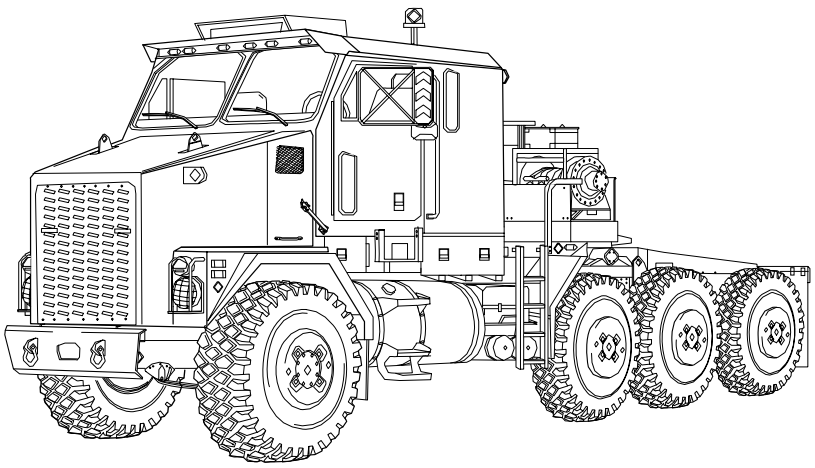
*TM 9-2320-360-20-3

VOLUME NO. 3

TECHNICAL MANUAL
UNIT MAINTENANCE



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

NSN 2320-01-318-9902

EIC: B5C

*Supersedes TM 9-2320-360-20-3 dated 01 September 1997

HEADQUARTERS, DEPARTMENT OF THE ARMY

May 2007

WARNING

CARBON MONOXIDE (EXHAUST GAS) CAN KILL YOU

Carbon monoxide is a colorless, odorless, DEADLY POISONOUS gas and when breathed deprives body of oxygen and causes SUFFOCATION. Breathing air with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, a sleepy feeling, and coma. Permanent BRAIN DAMAGE or DEATH may result from severe exposure.

The following precautions MUST be followed to ensure personnel are safe whenever personnel heater or main or auxiliary engine is operated for any purpose.

- DO NOT operate personnel heater or engine of vehicle in enclosed area without adequate ventilation.
- DO NOT idle engine for long periods without ventilator blower operation. If tactical situation permits, open hatches.
- DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.
- NEVER sleep in a vehicle when the heater is operating or the engine is idling.
- BE ALERT at all times during vehicle operation for exhaust odors or exposure symptoms. If either are present, IMMEDIATELY EVACUATE AND VENTILATE the area. Affected personnel treatment shall be: expose to fresh air; keep warm; DO NOT PERMIT PHYSICAL EXERCISE; if necessary, give artificial respiration as described in FM 4-25.11 and get medical attention.
- BE AWARE; neither the gas particulate filter unit nor field mask for nuclear, biological, and chemical protection will protect you from carbon monoxide poisoning.

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS GOOD VENTILATION.

WARNING

Personnel hearing can be PERMANENTLY DAMAGED if exposed to constant high noise levels of 85 dB (A) or greater. Wear approved hearing protection devices when working in high noise level areas. Personnel exposed to high noise levels shall participate in a hearing conservation program in accordance with DA PAM 40-501. Hearing loss occurs gradually but becomes permanent over time.

WARNING

Wear eye protection and use care when replacing snap rings and retaining rings. Snap/retaining rings are under spring tension and can act as projectiles when released and may cause severe eye injury.

WARNING

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

WARNING

- Adhesive -sealants and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If sealing compound gets on skin or clothing, wash immediately with soap and water.
- Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.
- On direct contact, uncured silicone sealant irritates eyes. In case of contact, flush eyes with water and seek medical attention. In case of skin contact, wipe off and flush with water.

WARNING

- **Dry cleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and don't breathe vapors. DO NOT use near open flame or excessive heat. The flash point is 100-138ºF (38-59ºC). If you become dizzy while using cleaning solvent, get fresh air immediately and medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.**
- **Compressed air for cleaning purposes will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).**
- **Steam cleaning creates hazardous noise levels and severe burn potential. Eye, skin, and ear protection is required. Failure to comply may result in injury to personnel.**
- **Face shield must be used by personnel operating spray gun. Failure to comply may result in injury to personnel.**

WARNING

When servicing this vehicle, performing maintenance, or disposing of materials such as engine coolant, transmission fluid, lubricants, batteries, battery acid or CARC paint, consult your Unit/local hazardous waste disposal center or safety office for local regulatory guidance. If further information is needed, please contact the Army environmental hotline at 1-800-872-3845. Improper disposal of this material may result in damage to environment or injury to personnel.

WARNING

Observe the following precautions when working on or around engine/transmission components.

- **Ensure engine is cool before performing maintenance. Failure to comply may result in severe burns.**
- **Use caution when draining hot oil. Oil may burn exposed skin and cause injury to personnel. If injured, seek medical attention immediately.**
- **Never use magnetic plug in center of engine oil pan to drain oil. Failure to comply may result in injury to personnel and could cause oil to drain on vehicle components.**
- **When working on a running engine, use caution around rotating parts. Tools, clothing, and hands may get caught causing serious injury or death to personnel.**
- **Use caution when working near hood mounting bracket that extends beyond firewall. Failure to comply may result in injury to personnel.**
- **Parking brake must be applied, with transmission range selector and transfer case in neutral before starting DDR cylinder cutout test. Failure to comply may result in vehicle moving unexpectedly and injury to personnel.**

WARNING

Observe the following precautions when working around fuel.

- **Fuel is very flammable and can explode easily. To avoid serious injury or death, keep fuel away from open fire and keep fire extinguisher within easy reach when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET OF VEHICLE.**
- **Never use fuel to clean parts. Fuel is highly flammable. Serious personnel injury could result if fuel ignites during cleaning.**
- **Starting fluid is toxic and highly flammable. Container is pressurized. Never heat container or discharge starting fluid in confined areas or near open flame. Failure to comply may result in injury to personnel. If injured, seek immediate medical attention.**
- **Ether is very flammable and could explode causing serious injury or death. Keep ether cylinders away from heat and open flame.**

WARNING

Observe the following precautions when working on or around exhaust system components.

- **Ensure exhaust pipe, tube, and muffler are cool before performing maintenance. Failure to comply may result in serious personal injury.**
- **Do not operate HET Tractor with muffler removed. Toxic exhaust fumes may enter cab, resulting in injury or death to personnel.**
- **Muffler weighs 91 lb (41 kg). Assistant is required when replacing muffler. Failure to comply may result in injury to personnel.**
- **Support tail pipe guards when replacing mounting hardware to prevent from falling, possibly causing injury to personnel.**

WARNING

Observe the following precautions when working on or around cooling system components.

- **Coolant and radiator may be very hot and under pressure from engine operation. Ensure engine and radiator are cool before performing maintenance. Failure to comply may cause serious injury.**
- **Keep out from under radiator while supported by lifting device to prevent serious injury.**
- **Keep out from under fan while removing it to prevent serious injury.**

WARNING

Observe the following precautions when working on or around electrical system components.

- **Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes. Always wear eye protection when working with batteries.**
- **Batteries must be disconnected before checking cables and wires on starter or tightening any connections. Failure to comply may result in injury to personnel.**
- **Battery acid (electrolyte) is extremely harmful. Always wear safety goggles and rubber gloves and do not smoke when performing maintenance on batteries. Injury will result if acid contacts skin or eyes. Wear rubber apron to prevent clothing being damaged.**
- **Never use open flame to apply heat to heatshrink tubing. Failure to comply may result in injury to personnel.**
- **Allow solder to cool before handling. Failure to comply may result in injury to personnel.**
- **Allow heatshrink tubing to cool before handling. Failure to comply may result in injury to personnel.**
- **Starter weighs 72 lb (33 kg) and is difficult to handle. To prevent injury, use caution when removing.**

WARNING

Support propeller shaft while performing maintenance. Personnel may be injured if propeller shaft falls.

WARNING

Observe the following precautions when working on or around brake system components.

- **Brake shoes may be coated with dust. Breathing dust may be harmful to personnel. Wear filter mask approved for use against brake dust.**
- **Do not allow grease or oil to contact brake linings. Linings can absorb grease and oil, causing early glazing and very poor brake action. Failure to comply may result in serious injury or death to personnel.**

WARNING

Observe the following precautions when working on or around brake system components (cont)

- **All brakes must be adjusted when performing brake adjustment procedure. Failure to comply may cause improper braking and result in injury to personnel .**
- **Brake shoes are installed with strong spring tension. Keep hands clear when installing parts to prevent serious injury.**
- **Brake drum weighs 135 lb (61 kg). Assistance is required when replacing brake drum. Failure to comply may result in injury to personnel.**
- **When replacing brake shoes, all four shoes on an axle must be replaced at the same time. Failure to comply may result in improper brake operation and injury to personnel.**
- **Never attempt to remove upper spring brake clamp ring. Failure to comply will result in personnel injury or death.**
- **Never try to repair rear brake chamber. High spring tension makes repair dangerous. Severe injury or death may result.**
- **When working on parking brake control system vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may result in injury or death to personnel.**

WARNING

Observe the following precautions when working on or around wheels and tires.

- **Hydraulic jack and jackstands must be positioned on flat surface. Placing jack or jackstands on unlevel or soft surface may result in truck falling and cause injury or death to personnel.**
- **If any loose or broken bolts are found after removing the wheel cover, deflate the tire completely before attempting to loosen lug nuts. Failure to comply may result in injury to personnel.**
- **Tire must be completely deflated before attempting to loosen nuts if any bolts are found loose or broken after removing wheel cover. Failure to comply may result in injury to personnel.**
- **High pressure air will be released from valve stem when core is removed. Stay clear of valve stem after core is removed. Failure to comply may result in personnel injury.**
- **Keep hands and fingers from between tire and bead lock. Failure to comply may result in injury to personnel.**
- **Tire may explode and cause serious injury or death. Place wheel and tire in safety cage before inflating. Stay back 10 ft (0.3 m) from cage when inflating. Minimum hose length is 10 ft (0.3 m).**
- **When conducting wheel runout check or wheel bearing check, HET Tractor must be on level ground and wheels must be chocked before parking brake is released. Otherwise, HET Tractor may roll and cause personnel injury.**
- **Wheel assembly weighs 523 lb (237 kg). Use caution when handling wheel. Failure to comply may result in serious injury or death to personnel.**

WARNING

Observe the following precautions when working on or around steering components.

- **Steering reservoir is heavy. Support steering reservoir while performing maintenance. Steering reservoir could fall resulting in injury to personnel.**
- **Support tee gear box before removing mounting screws to prevent injury.**
- **Tie rod end must be threaded into tie rod so that threads are beyond slot under clamp. Failure to comply may result in tie rod end separating from tie rod resulting in injury to personnel and loss of vehicle control.**

WARNING

Observe the following precautions when working on or around cab and frame components.

- **Hood springs may be under tension. Use care when replacing springs to prevent injury.**
- **Do not use hood as a work platform. Using hood as a work platform may result in injury to personnel and/or equipment damage.**
- **Hood weighs 235 lb (107 kg). Keep out from under hood. Hood could fall causing serious injury.**
- **Door is very heavy. If dropped, door may cause serious injury.**
- **Keep out from under spare wheel/tire carrier while supported by lifting device to prevent injury.**

WARNING

Observe the following precautions when working on or around fifth wheel.

- **Improper adjustment of fifth wheel may cause trailer to become uncoupled during operation. Serious injury or death may result.**
- **Fifth wheel plate must be secure before performing maintenance. Failure to do so may result in injury to personnel.**
- **Fifth wheel weighs 925 lb (420 kg). Use suitable lifting device to prevent injury to personnel.**
- **Ramp weighs 237 lb (108 kg). Keep out from under heavy parts. Falling parts may cause serious injury or death.**

WARNING

Observe the following precautions when working on or around suspension system components.

- **Air suspension will lower when air line/hoses are removed. To avoid injury, stay clear of HET Tractor frame until air suspension is completely lowered.**
- **Do not attempt to inflate air spring when it is removed from vehicle. Failure to comply may result in serious injury to personnel.**
- **Air suspension system may still be pressurized even though air pressure gage reads 0 psi. Remove air line slowly to allow air to escape. Failure to comply may result in air line blowing off causing serious injury to personnel.**

WARNING

Observe the following precautions when working on or around winch system components.

- **Always wear heavy duty gloves when handling winch cable. Never let cable run through hands. Frayed cable can cut hands severely.**
- **Use care when removing winch cable from drum. End of cable can spring up causing injury to personnel.**
- **Do not operate winch without guard in place.**
- **Do not place hands or feet near winch during operation.**
- **Auxiliary winch weighs approximately 130 lb (59 kg). Use lifting device to replace auxiliary winch. Failure to comply may result in injury to personnel.**
- **Control console panels are heavy. Use care when removing screws to avoid injury to personnel.**

WARNING

Chemical Agent Resistant Coating (CARC) paint contains isocyanate (HDI) which is highly irritating to skin and respiratory system. High concentrations of HDI can produce symptoms of itching and reddening of skin, a burning sensation in throat and nose, and watering of the eyes. In extreme concentrations, HDI can cause cough, shortness of breath, pain during respiration, increased sputum production, and chest tightness. The following precautions must be take whenever using CARC paint:

- DO NOT let skin or eyes come in contact with CARC paint. Always wear protective equipment (gloves, ventilation mask, safety goggles, etc.).
- NEVER weld or cut CARC-coated materials.
- DO NOT grind or sand painted equipment without high efficiency air purifying respirators in use.
- BE AWARE of CARC paint exposure symptoms; symptoms can occur a few days after initial exposure. Seek medical help immediately if symptoms are detected.

WARNING

After Nuclear, Biological, or Chemical (NBC) exposure of vehicle, all air filters shall be handled with extreme caution. Unprotected personnel may experience injury or death if residual toxic agents or radioactive material are present. If vehicle is exposed to chemical or biological agents, servicing personnel shall wear protective mask, hood, protective overgarments, and chemical protective gloves and boots in accordance with FM 3-11.4. All contaminated air filters shall be placed in double-lined plastic bags and moved swiftly to a segregation area away from the worksite. The same procedure applies for radioactive dust contamination. The Company NBC team should measure radiation prior to filter removal to determine extent of safety procedures required per the NBC Annex to the unit Standard Operating Procedures (SOP). The segregation area in which the contaminated air filters are temporarily stored shall be marked with appropriate NBC placards. Final disposal of contaminated air filters shall be in accordance with local SOP. Decontamination operation shall be in accordance with FM 3-11.5 and local SOP.

See FM 4-25.11 for additional first aid data.

LIST OF EFFECTIVE PAGES

Dates of issue for original pages

Original..... 31 May 2007

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 311 CONSISTING OF THE FOLLOWING:

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i thru vi	0
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* Zero In This Column Indicates An Original Page.

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

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 MAY 2007

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 publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Equipment Technical Publications) through the Internet on the Army Electronic Product Support (AEPS) Web site. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section on the AEPS public home page. Fill out the form and click on SUBMIT. Using this form on the AEPS site will enable us to respond quicker to your comments and to better manage the DA Form 2028 program. You may also mail, fax, or e-mail your letter or DA Form 2028 directly to: TACOM Life Cycle Management Command, ATTN: AMSTA-LC-LPIT / TECH PUBS, 1Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is ROCK-TACOM-TECH-PUBS@conus.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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*Supersedes TM 9-2320-360-20-3 dated 01 September 1997

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TABLE OF CONTENTS - Cont'd

J-1587 TO FLASH CODE CROSS REFERENCE

J-1587 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*
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S021 / 0	TOO MANY SRS (MISSING TRS)	41
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* 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
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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
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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 6
HOW TO USE THIS BOOK

16. Section 2 (Basic Knowledge Required) and Section 3 (Testing the DDEC III/IV System) should be read and understood completely.

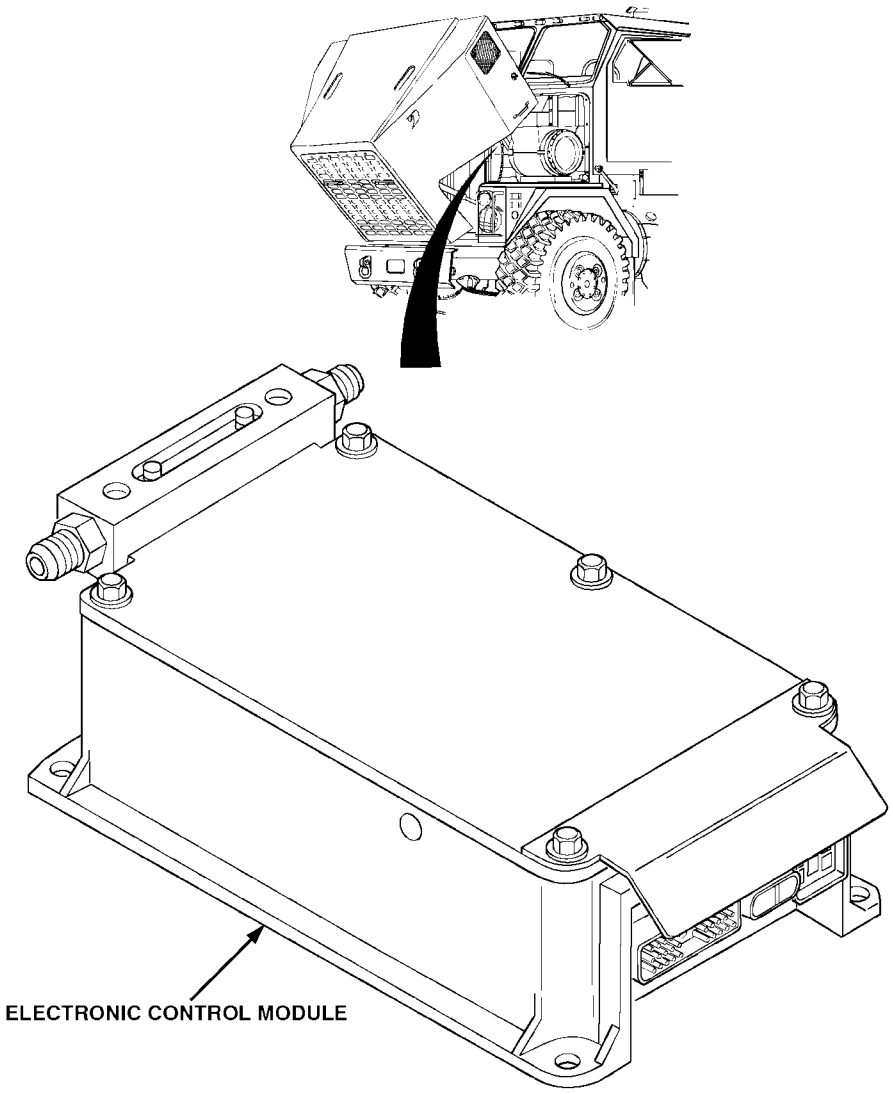
17. **If basic mechanical checks have been made, no trouble was found,** and the problem is now believed to be in the DDEC III/IV System, turn to Section 4 – Troubleshooting Charts. Always start with the first Chart (labeled START) on Page H–25. If a Diagnostic Data Reader (DDR) is not available, the chart labeled CEL (Check Engine Light) can be used.

18. 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
C2-9 Check ECM Connectors		
• 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.	Terminals and connectors are okay. →	Replace ECM. Then go to C2-30.
	Problem found. →	Repair terminals/connectors. Then go to C2-30.

19. 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).



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Section 7
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/IV 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-Ω 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 7
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.

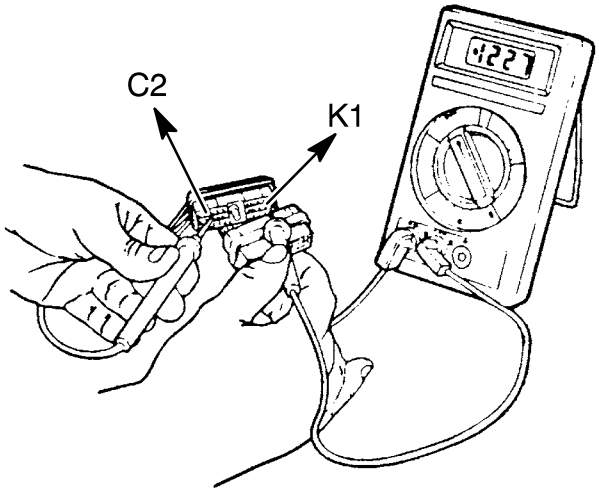
4. If your VOM does not work in the manner described above, you must know how your VOM operates in order to use this troubleshooting guide.

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/IV 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/IV 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 7
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:

3. 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.

4. 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.

DDEC IV – Fourth 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 7
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 7
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.

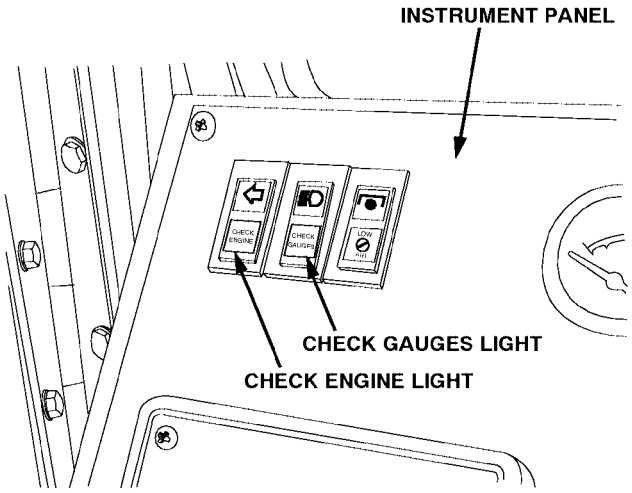
TPS – Throttle Position Sensor: Used to detect throttle request (a component of the EFPA). Also referred to as LSG.

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.



Section 7
BASIC KNOWLEDGE REQUIRED (Cont'd)

E. GENERAL DIAGNOSTIC INFORMATION

As a bulb and system check, the "Check Engine" and "Check Gauges" lights will come on for 5 seconds when the ignition switch is first turned on.

If the "Check Engine" light comes on during vehicle operation, this indicates the self diagnostic system has detected a fault.

When the diagnostic request switch is held, the diagnostic system will flash the orange lights located on the vehicle's dash. The light will be flashing the code(s) indicating the problem area(s). If the "Check Gauges" light comes on during vehicle operation, this indicates the DDEC System has detected a potential engine damaging condition. The engine should be shutdown immediately and have the engine checked for the problem.

*Active codes will be flashed on the "check gauges" light in order from most recent to least recent occurrence based on engine hours. If there are no active codes, a code 25 will be flashed.

*Inactive codes will be flashed on the "check engine" light in order from most recent to least recent occurrence based on engine hours. If there are no inactive codes, a code 25 will be flashed.

* FLASHING CODES SHOULD BE DONE WITH THE ENGINE NOT RUNNING AND IGNITION ON. *

A diagnostic code indicates a problem in a given circuit (i.e., diagnostic Code 14 indicates a problem in the oil or coolant temperature sensor circuit. This includes the oil or coolant temperature sensor, connector, harness, and Electronic Control Module (ECM). The procedure for finding the problem can be found in Diagnosis Chart Code 14. Similar charts are provided for each code. Remember, diagnosis should always begin at the starting chart (START). For an oil or coolant temperature sensor problem, it will quickly lead you to Chart 14 – but first it gets you to verify the code/symptom.

Since the self-diagnostics do not detect all possible faults, the absence of a code does not mean there are not problems in the system. If a DDEC III/IV problem is suspected, even in the absence of a code, go to START anyway. This chart can lead you to other charts which can aid in the troubleshooting process – where DDEC III/IV problems may occur but do not generate a code. **Basic mechanical checks, however, are <u>not</u> covered in this guide, refer to Chapter 2, Vehicle Troubleshooting**.