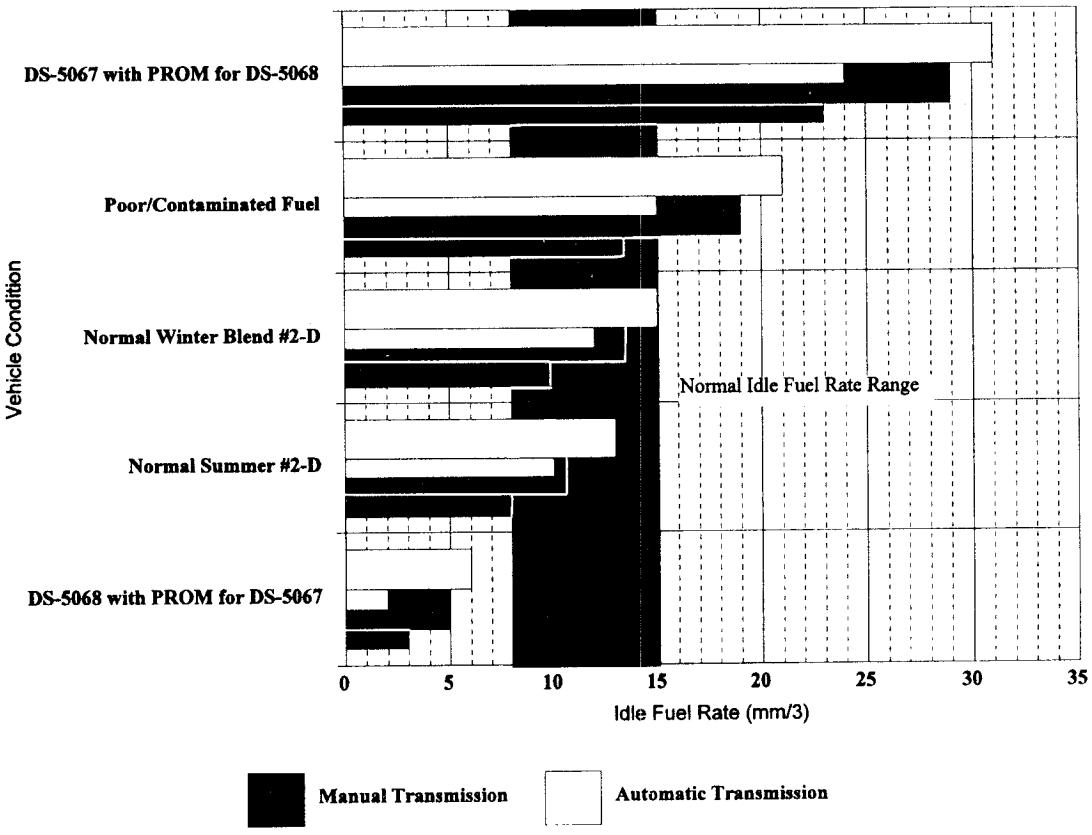


FIGURE 3