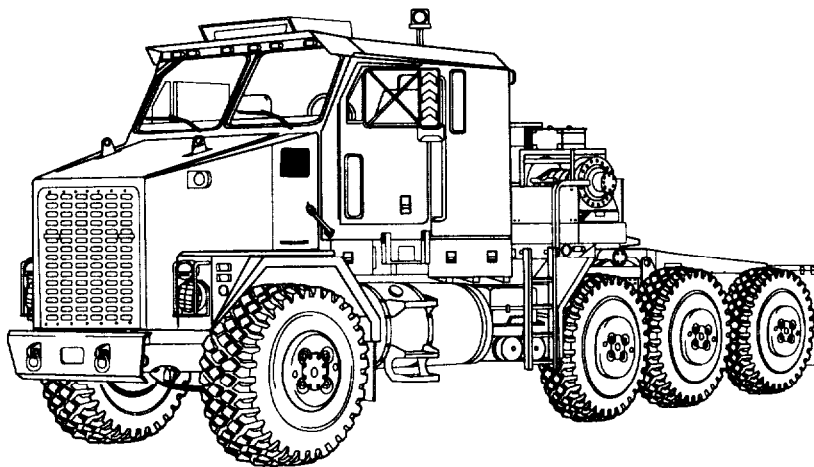


TECHNICAL MANUAL UNIT MAINTENANCE



**HOW TO USE
THIS BOOK** H-1

**TESTING THE
DDEC III SYSTEM** H-10

**TROUBLESHOOTING
CHARTS** H-40

**DIAGNOSTIC
CODE
CHARTS** H-103

**DIAGNOSTIC DATA
READER
INFORMATION** H-257

**TRUCK, TRACTOR, M1070,8 X 8,
HEAVY EQUIPMENT TRANSPORTER (HET)**

NSN 2320-01-318-9902

EIC:B5C

HEADQUARTERS, DEPARTMENT OF THE ARMY

SEPTEMBER 1997

Technical Manual
TM 9-2320-360-20-3

HEADQUARTERS
 DEPARTMENT OF THE ARMY
 WASHINGTON, D.C., 1 September 1997

UNIT MAINTENANCE

**TRUCK, TRACTOR, M1070, 8 X 8,
 HEAVY EQUIPMENT TRANSPORTER (HET)
 (NSN 2320-01-318-9902)
 EIC:B5C**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Director, Armament and Chemical Acquisition and Logistics Activity, ATTN: AMSTA-AC-NML, Rock Island, IL 61299-7630, A reply will be furnished to you.

TABLE OF CONTENTS

	Page
APPENDIX H DDEC III DIAGNOSTIC TROUBLESHOOTING GUIDE	
Section 1 How To Use This Book	H-1
Section 2 Basic Knowledge Required	H-3
A. Electrical Circuits	H-3
B. Use of Digital Volt-Ohm Meter	H-3
C. Important Information	H-4
D. Explanation of Abbreviations/Terms	H-5
E. General Diagnostic Information	H-9
Section 3 Testing The DDEC III System	H-10
A. Tools Needed to Diagnose the System	H-10
B. Differences Between DDEC III and DDEC II	H-10
C. Reading the Diagnostic Codes	H-11
D. Clearing Codes	H-13
E. Connector Checkout	H-13
F. Digital Input/Output Functions	H-13

Approved for public release: distribution is unlimited.

TABLE OF CONTENTS - Cont'd

		Page
Section 4	Troubleshooting Charts	H-15
A.	The Diagnostic Procedure - Where to Start	H-15
B.	DDEC III Diagnostic Codes/What They Mean	H-15
C.	Beginning Charts	H-25
	START - First Chart for Diagnosis of DDEC-III Using DDR	H-25
	CEL - First Chart for Diagnosis of DDEC-III When No DDR is Available	H-35
D.	Troubleshooting Charts	H-40
	Chart 1 - Intermittent Code or a Symptom and No Codes	H-40
	Chart 2 - Engine Cranks But Will Not Start..	H-43
	Chart 3 - Erratic Performance and No Codes	H-63
	Chart 4 - No "Check Engine" Light During Bulb Check or Cannot Clear Codes	H-65
	Chart 5 - "Check Engine" Light On and No Active Code on DDR	H-71
	Chart 6 - "Check Gauges" Light On and No Active Code on DDR	H-75
	Chart 7 - No Data to DDR..	H-79
	Chart 8 - No "Check Gauges" Light (CGL) During Bulb Check	H-65
	Chart 9 - Diagnostic Request Switch Inoperative	H-91
	Chart 10 - Variable speed Governor (VSG or PTO High Idle) Inoperative	H-95
E.	Diagnostics Code Charts	H-103
	Flash SAE	
	Codes: Codes: (Cross Reference on page vi)	
	11 P187 4 - Power Take Off Input Failed Low (Voltage Low)	
	(Also Called Variable Speed Governor - VSG)	H-103
	12 P187 3 - Power Take Off (PTO) Input Failed High (High Voltage)	
	(Also Called Variable Speed Governor - VSG)	H-111
	13 P111 4 - Coolant Level Circuit Failed Low (Low Voltage)	H-117
	14 P110 3 - Coolant Temperature Circuit Failed High (Voltage High)	
	OR: P175 3 - Oil Temperature Circuit Failed High (Voltage High)	H-121
	15 P110 4 - Coolant Temperature Circuit Failed Low (Low Voltage)	
	OR: P175 4 - Oil Temperature Circuit Failed Low (Low Voltage)	H-127
	16 P111 3 - Coolant Level Circuit Failed High (Voltage High)	H-133
	21 P91 3 - Electronic Foot Pedal ASM (EFPA) Circuit Failed High	
	(Voltage High) Also Called Throttle Position Sensor (TPS)	H-139
	22 P91 4 - Electronic Foot Pedal ASM (EFPA) Circuit Failed Low	
	(Voltage Low) Also Called Throttle Position Sensor (TPS)	H-145
	23 P174 3 - Fuel Temperature Circuit Failed High (High Voltage)	H-153
	24 P174 4 - Fuel Temperature Circuit Failed Low (Low Voltage)	H-157
	25 None - NoCodes	H-161

TABLE OF CONTENTS - Cont'd

	Page
E. Diagnostics Code Charts (Cont'd)	H-103
Flash SAE	
Codes: Codes:	
33 P102 3 - Turbo Boost Pressure Circuit Failed High (High Voltage)	H-163
34 P102 4 - Turbo Boost Pressure Circuit Failed Low (Low Voltage)	H-169
35 P100 3 - Oil Pressure Circuit Failed High (High Voltage)	H-177
36 P100 4 - Oil Pressure Circuit Failed Low (Low Voltage)	H-183
41 S21 0 -Too Many SRS (Missing TRS)	H-191
42 S21 1 - Too Few SRS (Missing SRS)	H-201
43 P111 1 - Coolant Level Low	H-211
44 P110 0 - Coolant Temperature High or	
P175 0 - Oil Temperature High	H-213
45 P100 1 - Oil Pressure Low	H-215
46 P168 1 - Battery Voltage Low	H-217
52 S254 12 - Analog to Digital (A/D) Conversion Failure	H-223
53 S253 12 - Nonvolatile Memory Failure	H-225
56 S250 12 - J1587 Data Link Fault	H-227
57 S249 12 - J1922 Data Link Fault	H-229
61 Sxxx 0 - Injector Response Time Long	See TM 9-2320-360-34-1
62 S026 3/4 - Auxiliary Output Short to Battery,	
- Auxiliary Output Open Circuit	H-231
63 S057 3/4 - PWM Short to Battery/PWM Open Circuit.	H-233
71 Sxxx 1 - Injector Response Time Short	See TM 9-2320-360-34-1
75 P168 0 - Battery Voltage High	H-235
76 P121 0 - Engine Overspeed with Engine Brake	H-237
85 P121 0 -Engine Overspeed	H-239
E. ENG5V - Engine Harness +5 Volts Supply	H-241
VEH5V - Vehicle Harness +5 Volts Supply	H-247
Section 5 Diagnostic Data Reader Information	H-257
A. Engine Data List	H-259
B. Diagnostic Codes	H-263
B.1 ActiveCodes	H-263
B.2 InactiveCodes.....	H-264
B.3 ClearCodes.....	H-264
B.4 Change Code Description	H-264

TABLE OF CONTENTS - Cont'd

	Page
C. View Calibration Configuration Selections	H-266
C.1 Engine Configuration	H-268
C.2 VSG Configuration	H-272
C.3 Engine Protection Configuration..	H-274
C.4 ECM Input and Output Configuration	H-276
D. Fuel Injector Information	H-280
D.1 Cylinder Cutout	H-280
D.2 Response Times	H-260
D.3 View Calibration	H-283
D.4 Update Calibration	H-283
E. Switch/Light Status..	H-285
F. Mid Messages Being Received	H-287

J-1587 TO FLASH CODE CROSS REFERENCE

J-1567 CODE (SID - PID/FMI)	DESCRIPTION	FLASH CODE
S001 / 0	INJECTOR RESPONSE LONG #1 CYL	61*
S002 / 0	INJECTOR RESPONSE LONG #2 CYL	61*
S003 / 0	INJECTOR RESPONSE LONG #3 CYL	61*
S004 / 0	INJECTOR RESPONSE LONG #4 CYL	61*
S005 / 0	INJECTOR RESPONSE LONG #5 CYL	61*
S006 / 0	INJECTOR RESPONSE LONG #6 CYL	61*
S007 / 0	INJECTOR RESPONSE LONG #7 CYL	61*
S008 / 0	INJECTOR RESPONSE LONG #8 CYL	61*
S001 / 1	INJECTOR RESPONSE SHORT #1 CYL	71*
S002 / 1	INJECTOR RESPONSE SHORT #2 CYL	71*
S003 / 1	INJECTOR RESPONSE SHORT #3 CYL	71*
S004 / 1	INJECTOR RESPONSE SHORT #4 CYL	71*
S005 / 1	INJECTOR RESPONSE SHORT #5 CYL	71*
S006 / 1	INJECTOR RESPONSE SHORT #6 CYL	71*
S007 / 1	INJECTOR RESPONSE SHORT #7 CYL	71*
S008 / 1	INJECTOR RESPONSE SHORT #8 CYL	71*
S021 / 0	TOO MANY SRS (MISSING TRS)	41
S021 / 1	TOO FEW SRS (MISSING SRS)	42
S026 / 3	AUXILIARY OUTPUT #1 SHORT TO BATTERY	62
S026 / 4	AUXILIARY OUTPUT #1 OPEN TO BATTERY	62
S057 / 3	PWM #1 SHORT TO BATTERY	63
S057 / 4	PWM #1 OPEN CIRCUIT	63
PO91 / 3	THROTTLE SENSOR CIRCUIT HIGH VOLTAGE	21
PO91 / 4	THROTTLE SENSOR CIRCUIT LOW VOLTAGE	22
P100 / 1	OIL PRESSURE LOW	45
P100 / 3	OIL PRESSURE CIRCUIT HIGH VOLTAGE	35
P100 / 4	OIL PRESSURE CIRCUIT LOW VOLTAGE	36
P102 / 3	BOOST PRESSURE CIRCUIT HIGH VOLTAGE	33
P102 / 4	BOOST PRESSURE CIRCUIT LOW VOLTAGE	34
P110/0	COOLANT TEMPERATURE HIGH	44
P110/3	COOLANT TEMP. CIRCUIT HIGH VOLTAGE	14
P110/4	COOLANT TEMP. CIRCUIT LOW VOLTAGE	15

* See TM 9-2320-360-34-1.

J-1587 TO FLASH CODE CROSS REFERENCE

J-1587 CODE (SID - PID/FMI)	DESCRIPTION	FLASH CODE
P111 / 1	COOLANT LEVEL LOW	43
P111 / 3	COOLANT LEVEL CIRCUIT HIGH VOLTAGE	16
P111 / 4	COOLANT LEVEL CIRCUIT LOW VOLTAGE	13
P121 / 0	ENGINE OVERSPEED WITH ENG. BRAKE	76
P168 / 0	BATTERY VOLTAGE HIGH	75
P168 / 1	BATTERY VOLTAGE LOW	46
P174 / 3	FUEL TEMP. CIRCUIT HIGH VOLTAGE	23
P174 / 4	FUEL TEMP. CIRCUIT LOW VOLTAGE	24
P175 / 0	OIL TEMPERATURE HIGH	44
P175 / 3	OIL TEMP. CIRCUIT HIGH VOLTAGE	14
P175 / 4	OIL TEMP. CIRCUIT LOW VOLTAGE	15
P187 / 3	PTO (VSG) CIRCUIT HIGH VOLTAGE	12
P187 / 4	PTO (VSG) CIRCUIT LOW VOLTAGE	11
P190 / 0	ENGINE OVERSPEED	85
S238 / 3	STOP ENGINE LIGHT SHORT TO BATTERY	32
S238 / 4	STOP ENGINE LIGHT OPEN CIRCUIT	32
S239 / 3	CHECK ENGINE LIGHT SHORT TO BATTERY	32
S239 / 4	CHECK ENGINE LIGHT OPEN CIRCUIT	32
S240 / 2	FRAM CHECKSUM INCORRECT	NONE**
S249 / 12	J1922 DATA LINK FAULT	57
S250 / 12	J1587 DATA LINK FAULT	56
S253 / 2	CALIBRATION CHECKSUM INCORRECT	NONE**
S253 / 13	INCOMPATIBLE CALIBRATION VERSION	NONE**
S253 / 12	NONVOLATILE MEMORY FAILURE	53
S254 / 0	FAILED EXTERNAL RAM	NONE**
S254 / 1	FAILED INTERNAL RAM	NONE**
S254 / 12	A/D CONVERSION FAILURE	52

** See Section 4 Troubleshooting Charts.

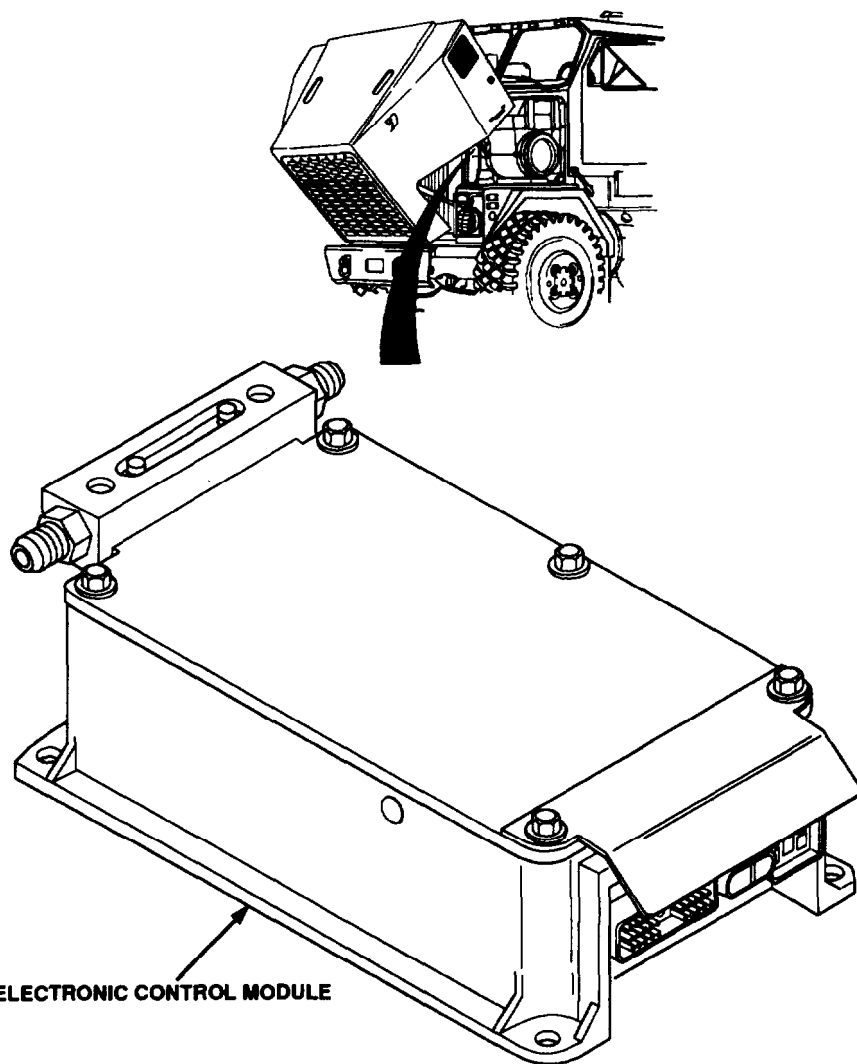
Section 1 HOW TO USE THIS BOOK

1. Section 2 (Basic Knowledge Required) and Section 3 (Testing the DDEC III System) should be read and understood completely.
2. If basic mechanical checks have been made, no trouble was found, and the problem is now believed to be in the DDEC III System, turn to Section 4 - Troubleshooting Charts. Always start with the first Chart (labeled START) on Page H-25. If a Diagnostic Data Reader (DDR) is not available, the chart labeled CEL (Check Engine Light) can be used.
3. Use the charts to pinpoint the problem and perform repairs. The charts are in a three-column format. The first column lists the test steps to perform and in what sequence to perform them. The second column gives the list of possible results you may obtain, based on the steps performed. The third column indicates what to do next, based on your results.

EXAMPLE

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<p>C2-9 Check ECM Connectors</p> <ul style="list-style-type: none"> • Turn ignition off. • Disconnect all connectors at the ECM. • Check terminals at all ECM connectors (both the ECM and harness side) for damage, corrosion, and unseated pins or sockets. 	<p>Terminals and connectors are okay.</p> <p>Problem found.</p>	<p>Replace ECM. Then go to C2-30.</p> <p>Repair terminals/connectors. Then go to C2-30.</p>

4. The charts will always instruct you to clear the codes after all repair work is done, and confirm the repair (typically by running the engine and checking if the codes and/or symptoms have returned).



ELECTRONIC CONTROL MODULE

ECM SHOWN REMOVED FOR CLARITY

Section 2 BASIC KNOWLEDGE REQUIRED

Before using this manual, there are some areas that you should be familiar. With this basic knowledge, you will have success using the diagnostic charts.

A. ELECTRICAL CIRCUITS

- You should understand the theory of electricity and know the meaning of voltage and ohms. You should understand what happens in a circuit with an open or shorted wire. You should be able to read and understand a wiring diagram.
- You should be able to use jumper wires to make circuit checks.

B. USE OF DIGITAL VOLT-OHM METER

- You should be familiar with the digital volt-ohm meter. You should be able to measure voltage and resistance. You should be familiar with the controls of the meter and how to use it correctly.

Instructions for use of a typical digital volt-ohm meter are as follows:

Resistance Measurements

1. Connect the red test lead to the V - Ω (Volt-Ohm) input connector and the black lead to the com input connector on the meter.
2. Set the function/range switch to the desired Ω position. If the magnitude of the resistance is not known, set the switch to the highest range, then reduce until a satisfactory reading is obtained.
3. If the resistance being measured is connected to a circuit, turn off the power to the circuit being tested (turn off ignition).
4. Connect the test leads to the circuit being measured. When measuring high resistance, be careful not to contact adjacent points, even if they are insulated. Some insulators have a relatively low insulation resistance which can affect the resulting measurement.
5. Read the resistance value on the digital display.

Continuity Checks

In addition to measuring the specific resistance value of a circuit, some meters will also tell if a continuous electrical path exists. If a path exists, the circuit is said to have "continuity." (This continuity check can be used in any section of the DDEC III Troubleshooting Guide where the test is looking for greater than, less than, or equal to 5 ohms.) An open circuit (broken electrical path) would have ∞ resistance and would not have continuity. To utilize this continuity feature of certain meters:

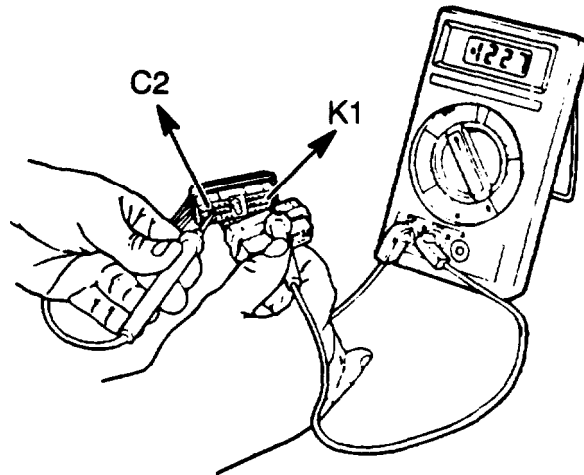
1. Place the function/range switch in any Ω range.
2. Connect the red lead to the V-D connector and the black lead to the com connector on the meter. With the test leads separated or measuring an out-of-range resistance, the digital display will indicate "OL" (overlimit; some meters show "1 +", "↑", or simply "1")

Section 2 BASIC KNOWLEDGE REQUIRED (Cont'd)

3. Put one test probe at one end of the wire or circuit to be tested. Use the other test lead to trace the circuit. When continuity is established, an Ω symbol will appear in the upper left corner of the digital display. If contact in the wire is maintained long enough (about 1/4 of a second), the OL will disappear and the resistance value of the wire or circuit will appear next to the symbol.
4. If your VOM does not work in the manner described above, you must know how your VOM operates in order to use this troubleshooting guide.

Voltage Measurements

1. Connect the red test lead to the V - Ω input connector and the black lead to the com input on the meter. If a DC-AC switch is present, make sure it is switched to the DC position.
2. Set the function range switch to the desired volts position. If the magnitude of the voltage is not known, set the switch to a range which will be able to read most voltages seen on a vehicle. (Typical, a 20V range will do.) Then reduce the range until a satisfactory reading is obtained.
3. Connect the test leads to the circuit being measured. In the DDEC III diagnostic procedures, voltage measurements are always given as being taken at pins, sockets, Battery +, or ground. Following the voltage measurement point, the color test lead to be used is given in parenthesis (red is the V - Ω connection, an black is the com connection). Example: If the procedure says, "Take voltage reading at socket C2 (red lead) to socket K1 (black lead)", the hook-up would be as follows:



C. IMPORTANT INFORMATION

The following items must be read and thoroughly understood before using this manual.

1. The engine and ignition should always be off before the harness connectors are disconnected or reconnected.
2. When disconnecting harness connectors, be sure that the pulling force is applied to the connectors themselves and not the wires extending from them.
3. After harness connectors are reconnected to the DDEC III system, the codes logged should be ignored and cleared.
4. In most all areas of Repair/Troubleshooting, a diagnostic data reader will be required.

Section 2

BASIC KNOWLEDGE REQUIRED (Cont'd)

D. EXPLANATION OF ABBREVIATIONS/TERMS

A/D - Analog to Digital: The computer inside the ECM uses an A/D converter to convert a sensor voltage into a number which the computer can work with.

BAT - Battery

BOI - Beginning of Injection: The number of crank angle degrees, Before Top Dead Center, where the ECM is requesting the injectors be turned on.

CAN Controller Area Network: J1939 High speed control data link.

CEL - Check Engine Light: Typically mounted on the instrument panel. It has two functions:

1. It is used as a warning lamp to tell the operator of the vehicle that a fault has occurred and the unit should be taken in for service as soon as possible.
2. It is used by the operator or technician to "flash" out inactive trouble codes to help diagnose a problem.

As a light bulb check and system check, the check engine light will come on for about 5 seconds when the ignition is turned on. If the CEL remains on, or comes back on, the self diagnostic system has detected a problem. If the problem goes away, the light will go out, but a trouble code will be stored in the ECM as an inactive code. (See general diagnostic information, section 2E for details.)

CGL - Check Gauges Light: Typically mounted on the instrument panel. It has two functions:

1. It is used as a warning to the operator that a potential engine damaging condition has been detected.
2. It is used by the operator or technician to "flash" out active trouble codes.

As a light bulb check and system check, the stop engine light will come on for about 5 seconds when the ignition is turned on.

CKT - Circuit

CLS - Coolant Level Sensor: Monitors coolant level at the radiator top tank or heat exchanger.

CP - Crankshaft Position: An ECM output generated anytime an SRS signal occurs.

COM - Common

CTS - Coolant Temperature Sensor: Monitors coolant temperature.

DDEC III - Third generation Detroit Diesel Electronic Controls.

DDL - Diagnostic Data Link: The lines (wires) over which the ECM transmits information which can be read by a Diagnostic Data Reader.

DDL+ - Data Link, Positive side: J1587 data link.

DDL- - Data Link, Negative side: J1587 data link.

Section 2
BASIC KNOWLEDGE REQUIRED (Cont'd)

- DDR - Diagnostic Data Reader: The hand held tool used for troubleshooting the DDEC system. MPSI PRO-LINK 9000.
- ECM - Engine Control Module: The controller of the DDEC III system. It reads the engine and vehicle inputs, sensors - and switches, calculates injector firing time and duration, and fires injectors at appropriate times.
- EERPOM - Electrically Erasable Programmable Read Only Memory
- PWM - Pulsewidth Modulated: Modulated signal provided by the DDEC system.
- EFPA - Electronic Foot Pedal Assembly: Contains the Throttle Position Sensor.
- EUI - Electronic Unit Injector
- FTS - Fuel Temperature Sensor: Monitors fuel temperature.
- GND - Ground
- INJ - Injector (fuel)
- LSG - Limiting Speed Governor
- N/A - Not Applicable
- OPS - Oil Pressure Sensor: Monitors oil pressure.
- OTS - Oil Temperature Sensor: Monitors oil temperature.
- PW - Pulsewidth

Section 2

BASIC KNOWLEDGE REQUIRED (Cont'd)

- SRS - Synchronous Reference Sensor: Detects when the first cylinder in the firing order is about to be fired.
- TBS - Turbocharged Boost Sensor: Monitors Turbo boost,
- TBD - To be determined.
- TD - Tachometer Driver: An output from the ECM for electronic tachometers and/or data loggers.
- TPS - Throttle Position Sensor: Used to detect throttle request (a component of the EFPA). Also referred to as LSG.
- TRS - Timing Reference Sensor: Used to detect whenever any cylinder is about to be fired.
- VIN - Vehicle Identification Number
- VSG - Variable Speed Governor. Also referred to as PTO (Power take off).
- VSS - Vehicle Speed Sensor: Used to detect vehicle speed.