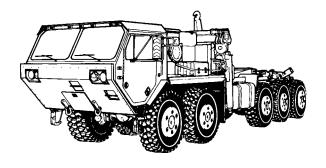
### TM 9-2320-364-20-1

THIS MANUAL SUPERSEDES TM 9-2320-364-20-1 DATED 01 AUG 1999, INCLUDING ALL CHANGES.

#### **TECHNICAL MANUAL**

# UNIT MAINTENANCE VOLUME I

### PALLETIZED LOAD SYSTEM



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### MODEL M1074/M1075

NSN 2320-01-304-2277 NSN 2320-01-304-2278

DISTRIBUTION RESTRICTION Approved for public release; distribution is unlimited.

- Drycleaning Solvent (P-D-680) is TOXIC and flammable. Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Drycleaning Solvent is 140 degrees F (60 degrees C) and Type III Drycleaning Solvent is 200 degrees F (93 degrees C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and
  medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts
  eyes, immediately flush eyes with water and get immediate medical attention.

### WARNING

Radiator, radiator cap, coolant, and hoses are very hot and pressurized during truck operation. Let radiator cool before checking hoses. Failure to do so may result in serious burns to personnel.

### WARNING

Use extreme care when removing the radiator pressure cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Slowly loosen cap to the first stop to relieve pressure before removing cap completely. After opening, securely tighten cap.

### WARNING

Use a clean, thick waste cloth or like material to remove radiator pressure cap. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.

### WARNING

Apply truck brakes and chock wheels before any maintenance tasks are performed. Otherwise serious injury to personnel could result.

### WARNING

Never use fuel to clean parts. Fuel is highly flammable. Serious personal injury could result if fuel ignites during cleaning.

Compressed air used for cleaning purposes will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc). Failure to comply may result in injury to personnel.

### WARNING

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.

### WARNING

Solvents used with a spray gun must be used in a spray booth with filter. Face shield must be used by personnel operating spray gun. Failure to comply may result in injury to personnel.

### WARNING

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

Do not drain engine oil while engine is hot. Severe injury to personnel may result.

### WARNING

Ensure engine is cool before performing this task or injury to personnel may result.

### WARNING

Use care when removing springs. Springs are under tension and can act as projectiles when released and could cause injury to personnel.

### WARNING

Use care when installing springs. Springs are under tension and can act as projectiles when released and could cause injury to personnel.

Adhesives, solvents, 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 adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.

### **WARNING**

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.

### WARNING

Do not remove the radiator cap when the engine is hot; steam and hot coolant can escape and burn personnel.

#### WARNING

After Nuclear, Biological, or Chemical (NBC) exposure of truck, 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 truck 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 3-4. 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 3-5 and local SOP.

### WARNING

Brake drum can get very hot during vehicle operation. Place hand near drum to check for excessive heat, but do not touch. Failure to comply may result in injury to personnel.

### WARNING

Use extreme care when removing coolant system pressure tester. Sudden release of pressure can cause injury to personnel.

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

### **WARNING**

Starting fluid is toxic and highly flammable. Container is pressurized. NEVER heat container and NEVER discharge starting fluid in confined areas or near open flame. Severe injury to personnel may result.

### WARNING

Allow engine to cool before performing maintenance on the muffler, exhaust pipe, exhaust manifold or turbocharger. If necessary, use insulated pads and gloves.

### WARNING

Muffler weighs 152 lbs (69 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

### WARNING

Ensure this task is done only when muffler is cool. Performing this task on a warm or hot muffler may result in severe burning to personnel.

### WARNING

Use extreme care when removing coolant system pressure tester. Sudden release of pressure can cause injury to personnel.

### **WARNING**

Excess coolant may splash out upon removal of tube from hump hose. Ensure proper eye protection is worn to prevent possible injury to personnel.

### WARNING

Cooling assembly weighs 925 lbs (420 kg). Attach suitable lifting device for removal and properly support cooling assembly to prevent possible injury to personnel.

Ensure all personnel stay clear of radiator while engine is running. Air in radiator will be released which may cause hot coolant to spray out and cause injury or death to personnel.

### WARNING

Engine cover assembly weighs 55 lbs (25 kg). Use an assistant to help remove engine cover assembly or injury to personnel may result.

#### WARNING

Radiator assembly weighs 575 lbs (261 kg). Do not stand directly under radiator assembly or injury to personnel may result.

### WARNING

Ensure grille assembly is fully supported by lifting device prior to removal of screws. Failure to comply may result in severe injury to personnel.

#### WARNING

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.

### WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

### WARNING

Starter weighs 73 lbs. (33 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

Starter weighs 73 lbs. (33 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

### WARNING

Use care when removing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

### WARNING

Use care when installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

### WARNING

Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

### WARNING

Do not remove screws securing fan brace. Removing screws will cause fan brace to drop and may result in severe injury or death to personnel.

### WARNING

Do not start engine or move truck when anyone is working on or under vehicle. Severe injury or death to personnel could result.

### WARNING

Upon removal of all wires and cables, ensure no contact is made with battery terminals or other wires and cables. Strap wires and cables away from battery terminals and other wires and cables as required to prevent damage to parts, personal injury, or death.

### WARNING

Ensure that exhaust pipe and turbo charger pipe connections are free from soot or debris. Failure to comply may result in exhaust leak and injury or death 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.

### **WARNING**

Be careful not to short out battery terminals. Do not smoke or use open flame near batteries. Batteries may explode from a spark. Battery acid is harmful to skin and eyes.

#### **WARNING**

Wear safety goggles and acid-proof gloves when battery cover must be removed or when adding electrolyte.

### WARNING

Avoid electrolyte contact with skin, eyes, or clothing. If battery electrolyte spills, take immediate action to stop burning effects:

- External: Immediately flush with cold running water to remove all acid.
- Eyes: Flush with cold water for at least 15 minutes. Seek immediate medical attention.
- Internal: Drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Seek immediate medical attention.
- Clothing or Vehicle: Wash at once with cold water. Neutralize with baking soda or household ammonia solution.

### WARNING

Injury will result if acid contacts skin or eyes. Wear rubber apron to prevent clothing being damaged.

### **WARNING**

Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes with large amounts of water for at least 15 minutes and get immediate medical attention.

Do not allow personnel to perform maintenance directly under boom or mast. Failure to follow proper procedures could cause serious injury or death.

### WARNING

22 to 28 vdc are always present on wire 1431 at the ENGINE switch. Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

### WARNING

22 to 28 vdc are always present on wire 1281 and DUVAC connectors. Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

### WARNING

22 to 28 vdc are always present on wire 1139 at starter solenoid. Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

### WARNING

Transmission oil will be extremely hot when drained. Do not come in contact with hot oil to avoid severe burns. If burned with hot oil, seek medical attention immediately.

### WARNING

Ensure there are no personnel in front of truck when placing it into drive. Failure to do so may result in injury or death to personnel.

### WARNING

Ensure transmission oil and filter are cool prior to removal. Failure to comply may result in injury to personnel.

### WARNING

Wear safety goggles when performing tests on valves. Failure to do so may result in serious eye injury due to high pressure air.

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.

### **WARNING**

Do not remove the radiator cap when the engine is hot; steam and hot coolant can escape and burn personnel.

#### **WARNING**

Driveshafts can weigh up to 100 lbs (45 kg), obtain aid from an assistant to prevent possible injury to personnel.

### WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death keep flame away from fuel and keep fire extinguisher within easy reach.

### **WARNING**

Use jackstands to support axle weight. Failure to comply may result in injury to personnel.

### WARNING

Brake shoes may be covered with dust. Breathing this dust may be harmful to your health. Do not use compressed air to clean brake shoes. Wear a filter mask approved for use against brake dust. Failure to comply may result in injury or death to personnel.

### WARNING

Use care when removing brake spring. Spring is under tension and can act as a projectile when released and could cause injury to personnel.

### WARNING

Use care when installing brake spring. Spring is under tension and can act as a projectile when released and could cause injury to personnel.

22 to 28 vdc are always present at DUVAC connectors. Care must be exercised when removing the DUVAC cover. Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuitc, a direct short may result. Damage to equipment, injury or death to personnel may occur.

### WARNING

Spring in air chamber is very powerful and is under tension. Failure to cage air chamber before removal will release tension of spring abruptly and could result in injury or death to personnel.

### WARNING

Air reservoir will fall when screws are removed. Support air reservoir prior to removing screws to prevent injury to personnel.

### WARNING

Do not touch hot exhaust system with bare hands; injury to personnel will result.

### WARNING

Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.

### WARNING

Terminal 1 and terminal 2 at DUVAC controller are electrically hot all of the time. Ensure bracket does not contact either terminal. Damage to equipment, injury or death to personnel may occur.

### WARNING

Terminal 1 and terminal 2 at DUVAC controller are electrically hot all of the time. Ensure DUVAC cover or bracket does not contact either terminal. Damage to equipment, injury or death to personnel may occur.

### WARNING

Inner wheel weighs 105 lbs (48 kg). Attach suitable lifting device prior to moving rim to prevent possible injury to personnel.

Ensure all personnel keep hands and fingers out from between tire and bead lock. Failure to comply may result in injury to personnel.

### WARNING

Alternator is capable of producing over 40 vdc. Be careful when taking a voltage reading not to get shocked.

#### WARNING

High pressure hydraulics [oil under 3,700 psi (25,512 kPa) pressure] operate this equipment. Refer to vehicle operator and maintenance manuals for hydraulic oil pressure. Never disconnect any hydraulic line or fittings without first dropping pressure to zero. High pressure oil stream can pierce body and cause severe injury to personnel.

### **WARNING**

Ensure all personnel wear proper eye protection. Do not stand directly in front of valve stem when draining air from tire. Tire is under extreme air pressure. Failure to comply may result in injury to personnel.

### WARNING

Prolonged contact with lubricating oil (MIL-L-2104) may cause a skin rash. Skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Saturated clothing should be removed immediately. Areas in which lubricating oil is used should be well-ventilated to keep fumes to a minimum.

### WARNING

Tie-rod end may unexpectedly pop-up when pressure is applied with hydraulic jack. Keep hands and face clear of tie-rod end. Failure to comply may result in severe injury to personnel.

#### WARNING

Skid plate weighs 130 lbs (59 kg). Attach suitable lifting device prior to removal to prevent injury to personnel.

Skid plate structure weighs 95 lbs (43 kg). Attach suitable lifting device prior to removal to prevent injury to personnel.

### WARNING

Skid plate crossmember weighs 55 lbs (25 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

### WARNING

Right hand and left hand extension assemblies weigh 110 lb (50 kg) each. Use the aid of an assistant when lifting to prevent injury to personnel.

### WARNING

Crossover tube weighs 100 lbs (45 kg). Attach a suitable lifting device prior to removal to prevent possible injury to personnel.

### WARNING

Each hard lift bracket weighs 67 lbs (30 kg). Attach a suitable lifting device prior to removal to prevent possible injury to personnel.

### WARNING

Self-guided coupler weighs 100 lbs (45 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

### WARNING

The exhaust pipe and muffler can become very hot during vehicle operation. Be careful not to touch these parts with bare hands, or allow body to come in contact with pipe or muffler. Exhaust system parts can become hot enough to cause serious burns.

### WARNING

Support hoist extension before removing retaining pin or injury to personnel may occur.

Tire carrier weighs 145 lbs (66 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

### **WARNING**

Wire rope can become frayed or contain broken wires. Wear heavy leather-palmed work gloves when handling wire rope. Frayed or broken wires can cause injury to personnel.

### WARNING

Never let moving wire rope slide through hands, even when wearing gloves. A broken wire could cut through glove and can cause injury to personnel.

### WARNING

Cab door weighs 100 lbs (45 kg). Support with suitable lifting device to avoid injury to personnel.

### WARNING

Do not let window fall. Broken glass may cause serious injury to personnel.

### WARNING

Platform assembly weighs 62 lbs (28 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

### WARNING

Always wear proper eye protection and protective clothing when handling glass. Failure to comply may result in injury to personnel.

### WARNING

Seat assembly weighs 55 lbs (25 kg). Attach suitable lifting device to prevent possible injury to personnel.

Box assembly weighs 92 lbs (42 kg). Ensure box assembly is properly supported to prevent possible injury to personnel.

### WARNING

Wear heavy gloves when handling crane cable. Never let cable run through hands; frayed cables can cut.

### WARNING

The crane hydraulic system operates at oil pressures up to 3,100 psi (21,375 kPa). Never disconnect any hydraulic line or fitting without first dropping the pressure to zero. Failure to comply may result in serious injury or death to personnel.

### WARNING

Self-recovery winch weighs 645 lbs (292 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Front tension guide weighs 60 lbs (27 kg). Use an assistant to prevent possible injury to personnel.

### WARNING

Leave top front screw installed in frame to prevent spacer from falling. Failure to comply may result in injury to personnel.

### WARNING

Front guide assembly weighs 75 lbs (34 kg). Use an assistant to prevent injury to personnel.

### WARNING

Position top front screw in frame to hold spacer in place. Failure to comply may result in injury to personnel.

Rear tension guide weighs 50 lbs (23 kg). Use an assistant to prevent injury to personnel.

### WARNING

Rear guide assembly weighs 65 lbs (29 kg). Use an assistant to prevent possible injury to personnel.

### WARNING

Rear roller assembly weighs 375 lbs (170 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

### WARNING

Do not remove heater hoses when engine is hot; steam and hot coolant can escape and burn personnel.

### WARNING

Use clean wiping rags or like material to remove heater hoses. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.

### WARNING

Coolant is slippery and can cause falls and injury. Clean up spilled coolant immediately.

### WARNING

Allow engine to cool prior to removal of heater core to prevent burns and injury to personnel.

### WARNING

Use caution when removing hoses to prevent getting antifreeze in eyes or mouth, if antifreeze does get in eyes or mouth, seek medical attention immediately.

### WARNING

Extreme care should be taken when removing heater hoses if water temperature gage reads above 180 degrees F (82 degrees C). Contact by steam or hot coolant may result in injury or death to personnel.

Allow engine to cool prior to removal of valve to prevent burns and possible injury to personnel.

### **WARNING**

Ensure engine is cool before performing this task or severe burns from hot hydraulic fluid may result.

### **WARNING**

The main hydraulic system operates at oil pressures up to 3,675 psi (25,339 kPa). Never disconnect any hydraulic line, fitting or component without first dropping pressure to zero. Failure to comply may result in serious injury or death to personnel.

### WARNING

Use extreme care when loosening filler cap. Sudden release of pressure could seriously injure personnel. Slowly loosen cap to relieve pressure and ensure proper eye protection is worn.

### WARNING

Hydraulic reservoir weighs 120 lbs (54 kg). The aid of an assistant is required to prevent possible injury to personnel.

### WARNING

Battery weighs 75 lbs (34 kg). Remove battery only with the aid of an assistant to prevent possible injury to personnel.

### WARNING

Battery weighs 75 lbs (34 kg). Install battery only with the aid of an assistant to prevent possible injury to personnel.

### WARNING

Battery box weighs 75 lbs (34 kg). Use the aid of an assistant to prevent possible injury to personnel.

Sharp edges of exhaust pipe could cause injury to personnel.

### **WARNING**

Coolant may run out of water jacket when turned. Wear eye protection or injury to personnel may result.

#### WARNING

High pressure hydraulics [oil under 3,100 psi (21,374 kPa) pressure] operate this equipment. Refer to vehicle operator and maintenance manuals for hydraulic oil pressure. Never disconnect any hydraulic line or fittings without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.

### WARNING

Machine gun ring weighs 295 lbs (134 kg). Attach suitable lifting device to prevent injury to personnel.

### WARNING

Machine gun ring front support weighs 55 lbs (25 kg). Attach suitable lifting device to prevent injury to personnel.

### WARNING

Circuit breakers CB5, CB6, CB12, CB20, CB22, CB23 and relays R3, R13 - R19, R26, R28, R32, R33 are always electrically hot and can cause severe injury to personnel. Care must be exercised when working under the electrical circuit board cover.

### WARNING

Ensure equipment will not move while repairing or inspecting it. For trailers, "red tag" the hitch, and block or chock wheels or tracks. For powered equipment, block or chock wheels or tracks, and "red tag" the starter. Prevent a "quick fix" from becoming a quick injury.

### **WARNING**

When adjustment or service requires a running engine, two personnel will be used; one at controls and one at service point. This helps prevent accidental movement of controls.

Wires 1866 and 1867 have 12 vdc at all times direct from batteries. Care must be exercised when working with these wires to avoid injury to personnel.

### WARNING

Ensure all personnel are clear of rear of truck before shifting into R (reverse). Failure to do so might result in injury or death to personnel.

### WARNING

Circuit breakers and relays are always electrically hot and can cause severe injury to personnel. Care must be exercised when working under the electrical circuit board cover.

### WARNING

Ether is toxic and highly flammable. Container is pressurized. Never heat container and never discharge ether into confined areas or near open flame. Severe injury to personnel may result.

### WARNING

Do not place any part of body in area of fan operation. Failure to do so will result in injury or death to personnel.

### WARNING

10 to 14 vdc are always present at terminals E and F of connector MC7.

### WARNING

Before inflating or deflating, stand out of the trajectory area or personal injury or death may result.

### WARNING

Hot transmission oil can cause severe burns and injury to personnel. Transmission should be allowed to cool before oil is drained.

Wear safety goggles when performing leakage tests on valves. Failure to do so may result in serious eye injury due to high pressure air.

### WARNING

If air lines are under high pressure when they are disconnected, they can whip around and cause injury to personnel. Caution should be exercised when loosening or disconnecting air line fittings.

#### **WARNING**

Exercise extreme caution when working around wheels or under truck while engine is operating. Movement of truck may cause injury or death to personnel.

### WARNING

Keep clear of equipment when equipment is being raised or lowered. Equipment may fall and cause serious injury or death to personnel.

### WARNING

Never crawl under equipment when performing maintenance unless equipment is securely blocked. Equipment may fall and cause serious injury or death to personnel.

### WARNING

Do not work on any item supported only by lift jacks or hoist. Always use blocks or proper stands to support the item prior to any work. Equipment may fall and cause injury or death to personnel.

### WARNING

Ensure transmission is cool before proceeding. Failure to comply may result in injury to personnel.

### WARNING

Keep hands and arms away from fan blade and drive while engine is running, or serious injury to personnel will result.

Maintain adequate distance from moving steering parts or serious injury to personnel may result.

### WARNING

Do not stand between wheels when engine is operating. Movement of vehicle can cause injury or death to personnel.

### WARNING

Truck must be on level ground and wheels must be chocked before parking brake is released. Otherwise, truck may roll and cause injury to personnel.

### WARNING

Do not use retread tires on vehicles equipped with a Central Tire Inflation System (CTIS). Use only the tires that are specified in the Repair Parts and Special Tools List (RPSTL). Failure to comply may result in tire failure and loss of vehicle control.

### WARNING

Ensure transfer case is cool before proceeding. Failure to comply may result in injury to personnel.

### WARNING

Failure to place wheel/tire assembly in safety cage prior to initial inflation could result in serious injury or death to personnel.

### WARNING

When a wheel/tire is in a restraining device, do not lean any part of body or equipment on or against the restraining device, or injury or death could result.

### WARNING

Stand clear of trajectory area during deflation or personal injury or death may result.

Always completely deflate tire by removing valve core from valve stem before attempting demounting operation. After air has finished exhausting from valve stem, carefully run a piece of wire through valve stem to ensure it is not plugged and tire is completely deflated. Failure to comply may result in injury to personnel.

### **WARNING**

Wheel/tire assembly must be deflated in a safety cage or personal injury or death may result.

### WARNING

Keep hands clear of studs and outer face of wheel to prevent injury to personnel.

### WARNING

Wheel/tire assembly weighs 523 lbs (237 kg). Attach suitable lifting device prior to moving to prevent possible injury to personnel.

#### WARNING

Stay out of the trajectory as indicated by the area shown. Under some circumstances, the trajectory may deviate from its expected path. Injury or death to personnel may result.

### WARNING

Container lock could drop suddenly if not supported. Failure to comply may result in injury to personnel.

### WARNING

Slider weighs 142 lbs (64 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Right front support bracket weighs 98 lbs (44 kg). Attach suitable lifting device to prevent possible injury to personnel.

Left front support bracket weighs 98 lbs (44 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Front support assembly weighs 660 lbs (299 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Front crossmember assembly weighs approximately 500 lbs (227 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Stow cone weldment weighs approximately 225 lbs (102 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Rear guide assembly weighs 70 lbs (32 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Slide arm weighs 65 lbs (29 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Lifting frame weighs 1600 lbs (726 kg). Attach suitable lifting device to prevent possible injury to personnel.

### WARNING

Stow weldment weighs 410 lbs (186 kg). Attach suitable lifting device to prevent possible injury to personnel.

Rear roller bracket weighs 150 lbs (68 kg). When removing one rear roller bracket, ensure remaining rear roller bracket is supported. Attach suitable lifting device to prevent possible injury to personnel.

### **WARNING**

Arm assembly weighs 240 lbs (109 kg). Attach suitable lifting device to prevent possible injury to personnel.

#### WARNING

Right strut bracket assembly weighs 80 lbs (36 kg). Attach suitable lifting device to prevent possible injury to personnel.

### **WARNING**

Alternator weighs 75 lbs (34 kg). Use the aid of an assistant to prevent possible injury to personnel.

### WARNING

Starter weighs 73 lbs (33 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

### WARNING

Ensure brake drum is not pulled back more than approximately two inches (5 cm). Failure to comply may result in injury or death to personnel.

### WARNING

Most circuit breakers are always electrically hot and can cause severe injury to personnel. Care must be exercised when working under the ECB cover.

### WARNING

Tip of removal tool is very sharp. Use caution when using tool. Failure to comply may result in injury to personnel.

Stand clear of tires while turning them. Failure to do so may result in injury or death to personnel

WARNING

Never inflate the wheel/tire assembly unless all ten outer wheel nuts have been properly torqued or personal injury could result.

WARNING

Brake drum weighs 132 lbs (60 kg). Attach suitable lifting device to prevent possible injury to personnel.

WARNING

Axle's No. 1 and No. 2 brake drums may swing out during removal. Use the aid of an assistant to support lifting device. Failure to comply may result in injury to personnel.

WARNING

Keep hands clear of studs and outer face of axles to prevent injury to personnel.

WARNING

Stand clear of tires while turning. Failure to do so may result in injury or death to personnel.

WARNING

Sharp edges of exhaust pipe could cause injury to personnel.

WARNING

Do not remove hoses when cooling system is hot; steam and hot coolant can escape and burn personnel.

The hydraulic system operates at high pressures. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. Failure to comply may result in serious injury or death to personnel.

#### WARNING

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 taken whenever using CARC paint:

- ALWAYS use air line respirators when using CARC paint unless air sampling shows exposure to be below standards. Use chemical cartridge respirator if air sampling is below standards.
- DO NOT let skin or eyes come in contact with CARC paint. Always wear protective equipment (gloves, ventilation mask, safety goggles, etc.).
- DO NOT use CARC paint without adequate ventilation.
- 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

Horizontal roller weighs 75 lbs (34 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

### WARNING

Do not put fingers in between boom sections when removing wear pads. Use a screwdriver or similar tool to remove wear pads. Failure to comply may result in injury to personnel.

### WARNING

Do not put fingers in between boom sections when installing wear pads. Use a screwdriver or similar tool. Failure to comply may result in injury to personnel.

Do not inhale fumes; could cause severe injury or death.

### WARNING

Do not over-tighten clamp during installation. Accumulator is filled with compressed gas, and a change in pressure could cause crane to malfunction. Failure to complay may result in injury or death to personnel.

### WARNING

Wire cable assembly can become frayed or contain broken wires. Wear heavy leatherpalmed work gloves when handling wire cable assembly. Frayed or broken wires can cause injury to personnel.

### WARNING

Never let moving wire cable assembly slide through hands, even when wearing gloves. A broken wire could cut through glove and cause injury to personnel.

### WARNING

Air cleaner assembly can weigh up to 100 lbs (45 kg). Ensure air cleaner assembly is properly supported during removal. Failure to comply may result in injury to personnel.

### WARNING

Ensure air cleaner assembly is properly supported. Failure to comply may result in injury to personnel.

### WARNING

Use care when removing retaining rings. Retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

### **WARNING**

Use care when installing retaining rings. Retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

### WARNING

Pull out ride control valve knob to release pressure in air-ride system. Failure to comply may result in injury to personnel.

### LIST OF EFFECTIVE PAGES

### Dates of issue for original and changed pages are:

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## TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 1132 CONSISTING OF THE FOLLOWING:

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iv Blank		G-1 thru G-4	0
1-1 thru 1-30	0	INDEX-1 thru INDEX-15	5 0
2-1 thru 2-79	0	INDEX-16 Blank	0
2-80 Blank		SCHMTC-1	0
2-80.1 thru 2-511	0	SCHMTC-2 Blank	0
2-512 Blank	0	SCHMTC-3	0
2-513 thru 2-516	0	SCHMTC-4 Blank	0
2-517 Blank	0	FP-1 thru FP-69	0
2-518 thru 2-809	0	FP-70 Blank	0
2-810 Blank	0	SCHMTC-5	0
A-1 and A-2	0	SCHMTC-6 Blank	0
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B-35 thru B-42	0		

<sup>\*</sup> Zero In This Column Indicates An Original Page.

#### **TECHNICAL MANUAL**

HEADQUARTERS
DEPARTMENT OF THE ARMY

Washington D.C.,30 November 2005

No. 9-2320-364-20

# Unit Maintenance Manual PALLETIZED LOAD SYSTEM

MODEL M1074/M1075 NSN 2320-01-304-2277 NSN 2320-01-304-2278

Current as of 31 October 2005

#### REPORTING OF 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 2028-2 (Recommended Changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <a href="http://aeps.ria.army.mil">http://aeps.ria.army.mil</a>. If you need a password, scroll down and click on "ACCESS REQUEST FORM." The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or email your letter, DA Form 2028, or DA Form 2028-2 direct to: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-LC-CIP-WT, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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#### **HOW TO USE THIS MANUAL**

This manual is designed to help maintain the Model M1074/M1075 Palletized Load System (PLS) truck. Listed below are some special features included in this manual to help locate and use the needed information:

- A front cover table of contents is provided for quick reference to chapters and sections that will be used often.
- WARNING, CAUTION, and NOTE headings, subject headings, and other essential information are printed in bold type making them easier to see.
- The maintenance tasks describe what must be done to the truck before starting the task (Equipment Condition), and what must be done to return the vehicle to operating condition after the task is finished (Follow-On Maintenance).
- The Appendixes are located at the end of the manual. They contain a reference guide to other manuals, the Maintenance Allocation Chart (MAC), a list of expendable supplies and materials, and other material for maintaining the PLS truck.
- In addition to text, there are exploded-view illustrations showing how to take a component off and put it back on. Cleaning and inspection procedures are also included as required.
- Chapter 2 of this manual covers Unit level Preventive Maintenance Checks and Services (PMCS) and basic troubleshooting, as well as general maintenance.

Follow these guidelines when using this manual:

- Read all WARNINGS and CAUTIONS before performing any procedure.
- The equipment conditions found in the maintenance procedures are of a general nature and the mechanic may be able to perform only certain steps within a procedure to accomplish the equipment condition.

#### **CHAPTER 1**

#### INTRODUCTION

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#### Section I. GENERAL INFORMATION

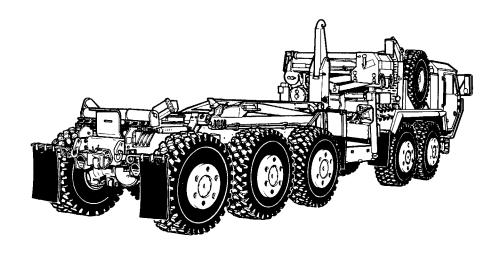
#### 1-1. SCOPE.

This chapter provides general information, equipment descriptions and principles of operation for the M1074/M1075 Palletized Load System (PLS). The PLS will herein be referred to as the truck.

- a. Type of Manual. Unit Maintenance Instructions, TM 9-2320-364-20.
- b. Model Numbers and Equipment Names. The different truck models are listed below:

M1074	Truck with crane (Figure 1-1)
M1075	Truck without crane (Figure 1-2)
M1076	Trailer (Figure 1-3)
M1077	Flatrack (Figure 1-4)

c. Purpose of Equipment. The PLS is an ammunition-hauling tactical wheeled truck and trailer combination with integral self-load/unload capability using the PLS flatrack (FR).



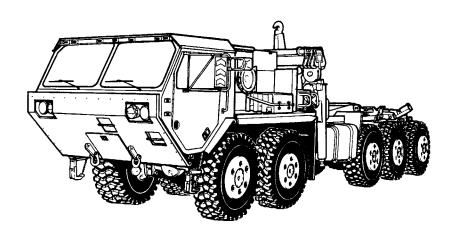
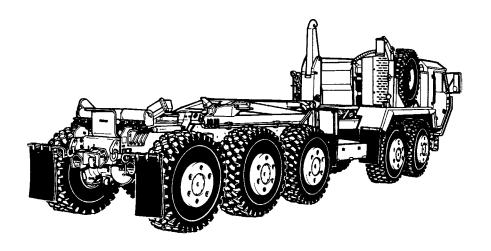


Figure 1-1. M1074 Palletized Load System Truck (With Crane)



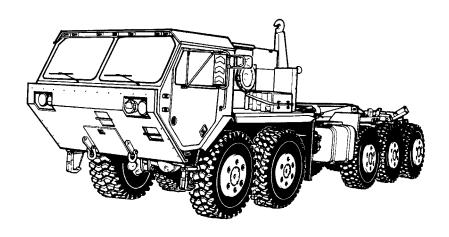


Figure 1-2. M1075 Palletized Load System Truck (Without Crane)

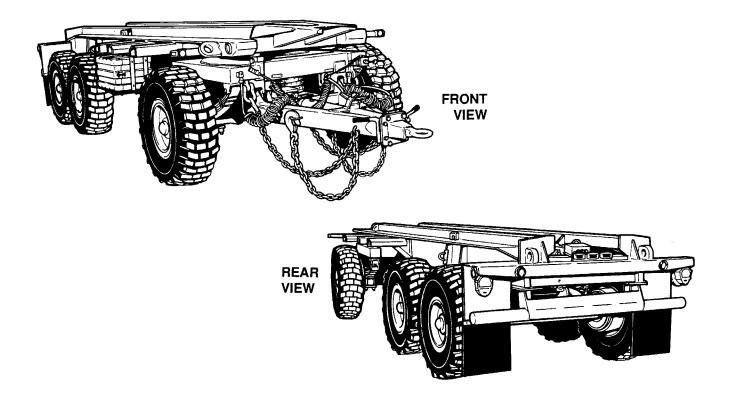


Figure 1-3. M1076 PLS Trailer

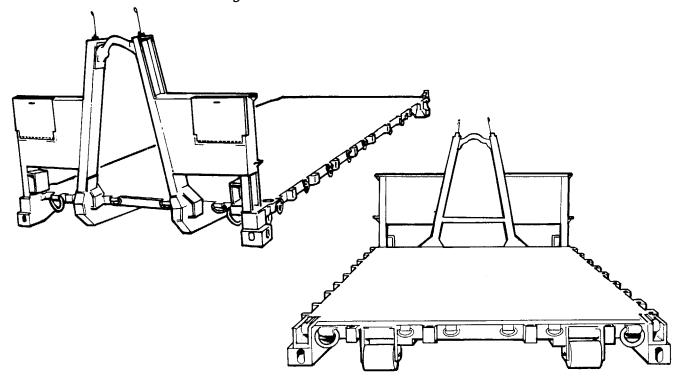


Figure 1-4. M1077 PLS Flatrack

#### 1-2. MAINTENANCE FORMS, RECORDS AND REPORTS.

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS) (Maintenance Management UPDATE).

#### 1-3. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE.

Command decision, according to tactical situation, will determine when the destruction of the truck will be accomplished. A destruction plan will be prepared by the using organization unless one has been prepared by a higher authority. For general destruction procedures for this truck, refer to TM 750-244-6, Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use (US Army Tank-Automotive Command).

#### 1-4. OFFICIAL NOMENCLATURE, NAMES AND DESIGNATIONS.

Table 1-1 lists the nomenclature cross-references used in this manual.

Common Name

Table 1-1. Nomenclature Cross-Reference

	GALLOW TOWNS AND THE PROPERTY OF THE PROPERTY
Cable	Wire rope
Cold Start System	Ether quick-start system
Engine Coolant	Antifreeze, ethylene glycol mixture
Gladhand	Quick-disconnect coupling
Truck	Palletized Load System
Jacobs Brake	Engine Retarder

Official Nomenclature

#### 1-5. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your Palletized Load System needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF368 (Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-E-MPA; Warren, Michigan 48397-5000. We'll send you a reply.

#### 1-6. WARRANTY INFORMATION.

Refer to PLS Warranty Technical Bulletin, TB 9-2320-364-15 for complete warranty information covering the truck. Warranty starts on the date found in block 23, DA Form 2408-9, in the logbook. Report all defects in material or workmanship to the supervisor, who will take appropriate action.

#### SECTION II. EQUIPMENT DESCRIPTION AND DATA

#### 1-7. EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES.

Refer to TM 9-2320-364-10 for equipment characteristics, capabilities and features.

#### 1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

Refer to TM 9-2320-364-10 for location and description of major components.

### 1-9. EQUIPMENT DATA.

Refer to TM 9-2320-364-10 for equipment data.

#### Section III. PRINCIPLES OF OPERATION

#### 1-10. POWER TRAIN.

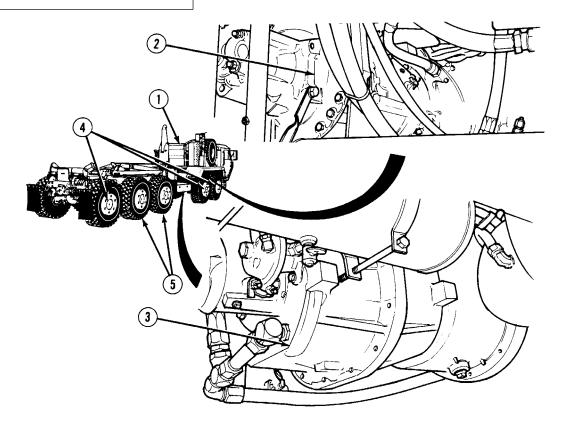


Figure 1-5. Power Train

Power for the truck is provided by a diesel engine (1, Figure 1-5) which is coupled directly to an automatic transmission (2). Power from the transmission is transferred to the transfer case (3) and on to the drive and steering axles (4) and the drive only axles (5) through a series of drive shafts and universal joints. The truck drive train is enhanced through the use of the Detroit Diesel Electronic Control II (DDEC II), or Detroit Diesel Electronic Control III/IV (DDEC III/IV) electronic engine controller and the Allison Transmission Electronic Control (ATEC) electronic transmission controller. The primary components of the ATEC system are an Electronic Control Unit (ECU) and shifter in the truck cab, an electrohydraulic valve module beneath the transmission gearing section that contains solenoid valves for clutch control, a throttle sensor that is activated by the accelerator pedal and an output speed sensor that relays the transmission out speed to the ECU for shifting and control functions.

- **a. Engine.** The truck is equipped with a Detroit Diesel Corporation (DDC) Model 8V92TA engine rated at 500 HP. The drive train control system consists of the engine and transmission systems.
- (1) The DDEC II and DDEC III/IV contain a microprocessor-based electronic control module to regulate the electronic distributor unit. This distributor unit controls the individual or unit injectors that regulate both the amount and timing of fuel delivery. The DDEC II and DDEC III/IV electronically govern engine speed and can be programmed to accommodate truck configuration changes. The DDEC II and DDEC III/IV are electronically linked with the transmission, through the ATEC, to improve truck performance.
- (2) The DDEC and ATEC systems perform self diagnostics, engine/transmission system diagnostics and truck performance diagnostics. Self diagnostics includes personnel initiated checks of main electronic components such as solenoids, wiring, sensors and control modules. System diagnostics monitor critical engine and transmission parameters such as oil temperature, oil pressure, coolant temperature, voltage and gear range attained. Truck performance diagnostic capabilities aid the mechanic in isolating problems outside of the electronic control system. Operating data is stored in the DDEC II's and DDEC III/IV's memory for display at a later time. Stored data includes total engine hours and fuel consumed. The DDEC II and DDEC III/IV also track intermittent problems by logging the number of occurrences and the engine hours of each occurrence.
- **b.** Transmission. The truck uses an Allison 700 Series Transmission, Model CLT-755. This hydro-kinetic type transmission has an integral-locking torque converter, lock-up clutch, constant mesh planetary gearing, the ATEC, a speedometer and a control valve body assembly.
- (1) The Electronic Control Unit (ECU), which contains the microprocessor based electronics, is located in a protected area within the truck. The ECU receives information, in the form of signals from switches and sensors, processes the information and sends electrical signals to the appropriate solenoids which control the transmission operation. The ECU features diagnostics which can sense many electronic system malfunctions and identify them with a displayed code. The ECU also protects the transmission from cold weather start-ups by inhibiting normal shifting functions until a minimum sump oil temperature of 20 degrees F (-7 degrees C) is attained.
- (a) The CHECK TRANS light alerts the operator, momentarily, every time the system is activated, as a lamp check, and/or when the ECU finds a problem in the system. If the check transmission light comes on, the problem is minor. In most cases, the transmission will continue to operate in a normal manner. However, in some cases the ECU will take action to reduce the possibility of damage to the truck or the transmission. The transmission should be serviced at the next opportunity.
- (b) The DO NOT SHIFT light and/or buzzer alerts the operator, momentarily, every time the system is activated as a lamp check and any time the ECU has detected a more severe problem in the system. The ECU will cause the transmission to hold-in-gear and disengage the lock-up clutch.
- (2) The push button range selector is totally electronic. Range selection is achieved by means of seven snap dome switches. To select a range, touch the pad. The pad will light up, a beep will be heard and a "click" will be felt. The transmission will be ready to operate in the selected range. The range selector also has a "DO NOT SHIFT" light and a warning tone or buzzer.
- (a) Select the Drive position and the truck will start in first (low range only) or second range and automatically upshift to a higher range as output speed increases. As the truck slows down, output speed decreases and the transmission automatically downshifts to the correct range. If a locked brake or a slick-surface condition should occur, the ECU will command converter operation and inhibit downshifts for a period of time or until normal wheel speed has been restored. Drive (4) should be selected for moderate loads, grades and over-the-road operation with restrictive speed limits. Drive (3) is appropriate for operating in rough terrain or in heavy traffic. Drive (2) should be selected when need for speed control requires a second gear hold condition such as descending steep grades where additional engine braking is required, for operation on rough terrain, or greater retarder action. Selecting Drive (1) permits the driver to operate the truck in areas where maximum performance in extremely rough terrain is required.

### 1-10. POWER TRAIN (CONT).



Do not allow a truck to coast in neutral. Engine braking is nullified and the transmission will not receive adequate lubrication.

- (b) Select the Neutral (N) pad when checking truck accessories and for extended periods of engine idle operation. The push button range selector will automatically select neutral when the master switch is turned on.
- (c) Stop the truck before shifting from Forward (F) to Reverse (R) or from Reverse (R) to Forward (F). Touch the reverse (R) pad on the selector. The light under the Reverse (R) pad will light and the reverse warning signal on rear of truck will be activated.
- (d) When the ECU detects a serious problem in the system, a beeper tone is produced for 10 seconds and a "DO NOT SHIFT" light is activated to warn the driver that the transmission is held-in-gear. Selecting another pad will have no affect or change, nor will a tone sound be produced.
- (3) All lubricating and clutch-applied oil is provided by an engine-driven pump (in the transmission). Because of the pump location ahead of the transmission gearing and clutches, the engine cannot be started by pushing or towing the truck. Therefore, anytime that the truck must be towed, or pushed, the drive-line must be disconnected.
- c. Transfer Case. The truck transfer case has two speeds and a 30/70 differential. The transfer case 30/70 differential provides full time, all wheel drive and proportions approximately 30 percent of the torque to the front tandem and 70 percent of the torque to the rear tridem. The differential has a driver-controlled air actuated lock-up mechanism which consists of a sliding lockout collar that locks the differential housing to the output shaft. This differential lock-up provides increased mobility in adverse operating conditions.
- d. Suspension. The front tandem suspension is a walking beam suspension with a special low-friction spring. The third axle suspension is an air ride suspension. The rear tandem suspension is a specially designed low-friction spring.
- (1) The suspension system design maintains tire/ground contact under adverse terrain profiles and conditions. The design equalizes loads between axles and provides the necessary roll stability to operate on a 30 percent side slope. The truck uses 16.00R20 tires of a tubeless radial design.
- (2) The truck uses three steering axles. The front tandem axle wheels and the last axle wheels steer. Power steering controls the steering gear at each steering axle. The power steering pump is direct driven at the engine. The cab steering wheel provides directional input to the first and second axle steering gears. A control link from the first axle master steering gear provides a mechanical link to the second axle slave steering gear. The second axle slave gear provides directional control from a rotary output shaft to the steering gear on the fifth axle. The steering gears are sized to turn the wheels when the truck is fully loaded.
  - e. Axles. The truck uses a three drive/steer hub reduction axle and two hub reduction axle design.

#### 1-11. ENGINE SYSTEMS.

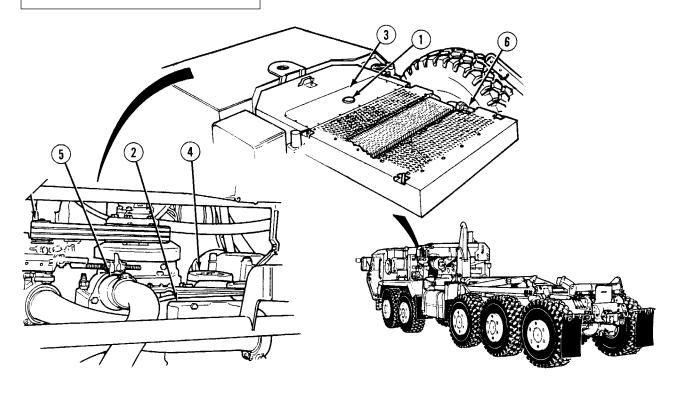


Figure 1-6. Cooling System

a. Cooling System. The pressure-type cooling system (Figure 1-6) protects the engine by removing heat generated during the combustion process. Pressure within the cooling system is regulated by a pressure release in the radiator filler cap (1). The hot coolant flows from the engine (2) to the radiator tank (3) and through the radiator core where a stream of air removes heat. This stream of air is drawn through the core by the fan. A water pump (4) draws the coolant from the radiator and pushes it through the engine repeating the cooling process. Thermostats (5) mounted in each coolant outlet elbow, remain closed until the coolant approaches a predetermined temperature at which time they open. When the coolant temperature drops below the thermostat rating, they close. An air vent line between the radiator and the water pump inlet removes air trapped in the engine when the cooling system is being filled. An oil cooler (6) is mounted in the radiator lower tank.

# 1-11. ENGINE SYSTEMS (CONT).

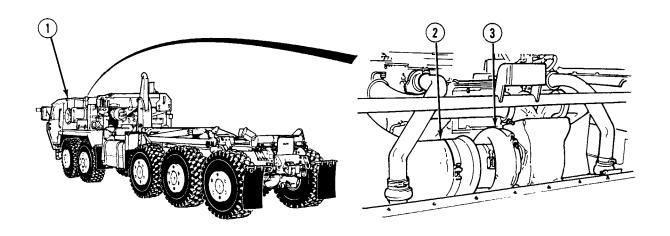


Figure 1-7. Air Intake System

b. Air Intake System. The air intake system (Figure 1-7) consists of a dry-type air cleaner (1), ducting (2), turbocharger (3) and engine blower. Engine exhaust gases flow through the turbocharger driving a turbine wheel. A compressor wheel on the opposite end of the turbine wheel shaft rotates and draws in fresh air through the air cleaner, compresses the air and delivers it to the engine blower.

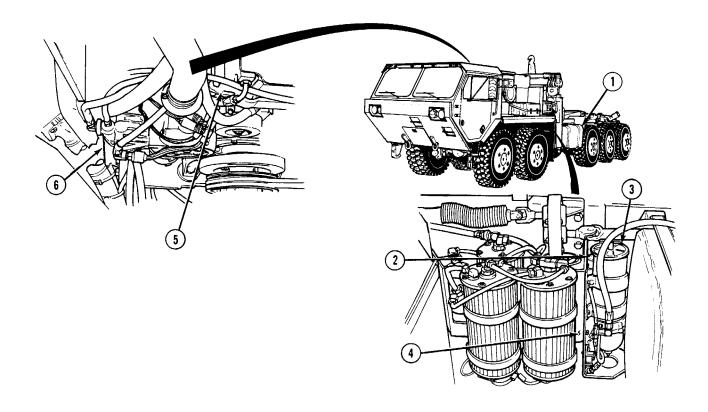


Figure 1-8. Fuel System

c. Fuel System. In the fuel system (Figure 1-8) fuel drawn from the fuel tank (1) and passes through the electrical priming fuel pump (2) and the fuel/water separator (3). A fuel shut-off valve (4) controls the flow of fuel to the engine. A mechanical fuel pump (5) draws fuel through the secondary fuel filter (6) to the engine. Surplus fuel from the injectors is returned to the fuel tank through a return line. The fuel/water separator removes water and large solid particles from the fuel. The finer particles are removed by the secondary filter before they can enter the fuel injectors.

## 1-12. ELECTRICAL SYSTEM.

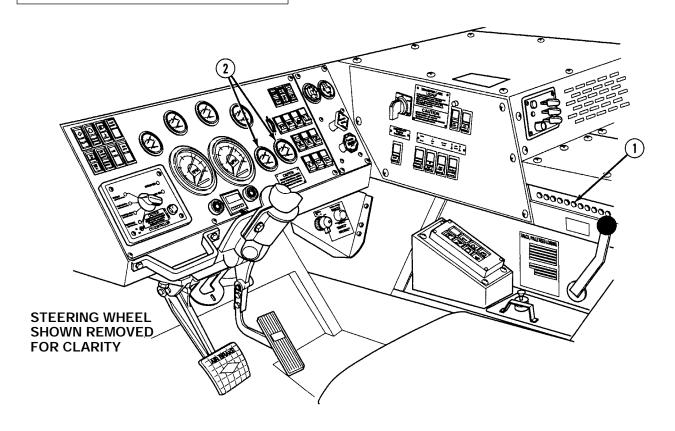


Figure 1-9. Electrical System

The 24 VDC electrical system (Figure 1-9) is waterproof, has reverse polarity protection and incorporates a 12 VDC lighting subsystem. Manual resetting circuit breakers (1) are used throughout the system and all circuits are identified. The voltages for the electrical system are indicated by two voltmeters (2) located on the dash panel inside the drivers compartment. Circuit breakers located in the cab protect the main circuits.

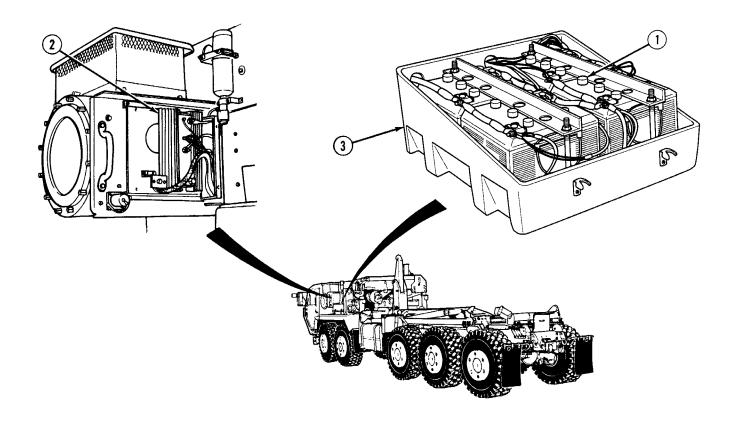


Figure 1-10. Electrical System

Electrical system (Figure 1-10) power is provided by four 12-volt series-parallel connected batteries (1). PLS trucks are either equipped with the dual voltage control system (DUVAC) and a 145 AMP alternator or the polarity protection system and a 200 AMP alternator. The DUVAC (2) delivers up to full alternator output on demand to either the 24 volt load, 12 volt load, or any combined load requirement from a single alternator. The DUVAC system can maintain battery equalization and balance even when the batteries are not matched or when they are in different charge states. Separate voltage regulation is provided for each battery bank. The battery box (3) is located on the left-hand fender and vents to the truck exterior. This location provides protection from the environment and allows ready access for service. The fiberglass battery box cover is designed to prevent short circuits during maintenance and operation. Power is distributed throughout the truck by wiring harnesses. The harnesses are interconnected by pin connectors are provided at the rear of the truck to supply power for towed loads.

## 1-12. ELECTRICAL SYSTEM (CONT).

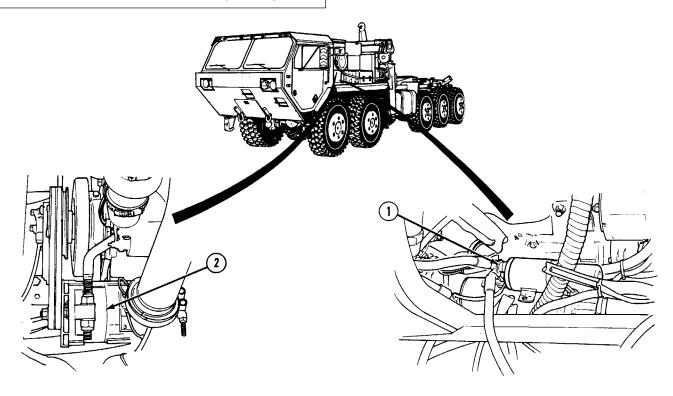


Figure 1-11. Electrical System

In the electrical system (Figure 1-11) a heavy duty starting motor (1) is mounted on the engine flywheel housing and provides the cranking power necessary for starting the engine. The DUVAC maintains both a 14- and 28-volt level for proper battery charging. The alternator (2) provides sufficient amperage to operate all electrical components and charge the batteries during engine idling. Truck exterior lights are mounted in protective locations or are protected to prevent damage. Protection is provided for lights during cross country travel. Polycarbonate lenses are provided for all lights except the sealed beam headlights and service lights. The PLS electrical system supplies all of the electrical power needed to operate the truck and trailer. The complete electrical system is made up of the following sub-systems:

- Power Storage and Generating
- Engine Starting and Stopping
- Service Lighting
- Blackout Lighting
- Accessory Lighting
- Instruments
- Warning Lights and Buzzers

a. Power Storage and Generating. Power storage for the truck consists of four 12-volt batteries. The four batteries are divided into two sets. Two batteries in each set are wired in parallel to produce higher amperage. The two sets are then wired in series to produce 24 volts. While the batteries can power all of the systems for a limited time, their primary purpose is to supply power to the engine's starting system. Once the engine is running, the generating system provides the electrical power for all of the systems. The engine driven alternator generates alternating current (AC) which is passed through a set of rectifiers that change it into direct current (DC). This direct current is used to charge the batteries and is distributed to the other systems of the PLS. The DUVAC adjusts alternator output to fit the needs of the electrical system.

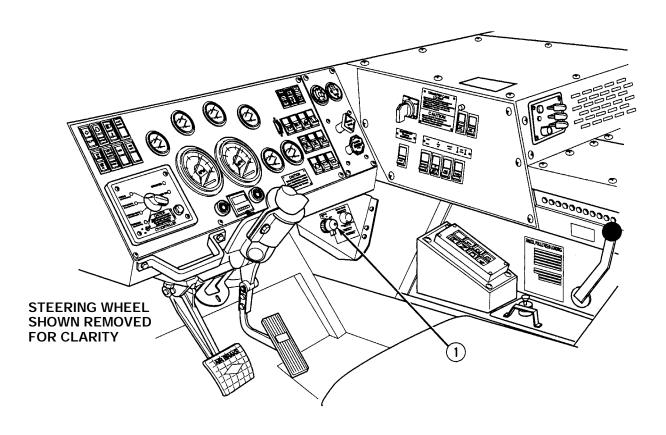


Figure 1-12. Engine Starting System

b. Engine Starting and Stopping. The engine starting system (Figure 1-12) uses the stored electrical energy of the batteries to turn the starter motor. When the ignition switch (1) is turned to the START position, electrical power is passed through the neutral safety switch to the starter relay. The starter relay, when energized, draws electrical power directly from the batteries and sends it to the starter motor solenoid. When the solenoid is energized, the starter motor draws electrical power from the batteries and turns the engine. To stop the engine, shut off ignition switch.

# 1-12. ELECTRICAL SYSTEM (CONT).

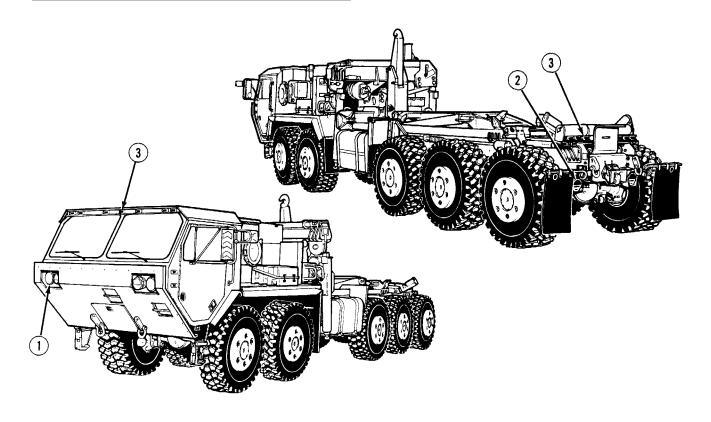


Figure 1-13. Service Lighting System

c. Service Lighting. The service lighting system (Figure 1-13) includes the headlights (1), tail lights (2) and clearance marker lights (3). They are energized by pressing the blackout light selector switch to the OFF position. The stop lights, clearance marker lights, panel lights, turn signals and emergency flashers are then controlled by separate switches located in the cab.

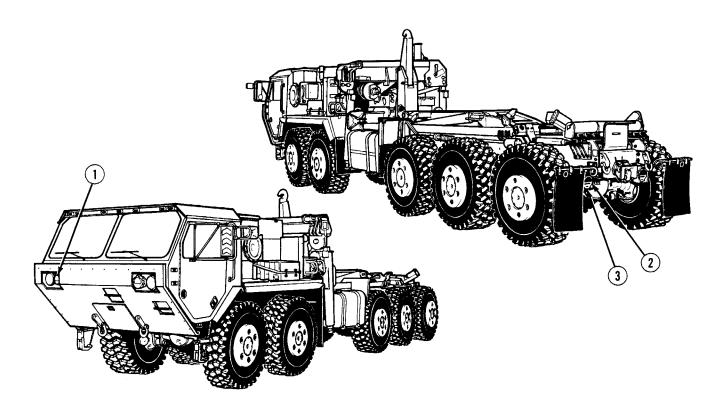


Figure 1-14. Blackout Lighting System

- d. Blackout Lighting. The blackout lighting system (Figure 1-14) includes the front blackout marker lights (1), rear blackout marker lights (2), blackout stop lights (3) and panel lights. These are energized by turning on the blackout light selector switch and either the blackout marker switch or the blackout drive switch. The blackout stop lights and the panel lights are then controlled by other switches located in the cab.
- e. Accessory Lighting. The accessory lighting system includes the dome light, beacon light and worklights. These are energized by turning the blackout light switch to the OFF position. The dome light, beacon light and worklights are then controlled by separate switches in the cab. The worklights also have switches built into the light assemblies themselves.

## 1-12. ELECTRICAL SYSTEM (CONT).

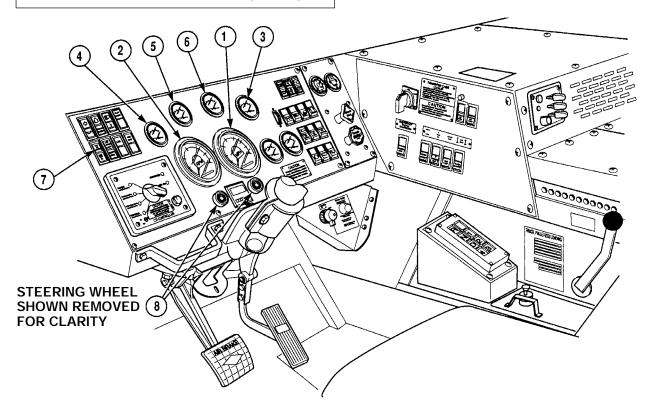


Figure 1-15. Instrument System

- f. Instruments. The instrument system (Figure 1-15) includes all gages that give the operator information. The speedometer (1) receives signals from a sending unit mounted on the transfer case. Tachometer (2) input is provided from the DDEC controller. The fuel gage (3), oil pressure gage (4), water temperature gage (5) and transmission oil temperature gage (6) all receive electrical signals from sending units. These sending units monitor fluid level, pressure and temperature and send this information to the gages.
- g. Warning Lights and Buzzers. The warning lights (7) and buzzers (8) in the cab are activated by sensors located in different systems. These include low air pressure, low engine oil pressure, low hydraulic oil level and high water temperature. When one or more of these sensors are activated, they energize the proper light and/or buzzer, informing the operator of a problem.

#### 1-13. AIR SYSTEM.

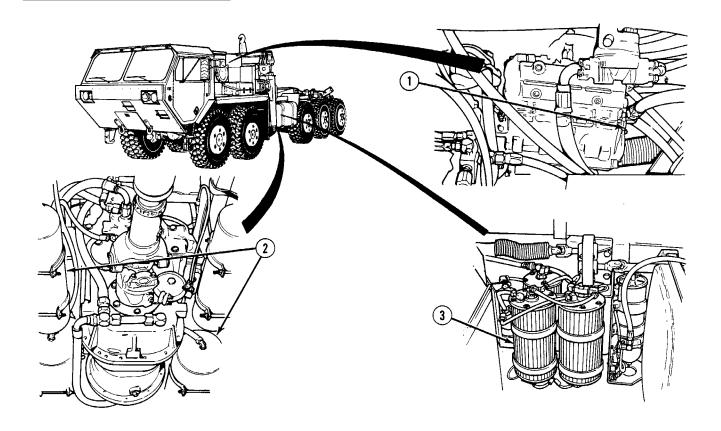


Figure 1-16. Air System

The air system (Figure 1-16) consists of an engine-driven air compressor (1) and five air reservoirs (2). The system includes the necessary valves and air lines to control the truck's air operated devices. Pressurized air from the air compressor is passed through the air dryer (3) to the reservoir. The air dryer removes dirt and moisture from the pressurized air. Air from one reservoir goes to the brake treadle valve. This air passes to the rear brake chambers, located on axles #3, #4, and #5, which control the rear axle service brakes. Air pressure in this system is shown by the red needle on the AIR PRESS gage. Air from another reservoir goes to the brake treadle valve. This air passes to the front brake chambers, located on axles #1 and #2, which control the front axle service brakes. Air pressure in this system is shown by the green needle on the AIR PRESS gage. The PARKING BRAKE valve applies or releases the rear axle (parking) brakes. The reservoirs are interconnected in such a way that if one reservoir fails, air will be supplied to release the rear axle (parking) brake from whichever reservoir is functioning. If air pressure falls below 60-70 psi (414-483 kPa) in either system, a buzzer will sound and the LOW AIR indicator warning light will light. If air pressure in the brake system falls below 30 psi (207 kPa), the rear brakes automatically apply.

## 1-14. HYDRAULIC SYSTEM.

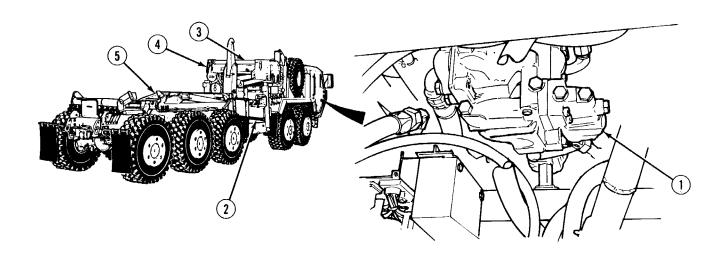


Figure 1-17. Hydraulic System

The hydraulic system (Figure 1-17) pumps (1) mounted in front of the engine provide the fluid power to operate the power steering, Self-Recovery Winch (SRW) (2), cooling fan (3), Material Handling Crane (MHC) (4) and Load Handling System (LHS) (5). A manually operated selector switch in the cab is used to select the auxiliary hydraulics.

#### 1-15. STEERING SYSTEM.

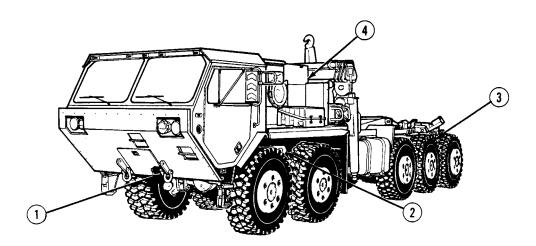


Figure 1-18. Steering System

Steering system (Figure 1-18) power is supplied to steering gears (1), (2) and (3) by an engine-driven pump. The steering fluid reservoir (4) is separate from the main hydraulic system. The steering wheel, which is mechanically linked to the steering gear, rotates a gear that positions a spool in the front steering gear (1). This motion is hydraulically transmitted to a piston in the intermediate steering gear (2) causing it to follow the pitman arm and transmit rotary motion to the rear steering gear (3). These pitman arms move the steering mechanism on the axles left or right causing the truck to steer left or right. An emergency backup hydraulic pump, driven by the transfer case middle shaft, supplies limited emergency steering.

# 1-16. SELF-RECOVERY WINCH (SRW).

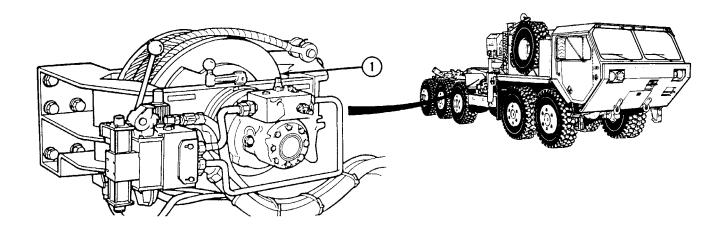


Figure 1-19. Self-Recovery Winch (SRW)

When specified, the truck is equipped with a winch (1, Figure 1-19) for self-recovery capable of forward and rearward deployment. The winch is equipped with a holding brake and hydraulic counter-balance valve to safely deploy and hold the full rated load of the winch. The winch brake is automatic and is fully engaged anytime the winch is stopped or not in use and is fully released during operation. The winch cable is equipped with a clevis end and roller assemblies are provided to guide the cable. The winch is controllable from the driver's position and at the winch itself. All controls revert to neutral when released.

### 1-17. MATERIAL HANDLING CRANE (MHC).

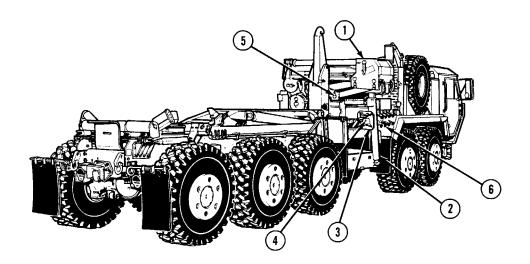


Figure 1-20. Material Handling Crane (MHC)

The truck Material Handling Crane (MHC) (Figure 1-20) is a fully hydraulic load-moment sensing crane (1), powered by the truck hydraulic system. The crane is mounted behind the cab, bolt-attached to the truck frame and is capable of lifting a 3,900 lb (1769 kg) pallet from any location on the FR. The crane can load/unload pallets to either side of the truck. Truck stability and leveling is accomplished with left- and right-side hydraulically operated stabilizers (2) that are fabricated as a part of the crane substructure. These stabilizers/outrigger jacks can be controlled from either side of the truck by individual hydraulic controls. The jacks can level the truck when it is inclined up to 7 degree side slope. Check valves are used to hold the outriggers position. Safety switches are installed in the outrigger jacks to prevent crane operation unless the outriggers are in place. The outrigger pads (3) are attached to the outrigger jacks by means of quick pins (4) and are stowed on the crane base. The pads swivel 360 degrees when installed on the jacks.

a. Hydraulic System. The hydraulic filters and strainers are located to provide direct access and to allow removal without causing damage to the truck. Bypasses are furnished, where necessary, to protect filters during cold temperature operation. All cylinder rods exposed during operations have a hard chromium plating. Integral mounted or cartridge-type holding valves prevent sudden cylinder collapse in the event of hose burst or major hydraulic failure. If a hydraulic system failure occurs, a hydraulic hand pump (5) located at the operator station permits the operator to lower any load to the ground and stow the crane. The MHC is operated by two hydraulic valve banks (6), located approximately 60 inches (152 cm) above ground on the passenger side of the truck. Four electro-proportional control valves with manual handles connected to spools are used to control crane proper function. Three additional proportional manual control valves are used for erection and outrigger control. The outrigger manual control valves are also duplicated on the driver's side of the truck.

## 1-17. MATERIAL HANDLING CRANE (CONT).

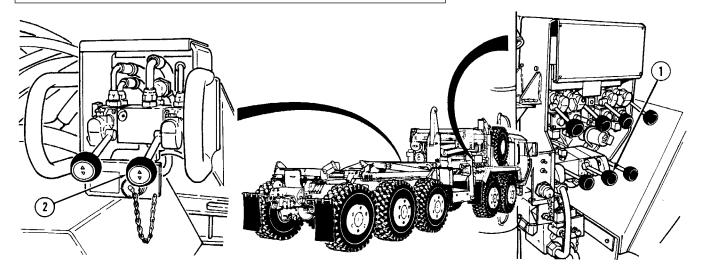


Figure 1-21. Fixed Controls

b. Fixed Controls. All crane controls and indicators (1, Figure 1-21) are located at the crane position on the passenger side of the truck. Controls (2) on the driver's side will also operate the outriggers. The controls are accessible to the operator while standing on the ground. Control valves, both crane and outrigger, automatically return to the neutral position should the operator inadvertently or intentionally release the control.

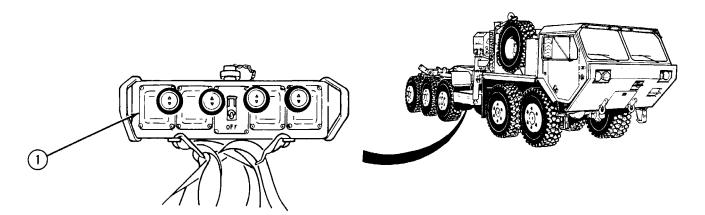


Figure 1-22. Remote Controls

c. Remote Controls. The remote control system (Figure 1-22) is designed to operate the spools of the directional control valve. Remote control is proportionally variable. Remote control (1) is provided with an emergency shutdown capability and designed so that when activated, all remote control crane functions cease and truck speed is reduced to idle. The operator can operate the remote control anywhere within 35 ft (10.7 m) of the crane base. The controller has multiple functions to match control levers on the fixed control except for the mast and outrigger controls.

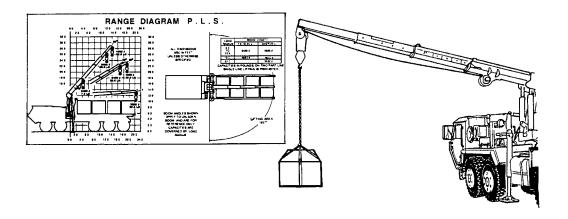


Figure 1-23. Overload Shutdown

d. Overload Shutdown. The crane is provided with an overload shutdown (Figure 1-23) which precludes structurally overloading. Two block and overload conditions are sensed through line-pull of the hoist. A preprogrammed micro-processor that is constantly comparing boom angle, boom length and hoist line pull activates solenoid valves in the telescope out, lift up, lift down and hoist up circuits when the unit is overloaded or two-blocked. During an overload condition, the crane's function cease. Hoist down, telescope in and swing in either direction can be used manually to bring the crane to a safe position.

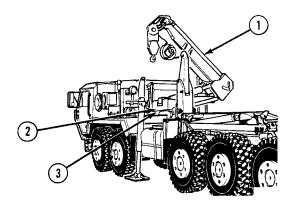


Figure 1-24. Hoist, Swing Drive and Brake

- e. Hoist. The crane provides vertical lift of a 3,900 lb (1769 kg) load at 22.5 ft (6.86 m) by means of a hoist (1, Figure 1-24) with a 5.8 cu. in. (95 cu. cm.) motor. The hoist is controllable by manual control at the fixed operators station, or at the remote control. The hoist has a spring applied, hydraulically released multi-disc pack brake, hydraulically coupled to the hoist circuit, which applies automatically when the hoist control is released.
- f. Swing Drive and Brakes. The swing drive (2) is a planetary gear box driven by a hydraulic motor to give a swing speed on 0.8 rpm. Mechanical stops limit the rotation to 180 degrees. The swing brake (3) is a spring applied, hydraulically released multi-disc pack, hydraulically coupled to the swing circuit, applying automatically when the swing control is released.

## 1-18. LOAD HANDLING SYSTEM (LHS).

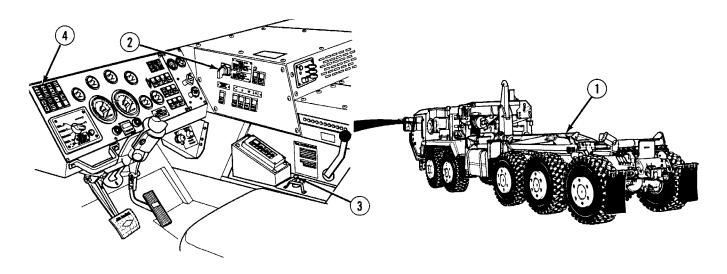


Figure 1-25. Load Handling System (LHS)

The truck is equipped with a Load Handling System (LHS) (Figure 1-25). The LHS (1) is fully hydraulic, powered by the truck hydraulic system and is operated by hydraulic selector switch (2) and joystick (3) located to the driver's right in the truck cab. The LHS control system is electrically powered from the truck electrical system. The LHS is capable of the following, with a flatrack (FR) loaded with 33,000 lb (15 metric tons) nominal payload:

- Loading/unloading the FR from the truck to 12 in. (30.5 cm) below ground level and any intermediate level,
- · Loading/unloading from uneven ground slopes of 10 degrees from the trucks lateral and horizontal axis,
- Loading/unloading to/from the trailer or ramps in which the height is equal to or less than the height from the ground to the bottom of the FR (while on the truck).
- a. Flatrack Locking. The LHS is designed with automatic locking features that secure the FR for all modes of transportation. The LHS can automatically guide, center and secure a FR to the truck so that even during rough trail operations, the FR remains safely secured.
- b. LHS Overload. The LHS will not function when the payload exceeds 36,300 lbs (16,466 kg) maximum. A warning light (4), located in the cab in plain view of the driver, activates when a FR with a payload between 34,500 and 35,500 lbs (15,649-16,103 kg) is being loaded by the LHS while under the worst conditions.
- c. Hydraulic System. Hydraulic filters are located to provide direct access and to allow removal without damage to the truck. By-passes are furnished where necessary to protect filters during cold temperature operation. All cylinder rods exposed during operation have a hard chromium plating.
- d. Slave Hydraulics. Self-sealing quick disconnect hydraulic couplings and a hose with appropriate connectors are provided so that one PLS truck can readily hydraulically power the LHS of another PLS truck.

#### 1-19. WHEELS AND TIRES.

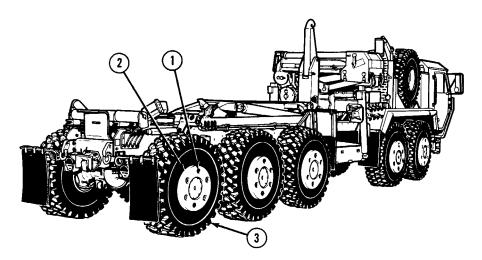


Figure 1-26. Wheels and Tires

Each truck has eleven wheel/tire assemblies (Figure 1-26); the ten installed on the truck axles plus a spare. The components of each wheel/tire assembly are the wheel, tire, valve stem, Central Tire Inflation System (CTIS), wheel valve, bead lock and wheel cover.

- a. Wheel. The 20 by 10 inch wheel is manufactured in two pieces. Twelve studs (1) that protrude from the rear wheel half are used to bolt the two halves together. These studs are also used to mount the CTIS wheel valve bracket and secure the wheel cover (2).
  - b. Tire. The 16.00R20 tires (3) are tubeless.
- c. Bead Lock. The bead lock is installed inside the assembled wheel and tire. It assures that the tire stays pressurized when tire pressure is low. It is manufactured in two halves that are bolted together.
- d. CTIS Wheel Valve. The wheel valve assembly allows air flow in and out of the tire during CTIS inflation/deflation cycles. It is mounted to the wheel and secured by a bracket assembly. The input and output ports are fitted with two flexible and steel tubes in parallel.
  - e. Valve Stem. The valve stem connects inside the wheel and is routed to the CTIS wheel valve.
- f. Wheel Cover. The entire wheel end contains a wheel cover to protect the CTIS valve and air lines from physical damage. This cover must always be in place whenever the truck is in operation. It is secured to the wheel via four of the wheel studs.

## 1-20. CENTRAL TIRE INFLATION SYSTEM (CTIS).

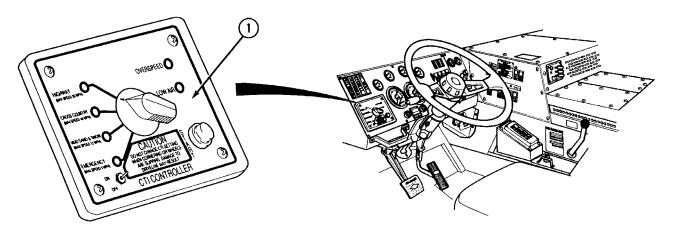


Figure 1-27. Central Tire Inflation System (CTIS)

The Central Tire Inflation System (CTIS) (Figure 1-27) is designed to adjust the pressure of all tires on the truck for different traction conditions. The CTIS controller (1) has four pressure settings which the operator selects and activates in the cab. The CTIS consists of control valves for air supply and distribution, a dash mounted electrical controller that adjusts tire pressure, along with required air tubing, electrical cables, air dryer and air compressor. The drive-line lock-up controls with the exception of the TRANSFER CASE LOCKUP are integrated with the CTIS to simplify operation of the truck. Refer to TM 9-2320-364-10 for operating controls and indicators for the CTIS.

## 1-21. CAB.

The truck cab features a full width configuration and is positioned forward of the first axle. The cab controls and operating mechanisms are designed to accommodate a crew of two wearing the full range of clothing. Heating, ventilation, lighting, noise, vibration and shock control is provided for personnel use. The cab contains all of the driving controls and gages and some operating controls for the mounted equipment. Refer to TM 9-2320-364-10 for information concerning operating controls and indicators.

## 1-22. PLS TRAILER (PLST).

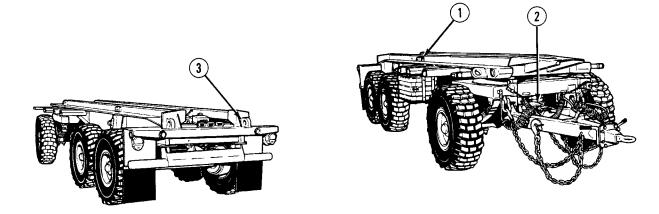


Figure 1-28. Palletized Load System Trailer (PLST)

The Palletized Load System Trailer (PLST) (Figure 1-28) is a three axle trailer designed to carry a Flatrack (FR) with a 33,000 lb (15 metric tons) nominal payload. It can accommodate both full and partial loaded flatracks. Guides laterally position the FR on the trailer rear stops and these locate the longitudinal position of the FR in relation to the PLST. These stops prevent the FR from sliding rearward. A pneumatic locking device (1), located between the frame rails just above the second axle, hooks to engage the lock points and secure the FR to the PLST. An air valve controls the position of the lock hooks. Springs retain the hooks in the locked position. The PLST has a standard 12 volt electrical system with 24 volt military adapters (2). Also provided are two intervehicular electrical connecting cables of sufficient length to reach the towing truck. Two towing eyes (3), at the rear of the PLST permit towing with a medium duty tow bar. The spare tire carrier is ahead of the second axle in the center of the frame. The spare tire is held in place with bolts through the wheel bolt pattern. The spare tire and wheel assembly can be raised and secured in the spare tire carrier by the trailer-provided hand-operated winch. The PLST uses turntable-type steering for tracking and turning and is equipped with an air braking system. All three axles use 16.5 in. diameter by 7 in. wide (420 mm by 180 mm) S-cam brakes. The PLST has a dual brake system with separate service and emergency brake system. The PLST brake system is activated and charged by the truck air supply. The brakes are self-adjusting. Refer to TM 9-2330-385-14 for Operator's, Unit, Direct Support and General Support Maintenance for the PLS Trailer.

a. Service Brakes. The six service brakes on the PLST are powered by 24/20 inch (61/51 cm) brake chambers. Six inch automatic slack adjusters are provided with all brake chambers. The service brakes are activated when a signal from the foot-operated treadle valve or hand operated control valve is sent through a series of relay valves. The relay valves convert the proportioned service brake signal from the truck into a regulated service brake chamber pressure.

## 1-22. PLS TRAILER (PLST) (CONT).

- b. Parking Brakes. Spring chamber parking brakes are provided on all PLST axles. The application and release of the six PLST spring brakes is controlled by a spring brake control valve. An absence of air pressure in the emergency/spring brake supply line causes the spring brake control valve to activate the spring brakes. The spring brake control valve also retains air pressure in the PLST air reservoir so the PLST spring brakes can be released by the spring release valve. The spring brake control valve also prevents compounding of pressures in the brake chambers by relieving the pressure on the spring brake side of the chambers when the spring brakes are set and the service brakes are applied. The PLST spring brake release valve is located on the right front corner of the trailer. This valve releases the PLST spring brakes without a prime mover air supply when there is sufficient air reservoir pressure. After the spring brakes have been released, they can be reapplied by actuating the release valve. When air is supplied through the emergency/spring brake supply line, the spring release valve is over-ridden and the trailer spring brakes are released. If there is insufficient air reservoir pressure to release the trailer parking brakes, a cage nut release is provided on each spring chamber to mechanically release the spring brakes.
- c. Emergency Brakes. Whenever there is a loss of pressure from the truck or PLST air reservoir, the emergency brakes are activated.

## 1-23. PLS FLATRACK (FR).

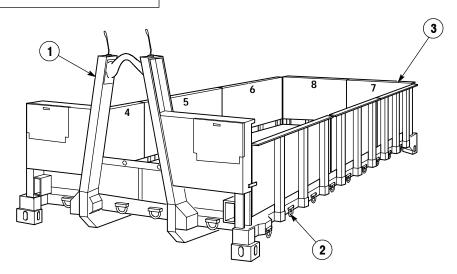


Figure 1-29. Palletized Load System Flatrack (FR)

The Flatrack (FR) (1, Figure 1-29) accommodates a 33,000 lb (15 metric tons) nominal payload during all modes of transportation and during all specified load/unload operations. The FR is designed to withstand the dynamic and static loads imposed while fully loaded during LHS load/unload operations. The FR has an empty weight of 3250 lb (1474 kg) without sideboards. The FR can accommodate palletized, break bulk and 20 ft (6.1 m) ISO container payloads. Tiedowns (2) and sideboards (3) are used to contain and hold cargo. Refer to TM 9-3990-206-14&P for Unit, Direct Support and General Support Maintenance for the PLS Flatrack.

# **CHAPTER 2**

# **VEHICLE MAINTENANCE**

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# Section I. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

#### 2-1. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

## 2-2. SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT.

For a listing of special tools, TMDE and support equipment, refer to the Maintenance Allocation Chart (MAC), Appendix B, of this manual and to the Repair Parts and Special Tools List (RPSTL), TM 9-2320-364-24P.

#### 2-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (TM 9-2320-364-24P) covering Unit Maintenance for this equipment.

#### Section II. SERVICE UPON RECEIPT

#### 2-4. UNPACKING AND DEPROCESSING.

- a. Unpacking. Upon receipt of a new truck, the receiving organization must see if it has been properly prepared for service and is in good condition. Inspect all assemblies, subassemblies and accessories to be sure they are in proper working order (TM 9-2320-364-10). Secure, clean and correctly adjust and/or lubricate as needed (Para 2-9 and TM 9-2320-364-10). Check all tools and equipment to be sure every item is accounted for (TM 9-2320-364-10-HR), in good condition, clean and properly mounted or stowed (TM 9-2320-364-10).
- b. Deprocessing. Read "Processing and Deprocessing Record of Shipping, Storage and Issue of Trucks and Spare Engines" tag, (DD Form 1397), and follow all precautions checked. This tag should be attached to the steering wheel, shifting lever or ENGINE START switch.

#### 2-5. HAND RECEIPT MANUAL AND INVENTORY OF EQUIPMENT.

When a new truck is first received by the using organization, it is necessary to inventory the truck equipment. For detailed procedures, refer to Hand Receipt Manual, TM 9-2320-364-10-HR.

#### 2-6. SERVICE BEFORE OPERATION.

- a. General.
  - (1) Refer to TM 9-2320-364-10 for operating instructions for the truck.

- (2) Upon receipt of a new, used or reconditioned truck, the receiving organization must see if it has been properly prepared for service and is in good condition (TM 9-2320-364-10). Inspect all assemblies, subassemblies and accessories to be sure they are in proper working order. Secure, clean and correctly adjust and/or lubricate (Para 2-9 and TM 9-2320-364-10) as needed. Check all tools and equipment to be sure every item is there (TM 9-2320-364-10-HR), in good condition, clean and properly mounted or stowed (TM 9-2320-364-10).
- (3) Follow general procedures for all services and inspections given in TM 9-2320-364-10.
- b. Inspection and Servicing Equipment.

#### NOTE

If truck has been driven to the using organization, most or all of the following work should have been done.

(1) When truck is received, inspect all items for damage that may have occurred during shipping and unloading operations. Pay close attention to any loose or missing nuts, bolts, screws, access plates, drain plugs, draincocks, oil plugs, assemblies, subassemblies, or components that may be easily lost or broken in transit. Check Basic Issue Items (BII) against checklist to make sure all items are accounted for and are in good condition (TM 9-2320-364-10-HR). Carefully list all discrepancies.

## **WARNING**

- Drycleaning Solvent (P-D-680) is TOXIC and flammable. Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Drycleaning Solvent is 140 degrees F (60 degrees C) and Type III Drycleaning Solvent is 200 degrees F (93 degrees C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and
  medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts
  eyes, immediately flush eyes with water and get immediate medical attention.
- (2) Clean all exterior surfaces coated with rust-preventive compound with drycleaning solvent (Item 87, Appendix C).
- (3) Perform the Semiannual (6-month or 3,000-mile) Preventive Maintenance Checks and Services (PMCS), Table 2-1.
- (4) Lubricate specific points shown in Para 2-9 and TM 9-2320-364-10 regardless of interval. Do not lubricate gear cases or engine. Check processing tag for gear case and engine oil. If tag states the oil is good for 500 miles (805 km) of operation and is of the proper grade for local climatic operation, check oil level but do not change oil.
- (5) Schedule a semiannual service in accordance with DA Pam 738-750. Arrange for front tandem crossmember torque check (Para 15-6) at 3,000 miles (4,828 km).
- (6) Activate battery if truck is delivered with dry-charged battery (TM 9-6240-200-12).

## 2-6. SERVICE BEFORE OPERATION (CONT).

### **WARNING**

- Do not remove the radiator cap when the engine is hot; steam and hot coolant can escape and burn personnel.
- Use extreme care when removing the radiator pressure cap. Sudden release of pressure
  can cause a steam flash which could seriously injure personnel. Slowly loosen cap to the
  first stop to relieve pressure before removing cap completely. After opening, securely
  tighten cap.
- Use a clean, thick waste cloth or like material to remove radiator pressure cap. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.
- (7) Check radiator coolant. Check if solution is adequate for expected climatic conditions. Refer to TB 750-651 for preparation of antifreeze solutions. Put tag near filler cap with type of antifreeze and degree of protection written on tag.
- c. Special Service Instructions.
  - (1) Truck Body and Sheet Metal Inspection.
    - (a) Inspect body and sheet metal for evidence of damage during shipment.
    - (b) Check doors, latches and hinges on compartments for proper operation.
    - (c) Check mounting hardware and tighten as necessary.
  - (2) Truck Cab Inspection.
    - (a) Inspect cab for evidence of damage during shipment.
    - (b) Inspect windshields and window glass for cracks or other damage.
    - (c) Check door latches, hinges and windows for proper operation.
    - (d) Check seats and seat belts to ensure they are securely installed and that operator's seat adjustments are functioning properly.
  - (3) Engine Inspection.
    - (a) Remove any seals, plugs or tape used to seal air inlets and ports on the engine during shipping.
    - (b) Check crankcase oil level with dipstick.
    - (c) Examine air cleaner element for dirty or restricted condition.
    - (d) Inspect engine and cooling hose connections for evidence of leakage.
    - (e) Clean away any obstruction of cooling air flow to radiator.

- (4) Transmission Inspection.
  - (a) Check fluid level with dipstick.
  - (b) Check external hoses and tubes for evidence of leakage.
- (5) Transfer Case Inspection.
  - (a) Check level of lubricant at fill plug.
  - (b) Inspect lubrication pump and external hoses and tubes for evidence of leakage.
  - (c) Operate driveline controls and observe power to front axle.
  - (d) Inspect bolts on driveline U-joints.
- (6) Electrical System Inspection.
  - (a) Inspect battery cable connections and clean and tighten as necessary.
  - (b) Check light for burned out lamps, loose connections and dirty or broken lenses.
  - (c) Ensure alternator is charging properly.
  - (d) Ensure all electrical equipment functions.
- (7) Air System Inspection.
  - (a) Drain any water from reservoirs.
  - (b) Inspect air lines and connections for leakage.
- (8) Steering System Inspection.
  - (a) Check steering hydraulic reservoir for proper fluid level.
  - (b) Examine steering linkage and steering gears for damage incurred during shipment.
  - (c) Examine steering hoses and connections for evidence of leakage.
  - (d) Check steering system for proper operation during road test.
- (9) Chassis and Running-Gear Inspection.
  - (a) Check all lubricant levels.
  - (b) Check axle housing pressure vents to ensure freedom from foreign matter.
- (10) Tire Inspection.
  - (a) Check tire inflation.
  - (b) Inspect tires for serious cuts, bubbles, cracks, bruises, dry-rot, foreign objects or exposure of internal cords. Remove foreign objects lodged between treads.
  - (c) Check all wheel mounting nuts for proper torque, (TM 9-2320-364-10).
  - (d) Check front and rear suspension for broken spring leaves, damaged components or damaged air bags.

## 2-6. SERVICE BEFORE OPERATION (CONT).

- (11) Fuel System Inspection.
  - (a) Check fuel level and replenish, if necessary.
  - (b) Inspect fuel hoses, tubes, connections and filters for evidence of leakage.
- (12) Arctic Kit. If truck is equipped with an arctic kit, and is going to operate in non-arctic climates, remove arctic alternator belts and replace with standard belts.

### Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

### 2-7. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION.

This section contains Unit Maintenance PMCS requirements for the truck. The PMCS tables contain checks and services necessary to ensure the truck is ready for operation. Using the PMCS tables, perform maintenance at the specified intervals. Perform preventive maintenance checks and services in TM 9-2320-364-10 before doing the Unit preventive maintenance.

#### 2-8. GENERAL MAINTENANCE PROCEDURES.

## **WARNING**

- Drycleaning Solvent (P-D-680) is TOXIC and flammable. Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Drycleaning Solvent is 140 degrees F (60 degrees C) and Type III Drycleaning Solvent is 200 degrees F (93 degrees C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- a. Cleanliness. Dirt, grease, oil and debris only get in the way and may cover up a serious problem. Use drycleaning solvent (Item 87, Appendix C) on metal surfaces and soapy water on rubber.
- b. Bolts, Nuts and Screws. Check bolts, nuts and screws for obvious looseness, missing, bent or broken condition and tighten or replace as necessary. If they cannot be checked with a tool, look for chipped paint, bare metal or rust around bolt heads.
- c. Welds. Look for loose or chipped paint, rust or gaps where parts are welded together. If a bad weld is found, notify the supervisor.
- d. Electric Wires and Connectors. Look for cracked or broken insulation, bare wires and loose or broken connectors. Tighten loose connectors and make sure the wires are in good shape.

- e. Fluid Hoses, Tubes and Fittings. Look for wear, damage, leaks and make sure clamps and fittings are tight. Wet spots show leaks, but a stain around a fitting or connector may indicate a leak. If connector or fitting is loose, tighten it. If something is broken or worn out, repair or replace per applicable procedure.
- f. Fluid Leakage. It is necessary to know how fluid leakage affects the status of fuel, oil, coolant and the hydraulic systems. The following are definitions of the types/classes of leakage necessary to know in order to determine the status of the truck. Learn, then be familiar with them and REMEMBER WHEN IN DOUBT, NOTIFY THE SUPERVISOR!



Equipment operation is allowable with minor leakage (Class I or II). Consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify the supervisor. When operating with Class I or II leaks, continue to check fluid levels as required in the PMCS. Class III leaks should be repaired per applicable procedure.

- (1) Class I. Seepage of fluid as indicated by wetness or discoloration not great enough to form drops.
- (2) Class II. Leakage of fluid great enough to form drops but not enough to cause drops that fall from item being checked/inspected.
- (3) Class III. Leakage of fluid great enough to form drops that fall from the item being checked/inspected.
- g. Air System Components. Look for worn, damaged or leaking components. Make sure clamps and fittings are tight. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, either repair or replace it.
- h. Damage. Damage is defined as any condition that affects safety or would make the truck unserviceable for mission requirements.
- *i.* Lubrication Fittings. Some trucks have lube for life tie-rod ends and drag link ends. These do not require lubrication and do not have a lube fitting.

#### 2-9. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) TABLES.

- a. Do the SEMIANNUAL PREVENTIVE MAINTENANCE (Table 2-1) once every six months and/or every 3,000 miles (4,828 km) whichever comes first.
- b. Do the ANNUAL PREVENTIVE MAINTENANCE (Table 2-1) once each year and/or every 6,000 miles (9,654 km) whichever comes first.
- c. Do the BIENNIAL PREVENTIVE MAINTENANCE (Table 2-1) once every two years and/or every 12,000 miles (19,312 km) whichever comes first.
  - d. Refer to the specific technical manuals (Table 2-2), for preventive maintenance for special kits.
- e. Always do the PREVENTIVE MAINTENANCE in the same order until it gets to be a habit. Once practiced, it will be easy to spot anything wrong in a hurry. Perform the checks and services listed in Tables 2-1 and 2-2 in the order listed.

# 2-9. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) TABLES (CONT).

- f. If something does not work, troubleshoot with instructions in Section IV.
- g. If anything looks wrong and is not fixed, write a DA Form 2404.
- *h.* When doing preventive maintenance, take along the tools and supplies needed to make all the checks, including a clean cloth or two.
  - *i.* The following is a breakdown of the PMCS table:
    - (1) "Item No." column. Checks and services are numbered in a logical order for moving around the truck. The item number column is used as a source of items numbers for the TM Number Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, for recording results of the PMCS.
    - (2) "Interval" column. The column identifies when the PMCS should be performed. Lubrication services coincide with the vehicle's Semiannual Preventive Maintenance Service. For this purpose, a 10 percent tolerance (variation) in specified lubrication point mileage is permissible. Those vehicles not accumulating 1,000 miles (1,609 km) in a 6-month period will be lubricated at the time of Semiannual Preventive Maintenance Service.
    - (3) "Item To Be Inspected" column. This column identifies the item to be inspected.
    - (4) "Procedure" column. This column contains all the information required to do the check/inspection. Art is integrated into the column to aid the user in identifying items. Whenever replacement or repair is recommended, reference is made to the applicable maintenance instructions.
    - (5) "Not Mission Capable If:" column. This column contains a brief statement of the condition (e.g., malfunction, shortage) that would cause the vehicle to be less than fully ready to perform its assigned mission.

#### NOTE

- If the vehicle must be kept in continuous operation, do only the procedures that can be
  done without disturbing operation. Make complete checks and services when the vehicle
  is shut down.
- Oil filters must be serviced/cleaned/changed as applicable, when they are known to be contaminated or clogged and at prescribed intervals.
- *j.* For operation of equipment in protracted cold temperatures below -15 degrees F (-26 degrees C), remove lubricants prescribed in lubrication table for temperatures above -15 degrees F (-26 degrees C). Relubricate with lubricants specified in lubrication table for temperatures below -15 degrees F (-26 degrees C). If OEA lubricant is required, see the temperature ranges prescribed in the lubrication table. OEA lubricant is to be used in place of OE/HDO 10 lubricant for all temperature ranges where OE/HDO 10 is specified in the lubrication table.
- *k.* Perform all semiannual inspections in addition to the annual inspections at the time of the annual inspection. Perform all annual and semiannual inspections in addition to the biennial inspections at the time of the biennial inspection.
- 1. Engine oil/transmission/hydraulic fluids must be sampled at 100 hours of operation or at 90-day intervals, whichever comes first, as prescribed by DA Pam 738-750. Hard-time intervals will be applied in the event AOAP laboratory support is not available.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			PRIOR TO ROAD TEST Ensure Operator/Crew has performed PMCS	
			listed in TM 9-2320-364-10.	
			ROAD TEST	
			Maintenance personnel will be with vehicle operator to assist in performing PMCS checks and verify pre-service checks.	
			NOTE	
			<ul> <li>The following will be performed during the road test. These inspections must be performed before any -20 level PMCS regardless of interval.</li> </ul>	
			<ul> <li>For road test, vehicle will be driven at least five miles over different ground to give enough time to detect any malfunctions.</li> </ul>	
1	Semi- Annual	Pre- Service Checks	<ul> <li>a. Notice if starter engages smoothly and turns the engine at normal cranking speed.</li> </ul>	<ul> <li>a. Starter inoperative or makes excessive grinding sound.</li> </ul>
			b. Listen for unusual engine noise at idle, at operating speeds, and under acceleration. Be alert for excessive vibration and the smell of oil, fuel, or exhaust.	b. Engine knocks, rattles, or smokes excessively.
			c. Check for transmission response to shifting and for smoothness of operation in all speed ranges. Be alert for unusual noises and difficulty in shifting in any speed range.	c. Transmission shifts improperly, does not shift or makes excessive noises.
			CAUTION	
			Truck must be parked and transmission in neutral when making this check. Transfer case will be damaged if shifted while truck is moving.	
			d. Check for transfer case response to shifting and for smoothness of operation in all gear ranges (HI and LO). Be alert for unusual noises and difficulty in shifting in any gear range.	d. Transfer case jumps out of gear or makes ex- cessive noises.
			e. Test for response to accelerator feed. Observe for sticking pedal.	e. Pedal sticking or binding.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		Pre- Service Checks (continued)	f. With vehicle speed approximately 5 mph (8 kph) turn steering wheel to left, then right, to detect steering backlash, shimmy, or free play of more than 1-1/2 inches (38 mm) in either direction. Vehicle should respond instantly. With vehicle moving on straight, level terrain, lightly hold steering wheel to check for pull and wandering.	f. Steering binds, grabs, wanders or free play is more than 1-1/2 inch (38 mm) in either direction.
			g. Apply brake pedal with steady force. Vehicle should slow down and stop without pulling to one side or jerking. Release brake pedal. The brakes should release immediately and without difficulty.	g. Brakes chatter, pull to one side or inoperative. Brakes will not release.
			<ul> <li>h. Observe vehicle response to road shocks.</li> <li>Side sway or continuous bouncing indicates a malfunction.</li> </ul>	<ul><li>h. Handling is unstable.</li></ul>
			<ul> <li>i. Check that Central Tire Inflation System (CTIS) controls and indicators operate properly in all modes.</li> </ul>	<ul> <li>i. If CTIS controls or indicators do not operate properly.</li> </ul>
			<ul><li>j. Set parking brake, set transmission to drive</li><li>(D) and run engine to 1000 rpm. Truck should not move.</li></ul>	<ul><li>j. Truck moves with parking brake on with engine at 1000 rpm.</li></ul>
			k. Check engine brake operation. Refer to Operator's Manual, TM 9-2320-364-10.	<i>k.</i> If brake does not work properly, or is unoperable.
			<ol> <li>Pay attention to how truck responds to road conditions. Swaying or constant bouncing indicates suspension damage.</li> </ol>	<ol> <li>If excessive swaying or bouncing is noticed.</li> </ol>

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			AFTER ROAD TEST	
			<ul> <li>a. Ensure the vehicle has been cleaned of mud, gravel, etc., from the underbody outside and crew compartment area.</li> </ul>	a. The vehicle is excessively dirty or covered with mud.
			CAUTION	
			Do not hold steering wheel at full left or right position for longer than 10 seconds. Oil overheating and pump damage can result.	
			b. With vehicle stopped, turn steering wheel to extreme left, then to extreme right to check for hard steering.	b. Hard steering is evident.
			c. Check engine operation at all speeds. Ensure that engine does not go over engine governed speed - no load (2175-2275 rpm).	c. Engine governed speed - no load is below 2175 rpms or exceeds 2275.
	LEFT FRO	ONT SIDE		
2	Semi- Annual	DUVAC	Check wiring for fraying, splits and loose connections. Tighten loose connections. Repair if wiring is frayed or split. Refer to Para 7-101.	Wiring is frayed or split or any loose connections.
3	Semi- Annual	Electric Slave Receptacle	Check electric slave receptacle terminals (1) for damage. Replace terminals if damaged. Refer to Para 7-101. Coat terminals with electrical sealant (Item 68, Appendix C).	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
4	Semi- Annual	Battery Box	Check battery box (1) for acid spills and debris. If acid spills are visible, clean batteries (2) and battery box (1).	
			NOTE	
			<ul> <li>If equipped with arctic batteries, follow same PMCS procedures for regular batteries.</li> </ul>	
			• Refer to TM 9-6140-200-14 for more specific details on battery maintenance.	
5	Semi- Annual	Batteries	Check and record specific gravity of each cell. Check battery cables (1) for fraying, splits and looseness. Tighten loose parts. Replace battery cables if frayed or split. Refer to Paras 7-90, 7-91 or 21-4.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
6	Semi- Annual	Sheet Metal and Frame	Inspect sheet metal and frame for evidence of corrosion damage such as surface color change, surface separation, blistered paint, rust-through, or other evidence of damage.	Sheet metal is affected to the point of damage to the parts.
			DRAG LINK END	LUBE FITTING
7	Semi- Annual	Axle No. 1 and No. 2 Drag Links and Tie-Rods	<ul> <li>a. Check tie-rods (1) and drag links (2) for damage. Replace missing nuts or bolts. Replace damaged tie-rods and adjust misaligned linkages (Para 14-11).</li> <li>b. Check for excessive wear of tie-rod ends or drag link ends (Para 14-12).</li> <li>NOTE</li> <li>When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.</li> <li>Some trucks have lube for life tie-rod ends and drag link ends. These do not require</li> </ul>	a. Drag links are bro- ken, cracked, or misa- ligned.
			lubrication and do not have a lube fitting.  c. Lubricate tie-rod ends and drag links with GAA every 1,500 miles (2,414 km) or semiannually, whichever comes first.	c. Fittings will not purge old lubricant out of component.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
8	Semi- Annual	Axle No. 1 and No. 2 Drag Links and Tie-Rods	a. Check steering shafts, intermediate steering gear, pitman arm, Axle No. 2 drag link, tie-rod and steering parts for looseness, breaks and cracks. Replace steering system parts if damaged or missing. Refer to Paras 14-3 through 14-17. Tighten loose parts.	a. Drag link or inter- mediate steering gear is damaged or missing.
			<ul> <li>b. Check for excessive wear of tie-rod ends or drag link ends (Para 14-12).</li> </ul>	
9	Semi- Annual	Steering Hoses and Tubes	Follow routing of all hydraulic steering hoses and tubes (1). Inspect for loose fittings, chafing, cracks and leaks.	Loose fittings, chafing, cracks or leaks.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			<ul> <li>NOTE</li> <li>Change lubricant in new or rebuilt axles at 1,000 miles (1,609 km), but no sooner than 500 mi (805 km). If truck is operated in ambient temperatures over 100 degrees F (38 degrees C) the lubricant should be drained and refilled every 3000 mi (4,828 km). During all lubricant changes, remove metal particles from magnetic drain plugs. Fill wheel ends first.</li> <li>Initial fill and level checks for the axles will be made from the housing side plugs. Oil level should be at bottom of the hole. Planetary wheel end level is at the bottom of the center check plug. Fill slowly through the 3/4 in. (19 mm) fill holes until oil runs out the center check location. Scheduled oil level checks will be made at these same locations.</li> <li>Axles No. 3 and 4 (non-steering axles). Scheduled oil level checks will be made only at the axle housing and not the planetary wheel ends on the rigid axles. Due to internal venting the wheel ends will seek the same level as the axle housing, and as a result, no checks should be made after</li> </ul>	
10	Semi- Annual	Planetary Hub Gears (all axles)	Remove center check plug and check lubricant level every 3,000 miles (4,828 km) or semiannually, whichever comes first. Fill as necessary with GO. Refer to Table 2-3.	ск

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:		
1	LUBE FITTING  STEERING COLUMN LINKAGE (UNDER DASH)  STEERING COLUMN LINKAGE (UNDER DASH)					
	(UNDER DASH)  LUBE FITTING  LUBE FITTING					
		ERING COLUMI FRONT STEEF	0.22	, DLUMN LINKAGE TEERING GEAR)		
11	Semi- Annual	Steering Column	Lubricate the steering column, steering linkage and front steering gear with GAA (6 fittings) every 1,500 miles (2,414 km) or semiannually, whichever comes first.	Fittings will not purge old lubricant out of component.		

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
N I	O. 2 STEER		FILL CHECK	LUBE
12	Semi- Annual	Steering Shaft and 2.21:1 Steering Gearbox	<ul> <li>a. Check shaft and gearbox for missing parts, bent parts, or misalignment. Replace missing or bent parts. Adjust misaligned parts. Refer to Para 14-9.</li> <li>NOTE</li> <li>If an air-operated grease gun does not purge the fitting, use a hand-operated grease gun. If the part does not purge, remove fitting and clean, install fitting and grease again. If part still does not purge, refer to maintenance task for that component.</li> <li>When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.</li> <li>When greasing steering shaft slip joint lube fitting, apply two pumps from a manual grease gun or two clicks from a pneumatic grease gun. If rubber boot appears to be full of grease, remove tie strap from end of rubber boot. Push boot forward and wipe off excess grease from boot and steering shaft. Position rubber boot correctly on steering shaft and install new tie strap.</li> </ul>	a. Intergear link is broken, cracked or misaligned.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			NOTE  When greasing fittings on steering gears, apply two pumps from a manual grease gun or two clicks from a pneumatic grease gun. This will prevent seal from being pushed out of bore.	
		Steering Shaft and 2.21:1 Steering	b. Lubricate the steering shaft and steering gearbox fittings with GAA every 1,500 miles (2,414 km) or semiannually, whichever comes first.	<ul><li>b. Fittings will not purge old lubricant out of component.</li></ul>
		Gearbox (continued)	c. Lubricate the intergear link fittings with GAA every 1,500 miles (2,414 km) or semiannually, whichever comes first.	c. Fittings will not purge old lubricant out of component.
			NOTE  Remove check plug from 2.21:1 steering gearbox and check oil level. Add oil as required until oil appears at check plug opening. Apply sealant (Item 72, Appendix C) to check plug threads prior to installing.	
			d. Check fluid level in 2.21:1 steering gearbox every 3,000 miles (4,828 km) or semiannually, whichever comes first. Fill with GO as required. Refer to Table 2-3.	d. Any Class III leaks are found.
			e. Follow routing of all hydraulic steering hoses and tubes. Inspect for loose fittings, chafing, cracks and leaks. If loose fittings are found, tighten.	e. Chafing, cracks or Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			LUBE FITTING 1	
13	Semi- Annual	Leaf Springs (Axles No. 1, No. 2, No. 4 and No. 5)	a. Check leaf springs (1) for cracks, missing leaves, misalignment or broken parts. Check spring clips, saddles, saddle caps, spring hangers and retaining hardware for looseness, cracks or visible damage.	<ul> <li>a. Parts are broken, cracked, loose or misa- ligned.</li> </ul>
			NOTE	
			• If an air-operated grease gun does not purge the fitting, use a hand-operated grease gun. If the part does not purge, remove fitting and clean, install fitting and grease again. If part still does not purge, refer to maintenance task for that component.	
			<ul> <li>When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.</li> </ul>	
			<ul> <li>If spring hanger pin does not accept grease, relieve load on spring pin by jacking truck up by frame as close to spring pin as possible. If spring pin still fails to take grease, notify Direct Support Maintenance to remove spring pin and/or bushing and replace if necessary.</li> </ul>	
			b. Lubricate the spring hangers with GAA every 3,000 miles (4,828 km) or semiannually, whichever comes first.	<ul><li>b. Fittings will not purge old lubricant out of component.</li></ul>
14	Semi- Annual	Equalizer Beam Bushings	Check equalizer beam center and end bushings for deterioration and wear.	Deterioration or wear is present.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
				2
15	Semi- Annual	Frame	Check for broken frame side rails (1), crossmembers (2) or broken welds on undercarriage.	Side rails or cross- members are damaged or welds are broken.
				EFT SIDE CAB MOUNT
16	Semi- Annual	Cab Mounts	Check rubber cab mount (1) on cab support (2).	Rubber cab mounts are missing or badly deteri- orated.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		3-		(4)
17	Semi- Annual	Rubber Bushings and Stops (All)	<ul><li>a. Check rubber bushings (1) on torque rods</li><li>(2) and shock absorbers (3). Check torque rods for looseness.</li></ul>	<ul> <li>a. Bushings are missing or badly deteriorated or torque rod is loose.</li> </ul>
			<ul><li>b. Check for distorted or frayed rubber stops</li><li>(4).</li></ul>	<ul><li>b. Rubber stops are distorted or frayed.</li></ul>
		AXLE 1 LOCAT	AXLE 3 LOCATION  1,2,4 AND 5	
18	Semi- Annual	Axle/Sus- pension	a. Check wheel bearings for looseness: (1) Raise vehicle from ground with suitable lifting device far enough to position crow bar between tire and ground.	a. Wheel bearings are frozen, binding, or loose.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		Axle/Suspension (continued)	AXLE 3 LOCATION  NOTE  Wheel should not be loose on hub.  (2) Brace crow bar on ground and push against tire.  (3) If there is any wheel bearing play, notify your supervisor.	Wheel bearing play is present. Any parts are missing.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
				WEAR TAB
19	Semi- Annual	Brakes (all axles)	• Brake drum can get very hot during vehicle operation. Place hand near drum to check for excessive heat, but do not touch. Failure to comply may result in injury to personnel.  • Apply truck brakes and chock wheels before any maintenance tasks are performed. Otherwise serious injury to personnel could result.  a. Carefully check and compare each brake drum for overheating which can indicate a dragging brake. Cool brake drum could mean improper adjustment, defective, or inoperative brakes.  NOTE  Brake assembly must be cleaned of dirt, mud and debris before starting inspection.  b. Check brake shoe linings for grooves, uneven wear, signs of overheating and thickness. If step on center edge wear tab (1) of brake shoe lining is not visible or 1/4 in. (6 mm) thick or less on any part of brake shoe, or there are signs of overheating, replace brake shoes. Refer to Para 12-2.	<ul> <li>a. Brake drums are overheated or excessively cool.</li> <li>b. Brake shoes show signs of wear, overheating or distortion.</li> </ul>
			<ul> <li>Check brake supply lines and brake vent lines for cracks, bends, breaks or looseness.</li> <li>Tighten loose parts if leaking. Replace lines or hoses if damaged. Refer to Para 12-36.</li> </ul>	c. Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
20	Semi- Annual	Differential (Axles No. 1,	NOTE  All axles are drained/filled the same way. After draining, fill through the axle bowl to a level even with the check and fill hole. Allow the oil level to stabilize and recheck. Add lubricant as needed.  Check fluid level in Axles No. 1 and No. 5 differentials every 3,000 miles (4,828 km) or	Any Class III leaks are found.
	Ainuai	and No. 5)	semiannually, whichever comes first. Fill with GO as required. Refer to Table 2-3.	
21	Semi- Annual	Torque Rods (All)	Check torque rods (1) for looseness and bent or broken parts. Tighten loose parts.	Torque rods are damaged.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			LUBE	
22	Semi- Annual	Rear Steering Shaft	a. Check steering shaft (1) for damaged or bent parts. Replace shaft if bent. Adjust misaligned shaft. Refer to Para 14-10.  NOTE	<ul><li>a. Shaft is damaged, bent, or misaligned.</li></ul>
			<ul> <li>If an air-operated grease gun does not purge the fitting, use a hand-operated grease gun.</li> <li>If the part does not purge, remove fitting and clean, install fitting and grease again. If part still does not purge, refer to maintenance task for that component.</li> </ul>	
			<ul> <li>When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.</li> </ul>	
			• When greasing steering shaft slip joint lube fitting, apply two pumps from a manual grease gun or two clicks from a pneumatic grease gun. If rubber boot appears to be full of grease, remove tie strap from end of rubber boot. Push boot forward and wipe off excess grease from boot and steering shaft. Position rubber boot correctly on steering shaft and install new tie strap.	
			b. Lubricate the steering shaft and U-joints with GAA every 1,500 miles (2,414 km) or semiannually, whichever comes first.	b. Fittings will not purge old lubricant out of component.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
23	Semi- Annual	Axles No.1 and No. 2 Shaft Seals and Yoke Nuts	Check shaft seals for cuts, nicks, gouges and leaks. Check input and output yoke nuts for proper staking. Both staked points on nuts should be in slots of pinion shafts.	Leaks or damage are found. Yoke nuts are loose, missing or not staked.
24	Semi- Annual	Axles No. 1 and No. 2 Constant Velocity Joints	Check constant velocity joints for wear, play and damage.  CHECK AND FILL PLUG	Joints are worn, damaged or have play.
			NOTE	
			<ul> <li>Some oil will transfer from the wheel end to the axle housing and a slight overfill condition at the axle housing may be noticed during checking of the axles. This is considered normal and should not be a reason for concern.</li> </ul>	
			<ul> <li>All axles are drained/filled the same way.         After draining, fill through the axle bowl to a level even with the check and fill hole.         Allow the oil level to stabilize and recheck.         Add lubricant as needed.     </li> </ul>	
25	Semi- Annual	Differential and Output Shaft (Axle No. 3)	Check fluid level in the axle No. 3 differential every 3,000 miles (4,828 km) or semiannually, whichever comes first. Fill with GO as required. Refer to Table 2-3.	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

	Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).				
Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:	
LUI	BE FITTING				
26	Semi- Annual	Rear Steering Gear	<ul> <li>a. Check rear steering gear (1) for any gouges, damage or leaks. Replace nuts or bolts if missing. Check adjustment holes for dirt and rust. If dirty, clean holes and fill with grease.         NOTE     </li> <li>When greasing fittings on steering gears, apply two pumps from a manual grease gun or two clicks from a pneumatic grease gun. This will prevent seal from being pushed out of bore.</li> <li>b. Lubricate the rear steering gear with GAA every 1,500 miles (2414 km) or semiannually, whichever comes first.</li> </ul>	<ul> <li>a. Any Class III leaks are found.</li> <li>b. Fittings will not purge old lubricant out of component.</li> </ul>	
		LUBE FITTING TIE-ROD END		LUBE FITTING PRAG LINK END	
27	Semi- Annual	Axle No. 5 Drag Link and Tie-Rods	<ul> <li>a. Check drag link (1) and tie-rods (2) for damage. Replace nuts or bolts if missing.</li> <li>Replace damaged tie-rods and adjust misaligned linkages.</li> </ul>	a. Drag link is broken, cracked or misaligned.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		LUBE FITTING TIE-ROD END		LUBE FITTING LINK
		Axle No. 5 Drag Link and Tie-Rods (continued)	b. Check for excessive wear of tie-rod ends or drag link ends (Para 14-12).	
			NOTE	
			When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.	
			<ul> <li>Some trucks have lube for life tie-rod ends and drag link ends. These do not require lubrication and do not have a lube fitting.</li> </ul>	
			<ul> <li>c. Lubricate drag links (1) and tie-rod ends</li> <li>(2) with GAA every 1,500 miles (2,414 km) or semiannually, whichever comes first.</li> </ul>	<ul><li>c. Fittings will not purge old lubricant out of component.</li></ul>
27.1	Semi- Annual	Steering Stop Bolt (Axles No. 1, No. 2 and No. 5)	Check for damaged or missing steering stop bolts (3). Check adjustment of steering stop bolts (Para 11-10).	Steering stop bolts are missing or damaged or will not adjust correctly.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
28	Semi- Annual	Double Cardon Joints (Axles No. 1, No. 2 and No. 5)  Driveshaft and Universal Joints (all axles)	NOTE  • If an air-operated grease gun does not purge the fitting, use a hand-operated grease gun. If the part does not purge, remove fitting and clean, install fitting and grease again. If part still does not purge, refer to maintenance task for that component.  • When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.  Lubricate the double cardon joints with GAA every 1,500 miles (2,414 km) or semiannually, whichever comes first.  WARNING  Do not start engine or move truck when anyone is working on or under vehicle. Severe injury or death to personnel could result.  NOTE  If an air-operated grease gun does not purge the fitting, use a hand-operated grease gun. If the part does not purge, remove fitting and clean, install fitting and grease again. If part still does not purge, refer to maintenance task for that component.	Fittings will not purge old lubricant out of component.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		Driveshaft and Univer- sal Joints (all axles) (continued)	<ul> <li>NOTE</li> <li>When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.</li> <li>Universal joint may have one or two grease fittings. If there are two fittings, grease either fitting. It is not necessary to grease both fittings.</li> </ul>	
			• Use the proper lubricant to purge all seals on each universal joint. Purging flushes abrasive contaminates from each bearing and ensures all bearings are filled properly. Pop the seals; these seals are made to be popped. If any seal fails to purge, move driveshaft from side-to-side while applying grease gun pressure. This allows greater clearance on thrust end of bearing that is not purging. If seals still do not purge, rock truck by starting engine, releasing parking brakes, putting transmission in Drive (D) or Reverse (R), and allowing truck to roll. This removes the wind up in the drive line and allows for a greater clearance on the thrust end of the universal joint.	
			<ul> <li>Because of the design of the universal joint seal, there will occasionally be one or more bearing seals that may not purge. Seal tension then has to be released. The procedure for releasing seal tension is as follows:</li> </ul>	
			(1) Loosen bolts holding bearing assembly that does not purge to release seal tension. It may be necessary to loosen bearing assembly approximately 1/16 in. (1.6 mm) minimum.	
			(2) If loosening does not result in purging, remove bearing assembly to determine cause of blockage.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			NOTE  • When lubricating spline end of driveshafts, apply grease to spline fitting until lubricant appears at pressure relief hole. Cover hole with finger and continue adding grease until it appears at sleeve yoke seal.	
		Driveshaft and Univer- sal Joints (all axles) (continued)	a. Lubricate the U-joints and driveshafts with GAA every 3,000 miles (4,828 km) or semiannually, whichever comes first.  LUBE SLEEVE YOKE	<ul> <li>a. Fittings will not purge old lubricant out of component.</li> </ul>
		-	FITTING SEAL LUBE FITTING	
			b. Check transfer case and axle driveshafts for bends, dents and cracks. Replace driveshafts if bent, broken or missing. Refer to Para 10-2.	
			c. Check U-joints for wear and play and broken or missing lubrication fittings. There should be no play at U-joints. Replace U-joints if damaged, show visible wear, or have play. Replace lubrication fittings if damaged. Refer to Para 10-2.	
30	Semi- Annual	No. 3, No. 4 and No. 5 Shaft Seals and Yoke Nuts	Check input and output shaft seals for cuts, nicks, gouges and leaks. Check input and output yoke nuts for proper staking. Both staked points or nuts should be in slots of pinion shafts.	Seals are damaged, leaking or missing.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		, F	CHECK AND FILL PLUG	
31	Semi- Annual	Differential and Output	NOTE  • Axle No. 4. Some oil will transfer from the wheel end to the axle housing and a slight overfill condition at the axle housing may be noticed during checking of the axles. This is considered normal and should not be a reason for concern.  • All axles are drained/filled the same way. After draining, fill through the axle bowl to a level even with the check and fill hole. Allow the oil level to stabilize and recheck. Add lubricant as needed.  • Lubricant will not purge from axle output shaft seal. When using a hand-operated grease gun, apply only two pumps of lubricant to the fitting. When using an air-operated grease gun, apply only a small amount of lubricant to the fitting.  a. Check fluid level in the axle No. 2 and No. 4 differentials every 3,000 miles (4,828 km) or	a. Any Class III leaks are found.
	7 Minual	Shaft (Axles No. 2 and No. 4)	semiannually, whichever comes first. Fill with GO as required. Refer to Table 2-3.  b. Lubricate the No. 2 and No. 4 axle output shafts with GAA every 3,000 miles (4,828 km) or semiannually, whichever comes first.	b. Fittings will not purge old lubricant out of component.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
32	Semi- Annual	Suspension System	Check suspension system for missing parts and broken bolts.	Suspension system has broken or missing parts or bolts.
33	Semi- Annual	Equalizer Beam Bushings	Check equalizer beam center and end bushings for deterioration and wear.	Deterioration or wear is present.
		LUBE FITTING	as The state of th	
			NOTE  • If an air-operated grease gun does not purge the fitting, use a hand-operated grease gun. If the part does not purge, remove fitting and clean, install fitting and grease again. If part still does not purge, refer to maintenance task for that component.	
			<ul> <li>When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.</li> </ul>	
34	Semi- Annual	Trunnions (Axles No. 1, No. 2 and No. 5)	Lubricate trunnion fittings with GAA every 1,500 miles (2,414 km) or semiannually, whichever comes first.	Fittings will not purge old lubricant out of component.
35	Semi- Annual	Wheels	Check wheels for bends, cracks or damage. Replace wheels if bent or damaged. Refer to Para 13-2.	Wheels are bent or damaged.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
36	Semi- Annual	Tires	Check tires for nicks, gouges and wear on tread and sidewall. If nicks and gouges are severe or tire tread shows signs of excessive wear, replace tire. Refer to Para 13-2.	Nicks and gouges are severe or tire tread shows signs of excessive wear.
			4	2
37	Semi- Annual	Rubber Bushings and Stops (typical)	<ul><li>a. Check rubber bushings (1) on torque rods</li><li>(2) and shock absorbers (3).</li></ul>	<ul> <li>a. Bushings are missing or badly deteriorated.</li> </ul>
		V-	b. Check rubber stops (4) for distortion or fraying.	b. Rubber stops are distorted, frayed or missing.
			2. 1	
			<b>8 9</b>	<b>8</b>
38	Semi- Annual	Frame	Check for broken frame side rails (1), crossmembers (2) or broken welds on undercarriage.	Damaged side rails, crossmembers or broken welds are found.
39	Semi- Annual	Mounting Brackets	Check for cracks, breaks, rust or looseness.	Mounting brackets are damaged or missing.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			BREATHER/FILL  CHECK PLUG  DRAIN PLUGS	
40	Semi-Annual	Transfer Case Oil Seals	<ul> <li>a. Check transfer case oil seals for cuts, nicks, gouges and leaks.</li> <li>b. Check transfer case for leaks, cracks, dents, damage and loose bolts.</li> <li>WARNING</li> <li>Drycleaning Solvent (P-D-680) is TOXIC and flammable. Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Drycleaning Solvent is 140 degrees F (60 degrees C) and Type III Drycleaning Solvent is 200 degrees F (93 degrees C). Failure to do so may result in injury or death to personnel.</li> <li>If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.</li> </ul>	<ul><li>a. Damage or leaks are found.</li><li>b. Damage or leaks are found.</li></ul>

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			BREATHER CHECK PLUG	/FILL
41	Semi-	Transfer Case Oil Seals (Continued)  Axle No. 5	C. Check transfer case breather for dirt. If dirty, remove breather and wash in dry cleaning solvent. Allow to air dry. Install breather. Refer to Para 9-8.  d. Check fluid level in transfer case every 1,500 miles (2,414 km) or semiannually, whichever comes first. Fill with OE/HDO as required. Refer to Table 2-3.  Check constant velocity joints for wear, play or	<ul><li>c. Breather is damaged or missing.</li><li>d. Any Class III leaks are found.</li></ul>
	Annual	Constant Velocity Joints	damage.	worn, damaged or have play.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

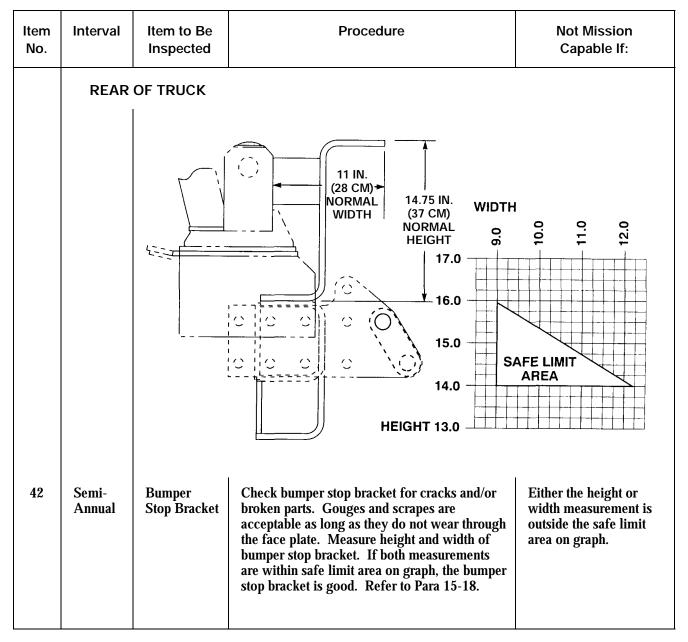


Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		<b>→</b>	WASHER  GAP  3/16 IN. (4.76 MM)  ADIAL WEAR LIMIT (TOTAL)  RADIAL	CIRCUMFERENCE
43	Semi- Annual	W Self-Guided Coupler	Check self-guided coupler (1) for cracks, damage, or excessive wear. Replace coupler if cracked or damaged. If radial wear exceeds 3/16 in. (4.76 mm) total, replace coupler before next mission. If axial clearance exceeds 1/32 in. (.79 mm), measure thickness of washer (2). If washer (2) thickness is under 3/16 in. (4.76 mm), replace washer. If washer thickness is larger than 3/16 in. (4.76 mm), adjust nut (3). Refer to Para 15-20.  If circumference at worn area of coupler jaw (4) is less than 8-1/2 in. (215.9 mm), replace coupler at next scheduled service. If circumference is less than 8-1/4 in. (209.6 mm), replace coupler before next mission. Refer to Para 15-20.	Radial wear exceeds 3/16 in. (4.76 mm).  Washer thickness is less than 3/16 in. (4.76 mm).  Circumference at worn area is less than 8-1/4 in. (209.6 mm).

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
44	Semi- Annual	Air Reservoirs No. 3 and No. 5	Check air reservoirs (1) attaching valves (2), lines and connections for mounting looseness, leaks, bends, dents and cracks. Replace air reservoir or attaching parts if leaking, or have bends, dents or cracks that could leak. Tighten loose parts. Refer to Paras 12-29, 12-31 and 12-36.	
45	Semi- Annual	Air Reservoirs No. 2 and No. 4	Check air reservoirs (1) attaching valves, lines and connections for mounting looseness, leaks, bends, dents and cracks. Replace air reservoir or attaching parts if leaking, or have bends, dents, or cracks that could leak. Tighten loose parts. Refer to Paras 12-28, 12-30 and 12-36.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			2	1/4 IN. MAX. (6.35 mm)
46	Semi- Annual	Lifting Frame (LF)	<ul> <li>a. If truck is equipped with Container Handling Unit (CHU), check lifting frame (1) for cracks or broken welds.</li> <li>b. Check lifting frame bail bar (2) for excessive wear. Wear is excessive if it exceeds limits shown.</li> </ul>	<ul><li>a. Cracks or broken welds are found.</li><li>b. Excessive wear on bail bar.</li></ul>
47	Semi- Annual	Rear Container Locks	<ul> <li>a. If truck is equipped with Container Handling Unit (CHU), check rear container locks (1) for cracks or broken welds.</li> <li>b. Check for cracked, bent or missing hooks (2).</li> </ul>	<ul><li>a. Cracks or broken welds are found.</li><li>b. Cracked, broken or missing hooks.</li></ul>

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		3		
48	Semi- Annual	Hooks	If truck is equipped with Container Handling Unit (CHU), check standard hooks (1), six foot hooks (2), half height hooks (3) and hooks (4) for cracks or bends.	Cracked or bent hooks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
49	Semi-	Bail Bar	If truck is equipped with Container Handling	Cracks or broken welds
	Annual	Lock	Unit (CHU), check bail bar lock (1) for cracks or broken welds.	are found.
50	Semi- Annual	Slide Arm Weldments	If truck is equipped with Container Handling Unit (CHU), check slide arm weldments (1) for cracks or broken welds.	Cracks or broken welds are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
51	Semi- Annual	Upper and Lower Support Leg	If truck is equipped with Container Handling Unit (CHU), check upper support leg (1) and lower support leg (2) for cracks or broken welds.	Cracks or broken welds are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
51.1	Semi- Annual		NOTE  Air system of truck must be charged prior to performing the following steps.  Lifting frame must be in stowed position prior to performing the following steps.  a. If truck is equipped with Container Handling Unit (CHU), pull flipper lock pin handle (1) out and lift air valve lever (2) up to rotate flipper bracket (3) and flipper bracket lock plate (4) onto pivot pin (5).  b. Ensure flipper bracket (3) and flipper bracket lock plate (4) align with and position over pivot pin (5). If flipper bracket lock plate (4) does not align with and position over pivot pin (5), adjust cone weldments (Para 18-13).  c. Pull flipper lock pin handle (1) out and push air valve lever (2) down to rotate flipper bracket (3) and flipper bracket lock plate (4) off of pivot pin (5).  d. Repeat steps (a) through (c) for other side of truck.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
52	Semi- Annual	Rear Sliders	If truck is equipped with Container Handling Unit (CHU), check rear sliders (1) for cracks or broken welds.	Cracks or broken welds are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
53	Semi- Annual	Container Guides	If truck is equipped with Container Handling Unit (CHU), check container guides (1) for cracks or broken welds.	Cracks or broken welds are found.
54	Semi- Annual	Long and Short Struts	If truck is equipped with Container Handling Unit (CHU), check long strut (1) and short strut (2) for cracks or broken welds.	Cracks or broken welds are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
55	Semi- Annual	Rail Supports	If truck is equipped with Container Handling Unit (CHU), check rail supports (1) for cracks or broken welds.	Cracks or broken welds are found.
56	Semi- Annual	Bumper Support	If truck is equipped with Container Handling Unit (CHU), check bumper support (1) for cracks or broken welds.	Cracks or broken welds are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

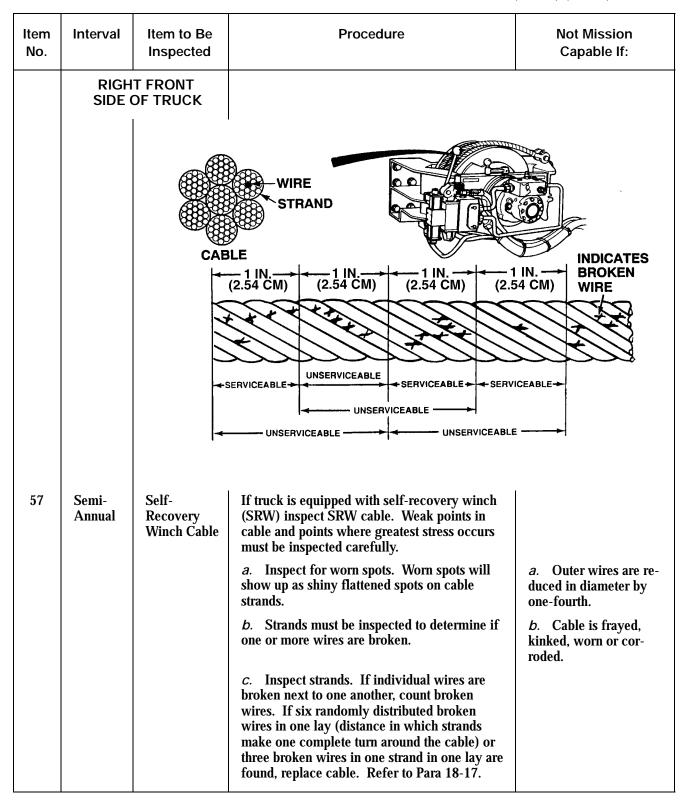


Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			PLUG IN FILL POSITION  PLUG IN FILL POSITION  PLUG IN DRAIN POSITION	
58	Semi- Annual	Self- Recovery Winch	Self-recovery winch (SRW) has two plugs. To check and fill SRW, one plug must be in upper position and second plug must be at side position. To drain SRW, one plug must be in side position and one plug must be at bottom position.  a. Check fluid level in SRW gearbox every 6,000 miles (9,656 km) or semiannually, whichever comes first. Fill with GO as required. Refer to Table 2-3.  b. Check torque of SRW mounting screws (1). Tighten SRW mounting screws to 210 lb-ft (285 N·m). Replace mounting screws if broken or missing. Refer to Para 18-12.	<ul><li>a. Any Class III leaks are found.</li><li>b. Mounting screws are loose, broken or missing.</li></ul>

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			CHECK INDICATOR	
			MAIN HYDRAULIC RETURN LINE FILTER	
59	Semi- Annual	Main Hydraulic Reservoir	<ul> <li>NOTE</li> <li>OE/HDO-30 must be used when temperatures are consistently above 60 degrees F (16 degrees C).</li> <li>When oil is cold, do not add or fill beyond the word "FULL" on the fluid level indicator.</li> <li>a. Check hydraulic reservoir for cracks, leaks or obvious damage. Refer to Para 20-11 and 20-12.</li> <li>b. Check hydraulic fluid level and fill with OE/HDO as required. Refer to Table 2-3.</li> <li>c. Take sampling of hydraulic fluid for AOAP analysis.</li> <li>d. Replace main hydraulic return line filter every 400 hours of operation or semiannually, whichever comes first. Refer to Para 20-9.</li> </ul>	<ul> <li>a. Any Class III leaks are found.</li> <li>c. Faulty oil results received from AOAP lab "Do not operate".</li> </ul>

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
60	Semi- Annual	Exhaust System	Check muffler (1) for looseness or leaks. Check for damaged pipes and loose clamps. Tighten loose parts. Replace exhaust system parts if damaged or missing. Refer to Paras 5-2 and 5-3.	
61	Semi- Annual	Exhaust System	Check all exhaust mounting clamps (2) for looseness. Tighten loose parts. Refer to Paras 5-2 and 5-3.	
62	Semi- Annual	Exhaust System	Check rain cap (3) to ensure it operates freely and that it closes off the tail pipe when the engine is not running. Replace rain cap if missing or damaged. Refer to Paras 5-2 and 5-3.	
	FROM	T OF CAB		
63	Semi- Annual	Skid Plate and Cab Metal	Inspect skid plate (1) and cab metal (2) for evidence of corrosion damage such as surface color change, surface separation, blistered paint, rust-through or other evidence of damage.	Skid plate or cab metal is affected to the point of damage to parts.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
64	Semi- Annual	Cab Mounts	Check rubber cab mount (1) on cab support (2).	Rubber cab mounts are missing or badly deteriorated.
		(1) (2)		
65	Semi- Annual	Cab Mounts	Check two rubber cab mounts (1) on front cab support (2).	Rubber cab mounts are missing or badly deteriorated.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
66	Semi- Annual	Air Reservoir No. 1	Check air reservoir (1), attaching valves, lines and connections for mounting looseness, leaks, bends, dents and cracks. Tighten loose parts. Replace reservoir or attaching parts if leaking, or have bends, dents or cracks that could leak. Refer to Paras 12-27 and 12-36.	Broken, missing or loose parts are found.
		1		
67	Semi- Annual	Torque Rods (All)	Check torque rods (1) for looseness and bent or broken parts.	Torque rods are bent or damaged.
68	Semi- Annual	Front Steering Gear	Check front steering gear (2) adjustment holes for dirt and rust. If dirty, clean holes and fill with grease. Check front steering gear (2), pitman arm, steering column U-joint, hydraulic pump driveshaft, Axle No. 1 drag link, intergear link and steering parts for looseness, breaks and cracks.	Parts are broken, cracked or missing.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
69	Semi- Annual	Hydraulic Pump	Inspect hydraulic pump (1) for leaks or loose parts.	Any Class III leaks, loose parts, or damage are found.
70	Semi- Annual	Hydraulic Hoses and Tubes	Follow routing of all hydraulic hoses and tubes (1). Inspect for loose fittings, chafing, cracks and leaks.	Loose fittings, cracks, leaks or chafing are found.
71	Semi- Annual	CTIS Manifolds (Front and Rear)	Check manifold and fittings for looseness and leaks. Replace manifold or fittings if damaged. Tighten loose parts if leaking. Replace hoses if damaged or missing. Refer to Paras 13-6 and 13-8 through 13-10.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			AIR FILTER ELEMENT	
			NOTE  When air restriction indicator (located on dash panel) reads 20 in., replace air filter element.	
72	Semi- Annual	Air Filter	Replace air filter as required. Refer to Para 4-5.  COALESCING FILTER  AIR DRYER GUARD SHOWN REMOVED FOR CLARITY (III	
73	Semi- Annual	Coalescing Filter	Replace coalescing filter every 1,000 hours of operation or semiannually, whichever comes first. Refer to Para 12-24.	Leon ( Lb)

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			CHECK AND FILL POWER STEERING FILTER  TURN TO REMOVE	RAIN
74	Semi- Annual	Power Steering Filter and Reservoir	<ul> <li>a. Change power steering filter every 400 hours of operation or semiannually, whichever comes first. Refer to Para 14-16.</li> <li>b. Check and fill power steering reservoir as required with OE/HDO. Remove rear noise panel. Check power steering reservoir (1) for cracks, leaks or obvious damage. Refer to Table 2-3.</li> </ul>	b. Any Class III leaks are found or reservoir is damaged.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		CHECK COOLANT CONDITION AND FILL CHECK LEVEL		
75	Semi- Annual	Cooling System	<ul> <li>a. Check coolant level and fill as necessary. Refer to Table 2-4.</li> <li>b. Check condition of coolant. Add or change coolant as necessary. Refer to Table 2-4.</li> <li>c. Check cooling system hoses and piping for looseness, splits, wear, cracks and leaks. Check hose clamps for wear or looseness. Tighten loose parts. Replace damaged parts (Para 6-8).</li> </ul>	c. Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			DOOR SHOWN REMOVED FOR CLARITY  2 1  LUBE FITTING	
76	Semi- Annual	Hydraulic Pump Driveshaft	<ul><li>a. Inspect universal joints (1) for looseness.</li><li>b. Inspect slip yoke (2) for looseness.</li></ul>	<ul><li>a. Movement of universal joints.</li><li>b. Movement of slip yoke.</li></ul>
			NOTE	ship yoke.
			• If an air-operated grease gun does not purge the fitting, use a hand-operated grease gun. If the part does not purge, remove fitting and clean, install fitting and grease again. If part still does not purge, refer to maintenance task for that component.	
			<ul> <li>When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.</li> </ul>	
			c. Lubricate the hydraulic pump driveshaft with GAA every 3,000 miles (4,828 km) or semiannually, whichever comes first.	c. Fittings will not purge old lubricant of component.
77	Semi- Annual	Transmission	Check transmission for cracks, leaks or obvious damage.	Obvious cracks, damage or leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			AIR WRENCH LUBRICATION POINT	
78	Semi- Annual	Air Wrench	NOTE  Pour 1/2 oz. (15 ml) of oil in the short hose installed on the air wrench. Connect air hose to air supply and operate air wrench for 10 to 15 seconds.  Use oil can to lubricate air wrench with OE/HDO.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			ENGINE OIL SAMPLING VALVE  TRANSMISSION SAMPLING VALVE	
			<ul> <li>Refer to DA Pam 738-750 for sampling requirements.</li> <li>After expiration of warranty, active Army units will send an oil sample to an AOAP laboratory for analysis every 90 days. Reserve and National Guard activities will send an oil sample to an AOAP Laboratory for analysis every 180 days.</li> <li>Intervals for sampling as well as draining and refilling lubricants may be changed by an AOAP laboratory.</li> <li>If AOAP laboratory support is not available, drain and refill crankcase oil every 3,000 mi (4,828 km) or semiannually, whichever comes first. Drain and refill transmission oil every 6,000 mi (9,656 km) or annually,</li> </ul>	
79	Semi- Annual	Engine and Transmission Oil Samples	whichever comes first.  a. Take engine oil sample for AOAP analysis.  b. Take transmission oil sample for AOAP analysis.	<ul><li>a. Faulty oil results received from AOAP lab "Do not operate".</li><li>b. Faulty oil results received from AOAP lab "Do not operate".</li></ul>

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			DRAIN PLUG	
80	Semi- Annual	Engine Oil	<ul> <li>NOTE</li> <li>Check oil level with truck parked on level ground and the engine off and cool. Do not overfill crankcase. Drain crankcase when hot.</li> <li>OE/HDO 40 must be used in temperatures consistently above 100 degrees F (38 degrees C).</li> <li>Drain engine oil from crankcase every 3,000 miles (4,828 km) or semiannually, whichever comes first. Refill with OE/HDO as required. Refer to Para 3-2.</li> </ul>	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			TURN TO REMOVE	TURN TO REMOVE
			STANDARD OIL FILTER	REMOTE OIL FILTER
81	Semi- Annual	Engine Oil Filter	NOTE  After installing new filter, fill crankcase, operate engine five minutes and check filter for leaks. Shut down engine, check crankcase level and bring to FULL mark.  Replace engine oil filter every 3,000 miles (4,828 km) or semiannually, whichever comes first.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
82	Semi- Annual	Fan Motor	Check fan motor for leaks or damage.	Any Class III leaks or damage are found.
83	Semi- Annual	Fan Blades	Check fan blades for damage or cracks. Replace fan blades if cracked or damaged. Refer to Para 6-3.	
84	Semi- Annual	Fluid Tubes	Check all fluid tubes for cracks, fraying, wear and leaks.	Tubes are cracked, frayed, show wear or leak.
85	Semi- Annual	Air Intake	Check air intake hoses and tubing (1) for proper installation, cracks, breaks or loose connections that could let unfiltered air into air intake system. Replace air cleaner, hoses or tubing if cracked or broken. Tighten loose parts. Refer to Para 4-4.	
86	Semi- Annual	Engine Compartment	Check rocker housing covers for evidence of leaks. If leak exists, replace rocker cover gasket. Refer to Para 3-4 and Para 3-5.	
87	Semi- Annual	Engine Compartment	Check alternator wiring for fraying, splits, missing insulation and loose terminal connections. Repair wiring if damaged. Tighten loose parts. Refer to Para 7-101.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
88	Semi- Annual	Engine Compartment	Check engine compartment wiring for fraying, splits, missing insulation or poor connections. Repair if wiring is frayed or split. Refer to Para 7-101.	
89	Semi- Annual	Engine Compartment	Remove cab engine access panel and check alternator mounting and attaching hardware for looseness and cracks or damage. Replace alternator mounting or attaching hardware if damaged or missing. Tighten loose parts. Refer to Para 7-2 or Para 7-3.	
90	Semi- Annual	Engine Compartment	Check alternator belts for cracks and frays. Check for correct belt tension. Replace belts if damaged or missing. Tighten belts to correct tension 55 to 65 lbs (245 to 289 N) for 145 amp and 60 to 65 lbs (260 to 289 N) for 200 amp. Refer to Para 7-4 or Para 7-5.	
91	Semi- Annual	Fuel System	Check fuel tubes and fittings for leaks. If tubes or fittings are leaking, tighten loose parts. Refer to Para 4-12.	Any Class III leaks are found.
92	Semi- Annual	Oil Tubes and Hoses	Check oil tubes and hoses for cracks, fraying, wear or leaks.	Tubes or hoses are damaged.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		W TI AI TI B	IRE DAVIT VINCH CABLE  RE DAVIT REEL ND REEL SHAFT  IRE DAVIT GEARS  IRE DAVIT CRANK USHING AND ATCHET SHAFT	
93	Semi- Annual	Spare Tire Davit Reel	<ul> <li>a. Clean and use oil can to lubricate tire davit winch cable with OE/HDO.</li> <li>b. Use oil can to lubricate tire davit reel and reel shaft with OE/HDO.</li> <li>c. Clean and lubricate tire davit gears and ratchet with GAA.</li> <li>d. Use oil can to lubricate the tire davit crank bushing and ratchet shaft with OE/HDO.</li> </ul>	
			TIRE DAVIT PULLEYS  TIRE DAVIT PIVOT POINT  TIRE DAVIT PULLEY	
94	Semi- Annual	Spare Tire Davit	<ul><li>a. Use oil can to lubricate tire davit pulleys with OE/HDO.</li><li>b. Clean and lubricate tire davit pivot point with GAA.</li></ul>	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
95	Semi- Annual	E (/4//)	WIRE  STRAND  3 IN.  (7.62 CM)  (	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
96	Semi- Annual	Material Handling Crane	<ul> <li>a. Raise crane boom (1) and extend stages</li> <li>(2) (TM 9-2320-364-10). Check cylinder piston rods (3) for bends and scoring.</li> <li>b. Check crane boom (1) for deformation, cracks or broken welds.</li> </ul>	<ul><li>a. Piston rods are scored or bent.</li><li>b. Crane boom is deformed, cracked or has broken welds.</li></ul>
97	Semi- Annual	Boom Chain/Cable Adjustment	Inspect boom chain/cable adjustment. Retract boom and manually push in end of boom completely back to stops. Pull out on adjusting nut (1) and check for clearance between washer (2) and stop plate (3).	Clearance is more than 1/32 in. (0.79 mm).

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		JBE FITTINGS	LUBE FITTING	LUBRICATE
		- BOOM SHE	BOOM SH	HEAVES
00	Som:	Poom	<ul> <li>NOTE</li> <li>If an air-operated grease gun does not purge the fitting, use a hand-operated grease gun. If the part does not purge, remove fitting and clean, install fitting and grease again. If part still does not purge, refer to maintenance task for that component.</li> <li>When using a grease gun, apply lubricant to the fitting until clean lubricant squeezes out of the part being lubricated.</li> </ul>	Fittings will not assure
98	Semi- Annual	Boom Sheaves	Remove front and rear covers on boom and lubricate boom sheaves with GAA semiannually.	Fittings will not purge.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
99	Semi- Annual	Material Handling Crane	While operating Material Handling Crane (MHC), check that engine maintains $1250 \pm 50$ rpm during hoisting operation. If engine surges erratically refer to troubleshooting, Section IV.	
100	Semi- Annual	Material Handling Crane	Check torque of inner turntable bearing screws. Tighten screws to 370 lb-ft (502 N⋅m).	Screws are missing.
101	Semi- Annual	Material Handling Crane	Check hydraulic tubes and hoses for splits, cracks, leaks or signs of wear.	Crane tubes or hoses are damaged.
102	Semi- Annual	Boom Wear Pads	<ul><li>a. Inspect boom wear pads on crane boom</li><li>(1) for wear. Replace worn pads. Refer to</li><li>Para 18-3.</li></ul>	a. Boom wear pads are worn.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
LUBF	CRANE	APPLY GREASE		
			BOOM (REAR VIEW,	BOOM RETRACTED)
		APPLY GREASE AR PADS		
		Boom Wear Pads (continued)	b. Lubricate boom wearpads with GAA, perform the following procedures:	
			(1) Refer to TM 9-2320-364-10 and shut off truck.	
			<ul><li>(2) Remove cover at rear of boom.</li><li>(3) Inject grease in front of each rear (upper)</li></ul>	
			wear pad.	
			wear pad.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		Boom Wear Pads (continued)	Do not allow personnel to perform maintenance directly under the boom or mast. Failure to follow proper procedures could cause serious injury or death.  (4) Refer to TM 9-2320-364-10 and erect crane and extend boom.  (5) Apply grease to front (lower) wear pads.  (6) Extend and retract boom. If boom chatters or does not smoothly extend/retract, refer to TM 9-2320-364-10, return crane to stowed position and shut	
			off truck. Repeat Steps (3) through (5).  (7) With boom extended, visually inspect that the boom sections undersides are evenly greased along the boom wear pad riding surfaces. If bare spots are present, refer to TM 9-2320-364-10, return crane to stowed position and shut off truck. Repeat Steps (3) through (6).	
			<ul><li>(8) Refer to TM 9-2320-364-10 and return crane to stowed position.</li><li>(9) Refer to TM 9-2320-364-10 and shut off truck.</li></ul>	
			(10) Install cover plate at rear of boom.	
103	Semi- Annual	Cab Compartment	Lubricate doors, side panels, engine cover hinges, locks and pivot points every 1,500 mi (2,414 km) or semiannually. Lubricate more often if usage is high. Lubricate door rotary locks and latches with lubricant cleaner. Refer to Table 2-3.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
	INS	IDE CAB		
104	Semi- Annual	Cab Compartment	Check hose clamps and GPFU mounts for looseness or damage. Replace clamps or mounts if damaged or missing. Tighten loose parts. Refer to Para 24-2.	
105	Semi- Annual	Cab Compartment	Check operator and crew seats and seat belts for loose mountings and damage. Replace operator or crew seat or seat belt mountings if damaged or missing. Tighten loose parts. Refer to Paras 17-40, 17-42 or 17-44.	Replace seat/seat mounts if damaged.  Replace seat belts if any seat belt system shows cuts, fraying, extreme wear, abrasions to seat belt webbing or damage to the buckle, latch plate retractor hardware.
106	Semi- Annual	Cab Compartment	Check air filter restriction indicator operation. See Operator's Manual (TM 9-2320-364-10). If indicated, replace air filter element. Refer to Para 4-5.	
			NOTE  After all services and inspections have been completed, take the truck on a short road test to make sure all corrections have been accomplished. Correct any defects or malfunctions that occur during this test.	
107	Semi- Annual	Cab Compartment	<ul> <li>During road test:</li> <li>a. Listen for any abnormal noise.</li> <li>b. Check steering operation.</li> <li>c. Check operation of brakes.</li> <li>d. Check transmission operation; all ranges.</li> <li>e. Check engine brake operation (TM 9-2320-364-10).</li> <li>f. Note any loss of power or rough running engine.</li> </ul>	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		LEFT SIDE VEHICLE		
108	Annual	90 Degree Gearbox	Check 90 degree gearbox (1) for cracks, dents, damage or loose bolts.	Damage or loose bolts are found.
109	Annual	Exterior	Check that the following items on the exterior are in place and in serviceable condition.  a. Fasteners b. Hinges c. Panels d. Stowage compartments	
110	Annual	Exterior	Check all data plates to ensure legibility. Replace data plates if damaged or missing.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
111	Annual	Tires (All)	4/32   8 (3.2 r	nm) .R TIRES) IN.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
112	Annual	Air and Fuel Filters	AIR DRYER GUARD SHOWN REMOVED FOR CLARITY (IF EQUIPPED)  REPLACE FOIL FILTER  REPLACE FILTERS  REPLACE DESICCANT  a. Replace air dryer/after cooler filters every 2,000 hours of operation or annually, whichever comes first. Refer to Para 12-21 and Para 12-22.  b. Replace air dryer desiccant every 2,000 hours of operation or annually, whichever comes first. Refer to Para 12-21.  c. Replace fuel/water separator filter every 6,000 miles (9,656 km) or annually, whichever comes first. Refer to Para 4-17.  d. Replace after cooler foil filter every 2,000 hours of operation or annually, whichever comes first. Refer to Para 4-17.  d. Replace after cooler foil filter every 2,000 hours of operation or annually, whichever comes first. Refer to Para 12-22.  e. Clean fuel priming pump filter every 6,000 miles (9,656 km), annually or more frequently if fuel is dirty. Refer to Para 4-3.	TER

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			TURN TO REMOVE	
113	Annual	Secondary Fuel Filter	Replace secondary fuel filter every 6,000 miles (9,656 km) or annually, whichever comes first. Refer to Para 4-13.	Any Class III leaks are found.
			TURN TO REMOVE	
114	Annual	Transmission Oil Filter	Replace transmission oil filter every 6,000 miles (9,656 km) or annually, whichever comes first. Refer to Para 8-4.	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
	(OLD STYL	N PLUG LE OIL PAN) N PLUG LE OIL PAN)		TRANSMISSION CHECK AND FILL
			<ul> <li>When initially filling or changing the transmission fluid, use the COLD band on dipstick. At an initial operating temperature of 60 to 120 degrees F (16 to 49 degrees C) fill the transmission so the fluid is in COLD range.</li> <li>Loosen T-handle on transmission dipstick approximately one full turn then dipstick can be removed from check and fill tube with slight resistance.</li> <li>Operate engine one minute at 1000 RPM, idle until transmission temperature reaches 180 to 220 degrees F (82 to 104 degrees C). With engine idling, transmission in neutral, and truck on level ground, check transmission dipstick. If oil level is within the HOT/RUN band the quantity of oil in the transmission is safe for operation. If oil level is on or below bottom line of HOT/RUN band, add oil.</li> </ul>	
115	Annual	Transmission Fluid and Breather	Drain fluid from transmission and service transmission breather every 6,000 miles (9,656 km) or annually, whichever comes first. Refer to Para 8-3 and Para 8-5. Refill with OE/HDO as required. Refer to Table 2-3.	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
116	Annual	Exhaust System	Check muffler (1), guard (2) and raincap (3) for looseness or leaks. Tighten loose parts. Refer to Paras 5-2 and 5-3.	Muffler, guard or raincap is missing.
				TURN TO REMOVE
117	Annual	Main Hydraulic High Pressure Filter	Replace main hydraulic high pressure filter every 6,000 miles (9,656 km) or annually, whichever comes first. Refer to Para 20-6.	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		REPLACE STRAINER	FILL FILL FILL FILL OF THE CHECK	INDICATOR
118	Annual	Main Hydraulic Reservoir	<ul> <li>Prior to checking fluid level, ensure the LHS and crane (if installed) are in the stowed position to obtain an accurate fluid level reading.</li> <li>OE/HDO-30 must be used when temperatures are consistently above 60 degrees F (16 degrees C).</li> <li>When oil is cold, do not add or fill beyond the word "FULL" on the fluid level indicator.</li> <li>a. Drain main hydraulic reservoir every 800 hours of operation or annually, whichever comes first. Refer to Para 20-11. Refill with OE/HDO as required. Refer to Table 2-3.</li> <li>b. Replace strainers in the main hydraulic reservoir every 800 hours of operation or annually, whichever comes first. Refer to Para 20-13.</li> </ul>	a. Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		CHECK AND FILL  DRAIN PL		LUGS
			NOTE	
			<ul> <li>OE/HDO-30 must be used when temperatures are consistently above 60 degrees F (16 degrees C).</li> </ul>	
			<ul> <li>Both drain plugs must be removed to completely drain the steering reservoir.</li> </ul>	
119	Annual	Power Steering Reservoir	Drain fluid from power steering reservoir every 800 hours of operation or annually, whichever comes first. Refer to Para 14-2. Refill with OE/HDO as required. Refer to Table 2-3.	Any Class III leaks are found.
120	Annual	U-Joint Mounting Screws	Make sure all U-joint mounting screws are tight. Tighten all parts. Replace screws if damaged or missing. Refer to Para 10-2.  NOTE	
			Per TB 43-0142, material handling cranes must be load tested after extensive repair, modification or if crane has remained idle for one or more years.	
121	Annual	Material Handling Crane	<ul> <li>a. Notify Direct Support Maintenance if vehicle crane meets requirements for load testing.</li> </ul>	
			b. Notify Direct Support Maintenance to perform Turntable Bearing Inspection.	
122	Annual	Air Governor	Check air governor operation and adjust as required. Refer to Para 12-41.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			PLUG IN CHECK POSITION	
			PLUG IN FILL POSITION	
			PLUG IN DRAIN POSITION	
			NOTE  The 50 hour interval is been derectual self	
			• The 50 hour interval is based on actual self-recovery winch operating hours. The hours can be tracked by the operator and recorded in the logbook. The self-recovery winch should be lubricated on a monthly or 50 actual operating hour interval, whichever comes first.	
			• Change oil in self-recovery winch (SRW) gearbox after the first 10 hours of winch operation.	
			• SRW has two plugs. To check and fill SRW, one plug must be in upper position and second plug must be at side position. To drain SRW, one plug must be in side position and one plug must be at bottom position.	
123	Annual	Self- Recovery Winch	Drain fluid from SRW every 12,000 miles (19,312 km) or annually, whichever comes first. Refill with GO as required. Refer to Table 2-3.	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		PU	ARCTIC HEATER AND MOUNTING HARDWARE  ARCTIC HEATER BRACKET MOUNTING HARDWARE  WARE HARDWARE	
123.1	Annual	Engine Arctic Heater Kit (Model B)	<ul> <li>a. Check arctic heater kit mounting for loose or missing hardware.</li> <li>b. Check coolant hoses for leaks, cuts, tears and other obvious damage.</li> <li>c. Check coolant hose clamps and fittings at arctic heater and engine block for looseness,</li> </ul>	<ul> <li>a. Loose or missing hardware.</li> <li>b. Leaks, cuts, tears or other damage evident.</li> <li>c. Looseness leaks or damage evident.</li> </ul>
		COOLA	CLAMP  FITTINGS  FITTINGS  FITTINGS  CLAMPS  HOSE  HOSE  HOSE  HOSE  HOSE	CLAMP

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			CLAMPS	FUEL METERING PUMP FUEL PICKUP PIPE  CLAMP
		Engine Arctic Heater Kit (Model B) (continued)	<ul> <li>d. Check fuel lines for leaks, cuts and other obvious damage.</li> <li>e. Check fuel line clamps and fittings at arctic heater, fuel metering pump and fuel tank for looseness, leaks and damage.</li> </ul>	<ul><li>d. Leaks, cuts or other damage evident.</li><li>e. Looseness, leaks or damage evident.</li></ul>

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		·	ARCTIC ENGINE HEATER  INTAKE PORT	EXHAUST PIPE
		Engine Arctic Heater Kit (Model B) (continued)	f. Check arctic heater intake port and exhaust tube for damage and obstructions.	f. Damage or obstruction evident.
			ARCTIC HEATER FUEL METERING PUMP CONNECTOR ARCTIC HEATER HARNESS CONNECTOR  ARCTIC HEATER FUEL METERING PUMP  ARCTIC HEATER CONTROL UNIT  g. Check arctic heater and fuel metering pump electrical connections for looseness and damage.	ARCTIC HEATER HARNESS CONNECTOR  g. Looseness or damage evident.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		HOIST DRI	JM O O O O O O O O O O O O O O O O O O O	
124	Biennial	Crane Hoist Drum	Check fluid level in hoist drum every 250 hours of operation or biennially, whichever comes first. Fill with GO as required. Refer to Table 2-3.	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
				VENT REDUCER ADAPTER FILL TUBE
125	Biennial	Crane Swing Drive Gear Box	To check and fill the swing drive gearbox, perform the following procedures:  (1) Remove vent cap at top of filler tube. (2) Check that lubricant is visible at bottom of tube. (3) If required, fill gearbox with lubricant. (4) Replace vent cap.  Check fluid level in swing drive gearbox every 250 hours of operation or biennially, whichever comes first. Fill with GO as required. Refer to Table 2-3.	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
				L ECK BAIN
			NOTE	
126	Biennial	Planetary Hub Gears (all axles)	<ul> <li>Following initial drain, change lubricant every 12,000 mi (19,312 km) or each two years of service, whichever comes first. If truck is operated in ambient temperatures over 100 degrees F (38 degrees C) the lubricant should be drained and refilled every 3,000 mi (4,828 km). During all lubricant changes, remove metal particles from magnetic drain plugs. Fill wheel ends first.</li> <li>Axles No. 1, 2 and 5 (steering axles). Planetary wheel end level is at the bottom of the center check plug. Fill slowly through the 3/4 in. (19 mm) fill holes until oil runs out the center check location. Scheduled oil level checks will be made at these same locations.</li> </ul>	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
		Planetary Hub Gears (all axles) (continued)	<ul> <li>Axles No.3 and 4 (non-steering axles). Planetary wheel end level on the rigid axles will initially be set at bottom of the center check plug. Filling will be through the 3/4 in. (19 mm) fill holes until oil runs out the center check location. Scheduled oil level checks will be made only at the axle housing and not the planetary wheel ends on the rigid axles. Due to internal venting the wheel ends will seek the same level as the axle housing, and as a result, no checks should be made after the initial fill/check of the wheel end.</li> <li>Axles No. 3 and 4 (non-steering axles). Some oil will transfer from the wheel end to the axle housing and a slight overfill condition at the axle housing may be noticed during checking of the axles. This is considered normal and should not be a reason for concern.</li> <li>Drain fluid from planetary hub gears. Refer to Para 11-2. Refill with GO as required. Refer to Table 2-3.</li> </ul>	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			CHECK AND FILL PLUG DRAIN PLUG	
			<ul> <li>Following initial drain, change lubricant every 12,000 mi (19,312 km) or each two years of service, whichever comes first. If truck is operated in ambient temperatures over 100 degrees F (38 degrees C) the lubricant should be drained and refilled every 3,000 mi (4,828 km). During all lubricant changes, remove metal particles from magnetic drain plugs. Fill wheel ends first.</li> <li>Initial fill and level checks for the axles will be made from the housing side plugs. Oil</li> </ul>	
			level should be at bottom of the hole. Scheduled oil level checks will be made at these same locations.	
			<ul> <li>All axles are drained/filled the same way.         After draining, fill through the axle bowl to a level even with the check and fill hole.         Allow the oil level to stabilize and recheck.         Add lubricant as needed.     </li> </ul>	
127	Biennial	Differential (Axles No. 1 and No. 5)	Drain fluid from Axles No. 1 and No. 5 differentials. Refer to Para 11-2. Refill with GO as required. Refer to Table 2-3.	Any Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			CHECK AND FILL PLUG	
128	Biennial	Differential (Axle No. 3)	<ul> <li>Following initial drain, change lubricant every 12,000 mi (19,312 km) or each two years of service, whichever comes first. If truck is operated in ambient temperatures over 100 degrees F (38 degrees C) the lubricant should be drained and refilled every 3,000 mi (4,828 km). During all lubricant changes, remove metal particles from magnetic drain plugs. Fill wheel ends first.</li> <li>Initial fill and level checks for the axles will be made from the housing side plugs. Level should be set at the bottom of the hole.</li> <li>Some oil will transfer from the wheel end to the axle housing and a slight overfill condition at the axle housing may be noticed during checking of the axles. This is considered normal and should not be a reason for concern.</li> </ul>	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			<ul> <li>All axles are drained/filled the same way.         After draining, fill through the axle bowl to a level even with the check and fill hole.         Allow the oil level to stabilize and recheck.         Add lubricant as needed.     </li> </ul>	
		Differential (Axle No. 3) (continued)	Drain fluid from the Axle No. 3 differential. Refer to Para 11-2. Refill with GO as required. Refer to Table 2-3.	Class III leaks are found.
			CHECK AND FILL PLUG  DRAIN PLUG	
129	Biennial	Differential (Axles No. 2 and No. 4)	• Following initial drain, change lubricant every 12,000 mi (19,312 km) or each two years of service, whichever comes first. If truck is operated in ambient temperatures over 100 degrees F (38 degrees C) the lubricant should be drained and refilled every 3,000 mi (4,828 km). During all lubricant changes, remove metal particles from magnetic drain plugs. Fill wheel ends first.	

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			<ul> <li>All axles are drained/filled the same way.         After draining, fill through the axle bowl to a level even with the check and fill hole.         Allow the oil level to stabilize and recheck.         Add lubricant as needed.     </li> </ul>	
			<ul> <li>Initial fill and level checks for the axles will be made from the housing side plugs. Level should be set at the bottom of the hole.</li> </ul>	
			<ul> <li>Axle No. 4. Some oil will transfer from the wheel end to the axle housing and a slight overfill condition at the axle housing may be noticed during checking of the axles. This is considered normal and should not be a reason for concern.</li> </ul>	
		Differential (Axles No. 2 and No. 4) (continued)	Drain fluid from the No. 2 and No. 4 axle differentials. Refer to Para 11-2. Refill with OE/HDO as required. Refer to Table 2-3.	Class III leaks are found.
			BREATHER/FILL	
			CHECK PLUG DRAIN PLUGS	
130	Biennial	Transfer Case	Drain fluid from the transfer case every 12,000 miles (19,308 km) or biennially, whichever comes first. Refer to Para 9-2. Refill with OE/HDO as required. Refer to Table 2-3.	Class III leaks are found.

Table 2-1. Unit Level Preventive Maintenance Checks and Services (PMCS) (CONT).

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
			NOTE	
			Tires should only be rotated on the same side within same tandem.	
131	Biennial	Tires	Rotate tires. On same side of truck, rotate tire with most wear with the tire with least wear (TM 9-2320-364-10).	
132	Biennial	Wheel Bearings	Check wheel bearings for looseness or damage.	Wheel bearings are loose or damaged.

Table 2-2. Unit Level Preventive Maintenance Checks and Services - Auxiliary Equipment

Item No.	Interval	Item to Be Inspected	Procedure	Not Mission Capable If:
	INSI	DE CAB		
1		Machine Gun Mount	Refer to TM 9-1005-245-14 for preventive maintenance checks and services.	
2		M-8 Chemical Alarm	Refer to TM 9-6665-225-12 for preventive maintenance checks and services.	
3		M-13 Decontamination Unit	Refer to TM 3-4230-214-12&P for preventive maintenance checks and services.	
4		Radio	Refer to TM 11-5820-498-12 for preventive maintenance checks and services.	

Table 2-3. Lubricants

(ICE ig Oil,	Component	Approximate Capacity	Expected Temperature	Intervals	
Luricating Oil, Internal Combustion Engine (ICE Tactical OE/HDO (MIL-L-2104) or Lubricating Oil, ICE. Artic. OEA (MIL-L-46167)	Engine	32 qt (30 l) w/std oil filter 37 qt (35 l) w/re- mote oil filter	See CHART A.		
nbusti 34) or 7)	Transmission	39.5 qt (37.4 l)	See CHART B.		
al Con L-21(	Transfer Case	10.5 qt (9.9l)	See CHART C.		
il, Interna IDO (MII IA (MIL-I	Power Steering Reservoir	34 qt (32 l)	See CHART D.	OC - ON - CONDITION	
ating O	Hydraulic Reservoir	234 qt (22 l)	See CHART D.	D - DAILY W - WEEKLY	07.
Lurica Tactio	Oil Can Points	As Required	See CHART G.	M - MONTHLY	.M 9-2
				AR - AS REQUIRED	호
	Axle No 1	33 pt (16 l)	See CHART H.	HRS - HOURS	refer
	Axle No 2	36 pt (17 l)	See CHART H.	S - SEMIANNUALLY (6 MONTHS)	ation, I
				A - ANNUALLY	per
esoc	Axle No 3	41 pt (19 l)	See CHART H.	BI - BIANNUALLY	tic
Gear, Multipurpose,	Axle No 4	40 pt (19 l)	See CHART H.	1.5 - 1,500 MILES 3 - 3,000 MILES	For arctic operation, refer to FM 9-207
ear, Mı	Axle No 5	32 pt (15 l)	See CHART H.	6 - 6,000 MILES	
		. ,		9 - 9,000 MILES	
ng, Oil, 2105)	Planetary Hub Gears	3.0 pt (1.4 l)	See CHART H.	12 - 12,000 MILES	
Lubricating, GO (MIL-L-2	Steering Gear Box 2.21:1	0.5 pt (0.237 l)	See CHART F.	24 - 24,000 MILES	
ĕ L	Self Recovery Winch Gearbox	2 qt (2 l)	See CHART E.		
	Hoist Gearbox	1 pt (0.47 l)	See CHART E.		
	Swing Drive Gearbox	1 pt (0.47 l)	See CHART E.		

Table 2-4. Other Fluids

Fluid	Capacity	Temperature	'n,
Drycleaning Solvent, SD-II, (P-D-680)	As Required	All Temperatures	operation // 9-207
Antifreeze, Ethylene Glycol (MIL-A-46153)	100 qt (95 l)*	Above -50 degrees F (-46 degrees C)	rrctic to FN
Antifreeze, Arctic-Type (MIL-A-11755)	103 qt (97 I)*	Use when extended periods of -40 degrees F (-40 degrees C) or below are encountered.	For a refer

<sup>\*</sup> Cooling System Capacity

### Table 2-5. Grease, Automotive and Artillery (GAA) (MIL-L-10924)

The following components are lubricated with GAA as required at all temperatures

Drive Train/Suspension Driveshafts, U-Joints, Double Cardon Joints, Spring Hangers, Trunnions (Fittings)	
SRW Tensioning Guides and Rollers (Fittings)	207.
Self-Guided Coupler (Fittings)	FM 9-
Steering System Pitman Arms, Steering Gears, Drag Links Steering Shafts, Steering Column Linkage Tie-Rod Ends, Intergear Link (Fittings)	or arctic operation, refer to FM 9-207
Tire Davit (Fittings)	opera
Hydraulic Pump Driveshaft (Fittings)	arctic
Load Handling System (Fittings)	For
Crane (Fittings)	

### Table 2-6. Antiseize Compound (MIL-A-907)

The following components are lubricated with antiseize compound as required at all temperatures.

Crane Jack Cylinder Barrels
Crane Tension Link

Table 2-7. Total Work Hours Required for Service

Table 2-8. Sealant (NSN 8030-01-166-0675)

The following components have sealant applied.

Steering	Gearhov	2 21	to 1
Steeming	Gearbox	<b>Z.Z</b> I	IU I

	TRUCK, M1074				
ос	1.04				
D	0.03				
W	0.03				
M/50 HRS	0.43				
S,Q	0.04				
Α	TBD				
BI	TBD				
1.51/Q	1.71				
3/S	0.72				
S/400 HRS	1.08				
6A	0.41				
12A	0.40				
20/A	0.33				
50/A	1.38				
12/BI	5.93				
8000 HRS/12	0.10				

<sup>\*</sup> The work-hours shown above have been established on an individual basis and, accordingly, are not applicable at maintenance facilities where production line methods are employed.

Chart A. Engine

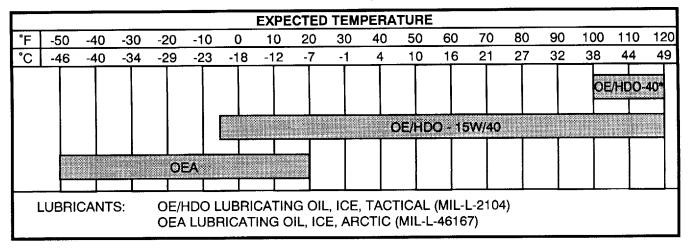


Chart B. Transmission

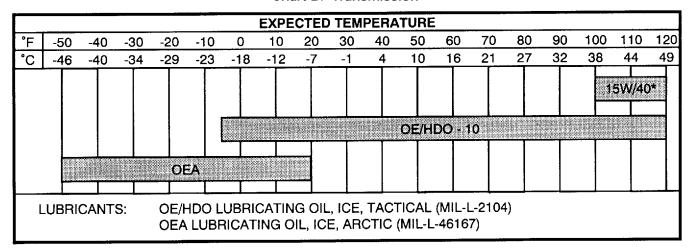


Chart C. Transfer Case

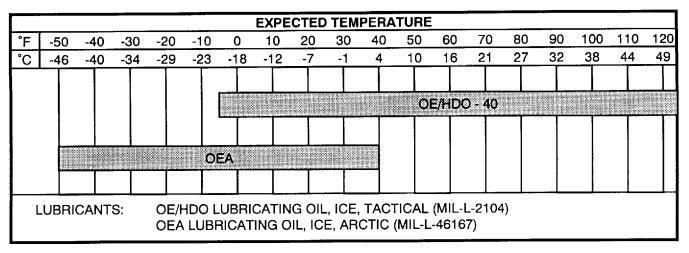


Chart D. Hydraulic Reservoir / Steering Reservoir

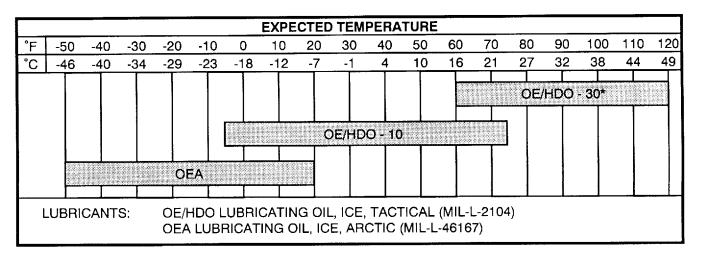


Chart E. SRW Gearbox, Hoist Gearbox, Swing Drive Gearbox

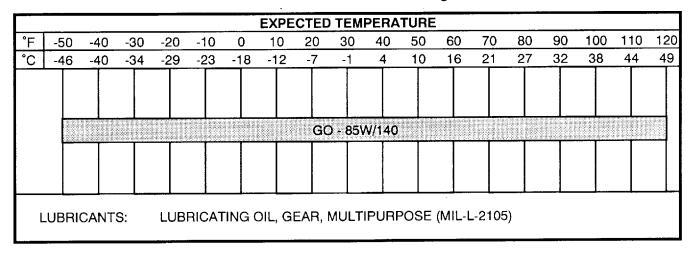


Chart F. Gearbox (Steering 2.21:1)

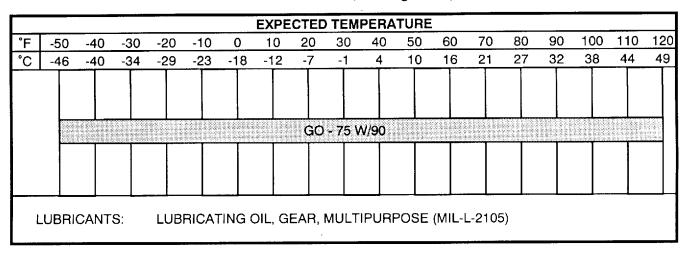


Chart G. Oil Can Points

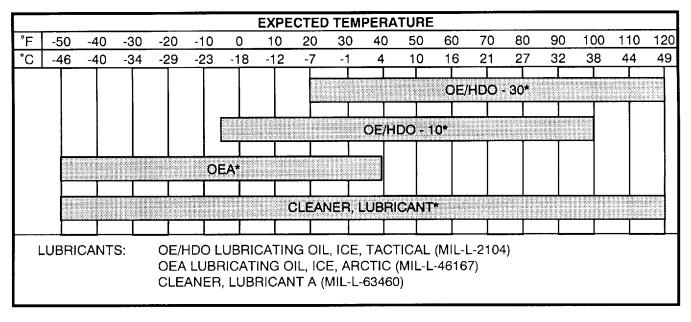


Chart H. Axles and Planetary Wheel Ends

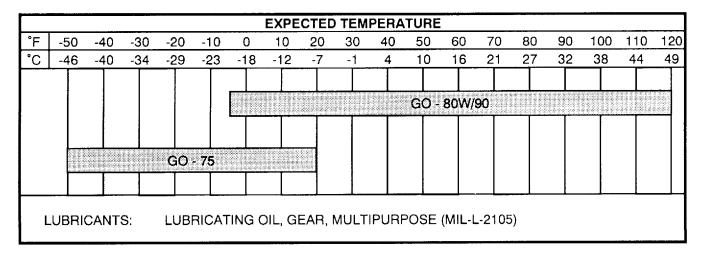


Table 2-9. SEMI-ANNUAL (3,000 MILE) PMCS PARTS LIST

ITEM NO.	PART NUMBER	NSN	NOMENCLATURE	QTY
1	V75500858	5330-01-350-6007	Preformed Packing (Planetary Drain)	11
2	V75503675	5310-01-389-2364	Washer (Planetary Center Screws)	6
3	23518524	2940-01-314-1345	Filter Element (Engine Oil)	1
4	1314130	4330-01-232-8305	Filter Element (Main Hydraulic Return Line)	1
5	1198559	5330-01-358-8219	Gasket (Main Hydraulic Return Line)	1
6	G-1399	2940-01-394-6172	Filter Element (Steering)	1
7	MTP-95-551	4330-01-026-6371	Kit (Filter, Coalising)	1

Table 2-10. ANNUAL (6,000 MILE) PMCS PARTS LIST

ITEM NO.	PART NUMBER	NSN	NOMENCLATURE	QTY
1	25010643	4330-01-132-4842	Filter Element (Transmission)	1
2	14079550	5330-00-107-3925	Nylon Washer (Transmission Drain Plug)	1
3	23518481	2910-01-423-2859	Filter Element (Secondary Fuel)	1
4	2020PMOR	2910-01-344-5791	Filter Element (Fuel/Water Separator)	1
5	11007B	5330-01-344-0539	Gasket (Fuel/Water Separator)	1
6	11350	5330-01-147-6003	Preformed Packing (Fuel/Water Separator)	1
7	CCS3	2940-01-359-8346	Filter Element (Main Hydraulic High Pressure)	1
8	2-238N674-70	5330-00-172-7223	Preformed Packing (High Pressure Filter)	1
9	8-238N300-90	5330-01-065-5959	Packing Retainer (High Pressure Filter)	1
10	22617-6	5330-01-198-8439	Preformed Packing (Main Hydraulic Drain Plug)	1

Table 2-10. ANNUAL (6,000 MILE) PMCS PARTS LIST - (CONT)

ITEM NO.	PART NUMBER	NSN	NOMENCLATURE	QTY
11	FB-7	5330-01-406-8221	Gasket (Main Hydraulic Fill/Breather Cap)	1
12	SS-2-100	4730-01-113-1458	Suction Strainer (Main Hydraulic Reservoir)	1
13	1958330	5330-01-358-5561	Reservoir Gasket (Main Hydraulic)	1
14	93613642	5310-01-068-8446	Lockwasher (Main Hydraulic Reservoir Cover)	27
15	22617-8	5330-01-244-2273	Preformed Packings (Steering Reservoir Drain Plug)	2
16	RN60V	5330-01-377-2460	Kit (Repair, After Cooler)	1
17	RN60A	4440-01-337-7324	Kit (Repair, Air Dryer)	2
18	2-X-5731	5310-01-447-4251	Locknut (Air Dryer, After Cooler)	18
19	92-158	5330-01-058-7118	Gasket (Electric Fuel Pump)	1
20	96-212	5305-01-205-0041	Screws, Lock (Electric Fuel Pump)	3

Table 2-11. BIENNIALLY (12,000 MILE) PMCS PARTS LIST

ITEM NO.	PART NUMBER	NSN	NOMENCLATURE	QTY
1	V75500858	5330-00-350-6007	Preformed Packing (Planetary Drain)	20
2	V75503675	5310-01-389-2364	Washer (Planetary Center Screw)	10

#### Section IV. TROUBLESHOOTING

#### 2-10. TROUBLESHOOTING INTRODUCTION.

This section contains step-by-step procedures for identifying, locating, isolating and repairing equipment malfunctions.

This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify the supervisor.

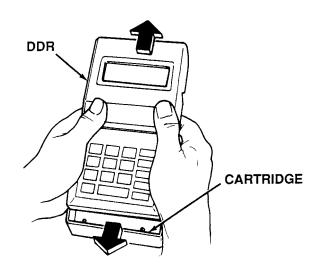
#### 2-11. TROUBLESHOOTING INSTRUCTIONS.

The first part of this section explains the use of the Troubleshooting Logic Tree. These procedures make use of Simplified Test Equipment for Internal Combustion Engines-Reprogrammable (STE/ICE-R), Detroit Diesel Electronic Control II (DDEC II) and Allison Transmission Electronic Control (ATEC) for testing and fault isolation. DDEC III/IV Troubleshooting is located in Para 2-14.

a. Simplified Test Equipment for Internal Combustion Engines - Reprogrammable (STE/ICE-R). The PLS truck is equipped with several STE/ICE-R sensors that are used to support troubleshooting procedures. STE/ICE-R tests, employing these sensors, are incorporated into the standard troubleshooting tests to aid in fault isolation. The STE/ICE-R acts as a conventional digital multimeter to measure voltage, current and resistance. It can also measure pressure, speed, compression unbalance, engine power and some specialized battery and starter evaluations. The STE/ICE-R is powered by the truck batteries using an electrical harness called the Diagnostic Connector Assembly (DCA). The complete system includes a truck test meter (VTM), a transducer kit (TK), cables, transit case and technical publications. The STE/ICE-R can make TK measurements while connected to the DCA. STE/ICE tests are referenced. VIN number for PLS truck is "38".

#### b. Diagnostic Data Reader (DDR) Description.

- (1) DDR cartridge replacement.
  - (a) Disconnect DDR cable from DDL connector MC13.
  - (b) Hold DDR with thumbs placed against slanted surface and grasp cartridge with fingers.
  - (c) Squeeze DDR, push thumbs forward against slanted surface, and slide cartridge back at the same time.
  - (d) Slide cartridge from DDR.
  - (e) Seat cartridge on back of DDR.





Damage will occur to the cartridge if it is held at an angle during installation. The cartridge must be held flat before sliding into place.

- (f) Slide cartridge forward until the cartridge clicks into place.
- (2) Cable connections to truck.
  - (a) The data/power cable must be connected to the truck before the DDR can function.
  - (b) The DDR will energize as soon as it is connected to the truck's electrical system and the ENGINE switch is turned ON. If it does not, there are several things to check.
- (3) Troubleshooting.
  - (a) If the unit does not power up, check that the cartridge is plugged in correctly. Slide the cartridge out and plug it in again. If there is grease, oil or other grime on the edgeboard, carefully remove it with a soft cloth. DO NOT use solvents and DO NOT attempt to clean the terminals in the DDR unit itself.
  - (b) Check the 2-amp fuse located inside the cartridge. Remove the screws to disassemble the cartridge. Always use a 2-amp fuse for replacement.
- (4) Readout window. The readout window contains a liquid crystal display (LCD). It has four lines, each with 20 characters. This provides a great deal of information at one time. A built-in backlight ensures that you will be able to read the display regardless of the lighting conditions in the truck. The readout uses letters, numbers and special symbols.
- (5) Keypad.
  - (a) The keypad features 16 keys. They are totally sealed against contamination, including grease and fluids. You can clean them with a damp cloth or mild cleaner. DO NOT immerse the DDR in fluids; the edgeboard connector is NOT sealed.
  - (b) The keys operate with a soft touch, but unlike membrane keys, they "give" to indicate that your entry has been made.

- (c) Ten NUMERIC KEYS arranged calculator-style for quick operation. Each key is imprinted with a single digit.
  - To the right side of the keypad, there are four arrow keys, each imprinted with a direction arrow. The UP and DOWN arrow keys are used to scroll through the lines of the display. Each touch of a key causes the display to move one line, up or down. The LEFT and RIGHT arrow keys are used to toggle back and forth between choices given by the display; they may have other purposes, depending on which cartridge is used.
  - **2** The FUNC key, below the arrow keys, lets you choose various DDR modes, or functions, depending on the cartridge in use. These include several operating modes and a printing mode.
  - 3 The ENTER key lets you tell the DDR when to do something. Depending on what's showing in the readout window display, the ENTER key can make a selection, confirm an answer, or instruct the DDR to continue to the next step.
- (6) RS232 port. On the right side of the DDR case is an RS232 port. Using the proper cables, you can connect to a printer or terminal.
- (7) DDL connector. The DDR receives information from the truck's on-board computer, the DDEC electronic control module (ECM) ATEC electronic control unit (ECU), through a connector called the Display Data Line (DDL). The DDL has 12 terminal cavities. The DDL adapter plug is located on the left side of the cab at left door hinge area under the edge of the instrument panel.

#### c. DDEC II Operation.

- (1) General instructions.
  - (a) The Check Engine Light (CEL) and Check Gages Light (CGL) will light for five seconds when the ENGINE switch is first turned ON as a bulb and system check. If the Check Engine Light remains on, the self-diagnostic system has detected a fault.
  - (b) The first step in diagnosis is identifying the symptom or problem condition. Always refer to DDEC II Troubleshooting (All Conditions) to begin troubleshooting.

Symptom A CEL comes on and stays on

Symptom B CEL is always off

Symptom C CEL operates normally (comes on for up to 5 seconds, then goes off) and a fault is present

Symptom D CEL and fault are intermittent

Symptom E Engine cranks but will not start

Symptom F CGL is always on or always off

(c) Once the key symptom is identified, refer to the fault index to find the page number of the flowchart for that symptom. Symptoms A, C, D and F's starting flowcharts will list secondary symptoms (Symptoms B and E have no secondary symptoms). Look to the right of the secondary symptom to find the page on which to begin troubleshooting. Go to that page.

- (d) Diagnosis is built on codes that are displayed on the Diagnostic Data Reader (DDR) (Table 2-12). Since the self-diagnostics do not detect all possible faults, the absence of a code does not mean there are no problems in the system. If a DDEC problem is suspected (even in the absence of a code), go to the DDEC II Troubleshooting (All Conditions) flowchart, (Para 2-13) or DDEC III/IV Troubleshooting (All Conditions) flow chart Para 2-14. This chart can lead you to other charts which can aid in the troubleshooting process.
- (e) If, after DDEC II or DDEC III/IV troubleshooting is completed and other symptoms remain, go to Engine Troubleshooting.
- (2) Using the Diagnostic Data Reader (DDR).
  - (a) Plug reader into truck connector and turn ENGINE switch ON.

Table 2-12. DDEC II System Code Index

Code Number	Affected Sensor	Description
11	Vernier Control	System on for 2 seconds with too low a voltage at the Vernier Control input to the DDEC ECM.
12	Vernier Control	System on for 2 seconds with too high a voltage at the Vernier Control input to the DDEC ECM.
14	Oil Temperature (OTS)	Engine running for 8 minutes with too high a voltage at the OTS input to the DDEC ECM.
15	Oil Temperature (OTS)	Engine running for 2 seconds with too low a voltage at the OTS input to the DDEC ECM.
21	Throttle Position (TPS)	System running for 2 seconds with too high a voltage at the TPS input to the DDEC ECM.
22	Throttle Position (TPS)	System running for 2 seconds with too low a voltage at the TPS input to the DDEC ECM.
23	Fuel Temperature (FTS)	Engine running for 8 minutes with too high a voltage at the FTS input to the DDEC ECM.
24	Fuel Temperature (FTS)	Engine running for 2 seconds with too low a voltage at the FTS input to the DDEC ECM.
25		NO CODES - No faults have been detected by DDEC since the last time the codes were cleared.
32		ECM FAILURE - The backup system inside the DDEC ECM has failed.
33	Turbo Boost (TBS)	Engine running (at less than 800 RPM or less than 30% of maximum torque) for 5 seconds with too high a voltage at the TBS input to the DDEC ECM.
34	Turbo Boost (TBS)	Engine running for 2 seconds with too low a voltage at the TBS input to the DDEC ECM.
35	Oil Pressure (OPS)	Engine running for 2 seconds at less than 800 RPM with too high a voltage at the OPS input to the DDEC ECM. Oil temperature must be greater than 60 degrees C to log this code.
36	Oil Pressure (OPS)	Engine running for 2 seconds with too low a voltage at the OPS input to the DDEC ECM.

Table 2-12. DDEC II System Code Index (CONT).

Code Number	Effected Sensor	Description
41	Timing Reference (TRS)	The number TRS pulses received per revolution was incorrect or completely missing. One pulse per cylinder per revolution is required.
42	Synchronous Reference (SRS)	Did not receive an SRS pulse on every firing of the #1 cylinder.
44		HIGH OIL TEMPERATURE - System running for 2 seconds with the oil temperature greater than a calibrated limit.
45		LOW OIL PRESSURE - Engine running with the oil pressure less than the limit (different limits at different RPM's) for 7 seconds.
46		LOW BATTERY VOLTAGE - Engine running with low battery voltage (less than 10 volts) for more than 30 seconds.
51		EEPROM ERROR - An error has been detected in the EEPROM (Electrically Erasable, Programmable, Read Only Memory) inside the DDEC ECM.
52		ECM FAILURE - The DDEC ECM was unable to correctly convert sensor voltages into numbers for computer usage.
53		EEPROM ERROR - An error has been detected in the EEPROM inside the DDEC ECM which affects the logging of trouble codes.
56		ECM FAILURE - The DDEC ECM was unable to correctly convert sensor voltages into numbers for computer usage.
61 thru 68		RESPONSE TIME TOO LONG - The response time of the injector was longer than the maximum limit or the injector never responded at all. Oil temperature must be greater than 30 degrees C and battery voltage must be between 11 volts and 16 volts to log this code. The code is only logged at less than 2000 RPM.
71 thru 78		RESPONSE TIME TOO SHORT - The response time of the injector was shorter than the minimum limit. Oil temperature must be greater than 30 degrees C and battery voltage must be between 11 volts and 16 volts to log this code. The code is only logged at less than 2000 RPM.

(b) When the reader powers up, observe the data readout window. It will remain on for several seconds. If the reader does not power up, check connections and be sure the ENGINE switch is ON.

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Data Readout Window

- (c) Observe the data readout window displaying a second message indicating communication with the DDEC Electronic Control Module (ECM). If needed, press ENTER on the DDR to display the screen.
- (d) After a few seconds, the first four lines in a data list will appear on the screen.
- (e) Use the UP and DOWN arrow keys to move through the list. The first four lines appear as follows:

01 ACTIVE CODES	YES
02 HISTORIC CODE	YES
04 ENGINE RPM	xxxx
05 ECM VOLTAGE	xxx

Data Readout Window

- (f) If, at any time, you observe a NO DATA message on the screen, check the cable connector and ensure the ENGINE switch is ON. Lastly, troubleshoot the DDEC ECM (Para 2-13).
- (g) Press the FUNC key to display the following screen:

FUNCTION SELECTIONS SELECT DESIRED MENU

[ENGINE] <- --> PRO LINK

Data Readout Window

- (h) Use the LEFT arrow key to toggle to the ENGINE choice, then press ENTER.
- (i) Observe the Engine menu with a list of choices. You can move up and down on the list using the UP and DOWN arrow keys.

ENG MENU SELECTIONS
DIAGNOSTIC CODES

Data Readout Window

(j) Select DIAGNOSTIC CODES and press ENTER to display the next menu screen:

DIAGNOSTIC CODE MENU MODE 01 ACTIVE CODES

Data Readout Window

(k) Use the UP and DOWN arrow keys to select MODE 1 ACTIVE codes, MODE 2 HISTORIC CODES and MODE 40 CLEAR CODES. Press ENTER for desired selections.

(l) Generally, you will select ACTIVE CODES. Refer to the specific malfunction or condition and referenced instructions for more information. An ACTIVE CODE display resembles:

DDEC II S60 12.7 PTO HIGH VOLTAGE ACTIVE CODE 12

Data Readout Window

(m) Clear DDEC codes.

CODES LAST CLEARED
AT XXXXXXXXX ENG HRS
DO YOU WANT TO CLEAR
CODES YES <- --> [NO]

Data Readout Window

- **1** Select Mode 40 on the DDR.
- **2** Use arrow keys on the DDR to select YES.
- 3 Press ENTER.

#### NOTE

When ENTER has been pressed, the DDR will clear all stored codes and check the DDEC ECM to ensure all codes are cleared. The DDR will then display the results of the clearing function.

CODES NOT CLEARED ENTER TO RETRY FUNC TO EXIT

Data Readout Window

- **<u>4</u>** Press ENTER to retry the clearing function or FUNC to exit Mode 40.
- (3) Tools needed for DDEC diagnosis. The following tools and equipment are required to properly diagnose a complete system:
  - (a) Voltmeter and Ohmmeter: Use a digital volt-ohmmeter J-34029, or equivalent digital multimeter to measure voltage and resistance when required. A digital multimeter must be used when specified in the procedure.
  - (b) Test Light 6V: Use when specified in the procedure.

- (c) Jumper Wires: Use to bypass a circuit and to insert between special connectors. This will permit access to the connector terminals for circuit checking.
- (d) Diagnostic Data Reader (DDR) PRO LINK 9000: J38500-203.
- (4) Reading diagnostic codes. If you have turned to this instruction to begin diagnosis of a problem and already know how to read, as well as understand Active and Historical codes, go to DDEC II Troubleshooting (All Conditions) and begin DDEC Troubleshooting.
- (5) DDEC mode descriptions. Table 2-13 lists and describes each DDR mode.
- (6) Flashing DDEC codes. DDEC troubleshooting procedures are designed to be performed with the DDR. In situations where a DDR is not available, DDEC codes can be read by flashing them on the CEL. For example, codes 13 and 23 will be flashed as follows:
  - (a) Turn OFF ENGINE switch (TM 9-2320-364-10).
  - (b) Place a jumper wire between wires 435 and 451 on DDL connector MC13, terminals A and M.
  - (c) Turn ON ENGINE switch, observe the CEL and record the codes being flashed.
  - (d) The CEL will flash once for the one in the number 13 and pause for about a half a second.
  - (e) Then the CEL will flash three times for the three in the number 13 and pause for about three seconds.
  - (f) After the three second pause, the CEL will flash two times for the two in the number 23 and pause for about a half of a second.
  - (g) After the half second pause, the CEL will flash three times for the three in the number 23.
  - (h) The CEL will continue to flash in this manner until all of the DDEC codes in the DDEC ECM memory are displayed.
  - (i) Turn OFF the ENGINE switch when all of the DDEC codes are flashed.
  - (j) Remove the jumper wire.
  - (k) Proceed to DDEC Troubleshooting (Para 2-13) and the first code flashed by the CEL.

Table 2-13. DDR Mode Index

Mode Number	Name	Description
01	ACTIVE CODES	If there is a condition present that causes the CEL to be ON, the condition is said to be active. An Active Code is set in DDEC ECM memory. The readout is YES if any active codes are present, and NO if there are none.
02	HISTORIC CODES	If a condition existed in the past to cause an active code, but the condition is no longer present, the condition is called historic. A Historic Code is set in DDEC ECM memory. The readout is YES if any historic codes are present, and NO if there are none. Engine protection codes (22,44, and 45) will also store additional information, which will tell the engine hours when the code was set, the duration the code existed, and the number of times the code was logged.
04	ENGINE RPM	This displays the engine crankshaft revolutions per minute as determined from the timing reference sensor (TRS).
05	ECM VOLTAGE	This is the battery voltage available to the DDEC ECM.
07	TPS COUNTS	This is a digital value for the throttle position sensor (TPS).  Range is 0 to 225 counts.
07	TPS IN %	This value is the percent opening of the throttle as determined from the throttle position sensor.
10	INJ RESP TIMES	This value is the fuel injector response time.
15	FUEL TEMP	This readout indicates the temperature of the fuel entering the engine in degrees Fahrenheit or Celsius, depending on which mode (English or Metric) you have chosen.
17	OIL PRS PSI (kPa)	Engine oil pressure is indicated in psi or kPa, depending on which mode (ENGLISH or METRIC) you have chosen.
18	OIL TEMP	This readout indicates the temperature of the engine oil in degrees Fahrenheit or Celsius, depending on which mode you have chosen.
19	BOOST PSI (kPa)	Turbo boost pressure is indicated in psi or kPa, depending on which mode you have chosen.
20	IDLE SPEED RPM	This is the engine idle RPM value.
21	PTO COUNTS	Power take-off counts is a digital representation of the PTO sensor voltage. Range 0 - 225 counts.
22	PTO SET RPM	This is an indication of the set RPM for the power take-off.
30	CHECK ENG LHT	This is an indication of the output command to the CEL. Readout is ON or OFF.
30	ENG BRK ENBLE	This is an indication of the status of the engine brake. Readout is ON or OFF.
30	STOP ENG LHT	This is an indication of the output command to the CGL. Readout is ON or OFF.
31	SRS RECEIVED	This is an indication of the signal from the synchronous reference sensor is being received. Readout is YES or NO.
40	CLEAR CODES	This mode is used to clear all stored codes in the DDEC ECM.

- d. ATEC Operation.
  - (1) The "CHECK TRANS" and "DO NOT SHIFT" lights will come ON when the ENGINE switch is first turned ON as a bulb and system check. If lights remain ON when truck is started and/or placed into gear, a failure has been detected. The ATEC ECU for the transmission will place a code into memory.
  - (2) System selection procedure.
    - (a) Copyright screen. When the DDR powers up, the readout displays the copyright screen for several seconds.

MPSI PRO-LINK 9000 SOFTWARE COPYRIGHT 1989 VERSION 1.00 ATEC I

Data Readout Window

(b) System selection process. In the ATEC I system, you must select the transmission type from the Transmission Type menu.

ATEC I SYSTEM
SELECT TRANS TYPE
MT(B) 600 OR V. HT (B)
OR C(L)(B)T 700

Data Readout Window

- (c) Note the arrow symbols in the DDR display. They remind you to use the UP and DOWN arrow keys to scroll to the desired transmission type. Each touch will move the display up or down by one item. If you hold an arrow key down, the display will scroll quickly. The list is circular; it will return to the beginning after the last one is viewed.
- (d) When you see the C(L)(B)T 700 on the bottom line, press the ENTER key. The DDR now begins to display data. Refer to Step (4) (Data display).
- (3) Non-volatile memory. The ATEC cartridge has a non-volatile memory. This means that stored data are not lost when the DDR is disconnected from the truck power source.

#### **NOTE**

When the DDR establishes communication with the ATEC ECU in a truck, the DDR memory buffers are all cleared. You cannot use a truck's DDL connector to power your DDR to review recorded data. The recorded data will be lost.

(a) When the DDR is connected to an external power source, for instance, at your workbench, the DDR recognizes that it is not communicating with an ATEC ECU. Under these conditions, the FUNC key is active. You can access stored data for review and printing. These include ATEC ECU operating data, diagnostic codes and snapshot data. For example, suppose you have used the DDR to store snapshot data during a road test. Later, using your workbench power supply, you can review the recorded data.

- (4) Data display.
  - (a) Data readout. The main function of the DDR is to provide you with data from the truck's on-board computer, called the ATEC electronic control unit (ECU). This is what the DDR automatically does after the system type has been determined.
    - 1 If the DDR is unable to established communication with the ATEC ECU in the truck, you will see a NO DATA display. Press ENTER to command the DDR to try again.

NO ATEC DATA RECEIVED

**ENTER TO RETRY** 

Data Readout Window

- 2 If communication cannot be establish and the NO DATA display reappears, see Step (4)(b).
- <u>3</u> When communication is established and the correct transmission type input, you will see the system configuration screen.

ATEC I SYSTEM
DATA LIST
MT(B) 600 OR V. VH (B)
OR C(L)(B)T 700

Data Readout Window

**<u>4</u>** This display will appear for about three seconds.

ECU A/N 16035879 DIAG CODES 21 32 TPS 128 CNTS 50 2% RANGE SEL N ATT N

Data Readout Window

5 Use the UP and DOWN arrow keys to scroll through the entire data list. Pressing a key causes the display to move one line. Holding a key causes the display to scroll quickly. Pressing the LEFT arrow key causes the display to advance four lines. Pressing the RIGHT arrow key causes the display to move backward four lines. When you reach the end of the list, you will see the display that tells you which system you are testing.

#### NOTE

Parameters in the data list that do not pertain to the system you are testing will be designated by NA, meaning not available.

6 For an explanation of each of the items in the data list, refer to Steps (11) through (30) of this section.

- (b) What to do with NO DATA Readout. If you get the NO DATA message, there are several things to check:
  - <u>1</u> Bad connection Check the truck cable at each terminal for a good connection. In an extreme case, a wire may be broken in the truck cable or in the ATEC ECU wiring.
  - **2** Engine ON OFF switch Be sure the ENGINE switch is ON.
  - **3** Bad ATEC ECU, or blown ATEC ECU fuse If the ATEC ECU is incapable of transmitting data, the DDR will not receive any.
- (c) Data freeze operation.
  - 1 There are times when you want to be able to quickly view several operating parameters at the same time, even though they are not normally together in the data list. One way to do this is to create a custom data list using the Custom Data List function. Another way is to use the Data Freeze function.

#### NOTE

There are two differences between Custom Data List and Data Freeze. In Custom Data, you can scroll the entire reorganized data list exactly like the normal data list. In Data Freeze, the items you "freeze" cannot be scrolled. The rest of the list scrolls normally. Also, you can use a custom list, but not a data freeze, when using Snapshot.

**2** To freeze a line of data, follow Steps **3** through **5**.

#### NOTE

You must be viewing the data list before you can freeze an item.

For the purposes of freezing data, the four lines in the readout display are numbered 1 through 4 from the top. Use the UP and DOWN arrow keys to scroll the data list. When an item you want to freeze is visible (on any readout line), press the numerical key that corresponds to the readout line of that item. A solid black square appears next to the item. In the following example, suppose you want to freeze OIL TEMP. To do so, press numerical key 3 because OIL TEMP is displayed on line 3.

LOCKUP RPM 1234 OUTPUT RPM 1234 OIL TEMP 123F 1234 FWD PRESS SW OFF

Data Readout Window

4 Now, when you use the UP and DOWN arrows to scroll the data list, OIL TEMP remains frozen in position on the third line of the display. Although the item is frozen, its value is able to change, according to system operation.

RETARD REQUEST YES
RETARD COMMAND YES
OIL TEMP 123F 123C
SPECIAL INPUT OFF

Data Readout Window

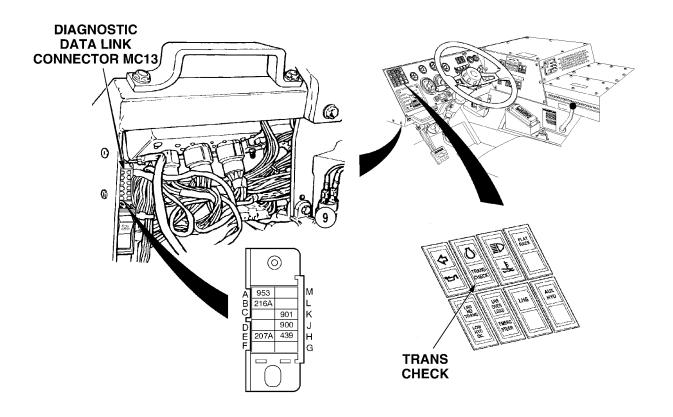
- Now, suppose you also want to watch SPECIAL INPUT. Use the UP and DOWN arrow keys to scroll the list. As you can see above, the third line remains frozen. Eventually, your item appears on line 4. Press numerical key 4. The square will appear to indicate that line 4 is also frozen. You can continue doing this until you have frozen data on all four lines.
- (d) Unfreezing data. There are two ways to unfreeze data. To unfreeze just one line, press the numerical key corresponding to the line you want to unfreeze. The solid square disappears and the line can now be scrolled. To unfreeze the entire display at once, press the numerical key 0 (zero). All solid squares disappear and all lines are unfrozen.
- (e) Functions. The DDR's main purpose is to display data and it does this automatically. The DDR can also perform several other jobs, called functions. These functions are of two types. Some of them relate to the way DDR communicates with the ATEC ECU in the truck, such as diagnostic codes and ranges. Other functions relate to the way the DDR itself operates, such as Snapshot, RS-232 Serial Port and Contrast Adjustment.
- (f) Use of the FUNC key. For access to the functions, press the FUNC key. The DDR is programmed to provide access to only those functions that apply. If you see a function displayed, it is available to use. If you do not see a function displayed, it does not apply.
- (5) Diagnostic codes. When the ENTER key is pressed on the DIAGNOSTIC CODES selection, the DDR will display the code number, along with a description of the code(s) stored in the ATEC ECU.
  - (a) When viewing DIAG CODES in the normal data list, the number on the left is usually a more severe code than the code on the right side of the display. If both memory locations have a code stored in the ATEC ECU, the arrows will appear on the bottom line of the code display screen.
  - (b) The readout contains the name of the system or component that caused the code to be set.

ATEC I DIAG CODES

SPEED SENSOR CODE 22

Data Readout Window

(c) Press the FUNC key to exit.



#### **NOTE**

Only one ATEC code will flash at a time. Correct problem, clear codes, then check for next code.

- (6) Flashing ATEC codes. ATEC codes are shown in Table 2-15. ATEC troubleshooting procedures are designed to be performed with the DDR. In situations where a DDR is not available, ATEC codes can be read by flashing them on the "TRANS CHECK" light. If "TRANS CHECK" light does not flash, no faults have been detected by ATEC since the last time the codes were cleared. For example, codes 13 and 23 will be flashed as follows:
  - (a) Turn OFF ENGINE switch (TM 9-2320-364-10).
  - (b) Place a jumperwire between terminals A and B on DDL connector MC13.
  - (c) Start engine, observe the "TRANS CHECK" light and record the codes being flashed.
  - (d) The "TRANS CHECK" light will flash once for the one in the number 13 and pause for about a half of a second.
  - (e) Then the "TRANS CHECK" light will flash three times for the three in the number 13 and pause for about three seconds.
  - (f) After the three second pause, the "TRANS CHECK" light will flash two times for the two in the number 23 and pause for about a half of a second.
  - (g) After the half second pause, the "TRANS CHECK" light will flash three times for the three in the number 23.

- (h) The "TRANS CHECK" light will continue to flash in this manner until all of the ATEC codes in the ATEC ECM memory are displayed.
- (i) Turn OFF the ENGINE switch when all of the ATEC codes are flashed.
- (j) Remove the jumperwire.
- (k) Proceed to ATEC Troubleshooting (Para 2-15) and the first code flashed by the "TRANS CHECK" light.
- (7) Clear ATEC codes.
  - (a) Turn OFF ENGINE switch (TM 9-2320-364-10).
  - (b) Place a jumperwire between terminals A and B on DDL connector MC13.
  - (c) Start engine (TM 9-2320-364-10).
  - (d) Observe "TRANS CHECK" light for codes being flashed.
  - (e) Apply brake and shift the transmission in the following sequence:
    - 1 N (Neutral).
    - **2** D (Drive).
    - **3** R (Reverse). (Leave in reverse until "TRANS CHECK" light stops flashing, approximately five seconds).
    - 4 N (Neutral).
  - (f) If "TRANS CHECK" light stops flashing, codes have been cleared and fault corrected.
  - (g) If "TRANS CHECK" light continues flashing, fault has not been corrected.
  - (h) Turn OFF ENGINE switch.
  - (i) Remove jumperwire.
- (8) Range selected/range attained. When the driver selects a specific range for the transmission, the ATEC ECU begins shifting the transmission through the various ranges, depending on operating conditions, until the selected range is attained. Under some conditions, the range selected and the range attained will be the same. In other cases, the transmission will not attain the range selected. This information is of diagnostic value.
  - (a) When you select this function, the DDR reads out the range selected and the range attained.

RANGE	<b>RANGE</b>
SELECTED	ATTAINED
N	N

Data Readout Window

## **NOTE**

In the diagnostic mode, the ATEC ECU update rate is approximately 1½ seconds. If the transmission is shifting rapidly, it is possible that the transmission may pass through several "attained" ranges more quickly than the readout can display them. This is not a fault of either the ATEC ECU or the DDR.

- (b) In this mode, the update rate is about ¼ of a second, so the values received will be more accurate than in the normal data list mode.
- (c) Range selected readout:
  - R Reverse
  - N Neutral
  - F5 1st through 5th (Drive)
  - F4 1st through 4th (Drive)
  - F3 1st through 3rd (Drive)
  - F2 1st through 2nd
  - F1 1st
- (d) Range attained readout:
  - R2 Second reverse
  - R Reverse
  - N Neutral
  - 1C 1st converter
  - 1L 1st lockup
  - 2C 2nd converter
  - 2L 2nd lockup
  - 3C 3rd converter
  - 3L 3rd lockup
  - 4C 4th converter
  - 4L 4th lockup
  - 5C 5th converter
  - 5L 5th lockup
- (9) Custom data list. When you use your DDR to read data for an ATEC I system, it will be displayed in the same order each time because the list is fixed in the DDR's memory.
  - (a) There may be some instances when the programmed order of the data list is not convenient. For example, in order to solve a particular driveability problem, you need to look at TPS, Range SEL/ATT and Lockup RPM, all at the same time. But these three pieces of information are not together in the data list. The following text describes a method to watch all three items at the same time.
  - (b) Locate Custom Data List in the DDR Main Function menu and press ENTER.
  - (c) Once you enter the Custom Data List mode, you will be given a choice between continuing to use the standard list or creating a custom list. The default is STANDARD.

# SELECT DATA LIST DESIRED

(STANDARD) CUSTOM

Data Readout Window

- (d) Use the LEFT and RIGHT arrows to toggle to your choice and press ENTER. Refer to Steps <u>1</u> and <u>2</u> for STANDARD instructions; or Step (e) for creating a custom list.
  - If you choose STANDARD, one of two things happens. If there was no custom list already in memory, you will be returned to the menu. If a custom list is still in DDR memory, you will see:

RESET CUSTOM LIST ARE YOU SURE?

YES [NO]

Data Readout Window

- This display gives you the choice of continuing to use the existing custom list (choose NO) or creating a new custom list (choose YES). If you choose NO, you will return to the menu. If you choose YES, refer to Step (e) below. Press ENTER to confirm your choice.
- (e) Creating a custom list. You are now ready to actually create a new custom list. The available diagnostic parameter list is displayed on the bottom line, one item at a time. Use the UP and DOWN arrow keys to scroll the list.

SELECT PARAMETER
PRESS ENTER
Current line = 2
RANGE SEL/ATT

Data Readout Window

- Line 4 now automatically indexes to the next item in the data list. Notice that the number on line 3 indicates that you are ready to select the parameter you want to place on the second line of your custom list. Use the UP and DOWN arrow keys to locate RANGE SEL/ATT in the list on line 4 and press ENTER. SEL/ATT in the list on line 4 and press ENTER. RANGE SEL/ATT is now entered on the second line of your customized list. Continue this process until you have located and entered each item you want on your customized list.
- **2** Press FUNC to exit. You can now use your customized list to read data. It is also available in Snapshot.

## NOTE

If you change your mind while creating a custom list, you can use the LEFT arrow key to back up through the list. When the item you wish to change appears, simply scroll the parameter list to locate the new item and ENTER it. Also note that backing up through the list erases each item you pass through. You will have to recreate the list from the point of the change item.

(10) Snapshot. The Snapshot function permits the DDR to record data while the truck is being driven. Then the data can be played back when you return to the shop. You can use this feature to locate operating problems that would be difficult to locate by any other method. Depending on truck type and the data rate, the DDR will record over 50 minutes of data.

#### NOTE

The amount of information that can be recorded is determined by the data update rate selected. Refer to Step (11)(f) (Data update rate).

- (a) When you are using Snapshot, the DDR is continuously recording data. When the memory is filled, the oldest data is dropped and the new data is continuously added. When an operating condition occurs, the DDR puts a marker in the data recording so you can find the exact spot later during play back. We call this ability to mark data for play back a "trigger". Because driveability problems are often related to diagnostic codes, one of your choices is to use a diagnostic code as the trigger. You can choose any code, or a specific code to be the trigger. Or you can trigger the recorder yourself manually if a suspicious driveability condition occurs.
- (b) It is sometimes helpful to look at data that occurred before the operating condition happened, for instance, looking for an unnatural trend. It is also sometimes helpful to look at data that occurred after the operating condition happened. DDR allows you to decide ahead of time how much data will be retained before, as well as after, the trigger point.
- (c) When you select the Snapshot function, you will see the Snapshot menu selection readout. Choices include Quick Trigger, Trigger Set-Up, Data Update Rate and Review Snapshot.

SNAPSHOT MODE XXX FRAMES FREE SELECTIONS QUICK TRIGGER

Data Readout Window

## NOTE

The second line indicates the amount of frames of memory available to record data. Although there is no simple way to relate frames to the amount of driving time that will be recorded, generally a larger number translates into more minutes of recording time than a smaller number.

(d) Quick trigger. You will use Quick Trigger to start the snapshot process. If you are using Snapshot for the first time, selecting Quick Trigger automatically chooses the default operation. This is the manual Any Numeric Key trigger.

- (e) If you are ready to take a second or third snapshot, using Quick Trigger permits you to use the operating parameters you used before. This means you do not have to constantly reset parameters.
- (f) Trigger setup. When you choose this menu entry, you can specify what will be used as the trigger.

SELECT SNAPSHOT TRIGGER SOURCE SELECTIONS ANY NUMERIC KEY

Data Readout Window

- (g) Any numeric key. When you specify Any Numeric Key as the trigger, the DDR will place a marker in the recording at the time you press any of the numeric keys. You will probably use this trigger when you want to find the cause of a driveability problem that you can feel or hear when driving the truck. When the condition occurs, trigger the DDR by pressing any numeric key.
- (h) After entering Any Numeric Key, you will be given the opportunity to adjust the memory trigger point. Refer to Step (n) (Adjust memory trigger point).
- (i) If you choose diagnostic code as trigger source. If you decide to use a code as the trigger, you will be given two additional choices: Any Code or Specific Code.

SELECT SNAPSHOT TRIGGER SOURCE SELECTIONS ANY CODE

Data Readout Window

- (j) If you use the ENTER key to choose Any Code, the DDR will recognize any diagnostic code as the trigger. You will now be given the opportunity to adjust the memory trigger point. Refer to Step (n) (Adjust memory trigger point).
- (k) If you use the ENTER key to choose Specific Code, the DDR will give you the opportunity to specify which code you want as the trigger.

SELECT CODE CURRENT CODE [21]

**CODE 21** 

Data Readout Window

(l) The code presently chosen is enclosed in the brackets on line 2. There are two ways to choose another diagnostic code. You can input your choice with the numerical keys and press ENTER. Or you can use the UP and DOWN arrow keys to scroll the list. The code number choices appear on line 4. When you see the code you desire, press ENTER.

- (m) You will now be given the opportunity to adjust the memory trigger point. Refer to Step (n) (Adjust memory trigger point).
- (n) Adjust memory trigger point. You will get to this point, regardless of which trigger method you chose. Now you have the opportunity to determine where in memory you want the trigger.

DO YOU WISH
TO ADJUST THE MEMORY
TRIGGER POINT?
YES [NO]

Data Readout Window

(o) If you do not wish to adjust the memory trigger point, press ENTER. The Snapshot function now begins. The readout displays the message: WAITING FOR TRIGGER.

ECU A/N 16035879
DIAG CODES 21 32
TPS 128 CNTS 50 2%
WAITING FOR TRIGGER

Data Readout Window

#### NOTE

To find out what happens when the trigger occurs, refer to Step (11) (Processing trigger).

(p) If you do wish to adjust the memory trigger point, use the LEFT arrow key to toggle the indicator to YES and press ENTER. The display will now permit you to choose how much data you want retained in memory before and after the trigger point.

T INDICATES LOCATION
OF TRIGGER IN MEMORY
BEG MID END
[ T ]

Data Readout Window

(q) Use the LEFT and RIGHT arrows to move the T to the place you want the trigger to be. If you do not move the T, the DDR will continue recording data after the trigger occurs, placing the trigger in the middle of the data recorded. If you place the T at the right, the DDR will quit recording data as soon as the trigger occurs. All of the data recorded will be before the trigger point. If you place the T at the left, the DDR will continue recording data after the trigger occurs, placing the trigger at the beginning of the data recorded.

#### NOTE

- The DDR begins recording data as soon as you see WAITING FOR TRIGGER on the
  bottom line of the readout. The DDR has no way of knowing when an operating condition
  is going to occur. So, when memory is full, the oldest data is dropped to make room for
  new data, in a continuing circular process. The trigger point you select actually
  determines how long the recording continues after the trigger occurs.
- To find out what happens when the trigger occurs, refer to Step (11) (Processing trigger).
- (11) Processing trigger. While the DDR is waiting for the trigger to occur, the bottom line reads WAITING FOR TRIGGER. As soon as the trigger occurs (numeric key, any code, or specific code), the bottom line reads PROCESSING TRIGGER. This notice remains until the DDR has taken sufficient data to satisfy the trigger point location you selected.
  - (a) When the recording is completed, the display will change to permit you to play back the data recorded.

ECU A/N 16035879 DIAG CODES 21 32 TPS 128 CNTS 50 2% T=27 C=14 GO TO...

Data Readout Window

## **NOTE**

- Refer to Step (b) (Review snapshot) to learn how to interpret this display.
- Regardless of which trigger you have chosen, when PROCESSING TRIGGER is
  visible on the readout, you can terminate the recording process at any time by pressing
  a numeric key.
- (b) Review snapshot.

## **NOTE**

The Review Snapshot mode choice does NOT appear in the Snapshot menu until you have actually triggered a recording.

(c) Choose this mode to play back the data recorded.

ECU A/N 16035879 DIAG CODES 21 32 TPS 128 CNTS 50 2% T=27 C-14 GO TO...

Data Readout Window

(d) The top three lines contain data. Use the UP and DOWN arrow keys to scroll through the list.

The bottom line contains the Snapshot operating information. The letter T indicates the number of the frame that contains the trigger. The letter C indicates the number of the frame you are CURRENTLY looking at. Use the LEFT and RIGHT arrow keys to increase or decrease the number of CURRENT frame. Observe the data as you move from one frame to the next. The display will show you the changes that took place. If you want to jump immediately to a specific frame, use the numeric keys to input the desired frame number. The numbers you input will replace the dashes after the GOTO. When you press ENTER, you will jump directly to the specified frame.

#### NOTE

- If you tell the DDR to GOTO a stream number larger than the highest one stored, the dashes will reappear.
- If you plan to print out the data just recorded, write down the frame numbers of the data streams you want to print. You will need to know these frame numbers when you enter the Print function.
- (f) Data update rate. The data displayed by your DDR is updated at specified intervals. You can specify how often you want this to happen using Data Update Rate.

DATA UPDATE RATE
SELECT DELAY
THEN PRESS ENTER
CURRENT=0.0 NEW=0.0

Data Readout Window

- (g) The amount of time that elapses between updates is called the delay. This can be varied from 0.0 to 9.9 seconds. Use the numerical keys to input a NEW delay rate. When this rate is displayed, press ENTER. The DDR will return to the Snapshot menu.
- (12) Contrast adjust. Contrast refers to the darkness of the readout letters and numbers when compared with the background. Under some viewing angles and at various air temperatures, you will be able to see the readout better if you adjust contrast.

#### NOTE

If you are using the DDR in direct sunlight, the heat of the sun may affect contrast. As temperature goes up, the display may darken. If so, adjust contrast.

(a) To adjust contrast, select the Contrast Adjust function.

**DISPLAY CONTRAST** 

TO CHANGE CONTRAST
DEPRESS OR

Data Readout Window

- (b) You can change contrast by holding down either the UP or DOWN arrow key. Both keys cause the contrast to move through its entire range. You must hold the key down for several seconds. After the contrast reaches minimum, the readout will seem to disappear. This is normal. Simply keep holding the key down and the readout will return.
- (c) To exit Contrast Adjust, press the FUNC key.

#### NOTE

Each time the DDR is powered up, the contrast is automatically set at an average value.

- (13) Restart. When you select Restart and press ENTER, the DDR system restarts from the beginning (Step [2]). The copyright screen will not appear. The display will read: REQUESTING ATEC DATA. Refer to Step (2)(b) (System selection procedure) earlier in this manual.
- (14) ECU/A/N. The ATEC ECU and the calibration PROM together are identified by an 8-digit assembly number.
- (15) Diagnostic codes. When certain conditions occur, a diagnostic code will be set in one of two memory locations of the ATEC ECU. Both memory locations are displayed and the code in the left position is usually more severe to transmission operation.
- (16) TPS counts and percent (%). Throttle position sensor (TPS) monitors the position of the fuel control lever on the engine. The resulting voltage signal is converted to digital counts by the ATEC ECU. It is possible for the readout to range from 255 counts at idle to nearly 0 counts at open throttle. The throttle position count is converted by the ATEC ECU to percentage of throttle applied. It is possible for the readout to range from 0% (closed) to 100% (fully open).
- (17) Range SEL. When the truck driver operates the shift selector in the truck cab, the readout indicates the range selected. Note that this is the range selected, not necessarily the range the transmission actually attains. Also refer to Step (18) (Range ATT). The readouts include:

R - Reverse F4 - 1st through 4th (Drive)
N - Neutral F3 - 1st through 3rd (Drive)
F2 - 1st through 2nd F5 - 1st through 5th (Drive)

F1 - 1st

(18) Range ATT. In response to the driver's request for a particular range, the ATEC ECU issues commands for the transmission to shift. Due to operating conditions, the range actually attained may or may not match the range selected. Also refer to Step (17) (Range SEL). The readouts include:

R2 - Second reverse
R - Reverse
3L - 3rd lockup
N - Neutral
4C - 4th converter
1C - 1st converter
4L - 4th lockup
1L - 1st lockup
5C - 5th converter
2C - 2nd converter
5L - 5th lockup

2L - 2nd lockup

#### NOTE

In the diagnostic mode, the ATEC ECU update rate is approximately  $1\frac{1}{2}$  seconds. If the transmission is shifting rapidly, it is possible that the transmission may pass through several "attained" ranges more quickly than the readout can display them. This is not a fault of either the ATEC ECU or the DDR.

- (19) The readout displays the transmission output shaft speed (rpm) when the transmission made its last range upshift or downshift. Converter lockups are excluded. Due to the slow update rate of the ATEC ECU, be careful to match the displayed value with the proper shift. If you are not certain, use the transmission HOLD feature to inhibit unwanted shifts.
- (20) A speed sensor is located on the rear cover of the transmission to detect output shaft rpm. The readout shows actual transmission output shaft speed in revolutions per minute; the readout lower limit is 60 rpm.
- (21) The readout indicates the transmission output shaft speed (rpm) when the last converter lock-up (engage or disengage) occurred. When the converter is locked up (engaged), it provides a direct mechanical link from the engine through the converter. When the converter is not locked (disengaged), the converter pump and turbine are connected by hydraulic fluid only. Lockup rpm is generally different at closed and open throttle positions.
- (22) Oil temperature. A temperature sensor is located in the transmission sump on CLT755 transmission. It is located in the lock-up valve body assembly. High oil temperature may result from overfilling or cooling system problems. Low oil temperature may result from cold weather conditions. The readout provides both Fahrenheit (-60°F to 350°F) and Celsius (-51°C to 177°C).
- (23) FWD PRESS SW. A pressure switch in the transmission detects if the transmission has attained a forward range. The readout is ON when there is forward pressure and OFF when there is no forward pressure. Because the ATEC ECU needs input from both forward and reverse switches to determine neutral range, refer to Step (24) (REV PRESS SW). Neutral is indicated when both readings are OFF.
- (24) REV PRESS SW. A pressure switch in the transmission detects if the transmission has attained a reverse range. The readout is ON when there is reverse pressure and OFF when there is no reverse pressure. Because the ATEC ECU needs input from both forward and reverse switches to determine neutral range, refer to Step (23) (FWD PRESS SW). Neutral is indicated when both readings are OFF.
- (25) When the transmission has been placed in reverse range, the readout indicates ON as a reverse warning signal. When the transmission is shifted from reverse range, the readout displays OFF.

#### **NOTE**

Oil level and fluidic sensor systems are used to detect low oil level conditions. The readout is OFF when a low oil level condition is detected. The readout is ON when the oil level is above the low oil level detection point.

- (26) Oil lube/LVL SW. This type of oil condition indicator is fluidic. The switch is used in the PLS truck.
- (27) Retard request. On the PLS truck, an instrument panel-mounted control is used to request operation of the engine brake. The readout indicates ON when the engine brake is requested and OFF when the engine brake is not requested. Refer to Step (28) (Retard command) for further information.

- (28) Retard command. When the retard control is operated (see Step (27) Retard request) the ATEC ECU gives a command to operate the engine brake. The readout indicates YES when the retard command is given and NO when the command is not given.
- (29) Special input. This readout indicates the position of a special input switch used for certain options, ON or OFE.
- (30) Range commanded. This is the output signal to indicate that a specific gear range has been attained. The readout is YES or NO.
- (31) Input voltage. The readout indicates the voltage available to the ATEC ECU.
- e. Measurements Required for Troubleshooting.



Use proper sized test leads and ensure care is used when checking for resistance, continuity or voltage at connectors or damage to equipment may result.

- (1) Resistance measurements.
  - (a) Connect red test lead to Volt-Ohm input connector and black lead to COM input connector on meter.
  - (b) Set the function/range switch to the desired ohm 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.
  - (c) If the resistance being measured is connected to a circuit, turn ENGINE switch OFF.
  - (d) Connect 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.
  - (e) Read the resistance value on the digital display.
- (2) Continuity checks.
  - (a) Place the function/range switch in any ohm range.

### **NOTE**

Some meters show "1+m", or simply "1" when function/range switch is in any ohm position.

- (b) Connect the red test lead to the volt-ohm connector and black lead to COM input connector on the meter. When the test leads are separated or measuring an out-of-range resistance, the digital display will indicate "OL" (Over Limit).
- (c) 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 ohm symbol will appear in the upper left corner of the digital display. If contact in the wire is maintained long enough (about ¼ of a second), the OL will disappear and the resistance value of the wire or circuit will appear next to the symbol.
- (d) If your multimeter does not work in this manner, learn how it operates before performing troubleshooting.

- (3) Voltage measurements. The PLS truck is equipped with both 12 vdc and 24 vdc circuits. Troubleshooting procedures will reference 12 vdc and 24 vdc measurements, however these values can vary. When the batteries are fully charged, 12.6 vdc can be measured on an open 12 volt circuit and 14.5 vdc can be measured when the engine is running at 1000 rpm. When the batteries are fully charged, 25.2 vdc can be measured on an open 24 volt circuit and 29 vdc can be measured when the engine is running at 1000 rpm.
  - (a) Connect the red test lead to the volt-ohm input connector and the black lead to the COM input on the meter. If a DC-AC switch is present, make sure it is set to the DC position.
  - (b) 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 the truck (typically, a 200V range will do). Then reduce the range until a satisfactory reading is obtained.
  - (c) Connect the test leads to the circuit being measured. In the DDEC II 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 tube used is given in parenthesis (red is volt-ohm connection and black is the COM connection).
- f. General Relay Troubleshooting Procedures. The following general relay troubleshooting procedures apply to all PLS relays.

#### NOTE

Configuration data covering each relay is listed in Table 2-14.

- (1) Pull relay out of socket just enough for the relay terminals to make contact with receptacle terminals. Leave about 1/4 to 3/8 in. (6.35 to 9.53 mm) space between the relay and relay socket to insert a multimeter lead and make contact with the terminal listed in the troubleshooting test.
- (2) Perform truck operation that will actuate the relay in question.
- g. General Wire Test Procedures. PLS troubleshooting isolates problems down to the components that could cause a specific failure. When all of the components in a circuit are tested without isolating a fault, the wires are the only other components that could be suspected of being damaged. Each wire that must be tested may pass through two or more connectors. The following procedures provide general instructions for testing electrical wires. These procedures will either attempt to measure a voltage at the working end of a circuit or continuity from the power end of a specific wire to the working end. Before either of these tests are performed, all connectors in the circuit must be checked for looseness.



Use proper sized test leads and ensure care is used when checking for resistance, continuity or voltage at connectors or damage to equipment may result.

- (1) Wire voltage drop test.
  - (a) Disconnect connector from the component (light, relay, motor, etc.) at the working end of the circuit.
  - (b) Check connector terminal(s) for damage; repair or replace connector as necessary.
  - (c) Setup truck conditions that will create voltage at the working end of the wire.

Table 2-14. Relay Configuation Data

					nal No./W				12 vdc into Relay at	24 vdc into Relay at	Contact Position 30 to 87A and 30 to 87 at
Voltage	Relay No.	Nomenclature	30	85	86	87	87A	Coil Resistance	Terminal	Terminal	Position
12 volt	R1	Head Lts	1927	1049	1435	1017/ 1017		Position 85-86/ 85 ±15 ohms	85 30		Closed Open
12 volt	R2	Cl. Lts	1835	1920	1435/ 1435	1012/ 1017		Position 85-86/ 85 ±15 ohms	85 30		Closed Open
12 volt	R3	Horn	1026	1031	1016	1168		Position 85-86/ 85 ±15 ohms	85 30		Closed Open
12 volt	R4	Work Lt	1040	1040A	1435/ 1435	1040B		Position 85-86/ 85 ±15 ohms	85 30		Closed Open
12 volt	R5	Dimmer	1017	1017A	1435/ 1435	1007	1006	Position 85-86/ 85 ±15 ohms	85 30		Closed Open
12 volt	R6	Beacon	1413	1184	1435/ 1435	1029		Position 85-86/ 85 ±15 ohms	85 30		Closed Open
12 volt	R7	Trans	1713	508/ white	1711/ white	1839		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
12 volt	R8	Retarder	1839/ 211	213	1871/ 1871	1716/ 1714		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
12 volt	R9	Ck. Trans	1409	215	1517		1435	Position 85-86/ 85 ±15 ohms	86 30		Closed Open
12 volt	R10	Reverse	1891	214	1871/ 1871	1149		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
12 volt	R11	Neutral	1021/ 1021	231	1871/ 1871	1021A		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
24 volt	R12	24 Volt	1189	1435/ 1435	1872	1189			30	86	Closed Open

Table 2-14. Relay Configuration Data - CONT.

Voltage	Relay No.	Nomenclature	30	Termi 85	nal No./W 86	ire No. 87	87A	Coil Resistance	12 vdc into Relay at Terminal	24 vdc into Relay at Terminal	Contact Position 30 to 87A and 30 to 87 at Position
12 volt	R13	Trailer B.O. Stop	1676/ 1676	1435/ 1435	1678	1678C		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
12 volt	R14	Trailer Serv Tail	1676/ 1676	1435/ 1435	1017	1008C		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
12 volt	R15	L.H. Turn	1676/ 1676	1435/ 1435	1003	1003C		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
12 volt	R16	R.H. Turn	1676/ 1676	1435/ 1435	1004	1004C		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
12 volt	R17	Trailer B.O. Tail	1676	1435/ 1435	1680	1680C		Position 85-86/ 85 ±15 ohms	86 30		Closed Open
24 volt	R18	DDEC	1075B	1435	1872	1871				86 30	Closed Open
24 volt	R19	Trans DDEC	1867	1435/ 1435	1872/ 1872	1875				86 30	Closed Open
24 volt	R20	Interaxle	1882/ 1882	1884	1888/ 1888	1889				86 30	Closed Open
24 volt	R21	Diff Lock	1882	1885	1888	1890				86 30	Closed Open
24 volt	R22	Crane Hi Idle	510	231	1737	510				86 30	Closed Open
24 volt	R23	Hi Range Lockout	1885	1435/ 1435	1095	1885				86 30	Closed Open
24 volt	R24	T.C. Dual Mode	309	1435/ 1435	1095	315/ 313				86 30	Closed Open

#### NOTE

PLS is equipped with 12 vdc and 24 vdc circuits. The troubleshooting fault that referenced these general wire tests will provide voltage information for testing wires.

- (d) Check for the required voltage at the working end of the wire.
  - 1 If the required voltage is not measured at the working end of the wire, go to Step (e).
  - **2** If the required voltage is measured at the working end of the wire, the fault has not been isolated. Continue with the fault isolation tests or notify supervisor.
- (e) Disconnect the first connector in line from the working end of the wire to the power source.
- (f) Check for the required voltage at the working end of the wire.
  - 1 If the required voltage is not measured at the working end of the wire, go to Step (g).
  - 2 If the required voltage is measured at the working end of the wire, a fault is in the section of wire most recently disconnected. Repair the wire and perform the voltage test again.
- (g) Repeat Steps (d) and (e) until all sections of the suspect wire are tested.
- (2) Wire continuity test.
  - (a) Disconnect wire from the component (light, relay, motor, etc.) at the working end of the circuit and from the power end.
  - (b) Setup truck conditions that will create the desired circuit.
  - (c) Check continuity from power end of the wire to the working end of the wire.
    - <u>1</u> If continuity is not measured go to Step (d).
    - **2** If continuity is measured, the fault has not been isolated. Continue with the fault isolation tests or notify supervisor.
  - (d) Disconnect the first connector from the working end of the wire in line to the power source.
  - (e) Check continuity.
    - $\underline{1}$  If continuity is not measured, go to Step (f).
    - 2 If continuity is measured, a fault is in the section of the wire most recently disconnected. Repair the wire and perform the continuity test again.
  - (f) Repeat Steps (d) and (e) until all sections of the suspect wire are tested.
- (3) Wire harness shorting wires test.
  - (a) Disconnect wire harness connector with wire suspected of damage.
  - (b) Set multimeter select switch to ohms.

- (c) Connect positive (+) multimeter lead to harness connector terminal of the suspected wire.
- (d) Connect negative (-) multimeter lead to each of the other terminals in the harness connector.
  - 1 If there is continuity, the suspected wire and the wire where continuity is measured are shorting together; repair wire.
  - 2 If there is no continuity, all wires are OK.
- (4) Wire repair. Refer to Para 7-101 for the repair of wire harness connectors. Refer to TM 43-0158 for detailed instructions concerning electrical wiring repairs. Wire harness repair is limited to splicing and taping of wires at Unit Maintenance. If a wire harness cannot be repaired, notify DS Maintenance.

## 2-12. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING.

- a. Page Layout. Troubleshooting procedures are divided into logic tree pages and test pages.
  - (1) A logic tree page is always a left-hand page, facing the test page on the right. The logic tree page provides the sequence of steps required to isolate a fault to a failed component. All critical information for decision making is on the left-hand page. Each logic tree page contains the following information:
    - (a) INITIAL SETUP This box is located only on the first logic tree page of a fault. INITIAL SETUP lists tools, materials, references, personnel and equipment needed to troubleshoot the fault.
    - (b) KNOWN INFO This box is located in the top left-hand column. KNOWN INFO lists conditions and information that will eliminate specific components as the cause of the fault.
    - (c) POSSIBLE PROBLEMS This box is located directly below KNOWN INFO. All of the system components that could cause a fault are listed in the POSSIBLE PROBLEMS box. The first component listed in the POSSIBLE PROBLEMS box is the one that will be tested at that step in the logic sequence. When one of the components is tested and found to be operational, it is entered at the bottom of the KNOWN INFO box as OK.
    - (d) QUESTION Each question, located in the middle column, refers to the first possible problem listed in POSSIBLE PROBLEMS. If the answer to the question is YES, proceed to the next step. If the answer is NO, follow the NO arrow to obtain directions for correcting the problem. If the step contains a WARNING or CAUTION message, a small shadow box is printed above the question. Text for WARNINGs or CAUTIONs is on the following right-hand page.
    - (e) TEST OPTIONS This box is located in the top right-hand column. TEST OPTIONS lists tests available for testing parts suspected of failing.
    - (f) REASON FOR QUESTION This box is located directly below TEST OPTIONS. It explains the purpose for the question in the middle column.
  - (2) A test page is always a right-hand page, facing the logic tree page on the left. The test provides detailed instructions for testing the first component listed in the POSSIBLE PROBLEMS box. This test will also provide an answer for the question in the middle column. Note the arrow connecting the test on the right-hand page to the REASON FOR QUESTION. When possible, illustrations are included to provide visual details. Warnings, cautions, and notes contain additional information for testing.

## b. How to Begin Troubleshooting.

- (1) Determine the symptom or condition that indicates a problem or failure. Troubleshooting is divided into symptoms peculiar to a truck system or component, for example: air system or engine. Refer to the Troubleshooting Fault Index (Table 2-15). Follow DDEC II and DDEC III/IV Troubleshooting BEFORE going to Engine Troubleshooting.
- (2) Go to the referenced page to begin troubleshooting. Open the manual flat so both the left-hand and right-hand pages are displayed before you. The information on both pages is important to resolve the problem or failure. However, the experienced technician can follow the left-hand page instructions and refer to the right-hand page when necessary.
- (3) Follow the Diagnostic Procedure. Answer question no. 1 on the left-hand page and follow the YES or NO path to either the remedy or the next question. If necessary, look on the right-hand page for test instructions and illustrations.
- (4) Observe warnings, cautions and notes. The formatting and symbols used in this manual for warnings, cautions and notes are as follows:

WARNING

This is the symbol for a warning statement. If you see the word WARNING above a question on the left-hand page, look on the right-hand page for the text of the message. WARNINGs describe a situation which could cause severe injury or death to personnel.



This is the symbol for a caution statement. If you see the word CAUTION above a question on the left-hand page, look on the right-hand page for the text of the message. CAUTIONs describe a situation which could cause damage to equipment.

#### NOTE

This is the symbol for a note. Notes are located directly above the test to which they refer. Notes provide additional information for performing a test.

#### c. Abbreviations and Commonly Used Terms.

- (1) A/D Analog to Digital: The computer inside the DDEC ECM uses an A/D converter to convert a sensor voltage into a number with which the computer can work.
- (2) Active Codes These are the codes that currently keep the Check Engine Light on. They can only be read using the Diagnostic Data Reader.
- (3) BAT Battery.

# 2-12. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT).

- (4) CEL Check Engine Light: Mounted on the dash panel. Has two functions:
  - (a) Serves as a warning lamp to tell the driver that a problem has occurred and that the truck should be taken in for service as soon as possible.
  - (b) Serves as a light bulb check and system check. The Check Engine Light (CEL) will come on for about 5 seconds when the ENGINE switch is turned ON. If the CEL remains on, the self-diagnostics system has detected a problem. If the problem goes away, the light will go out, but the HISTORICAL trouble code will be stored in the DDEC ECM memory.
- (5) CGL Check Gages Light: Mounted on the dash, it lights to warn the driver when a potential engine damaging condition has been detected (low oil pressure, low coolant, or engine over temperature). As a light bulb check, the CGL will come on for about 5 seconds when ignition switch is placed in the ON position.
- (6) CKT Circuit.
- (7) COM Common.
- (8) DCA Diagnostic Connector Assembly: An electrical harness on the truck which allows the STE/ICE-R to be powered and to make measurements of key truck signals from a single connection. In addition to many basic electrical signals such as starter voltage and current, it includes engine speed and fuel return pressure. The STE/ICE-R can make TK measurements while connected to the DCA.
- (9) DDEC II The Detroit Diesel Electronic Controls, second generation.
- (10) DDEC III The Detroit Diesel Electronic Controls, third generation.
- (10.1) DDEC IV The Detroit Diesel Electronic Controls, fourth generation.
- (11) DDL Diagnostic Data Link: The lines (wires) over which the DDEC ECM communicates information to be read by a Diagnostic Data Reader.
- (12) DDR Diagnostic Data Reader: The hand-held tool used for troubleshooting with the DDEC (DDR or PRO-LINK 9000).
- (13) Diagnostics Troubleshooting by following an exact procedure.
- (14) DL+ Data Link, positive side. Used for communications to the Diagnostic Data Reader, as well as other applications.
- (15) DL- Data Link, negative side. Used for communications to the Diagnostic Data Reader, as well as other applications.
- (16) DREQ Diagnostic Request Terminal: The pin on the DDL connector which must be grounded to obtain diagnostic codes (pin M).
- (17) ECM Electronic Control Module: The brains of DDEC II and DDEC III/IV. It receives input from the DDEC II and DDEC III/IV sensors and switches, calculates injector firing times and duration (using a built-in computer) and fires the injectors at the appropriate times. System operates on 12 vdc with 5 vdc input to sensors and switches back to ECM.
- (18) EEPROM Electronically Erasable Programmable Read Only Memory: Contains the engine calibration.
- (19) EFPA Electronic Foot Pedal Assembly.
- (20) Erratic Intermittent.

- (21) EUI Electronic Unit Injector.
- (22) Historical Codes All codes kept in DDEC ECM memory (may not trip the CEL). These codes can be cleared by using the Diagnostic Data Reader.
- (23) OPS Oil Pressure Sensor: Monitors oil pressure at the main oil gallery.
- (24) OTS Oil Temperature Sensor: Monitors oil temperature in the turbo oil supply line.
- (25) PW Pulsewidth: The amount of time in crank degrees that the DDEC ECM is requesting the injectors to be turned on.
- (26) SRS Synchronous Reference Sensor: Detects when the first cylinder in the firing order is about to be fired.
- (27) STE/ICE-R Simplified Test Equipment for Internal Combustion Engines Reprogrammable: A testing system used for performing tests and measurements on the truck. In addition to acting as a conventional digital multimeter to measure voltage, current and resistance, it is also capable of measuring pressure, speed, compression, unbalance, engine power and some specialized battery and starter evaluations. It is powered by the truck batteries. The complete system includes a truck test meter (VTM), a transducer kit (TK), cables, transit case and technical publications. STE/ICE tests are referenced.
- (28) System A collection of devices which all are related to each other because they depend on each other to do some function or job. For example, the function of the fuel system is to inject fuel into the cylinders at the correct time in the correct amount and with the correct quantity. The collection of devices that are required to do this include the fuel pump, fuel lines, lift pump, fuel filter and injectors.
- (29) TBS Turbo Boost Sensor: Used to monitor turbo boost pressure. The sensor generates a voltage (from 0 to 5 volts) which is proportional to pressure.
- (30) Test Chain: A series of tests to be followed in a particular order or sequence (numbered).
- (31) TPS Throttle Position Sensor: Used to detect throttle position (percent of throttle).
- (32) Troubleshooting The process of making measurements and observing the operation of the truck to find out if and where any problems exist.
- (33) TRS Timing Reference Sensor: Detects whenever any cylinder is about to be fired.
- (34) VIN Vehicle Identification Number.
- (35) VTM Truck Test Meter: A box which performs the measurement and analysis functions of the STE/ICE-R system.

Table 2-15. Troubleshooting Fault Index

Fault Number	Troublesho	oting Procedure	Page Number
DDEC II TROU	JBLESHOOTI	ING (ALL CONDITIONS)	
Α	Check Engin	e Light (CEL) Comes ON And Stays ON	2-148
A1	Check Engin	e Light (CEL) ON No Historical Or Active Codes Displayed On DDR	2-150
<b>A2</b>	DDR Display	y Reads "No DDEC Data Received"	2-156
<b>A3</b>	DDR Display	y Is Blank Or Random	2-164
<b>A4</b>	DDR reads a	ctive codes and does not read any historic codes:	
	CODE 11	Vernier Control Signal Voltage Low	2-172
	CODE 12	Vernier Control Signal Voltage High	2-192
	CODE 14	Oil Temperature Sensor (OTS) Signal Voltage High	2-202
	CODE 15	Oil Temperature Sensor (OTS) Signal Voltage Low	2-210
	CODE 21	Throttle Position Sensor (TPS) Signal Voltage High	2-218
	CODE 22	Throttle Position Sensor (TPS) Signal Voltage Low	2-230
	CODE 23	Fuel Temperature Sensor (FTS) Signal Voltage High	2-244
	CODE 24	Fuel Temperature Sensor (FTS) Signal Voltage Low	2-252
	CODE 32	DDEC ECM Backup System Failure	2-260
	CODE 33	Turbo Boost Sensor (TBS) Signal Voltage High	2-264
	CODE 34	Turbo Boost Sensor (TBS) Signal Voltage Low	2-274
	CODE 35	Oil Pressure Sensor (OPS) Signal Voltage High	2-286
	CODE 36	Oil Pressure Sensor (OPS) Signal Voltage Low	2-296
	CODE 41	Timing Reference Sensor (TRS)	2-312
	CODE 42	Synchronous Reference Sensor (SRS)	2-322
	CODE 44	High Oil Temperature	2-332
	CODE 45	Low Oil Pressure	2-334

Table 2-15. Troubleshooting Fault Index (CONT).

	Fault Number	Troubleshoot	ing Procedure	Page Number
DDE	C II TROU	BLESHOOTING	G (ALL CONDITIONS) (CONT).	
	A4 (CC	ONT) CODE 46	Lovy Pottomy Voltage	2-336
			Low Battery Voltage	£-330
		CODE 51	Electrically Erasable Programmable Read-Only Memory (EEPROM) Failure (Historical Code 51 On DDR)	2-348
		<b>CODE 52/56</b>	DDEC ECM - Analog To Digital Failure	2-350
		CODE 53	Electrically Erasable Programmable Read-Only Memory (EEPROM) Failure Affecting Code Memory	2-352
		CODES 61-68	Injector Response Time Too Long	2-354
		<b>CODES 71-78</b>	Injector Response Time Too Short	2-376
	A5A	Vehicle Harnes	s +5 Volt Supply	2-382
	A5B	Engine Harness	s +5 Volt Supply	2-400
	В	Check Engine l	Light (CEL) Always OFF	2-414
	C	Normal Operat	ion of Check Engine Light (CEL) And Fault Present	2-426
	C1	CEL Normal ar	nd Historical Codes Displayed On DDR	2-428
	C2	No Data Link a	and Lamp Check OK	2-432
	D	Check Engine l	Light (CEL) And Fault Are Intermittent	2-442
	D1	CEL Erratic an	d Historical Codes Displayed On DDR	2-444
	D2	<b>CEL and Fault</b>	are Intermittent	2-448
	<b>D3</b>	<b>CEL Flashes A</b>	Valid Active Code	2-452
	<b>D4</b>	Crane High Idle	e Not Working	2-458
	<b>D5</b>	Engine Brake I	noperative	2-472
	E1	<b>Engine Cranks</b>	But Will Not Start	2-476
	E2	Check Gages L	ight (CGL) Always ON Or Always OFF	2-494
	E3	Check Gages L	ight (CGL) Always ON	2-496
	<b>E4</b>	Check Gages L	ight (CGL) Always OFF	2-502

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Number
TEC SYSTEM	M FAULT INDEX	
1.	CODE 12 Low Oil Level	2-818
2.	CODE 13 Low Battery Voltage	2-828
3.	CODE 14 Forward Pressure Switch Inoperative	2-834
4.	CODE 15 Reverse Pressure Switch Inoperative	2-842
<b>5</b> .	CODE 21 Throttle Sensor Inoperative	-850
6.	CODE 22 Speed Sensor Inoperative	-862
7.	CODE 23 Shift Selector	-870
8.	CODE 24 Oil Temperature (High Limit Exceeded)	-884
9.	CODE 32 Transmission Direction Signal	-886
10.	CODE 33 Oil Temperature Sensor Inoperative	-896
11.	CODE 34 Prom Check	-904
12.	CODES 41 Through 45 And 51 Through 53: Solenoids J, F, D, C, B, A, G, E, Or H Inoperative	-908
13.	CODE 46 Solenoid A Inoperative	-914
14.	CODE 54 A, B, C, D, F, And J Solenoid Off Test	-920
15.	CODE 69 Electronic Control Unit (ECU) Failure	-930
NGINE SYST	EM FAULT INDEX	
1.	Engine Fails To Crank	2-936
2.	Low Engine Oil Pressure (Oil Press Gage Continuously Reads Less Than 35 To 40 psi [241 To 276 kPa] At 1800 To 2100 rpm)	2-968
3.	Excessive Engine Oil Consumption	2-974
4.	Excessive Black Or Gray Exhaust Smoke (Water Temp Gage Reads Over 180°F [82°C])	2-986
<b>5.</b>	Blue Exhaust Smoke (Water Temp Gage Reads Over 180°F [82°C])	2-990
6.	White Exhaust Smoke (Water Temp Gage Reads Over 180°F [82°C])	2-994
7.	Engine Does Not Develop Full Power	2-998
8.	Engine Has No Throttle Response With No Codes or Code 22	2-1000

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Numbe
FUEL SYSTE	M FAULT INDEX	
1.	Engine Cranks But Fails To Start Or Stalls After Starting	2-1014
2.	Engine Starts But Misfires, Runs Rough, Or Lacks Power	2-1044
3.	Engine Does Not Start When Ether Starting Aid Is Used In Cold Weather	-1058
COOLING SYS	STEM FAULT INDEX	
1.	Engine Overheats (Water Temp Gage Continuously Reads Over 230°F [110°C])	-1072
2.	Engine Runs Too Cool	-1090
EXHAUST SY	STEM FAULT INDEX	
1.	Exhaust System Unusually Noisy or Vibrates Excessively During Engine Operation	-1098
ELECTRICAL	SYSTEM FAULT INDEX	
1.	All 12 And 24 VDC Circuits Do Not Operate	-1132
2.	Headlights, Clearance Lights, Horn, Work Lights, Dimmer Or Beacon Light Do Not Operate	-1140
3.	CTIS, LHS, Crane And Heater Do Not Operate	-1168
4.	Windshield Wipers, Engine Brakes And Gages Do Not Operate	-1172
<b>5.</b>	Gage(s) Giving No Or Incorrect Readings	-1178
6.	Work Light(s) Will Not Operate	-1188
7.	Instrument Lights Do Not Operate	-1204
8.	Dome Light Does Not Operate	2-1208
9.	Beacon Light Does Not Operate	2-1216
10.	Headlight(s) Do Not Operate (Low Beam)	2-1228
11.	Headlight(s) Do Not Operate (High Beam)	2-1246
12.	Taillight(s) Do Not Operate	2-1256
13.	All Turn Signals Do Not Operate	2-1266
14.	Right Rear Turn Signal Does Not Operate	2-1272

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Number
ELECTRICAL	SYSTEM FAULT INDEX (CONT).	
15.	Left Rear Turn Signal Does Not Operate	2-1282
16.	Left Front Turn Signal Does Not Operate	2-1292
17.	Right Front Turn Signal Does Not Operate	2-1300
18.	Parking Light(s) Do Not Operate	2-1310
19.	Stoplight Does Not Operate	2-1316
20.	Reverse Light Does Not Operate	2-1326
21.	Reverse Alarm Does Not Operate	2-1338
22.	Clearance, Side Marker And Id Light(s) Do Not Operate	2-1342
23.	All Blackout Lights Do Not Operate	2-1358
24.	Blackout Drive Light Does Not Operate	2-1362
25.	Blackout Stoplights Do Not Operate	2-1370
26.	Rear Blackout Clearance Or Taillight(s) Does Not Operate	2-1380
27.	Front Blackout Clearance Or Marker Light Does Not Operate	2-1390
28.	Blackout Tail, Marker And Clearance Lights Do Not Operate	2-1400
29.	Horn Does Not Operate	2-1404
30.	Windshield Washers Do Not Operate	2-1420
31.	Windshield Wipers Do Not Operate At High Or Low Speed	2-1432
32.	Windshield Wipers Do Not Operate (Low Speed)	2-1442
33.	Windshield Wipers Do Not Operate (High Speed)	2-1448
34.	Engine Brake Does Not Operate In Low	2-1452
35.	Engine Brake Does Not Operate In High	-1482
36.	Shift Controller Panel Lamps Do Not Operate	-1490
37.	Shift Controller Range LED(s) Do Not Operate	-1500

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Numbei
LECTRICAL	SYSTEM FAULT INDEX (CONT).	
38.	Trans Check Light Will Not Operate	-1504
39.	Trans Check Light Will Not Go Out	-1512
40.	Emerg Steer Light Will No Go Out	-1522
41.	Trailer Marker Lights Do Not Operate	-1528
42.	Trailer R.H. Turn Signal/Stoplight Does Not Operate	-1536
43.	Trailer L.H. Turn Signal/Stoplight Does Not Operate	-1544
44.	Trailer Blackout Taillights Do Not Operate	-1552
45.	Trailer Blackout Stoplights Do Not Operate	-1560
46.	Low Air/Hydraulic Oil Alarm Does Not Operate	-1568
47.	Low Air Warning Light Does Not Operate	-1576
48.	Low Air Light And Low Air/Hydraulic Oil Alarm Does Not Operate	-1582
49.	Heater Does Not Operate Or Will Not Change Speed	-1586
<b>50.</b>	12 And 24 Volt Systems Not Charging Or Under Charging (145 AMP)	-1600
51.	12 Volt System Over Or Under Charging (145 AMP)	-1628
52.	24 Volt System Not Charging Or Under Charging (145 AMP)	-1632
53.	24 Volt System Over Charging (145 AMP)	-1642
54.	12 And 24 Volt Systems Not Charging Or Under Charging (200 AMP)	-1648
<b>55.</b>	12 Volt System Over Or Under Charging (200 AMP)	-1666
<b>56.</b>	24 Volt System Over Or Under Charging (200 AMP)	-1670
RANSMISSIC	ON SYSTEM FAULT INDEX	
1.	Transmission Overheats (Trans Temp Gage Continuously Reads Over 220°F (104°C))	-1676
2.	Transmission Will Not Shift Into Gear, Slips Into And Out Of Gear, Or Does Not Respond To Shift Selector Key Pad	-1682
4.	Transmission Shifts Roughly	2-1688
<b>5.</b>	Automatic Shifts Occur At Too High Or Low Of A Speed	2-1694

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Number
TRANSFER C	ASE SYSTEM FAULT INDEX	
1.	Transfer Case Unusually Noisy When Operating	2-1702
2.	Transfer Case Does Not Shift Into High Or Low Or Slips Out Of Gear	2-1712
3.	Transfer Case Will Not Lockup	2-1718
DRIVESHAFT	FAULT INDEX	
1.	Driveshafts or Universal Joints Unusually Noisy When Operating	2-1728
BRAKES SYS	TEM FAULT INDEX	
1.	Parking Brakes On Axles No. 3 Through No. 5 Do Not Release	2-1742
2.	Parking Brakes On Axle No. 3 Do Not Release	2-1750
3.	Parking Brakes On Axles No. 4 And No. 5 Do Not Release	2-1762
4.	Parking Brakes On Axles No. 3 Through No. 5 Do Not Apply	2-1772
5.	Parking Brakes On Axle No. 3 Do Not Apply	2-1778
6.	Parking Brakes On Axles No. 4 And No. 5 Do Not Apply	2-1786
7.	Trailer Service Brakes Do Not Apply When Hand Control Valve Is Operated	2-1796
8.	Service Brakes On Axles No. 3 Through No. 5 Do Not Apply	2-1804
9.	Service Brakes On Axles No. 3 Through No. 5 Do Not Release	2-1812
10.	Service Brakes On Axle No. 3 Do Not Apply	2-1818
11.	Service Brakes On Axle No. 3 Do Not Release	2-1828
12.	Service Brakes On Axles No. 4 And No. 5 Do Not Apply	2-1838
13.	Service Brakes On Axles No. 4 And No. 5 Do Not Release	2-1848
14.	Service Brakes On Axles No. 1 And No. 2 Do Not Apply	2-1858
15.	Service Brakes On Axles No. 1 And No. 2 Do Not Release	-1868
16.	Truck Brakes Unevenly; Pull To One Side	-1878
17.	Excessive Braking Distance	-1884
18.	Brake Drums Overheat	-1890

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Number
AXLE NO. 3 A	IR BAG SYSTEM FAULT INDEX	
1.	Axle No. 3 Air Bag(s) Will Not Inflate	-1896
2.	One Axle No. 3 Air Bag Will Not Deflate	-1908
ENTRAL TIR	E INFLATION SYSTEM (CTIS) FAULT INDEX	
1.	One Tire Will Not Inflate or Deflate	2-1916
2.	CTIS Inoperative	2-1924
3.	All Tires On Axles No. 3 Through No. 5 Will Not Deflate	2-1938
4.	All Tires On Axles No. 1 And No. 2 Will Not Deflate	2-1952
5.	Excess Inflation Time Axles No. 1 And No. 2, CTIS Green Indicator Flashes Too Long Or Continually	2-1964
6.	Excess Inflation Time Axles No. 3 Through No. 5, CTIS Green Indicator Flashes Too Long Or Continually	2-1988
7.	Axles No. 1 And No. 2 Tire Pressures Do Not Agree With CTIS Settings	2-2012
8.	Axles No. 3 Through No. 5 Tire Pressures Do Not Agree With CTIS Settings	2-2026
9.	CTIS Does Not Automatically Inflate To The Next Higher Setting	2-2040
10.	Front Manifold Clicks Continually/Low Air Light Flashing	2-2046
11.	Rear Manifold Clicks Continually/Low Air Light Flashing	2-2102
12.	Tires On No. 1 Through No. 5 Axles Deflate Upon Completion Of Adjustment Cycle	2-2158
13.	CTIS Low Air Indicator Stays On Over 110 psi	2-2168
IR SYSTEM	FAULT INDEX	
1.	Air Pressure Buildup Is Slow	2-2184
2.	Air Dryer(s) And/Or Aftercooler Continually Purge	2-2198
3.	Compressor Fails To Unload (Air System Pressure Builds Up To More Than 129 psi (889 kPa))	2-2204
4.	Noisy Air Compressor Operation	2-2208
5.	Air Pressure Drops Rapidly After Engine Shutdown	2-2214
6.	Air Horn Will Not Operate	2-2222

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Number
_OAD HANDL	ING SYSTEM (LHS) FAULT INDEX	
1.	LHS Light Does Not Operate	2-2236
2.	LHS No Trans Light Does Not Operate	2-2258
3.	LHS Overload Light Does Not Operate	2-2282
4.	LHS Overload Light Does Not Go Out	2-2300
5.	Loss Of Supply Voltage To Main Junction Box	2-2304
6.	Loss Of Middle Frame Safe Lowering Function	2-2308
7.	Loss Of Hook Arm Safe Lowering Function	2-2324
8.	LHS Does Not Operate	2-2340
9.	Hook Arm Does Not Unload In Manual Mode	2-2362
10.	Hook Arm Does Not Load In Manual Mode	2-2382
11.	Middle Frame Does Not Unload In Manual Mode	2-2402
12.	Middle Frame Does Not Load In Manual Mode	2-2422
13.	LHS Does Not Load In Auto Mode	2-2440
14.	LHS Does Not Unload In Auto Mode	2-2458
15.	LHS Inoperative With Interface Kit Installed	2-2474
CRANE SYST	EM FAULT INDEX	
1.	No Crane Functions Work Using Remote Control	2-2518
2.	Hoist Will Not Lower Using Remote Control Unit	2-2528
3.	Hoist Will Not Raise Using Remote Control Unit	2-2546
4.	Boom Will Not Lower Using Remote Control Unit	2-2564
5.	Boom Will Not Raise Using Remote Control Unit	2-2582
6.	Boom Will Not Telescope In Using Remote Control Unit	2-2600
7.	Boom Will Not Telescope Out Using Remote Control Unit	2-2618
8.	Crane Will Not Swing CW Using Remote Control Unit	2-2636
9.	Crane Will Not Swing CCW Using Remote Control Unit	2-2654
10.	Outriggers Do Not Operate	2-2672
11.	Loss Of Crane Functions (Swing, Telescope, Boom, And Hoist)	2-2720
12.	Boom Does Not Operate	2-2750

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Number
CRANE SYST	EM FAULT INDEX (CRANE)	
13.	Telescope Does Not Operate	2-2754
14.	Hoist Does Not Operate	2-2758
15.	Crane Does Not Swing	2-2762
16.	Mast Does Not Operate	2-2766
17.	Lift And Hoist Do Not Operate Or Operate Slowly	2-2770
18.	Swing And Telescope Do Not Operate Or Operate Slowly	2-2772
19.	Crane High Idle Not Working	2-2774
SELF RECOV	ERY WINCH (SRW) SYSTEM FAULT INDEX	
1.	Self Recovery Winch (SRW) Will Not Pay In Or Out Using Control Lever	2-2816
2.	Self Recovery Winch (SRW) Will Not Pay In Or Out Using Cab Winch In/Out Switch	2-2824
3.	Self Recovery Winch (SRW) Will Not Pay In Using Cab Winch In/Out Switch	2-2828
4.	Self Recovery Winch (SRW) Will Not Pay Out Using Cab Winch In/Out Switch	2-2834
<b>5.</b>	Cable Cannot Be Free-Spooled Out From Front Or Rear Of Truck	2-2840
HYDRAULIC S	SYSTEM FAULT INDEX	
1.	Auxiliary Hydraulics (Aux Hyd) Light Does Not Operate	2-2852
2.	Crane And Winch (SRW) Do Not Operate	2-2874
3.	LHS, Winch And Crane Do Not Operate	2-2884
4.	Fan, LHS, Winch And Crane Do Not Operate	2-2894
5.	Fan Does Not Operate	2-2904
6.	Fan Speed Does Not Lower From High Speed To Low Speed	2-2908
STEERING SY	STEM FAULT INDEX	
1.	Truck Is Hard To Steer	2-2940
2.	Truck Wanders, Pulls To One Side, Or Shimmies	2-2952
3.	Excessive Play When Turning Steering Wheel	2-2962

Table 2-15. Troubleshooting Fault Index (CONT).

Fault Number	Troubleshooting Procedure	Page Number		
STEERING SYSTEM FAULT INDEX				
4.	No Response When Turning Steering Wheel	2-2966		
5.	No Response At Axle No. 5 When Turning Steering Wheel	2-2970		
AXLES SYSTI	EM FAULT INDEX			
1.	Axle Differential(s) Unusually Noisy When Operating	2-2978		
2.	Differential Side To Side Lockup Will Not Engage With CTIS In Emergency With Transfer Case In Low	2-2982		
3.	Interaxle Front To Rear Lockup Will Not Engage With CTIS In Mud, Sand And Snow	2-3004		
SUSPENSION	SYSTEM FAULT INDEX			
1.	Ride Is Rough	2-3020		
WHEELS AND	TIRES FAULT INDEX			
1.	Tires Wear Unevenly Or Excessively	2-3026		
2.	Wheel Wobbles Or Shimmies	2-3032		
ARCTIC KIT (I	MODEL A) FAULT INDEX			
1.	Arctic Kit (Model A) Water Pump Does Not Operate	2-3040		
ARCTIC HEAT	TER (MODEL B) FAULT INDEX			
	Fault Code Retrieval Device (FCRD) Operation	2-3054.2		
1.	Arctic Heater Does Not Operate (Model B)	2-3054.8		
2.	Arctic Heater Indicator Light Does Not Illuminate (Model B)	2-3054.40		
3.	Fault Chart For Diagnostic of Arctic Heater Troubleshooting (Model B)	2-3054-50		
4.	Fault Code 001, 002, 010 or 011: Advanced Warning-Overvoltage Shutdown, Advanced Warning-Undervoltage Shutdown, Overvoltage Shutdown or Undervoltage Shutdown	2-3054-60		
5.	Fault Code 012, 013, 014, 015, 037, 042 or 059: Overheating, Excessive Temperature at Flame Sensor, Possible Overheating Detected, Too Many Overheats, Water Pump Is Not Working, Water Pump Short Circuit or Water Temperature Rises Too Quickly	2-3054.74		
6.	Fault Code 043, 047 or 048: Short Circuit At External Component, Fuel Metering Pump Short Circuit or Fuel Metering Pump Open Circuit	2-3054.86		
7.	Fault Code 050, 052, 053, 054, 055 or 056: Too Many Start Attempts, No Start Safety Time Exceeded, Flame Cutout in Boost Mode, Flame Cutout In High Mode, Flame Cutout In Medium Mode or Flame Cutout In Low Mode	2-3054.98		

# Table 2-15. Troubleshooting Fault Index (CONT).

	Fault Number	Troubleshooting Procedure	Page Number		
INTE	INTERFACE SYSTEM FAULT INDEX				
	1.	Loss Of Interface Air Supply	2-3060		
	2.	Interface Kit Hydraulics Inoperative	2-3066		
	3.	Loss Of Interface Power 12 VDC	2-3108		
	4.	Loss Of Interface Power 24 VDC	2-3122		
CON	CONTAINER HANDLING UNIT (CHU) FAULT INDEX				
	1.	Main Frame Does Not Unload	2-3140		
	2.	Rotary Paddle Cylinders Do Not Operate	2-3142		
	3.	LHS Does Not Unload In CHU Mode	2-3150		
	4.	CHU Mode Switch Inoperative (Lifting Frame Contacts Rear Rollers)	2-3164		
	5.	Hook Arm Extends Too Far In CHU Mode (AUTO)	2-3176		

## 2-13. DDEC II TROUBLESHOOTING.

## **NOTE**

Ensure that wire connections 150/150 on battery A1 ground terminal, and wire connections 240/241 on battery A1 positive terminal are tight and free of corrosion before starting to troubleshoot DDEC II system. Refer to Para 7-90 and 7-91 and tighten/clean any loose or corroded wire connections.

This paragraph covers DDEC II System Troubleshooting. The DDEC II System Fault Index, Table 2-16, lists faults for the DDEC II system of the PLS truck. Refer to schematic Figure 2-1 through 2-4 when performing tests and corrective actions.

Table 2-16. DDEC II System Fault Index

Fault No.		Troubleshooting F	ault	Page
A	CHECK ENGINE LIGHT (CEL) COMES ON AND STAYS ON			2-148
	A1	Check Engine Light	(CEL) ON And No Historical Or Active Codes	
		1 0		2-150
		1 0	"No DDEC Data Received"	
		1 0	nk Or Random	2-164
	<b>A4</b>	DDR Reads Active	Codes And Does Not Read Any Historic Codes	
FLAS	SH CODES	S: SAE CODES:		
COI	DE 11	P187 4	Vernier Control Signal Voltage Low	2-172
COI	DE 12	P187 3	Vernier Control Signal Voltage High	2-192
COI	DE 14	P175 3/P110 3	Oil Temperature Sensor (OTS) Signal Voltage High	2-202
COI	DE 15	P175 4/P110 4	Oil Temperature Sensor (OTS) Signal Voltage Low	2-210
COI	DE 21	P091 3	Throttle Position Sensor (TPS) Signal Voltage High	2-218
COI	DE 22	P091 4	Throttle Position Sensor (TPS) Signal Voltage Low	2-230
COI	DE 23	P174 3	Fuel Temperature Sensor (FTS) Signal Voltage High	2-244
COI	DE 24	P174 4	Fuel Temperature Sensor (FTS) Signal Voltage Low	2-252
COI	DE 32		DDEC ECM Backup System Failure	2-260
COI	DE 33	P102 3	Turbo Boost Sensor (TBS) Signal Voltage High	2-264
COI	DE 34	P102 4	Turbo Boost Sensor (TBS) Signal Voltage Low	2-274
COI	DE 35	P100 3	Oil Pressure Sensor (OPS) Signal Voltage High	2-286
COI	DE 36	P100 4	Oil Pressure Sensor (OPS) Signal Voltage Low	2-296
COI	DE 41	S021 0	Timing Reference Sensor (TRS)	2-312
COI	DE 42	S021 1	Synchronous Reference Sensor (SRS)	2-322
COI	DE 44	P175 0/P110 0	High Oil Temperature	2-332
COI	DE 45	P100 1	Low Oil Pressure	2-334
COI	DE 46	P168 1	Low Battery Voltage	2-336
COI	DE 51		Electrically Erasable Programmable Read-Only Memory (EEPROM) Failure (Historical Code 51 On DDR)	2-348
COI	DE 52/56	S254 12/S250 12	DDEC ECM - Analog to Digital Failure	2-350
	DE 53	S253 12	Electrically Erasable Programmable Read-Only Memory (EEPROM) Failure Affecting Code Memory	2-352
COI	DES 61-68	S SXXX 0	Injector Response Time Too Long	2-354
	DES 71-78		Injector Response Time Too Short	
501			Volt Supply	
			Volt Supply	

# Table 2-16. DDEC II System Fault Index (CONT).

Fault No.	Troubleshooting Fault		Page	
В	CHECK ENGINE LIGHT (CEL) ALWAYS OFF			
C	NORMAL OPERATION OF CHECK ENGINE LIGHT (CEL) AND FAULT PRESENT			
	C1 C2	CEL Normal And Historical Codes Displayed On DDR No Data Link And Lamp Check OK	2-428 2-432	
D	CHECK ENGINE LIGHT (CEL) AND FAULT ARE INTERMITTENT			
	D1 D2 D3 D4 D5	CEL Erratic And Historical Codes Displayed On DDR CEL And Fault are Intermittent CEL Flashes A Valid Active Code Crane High Idle Not Working Engine Brake Not Working	2-448 2-452 2-458	
E NO CODES DISPLAYED ON DE		DES DISPLAYED ON DDR	2-476	
	E1 E2 E3 E4	Engine Cranks But Will Not Start Check Gages Light (CGL) Always ON Or Always OFF Check Gages Light (CGL) Always ON Check Gages Light (CGL) Always OFF	2-494 2-496	

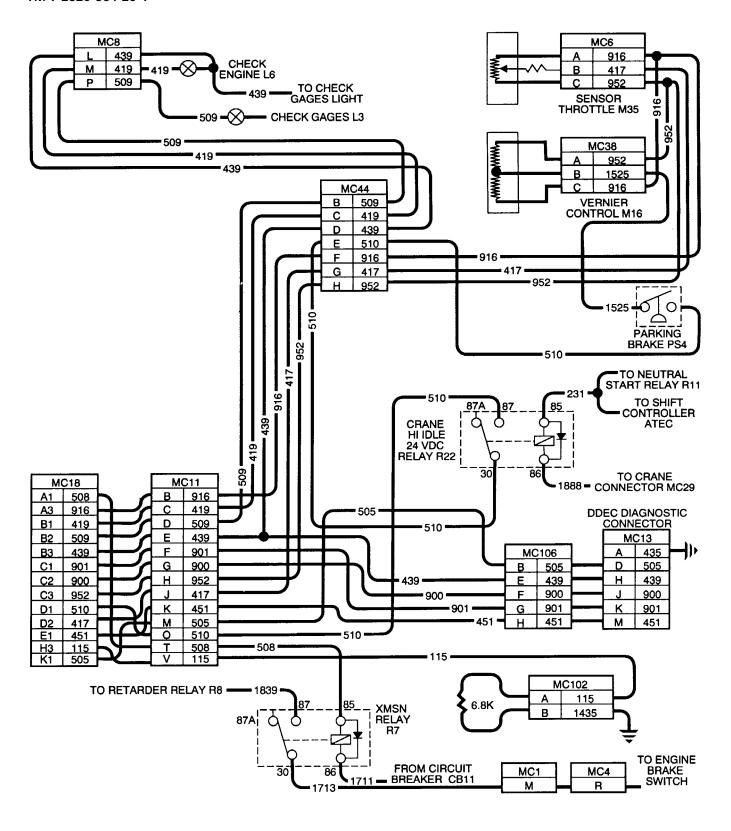


Figure 2-1. DDEC II Vehicle Harness Wiring Schematic

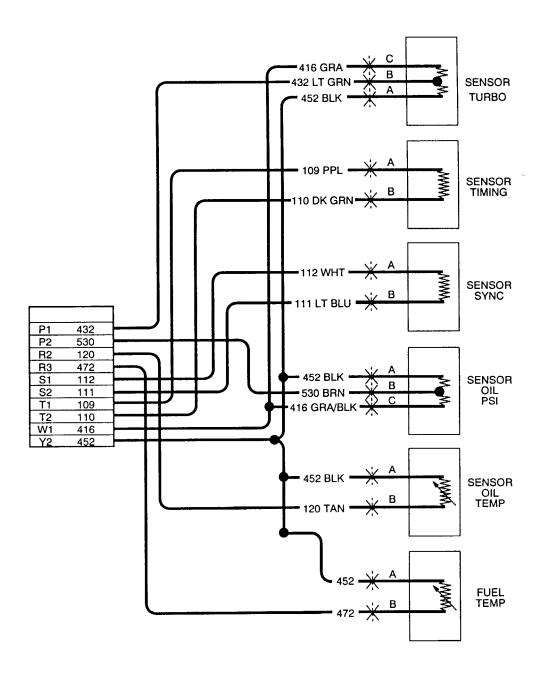


Figure 2-2. DDEC II Engine Harness Wiring Schematic

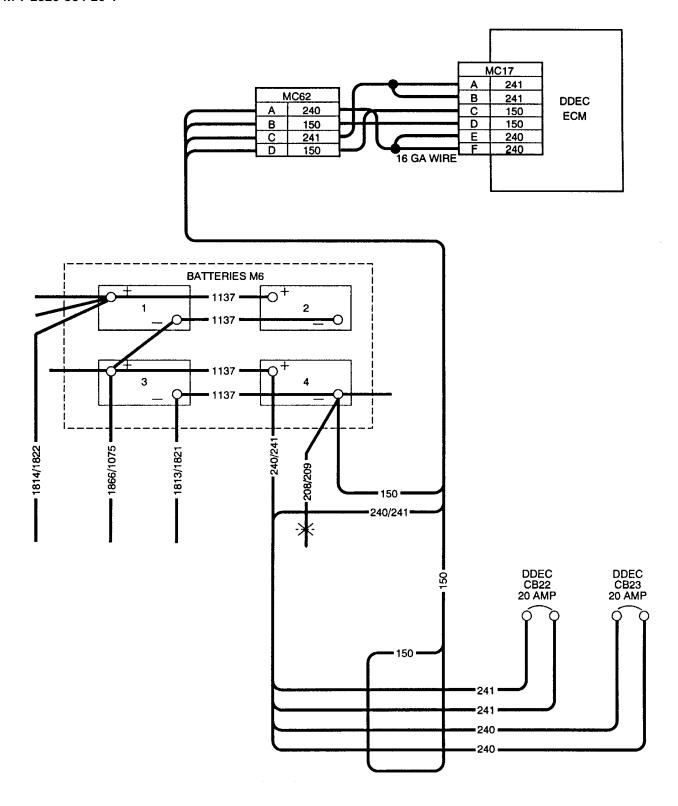


Figure 2-3. DDEC II Power Harness Wiring Schematic

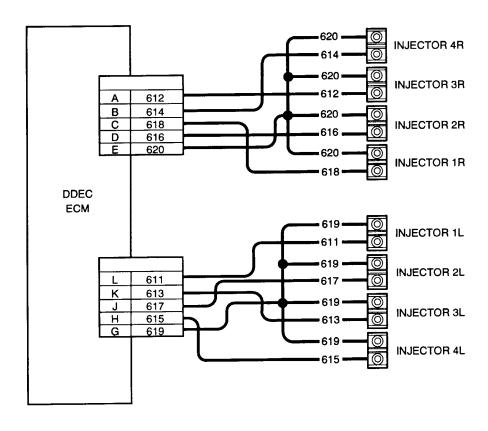


Figure 2-4. DDEC II Injector Harness Wiring Schematic

# 2-13. DDEC II TROUBLESHOOTING (CONT).

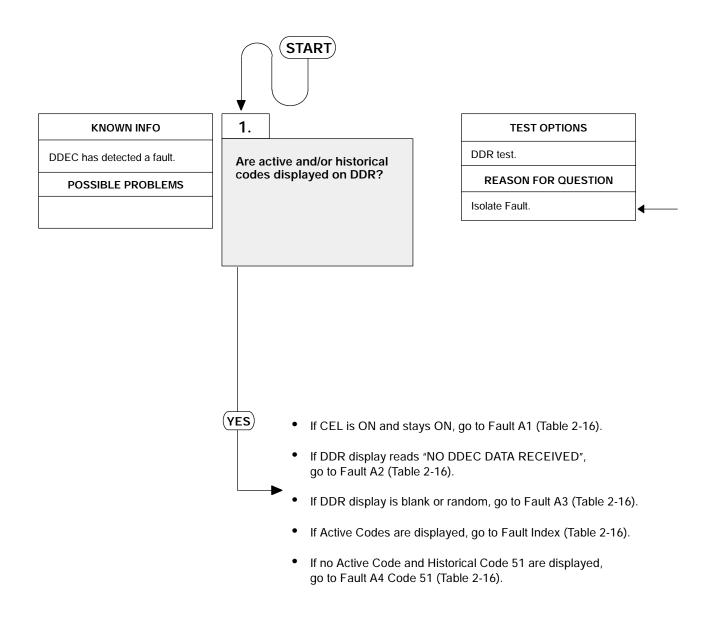
# A CHECK ENGINE LIGHT (CEL) COMES ON AND STAYS ON.

#### **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)

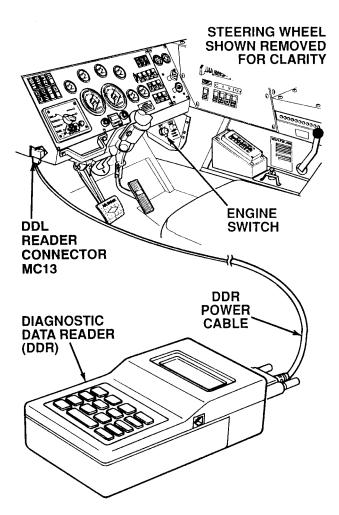


# **NOTE**

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

# **DDR TEST**

- (1) Turn OFF ENGINE switch
- (TM 9-2320-364-10). Connect DDR to DDL connector MC13.
- (3) Turn ON ENGINE switch.(4) Select MODE 01 (ACTIVE CODES) on DDR and read codes.
- Select Mode 02 (HISTORICAL CODES) on DDR and read codes.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

# A1 CHECK ENGINE LIGHT (CEL) ON AND NO HISTORICAL OR ACTIVE CODES DISPLAYED ON DDR.

# **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)
DDEC Repair Kit (Item 15, Appendix G)

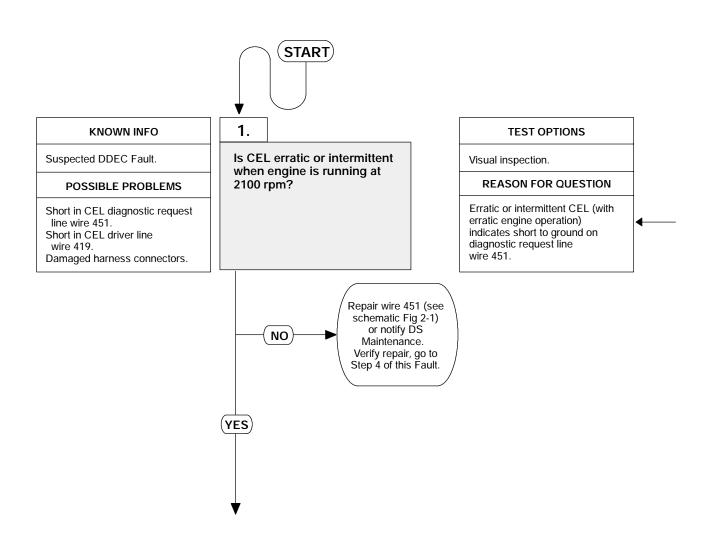
Reader, Diagnostic (Item 15, Appendix G)

References

TM 9-2320-364-10

# **Equipment Condition**

Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)
Top engine access cover opened,
(TM 9-2320-364-10)



# NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### VISUAL INSPECTION

- (1) Turn ON ENGINE switch (TM 9-2320-364-10) and observe
  - (a) If CEL lights erratically or intermittently, turn OFF ENGINE switch and repair wire 451 (see schematic Fig 2-1) or notify DS Maintenance.

- DS Maintenance.

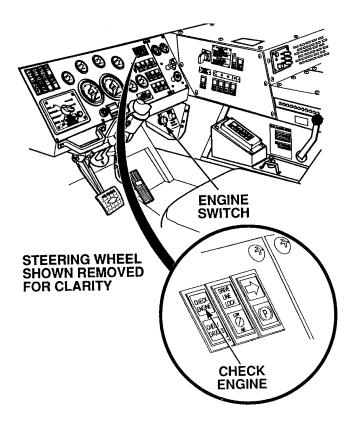
  (b) If CEL lights for five seconds and goes off, go to Step (2) below.

  (2) Start engine.

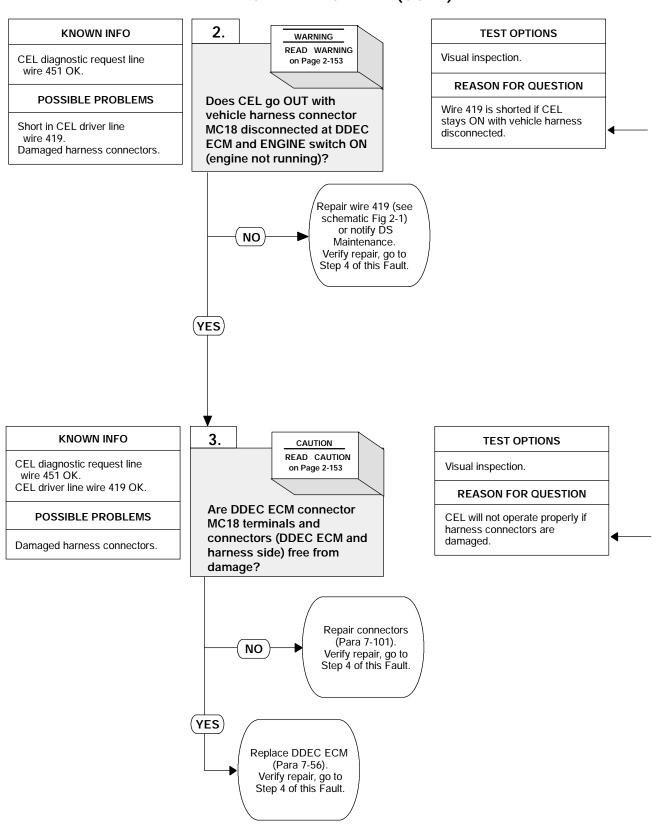
  (3) Increase engine speed to 2100 rpm and observe CEL.

  (a) If CEL lights erratically or intermittently, turn OFF ENGINE switch and repair wire 451 (see schematic Fig 2-1) or notify DS Maintenance.
- (b) If CEL goes off after five seconds and stays off after engine warms up, wire 451 is OK.

  (4) Turn OFF ENGINE switch.



# A1 CHECK ENGINE LIGHT (CEL) ON AND NO HISTORICAL OR ACTIVE CODES DISPLAYED ON DDR (CONT).



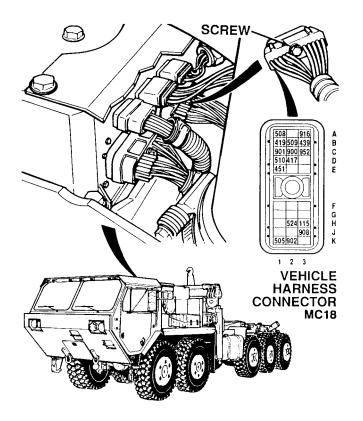
Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.

DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

## **VISUAL INSPECTION**

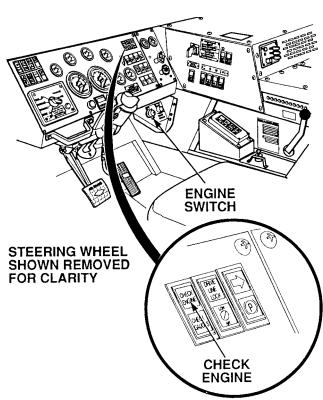
- (1) Loosen screw and disconnect vehicle harness connector MC18 from DDEC ECM.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10) and observe CEL.
  - (a) If CEL stays on, turn OFF ENGINE switch, and repair wire 419 (see schematic Fig 2-1) or notify DS Maintenance.

    (b) If CEL goes off after five seconds,
  - wire 419 is OK.
- (3) Turn OFF ENGINE switch.

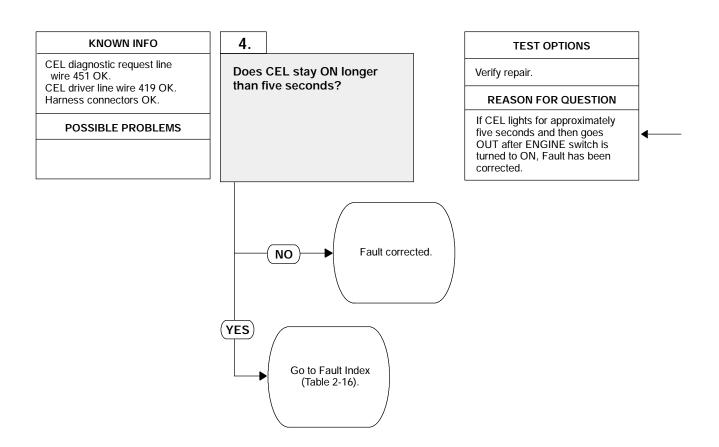


## **VISUAL INSPECTION**

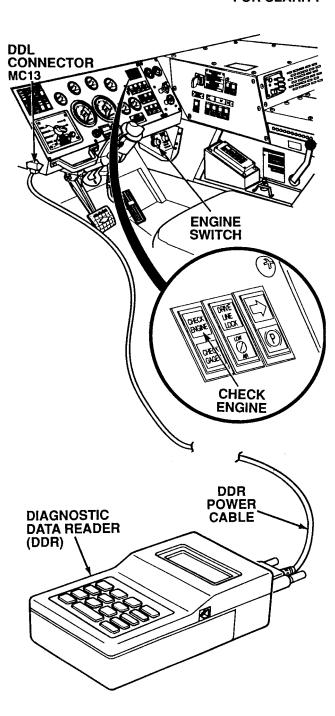
- (1) Check terminals at vehicle harness connector MC18 (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector MC18 is damaged, repair connector (Para 7-101).
  - (b) If harness connector MC18 is OK, replace DDEC ECM (Para 7-56).
  - (c) If DDEC ECM connector MC18 is damaged, replace DDEC ECM (Para 7-56).
- (2) Connect vehicle harness connector to DDEC ECM and tighten screw.
- (3) Close top engine cover.



# A1 CHECK ENGINE LIGHT (CEL) ON AND NO HISTORICAL OR ACTIVE CODES DISPLAYED ON DDR (CONT).



# STEERING WHEEL SHOWN REMOVED FOR CLARITY



#### **VERIFY REPAIR**

- (1) Connect DDR cable to DDL
- connector.
  (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Clear codes on DDR (Para 2-24).(4) If CEL does not stay ON, start engine and run for 8 minutes or until CEL
  - comes ON.

    (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected. Perform Steps (5) and (6) below.
- (b) If CHECK ENGINE light comes on and stays on, perform Steps (5) and (6) below and go to Fault Index (Table 2-16).

  (5) Turn OFF ENGINE switch.
- Disconnect DDR from DDL connector MC13.

# 2-13. DDEC II TROUBLESHOOTING (CONT).

# A2 DDR DISPLAY READS "NO DDEC DATA RECEIVED".

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G) STE/ICE-R (optional) (Item 3, Appendix G)

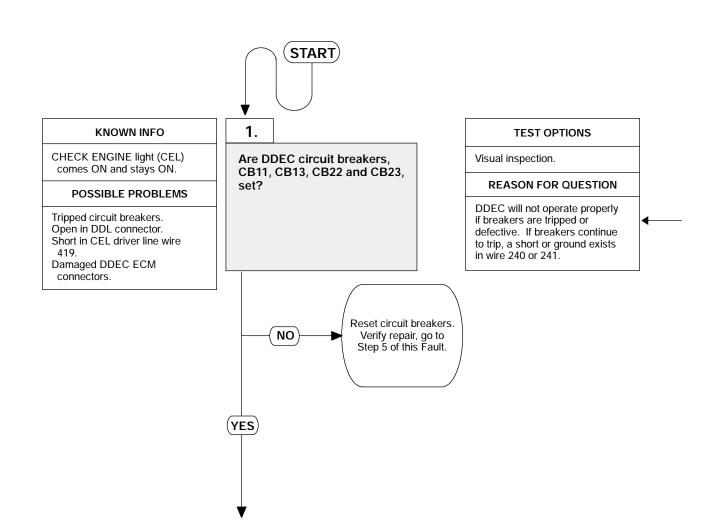
DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G) Reader, Diagnostic (Item 53, Appendix G)

References

TM 9-2320-364-10 TM 9-4910-571-12&P Equipment Condition

Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)
Top engine access cover opened,
(TM 9-2320-364-10)



# **NOTE**

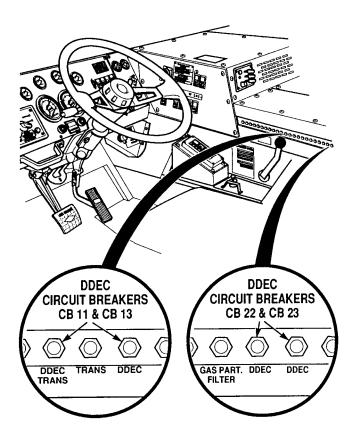
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

# VISUAL INSPECTION

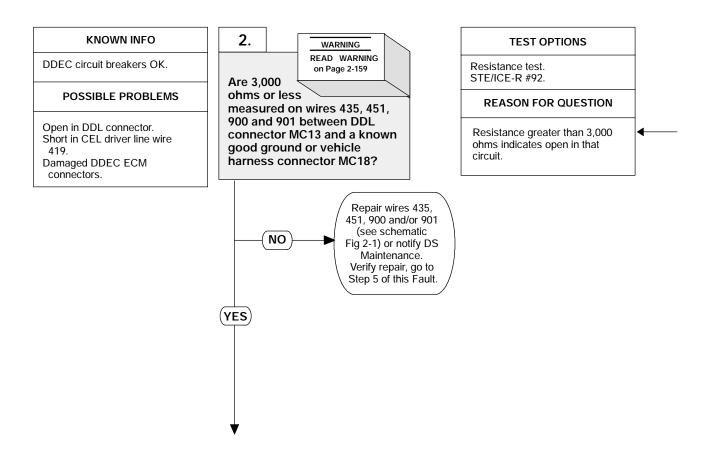
Check DDEC circuit breakers CB11, CB13, CB22 and CB23.

- (1) If any one of these circuit breakers
- are tripped, reset circuit breaker.

  (2) If none of these circuit breakers are tripped, go to Step 2 of this Fault.



# A2 DDR DISPLAY READS "NO DDEC DATA RECEIVED" (CONT).



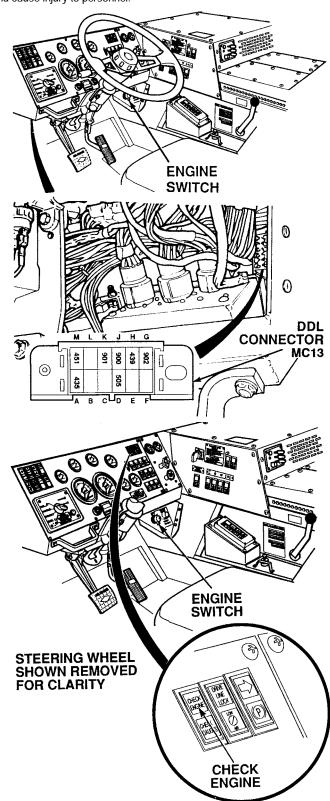
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



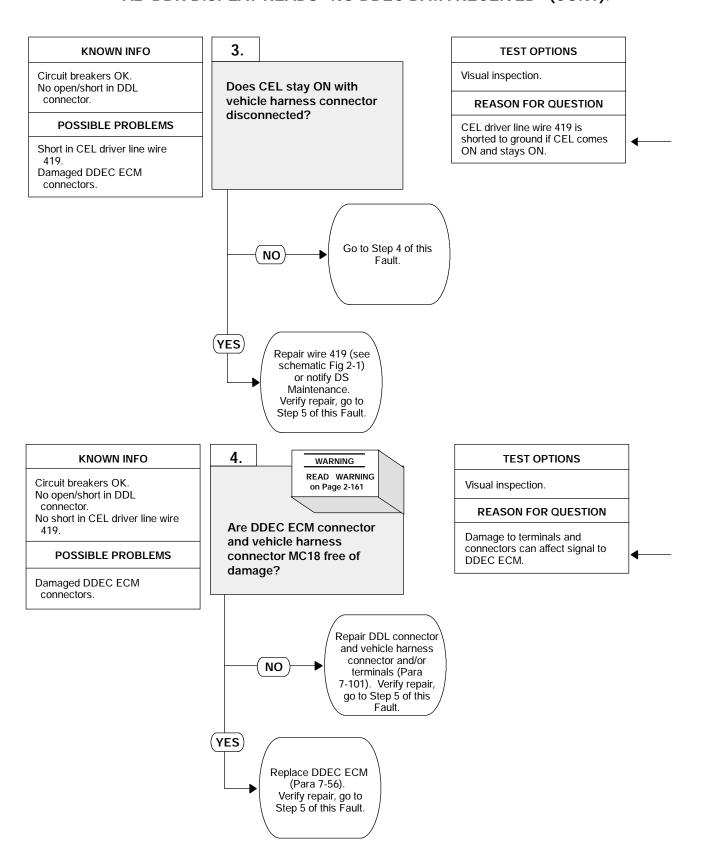
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

- Disconnect DDR cable from DDL connector.
- (2) Read resistance between wire 435 at DDL connector MC13, terminal A and a known good ground?
  - (a) If more than 3,000 ohms are present, repair wire 435 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If less than 3,000 ohms are present, go to Step (3) below.
- (3) Loosen screw and disconnect vehicle harness connector MC18 from DDEC ECM.
- (4) Are there more than 3,000 ohms present on the following wires: wire 451 between DDL connector MC13, terminal M and vehicle harness connector MC18, terminal E1.
  - wire 900 between DDL connector MC13, terminal J and vehicle harness connector MC18, terminal C2.
  - wire 901 between DDL connector MC13, terminal K and vehicle harness connector MC18, terminal C1.
  - (a) If more than 3,000 ohms are present, repair wires (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If less than 3,000 ohms are present, wires 451, 900 and/or 901 are OK.
- (5) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.



# A2 DDR DISPLAY READS "NO DDEC DATA RECEIVED" (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VISUAL INSPECTION**

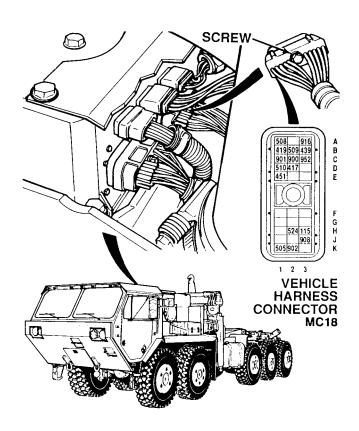
Turn ON ENGINE switch (TM 9-2320-364-10).

- If CEL comes on and stays on, turn OFF ENGINE switch and repair wire 419 (see schematic Fig 2-1) or notify DS Maintenance.
- (2) If CEL does not come on, turn OFF ENGINE switch and go to Step 4 of this Fault.

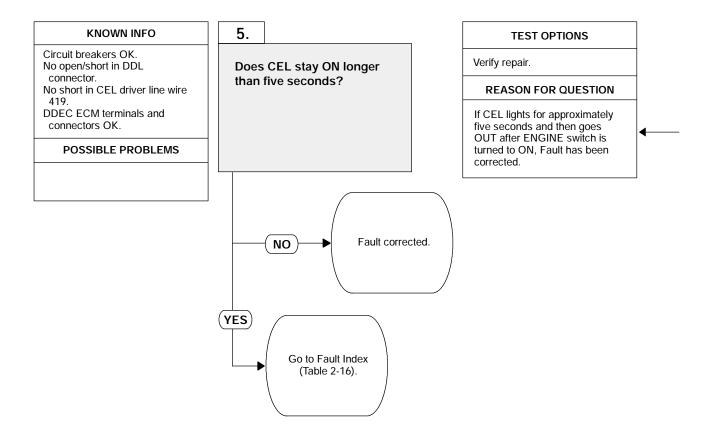
# ENGINE SWITCH STEERING WHEEL SHOWN REMOVED FOR CLARITY CHECK ENGINE

# VISUAL INSPECTION

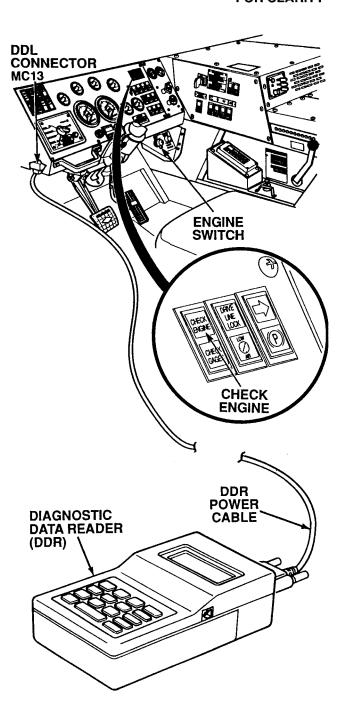
- Check terminals at vehicle harness connector MC18 (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).(c) If DDEC harness and ECM
  - (c) If DDEC harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Connect vehicle harness connector MC18 and tighten screw.
- (3) Close top engine access cover.



# A2 DDR DISPLAY READS "NO DDEC DATA RECEIVED" (CONT).



#### STEERING WHEEL **SHOWN REMOVED FOR CLARITY**



#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (2) Clear codes on DDR (Para 2-11).
  (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
  - Perform Steps (4) and (5) below.
    (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault
- Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.

# 2-13. DDEC II TROUBLESHOOTING (CONT).

# A3 DDR DISPLAY IS BLANK OR RANDOM.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

**Jumperwire** 

#### References

TM 9-2320-364-10

TM 9-4910-571-12&P

# **Equipment Condition**

Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

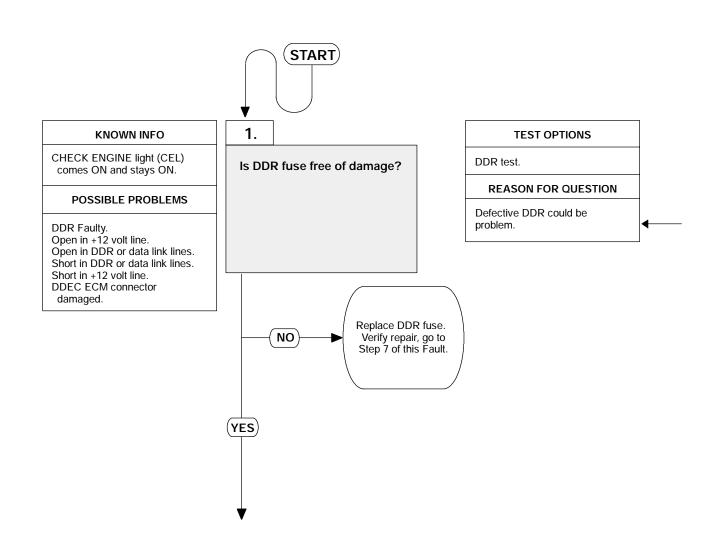
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)

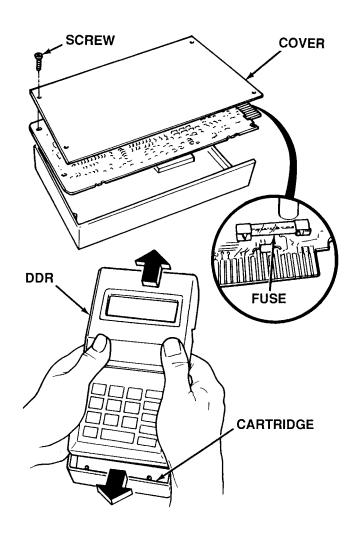
DDR disconnected from DDL connector MC13,

(Para 2-11)

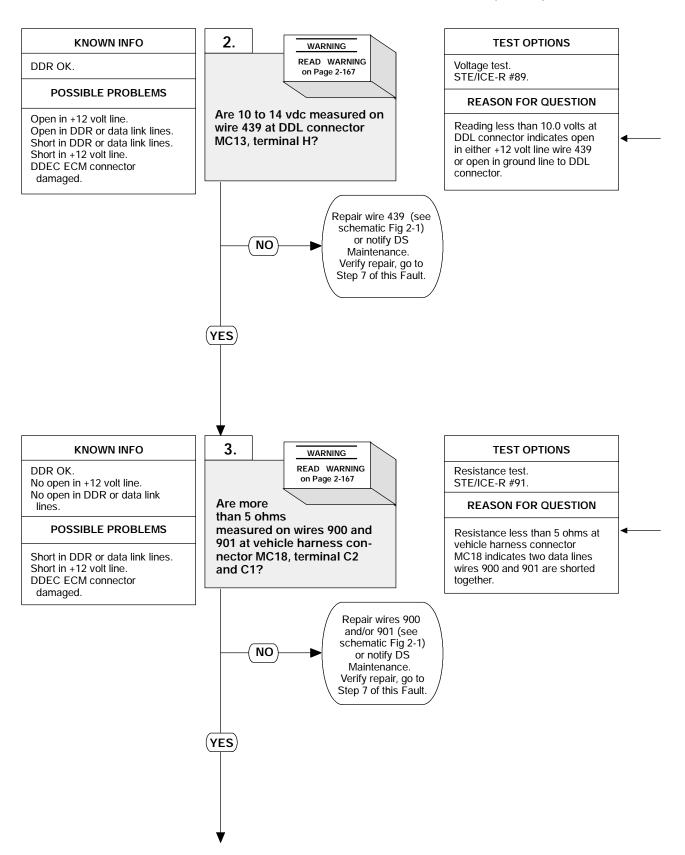


#### DDR TEST

- Hold DDR with thumbs placed against slanted surface and grasp cartridge with fingers.
   Squeeze DDR, push thumbs forward against slanted surface and slide cartridge back at the same time.
- (3) Slide cartridge from DDR.(4) Remove four screws, cover and circuit board.
- Remove fuse.
- Visually inspect fuse.
  - (a) If fuse is damaged, replace fuse and perform Steps 8 through 11.
    (b) If fuse is OK, go to Step 8 below.
- (7) Install fuse. (8) Install circuit Install circuit board, cover and four screws.
- (9) Seat cartridge flat on back of DDR.(10) Slide cartridge forward until it clicks into place.



# A3 DDR DISPLAY IS BLANK OR RANDOM (CONT).



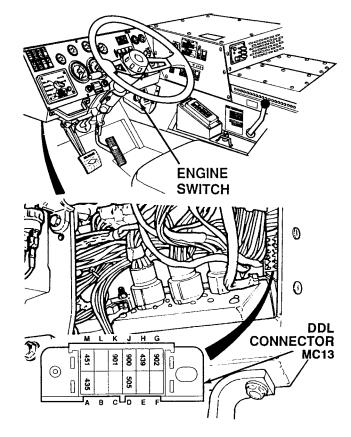
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur

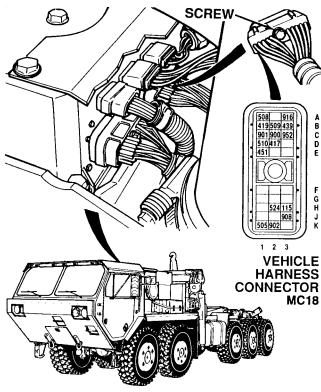
#### **VOLTAGE TEST**

- (1) Connect positive (+) multimeter lead to wire 439 on DDL connector MC13, terminal H.
- (2) Connect negative (-) multimeter lead to a known good ground.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
  - (a) If 10 to 14 vdc are not present, turn OFF ENGINE switch repair wire 439 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If 10 to 14 vdc are present, wire 439 is OK.
- (4) Turn OFF ENGINE switch.

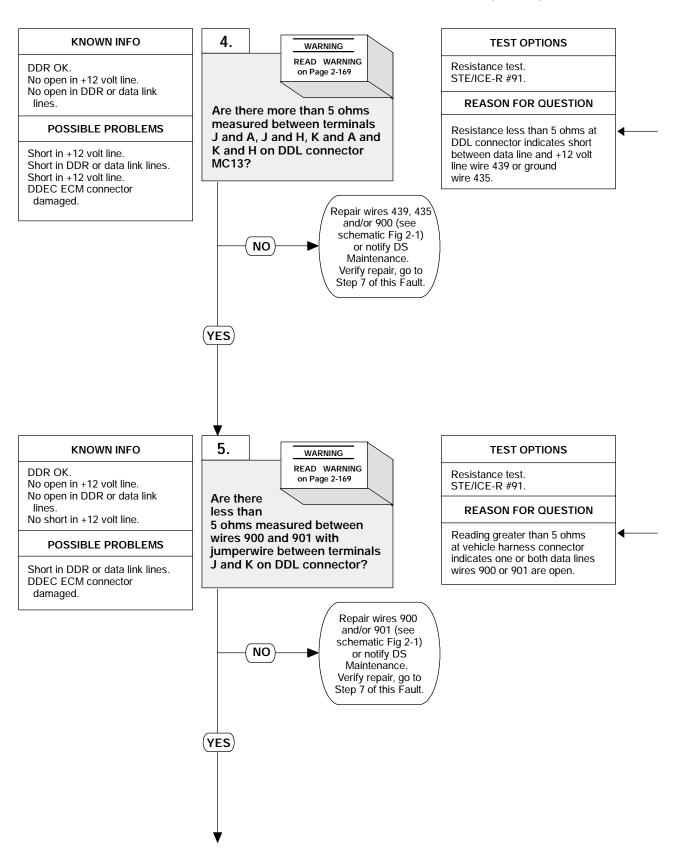
## RESISTANCE TEST

- (1) Place jumperwire between terminals J and K on DDL connector MC13.
- (2) Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (3) Read resistance between terminals C1 and C2 of vehicle harness connector MC18.
  - (a) If more than 5 ohms, repair wires 900 and/or 901 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If less than 5 ohms are present, wires 900 and 901 are OK.





# A3 DDR DISPLAY IS BLANK OR RANDOM (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

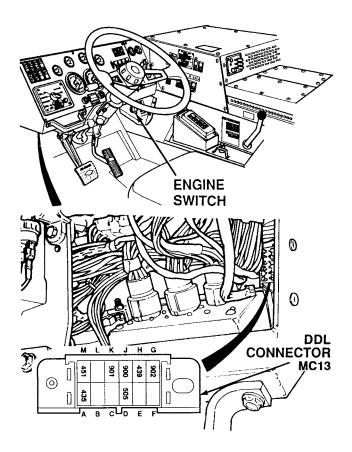
Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

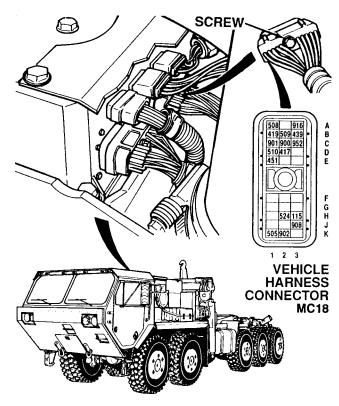
# RESISTANCE TEST

- Read resistance between terminals J and A and J and H on DDL connector MC13.
  - (a) If there are less than 5 ohms present, repair wires 435, 439 and/or 900 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are more than 5 ohms present, go to Step (2) below.
- (2) Read resistance between terminals K and A and K and H on DDL connector MC13.
  - (a) If there are less than 5 ohms present, repair wires 435, 439 and/or 901 (see schematic is 2-1) or notify DS Maintenance.
  - (b) If there are more than 5 ohms present, wires 435, 439, 900 and 901 are OK.

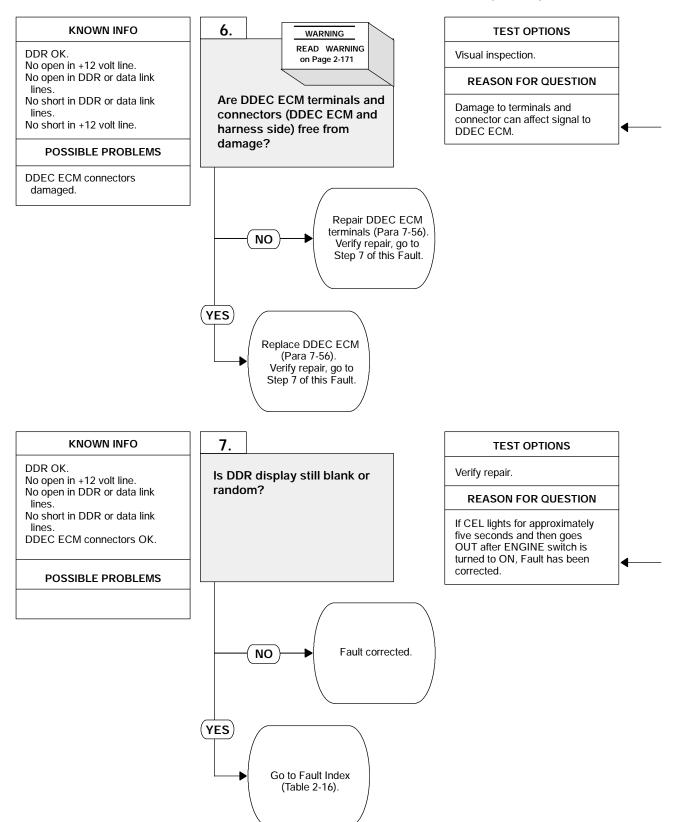
#### RESISTANCE TEST

- Read resistance between terminals C2 and C1 on vehicle harness connector MC18.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wires 900 and/or 901 (see schematic Fig 2-3).
  - (b) If there are less than 5 ohms present, wires 900 and 901 are OK.
- (2) Remove jumperwire.





# A3 DDR DISPLAY IS BLANK OR RANDOM (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting terminals.

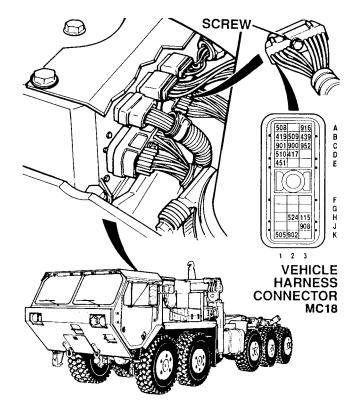
#### VISUAL INSPECTION

- Check terminals at vehicle harness connector MC18 (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56)
  - (Para 7-56).

    (c) If DDEC harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.
- (3) Close top engine access cover.

#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.
  - (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

# A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

Wrench, Torque (0 to 175 lb-ft [0-237 N·m])

(Item 95, Appendix G)

**Jumperwire** 

Materials/Parts

Compound, Corrosion Preventive

(Item 34, Appendix C)

Lockwasher (Item 168, Appendix F)

References

TM 9-2320-364-10

TM 9-4910-571-12&P

**Equipment Condition** 

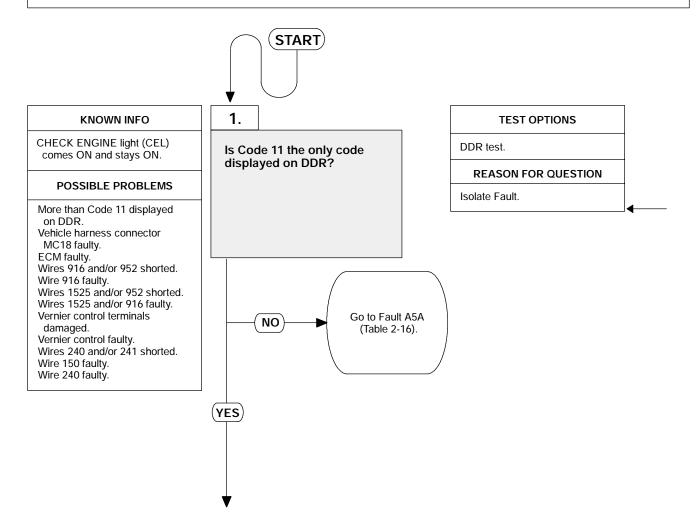
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)

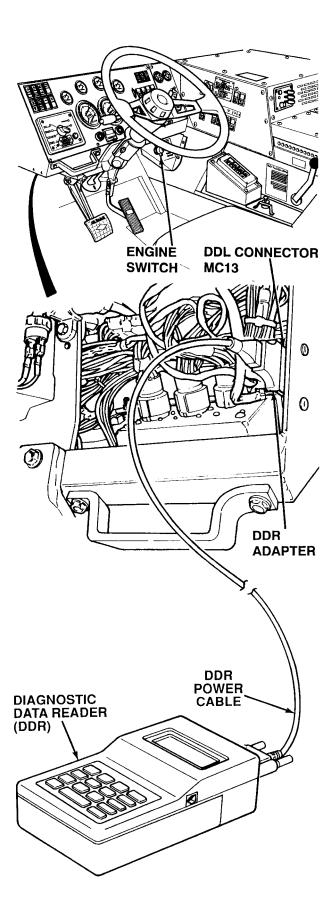


# **NOTE**

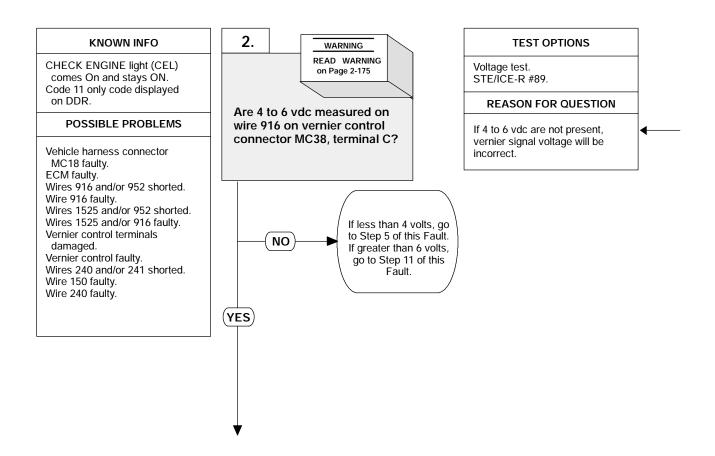
The code 11 troubleshooting procedures should only be used if DDEC Troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch (TM 9-2320-364-10). Select Mode 01 (ACTIVE CODES) on DDR.
  - (a) If Code 11 and/or 12, 21 or 22 are displayed, go to Fault A5A (Table 2-16).
    (b) If only Code 11 or no Codes are displayed, go to Step 2 of this
  - Fault.



# A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).

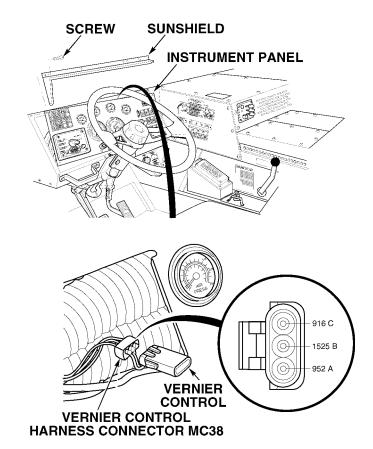


Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

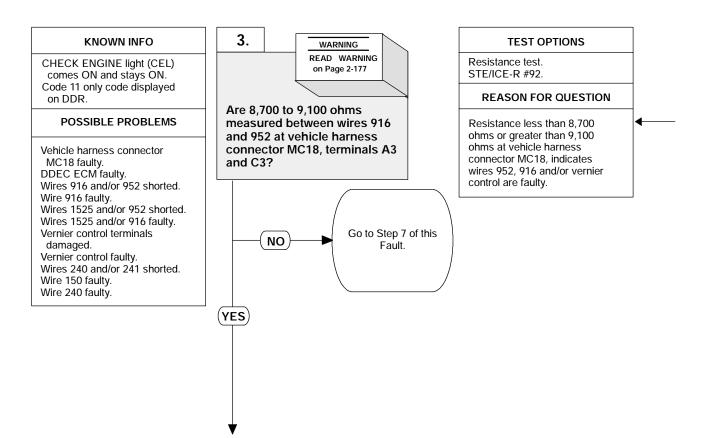
# **VOLTAGE TEST**

- (1) Remove ten screws and sunshield from instrument panel.
- Pull top of instrument panel towards steering wheel.
- Disconnect vernier control connector MC38.
- Set multimeter select switch to volts
- (5) Connect positive (+) multimeter lead to wire 916 on vernier control connector MC38, terminal C.
- Connect negative (-) multimeter lead to a known good ground.
  Turn ON ENGINE switch.
- - If less than 4 vdc are present, turn OFF ENGINE switch, and go to Step 5 of this Fault.

    If greater than 6 vdc are present,
  - (b) go to Step 6 of this Fault.
  - If there are 4 to 6 vdc present, turn OFF ENGINE switch, and go to Step 3 of this fault.



# A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).



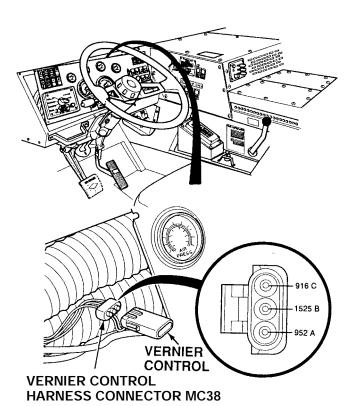
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

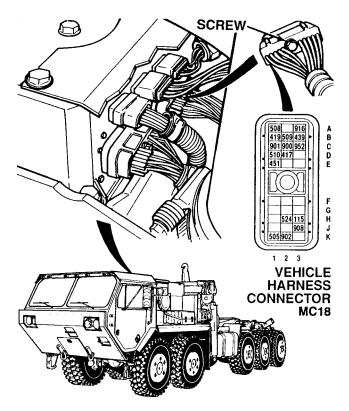


DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

- (1) Connect vernier harness connector to the vernier control.
- (2) Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (3) Read resistance between terminals A3 and C3 on vehicle harness connector MC18.
  - (a) If 8,700 to 9,100 ohms are not present, go to Step 7 of this Fault.
  - (b) If 8,700 to 9,100 ohms are present, go to Step 4 of this Fault.





# A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).

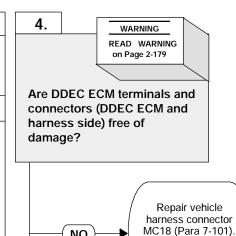
Verify repair, go to Step 12 of this Fault.

#### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. Code 11 only code displayed on DDR.

#### POSSIBLE PROBLEMS

Vehicle harness connector MC18 faulty. DDEC ECM faulty. Wires 916 and/or 952 shorted. Wire 916 faulty. Wires 1525 and/or 952 shorted. Wires 1525 and/or 916 faulty. Vernier control terminals damaged. Vernier control faulty.
Wires 240 and/or 241 shorted. Wire 150 faulty. Wire 240 faulty.

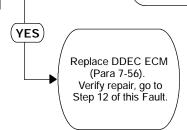


# **TEST OPTIONS**

Visual inspection.

#### **REASON FOR QUESTION**

Damaged terminals or connectors can affect signal to DDEC ECM.



NO

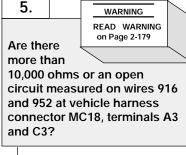
#### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. Code 11 only code displayed on DDR. Vehicle harness connector MC18 OK

DDEC ECM OK.

#### POSSIBLE PROBLEMS

Wires 916 and/or 952 shorted. Wire 916 faulty. Wires 1525 and/or 952 shorted. Wires 1525 and/or 916 faulty. Vernier control terminals damaged. Vernier control faulty. Wires 240 and/or 241 shorted. Wire 150 faulty. Wire 240 faulty.



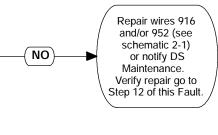
(YES)

# Resistance test. STE/ICE-R #92.

# REASON FOR QUESTION

**TEST OPTIONS** 

Resistance less than or equal to 10,000 ohms indicates vehicle +5 volt line wire 916 is shorted to the return line wire 952.



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



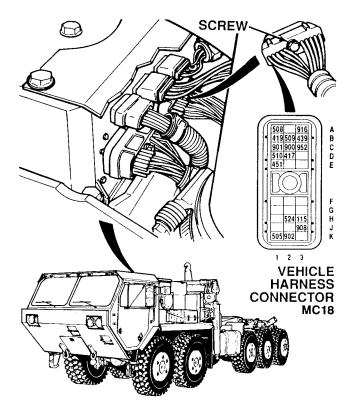
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VISUAL INSPECTION**

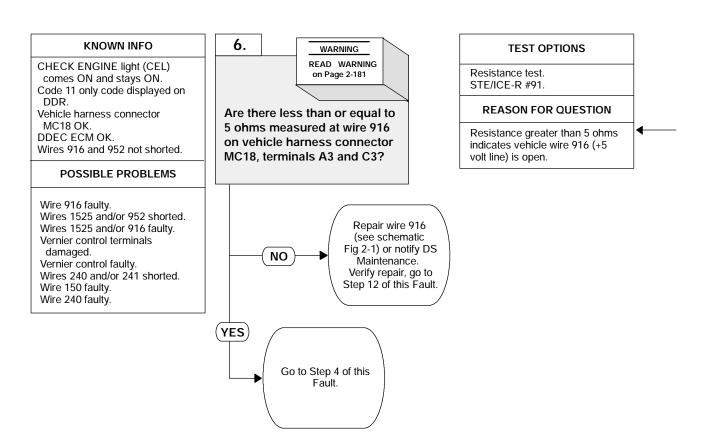
- Check terminals at vehicle harness connector MC18 (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals
  - (a) If vehicle harness connector is damaged, repair connector (Para 7-101) and perform Step (2) below.
  - (b) If DDÉC ECM connector is damaged, replace DDEC ECM (Para 7-56).
- (2) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.

#### RESISTANCE TEST

- (1) Loosen screw and disconnect vehicle harness connector MC18 from DDEC ECM.
- (2) Read resistance between terminals A3 and C3 on vehicle harness connector MC18.
  - (a) If there are less than 10,000 ohms, present, repair wires 916 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step 6 of this Fault.



# A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).



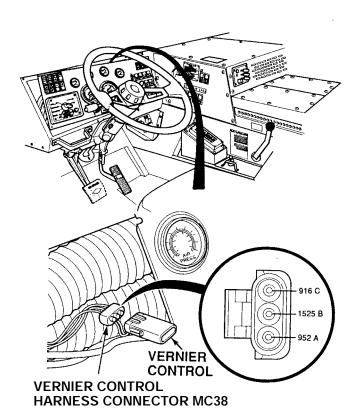
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

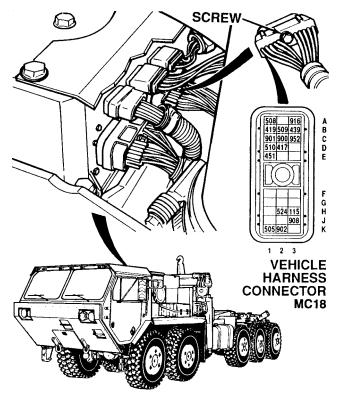
# CAUTION

- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

- Place jumperwire between terminals A and C vernier control connector MC38.
- (2) Read resistance between terminals A3 and C3 on vehicle harness connector MC18.
  - (a) If there are more than 5 ohms, remove jumperwire and repair wire 916 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are less than 5 ohms, wire 916 is OK.
- (3) Remove jumperwire.





# A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).

#### KNOWN INFO 7. **TEST OPTIONS** WARNING READ WARNING CHECK ENGINE light (CEL) Resistance test. on Page 2-183 comes ON and stays ON. STE/ICE-R #92. Code 11 only code displayed on Are there DDR. more than **REASON FOR QUESTION** Vehicle harness connector 10,000 ohms or an open MC18 OK. Resistance less than or equal to circuit between signal line DDEC ECM OK. 10,000 ohms indicates signal wires 1525 and 952 at vernier Wires 916 and 952 not shorted. line wire 1525 is shorted to control harness connector Wire 916 OK. return line wire 952. MC38, terminals A and B? POSSIBLE PROBLEMS Repair wires 1525 and/or 952, (see Wires 1525 and/or 952 shorted. Wires 1525 and/or 916 faulty. Vernier control terminals schematic 2-1) or notify DS NO damaged. Vernier control faulty. Wires 240 and/or 241 shorted. Maintenance. Verify repair go to Step 12 of this fault. Wire 150 faulty. Wire 240 faulty. (YES)

- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

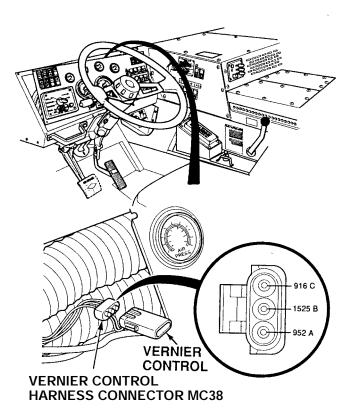


DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

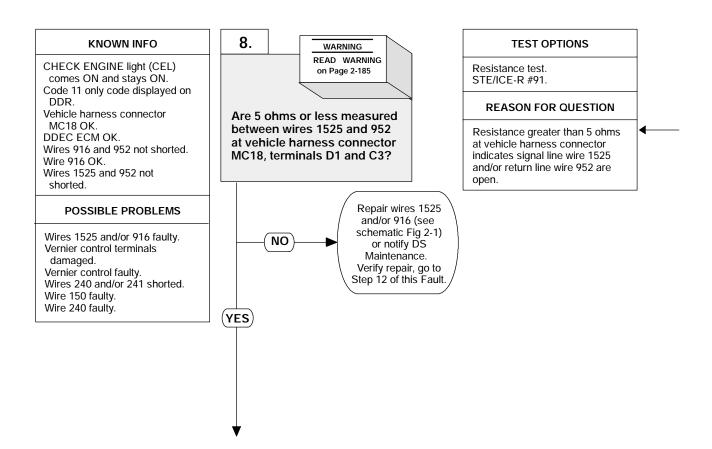
### RESISTANCE TEST

Read resistance between terminals A and B at the vernier control harness connector MC38.

- (1) If there are less than 10,000 ohms, present repair wires 1525 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
- (2) If there are more than 10,000 ohms present, go to Step 8 of this Fault.



### A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).



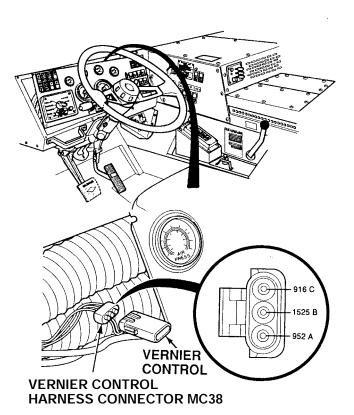
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

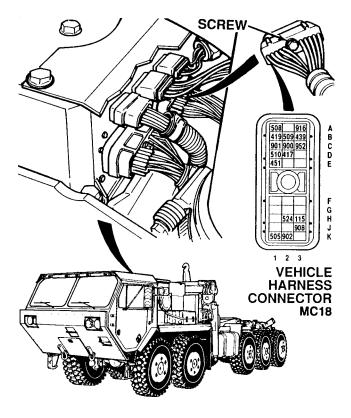
# CAUTION

- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

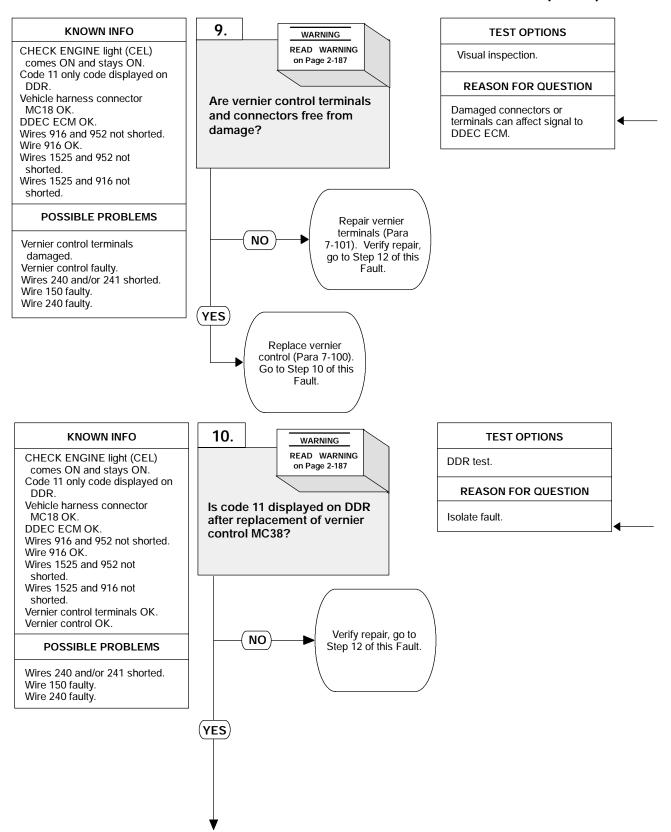
### RESISTANCE TEST

- Place jumperwire between terminals A and B of vernier control harness connector MC38.
- (2) Read resistance between terminals D1 and C3 on vehicle harness connector MC18.
  - (a) If there are more than 5 ohms, remove jumperwire and repair wires 1525 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are less than 5 ohms, wires 1525 and 952 are OK.
- (3) Remove jumperwire.





### A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).



Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

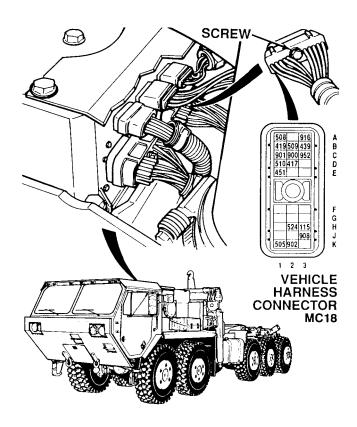
### VISUAL INSPECTION

- Check terminals at vernier control terminals and connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If terminals are damaged, repair connector (Para 7-101) and perform Step (2) below.
  - (b) If terminals are not damaged, replace vernier control (Para 7-100).
- (2) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.
- (3) Install instrument panel and sunshield with ten screws.

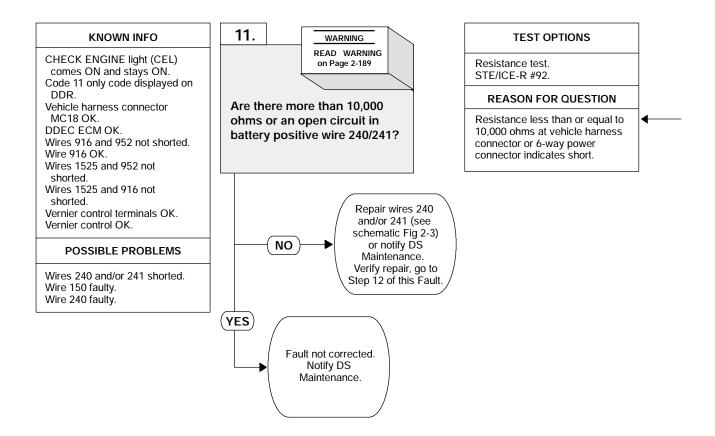
# INSTRUMENT PANEL INSTRUMENT PANEL 916 C 1525 B VERNIER CONTROL VERNIER CONTROL HARNESS CONNECTOR MC38

### **DDR TEST**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear all codes on DDR (Para 2-11).
- (3) Select MODE 01 (ACTIVE CODES) on DDR and read codes.
  - (a) If no codes appear on DDR, turn OFF ENGINE switch, and go to Step 12 of this Fault.
  - (b) If code 11 appears on DDR, turn OFF ENGINE switch, and go to Step 11 of This Fault.
- (4) Turn OFF ENGINE switch.



### A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).



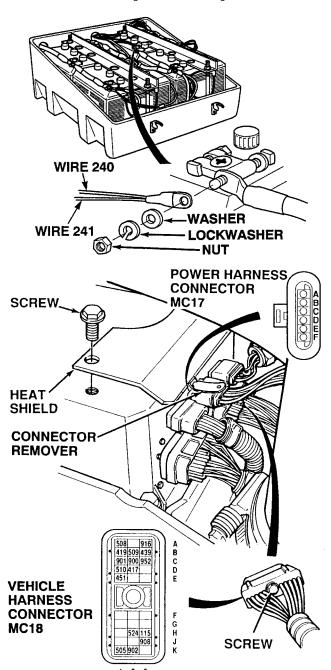
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact
  with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes
  with large amounts of water for at least 15 minutes and get immediate medical attention.

# CAUTION

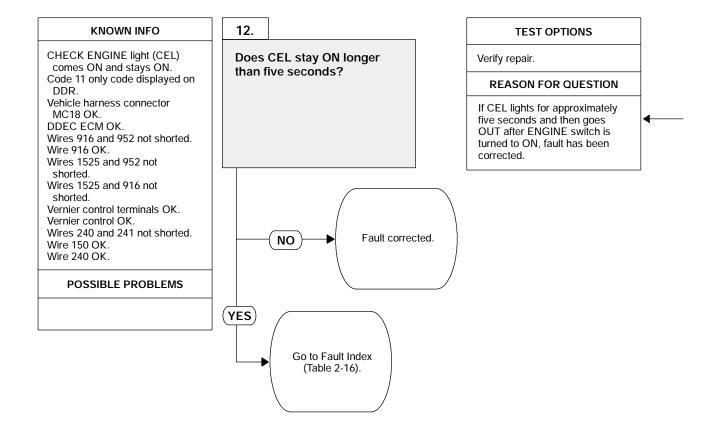
- While applying torque to nut, hold screw with wrench or damage to battery may occur.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting terminals.

### RESISTANCE TEST

- (1) Remove battery box cover.
- (2) Remove nut, washer, lockwasher, wires 240 and 241 from battery. Discard lockwasher.
- (3) Remove two screws and heatshield from DDEC ECM.
- (4) Disconnect power harness connector MC17 from DDEC ECM with connector remover.
- (5) Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (6) Are there more than 10,000 ohms present between terminals D1 and B3 at vehicle harness connector MC18.
  - (a) If less than 10,000 ohms are present, repair wires 240 and/or 241 (see schematic Fig 2-3) or notify DS Maintenance and perform Steps (8) through (15) below.
  - (b) If more than 10,000 ohms are present, go to Step (6) below.
- (7) Are there less than 10,000 ohms present on the following wires:
  - wire 150 between power connector MC17, terminal C and vehicle harness connector MC18, terminal D1
  - wire 150 between power connector MC17, terminal D and vehicle harness connector MC18, terminal D1
  - wire 240 between power connector MC17, terminal E and vehicle harness connector MC18, terminal D1
  - wire 240 between power connector MC17, terminal F and vehicle harness connector MC18, terminal D1
  - (a) If less than 10,000 ohms are present, repair wires (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If more than 10,000 ohms are present, perform Steps (8) through (15) below.
- (8) Connect power harness connector C17 to DDEC ECM.
- (9) Connect vehicle harness connector MC18 to DDEC ECM.
- (10) Install heatshield with two screws.
- (11) Connect wires 240 and 241 to battery with washer, lockwasher and nut.
- (12) Tighten nut to 23 lb-ft (31 N m).
- (13) Apply corrosion preventive compound on nut.
- (14) Install battery box cover.
- (15) Close top engine access cover.



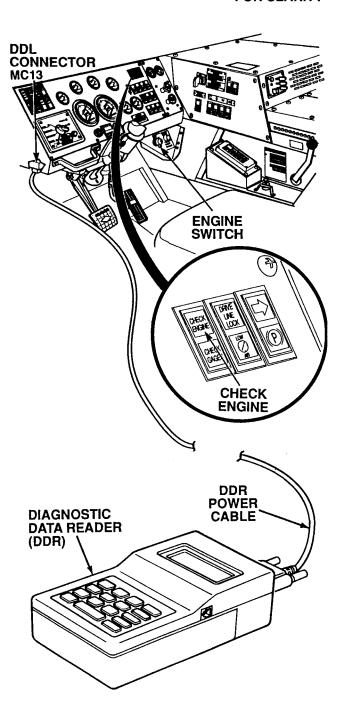
### A4 CODE 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT).



### STEERING WHEEL **SHOWN REMOVED FOR CLARITY**

# **VERIFY REPAIR**

- (1) Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (2) Clear codes on DDR (Para 2-11).
  (a) If CHECK ENGINE light comes on
  - for about five seconds and then goes off, fault has been corrected. Perform Steps (3)
- corrected. Perform Steps (3)
  and (4) below.
  (b) If CHECK ENGINE light comes on
  and stays on, perform Steps (3)
  and (4) below and go to Fault
  Index (Table 2-16).
  (3) Turn OFF ENGINE switch.
- (4) Disconnect DDR from DDL connector MC13.



### 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 12 VERNIER CONTROL SIGNAL VOLTAGE HIGH.

### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G) STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)
Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G) Jumperwire

References

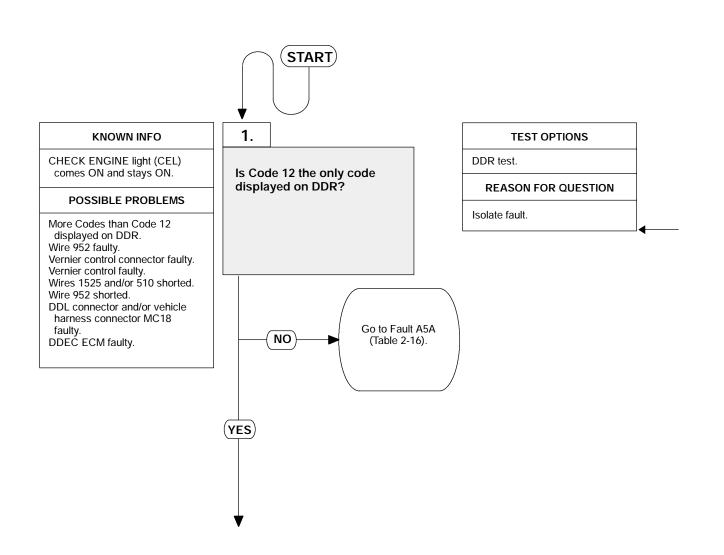
TM 9-2320-364-10 TM 9-4910-571-12&P **Equipment Condition** 

Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened, (TM 9-2320-364-10)

Hydraulic selector switch in CRANE/SRW position, (TM 9-2320-364-10)

CRANE/SRW switch in CRANE position, (TM 9-2320-364-10)



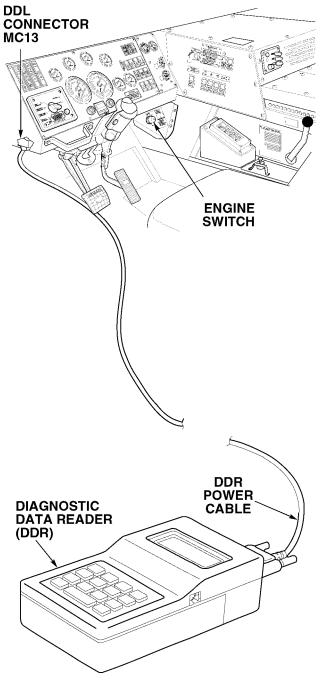
### **STEERING WHEEL** SHOWN REMOVED **FOR CLARITY**

## **NOTE**

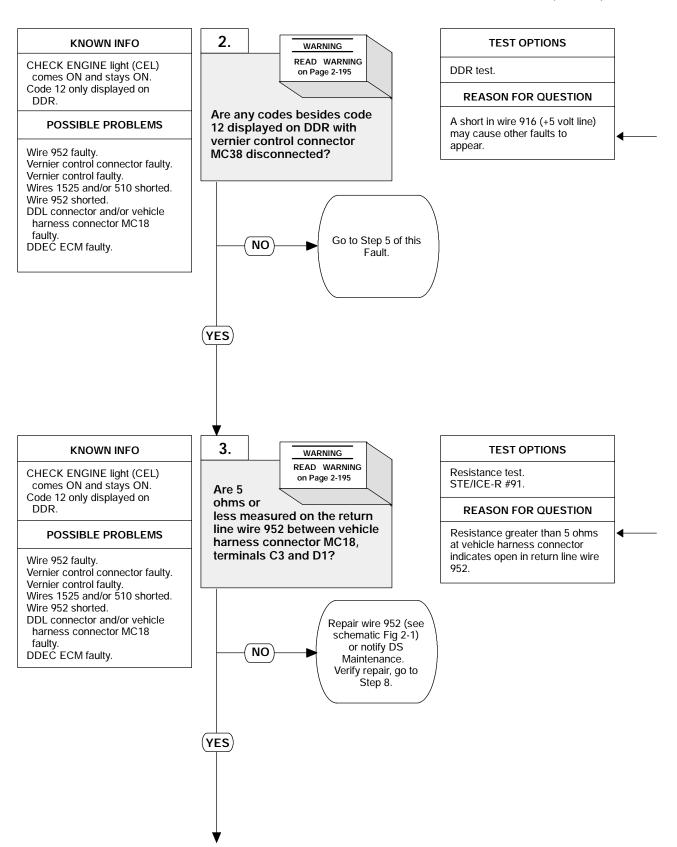
The following steps should only be used if Troubleshooting was started at DDEC II
Troubleshooting (All Conditions) and you were referred here.

### DDR TEST

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10). (3) Select MODE 01 (ACTIVE CODES)
  - (a) If there are more than Code 12 on DDR display, turn OFF ENGINE switch and go to Fault A5A (Table 2-16).
  - (b) If there are not more codes than Code 12, turn OFF ENGINE switch and go to Step 2 of this



### A4 CODE 12 VERNIER CONTROL SIGNAL VOLTAGE HIGH (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury, or death to personnel may occur.

### **DDR TEST**

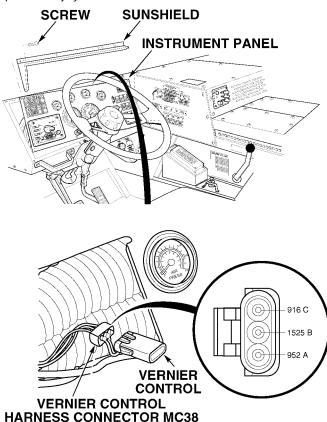
- (1) Remove ten screws, sunshield and tilt instrument panel.
- Disconnect vernier control harness connector MC38.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
- (4) Select MODE 01 (ACTIVE CODES) on DDR and read codes.
  - (a) If code 12 is only code displayed, turn OFF ENGINE switch and go to Step 5 of this Fault.
  - (b) If other codes are displayed, turn OFF ENGINE switch and go to Step 3 of this Fault.

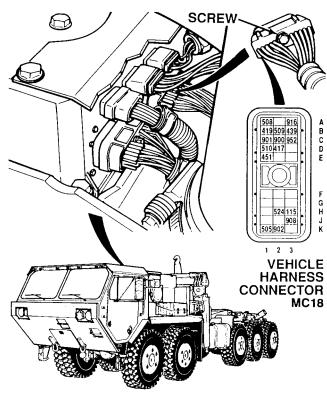
# CAUTION

- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

### RESISTANCE TEST

- Place jumperwire across terminals A and B of vernier control harness connector MC38.
- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
- (4) Turn on crane power switch and latch high idle.
- (5) Read resistance between terminals C3 and D1 on the vehicle harness connector MC18.
  - (a) If more than 5 ohms are present, perform Steps (6) and (7) below and remove jumperwire and repair wire 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If less than 5 ohms are present, wire 952 is OK, remove jumperwire and perform Steps (6) and (7) below.
- (6) Turn OFF ENGINE switch and crane power switch.
- (7) Connect vehicle harness connector MC18 and tighten screw.





### A4 CODE 12 VERNIER CONTROL SIGNAL VOLTAGE HIGH (CONT).

### 4. **KNOWN INFO TEST OPTIONS** CHECK ENGINE light (CEL) Visual inspection. comes ON and stays ON. Are vernier control Code 12 only displayed on connectors and/or REASON FOR QUESTION DDR. terminals OK? Wire 952 OK. Damaged connectors can affect POSSIBLE PROBLEMS signal to vernier control. Vernier control connector faulty. Vernier control faulty. Wires 1525 and/or 510 shorted. Wire 952 shorted. DDL connector and/or vehicle harness connector MC18 Repair vernier control DDEC ECM faulty. connectors NO (Para 7-101). Verify repair, go to Step 8 of this Fault. YES Replace vernier control (Para 7-100). Verify repair, go to Step 8 of this Fault. 5. **KNOWN INFO TEST OPTIONS** WARNING READ WARNING CHECK ENGINE light (CEL) Voltage test. on Page 2-197 comes ON and stays ON. STE/ICE-R #89. Code 12 only displayed on REASON FOR QUESTION DDR. Wire 952 OK. Is there less than 1.0 vdc Vernier control connector OK. between vernier control Greater than 1.0 vdc at harness Vernier control OK. connector indicates signal line harness connector MC38, wires 1525 or 510 are shorted to terminals B and A? vehicle wire 916 (+5 volt line) or POSSIBLE PROBLEMS another voltage source. Wire 952 shorted. Wires 1525 and/or 510 shorted. Repair wires 1525 and/or 510 (see DDL connector and/or vehicle harness connector MC18 schematic Fig 2-1) faulty. or notify DS NO DDEC ECM faulty. Maintenance. Verify repair, go to Step of 8 of this Fault (YES)

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

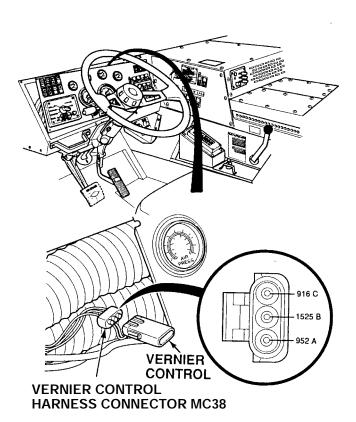
### **VISUAL INSPECTION**

Check terminals at vernier control harness connectors (connector and harness side) for damage; bent, corroded and unseated pins or terminals.

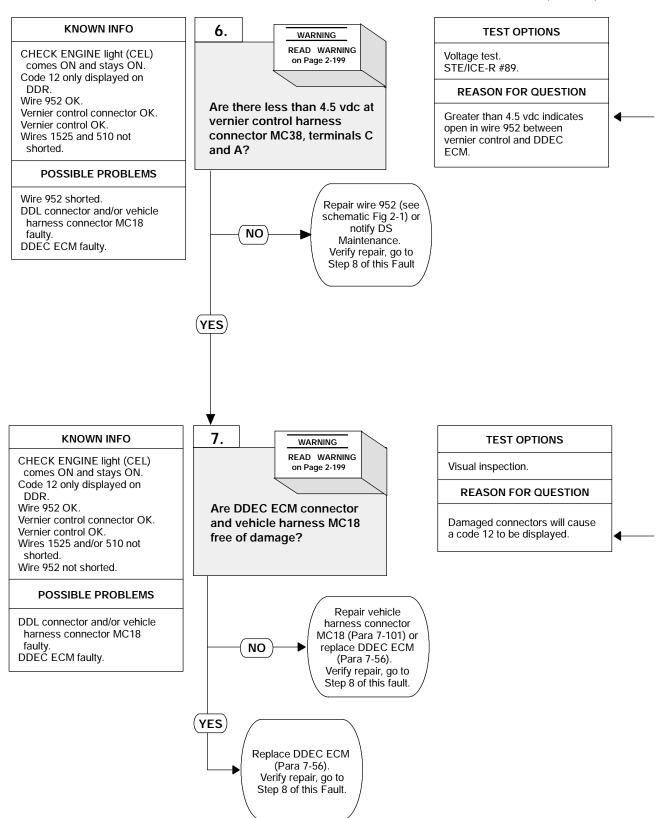
- If harness connectors are damaged, repair connectors (Para 7-101).
- If harness connectors are OK, replace vernier control (Para 7-100).

### **VOLTAGE TEST**

- (1) Set multimeter select switch to volts dc.
- Connect positive (+) multimeter lead to vernier control harness connector MC38, terminal A.
- (3) Connect negative (-) multimeter lead to vernier control harness connector MC38, terminal B.
- (4) Turn ON ENGINE switch (TM 9-2320-364-10).
- (5) Turn on crane power switch and latch high idle.
  - (a) If there is 1.0 vdc or more present, turn OFF ENGINE switch and repair wires 916, 1525 and/or 510 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If less than 1.0 vdc is present, wires 916, 1525 and 510 are OK.
- (6) Turn OFF ENGINE switch and crane power switch.



### A4 CODE 12 VERNIER CONTROL SIGNAL VOLTAGE HIGH (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

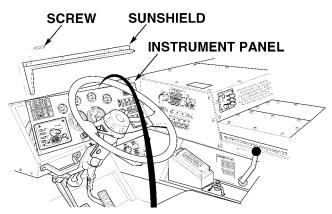
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

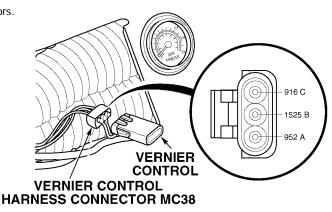
### **VOLTAGE TEST**

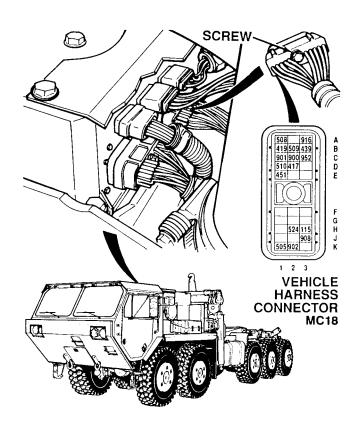
- Connect positive (+) multimeter lead to vernier control harness connector MC38, terminal A.
- (2) Connect negative (-) multimeter lead to vernier control harness connector MC38, terminal C.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
  - (a) If there are 4.5 vdc or more present, turn OFF ENGINE switch and repair wire 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are less than 4.5 vdc present, wire 952 is OK.
- (4) Connect vernier control harness connector MC38.
- (5) Install instrument panel and sunshield with ten screws.
- (6) Turn OFF ENGINE switch.

### **VISUAL INSPECTION**

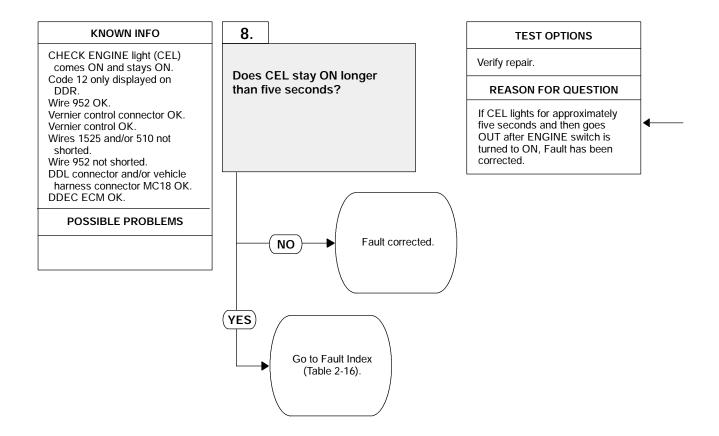
- Loosen screw and disconnect vehicle harness connector MC18 from DDEC ECM.
- (2) Check terminals at vehicle harness connector MC18 (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101) and perform Steps (3) through (5) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).(c) If DDEC harness and ECM
  - (c) If DDEC harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (3) Connect vehicle harness connector MC18 and tighten screw.
- (4) Install instrument panel and sunshield with ten screws.
- (5) Close top engine access cover.







### A4 CODE 12 VERNIER CONTROL SIGNAL VOLTAGE HIGH (CONT).

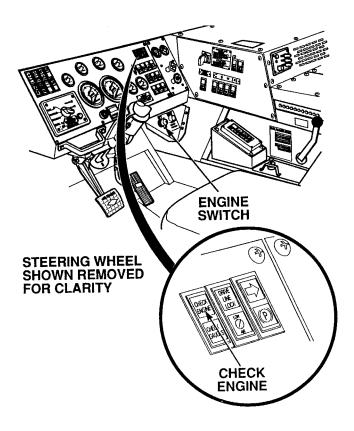


### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).
  (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL
  - comes ON.

    (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
    Perform Steps (4) and (5) below.

    (b) If CHECK ENGINE light comes on and stays on, perform to Epsilon.
- and (5) below and go to Fault Index (Table 2-16). (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



### 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 14 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE HIGH.

### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Jumperwire

Materials/Parts

Lockwasher (22) (Item 195, Appendix F)

References

TM 9-2320-364-10

TM 9-4910-571-12&P

**Equipment Condition** 

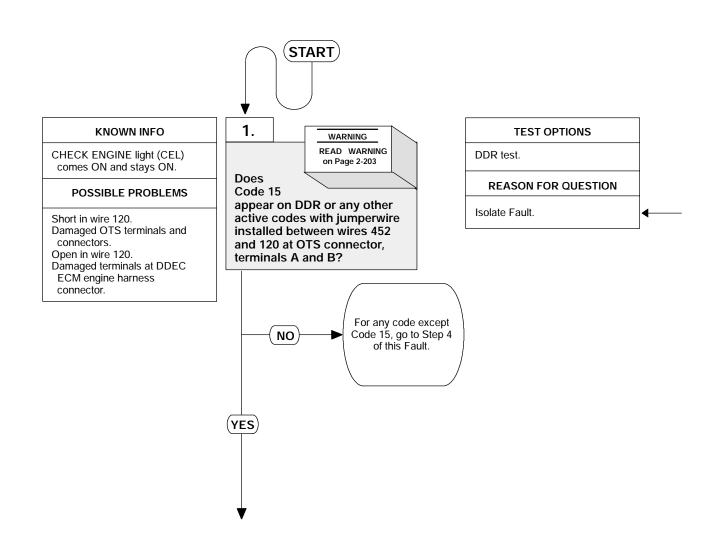
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

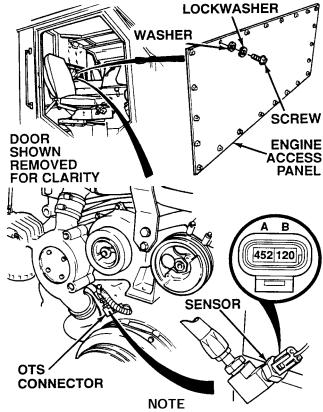
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)



Allow engine to cool before performing trouble-shooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were

### **DDR TEST**

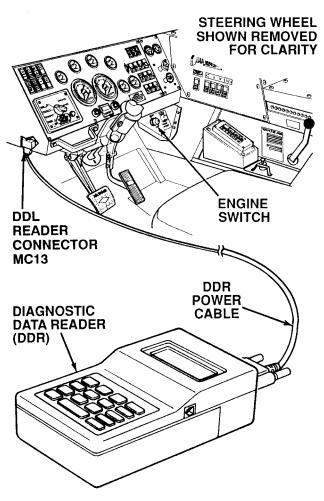
(1) Connect DDR to DDL connector MC13.

referred here.

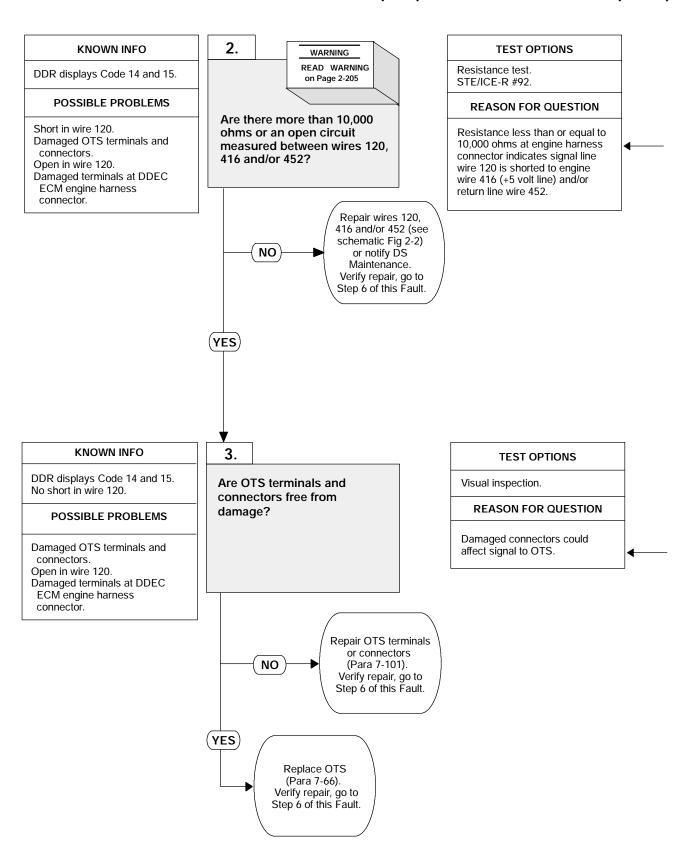
- (2) Remove 22 screws, lockwashers, washers and cab engine access panel. Discard lockwashers.
- (3) Disconnect oil temperature sensor (OTS) harness connector.
- (4) Place jumperwire between OTS harness connector, terminals A and B
- (5) Turn ON ENGINE switch.
- (6) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If code 15 or any other code does not appear, turn OFF ENGINE switch and go to Step 4 of this fault.
  - (b) If code 15 or any other active code does appear, turn OFF ENGINE switch and go to Step 2 of this Fault.



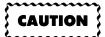
Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.



### A4 CODE 14 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE HIGH (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

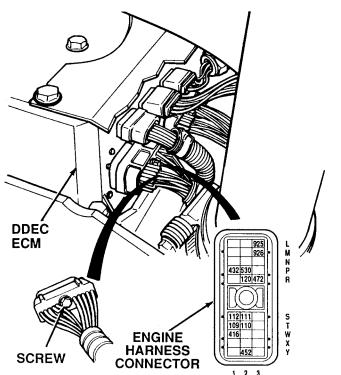
### RESISTANCE TEST

- (1) Remove jumperwire from OTS connector.
- (2) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (3) Read resistance between terminals R2 and W1 on engine harness connector.
  - (a) If there are less than 10,000 ohms present, repair wires 120, 416 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step 3 of this Fault.

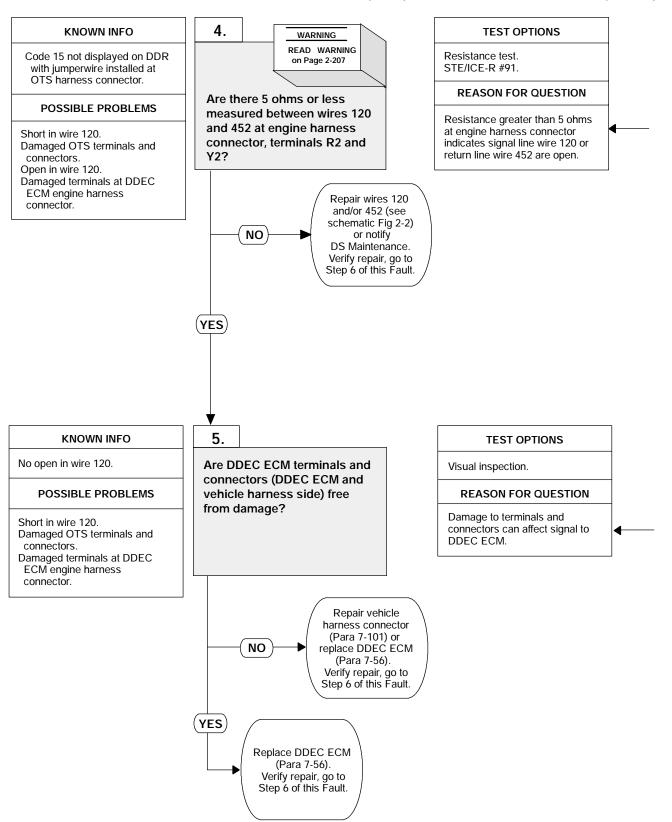
# DOOR SHOWN REMOVED FOR CLARITY OTS CONNECTOR

### **VISUAL INSPECTION**

- Check OTS and terminals at OTS connector (Both sensor and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors or terminals are damaged, repair connectors or terminals (Para 7-101).
  - (b) If connectors and terminals are free of damage, replace OTS (Para 7-66).
- (2) Connect engine harness connector to DDEC ECM and tighten screw.
- (3) Install engine access panel with 22 screws, washers and lockwashers.



### A4 CODE 14 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE HIGH (CONT).



- Allow engine to cool before performing trouble-shooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

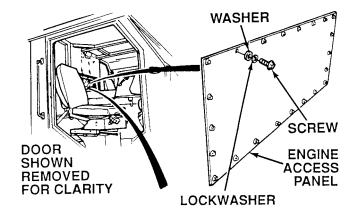
### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector from DDEC ECM.
- (2) Read resistance between wires 120 and 452 at engine harness connector terminals R2 and Y2.
  - (a) If 5 ohms or more are present, remove jumperwire and repair wires 120 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If 5 ohms or less are present, connect OTS harness connector and go to Step 5 of this Fault.

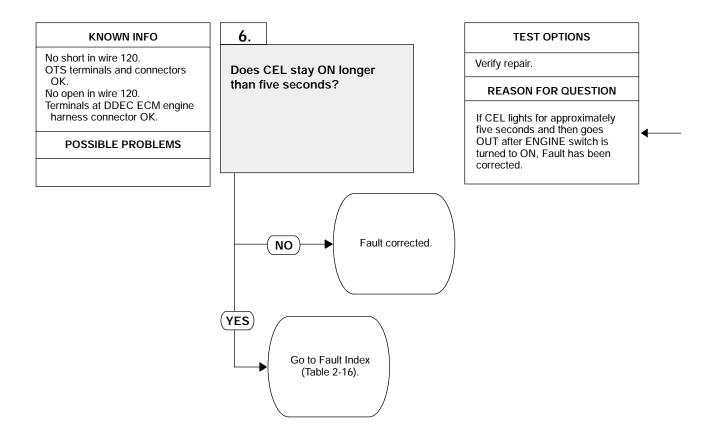
# DDEC ECM ENGINE HARNESS CONNECTOR L M N P R 120/472 W X Y

### VISUAL INSPECTION

- Check terminals at engine harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) through (4) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) DDEC harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Connect engine harness connector to DDEC ECM and tighten screw.
- (3) Install engine access panel with 22 washers, lockwashers and screws.
- (4) Close top engine access cover.



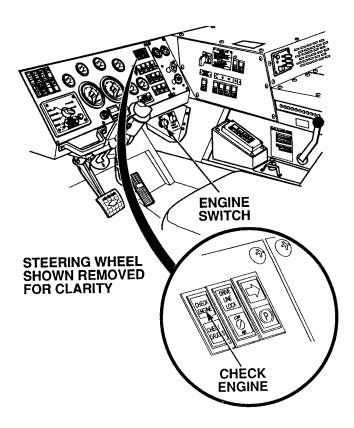
### A4 CODE 14 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE HIGH (CONT).



### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
  (2) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
  - goes orr, rault has been corrected.
    Perform Steps (4) and (5) below.

    (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



### 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 15 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE LOW.

### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

### Materials/Parts

Lockwasher (22) (Item 195, Appendix F)

### References

TM 9-2320-364-10 TM 9-4910-571-12&P

### **Equipment Condition**

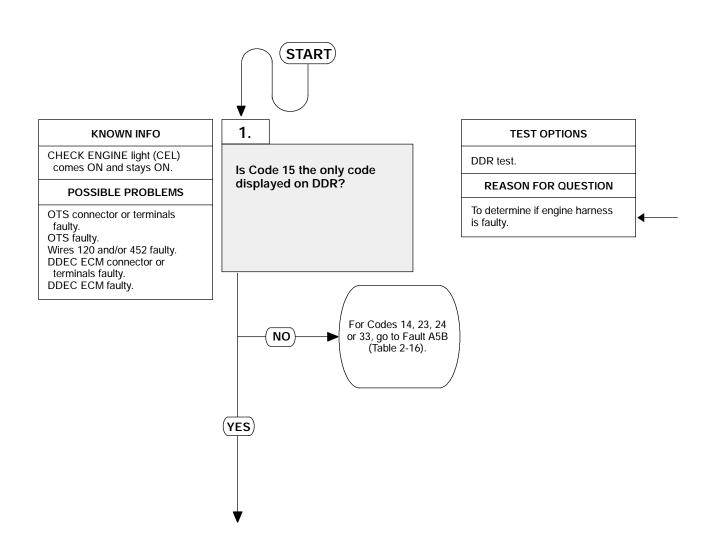
Engine OFF, (TM 9-2320-364-10)

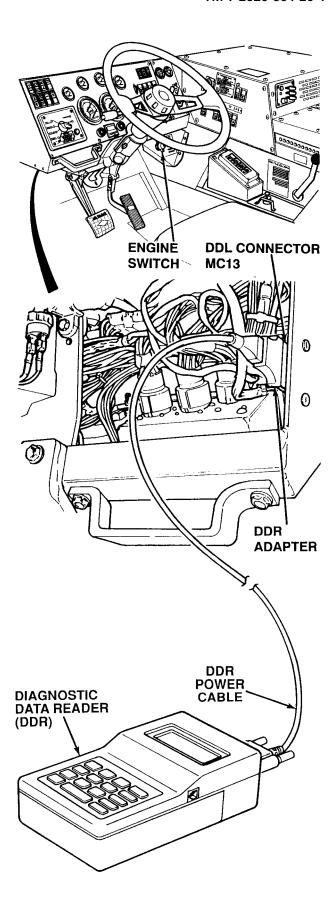
Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)





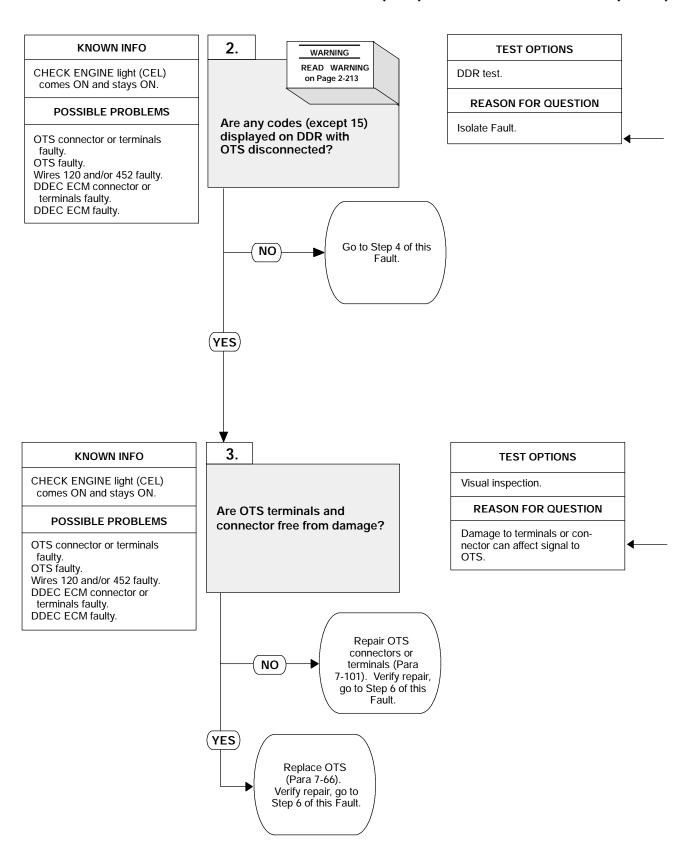
### **NOTE**

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

### DDR TEST

- (1) Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If Code 15 is not the only code and Codes 14, 23, 24 or 33 appear, turn OFF ENGINE switch and go to Fault A5B (Table 2-16).
  - (b) If Code 15 or any other codes except 14, 23, 24 or 33 appear, turn OFF ENGINE switch and go to Step 2 of this Fault.

### A4 CODE 15 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE LOW (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

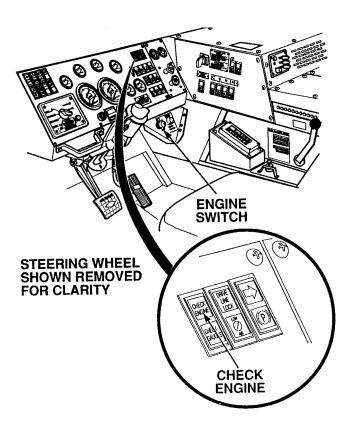
### DDR TEST

- Remove 22 screws, lockwashers, washers and cab engine access panel. Discard lockwashers.
- (2) Disconnect OTS connector.
- (3) Start engine and run until CEL comes ON, eight minutes maximum.(4) Select MODE 01 (ACTIVE CODES)
- (4) Select MODE 01 (ACTIVE CODES) and read codes with engine still running.
  - (a) If code 15 appears, turn OFF ENGINE switch and go to Step 4 of this Fault.
  - (b) If any codes other than 15 appear, turn OFF ENGINE switch and go to Step 3 of this Fault.

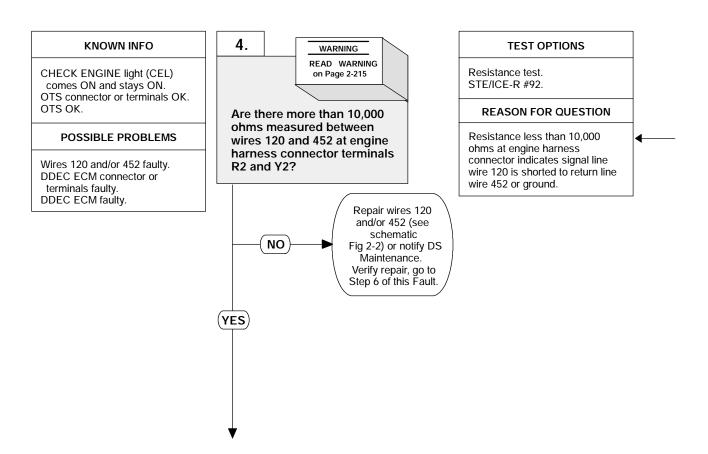
# DOOR SHOWN REMOVED FOR CLARITY OTS CONNECTOR A B 452|120

### VISUAL INSPECTION

- Check OTS terminals at OTS connector (OTS and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors are damaged, repair connectors (Para 7-101).
  - (b) If connectors are free of damage, replace OTS (Para 7-66).
- (2) Connect OTS connector.
- (3) Install cab engine access panel and 22 washers, lockwashers and screws.



### A4 CODE 15 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE LOW (CONT).



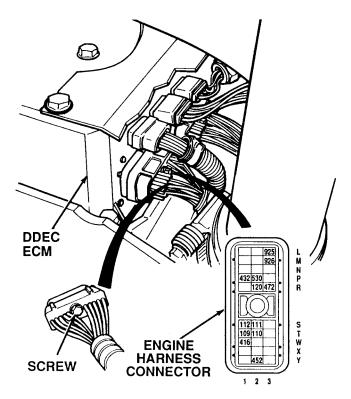
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result.
   Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

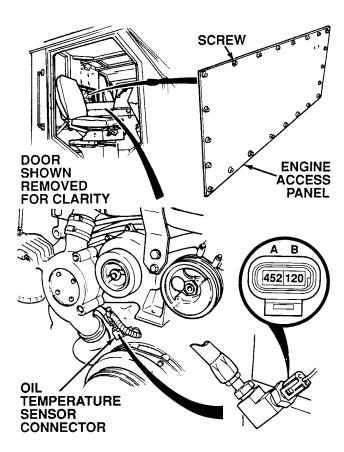


DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

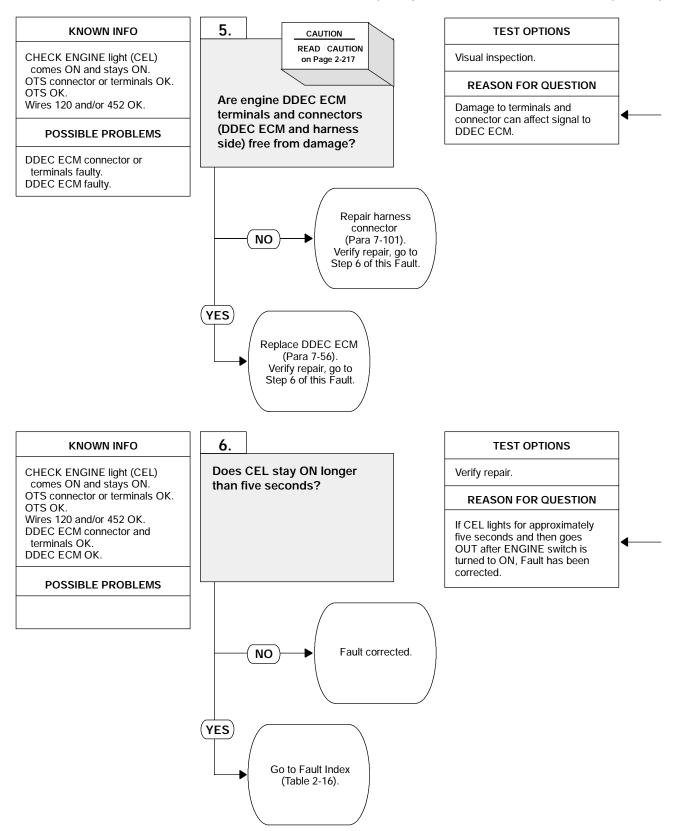
### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Read resistance between wires 120 and 452 at engine harness connector, terminals R2 and Y2.
  - (a) If there are less than 10,000 ohms present, repair wires 120 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, wires 120 and 452 are OK.
- (3) Connect OTS connector.
- (4) Install cab engine access panel and 22 washers, lockwashers and screws.





### A4 CODE 15 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE LOW (CONT).

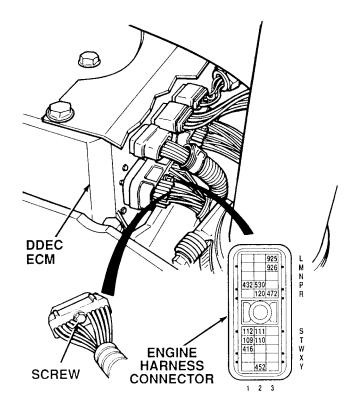




DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting terminals.

### VISUAL INSPECTION

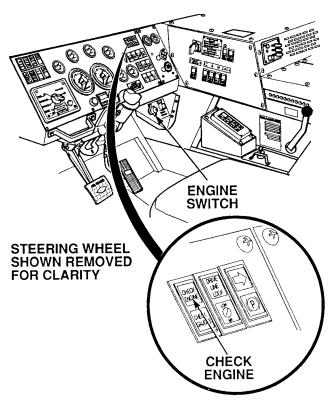
- (1) Check terminals at engine harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3) below.
  - If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If DDEC harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- Connect engine harness connector to DDEC ECM and tighten screw.
- (3) Close top engine access cover.



### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-24).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.
- (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



### 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH.

### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

Wrench, Torque (0 to 175 lb-ft [0-237 N·m])

(Item 95, Appendix G)

**Jumperwire** 

Materials/Parts

Compound, Corrosion Preventive

(Item 34, Appendix C)

Lockwasher (Item 168, Appendix F)

### References

TM 9-2320-364-10

TM 9-4910-571-12&P

### Equipment Condition

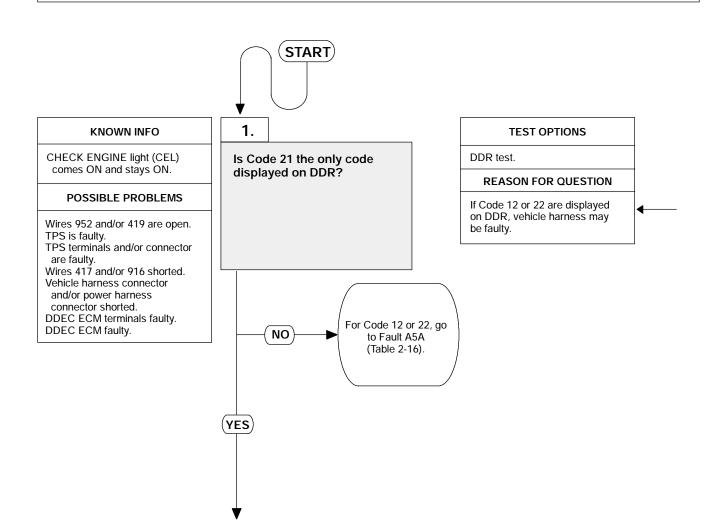
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)

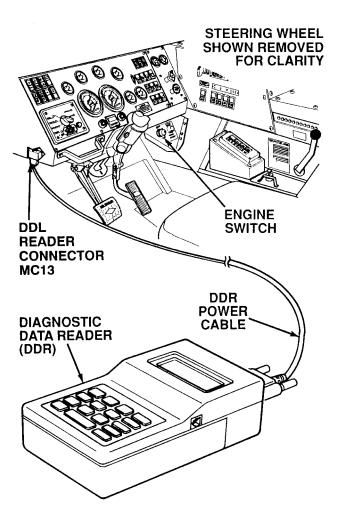


### **NOTE**

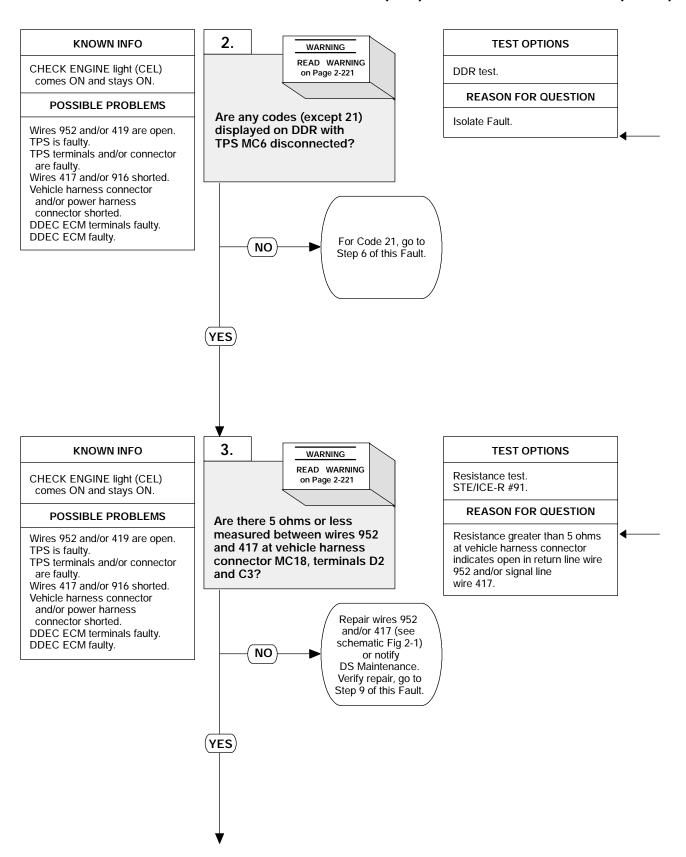
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
  (3) Select MODE 01 (ACTIVE CODES)
- on DDR.
  - (a) If other codes are displayed
    (12 or 22), turn OFF ENGINE
    switch and go to Fault A5A
    (Table 2-16).
    (b) If only Code 21 is displayed, turn
    OFF ENGINE switch and go to
  - Step 2 of this Fault.



### A4 CODE 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH (CONT).



Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.

## CAUTION

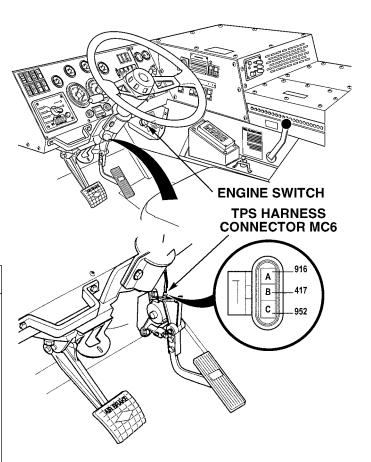
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting terminals.

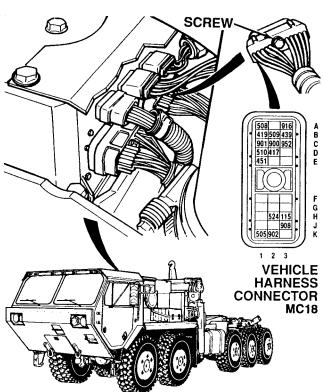
### **DDR TEST**

- (1) Disconnect TPS connector.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 01 (ÁCTIVE CODES) on DDR.
- (4) Are there any codes displayed on DDR.
  - (a) If code 21 and any other codes are present, turn OFF ENGINE switch and go to Step 6 of this Fault.
  - (b) If any codes other than 21 are present on DDR, turn OFF ENGINE switch and go to Step 3 of this Fault.

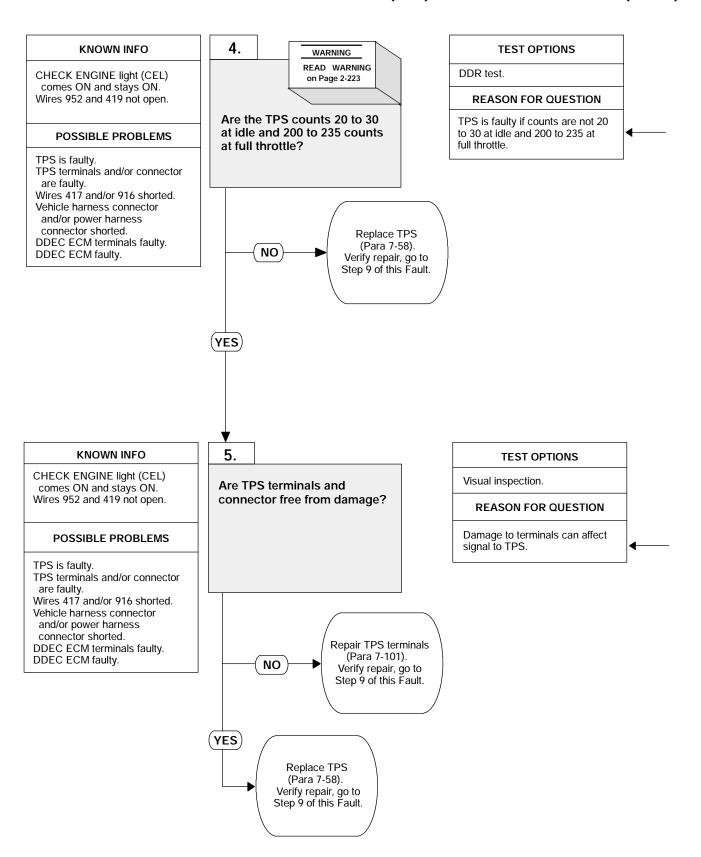
### RESISTANCE TEST

- Place jumperwire between terminals C and B at TPS harness connector MC6.
- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (3) Read resistance between wires 952 and 417 at vehicle harness connector MC18, terminals D2 and C3.
  - (a) If there are 5 ohms or more present, remove jumperwire and repair wires 952 and/or 417 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are 5 ohms or less, go to Step 4 of this Fault.
- (4) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.





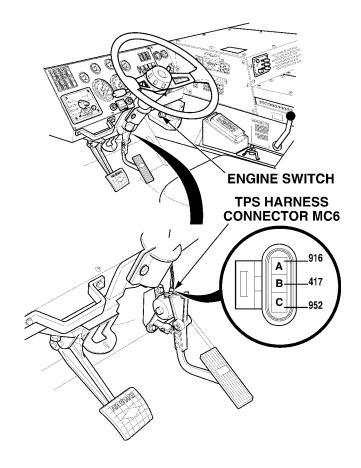
### A4 CODE 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

### DDR TEST

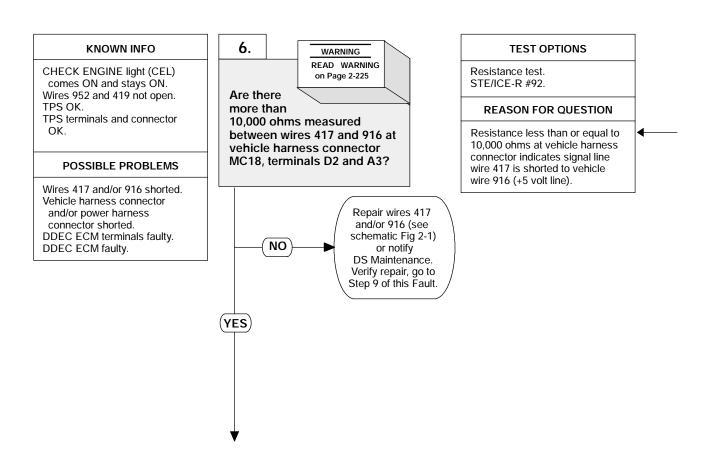
- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Select MODE 07 (TPS COUNTS) on DDR.
- (3) Read throttle counts at idle and at full throttle (engine not running).
  - (a) If throttle count is not 20 to 30 at idle and 200 to 235 at full throttle, turn OFF ENGINE switch and replace TPS (Para 7-58).
     (b) If throttle count is 20 to 30 at
  - (b) If throttle count is 20 to 30 at idle and 200 to 235 at full throttle, turn OFF ENGINE switch and go to Step 5 of this Fault.



### **VISUAL INSPECTION**

- (1) Disconnect TPS connector MC6.
- (2) Inspect TPS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors are damaged, repair connectors (Para 7-101).
  - (b) If connectors are free of damage, replace TPS (Para 7-58).

## A4 CODE 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH (CONT).



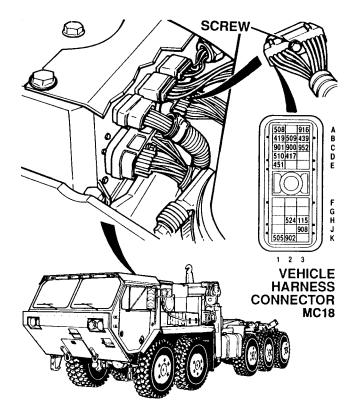
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



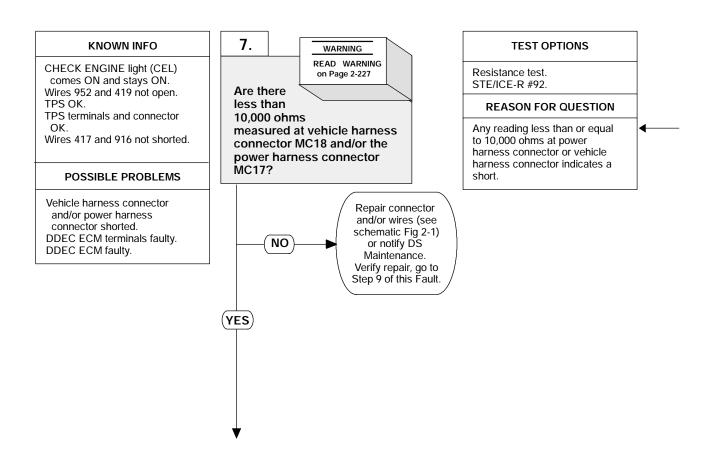
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

### RESISTANCE TEST

- Loosen screw and disconnect vehicle harness connector MC18 from DDEC ECM.
- (2) Read resistance between wires 417 and 916 at vehicle harness connector MC18, terminals D2 and A3.
  - (a) If 10,000 ohms or less are present, repair wires 417 and/or 916 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If more than 10,000 ohms are present, go to Step 7 of this Fault.



## A4 CODE 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH (CONT).



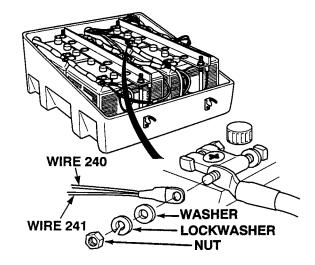
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.
- Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact
  with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes
  with large amounts of water for at least 15 minutes and get immediate medical attention.

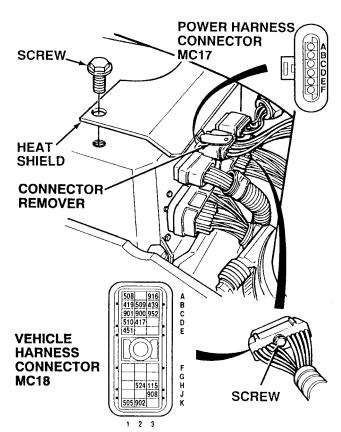
## CAUTION

- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.
- While applying torque to nut, hold screw with wrench or damage to battery may occur.

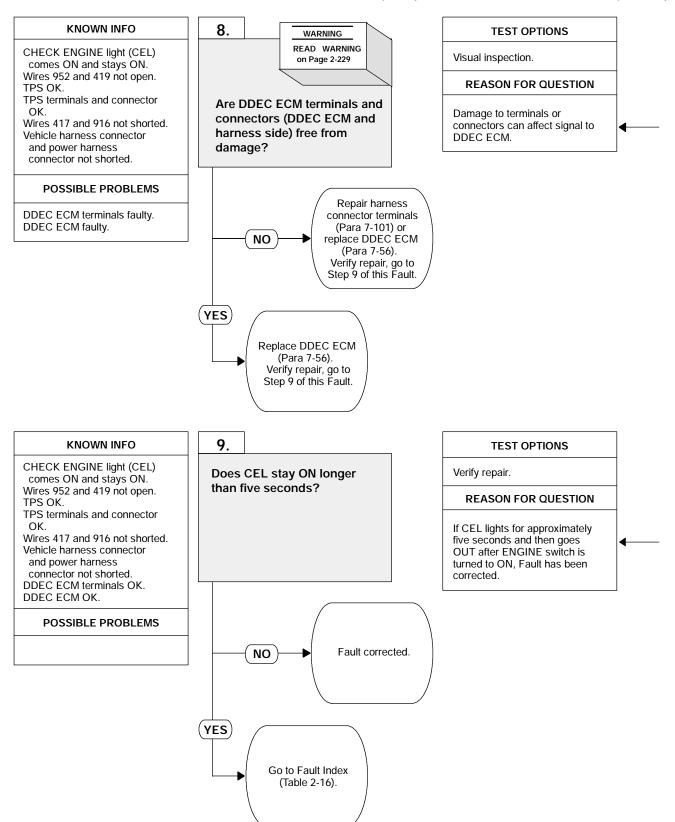
### RESISTANCE TEST

- Remove battery box cover (TM 9-2320-364-10).
- (2) Remove nut, washer, lockwasher, wire 240 and 241 from battery. Discard lockwasher.
- (3) Remove two mounting screws and heat shield from DDEC ECM.
- (4) Disconnect power harness connector MC17 from DDEC ECM with connector remover.
- Read resistance between wires 417 and 439 at vehicle harness connector MC18, terminals D2 and B3.
  - (a) If 10,000 ohms or less are present, repair wires 417 and 439. (See schematic Fig 2-3) or notify DS Maintenance and perform Steps (7) through (12) below
  - (b) If more than 10,000 ohms are present, perform Step (6) below.
- (6) Read resistance between wire 417 on vehicle harness connector MC18, terminal D2 and wires 241, 150 and 240, terminals A, B, D, E or F.
  - (a) If more than 10,000 ohms are present, repair wires 241, 150 and/or 240 (see schematic Fig 2-1) or notify DS Maintenance and perform Steps (7) through (12) below.
  - (b) If 10,000 ohms or less are present, wires 241, 150 and 240 are OK.
- (7) Connect power harness connector MC17.
- (8) Install heat shield with two mounting screws to DDEC ECM.
- (9) Connect wires 240/241 to battery with lockwasher, washer and nut.
- (10) Tighten nut to 23 lb-ft (31 N·m).
- (11) Apply corrosion preventive compound on nut.
- (12) Install battery box cover.





### A4 CODE 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

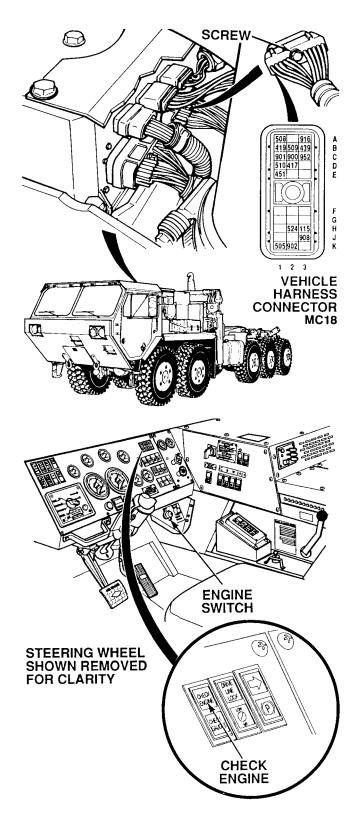
### VISUAL INSPECTION

- (1) Check terminals at vehicle harness connector MC18 (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If vehicle harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If DDEC harness and ECM connectors are damaged, replace DDEC ECM (Para 7-56).
- (2) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw
- (3) Close top engine access cover.

### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- Clear codes on DDR (Para 2-24).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.
- (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



### 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW.

### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)

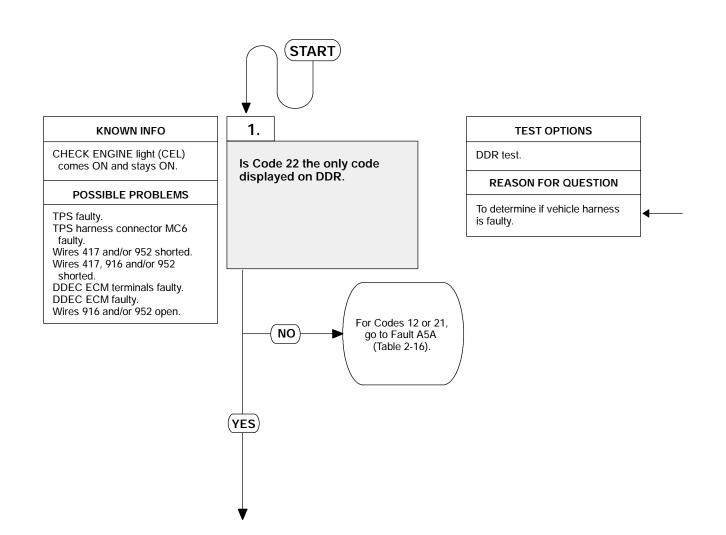
STE/ICE-R (optional) (Item 3, Appendix G) DDEC Repair Kit (Item 15, Appendix G) Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G) Jumperwire

References

TM 9-2320-364-10 TM 9-4910-571-12&P Equipment Condition

Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)
Top engine access cover opened,
(TM 9-2320-364-10)



### **NOTE**

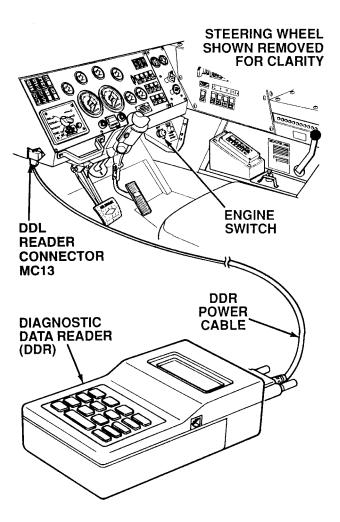
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

### **DDR TEST**

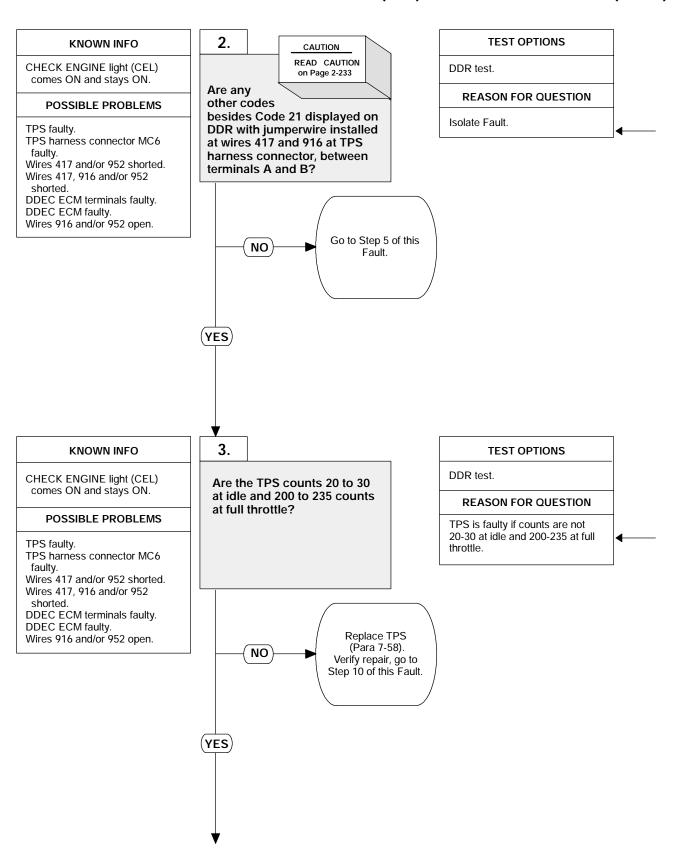
- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - on DDR.

    (a) If other codes are displayed (12 or 21), turn OFF ENGINE switch and go to Fault A5A (Table 2-16).

    (b) If only Code 22 is displayed, turn OFF ENGINE switch and go to Stan 2 of this Fault.
  - Step 2 of this Fault.



### A4 CODE 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW (CONT).





Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

### **DDR TEST**

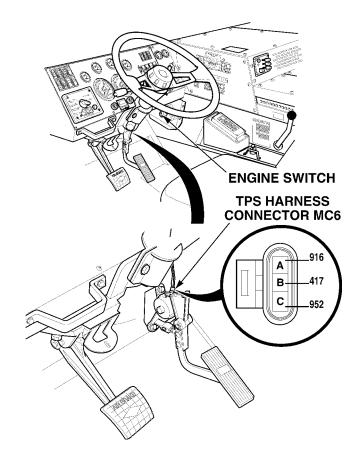
- (1) Disconnect TPS harness connector
- (2) Place jumperwire between terminals A and B at TPS harness connector MC6.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
- (4) Select MODE 01 (ACTIVE CODES) on DDR.
- (5) Is code 21 or any other codes displayed on DDR.
  - (a) If code 21 or any other code is not present on DDR, go to Step 5 of this Fault.
  - (b) If code 21 or any other code is present on DDR, go to Step 3 of this Fault.

### NOTE

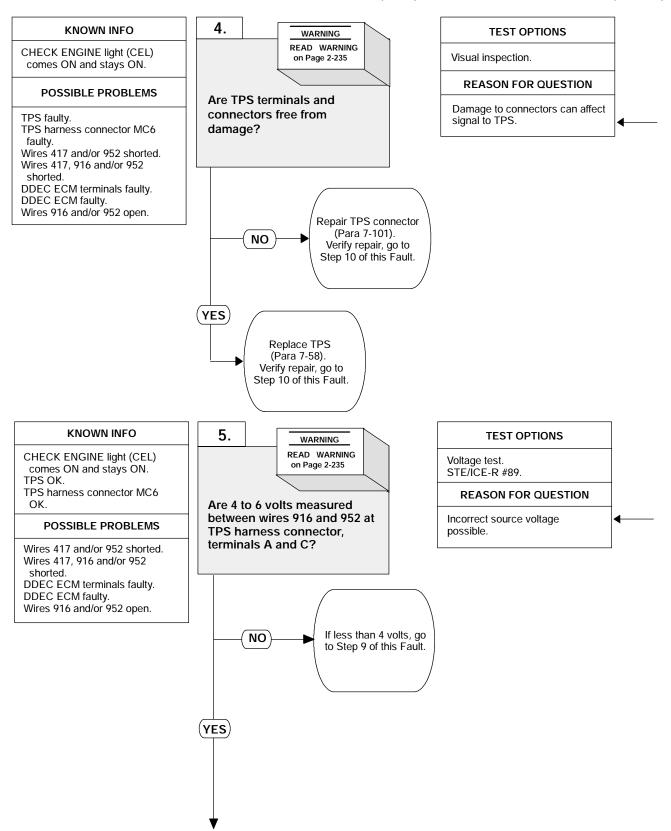
Ensure throttle control is fully depressed to the floor when checking full throttle counts.

### DDR TEST

- (1) Remove jumperwire.
- (2) Connect TPS connector.
- (3) Select MODE 07 (TPS COUNTS) on DDR.
- (4) Read throttle counts at idle and at full throttle (engine not running).
  - (a) If throttle count is not 20 to 30 at idle and 200 to 235 at full throttle, replace TPS (Para 7-58).
  - (b) If throttle count is 20 to 30 at idle and 200 to 235 at full throttle, go to Step 4 of this Fault.



### A4 CODE 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW (CONT).



Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



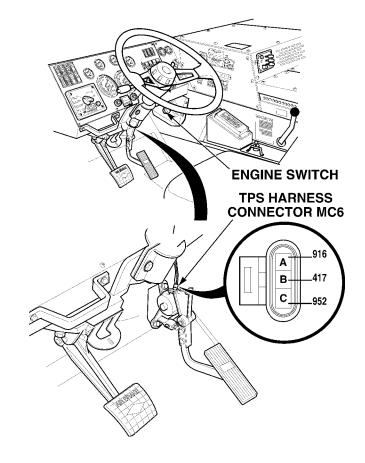
Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

### VISUAL INSPECTION

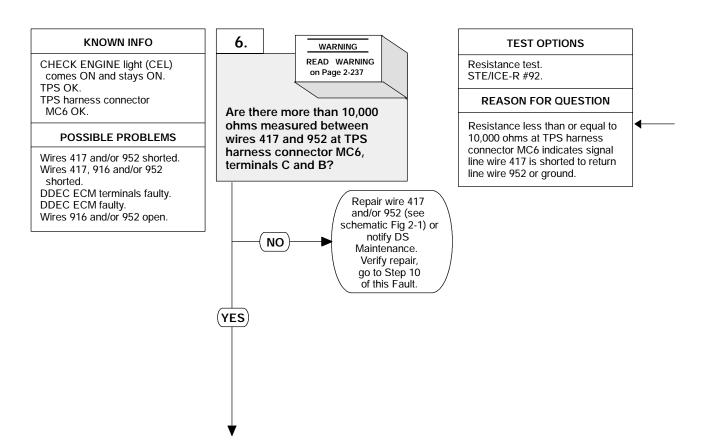
- (1) Disconnect TPS harness connector from TPS.
- (2) Inspect TPS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors are damaged, repair connectors (Para 7-101).
  - (b) If connectors are free of damage, replace TPS (Para 7-58).

### **VOLTAGE TEST**

- (1) Remove jumperwire.
- (2) Set multimeter select switch to volts dc.
- (3) Connect positive (+) multimeter lead to wire 952 on TPS harness connector, terminal C.
- (4) Connect negative (-) multimeter lead to wire 916 at TPS harness connector, terminal A.
- (5) Turn ON ENGINE switch (TM 9-2320-364-10).
  - (a) If less than 4 vdc are present, turn OFF ENGINE switch and go to Step 9 of this Fault.
  - (b) If 4 to 6 vdc are present, turn OFF ENGINE switch and go to Step 6 of this Fault.



### A4 CODE 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW (CONT).



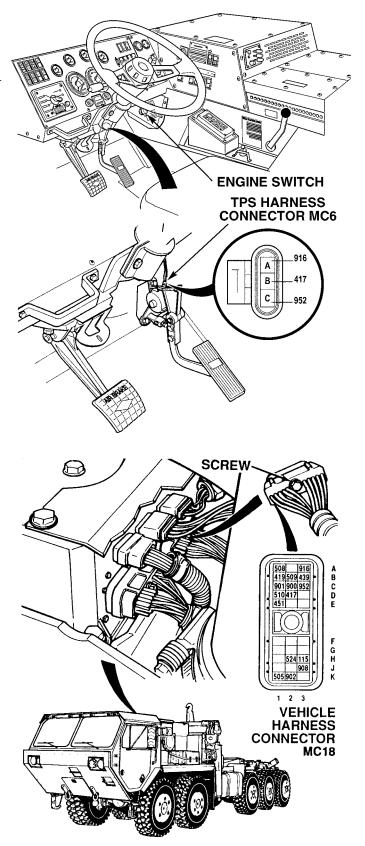
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



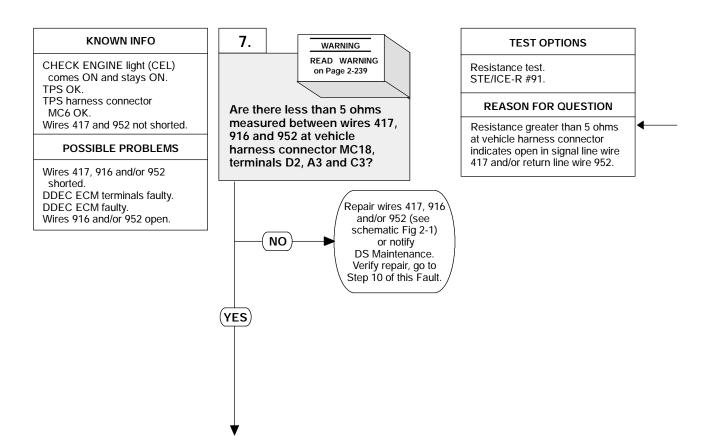
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

### **RESISTANCE TEST**

- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (2) Read resistance between wires 417 and 952 at TPS harness connector MC6, terminals C and B.
  - (a) If there are more than 10,000 ohms present, repair wires 417 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are 10,000 ohms or less, go to Step (3) below.
- (3) Read resistance between wire 417 and a known good ground at TPS harness connector, terminal B.
  - (a) If there are more than 10,000 ohms present, repair wire 417 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are 10,000 ohms or less, go to Step 7 of this Fault.



## A4 CODE 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW (CONT).



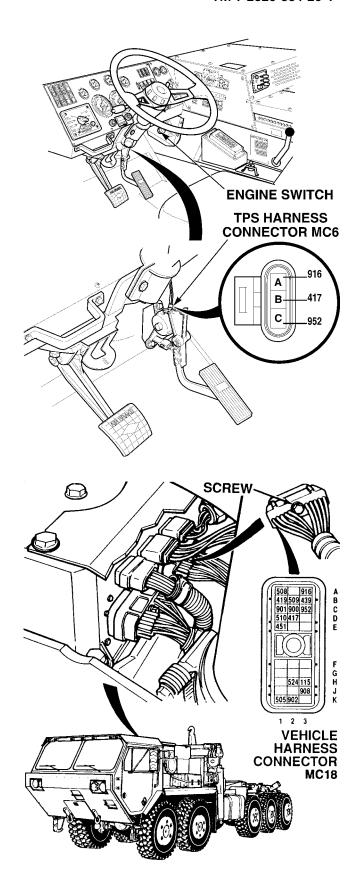
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

### RESISTANCE TEST

- (1) Place jumperwire between TPS harness connector MC6, terminals A and B.
- (2) Set multimeter select switch to ohms.
- (3) Read resistance between wires 417 and 952 at vehicle harness connector MC18, terminals C3 and D2.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wires 417 and/or 952
     (See schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are 5 ohms or less, go to Step (4) below.
- (4) Read resistance between wires 417, 916 and 952 at vehicle harness connector MC18, terminals D2, A3 and C3.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wires 417, 916 and/or 952 (See schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are 5 ohms or less, wires 417, 916 and 952 are OK.
- (5) Remove jumperwire.



### A4 CODE 22 THROTTLE POSITION SENSOR (TPS) SIGNAL LOW (CONT).

### **KNOWN INFO** 8. WARNING READ WARNING CHECK ENGINE light (CEL) on Page 2-241 comes ON and stays ON. TPS OK. TPS harness connector Are DDEC ECM terminals and MC6 OK. Wires 417 and 952 not shorted. connectors (DDEC ECM and Wires 417, 916 and 952 harness side) free from not open. damage? POSSIBLE PROBLEMS DDEC ECM terminals faulty. Repair harness DDEC ECM faulty. connector (Para 7-101) or replace DDEC ECM NO (Para 7-56). Verify repair, go to Step 10 of this Fault. YES Replace DDEC ECM (Para 7-56). Verify repair, go to Step 10 of this Fault.

9

# TEST OPTIONS Visual inspection. REASON FOR QUESTION Damaged terminals and connectors can affect signal to DDEC ECM.

### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON.
TPS OK.
TPS harness connector MC6 OK.
Wires 417 and 952 not shorted.
Wires 417, 916 and 952 not open.
DDEC ECM terminals OK.
DDEC ECM OK.

### POSSIBLE PROBLEMS

Wires 916 and/or 952 open.

READ CAUTION on Page 2-241 Are there 5 ohms or less measured between wires 916 and 952 at vehicle harness connector MC18, terminals A3 and C3? Repair wires 916 and/or 952 (see schematic Fig 2-1) or notify DS NO Maintenance. Verify repair, go to Step 10 of this Fault. YES) Fault not corrected. Notify DS Maintenance.

CAUTION

### **TEST OPTIONS**

Resistance test. STE/ICE-R #91.

### **REASON FOR QUESTION**

Resistance greater than 5 ohms at vehicle harness connector MC18 indicates wire 916 (+5 volt line) is open.

- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

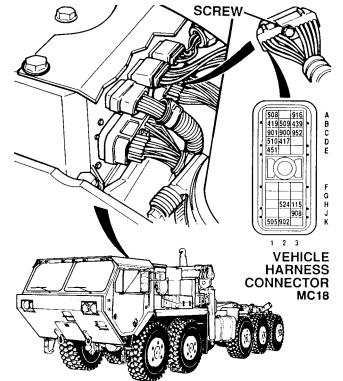
Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

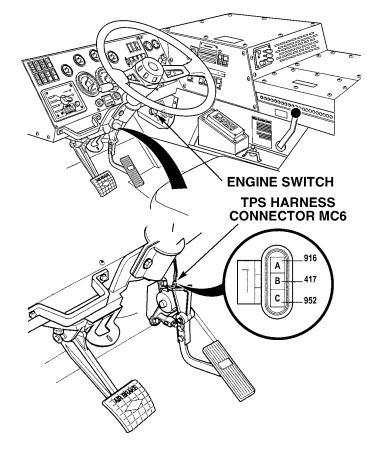
### **VISUAL INSPECTION**

- (1) Check terminals at vehicle harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3)
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If DDEC harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Connect vehicle harness connector to DDEC ECM and tighten screw.
- Close top engine access cover.

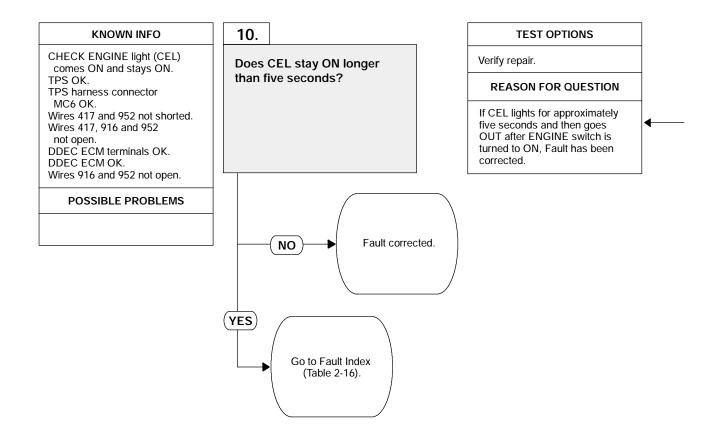
### RESISTANCE TEST

- (1) Loosen screw and disconnect vehicle harness connector MC18.
- (2) Place a jumperwire between terminals A and C on TPS harness connector.
- (3) Read resistance between wires 916 and 952 at vehicle harness connector MC18, terminals A3 and C3.
  - (a) If there are more than 5 ohms present, repair wires 916 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance and perform Steps (4) through (7).
  - (b) If there are 5 ohms or less present, wires 916 and 952 are OK.
- (4) Remove jumperwire.(5) Connect TPS connector.
- (6) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw
- Close top engine access cover.





### A4 CODE 22 THROTTLE POSITION SENSOR (TPS) SIGNAL LOW (CONT).



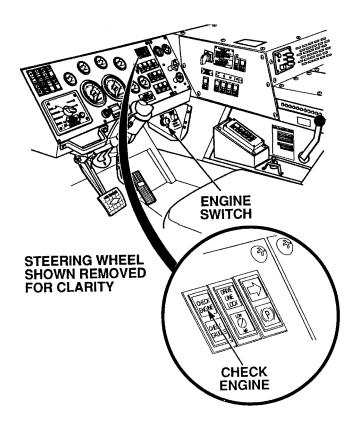
### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).(3) Select MODE 01 (ACTIVE CODES)
- (4) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then
- for about five seconds and then goes off, fault has been corrected. Perform Steps (5) and (6) below.

  (b) If CHECK ENGINE light comes on and stays on, perform Steps (5) and (6) below and go to Fault Index (Table 2-16).

  (5) Turn OFF ENGINE switch.

  (6) Disconnect DDR from DDL connector MC13
- MC13.



### 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 23 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE HIGH.

### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Jumperwire

### References

TM 9-2320-364-10

TM 9-4910-571-12&P

Equipment Condition

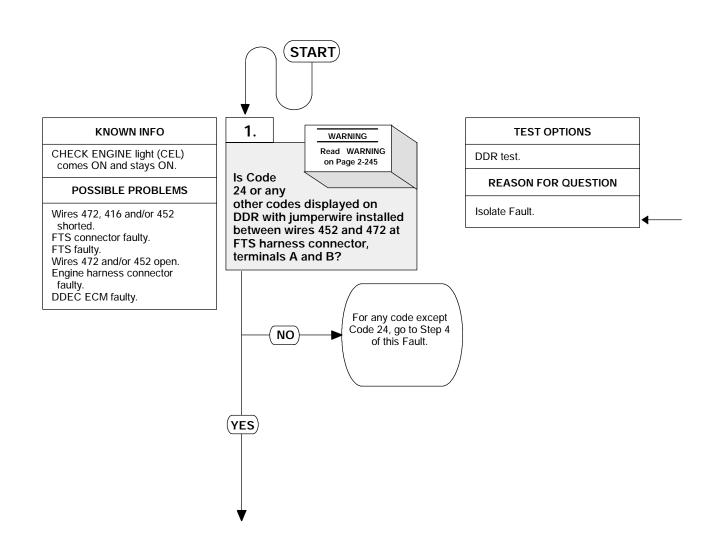
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

## CAUTION

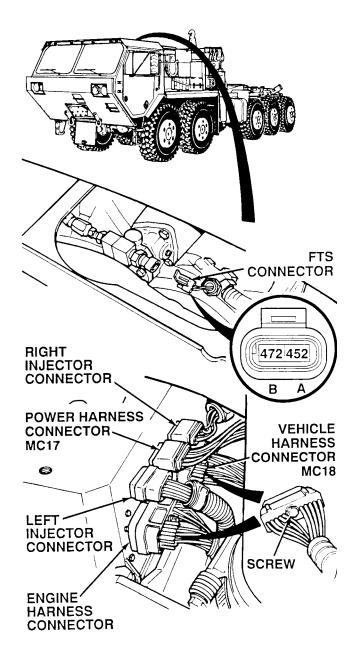
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

### **NOTE**

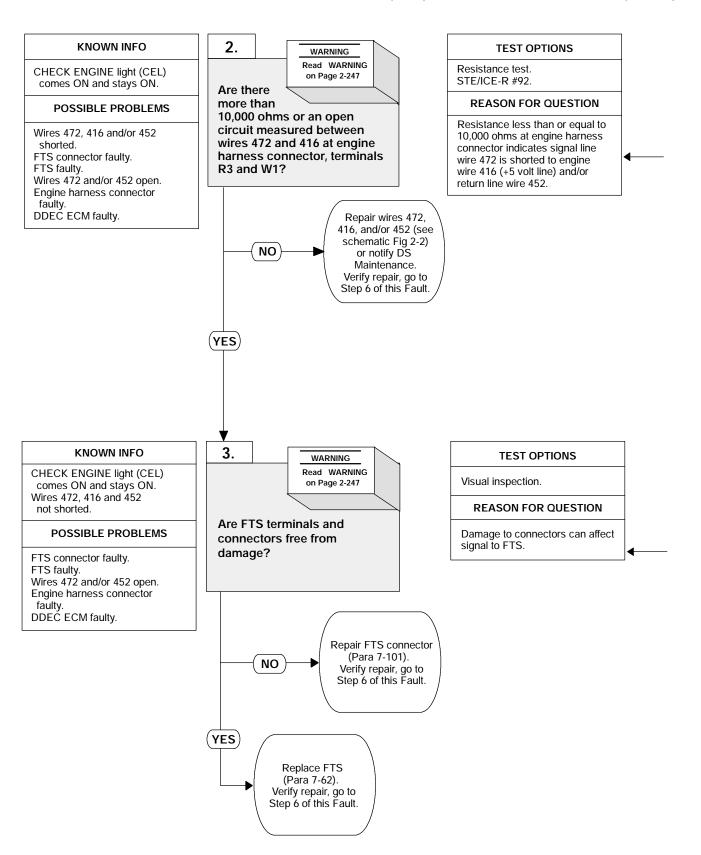
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

### **DDR TEST**

- (1) Remove DDEC ECM (Para 7-56).
- (2) Disconnect FTS.
- (3) Place jumperwire between terminals A and B at FTS harness connector.
- (4) Set ECM on mounting bracket.
- (5) Connect vehicle and engine harness connectors to DDEC ECM and tighten two screws.
- (6) Connect power harness connector and right and left injector harness connectors to DDEC ECM.
- (7) Connect DDR to DDL connector MC13.
- (8) Turn ON ENGINE switch (TM 9-2320-364-10).
- (9) Select MODE 01 (ACTIVE CODES) on DDR.
- (10) Is code 24 or any other codes displayed on DDR?
  - (a) If any code except Code 24 is displayed on DDR, turn OFF ENGINE switch and go to Step 4 of this Fault.
  - (b) If code 24 or any other code is displayed on DDR, go to Step 2 of this Fault.



### A4 CODE 23 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE HIGH (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



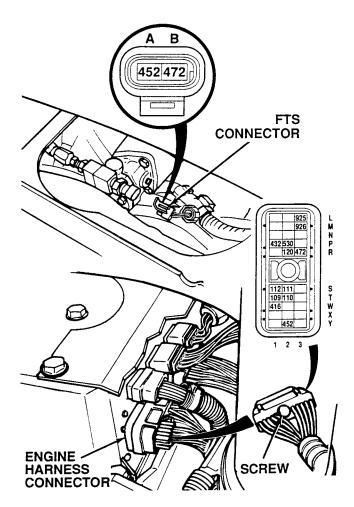
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

### RESISTANCE TEST

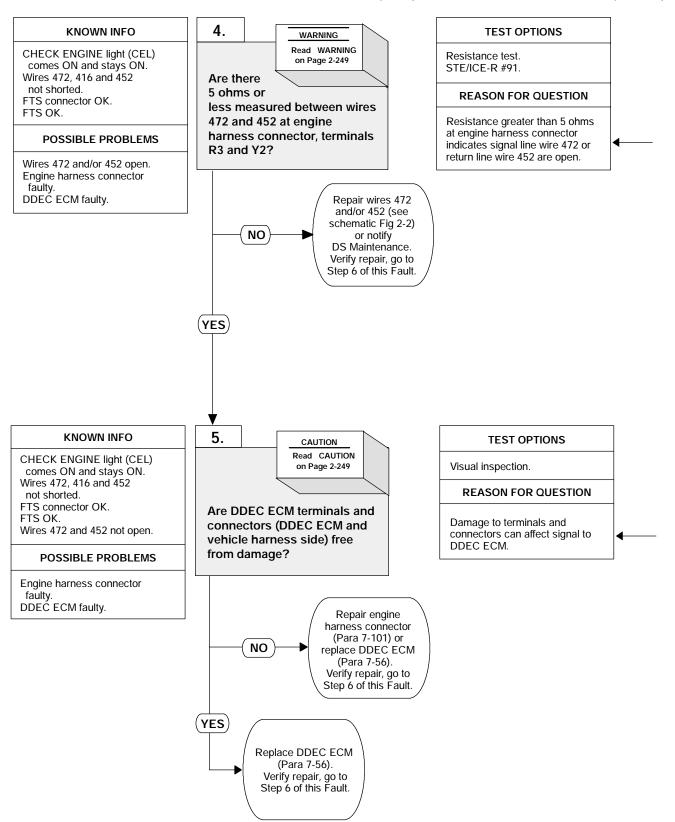
- (1) Loosen screw and disconnect engine harness connector from DDEC ECM.
- (2) Remove jumperwire.
- (3) Read resistance between wires 472 and 416 at engine harness connector, terminals R3 and W1.
  - (a) If there are less than 10,000 ohms present, repair wires 472, 416 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, wires are OK, go to Step 3 of this Fault.

### **VISUAL INSPECTION**

- Check terminals at FTS harness connector (sensor and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If terminals are damaged, repair connector (Para 7-101) or notify DS Maintenance.
  - (b) If terminals are not damaged, replace FTS (Para 7-62) and perform Steps (2) and (3) below.
- (2) Connect FTS harness connector.
- (3) Connect engine harness connector to DDEC ECM and tighten screw.



### A4 CODE 23 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE HIGH (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



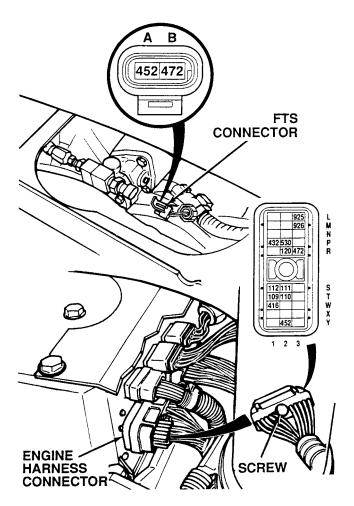
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

### RESISTANCE TEST

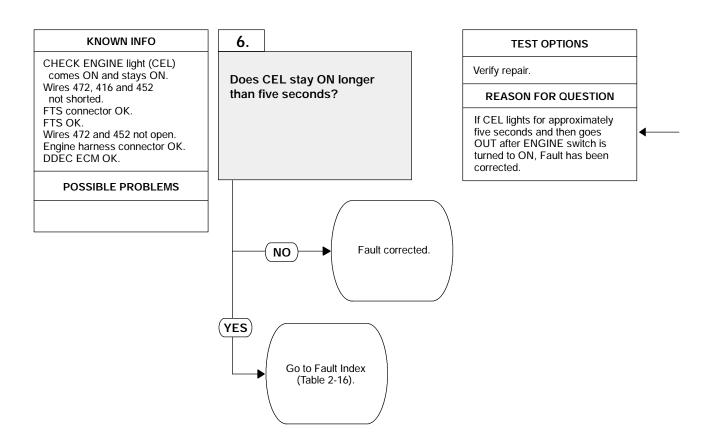
- (1) Loosen screw and disconnect engine harness connector from DDEC ECM.
- (2) Read resistance between wires 472 and 452 at engine harness connector, terminals R3 and Y2.
  - (a) If there are more than 5 ohms present, repair wires 472 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are 5 ohms or less present, wires 472 and 452 are OK.
- (3) Connect engine harness connector to DDEC ECM and tighten screw.
- (4) Remove jumperwire and connect FTS connector.

### **VISUAL INSPECTION**

- Check terminals at engine harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If engine harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If engine harness connector and DDEC ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Install DDEC ECM (Para 7-56).
- (3) Close top engine access cover.



### A4 CODE 23 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE HIGH (CONT).

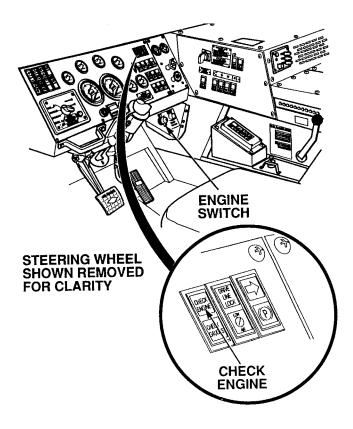


### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10). (2) Clear codes on DDR (Para 2-11).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
- Perform Steps (4) and (5) below.

  (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



### 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 24 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE LOW.

### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G) DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

**Jumperwire** 

### References

TM 9-2320-364-10 TM 9-4910-571-12&P

### Equipment Condition

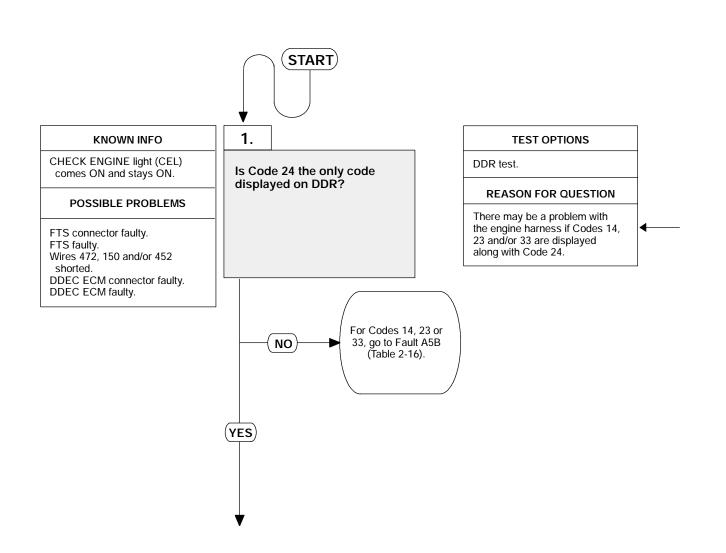
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

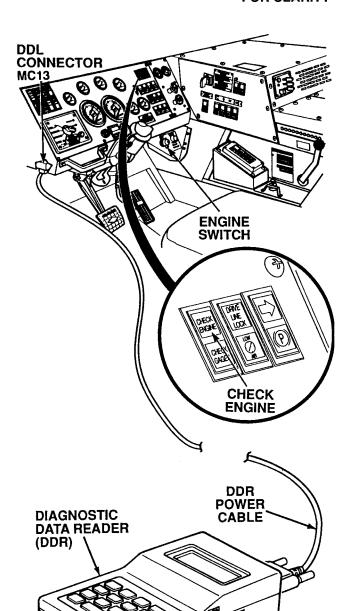
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)



### STEERING WHEEL **SHOWN REMOVED FOR CLARITY**



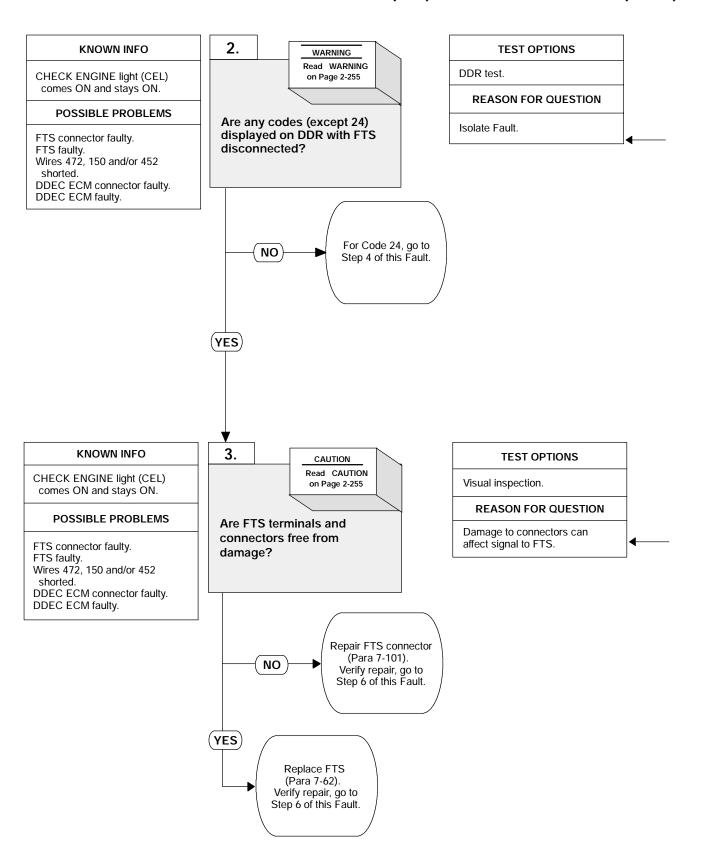
### NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
  (3) Select MODE 01 (ACTIVE CODES)
- on DDR.
  - (a) If there are other codes (14, 23 and/or 33), turn OFF ENGINE switch and go to Fault A5B (Table 2-16).
  - (b) If Code 24 is the only active code, turn OFF ENGINE switch and go to Step 2 of this Fault.

### A4 CODE 24 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE LOW (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



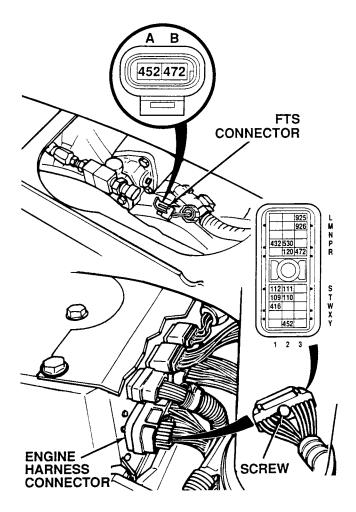
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **DDR TEST**

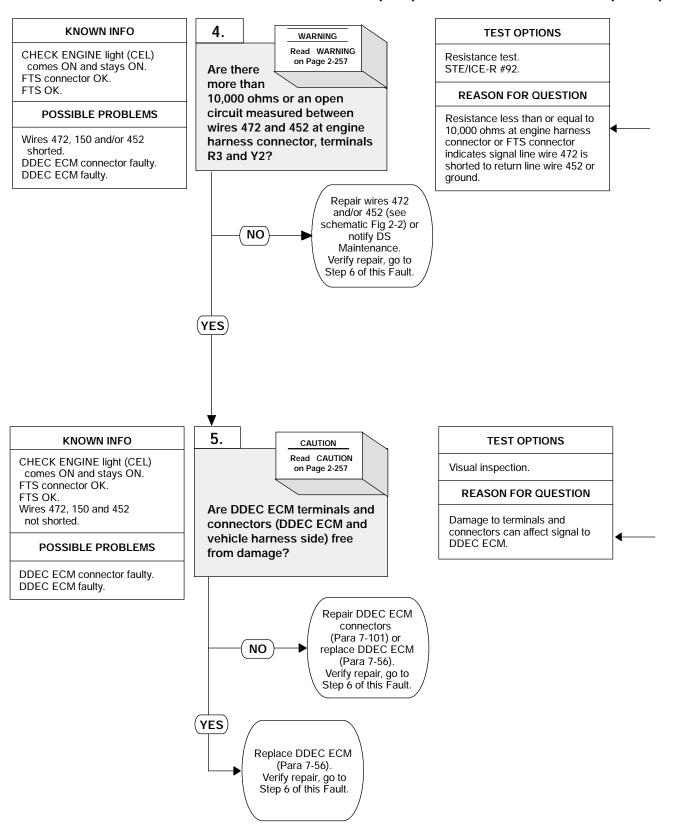
- (1) Remove DDEC ECM (Para 7-56).
- (2) Disconnect FTS.
- (3) Set DDEC ECM on mounting bracket.
- (4) Connect vehicle and engine harness connectors to DDEC ECM and tighten two screws.
- (5) Connect power harness connector and right and left injector connectors to DDEC ECM.
- (6) Start engine and run until CHECK ENGINE LIGHT (CEL) comes ON or for eight minutes.
- (7) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If code 24 is the only code that appears on DDR, turn OFF ENGINE switch and go to Step 4 of this Fault.
  - (b) If any other codes except code 24 appear on DDR, turn OFF ENGINE switch and go to Step 3 of this Fault.

### VISUAL INSPECTION

- (1) Disconnect FTS harness connector.
- (2) Inspect FTS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors are damaged, repair connectors (Para 7-101).
  - (b) If connectors are free of damage, replace FTS (Para 7-62).
- (3) Connect FTS harness connector.



# A4 CODE 24 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE LOW (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



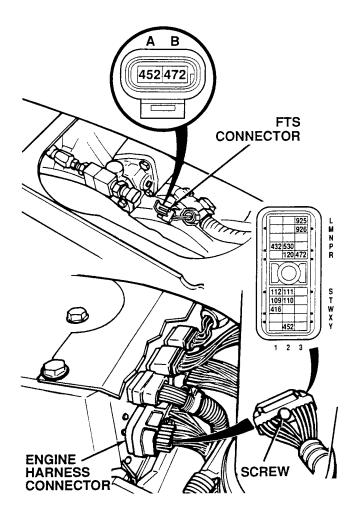
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

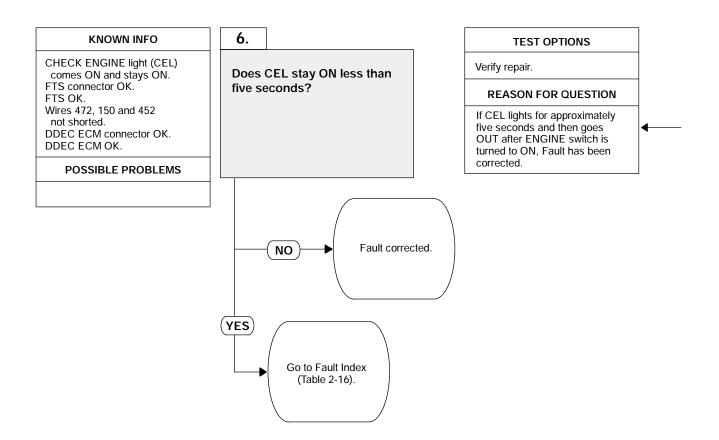
- (1) Loosen screw and disconnect engine harness connector from DDEC ECM.
- (2) Read resistance between wires 472 and 452 at engine harness connector, terminals R3 and Y2.
  - (a) If there are less than 10,000 ohms present, repair wires 472 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, wires 472 and 452, go to Step (3) below.
- (3) Read resistance between wire 472 on FTS connector terminal B and a known good ground.
  - (a) If there are less than 10,000 ohms present, repair wire 472 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present wire 472 is OK.

### VISUAL INSPECTION

- Check terminals at engine harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) through (4) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If engine harness and DDEC ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Connect engine harness connector to DDEC ECM and tighten screw.
- (3) Install DDEC ECM (Para 7-56).
- (4) Close top engine access cover.



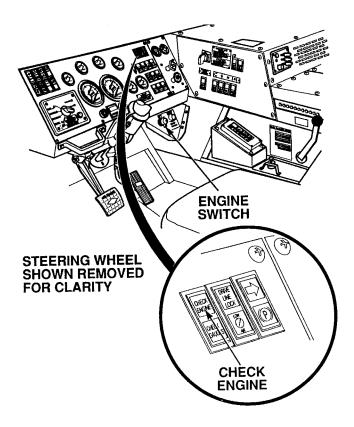
# A4 CODE 24 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE LOW (CONT).



### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch
- (TM 9-2320-364-10). Clear codes on DDR (Para 2-11).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
- goes off, fault has been corrected.
  Perform Steps (4) and (5) below.
  (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
  (5) Disconnect DDR from DDL connector
- MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

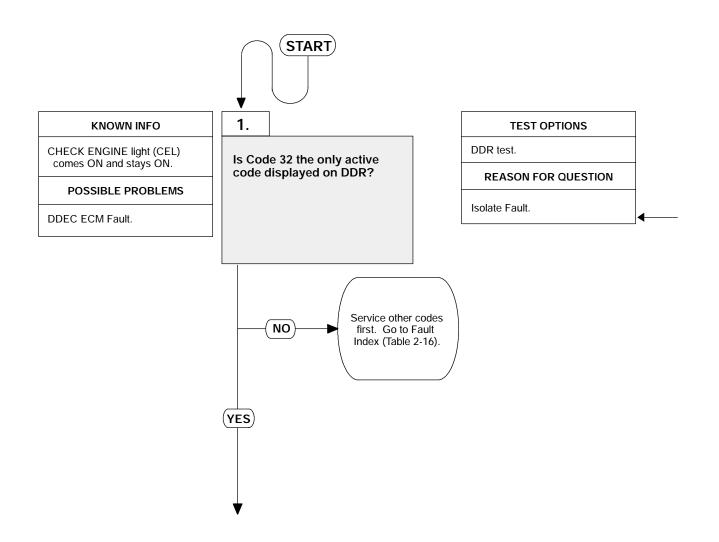
### A4 CODE 32 DDEC ECM BACKUP SYSTEM FAILURE.

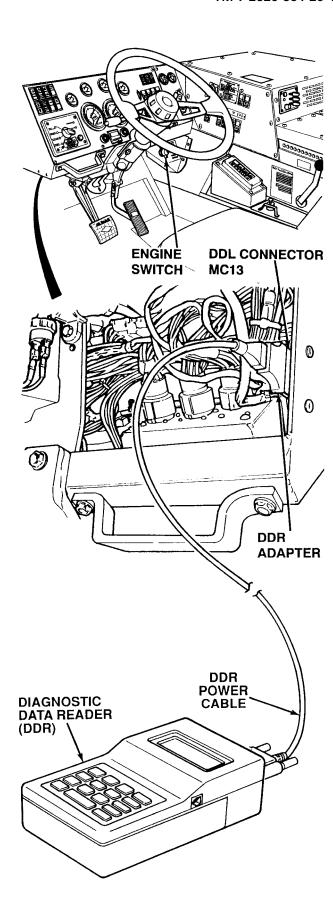
### **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)





# **NOTE**

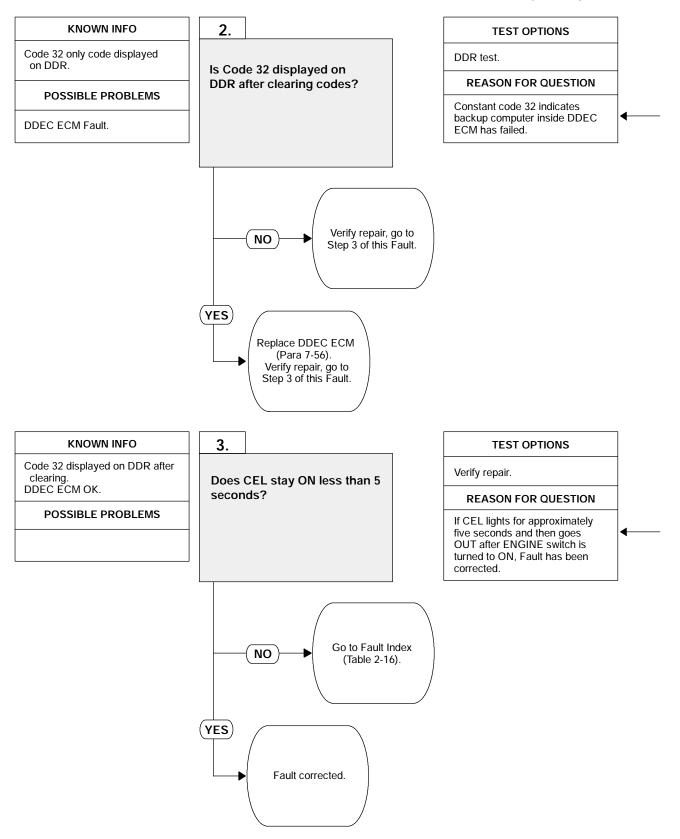
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10). (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If Code 32 is not the only active code displayed, turn OFF
  - code displayed, turn OFF
    ENGINE switch and go to Fault
    Index (Table 2-16).

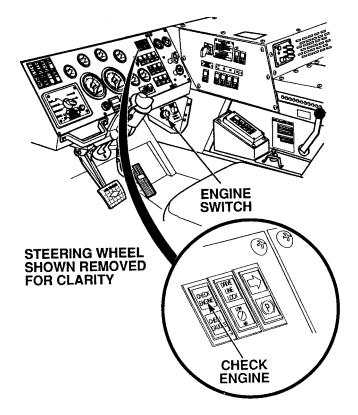
    (b) If Code 32 is the only active
    code displayed, turn OFF
    ENGINE switch and go to Step 2 of this Fault.

# A4 CODE 32 DDEC ECM BACKUP SYSTEM FAILURE (CONT).



#### **DDR TEST**

- (1) Clear codes on DDR (Para 2-11).
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If Code 32 does not appear, turn OFF ENGINE switch and go to Step 3 of this Fault.
  - (b) If Code 32 does appear, turn OFF ENGINE switch and replace DDEC ECM (Para 7-56).
- (4) Disconnect DDR from DDL connector MC13.
- (5) Turn OFF ENGINE switch.



#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
    (b) If CHECK ENGINE light comes on
  - (b) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.

# 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 33 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE HIGH.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

Wrench, Torque (0 to 175 lb-ft [0 to 237 N·m])

(Item 95, Appendix G)

**Jumperwire** 

# Materials/Parts

Compound, Corrosion Preventive

(Item 34, Appendix C)

#### References

TM 9-2320-364-10 TM 9-4910-571-12&P

### Equipment Condition

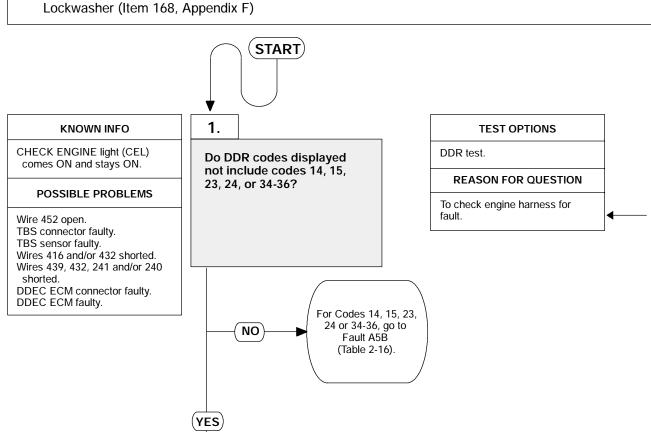
Engine OFF, (TM 9-2320-364-10)

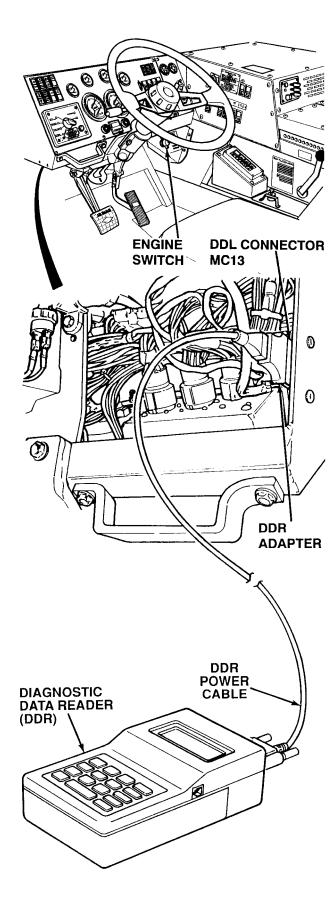
Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)





# **NOTE**

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

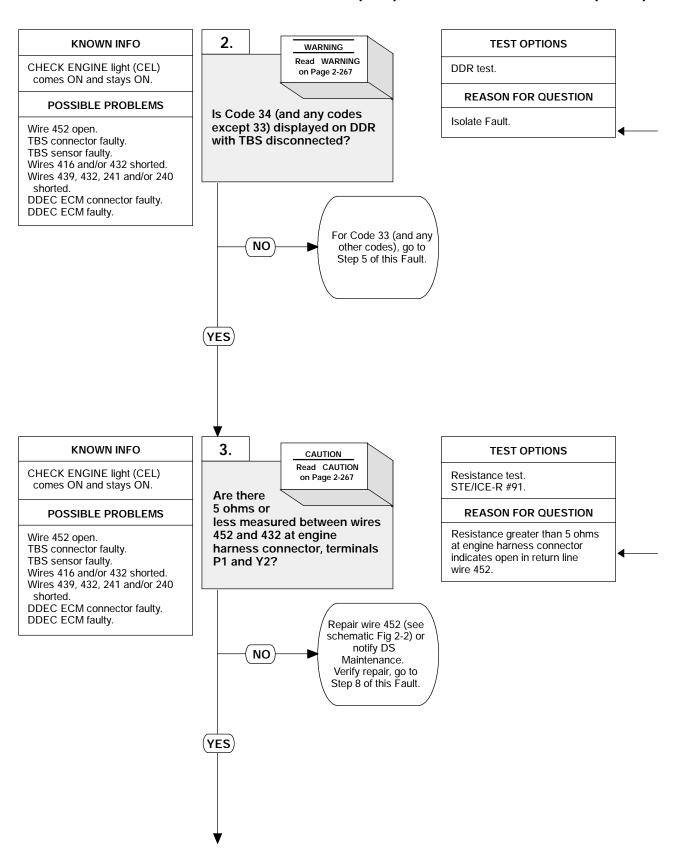
### **DDR TEST**

- (1) Connect DDR to DDL
- connector MC13.
  Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - on DDR.

    (a) If Code 33 is not the only active code displayed and Codes 14, 15, 23, 24 and/or 34 through 36 appear, turn OFF ENGINE switch and go to Fault Index A5B (Table 2-16).

    (b) If Code 33 is the only active code displayed, turn OFF ENGINE switch and go to Step 2 of this Fault
  - of this Fault.

# A4 CODE 33 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE HIGH (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



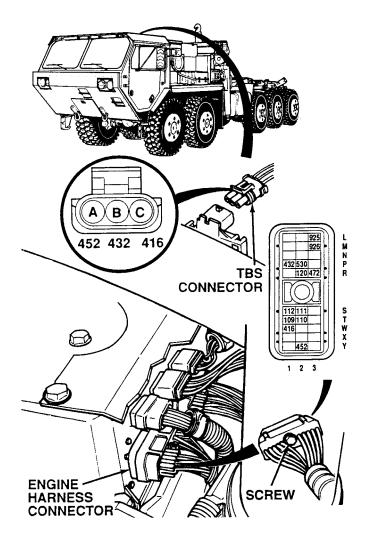
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

### **DDR TEST**

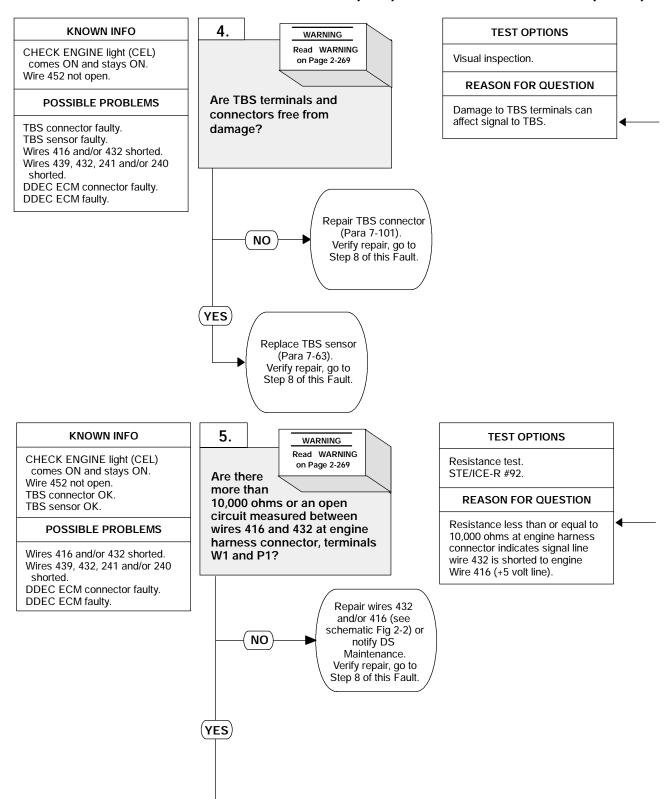
- (1) Disconnect TBS harness connector.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Start engine and run at idle.
- (4) Read active codes on DDR.
  - (a) If code 33 and any other codes appears on DDR, turn OFF ENGINE switch and go to Step 5 of this Fault.
  - (b) If code 34 or any other code except code 33 appear on DDR, turn OFF ENGINE switch and go to Step 3 of this Fault.

#### RESISTANCE TEST

- (1) Place jumperwire between terminals A and B at TBS harness connector.
- (2) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (3) Read resistance between wires 432 and 452 at engine harness connector, terminals P1 and Y2.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wire 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are 5 ohms or less present, wire 452 is OK.
- (4) Remove jumperwire.



# A4 CODE 33 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE HIGH (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors

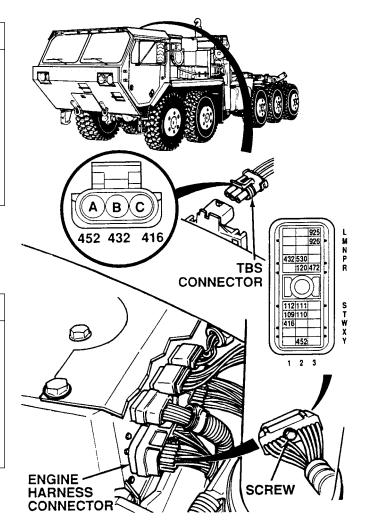
#### **VISUAL INSPECTION**

Check terminals at TBS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or terminals.

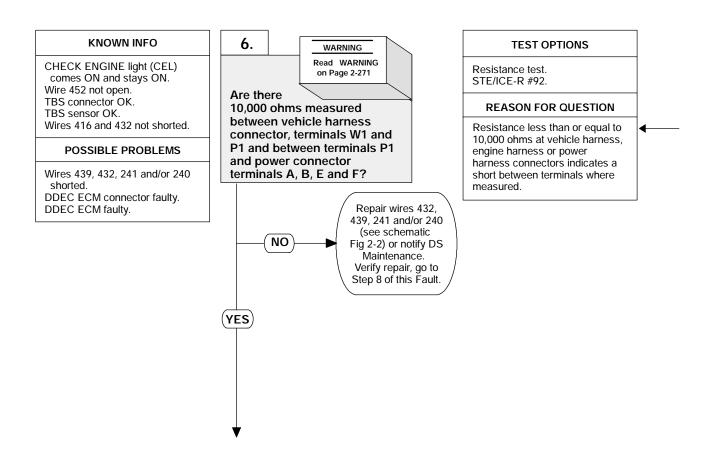
- (1) If connectors are damaged, repair connectors (Para 7-101) and connect TBS harness connector to sensor connector.
- (2) If connectors are free of damage, replace TBS (Para 7-63) and connect TBS harness connector to sensor connector.

#### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector from DDEC ECM.
- (2) Read resistance between wires 416 and 432 at engine harness connector, terminals W1 and P1.
  - (a) If 10,000 ohms or less are present, repair wires 416 and/or 432 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If more than 10,000 ohms are present, go to Step 6 of this Fault.



# A4 CODE 33 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE HIGH (CONT).



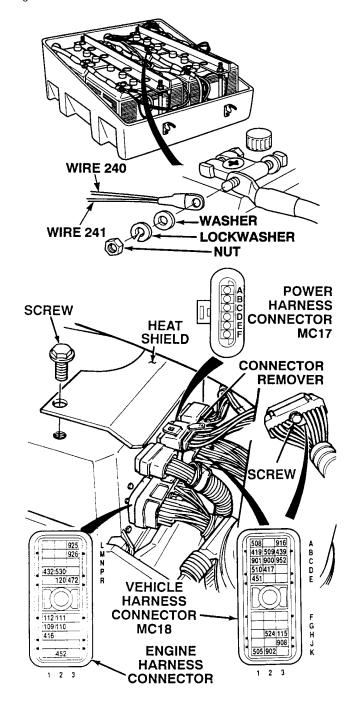
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.
- Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact
  with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes
  with large amounts of water for at least 15 minutes and get immediate medical attention.

# CAUTION

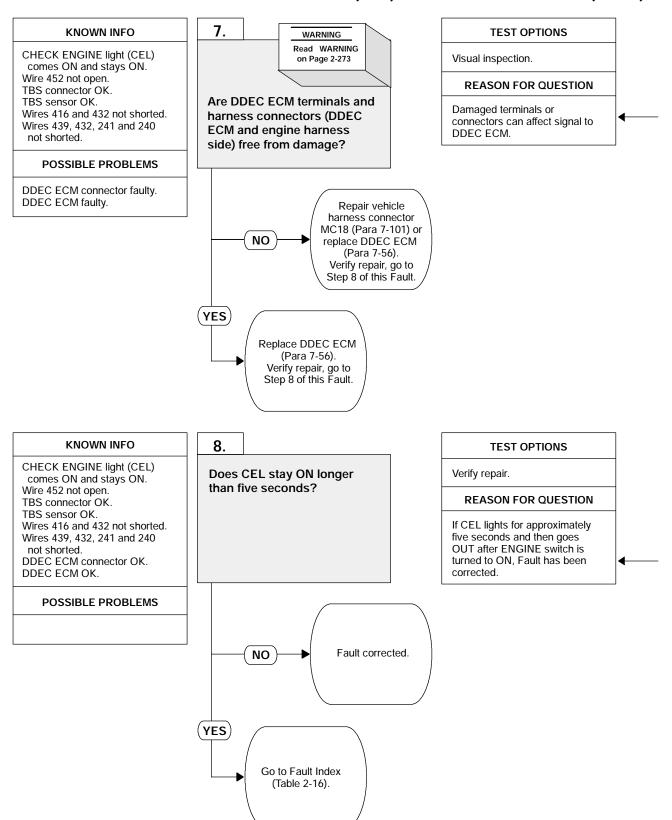
While applying torque to nut, hold screw with wrench or damage to battery may occur.

#### RESISTANCE TEST

- Remove battery box cover (TM 9-2320-364-10).
- (2) Remove nut, washer, lockwasher, wires 240 and 241 from battery. Discard lockwasher.
- Remove two mounting screws and heat shield from DDEC ECM.
- (4) Disconnect power harness connector at DDEC ECM with connector remover.
- (5) Loosen screw and disconnect vehicle harness connector MC18 from DDEC ECM.
- (6) Read resistance between wire 432 at engine harness connector, terminal P1 and wire 439 at vehicle harness connector MC18, terminal B3.
  - (a) If there are 10,000 ohms or less present, repair wires 432 and/or 439 (see schematic Fig 2-2 and/or 2-3) or notify DS Maintenance and perform Steps (8) through (14) below.
  - (b) If there are more than 10,000 ohms present, go to Step (7) below.
- (7) Read resistance between wire 432 at engine harness connector, terminal P1 and wires 241 and 240 at power harness connector MC17, terminals A, B, E and F.
  - (a) If there are 10,000 ohms or less present, repair wires 432, 241 and/or 240 (see schematic Fig 2-2 and/or 2-3) or notify DS Maintenance and perform Steps (8) through (14) below.
  - (b) If there are more than 10,000 ohms present, wires 432, 241 and 240 are OK.
- (8) Connect wires 240/241 to battery with lockwasher, washer and nut.
- (9) Tighten nut to 23 lb-ft (31 N·m).
- (10) Apply corrosion preventive compound on nut.
- (11) Install battery box cover.
- (12) Connect power harness connector to DDEC ECM.
- (13) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw
- (14) Install heat shield with two mounting screws to DDEC ECM.



# A4 CODE 33 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE HIGH (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

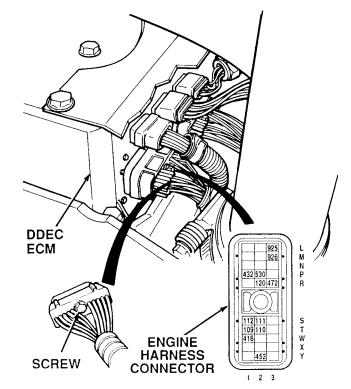
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

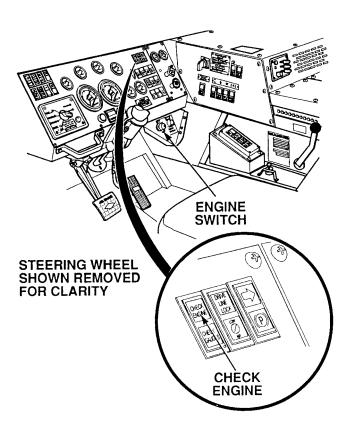
### **VISUAL INSPECTION**

- Check terminals at engine harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (Para 7-56).
    (c) If DDEC harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Connect engine harness connector to DDEC ECM and tighten screw.
- (3) Close top engine access cover.

### VERIFY REPAIR

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-24).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.
  - (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.





# 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW.

### **INITIAL SETUP**

Tools and Special Tools

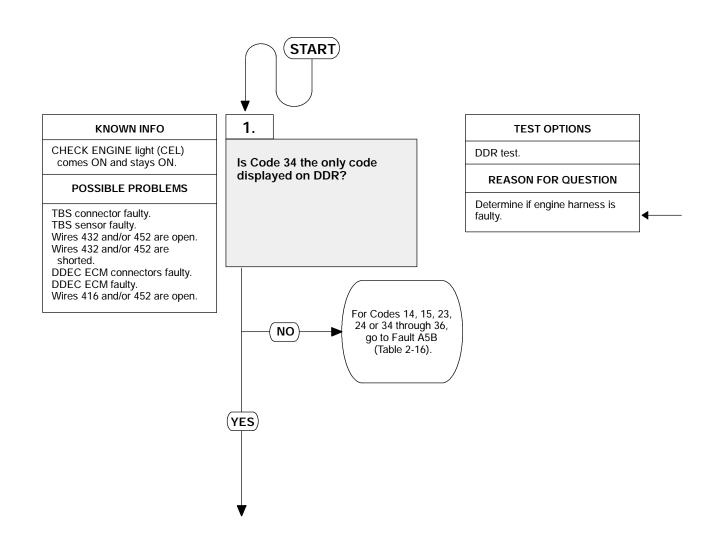
Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G) STE/ICE-R (optional) (Item 3, Appendix G) DDEC Repair Kit (Item 15, Appendix G) Multimeter (Item 44, Appendix G) Reader, Diagnostic (Item 53, Appendix G)

Jumperwire

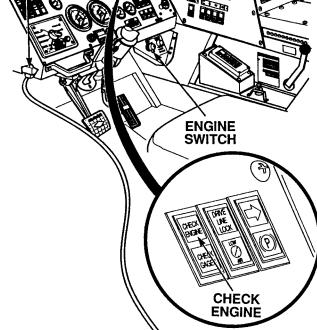
#### References

TM 9-2320-364-10 TM 9-4910-571-12&P **Equipment Condition** 

Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)
Top engine access cover opened,
(TM 9-2320-364-10)



### STEERING WHEEL SHOWN REMOVED FOR CLARITY



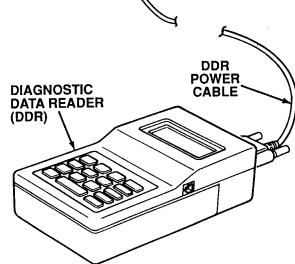
DDL CONNECTOR

### **NOTE**

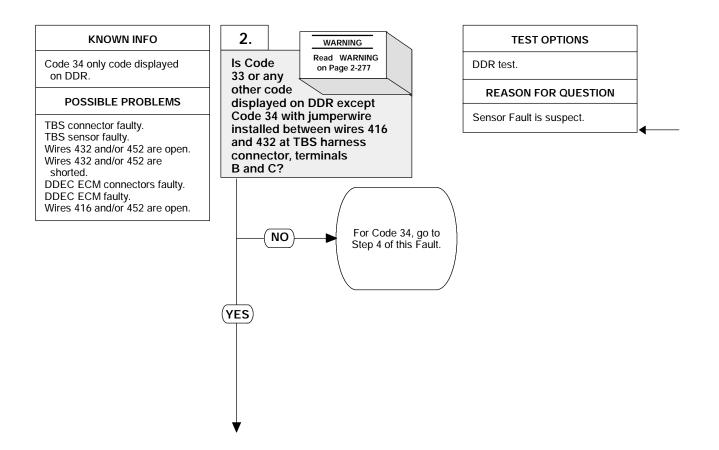
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If Code 34 is not the only active code displayed and Codes 14, 15, 23 or 34 through 36 are displayed, turn OFF ENGINE switch and go to Fault A5B (Table 2-16).
    (b) If Code 34 is the only active
  - (b) If Code 34 is the only active code displayed, turn OFF ENGINE switch and go to Step 2 of this Fault.



# A4 CODE 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



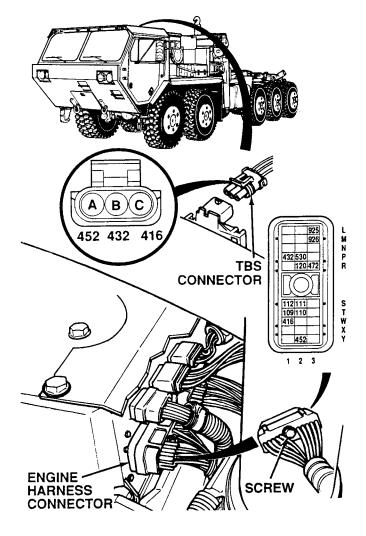
Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

### NOTE

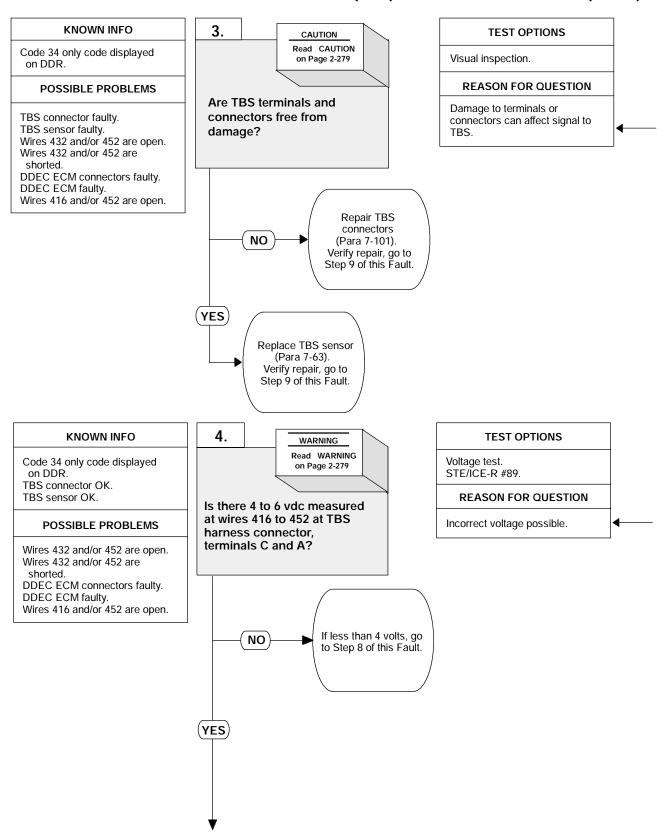
If no codes appear on DDR, start engine and run until either the CEL comes ON or the engine has been running at 120 to 160°F (49 to 71°C) for at least one minute at greater than 1,000 RPM.

### **DDR TEST**

- (1) Disconnect TBS harness connector.
- Place jumperwire between terminals B and C at TBS harness connector.
- Turn ON ENGINE switch (TM 9-2320-364-10).
- Select MODE 01 (ACTIVE CODES) on DDR.
- (5) Are codes 33 and/or 34 displayed on DDR.
  - (a) If code 34 and any other is displayed on DDR, turn OFF ENGINE switch and go to Step 4 of this Fault.
- (b) If code 33 and any other code except code 34 is displayed on DDR, turn OFF ENGINE switch and go to Step 3 of this Fault.
  (6) Remove jumperwire from TBS
- harness connector.



# A4 CODE 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW (CONT).



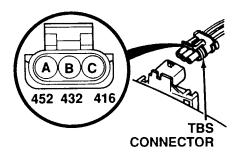
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

### **VISUAL INSPECTION**

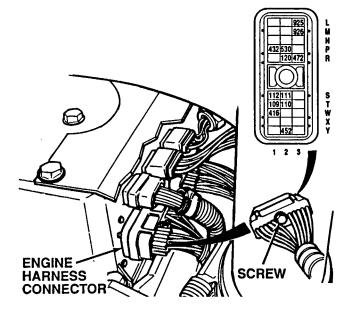
- (1) Remove jumperwire.
- (2) Check terminals at TBS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors are damaged, repair connectors (Para 7-101).
    If connectors are free of damage,
  - replace TBS (Para 7-63).



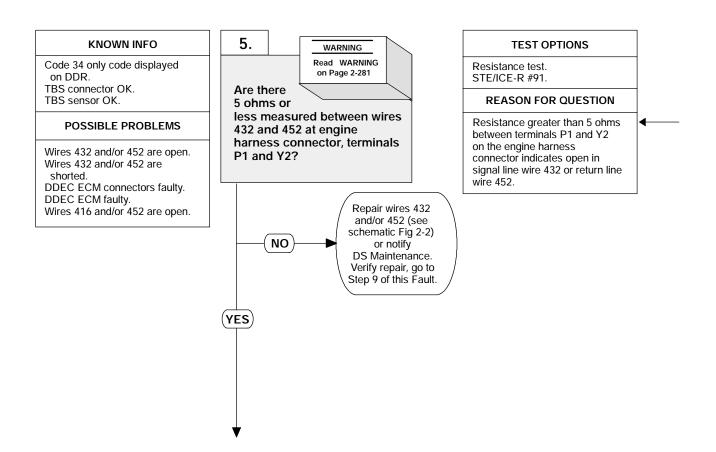
#### **VOLTAGE TEST**

- (1) Remove jumperwire.
- (2) Set multimeter select switch to volts dc.
- Connect positive (+) multimeter lead to TBS harness connector, terminal A.

  (4) Connect negative (-) multimeter lead
- to TBS harness connector, terminal C.
- (5) Turn ON ENGINE switch (TM 9-2320-364-10).
  - (a) If there are less than 4 to 6 vdc present, turn OFF ENGINE switch go Step 8 of this Fault.
  - (b) If there are 4 to 6 vdc present, turn OFF ENGINE switch and go to Step 5 of this Fault.



# A4 CODE 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW (CONT).



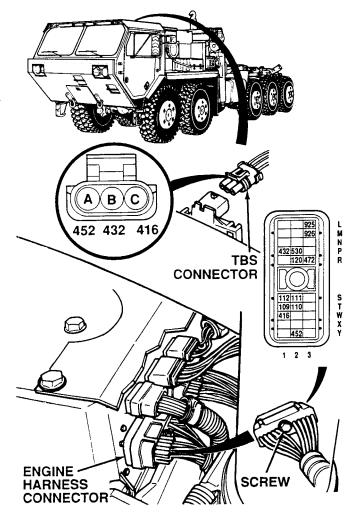
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

# CAUTION

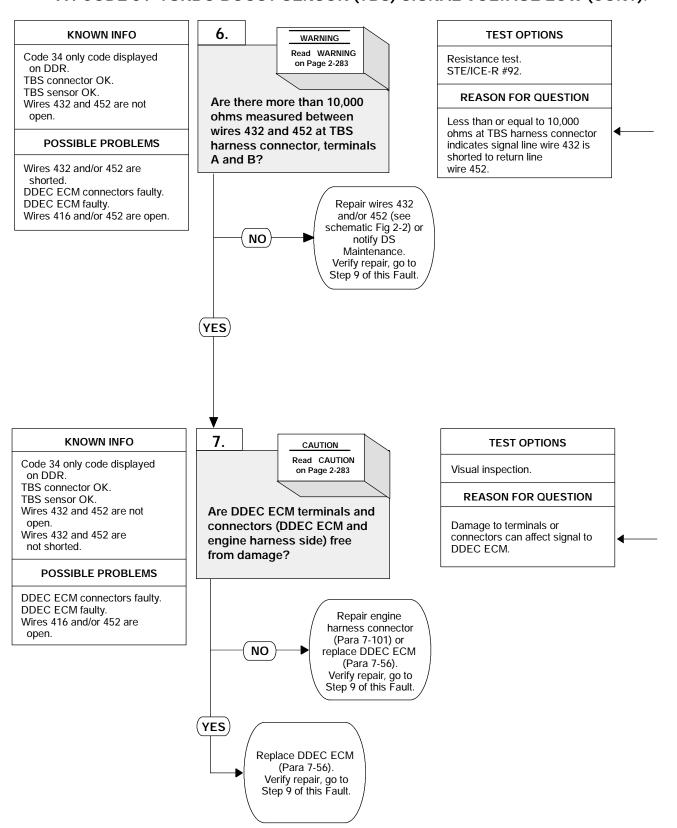
Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

#### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Place jumperwire between terminals B and A at TBS harness connector.
- (3) Read resistance between wires 432 and 452 at engine harness connector, terminals P1 and Y2.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wires 432 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are 5 ohms or less present, remove jumperwire and go to Step 6 of this Fault.



# A4 CODE 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW (CONT).



Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.



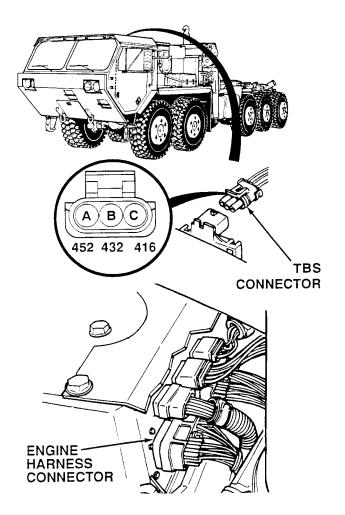
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

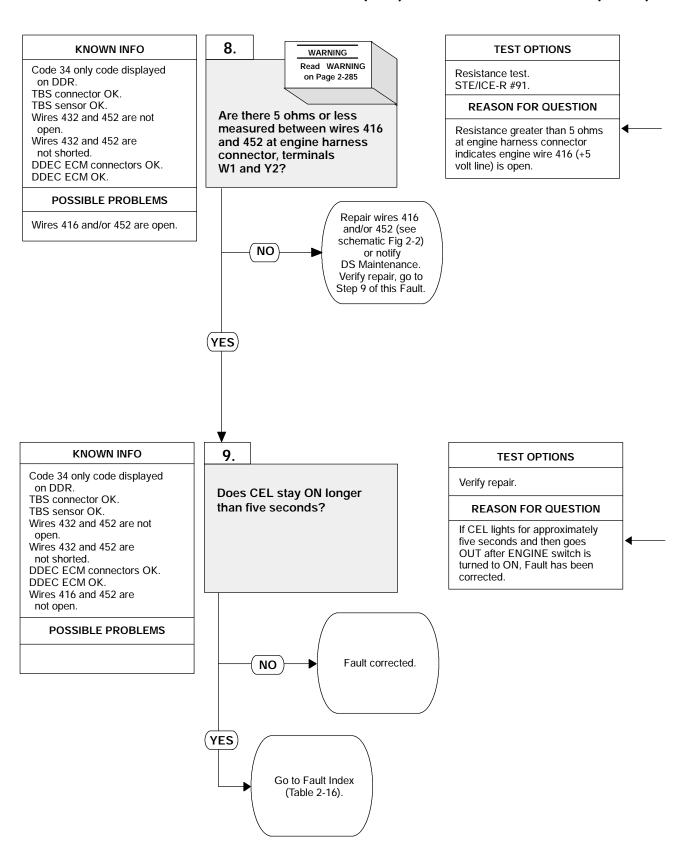
- (1) Remove jumperwire.
- (2) Read resistance between terminals A and B at TBS harness connector.
  - (a) If there are 10,000 ohms or less present, repair wires 432 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step (3) below.
- (3) Read resistance between terminal B at TBS harness connector and a known good ground.
  - (a) If there are less than 10,000 ohms present, repair wire 432 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, wires 432 and 452 are OK.

#### VISUAL INSPECTION

- Check terminals at engine harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connectors are damaged, repair connectors (Para 7-101) and perform Step (2) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If engine harness and DDEC ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Close top engine access cover.



# A4 CODE 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW (CONT).



Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.

# CAUTION

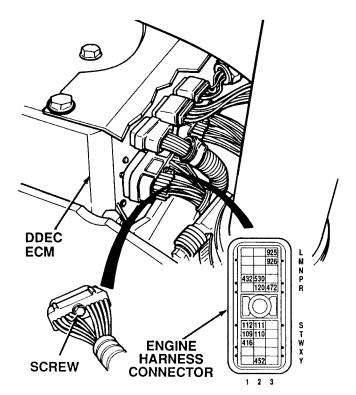
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

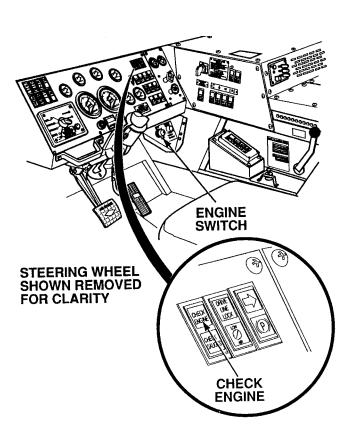
#### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector from DDEC ECM.
- (2) Place jumperwire between terminals A and C at TBS harness connector.
- (3) Read resistance between wires 416 and 452 at engine harness connector, terminals W1 and Y2.
  - (a) If there are more than 5 ohms present, repair wires 416 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance and perform Steps (4) through (7) below.
  - (b) If there are 5 ohms or less present, wires 416 and 452 are OK, perform Steps (4) through (7) below and go to Step 9 of this Fault.
- (4) Remove jumperwire from TBS harness connector.
- (5) Connect TBS harness connector.
- (6) Connect engine harness connector to DDEC ECM and tighten screw.
- (7) Close top engine access cover.

#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-24).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.
  - (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.





# 2-13. DDEC II TROUBLESHOOTING (CONT).

### A4 CODE 35 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE HIGH.

### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

Wrench, Torque (0 to 175 lb-ft [0 to 237 N·m])

(YES)

(Item 95, Appendix G)

**Jumperwire** 

### References TM 9-23

TM 9-2320-364-10

TM 9-4910-571-12&P

## **Equipment Condition**

Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)

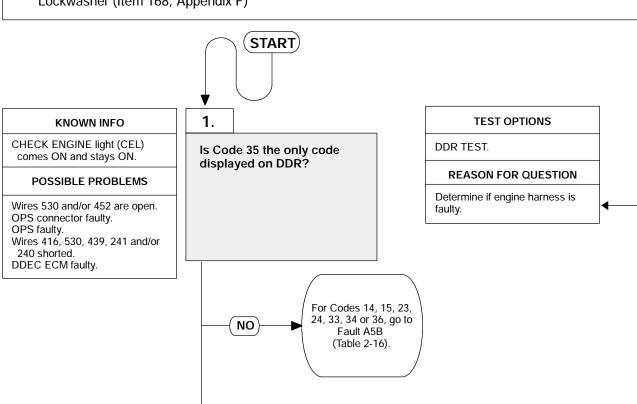
Right front fender skirt removed, (Para 17-33)

#### Materials/Parts

Compound, Corrosion Preventive

(Item 34, Appendix C)

Lockwasher (Item 168, Appendix F)





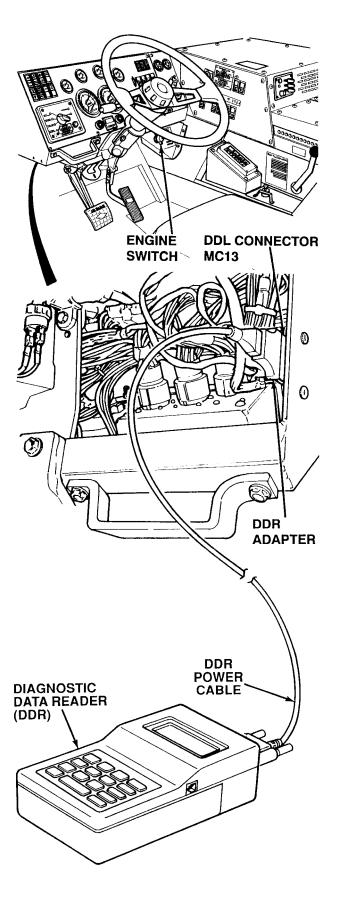
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **DDR TEST**

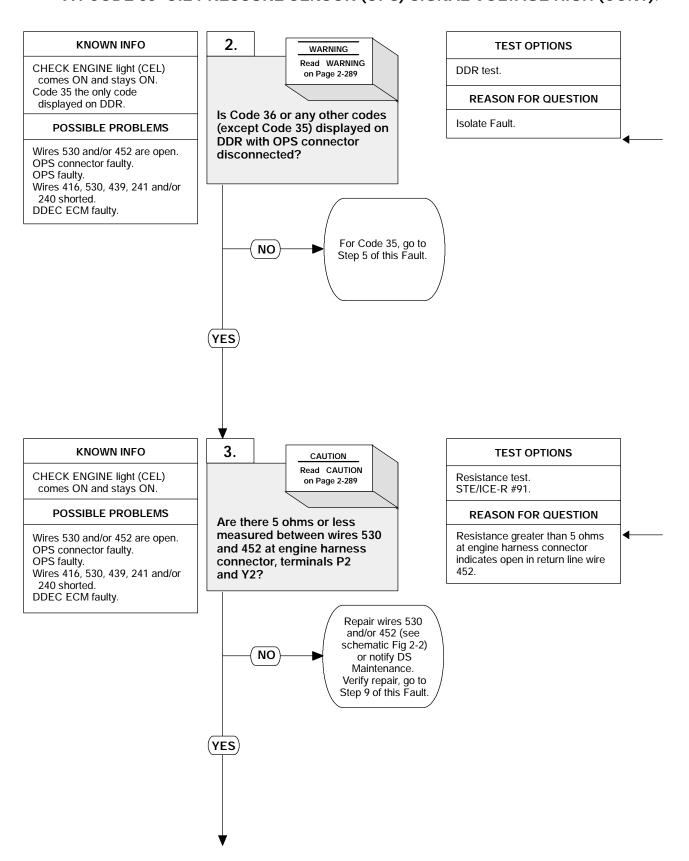
- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch (TM 9-2320-364-10). Select MODE 01 (ACTIVE CODES)
- on DDR.
  - on DDR.

    (a) If Code 35 is not the only active code displayed and Codes 14, 15, 23, 24, 33, 34 or 36 are displayed, turn OFF ENGINE switch and go to Fault A5B (Table 2-16).

    (b) If Code 35 is the only active code displayed, turn OFF
  - ENGINE switch and go to Step 2 of this Fault.



# A4 CODE 35 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE HIGH (CONT).



Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



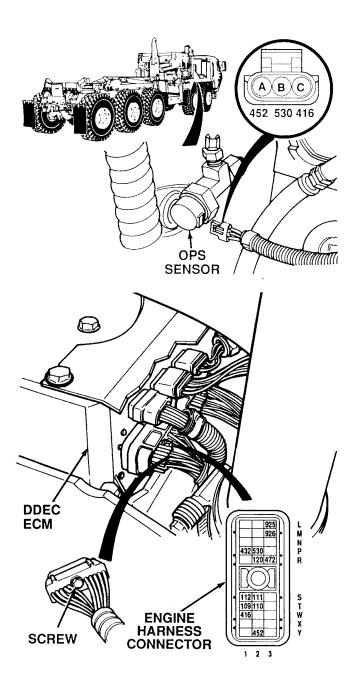
Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

#### DDR TEST

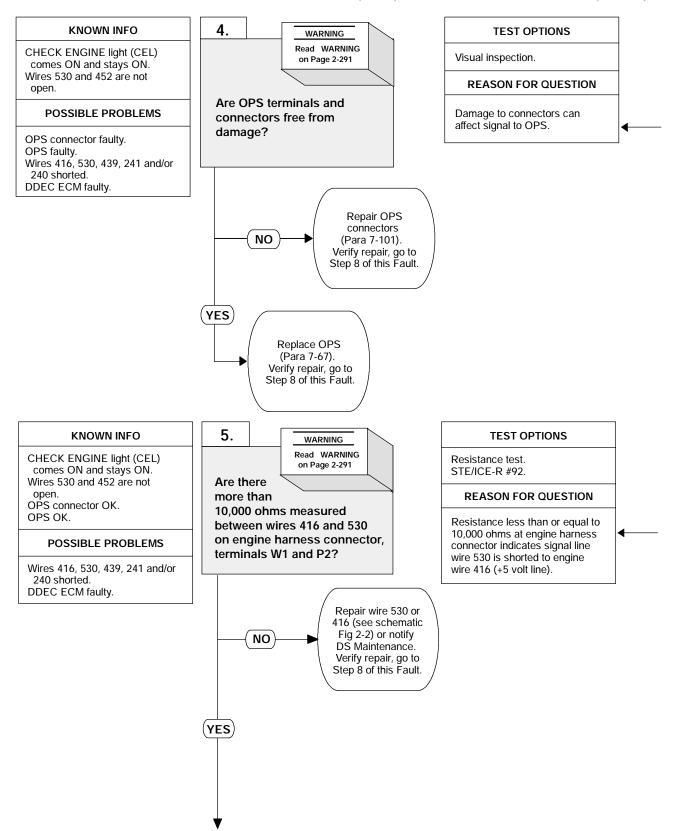
- (1) Disconnect OPS harness connector.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 18 (OIL TEMP) on DDR.
- (4) Run engine until oil temperature reading is greater than 140°F (60°C).
- (5) Is Code 36 or any other codes except Code 35 displayed on DDR with OPS connector disconnected.
  - (a) If Code 35 or any other code is displayed, turn OFF ENGINE switch and go to Step 5 of this Fault.
  - (b) If Code 36 and any other code except Code 35 is displayed, turn OFF ENGINE switch and go to Step 3 of this Fault.

#### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Place jumperwire between terminals A and B at OPS harness connector.
- (3) Read resistance between wires 452 and 530 at engine harness connector, terminals P2 and Y2.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wires 452 and/or 530 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are 5 ohms or less present, wires 452 and 530 are OK.
- (4) Remove jumperwire.



# A4 CODE 35 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE HIGH (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

# CAUTION

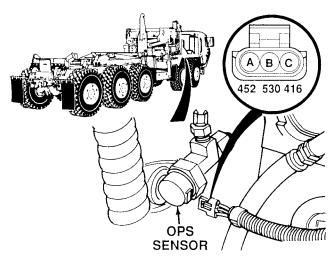
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

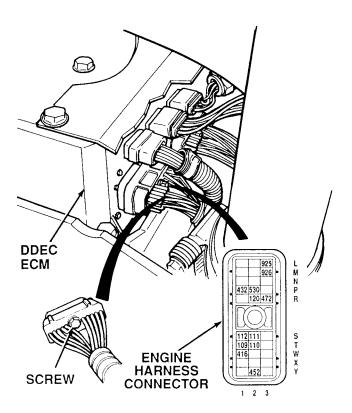
#### VISUAL INSPECTION

- Check terminals at OPS connector (sensor and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors are damaged, repair connectors (Para 7-101), perform Steps (2) through (4) below and go to Step 8 of this Fault.
  - (b) If connectors are free of damage, replace OPS (Para 7-67), perform Steps (2) through (4) below, and go to Step 8 of this Fault.
- (2) Connect OPS harness connector.
- (3) Close top engine access cover.
- (4) Install right front fender skirt (Para 17-33).

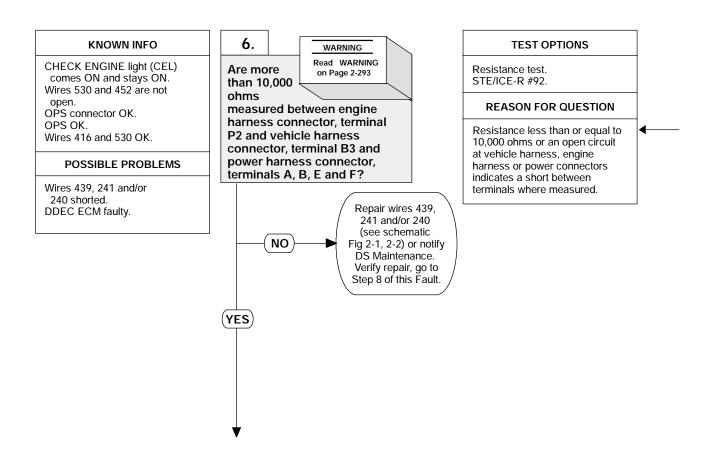
## RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector.
- (2) Read resistance between wires 416 and 530 on engine harness connector, terminals W1 and P2.
  - (a) If there are less than 10,000 ohms present, repair wires 416 and/or 530 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, wires are OK.





# A4 CODE 35 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE HIGH (CONT).



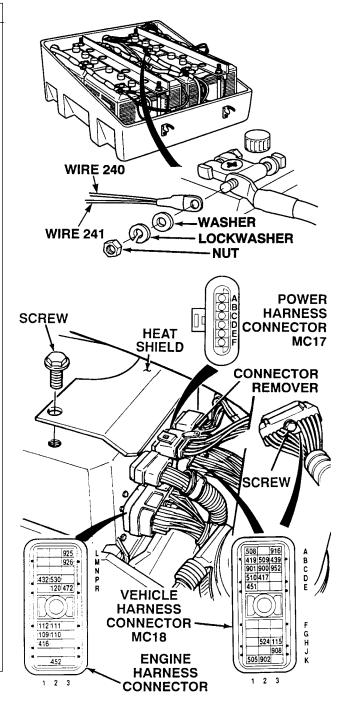
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.
- Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact
  with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes
  with large amounts of water for at least 15 minutes and get immediate medical attention.

# CAUTION

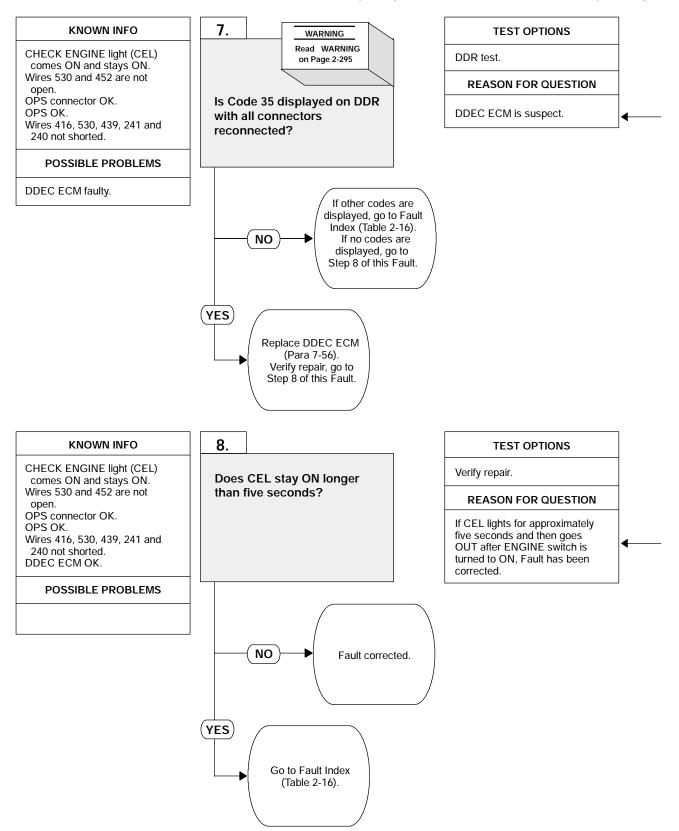
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.
- While applying torque to nut, hold screw with wrench or damage to battery may occur.

#### RESISTANCE TEST

- (1) Remove battery box cover (TM 9-2302-364-10).
- (2) Remove nut, washer, lockwasher and wires 240/241 from battery. Discard lockwasher
- (3) Remove two mounting screws and heat shield from DDEC ECM.
- (4) Disconnect power harness connector MC17 with connector remover.
- (5) Loosen screw and disconnect vehicle harness connector MC18 at DDEC FCM
- (6) Read resistance between engine harness connector, terminal P2 and wire 439 at vehicle harness connector MC18, terminal B3.
  - (a) If less than 10,000 ohms are present, repair wire 439 (see schematic Fig 2-1 and/or Fig 2-2) or notify DS Maintenance and perform Steps (8) through (17) below.
  - (b) If there are more than 10,000 ohms present, wire 439 is OK. Perform Step (7) below.
- (7) Read resistance between engine harness connector, terminal P2 and wires 241 and 240 at power harness connector MC17, terminals A, B, E and F
  - (a) If less than 10,000 ohms are present, repair wires 241 and/or 240 (see schematic Fig 2-1 and/or Fig 2-2) or notify DS Maintenance. Perform Steps (8) through (17) below.
  - (b) If more than 10,000 ohms are present, wires are OK. Go to Step 7 of this Fault.
- (8) Connect engine harness connector to DDEC ECM and tighten screw.
- (9) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.
- (10) Connect power harness connector MC17 to DDEC ECM.
- (11) Install heat shield with two mounting screws on DDEC ECM.
- (12) Connect wires 240/241 to battery with lockwasher, washer and nut.
- (13) Tighten nut to 23 lb-ft (31 N·m).
- (14) Apply corrosion preventive compound on nut.
- (15) Install battery box cover.
- (16) Close top engine access cover.
- (17) Install right front fender skirt (Para 17-33).



# A4 CODE 35 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE HIGH (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

#### DDR TEST

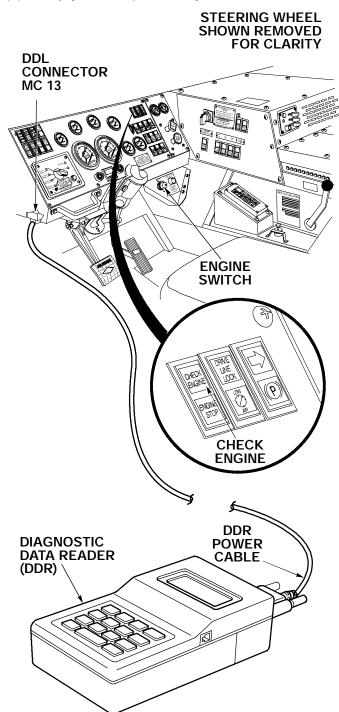
- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Select MODE 40 (CLEAR CODES) on DDR (Para 2-11).
- (3) Start engine (TM 9-2320-364-10).
- (4) Run engine for one minute or until CHECK ENGINE light (CEL) comes ON.
- (5) Select MODE 01 (ACTIVE CODES) on DDR.
- (6) Is Code 35 or any other codes displayed on DDR.
  - (a) If any other code (except Code 35) appears on DDR, turn OFF ENGINE switch, and go to Fault Index (Table 2-16).
  - (b) If Code 35 is displayed on DDR, turn OFF ENGINE switch, and replace DDEC ECM (Para 7-56).

#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.

    Perform Steps (4) and (5) below
  - Perform Steps (4) and (5) below.

    (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

# A4 CODE 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW.

## **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

Wrench, Torque (0 to 175 lb-ft [0 to 237 N·m])

(Item 95, Appendix G)

**Jumperwire** 

# Materials/Parts

Compound, Corrosion Preventive

(Item 34, Appendix C)

Lockwasher (Item 168, Appendix F)

#### References

TM 9-2320-364-10

TM 9-4910-571-12&P

# **Equipment Condition**

Engine OFF, (TM 9-2320-364-10)

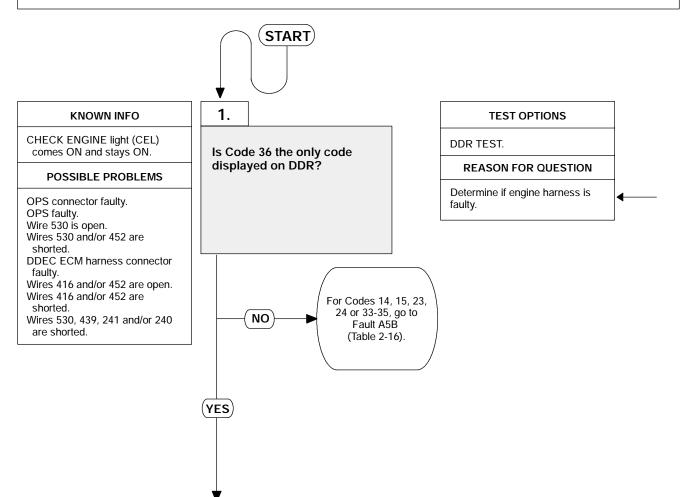
Parking brake applied, (TM 9-2320-364-10)

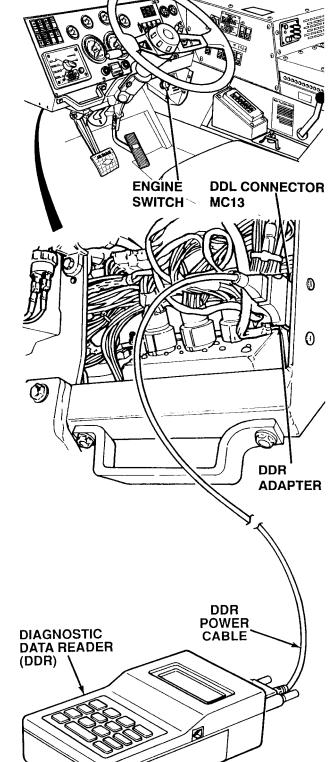
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)

Right front fender skirt removed, (Para 17-33)





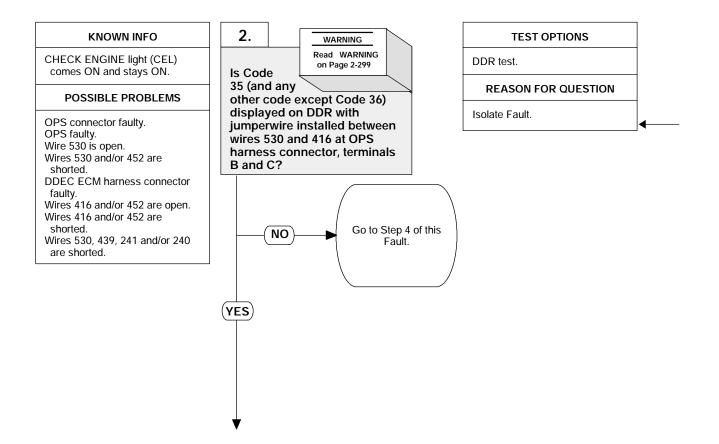
# **NOTE**

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

# **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If there are codes other than Code 36 displayed, turn OFF ENGINE switch go to Fault A5B (Table 2-16).
  - (b) If there are no other codes displayed, turn OFF ENGINE switch and go to Step 2 of this Fault.

# A4 CODE 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT).



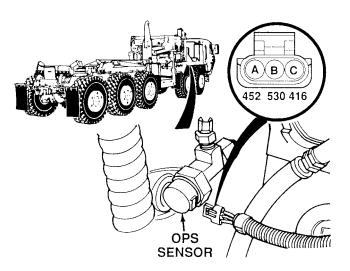
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



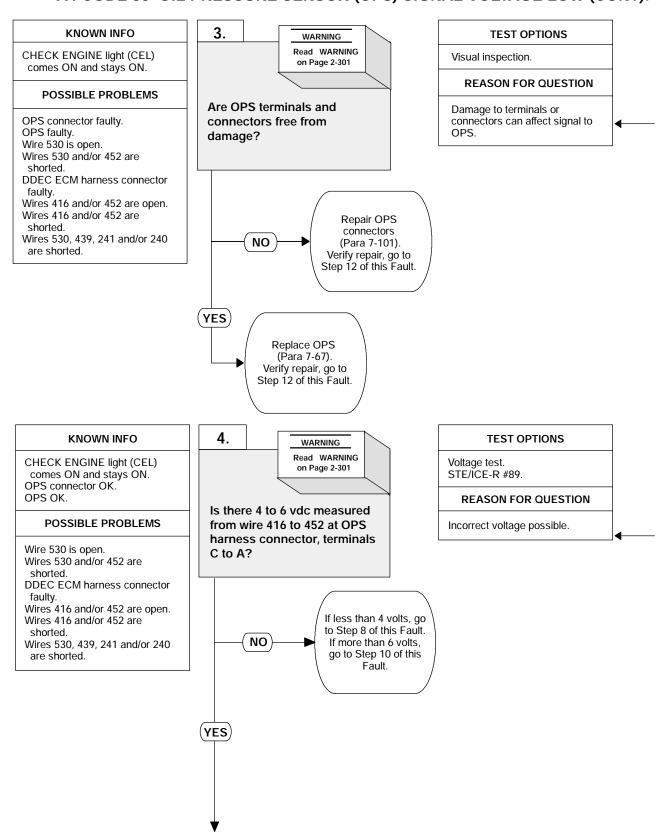
Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

#### **DDR TEST**

- (1) Disconnect OPS harness connector.(2) Place jumperwire between terminals B and C at OPS harness connector.
- Turn ON ENGINE switch (TM 9-2320-364-10).
- Select MODE 01 (ACTIVE CODES) on DDR.
- (5) Is Code 35 or any other codes displayed on DDR.
  - (a) If Code 36 or any other code is displayed on DDR, turn OFF ENGINE switch, remove jumperwire and go to Step 4 of this Fault.
  - (b) If Code 35 or any other code except Code 36 is displayed on DDR, turn OFF ENGINE switch, remove jumperwire and go to Step 3 of this Fault.



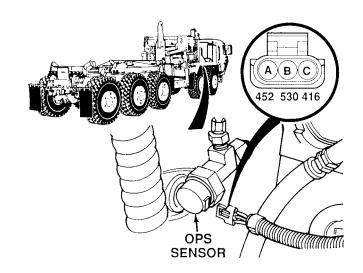
# A4 CODE 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

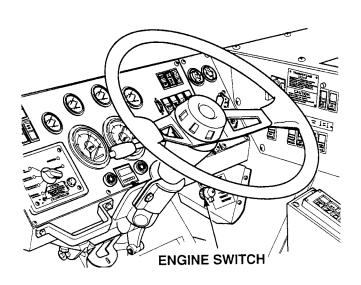
#### **VISUAL INSPECTION**

- Check terminals at OPS connector sensor and harness side for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors are damaged, repair connectors (Para 7-101).
  - (b) If connectors are free of damage, replace OPS (Para 7-67).
- (2) Close top engine access cover.
- (3) Install right front fender skirt (Para 17-33).

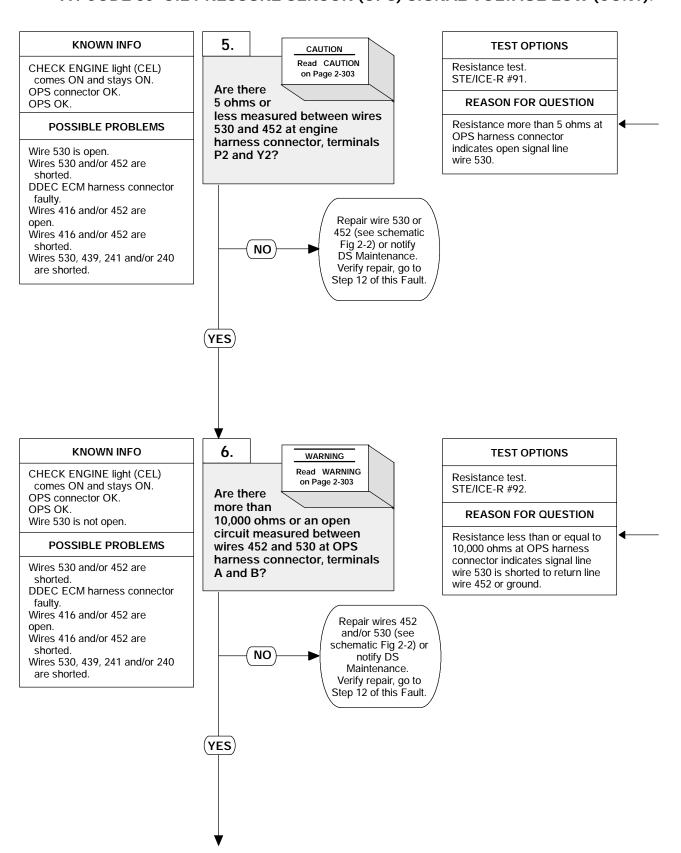


#### **VOLTAGE TEST**

- (1) Set multimeter select switch to volts dc.
- (2) Connect positive (+) multimeter lead to OPS harness connector, terminal A.
- (3) Connect negative (-) multimeter lead to OPS harness connector, terminal C.
- (4) Turn ON ENGINE switch (TM 9-2320-364-10).
  - (a) If there are less than 4 vdc present, turn OFF ENGINE switch and go to Step 8 of this Fault.
  - (b) If there are more than 6 vdc present, go to Step 10 of this Fault.
  - (c) If there are 4 to 6 vdc present, turn OFF ENGINE switch and go to Step 5 of this Fault.



# A4 CODE 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT).



Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



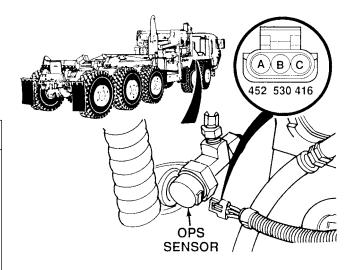
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

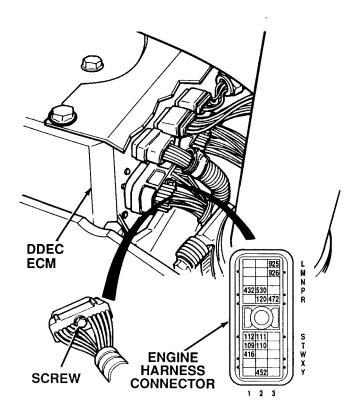
#### RESISTANCE TEST

- Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Place jumperwire between terminals A and B at OPS harness connector.
- (3) Set multimeter select switch to ohms.
- (4) Read resistance between wires 452 and 530 at engine harness connector, terminals P2 and Y2.
  - (a) If there are more than 5 ohms present, perform Step (5) below and repair wires 452 and/or 530 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are 5 ohms or less present, wires 452 and 530 are OK.
- (5) Remove jumperwire.

## RESISTANCE TEST

- Read resistance between wires 452 and 530 at OPS harness connector, terminals A and B.
  - (a) If there are less than 10,000 ohms present, repair wires 452 and/or 530 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step (2) below
- (2) Read resistance between wires 530 and 452 at OPS harness connector, terminal B and A and a known good ground.
  - (a) If there are less than 10,000 ohms present, repair wire 530 or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, wires 530 and 452 are OK.





# A4 CODE 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT).

Repair DDEC ECM

harness connector

(Para 7-101) or replace DDEC ECM

(Para 7-56).

#### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. OPS connector OK. OPS OK. Wire 530 is not open.

Wire 530 and 452 not shorted.

#### POSSIBLE PROBLEMS

DDEC ECM harness connector faulty. Wires 416 and/or 452 are open. Wires 416 and/or 452 are shorted.

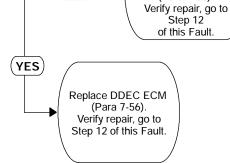
Wires 530, 439, 241 and/or 240 are shorted.

7. CAUTION Read CAUTION on Page 2-305 Are DDEC ECM terminals and connectors (DDEC ECM and engine harness side) free from damage?

**TEST OPTIONS** Visual inspection.

#### REASON FOR QUESTION

Damage to terminals can affect signal to DDEC ECM.



NO

#### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. OPS connector OK. OPS OK. Wire 530 is not open. DDEC ECM harness connector is OK.

# POSSIBLE PROBLEMS

Wires 416 and/or 452 are open. Wires 416 and/or 452 are shorted. Wires 530, 439, 241 and/or 240 are shorted. Wires 530 and/or 452 are shorted.

8. CAUTION Read CAUTION on Page 2-305

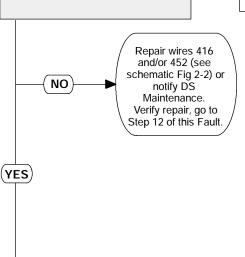
Are there 5 ohms or less measured between wires 416 and 452 at engine harness connector, terminals W1 and Y2?

#### **TEST OPTIONS**

Resistance test. STE/ICE-R #91.

#### REASON FOR QUESTION

Resistance more than 5 ohms at engine harness connector indicates wire 416 (+5 volt line) is open.



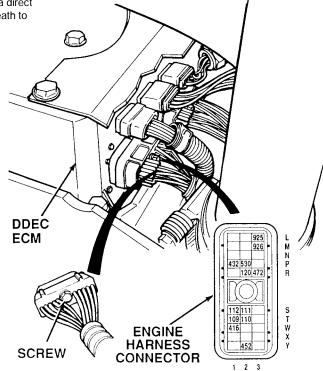
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

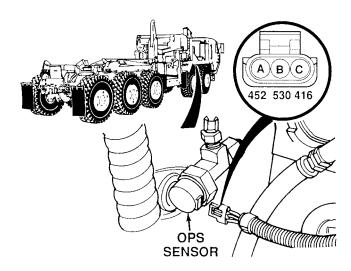
#### **VISUAL INSPECTION**

- Check terminal at engine harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If engine harness connector is damaged, repair connector (Para 7-101), and perform Steps
     (2) and (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If engine harness and DDEC ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Close top engine access cover.
- (3) Install right front fender skirt (Para 17-33).

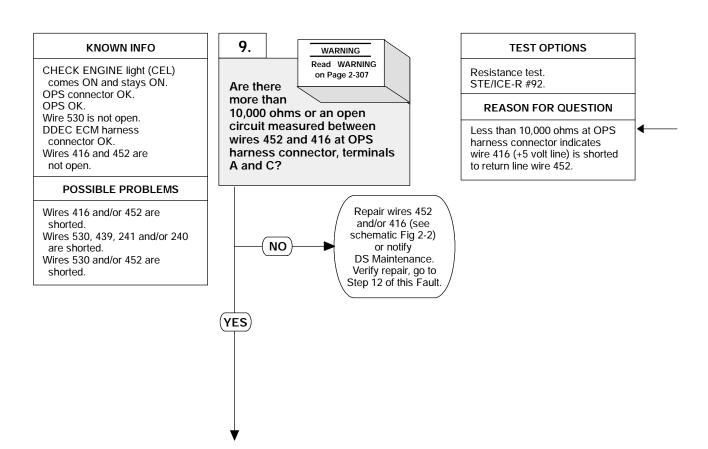


#### RESISTANCE TEST

- Place jumperwire between terminals A and C at OPS harness connector.
- (2) Read resistance at wires 416 and 452 at engine harness connector, terminals W1 and Y2.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wires 416 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are less than 5 ohms present, wires 416 and 452 are OK.
- (3) Remove jumperwire.



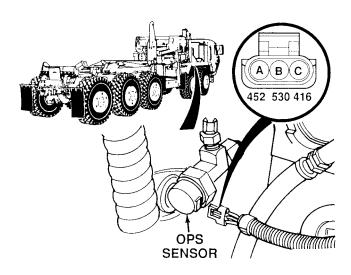
# A4 CODE 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT).



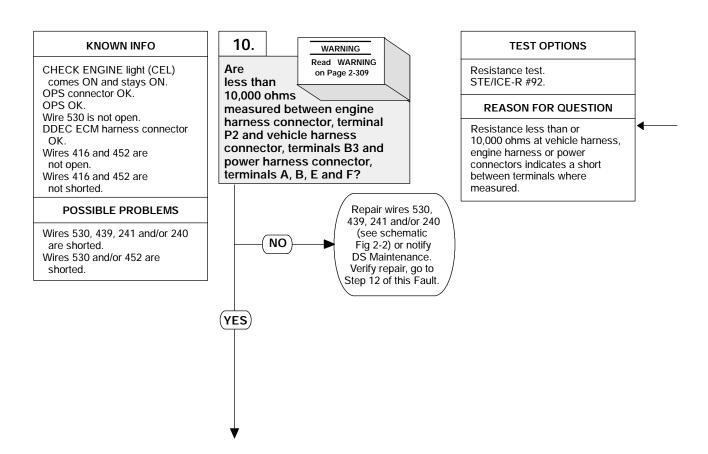
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

## RESISTANCE TEST

- (1) Read resistance between wires 452 and 416 at OPS harness connector, terminals A and C.
  - (a) If there are less than 10,000 ohms present, repair wires 452 and/or 416 (see schematic Fig 2-2) or notify DS Maintenance and perform Step (2) below.
  - perform Step (2) below.
    (b) If there are more than 10,000 ohms present, wires are OK.
- (2) Connect OPS harness connector.



# A4 CODE 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT).



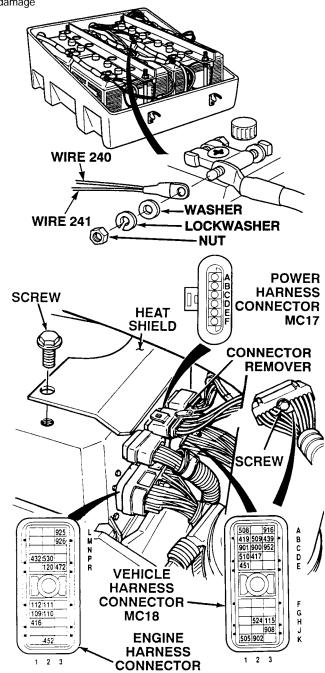
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact
  with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes
  with large amounts of water for at least 15 minutes and get immediate medical attention.

# CAUTION

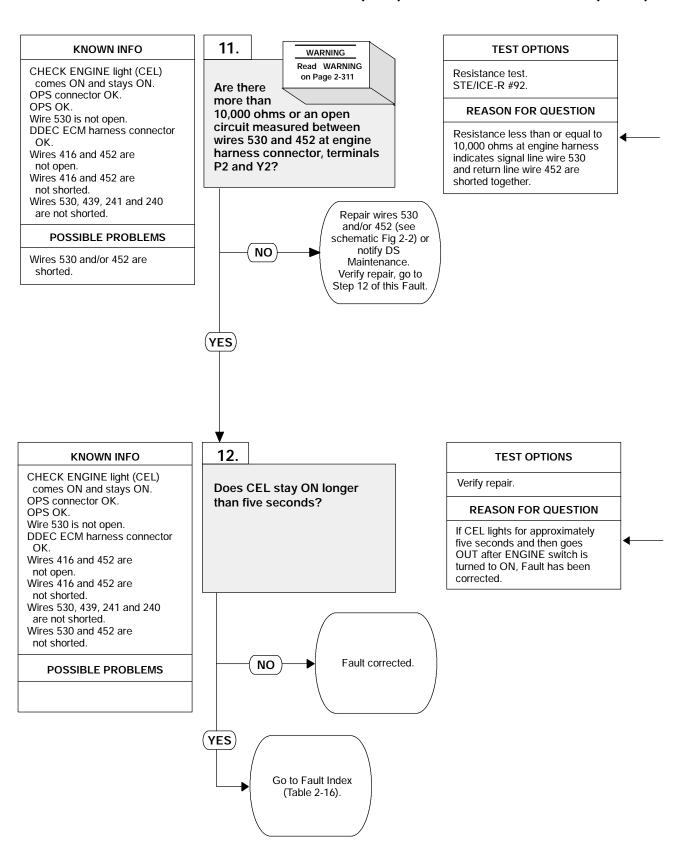
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.
- While applying torque to nut, hold screw with wrench or damage to battery may occur.

#### RESISTANCE TEST

- Remove battery box cover (TM 9-2320-364-10).
- (2) Remove nut, washer, lockwasher and wires 240/241 from battery. Discard lockwasher.
- (3) Remove two mounting screws and heat shield from DDEC ECM.
- (4) Disconnect power harness connector MC17 with connector remover.
- (5) Loosen screw and disconnect vehicle harness connector MC18 at DDEC FCM
- (6) Read resistance between wire 530 at engine harness connector, terminal P2 and wire 439 at vehicle harness connector MC18, terminal B3.
  - (a) If there are less than 10,000 ohms present, repair wires 530 and/or 439 (see schematic Fig 2-1, Fig 2-2) or notify DS Maintenance and perform Steps (8) through (15) below.
  - (b) If there are more than 10,000 ohms present, go to Step (7) below.
- (7) Read resistance between wire 530 at engine harness connector, terminal P2 and wires 241 and 240 at power harness connector MC17, terminals A, B, E and F.
  - (a) If there are less than 10,000 ohms present, repair wires 530, 241 and/or 240 (see schematic Fig 2-1, Fig 2-2) or notify DS Maintenance and perform Steps (8) through (15) below.
  - (b) If there are more than 10,000 ohms present, wires are OK.
- (8) Connect vehicle harness connector MC18 and tighten screw.
- (9) Connect power harness connector MC17.
- (10) Install heat shield with two mounting screws to DDEC ECM.
- (11) Connect wires 240/241 to battery with lockwasher, washer and nut.
- (12) Tighten nut to 23 lb-ft (31 N m).
- (13) Apply corrosion preventive compound on nut.
- (14) Install battery box cover.
- (15) Install right front fender skirt (Para 17-33).



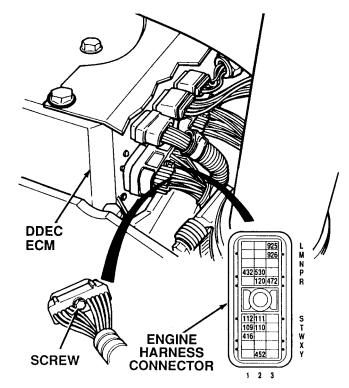
# A4 CODE 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

#### RESISTANCE TEST

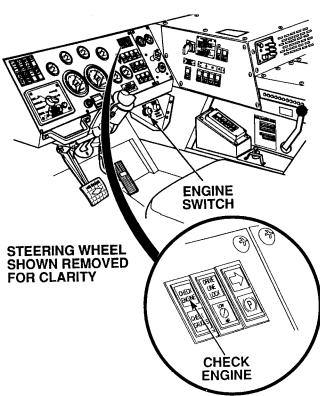
- (1) Read resistance between wires 530 and 452 at engine harness connector, terminals P2 and Y2.
  - (a) If there are less than 10,000 ohms present, repair wires 530 and/or 452 (see schematic Fig 2-2) or notify DS Maintenance and perform Step (2) below.
  - (b) If there are more than 10,000 ohms present, wires are OK.
- (2) Connect engine harness connector and tighten screw.
- (3) Close top engine access cover.



#### VERIFY REPAIR

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.
- (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

# A4 CODE 41 TIMING REFERENCE SENSOR (TRS).

# **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G) DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Jumperwire

## References

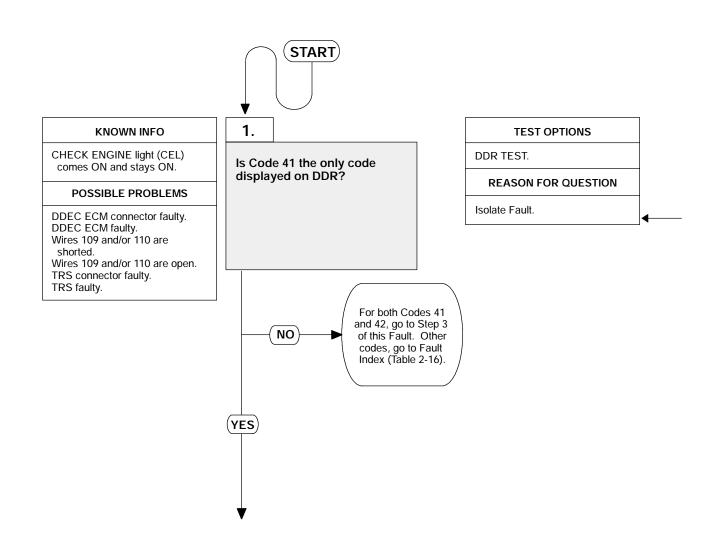
TM 9-2320-364-10 TM 9-4910-571-12&P Equipment Condition

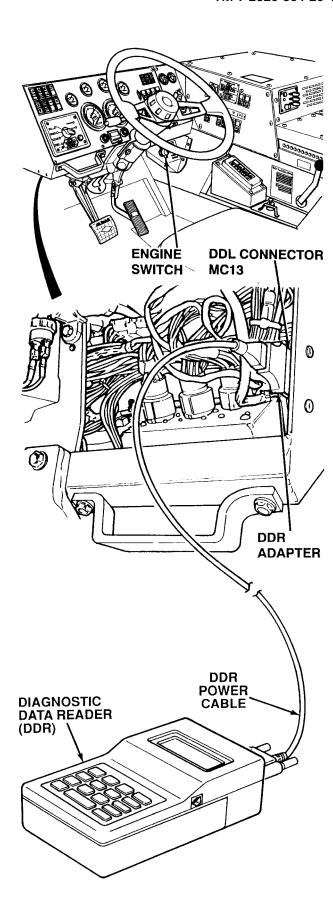
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10) Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)





# **NOTE**

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

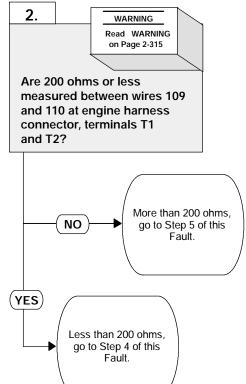
# **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If Code 41 is not the only active code displayed and Codes 41 and/or 42 is displayed, turn OFF ENGINE switch and go to Step 3 of this Fault. For any other codes displayed, go to Fault Index (Table 2-16).

    (b) If Code 41 is the only active code displayed, turn OFF
  - ENGINE switch and go to Step 2 of this Fault.

# A4 CODE 41 TIMING REFERENCE SENSOR (TRS) (CONT).

# KNOWN INFO CHECK ENGINE light (CEL) comes ON and stays ON. POSSIBLE PROBLEMS DDEC ECM connector faulty. DDEC ECM faulty. Wires 109 and/or 110 are shorted. Wires 109 and/or 110 are open. TRS connector faulty. TRS faulty.



# TEST OPTIONS

Resistance test. STE/ICE-R #91.

#### **REASON FOR QUESTION**

Resistance less than 100 ohms or greater than 200 ohms at DDEC ECM engine harness connector indicates TRS sensor or wiring faulty.

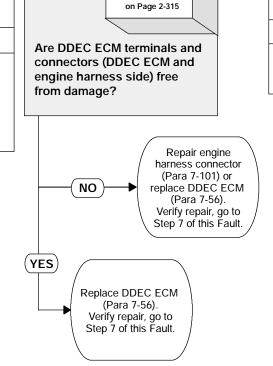
#### **KNOWN INFO**

3.

CHECK ENGINE light (CEL) comes ON and stays ON.

# POSSIBLE PROBLEMS

DDEC ECM connector faulty.
DDEC ECM faulty.
Wires 109 and/or 110 are shorted.
Wires 109 and/or 110 are open.
TRS connector faulty.
TRS faulty.



CAUTION

Read CAUTION

#### **TEST OPTIONS**

Visual inspection.

# **REASON FOR QUESTION**

Damage to terminals or connectors can affect signal to DDEC ECM.

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

# CAUTION

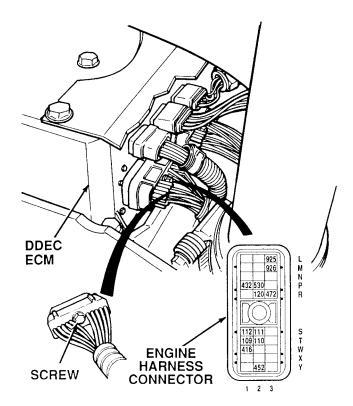
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

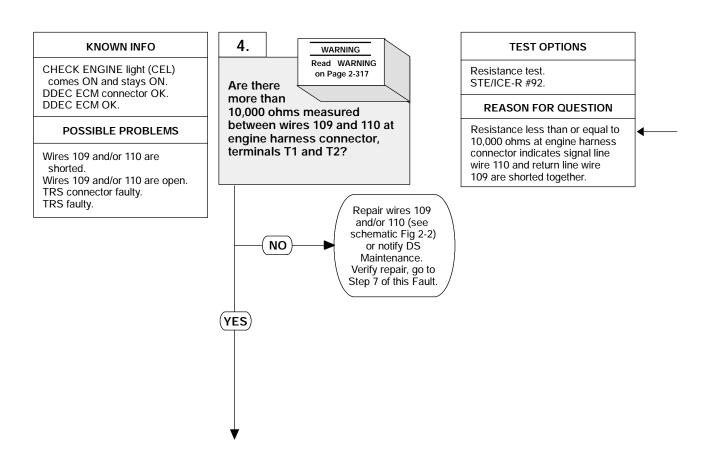
- Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Read resistance between wires 109 and 110 at engine harness connector, terminals T1 and T2.
  - (a) If there are 200 ohms or less present, go to Step 4 of this Fault.
  - (b) If there are more than 200 ohms present, go to Step 5 of this Fault.

#### **VISUAL INSPECTION**

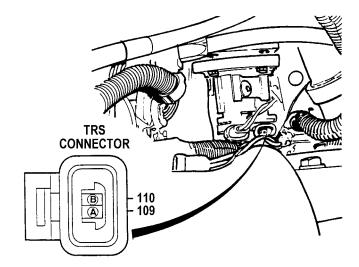
- Check terminals at engine harness connector (DDEC ECM and engine harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If engine harness connector is damaged, repair connector (Para 7-101).
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If engine harness connector and DDEC ECM connector are OK, replace DDEC ECM (Para 7-56).
- (2) Close top engine access cover.



# A4 CODE 41 TIMING REFERENCE SENSOR (TRS) (CONT).

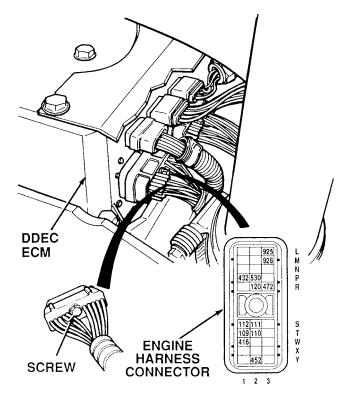


- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

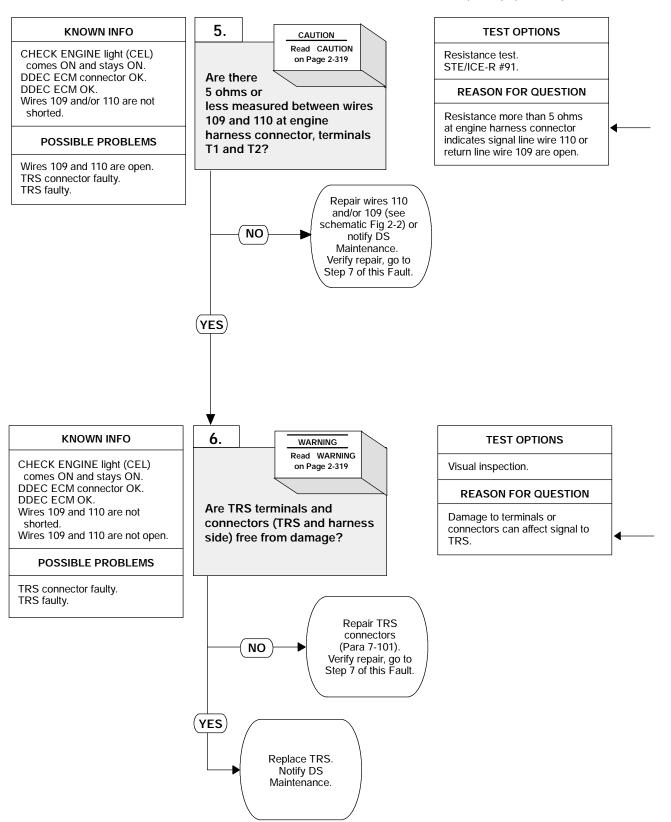


# RESISTANCE TEST

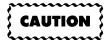
- (1) Remove DDEC ECM (Para 7-56).
- (2) Disconnect TRS harness connector.
- (3) Read resistance between wires 109 and 110 at engine harness connector, terminals T1 and T2.
  - (a) If there are less than 10,000 ohms present, repair wires 109 and/or 110 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step (4) below.
- (4) Read resistance between wires 109 and 110 between engine harness connector, terminals T1 and T2 and a known good ground.
  - (a) If there are less than 10,000 ohms present, repair wires 109 and/or 110 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step 5 of this Fault.



# A4 CODE 41 TIMING REFERENCE SENSOR (TRS) (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



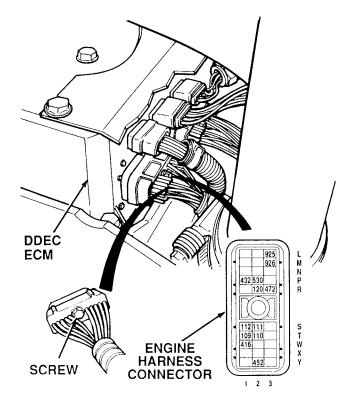
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

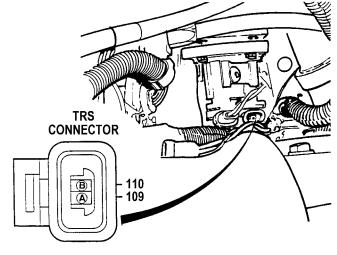
#### RESISTANCE TEST

- Place jumperwire between terminals A and B at the TRS harness connector.
- (2) Read resistance between wires 109 and 110 at engine harness connector, terminals T1 and T2.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wires 109 and/or 110 (see schematic Fig 2-2) or perform Step (3) below and notify DS Maintenance.
  - (b) If there are less than 5 ohms present, wires are OK, remove jumperwire and perform Step (3) below.
- (3) Connect engine harness connector and tighten screw.

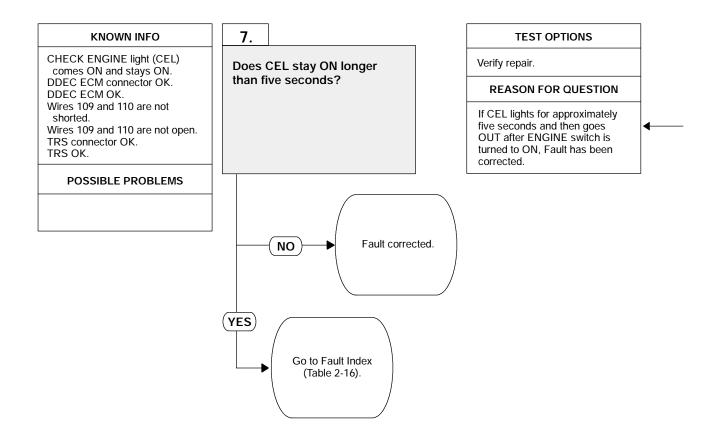
#### **VISUAL INSPECTION**

- Check TRS terminals and connectors (harness and TRS side) for damage; bent, corroded or unseated pins or terminals.
  - (a) If connectors and/or terminals are damaged, repair connector (Para 7-101).
  - (b) If connectors and/or terminals are free from damage, notify DS Maintenance.
- (2) Connect TRS harness connector.
- (3) Install DDEC ECM (Para 7-56).
- (4) Close engine access cover.





# A4 CODE 41 TIMING REFERENCE SENSOR (TRS) (CONT).

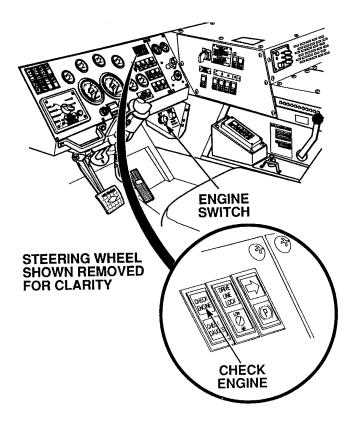


# **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10). (2) Clear codes on DDR (Para 2-24).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
- goes off, fault has been corrected.
  Perform Steps (4) and (5) below.

  (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

# A4 CODE 42 SYNCHRONOUS REFERENCE SENSOR (SRS).

# **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)

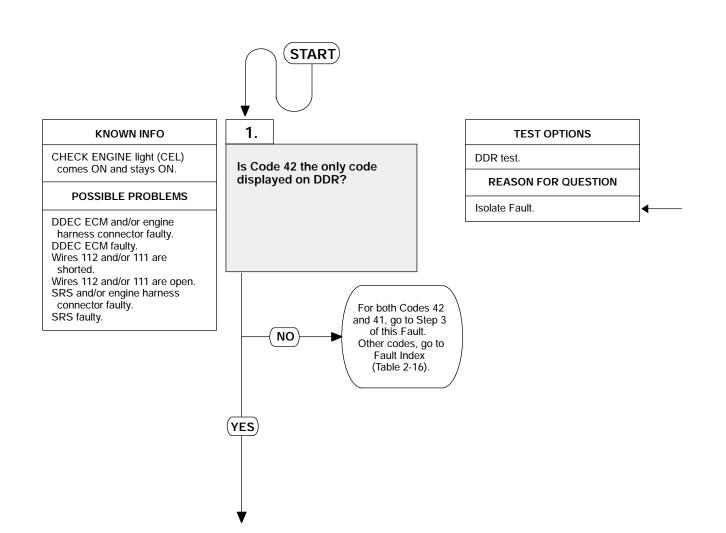
STE/ICE-R (optional) (Item 3, Appendix G) DDEC Repair Kit (Item 15, Appendix G) Multimeter (Item 44, Appendix G)

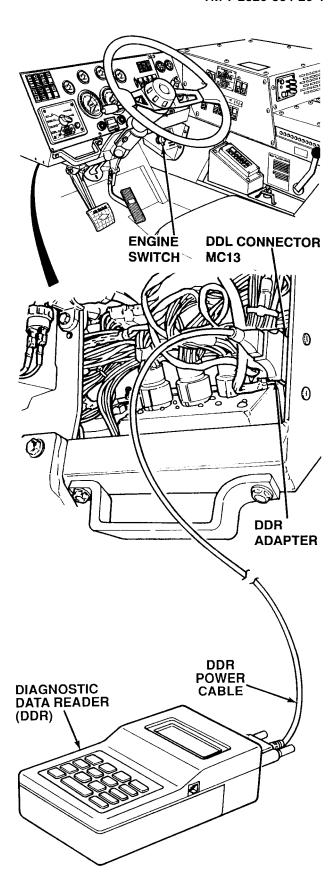
Reader, Diagnostic (Item 53, Appendix G) Jumperwire

References

TM 9-2320-364-10 TM 9-4910-571-12&P **Equipment Condition** 

Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)
Top engine access cover opened,
(TM 9-2320-364-10)





# NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

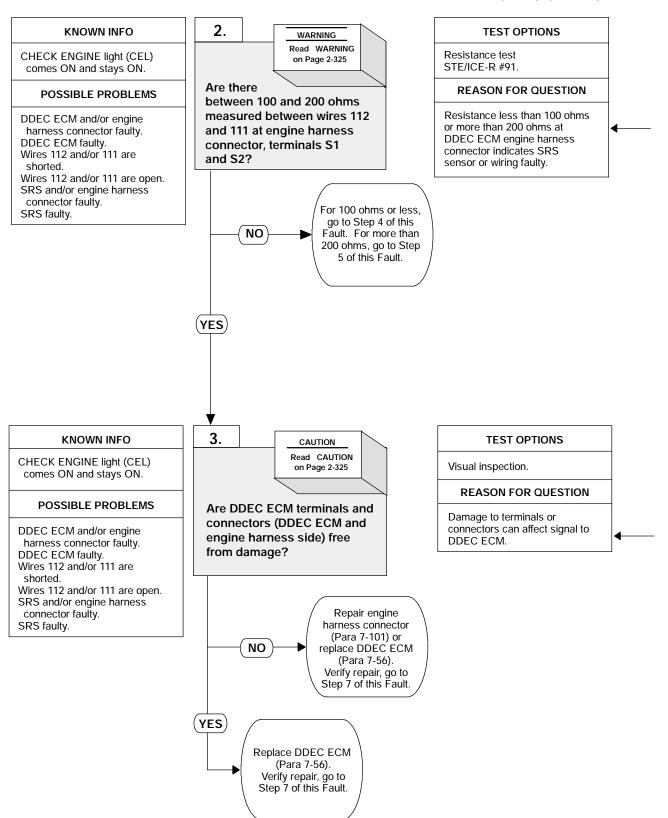
# **DDR TEST**

- (1) Connect DDR to DDL
- connector MC13.
  Turn ON ENGINE switch
- (TM 9-2320-364-10). Select MODE 01 (ACTIVE CODES) on DDR.
  - on DDR.

    (a) If Code 42 is not the only active code displayed and Codes 41 and/or 42 is displayed, turn OFF ENGINE switch and go to Step 3 of this Fault. If other codes are displayed, go to Fault Index (Table 2-16).

    (b) If Code 42 is the only active code displayed, turn OFF ENGINE switch and go to Step 2 of this Fault.
  - of this Fault.

# A4 CODE 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



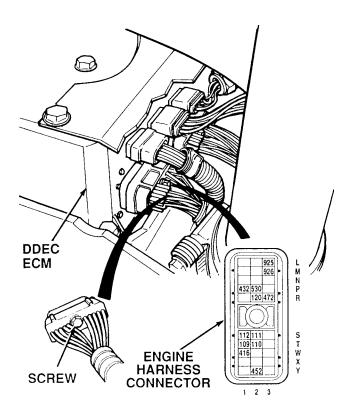
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors

#### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Are there 100 to 200 ohms present between wires 112 and 111 at engine harness connector, terminals S1 and S2?
  - (a) If there are less than 100 ohms present, go to Step 4 of this Fault.
  - (b) If there are more than 200 ohms present, go to Step 5 of this Fault.
  - (c) If there are between 100 and 200 ohms present, go to Step 3 of this Fault.

#### **VISUAL INSPECTION**

- (1) Check terminals at engine harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If engine harness connector is damaged, repair connector (Para 7-101).
     (b) If DDEC ECM connector
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If DDEC ECM connector and engine harness connector are OK, replace DDEC ECM (Para 7-56).
- (2) Close top engine access cover.



# A4 CODE 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT).

#### **KNOWN INFO** 4. **TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) Resistance test. on Page 2-327 comes ON and stays ON. STE/ICE-R #92. Are there DDEC ECM and engine more than harness connector OK. **REASON FOR QUESTION** 10,000 ohms or an open DDEC ECM OK. circuit between wires 112 and Resistance less than or equal to 111 at engine harness POSSIBLE PROBLEMS 10,000 ohms at engine harness connector, terminals S1 connector indicates signal line and S2? wire 111 and return line Wires 112 and/or 111 are wire 112 are shorted together. shorted. Wires 112 and/or 111 are open. SRS and/or engine harness Repair wires 112 connector faulty. and/or 111 (see SRS faulty. schematic Fig 2-2) or notify DS NO Maintenance. Verify repair, go to Step 7 of this Fault. (YES)

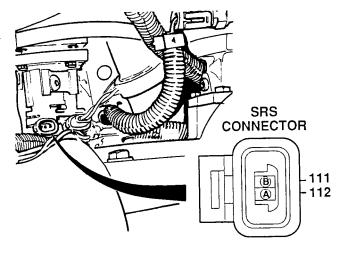
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

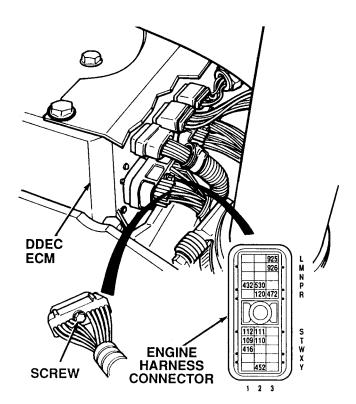


DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

- (1) Disconnect SRS harness connector.
- (2) Read resistance between wires 112 and 111 at engine harness connector, terminals S1 and S2.
  - (a) If there are less than 10,000 ohms present, repair wires 112 and 111 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step (3) below.
- (3) Read resistance between wire 112 at engine harness connector, terminal S1 and a known good ground.
  - (a) If there are less than 10,000 ohms present, repair wire 112 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step (4) below.
- (4) Read resistance between wire 111 at engine harness connector, terminal S2 and a known good ground.
  - (a) If there are less than 10,000 ohms present, repair wire 111 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, wire 111 is OK.





# A4 CODE 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT).

#### **KNOWN INFO** 5. **TEST OPTIONS** CAUTION Read CAUTION CHECK ENGINE light (CEL) Resistance test. Are there on Page 2-329 comes ON and stays ON. STE/ICE-R #91. 5 ohms or DDEC ECM and engine less measured harness connector OK. REASON FOR QUESTION between wires 112 and 111 at DDEC ECM OK. engine harness connector, Wires 112 and 111 are not Resistance more than 5 ohms terminals S1 and S2 with shorted. at engine harness connector jumperwire installed between indicates signal line wire 111 or terminals A and B at SRS return line wire 112 are open. POSSIBLE PROBLEMS harness connector? Wires 112 and/or 111 are open. SRS and/or engine harness Repair wires 112 connector faulty. SRS faulty. and/or 111 (see schematic Fig 2-2) or notify DS NO Maintenance. Verify repair, go to Step 7 of this Fault. YES **KNOWN INFO** 6. **TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) on Page 2-329 Visual inspection. comes ON and stays ON. DDEC ECM and engine REASON FOR QUESTION harness connector OK. Are SRS terminals and DDEC ECM OK. Damage to terminals or Wires 112 and 111 are not connectors (SRS and engine connectors can affect signal to shorted. harness side) free from SRS. Wires 112 and 111 are not open. damage? POSSIBLE PROBLEMS SRS and/or engine harness connector faulty. Repair SRS and/or SRS faulty. engine harness connectors NO (Para 7-101). Verify repair, go to Step 7 of this Fault. YES) SRS faulty. Notify DS Maintenance.

- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

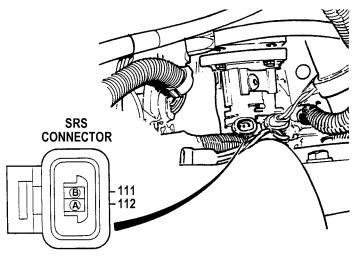
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

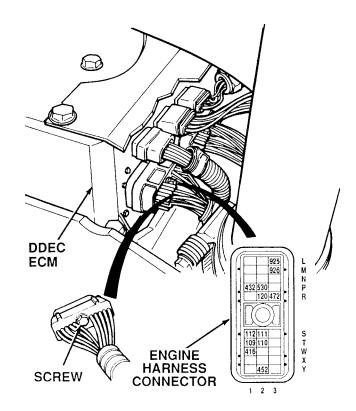
## RESISTANCE TEST

- (1) Place jumperwire between terminals A and B at SRS harness connector.
- (2) Read resistance between wires 112 and 111 at engine harness connector, terminals S1 and S2.
  - (a) If there are more than 5 ohms are present, remove jumperwire and repair wires 112 and/or 111 (see schematic Fig 2-2) or notify DS Maintenance and perform Step (3) below.
  - (b) If there are 5 ohms or less present, remove jumperwire, perform Step (3) below and go to Step 6 of this Fault.
- (3) Connect engine harness connector tighten screw.

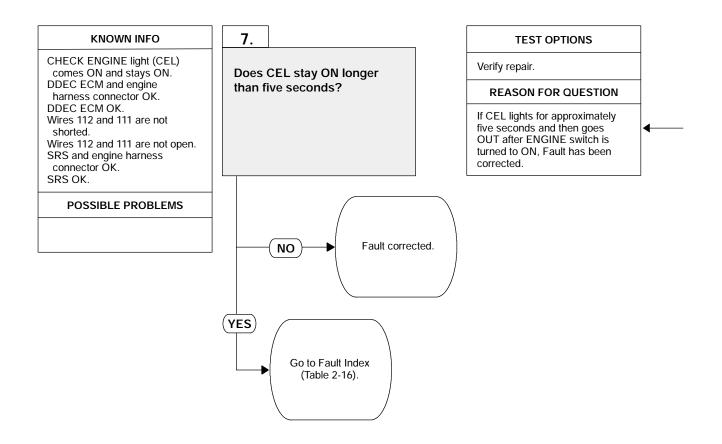
## **VISUAL INSPECTION**

- Check terminals at SRS connector (sensor and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors and/or terminals are damaged, repair connectors (Para 7-101).
  - (b) If connectors and/or terminals are free of damage, notify DS Maintenance.
- (2) Connect SRS connector.
- (3) Install DDEC ECM (Para 7-56).
- (4) Close top engine access cover.





# A4 CODE 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT).



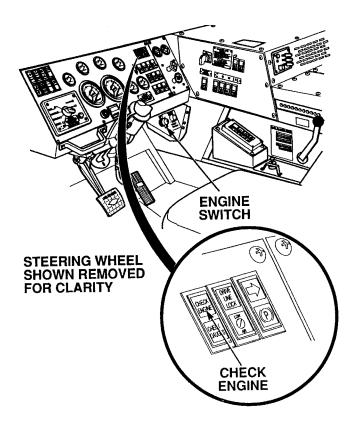
#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (2) Clear codes on DDR (Para 2-11).
  (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
- goes oil, fault has been corrected.

  Perform Steps (4) and (5) below.

  (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

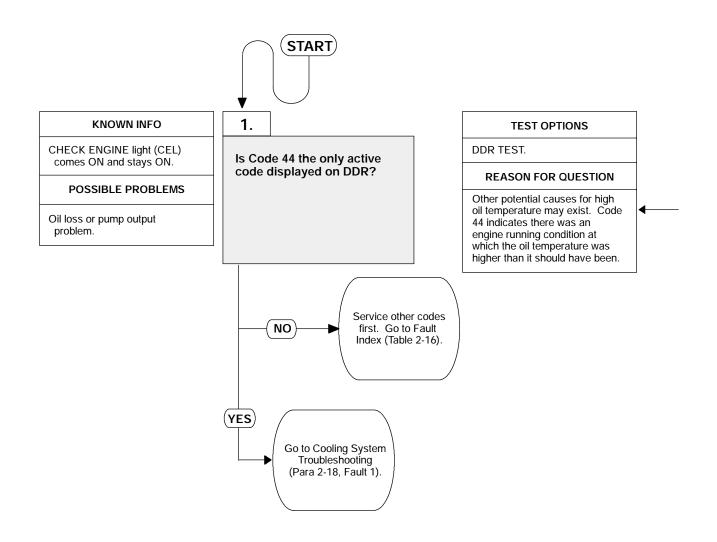
## A4 CODE 44 HIGH OIL TEMPERATURE.

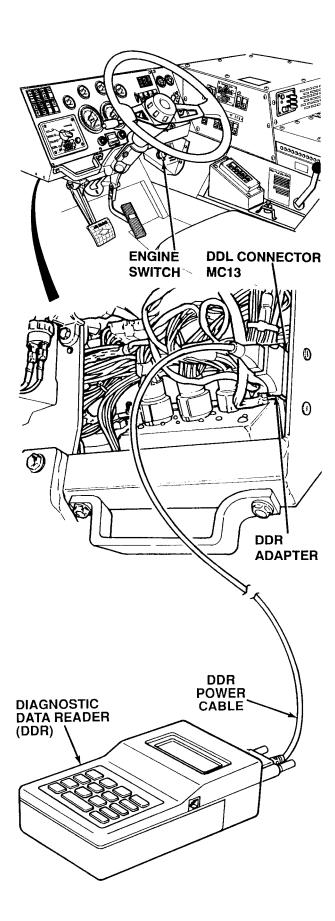
## **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)





## NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

## **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10). Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If Code 44 is not the only active code displayed, turn OFF ENGINE switch and perform Step (4) below and go to Fault Index
- (4) below and go to Fault muex (Table 2-16). (b) If Code 44 is the only active code displayed, turn OFF ENGINE switch, perform Step (4) below and go to Cooling System Troubleshooting (Para 2-18, Fault 1).

  (4) Disconnect DDR from DDL connector
- MC13.

# 2-13. DDEC II TROUBLESHOOTING (CONT).

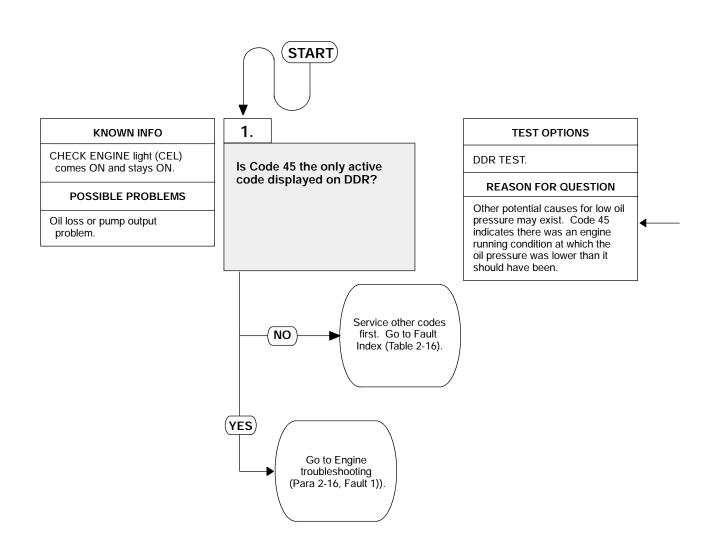
## A4 CODE 45 LOW OIL PRESSURE.

## **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)





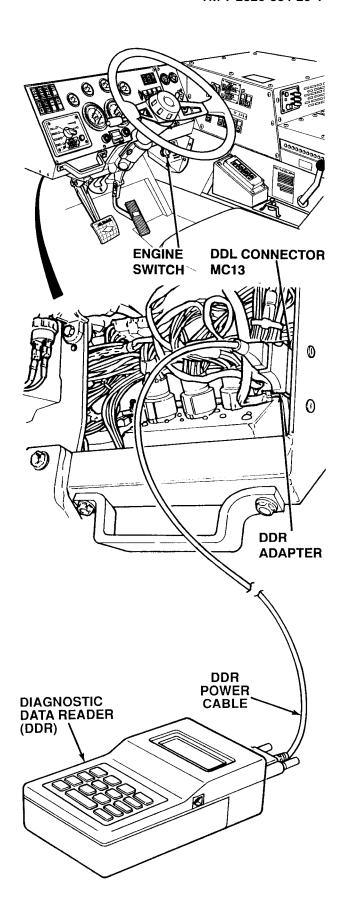
- The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.
- Oil Pressure can be monitored by selecting Mode 17 (OIL PRS PSI) on DDR.

#### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10). (3) SeeDER MODE 01 (ACTIVE CODES) on DDR.
  - on DDR.

    (a) If Code 45 is not the only active code displayed, turn OFF ENGINE switch and perform Step (4) below and go to Fault Index (Table 2-16).

    (b) If Code 45 is the only active code displayed, turn OFF ENGINE switch, perform Step (4) below and go to Engine
  - below and go to Engine Troubleshooting (Para 2-16, Fault 1).
- (4) Disconnect DDR from DDL connector MC13.



## 2-13. DDEC II TROUBLESHOOTING (CONT).

## A4 CODE 46 LOW BATTERY VOLTAGE.

## **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

#### References

TM 9-2320-364-10

TM 9-4910-571-12&P

## **Equipment Condition**

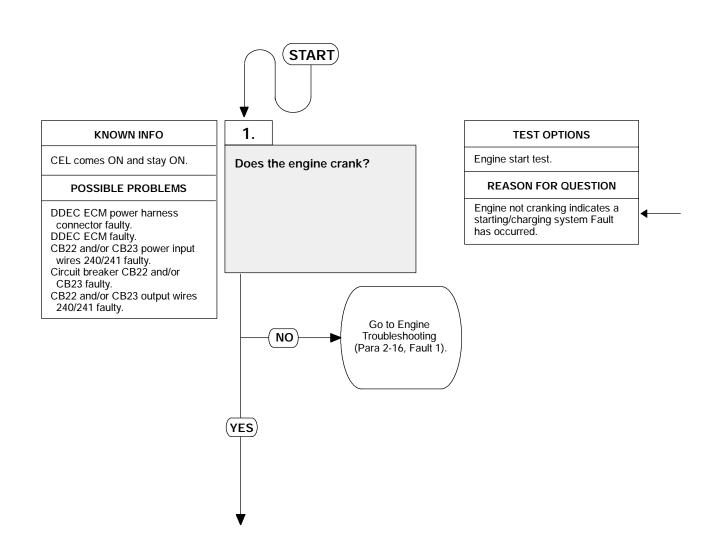
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)

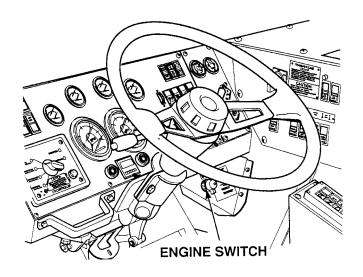


## **NOTE**

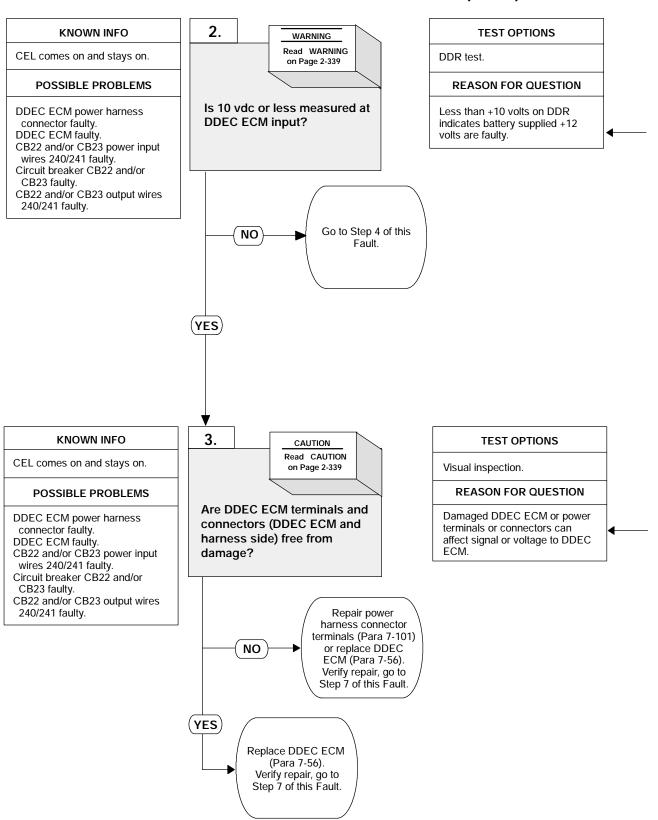
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

## **ENGINE START TEST**

- Attempt to start engine
  (TM 9-2320-364-10).
  (1) If engine does not start, turn
  OFF ENGINE switch and
  go to Engine Troubleshooting
  Procedures (Para 2-16, Fault 1).
  - (2) If engine starts, allow engine to run and go to Step 2 of this Fault.



## A4 CODE 46 LOW BATTERY VOLTAGE (CONT).



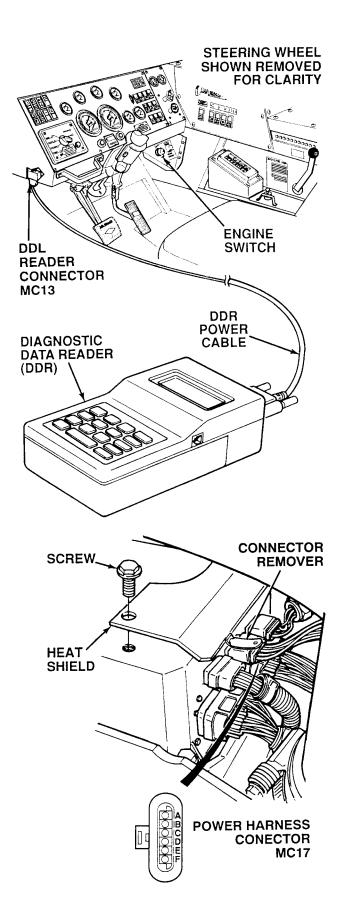
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

#### DDR TEST

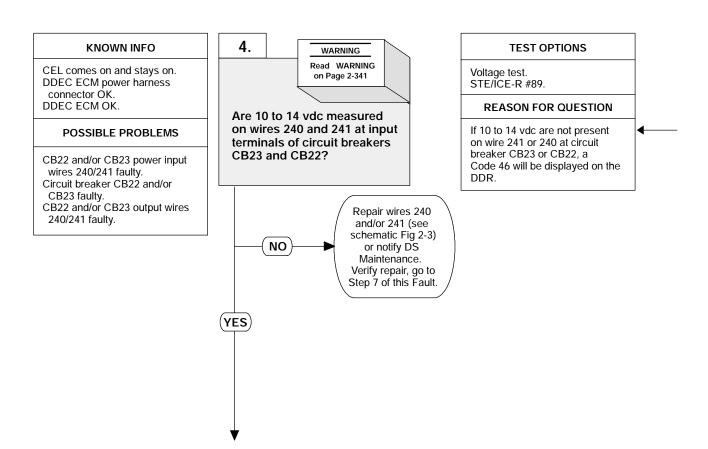
- (1) If referred here from Step 1, keep engine running.
- (2) Connect DDR to DDL connector MC13.
- (3) Select MODE 05 (DDEC ECM VOLTAGE) on DDR.
- (4) Observe DDEC ECM voltage reading on DDR.
  - (a) If there are more than 10 vdc present, turn OFF ENGINE switch (TM 9-2320-364-10) and go to Step 4 of this Fault.
  - (b) If there are less than 10 vdc present, turn OFF ENGINE switch and go to Step 3 of this Fault.

## **VISUAL INSPECTION**

- (1) Remove two screws and heat shield from DDEC ECM.
- (2) Disconnect power harness connector MC17 from DDEC ECM with connector remover.
- (3) Check terminals at the DDEC ECM power harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals
  - (a) If power harness connector MC17 is damaged, repair connector (Para 7-101) and perform Steps (4) and (5) below.
  - (b) If DDEC ECM power harness connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If DDEC harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (4) Connect power harness connector MC17.
- (5) Install heat shield and two screws on DDEC ECM.



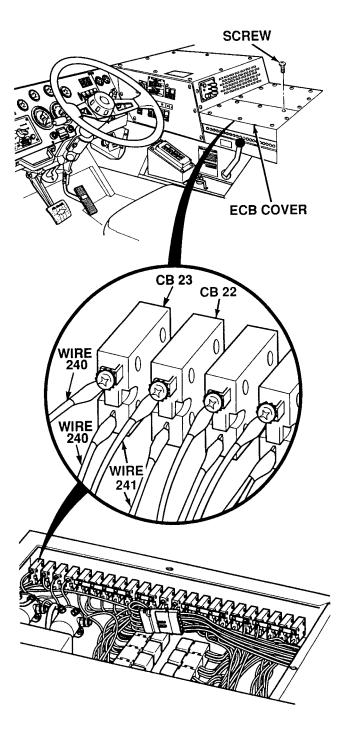
# A4 CODE 46 LOW BATTERY VOLTAGE (CONT).



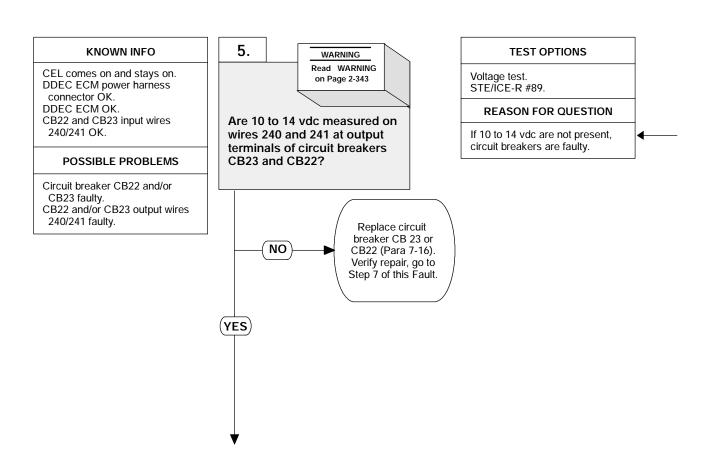
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury, or death to personnel may occur.
- Circuit breakers CB5, CB6, CB12, CB20, CB22, CB23 and relays R3, R13 R19, R26, R28, R32, R33 are always electrically hot and can cause severe injury to personnel. Care must be exercised when working under the electrical circuit board cover.

## **VOLTAGE TEST**

- (1) Remove 15 screws and two ECB covers.
- Set multimeter select switch to volts dc.
- Connect positive (+) multimeter lead to circuit breaker CB22 input (upper) terminal.
- Connect negative (-) multimeter lead to a known good ground.
- (5) Turn ON ENGINE switch (TM 9-2320-364-10).
  - (a) If 10 to 14 vdc are not present, turn OFF ENGINE switch and repair wire 241 (see schematic Fig 2-3) or notify DS
  - Maintenance.
    (b) If 10 to 14 VDC are present, turn OFF ENGINE switch and go to Step (6) below.
- (6) Connect positive (+) multimeter lead to circuit breaker CB23 input (upper) terminal.
- (7) Connect negative (-) multimeter lead to a known good ground.
  (8) Turn ON ENGINE switch.
- - (a) If 10 to 14 vdc are not present, turn OFF ENGINE switch and repair wire 240 (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If 10 to 14 vdc are present, turn OFF ENGINE switch and go to Step 5 of this Fault.



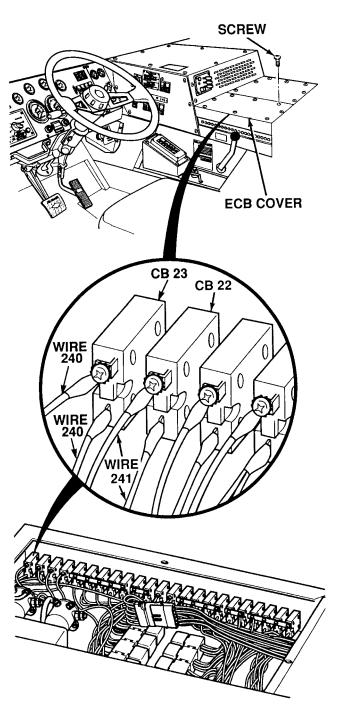
# A4 CODE 46 LOW BATTERY VOLTAGE (CONT).



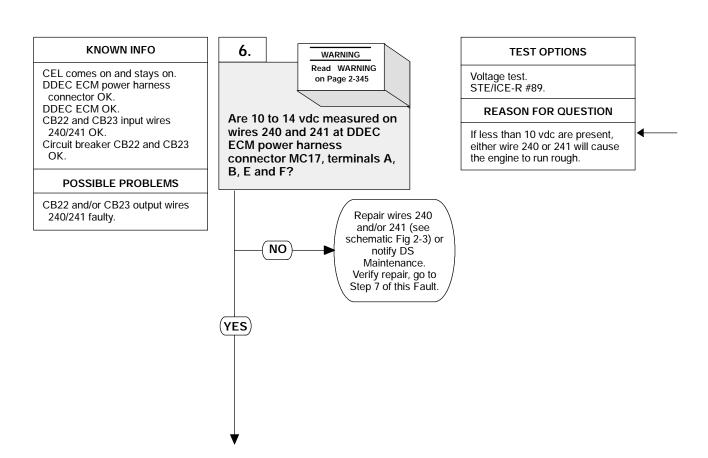
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury, or death to personnel may occur.
- Circuit breakers CB5, CB6, CB12, CB20, CB22, CB23 and relays R3, R13 R19, R26, R28, R32, R33 are always electrically hot and can cause severe injury to personnel. Care must be exercised when working under the electrical circuit board cover.

#### **VOLTAGE TEST**

- (1) Connect positive (+) multimeter lead to circuit breaker CB22 output (lower) terminal.
- Connect negative (-) multimeter lead to a known good ground. Turn ON ENGINE switch
- (TM 9-2320-364-10).
  - (a) If 10 to 14 vdc are not present, turn OFF ENGINE switch and replace circuit breaker CB22 (Para 7-16) and perform Step (7) below.
  - (b) If 10 to 14 vdc are present, turn OFF ENGINE switch and go to Step (4) below.
- (4) Connect positive (+) multimeter lead to circuit breaker CB23 output (lower) terminal.
- (5) Connect negative (-) multimeter lead to a known good ground.
- (6) Turn ON ENGINE switch.
  - (a) If 10 to 14 vdc are not present, turn OFF ENGINE switch and replace circuit breaker CB23 (Para 7-16) and perform Step (7) below.
  - (b) If 10 to 14 vdc are present, turn OFF ENGINE switch, perform Step (7) below and go to Step 6 of this Fault.
- (7) Install ECB cover and 15 screws.



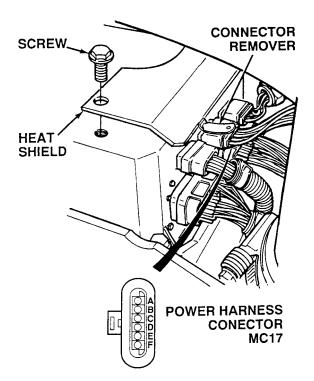
# A4 CODE 46 LOW BATTERY VOLTAGE (CONT).



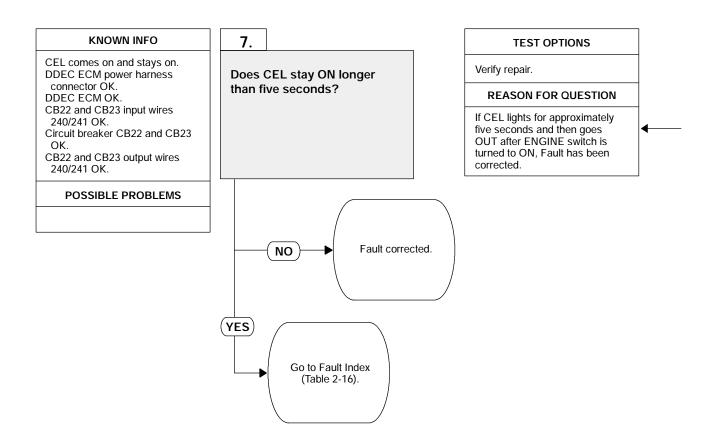
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

#### **VOLTAGE TEST**

- (1) Remove two screws and heat shield from DDEC ECM.
- Disconnect power harness connector MC17 from DDEC ECM with connector remover.
- Connect positive (+) multimeter lead to wire 241 at DDEC ECM power connector MC17, terminals E and F one at a time.
- (4) Connect negative (-) multimeter lead to a known good ground. Turn ON ENGINE switch
- (TM 9-2320-364-10).
  - (a) If 10 to 14 vdc are not present, turn OFF ENGINE switch and repair wire 241 (see schematic Fig 2-3) or notify DS Maintenance and perform Steps (7) through (9)
  - (b) If 10 to 14 vdc are present, turn OFF ENGINE switch and go to Step (6) below.
- (6) Connect positive (+) multimeter lead to wire 240, terminals A and B one at a time.
  - (a) If 10 to 14 vdc are not present, turn OFF ENGINE switch and repair wire 240 (see schematic Fig 2-3) or notify DS Maintenance and perform Steps (7) through (9) below.
  - (b) If 10 to 14 vdc are present, wire 240 is OK. Turn OFF ENGINE switch and perform Steps (7) through (9) below.
- (7) Connect power harness connector MC17 to DDEC ECM.
- Install heat shield and two screws.
- (9) Close top engine access cover.



# A4 CODE 46 LOW BATTERY VOLTAGE (CONT).

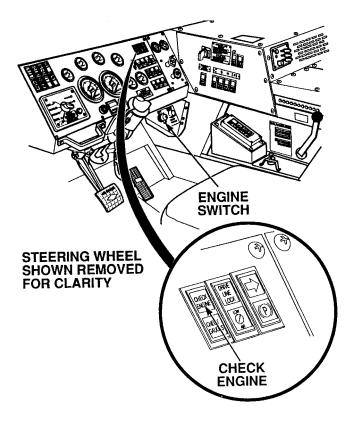


#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).
  (3) If CEL does not come ON, start engine and run for 8 minutes or until
  - CEL comes ON.

    (a) If CHECK ENGINE light comes on for about five seconds and then
  - tor about tive seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.

    (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
- (4) Turn OFF ENGINE switch.(5) Disconnect DDR from DDL connector MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

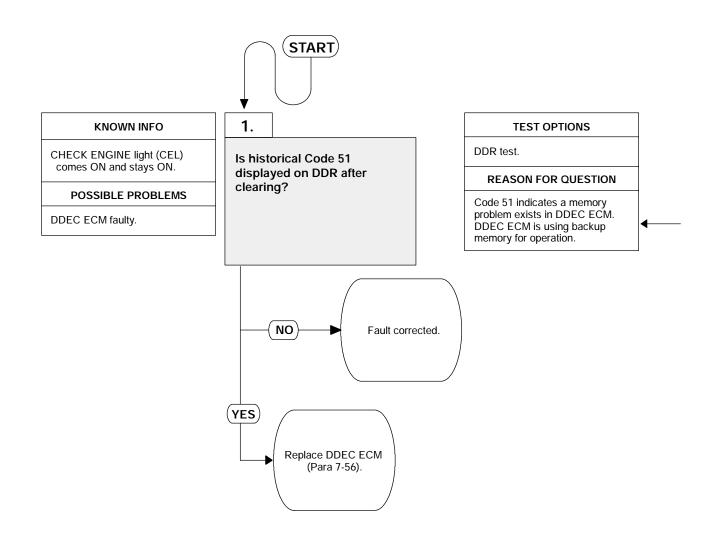
# A4 CODE 51 ELECTRICALLY ERASABLE PROGRAMMABLE READ-ONLY MEMORY (EEPROM) FAILURE (HISTORICAL CODE 51 ON DDR).

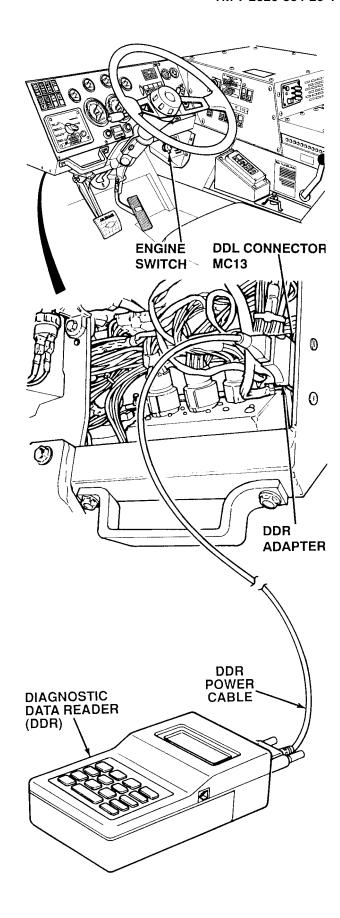
## **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)





## **DDR TEST**

- (1) Connect DDR to DDL connector
- MC13.
  (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Clear codes on DDR (Para 2-11).(4) Select MODE 02 (HISTORICAL CODES) on DDR.
  - (a) If historical Code 51 is not displayed, turn OFF ENGINE switch and perform Step (5) below.
- (b) If historical Code 51 is displayed, turn OFF ENGINE switch, replace DDEC ECM (Para 7-56) and perform Step (5) below. (5) Disconnect DDR from DDL connector
- MC13.

# 2-13. DDEC II TROUBLESHOOTING (CONT).

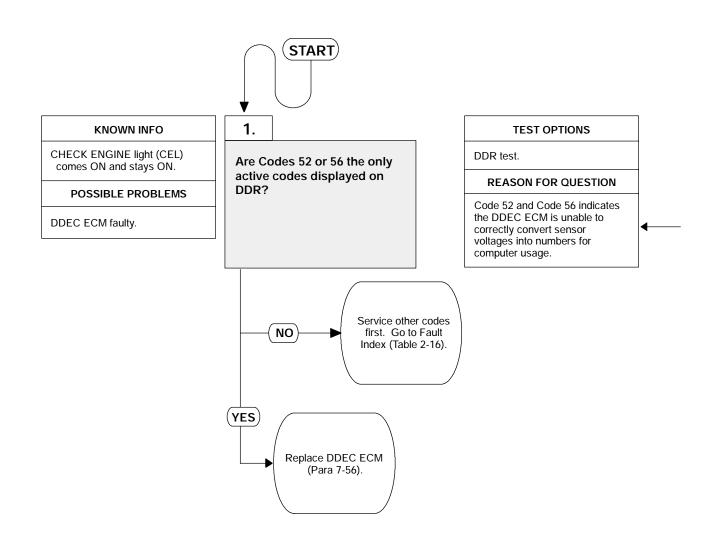
## A4 CODES 52 OR 56 DDEC ECM - ANALOG TO DIGITAL FAILURE.

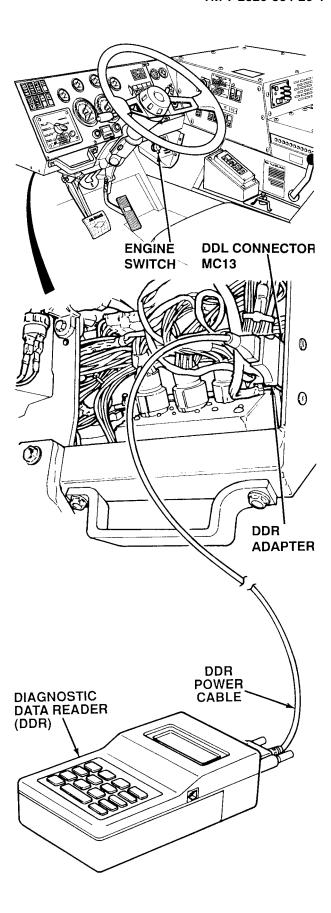
## **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)





## NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

## **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10). (3) Select MODE 01 (ACTIVE CODES)
- on DDR.
  - (a) If Codes 52 or 56 are not the only active codes displayed, perform Steps (4) and (5) below and go to
  - Fault Index (Table 2-16).

    (b) If Codes 52 and 56 are the only active codes displayed, perform Steps (4) and (5) below and replace DDEC ECM (Para 7-56).
- (4) Turn OFF ENGINE switch.(5) Disconnect DDR from DDL connector MC13.

## 2-13. DDEC II TROUBLESHOOTING (CONT).

# A4 CODE 53 ELECTRICALLY ERASABLE PROGRAMMABLE READ-ONLY MEMORY (EEPROM) FAILURE AFFECTING CODE MEMORY.

## **INITIAL SETUP**

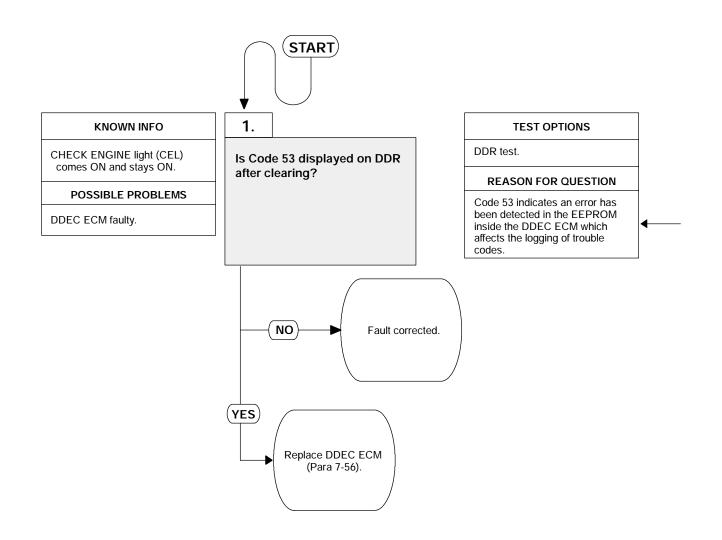
Tools and Special Tools

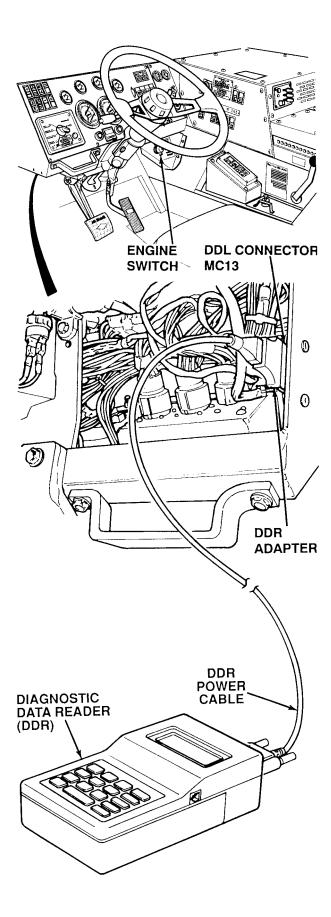
Reader, Diagnostic (Item 53, Appendix G)

References

TM 9-2320-364-10

Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)





## NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

## **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10). Clear codes on DDR (Para 2-11). Select MODE 01 (ACTIVE CODES) on DDR.
- Select MODE 02 (HISTORICAL CODES) on DDR and read codes.
  - (a) If Code 53 is not displayed on DDR, perform Steps (6) and (7) below.
- If Code 53 is displayed, perform Steps (6) and (7) below and replace DDEC ECM (Para 7-56).

  (6) Turn OFF ENGINE switch.
- (7) Disconnect DDR from DDL connector MC13.

## 2-13. DDEC II TROUBLESHOOTING (CONT).

## A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG.

## **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

#### References

TM 9-2320-364-10

TM 9-4910-571-12&P

**Equipment Condition** 

Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

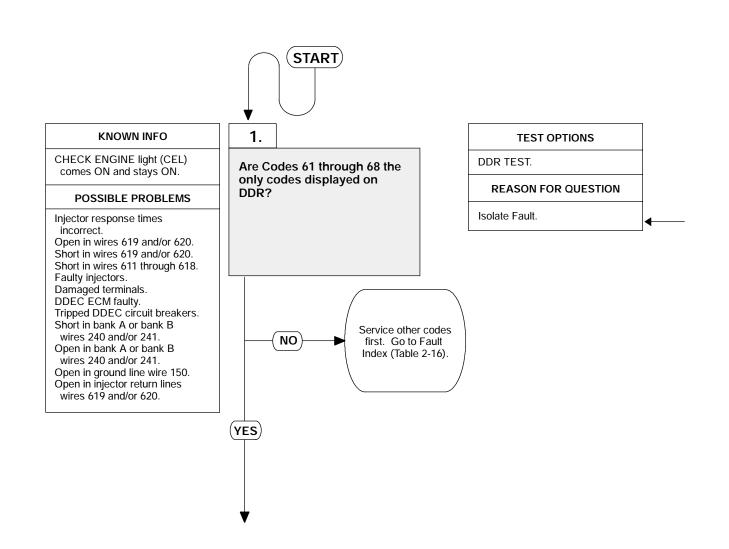
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)

Personnel Required

Two



## NOTE

- The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.
- Table 2-17 shows which injector is associated with each of the failure codes.
- Troubleshooting procedures for codes 71 through 78 are the same for codes 61 through 68.

Table 2-17. Injector Identification

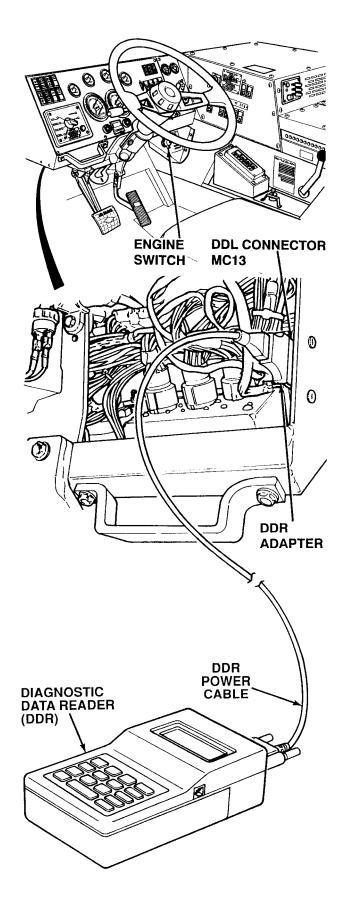
Code	Firing Order	Cylinder
61	1	1 Left
62	2	3 Right
63	3	3 Left
64	4	4 Right
65	5	4 Left
66	6	2 Right
67	7	2 Left
68	8	1 Right

## **DDR TEST**

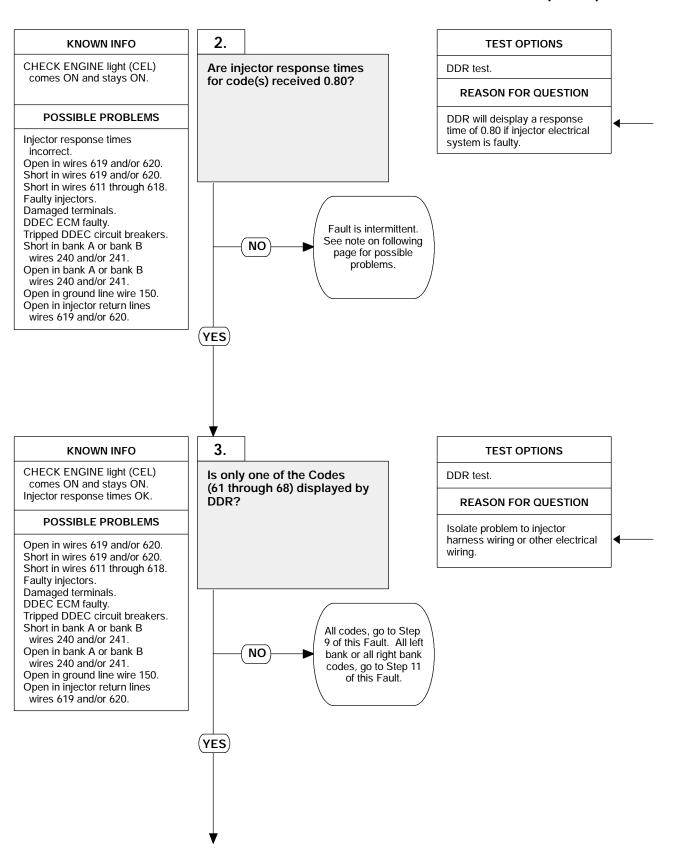
- (1) Connect DDR to DDL connector
- MC13. Turn ON ENGINE switch
- (TM 9-2320-364-10). Select MODE 01 (ACTIVE CODES) on DDR.
  - on DDR.

    (a) If Code(s) 61 through 68 are not the only codes displayed, turn OFF ENGINE switch and go to Fault Index (Table 2-16).

    (b) If Code(s) 61 through 68 are the only code(s) displayed, turn OFF ENGINE switch and go to Step 2 of this fault
  - of this fault.



# A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).



## NOTE

If response time(s) received is not 0.80 the following may be causing intermittent failures:

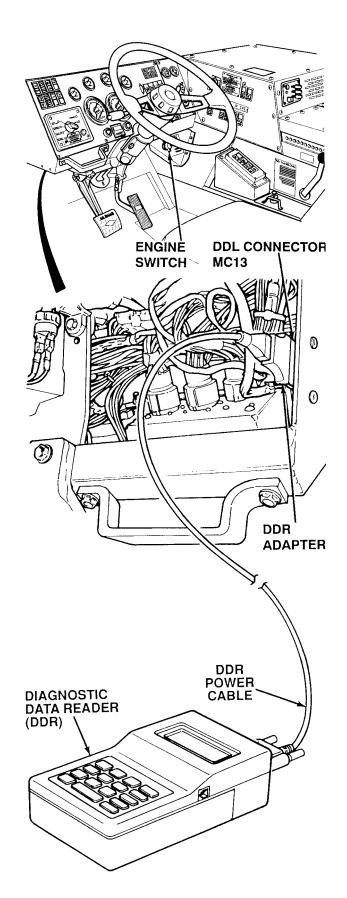
- a. Air in fuel (Refer to Fuel System Troubleshooting Para 2-17).
- b. Low battery charge (Refer to Electrical System Troubleshooting Para 2-20).
- Problems in the charging system (Loose alternator belt, bad grounds, etc.). (Refer to Electrical System Troubleshooting Para 2-20).
- d. Signs of insulation wear on injector harness (Remove Rocker Arm Cover Para 3-4 or 3-5).
- e. If problem has not been corrected notify DS Maintenance

#### **DDR TEST**

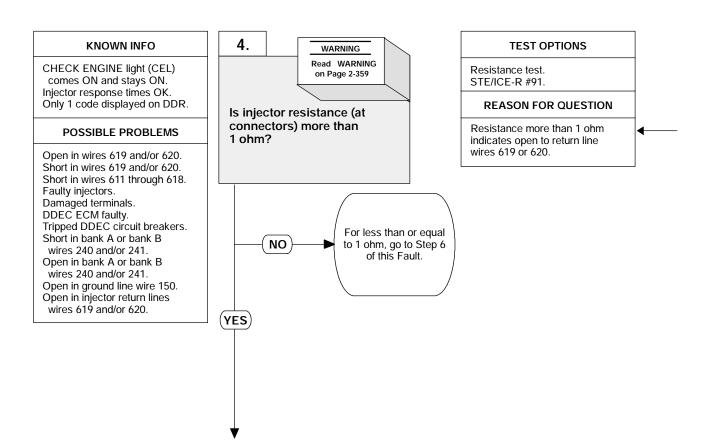
- (1) Start engine (TM 9-2320-364-10) and warm to operating temperature 180°F to 190°F (82°C to 88°C).
- (2) Select MODE 10 (INJ RESP TIMES) on DDR.
- (3) Read DDR display of injector response time (in firing order) through several cycles. Note response time(s) of cylinder by number in Fault code.
- (4) Refer to Table 2-17 for the firing sequence in relation to the code received.
- (5) Turn OFF ENGINE switch.

## DDR TEST

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Select MODE 40 (CLEAR CODES) on DDR and clear codes.
- (3) Select MODE 01 (ACTIVE CODES) on DDR.
- (4) Read displayed codes.
  - (a) All Codes (61 through 68), perform Steps (5) and (6) below and go to Step 9 of this Fault.
  - (b) For all left bank codes or right bank codes, perform Steps (5) and (6) below and go to Step 11 of this Fault.
  - (c) If only one Code (61 through 68) is displayed, perform Steps (5) and (6) below and go to Step 4 of this Fault.
- (5) Turn OFF ENGINE switch.
- (6) Disconnect DDR from DDL connector MC13.



# A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).



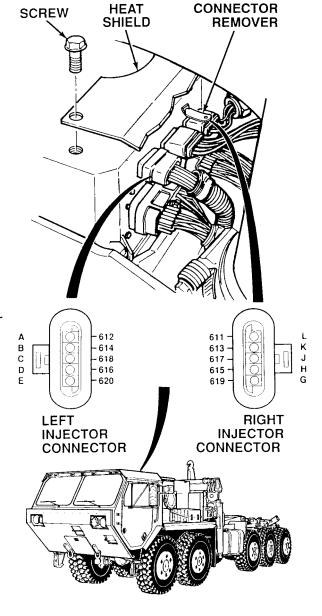
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

#### RESISTANCE TEST

- (1) Remove two screws and heat shield from DDEC ECM.
- (2) Disconnect both injector harness connectors at the DDEC ECM with connector remover.
- (3) Is there more than 1 ohm present between injector harness connector terminals when Codes 61-68 are received. (Example: read resistance between terminal G and L for Code 61).
- (4) Refer to Table 2-18 for injector harness connector identification.
  - (a) If there is more than 1 ohm present, go to Step 5 of this Fault.
  - (b) If there is 1 ohm or less present, go to Step 6 of this Fault.

Table 2-18. Injector Harness Connector Terminal Identification

DDEC CODE No.	Injector Harness Connector Terminal No.	Injector Harness Connector Terminal No.
61	L	G
62	А	E
63	К	G
64	В	E
65	Н	G
66	D	E
67	J	G
68	С	E



## A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).

#### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. Injector response times OK. Only 1 code displayed on DDR.

#### POSSIBLE PROBLEMS

Open in wires 619 and/or 620. Short in wires 619 and/or 620. Short in wires 611 through 618. Faulty injectors.
Damaged terminals.
DDEC ECM faulty.
Tripped DDEC circuit breakers.
Short in bank A or bank B wires 240 and/or 241.
Open in bank A or bank B wires 240 and/or 241.
Open in ground line wire 150.
Open in injector return lines wires 619 and/or 620.

5. WARNING
Read WARNING
on Page 2-361

Is there 1 ohm or less
measured at the injector

harness connector?

(YES

(YES)

Repair connector (see schematic Fig 2-4) or notify DS Maintenance.
Verify repair, go to Step 16 of this Fault.

#### **TEST OPTIONS**

Resistance test. STE/ICE-R #91.

#### REASON FOR QUESTION

Resistance less than or equal to 1 ohm indicates faulty injector. More than 1 ohm, open exists in wires where resistance was read.

#### KNOWN INFO

CHECK ENGINE light (CEL) comes ON and stays ON. Injector response times OK. Only 1 code displayed on DDR. No open in wires 619 and 620.

#### POSSIBLE PROBLEMS

Short in wires 619 and/or 620.
Short in wires 611 through 618.
Faulty injectors.
Damaged terminals.
DDEC ECM faulty.
Tripped DDEC circuit breakers.
Short in bank A or bank B wires 240 and/or 241.
Open in bank A or bank B wires 240 and/or 241.
Open in ground line wire 150.
Open in injector return lines wires 619 and/or 620.

Are there more than or equal to 10,000 ohms or an open circuit measured at the

injector harness connector?

Notify DS Maintenance, injector is faulty. See note on following page.

Repair wire (see schematic Fig 2-4) or notify DS Maintenance.
Verify repair, go to Step 16 of this Fault.

#### **TEST OPTIONS**

Resistance test. STE/ICE-R #92.

## REASON FOR QUESTION

Resistance less than or equal to 10,000 ohms indicates short in return lines.

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

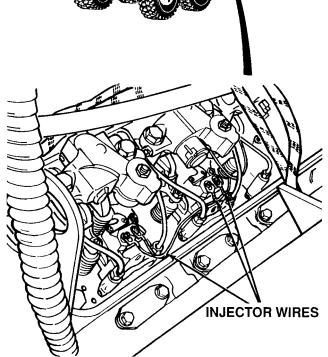
#### RESISTANCE TEST

- Remove rocker arm cover (Para 3-4 or 3-5) corresponding to injector identified by Table 2-17.
- (2) Disconnect the two wires of the injector identified.
- (3) Short these two wires together.
- (4) Referring to Table 2-18, measure the resistance between the injector harness connector terminals associated with the faulty injector.
  - (a) If 1 ohm or less is present, install rocker arm cover and notify DS Maintenance. Injector is faulty.
     (b) If more than 1 ohm is present,
  - b) If more than 1 ohm is present, repair wires tested, (see schematic Fig 2-4) or notify DS Maintenance and install rocker arm cover.



#### RESISTANCE TEST

- Remove rocker arm cover (Para 3-4 or 3-5) corresponding to injector identified by Table 2-17.
- Disconnect two wires of injector indicated.
- (3) Measure resistance at the injector harness connector terminals associated with faulty injector.
  - (b) If there are less than 10,000 ohms present, repair wires tested (see schematic Fig 2-4) or notify DS Maintenance.
  - (a) If there are more than 10,000 ohms present, go to Step 7 of this Fault.



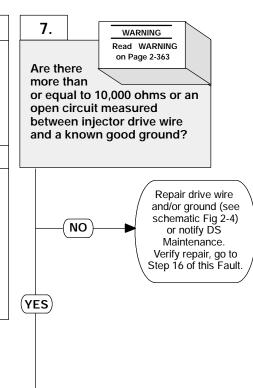
# A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).

#### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. Injector response times OK. Only 1 code displayed on DDR. No open in wires 619 and 620. No short in wires 619 and 620.

## POSSIBLE PROBLEMS

Short in wires 611 through 618. Faulty injectors.
Damaged terminals.
DDEC ECM faulty.
Tripped DDEC circuit breakers.
Short in bank A or bank B wires 240 and/or 241.
Open in bank A or bank B wires 240 and/or 241.
Open in ground line wire 150.
Open in injector return lines wires 619 and/or 620.



## **TEST OPTIONS**

Resistance test. STE/ICE-R #92.

## REASON FOR QUESTION

Resistance less than 10,000 ohms between injector drive wire and ground indicates injector drive wire is shorted to ground. Resistance less than 10,000 ohms from injector to ground indicates short to faulty injector.

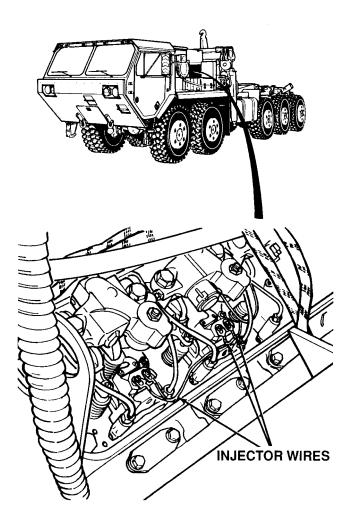
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

## **NOTE**

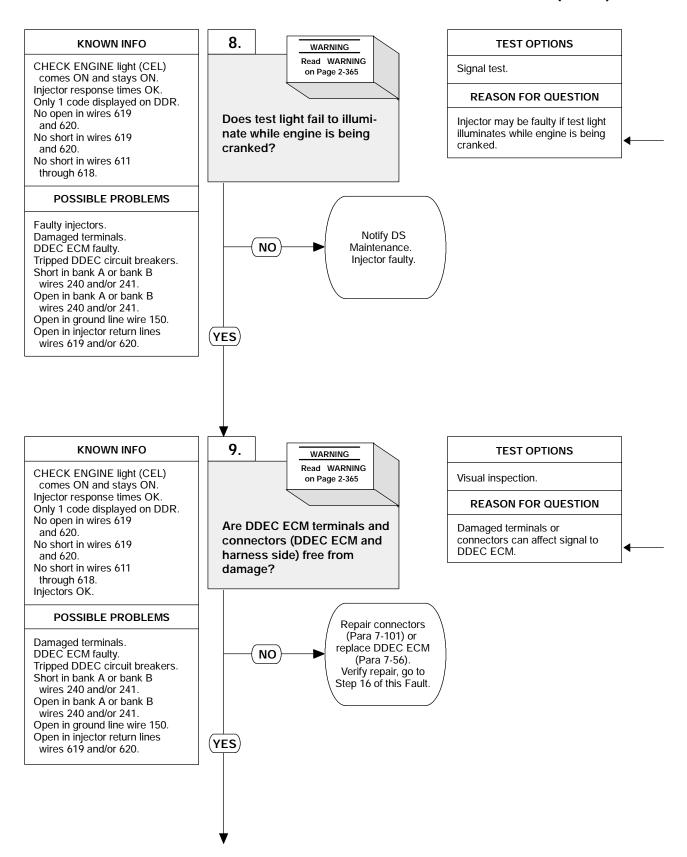
Injector drive wires are numbered 611 through 618 and injector return wires are numbered 619 and 624 on the DDEC Injector Harness Wiring Schematic (Fig 2-4).

## RESISTANCE TEST

- Check for short to ground, working with injector that has its two wires disconnected.
- (2) Measure resistance between injector drive wire and a known good ground.
  - (a) If there are less than 10,000 ohms present, repair wires tested (see schematic Fig 2-4) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, perform Step (3) below.
- (3) Measure resistance between one of the terminals of the injector (injector with disconnected wires) and a known good ground.
  - (a) If there are less than 10,000 ohms present, repair wires tested (see schematic Fig 2-4) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step 8 of this Fault.



## A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

#### NOTE

Troubleshooting procedures for codes 71 through 78 are the same for codes 61 through 68.

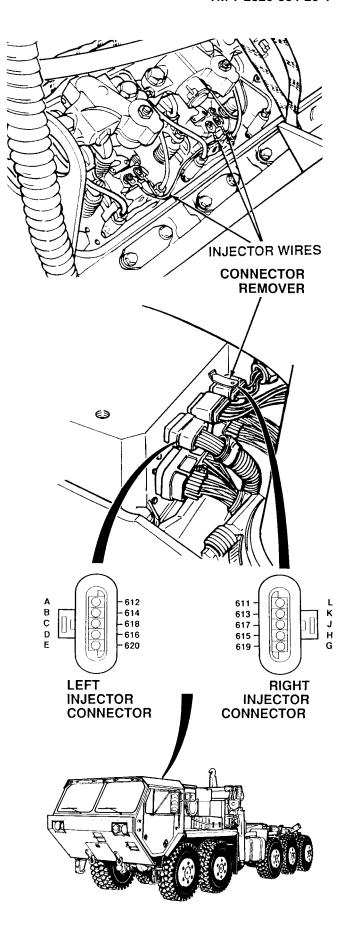
## SIGNAL TEST

- (1) Connect two injector harness connectors to DDEC ECM.
- Looking at injector with disconnected wires, reattach injector drive wire (Fig 2-4).
- (3) Connect one lead of test light to the common side of the injector.
- (4) Connect the second test light lead to a known good ground.
- While an assistant cranks the engine (TM 9-2320-364-10), observe the test
  - (a) If the test light does light steady or flashes, turn OFF ENGINE switch and notify DS Maintenance.
    (b) If the test light does not flash or
- light steady, injector is OK.

  (6) Turn OFF ENGINE switch.
- (7) Connect wire 619 or wire 620 to injector.

## VISUAL INSPECTION

- (1) Disconnect both injector harness connectors at the DDEC ECM with connector remover.
- (2) Check terminals at both harness connectors (harness and DDEC ECM sides) for damage; bent, corroded and unseated pins or terminals.
  - (a) If connectors are damaged, repair connectors (Para 7-101).
  - (b) If DDEC ECM connector terminals are damaged, replace DDEC ECM (Para 7-56).
  - (c) If connectors are free of damage, go to Step 10 of this Fault.
- (3) Connect both injector harnesses.



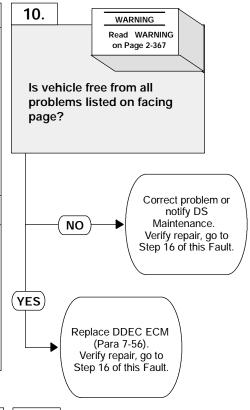
## A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).

## **KNOWN INFO** CHECK ENGINE light (CEL) comes ON and stays ON. Injector response times OK. Only 1 code displayed on DDR. No open in wires 619 and 620. No short in wires 619 and 620. No short in wires 611 through 618. Injectors OK. Terminals at injector harness OK. POSSIBLE PROBLEMS Fault with non-DDEC component. DDEC ECM faulty. Tripped DDEC circuit breakers. Short in bank A or bank B wires 240 and/or 241. Open in bank A or bank B

wires 240 and/or 241.

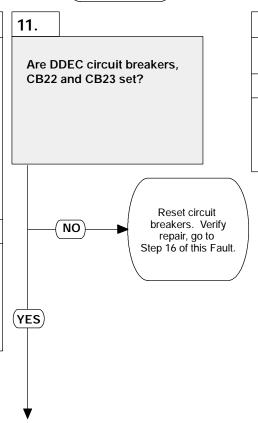
wires 619 and/or 620.

Open in ground line wire 150. Open in injector return lines



# **TEST OPTIONS** Visual inspection. REASON FOR QUESTION Fault may be caused by non-DDEC engine or chassis component.

## **KNOWN INFO** CHECK ENGINE light (CEL) comes ON and stays ON. Injector response times OK. Only 1 code displayed on DDR. No open in wires 619 and 620. No short in wires 619 and 620. No short in wires 611 through 618. Injectors OK. Terminals at injector harness OK. DDEC ECM OK. POSSIBLE PROBLEMS Tripped DDEC circuit breakers. Short in bank A or bank B wires 240 and/or 241. Open in bank A or bank B wires 240 and/or 241. Open in ground line wire 150. Open in injector return lines wires 619 and/or 620.



## REASON FOR QUESTION DDEC will not operate properly if breakers are tripped or defective. If breakers continue to trip, a short or ground exists in wire 240 or 241.

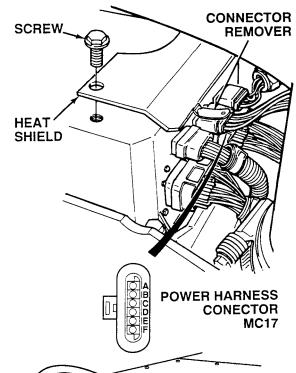
**TEST OPTIONS** 

Visual inspection.

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

#### **VISUAL INSPECTION**

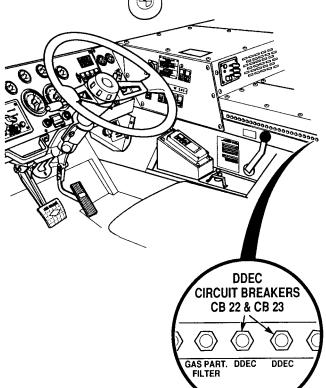
- (1) Check for and correct any of the following problems:
- Air in fuel (Refer to Fuel System Troubleshooting - Para 2-17).
- Low battery charge (Refer to Electrical System Troubleshooting Para 2-20).
- Problems in the charging system (Loose alternator belt, bad grounds, etc.). (Refer to Electrical System Troubleshooting - Para 2-20).
- Signs of insulation wear on injector harness (Remove Rocker Arm Cover Para 3-4 or 3-5) If problem has not been corrected notify DS Maintenance.
- (2) If none of the problems above are present, replace the DDEC ECM (Para 7-56).



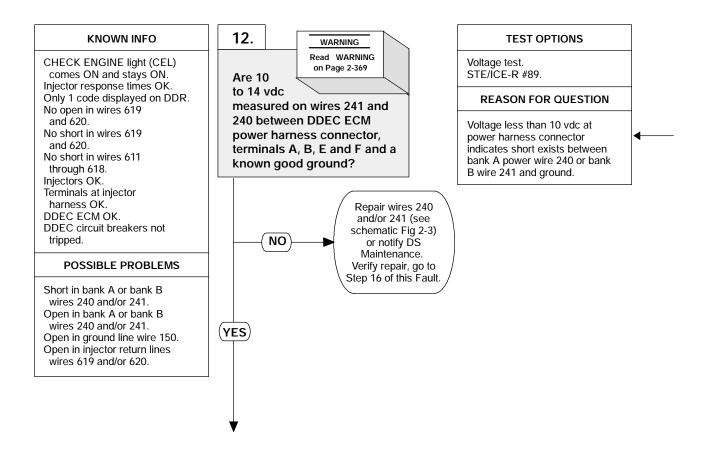
#### **VISUAL INSPECTION**

Check DDEC circuit breakers CB22 and CB23.

- If one of these circuit breakers are tripped, reset circuit breakers. Go to Step 16 of this fault.
- (2) If either of these circuit breakers continue to trip, go to Step 12 of this fault.



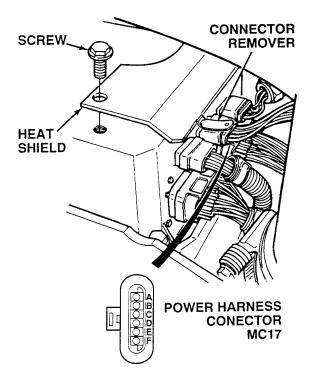
## A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).



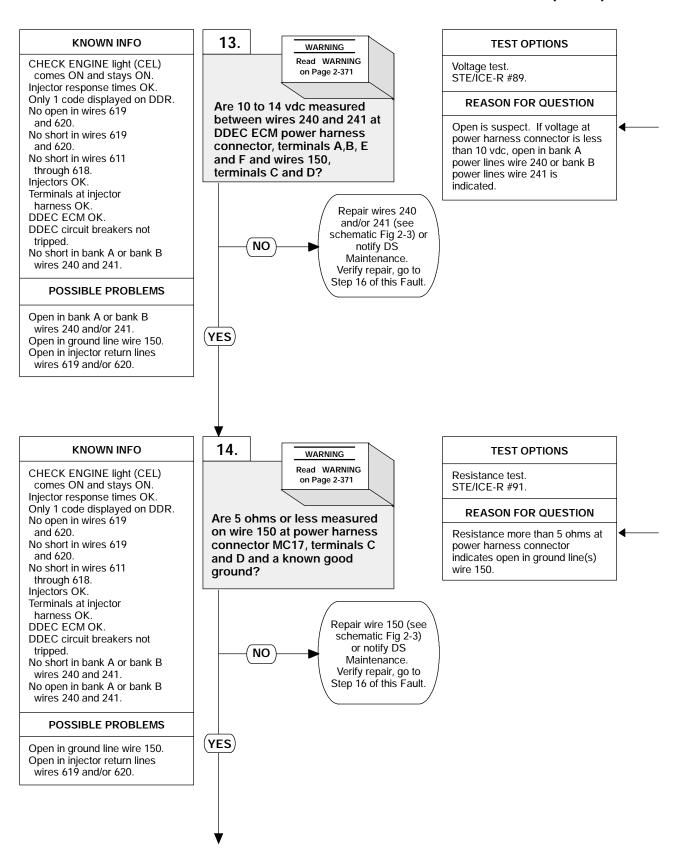
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

#### **VOLTAGE TEST**

- (1) Remove two screws and heat shield.
- (2) Disconnect power harness connector MC17 with connector remover.
- (3) Set multimeter select switch to volts dc.
- (4) Connect positive (+) multimeter lead to power harness connector MC17, terminals A, B, E and F.
- (5) Connect negative (-) multimeter lead to a known good ground.
- (6) Turn ON ENGINE switch (TM 9-2320-364-10).
  - (a) If there are less than 10 vdc present, turn OFF ENGINE switch and repair wire 240 or 241 (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If 10 to 14 vdc are present, wires 240 and 241 are OK. Turn OFF ENGINE switch and go to Step 13 of this Fault.



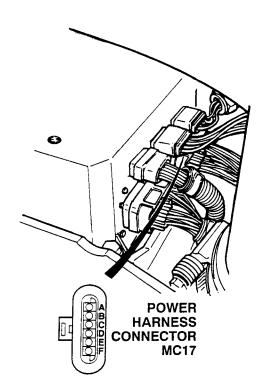
## A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

#### **VOLTAGE TEST**

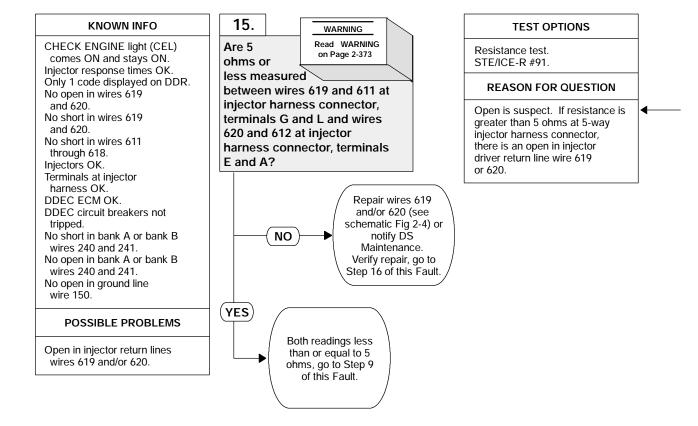
- Connect positive (+) multimeter lead to power harness connector MC17, terminals A, B, E and F one at a time.
- (2) Connect negative (-) multimeter lead to a known good ground.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
  - (a) If less than 10 vdc is present, turn OFF ENGINE switch and repair wire 240 or 241 (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If 10 to 14 vdc are present, wires 240 and 241 are OK. Turn OFF ENGINE switch and go to Step 14 of this Fault.



#### RESISTANCE TEST

- (1) Set multimeter select switch to ohms.
- (2) Read resistance between wire 150 at power harness connector MC17, terminal C and a known good ground.
  - (a) If there are more than 5 ohms present, repair wire 150 (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If there are less than 5 ohms present, wire 150 is OK and perform Step (3) below.
- (3) Read resistance between wire 150 at power harness connector MC17, terminal D and a known good ground.
  - (a) If there are more than 5 ohms present, repair wire 150 (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If there are less than 5 ohms present, wire 150 is OK. Go to Step 15 of this Fault.

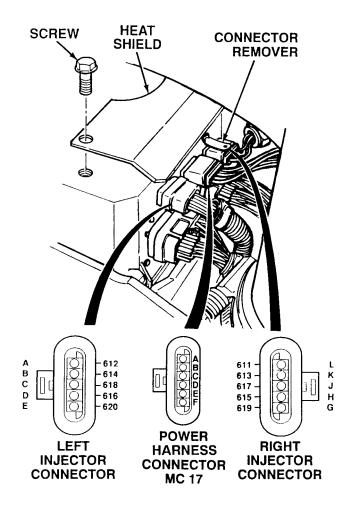
## A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).



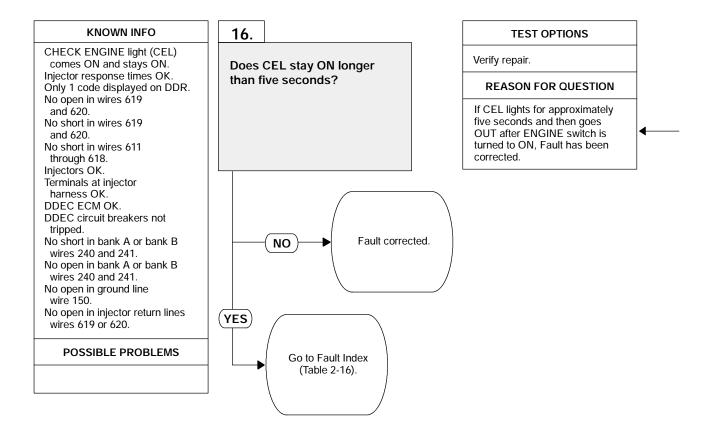
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

#### RESISTANCE TEST

- Disconnect both injector harness connectors at DDEC ECM with connector remover.
- (2) Read resistance between wires 619 and 611 at injector harness connector, terminals G and L.
  - (a) If more than 5 ohms are present, repair wire 619 (see schematic Fig 2-4) or notify DS Maintenance and perform Steps (4) through (8) below.
  - (b) If less than 5 ohms are present, wire 619 is OK.
- (3) Read resistance between wires 620 and 612 at injector harness connector, terminals E and A.
  - (a) If more than 5 ohms are present, repair wires 620 (see schematic Fig 2-4) or perform Steps (4) through (8) below and notify DS Maintenance.
  - (b) If less than 5 ohms are present, wire 620 is OK. Perform Steps (4) through (8) below and go to Step 16 of this Fault.
- (4) Connect power harness connector MC17 to DDEC ECM.
- (5) Connect both injector harness connectors to DDEC ECM.
- (6) Install heat shield and two mounting screws.
- (7) Install rocker arm covers (Para 3-4 and/or 3-5).
- (8) Close top engine access cover.



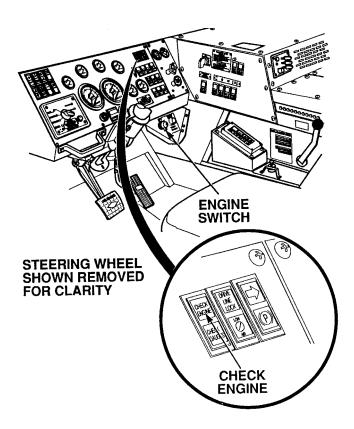
## A4 CODES 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT).



## **VERIFY REPAIR**

- (1) Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (2) Clear codes on DDR (Para 2-11).
  (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
- goes oil, fault has been corrected.
  Perform Steps (4) and (5) below.
  (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



## 2-13. DDEC II TROUBLESHOOTING (CONT).

## A4 CODES 71-78 INJECTOR RESPONSE TIME TOO SHORT.

## **INITIAL SETUP**

Tools and Special Tools

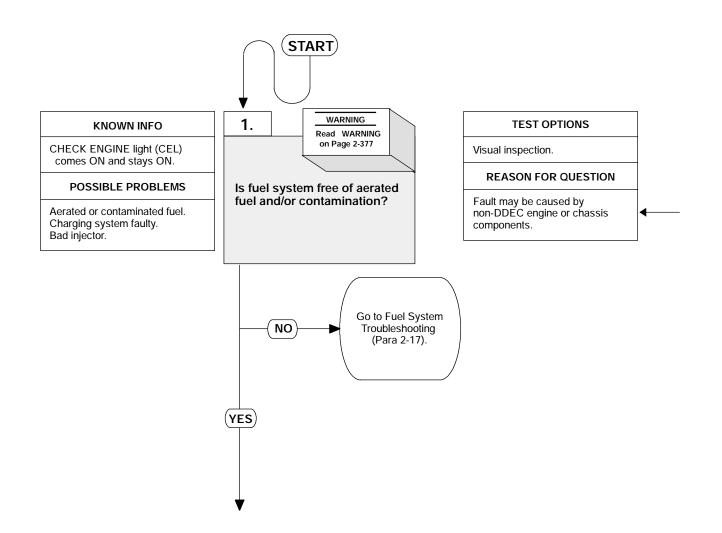
Multimeter (Item 44, Appendix G)

Pan, Drain (Item 47, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)

Personnel Required Two



## **NOTE**

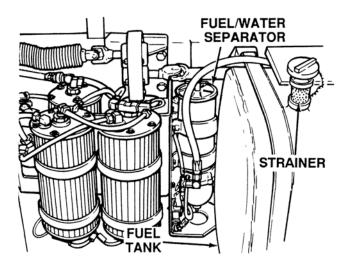
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### VISUAL INSPECTION

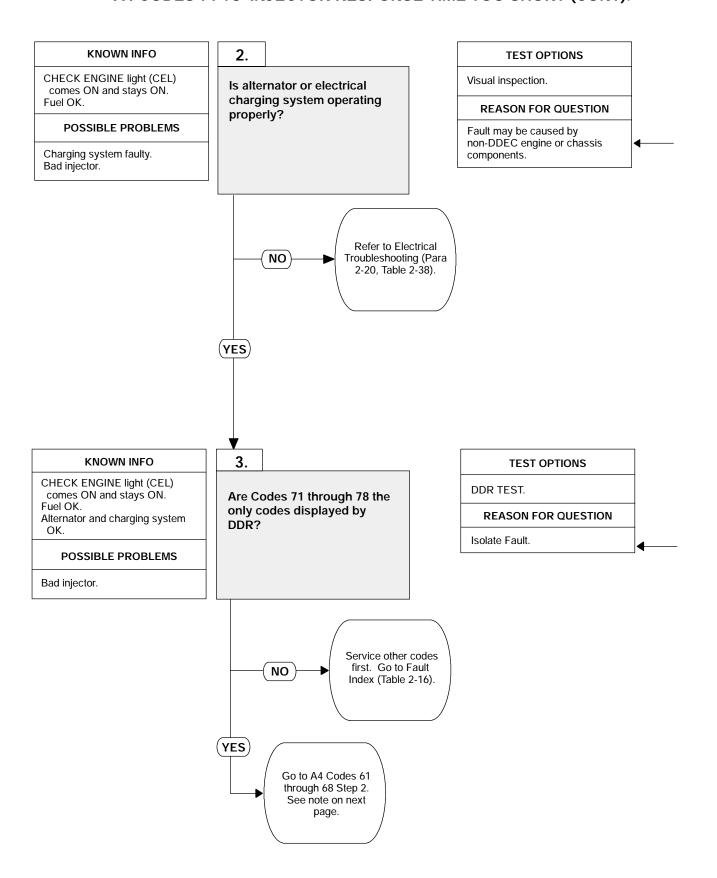
- (1) Check fuel/water separator for water and/or oil in the fuel according to Preventive Maintenance Checks and Services (TM 9-2320-364-10).
  - (a) If there is water in fuel, drain water from fuel/water separator.
- (b) If there is no water in fuel, go to Step (2) below.

  (2) Remove fuel tank cap and check fuel
- strainer for debris.
  - (a) If there is debris in fuel strainer, drain, clean and fill fuel tank (Para 4-8).
  - (b) If there is no debris in fuel strainer, go to Step 2 of this fault.

## AIR DRYER GUARD SHOWN REMOVED FOR CLARITY (IF EQUIPPED)



## A4 CODES 71-78 INJECTOR RESPONSE TIME TOO SHORT (CONT).



#### **ALTERNATOR TEST**

- (1) Start engine (TM 9-2320-364-10).
  - (a) If 10 to 14 vdc are not indicated on the 12V voltmeter and 22 to 28 vdc are not indicated on the 24V voltmeter, turn OFF ENGINE switch and go to electrical system troubleshooting (Para 2-20).

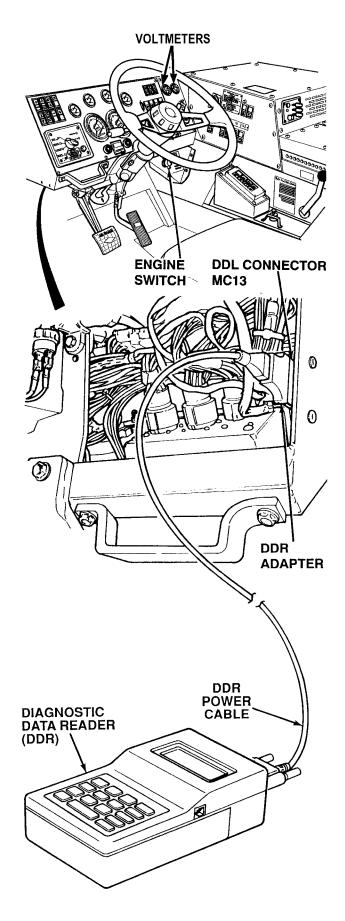
    (b) If 10 to 14 vdc are indicated on
    - (b) If 10 to 14 vdc are indicated on the 12V voltmeter and 22 to 28 vdc are indicated on the 24V voltmeter, alternator is OK.
- (2) Turn OFF ENGINE switch.

## **NOTE**

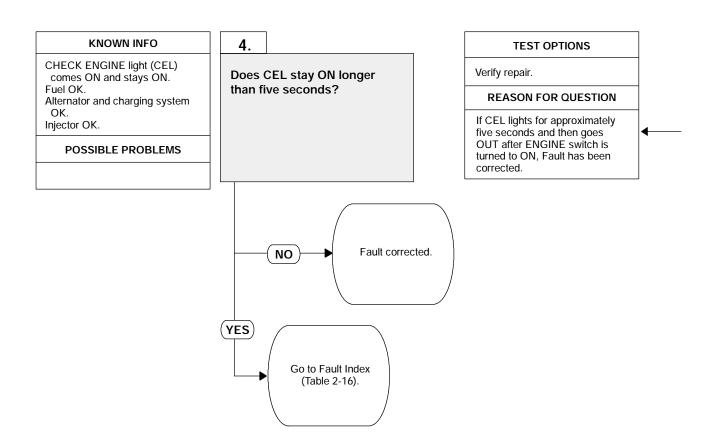
Troubleshooting procedures for Codes 71 through 78 are the same for Codes 61 through 68.

## **DDR TEST**

- (1) Connect DDR to connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 01 (ACTIVE CODES) on DDR.
  - (a) If there are other codes displayed, turn OFF ENGINE switch and refer to Fault Index (Table 2-16).
  - (Table 2-16).
    (b) If there are only Codes 71 through 78 displayed, turn OFF ENGINE switch and go to A4 Codes 61 through 68.



## A4 CODES 71-78 INJECTOR RESPONSE TIME TOO SHORT (CONT).



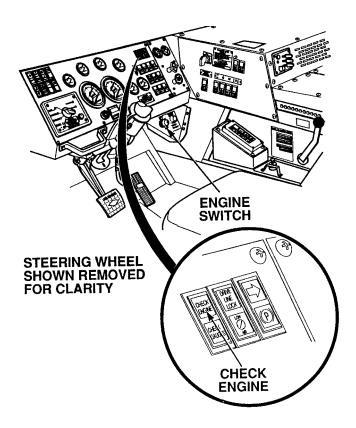
#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (2) Clear codes on DDR (Para 2-11).
  (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then
- for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.

  (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.

  (5) Disconnect DDR from DDL connector MC13
- MC13.



## 2-13. DDEC II TROUBLESHOOTING (CONT).

## A5A VEHICLE HARNESS +5 VOLT SUPPLY.

## **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

Wrench, Torque (0 to 175 lb-ft [0-237 N·m])

(Item 95, Appendix G)

**Jumperwire** 

#### Materials/Parts

Compound, Corrosion Preventive

(Item 34, Appendix C)

Lockwasher (Item 168, Appendix F)

#### References

TM 9-2320-364-10 TM 9-4910-571-12&P

## **Equipment Condition**

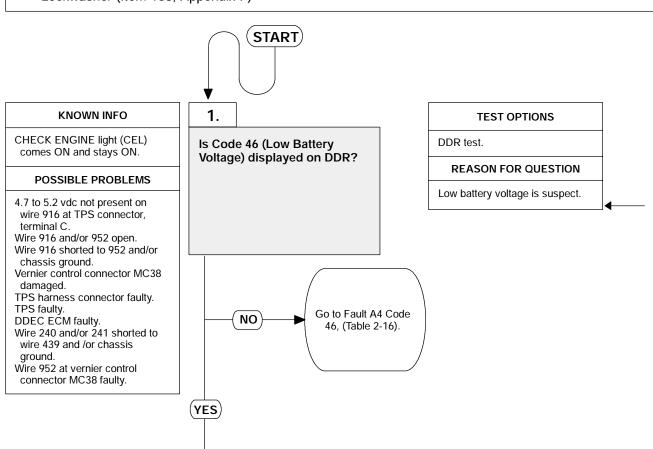
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)





The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

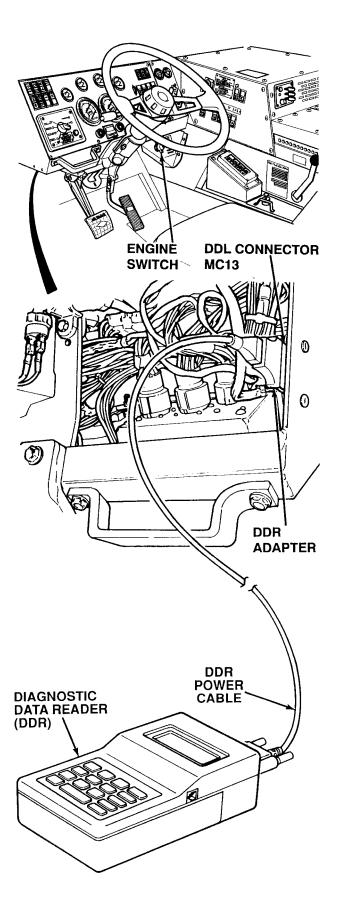
### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10). (3) Select MODE 01 (ACTIVE CODES)

  - on DDR.

    (a) If Code 46 fails to display on DDR, turn OFF ENGINE switch and go to Fault A4 (Table 2-16).

    (b) If Code 46 is the only active code displayed, turn OFF ENGINE switch and go to Step 2 of this fault.

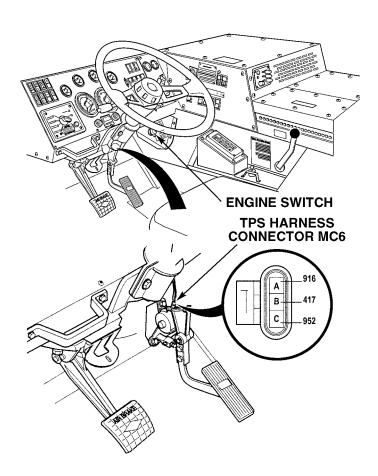


#### 2. KNOWN INFO **TEST OPTIONS** WARNING CHECK ENGINE light (CEL) Read WARNING Voltage Test. on Page 2-385 comes ON and stays ON. STE/ICE-R #89. ECM supply voltage OK. **REASON FOR QUESTION** POSSIBLE PROBLEMS Are between 4.7 and 5.2 vdc Voltage may not be in measured between wires 952 acceptable range. Acceptable range is 4.7 to 5.2 vdc. 4.7 to 5.2 vdc not present on and 916 at TPS connector, wire 916 at TPS connector, terminals A and C? terminal C. Wire 916 and/or 952 open. Wire 916 shorted to 952 and/or chassis ground. Vernier control connector MC38 damaged. Less than 4.7 vdc, go TPS faulty. to Step 3 of this Fault. TPS harness connector faulty. NO More than 5.2 volts, DDEC ECM faulty. go to Step 10 of this Wire 240 and/or 241 shorted to Fault. wire 439 and /or chassis ground. Wire 952 at vernier control connector MC38 faulty. (YES Between 4.7 and 5.2 vdc, go to Step 7 of this Fault.

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.

#### **VOLTAGE TEST**

- (1) Disconnect TPS harness connector MC6.
- Set multimeter select switch to volts dc.
- (3) Connect positive (+) multimeter lead to TPS harness connector MC6, terminal C.
- Connect negative (-) multimeter lead to TPS harness connector MC6, terminal A.
- Turn ON ENGINE switch (TM 9-2320-364-10).
  Are 4.7 to 5.2 vdc present on wire 952 to wire 916 at TPS harness connector MC6, terminals C and A.
  - (a) If 4.7 to 5.2 vdc are present, turn OFF Engine switch and go to Step 7 of this Fault.
  - (b) If more than 5.2 vdc are present, turn OFF Engine switch and go to Step 10 of this Fault.
  - (c) If less than 4.7 vdc are present, turn OFF Engine switch and go to Step 3 of this Fault.

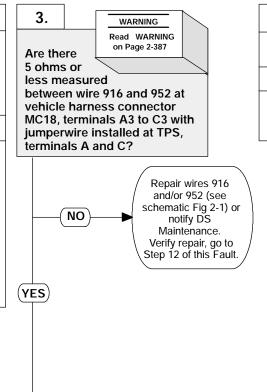


#### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. ECM supply voltage OK. 4.7 to 5.2 vdc present on wire 916 at TPS connector, terminal C.

## POSSIBLE PROBLEMS

Wire 916 and/or 952 open.
Wire 916 shorted to 952 and/or chassis ground.
Vernier control connector MC38 damaged.
TPS harness connector faulty.
TPS faulty.
DDEC ECM faulty.
Wire 240 and/or 241 shorted to wire 439 and /or chassis ground.
Wire 952 at vernier control connector MC38 faulty.



## **TEST OPTIONS**

Resistance test. STE/ICE-R #91.

#### REASON FOR QUESTION

Reading greater than 5 ohms indicates +5 volt line wire 916 or sensor return wire 952 is open.

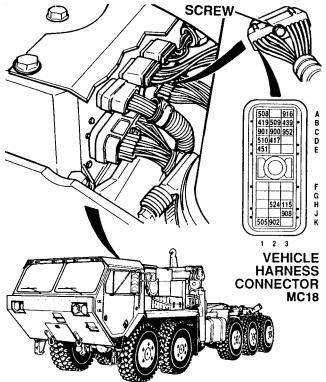
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

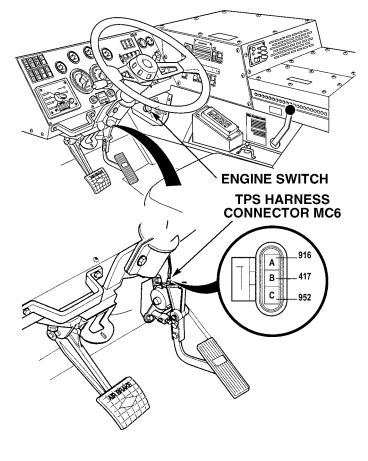
# CAUTION

- Use jumperwire only between terminals indicated.
   Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

- Loosen screw and disconnect vehicle harness connector MC18 from DDEC ECM.
- (2) Place jumperwire between terminals A and C at TPS harness connector MC6.
- (3) Set multimeter select switch to ohms.
- (4) Are there 5 ohms or less measured between wire 916 and 952 at vehicle harness connector MC18, terminals A3 to C3.
  - (a) If more than 5 ohms are present, remove jumperwire and repair wires 916 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If less than 5 ohms are present, remove jumperwire and go to Step 4 of this Fault.





#### **KNOWN INFO** 4. WARNING **TEST OPTIONS** Read WARNING CHECK ENGINE light (CEL) on Page 2-389 Resistance test. Are there comes ON and stays ON. STE/ICE-R #92. ECM supply voltage OK. 10,000 ohms 4.7 to 5.2 vdc present on or less measured between REASON FOR QUESTION wire 916 at TPS connector, wire 916 and 952 at TPS terminal C. Resistance less than or equal to connector, terminals A to C 10,000 ohms at TPS harness and wire 417 at TPS connector indicates short. connector, terminal B and a POSSIBLE PROBLEMS known good ground? Wire 916 and/or 952 open. Wire 916 shorted to 952 and/or chassis ground. Vernier control connector MC38 damaged. If readings are more TPS harness connector faulty. than 10,000 ohms, go NO TPS faulty. to Step 9 of this Fault. DDEC ECM faulty. Wire 240 and/or 241 shorted to wire 439 and /or chassis ground. Wire 952 at vernier control connector MC38 faulty. YES KNOWN INFO 5. WARNING Read WARNING CHECK ENGINE light (CEL) Voltage test. on Page 2-389

# **TEST OPTIONS** STE/ICE-R #89. REASON FOR QUESTION Reading less than 4.7 vdc at vernier control harness

connector indicates wire 916

line wire 952 or ground.

(+5 volt line) is shorted to return

comes ON and stays ON. ECM supply voltage OK. 4.7 to 5.2 vdc present on wire 916 at TPS connector, terminal C. No open in wires 916 and 952.

## POSSIBLE PROBLEMS

Wire 916 shorted to 952 and/or chassis ground. Vernier control connector MC38 damaged. TPS harness connector faulty. TPS faulty.
DDEC ECM faulty. Wire 240 and/or 241 shorted to wire 439 and /or chassis ground. Wire 952 at vernier control

connector MC38 faulty.

on wire 916 to wire 952 at vernier control harness connector MC38, terminals C to A? Repair wires 916 and/or 952 (see schematic Fig 2-1) or

notify DS Maintenance.

Verify repair, go to

Step 12 of this Fault.

or equal to 4.7 volts measured

(YES)

Are there

more than

NO

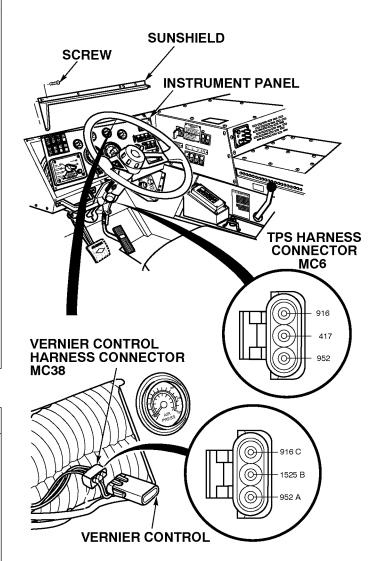
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

#### RESISTANCE TEST

- (1) Remove ten screws and sunshield from instrument panel.
- (2) Pull top of instrument panel towards steering wheel.
- (3) Disconnect vernier control harness connector MC38.
- (4) Are 10,000 ohms or less present between wires 916 and 952 at TPS harness connector MC6, terminals A and C?
  - (a) If there are 10,000 ohms or less present, repair wire(s) 916 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step (5) below.
- (5) Are there 10,000 ohms or less present between wire 417 at TPS harness connector MC6, terminal B and a known good ground?
  - (a) If there are 10,000 ohms or less present, repair wire 417 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms present, go to Step 5 of this Fault.

### **VOLTAGE TEST**

- Set multimeter select switch to volts dc.
- (2) Connect positive (+) multimeter lead to vernier control harness connector MC38, terminal C.
- (3) Connect negative (-) multimeter lead to vernier control harness connector MC38, terminal A.
- (4) Turn ON ENGINE switch (TM 9-2320-364-10).
- (5) Are there more than or equal to 4.7 vdc present on wire 916 to wire 952 at vernier control harness connector MC38, terminals C to A?
  - (a) If there are less than 4.7 vdc present, turn OFF ENGINE switch and repair wires 916 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are 4.7 vdc or more present, turn OFF ENGINE switch and go to Step 6 of this Fault.



Repair connectors

Verify repair, go to

Step 12 of this Fault.

(Para 7-101).

#### **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. ECM supply voltage OK. 4.7 to 5.2 vdc present on wire 916 at TPS connector, terminal C.

No open in wires 916 and 952. No short in wires 916 and 952.

#### POSSIBLE PROBLEMS

Vernier control connector MC38 damaged.
TPS harness connector faulty.
TPS faulty.
DDEC ECM faulty.
Wire 240 and/or 241 shorted to wire 439 and /or chassis ground.
Wire 952 at vernier control

connector MC38 faulty.

Are vernier control terminals and connectors (sensor side and harness side) free from damage?

TEST OPTIONS

Visual inspection.

REASON FOR QUESTION

Damage to terminals or connectors can affect signal to vernier control.

Replace vernier control (Para 7-100), Verify repair, go to Step 12 of this Fault.

NO

## **KNOWN INFO**

CHECK ENGINE light (CEL) comes ON and stays ON. ECM supply voltage OK. 4.7 to 5.2 vdc present on wire 916 at TPS connector, terminal C. No open in wires 916 and 952. No short in wires 916 and 952. Vernier control connector

MC38 OK.

## POSSIBLE PROBLEMS

TPS harness connector faulty. TPS faulty. DDEC ECM faulty. Wire 240 and/or 241 shorted to wire 439 and /or chassis ground. Wire 952 at vernier control connector MC38 faulty. 7.

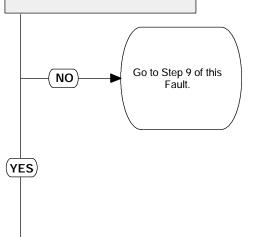
Are the TPS counts 20 to 30 at idle and 200 to 235 counts at full throttle?

### TEST OPTIONS

DDR test.

#### REASON FOR QUESTION

TPS counts should be 20 to 30 counts at idle and no more than 235 counts at full throttle.



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

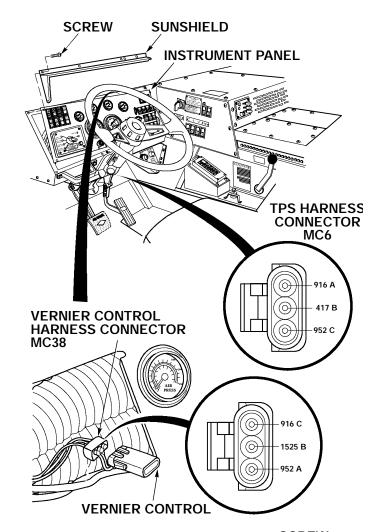
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

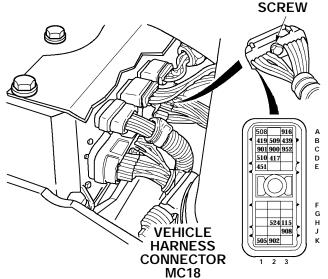
#### **VISUAL INSPECTION**

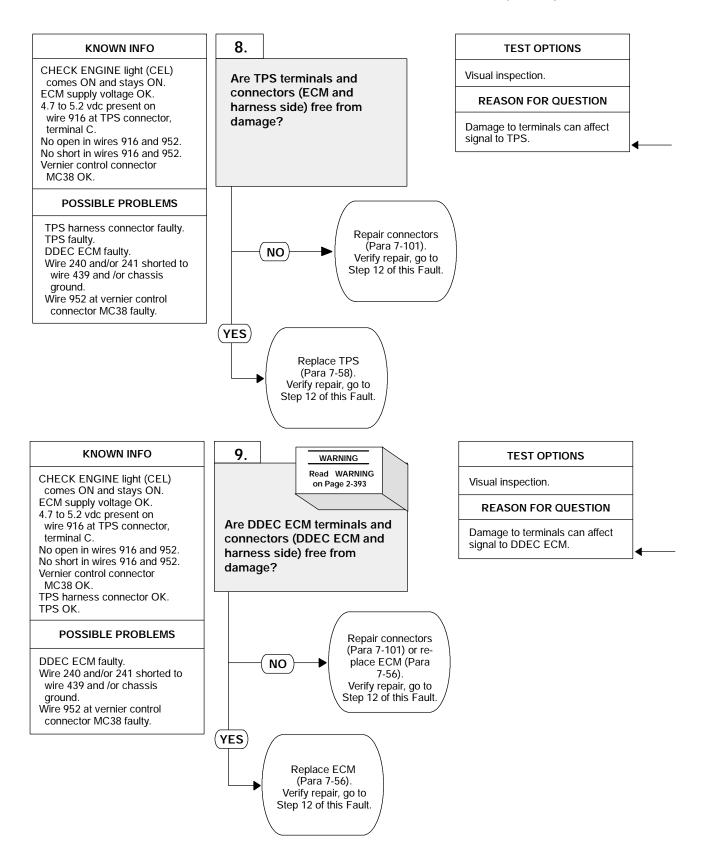
- (1) Check terminals at vernier control and harness connector for damage; bent, corroded and unseated pins or
  - (a) If terminals are damaged, repair connector (Para 7-101) and perform Steps (2) through (5) below.
  - (b) If terminals are not damaged, replace vernier control (Para 7-100) and perform Steps (2) through (5) below.
- (2) Connect vernier control harness connector MC38.
- Connect TPS harness connector MC6.
- Connect vehicle harness connector MC18 and tighten screw.
- Install instrument panel and sunshield with ten screws.

#### **DDR TEST**

- (1) Turn ON ENGINE switch
- (TM 9-2320-364-10). Select MODE 07 (TPS COUNTS) for display on the DDR.
- Read throttle counts at idle and at full throttle (engine not running).
  - (a) If throttle count is 20 to 30 at idle and 200 to 235 at full throttle, perform Steps (4) and (5) below and go to Step 9 of this Fault.
  - (b) If throttle count is not 20 to 30 at idle and 200 to 235 at full throttle, perform Steps (4) and (5) below and go to Step 8 of this Fault.
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.







- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

## CAUTION

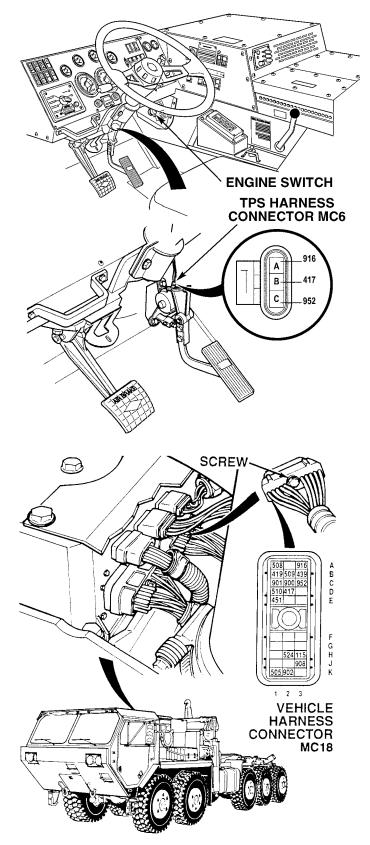
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VISUAL INSPECTION**

- (1) Disconnect TPS harness connector MC6.
- (2) Inspect TPS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If vehicle connector is damaged, repair connectors (Para 7-101) and connect TPS harness connector MC6
  - (b) If vehicle connector are free of damage, replace TPS (Para 7-58) and connect TPS harness connector MC6

### **VISUAL INSPECTION**

- (1) Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (2) Check terminals at vehicle harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If vehicle harness connector is damaged, repair connector (Para 7-101) and perform Step (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If vehicle harness connector and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (3) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.



#### **KNOWN INFO** 10. **TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) Resistance test. on Page 2-395 comes ON and stays ON. STE/ICE-R #92. Are there ECM supply voltage OK. 4.7 to 5.2 vdc present on wire 916 at TPS connector, more than REASON FOR QUESTION 10,000 ohms or an open terminal C. circuit measured at vehicle Resistance less than 10,000 No open in wires 916 and 952. harness connector MC18 ohms at power or vehicle No short in wires 916 and 952. and/or the power harness harness connectors indicates Vernier control connector short where measured. connector MC17? MC38 OK. TPS harness connector OK. TPS OK. Repair connector DDEC ECM OK. and/or wires 240, 241, 439, 916 (see POSSIBLE PROBLEMS schematic Fig 2-1 and Fig 2-3) or notify DS NO Wire 240 and/or 241 shorted to Maintenance. wire 439 and /or chassis Verify repair, go to ground. Step 12 of this Fault. Wire 952 at vernier control connector MC38 faulty. (YES)

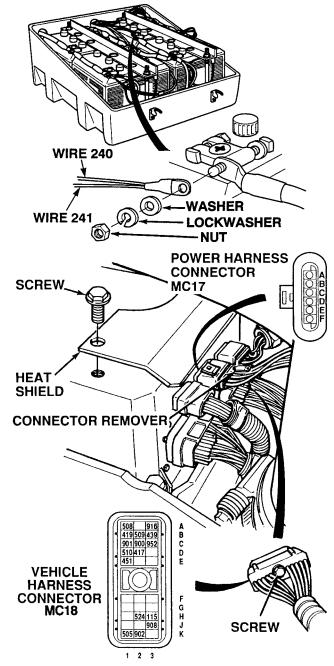
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact
  with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes
  with large amounts of water for at least 15 minutes and get immediate medical attention.

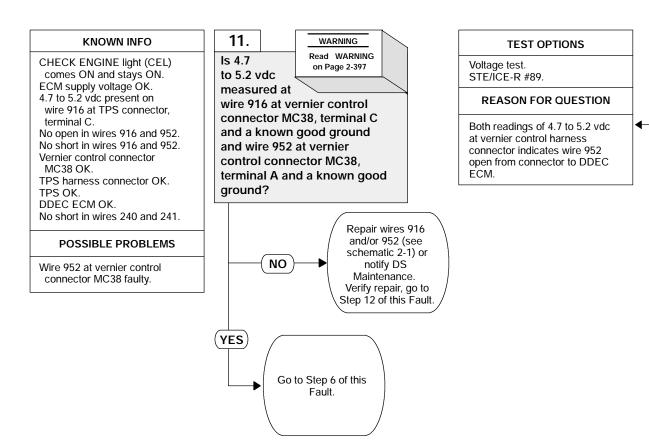
# CAUTION

- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.
- While applying torque to nut, hold screw with wrench or damage to battery may occur.

#### RESISTANCE TEST

- (1) Remove battery box cover (TM 9-2320-364-10).
- (2) Remove nut, washer, lockwasher, wires 240 and 241 from battery. Discard lockwasher.
- (3) Remove two mounting screws and heat shield from DDEC ECM.
- (4) Disconnect power harness connector MC17 at DDEC ECM with connector remover.
- (5) Loosen screw and disconnect vehicle harness connector MC18.
- (6) Set multimeter select switch to ohms.
- (7) Are there 10,000 ohms or more present between wires 916 and 439 at vehicle harness connector MC18, terminals A3 and B3.
  - (a) If 10,000 ohms or less are present, repair wires 916 and 439 (see schematic Fig 2-1) or notify DS Maintenance and perform Steps (9) through (16) below.
  - (b) If 10,000 ohms or more are present, go to Step (8) below.
- (8) Are there 10,000 ohms or less present between wire 916 on vehicle harness connector MC18, terminal A3 and wires 241 and 240, terminals A, B, E or F on power harness connector MC17?
  - (a) If there are 10,000 ohms or less present, repair wires 241 and/or 240 (see schematic Fig 2-3) or notify DS Maintenance and perform Steps (9) through (16) below.
  - (b) If there are 10,000 ohms or more present, wires 241 and 240 are OK. Perform Steps (9) through (16) below.
- (9) Connect power harness connector MC17.
- (10) Connect vehicle harness connector MC18 and tighten screw.
- (11) Install heat shield with two mounting screws to DDEC ECM.
- (12) Connect wires 240/241 to battery with washer, lockwasher and nut.
- (13) Tighten nut to 23 lb-ft (31 N·m).
- (14) Apply corrosion preventive compound on nut.
- (15) Install battery box cover.
- (16) Close engine access cover.

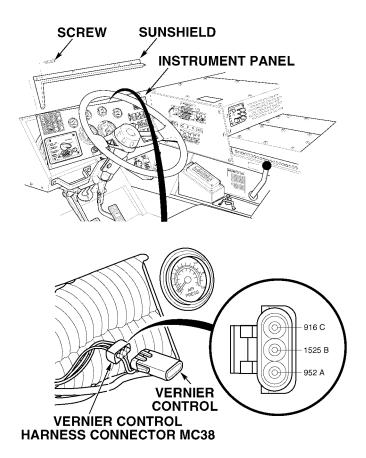


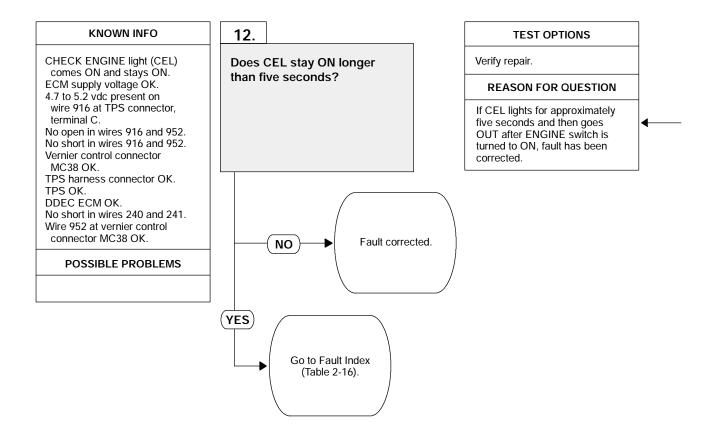


- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

#### **VOLTAGE TEST**

- (1) Set multimeter select switch to volts dc.
- Connect positive (+) multimeter lead to vernier control harness connector MC38, terminal C.
- (3) Connect negative (-) multimeter lead to a known good ground.
- (4) Turn ON ENGINE switch (TM 9-2320-364-10).
- (5) Are there 4.7 to 5.2 vdc present at wire 916 at vernier control harness connector MC38, terminal C and a known good ground.
  - (a) If there are 4.7 to 5.2 vdc present, repair wire 916 (see schematic Fig 2-1) or notify DS Maintenance and perform Steps (9) through (11) below.
  - (b) If there are less than or more than 4.7 to 5.2 vdc present, perform Step (6) below.
- (6) Connect positive (+) multimeter lead to vernier control harness connector MC38, terminal A.
- (7) Connect negative (-) multimeter lead to a known good ground.
- (8) Are there 4.7 to 5.2 vdc present at wire 952 at vernier control harness connector MC38, terminal A and a known good ground.
  - (a) If there are less than 4.7 vdc present, turn OFF ENGINE switch and repair wires 916 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance and perform Steps (9) through (11) below.
  - (b) If there are 5.2 vdc or more present, perform Steps (9) and (11) below and go to Step 6 of this Fault.
- (9) Turn OFF ENGINE switch.
- (10) Connect vernier control harness connector MC38.
- (11) Install instrument panel and sunshield with ten screws.





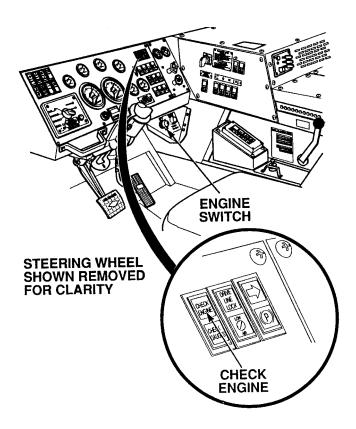
#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).(3) If CEL does not come ON, start engine and run for 8 minutes or until
  - (a) If CHECK ENGINE light comes on for about five seconds and then
- for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.

  (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).

  (4) Turn OFF ENGINE switch.

  (5) Disconnect DDR from DDL connector
- MC13.



#### 2-13. DDEC II TROUBLESHOOTING (CONT).

#### A5B ENGINE HARNESS +5 VOLT SUPPLY.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)
DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G) Remover, Connector (Item 55, Appendix G)

Wrench, Torque (0 to 175 lb-ft [0-237 N·m])

(Item 95, Appendix G)

Jumperwire

#### Materials/Parts

Compound, Corrosion Preventive (Item 34, Appendix C)

Materials/Parts - Continued

Lockwasher (Item 168, Appendix F)

Lockwasher (22) (Item 195, Appendix F)

#### References

TM 9-2320-364-10 TM 9-4910-571-12&P

#### Equipment Condition

Engine OFF, (TM 9-2320-364-10)

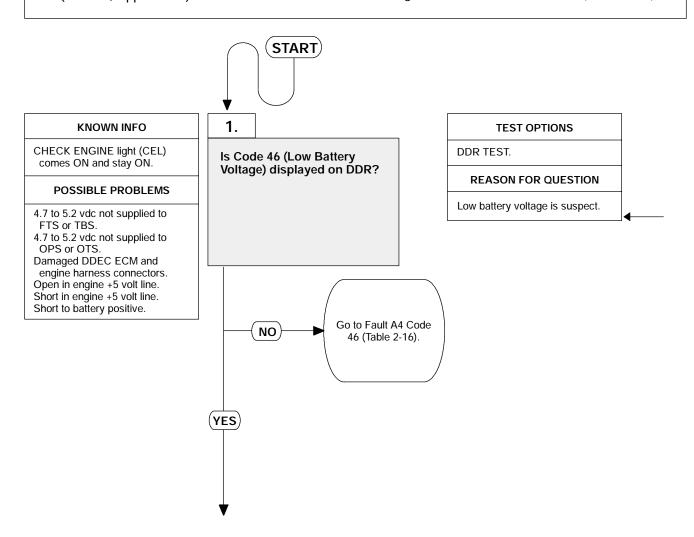
Parking brake applied, (TM 9-2320-364-10)

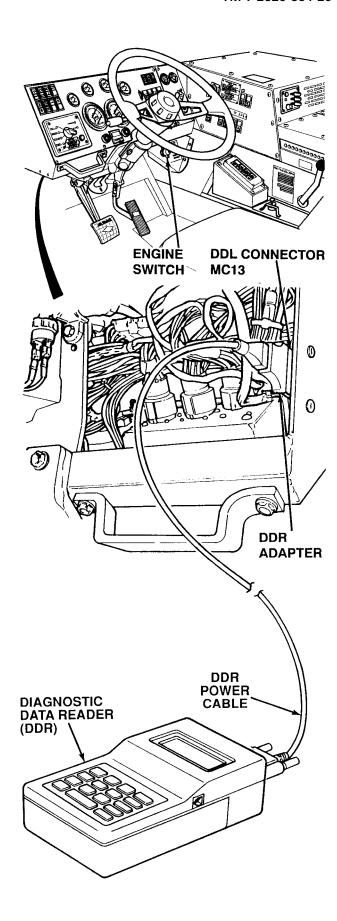
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)

Right front fender skirt removed, (Para 17-33)





#### **NOTE**

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (3) Select MODE 01 (ACTIVE CODES)
  - on DDR.

    (a) If Code 46 fails to display on DDR, turn OFF ENGINE switch and disconnect DDR from DDL MC13. Go to Fault A4 (Table 2-16).
  - (b) If Code 46 is the only active code displayed, turn OFF ENGINE switch and go to Step 2 of this fault.

#### A5B ENGINE HARNESS +5 VOLT SUPPLY (CONT).

#### 2. KNOWN INFO **TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) Voltage test. on Page 2-403 comes ON and stay ON. STE/ICE-R #89. ECM supply voltage OK. **REASON FOR QUESTION** Are 4.7 to 5.2 vdc measured POSSIBLE PROBLEMS between wires 452 and 472 at Readings between 4.7 and 5.2 vdc are acceptable. FTS and TBS harness 4.7 to 5.2 vdc not supplied to connectors, terminals A FTS or TBS. and B? 4.7 to 5.2 vdc not supplied to OPS or OTS. Damaged DDEC ECM and engine harness connector. Open in engine +5 volt line. Short in engine +5 volt line. If there are less than 4.7 vdc, go to Step 5 of this Fault. Short to battery positive. NO If there are more than 5.2 vdc, go to Step 7 of this Fault. (YES)

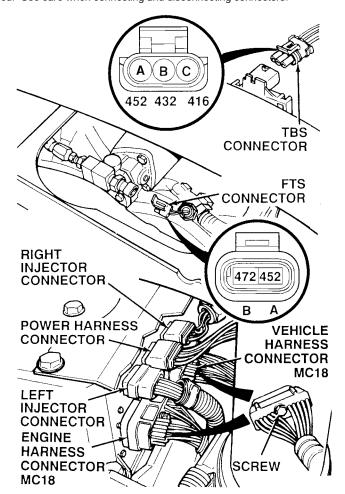
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VOLTAGE TEST**

- (1) Remove DDEC ECM (Para 7-56).
- (2) Disconnect FTS harness connector.
- (3) Set DDEC ECM on mounting bracket.
- (4) Connect vehicle and engine harness connectors, tighten two screws.
- (5) Connect power harness connector, and right and left injector connectors.
- (6) Connect positive (+) multimeter lead to FTS harness connector, terminal
- Connect negative (-) multimeter lead to FTS harness connector, terminal B.
- (8) Turn ON ENGINE switch (TM 9-2320-364-10).
- (9) Are 4.7 to 5.2 vdc present between wires 452 and 472 at FTS harness connector, terminals A and B?
  - (a) If less than 4.7 vdc are present, turn OFF ENGINE switch, and go to Step 5 of this Fault.
  - (b) If more than 5.2 vdc are present, turn OFF ENGINE switch and go to Step 7 of this Fault.
  - (c) If 4.7 and 5.2 vdc are present, go to Step (10) below.
- (10) Disconnect TBS harness connector from sensor.
- (11) Connect positive (+) multimeter lead to TBS harness connector, terminal A.
- (12) Connect negative (-) multimeter lead TBS harness connector, terminal C.
- (13) Turn ON ENGINE switch.
- (14) Are 4.7 to 5.2 vdc present between wires 452 and 416 at TBS connector MC6, terminals A and C.
  - (a) If less than 4.7 vdc are present, perform Steps (15) through (18) below and go to Step 5 of this Fault.
  - (b) If more than 5.2 vdc are present, perform Steps (15) through (18) below and go to Step 7 of this Fault.
  - (c) If 4.7 to 5.2 vdc are present, TBS connector is OK.
- (15) Turn OFF ENGINE switch.
- (16) Connect TBS connector to sensor.
- (17) Connect FTS harness connector to sensor.
- (18) Install DDEC ECM (Para 7-56).



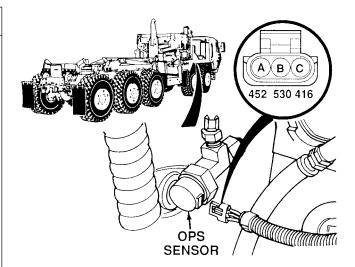
#### A5B ENGINE HARNESS +5 VOLT SUPPLY (CONT).

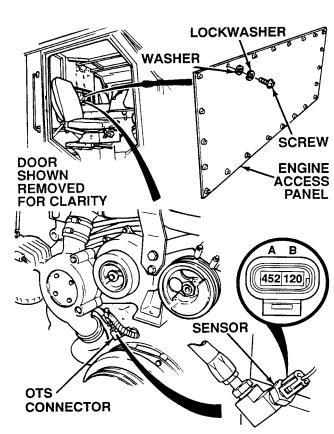
#### **KNOWN INFO** 3. **TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) Voltage test. on Page 2-405 comes ON and stays ON. STE/ICE-R #89. ECM supply voltage OK. 4.7 to 5.2 vdc supplied to FTS **REASON FOR QUESTION** Are 4.7 to 5.2 vdc measured or TBS. between wires 452 and 416 at Voltage of less than 4.7 vdc or POSSIBLE PROBLEMS more than 5.2 vdc will prevent **OPS and OTS harness** connectors, terminals A sensors from operating correctly or cause damage. and B? 4.7 to 5.2 vdc not supplied to OPS or OTS. Damaged ECM and engine harness connector. Open in engine +5 volt line. Short in engine +5 volt line. If less than 4.7 vdc are present, go to Step 5 of this Fault. If more than 5.2 vdc Short to battery positive. NO are present, go to Step 7 of this Fault. (YES)

- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

#### **VOLTAGE TEST**

- Remove 22 screws, lockwashers, washers and engine access panel. Discard lockwashers.
- (2) Disconnect OPS harness connector.
- (3) Connect positive (+) multimeter lead to OPS harness connector, terminal A.
- (4) Connect negative (-) multimeter lead OPS harness connector, terminal C.
- (5) Turn ON ENGINE switch, (TM 9-2320-364-10).
- (6) Are 4.7 to 5.2 vdc present between wires 452 and 416 at OPS connector, terminals A and C?
  - (a) If less than 4.7 vdc are present, turn OFF ENGINE switch and go to Step 5 of this Fault.
  - (b) If more than 5.2 vdc are present, go to Step 7 of this Fault.(c) If 4.7 and 5.2 vdc are present,
  - (c) If 4.7 and 5.2 vdc are present, OPS connector is OK. Perform Steps (7) and (8) below.
- (7) Turn OFF ENGINE switch.
- (8) Connect OPS connector to sensor.
- (9) Disconnect OTS harness connector from sensor.
- (10) Connect positive (+) multimeter lead to OTS harness connector, terminal A.
- (11) Connect negative (-) multimeter lead OTS harness connector, terminal B.
- (12) Turn ON ENGINE switch, (TM 9-2320-364-10).
- (13) Are 4.7 to 5.2 vdc present between wires 452 and 120 at OTS connector, terminals A and B?
  - (a) If less than 4.7 vdc are present, turn OFF ENGINE switch, perform Steps (15) through (17) below and go to Step 5 of this Fault.
  - (b) If more than 5.2 vdc are present, turn OFF ENGINE switch, perform Steps (15) through (17) below and go to Step 7 of this Fault.
  - (c) If between 4.7 and 5.2 vdc are present, OTS connector is OK, perform Steps (14) through (17) below.
- (14) Turn OFF ENGINE switch.
- (15) Connect OPS connector to sensor.
- (16) Install engine access panel with 22 washers, lockwashers and screws.
- (17) Install right front fender skirt (Para 17-33).





#### A5B ENGINE HARNESS +5 VOLT SUPPLY (CONT).

#### 4. **KNOWN INFO TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) Visual inspection. on Page 2-407 comes ON and stay ON. ECM supply voltage OK. **REASON FOR QUESTION** 4.7 to 5.2 vdc supplied to FTS Are ECM and engine harness or TBS. Damage to connectors can 4.7 to 5.2 vdc supplied to OPS connectors OK? affect signal to DDEC ECM. POSSIBLE PROBLEMS Damaged ECM and engine harness connector. Open in engine +5 volt line. Repair engine Short in engine +5 volt line. harness connector Short to battery positive. (Para 7-101) or re-NO place DDEC ECM (Para 7-56). Verify repair, go to Step 8 of this Fault. YES Replace DDEC ECM (Para 7-56). Verify repair, go to Step 8 of this Fault. 5. **KNOWN INFO TEST OPTIONS** CAUTION Read CAUTION CHECK ENGINE light (CEL) Resistance test. on Page 2-407 comes ON and stay ON. STE/ICE-R #91. ECM supply voltage OK. 4.7 to 5.2 vdc supplied to FTS REASON FOR QUESTION Are there 5 ohms or less meaor TBS. 4.7 to 5.2 vdc supplied to OPS sured between wires 416 and Resistance more than 5 ohms or OTS. 452 at engine harness conindicates open in wire 416 or ECM and engine harness sensor return wire 452. nector, terminals W1 and Y2? connectors OK. POSSIBLE PROBLEMS Repair wires 416 Open in engine +5 volt line. and/or 452 Short in engine +5 volt line. Short to battery positive. (see schematic NO Fig 2-2) or notify DS Maintenance. Verify repair, go to Step 8 of this Fault. (YES)

- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



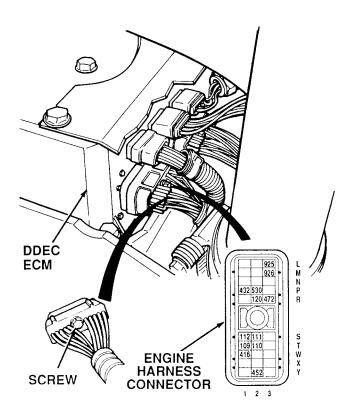
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### VISUAL INSPECTION

- (1) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Check engine harness connector and ECM connector for bent, corroded and unseated terminals.
  - (a) If harness connector is damaged, repair connector (Para 7-101).
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If engine harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).

#### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Place jumperwire between terminals A and C of any sensor harness connector that measured less than 4.7 vdc in Steps 2 and 3 of this Fault.
- (3) Place jumperwire between terminals A and B of any sensor harness connector that measured less than 4.7 vdc in Steps 2 and 3 of this Fault.
- (4) Set multimeter select switch to ohms.
- (5) Are there 5 ohms or less present between wires wire 416 and 452 at engine harness connector, terminals W1 and Y2?
  - (a) If more than 5 ohms are present, remove jumperwire and repair wires 416 and 452 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If less than 5 ohms are present, wire 416 and 452 are OK.
- (6) Remove jumperwire.
- (7) Install engine harness connector and tighten screw.



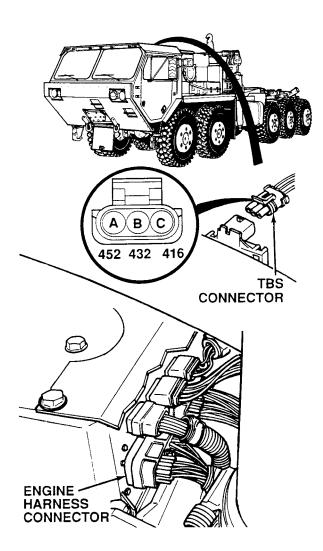
#### A5B ENGINE HARNESS +5 VOLT SUPPLY (CONT).

#### **KNOWN INFO** 6. **TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) Resistance test. on Page 2-409 comes ON and stay ON. STE/ICE-R #92. ECM supply voltage OK. 4.7 to 5.2 vdc supplied to FTS **REASON FOR QUESTION** Are there more than 10,000 or TBS. 4.7 to 5.2 vdc supplied to OPS ohms or an open circuit Resistance less than 10,000 or OTS. measured between wires 416 ohms at sensor connector ECM and engine harness and 452 at TBS connector, indicates wire 416 is shorted to connectors OK. return line wire 452 or ground. terminals A and C? POSSIBLE PROBLEMS Open in engine +5 volt line short Repair wires 416 in engine +5 volt line. and/or 452 (see schematic Fig 2-2) or Short to battery positive. notify DS NO Maintenance. Verify repair, go to Step 8 of this Fault. (YES) Go to Step 4 of this Fault.

- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

#### RESISTANCE TEST

- (1) Disconnect TBS harness connector.
- (2) Are there more than 10,000 ohms or an open circuit present between wires 416 and 452 at TBS connector, terminals A and C?
  - (a) If less than 10,000 ohms are present repair wires (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If there are more than 10,000 ohms or an open circuit, wires 416 and 452 are OK. Perform Step (3) below.
- (3) Are there more than 10,000 ohms or an open circuit present between wire 416 at TBS connector, terminal C and a known good ground?
   (a) If less than 10,000 ohms are
  - (a) If less than 10,000 ohms are present repair wire 416 (see schematic Fig 2-2) or notify DS Maintenance.
  - (b) If more than 10,000 ohms are present or an open circuit, wire 416 is OK. Go to Step 4 of this Fault.



#### A5B ENGINE HARNESS +5 VOLT SUPPLY (CONT).

#### **KNOWN INFO** 7. WARNING **TEST OPTIONS** Read WARNING Are there on Page 2-411 CHECK ENGINE light (CEL) Resistance test. comes ON and stay ON. more than STE/ICE-R #92. ECM supply voltage OK. 10,000 ohms 4.7 to 5.2 vdc supplied to FTS or an open circuit measured **REASON FOR QUESTION** or TBS. between wire 416 at engine 4.7 to 5.2 vdc supplied to OPS Resistance less than 10,000 harness connector, terminal or OTS. ohms at the power harness W1 and 439 at vehicle DDEC ECM and engine harness connector indicates short harness connector MC18, connectors OK. between terminals where terminal B3? No open in engine +5 volt line. measured. No short in engine +5 volt line. Repair wires 416, 240, 241 and/or 439 POSSIBLE PROBLEMS (see schematic Short to battery positive. Fig 2-1 and/or 2-2) or NO notify DS Maintenance. Verify repair, go to Step 8 of this Fault. (YES)

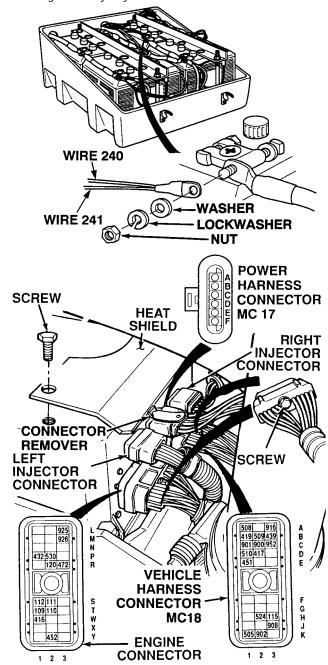
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact
  with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes
  with large amounts of water for at least 15 minutes and get immediate medical attention.

# CAUTION

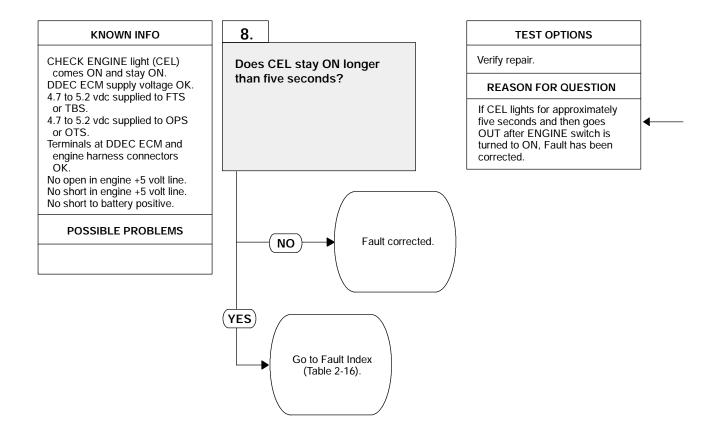
- ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.
- While applying torque to nut, hold screw with wrench or damage to battery may occur.

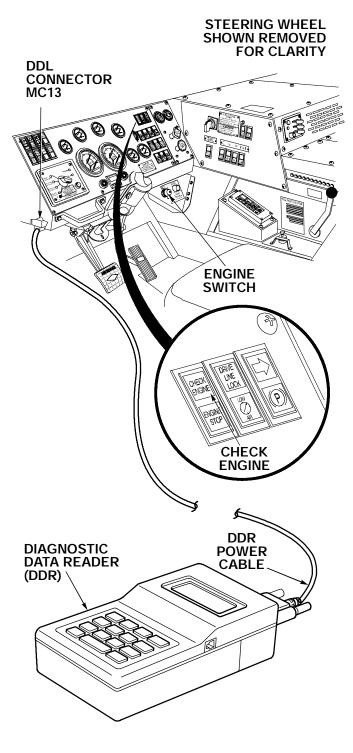
#### RESISTANCE TEST

- Remove battery box cover (TM 9-2320-364-10).
- (2) Remove nut, washer, lockwasher and disconnect wires 240 and 241 from battery No. 4. Discard lockwasher.
- (3) Remove two screws and heat shield from DDEC ECM.
- (4) Disconnect power harness connector MC17, right and left injector connectors with connector remover.
- (5) Loosen two screws and disconnect engine and vehicle harness connectors from DDEC ECM.
- (6) Are there more than 10,000 ohms or an open circuit present between wire 416 at engine harness connector, terminal W1 and wire 439 at vehicle harness connector MC18, terminal B3?
  - (a) If less than 10,000 ohms are present, repair wires 416 and 439 (see schematic Fig 2-1 and/or 2-2) or notify DS Maintenance and perform Steps (8) through (14) below.
  - (b) If more than 10,000 ohms are present or an open circuit, wires 416 and 439 are OK. Perform Step (7) below.
- (7) Are there more than 10,000 ohms present between wire 416 at engine harness connector, terminal W1 and wires 241 and 240 at power harness connector, terminals A, B, E and F?
  - (a) If less than 10,000 ohms are present, repair wires 416, 240 or 241 (see schematic Fig 2-2 and/or 2-3) or notify DS Maintenance and perform Steps (8) through (14) below.
  - (b) If more than 10,000 ohms are present, DDEC wiring is OK.
- (8) Connect engine and vehicle harness connectors to DDEC ECM and tighten two screws.
- (9) Connect DDEC ECM power connector and right and left injector connectors.
- (10) Connect wires 240/241 to battery
  No. 4 with washer, lockwasher and nut.
- (11) Tighten nut to 23 lb-ft (31 N·m).
- (12) Apply corrosion preventive compound on nut.
- (13) Install heatshield and two screws to DDEC ECM.
- (14) Install battery box cover.



#### A5B ENGINE HARNESS +5 VOLT SUPPLY (CONT).





#### VERIFY REPAIR

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).
  (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
- Perform Steps (4) and (5) below.

  (b) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16). (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.

#### 2-13. DDEC II TROUBLESHOOTING (CONT).

#### B CHECK ENGINE LIGHT (CEL) ALWAYS OFF.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G) DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G) Jumperwire

References

TM 9-2320-364-10

TM 9-4910-571-12&P

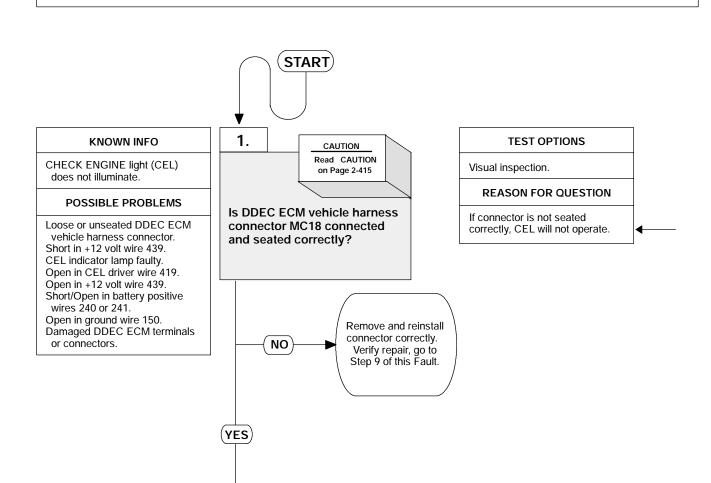
**Equipment Condition** 

Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10) Top engine access cover opened,

(TM 9-2320-364-10)





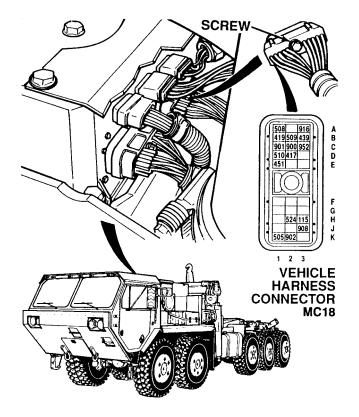
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VISUAL INSPECTION**

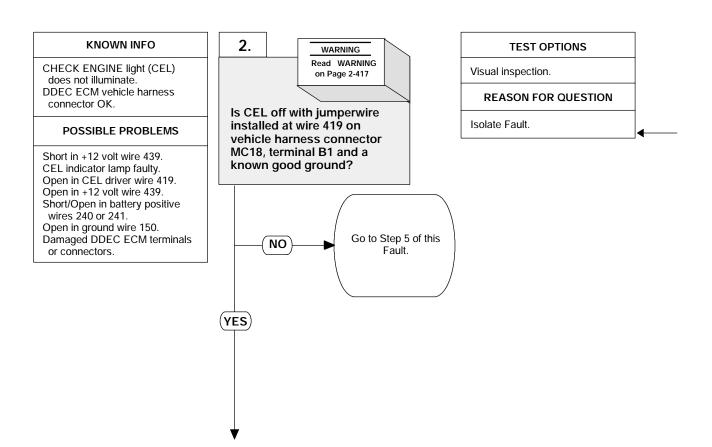
Visually inspect DDEC ECM vehicle harness connector MC18.

- (1) If connector is loose, reinstall and
- tighten screw.

  (2) If connector is OK, go to Step 2 of this Fault.



#### B CHECK ENGINE LIGHT (CEL) ALWAYS OFF (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

### CAUTION

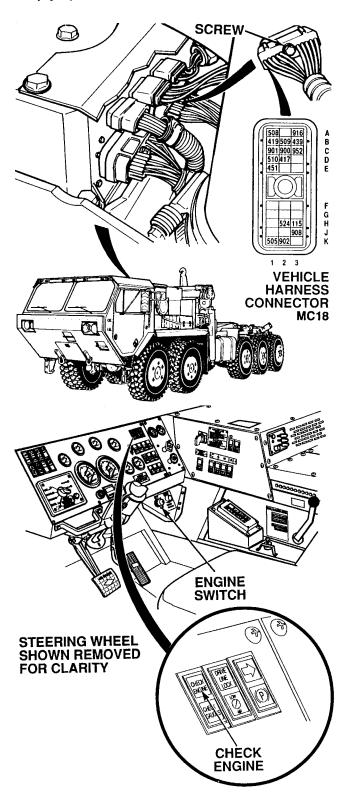
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **NOTE**

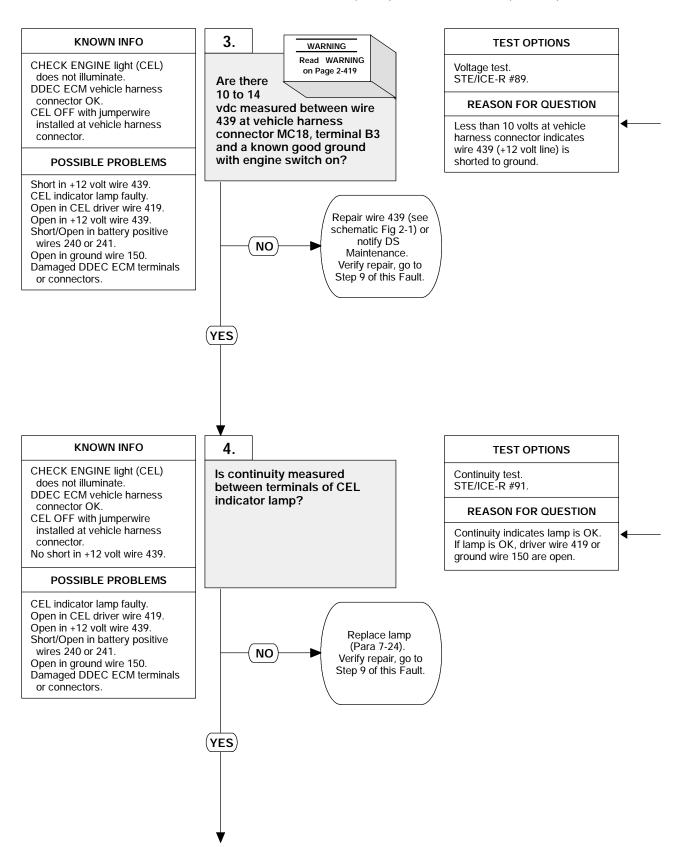
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **VISUAL INSPECTION**

- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (2) Place jumperwire between terminal B1 on vehicle harness connector MC18 and a known good ground.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
- (4) Observe CEL.
  - (a) If CEL does come ON, perform Steps (5) and (6) below and go to Step 5 of this fault.
  - (b) If CEL does not come ON, perform Steps (5) and (6) below and go to Step 3 of this fault.
- (5) Turn OFF ENGINE switch.
- (6) Remove jumperwire.



#### B CHECK ENGINE LIGHT (CEL) ALWAYS OFF (CONT).



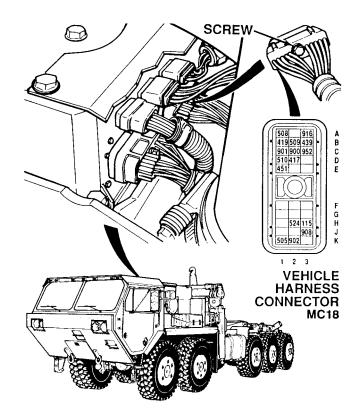
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

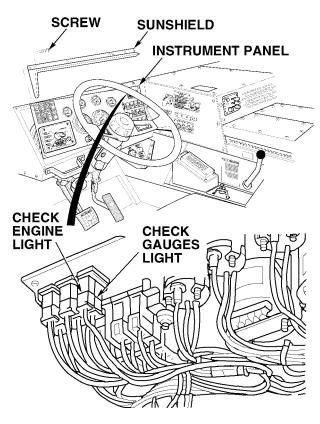
#### **VOLTAGE TEST**

- (1) Set multimeter select switch to volts dc.
- (2) Connect positive (+) multimeter lead to vehicle harness connector MC18, terminal B3.
- (3) Connect negative (-) multimeter lead to a known good ground.(4) Turn ON ENGINE switch
- (4) Turn ON ENGINE switch (TM 9-2320-364-10).(5) Are there 10 to 14 vdc present
- (5) Are there 10 to 14 vdc present between wire 439 at vehicle harness connector MC18, terminal B3 and a known good ground?
  - (a) If there are less than 10 vdc present, turn OFF ENGINE switch and repair wire 439 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are more than 10 vdc present, turn OFF ENGINE switch and go to Step 4 of this Fault.

#### **CONTINUITY TEST**

- (1) Remove ten screws and sunshield from instrument panel.
- (2) Pull top of instrument panel towards steering wheel.
- (3) Remove CEL lamp (Para 7-24).
- (4) Set multimeter select switch to ohms.
- (5) Is continuity measured across terminals of CEL indicator lamp?
  - (a) If there is no continuity, replace lamp (Para 7-24) and perform Step (7) below.
  - (b) If there is continuity, lamp is OK. Perform Steps (6) and (7) below.
- (6) Install CEL lamp.
- (7) Install instrument panel and sunshield with ten screws.





#### B CHECK ENGINE LIGHT (CEL) ALWAYS OFF (CONT).

#### **KNOWN INFO** 5. **TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) Voltage test. on Page 2-421 STE/ICE-R #89. does not illuminate. DDEC ECM vehicle harness connector OK. REASON FOR QUESTION Are there 10 to 14 vdc CEL OFF with jumperwire installed at vehicle harness measured between wire 439 at Less than 10 volts at vehicle connector. vehicle harness connector harness connector indicates No short in +12 volt line wire 439 (+12 volt line) is open. MC18, terminal B3 and a wire 439. known good ground? CEL indicator lamp OK. No open in CEL driver wire 419. POSSIBLE PROBLEMS Repair wire 439 (see schematic Fig 2-1) or Open in +12 volt wire 439. notify DS Short/Open in battery positive NO Maintenance. wires 240 or 241. Verify repair, go to Open in ground wire 150. Step 9 of this Fault. Damaged DDEC ECM terminals or connectors. (YES) KNOWN INFO 6. **TEST OPTIONS** WARNING Read WARNING CHECK ENGINE light (CEL) Voltage test. on Page 2-421 does not illuminate. STE/ĬCE-R #89. DDEC ECM vehicle harness connector OK. REASON FOR QUESTION Are 10 to 14 vdc measured CEL OFF with jumperwire installed at vehicle harness between wires 241 and 240 at Less than 10 volts at power connector. power harness connector harness connector indicates No short in +12 volt line MC17, terminals A, B, E and F battery positive lines wires wire 439. 240/241 are shorted and a known good ground? CEL indicator lamp OK. (CB22/CB23 tripped) or open. No open in CEL driver wire 419. No open in +12 volt wire 439. Repair wires 241 POSSIBLE PROBLEMS and/or 240 (see schematic Fig 2-3) Short/Open in battery positive NO or notify DS wires 240 or 241. Maintenance. Open in ground wire 150. Verify repair, go to Damaged DDEC ECM terminals Step 9 of this Fault. or connectors. (YES)

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



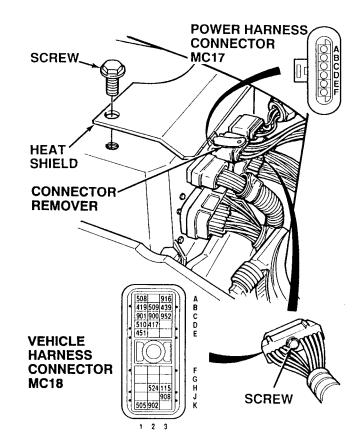
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VOLTAGE TEST**

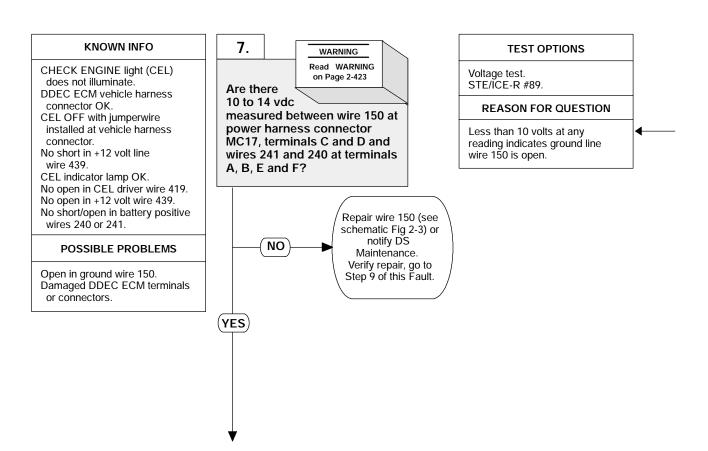
- Set multimeter select switch to volts dc.
- (2) Connect positive (+) multimeter lead to vehicle harness connector MC18, terminal B3.
- (3) Connect negative (-) multimeter lead to a known good ground.
- (4) Turn ON ENGINE switch (TM 9-2320-364-10).
- (5) Are there 10 to 14 vdc present between wire 439 at vehicle harness connector MC18, terminal B3 and a known good ground?
  - (a) If there are less than 10 vdc present, turn OFF ENGINE switch and repair wire 439 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If more than 10 vdc are present, perform Step (6) and (7) below and go to Step 6 of this Fault.
- (6) Turn OFF ENGINE switch.
- (7) Connect vehicle harness connector MC18 and tighten screw.

#### **VOLTAGE TEST**

- (1) Remove two mounting screws and heat shield from DDEC ECM.
- (2) Disconnect power harness connector MC17 at DDEC ECM with connector remover
- (3) Connect positive (+) multimeter lead to power harness connector MC17, terminals A, B, E and F, one at a time.
- (4) Connect negative (-) multimeter lead to a known good ground.
- (5) Turn ON ENGINE switch (TM 9-2320-364-10).
- (6) Are 10 to 14 vdc present between wires 241 and 240 at power harness connector MC17, terminals A, B, E and F and a known good ground?
  - (a) If there are less than 10 vdc present, turn OFF ENGINE switch and repair wires 241 and/or 240 (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If more than 10 vdc are present, turn OFF ENGINE switch and go to Step 7 of this Fault.



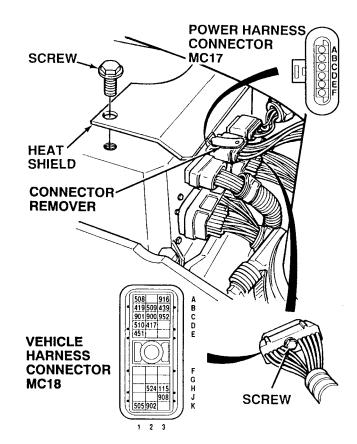
#### B CHECK ENGINE LIGHT (CEL) ALWAYS OFF (CONT).



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

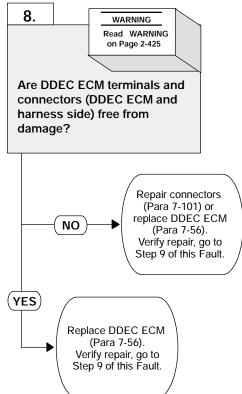
#### **VOLTAGE TEST**

- Connect positive (+) multimeter lead to power harness connector MC17, terminals C.
- (2) Connect negative (-) multimeter lead to terminals A, B, E and F.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
- (4) Are there more than 10 to 14 vdc present between wire 150 at power harness connector MC17, terminal C and wires 241 and 240 at terminals A, B, E and F one at a time?
  - (a) If there are less than 10 vdc present, repair wire 150 (see schematic Fig 2-3) or notify DS Maintenance and perform Steps
     (6) and (7) below.
  - (b) If there are 10 to 14 vdc present, go to Step (5) below.
- (5) Are there less than 10 vdc present between wire 150 at power harness connector MC17, terminal D and wires 241 and 240 at terminals A, B, E and F?
  - (a) If there are less than 10 vdc present, repair wire 150 (see schematic Fig 2-3) or notify DS Maintenance and perform Steps
     (6) and (7) below.
  - (b) If there are 10 to 14 vdc present, perform Steps (6) and (7) below and go to Step 8 of this Fault.
- (6) Connect power harness connector MC17.
- Install heat shield and two mounting screws.

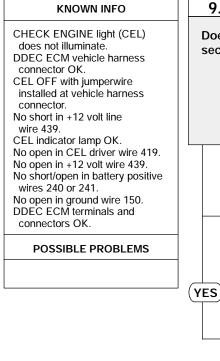


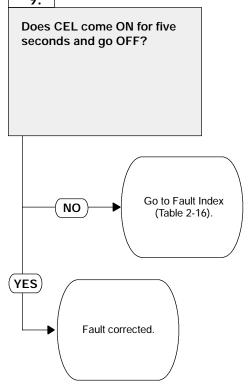
#### B CHECK ENGINE LIGHT (CEL) ALWAYS OFF (CONT).

#### **KNOWN INFO** CHECK ENGINE light (CEL) does not illuminate. DDEC ECM vehicle harness connector OK. CEL OFF with jumperwire installed at vehicle harness connector. No short in +12 volt line wire 439. CEL indicator lamp OK. No open in CEL driver wire 419. No open in +12 volt wire 439. No short/open in battery positive wires 240 or 241. No open in ground wire 150. POSSIBLE PROBLEMS Damaged DDEC ECM terminals or connectors.



# **TEST OPTIONS** Visual inspection. REASON FOR QUESTION Damaged DDEC ECM terminals and connectors can affect signal to DDEC ECM.





# REASON FOR QUESTION If CEL lights for approximately five seconds and then goes OUT after ENGINE switch is turned to ON, fault has been corrected.

**TEST OPTIONS** 

Verify repair.

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

# CAUTION

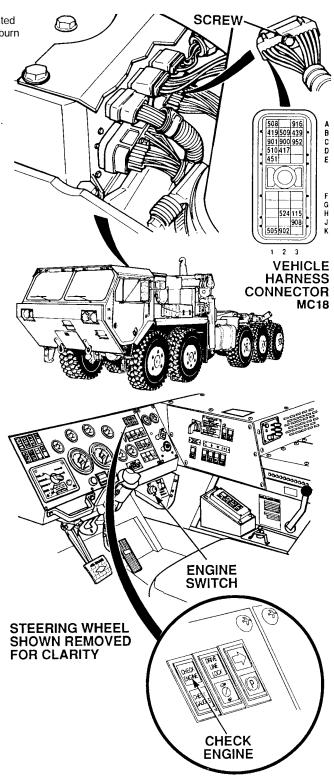
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VISUAL INSPECTION**

- Check terminals at vehicle harness connector (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If vehicle harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56) and go to Step 9 of this Fault.
  - (c) If vehicle harness and ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (2) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.
- (3) Close top engine access cover.

#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-11).
- (3) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If CHECK ENGINE light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
  - (b) If CHECK ENGINE light comes on for about five seconds and then goes off, fault has been corrected.
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



#### 2-13. DDEC II TROUBLESHOOTING (CONT).

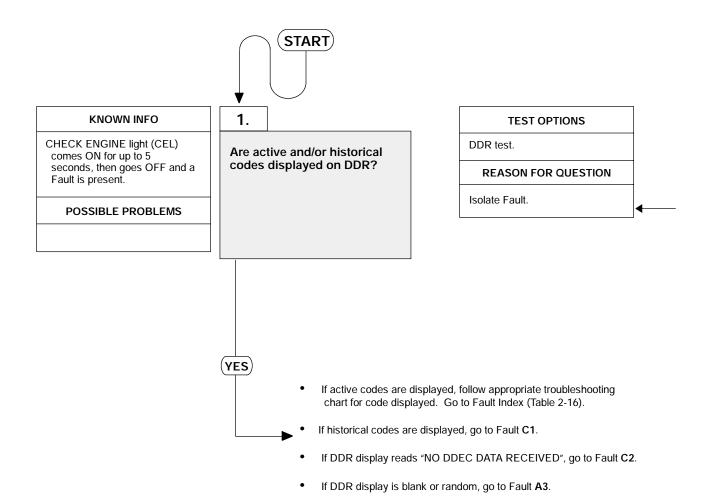
#### C NORMAL OPERATION OF CHECK ENGINE LIGHT (CEL) AND FAULT PRESENT.

#### **INITIAL SETUP**

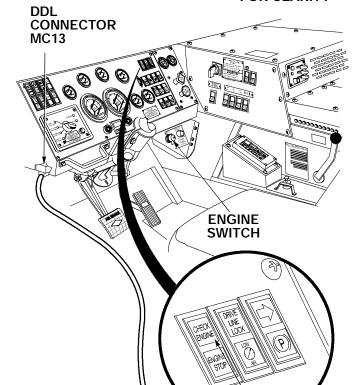
Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)



STEERING WHEEL **SHOWN REMOVED FOR CLARITY** 

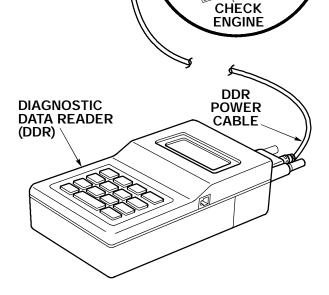


#### NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- Turn ON ENGINE switch
- (TM 9-2320-364-10). (3) Select MODE 01 (ACTIVE CODES) on DDR and read codes.
- Select MODE 02 (HISTORICAL CODES) on DDR and read codes.
- Turn OFF ENGINE switch.
- (6) Disconnect DDR from DDL connector MC13.



#### 2-13. DDEC II TROUBLESHOOTING (CONT).

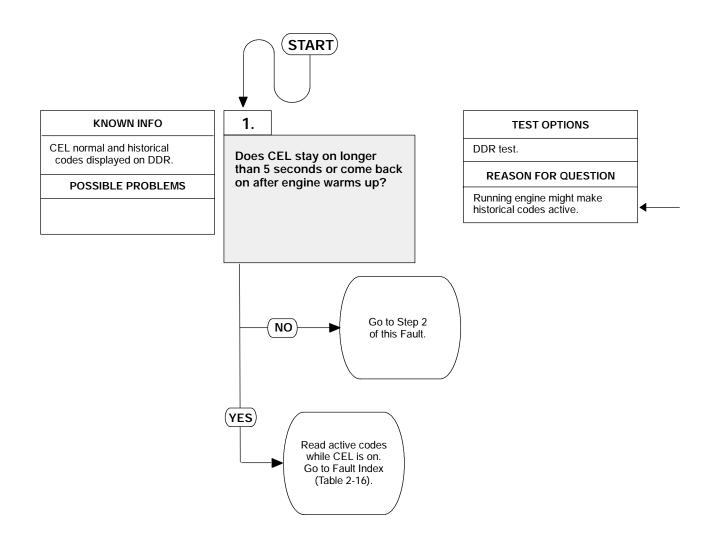
#### C1 CEL NORMAL AND HISTORICAL CODES DISPLAYED ON DDR.

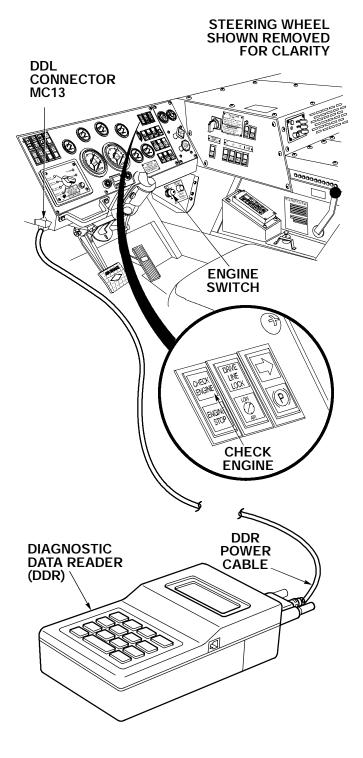
#### **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)

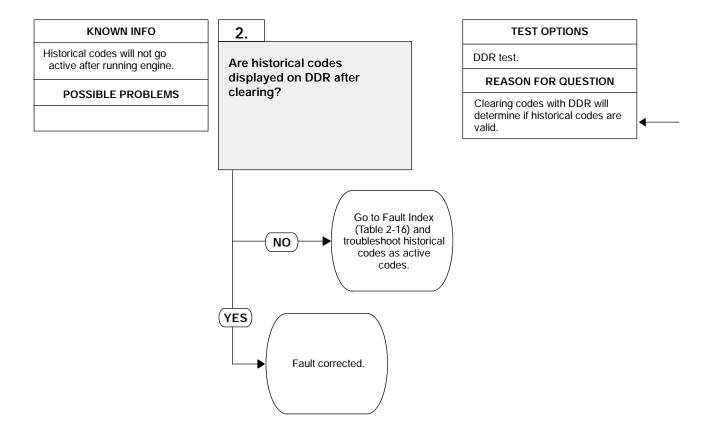


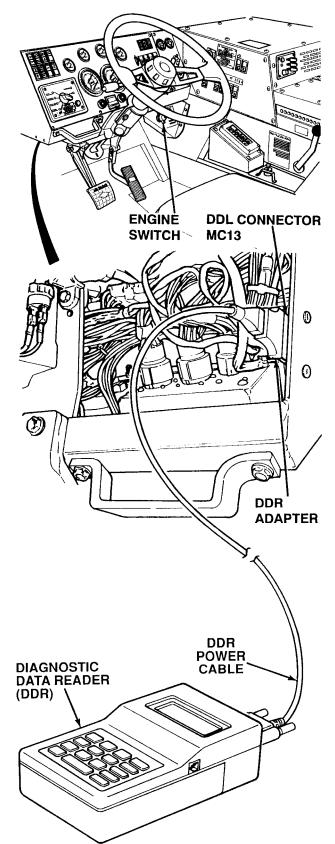


#### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- (2) Start engine (TM 9-2320-364-10).(3) Try to get the CEL ON by:
- - warming up the engine.
  - changing the RPM from idle to 1500.
- (4) Let engine run for 10 minutes or until
  - CEL comes ON.
    (a) If CEL comes ON, select
    MODE 01 (ACTIVE CODES), read codes and turn OFF ENGINE switch. Go to Fault Index (Table 2-16)
  - (b) If CEL does not come ON, turn OFF ENGINE switch and go to Step 2 of this Fault.

#### C1 CEL NORMAL AND HISTORICAL CODES DISPLAYED ON DDR (CONT).





#### DDR TEST

- (1) Turn ON ENGINE switch

- Turn ON ENGINE switch (TM 9-2320-364-10).
   Clear Codes on DDR (Para 2-11).
   Select MODE 02 (HISTORICAL CODES) on DDR and read codes.
   If codes are not displayed after clearing, perform Steps (4) and (5) below and go to Fault Index (Table 2-16) and troubleshoot historical codes as active codes.
   If codes are displayed, fault has been corrected.
  - been corrected.
- (4) Turn OFF ENGINE switch.(5) Disconnect DDR from DDL connector MC13.

#### 2-13. DDEC II TROUBLESHOOTING (CONT).

#### C2 NO DATA LINK AND LAMP CHECK OK.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

**Jumperwire** 

References

TM 9-2320-364-10

TM 9-4910-571-12&P

**Equipment Condition** 

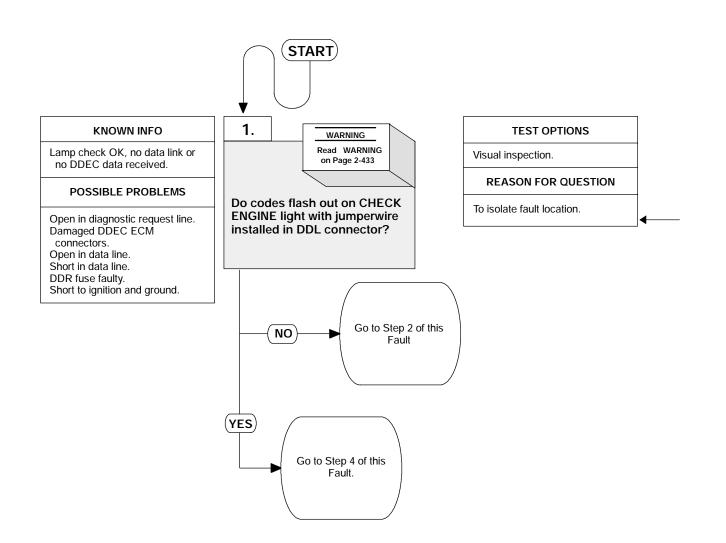
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

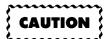
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

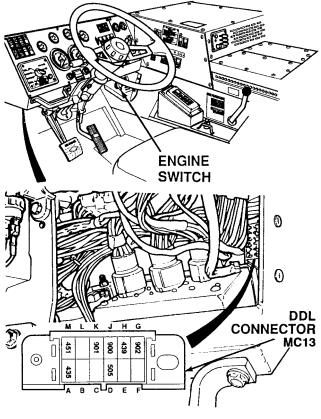
(TM 9-2320-364-10)



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

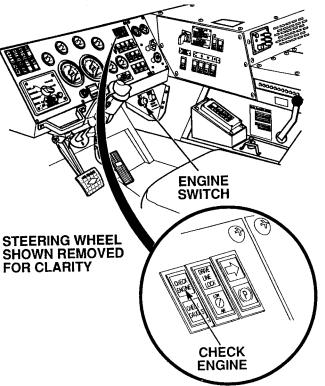


#### NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions), and you were referred here.

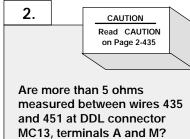
#### **VISUAL INSPECTION**

- Place jumperwire between terminals A and M at DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Observe CEL for flashing codes.
  - (a) If there are no flashing codes, perform Steps (4) and (5) below and go to Step 2 of this Fault.
  - (b) If there are flashing codes, perform Steps (4) and (5) below and go to Step 4 of this Fault.
- (4) Turn OFF ENGINE switch.
- (5) Remove jumperwire.



#### C2 NO DATA LINK AND LAMP CHECK OK (CONT).

# KNOWN INFO Lamp check OK, no data link or no DDEC data received. Codes are not flashing out when CHECK ENGINE light is illuminated. POSSIBLE PROBLEMS Open in diagnostic request line. Damaged DDEC ECM connectors. Open in data line. Short in data line. DDR fuse faulty. Short to ignition and ground.

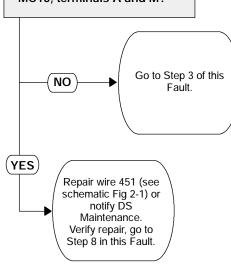


#### **TEST OPTIONS**

Resistance test. STE/ICE-R #91.

#### REASON FOR QUESTION

Resistance greater than 5 ohms at DDL connector indicates open in diagnostic request line wire 451 or bad ground at terminal A on DDL connector.

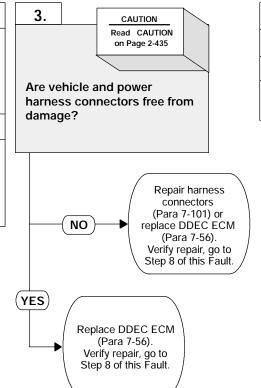


#### **KNOWN INFO**

Lamp check OK, no data link or no DDEC data received. Codes are not flashing out when CHECK ENGINE light is illuminated. Diagnostic request line OK.

# POSSIBLE PROBLEMS

Damaged DDEC ECM connectors.
Open in data line.
Short in data line.
DDR fuse faulty.
Short to ignition and ground.



#### **TEST OPTIONS**

Visual inspection.

#### REASON FOR QUESTION

Damaged connectors could affect signal to DDEC ECM.



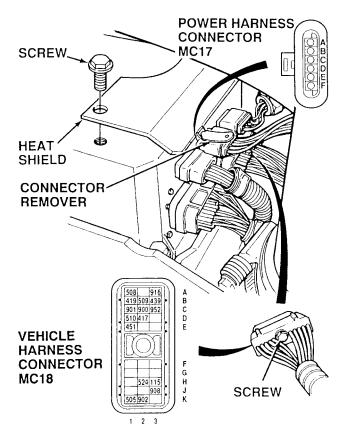
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

#### RESISTANCE TEST

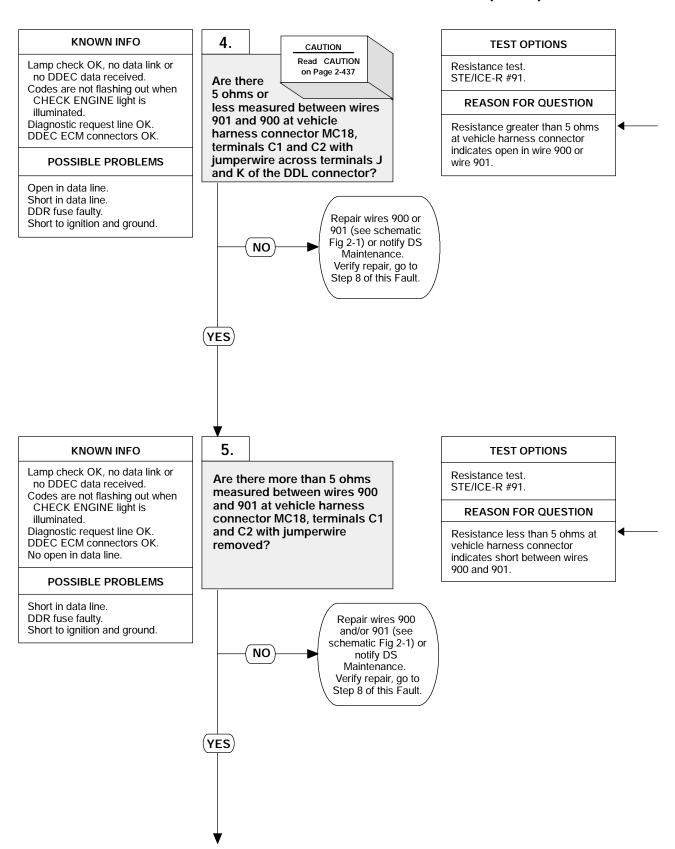
- (1) Remove two mounting screws and heat shield from DDEC ECM.
- (2) Disconnect power harness connector MC17 with connector remover.
- (3) Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (4) Place jumperwire between terminal E1 at vehicle harness connector MC18 and terminal D at power harness connector MC17.
- (5) Are more than 5 ohms present between wires 435 and 451 at DDL connector MC13, terminals A and M?
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wire 451 (see schematic Fig 2-1) or notify DS Maintenance
  - Fig 2-1) or notify DS Maintenance.
    (b) If there are 5 ohms or less present, wire 451 is OK. Remove jumperwire and go to Step 3 of this Fault

#### VISUAL INSPECTION

- Disconnect remaining harness connectors at DDEC ECM (Para 7-56).
- (2) Check all terminals at harness connectors (ECM and harness side) for damage, bent, corroded and unseated pins or terminals.
  - (a) If vehicle harness connector is damaged, repair connector (Para 7-101) and perform Steps (3) through (5) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If vehicle harness connector and DDEC ECM connector are OK, replace DDEC ECM (Para 7-56).
- (3) Connect all harness connectors to DDEC ECM (Para 7-56).
- (4) Install heat shield and two screws.
- (5) Close top engine access cover.



# C2 NO DATA LINK AND LAMP CHECK OK (CONT).

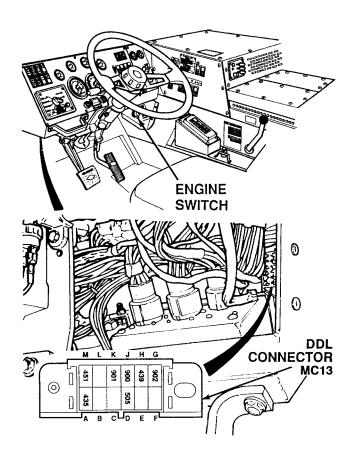




- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.
- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

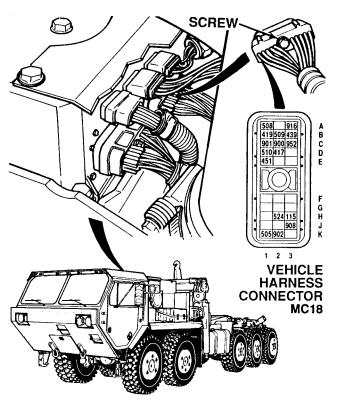
#### RESISTANCE TEST

- Loosen screw and disconnect vehicle harness connector MC18.
- Place jumperwire across terminals J and K at DDL connector MC13.
- (3) Are there 5 ohms or less present between wires 900 and 901 at vehicle harness connector MC18, terminals C1 and C2?
  - (a) If there are more than 5 ohms or an open circuit present, remove jumperwire and repair wires 900 or 901 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are less than 5 ohms present, remove jumperwire and go to Step 5 of this Fault.

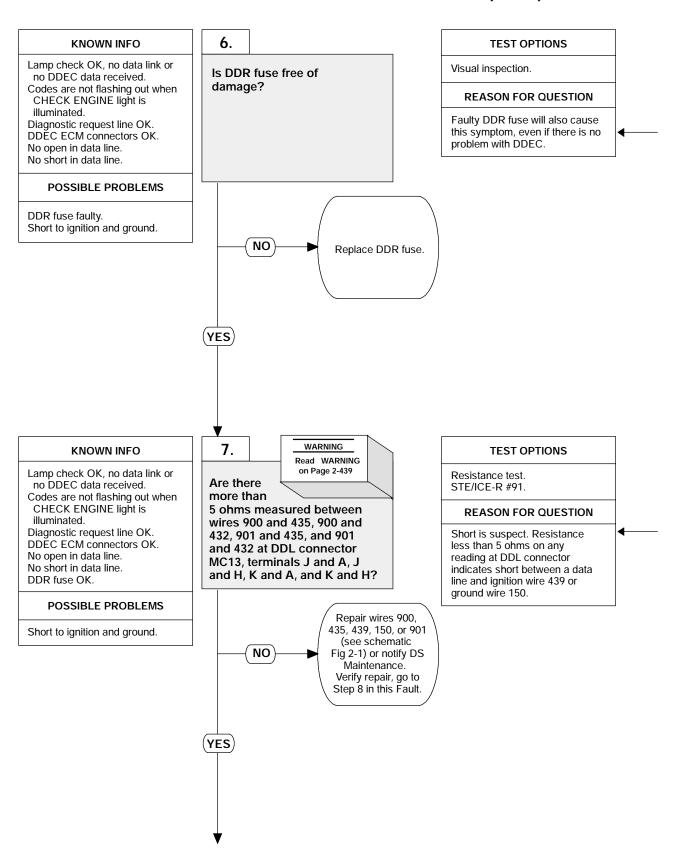


#### RESISTANCE TEST

- (1) Are there more than 5 ohms present between wires 900 and 901 at vehicle harness connector MC18, terminals C1 and C2?
  - (a) If there are less than 5 ohms, repair wires 900 and/or 901 (see schematic Fig 2-1) or notify DS Maintenance and perform Steps (2) through (4) below.
  - (b) If there are more than 5 ohms, wires 900 and 901 are OK. Perform Steps (2) through (4) below.
- (2) Remove jumperwire from DDL harness connector MC13.
- (3) Install vehicle harness connector MC18, and tighten screw.
- (4) Close top engine access cover.



# C2 NO DATA LINK AND LAMP CHECK OK (CONT).



Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

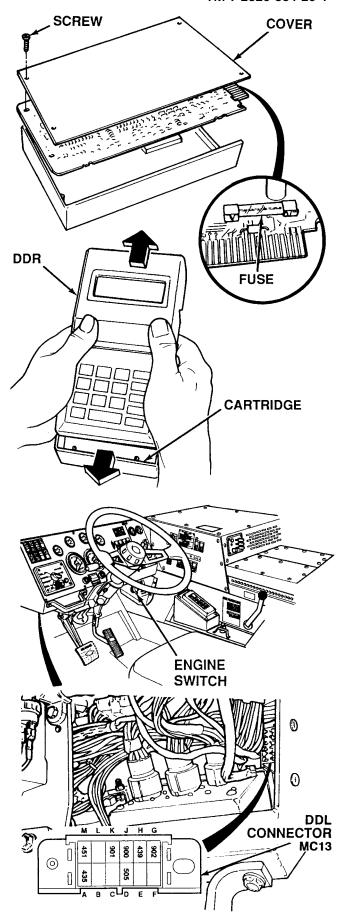
#### **VISUAL INSPECTION**

- Disconnect DDR from DDL connector MC13.
- (2) Hold DDR with thumbs placed against slanted surface and grasp cartridge with fingers.
   (3) Squeeze DDR, push thumbs
- (3) Squeeze DDR, push thumbs forward against slanted surface and slide cartridge back at the same time.
- (4) Slide cartridge from DDR.
- (5) Remove four screws, cover and circuit board.
- (6) Remove fuse.
- (7) Visually inspect fuse.
  - (a) If fuse is damaged, replace fuse and perform Steps (9) through (11) below.
  - b) If fuse is OK, perform Steps (8) through (11) below.
- (8) Install fuse.
- (9) Install circuit board, cover and four screws.
- (10) Seat cartridge flat on back of DDR.
- (11) Slide cartridge forward until it clicks into place.

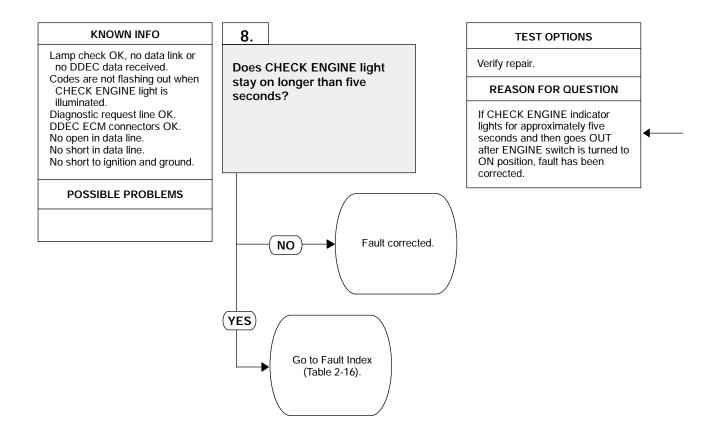
#### RESISTANCE TEST

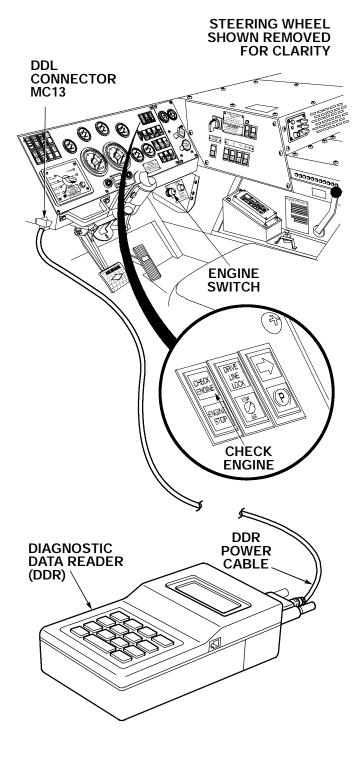
Check resistance between wires 900, 435, 900, 439, 150 or 190 at DDL connector MC13, terminals J and A, J and H, K and A, and K and H.

- (1) If less than 5 ohms are present, repair wires 439, 900, 435, 150, and/or 901 (see schematic Fig 2-1) or notify DS Maintenance.
- (2) If more than 5 ohms are present or an open circuit, wires are OK. Go to Step 8 of this Fault.



# C2 NO DATA LINK AND LAMP CHECK OK (CONT).





#### **VERIFY REPAIR**

- (1) Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10). Clear codes (Para 2-11).
- (4) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - comes ON.
    (a) If CHECK ENGINE light comes on and stays on, perform Steps (5) and (6) below and go to Fault Index (Table 2-16).
    (b) If check engine light comes on for about five seconds and then goes off, fault has been corrected.
- (5) Turn OFF ENGINE switch.
- (6) Disconnect DDR from DDL connector MC13.

# 2-13. DDEC II TROUBLESHOOTING (CONT).

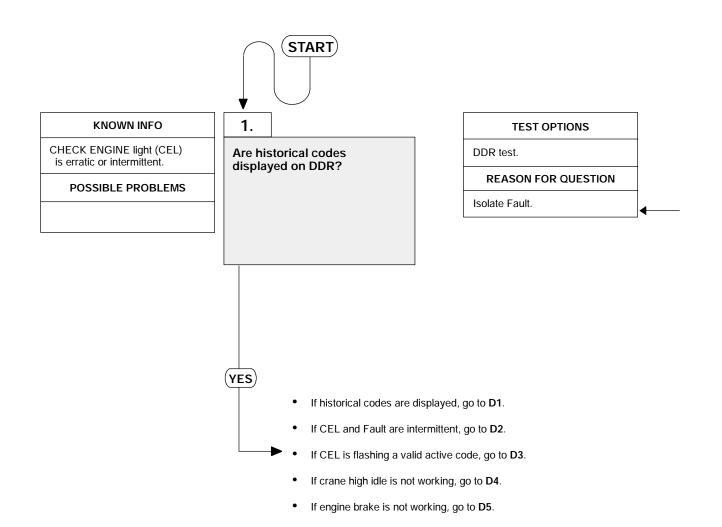
# D CHECK ENGINE LIGHT (CEL) AND FAULT ARE INTERMITTENT.

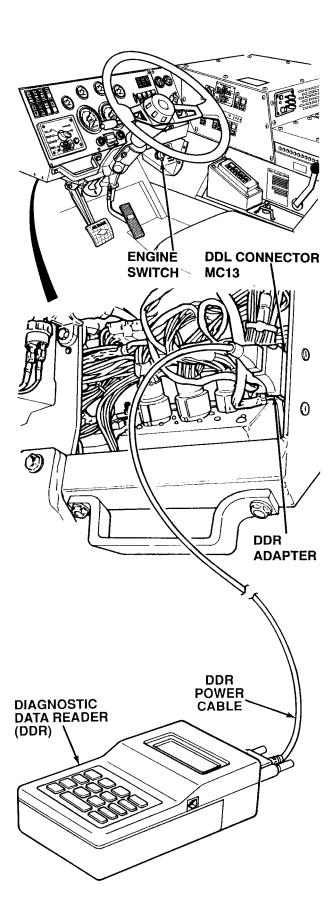
#### **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)





#### **NOTE**

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

### **DDR TEST**

- (1) Connect DDR to DDL
- connector MC13.
  Turn ON ENGINE switch
- (TM 9-2320-364-10).
  (3) Select MODE 02 (HISTORICAL CODES) on DDR and read codes.

# 2-13. DDEC II TROUBLESHOOTING (CONT).

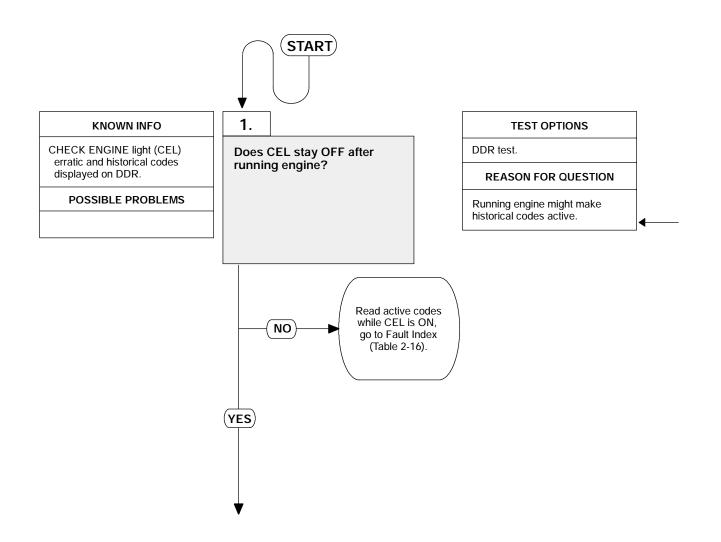
# D1 CEL ERRATIC AND HISTORICAL CODES DISPLAYED ON DDR.

#### **INITIAL SETUP**

Tools and Special Tools

Reader, Diagnostic (Item 53, Appendix G)

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)

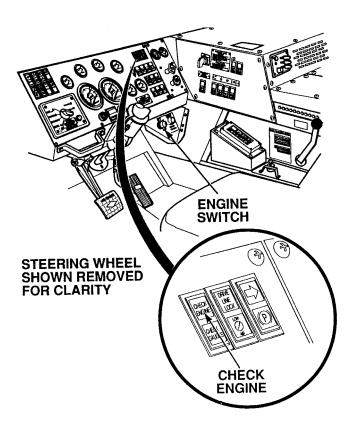


# **NOTE**

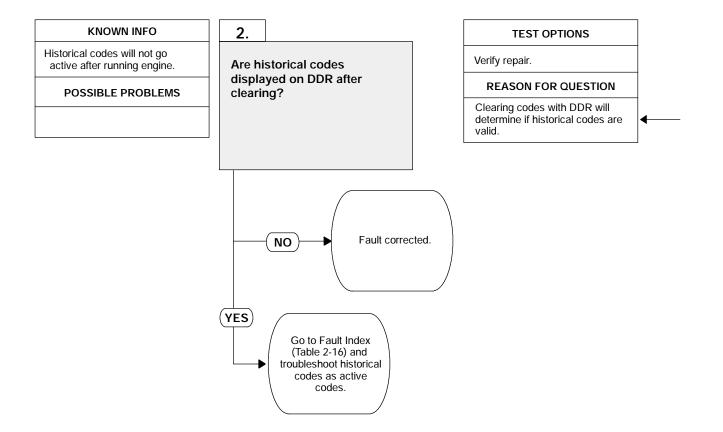
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **DDR TEST**

- (1) Start engine (TM 9-2320-364-10).(2) Try to get the CEL ON by:
- - · warming up the engine.
  - changing the RPM from idle to 1500.
- (3) Let engine run for 8 minutes or until CEL comes ON.
  - (a) If CEL comes ON, turn OFF ENGINE switch and select MODE 01 (ACTIVE CODES) and read codes (Para 2-11).
  - (b) If CEL does not come ON, turn OFF ENGINE switch.

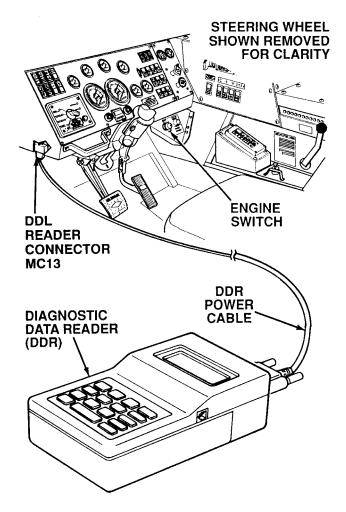


# D1 CEL ERRATIC AND HISTORICAL CODES DISPLAYED ON DDR (CONT).



# VERIFY REPAIR

- (1) Turn ON ENGINE switch
- (1) Turn ON ENGINE switch
  (TM 9-2320-364-10).
  (2) Clear Codes on DDR (Para 2-11).
  (3) Select MODE 02 (HISTORICAL
  CODES) on DDR and read codes.
  (a) If there are no historical codes
  - displayed, fault has been corrected. Perform Steps (4) and (5) below.
  - (b) If there are historical codes displayed, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
- (4) Turn OFF ENGINE switch.(5) Disconnect DDR from DDL
- connector MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

# D2 CEL AND FAULT ARE INTERMITTENT.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

References

TM 9-2320-364-10

**Equipment Condition** 

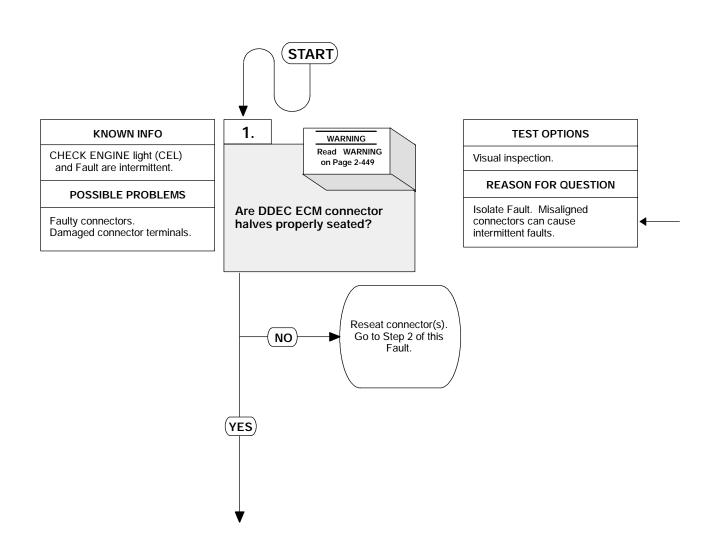
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)



Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



- Do not use any other procedures in this manual (except for the suggestions listed below and Fault steps) when trying to solve an intermittent problem. Use of any other procedures for this kind of problem CAN result in the replacement of non-defective parts. Many intermittent problems are caused by faulty electrical connectors or wiring. Diagnosis must include a careful inspection of the indicated wiring and connectors. Example: an intermittent Code 35 (Oil Pressure Sensor Voltage High) should cause suspicion of a problem in the following areas associated with the Oil Pressure Sensor.
  - 1. Wire 530 (signal line), Wire 416 (+5 volt line) or Wire 452 (ground line).
  - 2. The Oil Pressure Sensor connector or DDEC ECM connector.
  - 3. An intermittent in the Oil Pressure Sensor (least likely).
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

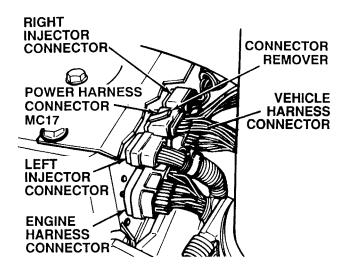
#### NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

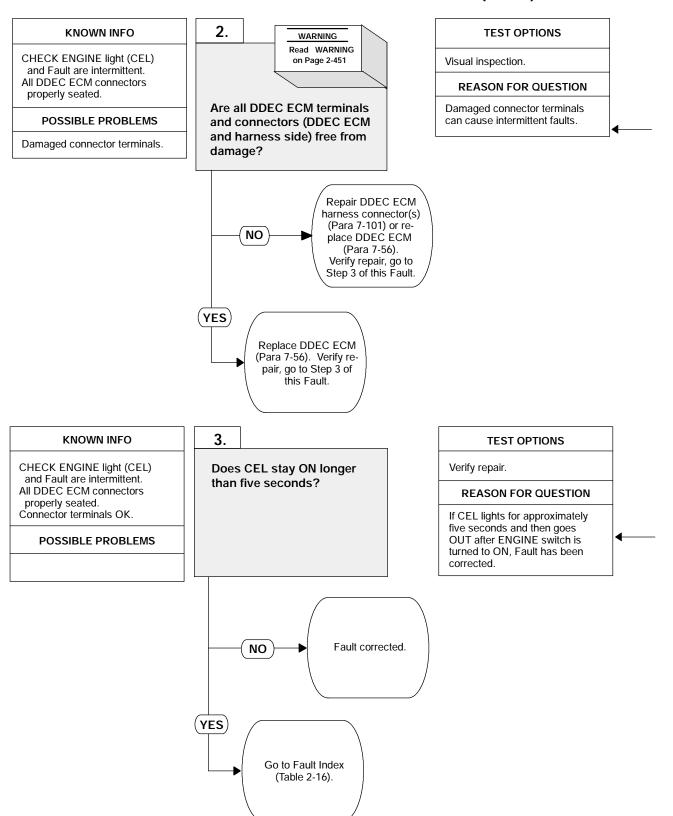
#### **VISUAL INSPECTION**

Inspect all DDEC ECM connectors for proper alignment and seating.

- If connectors are not seated properly, reseat and go to Step 2 of this Fault.
- (2) If connectors are seated properly, go to Step 2 of this Fault.



# D2 CEL AND FAULT ARE INTERMITTENT (CONT).



Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

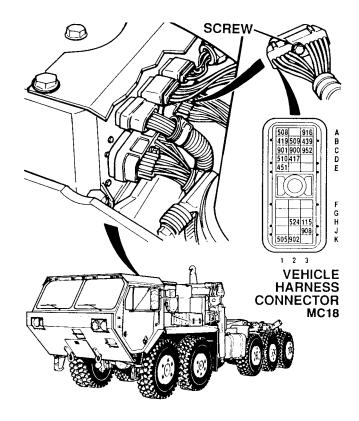
#### **VISUAL INSPECTION**

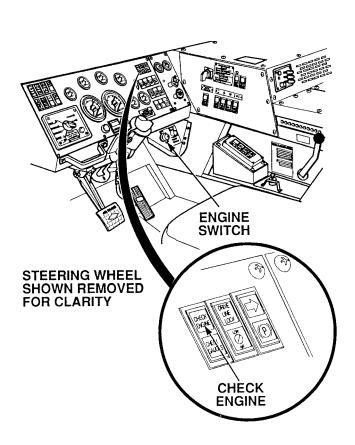
- (1) Disconnect all connectors at DDEC ECM (Para 7-56).
- Check terminals at connectors (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or
  - (a) If harness connector(s) is damaged, repair connector (Para 7-101) and perform Steps (3) through (5) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - If harness connector DDEC ECM connectors are OK, replace DDEC ECM (Para 7-56).
- (3) Connect all harness connectors to DDEC ECM (Para 7-56).

  (4) Install heat shield and two screws.
- (5) Close top engine access cover.

#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If check engine light comes on for about five seconds and then goes off, fault has been corrected. Perform Step (3) below.
  - (b) If check engine light comes on and stays on, perform Step (3) below and go to Fault Index (Table 2-16).
- (3) Turn OFF ENGINE switch.





# 2-13. DDEC II TROUBLESHOOTING (CONT).

# D3 CEL FLASHES A VALID ACTIVE CODE.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive (Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G) DDEC Repair Kit (Item 15, Appendix G)

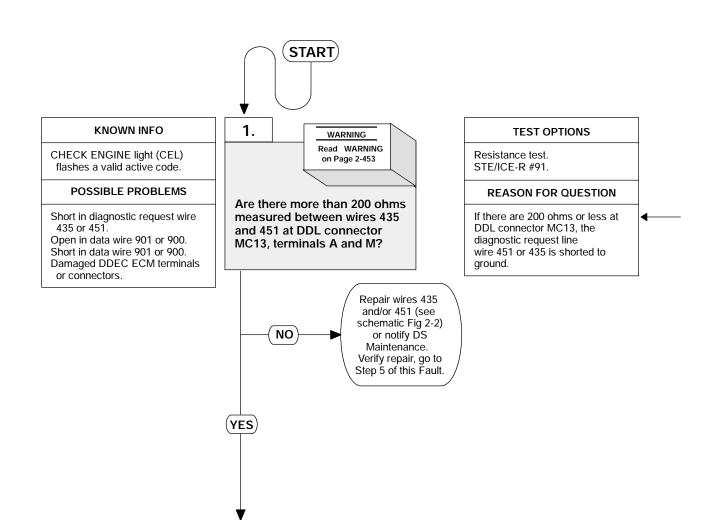
Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G) Jumperwire

References

TM 9-2320-364-10 TM 9-4910-571-12&P **Equipment Condition** 

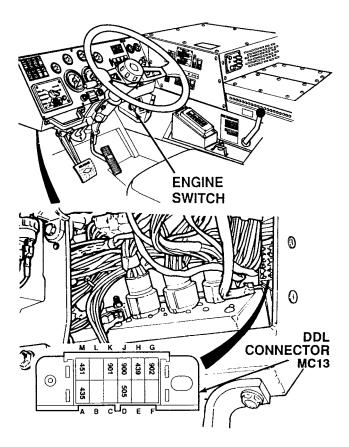
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)
Top engine access cover opened,
(TM 9-2320-364-10)



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

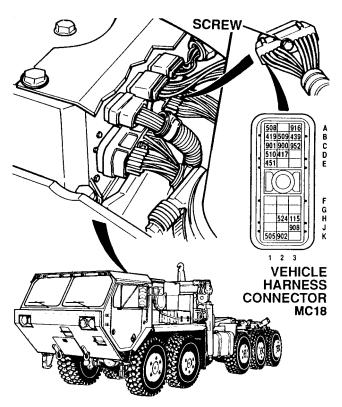


# **NOTE**

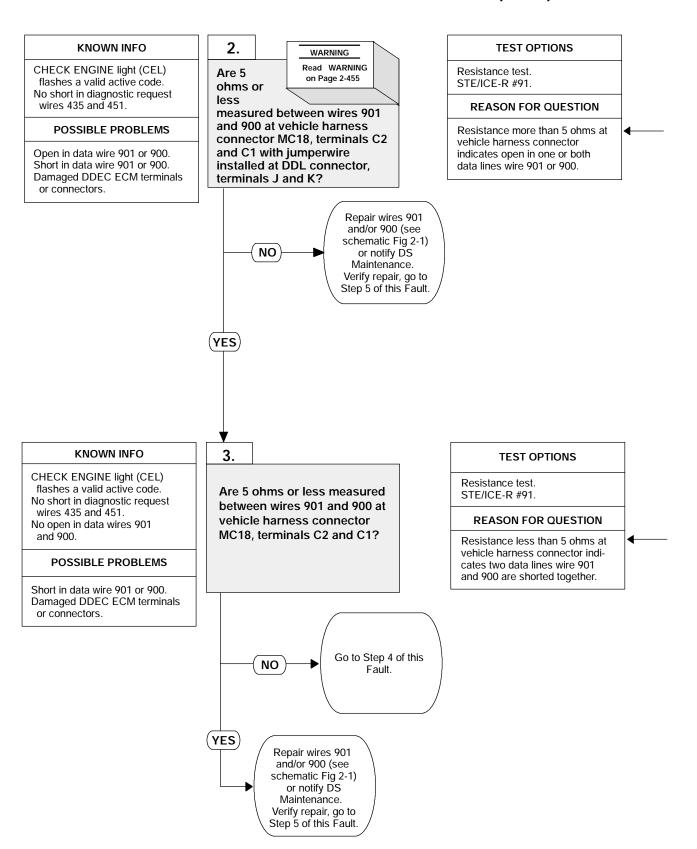
The following flowchart should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### RESISTANCE TEST

- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Are there more than 200 ohms present between wires 435 and 451 at DDL connector MC13, terminals A and M?
  - (a) If there are less than 200 ohms present, turn OFF ENGINE switch and repair wires 435 and/or 451 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are more than 200 ohms present, turn OFF ENGINE switch and go to Step 2 of this Fault.



# D3 CEL FLASHES A VALID ACTIVE CODE (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

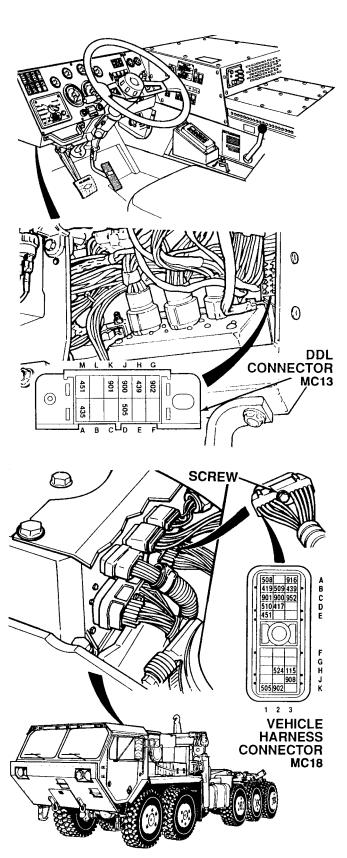
#### RESISTANCE TEST

- (1) Place jumperwire between terminals J and K at DDL connector MC13.
- (2) Are there 5 ohms or less present between wires 901 and 900 at vehicle harness connector MC18, terminals C2 and C1.
  - (a) If there are more than 5 ohms present, remove jumperwire and repair wires 901 and/or 900 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there are less than 5 ohms present, remove jumperwire and go to Step 3 of this Fault.

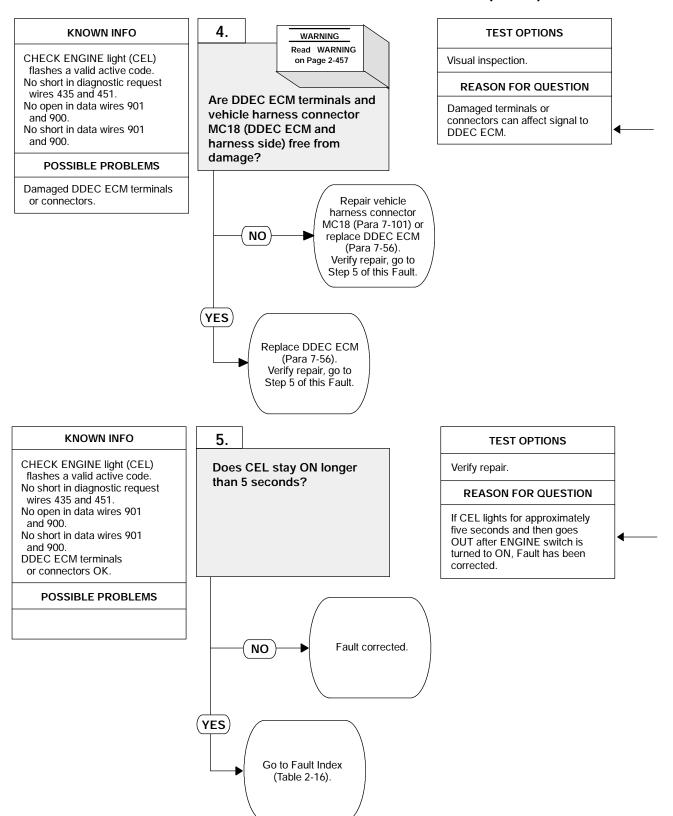
#### RESISTANCE TEST

Are there 5 ohms or less present between wires 901 and 900 at vehicle harness connector MC18, terminals C2 and C1.

- If there are more than 5 ohms present, repair wires 901 and/or 900 (see schematic Fig 2-1) or notify DS Maintenance.
- (2) If there are less than 5 ohms present, go to Step 4 of this Fault.



# D3 CEL FLASHES A VALID ACTIVE CODE (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



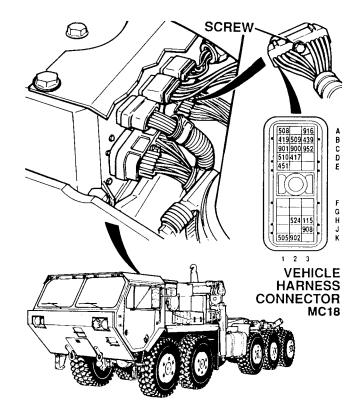
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

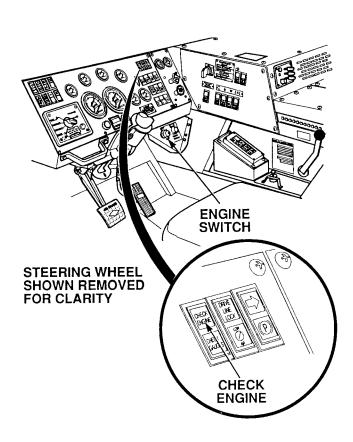
#### **VISUAL INSPECTION**

- Check terminals at vehicle harness connector MC18 (DDEC ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If vehicle harness connector is damaged, repair connector (Para 7-101) and perform Steps (2) and (3) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If vehicle harness connector and DDEC ECM connector are OK, replace DDEC ECM (Para 7-56).
- (2) Connect vehicle harness connector MC18, and tighten screw.
- (3) Close top engine access cover.

#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.
  - (a) If check engine light comes on for about five seconds and then goes off, fault has been corrected. Perform Step (3) below.
  - (b) If check engine light comes on and stays on, perform Step (3) below and go to Fault Index (Table 2-16).
- (3) Turn OFF ENGINE switch.





# 2-13. DDEC II TROUBLESHOOTING (CONT).

#### D4 CRANE HIGH IDLE NOT WORKING.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Terminal Remover (Item 70, Appendix G)

Weatherpac Crimper (Item 76, Appendix G)

Jumperwire

#### References

TM 9-2320-364-10 TM 9-4910-571-12&P

**Equipment Condition** 

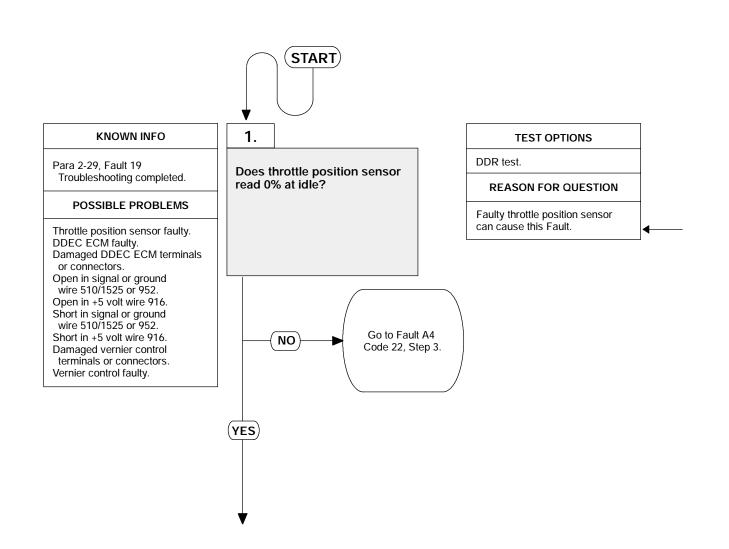
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)



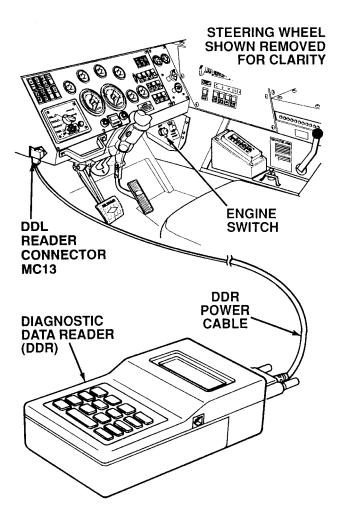
# **NOTE**

- The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.
- To verify throttle percent (%), the engine does not need to be running.

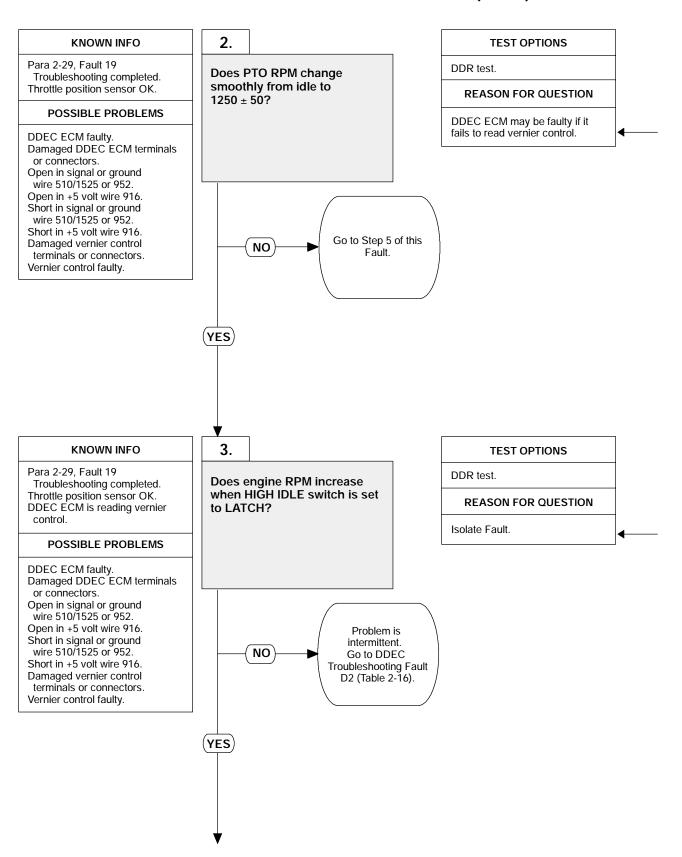
#### **DDR TEST**

- (1) Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch
- (TM 9-2320-364-10). Select MODE 07 (TPS IN %) on DDR (Para 2-11).
- (4) Read throttle position percentage with zero throttle.
  - (a) If throttle position is greater than 0%, turn OFF ENGINE switch and go to Fault A4
  - Code 22, Step 3.

    (b) If throttle position is 0% at idle, turn OFF ENGINE switch and go to Step 2 of this Fault.

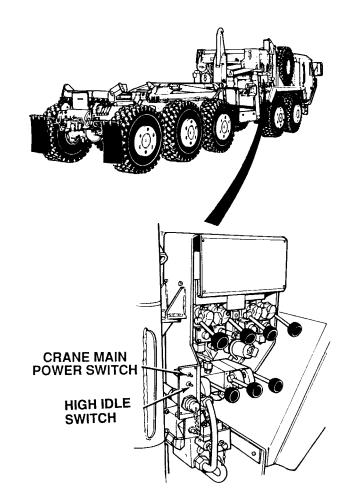


# D4 CRANE HIGH IDLE NOT WORKING (CONT).



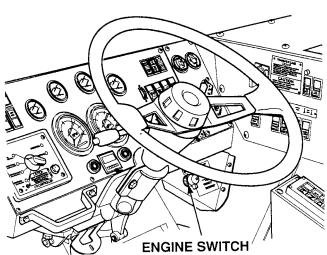
#### **DDR TEST**

- (1) Select MODE 22 (PTO RPM) on DDR (Para 2-11).
- Prepare crane for use
- (TM 9-2320-364-10). (3) Position CRANE MAIN POWER switch to ON and the ENGINE HIGH IDLE switch to LATCH. Note reading on DDR.
- (4) Does PTO RPM change smoothly from idle to  $1250 \pm 50$ ?
  - (a) If PTO RPM does not change smoothly, perform Steps (5) through (7) below and then go to Step 5 of this Fault.
- (b) If PTO RPM does change smoothly, perform Steps (5) through (7) below and go to Step 3 of this Fault. (5) Turn OFF CRANE MAIN POWER
- (6) UNLATCH HIGH IDLE switch.
- (7) Turn OFF ENGINE switch.



#### **DDR TEST**

- (1) Start engine (TM 9-2320-364-10).
- (2) Select MODE 04 (ENGINE RPM) on DDR (Para 2-11).
- (3) Position CRANE MAIN POWER switch to ON and the HIGH IDLE switch to LATCH. Note reading on
  - (a) If engine RPM increases, turn OFF ENGINE switch and go to DDEC Troubleshooting Fault D2 (Table 2-16).
  - (b) If engine RPM fails to increase, perform Steps (4) and (5) below and go to Step 4 of this Fault.
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



# D4 CRANE HIGH IDLE NOT WORKING (CONT).

#### **KNOWN INFO**

Para 2-43, Fault 19 Troubleshooting completed. Throttle position sensor OK. DDEC ECM is reading vernier control.

#### POSSIBLE PROBLEMS

DDEC ECM faulty. Damaged DDEC ECM terminals or connectors.

4. WARNING Read WARNING on Page 2-463 Are DDEC ECM terminals and vehicle harness connector MC18 (DDEC ECM and harness side) free from damage?

#### **TEST OPTIONS**

Visual inspection.

#### REASON FOR QUESTION

Damage to terminals or connectors can affect signal to DDEC ECM.

Repair vehicle harness connector MC18 (Para 7-101) or NO replace DDEC ECM (Para 7-56). Verify repair, go to Step 11 of this Fault. YES

# Replace DDEC ECM (Para 7-56). Verify repair, go to Step 11 of this Fault.

#### **KNOWN INFO**

Para 2-43, Fault 19 Troubleshooting completed. Throttle position sensor OK. DDEC ECM is reading vernier control. DDEC ECM terminals and connectors OK. DDEC ECM OK.

#### POSSIBLE PROBLEMS

Open in signal or ground wire 510/1525 or 952. Open in +5 volt wire 916. Short in signal or ground wire 510/1525 or 952. Short in +5 volt wire 916. Damaged vernier control terminals or connectors. Vernier control faulty.

5. CAUTION Read CAUTION Are less on Page 2-463 than 5 ohms measured between wires 510/1525 and 952 at vehicle harness connector MC18, terminals D1 and C3 with jumperwire installed at vernier control connector MC38, terminals A and B?

NO

(YES)

Repair wires 510, 1525 and/or 952 (see schematic Fig 2-1)

or notify DS

Maintenance.

Verify repair, go to

Step 11 of this Fault.

#### **TEST OPTIONS**

Resistance test. STE/ICE-R #91.

#### REASON FOR QUESTION

Resistance more than 5 ohms at vehicle harness connector indicates signal line wire 1525 or 510, ground line wire 952 are open.

- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

# CAUTION

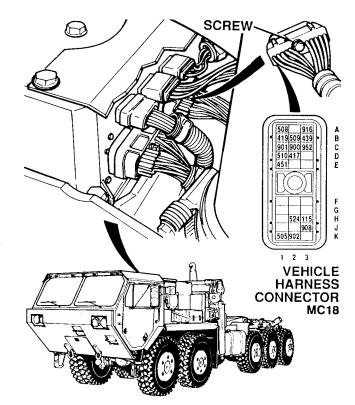
- Use jumperwire only between terminals indicated.
   Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connector.

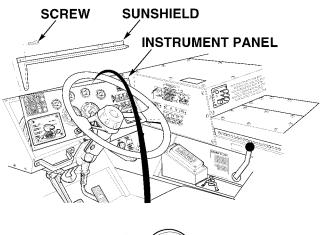
#### VISUAL INSPECTION

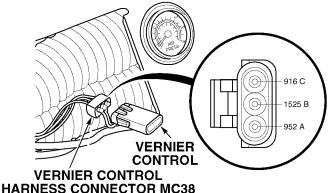
- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (2) Inspect terminals and connectors (DDEC ECM and harness side) at vehicle harness for damage; bent, corroded and unseated pins or terminals.
  - (a) If vehicle harness connector is damaged,repair connector (Para 7-101).(b) If DDEC ECM connector is
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If vehicle harness connector and if DDEC ECM connectors are OK, replace DDEC ECM (Para 7-56).

#### RESISTANCE TEST

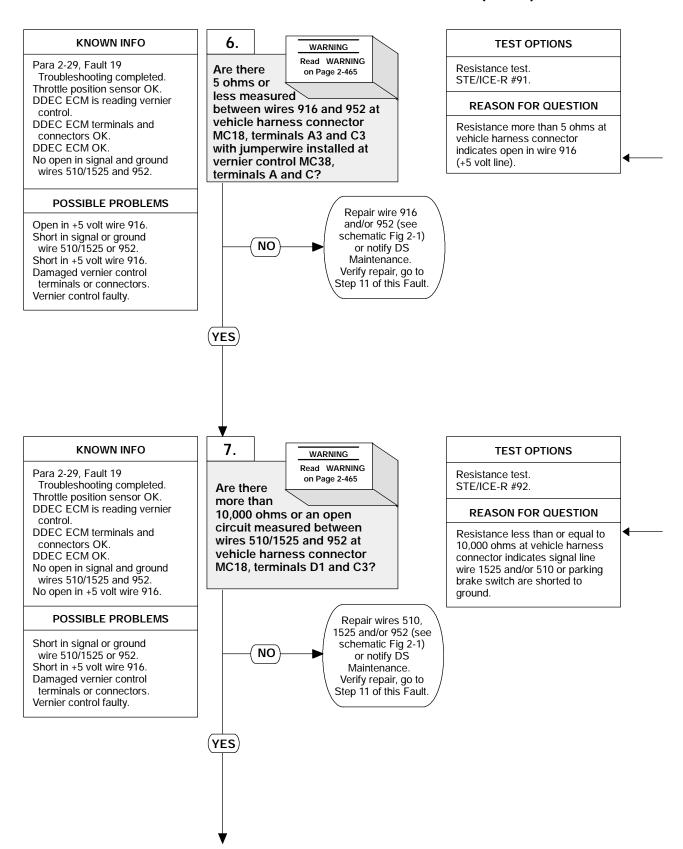
- (1) Remove ten screws and sunshield from instrument panel.
- (2) Pull top of instrument panel towards steering wheel.
- (3) Disconnect vernier control harness connector MC38.
- (4) Place jumperwire between terminals A and B at vernier control harness connector MC38.
- (5) Are there 5 ohms or less present between wires 510 and 952 at vehicle harness connector MC18, terminals D1 and C3?
  - (a) If more than 5 ohms are present, remove jumperwire and repair wires 510 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If less than 5 ohms are present, go to Step 6 of this Fault.







# D4 CRANE HIGH IDLE NOT WORKING (CONT).



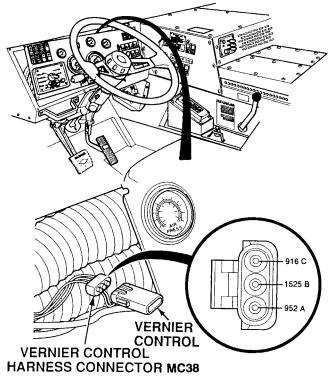
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

# CAUTION

Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

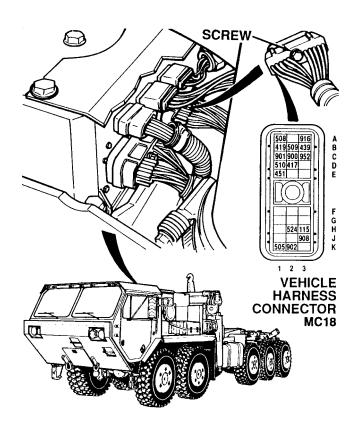
#### RESISTANCE TEST

- Place jumperwire between terminals C and A at vernier control harness connector MC38.
- (2) Are there 5 ohms are less present between wires 916 and 952 at vehicle harness connector MC18, terminals A3 and C3?
  - (a) If more than 5 ohms are present, remove jumperwire and repair wires 916 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If 5 ohms or less are present, remove jumperwire and go to Step 7 of this Fault.

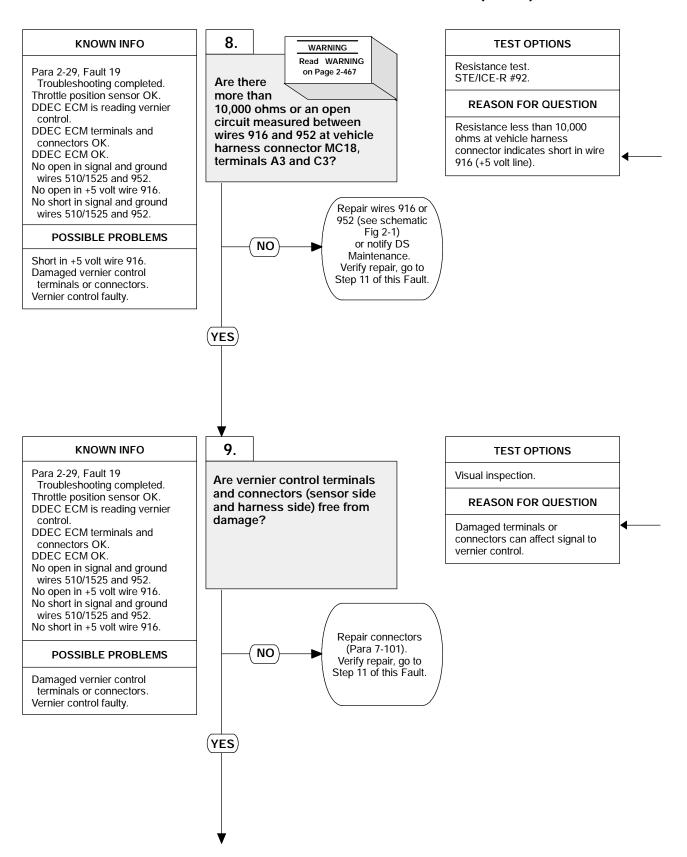


#### RESISTANCE TEST

- Are there more than 10,000 ohms or an open circuit measured between wires 510 and 952 at vehicle harness connector MC18, terminals D1 and C3?
  - (a) If less than 10,000 ohms are present, repair wires 510 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If more than 10,000 ohms are present, perform Step (2) below.
- (2) Are there more than 10,000 ohms or an open circuit measured between wires 510 at vehicle harness connector MC18, terminals D1 and a known good ground.
  - (a) If less than 10,000 ohms are present, repair wire 510 (see schematic Fig 2-1) or notify DS Maintenance
  - (b) If more than 10,000 ohms are present, wire 510 is OK, go to Step 8 of this Fault.



# D4 CRANE HIGH IDLE NOT WORKING (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

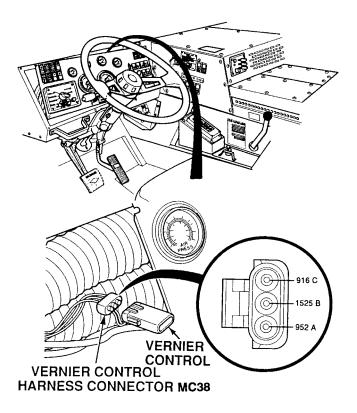
#### RESISTANCE TEST

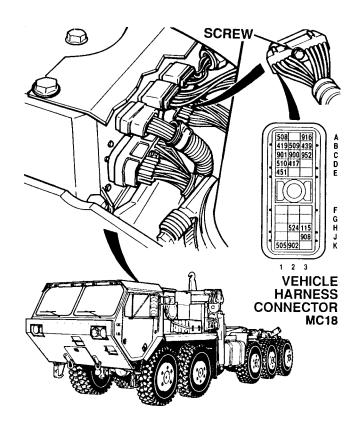
- (1) Are there more than 10,000 ohms or an open circuit measured between wires 916 and 952 at vehicle harness connector MC18, terminals A3 and C3?
  - (a) If less than 10,000 ohms are present, repair wires 916 and/or 952 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If more than 10,000 ohms are present, perform Step (2) below.
- (2) Are there more than 10,000 ohms or an open circuit measured between wires 916 at vehicle harness connector MC18, terminals A3 and a known good ground?
  - (a) If less than 10,000 ohms are present, repair wire 916 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If more than 10,000 are ohms present, wire 916 is OK, go to Step 9 of this Fault.

#### VISUAL INSPECTION

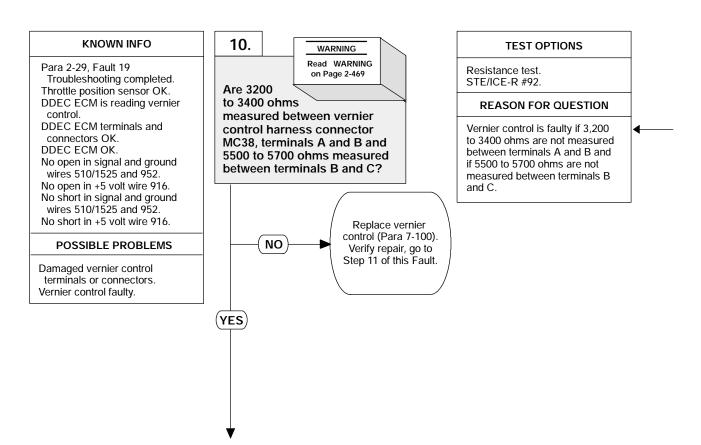
Check terminals at vernier control and vehicle harness connector MC18 for damage; bent, corroded and unseated pins or terminals.

- If terminals are damaged, repair connector (Para 7-101), go to Step 11 of this Fault.
- (2) If terminals are not damaged, go to Step 10 of this Fault.





# D4 CRANE HIGH IDLE NOT WORKING (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

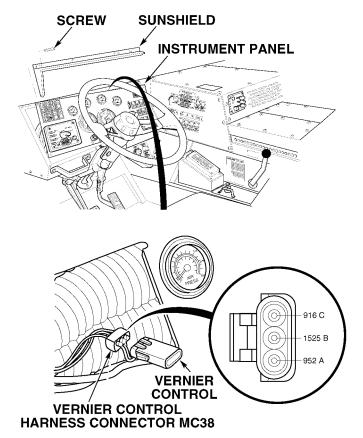


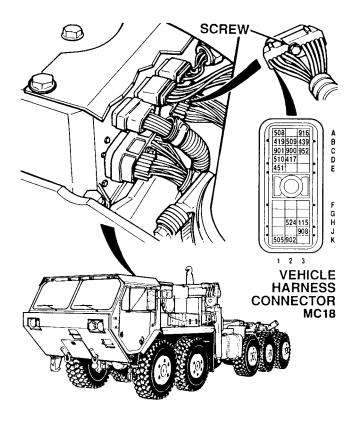
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

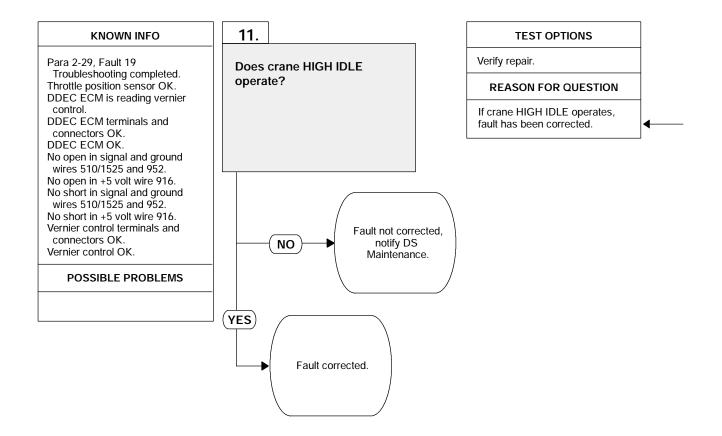
- (1) Are 3200 to 3400 ohms present at Vernier Control harness connector MC38 between terminals A and B?
  - (a) If 3200 to 3400 ohms are not present, replace vernier control (Para 7-100) and perform Steps (3) through (5) below.
  - through (5) below.

    (b) If 3200 to 3400 ohms are present, vernier control is OK, perform Step (2) below.
- (2) Are 5500 to 5600 ohms present at vernier control harness connector MC38 between terminals B and C?
  - (a) If 5500 to 5600 ohms are not present, replace vernier control (Para 7-100) and perform Steps (3) through (5) below.
  - (b) If 5500 to 5600 ohms are present, vernier control is OK.
- (3) Connect vehicle harness connector MC18 and tighten screw.
- (4) Connect vernier control harness connector MC38.
- (5) Install instrument panel and sunshield with ten screws.



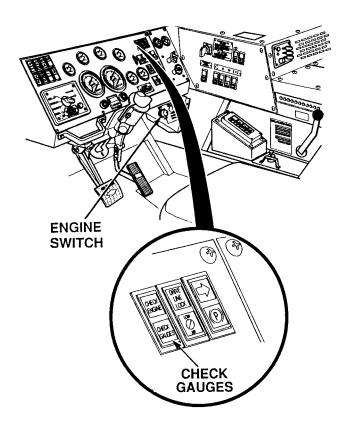


# D4 CRANE HIGH IDLE NOT WORKING (CONT).



#### **VERIFY REPAIR**

- Start engine (TM 9-2320-364-10).
   Operate crane.
   If crane HIGH IDLE does not operate, turn OFF ENGINE switch and notify DS Maintenance.
   If crane HIGH IDLE operates, fault has been corrected. Turn OFF ENGINE switch.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

#### D5 ENGINE BRAKE INOPERATIVE.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

References

TM 9-2320-364-10

**Equipment Condition** 

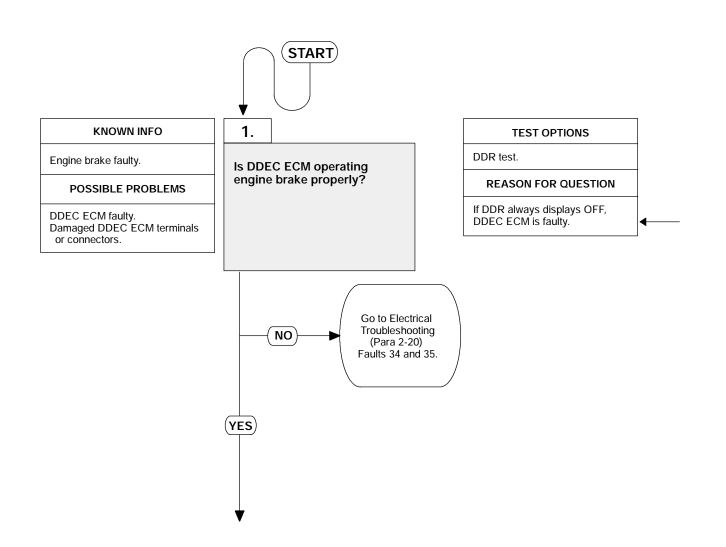
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)



# STEERING WHEEL SHOWN REMOVED **FOR CLARITY DDL CONNECTOR** MC13 **ENGINE SWITCH** CHECK **ENGINE DDR DIAGNOSTIC** POWER **DATA READER** CABLE (DDR)

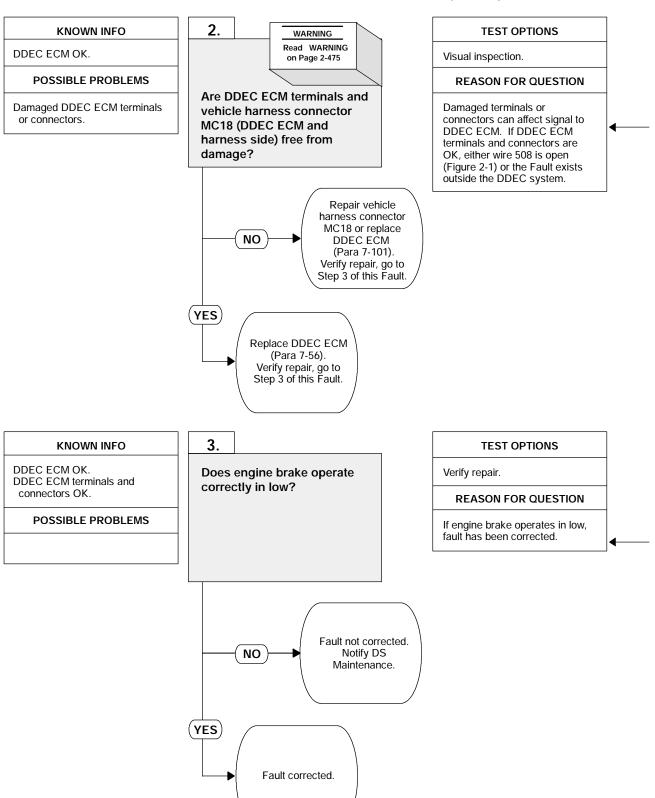
#### **NOTE**

DDR should read OFF when engine is started and while increasing or holding throttle. When throttle is released, display changes to ON. When engine returns to idle, DDR will read OFF.

#### **DDR TEST**

- (1) Connect DDR to DDL
- connector MC13.
  Start ENGINE (TM 9-2320-364-10).
  Select MODE 30 (ENG BRK ENBLE) on DDR.
- (4) Run engine at greater than 1800 rpm for 10 seconds and quickly release throttle control.
  - (a) If DDR does not read ON when throttle is released and return to OFF when engine speed returns to idle, turn OFF ENGINE switch and go to Electrical Troubleshooting (Para 2-20) Faults 34 and 35.
  - (b) If DDR reads ON when throttle is released and OFF when engine speed returns to idle, turn OFF ENGINE switch and go to Step 2 of this Fault.

# D5 ENGINE BRAKE INOPERATIVE (CONT).



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



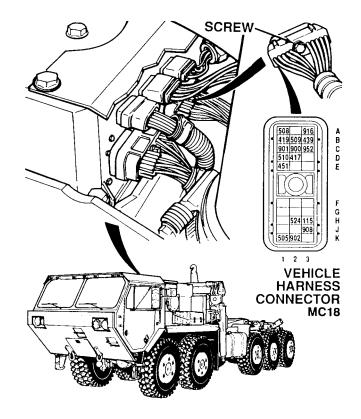
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VISUAL INSPECTION**

- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (2) Inspect DDEC ECM terminals and vehicle harness connector MC18 (DDEC ECM and harness side) at vehicle harness connector for damage; bent, corroded, or unseated pins or terminals.
  - (a) If vehicle harness connector is damaged, repair connector (Para 7-101) and perform Steps(3) and (4) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56) and perform Steps (3) and (4) below.
  - (c) If vehicle harness connector and DDEC ECM connector are OK, replace DDEC ECM (Para 7-56).
- (3) Connect vehicle harness connector MC18 and tighten screw.
- (4) Close top engine access cover.

#### VERIFY REPAIR

- (1) START engine (TM 9-2320-364-10).
- (2) Set engine brake switch to low position.
- (3) Drive truck and allow engine brake to apply.
  - (a) If engine brake does not operate, fault not corrected. Perform Steps (4) and (5) below and notify DS Maintenance.
  - (b) If engine brake operates, fault has been corrected.
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

#### E1 ENGINE CRANKS BUT WILL NOT START.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Pan, Drain (Item 47, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

#### References

TM 9-2320-364-10

TM 9-4910-571-12&P

#### **Equipment Condition**

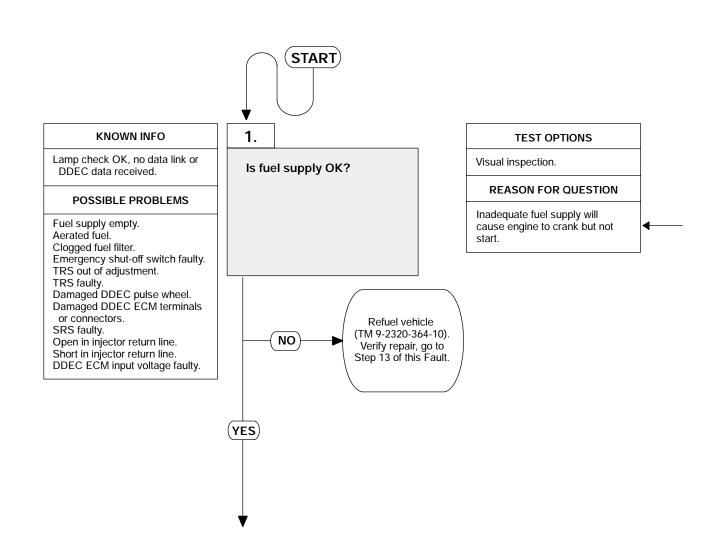
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

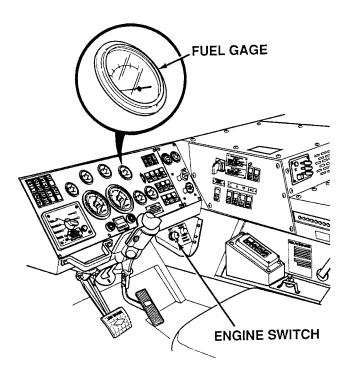
Top engine access cover opened,

(TM 9-2320-364-10)

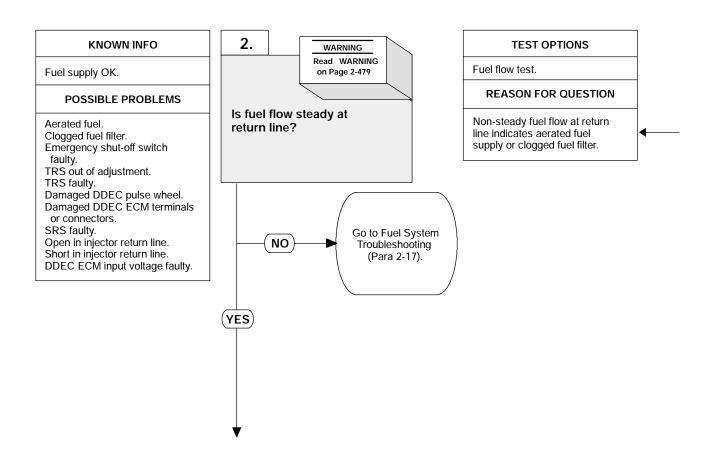


#### **VISUAL INSPECTION**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
  (2) Verify adequate fuel supply by observing fuel gage.
  (a) If fuel supply is low, turn OFF ENGINE switch and refuel vehicle.
  (b) If fuel supply is OK, turn OFF ENGINE switch and go to Step 2 of this Fault.



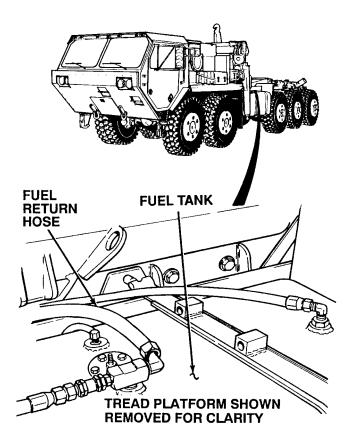
STEERING WHEEL SHOWN REMOVED FOR CLARITY

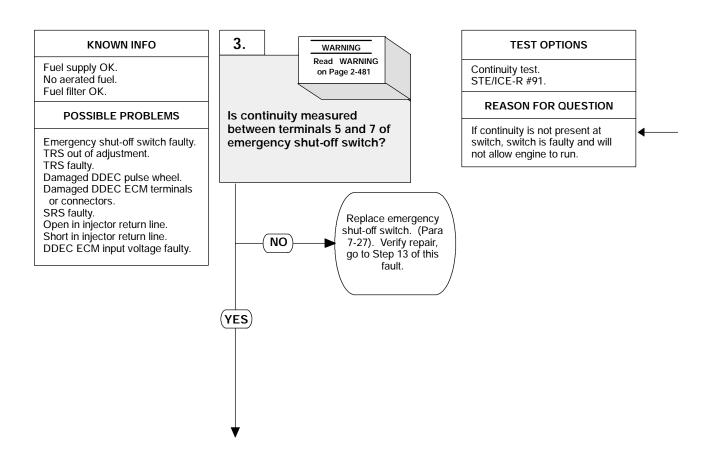


- Fuel is very flammable and can explode easily. To avoid serious injury or death, keep fuel away from
  open fire and keep fire extinguisher within easy reach when working with fuel. Do not work on fuel
  system when engine is hot. Fuel can be ignited by hot engine.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

#### **FUEL FLOW TEST**

- (1) Disconnect fuel return line from fuel tank.
- (2) Direct fuel into suitable container.
- (3) Observe fuel flow out of line while cranking engine (TM 9-2320-364-10).
  - (a) If fuel flow is intermittent or no flow, turn OFF ENGINE switch, connect fuel return line and go to Fuel System Troubleshooting (Para 2-17).
  - (b) If fuel supply is OK, turn OFF ENGINE switch, connect fuel return line and go to Step 5 of this Fault.

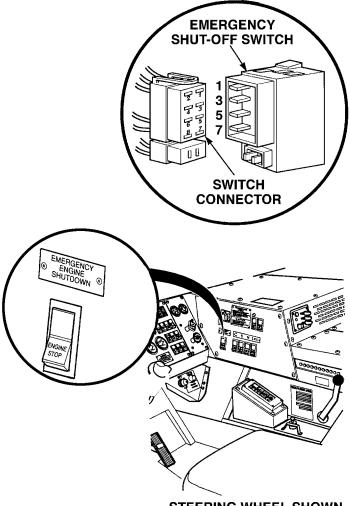




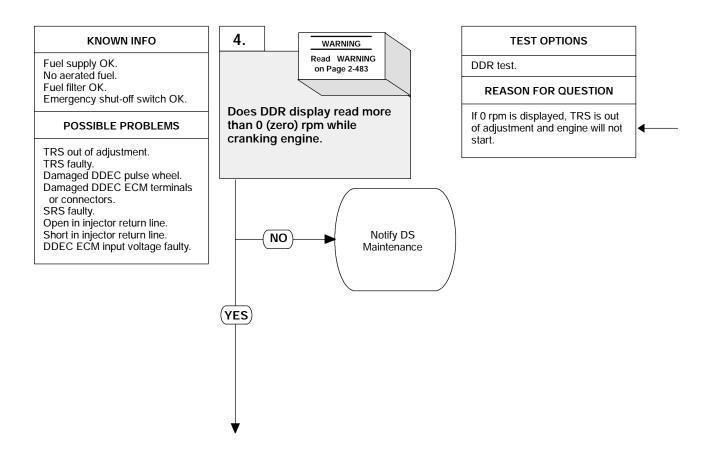
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

#### **CONTINUITY TEST**

- (1) Remove emergency shut-off switch from side cover (Para 7-27).
- (2) Disconnect emergency shut-off switch from switch connector.
  Set multimeter select switch to ohms.
- (4) Is there continuity between terminals 5 and 7 at emergency shut-off switch?
  - (a) If there is no continuity, replace emergency shut-off switch (Para 7-27).
- (b) If there is continuity, emergency shut-off switch is OK.
  (5) Connect emergency shut-off switch to
- switch connector.
- (6) Install emergency shut-off switch in side cover.



STEERING WHEEL SHOWN REMOVED FOR CLARITY



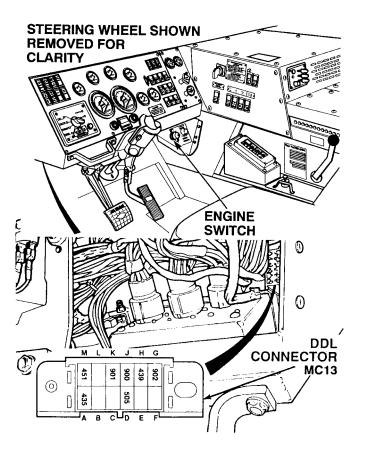
#### NOTE

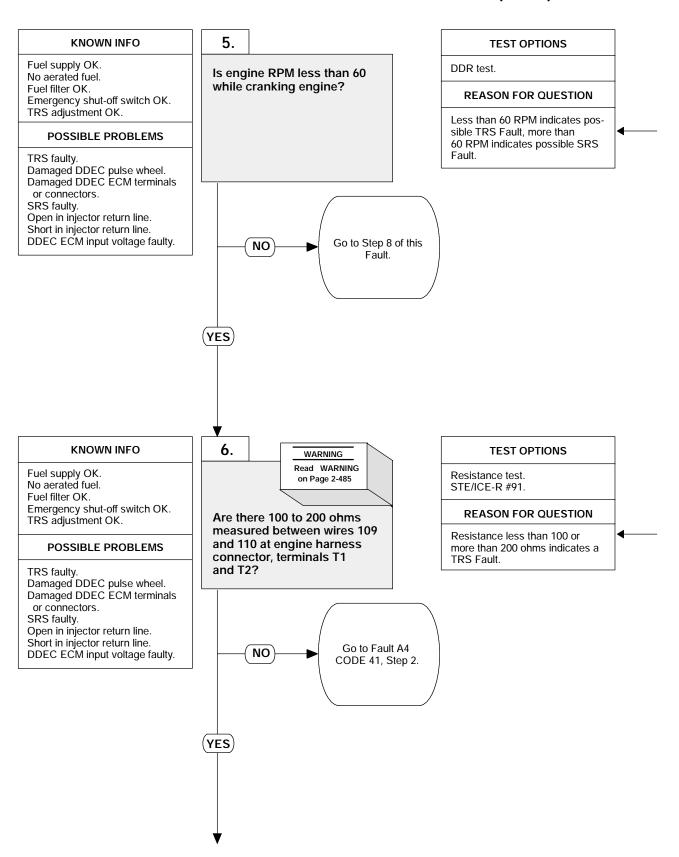
Battery voltage surges, while cranking the engine, may blank out or reset DDR.

#### **DDR TEST**

- Connect DDR to DDL connector MC13.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Select MODE 04 (ENGINE RPM) on DDR (Para 2-11).
- DDR (Para 2-11).
  (4) Turn engine switch to start and observe DDR display.
  - (a) If engine RPM is more than 0, turn OFF ENGINE switch and go to Step 5 of this Fault.

    (b) If engine RPM remains at 0, TRS
  - (b) If engine RPM remains at 0, TRS is not adjusted correctly. Turn OFF ENGINE switch and notify DS Maintenance.





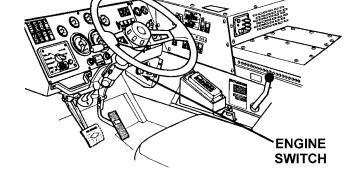
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical
  circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

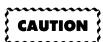
#### NOTE

Battery voltage surges, while cranking the engine, may blank out or reset DDR.

#### DDR TEST

- (1) Remove two mounting screws and heat shield from DDEC ECM.
- (2) Disconnect power harness connector MC17 from DDEC ECM with connector removed.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
- (4) Select MODE 04 (ENGINE RPM) on DDR (Para 2-11).
- (5) Turn engine switch to start and observe DDR display.
  - (a) If engine RPM is more than 60, turn OFF ENGINE switch and go to Step 8 of this Fault.
  - (b) If engine RPM is less than 60, turn OFF ENGINE switch and go to Step 6 of this Fault.

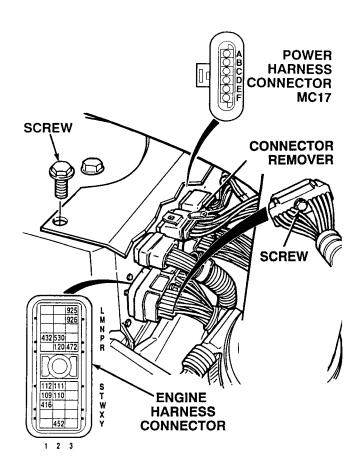




DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### RESISTANCE TEST

- (1) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Set multimeter select switch to ohms.
- (3) Are there 100 to 200 ohms present between wires 109 and 110 at engine harness connector, terminals T1 and T2?
  - (a) If there are less than 100 ohms or more than 200 ohms present, connect engine harness connector and go to A4 Code 41 Step 2.
  - (b) If there are 100 to 200 ohms present, go to Step 7 of this Fault.



# KNOWN INFO

Fuel supply OK.
No aerated fuel.
Fuel filter OK.
Emergency shut-off switch OK.
TRS adjustment OK.
TRS OK.
DDEC pulse wheel OK.

#### POSSIBLE PROBLEMS

Damaged DDEC ECM terminals or connectors. SRS faulty. Open in injector return line. Short in injector return line. DDEC ECM input voltage faulty.

7. WARNING Read WARNING on Page 2-487 Are all DDEC ECM terminals and connectors (DDEC ECM and harness side) free from damage? Repair connectors (Para 7-101) or replace DDEC ECM NO (Para 7-56). Verify repair, go to Step 13 of this Fault. (YES) Replace DDEC ECM (Para 7-56). Verify repair, go to

Step 13 of this Fault.

#### **TEST OPTIONS**

Visual inspection.

#### REASON FOR QUESTION

Damaged terminals and connectors can affect signal to DDEC ECM.

#### **KNOWN INFO**

Fuel supply OK.
No aerated fuel.
Fuel filter OK.
Emergency shut-off switch OK.
TRS adjustment OK.
TRS OK.
DDEC pulse wheel OK.
DDEC ECM terminals and connectors OK.

#### POSSIBLE PROBLEMS

SRS faulty.
Open in injector return line.
Short in injector return line.
DDEC ECM input voltage faulty.

# Is an SRS signal received?

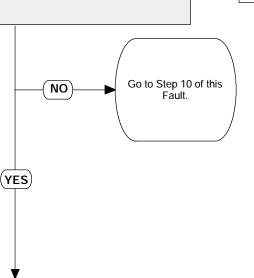
8.

# TEST OPTIONS

DDR test.

#### REASON FOR QUESTION

If an SRS signal is not received by DDEC ECM, the engine will not start.



- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### VISUAL INSPECTION

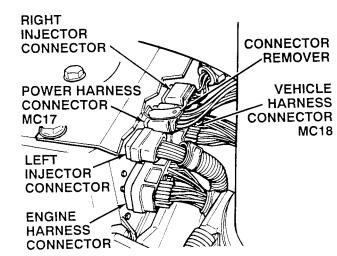
- (1) Disconnect all connectors at DDEC ECM (Para 7-56).
- (2) Check all terminals at harness connectors (ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector(s) is damaged, repair connector(s) (Para 7-101) and perform Steps (3) through (5) below.
  - (b) If DDEC ECM connector is damaged, replace DDEC ECM (Para 7-56).
  - (c) If harness connector and DDEC ECM harness connectors are OK, replace DDEC ECM (Para 7-56).
- (3) Connect engine harness connector to DDEC ECM and tighten screw.
- (4) Install heat shield and two screws.
- (5) Close top engine access cover.

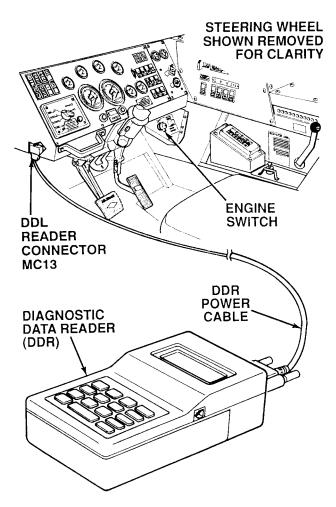
#### NOTE

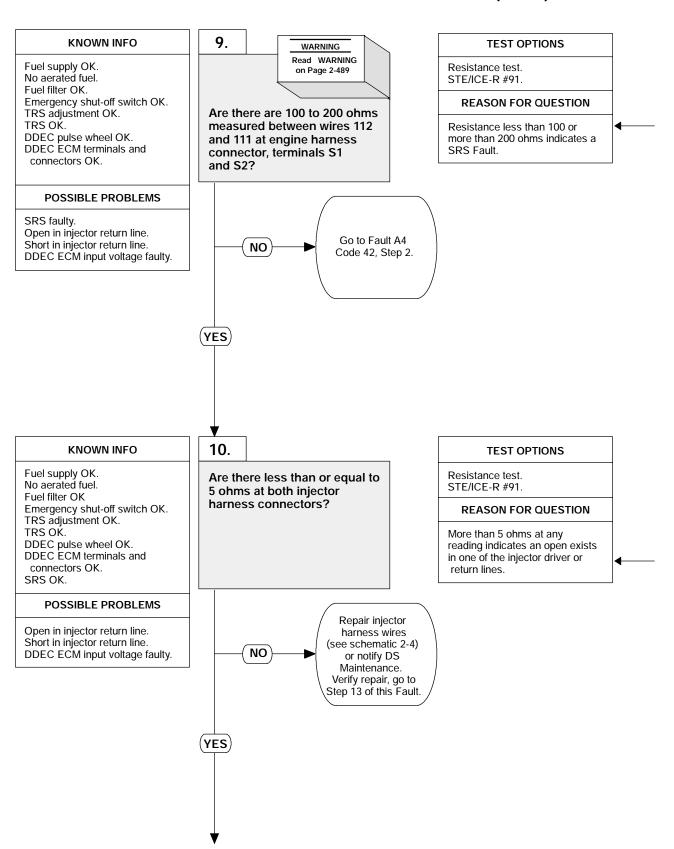
Battery voltage surges, while cranking the engine, may blank out or reset DDR.

#### DDR TEST

- (1) Select MODE 31 (SRS RECEIVED) on DDR.
- (2) Observe DDR display while cranking engine (TM 9-2320-364-10).
  - (a) If SRS received is not displayed in the DDR, SRS signal is faulty, turn OFF ENGINE switch and go to Step 8 of this Fault.
  - (b) If SRS received is displayed, SRS signal is OK. Turn OFF ENGINE switch and go to Step 9 of this Fault.







- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.



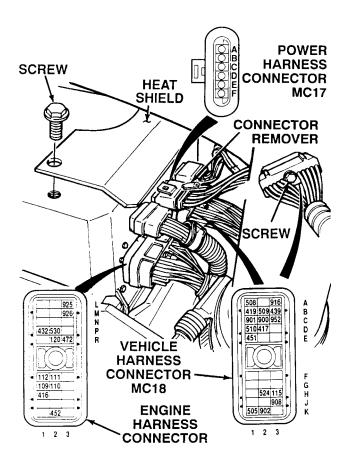
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

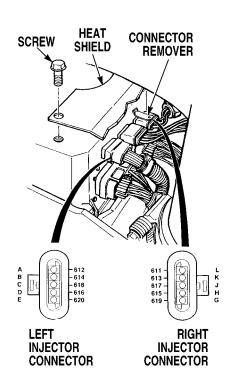
#### RESISTANCE TEST

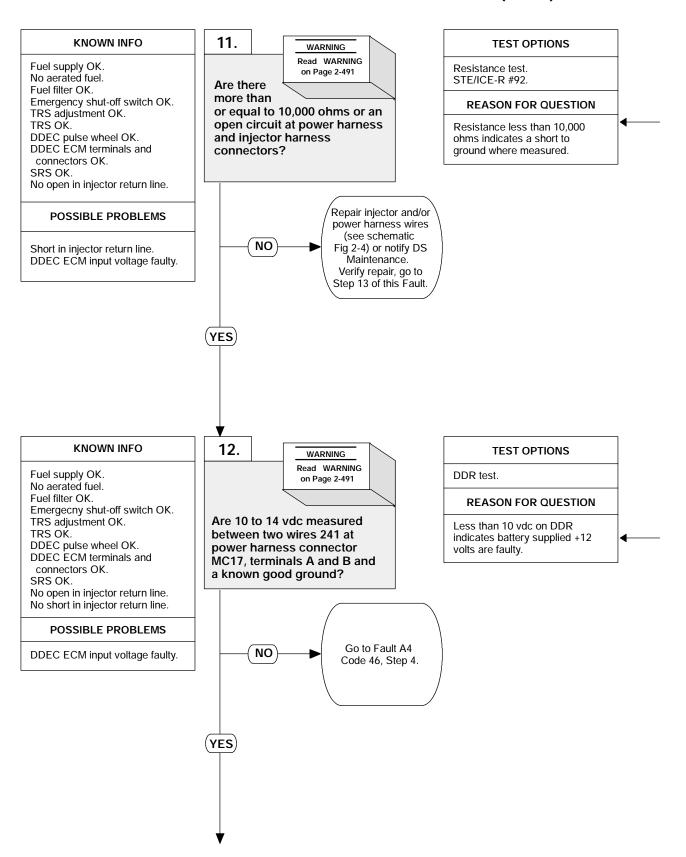
- (1) Loosen screw and disconnect engine harness connector at DDEC ECM.
- (2) Are there 100 to 200 ohms present between wires 112 and 111 at engine harness connector, terminals S1 and S2?
  - (a) If there are not 100 to 200 ohms present, perform Step (3) below and go to Fault A4 Code 42 Step 2.
  - (b) If there are between 100 to 200 ohms present, perform Step (3) below and go to Step 10 of this Fault.
- (3) Connect engine harness connector and tighten screw.

#### RESISTANCE TEST

- (1) Remove two screws and heat shield.
- (2) Disconnect both injector harness connectors at DDEC ECM with connector remover.
- (3) Read resistance between the injector return terminal and all the driver terminals at both harness connectors (Example: E to A, E to B, G to L, G to J, E to C and E to D).
  - (a) If less than 5 ohms are present, repair wires (see schematic Fig 2-4) or notify DS Maintenance.
  - (b) If 5 ohms or more are present, go to Step 11 of this Fault.







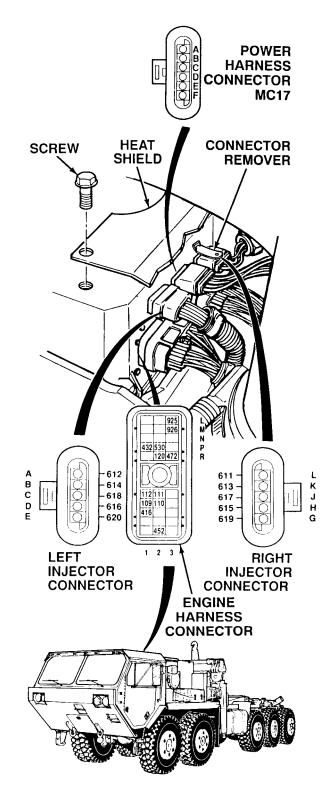
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

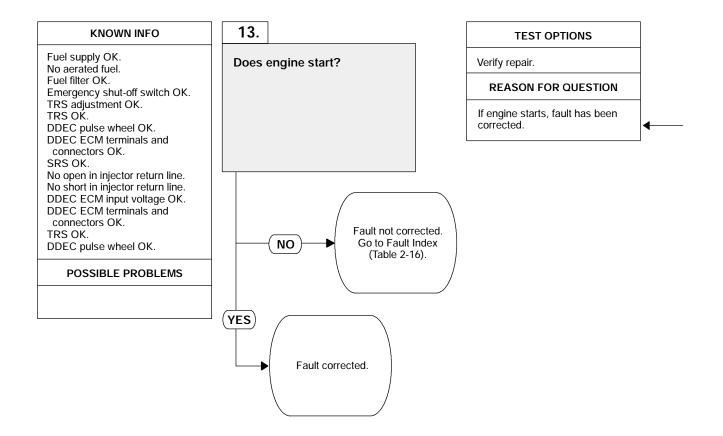
#### RESISTANCE TEST

- Read resistance between wire 150 at power harness connector MC17, terminal C and terminals A, B, C, D, E, G, H, J, K, and L of injector harness connectors.
  - (a) If less than 10,000 ohms are present, repair power harness wire 150 and/or injector wire(s) (see schematic Fig 2-4) or notify DS Maintenance and perform Steps (2) and (3) below.
  - (b) If more than 10,000 ohms are present, power harness and injector wires are OK. Perform Steps (2) and (3) below.
- (2) Connect both injector harness connectors to DDEC ECM.
- (3) Connect engine harness connector to DDEC ECM and tighten screw.

#### DDR TEST

- (1) Set multimeter select switch to volts dc.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).(3) Select MODE 05 (DDEC ECM
- VOLTAGE) on DDR (Para 2-11).
- (4) Are 10 to 14 vdc present between two wires 241 at power harness connector MC17, terminals A and B and a known good ground?
  - (a) If less than 10 vdc are present, turn OFF ENGINE switch, perform Steps (5) through (7) below and go to A4 Code 46, Step 4.
  - (b) If more than 14 vdc are present, turn OFF ENGINE switch and perform Steps (5) through (7) below.
- (5) Connect power harness connector MC17.
- (6) Install heat shield and tighten two mounting screws.
- (7) Close top engine access cover.





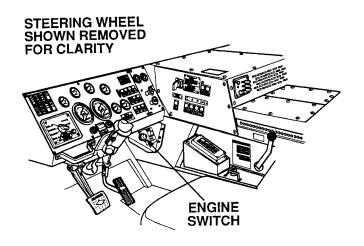
#### **VERIFY REPAIR**

- (1) Start ENGINE (TM 9-2320-364-10).(b) If engine starts, fault has been corrected. Perform Steps (2)
- and (3) below.

  (b) If engine does not start, turn OFF ENGINE switch and go to Fault Index (Table 2-16).

  (2) Turn OFF ENGINE switch.

  (3) Disconnect DDR from DDL
- connector MC13.

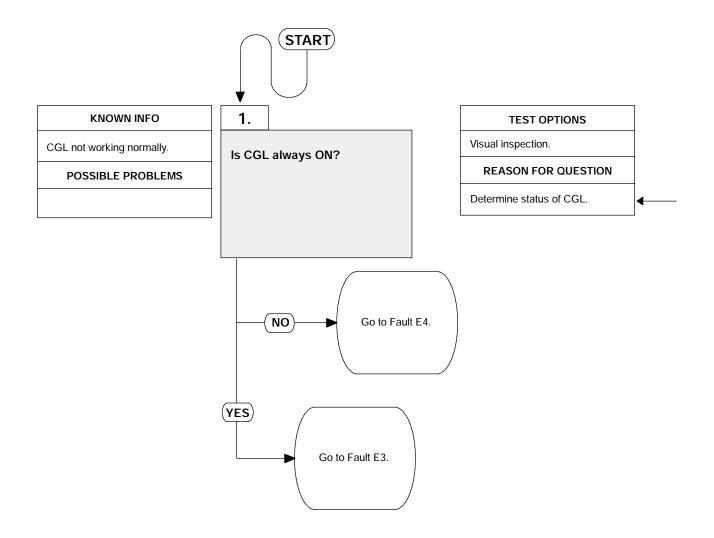


# 2-13. DDEC II TROUBLESHOOTING (CONT).

# E2 CHECK GAGES LIGHT (CGL) ALWAYS ON OR ALWAYS OFF.

#### **INITIAL SETUP**

References TM 9-2320-364-10 Equipment Condition
Engine OFF, (TM 9-2320-364-10)
Parking brake applied, (TM 9-2320-364-10)
Wheels chocked, (TM 9-2320-364-10)



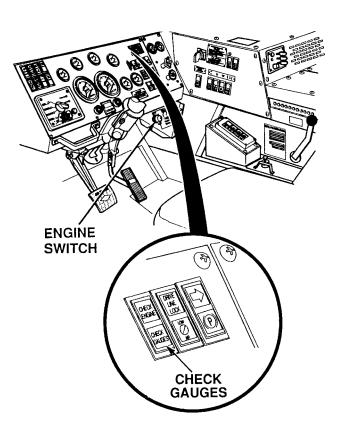
# NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **VISUAL INSPECTION**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
  (2) Is CGL always ON?
  (a) If CGL is not always ON, turn OFF ENGINE switch and go to
  - Fault E4.

    (b) If CGL is always ON, turn OFF ENGINE switch and go to go to Fault E3.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

# E3 CHECK GAGES LIGHT (CGL) ALWAYS ON.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Remover, Connector (Item 55, Appendix G)

References

TM 9-2320-364-10

**Equipment Condition** 

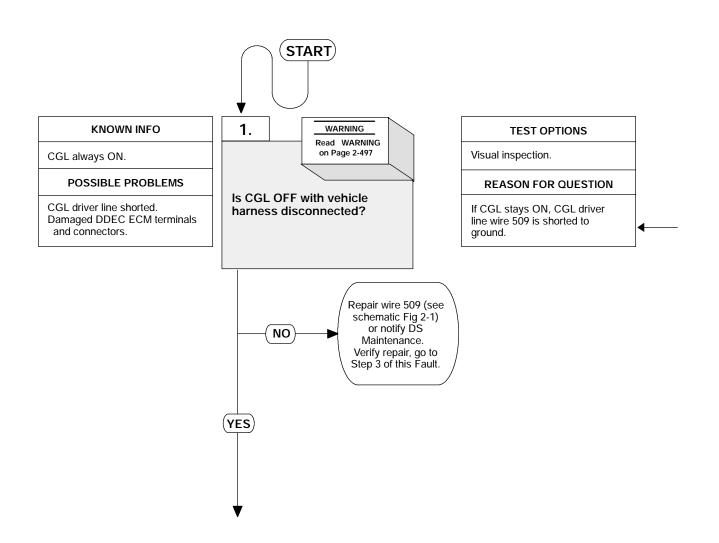
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

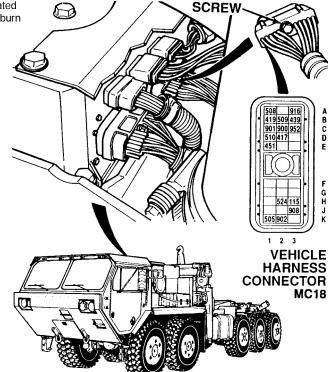
Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

(TM 9-2320-364-10)



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



# CAUTION

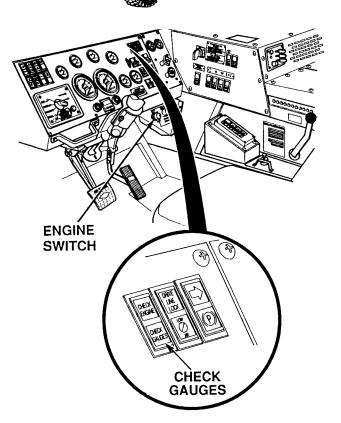
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **NOTE**

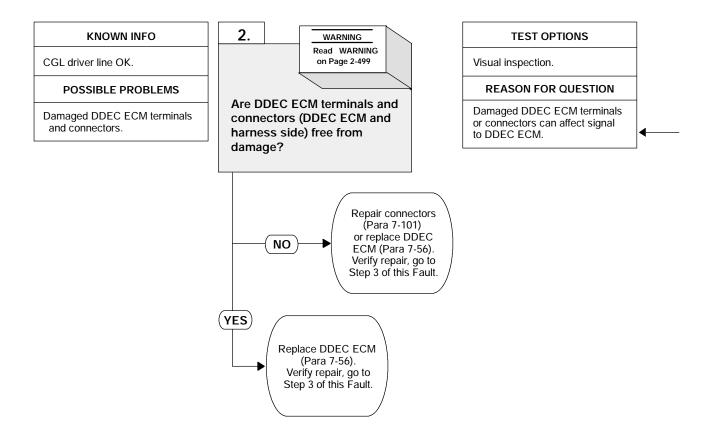
The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

#### **VISUAL INSPECTION**

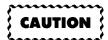
- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Is CGL OFF with vehicle harness disconnected?
  - (a) If CGL is ON with vehicle harness connector disconnected, turn OFF ENGINE switch and repair wire 509 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If CGL is OFF with vehicle harness connector disconnected, turn OFF ENGINE switch. Wire 509 is OK.



# E3 CHECK GAGES LIGHT (CGL) ALWAYS ON (CONT).



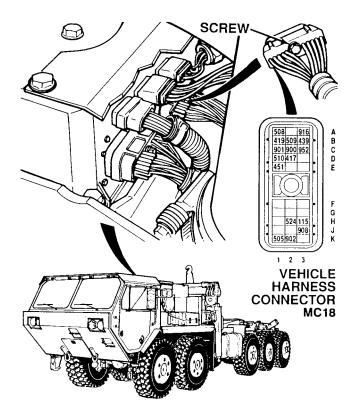
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.



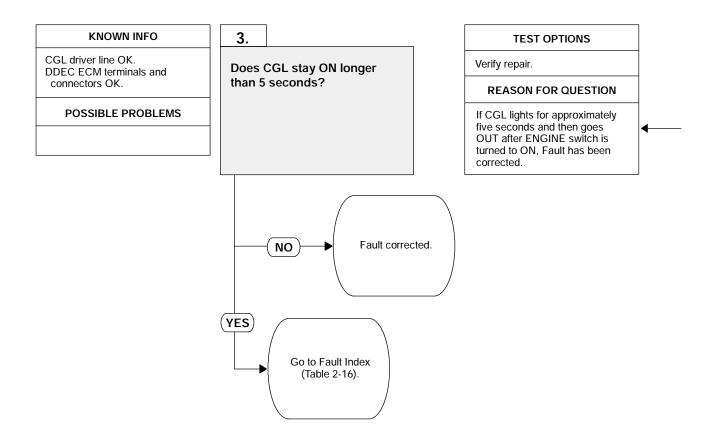
DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.

#### **VISUAL INSPECTION**

- (1) Disconnect all connectors at DDEC ECM (Para 7-56).
- (2) Check all terminals at harness connectors (ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector(s) is damaged, repair connector(s) (Para 7-101) and perform Steps (3) and (4) below.
  - (b) If DDEC ECM connector is damaged, replace ECM (Para 7-56).
  - (c) If harness connector and DDEC ECM harness connectors are OK, replace DDEC ECM (Para 7-56).
- (3) Connect vehicle harness connector MC18 to DDEC ECM and tighten screw.
- (4) Close top engine access cover.



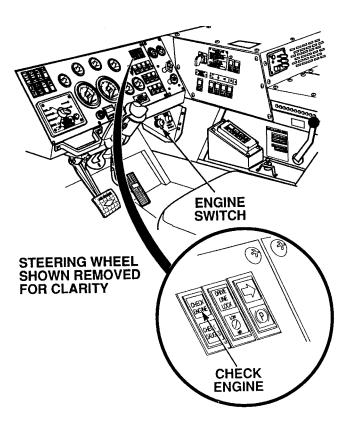
# E3 CHECK GAGES LIGHT (CGL) ALWAYS ON (CONT).



#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).(2) If CEL does not stay ON, start engine and run ON 8 minutes or until CEL comes ON.
  - (a) If check engine light comes on for about five seconds and then goes off, fault has been corrected.
  - Perform Step (3) below.

    (b) If check engine light comes on and stays on, perform Step (3) below and go to Fault Index (Table 2-16).
- (3) Turn OFF ENGINE switch.



# 2-13. DDEC II TROUBLESHOOTING (CONT).

# E4 CHECK GAGES LIGHT (CGL) ALWAYS OFF.

#### **INITIAL SETUP**

Tools and Special Tools

Tool Kit, General Mechanic's: Automotive

(Item 74, Appendix G)

STE/ICE-R (optional) (Item 3, Appendix G)

DDEC Repair Kit (Item 15, Appendix G)

Multimeter (Item 44, Appendix G)

Reader, Diagnostic (Item 53, Appendix G)

Remover, Connector (Item 55, Appendix G)

Jumperwire

References

TM 9-2320-364-10

TM 9-4910-571-12&P

**Equipment Condition** 

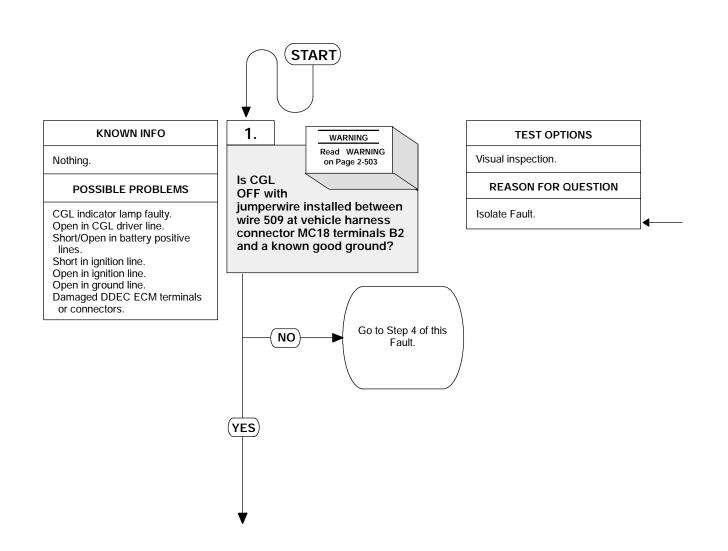
Engine OFF, (TM 9-2320-364-10)

Parking brake applied, (TM 9-2320-364-10)

Wheels chocked, (TM 9-2320-364-10)

Top engine access cover opened,

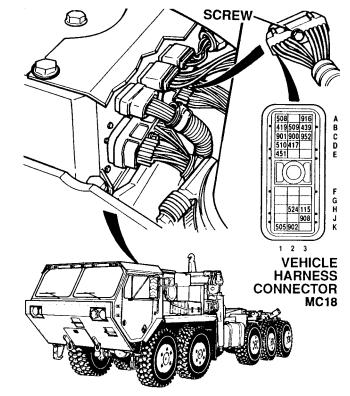
(TM 9-2320-364-10)



- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

# CAUTION

- Use jumperwire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.
- DDEC ECM connector terminals are easily damaged. Use care when connecting and disconnecting connectors.



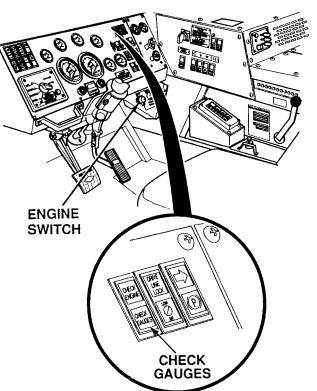
#### NOTE

The following steps should only be used if troubleshooting was started at DDEC II Troubleshooting (All Conditions) and you were referred here.

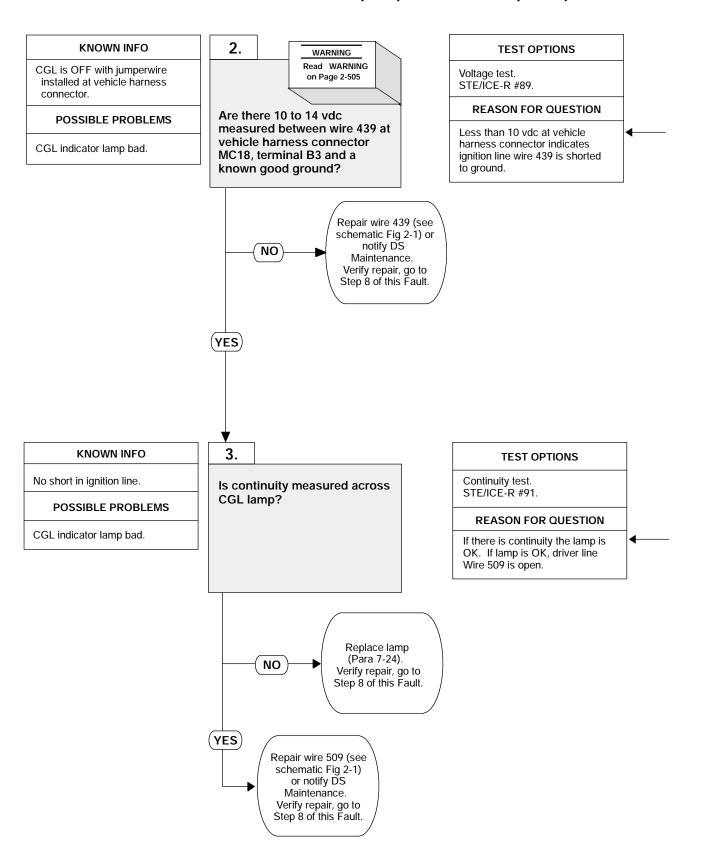
#### VISUAL INSPECTION

- Loosen screw and disconnect vehicle harness connector MC18 at DDEC ECM.
- (2) Place jumperwire between terminal B2 at vehicle harness connector MC18 and a known good ground.
- (3) Turn ON ENGINE switch (TM 9-2320-364-10).
- (4) Is CGL OFF with jumperwire installed at vehicle harness connector MC18?
  - at vehicle harness connector MC18?

    (a) If CGL is ON, remove jumperwire, turn OFF ENGINE switch and go to Step 4 of this fault.
  - (b) If CGL is OFF, remove jumperwire, turn OFF ENGINE switch and go to Step 2 of this Fault.



# E4 CHECK GAGES LIGHT (CGL) ALWAYS OFF (CONT).



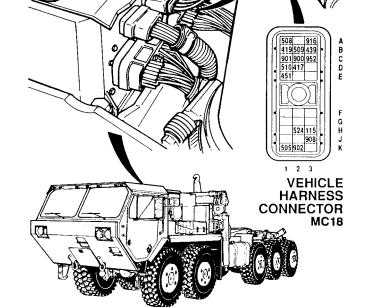
**SCREW** 

#### WARNING

- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.

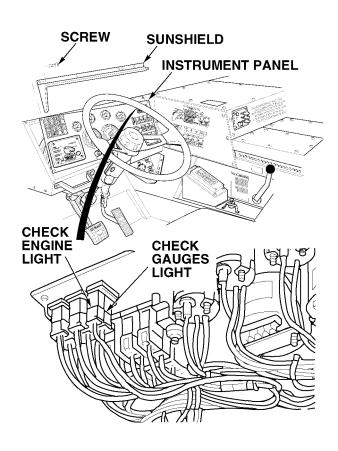
#### **VOLTAGE TEST**

- (1) Set multimeter select switch to volts dc.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Are there 10 to 14 vdc present between wire 439 at vehicle harness connector MC18, terminal B3 and a known good ground?
  - (a) If less than 10 to 14 vdc are not present, turn OFF ENGINE switch and repair wire 439 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If 10 to 14 vdc are present, turn OFF ENGINE switch and go to Step 3 of this Fault.
- (4) Connect vehicle harness connector MC18 and tighten screw.

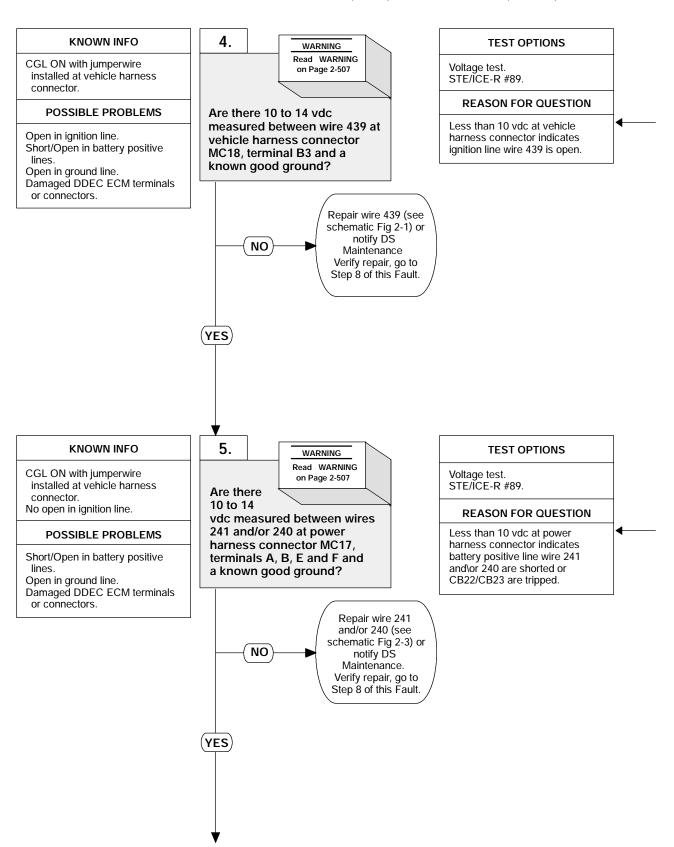


#### **CONTINUITY TEST**

- (1) Remove ten screws and sunshield from instrument panel.
- (2) Pull top of instrument panel towards steering wheel.
- (3) Remove CGL lamp.
- (4) Set multimeter select switch to ohms.
- (5) Is continuity measured across CGL lamp?
  - (a) If there is no continuity, replace lamp (Para 7-24).
  - (b) If there is continuity, lamp is OK. Repair wire 509 (see schematic Fig 2-1) or notify DS Maintenance.
- (6) Install instrument panel and sunshield with ten screws.
- (7) Close top engine access cover.



# E4 CHECK GAGES LIGHT (CGL) ALWAYS OFF (CONT).



#### WARNING

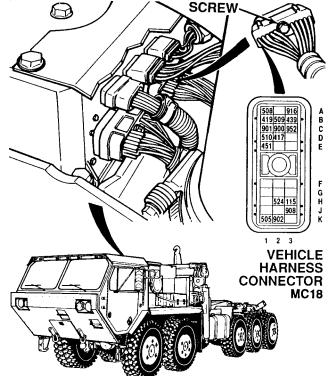
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

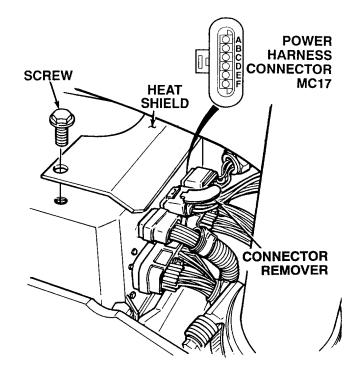
#### **VOLTAGE TEST**

- (1) Set multimeter select switch to volts dc.
- (2) Turn ON ENGINE switch (TM 9-2320-364-10).
- (3) Are there 10 to 14 vdc present between wire 439 at vehicle harness connector MC18, terminal B3 and a known good ground?
  - (a) If less than 10 vdc are present, turn OFF ENGINE switch and repair wire 439 (see schematic Fig 2-1) or notify DS Maintenance.
  - (b) If there is 10 to 14 vdc present, turn OFF ENGINE switch and go to Step 5 of this Fault.

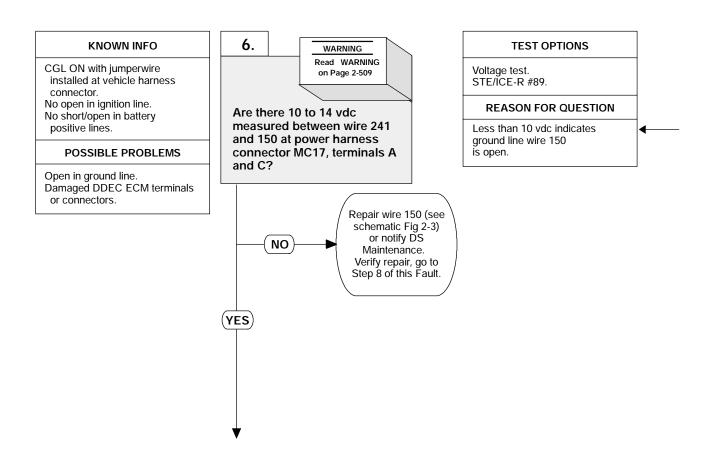
#### **VOLTAGE TEST**

- (1) Remove two screws and heat shield from DDEC ECM.
- (2) Disconnect power harness connector MC17 with connector remover.
- (3) Set multimeter select switch to volts dc.
- (4) Turn ON ENGINE switch (TM 9-2320-364-10).
- (5) Are there 10 to 14 vdc present between wire 241 at power harness connector MC17, terminal A and B and a known good ground?
  - (a) If less than 10 vdc are present, turn OFF ENGINE switch and repair wire 241 (see schematic Fig 2-3) or notify DS Maintenance and perform Steps (7) and (8) below.
  - (b) If 10 to 14 vdc are present, turn OFF ENGINE switch and perform Step (6) below.
- (6) Are there 10 to 14 vdc present between wire 240 at power harness connector MC17, terminal E and F and a known good ground?
  - (a) If less than 10 vdc are present, turn OFF ENGINE switch and repair wire 240 (see schematic Fig 2-3) or notify DS Maintenance and perform Steps (7) and (8) below.
  - (b) If 10 to 14 vdc are present, wire 240 is OK. Turn OFF ENGINE switch, perform Steps (7) and (8) below and go to Step 6 of this Fault.
- (7) Connect power harness connector MC17.
- (8) Install heat shield and two mounting screws.





## E4 CHECK GAGES LIGHT (CGL) ALWAYS OFF (CONT).



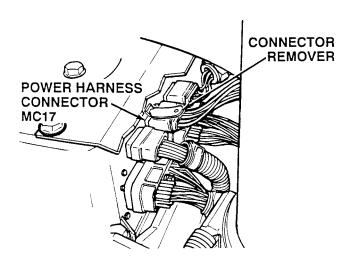
### **WARNING**

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts positive electrical circuits, a direct short may result. Damage to equipment, injury or death to personnel may occur.
- Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.

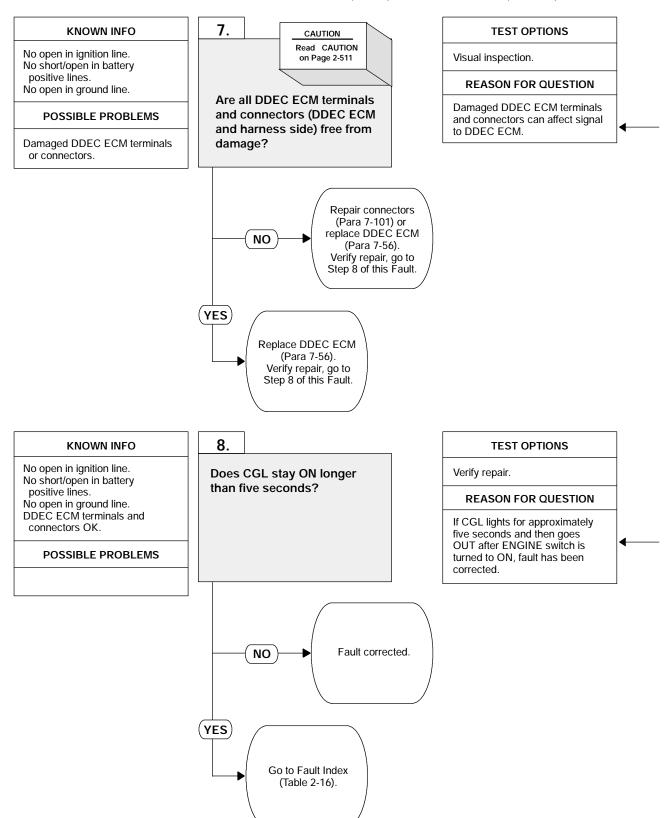
#### **VOLTAGE TEST**

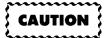
- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- Are there 10 to 14 vdc present between wires 241 and 150 at power and harness connector MC17, terminals A, B and C?
  - (a) If less than 10 vdc are present, turn OFF ENGINE switch and repair wire 150 (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If 10 to 14 vdc are present,
- perform Step (3) below.

  (3) Are there 10 to 14 vdc present between wire 150 and 240 at power harness connector MC17, terminals E. F and D and E?
  - (a) If less than 10 vdc are present, turn OFF ENGINE switch and repair wire 150 (see schematic Fig 2-3) or notify DS Maintenance.
  - (b) If 10 to 14 vdc are present, turn OFF ENGINE switch and go to Step 7 of this Fault.



## E4 CHECK GAGES LIGHT (CGL) ALWAYS OFF (CONT).

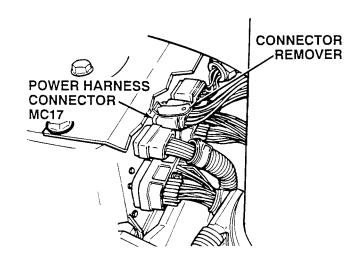




DDEC ECM connectors terminals are easily damaged. Use care when connecting and disconnecting connectors.

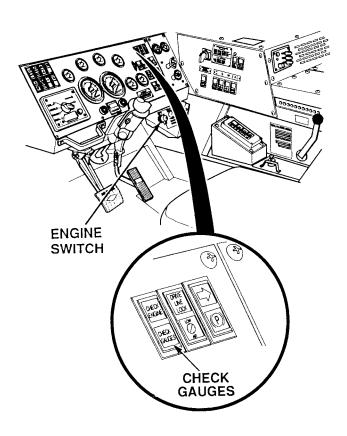
#### VISUAL INSPECTION

- (1) Disconnect all connectors at DDEC ECM (Para 7-56).
- (2) Check all terminals at harness connectors (ECM and harness side) for damage; bent, corroded and unseated pins or terminals.
  - (a) If harness connector(s) is damaged, repair connector(s) (Para 7-101) and perform Steps (3) through (5) below.
  - (b) If DDEC ECM connector is damaged, replace ECM (Para 7-56).
  - (c) If harness connector and DDEC ECM harness connectors are OK, replace DDEC ECM (Para 7-56).
- (3) Connect engine harness connector to DDEC ECM and tighten screw.
- (4) Install heat shield and two screws.
- (5) Close top engine access cover.



#### **VERIFY REPAIR**

- (1) Turn ON ENGINE switch (TM 9-2320-364-10).
- (2) Clear codes on DDR (Para 2-24).
- (3) If CGL does not stay ON, start engine and run for 8 minutes or until CGL comes ON.
  - (a) If check engine light comes on for about five seconds and then goes off, fault has been corrected. Perform Steps (4) and (5) below.
  - (b) If check engine light comes on and stays on, perform Steps (4) and (5) below and go to Fault Index (Table 2-16).
- (4) Turn OFF ENGINE switch.
- (5) Disconnect DDR from DDL connector MC13.



This paragraph covers DDEC III/IV System Troubleshooting. The DDEC III/IV System Index, Table 2-19, lists sections, subsections and charts associated with the DDEC III/IV system of the PLS truck.

Table 2-19. DDEC III/IV System Index

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Table 2-19. DDEC III/IV System Fault Index (CONT).

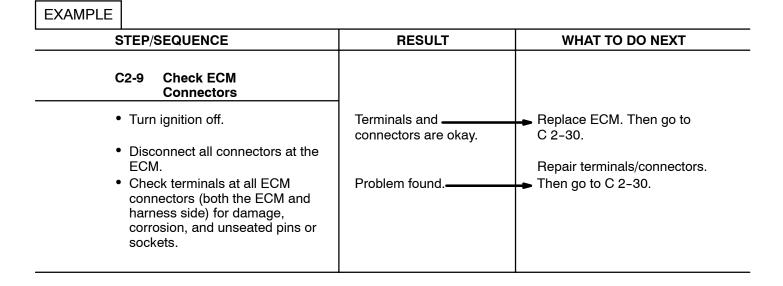
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	Chart 6	- "Che	ck Ga	nuges" Light On And No Active Code On DDR	2-589
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	Flash	SAI			
	Codes:	Code P187	e <b>s:</b> 4	(Refer to Table 2-20 for Cross Reference) -Vernier Control Input Failed Low (Voltage Low)	
	11	1107	4	(Also Called Variable Speed Governor - VSG)	2-617
	12	P187	3	- Vernier Control Input Failed High (High Voltage)	
				(Also Called Variable Speed Governor - VSG)	2-625
	14	P110	3	- Coolant Temperature Circuit Failed High (Voltage High)	
	OR:	P175	3	- Oil Temperature Circuit Failed High (Voltage High)	2-631
	15 OP-	P110	4	- Coolant Temperature Circuit Failed Low (Low Voltage)	2 (21
	OR: 21	P175 P91	4	<ul><li>Oil Temperature Circuit Failed Low (Low Voltage)</li><li>Electronic Foot Pedal ASM (EFPA) Circuit Failed High</li></ul>	2-631
	21	P91	3	(Voltage High) Also Called Throttle Position Sensor (TPS)	2-643
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	33	P102	3	- Turbo Boost Pressure Circuit Failed High (High Voltage)	2-667
	34	P102	4	- Turbo Boost Pressure Circuit Failed Low (Low Voltage)	
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	41	S21	0	- Too Many SRS (Missing TRS)	2-695
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## Table 2-19. DDEC III/IV System Fault Index (CONT).

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	Flash SAE	
	Codes: Codes:	
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	- Auxiliary Output Open Circuit	
	71 Sxxx 1 - Injector Response Time Short	
	75 P168 0 - Battery Voltage High	
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### Section I. HOW TO USE THIS PARAGRAPH

- 1. Section II (Basic Knowledge Required) and Section III (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/IV System, turn to Section IV (Troubleshooting Charts). Always start with the first Chart (labeled START) on page 2-539. If a Diagnostic Data Reader (DDR) is not available, the chart labeled CEL (Check Engine Light) on page 2-549 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.



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).

### Section II. 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- $\Omega$  (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  $\Omega$  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  $\infty$  resistance and would not have continuity. To utilize this continuity feature of certain meters:

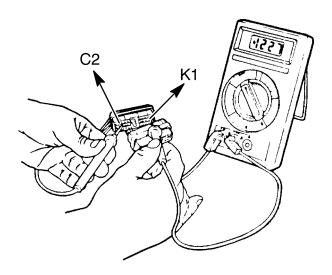
- 1. Place the function/range switch in any  $\Omega$  range.
- 2. Connect the red lead to the V-Ω connector and the black lead to the com connector on the meter. With the test leads separated or measuring an out-of-range resistance, the digital display will indicate "OL" (overlimit; some meters show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

### Section II. BASIC KNOWLEDGE REQUIRED (Cont.)

- 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  $\Omega$  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- $\Omega$  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, and 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. Procedures for disconnecting ECM connectors are found in para 7-57.
- 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 II. BASIC KNOWLEDGE REQUIRED (Cont.)

#### 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. (general diagnostic information, section II, E 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 "Check Gauges" light will come on for about 5 seconds when the ignition is turned on.

CKT - Circuit

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

COM - Common

CTS - Coolant Temperature Sensor: Monitors coolant temperature.

DDEC II - Second generation Detroit Diesel Electronic Controls.

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 II. BASIC KNOWLEDGE REQUIRED (Cont.)

DDR - Diagnostic Data Reader: The hand held tool used for troubleshooting the DDEC system. MPSI PRO-LINK

9000.

- 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

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.

- 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.

VSS - Vehicle Speed Sensor: Used to detect vehicle speed.

### Section II. BASIC KNOWLEDGE REQUIRED (Cont.)

#### **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.

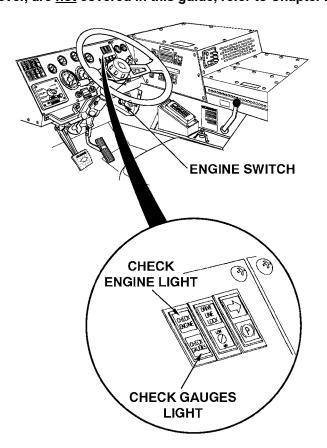
\*Active codes will be flashed on the "Check Gauges" light in order from most recent to least recent occurrence based on engine hours. If there are no active codes, a code 25 will be flashed.

\*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 not covered in this guide, refer to Chapter 2, Vehicle Troubleshooting.



#### Section III. TESTING THE DDEC III/IV SYSTEM

#### A. TOOLS NEEDED TO DIAGNOSE THE SYSTEM

The following tools and equipment are required to properly diagnose a complete system:

- MPSI PRO-LINK Diagnostic Data Reader (DDR) J38500-750 (cartridge only) (DDEC II/III only).
- Multi-protocol cartridge P/N 208040 and Smartcard P/N 802115 (DDEC III/IV only).
- Voltmeter and Ohmmeter: Use a digital volt-ohmmeter J-34029 or equivalent to measure voltage and resistance where required. A digital volt-ohmmeter must be used when specified in a procedure.
- Test Light 6V: Must be used when specified in the procedure.
- Jumper Wires: To bypass a circuit and to insert between special connectors. This will permit access to the connector terminals for circuit checking.
- TRS/SRS Alignment Tool: J-39815.
- .020" Feeler Gauge
- Crankshaft Position Timing Tool: J34930-A

#### B. DIFFERENCES BETWEEN DDEC III/IV AND DDEC II

To those thoroughly familiar with DDEC II, an outline is given of the differences in DDEC III/IV. From an installation and testing viewpoint, these differences are:

- DDEC fault codes are still able to be "flashed", but with DDEC III/IV, a diagnostic request switch has been installed. There are no longer provisions to use a jumper wire. The DDC assigned fault codes no longer appear on the "MPSI" diagnostic data reader.
- When using the MPSI DDR, the diagnostic codes are now displayed in a SAE J1587 format. The SAE have developed a standardized list of Parameter Identification Descriptions (PID), and a System Identification Description (SID). These PIDs and SID will define the area where the fault has occurred. Following the PID or SID will be a Failure Mode Identifier (FMI). The diagnostic codes (both DDEC and SAE) and their description can be found in Section IV of this Troubleshooting Guide.
- Fault codes are now referred to as active and inactive.
- DDEC III/IV requires injector calibrations to be entered into the EEPROM with the DDR. DDEC III/IV uses this information to provide proper cylinder balancing. Injector information must be programmed whenever an injector is replaced, or changed for different cylinder location.
- DDEC III/IV engines are equipped with a 36 tooth pulse wheel, instead of DDEC II's 13 tooth pulse wheel.
- Added information now appears for some fault codes. This data includes: the hour the code is first logged, last logged, number of occurrences, number of overrides (if applicable), and the value that caused the fault to be logged (if applicable).
   Refer to code 85 page 2-759 for details.

## Section III. TESTING THE DDEC III/IV SYSTEM (Cont.)

#### C. READING THE DIAGNOSTIC CODES

NOTE: If you have turned here to begin diagnosis of a problem and already know how to read codes, as well as understand active and inactive codes, turn to the first chart (labeled START) on page 2-539.

### 1. Active vs. Inactive Codes:

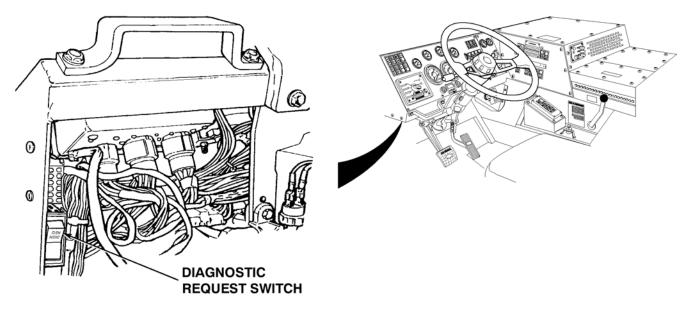
DDEC III/IV makes use of both types of codes. As their names imply, the difference between the two are as follows:

- a. <u>Active Codes</u> These are the codes which are currently keeping the "Check Engine or Check Gauges" light on. Active codes are flashed via the Check Gauges Light.
- b. <u>Inactive Codes</u> These are all the codes logged in the ECM (whether or not they are currently turning on the "Check Gauges or Check Engine" light). These codes can be cleared by using the Diagnostic Data Reader. Inactive codes are flashed via the Check Engine Light.

#### 2. Using the Diagnostic Request Switch - Flash Method

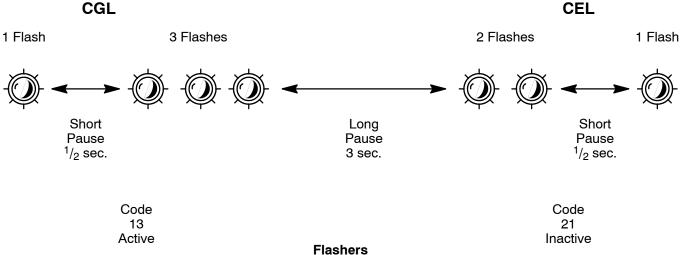
This Troubleshooting Guide is intended to be used with a Diagnostic Data Reader (DDR). In most instances, only the DDR can provide the information necessary for a quick diagnosis of the problem. Should you just need to read out codes, however, and not have a DDR available, the following procedure will let you read out codes on the CEL and CGL:

- a. Turn ignition on.
- b. Depress and hold the diagnostic request switch.



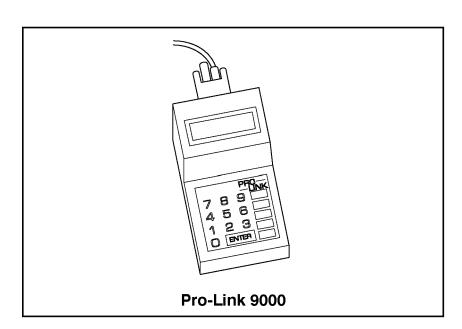
## Section III. TESTING THE DDEC III/IV SYSTEM (Cont.)

c. Observe the codes flashing out on the CEL and CGL. Example: Code 13 (active) and 21 (inactive) below.



This will continue as long as the diagnostic request switch is held with the ignition on.

3. Using the Diagnostic Data Reader (DDR) or PRO-LINK 9000.



Proper use of this reader is described in the instruction manual supplied. This device is infinitely more useful in reading fault codes and diagnosing engine electronic faults than the flash code process. Section V of this paragraph provides the information obtainable with the reader.

## Section III. TESTING THE DDEC III/IV SYSTEM (Cont.)

#### D. CLEARING CODES

This can only be done using the Diagnostic Data Reader (DDR). Refer to DDR Instruction Manual for details.

Note that removing the battery cables will not clear codes.

#### E. CONNECTOR CHECKOUT

All system connections are environmentally protected. These connectors protect the terminations from the harsh corrosive engine compartment environment. This is important since most system signals are low voltage and corrosion could make them inoperative.

Before repairing or replacing any system component (i.e., harness, sensor, ECM, etc.) as indicated by the diagnostic charts, you should:

- 1. Disconnect the appropriate connector(s) associated with the suspected defective component and check for bent, broken, or dirty terminals or mating tabs. Clean, straighten, or replace as required.
- 2. If a problem was found, reconnect all connectors previously disconnected. Then recheck the system to see if the problem has been corrected.

NOTE: Don't probe the back of a connector or pierce the DDEC III wiring for purposes of taking measurement. This can cause intermittent faults or system failures and may affect the engine warranty.

#### F. DIGITAL INPUT/OUTPUT FUNCTIONS

#### **DIGITAL OUTPUTS**

DDEC III/IV provides three discrete output pins on the vehicle harness which may be customized to the customer application. These outputs <u>provide</u> a ground (less than 0.8 volts with respect to DDEC ground) capable of sinking up to 1 ampere of DC current when the output is active.

The function may be selected by its "function number" found in the list below. No function should be assigned to more than one pin (except FUNCTION #0 - No Function).

#### Examples:

- 1. Pin J3 of the ECM's 30-pin vehicle harness connector has a transmission signal assigned to it. This function causes the DDEC ECM to provide a signal to the ATEC ECM. This provides a signal that corresponds with the Throttle Position Sensor. ATEC modulates shift point based on this position.
- 2. Pin A1 of the ECM's 30-pin vehicle harness connector has the engine brake function assigned to it. This function causes the DDEC ECM to provide a ground to activate the engine brake relay (R7) under those conditions when the engine brakes can be used. This function occurs under no-fuel conditions (TPS value = 0%) and when the engine speed is greater than 1000 RPM. Relay R8 is assigned to ATEC which is included in the engine brake operation.
- 3. Pin K1 of the ECM's 30-pin vehicle harness connector has the engine speed function assigned to it. This function causes the DDEC ECM to provide a digital output signal of the engine RPM to the tachometer.

#### Section IV. TROUBLESHOOTING CHARTS

#### A. THE DIAGNOSTIC PROCEDURE - WHERE TO START

When diagnosing the cause for engine performance, fuel economy or exhaust system complaints, perform Vehicle Troubleshooting (Chapter 2) before considering DDEC as the possible source of the problem.

When diagnosing the system, always start with the first chart (labeled "START") on page 2-539. This will ultimately lead to other diagnostic charts, even in the cases where no fault codes were logged but a symptom(s) was noted. In fact, if no faults were recorded (but a symptom remains), the "START" chart will refer you to "Diagnosis by Symptom", Chart 1, on page 2-554, which can identify fault trees to use based on the customer complaint.

NOTE: Although there are many charts connected with diagnostics, only one is needed to determine that the system is operating properly. Normally, only two charts are necessary to find a problem.

#### B. DDEC III/IV DIAGNOSTIC CODES/WHAT THEY MEAN

The following pages give a brief description of each diagnostic code. Basic facts about these codes are given below:

- Most problems must occur for a total of at least two (2) seconds before the "Check Engine" light comes on and a code is stored.
- · If a problem goes away, the "Check Engine" light will turn off. But the code will remain stored in the ECM.
- · Code 25 means no codes were stored at all.

FLASH CODE: 11

DDR DISPLAY: PTO SENSOR (VERNIER CONTROL) INPUT VOLTAGE LOW

SAE J1587 CODE: PID: 187 FMI: 4

Indicates that the vernier control input to the ECM has dropped below 5% (normally < 0.25 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) open sensor signal circuit
- (2) open sensor +5 volt supply circuit
- (3) sensor signal is shorted to the sensor return circuit or to ground
- (4) sensor +5 volt supply is shorted to sensor return circuit or to ground

FLASH CODE: 12

DDR DISPLAY: PTO SENSOR (VERNIER CONTROL) INPUT VOLTAGE HIGH

SAE J1587 CODE: PID: 187 FMI: 3

Indicates that the vernier control input to the ECM has exceeded 95% (normally > 4.75 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) open sensor return circuit
- (2) sensor signal circuit is shorted to the sensor +5 volt supply

## Section IV. TROUBLESHOOTING CHARTS (Cont.)

FLASH CODE: 14

DDR DISPLAY: COOLANT TEMP SENSOR INPUT VOLTAGE HIGH

SAE J1587 CODE: PID: 110 FMI: 3

Indicates that the engine Coolant Temperature Sensor (CTS) input to the ECM has exceeded 95% (normally 4.75 volts) of the sensor supply voltage. NOTE: This code will only be logged during warm engine operation. This diagnostic condition is typically:

(1) open sensor signal circuit

- (2) open sensor return circuit
- (3) sensor signal circuit is shorted to the sensor +5 volt supply

FLASH CODE: 14

DDR DISPLAY: OIL TEMP SENSOR INPUT VOLTAGE HIGH

SAE J1587 CODE: PID: 175 FMI: 3

Indicates that the engine Oil Temperature Sensor (OTS) input to the ECM has exceeded 95% (normally > 4.75 volts) of the sensor supply voltage. NOTE: This code will only be logged during warm engine operation. This diagnostic condition is typically:

- (1) open sensor signal circuit
- (2) open sensor return circuit
- (3) sensor signal circuit is shorted to the sensor +5 volt supply

FLASH CODE: 15

DDR DISPLAY: COOLANT TEMP SENSOR INPUT VOLTAGE LOW

SAE J1587 CODE: PID: 110 FMI: 4

Indicates that the engine Coolant Temperature Sensor (CTS) input to the ECM has dropped below 5% (normally < 0.25 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) sensor signal circuit is shorted to sensor return or to ground
- (2) sensor +5 volt supply is shorted to sensor return circuit or to ground

FLASH CODE: 15

DDR DISPLAY: OIL TEMP SENSOR INPUT VOLTAGE LOW

SAE J1587 CODE: PID: 175 FMI: 4

Indicates that the engine Oil Temperature Sensor (OTS) input to the ECM has dropped below 5% (normally < 0.25 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) sensor signal circuit is shorted to sensor return or to ground
- (2) sensor +5 volt supply is shorted to sensor return circuit or to ground

FLASH CODE: 21

DDR DISPLAY: THROTTLE SENSOR INPUT VOLTAGE HIGH

SAE J1587 CODE: PID: 91 FMI: 3

Indicates that the Throttle Position Sensor (TPS) input to the ECM has exceeded 95% (normally > 4.75 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) open sensor return circuit
- (2) sensor signal circuit is shorted to the sensor +5 volt supply

## Section IV. TROUBLESHOOTING CHARTS (Cont.)

FLASH CODE: 22

DDR DISPLAY: THROTTLE SENSOR INPUT VOLTAGE LOW

SAE J1587 CODE: PID: 91 FMI: 4

Indicates that the Throttle Position Sensor (TPS) input to the ECM has dropped below 5% (normally < 0.25 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) open sensor signal circuit
- (2) open sensor +5 volt supply circuit
- (3) sensor signal is shorted to sensor return circuit or to ground
- (4) sensor +5 volt supply is shorted to the sensor return circuit or ground

FLASH CODE: 23

DDR DISPLAY: FUEL TEMP SENSOR INPUT VOLTAGE HIGH

SAE J1587 CODE: PID: 174 FMI: 3

Indicates that the engine Fuel Temperature Sensor (FTS) input to the ECM has exceeded 95% (normally > 4.75 volts) of the sensor supply voltage. NOTE: This code will only be logged during warm engine operation. This diagnostic condition is typically:

- (1) open sensor signal circuit
- (2) open sensor return circuit
- (3) sensor signal circuit is shorted to the sensor +5 volt supply

FLASH CODE: 24

DDR DISPLAY: FUEL TEMP SENSOR INPUT VOLTAGE LOW

SAE J1587 CODE: PID: 174 FMI: 4

Indicates that the engine Fuel Temperature Sensor (FTS) input to the ECM has dropped below 5% (normally < 0.25 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) sensor signal circuit is shorted to sensor return or to ground
- (2) sensor +5 volt supply is shorted to sensor return circuit or to ground

FLASH CODE: 32

DDR DISPLAY: CHECK GAUGES LIGHT SHORT TO BATTERY (+)

SAE J1587 CODE: SID: 238 FMI: 3

Indicates that the Check Gauges Light (CGL) circuit is shorted to battery (+). This diagnostic condition is detected when the DDEC III/IV ECM is unsuccessful in turning **ON** the stop engine light. This diagnostic code is typically:

- (1) failed short CGL light bulb
- (2) CGL wire in vehicle harness is shorted to battery (+)

NOTE: The DDEC III/IV ECM supplies a switched ground to the stop engine light circuit to turn **ON** the light.

FLASH CODE: 32

DDR DISPLAY: CHECK GAUGES LIGHT OPEN CIRCUIT

SAE J1587 CODE: SID: 238 FMI: 4

Indicates that the Check Gauges Light (CGL) circuit is open or shorted to ground. This diagnostic condition is detected when the stop engine light is **OFF** and the DDEC III/IV ECM measures a low voltage on the stop engine light circuit output. This diagnostic code is typically:

- (1) failed open CGL light bulb
- (2) CGL wire in vehicle harness is open or shorted to ground

### Section IV. TROUBLESHOOTING CHARTS (Cont.)

FLASH CODE: 32

DDR DISPLAY: CHECK ENGINE LIGHT SHORT TO BATTERY (+)

SAE J1587 CODE: SID: 239 FMI: 3

Indicates that the Check Engine Light (CEL) circuit is shorted to battery (+). This diagnostic condition is detected when the DDEC III/IV ECM is unsuccessful in turning **ON** the stop engine light. This diagnostic code is typically:

(1) Failed short CEL light bulb

(2) CEL wire in vehicle harness is shorted to battery (+)

NOTE: The DDEC III/IV ECM supplies a switched ground to the check engine light circuit to turn **ON** the light.

FLASH CODE: 32

DDR DISPLAY: CHECK ENGINE LIGHT OPEN CIRCUIT

SAE J1587 CODE: SID: 239 FMI: 4

Indicates that the Check Engine Light (CEL) circuit is open or shorted to ground. This diagnostic condition is detected when the check engine light is **OFF** and the DDEC III/IV ECM measures a low voltage on the check engine light circuit output. This diagnostic code is typically:

(1) failed open CEL light bulb

(2) CEL wire in vehicle is open or shorted to ground

FLASH CODE: 33

DDR DISPLAY: TURBO BOOST SENSOR INPUT VOLTAGE HIGH

SAE J1587 CODE: PID: 102 FMI: 3

Indicates that the engine Turbo Boost Sensor (TBS) input to the ECM has exceeded 85% (normally > 4.25 volts) of the sensor supply voltage. This diagnostic condition is typically:

(1) open sensor return circuit

(2) sensor signal circuit is shorted to the sensor +5 volt supply

FLASH CODE: 34

DDR DISPLAY: TURBO BOOST SENSOR INPUT VOLTAGE LOW

SAE J1587 CODE: PID: 102 FMI: 4

Indicates that the engine Turbo Boost Sensor (TBS) input to the ECM has dropped below 5% (normally < 0.25 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) open sensor signal circuit
- (2) open sensor +5 volt supply circuit
- (3) sensor signal is shorted to the sensor return circuit or to ground
- (4) sensor +5 volt supply is shorted to sensor return circuit

FLASH CODE: 35

DDR DISPLAY: OIL PRESSURE SENSOR INPUT VOLTAGE HIGH

SAE J1587 CODE: PID: 100 FMI: 3

Indicates that the engine Oil Pressure Sensor (OPS) input to the ECM has exceeded 95% (normally > 4.75 volts) of the sensor supply voltage. This diagnostic condition is typically:

(1) open sensor return circuit

(2) sensor signal circuit is shorted to the sensor +5 volt supply

## Section IV. TROUBLESHOOTING CHARTS (Cont.)

FLASH CODE: 36

DDR DISPLAY: OIL PRESSURE SENSOR INPUT VOLTAGE LOW

SAE J1587 CODE: PID: 100 FMI: 4

Indicates that the engine Oil Pressure Sensor (OPS) input to the ECM has dropped below 5% (normally < 0.25 volts) of the sensor supply voltage. This diagnostic condition is typically:

- (1) open sensor signal circuit
- (2) open sensor +5 volt supply circuit
- (3) sensor signal is shorted to the sensor return circuit or to ground
- (4) sensor +5 volt supply is shorted to sensor return circuit

FLASH CODE: 41

DDR DISPLAY: TOO MANY SRS (MISSING TRS)

SAE J1587 CODE: PID: 21 FMI: 0

Indicates that the Synchronous Reference Sensor (SRS) has detected extra pulses, or the Timing Reference Sensor (TRS) has detected missing pulses.

FLASH CODE: 42

DDR DISPLAY: TOO FEW SRS (MISSING SRS)

SAE J1587 CODE: PID: 21 FMI: 1

Indicates that the Synchronous Reference Sensor (SRS) has detected missing pulses, or the Timing Reference Sensor (TRS) has detected extra pulses.

FLASH CODE: 44

DDR DISPLAY: COOLANT TEMPERATURE HIGH

SAE J1587 CODE: PID: 110 FMI: 0

Indicates that the Coolant Temperature Sensor (CTS) has detected that the engine coolant temperature has exceeded the recommended safe operating range.

FLASH CODE: 44

DDR DISPLAY: OIL TEMPERATURE HIGH

SAE J1587 CODE: PID: 175 FMI: 0

Indicates that the Oil Temperature Sensor (OTS) has detected that the engine oil temperature has exceeded the recommended safe operating range.

FLASH CODE: 45

DDR DISPLAY: OIL PRESSURE LOW SAE J1587 CODE: PID: 100 FMI: 1

Indicates that the Oil Pressure Sensor (OPS) has detected that the engine oil pressure has dropped below the recommended safe operating range.

FLASH CODE: 46

DDR DISPLAY: ECM BATTERY VOLTAGE LOW

SAE J1587 CODE: PID: 168 FMI: 1

Indicates that the DDEC III/IV ECM has detected that the main battery supply voltage to the ECM has dropped below the recommended operating range.

## Section IV. TROUBLESHOOTING CHARTS (Cont.)

FLASH CODE: 52

DDR DISPLAY: ECM A/D CONVERSION FAILURE

SAE J1587 CODE: SID: 254 FMI: 12

Indicates that the DDEC III/IV ECMs internal Analog to Digital (A/D) Convertor device has malfunctioned. Intermittent diagnostic conditions of this type can be caused by faulty external electrical system.

FLASH CODE: 53

DDR DISPLAY: NONVOLATILE MEMORY DATA INCORRECT

SAE J1587 CODE: SID: 253 FMI: 2

Indicates that the ECM upon startup has been unable to read a valid copy of a engine data record (calibration, faults, or accumulators) stored in nonvolatile memory.

FLASH CODE: 53

DDR DISPLAY: NONVOLATILE MEMORY FAILURE

SAE J1587 CODE: SID: 253 FMI: 12

Indicates that the ECM was unable to update an engine data record (calibration, faults, or accumulators) stored in nonvolatile memory.

FLASH CODE: 56

DDR DISPLAY: J1587 DATA LINK FAILURE

SAE J1587 CODE: SID: 250 FMI: 12

Indicates that the J1587 (diagnostic) data link is no longer allowing the ECM to transmit data. This diagnostic condition is typically:

- (1) either or both of the data link circuits are open at some point in the network
- (2) either or both of the data link circuits are shorted to ground at some point in the network
- (3) either or both of the data link circuits are shorted to battery (+) at some point in the network
- (4) the pair of data link circuits are shorted together

FLASH CODE: 61

DDR DISPLAY: XXX INJECTOR RESPONSE TIME LONG

SAE J1587 CODE: SID: XX FMI: 0

Indicates that the time it takes from when the DDEC III/IV ECM requests an injector be turned on to when the injector solenoid valve actually closes is longer than the high limit of the expected range. This diagnostic condition is typically:

- (1) bad injector harness/connection (high resistance)
- (2) blown fuses in the ECM battery (+) voltage supply harness
- (3) sticky solenoid valve

NOTE: The injector diagnostic SID (Subsystem Identifier) indicates which cylinder number has an injector with a long response time. The injector number describes the cylinder and/or bank which has the injector with a long response time.

Injector response times generally increase with low battery supply voltage and decrease with high battery supply voltage. Although injector response times vary from injector to injector at a given RPM, each individual injector response time should remain relatively consistent from one firing to the next. Wide variations in response time (typically +/- 0.2 msec) for one injector at a steady engine RPM may indicate an electrical problem (faulty alternator or voltage regulator, poor or broken ground cables, etc.).

## Section IV. TROUBLESHOOTING CHARTS (Cont.)

FLASH CODE: 62

DDR DISPLAY: (AUXILIARY OUTPUT #1) SHORT TO BATTERY (+)

SAE J1587 CODE: SID: 026 FMI: 3

Indicates that the function (engine brake) assigned to the Auxiliary Output #1 circuit output is shorted to battery (+). This diagnostic condition is detected when the DDEC III/IV ECM is unsuccessful in turning **ON** the configurable function.

NOTE: The DDR will display the parameter text description in TABLE 2-22 (ECM Output Options) to identify the function assigned to AUXILIARY OUTPUT #1.

The DDEC III/IV ECM supplies a switched ground to the AUXILIARY OUTPUT #1 circuit to turn **ON** the function assigned.

FLASH CODE: 62

DDR DISPLAY: (AUXILIARY OUTPUT #1) OPEN CIRCUIT

SAE J1587 CODE: SID: 026 FMI: 4

Indicates that the function (engine brake) assigned to the Auxiliary Output #1 circuit output is open or is shorted to ground. This diagnostic condition is detected when the Auxiliary Output #1 function is **OFF** and the DDEC III/IV ECM measures a low voltage on the circuit output.

NOTE: The DDR will display the parameter text description in TABLE 2-22 (ECM Output Options) to identify the function assigned to AUXILIARY OUTPUT #1.

FLASH CODE: 63

DDR DISPLAY: PWM DRIVER #1 SHORT TO BATTERY (+)

SAE J1587 CODE: SID: 057 FMI: 3

Indicates that the PWM DRIVER #1 circuit (transmission modulator) output is shorted to battery (+). This diagnostic condition is detected when the DDEC III/IV ECM is unsuccessful in turning ON the circuit function.

NOTE: The DDEC III/IV ECM supplies a switched ground to the PWM DRIVER #1 circuit to turn **ON** the circuit function.

FLASH CODE: 63

DDR DISPLAY: PWM DRIVER #1 OPEN CIRCUIT

SAE J1587 CODE: SID: 057 FMI: 4

Indicates that the PWM DRIVER #1 circuit (transmission modulator) output is open or is shorted to ground. This diagnostic condition is detected when the PWM Driver #1 function is OFF and the DDEC III/IV ECM measures a low voltage on the circuit output.

## Section IV. TROUBLESHOOTING CHARTS (Cont.)

FLASH CODE: 71

DDR DISPLAY: XXX INJECTOR RESPONSE TIME SHORT

SAE J1587 CODE: SID: XX FMI: 1

Indicates that the time it takes from when the DDEC III/IV ECM requests an injector be turned on to when the injector solenoid valve actually closes is shorter than the lower limit of the expected range. This diagnostic condition is typically:

(1) aerated fuel system

- (2) high system battery (+) supply voltage
- (3) failed solenoid valve

NOTE: The injector diagnostic SID (Subsystem IDentifier) indicates which cylinder number has an injector with a short response time. The injector number describes the cylinder and/or bank which has the injector with a short response time.

Injector response times generally increase with low battery supply voltage and decrease with high battery supply voltage. Although injector response times vary from injector to injector at a given RPM, each individual injector response time should remain relatively consistent from one firing to the next. Wide variations in response time (typically +/- 0.2 msec) for one injector at a steady engine RPM may indicate an electrical problem (faulty alternator or voltage regulator, poor or broken ground cables, etc.).

FLASH CODE: 75

DDR DISPLAY: ECM BATTERY VOLTAGE HIGH

SAE J1587 CODE: PID: 168 FMI: 0

Indicates that the DDEC III/IV ECM has detected that the main battery supply voltage to the ECM has exceeded the recommended operating range.

FLASH CODE: 76

DDR DISPLAY: ENGINE OVERSPEED WITH ENGINE BRAKE

SAE J1587 CODE: PID: 121 FMI: 0

Indicates that the engine RPM has exceeded the recommended safe operating range.

FLASH CODE: 85

DDR DISPLAY: ENGINE OVERSPEED

SAE J1587 CODE: PID: 190 FMI: 0

Indicates that the engine RPM has exceeded the recommended safe operating range.

FLASH CODE: --

DDR DISPLAY: FRAM CHECKSUM INCORRECT

SAE J1587 CODE: SID: 240 FMI: 2

Indicates that the ECM system operation software has been corrupted and is unable to operate. This diagnostic condition is typically:

The ECM system programming operation failed to run to completion. Replace ECM (para 7-57).

FLASH CODE: --

DDR DISPLAY: INCOMPATIBLE CALIBRATION VERSION

SAE J1587 CODE: SID: 253 FMI: 13

Indicates that the current ECM system operation software is not compatible with the engine calibration loaded in the ECM. This diagnostic condition is typically:

The ECM programming process was performed in the incorrect order or did not run to completion. Replace ECM (para 7-57).

## Section IV. TROUBLESHOOTING CHARTS (Cont.)

FLASH CODE: --

DDR DISPLAY: CALIBRATION CHECKSUM INCORRECT

SAE J1587 CODE: SID: 253 FMI: 2

Indicates that the engine calibration loaded in the ECM has been corrupted and is unable to operate. This diagnostic condition is typically:

The engine calibration programming operation failed to run to completion. Replace ECM (para 7-57).

FLASH CODE: --

DDR DISPLAY: FAILED EXTERNAL RAM

SAE J1587 CODE: SID: 254 FMI: 0

Indicates that some or all of the memory circuitry that is external to the ECM microprocessor has failed and is unable to operate. Replace ECM (para 7-57).

FLASH CODE: --

DDR DISPLAY: FAILED INTERNAL RAM

SAE J1587 CODE: SID: 254 FMI: 1

Indicates that some or all of the memory circuitry that is internal to the ECM microprocessor has failed and is unable to operate. Replace ECM (para 7-57).

# Section IV. TROUBLESHOOTING CHARTS (Cont.)

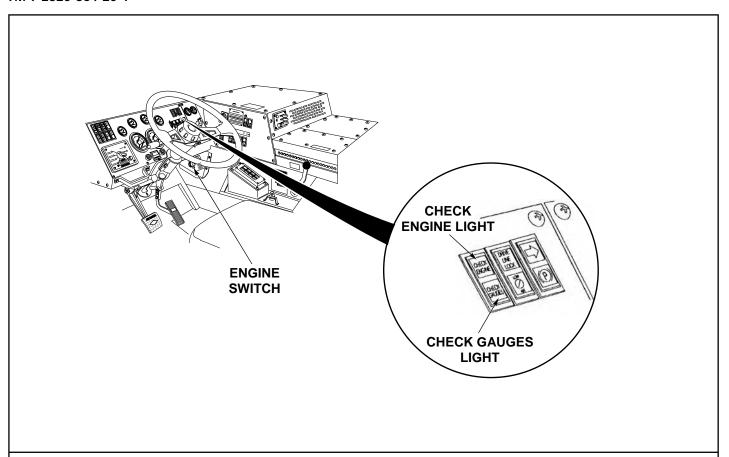
Table 2-20. J-1587 To Flash Code Cross Reference

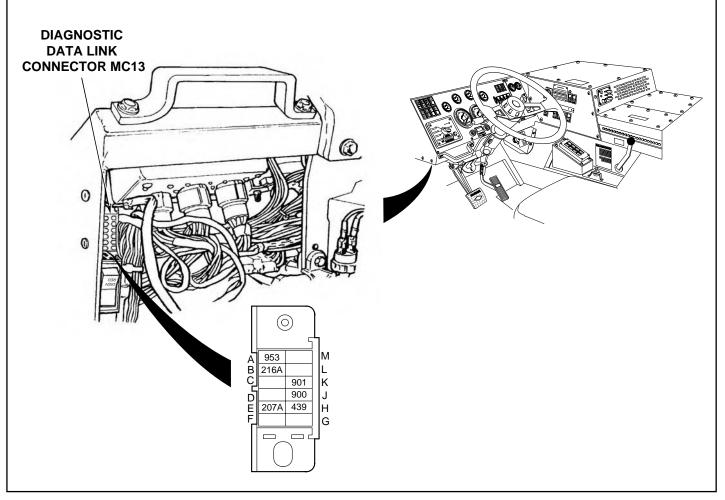
J-1587 CODE (SID - PID/FMI)	DESCRIPTION	FLASH CODE
S001 / 0	INJECTOR RESPONSE LONG #1 CYL	61
S002 / 0	INJECTOR RESPONSE LONG #2 CYL	61
S003 / 0	INJECTOR RESPONSE LONG #3 CYL	61
S004 / 0	INJECTOR RESPONSE LONG #4 CYL	61
S005 / 0	INJECTOR RESPONSE LONG #5 CYL	61
S006 / 0	INJECTOR RESPONSE LONG #6 CYL	61
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
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
P091 / 3	THROTTLE SENSOR CIRCUIT HIGH VOLTAGE	21
P091 / 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
P121 / 0	ENGINE OVERSPEED WITH ENG. BRAKE	76
P168 / 0	BATTERY VOLTAGE HIGH	75

Table 2-20. J-1587 To Flash Code Cross Reference (Cont.)

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	VERNIER CONTROL (VSG) CIRCUIT HIGH VOLTAGE	12
P187 / 4	VERNIER CONTROL (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*
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

<sup>\*</sup> See Table 2-19 for Troubleshooting Charts.

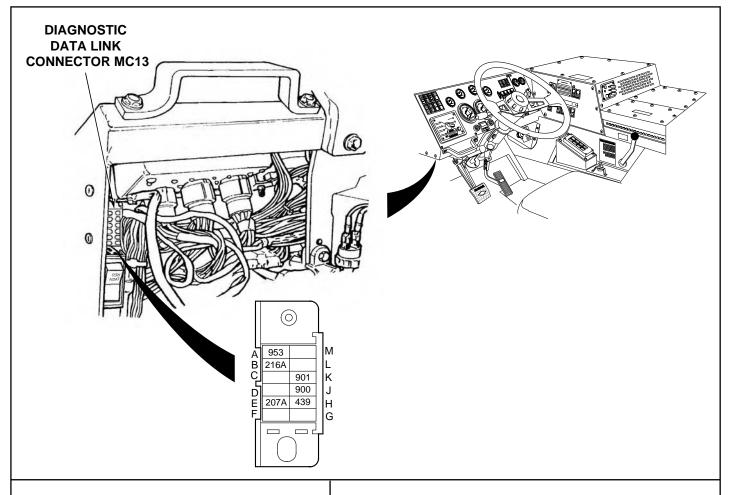


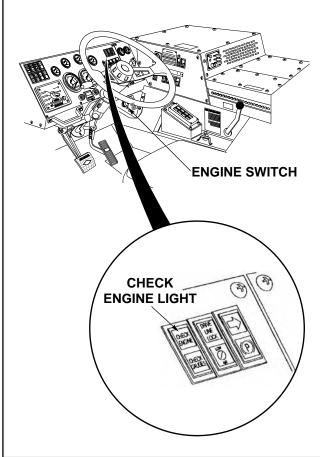


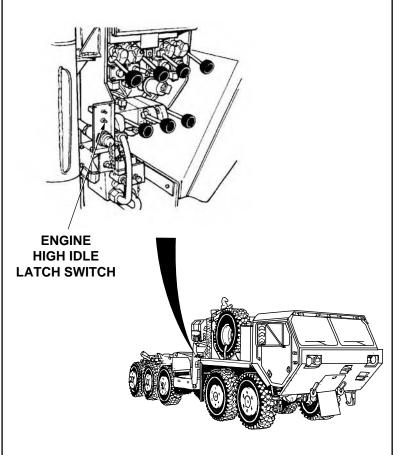
## Section IV. TROUBLESHOOTING CHARTS (Cont.)

## C. START - FIRST CHART FOR DIAGNOSIS OF DDEC III/IV USING DDR

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
START-1 Note "Check Engine/Check Gauges" Light		
<ul> <li>Turn ignition on while at the same time observing the "Check Engine/ Check Gauges" lights (engine not running).</li> </ul>	Light or lights—comes on and stays on.  Lights come—on for up to 5 seconds,	Go to START-2.  Go to START-3.
	then goes out.	Go to Chart 4, page 2-579. Go to START-7.
START-2 Read Active Codes Using DDR		
<ul> <li>Plug DDR into the DDL connector.</li> <li>Read active codes by selecting the DIAGNOSTIC CODE MENU (ACTIVE CODES) on the DDR.</li> </ul>	Active codes(other than "NO CODES") on DDR.  No active code	Follow appropriate diagnostic charts for code(s) received. (See Table 2-19).  Go to Chart 5, page 2-585.
(AOTIVE GODES) OIT the DDIT.	DDR display reads "NO DATA RECEIVED FROM SYSTEM" or "DDEC SYSTEM NOT RESPONDING".	
	DDR display isblank or random.	Go to START-9.





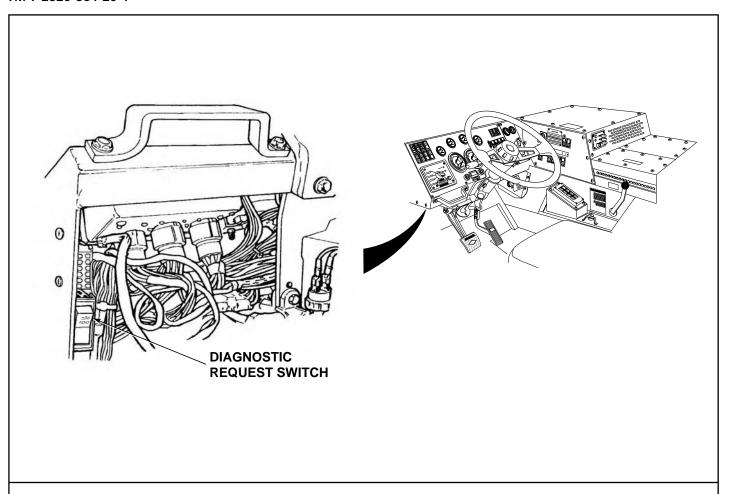


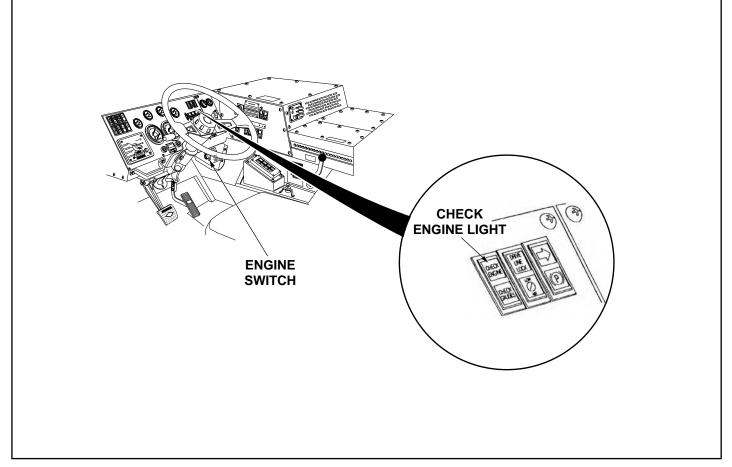
## Section IV. TROUBLESHOOTING CHARTS (Cont.)

## C. START - FIRST CHART FOR DIAGNOSIS OF DDEC III/IV USING DDR (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
START-3 Read All Codes Using DDR		
Plug DDR into DDL connector.	Codes 52, 110, 175/3, —— 174/3, or 190/0.	Follow appropriate diagnostic charts for code(s) received. (See Table 2-19).
<ul> <li>Read all inactive codes by selecting inactive codes on DDR.</li> </ul>	Any codes except ————————————————————————————————————	Go to START-4.
	No Codes.	Go to Chart 1, page 2-554.
	DDR display reads ————————————————————————————————————	→ Go to Chart 7, page 2-593.
	DDR display isblank or random.	→ Go to START-9.
START-4 Attempt to Make Codes Active		
*SEE NOTE BELOW*		
<ul> <li>Clear codes by selecting CLEAR CODES on the DDR.</li> <li>Attempt to start and run the engine (TM 9-2320-364-10).</li> </ul>	Engine will ————not start.	Go to Chart 2, page 2-557.
<ul> <li>Try to get the "Check Engine" light on by: <ul> <li>warming up the engine.</li> <li>slowly changing the RPM from idle to no load speed.</li> </ul> </li> <li>If truck is equipped with crane, push ENGINE HIGH IDLE LATCH switch to LATCH and release.</li> </ul>	"Check Engine" light is on.	Read active codes on DDR while light is on and follow the appropriate diagnostic chart in Table 2-19.
Run engine for 1 minute or until "Check Engine" light comes on.	"Check Engine" ————————————————————————————————————	Problem may be intermittent – See Chart 1, page 2-554, Step C 1-2.
	"Check Engine"	Go to START-5.

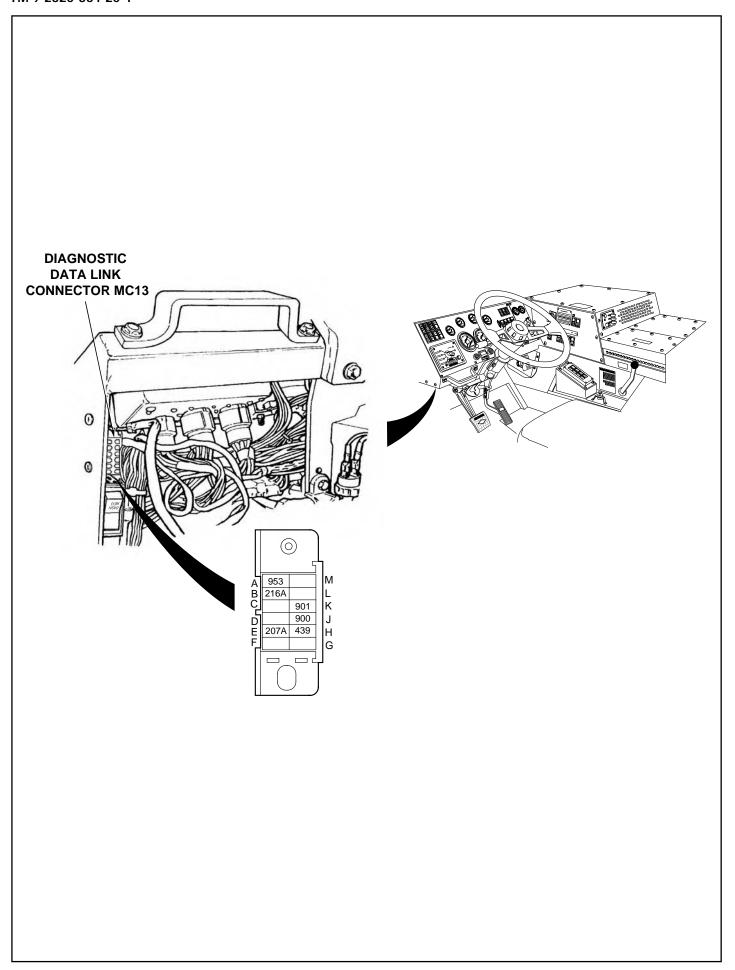
\*NOTE: If a potential engine damaging Code (i.e., 100/1) exists, monitor that parameter when running engine.





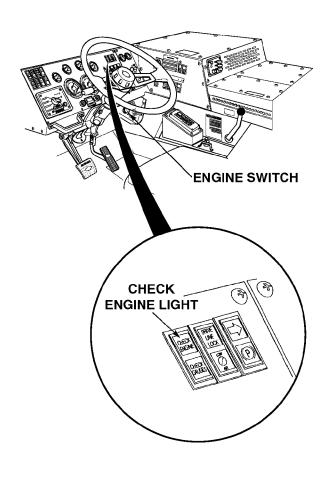
### C. START - FIRST CHART FOR DIAGNOSIS OF DDEC III/IV USING DDR (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
• Read inactive codes on DDR.		Follow appropriate diagnostic chart for codes received. (See Table 2-19).  Go to Chart 7, page 2-593.
	"NO DATA RECEIVED FROM SYSTEM" or "DDEC SYSTEM NOT RESPONDING".  DDR display is blank or random.	→ Go to START-9.
START-6 Read Codes on the "Check Engine" Light		
<ul> <li>Unplug the DDR.</li> <li>Ignition on.     Engine not running.     Depress and hold     diagnostic request switch.</li> <li>Read codes flashing out on the     "Check Engine" light.</li> </ul>	Flashes out — codes.  Does not flash — out codes.	To diagnose codes, follow appropriate diagnostic chart for codes received. (See Table 2-19). To diagnose DDR system, go to C 7-4, page 2-595.  Go to Chart 9, page 2-605.
START-7 Intermittent "Check Engine" Light		
Note whether flashing "Check Engine" light is reading a valid code or if it's just erratic.	Flashing a valid code.  Erratic or intermittent "Check Engine" light.	Go to START-8.  Go to Chart 1, page 2-554.



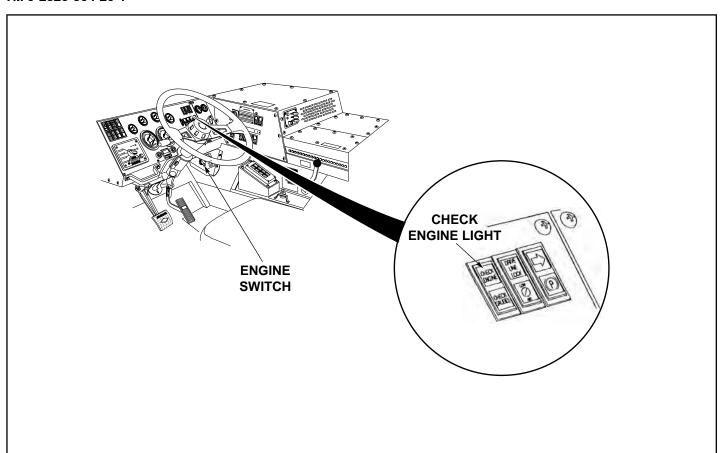
### C. START - FIRST CHART FOR DIAGNOSIS OF DDEC III/IV USING DDR (Cont'd)

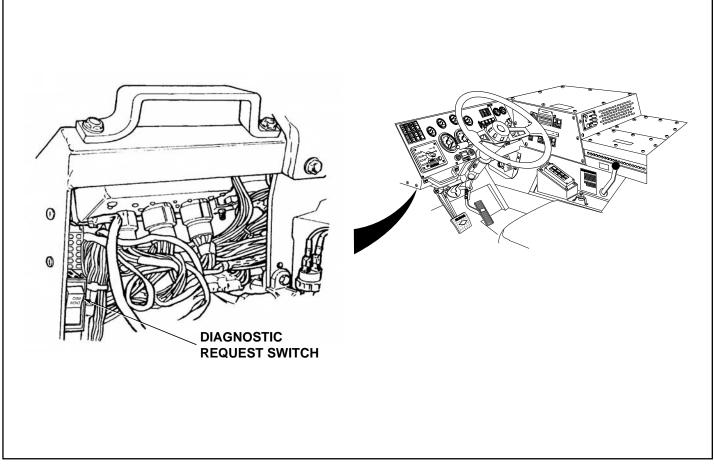
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
START-8 Check for Short		
<ul> <li>Plug DDR into Connector. Select SWITCH/LIGHT STATS on DDR.</li> <li>Read Diagnostic Request SW. status.</li> </ul>	ON. ————————————————————————————————————	Ckt #528 is shorted to ground. Repair short, then go to START-30.  Go to Chart 9, page 2-605.
START-9 Check for +12 Volts at DDR Connector		
<ul> <li>Turn ignition on.</li> <li>Read voltage at the DDR connector, from pin "H" (red lead) to pin "A" (black lead).</li> </ul>	Greater thanor equal to 10.0 volts.	There is a problem with either the DDR or the data link lines. Go to C 7-4, page 2-595. (For diagnosis of DDEC III/IV without a DDR, go to CEL-1 on page 2-549).
	Less than ————————————————————————————————————	Either the switched +12 volt line or the ground line is open to the DDR connector. Repair open. Then go to START-30.



# C. START - FIRST CHART FOR DIAGNOSIS OF DDEC III/IV USING DDR (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
START-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Turn ignition off.</li> <li>Turn ignition on.</li> <li>Observe the "Check Engine" light.</li> </ul>	"Check Engine"————————————————————————————————————	→ Repairs are complete.  All system diagnostics are complete. Please review this section from the first step to find the error.
	"Check Engine" light comes on and stays on.	Go to START-1, pg 2-539.



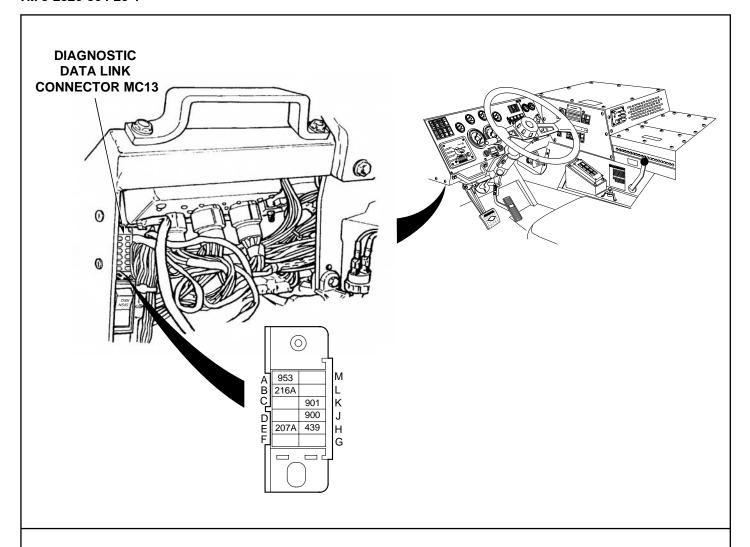


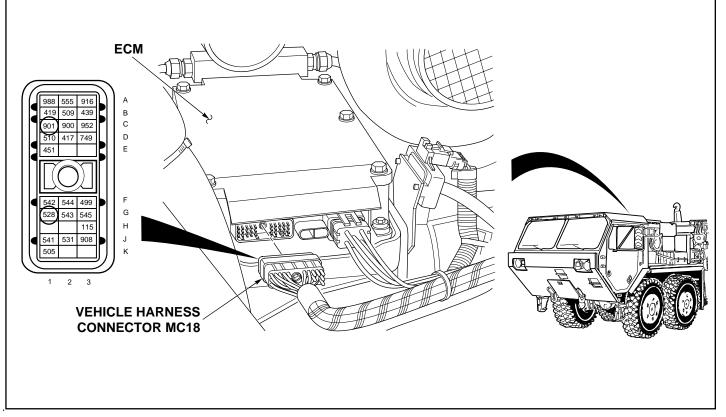
### **Section IV. TROUBLESHOOTING CHARTS (Cont.)**

#### C. CEL - FIRST CHART FOR DIAGNOSIS OF DDEC III/IV WHEN NO DDR IS AVAILABLE

**NOTE**: Although this section will help you get started, later sections of the Troubleshooting Guide may require using a DDR.

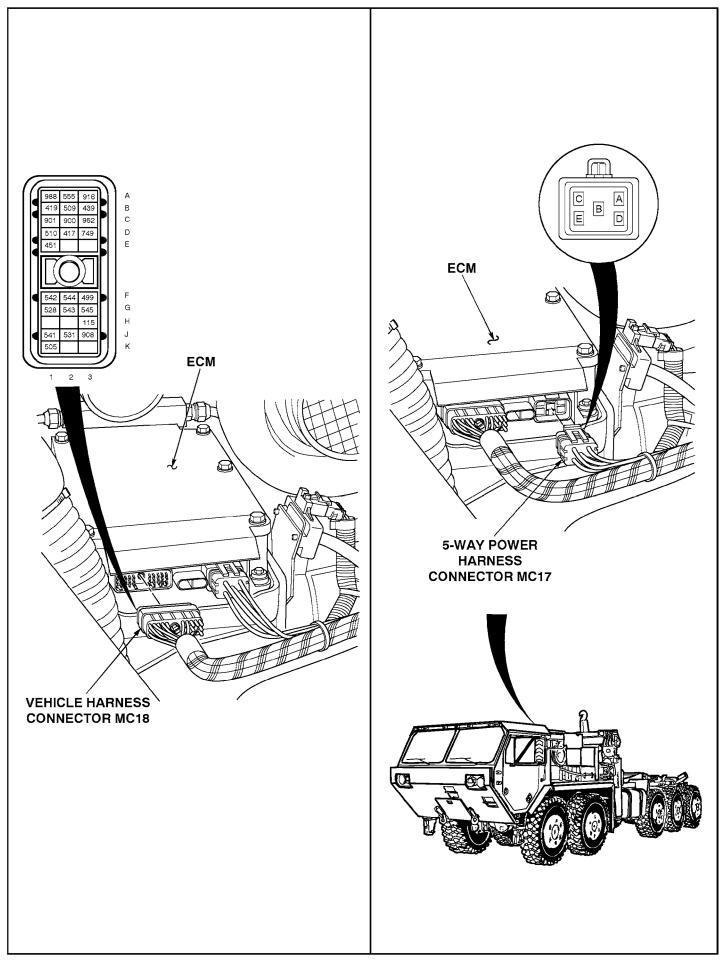
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Note "Check Engine" Light      Turn ignition on while at the same time observing the "Check Engine" light.	Light comes onand stays on.  Light comes on for up to	
	5 seconds, then goes out.	Go to Chart 4, page 2-579.
Turn ignition on.     Depress and hold the diagnostic request switch.	"Check Engine"light is always on but doesn't flash out codes. "Check Engine"light never comes on.	→ Go to CEL-3.  Go to Chart 6, page 2-589.  Go to CEL-6.
• Note and record code(s).	Flash Codes 14, 15, 23, 44, or 85.  Any flash codes except 14, 15, 23, 44, or 85.  Flash code 25 (No codes.)	<ul> <li>Follow appropriate diagnostic charts for the code(s) received. (See Table 2-19.)</li> <li>Go to CEL-4.</li> <li>If drive complaint persists, go to Chart 1, page 2-554.</li> </ul>





# C. CEL - FIRST CHART FOR DIAGNOSIS OF DDEC III/IV WHEN NO DDR IS AVAILABLE (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>CEL-4 Verify Code(s)</li> <li>Turn ignition on.</li> <li>Obtain a DDR.</li> <li>Clear codes.</li> <li>Turn ignition off then back on.</li> <li>Note status of "Check Engine" light.</li> </ul>	"Check Engine" light stays on.  "Check Engine" light goes on for 5 seconds, then goes out.  "Check Engine" light light is erratic or intermittent.	Read codes and follow appropriate diagnostic chart (see Table 2-19).  Go to CEL-5.  Go to CEL-8.
CEL-5 Verify Code(s) with the Engine Running  • Attempt to start and run the engine (TM 9-2320-364-10).  • Try to get the "Check Engine" light on by:  - warming up the engine  - slowly changing the engine from idle to no load speed.  • Run engine until the "Check Engine" light comes on or for	Engine will	→ Go to Chart 2, pg 2-557.  → Previous codes should be regarded as intermittent. Go to Chart 1, pg 2-554.  → Read codes.
1 minute.  CEL-6 Check for Open	light is on.	Follow appropriate diagnostic code chart, Table 2-19.
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector at the ECM.</li> <li>Install a jumper wire between sockets C1 and G1 of the vehicle harness connector.</li> <li>Also read resistance between pin A of DDL connector and a good ground.</li> </ul>	Less than or equal to 5 ohms on either reading.  Greater than 5 ohms or open on either reading.	An open exists either in the diagnostic request line (ckt #528) or in the DDR ground line (ckt #901). Repair open. Then go to CEL-30.



#### C. CEL - FIRST CHART FOR DIAGNOSIS OF DDEC III/IV WHEN NO DDR IS AVAILABLE (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
CEL-7 Check ECM Connectors		
<ul> <li>Disconnect the 5-way power harness connector at the ECM.</li> <li>Check terminals at both the 5-way power harness connector, and vehicle harness connector (both the ECM and harness side) for damage; bent, corroded and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to CEL-30.  Repair terminals/connectors (para 7-101). Then go to CEL-30.
CEL-8 Intermittent Check		
Note whether flashing "Check Engine" light is reading a valid code or if it's just erratic.	Flashing a valid code.  Erratic or intermittent "Check Engine" light.	Go to CEL-9.  Go to Chart 1, page 2-554.
CEL-9 Check for Short		
<ul> <li>Plug DDR into DDL connector. Select SWITCH/LIGHT STATS on DDR.</li> <li>Read Diagnostic Request SW. status.</li> </ul>	ON	Circuit #528 is shorted to ground. Repair short, then go to CEL-30.  Go to Chart 5, page 2-585.
CEL-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Turn ignition off.</li> <li>Turn ignition on while at the same time observing the "Check Engine" light.</li> </ul>	"Check Engine"————————————————————————————————————	<ul> <li>Repairs are complete.</li> <li>All system diagnostics are complete. Please review this section from the first step to find the error.</li> </ul>
	"Check Engine"————————————————————————————————————	Go to START-1, page 2-539.

### Section IV. TROUBLESHOOTING CHARTS (Cont.)

#### D. CHART -1 - INTERMITTENT CODE OR A SYMPTOM AND NO CODES

NOTE: This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, page 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 1-1 Diagnosis by Symptom		
Turn ignition off.	Intermittentcode.	Go to Chart 1, page 2-554.
<ul> <li>Go to appropriate result in the next column based on engine symptom.</li> </ul>	Engine cranks ————but will not start.	Go to Chart 2, page 2-557.
	Erratic performance ——— and No Codes.	Go to Chart 3, page 2-577.
	No "Check Engine" ————————————————————————————————————	Go to Chart 4, page 2-579.
	"Check Engine" light always on and No Codes.	Go to Chart 5, page 2-585.
	"Check Gauges"————————————————————————————————————	Go to Chart 6, page 2-589.
	No data to DDR.	Go to Chart 7, page 2-593.
	No "Check Gauges" light during bulb check.	Go to Chart 8, page 2-599.
	Diagnostic requestswitch inoperative.	Go to Chart 9, page 2-605.
	Vernier Control (VSG)——inoperative.	Go to Chart 10, page 2-609.

#### D. CHART -1 - INTERMITTENT CODE OR A SYMPTOM AND NO CODES (Cont'd)

#### STEP/SEQUENCE

# C 1-2 Diagnosis of an Intermittent Code or Symptom

NOTE: Do not use any other procedures in this manual (except for the suggestions listed below) when trying to solve an intermittent problem. Use of any other procedures for this kind of problem can result in the replacement of non-defective parts.

Many intermittent problems are caused by faulty electrical connectors or wiring. Diagnosis must include a careful inspection of the indicated circuit wiring and connectors. Example: an intermittent Code 35 (Oil Pressure Sensor High) should cause suspicion of a problem in the following areas associated with the Oil Pressure Sensor.

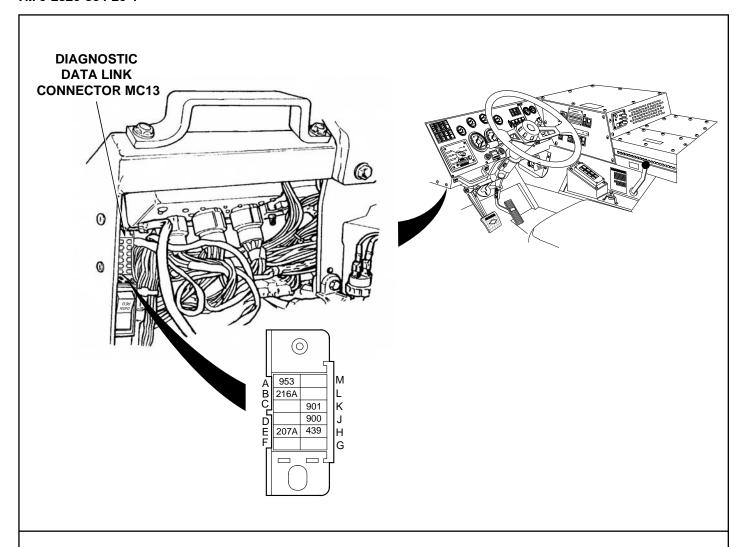
- 1. Wire #'s 530 (signal line), 416 (+5 volt line) or 452 (ground line).
- 2. The Oil Pressure Sensor connector or ECM connector.
- 3. An intermittent in the Oil Pressure Sensor (least likely).

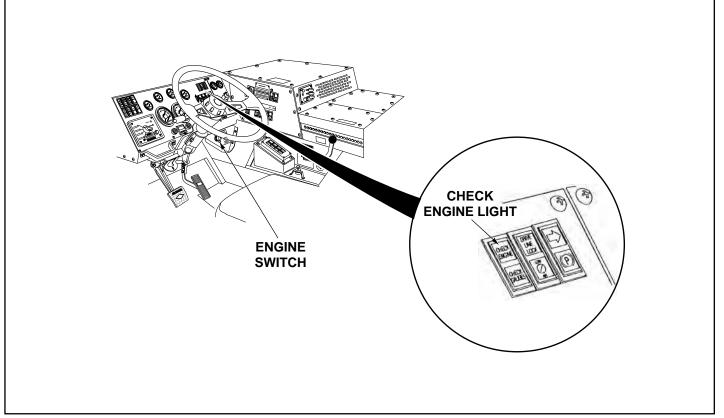
A good check list to run through includes the following:

- 1. Check for poor mating of the connector halves or terminals not fully seated in the connector body ("backed-out" terminals).
- 2. Look for improperly formed or damaged terminals. All connector terminals in the problem circuit should be carefully reformed to contact tension.
- 3. Electrical system interference caused by a defective relay, ECM driven solenoid, or a switch causing an electrical surge. Look for problems with the charging system (alternator, etc.). In certain cases, the problem can be made to occur when the faulty component is operated (as in the case of a relay).

After repairs or adjustments have been made, clear the codes and confirm that the "Check Engine" light does not come on (except for the 5 second bulb check when the ignition is first turned on). Also run the engine to see if that problem is cured. If the "Check Engine" light stays on, refer to the START-1 Chart on page 2-539.

Refer to the DDR instructions manual. Using the "Snapshot" function may assist in isolating the cause for the problem. This function is useful in troubleshooting many areas of the DDEC System.





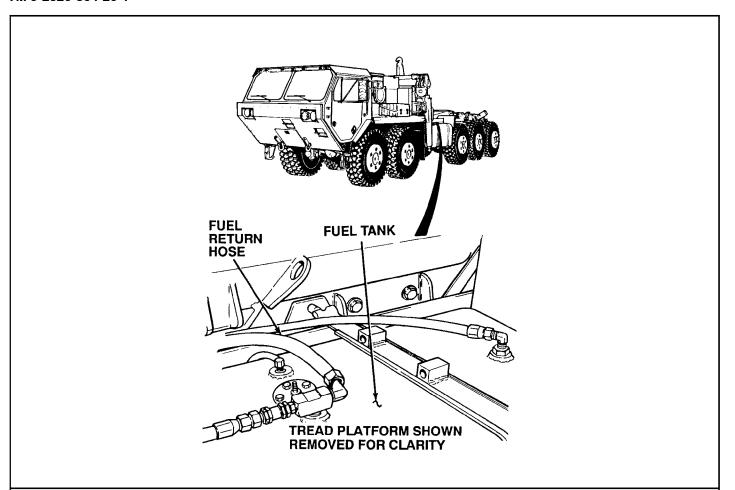
### Section IV. TROUBLESHOOTING CHARTS (Cont.)

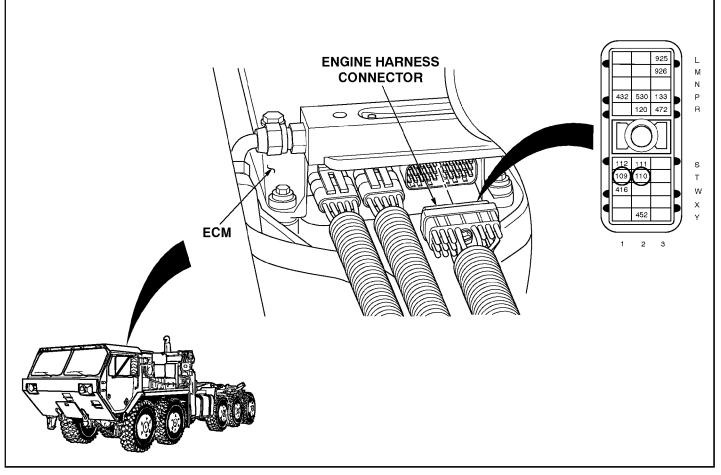
#### D. CHART -2 - ENGINE CRANKS BUT WILL NOT START

NOTE: This chart is only to be used if:

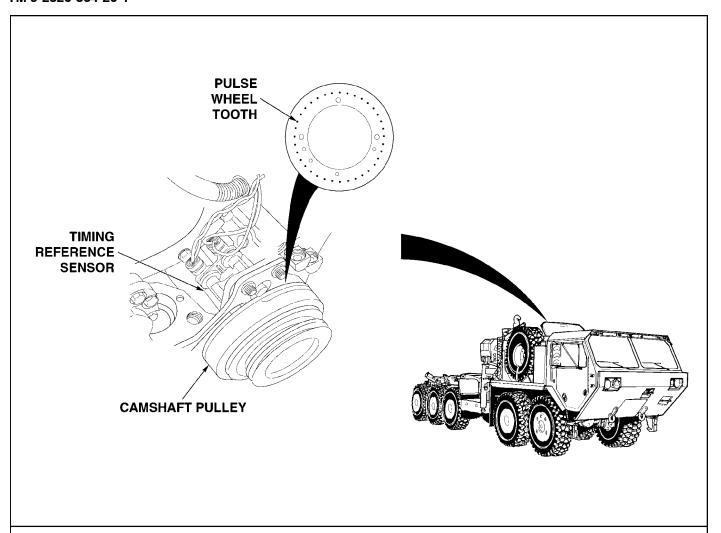
- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

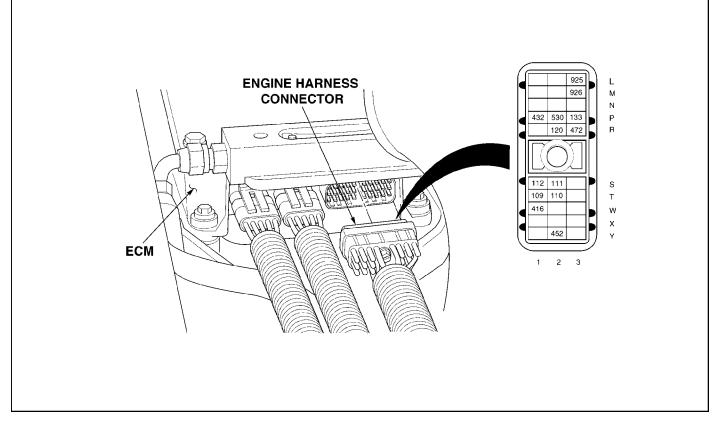
STEP/SEQUENCE		RESULT	WHAT TO DO NEXT
C 2-1 Observe " Light Stat	Check Engine" us		
Turn ignition on w the "Check Engin		"Check Engine" light comes on for up to 5 seconds, then goes out.	Go to C 2-3.
		"Check Engine" ————————————————————————————————————	— <b>→</b> Go to C 2–17.
		"Check Engine"————————————————————————————————————	Go to C 2-2.
C 2-2 Read Acti	ive Codes Using		
<ul> <li>Plug DDR into the</li> <li>Read active code (ACTIVE CODES</li> </ul>	s by selecting	Active codes on DDR.	Follow appropriate diagnostic charts for code(s) received. (See Table 2-19.)
		No codes.	Go to C 5-1.
		Display reads "NO DATA - RECEIVED FROM SYSTEM or DDEC SYSTEM NOT RESPONDING" or a blank or random display.	Go to START-6, page 2-543.
C 2-3 Check if C	Out of Fuel		
Check fuel supply	<i></i>	Fuel supply okay	Go to C 2-4.
		No fuel.	Refuel vehicle. May have to prime system (TM 9-2320-364-10). Then go to C 2-30.



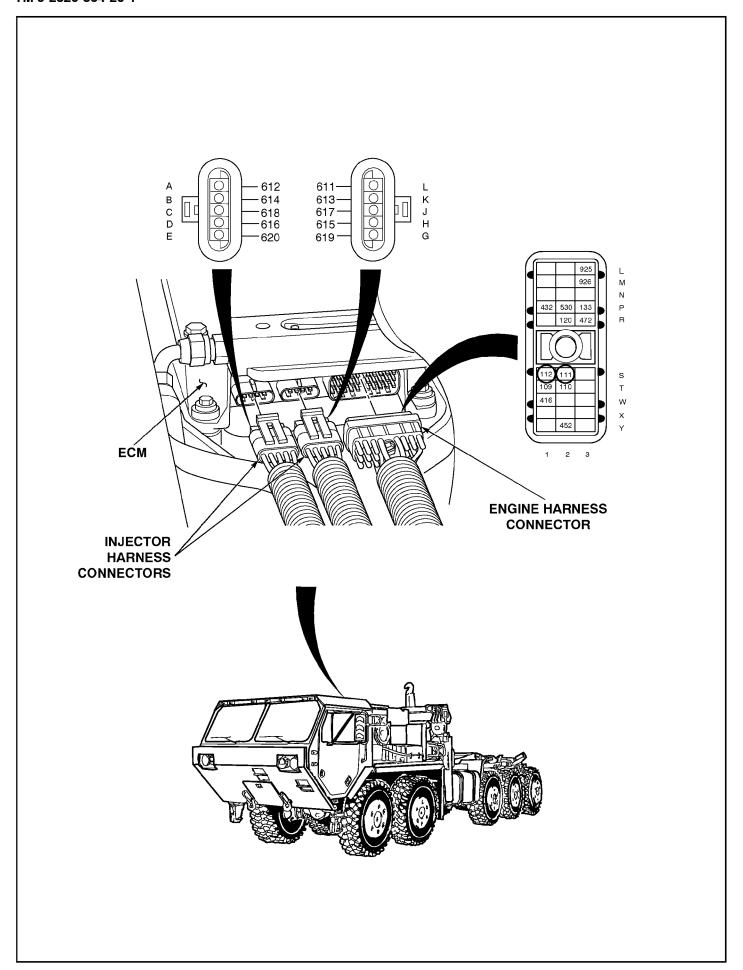


STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 2-4 Check for Aerated Fuel		
<ul> <li>Loosen fuel return line.</li> <li>Observe fuel flow out of line while cranking. (You can direct the fuel into a bucket.)</li> </ul>	Flow is steady.  No flow or intermittent flow.	Go to C 2-5.  Check fuel filter(s) and supply lines to determine cause of problem (refer to Chapter 2, Vehicle Troubleshooting, for details).
C 2-5 Check for White Smoke		
<ul> <li>Reconnect fuel return line.</li> <li>Look for white smoke coming out of the exhaust stack while cranking the engine.</li> </ul>	White smoke.  No white smoke.	Your problem appears to be with cylinder compression or restricted air intake. Notify supervisor.  Go to C 2-31.
C 2-6 Check TRS Status via RPM Read-out		
Select ENGINE RPM on DDR.     Crank engine while observing DDR display. (NOTE: Battery voltage surge while cranking with electric starters may blank out or reset DDR.)	Display alwaysreads greater than or equal to 60 RPM while cranking.  Display sometimes or always reads less than 60 RPM while cranking.	Go to C 2-12.  Go to C 2-7.
C 2-7 Check TRS		
<ul> <li>Turn ignition off.</li> <li>Disconnect engine harness connector at the ECM.</li> <li>Read resistance between sockets T1 and T2 at the engine harness connector.</li> </ul>	Between 100and 200 ohms.  Less than100 ohms.  Greater than200 ohms.	Go to C 2-8.  Go to 41-2.  Go to 41-3.

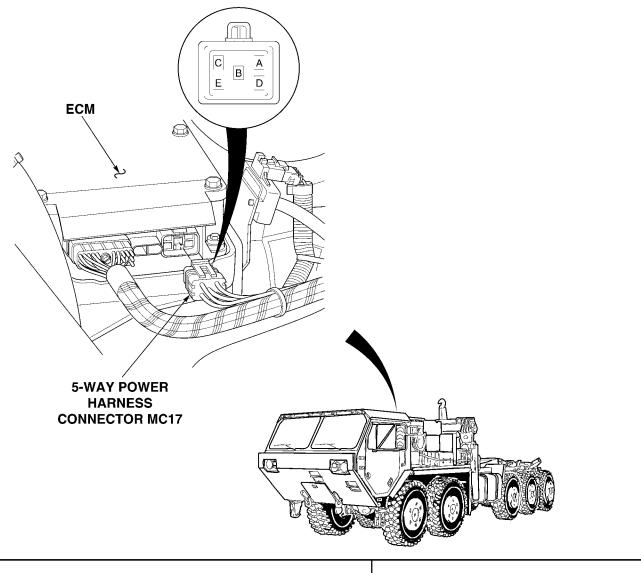


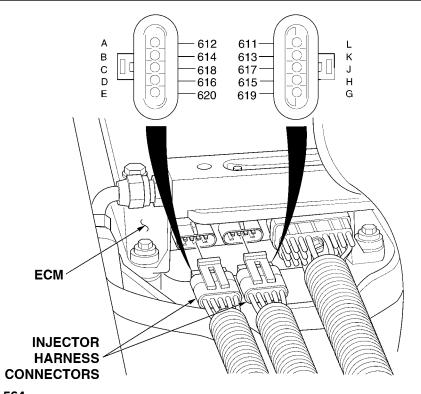


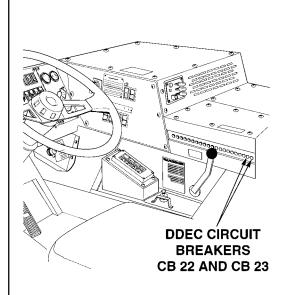
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 2-8 Check TRS/SRS Gap		
<ul> <li>Remove ECM (para 7-57).</li> <li>Turn camshaft counterclockwise until the TRS is over a TRS "tooth" of the pulse wheel.</li> <li>Tap the front of the camshaft rearward with a soft hammer (to remove camshaft end play).</li> </ul>	Incorrect gap.	Loosen the screw at the top of the TRS/SRS mounting bracket. (Don't touch the two screws that go into the block front end plate-they will affect engine timing.) Adjust the TRS/SRS until the gap setting is correct. Tighten screw. (If problems returns, pulse wheel may be loose or bad, notify supervisor.) Then go to C 2-30.
<ul> <li>Using a feeler gauge check gap between the pulse wheel teeth and TRS (nominal gap is 0.020" or 0.5 mm).</li> </ul>	Gap settingis correct.	Go to C 2-10.
C 2-10 Check Pulse Wheel		
<ul> <li>Inspect DDEC pulse wheel for:         <ul> <li>Loose wheel.</li> <li>Chipped or missing teeth.</li> </ul> </li> </ul>	Pulse wheel OK	Go to C 2-11.  Pulse wheel requires repair or replacement. Notify supervisor.
C 2-11 Check ECM Connectors		
<ul> <li>Turn ignition off.</li> <li>Disconnect all connectors at the ECM.</li> <li>Check terminal at all ECM connectors (both the ECM and harness side) for damage; bent, corroded and unseated pins or sockets.</li> </ul>	Terminal andconnectors are okay.  Problem found	Replace ECM (para 7-57). Then go to C 2-30.  Repair terminals/connectors (para 7-101). Then go to C 2-30.



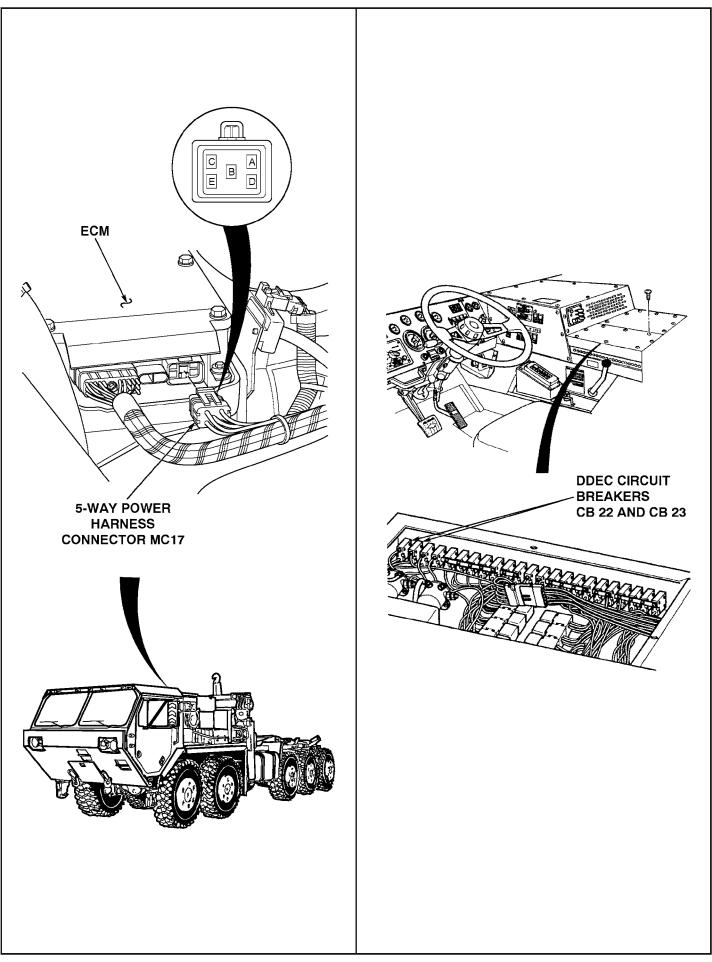
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 2-12 Check for Good SRS Signal  Select engine data list on DDR. Crank engine while observing DDR display of "SRS RECEIVED". (NOTE: Battery voltage surges while cranking with electric starters may blank out or reset DDR.)	Display reads SRS RECEIVED while cranking. Display does not read SRS RECEIVED while cranking.	Go to C 2-14.  Go to C 2-13.
C 2-13 Check SRS		
<ul> <li>Turn ignition off.</li> <li>Disconnect engine harness connector at the ECM.</li> <li>Read resistance between sockets S1 and S2 at the engine harness connector.</li> </ul>	Between 100 and 200 ohms.  Less than 100 ohms.  Greater than 200 ohms.	Go to C 2-8.  Go to 41-2, page 2-695.  Go to 41-2, page 2-695.
C 2-14 Check if Injector Return Wires are Open		
<ul> <li>Turn ignition off.</li> <li>Disconnect both injector harness connectors at the ECM.</li> <li>Read resistance between the injector return pin and all the power driver pins on both harness connectors (example: G to L, E to A, E to B, G to K, etc.).</li> <li>Circuits 620 and 619 are common.</li> </ul>	Less than or equal to 5 ohms for any reading.  Greater than 5 ohms on any reading.	An open exists in one of the injector power driver or return wires. Repair open. Then go to C 2-30.



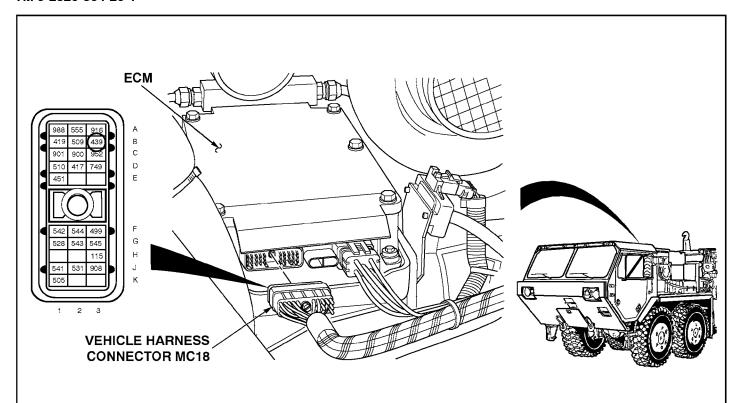


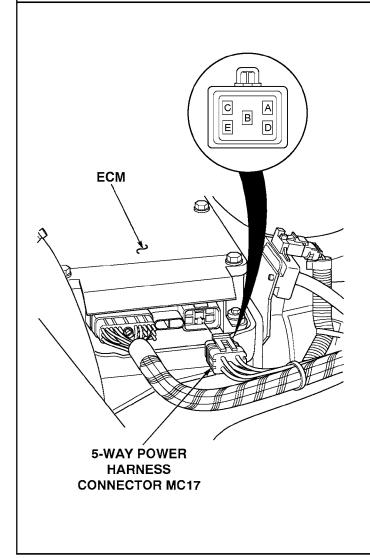


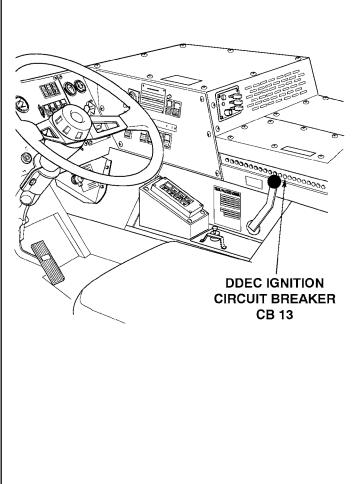
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 2-15 Check if Injector Drive or Return Lines are Shorted to Ground		
<ul> <li>Disconnect the 5-way power harness connector at the ECM.</li> <li>Read resistance between socket D of the 5-way power harness connector to the following sockets on the injector harness connectors: A, B, C, D, E, G, H, J, K, and L.</li> </ul>	Greater than or equal to 10,000 ohms or open on all readings.  Less than 10,000 ohms on any reading.	A short to ground on wire where resistance was less than 10,000 ohms. Repair short. Then go to C 2-30.
C 2-16 Injector Drive Pulses		
<ul> <li>Turn ignition off.</li> <li>Reconnect all ECM connectors.</li> <li>Remove rocker arm cover(s) (para 3-4 and 3-5).</li> <li>Place a 6 volt test light across the injector return side (return wire #619 or #620) and a good ground.</li> <li>Crank engine and note if the test light flashes.</li> <li>Reconnect the return wire.</li> <li>Repeat the above procedure with all other injectors until all have been tested or until one test fails.</li> </ul>	All tests pass.  Light not flashing for one or more tests.	The problem does not appear to be in the DDEC system. Refer to Chapter 2, Vehicle Troubleshooting, for other possible causes of a no-start condition.  Go to C 2-11.
C 2-17 Check DDEC Circuit Breakers		
Check two DDEC circuit breakers (CB22 and CB23).	Open circuit breaker(s).  Circuit breakers are okay.—	



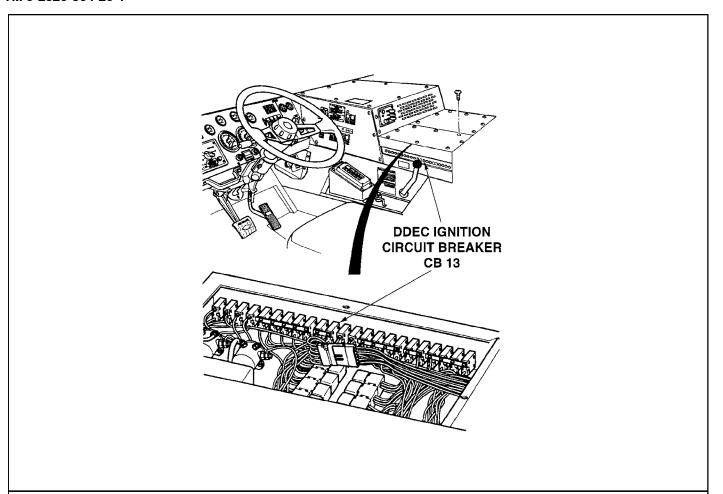
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 2-18 Check for Battery Volts at the 5-way Power Harness Connector		
<ul> <li>Turn ignition off.</li> <li>Disconnect the 5-way power harness connector.</li> <li>Read voltage from socket A (red lead) of 5-way power harness connector to a good ground (black lead).</li> <li>Also read voltage from socket C (red lead) to a good ground (black lead).</li> </ul>	Less than  11.5 volts on any reading.  Greater than 11.5 volts on all readings.	Go to C 2-19.  Go to C 2-21.
C 2-19 Check if ECM Power Line(s) are Open.		
<ul> <li>Read voltage between battery side of DDEC circuit breaker CB22 (red lead) and a good ground (black lead).</li> <li>Read voltage reading at DDEC circuit breaker CB23. (NOTE: Battery side does not contain #240 or #241 wires.)</li> </ul>	Less than 11.5 volts on either reading.  Greater than 11.5 volts on both readings.	Go to C 2-20.  An open exists in either Power line (ckt #240) or (ckt #241). Repair open. Then go to C 2-30.
C 2-20 Check Battery		
<ul> <li>Connect all connectors.</li> <li>Turn ignition on.</li> <li>Try to start engine.</li> <li>Read voltage at battery + terminal (red lead) to the battery - terminal (black lead).</li> </ul>	Less than 10.0 volts.	Service discharged battery (TM 9-6140-200-14). (NOTE: If a short to ground exists anywhere in a battery + circuit, the engine will shut down again if not repaired.) Then go to C 2-30.
	Greater than or equal to 10.0 volts.	An open or short to ground exists in the Batt + line. Repair open or short to ground. Then go to C 2-30.

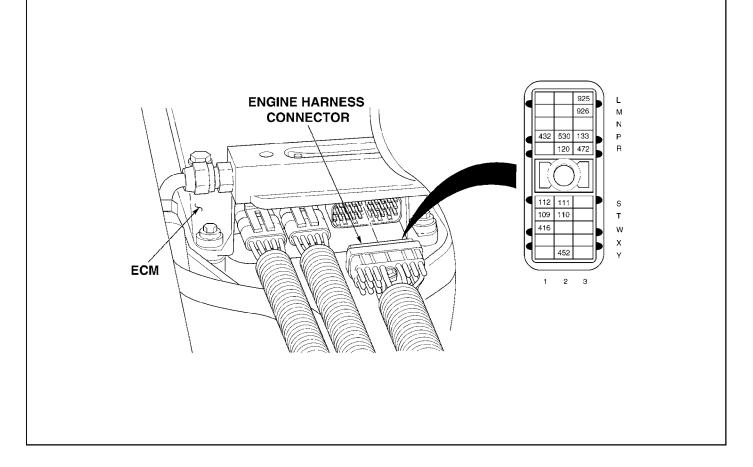




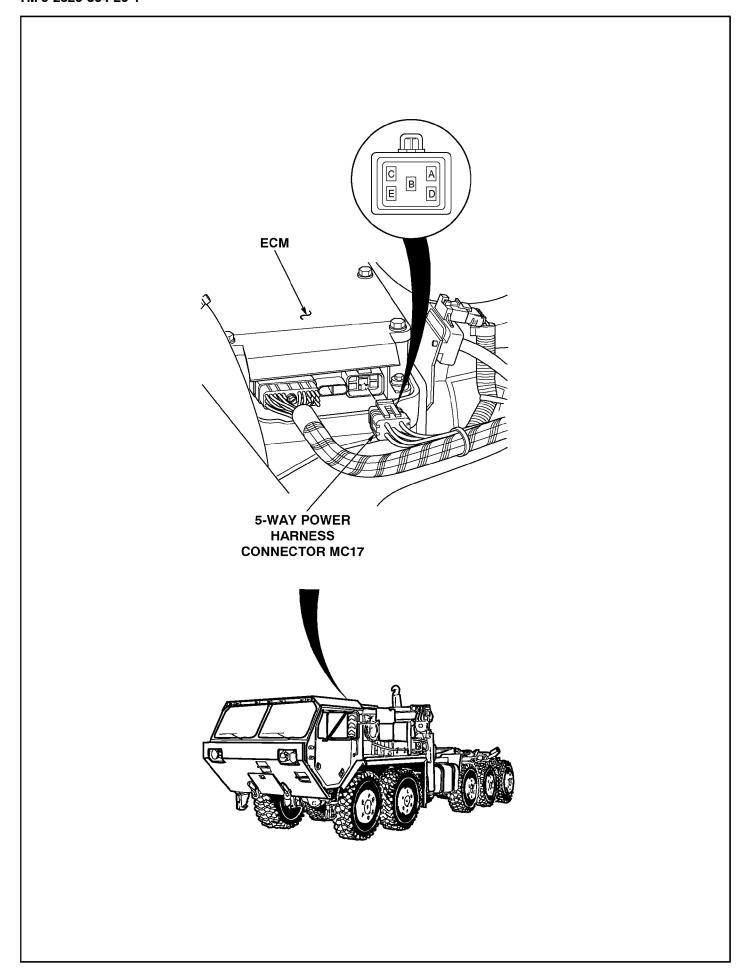


STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 2-21 Check for +12 or +24 Volts at Ignition Wire		
<ul> <li>Turn ignition off.</li> <li>Disconnect vehicle harness connector at ECM.</li> <li>Turn ignition on.</li> <li>Read voltage between socket B3 on the vehicle harness connector (red lead) and a good ground (black lead).</li> </ul>	Less than 11.5 volts.  Greater than or equal to 11.5 volts.	Go to C 2-23.  Go to C 2-22.
C 2-22 Check for Good Ground Wire		
Read voltage between socket B3 on vehicle harness connector (red lead) and socket D and E on 5-way power harness.	Less than 11.5 volts.  Greater than or equal to 11.5 volts.	ECM ground wire (ckt #150) is open or has a poor connection. Repair open or poor connection. Then go to C 2-30.  Go to C 2-11.
C 2-23 Check if Ignition Circuit Breaker is Okay  Turn ignition off. Check DDEC ignition circuit breaker (CB13).	Circuit breakeris okay. Circuit breaker open	

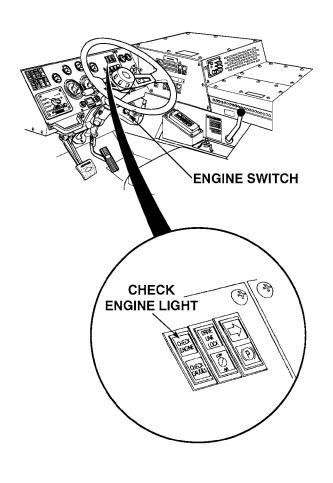




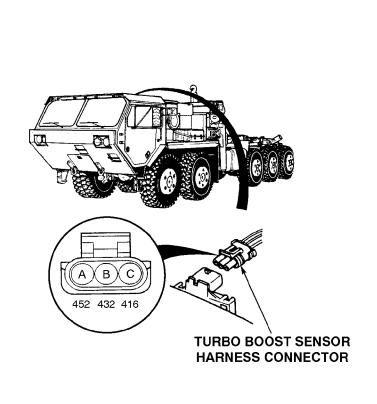
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 2-24 Check if Ignition Wire (Circuit #2) is Open  • Read voltage between battery side (hot side) of the DDEC ignition circuit breaker (CB13) (red lead) and a good ground (black lead).	Less than 11.5 volts.  Greater than or equal to 11.5 volts.	Go to C 2-27.  Ignition line (ckt #439) is open. Repair open. Then go to C 2-30.
C 2-25 Check if Ignition Wire is Shorted to Ground  • Reset open circuit breaker.  • Turn ignition on for at least 10 seconds.  • Turn ignition off.  • Check DDEC ignition circuit breaker (CB13) again.	Circuit breaker is still okay.  Circuit breaker open.	Go to C 2-26.  Ignition line (ckt #439) is shorted to ground. Repair short. Then go to C 2-30.
C 2-26 Check if Ignition Circuit Breaker is Okay   Reconnect all harness connectors at ECM. Attempt to start. If engine starts, run engine for at least one minute. Turn ignition off. Check DDEC ignition circuit breaker (CB13).	Circuit breakeris still okay.  Circuit breaker open	No short is currently present. (WARNING: If there is an intermittent short, engine will shut down again if not repaired. Also note circuit breaker may have blown due to temporary reverse voltage at the battery.) Go to C 2-30.  Go to C 2-11.

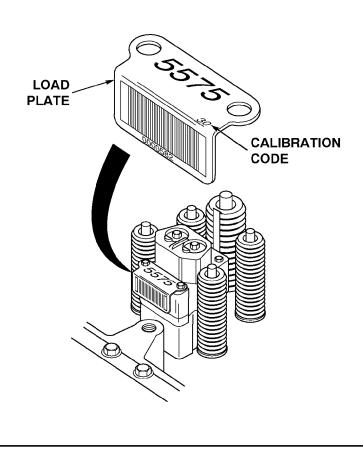


STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Disconnect battery cables at battery (para 7-87).     Read voltage at battery + terminal (red lead) to battery - terminal (black lead).	Less than 11.5 volts.  Greater than or equal to 11.5 volts.	Service discharged battery (TM 9-6140-200-14). (NOTE: If a short to ground exists anywhere in battery + circuit, this vehicle will shut down again if not repaired.) Then go to C 2-30.  An open or short to ground exists in unfused ignition line (ckt #1866). Repair open or short to ground. Then go to C 2-30.
C 2-28 Check if Fuses Blow Again		
<ul> <li>Turn ignition off.</li> <li>Disconnect the 5-way power harness connector at ECM.</li> <li>Reset DDEC circuit breaker(s).</li> <li>Wait 10 seconds.</li> <li>Check if circuit breaker(s) has blown or opened up again.</li> </ul>	Circuit breaker(s) are still okay.  Circuit breaker(s) are blown or open again.	
C 2-29 Check for Short to Ground in Wiring		
<ul> <li>Read resistance between (ckt #240) and a good ground.</li> <li>Read resistance between (ckt #241) and a good ground.</li> </ul>	Greater than or equal to 10,000 ohms or open on all readings.  Less than 10,000 ohms on any reading.	Go to C 2-11.  Short to ground exists. Repair short(s). Then go to C 2-30.



STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 2-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine"</li> </ul>	Engine will not start.	All system diagnostics are complete. Please review this section from the first step to find error.
light.  If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) for 1 minute	Engine starts and DDR reads No Codes.	Repairs are complete.
or until "Check Engine" light comes on. Stop engine.  • Read inactive codes.	Engine starts codes appear.	Go to START-1, pg 2-539, to service codes.
C 2-31 Check Fuel Filters		
<ul> <li>Turn ignition off.</li> <li>Check primary and secondary fuel filters to be sure they are not clogged and that they are full of clean fuel.</li> </ul>	Clogged filter(s).	Service fuel/water separator (para 4-15). Replace secondary filter (para 4-13). Prime system (TM 9-2320-364-10), if required. Then go to C 2-30.
	Clean filters and ———— no air in filters.	→ Go to C 2-6.



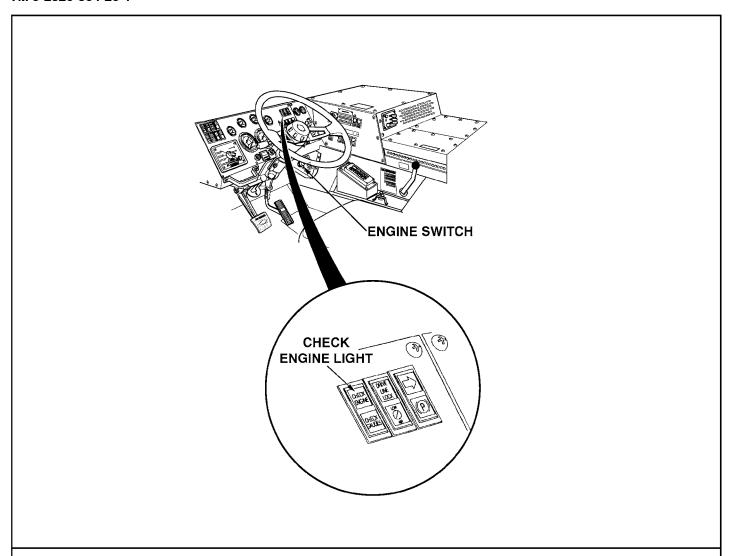


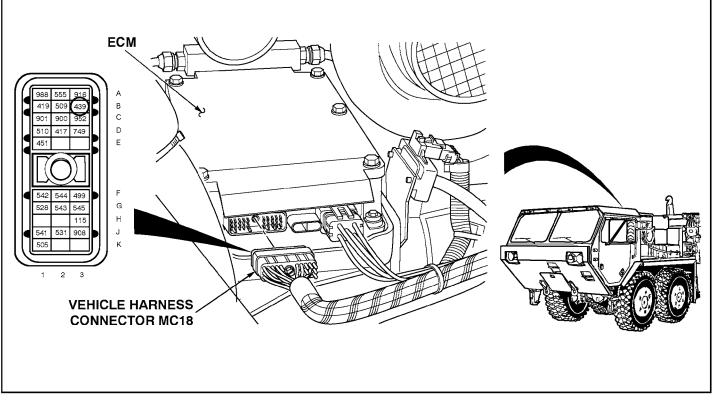
### **Section IV. TROUBLESHOOTING CHARTS (Cont.)**

#### D. CHART -3 - ERRATIC PERFORMANCE AND NO CODES

This is a helpful hints chart. It assumes that you have received no codes, made all the basic mechanical checks first, could not find the problem, and suspect the DDEC III/IV system to be at fault. Based on the particular symptom here's what to look for:

SYMPTOM	WHAT TO LOOK FOR
1. Can't get full power.	Plugged fuel filters (para 4-13 and 4-17). Hose not connected to Turbo Boost Sensor (TBS). Verify injector calibration(s) are correct: Remove rocker covers (para 3-4 and 3-5). Record the injector calibration codes found on the injector load plate for each injector. Compare the calibration codes with those on the DDR FUEL INJECTOR CAL display. Update calibration codes if necessary. See Section V for additional details. Install rocker covers (para 3-4 and 3-5).
2. Can't get full throttle.	Incorrect Throttle Position Sensor (TPS) counts. See Step 21-4 for details (page 2-643).
3. Runs rough, misses and/or occasionally stalls.	<ul> <li>Proper gapping of Timing Reference &amp; Synchronous Reference Sensors (TRS and SRS). See Step C 2-8 (page 2-561) on how to check this.</li> <li>Check for Fuel Leaks.</li> <li>Loose battery power (ckt #240 or #241), ignition (ckt #439), or ground (ckt #150) wires.</li> <li>Check power contribution from each cylinder using cylinder cut-out feature described in Diagnostic Data Reader (DDR) instruction manual.</li> <li>Check pulse wheel: missing teeth, damaged or loose.</li> <li>Check for signs of insulation wear on injector harnesses.</li> </ul>
4. Engine idles high (after warm-up) or slow return to idle.	<ul> <li>Check calibration of Throttle Position Sensor (TPS) using procedure in Step 21-4 (page 2-643). You may have a TPS or pedal problem.</li> <li>Check vernier control signal line (ckt #525) for short to voltage source.</li> </ul>





#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

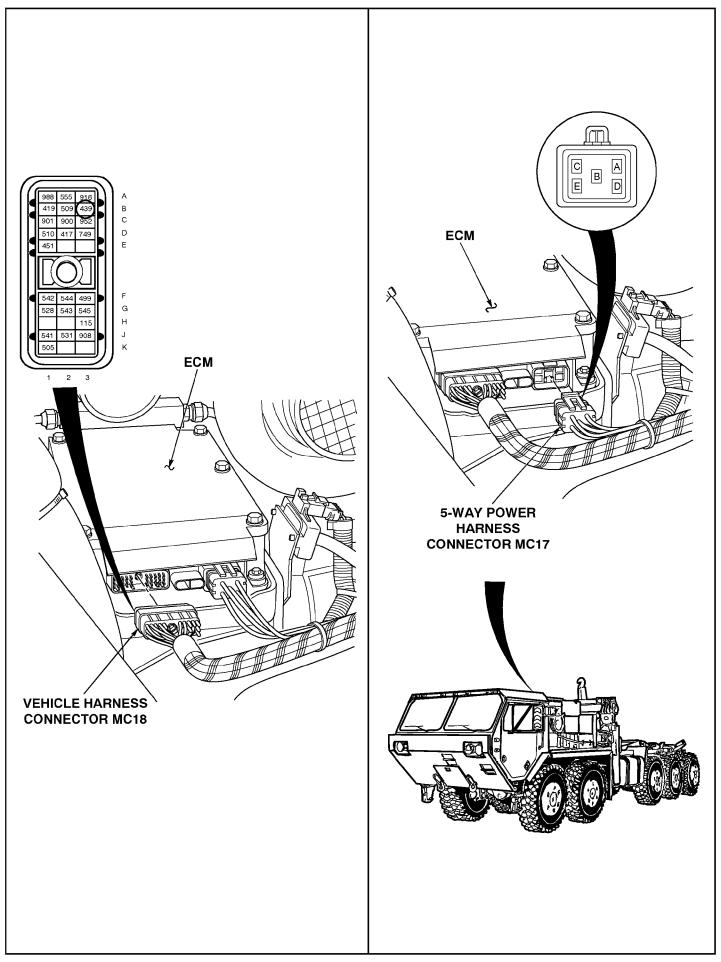
#### D. CHART -4 - NO "CHECK ENGINE" LIGHT DURING BULB CHECK OR CANNOT CLEAR CODES

**NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg. 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>C 4-1 Try to Force CEL On</li> <li>Plug in DDR.</li> <li>Turn ignition on.</li> <li>Select ACTIVATE OUTPUTS.</li> </ul>	DDR display is blank or random.	→ Go to C 4-2.
Activate "Check Engine" light.	"Check Engine" light is still off.  "Check Engine" light is still on.	
C 4-2 Check for Ignition      Read voltage on vehicle harness connector, socket B3 (red lead) to a good ground (black lead) with the ignition on and engine off.	Greater than or equal to 10.0 volts.	The DDEC ignition circuit breaker (CB13) is blown and/or ignition wires are open or shorted to ground, and/or the ignition line (ckt #439) is shorted to ground or is not wired to switch ignition source (See note below). Repair problem. Then go to C 4-30.  Go to C 4-3.
C 4-3 CEL Drive Line and Bulb Check  • Turn ignition off. • Remove CEL bulb and check whether it's burned out or otherwise damaged.	Bulb is okay.  Bulb is not okay.	CEL driver line (ckt #419) or ground line (ckt #150) is open. Repair open. Then go to C 4-30.  Replace bulb (para 7-24). Then go to C 4-30.

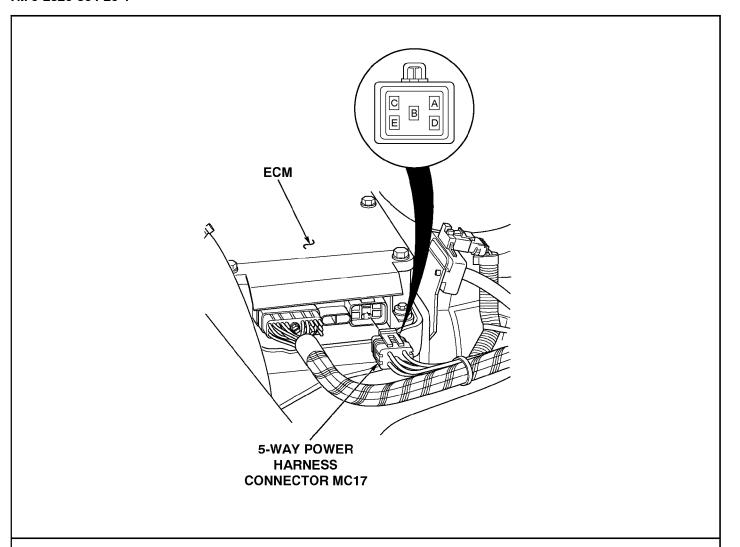
\*NOTE: Inactive codes will not clear and engine hours/fuel consumption values will not update if main ECM power (ckt #240 and #241) is switched off with or before ignition.

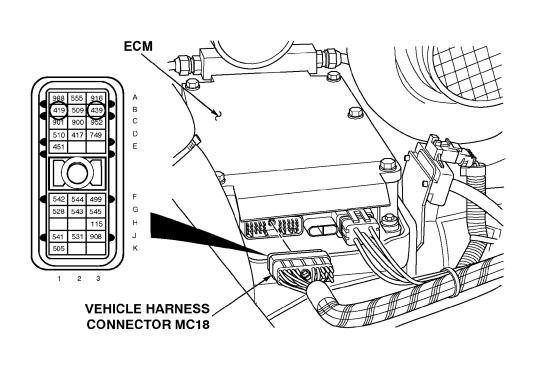


## D. CHART -4 - NO "CHECK ENGINE" LIGHT DURING BULB CHECK OR CANNOT CLEAR CODES (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 4-4 Check for Open      Remove jumper wire. With ignition on, read voltage on vehicle harness connector, socket B3 (red lead) to a good ground (black lead).	Less than 10.0 volts.  Greater than or equal to 10.0 volts.	The ignition line (ckt #439) is open. Repair open. Then go to C 4-30.  Go to C 4-5.
C 4-5 Check for Bat +      Turn ignition off.     Disconnect the 5-way power harness connector.     Read voltage at the 5-way power harness connector. Socket A (red lead) to a good ground (black lead).     Repeat voltage readings on 5-way power harness connector, keeping the black lead to a good ground and the red lead to socket C.	Less than	Either one of the 20 Amp, DDEC circuit breakers (CB22 or CB23) is blown and/or the Battery Power line(s) (ckt #240 or #241) has an open or short to ground. Check that the battery power (ckt #240 and #241) are not switched off when the ignition is turned off (see note below). Repair problem. Then go to C 4-30.  Go to C 4-6.

\*NOTE: Engine update information may not update if main ECM power (ckt #240 and #241) is switched off with/or before ignition.

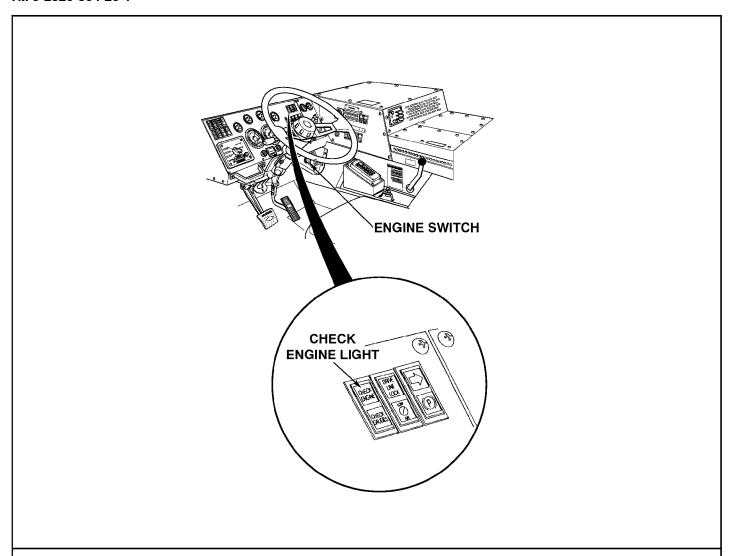


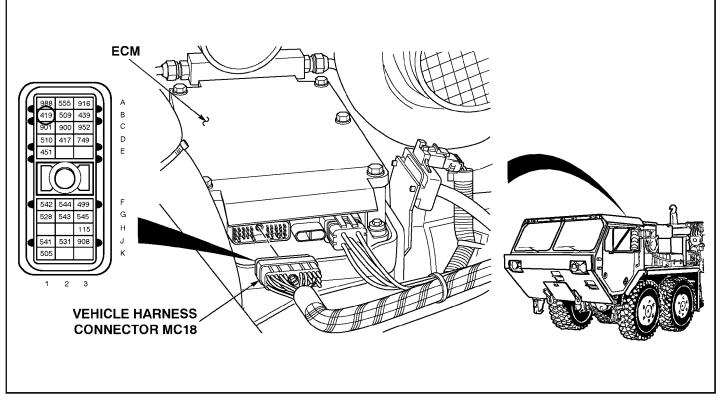


## D. CHART -4 - NO "CHECK ENGINE" LIGHT DURING BULB CHECK OR CANNOT CLEAR CODES (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Move black lead of voltmeter to socket D (of the 5-way power harness connector).</li> <li>Read voltage using red lead at sockets A and C of the 5-way power harness connector.</li> <li>Move black lead of voltmeter to socket E of the 5-way power harness connector.</li> <li>Again read voltage at sockets A, and C of the 5-way power harness connector.</li> <li>Move black lead to socket B of 5-way. Check voltage at A and C.</li> </ul>	Less than 10.0 volts on any reading.  Greater than or equal to 10.0 volts on all readings.	Ground line(s) (ckt #150 or 151) has an open. Repair open. Then go to C 4-30.  Go to C 4-7.
C 4-7 Check ECM Connectors  • Check terminals at vehicle harness (especially B3 and B1) and all the terminals in the 5-way power harness connectors (both the ECM and harness side) for damage; bent, corroded and unseated pins or sockets.	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to C 4-30.  Repair terminals/connectors (para 7-101).Then go to C 4-30.
<ul> <li>C 4-30 Verify Repairs</li> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Turn ignition off.</li> <li>Turn ignition on while at the same time observing the "Check Engine" light.</li> </ul>	"Check Engine" light comes on for up to 5 seconds, then goes out.  "Check Engine" light does not come on at all.  "Check Engine" light comes on and stays on.	All system diagnostics are complete. Please review this section from the first step to find the error.  Go to START-1, pg 2-539.

<sup>\*</sup>NOTE: Historical codes will not clear and engine hours/fuel consumption values will not update if main ECM power (ckt #240 and #241) is switched off with ignition.





## Section IV. TROUBLESHOOTING CHARTS (Cont.)

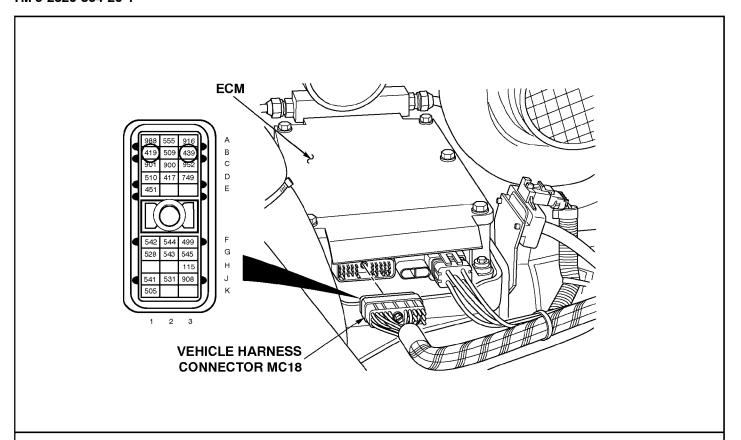
#### D. CHART -5 - "CHECK ENGINE" LIGHT ON AND NO ACTIVE CODE ON DDR

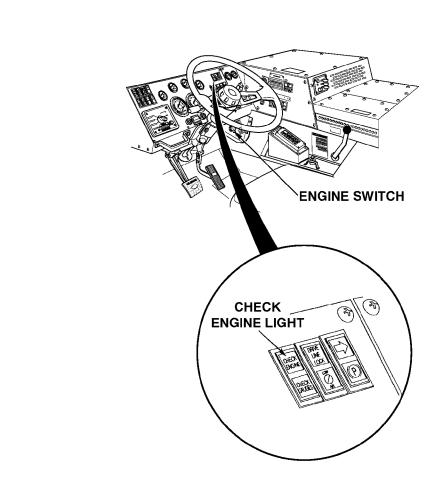
**NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

This is a digital output function.

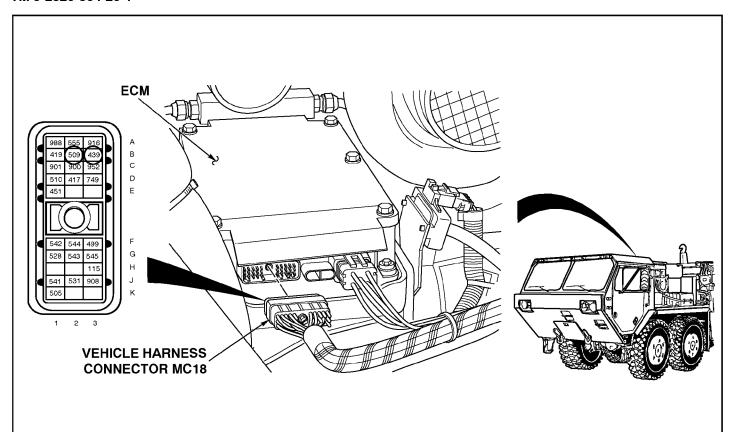
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 5-1 Check for Short (Ckt #528)  • Turn ignition on. Observe "Check Engine" light.	Erratic orintermittent "Check Engine" light.  "Check Engine"light comes on and stays on.	Check for short to ground on diagnostic request line (ckt #528). Repair short. Then go to C 5-30.  Go to C 5-2.
C 5-2 Check Light Status		
<ul><li>Plug in DDR.</li><li>Select SWITCH/LIGHT STATS.</li></ul>	CEL reads on	
<ul> <li>C 5-3 Check for Short (Ckt #419)</li> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector at ECM.</li> <li>Turn ignition on (engine not running) while at same time observing "Check Engine" light.</li> </ul>	"Check Engine" light comes on and stays on. "Check Engine" light stays off.	CEL driver line (ckt #419) is shorted to ground. Repair short Then go to C 5-30.
Install jumper wire between socket B1 of vehicle harness connector and a good ground.     Observe "Check Engine" light.	"Check Engine" light comes on and stays on.  "Check Engine" light stays off.	Go to C 5-5.  The ignition line (ckt #439) is not correctly wired to CEL bulb. See if bulb has been wired into ignition line (#439) instead of the proper #419 wire. Correct problem. Then go to C 5-30.

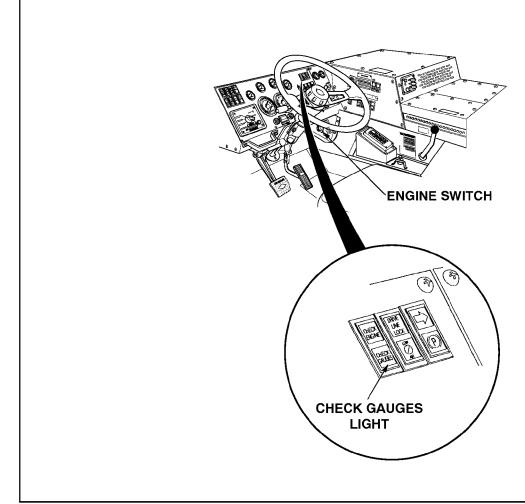




## D. CHART -5 - "CHECK ENGINE" LIGHT ON AND NO ACTIVE CODE ON DDR (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 5-5 Check ECM Connectors		
<ul> <li>Turn ignition off.</li> <li>Check terminals at vehicle harness connectors (both ECM and harness side) for damage; bent, corroded and unseated pins or sockets.</li> <li>Check terminals in connector to be sure B1 is wire #419 and B3 is wire #439.</li> </ul>	Terminals and connectors are okay.  Problem found	Replace ECM (para 7-57). Then to go C 5-30.  Repair terminals/connectors (para 7-101). Then go to C 5-30.
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Turn ignition off.</li> <li>Turn ignition on while at same time observing "Check Engine" light.</li> <li>If "Check Engine" light stays on, read inactive code.</li> </ul>	"Check Engine" light comes on for up to 5 seconds, then goes out.  "Check Engine" light does not come on at all.  No active codes and "Check Engine" light comes on and stays on.  Fault codes present.	Repairs are complete.  Go to C 4-1.  All system diagnostics are complete. Please review this section from first step to find the error.  Go to START-1, pg 2-539 to service other codes.





## Section IV. TROUBLESHOOTING CHARTS (Cont.)

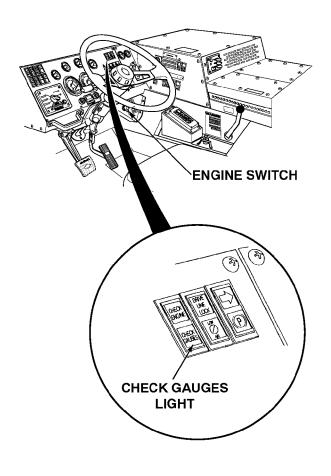
#### D. CHART -6 - "CHECK GAUGES" LIGHT ON AND NO ACTIVE CODE ON DDR

**NOTE -** This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

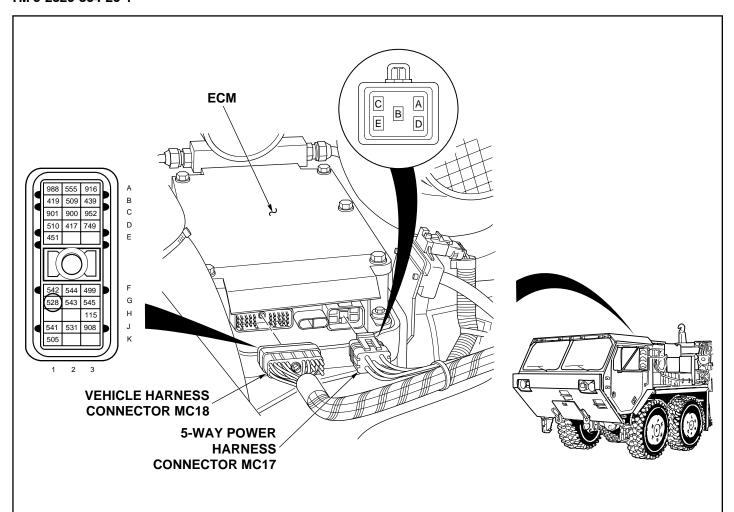
This is a Digital output function.

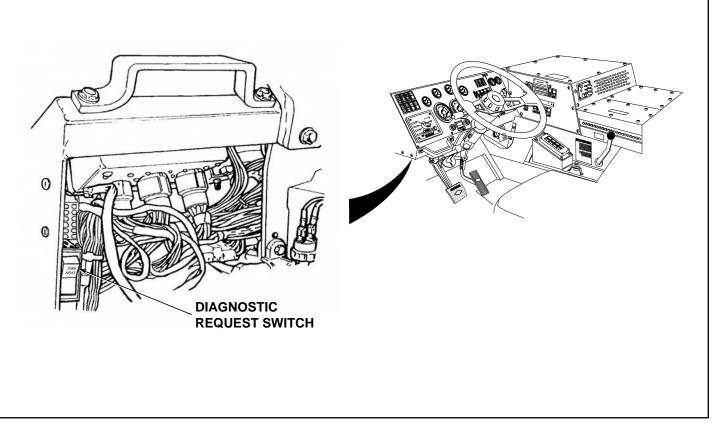
STEP/S	SEQUENCE	RESULT	WHAT TO DO NEXT
C 6-1	Determine "Check Gauges" Light Status		
runnin	gnition on (engine not g) while at the same time ving "Check Gauges" light.	"Check Gauges" light comes on for up to 5 seconds, then goes out.  "Check Gauges" light comes on and stays on.	This is the normal operation. Unless other problems exist, return to service.  Go to C 6-2.
C 6-2	Light Status - DDR		
	in DDR. et SWITCH/LIGHT STATS. I CGL.	CGL reads on	
C 6-3	Check for Short		
<ul><li>Disco conne</li><li>Turn i runnir</li></ul>	gnition off. nnect the vehicle harness ector at ECM. gnition on (engine not ng) while at same time ving "Check Gauges" light.	"Check Gauges" light comes on and stays on. "Check Gauges" light stays off.	"Check Gauges" light driver line (ckt #509) is shorted to ground. Repair short. Then go to C 6-30.  Go to C 6-4.
C 6-4	Check ECM Connectors		
harne: and ha bent, o pins o	terminals at vehicle ss connector (both ECM arness side) for damage corroded, and unseated r sockets. Pay close ion to B2 and B3.	Terminalsand connectors are okay.  Problem found	Replace ECM (para 7-57). Then go to C 6-30.  Repair terminals/connectors (para 7-101). Then go to C 6-30.



## D. CHART -6 - "CHECK GAUGES" LIGHT ON AND NO ACTIVE CODE ON DDR (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 6-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Turn ignition off.</li> <li>Turn ignition on while at same time observing "Check Gauges" light.</li> </ul>	"Check Gauges" light comes on for up to 5 seconds then goes out.  "Check Gauges" light comes on and stays on.	All system diagnostics are complete. Please review this section from the first step to find error.



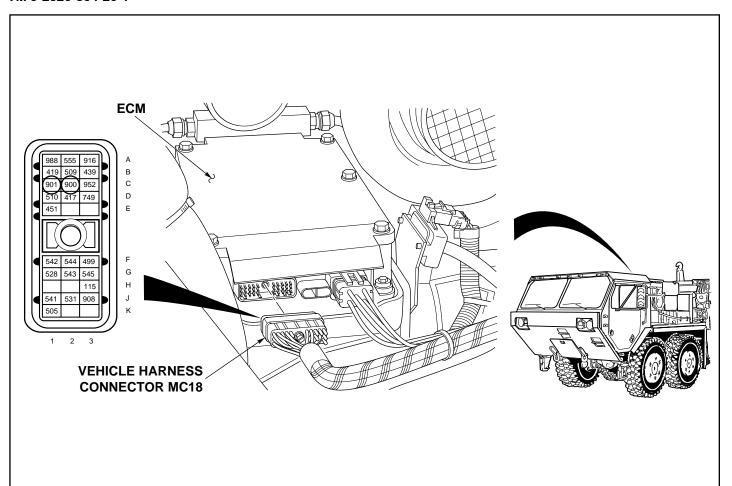


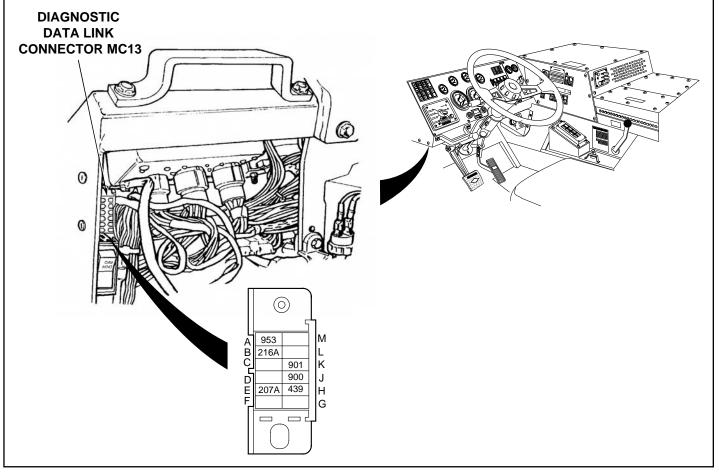
## Section IV. TROUBLESHOOTING CHARTS (Cont.)

#### D. CHART -7 - NO DATA TO DDR

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

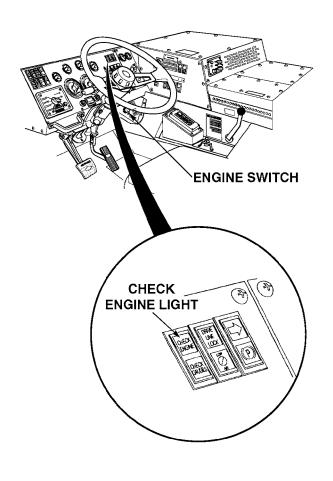
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>C 7-1 Read Codes on the "Check Engine" Light</li> <li>Unplug DDR.</li> <li>Ignition on. Engine not running.</li> <li>Depress and hold diagnostic request switch.</li> <li>Read codes flashing out on "Check Engine" light.</li> </ul>	Flashesout codes.  Does not flashout codes.	Go to C 7-4 (NOTE: If you wish to bypass diagnosis of a potential data line of DDR problem for now, go to CEL-3, page 2-549).  Go to C 7-2.
C 7-2 Check Diagnostic Request Circuit		
<ul> <li>Ignition on.</li> <li>Plug in DDR.</li> <li>Select VIEW CALIBRATION.</li> <li>Select ECM INs/OUTs to determine port assigned to "Diagnostic Request" (i.e., G1 - #528)</li> </ul>	Switch reads off.	The diagnostic request circuit (#528) is open or ground is poor or open. Repair open wire or bad ground. Then go to C 7-30.
<ul> <li>Go to SWITCH/LIGHT STATS.</li> <li>Depress and hold diagnostic request switch.</li> <li>Read status of diagnostic request.</li> </ul>	Switch reads on.	Go to C 7-3.
C 7-3 Check ECM Connectors		
Check terminals at vehicle harness and 5-way power harness connectors (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.	Terminals and connectors are okay.  Problem found	➤ Replace ECM (para 7-57). Then go to C 7-30.  ➤ Repair terminals/connectors (para 7-101). Then go to C 7-30.





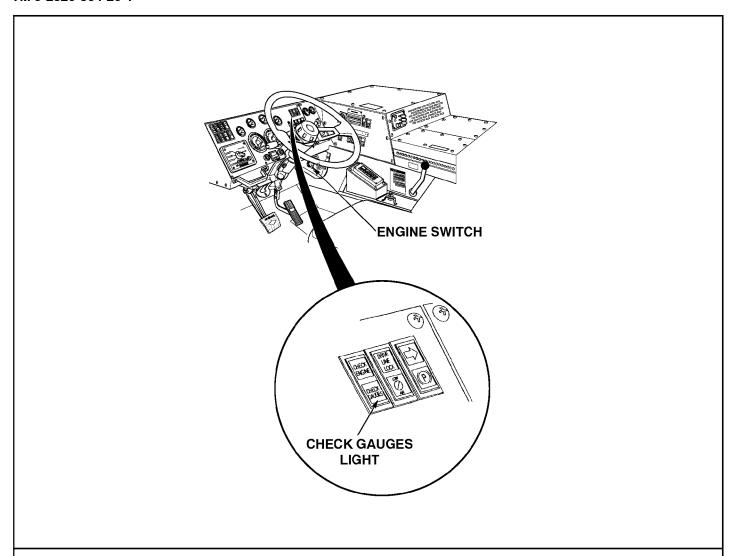
## D. CHART -7 - NO DATA TO DDR (Cont'd)

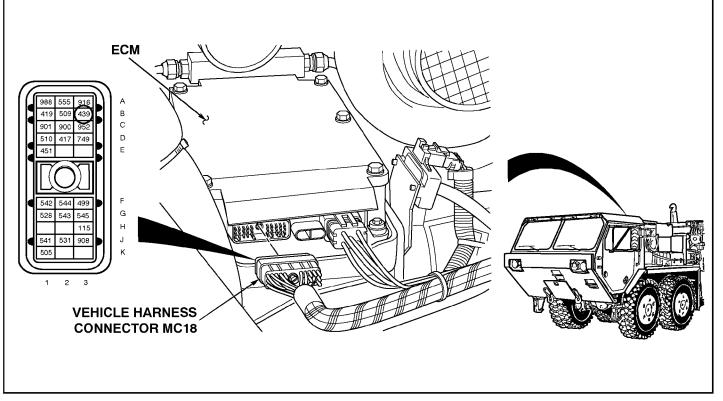
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>C 7-4 Check for Open Light</li> <li>Turn off ignition.</li> <li>Place a jumper wire across pins - J (#900) and K (#901) of DDL connector.</li> <li>Unplug vehicle harness connector and measure resistance between sockets C1 and C2.</li> </ul>	Greater than5 ohms.  Less than5 ohms.	One or both data wires (ckt #900 or #901) is open. Repair open and go to C 7-30.  Go to C 7-5.
<ul> <li>C 7-5 Check for Short</li> <li>Remove jumper wire from DDL connector.</li> <li>Read resistance between sockets C1 (#901) and C2 (#900) of vehicle harness connector.</li> </ul>	Less than 5 ohms.  Greater than 5 ohms.	Two data wires are shorted together (ckt #900 and #901). Repair short and go to C 7-30.  Go to C 7-6.
<ul> <li>C 7-6 Check for Short to Ignition and Ground</li> <li>Remove all jumpers from the DDL connector.</li> <li>Measure resistance between socket J (#900) and A (ground), J (#900) and C (sw-ign), K (#901) and A (ground), and K (#901) and C (sw-ign) of DDL connector.</li> </ul>	Less than 5 ohms on any reading.  Greater than 5 ohms on any reading.	A short exists between a data wires and ignition or ground. Repair short and go to C 7-30.  Go to C 7-7.
C 7-7 Check DDR on Another Engine  • Connect DDR to another engine and read any parameter in menu.	Works okay Does not work	Go to C 7-30.  DDR is probably defective. See DDR instruction manual for repair.



## D. CHART -7 - NO DATA TO DDR (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 7-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Turn ignition off.</li> <li>Turn ignition on.</li> </ul>	DDR display reads "NO DATA RECEIVED FROM SYSTEM" or "DDEC SYSTEM NOT RESPONDING".	All system diagnostics are complete. Review this section from first step to find error.
<ul> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run</li> </ul>	Engine starts and DDR reads No Codes.	Repairs are complete.
(TM 9-2320-364-10) for 1 minute or until "Check Engine" light comes on. Stop engine. • Read inactive codes.	Engine starts and code appears.	Go to START-1, pg 2-539, to service codes.



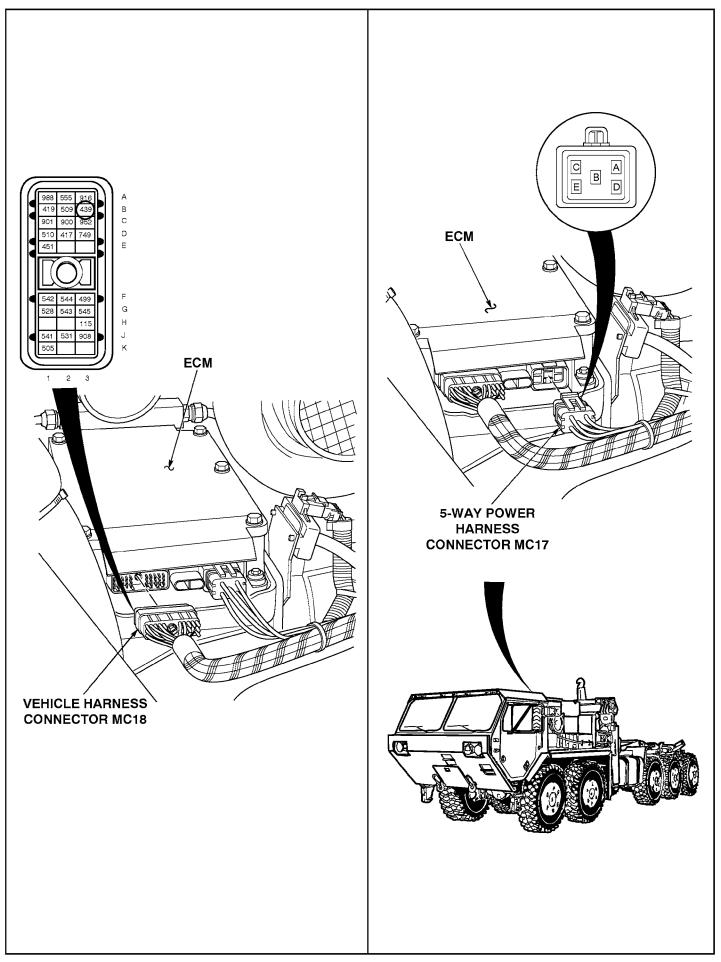


## Section IV. TROUBLESHOOTING CHARTS (Cont.)

## D. CHART -8 - NO "CHECK GAUGES" LIGHT (CGL) DURING BULB CHECK

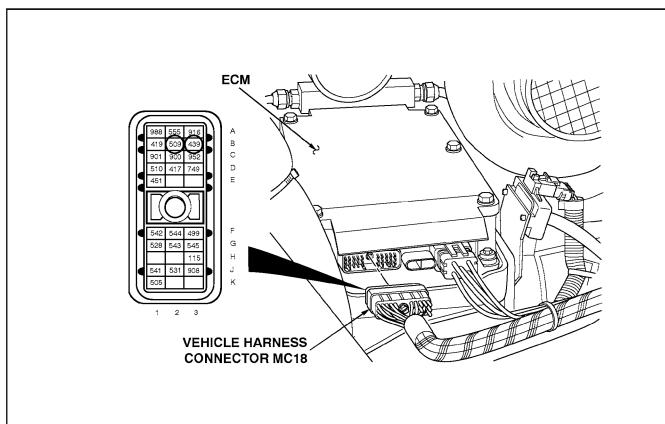
- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

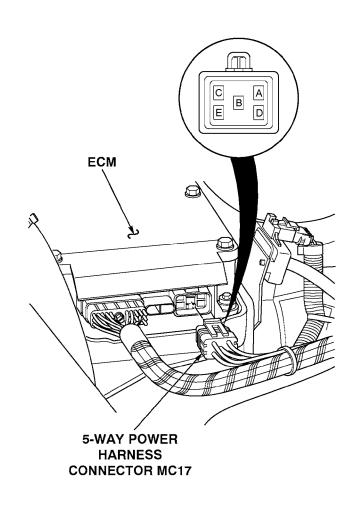
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>C 8-1 Try to Force CGL on</li> <li>Plug in DDR.</li> <li>Turn ignition on.</li> <li>Select activate outputs</li> <li>Activate CGL with DDR.</li> </ul>	CGL is still off	Go to C 8-2. Go to C 8-4.
C 8-2 Check for Short      Remove jumper wire.     Read voltage on vehicle harness connector, socket B3 (red lead) to a good ground (black lead).	Less than 11.5 volts.  Greater than or equal to 11.5 volts.	DDEC ignition circuit breaker (CB13) is blown, and/or ignition line (ckt #439) is open or shorted to ground. Repair problem. Then go to C 8-30.  Go to C 8-3.
Remove CGL bulb and check whether it's burned out or otherwise damaged.	Bulb is okay. Bulb is not okay.	CGL Driver line (ckt #509) is open. Repair open. Then go to C 8-30.  Replace bulb (para 7-24). Then go to C 8-30.



## D. CHART -8 - NO "CHECK GAUGES" LIGHT (CGL) DURING BULB CHECK (Cont'd)

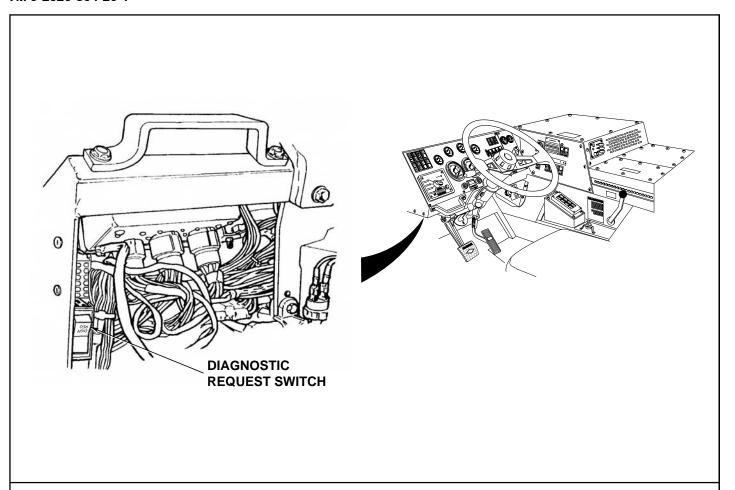
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Remove jumper wire.     Read voltage on vehicle harness connector, socket B3 (red lead) to a good ground (black lead).	Less than 11.5 volts.  Greater than or equal to 11.5 volts.	Ignition line (ckt #439) open. Repair open. Then go to C 8-30.  Go to C 8-5.
<ul> <li>C 8-5 Check for Battery +</li> <li>Turn ignition off.</li> <li>Disconnect 5-way power harness connector at ECM.</li> <li>Read voltage on 5-way power harness connector, socket A (red lead), to a good ground (black lead).</li> <li>Also read voltage on socket C (red lead) to a good ground (black lead).</li> </ul>	Less than  11.5 volts on either reading.  Greater than or equal to 11.5 volts on both readings.	Either a DDEC circuit breaker (CB22 or CB23) is blown, and/or battery power line(s)(ckt #240 or #241) has an open or short to ground. Repair problem. Then go to C 8-30.  Go to C 8-6.
C 8-6 Check for Ground      Read voltage on 5-way power harness connector, socket A (red lead) to socket D (black lead).      Also read voltage on 5-way power harness connector, socket C (#240) (red lead) to socket E (#150) (black lead).	Less than	Ground line(s) (ckt #150) has an open. Repair open. Then go to C 8-30.  Go to C 8-7.

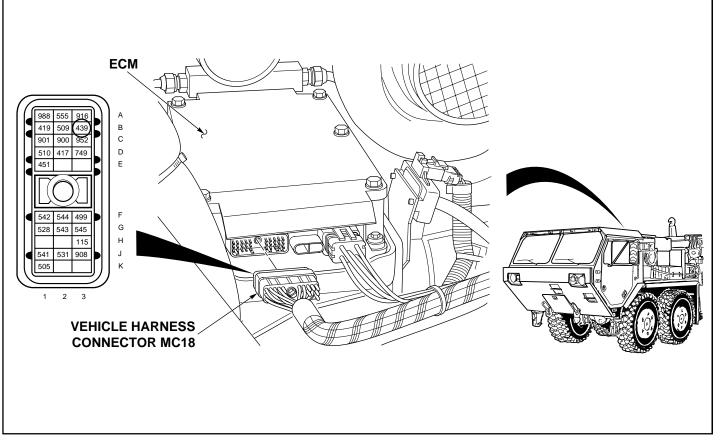




## D. CHART -8 - NO "CHECK GAUGES" LIGHT (CGL) DURING BULB CHECK (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 8-7 Check ECM Connectors		
Check terminals at both 5-way power harness and vehicle harness connectors (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets. Pay close attention to terminals B2 and B3 of vehicle harness connector and D and E power harness.	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to C 8-30.  Repair terminals/connectors (para 7-101). Then go to C 8-30.
C 8-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Turn ignition off.</li> <li>Turn ignition on while at same time observing "Check Gauges" light.</li> </ul>	"Check Gauges"light comes on for up to 5 seconds then goes out.  "Check Gauges"light comes on and stays on.	All system diagnostics are complete. Please review this section from the first step to find error.



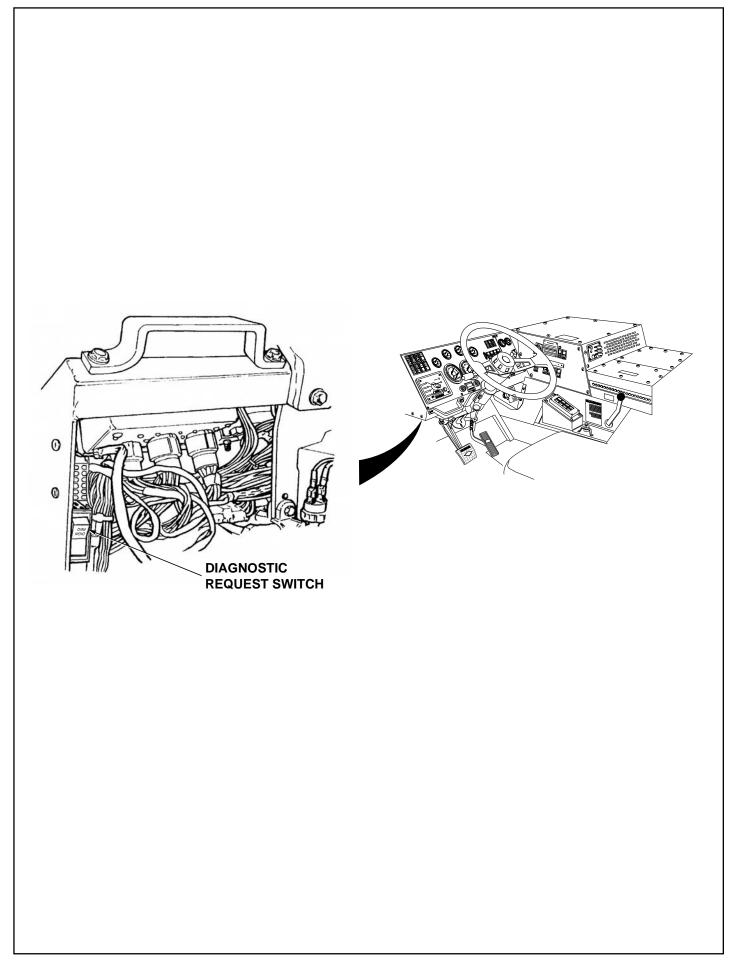


## Section IV. TROUBLESHOOTING CHARTS (Cont.)

#### D. CHART -9 - DIAGNOSTIC REQUEST SWITCH INOPERATIVE

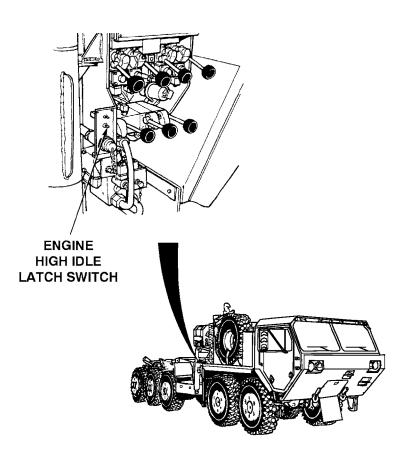
- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 9-1 Check Diagnostic Request Circuit		
<ul> <li>Turn ignition on/engine not running.</li> <li>Plug in DDR.</li> <li>Select SWITCH/LIGHT STATS</li> <li>Depress and hold diagnostic request switch.</li> <li>Observe "Diagnostic Request" status on DDR.</li> </ul>	Display reads "ON".  Display reads "OFF".	➤ Go to C 9-2.  Diagnostic request line (#528) is open, or is not being grounded when switch is depressed. Check #528 wire and ground for diagnostic request switch. Repair problem then go to C 9-30.
	Display reads "N/A".	► Replace ECM (para 7-57).
C 9-2 Check CGL/CEL Bulb		
<ul> <li>Turn ignition off.</li> <li>Remove CEL and CGL Bulb, check to see if it is burned out or damaged.</li> </ul>	Bulb is okay	Go to C 9-3.  Replace bulb(s) (para 7-24). Then go to C 9-30.
C 9-3 Check Ignition Line		
<ul> <li>Turn ignition off.</li> <li>Disconnect vehicle harness connector at ECM.</li> <li>Read voltage at cavity B3 (#439).</li> </ul>	Less than 11.5V. Greater than 11.5V.	<ul> <li>DDEC ignition circuit breaker (CB13) is blown and/or ignition line is open or shorted to ground.</li> <li>Ckt #419 or #509 is open. Repair open and go to C 9-30.</li> </ul>



## D. CHART -9 - DIAGNOSTIC REQUEST SWITCH INOPERATIVE (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 9-30 Verify Repairs		
<ul> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Depress and hold diagnostic request switch.</li> </ul>	Flashes codes (works).  Does not function.	Repairs are complete.  If any other problems exists, go to START-1, pg 2-539.  All system diagnostics are complete. Please review this section to find error.

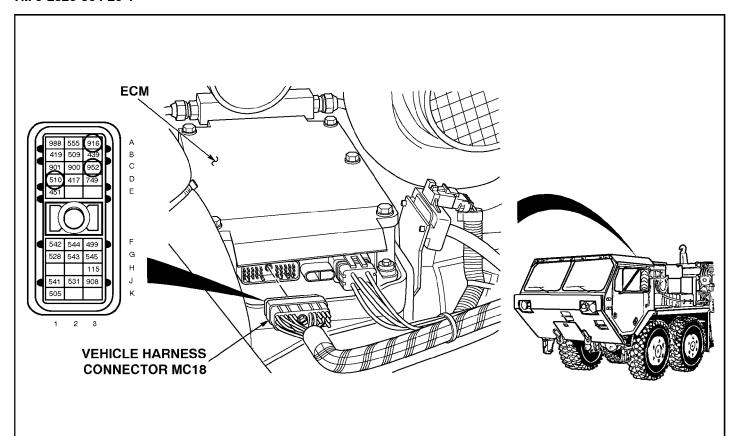


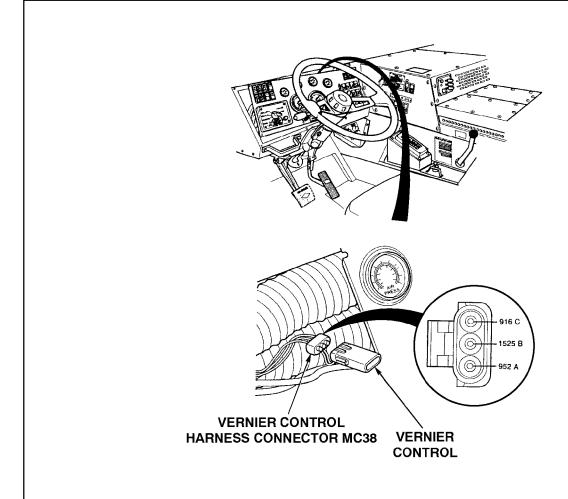
## Section IV. TROUBLESHOOTING CHARTS (Cont.)

#### D. CHART -10 - VARIABLE SPEED GOVERNOR (VSG OR CRANE HIGH IDLE) INOPERATIVE

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

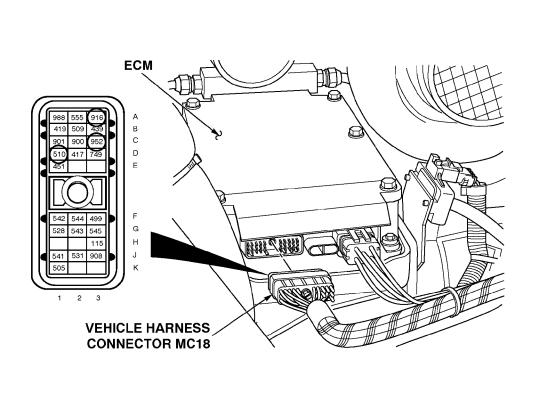
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 10-1 through C 10-4 (Deleted)		
C 10-5 Check Throttle Position Sensor		
<ul> <li>Turn ignition on.</li> <li>Plug DDR into DDL connector.</li> <li>Engine at no throttle.</li> <li>Read TPS PCT using DDR.</li> </ul>	At 0% throttle Greater than 0% throttle.	Go to C 10-6.  Check throttle position sensor adjustment. Go to 21-4 (page 2-643).
C 10-6 Check if ECM is Reading VSG Speed		
<ul> <li>Start engine (TM 9-2320-364-10).</li> <li>Position transmission range selector to N (neutral).</li> <li>Select the VSG RPM on the DDR reader.</li> <li>Push ENGINE HIGH IDLE LATCH switch to LATCH and release.</li> <li>Shut off engine (TM 9-2320-364-10).</li> </ul>	DDR display changes smoothly from idle (typically 650 RPM) to high idle speed (1275 RPM).  DDR does not change at all or does not change smoothly.	Go to C 10-7.  Go to C 10-9.
<ul> <li>C 10-7 Verify Complaint</li> <li>Start engine (TM 9-2320-364-10) and run at idle.</li> <li>Using the DDR reader, make sure that TPS PCT is 0.</li> <li>Position ENGINE HIGH IDLE LATCH switch to LATCH and release.</li> </ul>	RPM is increasing.  RPM does not increase.	Problem no longer exists. Go to C 1-2 for more information (page 2-555).  Go to C 10-8.

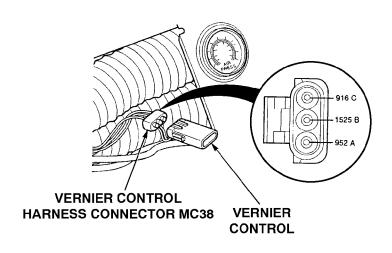




## D. CHART -10 - VARIABLE SPEED GOVERNOR (VSG OR CRANE HIGH IDLE) INOPERATIVE (Cont'd)

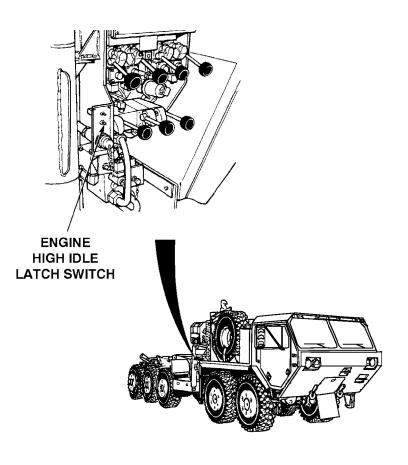
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 10-8 Check ECM Connectors		
<ul> <li>Turn ignition off.</li> <li>Disconnect vehicle harness connector at ECM.</li> <li>Check terminals at vehicle harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to C 10-30.  Repair terminals/connectors (para 7-101). Then go to C 10-30.
C 10-9 Check for Open		
<ul> <li>Turn ignition off.</li> <li>Make sure vehicle is in neutral.</li> <li>Disconnect vehicle harness connector at ECM.</li> <li>Also disconnect vernier control connector (para 7-95).</li> <li>Install a jumper wire between pins A and B of the vernier control connector.</li> <li>Read resistance between sockets D1 (#510) and C3 (#952) on vehicle harness connector.</li> </ul>	Greater than 5 ohms or open.  Less than or equal to 5 ohms.	Signal line (ckt #525 or #510) ground line (ckt #952) or the Neutral start circuit has an open. Repair open. Then go to C 10-30.  Go to C 10-10.
C 10-10 Check for +5 Volt Line Open		
<ul> <li>Move jumper so that it is now between pins C and A of vernier control connector.</li> <li>Read resistance between sockets A3 (#916) and C3 (#952) on vehicle harness connector.</li> </ul>	Greater than 5 ohms or open.  Less than or equal to 5 ohms.	The +5 volt line (ckt #916) is open. Repair open. Then go to C 10-30. Go to C 10-11.





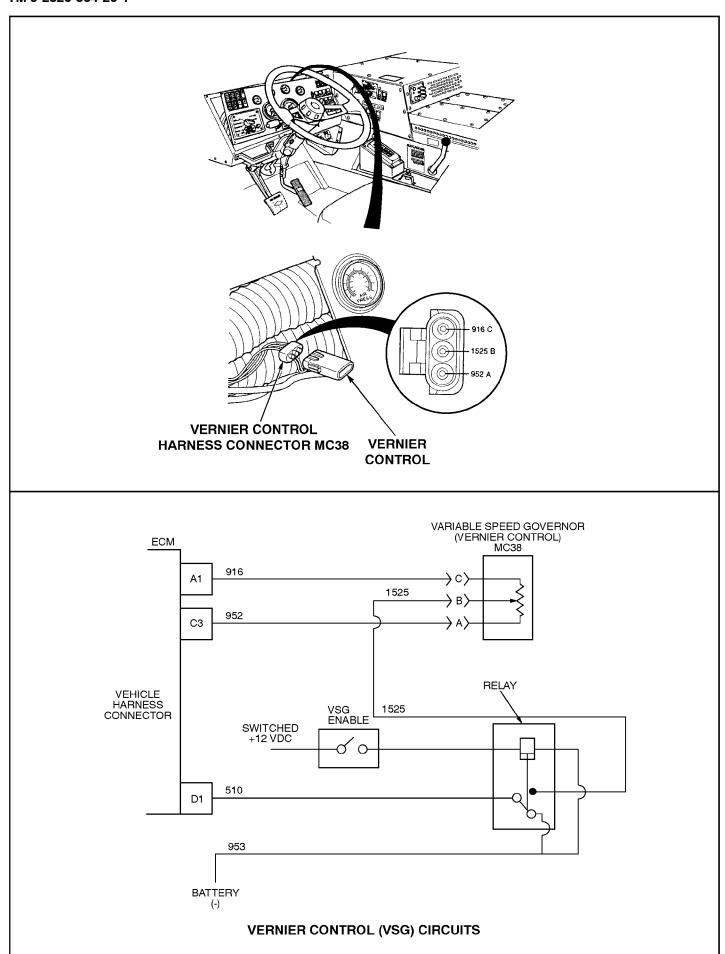
## D. CHART -10 - VARIABLE SPEED GOVERNOR (VSG OR CRANE HIGH IDLE) INOPERATIVE (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 10-11 Check for Short Between Signal and Ground  • Remove jumper wire. • Read resistance between sockets D1 (#510) and C3 (#952) on vehicle harness connector. • Also read resistance between socket D1 (#510) and a good ground.	Both readings are greater than 10,000 ohms or open.  Either reading is less than equal to 10,000 ohms.	Go to C 10-12.  Signal line (ckt #525 or #510) or Neutral start circuit is shorted to ground (either ckt #952 or chassis ground). Repair short. Then go to C 10-30.
C 10-12 Check for Short Between +5 Volt Line and Ground		
<ul> <li>Disconnect vernier control connector (para 7-95).</li> <li>Read resistance between sockets A3 (#916) and C3 (#952) on vehicle harness connector.</li> <li>Also read resistance between socket A3 (#916) and a good ground.</li> </ul>	Both readings are greater than 10,000 ohms or open.  Either reading is less than or equal to 10,000 ohms.	The +5 volt line (ckt #916) is shorted to ground (either ckt #952 or chassis ground). Repair short. Then to to C 10-30.
C 10-13 Check Vernier Control Connectors		
<ul> <li>Inspect terminals at vernier control connectors (sensor side and harness side) for damaged; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace vernier control (para 7-100). Then go to C 10-30.  Repair terminals/connectors (para 7-101). Then go to C 10-30.



## D. CHART -10 - VARIABLE SPEED GOVERNOR (VSG OR CRANE HIGH IDLE) INOPERATIVE (Cont'd)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
C 10-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Start engine (TM 9-2320-364-10).</li> </ul>	Crane high idle speedstill does not work.	All system diagnostics are complete. Please review this section from the first step to find error.
<ul> <li>Push ENGINE HIGH IDLE LATCH switch to LATCH and release.</li> <li>Stop engine.</li> </ul>	Crane high idle speed works and no codes.	Repairs are complete.
Read inactive codes.	Crane high idle speed works and codes appear.	Go to START-1, pg 2-539, to service codes.



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 11

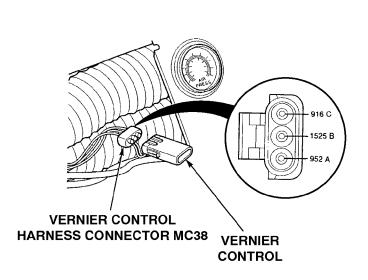
J1587 CODE: P187 4 - VERNIER CONTROL INPUT FAILED LOW (VOLTAGE LOW)

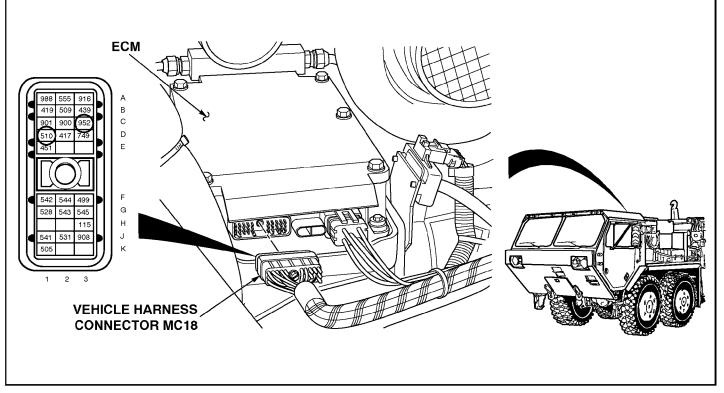
(ALSO CALLED VARIABLE SPEED GOVERNOR - VSG)

#### NOTE - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Multiple Code Check     Were there any other active codes	No other—	→ Go to 11-2.
besides 187/4?	active codes.  Yes, any or all of the following active codes: 187/3, 91/3 or 4, 100/4, 102/4, 110/4, 174/4, 175/4.  Yes - but none of the above.	→ Go to VEH5V-1 , page 2-767.  → Go to 11-2.
11-2 Sensor Check	of the above.	
Turn ignition off.     Disconnect vernier control connector.     Install a jumper wire between	Code 187/3 (and/or other codes).	— <b>→</b> Go to 11-6.
sockets B and C of the vernier harness connector.  Turn ignition on.  Read active codes.	Code 187/4 (and any other codes).	Go to 11−3.
11-3 Check Vernier Control Adjustment		
<ul> <li>Remove jumper and reconnect vernier control.</li> <li>Hook-up DDR to the DDL connector and select VSG CNTS.</li> <li>Push ENGINE HIGH IDLE LATCH switch to LATCH and release.</li> <li>Read counts.</li> </ul>	Getting 48 to 968 counts.  Not getting theabove readings.	Go to 11-5.  Go to 11-4.
11-4 Attempt Vernier Control Adjustment		
Replace vernier control (para 7-100).	Corrected problem so that Throttle Counts is now correct.  Could not correct the problem.	→ Go to 11-30.  Go to 11-5.

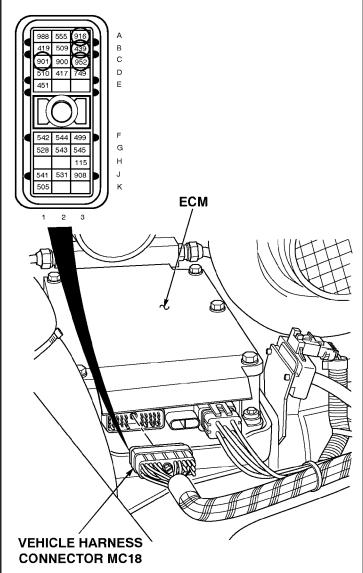


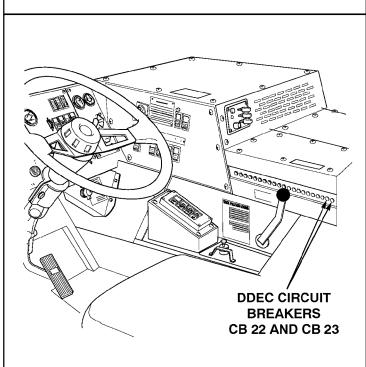


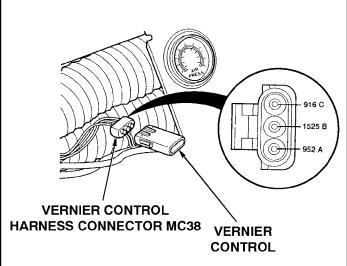
E. FLASH CODE: 11

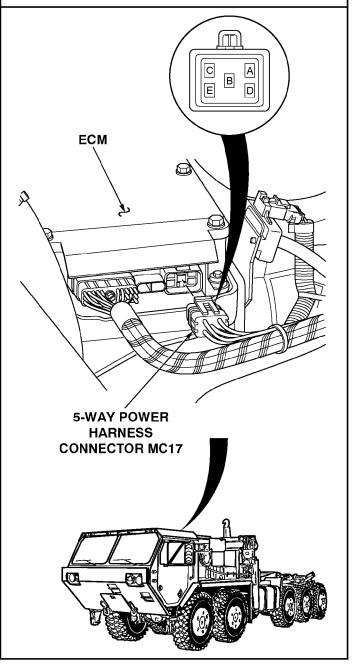
J1587 CODE: P187 4 - VERNIER CONTROL INPUT FAILED LOW (VOLTAGE LOW)
(ALSO CALLED VARIABLE SPEED GOVERNOR - VSG)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Check Vernier     Control Connectors      Inspect terminals at the vernier control connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets.	Terminals and connectors are okay.  Problem found.	Replace vernier control (para 7-100). Then go to 11-30.  Repair terminals/connectors (para 7-101). Then go to 11-30.
11-6 Check for +5 Volts		
<ul> <li>Remove jumper.</li> <li>Turn ignition on.</li> <li>Read voltage on vernier control connector, socket C (red lead) to socket A (black lead).</li> </ul>	Between ———————————————————————————————————	Go to 11-7.  Go to 11-10.
	Greater than 6 volts.	→ Go to 11-12.
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector ECM.</li> <li>Read resistance between sockets A and B on the vernier control connector.</li> </ul>	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	Signal line (ckt #1525) is shorted to the return line (ckt #952). Repair short. Then go to 11-30.  Go to 11-8.
<ul> <li>Install a jumper wire between sockets A and B of the vernier control connector.</li> <li>Read resistance between sockets D1 (510) &amp; C3 (952) on the vehicle harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Go to 11-9.  Signal line (ckt #510) is open, and/or signal return (ckt #952) is open. Repair open. If no open was found, check ECM terminals A3, D1, C3, and vernier control pins. Then go to 11-30.





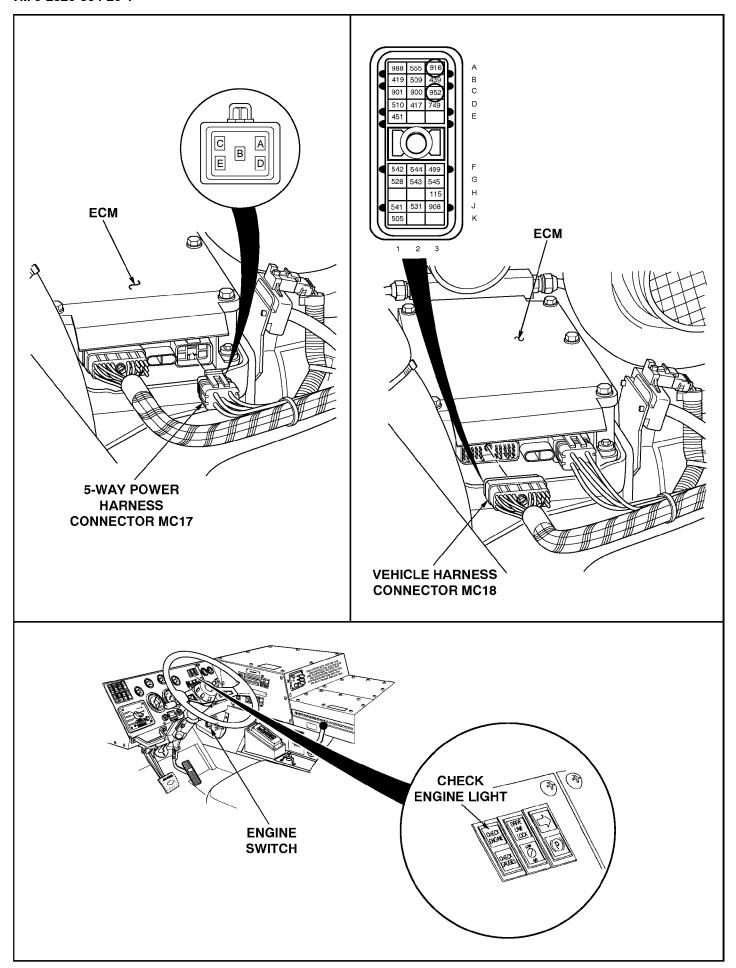




E. FLASH CODE: 11

J1587 CODE: P187 4 - VERNIER CONTROL INPUT FAILED LOW (VOLTAGE LOW)
(ALSO CALLED VARIABLE SPEED GOVERNOR - VSG)

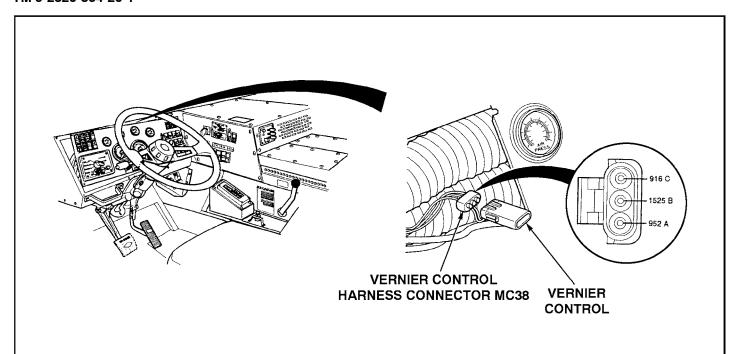
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
11-9 Check ECM Connectors		
<ul> <li>Check terminals at the vehicle harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals andconnectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 11-30.  Repair terminals/connectors (para 7-101). Then go to 11-30.
11-10 Check for Short		
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector at the ECM.</li> <li>Read resistance between sockets A and C on the vernier control connector.</li> </ul>	Less than orequal to 10,000 ohms.  Greater than10,000 ohms or open.	The vehicle +5 volt line (ckt #916) is shorted to the return line (ckt #952). Repair short. Then go to 11-30.  Go to 11-11.
11-11 Check for Open +5 Volt Line		
<ul> <li>Install a jumper wire between sockets A and C of the vernier control connector.</li> <li>Read resistance between sockets A3 (916) &amp; C3 (952) on the vehicle harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Go to 11-9.  The vehicle +5 volt line (ckt #916) is open. Repair open. Then go to 11-30.
11-12 Check for Short to Battery +		
<ul> <li>Turn ignition off.</li> <li>Pull out both DDEC circuit breaker buttons (CB22 &amp; CB23).</li> <li>Disconnect 5-way power harness connector at the ECM.</li> <li>Read resistance between sockets D1 (510) &amp; B3 (439) on the vehicle harness connector.</li> <li>Also read resistance between socket D1 (510) on the vehicle harness connector and the following sockets on the 5-way power harness connector: C, D, E, and B.</li> </ul>	All readings aregreater than 10,000 ohms or open.  Any reading isless than or equal to 10,000 ohms.	A short exists between sockets where less the 10,000 ohms resistance was read. Repair short and reset circuit breakers. Then go to 11-30.

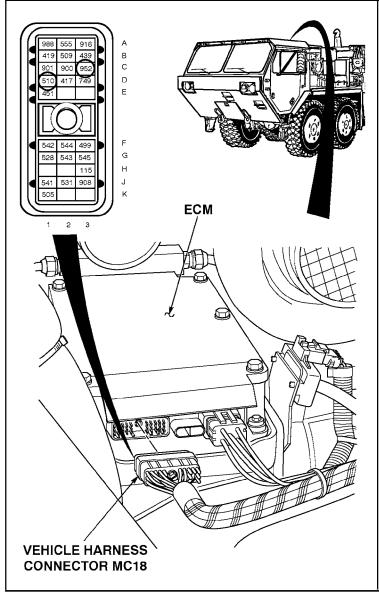


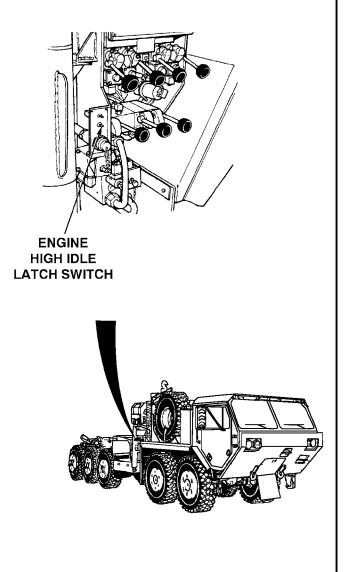
E. FLASH CODE: 11

J1587 CODE: P187 4 - VERNIER CONTROL INPUT FAILED LOW (VOLTAGE LOW)
(ALSO CALLED VARIABLE SPEED GOVERNOR - VSG)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
11-13 Check for Outside DDEC Battery +		
<ul><li>Turn ignition off.</li><li>Deleted.</li></ul>	All readings less than 4.0 volts.	→ Go to 11-9.
<ul> <li>Remove ECM vehicle harness connector.</li> <li>Turn ignition on.</li> <li>Read voltage A3 (916) to a good ground.</li> <li>Read voltage C3 (952) to a good ground.</li> </ul>	Either reading greater than or equal to 4.0 volts.	Outside power is shorted to either ckt #952 or ckt #916. Repair short. Then go to 11-30.
11-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or 1 minute.</li> <li>Stop engine.</li> <li>Read all codes.</li> </ul>		All system diagnostics are complete. Please review this section from the first step to find the error.  Go to START-1, pg 2-539, to service other codes.







### Section IV. TROUBLESHOOTING CHARTS (Cont.)

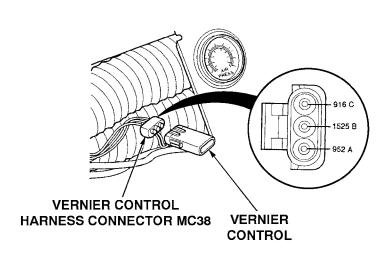
E. FLASH CODE: 12

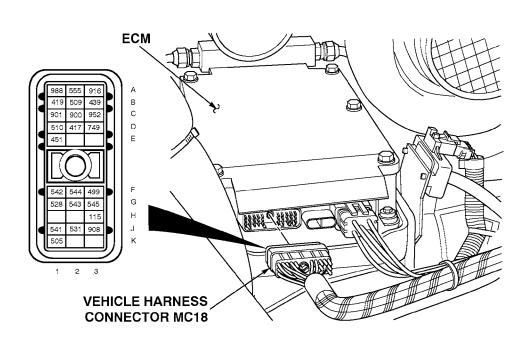
J1587 CODE: P187 3 - VERNIER CONTROL INPUT FAILED HIGH (HIGH VOLTAGE) (ALSO CALLED VARIABLE SPEED GOVERNOR - VSG)

**NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
12-1 Multiple Code Check		
<ul> <li>Were there any other active codes besides Code 187/3?</li> </ul>	No other active codes.	→ Go to 12-2.
besides dode 107/0:	Yes, either code ————91/3 or 4.	→ Go to VEH5V-1 , page 2-767.
	Yes - but none of the above.	→ Go to 12-2.
12-2 Sensor Check		
<ul> <li>Turn ignition off.</li> <li>Unplug the vernier control from vernier control harness connector.</li> </ul>	Any codesexcept Code 187/3.	→ Go to 12-3.
<ul><li>Turn ignition on.</li><li>Read active codes.</li></ul>	Code 187/3 (and any other codes).	→Go to 12-5.
12-3 Return Circuit Check		
<ul> <li>Transmission in neutral.</li> <li>Turn ignition off.</li> <li>Install a jumper wire between pin A and pin B of the vernier control connector.</li> <li>Disconnect the vehicle harness connector at the ECM.</li> <li>Turn ignition on.</li> <li>Push ENGINE HIGH IDLE LATCH switch to LATCH and release.</li> <li>Read resistance between sockets C3 (952) and D1 (510) on the vehicle harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	→ Go to 12-4.  Return line (ckt #952) is open. Repair open. Then go to 12-30.
12-4 Check Vernier Control Connectors		
<ul> <li>Inspect terminals at the vernier control connectors (sensor side and harness side) for damage; bent, corroded, and unseated</li> </ul>	Terminals andconnectors are okay.	Replace vernier control (para 7-100). Then go to 12-30.
pins or sockets.	Problem found.	Repair terminals/connectors (para 7-101). Then go to 12-30.

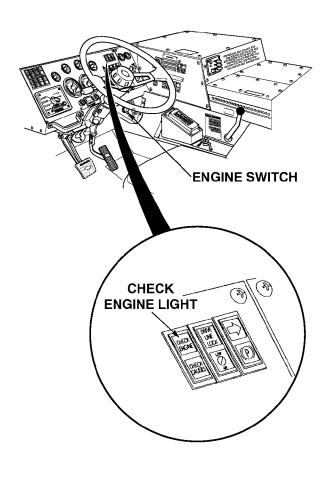




E. FLASH CODE: 12

J1587 CODE: P187 3 - VERNIER CONTROL INPUT FAILED HIGH (HIGH VOLTAGE)
(ALSO CALLED VARIABLE SPEED GOVERNOR - VSG)

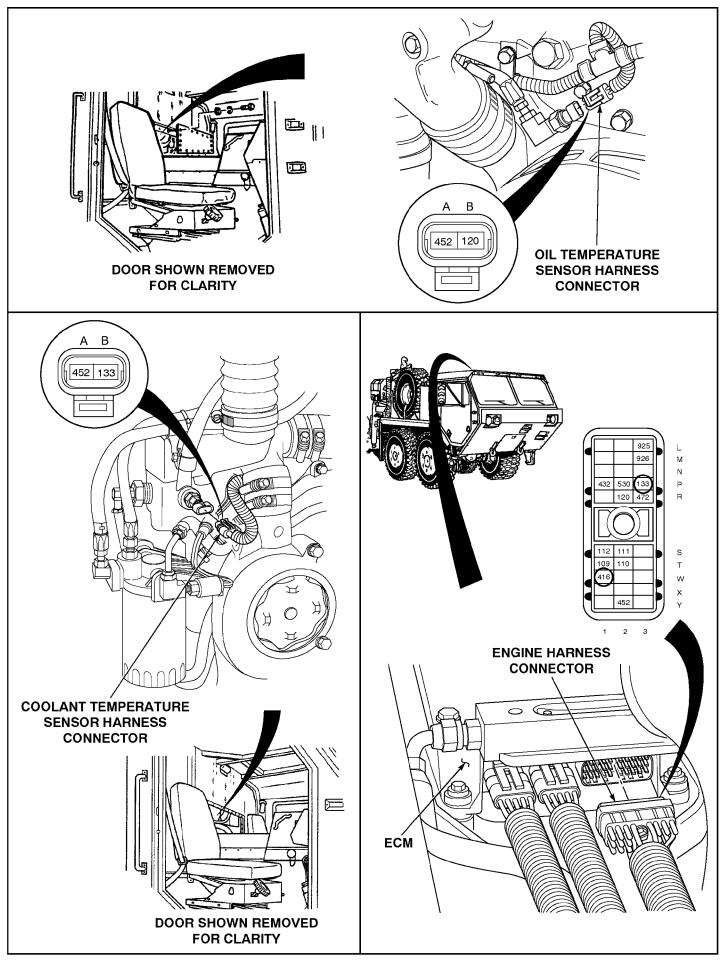
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
12-5 Check for Short to +5 Volt Line		
<ul> <li>Connect all connectors to ECM. Turn ignition on.</li> <li>Read voltage on vernier control harness connector pin B (1525) to pin A (952).</li> </ul>	Greater than 1.0 volts.	Signal line (ckt #510 or #1525) is shorted to the vehicle +5 volt line (ckt #916) or another voltage source. Repair short. Then go to 12-30.
	Less than or equal———— to 1.0 volts.	Go to 12-7.
12-7 Check ECM Connectors		
<ul> <li>Disconnect the vehicle harness connector.</li> <li>Check terminals at the vehicle harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 12-30.  Repair terminals/connectors (para 7-101). Then go to 12-30.



E. FLASH CODE: 12

J1587 CODE: P187 3 - VERNIER CONTROL INPUT FAILED HIGH (HIGH VOLTAGE)
(ALSO CALLED VARIABLE SPEED GOVERNOR - VSG)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
12-30 Verify Repairs		
Turn ignition off. Reconnect all connectors.	No codes.	Repairs are complete.
<ul> <li>Turn ignition on.</li> </ul>	Code 187/3 (and any	→ All system diagnostics are
<ul> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not</li> </ul>	other codes).	complete. Please review this section from the first step to find the error.
stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or 1 minute. Stop engine. • Read inactive codes.	Any other codes except Code 187/3.	Go to START-1, pg 2-539, to service other codes.



### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 14

J1587 CODE: P110 3 - COOLANT TEMPERATURE CIRCUIT FAILED HIGH (VOLTAGE HIGH)

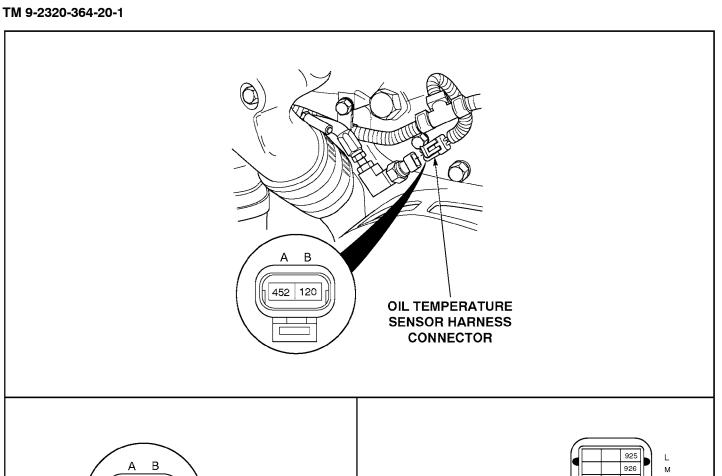
(BELOW)

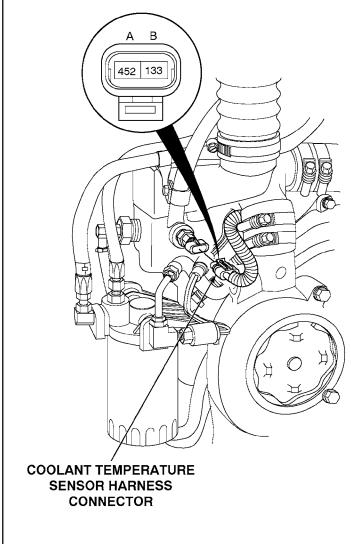
OR: P175 3 - OIL TEMPERATURE CIRCUIT FAILED HIGH (VOLTAGE HIGH) (BELOW)

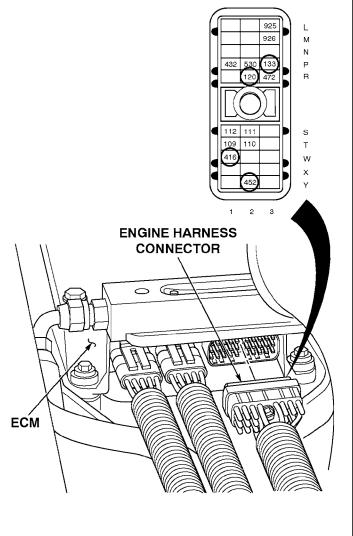
#### **NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Turn ignition on.     Plug in DDR and determine which code is present.	PID 110 - FMI 3 ———————————————————————————————————	
14-2 Coolant Temp Sensor Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect CTS (para 7-69) and install a jumper between the CTS connector sockets A and B.</li> <li>Turn ignition on.</li> <li>Read active codes.</li> </ul>	Code 110/4 (or any codesexcept Code 110/3).  Anything except Code 110/4.	
14-3 Oil Temp Sensor Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect OTS (para 7-70) and install jumper between OTS connector sockets A and B.</li> <li>Turn ignition on.</li> <li>Read active codes.</li> </ul>	Code 175/4 (or any codes- except Code 175/3).  Anything except  Code 175/4.	
14-4 Check for Short to +5 Volt Line		
<ul> <li>Turn ignition off.</li> <li>Remove jumper wire.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Read resistance between sockets P3 (ckt #133) and W1 (ckt #416) on the engine harness connector.</li> </ul>	Less than or equal to ———————————————————————————————————	Signal line (ckt #133) is shorted to the engine +5 volt line (ckt #416), and/or (ckt #133) signal line is shorted to ground, and/or sensor return (ckt #452).  Repair short. Then go to 14-30.
2 2geaeee eelootoi.	Greater than 10,000 ———ohms or open.	Go to 14-6.





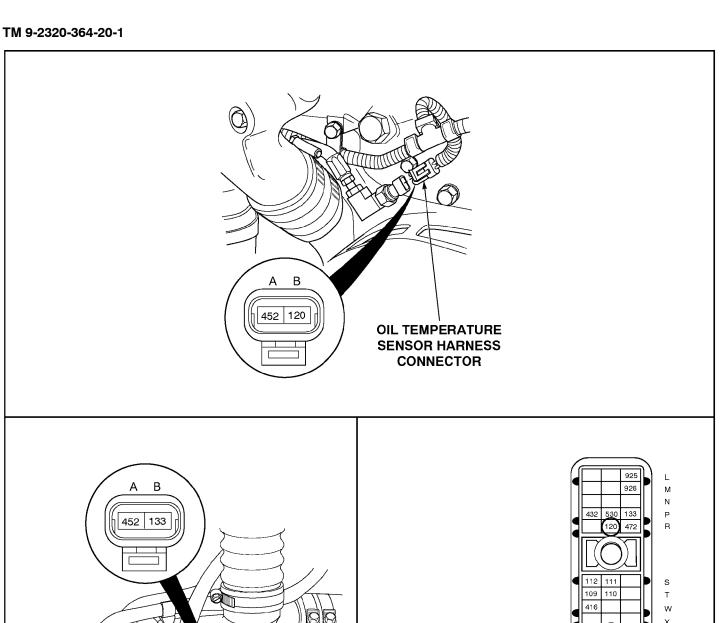


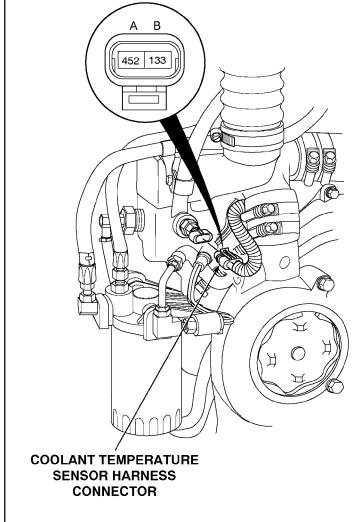
E. FLASH CODE: 14

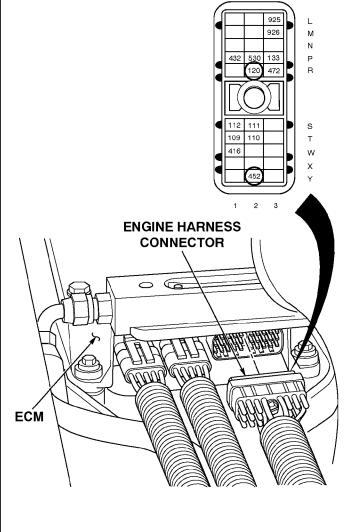
P110 3 - COOLANT TEMPERATURE CIRCUIT FAILED HIGH (VOLTAGE HIGH) P175 3 - OIL TEMPERATURE CIRCUIT FAILED HIGH (VOLTAGE HIGH) J1587 CODE:

OR:

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
14-5 Check for Short to +5 Volt Line		
<ul> <li>Turn ignition off.</li> <li>Remove jumper wire.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Read resistance between sockets R2 (ckt #120) and W1 (ckt #416) on the engine harness connector.</li> </ul>	Less than or equal to ———————————————————————————————————	Signal line (ckt #120) is shorted to the engine +5 volt line (ckt #416), and/or (ckt #120) signal line is shorted to ground and/or sensor return (ckt #452). Repair short. Then go to 14-30.  Go to 14-7.
14-6 Check CTS Connectors		
<ul> <li>Inspect terminals at the CTS connector (both the sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace CTS (para 7-69). Then go to 14-30.  Repair terminals/connectors (para 7-101). Then go to 14-30.
14-7 Check OTS Connectors  • Inspect terminals at the OTS	Terminals and —	Replace OTS (para 7-70).
connector (both the sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.	connectors are okay.  Problem found.	Then go to 14-30.  Repair terminals/connectors (para 7-101). Then go to 14-30.
14-8 Open Line Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Read resistance between sockets P3 (ckt #133) and Y2 (ckt #452) on the engine harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Signal line (ckt #133) or return line (ckt #452) is open. Repair open. Then go to 14-30.





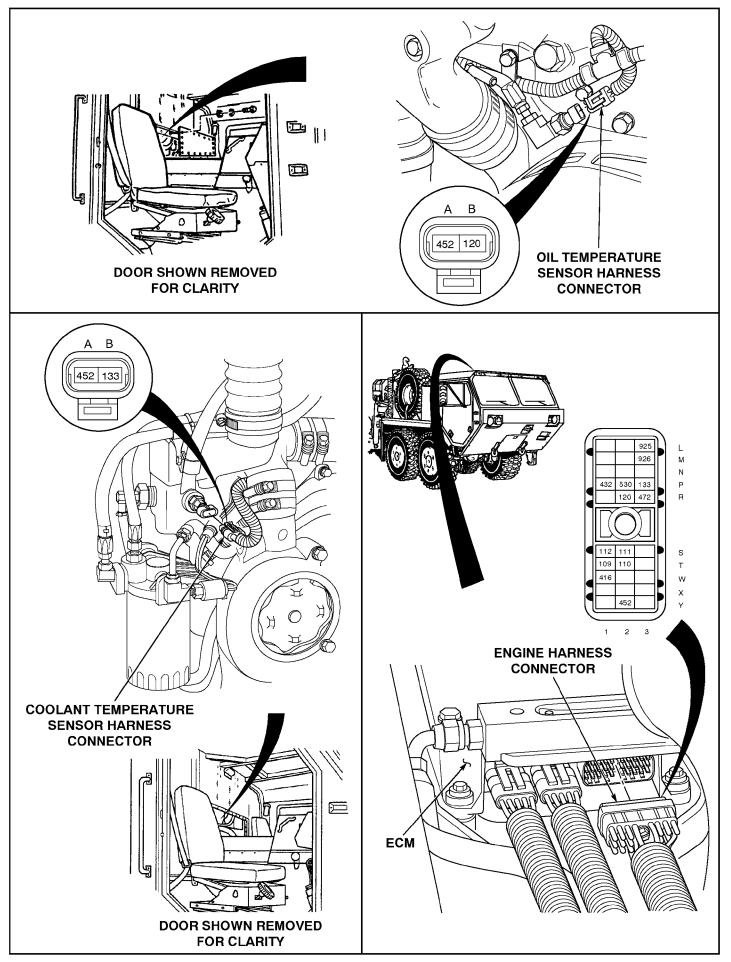


E. FLASH CODE: 14

J1587 CODE: P110 3 - COOLANT TEMPERATURE CIRCUIT FAILED HIGH (VOLTAGE HIGH)

OR: P175 3 - OIL TEMPERATURE CIRCUIT FAILED HIGH (VOLTAGE HIGH)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Read resistance between sockets R2 (ckt #120) and Y2 (ckt #452) on the engine harness connector.</li> </ul>	Less than orequal to 5 ohms.  Greater than5 ohms or open.	Go to 14-11.  Signal line (ckt #120) or return line (ckt #452) is open. Repair open. Then go to 14-30.
14-10 Check ECM Connectors		
<ul> <li>Check terminals at the ECM engine harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals andconnectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 14-30.  Repair terminals/connectors (para 7-101). Then go to 14-30.
14-11 Check ECM Connectors		
<ul> <li>Check terminals at the engine harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals andconnectors are okay.  Problem found	Replace ECM (para 7-57). Then go to 14-30.  Repair terminals/connectors (para 7-101). Then go to 14-30.
14-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or after 8 minutes. Stop engine.</li> <li>Read inactive codes.</li> </ul>	No codes.  Code 110/3 or 175/3 (any other codes.)  Any other codes except Codes 110/3 or 175/3.	All system diagnostics are complete. Please review this section from the start to find the error.  Go to START-1, pg 2-539, to service other codes.



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 15

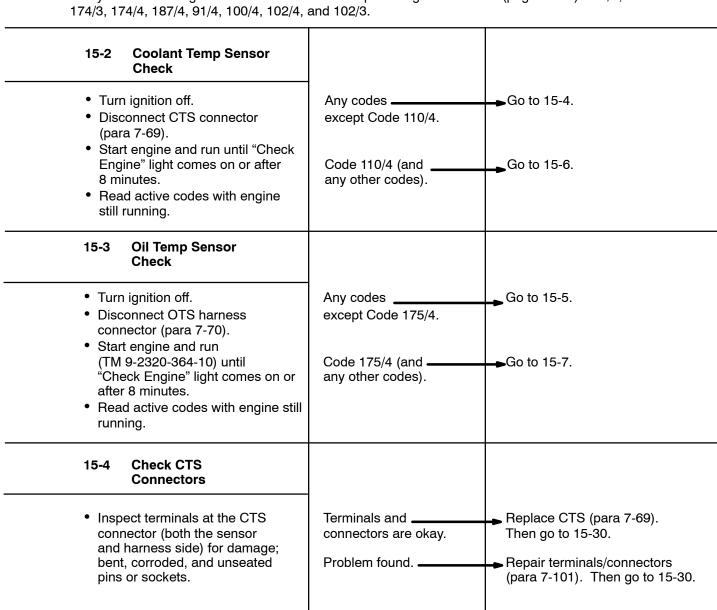
> J1587 CODE: P110 4 - COOLANT TEMPERATURE CIRCUIT FAILED LOW (LOW VOLTAGE) P175 4 - OIL TEMPERATURE CIRCUIT FAILED LOW (LOW VOLTAGE) OR:

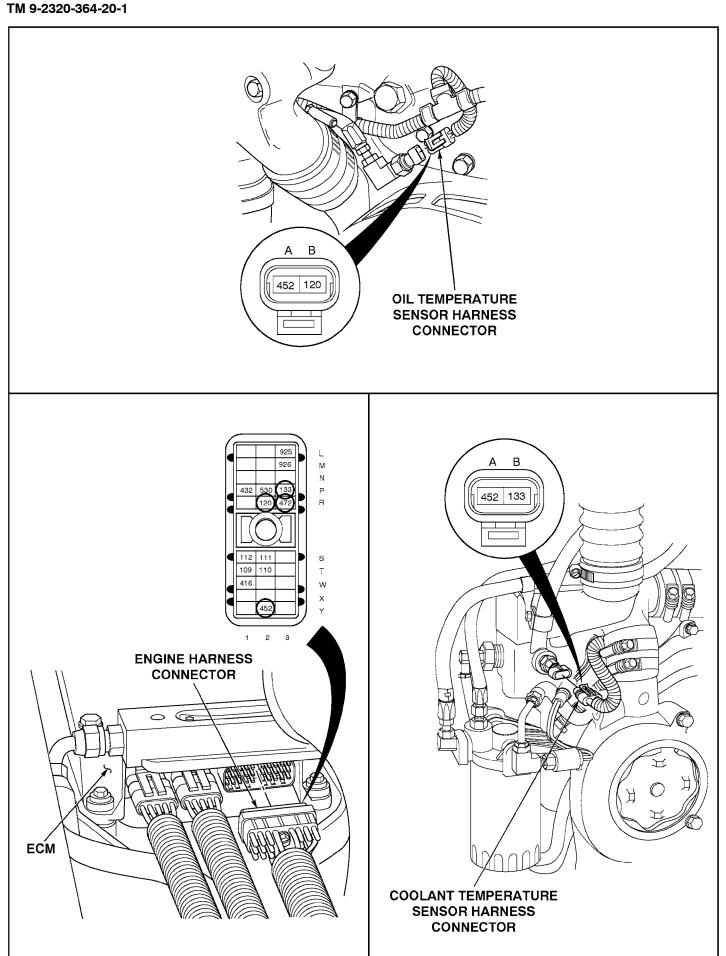
**NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
15-1 Code Check		
<ul> <li>Turn ignition on.</li> <li>Plug in DDR and determine which code is present.</li> </ul>	PID 110 - FMI 4 ————— PID 175 - FMI 4	Go to 15-2. Go to 15-3.

**NOTE:** If any of the following SAE J1587 Codes are also present go to ENG5V-1(page 2-761): 110/3,



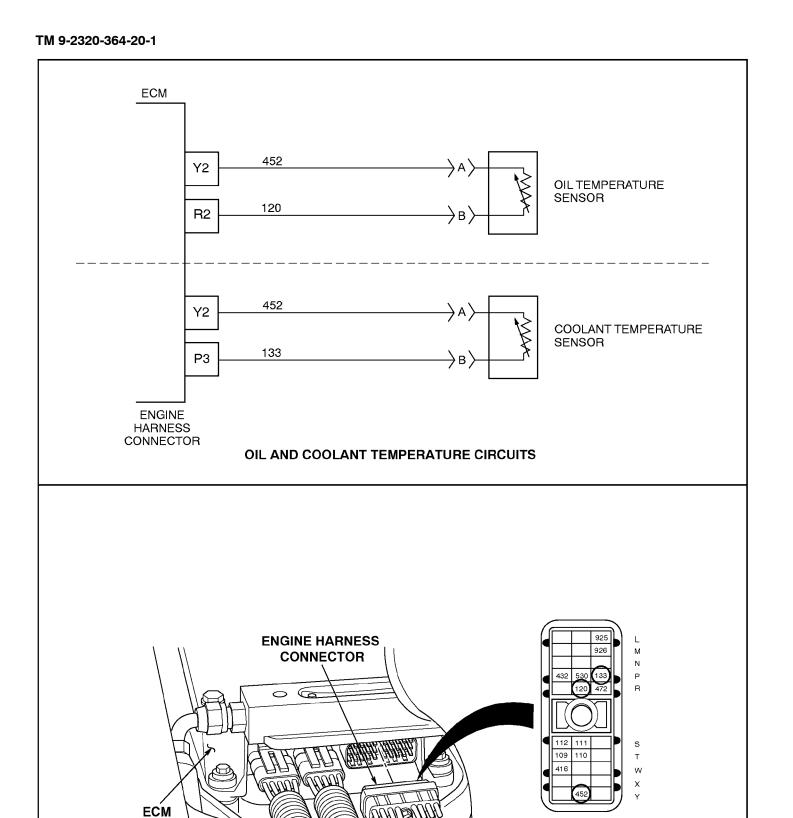


E. FLASH CODE: 15

J1587 CODE: P110 4 - COOLANT TEMPERATURE CIRCUIT FAILED LOW (LOW VOLTAGE)

OR: P175 4 - OIL TEMPERATURE CIRCUIT FAILED LOW (LOW VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Check OTS     Connectors      Inspect terminals at the OTS     connector (both the sensor     and harness side) for damage;     bent, corroded, and unseated     pins or sockets.	Terminals andconnectors are okay.  Problem found.	Replace OTS (para 7-70). Then go to 15-30.  Repair terminals/connectors (para 7-101). Then go to 15-30.
15-6 Check for Short		
<ul> <li>Turn ignition off.</li> <li>Disconnect engine harness connector at the ECM.</li> <li>Read resistance between sockets P3 (ckt #133) and Y2 (ckt #452) on the engine harness connector.</li> <li>Also read resistance between socket B of CTS connector and a good ground.</li> </ul>	Less than or equal to 10,000 ohms on either reading.  Greater than 10,000 ohms or open on both readings.	Signal line (ckt #133) is shorted to the return line (ckt #452) or battery ground. Repair short. Then go to 15-30.  Go to 15-8.
15-7 Check for Short		
<ul> <li>Turn ignition off.</li> <li>Disconnect engine harness connector at the ECM.</li> <li>Read resistance between sockets R2 (ckt #120) and Y2 (ckt #452) on the engine harness connector.</li> <li>Also read resistance between socket B of OTS connector and a good ground.</li> </ul>	Less than orequal to 10,000 ohms on either reading.  Greater than10,000 ohms or open on both readings.	Signal line (ckt #120) is shorted to the return line (ckt #452) or battery ground. Repair short. Then go to 15-30.  Go to 15-9.



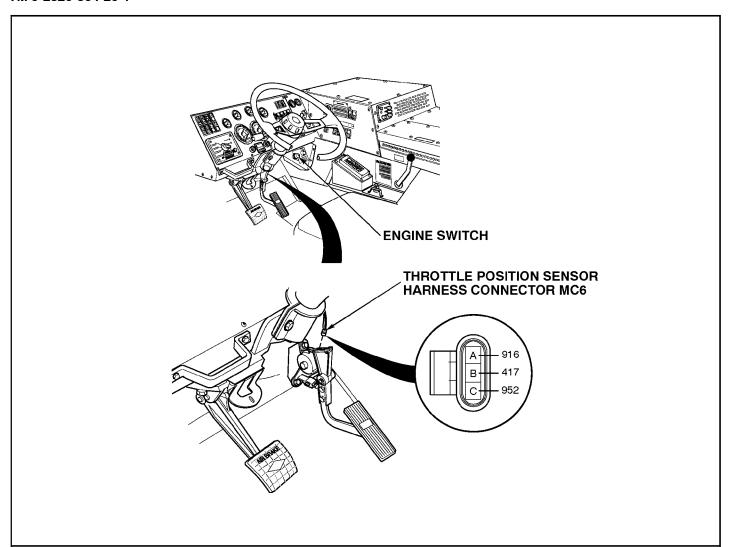
2 3

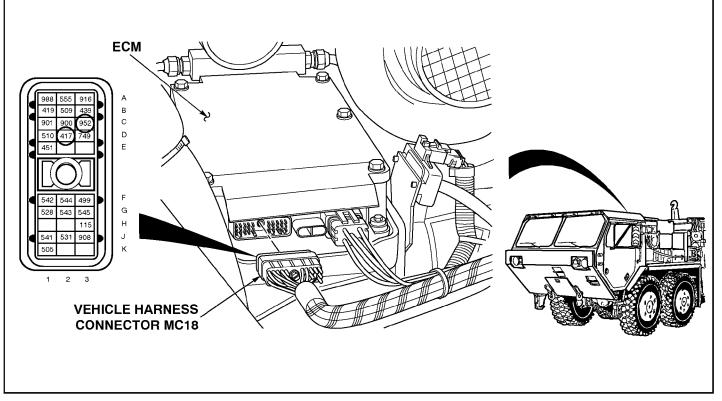
E. FLASH CODE: 15

J1587 CODE: P110 4 - COOLANT TEMPERATURE CIRCUIT FAILED LOW (LOW VOLTAGE)

OR: P175 4 - OIL TEMPERATURE CIRCUIT FAILED LOW (LOW VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
15-8 Check ECM Connectors		
<ul> <li>Check terminals at the engine harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets. Especially terminals P3 and Y2 of the engine harness connector.</li> </ul>	Terminals and connectors are okay.  Problem found.	<ul> <li>Replace ECM (para 7-57).</li> <li>Then go to 15-30.</li> <li>Repair terminals/connectors (para 7-101). Then go to 15-30.</li> </ul>
15-9 Check ECM Connectors		
<ul> <li>Check terminals at the engine harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets. Especially terminals R2 and Y2 of the engine harness connector.</li> </ul>	Terminals and connectors are okay.  Problem found.	<ul> <li>Replace ECM (para 7-57).</li> <li>Then go to 15-30.</li> <li>Repair terminals/connectors (para 7-101).</li> </ul>
15-30 Verify Repairs		
<ul><li>Turn ignition off.</li><li>Reconnect all connectors.</li></ul>	No codes	Repairs are complete.
<ul> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not</li> </ul>	Code 110 or 175/4(and any other codes).	<ul> <li>All system diagnostics are complete. Please review this section from the start to find the error.</li> </ul>
stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or for 1 minute. Stop engine.  • Read inactive codes.	Any other codes except Code 110 or 175/4.	Go to START-1, pg 2-539, to service other codes.





### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 21

J1587 CODE: P91 3 - ELECTRONIC FOOT PEDAL ASM (EFPA) CIRCUIT FAILED HIGH

(VOLTAGE HIGH) ALSO CALLED THROTTLE POSITION SENSOR

(TPS)

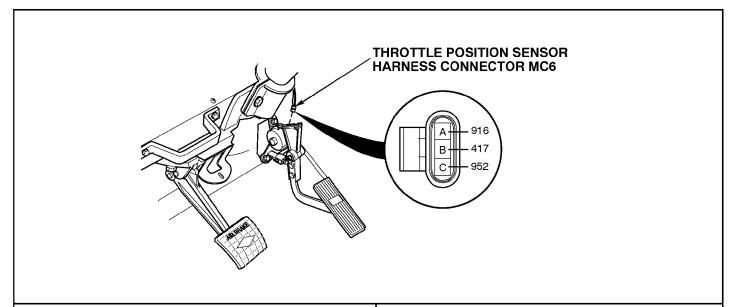
**NOTE** - This chart is only to be used if:

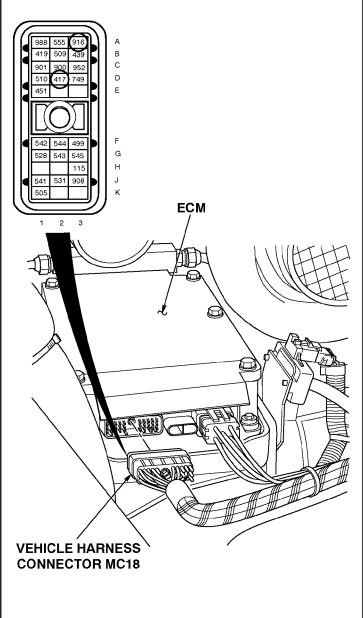
1) All basic mechanical checks and physical inspections have been performed with no problem found; and,

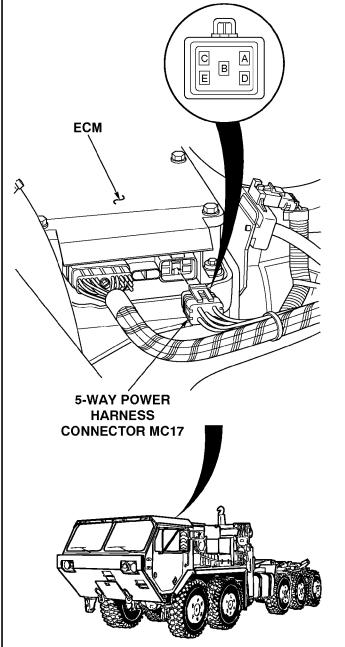
2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

NOTE - Checks at the TPS connector must be made at MC6, not at the connector on the electronic throttle.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
• Were there any other active codes besides 91/3?	Yes, any or all of the following active codes: 187/3, 91/4.  Yes - But none of the above.	Go to 21-2.  Go to VEH5V-1 (page 2-767).  Go to 21-2.
21-2 Sensor Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect TPS connector.</li> <li>Turn ignition on.</li> <li>Read active codes.</li> </ul>	Any code(except Code 91/3).  Code 91/3 (and anyother codes).	Go to 21-3.  Go to 21-7.
21-3 Return Circuit Check		
<ul> <li>Turn ignition off.</li> <li>Install a jumper wire between pins B and C of the TPS harness connector.</li> <li>Disconnect the vehicle harness connector at the ECM.</li> <li>Read resistance between sockets D2 and C3 on the vehicle harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms open.	Return line (ckt #952) and/or signal (ckt #417) is open. Repair open. Then go to 21-30.
21-4 Check TPS Adjustment		
<ul> <li>Reconnect vehicle harness connector and plug TPS back in.</li> <li>Hook-up DDR to the DDL connector and select TPS CNTS.</li> <li>Turn ignition on.</li> <li>Read TPS Counts at both no throttle and full throttle.</li> </ul>	Getting 64-205 counts at no throttle and less than 968 counts at full throttle.  Not getting the above	Go to 21-6.  Replace TPS (para 7-58). Then go to 21-30.







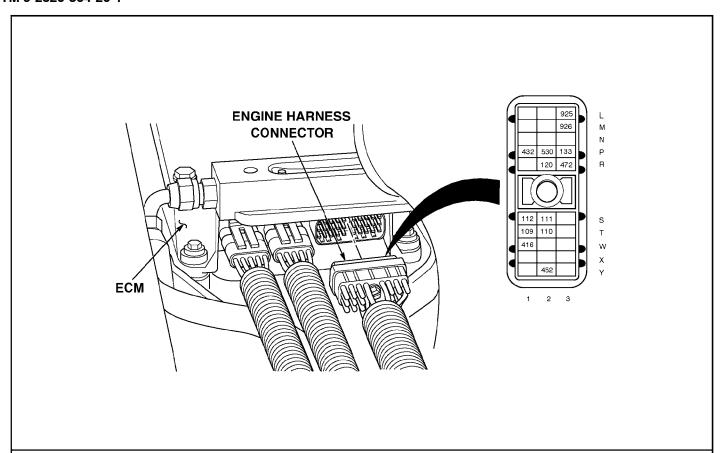
E. FLASH CODE: 21

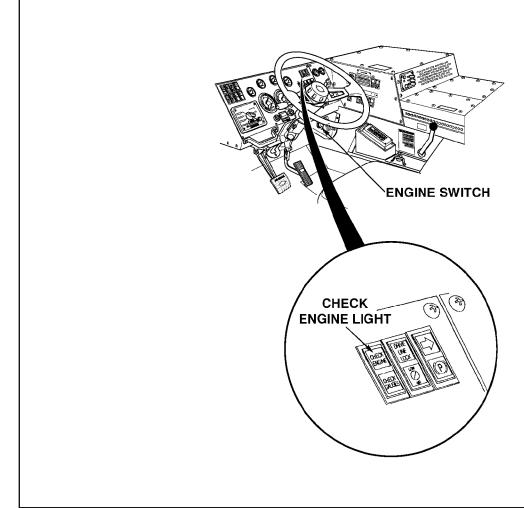
J1587 CODE: P91 3 - ELECTRONIC FOOT PEDAL ASM (EFPA) CIRCUIT FAILED HIGH

(VOLTAGE HIGH) ALSO CALLED THROTTLE POSITION SENSOR

(TPS)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
21-5 (Deleted)		
21-6 Check TPS Connectors		
<ul> <li>Inspect terminals at the TPS connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins of sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace TPS (Electronic Throttle) (para 7-58). Then go to 21-30.  Repair terminals/connectors (para 7-101). Then go to 21-30.
21-7 Check for Short		
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector at the ECM.</li> <li>Read resistance between sockets D2 and A3 on the vehicle harness connector.</li> </ul>	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	Signal line (ckt #417) is shorted to the vehicle + 5 volt line (ckt #916). Repair short. Then go to 21-30.  Go to 21-8.
21-8 Check for Short to Battery +		
<ul> <li>Disconnect batteries (para 7-90).</li> <li>Disconnect the vehicle harness and 5-way power harness connectors at the ECM.</li> <li>Read resistance between socket D2 of the vehicle harness connector and socket B3 of the vehicle harness connector.</li> <li>Also read resistance between socket D2 on the vehicle harness connector and the following sockets on the 5-way power harness connector: A and C.</li> </ul>	All readings are greater than 10,000 ohms or open.  Any reading is less than or equal to 10,000 ohms.	A short exists between the sockets where less than 10,000 ohms resistance was read. Repair short. Then go to 21-30.



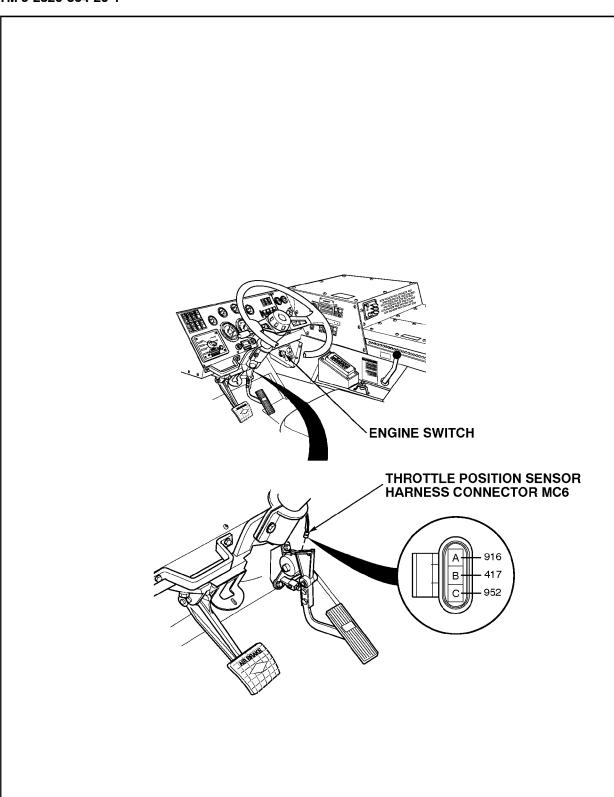


E. FLASH CODE: 21

ELECTRONIC FOOT PEDAL ASM (EFPA) CIRCUIT FAILED HIGH (VOLTAGE HIGH) ALSO CALLED THROTTLE POSITION SENSOR J1587 CODE: P91 3 -

(TPS)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
21-9 Check ECM Connectors		
<ul> <li>Check terminals at the vehicle harness connector (both the ECM and harness side) for damage; bent, corroded and unseated pins or sockets.</li> </ul>	Terminals andconnectors are okay.  Problem found	Replace ECM (para 7-57). Then go to 21-30.  Repair terminals/connectors (para 7-101). Then go to 21-30.
21-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or 1 minute. Stop engine.</li> <li>Read all codes.</li> </ul>	No codes.  Code 91/3 (and any other codes).  Any other codes except Code 91/3.	<ul> <li>Repairs are complete.</li> <li>All system diagnostics are complete. Please review this section from the first step to find the error.</li> <li>Go to START-1, pg 2-539, to service other codes.</li> </ul>



### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 22

J1587 CODE: P91 4 - ELECTRONIC FOOT PEDAL ASM (EFPA) CIRCUIT FAILED LOW

(VOLTAGE LOW) ALSO CALLED THROTTLE POSITION SENSOR

(TPS)

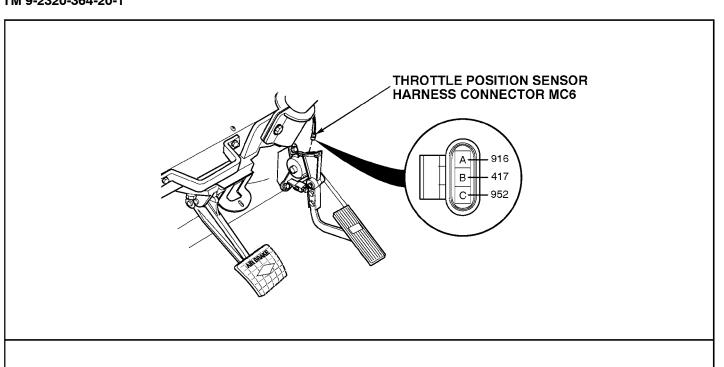
**NOTE** - This chart is only to be used if:

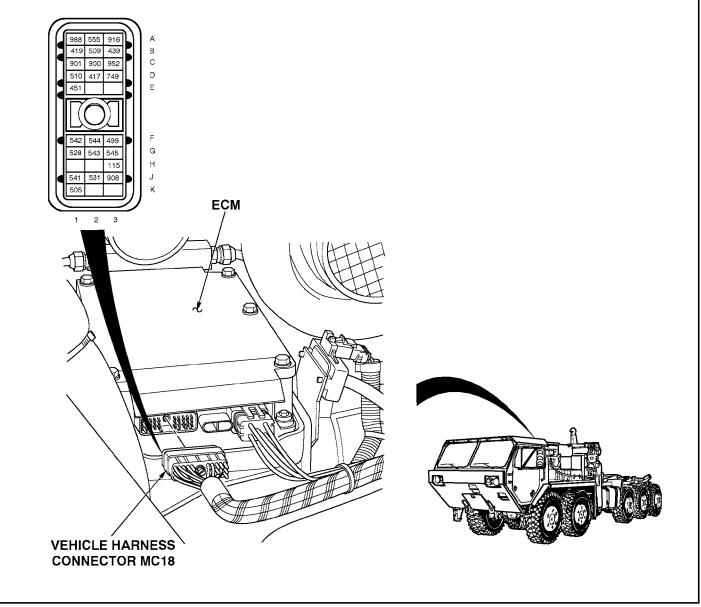
1) All basic mechanical checks and physical inspections have been performed with no problem found; and,

2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

NOTE - Checks at the TPS connector must be made at MC6, not at the connector on the electronic throttle.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Were there any other active codes besides 91/4?	Yes, any or all of the following codes: 187/3, 91/3.  Yes - But none of the above.	Go to 22-2.  Go to VEH5V-1 (page 2-767).  Go to 22-2.
<ul> <li>22-2 Sensor Check</li> <li>Turn ignition off.</li> <li>Disconnect the TPS connector.</li> <li>Install a jumper wire between sockets B and C of the TPS harness connector.</li> <li>Turn ignition on.</li> <li>Read active codes.</li> </ul>	Code 91/4 and/orother codes.  Code 91/3 (and anyother codes).	
<ul> <li>Remove jumper and reconnect TPS.</li> <li>Hook-up DDR to the DDL connector and select TPS CNTS.</li> <li>Read TPS Counts at both no throttle and full throttle.</li> </ul>	Getting 64-205 counts at no throttle and less than 968 counts at full throttle.  Not getting the above readings.	Go to 22-5.  Replace TPS (para 7-58). Then go to 22-30.





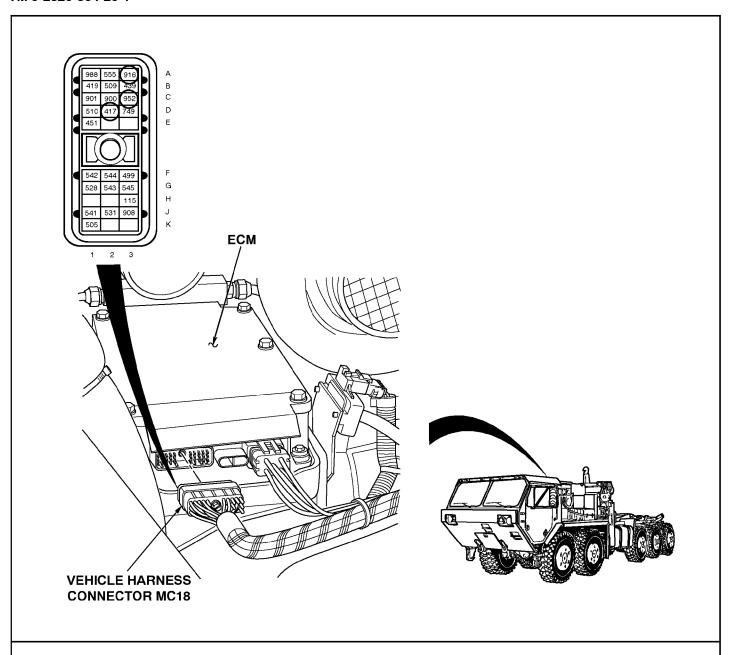
E. FLASH CODE: 22

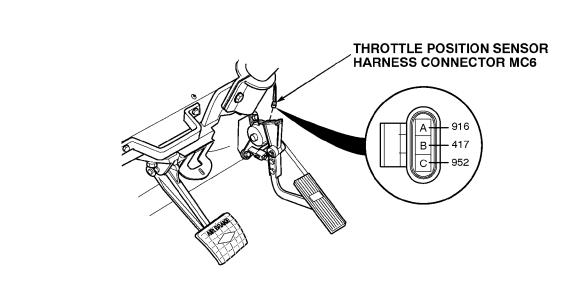
J1587 CODE: P91 4 - ELECTRONIC FOOT PEDAL ASM (EFPA) CIRCUIT FAILED HIGH

(VOLTAGE HIGH) ALSO CALLED THROTTLE POSITION SENSOR

(TPS)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
22-4 (Deleted)		
22-5 Check TPS Connectors		
<ul> <li>Inspect terminals at the TPS connectors (sensor side and harness side) for damage, corrosion, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace TPS (para 7-58). Then go to 22-30.  Repair terminals/connectors (para 7-101). Then go to 22-30
22-6 Check for +5 Volts		
<ul> <li>Turn ignition off.</li> <li>Remove jumper</li> <li>Turn ignition on.</li> <li>Read voltage on TPS connector, socket C (red lead) to socket A (black lead).</li> </ul>	Between4 to 6 volts.  Less than4 volts.  Greater than6 volts.	Go to 22-7.  Go to 22-10.  Go to 22-12.
22-7 Check for Short		
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector at ECM.</li> <li>Read resistance between sockets B and C on the TPS connector.</li> <li>Also read resistance between socket B of TPS connector and a good ground.</li> </ul>	Less than orequal to 10,000 ohms on either reading.  Greater than10,000 ohms or open on both readings.	Signal line (ckt #417) is shorted to the return line (ckt #952) or battery ground. Repair short. Then go to 22-30.  Go to 22-8.





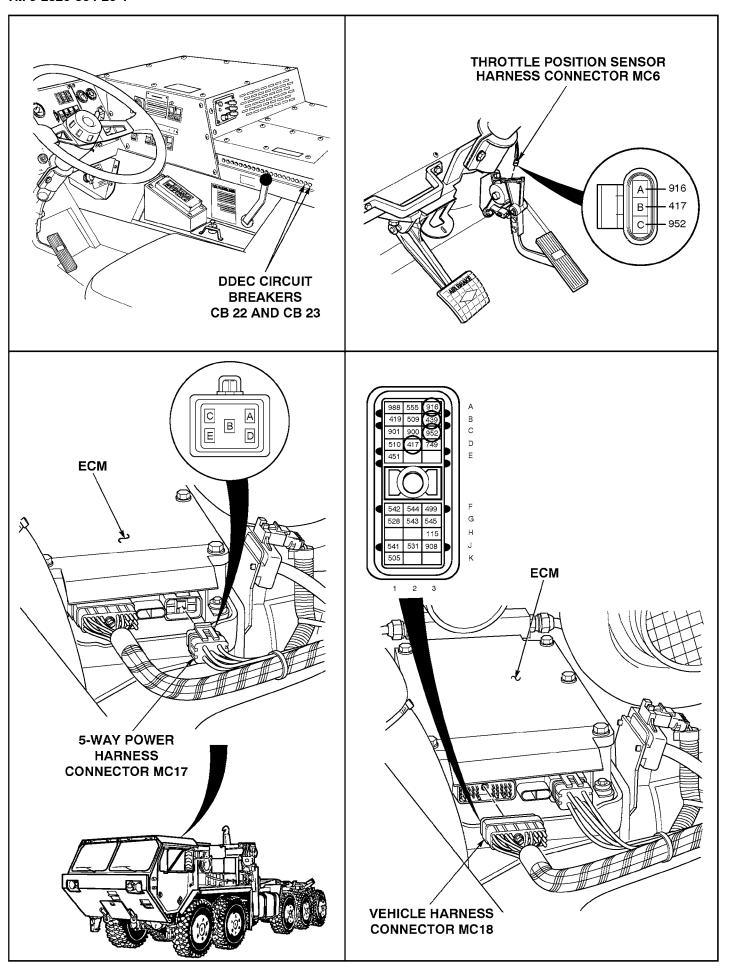
E. FLASH CODE: 22

J1587 CODE: P91 4 - ELECTRONIC FOOT PEDAL ASM (EFPA) CIRCUIT FAILED HIGH

(VOLTAGE HIGH) ALSO CALLED THROTTLE POSITION SENSOR

(TPS)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
22-8 Check for Signal Open		
<ul> <li>Install a jumper wire between sockets B and C of the TPS connector.</li> <li>Read resistance between sockets D2 and C3 on the vehicle harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Go to 22-9.  Signal line (ckt # 417) is open. and/or signal return (ckt #952) is open. Repair open. If no open was found, check ECM terminals A3, D2, C3, and TPS pins. Then go to 22-30.
22-9 Check ECM Connectors		
<ul> <li>Check terminals at the vehicle harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 22-30.  Repair terminals/connectors (para 7-101). Then go to 22-30.
22-10 Check for Short		
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector at the ECM.</li> <li>Read resistance between sockets A and C on the TPS connector.</li> </ul>	Less than orequal to 10,000 ohms.	The vehicle +5 volt line (ckt #916) is shorted to the return line (ckt #952). Repair short. Then go to 22-30.
	Greater than 10,000 ohms or open.	—→Go to 22-11.
22-11 Check for Open +5 Volt Line		
<ul> <li>Install a jumper wire between sockets A and C of the TPS connector.</li> </ul>	Less than orequal to 5 ohms.	Go to 22-9.
<ul> <li>Read resistance between sockets A3 and C3 on the vehicle harness connector.</li> </ul>	Greater than5 ohms or open.	The vehicle +5 volt line (ckt #916) is open. Repair open. Then go to 22-30.

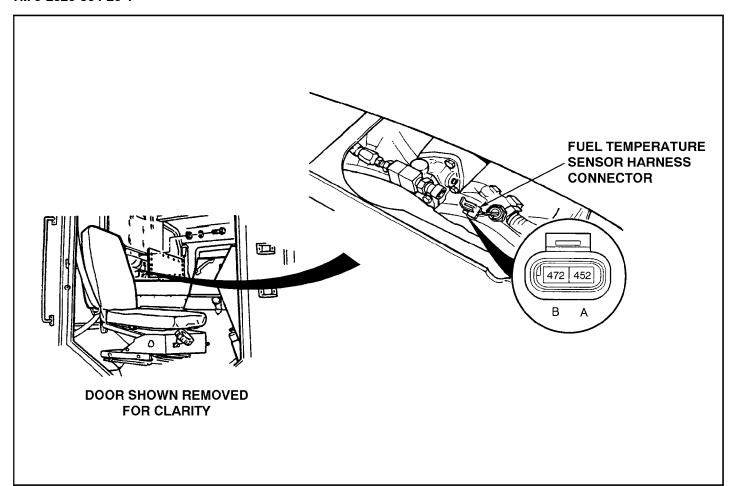


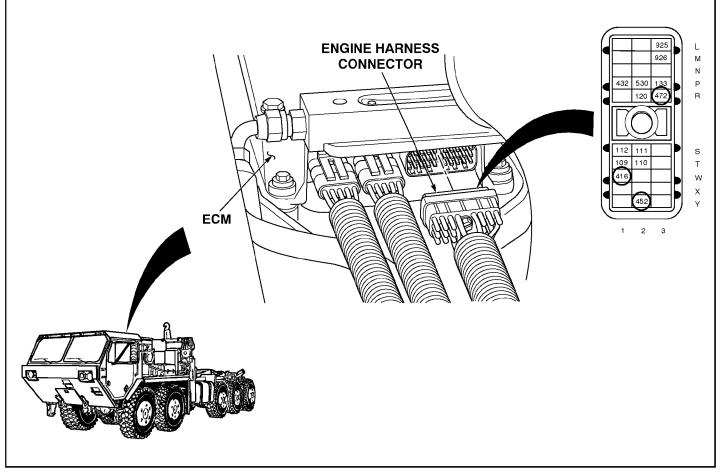
E. FLASH CODE: 22

J1587 CODE: P91 4 -

ELECTRONIC FOOT PEDAL ASM (EFPA) CIRCUIT FAILED HIGH (VOLTAGE HIGH) ALSO CALLED THROTTLE POSITION SENSOR

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
22-12 Check for Short to Battery +  • Turn ignition off. • Pull out both DDEC circuit breakers (CB22 & CB23). • Disconnect 5-way power harness connector at the ECM. • Read resistance between sockets D2 and B3 on the vehicle harness connector. • Also read resistance between socket D2 on the vehicle harness connector and the following sockets on the 5-way power harness connector: B, C, D, & E.	All readings are greater than 10,000 ohms or open.  Any reading is less than or equal to 10,000 ohms.	A short exists between sockets where less than 10,000 ohms resistance was read. Repair short and reset circuit breakers. Then go to 22-30.
22-13 Check for Outside DDEC Battery +  • Turn ignition off.  • Remove ECM 5-way power harness connectors.  • Remove vehicle harness connector.  • Turn ignition on.  • Read voltage A3 (red lead) to a good ground (black lead).  • Read voltage C3 (red lead) to a good ground (black lead).	All readings less than 4.0 volts.  Either reading greater than or equal to 4.0 volts.	Go to 22-9.  Outside power is shorted to either (ckt #952) or (ckt #916). Repair short. Then go to 22-30.
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or 1 minute. Stop engine.</li> <li>Read all codes.</li> </ul>	No codes.  Code 91/4 (and any other codes).  Any other codes except Code 91/4.	Repairs are complete.  All system diagnostics are complete. Please review this section from the first step to find the error.  Go to START-1, pg 2-539, to service other codes.





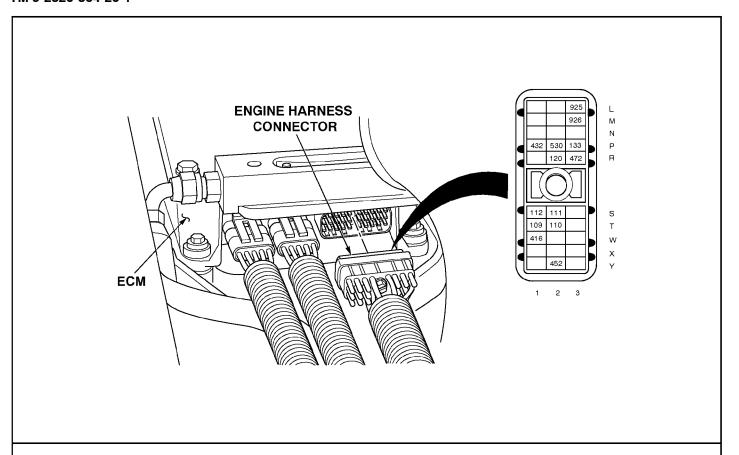
#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

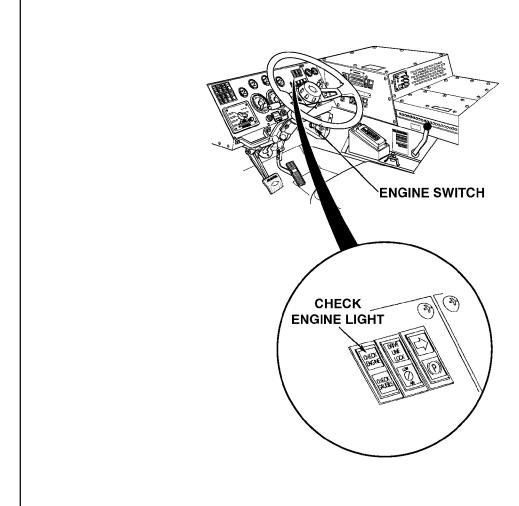
E. FLASH CODE: 23

J1587 CODE: P174 3 - FUEL TEMPERATURE CIRCUIT FAILED HIGH (HIGH VOLTAGE)

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Turn ignition off.</li> <li>Disconnect FTS sensor connector (para 7-62) and install a jumper wire between the FTS connector sockets A and B.</li> <li>Turn ignition on.</li> <li>Read active codes.</li> </ul>	Code 174/4 and/orany codes except Code 174/3.  Anything exceptCode 174/4.	Go to 23-2. Go to 23-4.
23-2 Check for Short to +5 Volt Line  • Turn ignition off. • Remove jumper wire. • Disconnect the engine harness connector at the ECM. • Read resistance between sockets R3 and W1 on the engine harness connector.	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	Signal line (ckt #472) is shorted to the engine +5 volt line (ckt #416), and/or (ckt #472) signal is shorted to (ckt #452) sensor return, and/or ground. Repair short. Then go to 23-30.  Go to 23-3.
Check FTS Connectors      Inspect terminals at the FTS connectors (both the sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.	Terminals and connectors are okay.  Problem found.	Replace FTS (para 7-62). Then go to 23-30.  Repair terminals/connectors (para 7-101). Then go to 23-30.
<ul> <li>Open Line Check</li> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Read resistance between sockets R3 and Y2 on the engine harness connector.</li> </ul>	Less than orequal to 5 ohms.  Greater than5 ohms or open.	Go to 23-5.  Signal line (ckt #472) or return line (ckt #452) is open. Repair open. Then go to 23-30.

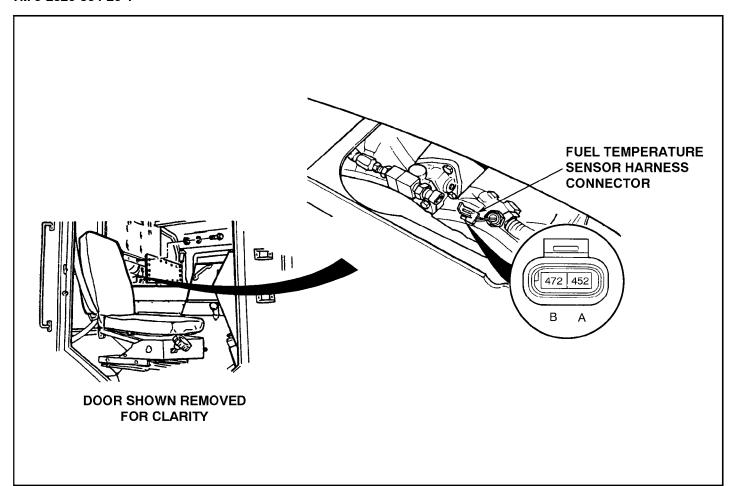


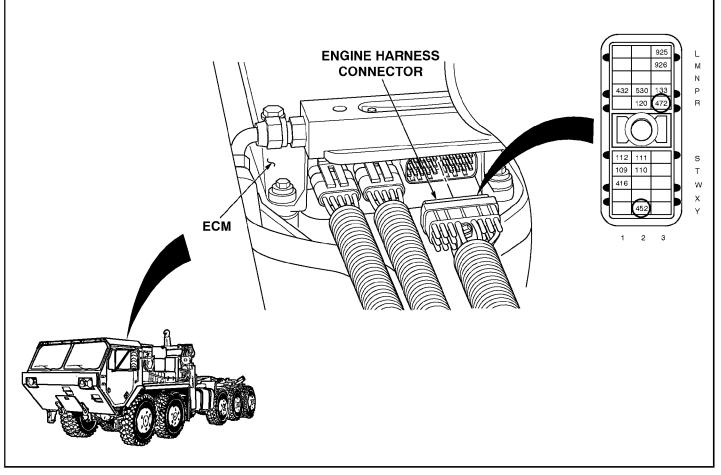


E. FLASH CODE: 23

J1587 CODE: P174 3 - FUEL TEMPERATURE CIRCUIT FAILED HIGH (HIGH VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Check ECM Connectors      Check terminals at the engine harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.	Terminals and connectors are okay. Problem found	Replace ECM (para 7-57). Then go to 23-30.  Repair terminals/connectors (para 7-101). Then go to 23-30.
23-30 Verify Repairs  • Turn ignition off.	No codes.	Repairs are complete.
<ul> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not</li> </ul>	Code 174/3 (and any other codes).	All system diagnostics are complete. Please review this section from the first step to find the error.
stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or for 8 minutes. Stop engine. • Read inactive codes.	Any other codes except Code 174/3.	Go to START-1, pg 2-539, to service other codes.





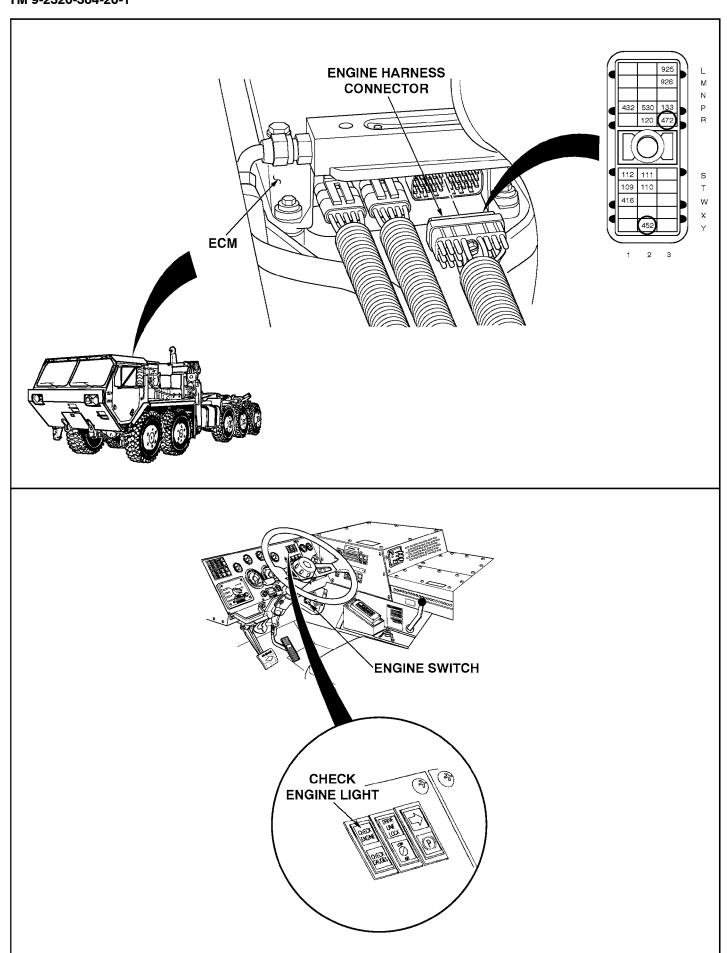
#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 24

J1587 CODE: P174 4 - FUEL TEMPERATURE CIRCUIT FAILED LOW (LOW VOLTAGE)

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

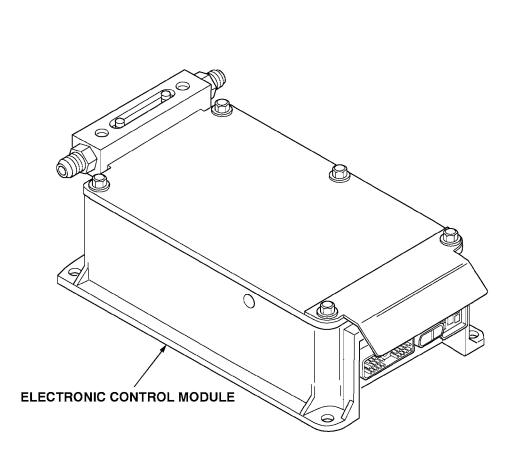
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Were there any other active codes besides Code 174/4?	No other codes	→ Go to 24-2.  → Go to VEH5V-1 (page 2-767).  → Go to 24-2.
24-2 Sensor Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect FTS connector (para 7-62).</li> <li>Start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or for 8 minutes.</li> <li>Read active codes with engine still running.</li> </ul>	Code 174/3 (or any other codes except Code 174/4).  Code 174/4 (and any other codes).	— Go to 24-3.  Go to 24-4.
24-3 Check FTS Connectors		
<ul> <li>Inspect terminals at the FTS connectors (both the sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals andconnectors are okay.  Problem found.	Replace FTS (para 7-62). Then go to 24-30.  Repair terminals/connectors (para 7-101). Then go to 24-30.
24-4 Open Line Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Read resistance between sockets R3 and Y2 on the engine harness connector.</li> <li>Also read resistance between socket B of FTS connector and a good ground.</li> </ul>	Less than or equal to 10,000 ohms on either reading.  Greater than 10,000 ohms or open on both readings.	■ Signal line (ckt #472) is shorted to the return line (ckt #452) or battery ground. Repair short. Then go to 24-30.  Go to 24-5.



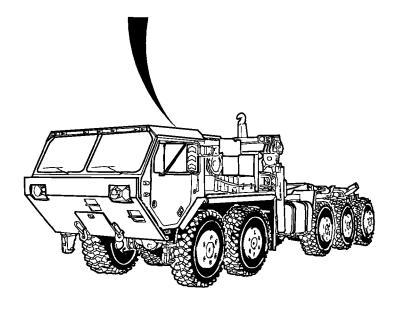
E. FLASH CODE: 24

J1587 CODE: P174 4 - FUEL TEMPERATURE CIRCUIT FAILED LOW (LOW VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
24-5 Check ECM Connectors		
<ul> <li>Check terminals at the engine harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets. Especially R3 and Y2 of the engine harness connector.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 24-30.  Repair terminals/connectors (para 7-101). Then go to 24-30.
24-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or for 8 minutes. Stop engine.</li> <li>Read inactive codes.</li> </ul>	No codes.  Code 174/4 (and any other codes).  Any other codes except Code 174/4.	All system diagnostics are complete. Please review this section from the start to find the error.  Go to START-1, pg 2-539, to service other codes.



**ECM SHOWN REMOVED FOR CLARITY** 



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

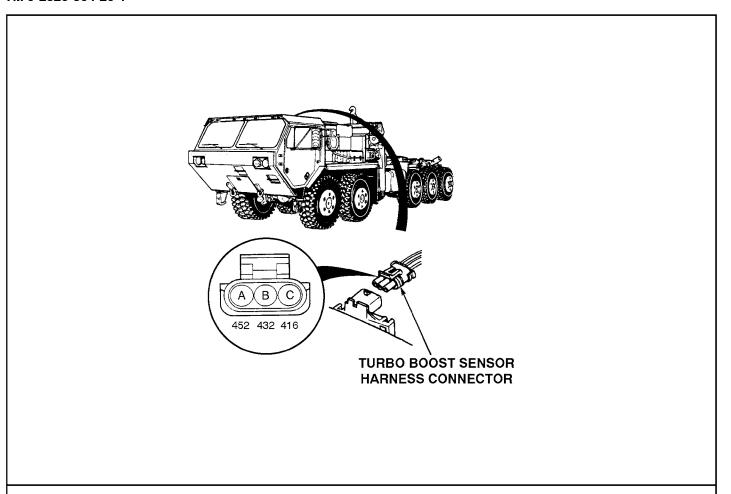
E. FLASH CODE: 25

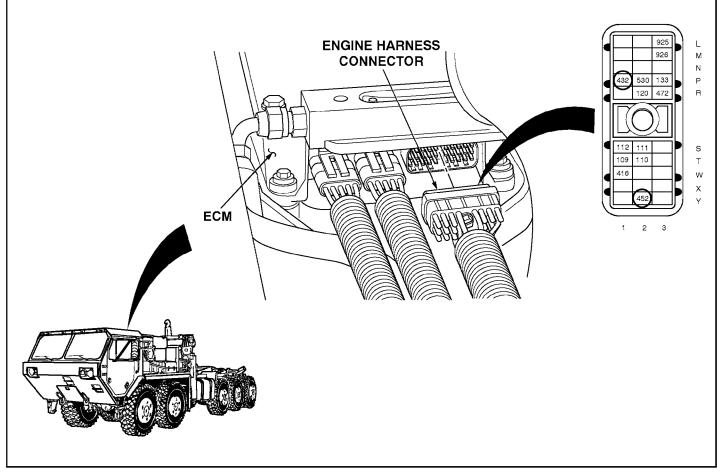
J1587 CODE: NONE NO CODES

**NOTE -** This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

No faults have been detected by DDEC III/IV since the last time the codes were cleared. If symptoms remain, and all basic mechanical and visual inspections have been performed with no causes to the problem found, you can try using Chart 1 (Intermittent Code or a Symptom and No Codes) on Page 2-554.





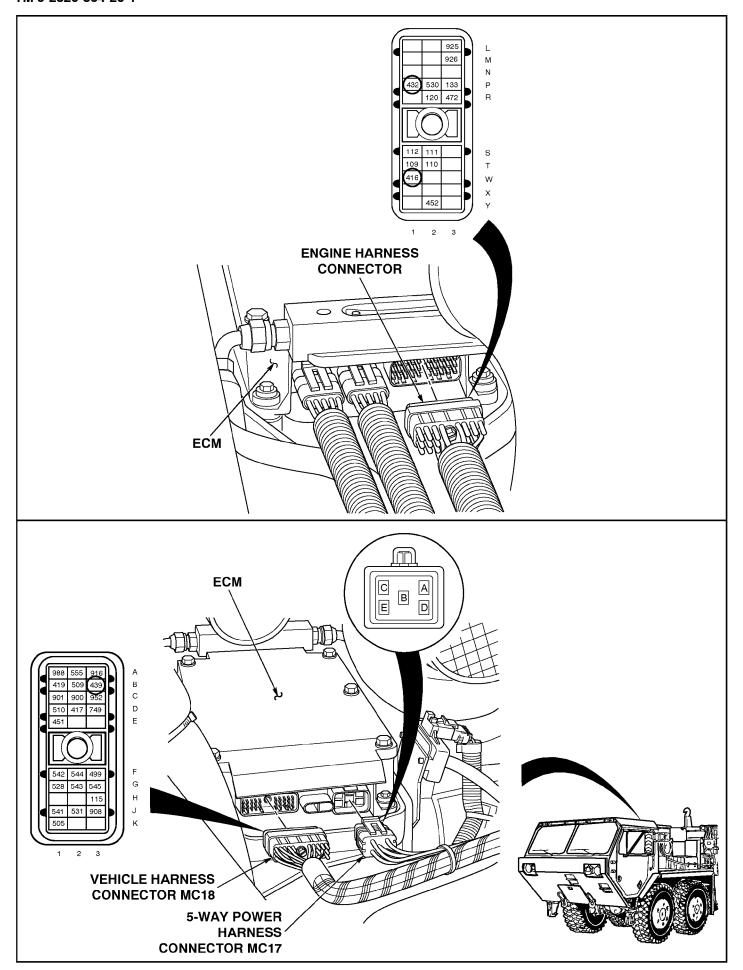
#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 33

J1587 CODE: P102 3 - TURBO BOOST PRESSURE CIRCUIT FAILED HIGH (HIGH VOLTAGE)

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

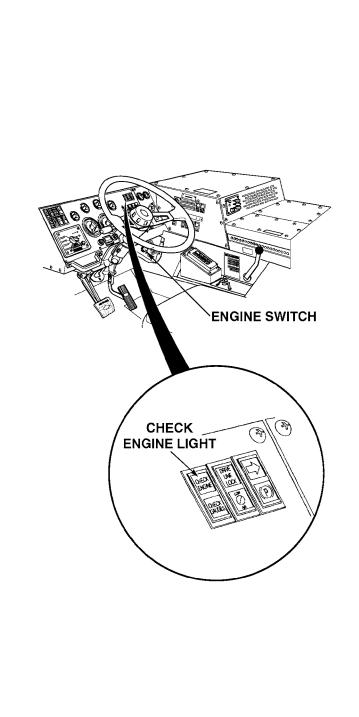
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Multiple Code Check      Were there any other active codes besides Code 102/3?	No other codes.  Yes, any or all of the following codes: 110/3 or 4, 175/3 or 4, 174/3 or 4, 100/3 or 4.  Yes - but none of the above.	Go to 33-2. Go to ENG5V-1 (pg 2-761). Go to 33-2.
33-2 Sensor Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect TBS connector (para 7-63).</li> <li>Start and run engine at idle (TM 0.2320.364.10)</li> </ul>	Code 102/4 (and any codes except Code 102/3).	Go to 33-3.  Go to 33-5.
<ul><li>(TM 9-2320-364-10).</li><li>Read active codes with engine running.</li></ul>	Code 102/3 (and any other codes).	G0 t0 33-5.
33-3 Return Circuit Check		
<ul> <li>Turn ignition off.</li> <li>Install a jumper wire between pins A and B of the TBS</li> </ul>	Less than or equal to 5 ohms.	→ Go to 33-4.
<ul> <li>Disconnect engine harness connector at the ECM.</li> <li>Read resistance between sockets P1 and Y2 on the engine harness connector.</li> </ul>	Greater than5 ohms or open.	Return line (ckt #452) is open. Repair open. Then go to 33-30.
33-4 Check TBS Connectors		
<ul> <li>Inspect terminals at the TBS connectors (both the sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace TBS (para 7-63). Then go to 33-30.  Repair terminals/connectors (para 7-101). Then go to 33-30



E. FLASH CODE: 33

J1587 CODE: P102 3 - TURBO BOOST PRESSURE CIRCUIT FAILED HIGH (HIGH VOLTAGE)

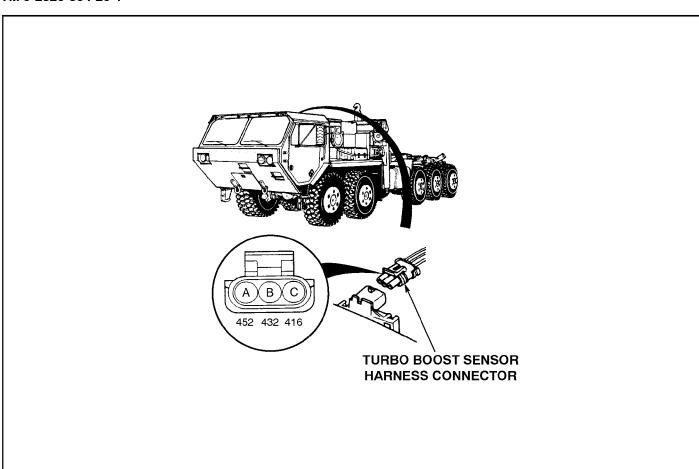
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>33-5 Check for Short to +5 Volt Line</li> <li>Turn ignition off.</li> <li>Disconnect engine harness connector at the ECM.</li> <li>Read resistance between sockets W1 and P1 on the engine harness connector.</li> </ul>	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	Signal line (ckt #432) is shorted to the engine +5 volt line (ckt #416). Repair short. Then go to 33-30.  Go to 33-6.
<ul> <li>Oisconnect batteries (para 7-87).</li> <li>Disconnect the vehicle harness and 5-way power harness connectors at the ECM.</li> <li>Read resistance between socket P1 of the engine harness connector and socket B3 of the vehicle harness connector.</li> <li>Also read resistance between socket P1 on the engine harness connector and the following sockets on the 5-way power harness connector: A and C.</li> </ul>	All readings are greater than 10,000 ohms or open.  Any reading is less than or equal to 10,000 ohms.	A short exists between the sockets where less than 10,000 ohms resistance was read. Repair short and connect batteries. Then go to 33-30.
Check terminals at the engine harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 33-30.  Repair terminals/connectors (para 7-101). Then go to 33-30.

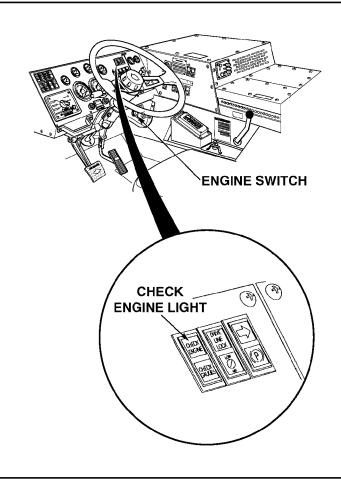


E. FLASH CODE: 33

J1587 CODE: P102 3 - TURBO BOOST PRESSURE CIRCUIT FAILED HIGH (HIGH VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
33-30 Verify Repairs		
<ul><li>Turn ignition off.</li><li>Reconnect all connectors.</li></ul>	No codes.	Repairs are complete.
<ul> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not</li> </ul>	Code 102/3 (and any other codes).	All system diagnostics are complete. Please review this section from the start to find the error.
stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or 1 minute. Stop engine.  • Read inactive codes.	Any other codes except Code 102/3.	Go to START-1, pg 2-539, to service other codes.





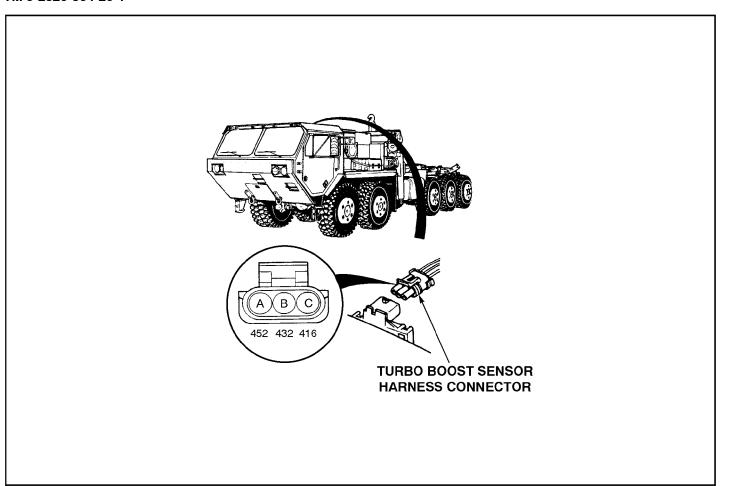
#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

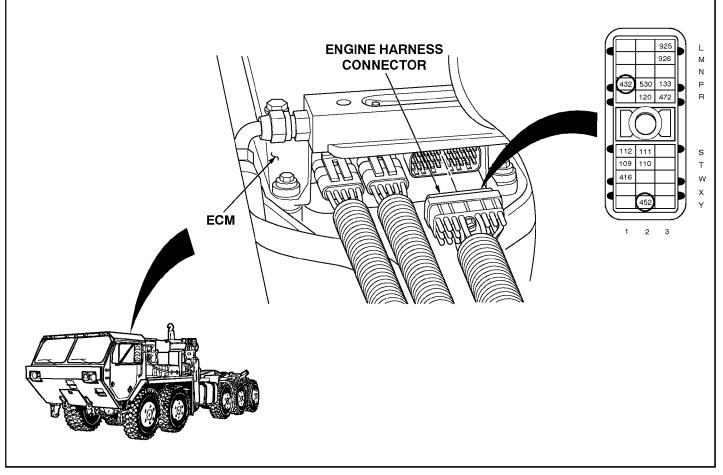
E. FLASH CODE: 34

J1587 CODE: P102 4 - TURBO BOOST PRESSURE CIRCUIT FAILED LOW (LOW VOLTAGE)

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Were there any other active codes besides Code 102/4?	No other codes.  Yes, any or all of the following codes: 110/3 or 4, 175/3 or 4, 174/3 or 4, 102/3, 100/3 or 4, 187/4, 91/4.  Yes - but none of the above.	Go to 34-2. Go to ENG5V-1 (page 2-761). Go to 34-2.
<ul> <li>Turn ignition off.</li> <li>Disconnect TBS connector (para 7-63).</li> <li>Install a jumper wire between sockets B and C of the TBS connector.</li> <li>Turn ignition on.</li> <li>Read active codes.</li> <li>If active Code 102/3 or 4 exist go to RESULT column.</li> <li>If no active Code 102/3 or 4 exists, start engine and run (TM 9-2320-364-10) until either "Check Engine" light come on or the engine has been run warm for at least one minute a greater than 1000 RPM.</li> <li>Read active codes.</li> </ul>	er es ining	Go to 34-3.  Go to 34-4.
Check TBS Connectors      Inspect terminals at the TBS connectors (both the sensor ar harness side) for damage; ben corroded, and unseated pins o sockets.	Terminals and connectors are okay.	Replace TBS (para 7-63). Then go to 34-30.  Repair terminals/connectors (para 7-101). Then go to 34-30.

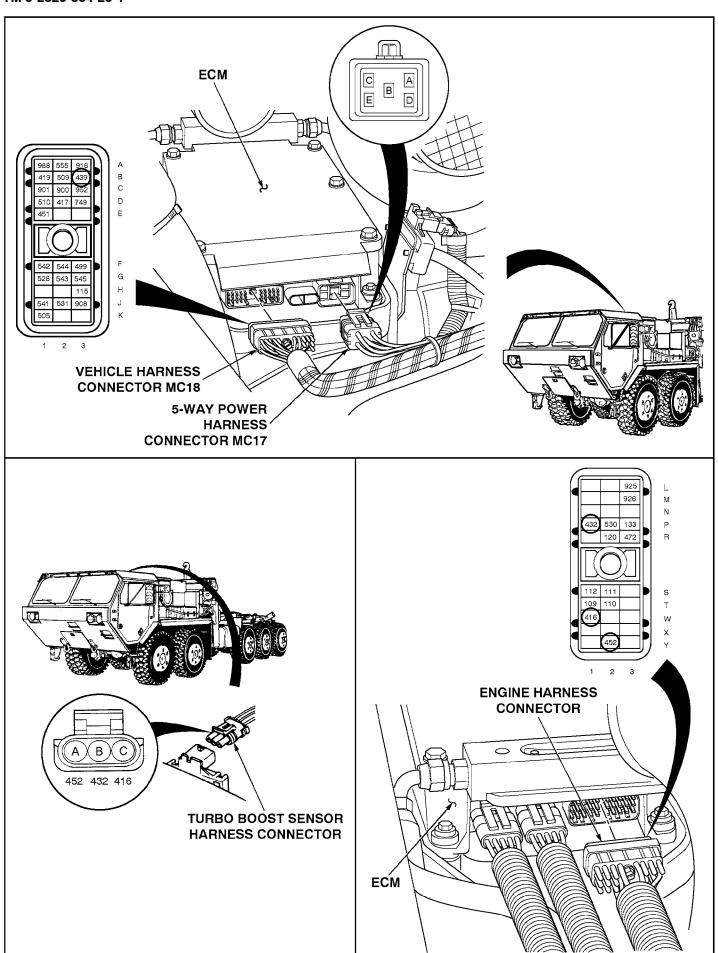




E. FLASH CODE: 34

J1587 CODE: P102 4 - TURBO BOOST PRESSURE CIRCUIT FAILED LOW (LOW VOLTAGE)

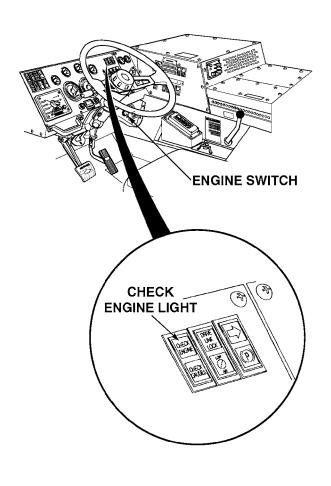
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
34-4 Check for +5 Volts		
Remove jumper wire.     Turn ignition on.	Between 4 to6 volts.	Go to 34-5.
<ul> <li>Read voltage on TBS connector, pin C (red lead) to pin A (black lead).</li> </ul>	Less than 4 volts.	Go to 34-8.
	Greater than 6 volts.	Go to 34-10.
34-5 Check for Signal Open		
<ul> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Install a jumper wire between pins A and B of the TBS connector.</li> <li>Read resistance between sockets P1 and Y2 on the engine harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Signal line (ckt #432) or return line (ckt #452) is open. Repeat check from pin A to Y2 and pin B to P1. Repair open. Then go to 34-30.
34-6 Check for Short		
<ul> <li>Remove jumper.</li> <li>Read resistance between pins A and B on the TBS connector.</li> <li>Also read resistance between socket B and a good ground.</li> </ul>	Less than orequal to 10,000 ohms on either readings.  Greater than10,000 ohms or open on both readings.	Signal line (ckt #432) is shorted to the return line (ckt #452). Repair short. Then go to 34-30.  Then go to 34-7.
34-7 Check ECM Connectors		
<ul> <li>Check terminals at the engine harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals andconnectors are okay.  Problem found. ————	Replace ECM (para 7-57). Then go to 34-30.  Repair terminals/connectors (para 7-101). Then go to 34-30.



E. FLASH CODE: 34

J1587 CODE: P102 4 - TURBO BOOST PRESSURE CIRCUIT FAILED LOW (LOW VOLTAGE)

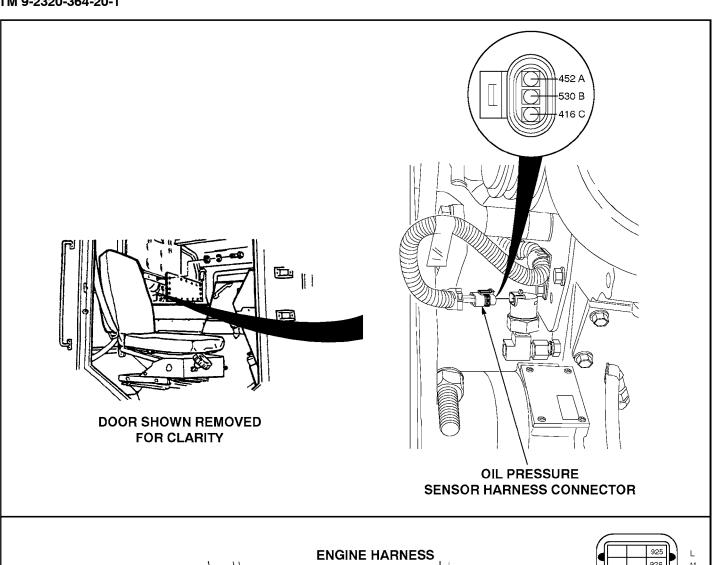
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
34-8 Check for Open +5 Volt Line		
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connectors at the ECM.</li> <li>Install a jumper wire between pins A and C of the TBS connector.</li> <li>Read resistance between sockets W1 and Y2 on the engine harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Go to 34-9.  The engine +5 volt line (ckt #416) is open. Repair open. Then go to 34-30.
34-9 Check for Short		
<ul> <li>Remove jumper.</li> <li>Read resistance between pins A and C on the TBS connector.</li> </ul>	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	The +5 volt line (ckt #416) is shorted to return line (ckt #452). Repair short. Then go to 34-30.  Go to 34-7.
34-10 Check for Short to Battery +		
<ul> <li>Turn ignition off.</li> <li>Disconnect batteries (para 7-87).</li> <li>Disconnect the engine harness vehicle harness and 5-way power harness connectors at the ECM.</li> <li>Read resistance between socket P1 of the engine harness connector and socket B3 of the vehicle harness connector.</li> <li>Also read resistance between socket P1 on the engine harness connector and the following sockets on the 5-way power harness connector: A and C.</li> </ul>	All readings are greater than 10,000 ohms or open.  Any reading is less than or equal to 10,000 ohms.	A short exists between the sockets where less than 10,000 ohms resistance was read. Repair short and connect batteries. Then go to 34-30.

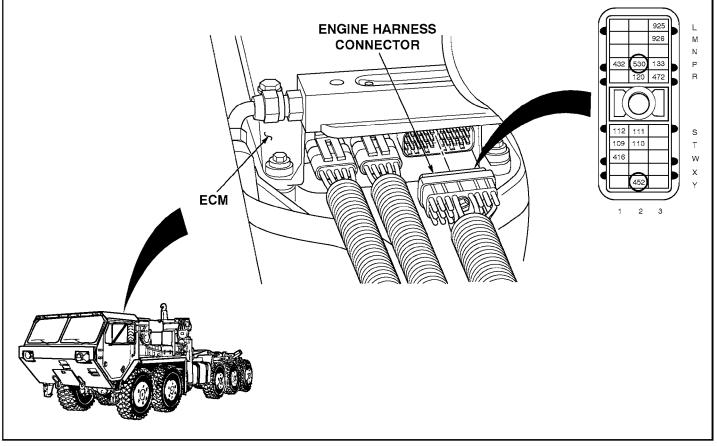


E. FLASH CODE: 34

J1587 CODE: P102 4 - TURBO BOOST PRESSURE CIRCUIT FAILED LOW (LOW VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
34-30 Verify Repairs		
<ul><li>Turn ignition off.</li><li>Reconnect all connectors.</li></ul>	No codes.	Repairs are complete.
<ul> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not</li> </ul>	Code 102/4 (and any other codes).	All system diagnostics are complete. Please review this section from the start to find the error.
stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or 1 minute. Stop engine.  • Read inactive codes.	Any other codes except Code 102/4.	Go to START-1, pg 2-539, to service other codes.





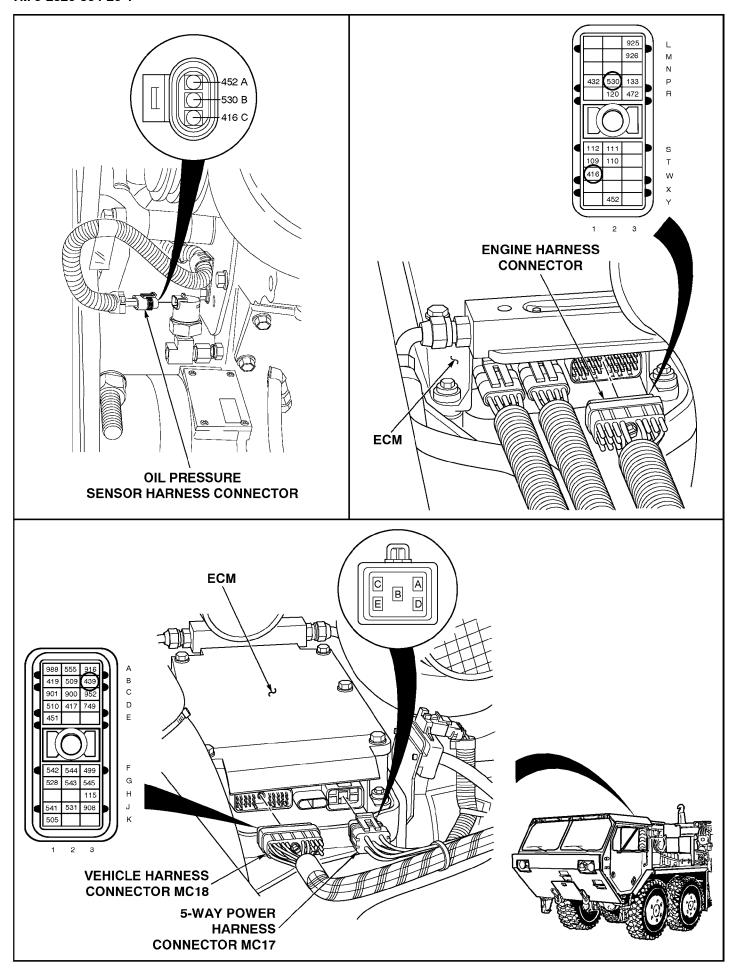
# 2-14. DDEC III/IV TROUBLESHOOTING (CONT). Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 35

J1587 CODE: P100 3 - OIL PRESSURE CIRCUIT FAILED HIGH (HIGH VOLTAGE)

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

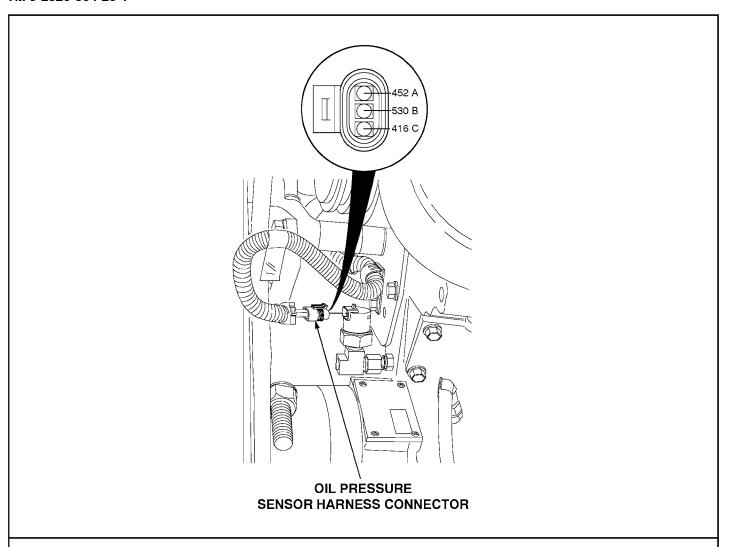
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Were there any other active codes besides Code 100/3?	No other codes.  Yes, any or all of the following codes: 110/3 or 4, 175/3 or 4, 174/3 or 4, 102/3 or 4, 100/4.  Yes - but none of the above.	Go to 35-2.  Go to ENG5V-1 (page 2-761).  Go to 35-2.
<ul> <li>Turn ignition off.</li> <li>Disconnect OPS connector (para 7-68).</li> <li>Turn ignition on.</li> <li>Start and run engine (TM 9-2320-364-10).</li> <li>Select Engine Temperature (COOLANT TEMP or OIL TEMP) on the DDR.</li> <li>Warm up engine until engine temperature reading is greater than 60 degrees C (140 degrees F).</li> <li>Leave engine running at idle after warm up.</li> <li>Read active codes.</li> </ul>	Code 100/4 (and any codes except Code 100/3).  Code 100/3 (and any other codes).	→Go to 35-3.  Go to 35-5.
<ul> <li>Turn ignition off.</li> <li>Disconnect engine harness connector at the ECM.</li> <li>Install a jumper wire between pins A and B of the OPS connector.</li> <li>Read resistance between sockets P2 and Y2 on the engine harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	→ Go to 35-4.  → Return line (ckt #452) is open. Repair open. Then go to 35-30.

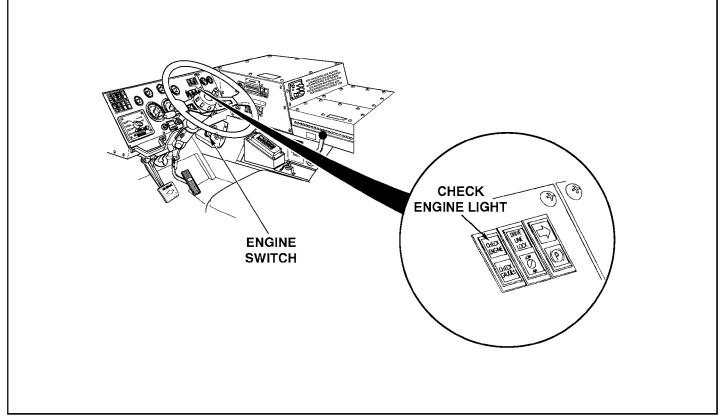


E. FLASH CODE: 35

J1587 CODE: P100 3 - OIL PRESSURE CIRCUIT FAILED HIGH (HIGH VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Check OPS Connectors      Inspect terminals at the OPS connectors (both the sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.	Terminals and connectors are okay.  Problem found.	Replace OPS (para 7-68). Then go to 35-30.  Repair terminals/connectors (para 7-101). Then go to 35-30.
<ul> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Read resistance between sockets W1 and P2 on the engine harness connector.</li> </ul>	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	Signal line (ckt #530) is shorted to the engine +5 volt line (ckt #416). Repair short. Then go to 35-30.  Go to 35-6.
Disconnect batteries (para 7-87). Disconnect the vehicle harness and 5-way power harness connectors at the ECM. Read resistance between socket P2 of the engine harness connector and socket B3 of the vehicle harness connector. Also read resistance between socket P2 on the engine harness connector and the following sockets on the 5-way power harness connector: A and C.	All readings are greater than 10,000 ohms or open.  Any reading is less than or equal to 10,000 ohms.	→ Go to 35-8.  A short exists between the sockets where less than 10,000 ohms resistance was read. Repair short and connect batteries. Then go to 35-30.

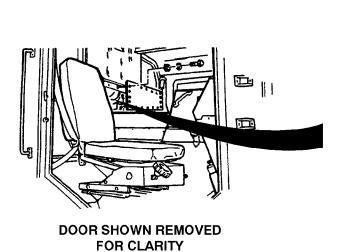


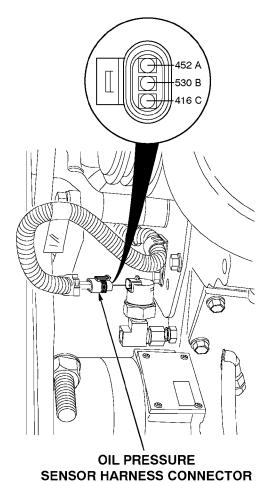


E. FLASH CODE: 35

J1587 CODE: P100 3 - OIL PRESSURE CIRCUIT FAILED HIGH (HIGH VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Start engine (TM 9-2320-364-10). Run for one minute or until "Check Engine" light comes on.</li> <li>Stop engine.</li> <li>Check active codes.</li> </ul>	Code 100/3.  No codes.  Any other codes except Code 100/3.	<ul> <li>Replace ECM (para 7-57).</li> <li>Then go to 35-30.</li> <li>Repairs are complete.</li> <li>Go to START-1, pg 2-539, to service other codes.</li> </ul>
Check OPS Connectors      Inspect terminals at OPS connectors (sensor and harness sides) for damage; bent, corroded and unseated pins or sockets.	Terminals and connectors are okay.  Problem found.	Replace OPS (para 7-68). Then go to 35-7. Repair terminals/connectors (para 7-101). Then go to 35-30.
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or engine has run warm (greater than 60 degrees C, 140 degrees F) 1 minute.</li> <li>Read inactive codes.</li> </ul>		<ul> <li>Repairs are complete.</li> <li>All system diagnostics are complete. Please review this section from the start to find the error.</li> <li>Go to START-1, pg 2-539, to service other codes.</li> </ul>





#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

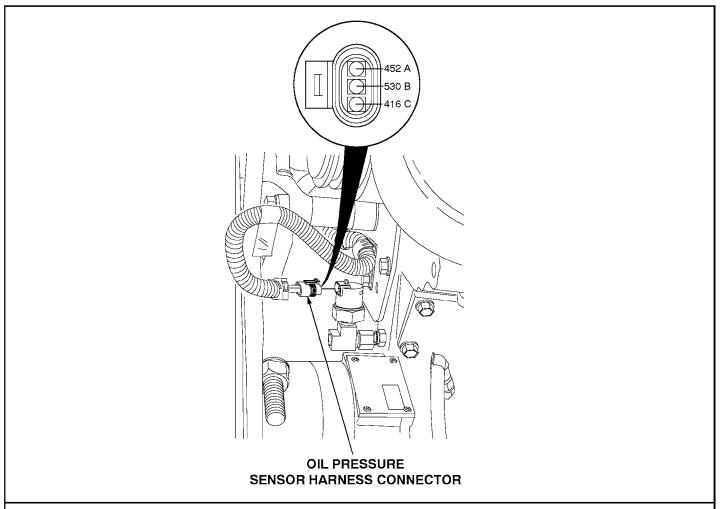
E. FLASH CODE: 36

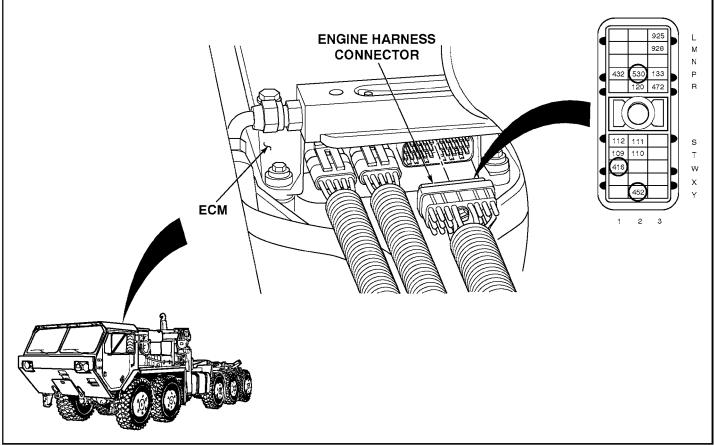
J1587 CODE: P100 4 - OIL PRESSURE CIRCUIT FAILED LOW (LOW VOLTAGE)

#### **NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
• Were there any other active codes besides Code 100/4?	Yes, any or all of the following codes: 110/3 or 4, 175/3 or 4, 174/3 or 4, 100/3, 187/4, 91/4.  Yes - but none of the above.	Go to 36-2.  Go to ENG5V-1 (page 2-761).  Go to 36-2.
36-2 Sensor Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect OPS connector (para 7-68) and install a jumper wire between sockets B and C of the OPS connector.</li> <li>Turn ignition on.</li> <li>Read active codes.</li> <li>If active Code 100/3 or 4 exists, go to RESULT column.</li> <li>If no active Code 100/3 or 4 exists, start and run engine (TM 9-2320-364-10) until either active Code 100/3 or 4 appears or the COOLANT TEMP or OIL TEMP on the DDR has been greater than 60 degrees C (140 deg F) for more than 1 minute.</li> </ul>	Code 100/3 (and — any codes except Code 100/4).  Code 100/4 (and any — other codes).  No codes.	Check to be sure ECM and OPS connectors are wired properly. If wired properly then go to 36-3.  Go to 36-4.  Go to 36-4.
36-3 Check OPS Connectors		
<ul> <li>Turn ignition off.</li> <li>Inspect terminals at the OPS connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay. Problem found.	Replace OPS (para 7-68). Then go to 36-30.  Repair terminals/connectors (para 7-101). Then go to 36-30.

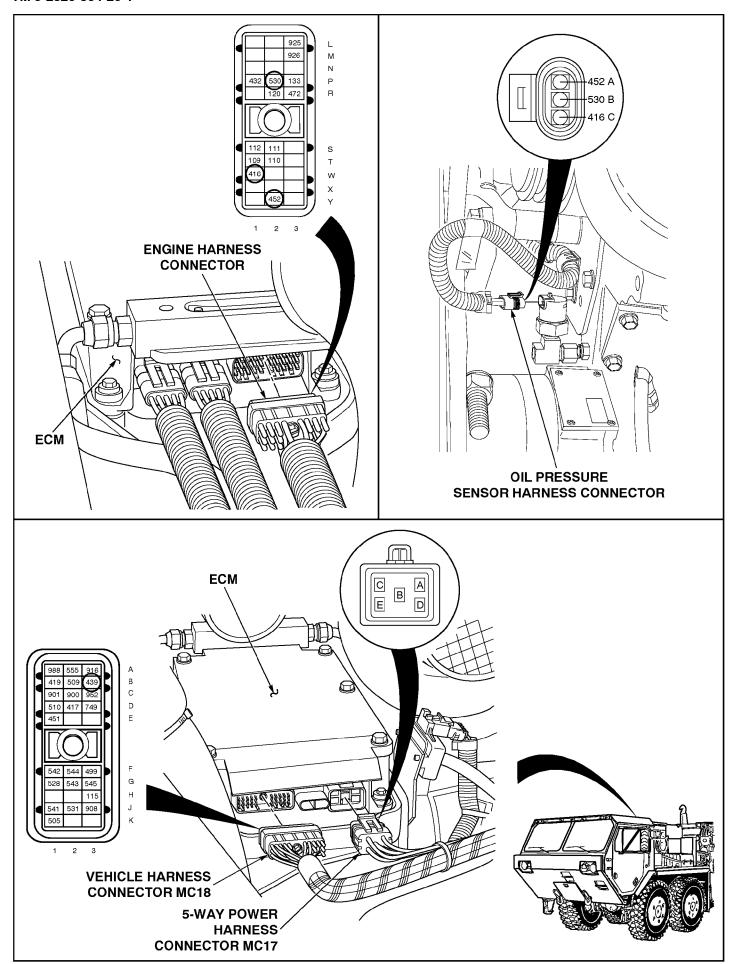




E. FLASH CODE: 36

J1587 CODE: P100 4 - OIL PRESSURE CIRCUIT FAILED LOW (LOW VOLTAGE)

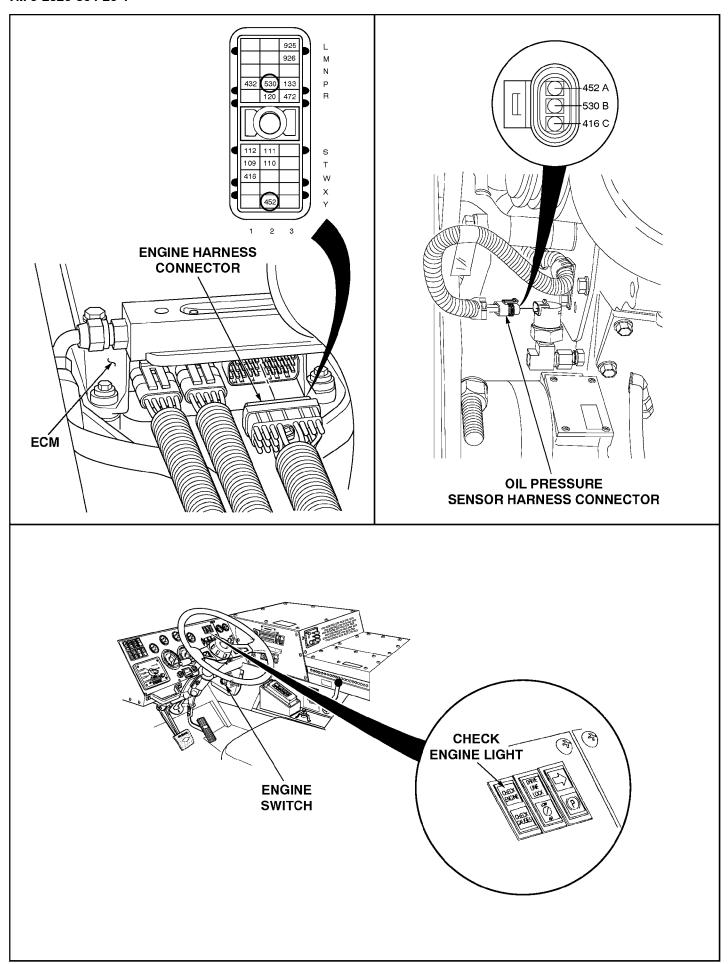
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
36-4 Check for +5 Volts		
<ul> <li>Turn ignition off.</li> <li>Remove jumper wire.</li> <li>Turn ignition on</li> </ul>	Between 4 to6 volts.	Go to 36-5.
<ul> <li>Turn ignition on.</li> <li>Read voltage on OPS connector, socket C (red lead) to socket A (black lead).</li> </ul>	Less than 4 volts.  Greater than 6 volts.	Go to 36-8.  Go to 36-10.
36-5 Check for Signal Open		
<ul> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Install a jumper wire between sockets A and B of the OPS connector.</li> <li>Read resistance between sockets P2 and Y2 on the engine harness connectors.</li> </ul>	Less than or equal to 5 ohms on either reading.  Greater than 5 ohms or open.	→ Go to 36-11.  Signal line (ckt #530) is open. Repair open. Then go to 36-30.
36-6 Check for Short		
<ul> <li>Remove jumper wire.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Read resistance between sockets A and B on the OPS connector.</li> <li>Also read resistance between socket B and a good ground.</li> </ul>	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open. on both readings.	Signal line (ckt #530) is shorted to the return line (ckt #452) or battery ground. Repair short. Then go to 36-30.  Go to 36-12.
36-7 Check ECM Connectors		
Check terminals at the engine harness connector (both the ECM and harness side) for damage; bent, corroded and unseated pins or sockets. Especially W1, P2, and Y2 terminals and pins at ECM.	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 36-30.  Repair terminals/connectors (para 7-101). Then go to 36-30.



E. FLASH CODE: 36

J1587 CODE: P100 4 - OIL PRESSURE CIRCUIT FAILED LOW (LOW VOLTAGE)

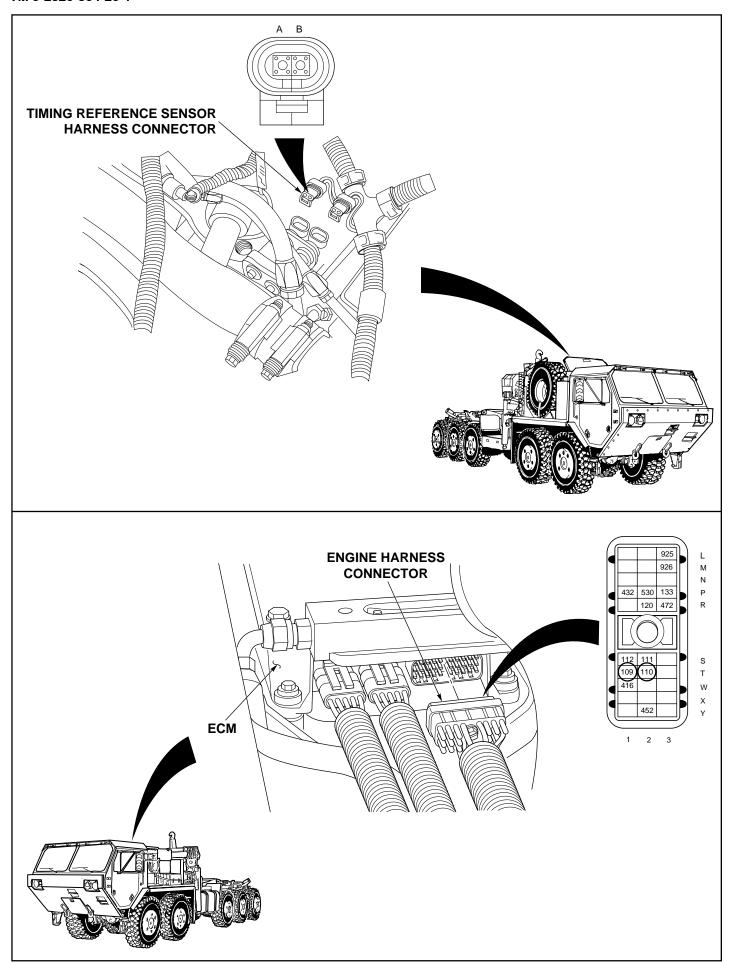
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
36-8 Check for Open +5 Volt Line		
<ul> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Install a jumper wire between sockets A and C of the OPS connector.</li> <li>Read resistance between sockets W1 and Y2 on the engine harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	→ Go to 36-9.  The engine +5 volt line (ckt #416) is open. Repair open. Then go to 36-30.
36-9 Check for Short		
<ul> <li>Remove jumper wire.</li> <li>Read resistance between sockets A and C of the OPS connector.</li> </ul>	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	The engine +5 volt line (ckt #416) is shorted to the return line (ckt #452). Repair short. Then go to 36-12.  Go to 36-12.
36-10 Check for Short to Battery +		
<ul> <li>Disconnect batteries (para 7-87).</li> <li>Disconnect the vehicle harness and 5-way power harness connectors at the ECM.</li> <li>Read resistance between socket P2 of the engine harness connector and socket B3 of the vehicle harness connector.</li> <li>Also read resistance between socket P2 on the engine harness connector and the following sockets on the 5-way power harness connector: A and C.</li> </ul>	All readings are greater than 10,000 ohms or open.  Any reading is less than or equal to 10,000 ohms.	A short exists between the sockets where less than 10,000 ohms resistance was read. Repair short and connect batteries. Then go to 36-30.



E. FLASH CODE: 36

J1587 CODE: P100 4 - OIL PRESSURE CIRCUIT FAILED LOW (LOW VOLTAGE)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Turn ignition off.</li> <li>Remove jumper wire.</li> <li>Measure resistance between sockets P2 and Y2 on the engine harness.</li> </ul>	Greater than 10,000 ohms.  Less than or equal to 10,000 ohms.	Go to 36-6.  Signal line (ckt #530) and return line (ckt #452) are shorted together. Repair short. Then go to 36-30.
<ul> <li>Turn ignition off.</li> <li>Replace OPS (para 7-68).</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Start engine (TM 9-2320-364-10). Run until "Check Engine" light comes on or for 1 minute.</li> </ul>	Check engine light comes on.  Check engine light does not comes on.	Go to 36-7.  Go to 36-30.
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or engine has run warm (greater than 60 degrees C, 140 degrees F) 1 minute.</li> <li>Read inactive codes.</li> </ul>		Repairs are complete.  All system diagnostics are complete. Please review this section from the start to find the error.  Go to START-1, pg 2-539, to service other codes.



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 41

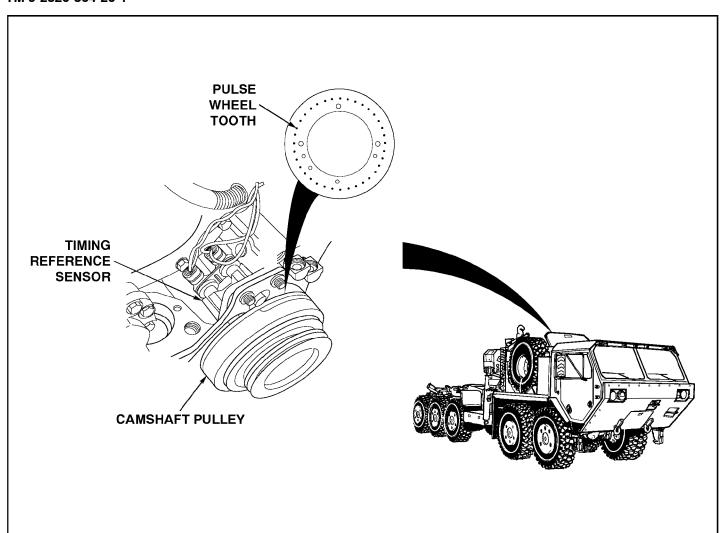
J1587 CODE: S21 0 - TOO MANY SRS (MISSING TRS)

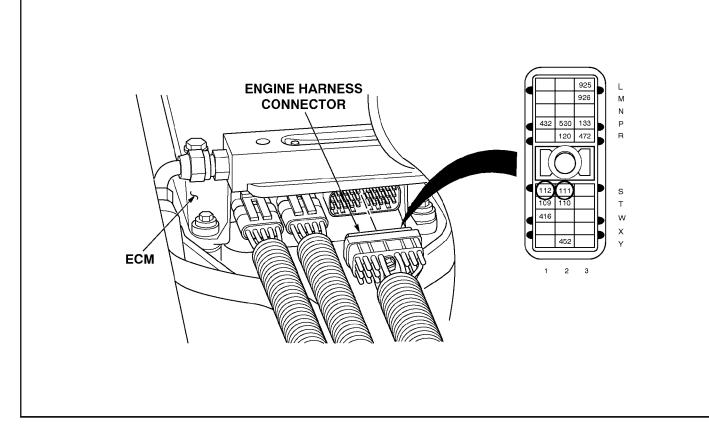
**NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

NOTE - ECM must be removed (para 7-57) for access to TRS/SRS connectors.

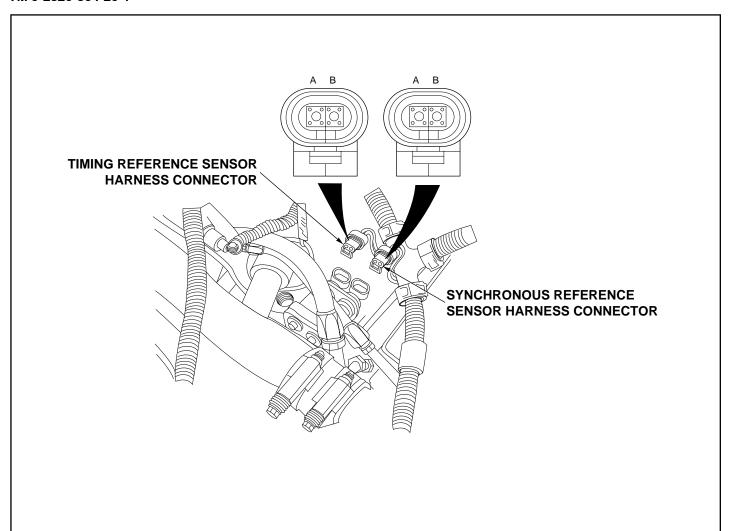
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>41-1 Resistance Check</li> <li>Turn ignition off.</li> <li>Disconnect engine harness connector at ECM.</li> <li>Read resistance between socket T1 and T2 on engine harness connector.</li> </ul>	Less than or equal to 200 ohms.  Greater than 200 ohms or open.	Go to 41-2.  Go to 41-3.
<ul> <li>41-2 Check for Short</li> <li>Remove ECM (para 7-57).</li> <li>Disconnect TRS connector.</li> <li>Read resistance between sockets T1 and T2 on the engine harness connector.</li> <li>Also read resistance between socket T1 and ground, then between socket T2 and ground.</li> </ul>	Less than or equal to 10,000 ohms on any reading.  Greater than 10,000 ohms or open on all readings.	A short exists between (ckt #110) and (ckt #109) or where resistance was less than 10,000 ohms. Repair short. Then go to 41-30.  Go to 41-4.
<ul> <li>41-3 Open TRS Line Check</li> <li>Remove ECM (para 7-57).</li> <li>Disconnect TRS connector and install a jumper wire between sockets A and B of the TRS connector.</li> <li>Read resistance between sockets T1 and T2 on the engine harness connector.</li> </ul>	Less than orequal to 5 ohms.  Greater than5 ohms or open.	Go to 41-4.  Signal line (ckt #110) or return and (ckt #109) is open. Repair open. Then go to 41-30.
Check TRS Resistance     Read resistance of TRS across sensor pins A and B.	Less than ————————————————————————————————————	Go to 41-12.  Go to 41-5.  Go to 41-12.

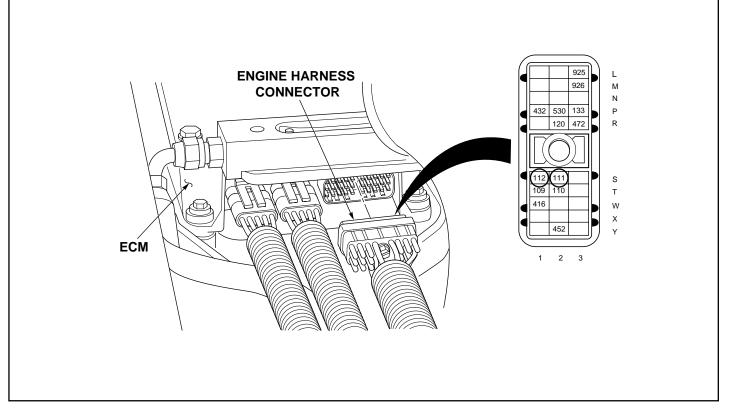




E. FLASH CODE: 41

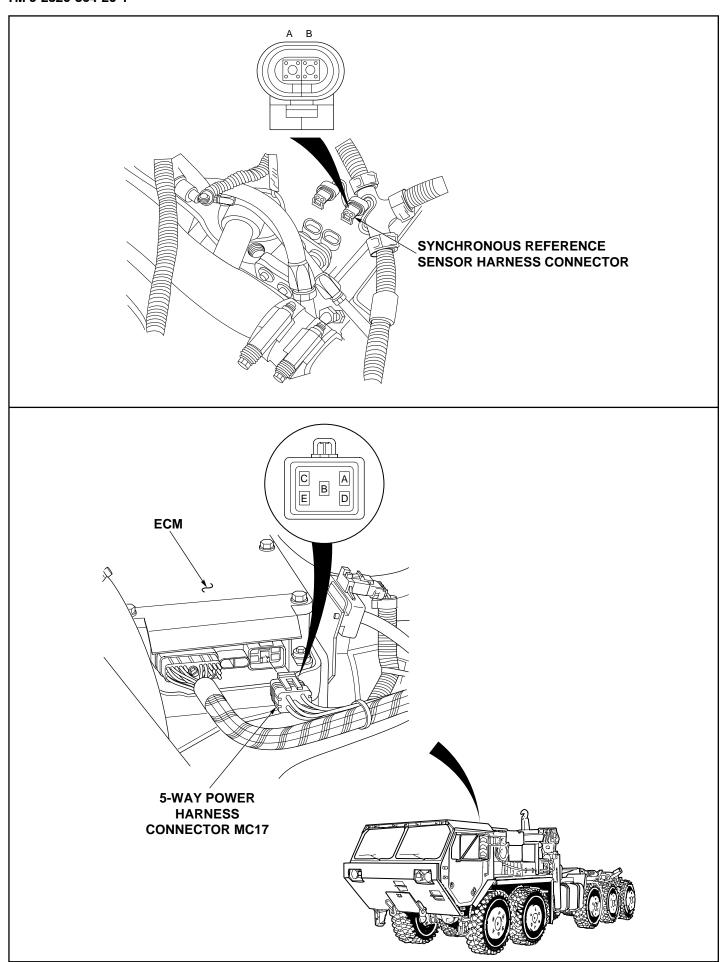
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
41-5 Check TRS/SRS Gap		
<ul> <li>Turn camshaft counterclockwise until TRS is over a TRS "tooth" of pulse wheel.</li> <li>Tap the front of camshaft rearward with a soft hammer (to remove camshaft end play).</li> <li>Using a feeler gauge check gap between the pulse wheel teeth and TRS (nominal gap 0.020" or 0.5 mm).</li> </ul>	Incorrect gap.	Loosen the screw at top of TRS/SRS mounting bracket. (Don't touch the two screws that go into block front end plate -they will affect engine timing.) Adjust the TRS/SRS until gap setting is correct. Tighten screw. (If problem returns, pulse wheel may be loose or bad, notify supervisor). Then go to 41-30.
	Gap setting is correct.	Go to 41-6.
41-6 Check for SRS Code		
Was there also a Code 21/1?	Yes	Go to 41-8.  Go to 41-15.
41-7 Check ECM Connectors		
<ul> <li>Check terminals at engine harness connector (both ECM and harness side) for damage, corrosion, and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 41-30.  Repair terminals/connectors (para 7-101). Then go to 41-30.
41-8 SRS Resistance Check		
Read resistance between sockets S1 and S2 on engine harness connector.	Less than or equal to 200 ohms.  Greater than 200 ohms or open.	→ Go to 41-9.  → Go to 41-10.





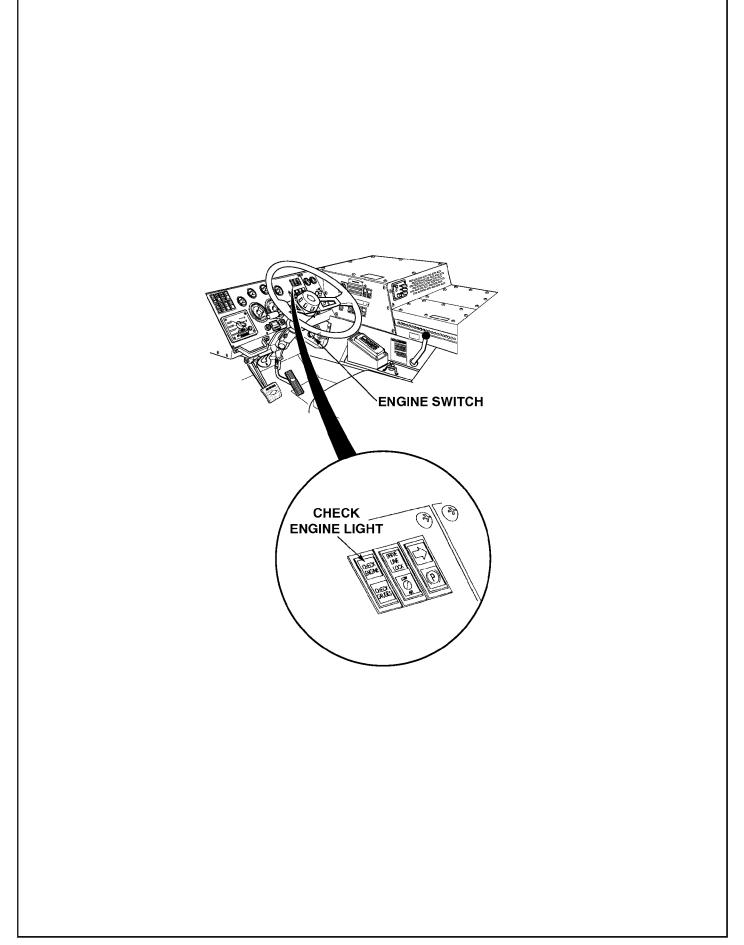
E. FLASH CODE: 41

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Disconnect SRS connector.     Read resistance between sockets S1 and S2 on engine harness connector.	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	Signal line (ckt #111) is shorted to return line (ckt #112). Repair short. Then go to 41-30.  Go to 41-11.
<ul> <li>Install a jumper wire between sockets A and B of SRS connector.</li> <li>Read resistance between sockets S1 and S2 of engine harness connector.</li> </ul>	Less than orequal to 5 ohms.  Greater than5 ohms or open.	Go to 41-11.  Signal line (ckt #111) or return line (ckt #112) is open. Repair open. Then go to 41-30.
Read resistance of the SRS across the sensor pins A and B.	Less than 100 ohms.  From 100 to 200 ohms.  Greater than 200 ohms.	Go to 41-13.  Go to 41-7.  Go to 41-13.
Check TRS     Connectors      Check connectors at the TRS (both the harness side and the TRS side) for damage; bent, corroded or unseated pins or sockets, or bad contacts.	Connectorsare okay.  Problem found	TRS requires replacement. Notify supervisor. Then go to 41-14.  Repair terminals/connectors (para 7-101). Then go to 41-30.



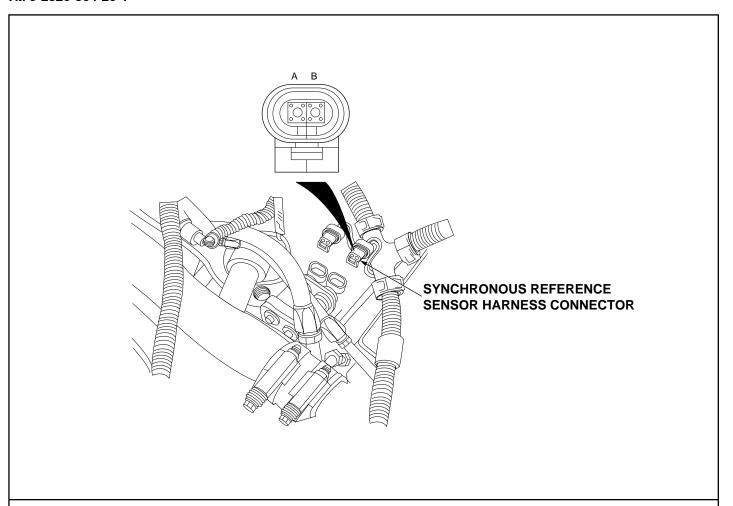
E. FLASH CODE: 41

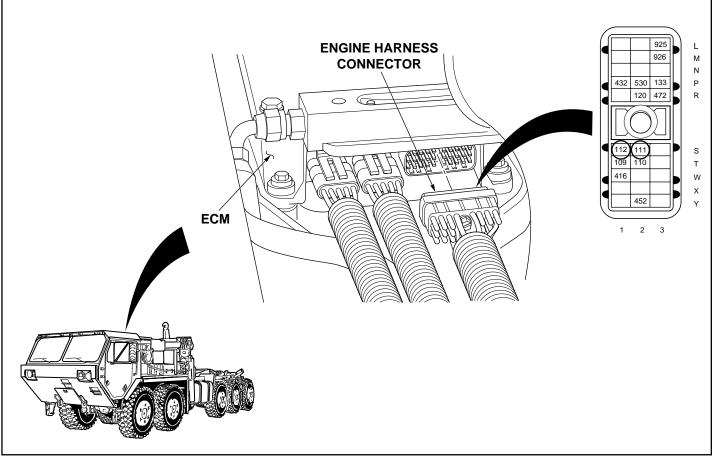
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Check connectors at the SRS (both the harness side and the sensor side) for damage; bent, corroded or unseated pins or sockets, or bad contacts.	Connectorsare okay.  Problem found	SRS requires replacement. Notify supervisor. Then go to 41-14.  Repair terminals/connectors (para 7-101). Then go to 41-30.
41-14 Verify TRS/SRS		
<ul> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Start and run engine until the "Check Engine" light comes on or for 1 minute (TM 9-2320-364-10).</li> <li>Stop engine.</li> <li>Read inactive codes.</li> </ul>	No codes.  Code 21/0 reappears (and any other codes).  Code(s) other than Code 21/0 received.	Repairs are complete.  If the SRS was just replaced, go to 41-15. If the SRS was not replaced, go to 41-6.  Go to START-1, pg 2-539, to service other codes.
41-15 Check Cranking Voltage		
<ul> <li>Turn ignition off.</li> <li>Connect other connectors.</li> <li>Fabricate temporary jumper harness per instructions in Appendix D, Figure D-14.</li> <li>Connect jumper harness to fully charged battery (12 volt).</li> <li>Connect jumper harness to ECM.</li> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Start engine (TM 9-2320-364-10). Run until "Check Engine" light comes on or for 1 minute.</li> <li>Stop engine.</li> <li>Read active codes.</li> </ul>	Engine won't start and/or Code 21/0 (and any other codes).  Engine starts and no Code 21/0.	Service discharged battery (TM 9-6140-200-14). Repair, then to go 41-30.



E. FLASH CODE: 41

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
41-30 Verify Repairs		
<ul><li>Turn ignition off.</li><li>Reconnect all connectors.</li></ul>	No codes.	Repairs are complete.
<ul> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not</li> </ul>	Code 21/0 (and any other codes).	All system diagnostics are complete. Please review this section from the start to find error.
stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or for 1 minute.  Stop engine.  Read inactive codes.	Any other codesexcept Code 21/0.	Go to START-1, pg 2-539 to service other codes.





#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 42

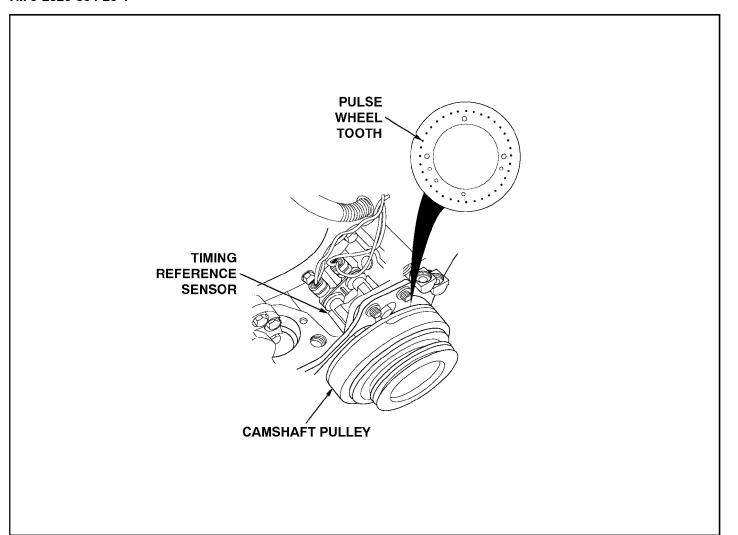
J1587 CODE: S21 1 - TOO FEW SRS (MISSING SRS)

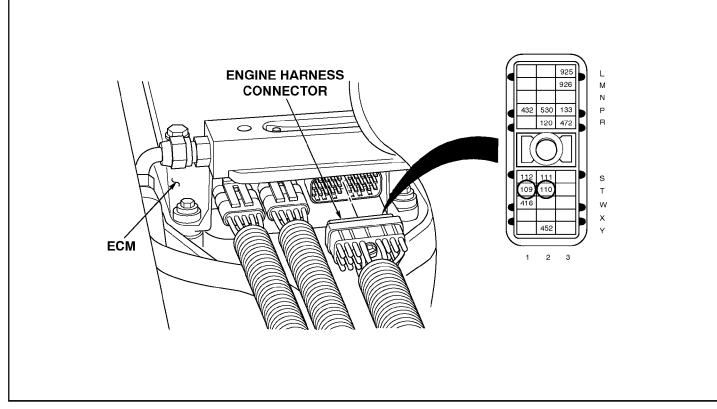
NOTE - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

NOTE - ECM must be removed (para 7-57) for access to TRS/SRS connectors.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
42-1 Resistance Check		
<ul> <li>Turn ignition off.</li> <li>Disconnect engine harness connector at ECM.</li> <li>Read resistance between socket S1 and S2 on engine harness connector.</li> </ul>	Less than or equal to 200 ohms.  Greater than 200 ohms or open.	Go to 42-2.  Go to 42-3.
42-2 Check for Short		
<ul> <li>Remove ECM (para 7-57).</li> <li>Disconnect SRS connector.</li> <li>Read resistance between sockets S1 and S2 on engine harness connector.</li> <li>Also read resistance between socket S1 and ground, then between socket S2 and ground.</li> </ul>	Less than orequal to 10,000 ohms on any reading.  Greater than10,000 ohms or open on all readings.	A short exists where resistance was less than 10,000 ohms. Repair short. Then go to 42-30.  Go to 42-4.
42-3 Open SRS Line Check		
<ul> <li>Remove ECM (para 7-57).</li> <li>Disconnect SRS connector and install a jumper wire between sockets A and B of the SRS connector.</li> <li>Read resistance between sockets S1 and S2 on the engine harness connector.</li> </ul>	Less than orequal to 5 ohms.  Greater than5 ohms or open.	Go to 42-4.  Signal line (ckt #111) or return line (ckt #112) is open. Repair open. Then go to 42-30.
42-4 Check SRS Resistance		
<ul> <li>Read resistance of SRS across sensor pins A and B.</li> </ul>	Less than 100 ohms. From 100 to 200 ohms.	Go to 42-12.  Go to 42-5.
	Greater than ————————————————————————————————————	Go to 42-12.

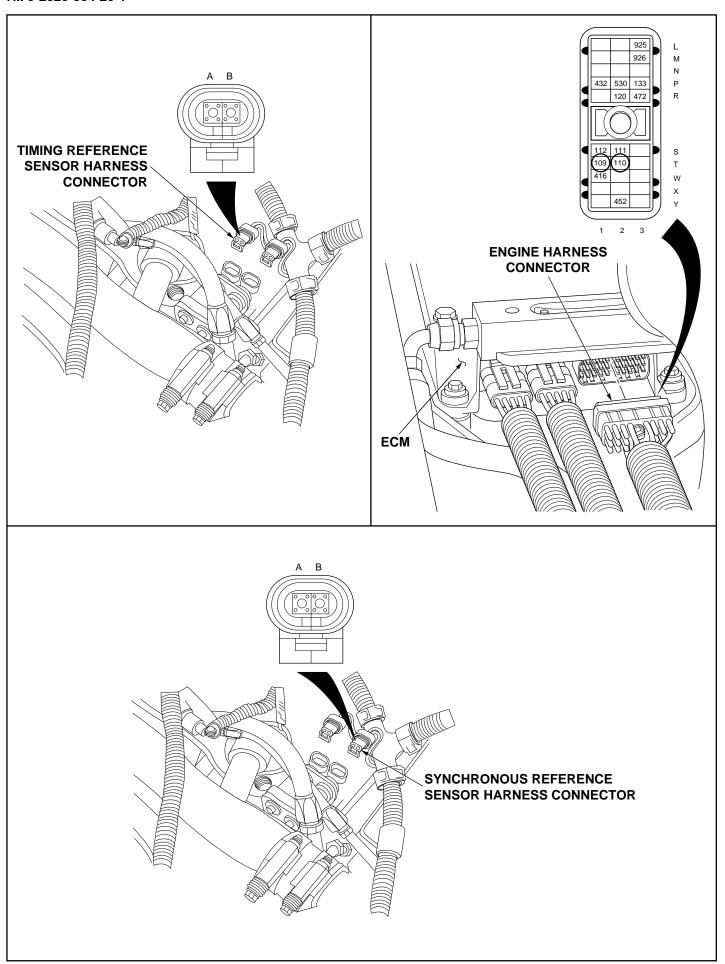




E. FLASH CODE: 42

J1587 CODE: S21 1 - TOO FEW SRS (MISSING SRS)

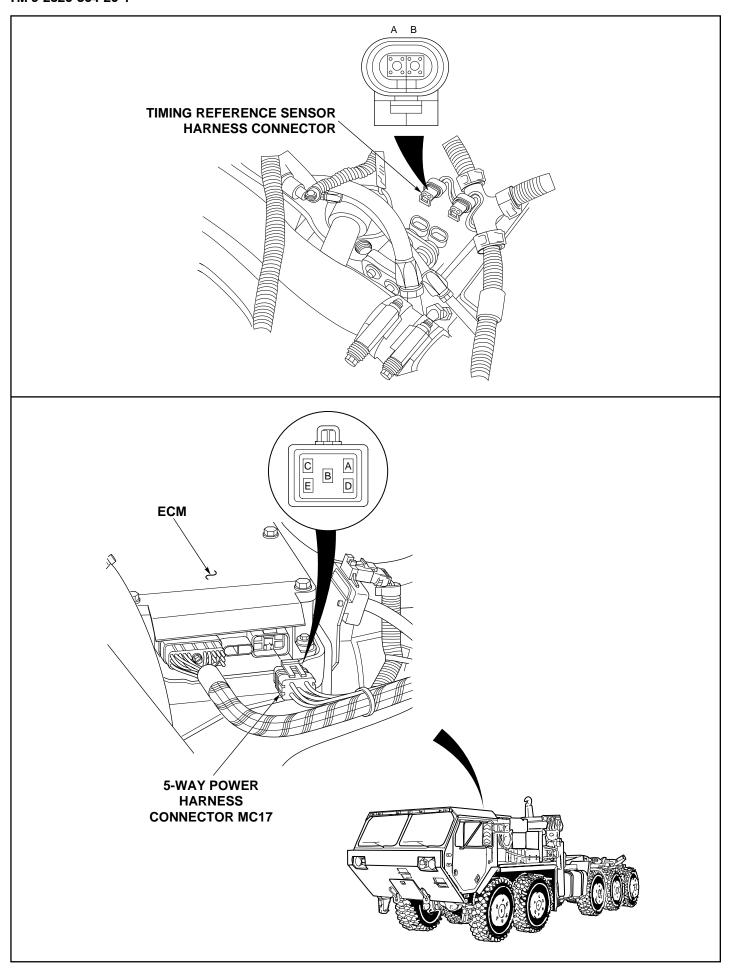
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
42-5 Check TRS/SRS Gap		
<ul> <li>Turn camshaft counterclockwise until TRS is over a TRS "tooth" of pulse wheel.</li> <li>Tap the front of camshaft rearward with a soft hammer (to remove camshaft end play).</li> <li>Using a feeler gauge check gap between the pulse wheel teeth and TRS (nominal gap 0.020" or 0.5 mm).</li> </ul>	Incorrect gap.	Loosen the screw at top of TRS/SRS mounting bracket. (Don't touch the two screws that go into block front end plate -they will affect engine timing.) Adjust the TRS/SRS until gap setting is correct. Tighten screw. (If problem returns, pulse wheel may be loose or bad, notify supervisor). Then go to 42-30.
	Gap setting is correct.	Go to 42-6.
42-6 Check for TRS Code		
• Was there also a Code 21/0?	Yes	Go to 42-8.
	No. ————————————————————————————————————	Go to 42-7.
42-7 Check ECM Connectors		
<ul> <li>Check terminals at engine harness connector (both ECM and harness side) for damage, corrosion, and unseated pins or sockets.</li> </ul>	Terminals andconnectors are okay.  Problem found.	Then go to 42-15.  Repair terminals/connectors (para 7-101). Then go to 42-30.
42-8 TRS Resistance Check		
<ul> <li>Read resistance between sockets T1 and T2 on engine harness connector.</li> </ul>	Less than or equal to 200 ohms.  Greater than 200 ohms or open.	Go to 42-9.  Go to 42-10.



E. FLASH CODE: 42

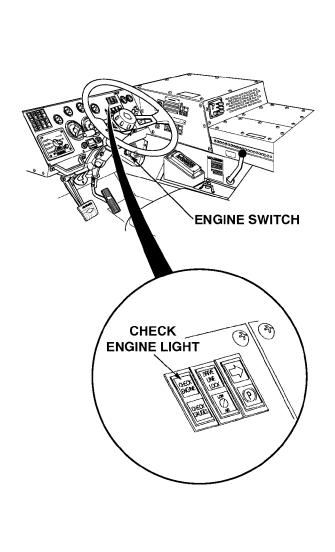
J1587 CODE: S21 1 - TOO FEW SRS (MISSING SRS)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Disconnect TRS connector.</li> <li>Read resistance between sockets T1 and T2 on engine harness connector.</li> </ul>	Less than or equal to 10,000 ohms.  Greater than 10,000 ohms or open.	Signal line (ckt #110) is shorted to return line (ckt #109). Repair short. Then go to 42-30.  Go to 42-11.
<ul> <li>42-10 Open TRS Line Check</li> <li>Install a jumper wire between sockets A and B of TRS connector.</li> <li>Read resistance between sockets T1 and T2 of engine harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Go to 42-11.  Signal line (ckt #110) or return line (ckt #109) is open. Repair open. Then go to 42-30.
Read resistance of TRS across sensor connector pins A and B.	Less than or 100 ohms.  From 100 to 200 ohms.  Greater than 200 ohms.	
Check SRS Connectors      Check connectors at SRS (both harness side and SRS side) for corrosion, damaged or unseated pins or sockets, or bad contacts.	Connectors are okay.  Problem found.	SRS requires replacement. Notify supervisor. Then go to 42-14.  Repair terminals/connectors (para 7-101). Then go to 42-30.



E. FLASH CODE: 42

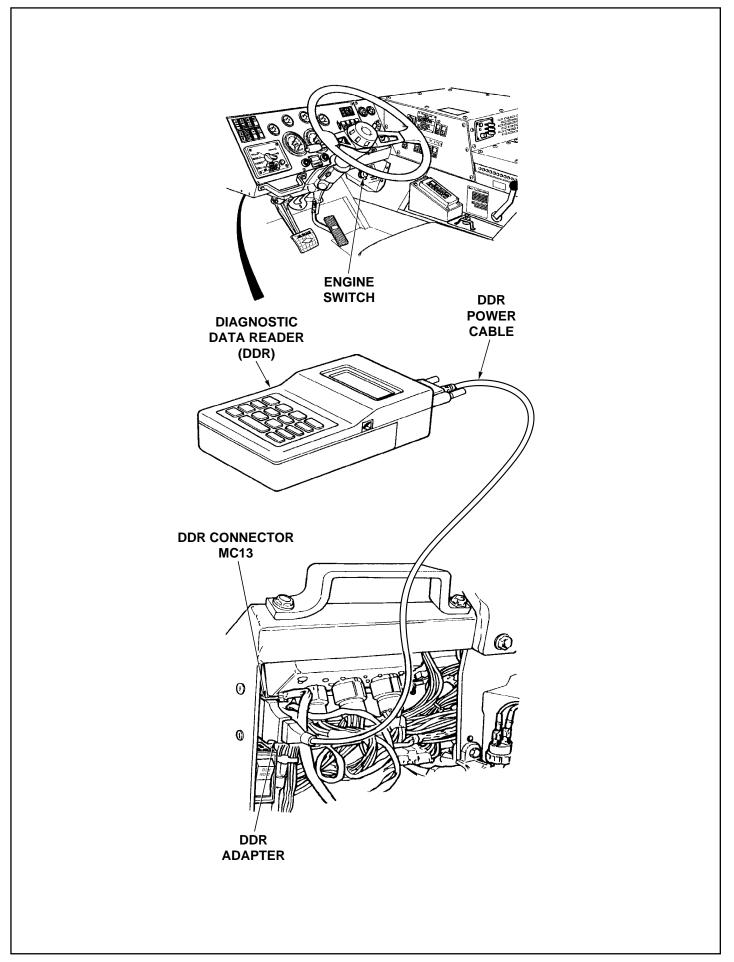
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Check connectors at TRS     (both harness side and sensor side) for damage; bent, corroded or unseated pins or sockets, or bad contracts.	Connectors ————————————————————————————————————	TRS requires replacement. Notify supervisor. Then go to 42-14.  Repair terminals/connectors (para 7-101). Then go to 42-30.
<ul> <li>42-14 Verify TRS/SRS</li> <li>Turn ignition off.</li> <li>Reconnect all connectors.</li> <li>Clear codes.</li> <li>Start and run (TM 9-2320-364-10) engine until "Check Engine" light comes on or for 1 minute.</li> <li>Stop engine.</li> <li>Read inactive codes.</li> </ul>	No Codes.  Code 21/1 reappears (and any other codes.)  Code(s) other than Code 21/1 received.	<ul> <li>Repairs are complete.</li> <li>If TRS was just replaced, go to 42-7. If the TRS was not replaced, go to 42-6.</li> <li>Go to START-1, pg 2-539, to service other codes.</li> </ul>
<ul> <li>42-15 Verify Cranking Voltage</li> <li>Turn ignition off.</li> <li>Connect all connectors.</li> <li>Fabricate temporary jumper harness per instructions in Appendix D, Figure D-14.</li> <li>Connect jumper harness to fully charged battery (12 volt).</li> <li>Connect jumper harness to ECM.</li> <li>Try to start engine.</li> </ul>	Engine starts.  Engine does not start.	Service discharged battery (TM 9-6140-200-14). Then go to 42-30.  Replace ECM (para 7-57). Then go to 42-30.



E. FLASH CODE: 42

J1587 CODE: S21 1 - TOO FEW SRS (MISSING SRS)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
42-30 Verify Repairs		
Turn ignition off.  Reconnect all connectors.	No Codes.	Repairs are complete.
<ul> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or for 1 minute.</li> <li>Stop engine.</li> <li>Read inactive codes.</li> </ul>	Code 21/1 (and any other codes).  Any other codes except Code 21/1.	All system diagnostics are complete. Please review this section from start to find error.  Go to START-1, pg 2-539, to service other codes.



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 44

J1587 CODE: P110 0 - COOLANT TEMPERATURE HIGH OR

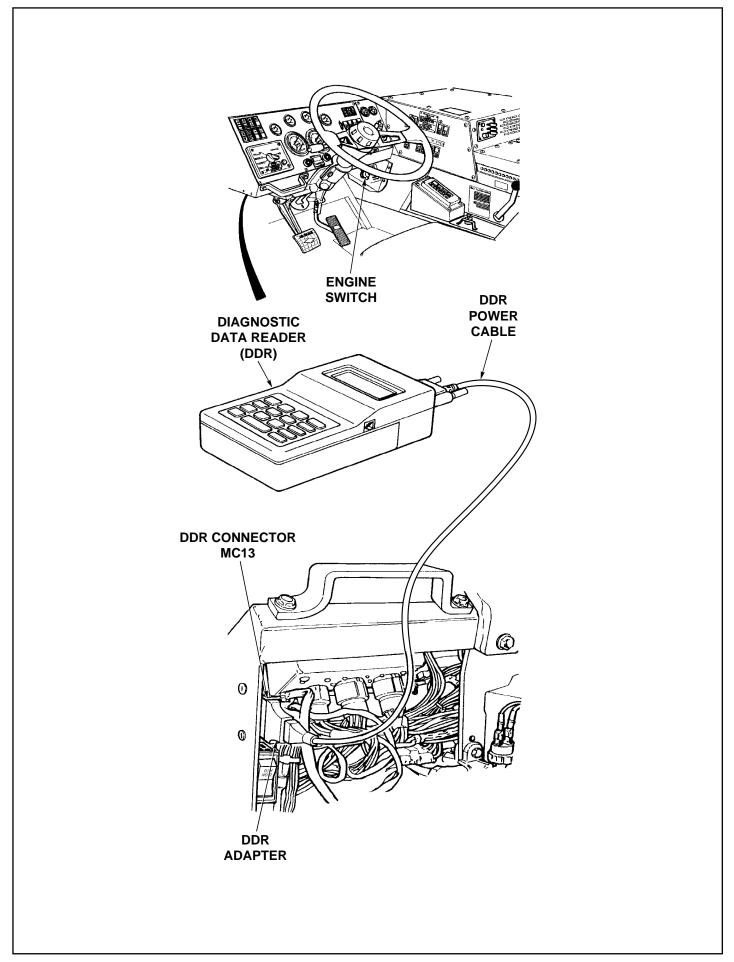
P175 0 - OIL TEMPERATURE HIGH

**NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

When (Inactive Codes) are displayed on DDR, additional audit trail information is also shown. For an understanding of this information refer to the example given in the Code 85 chart.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
44-1 Multiple Code Check		
<ul> <li>Were there any other codes besides 110/0 or 175/0?</li> </ul>	Yes	Service other codes first.
Plug in reader and determine if code is for high coolant temperature or high oil temperature.	No.	This fault codes indicates oil or coolant temperature was higher than it should have been. Refer to Chapter 2, Vehicle Troubleshooting, to determine potential causes for high oil or coolant temperatures.



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

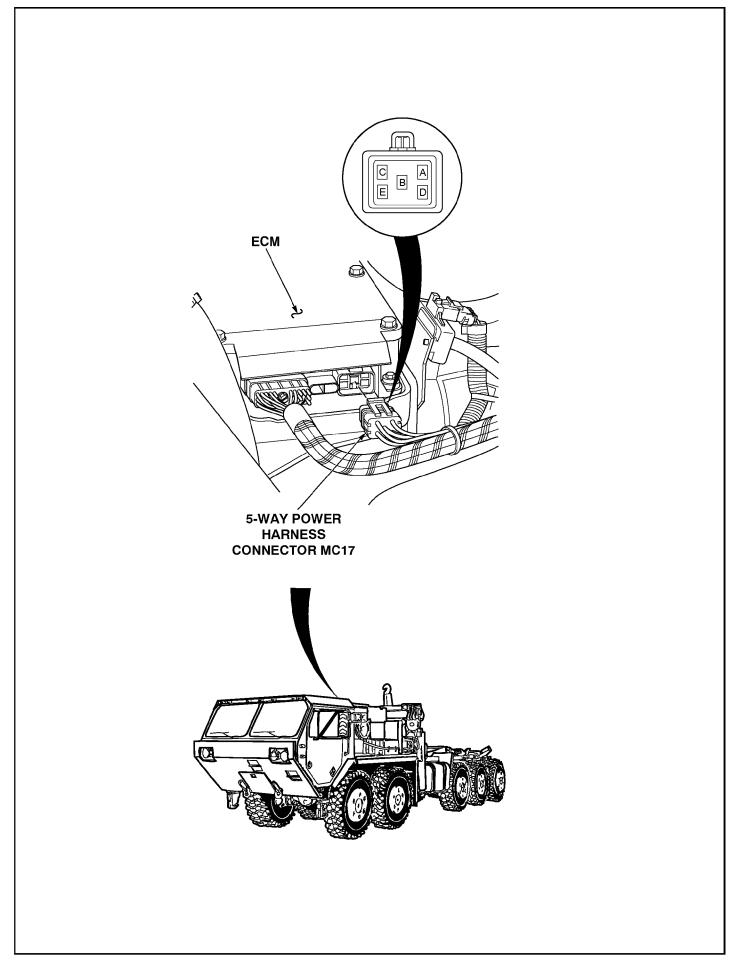
E. FLASH CODE: 45

J1587 CODE: P100 1 - OIL PRESSURE LOW

#### **NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
45-1 Multiple Code Check		
Were there any other codes besides 100/1?	Yes. — No	This code indicates that there was an engine running condition at which oil pressure was lower than it should have been. Refer to Chapter 2, Vehicle Troubleshooting, to determine potential causes for low oil pressure.



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

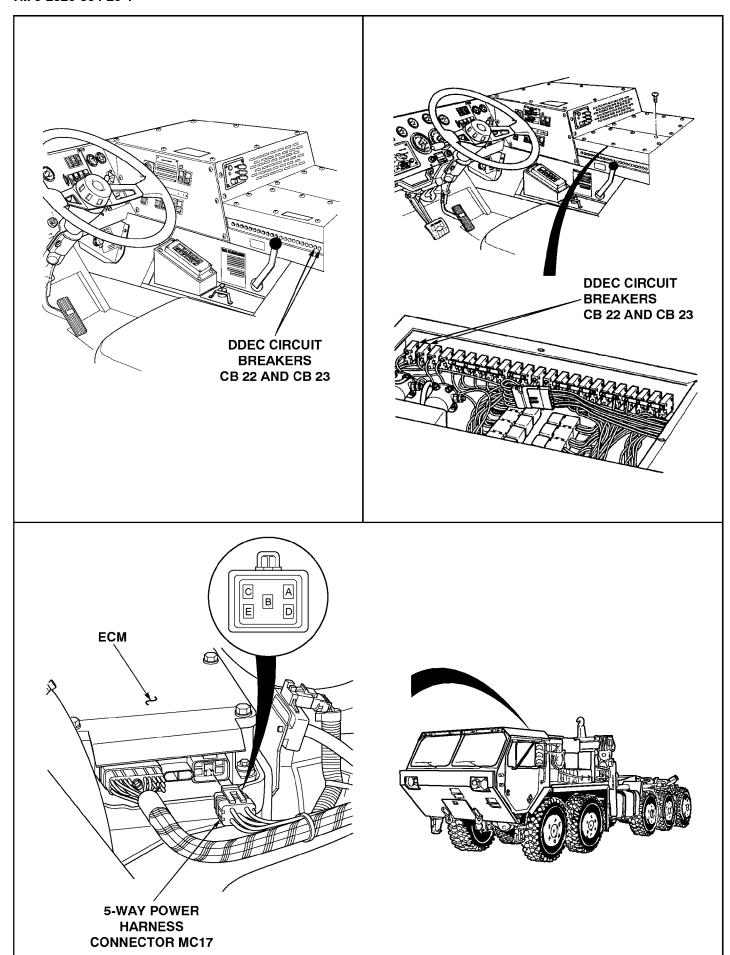
E. FLASH CODE: 46

J1587 CODE: P168 1 - BATTERY VOLTAGE LOW

#### **NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

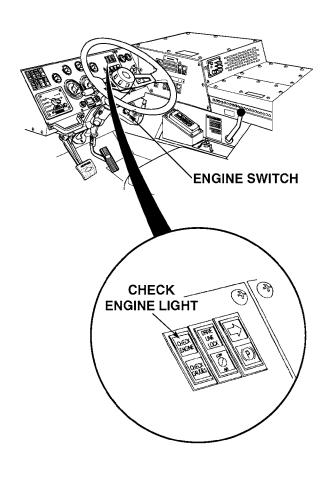
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
46-1 Battery Check		
<ul> <li>Start and run (TM 9-2320-364-10) engine for 1 minute.</li> <li>Measure voltage on Battery + terminal (red lead) to Battery - terminal (black lead).</li> </ul>	Engine does not start.	Determine cause for no-start.  Start with an inspection of the battery (possibly discharged) and/or starting/charging system. Refer to Chart 2, page 2-557, as a further aid in no-start diagnosis if battery and starting/ charging system are okay.
	Less than or equal to 10.0 volts.  Greater than 10.0 volts.	Service discharged battery (TM 9-6140-200-14) and/or starting/charging system.  Go to 46-2.
46-2 Voltage Check at ECM		
<ul> <li>Keep engine running.</li> <li>Select ECM VOLTS on DDR for display.</li> <li>Observe ECM voltage reading on DDR.</li> </ul>	Less than or equal to 10.0 volts.  Greater than 10.0 volts.	→ Go to 46-3.  → Go to 46-5.
46-3 Voltage Check at ECM		
<ul> <li>Turn ignition off.</li> <li>Disconnect 5-way power harness connector at the ECM.</li> <li>Read voltage from socket A and C of 5-way power harness connector and a good battery ground (black lead). Don't use (ckt #150) as ground reference.</li> </ul>	Less than or equal to 11.5 volts.  Greater than 11.5 volts.	Go to 46-4.  Go to 46-5.



E. FLASH CODE: 46

J1587 CODE: P168 1 - BATTERY VOLTAGE LOW

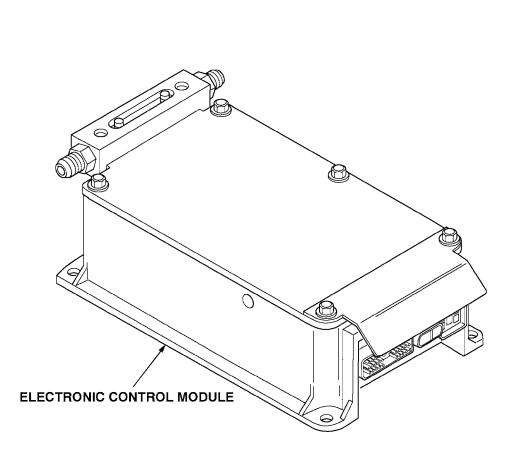
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Pull out both DDEC circuit breaker buttons (CB22 and CB23).</li> <li>Read voltage between battery side (hot side) of DDEC circuit breaker CB22 (red lead) and good ground (black lead).</li> <li>Repeat voltage reading at other DDEC circuit breaker CB23.</li> </ul>	Less than or equal to 11.5 volts on either reading.  Greater than 11.5 volts on both readings.	The Battery + line near Battery is open, or a corroded connection exists at Battery + terminal. Repair problem. Then go to 46-30.  The Battery + line between the DDEC circuit breaker and ECM has an open, or 5-way power harness connector has a corroded connection. Repair problem. Then go to 46-30.
<ul> <li>Disconnect the 5-way power harness connector at ECM (if you have not previously done so).</li> <li>Read voltage on socket C of 5-way power harness connector (red lead) to socket (black lead).</li> <li>Also read voltage on socket A (red lead) to socket D (black lead).</li> </ul>	Less than or equal to 11.5 volts on either reading.  Greater than 11.5 volts on both readings.	The ground wire (ckt #150) is open or has a corroded connection. Repair ground wire. Then go to 46-30.  Go to 46-6.
Check ECM Connectors      Check terminals at 5-way power harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to 46-30.  Repair terminals/connectors (para 7-101). Then go to 46-30.



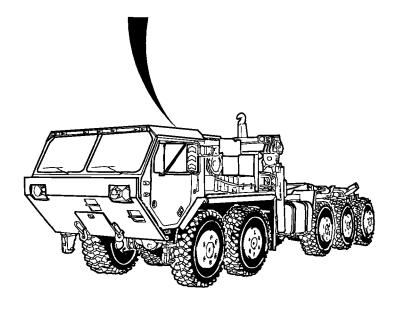
E. FLASH CODE: 46

J1587 CODE: P168 1 - BATTERY VOLTAGE LOW

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
46-30 Verify Repairs		
<ul><li>Turn ignition off.</li><li>Reconnect all connectors.</li></ul>	No Codes.	Repairs are complete.
<ul> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>Note status of "Check Engine" light.</li> <li>If "Check Engine" light does not</li> </ul>	Code 168/1 (and any other codes).	All system diagnostics are complete. Please review this section from start to find error.
stay on, start engine and run (TM 9-2320-364-10) until "Check Engine" light comes on or for 1 minute.  Stop engine.  Read inactive codes.	Any other codes except Code 168/1.	Go to START-1, pg 2-539, to service other codes.



**ECM SHOWN REMOVED FOR CLARITY** 



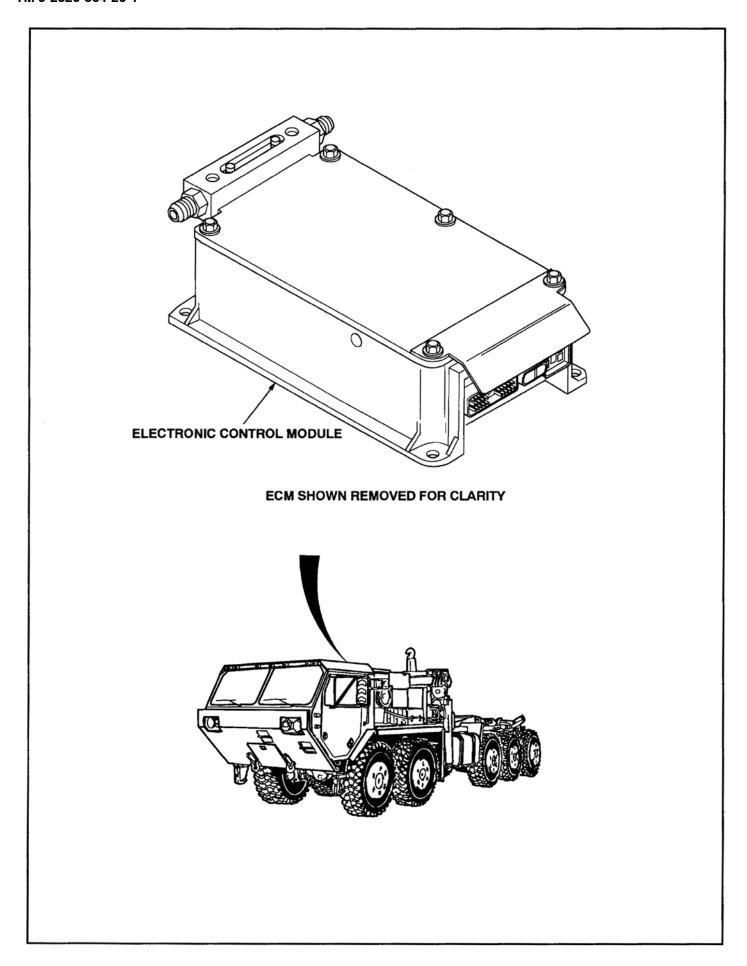
# Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 52

J1587 CODE: S254 12 ANALOG TO DIGITAL (A/D) CONVERSION FAILURE

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
52-1 Multiple Code Check		
Were there any other codes besides 254/12?	Yes.	Service other codes first.  Replace ECM (para 7-57). Then go to START-1, pg 2-539.



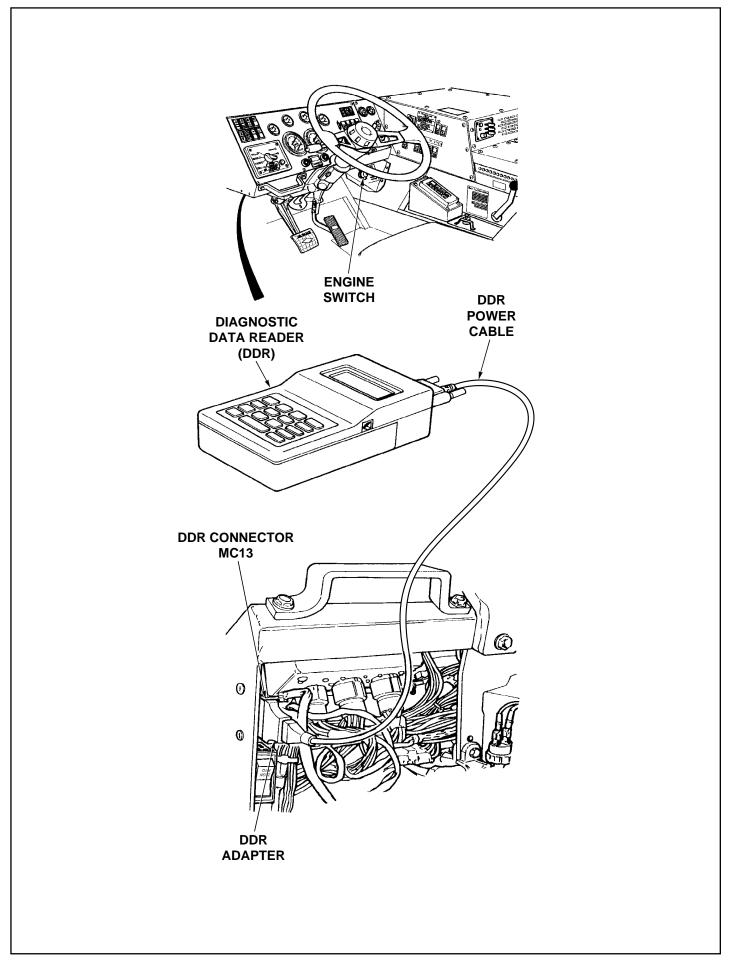
## Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 53

J1587 CODE: S253 12 NONVOLATILE MEMORY FAILURE

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
53-1 Replace ECM		
An error has been detected in EEPROM in the ECM which will cause it to not log codes correctly or at all.		Replace ECM (para 7-57).



## Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 56

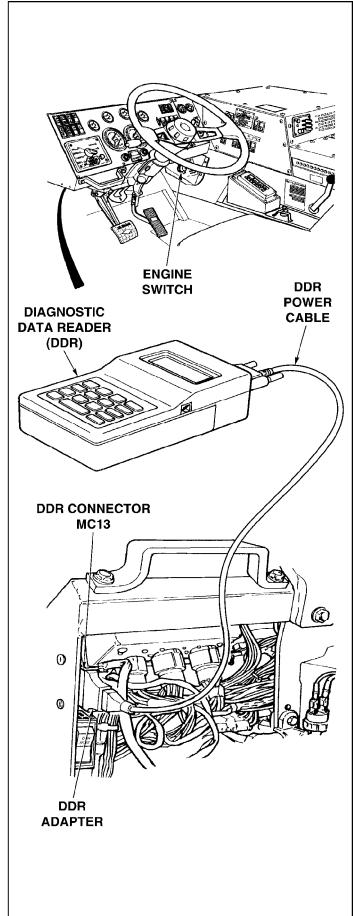
J1587 CODE: S250 12 - J1587 DATA LINK FAULT

#### **NOTE** - This chart is only to be used if:

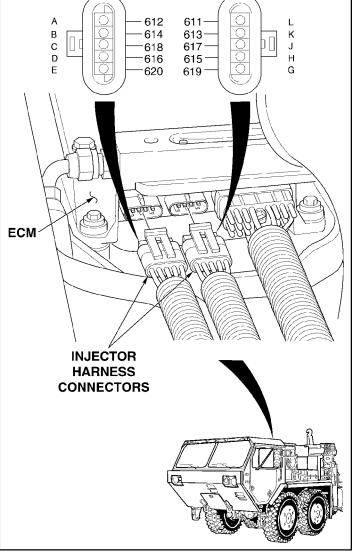
1) All basic mechanical checks and physical inspections have been performed with no problem found; and,

2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
56-1 Check for Codes		
<ul><li>Plug in DDR.</li><li>Turn ignition on.</li><li>Read codes.</li></ul>	No Data Received. ————————————————————————————————————	
	Any other codes present?	Service other codes first.
56-2 Clear Codes		
<ul> <li>Clear codes.</li> <li>Start and run engine (TM 9-2320-364-10) observe CEL code.</li> </ul>	CEL on w/code 250/12.  No CEL code.	→ Replace ECM (para 7-57). Then go to 56-30.  → Go to 56-30.
56-30 Verify Repairs		
<ul> <li>Turn ignition off.</li> <li>Turn ignition on and observe "Check Engine" light.</li> </ul>	"Check Engine" light comes on for 5 seconds and goes out.  "Check Engine" light comes on and stays on.	Repairs are complete.  All system diagnostics are complete. Please review this section to find the error.



Injector Identification Table		
Code	Firing Order	Cylinder
61/01	1	3 Right
61/02	2	3 Left
61/03	3	4 Right
61/04	4	4 Left
61/05	5	2 Right
61/06	6	2 Left
61/07	7	1 Right
61/08	8	1 Left



## Section IV. TROUBLESHOOTING CHARTS (Cont.)

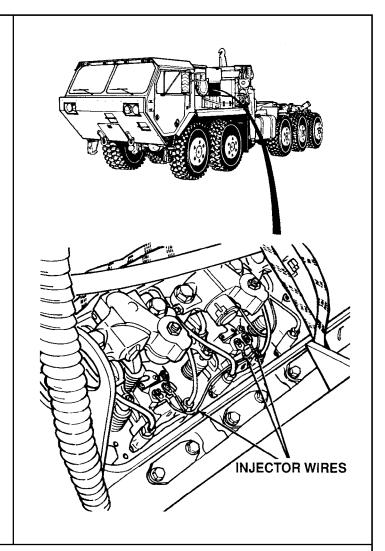
E. FLASH CODE: 61

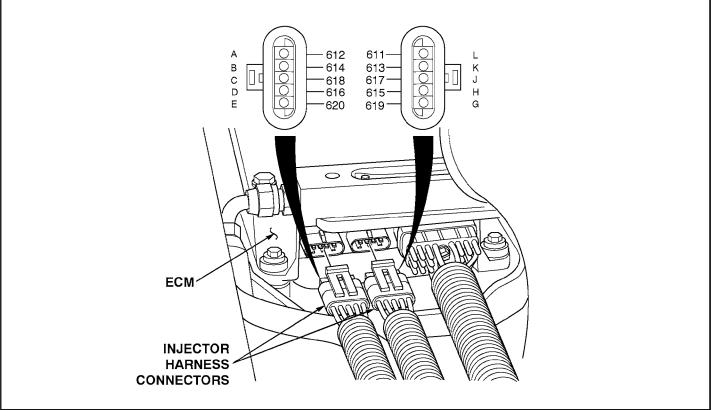
J1587 CODE: Sxxx 0 - INJECTOR RESPONSE TIME LONG

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
• Connect DDR to DDL connector MC13. • Turn ON ENGINE switch (TM 9-2320-364-10). • Read active codes using DDR.  61-2 DDR Test  • Start engine (TM 9-2320-364-10) and warm to operating temperature 180°F to 190°F (82°C to 88°C). • Select RESPONSE TIMES on DDR. • Read DDR display of injector response time (in firing order) through several cycles. Note response time(s) of cylinder by number in fault code. • Refer to Injector Identification Table for the firing sequence in relation to the code received. • Turn OFF ENGINE switch.	Other codes displayed.  No other codes displayed.  Injector response times for codes received equal 0.80.  Injector response times for codes received are not equal to 0.80.	Service other codes first. Go to START-1, page 2-539.  Go to 61-2.  Check for the following: Air in fuel (Refer to fuel system troubleshooting, para 2-17). Low battery charge (Refer to electrical system troubleshooting, para 2-20). Problems in the charging system (Loose alternator belt, bad grounds, etc.). (Refer to electrical system troubleshooting, para 2-20). Signs of insulation wear on injector harness (Remove rocker arm cover para 3-4 or 3-5). If problem has not been corrected, notify DS maintenance.
<ul> <li>Turn ON ENGINE switch (TM 9-2320-364-10).</li> <li>Select CLEAR CODES on DDR, and clear codes.</li> <li>Select ACTIVE CODES on DDR.</li> <li>Read displayed codes.</li> <li>Turn OFF ENGINE switch (TM 9-2320-364-10).</li> <li>Disconnect DDR from DDL connector MC13.</li> </ul>	One code (61) displayed on DDR. More than one code	Go to 61-4.  All codes (61), go to 61-9. All left bank or all right bank codes, go to 61-11.

Injector Harness Connector Terminal Identification Table		
DDEC Code No.	Injector Harness Connector Terminal No.	Injector Harness Connector Terminal No.
61	А	Ш
62	К	G
63	В	Ш
64	Н	G
65	D	E
66	J	Ш
67	С	Ш
68	L	G

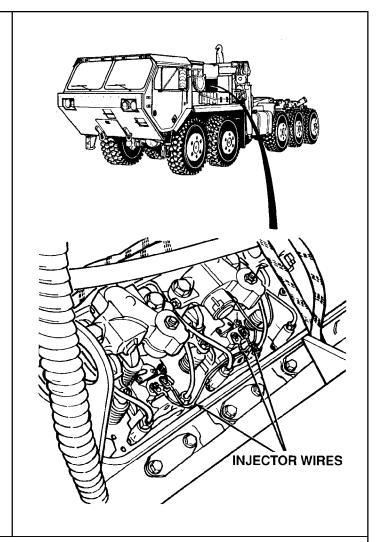


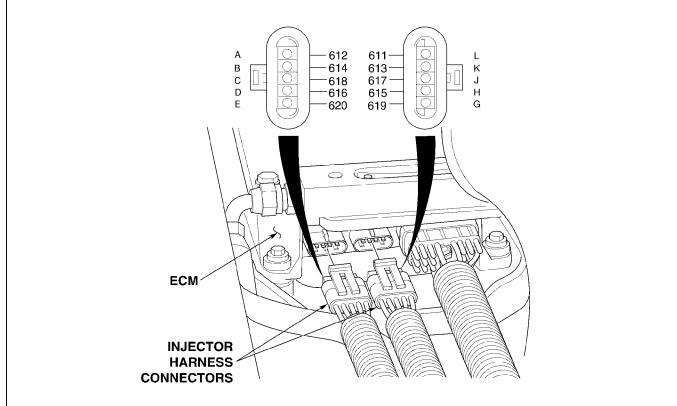


E. FLASH CODE: 61

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
WARNING  Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment, injury, or death to personnel may occur.  Allow engine to cool before performing troubleshooting maintenance. If necessary use insulated pads and gloves. Hot engine components will burn and cause personnel injury.  Disconnect both injector harness connectors at the DDEC ECM.  Is there more than 1 ohm present between injector harness connector terminals when Code 61 is received. (Example: read resistance between terminal G and L for Code 68/01).  Refer to Injector Harness Connector Terminal Identification Table.	Injector resistance (at connectors) is more than 1 ohm.  Injector resistance (at connector) is 1 ohm or less.	Go to 61-5.  Go to 61-6.
61-5 Resistance Test		
<ul> <li>Remove rocker arm cover (para 3-4 or 3-5) corresponding to injector identified by Injector Identification Table.</li> <li>Disconnect the two wires of the injector identified.</li> <li>Short these two wires together.</li> <li>Referring to Injector Harness Connector Terminal Identification Table, measure the resistance between the injector harness connector terminals associated with the faulty injector.</li> </ul>	1 ohm or less at injector harness connector.  More than 1 ohm.	Install rocker arm cover (para 3-4 or 3-5). Notify supervisor.  Repair connector or notify supervisor. Install rocker arm cover (para 3-4 or 3-5). Then go to 61-30.

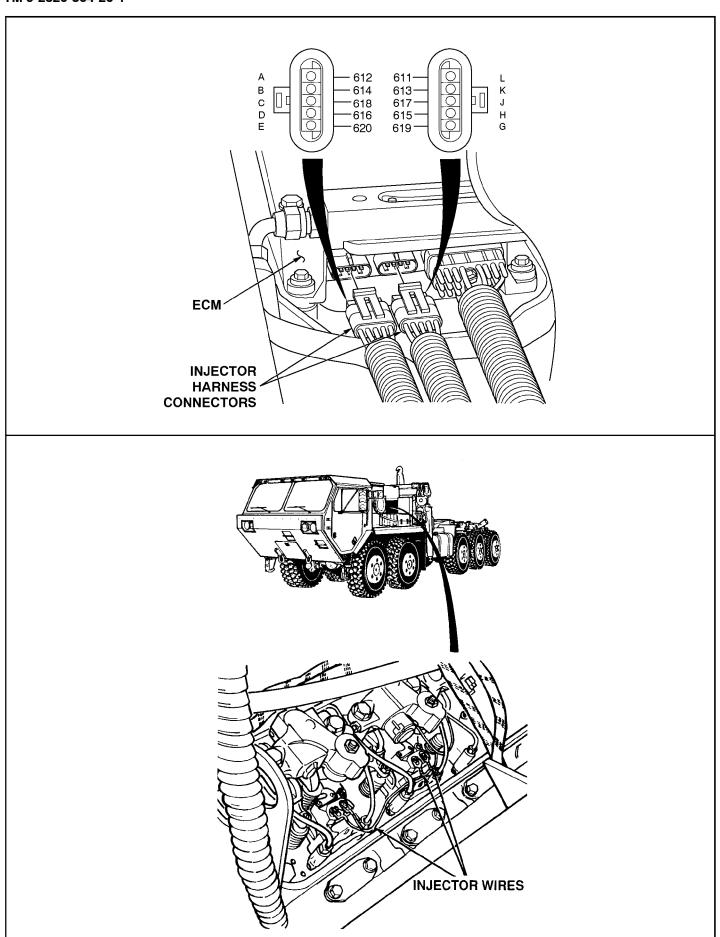
Injector Harness Connector Terminal Identification Table		
DDEC Code No.	Injector Harness Connector Terminal No.	Injector Harness Connector Terminal No.
61/01	А	E
61/02	К	G
61/03	В	E
61/04	Н	G
61/05	D	E
61/06	J	E
61/07	С	E
61/08	L	G





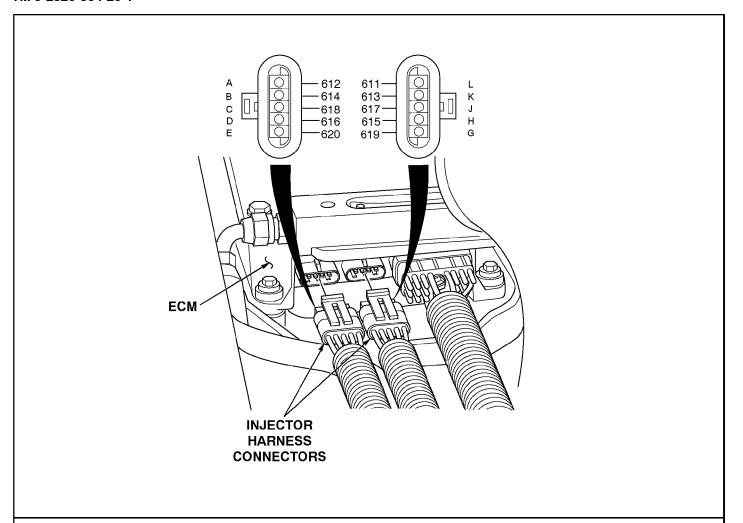
E. FLASH CODE: 61

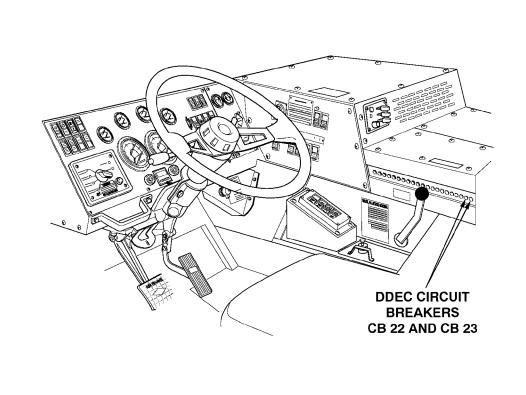
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Remove rocker arm cover (para 3-4 or 3-5) corresponding to injector identified by Injector Identification Table.</li> <li>Disconnect two wires of the injector indicated.</li> <li>Measure resistance at the injector harness connector terminals associated with the faulty injector.</li> </ul>	More than or equal to	Go to 61-7.  Repair wire or notify supervisor. Then go to 61-30.
NOTE Injector drive wires are numbered 611 through 618 and injector return wires are numbered 619 and 620 on the DDEC Injector Harness Wiring Schematic (Fig 2-4).  Check for short to ground, working with injector that has its two wires disconnected.  Measure resistance between injector drive wire and a known good ground.  If there are less than 10,000 ohms present, repair wires tested (see schematic Fig 2-4) or notify DS Maintenance.  If there are more than 10,000 ohms present, perform the step below.  Measure resistance between one of the terminals of the injector (injector with disconnected wires) and a known good ground.	More than or equal to 10,000 ohms or an open circuit measured between injector drive wire and a known good ground.  Less than 10,000 ohms present.	Go to 61-8.  Repair drive wire and/or ground or notify supervisor. Then go to 61-30.



E. FLASH CODE: 61

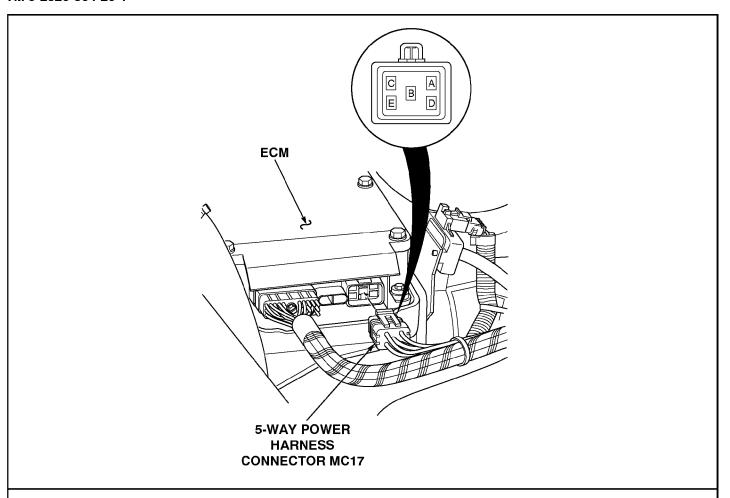
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Connect two injector harness connectors to DDEC III/IV ECM.</li> <li>Looking at injector with disconnected wires, reattach injector drive wire (Fig 2-4).</li> <li>Connect one lead of test light to the common side of the injector.</li> <li>Connect the second test light lead to a known good ground.</li> <li>While an assistant cranks the engine (TM 9-2320-364-10), observe the test light.</li> <li>Turn OFF ENGINE switch.</li> <li>Connect wire 619 or wire 620 to injector.</li> </ul>	Test light fails to illuminate while engine is being cranked.  Test light illuminates.	Go to 61-9.  Faulty injector. Notify supervisor.
<ul> <li>Oisconnect both injector harness connectors.</li> <li>Check terminals at both harness connectors (harness and DDEC III/IV ECM sides) for damage; bent, corroded and unseated pins or terminals.</li> <li>Connect both injector harness connectors.</li> </ul>	DDEC ECM terminals —— and connectors are free from damage.  Damaged terminals or —— connectors.	Go to 61-10.  Repair connectors (para 7-101) or replace DDEC III/IV ECM (para 7-57). Then go to 61-30.

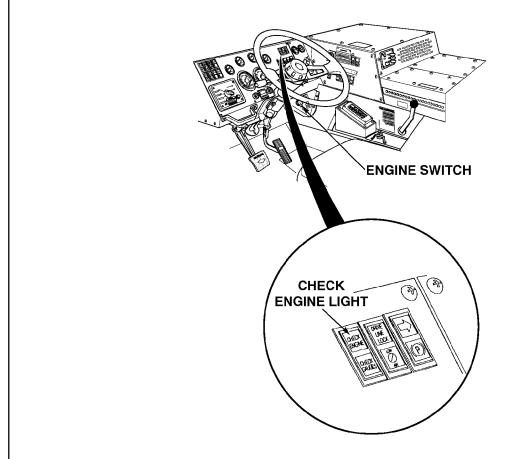




E. FLASH CODE: 61

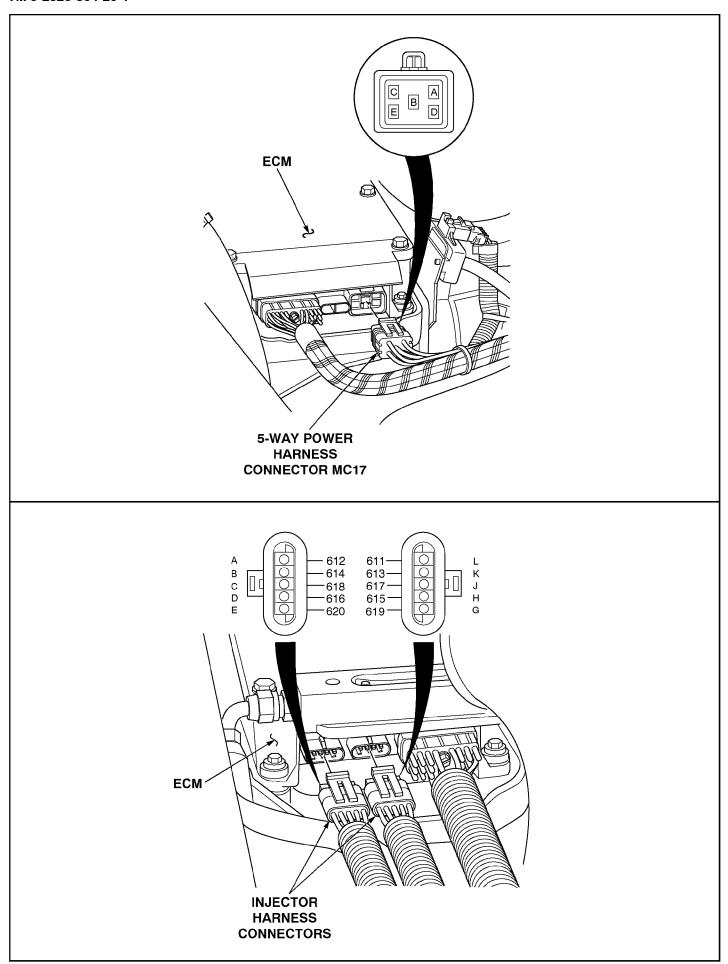
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
61-10 Visual Inspection		
<ul> <li>Check for and correct any of the following problems:</li> </ul>		
<ul> <li>Air in fuel (Refer to fuel system troubleshooting - para 2-17).</li> <li>Low battery charge (Refer to electrical system troubleshooting - para 2-20).</li> </ul>	No problems.	Replace DDEC III/IV ECM (para 7-57) Verify repair, go to 61-11.
<ul> <li>Problems in the charging system (Loose alternator belt, bad grounds, etc.). (Refer to electrical system troubleshooting - para 2-20).</li> <li>Signs of insulation wear on injector harness (Remove rocker arm cover para 3-4 or 3-5).</li> </ul>	Yes, problems exist.	Correct problem or notify supervisor. Then go to 61-30.
61-11 Visual Inspection		
Check DDEC circuit breakers CB22 and CB23.	DDEC circuit breakers — CB22 and CB23 set.  Circuit breakers not set. —	





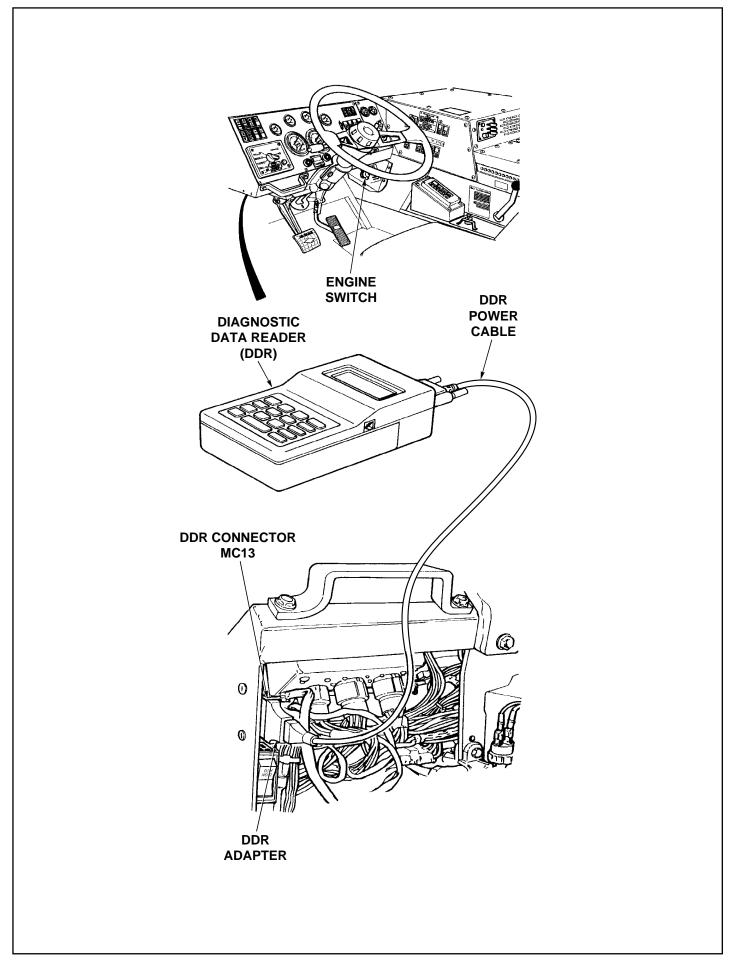
E. FLASH CODE: 61

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Disconnect 5-way power harness connector.</li> <li>Set multimeter select switch to volts dc.</li> <li>Connect positive (+) multimeter lead to 5-way power harness connector, terminals A and C.</li> <li>Connect negative (-) multimeter lead to a known good ground.</li> <li>Turn ON ENGINE switch (TM 9-2320-364-10).</li> </ul>	Wires 241 and 240 between 5-way power harness connector, terminals A and C and a good ground measure 10 to 14 vdc.  Less than 10 vdc present.	Turn OFF ENGINE switch. Go to 61-14.  Turn OFF ENGINE switch. Repair wires 240 and/or 241 or notify supervisor. Go to 61-30.
61-13 Voltage Test (Deleted		



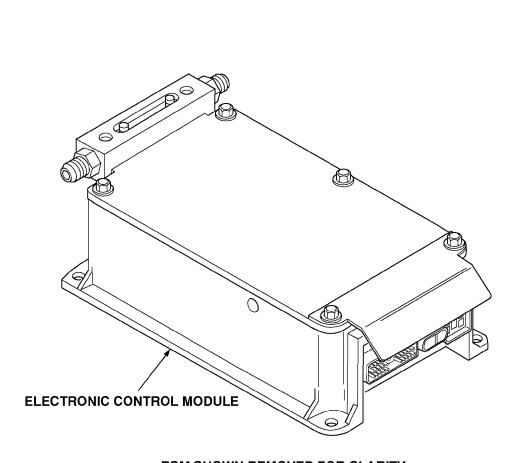
E. FLASH CODE: 61

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
61-14 Resistance Test		
<ul> <li>Set multimeter select switch to ohms.</li> <li>Read resistance between wire 150 at 5-way power harness connector, terminal D and a known good ground.</li> <li>Read resistance between wire 150 at 5-way power harness connector, terminal E and a known good ground.</li> </ul>	Wire 150 at 5-way power harness connector, terminals D and E, and a a known good ground measure 5 ohms or less.  More than 5 ohms.	Go to 61-15.  Repair wire 150 or notify supervisor. Go to 61-30.
61-15 Resistance Test		
<ul> <li>Disconnect both injector harness connectors at ECM.</li> <li>Read resistance between wires 619 and 611 at injector harness connector, terminals G and L.</li> <li>If more than 5 ohms are present, repair wire 619 (see schematic Fig 2-4) or notify DS Maintenance and perform the steps below.</li> <li>If less than 5 ohms are present, wire 619 is OK.</li> <li>Read resistance between wires 620 and 612 at injector harness connector, terminals E and A.</li> <li>Connect 5-way power harness connector to ECM.</li> <li>Connect both injector harness connectors to ECM.</li> <li>Install rocker arm covers (para 3-4 and/or 3-5).</li> </ul>	Wires 619 and 611 at injector harness connector, terminals G and L and wires 620 and 612 at injector harness connector, terminals E and A measure 5 ohms or less.  More than 5 ohms.	Both readings less than or equal to 5 ohms, go to 61-9.  Repair wires 619 and/or 620 or notify supervisor. Go to 61-30.

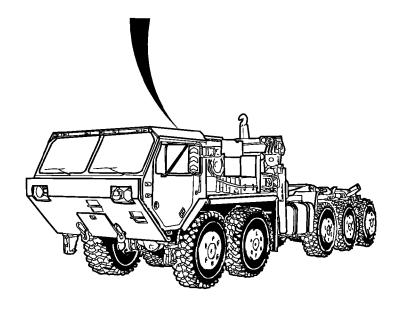


E. FLASH CODE: 61

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
61-30 Verfiy Repair		
<ul> <li>Turn ON ENGINE switch (TM 9-2320-364-10).</li> <li>Clear codes on DDR.</li> <li>If CEL does not stay ON, start engine and run for 8 minutes or until CEL comes ON.</li> <li>Turn OFF ENGINE switch.</li> <li>Disconnect DDR from DDL connector MC13.</li> </ul>	CEL stays ON longer ————————————————————————————————————	Go to START-1, pg 2-539. Fault corrected.



**ECM SHOWN REMOVED FOR CLARITY** 



### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 62

J1587 CODE: S026 3/4 - AUXILIARY OUTPUT SHORT TO BATTERY,

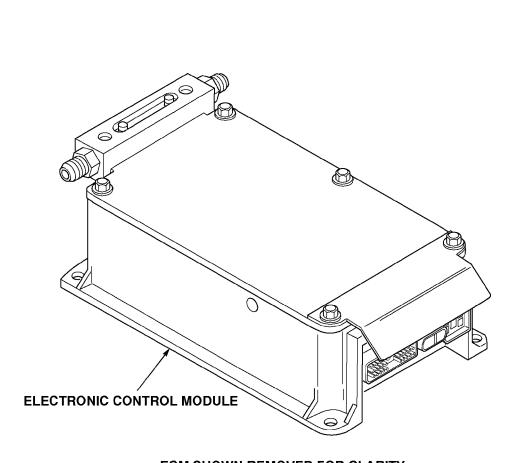
**AUXILIARY OUTPUT OPEN CIRCUIT** 

**NOTE** - This chart is only to be used if:

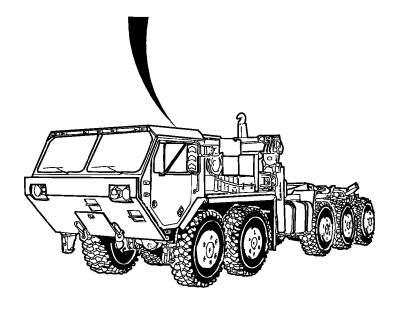
1) All basic mechanical checks and physical inspections have been performed with no problem found; and,

2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE		
62-1 Determine SAE Codes		
• 26-3 • 26-4	Auxiliary ouput Auxiliary ouput	#1 short to battery (ckt 988). #1 open circuit (ckt 988).



ECM SHOWN REMOVED FOR CLARITY



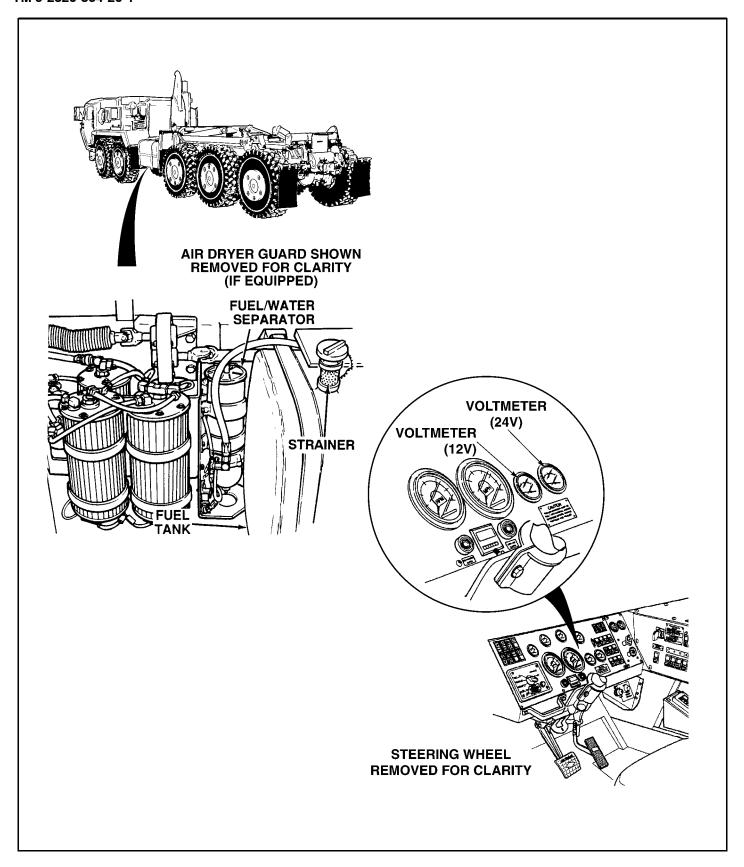
# Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 63

J1587 CODE: S057 3/4 - PWM SHORT TO BATTERY/PWM OPEN CIRCUIT

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE		
63 Determine SAE Codes		
• 57-3 • 57-4	PWM #1 PWM #1	Short to battery (ckt 908). Open circuit (ckt 908).



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 71

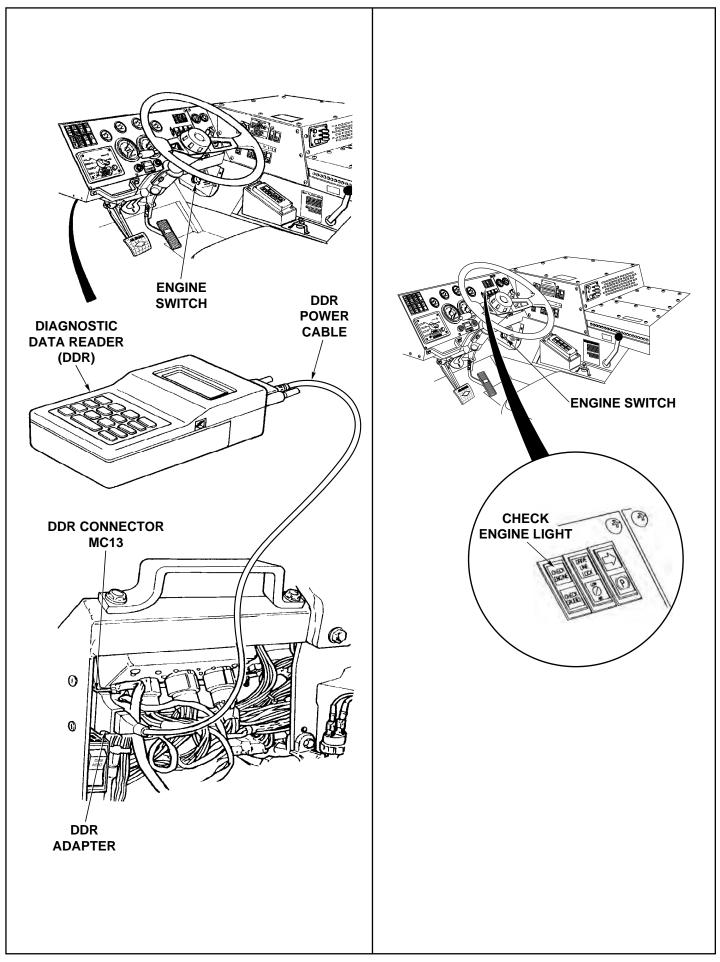
J1587 CODE: Sxxx 1 - INJECTOR RESPONSE TIME SHORT

**NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

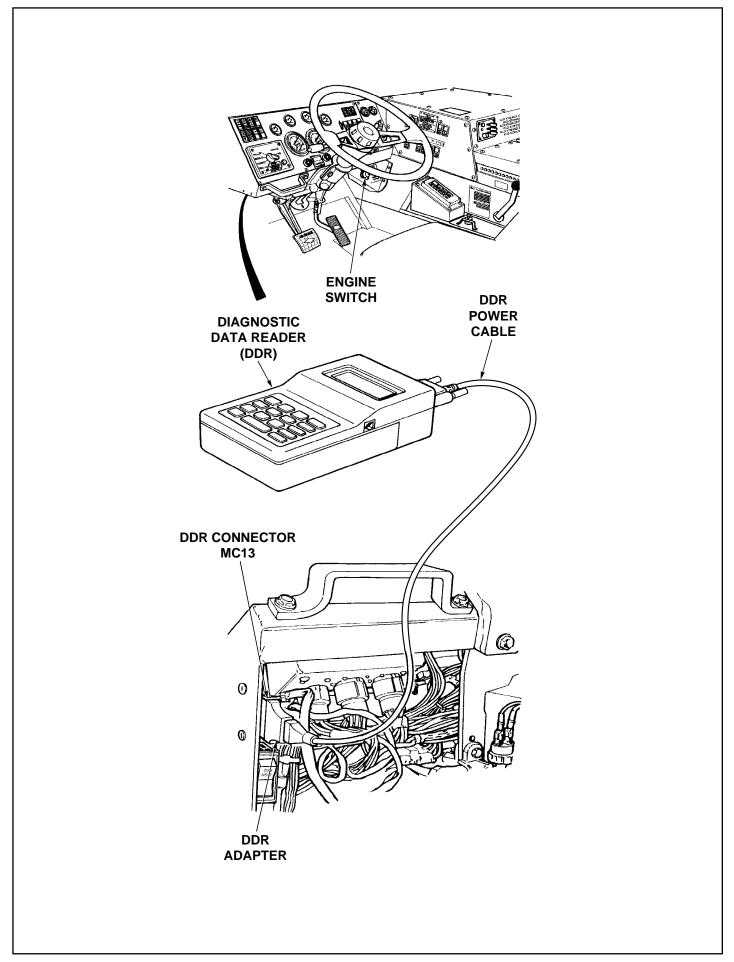
NOTE - Troubleshooting procedures for Code 71 is the same for Code 61.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Check fuel/water separator for water and/or oil in the fuel according to Preventive Maintenance Checks and Services (TM 9-2320-364-10).     Remove fuel tank cap and check fuel strainer for debris.	Fuel system is free of aerated fuel and/or contamination.  Fuel system is not free of aerated fuel and/or contamination.	Go to 71-2.  If there is water in fuel, drain water and fuel/water separator.  If there is debris in fuel strainer, clean and fill fuel tank (para 4-8).  Refer to fuel system troubleshooting (para 2-17) Then go to 71-30.
Start engine (TM 9-2320-364-10).  If 10 to 14 vdc are not indicated on the 12V voltmeter and 22 to 28 vdc are not indicated on the 24V voltmeter, turn OFF ENGINE switch and go to electrical system troubleshooting (para 2-19).  If 10 to 14 vdc are indicated on the 12V voltmeter and 22 to 28 vdc are indicated on the 24V voltmeter, alternator is ok.  Turn OFF ENGINE switch.	Alternator or electrical—charging system is operating properly.  Alternator or electrical—charging system is not operating properly.	Go to 71-3.  Refer to electrical troubleshooting (para 2-20, table 2-38). Then go to 71-30.



E. FLASH CODE: 71

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
<ul> <li>Tonnect DDR to connector M</li> <li>Turn ON ENGINE switch (TM 9-2320-364-10).</li> <li>Select ACTIVE CODES on E</li> </ul>	code displayed.	Turn OFF ENGINE switch. Go to Code 61-2. Then go to 71-30.  Turn OFF ENGINE switch. Service other codes first. Go to START-1, pg 2-539.
<ul> <li>Turn ON ENGINE switch (TM 9-2320-364-10).</li> <li>Clear codes.</li> <li>If CEL does not stay ON, statengine and run for 8 minutes or until CEL comes ON.</li> <li>Turn OFF ENGINE switch.</li> <li>Disconnect DDR from DDL connector MC13.</li> </ul>		Go to START-1, pg 2-539, to service other codes.  Repairs are complete.



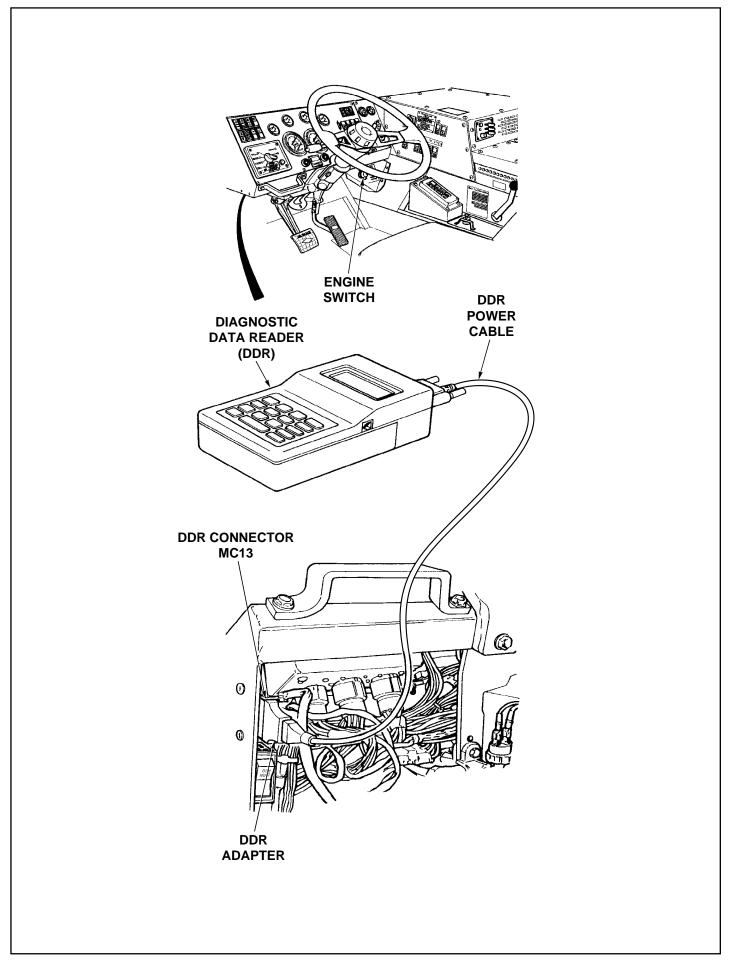
### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 75

J1587 CODE: P168 0 - BATTERY VOLTAGE HIGH

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
75-1 High Voltage		
<ul><li>Turn ignition on.</li><li>Plug in DDR.</li><li>Read codes.</li></ul>	Any code(s) other than 168/0.  Code 168/0	<ul> <li>Service other codes first.</li> <li>Code 168/0 indicates voltage is too high to the ECM. Check batteries and/or vehicle charging system.</li> </ul>



#### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 76

J1587 CODE: P121 0 - ENGINE OVERSPEED WITH ENGINE BRAKE

#### NOTE - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

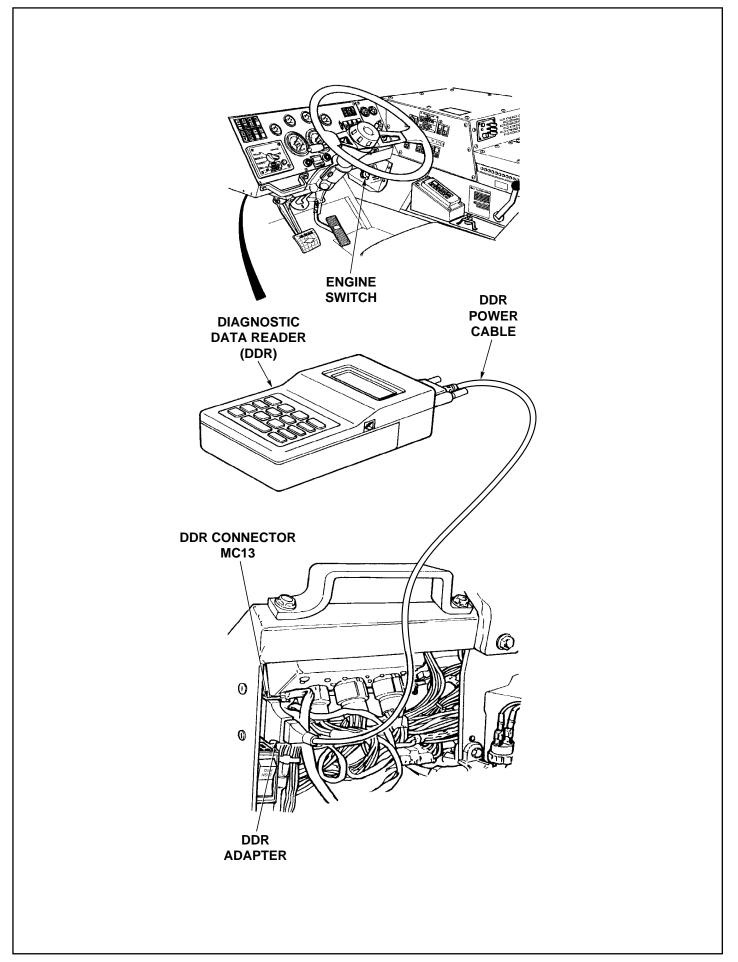
#### 76-1 Code Information

This code is for information purposes only. It is logged whenever the engine has been operating over 2500 rpm for at least 2 seconds with engine brake operation. To get complete information, do the following.

- · Turn ignition on.
- Plug in DDR.
- Select INACTIVE CODES.
- At least part of the display will look like the following example:

First Occurrence Last Occurrence Total Number Total Time

(For some) Min/Max Value that caused the code to be logged.



### Section IV. TROUBLESHOOTING CHARTS (Cont.)

E. FLASH CODE: 85

J1587 CODE: P190 0 - ENGINE OVERSPEED

### NOTE - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

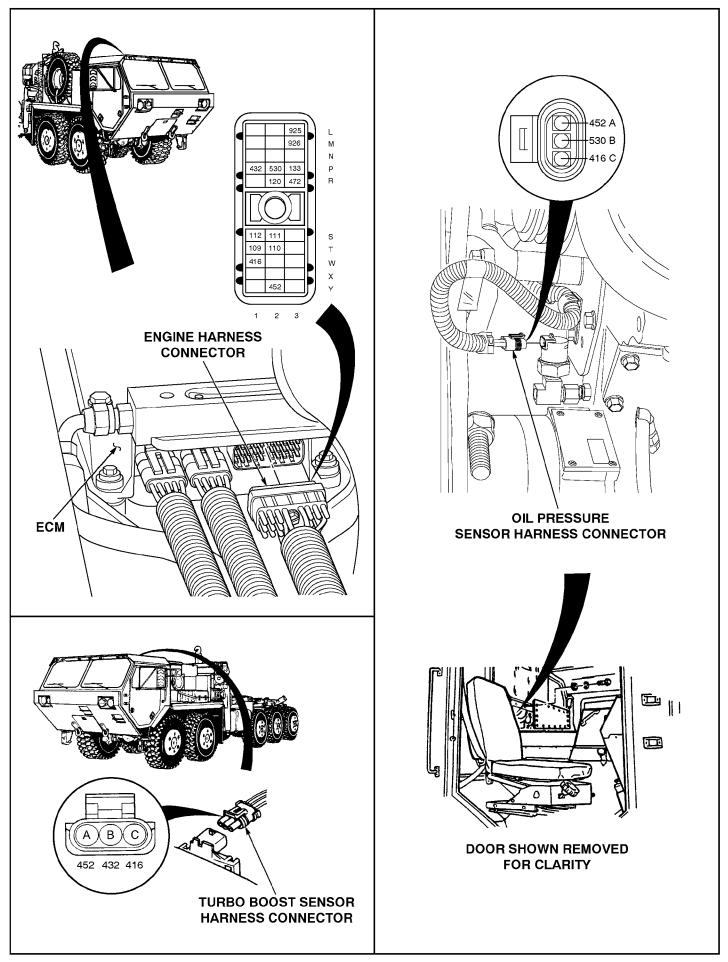
#### 85-1 Code Information

This code is for information purposes only. It is logged whenever the engine has been operating over 2500 rpm for at least 2 seconds. To get complete information, do the following.

- Turn ignition on.
- Plug in DDR.
- Select INACTIVE CODES.
- At least part of the display will look like the following example:

First Occurrence Last Occurrence Total Number Total Time

(For some) Min/Max Value that caused the code to be logged.



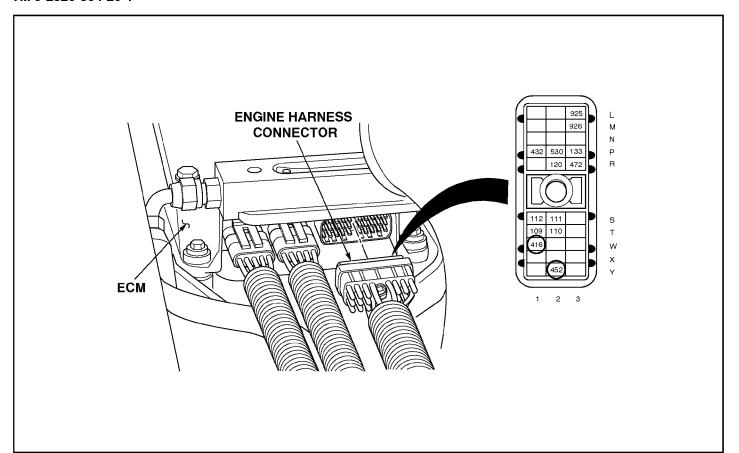
# Section IV. TROUBLESHOOTING CHARTS (Cont.)

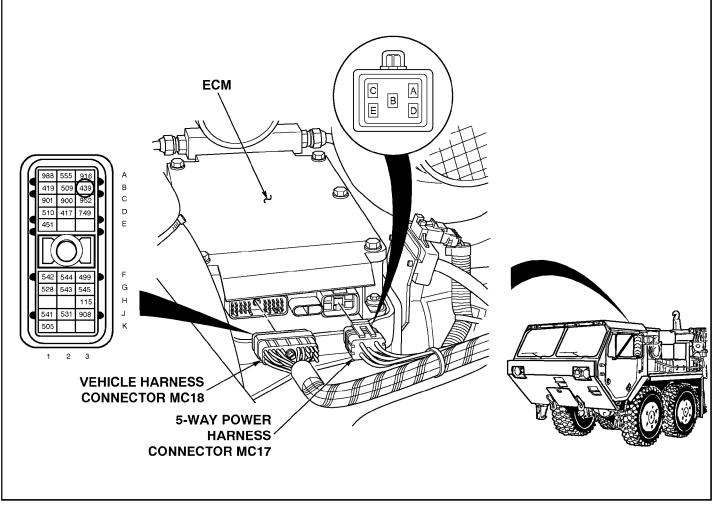
### E. ENG5V - ENGINE HARNESS +5 VOLTS SUPPLY

**NOTE** - This chart is only to be used if:

- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

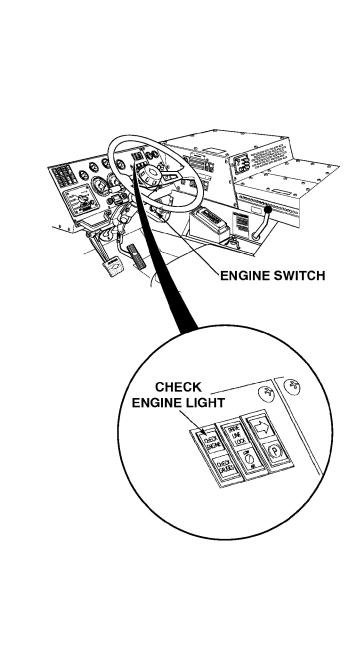
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
ENG5V-1 Check for Low Battery Voltage		
Was there also a Code 168/1?	Yes	Go to 46-1 (page 2-719).  Go to ENG5V-2.
ENG5V-2 Check for + 5 Volts		
<ul> <li>Turn ignition off.</li> <li>Disconnect the Oil Pressure Sensor (OPS) (para 7-68) and Turbo Boost Sensor (TBS) (para 7-63) connectors.</li> </ul>	Between 4.7 and 5.2 volts.	Voltage reading is correct. Check voltage at next connector. If all connector voltage readings are correct, go to ENG5V-3.
<ul> <li>Turn ignition on.         At each sensors harness connector, read voltage between socket C (red lead) and sockets A (black lead).     </li> </ul>	Less than 4.7 volts at any or all connectors. Greater than 5.2 volts at all connectors.	Go to ENG5V-4.  Go to ENG5V-6.
ENG5V-3 Check ECM Connectors		
<ul> <li>Check terminals at the engine harness connector (both the ECM and harness side) for damaged, bent, corroded and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problems found.	Replace ECM (para 7-57). Then go to ENG5V-30.  Repair terminals/connectors (para 7-101). Then go to ENG5V-30.





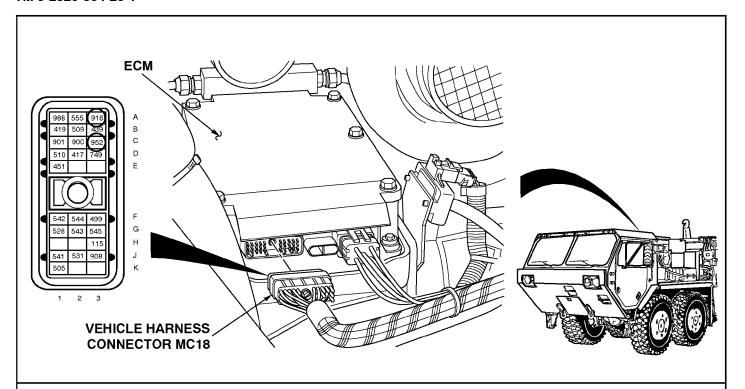
# E. ENG5V - ENGINE HARNESS +5 VOLTS SUPPLY (CONT'D)

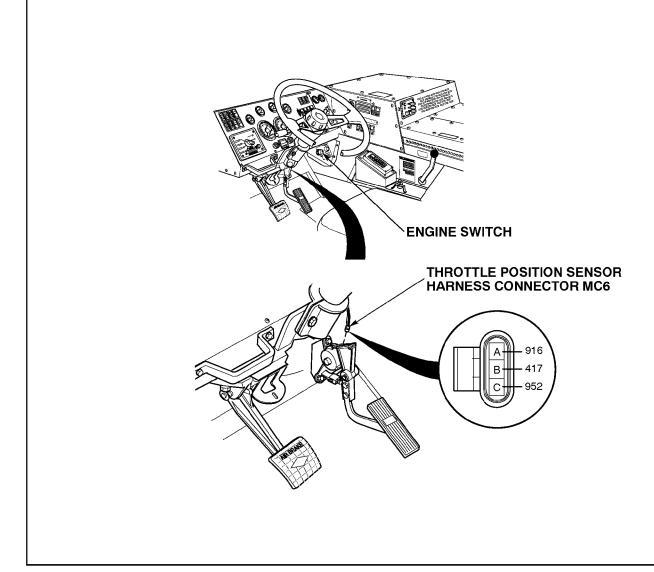
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
ENG5V-4 Check for +5 Volts or Return Open		
<ul> <li>Turn ignition off.</li> <li>Disconnect the engine harness connector at the ECM.</li> <li>Install a jumper wire between sockets A and C of any sensor connector that reads less than 4.7 volts in Step ENG5V-2.</li> <li>Read resistance between sockets W1 and Y2 of the engine harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Go to ENG5V-5.  Either the engine +5 volt line (ckt #416) or the sensor return line (ckt #452) is open. Repair open. Then go to ENG5V-30.
ENG5V-5 Check for Short to Ground		
<ul> <li>Turn ignition off.</li> <li>Remove jumper wire.</li> <li>Read resistance between sockets A and C of the sensor connector.</li> <li>Also read resistance between socket C of the sensor connector and a good ground.</li> </ul>	Both readings are greater than 10,000 ohms or open.  Either reading is less than or equal to 10,000 ohms.	Go to ENG5V-3.  The engine +5 volt line (ckt #416) is shorted to either the sensor return line (ckt #452) or to chassis ground. Repair short. Then go to ENG5V-30.
ENG5V-6 Check for Short to Battery +		
<ul> <li>Turn ignition off.</li> <li>Disconnect batteries (para 7-87).</li> <li>Disconnect all six connectors at the ECM.</li> <li>Read resistance between socket W1 on the engine harness connector and B3 on the vehicle harness connector.</li> <li>Also read resistance between socket W1 on the engine harness connector and the following</li> </ul>	All readings are greater than 10,000 ohms or open.  Any reading is less than or equal to 10,000 ohms.	A short exists between sockets where less than 10,000 ohms resistance was read. Repair short. Then go to ENG5V-30.
sockets on the 5-way power harness connector: A and C.		



# E. ENG5V - ENGINE HARNESS +5 VOLTS SUPPLY (CONT'D)

STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
ENG5V-30 Verify Repairs		
<ul><li>Turn ignition off.</li><li>Reconnect all connectors.</li></ul>	No codes.	Repairs are complete.
<ul> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>If "Check Engine" light does not stay on, start engine and run</li> </ul>	Codes which brought you to Chart ENG5V are still there.	→ Go to VEH5V-1, page 2-767.
(TM 9-2320-364-10) for 1 minute or until "Check Engine" light comes on.  Stop engine.  Read inactive codes.	Any codes except those which brought you to Chart ENG5V.	Go to START-1, page 2-539, to service other codes.





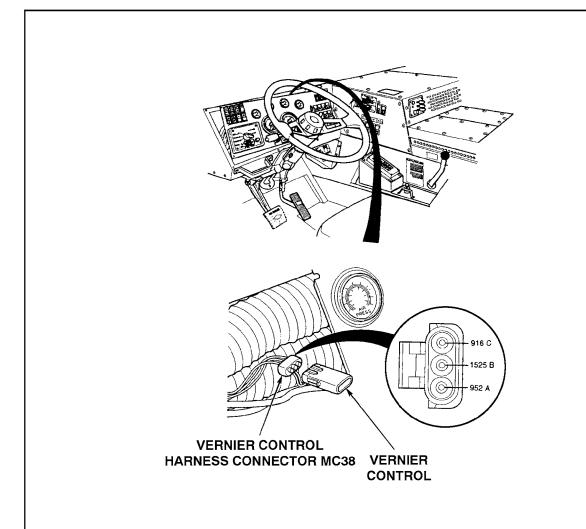
# Section IV. TROUBLESHOOTING CHARTS (Cont.)

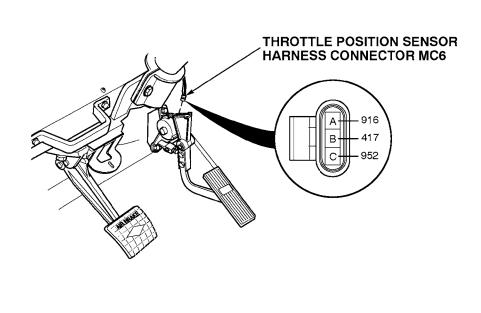
### E. VEH5V - VEHICLE HARNESS +5 VOLTS SUPPLY

**NOTE** - This chart is only to be used if:

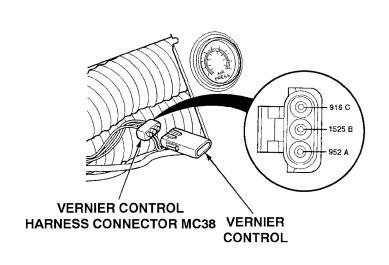
- 1) All basic mechanical checks and physical inspections have been performed with no problem found; and,
- 2) Diagnosis of DDEC III/IV was started at step START-1, pg 2-539, and you have now been referred here.

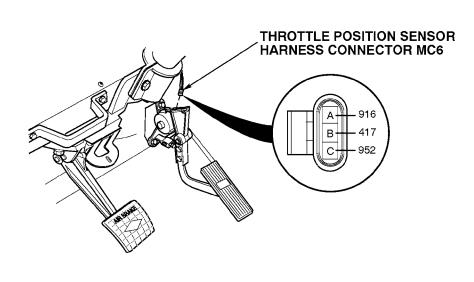
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
VEH5V-1 Check for Low Battery Voltage  • Was there also a Code 168/1?	Yes	→ Go to 46-1 (page 2-719).  → Go to VEH5V-2.
VEH5V-2 Check for +5 Volts at TPS		
<ul> <li>Turn ignition off.</li> <li>Disconnect the Throttle Position Sensor (TPS) connector.</li> <li>Turn ignition on.</li> <li>Read voltage on the TPS connector, pin C (red lead) to pin A (black lead).</li> </ul>	Less than	Go to VEH5V-3.  Go to VEH5V-11.  Go to VEH5V-8.
VEH5V-3 Check for +5 Volts or Return Open		
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector at the ECM.</li> <li>Install a jumper wire between pins A and C of the TPS connector.</li> <li>Read resistance between sockets A3 and C3 of the vehicle harness connector.</li> </ul>	Less than or equal to 5 ohms.  Greater than 5 ohms or open.	Go to VEH5V-4.  Either the engine +5 volt line (ckt #916) or the sensor return line (ckt #952) is open. Repair open. Then go to VEH5V-30.



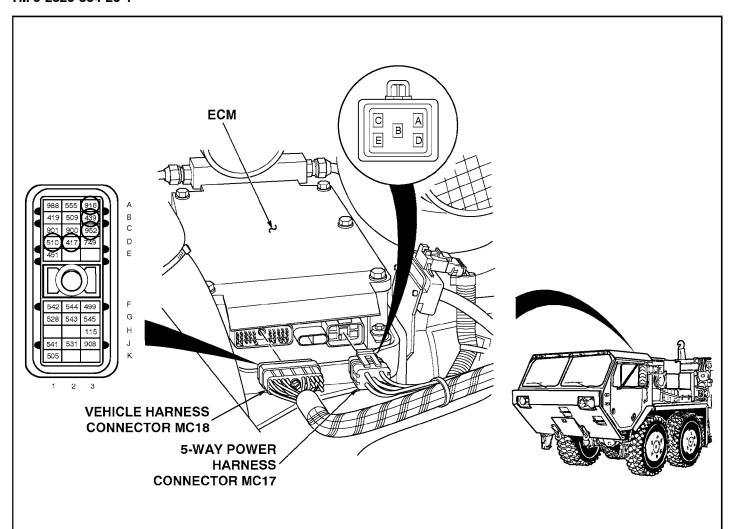


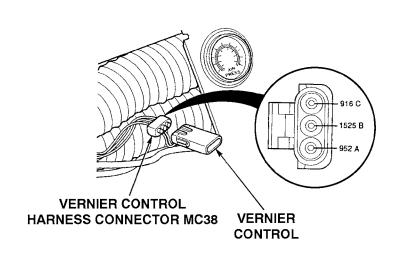
STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
VEH5V-4 Check for +5 Volt Short Ground		
<ul> <li>Remove jumper wire.</li> <li>Disconnect vernier control (para 7-100).</li> <li>Read resistance between pins A and C of the TPS connector.</li> <li>Also read resistance between pin B or the TPS connector and a good ground.</li> </ul>	Both readings are greater than 10,000 ohms or open.  Either reading is less than or equal to 10,000 ohms.	Go to VEH5V-10.  Go to VEH5V-6.
VEH5V-5 (Deleted)		
VEH5V-6  +5 Volts Check Using the Vernier Control  • Turn ignition on.  • Read voltage on the vernier control connector, socket C (red lead) to socket A (black lead).	Less than 4.7 volts.  Greater than or equal to 4.7 volts.	The engine +5 volt line (ckt #916) is shorted to either the sensor return line (ckt #952) or to chassis ground. Repair short. Then go to VEH5V-30.  Go to VEH5V-12.



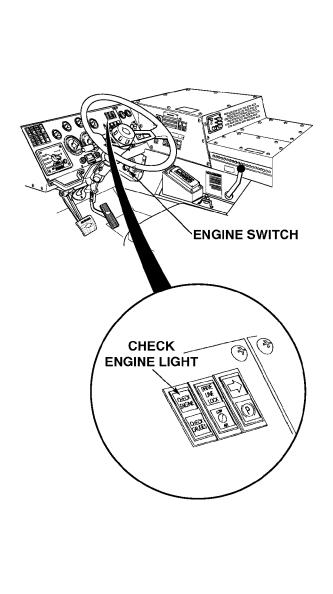


STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
Check Vernier Control Sensor Connectors      Inspect terminals at the vernier control connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or sockets.	Terminals and connectors are okay.  Problem found.	<ul> <li>Replace vernier control (para 7-100). Then go to VEH5V-30.</li> <li>Repair terminals/connectors (para 7-101). Then go to VEH5V-30.</li> </ul>
<ul> <li>VEH5V-8 Check TPS</li> <li>Turn ignition off.</li> <li>Reconnect the Throttle Position Sensor (TPS) connector.</li> <li>Turn ignition on.</li> <li>Select TPS CNTS for display on the DDR.</li> <li>Observe throttle counts at both no throttle and full throttle (engine not running).</li> </ul>	Getting 64-205 counts at no throttle and no more than 968 counts at full throttle.  Not getting the above readings.	Go to VEH5V-10.  Go to VEH5V-9.
<ul> <li>VEH5V-9 Check TPS Connectors</li> <li>Turn ignition off.</li> <li>Disconnect the Throttle Position Sensor (TPS) connector.</li> <li>Inspect terminals at the TPS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or sockets.</li> </ul>	Terminals and connectors are okay.  Problem found.	<ul> <li>Replace TPS (para 7-58). Then go to VEH5V-30.</li> <li>Repair terminals/connectors (para 7-101). Then go to VEH5V-30.</li> </ul>





STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
VEH5V-10 Check ECM Connectors		
<ul> <li>Turn ignition off.</li> <li>Disconnect the vehicle harness connector at the ECM (if not already disconnected).</li> <li>Check terminals at the vehicle harness connector (both the ECM and harness side) for damage; bent, corroded and unseated pins or sockets. Especially terminals #952, #916, #417, and #510. Install new terminal if in doubt.</li> </ul>	Terminals and connectors are okay.  Problem found.	Replace ECM (para 7-57). Then go to VEH5V-30.  Repair terminals/connectors (para 7-101). Then go to VEH5V-30.
<ul> <li>VEH5V-11 Check for Short to Battery +</li> <li>Turn ignition off.</li> <li>Disconnect batteries (para 7-90).</li> <li>Disconnect the vehicle harness and 5-way power harness connectors at the ECM.</li> <li>Read resistance between sockets A3 and B3 on the vehicle harness connector.</li> <li>Also read resistance between socket A3 on the vehicle harness connector and the following sockets on the 5-way power harness connector: A and C.</li> </ul>	All readings are greater than 10,000 ohms or open.  Any reading is less than 10,000 ohms.	Go to VEH5V-10.  A short exists between the engine +5 volt line (ckt #916) and the line(s) where less than 10,000 ohms was read (either: ckt #240, #241, or #439). Repair short. Then go to VEH5V-30.
Connect TPS connector.     Turn ignition on.     Read voltage on vernier control connector, socket C (red lead) and a good battery ground.     Repeat above only place red lead in socket A of the vernier control connector.	Both 4.7 to 5.2 volts.  Pin C greater than 4.7 volts and pin A is zero volts.	Repair open from ckt #952 to ECM. (Look at ECM terminal.) Repair open, then go to VEH5V-30.  Go to VEH5V-7.



STEP/SEQUENCE	RESULT	WHAT TO DO NEXT
VEH5V-30 Verify Repairs		
<ul><li>Turn ignition off.</li><li>Reconnect all connectors.</li></ul>	No codes.	Repairs are complete.
<ul> <li>Turn ignition on.</li> <li>Clear codes.</li> <li>If "Check Engine" light does not stay on, start engine and run</li> </ul>	Codes which brought you to Chart VEH5V are still there.	→ Go to ENG5V-1, page 2-761.
(TM 9-2320-364-10) for 8 minutes or until "Check Engine" light comes on.  • Stop engine.	Any codes except those which brought you to Chart VEH5V.	Go to START-1, pg 2-539, to service other codes.
Read inactive codes.		

### Section V. DIAGNOSTIC DATA READER INFORMATION

This section describes the DDEC III/IV information available through the use of the MPSI Pro-Link 9000 Diagnostic Data Reader (DDR). Pro-Link menu diagrams and parameter definitions are provided.

Engine Menu Selections and sub menus are defined as follows:

### A. ENGINE DATA LIST

#### **B. DIAGNOSTIC CODES**

- Active Codes
- Inactive Codes
- Clear Codes
- Change Code Description

### C. VIEW CALIBRATION CONFIGURATION SELECTIONS

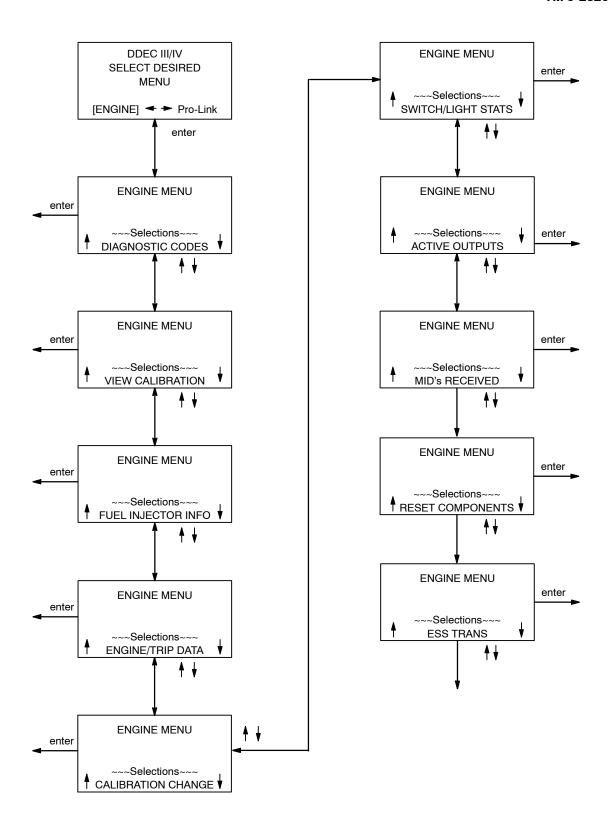
- Engine Configuration
- VSG Configuration
- Engine Protection Configuration
- ECM Input and Output Configuration

### D. FUEL INJECTOR INFORMATION

- Cylinder Cutout
- Response Times
- View Injector Calibration
- Upate Injector Calibration

### E. SWITCH/LIGHT STATUS

### F. MID MESSAGES BEING RECEIVED



### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

#### A. ENGINE DATA LIST

The Engine Data List menu selection displays the set of DDEC III/IV data that pertain to the operation of the engine and vehicle.

### NOTES:

- (1) Engine data list values that are displayed as 'N/A' (not available) typically indicate that the sensor(s) and/or function is not part of the engine configuration, or the data is not being transmitted by the DDEC III/IV ECM. These are not included in the following lists.
- (2) Engine sensor values that are displayed as 'FAIL' is an indication that a FMI 3 (Sensor Voltage High) or a FMI 4 (Sensor Voltage Low) diagnostic condition is currently active for that sensor(s).

#### **ACTIVE CODES**

Definition: Indicates the presence of a condition(s) that causes the check engine light to be on.

Typical Range: YES or NO

#### **INACTIVE CODES**

Definition: Indication that past active codes have been stored in the ECM memory.

Typical Range: YES or NO

#### **ENGINE RPM**

Definition: Indicates engine RPM as determined by the Timing Reference Sensor (TRS).

Typical Range: 0 to 2500 RPM

### **PULSEWIDTH**

Definition: Fuel Pulse Width - Number of degrees crankshaft rotation that the EUI's control valve is closed and fuel is

entering the cylinder

Typical Range: 0.0 to 25.5 Degrees

### **BOOST PSI**

Definition: Boost Pressure - Pressure of air measured by the Turbo Boost Sensor (TBS) downstream on the

compressor discharge side of the turbocharger.

Typical Range: (0.0 to 43.5 PSI) or (0 to 305 KPa)

#### **ENG LOAD PCT**

Definition: Indicates the percent engine load calculated from engine speed and torque.

Typical Range: 0 to 100%

### TORQUE LB-FT or N•M

Definition: Indicates the amount of torque available at the engine flywheel. Negative torque values will be displayed

with a minus sign in front of the value.

Typical Range: -9999 to 9999 LB-FT / -9999 to 9999 N•M

### **TPS CNTS**

Definition: Throttle Position Sensor (TPS) Counts (CNTS). Indicates the analog to digital (A/D) conversion of (0 to 5

volts) from the TPS to (0 to 1024 counts) that the ECM uses to compute the percent throttle opening.

Typical Range: (0 to 1024 Counts) or N/A

### **TPS PCT**

Definition: Indicates the percent opening of the Throttle Position Sensor (TPS).

Typical Range: 0 to 100%

### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **VSG CNTS**

Definition: Variable Speed Governor (VSG) - A/D Counts. Indicates the analog to digital (A/D) conversion of (0 to 5

volts) from the VSG to (0 to 1024 counts) that the ECM uses to compute the VSG set RPM.

Typical Range: (0 to 1024 Counts) or N/A

#### **VSG SETRPM**

Definition: Indicates the engine set speed for the Variable Speed Governor.

Typical Range: (0 to 2500 RPM) or N/A

#### BOI

Definition: Beginning of Injection - Specifies the timing of the injection event as the number of degrees crankshaft

rotation before piston TDC. This data is available for engineering purposes only.

Typical Range: (0.0 to 25.5 Degrees) or N/A

### **OIL TEMP**

Definition: Indicates the temperature of the engine oil that is measured by the Oil Temperature Sensor (OTS) in

degrees Fahrenheit or Celsius.

Typical Range: (-40 to 327 deg F) or (-40 to 150 deg C)

#### **COOLANT TEMP**

Definition: Indicates the temperature of the engine coolant that is measured by the Coolant Temperature Sensor

(CTS) in degrees Fahrenheit or Celsius.

Typical Range: (-40 to 327 deg F) or (-40 to 150 deg C)

#### **FUEL TEMP**

Definition: Indicates the temperature of the engine fuel that is measured by the Fuel Temperature Sensor (FTS) in

degrees Fahrenheit or Celsius.

Typical Range: (-40 to 214 deg F) or (-40 to 87 deg C)

#### **AMB AIR TEMP**

Definition:

Typical Range:

### **AIR INLET TEMP**

Definition: Indicates the temperature of the air entering the engine air induction system that is measured by the Air

Temperature Sensor (ATS) in degrees Fahrenheit or Celsius.

Typical Range: (-40 to 214 deg F) or (-40 to 87 deg C)

### **OIL PRS PSI**

Definition: Indicates the engine oil pressure that is measured by the Oil Pressure Sensor (OPS) in PSI or KPa.

Typical Range: (0.0 to 64.0 PSI) or (0 to 448 KPa)

### **BARO PRS PSI**

Definition: Barometric Pressure - Indicates the atmospheric pressure in PSI or KPa.

Typical Range: (0.0 to 999.9 PSI) or (0 to 9999 KPa)

### **ECM VOLTS**

Definition: Indicates the battery voltage available to the ECM

Typical Range: 0.0 to 32.0 Volts

### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **SRS RECEIVED**

Definition: Indicates that the ECM has received a signal from the Synchronous Reference Sensor (SRS) during this

ignition cycle.

Typical Range: YES or NO

### **IDLE SPD RPM**

Definition: Indicates the current engine idle speed in RPM.

Typical Range: 0 to 1000 RPM

### **ENG GOVR**

Definition: Indicates which DDEC governor is currently active.

Typical Range: NONE, IDLE, HIGH SPD, CRUISE, ROAD SPD, CRUZ VSG, H20 PGS

### **HALF ENGINE**

Definition: Indicates the active/inactive status of the Half Engine Mode.

Typical Range: YES or NO

#### **ENG BRAKE**

Definition: Indicates the active/inactive status of the engine brake.

Typical Range: LOW, MED, HIGH or OFF

#### **%TQ LIMIT**

Definition: Torque Reduction Factor - Indicates the ratio of current output torque allowed (due to adverse operating

conditions) to maximum torque available at current engine speed (under normal operating conditions).

Typical Range: 0 to 100%

### **FUEL RATE GHR**

Definition: Indicates the amount of fuel consumed by the engine per unit time.

Typical Range: 0.0 to 999.9 GPH / 0.0 to 999.9 LPH

### FUEL MPG or L/100km

Definition: Indicates the current fuel economy at the current vehicle velocity.

Typical Range: 0.0 to 99.9 MPG / 0.0 to 99.9 L/100km

### **VEHICLE SPD MPH** or **KPH**

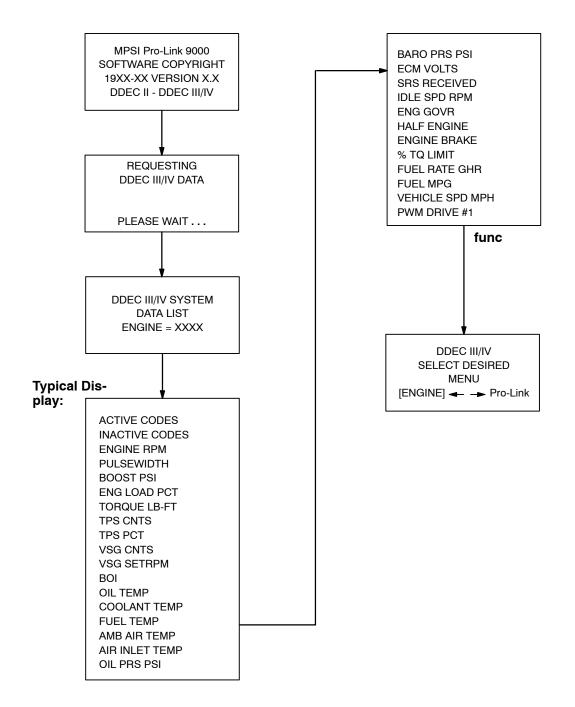
Definition: Indicates the vehicle road speed in MPH or KPH.

Typical Range: (0 to 999 MPH / 0 to 999 KPH) or N/A

### **PWM DRIVE #1**

Definition: Indicates the active duty cycle of the Pulse Width Modulated (PWM) port #1.

Typical Range: 0 to 100%



### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### B. DIAGNOSTIC CODES

The Diagnostic Code Menu Selections are defined as follows:

- Active Codes
- Inactive Codes
- Clear Codes
- Change Code Description

### MID Descriptions

MID: 128 ENGINE Single ECM applications

Diagnostic Codes with Subsystem Identification Characters (SIDs) reference DDEC III/IV Auxiliary Output #'s 1 – 8 (SIDs: 26) and use the looked-up parameter text description in TABLE 2-22 page 2-798 to identify the function assigned to the auxiliary output channel.

Injector Response Time Codes Long and Injector Response Time Codes Short will use TABLE 2-25 (Injector Numbering) page 2-799 to identify the appropriate engine cylinder number.

### **B.1 ACTIVE CODES**

Active Codes are conditions that are presently occurring and causing the Check Engine Light (CEL) to be illuminated. The display for each code is as follows:

Line 1: MID:XXX ENGINE XX

Line 2: PID Description Line 3: FMI Description

Line 4: ↑A## PID:XXX FMI:XX↓

### NOTES:

- (1) MID: Message Identification Character
- (2) PID: Parameter Identification Character
- (3) FMI: Failure Mode Identifer
- (4) A##: Numerical Count of Active Codes
- (5) ↑↓: Indicates additional codes are stored in ECM memory

### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **B.2 INACTIVE CODES**

Inactive Codes are faults that have occurred previously. The display for each code is as follows:

SCREEN #1 SCREEN #2

Line 1: MID:XXX ENGINE XX
Line 2: PID Description
Line 3: FMI Description
Line 4: ↑I## PID:XXX FMI:XX↓
Line 5: 1st: Last:
Line 6: Total#:
Line 7: Total Time:
Line 8: Min/Max:

### NOTES:

(1) I##: Numerical Count of Inactive Codes

(2) 1st: First occurrence of the diagnostic code in engine hours (3) Last: Last occurrence of the diagnostic code in engine hours

(4) Total#: Total number of occurrences

(5) Total Time: Total engine seconds that the diagnostic code was active(6) Min/Max: Minimum/Maximum value recorded during diagnostic condition

### **B.3 CLEAR CODES**

This function allows diagnostic codes stored in the ECM(s) to be erased. An audit trail of when the codes were last erased in engine hours will be displayed.

### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **B.4 CHANGE CODE DESCRIPTION**

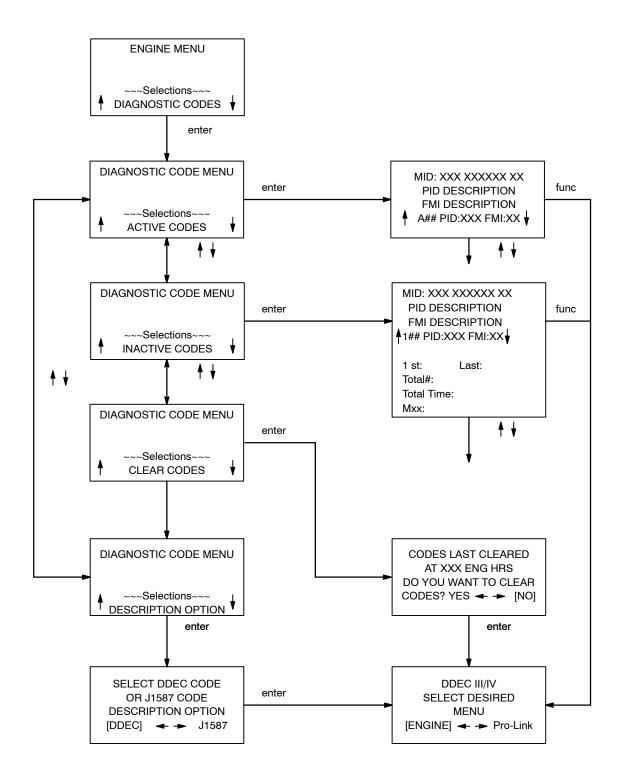
This function allows the user to specify the type of diagnostic code description by selecting either DDEC or J1587. With J1587 selected, the codes are identified according to the J1587 specification developed by the Society of Automotive Engineers (SAE) and the American Trucking Association (ATA).

If you are using J-1587 code description, the readout resembles this:

ENGINE
ENGINE OIL PRESSURE
VOLTAGE LOW
A 1 PID: 100 FM1: 4

If you are using DDEC code description, the readout resembles this:

36 MID: 128 ENGINE
OIL PRESSURE SENSOR
INPUT VOLTAGE LOW
A 1 PID: 100 FM1: 4



# Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### C. VIEW CALIBRATION CONFIGURATION SELECTIONS

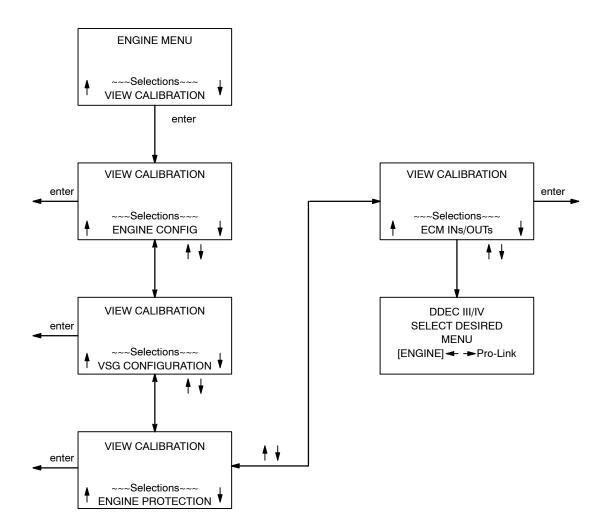
The View Calibration Configuration Menus are a set of selections that allow the viewing of engine and vehicle operating parameters that are stored in the DDEC III/IV Electrically Eraseable Programmable Read Only Memory (EEPROM). These values are typically referred to as the DDEC ECM calibration parameters.

### NOTES:

(1) Menu items that are not applicable (N/A) to PLS are not shown in the following charts.

View Calibration Configuration Menu Selections are defined as follows:

- Engine Configuration
- VSG Configuration
- Engine Protection
- ECM Input and Output Configuration



### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **C.1 ENGINE CONFIGURATION**

The view Engine Configuration menu selection displays the list that describes engine identification, application and rating information that is currently programmed in the calibration. DDEC III/IV ECM identification and software information is also provided.

### **NOTES:**

(1) Menu items that are not applicable (N/A) to PLS are not shown in the following charts.

### **ENGINE MODEL#**

Definition: Indicates the Detroit Diesel Corporation engine model number.

Typical Range: 8 Characters

### 6N4M#

Definition: Indicates the engine rating group designation.

Typical Range: 1 to 9999

### 6N4D#

Definition: Indicates the engine rating family designation.

Typical Range: 1 to 9999

### 6N4C#

Definition: Indicates the engine application group designation.

Typical Range: 1 to 9999

#### **UNIT#**

Definition:

Typical Range:

V

Definition: Indicates the vehicle identification number.

Typical Range: 17 Characters

### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

#### **ENGINE SN**

Definition: Indicates the engine serial number.

Typical Range: 10 Characters

### **ECM SN**

Definition: Indicates the ECM serial number.

Typical Range: 8 Characters ASCII

### **SOFTWARE LVL**

Definition: Indicates the DDEC ECM software version. The software level is incremented after every revision.

Typical Range: 0.00 to 999.99

### **EPA CERT#**

Definition: Indicates the EPA engine certification number.

Typical Range: 1 to 999

### **ENG SERIES**

Definition: Indicates the DDEC engine type.

Typical Range:

### **ENG BHP** or KW

Definition: Indicates the active engine rated horse power.

Typical Range: 0 to 9999 BHP / 0 to 9999 KW

### **ENG RATED RPM**

Definition: Indicates the rated speed.

Typical Range: 0 to 9999 RPM

### **LSG DROOP RPM**

Definition: Indicates the engine rated speed governor droop.

Typical Range: 0 to 999 RPM

### PEAK TRQ LB-FT or N•M

Definition: Indicates the engine peak operating torque. Typical Range: 0 to 9999 FT-LB / 0 to 9999 N•M

# Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **PEAK TRQ RPM**

Definition: Indicates the engine RPM at peak torque.

Typical Range: 0 to 2500 RPM

### **IDLE SPEED RPM**

Definition: Indicates the WARM engine idle speed.

Typical Range: 0 to 1000 RPM

### **IDLE ADJUST**

Definition: Indicates the idle RPM adjustment.

Typical Range: -25 to 150 RPM

### TRANS ALLISON ELECT

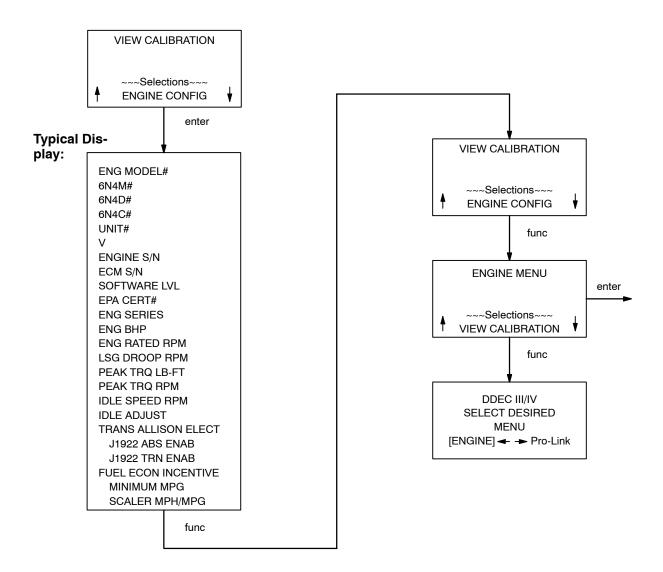
J1922 ABS ENAB

J1922 TRN ENAB

### **FUEL ECON INCENTIVE**

MINIMUM MPG (7.0)

SCALER MPH/MPG (5.0)



### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **C.2 VSG CONFIGURATION**

The view VSG Configuration selection is the set of DDEC III/IV data that identifies the Variable Speed Governor (VSG) configuration that is currently programmed in the DDEC III/IV calibration.

### **VSG DROOP RPM**

Definition: Indicates the variable speed governor droop in RPM.

Typical Range: 0 to 300 RPM

### **VSG MIN RPM**

Definition: Indicates the minimum variable speed governor RPM.

Typical Range: ("IDLE" to "VSG MAX RPM") "IDLE" = DDEC Unique ID 218 - Byte a

### **VSG MAX RPM**

Definition: Indicates the maximum variable speed governor RPM.

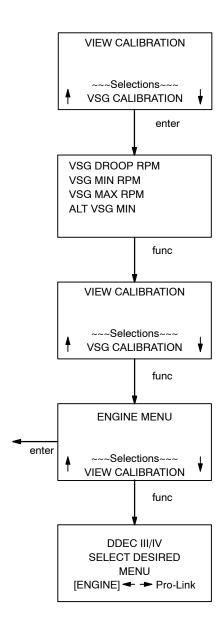
Typical Range: ("VSG MIN RPM" to "RATED") RPM

### **ALT VSG MIN**

Definition: Indicates the alternate variable speed governor minimum RPM. 'N/A' will be displayed if

(Function #16 -- ALT VSG MIN) is not configured as a vehicle input switch.

Typical Range: ("VSG MIN RPM" to "VSG MAX RPM") RPM, or N/A.



### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **C.3 ENGINE PROTECTION CONFIGURATION**

The view Engine Protection Configuration selection is the set of DDEC III/IV data that identifies to the type of engine protection configuration that is currently programmed in the DDEC III/IV calibration.

### NOTES:

(1) Engine protection values that are displayed as 'N/A' (not available) typically indicate that the sensor(s) and/or function is not part of the engine configuration. These are not listed on the following charts.

### **OIL TEMP**

Definition: Indication of the type of engine protection based on high engine oil temp.

Typical Range: Warn, Ramp, Shtdwn

### **COOLANT TMP**

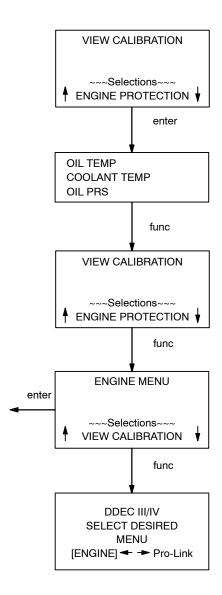
Definition: Indication of the type of engine protection based on high engine coolant temp.

Typical Range: Warn, Ramp, Shtdwn

### **OIL PRS**

Definition: Indication of the type of engine protection based on low engine oil pressure.

Typical Range: Warn, Ramp, Shtdwn



## Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### C.4 ECM INPUT AND OUTPUT CONFIGURATION

The view ECM Input and Output Configuration selection is the set of DDEC III/IV data that describe the functions assigned to the ECM input and output connector terminals that is currently programmed in the DDEC III/IV calibration.

### NOTES:

- (1) The connector cavity designations describe the physical locations of the assigned functions.
- (2) The DDR displays the assigned function text as described in Table 2-21 (Vehicle Switch Input Options) and Table 2-22 (ECM Output Options) on page 2-798.
- (3)  $^{\prime}$ N/A' will be displayed if a function number of (0 = NONE) has been assigned to any of the connector cavities.
- (4) Menu items that are not applicable (N/A) to PLS are not shown in the following charts.

### **G1 DIAG REQUEST**

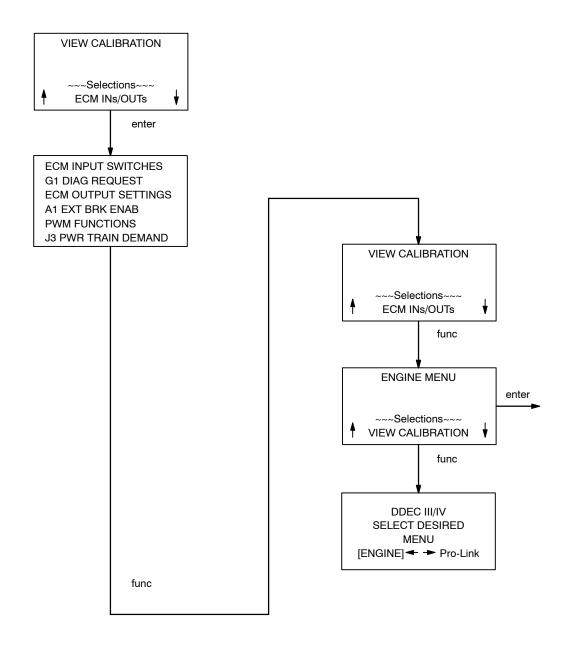
Definition: Indicates the functional configuration of the switch input at connector cavity G1 (diagnostic request switch).

#### A1 EXT BRK ENAB

Definition: Indicates the functional configuration of the output at connector cavity A1 (engine brake enable).

#### **J3 PWR TRAIN DEMAND**

Definition: Indicates the functional configuration of the PWM output at connector cavity J3 (power train demand).



## Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

	TABLE 2-21						
	Vehicle Switch	Input C	Options				
#	12345678901234567890	#	12345678901234567890				
0	XX NONE	1	XX ENGINE BRK LOW				
2	XX ENGINE BRK MED	3	XX AUX SHTDWN#1				
4	XX AUX SHTDWN#2	5	XX PARK BRK/ISD				
6	XX IDLE VALID	7	XX N/A				
8	XX PRS/RPM MODE	9	XX TPS INHIBIT				
10	XX RPM SYNC	11	XX RPM FREEZE				
12	XX ENGINE RATE SW1	13	XX ENGINE RATE SW2				
14	XX 2ND TQ CURVE	15	XX DIAG REQUEST				
16	XX ALT MIN VSG	17	XX SERV BRK REL				
18	XX CLUTCH REL	19	XX SET/COASTOFF				
20	XX SET/COAST ON	21	XX RES/ACCELOFF				
22	XX RES/ACCEL ON	23	XX CRUZ ENABLE				
24	XX PGS SYS ENAB	25	XX SEO/DIAG REQ				
26	XX ENGINE BRK DISA	27	XX N/A				
28	XX DUAL THROTT	29	XX A/C PRESSURE				
30	XX N/A	31	XX AUX CLS				
32	XX FAN OVERRIDE						

	TABLE 2-22							
	ECM Output Options							
#	12345678901234567890	#	12345678901234567890					
0	XX NONE	1	XX ENGINE BRK LOW					
2	XX ENGINE BRK MED	3	XX LO DDEC VOLT					
4	XX RPM SYNC LT	5	XX PGS ACTIVE					
6	XX VEH PWR DOWN	7	XX STRT LOCKOUT					
8	XX EXT ENGINE BRK	9	XX TRANS RET					
10	XX COOL LOW LT	11	XX CRUZ ACTIVE					
12	XX N/A	13	XX FAN CNTRL#1					
14	XX FAN CNTRL#2	15	XX DECEL LT					
16	XX ENGINE BRK ACT	17	XX VSG ACTIVE					

	TABLE 2-23						
	Transmission Options						
#	12345678901234567890	#	12345678901234567890				
0	J3 MANUAL	1	J3 ALLISON HYD				
2	J3 N/A	3	J3 VOITH AUTO				
4	J3 Z-F ECOMAT	5	J3 CEEMAT				
6	J3 RENK	7	J3 N/A				
8	J3 ELECTRIC DRIVE	9	3 ALLISON ELECT				
10	J3 MARINE GEAR	11	J3 NO TRANSMISSION				
12	J3 ALLISION WT	13	J3 N/A				
14	J3 AUTOMATIC						

	TABLE 2-24						
	PWM Function	n Options					
#	12345678901234567890	#	12345678901234567890				
0	XX NONE	1	XX BYPASS BLOWER				
2	XX GLOW PLUGS	3	XX THROTTLE POS				
4	XX FINAL TORQUE	5	XX PWR TRAIN DEMAND				
6	XX FAN CONTROL						

TABLE 2-25								
Injector Numbering								
SIDS	SIDS FIRING ORDER CYLINDER							
S001	1	3 Right						
S002	2	3 Left						
S003	3	4 Right						
S004	4	4 Left						
S005	5	2 Right						
S006	6	2 Left						
S007	7	1 Right						
S008	8	1 Left						

### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### D. FUEL INJECTOR INFORMATION

Fuel Injector Menu Selections are defined as follows:

- Cylinder Cutout
- Response Times
- View Injector Calibration
- Update Injector Calibration

### **D.1 CYLINDER CUTOUT**

The cylinder cutout function provides a test method to locate a injector whose pulse width output is different from the others. This is done by cutting out one injector at a time and comparing the resulting injector pulse width with the no cut-out pulse width established before the first cylinder was cutout.

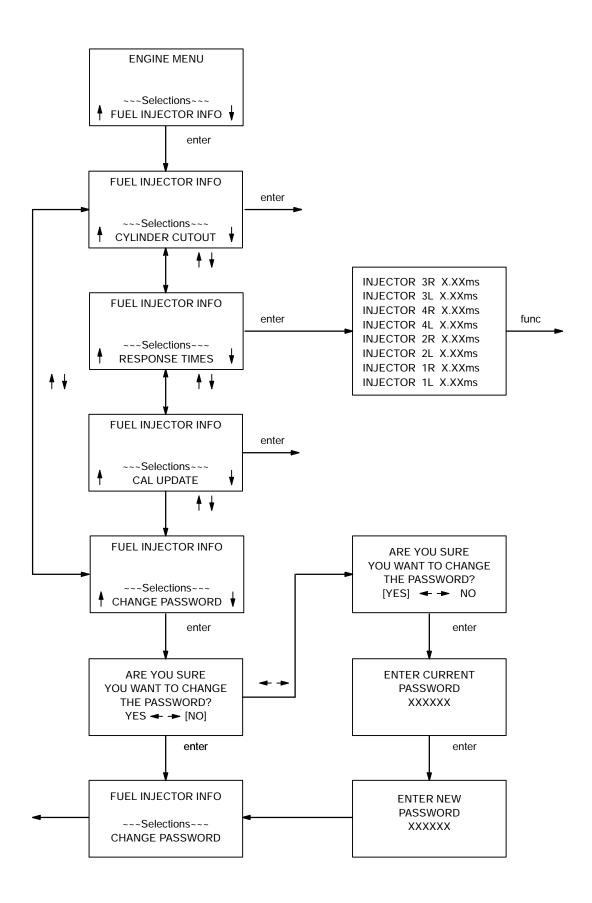
Cylinder cutout test options:

- (1) Run New Test or Review Last Results
- (2) Select RPM Setting: IDLE or 1000 RPM
- (3) Automatic Test or Manual Test

### **D.2 RESPONSE TIMES**

The injector solenoid response times are defined as the time it takes from when the DDEC III/IV ECM requests an injector be turned on to when the injector solenoid valve actually closes.

Injector response times generally increase with low battery supply voltage and decrease with high battery supply voltage. Although injector response times vary from injector to injector at a given RPM, each individual injector response time should remain relatively consistent from one firing to the next. Wide variations in response time (typically +/- 0.2 msec) for one injector at a steady RPM may indicate an electrical problem (faulty alternator or voltage regulator, poor or broken ground cables, etc.).



**FIGURE 2-13** 

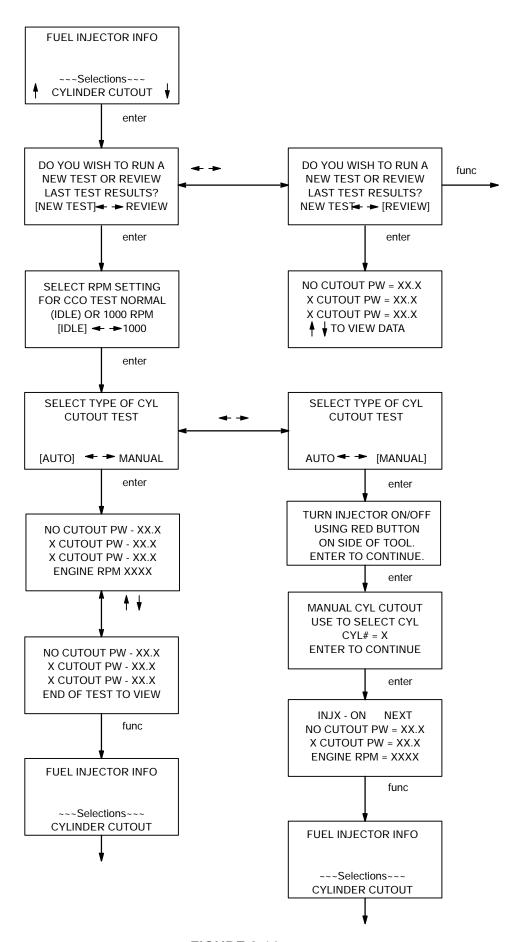


FIGURE 2-14

### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont'd)

### **D.3 VIEW INJECTOR CALIBRATION**

The injector calibration codes are used by the DDEC III/IV ECM to equalize the engine injector outputs. This compensation, obtained from properly programmed calibration codes, allows the DDEC III/IV ECM to perform optimum cylinder to cylinder power balancing.

### NOTES:

- (1) The engine cylinder numbers use TABLE 2-25 (Injector Numbering) page 2-799 to identify the appropriate injector cylinder calibration code.
- (2) Each injector typically has a unique calibration code which is physically indicated on the injector label.

### INJECTOR CAL CODE: - CYL #XXX CAL XX

Definition: Indicates the injector calibration that is currently programmed in the ECM.

Typical Range: CYL(#1 to # of cylinders) / CAL(0 to 99)

#### LAST UPDATE:

Definition: Indicates the engine hours of the last injector calibration update.

Typical Range: 0 to 65000 Hours

### TOOL ID#:

Definition: Indicates the tool indentification number used for last injector cal update.

Typical Range: 8 ASCII Characters

#### **# OF CHANGES:**

Definition: Indicates the total number of injector calibration updates.

Typical Range: 0 to 255

## Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### **D.4 UPDATE INJECTOR CALIBRATION**

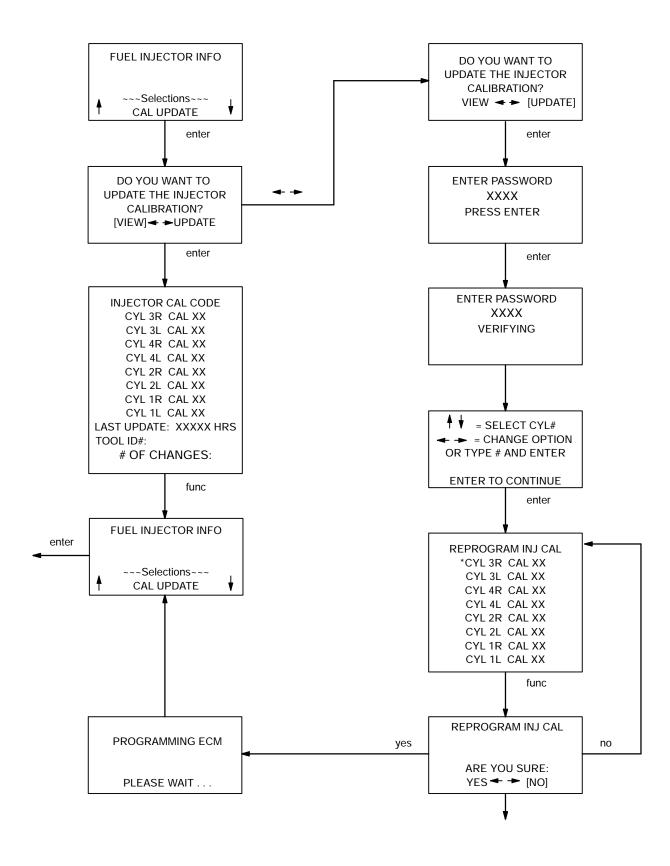
The Update Calibration selection allows the reprogramming of the injector calibration codes.

### NOTES:

- (1) The engine cylinder numbers use TABLE 2-25 (Injector Numbering) page 2-799 to identify the appropriate injector cylinder calibration code.
- (2) Each injector typically has a unique calibration code which is physically indicated on the injector label.

### REPROGRAM INJ CAL: - CYL #XXX CAL XX

Typical Range: CYL(#1 to # of cylinders) CAL(0 TO 99)



**FIGURE 2-15** 

### Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### E. SWITCH/LIGHT STATUS

The Switch/Light Status Menu is the set of DDEC III/IV data that describe the operational (ON/OFF) status of the functions assigned to the ECM input and output connector terminals.

#### NOTES:

- (1) The connector cavity designations describe the physical locations of the assigned functions.
- (2) The DDR displays the assigned function text as described in Table 2-21 (Vehicle Switch Input Options) and Table 2-22 (ECM Output Options) on page 2-798.
- (3)  $^{\prime}$ N/A' will be displayed if a function number of (0 = NONE) has been assigned to any of the connector cavities.
- (4) 'ON' indicates that the input switch or output function is active.
- (5) Menu items that are not applicable (N/A) to PLS are not shown in the following charts.

#### **ECM INPUT SWITCHES**

#### **G1 DIAG REQUEST**

Definition: Indicates the operational status of the switch input at vehicle connector cavity G1 (diagnostic request

switch).

Typical Range: ON or OFF

#### **ECM OUTPUTS STATUS**

#### **CHECK ENG LT**

Definition: Indicates the operational status of the **check engine** light.

Typical Range: ON or OFF

#### **CHECK GAUGES LT**

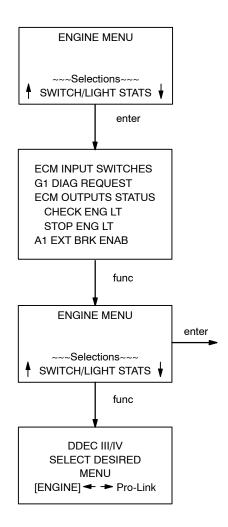
Definition: Indicates the operational status of the **check gauges** light.

Typical Range: ON or OFF

#### A1 EXT BRK ENAB

Definition: Indicates the operational status of the output at the vehicle connector cavity A1 (engine brake enable).

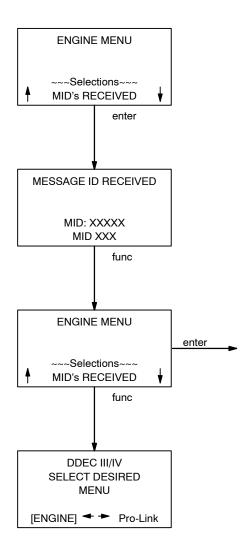
Typical Range: ON or OFF



## Section V. DIAGNOSTIC DATA READER INFORMATION (Cont.)

### F. MID MESSAGES BEING RECEIVED

This menu selection indicates the Message IDentifiers (MIDs) that the DDEC III/IV has acknowledged as received.



## **APPENDIX A**

### **REFERENCES**

### A-1. SCOPE.

Indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to material covered in this publication.

Military Publication Indexes.

### A-2. FORMS.

Refer to DA PAM 738-750, The Army Maintenance Management System (TAMMS), for instructions on the use of maintenance forms pertaining to the vehicle.

### A-3. FIELD MANUALS.

The following publications contain information pertinent to the vehicle material.

Camouflage	. FM 20-3
Manual for Wheel Vehicle Driver	. FM 21-305
Nuclear, Biological, and Chemical Defense	. FM 21-40
Basic Cold Weather Manual	. FM 31-70
Northern Operations	. FM 31-71
Chemical, Biological, and Radiological (CBR) Decontamination	. FM 3-5
Nuclear, Biological, and Chemical (NBC) Reconnaissance and Decontamination	
Operations (How to Fight)	. FM 3-87 (HTF)
Army Motor Transport Units and Operations	. FM 55-30
Operation and Maintenance of Ordnance Materiel in Cold Weather 0°F to -65°F	. FM 9-207

### A-4. TECHNICAL MANUALS.

Painting Instructions	TM 43-0139
General Shop Practice Requirements for Repair, Maintenance, and	
Test of Electronic Equipment	TM 43-0158

## A-4. TECHNICAL MANUALS (CONT).

Procedures for Destruction of Tank Automotive Equipment to Prevent	
Enemy Use (U.S. Army Tank-Automotive Command)	TM 750-244-6
Inspection, Care, and Maintenance of Antifriction Bearings	TM 9-214
Materials Used for Cleaning, Preserving, Abrading, and Cementing	
Ordinance Material and Related Materials Including Chemicals	TM 9-247
Operator/Unit/Direct Support/General Support Maintenance Manual	
for Care, Maintenance, Repair, and Inspection of Pneumatic	
Tires and Inner Tubes	TM 9-2610-200-14
Operator's and Organizational Maintenance Manual Including Repair Parts and	
Special Tools List for Simplified Test Equipment for Internal	
Combustion Engines	TM 9-4910-571-12&P
Maintenance and Repair for Lead-Acid Storage Batteries	TM 9-6140-200-14
Cooling System: Tactical Vehicles	TM 750-254
A-5. MISCELLANEOUS PUBLICATIONS.	
Description, Use, Bonding Techniques, and Properties of Adhesives	TB ORD1032
Safety Inspection and Testing of Lifting Devices	ТВ 43-0142
Operator's Circular for Welding Theory and Application	TC 9-237

# APPENDIX B MAINTENANCE ALLOCATION CHART

### Section I. INTRODUCTION

### THE ARMY MAINTENANCE SYSTEM (AMS)

This introduction provides a general explanation of all maintenance and repair functions authorized at the two maintenance levels under the Two-Level Maintenance System concept.

The MAC (immediately following the introduction) designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column 4 as:

Field - includes two subcolumns, Unit C (operator/crew) and O (unit/organizational

maintenance) and Direct Support (F) maintenance

Sustainment - includes two subcolumns, general support (H) and depot (D).

The tools and test equipment requirements (immediately following the MAC) list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

The remarks (immediately following the tools and test equipment requirements) contain supplemental instructions and explanatory notes for a particular maintenance function.

#### **MAINTENANCE FUNCTIONS**

Maintenance functions are limited to and defined as follows:

- 1. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).
- Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical
  characteristics of an item and comparing those characteristics with prescribed standards on a scheduled
  basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.
- Service. Operations required periodically to keep an item in proper operating condition: e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.
- Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.
- 5. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

### **MAINTENANCE FUNCTIONS - Continued**

- 6. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.
- 7. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.
- 8. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

### NOTE

The following definitions are applicable to the "repair" maintenance function:

Services. Inspect, test, service, adjust, align, calibrate, and/or replace.

Fault location/troubleshooting. The process of investigating and detecting the cause of equipment malfunctioning: the act of isolating a fault within a system or Unit Under Test (UUT).

Disassembly/assembly. The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

Actions. Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

- Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.
- 10. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.
- 11. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

### **EXPLANATION OF COLUMNS IN THE MAC**

**Column 1, Group Number.** Column 1 lists FGC numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

**Column 2, Component/Assembly.** Column 2 contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

**Column 3, Maintenance Function.** Column 3 lists the functions to be performed on the item listed in Column 2. (For a detailed explanation of these functions, refer to "Maintenance Functions" outlined above.)

### **EXPLANATION OF COLUMNS IN THE MAC - Continued**

Column 4, Maintenance Level. Column 4 specifies each level of maintenance authorized to perform each function listed in Column 3, by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

### Field:

C Operator or crew maintenance

O Unit maintenace

F Direct support maintenance

### Sustainment:

H General support maintenance

D Depot maintenance

### NOTE

The "L" maintenance level is not included in Column 4 of the MAC. Functions to this level of maintenance are identified by a work time figure in the "H" column of Column 4, and an associated reference code is used in the REMARKS Column 6. This code is keyed to the remarks and the SRA complete repair application is explained there.

**Column 5, Tools and Equipment Reference Code.** Column 5 specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

**Column 6, Remarks Code.** When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

### **EXPLANATION OF COLUMNS IN THE TOOLS AND TEST EQUIPMENT REQUIPMENTS**

**Column 1, Tool or Test Equipment Reference Code.** The tool or test equipment reference code correlates with a code used in Column 5 of the MAC.

**Column 2, Maintenance Level.** The lowest level of maintenance authorized to use the tool or test equipment.

**Column 3, Nomenclature.** Name or identification of the tool or test equipment.

Column 4, National Stock Number (NSN). The NSN of the tool or test equipment.

Column 5, Tool Number. The manufacturer's part number, model number, or type number.

**Explanation of Columns in the Remarks** 

**Column 1, Remarks Code.** The code recorded in Column 6 of the MAC.

**Column 2, Remarks.** This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

### Section II. MAINTENANCE ALLOCATION CHART

(1) Group	(2) Component/	(3) Maintenance		Maiı	(4) ntenanc	(5) Tools	(6) Remarks		
Number	Assembly	Function		Field		Sustainment		and Equipment	
			U	nit	DS	GS	Depot	Equipment	
			С	0	F	н	D		
01	ENGINE								
0100	Engine Assembly:								
	Engine Assembly	Inspect Test Service Adjust Replace Repair	0.4	1.0	2.0 21.5	44.4	*	23, 31, 148 1, 126 5, 6, 79 5, 6, 7, 205 5, 14, 86, 179	A B D
0101	Crankcase, Block, Cylinder Head:								
	Cylinder Block Assembly	Replace Repair				4.0 3.0		5, 6, 10, 12, 67, 81, 97 117, 133, 166, 187	
	Cylinder Head Assembly (One)	Replace Repair			17.7	3.0		5, 6, 41, 62, 100, 128 5, 6, 10, 29, 64	
	Cylinder Liner	Replace Repair				1.0 2.0		5, 155 5, 6, 10, 28, 67, 68, 87	C
0102	Crankshaft:								
	Crankshaft and Main Bearing	Replace Repair				6.8		5, 6, 144 5, 6, 24, 26	С
	Crankcase Front Cover And Oil Seal	Inspect Replace	0.2		6.5			5, 6, 107	
0103	Flywheel Assembly:								
	Flexplate Assembly	Replace			25.9			5, 6	

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Section II. MAINTENANCE ALLOCATION CHART (continued)

(1) Group	(2) Component/	(3) Maintenance			(4) ntenanc	(5) Tools	(6) Remarks		
Number	Assembly	Function	Field			Susta	inment	and Equipment	
			U	nit	DS	GS	Depot	-4	
			С	0	F	н	D		
0103	Flywheel Assembly - CONT:				-				
	Rear Oil Seal	Inspect Replace	0.2		26.2			5, 6, 53, 81, 102, 163	
0104	Pistons, Connecting Rods:								
	Piston and Connecting Rods	Replace Repair				4.4		5, 6, 155 5, 6, 10, 22, 46, 73, 115	С
0105	Valves, Camshafts and Timing System								
	Rocker Covers	Replace Repair		3.2		*		1, 2, 4 5, 6, 10	С
	Exhaust Valve Bridge	Replace Repair			7.1	*		5, 6 5, 6, 10	С
	Exhaust Bridge Guide	Repair				*		5, 6, 113, 151, 156	С
	Exhaust Valve	Replace Repair				25.6		5, 6, 10, 100 5, 6, 42, 95, 106, 179	С
	Exhaust Valve Guide	Repair				*		5, 100, 157	С
	Valve Seat Insert	Repair				*		5, 116, 153	С
	Camshaft Assembly	Replace Repair				1.5 *		5, 6 5, 6, 10	С
	Cam Follower/ Push Rod	Replace Repair			23.5	*		5, 6 5, 6, 10	С
	Rocker Arm	Replace Repair			5.4	0.5		5 5, 6, 10	
	Idler Gear Assembly	Replace Repair				0.5 0.3		5, 6 5, 6, 10, 130	

(1) Group	(2) Component/	(3) Maintenance		(4) Maintenance Level Field Sustainment				(5) Tools	(6) Remarks
Number	Assembly	Function		Field Init	DS	GS	Depot	and Equipment	
			С	0	F	Н	D	-	
0106	Engine Lubrication System:				-				
	Adapter Assembly Oil Filter	Replace Repair		1.1				1, 2 2, 4	С
	Oil Cooler Assembly Engine	Replace Test			4.9	*		5, 6 5, 6, 10	А
0108	Manifolds:								
	Exhaust Manifold	Inspect Replace		0.3	4.6			5, 6	
0112	Engine Brake:								
	Engine Brake Retarder	Adjust Replace Repair			0.9 4.2	*		5 5, 6 5, 6, 10	С
03	FUEL SYSTEM								
0301	Carburetor, Fuel Injector:								
	Fuel Injector	Adjust Test			0.5 1.5			5 1, 4, 5, 31,	
		Replace			4.9			42, 91, 148 5, 6, 30, 208	
0302	Fuel Pumps:								
	Fuel Pump Assembly	Replace			3.2			5, 6, 20	
	Fuel Pump, Priming	Replace		1.5				1, 2, 30	
0304	Air Cleaner:								
	Air Cleaner Assembly	Replace Repair		1.6 2.8				1, 4 1, 2, 4	
0305	Supercharger, Blower, Turbocharger or Altitude Compensator:								
	Blower Assembly	Replace Repair			12.1	3.0		5, 6, 20 5, 6, 10, 14, 117, 189	
	Blower Drive Assembly	Replace Repair			12.4	1.0		5, 6 5, 6, 10	

(1) Group	(2) Component/	(3) Maintenance			(4) ntenanc			(5) Tools	(6) Remarks
Number	Assembly	Function		Field	l	Sust	ainment	and Equipment	
			U	nit	DS	GS	Depot	Equipment	
			С	0	F	н	D		
0305	Supercharger, Blower, Turbocharger or Altitude Compensator - CONT:								
	Turbocharger Assembly	Inspect Replace Repair	0.1		5.6	2.0		5, 6 5, 6, 10, 61 89, 132	
0306	Tanks, Lines, Fittings, Headers:								
	Fuel Lines and Fittings (each)	Inspect Replace	0.1	0.2				1, 30	
0309	Fuel Filters:								
	Fuel Strainer	Service		0.1				1, 4	
	Fuel/Water Separator	Inspect Service Replace Repair	0.1 0.4	2.0	0.8			1, 2, 30 1, 2, 30 5, 6	
0311	Engine Starting Aids:								
	Ether Starting Aid	Replace		1.0				1	
04	EXHAUST SYSTEM								
0401	Muffler and Pipes:								
	Muffler	Inspect Replace	0.1	1.9				1, 2, 4	
	Pipes	Inspect Replace	0.1	1.5				1	
05	COOLING SYSTEM								
0501	Radiator, Evaporative Cooler or Heat Exchanger:								
	Cooling Assembly	Inspect Test Replace	0.1	0.2 1.9				1, 15, 186 1, 2, 4, 30, 126	
	Radiator	Service Test Replace	0.3	6.6	0.5	0.5		1, 2, 52 186 1, 2, 4, 30, 126	
D 0		Repair				1.0		5, 6, 30	

(1) Group	(2) Component/	(3) Maintenance			(4) ntenanc		(5) Tools	(6) Remarks	
Number	Assembly	Function		Field			tainment	and Equipment	
			U	nit	DS	GS	Depot	<u> </u>  -	
			С	0	F	Н	D		
0503	Water Manifold, Headers, Thermo- Stats and Housing Gaskets:								
	Right Thermostat Housing	Replace			8.4			5, 6, 84, 109	
	Left Thermostat Housing	Replace			2.4			5, 6, 84, 109	
	Cooling System Hoses And Tubes (each)	Inspect Replace	0.1	0.4				1, 4, 30	
	Aftercooler	Inspect Replace			* 13.1			5, 6	А
0504	Water Pump:								
	Water Pump Assembly	Replace Repair			2.0	0.6		5, 6, 30 5, 6, 15, 49 84, 114, 143, 158	
0505	Fan Assembly:								
	Fan	Inspect Adjust Replace	0.1		0.5 1.9			5, 6	
	Fan Control Solenoid Valve	Inspect Test Replace		0.1 0.5 0.5				1 1, 30, 126	
06	ELECTRICAL SYSTEM								
0601	Generator, Alternator:								
	Alternator Assembly	Test Replace Repair		0.3 2.0		3.2		2 1, 2, 65 6, 8, 10	
	Alternator Belts	Inspect Adjust Replace	0.1	0.2 1.2				1, 2, 65 1, 2, 65	

Section II. MAINTENANCE ALLOCATION CHART (continued)

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(1) Group	(2) Component/	(3) Maintenance		Mair	(4) ntenanc	e Leve	I	(5) Tools	(6) Remarks
Number	Assembly	Function		Field			ainment	and Equipment	
			U	nit	DS	GS	Depot	Equipment	
			С	0	F	н	D		
0602	Generator Alternator (Voltage):								
	Voltage Regulator	Adjust Test Replace		0.3 0.5 0.1				1, 4 4 1	А
	Polarity Protection Control (145 AMP)	Adjust Test Replace		0.3 0.5 1.5				1, 4	А
	Polarity Protection Control (200 AMP)	Test Replace		0.5 1.5				4	А
0603	Starting Motor:								
	Starter Motor	Test Replace Repair		0.3 2.6		4.0		4 1, 2, 4 6, 8, 10	
0607	Instrument or Engine Control Panel:								
	Instrument Panel Gages Wire Harness	Replace Repair		2.5				1	C, E
	Instrument Panel Switch Wire Harness	Replace Repair		1.0				1	C, E
0608	Miscellaneous Items:								
	Ether Start Aid Switch	Service Replace		0.4 1.2				1	
	Crane Junction Box	Replace Repair		2.0 1.0				5, 6 5, 6	
	Proximity Switches (LHS) (each)	Replace Adjust Test		0.5 *				1, 2, 71 1, 4	С
	Proximity Switch (Outrigger)	Replace Adjust Test		0.5 * 0.5				1 1, 2	С

(1) Group	(2) Component/	(3) Maintenance	(4) Maintenance Level					(5) Tools	(6) Remarks
Number	Assembly	Function		Field		Sus	tainment	and Equipment	
			υ	Jnit	DS	GS	Depot		
			С	0	F	н	D		
0609	Lights:								
	Head Light Assembly (each)	Inspect Adjust Replace	0.1	0.2 0.2				1 1, 4	
	Lights (each)	Inspect Replace Repair	0.1	0.5				1 1, 4	С
	Work Lamp	Replace Repair		1.0 0.3				1, 4 1, 4	
0610	Sending Units and Warning Switches:								
	Engine Cold Plate/ECM	Inspect Test		0.2				1, 4, 23, 31, 148	
		Replace		2.0				1, 2, 4, 42	
	Warning Buzzer	Inspect Replace	0.1	0.5				1	
	TRS/SRS	Replace Test			3.0			5, 6 1, 4, 23, 31, 32, 148	А
		Adjust			*			88, 194	А
	Engine Throttle Sensor	Test		0.3				1, 4, 23, 31, 32, 148	
		Replace		8.0				1	
	Fuel Temperature	Test		0.4				1, 4, 23, 31,	
	Sensor	Replace		0.4				32, 148 1	
	Engine Water Temperature Sensor	Test Replace		0.3 0.5				1, 4 1	
	Engine Oil Temperature Sensor	Test Replace		0.3 0.5				1, 4 1, 2	
	DDEC Engine Oil Pressure Sensor	Test		0.3				1, 4, 23, 31, 32, 42, 148	
		Replace		0.5				1, 2	
	Manifold Pressure	Test		0.3				1, 4, 23, 31, 32, 148	
		Replace	1	0.5				1, 4	

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(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level Field Sustain					(5) Tools and	(6) Remarks
Number	Assembly	Function		nit	DS	GS		Equipment	
			С	0	F	Н	Depot D	_	
0610	Sending Units and Warning Switches- CONT:		C	0	Г	_ n_	Б		
	Engine Fuel Pressure Sensor	Test Replace		0.3 1.0				1, 4 1	
	Transmission Electronic Control Unit (ECU)	Test Replace		0.5 1.0				1, 4	
	Magnetic Speed Sensor	Test Replace			0.3 0.7			5 5, 6	
	Tachometer Drive Assembly	Test Replace		* 1.1				1	А
	Sending Units (each)	Test Replace		* 0.5				1, 4	А
	EPAC	Test Adjust Replace			* *			5, 6 5 5	A C C
	Differential Pressure Switch	Test Replace		* 0.9				1, 2, 4, 30	А
0611	Horn, Siren:								
	Electric Horn	Replace		0.2				1	
	Horn Relay	Replace		0.4				1	
	Horn Button	Replace		0.1				1	С
0612	Batteries, Storage (Wet or Dry):								
	Batteries	Inspect Test	0.1	0.3				1, 4, 23, 31,	
		Service Replace		0.3 1.0				32, 42, 148 1, 4 1	
	Battery Box Assembly	Inspect Replace Repair	0.1	1.6 1.0				1 1, 2	

(1) Group	(2) Component/	(3) Maintenance			(4) ntenanc		(5) Tools	(6) Remarks	
Number	Assembly	Function		Field nit	DS	GS	ainment	and Equipment	
			С	0	F	Н	Depot D		
0613	Hull or Chassis Wiring Harness		C	0	F	п	D		
	Engine Wiring Harness	Test		*				1, 4, 23, 31,	А
		Replace Repair		*	12.0			32, 42, 148 5 1, 4, 45, 96	F C, E
	DDEC Wiring Harness	Test		*				1, 4, 23, 31, 32, 148	А
		Replace Repair		0.5	0.5			5, 42 1, 4, 42, 43, 44, 56, 57, 183, 184, 185, 197, 198	
	Cab Wiring Harness	Test		*				1, 4, 23, 31, 32, 42, 148	А
		Replace Repair		*	12.0			2, 5 1, 4, 45, 96	F C, E
	STE/ICE Wiring Harness	Test Replace Repair		*	2.0			5 1, 4, 45, 96	A F C, E
	Chassis Wiring Harness	Test Replace Repair		*	4.0			5 1, 4, 45, 96	A F C, E
	Crane Wiring Harness	Replace Repair		*	*			5 1, 4	C C, E
	LHS/Cab Interface Harness	Replace Repair		0.5	0.8			5 1, 4, 45, 96	
07	TRANSMISSION								
0705	Transmission Shifting Components:								
	Transmission Shift Selector	Replace Repair		0.4 0.2				1	
	Electronic Shifter Harness	Replace			*			5, 6	

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Section II. MAINTENANCE ALLOCATION CHART (continued) (1) (2) (4) (5) (6) (3)Group Component/ Maintenance Tools **Maintenance Level** Remarks Number . Assembly **Function** Field Sustainment and Equipment Unit DS GS Depot С 0 F Н D 0710 Transmission Assy: Replace 8.0 5, 6, 121 Flywheel 127 Repair 0.2 5, 6 **Torque Converter** Replace 1.0 5, 10, 86 Stator Repair С **Torque Converter** Replace 0.6 5, 6 Repair 5, 6, 10, 41, G Housing 0.3 73, 82, 83, 99, 108, 127, 152 **Torque Converter** Replace 1.0 5, 6, 142, Pump 164 Repair 0.3 5, 10, 150 G Transmission Inspect 0.1 Assembly Test 0.5 5, 6, 32, Α 85, 148 Service 1.0 1, 2, 4, 126 Replace 3.0 5.6 Repair 27.4 5, 6, 30, 61 В 86, 177 Overhaul D **Output Shaft** Replace 0.2 5 Repair 5, 6 Assembly 0.2 Replace Rear Transmission 0.2 5, 6 Cover Assembly Repair 5, 6, 10, 41, С 83, 99, 104, 111, 137 Transmission Yoke/ 5, 6, 16, 84, Replace 3.0 Dust Shield/Oil Seal 103, 143, 169 0713 Intermediate Clutch: First Clutch Assembly Replace 5 0.1 Repair 5, 6, 10, С 101

0.2

5

5.6

С

Adapter Housing

Replace

Repair

(1) Group	(2) Component/	(3) Maintenance			(4) tenance			(5) Tools	(6) Remarks
Number	Assembly	Function		Field			ainment	and Equipment	
				nit	DS	GS 	Depot		
0713	Intermediate Clutch- CONT:		С	0	F	Н	D		
	Forward Clutch And Input Shaft	Replace Repair				0.1 0.7		5, 6, 10, 192 5, 10, 21, 39, 138	
	Fifth Clutch	Replace Repair				0.1 0.3		5, 6, 123 5, 39	
	Fourth Clutch	Replace Repair				0.6 2.5		5, 6, 39 5, 10, 39	
	Third Clutch	Replace Repair				0.6 2.5		5, 27 5, 105	
	Center Support	Replace Repair				0.1 1.0		5, 6, 27, 123 5, 6, 10, 35, 66, 72, 101, 122	
0714	Servo Unit:								
	Control Valve Assembly	Replace Repair				*		5, 6 5, 6	C C
	Front Plate Assembly	Replace Repair				0.5		5, 6 5	С
	First Shift Valve Body Assembly	Replace Repair				*		5 5, 6, 10	C C
	First Trimmer Valve Body Assembly	Replace Repair				0.1 0.1		5 5, 6, 10	
0721	Coolers, Pumps, Motors:								
	Oil Pump Assembly	Replace Repair				*		5 5, 6	C C
	Low Oil Sensor Assembly	Test Replace			0.1 3.2			5 5, 6	
08	TRANSFER, FINAL DRIVE, PLANETARY AND DROP GEARBOX ASSEMBLIES (ON VEHICLE)								

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Section II. MAINTENANCE ALLOCATION CHART (continued) (2) (4) (5) (6) (1) (3)Group Component/ Maintenance Tools **Maintenance Level** Remarks Number . Assembly **Function** Field and Sustainment Equipment Unit DS GS Depot С 0 F Н D 0801 Power Transfer and Final Drive Assy: 0.1 **Transfer Case** Inspect 1, 2, 126 Assembly Service 0.3 5, 6, 30 С Replace 5, 6, 19 В Repair 8.0 58, 59, 60, С 61, 177 Overhaul D С Yokes Replace 2.8 5, 6 Oil Seats Inspect 0.1 Replace 1.6 5 Upper Shaft Assembly Repair 1.0 5, 6, 10 Center Shaft Assembly Repair 0.5 5, 6, 10, 58 Rear Shaft Assembly Repair 1.0 5, 6, 10 Differential Shaft 1.0 5, 6, 10 Repair Assembly Front Shaft Assembly 5, 6, 10 Repair 1.0 Differential Assembly Repair 0.6 5, 6, 10, 60 0803 Gear Shift, Vacuum Booster and Controls: Air Chamber, Inspect 0.3 Differential Adjust 0.5 1, 2, 4 Replace 1.0 Upper Shift Rod Repair 1.0 5, 6, 10 Assembly Lower Shift Rod Repair 1.0 5, 6, 10 Assembly Shift Control Cable Adjust 0.3 1, 2 Replace 2.5 0804 Lubrication, Cooling,

8.0

0.5

5, 6, 30

5, 6

Or Hyd Components:

Replace

Repair

Lube Pump

(1) Group	(2) Component/	(3) Maintenance			(4) tenance	(5) Tools	(6) Remarks		
Number	Assembly	Function		Field		Sustai	nment	and Equipment	
			U	nit	DS	GS	Dep ot	Equipment	
			С	0	F	н	D		
0804	Lubrication, Cooling Or Hyd Components- CONT:								
	Lube Hoses (each)	Inspect Replace	0.1	0.5				1, 2, 4, 30	
	Breather	Inspect Service Replace	0.1	0.1 0.1				1	
09	PROPELLER, PROPELLER SHAFTS, UNIVERSAL JOINTS, COUPLER ASSEMBLY								
0900	Propeller Shafts:								
	Propeller Shafts and Universal Joints	Inspect Service Replace Repair	0.2	0.1 0.9 0.9				1 1, 2, 4 1, 2, 4	
10	FRONT AXLE								
1000	Front Axle Assembly:								
	Axle No. 1 Assy	Inspect Service Replace Repair	0.1	0.6	15.2	10.0		1, 2 5, 6, 119 5, 176	
	Axle No. 2 Assy	Inspect Service Replace Repair	0.1	0.5	11.0	10.0		1, 2 5, 6, 119 5, 176	
1002	Differential:								
	Axle No. 1	Replace Repair				1.0 5.5		5, 6 5, 6, 10, 13, 19, 177	

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Section II. MAINTENANCE ALLOCATION CHART (continued)

(1) Group	(2) Component/	(3) Maintenance		Mai	(4) ntenanc	e Level		(5) Tools	(6) Remarks
Number	Assembly	Function		Field			ainment	and Equipment	
			U	Unit		GS	Depot		
			С	0	F	н	D		
1002	Differential: (CONT)								
	Axle No. 2 Differential Assembly	Replace Repair				1.5 9.8		5, 6 5, 6, 10, 13, 19, 177	
	Axle No. 2 Rear Output Assembly	Replace Repair				1.0 1.0		5, 6 5	
1003	Planetary or Final Drive:								
	Axles No. 1 and 2 Planetary Hub Gears	Service Replace		*	2.9			2, 5, 58	А
1004	Steering and Leaning Wheel Mechanism:								
	Constant Velocity Joint	Service Replace Repair	0.2		4.5 2.0			5, 6 6, 54, 55	
	Pivot and Spindle Assembly	Inspect Service Replace		0.1	3.0			2, 4 5, 6, 54, 55,	А
		Repair				3.0		69, 191 5, 6, 54, 55, 91	
11	REAR AXLE								
1100	Rear Axle Assembly:								
	Axle No. 3 Assy	Inspect Service Replace	0.1	0.5	8.0			1, 2 5, 6, 119, 201	
	Axle No. 4 Assy	Inspect Service Replace	0.1	0.5	8.0			1, 2 5, 6, 119	
	Axle No. 5 Assy	Inspect Service Replace	0.1	0.5	11.0			1, 2 5, 6, 119	
	Axles No. 3 and 4 Spindle Assembly	Replace Repaire			3.2			5, 6 5, 6, 142	С

(1) Group	(2) Component/	(3) Maintenance			(4) ntenanc		-	(5) Tools	(6) Remarks
Number	Assembly	Function		Field			inment	and Equipment	
				nit	DS	GS	Depot		
			С	0	F	Н	D		
1102	Differential: (CONT)								
	Axle No. 3 Differential Assembly	Replace Repair				1.6 4.9		5, 6 5, 6, 10, 13, 19, 51, 142, 173, 174, 175, 176	
	Axle No. 4 Differential Assembly	Replace Repair				1.6 4.9		5, 6 5, 6, 10, 13, 19, 177	
	Axle No. 5 Differential Assembly	Replace Repair				1.0 5.5		5, 6 5, 6, 10, 13, 19, 177	
1103	Planetary or Final Drive:								
	Axles No. 3, 4 and 5 Planetary Hub Gears	Service Replace		*	2.9			2, 5, 58	А
1104	Steering, Sideshift, and Wheel Leaning Mechanisms								
	Axle No. 5 Constant	Replace			*			5, 6, 54, 55,	С
	Velocity, Pivot & Spindle Assembly	Repair				*		69, 191 5, 6, 10, 165	С
12	BRAKES								
1202	Service Brakes:								
	Brakes	Inspect		0.2				1	
	Brake Assemblies (all)	Replace Repair			1.0 7.5			5, 6 5, 6,	
	Brake Shoes	Inspect Adjust Replace		0.2 0.5 1.0				1, 71 1, 4, 71	
1206	Mechanical Brake System:								
	Pneumatic Brake Valve	Replace Repair		3.0		1.5		1 1, 6, 135	

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(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level Field Sustainme					(5) Tools and	(6) Remarks
Number	Assembly	Function	U	nit	DS	GS	Depot	Equipment	
			С	0	F	Н	D		
1208	Air Brake System:				•				
	Air Dryer	Inspect Service Replace Repair	0.1	0.6 3.0 1.0				1 1, 2 1, 2, 4	
	Coalescing Filter/ Aftercooler	Inspect Replace Repair		0.1 0.7 0.1				1, 2 1, 4	
1209	Air Compressor Assembly:								
	Air Compressor	Inspect Replace Repair	0.2		3.2	4.0		5, 6, 30 5, 6, 10, 36, 117	
	Air Governor Assembly	Adjust Replace		0.2 1.5				1 1, 30	
	Air Lines	Replace Repair		*				1, 30 1, 4	C
1211	Trailer Brake Connections And Controls:								
	Load Sensing Valve	Adjust Replace		1.0 2.0				1, 135 1, 4	
13	WHEELS AND TRACKS								
1311	Wheel Assembly:								
	Wheel Assembly	Inspect Replace Repair	0.1 0.2	1.0				1, 4, 74	
	Wheel Hub Assembly	Inspect Service Replace Repair		0.2 0.1	3.4 2.1			1, 4 5, 6, 169 5, 6, 50, 51, 81, 139	
	Brake Drums (all axles)	Inspect Replace Repair		0.2 1.2		*		5, 6 1, 4	С

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level Field Sustainment				nmont	(5) Tools and	(6) Remarks
Number	Assembly	runction	U	nit	DS	GS	Dep	Equipment	
			С	0	F	н	D		
1311	Wheel Assembly - CONT:								
	Central Tire Inflation System (CTIS)	Inspect	0.2						
	CTIS Controller	Replace Repair		0.2 0.1				1	
	CTIS Front Manifold	Replace Repair Test		0.7 0.7 2.0				1, 4, 30, 206 1 1	
	CTIS Rear Manifold	Replace Repair		0.3 0.7				1, 4, 30, 206 1	
1313	Tires, Tubes, Tire Chains:								
	Tire	Inspect Replace Repair	0.1	*				1	C
14	STEERING								
1400	Steering System	Inspect Service Adjust	0.2	0.6	3.5			1, 2 1, 2, 4 5, 136	А
1401	Mechanical Steering Gear Assembly:								
	Steering Column	Inspect Service Replace	0.2	* 2.2				1, 2	А
	Drag Links	Inspect Service Replace Repair		0.1	* *			5, 6 5, 6, 10	A C C
	Intergear Link	Inspect Service Replace Repair		0.1	*			5, 6 5, 6, 10	A C C
	Steering Shafts	Inspect Service Replace		0.2 * 1.5				1, 2	А

Section II. MAINTENANCE ALLOCATION CHART (continued)

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(1) Group	(2) Component/	(3) Maintenance	(4) Maintenance Level Field Sustainment					(5) Tools	(6) Remark
Number	Assembly	Function		Field			ainment	and Equipment	S
			U	nit	DS	GS	Depot	-	
			С	0	F	Н	D		
1401	Mechanical Steering Gear Assembly - CONT:								
	Tie-Rod	Inspect Service Adjust Replace Repair		0.1 * 2.5 1.3 2.2				1, 2 1, 2, 4, 119 1, 2, 4	А
	90 Degree Gear Box	Replace Repair		1.0	3.2			1, 2 5, 6, 10	
	2.21:1 Gear Reducer	Service Replace Repair		*	0.5	0.1		5, 6 5, 6, 10, 143	A
	Axle No. 1	Align			4.0			5, 6, 26 134	
	Axle No. 2	Align			4.0			5, 6, 26, 134	
	Axle No. 5	Align			1.0			5, 6, 26, 134	
1407	Power Steering Gear Assembly:								
	Front Steering Gear Assembly	Inspect Service Adjust Replace Repair		0.1	0.5 1.3	2.1		5 5, 6, 30, 196 5, 6, 10, 143, 196	А
	Intermediate Steering	Inspect Service Replace Repair		0.1	1.0	0.7		5, 6, 30, 196 5, 6, 10 143, 196	А
	Rear Steering	Inspect Service Adjust Replace Repair		0.1 *	0.5 1.0	2.2		5 5, 6, 30, 196 5, 6, 10 143, 196	А

(1) Group	(2) Component/	(3) Maintenance	(4) Maintenance Level Field Sustainment					(5) Tools	(6) Remarks
Number	Assembly	Function		Field		Susta	inment	and Equipment	
			U	Init	DS	GS	Dep ot		
			С	0	F	н	D		
1410	Hydraulic Pump or Fluid Motor Assembly:								
	Emergency Steering Hydraulic Pump	Adjust Replace		1.0 2.0				1	
	Emergency Steering Hydraulic Valve	Adjust Replace			1.0 1.5			5 5, 6, 205	
1411	Hoses, Lines, and Fittings:								
	Hydraulic Lines And Fittings	Replace		*				1, 30	С
1413	Tanks, Reservoirs:								
	Steering Reservoir	Inspect Service Replace	0.1	* 1.2				1, 2, 4, 30,	А
		Repair		1.3				126, 205 1, 2, 4, 205	
	Steering Hydraulic Filter	Service Replace		* 0.2				1, 2, 4	А
	Steering Hydraulic Manifold	Replace Repair			1.3 0.3			5, 6, 30 5, 6	
15	FRAME, TOWING ATTACHMENTS, DRAWBARS, AND ARTICULATION SYSTEMS								
1501	Frame Assembly:								
	Cab Step Assembly	Replace Repair		0.5 0.2				1	
	Frame Assembly	Inspect Repair	0.1					5, 6, 9, 205	
1503	Pintles and Towing Attachments:								
	Self-Guided Coupler	Inspect Service Replace Repair	0.1	0.1 1.0 1.5				1 1, 2, 4 1, 2, 4, 6	

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(1) Group	(2) Component/	(3) Maintenance	(4) Maintenance Level Field Sustainmen					(5) Tools	(6) Remark
Number	Assembly	Function		Field		Susta	inment	and Equipment	S
			U	Init	DS	GS	Depot		
			С	0	F	Н	D		
1504	Spare Wheel Carrier And Tire Lock:								
	Tire Carrier and Davit	Inspect Service Replace	0.1	* 2.3				1	А
16	SPRINGS AND SHOCKS ABSORBERS								
1601	Springs:								
	Spring Hangers	Inspect Service Replace	0.1	*	*			5	A C
	Springs	Inspect Replace	0.1		*			5, 6, 118	С
	No. 3 Axle Suspension Air Bags	Inspect Replace	0.1		1.0			5, 6	
1604	Shock Absorber Equipment:								
	Shock Absorber and Bushings (each)	Inspect Replace		0.1 0.3				1, 2	
1605	Torque, Radius, and Stabilizer Rods:								
	Equalizer Beam (each)	Replace Repair			2.2 2.0			5, 6, 118 5, 93, 190	
	No. 3 Axle Air Suspension Beam Assembly	Replace Repair			3.0 1.5			5, 6 5	
	No. 3 Axle Suspension Arm	Inspect Replace Repair	0.1		* 3.0			5, 6 5, 6 35, 202	С
	Torque Rods (each)	Inspect Replace		0.1	1.3			5, 6, 119	

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level Field Sustainment				(5) Tools and	(6) Remarks	
Number	Assembly	Tunction	u	Init	DS	GS	Dep	Equipment	
			С	0	F	Н	D		
18	BODY, CAB, HOOD AND HULL								
1801	Body, Cab, Hood, and Hull Assemblies:								
	Cab Assembly	Inspect Service Replace	0.2 0.1		7.5			5, 6	
	Cab Door	Adjust Replace Repair		0.3 1.5 2.5				1 1 1, 4	
	Engine Cover Assembly	Replace Repair		0.1 0.4				1	
1802	Fenders, Running Boards with Mount- Ing and Attaching Parts, Windshield, Glass, Etc.:								
	Windshield Glass	Inspect Replace	0.1		1.4			5	
1806	Upholstery Seats and Carpets:								
	Seat Assembly	Replace Repair Alignment		0.6 1.5 0.4				1, 4 1, 4 1, 4	
	Sun Visor Assembly	Inspect Replace		0.1 0.3				1	
1808	Stowage Racks, Boxes, Straps, Carrying Cases, Cable Reels, Hose Reels:								
	Ladder Support	Replace Repair		0.5				1, 2 1, 2	
	Stowage Box, Crane	Replace Repair		0.5 0.4				1, 4 1, 2, 4	

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(1) Group	(2) Component/	(3) Maintenance	(4) Maintenance Level Field Sustainment					(5) Tools	(6) Remark
Number	Assembly	Function		Field			inment	and Equipment	s
			U	nit	DS	GS	Depot	-	
			С	0	F	Н	D		
20	HOIST, WINCH, CAPSTAN, WINDLASS, POWER CONTROL UNIT, AND POWER TAKE-OFF								
2001	Hoist, Capstan, Windlass, Crane or Winch Assembly:								
	Crane Assembly	Inspect Service Test Adjust Replace	0.1	0.5	* 0.5 4.0			1 1, 5, 158 5, 6 5, 6, 30, 201	А
	Boom Assembly	Replace Repair			2.0 4.8			5, 6, 30 5, 6	
	Erection Cylinder	Replace Repair			0.6	1.5		5, 6, 30 5, 6	
	Lift Cylinder Assembly	Replace Repair			0.7	0.9		5, 6, 30 5, 6, 196	
	Tension Link Assembly	Replace Repair			0.2	0.5		5, 6 5, 6	
	Mast Assembly	Replace Repair			0.6	*		5, 6, 30 5, 6	С
	Telescope Cylinder	Replace Repair			0.7	0.8		5, 6, 30 5, 6	
	Hoist Assembly	Inspect Service Replace Repair	0.1	0.3	1.4	1.6		1 5, 6 5, 6, 10	
	Hydraulic Hoist Motor	Replace Repair			0.2	1.0		5, 6, 30 5, 6	
	Remote Control Box	Replace Repair		0.3 1.0				1 1, 2, 4, 202	

(1) Group	(2) Component/	(3) Maintenance	(4) Maintenance Level					(5) Tools	(6) Remarks
Number	Assembly	Function		Field	1	Susta	inment	and	
			U	Init	DS	GS	Dep ot	Equipment	
			С	0	F	Н	D		
2001	Hoist, Capstan, Windlass Crane Or Winch Assembly - CONT:								
	Crane Cable	Inspect Service Replace		* * 1.0				1, 4	A A
	Motor Valve Assembly	Replace Repair			0.1 0.4			5, 6, 30 5, 6	
	Hoist Brake Assembly	Replace Repair			0.4	1.4		5, 6, 30 5, 6	
	Cable Follower Assembly	Replace Repair			0.7 0.6			5, 6, 30 5, 6	
	Sub-Frame Assembly	Replace Repair			1.7	7.0		5. 6 5, 6	
	Swing Drive Brake	Replace Repair			2.0	1.0		5, 6 5, 6	
	Gear Reducer	Replace Repair			1.7	1.2		5, 6, 30, 172 5, 6, 175	
	Override Solenoid	Replace Repair Test			1.3 2.1 0.5			5, 6, 30 5, 6 6	
	Hook Block Assembly	Replace Repair		0.5 0.5				1, 2 1, 2, 4, 132	
	Hoist Motor	Replace Repair			0.5 0.1			5, 6, 30, 201 5, 6	
	Hand Pump	Replace Repair		1.5 0.5				1, 2, 30 1, 2, 4	
	Accumulator	Service Replace		0.2	*			1, 33 1	А
	Remote Control Box Cable Assembly	Replace Repair Test		0.3 0.2 0.5				1 1 2	

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(1) Group	(2) Component/	(3) Maintenance	(4) Maintenance Level Field Sustainment					(5) Tools	(6) Remark
Number	Assembly	Function			DC			and Equipment	S
			С	Init O	DS F	GS H	Depot D	-	
2001	Hoist, Capstan, Windlass, Crane or Winch Assembly: CONT:				-				
	Self-Recovery Winch Assembly	Inspect Service Replace	0.1	0.3 4.5				1, 2, 4, 30,	
		Repair				*		201 5, 6, 10	С
	Counter Balance Valve	Replace Repair			0.9 0.9			5, 6, 30 5, 6, 10	
	Winch Brake	Replace Repair				1.0		4, 5 5, 6, 10	
	Front Tensioner Assembly	Service Replace Repair		* 1.0 0.4				1 1, 2, 4	А
	Front Cable Guide	Service Replace		* 0.1				1, 4	А
	Rear Tensioner	Service Replace Repair		* 1.0 0.4				1, 4 1, 2, 4	А
	Rear Cable Guide	Service Replace		* 1.0				1	А
	Winch Cable	Inspect Service Replace	*	* 0.8				1, 4	A A
	Hook Machining Arm	Replace Repair			1.8			5, 6, 207 5, 6	С
	Middle Mach Frame	Replace Repair			6.8 *			5, 6, 30, 204 5	С
2006	Bulldozer Tripod, Main Frame, Jack And Mounting:								
	Outrigger Cylinder	Replace Repair			1.0	4.1		5, 6, 30 5, 6	
	Outrigger Pad Assembly	Replace Repair		0.2 0.2				1, 2, 4	

(1) Group	(2) Component/	(3) Maintenance	(4) Maintenance Level Field Sustainment					(5) Tools	(6) Remarks
Number	Assembly	Function		Field		Susta	inment	and Equipment	
			U	nit	DS	GS	Dep ot	Equipment	
			С	0	F	н	D		
22	BODY, CHASSIS, AND HULL ACCESSORY ITEMS								
2202	Accessory Items:								
	Heater	Replace Repair		1.3 3.2				1, 30 1	
	Heater Blower Motor	Replace Repair		1.0				1 1, 4	С
	Heater Control Panel	Replace Repair		0.8				1	С
2210	Data Plates and Instruction Holders:								
	Data Plate (each)	Replace		0.2				1, 2	
24	HYDRAULIC AND FLUID SYSTEMS								
2400	Major Assemblage (Load Handling System):								
	Load Handling System	Inspect Service Test Replace Repair	0.1	*	0.6 2.0 2.0			5, 6 5, 6, 30, 201	А
2401	Hydraulic Pump:								
	Main Hydraulic Pump Assembly	Inspect Replace Repair		0.2	12 19.3			5, 6, 30, 146 5, 6, 10, 199	
	Pump Driveshaft	Inspect Service Replace Repair		* * 1.0 0.5				1, 2 1, 2, 4	A C

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(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function		Mair Field	(4) ntenanc	inmont	(5) Tools and	(6) Remark s	
Number	Assembly	Function		nit	DS	GS	Depot	Equipment	5
			С	0	F	Н	D		
2402	Manifold and/or Control Valves:								
	LHS Load Sensing Valve	Replace Test		* 0.5				1, 2	С
	Multifunction Manifold	Replace Repair			3.0			5, 6 5, 6	С
2405	Mast Column:								
	LHS Hook Arm Cylinder	Service Replace		*	1.4			5, 6, 131, 210	А
		Repair			2.5			5, 6, 23, 196	
2406	Strainers, Filters, Lines and Fittings, Etc.:								
	LHS Main Manifold Relief Valve	Adjust Replace Test			0.5 1.0 0.5			6 5, 6 6	
	LHS Main Cylinder	Replace Repair			1.1 2.5			5 5, 6, 23, 196	
	Hose Assembly, Low Pressure	Replace Repair		1.0				1, 30, 126	С
	High Pressure Hydraulic Filter Head	Replace Repair		2.0				1, 4	С
	LHS Hook Arm Manifold Assembly	Replace Repair			1.6 1.6			1, 201, 205	
	LHS Main Manifold	Replace Repair			0.6 0.6			5, 6, 30 5	
2408	Liquid Tanks or Reservoirs:								
	Hydraulic Reservoir Assembly	Service		0.5				1, 2, 4, 52 126	
		Replace		5.9				1, 2, 4, 201 205, 207	
		Repair		0.5				1	

(1) Group	(2) Component/	(3) Maintenance	nance Maintenance Level		(5) Tools	(6) Remarks			
Number	Assembly	Function		Field		Susta	inment	and Equipment	
			U	Init	DS	GS	Dep ot	Equipment	
			С	0	F	н	D		
33	SPECIAL PURPOSE KITS								
3303	Winterization Kits:								
	Engine Arctic Kits	Inspect Install Replace Repair	0.1	4.5	*			5, 6 1 1, 2, 4	C C
3307	Special Purpose Kits:								
	EMM Power Interface Kit	Replace Repair Install							
	CHU Control Box	Repair		*				1	С
	CHU Proximity Switch And Sensing Plate (Hook Arm Up)	Adjust Replace		*				1, 71	A C
	CHU Mode Switch	Adjust Replace		*				1	A C
	CHU Rear Lock Limit Switch	Adjust Replace		*				1	A C
	CHU Light Bar and Brackets Assembly	Repair		*				1	С
	CHU Container Guide	Repair		*				1	С
	CHU Slider/Pivot Assembly	Repair		*		*		1, 132	С
	CHU Short Strut and Pin Bracket Assembly	Repair		*				1, 132	С
	CHU Slider Arm Assembly	Repair		*		*		1, 132	С
	CHU Long Strut Bracket Assembly	Repair		*				1, 132	С
	CHU Lifting Frame Lower Container Lock Plate	Repair		*				1	С
	CHU Lifting Frame Flipper Bracket and Lock Plate	Repair		*				1	С

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(1) Group	(2) Component/	(3) Maintenance			(4) ntenance			(5) Tools	(6) Remark
Number	Assembly	Function		Field			inment	and Equipment	S
			U	nit	DS	GS	Depot		
			С	0	F	Н	D		
3307	Special Purpose Kits - CONT:								
	CHU Air Cylinder and Rotary Paddle	Adjust Replace		*				1, 132	A C
	CHU Pivot	Repair		*				1	С
	CHU Lifting Frame Lower Container Lock Handle	Repair		*				1	С
	CHU Rail Transport ISO Corner Locks	Repair		*				1	С
34	ARMAMENT AND SIGHTING AND FIRE CONTROL (ELECTRIC/ ELECTRONIC MATERIAL)								
3402	Small Arms:								
	Machine Gun Mounting Kit	Inspect Replace	0.1	1.0				1, 2	
47	GAGES (NON- ELECTRICAL) WEIGHING AND MEASURING DEVICES								
4702	Gages, Mounting, Lines, and Fittings:								
	Restrictor Indicator Assembly	Inspect Replace	0.1	0.5				1	
68	RADIO TELEPHONE SYSTEMS								
6809	Radio Telephone System:								
	Radio Kit	Replace Install		1.0	*			1, 2 5	С

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function		(4) Maintenance Level Field Sustainment		(5) Tools and	(6) Remarks		
			U	Init	DS	GS	Dep ot	Equipment	
			С	0	F	н	D		
91	CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL (CBR) EQUIPMENT								
9111	Gas Particulate Filter Kits:								
	Gas Particulate Filter Unit Kit	Inspect Install Replace	0.2	2.2	2.0			5 1	
9131	Chemical Agent Alarms:								
	Chemical Alarm Kit	Inspect Install Replace	0.2	1.8	2.3			5, 6 1	
	Decontamination Kit	Inspect Install Replace	0.2	0.5	1.0			5 1, 2	

### Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

Table B-1. Tool and Test Equipment Requirements

		The rest Equipment Requi	T	
Tool or Test Equipment	Maintenance	No was a statum	National/ NATO	Tool
Ref Code	Category	Nomenclature	Stock Number	Number
1	0	TOOL KIT, General Mechanic's: Automotive	5180-00-177-7033	SC 5180-90-N26
2	0	SHOP EQUIPMENT, Automotive Maint and Repair: Common No. 1	4910-00-754-0654	SC 4910-95-A74
3	О	SHOP EQUIPMENT, Automotive Maintenance and Repair: Supp. 1	4910-00-754-0653	SC 4910-95-A73
4	0	SHOP EQUIPMENT, Automotive Maint and Repair: Common No. 2	4910-00-754-0650	SC 4910-95- A72-HR
5	F	TOOL KIT, General Mechanic's	5180-00-699-5273	SC 5180-90- N05-HR
6	F	SHOP EQUIPMENT, Automotive Maintenance and Repair: Field Maintenance, Basic	4910-00-754-0705	SC 4910-95-A31
7	F	SHOP EQUIPMENT, Automotive Maintenance and Repair: Field Maintenance	4910-00-754-0706	SC 4910-95-A62
8	F	SHOP EQUIPMENT, Fuel and Electrical System, Engine: Field Maintenance, Basic	4940-00-754-0714	SC 4940-95-
		,		B20-HR
9	F	SHOP WELDING SET	3433-00-357-6311	SC 3433-90- N01-HR
10	Н	SHOP EQUIPMENT, Automotive Maintenance and Repair: Field Maintenance, Supp. 2	4910-00-754-0707	SC 4910-95-A63
11	F	SHOP EQUIPMENT, Machine Shop	3470-00-754-0708	SC 3470-95-A02
12	Н	•	4910-00-146-9624	J33850
		ADAPTER, Engine Stand	4310-00-140-3024	133030
13	Н	ADAPTER, Maintenance Stand, Differential	4910-01-384-6264	J-39929-A
14	F	ADAPTER, Mechanical Puller	5120-00-733-8890	J7932
15	F	ADAPTER, Quick Disconnect	5935-01-297-2481	J33765
16	0	ADAPTER, Radiator	4910-01-170-4929	J29003-A
17	F	ADAPTER, Socket (3/4 in. Female to 1/2 in. Male)	5120-00-227-8088	97-3725
18	F	ADAPTER, Socket (3/4 in. Female to 1 in. Male)	5120-00-227-8104	A-A-2172
19	Н	ADAPTER KIT, Transfer Case	4910-01-385-6779	J-39911
20	F	ALIGNMENT TOOL, Blower	5120-01-158-3991	J33001

Table B-1. Tool and Test Equipment Requirements (Cont).

Tool or Test Equipment Ref Code	Maintenance Category	Nomenclature	National/ NATO Stock Number	Tool Number
21	Н	ALIGNMENT TOOL, Clutch	5120-01-115-1156	J24221
22	Н	ALIGNMENT TOOL, Pin	5120-01-232-0007	J24285
23	О	ANALYZER SET, STE/ICE-R	1910-01-222-6589	12259266
24	Н	ATTMENT, BALL, MICRO	5120-00-221-1921	J4757
25	Н	BRACKET, Lifting	5306-01-338-6292	J24408-A
26	F	BOX, Chalk, Reel and Line	5210-00-273-9793	GGG-C-291
27	Н	BRACKET, Lifting	5120-01-115-1157	J24196
28	Н	BRACKET, Mounting, Cylinder Liner	5340-01-158-3984	J24565-02
29	Н	BRUSH, Wire, Valve Cylinder	5120-00-766-2141	J5437
30	0	CAP AND PLUG SET	5340-00-450-5718	10935405
31	0	CARTRIDGE, DDEC	7030-01-354-6174	J38500-750
32	0	CARTRIDGE, ATEC	4940-01-367-6194	J38500-300
33	F	CHARGING KIT, Pressure	4910-01-046-7109	12252157
34	F	COMPRESSOR, Air Unit	4130-00-752-9633	MIL-C-13874
35	Н	COMPRESSOR SET, Snap Ring	5120-01-116-5016	J24208-D
36	Н	COMPRESSOR, Ring	5120-01-048-3129	J24204-1
37	Н	COMPRESSOR, Ring	4910-01-158-3974	J24227
38	F	COMPRESSOR, Ring, Piston	5120-00-250-6055	RC40C
39	Н	COMPRESSOR, Seal	5120-01-048-2159	J24204-3
40	F	COMPRESSOR, Spring Valve	5120-01-297-2397	J7455-A
41	Н	COMPRESSOR, Spring	5120-01-048-2160	J24219
42	О	CONNECTOR REMOVER	5120-01-355-3012	J38384
43	0	CONNECTOR REMOVER Electrical Contact	5120-01-158-4707	114010
44	0	CRIMPING TOOL	5120-01-355-0844	J35123
45	0	CRIMPING TOOL (CANNON)		995-0001-904
46	Н	DETECTOR, Leak, Vacuum Gage	6685-01-061-4253	J23987-B
47	F	DRILL MACHINE, Upright	3413-00-165-4117	MIL-D-80038
48	F	DRIVER	5120-01-374-6200	2HE496
49	Н	DRIVER BEARING, Gear	5120-01-033-8902	J25257
50	F	DRIVER, CTIS Seal	5120-01-355-0857	J41112
51	F	DRIVER, CTIS Seal	5120-01-355-0858	J41113
52	О	DRUM, Storage 57 gal	8110-00-082-2626	MIL-D-6054
53	F	EXPANDER, Seal, Oil	5120-00-336-0445	J4239
54	F	EXTRACTOR, Inertial		2HE226

Table B-1. Tool and Test Equipment Requirements (Cont).

Tool or Test		. Tool and Test Equipment Hequirer		
Equipment Ref Code	Maintenance Category	Nomenclature	National/ NATO Stock Number	Tool Number
55	F	EXTRACTOR, Inertial	5120-01-354-9543	2HE227
56	О	EXTRACTOR TOOL, Elect	5120-01-015-2154	91019-3
57	О	EXTRACTOR TOOL, Elect	5120-00-020-5926	305183R
58	F	EYES, Lifting	5306-01-197-6569	3016Т39
59	F	EYES, Lifting	5306-01-333-5486	8891T82
60	F	EYES, Lifting	5306-01-239-5053	3016T65
60.1	О	FAULT CODE RETRIEVAL DEVICE (FCRD)		CA1 05 020
61	Н	FIXTURE, Holding	5120-01-115-1165	J24310
62	F	FIXTURE, Lifting, Cylinder Head	4910-00-456-7620	J22062-01
63	Н	FIXTURE, PTO, Gear	4910-01-158-3969	J26899
64	Н	FIXTURE, Test, Head	4910-01-158-3985	J28454
65	О	GAGE, Belt Tension	4935-01-254-9808	BT-33-73-BF
66	Н	GAGE, Center and Front	5210-01-133-6888	J29198-3
67	Н	GAGE, Cylinder, Bore	5210-01-070-4543	Ј5347-В
68	Н	GAGE, Depth Cylinder, Liner	5210-01-174-4498	J24898
69	F	GAGE, Depth	5210-00-023-4798	J22273-01
70	F	GAGE, Dial	5120-00-494-1846	J-8165-2
71	О	GAGE, Feeler, Jacobs Brake	5210-01-214-2138	007958
72	F	GAGE, Feeler	5120-00-671-2275	J3174-02
73	Н	GAGE, Groove	5220-01-028-1109	J24599
74	О	GAGE, Inflation	4910-00-204-2644	100708
75	F	GAGE Set, Feeler	5210-01-119-7601	FB310B
76	F	GAGE Set, Feeler	5210-01-245-9564	J1698-02
77	F	GAGE Set, Feeler, Piston	5210-00-416-1631	J5438-01
78	F	GAGE, Timing, Injector	5220-01-348-1638	J25502
79	F	GAGE, Valve, Adjustable	5220-00-176-0638	J9708-15
80	F	HAMMER, Slide	5120-01-112-2165	J6125-16
81	F	HANDLE, Driver	5120-00-677-2259	J8092
82	Н	HANDLE, Driver	5120-00-808-5082	J3154-1
83	Н	HANDLE, Driver	5120-01-054-4048	J24202-4
84	О	HANDLE, Installer	5120-00-977-5578	J7079-2
85	О	HARNESS, Breakout	6150-01-373-7771	J34517
86	F	HOLDER, Stator, Roller	5120-01-115-1158	J24218-2
87	Н	HONING UNIT	5130-00-629-9782	J5902-01
88	F	INDICATOR, Dial, Timing Tool	2815-01-355-6628	J34930-A

Table B-1. Tool and Test Equipment Requirements (Cont).

Tool or Test Equipment Ref Code	Maintenance Category	Nomenclature	National/ NATO Stock Number	Tool Number
89	F	INDICATOR, Dial	5120-00-402-9619	J7872
90	H	INDICATOR, Dial, Set	5120-00-794-9178	J5959-01
91	F	RECONDITIONING SET Injector, Tube	5180-00-146-9619	J22525-B
92	F	INSERTER AND REMOVER	5120-01-166-0572	J33080
93	Н	INSERTER, Bearing and Bushing	5120-01-158-3946	J25562
94	Н	INSERTER, PLUG, Cylinder Block	5120-01-166-5419	J21850
95	Н	INSERTER, SEAL	5120-01-340-1820	J35373
96	О	INSERTION TOOL (CANNON)	5120-01-374-8968	CIT-SS-10
97	Н	INSTALLER AND REMOVER	5120-01-048-2180	J25275
98	Н	INSTALLATION TOOL, Cup Plug	5120-01-297-2457	J33420
99	Н	INSTALLER, Bearing	5120-01-115-1160	J24197
100	F	INSTALLER, Guide, Valve	5120-00-999-8617	J21520
101	Н	INSTALLER, Lock Ring	5120-01-054-4050	J24453
102	F	INSTALLER, Oil Seal	5120-01-227-8483	J21983
103	Н	INSTALLER, Output Shaft	5120-01-054-4042	J24202-1A
104	Н	INSTALLER, Plug	5120-01-385-7288	J24411
105	Н	INSTALLER, Plug	5120-01-054-4053	J24369
106	F	INSTALLER, Seal	5120-01-054-4049	J24198
107	F	INSTALLER, Seal, Crankshaft, Front	5120-00-936-4377	J9783
108	F	INSTALLER, Seal	5120-01-013-1678	J9791
109	0	INSTALLER, Seal	5120-00-977-5579	J8550
110	F	INSTALLER, Seal, Flywheel	4910-01-176-4230	J21112-B
111	Н	INSTALLER, Seal, Oil	5120-00-937-7267	J8501
112	Н	INSTALLER, Seal, Transfer Case	5120-01-383-7878	TRS6227
113	Н	INSTALLER, Valve Bridge	5120-00-999-8616	J7482
114	Н	INSTALLER, Water Pump Seal	5120-01-365-4079	J-38858
115	Н	INSTALLING TOOL, Piston	5120-00-127-7757	J23762-A
116	Н	INSTALLING TOOL, Valve	5120-01-048-3118	J24357
117	Н	INSTALLING/REMOVING Tool	5120-01-130-8864	J23019
118	F	JACK, Stabilizer	2590-00-23-7418	10876244
119	О	JACK KIT, Hydraulic, Hand	5120-00-587-4144	GGG-J-60
120	F	LEVEL	4920-00-064-8974	2579573-002
121	F	LIFTING BRACKET, Flywheel	5120-01-116-6049	J24365

Table B-1. Tool and Test Equipment Requirements (Cont).

Tool or Test Equipment Ref Code	Maintenance Category	Nomenclature	National/ NATO Stock Number	Tool Number
122	Н	LIFTING Bracket, Center	5120-01-116-6048	J24195
122	н Н	LIFTING Biacket, Center LIFTING Fixture, Clutch	5120-01-115-0048	J24195 J24209
123	H	MAG INS. UNIT, Stat	6635-00-566-9772	MIL-M-6867C
	F			
125		OIL, Seal, Expander	5120-01-232-0005	J8682
126	0	PAN, DRAIN 6 Gal	4910-00-287-2944	MIL-P-45819
127	F	PIN, Guide Set	5120-01-115-1163	J24315
128	F	STUDS, Guide	5315-01-162-3630	J24748
129	Н	PIN, GUIDE	5315-01-165-1469	J1126
130	Н	PLATE KIT, Gear Bearing	5180-01-167-4285	2SK900
131	F	PLIERS, Channel Lock	5120-00-287-2512	GGG-W-649
132	0	PLIERS, Retaining Ring	5120-01-375-5699	2BH945
133	F _	PLUG, Cylinder Block	5120-01-166-5421	J24597
134	F	PLUMB BOB	5210-00-007-8229	GGG-P-501
135	0	PRESSURE TEST KIT	4910-01-378-9068	3SK911
136	F	PRESSURE TEST KIT	4910-01-378-8863	3SK912
137	Н	PROTECTOR, Piston	5120-01-048-2156	J24210
138	Н	PROTECTOR, Seal	5120-01-048-2157	J24216-01
139	F	PROTECTOR, Spindle	3830-01-349-7390	2HE234
140	F	PROTRACTOR, Magnetic	5210-01-415-0075	2150A251
141	F	PROTRACTOR, Square	5210-00-273-1937	05-12INCH
142	F	PULLER, Bolts	5120-01-185-6811	J26901-A
143	Н	PULLER, Mech	5120-00-219-8397	J1902-B
144	F	PULLEY REMOVER	5120-00-944-0363	J5356
145	F	PUMP, FORCE	4130-01-192-0496	466-46485
146	0	PULLEY KIT, Pump, Roof Mount	5120-01-375-5700	2HP645
147	F	PUNCH, DRIFT	5120-00-004-4921	PWA14920
148	0	READER, Diagnostic (DDEC)	4910-01-343-3508	J38500-1
149	Н	REMOVER, Bearing, Front Support	5120-01-117-2523	J28557
150	Н	REMOVER, Snap Ring	4910-01-158-3996	J26598-A
151	Н	REMOVER, Valve Bridge	5120-00-999-8615	J7453
152	Н	REMOVER, Valve Pin	5120-01-048-3128	J-24412-2
153	Н	REMOVER, Valve Seat	5120-01-165-1935	J23479-E
154	F	REMOVER AND INSTALLER, Piston Ring	5120-00-494-1846	7950177

Table B-1. Tool and Test Equipment Requirements (Cont).

Tool or Test			National/	
Equipment	Maintenance		NATO	Tool
Ref Code	Category	Nomenclature	Stock Number	Number
155	F	REMOVER ASSEMBLY	4910-01-158-3982	J24563-A
156	Н	REMOVER SET, Valve Bridge	5120-00-999-8614	J7091-01
157	Н	REMOVER, Guide Valve	5120-00-733-8880	J6569
158	Н	REMOVER, Seal, Waterpump	4910-01-158-3979	J22150-B
159	Н	COLLECTOR RING, Installer/Stalking SET	5120-01-048-3126	J24200
160	F	RIVET GUN	5130-00-982-8078	352
161	F	RULE, STEEL, Machinist	5120-00-204-1283	GGG-R-791
162	F	SCALE, TENSION	4910-00-779-6832	J-8129
163	F	SCREW, Guide	5120-01-144-4483	J1927-01
164	Н	SLEEVE, Puller	4910-01-162-3633	J25007-4
165	Н	SOCKET, 1-11/16 in.	5120-01-024-0168	GGG-W-641
166	Н	SOCKET WRENCH Attachment, Screwdriver	5120-01-297-2374	J34650
167	Н	SOCKET, 55mm	5120-01-386-5999	J39938
168	Н	SOCKET, 63mm	5120-01-386-5988	J39939
169	F	SOCKET, Spindle Nut	5120-01-354-9451	J41111
170	Н	SOCKET, Socket Head Screw	4470-01-350-0895	LAW124A
171	Н	SOCKET, 12mm Hex Head	5120-00-240-6148	849550-3-8AF
172	F	SOCKET, Swivel 13/16 in.	5120-00-236-7619	A-A-1396
173	Н	SPANNER	5120-01-354-9452	12379639
174	Н	SPANNER	5120-01-354-9450	12379638
175	Н	SPANNER	5120-01-354-9449	12379637
176	Н	STAND, Maintenance, Axle	4910-00-241-3329	150-AX
177	Н	STAND, Maintenance, Engine	4910-00-808-3372	J29109
178	Н	STEAM CLEANER	7910-01-157-8272	PRO 12-5
179	Н	STONE, Abrasive Cylinder	5130-00-937-7280	J5902-14
180	Н	STONE, Sharpening	5345-00-584-4607	A6F0
181	Н	STUD SET	5120-01-048-2155	J25002
182	F	TAP AND DIE SET	5136-01-119-0005	TDM99117
183	0	TERMINAL CRIMPER	5120-01-355-0845	J35688
184	0	TERMINAL REMOVER	5120-01-357-2937	J35689-A
185	0	TERMINAL REMOVER	5120-01-353-2534	J33095
186	0	TESTER, Pressure, Radiator	4910-01-170-4928	J24460-01
187	Н	TESTING KIT, Cylinder	5180-01-252-9800	2SK737

Table B-1. Tool and Test Equipment Requirements (Cont).

Tool or Test			National/	
Equipment	Maintenance		NATO	Tool
Ref Code	Category	Nomenclature	Stock Number	Number
188	F	OSS TESTER	4910-01-370-4908	13189
189	Н	TOOL SET, Blower	4940-00-611-7945	J6270-G
190	F	TOOL SET, Equalizer Beam	4940-01-386-6108	1764
191	F	TOOL, Knuckle, Adjusting	5120-01-355-6571	J41115
192	Н	TOOL, Lifting	5120-01-159-1736	J33079-1
193	Н	TOOL, Staking	5120-01-359-2757	J24200-1
194	0	TOOL, SRS/TRS Alignment	5120-01-343-1001	J39815
195	F	TORCH, Propane	3433-01-161-4998	737-1-0000
196	F	VISE, Pipe, Chain	5120-00-078-6662	CV12
197	0	WEATHERPAC CRIMPER	5120-01-374-8936	J38852
198	0	WEATHER TERMINAL REMOVER	5120-01-374-8969	J36400-5
199	F	WINCH, Cable, Hand Operating	3950-00-079-1202	415526-1
200	F	WRENCH, Chain	5120-01-192-9403	CW24
201	0	WRENCH, Combination 1 5/8 in.	5120-01-016-7144	1180
202	0	WRENCH, Combination 1 11/16 in.	5120-00-184-8566	A-A-1351
203	0	WRENCH, Combination 1 3/4 in.	5120-00-020-8658	1256
204	F	WRENCH, Combination 1 13/16 in.	5120-00-081-9099	GGG-W-636
205	0	WRENCH, Combination 1 7/8 in.	5120-00-020-8632	1260
206	0	WRENCH, Combination 2 in.		
207	О	WRENCH, Combination 2 1/8 in.	5120-00-203-4795	1268
208	0	WRENCH, Fuel Line	5120-00-019-5232	J-8932-B
209	F	WRENCH SET, Pushrod	5120-00-132-2109	J21100-D
210	Н	WRENCH, Spanner	5120-01-375-4502	J41108

### Section IV. REMARKS

REFERENCE CODE	REMARK
A	No specific times established. Times required for inspection, service, or test will depend on extent of testing required.
В	This task covers the entire on-stand repair. Use tools listed in the individual tasks for those tasks.
С	No specific times established. Times required for replacement or repair will depend on extent of work required.
D	No specific times established. Times required for overhaul will depend on extent of work required.
E	In the "O" category repair is limited to splicing of wires, taping of the harness or wires, and the replacement of wire ends.
F	At the "F" level the entire wire harnes is replaced.
G	Repair consists of replacing individual items.
Н	High pressure hoses are non-repairable.
I	Repair of the gas particulate filter is covered in TM-(TBD).
J	Repair of the M-8 chemical alarm is covered in TM 3-6665-225-12.
K	Repair of the M-13 decontamination unit is covered in TM 3-4230-214-12&P.

### **APPENDIX C**

### **EXPENDABLE SUPPLIES AND MATERIALS LIST**

#### Section I. INTRODUCTION.

#### C-1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain the PLS. These items are authorized to you by CTA50-970, Expendable Items (Except Medical, Class V, Repair parts and Heraldic Items) or CTA8-100, Army Medical Department Expendable/Durable Items.

#### C-2. EXPLANATION OF COLUMNS.

- **a.** Column (1) Item Number. This number is assigned to the entry in the listing and is referenced in the narrative task box to identify the material (e.g., "Compound, Cleaning, Item 5, Appendix C").
  - b. Column (2) Level. This is the maintenance level approved to use the item listed.
- **c.** Column (3) National Stock Number. This is the National Stock Number assigned to the item; use it to request or requisition the item.
- **d.** Column (4) Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity (CAGE) code in parentheses followed by the part number.
- **e.** Column (5) Unit of Measure. Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in. or pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1)	(2)	(3)	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
1	О		Adhesive (45152) 1490170 Sikaflex 221 gray	gl
1.1	О	8040-01-388-8704	Adhesive No. 380 (05972) OTC P/N 3303334 3 gm tube (05972), 38004	gm
		8040-01-406-8424	1 oz bottle (05972), ITEM 3850	oz
		8040-01-284-3984	1 oz can (05972), 3850	
2	О	8040-01-321-1254	Adhesive (05972) Loctite #409 20 gram tube	gm
3	О		Deleted	
4	O	8040-01-046-5061	Adhesive (05972) Loctite #44581 4 gram kit	gm
5	О	8040-00-148-7182	Adhesive (04963) 1300 5 ounce tube	OZ
6	О	8040-00-851-0211 8040-00-865-8991 8040-01-331-7470	Adhesive (71984) RTV 732 Black 5 oz kit 12 oz kit (80244) MIL-A-46106 Group 1 Type 1 5 oz tube	OZ OZ
7	O	8040-00-701-9546 8040-01-010-8758 8040-01-331-7469 8040-01-331-7475	Adhesive (71984) RTV 732 Clear 5 oz kit 12 oz kit (80244) MIL-A-46106 Group 1 Type 1 3 oz tube 12 oz cartridge	OZ OZ OZ OZ
8	О	8040-01-260-1939	Adhesive (71984) RTV 738 5 oz tube	OZ
9	О		Adhesive (01139) RTV-162 (71984) Silastic 738 RTV (81349) MIL-A-46146	
		8040-00-118-2695	3 oz kit	OZ

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (CONT)

(1)	(2)	(3)	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
10	О	8040-00-843-0802 8040-01-173-9815	Adhesive (01139) RTV 108 3 ounce kit 12 ounce tube	OZ OZ
11	О	8040-00-390-7959	Adhesive (18876) 13086263 1 quart can	qt
12	О	8040-01-515-1050	Adhesive, Insulation (28112) 540 (OTC P/N 1372150) 10.3 oz (305 ml) cartridge	oz
13	О	8030-01-303-0502	Adhesive, Retaining (05972) 68035 50 ml bottle	bt
14	О		Adhesive Sealant (45152) 24758FX	OZ
15	О		Adhesive, (0PMN0) Sika 255 FC Blk (45152) 3145938	OZ
16	О		Adhesive Spray (45152) 1537350	oz
17	0	6810-01-075-5546	Alcohol, Isopropyl (53390) 7618-19-4 40 oz bottle	OZ
18	О	6850-00-174-1806	Antifreeze (81349) MIL-A-11755 55 gallon drum	gl
19	О	6850-00-181-7929 6850-00-181-7940	Antifreeze (81349) MIL-A-46153 1 gallon bottle 55 gallon drum	gl gl
20	0	8030-00-155-6444	Antiseize Compound (81349) MIL-A-907 16 oz aerosol can	OZ
21	0	8030-00-251-3980	Antiseize Compound (81349) MIL-A-907 1 lb can	lb
22	О	8030-00-597-5367	Antiseize Compound, High Temperature (81349) MIL-A-907 2-1/2 lb can	lb
23	О	8020-00-178-8305	Brush, Paint (96906) MS16866	ea
24	0	6840-00-300-6373 6840-01-173-6940	Biocide, Fuel Preservative (OU7J1) Biobar J.F. 1 quart 5 gallon	qt gl

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (CONT)

(1)	(2)	(3)	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
25	О	5975-01-273-8133	Cable Ties (96906) MS3367-3 12 inches long, 100 per package	hd
26	О	5975-00-074-2072	Cable Ties (96906) MS3367-1 6 inches long, 100 per package	hd
27	О	4310-01-115-2297	Cable Ties (56501) TY525MX	ea
28	О	7510-00-537-6426	Chalk, Marking, White (83030) 1400	ea
29	О	9150-01-079-6124	Cleaner, Lubricant A (81349) MIL-L-63460 4 oz bottle, w/extender tube	OZ
30	О	5350-00-221-0872	Cloth, Abrasive (Crocus) (58536) A-A-1206 50 sheet package	sh
31	О	7920-00-165-7195 7920-00-044-9281	Cloth, Cleaning (81349) MIL-C-85043 Type 1 - 10 lb box Type 2 - 10 lb box	lb lb
32	О	8030-00-546-8621	Coating Compound, Bituminous, Solvent Type (70842) 765-1505 21 ounce aerosol can	oz
33	О	8030-00-231-2349 8030-00-231-2344 8030-00-174-3242	Coating, Rust Arresting (81349) MIL-R-10036 1 gallon can 5 gallon can 55 gallon drum	තු <u>.</u> තු. තු.
34	О	8030-00-062-6950 8030-01-149-1731 8030-00-837-6557 8030-00-903-0931	Corrosion Preventive Compound (81349) MIL-C-16173 Grade 1 - 1 quart can Grade 2 - 1 quart can Grade 3 - 1 pint can Grade 4 - 1 pint can	qt qt pt pt
35	0		Corrosion Preventive Compound (13548) 97940 8 ounce can	OZ
36	О	8030-00-231-2353 8030-00-285-1570	Corrosion Preventive Compound (81349) MIL-C-11796 5 lb 35 lb	lb lb
37	О	8010-00-652-3626	Dye, Prussian Blue (81349) MIL-P-30501	oz

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (CONT)

(1)	(2)	(3)	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
38	О	8040-00-092-2816	Epoxy (96900) 04001	ea
39	О	5330-01-325-6993	Gasket, Forming Compound (0597) Loctite #515 50 ml tube	ml
40	О		Gasket, Strip (45152) 2011160 50 ft. roll	in
41		9150-01-197-7688 9150-01-197-7690 9150-01-197-7689	Grease (45152) 1864450 2.25 oz tube 1.75 lb can 6.5 lb can	oz lb lb
42	О	9150-01-197-7688 9150-01-197-7690 9150-01-197-7689	Grease, Automotive And Artillery (70878) 5542P (81349) MIL-G-10924 2.25 oz tube 1.75 lb can 6.5 lb can	oz lb lb
43	О	9150-01-306-9202 9150-00-235-5555 9150-00-823-8047	Grease, General Purpose (81349) MIL-G-23549 1 pound can 6.5 pound can 35 pound can	lb lb lb
44	О	9150-01-154-1259	Grease, High Temperature (81349) DOD-G-85733	qt
45	О	9150-01-235-5057	Grease, Instrument (97343) SRI2 1 pint can	pt
46	О	9150-00-076-1887	Grease, Lubriplate (73219) 06706	oz
47	О	9150-01-091-9336	Grease, Molybdenum Disulfide (58372) 60G 1.5 lb can	lb
		9150-00-754-2595 9150-00-223-4004 9150-00-965-2003	(81349) MIL-G-21164 1.75 lb can 6.5 lb can 35 lb can	lb lb lb
48	О	5970-00-815-1295	Heatshrink, Sealed (45152) 1704950	ea
48.1	О		Heatshrink, Sealed (45152) 1704940	ea
49	О		Hot Melt (04963) 3783	oz

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (CONT)

(1)	(2)	(3)	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
50	0	9150-00-189-6727 9150-01-177-3988 9150-00-191-2772 9150-00-183-7807	Hydraulic Oil, OE/HDO 10 (81349) MIL-L-2104 1 quart can 12 quart box 55 gallon drum Bulk	qt qt gl gl
51	О	6850-00-779-6851	Injector Test Oil (33287) J-26400-5	oz
52	О		Insulation, Cab (40501) MC5150-1/2 blk	ft
53	О	2540-00-256-5529 2540-00-256-5526 2540-00-256-5527	Lubricant, Tire (96980) AA20 5 gallon can 1 quart can (96980) AA17 1 gallon can	gl qt gl
54	О	9250-00-186-6681 9150-00-188-9858 9150-00-189-6729	Lubricating Oil, Engine OE/HDO 30 (81349) MIL-L-2104 1 quart can 5 gallon can 55 gallon drum	qt gl gl
55	О	9150-00-189-6730 9150-00-188-9862 9150-00-405-2987	Lubricating Oil, Engine OE/HDO 40 (81349) MIL-L-2104 1 quart can 55 gallon drum Bulk	qt gl gl
56	О	9150-01-152-4117 9150-01-178-4725 9150-01-152-4118 9150-01-152-4119	Lubricating Oil, Engine OE/HDO 15W/40 (81349) MIL-L-2104 1 quart can 12 quart box 5 gallon can 55 gallon drum	qt qt gl gl
57	О	9150-00-402-4478 9150-00-402-2372 9150-00-491-7197	Lubricating Oil, Engine OEA (81349) MIL-L-46167 1 quart can 5 gallon can 55 gallon can	qt gl gl
58	О	9150-01-035-5390 9150-01-048-4593 9150-01-035-5391	Lubricating Oil, Gear GO 75W (81349) MIL-L-2105 1 quart can 1 gallon can 5 gallon can	qt gl gl

# Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (CONT)

(1)	(2)	(3) National Stock	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
59	О	9150-01-035-5392 9150-01-313-2191 9150-00-001-9395	Lubricating Oil, Gear GO 80W/90 (81349) MIL-L-2105 1 quart can 1 gallon can 5 gallon can	qt gl gl
60	О	9150-01-293-7696 9150-01-293-2792	Lubricating Oil, Preservative (15W40) (Engine) (81349) MIL-L-21260C 5 gallon 55 gallon	gl gl
61	С	9140-00-286-5286	Oil, Fuel, Diesel Winter Bulk	gl
62	С	9140-00-286-5294	Oil, Fuel, Diesel Regular Bulk	gl
63	О	9150-00-250-0931 9150-00-250-0926 9150-00-250-0933	Petrolatum, Technical (81348) VV-P-236 8 ounce tube 1.75 pound can 7.5 pound can	oz lb lb
64	О		Primer, (0PMN0) Sika Cleaner 205 (45152) 3145939	OZ
65	О	8030-01-388-5604	Primer, "T" 7471 (05972) 19267	oz
66	О		Protective Coating (45152) 1412020 1 quart can	qt
67	О	7920-00-205-1711	Rags, Wiping (58536) A-A-531 50 pound bale	lb
68	О		Sealant, Electrical (00CE9) RTV200-257	
69	О		Sealant, Metal (45152) 1317520	
70	О		Sealant, Rubber (45152) 1494320	
71	О	1015-01-255-4144	Sealant, Teflon Pipe (19207) 12297953 50 ml tube	ml

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (CONT)

(1)	(2)	(3)	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
72	О	8030-01-054-0740 8030-00-204-9149 8030-01-166-0675	Sealing Compound (05972) Loctite #567 50 ml bottle 250 ml tube (05972) Loctite #567-47 50 ml tube	ml ml ml
73	0	8030-00-111-2763 8030-00-111-2762 8030-01-050-8288	Sealing Compound (05972) Loctite #290 (80244) MIL-S-46163 Type 3 Grade R 10 ml bottle 50 ml bottle 150 ml bottle	ml ml ml
74	0	8030-00-148-9833 8030-01-158-6070	Sealing Compound (05972) Loctite #271 (80244) MIL-S-46163 Type 1 Grade K 10 ml bottle 50 ml bottle	ml ml
75	О	8030-00-656-1426	Sealing Compound (77247) Permatex-3D (80244) MIL-S-45180 Type 3 1 pint can	pt
76	0	8030-01-159-4374 8030-01-142-9830 8030-01-142-3131	Sealing Compound (05972) Loctite #262 10 ml bottle 50 ml bottle 250 ml bottle	ml ml ml
77	0	8030-01-104-5392 8030-01-014-5869 8030-01-025-1692	Sealing Compound (05972) Loctite #242 (80244) MIL-S-46163A Type 2 Grade N 10 ml bottle 50 ml bottle 250 ml bottle	ml ml ml
78	О	8030-01-054-3968 8030-01-069-3046 8030-01-055-6126	Sealing Compound (05972) Loctite 222 (80244) MIL-S-46163A Type II Grade M 10 ml bottle 50 ml bottle 250 ml bottle	ml ml ml
79		8030-01-303-0502 8030-01-387-2007	Sealing Compound (05972) Loctite #680 50 ml bottle 250 ml bottle	ml ml
80	0	8030-01-023-4535	Sealing Compound (04963) 3M2084	oz

# Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (CONT)

(1)	(2)	(3)	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
81	0	8030-00-954-9371	Sealing Compound (77247) 51D 1 pint can	pt
82	О	0000 00 001 0071	Sealing Compound	Pt.
		8030-01-104-5392 8030-01-014-5869 8030-01-025-1692	(45152) 079-820400 10 ml bottle 50 ml bottle 250 ml bottle	ml ml ml
83	0	8030-01-104-5392 8030-01-014-5869 8030-01-025-1692	Sealing Compound (45152) 65270AX 10 ml bottle 50 ml bottle 250 ml bottle	ml ml ml
84	0	6850-00-294-0860	Silicone Compound (72984) DC 111 5 ounce Tube	oz
85	0	6850-00-177-5094	Silicone Compound, Anti-Corrosion (71984) DC4-2OZ 2 ounce tube	oz
86	0	6810-00-252-1345	Solution, Soap (81349) MIL-W-15000 Class C 1 quart bottle	qt
87	0	6850-00-664-5685 6850-00-264-9038 6850-01-378-0679	Solvent, Drycleaning (58536) A-A-711 (81348) P-D-680 1 quart can 5 gallon can (Environmentally Compliant Solvent) (0K209) Breakthrough 5 gallon can	qt gl gl
88	0	9905-00-720-3577	Tag, Identification (16956) 12-105 white	ea
89	О	9905-00-537-8957 9905-00-537-8955	Tags, Identification (81349) MIL-T-12755 white yellow	ea ea
90	0	7510-00-079-7604	Tape, Adhesive (26066) 4516 36 yard roll	yd
91	О		Tape, Foam 36 yard roll	yd

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (CONT)

(1)	(2)	(3)	(4)	(5)
Item Number	Level	National Stock Number	Description	U/M
92	0	5330-01-084-5058	Tape, Foam (45152) 107685A	in
93	0	8030-00-889-3535	Tape, Antiseizing (81755) P5025-2R (81349) MIL-T-27730 260 inch spool	in
94	0	7510-01-358-8770	Tape, Pressure Sensitive (52152) 4950 36 yard roll	yd
95			Deleted	
96			Deleted	
97	О	8010-00-401-0421	Varnish (79819) FIXATIF 1 quart can	qt
98	С	6850-00-926-2275	Washer Fluid (81348) O-C-1901 1 gallon bottle	gl
99	0	6145-01-074-7535	Wire, 16 Gage (45152) 1927FX	ft
100	0	9505-00-331-3275	Wire, Safety (96906) MS20995C41	lb
101	0	5330-01-325-6993	Wrench, Loctite #515 (05972) 25824AX	ml

### **APPENDIX D**

### **ILLUSTRATED LIST OF MANUFACTURED ITEMS**

#### Section I. INTRODUCTION

#### D-1. SCOPE.

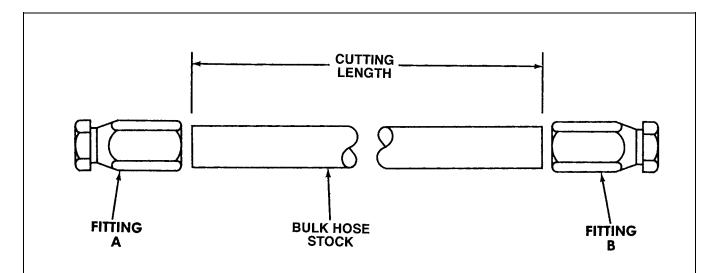
This appendix includes complete instructions for manufacturing or fabricating authorized items locally. All bulk materials needed to manufacture an item are listed by part number or specification number in a tabular list with an illustration, as needed.

### Section II. MANUFACTURED ITEMS

### D-2. FUEL HOSE FABRICATION.

The following hoses are cut from bulk hose using a fine toothed hacksaw or suitable cutting device. Locations and installation instructions for fuel hoses are found in Para 4-12. Table D-1 lists the fuel hoses.

Table D-1. Fuel System Hoses



Hose Assembly	Bulk Hose	Cutoff I	_ength
Part Number	Part Number	Inches	cm
65068AX-024	2575-48RL	24	61
47371AXU-018	FC350-04	18	46
EU102958-025	FC350-06	25	64
EU102958-052	FC350-06	52	132
1924600U-034	FC350-10	34	86
56845AXU-005	FC350-10	5	13

### D-3. AIR INTAKE HOSE FABRICATION.

There are two hoses in the air intake system that require fabrication. Both hoses can be cut from bulk stock using a fine-toothed hacksaw or suitable cutting device. Refer to Para 4-7 for locations and installation instructions.

Table D-2. Air Intake Hoses

Hose Assembly	Bulk Hose	Cutoff	Length
Part Number	Part Number	Inches	cm
21033FXW-120 1732400U-067	21020FX FC300-16	120 67	305 170

### D-4. COOLING SYSTEM HOSES FABRICATION.

The following hoses for the cooling system are cut from bulk hose using a fine-toothed hacksaw or suitable cutting device. Locations and installation instructions are found in Para 6-8.

Table D-3. Cooling System Hoses

Hose Assembly	Bulk Hose	Cutoff	Length
Part Number	Part Number	Inches	cm
69940AX-048 4811FX-100	3230-0293 4811FX	48 100	122 254
46754AX-U-020	FC350-06	20	51

## D-5. SEAL FABRICATION.

Fabricate seals from bulk seal stock listed in Table D-4. Use a suitable cutting tool to cut seal to length required.

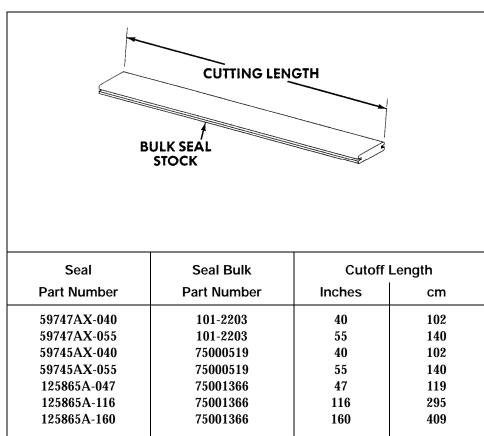


Table D-4. Seal, Nonmetallic

#### D-6. EDGING AND MOLDING FABRICATION.

Edging and molding can be fabricated from bulk stock listed in Table D-5. Use suitable cutting tool to cut to length required.

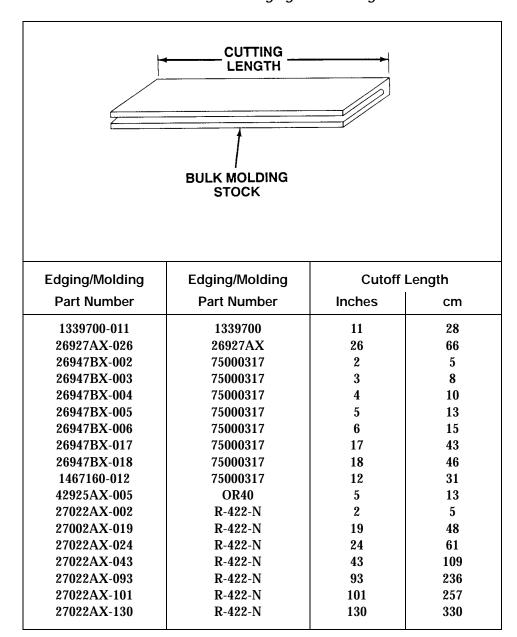
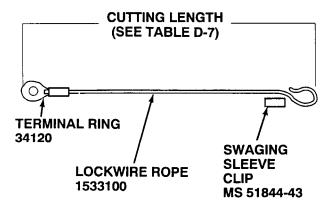


Table D-5. Edging and Molding

# D-7. LOCKWIRE ROPE FABRICATION.

The lockwire length is shown in Table D-6. Crimped button stop caps are used to attach the lockwire to other components. Each application requires two swaging sleeve clips.



#### NOTES:

- 1. OBTAIN ALL COMPONENTS REQUIRED TO FABRICATE LOCKWIRE.
- 2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT LOCKWIRE TO LENGTH REQUIRED.
- 3. SLIDE WIRE THROUGH HOLE IN COMPONENT, UNTIL LOCKWIRE COMES THROUGH OTHER SIDE.
- 4. SLIDE CAP ONTO LOCKWIRE, UNTIL CAP BOTTOMS AGAINST COMPONENT AND WIRE COMES THROUGH CAP.
- 5. CRIMP CAP TO LOCKWIRE.
- 6. SLIDE OPPOSITE END OF WIRE THROUGH ASSEMBLY, AND SLIDE OTHER CAP OVER END OF WIRE.
- 7. SLIDE WIRE THROUGH HOLE IN COMPONENT, UNTIL LOCKWIRE COMES THROUGH OTHER SIDE.
- 8. SLIDE CAP ONTO LOCKWIRE, UNTIL CAP BOTTOMS AGAINST COMPONENT AND WIRE COMES THROUGH CAP.
- 9. CRIMP CAP TO LOCKWIRE.

The following wire rope is cut from bulk stock. Refer to Table D-6 for cutting lengths.

Table D-6. Lockwire Rope

Lockwire Rope	Lockwire Rope	Cutoff Length			
Part Number	Part Number	Inches	cm		
1533100-010	1533100	10	25		
1533100-015	1533100	15	38		
1533100-020	1533100	20	51		
1533100-024	1533100	24	61		

#### D-8. WIRE AND WIRE ASSEMBLIES FABRICATION.

Fabricate from bulk wire stock listed in Table D-7. Use wire cutters to cut wire to required length, then strip ends of wire  $\frac{1}{4}$  in. (6.35 mm). Crimp the required lugs or terminals onto wire ends.

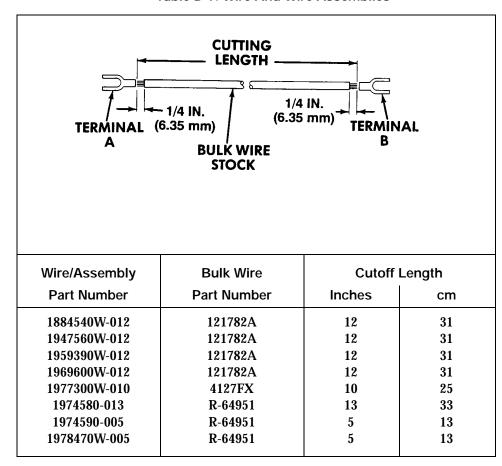


Table D-7. Wire And Wire Assemblies

#### D-9. HOSES AND TUBES.

Fabricate hoses and tubes from bulk hose or tube stock listed in Table D-8. Use a fine toothed hacksaw or suitable cutting device and cut hose/tube to desired length. Place fitting A in vise and screw hose/tube counterclockwise until hose/tube bottoms out in fitting. Back off ½ turn. Repeat for fitting B.

Table D-8. Hoses and Tubes

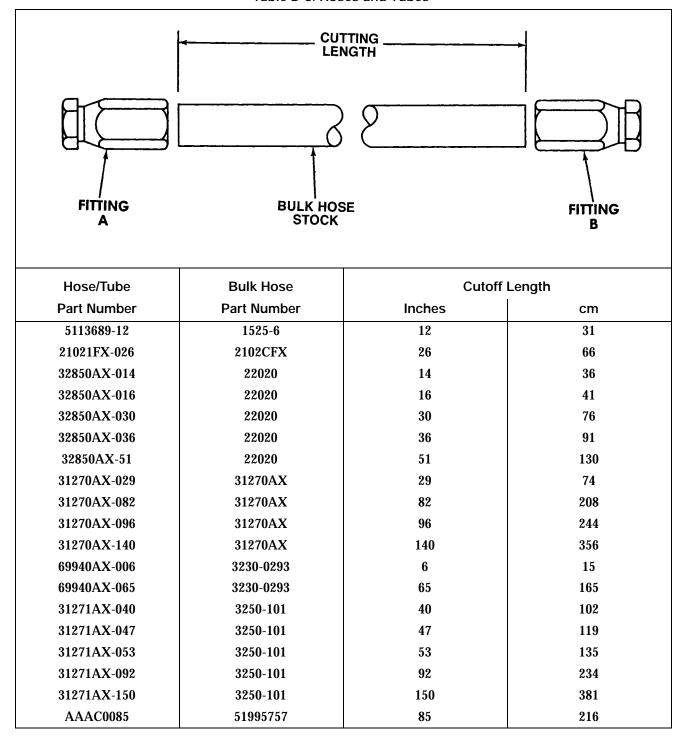


Table D-8. Hoses and Tubes (Cont)

Hose/Tube	Bulk Hose	Cutoff	Length	
Part Number	Part Number	Inches	cm	
AAAC0105	5199575	105	267	
AAAC0190	5199575	190	483	
AAAC0260	5199575	260	660	
AAAE0090	5199575	90	229	
1944510	70-062		Variable	
1944520	70-062		Variable	
23319FX-012	C604-200 BLK	12	31	
23319FX-023	C604-200 BLK	23	58	
23319FX-029	C604-200 BLK	29	74	
23319FX-244	C604-200 BLK	244	620	
23319FX-257	C604-200 BLK	257	653	
23323FX-008	C606 BLACK	8	20	
23323FX-008	C606 BLACK	8	20	
23323FX-010	C606 BLACK	10	25	
23323FX-010	C606 BLACK	10	25	
23323FX-012	C606 BLACK	12	31	
23323FX-014	C606 BLACK	14	36	
23323FX-019	C606 BLACK	19	48	
23323FX-022	C606 BLACK	22	56	
23323FX-026	C606 BLACK	26	66	
23323FX-030	C606 BLACK	30	76	
23323FX-033	C606 BLACK	33	84	
23323FX-042	C606 BLACK	42	107	
23323FX-042	C606 BLACK	42	107	
23323FX-044	C606 BLACK	44	112	
23323FX-046	C606 BLACK	46	117	
23323FX-050	C606 BLACK	50	127	
23323FX-052	C606 BLACK	52	132	
23323FX-055	C606 BLACK	55	140	
23323FX-057	C606 BLACK	57	145	
23323FX-060	C606 BLACK	60	152	
23323FX-060	C606 BLACK	60	152	
23323FX-082	C606 BLACK	82	208	
23323FX-087	C606 BLACK	87	221	
23323FX-089	C606 BLACK	89	226	
23323FX-148	C606 BLACK	148	376	

Table D-8. Hoses and Tubes (Cont)

Hose/Tube	Bulk Hose	Cutoff	Length	
Part Number	Part Number	Inches	cm	
23323FX-159	C606 BLACK	159	404	
23323FX-163	C606 BLACK	163	414	
23323FX-200	C606 BLACK	200	508	
23323FX-335	C606 BLACK	335	851	
23323FX-377	C606 BLACK	377	958	
198872A U-200	FC300-04	20	51	
115134A W-004	FC300-04	4	10	
1732400 U-067	FC300-16	67	170	
1620950 U-099	FC350-04	99	252	
47371AX U-055	FC350-04	5	13	
47371AX U-006	FC350-04	6	15	
47371AX U-012	FC350-04	12	31	
47371AX U-017	FC350-04	17	43	
47371AX U-018	FC350-04	18	46	
47371AX U-120	FC350-04	120	305	
60264AX U-031	FC350-04	31	79	
60264AX U-034	FC350-04	34	86	
60264AX U-054	FC350-04	54	137	
60264AX U-057	FC350-04	57	145	
60264AX U-063	FC350-04	63	160	
60264AX U-082	FC350-04	82	208	
60296AX U-029	FC350-04	29	74	
60296AX U-036	FC350-04	36	91	
60296AX U-061	FC350-04	61	155	
1780700 U-032	FC350-06	32	81	
1780700 U-035	FC350-06	35	89	
1780700 U-039	FC350-06	39	99	
1780700 U-041	FC350-06	41	104	
1782400 U-022	FC350-06	22	56	
1782410 U-021	FC350-06	21	53	
1782450 U-025	FC350-06	25	64	
47336AX-060	FC350-06	60	152	
47554AX U-020	FC350-06	20	51	
118971A U-022	FC350-06	22	56	
118971A U-095	FC350-06	95	241	
119784A U-010	FC350-06	10	25	

Table D-8. Hoses and Tubes (Cont)

Table D-8. Hoses and Tubes (Cont)								
Hose/Tube	Bulk Hose	Cutoff	Length					
Part Number	Part Number	Inches	cm					
119784A U-021	FC350-08	21	53					
119784A U-047	FC350-08	47	119					
1782340 U-019	FC350-08	19	48					
1782360 U-020	FC350-08	20	51					
1921290 U-025	FC350-08	25	64					
1936150 U-032	FC350-08	32	81					
1936150 U-034	FC350-08	34	86					
1936150 U-038	FC350-08	38	97					
1936150 U-040	FC350-08	40	102					
69390AX U-006	FC350-08	6	15					
69390AX U-019	FC350-08	19	48					
69390AX U-020	FC350-08	20	51					
69390AX U-020	FC350-08	20	51					
69390AX U-021	FC350-08	21	53					
69390AX U-025	FC350-08	25	37					
1780720 U-020	FC350-10	20	51					
1780720 U-051	FC350-10	51	130					
1782370 U-037	FC350-10	37	94					
1782380 U-031	FC350-10	31	79					
1782390 U-020	FC350-10	20	51					
1782420 U-039	FC350-10	39	99					
1782430 U-031	FC350-10	31	79					
1782440 U-019	FC350-10	19	48					
1924600 U-090	FC350-10	90	229					
47750AX U-009	FC350-10	9	23					
58989AX U-020	FC350-10	20	51					
58989AX U-034	FC350-10	34	86					
58989AX U-064	FC350-10	64	163					
66798AX U-020	FC350-10	20	51					
66798AX U-025	FC350-10	25	64					
66798AX U-030	FC350-10	30	76					
66798AX U-077	FC350-10	77	196					
1780710 U-082	FC350-12	82	208					
1780710 U-083	FC350-12	83	211					
47369AX U-127	FC350-12	127	323					
61608AX U-093	FC350-12	93	236					

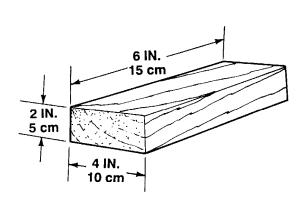
Table D-8. Hoses and Tubes (Cont)

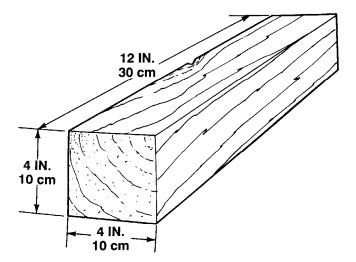
Hose/Tube	Bulk Hose	Cutoff	Length	
Part Number	Part Number	Inches	cm	
61608AX U-142	FC350-12	142	361	
47468AX U-011	FC350-16	11	28	
47468AX U-022	FC350-16	22	56	
47468AX U-045	FC350-16	45	114	
47468AX U-046	FC350-16	46	117	
47468AX U-089	FC350-16	89	226	
47213AX-012	NT10012-50FT	12	31	
47213AX-015	NT10012-50FT	16	41	
47213AX-021	NT10012-50FT	21	53	
47213AX-023	NT10012-50FT	23	58	
47213AX-025	NT10012-50FT	25	64	
47213AX-025	NT10012-50FT	25	64	
47213AX-060	NT10012-50FT	60	152	
47213AX-073	NT10012-50FT	73	185	
47213AX-073	NT10012-50FT	73	185	
47213AX-173	NT10012-50FT	173	439	
47213AX-194	NT10012-50FT	194	493	
1656500-128	PFT-10B-GRN	128	325	
1656500-183	PFT-10B-GRN	183	465	
1656490-102	PFT-10B-RED	102	259	
1656490-202	PFT-10B-RED	202	513	
1656490-257	PFT-10B-RED	257	653	
1656470-030	PFT-4A-BLU	30	76	
1656470-104	PFT-4A-BLU	104	264	
1656470-115	PFT-4A-BLU	115	292	
1656470-139	PFT-4A-BLU	139	353	
1605260-008	PFT-4A-GRN	8	20	
1605330-020	PFT-4A-ORG	20	51	
1605330-040	PFT-4A-ORG	40	102	
1605330-071	PFT-4A-ORG	71	180	
1605330-112	PFT-4A-ORG	112	285	
1605330-124	PFT-4A-ORG	124	315	
1605170-007	PFT-4A-RED	7	18	
1605270-023	PFT-6B-GRN	23	58	
1605270-028	PFT-6B-GRN	28	71	
1605270-056	PFT-6B-GRN	56	142	

Table D-8. Hoses and Tubes (Cont)

Hose/Tube	Bulk Hose	Cutoff Length			
Part Number	Part Number	Inches	cm		
1605270-057	PFT-6B-GRN	57	145		
1605270-100	PFT-6B-GRN	100	254		
1605270-108	PFT-6B-GRN	108	274		
1605270-146	PFT-6B-GRN	146	371		
1605320-205	PFT-6B-ORG	205	521		
1605160-012	PFT-6B-RED	12	31		
1605160-014	PFT-6B-RED	14	36		
1605160-030	PFT-6B-RED	30	76		
1605160-031	PFT-6B-RED	31	79		
1605160-047	PFT-6B-RED	47	119		
1605160-048	PFT-6B-RED	48	122		
1605160-049	PFT-6B-RED	49	125		
1605160-055	PFT-6B-RED	55	140		
1605160-102	PFT-6B-RED	102	259		
1605160-103	PFT-6B-RED	103	262		
1605160-114	PFT-6B-RED	114	290		
1605160-165	PFT-6B-RED	165	419		
1605160-213	PFT-6B-RED	213	541		
1605300-026	PFT-6B-YEL	26	66		
1605300-066	PFT-6B-YEL	66	168		
1605300-070	PFT-6B-YEL	70	178		
1605300-129	PFT-6B-YEL	129	328		
1605300-132	PFT-6B-YEL	132	335		
1605300-150	PFT-6B-YEL	150	381		
1605300-022	PFT-8B-BLU	22	56		
1605300-316	PFT-8B-BLU	316	803		
W-22-13	W-22	13	33		
W-22-9	W-22	9	23		
40AW168-010	W-22-L	10	25		
40AW168-050	W-22-L	50	127		
40AW168-19	W-22-L	19	48		
40AW168-27	W-22-L	27	69		
40AW168-45	W-22-L	45	114		

# D-10. WOODEN BLOCKS.



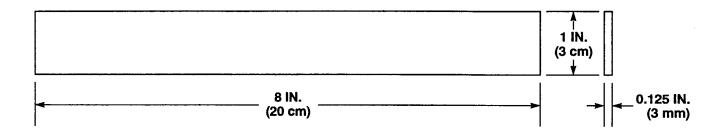


- a. Fabricate from MML751 lumber stock.
- b. Using saw and standard planing machine, cut stock to size required in Table D-9.

Table D-9. Wooden Blocks

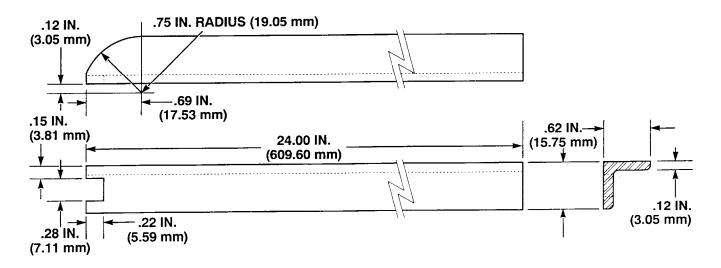
Para Number	Finished Dimensions of Block In. (cm)
2-28	4 by 4 by 12 in. (10 by 10 by 30 cm)
5-2	2 by 4 by 6 in. (5 by 10 by 15 cm)
13-2	4 by 4 by 12 in. (10 by 10 by 30 cm)

## D-11. STEERING STOP PLATE.



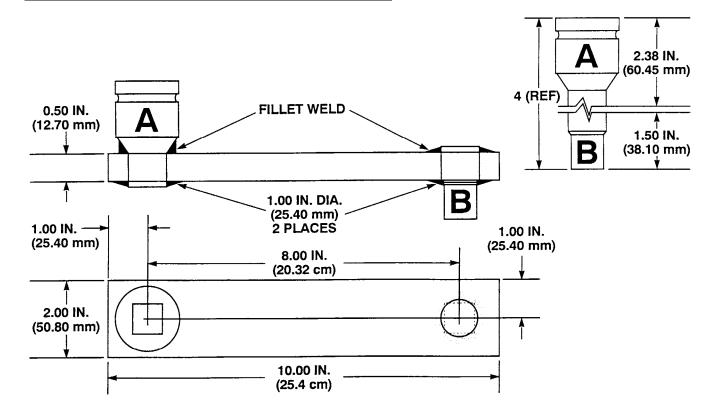
Fabricate steering stop plate from 1/8 in. (3mm) thick mild steel stock. Using a hacksaw, cut to dimension shown. File off rough edges.

# D-12. BAR-BRAKE RETURN SPRING REMOVAL TOOL.



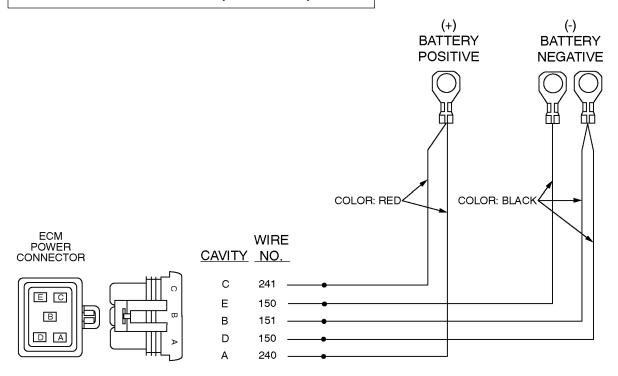
Fabricate bar-brake return spring removal tool from ASTM A36 angle aluminum. Using a hacksaw, cut to dimension shown. File off rough edges.

# D-13. ADAPTER, TORQUE, 3/4 IN. DRIVE.



Fabricate torque adapter from Extension, P/N L32, NSN 5120-00-273-9208, and bar stock, Spec 23 or better. Cut part A and part B to dimensions shown.

# D-14. JUMPER HARNESS (DDEC III/IV).



- (1) Fabricate from 16-gage wire.
- (2) Using wire cutters, cut five pieces of 16-gage wire to 180 in. (457 cm).
- (3) Strip both ends of each wire .25 inch (6.4 mm).
- (4) Crimp five terminals (PN 12077413) and five cable seals (PN 12015193) on wires.
- (5) Insert terminals and cable seals into connector body (PN 12124634) as illustrated.
- (6) Secure terminals and cable seals in connector body with secondary lock (PN 12052816).
- (7) Attach terminals (PN-D-351-38) to other end of wires 150, 150 & 151, and 240 & 241, as illustrated.

### **APPENDIX E**

#### **TORQUE LIMITS**

#### E-1. SCOPE.

This section provides general torque limits for the screws, hoses and fittings used on the truck. Special torque limits are listed in the maintenance procedures for applicable components. The general torque limits given in this appendix shall be used when specific torque limits are not indicated in the maintenance procedure. These general torque limits cannot be applied to screws that retain rubber components. The rubber components will be damaged before the torque limit is reached. If a special torque limit is not given in the maintenance instructions, tighten the screw or nut until it touches the metal bracket then tighten it one more turn.

#### E-2. TORQUE LIMITS.

Table E-1 lists the torque limits for wet flange nuts. Table E-2 lists the torque limits for wet socket head capscrews. Table E-3 lists dry torque limits for capscrews. Dry torque limits are used on screws that do not have high pressure lubricants applied to the threads. Table E-4 lists wet torque limits for capscrews. Wet torque limits are used on screws that have high pressure lubricants applied to the threads. Table E-5 lists the torque limits for SAE 37 degree flare hose connections. Table E-6 lists the torque limits for SAE 45 degree flare hose connections. Table E-7 lists the torque limits for NPSM swivel connections.

#### E-3. HOW TO USE TORQUE TABLE.

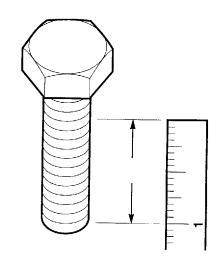
#### a. Screws and Nuts.

(1) Measure the diameter of the screw you are installing with a ruler.



# E-3. HOW TO USE TORQUE TABLE (CONT).

- (2) Measure out one inch with a ruler and count the number of threads per inch.
- (3) Under the heading SIZE, look down the left hand column until you find the diameter of the screw you are installing (there will usually be two lines beginning with the same size).
- (4) In the second column under SIZE, find the number of threads per inch that matches the number of threads per inch you counted in Step 2. (Not required for metric screws).
- (5) To find the grade screw you are installing, match the markings on the head to the correct picture of CAPSCREW HEAD MARKINGS on the torque table.
- (6) Look down the column under the picture you found in Step 5. until you find the torque limit (lb-ft or N·m) for the diameter and threads per inch of the screw you are installing.
- (7) Use wet torque values.



#### **CAPSCREW HEAD MARKINGS**

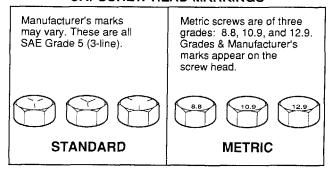


Table E-1. Torque Limits For Wet Flange Nuts

SPIRALOCK FLANGE NUT MARKINGS			THREADS PER INCH	TOR	QUE
GRADE 8	IN.	MM		LB-FT	N·m
SL	1/4 5/16 3/8 1/2 5/8 3/4	6.35 7.94 9.65 12.70 15.87 19.05	20 18 16 13 11	15 25 45 110 210 375	20 34 61 149 285 508

Table E-2. Torque Limits For Wet Socket Head Cap Screws

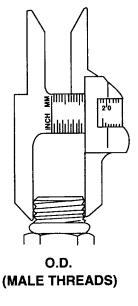
SOC HEAD/12 PT.	TORQUE IN FT. LBS. (CAP SCREWS) LUBED					
	SIZE	SOC HD OR 12 PT	SOC FLAT HD			
	.10-24	5	2.5			
	.25-20	12	6			
	.31-18	25	12			
	.38-16	44	22			
SOC FLAT HEAD	.50-13	70	36			
	.56-12	106	53			
	.62-11	212	106			
	.75-10	375	187			
	1.00-8	781				

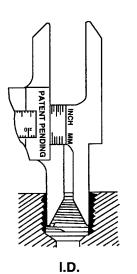
## b. Hoses and Fittings.

# **NOTE**

Most fluid piping system sizes are measured by dash numbers. These are universally used abbreviations for the size of the component expressed as the numerator of the fraction with the denominator always being 16. For example, a -04 port is 4/16 or 1/4-inch. Dash numbers are usually nominal (in name only) and are abbreviations that make ordering of components easier.

- (1) Measure the I.D./O.D. diameter with a caliper as shown.
- (2) Under the heading MALE THREAD O.D. and FEMALE THREAD I.D., match the measurements with the row in table to determine proper torque.





(FEMALE THREADS)

(3) To find the sealing surface angle, use a protractor and measure the sealing surface parallel to the center line of the fitting.

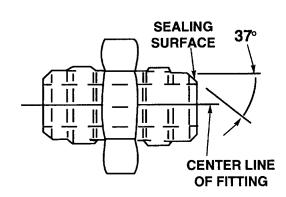


Table E-3. Torque Limits For Dry Fasteners

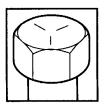
# **CAPSCREW HEAD MARKINGS**

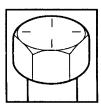


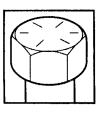












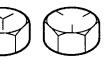
Manufacturer's	marks	may v	ary.
These are all S	AE Gra	ade 5	(3-line).

	0		TORQUE							
	SIZE			GRADE D. 2		GRADE D. 5		GRADE 6 or 7		GRADE D. 8
DIA. INCHES	THREADS PER INCH	MILLIMETERS	POUNDS FEET	NEWTON METERS	POUNDS FEET	NEWTON METERS	POUNDS FEET	NEWTON METERS	POUNDS FEET	NEWTON METERS
1/4	20	6.35	5	7	8	11	10	14	12	16
1/4	28	6.35	6	9	10	14	12	16	14	19
5/16	18	7.94	11	15	17	23	21	28	25	34
5/16	24	7.94	12	16	19	26	24	33	25	34
3/8	16	9.53	20	27	30	41	40	54	45	61
3/8	24	9.53	23	31	35	47	45	61	50	68
7/16	14	11.11	30	41	50	68	60	81	70	95
7/16	20		35	47	55	75	70	95	80	108
1/2	13	12.70	50	68	75	102	95	129	110	149
1/2	20		55	75	90	122	100	136	120	163
9/16	12	14.29	65	88	110	149	135	183	150	203
9/16	18		75	102	120	163	150	203	170	231
5/8	11	15.88	90	122	150	203	190	258	220	298
5/8	18		100	136	180	244	210	285	240	325
3/4	10	19.05	160	217	260	353	320	434	380	515
3/4	16		180	244	300	407	360	488	420	569
7/8	9	22.23	140	190	400	542	520	705	600	814
7/8	14		155	210	440	597	580	786	660	895
1	8	25.40	220	298	580	786	800	1085	900	1220
1	12		240	325	640	868	860	1166	1000	1356
1-1/8	7	25.58	300	407	800	1085	1120	1519	1280	1736
1-1/8	12		340	461	880	1193	1260	1709	1440	1953
1-1/4	7	31.75	420	597	1120	1519	1580	2142	1820	2468
1-1/4	12		460	624	1240	1681	1760	2387	2000	2712
1-3/8	6	34.93	560	759	1460	1980	2080	2820	2380	3227
1-3/8	12		640	868	1680	2278	2380	3227	2720	3688
1-1/2	6	38.10	740	1003	1940	2631	2780	3770	3160	4285
1-1/2	12		840	1139	2200	2983	3100	4204	3560	4827

Table E-4. Torque Limits For Wet Fasteners

# **CAPSCREW HEAD MARKINGS**

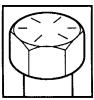












		rks may vary. Grade 5 (3-line)	ا.							
						TOR	QUE			
	SIZE			GRADE D. 2		SAE GRADE NO. 5		GRADE 6 or 7	SAE GRADE NO. 8	
DIA. INCHES	THREADS PER INCH	MILLIMETERS	POUNDS FEET	NEWTON METERS	POUNDS FEET	NEWTON METERS	POUNDS FEET	NEWTON METERS	POUNDS FEET	NEWTON METERS
1/4	20	6.35	4	6	6	8	8	11	9	12
1/4	28	6.35	5	7	7	9	9	12	10	14
5/16	18	7.94	8	11	13	18	16	22	18	24
5/16	24	7.94	9	12	14	19	18	24	20	27
3/8	16	9.53	15	20	23	31	30	41	35	47
3/8	24	9.53	17	23	25	34	30	41	35	47
7/16	14	11.11	24	33	35	47	45	61	55	75
7/16	20		25	34	40	54	50	68	60	81
1/2	13	12.70	35	47	55	75	70	95	80	108
1/2	20		40	54	65	88	80	108	90	122
9/16	12	14.29	50	68	80	108	100	136	110	149
9/16	18		55	75	90	122	110	149	130	176
5/8	11	15.88	70	95	110	149	140	190	170	231
5/8	18		80	108	130	176	160	217	180	244
3/4	10	19.05	120	163	200	271	240	325	280	380
3/4	16		140	190	220	298	280	380	320	434
7/8	9	22.23	110	149	300	407	400	542	460	624
7/8	14		120	163	320	434	440	597	500	678
1	8	25.40	160	217	440	597	600	814	680	922
1	12		170	231	480	651	660	895	740	1003
1-1/8	7	25.58	220	298	600	814	840	1139	960	1320
1-1/8	12		260	353	660	895	940	1275	1080	1464
1-1/4	7	31.75	320	434	840	1139	1100	1492	1360	1844
1-1/4	12		360	488	920	1248	1320	1790	1500	2034
1-3/8	6	34.93	420	570	1100	1492	1560	2115	1780	2414
1-3/8	12		460	624	1260	1709	1780	2414	2040	2776
1-1/2	6	38.10	560	760	1460	1980	2080	2820	2360	3200
1-1/2	12		620	841	1640	2224	2320	3146	2660	3607

Thread T Thread I.D. O.D. **Female Half Male Half INCH TORQUE TORQUE DASH THREAD** SIZE NO. SIZE LB.FT.  $N \cdot m$ 1/4 04 7/16-20 11-12 15-16 3/8 06 9/16-18 18-21 24-28 3/4-16 36-39 49-53 1/2 80 77-84 5/8 10 7/8-14 57-62 3/4 12 1 1/16-12 79-87 107-118 7/8 14 1 3/16-12 83-91 113-123 1 5/16-12 108-113 146-153 1 16 1 1/4 20 1 5/8-12 127-133 172-180 1 7/8-12 1 1/2 24 158-167 214-224 2 32 2 1/2-12 245-258 332-350

Table E-5. Torque Limits For 37 Degree Flare Hose Connections

Table E-6. Torque Limits For 45 Degree Flare Hose Connections

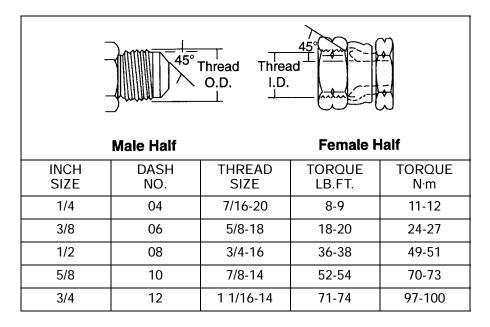


Table E-7. Torque Limits For ORS Preformed Packing Face Seal Hose Connections

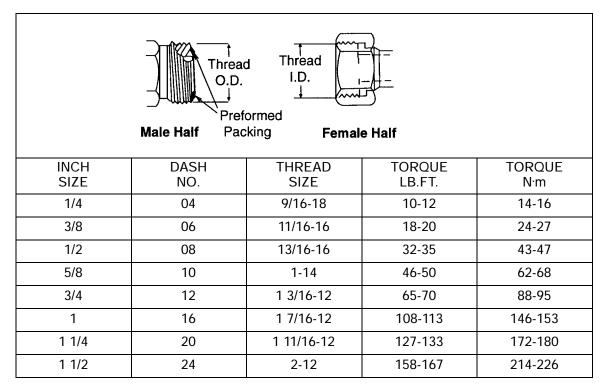
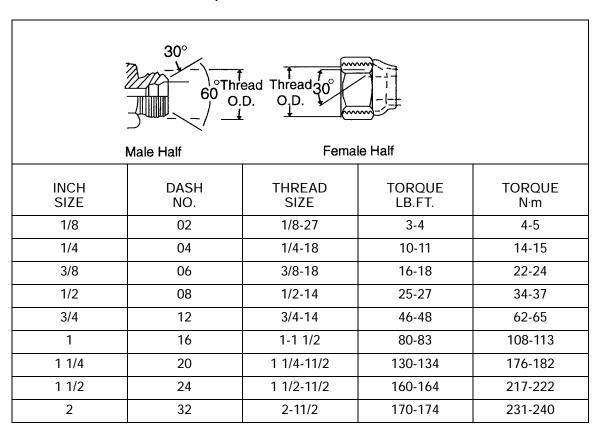


Table E-8. Torque Limits For NPSM Swivel Connections



# APPENDIX F

## MANDATORY REPLACEMENT PARTS

#### Section I. INTRODUCTION

#### F-1. SCOPE.

This appendix lists all mandatory replacement parts required for performance of Unit Support Maintenance of the PLS truck. It authorizes the requisitioning, issue, and disposition of consumable repair parts. All consumable repair parts listed in the maintenance tasks are listed here for ease of reference.

## F-2. EXPLANATION OF COLUMNS (SECTION II).

- a. Column (1) Replacement Part Reference Code. This number is assigned to the entry in the listing and is referenced in the narrative task box to identify the part e.g., Clamp (Item 12, Appendix F).
- **b.** Column (2) Nomenclature. Indicates the federal item name and, if required, a description to identify the item.
  - c. Column (3) Part Number. This is the vendor number assigned to the item.
- **d.** Column (4) National Stock Number. This is the National Stock Number assigned to the item; use it to request or requisition the item.

Section II. MANDATORY REPLACEMENT PARTS LIST

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
1	Belt Set, (3)	3113452	
2	Belt Set, Vee, (2)	1934800	3030-00-492-8106
3	Bushing	1X1/4PTR-B	4730-01-338-1459
4	Bushing	12406FX	5365-00-402-5376
5	Bypass Valve	A-DF-216	4820-01-359-1067
6	Cable, Drain Valve	SN-153	4010-01-348-6039
7	Cap, End Splice	7040700	
8	Capacitor	1972630	5910-01-364-9163
9	Channel	AS-1340	5330-01-111-2281
10	Channel, Rubber	101-2203	5330-01-267-7542
11	Channel, Rubber	126890	5330-01-155-1938
12	Clamp	24433	5340-01-131-8313
13	Clamp	32664AX	5340-01-131-8312
14	Clamp	5137620	5340-01-114-5623
15	Clamp	700-118	4730-01-212-8276
16	Clamp	700-120	4730-01-199-1458
17	Clamp	700-88	5340-01-355-7648
18	Clamp	90359-A	4730-01-353-9723
19	Clamp	B54-32780	4730-00-278-2523
20	Clamp	C0V-2515	5340-01-060-8686
21	Clamp	51689AX	5340-01-167-4146
22	Clamp, Loop	H360-4-2	5340-01-151-8391
23	Clip, Cable	57972	5340-01-193-9654
24	Clip, Push	Н360-7-2	5340-01-224-8368
25	Contact, Electrical	12034051	5940-01-342-0712
26	Contact, Electrical	12084563	5999-01-321-1925
27	Contact, Electrical	12089305	5999-01-319-7394
28	Cross and Bearing	5-103X	2530-01-244-4949
29	Dust Boot	12010293	5975-01-226-8078
30	Dust Boot	12015323	5975-01-310-5011
31	Element, Filter	100696-E	2940-01-213-1135
32	Element, Filter	1317673	2940-01-347-7460

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
33	Element, Filter	2020-PMOR	2910-01-344-5791
34	Element, Strainer	5106910	4730-01-160-5668
35	Fastener And Seal Kit	50009501	5340-01-363-9215
36	Fastener And Seal Kit	50009503	5330-01-358-9309
37	Fastener And Seal Kit	50009504	5330-01-358-9308
38	Filter and Gasket	23518524	2940-01-314-1345
39	Filter Element Kit	MTP-95-551	4330-01-026-6371
40	Filter, Fuel	23518481	2910-01-423-2859
41	Filter, Hydraulic	1314130	4330-01-232-8305
42	Fitting, Lubrication	MS15002-3	4730-00-172-0015
43	Gasket	02343-02	5330-01-193-5315
44	Gasket	0-615C46XA	5330-01-348-8345
45	Gasket	11007B	5330-01-344-0539
46	Gasket	1198559	5330-01-358-8219
47	Gasket	1199479	5330-01-234-2618
48	Gasket	12357897	6220-01-319-5509
49	Gasket	14079550	5330-00-107-3925
50	Gasket	1728230	5330-01-347-9858
51	Gasket	1958330	5330-01-358-5561
52	Gasket	23016336	5330-01-328-7634
53	Gasket	5100860	5300-01-058-8267
54	Gasket	5104081	5330-01-078-7186
55	Gasket	5117786	5330-00-781-7117
56	Gasket	5130995	5330-00-980-1546
57	Gasket	5136678	5330-00-198-7953
58	Gasket	5766-1211-6	5330-01-242-2698
59	Gasket	731740-002	
60	Gasket	7716570	5330-00-771-6570
61	Gasket	8921312	5330-01-206-3263
62	Gasket	8924413	
63	Gasket	92-158	5330-01-058-7118
64	Gasket	A/281	5330-01-352-1997

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
65	Gasket	DIN7603A 14X18	
66	Gasket	EE100969	9330-01-185-4466
67	Gasket	M25988/1-246	5330-01-189-6351
68	Gasket	NE-71A	5330-01-277-5103
69	Gasket Strip	2050690	5330-01-394-8346
70	Gasket, Breather Filler	FB-7	5330-01-406-8221
71	Gasket, Headlight	1400940	5330-01-234-7640
72	Grommet	459-A	5330-01-049-0550
73	Guide Assy, Pawl	NA1779M195	3040-01-351-4061
74	Guide Assy, Pawl	NA22297U4597	3040-01-350-3980
75	Hardware, Mounting	GS-2655	5340-01-365-3144
76	Housing, Tach	5106771	6680-01-086-4470
77	Insulation	1949200	2540-01-370-6144
78	Insulation	1949220	2540-01-367-7392
79	Insulation	1949230	2540-01-368-9962
80	Insulation	C04610	2510-01-389-0708
81	Isolator	23512307	5340-01-414-2177
82	Journal And Bearing Kit	5-438X	2520-01-339-0533
83	Journal And Bearing Kit	5-510X	2520-01-339-0532
84	Journal And Bearing Kit	5-515X	2520-01-289-8307
85	Key	1363190	5315-01-165-2188
86	Kit, Mounting	893236	4810-01-400-6041
87	Kit, Packing	SK-10-4	
88	Lamp	E-013-001	6210-01-345-6315
89	Locknut	0-952A14	5310-00-725-9479
90	Locknut	10095	5310-01-063-1755
91	Locknut	110310A	5310-01-159-8178
92	Locknut	110311A	5310-01-111-0645
93	Locknut	110312A	5310-01-150-5918
94	Locknut	112556A	5310-01-372-6378
95	Locknut	114358AX	
96	Locknut	115307A	5310-01-151-1036

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
97	Locknut	1244954-2	5310-00-074-1387
98	Locknut	1333510	5310-01-340-5671
99	Locknut	1334320	5310-01-161-9123
100	Locknut	1408910	5310-01-111-0645
101	Locknut	1437220	
102	Locknut	1525130	5310-01-357-8840
103	Locknut	1571850	5310-01-288-5096
104	Locknut	1571870	5310-01-352-7732
105	Locknut	1598030	5310-01-342-8595
106	Locknut	1600460	5310-01-346-9445
107	Locknut	1605420	5310-00-542-0087
107.1	Locknut	1HT191	5310-01-383-6080
108	Locknut	203145	5310-00-012-0368
109	Locknut	21NE-040	5310-01-066-6759
110	Locknut	22NM04	5310-00-207-9341
111	Locknut	2-X-5731	5310-00-447-4251
112	Locknut	40X-1239	5310-01-377-1996
113	Locknut	41NE120	5310-00-530-0239
114	Locknut	434-A	5310-01-063-8970
115	Locknut	44NTE-1210	5310-01-346-3789
116	Locknut	5340910	5310-01-280-6538
117	Locknut	60860AX	
118	Locknut	60861A	5310-01-061-5678
119	Locknut	7-660-082504	5310-01-354-8734
120	Locknut	767HX1	5310-01-058-3183
121	Locknut	76985	5310-00-432-3959
122	Locknut	88881	5310-01-349-0759
123	Locknut	93604342	5310-01-081-5351
124	Locknut	AN365-1024A	5310-00-208-1918
125	Locknut	ATS2-518	5340-01-196-0380
126	Locknut	F41NE2076-1216	5310-01-357-4700
127	Locknut	L-10-MNS-500-X-1	5310-01-345-2350

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

Index No.   Nomenclature   Part Number   National Stock Number	(1)	(2)	(3)	(4)
129	Index No.	Nomenclature	Part Number	National Stock Number
130	128	Locknut	MS17828-7C	5310-01-117-5055
131	129	Locknut	MS21044C08	5310-00-982-6814
132	130	Locknut	MS51849-74	5305-00-470-3321
133	131	Locknut	MS51922-1	5310-00-088-1251
134         Locknut         MS51943-31         5310-00-061-4560           135         Locknut         MS51968-14         5310-00-732-0560           136         Locknut         N08         5310-00-185-6389           137         Locknut         N9406         5310-01-362-6171           138         Locknut         N9410         5310-01-348-8398           139         Locknut         SN104-NM-22         5310-01-355-0217           140         Locknut         T893R         5310-01-288-1116           141         Locknut         TLA-1213-GRC         5310-01-081-8244           142         Locknut         TLA-3410-GRC         5310-01-080-5747           143         Locknut         TLA-3816-GRC         5310-01-080-5747           143         Locknut         TLA-7809-GRC         5310-01-107-3586           145         Locknut         V75700689         5310-01-107-3586           145         Locknut         XB-769         5310-01-150-8599           147         Lockscrew         11504603         5305-01-336-6757           148         Lockscrew         31 WLFS 1420         5310-01-393-7077           149         Lockwasher         100-0000-051         5310-01-081-078           1	132	Locknut	MS51922-17	5310-00-087-4652
135         Locknut         MS51968-14         5310-00-732-0560           136         Locknut         N08         5310-00-185-6389           137         Locknut         N9406         5310-01-362-6171           138         Locknut         N9410         5310-01-348-8398           139         Locknut         SN104-NM-22         5310-01-355-0217           140         Locknut         T893R         5310-01-288-1116           141         Locknut         TLA-1213-GRC         5310-01-081-8244           142         Locknut         TLA-3410-GRC         5310-01-080-5747           143         Locknut         TLA-3816-GRC         5310-01-080-5747           143         Locknut         TLA-7809-GRC         5310-01-222-9097           144         Locknut         TLA-7809-GRC         5310-01-373-3557           146         Locknut         XB-769         5310-01-355-357           146         Locknut         XB-769         5310-01-150-8599           147         Lockscrew         11504603         5305-01-336-6757           148         Lockwasher         100-0000-051         5310-01-393-7077           149         Lockwasher         114021         5310-01-081-078           151	133	Locknut	MS51922-9	5310-00-984-3806
136         Locknut         N9406         5310-00-185-6389           137         Locknut         N9406         5310-01-362-6171           138         Locknut         N9410         5310-01-348-8398           139         Locknut         SN104-NM-22         5310-01-355-0217           140         Locknut         T893R         5310-01-288-1116           141         Locknut         TLA-1213-GRC         5310-01-081-8244           142         Locknut         TLA-3410-GRC         5310-01-080-5747           143         Locknut         TLA-3816-GRC         5310-01-222-9097           144         Locknut         TLA-7809-GRC         5310-01-222-9097           144         Locknut         V75700689         5310-01-325-3757           146         Locknut         XB-769         5310-01-345-3757           146         Locknut         XB-769         5310-01-35-8599           147         Lockscrew         11504603         5305-01-336-6757           148         Lockscrew         31 WLFS 1420         5310-01-393-7077           149         Lockwasher         100-0000-051         5310-01-393-7077           149         Lockwasher         1244954-2         5310-01-081-0798           1	134	Locknut	MS51943-31	5310-00-061-4560
137	135	Locknut	MS51968-14	5310-00-732-0560
138         Locknut         N9410         5310-01-348-8398           139         Locknut         SN104-NM-22         5310-01-355-0217           140         Locknut         T893R         5310-01-288-1116           141         Locknut         TLA-1213-GRC         5310-01-081-8244           142         Locknut         TLA-3410-GRC         5310-01-080-5747           143         Locknut         TLA-3816-GRC         5310-01-080-5747           144         Locknut         TLA-7809-GRC         5310-01-222-9097           144         Locknut         TLA-7809-GRC         5310-01-107-3586           145         Locknut         V75700689         5310-01-345-3757           146         Locknut         XB-769         5310-01-345-3757           148         Lockscrew         11504603         5305-01-336-6757           148         Lockscrew         31 WLFS 1420         5310-01-393-7077           149         Lockwasher         100-0000-051         5310-01-393-7077           149         Lockwasher         114021         5310-01-081-0798           151         Lockwasher         1244954-2         5310-00-074-1387           152         Lockwasher         1344950         5310-00-013-8526 <t< td=""><td>136</td><td>Locknut</td><td>N08</td><td>5310-00-185-6389</td></t<>	136	Locknut	N08	5310-00-185-6389
139	137	Locknut	N9406	5310-01-362-6171
140       Locknut       T893R       5310-01-288-1116         141       Locknut       TLA-1213-GRC       5310-01-081-8244         142       Locknut       TLA-3410-GRC       5310-01-080-5747         143       Locknut       TLA-3816-GRC       5310-01-222-9097         144       Locknut       TLA-7809-GRC       5310-01-107-3586         145       Locknut       V75700689       5310-01-345-3757         146       Locknut       XB-769       5310-01-345-3757         148       Lockscrew       11504603       5305-01-336-6757         148       Lockscrew       31 WLFS 1420       5310-01-333-7077         149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-01-373-2539         156       Lockwasher       201506       5310-01-373-2539	138	Locknut	N9410	5310-01-348-8398
141       Locknut       TLA-1213-GRC       5310-01-081-8244         142       Locknut       TLA-3410-GRC       5310-01-080-5747         143       Locknut       TLA-3816-GRC       5310-01-222-9097         144       Locknut       TLA-7809-GRC       5310-01-107-3586         145       Locknut       V75700689       5310-01-345-3757         146       Locknut       XB-769       5310-01-150-8599         147       Lockscrew       11504603       5305-01-336-6757         148       Lockscrew       31 WLFS 1420       5310-01-393-7077         149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-01-101-2490 <td>139</td> <td>Locknut</td> <td>SN104-NM-22</td> <td>5310-01-355-0217</td>	139	Locknut	SN104-NM-22	5310-01-355-0217
142         Locknut         TLA-3410-GRC         5310-01-080-5747           143         Locknut         TLA-3816-GRC         5310-01-222-9097           144         Locknut         TLA-7809-GRC         5310-01-107-3586           145         Locknut         V75700689         5310-01-345-3757           146         Locknut         XB-769         5310-01-150-8599           147         Lockscrew         11504603         5305-01-336-6757           148         Lockscrew         31 WLFS 1420         5310-01-393-7077           149         Lockwasher         100-0000-051         5310-00-045-3299           150         Lockwasher         114021         5310-01-081-0798           151         Lockwasher         1244954-2         5310-00-074-1387           152         Lockwasher         1344950         5305-01-155-6107           153         Lockwasher         138526         5310-00-013-8526           154         Lockwasher         1459-254         5310-00-171-1734           155         Lockwasher         16FW008032         5310-00-988-8820           156         Lockwasher         201506         5310-01-373-2539           158         Lockwasher         201946         5310-00-013-8572	140	Locknut	T893R	5310-01-288-1116
143       Locknut       TLA-3816-GRC       5310-01-222-9097         144       Locknut       TLA-7809-GRC       5310-01-107-3586         145       Locknut       V75700689       5310-01-345-3757         146       Locknut       XB-769       5310-01-150-8599         147       Lockscrew       11504603       5305-01-336-6757         148       Lockscrew       31 WLFS 1420       5310-01-393-7077         149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-01-101-2490	141	Locknut	TLA-1213-GRC	5310-01-081-8244
144       Locknut       TLA-7809-GRC       5310-01-107-3586         145       Locknut       V75700689       5310-01-345-3757         146       Locknut       XB-769       5310-01-150-8599         147       Lockscrew       11504603       5305-01-336-6757         148       Lockscrew       31 WLFS 1420       5310-01-393-7077         149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-01-101-2490	142	Locknut	TLA-3410-GRC	5310-01-080-5747
145       Locknut       V75700689       5310-01-345-3757         146       Locknut       XB-769       5310-01-150-8599         147       Lockscrew       11504603       5305-01-336-6757         148       Lockscrew       31 WLFS 1420       5310-01-393-7077         149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	143	Locknut	TLA-3816-GRC	5310-01-222-9097
146       Locknut       XB-769       5310-01-150-8599         147       Lockscrew       11504603       5305-01-336-6757         148       Lockscrew       31 WLFS 1420       5310-01-393-7077         149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	144	Locknut	TLA-7809-GRC	5310-01-107-3586
147       Lockscrew       11504603       5305-01-336-6757         148       Lockscrew       31 WLFS 1420       5310-01-393-7077         149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	145	Locknut	V75700689	5310-01-345-3757
148       Lockscrew       31 WLFS 1420       5310-01-393-7077         149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	146	Locknut	XB-769	5310-01-150-8599
149       Lockwasher       100-0000-051       5310-00-045-3299         150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	147	Lockscrew	11504603	5305-01-336-6757
150       Lockwasher       114021       5310-01-081-0798         151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	148	Lockscrew	31 WLFS 1420	5310-01-393-7077
151       Lockwasher       1244954-2       5310-00-074-1387         152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	149	Lockwasher	100-0000-051	5310-00-045-3299
152       Lockwasher       1344950       5305-01-155-6107         153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	150	Lockwasher	114021	5310-01-081-0798
153       Lockwasher       138526       5310-00-013-8526         154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	151	Lockwasher	1244954-2	5310-00-074-1387
154       Lockwasher       1459-254       5310-00-171-1734         155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	152	Lockwasher	1344950	5305-01-155-6107
155       Lockwasher       16FW008032       5310-00-988-8820         156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	153	Lockwasher	138526	5310-00-013-8526
156       Lockwasher       1978HX         157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	154	Lockwasher	1459-254	5310-00-171-1734
157       Lockwasher       201506       5310-01-373-2539         158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	155	Lockwasher	16FW008032	5310-00-988-8820
158       Lockwasher       201946       5310-00-013-8572         159       Lockwasher       202210       5310-01-101-2490	156	Lockwasher	1978HX	
159 Lockwasher 202210 5310-01-101-2490	157	Lockwasher	201506	5310-01-373-2539
	158	Lockwasher	201946	5310-00-013-8572
160 Lockwasher 210104 5310-01-K49-2583	159	Lockwasher	202210	5310-01-101-2490
	160	Lockwasher	210104	5310-01-K49-2583

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
161	Lockwasher	2239HX	5310-00-209-1218
162	Lockwasher	2249HX	
162.1	Lockwasher	2250HX	
163	Lockwasher	2251HX	5310-01-354-3729
164	Lockwasher	2434	5310-00-775-5139
165	Lockwasher	318B	5310-01-061-5302
166	Lockwasher	318BX	
167	Lockwasher	3231	5310-00-032-1814
168	Lockwasher	351AX	5310-01-129-0450
169	Lockwasher	352A	5310-01-081-1283
170	Lockwasher	352AX	5310-01-081-1283
171	Lockwasher	353AX	5310-00-582-5965
172	Lockwasher	354AX	5310-01-068-8446
173	Lockwasher	355AX	5310-01-133-2130
174	Lockwasher	362AX	5310-01-062-3379
175	Lockwasher	371AX	5310-00-775-5139
176	Lockwasher	62ANBH-4	4730-01-349-7765
177	Lockwasher	777-A	5310-01-061-4481
178	Lockwasher	7-950-160050	5310-01-292-4150
179	Lockwasher	8104200064	5310-01-358-6624
180	Lockwasher	93613642	5310-01-068-8446
180.1	Lockwasher	CA300302	5310-01-478-2605
181	Lockwasher	C-972	5310-01-210-7427
182	Lockwasher	HLKW025EG	5310-01-105-2652
183	Lockwasher	L051275	5310-10-244-8747
184	Lockwasher	MS35333-37	5310-00-579-0079
185	Lockwasher	MS35333-40	5310-00-550-1130
186	Lockwasher	MS35333-51	5310-00-655-6927
187	Lockwasher	MS35335-30	5310-00-209-0788
188	Lockwasher	MS35335-31	5310-00-596-7693
189	Lockwasher	MS35335-49	5310-00-582-6714
190	Lockwasher	MS35338-100	5310-00-261-8278
191	Lockwasher	MS35338-103	5310-00-184-8971

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
192	Lockwasher	MS35338-15	5310-00-012-1326
193	Lockwasher	MS35338-42	5310-00-045-3299
194	Lockwasher	MS35338-43	5310-00-045-3296
195	Lockwasher	MS35338-44	5310-00-582-5965
196	Lockwasher	MS35338-45	5310-00-407-9566
197	Lockwasher	MS35338-46	5310-00-637-9541
198	Lockwasher	MS35338-48	5310-00-584-5272
199	Lockwasher	MS35338-50	5310-00-820-6653
200	Lockwasher	MS35338-51	5310-00-584-7888
201	Lockwasher	MS35338-6	5310-00-010-3319
202	Lockwasher	MS35338-8	5310-00-261-7340
203	Lockwasher	MS35649-204	5310-00-954-9760
204	Lockwasher	MS45904-60	5310-00-080-9786
205	Lockwasher	MS51413-8	
206	Lockwasher	MS51848-12	5310-00-688-2195
207	Lockwasher	N405P13C16	5310-01-044-2295
208	Lockwasher	N9015	5310-01-046-0186
209	Lockwasher	N9018	5310-01-032-4827
210	Lockwasher	N9461	5310-01-348-8392
211	Lockwasher	W08	5310-01-355-8794
212	Lockwasher (#10 Stud)	85020	5310-01-373-6180
213	Nut	MS35650-103	5310-00-988-2652
214	Nut	MS51967-32	5310-00-762-6242
215	Nut	MS51967-35	5310-00-762-6241
216	Nut	MS51967-38	5310-00-762-6247
217	Nut, Push On	C12044-017-4	5310-00-110-8742
218	Nut, Stop	A1300R	
219	Nut, Tenz	1244954-2	5310-00-074-1387
220	Packing, Preformed	0526453-00	5330-00-071-6651
221	Packing, Preformed	11-222	5330-00-198-6190
222	Packing, Preformed	11350	5330-01-147-6003
223	Packing, Preformed	11639519-1	5330-00-463-0200

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
224	Packing, Preformed	11639519-2	5330-00-462-0907
225	Packing, Preformed	2014N103-70	5330-00-213-8722
226	Packing, Preformed	2-016N552-90	5330-01-115-8225
227	Packing, Preformed	2-021N0552	4730-00-541-0938
228	Packing, Preformed	22012-6	5330-00-200-8125
229	Packing, Preformed	22012-8	5330-00-996-8627
230	Packing, Preformed	2-238N674-70	5330-00-172-7223
231	Packing, Preformed	22617-10	5330-01-040-4772
232	Packing, Preformed	22617-12	5330-00-228-7196
233	Packing, Preformed	22617-16	5330-01-168-0885
234	Packing, Preformed	22617-20	5330-01-168-1802
235	Packing, Preformed	22617-4	
236	Packing, Preformed	22617-6	5330-01-198-8439
237	Packing, Preformed	22617-8	5330-01-224-2273
238	Packing, Preformed	2282320	
239	Packing, Preformed	2282330	
240	Packing, Preformed	23017303	5330-01-334-9946
241	Packing, Preformed	23504641	5330-01-336-2997
242	Packing, Preformed	235063	5330-00-454-0370
243	Packing, Preformed	262332	5330-00-443-2045
244	Packing, Preformed	3-916N0552	
245	Packing, Preformed	3-924N552-90	5330-01-038-3074
246	Packing, Preformed	52-49529-00	5330-01-348-8331
247	Packing, Preformed	A-103	5330-00-115-6327
248	Packing, Preformed	A307777000-8	5330-00-920-4157
249	Packing, Preformed	ARP568-014	5330-01-213-6795
250	Packing, Preformed	FF9446-14	
251	Packing, Preformed	FF9446-18	5330-01-092-5503
252	Packing, Preformed	FF9446-21	5330-01-269-4323
253	Packing, Preformed	FF9446-219	5330-00-013-7784
254	Packing, Preformed	FF9446-222	5330-00-984-3808
255	Packing, Preformed	FF9446-25	5330-01-269-6152

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
256	Packing, Preformed	FF9855-12	5330-01-376-9629
257	Packing, Preformed	GG108-NP04-10	4730-01-346-4684
258	Packing, Preformed	MS28775-013	5331-00-684-3420
259	Packing, Preformed	MS28775-223	5330-00-171-6649
260	Packing, Preformed	MS29512-16	5330-00-263-8034
261	Packing, Preformed	V75500858	5330-01-350-6007
262	Packing, Preformed	VS-1087-4	5330-01-371-5119
263	Packing, Pump Piston	P4-4	5330-00-122-0624
264	Pad, Rubber	1946480	5330-01-363-7020
265	Pin, Cotter	0900806-1	5315-00-254-1657
266	Pin, Cotter	126761A	5315-01-157-0960
267	Pin, Cotter	1749HX	
268	Pin, Cotter	1840070	
269	Pin, Cotter	L6451-101	5315-00-187-9591
270	Pin, Cotter	MS24665-134	5315-00-839-5820
271	Pin, Cotter	MS24665-151	5315-00-815-1405
272	Pin, Cotter	MS24665-319	5315-01-267-7570
273	Pin, Cotter	MS24665-353	5315-00-839-5822
274	Pin, Cotter	MS24665-491	5315-00-059-0206
275	Pin, Cotter	MS24665-498	5315-00-849-9854
276	Pin, Cotter	MS24665-624	5315-00-059-0217
277	Pin, Cotter	MS24665-627	5315-00-013-7508
278	Pin, Cotter	XB-T-60	5315-01-204-4893
279	Pin, Roll	1840070	
280	Pin, Roll	XB-21-S-187-1250	5315-01-448-0604
281	Pin, Roll	XB-21-S-312-1250	
282	Pin, Roll	XB-21-S-312-2500	
283	Pin, Roll	XB-21-S-500-1000	5315-01-448-0599
284	Pin, Roll	XB-S05742	
285	Pin, Spring	3145955	
286	Plug	A-LF-2550	5330-01-276-7351
287	Preformed Packing Kit	RN-60-A	4440-01-337-7324

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
288	Preformed Packing Kit	RN-60-V	5330-01-377-2460
289	Quick Edge	75000317	2510-01-176-1177
290	Retainer, Packing	8-238N300-90	5330-01-065-5959
291	Rubber Liner	124660A	
292	Rubber Strip	70-17-30	9320-00-491-5351
293	Screw	118941A	5305-01-156-5099
294	Screw	1344950	5305-01-155-6107
295	Screw	1778HX	5305-01-133-2114
296	Screw	23512308	5306-01-411-6384
297	Screw	5103642	5305-01-078-1999
298	Screw	59030AX	5305-00-984-6210
299	Screw	B71-10015-002	5305-01-352-2066
300	Screw	MS35206-267	5305-00-984-6214
301	Screw	MS35207-267	5305-00-993-1851
302	Screw	MS90725-34	5306-00-225-8499
303	Screw	MS90725-60	5305-00-269-3211
304	Screw	MS90725-8	5305-00-225-3839
305	Screw	SPLE101D05	5306-01-156-8678
306	Screw (Sheet Metal)	1381HX1	5305-01-134-2052
307	Screw Washer Assembly	1756840	5305-01-354-5708
308	Screw Washer Assembly	2050700	5305-01-394-3551
309	Screw, Self-locking	02092	5305-00-696-5115
310	Screw, Self-locking	1367HX1	5305-01-062-1017
311	Screw, Self-locking	23015458	5306-01-363-4057
312	Screw, Self-locking	96-212	5305-01-205-0041
313	Screw, Self-tapping	1324510	5305-01-157-5624
314	Screw, Self-tapping	1345280	5305-01-159-8544
315	Screw, Self-tapping	1354490	5305-01-274-0028
316	Screw, Self-tapping	1723180	5305-01-145-4003
317	Screw, Self-tapping	54067AX	5305-01-150-8714
318	Screw, Tapping	2763HX	5305-01-353-6120
319	Screws, Self-locking	31 WLFS 51618-062	5306-01-350-8223

Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
320	Seal	1862760	
321	Seal	1941570	5330-01-363-7019
322	Seal	2282340	
323	Seal	2282350	
324	Seal	23504641	5330-01-336-2997
325	Seal	3S9643-00	5330-00-246-6380
326	Seal	5104105	5330-01-163-8178
327	Seal	75001366	9390-01-179-4508
328	Seal	NE-71A	5330-01-277-5103
329	Seal, Door	75001366	9390-01-179-4508
330	Seal, Plain	5103646	5330-01-088-2740
331	Seal, Preformed	101-2203	5330-01-267-7542
332	Seal, Ring	N1205B1666	5330-01-351-7881
333	Seal, Ring	N1205C1667	5330-01-350-5385
334	Splice, Conductor	327025	5940-01-368-9579
335	Stem, Valve	N-1268	2640-01-354-9424
336	Strip, Nut	128757A	5310-01-157-0894
337	Strip, Rubber	350907	5330-01-156-5266
338	Strip, Rubber	352731	5330-00-114-2073
339	Stud	52-49523-00	5307-01-348-7046
340	Tape, Rubber Adhesive	SJ5816	9320-01-299-3332
341	U-joint Kit	5-471X	2520-01-359-8444
342	Valve Core	8500V	2640-00-004-8297
343	Washer	1605640	5310-01-383-7327
344	Washer	MS27183-10	5310-00-809-4058
345	Washer	MS27183-7	5310-00-809-8544
346	Washer	MS27183-8	5310-00-809-8546
347	Washer	MS37183-62	5310-01-380-3474
348	Washer	V75503675	5310-01-389-2364
349	Washer, Copper	31425BX	2520-01-041-3542
350	Washer, Key	TW107	5310-01-014-5136
351	Washer, Plastic	16FW008032	5310-00-988-8820

# Section II. MANDATORY REPLACEMENT PARTS LIST (CONT)

(1)	(2)	(3)	(4)
Index No.	Nomenclature	Part Number	National Stock Number
352 353 353.1	Washer, Rubber Washer, Sealing Washer, Special	8-325N300-90 1760040 3264358	5330-00-156-3208 5310-01-353-2062
354	Washer, Star	50001716	5310-01-372-6391

## **APPENDIX G**

# **TOOL IDENTIFICATION LIST**

### Section I. INTRODUCTION

# G-1. SCOPE.

This appendix lists all of the tools needed to repair the truck.

### G-2. GENERAL.

This appendix is a list of tools, both common and special, test equipment and tool kits used at unit level to repair the truck. This list is arranged alphabetically and shows the nomenclature, part number (P/N), National Stock Number (NSN) and references when applicable. The index number corresponds to the index number found in the task box of maintenance procedures.

Section II. COMMON TOOLS, TEST EQUIPMENT AND TOOL KITS

Item No.	Description	Part No.	NSN	Reference
1	Adapter, Torque Wrench	J-8932-B	5120-00-019-5232	
2	Adapter, Radiator	J-29003-A	4910-01-170-4929	
3	Analyzer Set, STE/ICE-R	12259266	4910-01-222-6589	
4	Bar, Crow	10501985	5120-00-224-1390	SC 4910-95-A74
5	Bar, Wrecking	130	5120-00-293-0665	SC 4910-95-A72-HR
6	Bit, Set	38699-1	5120-01-170-4454	SC 4910-95-A72-HR
7	Caliper, Micrometer, Inside	124B	5120-00-221-1921	
8	Cap And Plug Set	10935405	5340-00-450-5718	
9	Caps, Vise Jaw	GGG-C-137	5120-00-221-1506	SC 4910-95-A74
10	Clamp, Machinist's	GGG-C-406	5120-00-222-1612	SC 4910-95-A72-HR
11	Compressor Unit, Air	MIL-C-13874	4130-00-752-9633	SC 4910-95-A72-HR
12	Connector Remover (DEUTSCH)	114010	5120-01-158-4707	
13	Crimping Tool	J35123	5120-01-355-0844	
14	Crimping Tool (Cannon)	995-0001-904	5120-01-374-8937	
15	DDEC Repair Kit	J-35888	2815-01-355-5993	
16	Dispensing Pump	FEDXXD370	4930-00-287-8293	SC 4910-95-A72-HR
17	Drill, Electric, Portable	WD00661	5130-00-293-1849	SC 4910-95-A74
18	Drill, Electric, Portable, 1/4 in.	1070	5130-00-889-8993	SC 4910-95-A31
19	Drill Set, Twist	GGG-D-751	5133-00-293-0983	SC 4910-95-A74
20	Drill Set, Twist	GGG-D-751	5133-00-449-6775	SC 3470-95-A02
21	Drum, Storage 57 Gal	MIL-D-6054	8110-00-082-2626	
22	Extractor Tool, Electrical	901019-3	5120-01-015-2154	
23	Extractor Tool, Electrical	305183	5120-01-020-5926	

Section II. COMMON TOOLS, TEST EQUIPMENT AND TOOL KITS (CONT)

Item No.	Description	Part No.	NSN	Reference
23.1	Fault Code Retrieval Device (FCRD)	CA1 05 020		
24	Funnel	L-F-1593	7240-00-404-9795	SC 4910-95-A74
25	Gage, Air Inflation	1506	4910-00-204-2644	
26	Gage, Belt Tension (Tensiometer)	BT-33-73BF	4935-01-254-9808	
27	Gage, Feeler	007958	5210-01-214-2138	
28	Gloves, Chemical Oil Protective	ZZ-G-381	8415-00-641-4601	SC 4910-95-A74
29	Gloves, Heavy Duty	A-A-50022	8415-00-268-7859	SC 4910-95-A72-HR
30	Goggles, Industrial	GGG-G-13	4140-00-269-7912	SC 4910-95-A74
31	Gun, Air Blow	GGG-G-770	4940-00-333-5541	SC 4910-95-A72-HR
32	Gun, Heat	500	4940-00-561-1002	
33	Hammer, Hand Soft Plastic	3-HD	5120-01-065-9037	SC 4910-95-A72-HR
34	Handle, Driver	J-3154-1	5120-00-808-5082	
35	Handler, Installer	J7079-2	5120-01-977-5578	
36	Harness, Breakout	J34517	6150-01-373-7771	
37	Hose, Drain	ZZ-H-461	4720-00-356-8557	SC 4910-95-A74
38	Insertion Tool, (Cannon)	CIT-SS-10	5120-01-374-8968	
39	Installer, Seal	J8550	5120-00-977-5579	
40	Jack, Hydraulic, Hand	5029209-111-101	5120-00-224-7330	SC 4910-95-A74
41	Jack, Kit, Hydraulic, Hand	GGG-J-60	5120-00-587-4144	
42	Jackstand, Trestle	306	4910-00-251-8013	SC 4910-95-A74
43	Measure, Liquid	MIL-M-43530	7240-00-138-7984	
44	Multimeter	ANURM105C	6625-00-999-6282	SC 4910-95-A72-HR
45	Multiplier, Torque	292	5120-00-574-9318	SC 4910-95-A72-HR
46	Pan, Drain (6 Gal)	MIL-P-45819	4940-00-795-3595	
47	Pan, Drain (4 Gal)	450	4940-00-387-9592	SC 4910-95-A74
48	Pliers, Brake Repair	131A	5120-00-690-8044	SC 4910-95-A74
49	Pliers, Retaining Ring	2BH945	5120-01-375-5699	
50	Pressure Test Kit	3SK911	4910-01-378-9068	
51	Puller Kit, Universal	1677	5180-00-423-1596	SC 4910-95-A73
52	Pulley Kit, Pump, Roof Mount	2HP645	5120-01-375-5700	
53	Reader, Diagnostic	J38500-1	4910-01-343-3508	
54	Removal Tool, Oil Filter	2304	5120-00-865-0933	SC 4910-95-A72-HR
55	Remover, Connector	J38384	5120-01-355-3012	
56	Repair Tool, Pneumatic Tire, Valve	7471	5120-00-308-3809	SC 4910-95-A74
57	Respirator, Air Filter	GGG-M-125/6	4240-00-022-2524	SC 4910-95-A72-HR
58	Rivet Gun	352	5130-00-982-8078	
59	Scriber, Machinist's, 8 To 9 In Long	68A	5120-00-221-7063	
60	Socket Set, Deepwell, 1/2 In.	GGG-W-641	5120-00-596-8622	SC 4910-95-A72-HR
61	Socket Set, 3/4 In.	GGG-W-641	5120-00-204-1999	SC 4910-95-A72-HR
62	Socket Set, 3/8 In.	221FSMY	5120-01-117-3876	SC 4910-95-A72-HR

Section II. COMMON TOOLS, TEST EQUIPMENT AND TOOL KITS (CONT)

Section II. Common 100E3, 1E31 EQUIPMENT AND 100E RITS (CONT)				
Item No.	Description	Part No.	NSN	Reference
63	Socket, Wheel Bearing Adj. Nut			
	3 1/4 In. 6 Pt.	1908	5120-01-144-5331	SC 4910-95-A74
64	Soldering Kit, Torch	LP-999G	3439-00-542-0531	SC 4910-94-A74
65	Strainer Tool	FC 88A	5120-01-328-2504	
66	Tape, Measurer	GGG-T-106	5120-01-554-7085	SC 4910-95-A72-HR
67	Terminal Crimper	J35688	5120-01-355-0845	
68	Terminal Remover	J33095	5120-01-353-2534	
69	Terminal Remover	J35689-A	5120-01-357-2937	
70	Terminal Remover, Weatherpac	J36400-5	5120-01-374-8969	
71	Tester, Pressure, Radiator	J24460-01	4910-01-170-4928	
72	Tool Kit, Blind Rivet	D-100-MIL-1	5180-01-201-4978	SC 4910-95-A74
73	Tool Kit, Electric	7550526	5180-00-876-9336	SC 4910-95-A72-HR
74	Tool Kit, General Mechanic's: Automotive	SC-5180-90-N26	5180-00-177-7033	SC 5180-90-N26
75	Vise, Machinist's	504M2	5120-00-293-1439	SC 4910-95-A74
75 76	· ·	J38852	5120-00-293-1439	SC 4910-95-A/4
	Wearsh Pay 1/2 In			
77 79	Wrench, Box 1/2 In.	J4242	5120-00-591-2685	SC 4010 05 A74
78 79	Wrench, Combination 1 1/16 In.	1234	5120-00-228-9515	SC 4910-95-A74
	Wrench, Combination 1 1/8 In.	1172	5120-00-228-9516	SC 4910-95-A74
80	Wrench, Combination 1 1/4 In.	1173	5120-00-228-9517	SC 4910-95-A74
81	Wrench, Combination 1 5/16 In.	1174	5120-00-228-9518	SC 4910-95-A74
82	Wrench, Combination 1 3/8 In.	1176A	5120-00-228-9519	SC 4910-95-A74
83	Wrench, Combination 1 1/2 In.	1178	5120-00-277-8834	SC 4910-95-A74
84	Wrench, Combination 1 5/8 In.	1180	5120-01-016-7144	
85	Wrench, Combination 1 11/16 In.	A-A-1351	5120-00-184-8566	
86	Wrench, Combination 1 3/4 In.	1256	5120-00-020-8658	
87	Wrench, Combination 1 7/8 In.	1260	5120-00-020-8632	
88	Wrench, Combination 2 In.	1190	5120-00-957-3115	
89	Wrench, Combination 2 1/8 In.	1268	5120-00-203-4795	
90	Wrench, Crowfoot 1/2 In., 3/8 In Drive	FRH-1605	5120-01-114-4933	SC 4910-95-A74
91	Wrench, Pipe 3 1/2 In. Opening	GGG-W-651	5120-00-277-1485	
92	Wrench, Set, Combination	GGG-W-00645	5120-00-895-9566	SC 4910-95-CL-A74
93	Wrench Set, Socket 3/8 In. Drive	51200017510	5120-00-322-6231	SC 4910-95-A31
94	Wrench, Spanner	J41108	5120-01-375-4502	
95	Wrench, Torque (0 To 175 Lb-Ft [0-237 N·M])	1753LDF	5120-00-640-6364	SC 4910-95-A74
96	Wrench, Torque (0 To 300 Lb-Ft [0-407 N·M])	6134A	5120-00-555-1523	SC 4910-95-A72-HR
97	Wrench, Torque (0 To 600 Lb-Ft [0-814 N·M])	SW130-301	5120-00-221-7983	SC 4910-95-A31

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# Section II. COMMON TOOLS, TEST EQUIPMENT AND TOOL KITS (CONT)

Item No.	Description	Part No.	NSN	Reference
98	Wrench, Torque, 3/8 In. Drive (0 To 60 N·M)	TESI60	5120-01-112-9531	SC 4910-95-A72-HR
99	Zonal Separator, Oil And Water Spray Gun (Variable Air Supply)	MIL-S-12928CLASS1	4940-00-242-4100	SC 4910-95-A73

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# **SCHEMATICS**

The following sections contain the schematics which are the same in all volumes of TM 9-2320-364-20 and TM 9-2320-364-34.

Section I contains the schematics for trucks equipped with the 145 amp alternator and the DDEC II engine.

Section II contains the schematics for trucks equipped with the 200 amp alternator and the DDEC III/IV engine.

# **SCHEMATICS**

# Section I. 145 AMP ALTERNATOR AND DDEC II ENGINE.

Section I contains the schematics for trucks equipped with the 145 amp alternator and the DDEC II engine.

MULTIPLE CONNECTORS	MULTIPLE CONNECTORS	MULTIPLE CONNECTORS	LIGHTS	SWITCHES	TEMPERATURE SWITCHES
NUMBER ZONE SH DESCRIPTION	MUMBER ZONE SH DESCRIPTION	NUMBER ZONE SH DESCRIPTION	NUMBER ZONE SH DESCRIPTION	NUMBER ZONE SH DESCRIPTION	NUMBER ZONE SH DESCRIPTION
MC1 H3 3 CAB/ELECTRICAL BOX	MC50 C7 4 RELAYS/ATEC	MC105 E24 3 CTT ACCESS OUTPUT	LI GI6 3 PARKING BRAKE IND	SI H6 3 TURN SIGNAL/DIMMER	TSI C23 5 ETHER START
MC1 C26 4 CAB/ELECTRICAL BOX	MC51 C6 4 ECU ATEC	MC106 H4 3 DDEC DIAGNOSTIC	L2 G17 3 LOW AIR INDICATOR	S2 E13 3 IGNITION	TS2 D23 5 ENGINE WATER
MC2 D3 3 CAB/ELECTRICAL BOX	MC52 B23 4 HEATER/DIMMER	MC107 D6 6 FUEL WATER SEP	L3 G17 3 CHECK GAUGES IND	S3 F5 3 HEATER	TS3 F10 6 ENGINE WATER
MC2 D26 4 CAB/ELECTRICAL BOX	MC53 F23 3 ENGINE BRAKE	MC 108 C20 5 FUEL PUMP	L4 G17 3 RH TURN INDICATOR	S4 D8 3 SELF RECOVERY CRANE	TS4 GIO 6 ENGINE WATER
MC3 C3 3 CHASSIS	MC54 F8 6 WORK LIGHT	MC109 C15 6 CTI POWER MANIFOLD	L5 G24 3 TRANS CHECK IND	S5 HI2 3 BEACON LIGHT	
MC3 H17 6 CHASSIS	MC55 B13 6 SELF RECOVERY WINCH	MC110 C24 3 CTI AUX MANF CAB	L6 G18 3 CHECK ENGINE IND	S6 HI3 3 WORK LIGHT	
MC4 GIO 3 SWITCHES	MC56 C23 5 ETHER THERMOSTAT	MC111 B24 3 CTI POWER MANE CAB	L7 G17 3 DRIVE LINE LOCK IND	S7 HI4 3 WINDSHIELD WASHER	RELAYS
	MC57 F6 6 DRIVE LINE LOCK	MC112 B19 3 LHS LIGHTS	L8 G24 3 HI WATER TEMP IND	S8 G15 3 WINDSHIELD WIPER	NUMBER ZONE SH DESCRIPT
MC5 B12 3 WIPER MOTOR	MC58 E7 3 GAS PART FILTER	MC113 F16 6 EMERGENCY STEER SW	L9 G24 3 LOW OIL PSI IND	S9 F16 3 BLACK OUT SVCE SEL	RI G24 4 HEADLIGHTS
MC6 D15 3 THROTTLE SENSOR	\	MC114 G18 5 200 AMP OPTION	LIO G25 3 HI BEAM INDICATOR	SIO F54 3 BLACK OUT MARKER	R2 G23 4 ID/CLEARANCE
MC7 H8 3 TURN SIGNAL	MC59 G13 6 FAN CONTROL				R3 G22 4 HORN
MC8 F19 3 GAUGES	MC60 G24 5 REVERSE PLRT PROTR	MC115 H16 5 200 AMP OPTION	LII G28 3 LH TURN INDICATOR	SII FI4 3 BLACK OUT DRIVE	
MC9 G4 4 ECU ATEC	MC61 G10 6 FAN CONTL WTR TEMP	MC116 B12 4 EMER ENG SHUT DOWN	L12 F27 3 RH HEADLIGHT	S12 F14 3 HEADLIGHTS	
MC10 G4 4 ECU ATEC	MC62 F13 5 DOEC ENGINE POWER		L13 G27 3 RH SIDE TURN SIGNAL	SI3 F5 6 DRIVE LINE LOCK	R5 G20 4 DIMMER
MCII D3 4 DDEC	MC63 GII 6 FAN CONTROL	MC118 A9 5 STE/ICE	L14 F27 3 RH COMPOSITE	SI4 FI2 3 RHEOSTAT	R6 G19 4 BEACON LIGHT
MCII D26 5 DDEC	MC64 D15 6 AUXILIARY CTI MANF	MC119 B22 4 ARCTIC PUMP	LI5 E27 3 BLACKOUT DRIVE	S15 F7 3 HORN	R7 G18 4 TRANSMISSION
MC12 H26 4 SHIFT CONT ATEC	MC65 E5 5 STE/ICE ENGINE	MC120 B7 6 ARCTIC PUMP	LI6 D27 3 LH COMPOSITE	S16 F13 3 ENGINE BRAKE	R8 G18 4 RATARDER
MC13 F6 3 DIGN CONN DDEC	MC66 G2 5 TURBO OUTLET PSI	MC121 C12 6 SELF RECOVERY WINCH	L17 C27 3 LH HEADLIGHT		R9 G18 4 CK TRANSMISS
	MC67 E2 5 AIR CLEANER	MC122 D12 6 SELF RECOVERY WINCH	LI8 C27 3 LH SIDE TURN SIGNAL	S18 D7 3 SELF RECOVERY WINCH	RIO GI7 4 REVERSE
MC15 B4 6 MILITARY CONNECTOR	MC68 D2 5 AIR BOX PSI	MC123 D12 6 SELF RECOVERY WINCH	L19 B27 3 ID & CLEARANCE	SI9 06 3 GAS PARTIULATE FLTR	RII GI6 4 NEUTRAL STAR
		MC124 E3 6 BACK-UP LIGHT/ALARM	L20 H10 3 DOME	S20 D5 3 CHEMICAL ALARM	R12 G15 4 12 V MAG SWI
MC16 D4 6 TRAILER		MC125 G18 3 AIR RESTRICTION LT	L21 G7 6 RH WORK LIGHT	S21 HI5 3 DOME LIGHT	RI3 GI5 4 B.O. STOP
MC17 G11 5 DDEC	MC70 C2 5 ENGINE OIL TEMP		L22 G2 6 RH REAR COMPOSITE	S22 C8 5 STE/ICE ZEROING	RIA GIA A BO SERVICE T
MC18 E11 5 DDEC	MC71 B2 5 ENGINE WATER TEMP	MC126 E11 3 STOP LIGHTS			RIS GIS 4 LH TURN SIGN
MC19 E13 5 TRANSMISSION	MC73 F13 6 FAN CONTROL	MC127 B15 3 THROTTLE POSN SW	L23 G2 6 BACK UP	S23 C22 7 PROX SW HOOK ARM UP	
MC20 E12 5 TRANSMISSION		MC128 G10 6 AUX WATER TEMP SW	L24 F2 6 LH REAR COMPOSITE	S24 C23 7 PROX SW MDL FR DOWN	RI6 GI2 4 RH TURN SIGN
MC21 E2 3 ENGINE SENSOR	MC76 FII 6 FAN CONTROL VALVE		L25 C2 6 ID/CLEARANCE REAR	S25 D13 3 ETHER START	RI7 GI2 4 BLACK OUT TA
MC21 H26 5 ENGINE SENSOR	MC77 E3 6 BACK UP LIGHT		L26 E22 3 LHS INDICATOR	S26 F7 3 TC LOCKUP	RI8 GII 4 DOEC
MC22 G21 5 REGULATOR	MC78 F4 6 REAR LIGHT GROUP		L27 E22 3 AUXILLARY HYDR IND	S27 E5 7 HOOK ARM DOWN	R19 G10 4 TRANS DOEC
MC23 B23 5 ETHER START	MC79 G7 6 WORK LIGHT		L28 E23 3 TRANSIT INDICATOR	S28 G8 7 OVERLOAD PSI	R20 G9 4 INTER AXLE
MC24 G19 5 ALTERNATOR	MC80 G4 6 REAR LIGHT GROUP		L29 E23 3 LHS OVERLOAD IND	S29 B19 4 ARCTIC PUMP	R21 G9 4 DIFFERENTIAL
MC25 C17 6 TRAILER 24VDC	MC81 E13 7 LHS			S30 E9 3 EMER ENG SHUT DOWN	R22 G8 4 CRANE HI IDL
MC27 F18 6 FRONT TOW	MC82 E12 7 LHS		L31 D2 6 RH REAR S MKR (RED)	S31 C16 3 THROTTLE POSITION	R23 G7 4 HIGH RANGE L
			L32 H4 6 RH SIDE MKR (AMBER)		R24 G6 4 T.C. DUAL MC
MC28 E6 3 BEACON LIGHT	MC83 E14 7 LHS			PRESSURE SWITCHES	R25 B17 4 MAGNETIC SW
MC29 F8 6 CRANE	MC84 E15 7 LHS			WHOCH TONE OU DECENTATION	R26 B18 4 MAGNETIC SW
MC30 C5 6 TRAILER	MC85 E9 7 LHS		L34 H4 6 LH REAR S MKR (RED)	NUMBER ZONE SH DESCRIPTION	
MC31 B21 3 CAB/CHASSIS	MC86 E7 7 LHS		L35 G16 3 EMERGENCY STEERING	PSI G9 3 FRONT BRAKE	R27 D19 5 MAGNETIC SWI
MC32 B23 3 CTI CHASSIS	MC87 05 7 LHS		L36 G16 3 LOW HYD OIL	PS2 F9 3 REAR BRAKE	R28 C21 4 MAGNETIC SWI
MC33 F17 7 LHS CAB	MC88 E6 7 LHS		L37 D21 3 ENGINE BRAKE	PS3 F9 3 HAND BRAKE	R29 CIO 7 MIDDLE FR LC
MC34 C19 3 24V METERS	MC90 C3 6 REAR LIGHT GP HARN		L38 D21 3 FLAT RACK	PS4 C14 3 PARKING BRAKE	
MC35 D24 3 CTI	MC91 G8 3 STRN COLCAB HARN		L39 F7 6 LH WORK LIGHT	PS5 B15 3 PARKING BRAKE SW	
MC36 A5 4 THROTTLE SENSOR	MC92 F8 3 STRG COLCAB HARN		L40 F7 3 T.C. LOCKUP	PS6 D17 3 LOW AIR PRESSURE	R32 B21 4 ARCTIC PUMP
MC38 C15 3 VERNIER CONTROL	MC93 C17 7 LHS		L41 C2 6 L.H. B.O. CL LIGHT	PS7 D17 3 LOW AIR PRESSURE	R33 B20 4 ARCTIC PUMP
MC39 H7 5 STE/ICE	MC94 B17 7 LHS		L42 D2 6 R.H. B.O. CL LIGHT	PS8 C22 5 ATEC OIL PRESSURE	
	MC95 B15 5 DDEC BATTERY POWER		L43 85 3 POST LIGHT	PS9 D22 5 ENGINE OIL	
MC40 G5 5 STE/ICE MODULE			L44 F5 3 HEATER PANEL LIGHT	PSIO GOVERNOR PRESSURE	SENDING UNIT
MC41 G2 5 PULSE TACH DRIVE	MC96 C2 3 LOW HYD OIL	<del>                                      </del>	L44 FO S MEASER PANEL LIGHT	PSII GOVERNOR PRESSURE	NUMBER ZONE SH DESCRIPT
MC42 H4 5 DIFFERENTIAL PRESS	MC97 BIO 6 AIR DRYER				SUI E21 5 WATER TEMPER
MC43 F2 5 FUEL PRESSURE	MC98 B9 6 AIR DRYER			PS13 F15 6 EMERGENCY STEER	
MC44 C5 3 CAB/TRANSMISSION	MC99 B8 6 AFTER COOLER				SU2 D21 5 TRANSMISSIO
MC44 F26 4 CAB/TRANSMISSION	MC102 A3 4 DDEC 6.8K RESISTOR			PS15 F26 5 BOOST PRESSURE	SU3 D21 5 ENGINE OIL
MC45 D5 4 ECU ATEC	MC 103 E5 3 CHEM DETECTOR				SU4 F6 6 SPEEDOMTER
	MC 104 E5 3 CHEM ALARM				SUS D6 6 FUEL LEVEL
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				FIGURE FO-I	I. ELECTRICAL SYSTEM SCH
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				Ì	ENĞINEERING DWĞ 18782 FP-1/F

CIRCUIT BREAKERS	MISCELLANEOUS	MISCELLANEOUS	CODE SORT	CODE SORT CN 242
NUMBER ZONE SH DESCRIPTION	NUMBER ZONE SH DESCRIPTION	NUMBER ZONE SH DESCRIPTION	CODE ROUTING SH DESCRIPTION	CODE ROUTING SH DESCRIPTION
CB1 D22 4 15 AMP	MI B6 3 WINDSHIELD WSHR SOL	M57 G9 7 LHS FREEFLOW	104 MC36-M4 4 THROTTLE SENSOR	212 MC9-MC12 4
CB2 D22 4 I5 AMP	M2 B13 3 WIPER MOTOR	M58 G9 7 LHS TRANSIT	104 MC10-MC36 4 THROTTLE SENSOR	213 MC50-R8 4 RETARDER
CB3 D21 4 15 AMP	M3 E17 3 LOW OIL & AIR ALARM	M59 F3 7 LHS LH HOOK ARM A	105 MC10-MC19 4/5 ATEC	213 MC9-MC50 4 REVERSE
CB4 D21 4 15 AMP	M4 A5 4 THROTTLE POSN CONT	M60 F3 7 LHS LH HOOK ARM B	106A   MC10-MC36   4   THROTTLE SENSOR     106A   MC36-M4   4   THROTTLE SENSOR	214 MC50-R10 4 REVERSE 214 MC9-MC50 4
CB5 D20 4 20 AMP	M5 C20 4 FLASHER	M6! F2 7 LHS RH HOOK ARM A	106A MC36-M4 4 THROTTLE SENSOR 106A MC10-106B 4/5 ATEC	215 MC9-MC50 4
C86 D20 4 15 AMP	M6 C16 5 BATTERIES	M62 F2 7 LHS RH HOOK ARM B M64 H21 5 DUVAC CONTROLLER	106B 106A-MC19 4/5 ATEC	215 MC50-R9 4 CHECK TRANSMISSION
CB7 D19 4 10 AMP	M7 E17 5 STARTER  M8 B22 5 ETHER START	M65 G17 5 ALTNTR 200 AMP OPT.	107 MC10-MC19 4/5 ATEC	216A MC106-MC13 3
CB8   D19   4   15 AMP	M9 D6 6 FUEL/WATER SEP	M66 G16 3 RECTIFIER	108 MC10-MC19 4/5 ATEC	216A MC9-MC51 4 ATEC
CB9 D18 4 10 AMP CB10 D17 4 3 AMP	MIO CIO 6 LHS SOLENOID VALVE	M67 C8 3 RECTIFIER	109 MC10-MC19 4/5 ATEC	216A MC51-MC106 4 ATEC
CB11 D16 4 8 AMP	MII C8 6 AFTERCOOLER	M68 G12 7 RECTIFIER	110 MC10-MC19 4/5 ATEC	218 MC9-MC12 4 ATEC
CB12 D16 4 8 AMP	MI2 C20 5 FUEL PUMP	M70 F2 5 TURBO OUTLET PSI	111 MC10-MC19 4/5 ATEC	219 MC9-MC12 4 ATEC
CB13 D15 4 8 AMP	MI3 BIO 6 AIR DRYER	M71 E2 5 AIR CLEANER	112 MC10-MC20 4/5 ATEC	220 MC9-MC12 4 ATEC
C814 D14 4 I5 AMP	MI4 E6 3 CHEMICAL DETECTOR	M72 D2 5 AIR BOX PSI	113 MC10-MC20 4/5 ATEC	221 MC9-MC12 4 ATEC
CB15 D13 4 15 AMP	MI4 B9 6 AIR DRYER	M73 C2 5 FUEL RETURN	114 MC10-MC19 4/5 ATEC	222 MC9-GROUND 4 ATEC
CB16 D12 4 15 AMP	MIS DI 3 HORN	M74 C2 5 ENGINE OIL TEMP	115 MCII-MCI8 5 ECM	223A MC51-CB14 4 TRANSMISSION
CB17 D12 4 3 AMP	MI6 DI6 3 VERNIER CONTROL	M75 B2 5 ENGINE WATER TEMP	115 MC11-MC102 4 6.8K RESISTOR	223A MC51-SPLICE 4
CB18 D11 4 10 AMP	MI7 F5 3 HEATER MOTOR	M76 E10 4 RECTIFIER	115 MC10-MC19 4/5 ATEC	22JA SPLC-SPLC 4
CB19 D10 4 15 AMP	MI8 F24 3 LOW OIL PRESS ALARM	M77 B17 5 ARCTIC BATTERIES	116 MC10-MC19 4/5 ATEC	223A SPLC-SPLC 4
CB20 D9 4 I5 AMP	MI9 F21 5 REGULATOR/DVS	M78 E2 6 BACK-UP ALARM	117 MC10-MC19 4/5 ATEC	223A SPLC-SPLC 4
CB21 D9 4 30 AMP	M20 G22 5 ALTERNATOR,STD		118 MC10-MC19 4/5 ATEC	223A SPLICE-MC9 4
CB22 D7 4 20 AMP	M21 C25 5 RH SIDE ENG BK COIL	M80 B7 6 ARCTIC PUMP	119 MC10-MC19 4/5 ATEC	223B MC12-SPLICE 4 225 CB11-MC12 4
CB23 D7 4 20 AMP	M22 C24 5 LH SIDE ENG BK COIL	M81 F4 3 RECTIFIER	120 MC10-MC19 4/5 ATEC	225 CBII-MCI2 4 230 MCI2-234 4
CB24 C20 5 3 AMP	M23 D18 5 SLAVE CONNECTER	M82 E13 3 ISOLATOR	121 MC10-MC19 4/5 ATEC	231 MC50-MC12 4
`	M24 B15 6 CTI POWER MANIFOLOD		122 MC10-MC19 4/5 ATEC	231 . MC50-R22 4 CRANE HI IDLE
GAUGES	M25 D15 6 CTI AUXILIARY MANE		123 MC10-MC19 4/5 ATEC 124 MC36-M4 4 THROTTLE SENSOR	231 MC50-M36 4
	M26 E13 7 LHS CAB CONTROLLER		124 MC10-MC36 4 THROTTLE SENSOR	231 M36-R11 4 NEUTRAL START
NUMBER ZONE SH DESCRIPTION	M27 B13 6 SELF RECOVERY WINCH M28 E25 3 CTI CONTROLLER		150 MC62-MC62 5/4	233 MC50-MC12 4
G1 G20 3 WATER TEMPERATURE G2 G21 3 OIL PRESSURE	M29 G14 7 CHEMICAL ALARM		150 MC17-MC62 5	234 MC12-GROUND 4
G3 G22 3 FUEL LEVEL	M30 D11 3 GAS PART FILTER		195 MC5-M2 3	240 MC62-CB23 5/4
G4 G22 3 TACHOMETER	M31 D11 3 AIR HEATER DRIVER		201 MC51-GROUND 4	240 CB23-M6 4/5
G5 G23 3 SPEEDOMTER	M32 D12 3 AIR HEATER PASS		201 MC9-MC51 4	240 MC17-MC62 5
G6 G19 3 VOLTMETER 12V	M33 D3 7 SRW SOLENOID VALVE		202A MC9-SPLICE 4	240 MC62-M6 5
G7 G19 3 VOLTMETER 24V	M35 E15 3 THROTTLE POSITIONER		203 MC9-MC51 4	241 MC62-CB22 5/4
GIO G20 3 XMSN DIL TEMP	M36 C9 4 DIODE		203 MC51-CB12 4	241 MC62-M6 5
GII GI8 3 AIR PRESSURE	M39 F9 4 RECTIFIER		204 MC9-MC12 4 ATEC	241 MC17-MC62 5
GI2 HI8 3 AIR RESTRICTION	M40 G2 5 PULSE TACH DRIVE		206 MC9-MC12 4 ATEC	241 CB22-M6 4/5
	M41 H5 5 DIFFERENTIAL PRESS		207A MC51-MC106 4 ATEC	309 MC45-R24 4 TC DUAL MODE 313 MC45-R24 4 TC DUAL MODE
	M42 F2 5 FUEL PRESSURE		207A MC9-MC51 4 ATEC	313 MC45-R24 4 TC DUAL MODE  315 MC45-R24 4 TC DUAL MODE
	M43 G5 5 STE/ICE MODULE		207A MC106-MC13 4	417 MC6-M35 3
	M45 FIO 6 FAN CONTROL VALVE		208/209 MCII-SPLICE 4 208/209 SPLICE-MC51 4	417 MC11-MC44 4
	M48 D16 5 SHUNT M49 B9 3 XFR CASE LKUP SOL		208/209 M6-MC95 5	417 MC11-MC18 5 ECM
<del>                                     </del>	M49 B9 3 XFR CASE LRUP SUL	<del> </del>	208/209 MC95-MC11 5	417 MC44-MC6 3 THROTTLE SENSOR
	M50 88 3 INTER AXLE SUL V		208/209 MC51-MC9 4	419 MC11-MC18 5 ECM
	M51 CII 6 FAN		210A MC9-MC12 4	419 MC11-MC44 4
	M52 A21 4 RECTIFIER		211 R8-MC50 4	419 MC44-MC8 3
	M53 GTT 7 LHS HUUK ARM U		211 MC50-R8 4 RETARDER	419 MC8-L6 3 CHECK ENGINE LIGHT
	M54 G10 7 LHS HUUK ARM A		211 MC9-MC50 4	
	M55 G10 7 LHS MAIN CYLINDER B			
	M56 GIO 7 LHS MAIN CYLINDER A			
				FIGURE FO-1. ELECTRICAL SYSTEM SCHEMATIC FOLDOUT 2 OF 35 ENGINEERING DWG_1878290 SHE
				FULLULI E DE 1878200 CUE

TM 9-2320-364-20 REVISION W CN 24230 4-15-93 CODE SORT CODE SORT CODE SORT DESCRIPTION CODE ROUTING SH DESCRIPTION SH ROUTING DESCRIPTION CODE ROUTING CODE 6 FRONT TOW 3 RH HEADLIGHT 1008 MC27-MC3 1001 S1-MC7 439 MC116-MC106 4 EMERGENCY ENG STOP 1002 SI-MC7 3 LH HEADLIGHT 1008 MC3-SPLICE 3 MC116-530 3 EMERGENCY ENG STOP 439 3 EMERGENCY ENG STOP 1002 MC8-L11 3 1008 MC3-MC4 439 MC116-S30 1008 MC3-MC16 6 TRAILER CONN 12VDC 1002 MC7-SPLICE 3 439 4 DDEC MC116-CB13 1002 SPLICE-MC8 3 1008 MC78-L22 6 RH TAIL LIGHT 439 MC106-MC13 3 3 1008 MC78-L24 6 LH TAIL LIGHT 439 SPLC-MC106 1002 SPLICE-LI8 4 1008C MC25-MC15 6 TRAILER CONN 24VDC 3 439 MC11-MC18 5 ECM 1002 SPLICE-LI6 4 B.O. SERVICE 1003 MC7-MC3 1008C MC25-R14 439 MC8-L6 3 CHECK ENGINE LIGHT 3 LH RR TURN SIGNAL 1009 PS2-PS3 3 1003 SI-MC7 439 MC8-L3 3 ENGINE STOP LIGHT 1009 PS1-PS2 3 1003 MC3-MC80 439 MC44-MC8 3 6 1009 MC2-PS1 6 TRAILER CONN 12VDC 1003 MC3-MC16 3 439 MCII-SPLICE 4 4 STOP LIGHT 1009 MC2-CB6 1003 MC1-R15 4 LH TURN LIGHT 439 SPLICE-MC44 4 1003 MC80-L24 6 LH STOP LIGHT 1012 MC3-SPLICE 3 439 SPLC-MC116 4 6 FRONT TOW 1012 SPLC-SPLC 3 451 5 ECM 1003 MC27-MC3 MCII-MCI8 1012 MC2-SPLICE 3 1003 MC7-MC1 3 451 MC106-MC13 3 4 LH TURN LIGHT 1012 SPLC-SPLC 3 1003C MC25-R17 451 MCII-MCI06 4 1003C MC25-MC15 6 TRAILER CONN 12VDC 1012 SPLICE-L19 3 505 MC106-MC13 3 1012 MC2-R2 4 CLEARANCE LIGHTS 1004 MC7-MC1 3 505 MC11-MC106 4 3 1012 MC3-SPLICE 505 MCII-MCI8 1004 MC7-MC3 5 ECM 508 MC11-R7 4 TRANSMISSION 1004 SI-MC7 3 1012 SPLICE-MC27 1004 MC3-MC80 6 1012 SPLICE-MC80 508 MCII-MCI8 5 ECM 6 RH STOP LIGHT 1012 SPLICE-L32 6 RH SIDE MARKER 1004 MC80-L22 509 MC11-MC18 5 ECM 6 LH SIDE MARKER 1012 SPLICE-L34 509 MC8-L3 3 ENGINE STOP LIGHT 1004 MC27-MC3 6 6 RR SIDE MARKER 1012 MC90-L31 509 MC44-MC8 3 1004 MC3-MC78 6 6 ID LIGHTS 1004 MC3-MC16 6 1012 MC90-L25 509 MC11-MC44 1012 MC80-MC90 MCII-MCI8 5 ECM 1004 MCI-R16 4 510 1012 MC90-L33 6 RR SIDE MARKER 3 PARKING BRAKE 1004C MC25-R16 4 RH TURN LIGHT 510 MC44-PS4 6 TRAILER CONN 24VDC 1016 MC92-MC2 3 1004C MC25-MC15 R22-MC44 4 510 3 1016 S15-MC92 3 1005 MC126-S9 510 MC11-R22 4 1016 MC2-R3 4 HORN 3 MCII-MCI06 4 1005 PS3-MC3 900 1017 SPLICE-R5 4 6 TRAILER CONN 24VDC 1005 MC3-MC16 900 MCII-MCI8 5 ECM 1005 MC126-PS1 1017 MC52-R14 4 900 MC106-MC13 3 | 901 MCII-MCI8 1005 PS2-PS3 1017 R2-MC52 4 5 ECM 1017 MC2-SPLICE 1005 MC27-MC3 6 FRONT TOW 901 MC106-MC13 3 1017 SPLICE-RI 1005 PSI-PS2 4 901 MCII-MCI06 4 - 3 1017 MC91-MC2 3 908 MCII-MCI8 5 ECM 1005A MC7-MC126 3 1017 SI-MC91 3 908 MCII-M4 4 THROTTLE POSN CONT 1005A MC126-S9 3 1005A S1-MC7 3 TURN SIGNAL/DIM SW 1017A MC91-MC2 3 916 MC44-MC6 3 1017A S1-MC91 3 MCII-MC44 4 1006 MC2-SPLICE 3 916 1017A MC2-R5 1006 SPLICE-L12 4 3 3 916 MC38-M16 1018 MC8-L10 3 HIGH BEAM 1006 SPLICE-L17 3 VERNIER CONTROL 3 916 MC6-MC38 1018 MC8-1007 3 1006 MC2-R5 4 DIMMER 916 MC6-M35 3 THROTTLE SENSOR 1019 L15-1679 3 5 ECM 1007 MC2-R5 4 DIMMER 916 MC11-MC18 3 1020 L14-L16 952 MC38-M16 3 1007 MC2-SPLICE 1020 DUVAC IGN 5 FUEL PUMP 952 1007 SPLICE-LI2 3 MCII-MC44 4 1020 S2-MC21 3 1007 SPLICE-LI7 952 MC44-MC6 3 THROTTLE SENSOR 3 1020 R27-MC48 952 MCII-MCI8 5 ECM 1008 MC3-MC78 5 1020 MC60-IGN 5 DUVAC CONTROLLER 952 MC6-MC38 3 VERNIER CONTROL 1008 MC4-S12 3 HEADLIGHTS 1001 MC8-L4 3 1020 MC21-MC60 5 1001 MC7-SPLICE 3 1020 MC108-M81 5 MC8-SPLICE 3 1020 M81-MC60 5 1001 1021 MC2-S2 3 SPLICE-LI3 3 1001 1001 SPLICE-L14 3 1021 MC2-R11 4 1021 R11-M76 4 ELECTRICAL SYSTEM SCHEMATIC FOLDOUT 3 OF 35 ENGINEERING DWG\_1878290 SHEET FIGURE FO-1.

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FP-5/FP-6 BLANK

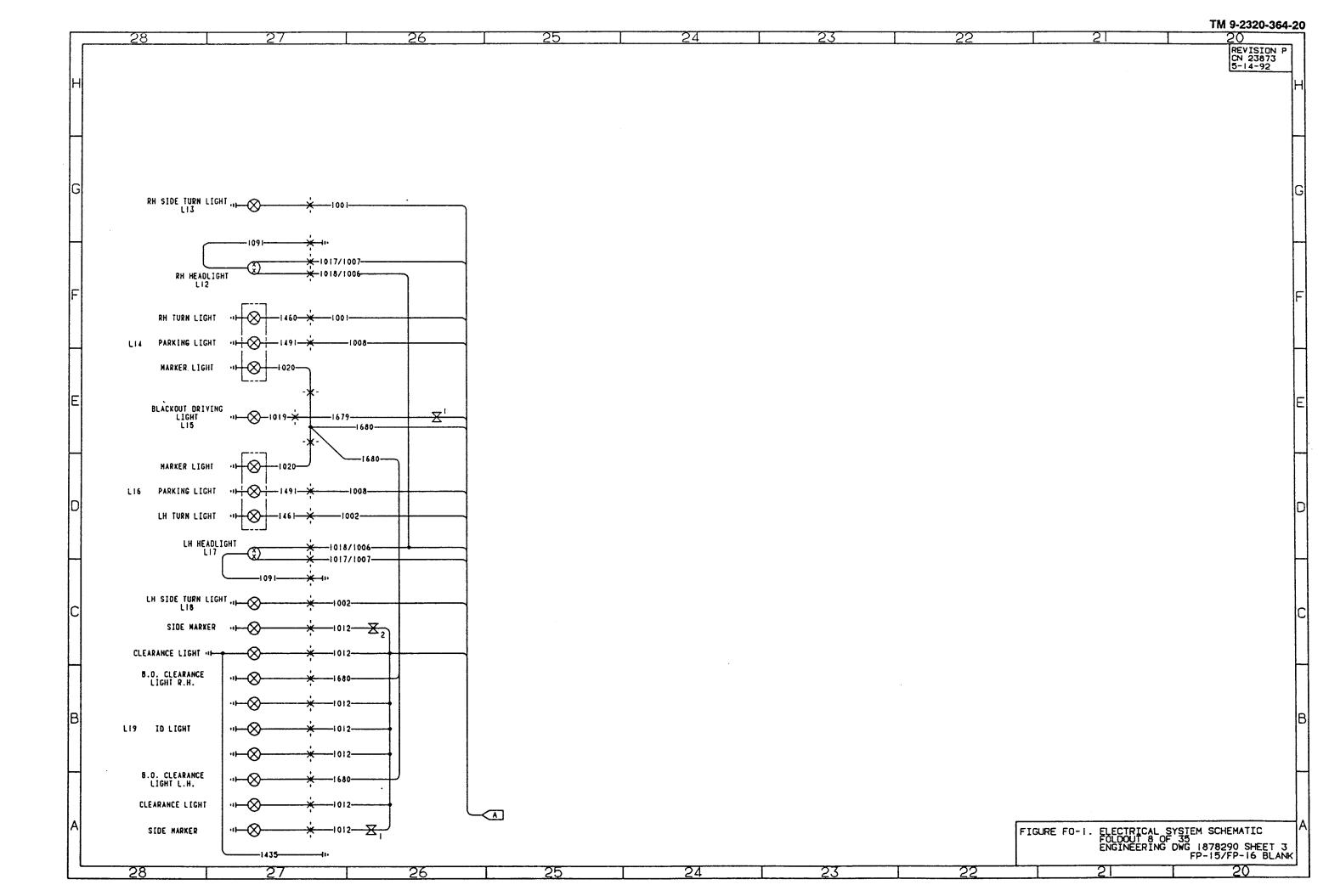
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	7000 7000	CODE SORT	CODE SORT				CN 2
Н	CODE SORT						
	CODE ROUTING SH DESCRIPTION	CODE ROUTING SH DESCRIPTION	CODE ROUTING SH DESCRIPTION				
	1021 MC52-R11 4 FRONT TOW	1052 MCI-SPLICE 3	1080 MC2-M5 4 TURN SIGNAL/FLASHER				
	1021A R11-MC1 4	1052 SPLICE-L43 3 POST LIGHT	1082 MC2-MC52 4 1082 MC2-M81 3				
	1021A MC1-MC21 3	1052   SPLC-MC125   3     1052   MC125-G12   3   AIR RESTRICTION G					
	1021A MC21-MC60 5	1052 MC1-SPLICE 3	1082 MC52-CB15 4 HEATER				
	1021 MC60-R27 5	1052 MC1-CB1 4 15 AMP HEADLIGHT	1084 MC1-CB5 4 B.O. LIGHTS				
1	1029 MC2-R6 4 BEACON	1052 MC50-MC1 4	1084 MC4-MC1 3				
G	1029 MC2-MC28 3	1055 MC115-M7 5	1084 MC4-S9 3				
	1031 R3-SPLICE 4	1055 M7-1277 5	1091 L17-GROUND 3				
-	1032 MC8-MC21 3	1055 M7-1281 5	1092 L7-MC8 3	•			
	1032 M39-L9 3 LOW OIL PSI	1056 MC111-MC32 3	1092 MC8-M51 3				
_	1032 MC8-M39 3	1056 MC32-MC109 6 CTI POWER MANIFOLE					
	1032 PS9-MC21 5 ENGINE OIL PSI SW	1057 M20-M20 `5	1093 MC1-MC31 3				
	1033 M39-M18 3 OIL PSI/H WTR ALM	1057 MC111-MC32 3	1093 MC1-CB16 4				
	1036 MC23-M8 5	1057 MC32-MC109 6 CTI POWER MANIFOLI	1093 MC57-SI3 6 DRIVE LINE LOCK-UP				
F	1036 MC23-M7 5	1058 MC32-MC109 6 CTI POWER MANIFOLI	1094 S5-S14 3				
'	1036 MC21-MC56 5 ETHER START	1058 MC111-MC32 3	1095 R23-R24 4				
	1036 MC21-S25 3	1059 MC32-MC109 6 CTI POWER MANIFOLI	· · · · · · · · · · · · · · · · · · ·				
	1040 C84-R4 4 WORKLIGHT	1059 MC111-MC32 3	1095 MC31-MC44 3				
	1040A S6-MC4 3	1061 MC22-MC109 6 CTI POWER MANIFOL					
	1040A MC2-R4 4 WORKLIGHT	1061 MC111-MC32 3	1095 MC31-MC57 6				
	1040A MC4-MC2 3	1062 MC32-MC109 6 CTI POWER MANIFOL					
	1040B MC3-MC79 6 RH WORKLIGHT	1062 MC111-MC32 3	1108 505-MC44 4				
	1040B MC2-MC3 3	1063 MC32-MC109 6 CTI POWER MANIFOL					
-1	1040B MC2-R4 4 WORKLIGHT	1064 MC32-MC109 6 CTI POWER MANIFOL	1113 MC8-MC21 3				
1	1040B MC3-MC54 6 LH WORKLIGHT	1064 MC111-MC32 3 1 1065 MC32-MC109 6 CTI POWER MANIFOL					
	1045 R27-M7 5 1049 MC2-R1 4 HEADLIGHTS	1065 MC111-MC32 3	1114 M66-MC8 3				
l	1049 MC4-MC2 3	1066 MC32-MC64 6 CTI AUX MANIFOLD	III4 MC96-MC8 3 LOW OIL LEVEL LIGHT				
	1049 S12-MC4 3	1066 MC110-MC32 3	1114 MC8-L36 3				
	1052 S20-S19 3 CHEM ALM-GPF	1067 MC32-MC64 6 CTI AUX MANIFOLD	1114 L36-M66 3				
	1052 S19-S18 3 GAS PART FLTR-SRW	1068 MC32-MC64 6 CTI AUX MANIFOLD	1118 MC4-1919 3				
$\neg$	1052 S18-S4 3 SRW-SRW/MHC	1068 MC110-MC32 3	1118 S8-MC4 3				
기	1052 S4-S30 3 SRW/MHC-EMER ENG S E	1070 MC32-MC64 6 CTI AUX MANIFOLD	1120 M66-MC8 3				
	1052 S30-SPLICE 3 EMER ENG SHUT DOWN	1070 MC110-MC32 3	1120 M66-M3 3				
	1052 SPLICE-GII 3 AIR PRESSURE GAUGE	1071 MC110-MC32 3	1120 PS6-PS7 3				
	1052 MC4-SPLICE 3	1071 MC32-MC64 6 CTI AUX MANIFOLD	1120 PS6-MC8 3				
	1052 SPLICE-L44 3 HEATER PANEL LIGHT	1072 R26-R25 3	1120 L2-M66 3				
	1052 S5-S6 3 BEACON LT-WORK LT	1072 MC110-MC32 3	1137 M6(1)-M6(2) 5				
	1052 S6-S7 3 WORK LT-WSHLD WSHR	1072 MC32-MC64 6 CTI AUX MANIFOLD	1137 M6(3)-M6(4) 5				
	1052 S7-S8 3 WSHLD WASHER-WIPERS	1073 MC32-MC64 6 CTI AUX MANIFOLD	1138 M48-M7 5 SHUNT				
	1052 S8-S21 3 WIPERS-DOME LIGHT	1073 MC110-MC32 3					
	1052   S21-S9   3   DOME LT-B.O.SERV SEL	1074 MC110-MC32 3					
	1052 S9-S10 3 B0 SERV SEL-B0 MKR	1074 R25-CB10 4 1074 MC32-MC64 6 CTI AUX MANIFOLD	1139 M7-M23 5 SLAVE				
	1052   S10-S11   3   B.O. MARKER-B.O. DR   1052   S11-S12   3   B.O. DRIVE-HEADLTS	1074 MC32-MC84 6 C11 AUX MANIFULD	1139 M6-M7 5				
	1052 S12-S16 3 HEADLIGHTS-ENG BK	1075B R25-R18 4	1139 M77-M7 5 ARCTIC BATTERIES				
	1052 S16-S14 3 ENG BRAKE-RHE0/DOME	1076 MC110-MC32 3	1147 TS2-MC21 5 ENG WTR TEMP SNDG UN				
1	1052 SI4-SPLICE 3 RHEOSTAT/DOME	1076 MC32-MC64 6 CTI AUX MANIFOLD	1147 M39-L8 3 HIGH WATER TEMP				
	1052 SPLICE-G6 3 VOLTMETER 12V	1079 CB5-M6 4 HAZARD LIGHTS	1147 MC8-MC21 3				
	1052 SPLC-SPLC 3	1080 MC7-MC2 3	1147 MC8-M39 3				
	1052 SPLICE-GIO 3 XMSN OIL TEMP GAUGE		1149 MCI-R10 4 REVERSE				
	1052 SPLICE-GI 3 WATER TEMP GAUGE		1149 MC3-MC78 6		•		
	1052 SPLICE-G2 3 OIL PRESSURE GAUGE		1149 MC1-MC124 3				
	1052 SPLICE-G4 3 TACHOMETER		1149 MC78-MC77 6 REVERSE LIGHT				
	1052 SPLICE-G5 3 SPEEDOMETER		1149 MC124-MC77 6				
	1052 SPLICE-G3 3 FUEL GAUGE						
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A					FIGURE	FO-1. ELECTRIC	CAL SYSTEM SCHEMAT
						ENGINEE	RÎNG DWG_1878290 S

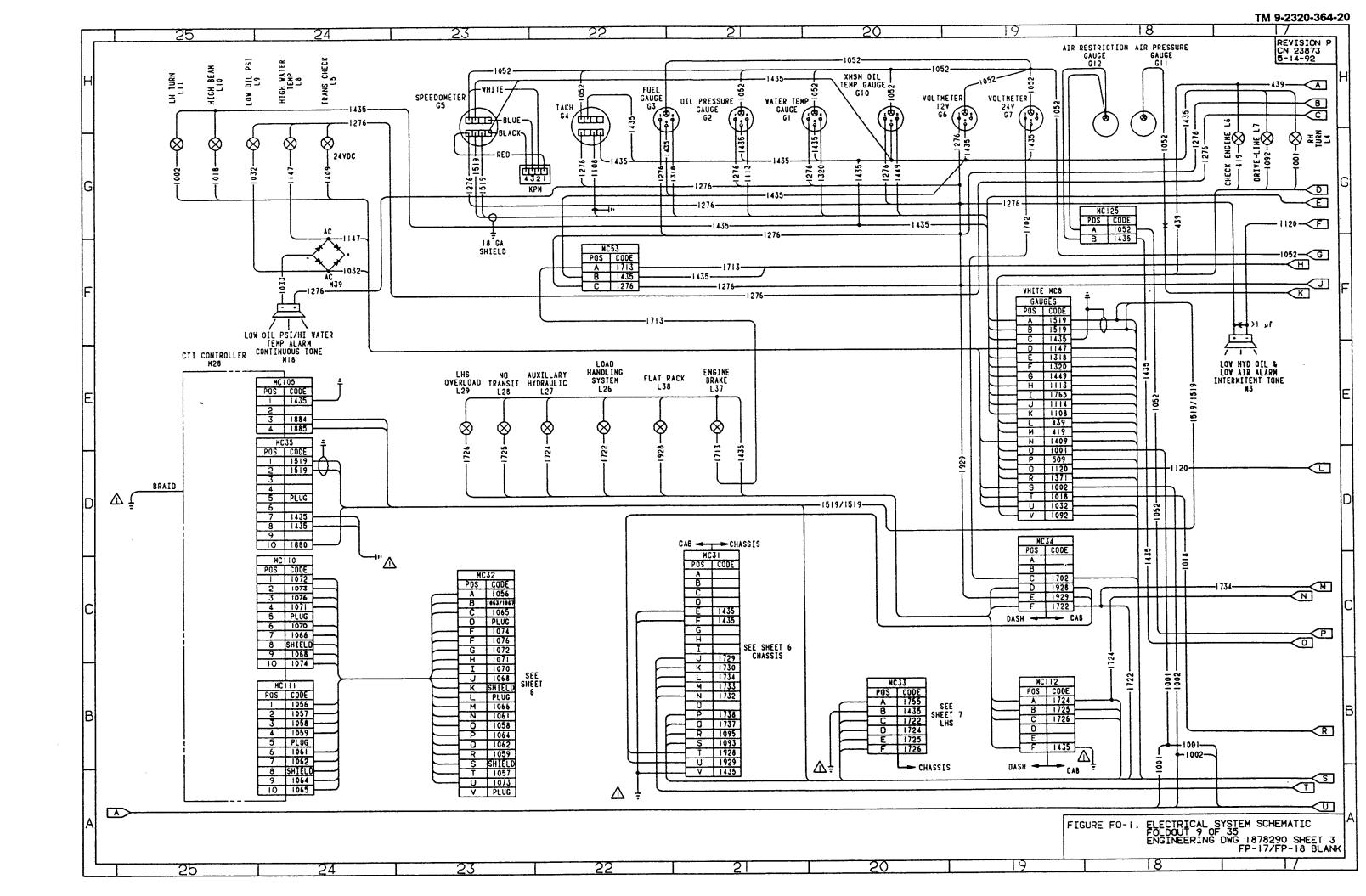
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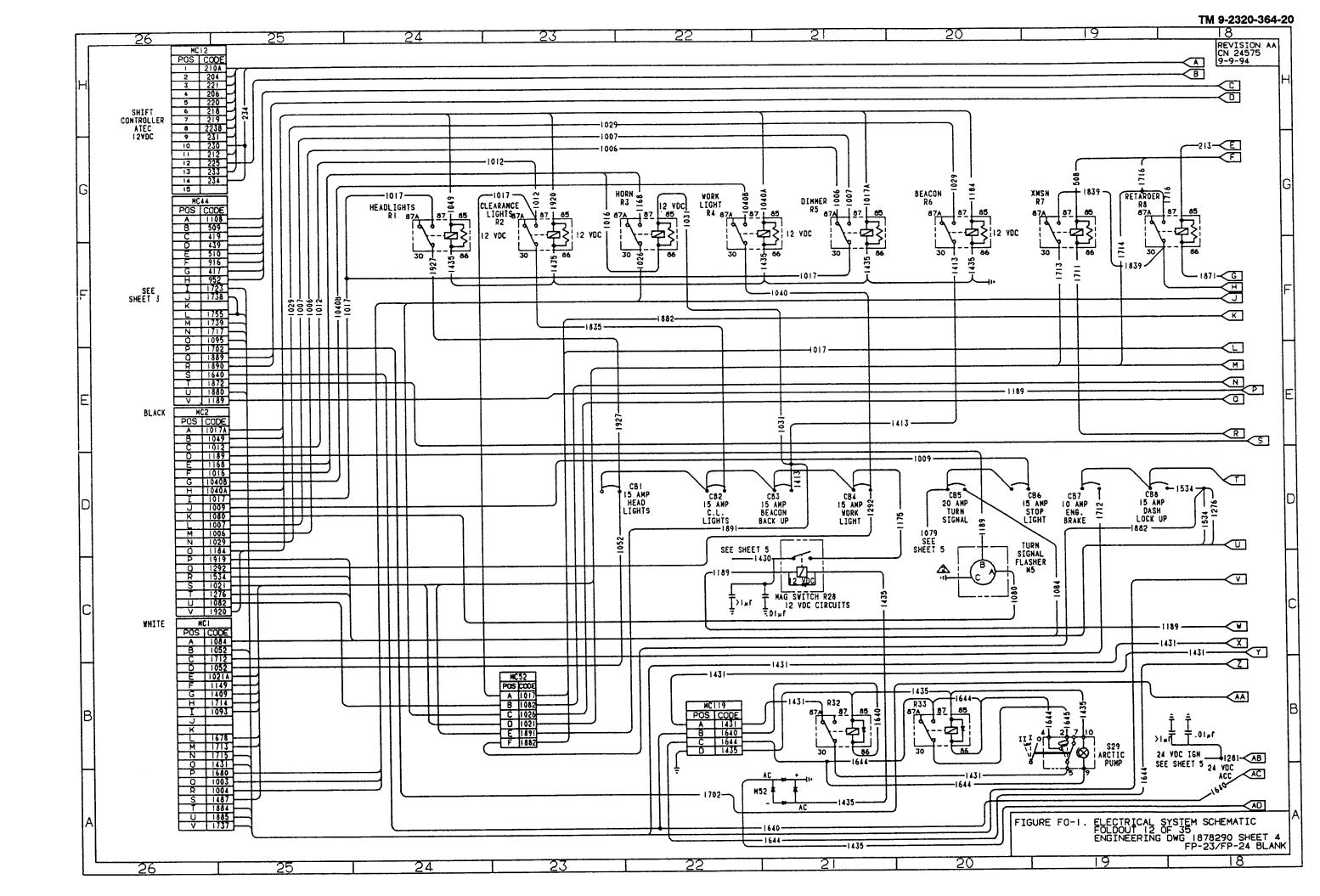
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!	1153 MC4-L20 3 DOME LIGHT	1279 MC115-PS14 5	1454 MC81-MC82 7	1519 MC3-MC8 3 SPEEDOMETER	
,	i 168 MC2-R3 4 HORN	1279 M64-1280 5	1460 MC81-MC82 7	1519 MC8-MC35 3 CTI OVERSPEED	
1	1168 MC2-M15 3	1280 C821-R26 4	1461 MC86-MC87 7	1519 G5-MC8 3 SPEEDOMETER	
•	1174 BUS BAR 4	1280 1281-R26 5	1461 MC85-MC86 7	1519 MC3-SU4 6 SPEEDOMETER	
ļ	1175 R28-CB5 4	1281 1280-MC47 5	1462 MC81-MC82 7	1519 G5-MC8 3 SPEEDOMETER	
!	1176 MC113-PS13 6 EMERGENCY STEER		1463 MC81-MC82   7	1519   MC3-MC8   3   SPEEDOMETER     1519   MC3-SU4   6   SPEEDOMETER	
ļ	1184 S5-MC4 3		1464   MC81 - MC82   7	1519 ML3-SU4 6 SPEEDUMETER	
,	1184   MC2-R6   4	1292 ML4-56 3 1292 CB4-MC2 4	1466 MC85-MC86 7	1534 MC107-M9 6 FUEL/WATER SEP	
!	1184 MC2-MC4 3	1292 MC2-MC4 3	1466 MC86-MC87 7	1534 MC2-SPLICE 4	
!	1189 MC44-R28 4	1292 MC4-S12 3	1467 MC81-MC82 7	1534 SPLICE-CB8 4	
,	1189 MC4-SPLICE 3	1314 1118-57 3	1468 MC81-MC82 7	1534 MC3-MC107 ' 6	
1	1189 MC4-S21 3	1318 MC3-MC8 3	1469 MC81-MC82 7	1534 MC2-MC3 3	
ļ	1189 MC2-SPLICE 3	1318 MC3-G3 3 FUEL GAUGE	1469 MC86-MC87 7	1534 MC3-S22 3 T-CASE LOCK-UP	
1	1189 MC2-M5 4	1318 MC3-SU5 6 FUEL LEVEL	1469 MC85-MC86 7	1534 CB15-M76 4	
Į	1189 SPLICE-MC44 3	1320 SUI-MC2 5 WATER TEMP SNOG UN	1470 MC86-MC87 7	1538 MC97-M13 6 AIR DRYER	
!	1274 MC115-SPLC. 5	1320 GI-MC8 3 WATER TEMP	1470 MC85-MC86 7	1538 MC25-MC97 6	
1	1274 M64-SPLICE 5	1320 MC8-MC21 3	i47i MC85-MC86 7	1538 MC25-C815 4	
!	1274 M8-SPLICE 5	1340 CB15-MC14 4 SWING FIRE	1471 MC86-MC87 7	1538 MC25-MC98 6	
į	1275 M6-M20 5	1344 M20-MC22 5	1471 MC81-MC82 7	1538 MC99-MII 6 AFTER COOLER	
!	1275 M6-200 AMP 5	1362 R27-M64 5	1472 MC85-MC86 7	1538 MC98-M14 6 AIR DRYER	
1	1276 MC2-MC4 3	1371 MC8-PS5 3	1472 MC81-MC82 7	1538 MC25-MC99   6	
I	1276 MC2-CB8 3	1371 L1-MC8 3	1472 MC86-MC88 7	1538 MC25-MC73 6 FAN CONTROL	
. '	1276   SPLICE-S14   3	1409 MC8-MC1 3	1475 MC85-MC86 7	1538 M76-MC25 4	
!	1276 SPLICE-MC53 3	1409 L5-MC8 3	1475 MC86-MC87 7	1640 MC119-SPLC	
1	1276   MC4-SPLICE   3	1409 MC1-R9	1480 MC84-MC93 7 1480 MC84-MC83 7	1640   SPLICE-MC44   4	
!	1276 MC2-SPLICE 4	1413 CB3-SPLICE 4	1481 MC84-MC83 7	1640 MC44-S2 3	
I	1276 SPLC-SPLC 3	1430 R28-SH5 4/5	1481 MC84-MC93 7	1640 MC119-R32 4	
!	1276 SPLC-SPLC 3	1430 1832-R28 5	1482 MC84-MC93 7	1644 MC119-R33 4	
	1276 SPLICE-M3 3 LOW AIR ALARM	1431 MC3-52 3	1482 MC84-MC83 7	1644 R33-R33 4	
	1276 SPLICE-G5 3 SPEEDOMETER	1431 MC3-M6 6 BATTERIES	1483 MC83-MC84 7	1644 MC119-S29 4 ARCTIC PUMP	1
	1276 SPLICE-LI 3 PARKING BRAKE	1431 MC3-M6 6 BATTERIES	1483 MC84-MC93 7	1644 R33-S29 4 ARCTIC PUMP	ı
	1276 SPLICE-L2 3 LOW AIR	1431 MC1-MC119 4	1484 MC83-MC84 7	1644 MC119-MC25 4	i
	1276 SPLICE-L35 3 EMERGENCY STEERING		1484 MC84-MC93 7	1644 MC25-MC120 6	ı
	1276 SPLICE-L36 3 LOW HYDR OIL	1431   R32-S29   4   ARCTIC PUMP	1485 MC84-MC94 7	1644 MC120-M80 6 ARCTIC PUMP	1
	1276 SPLC-SPLC 3	1431 MC119-CB20 4	1485 MC83-MC84 7	1645 S29-R33 4 ARCTIC PUMP	i
	1276 SPLICE-L5 3 XMSN CHECK	1435 MC78-MC124 6	1486 MC84-MC94 7	1665C MC25-MC15   6   TRAILER CONN 24VDC   1665C MC25-CB20   4	1
	1276 SPLICE-L8 3 HIGH WATER TEMP	1435 MC124-M78 6	1486   MC83-MC84   7	1674 S11-S10 3	ı
	1276 SPLICE-L9 3 LOW OIL PSI 1276 SPLICE-G3 3 FUEL GAUGE	1435 MC77-MC124 6	1487 MC1-CB15 4	1674 S11-S9 3	1
	1276   SPLICE-G3   3   FUEL GAUGE   1276   SPLICE-G6   3   VOLTMETER   12V	1435 MC86-MC87 7	1487 MC83-MC84 7	1676 R17-R16 4	4
	1276 SPLICE-GI 3 WATER TEMP GAUGE	1435 MC33-MC84 7	1487 MC84-MC94 7	1676 R16-R15 4	ı
	1276 SPLICE-G2 3 OIL PRESSURE GAUGE		1488 MC84-MC94 7	1676 R14-R3 4	ı
	1276 SPLICE-G4 3 TACHOMETER	1435 MC81-MC82 7	1488 MC83-MC84 7	1676 R15-R14 4	<b>i</b>
	1276 SPLICE-GIO 3 XMSN OIL TEMP GAUGE		1489 MC83-MC84 7	1676 CB20-R17 4	i
	1276 SPLICE-MI8 3 ALARM	1435 MC81-MC82 7	1489 MC84-MC94 7	1678 MC3-MC78 6	1
	1277 MC115-SPLC 5	1435 MC108-GND 5	1490 MC84-MC94 . 7	1678 MC1-SPLICE 3	i
	1277 MC8-SPLICE 5	i 435 GND 5	1490 MC83-MC84 7	1678 MC78-L24 6 LH B.O. STOP LIGHT	i
	1278 M20-M79 5	1435 MC22-GND 5	1491 L16-1008 3		1
	1278 MC8-SPLICE 5	1435 M52-R26 4	1491 L14-1008 3		4
		i 435 M52-R28 4	1517 PS8-MC11 5 ATEC OIL PSI SWITCH	1	4
		1435 R27-GND 5	1517 MC11-R9 4		4
		1435 MC125-GND 3	1		4
		1449 MC8-MC21 3	4	<u> </u>	4
		1449 GIO-MC8 3 TRANS DIL TEMP	1		I .
				FIGURE FO-1. ELECTRICAL S FOLDOUT 5 OF	SYSTEM SCHEMAT
				ENGINEERING	DWG 1878290 S FP-9/FP-10

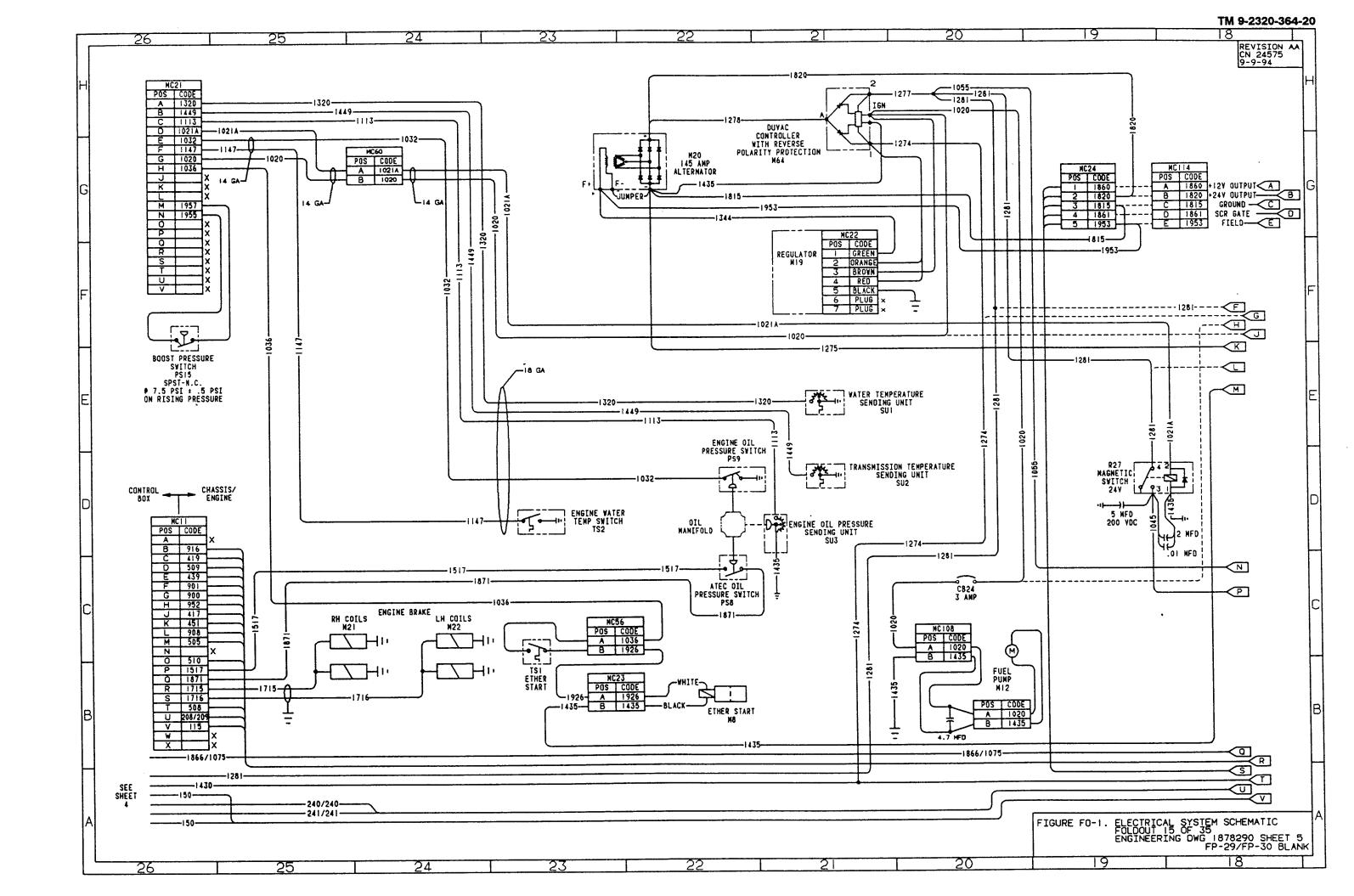
TM 9-2320-364-20 12 4 13 REVISION V CN 24138 CODE SORT CODE SORT CODE SORT CODE SORT DESCRIPTION DESCRIPTION SH POLITING ROUTING SH DESCRIPTION ROUTING DESCRIPTION CODE ROUTING CODE CODE 5 STARTER 3 GAS PARTICULATE SW 1818 MC39-M7 1722 L26-MC34 1739 MC44-S19 1678 MC78-L22 6 RH B.O. STOP LIGHT 3 5 STE/ICE 1818 MC39-MC65 1722 MC33-MC84 7 1678 SPLICE-MC3 3 1819 MC39-M7 5 1722 MC84-MC83 7 1744 S4-M67 1678 MC1-R13 4 3 SELF RECOVERY WN SW 1745 MC103-S20 3 CHEMICAL ALARM 1820 MC24-M20 5 1723 MC44-S18 1678 SPLICE-MC4 3 1820 MC24-M20 5 1723 MC44-CB18 4 1678 MC4-S9 1820 MC39-MC24 5 1724 MC112-SPLC 1746 MC103-M29 3 CHEMICAL ALARM 3 1678C MC25-R13 4 B.O. STOP LIGHT 5 1724 SPLICE-MC33 1821 MC39-M6 1678C MC25-MC15 6 TRAILER CONN 24VDC 3 1822 MC39-M6 5 BATTERIES 1724 MC33-MC93 7 1679 L15-MC4 3 1747 MC103-M29 3 CHEMICAL ALARM 1824 SPLICE-MC67 5 1724 L27-MC112 3 1679 MC4-SII 1824 MC66-M70 5 1724 M67-SPLICE 1680 MC3-SPLICE 3 3 1824 MC68-M72 5 1724 SPLC-MCI12 1680 SPLICE-MC1 3 3 1824 SPLICE-MC70 5 1724 M67-MC33 3 1680 SPLC-SPLC 3 1725 L28-MC112 3 1824 SPLICE-MC71 5 1680 SPLICE-MC4 3 1824 MC65-MC39 5 STE/ICE 1725 MC84-MC83 7 1680 SPLC-SPLC 3 1824 SPLICE-MC68 5 1725 MC33-MC84 7 1680 SPLC-SPLC 1824 MC67-M71 5 1680 SPLICE-L19 1725 MC112-MC33 3 3 5 FUEL PSI 1824 MC43-M42 1680 SPLICE-L19 1726 MC33-MC84 3 5 1755 MC84-MC83 1824 MC69-M73 1680 MC3-MC78 1726 MC84-MC83 7 6 1755 MC44-CB18 1824 MC70-M74 5 1726 MC112-MC33 1680 MC4-S10 3 3 1824 MC71-M75 5 1755 MC33-MC84 1726 L29-MC112 1680 MC78-L24 6 LH B.O. TAIL LIGHT 3 1755 MC33-MC44 1824 SPLICE-MC69 5 3 1680 MC1-R17 4 B.O. LIGHTS 1824 MC66-SPLICE 5 1765 MC3-MC113 6 1680 MC78-L22 6 RH B.O. TAIL LIGHT 1824 SPLICE-MC65 | 5 1765 L35-MC8 6 TRAILER CONN 24VDC 3 1680C MC25-MC15 1824 SPLICE-MC43 1765 MC3-MC8 3 5 1680C MC25-MC15 6 TRAILER CONN 24VDC 4 B.O. TAIL LIGHTS 1825 MC68-MC69 5 1729 MC31-S18 3 SELF RECOVERY WINCH 1680C MC25-R17 6 TRAILER CONN 24VDC 1729 MC31-MC55 1825 MC70-MC71 5 1680C MC25-MC15 6 1825 MC65-MC43 5 1729 MC55-MC121 6 SELF RECOVERY WINCH 1702 MC44-MC34 1825 MC43-MC67 5 3 SELF RECOVERY WINCH 1702 MC34-G7 1730 MC31-S18 1825 MC67-MC68 5 1730 MC55-MC122 6 SELF RECOVERY WINCH 1702 MC44-R26 1825 MC70-M74 5 1708 M32-1709 3 PASSENGER AIR HTR 1730 MC31-MC55 1825 MC69-MC70 5 1709 MC58-S19 3 GAS PART FILTER SW 1731 MC3-S4 3 SELF RECOVERY WINCH 5 1825 MC41-MC65 1731 MC3-S4 3 SELF RECOVERY WINCH 1709 MC58-M30 3 5 3 DRIVER AIR HEATER 1825 MC68-M72 1731 MC3-MC29 6 CRANE 1710 M31-1709 6 SELF RECOVERY WINCH 1825 MC66-M70 5 TURBO OUTLET PSI 1809 MC41-MC65 5 PULSE TACH DRIVE 1732 MC55-MC123 1711 CB11-R7 4 3 SELF RECOVERY WINCH 5 STE/ICE 1825 MC65-MC39 5 STE/ICE 1732 S4-MC31 1809 MC65-MC39 1712 MC1-CB7 4 ENGINE BRAKE 5 PULSE TACH DRIVE 1825 MC69-M73 5 1809 MC41-M40 1732 MC31-MC55 1712 MC4-MC1 3 1825 MC67-M71 5 1733 MC31-M67 1810 MC65-MC39 5 STE/ICE 1713 MC53-L37 3 - 3 1825 MC39-MC40 5 STE/ICE MODULE 1810 MC41-M40 5 PULSE TACH DRIVE 1713 MC4-MC1 1733 MC31-M51 6 3 1825 MC43-M42 5 FUEL PSI 1734 M67-SPLICE 3 1810 MC41-MC65 5 PULSE TACH DRIVE 1713 S16-MC4 3 ENGINE BRAKE 1734 SPLC-SPLC 5 DIFFERENTIAL PSI 1825 MC71-M75 5 3 1811 MC42-M41 4 TRANSMISSION 1713 MC1-R7 1811 MC42-MC39 1825A MC39-MC40 5 STE/ICE MODULE 5 STE/ICE 1734 SPLICE-MC31 3 1713 S16-MC53 3 5 DIFFERENTIAL PSI 1826 MC40-MC39 5 1812 MC42-M41 1734 MC31-M10 6 1714 MC1-1716 1827 MC40-MC39 5 STE/ICE 5 1714 MC4-MC1 3 ENGINE BRAKE 1736 MC39-MC39 5 1812 MC42-MC39 1828 MC39-M48 5 SHUNT 1813 MC39-M6 1714 S16-MC4 3 ENGINE BRAKE 1737 MC31-MC1 3 5 SHUNT 4 CRANE HI IDLE 5 BATTERIES 1829 MC39-M48 1737 MC1-R22 1814 MC39-M6 1715 MC4-MC1 3 ENGINE BRAKE 6 CRANE 1835 R2-CB2 4 1815 MC39-MC24 5 1715 S16-MC4 3 ENGINE BK RH COILS 1737 MC31-MC29 1839 R7-R8 4 1815 MC24-MC114 5 1715 MC11-MC1 1738 MC44-1755 4 1860 MC39-MC24 5 1715 MC11-M21 5 LH ENGINE BRAKE 1738 MC44-MC31 3 1815 MC24-M20 5 1860 MC24-MC114 5 1816 MC39-MC65 5 STE/ICE 1716 MC11-R5 4 RETARDER 1738 MC31-MC29 6 CRANE 1861 MC24-MC114 5 1816 MC39-M7 5 STARTER 1716 MC11-M22 5 RH ENGINE BRAKE 1739 MC44-CB21 4 1717 MC44-S20 3 CHEMICAL ALARM SW 1717 MC44-CB19 1718 M76-M77 6 BACK-UP ALARM 1722 MC34-1734 3 FIGURE FO-1. ELECTRICAL SYSTEM SCHEMATIC FOLDOUT 6 OF 35 ENGINEERING DWG\_1878290 SHEET 2 FP-11/FP-12 BLANK TO T4 16

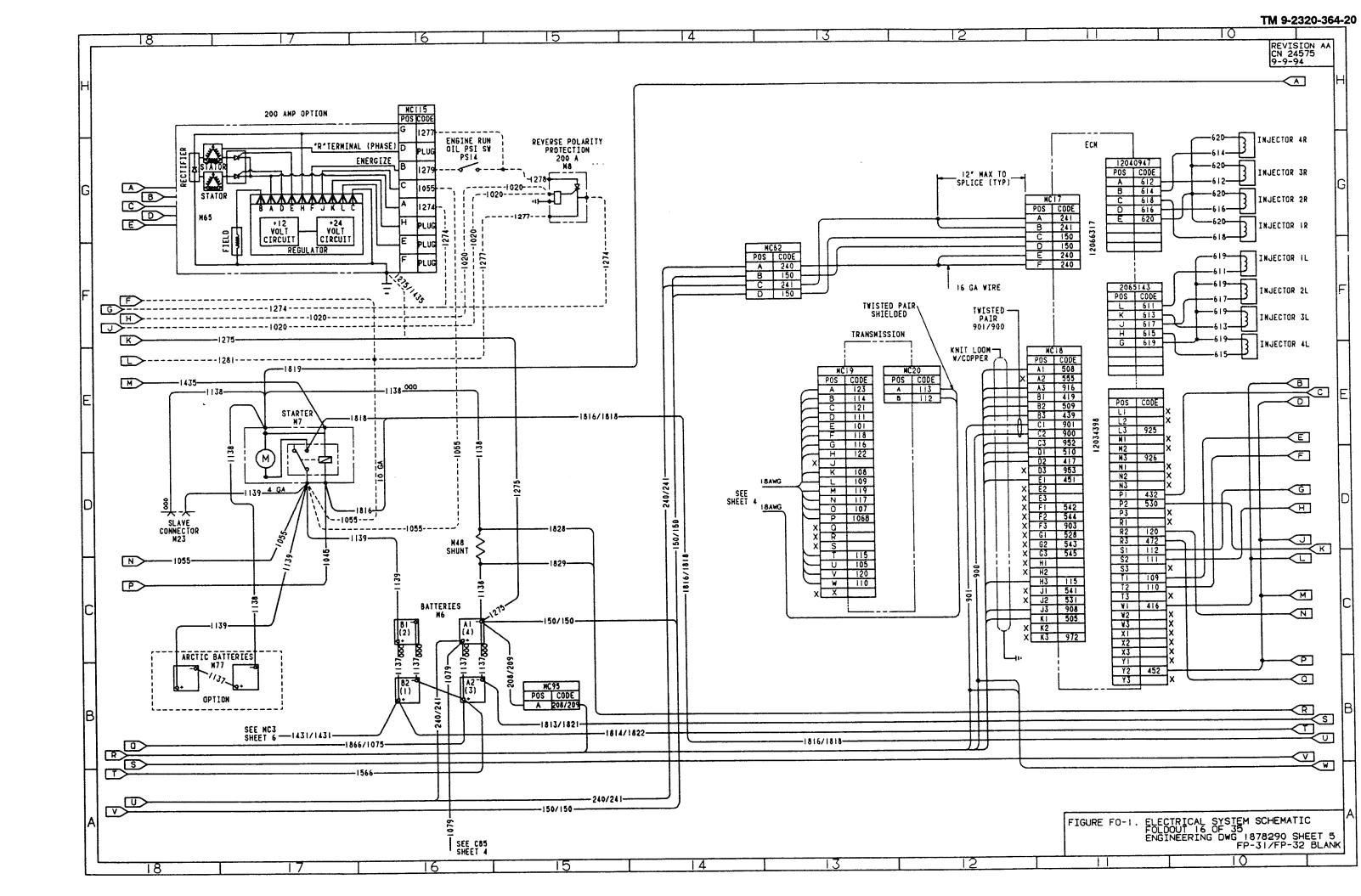
TM 9-2320-364-20 4 6 REVISION V CN 24138 CODE SORT CODE SORT CODE SORT DESCRIPTION ROUTING SH DESCRIPTION COOE ROUT ING DESCRIPTION COOE CODE ROUTING 1946 MC65-MC39 5 STE/ICE MC39-MC24 5 1861 1946 MC68-M72 5 AIR BOX PSI 4 CB12-M6 1866 1946 MC68-MC65 4/3 1866 M6-CB12 1947 MC67-MC65 1867 R19-CB12 4 5 ETHER START 1947 MC65-MC39 5 STE/ICE 1926 MC56-MC23 1871 MCII-CBII 4 DOEC TRANS 1947 MC67-M71 5 AIR CLEANER PS8-MC11 5 ATEC OIL PSI SWITCH 1927 RI-CBI 4 HEADLIGHTS 1871 5 1948 MC67-MC65 1871 MC11-R8 1928 MC34-MC31 4 1948 MC65-MC39 5 STE/ICE 1871 MC11-R11 1928 L38-MC34 4 6 TRAILER 1949 MC69-MC65 5 FUEL RETURN 1928 MC31-MC30 1871 MC11-R10 4 6 TRAILER 1949 MC69-MC65 1929 MC31-MC30 5 1871 MC11-R18 4 1949 MC65-MC39 5 STE/ICE 1872 R19-MC44 4 1929 MC34-MC31 1950 MC5-MC4 1932 MC128-MC61 6 WATER TEMP 3 | 1872 MC44-R18 4 DOEC 1932 MC61-TS3 6 WATER TEMP 1950 S8-MC4 3 1872 MC44-1020 3 1951 MC65-MC39 5 STE/ICE 1932 MC59-MC63 1875 CB14-R19 4 6 1932 MC63-MC128 5 FUEL RETURN 1951 MC69-M73 6 3 1880 MC4-MC35 1951 MC69-MC65 5 1933 MC61-TS3 1880 MC44-CB17 4 CTI 6 WATER TEMP 1952 MC65-MC39 5 1882 MC52-R21 1933 MC63-MC61 5 ENGINE OIL TEMP 1933 MC59-MC63 1952 MC70-M74 1882 MC52-SPLICE 4 6 FAN CONTROL VALVE 1952 MC70-MC65 1882 MC52-R20 1935 MC76-M45 1935 MC59-MC76 1952B MC39-S22 5 STE/ICE ZEROING 1883 | S26-L40 3 TC LOCK-UP LIGHT 6 1935 MC76-M45 6 FAN CONTROL VALVE 1953 MC39-MC24 5 1883 S26-M49 3 TC LOCK-UP 1953 MC24-MC114 5 1884 MCI-R20 4 INTER AXLE 1935 MC59-MC76 6 1884 MCI-M39 1938 MC70-M74 5 1953 MC24-M20 5 1884 MCI-MC105 3 1938 MC70-MC65 1955 M67-MC21 3 FAN SPEED CONTROL 1956 MC127-MC44 3 FAN SPEED CONTROL 1885 MCI-M39 4 1938 MC65-MC39 5 1957 MC127-MC21 3 FAN SPEED CONTROL 1938B MC39-S22 5 STE/ICE ZEROING 1885 MC1-MC105 3 1939 MC71-M75 5 ENGINE WATER TEMP 1885 R23-R21 4 5 STE/ICE 1939 MC65-MC39 1885 MC1-R23 1939 MC71-MC65 1888 CB16-R21 4 DIFFERENTIAL LOCK 5 STE/ICE ZEROING 4 INTER AXLE 1939B MC39-S22 1888 CB16-R20 1940 MC71-MC65 1889 MC44-R20 4 INTER AXLE 1940 MC71-M75 5 ENGINE WATER TEMP 1889 MC44-M50 3 INTER AXLE LOCK 3 DIFFERENTIAL LOCK 1940 MC65-MC39 5 STE/ICE SHIELD MC32-MC64 6 CTI AUX MANIFOLD 1890 MC44-M51 6 CTI POWER MANIFOLD 1890 MC44-R21 4 DIFFERENTIAL LOCK 1940B MC39-S22 5 STE/ICE ZEROING SHIELD MC32-MC109 1941 MC43-M42 5 FUEL PSI 1891 MC52-SPLICE 4 1891 MC52-R10 4 REVERSE 1941 MC43-MC65 5 1916 S8-MC4 3 1941 MC65-MC39 5 STE/ICE 1916 MC5-M2 1942 MC43-MC65 3 WIPER MOTOR 5 1916 MC5-MC4 3 WIPER MOTOR 1942 MC65-MC39 5 1942 MC43-M42 5 FUEL PSI 1917 MC5-M2 3 5 STE/ICE 1943 MC65-MC39 1917 MC5-MC4 3 1917 S8-MC4 1943 MC66-M70 5 TURBO OUTLET PSI 3 1943 MC66-MC65 5 TURBO OUTLET PSI 1919 MC2-MC5 3 1919 MC5-M2 1944 MC66-M70 5 3 1944 MC65-MC39 5 STE/ICE 1919 MC5-1118 3 1944 MC66-MC65 5 TURBO OUTLET PSI 1919 MC2-CB10 4 1920 MC2-1008 1945 MC68-MC65 5 1920 MC2-R2 4 CLEARANCE LIGHTS 1945 MC68-M72 5 AIR BOX PSI 1921 S7-MC4 1945 MC65-MC39 5 SIE/ICE 3 3 1946 MC67-M71 5 1921 M1-MC4 ELECTRICAL SYSTEM SCHEMATIC FOLDOUT 7 OF 35 ENGINEERING DWG\_1878290 SHEET 2 FIGURE FO-1. FP-13/FP-14 BLANK 6 8

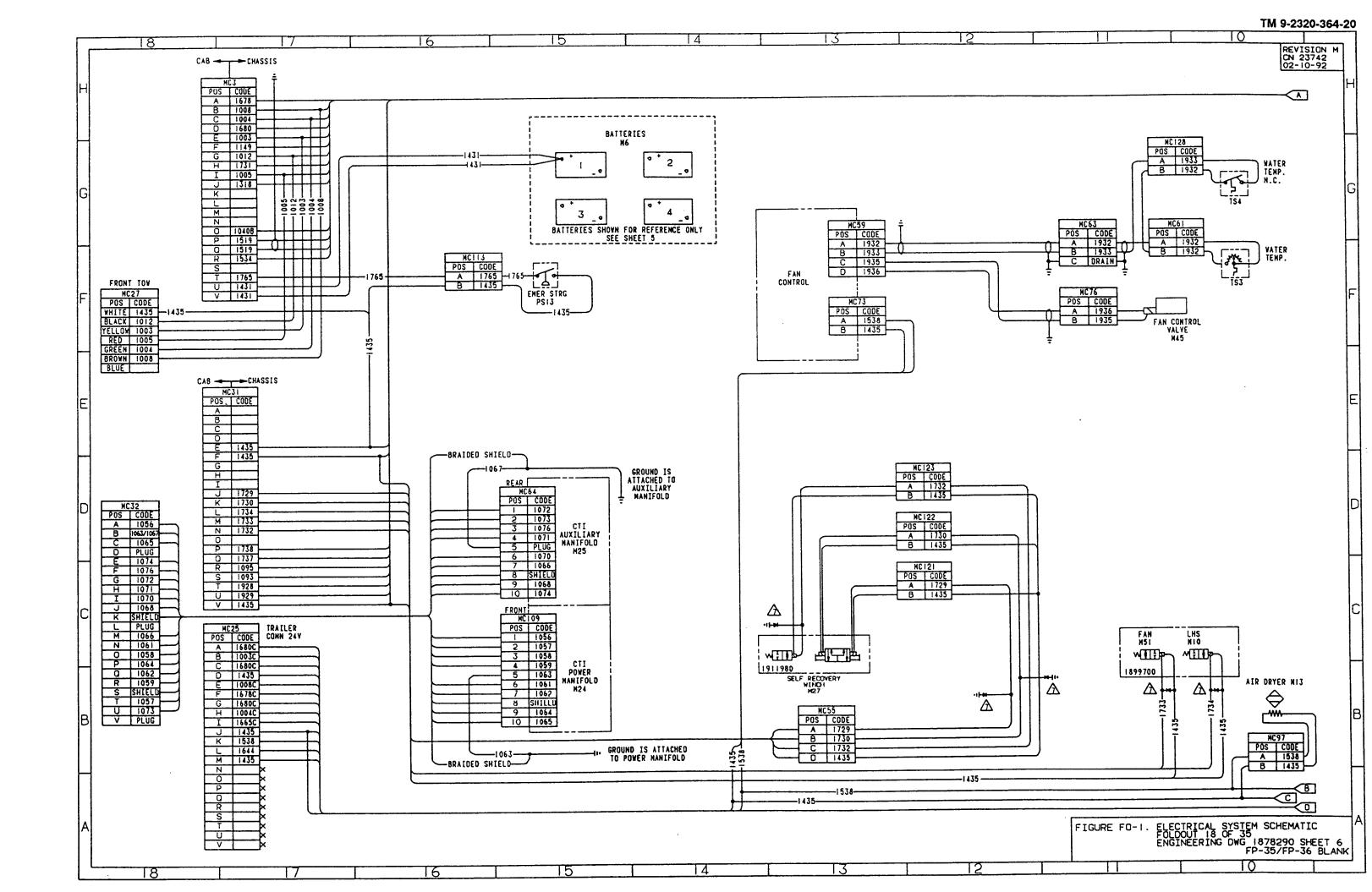


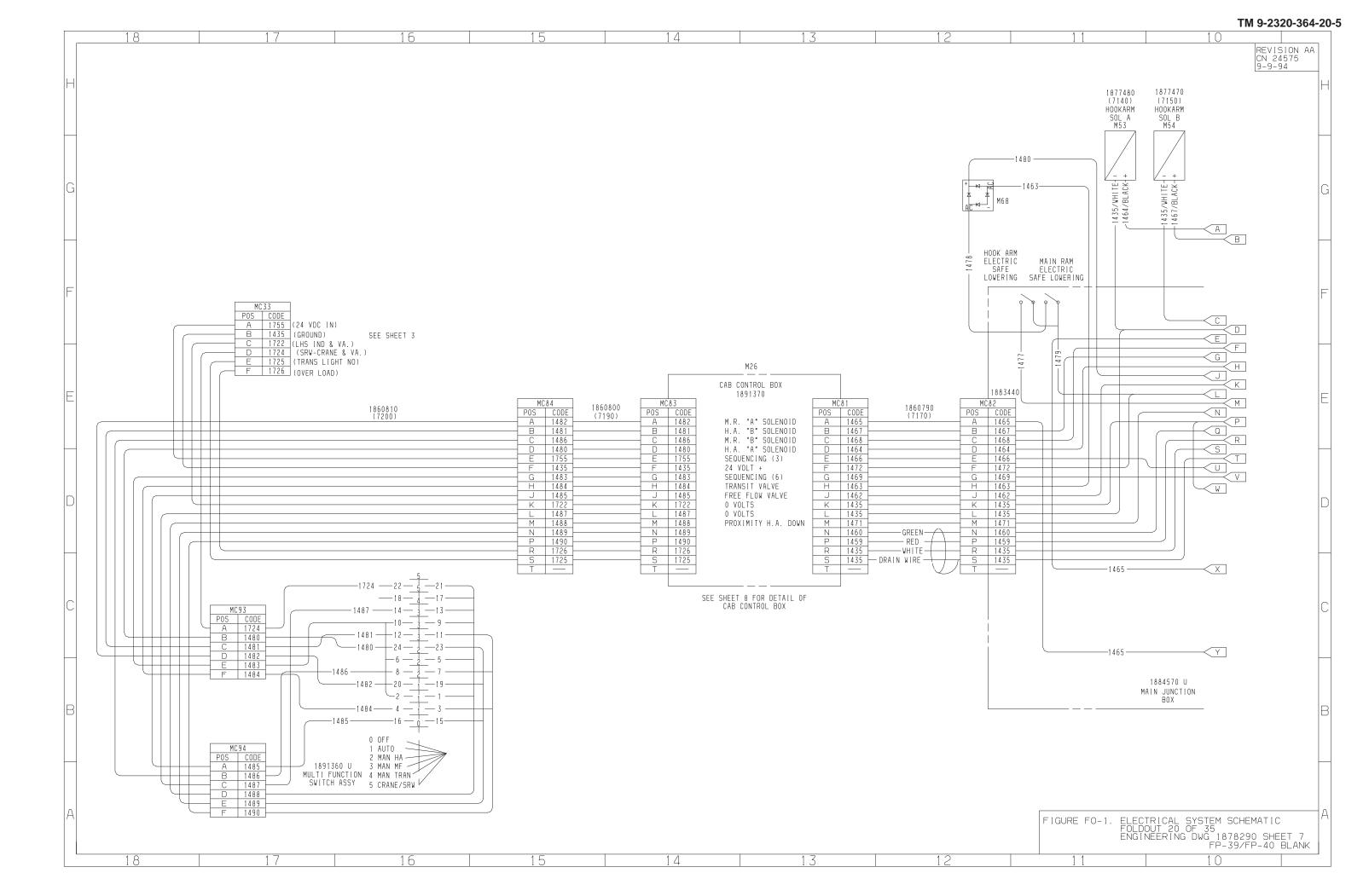


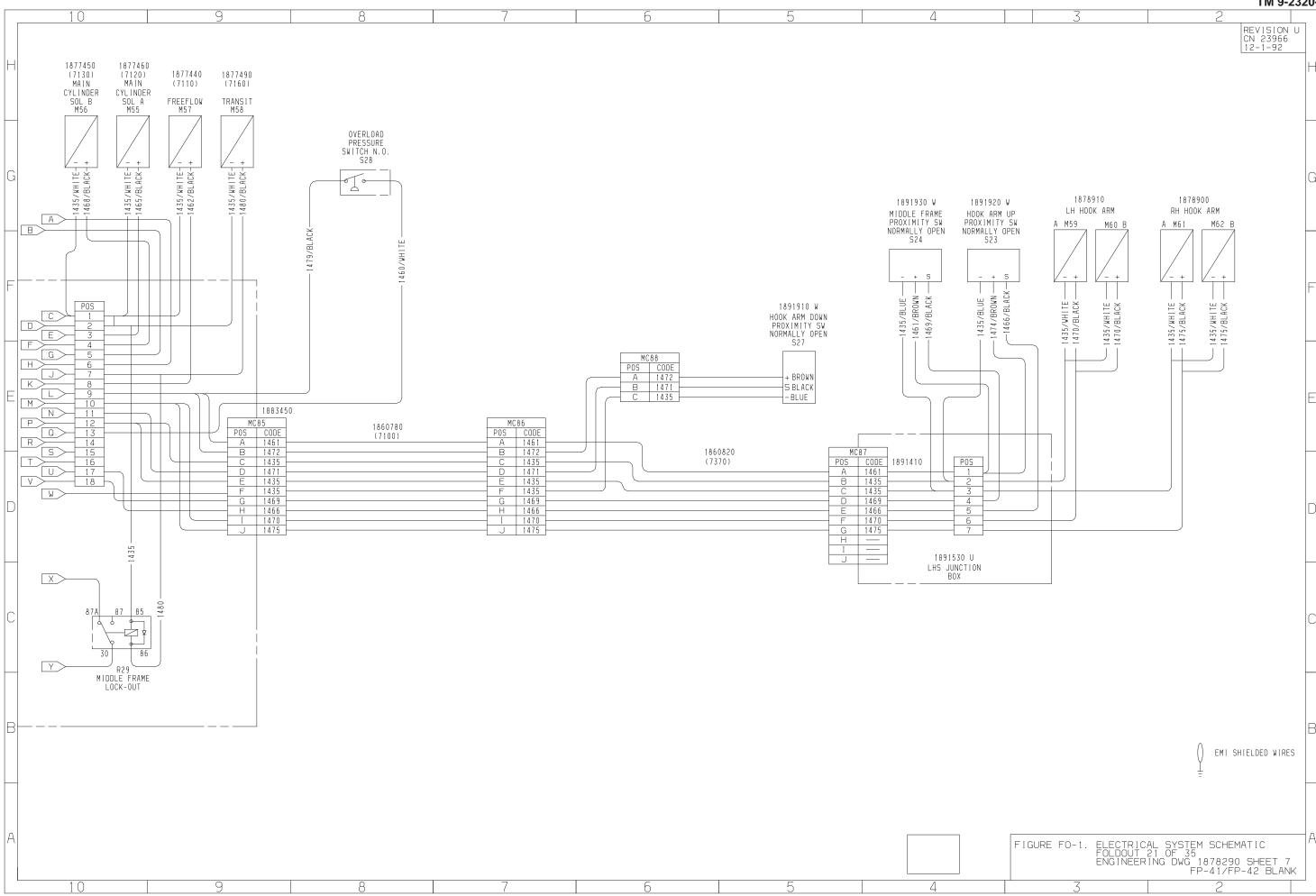




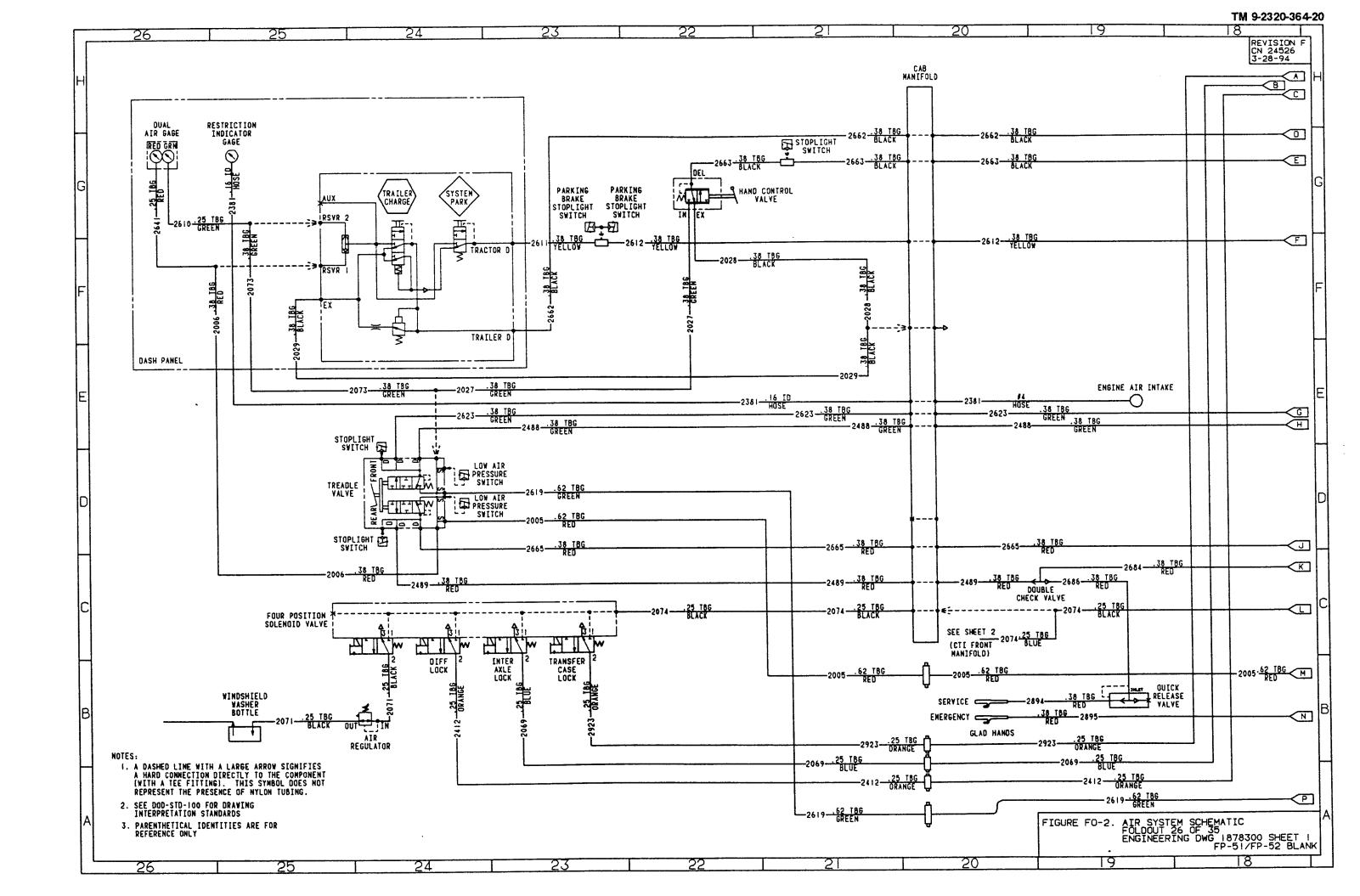


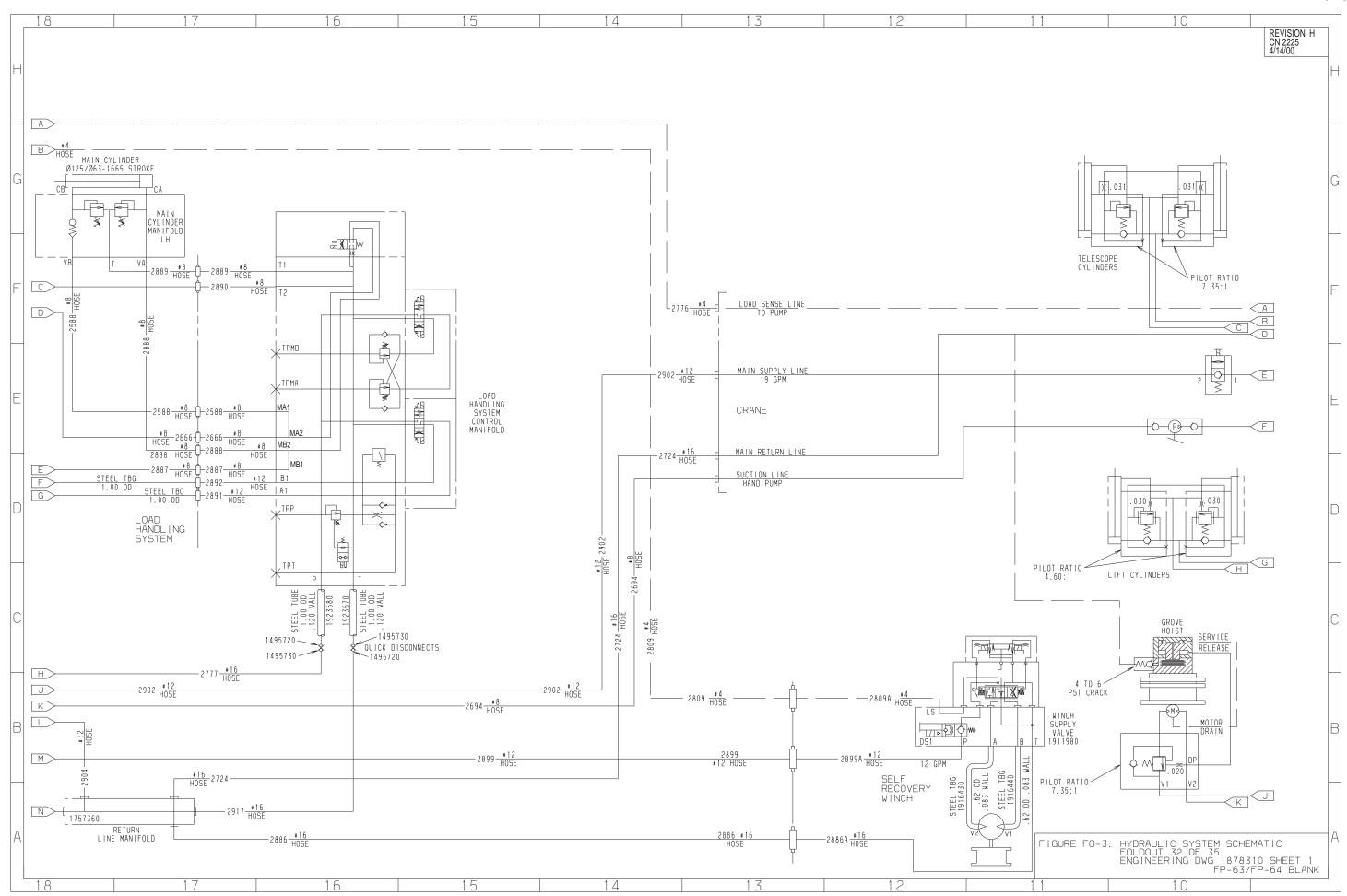






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## **SCHEMATICS**

## Section II. 200 AMP ALTERNATOR AND DDEC III/IV ENGINE.

Section II contains the schematics for trucks equipped with the 200 amp alternator and the DDEC III/IV engine.

WEST   STATE   STATE	18
WEST   STATE   STATE	REVISI CN 2
WEST   STATE   STATE	ATURE SWITCHES 4/14/00
Mile	
SCI   COL	
MEDIT   10   AND STREET   MEDIT   MEDI	
NO.   10.5   1.5	
MET   C   S   2   MASSIS   MET   E   12   SER FEBRUARY   MATERIAL   MATERIA	5 ENGINE WATER
MCC   01   3   STOCKED   MCC   02   3   STOCKED   MCC   03   0   STOCKED   MCC   04   STOCKE	
Mode   10   25   25   25   10   10   25   25   25   25   25   25   25   2	DELAVO
MCC   DIS 3   THROTHE BENDON   MCC   MCC	RELAYS
Yes   16   3   TANN SIGNAL	H DESCRIPTION
Micro   19   3   200425   Micro   16   6   Micro   16	1 HEADLIGHTS
NOTE OF ALL AS EQUIPMENT   NOTE OF ALL AS EXAMPLES   NOTE OF ALL AS	ID/CLEARANCE LIGHTS
MOTO   Graph   Section   MOSS   11   3   5   5   5   5   5   5   5   5   5	
MC11   03   0   0   0   0   0   0   0   0	WORK LIGHTS
MC11   296   6   OBCC	BEACON LIGHTS
MOIS   MOS   4 SHIFT CONTAINES   MOS   6 S   5 EFFECE ENGINE   MOIS   7 S   MOSTER CAPACITY   MOSTER   MOSTER   MOSTER   MOIS   MOSTER	TRANSMISSION
MC1   FG   3   DION CONN DEEC   MC6   C2   S   TUBS OUTLET PSI   MC12   C1   G   SELF RECOVERY WINCH   MC12   C1   SELF RECOVERY   MC12   C1   SELF RECOVERY   MC12   C1   SELF RECOVERY   MC12   SELF RECOV	RATARDER
MC15   B4   6   MILITRAY CONNECTOR   MC68   02   5   ATR BOX PSI   MC12   D12   6   SELF RECOVERY WINCH   L20   H3   3   OCC   SELF RECOVERY WINCH   MC15   D13   S   OCC   SELF RECOVERY WINCH   MC16   D13   S   OCC   S   SELF RECOVERY WINCH   MC16   D13   S   OCC   SELF RECOVERY WINCH   M	1 CK TRANSMISSION
MC16   0.4   6   TRAILLER   MC9   0.2   5   FULL RETURN   MC126   0.3   6   MOKENUP LIGHT/ALDRIN   1.21   0.7   6   New York Light   1.21   0.7	REVERSE
MC17   G11   5   DICC	NEUTRAL START
MC16   E11   5   DDC	1 12 V MAG SWITCH
MC73   F13   6   FAN CONTROL   MC12   B15   3   TRADITLE POSN SW   L23   G2   6   BACK LP   S24   G2   7   ROOK SW HOCK ARM UP   R15   G13   A   RC12   B15   B16   G12   A   RC12   B16   B16	
MC20   E1 2   5   TRANSMISSION   MC27   E3 2   E3 CHE SENSOR   MC78   E1 3   FAN CONTROL VALVE   L28   E2 3   ENGINE SENSOR   MC78   E1 3   FAN CONTROL VALVE   L28   E2 3   LES INDICATOR   S26   E7 3   TO LOCKUP   R16   E1 4   E1 4   E2 2 3   LES INDICATOR   S27   E5 7   HOCK ARM COUN   R10   E1 4   E1 4   E1 4   E2 2 3   AUXILLERY HOR IND   S27   E5 7   HOCK ARM COUN   R10   E1 4	BO SERVICE TAIL LTS
MC21   E2   3   ENGINE SENSOR   MC76   F11   6   FAN CONTROL VALVE   L26   E22   3   L15   INDICATOR   S26   E3   E1   E1   E1   E3   E3   E1   E1	
MC21   Mc6   5   NOINE SENSOR   MC79   67   60   REPRELIGHT GROUP   L27   E22   3   LESTINATION   L28   E23   3   TRANSIT INDICATOR   S27   E5   7   HOK ARR DOWN   R19   G10   4   R19   G1	BLACK OUT TAIL LTS
MC24   G19   5   ALTERNATOR   MC78   F4   6   REAR LIGHT GROUP   L28   E23   3   TARNST INDICATOR   R20   G3   ALTERNATOR   MC84   G19   5   ALTERNATOR   MC80   G4   6   REAR LIGHT GROUP   L29   E23   3   LANGLUARY HYDE IND   S29   B19   4   ARCTIC PUMP   R21   G3   A   MC82   C17   6   TARLER 24VOC   MC81   E13   7   LHS   L13   LHS   LHS   L13   LHS   LH	
MC23   B23   S   ETHER START	TRANS DDEC
MC25   C17 6   TRAILER 24VDC   MC81   E13 7   LHS	INTER AXLE
MC27   F18   6   FRONT TOW   MC82   E12   7   LHS   LHS   LHS   L31   D2   6   RH REAR S MKR (RED)   S32   C17   S ATTERY DISCONNECT   R24   G6   At RC29   F8   6   CRANE   MC84   E15   7   LHS   LHS   L33   B2   6   LH S LIDE MKR (AMBER)   S32   C17   S ATTERY DISCONNECT   R24   G6   At RC29   F8   6   CRANE   MC85   E9   7   LHS   LHS   L33   B2   6   LH S LIDE MKR (AMBER)   S32   C17   S ATTERY DISCONNECT   R24   G6   At RC29   F8   G ATTERY DISCONNECT   R25   G17   At RC29   F8   G ATTERY DISCONNECT   R25   G17   At RC29   F8   G17   At RC29   G18   At RC29   At RC29	DIFFERENTIAL LOCK
MC28   E6   3   BEACON LIGHT   MC83   E14   7   LHS   L32   H4   6   RH SIDE MKR (AMBER)   FRESSURE SUITCHES   R24   G6   4   MC85   E14   7   LHS   L33   B2   6   LH SIDE MKR (AMBER)   FRESSURE SUITCHES   R25   B17   At MC83   E14   T   LHS   L33   B2   6   LH SIDE MKR (AMBER)   FRESSURE SUITCHES   R25   B17   At MC83   E14   T   LHS   L33   B2   6   LH SIDE MKR (AMBER)   FRESSURE SUITCHES   R25   B17   At MC83   E14   T   LHS   L33   B2   B18   At MC83   E14   T   LHS   L35   B18   At MC83   E14   T   LHS   L35   B18   At MC83   E14   T   LHS   L35   B18   At MC85   E14   T   LHS   L35   B18   At MC83   E14   T   LHS   L35   E14   T   L45   E14	CRANE HI IDLE
MC29   F8   6   CRANE   MC84   E15   7   LHS   L34   H4   6   LH REAR S MICE (RED)   NUMBER (2016   S HE COLOR S)   RESULTE SWITCHES   R25   B17   4   MC31   B21   3   CAP/CHASSIS   MC86   E7   T   LHS   L34   H4   6   LH REAR S MICE (RED)   NUMBER (2016   S HE COLOR S)   R25   B18   A   MC31   B21   3   EMPCREDARY STEERING   R26   B18   A   MC31   B21   3   EMPCREDARY STEERING   R26   B18   A   MC33   F17   T   LHS   L35   G16   3   LOW HYD OIL   PS2   F9   3   REAR BRAKE   R27   G19   5   F18	HIGH RANGE LOCKOUT
MC30         C5         6         TRAILER         MC85         E9         7         LHS         L34         H4         6         LH REAR S MKR (RED)         NUMBER ZONE SH         DESCRIPTION         R26         B16         4           MC31         B21         3         CAB/CHASSIS         MC86         E7         7         LHS         L35         G16         3         EMERGENCY STEERING         PSI         G9         3         FRONT BRAKE         R27         D19         5           MC33         F17         LHS CAB         MC88         E6         7         LHS         L36         G16         3         LOW HYD OIL         PS2         F9         3         RRAKE         R29         C10         -7         MC92         C8         RARKE         R29         C10         -7         L4         L37         D21         3         ENGINE BRAKE         PS3         F9         3         HRAKE         R29         C10         -7         L4         L4         C8         L1         AFRAKE         R29         C10         -7         L4         R29         C10         -7         L4         R29         C10         -7         L4         L4         L4         L4	T.C. DUAL MODE
MC31   B21   3   CAB/CHASSIS   MC86   E7   7   CHS	
MC32   B23   3   CT1 CHASSIS   MC86   C5   7   LHS   MC86   E6   TIS   TIS   MC86   E6   TIS   MC86   E6   TIS   TIS   TIS   MC86   E6   TIS   TIS	
MC33   F17   7   LHS CAB   MC88   E6   7   LHS   MC90   C3   G   REAR LIGHT GP HARN   MC91   G8   G   S   STRN COLCAB HARN   MC92   F8   G   S   STRN COLCAB HARN   MC93   C15   3   VERNIER CONTROL   MC93   C17   C18   MC94   B17   7   LHS   MC40   G5   5   STE/ICE   MC42   F8   G   S   STE/ICE   MC42   F8   G   S   STE/ICE   MC44   F8   G   S   STE/ICE   MC44   F8   G   G   S   STE/ICE   MC44   F8   G   S   G   S   STE/ICE   MC44   F8   G   S   G   S   STE/ICE   MC94   B16   A   B   B16   A   B   B17   C18   B17   C18   B18   B18   B19	MAGNETIC SWITCH
MC34   C19   3   24 V METERS   MC90   C3   6   REAR LIGHT GP HARN   MC35   D24   3   CT1   MC36   A5   4   THROTTLE SENSOR   MC92   F8   3   STRC COLCAB HARN   MC39   H7   5   STE/ICE   MC94   G5   5   STE/ICE   MC94   G2   5   PULSE TACH DRIVE   MC95   B15   5   DEC BATTERY POWER   MC41   G2   5   PULSE TACH DRIVE   MC94   G5   3   CAB/TRANSMISSION   MC42   G5   3   CAB/TRANSMISSION   MC44   F26   4   CAB/TRANSMISSION   MC45   D5   4   EU ATEC   MC94   E76   4   CAB/TRANSMISSION   MC102   A3   4   DEC 6. 8K RESISTOR   MC103   E5   3   CHM DETECTOR   MC94   F6   6   EWARD AND ALL AND AL	MIDDLE FR LOCKOUT
MC36         A5         4         THROTTLE SENSOR         MC92         F8         3         STRG COLCAB HARN           MC38         C15         3         VERNIER CONTROL         MC93         C17         7         LHS         L41         C2         6         L.H. B.O. CL LIGHT         PS6         D17         3         LOW AIR PRESSURE         R3         B20         4           MC40         G5         5         STE/ICE         MC94         B17         7         LHS         L42         D2         6         R.H. B.O. CL LIGHT         PS6         C2         5         ATEC OIL PRESSURE         R40         G5         10           MC41         G2         FPULSE TACH DRIVE         MC95         B15         5         DDEC BATTERY POWER         MC96         C2         3         LOW HYD OIL         L44         F5         3         HEATER PANEL LIGHT         PS10         GOVERNOR PRESSURE         NUMBER ZONE SHE         NUMBER ZONE	
MC38         C15         3         VERNIER CONTROL         MC93         C17         7         LHS           MC39         H7         5         STE/ICE         MC94         B17         7         LHS         L41         C2         6         R.H.         B.O.         CL LIGHT         PS8         C22         5         ATEC OIL PRESSURE         R40         G5         10           MC41         G2         5         PULSE TACH DRIVE         MC96         C2         3         LOW HYD OIL         L44         F5         3         HEATER PANEL LIGHT         PS9         D22         5         ENGINE OIL         PS10         GOVERNOR PRESSURE         NUMBER ZONE SH         SU1         E21         5           MC44         F26         4         CAB/TRANSMISSION         MC99         B8         6         AFTER COOLER         MC102         A3         4         DEC 6.8K RESISTOR         MC103         E5         3         CHEM DETECTOR         NC103         E5         3         CHEM DETECTOR         NC103         E5         3         CHEM DETECTOR         NC103         E5         A LEAT COOLER         NC103         E5         B. L	
MC39       H7       5       STE/ICE       MC94       B17       7       LHS       L42       D2       6       R. H. B.O. CL LIGHT       PS8       C22       5       ATEC OIL PRESSURE       R40       G5       10         MC40       G5       5       STE/ICE MODULE       MC95       B15       5       DDEC BATTERY POWER       L43       B5       3       POST LIGHT       PS9       D22       5       ENGINE OIL       PS10       GOVERNOR PRESSURE       NUMBER ZONE SH       SU1       E21       5         MC45       D5       4       ECU ATEC       A DEC 6.8K RESISTOR       MC103       E5       3       CHEM DETECTOR       NUMBER ZONE SH	ARCTIC PUMP
MC40         G5         5         STE/ICE MODULE         MC95         B15         5         DDEC BATTERY POWER         L43         B5         3         POST LIGHT         PS9         D22         5         ENGINE OIL         PS10         GOVERNOR PRESSURE         NUMBER ZONE SH         NUMBER ZONE SH <t< td=""><td>ARCTIC PUMP</td></t<>	ARCTIC PUMP
MC41         G2         5         PULSE TACH DRIVE         MC96         C2         3         LOW HYD OIL         L44         F5         3         HEATER PANEL LIGHT         PS10         GOVERNOR PRESSURE         NUMBER ZONE SLINE         NUMBE	0 CRANE/SRW RELAY
MC42         H4         5         DIFFERENTIAL PRESS         MC97         B10         6         AIR DRYER           MC43         F2         5         FUEL PRESSURE         MC98         B9         6         AIR DRYER         NUMBER ZONE SITE         PS13         F15         6         EMERGENCY STEER         SU1         E21         5           MC44         F26         4         CAB/TRANSMISSION         MC102         A3         4         DDEC 6.8K RESISTOR         MC103         E5         3         CHEM DETECTOR         SU4         F6         6	ENDING UNIT
MC43         F2         5         FUEL PRESSURE         MC98         B9         6         AIR DRYER           MC44         C5         3         CAB/TRANSMISSION         MC99         B8         6         AFTER COOLER         SU1         E21         5           MC45         D5         4         ECU ATEC         MC102         A3         4         DDEC 6.8K RESISTOR         SU2         D21         5           MC45         D5         4         ECU ATEC         MC103         E5         3         CHEM DETECTOR         SU3         D21         5	H DESCRIPTION
MC44       C5       3       CAB/TRANSMISSION       MC99       B8       6       AFTER COOLER         MC44       F26       4       CAB/TRANSMISSION       MC102       A3       4       DDEC 6.8K RESISTOR       DDEC 6.8K RESIST	WATER TEMPERATURE
MC44 F26 4 CAB/TRANSMISSION MC102 A3 4 DDEC 6.8K RESISTOR MC45 D5 4 ECU ATEC PS15 F26 5 BOOST PRESSURE SU3 D21 5 SU4 F6 6	TRANSMISSION TEMP
MC45 D5 4 ECU ATEC MC103 E5 3 CHEM DETECTOR SU4 F6 6	ENGINE OIL PRESSURE
MC104 E5 3 CHEM ALARM  SU5 D6 6	SPEEDOMTER
	FUEL LEVEL
	+
FIGURE FO-1. ELECTRICAL	SYSTEM SCHEMATIC
FOLDOUT 1 0	OF 26 G DWG 3053493 SHEE1
ENGINEERING	FP-1/FP-2 BLAN
26 25 24 23 22 21 20 19	1.8

18	17	16 15	14	13 12	11 10 1
					REVISION CN 15194 12/23/97
	CIRCUIT BREAKERS	MISCELLANEOUS	MISCELLANEOUS	CODE SORT	CODE SORT [12/23/97
H	NUMBER ZONE SH DESCRIPTION	NUMBER ZONE SH DESCRIPTION	NUMBER ZONE SH DESCRIPTION	CODE ROUTING SH DESCRIPTION	CODE ROUTING SH DESCRIPTION
	CB1 D22 4 15 AMP	M1 86 3 WINDSHIELD WSHR SOL	M57 G9 7 LHS FREEFLOW	104 MC36-M4 4 THROTTLE SENSOR	212 MC9-MC12 4
	CB2 D22 4 15 AMP	M2 B13 3 WIPER MOTOR	M58 G9 7 LHS TRANSIT	104 MC10-MC36 4 THROTTLE SENSOR	213 MC50-R8 4 RETARDER
H	CB3 D21 4 15 AMP	M3 E17 3 LOW OIL & AIR ALARM M4 A5 4 THROTTLE POSN CONT	M59 F3 7 LHS LH HOOK ARM A	105 MC10-MC19 4/5 ATEC 106A MC10-MC36 4 THROTTLE SENSOR	213 MC9-MC50 4
	CB4 D21 4 15 AMP CB5 D20 4 20 AMP	M4 A5 4 THROTTLE POSN CONT M5 C20 4 FLASHER	M60 F3 7 LHS LH HOOK ARM B	106A   MC10-MC36   4   THROTTLE SENSOR     106A   MC36-M4   4   THROTTLE SENSOR	214 MC50-R10 4 REVERSE 214 MC9-MC50 4
	CB6 D20 4 15 AMP	M6 C16 5 BATTERIES	M62 F2 7 LHS RH HOOK ARM B	106A MC10-106B 4/5 ATEC	215 MC9-MC50 4
	CB7 D19 4 10 AMP	M7 E17 5 STARTER	M64 C19 5 POLARITY PROTECTION	106B 106A-MC19 4/5 ATEC	215 MC50-R9 4 CHECK TRANSMISSION
	CB8 D19 4 15 AMP	M8 B22 5 ETHER START		107 MC10-MC19 4/5 ATEC	216A MC106-MC13 3
	CB9 D18 4 10 AMP CB10 D17 4 3 AMP	M9 D6 6 FUEL/WATER SEP M10 C10 6 LHS SOLENOID VALVE	M66 G16 3 RECTIFIER M67 C8 3 RECTIFIER	108 MC10-MC19 4/5 ATEC 109 MC10-MC19 4/5 ATEC	216A MC9-MC51 4 ATEC 216A MC51-MC106 4 ATEC
	CB11 D16 4 8 AMP	M11 C8 6 AFTERCOOLER	M68 G12 7 RECTIFIER	110 MC10-MC19 4/5 ATEC	218 MC9-MC12 4 ATEC
H	CB12 D16 4 8 AMP	M12 C20 5 FUEL PUMP	M70 F2 5 TURBO OUTLET PSI	111 MC10-MC19 4/5 ATEC	219 MC9-MC12 4 ATEC
	C813 D15 4 8 AMP	M13 B10 6 AIR DRYER	M71 E2 5 AIR CLEANER	112 MC10-MC20 4/5 ATEC	220 MC9-MC12 4 ATEC
	CB14 D14 4 15 AMP	M14 E6 3 CHEMICAL DETECTOR	M72 D2 5 AIR BOX PSI	113 MC10-MC20 4/5 ATEC	221 MC9-MC12 4 ATEC
	CB15 D13 4 15 AMP CB16 D12 4 15 AMP	M14 89 6 AIR DRYER M15 D1 3 HORN	M73 C2 5 FUEL RETURN M74 C2 5 ENGINE OIL TEMP	114 MC10-MC19 4/5 ATEC 115 MC11-MC18 5 ECM	222 MC9-GROUND
[ ]	CB17 D12 4 3 AMP	M16 D16 3 VERNIER CONTROL	M75 B2 5 ENGINE WATER TEMP	115 MC11-MC102 4 6.8K RESISTOR	223A MC51-SPLICE 4
	CB18 D11 4 10 AMP	M17 F5 3 HEATER MOTOR	M76 E10 4 RECTIFIER	115 MC10-MC19 4/5 ATEC	223A SPLC-SPLC 4
	CB19 D10 4 15 AMP	M18 F24 3 LOW OIL PRESS ALARM	M77 B17 5 ARCTIC BATTERIES	116 MC10-MC19 4/5 ATEC	223A SPLC-SPLC 4
H	CB20 D9 4 15 AMP CB21 D9 4 30 AMP	M20 G22 5 ALTERNATOR, STD	M78 E2 6 BACK-UP ALARM	117 MC10-MC19 4/5 ATEC 118 MC10-MC19 4/5 ATEC	223A   SPLC-SPLC   4
	CB22 D7 4 20 AMP	M21 C25 5 RH SIDE ENG BK COIL	M80 B7 6 ARCTIC PUMP	119 MC10-MC19 4/5 ATEC	2238 MC12-SPLICE 4
	CB23 D7 4 20 AMP	M22 C24 5 LH SIDE ENG BK COIL	M81 F4 3 RECTIFIER	120 MC10-MC19 4/5 ATEC	225 CB11-MC12 4
<sub>c</sub>	CB24 C20 5 3 AMP	M23 D18 5 SLAVE CONNECTER		121 MC10-MC19 4/5 ATEC	230 MC12-234 4
[E] .	CB25 A14 4 15 AMP	M24 B15 6 CTI POWER MANIFOLOD	M83 F3 10 LHS FUSE - 5 AMP	122 MC10-MC19 4/5 ATEC	231 MC50-MC12 4
	CB26 A13 4 15 AMP	M25 D15 6 CT1 AUXILIARY MANF M26 E13 7 LHS CAB CONTROLLER		123 MC10-MC19 4/5 ATEC 124 MC36-M4 4 THROTTLE SENSOR	231 MC5D-R22 4 CRANE HI IDLE 231 MC5D-M36 4
	GAUGES	M27 B13 6 SELF RECOVERY WINCH		124 MC10-MC36 4 THROTTLE SENSOR	231 M36-R11 4 NEUTRAL START
H	NUMBER ZONE SH DESCRIPTION	M28 E25 3 CT1 CONTROLLER		150 MC62-MC62 5/4	233 MC50-MC12 4
	G1 G20 3 WATER TEMPERATURE	M29 G14 7 CHEMICAL ALARM		150 MC17-MC62 5	234 MC12-GROUND 4
	G2 G21 3 OIL PRESSURE G3 G22 3 FUEL LEVEL	M30 D11 3 GAS PART FILTER M31 D11 3 AIR HEATER DRIVER		195 MC5-M2 3 201 MC51-GROUND 4	240 MC62-CB23 5/4 240 CB23-M6 4/5
	G4 G22 3 TACHOMETER	M32 D12 3 AIR HEATER PASS		201 MC9-MC51 4	240 MC17-MC62 5
	G5 G23 3 SPEEDOMTER	M33 D3 7 SRW SOLENOID VALVE		202A MC9-SPLICE 4	240 MC62-M6 5
	G6 G19 3 VOLTMETER 12V	M35 E15 3 THROTTLE POSITIONER		203 MC9-MC51 4	241 MC62-CB22 5/4
	G7 G19 3 VOLTMETER 24V	M36 C9 4 DIODE		203 MC51-CB12 4	241 MC62-M6 5
<b>-</b> -	G10 G20 3 XMSN OIL TEMP G11 G18 3 AIR PRESSURE	M39 F9 4 RECTIFIER M40 G2 5 PULSE TACH DRIVE		204 MC9-MC12 4 ATEC 206 MC9-MC12 4 ATEC	241 MC17-MC62 5 241 CB22-M6 4/5
	G12 H18 3 AIR RESTRICTION	M41 H5 5 DIFFERENTIAL PRESS		207A MC51-MC106 4 ATEC	309 MC45-R24 4 TC DUAL MODE
		M42 F2 5 FUEL PRESSURE		207A MC9-MC51 4 ATEC	313 MC45-R24 4 TC DUAL MODE
		M43 G5 5 STE/ICE MODULE		207A MC106-MC13 4	315 MC45-R24 4 TC DUAL MODE
		M45 F10 6 FAN CONTROL VALVE		208/209 MC11-SPLICE 4 208/209 SPLICE-MC51 4	417 MC6-M35 3 417 MC11-MC44 4
		M48 D16 5 SHUNT M49 B9 3 XFR CASE LKUP SOL		208/209 SPLICE-MC51 4 208/209 M6-MC95 5	417 MC11-MC18 5 ECM
		M50 88 3 INTER AXLE SOL V		208/209 MC95-MC11 5	417 MC44-MC6 3 THROTTLE SENSOR
H		M51 B8 3 DIFF SOLENOID VALVE		208/209 MC51-MC9 4	419 MC11-MC18 5 ECM
		M51 C11 6 FAN		210A MC9-MC12 4	419 MC11-MC44 4
		M52 A21 4 RECTIFIER M53 G11 7 LHS HOOK ARM B		211 R8-MC50 4 211 MC50-R8 4 RETARDER	419 MC8-L6 3 CHECK ENGINE LIGHT
R		M54 G10 7 LHS HOOK ARM A		211 MC50-R6 4 RETARDER	J CHECK ENGINE LIGHT
		M55 G10 7 LHS MAIN CYLINDER B			
		M56 G10 7 LHS MAIN CYLINDER A			
		<b> </b>	<del>                                     </del>		<del>                                      </del>
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[^]					FIGURE FO-1. ELECTRICAL SYSTEM SCHEMATIC FOLDOUT 2 OF 26 ENGINEERING DWG 3053493 SHEET
					ENGINEERING DWG 3053493 SHEET
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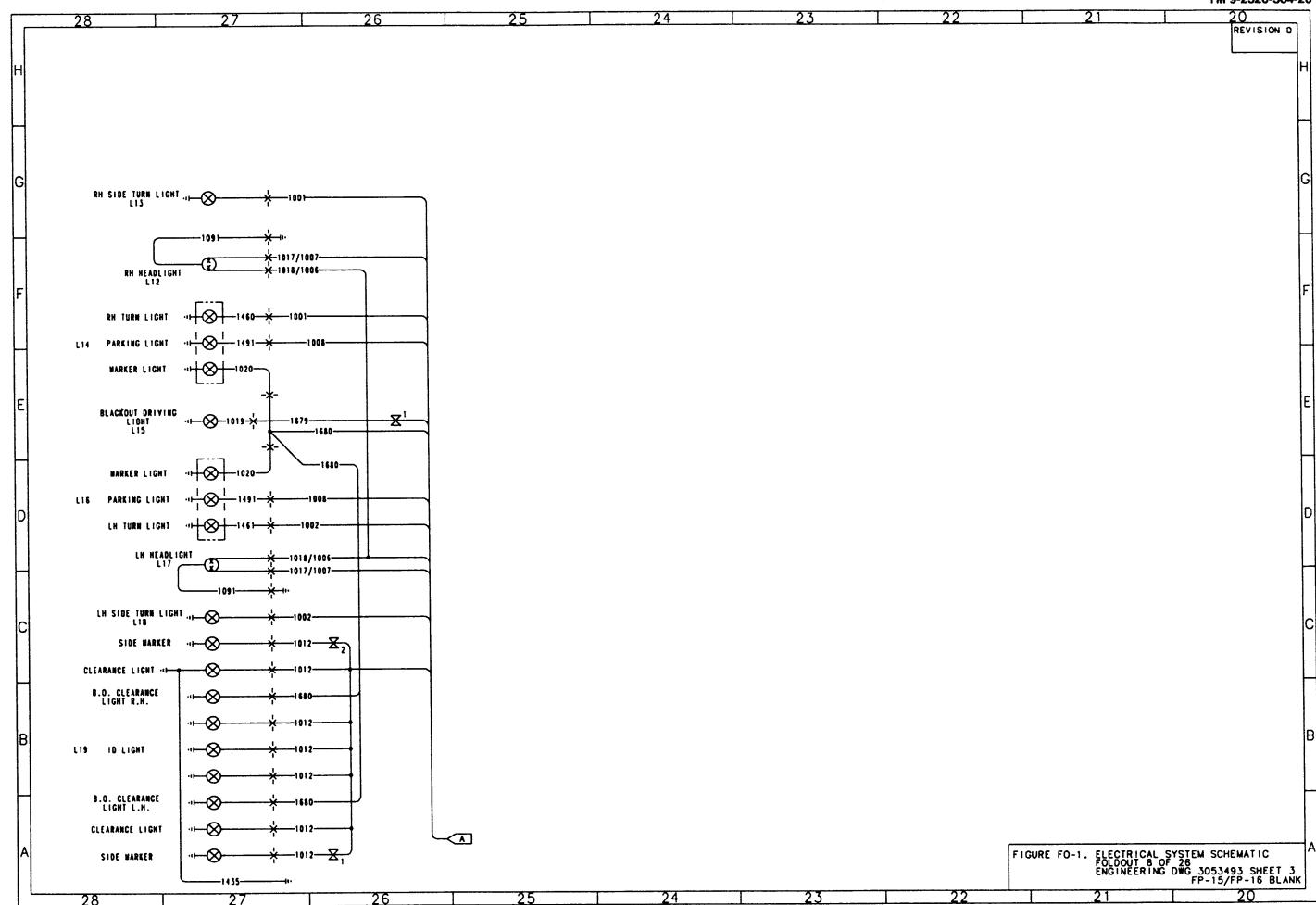
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					CN 15194 12/23/97
CODE SORT	CODE SORT	CODE SORT			
CODE ROUTING SH DESCRIPTION	CODE ROUTING SH DESCRIPTION	CODE ROUTING SH DESCRIPTION			]
439 MC116-MC106 4 EMERGENCY ENG STOP	1001 MC7-SPLICE 3	1008 MC27-MC3 6 FRONT TOW			į
439 MC116-S30 3 EMERGENCY ENG STOP	1001 MC8-SPLICE 3	1008 MC3-SPLICE 3			
439 MC116-S30 3 EMERGENCY ENG STOP	1001 SPLICE-L13 3	1008 MC3-MC4 3			-
439 MC116-C813 4 DDEC	1001 SPLICE-L14 3	1008 MC3-MC16 6 TRAILER CONN 12VDC			
439 MC106-MC13 3	1001 S1-MC7 3 RH HEADLIGHT	1008 MC78-L22 6 RH TAIL LIGHT 1008 MC78-L24 6 LH TAIL LIGHT			
439 SPLC-MC106 4 439 MC11-MC18 5 ECM	1002 S1-MC7 3 LH HEADLIGHT 1002 MC8-L11 3	1008 MC78-L24 6 LH TAIL LIGHT 1008C MC25-MC15 6 TRAILER CONN 24VDC			
439 MC11-MC18 5 ECM  439 MC8-L6 3 CHECK ENGINE LIGHT	1002 MC7-SPLICE 3	1008C MC25-R14 4 B.O. SERVICE			lo
439 MC8-L3 3 ENGINE STOP LIGHT	1002 SPLICE-MC8 3	1009 PS2-PS3 3			
439 MC44-MC8 3	1002 SPLICE-L18 3	1009 PS1-PS2 3			
439 MC11-SPLICE 4	1002 SPLICE-L16 3	1009 MC2-PS1 3			
439 SPLICE-MC44 4	1003 MC7-MC3 3	1009 MC2-CB6 4 STOP LIGHT			<u> </u>
439 SPLC-MC116 4	1003 S1-MC7 3 LH RR TURN SIGNAL	1012 MC3-SPLICE 3			
505 MC44-MC8 3 TACHOMETER	1003 MC3-MC80 6	1012 SPLC-SPLC 3			
505 MC11-MC44 4	1003 MC3-MC16 6 TRAILER CONN 12VDC	1012 MC2-SPLICE 3			1
505 MC8-G4 3	1003 MC1-R15 4 LH TURN LIGHT	1012 SPLC-SPLC 3			
505 MC11-MC18 5 5 509 MC11-MC18 5 ECM	1003 MC80-L24 6 LH STOP LIGHT 1003 MC27-MC3 6 FRONT TOW	1012   SPLICE-L19   3			
509 MC8-L3 3 ENGINE STOP LIGHT	1003 MC7-MC1 3	1012 MC3-SPLICE 6			
509 MC44-MC8 3	1003C MC25-R17 4 LH TURN LIGHT	1012 SPL1CE-MC27 6			
509 MC11-MC44 4	1003C MC25-MC15 6 TRAILER CONN 12VDC	1012 SPLICE-MC80 6			
510 MC11-MC18 5 ECM	1004 MC7-MC1 3	1012 SPLICE-L32 6 RH SIDE MARKER			
510 MC44-PS4 3 PARKING BRAKE	1004 MC7-MC3 3	1012 SPLICE-L34 6 LH SIDE MARKER			
510 R22-MC44 4	1004 S1-MC7 3	1012 MC90-L31 6 RR SIDE MARKER			
510 MC11-R22 4	1004 MC3-MC80 6	1012 MC90-L25 6 ID LIGHTS			
528 MC11-MC18 5 DIAG. REQ.	1004 MC80-L22 6 RH STOP LIGHT	1012 MC80-MC90 6			
528 MC106-S17 3	1004 MC27-MC3 6 1004 MC3-MC78 6	1012 MC90-L33 6 RR SIDE MARKER 1016 MC92-MC2 3			
528 MC11-MC106 4 900 MC11-MC106 4	1004 MC3-MC78 6 1004 MC3-MC16 6	1016 S15-MC92 3			
900 MC11-MC18 5 ECM	1004 MC1-R16 4	1016 MC2-R3 4 HORN			
900 MC106-MC13 3	1004C MC25-R16 4 RH TURN LIGHT	1017 SPLICE-R5 4			
901 MC11-MC18 5 ECM	1004C MC25-MC15 6 TRAILER CONN 24VDC	1017 MC52-R14 4			
901 MC106-MC13 3	1005 MC126-S9 3	1017 R2-MC52 4			
901 MC11-MC106 4	1005 PS3-MC3 3	1017 MC2-SPLICE 4			
908 MC11-MC18 5 ECM	1005 MC3-MC16 6 TRAILER CONN 24VDC	1017   SPLICE-R1   4			
908 MC11-M4 4 THROTTLE POSN CONT	1005 MC126-PS1 3	1017 MC91-MC2 3 1017 S1-MC91 3			
916 MC44-MC6 3 916 MC11-MC44 4	1005 PS2-PS3 3 1005 MC27-MC3 6 FRONT TOW	1017 S1-MC91 S			
916 MC38-M16 3	1005 PS1-PS2 3	1017A S1-MC91 3			
916 MC6-MC38 3 VERNIER CONTROL	1005   MC7-MC126 3	1017A MC2-R5 4			
916 MC6-M35 3 THROTTLE SENSOR	1005A MC126-S9 3	1018 MC8-L10 3 HIGH BEAM			
916 MC11-MC18 5 ECM	1005A S1-MC7 3 TURN SIGNAL/DIM SW	1018 MC8-1007 3			
952 MC38-M16 3	1006 MC2-SPLICE 3	1019 L15-1679 3			
952 MC11-MC44 4	1006 SPLICE-L12 3	1020 L14-L16 3			
952 MC44-MC6 3 THROTTLE SENSOR	1006 SPLICE-L17 3	1020 S2-MC21 3			
952 MC11-MC18 5 ECM	1006 MC2-R5 4 DIMMER	1020 MC60-CB24 5			
952 MC6-MC38 3 VERNIER CONTROL	1007 MC2-R5 4 DIMMER	1020 MC21-MC60 5			
953 M6-MC14 5 DDEC SIGNAL GROUND 953 MC14-SPLICE 4	1007 MC2-SPLICE   3   1007 SPLICE-L12   3	1020 M12-MC80 5			
953 MC14-SPLICE 4   953 SPLICE-MC102 4	1007 SPLICE-L17 3	1020B PS12-ENG 5 ALTERNATOR			
953 SPLICE-R22 4	1008 MC3-MC78 6	1021 MC2-S2 3			
953 SPLICE-MC106 4	1008 MC4-S12 3 HEADLIGHTS	1021 MC2-R11 4			
953 MC106-S17 3		1021 R11-M76 4			
953 S17-MC13 3		1021A R11-MC1 4			
988 MC11-R7 4 TRANSMISSION		1021A MC1-MC21 3			
988 MC11-MC18 5 ECM		10218 MC21-MC60 5			
1001 MC8-L4 3		10218 MC60-R27 5			
Δ				[	
				FIGURE FO-1. ELECTRICAL FOLDOUT 3 ENGINEERII	_ SYSTEM SCHEMATIC OF 26
				ĖŇĞĬŇĚĖRĬI	NG DWG 3053493 SHEET 1
					FP-5/FP-6 BLANK
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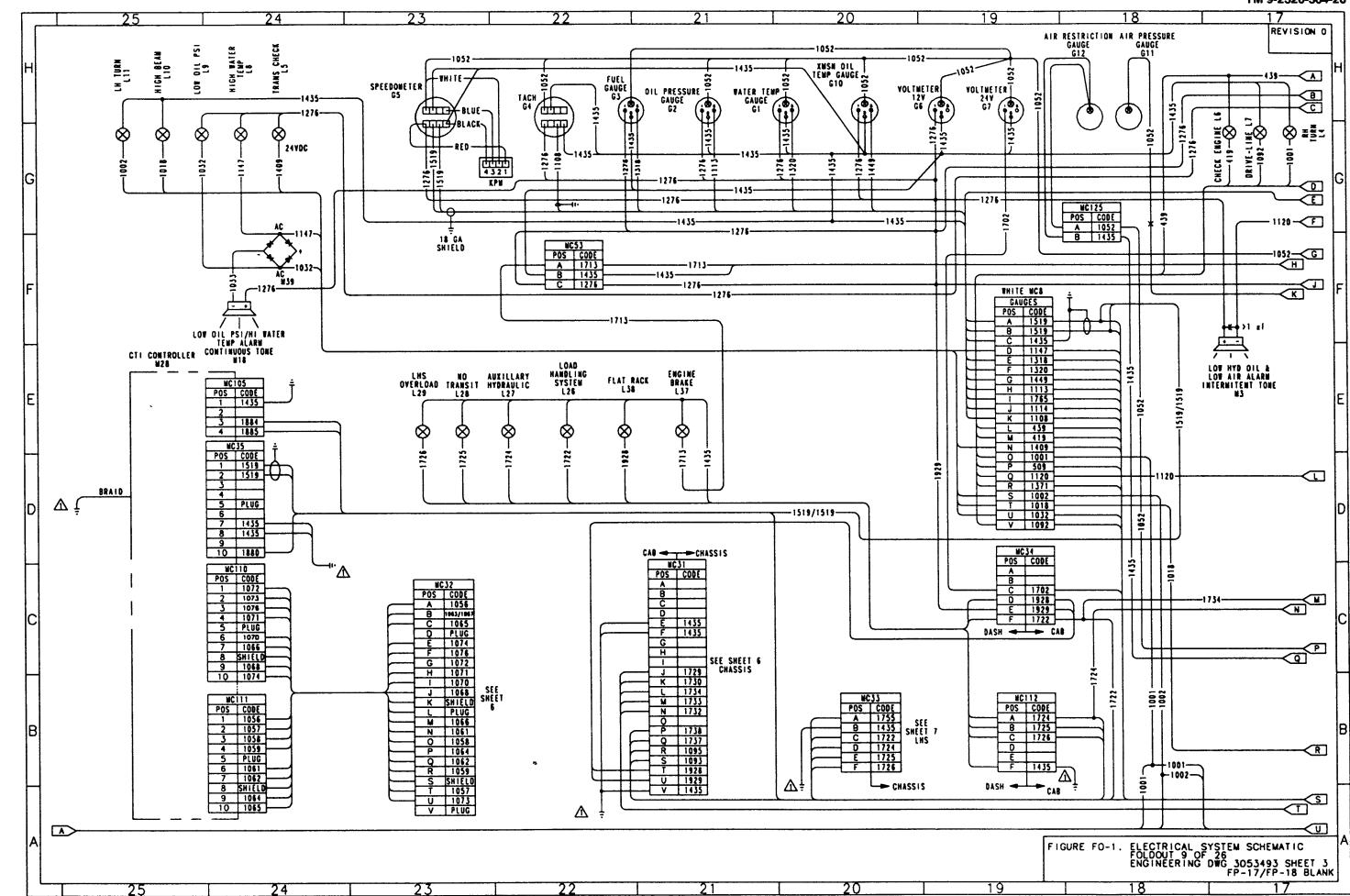
28 27	26 25	24 23	22	21 20 REVISION
2005 2007	CODE CODY	T002 2000		
CODE SORT	CODE SORT	CODE SORT		
CODE ROUTING SH DESCRIPTION	CODE ROUTING SH DESCRIPTION	CODE ROUTING SH DESCRIPTION		
1021 MC52-R11 4 FRONT TOW	1052 MC1-SPLICE   3   1052 SPLICE-L43   3   POST LIGHT	1080 MC2-M5 4 TURN SIGNAL/FLASHER 1082 MC2-MC52 4		
1021A R11-MC1 4 1021A MC1-MC21 5	1052 SPLC-MC125 3	1082 MC2-M81 3		
1021A MC21-MC60 5	1052 MC125-G12 3 AIR RESTRICTION G/			
1021A MC60-R27 5	1052 MC1-SPLICE   3	1082 MC52-CB15 4 HEATER		
1026 MC52-CB16 4	1052 MC1-CB1 4 15 AMP HEADLIGHT	1084 MC1-CB5 4 B.O. LIGHTS		
1029 MC2-R6 4 BEACON	1052 MC50-MC1 4	1084 MC4-MC1 3		
1029 MC2-MC28 3		1084 MC4-S9 3		
1031 R3-SPLICE 4	1055 M7-R27 5	1091 L17-GROUND 3		
1032 MC8-MC21 3		1092 L7-MC8 3		
1032 M39-L9 3 LOW OIL PSI	1056 MC111-MC32 3	1092 MC8-M51 3		
1032 MC8-M39 3	1056 MC32-MC109 6 CTI POWER MANIFOLE	1093 MC31-MC57 6		
1032 PS9-MC21 5 ENGINE OIL PSI SW		1093 MC1-MC31 3		
1033 M39-M18 3 OIL PSI/H WTR ALM	1057 MC111-MC32 3	1093 MC1-CB16 4		
1036 MC23-M8 5	1057 MC32-MC109 6 CTI POWER MANIFOL			
1036 MC23-M7 5	1058 MC32-MC109 6 CT1 POWER MANIFOL			
1036 MC21-MC56 5 ETHER START	1058 MC111-MC32 3	1095 R23-R24 4		
1036 MC21-S25 3	1059 MC32-MC109 6 CTI POWER MANIFOL			
1040 CB4-R4 4 WORKLIGHT	1059 MC111-MC32 3	1095 MC31-MC44 3		
1040A S6-MC4 3	1061 MC22-MC109 6 CT1 POWER MANIFOL			
1040A MC2-R4 4 WORKLIGHT	1061 MC111-MC32 3 1062 MC32-MC109 6 CTI POWER MANIFOL	1095 MC31-MC57 6		
1040A MC4-MC2 3 1040B MC3-MC79 6 RH WORKLIGHT	1062 MC32-MC109 6 CTI POWER MANIFOL	<sup>2</sup> -{ }		
10408 MC3-MC79 6 RH WORKLIGHT 10408 MC2-MC3 3	1063 MC32-MC109 6 CTI POWER MANIFOL			
1040B MC2-R4 4 WORKLIGHT	1064 MC32-MC109 6 CT1 POWER MANIFOL			
10408 MC3-MC54 6 LH WORKLIGHT	1064 MC111-MC32 3	1113 G2-MC8 3 OIL PSI GAUGE		
1045 R27-M7 5	1065 MC32-MC109 6 CTI POWER MANIFOL			
1049 MC2-R1 4 HEADLIGHTS	1065 MC111-MC32 3	1114 M66-MC8 3		
1049 MC4-MC2 3	1066 MC32-MC64 6 CTI AUX MANIFOLD	1114 MC96-MC8 3 LOW OIL LEVEL LIGHT		
1049 S12-MC4 3	1066 MC110-MC32 3	1114 MC8-L36 3		
1052 S20-S19 3 CHEM ALM-GPF	1067 MC32-MC64 6 CT: AUX MANIFOLD	1114 L36-M66 3		
1052 S19-S18 3 GAS PART FLTR-SRW	1068 MC32-MC64 6 CTI AUX MANIFOLD	1118 MC4-1919 3		
1052 S18-S4 3 SRW-SRW/MHC	1068 MC110-MC32 3	1118 S8-MC4 3		
1052 S4-S30 3 SRW/MHC-EMER ENG S D		1120 M66-MC8 3		
1052 S30-SPLICE 3 EMER ENG SHUT DOWN	1070 MC110-MC32 3	1120 M66-M3 3		
1052 SPLICE-GII 3 AIR PRESSURE GAUGE	1071 MC110-MC32 3 1071 MC32-MC64 6 CT! AUX MANIFOLD	1120 PS6-PS7 3 1120 PS6-MC8 3		
1052 MC4-SPLICE 3   1052 SPLICE-L44 3   HEATER PANEL LIGHT	1071 MC32-MC64 6 C11 AUX MAN1FOLD	1120 L2-M66 3		
1052 S5-S6 3 BEACON LT-WORK LT	1072 MC110-MC32 3	1137 M6(1)-M6(2) 5		
1052 S6-S7 3 WORK LT-WSHLD WSHR	1072 MC32-MC64 6 CTI AUX MANIFOLD	1137 M6(3)-M6(4) 5		
1052 S7-S8 3 WSHLD WASHER-WIPERS	1073 MC32-MC64 6 CTI AUX MANIFOLD	1138 M48-M7 5 SHUNT		
1052 S8-S21 3 WIPERS-DOME LIGHT	1073 MC11D-MC32 3	1138 M7-M23 5 SLAVE		
1052 S21-S9 3 DOME LT-B.O.SERV SEL		1138 M6-M48 5 SHUNT		
1052 S9-S10 3 BO SERV SEL-BO MKR	1074 R25-CB10 4	1138 M77-M7 5 ARCTIC BATTERIES		
1052 S10-S11 3 B.O. MARKER-B.O. DR	1074 MC32-MC64 6 CTI AUX MANIFOLD	1139 M7-M23 5 SLAVE		
1052 S11-S12 3 B.O. DRIVE-HEADLTS	1075 M6-R25 4/3	1139 M6-M7 5		
1052 S12-S16 3 HEADLIGHTS-ENG BK	1075B R25-R18 4	1139 M77-M7 5 ARCTIC BATTERIES		
1052 S16-S14 3 ENG BRAKE-RHEO/DOME	1076 MC110-MC32 3	1147 TS2-MC21 5 ENG WTR TEMP SNDG UN		
1052 S14-SPLICE 3 RHEOSTAT/DOME	1076 MC32-MC64 6 CT1 AUX MANIFOLD	1147 M39-L8 3 HIGH WATER TEMP		
1052 SPLICE-G6 3 VOLTMETER 12V	1079 CB5-M6 4 HAZARD LIGHTS	1147 MC8-MC21 3		
1052 SPLC-SPLC 3	1080 MC7-MC2 3	1147 MC8-M39 3		
1052 SPLICE-GIO 3 XMSN OIL TEMP GAUGE	<b>                                     </b>	1149 MC1-R10 4 REVERSE		
1052 SPLICE-G1 3 WATER TEMP GAUGE		1149 MC3-MC78 6		
1052 SPLICE-G2 3 OIL PRESSURE GAUGE		1149 MC1-MC124 3		
1052 SPLICE-G4 3 TACHOMETER		1149 MC78-MC77 6 REVERSE LIGHT 1149 MC124-MC77 6		
1052 SPLICE-G5 3 SPEEDOMETER		1173 MU127-MU// 0		
1052 SPLICE-G3 3 FUEL GAUGE				
			[5:0:05 50	1 FLECTOICAL EVETEN COURTER
			FIGURE FO	-1. ELECTRICAL SYSTEM SCHEMATIC FOLDOUT 4 OF 26 ENGINEERING DWG 3053493 SHEE!
			1	ÉNĞİNEERING DWG 3053493 SHEET FP-7/FP-8 BLAN
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C0	DDE ROUTING	SH DESCRIPTION	CODE ROUTING	SH DESCRIPTION	CODE ROUTING	SH DESCRIPTION	CODE ROUTING	SH DESCRIPTION
_	53 S21-MC4	3	1280 1281-R26	5.	1449 MC8-MC21	3	1519 MC8-MC35	3 CTI OVERSPEED
	53 MC4-L20	3 DOME LIGHT	1281 1280-MC47	5	1449 G10-MC8	3 TRANS OIL TEMP	1519 MC3-MC8	3 SPEEDOMETER
1.16	68 MC2-R3	4 HORN	1281 R27-M81	5	1449 SU2-MC21	5 TRANS TEMP SNDG UN	1519 MC8-MC35	3 CTI OVERSPEED
1.16	68 MC2-M15	3	1281A M6-S32	5 BATTERIES	1454 MC81-MC82	7	1519 G5-MC8	3 SPEEDOMETER
	74 BUS BAR	4	1281A S32-SPLICE	5	1460 MC81-MC82	7	1519 MC3-SU4	6 SPEEDOMETER
	75 R28-CB5	4	1281A SPLICE-M64	5	1461 MC86-MC87	7	1519 G5-MC8	3 SPEEDOMETER
	76 MC113-PS13	6 EMERGENCY STEER	1281A SPLICE-M20	5	1461 MC85-MC86	7	1519 MC3-MC8	3 SPEEDOMETER
	84 S5-MC4	3 4	1292 MC4-S6	3	1462 MC81-MC82	7	1519 MC3-SU4 1525 M16-PS4	6 SPEEDOMETER 3
_	84 MC2-R6 84 MC2-MC4	3	1292 CB4-MC2 1292 MC2-MC4	3	1463 MC81-MC82 1464 MC81-MC82	7	1525 M16-PS4 1534 MC107-M9	6 FUEL/WATER SEP
_	89 MC4-S9	3	1292 MC4-S12	3	1465 MC81-MC82	7	1534 MC2-SPLICE	4
_	89 MC44-R28	4	1314 1118-S7	3	1466 MC85-MC86	7	1534 SPLICE-CB8	4
	89 MC4-SPLICE	3	1318 MC3-MC8	3	1466 MC86-MC87	7	1534 MC3-MC107	6
1.18	89 MC4-S21	3	1318 MC3-G3	3 FUEL GAUGE	1467 MC81-MC82	7	1534 MC2-MC3	3
1.18	89 MC2-SPLICE	3	1318 MC3-SU5	6 FUEL LEVEL	1468 MC81-MC82	7	1534 MC3-S22	3 T-CASE LOCK-UP
1.18	89 MC2-M5	4	1320 SU1-MC2	5 WATER TEMP SNDG UN	1469 MC81-MC82	7	1534 CB15-M76	4
	89 SPLICE-MC44	3	1320 G1-MC8	3 WATER TEMP	1469 MC86-MC87	7	1538 MC97-M13	6 AIR DRYER
12	74 M20-M6	5	1320 MC8-MC21	3	1469 MC85-MC86	7	1538 MC25-MC97	6
100	7.4 140 000 100		1340 CB15-MC14	4 SWING FIRE	1470 MC86-MC87	7	1538 MC25-CB15	4
-	74 M8-SPLICE	5	1344 M20-MC22	5	1470 MC85-MC86	7	1538 MC25-MC98	6
12	75 M6-M20	5	1362 R27-M64 1371 MC8-PS5	3	1471 MC85-MC86 1471 MC86-MC87	7 7	1538 MC99-M11 1538 MC98-M14	6 AFTER COOLER 6 AIR DRYER
12	76 MC2-MC4	3	1371 L1-MC8	3	1471 MC81-MC82	7	1538 MC25-MC99	6
-	76 MC2-CB8	3	1409 MC8-MC1	3	1472 MC85-MC86	7	1538 MC25-MC73	6 FAN CONTROL
_	76 SPLICE-S14	3	1409 L5-MC8	3	1472 MC81-MC82	7	1538 M76-MC25	4
12	76 SPLICE-MC53	3	1409 MC1-R9	4	1472 MC86-MC88	7	1640 MC119-SPLC	4
12	76 MC4-SPLICE	3	1413 CB3-SPLICE	4	1475 MC85-MC86	7	1640 SPLICE-R26	4
12	76 MC2-SPLICE	4	1413 SPLICE-R6	4	1475 MC86-MC87	7	1640 SPLICE-MC44	4
-	76 MC53-SPLICE	3	1430 R28-SH5	4/5	1480 MC84-MC93	7	1640 MC44-S2	3
	76 SPLC-SPLC	3	1430 1832-R28	5	1480 MC84-MC83	7	1640 MC119-R32	4
	76 SPLC-SPLC	3	1431 MC3-S2	3	1481 MC84-MC83	7	1644 MC119-R33	4
	76 SPLICE-M3	3 LOW AIR ALARM	1431 MC3-M64	5/6 POLARITY PROTECTION	1481 MC84-MC93	7	1644 R33-R33	4 000710 01140
	76 SPLICE-G5 76 SPLICE-L1	3 SPEEDOMETER 3 PARKING BRAKE	1431 MC3-M64 1431 MC1-MC119	5/6 POLARITY PROTECTION 4	1482 MC84-MC93 1482 MC84-MC83	7	1644 MC119-S29 1644 R33-S29	4 ARCTIC PUMP 4 ARCTIC PUMP
_	76 SPLICE-L2	3 LOW AIR	1431 MC119-R32	4	1482 MC83-MC84	7	1644 MC119-MC25	4
_	76 SPLICE-L35	3 EMERGENCY STEERING	1431 R32-S29	4 ARCTIC PUMP	1483 MC84-MC93	7	1644 MC25-MC120	6
_	76 SPLICE-L36	3 LOW HYDR OIL	1431 MC119-CB20	4	1484 MC83-MC84	7	1644 MC120-M80	6 ARCTIC PUMP
_	76 SPLC-SPLC	3	1435 MC78-MC124	6	1484 MC84-MC93	7	1645 S29-R33	4 ARCTIC PUMP
12	76 SPLICE-L5	3 XMSN CHECK	1435 MC124-M78	6	1485 MC84-MC94	7	1665C MC25-MC15	6 TRAILER CONN 24VDC
12	76 SPLICE-L8	3 HIGH WATER TEMP	1435 MC77-MC124	6	1485 MC83-MC84	7	1665C MC25-CB20	4
_	76 SPLICE-L9	3 LOW OIL PSI	1435 MC85-MC86	7	1486 MC84-MC94	7	1674 S11-S10	3
	76 SPLICE-G3	3 FUEL GAUGE	1435 MC86-MC87	7	1486 MC83-MC84	7	1674 S11-S9	3
	76 SPLICE-G6	3 VOLTMETER 12V	1435 MC33-MC84	7	1487 MC1-S25	3	1676 R17-R16	4
	76 SPLICE-G1	3 WATER TEMP GAUGE	1435 GROUND	3	1487 MC1-CB15	4	1676 R16-R15	4
_	76 SPLICE-G2	3 OIL PRESSURE GAUGE 3 TACHOMETER	1435 MC81-MC82 1435 MC84-MC83	7 7	1487 MC83-MC84 1487 MC84-MC94	7 7	1676 R14-R3 1676 R15-R14	4 4
	76 SPLICE-G4 76 SPLICE-G10	3 XMSN OIL TEMP GAUGE	1435 MC84-MC83	7	1487 MC84-MC94	7	1676   R15-R14	4
	76 SPLICE-M18	3 ALARM	1435 MC108-GND	5	1488 MC83-MC84	7	1678 MC3-MC78	6
<u> </u>		· · · · · · · · · · · · · · · · · · ·	1435 GND	5	1489 MC83-MC84	7	1678 MC1-SPLICE	3
			1435 MC22-GND	5	1489 MC84-MC94	7	1678 MC78-L24	6 LH B.O. STOP LIGHT
			1435 M52-R26	4	1490 MC84-MC94	7		
			1435 M52-R28	4	1490 MC83-MC84	7		
12	79 PS14-1277	5	1435 R27-GND	5	1491 L16-1008	3		
	79 MC115-PS14	5	1435 MC125-GND	3	1491 L14-1008	3		
_	79 M64-1280	5	1435 MC23-M7	5	1517 PS8-MC11	5 ATEC OIL PSI SWITCH		
128	80 CB21-R26	4	1435 MC23-M8	5 EITHER START	1517 MC11-R9	4		
								OUDE EQ. 4. EL EGED LONG.
							FI	GURE FO-1. ELECTRICAL SYSTEM FOLDOUT 5 OF 26

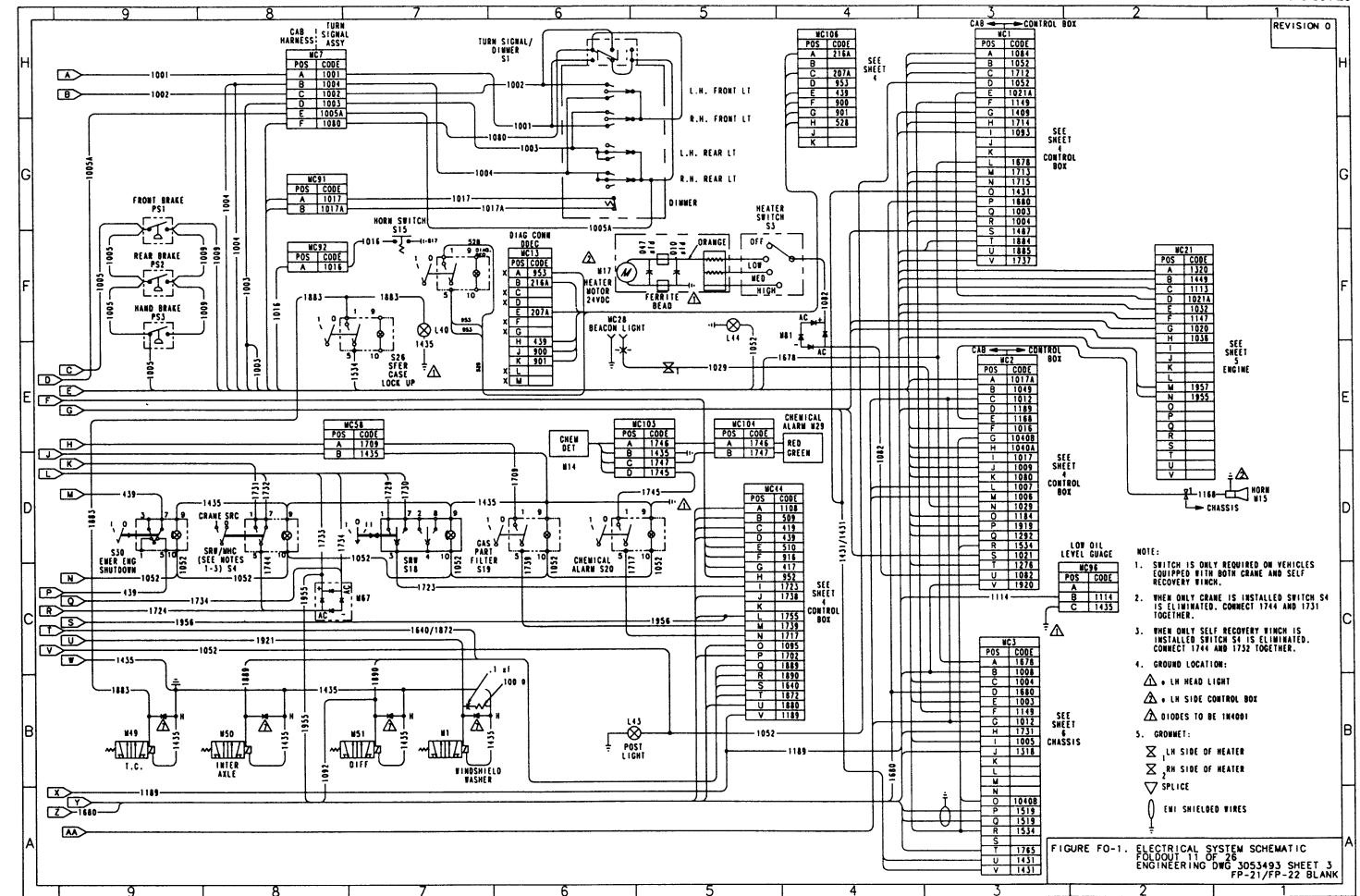
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	1678 MC78-L22 6 RH B.O. STOP LIGHT	1722 L26-MC34 3		1818 MC39-M7 5 STARTER
	1678 SPLICE-MC3 3	1722 MC33-MC84 7		1818 MC39-MC65 5 STE/ICE
	1678 MC1-R13 4	1722 MC84-MC83 7		1819 MC39-M7 5
	1678 SPLICE-MC4 3	1723 MC44-S18 3 SELF RECOVERY WN SW		1820 MC24-M20 5
	1678 MC4-S9 3	1723 MC44-CB18 4		1820 MC24-M20 5
	1678C MC25-R13 4 B.O. STOP LIGHT	1724 MC112-SPLC 3		1820 MC39-MC24 5 1821 MC39-M6 5
	1678C MC25-MC15 6 TRAILER CONN 24VDC	1724 SPLICE-MC33 3		1821 MC39-M6 5 1822 MC39-M6 5 BATTERIES
	1679 L15-MC4 3			1824 SPLICE-MC67 5
	1679 MC4-S11 3	1724 L27-MC112 3 1724 M67-SPLICE 3		1824 MC66-M70 5
	1680 MC3-SPLICE   3   1680 SPLICE-MC1   3	1724 SPLC-MC112 3		1824 MC68-M72 5
	1680 SPLICE-MC1 3	1724 M67-MC33 3		1824 SPLICE-MC70 5
		1725 L28-MC112 3		1824 SPLICE-MC71 5
	1680   SPLICE-MC4   3   1680   SPLC-SPLC   3	1725 MC84-MC83 7		1824 MC65-MC39 5 STE/ICE
	1680 SPLC-SPLC 3	1725 MC33-MC84 7		1824 SPLICE-MC68 5
	1680 SPLICE-L19 3	1725 MC112-MC33 3		1824 MC67-M71 5
	1680 SPLICE-L19 3	1726 MC33-MC84 7		1824 MC43-M42 5 FUEL PSI
	1680 MC3-MC78 6	1726 MC84-MC83 7		1824 MC69-M73 5
	1680 MC4-S10 3	1726 MC112-MC33 3		1824 MC70-M74 5
	1680 MC78-L24 6 LH B.O. TAIL LIGHT	1726 L29-MC112 3		1824 MC71-M75 5
	1680 MC1-R17 4 B.O. LIGHTS			1824 SPLICE-MC69 5
	1680 MC78-L22 6 RH B.O. TAIL LIGHT			1824 MC66-SPLICE 5
	1680C MC25-MC15 6 TRAILER CONN 24VDC		1765 L35-MC8 3	1824 SPLICE-MC65 5
	1680C MC25-MC15 6 TRAILER CONN 24VDC		1765 MC3-MC8 3	1824 SPLICE-MC43 5
	1680C MC25-R17 4 B.O. TAIL LIGHTS	1729 MC31-S18 3 SELF RECOVERY WINCH		1825 MC68-MC69 5
-	1680C MC25-MC15 6 TRAILER CONN 24VDC	1729 MC31-MC55 6		1825 MC70-MC71 5
	1702 MC44-MC34 3	1729 MC55-MC121 6 SELF RECOVERY WINCH		1825 MC65-MC43 5
	1702 MC34-G7 3	1730 MC31-S18 3 SELF RECOVERY WINCH		1825 MC43-MC67 5
	1702 MC44-R26 4	1730 MC55-MC122 6 SELF RECOVERY WINCH		1825 MC67-MC68 5
	1708 M32-1709 3 PASSENGER AIR HTR	1730 MC31-MC55 6		1825 MC70-M74 5
	1709 MC58-S19 3 GAS PART FILTER SW			1825 MC69-MC70 5
	1709 MC58-M30 3	1731 MC3-S4 3 SELF RECOVERY WINCH		1825 MC41-MC65 5
	1710 M31-1709 3 DRIVER AIR HEATER	1731 MC3-MC29 6 CRANE		1825 MC68-M72 5
	1711 CB11-R7 4	1732 MC55-MC123 6 SELF RECOVERY WINCH		1825 MC66-M70 5 TURBO OUTLET PSI
	1712 MC1-CB7 4 ENGINE BRAKE	1732 S4-MC31 3 SELF RECOVERY WINCH	1809 MC65-MC39 5 STE/ICE	1825 MC65-MC39 5 STE/ICE
	1712 MC4-MC1 3	1732 MC31-MC55 6	1809 MC41-M40 5 PULSE TACH DRIVE 1810 MC65-MC39 5 STE/ICE	1825 MC69-M73 5 1825 MC67-M71 5
	1713 MC53-L37 3	1733 MC31-M67 3		1825 MC67-M/1 5
	1713 MC4-MC1 3	1733 MC31-M51 6		1825 MC43-M42 5 FUEL PSI
	1713 S16-MC4 3 ENGINE BRAKE	1734 M67-SPLICE 3 1734 SPLC-SPLC 3		1825 MC71-M75 5
	1713 MC1-R7 4 TRANSMISSION	1734   SPLC-SPLC   3		1825A MC39-MC40
	1713 S16-MC53 3	1734 SPLICE-MC31 3		1826 MC40-MC39 5
	1714 MC1-1716 4 1714 MC4-MC1 3 ENGINE BRAKE	1734 MC31-M10 6		1827 MC40-MC39 5
	1714 MC4-MC1 3 ENGINE BRAKE 1714 S16-MC4 3 ENGINE BRAKE	1737 MC31-MC1 3	1813 MC39-M6 5	1828 MC39-M48 5 SHUNT
	1715 MC4-MC1 3 ENGINE BRAKE	1737 MC1-R22 4 CRANE HI IDLE		1829 MC39-M48 5 SHUNT
	1715 S16-MC4 3 ENGINE BK RH COILS		1815 MC39-MC24 5	1835 R2-CB2 4
	1715 MC11-MC1 4	1738 MC44-1755 4	1815 MC24-MC114 5	1839 R7-R8 4
	1715 MC11-MC1 5 LH ENGINE BRAKE	1738 MC44-MC31 3	1815 MC24-M20 5	1860 MC39-MC24 5
	1716 MC11-R5 4 RETARDER	1738 MC31-MC29 6 CRANE	1816 MC39-MC65 5 STE/ICE	1860 MC24-MC114 5
	1716 MC11-M22 5 RH ENGINE BRAKE	1739 MC44-CB21 4	1816 MC39-M7 5 STARTER	1861 MC24-MC114 5
	1717 MC44-S20 3 CHEMICAL ALARM SW			
	1717 MC44-CB19 4			
	1718 M76-M77 6 BACK-UP ALARM			
	1722 MC34-1734 3			
	1,722 1,737 3	<b>+   - +   </b>		
				FIGURE FO-1. ELECTRICAL SYSTEM S
				FIGURE FO-1. ELECTRICAL SYSTEM S FOLDOUT 6 OF 26 ENGINEERING DWG 305

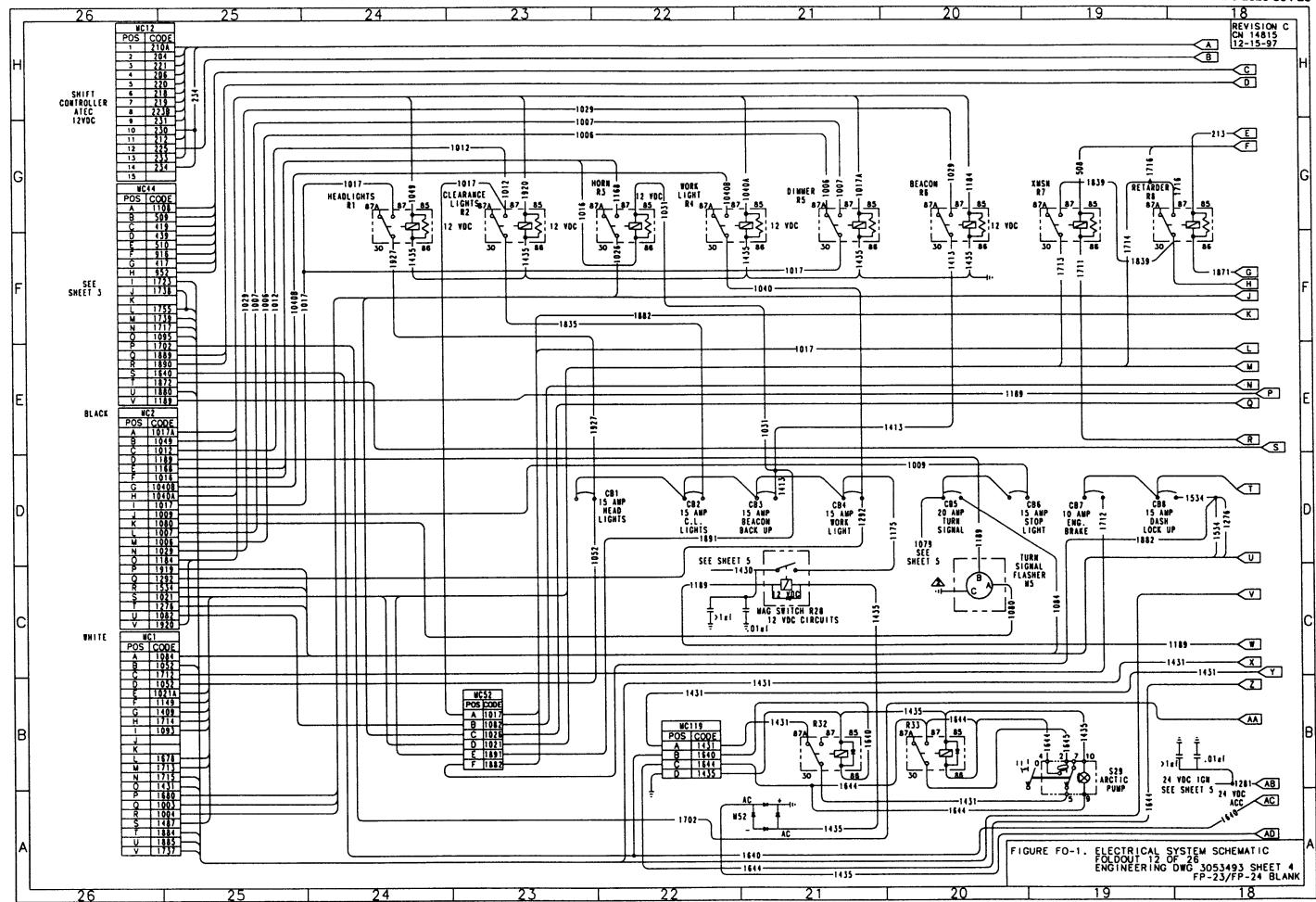
FIGURE FO-1. ELECTRICAL SYSTEM SCHEMATIC
FOLDOUT 7 OF 26
ENGINEERING DWG 3053493 SHEET 2
FP-13/FP-14 BLANK





15





CB26 15 AMP 24V AUX

13

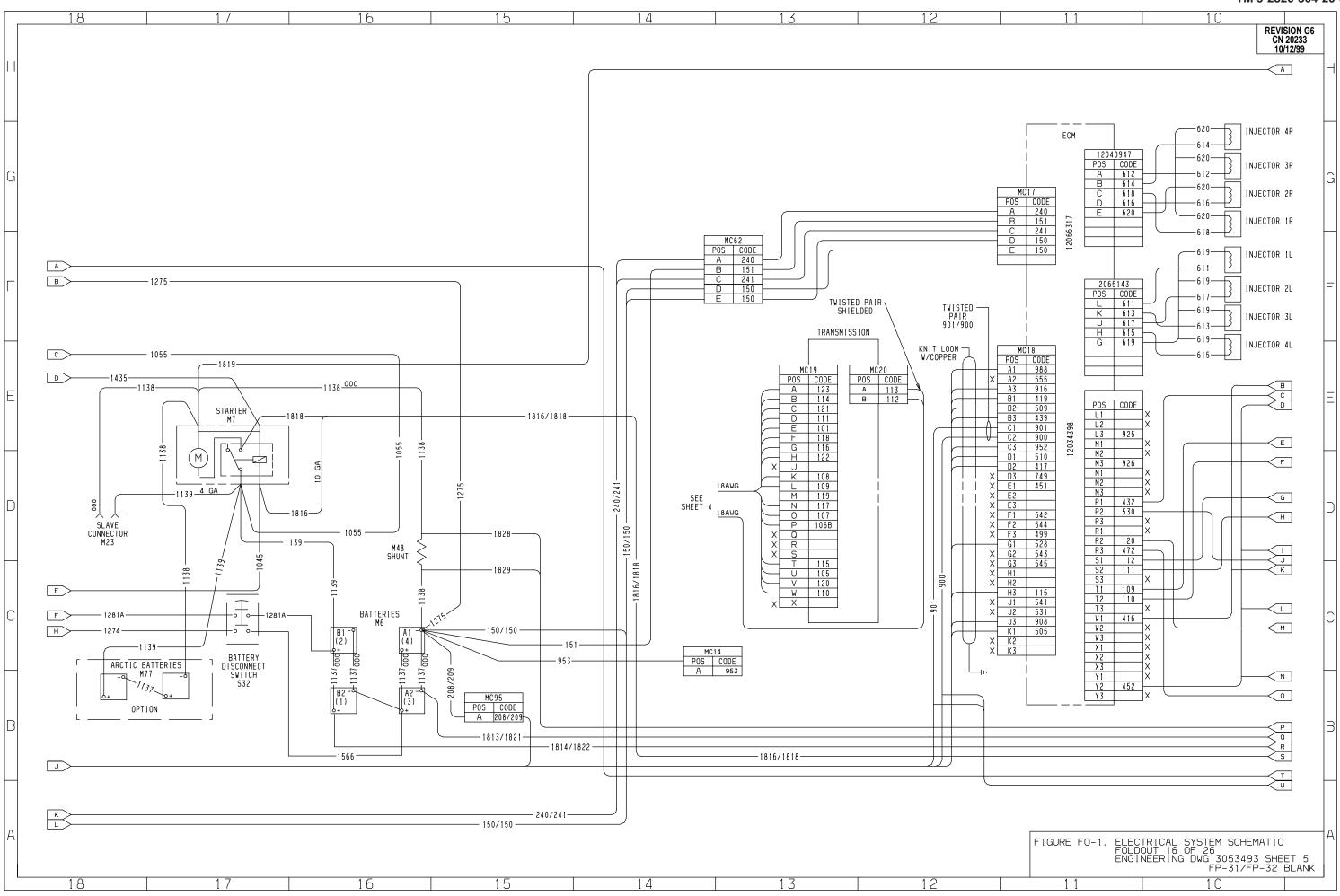
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FIGURE FO-1. ELECTRICAL SYSTEM SCHEMATIC
FOLDOUT 13 OF 26
ENGINEERING DWG 3053493 SHEET 4
FP-25/FP-26 BLANK

O CB25 15 AMP 12V AUX

15

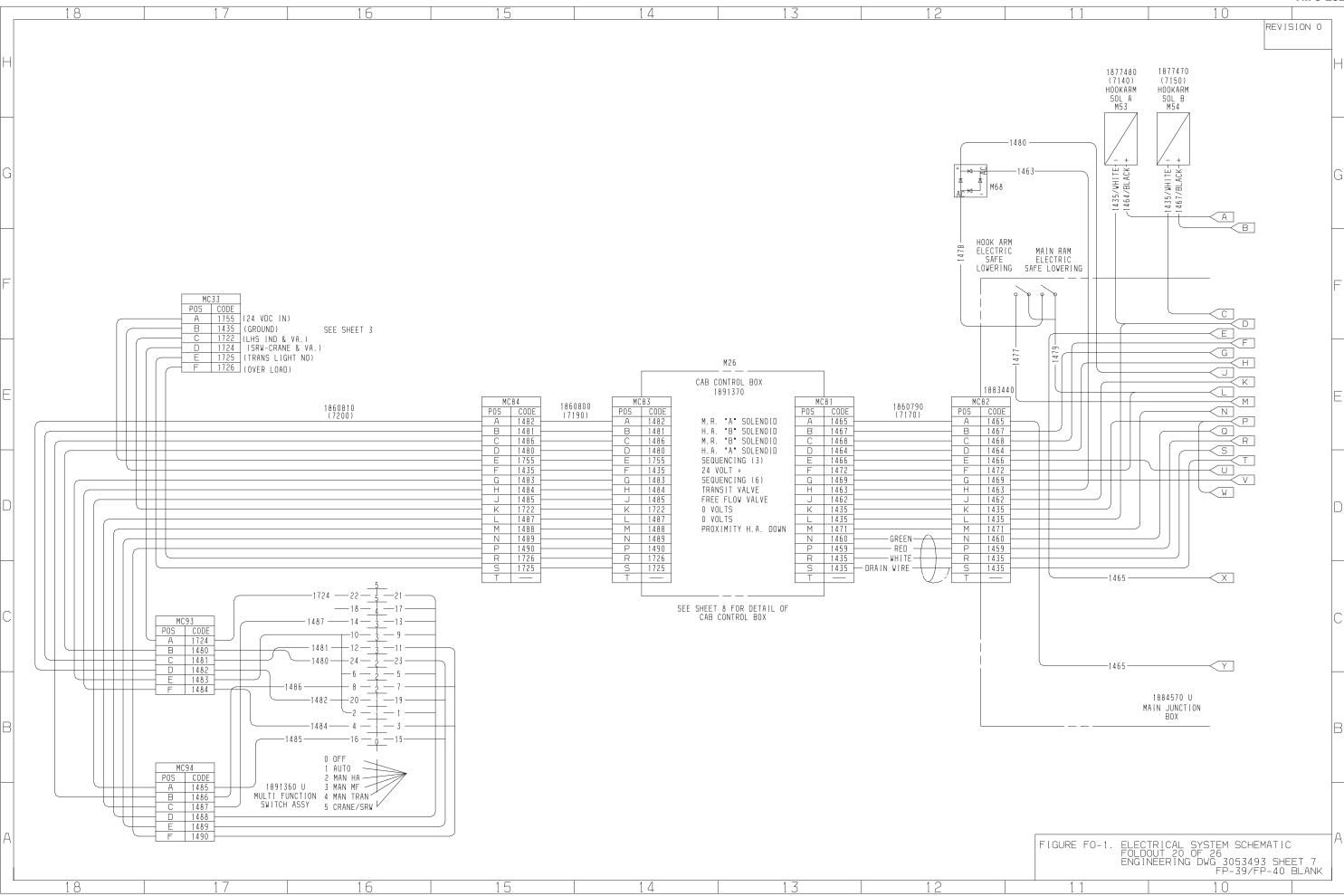
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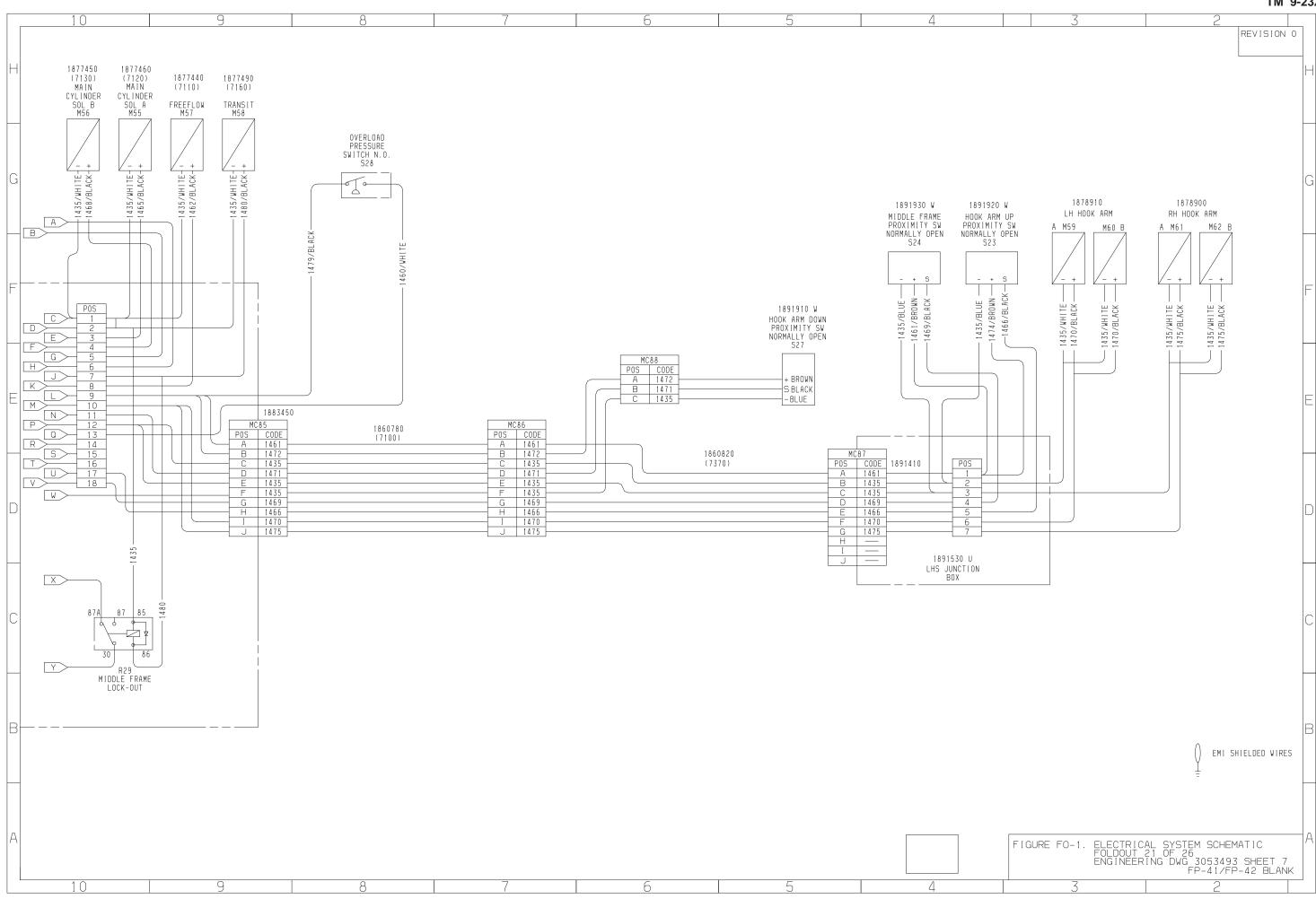


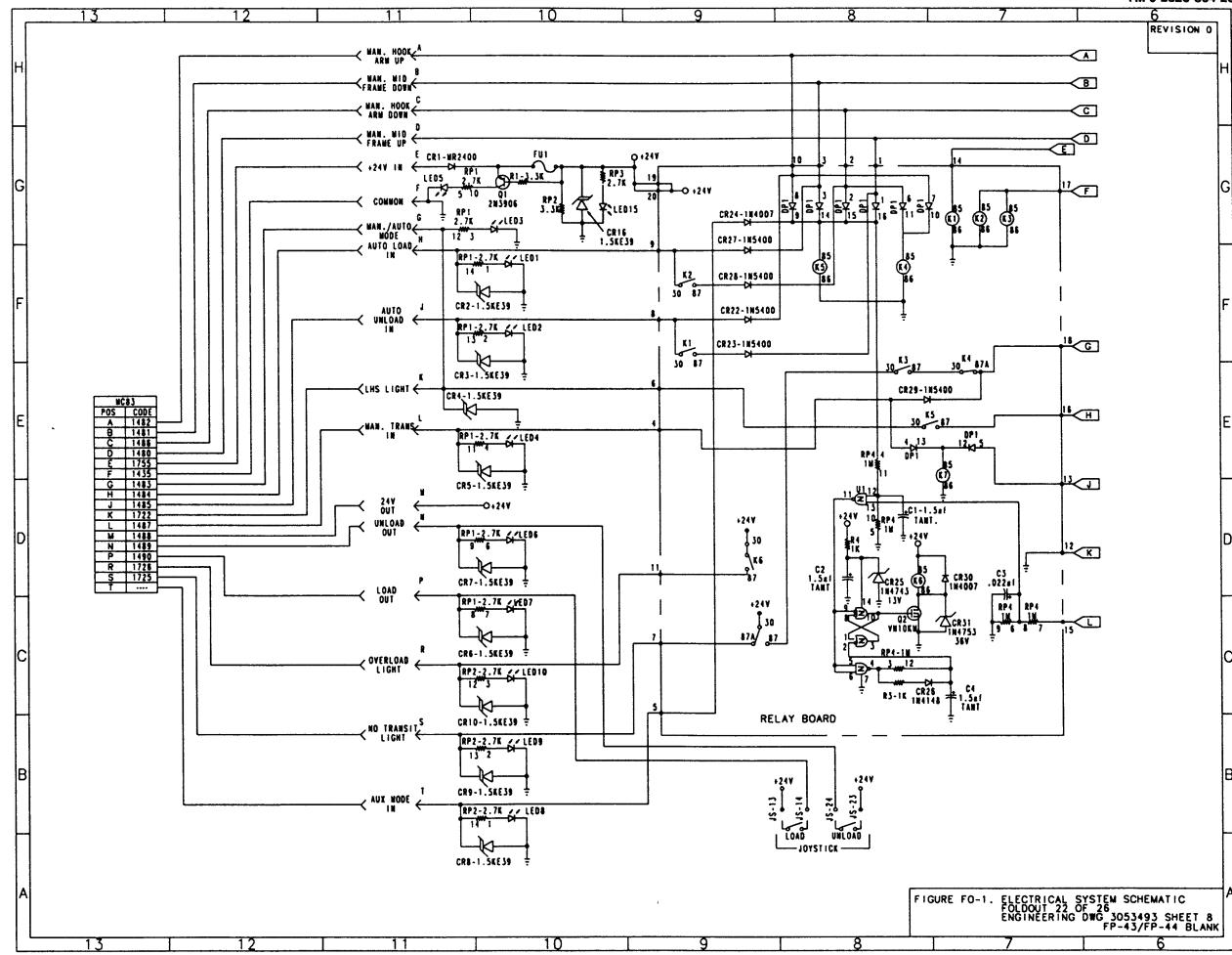
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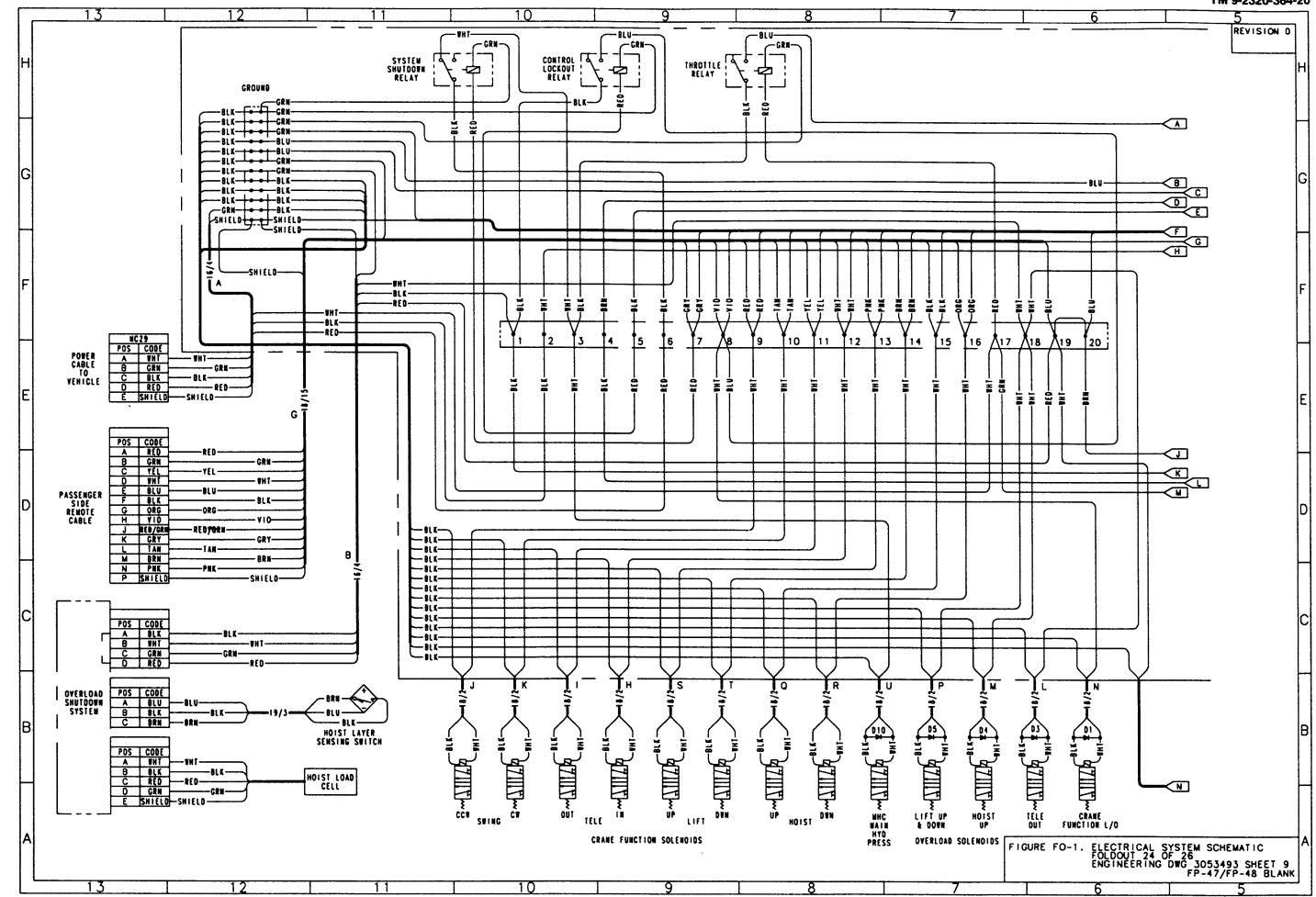
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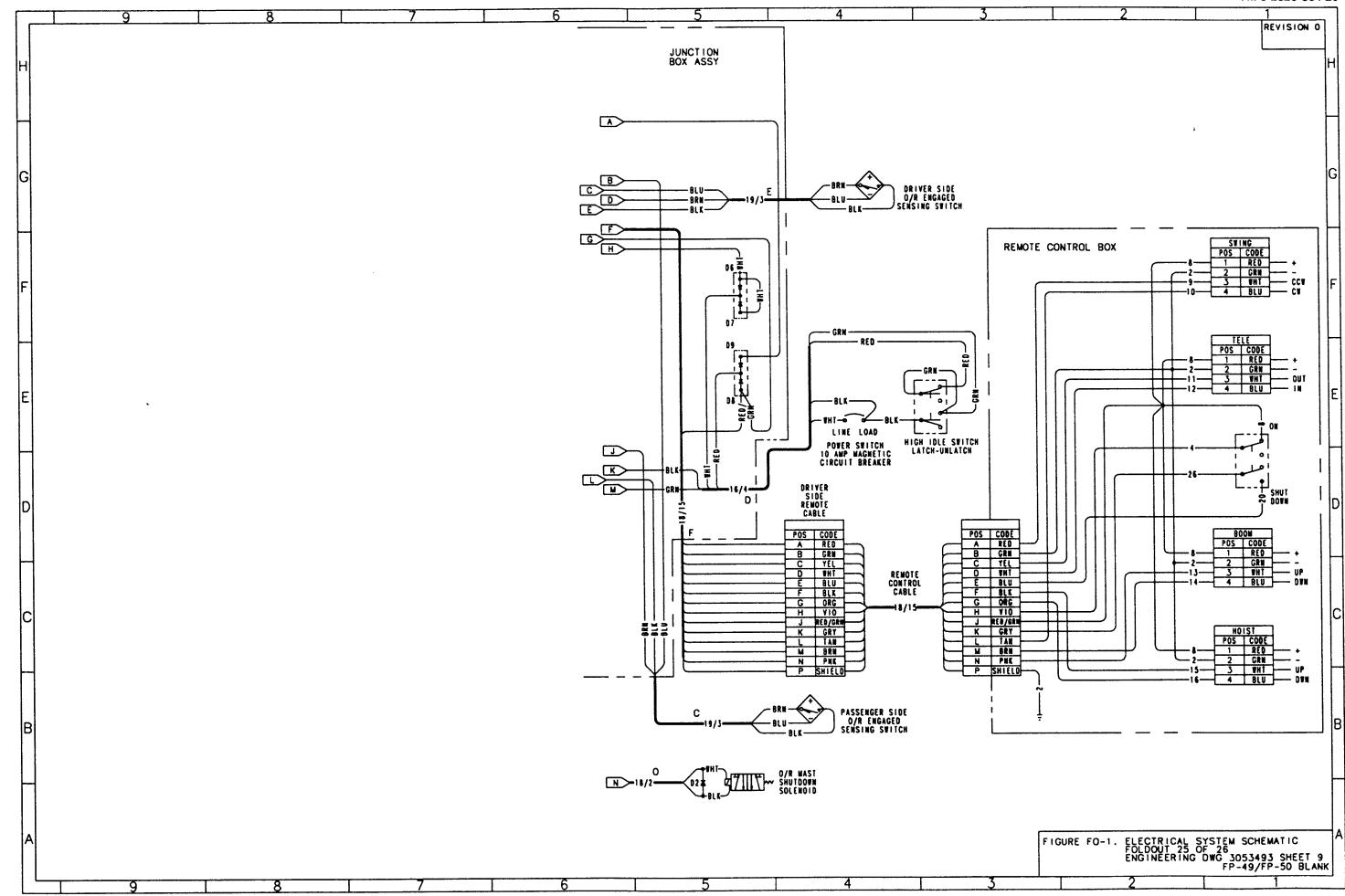
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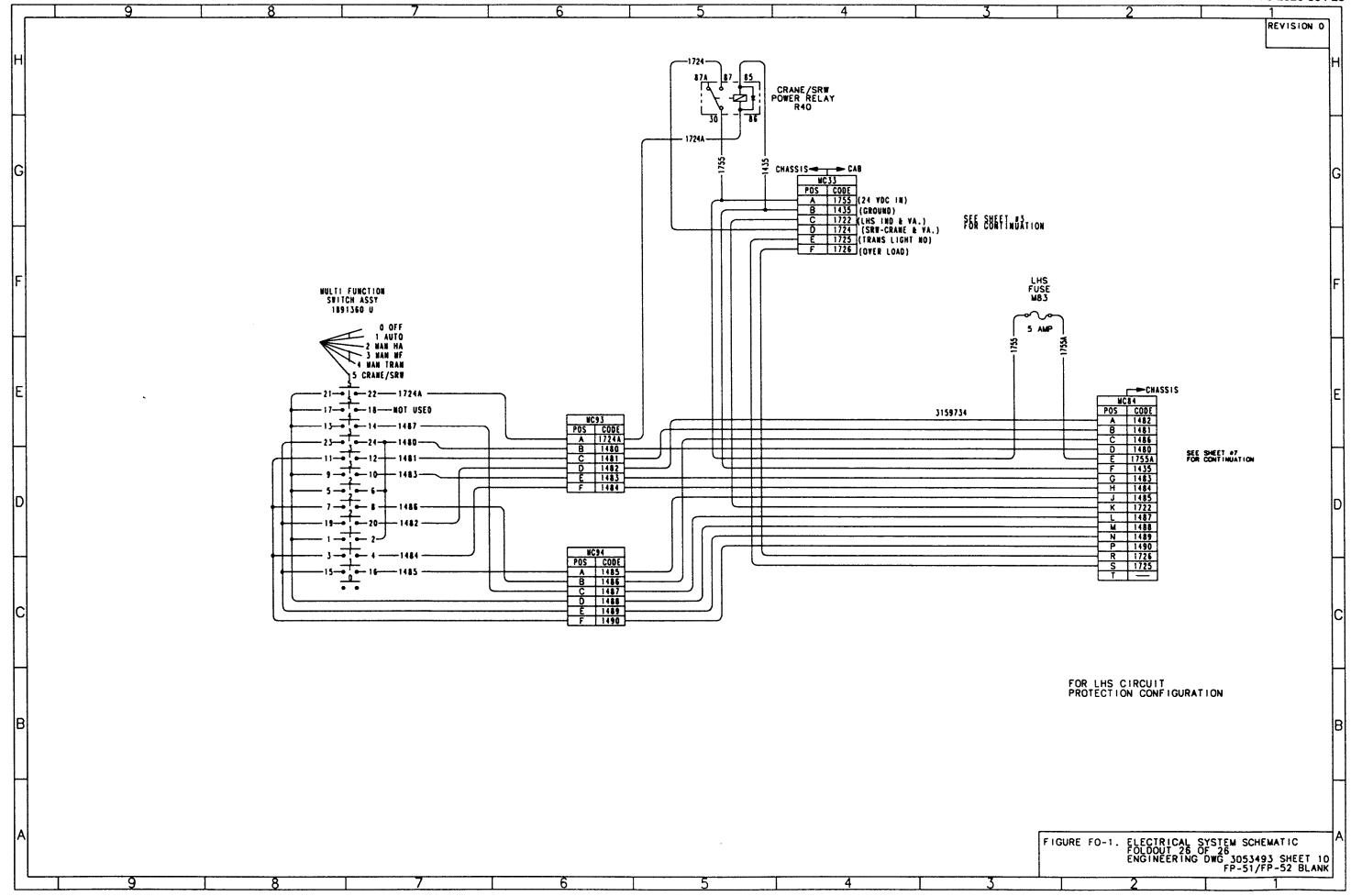












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PETER J. SCHOOMAKER General, United States Army Chief of Staff

Official:

SANDRA R.RILEY

Administrative Assistant to the

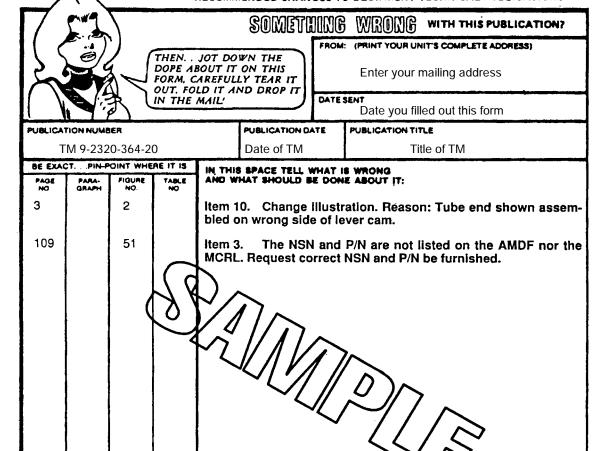
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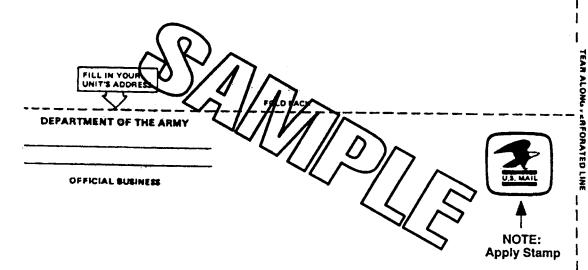
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#### THE METRIC SYSTEM AND EQUIVALENTS

### LINEAR MEASURE

- 1 Centimeter=10 Millimeters=0.01 Meters=0.3937 Inches
- 1 Meter=100 Centimeters=1000 Millimeters=39.37 Inches
- 1 Kilometer=1000 Meters=0.621 Miles

#### WEIGHTS

- 1 Gram=0.001 Kilograms=1000 Milligrams=0.035 Ounces
- 1 Kilogram=1000 Grams=2.2 Lb

TO CHANGE

1 Metric Ton=1000 Kilograms=1 Megagram=1.1 Short Tons

- <u>LIQUID MEASURE</u>

  1 Milliliter=0.001 Liters=0.0338 Fluid Ounces
- 1 Liter=1000 Milliliters=33.82 Fluid Ounces

#### SQUARE MEASURE

- 1 Sq Centimeter=100 Sq Millimeters=0.155 Sq Inches 1 Sq Meter=10,000 Sq Centimeters=10.76 Sq Feet
- 1 Sq Kilometer=1,000,000 Sq Meters=0.386 Sq Miles

### CUBIC MEASURE

- 1 Cu Centimeter=1000 Cu Millimeters=0.06 Cu Inches 1 Cu Meter=1,000,000 Cu Centimeters=35.31 Cu Feet

#### **TEMPERATURE**

 $5/9 (^{\circ}F - 32) = ^{\circ}C$ 

212° Fahrenheit is equivalent to 100° Celsius 90° Fahrenheit is equivalent to 32.2° Celsius

32° Fahrenheit is equivalent to 0° Celsius

 $9/5 \, \text{C}^\circ + 32 = \text{F}^\circ$ 

**MULTIPLY BY** 

#### **APPROXIMATE CONVERSION FACTORS**

Feet ...... Meters ...... 0.305 Yards...... Meters ...... 0.914

<u>TO</u>

Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds/Sq Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609
TO CHANGE	TO MULTIPL	<u>Y BY</u>
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Sq Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Sq Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Ordela Makana		
Cubic Meters	Cubic Yards	1.308
Milliliters	Cubic YardsFluid Ounces	1.308 0.034
Milliliters	Fluid Ounces	0.034
Milliliters	Fluid Ounces	0.034 2.113
Milliliters Liters Liters	Fluid Ounces	0.034 2.113 1.057
Milliliters Liters Liters Liters	Fluid Ounces	0.034 2.113 1.057 0.264
Milliliters Liters Liters Liters Citers Grams	Fluid Ounces	0.034 2.113 1.057 0.264 0.035
Milliliters	Fluid Ounces	0.034 2.113 1.057 0.264 0.035 2.205
Milliliters Liters Liters Liters Grams Kilograms Metric Tons	Fluid Ounces	0.034 2.113 1.057 0.264 0.035 2.205 1.102
Milliliters	Fluid Ounces	0.034 2.113 1.057 0.264 0.035 2.205 1.102 0.738
Milliliters	Fluid Ounces	0.034 2.113 1.057 0.264 0.035 2.205 1.102 0.738 0.145
Milliliters Liters Liters Grams Kilograms Metric Tons Newton-Meters Kilopascals Km per Liter	Fluid Ounces	0.034 2.113 1.057 0.264 0.035 2.205 1.102 0.738 0.145 2.354



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