ARMY *TM 9-2355-106-23-1

AIR FORCE TO 36A12-1C-2400-2-1

TECHNICAL MANUAL

FIELD MAINTENANCE MANUAL
FOR

MINE RESISTANT AMBUSH PROTECTED (MRAP)

M1224
(NSN 2355-01-553-4634) (EIC 1XF)

M1224A1
(NSN 2355-01-561-0281) (EIC 1XM)

* **SUPERSEDURE NOTICE** – This manual supersedes TM 9-2355-106-23-1, dated 27 April 2009, including all changes.

HEADQUARTERS, DEPARTMENTS OF THE ARMY AND AIR FORCE

19 NOVEMBER 2012

WARNING SUMMARY

EXPLANATION OF WARNING ICONS

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and hazardous materials icons used within the technical manual.

FIRST AID

First aid is the emergency care given to the sick, injured, or wounded before being treated by medical personnel. First aid data can be found in FM 4-25.11. This manual contains procedures for all types of casualties and the measures described are for use by all service members. Service members may be able to save a life, prevent permanent disability, or reduce long periods of hospitalization by knowing WHAT to do, WHAT NOT to do, and WHEN to seek medical assistance.

WARNING SUMMARY – (Continued)

EXPLANATION OF GENERAL SAFETY ICONS

EAR PROTECTION – headphones over ears shows that noise level will harm ears.

ELECTRICAL – electrical wire to arm with electricity symbol running through body shows that shock hazard is present.

ELECTRICAL – electrical wire to hand with electricity symbol running through body shows that shock hazard is present.

FALLING PARTS – arrow bouncing off human shoulder and head shows that failing parts present a danger to life or limb.

FLYING PARTICLES – arrows bouncing off face shows that particles flying through air will harm face.

FLYING PARTICLES – arrows bouncing off face with face shield shows that particles flying through the air will harm face.

HEAVY OBJECT – human figure stooping over heavy object shows physical injury potential from improper lifting technique.

HEAVY PARTS – foot with heavy object on top shows that heavy parts can crush and harm.

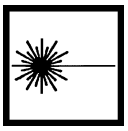
HEAVY PARTS – heavy object on human figure shows that heavy parts present a danger to life or limb.

WARNING SUMMARY – (Continued)

HEAVY PARTS – heavy object pinning human figure against wall shows that heavy, moving parts present a danger to life or limb.

HELMET PROTECTION – arrow bouncing of head with helmet shows that falling parts present a danger.

HOT AREA – hand over object radiating heat shows that part is hot and can burn.



LASER LIGHT – laser light hazard symbol indicates extreme danger for eyes from laser beams and reflections.

MOVING PARTS – human figure with an arm caught between gears shows that the moving parts of the equipment present a danger to life or limb.

MOVING PARTS – hand with fingers caught between gears shows that the moving parts of the equipment present a danger to life or limb.

MOVING PARTS – hand with fingers caught between rollers shows that the moving parts of the equipment present a danger to life or limb.

SHARP OBJECT – pointed object in hand shows that a sharp object presents a danger to life or limb.

SHARP OBJECT – pointed object in hand shows that a sharp object presents a danger to life or limb.

WARNING SUMMARY – (Continued)

SHARP OBJECT – pointed object in foot shows that a sharp object presents a danger to life or limb.

SLICK FLOOR – wavy line on floor with legs prone shows that slick floor presents a danger for falling.

EYE PROTECTION – person with goggles shows that the material will injure the eyes.

GENERAL WARNINGS

WARNING

Before performing any maintenance procedure, ensure vehicle is parked on level surface, engine is off, parking brake is applied, transmission is in NEUTRAL (N), and wheels are chocked. Wear eye protection and stay clear of rotating parts and hot surfaces. Make sure all electrical tools are grounded. Use extreme caution when working under vehicle. Use hydraulic jack to raise vehicle, and place jackstands under frame rails to support axle. Keep first-aid and fire-control equipment available during all operation and maintenance procedures. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

A/C

Do not install or remove air-conditioning testing or charging equipment while engine is running. Failure to comply may result in serious injury or death to personnel.

WARNING

AIR DRAIN VALVES

WARNING SUMMARY – (Continued)

Air drain valves are under pressure. Wear protective goggles and do not place face in front of air drain valves while draining air reservoirs. Open air drain valves slowly to release air pressure gradually. Failure to comply may result in serious injury or death to personnel.

WARNING

AIR LINES

Do not disconnect any air line or fitting until system pressure has been relieved. Hoses may whip and injure personnel, and air under pressure can penetrate skin. Failure to comply may result in serious injury or death to personnel.

Do not operate vehicle with air pressure system loss. Vehicle has reduced or no braking capability and may not stop. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

BATTERIES

Wear protective eye goggles, face shield, and long sleeves when working on or near batteries. Batteries contain corrosive acid and can produce explosive gases. Batteries supply electrical current that can cause burns and electrical shock. Always check electrolyte level with engine off. Avoid leaning over or onto battery. Do not wear jewelry and do not smoke or have open flame or spark near battery. Do not allow tools to contact battery box or battery terminals. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Battery acid must not contact eyes, skin, or clothing. If battery acid contacts eyes or skin, flush area with large amounts of water for 15 minutes and seek immediate medical care. If swallowed, do not induce vomiting. Drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Seek immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Disconnect battery ground cable or power source prior to working on electrical components. If electrical shock occurs, administer first aid and seek medical assistance immediately. Failure to comply may result in serious injury or death to personnel.

Ensure batteries are disconnected before removing ESC. Failure to comply may result in serious injury or death to personnel.

WARNING SUMMARY – (Continued)

WARNING

BRAKES (ALSO SEE HAZARDOUS MATERIALS WARNINGS)

Before working on air brake system or any auxiliary pressurized system, make sure air pressure has been drained from all reservoirs. Failure to comply may result in serious injury or death to personnel.

If springs are missing or damaged, replace with new spring hardware kit before installing new brake shoes. Replace brake shoes if there are any signs of overheating, if step on center wear tab of brake shoe lining is not visible, or if thickness on any part of brake shoe is ¼ in. (6 mm) or less. Drums must be turned or replaced if there were any signs of overheating on old brake shoes. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Do not allow grease or oil to contact brake linings. Linings can absorb grease and oil, causing early glazing and reduced braking action. Failure to comply may result in serious injury or death to personnel.

Before removing ABS Control Module, disconnect battery disconnect switch and disconnect batteries. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

CAB DOOR WINCH STRAPS

Cab doors must be secured in the open position by using heavy duty winch straps to prevent accidental closure during vehicle maintenance. Failure to comply may result in serious injury or death to personnel.

WARNING

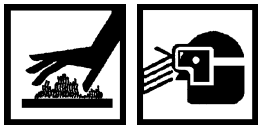
COMPRESSED AIR

Do not use compressed air exceeding 30 psi (207 kPa) for cleaning purposes. Use only with effective chip-guarding and personal protective equipment, including goggles or face shield and gloves. Failure to comply could result in serious injury or death to personnel.

WARNING

COOLING SYSTEM/RADIATOR

WARNING SUMMARY – (Continued)



Cooling system components become pressurized and extremely hot during normal operation. To prevent serious injury from hot coolant or scalding steam, use the following safety procedure when removing radiator cap, surge tank cap, or deaeration cap:
• Allow engine to cool for 15 minutes.
• Wrap a thick cloth around cap to be removed.
• Loosen cap slowly one-quarter to one-half turn counterclockwise, and pause to allow pressure to release.
• Continue to turn cap counterclockwise to remove.
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. Failure to comply may result in serious injury to personnel.

WARNING

DMM (DIGITAL MULTIMETER)

Ensure power is off before cutting, soldering, or removing a circuit component to insert the Digital Multi-meter (DMM) for current measurements. Even small amounts of current can be dangerous. Failure to comply may result in serious injury to personnel.

When routing DMM leads, do not crimp leads, run leads too close to moving parts, or let leads touch hot engine surfaces. Failure to comply may result in serious injury to personnel.

WARNING

ELECTRICAL

Turn off ignition switch and main power switch before performing electrical system maintenance. Failure to comply may result in serious injury or death to personnel.

Disconnect negative ground cable from batteries before removing any electrical component. Failure to comply may result in serious injury or death to personnel.

Never attempt a voltage measurement with test probe lead in current jack (10A or 300mA). Failure to comply may result in serious injury to personnel.

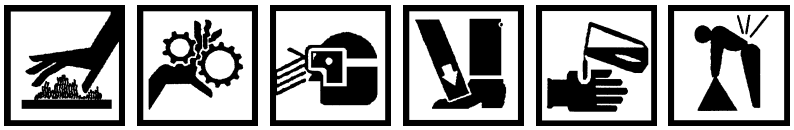
Shut engine down before performing voltage checks for injector solenoids. When engine is running, injector circuits have high voltage and amperage. Failure to comply may result in serious injury to personnel.

WARNING SUMMARY – (Continued)

Do not use a circuit breaker, fuse, or relay with higher amperage rating than listed for a particular application. Using higher amperage will overheat the electrical circuit, causing melted components and possible fire. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

ENGINE (ALSO SEE HAZARDOUS MATERIALS WARNINGS.)



Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing maintenance. Use extreme care when working in close quarters in engine compartment. Stay clear of rotating parts. Wear safety goggles, work gloves, and long sleeves or shop coat. Failure to comply may result in serious injury or death to personnel.

Some engine components are heavy and bulky and require assistance for lifting. Use assistance of crewmember or lifting device as required. Failure to comply may result in damage to equipment and serious injury to personnel.

Do not rotate diesel engine when priming with oil. This may cause engine to accidentally start. Failure to comply may result in serious injury or death to personnel.

Prior to performing work on crossmember, place wooden block between crossmember and front engine mount. Failure to comply may result in damage to equipment and serious injury to personnel.

WARNING

EMERGENCY HATCH

Emergency hatch door is extremely heavy. Use caution and keep arms, hands, and head clear of hatch when opening or closing. Ensure hatch door is properly secured in both the open or closed position. Do not operate vehicle with emergency roof hatch open. Failure to comply may result in serious injury or death to personnel.

Use lifting device capable of lifting 1000 lbs to lift emergency hatch from vehicle. Clear all nonessential personnel from area when lifting hatch from vehicle. Do not stand directly under hatch door while lowering to floor. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

EXHAUST

WARNING SUMMARY – (Continued)

Exhaust system components can be hot. Do not touch with bare hands or allow contact with other skin surface. Wear protective work gloves and long sleeves. Do not use exhaust tailpipe as a step. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

FAN BLADE

Do not attempt to restrict fan blade rotation during engine operation. Improper use of application or modification of fan drive or fan can damage fan drive. Do not operate vehicle with malfunctioning or damaged fan drive or fan blades. Failure to comply may result in damage to equipment and serious injury to personnel.

WARNING

FSS (FIRE SUPPRESSION SYSTEM)

Before installing FSS extinguisher, verify correct part number is being installed. Check for visible damage to the canister, such as dents, cracked plastic, chips, or scratches where hoses connect. If damage is visible anywhere, do not use; contact your supervisor. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Prior to servicing FSS, make sure FSS power is off, main power switch is off, unless otherwise instructed. If damage is visible, anywhere, do not use. Contact your supervisor. Failure to comply may result in discharging of system and serious injury or death to personnel.

Before handling extinguisher, make sure anti-recoil plug is installed in valve outlet port and mechanical lever lockpin is installed in lever lock holes. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Some fire suppression systems have a safety pin to install before disconnecting lines. Check to see if system uses a safety pin and install it before disconnecting lines. When disconnecting the extinguisher lines, use extreme caution. Do not disturb the pyrotechnic actuator and pressure switch; this will cause the extinguisher to discharge automatically. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING SUMMARY – (Continued)

Do not drop or strike FSS extinguisher. Extinguisher can discharge accidentally and chemical agent can escape through holes in side of ant-recoil plug. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Do not release extinguisher bottle band clamps unless anti-recoil plug is installed in valve outlet port and mechanical lever lockpin is installed in lever lock holes. Failure to comply may result in personal injury or death, or damage to equipment.

FSS extinguisher can move violently when discharging. Ensure extinguisher is properly secured during use. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Replace fire extinguisher immediately after use, even if only partly used. Failure to comply may result in serious injury or death to personnel.

Exposure to large quantities of dry chemical fire extinguisher in cab may result in temporary breathing difficulty during and immediately after discharge. If possible, discharge fire extinguisher from outside cab. Ventilate and wash cab thoroughly prior to reentry. If respiratory irritation or distress occurs, move victim to fresh air. Seek medical attention if irritation persists.

Chemical fire suppression agents are refrigerants and can freeze skin. Extinguisher will be extremely cold after discharging. Avoid contact with chemical agent and do not touch extinguisher after use. Failure to comply may result in serious personal injury.

WARNING

FUEL LINES/PUMP

Do not loosen fuel lines at filter housing to bleed fuel system. Periodic loosening of fittings will result in increased thread wear. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Do not overtighten bolts for fuel pump or cross-thread connections on fuel lines. This will interfere with sealing and operation of fuel pump. If seal is not complete or lines leak due to cross-threads, fuel pump will not operate properly and vehicle may not run. Starting vehicle without fuel pressure in lines or pump may result in damage to equipment and serious injury or death to personnel.

WARNING

GUNNER HATCH

WARNING SUMMARY – (Continued)

Gunner hatch is extremely heavy. Use caution when opening and closing. Wear safety goggles when removing, installing, or working on interior of gunner hatch. Keep arms and hands clear of gunner hatch when closing. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Gunner sliding hatch can only be opened or closed when vehicle is stationary and on level surface. Do not attempt to open or close the hatch when vehicle is in motion. Make sure latch locks are secured into place in the open or closed positions before vehicle starts moving. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Ensure gunner hatch is completely locked in open position before moving vehicle with gunner in position. Use extreme caution when standing in gunner hatch while vehicle is in motion. Gunner should be holding onto weapon or other support to maintain stability at all times. Failure to comply may result in serious injury or death to personnel.

WARNING

HEATSHRINK TUBING

Never use open flame to apply heat to heatshrink tubing. Allow heatshrink tubing to cool before handling. Failure to comply may result in serious injury to personnel.

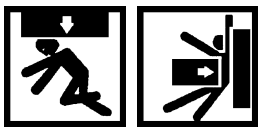
WARNING

HEAVY LIFTING

Prior to moving heavy components with lifting device, clear path of travel and clear personnel from area. Use extreme caution if lifting objects overhead or backing up. Stop and lower load as soon as possible. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

HOOD



Hood is extremely heavy. Ensure there is adequate space to open hood completely without pinning personnel between hood and another structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

WARNING SUMMARY – (Continued)

WARNING

INSTRUMENT PANEL

The instrument panel is bulky and heavy and cannot be removed by one person. Before removing the side A-pillar mounting bolts, obtain assistance for remainder of removal. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

JACKS

Before lifting vehicle off ground, make sure it is parked on level surface. Set parking brake and chock wheels. Use hydraulic jack to lift vehicle. Do not use jack alone to support vehicle. Never work under or near a vehicle supported only by jack or lifting device. Use rated jackstands under frame rails to properly support vehicle. Do not support vehicle under front and rear axles. Use additional jackstands as necessary to support vehicle components during removal and installation procedures. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

LITTER

Keep personnel clear of litter-lift moving parts. Ensure litters and patients are properly secured and clear of rear door/ramp and all other obstacles during litter-lift movement. Failure to comply may result in serious injury or death to personnel.

Hold litter stub and connector plate up while removing or installing hex-head screws from bracket. If connector plate and stub fall and slide down stainless sliding rail, serious damage to parts may occur. Failure to comply may result in serious injury or death to personnel.

WARNING

PITMAN ARM

Pitman arm will be extremely tight. Do not pound on pitman arm or apply heat to pitman arm or sector shaft. Never weld pitman arm or sector shaft. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING SUMMARY – (Continued)

Proper installation of pitman is critical to vehicle safety. Install pitman arm after steering gear is mounted on vehicle so proper torque can be applied to pitman arm. Otherwise, pitman arm could loosen and cause an accident. If pitman arm is loose, replace pitman arm and sector shaft. Always use a new tab lock retainer. If tabs and notches do not line up, tighten beyond specified torque value until two tabs align. Never back off retainer to align retaining tabs. Failure to comply may result in damage to equipment and serious injury or death to personnel.

When installing new cotter pin, tighten nut until slot appears and insert cotter pin. Never back off nut to install cotter pin. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

REAR CABIN DOOR/RAMP

Rear cabin door/ramp is heavy. Make sure door/ramp /is secured so it will not move. Failure to comply may result in serious personal injury or death to personnel.

Ensure no one is behind vehicle when lowering rear door/ramp. Use extreme caution when using emergency rear door/ramp release, to ensure no one is struck by door as it falls open. Keep arms and legs clear of rear door/ramp when closing. Do not operate rear door/ramp when vehicle is in motion. Failure to comply may result in serious injury or death to personnel.

Attach a lifting device and sling to rear door/ramp prior to removing mounting bolts. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Rear door/ramp is heavy. Ensure lifting device and sling are in place prior to removing rear door/ramp mounting bolts. Failure to comply may result in serious injury or death to personnel.

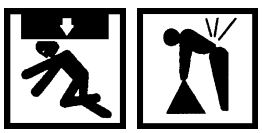
WARNING

RIFLES

Remove rifles from rifle racks being worked on. Ensure rifles are not loaded and store in safe manner. Failure to comply may result in serious injury or death to personnel.

WARNING

TOWING EYES



Do not remove both rear towing eyes at the same time, Entire rear frame crossmember assembly will fall. Replace one towing eye at a time. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING SUMMARY – (Continued)

WARNING

TRANSFER CASE

During normal vehicle operation, transfer case and oil cooler can become very hot. Allow transfer case and oil cooler to cool prior to servicing oil cooler. Wear safety goggles, work gloves, and protective clothing. Use extreme caution when opening drain valves and removing bolts. Failure to comply may result in serious injury to personnel.

WARNING

TRANSMISSION

Use care when working with hot transmission and fluid during maintenance procedures. Wear protective goggles, work gloves, and long sleeves to avoid injury. Avoid contact with hot transmission oil or sump when draining transmission oil. If transmission oil temperature is above 220°F (104°C), allow transmission oil to cool before removing dipstick. Failure to comply may result in serious injury or death to personnel.

WARNING

WHEELS/TIRES

Wheel and tire assemblies are heavy. Do not attempt to lift wheel and tire assemblies without assistance from crewmember. Wear safety goggles and work gloves. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Ensure vehicle is parked on hard, level surface before changing wheel and tire assembly. Soft or uneven ground may cause jack or jackstand to slip, resulting in damage to equipment and serious injury or death to personnel.

EXPLANATION OF HAZARDOUS MATERIALS ICONS

WARNING SUMMARY – (Continued)

BIOLOGICAL – abstract symbol bug shows that a material may contain bacteria or viruses that present a danger to life or health.

CHEMICAL – drops of liquid on hand shows that the material will cause burns or irritation to human skin or tissue.

CRYOGENIC – hand in block of ice shows that the material is extremely cold and can injure human skin or tissue.

EXPLOSION – rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition or high pressure.

FIRE – flame shows that a material may ignite and cause burns.

POISON – skull and crossbones shows that a material is poisonous or is a danger to life.

RADIATION – three circular wedges shows that the material emits radioactive energy and can injure human tissue.

VAPOR – human figure in a cloud shows that material vapors present a danger to life or health.

WARNING

ANTI-SEIZE COMPOUND

WARNING SUMMARY – (Continued)

Anti-seize compound is flammable and toxic. Container may explode from excessive heat. Vapors can cause headache, dizziness, unconsciousness, corneal injury, and respiratory tract irritation. Use only in well-ventilated area. Use approved respirator with dual organic vapor/mist and particulate cartridge. Wear chemical safety goggles and full-face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves. In case of contact, remove contaminated clothing and immediately wash area with soap and water. If compound contacts eyes, flush eyes with large amounts of water for at least 15 minutes and obtain immediate medical attention. If swallowed, do not induce vomiting; obtain immediate medical attention. Failure to comply may result in serious injury or death to personnel.

WARNING

ASBESTOS

Brake dust contains asbestos, a known health hazard. Always wear safety goggles and an approved respirator during all brake service procedures. Wear respirator during removal of wheels through assembly. Handle all brake parts with care; brake dust covers all brake parts. Failure to comply may result in serious injury or death to personnel.

Never use compressed air or dry brushing to clean brake parts or assemblies. Use an industrial vacuum cleaner with a HEPA filter system to clean dust from brake drums, backing plates, and other brake parts. After vacuuming, remove any remaining dust with a rag soaked in water and wrung until nearly dry. Carefully clean parts in a well-ventilated or open-air area. During brake disassembly, carefully place all parts on the floor to avoid getting dust into the air. Do not use compressed air to clean clothing after working on brakes; use vacuum with HEPA filter system. Failure to comply may result in serious injury or death to personnel.

WARNING

CARBON MONOXIDE

Carbon monoxide is a colorless, odorless, and dangerous gas that deprives the body of oxygen and causes suffocation. Use the following precautions to avoid carbon monoxide poisoning. Failure to comply may result in permanent brain damage or death to personnel.

- Do not idle engine for long periods of time.
- If necessary to run engine in confined area during vehicle service, use proper equipment to vent exhaust gasses outside work area.
- Do not operate personnel heater in enclosed area without adequate ventilation.
- Turn auxiliary diesel heater switch off before filling any fuel tank on vehicle.
- Do not sleep in vehicle with heater operating or engine idling.
- Notify Field Maintenance if exhaust fumes are detected in crew compartment while operating the vehicle.
- Be alert at all times for exhaust odors and symptoms of exposure to carbon monoxide, such as headaches, dizziness, loss of muscular control, apparent drowsiness, and coma. If symptoms are evident, move affected personnel to fresh air, keep them warm, do not permit physical exercise, administer artificial respiration (if necessary), and seek immediate medical attention.

WARNING

WARNING SUMMARY – (Continued)

CARC (CHEMICAL AGENT RESISTANT COATING)

Vehicles are finished with a chemical agent resistant coating (CARC). CARC contains isocyanates, which are highly irritating to skin and respiratory system. Breathing CARC vapor or dried paint dust can cause coughing, shortness of breath, burning sensation in throat and nose, watering of eyes, pain during respiration, and chest tightness. Skin contact with particulates can cause itching or redness of skin. Sensitivity to isocyanates may increase from repeated exposure. Use the following precautions to prevent injury from exposure. Failure to comply may result in serious injury to personnel.

• Never weld or cut CARC coated surfaces. Grinding or sanding CARC coated surfaces will create harmful dust.

• Personnel who have lung or breathing problems or who have had a reaction to isocyanates must not be in any area where CARC painting operations are performed or CARC dust particles are present.

• CARC painting operations must be performed only by qualified painters wearing protective gear and respirators and working in fully equipped facilities. All personnel in the area must wear high-efficiency air purifying respirators, protective goggles, gloves, and other protective clothing. Thoroughly wash all clothing before reuse.

WARNING

CLEANING SOLVENTS

Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. Wear goggles and protective clothing. Keep away from open flame and use in well-ventilated area. If adhesive, solvent, or sealing compound get on skin or clothing, wash immediately with soap and water. Failure to comply may result in injury or death to personnel.

WARNING

CONNECTOR LUBRICANT

Connector lubricant is harmful to skin and eyes. If lubricant contacts eyes, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious injury to personnel.

WARNING

CORROSION PREVENTIVE COMPOUND

WARNING SUMMARY – (Continued)

Corrosion preventive compound is toxic. Use only in well-ventilated area. Use approved respirator with dual organic vapor/mist and particulate cartridge. Do not get in eyes; wear chemical safety goggles and full-face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves. In case of contact, remove contaminated clothing and immediately wash area with soap and water. If compound contacts eyes, flush eyes with large amounts of water for at least 15 minutes and get immediate medical attention. If swallowed, do not induce vomiting; contact a physician immediately. Failure to comply may result in serious injury or death to personnel.

WARNING

DIELECTRIC GREASE

Dielectric grease is harmful to skin and eyes. If grease contacts eyes, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious injury to personnel.

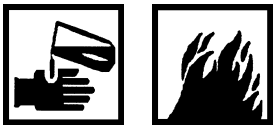
WARNING

ETHER CANISTER

Ether canisters contain hazardous, combustible and flammable materials. Handle with care and dispose of in accordance with standard operating procedures. Use approved respirator with dual organic vapor/mist and particulate cartridge. Avoid contact with skin and eyes, and avoid breathing fumes. If swallowed, do not induce vomiting. Obtain immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Ether canisters are pressurized, combustible and flammable. Keep away from flames and sparks. Do not incinerate or puncture canister. Do not expose to temperatures above 120°F (49°C). Do not store spare canister in vehicle cab. Failure to comply may result in serious injury or death to personnel.

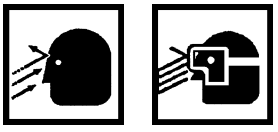
WARNING



ENGINE FLUIDS

Engine fluids (oil, fuel, and coolant) may flammable and may be hazardous to human health and the environment. Handle all fluids and other contaminated materials (such as filters and rags) in accordance with standard operating procedures. Recycle or dispose of engine fluids, filters, and other contaminated materials in accordance with standard operating procedures. Failure to comply may result in environmental damage and injury to personnel.

WARNING



WARNING SUMMARY – (Continued)

FIBERGLASS

Direct contact with fiberglass materials or exposure to airborne fiberglass dust may irritate skin, eyes, nose, and throat. Minimize exposure to fiberglass particles by wearing long sleeves and long pants, work gloves, hat, and face shield or safety goggles with side shields. Personnel who experience irritation or have a known sensitivity should wear an approved particulate respirator. After working with fiberglass materials, wash skin with soap and running water and change clothing before touching eyes. Failure to comply may result in injury to personnel.

WARNING

FUEL

Fuel is flammable and can explode. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel and keep fire extinguisher nearby. Do not smoke when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. Failure to comply may result in serious injury or death to personnel.

Be alert at all times for the smell of fuel. Hot engines and components can ignite fuel. If fuel smell is detected while operating vehicle, shut down vehicle immediately. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Store diesel fuel in an approved container clearly marked DIESEL FUEL or JP-8, accordingly. Dispose of fuel in an approved container clearly marked DIESEL FUEL or JP-8, accordingly, in accordance with standard operating procedures.

Never use diesel fuel or JP-8 to clean parts. Fuel is highly flammable. Failure to comply may result in damage to equipment and serious injury or death to personnel.

WARNING

HYDRAULIC FLUID

Hydraulic fluid is flammable and harmful to skin and eyes. Wear work gloves and eye protection when handling fluids. Do not perform maintenance while smoking or near flame or sparks. If fluid contacts skin, wash affected area immediately. In case of eye contact, flush with water for 15 minutes and seek medical care immediately. Dispose of hydraulic fluid in accordance with standard operating procedures. Failure to comply may result in serious injury to personnel.

WARNING

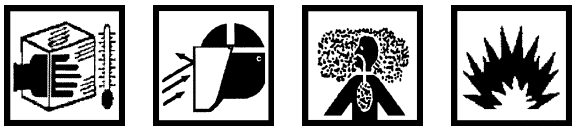
NBC (NUCLEAR, BIOLOGICAL, and CHEMICAL) SYSTEM

NBC system maintenance procedures require at least two personnel due to risk of medical emergency from possible exposure to NBC agents. Maintenance must be performed by properly trained, authorized personnel with proper safety equipment and protective clothing. Make sure batteries are disconnected and

WARNING SUMMARY – (Continued)

area is well ventilated. Do not smoke or allow open flame near vehicle. Never operate system with cover or panel removed. Failure to comply may result in serious injury or death to personnel.

WARNING



REFRIGERANT

Do not expose refrigerant containers, empty or full, to open flames or temperatures above 125°F (52°C). Do not discard empty containers where they may be subject to heat from a trash burner; containers may explode. Failure to comply may result in damage to equipment and serious injury or death to personnel.

The temperature of liquid refrigerant is -20°F (-29°C). Wear full face shield, protective rubberized gloves, and protective clothing when working with refrigerant. If refrigerant contacts skin, remove all contaminated clothing. Treat skin as though it were frostbitten or frozen and seek immediate medical attention. If refrigerant contacts eyes, do not rub them. Flush eyes with cold water for at least 15 minutes to gradually increase temperature above freezing point. Seek immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Refrigerant becomes a poisonous gas in the presence of heat. Do not smoke or allow any type of flame in immediate area while servicing air conditioning system. Never weld, solder, steam clean, or use excessive heat on any part of the air conditioning system while charged/pressurized. Failure to comply may result in damage to equipment and serious injury or death to personnel.

R-134a refrigerant must not be mixed with air and then pressurized. When mixed with large quantities of air and pressurized, R-134a becomes combustible. Failure to comply may result in damage to equipment and environment, and serious injury or death to personnel.

Refrigerant evaporates very quickly and may displace oxygen surrounding work area, especially in a small or enclosed area. This can cause suffocation or brain damage. If leak occurs, avoid breathing refrigerant vapor and thoroughly ventilate area before continuing service. If personnel breathe refrigerant vapors, obtain immediate medical assistance. Failure to comply may result in serious injury or death to personnel.

Federal and state laws require that refrigerant be recovered and recycled. Refrigerant must be recovered from system with authorized recommended equipment before any work can be performed on unit. Always use approved recycling equipment to prevent accidental discharge. Failure to comply may result in damage to equipment and environment, and serious injury or death to personnel.

WARNING

HVAC SYSTEM

Do not check compressor oil level when HVAC system is charged with refrigerant. Never open the high side hand valve of the manifold gauge set while HVAC system is operating. If hot, high pressure refrigerant is forced through gauge to refrigerant supply cylinder, which could rupture. Do not disconnect HVAC lines from compressor. Release of refrigerant may cause damage to equipment or environment and serious injury or death to personnel.

Do not use parts other than those specified for the system being serviced. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Accidental or intentional introduction of liquid contaminants into the environment is a violation of state, federal, and military regulations. Store, install, and dispose of containers in accordance with standard operating procedures.

WARNING SUMMARY – (Continued)

Refer to Army POL (para. 1-8) for information concerning storage, use, and disposal of liquid contaminants. Failure to comply may result in damage to environment and serious injury or death to personnel.

WARNING

SILICONE GASKET MATERIAL

Silicone gasket material emits a small amount of acid vapor. Ensure work area is well ventilated. Read and carefully follow manufacturer's instructions before use. If silicone gasket material contacts eyes, follow manufacturer's emergency procedures. Seek medical assistance as soon as possible. Failure to comply may result in serious injury to personnel.

WARNING

SILICONE GREASE

Silicone grease is harmful to skin and eyes. If silicone grease contacts eyes, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious injury to personnel.

WARNING

THREAD SEALING COMPOUND

Thread sealing compound is harmful to skin and eyes. If thread sealing compound contacts eyes, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious injury to personnel.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

NOTE: This manual supersedes TM 9-2355-106-23-1, Dated 27 April 2009.
Zero in the “Change No.” column indicates an original page or work package.

Date of issue for original manual is:

Original 19 November 2012

THE TOTAL NUMBER OF VOLUMES IS 5, TOTAL NUMBER OF FRONT AND REAR PAGES IS 212, AND THE TOTAL NUMBER OF WORK PACKAGES IS 796, CONSISTING OF THE FOLLOWING:

LIST OF EFFECTIVE PAGES/WORK PACKAGES

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LIST OF EFFECTIVE PAGES/WORK PACKAGES

HEADQUARTERS, DEPARTMENTS OF THE ARMY AND AIR FORCE
WASHINGTON, D.C., 19 NOVEMBER 2012

TECHNICAL MANUAL

FIELD MAINTENANCE MANUAL
FOR

MINE RESISTANT AMBUSH PROTECTED (MRAP)

M1224
(NSN 2355-01-553-4634) (EIC 1XF)

M1224A1
(NSN 2355-01-561-0281) (EIC 1XM)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

(A) Army - You can help improve this publication. If you find any errors, or if you would like to recommend any improvements to the procedures in this publication, please let us know. The preferred method is to submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms) through the Internet, on the TACOM unique Logistics Support Applications (TULSA) Web site. The Internet address is https://tulsa.tacom.army.mil. Access to all applications requires CAC authentication, and you must complete the Access Request form the first time you use it. The DA Form 2028 is located under the TULSA Applications on the left-hand navigation bar. Fill out the form and click on SUBMIT. Using this form on the TULSA Web site will enable us to respond more quickly to your comments and to better manage the DA Form 2028 program. You may also mail, e-mail, or fax your comments or DA Form 2028 directly to the U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command, ATTN: AMSTA-LCL-MPP/ TECH PUBS, MS 727, 6501 East 11 Mile Road, Warren, MI 48397–5000. The e-mail address is tacomlcmc.daform2028@us.army.mil. The fax number is DSN 786-1856 or Commercial (586) 282-1856. A reply will be furnished to you.

(F) Air Force - By Air Force AFTO Form 22 directly to Warner Robins, Tech Data Home office, 584 CBSS/GBHDE, 480 Richard Ray Blvd Ste 200, Robins AFB GA 31098-1640. You may also send in your recommended changes via electronic mail or by fax. Our fax number is DSN 472-3104 or Commercial (478) 222-3104. Forward all electronic AFTO 22 submissions to the following mail account: Robins.ce.afto22@robins.af.mil. Recommendations concerning changes to this manual shall be submitted in accordance with TO 00-5-1-WA-1.

* **SUPERSEDURE NOTICE**– This manual supersedes TM 9-2355-106-23-1, dated 27 April 2009, including all changes.

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HOW TO USE THIS MANUAL

Field Maintenance personnel shall familiarize themselves with the format and contents of this Technical Manual (TM) prior to performing maintenance procedures. Learning how to use this TM will enable personnel to quickly locate information, gain proper knowledge of the M1224 and M1224A1 vehicles, and shorten the time necessary to complete a required procedure.

This manual describes in detail the Field Maintenance authorized by the Maintenance Allocation Chart (MAC) and Repair Parts and Special Tools List (RPSTL) (TM 9-2355-106-23P). It is divided into the following ten chapters:

- Chapter 1 – General Information, Equipment Description, and Theory of Operation
- Chapters 2, 3, 4, and 5 – Troubleshooting Procedures
- Chapter 6 – Preventive Maintenance Instructions
- Chapters 7, 8, and 9– Maintenance Instructions
- Chapter 10 – Supporting Information, including publication references; tools, parts, and materials information; and the Maintenance Allocation Chart (MAC)

A Warning Summary appears at the front of the manual. Become familiar with these warnings before performing maintenance on the vehicle.

The Table of Contents in the front of the manual lists all chapters and work packages (WPs) by title and number. An alphabetical index is included at the back of the manual to help locate information quickly by topic.

Three types of notations appear throughout the manual:

WARNINGS identify risk of injury or death to personnel.

CAUTIONS identify risk of damage to equipment.

NOTES provide additional explanations or helpful information for the user.

HOW TO USE THIS MANUAL – (Continued)

GENERAL INFORMATION, EQUIPMENT DESCRIPTION, AND THEORY OR OPERATION

General Information contains information that may be useful to maintainer. For example, equipment designations and purpose statements.

Equipment Description and Data provides a brief description and location of major parts and components. Descriptions are supported by illustrations.

Theory of Operation describes components and systems in detail to support troubleshooting resolution.

Maintainers should review and become familiar with these sections prior to performing maintenance procedures on the equipment.

WORK PACKAGE (WP) FEATURES

Each chapter of this TM is organized in WPs. Each WP is an independent, stand-alone data unit. Each WP is assigned a four-digit sequence number.

In general, WP content is either information oriented or procedure oriented. System description WPs explain system function for background information needed during repair. Troubleshooting WPs give step-by-step instructions to locate and isolate a fault or failure in specific systems. Maintenance WPs provide step-by-step instructions for removal and installation of components.

MAINTENANCE PROCEDURES OVERVIEW

Procedural WPs contain a section titled “Initial Setup,” which includes the following information:

- Test Equipment: Test equipment needed to complete a task. If test equipment is not required, this heading will not be used.
- Tools and Special Tools: General Mechanic's Tool Kit, special tools, and other common tools required to perform maintenance tasks. Torque wrenches are required for many tasks; the proper torque wrench should be available to tighten mounting hardware.
- Materials/Parts: Mandatory replacement parts (gaskets, O-rings, etc.) as well as expendable/durable items and materials required for the task. To replace other unserviceable parts, refer to TM 9-2355-106-23P for requisition data. If no mandatory replacement materials/parts are required, this heading will not be used.
- Personnel Required: The number of personnel needed to perform a task. If only one maintainer is needed, this heading will not be used.
- References: TMs and work packages needed to complete the task.
- Equipment Conditions: Conditions that must exist before starting the task. If none are required, this heading will not be used.

HOW TO USE THIS MANUAL – (Continued)

The Initial Setup section also includes cross-references to supporting information WPs, other publications, and other maintenance WPs as necessary for the task.

Table . Initial Setup Example.

INITIAL SETUP:	**References**
Test Equipment	TM 9-2355-106-10
Maintenance Support Device (MSD), (WP0697, Item 28)	TM 9-2355-106-23P
Tools and Special Tools	**Equipment Condition**
General Mechanic's Tool Kit (GMTK), (WP0697, Item 6)	Parking brake set (TM 9-2355-106-10)
Materials/Parts	Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Grease, (WP0696, Item 14)	Engine off (TM 9-2355-106-10)
Personnel Required	MAIN POWER switch off (TM 9-2355-106-10)
Maintainer (2)	Wheels chocked (TM 9-2355-106-10)
	Engine hood open and secured (TM 9-2355-106-10)
	Belly armor removed (WP 0496)
	Starter motor removed (WP 0222)

In addition to the Initial Setup information detailed above, maintenance procedures have Follow-On Maintenance tasks to be performed at the end of the procedure before the vehicle is returned to service.

In some maintenance procedures, special torque specifications may be listed for fasteners. If a special torque is not listed, the maintainer will be instructed to install a fastener and tighten securely. In such cases, the maintainer must use the standard torque for the size and grade fastener. For further information, refer to Torque Limits (WP 0786).

PMCS OVERVIEW

To ensure the vehicle is ready for operation at all times, it must be inspected on a regular basis so items to be serviced may be found before they result in serious damage, equipment failure, or injury to personnel. The PMCS table contains systematic inspections and services to maintain the vehicle in mission-ready condition.

TROUBLESHOOTING PROCEDURES OVERVIEW

This section gives instructions on proper diagnostic techniques for all diagnostic procedures.

The troubleshooting procedures in this TM are designed to isolate one failure at a time and cannot give answers to every possible vehicle malfunction encountered. However, the procedures do list the most common answers to a problem in an organized, step-by-step manner. Faults are listed in the Vehicle Troubleshooting Symptom Index (WP 0005). The Vehicle Troubleshooting Symptom Index will direct the user to WPs that include tests and inspections to locate the source of a problem and lead to a successful correction. It is assumed that the vehicle will be returned to operating condition at the end of the troubleshooting procedure.

Troubleshooting Guidelines

After reading this Troubleshooting Procedures Overview, begin all troubleshooting with the Vehicle Operational Checkout Procedure (WP 0010).

When performing troubleshooting, use the following process.

VERIFY THE PROBLEM

Operate the complete system and list all symptoms, in order to:

1. Check the accuracy and completeness of the complaint.
2. Learn more that might give a clue to the nature and location of the problem.
3. Analyze which parts of the system are working.

HOW TO USE THIS MANUAL – (Continued)

PERFORM PRELIMINARY STEPS BEFORE TESTING

1. Gather information by talking to the operator, if possible. Try to determine the exact symptoms by gathering relevant information:
   a. What happened and when?
   b. Under what conditions?
   c. When did the symptoms begin?
   d. What else occurred at that time?
2. Verify that all operator maintenance tasks have been completed (TM 9-2355-106-10). Verify that any operator troubleshooting tasks that apply to the current symptom have been completed (TM 9-2355-106-10).
3. Avoid preconceived ideas. Eliminate any nonelectrical causes for the problem first (contaminated fuel, clogged air filters, etc.).
4. Ensure the vehicle batteries are at 75% State Of Charge (SOC) or higher when measuring specific gravity. This represents an Open Circuit Voltage (OCV) of 12.4V. Batteries with an OCV of 12V or less are considered to be either completely discharged or to have a dead cell.
5. Check any light or indicator lamp filament that is suspected of being open (burned out). This is done to avoid unnecessary extensive circuit checks.
6. Inspect all connectors for spread-open terminals and loose, corroded, or damaged pins, wires, etc. If a fuse is blown, locate the cause of the overload condition and repair it. The common procedure is as follows: Isolate sections of the circuit by disconnecting connectors, and measure the resistance to ground to find the circuit that is shorted to ground. Then locate the damaged spot in the wire or connector and replace it.
7. Inspect fuses visually for an open element when possible, and test electrically for resistance or voltage drop across the terminals.
8. Multiple symptoms may occur when a ground stud is loose or has poor contact. When multiple symptoms are present, inspect ground studs at engine bulkhead and starter for loose connection or corrosion. If required, disassemble ground stud connection and clean with a wire brush.

CHECK THE INSTRUMENT PANEL CLUSTER (IPC) INDICATOR LAMPS

- Some IPC indicators provide direct indication of a fault with a specific system. Examples are the engine oil pressure gauge and the engine coolant temperature gauge. Certain IPC indicator lamps indicate a fault in a general system, such as the engine or transmission. Diagnosis of a specific Diagnostic Trouble Code (DTC) for that system will isolate the fault.
- The IPC activates the RED ENGINE warning indicator when it receives a message on the drivetrain 1939 data link from the engine controller. The engine controller will send this message when warning thresholds for coolant temperature, coolant level, or low engine oil pressure have been exceeded. The indicator lamp will be accompanied by a message on the odometer display and the IPC alarm will sound.
- The IPC activates the YELLOW ENGINE warning indicator when it receives a message on the drivetrain 1939 data link from the engine controller. The engine controller will send this message when it detects certain faults in engine components, such as fuel injectors and engine sensors. The light will be accompanied by a message on the odometer display.
- The IPC activates the CHECK TRANS lamp when it receives a message on the drivetrain 1939 data link from the Electronic System Controller (ESC). The ESC generates this message when the transmission controller notifies it that a fault has been detected.
- The IPC activates the ABS indicator when it receives a message on the drivetrain 1939 data link from the ESC. The ESC generates this message when the ABS controller notifies it that a fault has been detected or when ABS is activated.

HOW TO USE THIS MANUAL – (Continued)

CHECK THE CIRCUIT DIAGRAM

Refer to the circuit diagram for possible clues to the problem. If several circuits fail at the same time, check for a common power source or common ground connection. If part of a circuit fails, check the connections between the part that works and the part that doesn't work.

For example, if the low-beam headlights work, but both high-beam lights and the high-beam indicator do not work, then the power and ground paths must be good. Since the dimmer switch is the component that switches the power to the high-beam headlights, it is the most likely cause of failure.

CHECK FOR CAUSE OF THE PROBLEM

Do the easiest things first. Look for the most obvious cause of a problem. For example, excessive oil consumption may be the result of leaks at gaskets or loose line connections.

Double-check the diagnosis before disassembly. The source of most engine problems can be traced to more than one part in a system. For example:

- Excessive fuel consumption may not be caused by the fuel pump alone. Instead, the trouble could be a clogged air cleaner or a restricted exhaust passage causing severe back-pressure.
- Engines are often disassembled in search of a problem and the real evidence of the problem is destroyed. Check again to be sure an easier solution to the problem has not been overlooked.

Before correcting a problem, diagnose the cause of the problem. Do not allow the same failure to occur again.

CIRCUIT TESTING

During circuit testing, it is expected that the specified circuit will be tested from one end to the other, including all splices and connections in between.

When probing terminals, take care not to damage the terminal.

Schematics facilitate testing by dividing a circuit into segments.

HOW TO USE THIS MANUAL – (Continued)

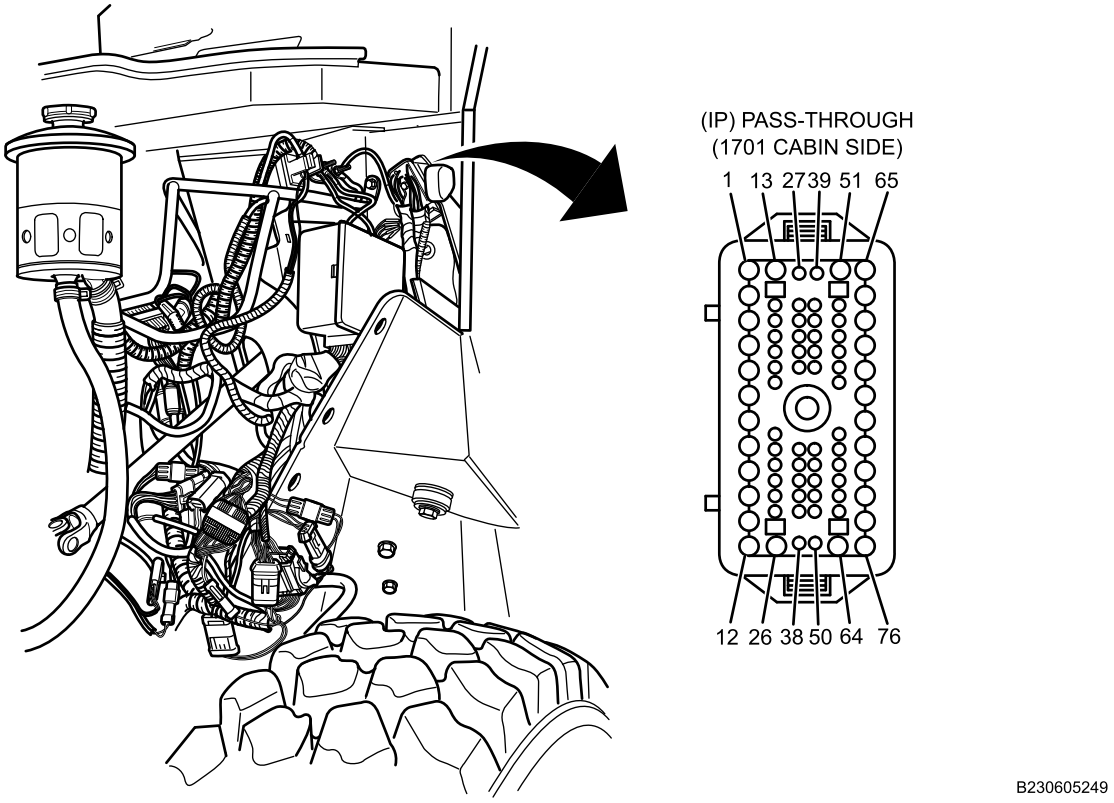

Figure 1. Connector Terminal Numbering Example.

Some work packages may reference a connector composite view that has only the outside terminals labeled. In such cases, the maintainer must identify the correct terminal by counting terminals in the applicable row. For example, if the desired terminal is terminal 60, the maintainer identifies row 51 through 64, and then counts up from terminal 51 or down from terminal 64 until terminal 60 is identified. Refer to Figure

MAKE THE REPAIR

It is expected that once a fault is located, it will be repaired or replaced as required.

VERIFY THE REPAIR IS COMPLETE

Operate the system and check that the repair has eliminated all symptoms and has not caused any new symptoms.

Troubleshooting Methods

Three troubleshooting methods are used in this TM:

- Logic process (Troubleshooting Procedure WPs)
- Operational checkout (Operational Checkout Procedure WPs)
- Symptom based (Troubleshooting Procedure WPs)

Each method is explained below.

HOW TO USE THIS MANUAL – (Continued)

Logic Process

The logic process is used to isolate a fault through a series of tests. Each test yields an indication or condition (result observed during the testing). The maintainer selects the corresponding answer to determine the next action to isolate the fault. Generally, this method is referred to as a logic tree. The logic tree has various paths (branches) that the maintainer will traverse to determine or isolate the fault. Each path or branch has a test, a question (What did the maintainer observe?), and a choice of answers to the question. Each answer leads the maintainer to the next appropriate test until the fault is isolated.

Logic Troubleshooting Procedure Example:

STEPS

1. Turn ignition OFF (TM 9-2355-106-10).
2. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
3. Disconnect connector 1804.
4. Measure resistance between connector 1804 terminal B and ground with multimeter.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES – Go to Step 8.

NO – Go to next step.

STEP

5. Measure resistance between connector 1804 terminal F and ground with multimeter.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO – Go to Step 7.

YES – Go to next step.

MALFUNCTION

6. Steering column wiring harness is faulty.

ACTION

Replace steering column wiring harness. Refer to Steering Column Harness Removal and Installation (WP 0192). Return vehicle to service.

Operational Checkout

An operational checkout contains an ordered set of test procedures to determine if a system is operational or requires corrective action. Each operational test procedure leads to a condition/indication. If a normal condition/indication is obtained, the next operational checkout step is performed. When an abnormal condition/indication is observed, the maintainer is instructed to perform the corrective action provided or to refer to a specified WP for detailed troubleshooting or maintenance instructions.

Operational Checkout Procedure Example:

STEPS

1. Turn ignition on (TM 9-2355-106-10).
2. Turn MAIN POWER switch on (TM 9-2355-106-10).
3. Put Master Vehicle Light Switch (MVLS) in PARK mode (TM 9-2355-106-10).
4. Firmly push on horn pad on steering wheel (TM 9-2355-106-10).

HOW TO USE THIS MANUAL – (Continued)

5. If both horns operate, return vehicle to service.

CONDITION/INDICATION

Horns are on without pressing horn pad.

CORRECTIVE ACTION

Refer to Electric Horns Sound Without Pressing Horn Pad Troubleshooting Procedure (WP 0190).

CONDITION/INDICATION

Only one horn does not operate.

CORRECTIVE ACTION

Refer to Single Horn Fault Troubleshooting Procedure (WP 0191).

Symptom Based Procedure

A symptom based procedure lists a vehicle symptom, followed by one or more possible malfunctions. Each malfunction lists one or more possible corrective actions, with corresponding WP references.

Symptom Based Procedure Example:

SYMPTOM

VEHICLE PULLS LEFT OR RIGHT

MALFUNCTION

Improper wheel alignment.

CORRECTIVE ACTION

Adjust as necessary. Refer to Front Axle Alignment Procedure (WP 2990).

MALFUNCTION

Loose, damaged, or leaking shock absorber.

CORRECTIVE ACTION

Replace as necessary. Refer to Front Shock Absorber Removal and Installation (WP 3660).

MALFUNCTION

Broken spring or loose spring bushings.

CORRECTIVE ACTION

Adjust as necessary. Refer to Front Spring Assembly Removal and Installation (WP 3630) or Rear Spring Assembly Removal and Installation (WP 3640).

MALFUNCTION

Broken or loose U-bolts.

CORRECTIVE ACTION

Adjust as necessary. Refer to Front Spring Assembly Removal and Installation (WP 3630) or Rear Spring Assembly Removal and Installation (WP 3640).

CHAPTER 1

GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND THEORY OF OPERATION

FOR

MINE RESISTANT AMBUSH PROTECTED (MRAP)

FIELD MAINTENANCE

GENERAL INFORMATION

SCOPE

This Technical Manual (TM) contains Field Maintenance instructions for maintaining and servicing the M1224 MRAP and M1224A1 with MRAP with Expedient Armor Program (MEAP). It includes cautions and warnings regarding safety for personnel and equipment, equipment description and data, and troubleshooting procedures to be followed to identify and locate vehicle malfunctions. It also contains preventive maintenance checks and service procedures, a Maintenance Allocation Chart, and other Field level supporting information.

- **Type of Manual –** Field
- **Model number and equipment names:**

  M1224 MRAP

  M1224A1 MRAP

- **Purpose of equipment –** These vehicles are capable of supporting multiple missions to include recon, convoy operations, troop transport, CASEVAC, and Combat Engineer and EOD missions for maneuver units. They provide increased survivability for personnel via an armored cabin and V-shaped blast resistant hull.

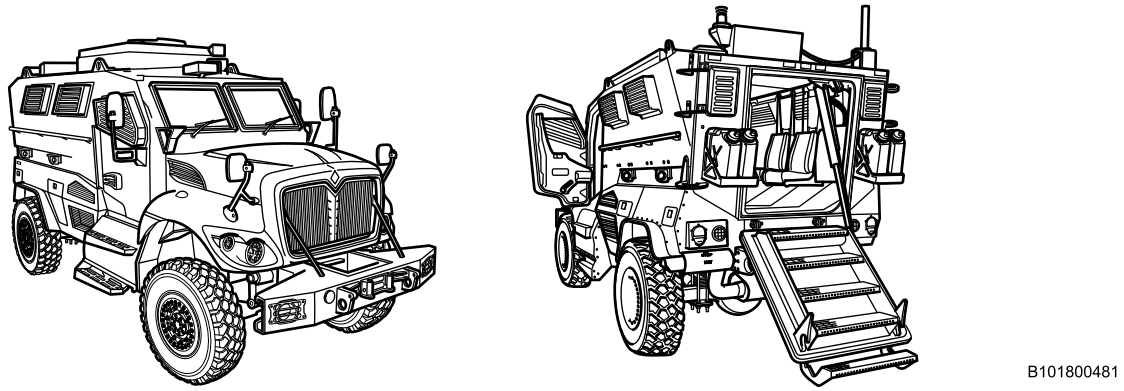

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Figure 1. M1224 MRAP

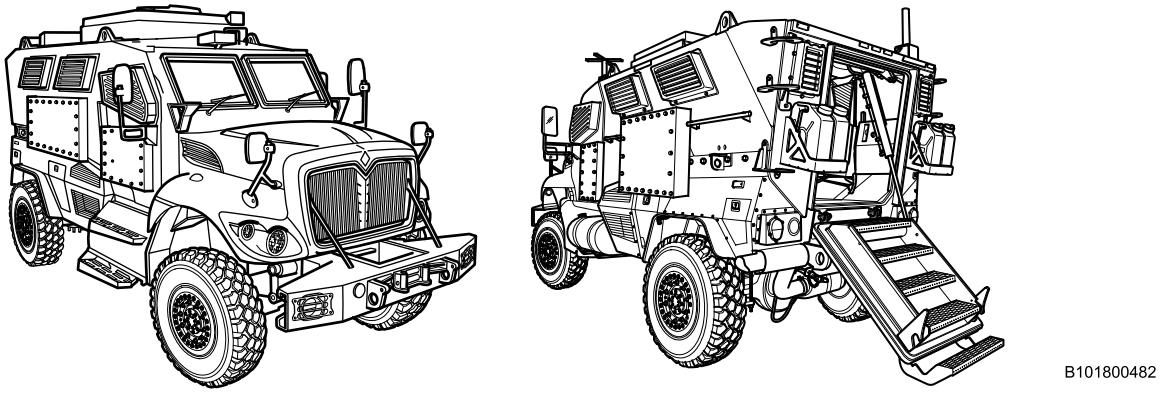

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Figure 2. M1224A1 MRAP

GENERAL INFORMATION - (CONTINUED)

MAINTENANCE FORMS RECORDS AND REPORTS

1. (A) Department of the Army forms and procedures used for equipment maintenance will be those prescribed by (as applicable) DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual; DA PAM 738-751, Functional Users Manual for the Army Maintenance Management Systems - Aviation (TAMMS-A); or AR 700-138, Army Logistics Readiness and Sustainability.
2. (AF) Maintenance forms and records used by Air Force personnel are prescribed in AFI 21-101 and the applicable TO 00-20 Series Technical Orders.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your MRAP vehicle 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 do not like the design or performance.

All non-Aviation/Missile EIRs and PQDRs must be submitted through the Product Data Reporting and Evaluation Program (PDREP) Web site. The PDREP site is: https://www.pdrep.csd.disa.mil/.

If you do not have Internet access, you may submit your information using an SF 368 (Product Quality Deficiency Report). You can send your SF 368 using email, regular mail, or fax using the addresses/fax numbers specified in DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual. We will send you a reply.

CORROSION PREVENTION AND CONTROL

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

Corrosion specifically occurs with metals. It is an electrochemical process that causes the degradation of metals. It is commonly caused by exposure to moisture, acids, bases, or salts. An example is the rusting of iron. Corrosion damage in metals can be seen, depending on the metal, as tarnishing, pitting, fogging, surface residue, and/or cracking. Plastics, composites, and rubbers can also degrade. Degradation is caused by thermal (heat), oxidation (oxygen), solvation (solvents), or photolytic (light, typically UV) processes. The most common exposures are excessive heat or light. Damage from these processes will appear as cracking, softening, swelling, and/or breaking. SF Form 368, Product Quality Deficiency Report, should be submitted to the address specified in DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For general vehicle destruction procedures, refer to TM 750-244-6, Procedures for Destruction of Tank - Automotive Equipment to Prevent Enemy Use (U.S. Army Tank-Automotive and Armaments Command).

PREPARATION FOR STORAGE OR SHIPMENT

No special preparation, other than maintenance, is required when MRAPs are driven under their own power to their destination.

All doors, except the driver door, should be tied closed. All material that exceeds the width of the vehicle should be removed and secured inside the vehicle. All antennas should be lowered and tied down.

Turn off all Government Furnished Equipment (GFE).

Vehicle Storage

The unit is responsible for adequate storage and protection of new vehicles. Maintain records for vehicles in storage so that proper inspection and maintenance can be performed. Perform the following procedures before storing vehicle:

GENERAL INFORMATION - (CONTINUED)

Storage Duration Two Months or Less

NOTE

To avoid damaging the finish, avoid wiping dirt off of dry surfaces; wash vehicle when surface is cool to the touch.

A low electrolyte level is normally the result of a broken battery case or years of usage. It will not normally be seen on new vehicles.

1. Wash vehicle with warm water and mild soap. Dry wet surfaces with a chamois or soft cloth.
2. Inspect painted surfaces; touch up all exposed primed or raw metal areas to prevent rust.
3. Check radiator coolant reservoir for proper level and adequate freeze protection.
4. Cover open ends of exhaust and air intake for the HVAC system.
5. Check batteries state of charge. Charge batteries if open circuit voltage is below 12.6 volts.
6. Fill fuel tank to maximum level. Ventilate system by releasing filler cap. If this can't be accomplished, completely drain the fuel tank.
7. Inspect vehicle prior to storage by performing the next appropriate PMCS, and make any repairs necessary. Ensure that maintenance services and lubrication are up to date.

Storage Duration Over 2 Months

NOTE

After every 3 months of additional storage, repeat items 1 through 10.

Units in storage for longer than 2 months require the following additional procedures.

1. Inspect for the following:
   a. Leaks
   b. Low or flat tires
   c. Corrosion
   d. Water in compartments
   e. Other problems or shortcomings
2. Perform the next scheduled major maintenance service.
3. Start and run vehicle at fast idle until it reaches operating temperature.
4. To remove surface charge from the battery, operate heater and air conditioner and turn on headlights and other accessories for a few minutes.
5. Drive the vehicle a short distance. Shift the transmission in various ranges; apply and release the service and parking brake systems.
6. Turn off heater and air conditioner and any other accessories; shut off lights. Park vehicle and shut off engine.
7. Disconnect and remove batteries and store in a cool, well-ventilated area. Recharge and clean before use.
8. Drain air brake reservoirs and close drain cocks.
9. Check radiator coolant reservoir for proper level and adequate freeze protection.
10. Lubricate all exposed components.
11. For vehicles exposed to ultraviolet rays of the sun, apply a coating of powdered cleanser or similar product to the inside surfaces of windshield and windows to shade the interior.

GENERAL INFORMATION - (CONTINUED)

Storage Facilities

1. Whenever possible, store vehicles indoors, protected from sunlight, in a dry, well-ventilated area. If indoor storage is not available, select storage lots to eliminate conditions that cause deterioration.
2. Park away from transformers and/or electrical motors. When the protective wax in tire compound cracks, ozone in the air attacks the exposed areas.
3. Park away from trees, high weeds, and grass to prevent damage from tree or weed sap and to minimize bird and insect stains.
4. Park away from railroad tracks, paint shops, smoky industrial areas, and locations of possible road splash contact.
5. If a vehicle is parked on an incline, block the wheels.

NOMENCLATURE CROSS-REFERENCE LIST

This listing includes nomenclature cross references used in this manual:

Table 1. Nomenclature Cross-reference List

Common Name	Official Nomenclature
110V Battery Disconnect Switch	Switch, Battery
110V Cover, Outlet, and Box	Box, Receptacle
110V Inverter	Inverter, 1800 W
110V Outlet Harness	Harness, 110 Volt
12V and 24V Battery Disconnect Switch	Switch, Battery Disconnect, Solenoid
12V Battery Disconnect Switch Solenoid Feed Cable	Cable, Disconnect
12V to 24V Disconnect Battery Switch Solenoid Feed Harness	Cable Assembly, Positive
12V to 24V Disconnect Battery Switch Solenoid Ground Harness	Cable Assembly, Negative
12V Underhood Megafuse	Fuse, Mega
12V Underhood Megafuse Holder	Holder, Megafuse
24V Battery Disconnect Switch Solenoid Feed Cable	Cable, Disconnect
24V Body Feed Harness	Cable, 24V Body Feed
24V Gauge	Gauge, Battery-Generator
24V Gauge Bulb	Bulb
24V Government Furnished Equipment (GFE) Wiring Harness	Harness, IP Feed, 24-Volt
24V Instrument Panel (IP) Feed Wiring Harness	Harness, IP Feed, 24-Volt
24V Inverter Megafuse	Megafuse, 150A
24V Inverter Megafuse Holder	Holder, Megafuse
24V Power Distribution Module (PDM)	Box, Circuit Breaker Power Distribution Panel
24V Power Distribution Module (PDM) Ground Cable	Cable, Ground
24V Underhood Junction Block	Block, Junction
4-Pack Air Solenoid Module	Solenoid, Air, Transfer Case
4-Pack Air Solenoid Module Support	Support, 4-Pack, Air Solenoid
Accelerator Pedal Sensor (APS)	Sensor, Throttle Position
Air 1 Pressure Gauge and Harness	Gauge Electronic Air 1
Air 2 Pressure Gauge and Harness	Gauge Electronic Air 2
Air Brake Double Check Valve	Valve, Check
Air Brake Quick Release Valves	Valve, Brake, Quick Release
Air Brake Relay Valve	Valve, Relay, R-14
Air Cleaner Assembly	Cleaner, Air, Assembly
Air Cleaner Support	Bracket, Mounting
Air Compressor	Compressor, Air

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Air Compressor Delivery Air Line	Tube, Air Compressor
Air Compressor Governor	Governor, Air Compressor
Air Compressor Supply Air Line	Hose, Heater, 3/4-in. ID
Air Conditioner (A/C) Belt	Belt, A/C Compressor
Air Conditioner (A/C) Condenser Fan Motor Relay	Relay, General Control
Air Conditioner Condenser Fan Assembly	Blowers Assembly
Air Conditioning (A/C) Belt Tensioner	Tensioner, Belt
Air Conditioning A/C Condenser Panel	Panel, AC Condenser
Air Dryer	Dryer Assembly, Air
Air Dryer Bracket	Bracket, Air Dryer
Air Dryer Desiccant Cartridge	Cartridge, Desiccant
Air Filter Restriction Gauge	Gauge, Air Cleaner
Air Gauge Transducer	Transducer, Air Pressure Gauge
Air Hose Fitting	Elbow
Air Hose Quick-Connect Fitting	Coupling, Air Hose
Air Intake Tube (To Turbo)	Pipe, Air
Air Reservoir Tank	Tank, Air Secondary
Alternator	Generator, Alternator
Alternator Bracket	Bracket, Alternator
Alternator Interconnect Positive Cable	Cable, Alternator
Alternator Pulley	Pulley, Groove
Antilock Brake System (ABS) Blink Code Switch	ABS-6 Blink Code Switch
Antilock Brake System (ABS) Control Module	Module, ABS Control
A-Pillar Assist Handle	Handle
A-Pillar Cover Trim	Cover, A-Pillar
Armor Grille	Grille Assembly
Armor Grille Support and Armor Grille Support Bracket	Support, Assembly Lower Grill
Auxiliary Spring	Spring, Rubber, Auxiliary
Axle Shaft Oil Seal	Seal, Oil Spindle
Backup Light Assembly	Light, White, Backup
Barometric Pressure Sensor	Sensor, Barometric Pressure
Battery	Battery, Storage
Battery Body Ground Cable	Cable, Negative
Battery Box	Tray Module, Battery
Battery Cable and Clean Power Harness	Cable Assembly, Battery
Battery Cables	Cable, Positive
Battery Disconnect Switch	Switch, Battery
Battery Equalizer	Converter Equalizer, Battery
Belly Armor	Belly Deflector, Pan
Blackout Drive Light Assembly	Light, Blackout
Body Armor Rear Wall, Riot Guard, and Bracket	Armor, Rear Wall
Body Ground to Firewall Ground Cable	Cable, Negative
Bottom Ramp Step	Steps, Welded
Brake Pedal	Pedal, Brake
Brake Stoplight Switch	Switch, Pressure, Stop Light
Cabin Door	Door, Assembly
Cabin Door Assist System Actuator Air Line Tubing	Tube, Black Nylon 1/4-In. OD.
Cabin Door Assist System Limit Valve	Elbow
Cabin Door Assist System Supply Air Line Tubing	Tube, Black Nylon
Cabin Door Assist System Supply Pass-Through Air Line Tubing	Tube, Black Nylon
Cabin Door Combat Lock Assembly	Handle, Outside Door, Assembly

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Cabin Door Exterior Handle Assembly	Handle, Outside Door, Assembly
Cabin Door Interior Handle Assembly	
Cabin Door Interior Handle Assembly	Handle, Door
Cabin Door Seal	Seal
Cabin Door Striker and Cabin Door Check Stop Assemblies	Cabin Door Check Stop
Cabin Electrical Ground Stud Plate	Stud, M8 X 1 MM
Cabin Emergency Hatch and Hinge	Emergency Hatch
Cabin Emergency Hatch Handle/Lock Assembly	Emergency, Hatch, Lock
Cabin Emergency Hatch Seal	Seal Ring, Escape Hatch
Cabin Roof Molding	Moulding
Cabin Window Armor Glass	Window, Armor Glass Assembly
Camshaft Position (CMP) Sensor	Sensor, Camshaft Position
Center Chassis Harness	Harness, Chassis, Center
Center Floor Panel	Panel, Floating Floor Center
Center Panel Air Filter Restriction Gauge Tubing and Fitting	Tube, Black Nylon, 1/4-In. OD.
Charge Air Cooler (CAC) Assembly	Cooler, Charge Air
Charge Air Cooler (CAC) Hose	Pipe, Air Duct
Clearance and Marker Light Harness	Harness
Clearance Lights Cabin Jumper Harness	Harness, Roof
Climate Control Unit CCU Box	CCU Box
Communications Rack	Rack, Communications
Composite Taillamp Assembly	Taillamp, Composite, Assembly
Cooling Fan Actuator Solenoid	Solenoid, Air Valve
Cooling Fan Drive Assembly	Drive, Fan
Cowl Panel Drain Tube	Tube, Drain
Crankshaft Damper	Damper, Vibration
Crew and Front Passenger Seat	Seat, Front, Passenger
Cross-Vehicle Equipment Bracket	Bracket, Cross Vehicle Equipment
Cruise Control Switch Module	Switch, Steering Wheel
Deaeration Tank	Tank, Deaeration
Deaeration Tank Pressure Cap	Cap, Filler Opening
Door Armor Panel	Panel, Armor
Door Mounted Mirror	Mirror, Powered, Assembly
Door Window Armor Glass	Glass, Door Assembly
Door Window Riot Guard	Guard, Riot Protection
Driver Control Module (DCM) Left Air Line Grommet	Guide, Tube Passthru Gland Low
Driver Control Mounting (DCM) Bracket Assembly	DCM Base
Driver Control Mounting (DCM) Bracket Assembly Exterior Armor	Cover, DCM, Main
Driver Control Mounting (DCM) Bracket Assembly Interior Armor	Bracket, DCM Interior Armor
Driver Seat	Seat, Driver
Dual-Pneumatic Door Actuator	Actuation Assembly
Electric Horn	Horn, W/Brackets
Electronic System Controller (ESC)	Controller, Electronic System
Electronic System Controller (ESC) Brace	Brace
Engine Control Module (ECM)	Module, Electronic Control
Engine Control Module (ECM) and the Transmission Control Module (TCM) Fuse	Fuse, Blade Type
Engine Control Module (ECM) and Transmission Control Module (TCM) Clean Power and Ground Harness	Cable Assembly, Battery
Engine Coolant Temperature (ECT) Sensor	Sensor, Oil/Coolant Temperature

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Engine Cover	Cover, Engine
Engine Mount Crossmember Assembly	Crossmember
Engine Oil Breather Tube	Tube Assembly, Breather
Engine Oil Cooler	Cooler Assembly, Oil
Engine Oil Cooler Pressure Regulator	Valve, Regulating
Engine Oil Filter	Filter, Oil
Engine Oil Pan	Oil Pan Assembly
Engine Oil Pickup Tube	Tube Assembly, Oil Pick Up
Engine Oil Pressure (EOP) Sensor	Sensor, Engine Oil Pressure
Engine Oil Temperature (EOT) Sensor	Sensor, Oil/Coolant Temperature
Engine Sensor Wiring Harness	Wiring, Electronic
Engine Water Outlet Pipe	Assembly, Pipe
Engine Water Outlet Pipe Elbow	Elbow, Pipe, Vibralok
Engine Water Pump	Pump, Water
Engine Wiring Harness	Harness, Base 24-V
Equalizer Cables	Cable, Converter
Ether (Cold) Start Valve and Atomizer Assembly	Ether Start Assembly
Ether Start Switch	Switch, Ether Start
Exhaust Brake	Brake, Exhaust Compression
Exhaust Brake Solenoid	Solenoid, Exhaust Brake
Exhaust Brake Supply Air Line	Tube, Black Nylon
Exhaust Manifold	Manifold, Exhaust, Center
Exhaust Pipe	Pipe, Exhaust
Exterior Battery Box Armor Door	Side Belly, Door Right
Exterior Body Armor Left Front Panel	Panel, Armor, Left Side, Front
Exterior Body Armor Left Middle Front Panel	Panel, Armor, Side, Front-Middle
Exterior Body Armor Middle Rear Panel	Panel, Armor, Side, Rear-Middle
Exterior Body Armor Rear Panel	Panel, Armor, Side, Rear
Exterior Body Armor Right Front Panel	Panel, Armor, Right Side, Front
Exterior Body Armor Riot Guard	Guard, Riot Protection, Side, Front
Exterior Fuel Tank Armor Door	Side Belly, Fuel Tank Door, Left
Fender and Reinforcement	Extension, Fender
Flexplate Assembly	Plate, Flex
Floor Panel (Front Center)	Panel, Floating Floor Center
Floor Panel (Front)	Panel, Floating Floor Front
Foot Brake Valve	Valve
Forward Chassis Harness	Harness Assembly, Forward Chassis
Front and Rear Clearance Lights Roof Harness	Harness, Roof
Front Antilock Brake System (ABS) Modulator Valve	Valve, Air Modulator
Front Antilock Brake System (ABS) Sensor	Transmitter, Speed Sensor
Front Axle Antilock Brake System (ABS) Tone Ring	Ring, ABS Tone
Front Axle Assembly	Axle, Front, Assembly
Front Axle Breather	Breather Assembly
Front Axle Bumper Stop	Bumper, Front Spring
Front Axle Bumper Stop Bracket	Stop, Front Axle
Front Brake Air Chamber	Chamber, Brake
Front Brake Air Hose	Tubing, Nonmetallic
Front Brake Drum	Drum, Brake
Front Brake Dust Shield	Shield, Dust, Brake
Front Brake S-Camshaft	Camshaft, Brake
Front Brake Shoes	Shoe, Brake
Front Brake Spider and Spindle Assembly	Spider, Brake, With Bushing

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Front Bumper	Bumper, Front
Front Bumper Right Harness	Harness, Electrical, Right
Front Bumper Turn Signal and Parking Light Assembly	Light, Turn Signal
Front Clearance Light Assembly	Bar, Front Marker Light
Front Clearance Light Bar Harness	Harness Front - Clearance Light Bar
Front Crew Light	Light, Front, Crew
Front Engine Cover	Front Cover, Front Half
Front Engine Mount	Insulator, Engine Front Mounting
Front Fender Light Assembly	Light, Turn Signal Assembly
Front Fender Light Bulb	Light, Turn Signal, Amber
Front Frame Crossmember and Radiator Support	Crossmember, Front
Front Frame Crossmember and Support	Crossmember, Front
Front Litter Arm Mount Plate and Arm Support	Forward Mounting
Front Oil Pump Assembly	Rotor, Pump
Front Shock Absorber	Shock Absorber
Front Shock Absorber Lower Mounting Bracket	Seat, U-Bolt Front
Front Shock Absorber Upper Mounting Bracket	Bracket, Front Shock Mounting
Front Slack Adjuster Assembly	Adjuster, Slack
Front Spring Assembly	Spring Assembly
Front Spring Shackle	Shackle
Front Towing Eye	Eye, Tow
Front Trailer Hookup Cover	Cover, Socket
Front Trailer Hookup Harness	Harness, Front Trailer
Front Turn Signal and Parking Light Bulb	Light, Turn Signal, Amber
Front Wheel Hub	Hub Assembly
Front Wheel Hub Bearing	Bearing, Inner
FSS Cabin Cylinder	Extinguisher, 9-kg
FSS Cabin Sensor	Sensor, Cabin
FSS Cabin Wiring Harness	Harness, Cabin
FSS Cabin/Crew Dispersion Unit and Pipe	Nozzle, Water Mist, Front
FSS Chassis Harness	Harness, Chassis
FSS Control Unit	System, Control
FSS Control Unit Bracket	Bracket, Control Box
FSS Engine Compartment Sensor	Sensor, Engine
FSS Engine Cylinder	Extinguisher, 2 kg
FSS Engine Dispersion Unit and Pipe	Nozzle, Flood
FSS Front Tire Dispersion Unit and Pipe	Nozzle, Foam
FSS Fuel Tank Cylinder	Extinguisher, 6-kg
FSS Fuel Tank Dispersion Unit and Pipe	Nozzle, Powder
FSS Rear Tire Dispersion Unit and Pipe	Nozzle, Foam
FSS Tire Cylinder	Extinguisher, 9-kg
Fuel Filter and Strainer	Filter, Fuel
Fuel Filter Header/Primer Pump Assembly	Header, Fuel Filter Assembly
Fuel Hose	Tube Assembly, Formed Fuel Line
Fuel Injector	Injector, Assembly
Fuel Injector Harness	Harness, Injector
Fuel Level Sending Unit	Sending Unit, Fuel
Fuel Pressure Regulator	Valve, Regulator
Fuel Pump	Pump, Low Pressure Fuel
Fuel Tank	Tank, Fuel
Fuel/Water Separator Filter	Element, Fuel Filter
Fuel-Fired Heater	Heater Assembly, Fuel Fired
Fuel-Fired Heater and Fuel-Fired Heater Fuel Pump Harness	Harness, Chassis - Fuel Fired Heater
Fuel-Fired Heater Fuel Pump	Pump, Fuel

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Fuel-Fired Heater Fuel Pump Fuel Line	Hose, Fuel Line
Fuel-Fired Heater Timer Control	Control, Timer Fuel
Gladhands	Coupling Half, Quick Disconnect
Gun Port	Port, Gun Hole
Gunner Platform Stand	Platform, Adjustable Gunner
Hand Brake Control Valve	Valve
Headlamp Assembly	Headlamp Assembly
High-Pressure Injector Pump	Pump
Hood Assembly	Hood Assembly, N/Access
Hood Assembly Air Intake Grille	Grille, Assembly, Air
Hood Assembly/Fender Extension Latch	Latch, Hood Strap
Hood Grille Surround Assembly	Grille, Surround Assembly
Hood Hinge Assembly	Hinge, Hood
Hood Mirror	Mirror, Assembly
Hood Safety Cable Assembly	Cable Hood Assembly
Hood Torsion Assist Bar	Bar, Torsion
Horn Button Assembly	Cap, Horn Steering
HVAC 3-Way Valve and Bracket	Valve, Three-Way
HVAC 3-Way Valve Bracket	Support, Three-Way Valve
HVAC 3-Way Valve Coolant Inlet Hose	Hose, Heater
HVAC 3-Way Valve Coolant Outlet Hose	Hose, Heater
HVAC Cabin Heater Hose	Hose, Heater
HVAC Compressor	Compressor, Assembly
HVAC Compressor Discharge Hose	Hose, Compressor Discharge
HVAC Compressor Suction Hose	Hose, Compressor Suction
HVAC Control 2 Wiring Harness	Harness, Control II
HVAC Control Input Wiring Harness	Harness, AC Section
HVAC Evaporator Inlet Hose	Hose, Evaporator Inlet
HVAC Evaporator Outlet Hose	Hose, Evaporator Outlet
HVAC Filter Outlet Hose	Hose, Filter Outlet
HVAC Fresh Air Inlet Tube	Tube, Inlet Air
HVAC Fuel-Fired Heater Coolant Inlet Hose	Hose, Heater
HVAC Fuel-Fired Heater Coolant Outlet Hose	Hose, Heater
HVAC Heater Radiator	Radiator, Vehicular
HVAC Left Condenser Control Wiring Harness	Harness, Left Condenser
HVAC Left-Side Condenser Inlet Hose	Hose, Condenser Inlet
HVAC Left-Side Condenser Outlet Hose	Hose, Condenser Exit
HVAC Main Evaporator Assembly	Evaporator, Main
HVAC Pressure Gauge	Gauge, Driver Control, HVAC Pressure
HVAC Receiver/Drier	Receiver, Dryer
HVAC Recirculated Air RA Temperature Sensor	Sensor, Recirculated Air Temperature
HVAC Refrigerant Filter	Filter Unit
HVAC Right Condenser Control Wiring Harness	Harness, Right Condenser
HVAC Right-Side Condenser Inlet Hose	Hose, Condenser Inlet
HVAC Right-Side Condenser Outlet Hose	Hose, Condenser Exit
HVAC Service Port/Schrader Valve	Valve, Schrader
HVAC Water Drainage Hose	Hose, Water Drainage
HVAC/LSS Air Duct Louver	Louver
HVAC/LSS Box	LSS Box Assembly
HVAC/LSS Control Power Wiring Harness	Harness, CCU Power
HVAC/LSS Control Wiring Harness	Harness, Control Input
HVAC/LSS Defogging Air Duct	Duct, Air Defogging

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
HVAC/LSS Diffuser Air Duct	Duct, Air Diffuser
HVAC/LSS Engine Wiring Harness	Harness, AC, Engine
HVAC/LSS Fresh Air Inlet Flange	Flange, Fresh Air
HVAC/LSS Main Air Duct	Duct, Air
HVAC/LSS Main Blower Motor and Support	Blower, Main
HVAC/LSS Main Blower Motor Wiring Harness	Harness, RA Blower
HVAC/LSS Operator Panel	Operating Panel Assembly
HVAC/LSS Overpressure Relief Valve	Valve, Relief
HVAC/LSS Upper Blower	Blower Assembly
HVAC/LSS Upper Blower Wiring Harness	Harness, FA Blower
HVAC/LSS Upper Panel	Cover, Housing Upper
Infrared (IR) Light Assembly	Light, Infrared
Infrared (IR) Light Switch	Control Assembly, IR Light
Injection Control Pressure (ICP) Sensor	Sensor, Injector Control Pressure
Injection Pressure Regulator (IPR) Sensor	Regulator Assembly, Injection, Pressure
Inner Wheel Deflector Armor Plate	Wheel Deflector
Instrument Panel (I/P) Cluster Closeout	Closeout, Instrument Panel, Cluster
Instrument Panel (IP)	Carrier Assembly, Driver Control, Main
Instrument Panel (IP) Center Relay	Relay, Gen Control
Instrument Panel (IP) Center Trim Panel	Panel, Trim, Instrument Panel, Center
Instrument Panel (IP) Circuit Breaker, Fuse, and Relay	Breaker, Circuit
Instrument Panel (IP) Cluster	Housing, IPC
Instrument Panel (IP) Feed Harness	Harness, Instrument Panel Feed
Instrument Panel (IP) Harness	Harness, Instrument
Instrument Panel (IP) Light Bulb	Lamp, Socket
Instrument Panel (IP) Right Side Closeout	Passenger Trim, Upper Assembly
Instrument Panel (IP) Storage Bin	Box, Storage Bin
Instrument Panel Center Closeout	Panel, Trim, Instrument Panel, Center
Instrument Panel Cluster Right Side Warning Panel	Light, Instrument With Harness
Intake Air Temperature (IAT) Sensor	Sensor, Temperature
Interior Lights Crew Light Limit Switch	Switch, Limit
Interior Lights Crew Light Limit Switch Jumper Harness	Harness, Jumper
Interior Lights Left Rear Crew Light Harness	Harness, Dome Light
Interior Lights Right Rear and Front Crew Lights Harness	Harness, Dome Light
Inverter and Battery Disconnect Switch Solenoid Cables	Cable, Inverter
Inverter Disconnect Battery Switch Solenoid Harness	Harness, Disconnect, Converter Equalizer
Keyless Ignition Switch	Switch, Keyless
King Pin	Cap, King Pin Upper
Left 12V Socket and Feed Harness	Harness, Socket, 12-Volt, Right
Left Door Air Supply Line	Tube, Black Nylon
Left Headlamp and Turn Signal Harness	Harness, Electrical, Left
Left Inner Wheel Deflector Bracket	Bracket, Wheel Left
Left Rear Stowage Box	Box, Storage, Rear Left
Left Side Engine Armor Plate	Armor, Engine Side, Upper
Left Side Engine Armor Plate Bracket	Armor, Engine Side, Left
Left Side Forward Stowage Box	Box, Storage, Middle Left
Litter Arm Storage Bracket	Litter, Arm Storage
Lower Cabin Door Lock, Spacer, and Bracket	Lock Mechanism, Assembly
Manifold Absolute Pressure (MAP) Sensor	Sensor, Map
Master Crew Light Switch	Switch, Light, Assembly
Master Crew Light Switch Jumper Harness	Harness, Jumper Crew
Master Disconnect Harness	Harness, Disconnect, Converter Equalizer
Master Rear Door/Ramp Switch	Switch, Ramp

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Master Rear Door/Ramp Switch Jumper Harness	Harness, Jumper
Master Vehicle Light Switch (MVLS)	Switch, Light Master
Master Vehicle Light Switch (MVLS) Ground Harness	Cable Assembly, Jumper
Mirror Remote Control Switch	Switch, Power Mirror
Mirror Remote Control Switch Wiring Harness	Cable, Mirror Jumper Harness
Motor Baffle	Baffle, Motor
Muffler and Shield	Muffler Assembly, Exhaust
Multifunction Turn Signal Switch Assembly	Switch, Turn Signal
NATO Jump Start Connector	Connector, NATO Jump Start
NATO Jump Start Connector Cable	Cable, Negative, NATO Jump Start
NATO Jump Start Connector Cable	Cable, Positive, NATO Jump Start
NBC Dust Tube	Tube, Dust
NBC Filter	Filter, NBC
NBC Filter Cover and Housing	Housing, NBC Filter
NBC Particle Separator Filter	Separator, Particle
Oil Gauge Tube	Tube, Eng Oil Fill
Oil/Fuel Manifold	Manifold, High-Pressure Oil/Fuel
Outside Gunner Protection Armor	Gunner Protection
Outside Gunner Protection Riser	Support, Turret
Parking Brake Lamp Transducer	Switch, Pressure, Park Brake
Pitman Arm	Arm, Pitman Power
Power Distribution Center (PDC) Fuse	Fuse
Power Distribution Center (PDC) Harness	Harness, Dash Wiring
Power Distribution Center (PDC) Junction Box	Box, Power Distribution Center
Power Distribution Center (PDC) Relay	Relay
Power Steering Filter	Filter, Oil Power
Power Steering Pump	Pump Assembly, Power
Power Steering Reservoir	Reservoir, Power Steering
Power Steering Tubing and Hose	Hose, Power Steering
Pressure Protection Valve	Valve, Reservoir Control
Prop Shaft	Drive Shaft Assembly
Radiator	Housed Radiator Assembly
Radiator Fan and Fan Shroud	Recirc Shield Assembly
Radiator Pipes/Hoses	Pipe, Radiator Upper
Radiator Surge Overflow Tank	Tank, Overflow
Rear Antilock Brake System (ABS) Modulator Valve	Valve, Modulator
Rear Antilock Brake System (ABS) Sensor	Sensor, Transmitter, Wheel Speed
Rear Axle Assembly	Axle, Rear, Assembly
Rear Axle Shaft and Gasket	Axle Shaft
Rear Brake Air Chamber	Chamber, Brake
Rear Brake Air Hoses	Tubing, Nonmetallic
Rear Brake Drum and Hub Assembly	Drum, Brake
Rear Brake Dust Shield	Shields, Dust
Rear Brake S-Camshaft	Camshaft, "S" Head
Rear Brake S-Camshaft Tube Support Bracket	Bracket, Camshaft
Rear Brake Shoes	Shoe, Brake W/Lining
Rear Brake Spider Assembly	Brake Spider
Rear Center Floor Panel	Panel, Floating Floor Center
Rear Chassis Harness	Harness, Chassis, Rear
Rear Clearance Light Assembly	Plate, Mounting, Light Bracket Retention
Rear Clearance Light Bar Harness	Harness, Rear, Clearance Light Bar
Rear Communication Rack	Tray, Duke Mounting

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Rear Crankshaft Oil Seal	Seal Assembly, Radial Lip
Rear Crew Light	Light, Rear, Crew
Rear Door/Ramp Assembly	Door, Ramp Welded
Rear Door/Ramp Feed Wiring Harness	Harness, 24-Volt
Rear Door/Ramp Hydraulic Cylinder	Hydraulic Cylinder
Rear Door/Ramp Hydraulic Hoses	Hose Assembly, Hydraulic
Rear Door/Ramp Hydraulic Power Unit Manifold and Module	Manifold, Power Unit
Rear Door/Ramp Hydraulic Pump	Hydraulic Power Unit
Rear Door/Ramp Hydraulic Pump Cover	Cover Assembly, Liftgate Hydraulic Pump Access
Rear Door/Ramp Hydraulic System Control Harness	Assembly, Wire Harness
Rear Door/Ramp Hydraulic System Harness	Harness, Jumper
Rear Door/Ramp Lock Assembly	Latch Door Assembly, Stairs
Rear Door/Ramp Seal	Seal, Nonmetallic
Rear Engine Mount	Insulator, Engine Rear Mounting
Rear Floor Panel	Panel, Floating Floor Rear
Rear Frame Crossmember and Support	Crossmember, Frame, Rear
Rear Hub Assembly Bearing and Bearing Cup	Hub, Machined
Rear Litter Arm Mount Plate and Arm Support	Rear Mounting Plate
Rear Sidemarker Light Assembly	Marker, Red Light
Rear Slack Adjuster Assembly	Adjuster, Brake Slack
Rear Spring Assembly	Spring, Assy RR 31k
Rear Towing Eye	Hook, Tow
Rear Trailer Hookup Harness	Harness, Trailer
Rear Window Armor Glass	Window, Armor Glass, Rear Wall Assembly
Rifle Rack	Base, Gun
Right 12V Socket and Feed Harness	Harness, Socket, 12-Volt, Left
Right Cabin Door Assist System Supply Air Line Tubing	Tube, Black Nylon
Right Floor Seat Bracket	Bracket, Floor Seat
Right Headlamp and Turn Signal Harness	Harness, Electrical, Right
Right Inner Wheel Deflector Bracket	Bracket, Wheel Right
Right Rear Stowage Box Latch	Locker Assembly
Right Side Engine Armor Plate	Armor, Engine Side, Right
Right Side Forward Stowage Box	Storage Box, Middle, Right
Right Side Rear Stowage Box	Storage Box, Rear, Right
Rocker Switch	Switch, High/Neutral
Roof Armor Front Panel	Armor, Add On, Front
Roof Armor Front Spoiler	Front-Spoiler Assembly
Roof Armor Middle Front Panel	Armor, Add-On, Middle, Left, Front
Roof Armor Middle Rear Panel	Armor, Add-On, Middle, Left, Rear
Roof Armor Rear Panel	Armor, Add-On, Hatch
Roof Armor Rear Spoiler	Armor, Add-On, Rear
Seatbelt	Restraints
Serpentine Belt	Belt, V-Rib
Serpentine Belt Idler Pulley	Pulley, Groove
Serpentine Belt Tensioner	Tensioner, Pulley
Serpentine Belt Upper Idler Pulley	Pulley, Groove
Side Cowl Body Armor Panel	Armor, Cowl, Add On
Spotlight	Light, Spot
Spotlight Control	Control, Electronic
Spotlight Exterior Harness	Harness, Exterior Spot Light
Spotlight Interior Harness	Harness, Spot Light - Interior
Spotlight Light Bulb	Bulb, Spotlight
Spring Brake Modulating Valve	Valve, Air Modulator
Starter Motor	Motor, Starter

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Starter Motor-to-Battery Feed Cable	Cable, Positive
Starter Motor-to-Battery Ground Cable	Cable, Negative
Starter Motor-to-Engine Ground Jumper Cable	Jumper, Engine Ground
Starter Motor-to-Frame Ground Jumper Cable	Jumper, Starter Ground
Starter Ring Gear	Gear, Ring
Steering Arm	Arm, Steering
Steering Column	Column, Steering
Steering Column Covers	Covers, Steering Column
Steering Column Wiring Harness	Harness, Electrical
Steering Drag Link	Link, Steering Drag
Steering Gear	Steering Gear Assembly
Steering Knuckle	Knuckle, Steering With Bushing
Steering Shaft	Shaft, Steering
Steering Wheel and Clock Spring	Wheel, Steering
Step and Brackets	Stair Mount
Taillamp Harness	Harness, Taillamp
Towing Pintle Hook	Hook, Pintle
Tractor Protection Valve	Valve, Tractor Protection
Trailer Control Valve	Hand Control, Valve
Transfer Case Air Lines	Tube, Black Nylon
Transfer Case Armor	Plate, Mounting
Transfer Case Mount and Support	Bracket, Support
Transfer Case Oil Cooler	Cooler, Lubricating
Transfer Case Oil Cooler Hose	Hose Assembly
Transmission Assembly	Transmission
Transmission Auto Shift Control Module	Control, Shift
Transmission Breather	
Transmission Control Module and Brace	Module, Transmission Control
Transmission Control Module Brace	Bracket, Transmission Control Module
Transmission Cooler Hose	Hose Assembly, Oil Cooler, Transmission
Transmission Fluid and Filter	Filter, Fluid
Transmission Fluid Temperature Gauge and Harness	Gauge, Transmission Oil Temp
Transmission Mounting Crossmember	Mounting Assembly, Rear
Transmission to Transfer Case Propshaft	Driveshaft, Transmission To Transfer Case
Turbocharger	Turbo, GT3782
Turbocharger Lubricant Lines	Tube, Turbo Oil Inlet
Turret Mounting Plate	Mounting Plate
Turret Power Feed Wiring Harness	Wiring Harness
Upper Air Line Grommet	Guide, Tube Passthru Gland Up
Upper and Lower King Pin Bushing	Bushing, King Pin
Upper Cabin Door Lock, Spacer, and Bracket	Lock Mechanism, Assembly
Valve Cover and Gasket	Valve Cover Assembly
Valve Cover Gasket	Parts Kit, Seal Replacement
Water Inlet Elbow	Inlet, Water
Water Sensor Probe	Probe, Water Sensor
Weapon (Sliding) Hatch (Gunner Hatch)	Hatch, Sliding Roof
Weapon (Sliding) Hatch (Gunner Hatch) Inner Lock Assembly	Hook, Locker
Wheel and Tire Assembly	Wheel Assembly
Winch Battery Cable Junction Block	Block, Junction
Winch Battery Cable Junction Bracket Support Assembly	Bracket, Junction Block, Winch

GENERAL INFORMATION - (CONTINUED)

Common Name	Official Nomenclature
Winch Cable	Cable, Winch
Winch Ground Cable	Harness, Cable Winch
Winch Megafuse	Megafuse, 300 Amp
Winch Megafuse Feed Cable	Cable, Battery Positive
Winch Megafuse Holder	Holder, Megafuse
Winch Remote Control Connector Support	Extension, Winch
Windshield Armor	Armor, Front, Add On
Windshield Armor Glass	Window, Windshield
Windshield Washer Hose Assembly	Hose, Washer Supply
Windshield Washer Reservoir and Pump Motor Assembly	Assembly, Bottle, Washer
Windshield Washer Reservoir Bracket	Support, Washer Bottle
Windshield Wiper Arm and Blade	Assembly, Wiper Arm
Windshield Wiper Motor Harness	Harness, Wiper
Windshield Wiper Motor, Transmission, Bracket, and Linkage Assembly	Assembly, Windshield Wiper
Wiper Cowl Panel	Cover, Wiper Assembly

GENERAL INFORMATION - (CONTINUED)

LIST OF ABBREVIATIONS/ACRONYMS

Table 2. Abbreviations/Acronyms

Abbreviations/Acronyms	Definition
A or Amp	Ampere
AAL	Additional Authorization List
ABS	Antilock Brake System
AC	Alternating Current
A/C	Air Conditioner
ACC	Accessory
ACCEL	Accelerate
ADJ	Adjust
AGSP	Auxiliary Gauge Switch Pack
AIC	1: Atlantic Intelligence Command; 2: Afloat Intelligence Center
AIR	Aerospace Information Reports
ALT	Acquisition, Logistics, and Technology
Amb	Ambient
AMF	ACE (Allied Command, Europe) Mobile Force
AMP	Ampere
ANSI	American National Standards Institute
AOAP	Army Oil Analysis Program
APS	Accelerator Position Sensor
APS/IVS	Accelerator Position Sensor/Idle Validation Switch
ASB	Aviation Support Battalion
ASTM	American Society for Testing and Materials
ATA	American Trucking Association
ATC	Automatic Traction Control
AUX	Auxiliary
AWG	American Wire Gauge
B+ or VBAT	Battery Voltage
B.O B/O	Blackout
BAP	Barometric Pressure Sensor
BARO	Barometric Absolute Pressure
BAT	Battery
BATT	Battery
BCP	Brake Control Pressure
BCS	Brake Control Pressure
BDC	Bottom Dead Center
bhp	Brake Horsepower
BII	Basic Issue Items
BIO	1: Biotechology Industry Organization 2: BIO markers
BNO	Brake Normally Open
BOI	Basis of Issue
BPS	Brake Pressure Switch
BRT	Bright (on Instrument Panel)
BTDC	Before Top Dead Center
BTRY	1: Battery; 2: Field Artillery
BTU	British Thermal Unit
C-Celsius	Celsius
CAC	Charge Air Cooler
CAGEC	Commercial and Government Entity Code
CAN	Controller Area Network
CAP	Cold Ambient Protection
CARC	Chemical Agent Resistant Coating

GENERAL INFORMATION – (CONTINUED)

Abbreviations/Acronyms	Definition
cc	cubic centimeter
CCA	Cold Cranking Ampere
CCU	Climate Control Unit
CEC	Consolidated Engine Controlle
cfm	cubic feet per minute
cfs	cubic feet per second
CID	Cubic Inch Displacement
CIRC	Circuit
CKP	Crankshaft Position
CLS	1: Coolant Level Switch 2: Contractor Logistics Support
cm	Centimeter
CMD	Command
CMP	Camshaft Position Sensor
CNTR	Center
CNTRL	Control
COO	Cruise ON/OFF Switch
COTS	Commercial Off the Shelf
CPC	Corrosion Prevention and Control
CPU	Central Processing Unit
CTA	1: Common Table of Allowance 2: Contractor Logistics Support
CTC	Coolant Temperature Compensation
CTRL	Control
CTRLR	Controller
Cyl	Cylinder
D	Drive
DC	Direct Current
DCL	Data Communications Link
DCM	Driver Control Module
DIA	Diameter
DIFF	Differential
DLC	Data Link Connector
DME	Dimethyl Ether
DMM	Digital Multimeter
DOD	Department of Defense
DT	Diesel Turbocharged
DTC	Diagnostic Trouble Code
DTRM	Diesel Thermo Recirculation Module
EBP	Exhaust Back Pressure
ECI	Engine Crank Inhibit
ECL	Engine Coolant Level
ECM	Electronic Control Module
ECM PWR	Electronic Control Module Power
ECT	Engine Coolant Temperature
ECU	Electronic Control Unit
EFC	Engine Fan Control
EFP	1: Engine Fuel Pressure 2: Explosively Forged Projectiles
EFRC	Engine Family Ratings Code
EGC	Electronic Gauge Cluster
EGDP	Exhaust Gas Differential Pressure
EIC	End Item Code
EIR	Equipment Improvement Recommendation
EMP	Electromagnetic Pulse

GENERAL INFORMATION - (CONTINUED)

Abbreviations/Acronyms	Definition
EOD	Explosive Ordnance Disposal
EOP	Engine Oil Pressure
EOT	Engine Oil Temperature
EPA	Environmental Protection Agency
EPG	Electronic Pressure Governor
EPR	Engine Pressure Regulator
ESC	Electronic System Controller
ESD	Electrostatic Discharge
EST	Electronic Service Tool
F	Fahrenheit
FA	Fresh Air (Blower HVAC)
FGC	Functional Group Code
FMI	Failure Mode Indicator
FPC	Fuel Pump Control
FPCV	Fuel Pressure Control Valve
FRP	Fuel Rail Pressure
FRS	Forward Repair System
FSS	Fire Suppression System
ft	Feet
FWD	Forward
GAA	Grease, Automotive and Artillery
gal	gallon
gal/h	U.S. gallons per hour
gal/min	U.S. gallons per minute
GAWR	Gross Axle Weight Rating
GCW	Gross Combined Weight
GCWR	Gross Combined Weight Rating
GFE	Government Furnished Equipment
GFCI	Ground Fault Circuit Interrupter
GMTK	General Mechanic's Tool Kit
GND	Ground (Electrical)
GPC	Glow Plug Control
GPD	Glow Plug Diagnostic
GPR	Glow Plug Relay
GRND	Ground
GVW	Gross Vehicle Weight
H_2O	Water
HC	Hydrocarbons
HCI	Hardness Critical Item
HDO	Heavy Duty Oil (used with OE/HDO)
HEUI	Hydraulically Actuated Electronically Controlled Unit Injector(s)
Hg	Mercury
HI	High
Hp	Horsepower
HPU	Hydraulic Power Unit
HTR	Heater
HTRWIF	Heater Water In Fuel
HVAC	Heating Ventilating and Air Conditioning
IAHC	Inlet Air Heater Control
IAHD	Inlet Air Heater Diagnostic
IAHR	Inlet Air Heater Relay
IAT	Intake Air Temperature
IAW	In Accordance With
ICP	Injector Control Pressure

GENERAL INFORMATION - (CONTINUED)

Abbreviations/Acronyms	Definition
ICS	Interactive Communication System
ID	Inside Diameter
IDM	Injector Drive Module
IED	Improvised Explosive Device
IGM	Ignition
in.	Inch
in. H_2O	inch of water
in. Hg	inch of Mercury
IP	Instrument Panel
IPC	Instrument Panel Cluster
IPR	1: Injection Pressure Regulator 2: In Process Review
IR	Infrared
ISO	International Organization for Standardixation
ISS	Independent Suspension System
IST	1: Idle Shutdown time 2: In-Service Training
ITP	Internal Transfer Pump
IVS	Idle Validation Switch
JCT	Junction (Electrical)
JTA	Joint Table of Allowances
kg	Kilogram
km	Kilometer
km/h	Kilometers per hour
km/l	Kilometers per liter
KOEO	Key-On Engine-Off
KOER	Key-On Engine-Running
kPa	Kilopascal
L	Liter
L/h	Liters per hour
L/m	Liters per minute
L/s	Liters per second
lb	Pound
lb-ft	Pound force foot
lb-in	Pound force inch
lb/s	Pounds per second
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LO	Low
LSD	Low Sulfur Diesel
LSS	Life Support System
m	Meter
m/s	meters per second
MAC	Maintenance Allocation Chart
MAF	Mass Air Flow
MAG	Magnetic
MAP	Manifold Absolute Pressure (Sensor)
MAT	Manifold Air Temperature
MAX	Maximum
MEAP	MRAP Expedient Armor Program
mi	Mile
MIL	Military
mm	Millimeter
MOD	1: Modification 2: Module
MPa	Megapascal
mpg	Miles per Gallon

GENERAL INFORMATION - (CONTINUED)

Abbreviations/Acronyms	Definition
mph	Miles per Hour
MPR	Main Power Relay
MRAP	Mine Resistant Ambush Protected
MSD	Maintenance Support Device
MSG	Micro Strain Gauge
MSM	Multiplex System Module
MTOE	Modified Table of Organization and Equipment
MVLS	Master Vehicle Light Switch
N	Neutral
N•m	Newton Meter
NATO	North Atlantic Treaty Organization
NBC	Nuclear Biological and Chemical
NC	Normally Closed (Electrical)
NCO	Non-Commissioned Officer
NDTI	Nondestructive Testing Inspection
NHA	Next Higher Authority
NIIN	National item Identification Number (consists of last 9 digits of the NSN)
NSN	National Stock Number
OCC	Output Circuit Check
OCP	Overcrank Protection
OCV	Open Circuit Voltage
OD	Outside Diameter
OEA	Oil, Engine, Arctic
OHM	unit of electrical resistance
OSHA	Occupational Safety and Health Administration
OWL	Oil/Water Lamp
P/N	Part Number
PAG	Polyalkylene Glycol (refrigerant oil)
PAM	1: Pamphlet 2: Pyrometer Ammeter Module
PDC	Power Distribution Center
PDM	Power Distribution Module
PID	Parameter Identifier
PMCS	Preventative Maintenance Checks and Services
PMV	Pressure Modulator Valve
POL	Petroleum Oil and Lubricants
ppm	parts per million
PQDR	Product Quality Deficiency Report
PRF	MIL-PRF: Military Performance Specification
PROM	Programmable Read Only Memory
psi	Pounds per square inch
psia	Pounds per square inch absolute
psig	Pounds per square inch gauge
pt	Pint
PTC	Positive Temperature Coefficient
PTO	1: Power Takeoff 2: Preliminary Technical Order
PVC	polyvinyl chloride
PWM	Pulse Width Modulation
PWR	Power (voltage)
qt	Quart
QTY	Quantity
R	Reverse
RA	Recirculated (Reclyed) Air (Blower HVAC)
RAM	1: Random Access Memory 2: Reliability, Availability, Maintainability

GENERAL INFORMATION - (CONTINUED)

Abbreviations/Acronyms	Definition
RAS	Resume/Accelerate Switch (Speed Control)
REF	Reference
rev	Revolution
RFI	1: Request for Information 2: Radio Frequency Interface
RLY	Relay
RMS	Reliability, Maintainability, and Supportability
ROM	Read-Only Memory
RPG	Rocket Propelled Grenade
rpm	Revolutions per minute
RPS	Remote Accelerator Position Sensor
RPSTL	Repair Parts and Special Tools List
RTV	Room Temperature Vulcanization (type of silicone)
SAE	Society of Automotive Engineers (developer of aerospace, automotive, and commercial vehicle standards)
SATS	Standard Automotive Tool Set
SC/SM	Supply Catalogs/Supply Manuals
SCCS	Speed Control Command Switches
SCS	Speed Control Switch
SHD	Shield (Electrical)
SID	Subsystem Identifier
SIG GRD	Signal Ground
SMR	Source, Maintenance, and Recoverability (Codes)
SOC	State of Charge (electrical)
SPAWAR	Space and Naval Warfare Systems Command
SRA	Specialized Repair Activity
STI	Self-Test Input
SW	Switch (Electrical)
SYNC	Synchronization
TACH	Tachometer Output
TACOM	U.S. Army Tank Automotive and Armaments Command
TAMMS	The Army Maintenance Management System
TASMG	Theatre Aviation Sustainment Maintenance Group
TCM	Transmission Control Module
TDA	Tables of Distribution and Allowances
TDC	Top Dead Center
TEMP	Temperature
TM	Technical Manual
TMDE	Test Measurement and Diagnostic Equipment
TTS	Transmission Tailshaft Speed
TXV	Thermal Expansion Valve
U/I	Unit of Issue
UOC	Usable on Code
USAPPC	United States Army Publications and Printing Command
USB	Universal Serial Bus
UVC	Under Valve Cover
V	Volt
VBAT or B+	Battery Voltage
VC	Volume Control
VEPS	Vehicle Electronics Programming System
VFI	Valve Function Insert
VGT	Variable Geometry Turbocharger

GENERAL INFORMATION - (CONTINUED)

Abbreviations/Acronyms	Definition
RAS	Resume/Accelerate Switch (Speed Control)
REF	Reference
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TDA	Tables of Distribution and Allowances
TDC	Top Dead Center
TEMP	Temperature
TM	Technical Manual
TMDE	Test Measurement and Diagnostic Equipment
TTS	Transmission Tailshaft Speed
TXV	Thermal Expansion Valve
U/I	Unit of Issue
UOC	Usable on Code
USAPPC	United States Army Publications and Printing Command
USB	Universal Serial Bus
UVC	Under Valve Cover
V	Volt
VBAT or B+	Battery Voltage
VC	Volume Control
VEPS	Vehicle Electronics Programming System
VFI	Valve Function Insert
VGT	Variable Geometry Turbocharger

GENERAL INFORMATION - (CONTINUED)

Abbreviations/Acronyms	Definition
VIW	Vehicle Interface Wiring
VLV	Valve
VOP	Valve Opening Pressure
VRE	Vehicle Retarder Enable
VREF	Reference Voltage
VSO	Vehicle Speed Output
VSR	Variable Speed Reversing
VSS	Vehicle Speed Sensor
WCA	Warranty Claim Action
WIF	Water In Fuel
WP	Work Package
WTEC	World Transmission Electronically Controlled Automatic Transmissions (Allison)
XFER	Transfer
ZIP	Zip Code
+/- ±	plus or minus
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
°	degrees (temperature)
®	registered trademark
™	unregistered trademark

QUALITY OF MATERIAL

Material used for replacement, repair, or modification must meet the requirements of this Field Maintenance Manual, TM 9-2355-106-23. If quality of material requirements are not stated in this manual, the material must meet the requirements of the drawings, standards, specifications, or approved engineering change proposals applicable to the subject equipment.

SAFETY, CARE AND HANDLING

The following procedures should be observed when handling all ESD sensitive components and units containing such components. Failure to observe all of these precautions can cause permanent damage to the electrostatic device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

1. Turn off and /or disconnect all power, signal sources and loads used with the unit.
2. Place the unit on a grounded non-conductive work surface.
3. Ground the repair maintainer using a non-conductive wrist strap or other device using 1 mega-ohm series resistor to protect the operator.
4. Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator’s hand provides sufficient ground for tools that are otherwise electrically isolated.
5. All electrostatic sensitive replacement components are shipped in non-conductive foam or tubes and must be stored in the original shipping container until installed.
6. When these devices and assemblies are removed from the unit, they should be placed on the non-conductive work surface or in non-conductive containers.
7. When not being worked on, place disconnected circuit boards in plastic bags that have been coated or impregnated with a non-conductive material.
8. Do not handle these devices unnecessarily or remove them from their packages until actually used or tested.

GENERAL INFORMATION - (CONTINUED)

COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment, or CTA 8-100, Army Medical Department Expendable/Durable Items, as applicable to your unit.

SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL) TM 9-2355-106-23P.

Special tools: Test, Measurement, and Diagnostic Equipment (TMDE); and support equipment are listed in Tool Identification List (WP 0795); and mandatory replacement items are listed in (WP 0796).

The Maintenance Allocation Chart (MAC) (WP 0793) designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component.

REPAIR PARTS

Repair parts are listed and illustrated in the repair parts and special tools list TM 9-2355-106-23P.

END OF WORK PACKAGE

FIELD MAINTENANCE

EQUIPMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The Mine Resistant Ambush Protected (MRAP) M1224 and M1224A1 general characteristics, capabilities, and features are described in the Operator's Manual (TM 9-2355-106-10). This work package describes the technical features of MRAP systems.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

POWERTRAIN SYSTEM

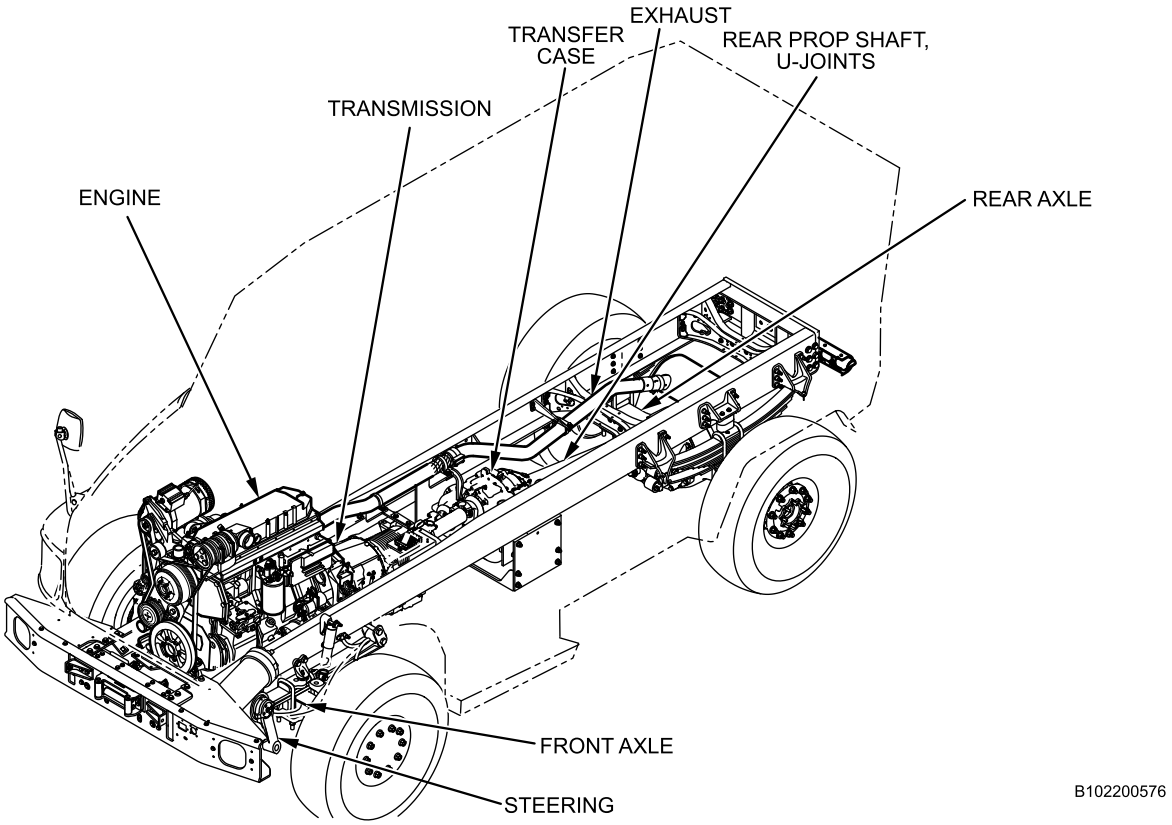

Figure 1. Powertrain.

The powertrain system consists of the following major components: engine, transmission, transfer case, exhaust, prop shafts, U-joints, rear axle, front axle, and steering.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

ENGINE

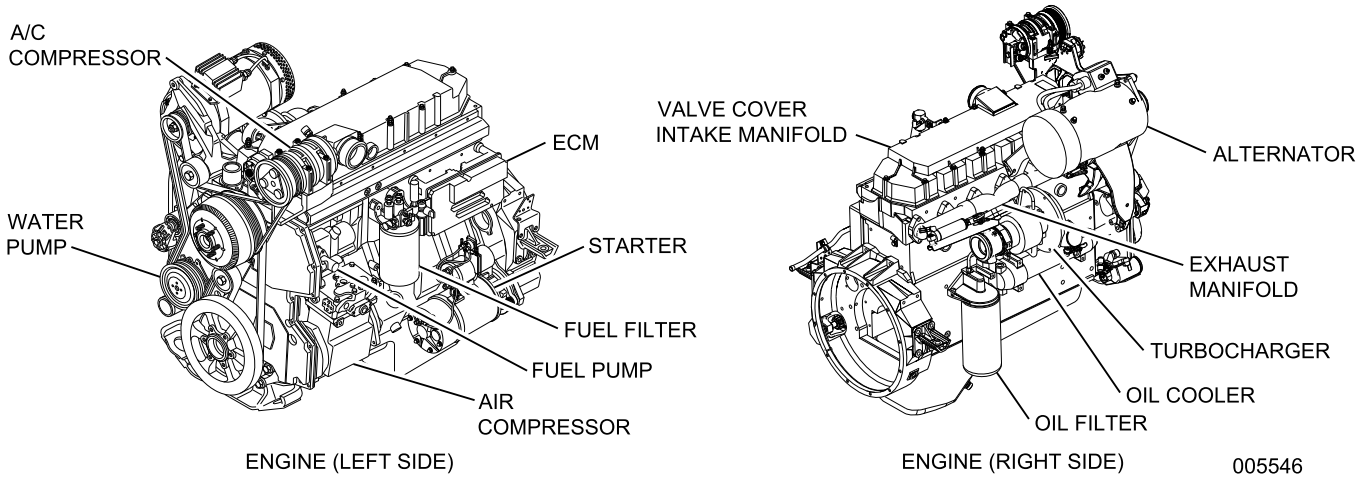

Figure 2. Engine.

The vehicle is powered by a DT 530 in-line, six-cylinder fuel injected diesel engine with a 530-cubic-inch (8.7 L) displacement. The engine firing order is 1-5-3-6-2-4. Basic engine features include two valves per cylinder, direct injection, a wet-sleeve cylinder design, and seven main bearings. Figure 2 identifies some major components of the engine; A/C compressor, alternator, turbocharger, oil filter, starter, and fuel pump.

EXHAUST SYSTEM

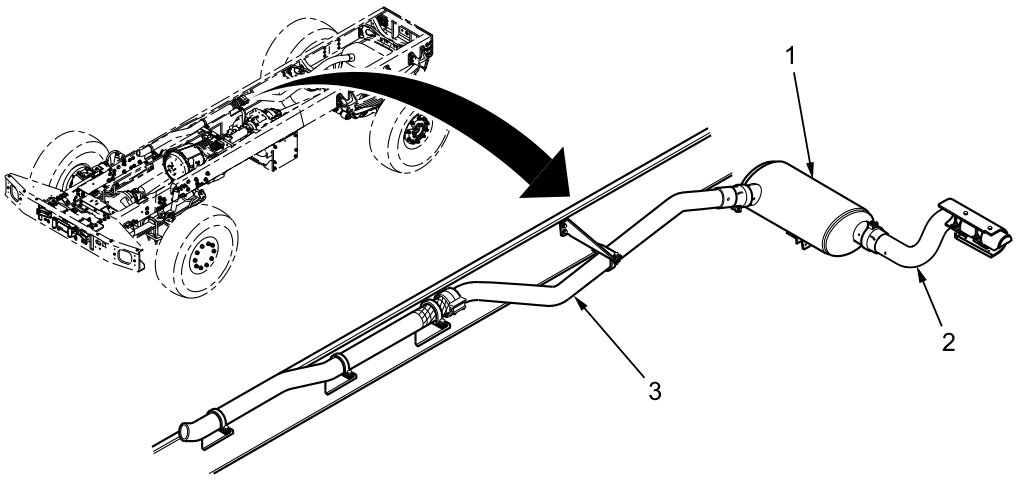

Figure 3. Exhaust Pipe, Muffler, and Tailpipe Assembly.

The exhaust system includes an exhaust pipe (Figure 3, Item 3), muffler (Figure 3, Item 1), tailpipe (Figure 3, Item 2), and exhaust brake mounted to the turbocharger exhaust port. The exhaust pipe, muffler, and tailpipe assembly route exhaust gasses away from operator and crew, as well as reduce operating noise.

The exhaust brake system on the MRAP has been disabled. The system will provide NO braking assist. There is a nonfunctioning exhaust brake switch on the IP. There is also a nonfunctioning exhaust brake valve directly in the exhaust stream near the turbocharger exhaust outlet.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

TRANSMISSION

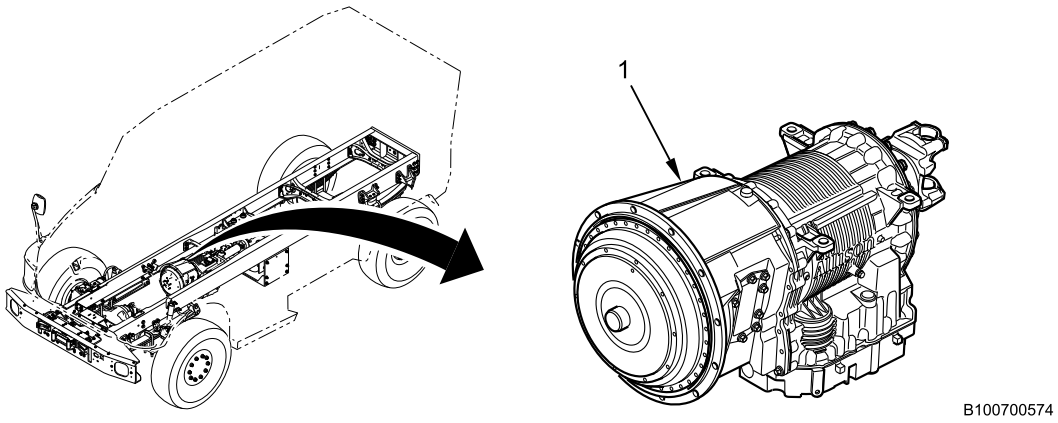

Figure 4. Transmission.

The M1224 and M1224A1 vehicles are equipped with an Allison 3000SP series automatic transmission (Figure 4, Item 1). The transmission is divided into four major modules:

- Input module
- Main housing and gear module
- Control module
- Output module

The input module includes the torque converter, torque converter housing, and engine adaptation ring. An input speed sensor is mounted to the torque converter housing.

The main housing and gear module includes the oil pump charging system, three planetary gear sets, two rotating clutches, and three stationary clutches. Gear range clutches are multiple-disc, wet-type clutches.

The control module is attached to the bottom of the transmission and is covered by the oil pan. The control module houses both oil filters and all control solenoids, control valves, and temperature sensors. Internal electrical wiring is routed up through the control module to a connector mounted to the transmission case. Oil filters are cartridge style, disposable, external access type. The control system is capable of recognizing hydraulic and electronic conditions that are not within calibrated operating limits. Some out-of-limit conditions can be corrected by the control system. All out-of-limit condition Diagnostic Trouble Codes (DTCs) are stored in the Transmission Control Module (TCM) for later retrieval.

The output module supports the output flange and the output speed sensor.

Features unique to Allison 3000SP series transmissions include:

- Torque converter with lockup clutch and torsional damper
- Dual internal oil filters, serviceable without complete loss of transmission fluid
- Adaptive, electronic, closed loop controls with self-diagnostic capabilities

The transmission is equipped with an oil fill tube and dipstick.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

TRANSFER CASE

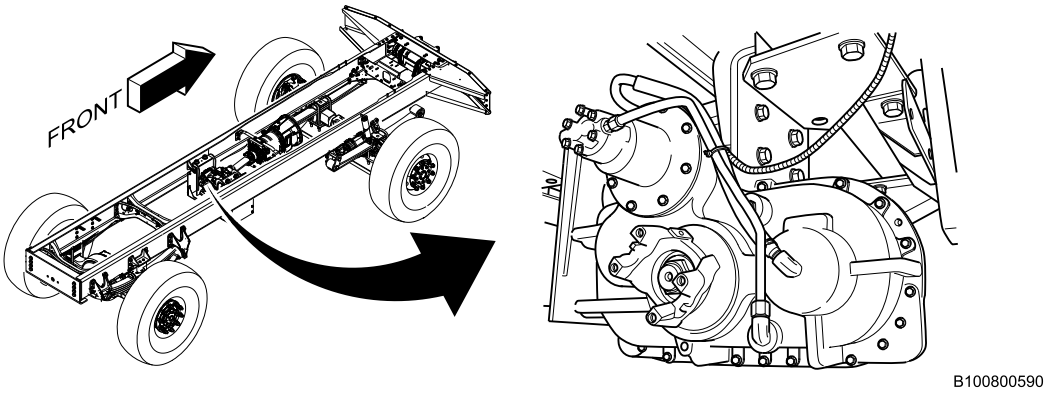

Figure 5. Transfer Case.

The M1224 and M1224A1 vehicles are equipped with a Meritor MTC-4210 series transfer case. This transfer case is a four-shaft design with two-speed front and rear output. Gear ratios are 1:1 and 2.05:1.

The transmission provides the two-speed transfer case with power via a propshaft. Operators send inputs to the Electronic System Controller (ESC) via rocker switches on the Instrument Panel (IP). The ESC controls air solenoids that actuate an air-operated shift fork and collar that place the transfer case gears in LO, HIGH, or NEUTRAL.

ESC controlled air solenoids also actuate the front axle de-clutch pushrod and shift fork to connect or disconnect the front axle and allow two wheel drive operation. Propshafts at the front and rear of the transfer case send power to the front and rear axles.

PROPELLER SHAFTS

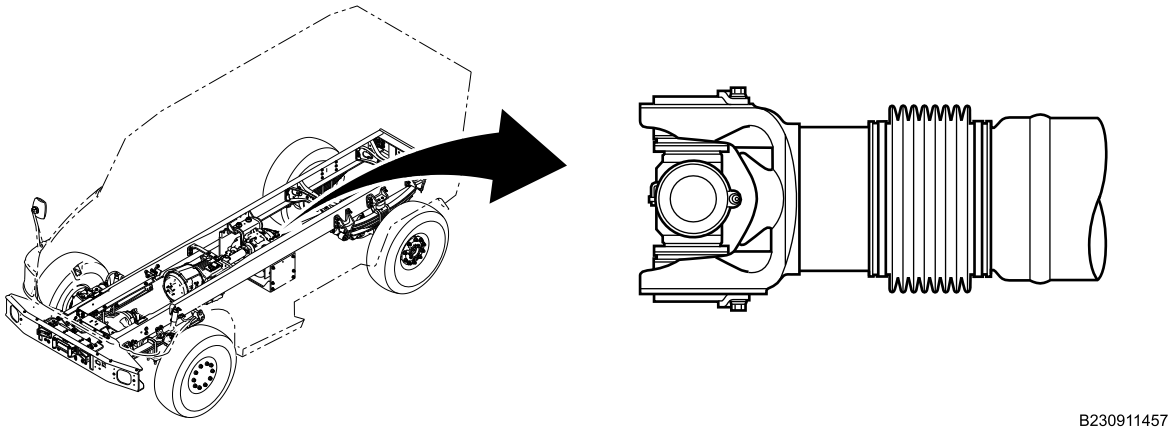

Figure 6. Propeller Shaft.

The vehicle is equipped with three propeller shafts:

- Transmission-to-transfer case propeller shaft
- Rear axle-to-transfer case propeller shaft
- Front axle-to-transfer case propeller shaft

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

Each propeller shaft is equipped with a universal joint (U-joint) on each end. Each propeller shaft also has a length compensation joint and boot that compensate for propeller shaft length changes due to suspension travel and chassis torque. Each U-joint has a grease fitting.

FRONT AXLE

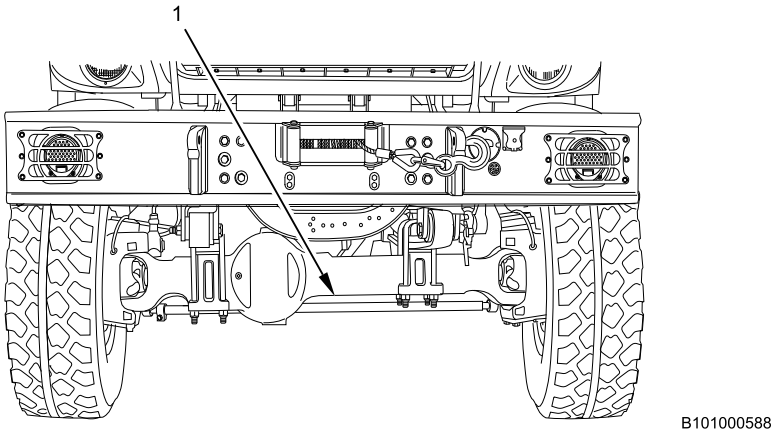

Figure 7. Front Axle.

The front steering axle (Figure 7, Item 1) has an 18,000-lb Gross Axle Weight Rating (GAWR). The single-speed differential features a 4:33:1 gear ratio. Upper and lower kingpin bushings provide pivot points for the steering knuckles. Shock absorbers are used on the front axle only.

REAR AXLE, SUSPENSION

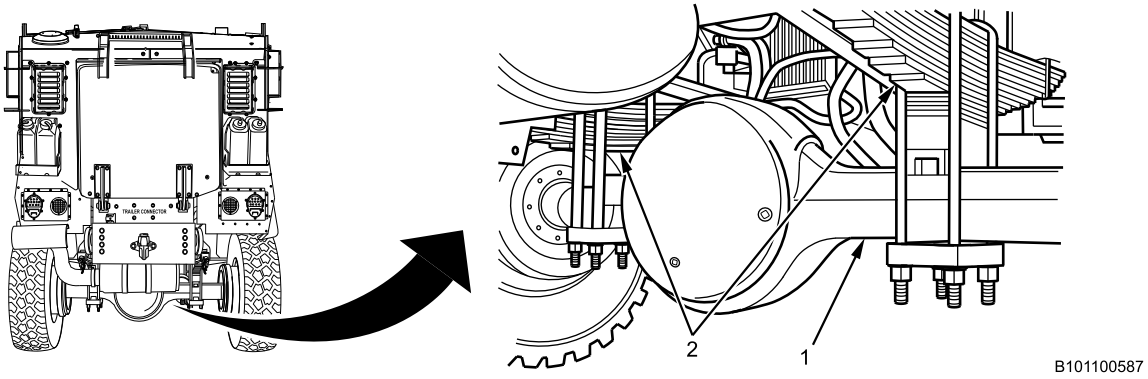

Figure 8. Rear Axle.

The rear drive axle (Figure 8, Item 1) has a 23,000-lb GAWR. Like the front steer axle, the rear drive axle has a single-speed differential that provides a 4:33:1 gear ratio. The MRAP suspension uses leaf springs (Figure 8, Item 2).

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

STEERING GEAR

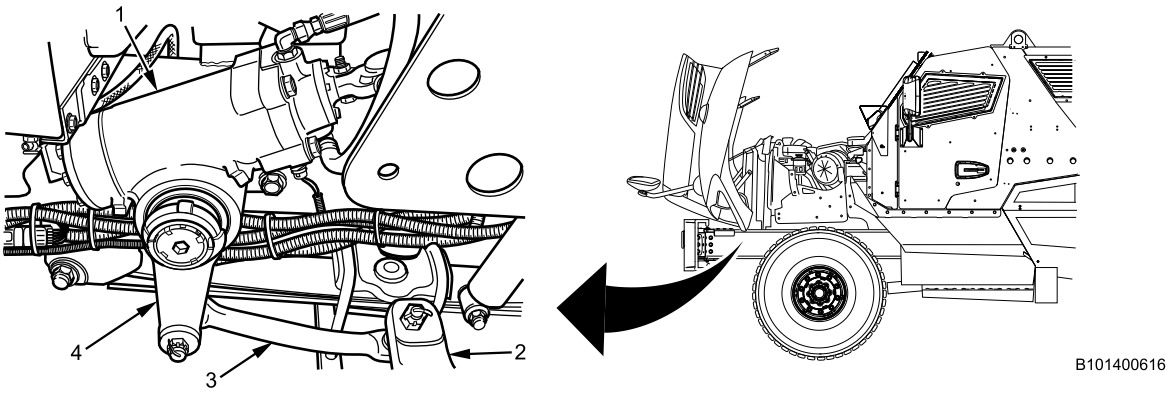

Figure 9. Steering Gear.

The M1224 and M1224A1 vehicles are equipped with a Sheppard M110 series steering gear (Figure 9, Item 1) providing full-time power assist. The steering gear connects to the left steering knuckle (Figure 9, Item 2) by means of a pitman arm (Figure 9, Item 4) and drag link (Figure 9, Item 3). Manual effort is required only as necessary to overcome the internal torsion bar and turn the rotary valve. The power steering pump, located behind the air compressor on the left side of the engine, uses a remote reservoir. A tie rod relays steering inputs to the right side. Toe is adjustable.

The steering gear has the following features:

- 23.0:1 internal gear ratio
- 100-degree gear travel
- 2,175 psi (14996 kPa) rated pressure
- 2.25-inch (57.2-mm) output shaft diameter

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

ELECTRICAL SYSTEM

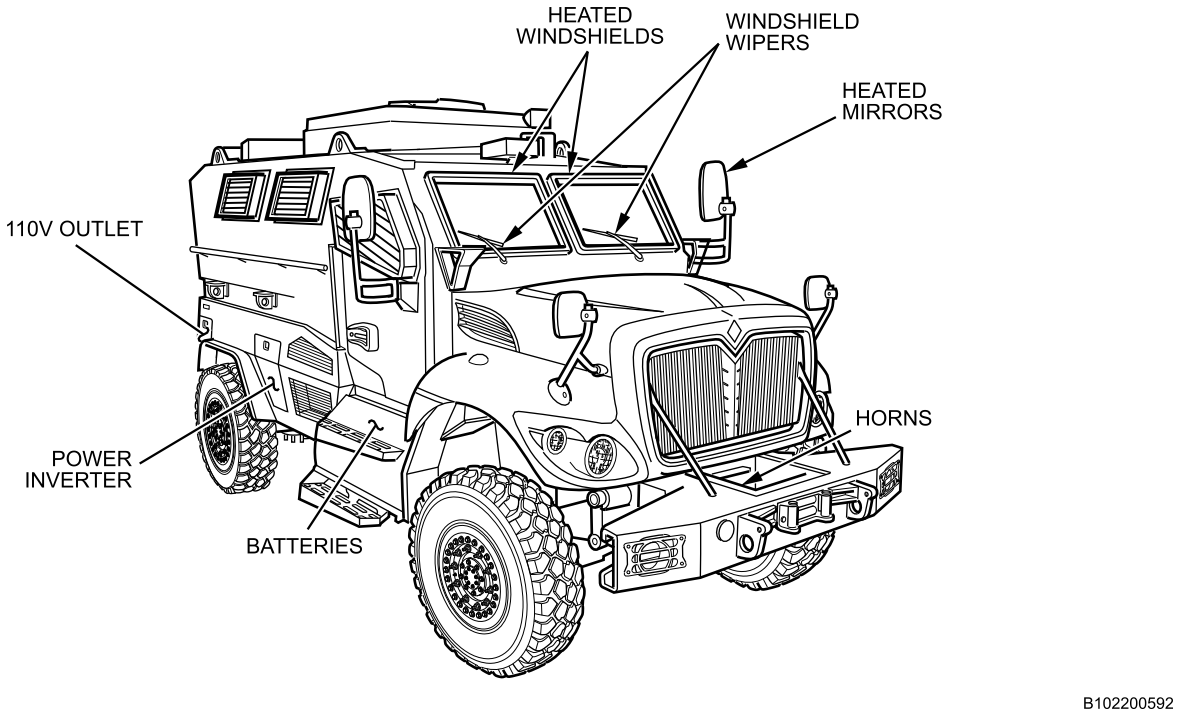

Figure 10. Electrical Components.

The electrical system consists of the following major components: heated windshields, windshield wipers, heated mirrors, horns, batteries, power inverter, and 110V outlet.

BATTERIES

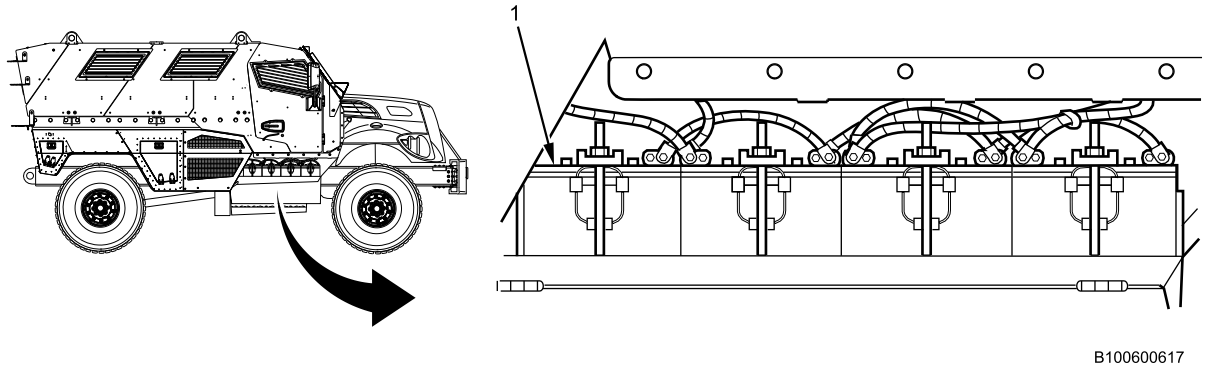

Figure 11. Batteries.

Four lead-acid batteries (Figure 11, Item 1), rated at 725 CCA each, are connected in series-parallel. The batteries provide 12V and 24V power for vehicle systems.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

BATTERY EQUALIZERS

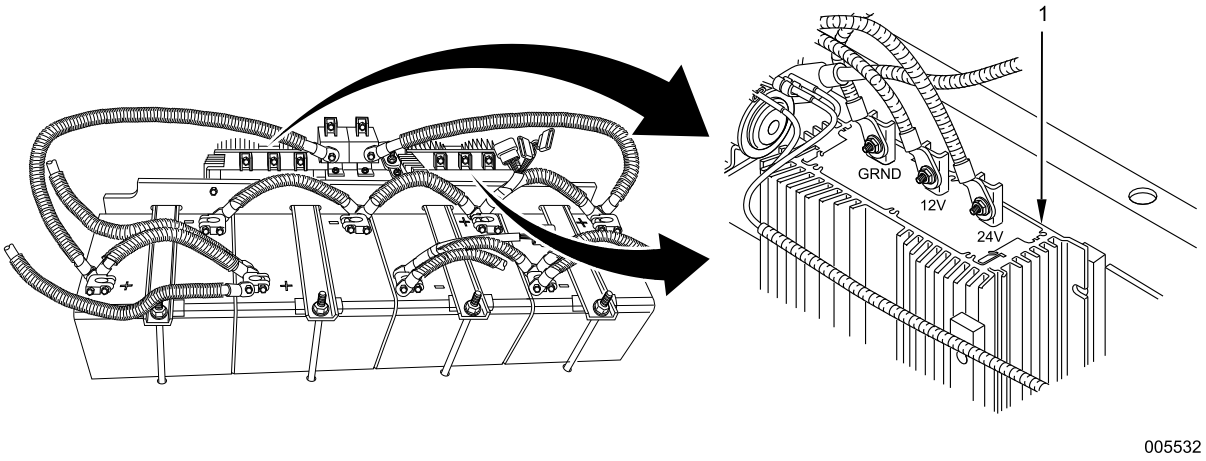

Figure 12. Battery Equalizers.

Two battery equalizers (Figure 12, Item 1) mounted near the batteries regulate power between the 12V and 24V sides of the system. The battery equalizers also maintain an equal state-of-charge on all batteries.

110V POWER INVERTER, 110V OUTLET, AND NATO SLAVE START CONNECTOR

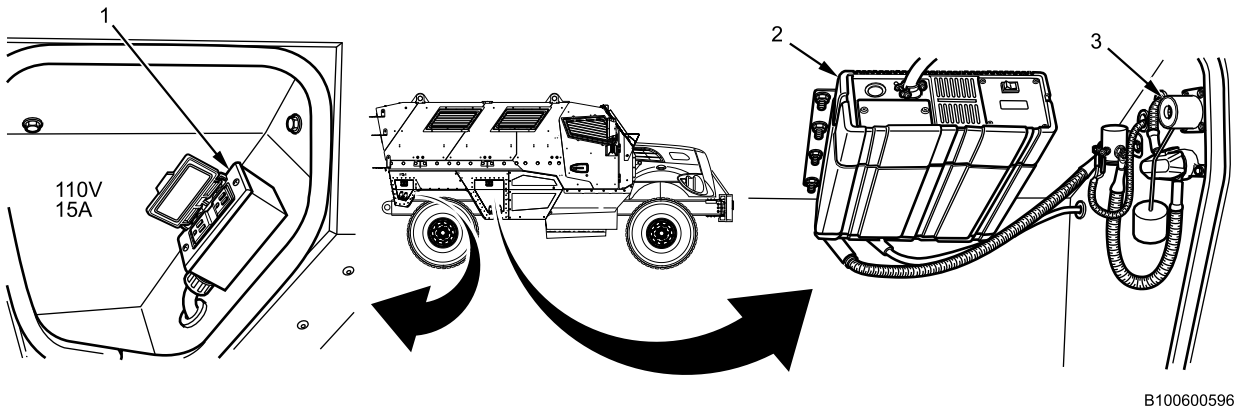

Figure 13. 110V Power Inverter, 110V Outlet, and NATO Slave Start Connector.

The vehicle is equipped with an 1800 watt, 110V, alternating current (AC) inverter (Figure 13, Item 2) to provide power for auxiliary AC equipment. A 110V outlet (Figure 13, Item 1) is located in the rear storage box. The 110V power inverter has the following features:

- 1800 watt AC output with 2900 watt surge capacity
- True sine wave AC output
- Powersave mode draws only 1.5 watts with no load
- Over-temperature shutdown and automatic overload protection
- Over-voltage and under-voltage protection
- Short circuit and AC back-feed protection

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

The NATO slave start connector (Figure 13, Item 3) is used to jump-start a disabled vehicle with the NATO slave start cable.

CABIN FUSE AND RELAY CENTER AND CIRCUIT BREAKER CENTER

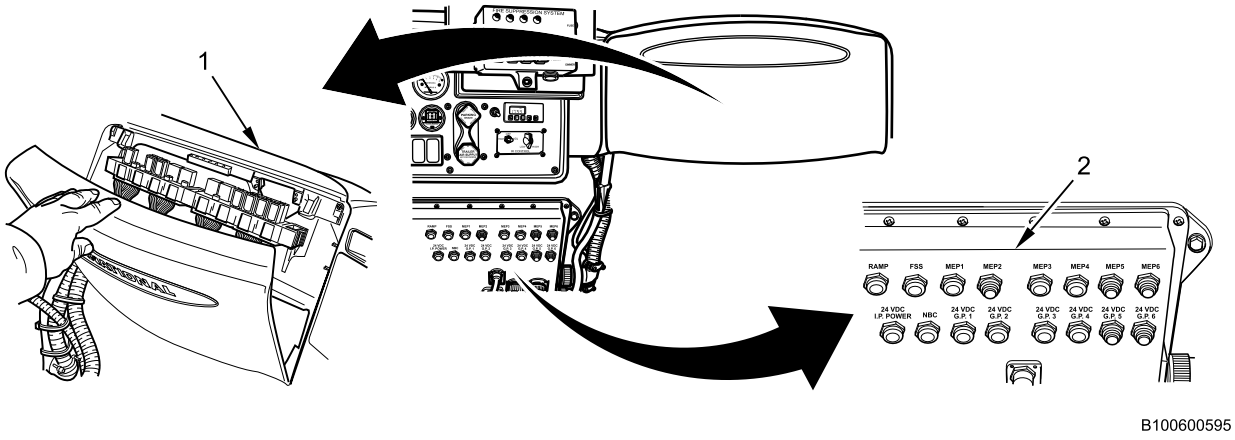

Figure 14. Cabin Fuse and Relay Center and Circuit Breaker Center.

The cabin fuse and relay center is located behind a panel on the right side of the IP (Figure 14, Item 1). A circuit breaker panel (Figure 14, Item 2) is located on the lower part of the IP between the front seats. Components are identified on the circuit breaker panel and fuse and relay center.

POWER DISTRIBUTION CENTER (PDC)

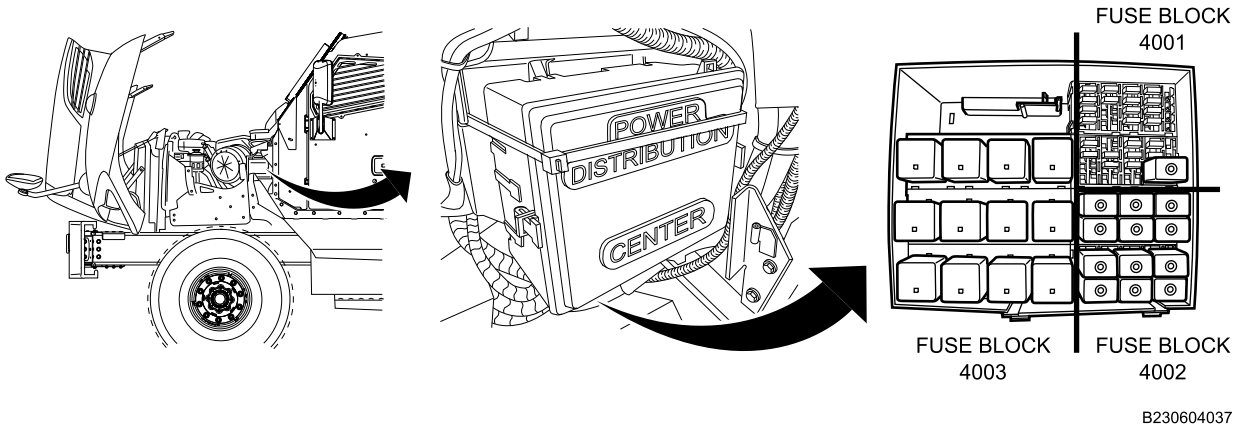

Figure 15. Engine Compartment PDC.

The PDC is located under the hood on the right side of the engine compartment. The PDC contains fuse blocks 4001, 4002, and 4003. Graphics on the cover of the PDC identify components.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

STARTER AND ALTERNATOR

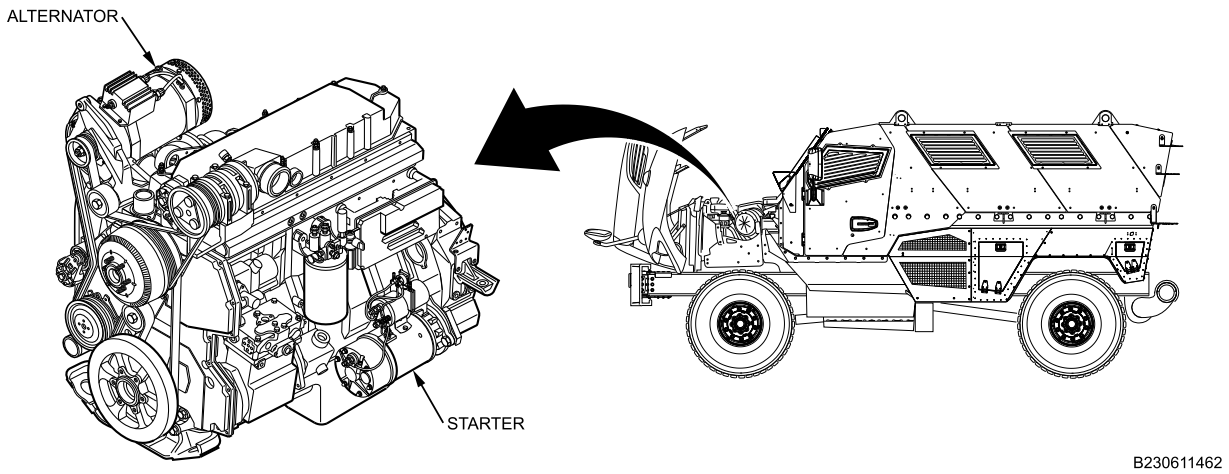

Figure 16. Starter and Alternator.

A 400-amp alternator, driven by the engine accessory drivebelt, charges the batteries. The 24V starter is mounted on the left side of the engine.

ELECTRONIC SYSTEM CONTROLLER (ESC)

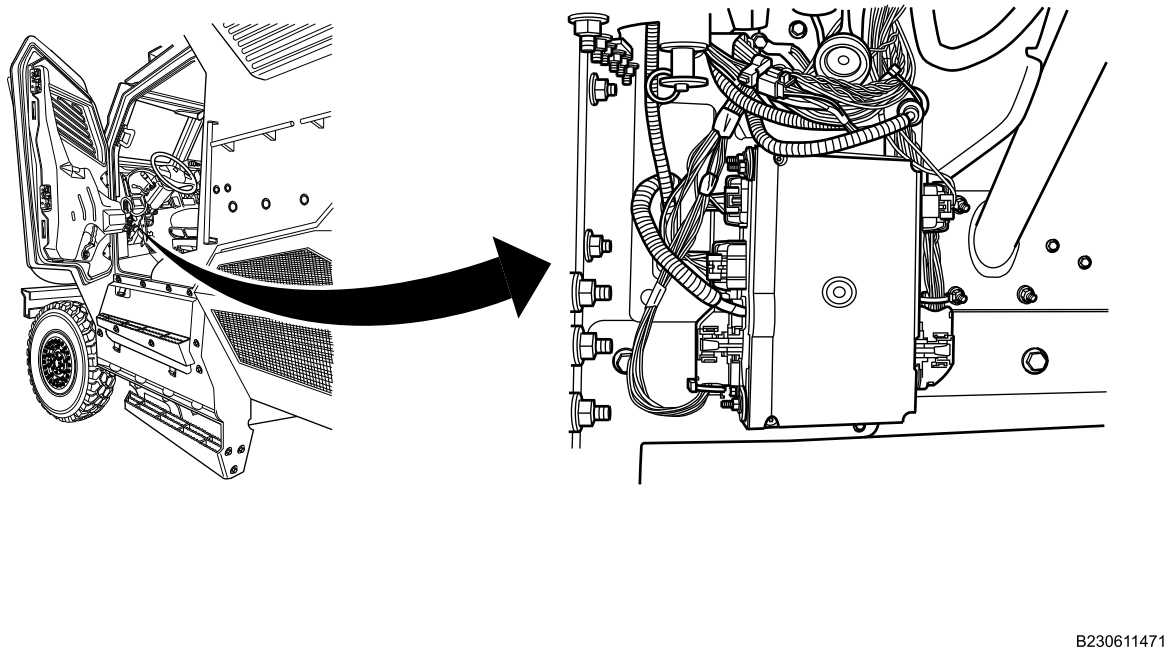

Figure 17. ESC.

To manage electrical system functions, the vehicle uses an ESC, located to the left of the steering column, an Instrument Panel Cluster (IPC), located at the left side of the IP, and a switch pack, located in the center of the IP. The ESC and IPC are on the J1939 datalink. The ESC communicates with the switch pack via a dedicated J1708 datalink. The ESC monitors systems and receives inputs from the Engine Control Module (ECM), Transmission Control Module (TCM), Antilock Brake System (ABS) module, and Electronic Gauge Cluster (EGC) for diagnostic purposes. An MSD can be used to retrieve trouble codes, to monitor system operation, and to initiate tests.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

PNEUMATIC CABIN DOOR ACTUATOR

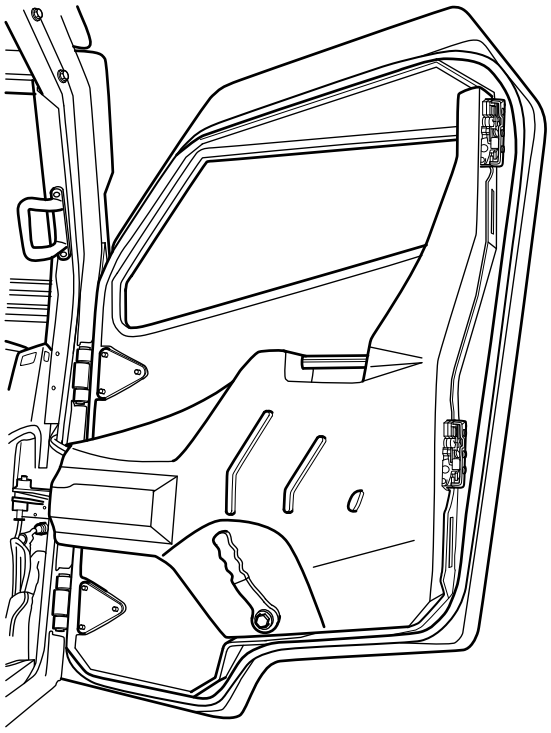

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Figure 18. Right Cabin Door Actuator.

Both cabin side doors utilize hidden pneumatic door actuators to assist in opening and closing the armored doors. Each door has a door handle shaft. The door handle and actuator air valve linkage mount to the door handle shaft. The actuator air valve supplies pressurized air to pneumatic cylinders attached to the door. Vehicles that have a door with a lower interior combat lock utilize a single piston door actuator. Vehicles that have a door with an upper interior combat lock utilize a dual piston door actuator. If single piston systems sustain damage, the systems are replaced with dual piston units.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

AIR BRAKES

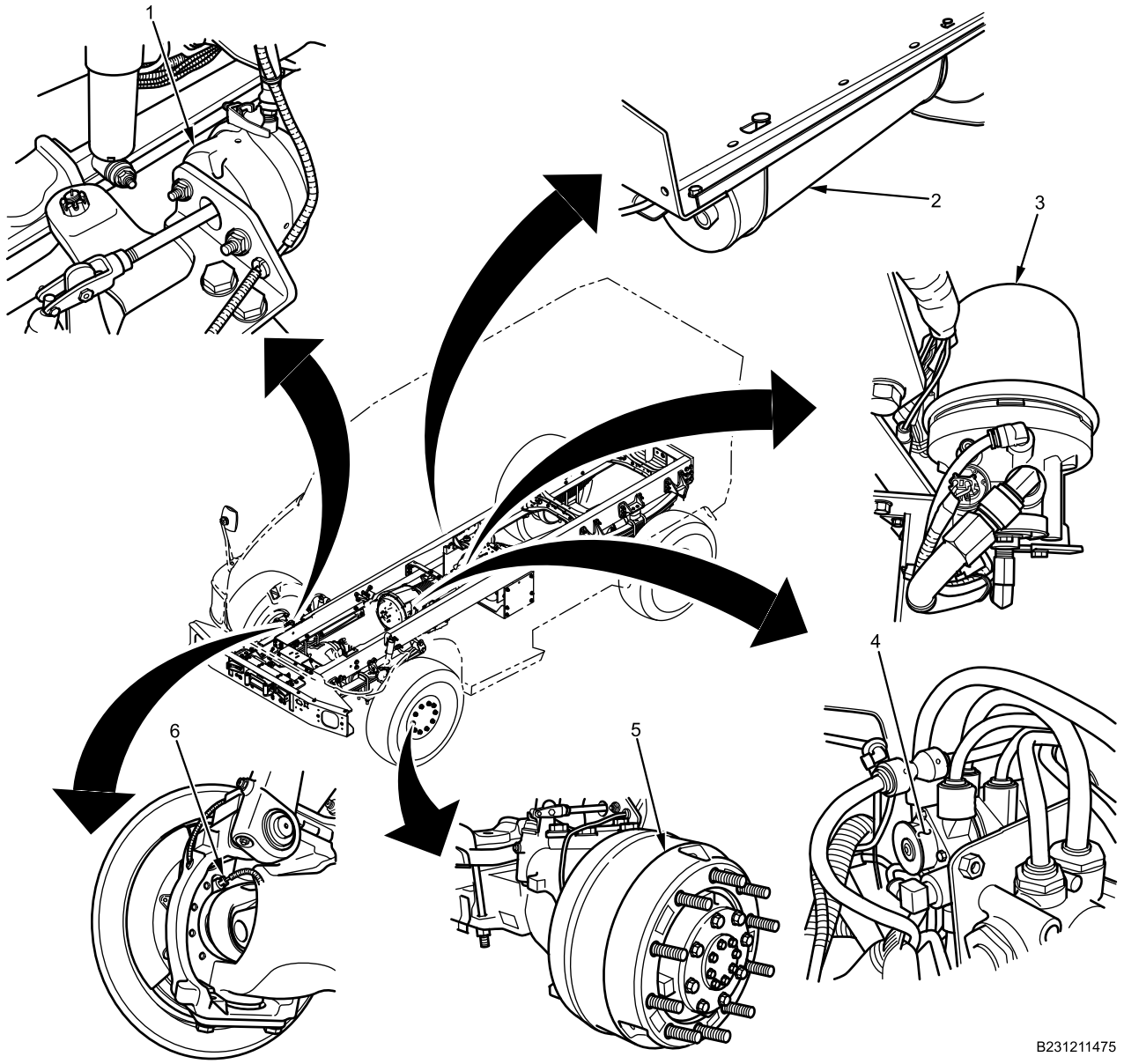

Figure 19. Air Brakes.

The vehicle features air-operated brakes at all four wheels. Air pressure is provided by an air compressor located on the lower left side of the engine. The compressor output is routed through an air dryer (Figure 19, Item 3), which contains a desiccant material that removes moisture from the air. Air is then routed to the dual air tanks (Figure 19, Item 2) on the right side of the vehicle.

The service brakes are actuated by the foot valve (Figure 19, Item 4) that is directly attached to the service brake pedal in the cabin.

All four wheels utilize brake drums (Figure 19, Item 5) that contain S-camshaft actuated brake shoes. The S-camshafts are actuated by air brake chambers (Figure 19, Item 1). Spring brakes on the rear wheels actuate when air pressure falls below 25 psi (172 kPa). IP mounted controls operate the parking brake and send air to trailer brake connectors at the rear of the vehicle.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

The ABS relies on inputs from wheel-speed sensors (Figure 19, Item 6) installed at each wheel. The sensors send signals to the ABS controller. The controller is located under the right side IP. The controller operates four air pressure modulator valves that are used to hold and release air in the brake air chambers. The controller monitors ABS components for malfunctions and can record trouble codes. Codes can be retrieved via a switch under the left side of the IP or via ABS troubleshooting software on the Maintenance Support Device (MSD).

AIR COMPRESSOR

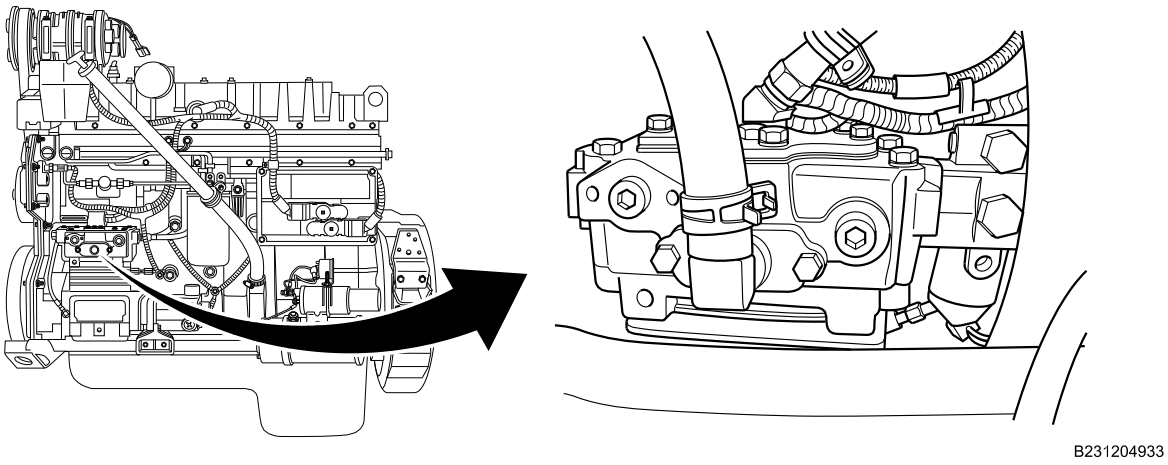

Figure 20. Air Compressor, Below Air Filter.

The air compressor is a gear-driven dual piston pump that supplies pressurized air to the vehicle air reservoirs. The air reservoirs provide large volumes of pressurized air to the air brakes, door actuators, and front and rear gladhand connections.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

BODY AND CHASSIS SYSTEMS

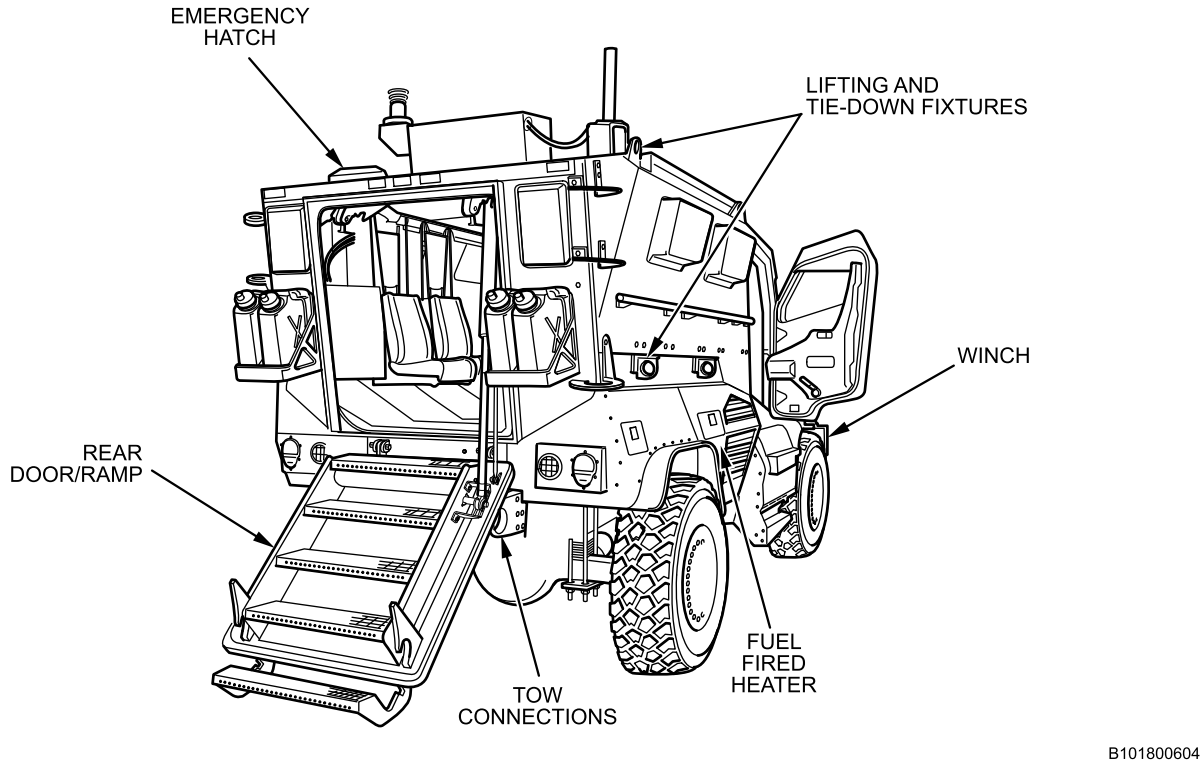

Figure 21. Body and Chassis Systems – Exterior.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

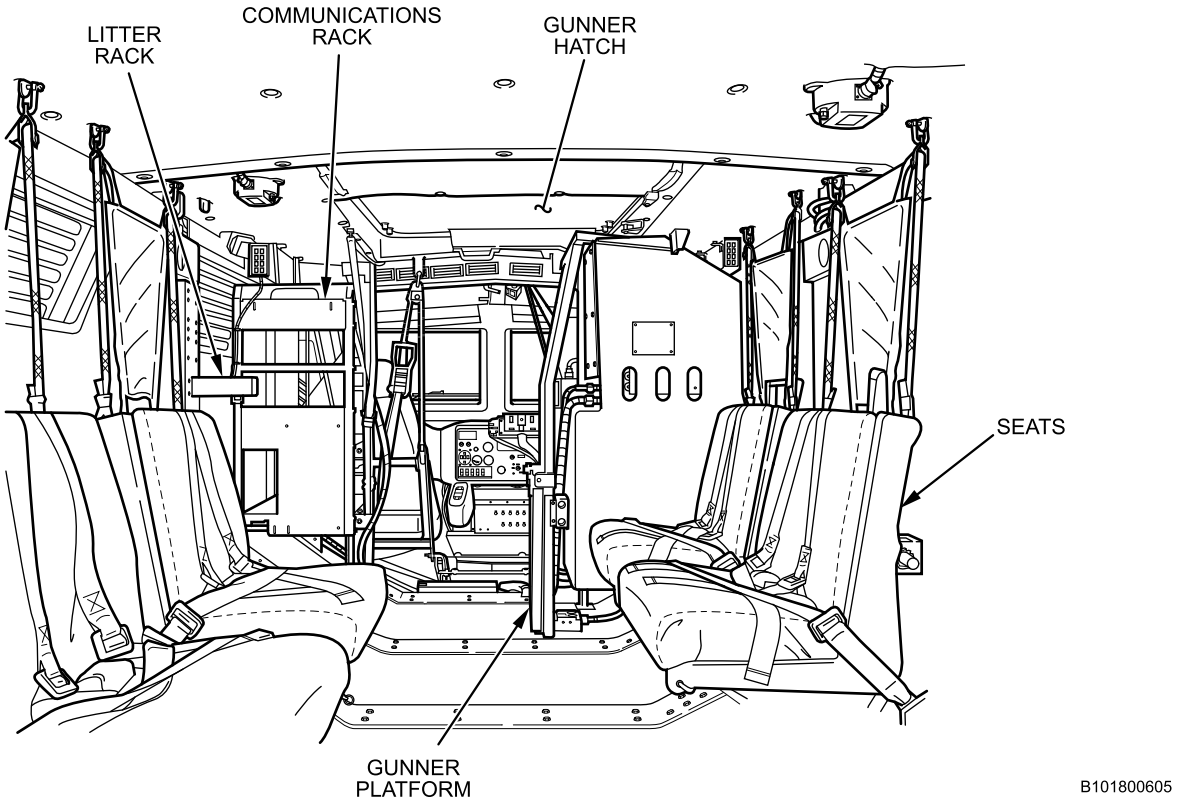

Figure 22. Body and Chassis Systems – Interior.

The body and chassis systems consist of the following major components: emergency hatch, lifting and tie-down fixtures, electric winch, fuel fired heater, tow connections, rear door/ramp, litter rack, communications rack, gunner hatch, interior lighting, seats, and gunner platform.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

FUEL-FIRED HEATER

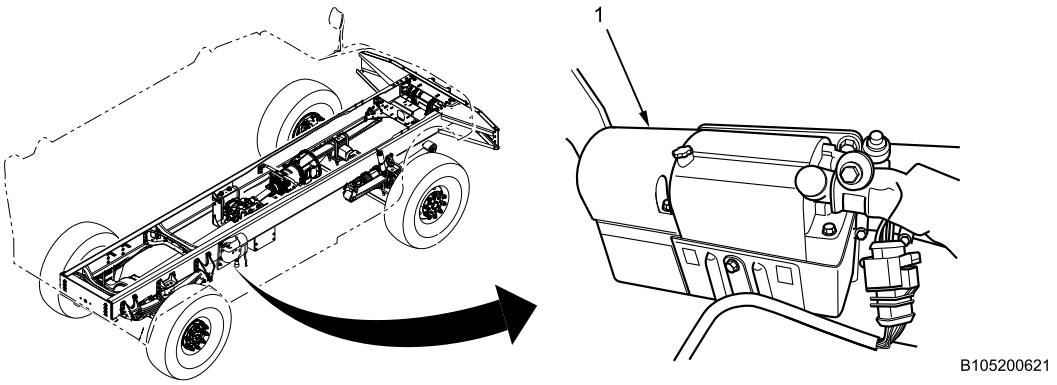

Figure 23. Fuel-Fired Heater.

A diesel-fuel-fired auxiliary heater (Figure 23, Item 1) on the right side of the vehicle warms the engine coolant. The heater ignites a burner by means of a glow pin. An electric pump sends coolant through a heat exchanger and circulates it through the cooling system to provide cabin heating. The auxiliary heater operation can be programmed to occur at specific times or can be manually activated. Temperature can be regulated between 149°F (65°C) and 176°F (80°C).

REAR DOOR/RAMP

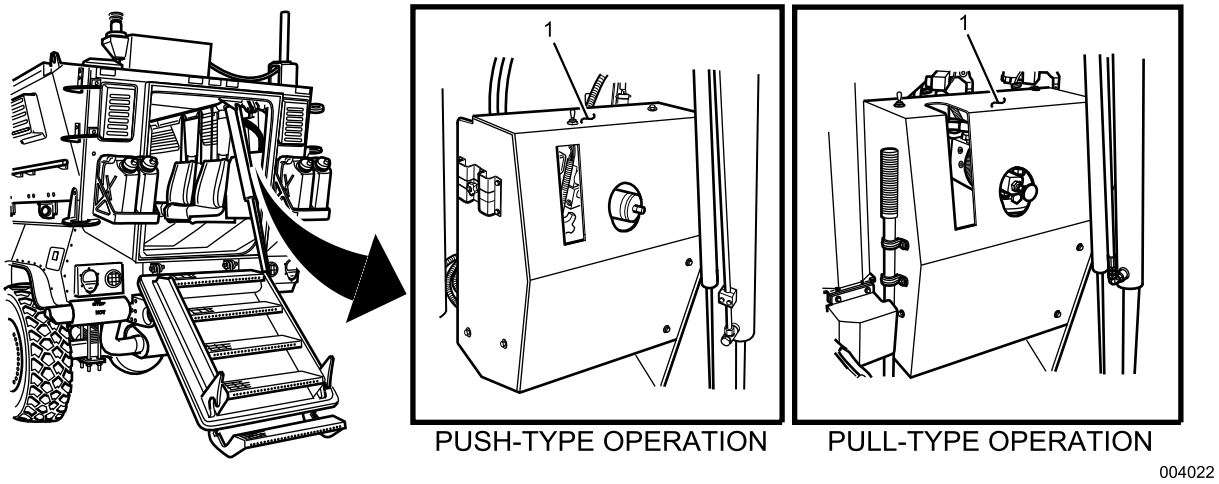

Figure 24. Rear Door/Ramp Pump Assemblies.

The rear door/ramp is operated by a hydraulic system (Figure 24, Item 1) inside the cabin at the rear of the vehicle. There are two designs: push-type and pull-type operation. Switches on the IP and on the rear door/ramp hydraulic assembly provide inputs for operating the rear door/ramp. The inputs operate an electric motor and hydraulic pump, which extends and retracts the hydraulic cylinder to lower and raise the door/ramp. If the 24V electric motor does not function, the door/ramp can be raised or lowered by a manually operated solenoid valve and pump.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

FIRE SUPPRESSION SYSTEM (FSS)

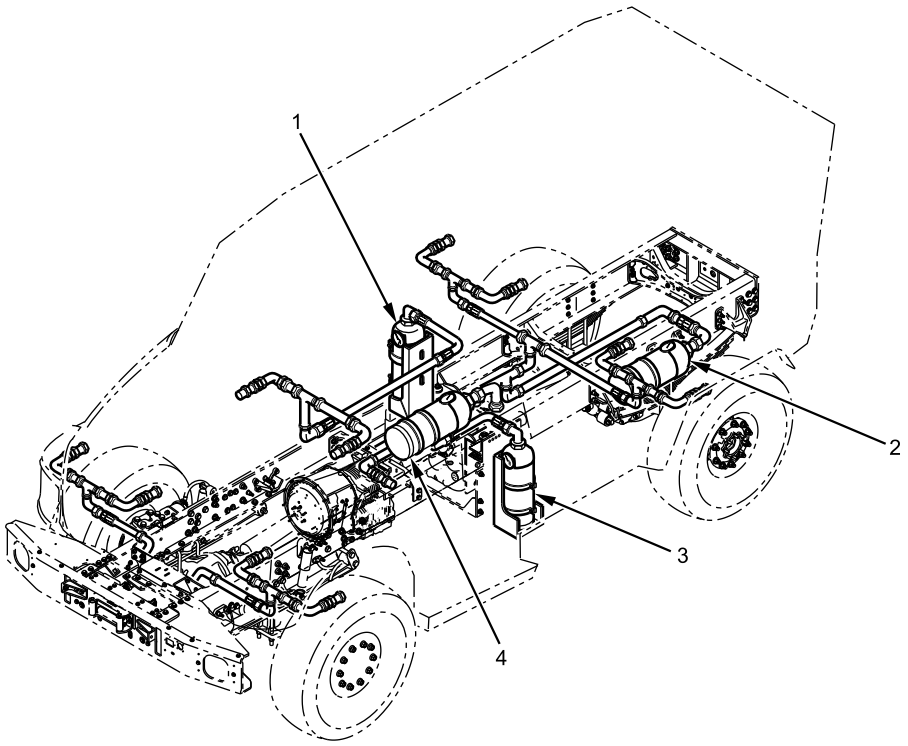

Figure 25. FSS Cylinders.

The FSS provides automatic fire extinguishing for the engine compartment and the cabin. Manual switches are provided for the engine compartment, cabin, tires, and fuel tanks. Each area uses a different FSS:

- Cabin fire suppression unit (Figure 25, Item 4) is located inside the cabin, under the communications rack, and contains water.
- Engine fire suppression unit (Figure 25, Item 1) is located outside the vehicle, behind the right side air conditioning condensers, and contains HFC 227ea agent.
- Tire fire suppression unit (Figure 25, Item 2) is located outside the vehicle, behind the left side rear stowage box, and contains Petrotech TM25.
- Fuel tank fire suppression unit (Figure 25, Item 3) is located outside the vehicle, behind the left side air conditioning condensers, and contains a dry chemical.

Each fire suppression unit incorporates a 24V pressure sensing transducer and a 24V dispersion solenoid. Fire suppression units are under pressure when full. The transducers send a signal to the fire suppression control box to indicate the state of charge. If the state of charge is low, a corresponding RED Light Emitting Diode (LED) will illuminate on the control box for the affected system.

There are two heat detectors:

- One heat detector is located inside the vehicle, at the right front A-pillar near the floor. The sensor wire runs from the front of the vehicle to the rear of the vehicle, along the interior roof. If a sudden increase in temperature is detected along this wire, the heat detector will activate the cabin fire suppression unit. If the heat detector fails to detect a fire, the CABIN switch on the control box can be used to override the heat detector and activate the cabin fire suppression unit.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

- The other heat detector is located in the engine compartment. The sensor wire is mounted to the engine hood. If a sudden increase in temperature is detected along this wire, the heat detector will activate the engine fire suppression unit. If the heat detector fails to detect fire, the ENGINE switch on the control box can be used to override the heat detector and activate the engine fire suppression unit.

There are no heat detectors for the tires or the fuel tank. The fire suppression units are manually activated by using the corresponding switch on the control box.

The control box manages the automatic and manual functions of the FSS and monitors the pressure in the fire suppression units. A RED LED is provided for each fire suppression unit. An illuminated RED LED indicates one of the following conditions:

- An automatic or manual request for fire suppression was requested and successfully delivered.
- The corresponding fire suppression unit is low on pressure or is empty.
- An open circuit has been detected between the control box and the corresponding fire suppression unit.

All four RED LEDs will illuminate when the LAMP TEST button is pushed. The GREEN light will illuminate when the MAIN POWER switch and FSS power (FUSE) switch are turned on.

HEATING VENTILATION AND AIR CONDITIONING (HVAC)/LIFE SUPPORT SYSTEM (LSS)

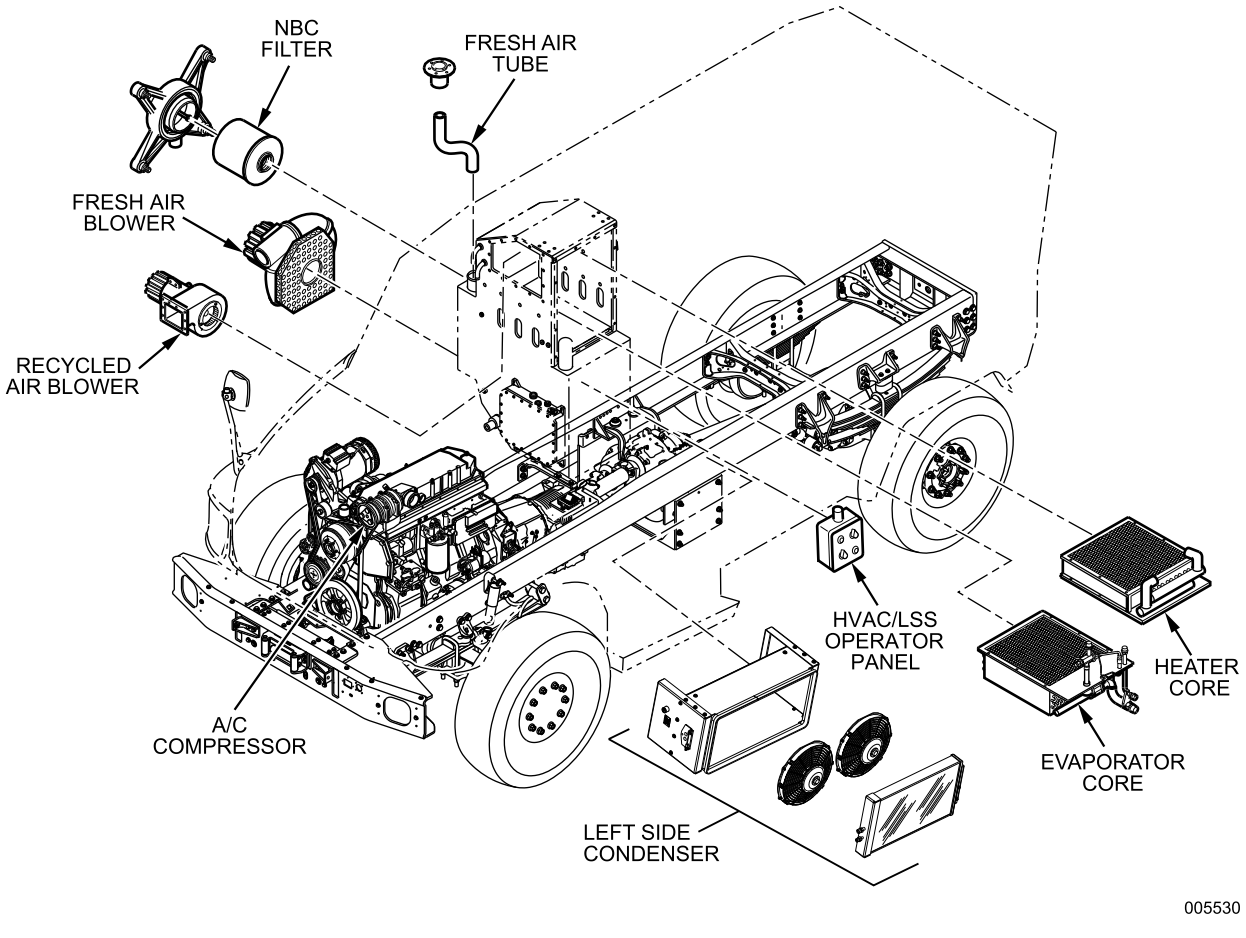

Figure 26. HVAC/LSS Component Locations.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

The M1224 and M1224A1 are equipped with a high performance HVAC/LSS system. Major components of the system include:

- Refrigerant compressor
- Recycled Air (RA) and Fresh Air (FA) blowers
- Nuclear, Biological, and Chemical (NBC) filter
- Fresh air tube
- Heater core
- Evaporator core
- HVAC/LSS operator panel and Climate Control Unit (CCU)
- Dual A/C condensers (one on each side of vehicle)

When activated, the HVAC/LSS produces an over-pressure condition in the crew cabin to prevent entry of outside contaminants. An FA blower draws outside air into the system through an inlet in the roof. Outside air then passes through the NBC filter canister and across an evaporator core and heater core before being mixed with recycled cabin air via the RA blower.

The HVAC/LSS operator panel located behind the passenger seat, has controls for mode (vent, cool, heat, and dry), temperature, and fan speed. The CCU is located directly below the operator panel. When cool mode is selected at the HVAC/LSS operator panel, the condenser fans activate and cool the condenser.

HEATED WINDSHIELD AND MIRRORS

Refer to TM 9-2355-106-10 for a description of the heated windshield and mirrors.

HORNS

Refer to TM 9-2355-106-10 for a description of the horns.

WINDSHIELD WIPERS

Refer to TM 9-2355-106-10 for a description of the windshield wipers.

LIGHTING SYSTEM

Refer to TM 9-2355-106-10 for location and description of lights.

INFRARED (IR) LIGHTING

Refer to TM 9-2355-106-10 for information on IR lighting.

COMPRESSED AIR STORAGE TANK

Refer to TM 9-2355-106-10 for information on the compressed air storage tank.

AIR COMPRESSOR FITTING

Refer to TM 9-2355-106-10 for information on the air compressor fitting.

EMERGENCY HATCH

Refer to TM 9-2355-106-10 for a description of the emergency hatch.

LIFTING AND TIE-DOWN FIXTURES

Refer to TM 9-2355-106-10 for a description of the lifting and tie-down fixtures.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

ELECTRIC WINCH

Refer to TM 9-2355-106-10 for information on the electric winch.

FLAT TOWING CONNECTIONS

Refer to TM 9-2355-106-10 for a description of flat towing connections.

LITTER RACKS

Refer to TM 9-2355-106-10 for a description of the litter racks.

COMMUNICATIONS RACK

Refer to TM 9-2355-106-10 for a description of the communications rack.

GUNNER HATCH

Refer to TM 9-2355-106-10 for a description of the gunner hatch.

INTERIOR LIGHTING

Refer to TM 9-2355-106-10 for a description of the interior lighting.

SEATS

Refer to TM 9-2355-106-10 for a description of the seats.

GUNNER PLATFORM

Refer to TM 9-2355-106-10 for a description of the gunner platform.

PLATES, STENCIL, AND SERIAL NUMBERS

Refer to TM 9-2355-106-10 for warranty plate, stencil, or location of serial numbers.

DIFFERENCES BETWEEN MODELS

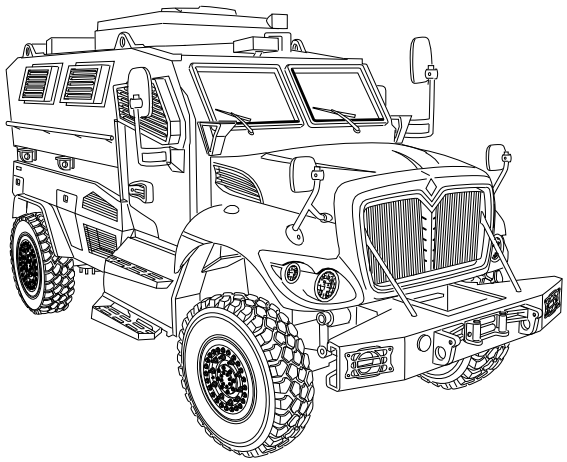

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Figure 27. M1224.

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

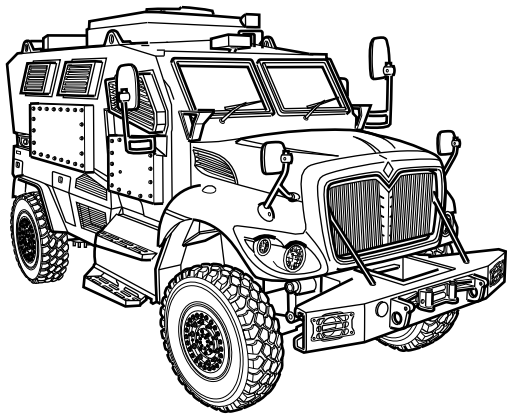

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Figure 28. M1224A1.

Figure 27 shows an MRAP Base vehicle (M1224). Figure 28 shows an MRAP vehicle with additional armor installed under the MRAP Expedient Armor Program (MEAP). MEAP equipped vehicles (M1224A1) have a curb weight of 41,000 pounds and a GVW of 46,500 pounds. The increased weight of MEAP equipped vehicles requires that they be operated accordingly.

Table 1. Differences Between Models.

MODEL	**ITEM** (@ gross wt)	SPECIFICATION
M1224	Vehicle Weight	Curb Weight: 37,850 lbs Gross Vehicle Weight (GVW): 43,500 lbs
M1224A1 (with MEAP kit)	Vehicle Weight	Curb Weight: 41,000 lbs Gross Vehicle Weight (GVW): 46,500 lbs
M1224	Width	99 in. (2.51 m)
M1224A1 (with MEAP kit)	Width	119.3 in. (3.0 m)
M1224	Power to Weight Ratio	15 hp/ton
M1224A1 (with MEAP kit)	Power to Weight Ratio	14.5 hp/ton
M1224	Maximum Grade (climb)	60%
M1224A1 (with MEAP kit)	Maximum Grade (climb)	50%
M1224	Maximum Grade (descent)	60%
M1224A1 (with MEAP kit)	Maximum Grade (descent)	50%
M1224	Maximum Grade (parking)	60%
M1224A1 (with MEAP kit)	Maximum Grade (parking)	20%

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

EQUIPMENT DATA

Refer to the following tables for specific equipment data.

Table 2. Vehicle Weight.

VEHICLE CATEGORY	SPECIFICATION
M1224 (without MEAP kit)	Curb Weight: 37,850 lbs Gross Vehicle Weight (GVW): 43,500 lbs
M1224A1 (with MEAP kit)	Curb Weight: 41,000 lbs Gross Vehicle Weight (GVW): 46,500 lbs

Table 3. Dimensions.

GROUND CLEARANCE	SPECIFICATION
Front Axle Housing	13.0 in. (33.0 cm)
Belly Pan Armor	15.0 in. (38.1 cm)
Rear Axle Housing	10.25 in. (26.0 cm)

Table 4. Performance.

ITEM	SPECIFICATION
Power to Weight Ratio (gross wt)	15 hp/ton
Power to Weight Ratio (MEAP gross wt)	14.5 hp/ton
Fuel Consumption (moving)	4.4 mpg
Angle of Approach	58 degrees
Angle of Departure	46 to 48 degrees
Maximum Grade (climb)	60%
Maximum Grade (descent)	60%
Maximum Grade (side)	30%
Ford Depth	36 in. (0.91 m)
Turning Radius, Curb to Curb	62 feet (18.9 m)
Top Speed	65 mph (105 km/h)
Vehicle Operating Temperature Range	-25° to +125°F (-32° to +52°C)

Table 5. Capacities.

ITEM	SPECIFICATION
Engine Oil with Filter	30 qt (28.3 L) (OE/HDO-15-40)
Cooling System	29 qt (27.6 L) (CID A-A-52624A; Type I/ A or C; ethylene glycol) (50/50 mix with water)
Coolant Overflow Tank	4.8 qt (4.5 L)
Coolant Deaeration Tank	5.9 qt (5.6 L)
Transmission with Filter – Dry	29 qt (27.4 L) (OE/HDO-10)
Transmission with Filter – Drain and Refill	19 qt (18 L) (OE/HDO-10)
Axle – Front	13 qt (12.3 L) (SAE 80W90)
Axle – Rear	19.5 qt (18.5 L) (SAE 80W90)
Wheel Bearing – Rear	1.6 qt (1.5 L) (SAE 80W90)
Rear Door/Ramp Hydraulic Fluid	6.5 qt (6.2 L) (MIL-PRF-46170; Type I)
Power Steering	5.5 qt (5.2 L) (OE/HDO-15-40)
Transfer Case – w/ Cooler	MTC4210 GCS transfer case: 6 qt (5.7 L) (SAE 80W90). MTC4210XL-100 transfer case: 8 qt (7.6 L) (SAE 80W90)
Windshield Wiper Fluid	4 qt (3.8 L) Cleaning Compound, Windshield
A/C System	7.05 lb (3.19 kg) (R134A)

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

Table 6. Cooling System.

ITEM	SPECIFICATION
Radiator Working Pressure	15 psi (103 kPa) low idle

Table 7. Engine Configuration.

ITEM	SPECIFICATION
Make	International®
Model	DT 530 ST
Type	Four-stroke, in-line
Cylinders	Six
Bore	4.59 in. (116.6 mm)
Stroke	5.35 in. (135.9 mm)
Displacement	530 cu-in. (8.7 L)
Peak Torque	950 lb-ft @ 1200 rpm
Maximum Brake Horsepower (at 2,000 rpm)	330 hp
Maximum Governed Engine Speed	2,200 rpm

Table 8. Oil Filter.

ITEM	SPECIFICATION
Type	Full flow, spin-on
Quantity	1
Oil Pressure	40-70 psi (276-483 kPa)

Table 9. Fuel System Configuration.

ITEM	SPECIFICATION
Type	Diesel injection (electronically controlled)
Fuel Tank Capacity	57 gal. (216 L)
Air Cleaner	Dual element
Fuel Type	Diesel or JP8
Fuel Pressure	66 psi ± 5 psi (455 kPa ± 34 kPa)

Table 10. Electrical System.

ITEM	SPECIFICATION
Alternator	400 amp Neihoff
Front Engine Accessory Drive	Single serpentine belt
Batteries	Exide lead acid (12V, 725 CCA, 4 each, connected in series-parallel for 12V and 24V power)

Table 11. Transmission.

ITEM	SPECIFICATION
Make	Allison
Model	3000SP five-speed
Type	Electronic Control System, WTEC III – Allison 4th Generation

Table 12. Transmission Speeds.

ITEM	SPECIFICATION
Forward	Five
Reverse	One

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

Table 13. Transfer Case.

ITEM	SPECIFICATION
Make	Meritor
Model	MTC4210 GCS MTC4210XL-100
Type	Two-speed with NEUTRAL (NEUTL)

Table 14. Axles.

ITEM	SPECIFICATION
Front	MX-18-120/18,000 lbs – Meritor
Rear	RS-23-160/23,000 lbs – Meritor

Table 15. Brake System.

ITEM	SPECIFICATION
Actuation	Air
Number of Brake Chambers	Two per axle, rear also equipped with spring brakes
Type	S-Cam
Front	Bendix shoes – 16.5 x 7
Rear	Bendix shoes – 16.5 x 7
Air Compressor	Bendix Tu-Flo 550
Truck Air System	110-130 psi (758-896 kPa)

Table 16. Wheels.

ITEM	SPECIFICATION
Type	Two-piece bolt-together Hutchinson run flat
Quantity	4
Rim Size	20 x 10.00
Stud Quantity per Wheel	10
Wheel Assembly Bolt Torque	150-170 lb-ft (203-230 N•m)
Lug Nut Torque	450-500 lb-ft (610-678 N•m)
Spacer Plate Torque	175-200 lb-ft (237-271 N•m)

Table 17. Tires.

ITEM	SPECIFICATION
Type	Tubeless radial
Quantity	4 per vehicle
Tire Model	Michelin XZL
Size	395/85R20
Load Range	J
Tire Pressure: Highway (Front and Rear with 23k Rear Axle) (M1224)	115 psi (793 kPa) @ 60 mph
Tire Pressure: Highway (Front with 25.5k Rear Axle) (M1224A1)	115 psi (793 kPa) @ 55 mph
Tire Pressure: Highway (Rear with 25.5k Rear Axle) (M1224A1)	127 psi (876 kPa) @ 55 mph
Tire Pressure: Cross-Country (Front and Rear – All)	77 psi (531 kPa) @ 45 mph
Tire Pressure: Mud/Sand/Snow (Front and Rear – All)	45 psi (310 kPa) @ 20 mph
Tire Pressure: Emergency (Front and Rear – All)	40 psi (276 kPa) @ 10 mph

Table 18. Towing and Lifting.

ITEM	SPECIFICATION
Pintle Hook Maximum Load Capacity	49,000 lb (22,226 kg)
Front Tiedown Eyes Maximum Load Capacity	49,000 lb (22,226 kg)

EQUIPMENT DESCRIPTION AND DATA - (CONTINUED)

Rear Tiedown Eyes Maximum Load Capacity	49,000 lb (22,226 kg)
Side Tiedown Eyes Maximum Load Capacity	25,000 lb (11,339 kg)
Front Tow Eyes Maximum Load Capacity	61,500 lb (27,896 kg)
Forward Lifting Eyes Maximum Load Capacity	30,500 lb (13,835 kg)
Front Hook for Towing Maximum Load Capacity	15,000 lb (6,804 kg)

Table 19. Winch Cable.

ITEM	SPECIFICATION
Diameter	5/8 in. (15.9 mm)
Length	70 ft (21.3 m)
Ultimate Strength	40,000 lb (18,144 kg)
Working Load (Winch Maximum Rated Load)	18,000 lb (8,165 kg)

Table 20. Cabin.

ITEM	SPECIFICATION
Windshield, Door, Side, and Rear Window Glazing	Transparent armor
Personnel Capacity	6

END OF WORK PACKAGE

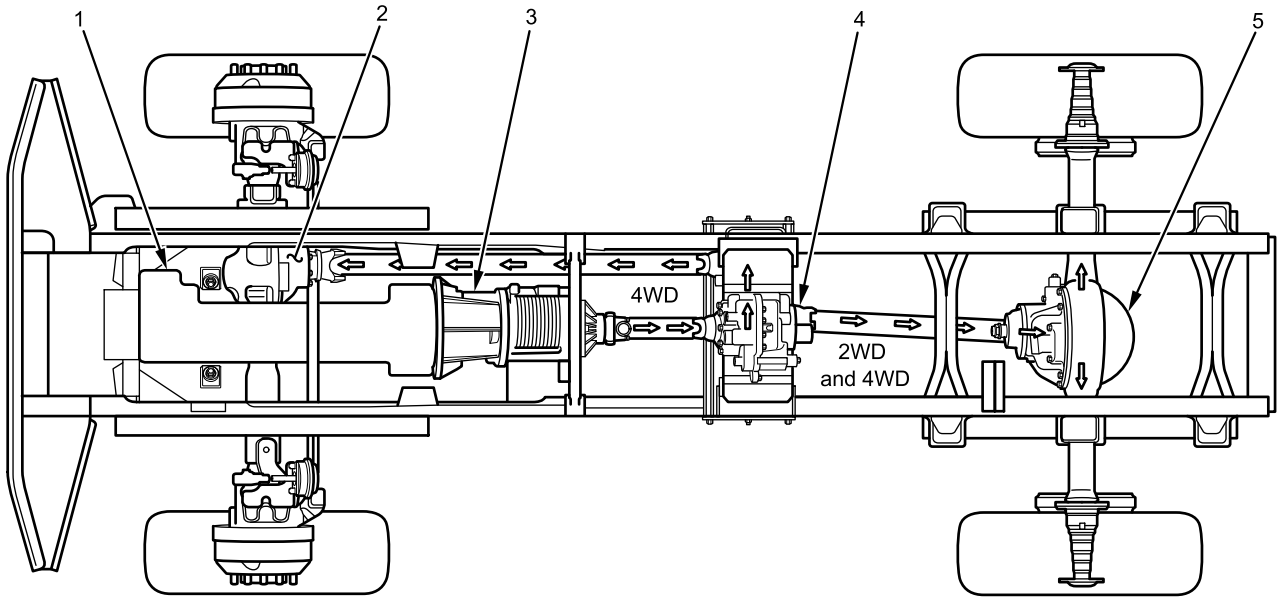
FIELD MAINTENANCE

THEORY OF OPERATION

VEHICLE DESCRIPTION AND FEATURES

For a description of basic vehicle features, refer to General Information and Equipment Description and Data in the Operator's Manual (TM 9-2355-106-10). Additional information about the general characteristics of the M1224 and M1224A1 can be found in Equipment Description and Data (WP 0002).

DRIVETRAIN



LEGEND

1 ENGINE
2 FRONT DIFFERENTIAL
3 TRANSMISSION
4 TRANSFER CASE
5 REAR DIFFERENTIAL

B230111472

Figure 1. Drivetrain Powerflow.

The M1224 and M1224A1 are equipped with a DT530 in-line, six cylinder, fuel-injected, four-cycle, water-cooled turbodiesel engine. The engine provides input power to the automatic transmission. The engine is equipped with a turbocharger, overhead valves with replaceable valve guides, and replaceable valve seats for both intake and exhaust. The engine is fueled by a direct injection fuel system with electronic sensors and Hydraulically actuated Electronically controlled Unit Injectors (HEUI). The firing order is 1-5-3-6-2-4.

The front differential transfers power from the drivetrain to the front wheels and allows the front wheels to rotate at different speeds during a turn. The front differential receives input torque from the front drive shaft when the vehicle is in four-wheel drive mode.

The vehicles are equipped with an Allison 3000SP series automatic transmission. The transmission uses a combination of a torque converter, three planetary gear sets, and five clutch packs to provide multiple output gear ratios. The transmission allows the turbodiesel engine to remain within operational range while providing a wide range of transmission output shaft speeds and vehicle speeds.

The vehicles are equipped with a Meritor MTC-4210 series transfer case. This transfer case is a four-shaft design with two-speed front and rear output. Gear ratios are 1:1 and 2.05:1. The Electrical System Controller (ESC) controls air solenoids that actuate an air-operated shift fork and collar that place the transfer case gears in LO, HIGH, or NEUTRAL.

THEORY OF OPERATION - (CONTINUED)

The rear differential transfers power from the drivetrain to the rear wheels and allows the rear wheels to rotate at different speeds during a turn. The rear differential receives input torque from the rear drive shaft anytime the vehicle is moving. The rear differential can not be disengaged.

ENGINE CONTROLS SYSTEM DESCRIPTION

The Engine Control Module (ECM) is mounted on the left side of the engine below the high pressure oil rail. One 60-way connector (LAM1019) links the ECM to input and output components on the engine harness. Another 60-way connector (6007) is located lower on the side of the ECM. It links the ECM to additional engine-related components and to the vehicle electrical system.

The ECM performs the following functions:

- Supplies input components with power and ground circuits.
- Processes signals from inputs.
- Calculates engine control strategy based on stored operating instructions.
- Controls actuators by means of output drivers and pulse width modulated signals.

ECM POWER SUPPLY

When the ignition switch is turned ON, ignition voltage is supplied to ECM connector 6007, terminal 24. This signals the ECM to connect a battery feed to additional ECM pins by means of the ECM power relay.

One side of the ECM power relay coil (terminal 86) is provided with a battery feed. To actuate the relay, the ECM provides a path to ground (terminal 85) for the relay coil via ECM connector 6007, terminal 25. As a result, battery power at terminal 30 of the relay is connected to terminal 87 of the relay and to ECM connector 6007, terminals 21, 22, and 41.

ECM terminals 23 and 42 on the 6007 connector provide the ECM with a battery ground.

The ECM monitors the power circuits and can record Diagnostic Trouble Codes if it detects a malfunction.

DTC 112 can be caused by an alternator that is overcharging or improper voltage during a jump-start.

DTC 113 can be caused by an alternator that is undercharging, weak batteries, high resistance, or poor connections in B+ circuits.

DTC 626 will be set any time the ECM powers down due to an interruption in a power or ground circuit. When power or ground is restored, the ECM will reboot itself. Relearning engine parameters may cause erratic engine operation. Turning the ignition switch OFF and then ON again causes the code to change from active to inactive.

THEORY OF OPERATION - (CONTINUED)

ECM INPUTS AND OUTPUTS

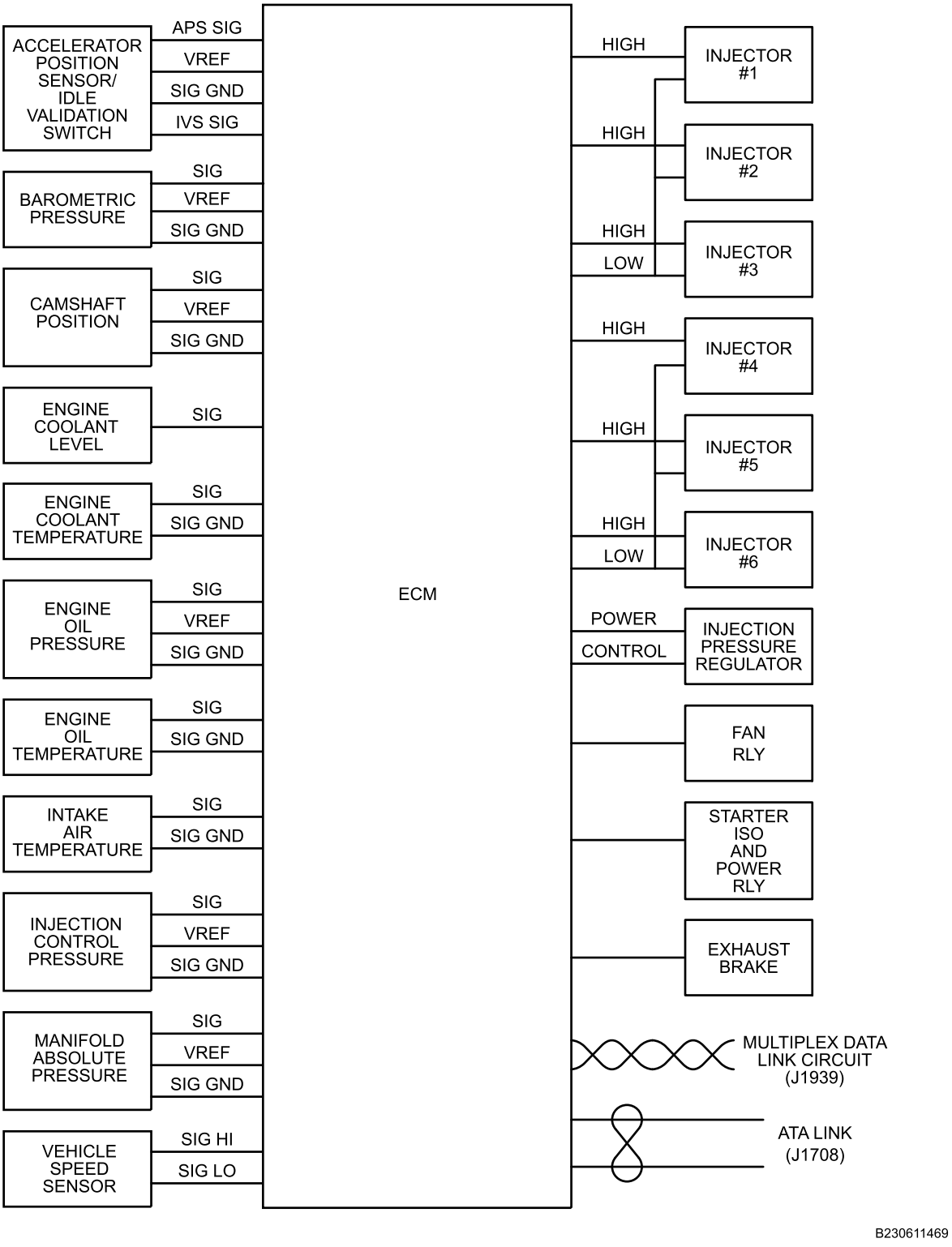


Figure 2. ECM Inputs and Outputs.

THEORY OF OPERATION - (CONTINUED)

Engine and vehicle sensors send input signals to the ECM by:

- •Changing reference voltage to produce a signal.
- •Generating signal voltage.
- •Switching a voltage feed on and off.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS)

The vehicle engine uses an electronic accelerator pedal assembly that includes an Accelerator Position Sensor (APS) and an Idle Validation Switch (IVS). The APS and IVS are integrated into one component mounted on the accelerator pedal. The ECM determines accelerator pedal position by processing input signals from the APS and IVS.

The ECM sends a regulated 5V signal through ECM chassis connector 6007, terminal 3 to APS connector terminal C. The APS returns a variable voltage signal (depending on pedal position) from APS connector terminal A to ECM connector 6007, terminal 8. Terminal B of the APS connector is provided a ground by the ECM at connector 6007, terminal 11.

The ECM determines lowest and the highest pedal positions by reading and storing minimum and maximum voltage levels from the APS during each ignition cycle. When the pedal is disconnected (or a new one is installed), the pedal does not need calibration, since calibration occurs each time ignition switch is turned on.

The IVS receives 12V from ignition fuse. The ECM expects to receive one of two IVS signals through ECM connector 6007, terminal 27 from APS/IVS connector terminal D: 0V when the pedal is in the idle position; 12V when the pedal is depressed.

The APS/IVS unit can be replaced without replacing the entire accelerator pedal assembly.

BAROMETRIC ABSOLUTE PRESSURE (BAP) SENSOR

The Barometric Absolute Pressure Sensor (BAP) is located behind the instrument cluster.

The BAP sensor is a variable capacitance device that, when supplied with a 5V reference signal from ECM, produces a linear analog voltage signal that indicates pressure.

The BAP signal is used to calculate altitude, which allows ECM to adjust timing and fuel quantity for improved engine operation and smoke control.

A BAP signal detected Out of Range High or Out of Range Low by the ECM will cause the ECM to ignore the BAP signal and use the Manifold Absolute Pressure (MAP) signal generated at low idle as an indication of barometric pressure. If a MAP fault is also detected, the BAP value will default to 29.6 in. Hg (barometric pressure at sea level).

The ECM sends a regulated 5V signal from ECM connector LAM1019, terminal 3, to the BAP connector terminal 2. The BAP sensor returns a variable voltage signal (representing atmospheric pressure) from BAP connector terminal 3 to the ECM at connector LAM1019, terminal 29. Terminal 1 of the BAP connector is provided a ground at ECM connector LAM1019, terminal 11.

The ECM continuously monitors signals from the BAP sensor at terminal 29. If a signal is out of the expected range, a Diagnostic Trouble Code is logged. The warning light does NOT turn on.

BRAKE SWITCH CIRCUIT

The brake switch is located on the air lines in the instrument panel. The switch signals the Electronic System Controller (ESC) when the brakes are applied. This ESC sends this information to the ECM over the J1939 data link circuit. It is used by the ECM to disengage cruise control functions and to enable the exhaust brake. The brake signal will interrupt the cold ambient protection feature and reset the time interval for the idle shutdown feature.

THEORY OF OPERATION - (CONTINUED)

CAMSHAFT POSITION (CMP) SENSOR

The engine control system includes a CMP sensor located on the front of the engine near the auto belt tensioner. The CMP sensor, along with a timing disk at the front of the camshaft, provide the ECM with a signal that indicates camshaft position and engine speed. A narrow vane on the disk (corresponding with a wider window) is used to indicate the position of the number one piston.

The CMP sensor is a Hall-Effect-type device that generates a digital frequency as windows on the timing disk pass through its magnetic field. The frequency of the windows passing by the sensor, as well as the width of selected windows, allows the ECM to detect engine speed and position. When the narrow vane passes the CMP sensor, the signal on-time is less than when the other vanes pass the sensor. This produces a signal that the ECM uses to indicate engine position.

The ECM uses the CMP sensor signal to synchronize piston position with injector firing sequence. The injection sequence begins when the ECM detects the narrow vane on the timing disk indicating cylinder 1. The piston position for each cylinder is then continuously calculated as each vane on the timing disk passes by the CMP sensor. This information is processed by the ECM and used for injection timing and fuel delivery control. The engine will not operate without a functioning CMP signal.

After every two crankshaft revolutions, the ECM verifies synchronization. If the ECM receives too many or too few pulses for the number of engine revolutions, it will set a DTC. However, the ECM will attempt to determine the cause of an invalid signal and identify it with a DTC. CMP codes that are set will become inactive codes if the ignition switch is turned off. These codes can be retrieved using the MSD, or cruise control switches and the cluster display.

The ECM provides a 5-volt reference signal to CMP sensor terminal B via connector LAM1019, terminal 40. It provides a ground to CMP sensor terminal A via connector LAM1019, terminal 53. The ECM receives the signal from CMP sensor terminal C at connector LAM1019, terminal 51.

ENGINE COOLANT LEVEL SYSTEM

The engine coolant level system monitors the engine coolant level. ECM connector 6007, terminal 10 provides a 5-volt reference signal to level sensor terminal A. Terminal B is connected to the ECM signal ground. The magnetic sensor in the coolant surge tank is open when the tank is full.

The engine coolant level sensor is used with the optional engine warning and protection feature. The coolant level system monitors coolant level in the surge tank to protect the engine from damage due to operating the engine when the coolant level is low. When this feature has been enabled and the engine is running, the ECM will cause the red LOW COOLANT warning light to flash and the warning buzzer to sound if the coolant level is below the level of the sender in the surge tank. If the system is programmed for engine shutdown, the ECM will cause the engine to stop running after the coolant level has been depleted below the coolant level sensor and the preprogrammed warning time has expired. If the engine stops running in this condition, it can be restarted and run again for the warning time period, provided it is capable of restarting.

DTC 236 will be active when a low coolant situation is present, and the MSD will indicate Engine Coolant Level Below Warning/Critical level. After the coolant has been restored to proper levels, DTC 323 will remain as an inactive code and the ECM will log the engine hours of the occurrence.

THEORY OF OPERATION - (CONTINUED)

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

The engine control system includes an ECT sensor located on the right side of the engine behind the alternator mounting bracket. The ECT sensor is a thermistor-type device that modifies a 0 to 5V signal by changing resistance in response to changes in coolant temperature. When the temperature of the coolant decreases, the resistance of the thermistor increases, which causes the signal voltage to increase. As the temperature of the coolant increases, the resistance of the thermistor decreases, which causes the signal voltage to decrease. The ECT sensor is supplied a regulated 5V reference signal at terminal B from ECM connector LAM1019, terminal 13. The sensor is grounded at terminal A through the signal return at ECM connector LAM1019, terminal 19. As the coolant temperature increases or decreases, the sensor changes resistance and provides the ECM with the coolant temperature signal.

The ECM uses the ECT signal for engine fan control, coolant temperature compensation, and the optional high temperature warning and shutdown systems. Coolant temperature compensation is used to protect the engine if the coolant temperature is too high.

If the coolant reaches 214°F (101°C), the ECM will reduce the fuel delivery by 6% for each °C of temperature increase. If the coolant temperature increases to 218°F (104°C), fuel quantity will be reduced 3% for each °C of temperature increase. Coolant temperature compensation can be programmed to be inoperative in certain applications where full engine performance is required over the protection of the engine. For engines equipped with an engine warning system, the ECM will activate the audible warning alarm and illuminate the RED OIL/WATER warning light when the engine coolant temperature reaches 225°F (107°C). For engines equipped with an engine shutdown system, the ECM will shut the engine off when the coolant temperature reaches 235°F (112.5°C). The vehicle operator may restart the engine by turning the ignition switch OFF and then restarting it. After restart, the ECM will allow the engine to run for an additional 30 seconds before shutting it off again.

With the ignition switch ON, the ECM continuously monitors the ECT circuit for expected voltages. If the signal voltage is more or less than the expected value, the ECM will set a DTC. In that case, the ECM will disregard the signal voltage and default to a temperature of 180°F (82°C) for engine running operation and -29°F (-33.9°C) for starting the engine. If the DTC is no longer present, the ECM will return to normal operation using the ECT signal for processing.

ENGINE CRANK INHIBIT (ECI) SYSTEM

The engine starting system is controlled by the ECM through its control of a ground for the starter relay. The starter relay controls the current to the helper relay and starter solenoid. While the engine is running, the ECM prevents starter motor operation and possible damage to the starter pinion and ring gear. In addition, ECM control prevents the starter motor from engaging unless the transmission is in NEUTRAL.

The ECI system includes the following:

- Gear position input from Transmission Control Module (TCM)
- Ignition switch
- Starter relay
- Starter motor and solenoids
- Batteries and cables

When the ECM recognizes that the engine is not running, it grounds terminal 46 on connector 6007, providing the TCM signals that the transmission is not in gear. Grounding terminal 46 provides a current path for the starter relay coil when the ignition switch is moved to START. When the ECM recognizes that the engine is running, the ECM will open terminal 46. This will prevent the starter relay coil from energizing and the starter motor from engaging.

THEORY OF OPERATION - (CONTINUED)

ENGINE FAN CONTROL (EFC)

The EFC solenoid provides ON/OFF control for the engine cooling system fan and a load for engine braking when required. To operate the solenoid, the ECM monitors inputs from the engine coolant temperature and the exhaust brake signal.

The AIR FAN SHUTTER fuse in the Power Distribution Center provides the fan solenoid with 12 volts when the ignition is turned ON. The ECM controls the solenoid at connector LAM1019, terminal 8. Normal fan ON temperature is 212°F (100°C). Normal fan OFF temperature is 207.5°F (97.5°C).

If a malfunction occurs in either the power or ground circuit, EFC is disabled and the engine fan is on all the time.

For test purposes, EFC solenoid can be turned ON/OFF through Key-On, Engine-Off Standard Test on the MSD. During this test, the ECM performs an output circuit test that momentarily enables the EFC solenoid and measures the voltage drop across the solenoid. DTC 246 is set only during this test.

ENGINE OIL PRESSURE (EOP) SENSOR

The EOP sensor is a variable capacitance device located near the fuel filter on the left side of the engine. When pressure is applied to the sensor, the capacitance changes in proportion with the pressure. ECM connector LAM1019, terminal 40, supplies a regulated 5V signal to terminal B of the EOP sensor. The EOP sensor is supplied with a signal ground at terminal A by ECM connector LAM1019, terminal 19. The oil pressure signal from the sensor at terminal C is sent to terminal 14 of ECM connector LAM1019. This signal increases in proportion to an increase in pressure up to a maximum of 85.3 psi (588 kPa).

The ECM monitors the EOP signal to provide information for the oil pressure gauge and for warning lamp operation. If the vehicle is equipped with the engine shutdown system and the oil pressure drops to 2.0 psi (14 kPa) @ 700 rpm, 5.0 psi (34 kPa) @ 1400 rpm, or 12.0 psi (83 kPa) @ 2000 rpm, the ECM will shut the engine off.

During engine operation, the ECM compares the expected oil pressure to engine speed. If the ECM detects low oil pressure for a given engine speed, the ECM will set a DTC. If the oil pressure is lower than the critical level, the ECM will record a DTC. The ECM automatically records this as a low oil pressure event that cannot be erased using the MSD. This becomes a record of engine operation.

ENGINE OIL TEMPERATURE (EOT) SENSOR

The EOT sensor is a thermistor-type device which produces a 0 to 5V signal in response to changes in engine oil temperature. It is located on the back of the front cover on the left side of the engine. The ECM uses the EOT sensor signal to adjust fuel timing and quantity to compensate for oil viscosity changes during temperature variations.

When oil temperature decreases, the resistance of the thermistor increases, which causes the signal voltage to increase. As oil temperature increases, the resistance of the thermistor decreases, causing the signal voltage to decrease. The EOT sensor is supplied a regulated 5V reference signal at terminal B from ECM connector LAM1019, terminal 12. A ground circuit is supplied at terminal A by ECM connector LAM1019, terminal 19.

With the ignition switch ON, the ECM continuously monitors the EOT signal to determine if it is within expected values. If the signal voltage is above or below the expected levels, the ECM will set a DTC. If the ECM detects an EOT signal that is Out of Range High or Out of Range Low, it will ignore the EOT signal and default to the ECT sensor. If the ECT sensor is not sending a correct signal, the ECM will default to 29°F (-1.7°C) for starting or 212°F (100°C) for engine running operation.

The AMBER ENGINE lamp is illuminated as long as the DTC condition exists.

THEORY OF OPERATION - (CONTINUED)

INTAKE AIR TEMPERATURE (IAT) SENSOR

The IAT sensor is a thermistor-type device that modifies a 0 to 5V signal in response to changes in temperature. It is located on the air filter housing. The IAT signal determines the timing and quantity of fuel required for starting in cold weather to limit smoke emissions.

When intake air temperature decreases, the resistance of the thermistor increases, which causes the signal voltage to increase. As intake air temperature increases, the resistance of the thermistor decreases, causing the signal voltage to decrease. The IAT sensor is supplied a regulated 5V reference signal at terminal B from ECM connector 6007, terminal 11. A return circuit (ground) is supplied at terminal A from ECM connector 6007, terminal 12.

With the ignition switch ON, the ECM continuously monitors the IAT signal to determine if it is within expected values. If the signal voltage is above or below the expected levels, the ECM will set a DTC. If the ECM detects an IAT signal that is Out of Range High or Out of Range Low, the ECM will ignore the IAT signal and default to 77°F (25°C).

The AMBER ENGINE lamp is illuminated as long as the DTC condition exists.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The engine control system includes a MAP sensor located on the top of the intake manifold. The ECM measures the signal from the MAP sensor to determine intake manifold (boost) pressure. From this information, the ECM can control fuel quantity and modify injection timing for engine operating conditions.

The MAP sensor is a variable capacitance device that produces a linear analog voltage signal. Pressure applied to the MAP sensor changes the capacitance of the sensor, which varies the signal voltage sent to the ECM. As boost pressure increases, the signal voltage increases.

The MAP sensor is supplied 5V at sensor terminal B from ECM connector LAM1019, terminal 40. A ground circuit is supplied to terminal A of the sensor from ECM connector LAM1019, terminal 19. MAP sensor terminal C provides a signal to ECM connector LAM1019, terminal 30.

The ECM monitors the MAP sensor signal for expected values. If the ECM detects the MAP signal is more or less than the desired value, it will set a DTC. If an active DTC for the MAP sensor is set, the ECM will ignore the MAP sensor signal and operate the engine using programmed default values. Active DTCs for the MAP sensor will cause the ECM to illuminate the amber engine warning light.

VEHICLE SPEED SENSOR (VSS)

The VSS sensor is located in the top of the transfer case.

The transfer case output speed signal is generated by a magnetic pickup that responds to the rotation of a toothed gear installed in the transfer case. This Alternating Current (AC) sine wave signal is received by the ECM at connector 6007, terminals 39 and 40. The signal is used with tire size and axle ratio to calculate vehicle speed. Calculated vehicle speed is transmitted to the instrument cluster on the J1939 data link to operate the speedometer. Calculated vehicle speed is also used in the control strategies for features such as cruise control and road speed limiting.

When the ECM determines that the vehicle is operating at 0 mph, it performs diagnostic checks of the VSS circuit. A voltage signal transmitted by the ECM will detect if the return voltage is Out of Range High or Out of Range Low. An Out of Range Low DTC normally indicates an open or short to ground. An Out of Range High DTC normally indicates a short to voltage. When a VSS DTC is detected, the ECM disables cruise control operation. If road speed limiting is enabled, it will limit engine rpm in all gears.

FUEL SYSTEM

The fuel system consists of three major subsystems:

- Fuel supply system
- Injection Control Pressure (ICP) system
- Fuel injectors

THEORY OF OPERATION - (CONTINUED)

These subsystems work together to inject pressurized fuel into the combustion chambers. The fuel supply system delivers fuel from the fuel tanks to the injectors. The ICP system supplies the injectors with high pressure oil, and the fuel injectors deliver high pressure fuel to the engine in response to ECM inputs.

FUEL SUPPLY SYSTEM

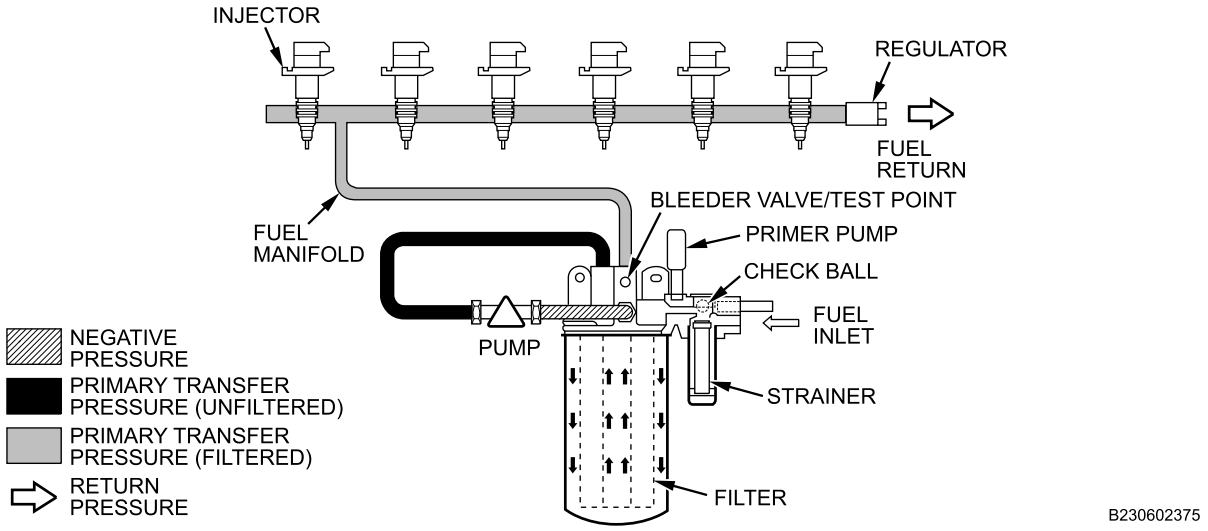


Figure 3. Fuel Supply System.

The fuel supply system includes the following:

- Tank
- Supply lines
- Strainer
- Filter
- Supply pump
- Supply manifold
- Passages (within fuel supply manifold and cylinder head to feed injectors)
- Fuel pressure regulator
- Return lines

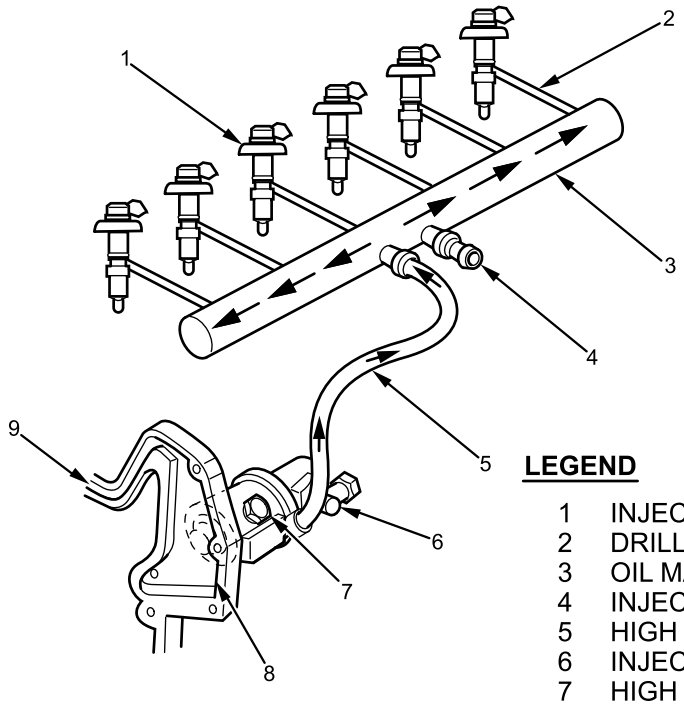
Fuel Flow

The suction side of the supply pump draws fuel from the tank to the strainer. Fuel then flows through the strainer into the supply pump. The pump increases fuel pressure to approximately 65 psi (448 kPa). Pressurized fuel is pumped through the filter to the supply manifold for distribution through passages in the head to the fuel injectors.

The supply manifold pressure is controlled to 65 psi (448 kPa) by a fuel pressure regulator mounted at the rear of the manifold. After flowing through the pressure regulator, excess fuel is returned to the tank.

THEORY OF OPERATION - (CONTINUED)

INJECTION CONTROL PRESSURE (ICP) SYSTEM



LEGEND

1 INJECTOR
2 DRILLED SUPPLY PASSAGE
3 OIL MANIFOLD
4 INJECTION CONTROL PRESSURE (ICP) SENSOR
5 HIGH PRESSURE OIL LINE
6 INJECTION PRESSURE REGULATOR (IPR)
7 HIGH PRESSURE OIL PUMP
8 OIL RESERVOIR
9 FROM MAIN GALLEY

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Figure 4. Injection System.

The ICP system includes the following components:

- Internal reservoir (cast into the front cover)
- High pressure pump assembly
- Injection Pressure Regulator (IPR)
- High pressure supply hose
- High pressure supply rail
- Drilled passages in the cylinder head
- ICP sensor

The ICP system provides the necessary energy to actuate the injection system hydraulically. Engine lube oil is the hydraulic fluid used for this purpose.

An oil reservoir integral to the front cover provides a constant supply of oil to a high pressure hydraulic pump mounted on the front cover. The high pressure pump is a gear-driven, swash-plate-type pump. High pressure oil is delivered by the high pressure pump to the high pressure oil supply manifold and into passages machined into the cylinder head.

When the injector solenoid is energized, high pressure lube oil is used to pressurize and atomize fuel. After fuel injection into the combustion chamber is complete, the solenoid is deactivated. Oil within the injector is vented through the top portion of the injector and allowed to drain back to the oil pan.

ICP Sensor and IPR Valve

The ECM continuously monitors pressure using the ICP sensor and controls injection pressure by operating the IPR. This control based on sensor feedback is known as Closed Loop.

THEORY OF OPERATION - (CONTINUED)

The ICP sensor is a variable capacitance device. When pressure is applied to the sensor, the capacitance changes in relation to the pressure. The ECM supplies a regulated 5V signal to terminal B of the ICP sensor from ECM connector LAM1019, terminal 40. The ICP sensor is supplied a ground at terminal A to ECM connector LAM1019, terminal 19. During engine operation, oil pressure changes sensor capacitance; the incoming 5V reference signal changes in relation to pressure. The oil pressure signal from the sensor at terminal C is sent to terminal 16 of ECM connector LAM1019. This signal increases equally in proportion to an increase in pressure.

The IPR valve is sent a pulse width modulated signal by the ECM to control the pressure of the oil in the ICP system. The pulse width is modulated between 8% and 60% to control pressure in the range of 500-3000 psi (3.4-20 MPa). The regulator is mounted in the high pressure oil pump and maintains desired injection control pressure by dumping excess oil through an (internal shuttle) spool valve into the front cover and back to the oil pan.

Diagnostic codes can be set by the ECM if the ICP electrical signal is out of range or if the ICP signal received corresponds to an out-of-range value for the ICP for a given operating condition.

If these failures occur, the ECM will ignore the ICP signal and control the IPR valve from programmed default values. This is called open loop operation.

FUEL INJECTOR OPERATION

The ECM controls:

- Correct firing sequence
- Injector timing
- Injection duration

The ECM monitors engine speed and cylinder positions by constantly monitoring the camshaft position sensor signal. When the narrow vane of the timing sensor disc passes in front of the camshaft position sensor, the difference in the signal it generates indicates the position of piston 1. The positions of pistons 2 through 6 are based on the position of piston 1.

The ECM provides a constant ground path to all fuel injectors.

By using output driver transistors, the ECM supplies 115+ volts DC to each injector, following the firing order 1, 5, 3, 6, 2, 4. The ECM has an output driver for each fuel injector.

The 115+ volt DC supply is created by the ECM by making and breaking a 12-volt source across an internal coil, based on the same principle as an automotive ignition coil.

The injection operation is divided into three stages:

1. Fill stage

   During the fill stage, the injector solenoid is deactivated and the poppet valve is closed, preventing the flow of high pressure oil to the intensifier piston. At this point, the intensifier piston is up, allowing fuel to enter and fill the injector nozzle.

2. Injection stage

   To initiate injection, the ECM energizes the solenoid. This rapidly lifts the poppet valve from its seat, allowing high pressure oil to enter the injector. At the intensifier piston, pressure is transmitted from the high pressure oil to the fuel and multiplied 6 to 7 times, creating fuel injection pressures of up to 21,000 psi (145 MPa).

   As fuel pressure increases, check valves prevent the fuel from flowing back to the supply manifold. When pressure is high enough to lift the needle valve, high-pressure atomized fuel is injected into the combustion chamber.

3. End of injection

   When injection is complete, the ECM deactivates the solenoid; the poppet valve and intensifier piston return to their closed position, and the injector returns to the fill stage.

THEORY OF OPERATION - (CONTINUED)

Injector Scuff Test

The injector scuff test detects problems with injection and combustion. The test analyzes the individual contribution of each power cylinder. Its primary function is to detect a bad injector, although it will also detect problems that could affect the cylinder performance (i.e., valves, push rods, pistons, rings, etc.). Further diagnostic testing may be necessary to resolve mechanical issues. During this test, the ECM controls fuel delivery and determines each cylinder's power contribution. If a cylinder is not performing satisfactorily, a DTC may be set.

TRANSMISSION

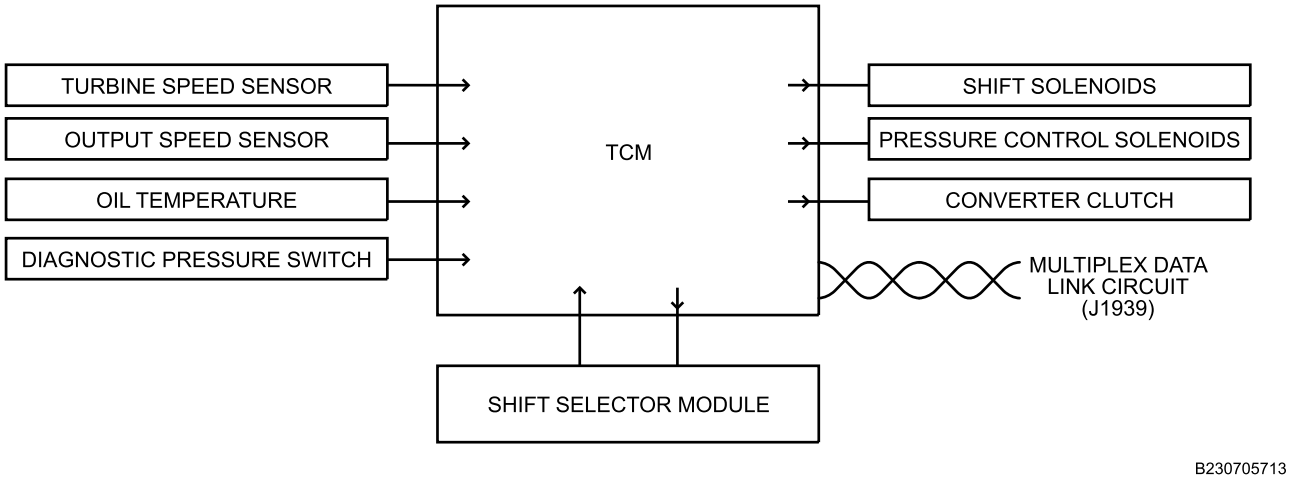


Figure 5. Transmission Control Module (TCM) Inputs and Outputs.

Operators select automatic or manual shifts with the shift selector module in the center instrument panel. In DRIVE (D), the transmission automatically shifts through gears 1-5. Up and down arrows on the shift selector provide the option of manual shifts. The shift selector is one of several inputs the TCM uses in shifting between gears. For main transmission inputs and outputs, refer to Figure 5.

The TCM is located on a bracket mounted on the left frame rail above the transmission. The TCM communicates with the vehicle electrical system via an 80-way connector. A 20-way connector on the back of the transmission housing connects the TCM to the transmission internal wiring harness.

To provide 5 forward gear ratios and 1 reverse gear ratio, the transmission employs solenoids to control five clutches, which hold or release parts of 3 planetary gear modules. In the event of electrical system failure, transmission valves are designed to return to default hydraulic positions and provide limp-in gear ratios.

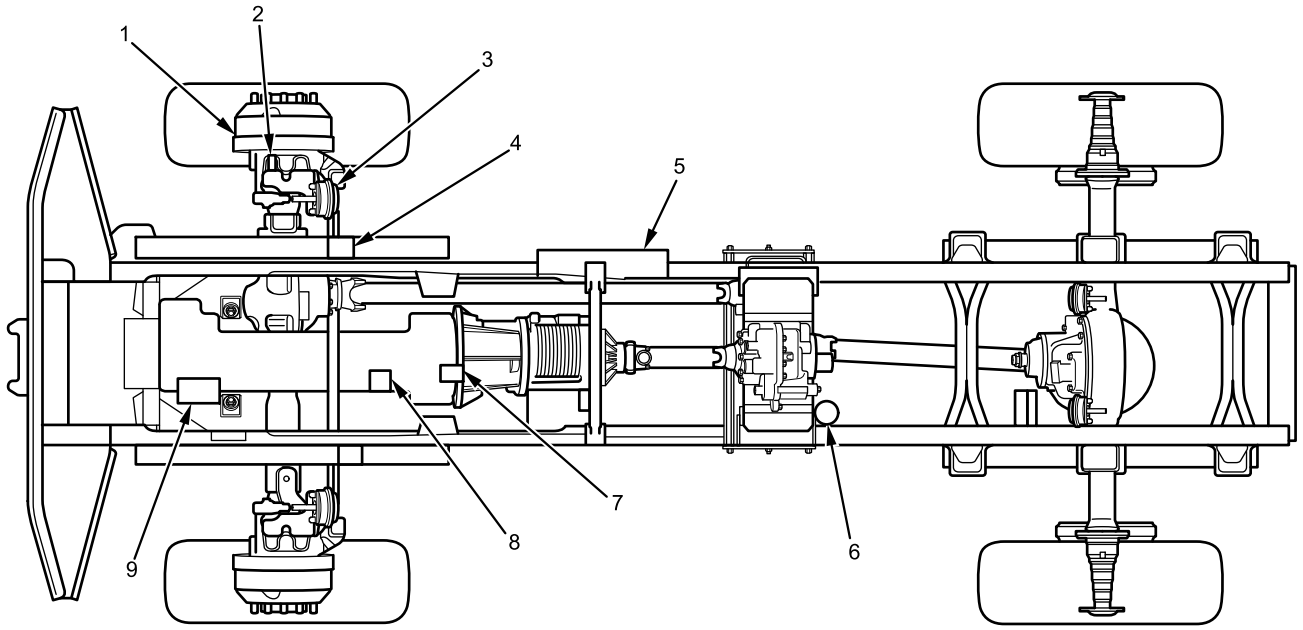
The TCM monitors transmission circuits for proper operation and records DTCs when it detects malfunctions. DTCs can be retrieved with the MSD or by using shift selector UP and DOWN buttons and the shift selector display. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012) for details.

TRANSFER CASE

The switch pack in the center instrument panel provides inputs to Electronic System Controller (ESC) for transfer case operation. The ESC then operates the solenoids that route air pressure to transfer case shift mechanisms. A shift fork and collar connects the input shaft to low-range or high-range gears, which are coupled to an idler gear assembly. The idler gear then turns the gear on the rear output shaft. A pushrod and shift fork connects the gear on the rear output shaft to a gear on the front output shaft for front axle operation.

THEORY OF OPERATION - (CONTINUED)

BRAKE AND PNEUMATIC SYSTEMS



LEGEND

1 DRUM BRAKE
2 WHEEL SPEED SENSOR
3 BRAKE CHAMBER
4 ABS MODULATOR VALVE
5 PRIMARY/SECONDARY AIR TANKS
6 AIR DRYER
7 RELAY VALVE
8 FOOT VALVE
9 AIR COMPRESSOR

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Figure 6. Brake and Pneumatic System Components.

For brake and pneumatic system component identification and location, refer to Figure 6.

The M1224 and M1224A1 vehicles are equipped with air-operated drum brakes on all four wheels and an Antilock Brake System (ABS).

The ABS Electronic Control Unit (ECU) employs wheel speed sensors and ABS modulator valves to enhance vehicle control during braking. The ECU uses wheel speed sensors to monitor individual wheels for locking tendencies and for feedback during antilock braking. The ECU operates the pressure modulator valves to adjust the brake pressure at each wheel, optimizing traction between the tire and the road surface.

THEORY OF OPERATION - (CONTINUED)

At brake actuation, air pressure in the brake chamber rotates the S-camshaft, which then pushes rollers located on the brake shoes against the brake drum. When a brake shoe is forced into the drum, friction slows the movement of the drum to stop the vehicle.

The ABS uses an ABS modulator valve to regulate the flow of air to the brake chambers during braking.

An air dryer removes moisture from the compressed air provided by the air compressor. The air dryer uses a replaceable desiccant cartridge to remove moisture. The air dryer periodically purges moisture out of a purge vent.

To prevent brake lag, a relay valve is used to actuate the brakes. Brake lag is the amount of time between when the operator actuates the foot valve and the air reaches the brake chambers. The relay valve controls the flow of air between the brake chambers and the reservoirs. The foot valve provides air pressure to the relay valve, and the relay valve opens and closes in proportion to the amount of pressure applied by the foot valve. Since the relay valve can flow more air than the foot valve, brake lag is limited.

The vehicle brake pedal is connected to a foot valve that controls air pressure to the brake chambers. The pressure is determined by the driver's pedal stroke.

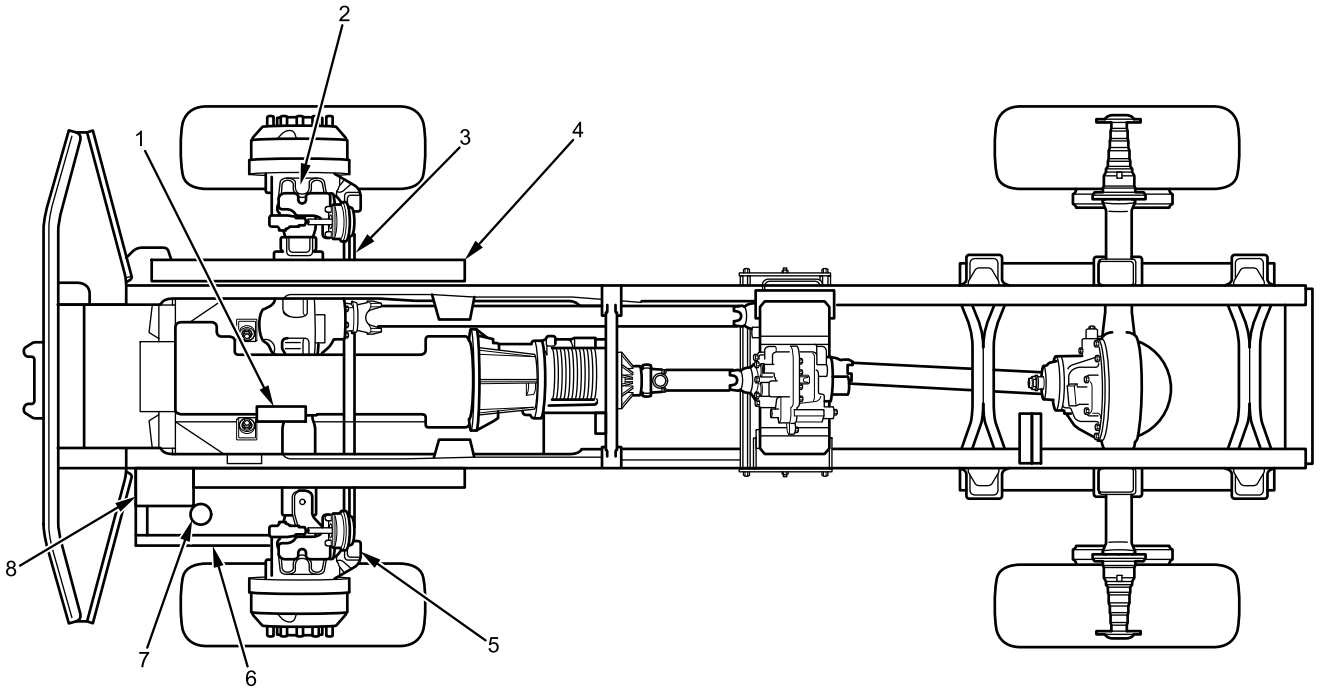
The ECU monitors ABS circuits for proper operation and records DTCs when it detects malfunctions. The DTCs can be retrieved via the MSD or via the cluster ABS indicator lamp and an ABS blink switch to the left of the steering column. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012) for details.

Air pressure is supplied by an engine-driven air compressor. The system has two air supply tanks. One tank supplies air for the front (secondary) brake system. The other supplies air to the rear (primary) brakes. The rear axle also has spring-applied parking brakes.

Pneumatic cylinders assist the opening and closing of the armor-reinforced cabin doors. Air is routed to the cylinders by air valves connected to the latch handle assembly. M1224 models that have the lower combat door lock type have a single-cylinder for each door. M1224 models that have the upper combat door lock type have dual cylinders. Linkage rods feature adjustable ends for door latching and air valve operation adjustment. Door opening and closing speed is also adjustable.

THEORY OF OPERATION - (CONTINUED)

STEERING AND SUSPENSION



LEGEND

1 POWER STEERING PUMP
2 KING PIN (UPPER)
3 TIE ROD ASSEMBLY
4 LEAF SPRING
5 STEERING ARM
6 PITMAN ARM AND DRAG LINK
7 POWER STEERING FLUID RESERVOIR
8 STEERING GEAR

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Figure 7. Steering Components.

For steering and suspension component identification and location, refer to Figure 7.

The power steering pump is mounted on the left side of the engine, behind the air compressor. The pump supplies high pressure fluid to the steering gear. A remote reservoir receives return fluid from the steering gear and routes it back to the power steering pump.

Upper and lower king pin bushings are pressed into the axle housing and are replaceable separately. The kingpins allow the front wheels to pivot and turn the vehicle.

The tie rod assembly consists of two tie rod ends and a connecting tube or tie rod. The length of the tie rod assembly is adjustable to allow front wheel alignment.

The suspension on the M1224 and M1224A1 consists of front and rear leaf springs and front shock absorbers.

THEORY OF OPERATION - (CONTINUED)

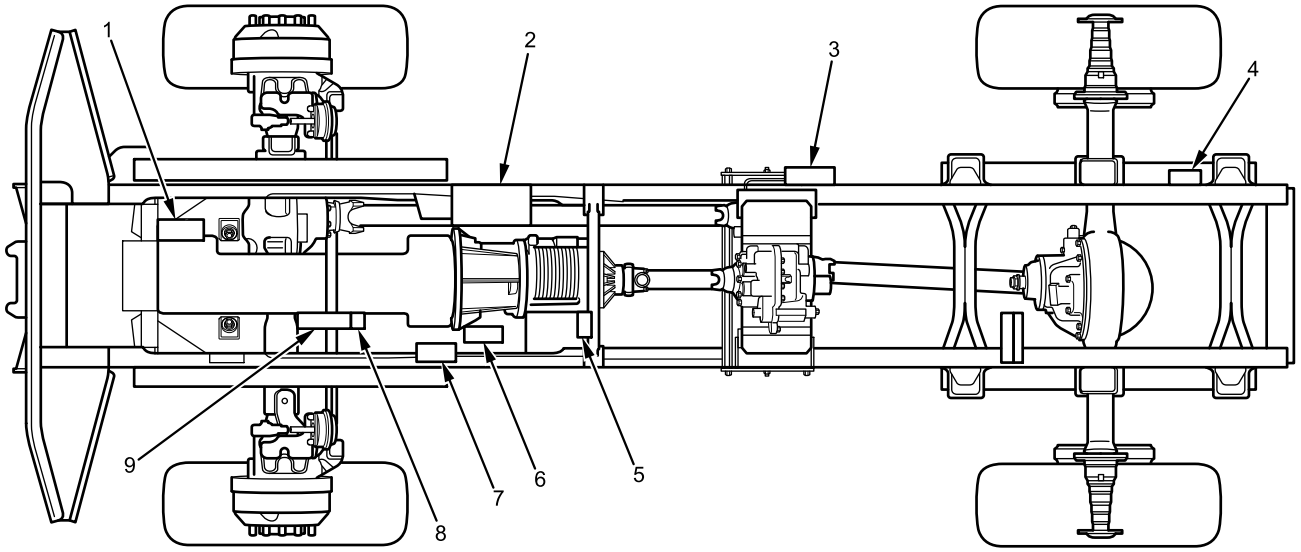
The power steering fluid reservoir is located near the radiator above the left front tire. The reservoir stores and cools fluid that is not currently being used by the power steering pump.

The steering wheel and steering column inside the cab and the steering shaft in the engine compartment provide input to the steering gear, mounted above the left frame rail near the bumper. A pitman arm and drag link connect the steering gear to a steering arm on the left kingpin assembly.

TIRES AND WHEELS

The M1224 is equipped with 395/85R20 tires mounted on two-piece, 20-inch forged aluminum wheels. The wheel inner and outer pieces are bolted together and have an internal O-ring seal between them. The tire and wheel assemblies also incorporate a Variable Function Insert (VFI) that provides run flat capability and prevents the tire beads from excessive movement on the wheel.

ELECTRICAL SYSTEM COMPONENTS AND POWER DISTRIBUTION



LEGEND

1 24V ALTERNATOR
2 BATTERIES, CLEAN POWER DISCONNECT, 300 AMP MEGAFUSE, BATTERY EQUALIZERS, MAG SWITCHES
3 INVERTER, POWER OUTLET, NATO SLAVE CONNECTION
4 120V OUTLET
5 TRANSMISSION CONTROL MODULE
6 100 AMP MEGAFUSE
7 POWER DISTRIBUTION CENTER
8 24V STARTER
9 ENGINE CONTROL MODULE

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Figure 8. Electrical System Components.

The vehicle has a dual electrical system with four batteries in a series-parallel configuration that provides 12V or 24V power. The batteries are located behind a cover below the right door.

THEORY OF OPERATION - (CONTINUED)

The system uses a 24V high output alternator for battery charging.

Four lead-acid batteries, rated at 725 CCA each, are connected in series-parallel. The batteries are split into two pairs. Each pair of batteries is wired in series and has a battery equalizer to provide 12V or 24V power. The 12V and 24V outputs from each pair of batteries are wired in parallel to the mag switches.

The battery equalizers, mounted near the batteries, regulate power between the 12V and 24V batteries. The battery equalizer has three connections: 24V battery positive, 12V battery positive, and ground. The battery equalizer senses the voltage of each battery. When a 12V load is activated, 12V battery voltage will begin to drop. The equalizer will pull 24V energy from the 24V battery, convert it to 12V energy, and provide it to the 12V battery until voltages between the two batteries are equal. In effect, the battery equalizer allows 12V loads to pull equally from both batteries.

The vehicle is equipped with an 1800–watt, 110V, alternating current (AC) inverter to provide power for auxiliary AC equipment. A 110V outlet is located in the rear storage box. The NATO jump start connector is also located there. The jump start connector is wired directly to the batteries.

The 110V power inverter has the following features:

- 1800-watt AC output with 2900-watt surge capacity
- True sine wave AC output
- Powersave mode that draws only 1.5 watts with no load
- Over-temperature shutdown and automatic overload protection
- Over-voltage and under-voltage protection
- Short circuit and AC back-feed protection

The transmission control module is a microprocessor that controls the operation of the transmission.

The primary power distribution and control points in the electrical system are the MAIN POWER switch, the 12V and two 24V mag switches, megafuses, engine compartment power distribution center, and cabin fuse and relay center.

The MAIN POWER switch provides a ground for 12V and 24V mag switches in the battery compartment. The mag switches, in turn, supply both 12V and 24V power to the power distribution center and the cabin fuse and relay center.

In addition, this 24V mag switch provides a feed for 24V body systems such as the remote controlled spotlight, climate control, Fire Suppression System (FSS), and rear door pump motor. The vehicle winch is powered by the unswitched side of this 24V mag switch and protected by a 300-amp megafuse.

Another 24V mag switch provides power to an inverter that supplies 110V AC at the right front and right rear storage boxes. This circuit is protected by a separate 150-amp megafuse.

The 12V mag switch supplies power to a junction with a 100-amp megafuse near the power distribution center. From the unfused side of the megafuse, power is supplied to the Electronic System Controller (ESC) and to the 12V battery feed for the chassis. From the fused side of the megafuse, power is supplied to the cabin fuse and relay center.

24V power is supplied from the vehicle batteries to the starter motor solenoid terminal 2 on a 4/0 cable. The negative battery terminals are connected to the starter motor ground stud. The negative battery terminals are also connected directly to the frame rail. The engine block ground, cab, and frame are connected by ground cables or circuits to the starter motor ground.

The engine control module is a microprocessor that control the operation of the diesel engine.

THEORY OF OPERATION - (CONTINUED)

STARTING CIRCUIT

Starting system components include the ignition switch, starter ISO and power relay, engine crank inhibit circuit, helper relay, starter solenoid, and starter motor. In the START position, the ignition switch routes 12 volts to the coil side of the starter ISO and power relay. As long as the engine is not running and the transmission is not in gear, the engine crank inhibit circuit provides a ground for the coil. As a result, the ISO and power relay supplies a 24-volt feed to the helper relay. The helper relay then provides 24 volts to the starter solenoid, which supplies the starter motor with battery power.

CHARGING CIRCUIT

When the vehicle is running, the alternator supplies 24V power through two positive alternator terminals. Wiring and fusible links connect these terminals to the starter motor solenoid positive battery stud. From this stud, current flows to the batteries through the positive battery cable.

Wiring connects two negative terminals on the alternator to engine block grounds above the starter motor.

DATA LINK CIRCUITS

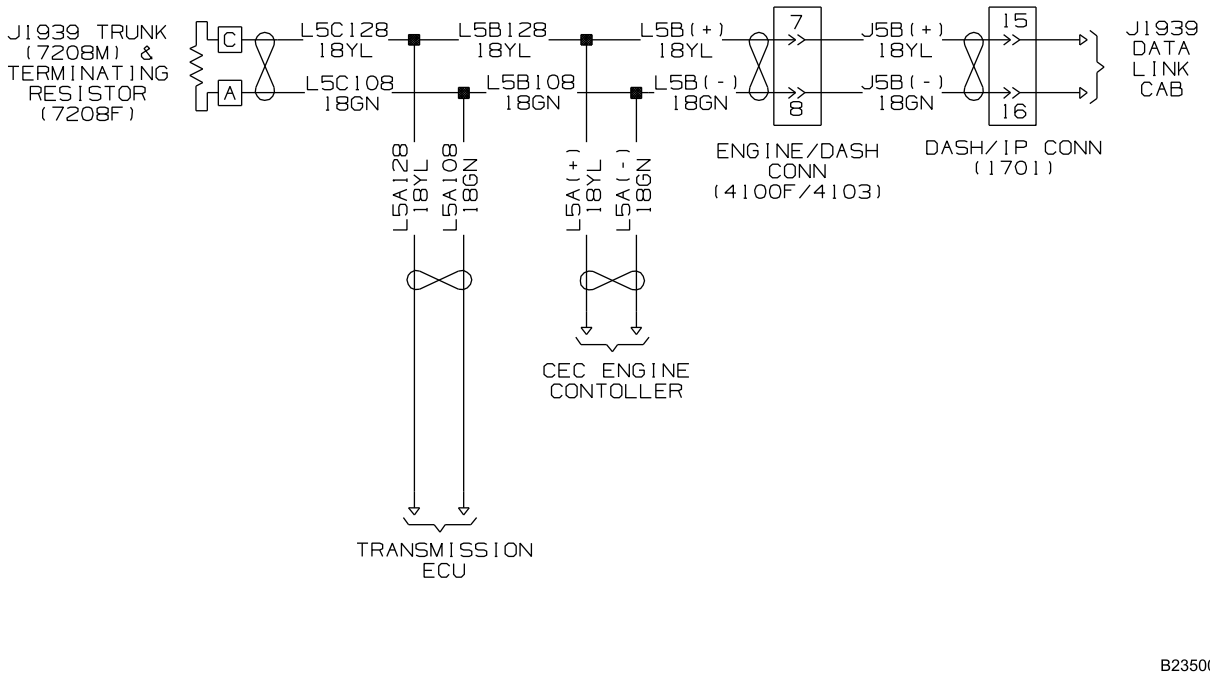


Figure 9. J1939 Data Link Circuit (Chassis).

For a diagram of the chassis part of the J1939 data link circuit, refer to Figure 9.

For a diagram of the cabin part of the J1939 data link circuit, refer to Figure 10.

Multiplexing, in the form of data link circuits, simplifies module communication and reduces wiring complexity on the M1224. The vehicle uses two types of data link circuits; J1708 and J1939. Both are two-wire systems. The J1708 data link is often referred to as American Trucking Association (ATA), and J1939 is often referred to as Controller Area Network (CAN).

There are three separate data links used on the vehicle:

- Drivetrain J1939 data link - This data link provides the main path for communication between vehicle modules: engine controller, transmission controller, Antilock Brake System (ABS) controller, Instrument Panel Cluster (IPC), ESC, and the shift selector module. The circuit terminates at each end with a 120-ohm resistor, one above the transmission and the other behind the right side of the instrument panel. An additional branch of the

THEORY OF OPERATION - (CONTINUED)

J1939 data link circuit is routed to the data link connector and provides a link for the Maintenance Support Device (MSD). The data link connector is located to the left of the steering column.

• Switch data link - This J1708 data link provides a path for communication between the center panel switch pack and ESC.

• J1708 data link - This data link connects the ECM to the data link connector for engine diagnostics.

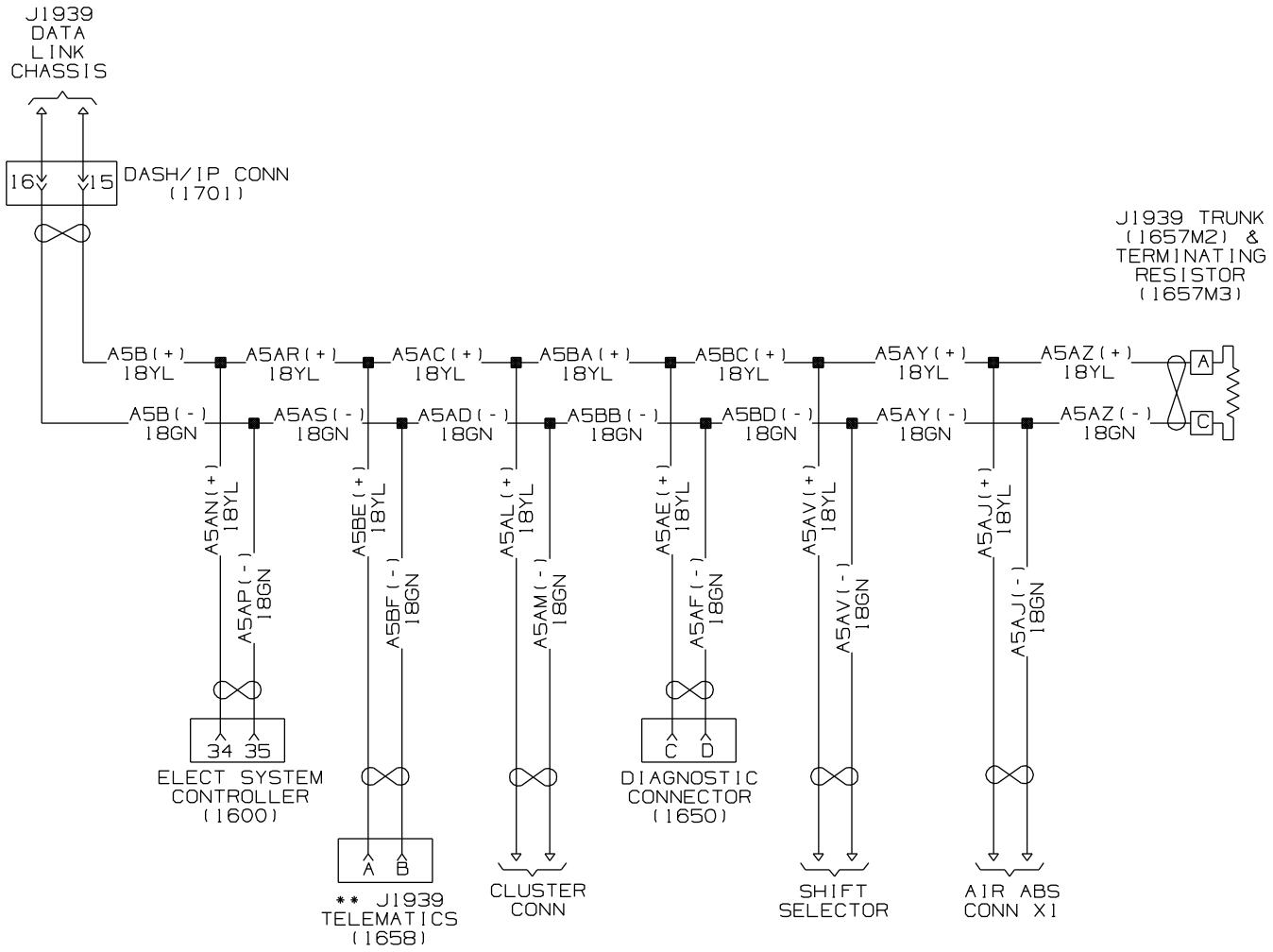
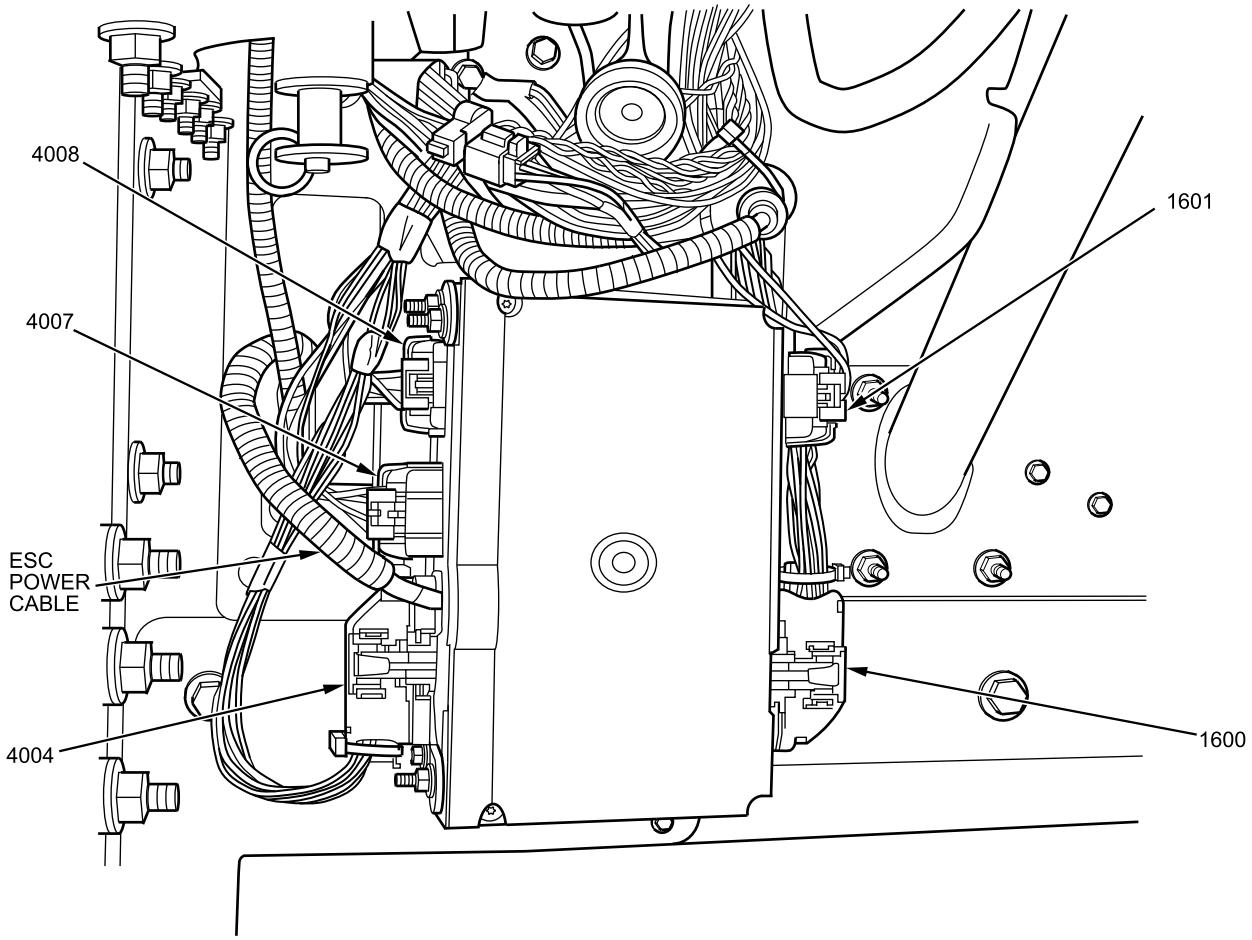


Figure 10. J1939 Data Link Circuit (Cabin).

THEORY OF OPERATION - (CONTINUED)

ELECTRONIC SYSTEM CONTROLLER (ESC)



LEGEND

(1600) 36-WAY ESC CONNECTOR (INSIDE CAB)
(1601) BROWN 8-WAY ESC CONNECTOR (INSIDE CAB)
(4004) 36-WAY ESC CONNECTOR (ENGINE COMPARTMENT)
(4007) BROWN 8-WAY ESC CONNECTOR (ENGINE COMPARTMENT)
(4008) BLUE 8-WAY ESC CONNECTOR (ENGINE COMPARTMENT)

Figure 11. ESC.

The ESC is mounted below the instrument panel to the left of the steering column. It connects with the vehicle electrical system via two 36-way connectors and three 8-way connectors. Power is provided by a cable from the unfused side of the 100-amp mega fuse in the engine compartment. The ESC receives inputs from switches and sensors and distributes electrical power to provide the driver with control over vehicle systems and indications of vehicle performance. It performs the following functions:

THEORY OF OPERATION - (CONTINUED)

- Communicates with the IPC on the J1939 data link to display vehicle information and system diagnostics.
- Communicates with the instrument panel switch pack through a dedicated J1708 data link.
- Receives input from the switch pack and controls power to the solenoid air pack for transfer case operation.
- Receives inputs from the switch pack and sends requests for exhaust brake operation to the ECM.
- Receives inputs from the cruise control switches and sends requests for cruise control operation to the ECM.
- Receives inputs from steering column switches and controls the horns, turn signals, and washers/wipers.
- Receives inputs from the brake switch to control the brake lights.
- Communicates with the IPC on the J1939 data link to supply the service headlights with power.

DIAGNOSTICS

The ESC monitors circuits for proper operation and records Diagnostic Trouble Codes (DTCs) when it detects malfunctions. DTCs can be retrieved with the Maintainance Support Device (MSD) or by using the CRUISE ON switch and the cruise RESUME/ACCEL switch and the Instrument Panel Cluster (IPC) display. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012) for details.

SWITCH PACK

The switch pack module is located in the center instrument panel. The mechanical assembly for each switch snaps into the switch receptacle and can be released from the rear of the switch pack. The switches communicate with the ESC over a dedicated J1708 data link. Switch positions and functions are programmed into the ESC. Based on switch inputs, the ESC operates vehicle features or sends messages to other modules requesting operation.

Some switches will flash when a switch is malfunctioning or there is an error associated with the feature controlled by the switch. The ESC continuously monitors switch pack communication on the switch data link. In most cases, the switch pack will notify the ESC if one of the individual switches has failed. In addition, if a switch pack fails to communicate with the ESC within the expected period of time, the ESC will record a DTC.

THEORY OF OPERATION - (CONTINUED)

INSTRUMENT PANEL CLUSTER (IPC)

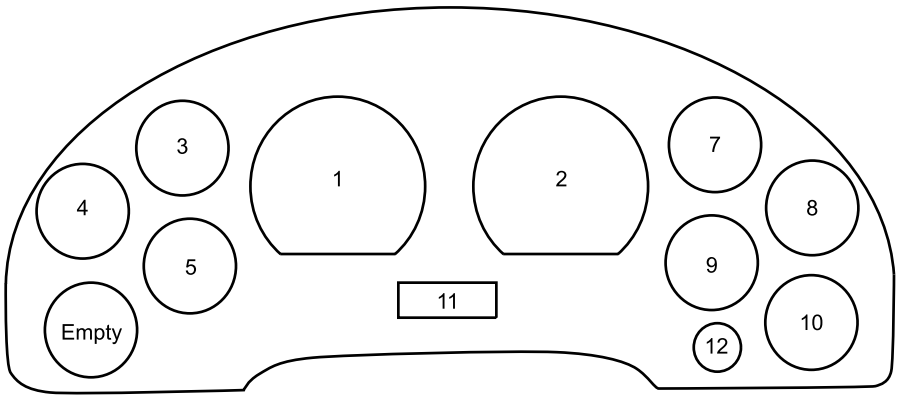


Figure 12. IPC Gauges, Digital Display, and Reset Switch.

Table 1. Gauges, Digital Display, and Reset Switch.

LOCATION	COMPONENT	GAUGE MIN./GAUGE MAX.	WARNING LIGHT TRIP POINT
1	Tachometer	0-3000 rpm	N/A
2	Speedometer	0-85 mph (0-137 kph)	N/A
3	Engine coolant temperature gauge with integral warning light	140/260°F (60/126°C)	> 230°F (> 110°C)
4	Transmission oil temperature gauge with integral warning light	100-400°F (38-204°C)	> 250°F (121°C)
5	Engine oil pressure gauge with integral warning light	0-100 psi (689.48 kPa)	< 7 psi (48.26 kPa) and engine speed > 325 rpm
5	Engine oil temperature gauge with integral warning light	100-300°F (38-149°C)	> 230°F (> 110°C)
7	Fuel level gauge with integral warning light	Empty/Full	< 12.8%
8	Primary air pressure gauge with integral warning light	0-150 psi (1034 kPa)	< 70 psi (482 kPa)
9	Voltmeter gauge with integral warning light (12-volt system only)	10/16 volts	< 12V or > 15.0V DC and engine speed > 325 rpm
10	Secondary air pressure gauge with integral warning light	0-150 psi (1034 kPa)	< 70 psi (482 kPa)
11	Digital display		
12	Reset switch		

THEORY OF OPERATION - (CONTINUED)

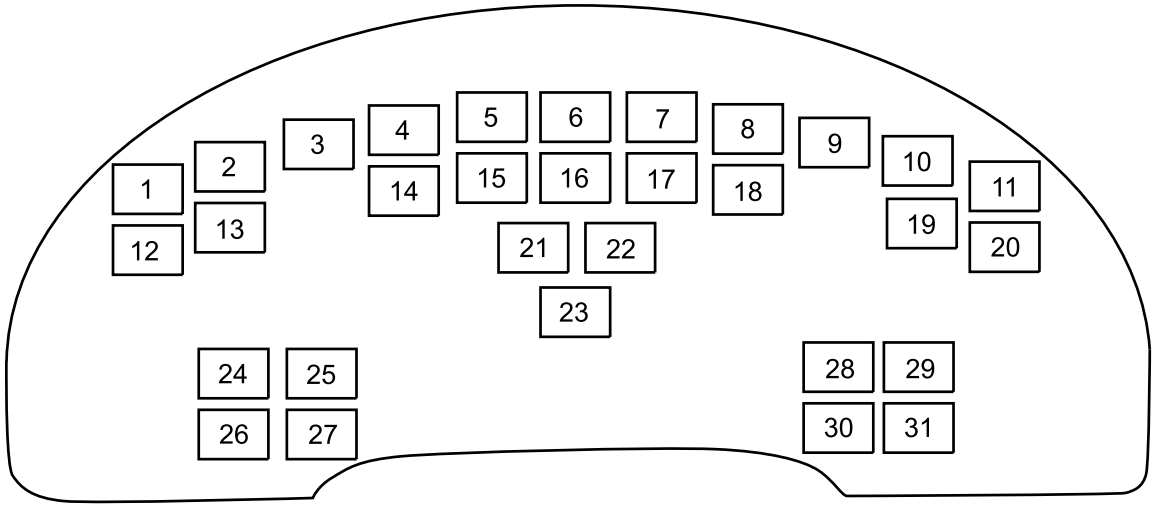


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Figure 13. IPC Lights.

Table 2. Warning Lamps.

LOCATION	WARNING LIGHT	REPRESENTATION	COLOR	DRIVEN BY
1	Range inhibited	RANGE INHIBITED	YELLOW	Status transmitted on drivetrain J1939 data link from ESC. Input to ESC from transmission controller.
2	Economy	ECON	N/A	Lamp is not used.
3	Fuel filter	FUEL FILTER	N/A	Lamp is not used.
4	Warn engine	ENGINE	YELLOW	Status transmitted on drivetrain J1939 data link from engine controller.
5	Stop engine	ENGINE	RED	Status transmitted on drivetrain J1939 data link from engine controller.
6	Brake warning	BRAKE	N/A	Lamp is not used.
7	Brake fluid	BRAKE FLUID	N/A	Lamp is not used.
8	Wait to start	WAIT TO START	N/A	Lamp is not used.
9	Check transmission	CHECK TRANS	YELLOW	Status transmitted on drivetrain J1939 data link from ESC. Input to ESC from transmission controller.
10	Trailer ABS	Trailer ABS icon	YELLOW	Status transmitted on drivetrain J1939 data link from ESC. Input to ESC from ABS controller.
11	Washer Fluid	WASHER FLUID	N/A	Lamp is not used.
12	Left turn	Left turn signal icon	GREEN	Status transmitted from ESC on drivetrain J1939 data link. Input to ESC from turn signal switch.

THEORY OF OPERATION - (CONTINUED)

13	Traction control	TRAC CTRL	N/A	Lamp is not used.
14	Water in fuel	WATER IN FUEL	YELLOW	Status transmitted on drivetrain J1939 data link from ESC. Input to ESC from fuel filter. (Does not light up during testing procedures.)
15	Service park brake	SERVICE (P)	N/A	Lamp is not used.
16	Check electrical system	CHECK ELEC SYS	N/A	Lamp is not used.
17	Park brake	PARK BRAKE	RED	Status transmitted on drivetrain J1939 data link from ESC. Input to ESC from park brake switch.
18	Cruise control active	CRUISE	GREEN	Active status transmitted on drivetrain J1939 data link from ESC. Input to ESC from cruise switch.
19	Antilock braking system	ABS icon	YELLOW	Status transmitted on drivetrain J1939 data link from ESC. Input to ESC from ABS controller.
20	Right turn	Right turn signal icon	GREEN	Status transmitted on drivetrain J1939 data link from ESC. Input to ESC from turn signal switch.
21	Coolant level	COOLANT LEVEL	RED	Status transmitted on drivetrain J1939 data link from ESC. On when coolant level < 25%. Input to ESC from surge tank.
22	Fasten seatbelt	Fasten seatbelt icon	RED	Status transmitted on drivetrain J1939 data link from ESC. On when engine on, occupants in driver and commander seats, and seatbelts unfastened
23	High beam	High beam icon	BLUE	Status transmitted on drivetrain J1939 data link from ESC. Input to ESC from high beam switch.
24	Idle shut down	IDLE SHUT DOWN	N/A	Lamp is not used.
25	Blank	N/A	N/A	Lamp is not used.
26	Retard Overheat	RETARD OVERHEAT	N/A	Lamp is not used.
27	Power take-off	PTO	N/A	Lamp is not used.
28	Front axle differential lock	FR AXLE DIFF LOCK	N/A	Lamp is not used.
29	Rear axle differential lock	RR AXLE DIFF LOCK	N/A	Lamp is not used.
30	Snow valve	SNOW VALVE	N/A	Lamp is not used.
31	Front axle engaged	FR AXLE ENGAGED	N/A	Lamp is not used.

For IPC gauge, digital display, and reset switch location, refer to Figure 12 For IPC warning light location, refer to Figure 13.

The IPC components include gauges, warning lamps, a digital display, a display set/reset button, an audible alarm, and a panel dimmer switch. The IPC communicates with the Electronic System Controller (ESC) and other controllers through the J1939 data link.

GAUGES

The IPC has nine stepper motor-driven gauges. All gauges except the speedometer and tachometer have their own warning lights, which signal the operator when gauge readings are outside preset limits.

THEORY OF OPERATION - (CONTINUED)

GAUGE DATA

The IPC continuously monitors incoming gauge data for out-of-range or data-not-present conditions. If the data is out of range, the cluster or gauge pack will turn on the Light Emitting Diode (LED) embedded in the respective gauge.

If data is not available for a small gauge in the IPC, the needle will be driven clockwise to the 6 o'clock position. If data is not available for the speedometer or tachometer, the gauge will repeat the following sequence three times:

1. Go immediately to the zero position.
2. Sweep up to the 50% position.
3. Sweep back to zero.
4. Pause.

GAUGE, WARNING LAMP, AND LCD CHECK AT KEY ON

After the ignition is turned on, the Instrument Panel Cluster (IPC) displays a gauge and lamp check sequence. All gauges must sweep from zero to maximum to zero in unison. All of the gauge warning lights will illuminate along with the panel warning lights that are associated with features installed on the vehicle. The alarms associated with each gauge warning light do not sound. All of the segments of the IPC Liquid Crystal Display (LCD) should display while the gauges sweep. At the end of the sweep, the LCD will turn off all segments for 5 seconds, display the firmware version number, and then return to operational mode. The lights controlled by the panel dimmer in the IPC will also come on during the gauge sweep.

If the instrument cluster experiences a system fault, it will transmit a fault message to the Electronic System Controller (ESC).

Mode and Select/Reset Switch

The IPC includes a select/reset switch, used to control the digital display. The switch interfaces directly with the IPC and is located on the lower right of the IPC lens. The switch allows the user to select modes within each major area of the display and perform reset functions. Each time the switch is momentarily depressed, the display will progress to the next mode. Depressing the switch for 3 seconds while in the odometer mode will switch the display between miles and kilometers. Depressing the switch for 3 seconds or more in other modes will clear the display or toggle between options, depending upon the current mode. The reset function has no effect if the parameter cannot be reset.

AUDIBLE ALARM SYSTEM

The Instrument Panel Cluster (IPC) contains an audible alarm that is capable of producing different beep counts and beep durations. The alarm type for each gauge is determined by the alarm code programmed for that gauge in the Electronic Systems Controller (ESC).

Pressing and holding the top of the panel dimmer switch and the set/reset switch for 5 seconds will disable the cluster alarm for all warning conditions until the engine speed reaches 325 rpm or the ignition is cycled.

One-Time, Five-Short-Beeps Alarm

An out-of-range value in any of the following gauges will trigger a one-time, five-short-beeps, audible alarm and visual indicator light in the corresponding gauge. The alarm will sound only once per gauge during each ignition cycle.

- Fuel level
- Voltmeter
- Engine oil pressure
- Engine coolant temperature

THEORY OF OPERATION - (CONTINUED)

- Transmission oil temperature
- Engine oil temperature

Repetitive, One-Long-Beep Alarm

An out-of-range-value in either of the following gauges will trigger a repetitive, one-long-beep, audible alarm and visual indicator light in the corresponding gauge. The alarm will stop as soon as normal conditions are re-established.

- Primary air pressure
- Secondary air pressure

One-Time, 10-Short-Beeps Alarm

A loss of communication to the IPC from the ESC or engine controller on the J1939 data link will trigger a one-time, 10-short-beeps, audible alarm.

One-Time, Three-Long-Beeps Alarm

A sensor fault error will result in the small gauge pointer being driven clockwise to the 6 o'clock position and a three-long-beep audible alarm. The same audible alarm accompanies the speedometer and tachometer if they are missing data. The gauge pointers in the speedometer and tachometer will repeat the following sequence three times and then park the pointer at the minimum position until the sensor fault is no longer active.

1. Go immediately to the zero position
2. Sweep up to a 50% position
3. Immediately sweep back to zero
4. Pause

Repetitive Short-Duration Blips

The turn signal will be accompanied by a sequence of short blips synchronized with the flashing of the lamps. This audio indicator repeats each time the ESC requests that the IPC turn on the turn signal lights. The audio indicator does not accompany the application of the hazard lights.

HEATING VENTILATION and AIR CONDITIONING (HVAC)

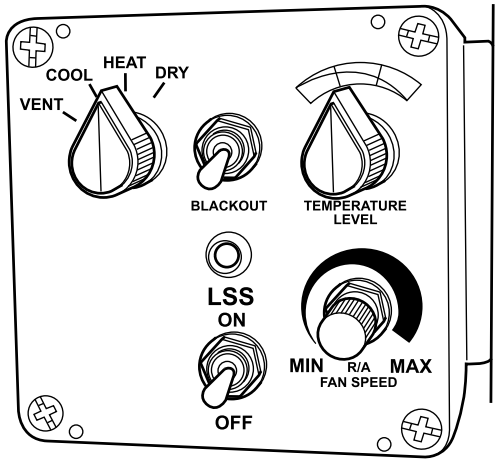


Figure 14. HVAC/LSS System Controls.

THEORY OF OPERATION - (CONTINUED)

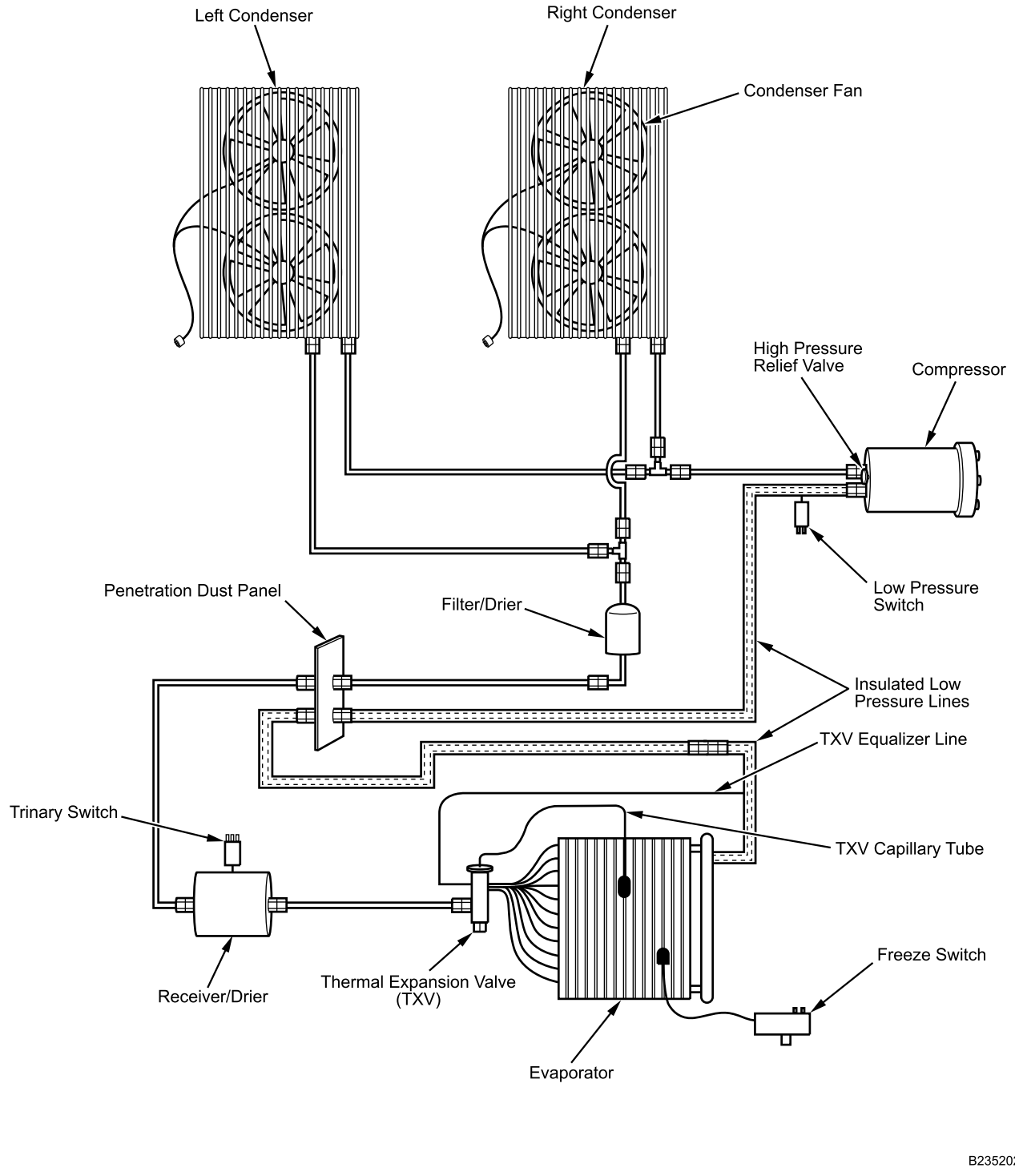


Figure 15. HVAC System Air Conditioning (A/C) Diagram.

For HVAC/LSS controls refer to Figure 14 For an HVAC/LSS system A/C diagram refer to Figure 15.

THEORY OF OPERATION - (CONTINUED)

Airflow

Fresh air is drawn through the fresh air inlet tube, which is located behind the passenger seat and connected between the roof and HVAC/LSS box. The Fresh Air (FA) blower forces air through the Nuclear, Biological, and Chemical (NBC) filter and across the A/C evaporator and heater core. Conditioned air is then mixed with recycled cabin air and distributed throughout the cabin by the Recycled Air (RA) blower.

The FA blower and RA blower are running anytime the LSS switch is in the ON position. The FA blower speed is not adjustable and is limited to 100 cubic feet per minute (cfm) by the NBC filter. The RA blower speed can be controlled with the R/A FAN SPEED control knob on the HVAC/LSS operator panel. The HVAC/LSS employs a cabin overpressure strategy that utilizes the FA blower and an overpressure relief valve to achieve a cabin pressure of 2.8 inch W.C. (± 0.8 inch W.C.) (700 pascal [± 200 pascal]) above atmospheric pressure. The overpressure relief valve is located in the cabin roof, near the back of the cabin, on the left side.

Operating Modes

The HVAC/LSS operator panel offers four operating modes: VENT, COOL, HEAT, and DRY. Mode doors are not used to control temperature. The A/C compressor is commanded on for cooling, and coolant is routed to the heater core for heating. A manually operated mode door can redirect some air from the main air duct to the defogging air duct to eliminate moisture from the windshield. Mode switch operation is as follows:

- VENT mode selected and LSS switch ON: FA and RA blowers will be commanded on. RA blower speed may be changed via the R/A FAN SPEED knob. The HVAC/LSS will not heat or cool the cabin air in this mode.
- COOL mode selected, LSS switch ON: engine running. FA and RA blowers will be commanded on. RA blower speed may be changed using the RA/FAN SPEED knob. If the transmission is in N (NEUTRAL), the Climate Control Unit (CCU) will command an increased idle speed by sending a 24V signal through the high idle request circuit to the AIR COND relay. The AIR COND relay will complete a ground circuit to the Electronic Systems Controller (ESC). The ESC sends a high idle speed request via the J1939 data link to the engine controller. The engine controller will increase engine speed to 1,300 rpm (± 800 rpm) within 10 seconds. If transmission gear selector is taken out of N (NEUTRAL) or the parking brake (YELLOW knob) is not applied, the engine speed will immediately return to base engine idle speed.
  The CCU monitors the RA temperature sensor to determine if the A/C compressor should be commanded on. The CCU will command the A/C compressor on only when RA temperature is warmer than 67°F (± 4°F) (19.4°C [± 2°C]). The condenser fans turn on when A/C system high-side pressure reaches 232 psi (± 25.4 psi) (1,600 kPa [± 175 kPa]). The freeze switch will signal the CCU to turn off the A/C compressor clutch if the A/C evaporator temperature is colder than 39.2ºF (± 3.6ºF) (4ºC [± 2ºC]). It will not turn back on until A/C evaporator temperature is warmer than 42.8ºF (± 3.6ºF) (6ºC [± 2ºC]).
- HEAT mode selected, TEMPERATURE LEVEL switch in maximum heat position, and LSS switch ON: Engine running at operating temperature, FA and RA blowers will be commanded on. The RA blower speed may be changed using the R/A FAN SPEED knob. The CCU monitors the RA temperature sensor and opens or closes the 3-way valve to divert hot engine coolant to the heater core to regulate cabin temperature. The A/C compressor will not be commanded on in this mode.

THEORY OF OPERATION - (CONTINUED)

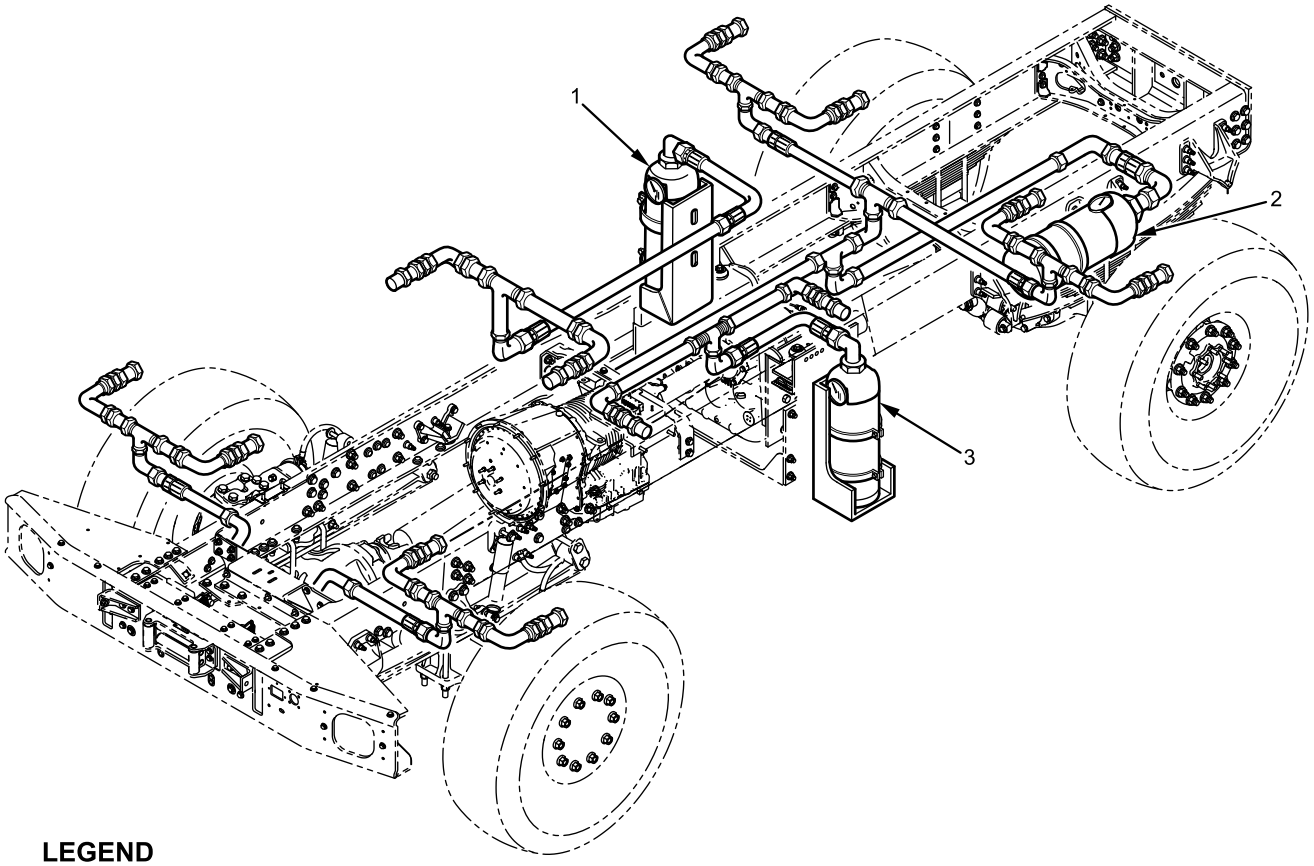
- DRY mode selected, LSS switch ON: engine running. FA and RA blowers will be commanded on. The RA blower speed may be changed using the R/A FAN SPEED knob. If the transmission gear selector is in N (NEUTRAL), the CCU will command an increased idle speed by sending a 24V signal through the high-idle request circuit to the AIR COND relay. The AIR COND relay will complete a ground circuit to the Electronic Systems Controller (ESC). The ESC sends a high-idle speed request via the J1939 data link circuit to the engine controller. The engine controller will increase engine speed to 1,300 rpm (± 800 rpm) within 10 seconds. If transmission gear selector is taken out of N (NEUTRAL) or parking brake (YELLOW knob) is not applied, the engine speed will immediately return to base engine idle speed. The A/C compressor will be commanded on. Within about 15 seconds, the condenser fans will be commanded on. In this mode, the compressor will continue running while the condenser fans cycle on and off to keep A/C high-side pressure between 174 psi (± 29 psi) and 232 psi (± 25.4 psi) (1,200 kPa [± 200 kPa] and 1,600 kPa [± 175 kPa]). The CCU uses the trinary medium switch to monitor high-side refrigerant pressure to determine condenser fan operation. The CCU will command the 3-way valve to divert hot engine coolant to the heater core in the HVAC/LSS. The CCU monitors the RA temperature sensor and opens or closes the 3-way valve to divert hot engine coolant to the heater core to regulate cabin temperature. Air is heated and dehumidified in DRY mode.

NOTE

In DRY mode, when the three-position TEMPERATURE LEVEL switch is cycled from cool to warm, the A/C compressor and condenser fans may shut off for 2-8 minutes. During this time, turning the LSS switch off, then back on, will reset the system, restarting the A/C compressor and condenser fans. If the LSS switch is not switched off and then back on, the CCU will automatically reset and restart the A/C compressor and condenser fans.

THEORY OF OPERATION - (CONTINUED)

FIRE SUPPRESSION SYSTEM (FSS)



LEGEND

1 ENGINE CYLINDER
2 TIRES CYLINDER
3 FUEL TANK CYLINDER

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Figure 16. Fire Suppression System Chassis Components.

THEORY OF OPERATION - (CONTINUED)

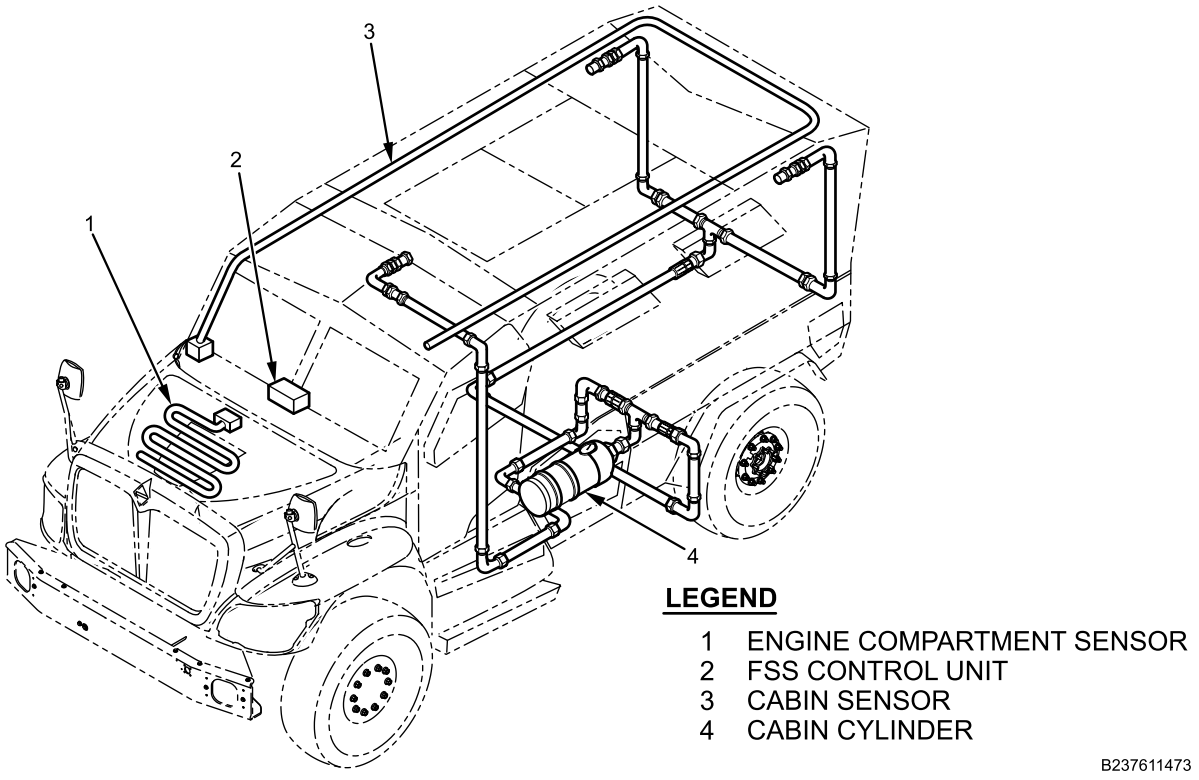


Figure 17. Fire Suppression System Cabin and Hood Components.

For fire suppression system chassis component location and identification, refer to Figure 16. For fire suppression system cabin and hood component location and identification, refer to Figure 17.

The vehicle is equipped with a sensor-activated and crew-operated fire suppression system (FSS) with four subsystems that protect the cabin and occupants, the engine, the tires, and the fuel tank.

The cabin protection system uses a water mist spray without chemical additives, designed to protect occupants from extreme heat for a period of 3 minutes. There are different media for the other three areas: HFC227ea Clean Agent for the engine, Petrotech TM25 for the tires, and Dry Powder ABC 70 for the fuel tank.

The control unit for the FSS is located between the driver and front passenger seats.

Fire suppression cylinders are under pressure when full. Each fire suppression unit incorporates a 24V pressure-sensing transducer and a 24V dispersion solenoid. The transducers send a signal to the fire suppression control box to indicate the state of charge. When the 24V dispersion solenoid is activated, pressure in the suppression unit cylinder forces the fire suppression media to escape through corresponding dispersion hoses, pipes, and nozzles.

There are two heat detector sensor modules and detection circuits. The sensor module for the cabin heat detector is located inside the vehicle at the right front A-pillar near the floor. The sensor wire runs up the A-pillar, to the rear of the vehicle along the interior roof, along the back of the vehicle, and then forward. If a sudden increase in temperature is detected along this wire, the control unit will activate the cabin fire suppression unit. If the heat detector fails to detect a fire, the CABIN switch on the control unit can be used to override the heat detector and activate the cabin fire suppression unit.

The engine compartment heat detector sensor module and circuit are located under the hood in the engine compartment. If a sudden increase in temperature is detected along this wire, the control unit will activate the engine fire suppression unit. If the heat detector fails to detect fire, the ENGINE switch on the control unit can be used to override the heat detector and activate the engine fire suppression unit.

THEORY OF OPERATION - (CONTINUED)

There are no heat detectors for the tires or the fuel tank. The fire suppression units are manually activated by using the corresponding switch on the control box.

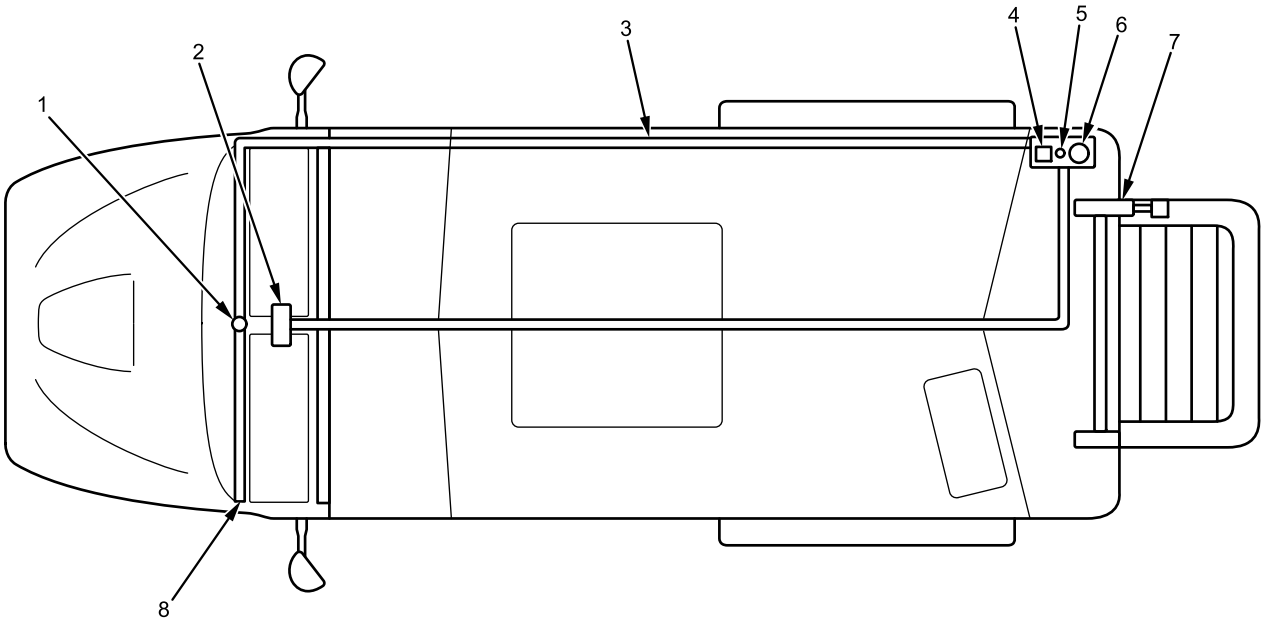
The control unit manages the automatic and manual functions of the FSS and monitors the pressure in the fire suppression units. A RED LED is provided for each fire suppression unit. An illuminated RED LED indicates one of several conditions:

- An automatic or manual request for fire suppression was received.
- The corresponding fire suppression cylinder is low on pressure or is empty.
- An open circuit between the control box and the corresponding fire suppression unit has been detected.

All four RED LEDs will illuminate when the LAMP TEST button is pushed.

The GREEN light will illuminate when the MAIN POWER switch and FSS power switch are turned on.

REAR DOOR/RAMP



LEGEND

1 SWITCH
2 24V POWER DISTRIBUTION PANEL
3 REAR DOOR CONTROL HARNESS
4 HAND PUMP
5 SWITCH
6 MOTOR AND PUMP
7 HYDRAULIC CYLINDER
8 IP HARNESS

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Figure 18. Rear Door Ramp System Diagram.

For rear door/ramp system component identification and location, refer to Figure 18

Hydraulic pressure controls the movement of the rear door/ramp assembly and related components. The following components are part of the hydraulic lift system:

• The hydraulic power unit (HPU) consists of the electric motor and pump, manifold, hand pump, and, on some HPUs, an accumulator. The HPU is fastened to vehicle-mounted brackets at the right rear corner of the crew

THEORY OF OPERATION - (CONTINUED)

compartment. The manifold uses solenoids to direct the hydraulic fluid in the proper direction to extend or retract the rear door/ramp hydraulic cylinder. Operator switches located on the pump cover and center instrument panel energize the pump and solenoids. On vehicles so equipped, the accumulator stores the hydraulic fluid necessary to operate the system. A hand pump is incorporated into the HPU to allow manual operation of the hydraulic system if there is an electrical system failure. A hose at the bottom of the motor and pump or, on vehicles so equipped, the accumulator transfers hydraulic fluid to the hand pump for manual system operation.

• Two hydraulic hoses connect the HPU manifold to the hydraulic cylinder manifold. Hydraulic fluid is directed through the hoses by the solenoids on the HPU manifold.

• The hydraulic cylinder consists of a hydraulically operated cylinder with a manifold and, on some cylinders, a counterbalance valve. In response to switch input, the manifold on the HPU directs fluid through hoses, to the proper side of the hydraulic cylinder's manifold, to raise or lower the rear door/ramp. The hydraulic cylinder is attached to the rear door/ramp and the roof-mounted interior bracket. Cylinder movement is dampened by a gas spring.

END OF WORK PACKAGE

CHAPTER 2

TROUBLESHOOTING PROCEDURES

FOR

MINE RESISTANT AMBUSH PROTECTED (MRAP)

FIELD MAINTENANCE

TROUBLESHOOTING INDEX

Troubleshooting Index - (CONTINUED)

Troubleshooting Index - (CONTINUED)

Transmission

Transfer Assembly

Troubleshooting Index - (CONTINUED)

Troubleshooting Index - (CONTINUED)

END OF WORK PACKAGE

CHAPTER 3

TROUBLESHOOTING PROCEDURES

FOR

MINE RESISTANT AMBUSH PROTECTED (MRAP)

FIELD MAINTENANCE

VEHICLE TROUBLESHOOTING SYMPTOM INDEX

Vehicle Troubleshooting Symptom Index - (CONTINUED)

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE DIAGNOSTIC TROUBLE CODE (DTC) INDEX

INITIAL SETUP:

NOT APPLICABLE

Table 1. DTC Table.

DTC	CONDITION/DESCRIPTION	REPAIR INFORMATION
*Indicates AMBER engine lamp is ON and odometer message is displayed when DTC is set.		
111	No errors detected - System OK	
112	Electrical system voltage B+ Out of Range HIGH.	Refer to Engine Control Module (ECM) Troubleshooting Procedure (WP 0049).
113	Electrical system voltage B+ Out of Range LOW.	Refer to Engine Control Module (ECM) Troubleshooting Procedure (WP 0049).
114*	Engine Coolant Temperature (ECT) signal Out of Range LOW.	Refer to Engine Coolant Temperature (ECT) Sensor Troubleshooting Procedure (WP 0047).
115*	ECT signal Out of Range HIGH.	Refer to Engine Coolant Temperature (ECT) Sensor Troubleshooting Procedure (WP 0047).
121*	Intake Manifold Absolute Pressure (MAP) signal Out of Range HIGH.	Refer to Manifold Absolute Pressure (MAP) Sensor Troubleshooting Procedure (WP 0056).
122*	MAP signal Out of Range LOW.	Refer to Manifold Absolute Pressure (MAP) Sensor Troubleshooting Procedure (WP 0056).
123*	MAP in range DTC.	Refer to Manifold Absolute Pressure (MAP) Sensor Troubleshooting Procedure (WP 0056).
124*	Injection Control Pressure (ICP) signal Out of Range LOW.	Refer to Injection Control Pressure (ICP) Sensor Troubleshooting Procedure (WP 0040).
125*	ICP signal Out of Range HIGH.	Refer to Injection Control Pressure (ICP) Sensor Troubleshooting Procedure (WP 0040).
131*	Accelerator Position Signal (APS) Out of Range LOW.	Refer to Accelerator Position Sensor (APS)/Idle Validation Switch (IVS) Troubleshooting Procedure (WP 0050).
132*	APS Out of Range HIGH.	Refer to Accelerator Position Sensor (APS)/Idle Validation Switch (IVS) Troubleshooting Procedure (WP 0050).
133*	APS in range DTC.	Refer to Accelerator Position Sensor (APS)/Idle Validation Switch (IVS) Troubleshooting Procedure (WP 0050).
134*	Accelerator position and Idle Validation Switch (IVS) disagree.	Refer to Accelerator Position Sensor (APS)/Idle Validation Switch (IVS) Troubleshooting Procedure (WP 0050).
135*	IVS circuit DTC.	Refer to Accelerator Position Sensor (APS)/Idle Validation Switch (IVS) Troubleshooting Procedure (WP 0050).
141	Vehicle Speed Signal (VSS) Out of Range LOW.	Refer to Vehicle Speed Sensor (VSS) Troubleshooting Procedure (WP 0058).
142	VSS Out of Range HIGH.	Refer to Vehicle Speed Sensor (VSS) Troubleshooting Procedure (WP 0058).
143	Wrong number of Camshaft Position (CMP) signal transitions per camshaft revolution.	Refer to Camshaft Position (CMP) Sensor Troubleshooting Procedure (WP 0030).
144	CMP signal noise detected.	Refer to Camshaft Position (CMP) Sensor Troubleshooting Procedure (WP 0030).
145*	CMP signal inactive while ICP has increased.	Refer to Camshaft Position (CMP) Sensor Troubleshooting Procedure (WP 0030).
151	Barometric Pressure Sensor (BAP) signal Out of Range HIGH.	Refer to Barometric Pressure Sensor (BAP) Troubleshooting Procedure (WP 0052).
152	BAP signal Out of Range LOW.	Refer to Barometric Pressure Sensor (BAP) Troubleshooting Procedure (WP 0052).

ENGINE DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

154	Intake Air Temperature (IAT) signal Out of Range LOW.	Refer to Intake Air Temperature (IAT) Sensor Troubleshooting Procedure (WP 0055).
155	IAT signal Out of Range HIGH.	Refer to Intake Air Temperature (IAT) Sensor Troubleshooting Procedure (WP 0055).
211*	Engine Oil Pressure (EOP) signal Out of Range LOW.	Refer to Engine Oil Pressure (EOP) Sensor Troubleshooting Procedure (WP 0028).
212*	EOP signal Out of Range HIGH.	Refer to Engine Oil Pressure (EOP) Sensor Troubleshooting Procedure (WP 0028).
213	Remote throttle signal Out of Range LOW.	Vehicle not equipped with this feature.
214	Remote throttle signal Out of Range HIGH.	Vehicle not equipped with this feature.
215	VSS frequency Out of Range HIGH.	Refer to Vehicle Speed Sensor (VSS) Troubleshooting Procedure (WP 0058).
216	Electronic Pressure Governor (EPG) signal Out of Range LOW.	Vehicle not equipped with this feature.
225	EOP sensor signal in-range DTC.	Refer to Engine Oil Pressure (EOP) Sensor Troubleshooting Procedure (WP 0028).
226	EPG sensor signal Out of Range HIGH.	Vehicle not equipped with this feature.
231	American Truckers Association (ATA) data communication link error.	Refer to American Truckers Association (ATA) Communications/Data Communications Link (DLC) Troubleshooting Procedure (WP 0051).
236	Engine coolant level switch circuit DTC.	Refer to Engine Coolant Level System Troubleshooting Procedure (WP 0046).
241	Injection Pressure Regulator (IPR) regulator self-test failed.	Refer to Injection Pressure Regulator (IPR) Troubleshooting Procedure (WP 0041).
246	Engine Fan Control (EFC)-self-test failed.	Refer to Engine Fan Control (EFC) Troubleshooting Procedure (WP 0048).
256	Radiator shutter enable self-test failed.	If equipped
265	Exhaust Brake relay DTC.	Refer to Exhaust Brake Troubleshooting Procedure (WP 0090).
311*	Engine Oil Temperature (EOT) signal Out of Range LOW.	Refer to Engine Oil Temperature (EOT) Sensor Troubleshooting Procedure (WP 0029).
312*	EOT signal Out of Range HIGH.	Refer to Engine Oil Temperature (EOT) Sensor Troubleshooting Procedure (WP 0029).
313	EOP below warning level.	Refer to Engine Oil Pressure (EOP) Sensor Troubleshooting Procedure (WP 0028).
314	EOP below critical level.	Refer to Engine Oil Pressure (EOP) Sensor Troubleshooting Procedure (WP 0028).
315*	Engine speed above warning level.	Refer to Camshaft Position (CMP) Sensor Troubleshooting Procedure (WP 0030).
316	ECT unable to reach commanded set point.	Refer to Engine Coolant Temperature (ECT) Sensor Troubleshooting Procedure (WP 0047).
321	ECT above warning level.	Refer to Engine Coolant Temperature (ECT) Sensor Troubleshooting Procedure (WP 0047).
322	ECT above critical level.	Refer to Engine Coolant Temperature (ECT) Sensor Troubleshooting Procedure (WP 0047).
323	Engine coolant below warning/critical level.	Refer to Engine Coolant Level System Troubleshooting Procedure (WP 0046).
325	Power reduced, matched to cooling system performance.	Refer to Engine Coolant Temperature (ECT) Sensor Troubleshooting Procedure (WP 0047).
331*	ICP above system working range.	Refer to Injection Pressure Regulator (IPR) Troubleshooting Procedure (WP 0041).

ENGINE DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

332*	ICP above spec with engine off.	Refer to Injection Control Pressure (ICP) Sensor Troubleshooting Procedure (WP 0040).
333*	ICP above/below desired level.	Refer to Injection Pressure Regulator (IPR) System Troubleshooting Procedure (WP 0042).
334	ICP unable to achieve set point in time (poor performance).	Refer to Injection Pressure Regulator (IPR) System Troubleshooting Procedure (WP 0042).
335	ICP unable to build pressure during cranking.	Refer to Injection Pressure Regulator (IPR) System Troubleshooting Procedure (WP 0042).
421-426	Injector high side to low side open (cyl. number indicated).	Refer to Injector Drive Circuit Troubleshooting Procedure (WP 0054).
431-436	Injector high side shorted to low side (cyl. number indicated).	Refer to Injector Drive Circuit Troubleshooting Procedure (WP 0054).
451-456	High side shorted to ground or V BAT (cyl. number indicated).	Refer to Injector Drive Circuit Troubleshooting Procedure (WP 0054).
461-466	Cylinder contribution test failed (cyl. number indicated).	Refer to Diagnosing Scuffed Injectors Troubleshooting Procedure (WP 0039).
513*	Low side to bank 1 open.	Refer to Injector Drive Circuit Troubleshooting Procedure (WP 0054).
514*	Low side to bank 2 open.	Refer to Injector Drive Circuit Troubleshooting Procedure (WP 0054).
515*	Bank 1 low side short to ground or B+.	Refer to Injector Drive Circuit Troubleshooting Procedure (WP 0054).
521*	Bank 2 low side short to ground or B+.	Refer to Injector Drive Circuit Troubleshooting Procedure (WP 0054).
525*	Injector driver circuit DTC.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
612*	Incorrect ECM installed for CMP timing wheel.	Refer to Camshaft Position (CMP) Sensor Troubleshooting Procedure (WP 0030).
614*	Engine Family Rating Code (EFRC)/ECM configuration mismatch.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
621*	Engine using mfg. default rating program engine.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
622*	Engine using field default rating.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
623*	Invalid engine rating code; check ECM programming.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
624	Field defaults active.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
626	ECM unexpected reset.	Refer to Engine Control Module (ECM) Troubleshooting Procedure (WP 0049).
631*	Read Only Memory (ROM) self-test DTC.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
632	RAM memory - CPU self-test DTC.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
655	Programmable parameter list level incompatible.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
661	RAM programmable parameter list corrupt.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).

ENGINE DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

664	Calibration level incompatible.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).
665	Programmable parameter memory content corrupt.	Refer to Engine Control Module (ECM) Self-Diagnosis Troubleshooting Procedure (WP 0053).

END OF WORK PACKAGE

FIELD MAINTENANCE

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX

INITIAL SETUP:

NOT APPLICABLE

Table 1. DTC Table.

DTC	ESC CONNECTOR AND PIN NUMBER	CONDITION/DESCRIPTION	REPAIR INFORMATION
70 14 1 0	1600/4004/16, 32, 16	Park brake cannot be applied or cannot be released.	Refer to Park Brake Warning Lamp Troubleshooting Procedure (WP 0077).
70 14 1 1	1600/4004/16, 32, 16	Failure in the auto apply relay or in the air lines between the auto apply relay and the park brake switch.	Refer to Park Brake Warning Lamp Troubleshooting Procedure (WP 0077).
597 14 1 0	Hyd or Air w/o 4091 - 1600 Air w/4091 - 4004/33	Brake switch is stuck in the open or closed position.	Refer to Brake Switch Circuits Troubleshooting Procedure (WP 0168).
597 14 2 0	Hyd or Air w/o 4091 - 1600 Air w/4091 - 4004/33	Brake switch inputs do not match.	Refer to Brake Switch Circuits Troubleshooting Procedure (WP 0168).
610 14 1 0	1600/12	Loss of ignition feed for 10 seconds while the engine is running.	Refer to ESC Troubleshooting Procedure (WP 0068).
610 14 2 0	1600/2	Loss of accessory feed for 10 seconds while the engine is running.	Refer to ESC Troubleshooting Procedure (WP 0068).
611 14 2 1	4008/A	Solenoid power under-current.	Refer to 4-Pack Air Solenoid Circuits From Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
611 14 2 2	4008/A	Solenoid power over-current.	Refer to 4-Pack Air Solenoid Circuits From Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
611 14 2 3	4008/A	Solenoid power less than normal.	Refer to 4-Pack Air Solenoid Circuits From Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
611 14 2 4	4008/A	Solenoid power greater than normal.	Refer to 4-Pack Air Solenoid Circuits From Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
611 14 2 6	4008/A	Solenoid power has current flow when output commanded off.	Refer to 4-Pack Air Solenoid Circuits From Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
611 14 6 1	4008/F	Wiper power under-current.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
611 14 6 2	4008/F	Wiper power over-current.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

611 14 6 3	4008/F	Wiper power less than normal low current but more than open circuit.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
611 14 6 4	4008/F	Wiper power greater than normal high current and less than fusing current.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
611 14 6 6	4008/F	Wiper power has current flow when output commanded off.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
611 14 12 1	4007/E	Electric horn under-current.	Refer to Electric Horns Operational Checkout Procedure (WP 0107).
611 14 12 2	4007/E	Electric horn over-current.	Refer to Electric Horns Operational Checkout Procedure (WP 0107).
611 14 12 3	4007/E	Electric horn less than normal low current but more than open circuit.	Refer to Electric Horns Operational Checkout Procedure (WP 0107).
611 14 12 4	4007/E	Electric horn greater than normal high current and less than fusing current.	Refer to Electric Horns Operational Checkout Procedure (WP 0107).
611 14 12 6	4007/E	Electric horn has current flow when output commanded off.	Refer to Electric Horns Operational Checkout Procedure (WP 0107).
612 14 0 1	1600/2	Ignition out of range low.	Refer to ESC Troubleshooting Procedure (WP 0068).
612 14 0 2	1600/2	Ignition out of range high.	Refer to ESC Troubleshooting Procedure (WP 0068).
612 14 1 1	1600/33	Brake switch out of range low.	Refer to Brake Switch Circuits (WP 0168).
612 14 1 2	1600/33	Brake switch out of range high.	Refer to Brake Switch Circuits (WP 0168).
612 14 3 1	1600/16	Secondary air sensor out of range low. Pin 16 short to ground or open circuit.	Refer to Secondary Air Pressure Gauge Troubleshooting Procedure (WP 0087).
612 14 3 2	1600/16	Secondary air sensor out of range high. Pin 16 shorted high.	Refer to Secondary Air Pressure Gauge Troubleshooting Procedure (WP 0087).
612 14 4 1	1600/15	Primary air sensor/auxiliary air sensor out of range low. Pin 15 shorted low.	Refer to Primary Air Pressure Gauge (WP 0086).
612 14 4 2	1600/15	Primary air sensor/auxiliary air sensor out of range high. Pin 15 shorted high.	Refer to Primary Air Pressure Gauge Troubleshooting Procedure (WP 0086).
612 14 5 1	1600/10	Analog cruise switch input out of range low. Pin 10 shorted to ground or open circuit.	Refer to Cruise Control Troubleshooting Procedure (WP 0106).
612 14 5 2	1600/10	Analog cruise switch input out of range high. Pin 10 shorted high.	Refer to Cruise Control Troubleshooting Procedure (WP 0106).
612 14 23 1	4004/4	Fuel level sensor out of range low. Pin 4 shorted to ground.	Refer to Fuel Level Gauge Troubleshooting Procedure (WP 0085).
612 14 23 2	4004/4	Fuel level sensor out of range high. Pin 4 shorted high or open circuit.	Refer to Fuel Level Gauge Troubleshooting Procedure (WP 0085).
612 14 25 1	4004/5	Fuel level sensor out of range low. Pin 5 short to ground.	Refer to Fuel Level Gauge Troubleshooting Procedure (WP 0085).
612 14 25 2	4004/5	Fuel level sensor out of range high. Pin 5 shorted high or open circuit.	Refer to Fuel Level Gauge Troubleshooting Procedure (WP 0085).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

612 14 30 1	4004/27	Switched 5V sensor supply out of range low. Pin 27 shorted to ground or open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
612 14 30 2	4004/27	Switched 5V sensor supply out of range high. Pin 27 shorted high.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
612 14 33 1	4004/10	Engine oil temperature/park brake out of range low. Pin 10 short to ground.	Refer to Engine Oil Temperature (EOT) Gauge Troubleshooting Procedure (WP 0029). Refer to Secondary Air Pressure Gauge Troubleshooting Procedure (WP 0087).
612 14 33 2	4004/10	Engine oil temperature/park brake out of range high. Pin 10 short high.	Refer to Engine Oil Temperature (EOT) Gauge Troubleshooting Procedure (WP 0029). Refer to Secondary Air Pressure Gauge Troubleshooting Procedure (WP 0087).
612 14 35 1	4004/13	Brake application air out of range low. Pin 13 short to ground or open circuit.	Refer to AIR 1/Primary Air Pressure Gauge Troubleshooting Procedure (WP 0086).
612 14 35 2	4004/13	Brake application air out of range high. Pin 13 short high.	Refer to AIR 1/Primary Air Pressure Gauge Troubleshooting Procedure (WP 0086).
612 14 36 1	4004/3	Transmission oil temp out of range low. Pin 3 short to ground.	Refer to Malfunctioning Instrument Panel Cluster (IPC) Troubleshooting Procedure (WP 0072).
614 14 1 1	1600/34, 35, 36	Instrument Panel Cluster (IPC) / ESC communication error.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
614 14 1 2	1600/34, 35, 36	Instrument Panel Cluster (IPC) / ESC communication error.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
614 14 23 1	1600/34, 35, 36	Instrument Panel Cluster (IPC) / ESC communication error.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
614 14 23 2	1600/34, 35, 36	Instrument Panel Cluster (IPC) / ESC communication error.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
625 14 5 0	1600/29, 30	Switch pack data link fault.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
625 14 5 17	1600/29, 30	Switch Pack 4 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 18	1600/29, 30	Switch Pack 4 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 19	1600/29, 30	Switch Pack 4 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 20	1600/29, 30	Switch Pack 4 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

625 14 5 21	1600/29, 30	Switch Pack 4 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 33	1600/29, 30	Switch Pack 4 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 34	1600/29, 30	Switch Pack 4 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 35	1600/29, 30	Switch Pack 4 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 36	1600/29, 30	Switch Pack 4 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 37	1600/29, 30	Switch Pack 4 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 49	1600/29, 30	Switch Pack 4 Switch 3, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 50	1600/29, 30	Switch Pack 4 Switch 3, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 51	1600/29, 30	Switch Pack 4 Switch 3, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 52	1600/29, 30	Switch Pack 4 Switch 3, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 53	1600/29, 30	Switch Pack 4 Switch 3, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 65	1600/29, 30	Switch Pack 4 Switch 4, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 66	1600/29, 30	Switch Pack 4 Switch 4, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 67	1600/29, 30	Switch Pack 4 Switch 4, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 68	1600/29, 3	Switch Pack 4 Switch 4, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 69	1600/29, 30	Switch Pack 4 Switch 4, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 81	1600/29, 30	Switch Pack 4 Switch 5, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 82	1600/29, 30	Switch Pack 4 Switch 5, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

625 14 5 83	1600/29, 30	Switch Pack 4 Switch 5, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 84	1600/29, 30	Switch Pack 4 Switch 5, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 85	1600/29, 30	Switch Pack 4 Switch 5, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 97	1600/29, 30	Switch Pack 4 Switch 6, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 98	1600/29, 30	Switch Pack 4 Switch 6, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 99	1600/29, 30	Switch Pack 4 Switch 6, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 100	1600/29, 30	Switch Pack 4 Switch 6, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 5 101	1600/29, 30	Switch Pack 4 Switch 6, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 0	1600/29, 30	Switch Pack 3 not communicating with ESC. Switch data link fault.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 17	1600/29, 30	Switch Pack 3 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 18	1600/29, 30	Switch Pack 3 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 19	1600/29, 30	Switch Pack 3 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 20	1600/29, 30	Switch Pack 3 Switch 1. micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 21	1600/29, 30	Switch Pack 3 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 33	1600/29, 30	Switch Pack 3 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 34	1600/29, 30	Switch Pack 3 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 35	1600/29, 30	Switch Pack 3 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

625 14 6 52	1600/29, 30	Switch Pack 3 Switch 3, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 53	1600/29, 30	Switch Pack 3 Switch 3. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 68	1600/29, 30	Switch Pack 3 Switch 4, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 69	1600/29, 30	Switch Pack 3 Switch 4. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 84	1600/29, 30	Switch Pack 3 Switch 5, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 85	1600/29, 30	Switch Pack 3 Switch 5. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 100	1600/29, 30	Switch Pack 3 Switch 6, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 6 101	1600/29, 30	Switch Pack 3 Switch 6. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 17	1600/29, 30	Switch Pack 2 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 21	1600/29, 30	Switch Pack 2 Switch 1. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 36	1600/29, 30	Switch Pack 2 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 37	1600/29, 30	Switch Pack 2 Switch 2. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 52	1600/29, 30	Switch Pack 2 Switch 3, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 53	1600/29, 30	Switch Pack 2 Switch 3. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 68	1600/29, 30	Switch Pack 2 Switch 4, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 69	1600/29, 30	Switch Pack 2 Switch 4. Switch actuator or faulty micro switch	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 84	1600/29, 30	Switch Pack 2 Switch 5, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 85	1600/29, 30	Switch Pack 2 Switch 5. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 100	1600/29, 30	Switch Pack 2 Switch 6, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 7 101	1600/29, 30	Switch Pack 2 Switch 6. Switch actuator or faulty micro switch	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 17	1600/29, 30	Switch Pack 1 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 20	1600/29, 30	Switch Pack 1 Switch 1, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

625 14 15 21	1600/29, 30	Switch Pack 1 Switch 1. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 36	1600/29, 30	Switch Pack 1 Switch 2, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 37	1600/29, 30	Switch Pack 1 Switch 2. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 52	1600/29, 30	Switch Pack 1 Switch 3, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 53	1600/29, 30	Switch Pack 1 Switch 3. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 68	1600/29, 30	Switch Pack 1 Switch 4, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 69	1600/29, 30	Switch Pack 1 Switch 4. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 84	1600/29, 30	Switch Pack 1 Switch 5, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 85	1600/29, 30	Switch Pack 1 Switch 5. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 100	1600/29, 30	Switch Pack 1 Switch 6, micro switch inputs are in an invalid state.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
625 14 15 101	1600/29, 30	Switch Pack 1 Switch 6. Switch actuator or faulty micro switch.	Refer to Switch Pack Modules Troubleshooting Procedure (WP 0069).
627 14 11	4009/4010	ESC main power and ground interruption	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
639 14 0 240	1600/34, 35, 36	Engine brake torque not being communicated from the ECM or transmission retarder torque not being communicated from transmission.	Refer to Transmission Operational Checkout Troubleshooting Procedure (WP 0142).
639 14 1 240	1600/34, 35, 36	ABS controller not communicating with the ESC.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139).
639 14 2 240	1600/34, 35, 36	Electronic transmission controller communication has not been received.	Refer to Transmission Circuit Troubleshooting Procedure (WP 0141).
639 14 3 240	1600/34, 35, 36	Accelerator position not communicated to ESC.	Refer to Multiplexing Data Link Troubleshooting Procedure (WP 0067).
639 14 4 240	1600/34, 35, 36	Engine speed not communicated to ESC.	Refer to Multiplexing Data Link Troubleshooting Procedure (WP 0067).
639 14 5 240	1600/34, 35, 36	Current gear, range inhibit and check transmission lamps not communicated to ESC.	Refer to Transmission Operational Checkout Troubleshooting Procedure (WP 0142).
639 14 8 240	1600/34, 35, 36	Electronic pressure mode indicator not communicated to ESC.	Refer to Multiplexing Data Link Troubleshooting Procedure (WP 0067).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

639 14 33 239	1600/34, 35, 36	IPC not communicating with ESC.	Refer to Instrument Panel Cluster (IPC) Power and Data Link Circuits Troubleshooting Procedure (WP 0071).
639 14 82 254	1600/34, 35, 36	Pyrometer ammeter not communicating to ESC.	Refer to Engine Oil Pressure Gauge Operational Checkout Procedure (WP 0082).
1542 14 11	1600/1, 2, 12	ESC main power or ground interruption.	Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2023 14 105 or 205 6	N/A	IPC gauge location 5 (oil pressure) data unavailable to IPC. Data for this gauge is not being transmitted on the data link.	Refer to Engine Oil Pressure Gauge Operational Checkout Procedure (WP 0082).
2023 14 105 or 205 7	N/A	IPC gauge location 5 (oil pressure) data missing to IPC. Data for this gauge is not being transmitted on the data link.	Refer to Engine Oil Pressure Gauge Operational Checkout Procedure (WP 0082).
2023 14 106 or 206 5	N/A	IPC gauge location 6 sensor fault to primary IPC. There is a problem with the sensor that provides the data for this gauge. The gauge in this location is optional.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
2023 14 106 or 206 6	N/A	IPC gauge location 6 data unavailable to primary IPC. The data that this gauge displays should be, but is not, available at this time. The gauge in this location is optional.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
2023 14 106 or 206 7	N/A	IPC gauge location 6 data missing to primary IPC. The data for this gauge is not being transmitted on the data link. The gauge in this location is optional.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
2023 14 107 or 207 5	N/A	IPC gauge location 7 (fuel level) sensor fault to primary IPC. There is a problem with the sensor that provides the data for this gauge.	Refer to Fuel Level Gauge Troubleshooting Procedure (WP 0085).
2023 14 107 or 207 6	N/A	IPC gauge location 7 (fuel level) data unavailable to IPC. The data that this gauge displays should be, but is not, available at this time.	Refer to Fuel Level Gauge Troubleshooting Procedure (WP 0085).
2023 14 107 or 207 7	N/A	IPC gauge location 7 (fuel level) data unavailable to IPC. The data that this gauge displays should be, but is not, available at this time.	Refer to Fuel Level Gauge Troubleshooting Procedure (WP 0085).
2023 14 108 or 208 5	N/A	IPC gauge location 8. Primary Air Pressure Gauge sensor fault to IPC. There is a problem with the sensor that provides the data for this gauge.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

2023 14 108 or 208 6	N/A	IPC gauge location 8. Primary Air Pressure Gauge sensor fault to IPC. There is a problem with the sensor that provides the data for this gauge.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
2023 14 108 or 208 7	N/A	IPC gauge location 8. Primary Air Pressure Gauge sensor fault to IPC. The data for this gauge is not being transmitted on the data link.	Refer to Instrument Panel Cluster (IPC) Operational Checkout Procedure (WP 0070).
2023 14 109 or 209 5	N/A	IPC gauge location 9. Voltmeter sensor fault to IPC. There is a problem with the sensor that provides the data for this gauge.	Refer to 12V Voltmeter Operational Checkout Procedure (WP 0080).
2023 14 109 or 209 6	N/A	IPC gauge location 9. Voltmeter data unavailable to IPC. The data that this gauge displays should be, but is not, available at this time.	Refer to 12V Voltmeter Operational Checkout Procedure (WP 0080).
2023 14 109 or 209 7	N/A	IPC gauge location 9. Voltmeter data missing to IPC. The data for this gauge is not being transmitted on the data link.	Refer to 12V Voltmeter Operational Checkout Procedure (WP 0080).
2023 14 110 or 210 5	N/A	IPC gauge location 10. Secondary AirPressure Gauge sensor fault to IPC. There is a problem with the sensor that provides the data for this gauge.	Refer to IPC Operational Checkout Procedure (WP 0070).
2023 14 110 or 210 6	N/A	IPC gauge location 10. Secondary Air Pressure Gauge data unavailable to IPC. The data that this gauge displays should be, but is not, available at this time.	Refer to IPC Operational Checkout Procedure (WP 0070).
2023 14 110 or 210 7	N/A	IPC gauge location 10. Voltmeter data missing to IPC. The data for this gauge is not being transmitted on the data link.	Refer to IPC Operational Checkout Procedure (WP 0070).
2023 14 150 or 250 1	N/A	Loss of data link from ESC to IPC. Loss of communication in excess of 10 seconds.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2023 14 150 or 250 2	N/A	ECM not communicating with IPC. Loss of communication in excess of 10 seconds.	Refer to Multiplexing Data Link Troubleshooting Procedure (WP 0067).
2023 14 150 or 250 8	N/A	ABS warning light malfunction on IPC.	Refer to ABS Warning Lamp Troubleshooting Procedure (WP 0079).
2023 14 150 or 250 9	N/A	Trailer ABS warning light malfunction on primary IPC.	Refer to ABS Warning Lamp Troubleshooting Procedure (WP 0079).
2033 14 1 0	1601/A	Connector 1601 pin A is drawing current and it is configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

2033 14 1 1	1601/A	Connector 1601 pin A current overload.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 1 2	1601/A	Connector 1601 pin A output open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 1 3	1601/A	Connector 1601 pin A output shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 2 0	1601/E	Connector 1601 pin E is drawing current and it is configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 2 1	1601/E	Connector 1601 pin E (reverse lamps) current overload.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 2 2	1601/E	Connector 1601 pin E (reverse lamps). Output open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 2 3	1601/E	Connector 1601 pin E (reverse lamps). Output shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 3 0	1600/11	Connector 1600 pin 11. Electric Door Control Open Command, is drawing current and it is configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 3 1	1600/11	Connector 1600 pin 11. Electric Door Open current overloaded.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 3 2	1600/11	Connector 1600 pin 11. Electric Door Open circuit open.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 3 3	1600/11	Connector 1600 pin 11. Electric Door Open shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 4 0	1600/6	Connector 1600 pin 6. Fog Light Command is drawing current and it is configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 4 1	1600/6	Connector 1600 pin 6, Fog Light Command Output, current overload.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 4 2	1600/6	1600 pin 6, Fog Light Command Output, open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 4 3	1600/6	Connector 1600 pin 6, Fog Light Command Output, shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 5 0	1600/4	Connector 1600 pin 4 is drawing current and it is configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 5 1	1600/4	Connector 1600 pin 4 (Bus - Park Brake Relay). Output overloaded. Connector 1600 pin 4 current overload.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

2033 14 5 2	1600/4	Connector 1600 pin 4 open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 5 3	1600/4	Connector 1600 pin 4 shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 6 0	4004/17	Connector 4004 pin 17. There is a load on this pin that has been configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 6 1	4004/17	Connector 4004 pin 17. Body Trailer Marker & Tail Lamp relay is output overloaded.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 6 2	4004/17	Connector 4004 pin 17. Body Trailer Marker & Tail Lamp relay is output open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 6 3	4004/17	Connector 4004 pin 17. Body Trailer Marker & Tail Lamp relay is Output shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 7 0	4004/19	Connector 4004/ pin 19. There is a load on this pin that has been configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 7 1	4004/19	Connector 4004/ pin 1. (Air Solenoid Power) output overloaded.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 7 2	4004/19	Connector 4004/ pin 19 (Air Solenoid Power) output open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 7 3	4004/19	Connector 4004/ pin 19 (Air Solenoid Power) output shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 8 0	4004/20	Connector 4004/ pin 20 (Wiper High Speed Relay). There is a load on this pin that has been configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 8 1	4004/20	Connector 4004/ pin 20 (Wiper High Speed Relay) output overloaded.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 8 2	4004/20	Connector 4004/ pin 20 (Wiper High Speed Relay) output open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 8 3	4004/20	Connector 4004/ pin 20 (Wiper High Speed Relay) output shorted to ground.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
2033 14 9 0	4004/21	Connector 4004/ pin 21 (Stop Relay). There is a load on this pin that has been configured as Unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 9 1	4004/21	Connector 4004/ pin 21 (Stop Relay) output overloaded.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 9 2	4004/21	Connector 4004/ pin 21 (Stop Relay) output open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

2033 14 9 3	4004/21	Connector 4004/ pin 21 (Stop Relay) output shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 10 0	4004/22	Connector 4004/ pin 22. (4-Pack Air Solenoid Channel 3). There is a load on this pin that has been configured as unused.	Refer to 4-Pack Air Solenoid Circuits From Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 10 1	4004/22	4004/ pin 22 (4-Pack Air Solenoid Channel 3) current overload. Defective relay, or 4-pack air solenoid module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 10 2	4004/22	Connector 4004/ pin 22. Output open circuit (4-Pack Air Solenoid Channel 3). Open circuit, defective relay, or 4-pack air solenoid module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 10 3	4004/22	Connector 4004/ pin 22 (4-Pack Air Solenoid Channel 3). Output shorted to ground, defective relay, or 4-pack air solenoid module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 10 4	4004/22	Connector 4004/ pin 22 shorted to ground. Power to solenoid pack has been disabled due to solenoid 3 being shorted to ground.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 11 0	4004/23	4004/ pin 23 is drawing current and it is configured as unused.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 11 1	4004/23	Connector 4004/ pin 23 current overload.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 11 2	4004/23	Connector 4004/ pin 23 output open circuit.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 11 3	4004/23	Connector 4004/ pin 23 output shorted to ground.	Refer to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
2033 14 12 0	4004/24	4004/ pin 24 (4-Pack Air Solenoid Channel 2) is drawing current and it is configured as unused.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 12 1	4004/24	Connector 4004/ pin 24 (4-Pack Air Solenoid Channel 2) output overloaded.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 12 2	4004/24	Connector 4004/ pin 24 (4-Pack Air Solenoid Channel 2) open circuit, defective relay, or 4-Pack Air Solenoid Module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 12 3	4004/24	Connector 4004/ pin 24 (4-Pack Air Solenoid Channel 2) shorted to ground. defective relay or 4-Pack Air Solenoid Module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

2033 14 12 4	4004/24	Connector 4004/ pin 24 shorted to ground. Power to the solenoid pack has been turned off due to a short in solenoid 2.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 13 0	4004/25	Connector 4004/ pin 25, Park Position Unlock solenoid. There is a load on this pin and it has been configured as unused.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 13 1	4004/25	Connector 4004/ pin 25. Output overloaded. Bus connector 1602 pin 25, Park Position Unlock solenoid, output overloaded.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 13 2	4004/25	Connector 4004/ pin 25. Park Position Unlock solenoid, Output open circuit.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 13 3	4004/25	Connector 4004/ pin 25. Park Position Unlock solenoid, output shorted to ground.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 14 0	4004/29	Connector 4004/ pin 29 is drawing current and it is configured as unused.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
2033 14 14 1	4004/29	Connector 4004/ pin 29 current overload.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
2033 14 14 2	4004/29	Connector 4004/ pin 29 open circuit.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
2033 14 14 3	4004/29	Connector 4004/ pin 29 shorted to ground.	Refer to Windshield Wiper and Washer Operational Checkout Procedure (WP 0113).
2033 14 15 0	4004/30	4004/ pin 30 (4-Pack Air Solenoid Channel 4) is drawing current and it is configured as unused.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 15 1	4004/30	Connector 4004/ pin 30 (4-Pack Air Solenoid Channel 4) current overload.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 15 2	4004/30	Connector 4004/ pin 30 (4-Pack Air Solenoid Channel 4) open circuit.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 15 3	4004/30	Connector 4004/ pin 30 (4-Pack Air Solenoid Channel 4) shorted to ground, defective relay, or 4-pack air solenoid module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 15 4	4004/30	Connector 4004/ pin 30 shorted to ground. Power to the solenoid pack has been turned off due to a short in solenoid 4.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 16 0	4004/31	Connector 4004/ pin 31 is drawing current and it is configured as unused.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).

ELECTRONIC SYSTEM CONTROLLER (ESC) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

2033 14 16 1	4004/31	. Connector 4004/ pin 31 (4-Pack Air Solenoid Channel 1). Current overload, defective relay, or 4-Pack Air Solenoid Module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 16 2	4004/31	Connector 4004/ pin 31 (4-Pack Air Solenoid Channel 1). Open circuit, defective relay, or 4-Pack Air Solenoid Module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 16 3	4004/31	Connector 4004/ pin 31 (4-Pack Air Solenoid Channel 1). Shorted to ground, defective relay, or 4-Pack Air Solenoid Module.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).
2033 14 16 4	4004/31	Connector 4004/ pin 31 shorted to ground. Power to the solenoid pack has been turned off due to a short in solenoid 1.	Refer to 4-Pack Air Solenoid Circuits from Electronic System Controller (ESC) Troubleshooting Procedure (WP 0138).

END OF WORK PACKAGE

FIELD MAINTENANCE

TRANSMISSION DIAGNOSTIC TROUBLE CODE (DTC) INDEX

INITIAL SETUP:

NOT APPLICABLE

Table 1. DTC Table.

DTC	CONDITION/DESCRIPTION	REPAIR INFORMATION
*Indicates AMBER CHECK TRANS lamp is ON when DTC is set.		
P0121	Pedal Position Sensor, Low Voltage.	Refer to Accelerator Position Sensor (APS)/Idle Validation Switch (IVS) Troubleshooting Procedure (WP 0050).
P0123	Pedal Position Sensor, High Voltage.	Refer to Accelerator Pedal Sensor/Idle Validation Troubleshooting Procedure (WP 0050).
P0218	Transmission Fluid Over Temperature.	Refer to Transmission Fluid Over Temperature Troubleshooting Procedure (WP 0143).
P0602*	Transmission Control Module (TCM) Not Programmed.	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0144).
P0610*	Transmission Control Module (TCM) Vehicle Options (TRANS ID) Error.	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0144).
P0613*	Transmission Control Module (TCM) Processor.	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0144).
P0614*	Torque Control Data Mismatch – Engine Control Module (ECM)/Transmission Control Module (TCM).	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0144).
P0634*	Transmission Control Module (TCM) Internal Temperature Too High.	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0144).
P063E*	Auto Configuration Throttle Input Not Present.	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0144).
P063F	Auto Configuration Engine Coolant Temp Input Not Present.	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0144).
P0658*	Actuator Supply Voltage 1 (HSD1) Low.	Refer to Transmission High Side Driver Troubleshooting Procedures (WP 0145).
P0659*	Actuator Supply Voltage 1 (HSD1) High.	Refer to Transmission High Side Driver Troubleshooting Procedures (WP 0145).
P0702*	Transmission Control System Electrical (Trans ID).	Refer to Transmission Control System ID Troubleshooting Procedures (WP 0146).
P070C	Transmission Fluid Level Sensor, Low.	Refer to Transmission Fluid Level Sensor Troubleshooting Procedures (WP 0147).
P070D	Transmission Fluid Level Sensor, High.	Refer to Transmission Fluid Level Sensor Troubleshooting Procedures (WP 0147).
P0711*	Transmission Fluid Temperature Sensor Performance.	Refer to Transmission Temperature Sensor Troubleshooting Procedures (WP 0148).
P0712*	Transmission Fluid Temperature Sensor, Low.	Refer to Transmission Temperature Sensor Troubleshooting Procedures (WP 0148).
P0713*	Transmission Fluid Temperature Sensor, High.	Refer to Transmission Temperature Sensor Troubleshooting Procedures (WP 0148).
P0721*	Output Speed Sensor Performance.	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0149).
P0722*	Output Speed Sensor, No Signal.	Refer to Transmission Control Module (TCM) Operational Checkout Procedure (WP 0149).
P0726	Engine Speed Sensor Performance.	Refer to Transmission High Side Driver Troubleshooting Procedures (WP 0150).

TRANSMISSION DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

P0727	Engine Speed Sensor, No Signal.	Refer to Transmission High Side Driver Troubleshooting Procedures (WP 0150).
P0731*	Incorrect 1st Gear Ratio.	Refer to Internal Transmission Operational Checkout Procedure (WP 0151).
P0732*	Incorrect 2nd Gear Ratio.	Refer to Internal Transmission Operational Checkout Procedure (WP 0151).
P0733*	Incorrect 3rd Gear Ratio.	Refer to Internal Transmission Operational Checkout Procedure (WP 0151).
P0734*	Incorrect 4th Gear Ratio.	Refer to Internal Transmission Operational Checkout Procedure (WP 0151).
P0735*	Incorrect 5th Gear Ratio.	Refer to Internal Transmission Operational Checkout Procedure (WP 0151).
P0736*	Incorrect Reverse Gear Ratio.	Refer to Internal Transmission Operational Checkout Procedure (WP 0151).
P0776*	Pressure Control Solenoid 2, Stuck Off.	Refer to Transmission Pressure Control Solenoid 2 Troubleshooting Procedures (WP 0152).
P0777*	Pressure Control Solenoid 2, Stuck On.	Refer to Transmission Pressure Control Solenoid 2 Troubleshooting Procedures (WP 0152).
P0796*	Pressure Control Solenoid 3, Stuck Off.	Refer to Transmission Pressure Control Solenoid 3 Troubleshooting Procedure (WP 0153).
P0797*	Pressure Control Solenoid 3, Stuck On.	Refer to Transmission Pressure Control Solenoid 3 Troubleshooting Procedure (WP 0153).
P0842*	Transmission Pressure Switch 1, Low.	Refer to Transmission Pressure Switch Troubleshooting Procedures (WP 0154).
P0843*	Transmission Pressure Switch 1, High.	Refer to Transmission Pressure Switch Troubleshooting Procedures (WP 0154).
P0880	Transmission Control Module (TCM) Power Input Signal.	Refer to Transmission Circuit Troubleshooting Procedure (WP 0141).
P0881	Transmission Control Module (TCM) Power Input Signal Performance.	Refer to Transmission Circuit Troubleshooting Procedure (WP 0141).
P0882	Transmission Control Module (TCM) Power Input Signal, Low.	Refer to Transmission Circuit Troubleshooting Procedure (WP 0141).
P0883	Transmission Control Module (TCM) Power Input Signal, High.	Refer to Transmission Circuit Troubleshooting Procedure (WP 0141).
P0894*	Transmission Component Slipping.	Refer to Transmission Slipping Operational Checkout Procedure (WP 0155).
P0960*	Pressure Control Solenoid Main Modulation Control, Open.	Refer to Transmission Pressure Control Main MOD Troubleshooting Procedures (WP 0156).
P0962*	Pressure Control Solenoid Main Mod Control, Low.	Refer to Transmission Pressure Control Main MOD Troubleshooting Procedures (WP 0156).
P0963*	Pressure Control Solenoid Main Mod Control, High.	Refer to Transmission Pressure Control Main MOD Troubleshooting Procedures (WP 0156).
P0964*	Pressure Control Solenoid 2 Control, Open.	Refer to Transmission Pressure Control Solenoid 2 Troubleshooting Procedures (WP 0152).
P0966*	Pressure Control Solenoid 2 Control, Low.	Refer to Transmission Pressure Control Solenoid 2 Troubleshooting Procedures (WP 0152).
P0967*	Pressure Control Solenoid 2 Control, High.	Refer to Transmission Pressure Control Solenoid 2 Troubleshooting Procedures (WP 0152).
P0968*	Pressure Control Solenoid 3 Control, Open.	Refer to Transmission Pressure Control Solenoid 3 Troubleshooting Procedures (WP 0153).
P0970*	Pressure Control Solenoid 3 Control, Low.	Refer to Transmission Pressure Control Solenoid 3 Troubleshooting Procedures (WP 0153).
P0971*	Pressure Control Solenoid 3 Control, High.	Refer to Transmission Pressure Control Solenoid 3 Troubleshooting Procedures (WP 0153).

TRANSMISSION DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

P0973*	Shift Solenoid 1 Control, Low.	Refer to Transmission Shift Solenoid 1 Troubleshooting Procedures (WP 0153).
P0974*	Shift Solenoid 1 Control, High.	Refer to Transmission Shift Solenoid 1 Troubleshooting Procedures (WP 0153).
P1739*	Incorrect Low Gear Ratio.	Refer to Transmission Low Gear Troubleshooting Procedures (WP 0158).
P2670*	Actuator Supply Voltage 2 (HSD2), Low.	Refer to Transmission High Side Driver 2 Troubleshooting Procedures (WP 0159).
P2671*	Actuator Supply Voltage 2 (HSD2), High.	Refer to Transmission High Side Driver 2 Troubleshooting Procedures (WP 0159).
P2685*	Actuator Supply Voltage 3 (HSD3), Low.	Refer to Transmission High Side Driver 3 Troubleshooting Procedures (WP 0160).
P2686*	Actuator Supply Voltage 3 (HSD3), High.	Refer to Transmission High Side Driver 3 Troubleshooting Procedures (WP 0160).
P2714*	Pressure Control Solenoid 4, Stuck Off.	Refer to Transmission Pressure Control Solenoid 4 Troubleshooting Procedures (WP 0161).
P2715*	Pressure Control Solenoid 4, Stuck On.	Refer to Transmission Pressure Control Solenoid 4 Troubleshooting Procedures (WP 0161).
P2718*	Pressure Control Solenoid 4 Control, Open.	Refer to Transmission Pressure Control Solenoid 4 Troubleshooting Procedures (WP 0161).
P2720*	Pressure Control Solenoid 4 Control, Low.	Refer to Transmission Pressure Control Solenoid 4 Troubleshooting Procedures (WP 0161).
P2721*	Pressure Control Solenoid 4 Control, High.	Refer to Transmission Pressure Control Solenoid 4 Troubleshooting Procedures (WP 0161).
P2723*	Pressure Control Solenoid 1, Stuck Off.	Refer to Transmission Pressure Control Solenoid 1 Troubleshooting Procedures (WP 0162).
P2724*	Pressure Control Solenoid 1, Stuck On.	Refer to Transmission Pressure Control Solenoid 1 Troubleshooting Procedures (WP 0162).
P2727*	Pressure Control Solenoid 1 Control, Open.	Refer to Transmission Pressure Control Solenoid 1 Troubleshooting Procedures (WP 0162).
P2729*	Pressure Control Solenoid 1 Control, Low	Refer to Transmission Pressure Control Solenoid 1 Troubleshooting Procedures (WP 0162).
P2730*	Pressure Control Solenoid 1 Control, High.	Refer to Transmission Pressure Control Solenoid 1 Troubleshooting Procedures (WP 0162).
U0010	Controller Area Network (CAN) Bus Reset Counter Overrun.	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).
U0100*	Lost Communication with Engine Cotrol Module (ECM) (J1587).	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).
U0103*	Lost Communication with Gear Shift Module (Shift Selector) 1.	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).
U0115*	Lost Communication With Engine Control Module (ECM).	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).
U0291*	Lost Communication with Gear Shift Module (Shift Selector) 2.	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).
U0304*	Incompatible Gear Shift Module 1 (Shift Selector ID).	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).
U0333*	Incompatible Gear Shift Module 2 (Shift Selector ID).	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).

TRANSMISSION DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

U0404*	Invalid Data Received from Gear Shift Module (Shift Selector) 1.	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).
U0592*	Invalid Data Received from Gear Shift Module (Shift Selector) 2.	Refer to Transmission Communication Troubleshooting Procedures (WP 0163).

END OF WORK PACKAGE

FIELD MAINTENANCE

ANTILOCK BRAKE SYSTEM (ABS) DIAGNOSTIC TROUBLE CODE (DTC) INDEX

INITIAL SETUP:

NOT APPLICABLE

NOTE

Sequences of blinks illuminate the ABS indicator lamp for half a second, with half-second pauses between them. Pauses between blink code digits are 1.5 seconds. Pauses between blink code messages are 2.5 seconds. The lamp remains on for 5 seconds at the end of messages.

Once the ABS indicator lamp begins displaying a sequence of codes, it continues until all blink code messages have been displayed and then returns to the normal operating mode. During this time, the ABS control module will ignore any additional blink code switch activation.

Table 1. DTC Table.

1st BLINK CODE	2nd BLINK CODE	CONDITION/DESCRIPTION	REPAIR INFORMATION
2	1	Left Steer Axle Sensor Excessive Air Gap.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
2	2	Left Steer Axle Sensor Output Low at Drive-Off.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
2	3	Left Steer Axle Sensor Open or Shorted.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
2	4	Left Steer Axle Sensor Loss of Sensor Signal.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
2	5	Left Steer Axle Sensor Wheel End.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
2	6	Left Steer Axle Sensor Erratic Sensor Signal.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
2	7	Left Steer Axle Sensor Tire Size Calibration.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
2	10	Left Steer Axle Sensor Configuration Error.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
3	1	Right Steer Axle Sensor Excessive Air Gap.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
3	2	Right Steer Axle Sensor Output Low at Drive-Off.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
3	3	Right Steer Axle Sensor Open or Shorted.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
3	4	Right Steer Axle Sensor Loss of Sensor Signal.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
3	5	Right Steer Axle Sensor Wheel End.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
3	6	Right Steer Axle Sensor Erratic Sensor Signal.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
3	7	Right Steer Axle Sensor Tire Size Calibration.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
3	10	Right Steer Axle Sensor Configuration Error.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
4	1	Left Drive Axle Sensor Excessive Air Gap.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).

ANTILOCK BRAKE SYSTEM (ABS) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

4	2	Left Drive Axle Sensor Output Low at Drive-Off.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
4	3	Left Drive Axle Sensor Open or Shorted.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
4	4	Left Drive Axle Sensor Loss of Sensor Signal.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
4	5	Left Drive Axle Sensor Wheel End.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
4	6	Left Drive Axle Sensor Erratic Sensor Signal.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
4	7	Left Drive Axle Sensor Tire Size Calibration.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
4	10	Left Drive Axle Sensor Configuration Error.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
5	1	Right Drive Axle Sensor Excessive Air Gap.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
5	2	Right Drive Axle Sensor Output Low at Drive-Off.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
5	3	Right Drive Axle Sensor Open or Shorted.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
5	4	Right Drive Axle Sensor Loss of Sensor Signal.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
5	5	Right Drive Axle Sensor Wheel End.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
5	6	Right Drive Axle Sensor Erratic Sensor Signal.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
5	7	Right Drive Axle Sensor Tire Size Calibration.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
5	10	Right Drive Axle Sensor Configuration Error.	Refer to Antilock Brake System (ABS) Wheel Speed Sensor Troubleshooting Procedure (WP 0177).
6	1	Power Supply Battery Voltage Too Low.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
6	2	Power Supply Battery Voltage Too High.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
6	3	Power Supply Battery Voltage Too Low During ABS.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
6	4	Power Supply Battery Voltage Open Circuit.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
6	5	Power Supply Ignition Voltage Too Low.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
6	6	Power Supply Ignition Voltage Too High.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
6	7	Power Supply Ignition Voltage Too Low During ABS.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
6	8	Power Supply Input Voltage Has Excessive Noise (Temporary).	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
6	9	Power Supply Input Voltage Has Excessive Noise.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139)
7	1	Left Steer Axle Release Solenoid Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
7	2	Left Steer Axle Release Solenoid Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
7	3	Left Steer Axle Release Solenoid Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
7	4	Left Steer Axle Hold Solenoid Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).

ANTILOCK BRAKE SYSTEM (ABS) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

7	5	Left Steer Axle Hold Solenoid Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
7	6	Left Steer Axle Hold Solenoid Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
7	7	Left Steer Axle Common Circuit Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
7	8	Left Steer Axle Configuration Error.	If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
8	1	Right Steer Axle Release Solenoid Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
8	2	Right Steer Axle Release Solenoid Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
8	3	Right Steer Axle Release Solenoid Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
8	4	Right Steer Axle Hold Solenoid Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
8	5	Right Steer Axle Hold Solenoid Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
8	6	Right Steer Axle Hold Solenoid Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
8	7	Right Steer Axle Common Circuit Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
8	8	Right Steer Axle Configuration Error.	If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
9	1	Left Drive Axle Release Solenoid Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
9	2	Left Drive Axle Release Solenoid Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
9	3	Left Drive Axle Release Solenoid Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
9	4	Left Drive Axle Hold Solenoid Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
9	5	Left Drive Axle Hold Solenoid Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
9	6	Left Drive Axle Hold Solenoid Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
9	7	Left Drive Axle Common Circuit Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
9	8	Left Drive Axle Configuration Error.	If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
10	1	Right Drive Axle Release Solenoid Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
10	2	Right Drive Axle Release Solenoid Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
10	3	Right Drive Axle Release Solenoid Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
10	4	Right Drive Axle Hold Solenoid Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
10	5	Right Drive Axle Hold Solenoid Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).

ANTILOCK BRAKE SYSTEM (ABS) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

10	6	Right Drive Axle Hold Solenoid Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
10	7	Right Drive Axle Common Circuit Open Circuit.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Troubleshooting Procedure (WP 0178).
10	8	Right Drive Axle Configuration Error.	If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
11	1	J1939 Serial Communications Error.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139).
11	2	J1939 Retarder Communications Error.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139).
11	3	J1939 Engine Communications Error.	Refer to Antilock Brake System (ABS) J1939 Serial Communications Troubleshooting Procedure (WP 0139).
12	1	Stop Lamp Switch Not Detected.	Vehicle is not equipped with this feature. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
12	2	Stop Lamp Switch Defective.	Vehicle is not equipped with this feature. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
12	3	Automatic Traction Control (ATC) Disabled or Dynamometer Test Mode Active.	ABS control module has been placed in the dynamometer test mode by either the diagnostic blink code switch or a hand-held or PC-based diagnostic tool. ATC is disabled. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
12	7	PMV Common Shorted to Ground.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Common Circuit Troubleshooting Procedure (WP 0140).
12	8	PMV Common Shorted to Voltage.	Refer to Antilock Brake System (ABS) Pressure Modulator Valve (PMV) Common Circuit Troubleshooting Procedure (WP 0140).
12	9	ATC Disabled to Prevent Brake Fade.	ATC is temporarily disabled to prevent excessive heating of the foundation brakes. Informational DTC, no repair required.
12	10	Tire Size Out of Range (Front to Rear).	Verify proper tire inflation (TM 9-2355-106-10).Verify tire tread wear is not excessive. Refer to Preventive Maintenance Checks And Services (PMCS) Including Lubrication Instructions (WP 0216). Verify tone ring teeth are not damaged. Refer to Front Axle Antilock Brake System (ABS) Tone Ring Removal and Installation (WP 0483).
12	11	Wheel Speed Sensors Reversed on an Axle.	Sensors are reversed (left to right) on one of the axles. Verify proper installation, connection, and wiring of the sensors. Refer to Front Antilock Brake System (ABS) Sensor Removal and Installation (WP 0425).
12	12	Differential Lock Solenoid Shorted to Ground or Open Circuit.	Vehicle is not equipped with this feature. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
12	13	Differential Lock Solenoid Shorted to Voltage.	Vehicle is not equipped with this feature. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).

ANTILOCK BRAKE SYSTEM (ABS) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

12	23	I/O 2 or I/O 3 Shorted High.	Check for short circuit condition between voltage and the I/O 2 and I/O 3 circuits.
13	2	ABS control module circuit failure (10).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	3	ABS control module circuit failure (11).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	4	ABS control module circuit failure (12).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	5	ABS control module circuit failure (13).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	6	ABS control module circuit failure (14).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	7	ABS control module circuit failure (15).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	8	ABS control module circuit failure (16).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	9	ABS control module circuit failure (17).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	10	ABS control module circuit failure (18).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	11	ABS control module circuit failure (1A).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).

ANTILOCK BRAKE SYSTEM (ABS) DIAGNOSTIC TROUBLE CODE (DTC) INDEX - (CONTINUED)

13	12	ABS control module circuit failure (1B).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
13	13	ABS control module circuit failure (80).	Check for damaged or corroded connectors. Check for damaged wiring. Clear trouble codes. If DTCs return, replace the ABS control module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
18	1	Traction Control Valve (TCV) Solenoid Shorted to Ground.	Vehicle is not equipped with this feature. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
18	2	TCV Solenoid Shorted to Voltage.	Vehicle is not equipped with this feature. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
18	3	TCV Solenoid Open Circuit.	Vehicle is not equipped with this feature. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).
18	4	TCV Configuration Error.	Vehicle is not equipped with this feature. If this DTC sets, ABS control module is faulty. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).

END OF WORK PACKAGE

FIELD MAINTENANCE

VEHICLE OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0032
WP 0409
WP 0412
WP 0317
WP 0333
WP 0448
WP 0449
WP 0422
WP 0034
WP 0014
WP 0011
WP 0078
WP 0005
WP 0012
WP 0006
WP 0172
WP 0174
WP 0173
WP 0009
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

It is assumed that if a fault is found, the technician will correct it.

STEP

1. Perform following preliminary inspections:
2. Ensure that battery is fully charged. Refer to Battery Power Troubleshooting Procedure (WP 0032).
3. Ensure that battery cables are clean and tight. Refer to Battery Stud Adapter Terminal Clamp Removal and Installation (WP 0409).
4. Inspect for open fuses at following locations:
   - Engine Control Module (ECM) and Transmission Control Module (TCM) Clean Power Fuse (WP 0412)
   - Instrument Panel Circuit Breaker, Fuse, and Relay (WP 0317)
   - Power Distribution Center (PDC) Fuse and Relay (WP 0333)
   - Winch Mega Fuse and Holder (WP 0448)
   - 24V Inverter Megafuse and Fuse Holder (WP 0449)
   - 12V Underhood Megafuse and Holder (WP 0422)
5. Inspect easily accessible systems or visible system components for obvious damage or conditions that could cause symptom.

VEHICLE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Was condition found and corrected?

DECISION

YES Return vehicle to service.
NO Go to next step.

STEP

6. Note which vehicle system symptom is related to.

CONDITION/INDICATION

Is symptom related to engine?

DECISION

NO Go to Step 13.
YES Go to next step.

STEP

7. Perform engine start procedure (TM 9-2355-106-10).

CONDITION/INDICATION

Does engine crank?

DECISION

NO Go to Engine Does Not Crank Troubleshooting Procedure (WP 0034).
YES Go to next step.

STEP

8. Refer to results from Step 7.

CONDITION/INDICATION

Does engine start and run?

DECISION

NO Go to Hard Start/No Start Operational Checkout Procedure (WP 0014).
YES Go to next step.

STEP

9. Perform engine shutdown procedure (TM 9-2355-106-10).
10. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).

CONDITION/INDICATION

Does MSD communicate with Transmission Control Module (TCM) or Electronic System Controller (ESC)?

DECISION

NO Go to Diagnostic Connector Troubleshooting Procedure (WP 0078).
YES Go to next step.

VEHICLE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

STEP

11. Refer to results from Step 10.

CONDITION/INDICATION

Does MSD communicate with ECM?

DECISION

NO Go to Engine Control Module (ECM) Troubleshooting Procedure (WP 0049).
YES Go to next step.

STEP

12. Obtain Diagnostic Trouble Codes (DTCs) for ECM with MSD. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

Does MSD display current DTCs?

DECISION

NO Go to Vehicle Troubleshooting Symptom Index (WP 0005).
YES Go to Engine DTC Index (WP 0006).

STEP

13. Note which vehicle system symptom is related to.

CONDITION/INDICATION

Is symptom related to transmission?

DECISION

NO Go to Step 16.
YES Go to next step.

STEP

14. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).

CONDITION/INDICATION

Does MSD communicate with TCM?

DECISION

NO Go to Transmission Control Module (TCM) Power Operational Checkout Procedure (WP 0142).
YES Go to next step.

STEP

15. Obtain DTCs for TCM with MSD. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

VEHICLE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does MSD display current DTCs?

DECISION

NO Go to Vehicle Troubleshooting Symptom Index (WP 0005).
YES Go to Transmission DTC Index (WP 0008).

STEP

16. Note which vehicle system symptom is related to.

CONDITION/INDICATION

Is symptom related to chassis?

DECISION

NO Go to Step 19.
YES Go to next step.

STEP

17. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).

CONDITION/INDICATION

Does MSD communicate with ESC?

DECISION

NO Go to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
YES Go to next step.

STEP

18. Obtain DTCs for ESC with MSD. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

Does MSD display current DTCs?

DECISION

NO Go to Vehicle Troubleshooting Symptom Index (WP 0005).
YES Go to ESC DTC Index (WP 0007).

STEP

19. Note which vehicle system symptom is related to.

CONDITION/INDICATION

Is symptom related to antilock brakes?

DECISION

NO Go to Step 22.
YES Go to next step.

VEHICLE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

STEP

20. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).

CONDITION/INDICATION

Does MSD communicate with antilock brake control module?

DECISION

NO Go to American Truckers Association (ATA) Communications/Data Communications Link (DLC) Troubleshooting Procedure(WP 0051).
YES Go to next step.

STEP

21. Obtain DTCs for antilock brake module. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

Does antilock brake module display DTCs?

DECISION

NO Go to Vehicle Troubleshooting Symptom Index (WP 0005).
YES Go to Antilock Brake Diagnostic Trouble Code (DTC) Index (WP 0009).

STEP

22. Note which vehicle system symptom is related to.

CONDITION/INDICATION

Is symptom related to transfer case?

DECISION

YES Go to Vehicle Troubleshooting Symptom Index (WP 0005).
NO Go to next step.

STEP

23. Note which vehicle system symptom is related to.

CONDITION/INDICATION

Is symptom is related to service brakes?

DECISION

NO Go to Vehicle Troubleshooting Symptom Index (WP 0005).
YES Go to Air Brake System Operational Checkout Procedure (WP 0172), Air Dryer Heater and Thermostat Troubleshooting Procedure (WP 0174), and Air Brake Component Operational Checkout Procedure (WP 0173).

END OF WORK PACKAGE

FIELD MAINTENANCE

CONNECTING MAINTENANCE SUPPORT DEVICE (MSD)

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

MAINTENANCE SUPPORT DEVICE

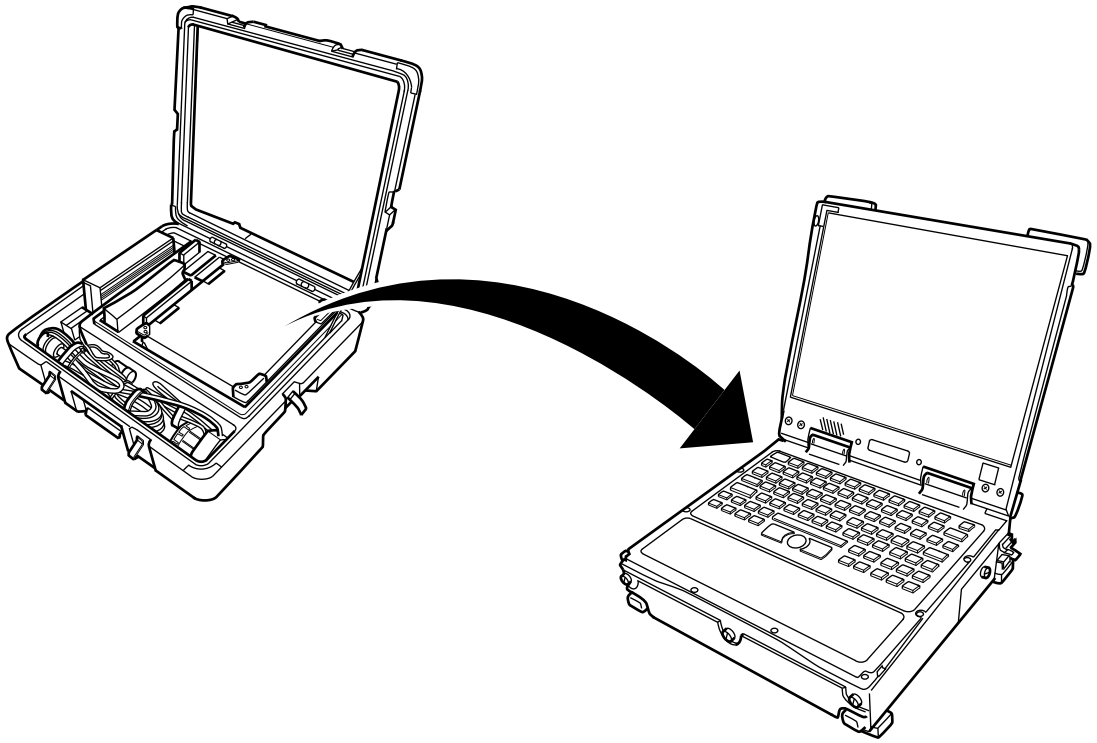


Figure 1. Maintenance Support Device and Power Cables.

The MSD laptop computer, along with troubleshooting software, is used to diagnose vehicle systems. The MSD communicates with vehicle control modules by means of an interface cable. The cable connects to the 9-pin American Trucking Association (ATA) diagnostic connector, located to the left of the steering column.

CONNECTING MAINTENANCE SUPPORT DEVICE (MSD) - (CONTINUED)

CONNECTING MSD TO VEHICLE

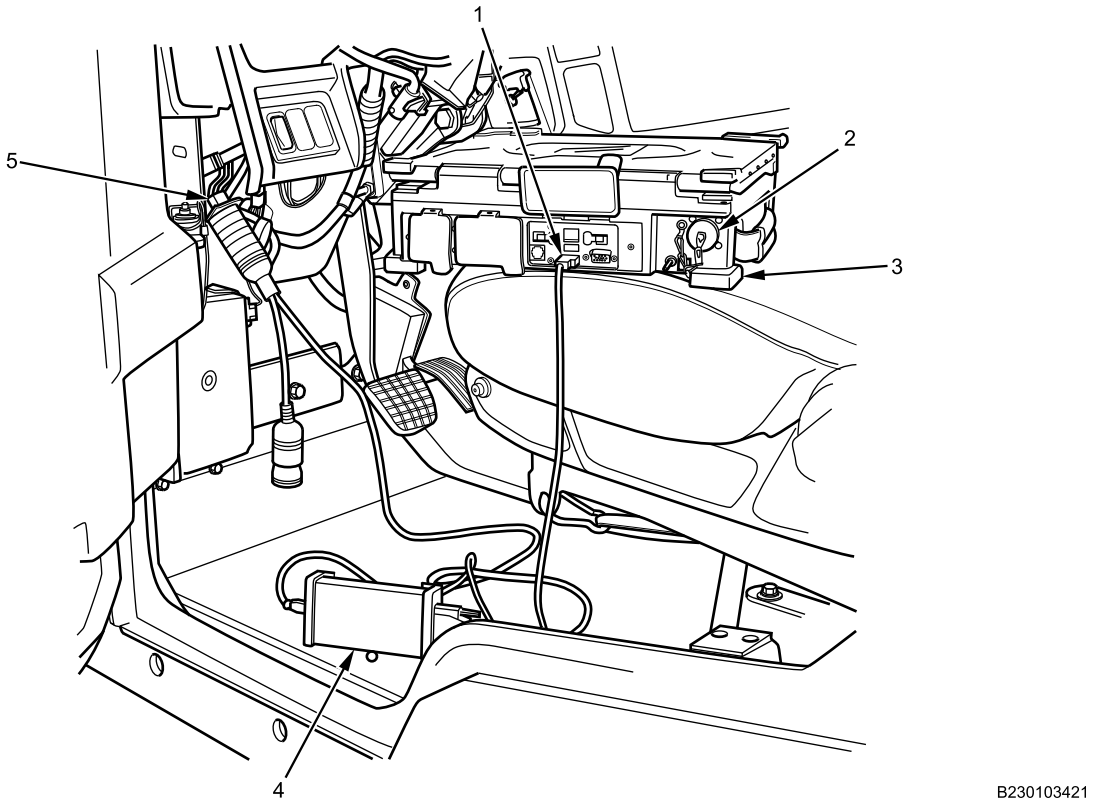


Figure 2. MSD to ATA Connection.

1. Connect 9-pin connector of truck interface cable (Figure 2, Item 4) to ATA 9-pin connector (Figure 2, Item 5) to left of steering column.
2. Connect USB connector on truck interface cable (Figure 2, Item 4) to USB port (Figure 2, Item 1) on back of MSD (Figure 2, Item 3).
3. To operate from external power, connect power cable or power pack to MSD power port (Figure 2, Item 2).
4. Turn MAIN POWER switch ON (TM 9-2355-106-10).
5. Turn ignition switch on.
6. Power up MSD (Figure 2, Item 3).

Table 1. Diagnostic Software.

System	Software
Engine	Service Assistant™
Transmission	Allision-DOC™ for PC-Service Tool
Antilock Brake System (ABS)	ACom™ Diagnostics
Body, Electronic System Controller (ESC), Instrument Panel Cluster (IPC), Switch Pack, J1939 Data Link Circuit	Diamond Logic® Builder

7. Double-click icon for appropriate diagnostic software. Refer to Table 1.

END OF WORK PACKAGE

FIELD MAINTENANCE

DIAGNOSTIC TROUBLE CODE (DTC) ACCESS PROCEDURE

INITIAL SETUP:

Test Equipment	TM 9-2355-106-23P
Maintenance Support Device (MSD) (WP 0795, Item 70)	WP 0011 WP 0782

References
TM 9-2355-106-10

This procedure covers retrieval of stored DTCs for the following control modules:

- Electronic System Controller (ESC)
- Engine Control Module (ECM)
- Antilock Brake System (ABS)
- Transmission Control Module (TCM)

MSD AVAILABLE

The MSD is capable of retrieving stored DTCs from each control module listed above. If available, use the MSD to retrieve DTCs.

DTC Retrieval Using MSD

1. Set transmission in NEUTRAL (N) (TM 9-2355-106-10).
2. Set parking brake (TM 9-2355-106-10).
3. Shut engine off (TM 9-2355-106-10).
4. Turn MAIN POWER switch off (TM 9-2355-106-10).
5. Chock wheels (TM 9-2355-106-10).
6. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
7. Turn MAIN POWER switch ON (TM 9-2355-106-10).
8. Turn ignition switch ON (TM 9-2355-106-10).
9. Record stored DTCs using MSD.

MSD UNAVAILABLE

If the MSD is unavailable, use the off-line diagnostic mode to retrieve DTCs by performing the following steps. The mode is specific to each control module.

ESC

1. Set parking brake (TM 9-2355-106-10).
2. Set transmission in NEUTRAL (N) (TM 9-2355-106-10).
3. Shut engine off (TM 9-2355-106-10).
4. Turn MAIN POWER switch ON (TM 9-2355-106-10).
5. Turn ignition switch ON (TM 9-2355-106-10).
6. Press and release CRUISE ON and RESUME/ACCEL buttons simultaneously during Instrument Panel (IP) gauge sweep.
7. Observe odometer display.
   a. The display will show the number of stored DTCs.
   b. After 10 seconds, the first DTC displays for 10 seconds before displaying the next DTC in the list. The cycle continues for all stored DTCs.

DIAGNOSTIC TROUBLE CODE (DTC) ACCESS PROCEDURE - (CONTINUED)

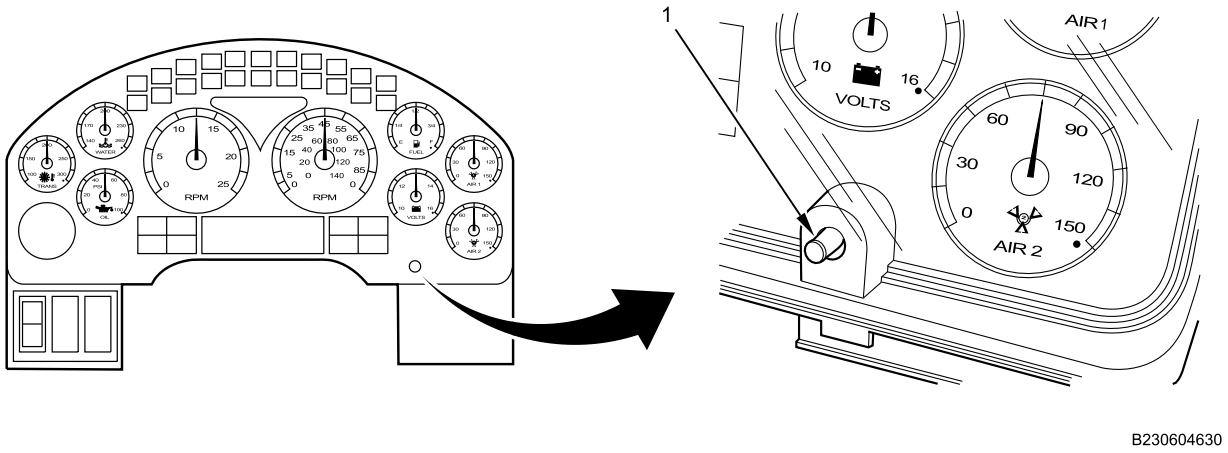


Figure 1. Select/Reset Button.

8. To manually cycle through the DTC list, press and release the cluster select/reset button (Figure 1, Item 1).
9. Record DTCs.

ECM

NOTE

All ECM DTCs are three digits. The IP uses the RED and AMBER ENGINE lamps to display DTCs. Code 111 indicates no stored ECM DTCs.

1. Set parking brake (TM 9-2355-106-10).
2. Set transmission in NEUTRAL (N) (TM 9-2355-106-10).
3. Shut engine off (TM 9-2355-106-10).
4. Turn MAIN POWER switch ON (TM 9-2355-106-10).
5. Turn ignition switch ON (TM 9-2355-106-10).
6. Press and release CRUISE ON and RESUME/ACCEL buttons simultaneously during IP gauge sweep.
7. Observe RED ENGINE lamp. Lamp will flash once to indicate start of active DTC retrieval.
8. Count each time AMBER ENGINE lamp flashes. A slight pause will occur between each series of flashes. A sequence of three series of flashes and pauses represents the DTC. The following is an example:

   Two flashes, pause, three flashes, pause, and two flashes indicate DTC 232 is set.
9. Record each active DTC.
10. Observe RED ENGINE lamp after AMBER ENGINE lamp flashes. RED ENGINE lamp indicates the following conditions:
    a. If there is more than one DTC, the RED ENGINE lamp will flash one time to indicate the beginning of a new DTC.

       Continue recording active DTCs.
    b. RED ENGINE lamp will flash two times to indicate beginning of inactive DTCs.
       (1) Count each time the AMBER ENGINE lamp flashes.
       (2) Record each inactive DTC.
    c. RED ENGINE lamp will flash three times after retrieval of all active and inactive DTCs.

DIAGNOSTIC TROUBLE CODE (DTC) ACCESS PROCEDURE - (CONTINUED)

ABS Module

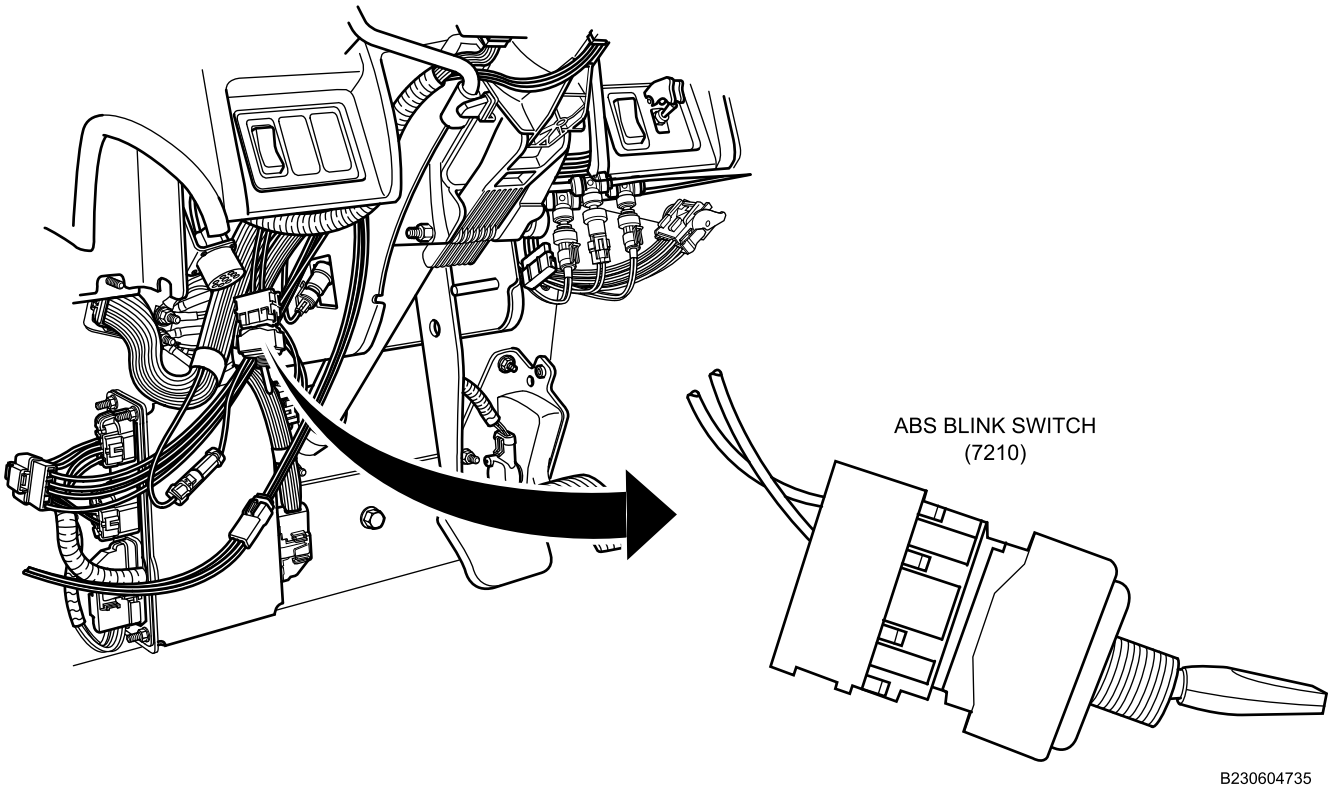


Figure 2. ABS Blink Switch.

1. Set parking brake (TM 9-2355-106-10).
2. Set transmission in NEUTRAL (N) (TM 9-2355-106-10).
3. Shut engine off (TM 9-2355-106-10).
4. Turn MAIN POWER switch ON (TM 9-2355-106-10).
5. Turn ignition switch ON (TM 9-2355-106-10).
6. Depress and release ABS blink switch one time. Refer to Figure 2.
7. Observe ABS indicator lamp.
8. Count each time ABS lamp flashes. Lamp will flash for 0.5 seconds, with 0.5-second pauses between flashes. A pause of 1.5 seconds indicates the end of each digit of the DTC. A 2.5-second pause between flashes occurs between DTCs.
9. Record each DTC.
10. Observe ABS lamp. Lamp will remain on for 5 seconds after retrieval of all ABS DTCs.

DIAGNOSTIC TROUBLE CODE (DTC) ACCESS PROCEDURE - (CONTINUED)

TCM

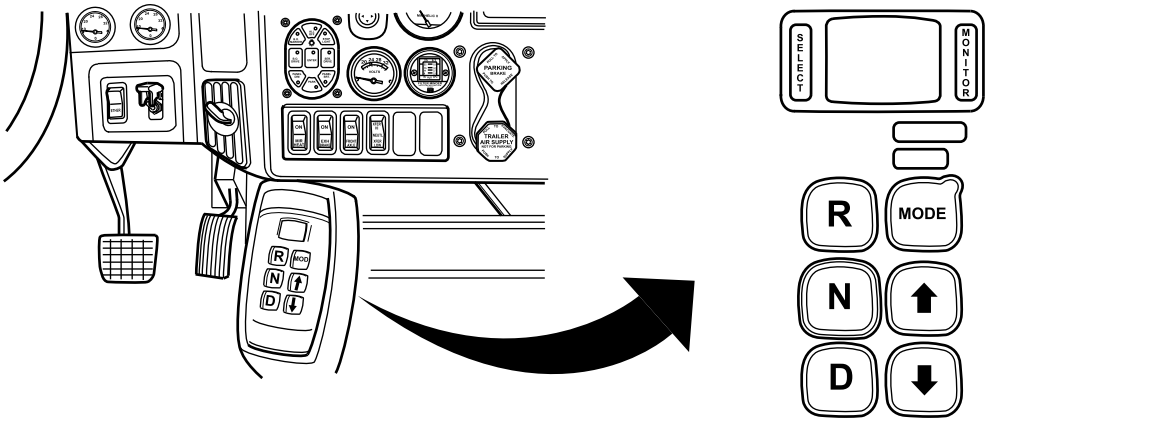


Figure 3. Transmission Shift Selector.

1. Set parking brake (TM 9-2355-106-10).
2. Set transmission in NEUTRAL (N) (TM 9-2355-106-10).
3. Shut engine off (TM 9-2355-106-10).
4. Turn MAIN POWER switch ON (TM 9-2355-106-10).
5. Turn ignition switch ON (TM 9-2355-106-10).
6. Press shift selector UP and DOWN arrows simultaneously two times. Refer to Figure 3.
7. Record DTCs displayed on shift selector.

END OF WORK PACKAGE

FIELD MAINTENANCE

CLEARING INACTIVE DIAGNOSTIC TROUBLE CODE (DTC) PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

This procedure covers clearing inactive DTCs for the following control modules:

- Engine Control Module (ECM)
- Electronic System Controller (ESC)
- Antilock Brake System (ABS) Control Module
- Transmission Control Module (TCM)

Procedure With MSD

NOTE

Clearing inactive DTCs stored in the ECM requires use of MSD.

1. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) WP 0011.
2. Clear inactive DTCs stored in specific control module, using MSD.

ESC Procedure Without MSD
1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Press and release CRUISE ON and RESUME/ACCEL buttons simultaneously during Instrument Panel (IP) gauge sweep.
4. Press SER. DRIVE on Master Vehicle Light Switch (MVLS) two times (TM 9-2355-106-10).
5. Press ENTER on Master Vehicle Light Switch (MVLS) (TM 9-2355-106-10).
6. Place turn signal switch in left turn position (TM 9-2355-106-10).
7. Press CRUISE ON and SET/CRUISE buttons simultaneously (TM 9-2355-106-10).
8. Release cruise control buttons (TM 9-2355-106-10).

ABS Blink Switch Procedure Without MSD
1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Wait two seconds after turning ignition switch on.
4. Depress and release blink switch three times.

TCM Without MSD
1. Turn ignition switch ON (TM 9-2355-106-10).
2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Press shift selector UP and DOWN arrows simultaneously two times.

CLEARING INACTIVE DIAGNOSTIC TROUBLE CODE (DTC) PROCEDURE - (CONTINUED)

4. Press and hold shift selector MODE button for 10 seconds.

END OF WORK PACKAGE

FIELD MAINTENANCE

HARD START/NO START OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0037
WP 0017
WP 0018
WP 0019
WP 0049
WP 0020
WP 0021
WP 0035
WP 0032
WP 0066
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Perform engine startup procedure (TM 9 2355–106–10).

CONDITION/INDICATION

Vehicle cranks but will not start or is difficult to start.

CORRECTIVE ACTION

Perform the following diagnostic procedures in order listed.

1. Battery Power Operational Checkout Procedure (WP 0032)
2. Keyless Ignition Switch Troubleshooting Procedure (WP 0066)
3. Fuel Operational Checkout Procedure (WP 0037)
4. Engine Systems Operational Checkout Procedure (WP 0017)
5. Engine Oil Operational Checkout Procedure (WP 0018)
6. Intake/Exhaust Troubleshooting Procedure (WP 0019)
7. Engine Control Module (ECM) Troubleshooting Procedure (WP 0049)
8. Injection Control Pressure (ICP) No Start Operational Checkout Procedure (WP 0020)

1. Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE PERFORMANCE OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0018
WP 0035
WP 0036
WP 0019
WP 0038
WP 0022
WP 0023
WP 0025
WP 0026
WP 0024
WP 0027
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Start vehicle and evaluate engine performance.

CONDITION/INDICATION

Engine runs but has performance issues.

CORRECTIVE ACTION

Perform the following diagnostic procedures in the order listed.
1. Engine Oil Operational Checkout Procedure (WP 0018)
2. Fuel Pump Pressure Troubleshooting Procedure (WP 0035)
3. Fuel Pump Restriction Troubleshooting Procedure (WP 0036)
4. Intake/Exhaust Troubleshooting Procedure (WP 0019)
5. Fuel Pressure (Full Load) Troubleshooting Procedure (WP 0038)
6. Injection Control Pressure (ICP) Troubleshooting Procedure (WP 0022)
7. Boost Pressure Troubleshooting Procedure (WP 0023)
8. Crankcase Pressure Troubleshooting Procedure (WP 0025)
9. Wastegate Actuator Troubleshooting Procedure (WP 0026)
10. Charge Air Cooler Pressure Operational Checkout Procedure (WP 0024)
11. Valve Adjustment Troubleshooting Procedure (WP 0027)

1. Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE MECHANICAL OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

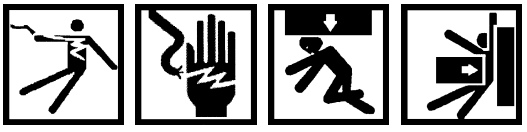
Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
WP 0011
WP 0019
WP 0014
WP 0015
WP 0020
WP 0025
WP 0045
WP 0218
WP 0219
WP 0222
WP 0228
WP 0249
WP 0250
WP 0233
WP 0236
WP 0234
WP 0253
WP 0261
WP 0277
WP 0283
WP 0527
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

EXCESSIVE OIL CONSUMPTION

WARNING



Use extreme caution when testing or working on electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

ENGINE MECHANICAL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

STEP

1. Visually inspect for external oil leaks.

CONDITION/INDICATION

External oil leaks are detected.

CORRECTIVE ACTION

Perform necessary repairs to correct external oil leaks. Refer to Chapter 4 Index for required removal and replacement procedures.

1. Inspect engine air filter (TM 9-2355-106–10).

Air filter is restricted.

Replace air filter. Refer to (TM 9-2355-106–10). Return vehicle to service.

1. Visually inspect engine air induction system for damage and leaks. Refer to Intake/Exhaust Restriction Troubleshooting Procedure (WP 0019).

Inspection of engine air induction system reveals damage or leaks.

Perform necessary repairs to correct engine air induction system leaks or damage. Refer to Alphabetical Index for required removal and installation procedures.

1. Verify crankcase pressure is not excessive. Refer to Crankcase Pressure Troubleshooting Procedure (WP 0025).

Crankcase pressure is excessive.

Replace engine. Refer to Engine Assembly Removal (WP 0218) and Engine Assembly Installation (WP 0219). Return vehicle to service.

1. Remove air dryer governor supply air line from air dryer. Refer to Air Compressor Supply Air Line Removal and Installation (WP 0523).

Oil in air line.

Replace air compressor. Refer to Air Compressor Removal and Installation (WP 0527). Return vehicle to service.

1. Check engine oil level (TM 9-2355-106-10).

Engine oil level is excessive.

Change engine oil. Fill with recommended amount and viscosity of new engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233). Return vehicle to service.

1. Verify engine oil is recommended viscosity. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

Unable to verify engine oil is recommended viscosity.

Change engine oil. Fill with recommended amount and viscosity of new engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233). Return vehicle to service.

1. Verify vehicle is not moving over-rated loads. Refer to (TM 9-2355-106-10).

Vehicle is moving over-rated loads.

Reduce load. Return vehicle to service.

1. Verify vehicle is not operated in incorrect gear range that lugs the engine.

Vehicle is operated in incorrect gear range that lugs engine.

Operate vehicle in correct gear or transfer case range. Refer to (TM 9-2355-106-10). Return vehicle to service.

1. Inspect turbocharger inlets and outlets. Refer to Turbocharger Removal and Installation (WP 0261).

Turbocharger compressor inlet is clean while outlet is oily, turbocharger turbine outlet is coked while inlet is not or turbocharger shows other visible signs of oil leakage.

Replace turbocharger. Refer to Turbocharger Removal and Installation (WP 0261). Return vehicle to service.

ENGINE MECHANICAL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

1. Verify fuel injector O-rings and injectors are not leaking engine oil. Refer to Injection Control Pressure (ICP) Troubleshooting Procedure (WP 0020).

Fuel injector O-rings or injectors leak engine oil.

Replace fuel injector O-rings or fuel injectors. Refer to Fuel Injector Removal and Installation (WP 0249). Return vehicle to service.

EXCESSIVE FUEL CONSUMPTION

STEP

1. Visually inspect for fuel leaks.

CONDITION/INDICATION

Fuel leaks are detected.

CORRECTIVE ACTION

Refer to Chapter 4 Index for replacement procedures to repair fuel leak.

1. Check engine oil level regularly.

Engine oil level is increasing.

STEP 1. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).

STEP 2. Perform injector tests with MSD. Replace injectors operating incorrectly. Refer to Fuel Injector Removal and Installation (WP 0249). Return vehicle to service.

1. Monitor engine speed during use.

Engine speed is too high or too low.

Adjust driving practices to operate engine in correct speed range for operating conditions. Refer to (TM 9-2355-106-10). Return vehicle to service.

1. Monitor idle time.

Idle time is excessive.

Reduce idle time.

1. Monitor actual fuel used during specific operating periods and conditions. Compare to another vehicle during similar operating periods and conditions.

Fuel use is excessive when compared to another vehicle.

Perform all performance and hard start/no start diagnostics. Refer to Engine Performance Operational Checkout Procedure (WP 0015), and Hard Start/No Start Operational Checkout Procedure (WP 0014).

HIGH COOLANT TEMPERATURE OR COOLANT LOSS

STEP

1. Verify engine cooling system overheats.

CONDITION/INDICATION

Cooling system overheats.

CORRECTIVE ACTION

Refer to Cooling System Troubleshooting Procedure (WP 0045).

ENGINE MECHANICAL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

EXCESSIVE EXHAUST SMOKE

STEP

1. Visually inspect air filter for restriction (TM 9-2355-106-10).

CONDITION/INDICATION

Air filter is restricted.

CORRECTIVE ACTION

Replace air filter (TM 9-2355-106-10). Return vehicle to service.

1. Visually inspect air induction system for restriction. Refer to Intake/Exhaust Restriction Troubleshooting Procedure (WP 0019).

Induction system is restricted.

Remove restriction or replace restricted components. Refer to Chapter 4 Index for applicable replacement procedures.

1. Inspect turbocharger compressor housing for engine oil leakage. Refer to Turbocharger Removal and Installation (WP 0261).

Inspection of turbocharger compressor housing indicates engine oil leakage.

Replace Turbocharger. Refer to Turbocharger Removal and Installation (WP 0261). Return vehicle to service.

1. Verify engine operating temperature is correct (TM 9-2355-106-10).

Engine operating temperature is below normal.

Replace thermostat. Refer to Thermostat Removal and Installation (WP 0283). Return vehicle to service.

1. Check engine oil regularly (TM 9-2355-106-10).

Engine oil level is decreasing.

Refer to Excessive Oil Consumption in this work package.

FUEL DILUTION OF ENGINE OIL

STEP

1. Visually inspect fuel pump for indication of fuel leaks. Refer to Fuel Pump Removal and Installation (WP 0253).

CONDITION/INDICATION

Fuel leaks are indicated.

CORRECTIVE ACTION

Replace fuel pump. Refer to Fuel Pump Removal and Installation (WP 0253). Return vehicle to service.

1. Perform injector tests in Performance and Hard Start/No Start. Refer to Hard Start/No Start Operational Checkout Procedure (WP 0014).

One or more fuel injectors fail tests.

Replace fuel injector. Refer to Fuel Injector Removal and Installation (WP 0249). Return vehicle to service.

1. Visually inspect fuel injector O-rings for damage and deterioration. Refer to Fuel Injector Removal and Installation (WP 0249).

Damaged or deteriorated fuel injector O-rings are indicated.

Replace damaged or deteriorated O-rings. Refer to Fuel Injector Removal and Installation (WP 0249). Return vehicle to service.

ENGINE MECHANICAL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

COOLANT IN LUBRICATING OIL OR LUBRICATING OIL IN COOLANT

STEP

1. Visually inspect engine oil dipstick for WHITE or milky oil (TM 9-2355-106-10).
2. Visually inspect radiator surge overflow tank for engine oil (TM 9-2355-106-10).

CONDITION/INDICATION

Engine oil is milky WHITE or engine oil is in overflow tank.

CORRECTIVE ACTION

Replace engine. Refer to Engine Assembly Removal (WP 0218)and Engine Assembly Installation (WP 0219). Return vehicle to service.

EXCESSIVE SMOKE OR OIL DISCHARGE FROM ENGINE OIL BREATHER TUBE

STEP

1. Inspect turbocharger compressor housing for engine oil leakage. Refer to turbocharger removal and installation (WP 0261).

CONDITION/INDICATION

Inspection of turbocharger compressor housing indicates engine oil leakage.

CORRECTIVE ACTION

Replace Turbocharger. Refer to Turbocharger Removal and Installation (WP 0261). Return vehicle to service.

1. Inspect engine oil breather tube for engine oil leakage. Refer to engine oil breather tube removal and installation (WP 0231).

Inspection of engine oil breather tube indicates engine oil leakage.

Replace air compressor. Refer to Air Compressor Removal and Installation (WP 0527). Return vehicle to service.

1. Perform Crankcase Pressure Troubleshooting Procedure. Refer to Crankcase Pressure Test Troubleshooting Procedure (WP 0025).

Crankcase Pressure Troubleshooting Procedure results are out of specification.

Replace engine. Refer to Engine Assembly Removal (WP 0218) and Engine Assembly Installation (WP 0219). Return vehicle to service.

LUBE OIL IN FUEL

STEP

1. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Perform fuel injector balance test with MSD.

CONDITION/INDICATION

One or more fuel injectors indicate faults.

CORRECTIVE ACTION

STEP 1. Inspect fuel injector O-rings for faults. Refer to Fuel Injector Removal and Installation (WP 0249).

STEP 2. Replace faulty fuel injector O-rings. Refer to Fuel Injector Removal and Installation (WP 0249).

STEP 3. If no O-rings appear faulty, replace suspect fuel injector. Refer to Fuel Injector Removal and Installation (WP 0249). Return vehicle to service.

1. Inspect fuel/oil manifold gasket for leaks. Refer to Oil/Fuel Manifold Removal and Installation (WP 0250).

Leaking fuel/oil manifold gasket is indicated.

ENGINE MECHANICAL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Replace fuel/oil manifold. Refer to Oil/Fuel Manifold Removal and Installation (WP 0250). Return vehicle to service.

1. Inspect for cracked or porous fuel/manifold. Refer to Oil/Fuel Manifold Removal and Installation (WP 0250).

Cracked or porous fuel/oil manifold is indicated.

Replace fuel/oil manifold. Refer to Oil/Fuel Manifold Removal and Installation (WP 0250). Return vehicle to service.

1. Inspect for cracked or porous cylinder head. Refer to Cylinder Head and Gasket Removal and Installation (WP 0222).

Cracked or porous cylinder head is indicated. Refer to Cylinder Head and Gasket Removal and Installation (WP 0222).

Replace cylinder head. Refer to Cylinder Head and Gasket Removal and Installation (WP 0222). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE SYSTEMS OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
WP 0014
WP 0045
WP 0033
WP 0250
WP 0256
WP 0257
WP 0263
WP 0264
WP 0265
WP 0268
WP 0333
WP 0334
WP 0336
WP 0330
WP 0407
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

ENGINE SYSTEMS OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

WARNING

Fuel is flammable and can explode. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel and keep fire extinguisher nearby. Do not smoke when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. Failure to comply may result in serious injury or death to personnel.

Be alert at all times for the smell of fuel. Hot engines and components can ignite fuel. If fuel smell is detected while operating vehicle, shut down vehicle immediately. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Store diesel fuel in an approved container clearly marked DIESEL FUEL. Dispose of fuel in an approved container clearly marked DIESEL FUEL in accordance with standard operating procedures.

Use extreme caution when testing or working on electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

NOTE

Engine will not start with Injection Pressure Regulator (IPR) or Camshaft Position Sensor (CMP) disconnected.

STEP

ENGINE SYSTEMS OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

1. Inspect engine electrical connections. Refer to Figure 1.

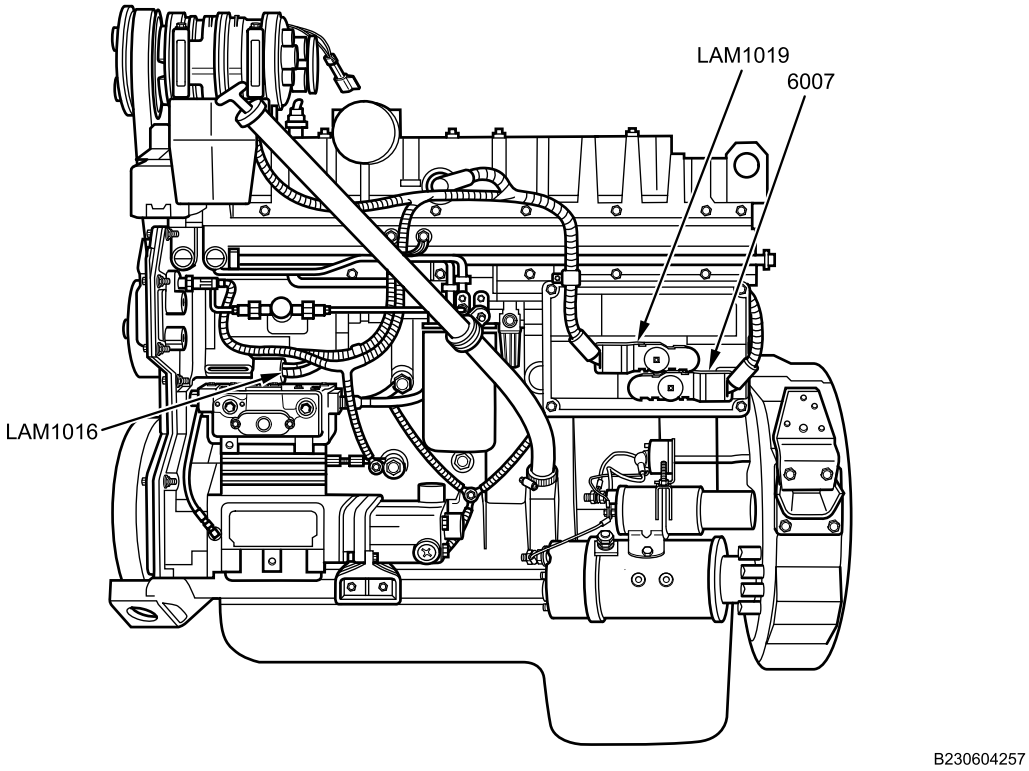


Figure 1. Connectors LAM 1016, LAM 1019, and 6007.

CONDITION/INDICATION

Injector Pressure Regulator (IPR) or Engine Control Module (ECM) connections loose, damaged, or corroded.

CORRECTIVE ACTION

Replace engine sensor wiring harness or replace engine wiring harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0330) or Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

ENGINE SYSTEMS OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

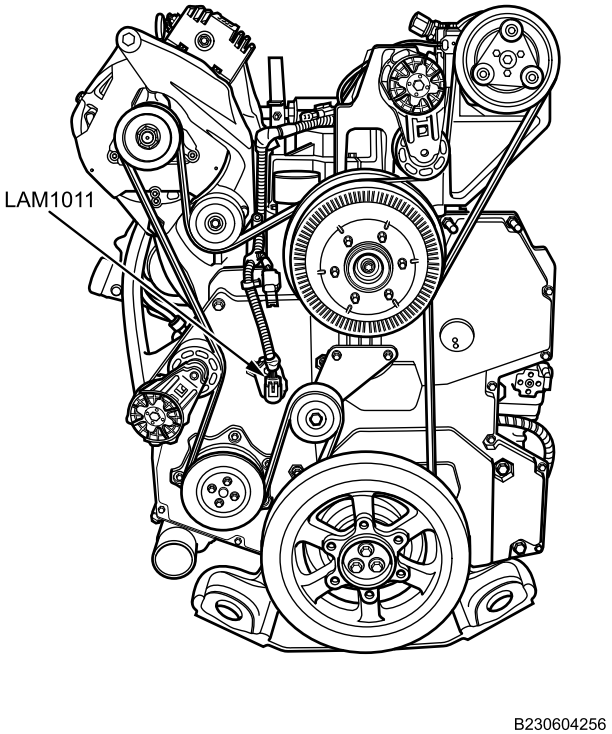


Figure 2. Connector LAM 1011.

1. Inspect Camshaft Position Sensor electrical connector. Refer to Figure 2.

Camshaft Position Sensor connector loose, damaged, or corroded.

Replace engine sensor wiring harness or replace engine wiring harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0330) or Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

1. Inspect Power Distribution Center (PDC) electrical connections. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

Fuse or relay connections loose, damaged, or corroded.

Replace PDC. Refer to Power Distribution Center (PDC) Junction Box Removal and Installation (WP 0334). Return vehicle to service.

1. Inspect battery electrical connections. Refer to Battery Cable Troubleshooting Procedure (WP 0033).

Battery connections loose, damaged, or corroded.

Replace or tighten battery cables. Refer to Battery Cables Removal and Installation (WP 0407). Return vehicle to service.

1. Visually inspect engine sensor wiring harnesses.

Engine sensor wiring harnesses are pinched or chafed.

Replace engine sensor harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0330). Return vehicle to service.

1. Visually inspect fuel system for leaks.

Leaks in fuel lines or tank is present.

Damage to fuel lines or tank is present.

Replace fuel hoses. Refer to Fuel Hose Removal and Installation (WP 0268). Replace fuel tank. Refer to Fuel Tank and Bracket Removal and Installation (WP 0265). Return vehicle to service.

1. Visually inspect cooling system for leaks.

ENGINE SYSTEMS OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Cooling system leaks are present.

Repair as required. Refer to Cooling System Operational Checkout Procedure (WP 0045). Return vehicle to service.

1. Visually inspect engine oil, system for leaks.

Oil line and supply manifold leaks are present.

Repair as required. Refer to Oil and Fuel Manifold Removal and Installation (WP 0250). Return vehicle to service.

1. Visually inspect air induction system for leaks.

Air cleaner housing damage or distortion that could allow unfiltered air into engine.

Replace air cleaner housing. Refer to Air Cleaner Assembly Removal and Installation (WP 0257). Return vehicle to service.

Air filter element has holes, damaged end cap or seals, or is plugged with dirt/debris.

Replace air cleaner housing. Refer to Air Cleaner Assembly Removal and Installation (WP 0257). Return vehicle to service.

Air intake hoses and clamps are loose or not properly positioned over sealing beads.

Properly install hoses and tighten clamps. Refer to Air Intake Tube (To Turbo) Removal and Installation (WP 0256) and Charge Air Cooler (CAC) Hose Removal and Installation (WP 0264). Return vehicle to service.

Charge air cooler and hoses are leaking or damaged.

Replace charge air cooler or hoses. Refer to Charge Air Cooler (CAC) Assembly Removal and Installation (WP 0263) or Charge Air Cooler (CAC) Hose Removal and Installation (WP 0264). Return vehicle to service.

1. Return to Hard Start/No Start Toubleshooting Procedure (WP 0014).

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE OIL OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Materials/Parts
Rags - (2) (WP 0794, Item 39)
Lubricating oil (WP 0794, Item 27)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0014
WP 0015
WP 0025
WP 0216
WP 0222
WP 0249
WP 0233
WP 0234
WP 0253
WP 0261
WP 0264
WP 0527
WP 0524
WP 0597
WP 0598
WP 0599
WP 0606
WP 0782

Equipment Condition
Vehicle positioned on level surface
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Belly armor removed (WP 0606)
Left side engine armor removed (WP 0597)
Left engine armor plate bracket removed (WP 0598)
Right side engine armor removed (WP 0599)
Right side engine armor plate removed (WP 0599)

WARNING

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing maintenance. Use extreme care when working in close quarters in engine compartment. Stay clear of rotating parts. Wear safety goggles, work gloves, and long sleeves or shop coat. Failure to comply may result in serious injury or death to personnel.

Use caution when working under hood with ignition ON. Failure to comply may result in damage to equipment and serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedure Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Remove oil fill cap. Refer to TM 9-2355-106-10.
2. Check bottom of oil fill cap for milky-white residue or smell of antifreeze.

CONDITION/INDICATION

ENGINE OIL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

1. Oil fill cap has milky-white residue or smells like antifreeze.

CORRECTIVE ACTION

STEP 1. Engine coolant is leaking into crankcase. Perform the following inspections:

a. Remove air compressor and gasket. Refer to Air Compressor Removal and Installation (WP 0527). Inspect gasket and air compressor for cracks and evidence of coolant leak. Replace faulty component as necessary. If a fault is found, change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

b. Remove engine cylinder head and gasket. Refer to Engine Cylinder Head and Gasket Removal and Installation (WP 0222). Inspect cylinder head gasket and cylinder head for cracks and evidence of coolant leaking into crankcase. Replace faulty component as necessary. If a fault is found, change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

1. Compare sample of oil from this vehicle to sample of known-good oil for this vehicle. Verify color and odor of samples are similar.

Engine contains incorrect oil.

STEP 1. Change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

NOTE

Ensure engine has been off for at least 1 minute.

1. Check engine oil level. Refer to TM 9-2355-106-10.

Engine oil level is too low.

NOTE

Excessive oil consumption can be caused by towing abnormally heavy loads, driving in an incorrect gear causing the engine to lug, over-revving the engine, and other improper operation. Refer to TM 9-2355-106-10 for proper vehicle operation.

STEP 1. Visually inspect engine and vehicle undercarriage for external engine oil leaks. If oil leak is present, visually follow oil trail to source of leak. If oil leak is found, refer to Chapter 4, Maintenance Instructions, index for repair procedures. If oil leak is present but source cannot be found, perform the following steps:

a. Clean oil residue from engine and undercarriage.

b. Top-off engine oil level (TM 9-2355-106-10).

c. Turn MAIN POWER switch ON (TM 9-2355-106-10).

d. Start engine and let idle for 10 minutes. Do not let engine run out of oil. Turn engine off immediately if oil leak is severe.

e. Turn engine off (TM 9-2355-106-10).

f. Inspect engine and vehicle undercarriage for external engine oil leaks.

STEP 2. Observe engine intake air filter restriction gauge (TM 9-2355-106-10). If restriction gauge indicates restriction, refer to Intake Restriction Test Troubleshooting Procedure (WP 0259).

STEP 3. Compare sample of oil from this vehicle to sample of known-good oil for this vehicle. Verify that color, odor, and thickness of samples are similar. If incorrect oil viscosity was used, change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

STEP 4. Ensure air brake compressor is not leaking engine oil internally by inspecting air dryer desiccant cartridge for oil residue. Refer to Air Dryer Desiccant Cartridge Removal and Installation (WP 0519). If oil is found in desiccant cartridge, replace air compressor and desiccant cartridge. Refer to Air Compressor Removal and Installation (WP 0527) and Air Dryer Desiccant Cartridge Removal and Installation (WP 0519).

ENGINE OIL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

STEP 5. Ensure turbocharger is not leaking internally by inspecting charge air cooler inlet pipe for oil residue. Refer to Charge Air Cooler (CAC) Hose Removal and Installation (WP 0264) to remove piping between turbocharger and charge air cooler for inspection. If oil residue is found, replace turbocharger. Refer to Turbocharger Removal and Installation (WP 0261).

NOTE

Fuel injector O-rings and seals must be replaced anytime the fuel injectors are removed. After inspecting the injector seals and O-rings during the next step, install new O-rings and seals as instructed in the injector installation procedure.

Engine could be consuming oil due to an internal engine mechanical fault.

STEP 6. Remove fuel injectors, refer to Fuel Injector Removal and Installation (WP 0249) and inspect O-rings and seals for damage.

STEP 7. To determine if an internal engine mechanical fault is present. Refer to Crankcase Pressure Test Troubleshooting Procedure (WP 0025).

STEP 8. Perform the following steps to determine if valve guides and seals are worn.

a. Top-off engine oil level (TM 9-2355-106-10).
b. Turn MAIN POWER switch ON (TM 9-2355-106-10).
c. Start the engine and let idle for 10 minutes (TM 9-2355-106-10).
d. Test drive vehicle for 10 miles (TM 9-2355-106-10).
e. Turn engine OFF (TM 9-2355-106-10).
f. Turn MAIN POWER switch off (TM 9-2355-106-10).
g. Keep engine off for at least 4 hours (TM 9-2355-106-10).
h. Turn MAIN POWER switch ON (TM 9-2355-106-10).
i. Start engine and observe tailpipe (TM 9-2355-106-10).
j. If unusual blue smoke comes from tailpipe upon startup, replace engine cylinder head and gasket. Refer to Engine Cylinder Head and Gasket Removal and Installation (WP 0222).

Engine oil level is too high.

STEP 1. Drain enough oil to bring oil level to recommended level. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

STEP 2. Capture sample of engine oil in container for inspection. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

STEP 3. Compare oil sample with used oil from another vehicle. Comparison sample should be taken from vehicle with same engine model that does not exhibit same symptoms as vehicle being checked.

STEP 4. If engine oil is milky-white in color or smells like antifreeze, engine coolant is leaking into crankcase. Perform the following inspections:

a. Remove air compressor and gasket. Refer to Air Compressor Removal and Installation (WP 0527). Inspect gasket and air compressor for cracks and evidence of a coolant leak. Replace faulty component as necessary. If a fault is found, change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).
b. Remove engine cylinder head and gasket. Refer to Engine Cylinder Head and Gasket Removal and Installation (WP 0222). Inspect cylinder head gasket and cylinder head for cracks and evidence of coolant leaking into crankcase. Replace faulty component as necessary. If a fault is found, change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

ENGINE OIL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

STEP 5. If engine oil smells of fuel, oil is contaminated with diesel fuel. Perform the following inspections:

a. Remove fuel pump. Refer to Fuel Pump Removal and Installation (WP 0253). Inspect gasket and fuel pump for evidence of fuel leaking into crankcase. Replace faulty component as necessary. If a fault is found, change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

b. Remove oil/fuel manifold. Refer to Oil/Fuel Manifold Removal and Installation (WP 0250), replace gasket and change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

1. If oil meets specification, return to Hard Start/No Start Troubleshooting Procedure (WP 0014).

END OF WORK PACKAGE

FIELD MAINTENANCE

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Materials/Parts
Goggles (WP 0794, Item 20)
Gloves (WP 0794, Item 19)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0014
WP 0015
WP 0024
WP 0056
WP 0246
WP 0256
WP 0257
WP 0263
WP 0264
WP 0275
WP 0276
WP 0335
WP 0336
WP 0247
WP 0597
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

WARNING

Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing maintenance. Use extreme care when working in close quarters in engine compartment. Stay clear of rotating parts. Wear safety goggles, work gloves, and long sleeves or shop coat. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

1. Observe FILTER MINDER (Figure 1, Item 1) air filter restriction gauge located in center of Instrument Panel (IP). Refer to TM 9-2355-106-10.

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

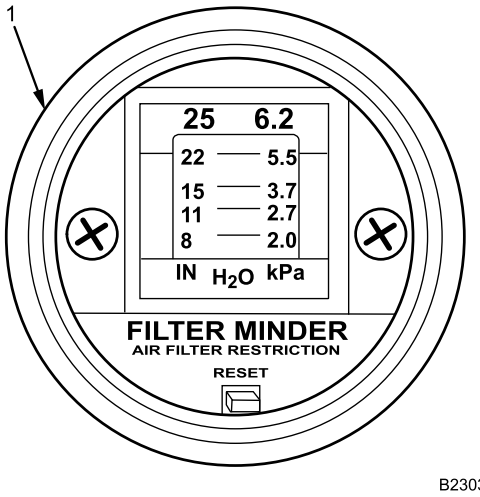


Figure 1. Filter Minder Air Filter Restriction Gauge.

CONDITION/INDICATION

Does FILTER MINDER air filter restriction gauge read 22 in. H2O (5.5 kPa) or more?

DECISION

NO Go to Step 3.
YES Go to next step.

STEP

2. Remove engine air filter and inspect. Refer to TM 9-2355-106-10. Air filter should be clean and undamaged.

CONDITION/INDICATION

Is air filter dirty or damaged?

DECISION

YES Go to Step 23.
NO Go to Step 24.

STEP

3. Remove air cleaner housing, refer to Air Cleaner Assembly Removal and Installation (WP 0257). Inspect air cleaner housing for debris, damage, and restrictions.

CONDITION/INDICATION

Is air filter housing damaged or restricted?

DECISION

YES Go to Step 24.
NO Go to next step.

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

4. Remove air intake tube between air filter housing and turbo fresh air inlet, refer to Air Intake Tube (To Turbo) Removal and Installation (WP 0256). Inspect intake tube for debris, damage, and restrictions.

CONDITION/INDICATION

Is intake tube damaged or restricted?

DECISION

YES Go to Step 25.
NO Go to next step.

STEP

5. Inspect Charge Air Cooler (CAC) hoses, pipes, and clamps for damage, restrictions, or looseness. Refer to Charge Air Cooler (CAC) Hose Removal and Installation (WP 0264).

CONDITION/INDICATION

Are any CAC hoses, pipes, or clamps damaged, restricted, or loose?

DECISION

YES Go to Step 26.
NO Go to next step.

STEP

6. Perform CAC pressure test. Refer to Charge Air Cooler Pressure Operational Checkout Procedure (WP 0024).

CONDITION/INDICATION

Did CAC pressure test pass?

DECISION

NO Go to Step 27.
YES Go to next step.

STEP

7. Visually inspect exhaust pipes (Figure 2, Item 1), muffler (Figure 3, Item 2), and tailpipe (Figure 3, Item 1) for damage or restrictions.

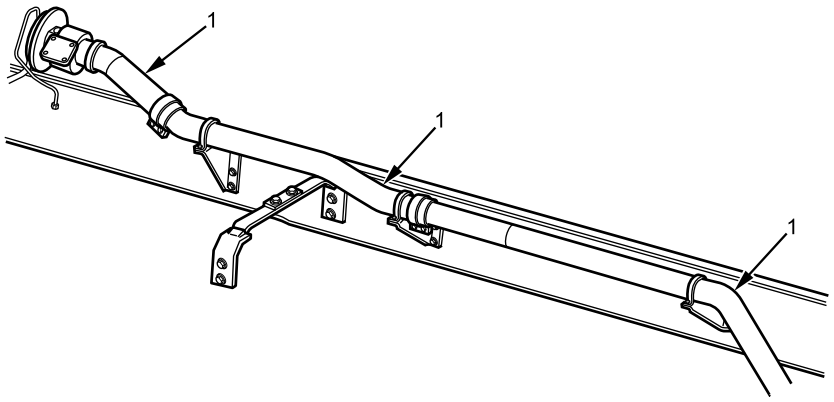


Figure 2. Exhaust Pipes.

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

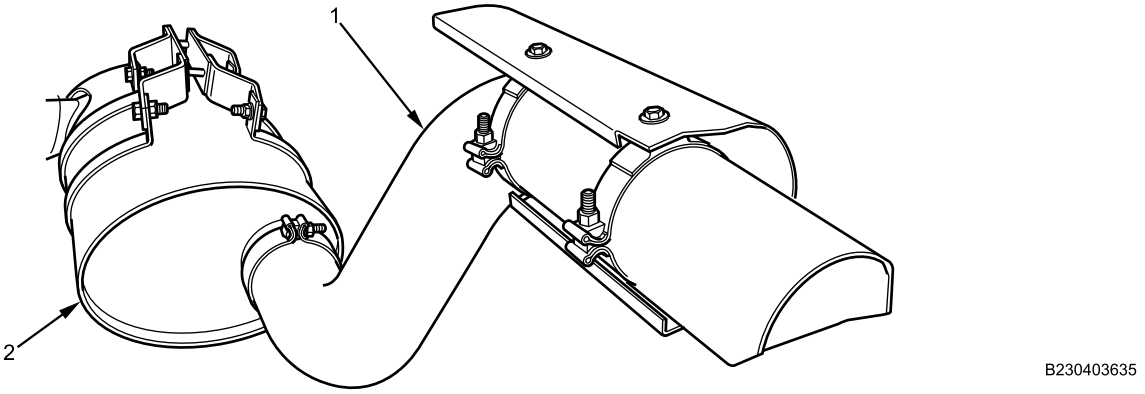


Figure 3. Muffler and Tailpipe.

CONDITION/INDICATION

Are exhaust pipes, muffler, or tailpipe damaged or restricted?

DECISION

YES Go to Step 28.
NO Go to next step.

STEP

8. Remove muffler. Refer to Muffler and Shield Removal and Installation (WP 0276).
9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Start engine (TM 9-2355-106-10).

CONDITION/INDICATION

Does engine start normally?

DECISION

YES Go to Step 29.
NO Go to next step.

STEP

11. Inspect exhaust brake valve actuator arm (Figure 4, Item 1). Arm should be in position shown in illustration.

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

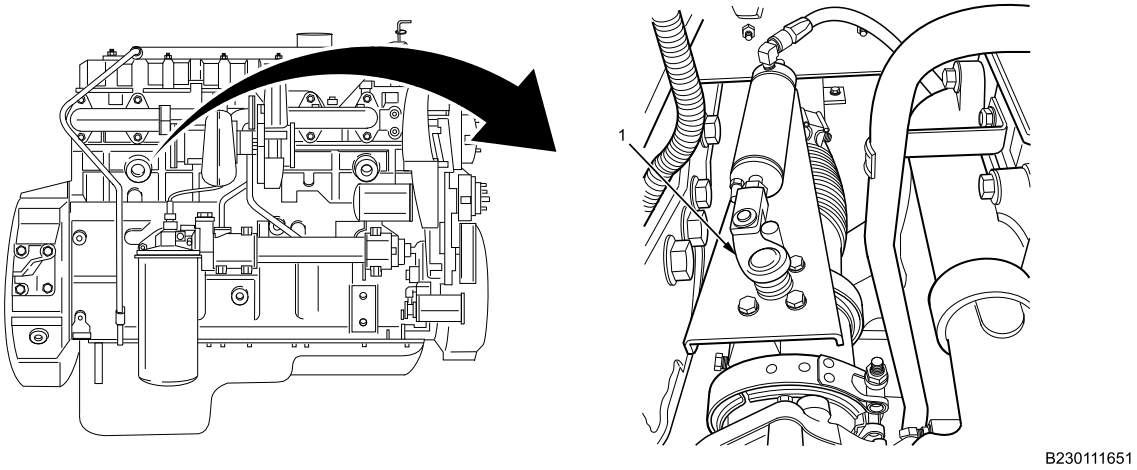


Figure 4. Right Side of Engine, Behind Turbocharger Area.

CONDITION/INDICATION

Is exhaust brake valve actuator arm in position indicated?

DECISION

YES Go to next step.
NO Go to Step 18.

STEP

12. Turn ignition switch OFF (TM 9-2355-106-10).
13. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
14. Remove exhaust brake. Refer to Exhaust Brake Removal and Installation (WP 0246).
15. Turn MAIN POWER switch on (TM 9-2355-106-10).
16. Start engine (TM 9-2355-106-10).

CONDITION/INDICATION

Does engine start normally?

DECISION

YES Go to Step 30.
NO Go to next step.

STEP

17. Start engine (TM 9-2355-106-10).

CONDITION/INDICATION

Does a hard start or no start condition still exist?

DECISION

YES Proceed to Hard Start/No Start Operational Checkout Procedure (WP 0014) or Engine Performance Troubleshooting Procedures (WP 0015)
NO Return vehicle to service.

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

WARNING

Wear eye protection when working on or around air systems. Air lines, fittings, and components contain air under pressure. Failure to comply may result in injury or death to personnel.

18. Disconnect air line (Figure 5, Item 2) from exhausted brake valve actuator while observing actuator arm (Figure 5, Item 1) for movement. Actuator arm should move back to position indicated in illustration.

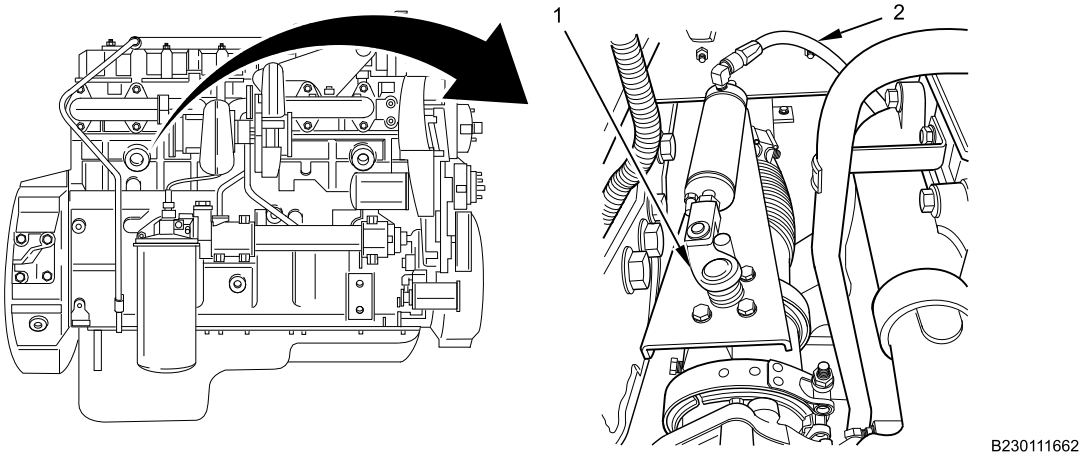


Figure 5. Right Side of Engine, Behind Turbocharger Area.

CONDITION/INDICATION

Did actuator arm move to position indicted?

DECISION

YES Go to next step.
NO Go to Step 30.

STEP

19. Remove left side engine armor. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
20. Disconnect connector 4100F/4103 (connector with 18 wires). Refer to Figure 6.

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

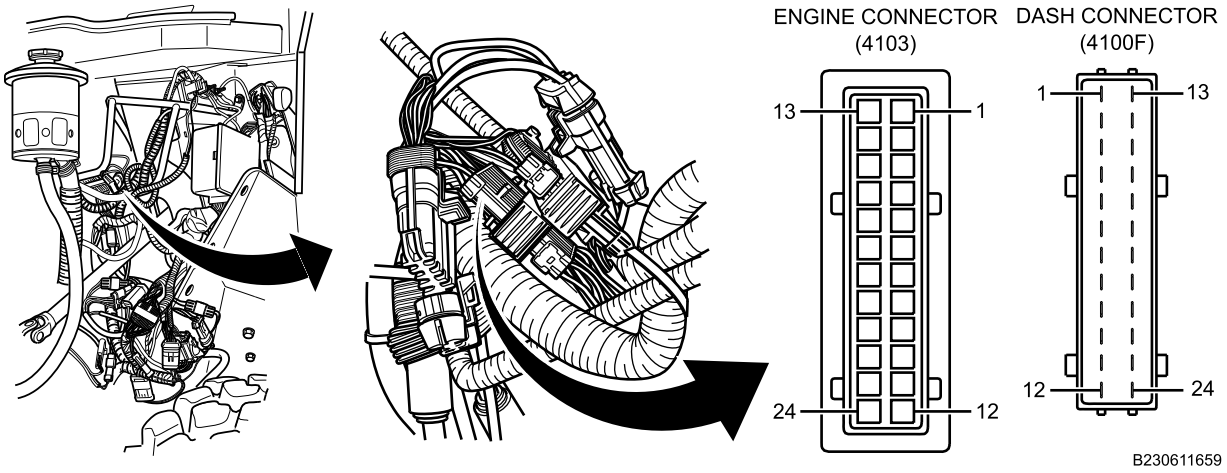


Figure 6. Left Side Engine Compartment.

21. Measure resistance between connector 4103 terminal 15 and all other terminals on connector 4103 with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Did multimeter read OL for all terminals?

DECISION

YES Go to next step.
NO Go to Step 32.

STEP

22. Measure resistance between connector 4100F terminal 15 and all other terminals on connector 4100F with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Did multimeter read OL for all terminals?

DECISION

YES Go to Step 33.
NO Go to Step 31.

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 23. Air filter is faulty.

ACTION

Replace air filter. Refer to TM 9-2355-106-10. Return vehicle to service.

END OF TEST

MALFUNCTION

- 24. Air cleaner housing is faulty.

ACTION

Replace air cleaner housing. Refer to Air Cleaner Assembly Removal and Installation (WP 0257). Return vehicle to service.

END OF TEST

MALFUNCTION

- 25. Air intake tube is faulty.

ACTION

Replace air intake tube. Refer to Air Intake Tube (To Turbo) Removal and Installation (WP 0056). Return vehicle to service.

END OF TEST

MALFUNCTION

- 26. Hoses, pipes, or clamps are damaged, restricted, or loose.

ACTION

Repair as necessary. Refer to Charge Air Cooler (CAC) Hose Removal and Installation (WP 0264). Return vehicle to service.

END OF TEST

MALFUNCTION

- 27. CAC is faulty.

ACTION

Replace CAC. Refer to Charge Air Cooler (CAC) Removal and Installation (WP 0263). Return vehicle to service.

END OF TEST

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 28. Exhaust pipes, muffler, or tailpipe is faulty.

ACTION

Replace exhaust pipes, muffler, or tailpipe. Refer to Exhaust Pipe Removal and Installation (WP 0275) or Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.

END OF TEST

MALFUNCTION

- 29. Muffler is faulty.

ACTION

Replace muffler. Refer to Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.

END OF TEST

MALFUNCTION

- 30. Exhaust brake is faulty.

ACTION

Replace exhaust brake. Refer to Exhaust Brake Removal and Installation (WP 0246). Return vehicle to service.

END OF TEST

MALFUNCTION

- 31. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 32. PDC harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 33. Exhaust brake solenoid is faulty.

ACTION

Replace exhaust brake solenoid. Refer to Exhaust Brake Solenoid Removal and Installation (WP 0247). Return vehicle to service.

INTAKE/EXHAUST TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

INJECTION CONTROL PRESSURE (ICP) NO START OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Tee, 3-wire pressure sensor breakout (ZTSE4347) (WP 0795, Item 116)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0021
WP 0035
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

INJECTION CONTROL PRESSURE (ICP) NO START OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

1. Install 3-wire breakout tee between ICP sensor (Figure 1, Item 1) and harness connector. Refer to Figure 1.

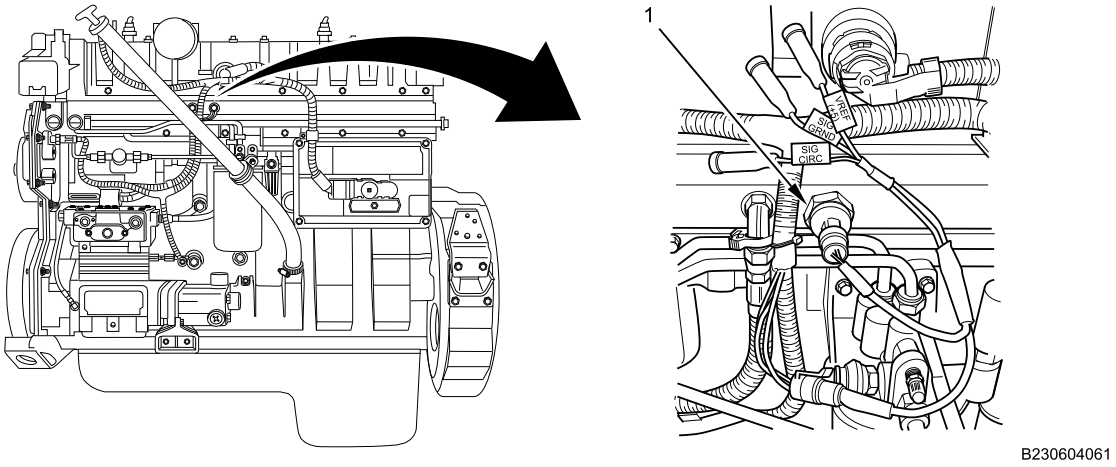


Figure 1. ICP Breakout Tee Installed.

2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).
4. Measure DC voltage between breakout tee GREEN SIG CIRC test lead and BLACK SIG GRND test lead with multimeter. Refer to Figure 1.
5. Observe multimeter while cranking engine and record ICP voltage. A minimum of 1.0V is necessary to start engine.

CONDITION/INDICATION

ICP voltage less than 1.0V.

CORRECTIVE ACTION

Refer to Low Injection Control Pressure (ICP) Pressure Troubleshooting Procedure (WP 0021).

CONDITION/INDICATION

ICP voltage more than 1.0V.

CORRECTIVE ACTION

Refer to Fuel Pump Pressure Troubleshooting Procedure (WP 0035).

END OF WORK PACKAGE

FIELD MAINTENANCE

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Maintenance Support Device (MSD) (WP 0795, Item 70)
Tee, Injection Control Pressure (ICP) adapter (ZTSE4594) (WP 0795, Item 119)
Gun, air (WP 0795, Item 43)

Materials/Parts
Sealing compound (WP 0794, Item 44)
Gloves (WP 0794, Item 18)
Goggles, industrial (WP 0794, Item 20)

Personnel Required
Maintainer - (2)

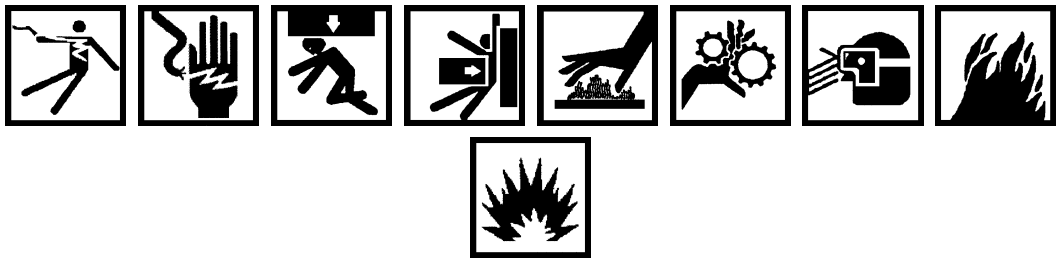
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0007
WP 0228
WP 0249
WP 0233
WP 0252
WP 0253
WP 0389
WP 0391
WP 0396
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing maintenance. Use extreme care when working in close quarters in engine compartment. Stay clear of rotating parts. Wear safety goggles, work gloves, and long sleeves or shop coat. Failure to comply may result in serious injury or death to personnel.

Fuel is flammable and can explode. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel and keep fire extinguisher nearby. Do not smoke when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

If Diagnostic Trouble Codes (DTCs) were detected, perform those diagnostics first (WP 0007).

STEP

1. Remove Engine Oil Temperature (EOT) sensor. Refer to Engine Oil Temperature (EOT) Sensor Removal and Installation (WP 0389).

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

2. Oil should come out of EOT opening on front cover. Install EOT sensor when complete. Refer to Engine Oil Temperature (EOT) Sensor Removal and Installation (WP 0389).

CONDITION/INDICATION

Did oil come out of EOT sensor opening on front cover?

DECISION

NO Go to Step 26.
YES Go to next step.

STEP

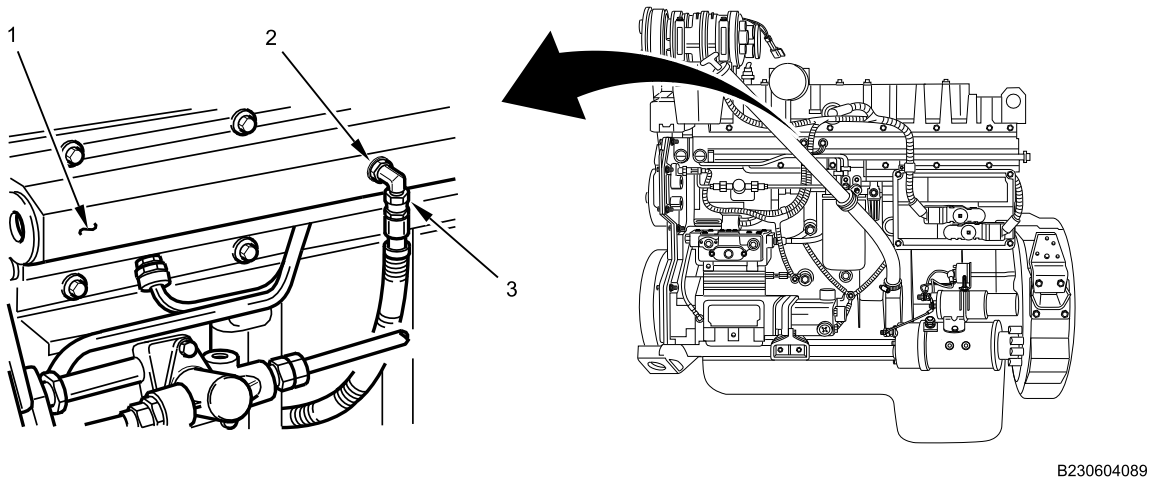


Figure 1. High-Pressure Oil Hose.

3. Disconnect high-pressure oil hose (Figure 1, Item 3) from elbow fitting (Figure 1, Item 2) on high-pressure oil manifold (Figure 1, Item 1).

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

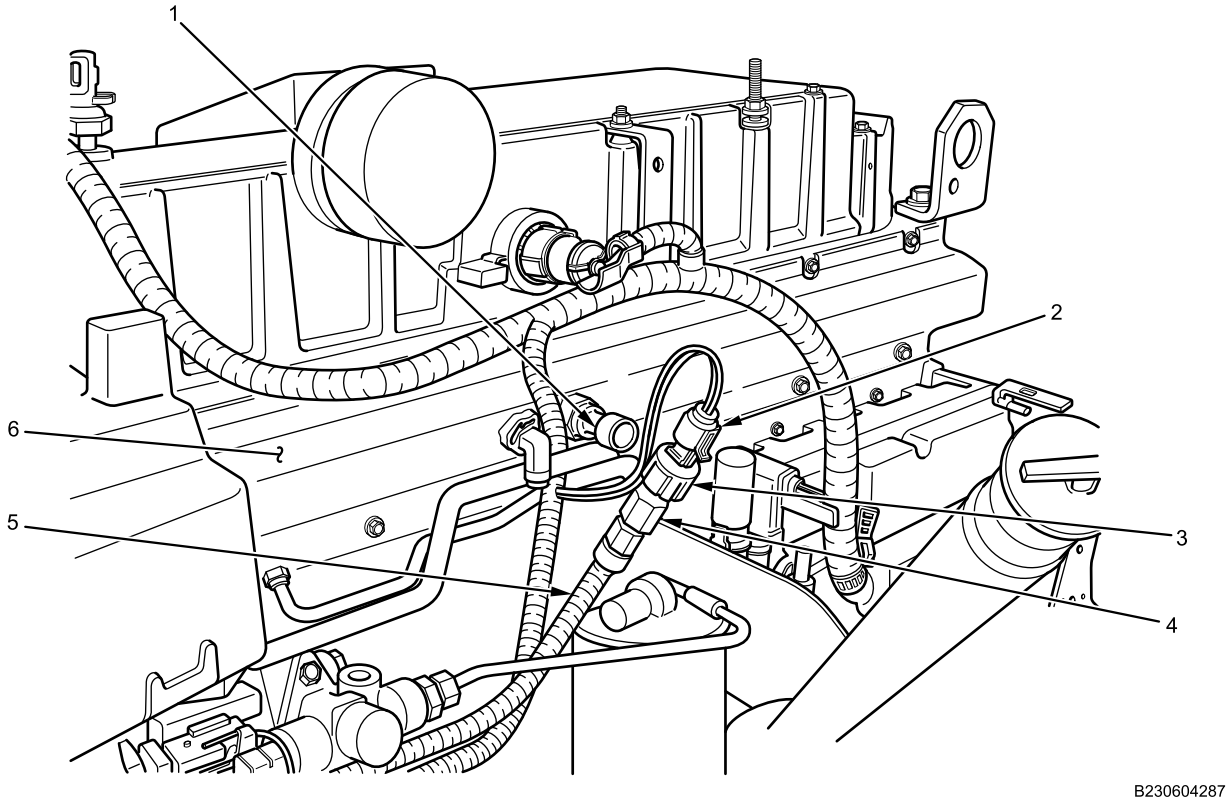


Figure 2. ICP Adapter.

4. Install ICP adapter (Figure 2, Item 4) into end of high-pressure hose (Figure 2, Item 5).
5. Install new ICP sensor (Figure 2, Item 3) into ICP adapter (Figure 2, Item 4).
6. Transfer ICP harness connector (Figure 2, Item 2) from original ICP sensor (Figure 2, Item 1) on high-pressure oil manifold (Figure 2, Item 6) to new ICP sensor (Figure 2, Item 3) in high-pressure hose (Figure 2, Item 5). Leave original ICP sensor (Figure 2, Item 1) in high-pressure oil manifold (Figure 2, Item 6).
7. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
8. Observe ICP on MSD while cranking engine (TM 9–2355–106–10).

CONDITION/INDICATION

Is ICP more than 500 psi (3,447 kPa)?

DECISION

NO Go to Step 20.
YES Go to next step.

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

9. Remove ICP harness connector (Figure 2, Item 2), new ICP sensor (Figure 2, Item 3), and ICP adapter (Figure 2, Item 4) from high-pressure hose (Figure 2, Item 5).
10. Install ICP harness connector (Figure 2, Item 2) on original ICP sensor (Figure 2, Item 1).

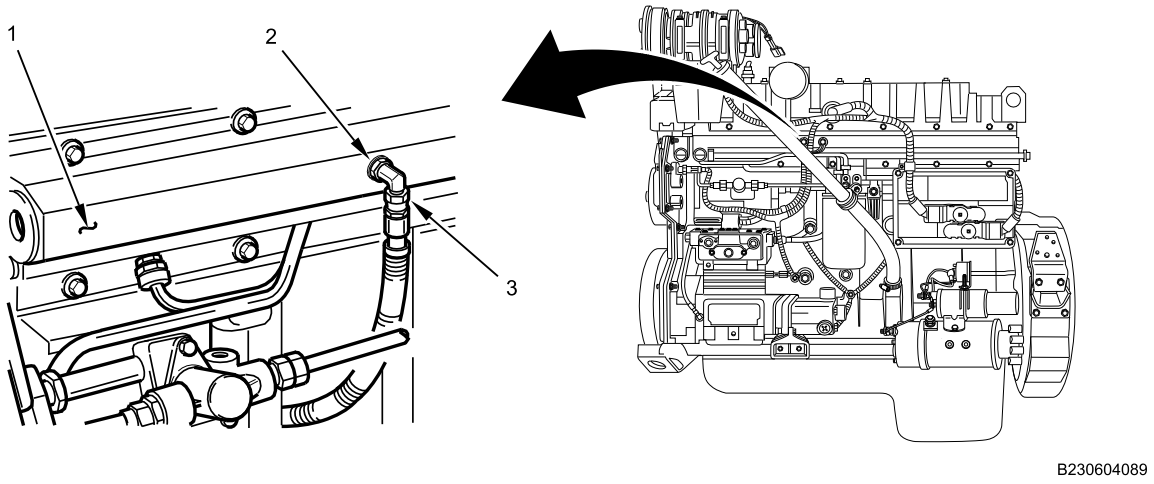


Figure 3. High-Pressure Oil Hose.

11. Install high-pressure hose (Figure 3, Item 3) to fitting (Figure 3, Item 2) on high-pressure oil manifold (Figure 3, Item 1). Tighten hose securely.
12. Remove valve cover. Refer to Valve Cover Removal and Installation (WP 0228).

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

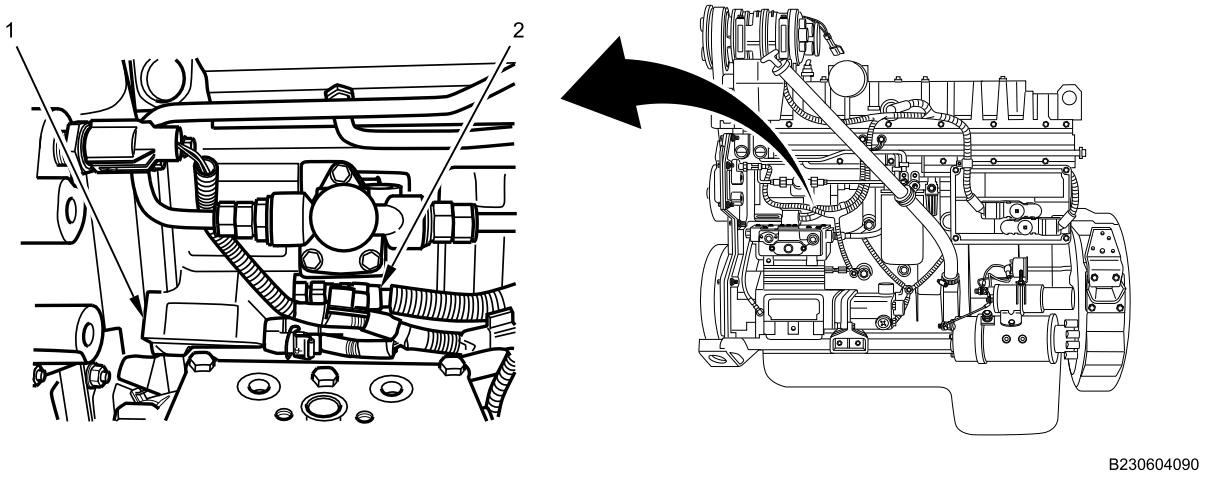


Figure 4. High-Pressure Hose at Pump.

13. Remove high-pressure hose (Figure 4, Item 2) from high-pressure injector pump (Figure 4, Item 1).

NOTE

Regulate shop air to 100 psi (689 kPa).

14. Apply more than 100 psi (689 kPa) of shop air into high-pressure hose (Figure 4, Item 2) using air gun.

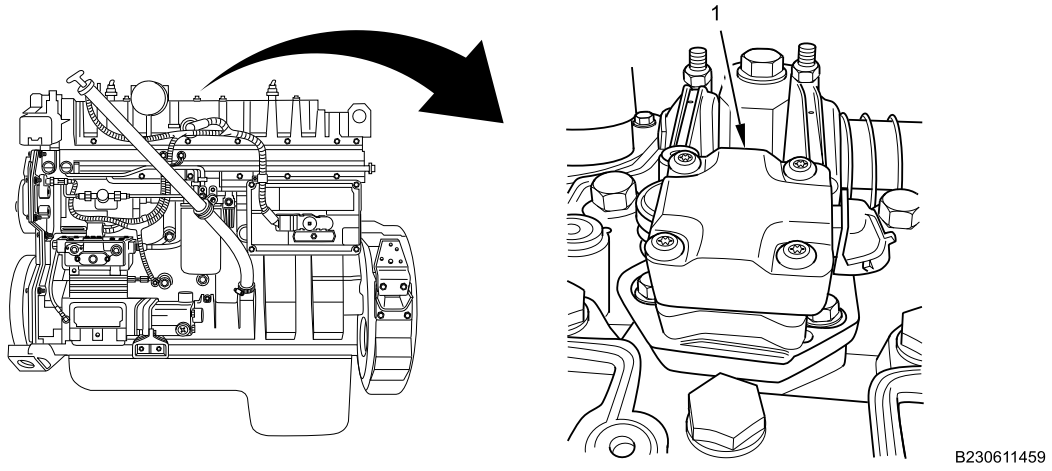


Figure 5. Injector.

15. Inspect for leakage around base of each fuel injector (Figure 5, Item 1). Some leakage around top of fuel injector is normal. One injector shown (Figure 5, Item 1).

CONDITION/INDICATION

Are any fuel injectors leaking?

DECISION

YES Go to Step 27.
NO Go to next step.

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

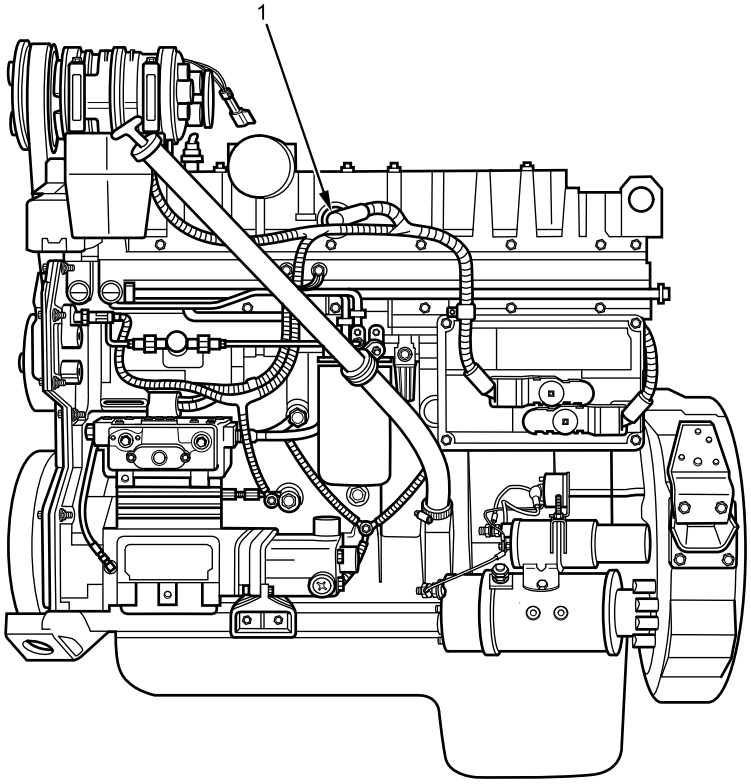


Figure 6. Fuel Injector Harness Connector.

16. With valve cover still off, connect fuel injector harness connector (Figure 6, Item 1) to harness on fuel injectors.
17. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
18. With air pressure still applied, command injectors ON using MSD.

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

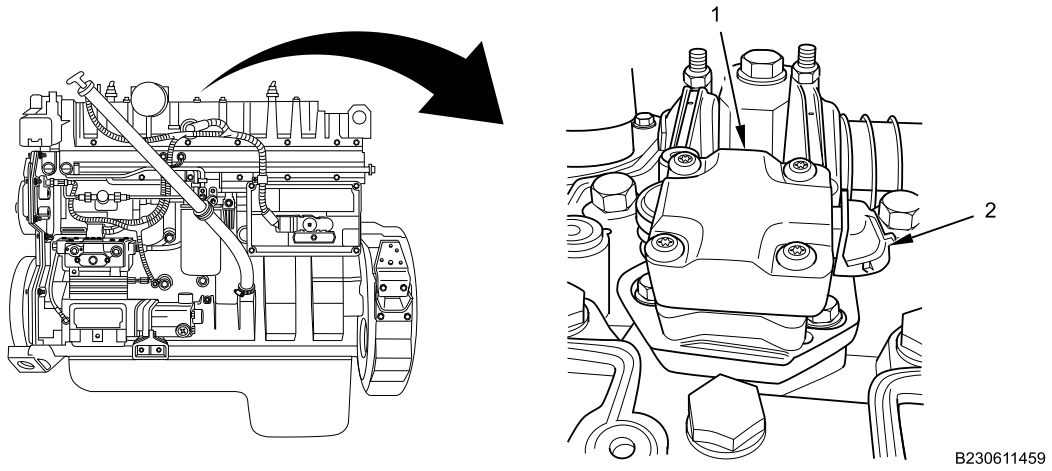


Figure 7. Injector.

19. Check for oil discharge from each injector (Figure 7, Item 1). Oil discharge should be equal. Excess oil discharge indicates faulty fuel injector. One injector shown. (Figure 7, Item 1).

CONDITION/INDICATION

Did any fuel injectors have excessive oil discharge?

DECISION

YES Go to Step 28.
NO Go to Step 27.

STEP

20. Remove fuel pump from high-pressure injector pump. Refer to Fuel Pump Removal and Installation (WP 0253).
21. Disconnect fuel injector harness connector (Figure 7, Item 2).

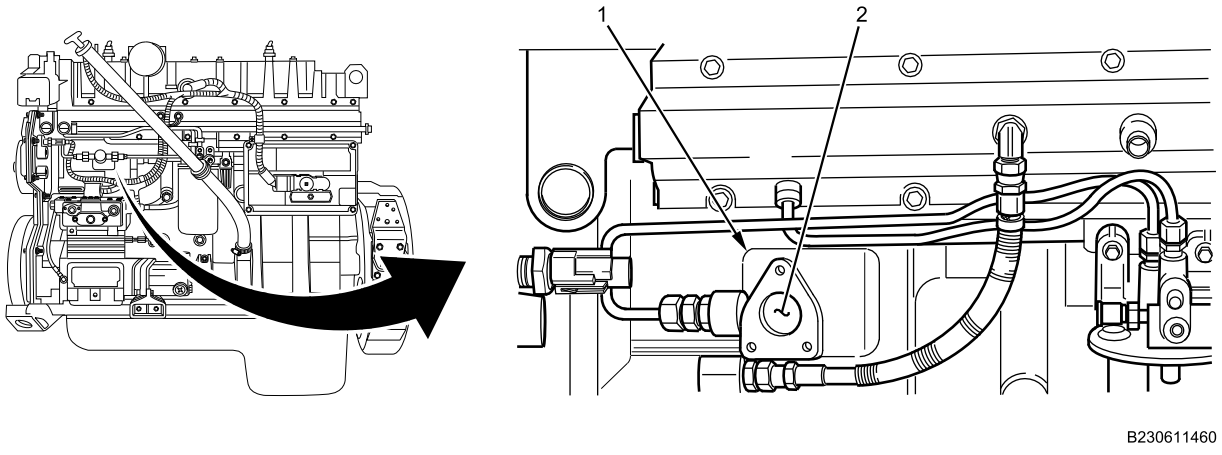


Figure 8. Fuel Pump Camshaft.

22. With assistant, crank engine and check for rotation of fuel pump camshaft (Figure 8, Item 2) inside high-pressure injector pump housing (Figure 8, Item 1).

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Is camshaft rotating?

DECISION

YES Go to Step 29.
NO Go to next step.

STEP

23. Remove high-pressure injector pump. Refer to High-Pressure Injector Pump Removal and Installation (WP 0252).

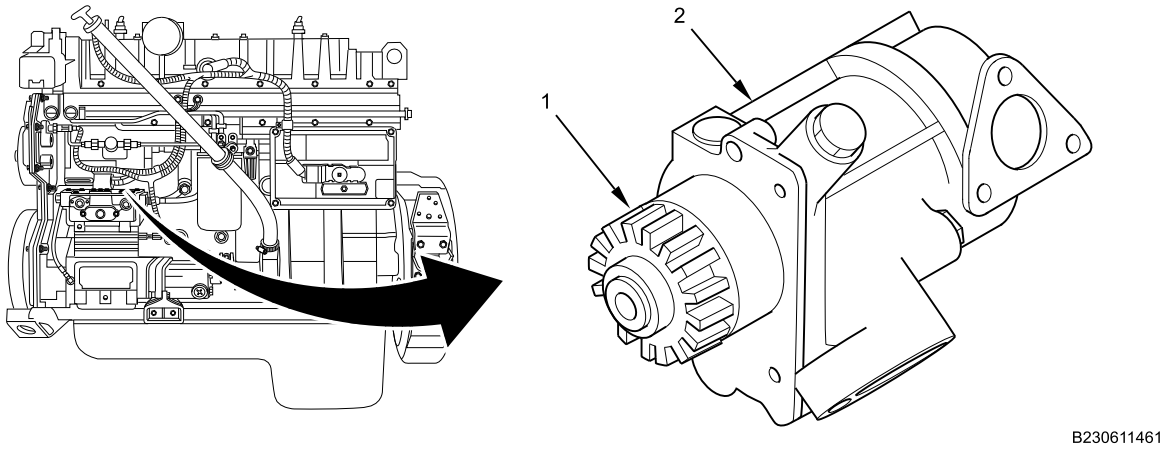


Figure 9. High-Pressure Pump.

24. Check drive gear (Figure 9, Item 1) on high-pressure pump (Figure 9, Item 2) for tightness.

CONDITION/INDICATION

Is drive gear tight?

DECISION

YES Go to Step 30.
NO Go to next step.

MALFUNCTION

- 25. Drive gear is loose.

ACTION

Tighten drive gear mounting bolt. Return vehicle to service.

END OF TEST

MALFUNCTION

- 26. Lubrication system low on oil.

LOW INJECTOR CONTROL PRESSURE (ICP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Go to Engine Oil Drain/Fill Procedure (WP 0233). Return vehicle to service.

END OF TEST

MALFUNCTION

- 27. Fuel injector O-rings faulty.

ACTION

Replace fuel injector O-rings. Go to Fuel Injector Removal and Installation (WP 0249). Return vehicle to service.

END OF TEST

MALFUNCTION

- 28. Fuel injector faulty.

ACTION

Replace fuel injector. Go to Fuel Injector Removal and Installation (WP 0249). Return vehicle to service.

END OF TEST

MALFUNCTION

- 29. Injection pressure regulator faulty.

ACTION

Replace injection pressure regulator. Go to Injection Pressure Regulator Removal and Installation (WP 0396). Return vehicle to service.

END OF TEST

MALFUNCTION

- 30. High-pressure injector pump faulty.

ACTION

Replace high-pressure injector pump. Go to High-Pressure Injector Pump Removal and Installation (WP 0252). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

INJECTION CONTROL PRESSURE (ICP) OPERATIONAL CHECKOUT PROCEDURE

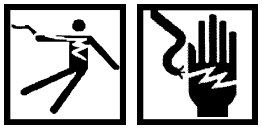
INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0015
WP 0021
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Start engine (TM 9-2355-106-10).
3. Observe ICP voltage on MSD while driving vehicle.

NOTE

Vehicle can be driven uphill or fully loaded to reach 100% engine load.

4. Drive vehicle on road until engine reaches operating temperature. On an open section of road, select suitable gear. Press accelerator pedal to floor and accelerate to 100% load.
5. Record ICP voltage at full load.
6. Stop vehicle and record ICP voltage at 1200 rpm.
7. Record ICP voltage at idle.

INJECTION CONTROL PRESSURE (ICP) OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

8. Turn engine OFF (TM 9-2355-106-10).

CONDITION/INDICATION

ICP voltages do not meet the following specifications:

Full load – 3.54V and 3.74V

1200 rpm – 1.87V and 2.07V

Idle – 0.38V and 0.58V

CORRECTIVE ACTION

Proceed to Low ICP Pressure Test Troubleshooting Procedure (WP 0021).

1. Return to next step in Engine Performance Operational Checkout Procedure (WP 0015).

END OF WORK PACKAGE

FIELD MAINTENANCE

BOOST PRESSURE OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0026
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch to the START position (TM 9-2355-106-10).
3. Start engine (TM 9-2355-106-10).
4. Verify correct engine performance. Refer to Engine Performance Operational Checkout Procedure (WP 0015).

CONDITION/INDICATION

BOOST PRESSURE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

NOTE

Insufficient boost pressure may result in poor engine performance at full load.

Engine does not perform correctly at full load.

CORRECTIVE ACTION

STEP 1. Turn all accessories and ignition OFF (TM 9-2355-106-10).

STEP 2. Connect MSD to American Trucking Association (ATA) diagnostic connector. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).

STEP 3. Drive vehicle on road until engine reaches operating temperature. Find open section of road and select suitable gear. Depress accelerator pedal (full depression) to floor and accelerate to rated speed and 100% load. Drive vehicle uphill or fully loaded to reach correct engine loading at rated engine speed (TM 9-2355-106-10).

STEP 4. Record intake manifold boost pressure from the MSD at full load and rated engine speed.

CONDITION/INDICATION

Pressure equals 4.13V/32 psi (1.5 kPa).

CORRECTIVE ACTION

Return to next step in Vehicle Operational Checkout Procedure (WP 0010).

CONDITION/INDICATION

Pressure does not equal 4.13V/32 psi (1.5 kPa).

CORRECTIVE ACTION

Perform Wastegate Actuator test. Refer to Wastegate Actuator Operational Checkout Procedure (WP 0026).

END OF WORK PACKAGE

FIELD MAINTENANCE

CHARGE AIR COOLER (CAC) PRESSURE OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (Item 37)
Charge air cooler tester (ZTSE4341) (WP 0795, Item 124)

Materials/Parts
Gloves, leather (WP 0794, Item 19)
Goggles (WP 0794, Item 20)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left side engine armor plate removed (WP 0597)
Right side engine armor plate removed (WP 0599)

WARNING

Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing maintenance. Use extreme care when working in close quarters in engine compartment. Stay clear of rotating parts. Wear safety goggles, work gloves, and long sleeves or shop coat. Failure to comply may result in serious injury or death to personnel.

To prevent coupler from blowing off charge air cooler hose during test, connect safety chain before applying air pressure to system. Increase air pressure slowly to prevent adapters from blowing off. After testing, relieve pressure slowly through bleed valve before removing test equipment. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

CAUTION

To prevent foreign matter from entering the engine, cover the turbocharger exhaust and intake piping while the charge air cooler is disconnected. Failure to comply may result in damage to equipment.

NOTE

Charge air coolers are not required to be leak-proof. Do not test the cooler core for leaks by submerging it in a radiator test tank. Almost all charge air cooler units will show leakage if they are submerged.

It is not necessary to remove charge air cooler from the vehicle to perform the test in this work package.

CHARGE AIR COOLER (CAC) PRESSURE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

NOTE

End seal movement is indicated by a polished area at seal contact area in air cleaner housing.

1. Inspect air induction system components.

CONDITION/INDICATION

- Air cleaner housing damage or distortion that could allow unfiltered air into engine.
- Air filter end seal movement inside housing.
- Air filter element end cap dents, holes, damaged seals, or soot.
- Air intake hoses and clamps loose or not properly positioned over sealing beads.

CORRECTIVE ACTION

Replace air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).

CONDITION/INDICATION

Chassis-mounted CAC and piping damaged.

CORRECTIVE ACTION

Replace CAC hose. Refer to Charge Air Cooler (CAC) Hose Removal and Installation (WP 0251).

NOTE

An instruction manual accompanies the CAC tester.

1. Install CAC tester bleed-off coupler at CAC cold side rubber hose (Figure 1, Item 1).

CHARGE AIR COOLER (CAC) PRESSURE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

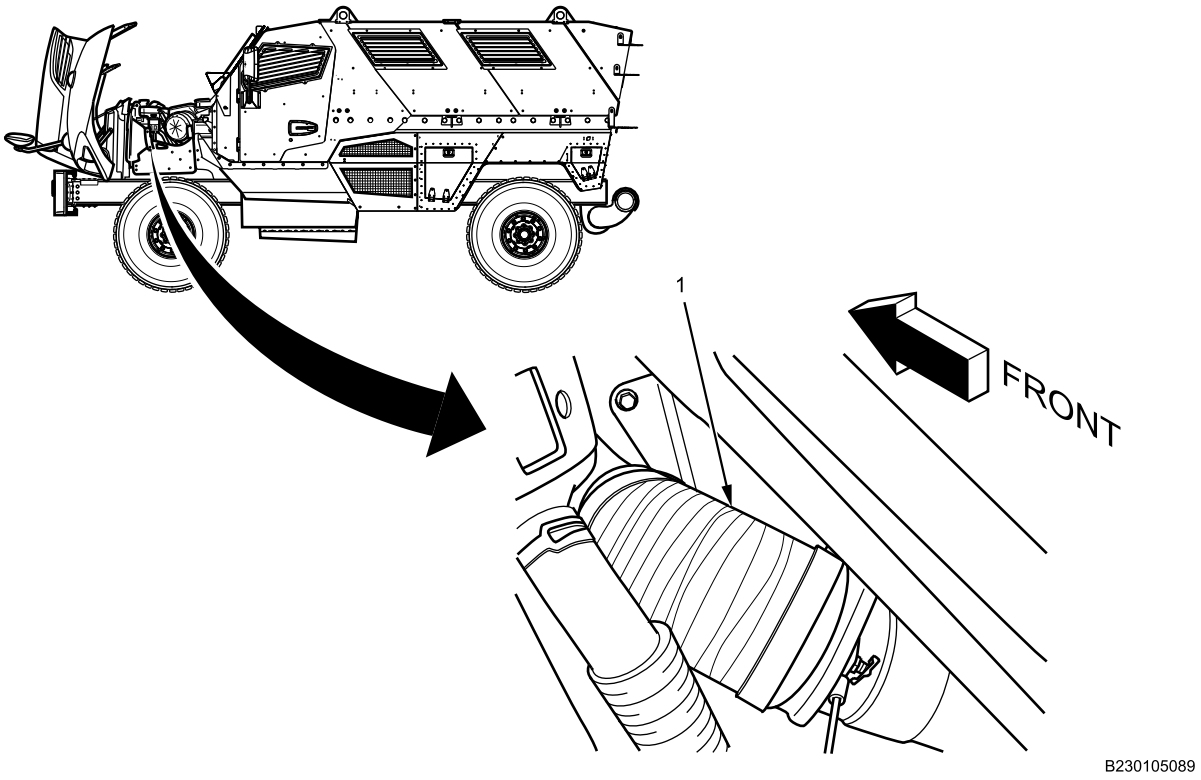


Figure 1. CAC Tester on Cold Side of CAC.

CHARGE AIR COOLER (CAC) PRESSURE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

2. Install CAC tester gauge and regulator assembly (Figure 2, Item 2) at CAC hot side rubber hose (Figure 2, Item 3).

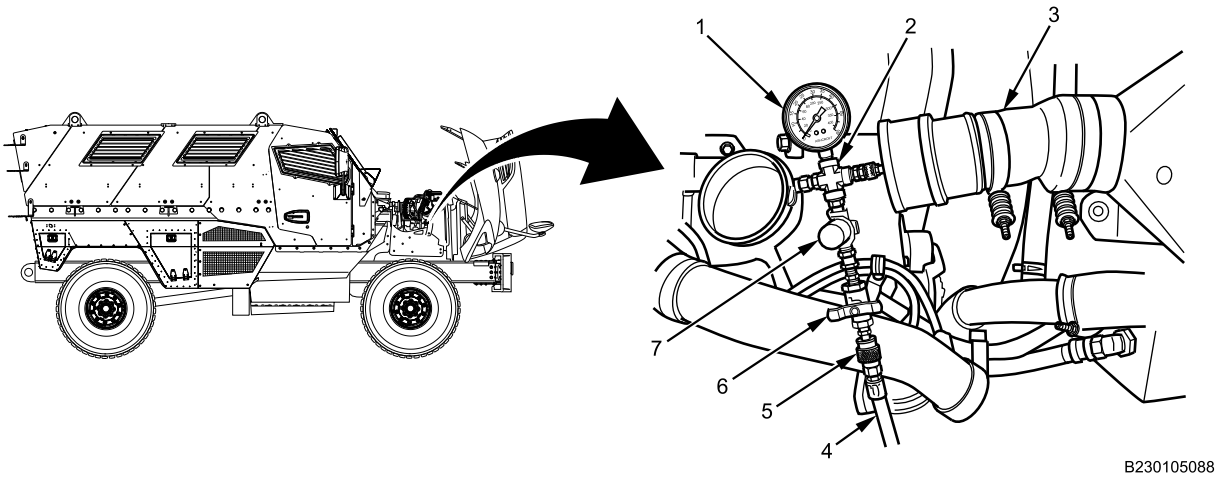


Figure 2. CAC Tester on Hot Side of CAC.

3. Connect filtered air supply (Figure 2, Item 4) to quick disconnect fitting (Figure 2, Item 5) on CAC tester gauge and regulator assembly (Figure 2, Item 2).
4. Open air valve (Figure 2, Item 6) and adjust regulator (Figure 2, Item 7) to 30 psi (206.9 kPa), and then shut off air valve and monitor gauge (Figure 2, Item 1). Note decrease in air pressure.

Air pressure drop is 5 psi (34.5 kPa) or less in 15 seconds.

Go to Engine Performance Operational Checkout Procedure (WP 0015).

1. Coat following areas with soapy water:
   - All pipe and hose surfaces.
   - All pipes to and from charge air cooler.
2. Open air valve (Figure 2, Item 6) and adjust regulator (Figure 2, Item 7) to 30 psi (206.9 kPa), and then shut off air valve.

Bubbles from soapy water indicate presence of leaks.

Replace CAC hose. Refer to Charge Air Cooler (CAC) Hose Removal and Installation (WP 0251). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

CRANKCASE PRESSURE OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

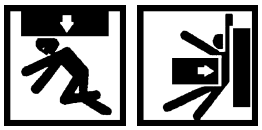
Test Equipment
Pressure Test Kit (ZTSE4409) (WP 0795, Item 77)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Adapter, crankcase pressure test (WP 0795, Item 1)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0017
WP 0524
WP 0606
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Belly armor removed (WP 0606)

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Excessive crankcase pressure may indicate engine mechanical faults that result in poor engine performance.

STEP

1. Park vehicle on level ground (TM 9-2355-106-10).
2. Verify engine oil level is not above full mark and oil dipstick is secured (TM 9-2355-106-10).
3. Verify intake manifold gasket is not leaking. Refer to Engine Systems Operational Checkout Procedures (WP 0017).
4. Verify breather tube is clean and valve rocker cover is tight. Refer to Engine Systems Operational Checkout Procedures (WP 0017).
5. Verify air compressor does not affect test results by disconnecting air compressor delivery line. Refer to Air Compressor Delivery Air Line Removal and Installation (WP 0524).

CONDITION/INDICATION

Engine does not perform correctly.

CORRECTIVE ACTION

CRANKCASE PRESSURE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

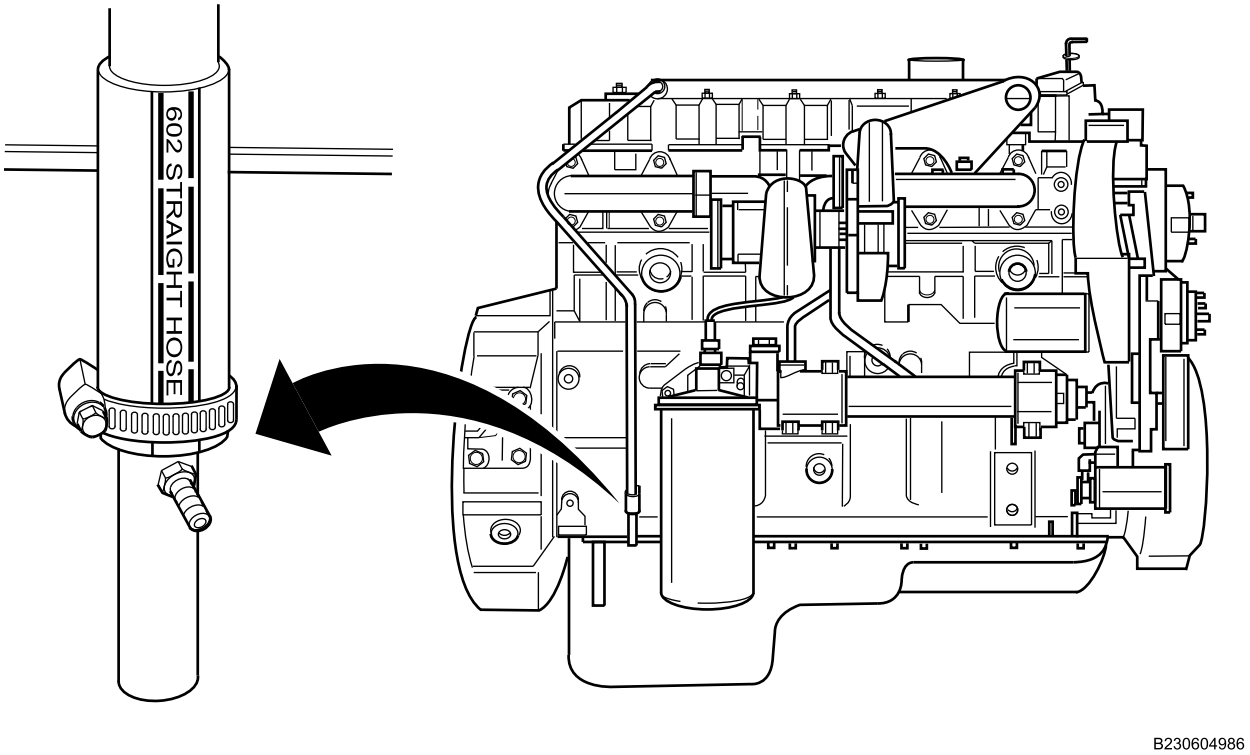


Figure 1. Right Side of Engine.

NOTE

If engine has a breather extension tube, remove extension tube before installing the crankcase breather tool.

STEP 1. Install crankcase breather tool (Figure 1).

CRANKCASE PRESSURE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

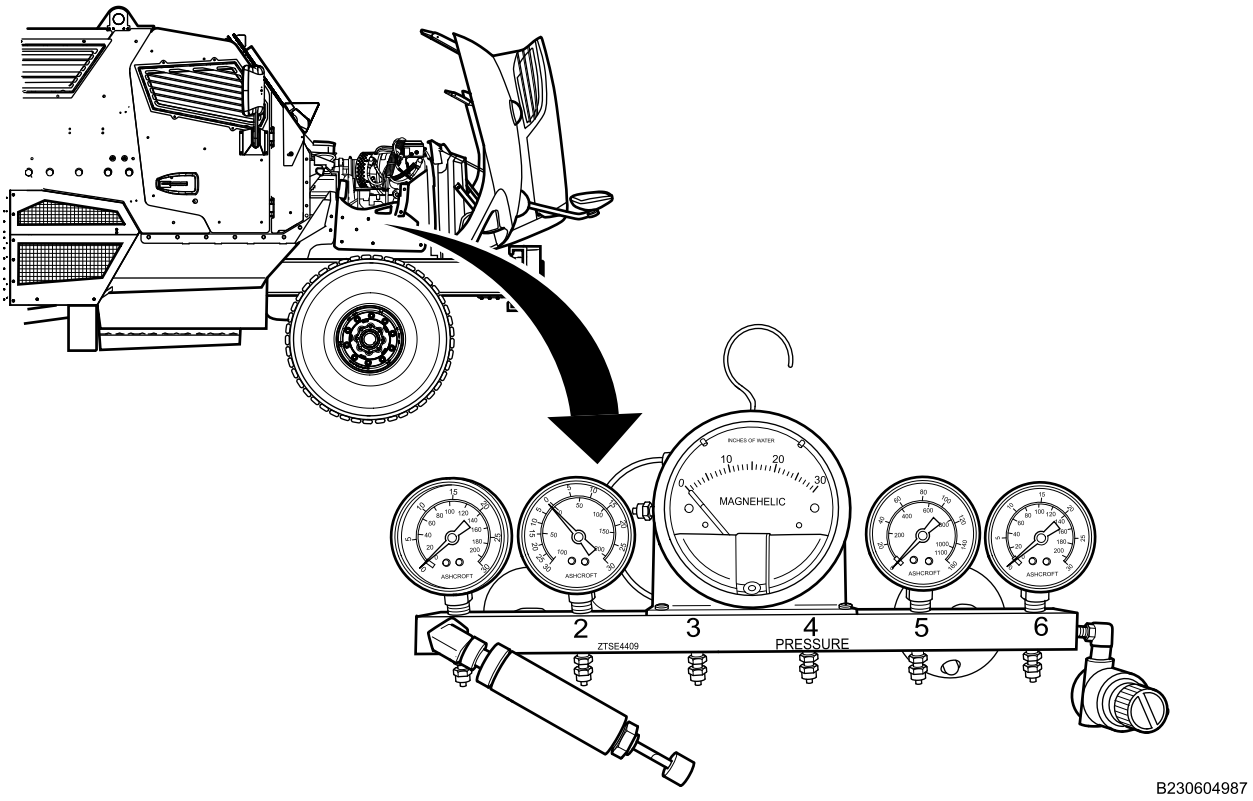


Figure 2. Right Side of Vehicle.

STEP 2. Connect a line from the crankcase breather tool to position 4 of magnehelic gauge (Figure 2).

STEP 3. Turn MAIN POWER switch on (TM 9-2355-106-10) .

STEP 4. Start engine (TM 9-2355-106-10).

STEP 5. Run engine to reach normal operating temperature (TM 9-2355-106-10).

STEP 6. Run engine at high idle (no load) rpm.

NOTE

Allow the gauge reading to stabilize before taking the pressure reading.

STEP 7. Record crankcase pressure.

STEP 8. Turn engine off (TM 9-2355-106-10).

STEP 9. Turn MAIN POWER switch off (TM 9-2355-106-10).

CONDITION/INDICATION

Recorded pressure is less than 6.0 in. H2O.

CORRECTIVE ACTION

Return vehicle to service.

CONDITION/INDICATION

Recorded pressure is more than 6.0 in. H2O.

CRANKCASE PRESSURE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

CORRECTIVE ACTION

Replace engine. Refer to Engine Assembly Removal (WP 0218) and Engine Assembly Installation (WP 0219). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

WASTEGATE ACTUATOR OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Pressure Test Kit (ZTSE4409) (WP 0795, Item 77)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Soapstone (WP 0795, Item 93)

Materials/Parts
Goggles, industrial (WP 0794, Item 20)
Face shield, industrial (WP 0794, Item 16)
Gloves (WP 0794, Item 19)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0015
WP 0256
WP 0261
WP 0600
WP 0599
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

WARNING

Wear protective eye goggles, face shield, and long sleeves when working on or near batteries. Batteries contain corrosive acid and can produce explosive gases. Batteries supply electrical current that can cause burns and electrical shock. Always check electrolyte level with engine off. Avoid leaning over or onto battery. Do not wear jewelry and do not smoke or have open flame or spark near battery. Do not allow tools to contact battery box or battery terminals. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing maintenance. Use extreme care when working in close quarters in engine compartment. Stay clear of rotating parts. Wear safety goggles, work gloves, and long sleeves or shop coat. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

WASTEGATE ACTUATOR OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

1. Verify correct engine performance. Refer to Engine Performance Operational Checkout Procedure (WP 0015).

CONDITION/INDICATION

NOTE

Incorrect wastegate operation may cause poor engine performance.

Engine does not perform correctly.

CORRECTIVE ACTION

STEP 1. Remove right side engine armor plate. Refer to Right Side Engine Armor Plate Removal and Installation (WP 0599).

STEP 2. Remove right engine armor plate bracket. Refer to Right Engine Armor Plate Bracket Removal and Installation (WP 0600).

STEP 3. Remove air intake tube. Refer to Air Intake Tube (to Turbo) Removal and Installation (WP 0256).

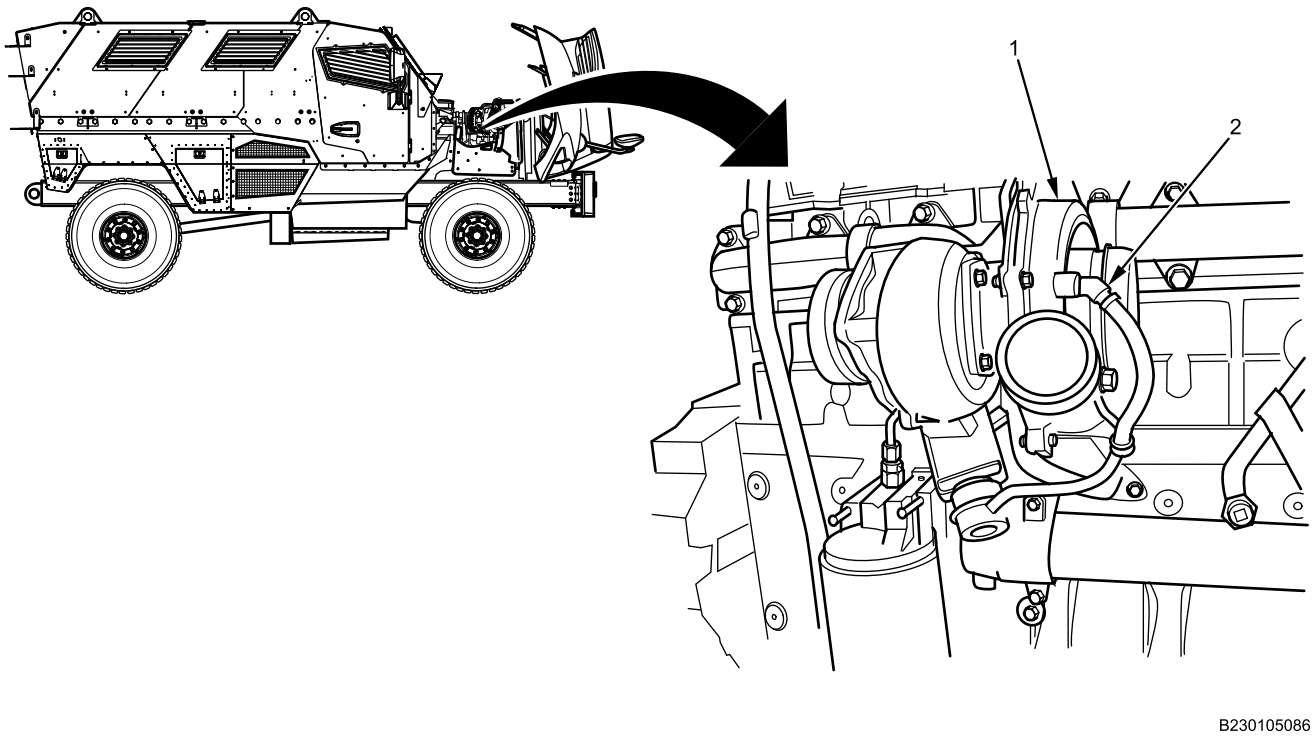


Figure 1. Right Side of Engine.

STEP 4. Remove actuator boost line (Figure 1, Item 2) from turbocharger housing (Figure 1, Item 1).

WASTEGATE ACTUATOR OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

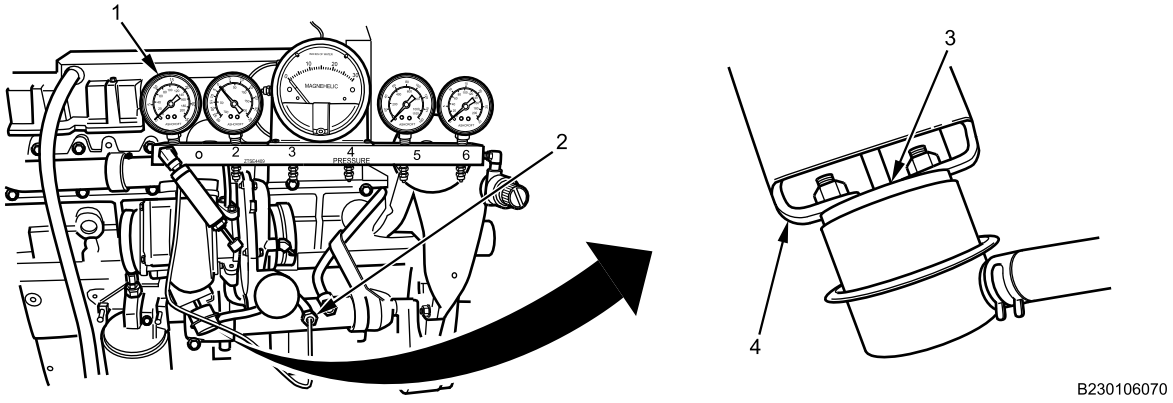


Figure 2. Pressure Test Kit ZTSE4409.

STEP 5. Connect air regulator with 0-60 psi gauge (Figure 2, Item 1) to actuator boost line (Figure 2, Item 2).

STEP 6. Mark actuator shaft (Figure 2, Item 3) at wastegate actuator bracket (Figure 2, Item 4) with soapstone marker. Spray leak detector or soap solution around actuator housing.

STEP 7. Slowly apply air pressure to actuator. Movement of actuator shaft (Figure 2, Item 3) (indicated by position of soapstone mark) should start at 26-30 psi (179-207 kPa).

STEP 8. Measure movement of actuator shaft (Figure 2, Item 3) between soapstone mark and wastegate actuator bracket (Figure 2, Item 4) with ruler.

CONDITION/INDICATION

Actuator shaft does not move at 26-30 psi (179-207 kPa).

CORRECTIVE ACTION

Replace turbocharger. Refer to Turbocharger Removal and Installation (WP 0261). Return vehicle to service.

CONDITION/INDICATION

Actuator shaft does not move more than 0.25 in. (6.35 mm).

CORRECTIVE ACTION

Replace turbocharger. Refer to Turbocharger Removal and Installation (WP 0261). Return vehicle to service.

CONDITION/INDICATION

Actuator housing leaks.

CORRECTIVE ACTION

Replace turbocharger. Refer to Turbocharger Removal and Installation (WP 0261). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

VALVE ADJUSTMENT TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

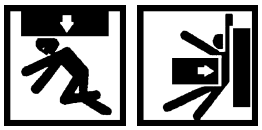
Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0015
WP 0229
WP 0228
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Engine valve cover removed (WP 0228)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

NOTE

Perform engine valve clearance check on cold engine.

SYMPTOM

Engine performance is poor.

MALFUNCTION

Engine valve adjustment may be incorrect.

CORRECTIVE ACTION

VALVE ADJUSTMENT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP 1. Rotate crankshaft until piston number 1 is on compression stroke and timing mark on damper pulley is aligned with TDC mark on front cover. Refer to Engine Valve Adjustment (WP 0229).

Valve Adjustments with No. 1 Piston and No. 6 Piston at TDC												
Piston Position	**Cylinder 1**		**Cylinder 2**		**Cylinder 3**		**Cylinder 4**		**Cylinder 5**		**Cylinder 6**	
No. 1 Piston (TDC compression)	Intake valve 1	Exhaust valve 2	Intake valve 3			Exhaust valve 6	Intake valve 7			Exhaust valve 10		
No. 6 Piston (TDC compression)				Exhaust valve 4	Intake valve 5			Exhaust valve 8	Intake valve 9		Intake valve 11	Exhaust valve 12

B230602751

Figure 1. Valve Adjustment with No. 1 Piston and No. 6 Piston at Top Dead Center (TDC).

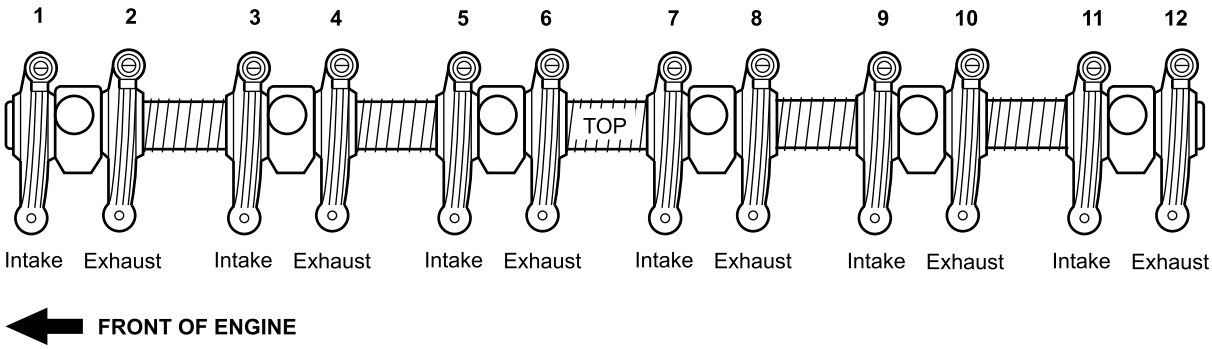


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Figure 2. Valve Adjustment Sequence.

STEP 2. Check valve adjustment for valves 1, 2, 3, 6, 7, and 10 by inserting a 0.025-inch (0.64-mm) feeler gauge between rocker arm and valve stem tip. A light drag on feeler gauge indicates correct valve clearance. Refer to Figure 1 and Figure 2. If valve clearance is incorrect, refer to Engine Valve Adjustment (WP 0229).

STEP 3. Position piston number six at TDC in the compression stroke. Refer to Engine Valve Adjustment (WP 0229).

STEP 4. Check valve adjustment for valves 4, 5, 8, 9, 11, and 12 by inserting a 0.025-inch (0.64-mm) feeler gauge between rocker arm and valve stem tip. A light drag on feeler gauge indicates correct valve clearance. Refer to Figure 1 and Figure 2. If valve clearance is incorrect refer, to Engine Valve Adjustment (WP 0229).

STEP 5. Return to next step in Engine Performance Operational Checkout Procedure (WP 0015).

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Pressure Test Kit (ZTSE4409) (WP 0795, Item 77)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Tee, 3-wire pressure sensor breakout (ZTSE4347) (WP 0795, Item 116)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0392
WP 0238
WP 0393
WP 0329
WP 0317
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left side engine armor plate removed (WP 0597)
Left engine armor plate bracket removed (WP 0598)

Drawings Required
WP 0789, Figure 79

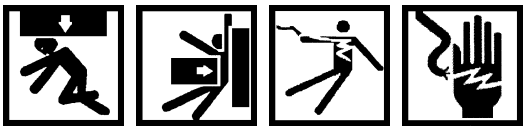
This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 211
- 212
- 225
- 313
- 314

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

When routing DMM leads, do not crimp leads, run leads too close to moving parts, or let leads touch hot engine surfaces. Failure to comply may result in serious injury to personnel.

Keep hands and clothing clear of moving parts in the engine compartment. Rotating parts can cause severe injury to personnel. Ensure that all guards are in place and do not wear loose clothing when conducting maintenance. Always check to ensure that the area is clear of personnel and obstructions before starting the engine. Failure to comply may result in injury to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Make sure engine oil is at the proper level before performing the work package.

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Disconnect harness connector LAM1013. Refer to Figure 1.

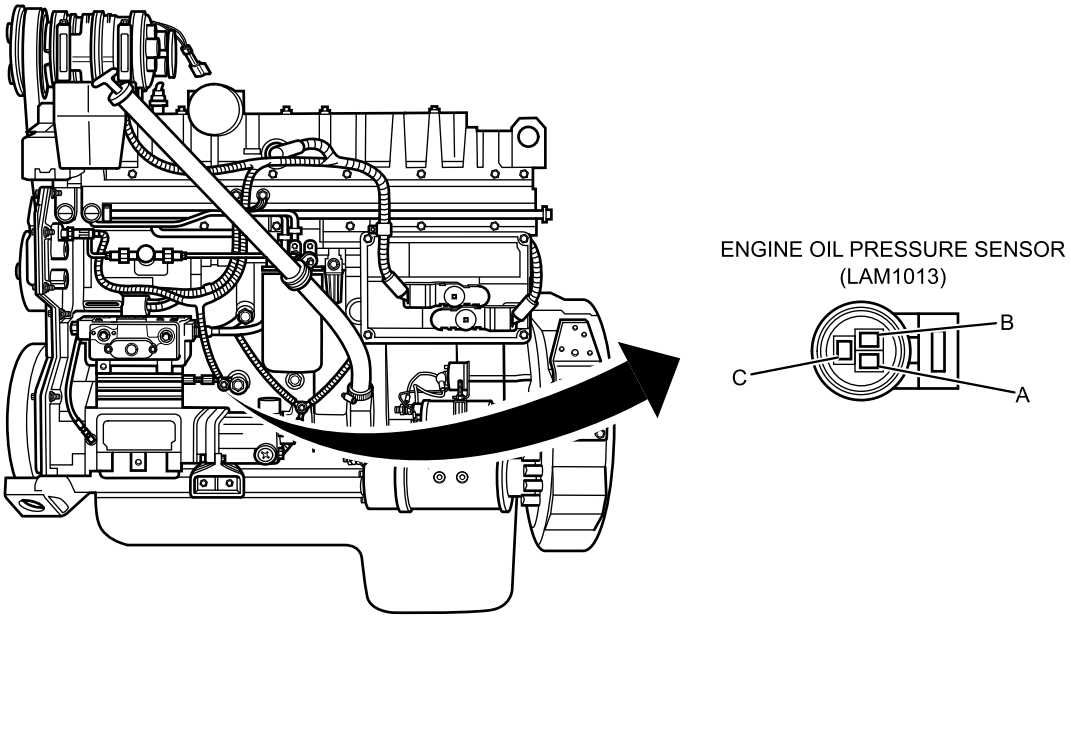


Figure 1. Left Engine, Behind Air Compressor.

2. Install 3-wire breakout harness between EOP sensor and harness connector LAM1013. Refer to Figure 2 and Figure 1.

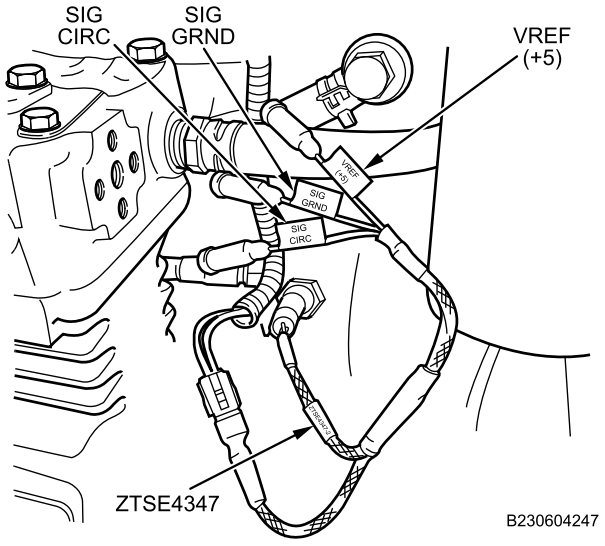


Figure 2. 3-Wire Breakout Harness (ZTSE4347).

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

3. Turn ignition switch ON (TM 9-2355-106-10).
4. Turn MAIN POWER switch ON (TM 9-2355-106-10).
5. Measure DC voltage between breakout harness SIG CIRC and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 0.039V and 1.49V?

DECISION

NO Go to Step 14.
YES Go to next step.

STEP

6. Measure DC voltage between breakout harness SIG CIRC and ground with multimeter. Refer to Figure 3.

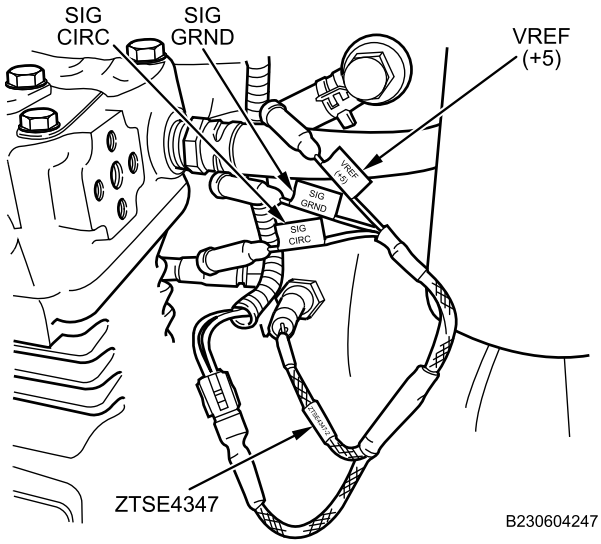


Figure 3. 3-Wire Breakout Harness (ZTSE4347).

7. Observe multimeter while assistant operates engine at 700 rpm, 1400 rpm, and 2000 rpm.

CONDITION/INDICATION

Does multimeter read more than 1V at 700 rpm, 1.2V at 1400 rpm, and 1.7V at 2000 rpm?

DECISION

YES Return vehicle to service.
NO Go to next step.

STEP

8. Turn ignition switch OFF (TM 9-2355-106-10).
9. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
10. Remove 3-wire breakout harness (ZTSE4347) from EOP sensor and harness connector LAM1013. Refer to Figure 3.
11. Remove EOP sensor. Refer to Engine Oil Pressure (EOP) Sensor Removal and Installation (WP 0392).
12. Install pressure test kit (ZTSE4409) mechanical gauge 5 to EOP sensor location on engine. Refer to Figure 4.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

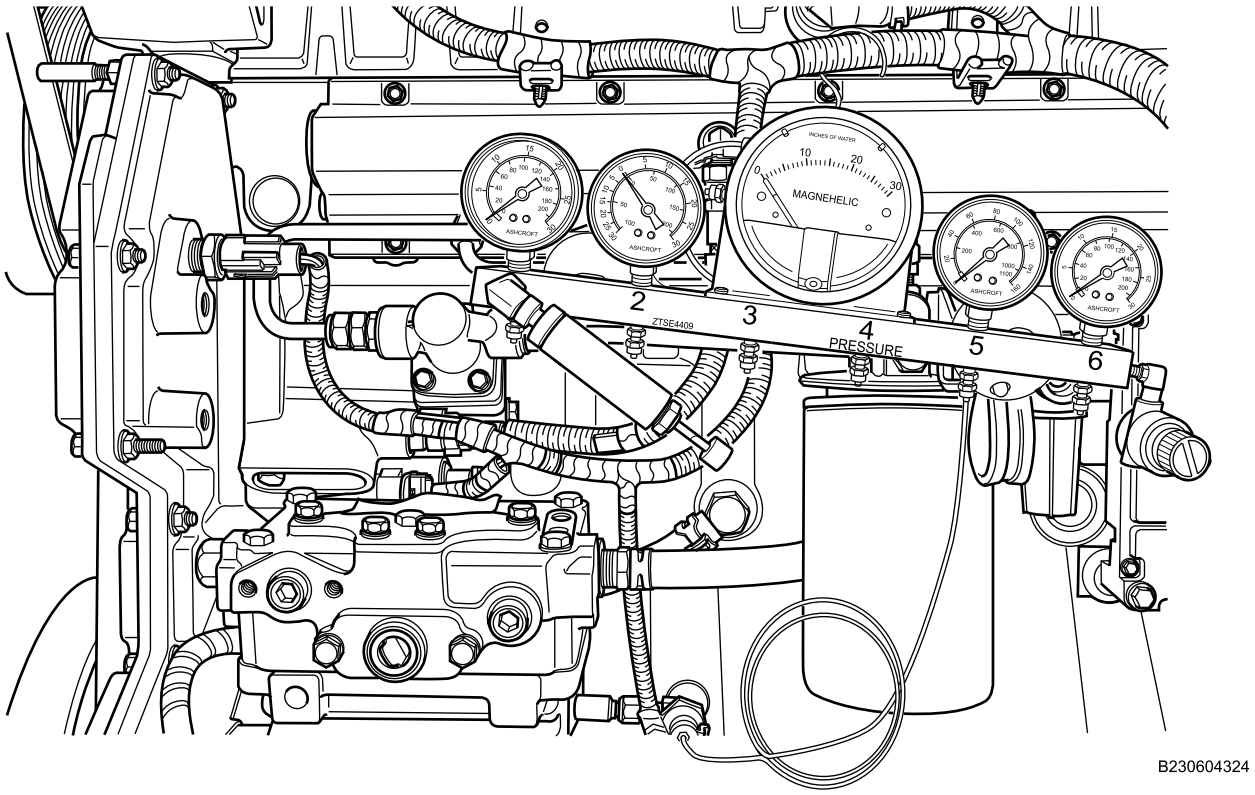


Figure 4. Pressure Test Kit (ZTSE4409).

13. Observe multimeter while assistant operates engine at 700 rpm, 1400 rpm, and 2000 rpm.

CONDITION/INDICATION

Does mechanical gauge 5 read more than 5 psi at 700 rpm, 10 psi at 1400 rpm, and 20 psi at 2000 rpm?

DECISION

NO Go to Step 45.
YES Go to Step 50.

STEP

14. Turn ignition switch OFF (TM 9-2355-106-10).
15. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
16. Measure resistance between connector LAM1013 terminal A and ground with multimeter. Refer to Figure 5.

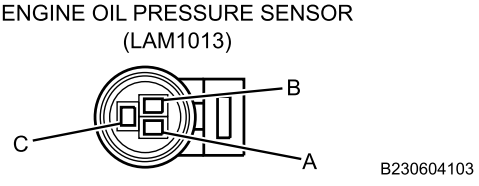


Figure 5. Connector LAM1013.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 20.
YES Go to next step.

STEP

17. Turn MAIN POWER switch ON (TM 9-2355-106-10).
18. Turn ignition switch ON (TM 9-2355-106-10).
19. Measure DC voltage between connector LAM1013 terminal B and ground with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 22.
YES Go to Step 33.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

20. Disconnect connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 6.

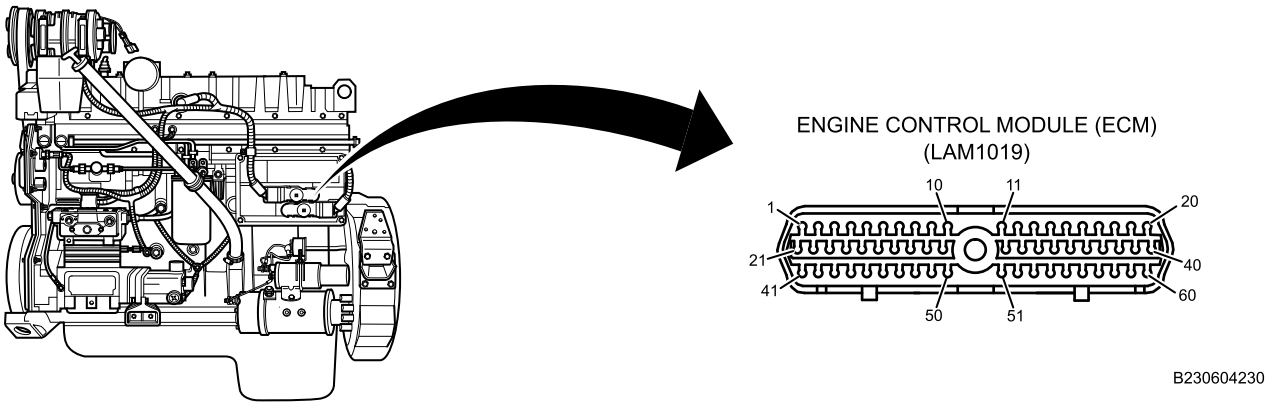


Figure 6. Left Rear of Engine.

21. Measure resistance between connector LAM1013 terminal A and connector LAM1019 terminal 19 with multimeter. Refer to Figure 5 and Figure 6.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 51.
NO Go to Step 49.

STEP

22. Turn ignition switch OFF (TM 9-2355-106-10).
23. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
24. Disconnect connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 6.
25. Turn MAIN POWER switch ON (TM 9-2355-106-10).
26. Turn ignition switch ON (TM 9-2355-106-10).
27. Measure DC voltage between connector LAM1013 terminal B and ground with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 49.
NO Go to next step.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Turn ignition switch OFF (TM 9-2355-106-10).
29. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
30. Measure resistance between connector LAM1013 terminal B and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 49.
YES Go to next step.

STEP

31. Measure resistance between connector LAM1013 terminals B and A with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 49.
YES Go to next step.

STEP

32. Measure resistance between connector LAM1013 terminal B and connector LAM1019 terminal 40 with multimeter. Refer to Figure 7 and Figure 8.

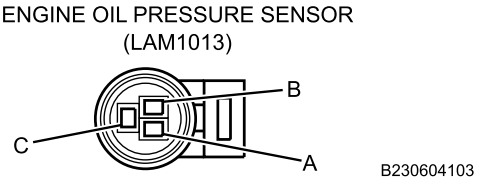


Figure 7. Connector LAM1013.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 51.
NO Go to Step 49.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

33. Turn ignition switch OFF (TM 9-2355-106-10).
34. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
35. Disconnect connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 8.

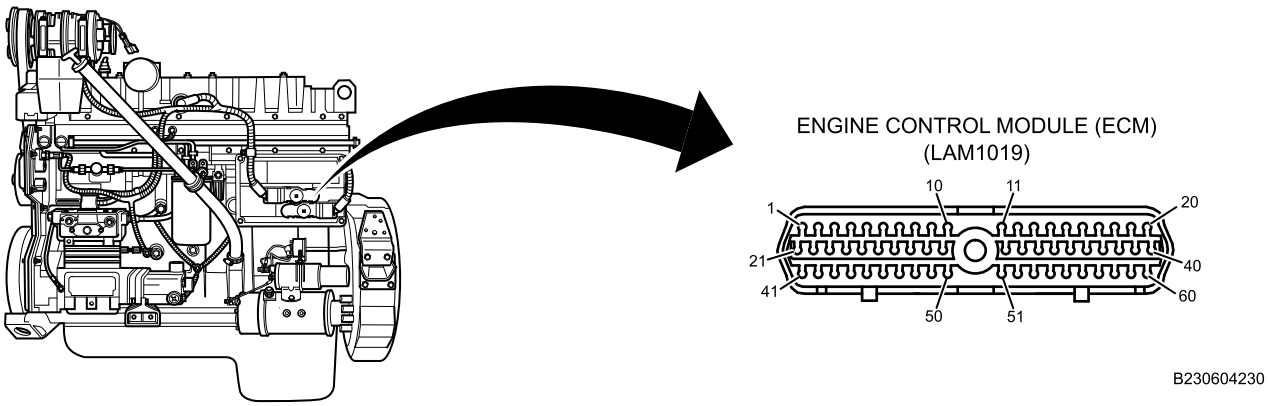


Figure 8. Left Rear of Engine.

36. Turn MAIN POWER switch ON (TM 9-2355-106-10).
37. Turn ignition switch ON (TM 9-2355-106-10).
38. Measure DC voltage between connector LAM1013 terminal C and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 49.
NO Go to next step.

STEP

39. Turn ignition switch OFF (TM 9-2355-106-10).
40. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
41. Measure resistance between connector LAM1013 terminals C and B with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 49.
YES Go to next step.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

42. Measure resistance between connector LAM1013 terminal C and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 49.
YES Go to next step.

STEP

43. Measure resistance between connector LAM1013 terminals C and A with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 49.
YES Go to next step.

STEP

44. Measure resistance between connector LAM1013 terminal C and connector LAM1019 terminal 14 with multimeter. Refer to Figure 9 and Figure 10.

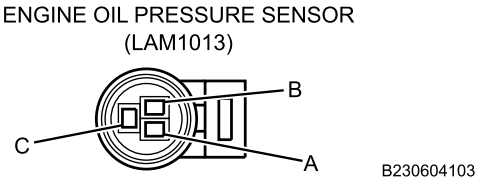


Figure 9. Connector LAM1013.

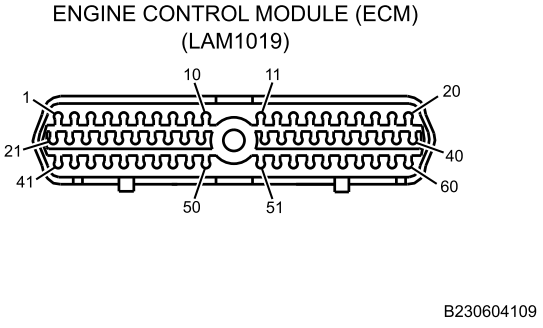


Figure 10. Connector LAM1019.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 51.
NO Go to Step 49.

STEP

45. Replace engine oil pump. Refer to Front Oil Pump Assembly Removal and Installation (WP 0238).
46. Install pressure test kit (ZTSE4409) mechanical gauge 5 to EOP sensor location on engine. Refer to Figure 11.

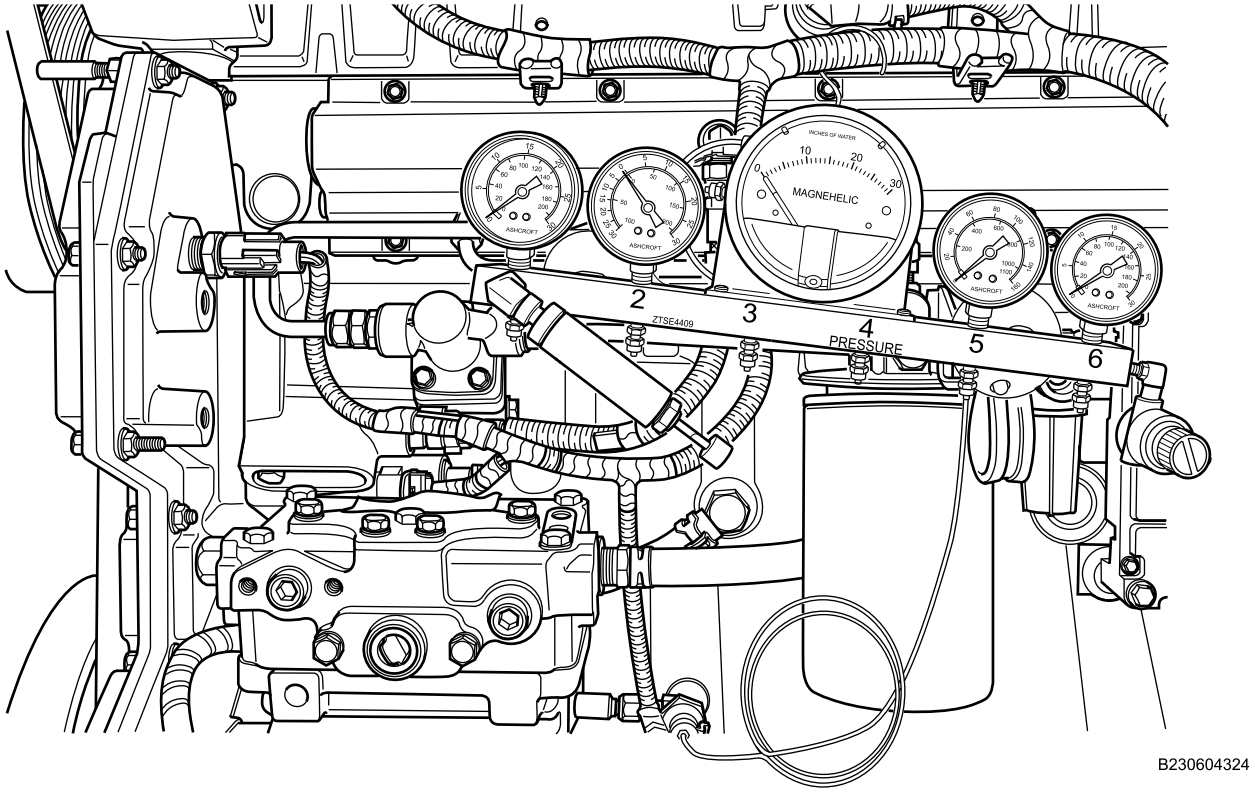


Figure 11. Pressure Test Kit (ZTSE4409).

47. Turn ignition switch ON, with engine running (TM 9-2355-106-10).
48. Observe multimeter while assistant operates engine at 700 rpm, 1400 rpm, and 2000 rpm.

CONDITION/INDICATION

Does mechanical gauge 5 read more than 5 psi at 700 rpm, 10 psi at 1400 rpm, and 20 psi at 2000 rpm?

DECISION

NO Go to Step 52.
YES Return vehicle to service.

ENGINE OIL PRESSURE (EOP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 49. Engine sensor harness is faulty.

ACTION

Replace engine sensor harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0317). Return vehicle to service.

END OF TEST

MALFUNCTION

- 50. EOP sensor is faulty.

ACTION

Replace EOP sensor. Refer to Engine Oil Pressure (EOP) Sensor Removal and Installation (WP 0393). Return vehicle to service.

END OF TEST

MALFUNCTION

- 51. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 52. An engine mechanical fault is present.

ACTION

Replace engine. Refer to Engine Assembly Removal and Installation (WP 0215). Return the vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE OIL TEMPERATURE (EOT) SENSOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Tee, 2-way breakout (WP 0795, Item 115)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0329
WP 0317
WP 0330
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

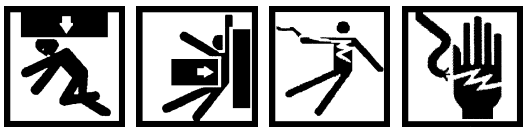
Drawings Required
Schematic (WP 0789, Figure 79)

This procedure covers the following Diagnostic Trouble Code (DTCs):

- DTC 311
- DTC 312

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

ENGINE OIL TEMPERATURE (EOT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

1. Disconnect harness connector LAM1015 from EOT sensor. Refer to Figure 1.

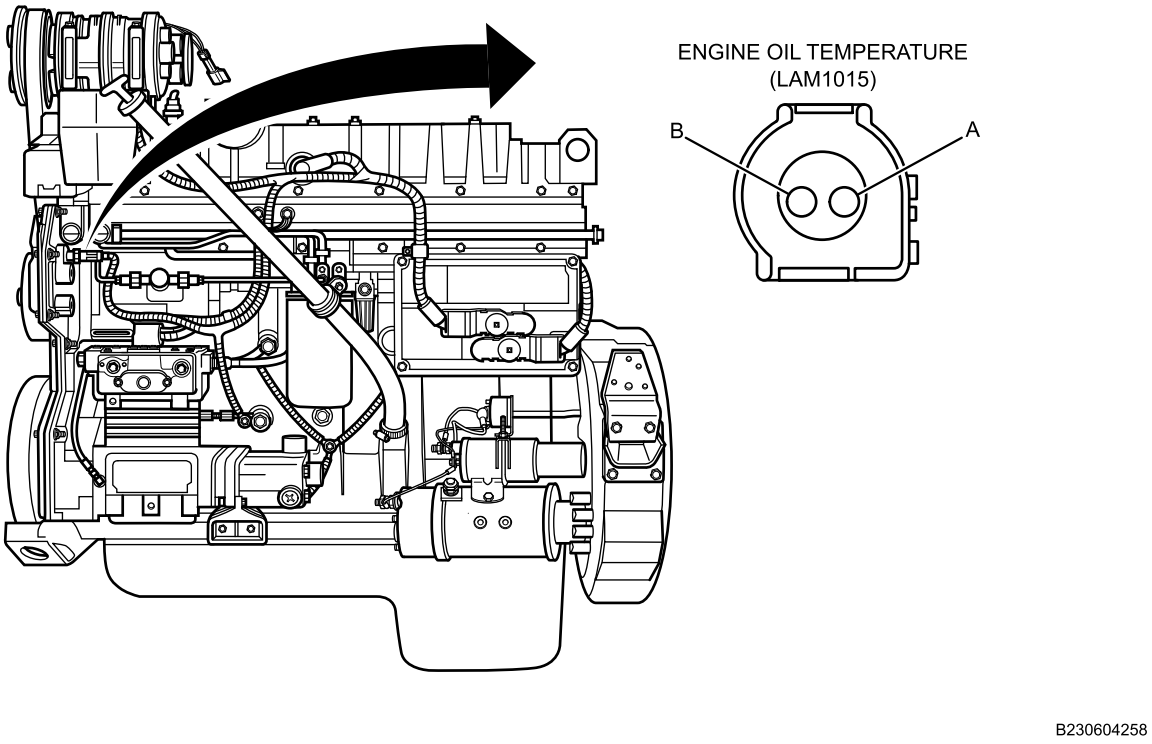


Figure 1. Left Front of Engine, Above Air Compressor.

2. Measure resistance between connector LAM1015 terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 11.
NO Go to next step.

STEP

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TN 9-2355-106-10).
5. Measure DC voltage between EOT signal circuit terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

ENGINE OIL TEMPERATURE (EOT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 13.
YES Go to next step.

STEP

6. Turn ignition switch OFF (TM 9-2355-106-10).

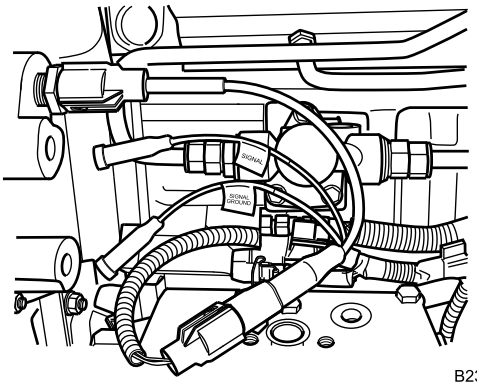


Figure 2. Breakout Tee (ZTSE4483).

7. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
8. Install breakout tee (ZTSE4483) between EOT harness and EOT sensor. Refer to Figure 2.
9. Turn ignition switch ON (TM 9-2355-106-10).
10. Measure DC voltage between breakout tee (ZTSE4483) terminals SIGNAL and SIGNAL GROUND with multimeter.

CONDITION/INDICATION

Table 1. Ambient Temperature vs Voltage.

VOLTAGE	TEMPERATURE °F	TEMPERATURE °C
0.82-0.89V	212	100
3.78-3.86V	68	20
4.35-4.39V	32	0

Does multimeter read voltage corresponding to specifications in Table 1?

DECISION

NO Go to Step 19.
YES Go to Step 18.

ENGINE OIL TEMPERATURE (EOT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

11. Disconnect harness connector LAM1019. Refer to Figure 3. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

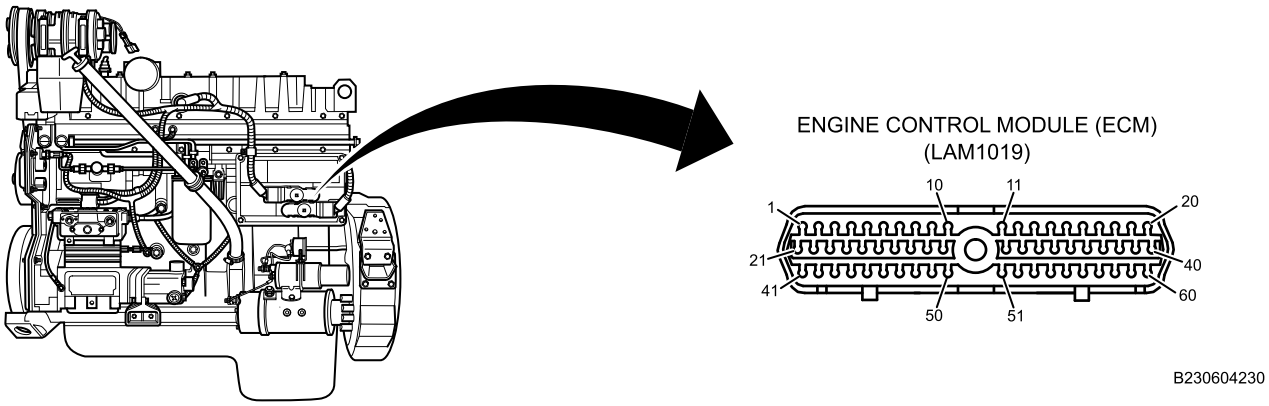


Figure 3. Left Rear of Engine.

12. Measure resistance between harness connector LAM1015 terminal A and harness connector LAM1019 terminal 19 with multimeter. Refer to Figure 3 and Figure 4.

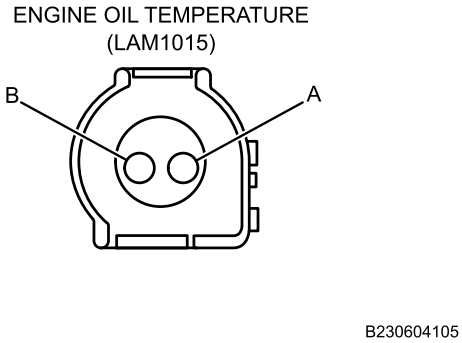


Figure 4. Connector LAM1015.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 18.
YES Go to Step 20.

ENGINE OIL TEMPERATURE (EOT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Turn ignition switch OFF (TM 9-2355-106-10).
14. Disconnect harness connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 3.
15. Measure resistance between harness connector LAM1015 terminal B and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 20.
YES Go to next step.

STEP

16. Measure resistance between harness connector LAM1015 terminal B and harness connector LAM1019 terminal 12 with multimeter. Refer to Figure 3 and Figure 4.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 20.
NO Go to next step.

STEP

17. Measure resistance between harness connector LAM1019 terminal 12 and all other harness connector LAM1019 terminals. Multimeter should read OL for each test. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 18.
NO Go to Step 20.

ENGINE OIL TEMPERATURE (EOT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 18. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 19. EOT sensor is faulty.

ACTION

Replace EOT sensor. Refer to Engine Oil Temperature (EOT) sensor removal and installation(WP 0330). Return vehicle to service.

END OF TEST

MALFUNCTION

- 20. Sensor wiring harness is faulty.

ACTION

Replace engine sensor harness. Refer to Engine Sensor Harness Removal and Installation (WP 0317). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0329
WP 0317
WP 0393
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 79

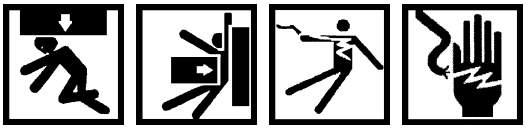
This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 143
- 144
- 145
- 315
- 612

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

When routing DMM leads, do not crimp leads, run leads too close to moving parts, or let leads touch hot engine surfaces. Failure to comply may result in serious injury to personnel.

Keep hands and clothing clear of moving parts in the engine compartment. Rotating parts can cause severe injury to personnel. Ensure that all guards are in place and do not wear loose clothing when conducting maintenance. Always check to ensure that the area is clear of personnel and obstructions before starting the engine. Failure to comply may result in injury to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Disconnect harness connector LAM1011. Refer to Figure 1.

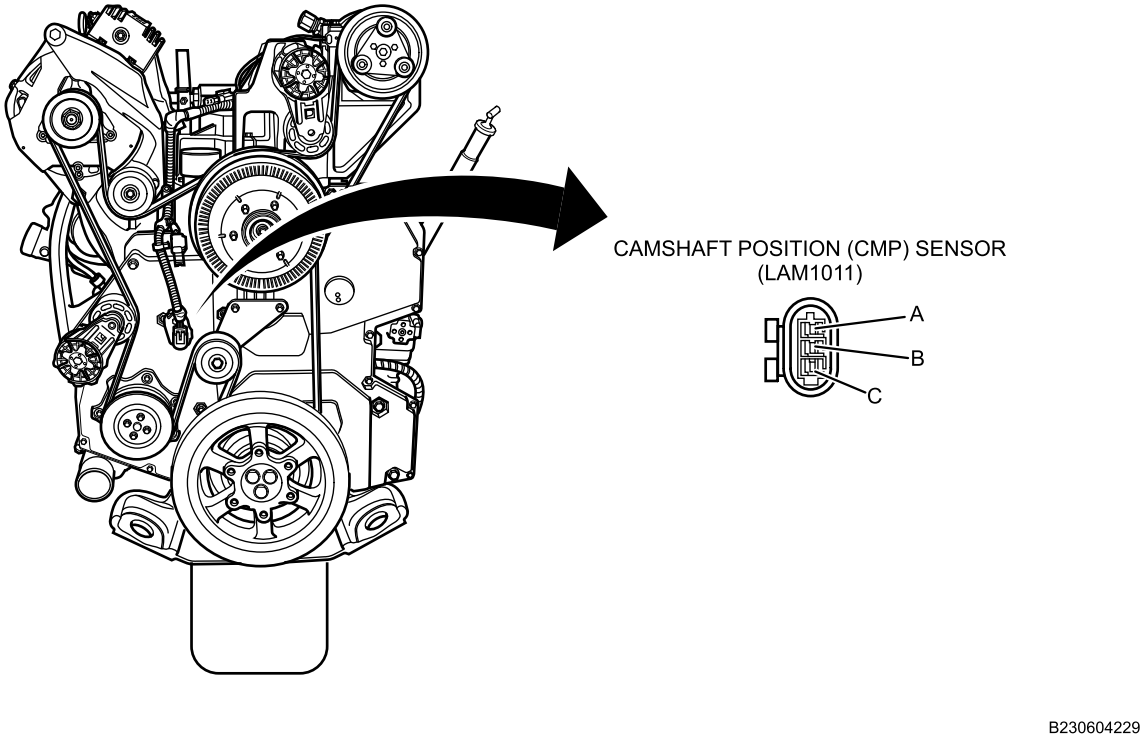


Figure 1. CMP Sensor.

2. Measure resistance between connector LAM1011 terminal A and ground with multimeter. Refer to Figure 1

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 12.
YES Go to next step.

STEP

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Measure DC voltage between connector LAM1011 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 14.
YES Go to next step.

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

6. Measure DC voltage between connector LAM1011 terminal C and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 25.
YES Go to next step.

STEP

7. Measure DC amperage between connector LAM1011 terminal B and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 2 milliamps and 10 milliamps?

DECISION

YES Go to Step 37.
NO Go to next step.

STEP

8. Turn ignition switch OFF (TM 9-2355-106-10).
9. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
10. Disconnect connector LAM1019. Refer to Figure 2 Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

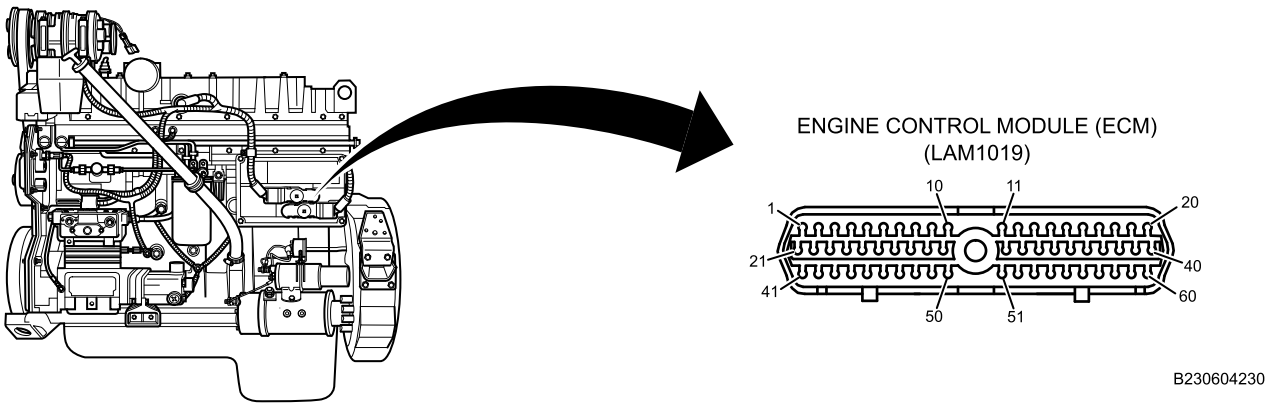


Figure 2. Engine Control Module (ECM).

11. Measure resistance between connector LAM1011 terminals B and C with multimeter. Refer to Figure 3.

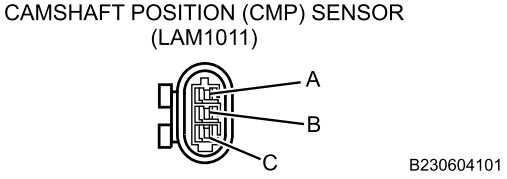


Figure 3. Connector LAM1011.

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 38.
NO Go to Step 36.

STEP

12. Disconnect connector LAM1019. Refer to Figure 2. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).
13. Measure resistance between connector LAM1011 terminal A and connector LAM1019 terminal 53 with multimeter. Refer to Figure 3 and Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 38.
NO Go to Step 36.

STEP

14. Turn ignition switch OFF (TM 9-2355-106-10).
15. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
16. Disconnect connector LAM1019. Refer to Figure 2. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).
17. Turn MAIN POWER switch ON (TM 9-2355-106-10).
18. Turn ignition switch ON (TM 9-2355-106-10).
19. Measure DC voltage between connector LAM1011 terminal B and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 36.
NO Go to next step.

STEP

20. Turn ignition switch OFF (TM 9-2355-106-10).
21. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
22. Measure resistance between connector LAM1011 terminal B and ground with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read OL?

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 36.
YES Go to next step.

STEP

23. Measure resistance between connector LAM1011 terminals B and A with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 36.
YES Go to next step.

STEP

24. Measure resistance between connector LAM1011 terminal B and connector LAM1019 terminal 40 with multimeter. Refer to Figure 5 and Figure 4.

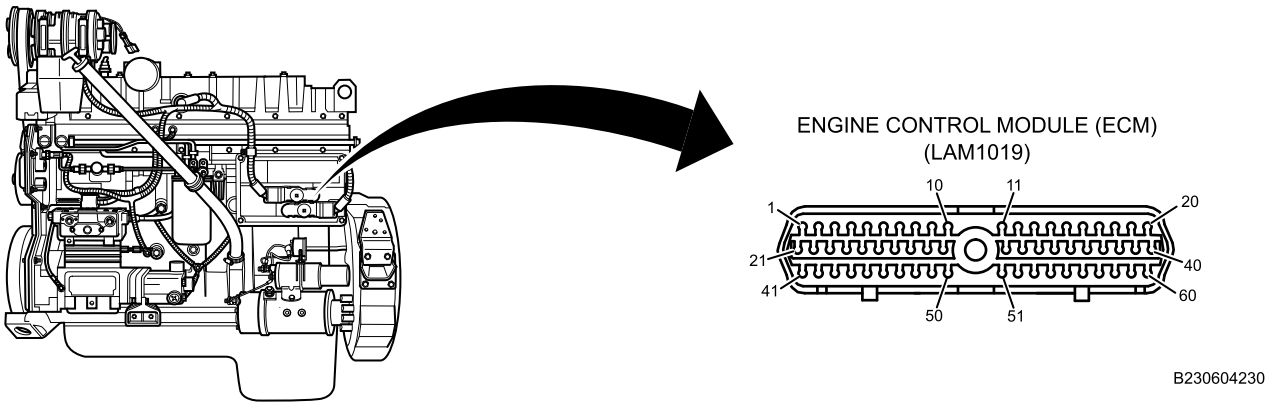


Figure 4. Engine Control Module (ECM).

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 38.
NO Go to Step 36.

STEP

25. Turn ignition switch OFF (TM 9-2355-106-10).
26. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
27. Disconnect connector LAM1019. Refer to Figure 4. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).
28. Turn MAIN POWER switch ON (TM 9-2355-106-10).
29. Turn ignition switch ON (TM 9-2355-106-10).
30. Measure DC voltage between connector LAM1011 terminal C and ground with multimeter. Refer to Figure 5.

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 36.
NO Go to next step.

STEP

31. Turn ignition switch OFF (TM 9-2355-106-10).
32. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
33. Measure resistance between connector LAM1011 terminal C and ground with multimeter. Refer to Figure 5.

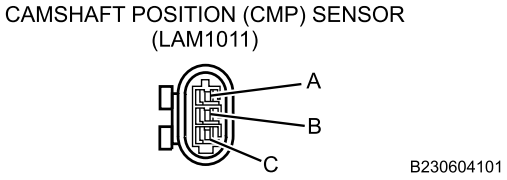


Figure 5. Connector LAM1011.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 36.
YES Go to next step.

STEP

34. Measure resistance between connector LAM1011 terminals C and A with multimeter. Refer to Figure 5.

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 36.
YES Go to next step.

STEP

35. Measure resistance between connector LAM1011 terminal C and connector LAM1019 terminal 51 with multimeter. Refer to Figure 6 and Figure 7.

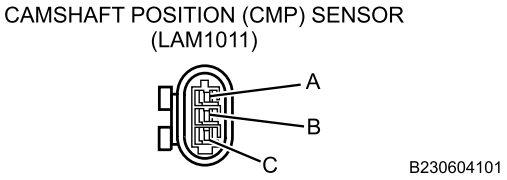


Figure 6. Connector LAM1011.

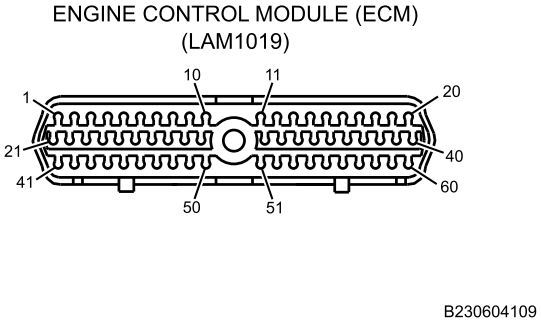


Figure 7. Connector LAM1019.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 38.
NO Go to Step 36.

MALFUNCTION

- 36. Engine sensor wiring harness is faulty.

ACTION

Replace engine sensor wiring harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0317). Return vehicle to service.

END OF TEST

MALFUNCTION

- 37. CMP sensor is faulty.

CAMSHAFT POSITION (CMP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace CMP sensor. Refer to Camshaft Position (CMP) Sensor Removal and Installation (WP 0393). Return vehicle to service.

END OF TEST

MALFUNCTION

- 38. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE COOLING FAN OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

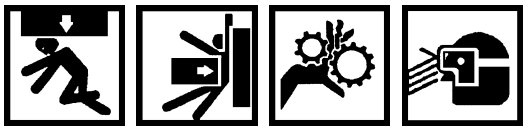
Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

Materials/Parts
Goggles, industrial (WP 0794, Item 20)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0287
WP 0288
WP 0499
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Do not attempt to restrict fan blade rotation during engine operation. Improper use of application or modification of fan drive or fan can damage fan drive. Do not operate vehicle with malfunctioning or damaged fan drive or fan blades. Failure to comply may result in damage to equipment and serious injury to personnel.

Air drain valves are under pressure. Wear protective goggles and do not place face in front of air drain valves while draining air reservoirs. Open air drain valves slowly to release air pressure gradually. Failure to comply may result in serious injury or death to personnel.

Do not disconnect any air line or fitting until system pressure has been relieved. Hoses may whip and injure personnel, and air under pressure can penetrate skin. Failure to comply may result in serious injury or death to personnel.

Do not operate vehicle with air pressure system loss. Vehicle has reduced or no braking capability and may not stop. Failure to comply may result in damage to equipment and serious injury or death to personnel.

ENGINE COOLING FAN OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Let air pressure build in both tanks to 100 psi (689 kPa) before releasing the parking brake. Low air pressure may affect vehicle braking capability. Failure to comply may result in injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Connect Maintenance Support Device (MSD) to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Read Diagnostic Trouble Codes (DTCs).

CONDITION/INDICATION

DTC 246 is set.

CORRECTIVE ACTION

Refer to Engine Diagnostic Trouble Code (DTC) Index (WP 0006).

1. Verify no other engine DTCs are set.

Other engine DTCs set.

Refer to Engine Diagnostic Trouble Code (DTC) Index (WP 0006).

1. Check fan clutch air hose for damage and leaks. Refer to Cooling Fan Actuator Solenoid Removal and Installation (WP 0288).

Fan clutch air hose damaged or leaking.

Replace fan clutch air hose. Refer to Cooling Fan Actuator Solenoid Removal and Installation (WP 0288). Return vehicle to service.

1. Drain air supply in secondary and supply tanks. Refer to Air Reservoir Tank Removal and Installation (WP 0499).
2. Remove outlet side air hose to engine cooling fan from cooling fan actuator solenoid. Refer to Cooling Fan Actuator Solenoid Removal and Installation (WP 0288).
3. Start engine (TM 9-2355-106-10) and build air pressure in Air 2 pressure gauge to 30 psi (207 kPa).
4. Turn ignition OFF (TM 9-2355-106-10).
5. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
6. Check for air leaking from cooling fan actuator solenoid. Refer to Cooling Fan Actuator Solenoid Removal and Installation (WP 0288).

Air leaking from solenoid.

Replace cooling fan actuator solenoid. Refer to Cooling Fan Actuator Solenoid Removal and Installation (WP 0288). Return vehicle to service.

1. Start engine (TM 9-2355-106-10) and build air pressure to more than 70 psi (483 kPa).
2. Turn ignition OFF (TM 9-2355-106-10).
3. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
4. With engine off, attempt to spin fan blades.

Fan blades spin.

Replace cooling fan drive assembly. Refer to Cooling Fan Drive Assembly Removal and Installation (WP 0287). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

BATTERY POWER OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Battery filler, gravity (WP 0795, Item 14)
Battery Service Kit (WP 0795, Item 15)
Analyzer, battery and charging system (WP 0795, Item 7)
Tester, antifreeze solution/battery specific gravity (WP 0795, Item 123)

Materials/Parts
Water, distilled (WP 0794, Item 15)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0418
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Batteries removed (WP 0418)

WARNING

Wear protective eye goggles, face shield, and long sleeves when working on or near batteries. Batteries contain corrosive acid and can produce explosive gases. Batteries supply electrical current that can cause burns and electrical shock. Always check electrolyte level with engine off. Avoid leaning over or onto battery. Do not wear jewelry and do not smoke or have open flame or spark near battery. Do not allow tools to contact battery box or battery terminals. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Battery acid must not contact eyes, skin, or clothing. If battery acid contacts eyes or skin, flush area with large amounts of water for 15 minutes and seek immediate medical care. If swallowed, do not induce vomiting. Drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Seek immediate medical attention. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

NOTE

Before beginning these test procedures, make sure the vehicle batteries are at 75% state of charge (SOC) or higher. This represents an open circuit voltage (OCV) of 12.4 volts. Verify accessories have not been left on for an extended period.

STEP

1. Check for proper electrolyte level in each cell of all batteries as indicated on batteries (TM 9-2355-106-10).
2. Verify specific gravity in each cell of all batteries with gravity tester.
3. Verify all battery terminals are free of corrosion (TM 9-2355-106-10).

BATTERY POWER OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

NOTE

When the battery analyzer is connected to the battery, instructions appear on the analyzer screen. Follow instructions to perform the test. An instruction manual accompanies the analyzer.

4. Connect battery analyzer to battery and test each battery with battery and charging analyzer.

CONDITION/INDICATION

Electrolyte level low.

CORRECTIVE ACTION

Fill low cell as indicated on battery with distilled water (TM 9-2355-106-10). Charge batteries after adding distilled water.

CONDITION/INDICATION

Battery terminals are corroded.

CORRECTIVE ACTION

Clean battery terminals (TM 9-2355-106-10).

CONDITION/INDICATION

Battery fails specific gravity test per tester. Specific gravity results must be within 0.05 units between each cell.

CORRECTIVE ACTION

Replace battery. Refer to Battery Removal and Installation (WP 0418).

CONDITION/INDICATION

Battery fails test per analyzer.

CORRECTIVE ACTION

Replace battery. Refer to Battery Removal and Installation (WP 0418).

END OF WORK PACKAGE

FIELD MAINTENANCE

BATTERY CABLE TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Terminal Test Kit (WP 0795, Item 122)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Gloves, rubber (WP 0795, Item 38)

Materials/Parts
Goggles, industrial (WP 0794, Item 20)
Face shield, industrial (WP 0794, Item 16)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0014
WP 0032
WP 0187
WP 0414
WP 0333
WP 0336
WP 0407
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 28

BATTERY CABLE TESTING

NOTE

Battery condition and state of charge must be confirmed before any load tests can be performed. Refer to Battery Power Troubleshooting Procedure (WP 0032).

Ensure nuts holding battery cables to starter solenoid and starter terminals are tight.

Slow cranking is often caused by high resistance in the battery cables or connections, especially in cold weather. After all batteries check good and terminals are clean and tight, check the battery cables using the sequence of measurements described in this test.

The voltage loss on the positive side plus the voltage loss on the negative side equals the difference between the voltage available in the batteries and the voltage available at the starter. A multimeter reading of more than 0.5V indicates a faulty cable.

BATTERY CABLE TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

BATTERY CABLE TEST

WARNING

Wear protective eye goggles, face shield, and long sleeves when working on or near batteries. Batteries contain corrosive acid and can produce explosive gases. Batteries supply electrical current that can cause burns and electrical shock. Always check electrolyte level with engine off. Avoid leaning over or onto battery. Do not wear jewelry and do not smoke or have open flame or spark near battery. Do not allow tools to contact battery box or battery terminals. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Battery acid must not contact eyes, skin, or clothing. If battery acid contacts eyes or skin, flush area with large amounts of water for 15 minutes and seek immediate medical care. If swallowed, do not induce vomiting. Drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Seek immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing maintenance. Use extreme care when working in close quarters in engine compartment. Stay clear of rotating parts. Wear safety goggles, work gloves, and long sleeves or shop coat. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

BATTERY CABLE TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

The starter solenoid B+ terminal is at battery voltage (24V) when batteries are connected.

STEP

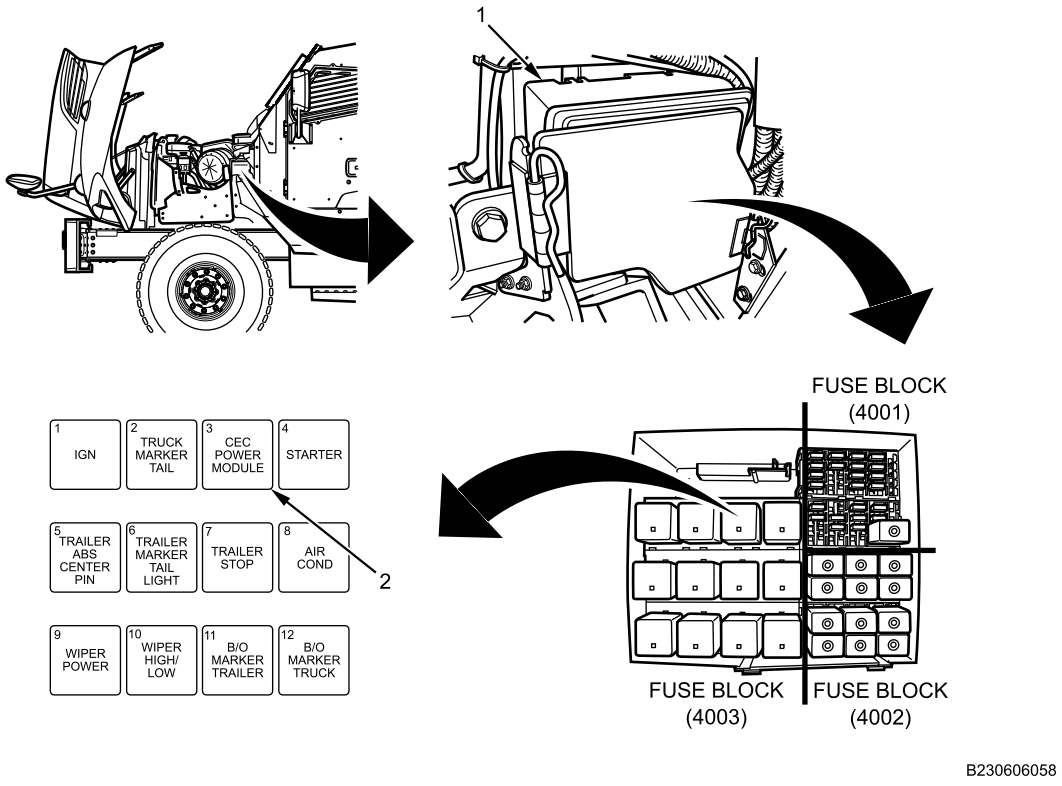


Figure 1. CEC Power Module Location.

1. To prevent engine from starting during test, remove CEC Power Module relay (Figure 1, Item 2) from Power Distribution Center (Figure 1, Item 1) at rear of engine compartment on driver side. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

BATTERY CABLE TROUBLESHOOTING PROCEDURE - (CONTINUED)

2. Connect multimeter from either alternator B+ terminal to battery positive post as shown by meter 1. Refer to Figure 2. Measure voltage from battery post, not cable end.

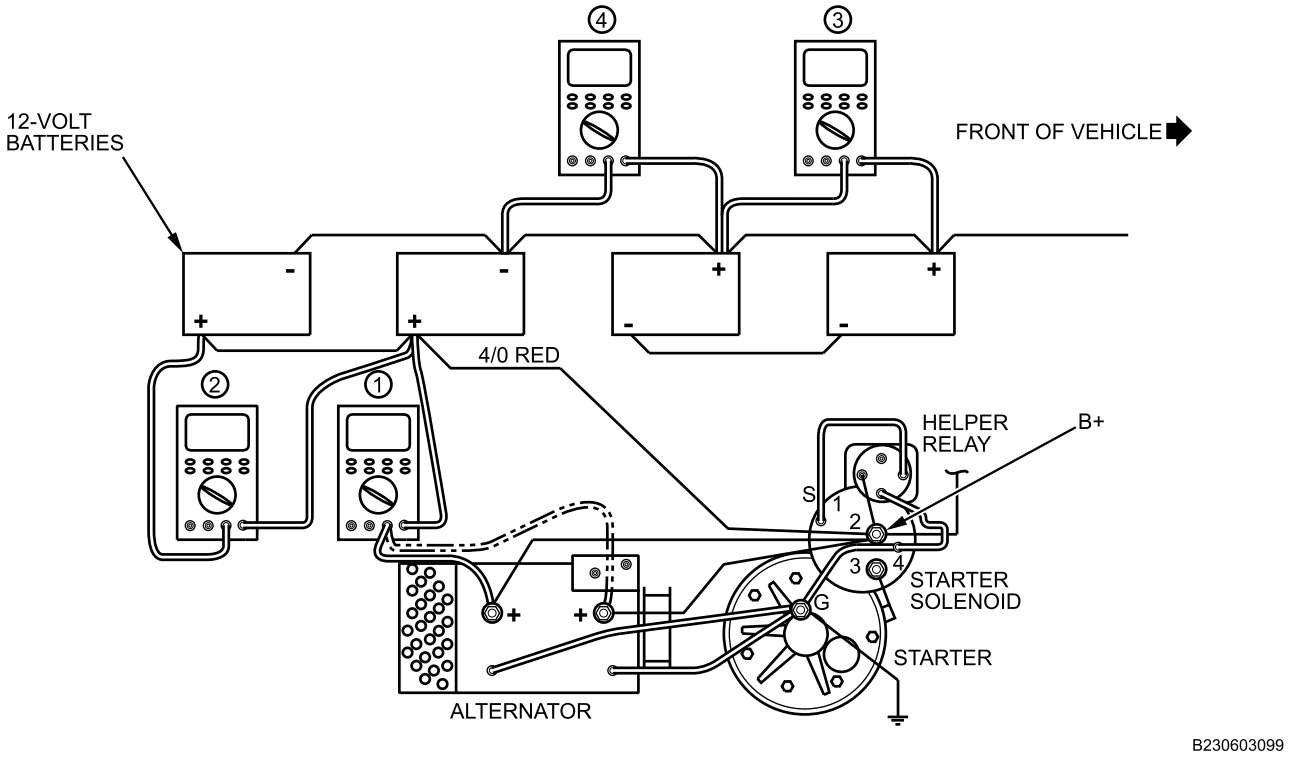


Figure 2. Sequence of Meter Lead Connections on Positive Side.

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Have assistant crank engine. Note reading on multimeter while engine is cranking.

CONDITION/INDICATION

Does multimeter read more than 0.5V?

DECISION

YES Go to Step 9.
NO Go to next step.

BATTERY CABLE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

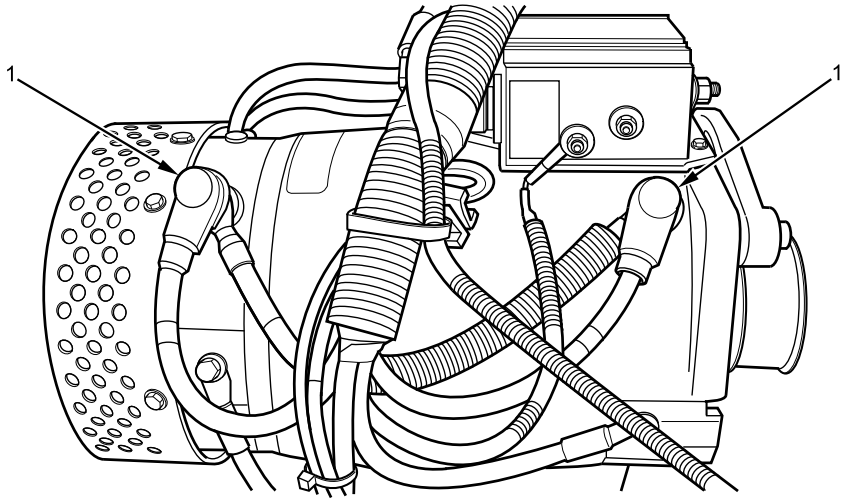


Figure 3. Alternator Positive Terminals.

5. Move test lead connected to one B+ terminal on alternator to other B+ terminal on alternator (Figure 3, Item 1). Repeat Steps 3 and 4.

CONDITION/INDICATION

Does multimeter read more than 0.5V?

DECISION

YES Go to Step 9.
NO Go to next step.

BATTERY CABLE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

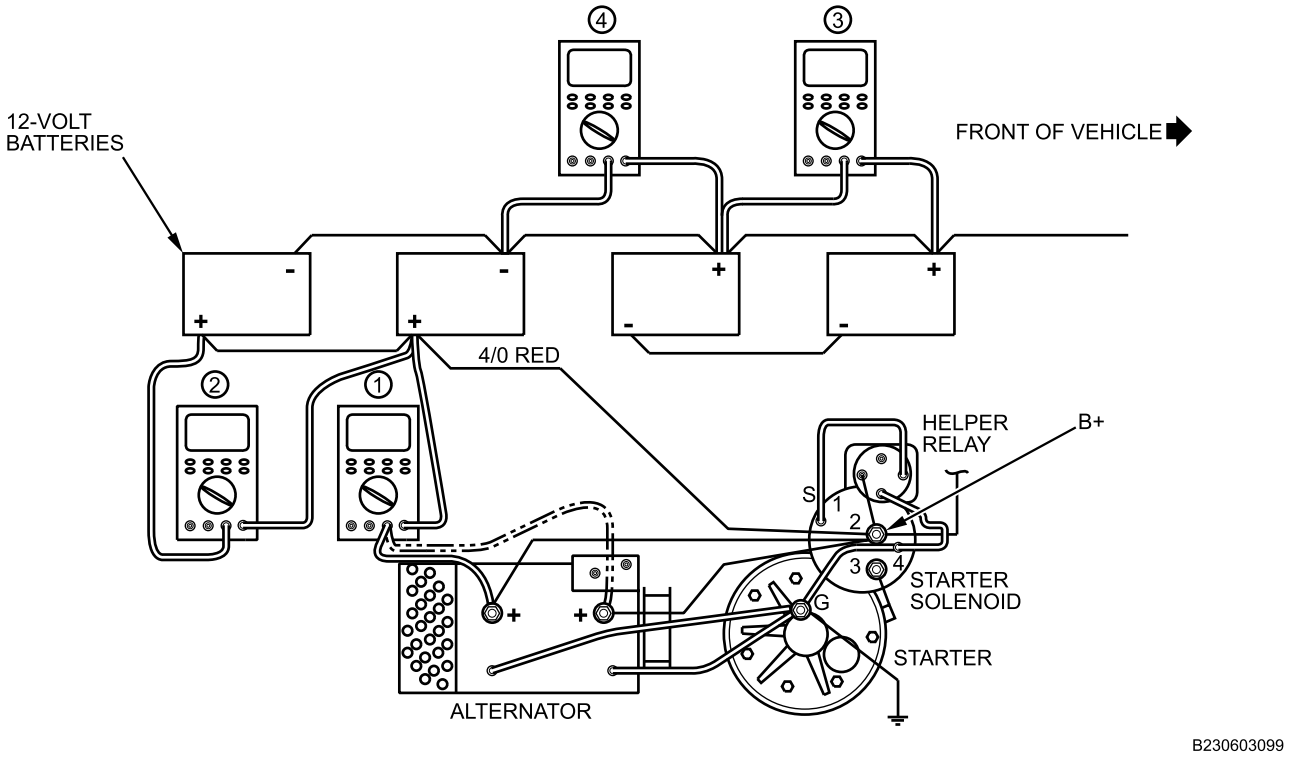


Figure 4. Sequence of Meter Lead Connections on Positive Side.

6. Connect meter leads as shown by meters 2, 3, and 4. Refer to Figure 4. Repeat Steps 3 and 4 for each meter connection.

CONDITION/INDICATION

Does multimeter read more than 0.5V for one or more tests?

DECISION

YES Go to Step 9.
NO Go to next step.

BATTERY CABLE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

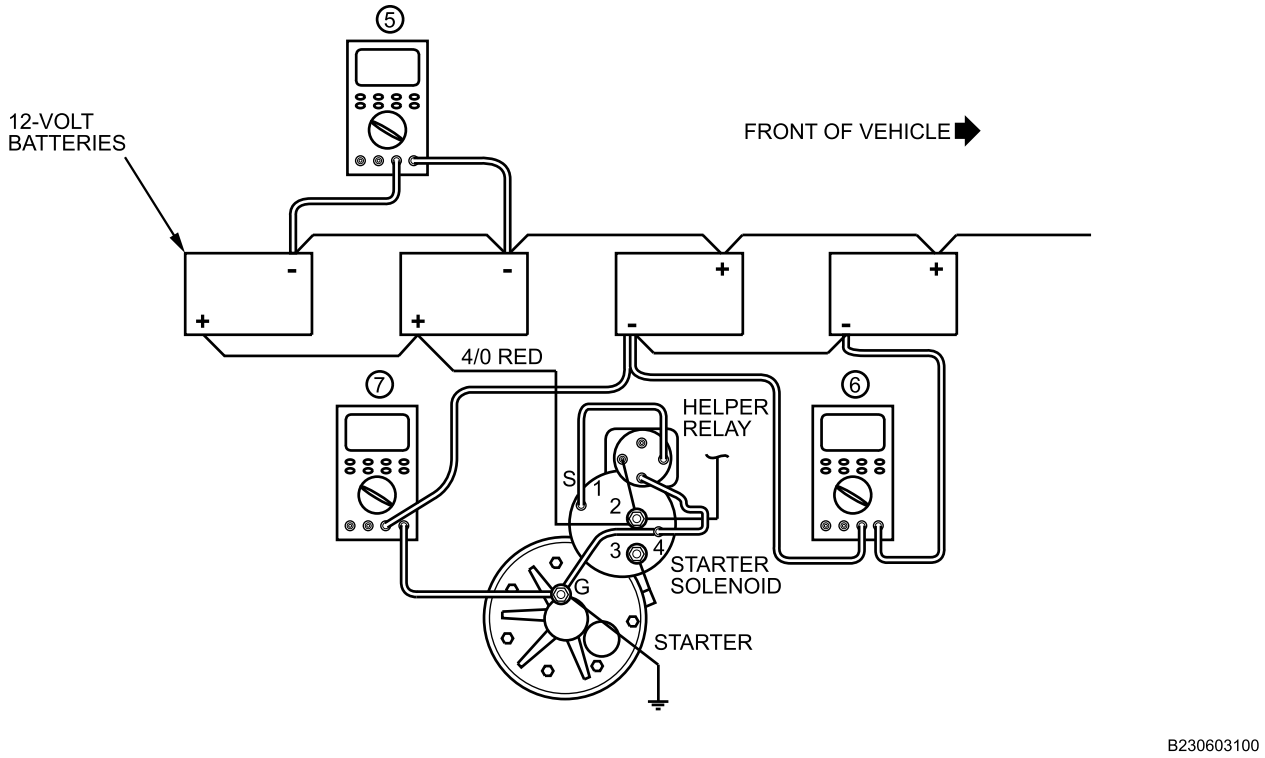


Figure 5. Sequence of Meter Lead Connections on Negative Side.

7. Connect meter leads as shown by meters 5 and 6. Refer to Figure 5. Repeat Steps 3 and 4 for each meter connection.

CONDITION/INDICATION

Does multimeter read more than 0.5V for one or more tests?

DECISION

YES Go to Step 9.
NO Go to next step.

BATTERY CABLE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

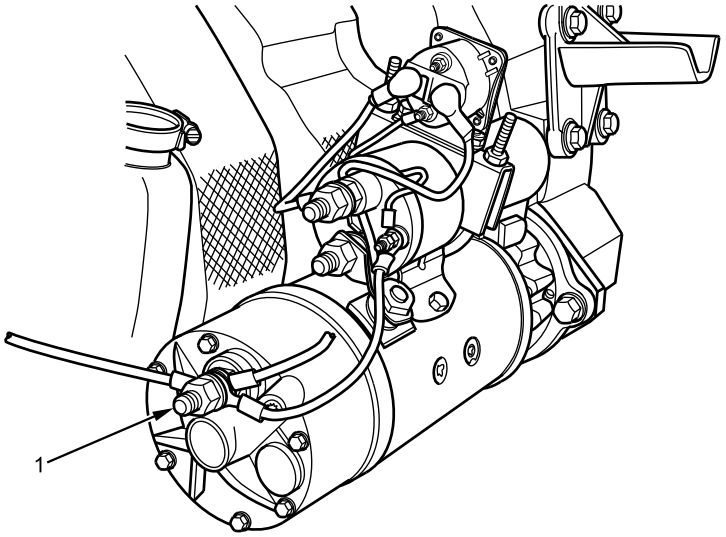


Figure 6. Starter Ground Terminal.

8. Connect multimeter between negative battery post and starter ground terminal as shown by meter 7. Refer to Figure 5. Attach lead directly to starter ground stud (Figure 6, Item 1), not cable end. Repeat Steps 3 and 4.

CONDITION/INDICATION

Does multimeter read more than 0.5V?

DECISION

YES Go to Step 9.
NO Refer to next step in Hard Start/No Start Troubleshooting Procedures (List) Operational Checkout Procedure (WP 0014).

MALFUNCTION

- 9. Faulty cables.

ACTION

Replace battery cable or cables that failed test. For cables on alternator, refer to Engine Wiring Harness Removal and Installation (WP 0336). For cable on starter, refer to Starter Motor to Battery Ground Cable Removal and Installation (WP 0414). For all other cables, refer to Battery Cables Removal and Installation (WP 0407). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0067
WP 0032
WP 0034
WP 0257
WP 0292
WP 0302
WP 0329
WP 0317
WP 0333
WP 0335
WP 0336
WP 0407
WP 0411
WP 0418
WP 0419
WP 0606
WP 0782

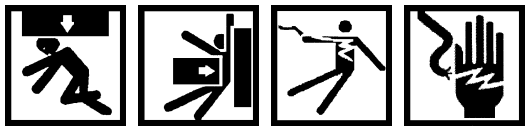
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Battery box removed (WP 0419)
Belly armor removed (WP 0606)

Drawings Required
WP 0789, Figure 18

TROUBLESHOOTING PROCEDURE

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Verify battery ground stud connections (Figure 1, Item 1) are clean and tight.

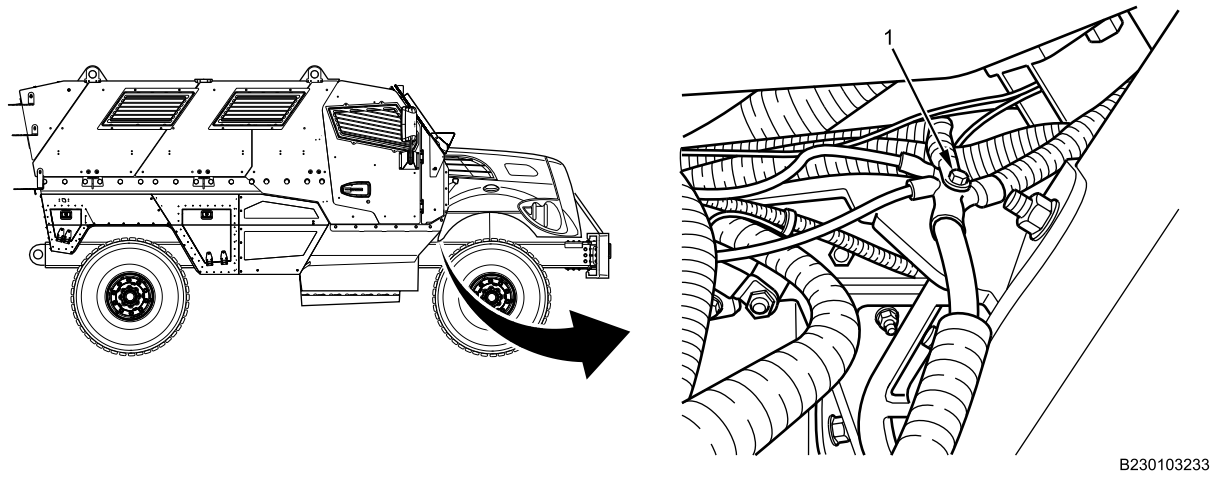


Figure 1. Battery Ground Stud Located Forward of Batteries.

2. Verify starter engine ground jumper cable terminals are clean and tight at engine stud (Figure 2, Item 1) and starter ground stud (Figure 2, Item 2).

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

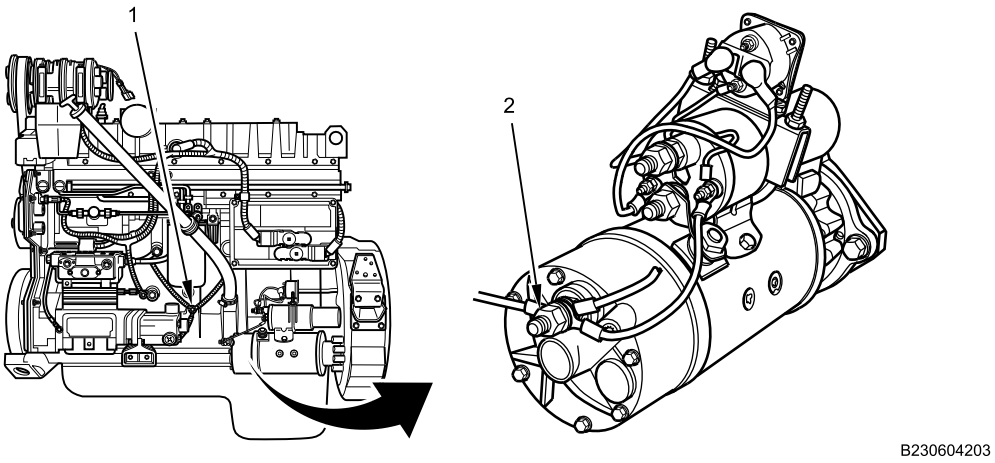


Figure 2. Starter Engine Ground Jumper.

3. Verify starter frame ground jumper cable terminal is clean and tight at frame. Refer to Figure 3.

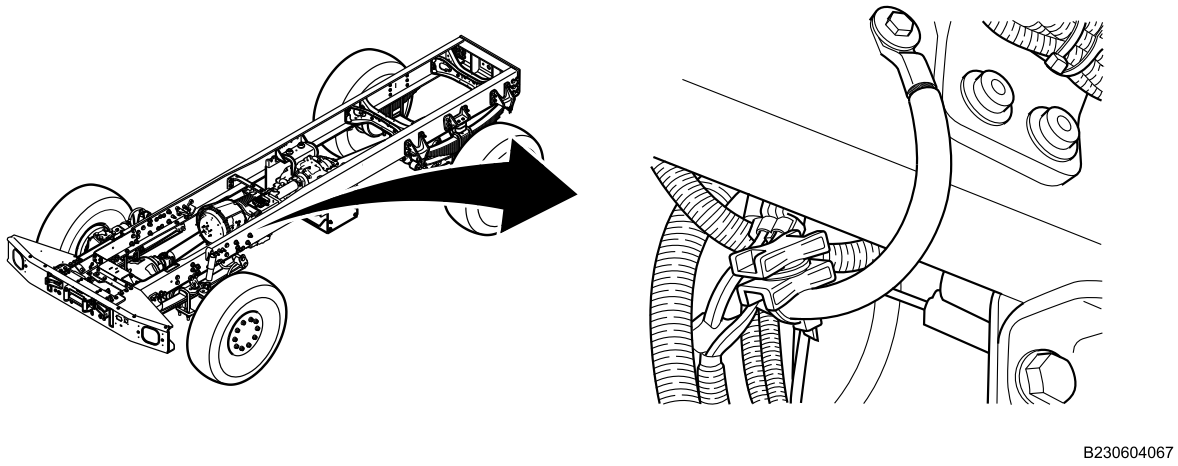


Figure 3. Starter Frame Ground Jumper Cable.

4. Verify batteries are fully charged. Refer to Battery Power Troubleshooting Procedure (WP 0032).

CONDITION/INDICATION

Are batteries fully charged?

DECISION

YES Go to Step 11.
NO Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Charge batteries.
6. Test batteries to verify batteries are good. Refer to Battery Power Troubleshooting Procedure (WP 0032). Replace batteries found to be faulty. Refer to Battery Removal and Installation (WP 0418).
7. Turn MAIN POWER switch ON (TM 9-2355-106-10).
8. Turn ignition switch ON (TM 9-2355-106-10).
9. Verify transmission is in Neutral (N) (TM 9-2355-106-10).
10. Attempt to start engine (TM 9-2355-106-10).

CONDITION/INDICATION

Does engine crank?

DECISION

NO Go to Step 15.
YES Return vehicle to service.

STEP

11. Turn MAIN POWER switch ON (TM 9-2355-106-10).
12. Turn ignition switch ON (TM 9-2355-106-10).
13. Verify transmission is in Neutral (N) (TM 9-2355-106-10).
14. Attempt to start engine (TM 9-2355-106-10).

CONDITION/INDICATION

Does engine crank?

DECISION

YES Return vehicle to service.
NO Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

15. Measure DC voltage between starter solenoid positive stud (Figure 4, Item 1) and ground with multimeter.

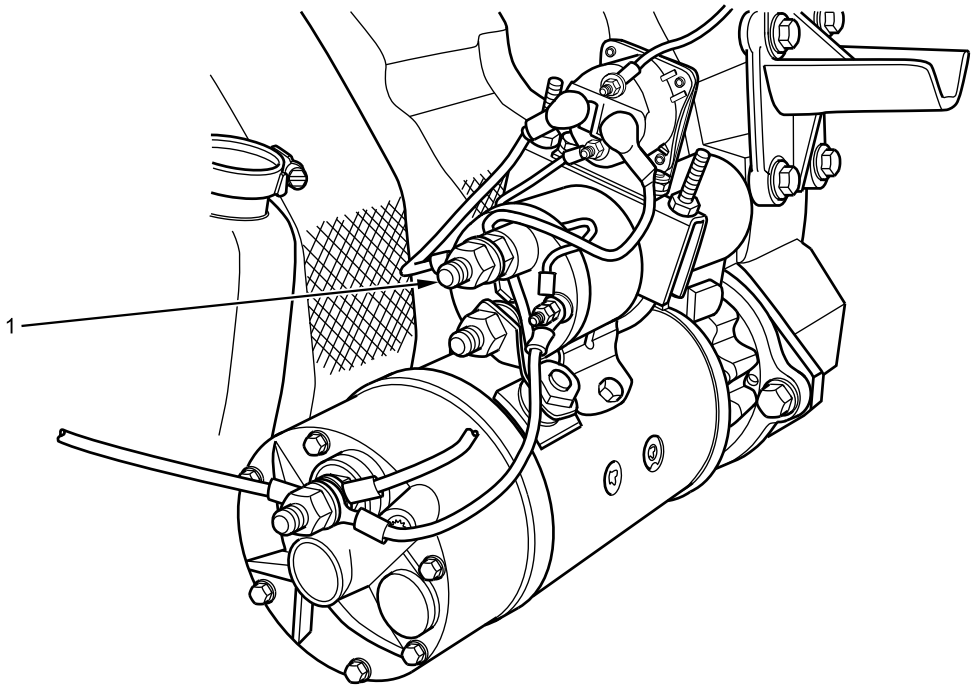


Figure 4. Starter Motor Positive Stud.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

NO Go to Step 50.
YES Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

16. Measure DC voltage between starter motor solenoid terminal S (Figure 5, Item 1) and ground with multimeter.

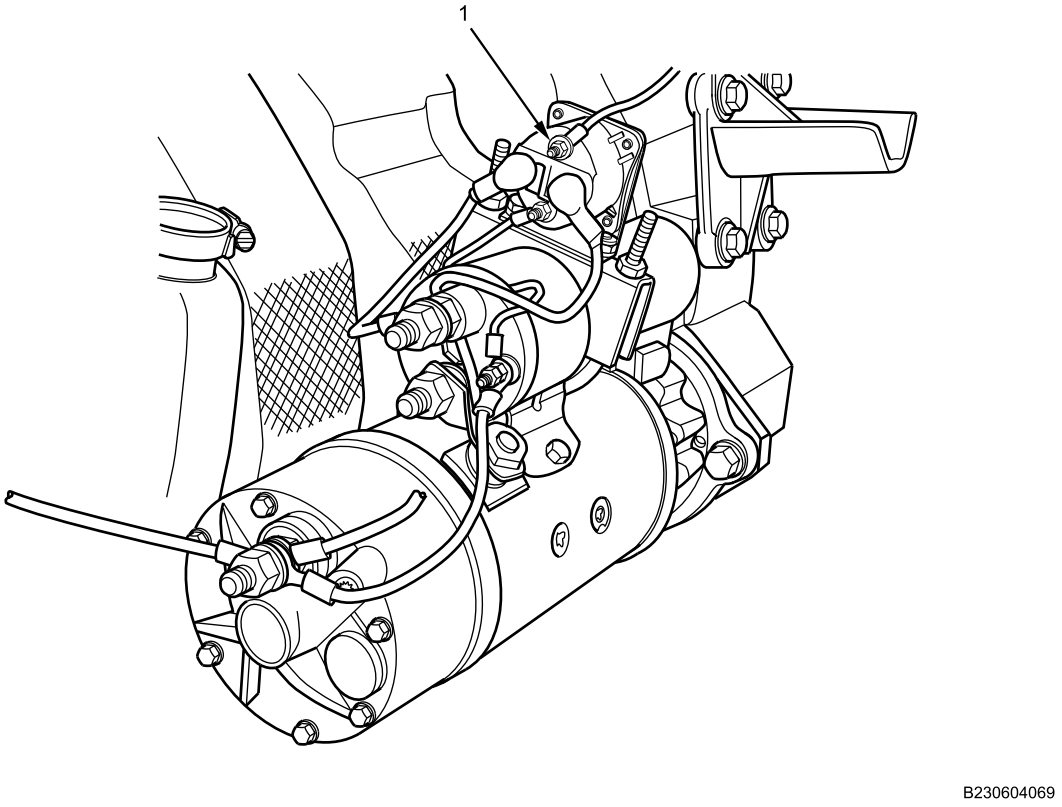


Figure 5. Starter Motor Solenoid Terminal S.

17. Have assistant hold ignition switch in START position (TM 9-2355-106-10) while observing multimeter.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

YES Go to Step 51.
NO Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

18. Remove starter relay from power distribution center. Refer to Figure 6. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

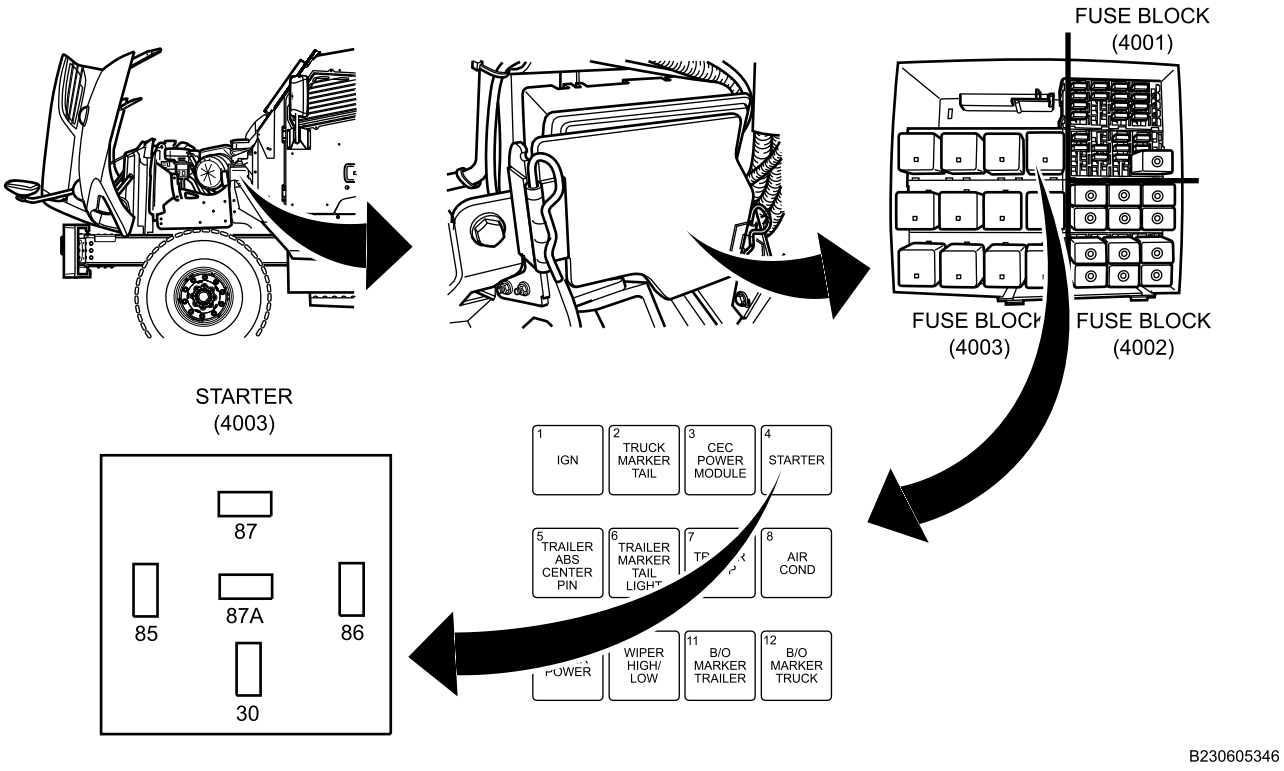


Figure 6. Power Distribution Center.

WARNING

Engine may start when testing or jumpering terminals. Always check to ensure that area is clear of personnel and obstructions before testing. Failure to comply may result in injury to personnel.

19. Install a jumper wire between starter relay terminal 30 and terminal 87. Refer to Figure 6.

CONDITION/INDICATION

Does engine crank?

DECISION

NO Go to Step 31.
YES Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

20. Measure DC voltage between starter relay terminal 86 and ground with a multimeter. Refer to Figure 6.
21. Have assistant hold ignition switch in START position (TM 9-2355-106-10) while observing multimeter.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 40.
YES Go to next step.

STEP

22. With assistance, measure resistance between starter relay terminal 85 and ground with multimeter. Refer to Figure 6.
23. Have an assistant turn ignition switch to START position (TM 9-2355-106-10) while observing multimeter.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 49.
YES Go to next step.

STEP

24. Turn ignition switch OFF.
25. Turn MAIN POWER switch OFF.
26. Disconnect BLACK engine control module connector 6007. Refer to Figure 7. Refer to ECM Removal and Installation (WP 0329).

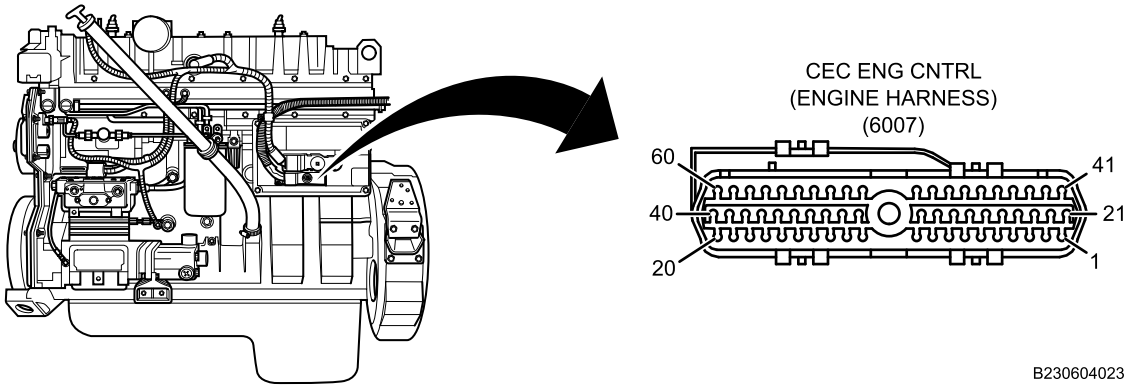


Figure 7. Engine Control Module (ECM).

27. With assistant, measure resistance between connector 6007 terminal 46 and connector 4003 terminal 85 with multimeter. Refer to Figure 7 and Figure 8.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

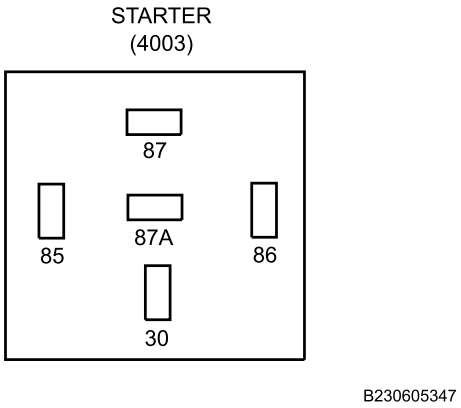


Figure 8. Connector 4003.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 46.
YES Go to next step.

STEP

28. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
29. Disconnect connector 4103. Refer to Figure 9.

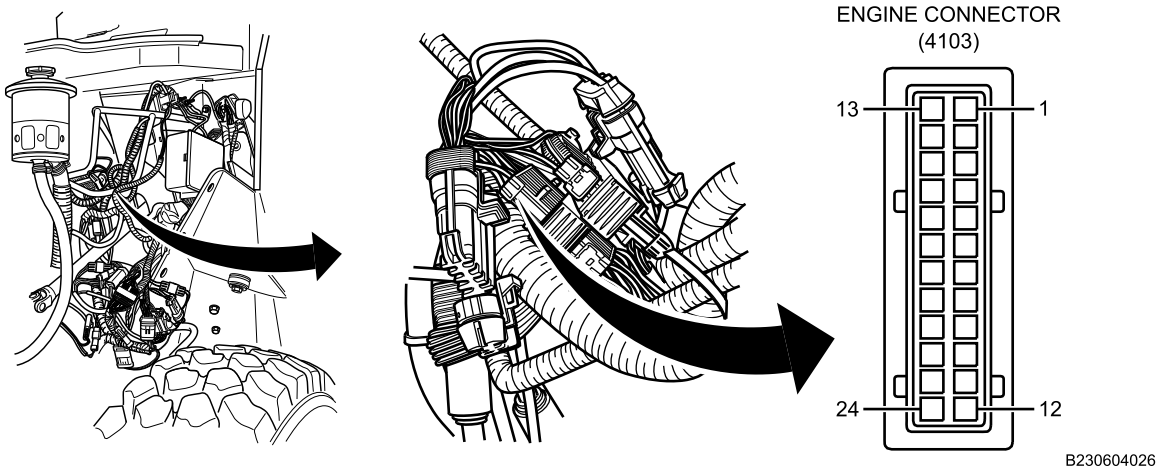


Figure 9. Left Side Engine Compartment Area.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

30. Measure resistance between connector 4103 terminal 17 and connector 4003 terminal 85 with multimeter. Refer to Figure 9 and Figure 10.

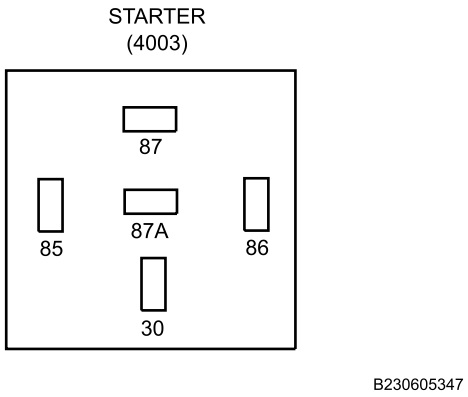


Figure 10. Connector 4003.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 52.
NO Go to Step 53.

STEP

31. Measure voltage between connector 4003 terminal 30 and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

YES Go to Step 33.
NO Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

32. Measure voltage between connector 4025 and ground with multimeter. Refer to Figure 11.

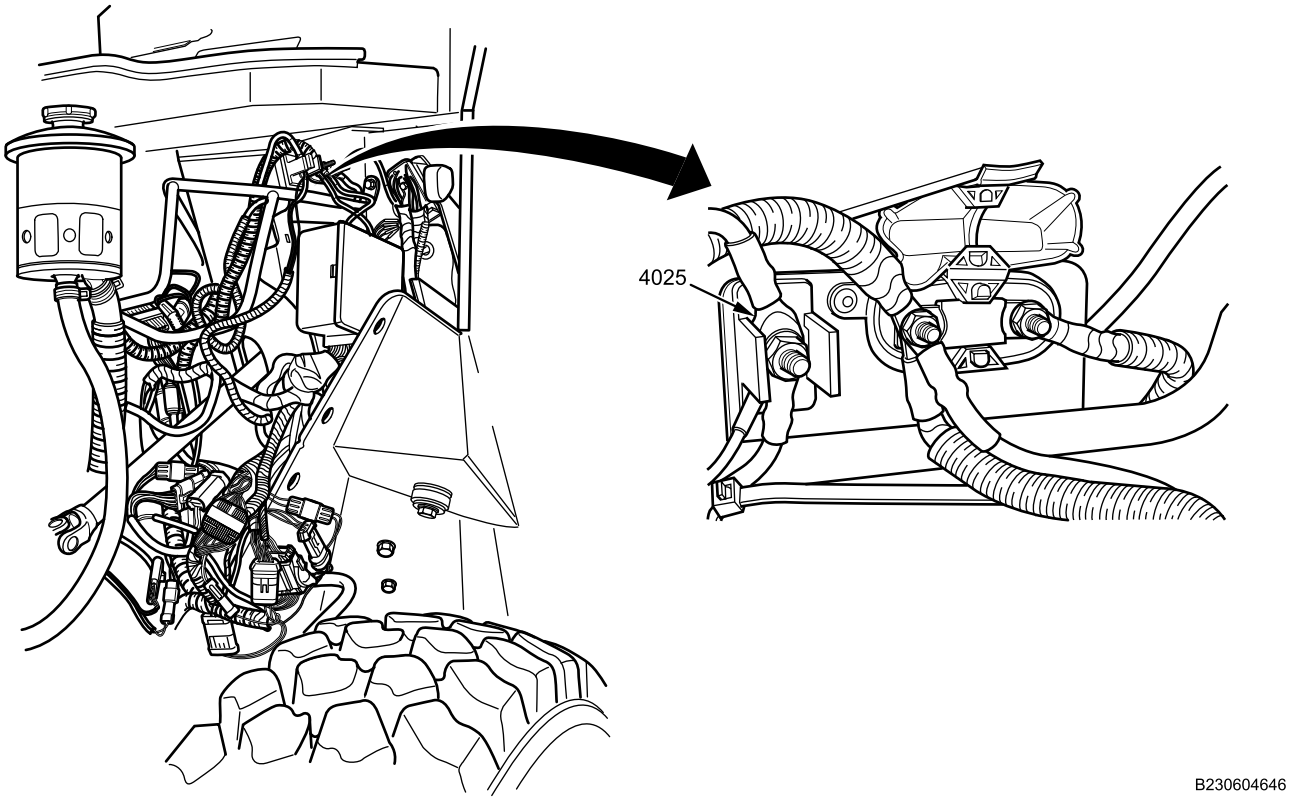


Figure 11. Left Side Engine Compartment Area.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

YES Go to Step 52.
NO Go to Step 54.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

33. Turn ignition switch OFF.
34. Turn MAIN POWER switch OFF.
35. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
36. Disconnect connector 4101M. Refer to Figure 12.

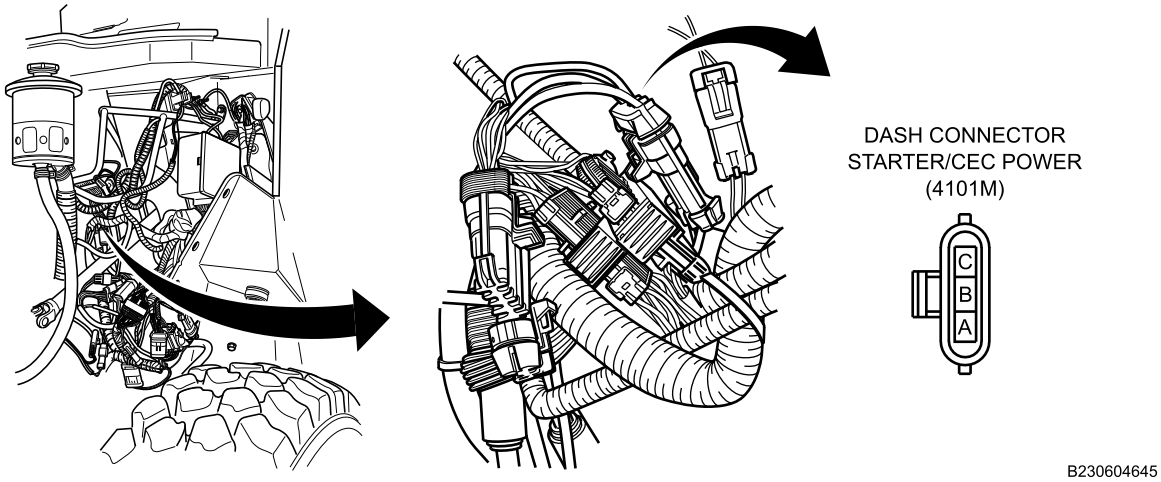


Figure 12. Left Side Engine Compartment Area.

37. Install starter relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).
38. Measure DC voltage between connector 4101M terminal A and ground. Refer to Figure 12.
39. Have an assistant turn ignition switch to START position (TM 9-2355-106-10) while observing multimeter.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

NO Go to Step 52.
YES Go to Step 53.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

40. Disconnect connector 1701. Refer to Figure 13.

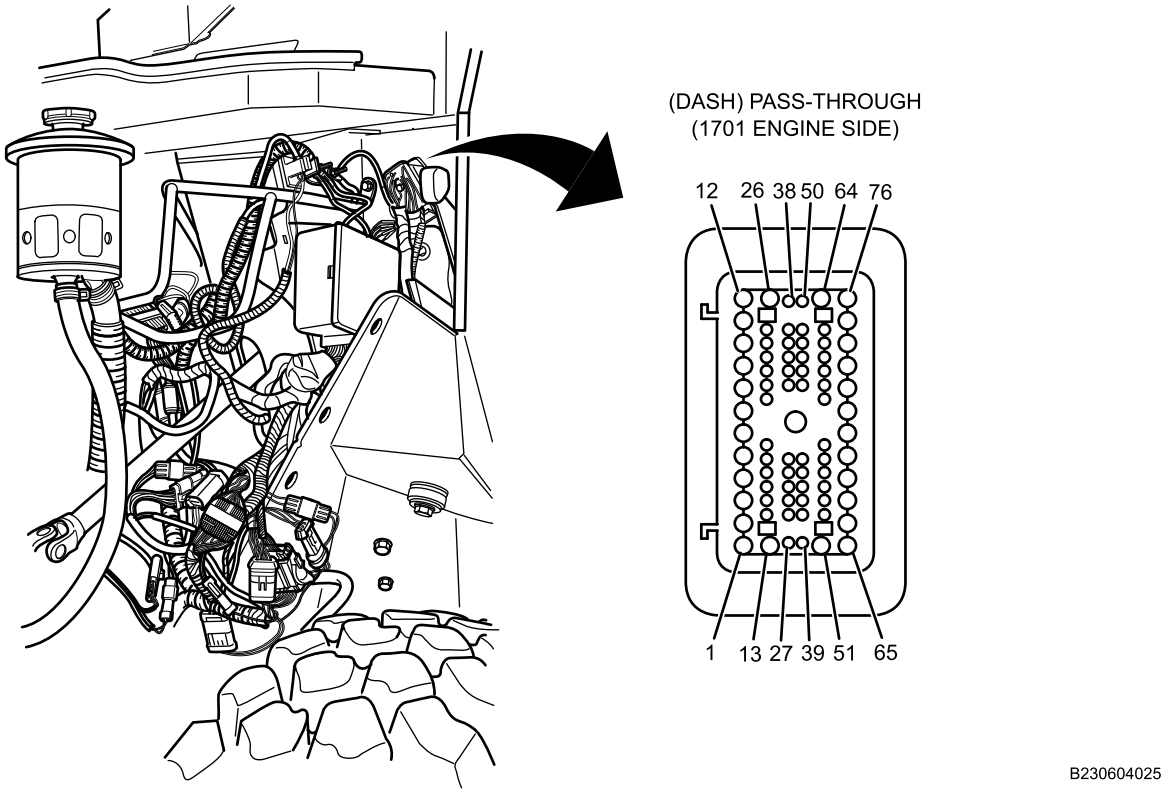


Figure 13. Left Side Engine Compartment Area.

41. Measure resistance between connector 1701 (engine harness side) terminal 8 and ground with multimeter. Refer to Figure 13.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 52.
NO Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

42. Measure resistance between relay connector 4003 terminal 86 and connector 1701 (engine side) terminal 8. Refer to Figure 14 and Figure 15.

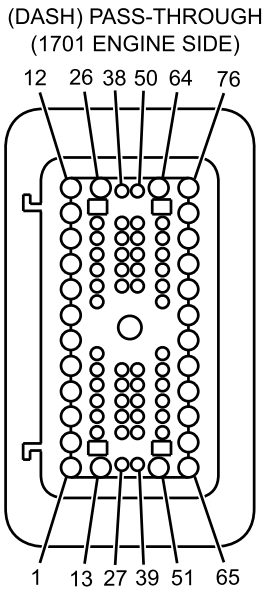


Figure 14. Connector 1701.

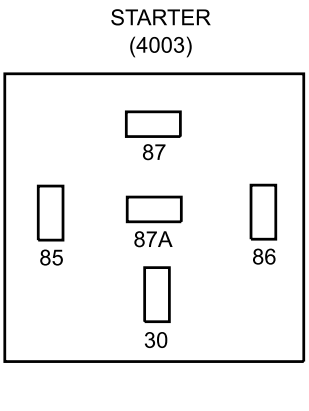


Figure 15. Connector 4003.

CONDITION/INDICATION

Is resistance more than 5 ohms?

DECISION

YES Go to Step 52.
NO Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

43. Disconnect ignition switch connector 1100M. Refer to Figure 16. Refer to Keyless Ignition Switch Removal and Installation (WP 0302).

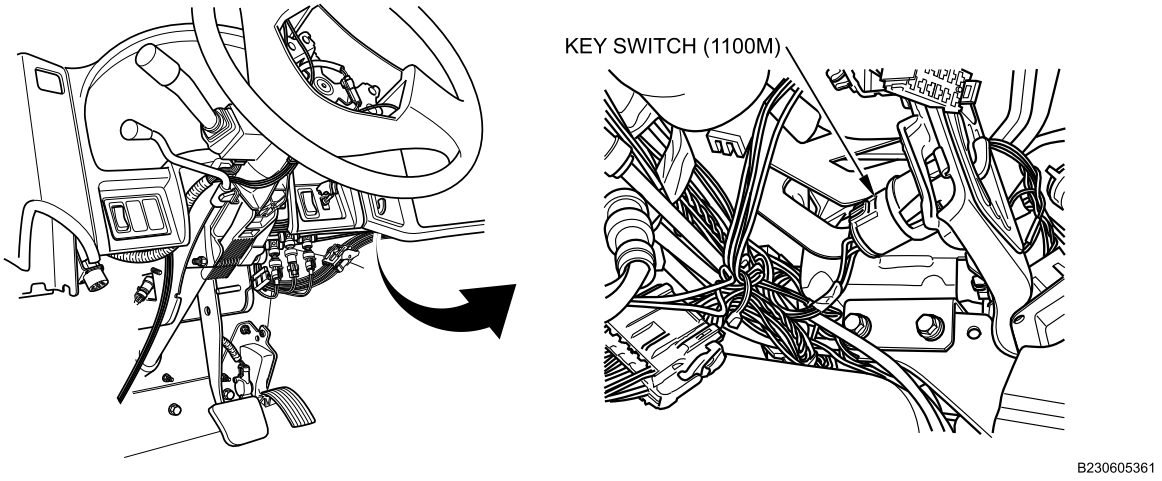


Figure 16. Behind Dash.

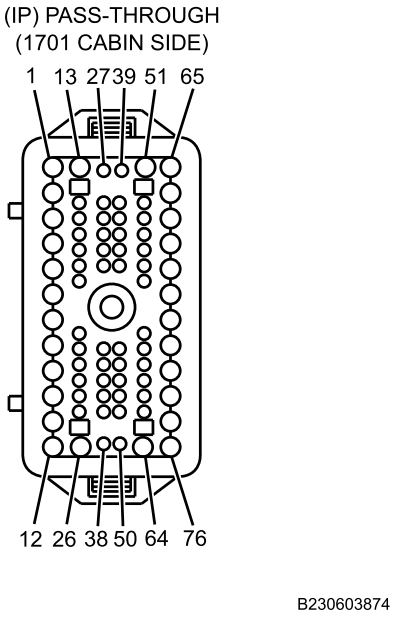


Figure 17. Connector 1701.

44. Measure resistance between connector 1701 terminal 8 (cabin side) and ground with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 55.
NO Go to next step.

STEP

45. Measure resistance between connector 1100M terminal B and connector 1701 terminal 8 with multimeter. Refer to Figure 17 and Figure 18.

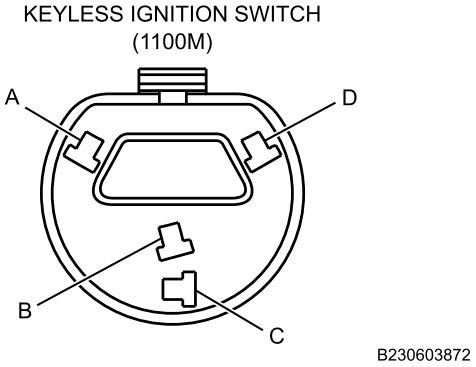


Figure 18. Connector 1100M.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 55.
NO Go to Step 56.

STEP

46. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
47. Verify MSD indicates vehicle is in neutral.

CONDITION/INDICATION

Does MSD indicate vehicle is in NEUTRAL (N)?

DECISION

YES Go to Step 57.
NO Go to next step.

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 48. Data links are faulty.

ACTION

Diagnose and repair/replace data links. Refer to Multiplexing Data Link Circuits Troubleshooting Procedure (WP 0067).

END OF TEST

MALFUNCTION

- 49. Start relay is faulty.

ACTION

Replace start relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

END OF TEST

MALFUNCTION

- 50. Battery cable between batteries and starter motor solenoid is faulty.

ACTION

Replace battery cable. Refer to Battery Cable Removal and Installation (WP 0407). Return vehicle to service.

END OF TEST

MALFUNCTION

- 51. Starter motor is faulty.

ACTION

Replace starter motor. Refer to Starter Motor Removal and Installation (WP 0292). Return vehicle to service.

END OF TEST

MALFUNCTION

- 52. PDC wiring harness is faulty.

ACTION

Replace PDC wiring harness. Refer to PDC Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

ENGINE DOES NOT CRANK TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 53. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 54. Battery cable is faulty.

ACTION

Replace battery cable between starter motor and 24 volt stud. Refer to Battery Cable Removal and Installation (WP 0407). Return vehicle to service.

END OF TEST

MALFUNCTION

- 55. IP wiring harness is faulty.

ACTION

Replace IP wiring harness. Refer to Instrument Panel (IP) Feed Harness Removal and Installation (WP 0411). Return vehicle to service.

END OF TEST

MALFUNCTION

- 56. Ignition switch is faulty.

ACTION

Replace ignition switch. Refer to Keyless Ignition Switch Removal and Installation (WP 0302). Return vehicle to service.

END OF TEST

MALFUNCTION

- 57. Engine Control Module (ECM) is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

FUEL PUMP PRESSURE TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Pressure Test Kit (ZTSE4409) (WP 0795, Item 77)
Cap and plug set (WP 0795, Item 23)

Personnel Required
Maintainer (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0005
WP 0011
WP 0396
WP 0036
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

WARNING

Fuel is flammable and can explode. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel and keep fire extinguisher nearby. Do not smoke when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. Failure to comply may result in serious injury or death to personnel.

Be alert at all times for the smell of fuel. Hot engines and components can ignite fuel. If fuel smell is detected while operating vehicle, shut down vehicle immediately. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Hood is extremely heavy. Ensure there is adequate space to open hood completely without pinning personnel between hood and another structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

FUEL PUMP PRESSURE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Remove cap (Figure 1, Item 2) and air bleed valve (Figure 1, Item 3) from fuel filter header (Figure 1, Item 1).

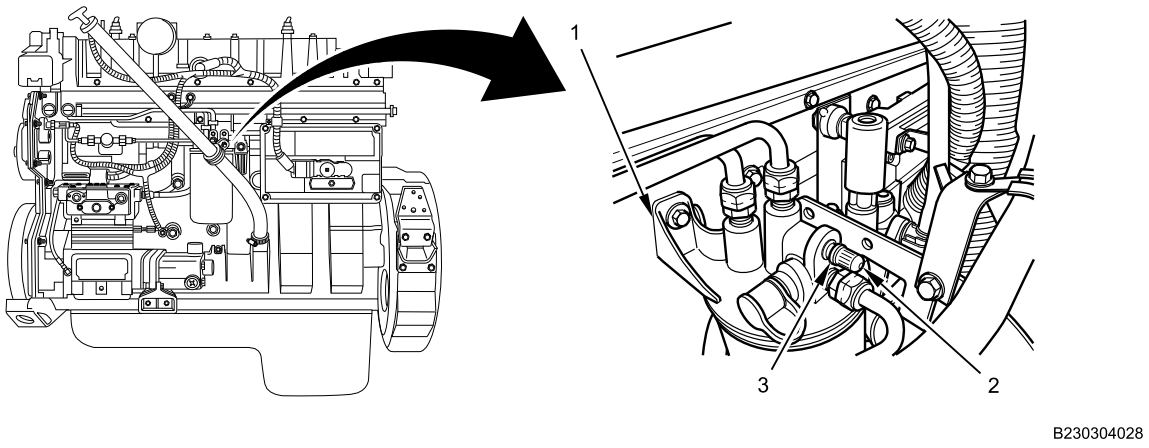


Figure 1. Fuel Filter Header Air Bleed Valve.

2. Install adapter (Figure 2, Item 3) from fuel Pressure Test Kit into air bleed valve opening on fuel filter header (Figure 2, Item 2).

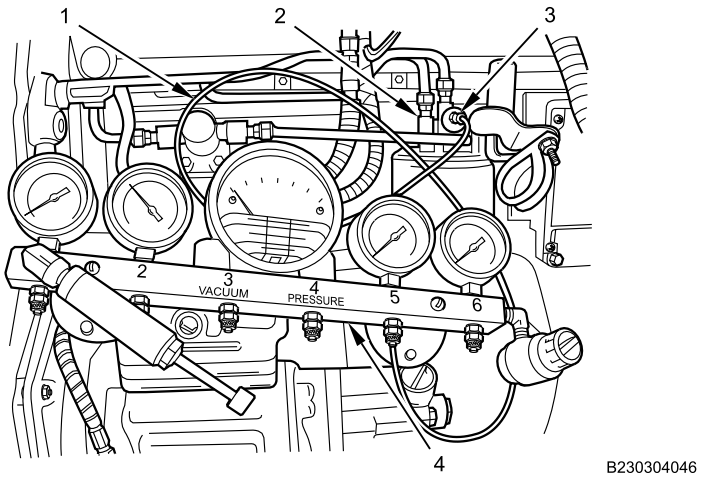


Figure 2. Fuel Pressure Gauge Set.

3. Install fuel pressure gauge set by connecting line (Figure 2, Item 1), contained in fuel Pressure Test Kit, from adapter (Figure 2, Item 3) to fuel pressure gauge 5 on gauge bar (Figure 2, Item 4).

NOTE

Cranking engine with fuel injector harness connector disconnected will prevent the engine from starting and cause additional Diagnostic Trouble codes (DTC) to set.

4. Disconnect fuel injector harness connector (Figure 3, Item 1) from valve cover (Figure 3, Item 2).

FUEL PUMP PRESSURE TROUBLESHOOTING PROCEDURE - (CONTINUED)

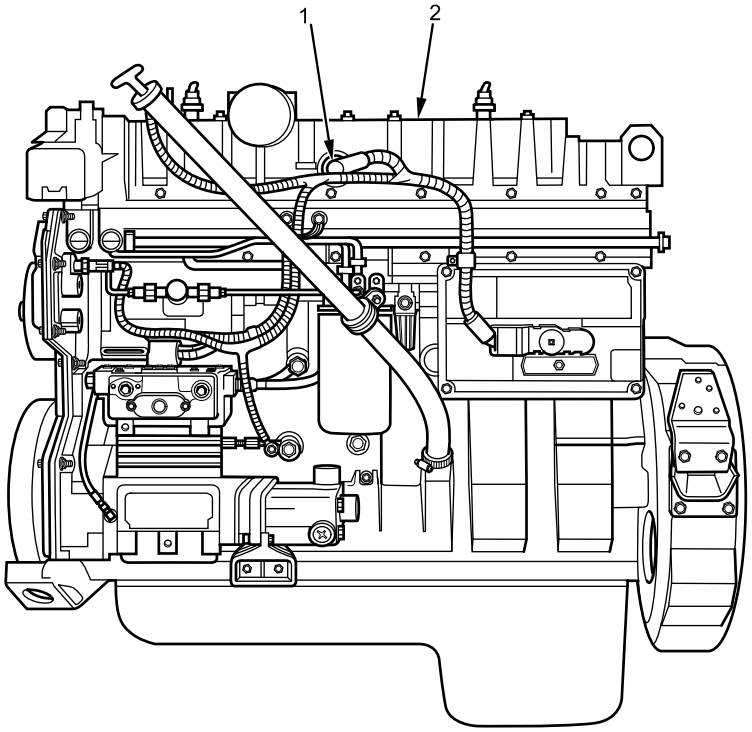


Figure 3. Fuel Injector Harness Connector.

5. Record maximum pressure shown on fuel pressure gauge 5, while assistant cranks engine for 20 seconds.

CONDITION/INDICATION

Is fuel pressure more than 35 psi (241.3 kPa)?

DECISION

YES Remove test equipment and install air bleed valve and cap. Connect fuel injector harness connector (Figure 3, Item 1) to valve cover (Figure 3, Item 2) and go to Vehicle Troubleshooting Symptom Index (WP 0005).
NO Go to next step.

STEP

6. Replace fuel filter (WP 0269).
7. Clean fuel strainer (WP 0269).
8. Record maximum pressure shown on fuel pressure gauge 5, while assistant cranks engine for 20 seconds.

CONDITION/INDICATION

Is fuel pressure more than 35 psi (241.3 kPa)?

DECISION

YES Remove test equipment and install air bleed valve and cap. Connect fuel injector harness connector (Figure 3, Item 1) to valve cover (Figure 3, Item 2) and return vehicle to service.
NO Go to next step.

FUEL PUMP PRESSURE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

9. Disconnect fuel pressure regulator connector (Figure 4, Item 2) from fuel pressure regulator valve (Figure 4, Item 3).

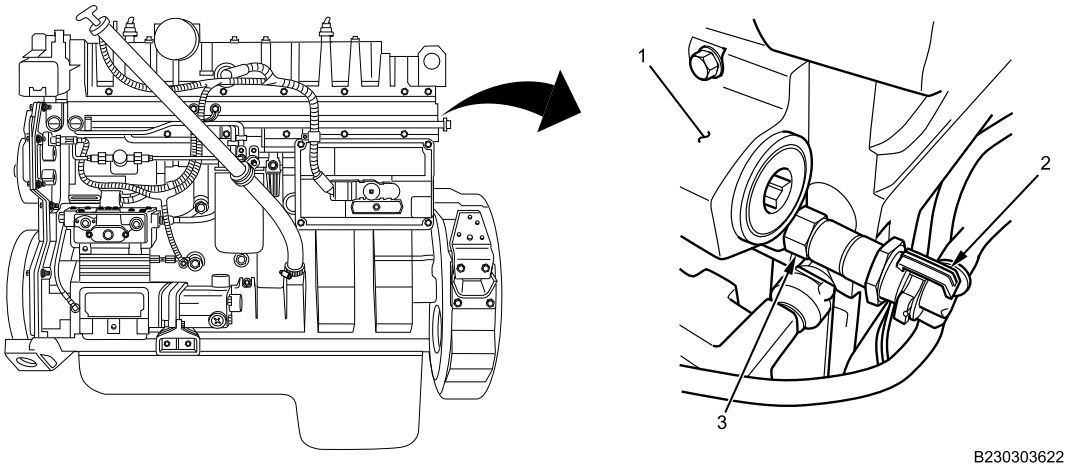


Figure 4. Fuel Pressure Regulator.

10. Remove fuel pressure regulator valve (Figure 4, Item 3) from rear of fuel/oil supply manifold (Figure 4, Item 1).
11. Install new fuel pressure regulator valve (Figure 4, Item 3) on fuel/oil supply manifold (Figure 4, Item 1). Tighten fuel pressure regulator valve securely.
12. Install fuel pressure regulator connector (Figure 4, Item 2) on fuel pressure regulator valve (Figure 4, Item 3).

NOTE

Cranking engine with fuel injector harness connector disconnected will prevent the engine from starting and cause additional Diagnostic Trouble codes (DTC) to set.

13. Ensure fuel injector harness connector (Figure 5, Item 1) is still disconnected from valve cover (Figure 5, Item 2).

FUEL PUMP PRESSURE TROUBLESHOOTING PROCEDURE - (CONTINUED)

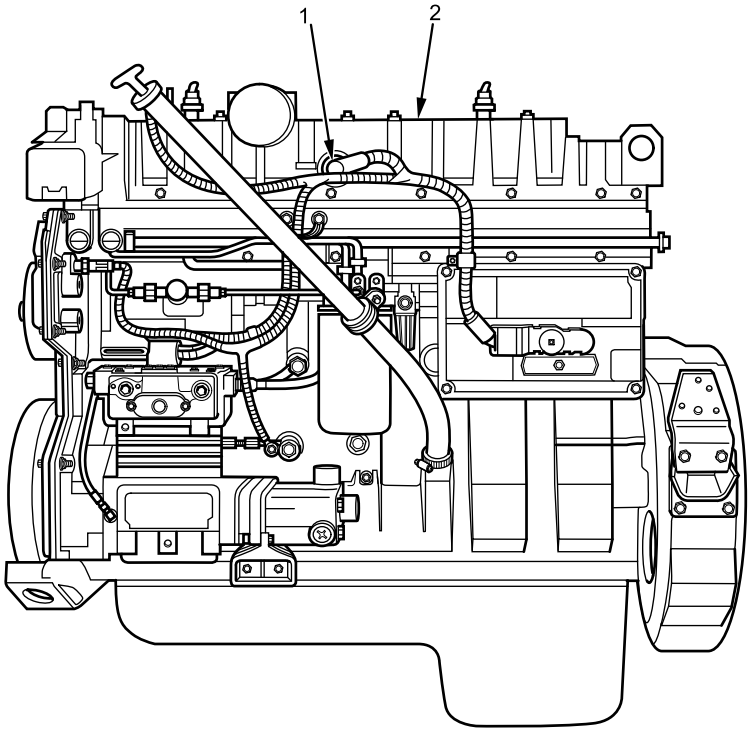


Figure 5. Fuel Injector Harness Connector.

14. Record maximum pressure shown on fuel pressure gauge 5, while assistant cranks engine for 20 seconds.

CONDITION/INDICATION

Is maximum pressure more than previously recorded pressure?

DECISION

NO Go to Step 16.
YES Go to next step.

STEP

15. Verify correct engine performance.

CONDITION/INDICATION

Does engine perform correctly?

DECISION

YES Connect fuel injector harness connector to valve cover (Figure 5, Item 2) and return vehicle to service.
NO Go to Engine Performance Check (WP 0015).

MALFUNCTION

- 16. Fuel pump restriction.

FUEL PUMP PRESSURE TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Perform fuel pump restriction troubleshooting procedure. Refer to Fuel Pump Restriction Troubleshooting Procedure (WP 0036).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

FUEL PUMP RESTRICTION TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Pressure Test Kit (ZTSE4409) (WP 0795, Item 77)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Cap and Plug kit (WP 0795, Item 23)

Personnel Required
Maintainer (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0268
WP 0253
WP 0270
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left side engine armor removed (WP 0597)

TROUBLESHOOTING PROCEDURE

WARNING

Fuel is flammable and can explode. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel and keep fire extinguisher nearby. Do not smoke when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. Failure to comply may result in serious injury or death to personnel.

Be alert at all times for the smell of fuel. Hot engines and components can ignite fuel. If fuel smell is detected while operating vehicle, shut down vehicle immediately. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

FUEL PUMP RESTRICTION TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Remove cap (Figure 1, Item 3) and vacuum side quick connect fitting (Figure 1, Item 2) from fuel filter header (Figure 1, Item 1).

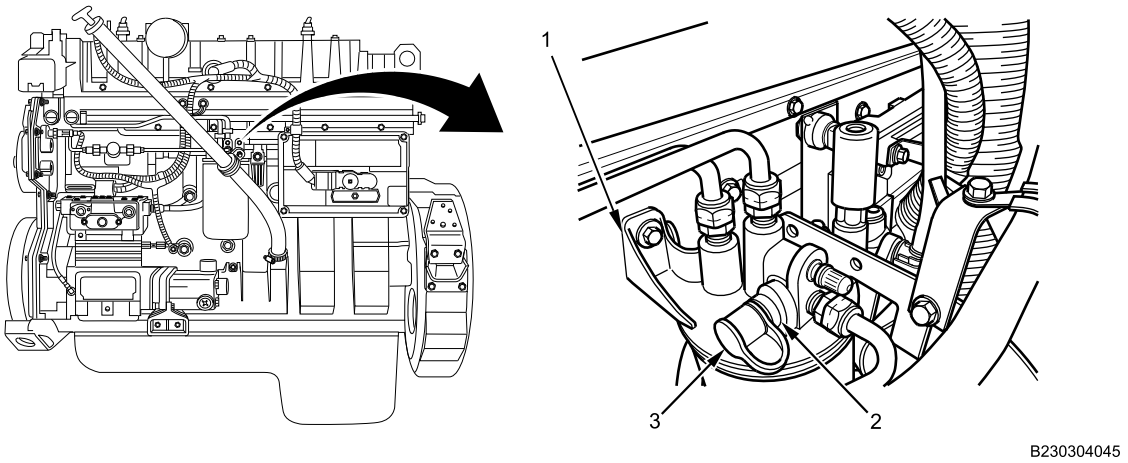


Figure 1. Fuel Filter Header Vacuum Side Quick Connect.

2. Install adapter (Figure 2, Item 2) from Fuel Pressure Test Kit into vacuum side quick connect opening on fuel filter header (Figure 2, Item 3).

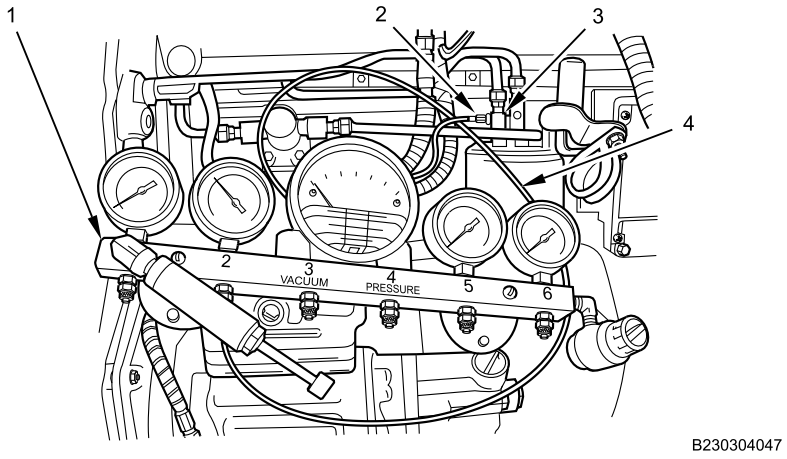


Figure 2. Fuel Pressure Gauge Set.

3. Install fuel pressure gauge set by connecting Fuel Pressure Test Kit line (Figure 2, Item 4) from adapter (Figure 2, Item 2) on fuel filter header (Figure 2, Item 3) to gauge 2 on gauge bar (Figure 2, Item 1).
4. Have assistant start engine (TM 9-2355-106-10).
5. Check for fuel leaks in line (Figure 2, Item 4) to gauge 2 on gauge bar (Figure 2, Item 1)
6. Measure vacuum at 1200 rpm and record reading.

FUEL PUMP RESTRICTION TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Is vacuum more than 8 in.Hg (203 mm Hg)?

DECISION

NO Go to Step 10
YES Go to next step.

STEP

7. Replace fuel/water separator filter. Refer to Fuel/Water Separator Filter Removal and Installation (WP 0270).
8. Have assistant start engine (TM 9-2355-106-10).
9. Measure vacuum at 1200 rpm and record reading.

CONDITION/INDICATION

Is vacuum more than 8 in.Hg (203 mm Hg)?

DECISION

YES Go to Step 17.
NO Return vehicle to service.

STEP

10. Check fuel filter outlet to supply pump inlet fuel line (Figure 3, Item 1) for damage, rust, or kinks.

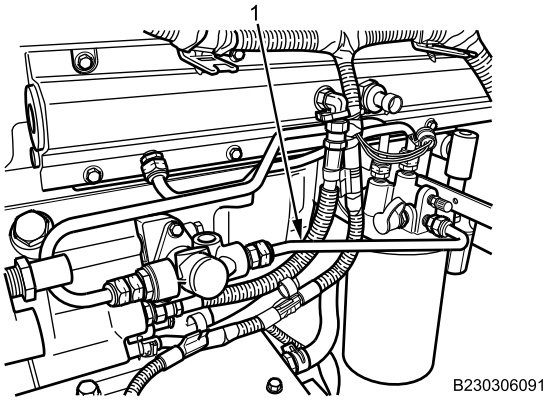


Figure 3. Fuel Filter Inlet to Supply Pump Inlet Fuel Line.

CONDITION/INDICATION

Does the fuel filter outlet to supply pump inlet fuel line have any damage, rust, or kinks?

DECISION

YES Go to Step 19.
NO Go to next step.

FUEL PUMP RESTRICTION TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

11. Turn off engine (TM 9-2355-106-10).
12. Remove fuel supply hose (Figure 4, Item 1) from fuel filter header (Figure 4, Item 2).

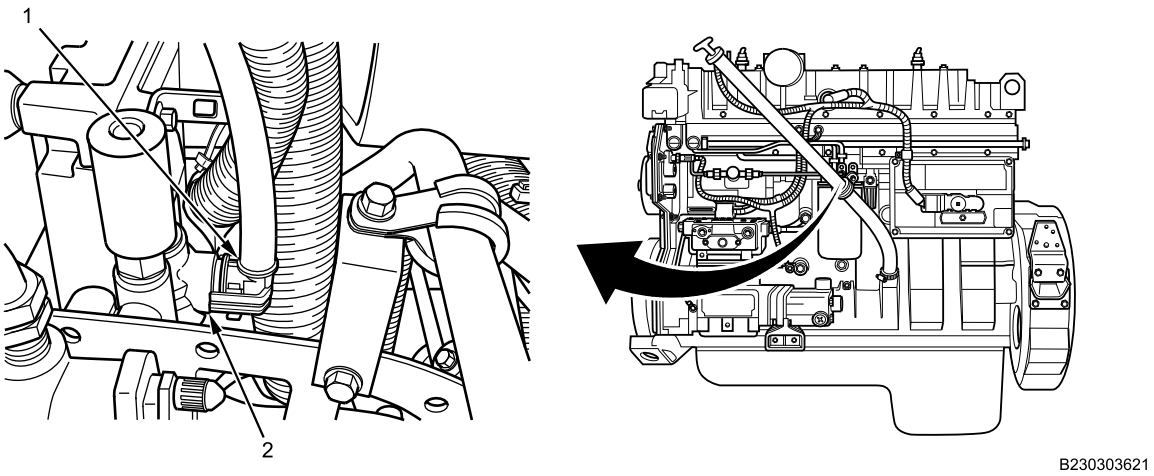


Figure 4. Fuel Supply Hose.

13. Install plug to seal off fuel supply hose opening at fuel filter header (Figure 4, Item 2).
14. Have assistant start engine (TM 9-2355-106-10).
15. Measure vacuum at 1200 rpm and record reading.

CONDITION/INDICATION

Is recorded reading more than 17 in.Hg (431 mm Hg)?

DECISION

YES Go to Step 18.
NO Go to next step.

MALFUNCTION

- 16. Fuel pump is faulty.

ACTION

Replace fuel pump. Refer to Fuel Pump Removal and Installation (WP 0253). Return vehicle to service.

END OF TEST

FUEL PUMP RESTRICTION TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 17. Fuel supply hose restricted.

ACTION

Replace fuel supply hose. Refer to Fuel Hose Removal and Installation (WP 0268). Return vehicle to service.

END OF TEST

MALFUNCTION

- 18. Fuel supply hose leaking.

ACTION

Replace fuel supply hose. Refer to Fuel Hose Removal and Installation (WP 0268). Return vehicle to service.

END OF TEST

MALFUNCTION

- 19. Damaged fuel filter outlet to supply pump inlet fuel line.

ACTION

Replace fuel filter outlet to supply pump inlet fuel line. Refer to Fuel Pump Removal and Installation (WP 0253). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

FUEL OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Pressure Test Kit (WP 0795, Item 77)

Materials/Parts
Hose (WP 0794, Item 24)
Measure, liquid (WP 0794, Item 34)

Personnel Required
Maintainer (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0016
WP 0035
WP 0254
WP 0255
WP 0265
WP 0268
WP 0271
WP 0269
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

WARNING

Fuel is flammable and can explode. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel and keep fire extinguisher nearby. Do not smoke when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. Failure to comply may result in serious injury or death to personnel.

Be alert at all times for the smell of fuel. Hot engines and components can ignite fuel. If fuel smell is detected while operating vehicle, shut down vehicle immediately. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Store diesel fuel in an approved container clearly marked DIESEL FUEL. Dispose of fuel in an approved container clearly marked DIESEL FUEL in accordance with standard operating procedures.

Do not fill fuel tank with engine running. Do not overfill fuel tank. Clean fuel spills immediately. Ensure fuel nozzle is grounded to filler neck to prevent sparks. Failure to comply may result in injury or death to personnel and damage to equipment.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

FUEL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

STEP

1. Remove fuel cap and visually inspect fuel level in fuel tank (TM 9-2355-106-10).

CONDITION/INDICATION

Fuel is very low or empty.

CORRECTIVE ACTION

Add fuel and follow priming procedure. Refer to Fuel Primer Sequence (WP 0255).

1. Take fuel sample at water separator. Refer to Fuel/Water Separator Assembly Purge, Removal, and Installation (WP 0271).

Water is present in fuel sample.

Drain separator. Refer to Fuel/Water Separator Assembly Purge, Removal and Installation (WP 0271). Drain and replace fuel. Refer to Fuel Tank and Bracket Removal and Installation (WP 0265). Move vehicle to a warm building and allow time for vehicle to warm up to ensure there is no ice in lines.

1. Inspect fuel sample for gelling.

Fuel sample is gelled.

Move vehicle to a warm building and allow it time for vehicle to warm up. Flush fuel system, replace fuel filter, and replace fuel. Refer to Fuel Filter and Strainer Removal and Installation (WP 0269).

1. Compare fuel sample to known good fuel supply.

Fuel sample is much darker than known good fuel.

Dark color may indicate oil contaminated fuel. Refer to Engine Mechanical Operations Checkout Procedure – Lube Oil in Fuel (WP 0016).

Fuel sample is lighter than known good fuel or has gasoline smell.

1. Replace fuel filter. Refer to Fuel Filter and Strainer Removal and Installation (WP 0269).
2. Drain and replace fuel. Refer to Fuel Tank and Bracket Removal and Installation (WP 0265).

1. Disconnect fuel outlet line (Figure 1, Item 2) at fuel rail (Figure 1, Item 1) and fuel filter header outlet (Figure 1, Item 3).

FUEL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

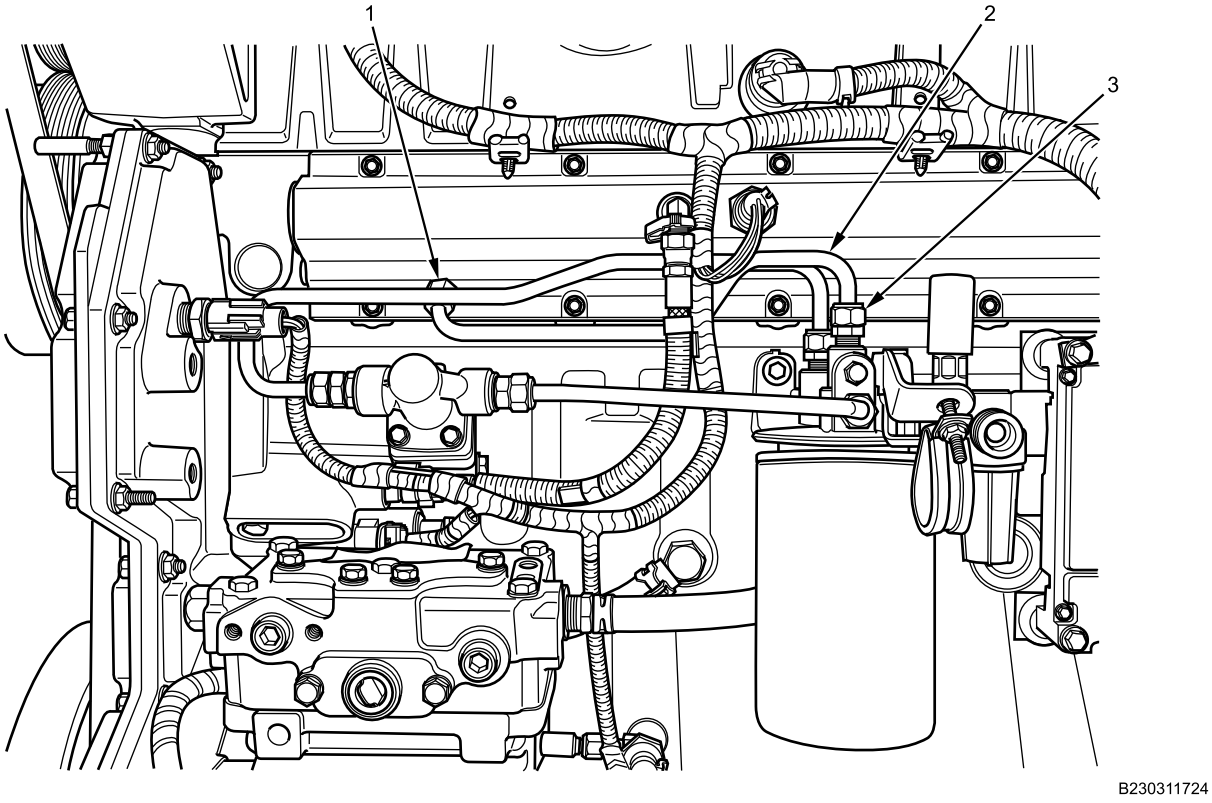


Figure 1. Fuel Filter Header Outlet Line

2. Remove outlet line (Figure 1, Item 2).
3. Reposition and install fuel outlet line (Figure 2, Item 1) on fuel filter outlet port (Figure 2, Item 2).

FUEL OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

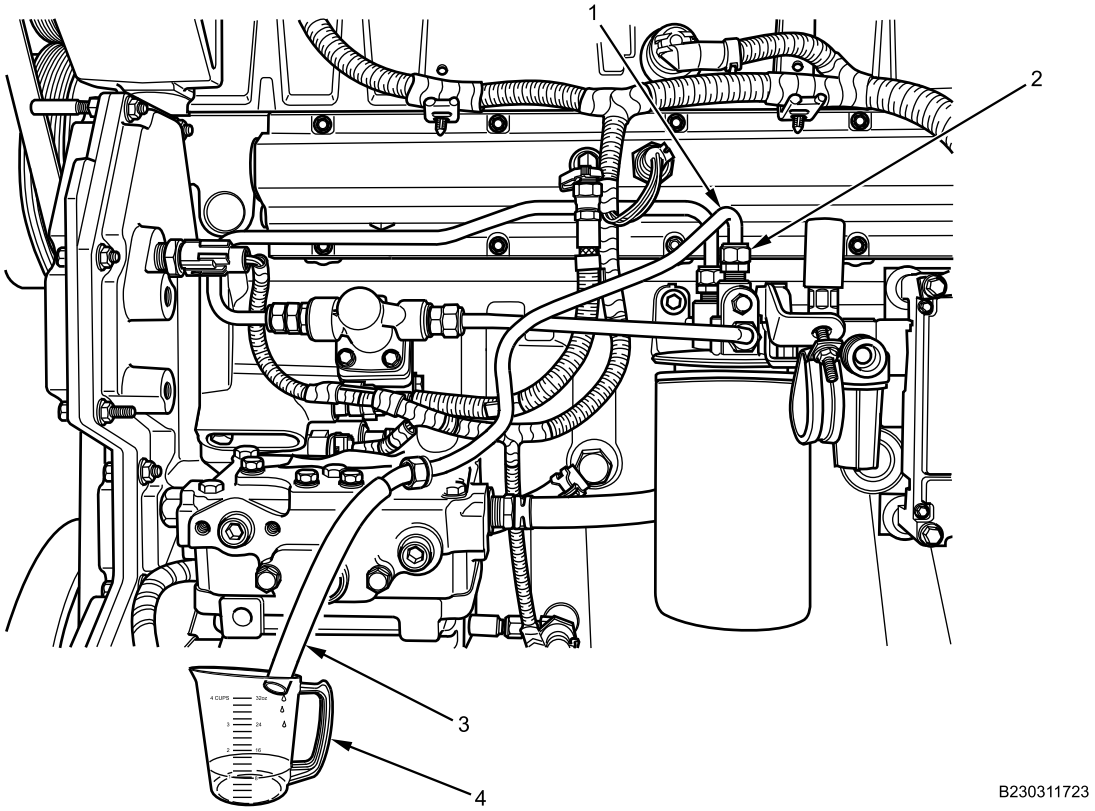


Figure 2. Fuel Outlet Line

4. Install an 18-inch section of 3/8-in. ID fuel hose (Figure 2, Item 3) on fuel outlet line (Figure 2, Item 1), and place open end of hose into measuring cup (Figure 2, Item 4).
5. Take fuel sample from fuel filter outlet header while assistant cranks engine.

Less than 8 oz fuel is delivered during 15 seconds of cranking.

Replace fuel filter and clean filter inlet screen. Refer to Fuel Filter and Strainer Removal and Installation (WP 0269).

1. Visually inspect for damaged or crimped fuel hoses (TM 9-2355-106-10).

Damaged or crimped fuel hoses are detected.

Replace damaged or crimped fuel hoses or pickup. Refer to Fuel Hose Removal and Installation (WP 0268).

1. Verify fuel sending unit is not crimped. Refer to Fuel Tank and Bracket Removal and Installation (WP 0265).

Fuel sending unit is crimped or damaged.

Replace fuel sending unit. Refer to Fuel Tank and Bracket Removal and Installation (WP 0265).

1. Test fuel pressure. Refer to Fuel Pump Pressure Test Troubleshooting Procedure (WP 0035).

END OF WORK PACKAGE

FIELD MAINTENANCE

FUEL PRESSURE (FULL LOAD) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Pressure Test Kit (ZTSE4409) (WP 0795, Item 77)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0015
WP 0036
WP 0255
WP 0269
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

WARNING

Fuel is flammable and can explode. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel and keep fire extinguisher nearby. Do not smoke when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. Failure to comply may result in serious injury or death to personnel.

Be alert at all times for the smell of fuel. Hot engines and components can ignite fuel. If fuel smell is detected while operating vehicle, shut down vehicle immediately. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

FUEL PRESSURE (FULL LOAD) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Remove cap (Figure 1, Item 2) and air bleed valve (Figure 1, Item 3) from fuel filter header (Figure 1, Item 1).

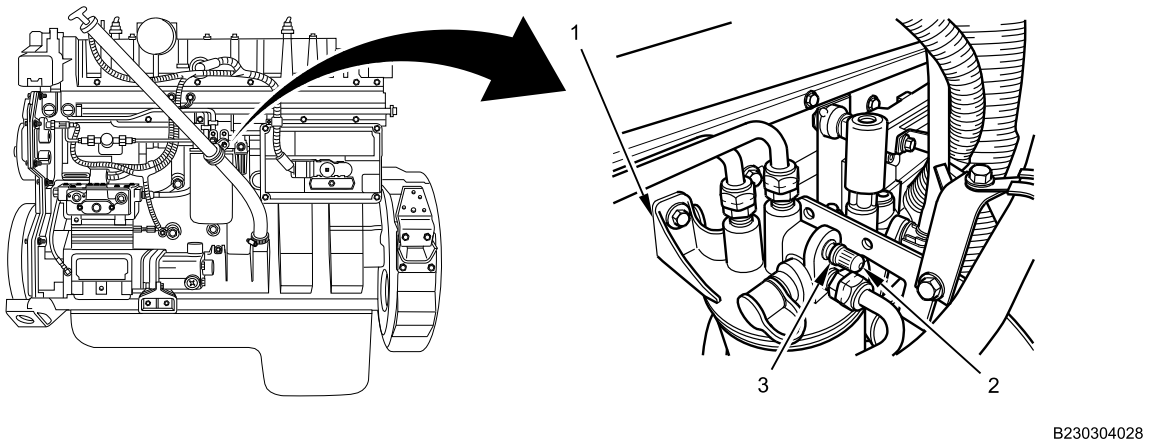


Figure 1. Fuel Filter Header Air Bleed Valve.

2. Install adapter (Figure 2, Item 3) from Fuel Pressure Test Kit into air bleed valve opening on fuel filter header (Figure 2, Item 2).

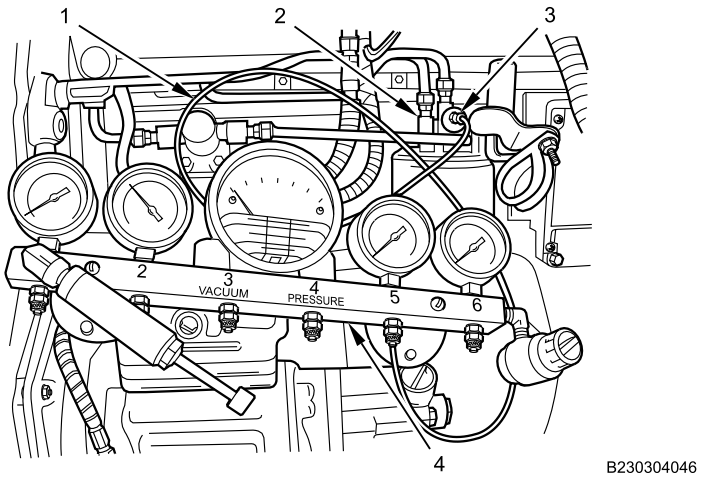


Figure 2. Fuel Pressure Gauge Set.

3. Install fuel pressure gauge set by connecting Fuel Pressure Test Kit line (Figure 2, Item 1) from adapter (Figure 2, Item 3) on fuel filter header (Figure 2, Item 2) to fuel pressure gauge 5 on gauge bar (Figure 2, Item 4).
4. Bleed air from fuel line to ensure accurate reading by loosening line at gauge and priming fuel system (WP 0255). Tighten line securely after bleeding fuel system.
5. Start engine and run at idle to check for fuel leaks in line (Figure 2, Item 1) to pressure gauge.

FUEL PRESSURE (FULL LOAD) TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Ensure gauge set is secured to right side windshield, outside of vehicle in position viewable by assistant during road test.

6. Drive vehicle on road until engine reaches operating temperature. Find open section of road and select suitable gear. Press accelerator pedal to floor and accelerate to 100% load. Drive vehicle uphill or fully loaded to reach correct engine loading at rated engine speed.
7. With assistant, measure and record fuel pressure.

CONDITION/INDICATION

Is recorded fuel pressure more than 45 psi (310 kPa)?

DECISION

YES Refer to Engine Performance Operational Checkout Procedure (WP 0015).
NO Go to next step.

STEP

8. Replace fuel filter (WP 0269).
9. Clean fuel strainer (WP 0269).
10. Drive vehicle on road until engine reaches operating temperature. Find open section of road and select suitable gear. Press accelerator pedal to floor and accelerate to 100% load. Drive vehicle uphill or fully loaded to reach correct engine loading at rated engine speed.
11. With assistant, measure and record fuel pressure.

CONDITION/INDICATION

Is recorded fuel pressure more than 45 psi (310 kPa)?

DECISION

YES Go to next step.
NO Go to Step 13.

STEP

12. Verify correct engine performance.

CONDITION/INDICATION

Does engine perform correctly?

DECISION

YES Return vehicle to service.
NO Refer to next step in Engine Performance Operational Checkout Procedure (WP 0015).

FUEL PRESSURE (FULL LOAD) TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 13. Restriction in fuel pump.

ACTION

Perform fuel pump restriction troubleshooting procedure. Refer to Fuel Pump Restriction Troubleshooting Procedure (WP 0036).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

FUEL INJECTOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0218
WP 0219
WP 0249
WP 0250
WP 0265
WP 0270
WP 0269
WP 0782

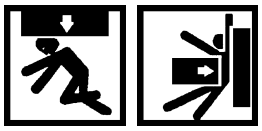
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 461
- 462
- 463
- 464
- 465
- 466

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

SYMPTOM

Yellow engine warning lamp is on.

MALFUNCTION

One or more of the following DTCs are set: 461, 462, 463, 464, 465, or 466.

FUEL INJECTOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

SYMPTOM

Fuel injectors show signs of rust or corrosion.

MALFUNCTION

Fuel system has water or other foreign contamination found during fuel injector replacement.

CORRECTIVE ACTION

Remove any water or other foreign contamination from entire fuel system, including fuel tanks, fuel filter housings, strainers, and fuel supply manifold. Replace all injectors that show signs of rust or corrosion. Refer to one or more of the following procedures:

- Fuel Injector Removal and Installation (WP 0249).
- Fuel Tank and Bracket Removal and Installation (WP 0265).
- Fuel/Water Separator Filter Removal and Installation (WP 0270).
- Fuel Filter and Strainer Removal and Installation (WP 0269).
- Oil/Fuel Manifold Removal and Installation (WP 0250).

SYMPTOM

Fuel injector has been replaced and one or more of the following DTCs returns: 461, 462, 463, 464, 465, or 466.

MALFUNCTION

Internal engine malfunction causing one or more of the following DTCs to set: 461, 462, 463, 464, 465, or 466.

CORRECTIVE ACTION

Replace engine. Refer to Engine Assembly Removal (WP 0218) and Engine Assembly Installation (WP 0219). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

INJECTION CONTROL PRESSURE (ICP) SENSOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0329
WP 0317
WP 0391
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Air cleaner assembly removed (WP 0257)

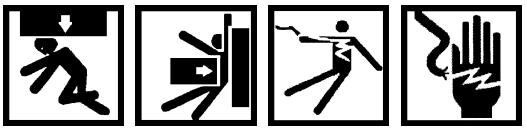
Drawings Required
Schematic (WP 0789, Figure 79)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 124
- 125
- 332

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

INJECTION CONTROL PRESSURE (ICP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Disconnect harness connector LAM1018. Refer to Figure 1.

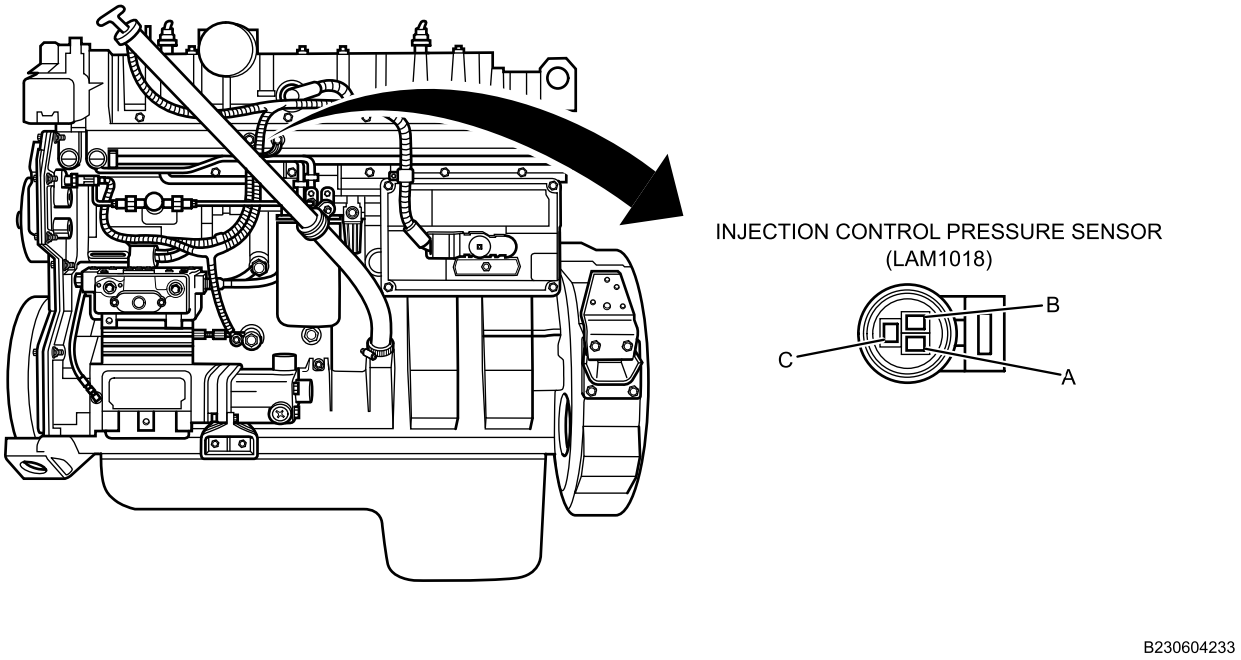


Figure 1. Injection Control Pressure (ICP) Sensor.

2. Measure resistance between connector LAM1018 terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 7.
YES Go to next step.

STEP

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Measure DC voltage between connector LAM1018 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

INJECTION CONTROL PRESSURE (ICP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 9.
YES Go to next step.

STEP

6. Measure DC voltage between connector LAM1018 terminal C and ground with multimeter. Refer to Figure 2.

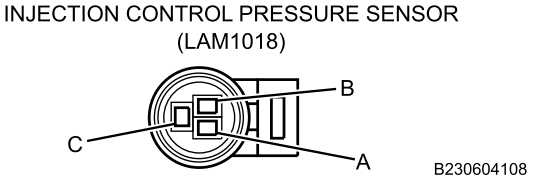


Figure 2. Connector LAM1018.

CONDITION/INDICATION

Does multimeter read between 0.01V and 0.25V?

DECISION

YES Go to Step 32.
NO Go to Step 20.

STEP

7. Disconnect connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 3.

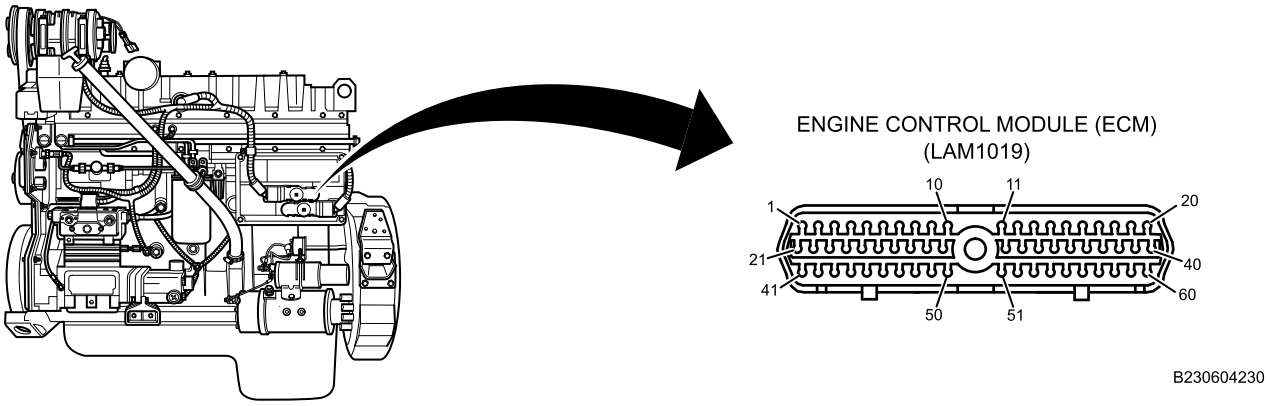


Figure 3. Engine Control Module (ECM).

8. Measure resistance between connector LAM1018 terminal A and connector LAM1019 terminal 19 with multimeter. Refer to Figure 2 and Figure 3.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

INJECTION CONTROL PRESSURE (ICP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 33.
NO Go to Step 31.

STEP

9. Turn ignition switch OFF (TM 9-2355-106-10).
10. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
11. Disconnect connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 3.
12. Turn MAIN POWER switch ON (TM 9-2355-106-10).
13. Turn ignition switch ON (TM 9-2355-106-10).
14. Measure DC voltage between connector LAM1018 terminal B and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 31.
NO Go to next step.

STEP

15. Turn ignition switch OFF (TM 9-2355-106-10).
16. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
17. Measure resistance between connector LAM1018 terminal B and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 31.
YES Go to next step.

STEP

18. Measure resistance between connector LAM1018 terminals B and A with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 31.
YES Go to next step.

STEP

19. Measure resistance between connector LAM1018 terminal B and connector LAM1019 terminal 40 with multimeter. Refer to Figure 4 and Figure 5.

INJECTION CONTROL PRESSURE (ICP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

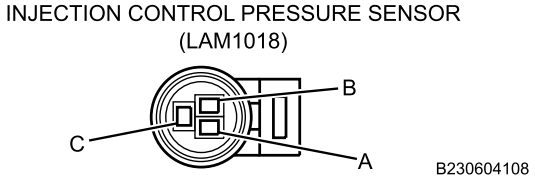


Figure 4. Connector LAM1018.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 33.
NO Go to Step 31.

STEP

20. Turn ignition switch OFF (TM 9-2355-106-10).
21. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
22. Disconnect connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 5.

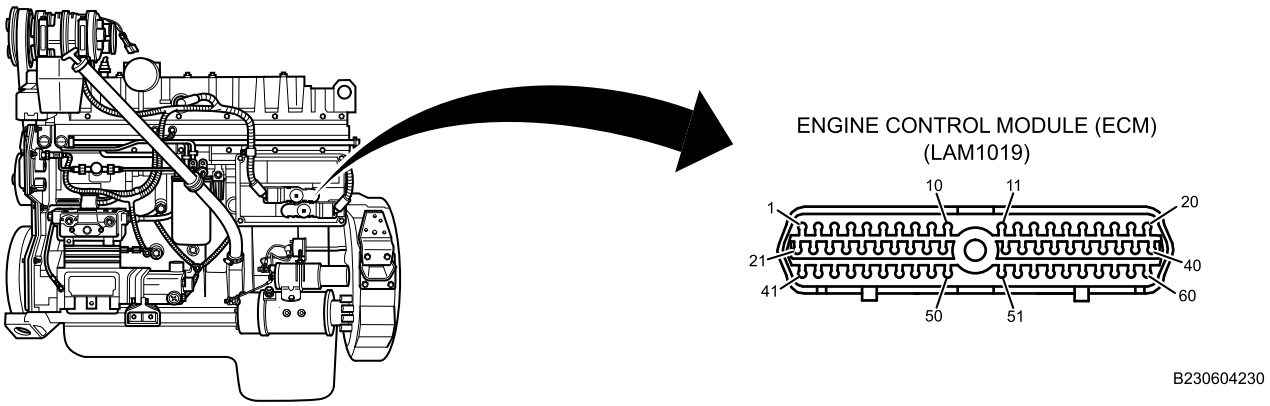


Figure 5. Engine Control Module (ECM).

23. Turn MAIN POWER switch ON (TM 9-2355-106-10).
24. Turn ignition switch ON (TM 9-2355-106-10).
25. Measure DC voltage between connector LAM1018 terminal C and ground with multimeter. Refer to Figure 4.

INJECTION CONTROL PRESSURE (ICP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 31.
NO Go to next step.

STEP

26. Turn ignition switch OFF (TM 9-2355-106-10).
27. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
28. Measure resistance between connector LAM1018 terminal C and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 31.
YES Go to next step.

STEP

29. Measure resistance between connector LAM1018 terminals C and A with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 31.
YES Go to next step.

INJECTION CONTROL PRESSURE (ICP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

30. Measure resistance between connector LAM1018 terminal C and connector LAM1019 terminal 16 with multimeter. Refer to Figure 6 and Figure 7.

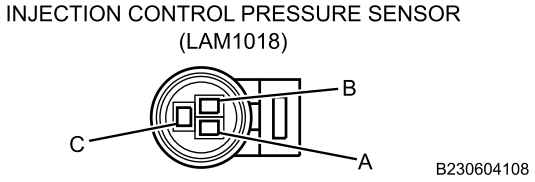


Figure 6. Connector LAM1018.

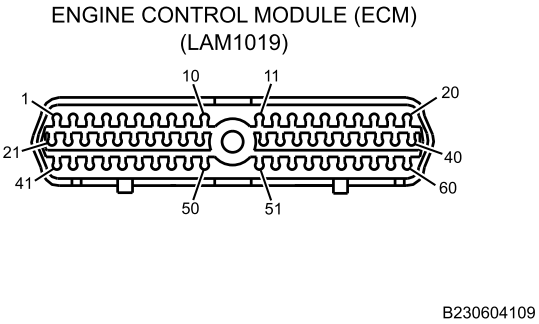


Figure 7. Connector LAM1019.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 33.
NO Go to nest step.

MALFUNCTION

- 31. Engine sensor harness is faulty.

ACTION

Replace engine sensor harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0317). Return vehicle to service.

END OF TEST

INJECTION CONTROL PRESSURE (ICP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 32. ICP sensor is faulty.

ACTION

Replace ICP sensor. Refer to Injection Control Pressure (ICP) Sensor Removal and Installation (WP 0391). Return vehicle to service.

END OF TEST

MALFUNCTION

- 33. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

INJECTOR PRESSURE REGULATOR (IPR) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0012
WP 0257
WP 0329
WP 0396
WP 0330
WP 0597
WP 0599
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left engine armor plate removed (WP 0597)
Air cleaner assembly removed (WP 0257)

Drawings Required
WP 0789, Figure 79

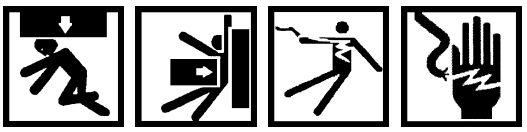
This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 241*
- 331

* DTC does not illuminate engine warning lamp.

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use caution when working under hood with ignition ON. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

INJECTOR PRESSURE REGULATOR (IPR) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Retrieve engine DTCs manually or with MSD. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

Do DTCs 231 or 331 display?

DECISION

NO Return vehicle to service.
YES Go to next step.

STEP

NOTE

Engine will not run with DTC 241 active or IPR disconnected.

2. Turn ignition switch OFF (TM 9-2355-106-10).
3. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
4. Disconnect connector LAM1016. Refer to Figure 1.

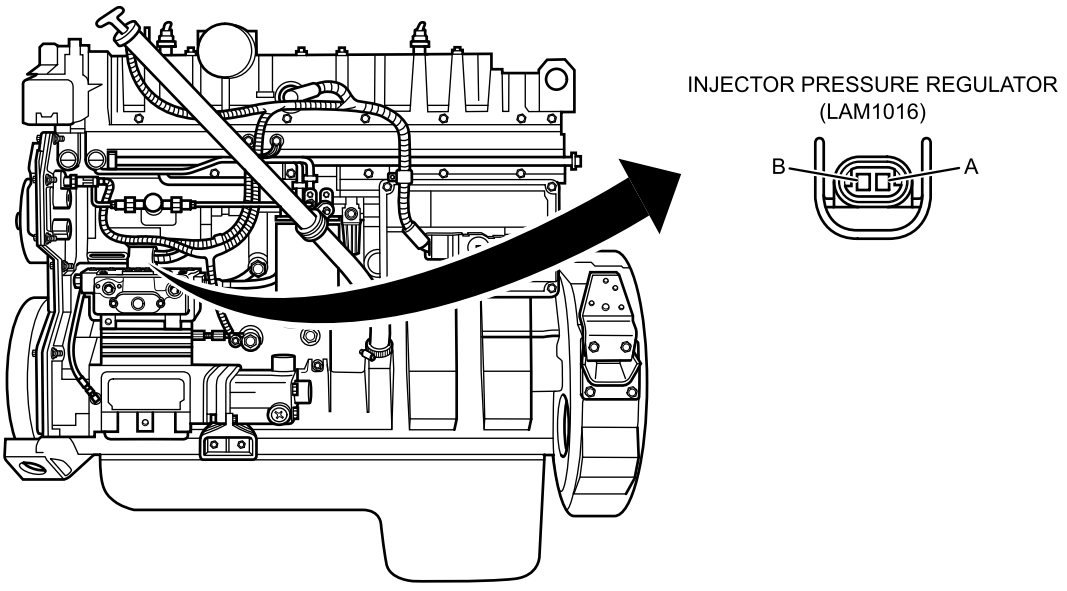


Figure 1. IPR.

INJECTOR PRESSURE REGULATOR (IPR) TROUBLESHOOTING PROCEDURE - (CONTINUED)

5. Turn MAIN POWER switch ON (TM 9-2355-106-10).
6. Turn ignition switch ON (TM 9-2355-106-10).
7. Measure DC voltage between connector LAM1016 terminals A and B with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 21.
NO Go to next step.

STEP

8. Measure DC voltage between connector LAM1016 terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 16.
NO Go to next step.

STEP

9. Turn ignition switch OFF (TM 9-2355-106-10).
10. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
11. Disconnect connector LAM1019. Refer to Figure 2. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

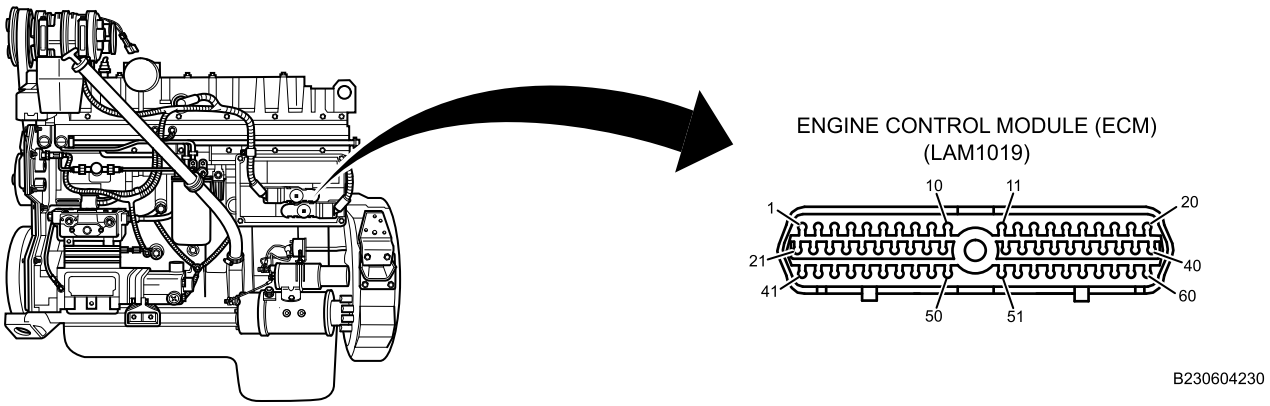


Figure 2. Engine Control Module (ECM).

12. Measure resistance between connector LAM1016 terminal A and connector LAM1019 terminal 17 with multimeter. Refer to Figure 3 and Figure 2.

INJECTOR PRESSURE REGULATOR (IPR) TROUBLESHOOTING PROCEDURE - (CONTINUED)

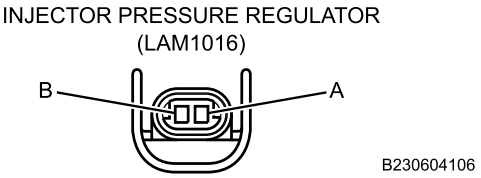


Figure 3. Connector LAM1016.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 27.
YES Go to next step.

STEP

13. Measure resistance between connector LAM1016 terminal A and all other terminals on connector LAM1019 with multimeter. Refer to Figure 3 and Figure 2.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 27.
YES Go to next step.

STEP

14. Connect connector LAM1016. Refer to Figure 3.
15. Measure resistance between connector LAM1019 terminal 17 and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 26.
YES Go to Step 28.

STEP

16. Turn ignition switch OFF (TM 9-2355-106-10).
17. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
18. Disconnect connector LAM1019. Refer to Figure 2. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).
19. Measure resistance between connector LAM1016 terminal B and connector LAM1019 terminal 37 with multimeter. Refer to Figure 3 and Figure 2.

CONDITION/INDICATION

Does multimeter read between 0 and 3 ohms?

INJECTOR PRESSURE REGULATOR (IPR) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 27.
YES Go to next step.

STEP

20. Measure resistance between connector LAM1016 terminal B and all other terminals on connector LAM1019 with multimeter. Refer to Figure 3 and Figure 2.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 28.
NO Go to Step 27.

STEP

21. Turn ignition switch OFF (TM 9-2355-106-10).
22. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
23. Disconnect connector LAM1019. Refer to Figure 4. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

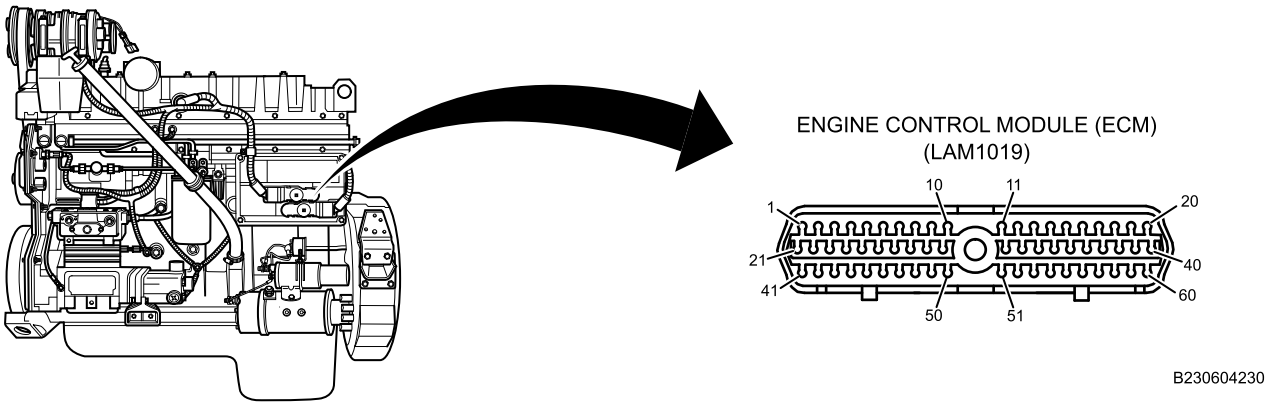


Figure 4. Engine Control Module (ECM).

24. Measure resistance between connector LAM1016 terminal B and connector LAM1019 terminal 37 with multimeter. Refer to Figure 4 and Figure 5.

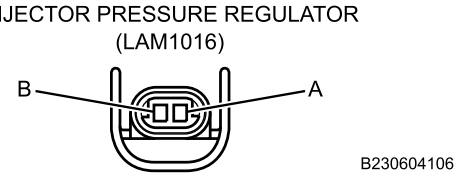


Figure 5. Connector LAM1016.

INJECTOR PRESSURE REGULATOR (IPR) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 27.
YES Go to next step.

STEP

25. Measure resistance between connector LAM1016 terminal B and all other terminals on connector LAM1019 with multimeter. Refer to Figure 4 and Figure 5.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 28.
NO Go to Step 27.

MALFUNCTION

- 26. Faulty ECM.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 27. Faulty engine sensor wiring harness.

ACTION

Replace engine sensor wiring harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0330). Return vehicle to service.

END OF TEST

MALFUNCTION

- 28. Faulty IPR.

ACTION

Replace IPR. Refer to Injector Pressure Regulator (IPR) Valve Removal and Installation (WP 0396). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

INJECTION PRESSURE REGULATOR (IPR) SYSTEM OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

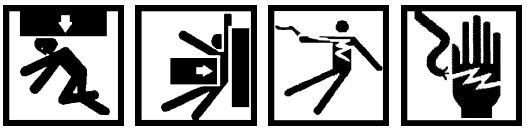
Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanics Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0018
WP 0020
WP 0012
WP 0040
WP 0041
WP 0083
WP 0391
WP 0396
WP 0597
WP 0598
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Left side engine armor plate removed (WP 0597)
Left engine armor plate bracket removed (WP 0598)

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

INJECTION PRESSURE REGULATOR (IPR) SYSTEM OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

STEP

1. Retrieve DTCs manually or with MSD. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

DTCs 124, 125, or 332 set.

CORRECTIVE ACTION

Refer to Injection Control Pressure (ICP) No Start Operational Checkout Procedure (WP 0020).

1. Check engine oil for contamination, correct grade, and correct oil level. Refer to Engine Oil Operational Checkout Procedure (WP 0018).
2. Check Injection Control Pressure (ICP) sensor for proper function. Refer to Injection Control Pressure (ICP) Sensor Troubleshooting Procedure (WP 0040).
3. Check Injection Pressure Regulator (IPR) for proper function. Refer to Injection Pressure Regulator (IPR) Troubleshooting Procedure (WP 0041).

Wrong oil grade used or oil contamination.

Change engine oil. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

Vehicle driven less than 20 miles (32 kilometers) after oil change.

Drive vehicle 15 to 20 miles, (24 to 32 kilometers) to eliminate air bubbles from oil reservoir and high pressure system.

Engine oil level is too high or low.

Fill or drain engine oil to proper level. Refer to Engine Oil Drain/Fill Procedure (WP 0233).

Injection Control Pressure (ICP) sensor faulty.

Replace ICP sensor. Refer to (WP 0391).

Injection Pressure Regulator (IPR) valve faulty.

Replace IPR valve. Refer to (WP 0396).

END OF WORK PACKAGE

FIELD MAINTENANCE

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Materials/Parts
Cable lock strap (WP 0796, Item 155)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0059
WP 0271
WP 0333
WP 0335
WP 0424
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left engine armor plate bracket removed (WP 0598)
Air filter removed (WP 0258)
Right engine armor plate removed (WP 0599)

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

Remove cable lock straps as necessary to perform procedure. Note position and size of cable lock straps to aid installation.

Fuel/water separator temperature must be below 50°F (10°C).

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10). Fuel/water separator should begin to feel warm to touch within 5 minutes.

CONDITION/INDICATION

Is fuel/water separator warm?

DECISION

YES Return vehicle to service.
NO Go to next step.

STEP

3. Turn ignition switch OFF (TM 9-2355-106-10).
4. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
5. Disconnect connector 4042 from fuel/water separator heater terminal. Refer to Figure 1.

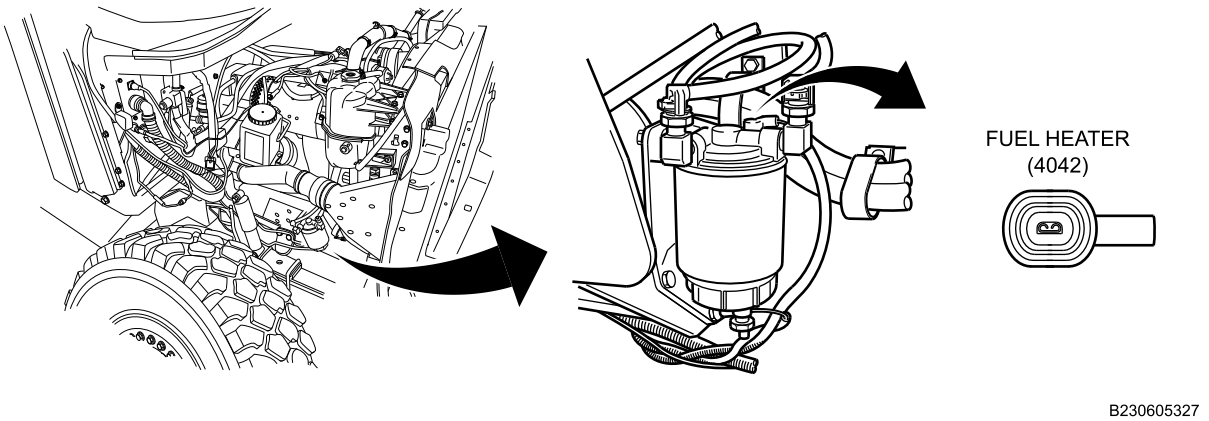


Figure 1. Inboard Right Front Wheel.

6. Turn MAIN POWER switch ON (TM 9-2355-106-10).
7. Turn ignition switch ON (TM 9-2355-106-10).
8. Measure DC voltage between fuel/water separator heater harness connector 4042 terminal and ground with multimeter. Refer to Figure 1.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 36.
NO Go to next step.

STEP

9. Turn ignition switch OFF (TM 9-2355-106-10).

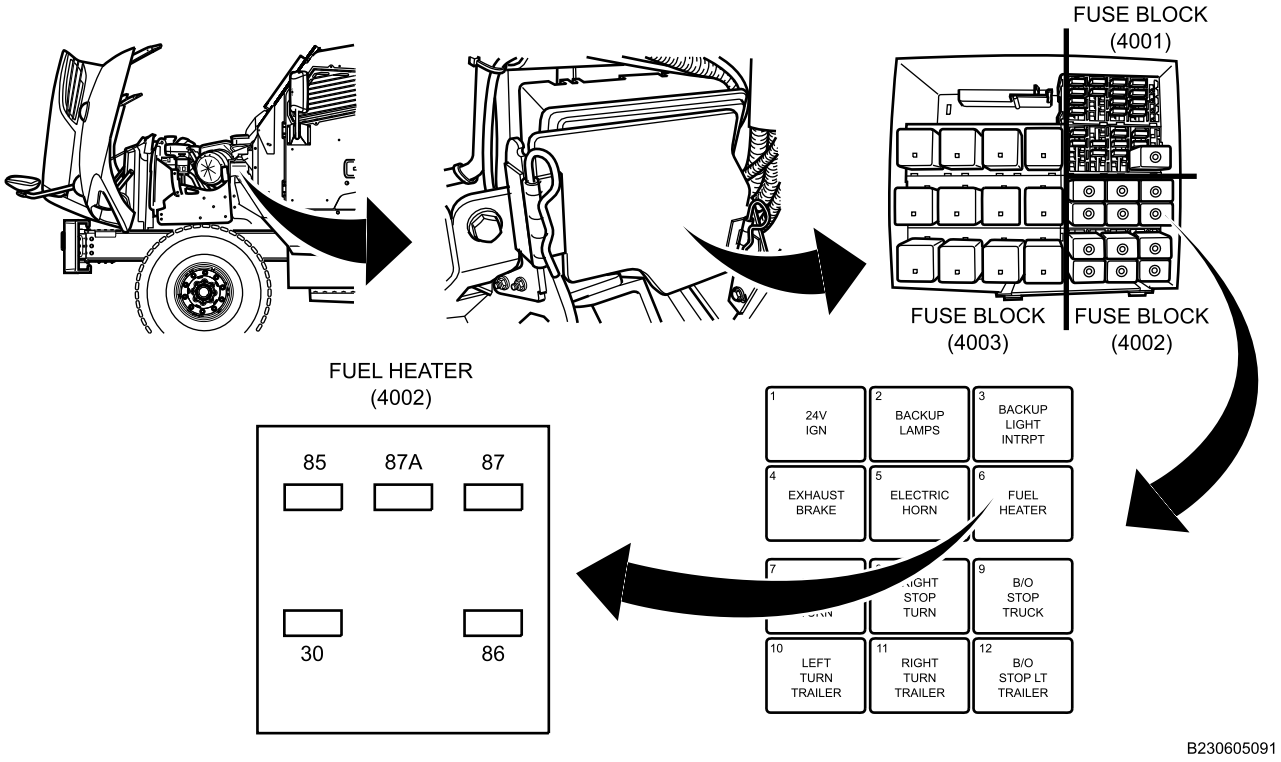


Figure 2. Underhood Power Distribution Center (PDC).

10. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
11. Remove fuel heater relay 4002. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).
12. Measure resistance between relay socket terminal 85 and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 37.
YES Go to next step.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Turn MAIN POWER switch ON (TM 9-2355-106-10).
14. Turn Ignition switch ON (TM 9-2355-106-10).
15. Measure DC voltage between relay 4002 socket terminals 85 and 86 with multimeter. Refer to Figure 3.

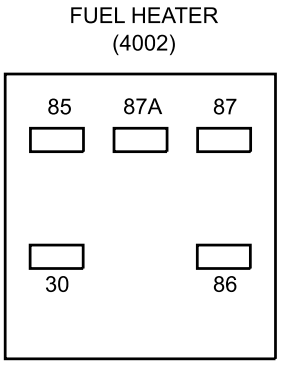


Figure 3. Fuel Heater Relay Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 21.
YES Go to next step.

STEP

16. Measure DC voltage between relay 4002 socket terminals 85 and 87 with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 26.
YES Go to next step.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

17. Install jumper wire between relay 4002 socket terminals 30 and 86. Refer to Figure 3.
18. Measure DC voltage between fuel/water separator heater harness connector 4042 terminal and ground with multimeter. Refer to Figure 4.

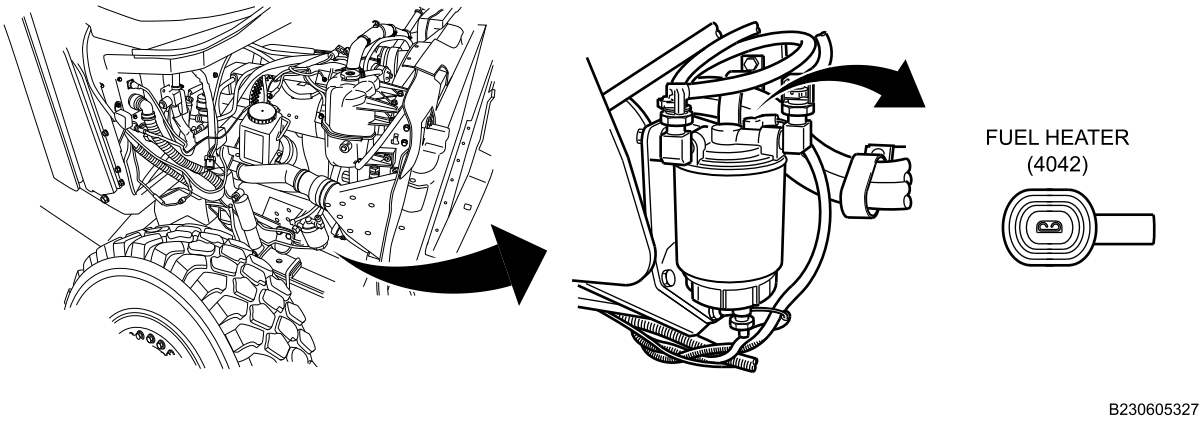


Figure 4. Inboard Right Front Wheel.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 38.
NO Go to next step.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

19. Disconnect connector 4305F/4305M. Refer to Figure 5.

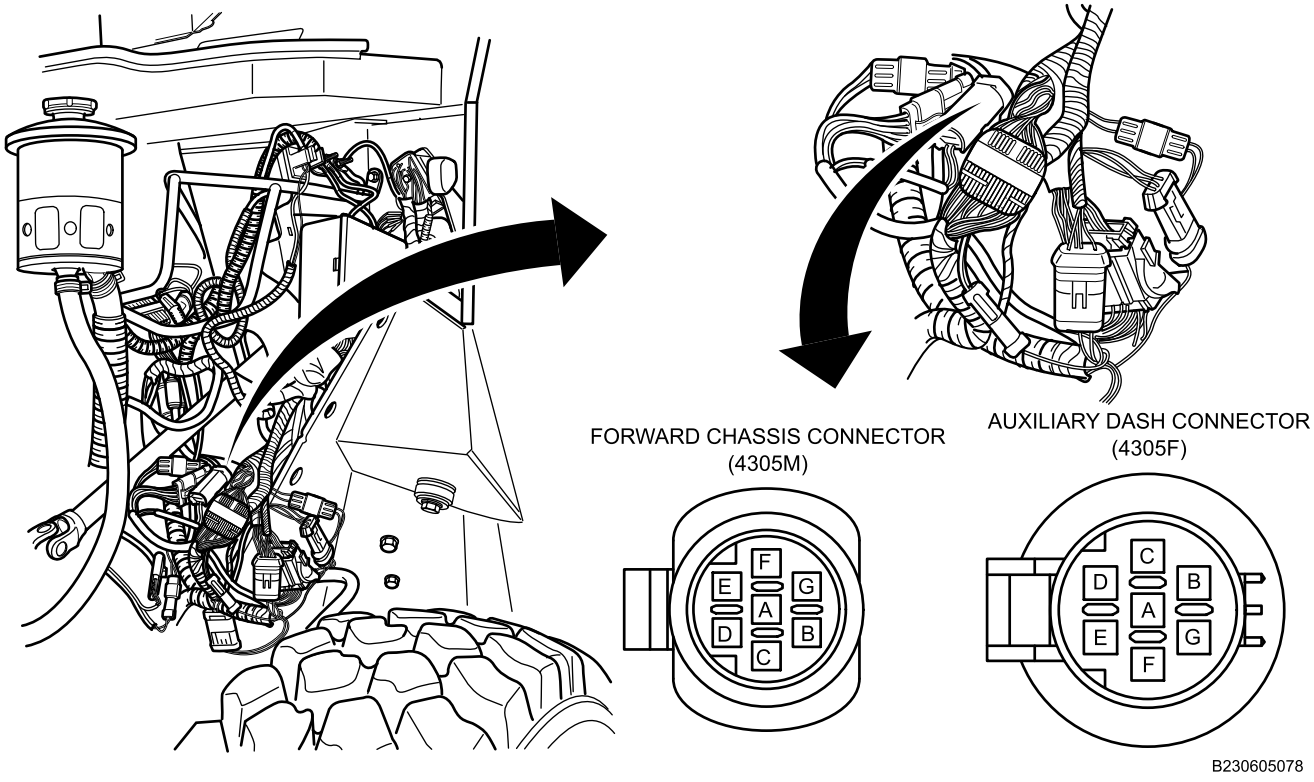


Figure 5. Left Side Engine Compartment.

20. Measure DC voltage between connector 4305F terminal E and ground with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 39.
NO Go toStep 37.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

21. Remove and inspect 10A IGNITION BUS fuse. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

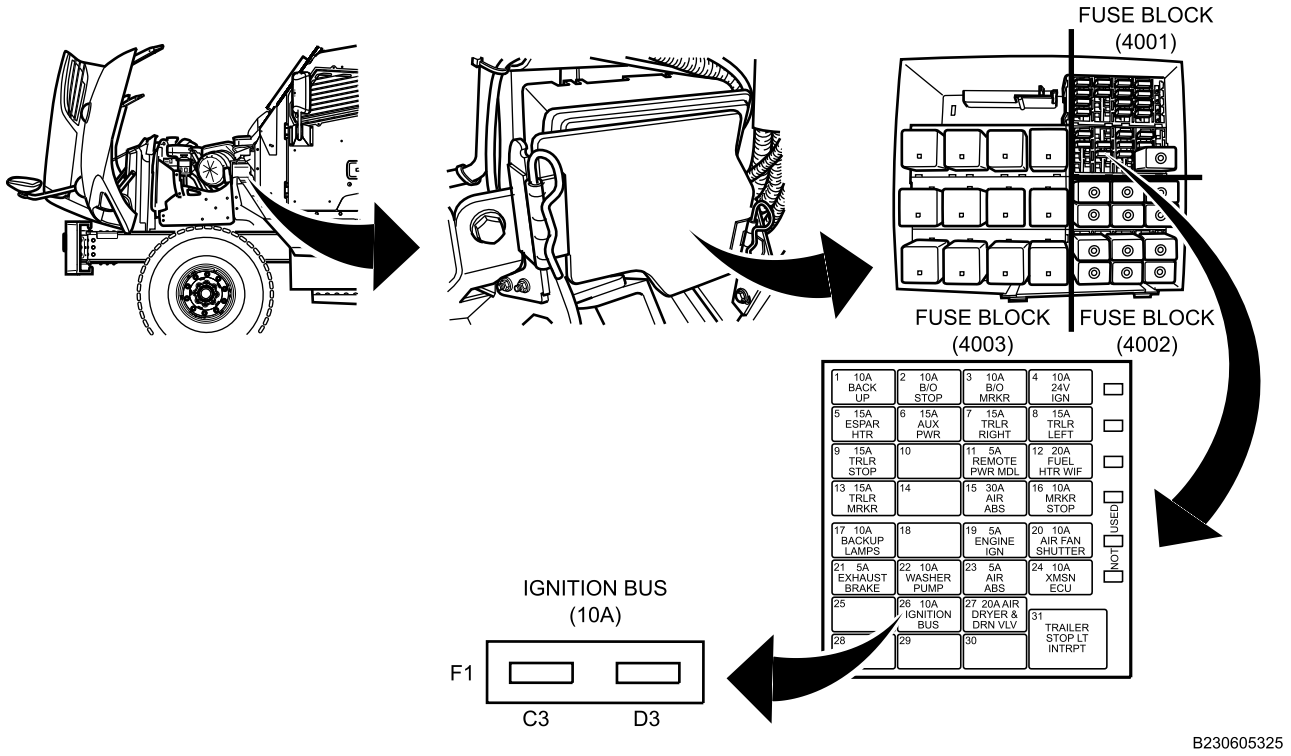


Figure 6. Underhood Power Distribution Center (PDC).

CONDITION/INDICATION

Is fuse open?

DECISION

YES Go to Step 23.
NO Go to next step.

STEP

22. Measure DC voltage between each fuse socket terminal C3 and D3 to ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

NO Go to Step 40.
YES Go to Step 37.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

23. Turn ignition switch OFF (TM 9-2355-106-10).
24. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
25. Measure resistance between relay 4002 socket terminal 86 and ground with multimeter. Refer to Figure 7.

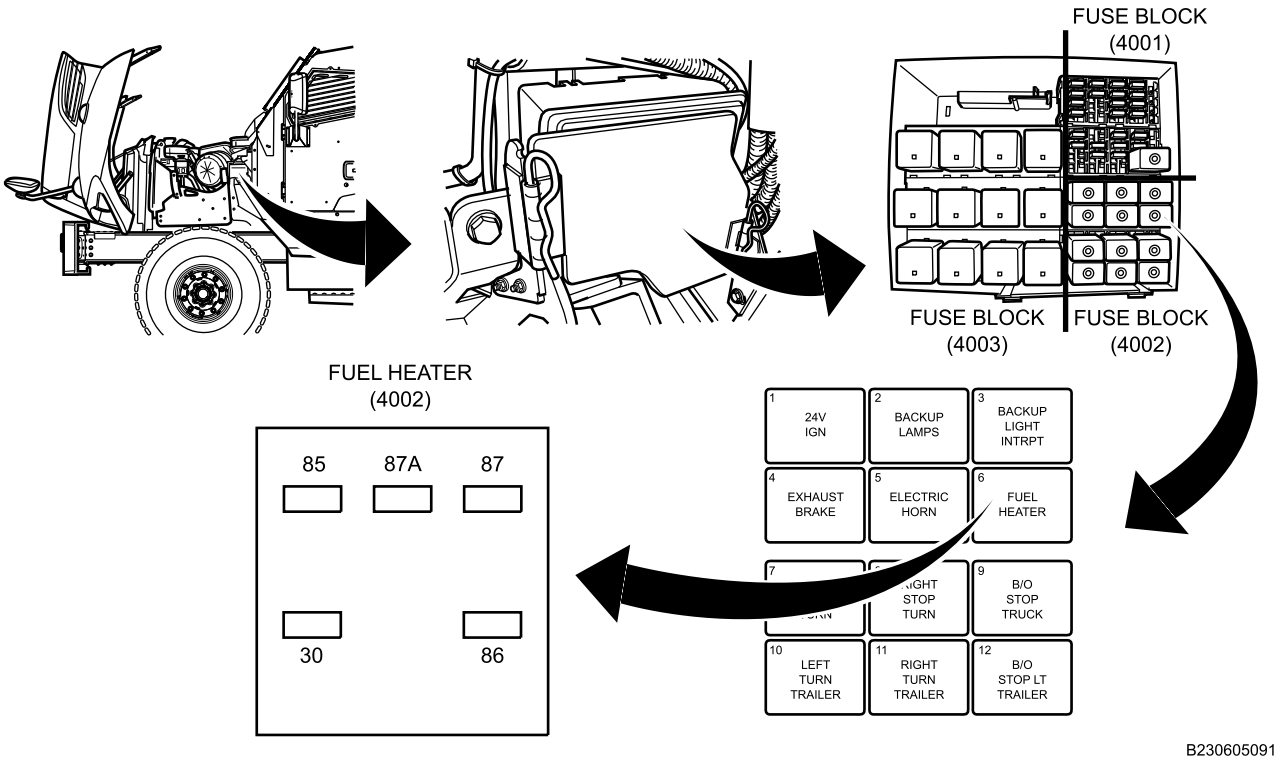


Figure 7. Underhood Power Distribution Center (PDC).

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 37.
YES Go to Step 38.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

26. Remove and inspect 20A FUEL HTR WIF fuse. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

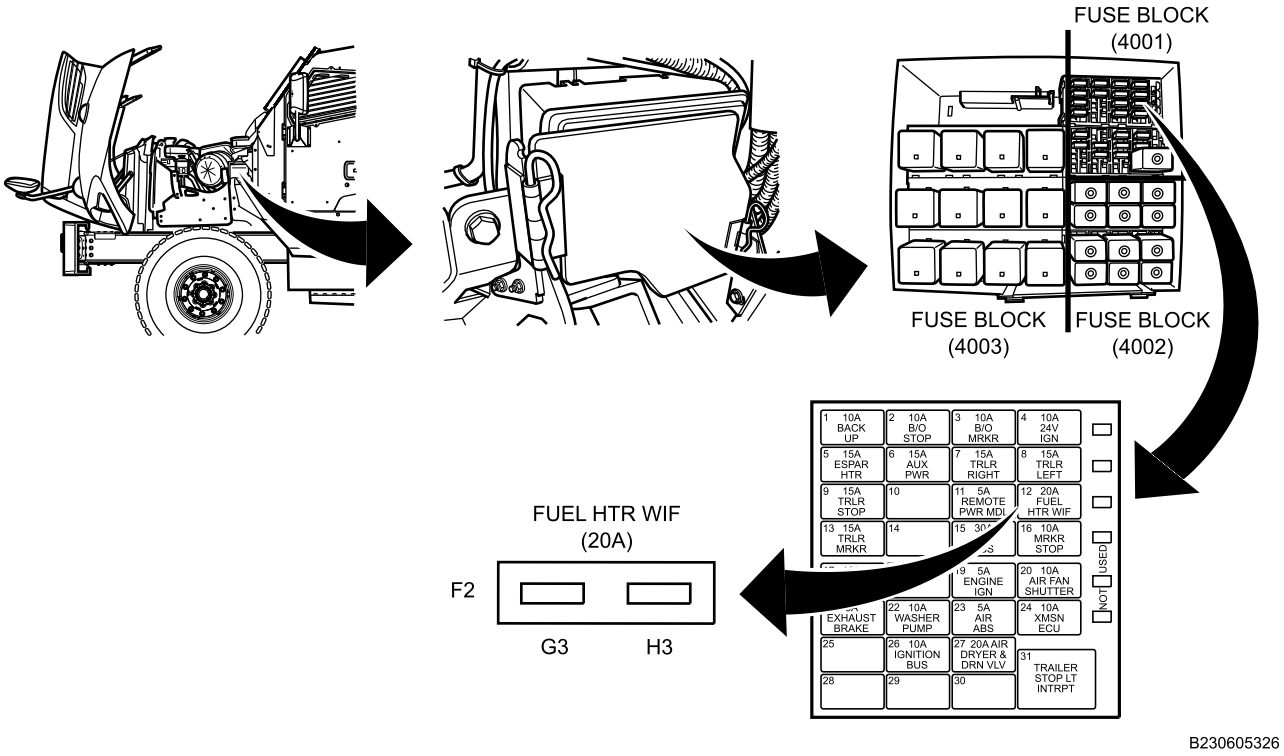


Figure 8. Underhood Power Distribution Center (PDC).

CONDITION/INDICATION

Is fuse open?

DECISION

YES Go to Step 28.
NO Go to next step.

STEP

27. Measure DC voltage between each fuse socket terminal G3 and H3 to ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

NO Go to Step 40.
YES Go to Step 37.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Turn ignition switch OFF (TM 9-2355-106-10).
29. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
30. Measure resistance between relay 4002 socket terminal 87 and ground with multimeter. Refer to Figure 9.

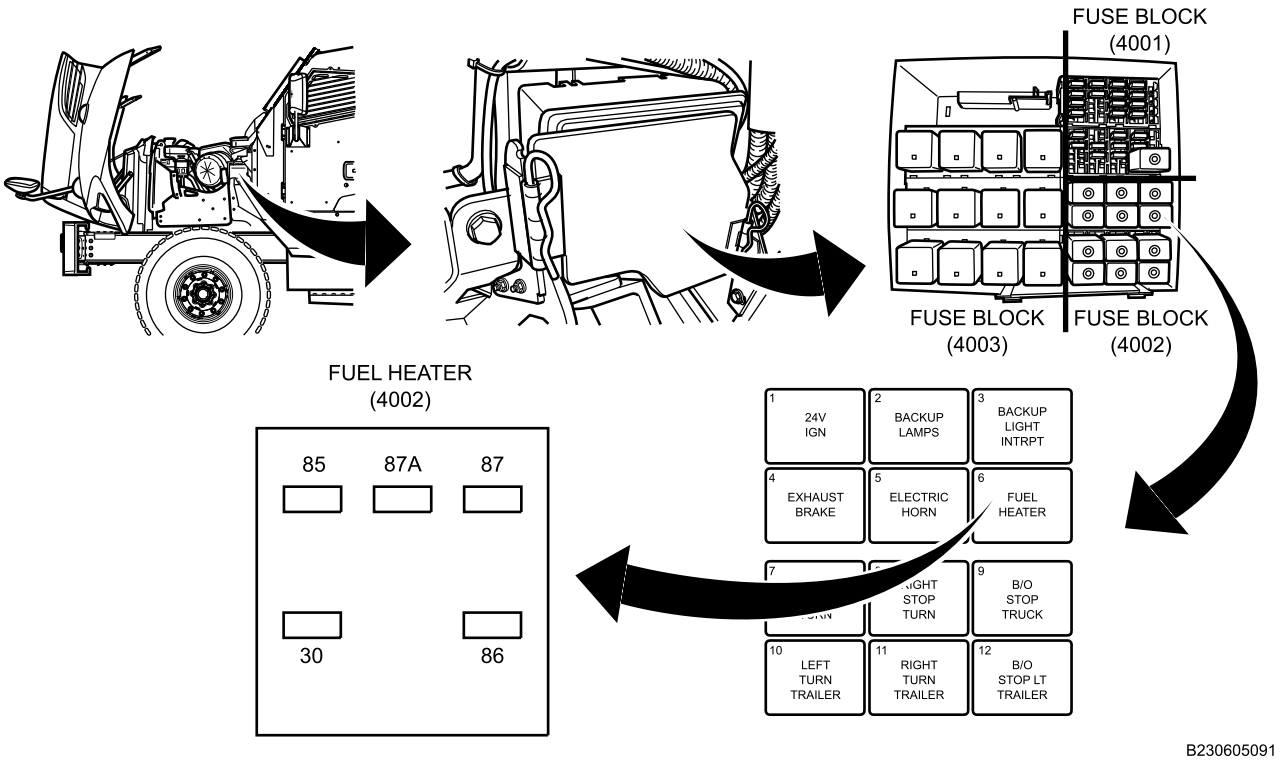


Figure 9. Underhood Power Distribution Center (PDC).

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 37.
YES Go to next step.

STEP

31. Measure resistance between relay 4002 socket terminal 30 and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 34.
NO Go to next step.

STEP

32. Disconnect connector 4305F/4305M. Refer to Figure 10.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

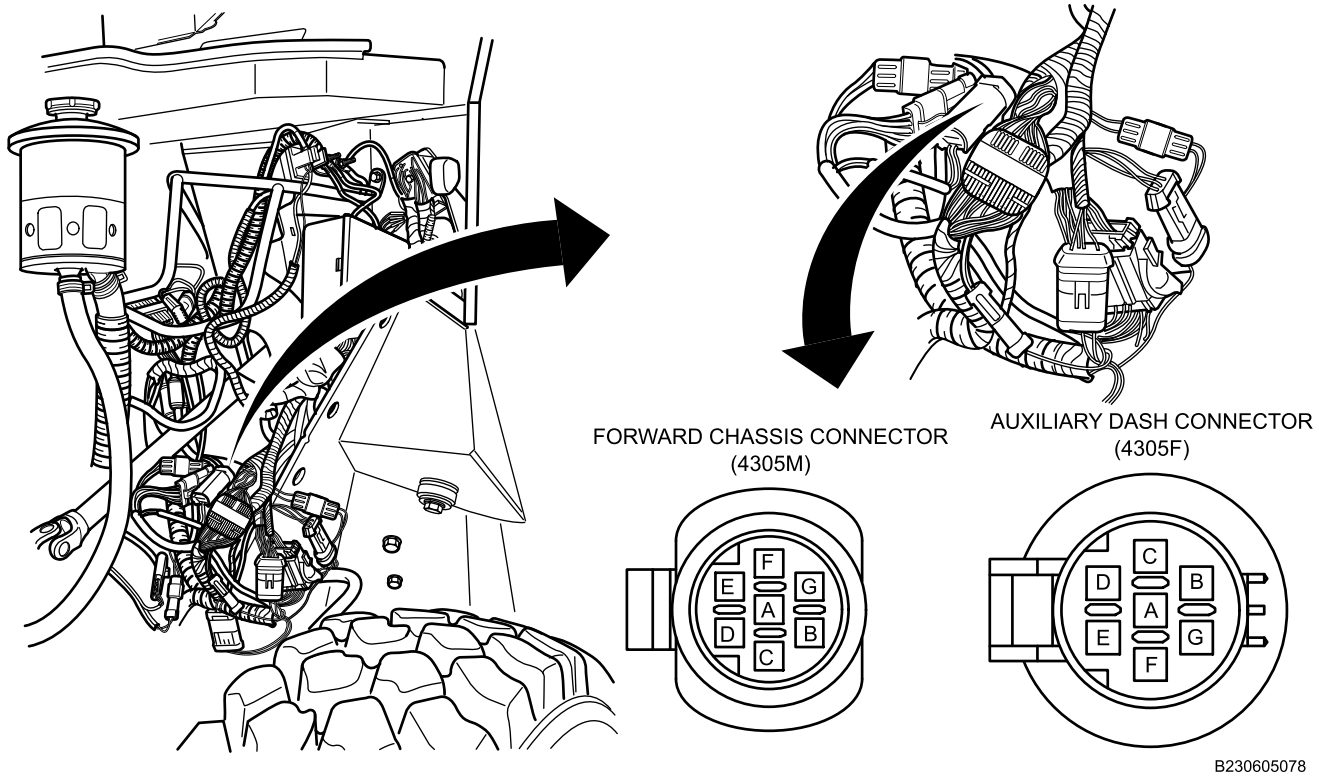


Figure 10. Left Side Engine Compartment.

33. Measure resistance between relay 4002 socket terminal 30 and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 37.
NO Go to Step 39.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

NOTE

Fuel/water separator must be below 50°F (10°C) for following test.

34. Connect fuel/water separator heater harness connector 4042. Refer to Figure 11.

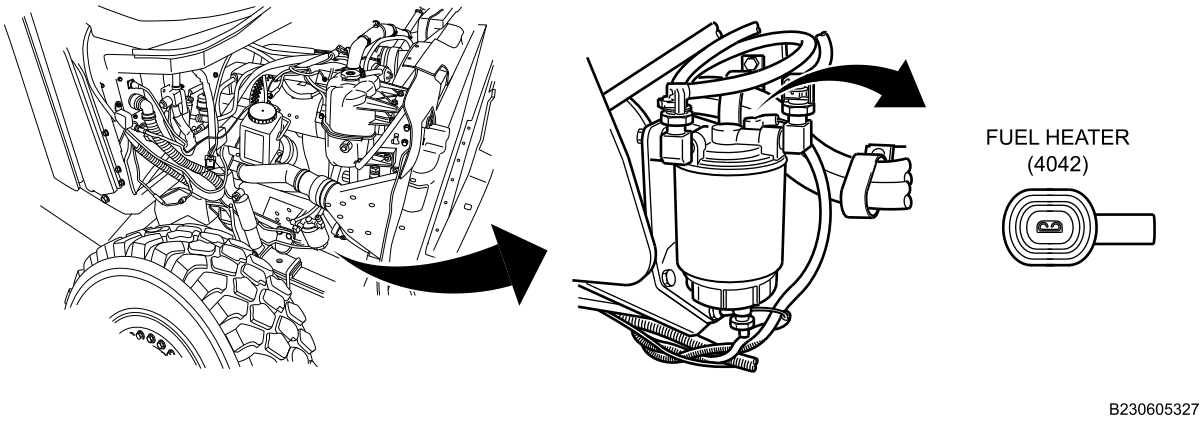


Figure 11. Inboard Right Front Wheel.

35. Measure resistance between relay 4002 socket terminal 30 and ground with multimeter. Refer to Figure 12.

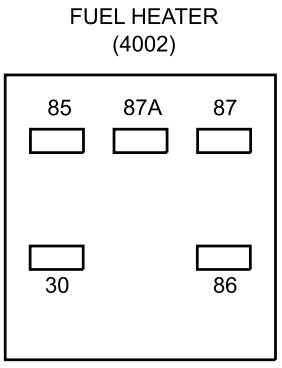


Figure 12. Fuel Heater Relay 4002.

CONDITION/INDICATION

Does multimeter read more than 1 ohm?

DECISION

NO Go to Step 36.
YES Go to Step 38.

FUEL/WATER SEPARATOR WITH 12V DC FUEL PRE-HEATER TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 36. Fuel/water separator is faulty.

ACTION

Replace fuel/water separator. Refer to Fuel/Water Separator Assembly Purge, Removal, and Installation (WP 0271). Return vehicle to service.

END OF TEST

MALFUNCTION

- 37. Power Distribution Center (PDC) harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 38. Fuel heater relay is faulty.

ACTION

Replace fuel heater relay. Refer to Power Distribution Center (PDC) Fuel and Relay Removal and Installation (WP 0333). Return vehicle to service.

END OF TEST

MALFUNCTION

- 39. Forward chassis harness is faulty.

ACTION

Replace forward chassis harness. Refer to Forward Chassis Harness Removal and Installation (WP 0424). Return vehicle to service.

END OF TEST

MALFUNCTION

- 40. Power Distribution Center (PDC) is faulty.

ACTION

Refer to Power Distribution Troubleshooting Procedure (WP 0059).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

EXHAUST SYSTEM OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

Materials/Parts
Gloves, leather (WP 0794, Item 19)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0246
WP 0261
WP 0275
WP 0276

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Belly armor removed (WP 0606)

WARNING

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Exhaust system components can be hot. Do not touch with bare hands or allow contact with other skin surface. Wear protective work gloves and long sleeves. Do not use exhaust tailpipe as a step. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Do not remove hot exhaust system from vehicle. Bolts can stretch, crack, and break when hot. Allow exhaust system to cool before loosening bolts on C-clamps. Failure to comply may result in damage to equipment and injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

EXHAUST SYSTEM OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

1. Inspect tailpipe (Figure 1, Item 3), shield assembly (Figure 1, Item 2), tailpipe bracket (Figure 1, Item 1) and C-clamp (Figure 1, Item 4) for looseness, damage, or rust.

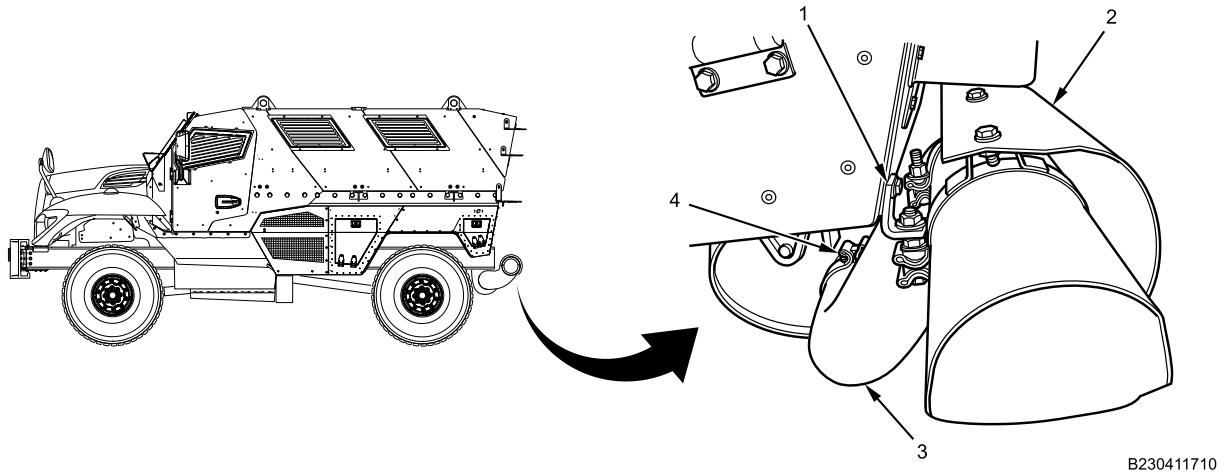


Figure 1. Tailpipe and Shield.

CONDITION/INDICATION

Tail pipe rattling, contacting body, or rusted.

CORRECTIVE ACTION

1. Tighten tailpipe connection at C-clamp.
2. Replace C-clamp if unable to tighten, rusted, or damaged. Refer to Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.
3. Replace tailpipe if damaged or rusted. Refer to Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.

CONDITION/INDICATION

Shield assembly loose, damaged, or rusted.

CORRECTIVE ACTION

1. Tighten shield assembly.
2. Replace shield assembly if unable to tighten, damaged, or rusted. Refer to Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.

CONDITION/INDICATION

Tailpipe bracket loose or damaged.

CORRECTIVE ACTION

1. Tighten tailpipe bracket.
2. Replace tailpipe bracket if damaged. Refer to Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.

1. Inspect muffler (Figure 2, Item 2), C-clamp (Figure 2, Item 3), and muffler holding straps (Figure 2, Item 1) for looseness, damage, or rust.

EXHAUST SYSTEM OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

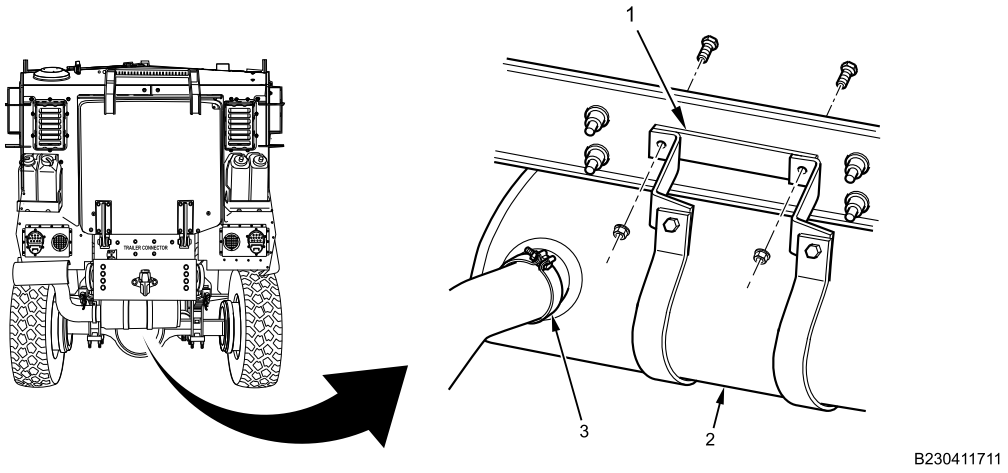


Figure 2. Muffler and Muffler Holding Straps.

Muffler noisy or exhaust smell inside vehicle.

1. Tighten muffler connection at C-clamp. Replace C-clamp if unable to tighten, damaged, or rusted. Refer to Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.
2. If muffler is damaged, has holes, or rust-through areas, replace muffler. Refer to Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.

Muffler loose, rattling, or hanging low under vehicle.

1. Inspect muffler holding straps for looseness, damage, or rusted.
2. Tighten loose components.
3. Replace damaged or rusted components. Refer to Muffler and Shield Removal and Installation (WP 0276). Return vehicle to service.

1. Inspect exhaust pipes (Figure 3, Item 3 and 5), pipe coupling (Figure 3, Item 4), loop clamps (Figure 3, Item 1) and hangers (Figure 3, Item 2).

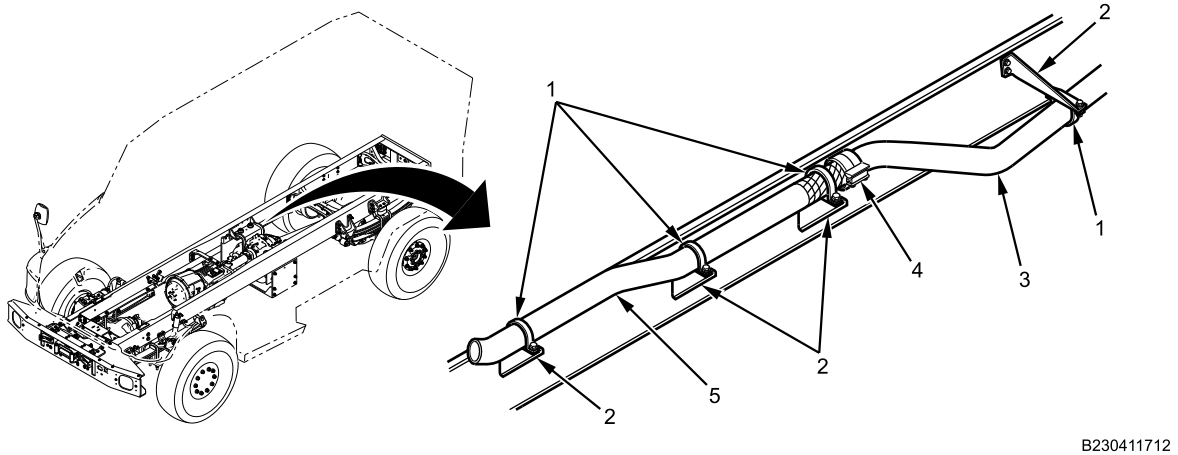


Figure 3. Exhaust Pipes and Hangers.

EXHAUST SYSTEM OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Excessive exhaust noise or exhaust smell inside vehicle.

1. Inspect front and rear exhaust pipes for damage, holes, or rust-through areas.
2. Replace defective exhaust pipes. Refer to Exhaust Pipe Removal and Installation (WP 0275). Return vehicle to service.
3. Inspect exhaust pipe coupling. Tighten if loose.
4. If unable to tighten coupling, or if damaged or rusted, replace coupling. Refer to Exhaust Pipe Removal and Installation (WP 0275). Return vehicle to service.

Rattling or banging noise under vehicle during operation.

1. Inspect front exhaust hangers and rear exhaust hangers for looseness, damage, or rust.
2. Inspect loop clamps for looseness, damage, or rust.
3. Tighten loose components.
4. Replace damaged or rusted components. Refer to Exhaust Pipe Removal and Installation (WP 0275). Return vehicle to service.

1. Inspect turbocharger pipe (Figure 4, Item 1) and pipe clamp (Figure 4, Item 2).

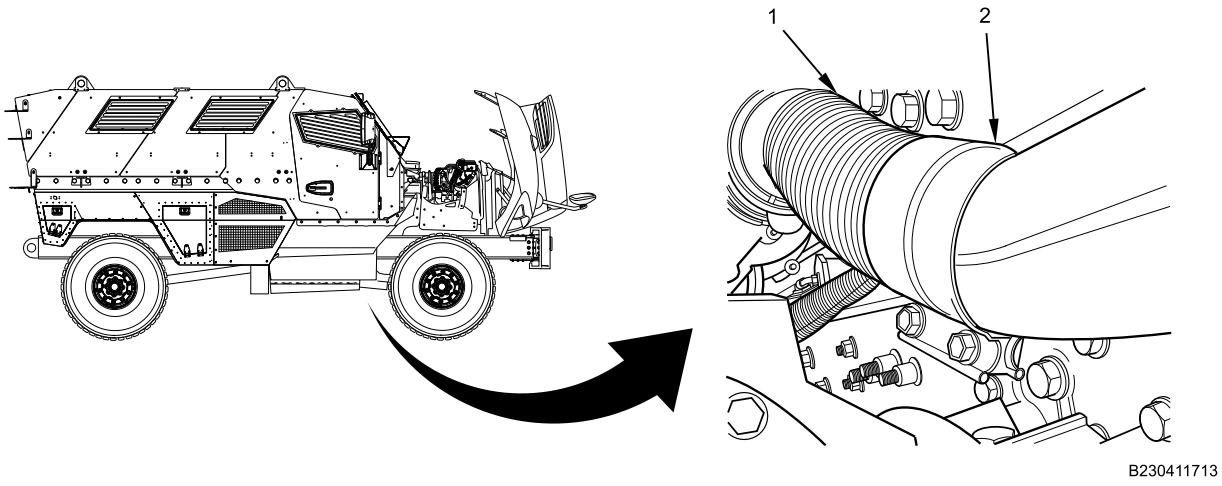


Figure 4. Turbocharger Pipe and Clamp.

EXHAUST SYSTEM OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Excessive exhaust noise or exhaust smell inside vehicle.

1. Inspect turbocharger pipe for leaking, damage, or rust-through areas. Replace pipe if defective. Refer to Exhaust Pipe Removal and Installation (WP 0275). Return vehicle to service.
2. Inspect for leaking, damage, or rust-through areas of pipe clamp. Replace pipe clamp if found defective. Refer to Exhaust Pipe Removal and Installation (WP 0275). Return vehicle to service.

1. Inspect exhaust brake clamps (Figure 5, Item 1 and 2) for leaks.

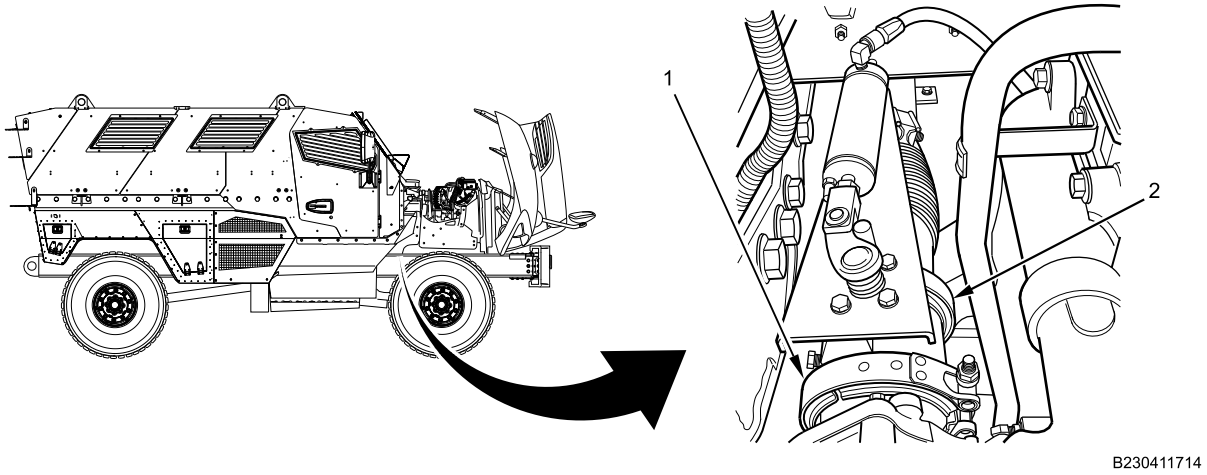


Figure 5. Exhaust Brake Clamps.

Excessive exhaust noise, exhaust brake not operating properly, or exhaust smell inside vehicle.

1. Inspect exhaust brake-to-turbocharger clamp for leaking or damage. If found defective, replace clamp. Refer to Exhaust Brake Removal and Installation (WP 0246). Return vehicle to service.
2. Inspect exhaust brake-to-turbocharger pipe clamp for leaking or damage. If found defective, replace clamp. Refer to Exhaust Brake Removal and Installation (WP 0246). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

COOLING SYSTEM OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

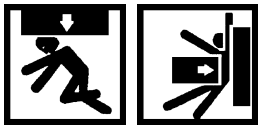
Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)
Radiator Test Kit (SVTS262KIT) (WP 0795, Item 83)

Materials/Parts
Gloves, leather (WP 0794, Item 19)
Goggles (WP 0794, Item 20)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0004
WP 0031
WP 0283

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

1. Verify coolant level is not low (TM 9-2355-106-10).

CONDITION/INDICATION

Coolant level is low.

CORRECTIVE ACTION

Fill to proper level and verify that vehicle achieves proper operating temperature (TM 9-2355-106-10).

1. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Retrieve DTCs. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

DTCs associated with engine cooling are set.

Diagnose DTCs. Refer to Engine Diagnostic Trouble Code (DTC) Index (WP 0006).

COOLING SYSTEM OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

WARNING

Cooling system components become pressurized and extremely hot during normal operation. To prevent serious injury from hot coolant or scalding steam, use the following safety procedure when removing radiator cap, surge tank cap, or deaeration cap:

Allow engine to cool for 15 minutes.

Wrap a thick cloth around cap to be removed.

Loosen cap slowly one-quarter to one-half turn counterclockwise, and pause to allow pressure to release.

Continue to turn cap counterclockwise to remove.

1. Carefully remove cap from deaeration tank. Refer to Deaeration Tank Pressure Cap Removal and Installation (WP 0280). Test cooling system for leaks. Perform the following steps:
   a. Connect Radiator Test Kit SVTS262KIT.

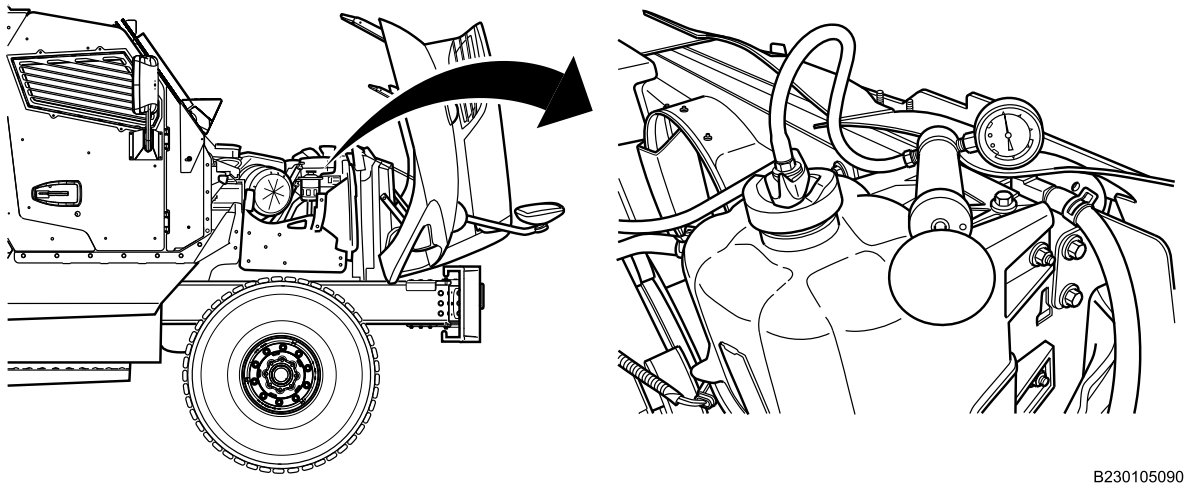


Figure 1. Radiator Test Kit.

   b. Apply 16 psi (110.3 kPa) to cooling system. System should maintain 16 psi (110.3 kPa) for 10 minutes.

System does not maintain 16 psi (110.3 kPa) for 10 minutes.

- Visually inspect engine, water pump, and all cooling system components for leaks and repair or replace as necessary. Refer to Chapter 4 Work Package Index, for relevant repair procedures.
- Inspect cabin heater components and hoses for coolant leaks and repair or replace as necessary. Refer to Chapter 4 Work Package Index, for relevant repair procedures.
- Inspect for coolant in engine oil. Refer to Engine Mechanical Troubleshooting Procedure (WP 0016).

1. Verify fan, clutch, and drive belt are operating correctly. Refer to Engine Cooling Fan Operational Checkout Procedure (WP 0031).

COOLING SYSTEM OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Fan, clutch, or drive belt is not operating correctly.

Refer to Chapter 4 Work Package Index, for relevant repair procedures.

1. Observe temperature gauge to verify engine reaches operating temperature (TM 9-2355-106-10).

Engine does not reach operating temperature.

Replace thermostat. Refer to Thermostat Removal and Installation (WP 0283). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE COOLANT LEVEL SYSTEM TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0281
WP 0329
WP 0336
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 68

This procedure covers the following DTCs:

- 236
- 323

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

ENGINE COOLANT LEVEL SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Disconnect connector 6401M. Refer to Figure 1.

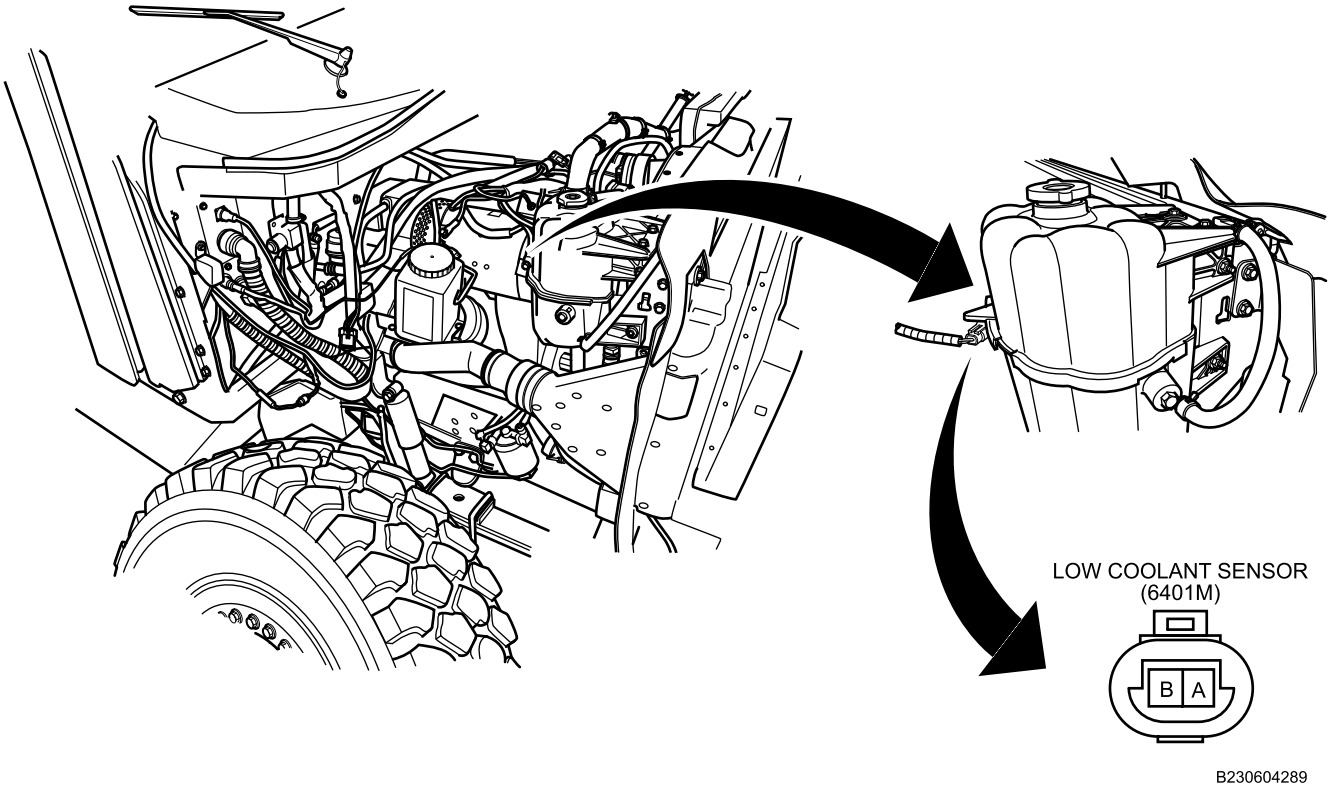


Figure 1. Right Engine Compartment.

2. Measure resistance between connector 6401M terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 13.
YES Go to next step.

ENGINE COOLANT LEVEL SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Measure DC voltage between connector 6401M terminal A and ground with multimeter. Refer to Figure 2.

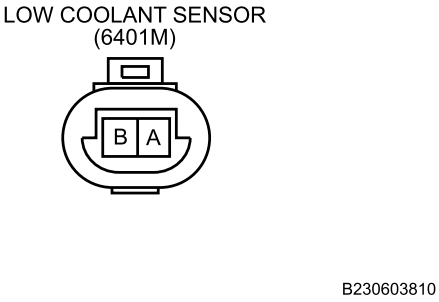


Figure 2. Connector 6401M.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

YES Go to Step 12.
NO Go to next step.

STEP

6. Turn ignition switch OFF (TM 9-2355-106-10).
7. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
8. Disconnect connector 6007. Refer to Figure 3. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

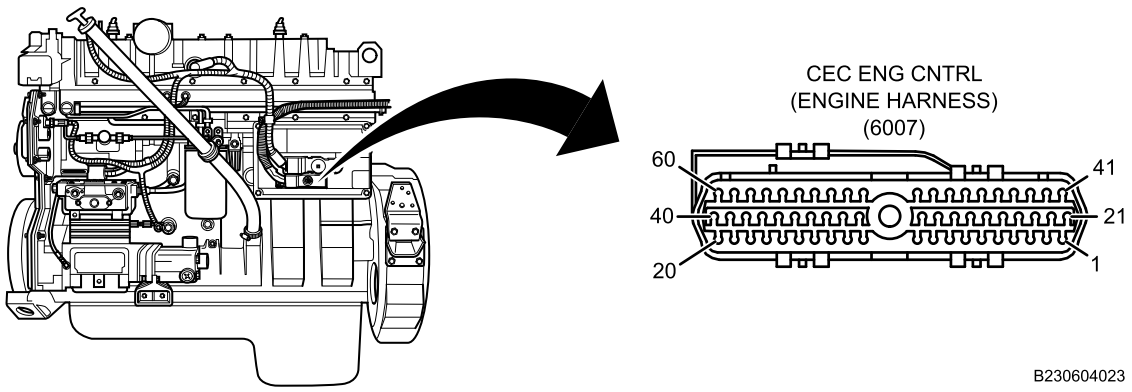


Figure 3. Engine Control Module (ECM).

ENGINE COOLANT LEVEL SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

9. Measure resistance between connector 6401M terminal A and ground with multimeter. Refer to Figure 4.

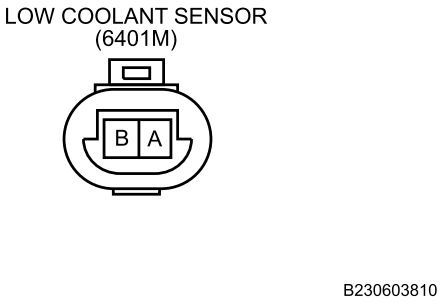


Figure 4. Connector 6401M.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 13.
YES Go to next step.

STEP

10. Measure resistance between connector 6401M terminal A and connector 6007 terminal 10 with multimeter. Refer to Figure 5 and Figure 6.

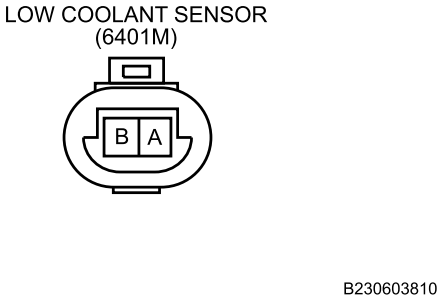


Figure 5. Connector 6401M.

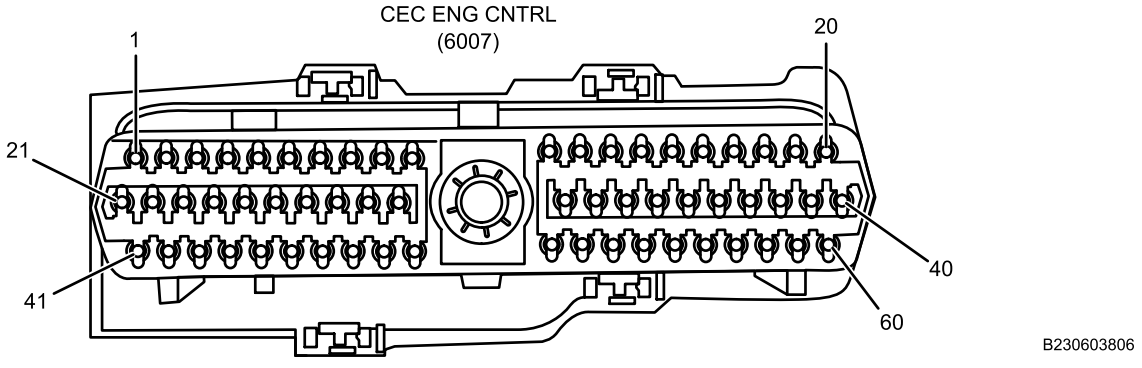


Figure 6. Connector 6007.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

ENGINE COOLANT LEVEL SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 13.
YES Go to next step.

STEP

11. Measure resistance between connector 6007 terminal 10 and all other terminals in connector 6007. Multimeter should read OL for each test. Refer to Figure 7.

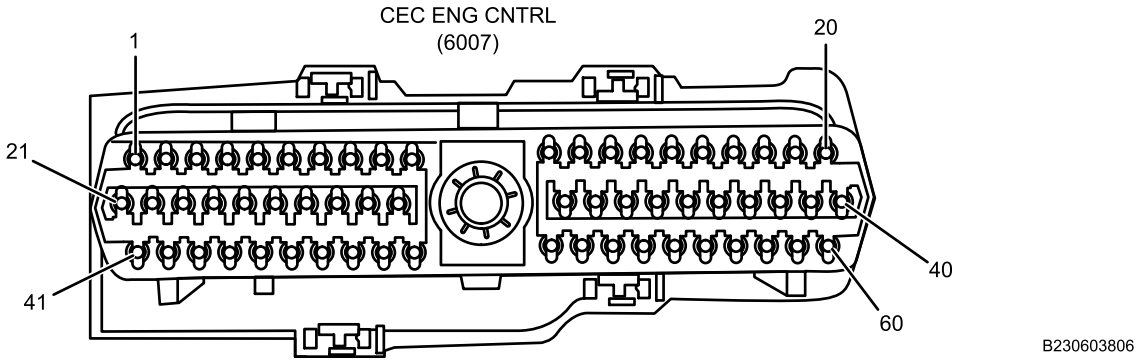


Figure 7. Connector 6007.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 13.
YES Go to Step 14.

MALFUNCTION

- 12. Coolant level sensor is faulty.

ACTION

Replace deaeration tank. Refer to Deaeration Tank Removal and Installation (WP 0279). Return vehicle to service.

END OF TEST

MALFUNCTION

- 13. Engine harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

ENGINE COOLANT LEVEL SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 14. Engine Control Module (ECM) is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE COOLANT TEMPERATURE (ECT) SENSOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Tee, 2-way breakout (ZTSE4483) (WP 0795, Item 115)

Materials/Parts
Tape (WP 0794, Item 52)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0289
WP 0290
WP 0329
WP 0336
WP 0388
WP 0782

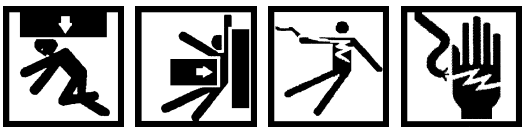
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Alternator removed (WP 0289)
Alternator bracket removed (WP 0290)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- DTC 114
- DTC 115
- DTC 316
- DTC 321
- DTC 322
- DTC 325

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

After removing the alternator and prior to connecting vehicle batteries, wrap the terminal ends of the alternator battery cables with electrical tape to prevent accidental contact with ground. Failure to comply may result in damage to system components.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Disconnect harness connector LAM1040. Refer to Figure 1.

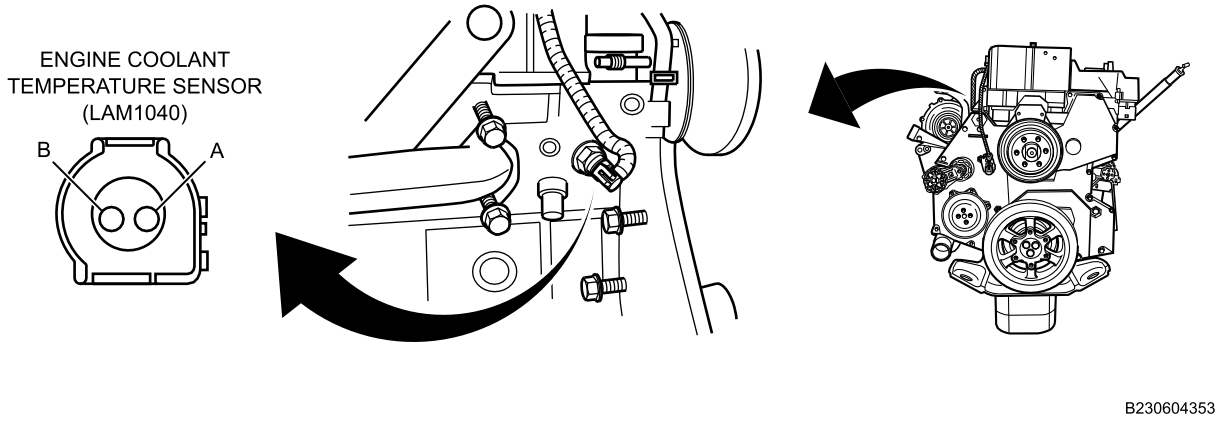


Figure 1. ECT Sensor.

2. Measure resistance between connector LAM1040 terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 13.
NO Go to next step.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

3. Connect vehicle batteries. Refer to MAIN POWER Procedure (WP 0404).
4. Turn MAIN POWER switch ON (TM 9-2355-106-10).
5. Turn ignition switch ON (TM 9-2355-106-10).
6. Measure DC voltage between harness connector LAM1040 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between than 4.5 volts and 5.5 volts?

DECISION

NO Go to Step 15.
YES Go to next step.

STEP

7. Turn ignition switch OFF (TM 9-2355-106-10).
8. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
9. Install breakout tee (ZTSE4483) between ECT sensor and harness connector LAM1040. Refer to Figure 2.

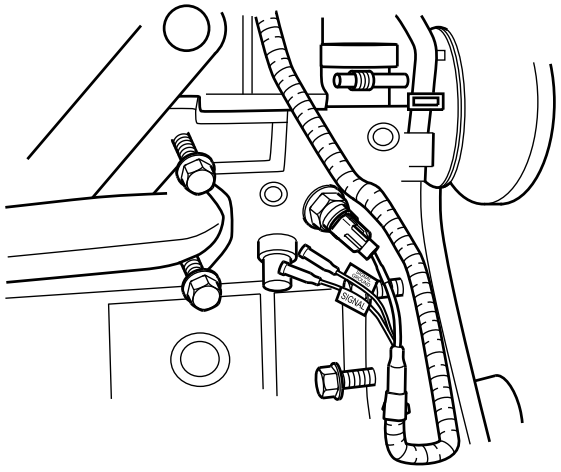


Figure 2. Breakout Tee (ZTSE4483).

10. Turn MAIN POWER switch ON (TM 9-2355-106-10).
11. Turn ignition switch ON (TM 9-2355-106-10).
12. Measure and record DC voltage between breakout tee (ZTSE4483) terminals SIGNAL and SIGNAL GROUND.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Table 1. Sensor Temperature vs Resistance.

VOLTAGE	TEMPERATURE °F	TEMPERATURE °C	SENSOR RESISTANCE
0.356V	230	110	1.19k ohms
3.87V	32	0	69.2k ohms
4.33V	5	-20	131k ohms

Does multimeter read voltage corresponding to specifications in Table 1?

DECISION

NO Go to Step 21.
YES Go to Step 20.

STEP

13. Disconnect harness connector LAM1019 . Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 3.

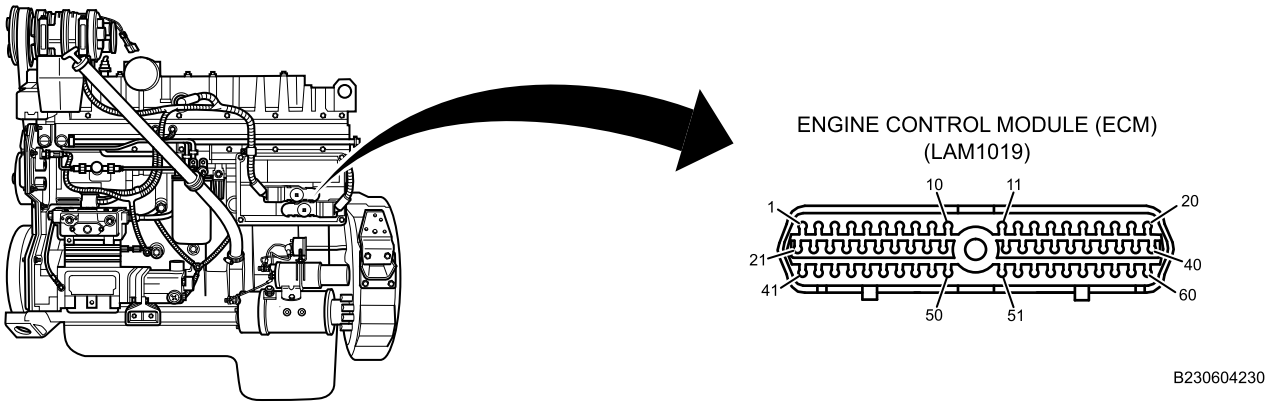


Figure 3. Engine Control Module (ECM).

14. With assistance, measure resistance between sensor connector LAM1040 terminal A and harness connector LAM1019 terminal 19 with multimeter. Refer to Figure 4 and Figure 3.

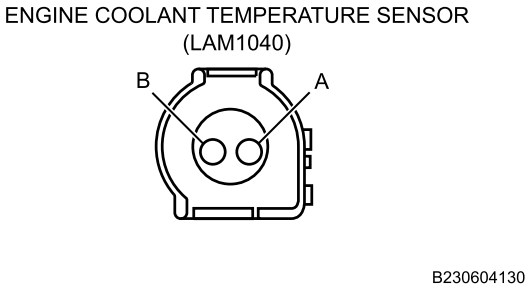


Figure 4. Connector LAM1040.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 20.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

YES Go to Step 22.

STEP

15. Turn ignition switch OFF (TM 9-2355-106-10).
16. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
17. Measure resistance between harness connector LAM1040 terminal B and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 22.
YES Go to next step.

STEP

18. With assistance, measure resistance between harness connector LAM1040 terminal B and harness connector LAM1019 terminal 13 with multimeter. Refer to Figure 4 and Figure 3.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 22.
NO Go to next step.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

19. With assitance, measure resistance between harness connector LAM1019 terminal 13 and all other harness connector LAM1019 terminals. Multimeter should read OL for each test. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 20.
NO Go to Step 22.

MALFUNCTION

- 20. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 21. ECT sensor is faulty.

ACTION

Replace ECT sensor. Refer to Engine Coolant Temperature (ECT) Sensor Removal and Installation(WP 0388). Return vehicle to service.

END OF TEST

MALFUNCTION

- 22. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

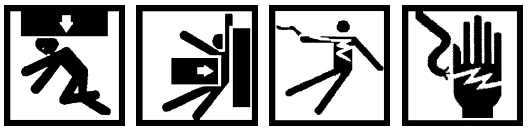
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0059
WP 0257
WP 0288
WP 0329
WP 0333
WP 0335
WP 0330
WP 0597
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left side engine armor removed (WP 0597)
Air cleaner assembly removed (WP 0257)

Drawings Required
WP 0789, Figure 70

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Disconnect EFC solenoid connector 4111M. Refer to Figure 1.

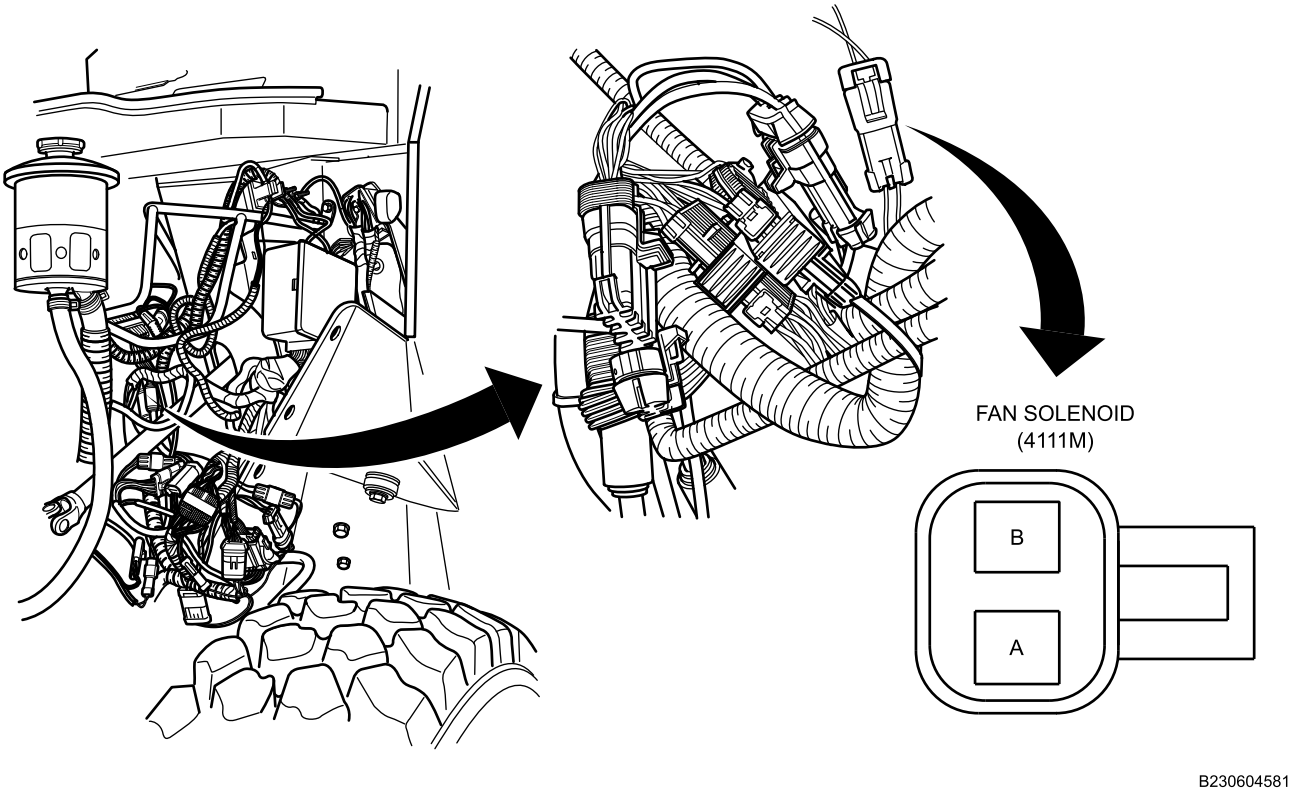


Figure 1. Left Engine Area.

2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).
4. Measure DC voltage between connector 4111M terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

NO Go to Step 11.
YES Go to next step.

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Turn ignition switch OFF (TM 9-2355-106-10).
6. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
7. Measure resistance between connector 4111M terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 1,000 ohms?

DECISION

YES Go to Step 20.
NO Go to next step.

STEP

8. Turn MAIN POWER switch ON (TM 9-2355-106-10).
9. Turn ignition switch ON (TM 9-2355-106-10).
10. Measure DC voltage connector 4111M terminals A and B with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

YES Go to Step 18.
NO Go to Step 29.

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

11. Remove and inspect AIR FAN SHUTTER fuse. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 2.

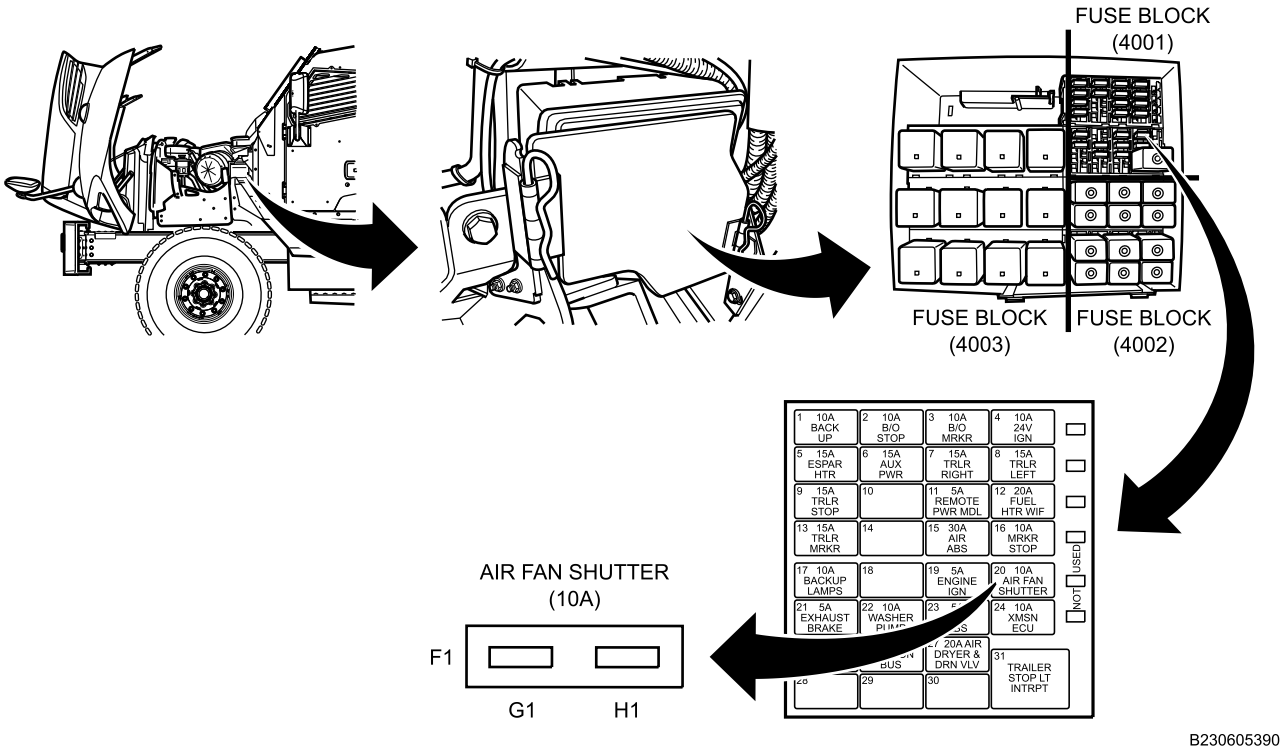


Figure 2. Air Fan Shutter Fuse

CONDITION/INDICATION

Is AIR FAN SHUTTER fuse open?

DECISION

YES Go to Step 24.
NO Go to next step.

STEP

12. Measure DC voltage between each AIR FAN SHUTTER fuse socket terminals and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts for either test?

DECISION

NO Go to Power Distribution Troubleshooting (WP 0059).
YES Go to next step.

STEP

13. Install AIR FAN SHUTTER fuse. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

14. Turn ignition switch OFF (TM 9-2355-106-10).
15. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
16. Disconnect Connector 4103. Refer to .Figure 3

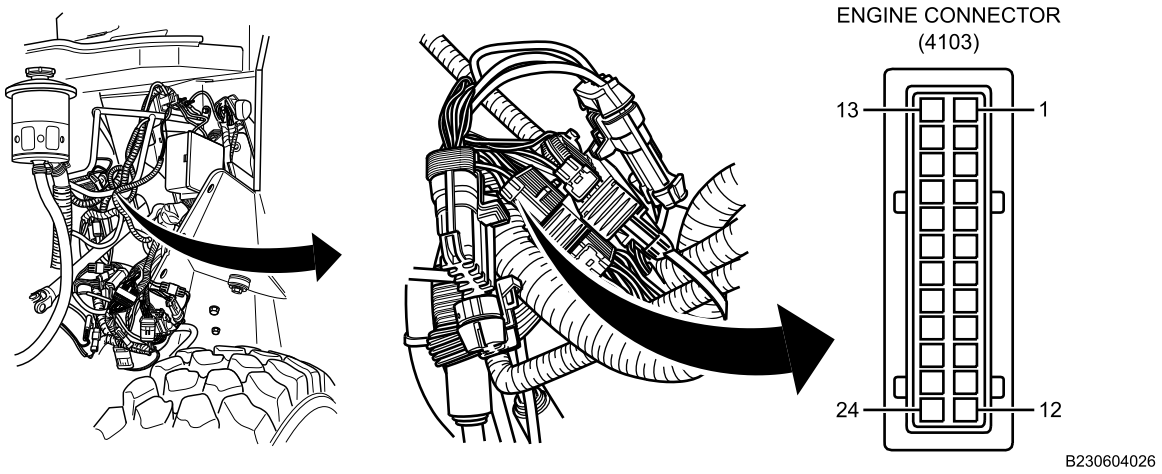


Figure 3. Left Engine Area.

17. Measure resistance between connector 4111M terminal A and connector 4103 terminal 14 with multimeter. Refer to Figure 4. Refer to Figure 3.

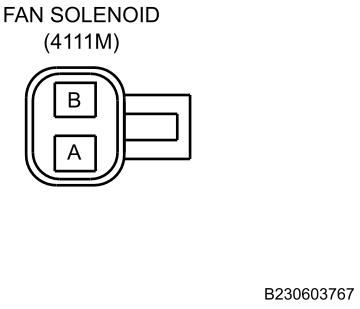


Figure 4. Connector 4111M.

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 30.
YES Go to Step 31.

STEP

18. Turn ignition switch OFF (TM 9-2355-106-10).
19. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
20. Disconnect LAM 1019 harness connector. Refer to Figure 5. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

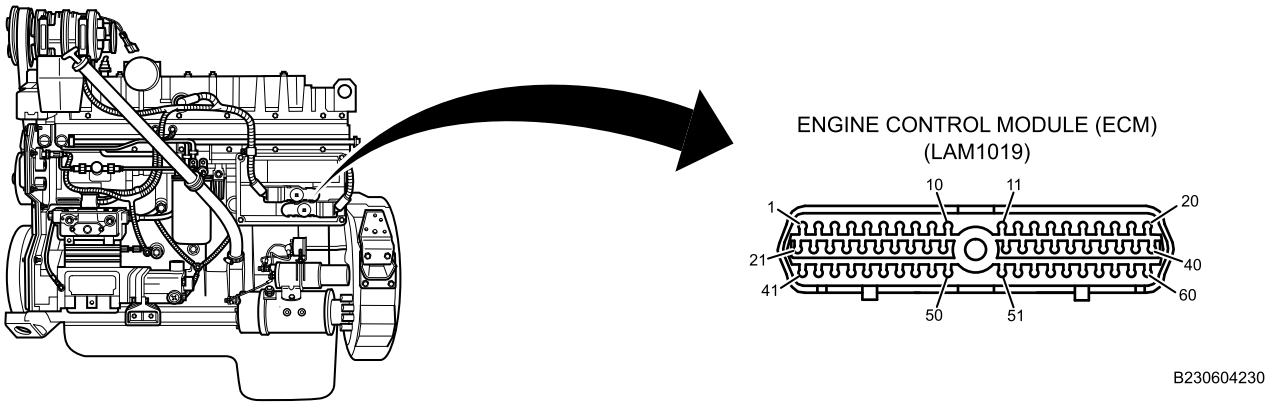


Figure 5. Engine Control Module (ECM).

21. Measure resistance between connector 4111M terminal B and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 30.
YES Go to next step.

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Measure resistance between connector 4111M terminal B and connector LAM 1019 terminal 8 with multimeter. Refer to Figure 6. Refer to Figure 7.

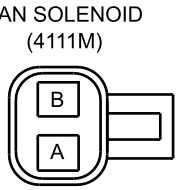


Figure 6. Connector 4111M.

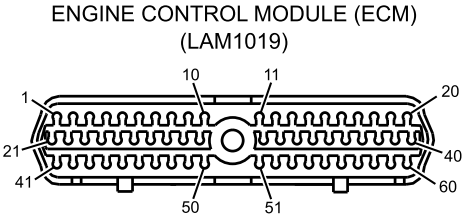


Figure 7. Connector LAM 1019.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 30.
YES Go to next step.

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

23. Measure resistance between connector LAM 1019 terminal 8 and all other terminals in ECM GRAY LAM 1019 connector with multimeter. Multimeter should read OL for each test. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 30.
YES Go to Step 32.

STEP

24. Turn ignition switch OFF (TM 9–2355–106–10).
25. Turn MAIN POWER switch OFF (TM 9–2355–106–10).
26. Measure resistance between connector 4111M terminal A and ground with multimeter. Refer to Figure 8.

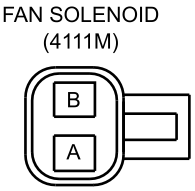


Figure 8. Connector 4111M.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 29.
NO Go to next step.

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

27. Disconnect connector 4103. Refer to Figure 9.

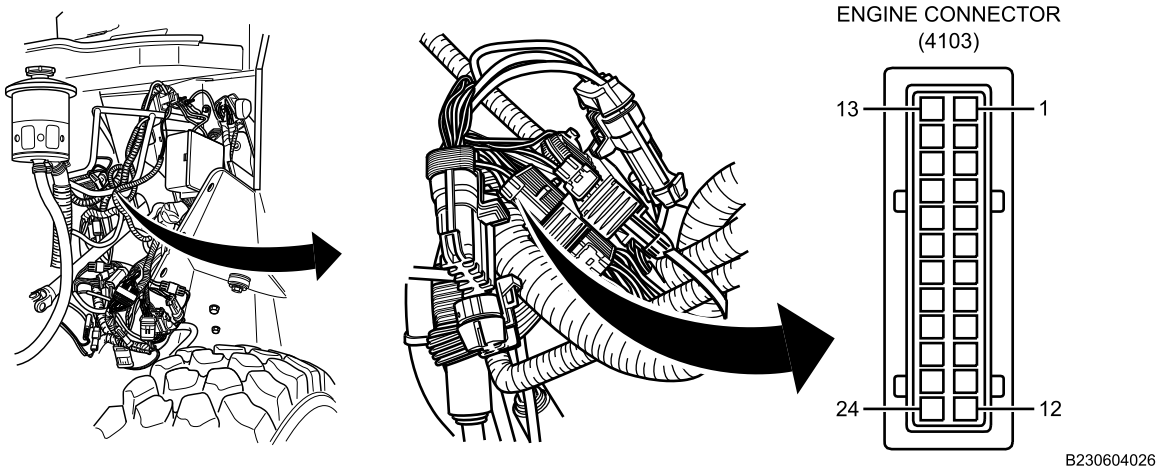


Figure 9. Left Engine Area.

28. Measure resistance between connector 4111M terminal A and ground with multimeter. Refer to Figure 10.

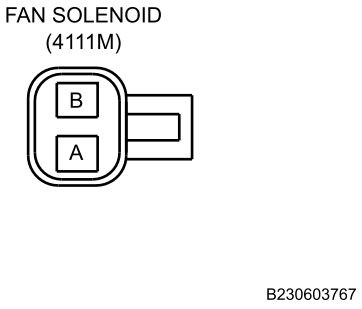


Figure 10. Connector 4111M.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 30.
YES Go to Step 31.

MALFUNCTION

- 29. EFC Solenoid is faulty.

ENGINE FAN CONTROL (EFC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace EFC solenoid. Refer to Cooling Fan Actuator Solenoid Removal and Installation (WP 0288). Return vehicle to service.

END OF TEST

MALFUNCTION

- 30. Engine sensor harness is faulty.

ACTION

Replace engine sensor harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0330). Return vehicle to service.

END OF TEST

MALFUNCTION

- 31. Power Distribution Center (PDC) wiring harness is faulty.

ACTION

Replace PDC wiring harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 32. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)
Gloves, rubber (WP 0795, Item 38)

Materials/Parts
Goggles, industrial (WP 0794, Item 20)
Faceshield, industrial (WP 0794, Item 16)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0014
WP 0012
WP 0051
WP 0257
WP 0329
WP 0334
WP 0336
WP 0404
WP 0412
WP 0405
WP 0598
WP 0606
WP 0789
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Belly armor removed (WP 0606)
Left side engine armor plate bracket removed (WP 0598)
Air cleaner assembly removed (WP 0257)

Drawings Required
WP 0789, Figure 17
WP 0789, Figure 68

This procedure covers the following ECM Diagnostic Trouble Codes (DTCs):

- 112
- 113
- 626

These DTCs will not illuminate amber engine warning lamp.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING

Wear protective eye goggles, face shield, and long sleeves when working on or near batteries. Batteries contain corrosive acid and can produce explosive gases. Batteries supply electrical current that can cause burns and electrical shock. Always check electrolyte level with engine off. Avoid leaning over or onto battery. Do not wear jewelry and do not smoke or have open flame or spark near battery. Do not allow tools to contact battery box or battery terminals. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Battery acid must not contact eyes, skin, or clothing. If battery acid contacts eyes or skin, flush area with large amounts of water for 15 minutes and seek immediate medical care. If swallowed, do not induce vomiting. Drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Seek immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Perform engine start procedure (TM 9-2355-106-10).

CONDITION/INDICATION

Does engine start and run?

DECISION

YES Go to Step 9.
NO Go to next step.

STEP

2. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).

CONDITION/INDICATION

Does MSD communicate with the Engine Control Module (ECM)?

DECISION

NO Go to American Truckers Association (ATA) Communications/Data Communications Link (DLC) Troubleshooting Procedure (WP 0051).
YES Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

3. Turn ignition switch OFF (TM 9-2355-106-10).
4. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
5. Disconnect fuel injector harness. Refer to Figure 1.

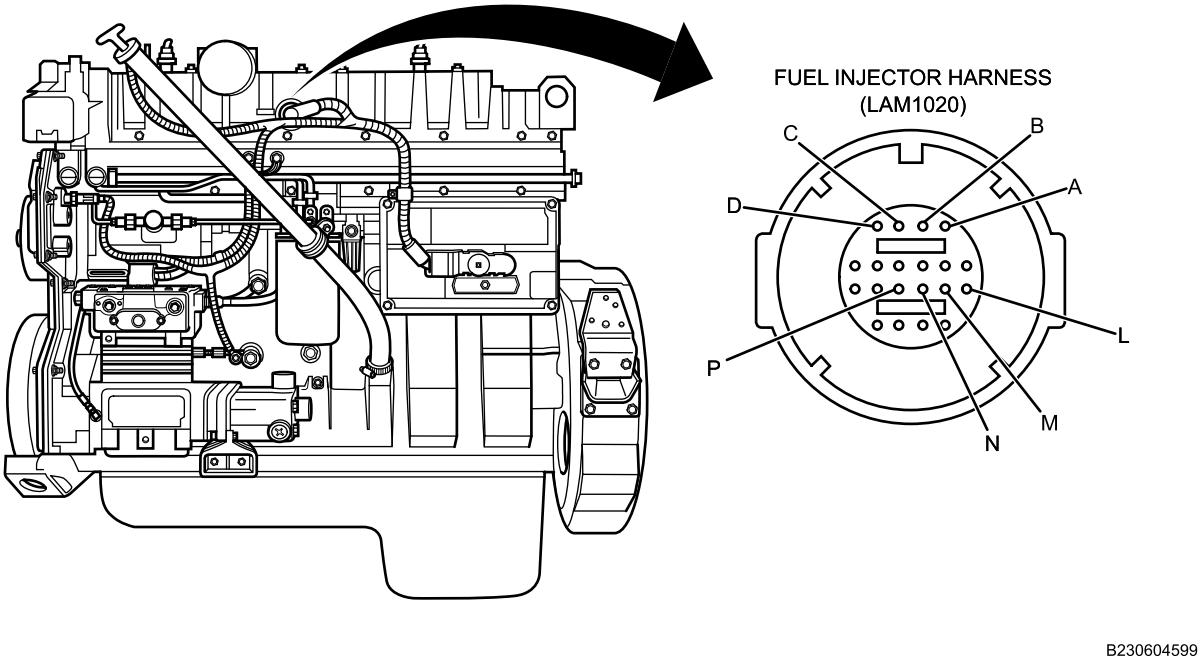


Figure 1. Left Side of Engine On Valve Cover.

6. Turn MAIN POWER switch ON (TM 9-2355-106-10).
7. Turn ignition switch ON (TM 9-2355-106-10).
8. With MSD, check voltage on ECM while cranking engine (TM 9-2355-106-10). A minimum of 7 volts is necessary to start engine.

CONDITION/INDICATION

Does MSD read more than 7V?

DECISION

YES Go to Step 59.
NO Go to Step 10.

STEP

9. Retrieve ECM DTCs. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Are DTCs 112, 113, or 626 displayed?

DECISION

NO Go to Step 60.
YES Go to next step.

STEP

10. Turn ignition switch OFF (TM 9-2355-106-10).
11. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
12. Remove Power Distribution Center (PDC) armor and cover. Refer to Power Distribution Center (PDC) Removal and Installation (WP 0334).
13. Remove Consolidated Engine Controller (CEC) power module relay. Refer to Figure 2.

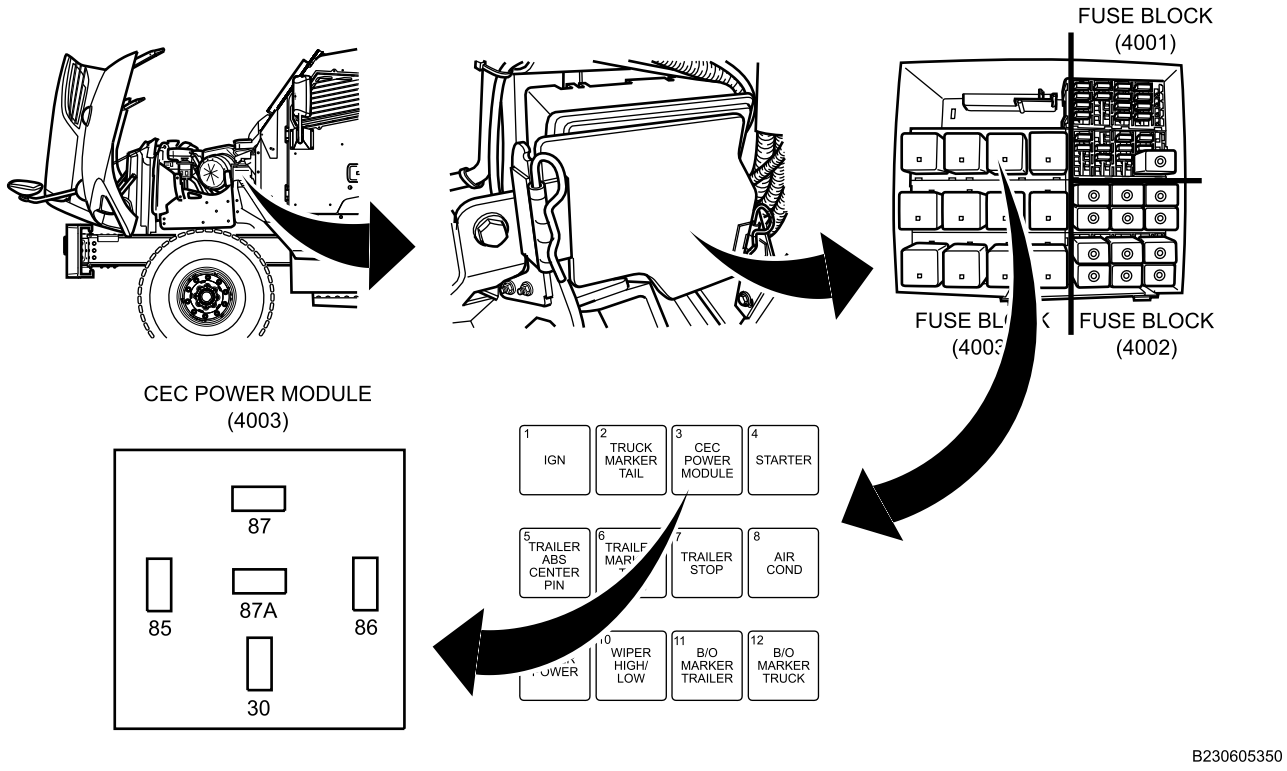


Figure 2. Consolidated Engine Controller (CEC) Power Module Relay.

14. Turn MAIN POWER switch ON (TM 9-2355-106-10).
15. Turn ignition switch ON (TM 9-2355-106-10).
16. Turn all accessories off (TM 9-2355-106-10).
17. Measure DC voltage between ground and CEC POWER MODULE relay terminals 86 and 30 with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.8V for each test?

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 30.
YES Go to next step.

STEP

18. Install and remove CEC power module relay two or three times while listening and feeling for CEC power module relay click.

CONDITION/INDICATION

Does CEC power module relay click?

DECISION

YES Go to Step 21.
NO Go to next step.

STEP

19. Substitute known-good CEC power module relay.
20. Install and remove known-good CEC power module relay two or three times while listening and feeling for known-good CEC power module relay click.

CONDITION/INDICATION

Does known-good CEC power module relay click?

DECISION

NO Go to Step 41.
YES Go to Step 65.

STEP

21. Turn ignition switch OFF (TM 9-2355-106-10).
22. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
23. Disconnect connector 6007. Refer to Figure 3. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

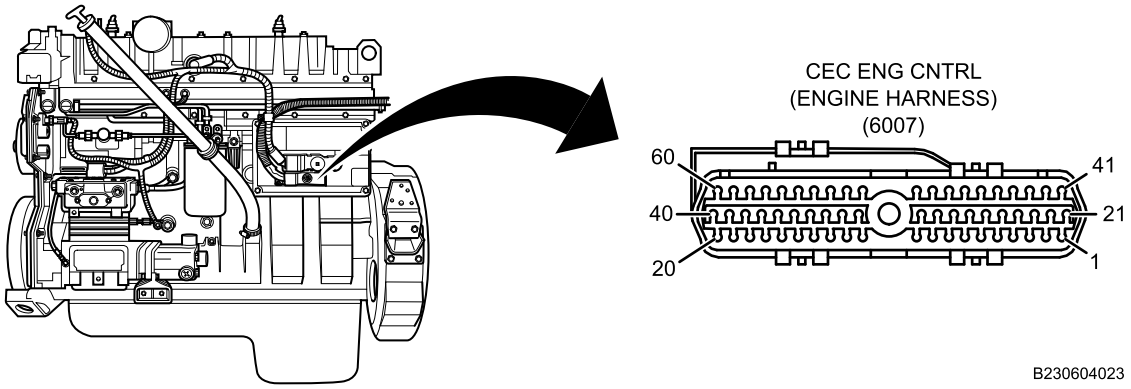


Figure 3. Engine Control Module (ECM).

24. Disconnect connector 9260F from 9260M. Refer to Figure 4.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

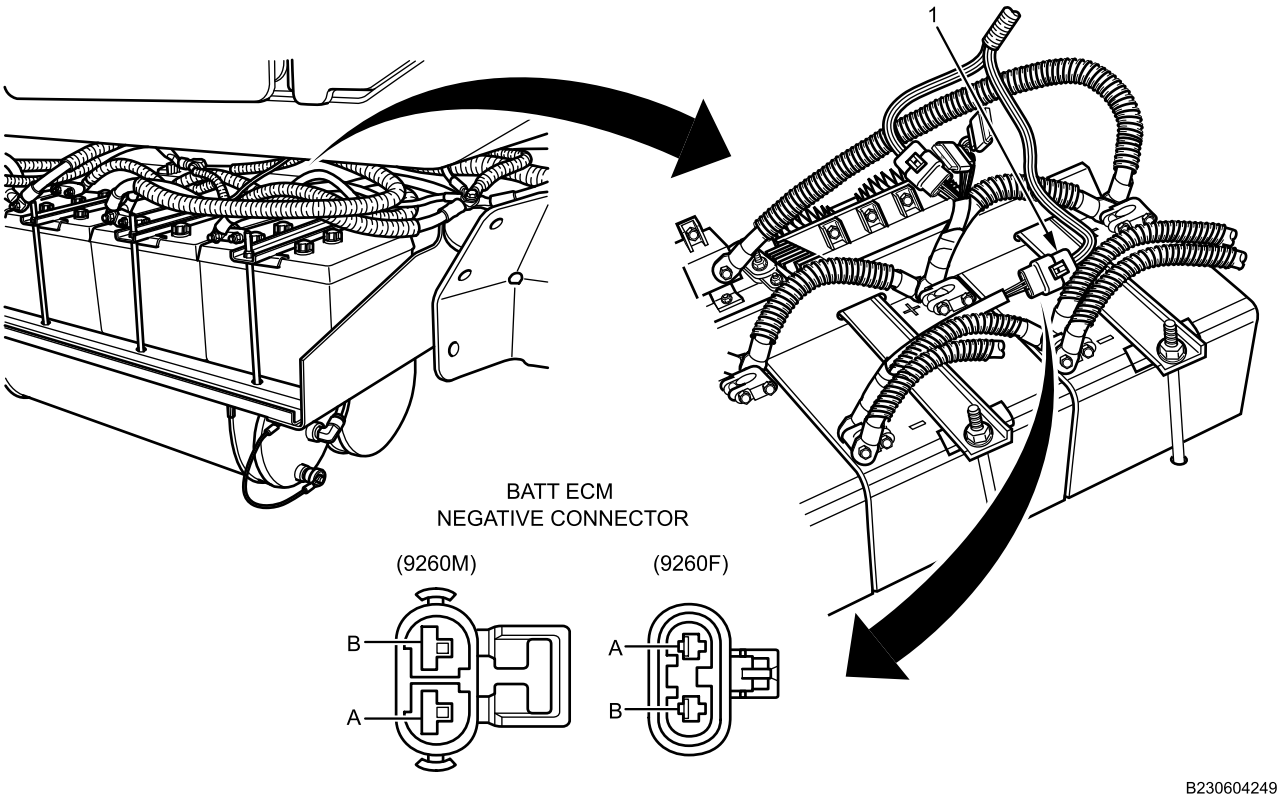


Figure 4. Right Side of Battery Box Above Battery.

25. Measure resistance between connector 9260F terminal A and connector 6007 terminals 1, 2, 23, and 42 with multimeter. Refer to Figure 4 and Figure 3.

CONDITION/INDICATION

Does multimeter read less than 3 ohms for each test?

DECISION

NO Go to Step 48.
YES Go to next step.

STEP

26. Measure resistance between connector 9260M terminal A and ground terminal (Figure 6, Item 1) with multimeter. Refer to Figure 5.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

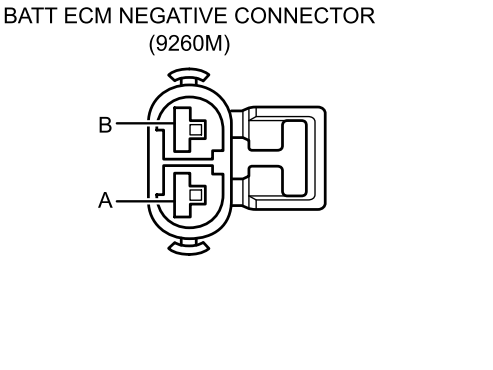


Figure 5. Connector 9260M.

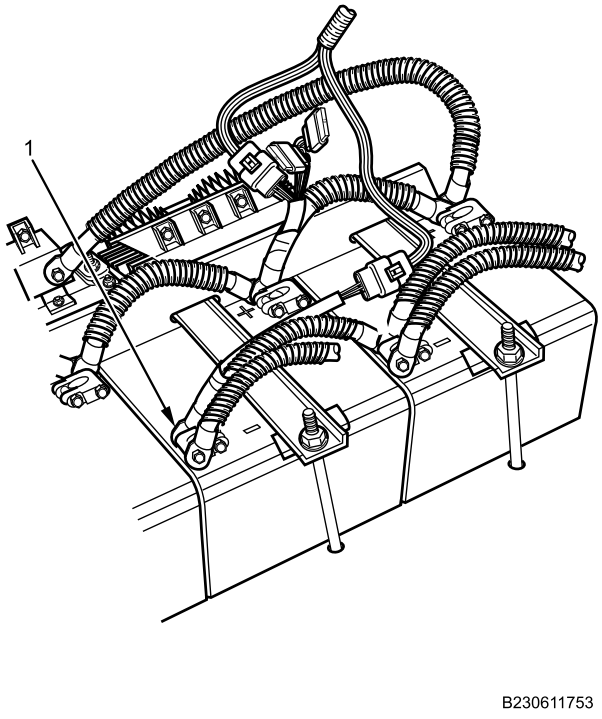


Figure 6. ECM Clean Ground Battery Terminal.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

NO Go to Step 61.
YES Go to next step.

STEP

27. Measure resistance between CEC power module relay terminal 87 and connector 6007 terminals 21, 22, and 41 with multimeter. Refer to Figure 7 and Figure 8.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

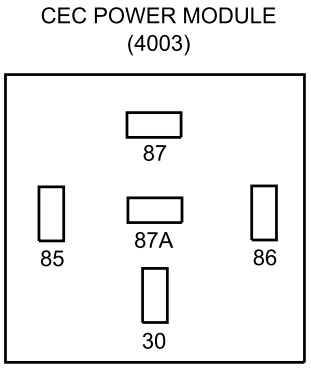


Figure 7. CEC Power Module Relay.

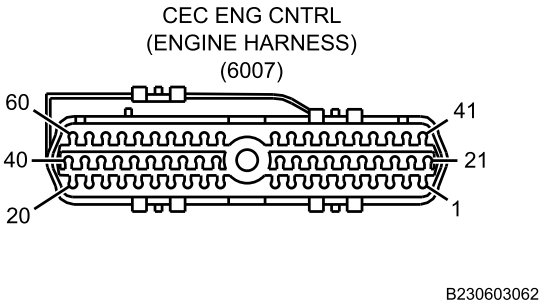


Figure 8. Connector 6007.

CONDITION/INDICATION

Did multimeter read less than 3 ohms for each test?

DECISION

YES Go to Step 65.
NO Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Disconnect connectors 4105/4101M. Refer to Figure 9.

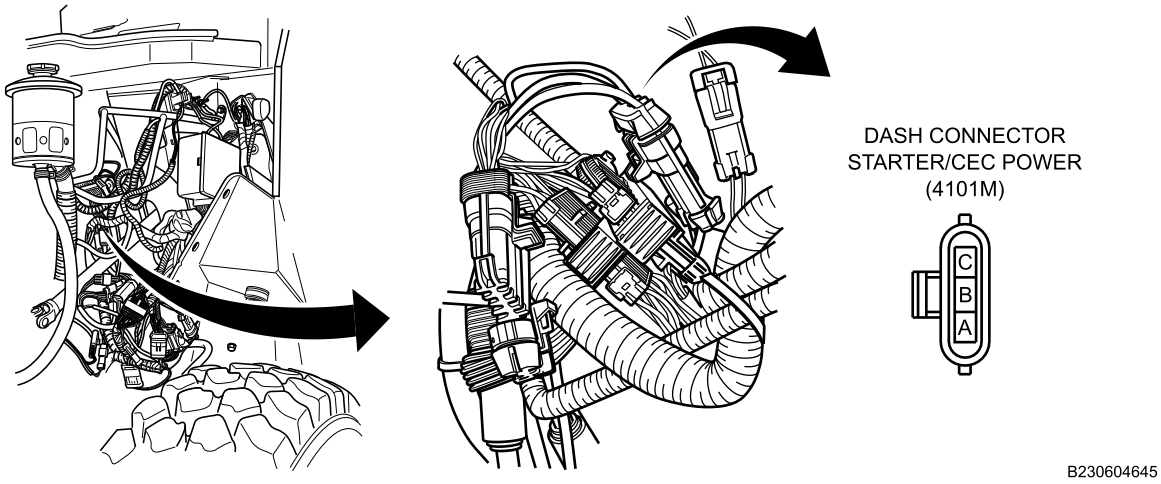


Figure 9. Harness Bundle Below Air Cleaner Assembly.

29. Measure resistance between connector 4101M terminal A and connector 6007 terminals 21, 22, and 41 with multimeter. Refer to Figure 9 and Figure 10.

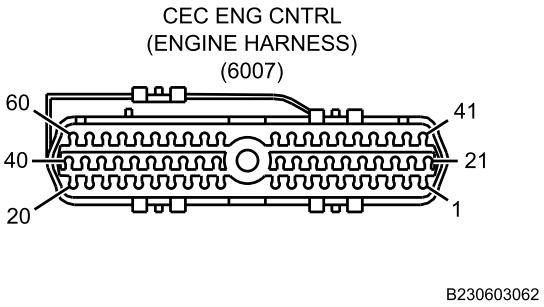


Figure 10. Connector 6007.

CONDITION/INDICATION

Does multimeter read less than 3 ohms for each test?

DECISION

NO Go to Step 69.
YES Go to Step 70.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

30. Turn ignition switch OFF (TM 9-2355-106-10).
31. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
32. Measure resistance between CEC power module relay terminals 86 and 30 with multimeter. Refer to Figure 11.

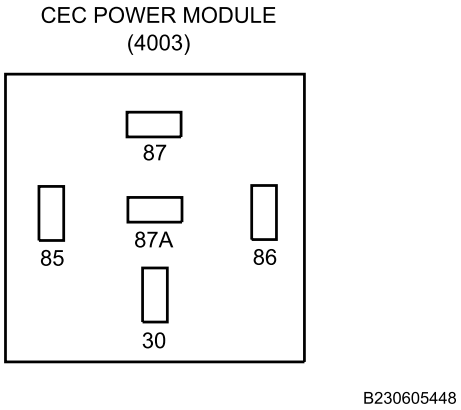


Figure 11. CEC Power Module Relay.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

NO Go to Step 70.
YES Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

33. Remove and test engine ECM feed 40A fuse (Figure 12, Item 1). Refer to Engine Control Module (ECM) and Transmission Control Module (TCM) Clean Power and Ground Fuse Removal and Installation (WP 0412).

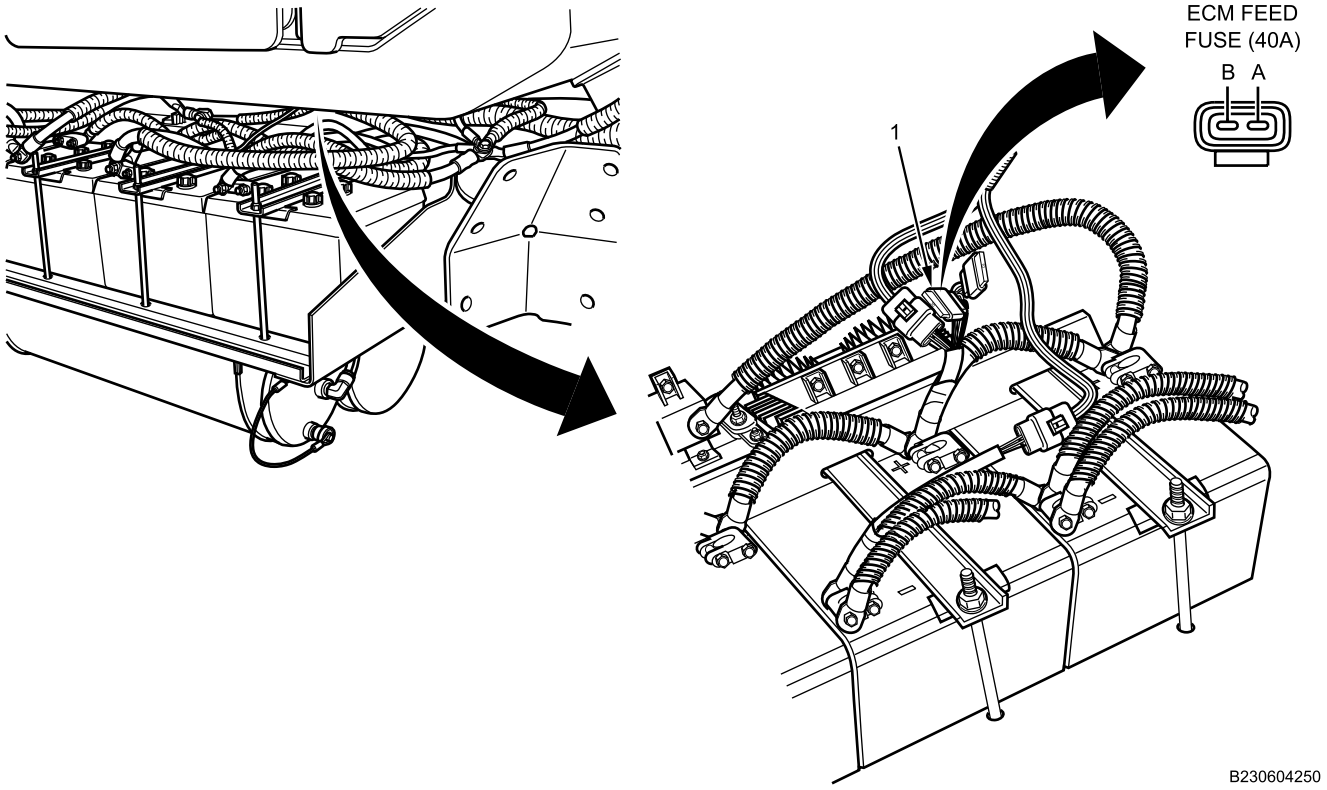


Figure 12. Right Side of Battery Box Above Battery.

CONDITION/INDICATION

Is fuse good?

DECISION

NO Go to Step 50.
YES Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

34. With assistant, measure resistance between CEC power module relay terminal 86 and ECM feed 40A fuse terminal B with multimeter. Refer to Figure 13 and Figure 12.

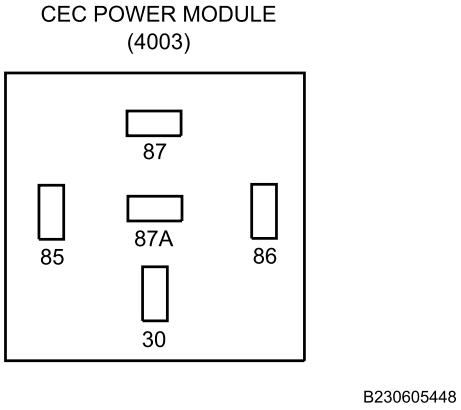


Figure 13. CEC Power Module Relay.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

YES Go to Step 61.
NO Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

35. Disconnect connector 4101M. Refer to Figure 14.

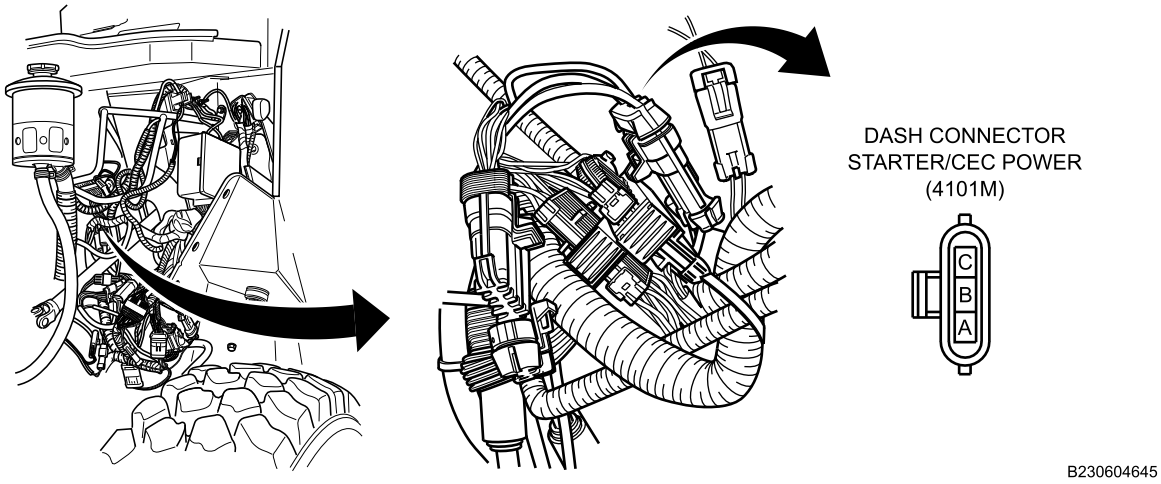


Figure 14. Harness Bundle Below Air Cleaner Assembly.

36. With assistant, measure resistance between engine ECM feed fuse terminal B and connector 4101M terminal B with multimeter. Refer to Figure 14 and Figure 15.

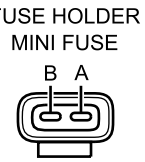


Figure 15. ECM Feed Fuse.

CONDITION/INDICATION

Does multimeter read between 0 ohms and 3 ohms?

DECISION

YES Go to Step 70.
NO Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

NOTE

There are two connectors in this area. Each connector contains two wires. Connector 6323M/6323F is the larger of the two connectors and contains the larger wires.

37. Disconnect connector 6323M. Refer to Figure 16.

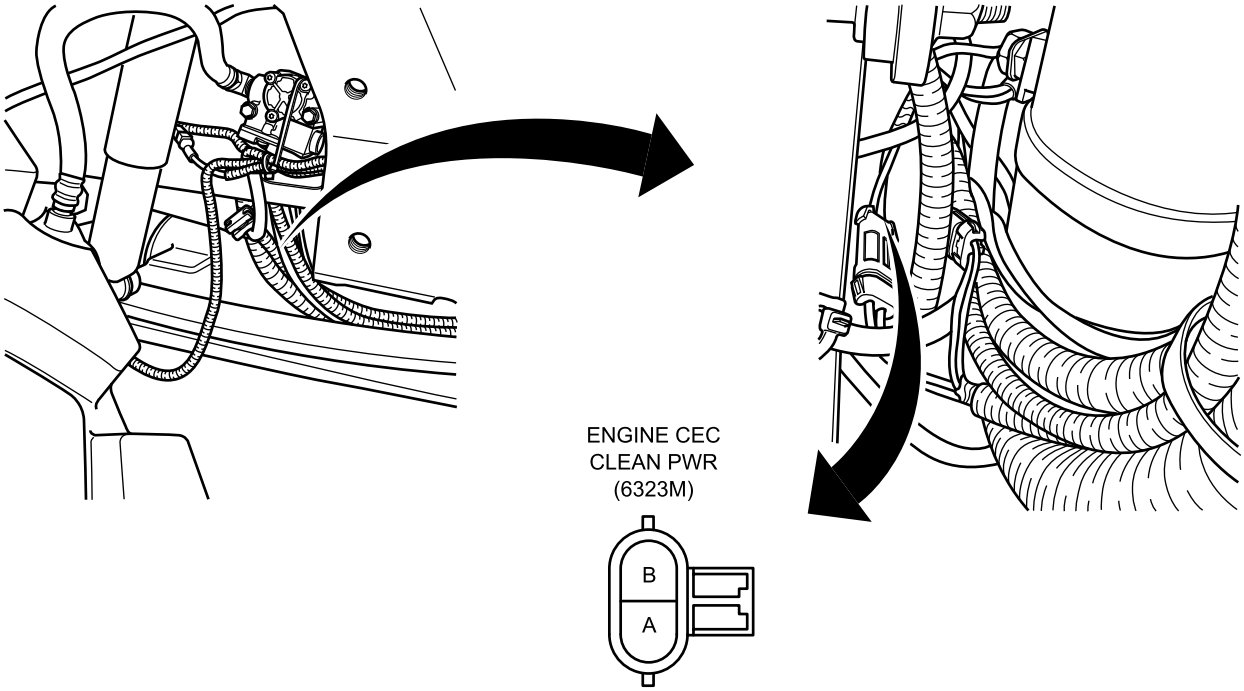


Figure 16. Under Left Front of Vehicle, Inboard Frame Rail.

38. With assistance, measure resistance between engine ECM feed fuse terminal B and connector 6323M terminal A with multimeter. Refer to Figure 16 and Figure 15.

CONDITION/INDICATION

Does the multimeter read between 0 ohms and 3 ohms?

DECISION

YES Go to Step 69.
NO Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

39. Disconnect connectors 9261F/9261M. Refer to Figure 17.

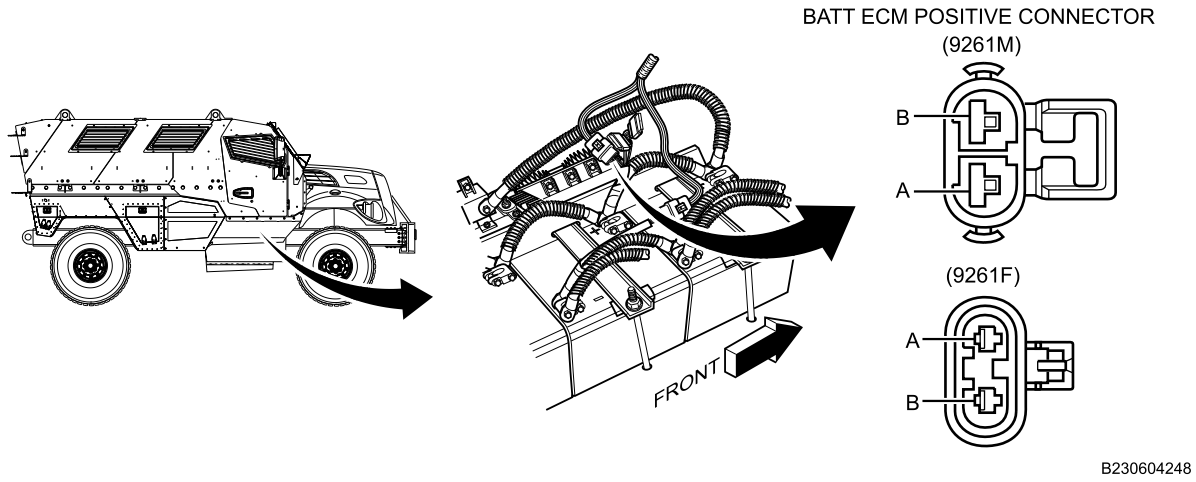


Figure 17. Right Side of Battery Box Above Battery.

40. Measure resistance between engine ECM feed fuse terminal B and connector 9261F terminal A with multimeter. Refer to Figure 17 and Figure 18.

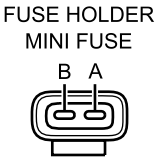


Figure 18. ECM Feed Fuse.

CONDITION/INDICATION

Does the multimeter read between 0 ohms and 3 ohms?

DECISION

NO Go to Step 61.
YES Go to Step 66.

STEP

41. Turn ignition switch OFF (TM 9-2355-106-10).

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

42. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
43. Disconnect connector 4103/4100F. Refer to Figure 19.

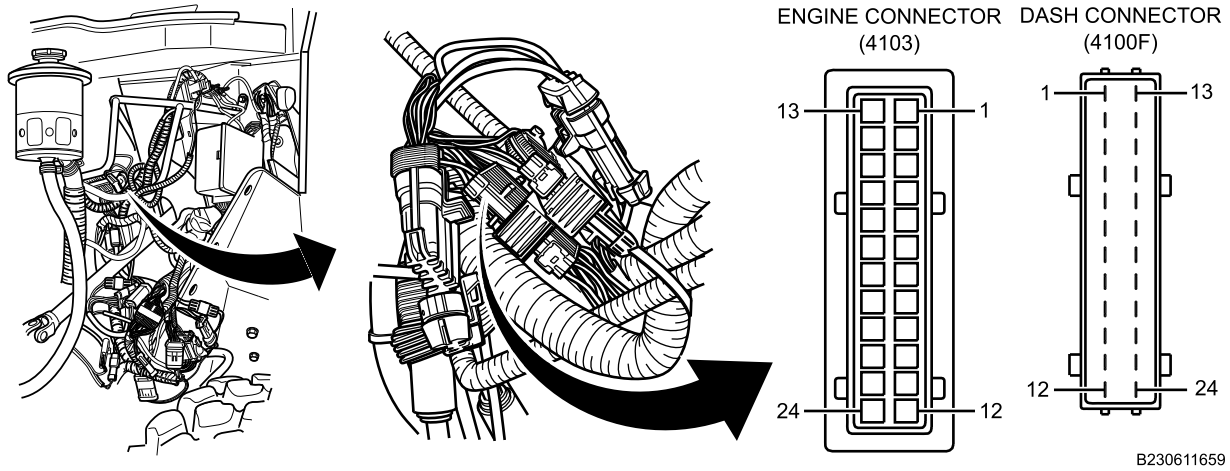


Figure 19. Harness Bundle Below Air Cleaner Assembly.

44. Measure resistance between CEC power module relay terminal 85 and connector 4103 terminal 18 with multimeter. Refer to Figure 19 and Figure 20.

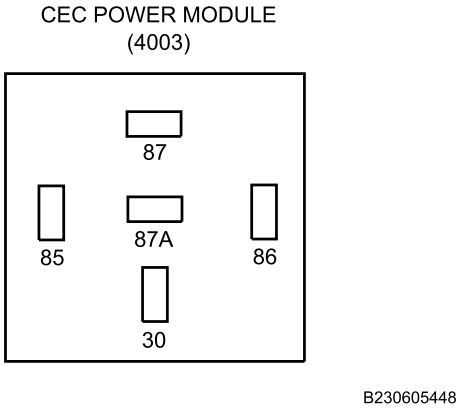


Figure 20. CEC Power Module Relay.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

NO Go to Step 70.
YES Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

45. Disconnect connector 6007. Refer to Figure 21. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

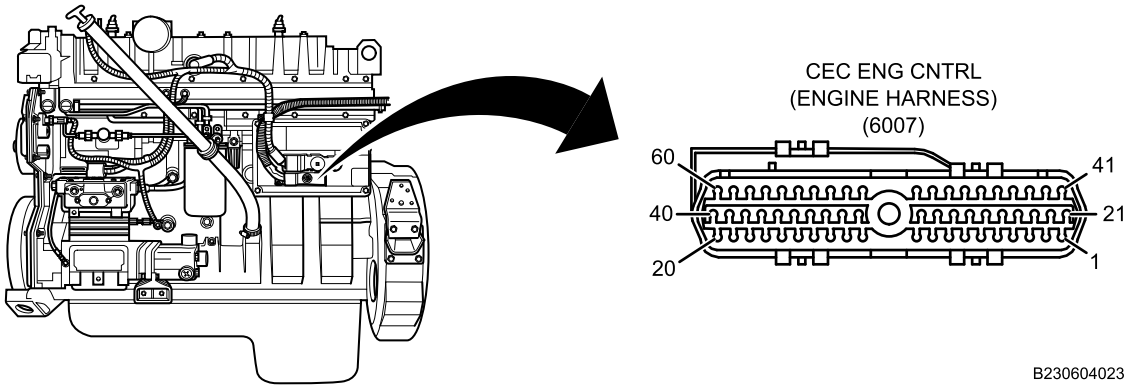


Figure 21. Engine Control Module (ECM).

46. Measure resistance between connector 4100F terminal 18 and connector 6007 terminal 25 with multimeter. Refer to Figure 21 and Figure 22.

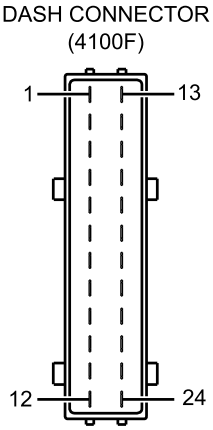


Figure 22. Connector 4100F.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

NO Go to Step 69.
YES Go to next step.

STEP

47. Measure resistance between ground and connector 6007 terminals 1, 2, 23, and 42 with multimeter. Refer to Figure 23.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

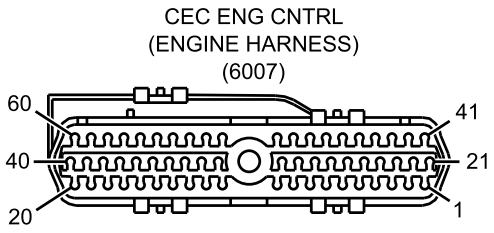


Figure 23. Connector 6007.

CONDITION/INDICATION

Does multimeter read less than 3 ohms for each test?

DECISION

YES Go to Step 63.
NO Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

NOTE

There are two connectors in this area. Each connector contains two wires. Connector 6323M/6323F is the larger of the two connectors and contains the larger wires.

48. Disconnect connector 6323F. Refer to Figure 24.

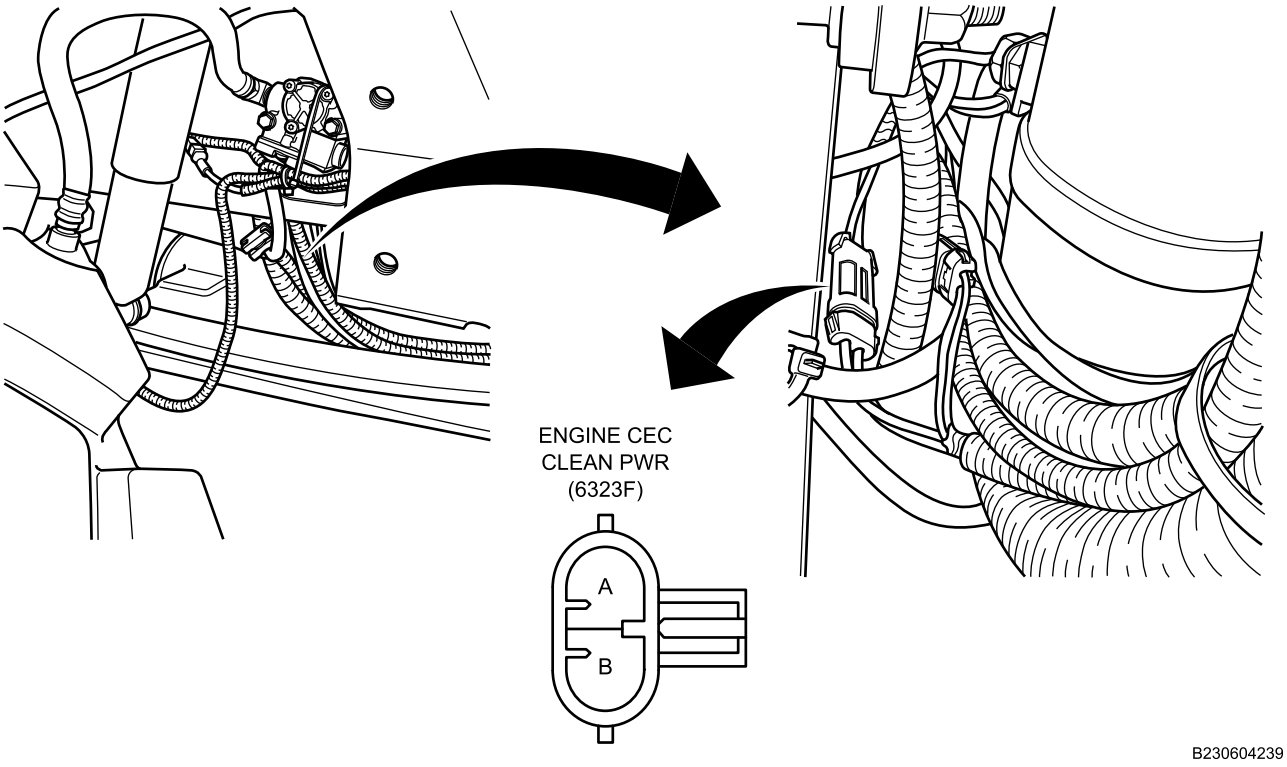


Figure 24. Under Left Front of Vehicle, Inboard Frame Rail.

49. Measure resistance between connector 6323F terminal B and connector 6007 terminals 1, 2, 23, and 42 with multimeter. Refer to Figure 24 and Figure 25.

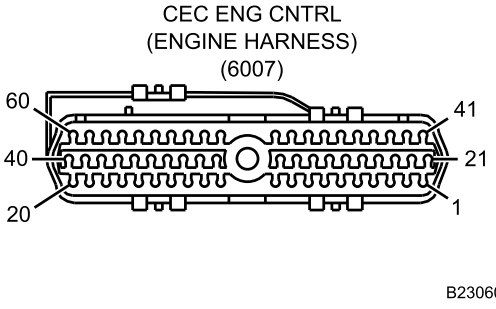


Figure 25. Connector 6007.

CONDITION/INDICATION

Did multimeter read less than 3 ohms for each test?

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 69.
YES Go to Step 66.

STEP

50. Disconnect connectors 9261M/9261F. Refer to Figure 26.

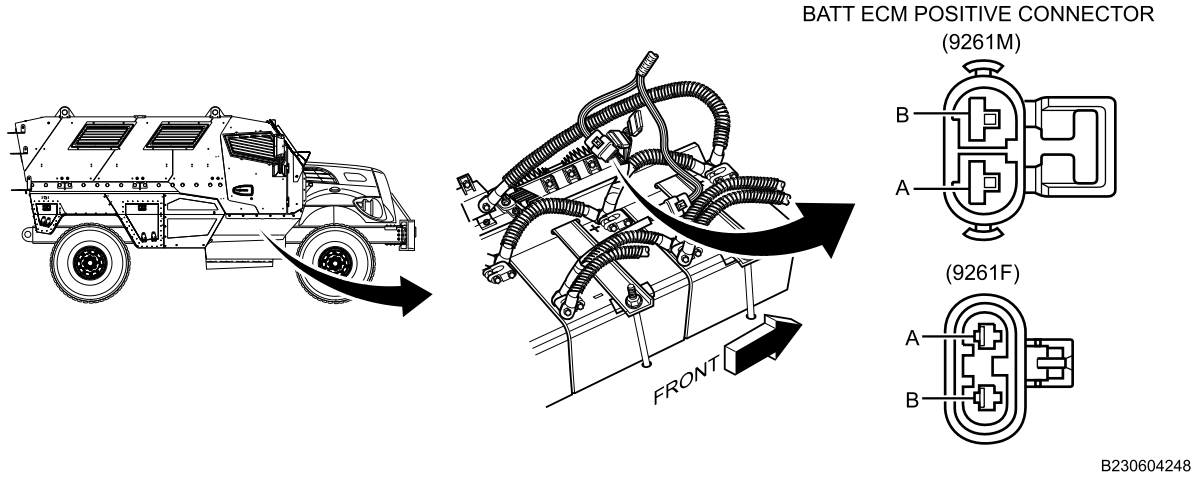


Figure 26. Right Side of Battery Box Above Battery.

51. Measure resistance between connector 9261F terminal A and ground with multimeter. Refer to Figure 26.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 62.
YES Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

52. Disconnect connectors 6323M/6323F. Refer to Figure 27.

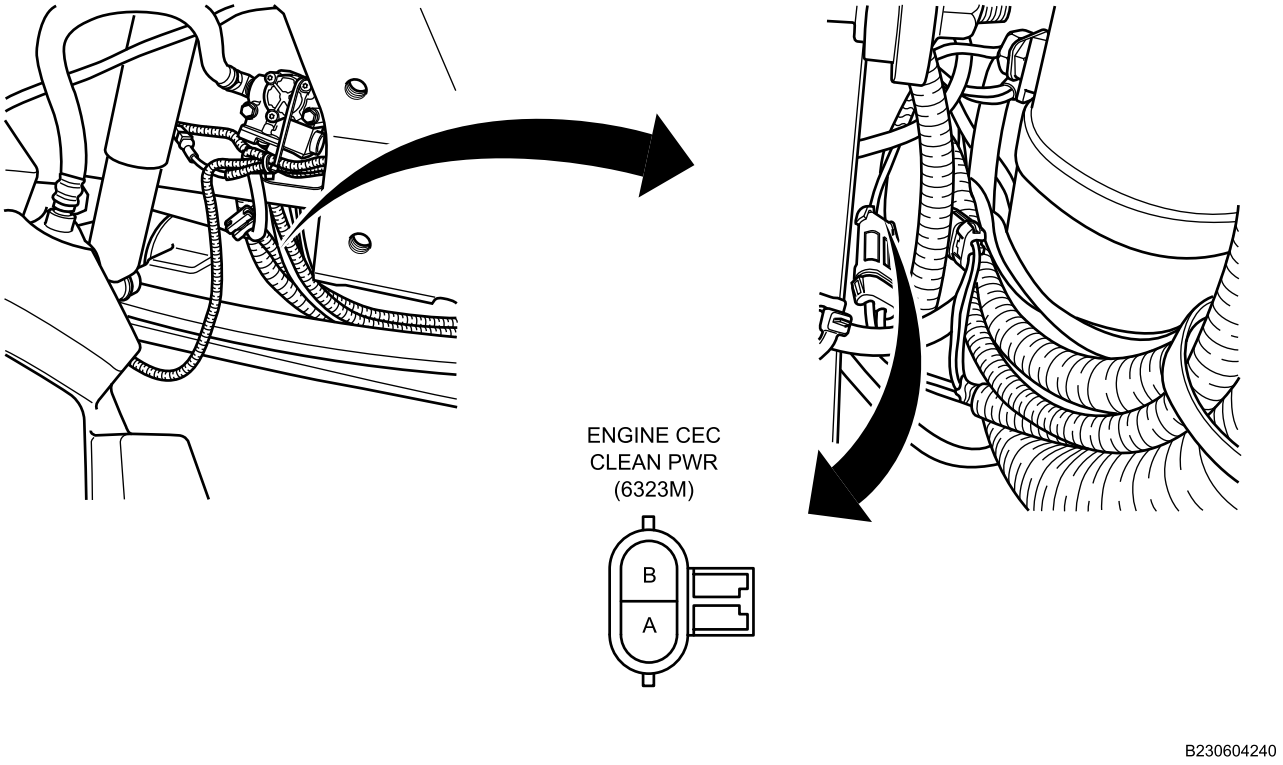


Figure 27. Under Left Front of Vehicle, Inboard Frame Rail.

53. Measure resistance between connect 6323M terminal A and ground with multimeter. Refer to Figure 27.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 67.
YES Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

54. Disconnect connector 4105 from 4101M. Refer to Figure 28.

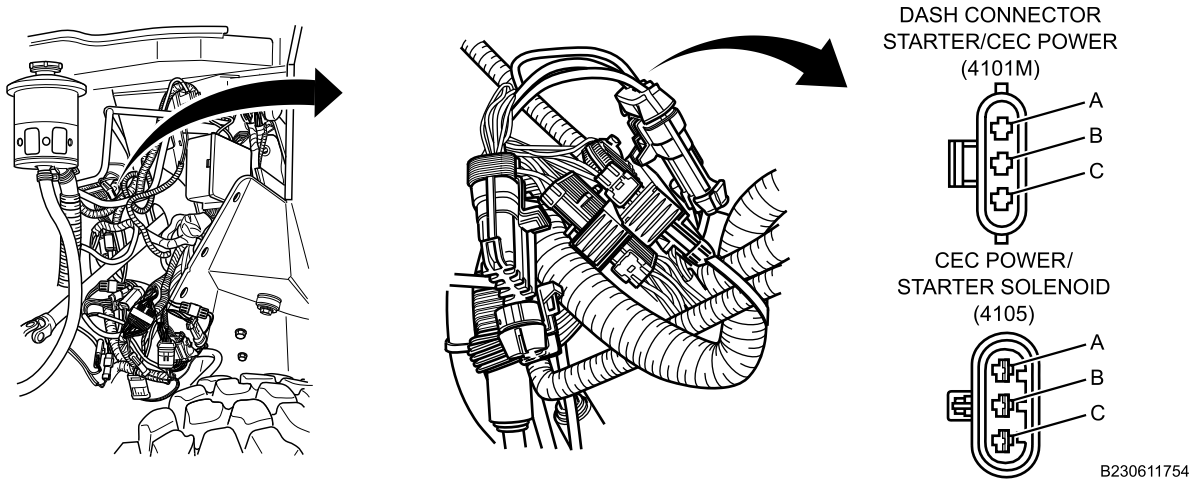


Figure 28. Harness Bundle Below Air Cleaner Assembly.

55. Measure resistance between ground and connector 4105 terminals A and B with multimeter. Refer to Figure 28.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 71.
YES Go to next step.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

56. Measure resistance between connector 4101M terminal B and ground with multimeter. Refer to Figure 29.

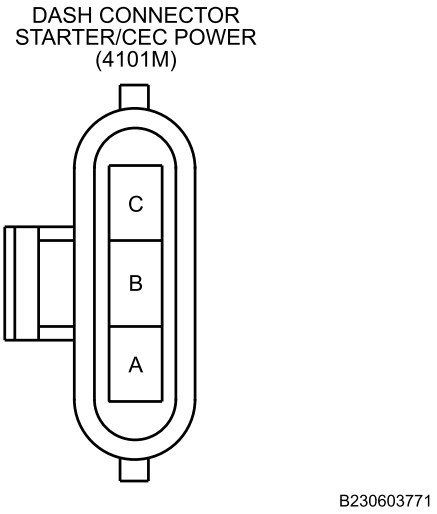


Figure 29. Connector 4101M.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 68.
YES Go to next step.

STEP

57. Disconnect connector 6007. Refer to Figure 30. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

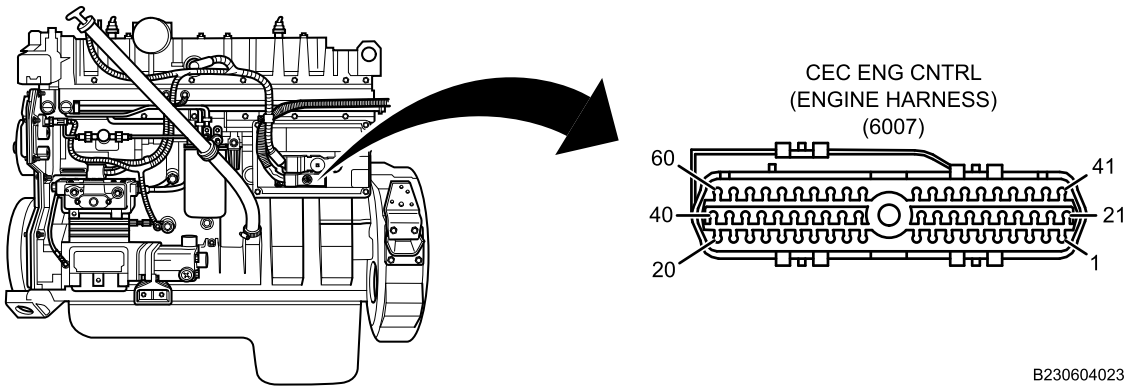


Figure 30. Engine Control Module (ECM).

58. Measure resistance between connector 4101M terminal A and ground with multimeter. Refer to Figure 29.

CONDITION/INDICATION

Does multimeter read OL?

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 68.
YES Go to Step 64.

MALFUNCTION

- 59. ECM cranking voltage is sufficient to allow engine to start.

ACTION

Return to Hard Start/No Start Toubleshooting Procedure (WP 0014).

END OF TEST

MALFUNCTION

- 60. ECM voltage is currently within specifications.

ACTION

Return vehicle to service.

END OF TEST

MALFUNCTION

- 61. Battery cable and clean power harness faulty.

ACTION

Replace battery cable and clean power harness. Refer to Battery Cable and Clean Power Harness Removal and Installation (WP 0405).

END OF TEST

MALFUNCTION

- 62. Battery cable and clean ground harness faulty.

ACTION

Replace battery cable and clean ground harness. Refer to Battery Disconnect Procedure (WP 0404).

END OF TEST

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 63. ECM faulty.

ACTION

Replace ECM. Refer to ECM Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 64. ECM faulty.

ACTION

Replace 40A engine ECM feed fuse and ECM. Refer to Engine Control Module (ECM) and Transmission Control Module (TCM) Clean Power and Ground Fuse Removal and Installation (WP 0412). Refer to ECM Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 65. Relay faulty.

ACTION

Replace relay. Return vehicle to service.

END OF TEST

MALFUNCTION

- 66. ECM and Transmission Control Module (TCM) clean power and ground harness faulty.

ACTION

Replace ECM and TCM clean power and ground harness. Refer to ECM and TCM Clean Power and Ground Harness Removal and Installation (WP 0406). Return vehicle to service.

END OF TEST

MALFUNCTION

- 67. ECM and Transmission Control Module (TCM) clean power and ground harness faulty.

ACTION

Replace 40A fuse and ECM and Transmission Control Module (TCM) clean power and ground harness. Refer to Refer to ECM and TCM Clean Power and Ground Harness Removal and Installation (WP 0406). Return vehicle to service.

END OF TEST

MALFUNCTION

- 68. Engine wire harness faulty.

ENGINE CONTROL MODULE (ECM) TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace 40A fuse. Refer to Engine Control Module (ECM) and Transmission Control Module (TCM) Clean Power and Ground Fuse Removal and Installation (WP 0412). Refer to Replace engine wire harness. Refer to Engine Wire Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 69. Engine wire harness faulty.

ACTION

Replace engine wire harness. Refer to Engine Wire Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 70. Power Distribution Center (PDC) harness faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 71. Power Distribution Center (PDC) harness faulty.

ACTION

Replace 40A fuse and PDC harness. Refer to Engine Control Module (ECM) and Transmission Control Module (TCM) Clean Power and Ground Fuse Removal and Installation (WP 0412). Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Tee, Accelerator Position Sensor (APS)/Idle Validation Switch (IVS), Sensor Breakout (ZTSE4485) (WP 0795, Item 117)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0324
WP 0329
WP 0319
WP 0335
WP 0336
WP 0397
WP 0257
WP 0062
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left side engine armor plate removed (WP 0598)
Left cabin door open and secured (WP 0608)

Drawings Required
WP 0789, Figure 68

This procedure covers the following DTCs:

- 131
- 132
- 133
- 134
- 135

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Cabin door must be secured in the open position by using heavy duty straps to prevent accidental closure during vehicle maintenance. Pull check link retaining pin prior to securing door open. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Disconnect harness connector 1804. Refer to Figure 1.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

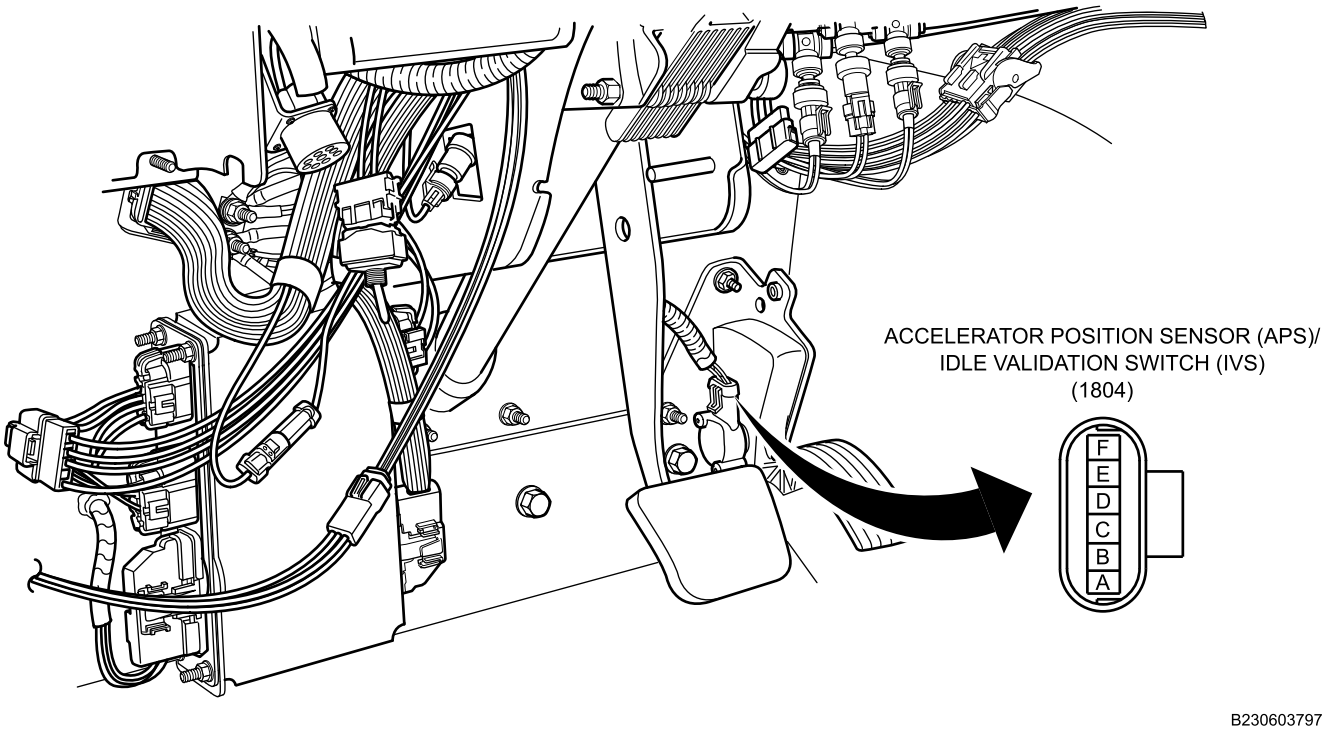


Figure 1. Accelerator Position Sensor (APS)/Idle Validation Switch (IVS).

2. Measure resistance between harness connector 1804 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 24.
NO Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Measure DC voltage between harness connector 1804 terminal C and ground with multimeter. Refer to Figure 2.

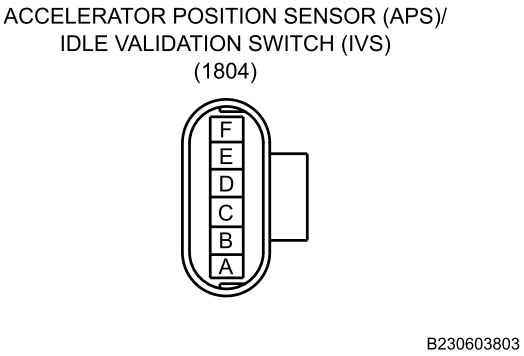


Figure 2. Connector 1804.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 33.
YES Go to next step.

STEP

6. Turn ignition switch OFF (TM 9-2355-106-10).
7. Turn MAIN POWER switch OFF (TM 9-2355-106-10)..
8. Measure resistance between harness connector 1804 terminal A and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 300,000 ohms and 400,000 ohms?

DECISION

NO Go to Step 54.
YES Go to next step.

STEP

9. Measure resistance between harness connector 1804 terminal D and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 1,300 ohms and 1,500 ohms?

DECISION

NO Go to Step 65.
YES Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

10. Turn MAIN POWER switch ON (TM 9-2355-106-10).
11. Turn ignition switch ON (TM 9-2355-106-10).
12. Measure DC voltage between harness connector 1804 terminal F and ground. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 76.
YES Go to next step.

STEP

13. Turn ignition switch OFF (TM 9-2355-106-10).
14. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
15. Measure resistance between harness connector 1804 terminal E and ground. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 91.
YES Go to next step.

STEP

16. Measure resistance between harness connector 1804 terminal E and all other terminals in harness connector 1804. Refer to Figure 2. Multimeter should read OL for each test.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 91.
YES Go to next step.

STEP

17. Install APS-IVS breakout harness (ZTSE4485) between APS-IVS sensor and harness connector 1804. Refer to Figure 3.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

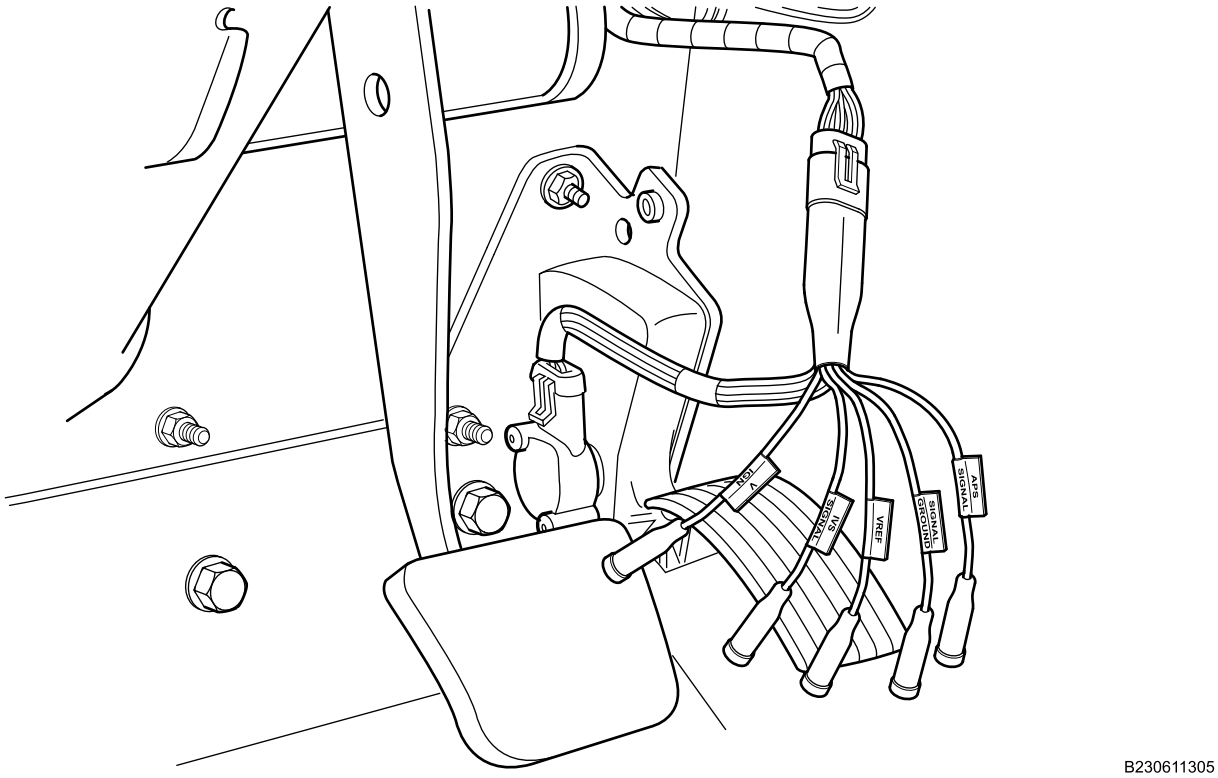


Figure 3. Accelerator Position Sensor (APS)/Idle Validation Switch (IVS) Breakout Harness (ZTSE4485).

18. Turn MAIN POWER switch ON (TM 9-2355-106-10).
19. Turn ignition switch ON (TM 9-2355-106-10).
20. Measure DC voltage between APS-IVS breakout harness (ZTSE4485) GREEN APS SIGNAL test lead and ground with multimeter. Refer to Figure 3.
21. Observe multimeter while slowly depressing accelerator pedal.

CONDITION/INDICATION

Does voltage transition smoothly from 0.6V to 4.0V?

DECISION

NO Go to Step 95.
YES Go to next step.

STEP

22. Measure DC voltage between APS-IVS breakout harness (ZTSE4485) WHITE IVS SIGNAL test lead and ground with multimeter. Refer to Figure 3.
23. Observe multimeter while slowly depressing accelerator pedal.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V from just off idle to wide-open throttle?

DECISION

YES Go to Step 96.
NO Go to Step 95.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

24. Disconnect harness connector 1800/1805. Refer to Figure 4.

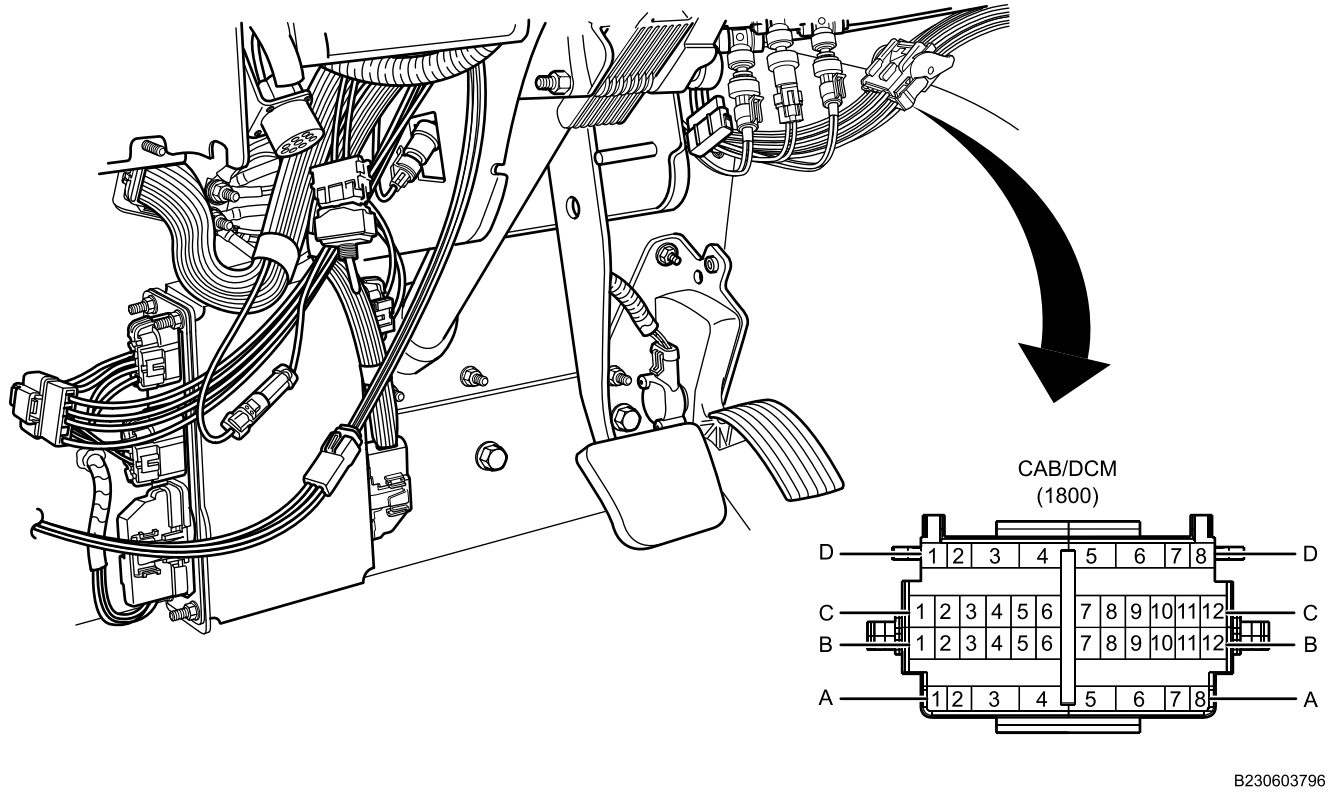


Figure 4. Below Instrument Panel (IP).

25. Measure resistance between harness connector 1800 terminal B4 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 91.
YES Go to next step.

STEP

26. Disconnect connector 1701. Refer to Figure 5.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

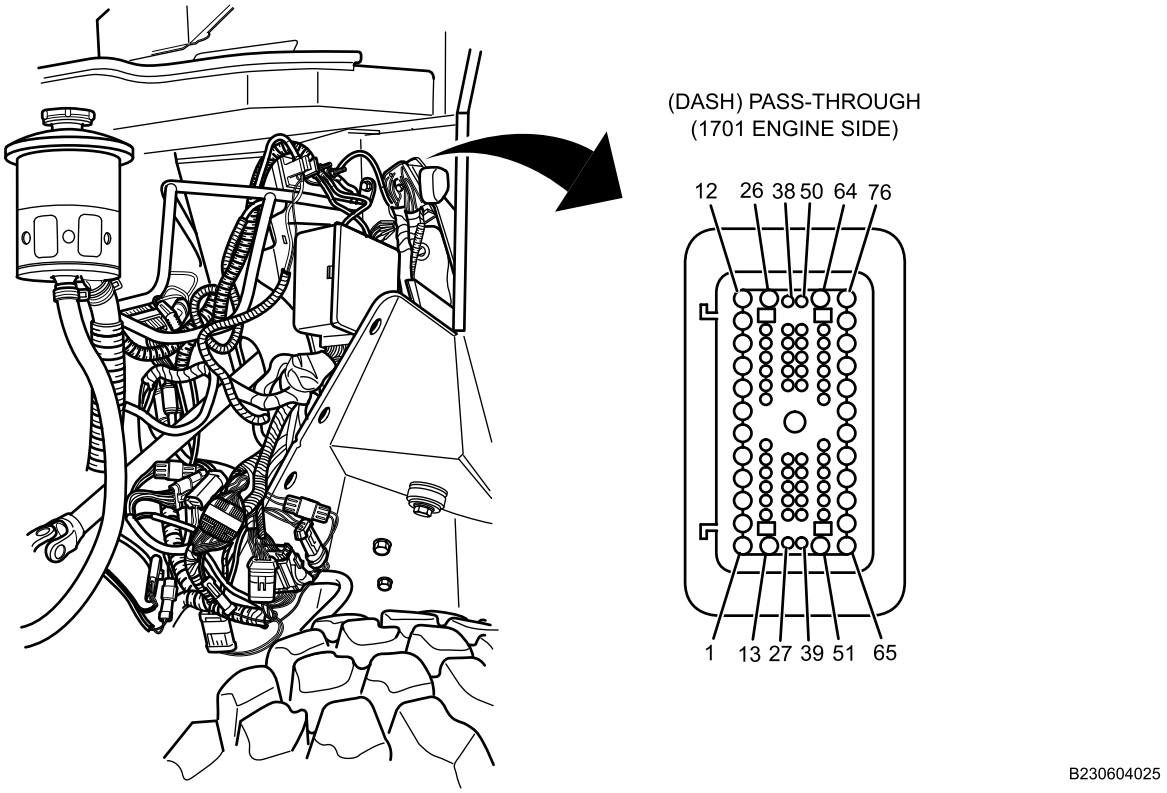


Figure 5. Firewall Pass-Through.

27. Measure resistance between connector 1701 terminal 2 (engine harness side) and ground with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 94.
YES Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).

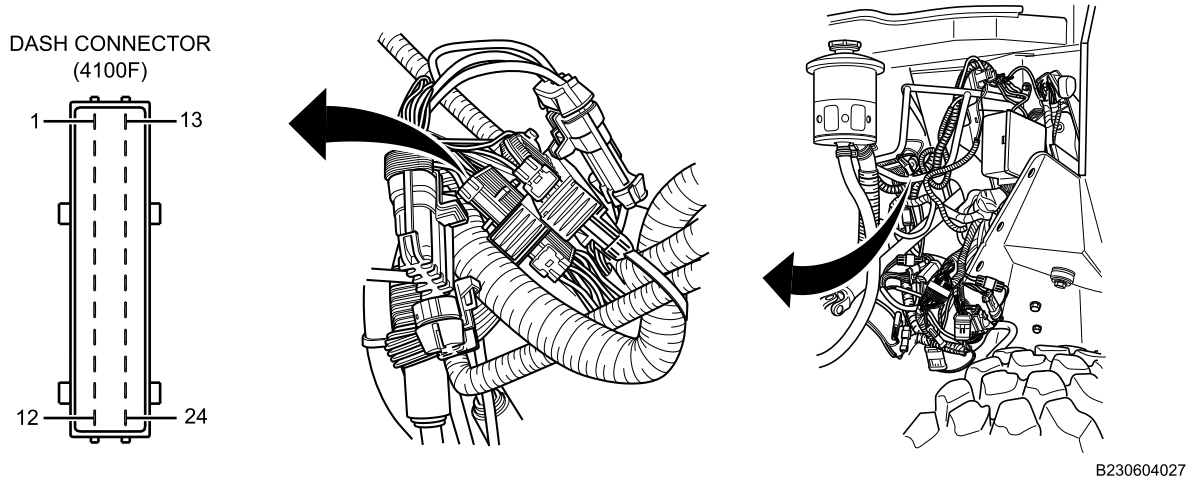


Figure 6. Below Air Filter.

29. Disconnect 18-wire harness connector 4100F/4103. Refer to Figure 6.
30. Measure resistance between harness connector 4100F terminal 6 and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 92.
YES Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

31. Disconnect ECM connector 6007. Refer to Figure 7. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

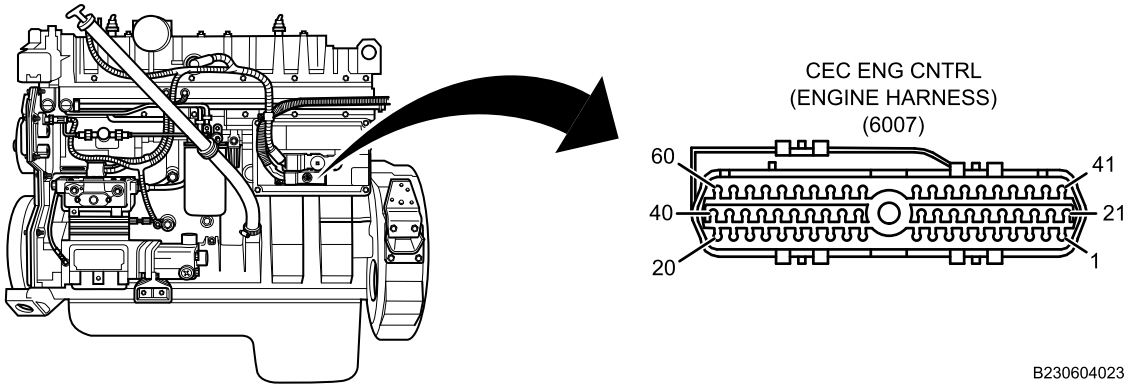


Figure 7. ECM Connectors.

32. Measure resistance between connector 4100F terminal 6 and connector 6007 terminal 11 with multimeter. Refer to Figure 8 and Figure 7.

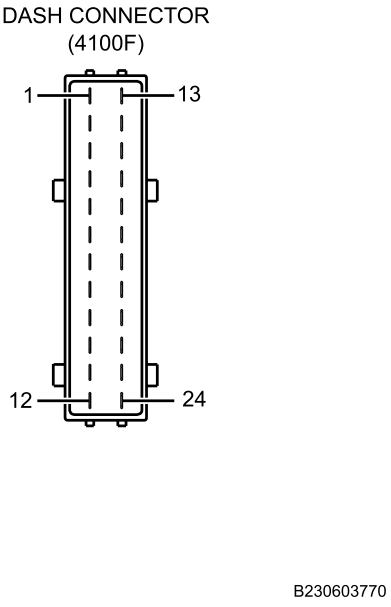


Figure 8. Connector 4100F.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 96.
YES Go to Step 93.

STEP

33. Turn ignition switch OFF (TM 9-2355-106-10).

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

34. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
35. Disconnect harness connector 1800/1805. Refer to Figure 9.

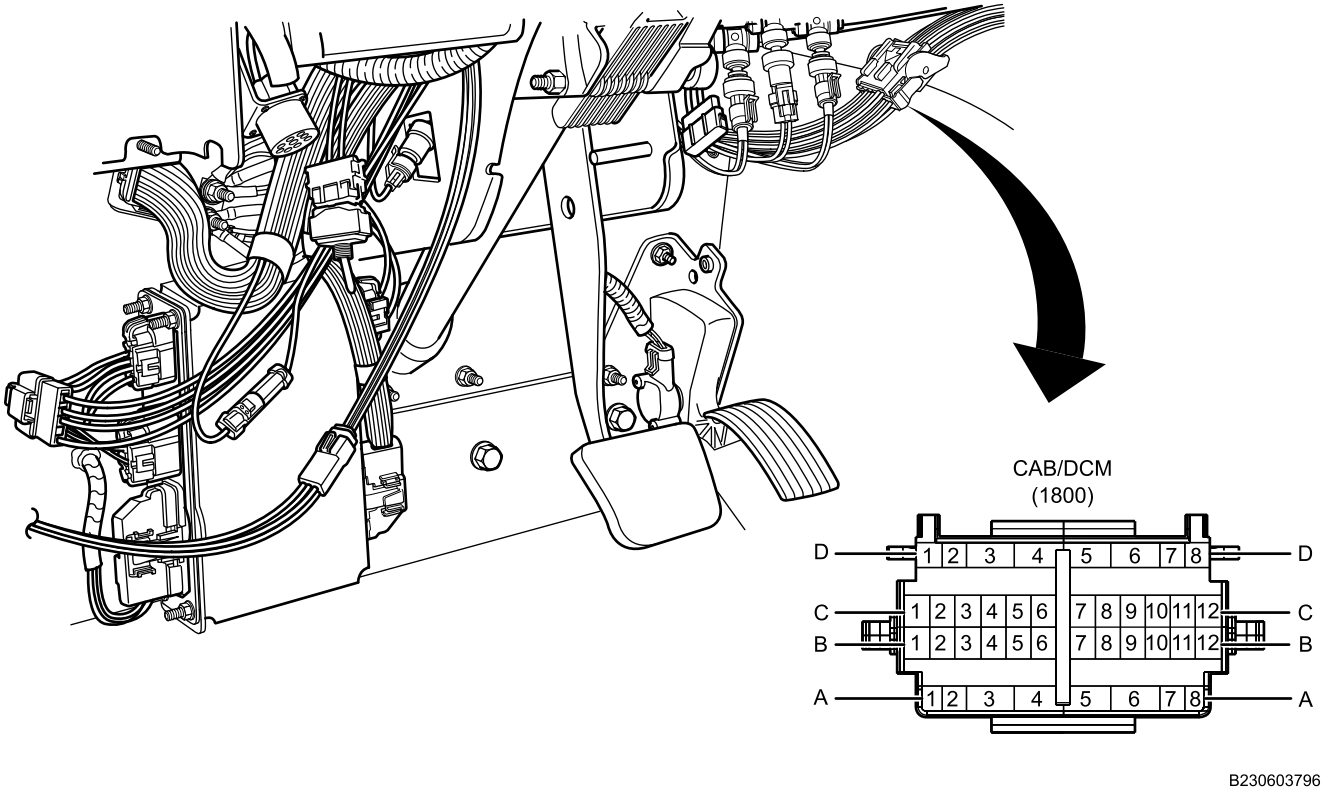


Figure 9. Below Instrument Panel (IP).

36. Turn MAIN POWER switch ON (TM 9-2355-106-10).
37. Turn ignition switch ON (TM 9-2355-106-10).
38. Measure DC voltage between harness connector 1800 terminal C5 and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

YES Go to Step 91.
NO Go to next step.

STEP

39. Turn ignition switch OFF (TM 9-2355-106-10).
40. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
41. Disconnect connector 1701. Refer to Figure 10.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

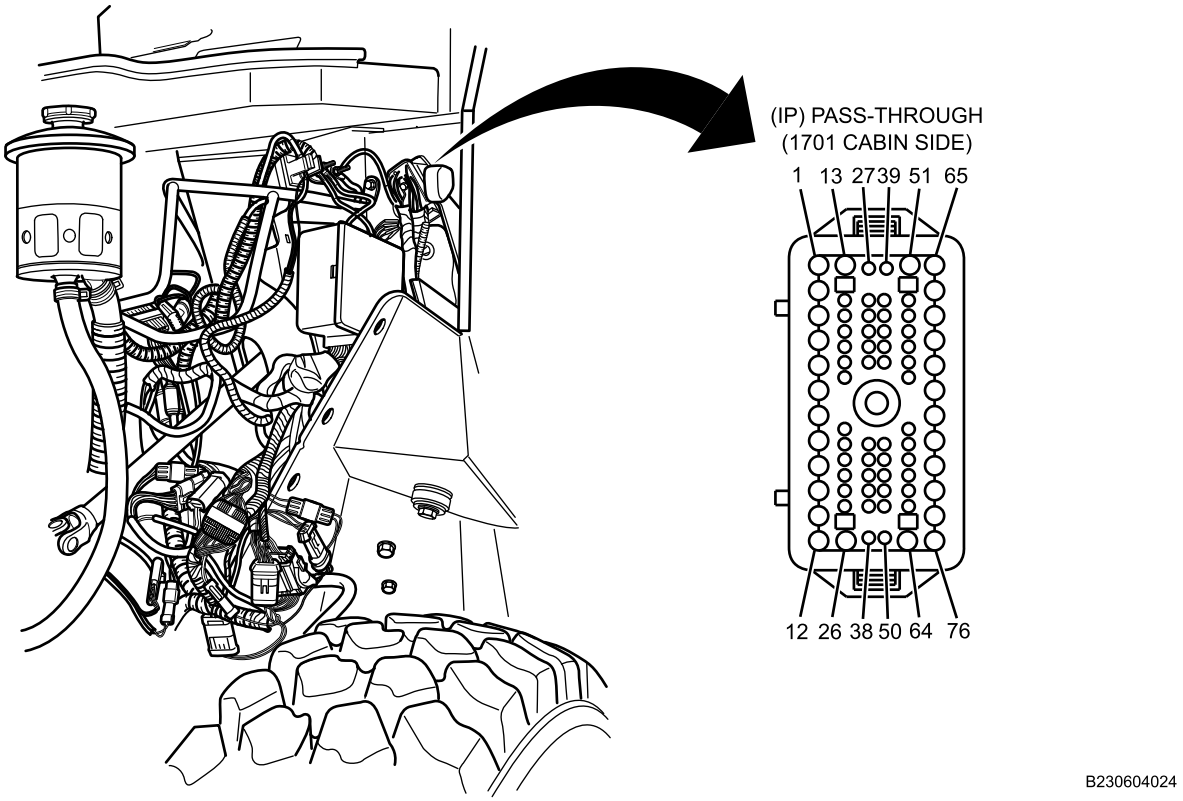


Figure 10. Firewall Pass-Through.

42. Measure resistance between harness connector 1800 terminal C5 and ground with multimeter. Refer to Figure 11.

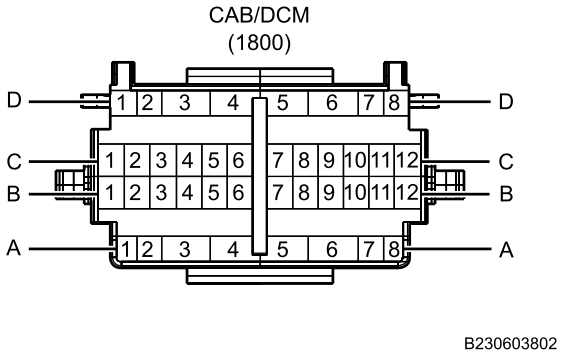


Figure 11. Connector 1800.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 94.
YES Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

43. Measure resistance between harness connector 1800 terminal C5 and connector 1701 terminal 5 (cabin side) with multimeter. Refer to Figure 11 and Figure 10.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 94.
YES Go to next step.

STEP

44. Measure resistance between connector 1701 terminal 5 (cabin side) and all other connector 1701 (cabin side) terminals with multimeter. Multimeter should read OL for each test. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 94.
YES Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

45. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).

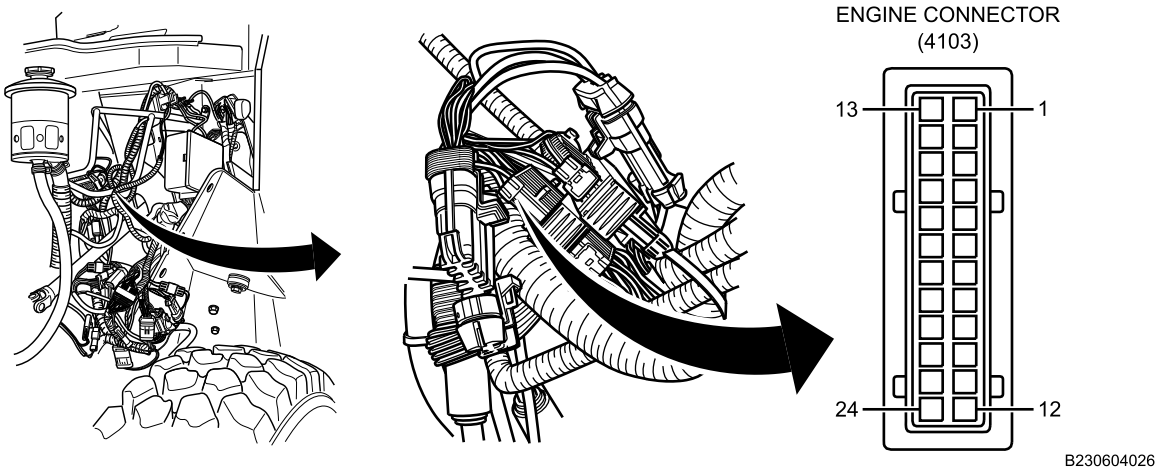


Figure 12. Below Air Filter.

46. Disconnect 18-wire harness connector 4100F/4103. Refer to Figure 12.
47. Measure resistance between harness connector 4103 terminal 4 and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 92.
YES Go to next step.

STEP

48. Measure resistance between harness connector 4103 terminal 4 and harness connector 1701 (engine harness side) terminal 5 with multimeter. Refer to Figure 12 and Figure 13.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

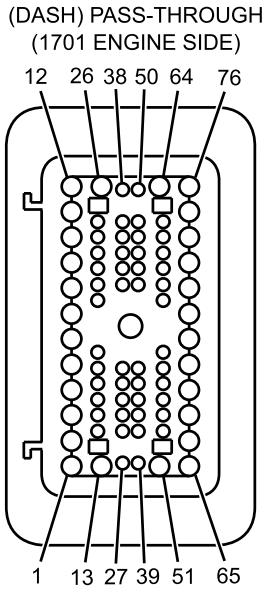


Figure 13. Connector 1701-Engine Side.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 92.
YES Go to next step.

STEP

49. Measure resistance between harness connector 4103 terminal 4 and all other harness connector 4103 terminals. Multimeter should read OL for each test. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 92.
YES Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

50. Disconnect Engine Control Module (ECM) connector 6007. Refer to Figure 14. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

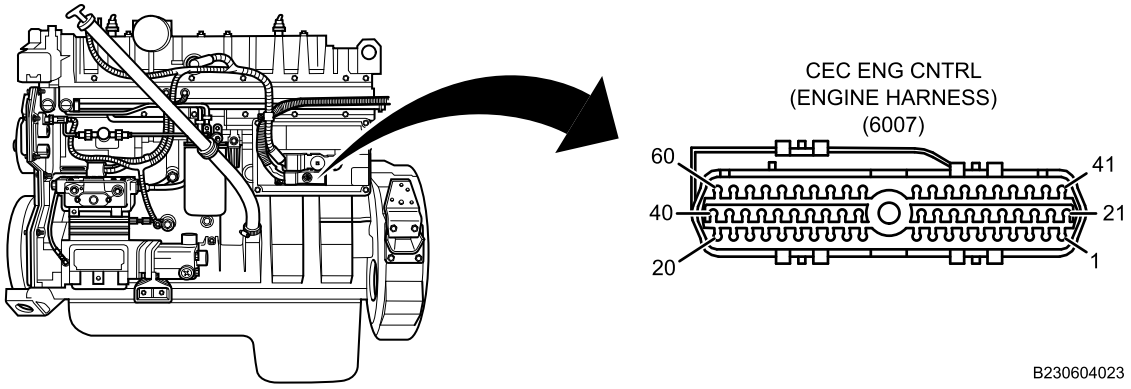


Figure 14. ECM Connectors.

51. Measure resistance between harness connector 4100F terminal 4 and ground with multimeter. Refer to Figure 15.

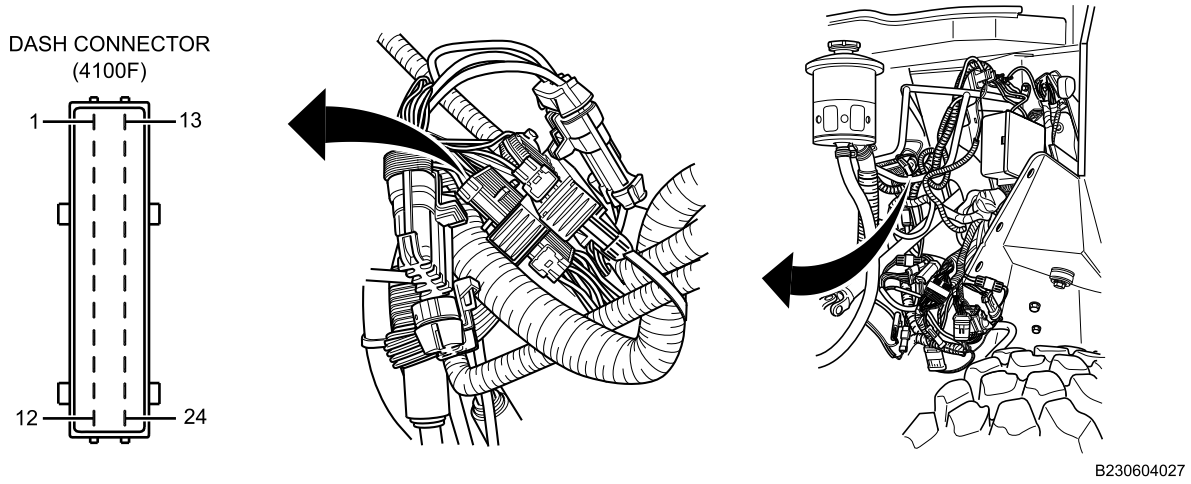


Figure 15. Below Air Filter.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 93.
YES Go to next step.

STEP

52. Measure resistance between harness connector 4100F terminal 4 and harness connector 6007 terminal 3 with multimeter. Refer to Figure 15 and Figure 14.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 93.
YES Go to next step.

STEP

53. Measure resistance between harness connector 6007 terminal 3 and all other terminals in harness connector 6007 with multimeter. Multimeter should read OL for each test. Refer to Figure 14.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 93.
YES Go to Step 96.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

54. Disconnect harness connector 1800/1805. Refer to Figure 16.

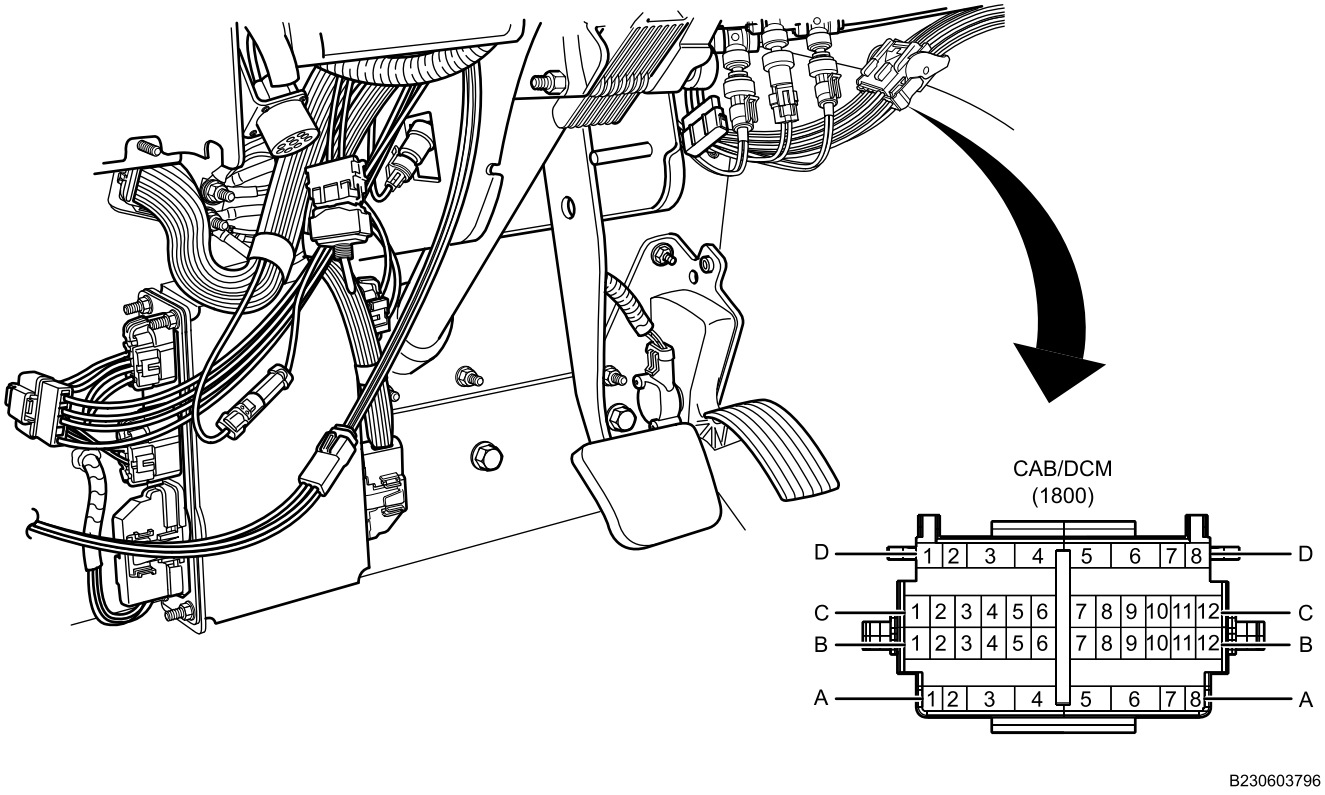


Figure 16. Below Instrument Panel (IP).

55. Measure resistance between harness connector 1800 terminal C4 and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read between 300,000 ohms and 400,000 ohms?

DECISION

YES Go to Step 91.
NO Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

56. Disconnect connector 1701. Refer to Figure 17.

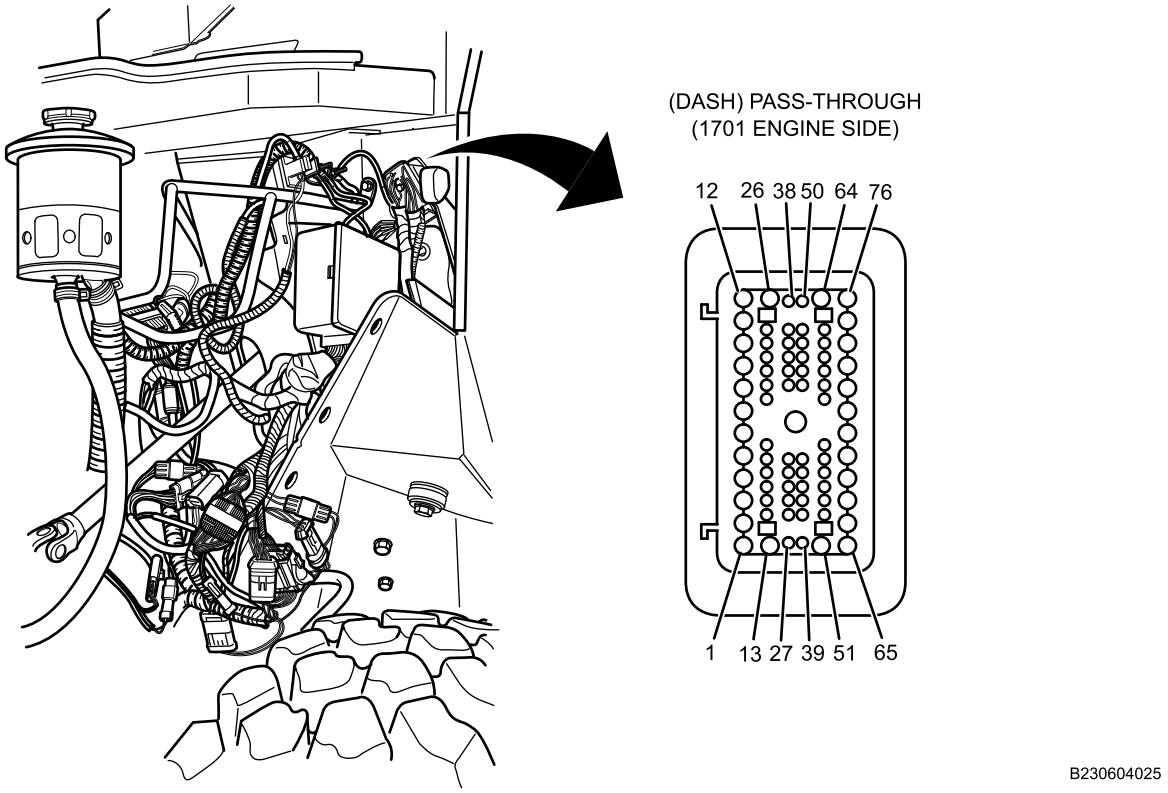


Figure 17. Firewall Pass-Through.

57. Measure resistance between harness connector 1701 (engine harness side) terminal 1 and ground with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read between 300,000 ohms and 400,000 ohms?

DECISION

YES Go to Step 94.
NO Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

58. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
59. Disconnect 18-wire harness connector 4100F/4103. Refer to Figure 18.

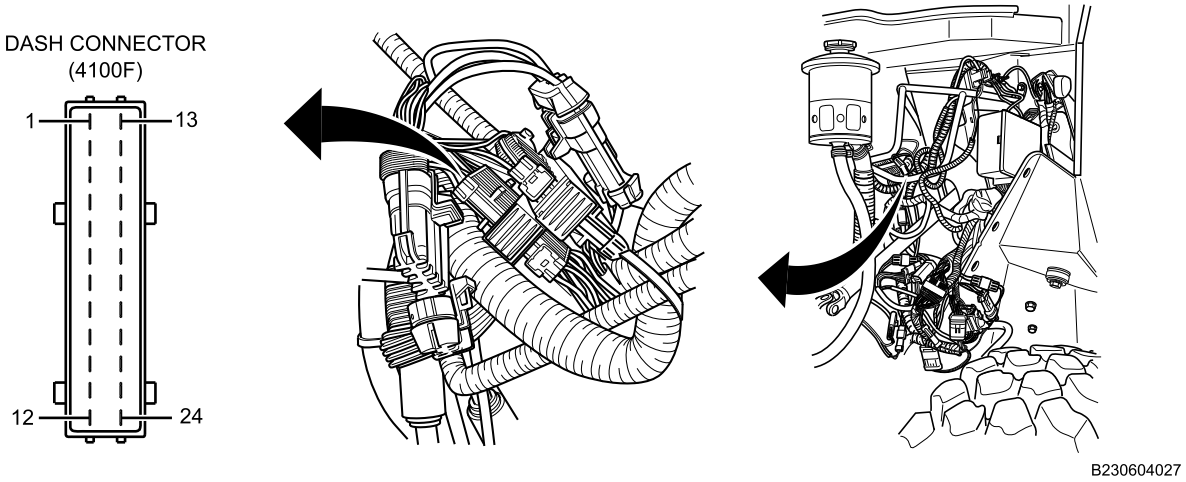


Figure 18. Below Air Filter.

60. Measure resistance between harness connector 4100F terminal 5 and ground with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read between 300,000 ohms and 400,000 ohms?

DECISION

YES Go to Step 92.
NO Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

61. Disconnect ECM connector 6007. Refer to Figure 19. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

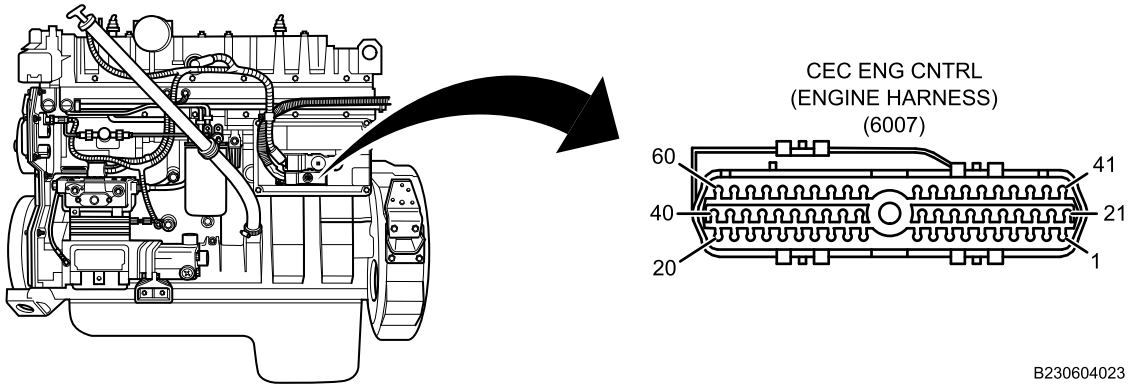


Figure 19. ECM Connectors.

62. Measure resistance between harness connector 4100F terminal 5 and ground with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 93.
YES Go to next step.

STEP

63. Measure resistance between harness connector 4100F terminal 5 and harness connector 6007 terminal 8 with multimeter. Refer to Figure 18 and Figure 19.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 93.
YES Go to next step.

STEP

64. Measure resistance between harness connector 6007 terminal 8 and all other terminals in harness connector 6007 with multimeter. Multimeter should read OL for each test. Refer to Figure 19.

CONDITION/INDICATION

Does multimeter read OL for each test?

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 93.
YES Go to Step 96.

STEP

65. Disconnect harness connector 1800/1805. Refer to Figure 20.

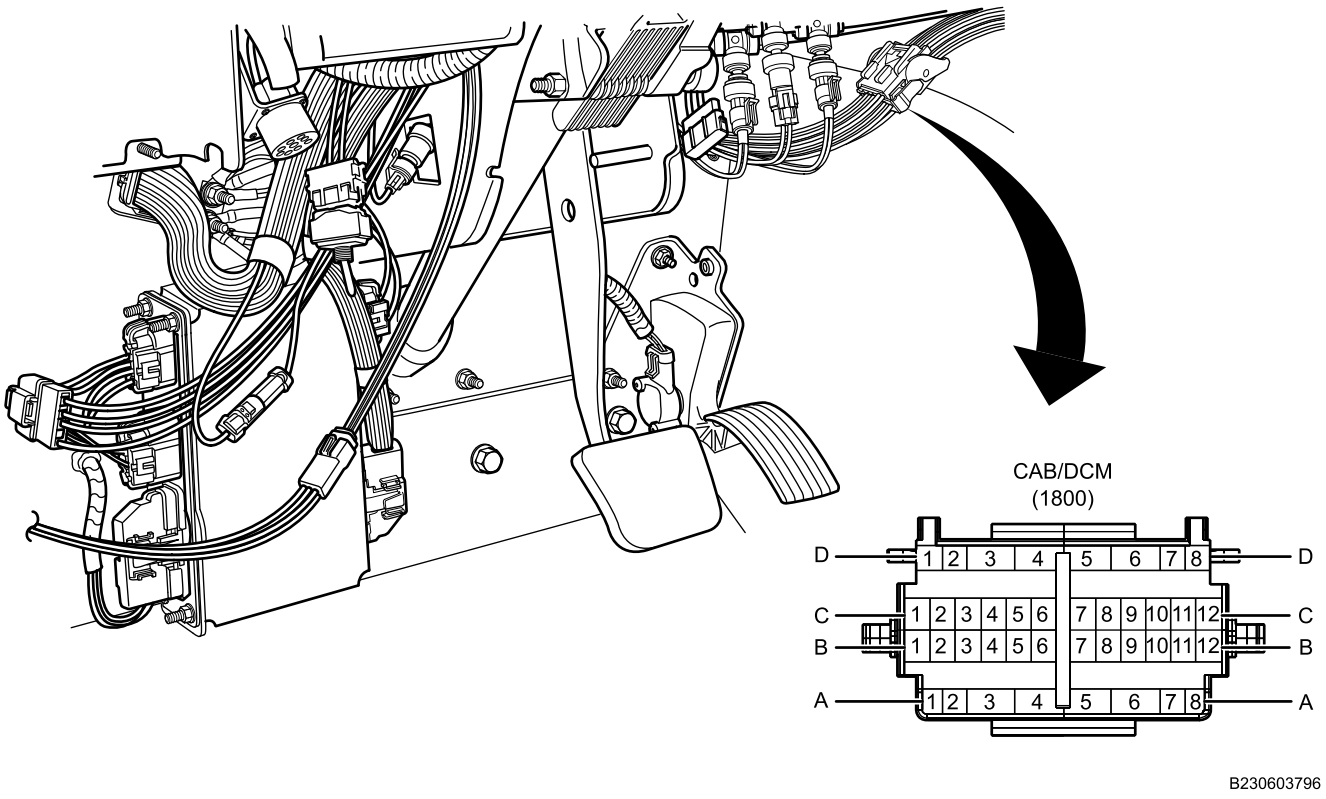


Figure 20. Below Instrument Panel (IP).

66. Measure resistance between harness connector 1800 terminal B5 and ground with multimeter. Refer to Figure 20.

CONDITION/INDICATION

Does multimeter read between 300,000 ohms and 400,000 ohms?

DECISION

YES Go to Step 91.
NO Go to next step.

STEP

67. Disconnect connector 1701. Refer to Figure 21.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

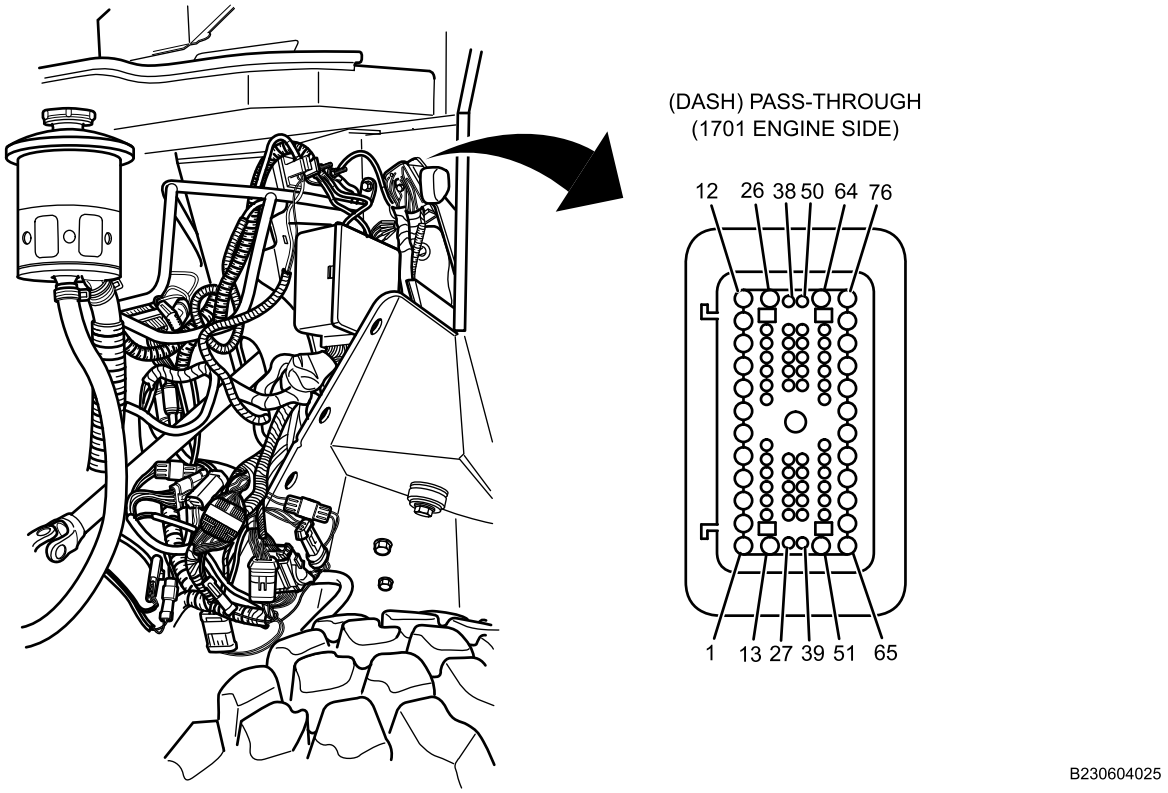


Figure 21. Firewall Pass-Through.

68. Measure resistance between harness connector 1701 (engine harness side) terminal 4 and ground with multimeter. Refer to Figure 21.

CONDITION/INDICATION

Does multimeter read between 300,000 ohms and 400,000 ohms?

DECISION

YES Go to Step 94.
NO Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

69. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
70. Disconnect 18-wire harness connector 4100F/4103. Refer to Figure 22.

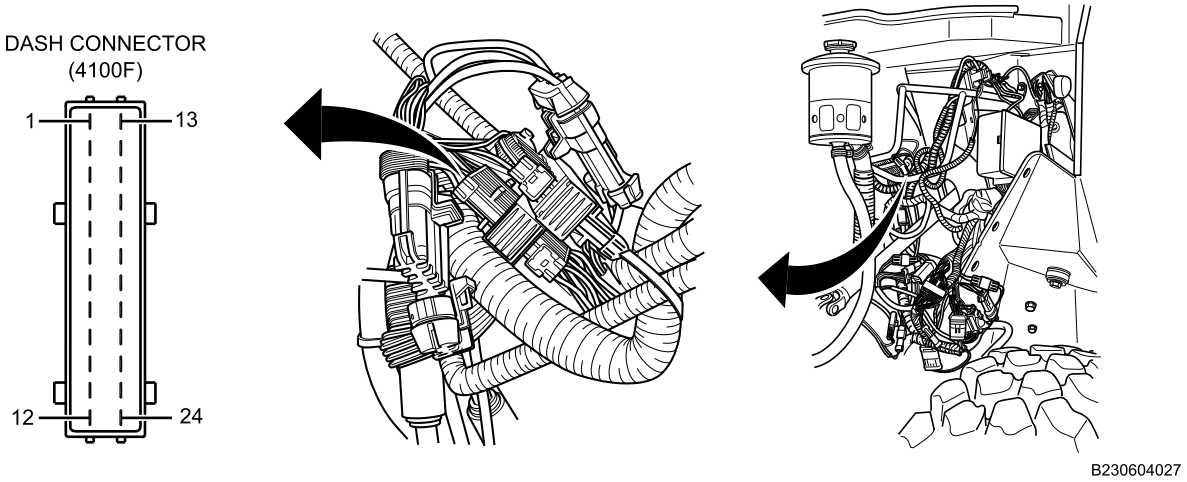


Figure 22. Below Air Filter.

71. Measure resistance between harness connector 4100F terminal 2 and ground with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read between 300,000 ohms and 400,000 ohms?

DECISION

YES Go to Step 92.
NO Go to next step.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

72. Disconnect ECM connector 6007. Refer to Figure 23. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

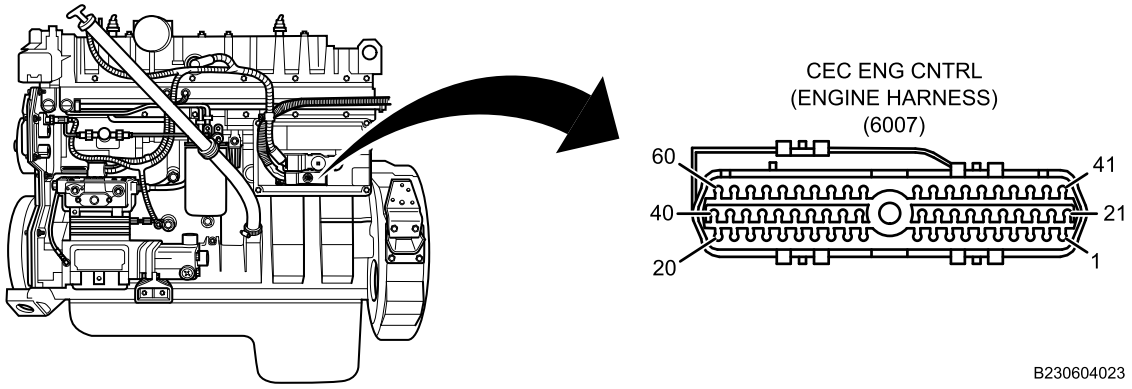


Figure 23. ECM Connectors.

73. Measure resistance between harness connector 4100F terminal 2 and ground with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 93.
YES Go to next step.

STEP

74. Measure resistance between harness connector 4100F terminal 2 and harness connector 6007 terminal 27 with multimeter. Refer to Figure 22 and Figure 23.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 93.
YES Go to next step.

STEP

75. Measure resistance between harness connector 6007 terminal 8 and all other terminals in harness connector 6007 with multimeter. Multimeter should read OL for each test. Refer to Figure 23.

CONDITION/INDICATION

Does multimeter read OL for each test?

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 93.
YES Go to Step 96.

STEP

76. Turn ignition switch OFF (TM 9-2355-106-10).
77. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
78. Remove and Inspect fuse F24. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 24.

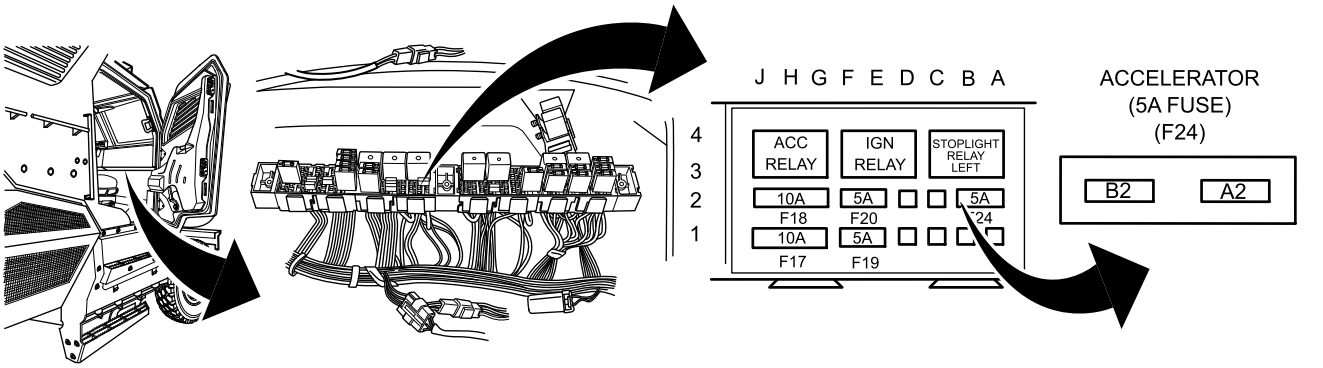


Figure 24. Fuse Locator.

CONDITION/INDICATION

Is fuse F24 open?

DECISION

YES Go to Step 86.
NO Go to next step.

STEP

79. Turn ignition switch ON (TM 9-2355-106-10).
80. Turn MAIN POWER switch ON (TM 9-2355-106-10).
81. Measure DC voltage between ground and fuse block 1012 terminals A2 and B2 with multimeter. Refer to Figure 24.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Cabin Fuse Block 1012 Troubleshooting Procedure (WP 0062).
YES Go to next step.

STEP

82. Turn ignition switch OFF (TM 9-2355-106-10).
83. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

84. Disconnect harness connector 1800/1805. Refer to Figure 25.

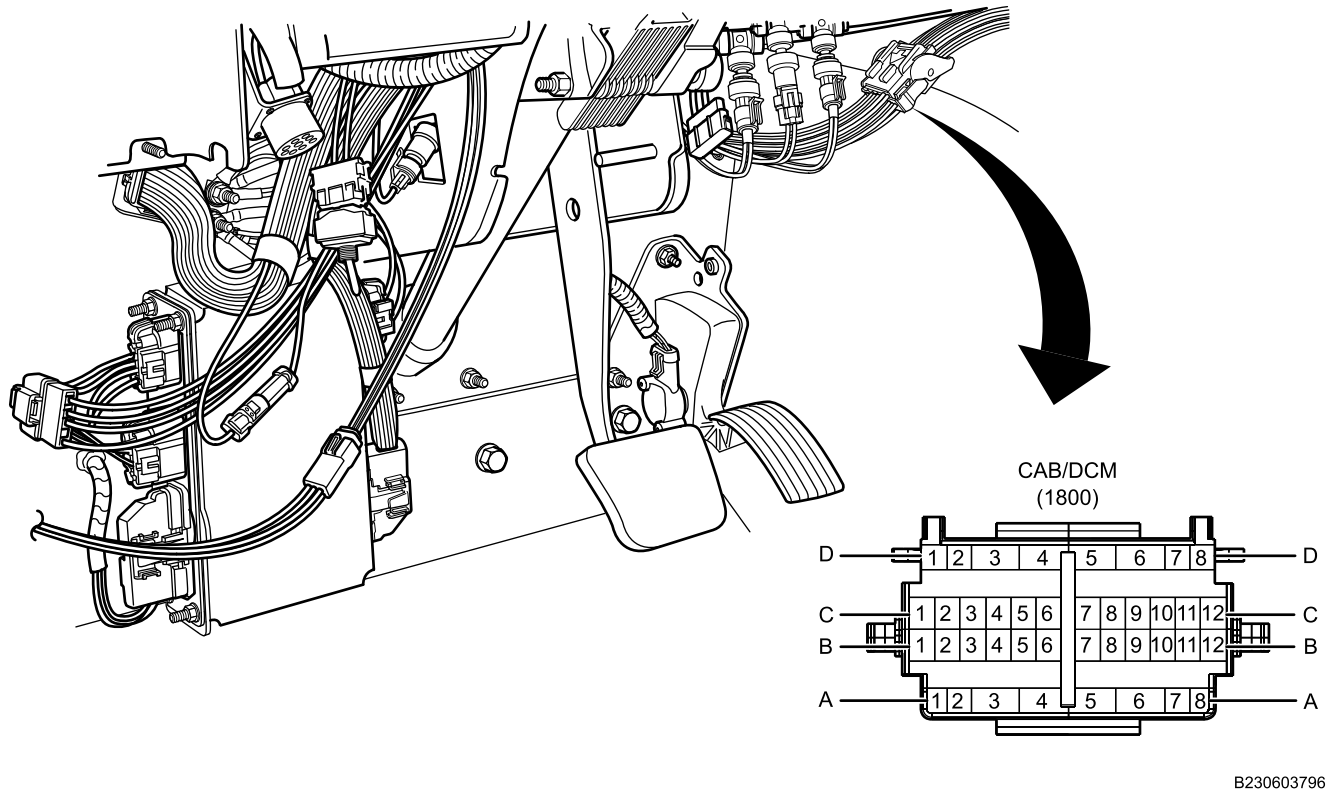


Figure 25. Below Instrument Panel (IP).

85. Measure resistance between harness connector 1800 terminal C6 and accelerator fuse (F24) terminal B2 with multimeter. Refer to Figure 25 and Figure 24.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 94.
NO Go to Step 91.

STEP

86. Turn ignition switch OFF (TM 9-2355-106-10).
87. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
88. Measure resistance between harness connector 1804 terminal F and ground with multimeter. Refer to Figure 26.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

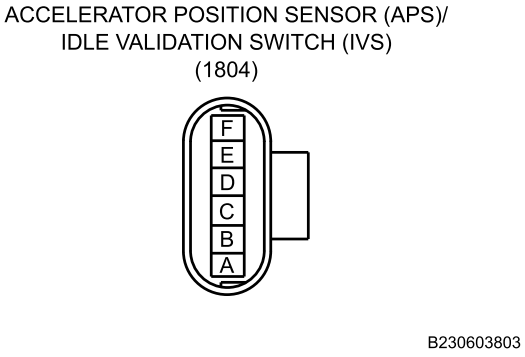


Figure 26. Connector 1804.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 95.
NO Go to next step.

STEP

89. Disconnect harness connector 1800/1805. Refer to Figure 27.

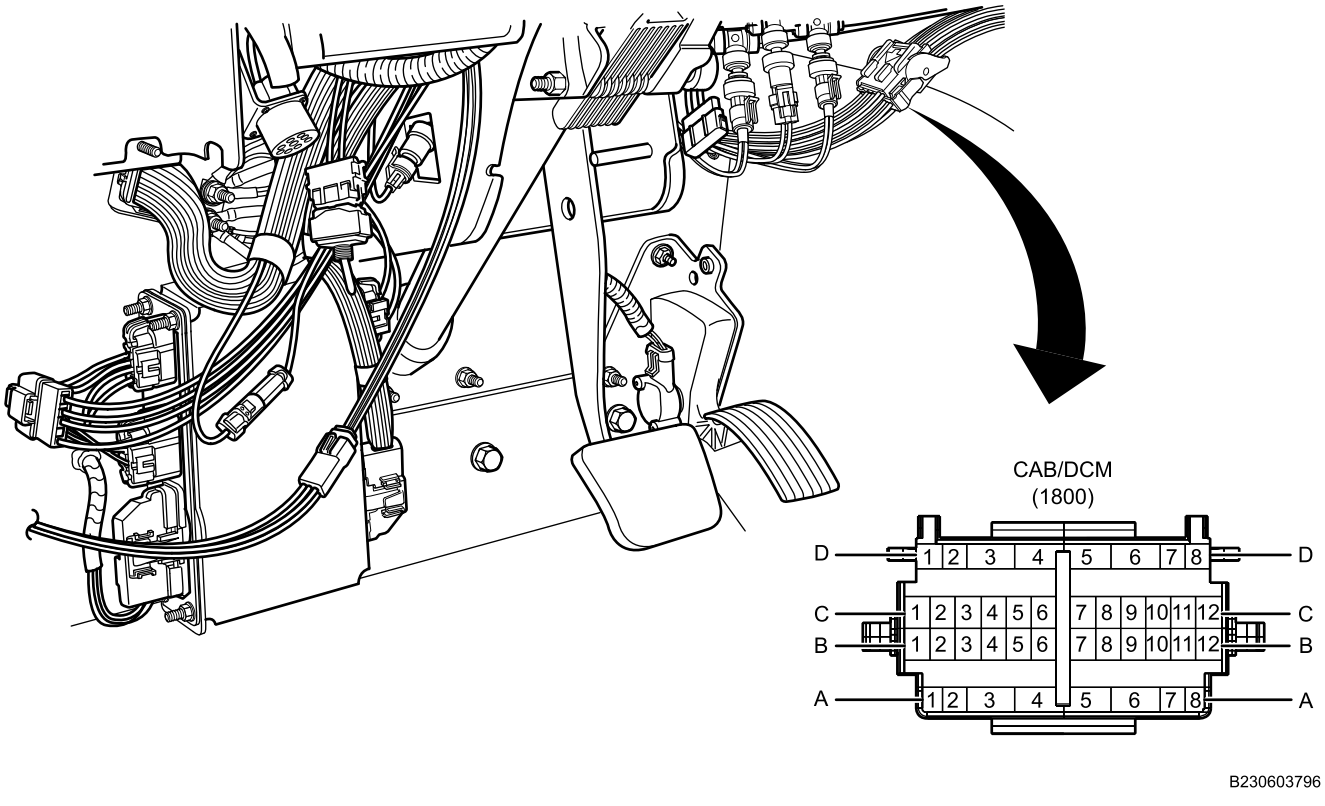


Figure 27. Below Instrument Panel (IP).

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

90. Measure resistance between harness connector 1804 terminal F and ground with multimeter. Refer to Figure 26.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 91.
YES Go to Step 94.

MALFUNCTION

- 91. Steering column wiring harness is faulty.

ACTION

Replace steering column wiring harness. Refer to Steering Column Harness Removal and Installation (WP 0324). Return vehicle to service.

END OF TEST

MALFUNCTION

- 92. Power distribution center harness is faulty.

ACTION

Replace power distribution center harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 93. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 94. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel Harness Removal and Installation (WP 0319). Return vehicle to service.

ACCELERATOR POSITION SENSOR (APS)/IDLE VALIDATION SWITCH (IVS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 95. APS/IVS sensor is faulty.

ACTION

Replace APS/IVS sensor. Refer to APS/IVS Sensor Removal and Installation (WP 0397). Return vehicle to service.

END OF TEST

MALFUNCTION

- 96. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0257
WP 0329
WP 0319
WP 0335
WP 0336
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 1

DIAGNOSTIC TROUBLE CODES AND SYMPTOMS.

This procedure covers the following DTCs:

- 231

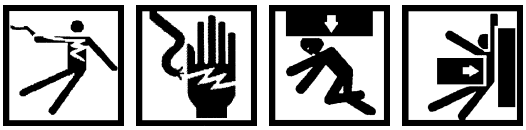
This procedure covers the following symptoms:

- No ATA data communication
- DTCs will not display or MSD will not power up
- Instrument cluster display for speedometer, tachometer, oil pressure, coolant temperature, and battery voltage does not function

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Measure DC voltage between connector 1650 terminal F and ground with multimeter. Refer to Figure 1.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

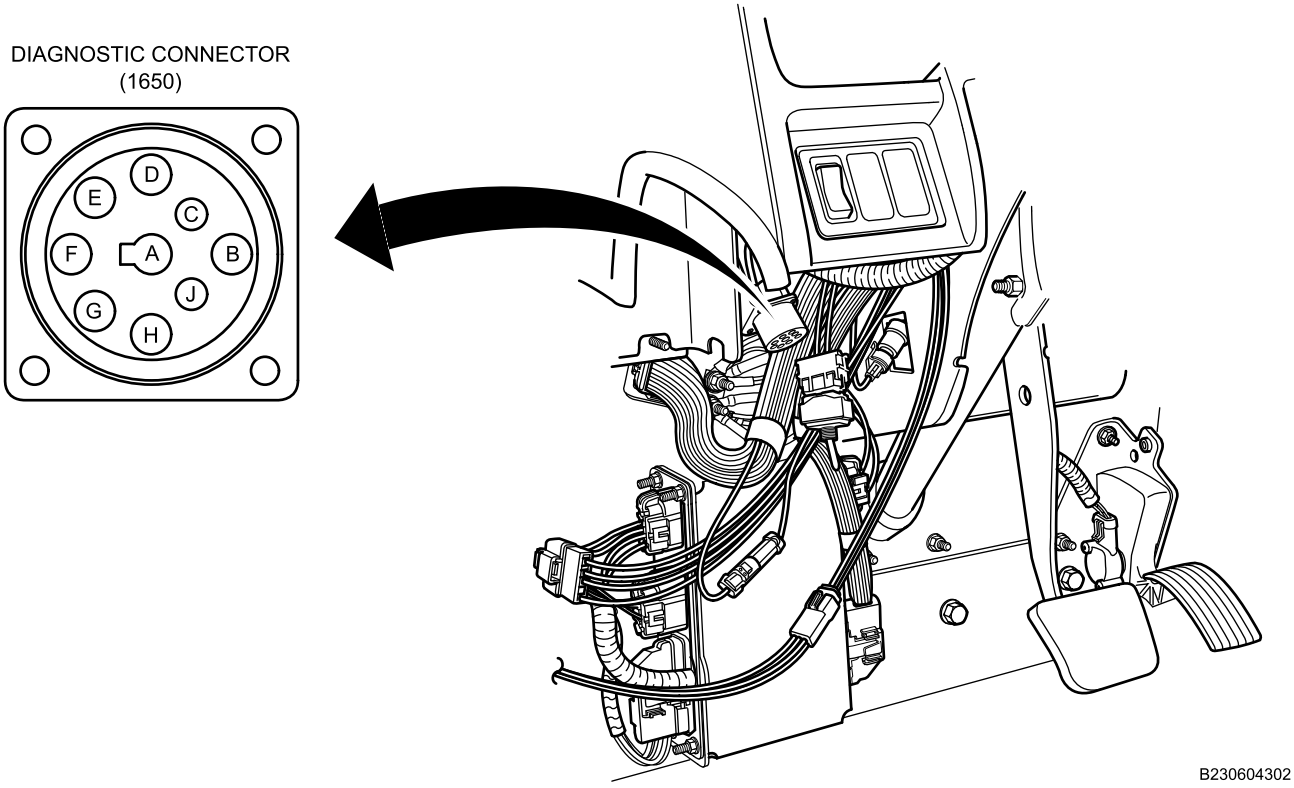


Figure 1. Under Left Side of Instrument Panel (IP).

CONDITION/INDICATION

Does multimeter read more than 4.5V?

DECISION

YES Go to Step 17.
NO Go to next step.

STEP

4. Measure DC voltage between connector 1650 terminal F and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 2.5V?

DECISION

YES Go to Step 24.
NO Go to next step.

STEP

5. Measure DC voltage between connector 1650 terminal G and ground with multimeter. Refer to Figure 1.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 1.5V?

DECISION

YES Go to Step 34.
NO Go to next step.

STEP

6. Measure DC voltage between connector 1650 terminal G and ground with multimeter. Refer to Figure 2.

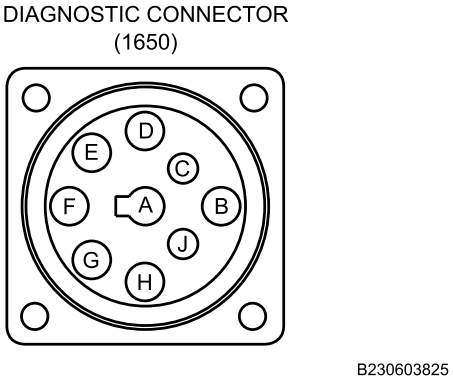


Figure 2. Connector 1650.

CONDITION/INDICATION

Does multimeter read less than 0.5V?

DECISION

YES Go to Step 41.
NO Go to next step.

STEP

7. Turn ignition switch OFF (TM 9-2355-106-10).
8. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
9. Measure resistance between connector 1650 terminal G and terminal F with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 1000 ohms?

DECISION

NO Go to Step 66.
YES Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

10. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
11. Disconnect connector 1701. Refer to Figure 3.

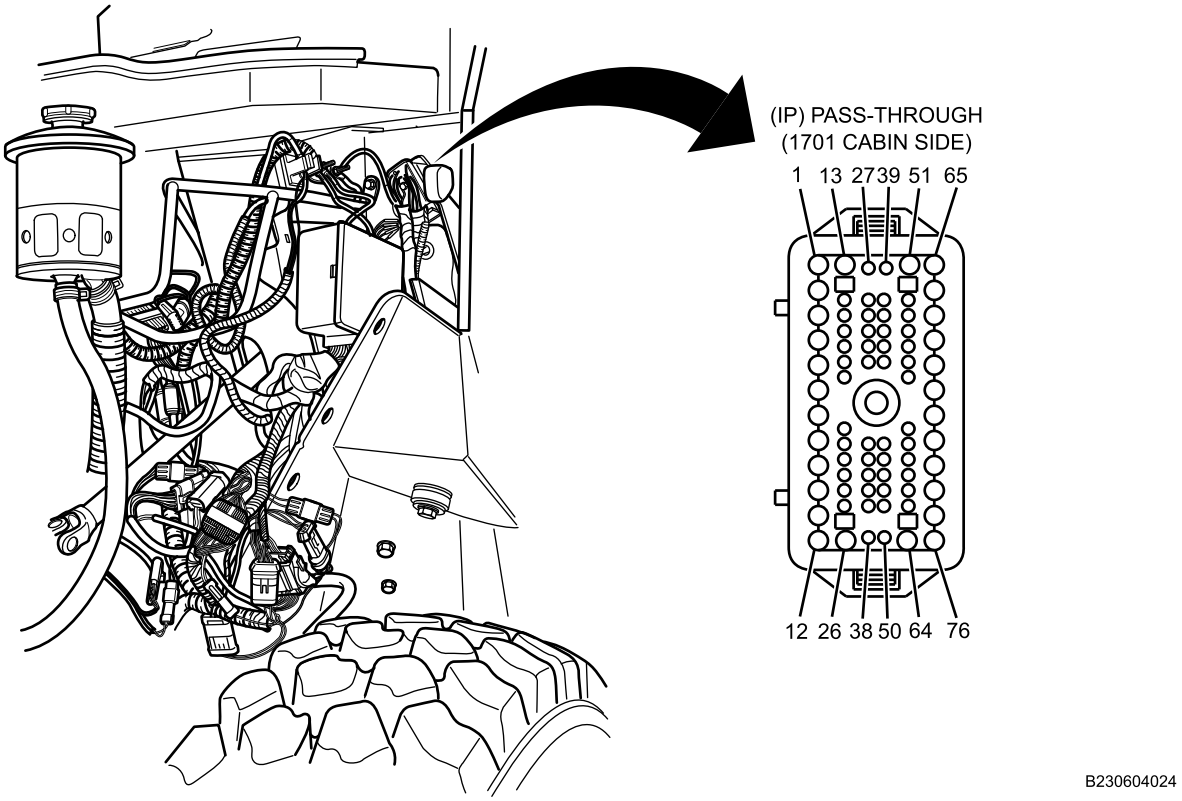


Figure 3. IP Pass-Through Connector Near Power Distribution Center (PDC) Under Hood.

12. Measure resistance between connector 1701 terminal 40 and 41 with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read less than 1000 ohms?

DECISION

YES Go to Step 65.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Disconnect connector 4100F (connector with 18 wires). Refer to Figure 4.

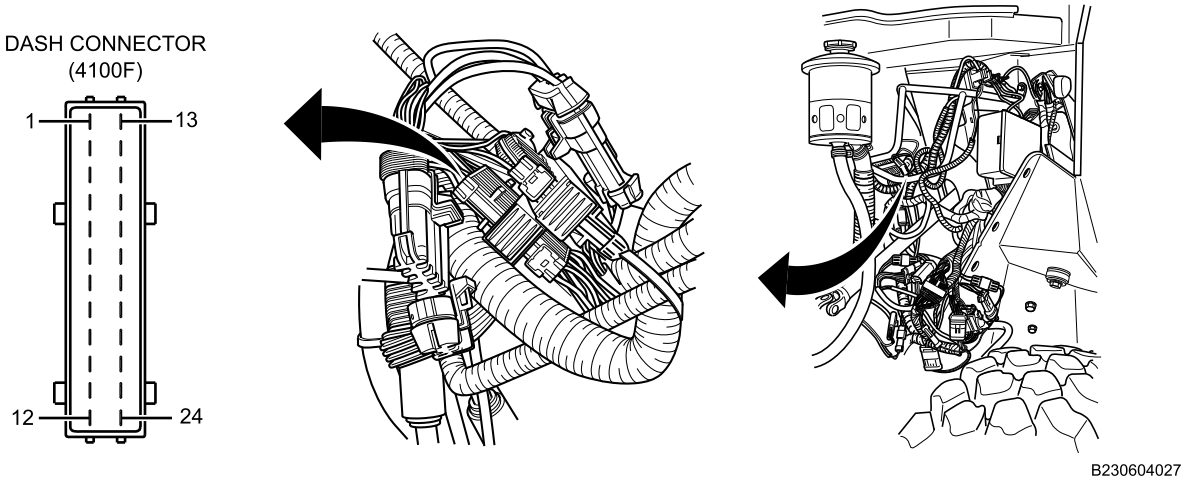


Figure 4. Engine/Dash Connector Under Hood.

14. Measure resistance between connector 4100F terminal 10 and 11 with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read more than 1000 ohms?

DECISION

YES Go to Step 64.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

15. Disconnect ECM connector 6007. Refer to Figure 5. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

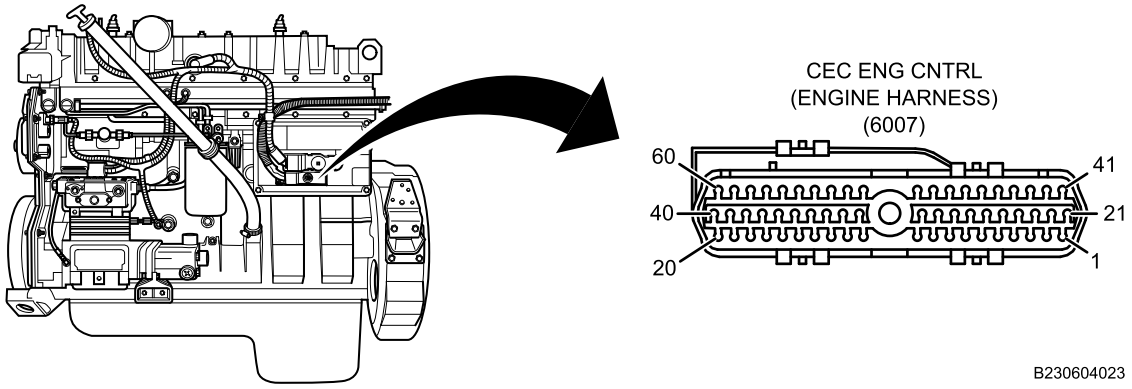


Figure 5. ECM Connector on Left Side of Engine.

16. Measure resistance between connector 4100F terminal 10 and 11 with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read more than 1000 ohms?

DECISION

YES Go to Step 66.
NO Go to Step 63.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

17. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
18. Disconnect connector 1701. Refer to Figure 6.

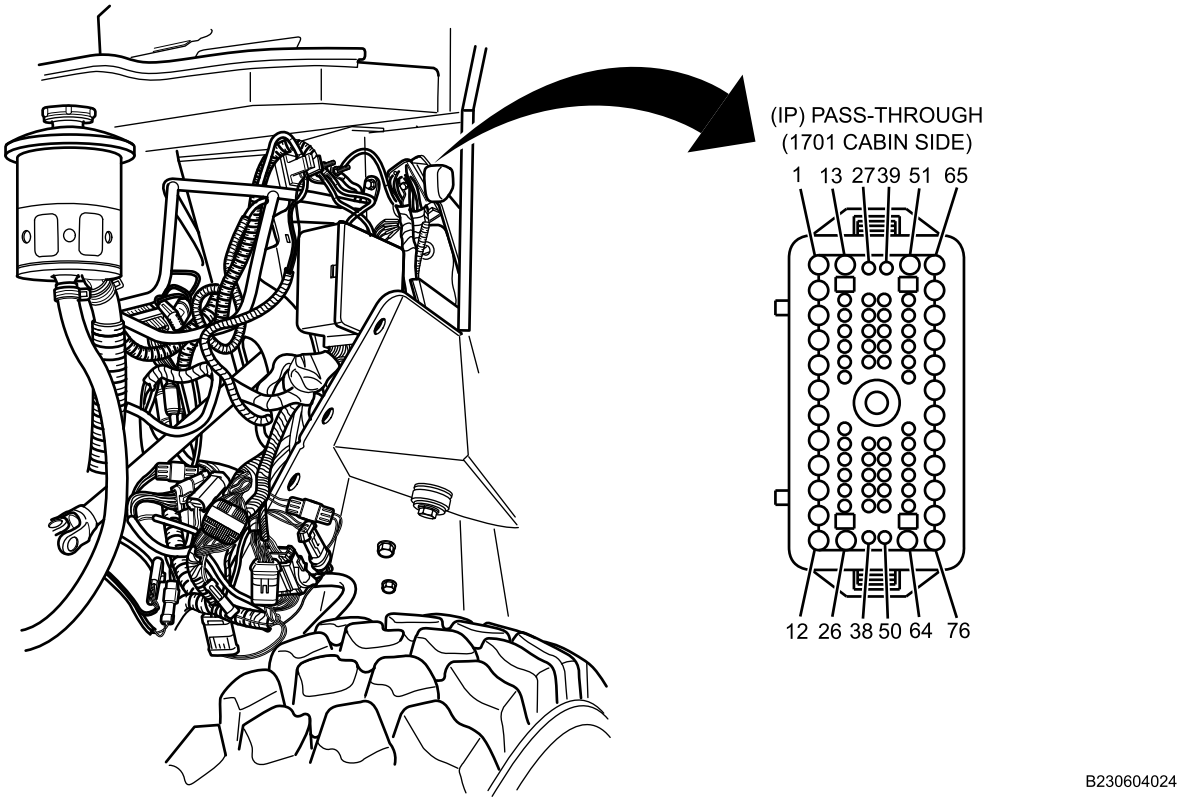


Figure 6. IP Pass-Through Connector Near Power Distribution Center (PDC) Under Hood.

19. Measure resistance between connector 1701 terminal 40 and all other connector 1701 terminals with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 65.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

20. Disconnect connector 4103/4100F (connector with 18 wires). Refer to Figure 7.

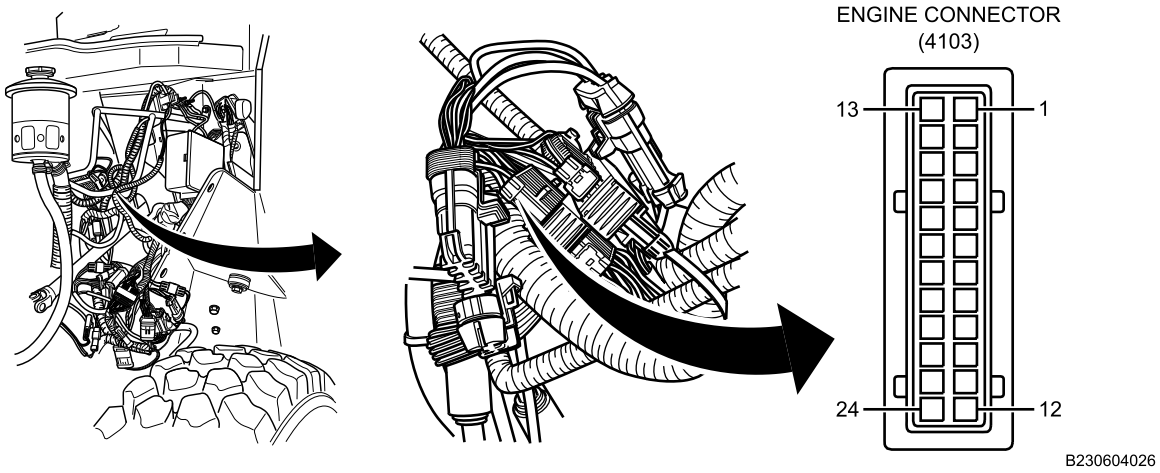


Figure 7. Engine/Dash Connector Under Hood.

21. Measure resistance between connector 4103 terminal 10 and all other connector 4103 terminals with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 64.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Disconnect ECM connector 6007. Refer to Figure 8. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

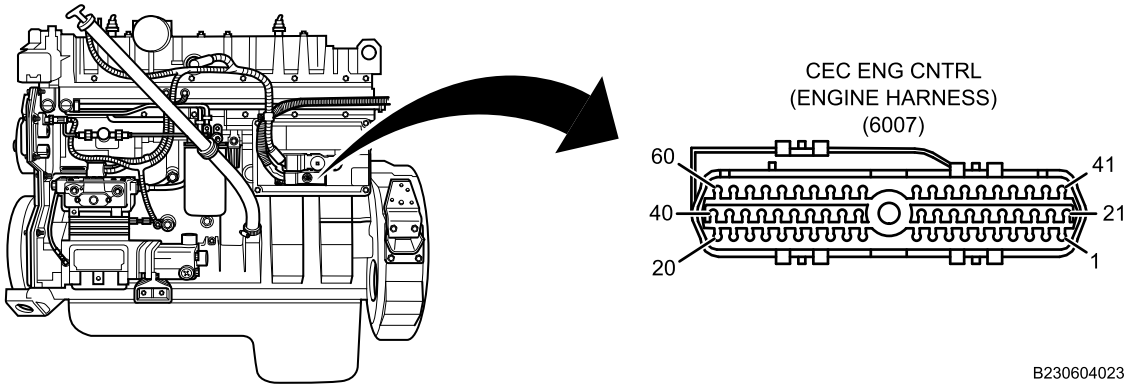


Figure 8. ECM Connector on Left Side of Engine.

23. Measure resistance between connector 4100F terminal 10 and all other connector 4100F terminals with multimeter. Refer to Figure 9.

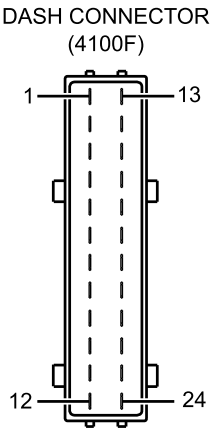


Figure 9. Connector 4100F.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 63.
NO Go to Step 61.

STEP

24. Turn ignition switch OFF (TM 9-2355-106-10).
25. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
26. Measure resistance between connector 1650 terminal F and ground with multimeter. Refer to Figure 10.

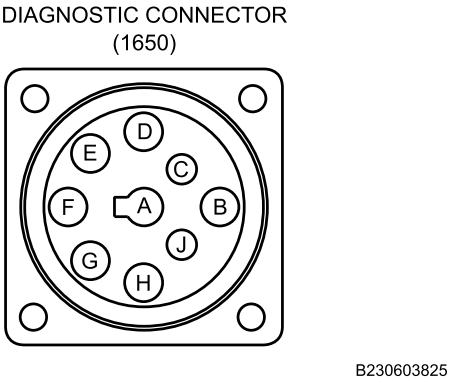


Figure 10. Connector 1650.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 47.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

27. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
28. Disconnect connector 1701. Refer to Figure 11.

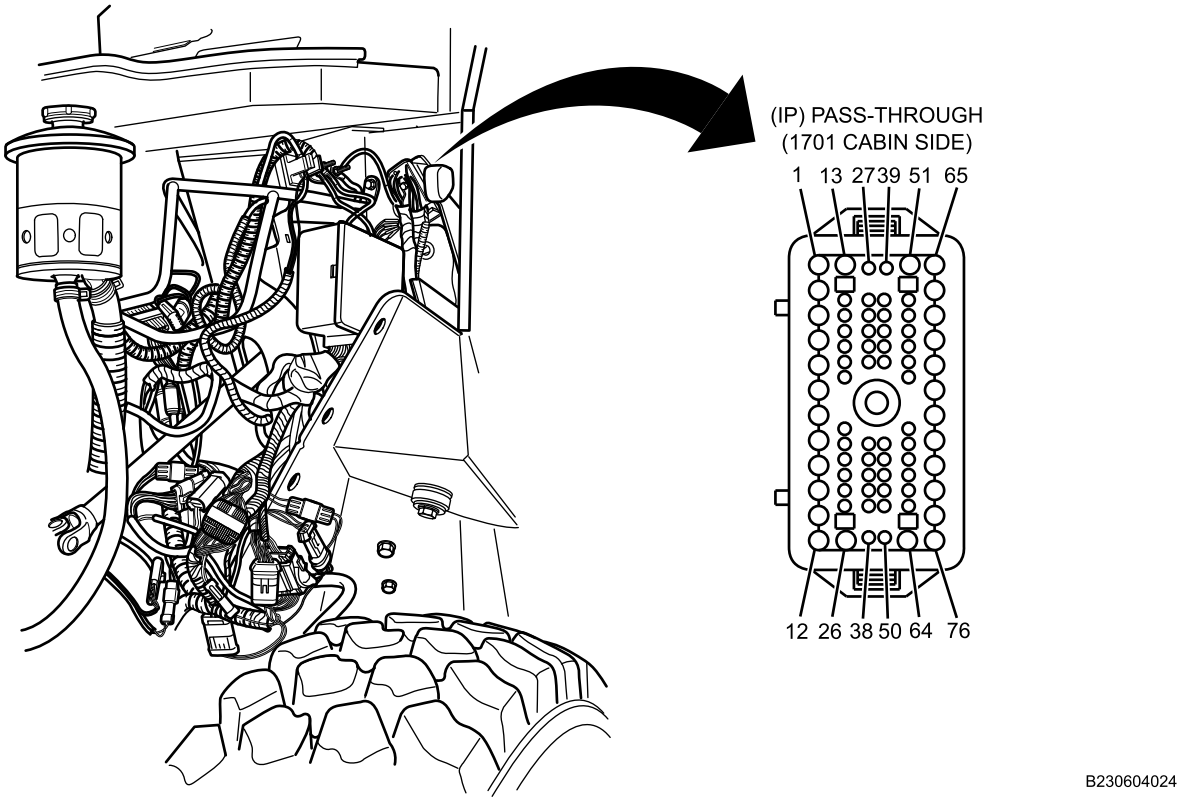


Figure 11. IP Pass-Through Connector Near Power Distribution Center (PDC) Under Hood.

29. Measure resistance between connector 1701 terminal 40 and connector 1650 terminal F with multimeter. Refer to Figure 11 and Figure 12.

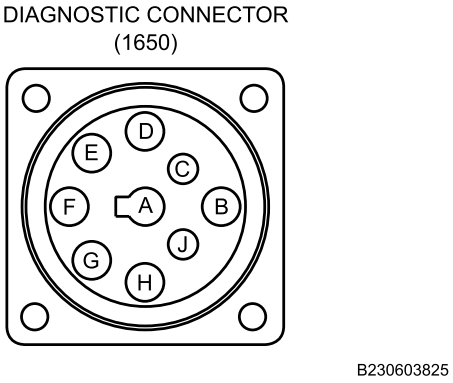


Figure 12. Connector 1650.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 65.
NO Go to next step.

STEP

30. Disconnect connector 4103/4100F (connector with 18 wires). Refer to Figure 13.

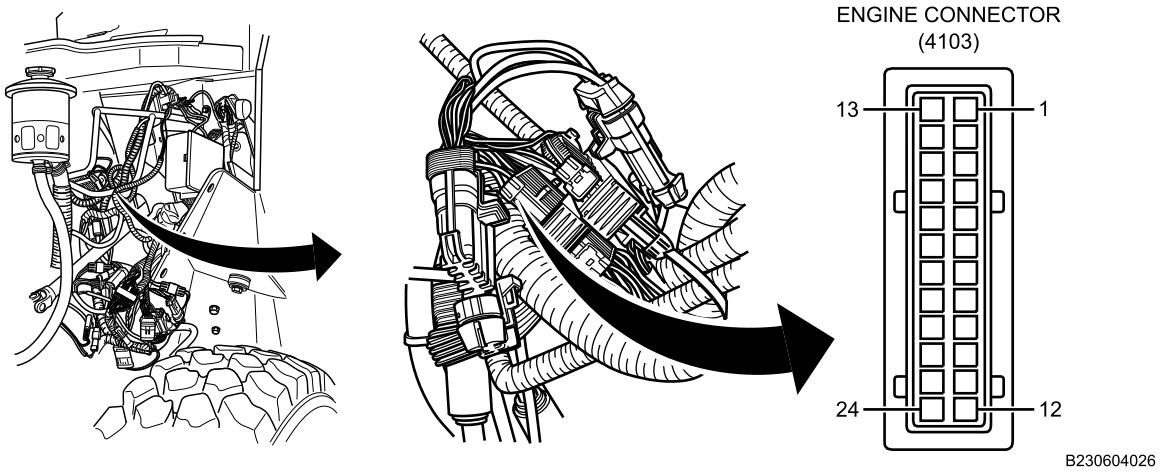


Figure 13. Engine/Dash Connector Under Hood.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

31. Measure resistance between connector 4103 terminal 10 and connector 1701 terminal 40 with multimeter. Refer to Figure 14 and Figure 15.

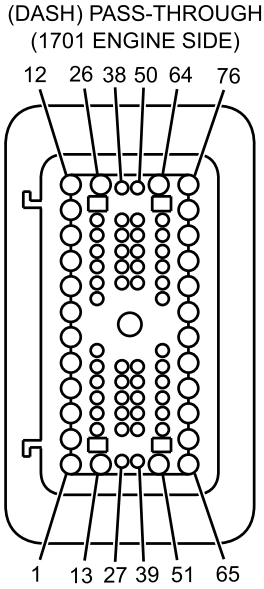


Figure 14. Connector 1701.

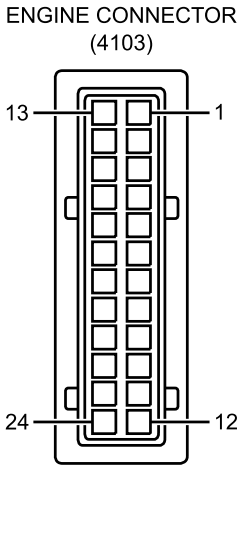


Figure 15. Connector 4103.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 64.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

32. Disconnect ECM connector 6007. Refer to Figure 16. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

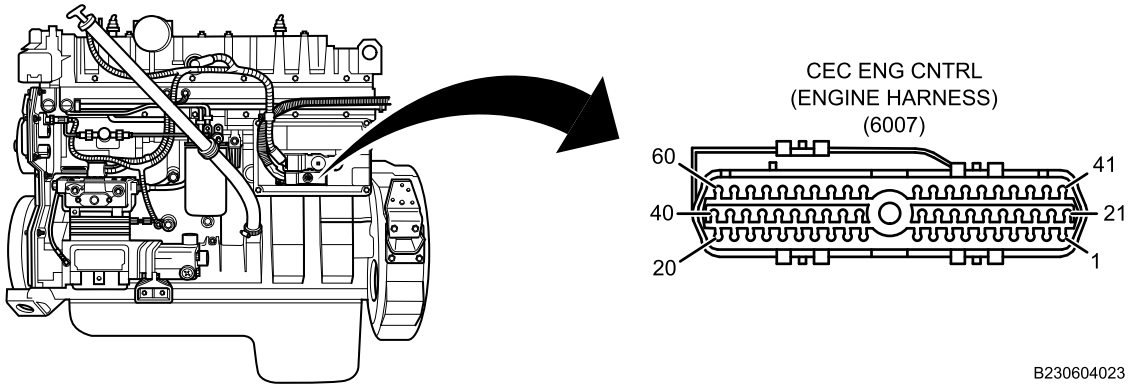


Figure 16. ECM Connector on Left Side of Engine.

33. Measure resistance between connector 6007 terminal 16 and connector 4100F terminal 10 with multimeter. Refer to Figure 16 and Figure 17.

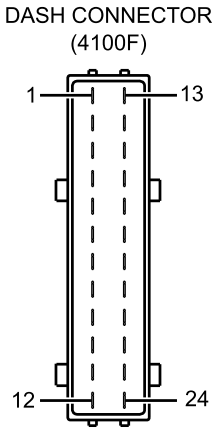


Figure 17. Connector 4100F.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 63.
NO Go to Step 66.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

34. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
35. Disconnect connector 1701. Refer to Figure 18.

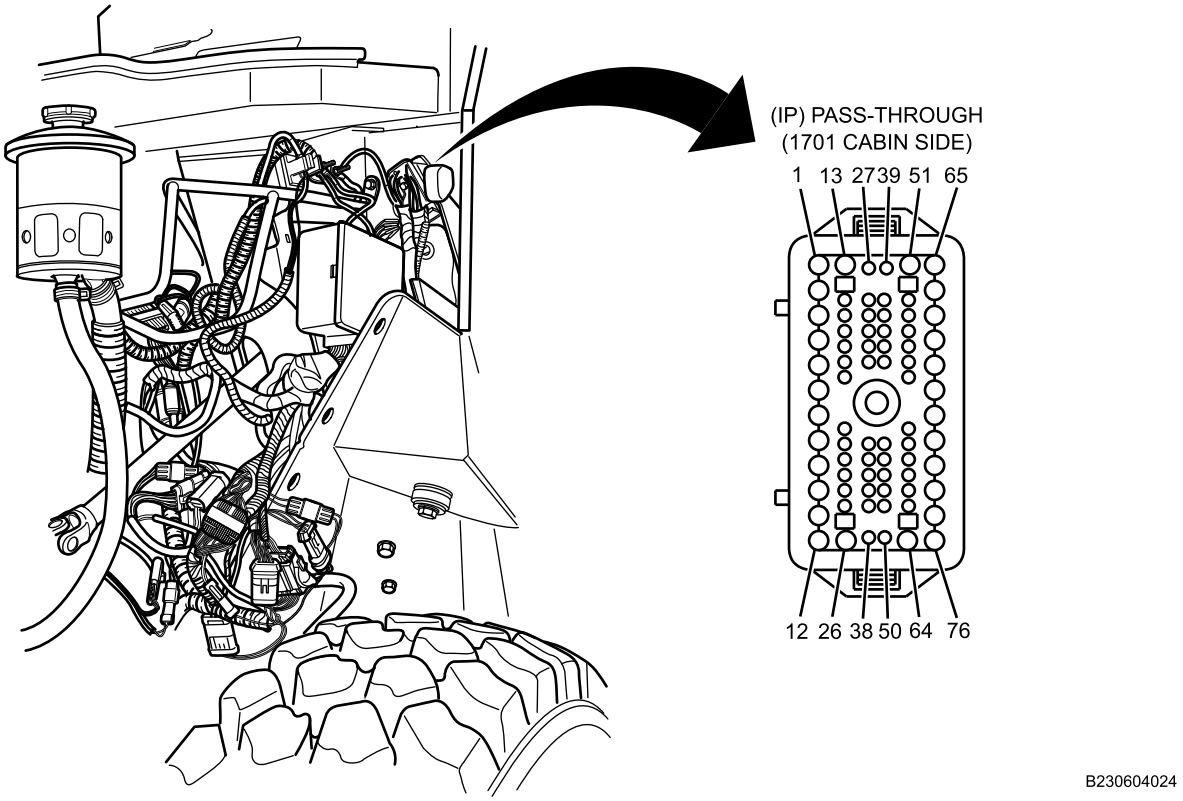


Figure 18. IP Pass-Through Connector Near Power Distribution Center (PDC) Under Hood.

36. Measure resistance between connector 1701 terminal 41 and all other connector 1701 terminals with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 65.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

37. Disconnect connector 4100F/4103 (connector with 18 wires). Refer to Figure 19.

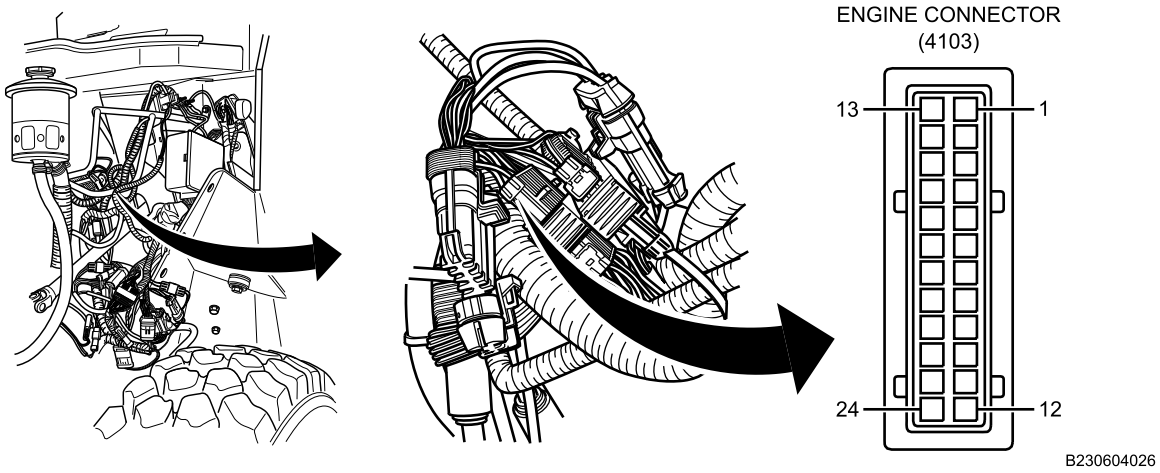


Figure 19. Engine/Dash Connector Under Hood.

38. Measure resistance between connector 4103 terminal 11 and all other connector 4103 terminals with multimeter. Refer to Figure 19.

CONDITION/INDICATION

Does multimeter less than 5 ohms for any terminal?

DECISION

YES Go to Step 64.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

39. Disconnect ECM connector 6007. Refer to Figure 20. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

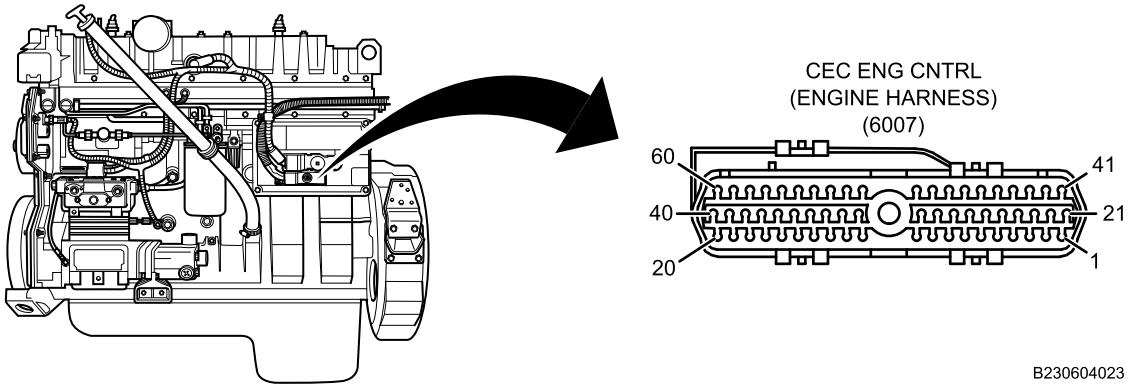


Figure 20. ECM Connector on Left Side of Engine.

40. Measure resistance between connector 4100F terminal 11 and all other connector 4100F terminals with multimeter. Refer to Figure 21.

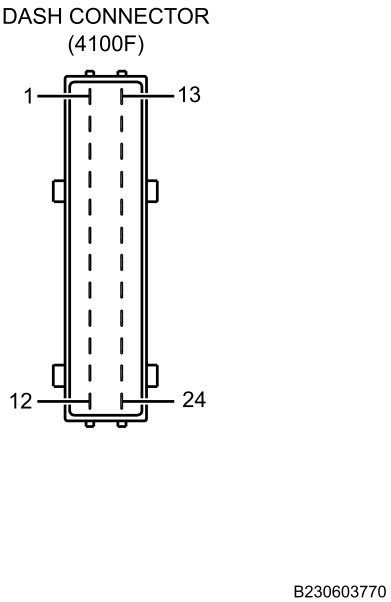


Figure 21. Connector 4100F.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 63.
NO Go to Step 62.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

41. Turn ignition switch OFF (TM 9-2355-106-10).
42. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
43. Measure resistance between connector 1650 terminal G and ground with multimeter. Refer to Figure 22.

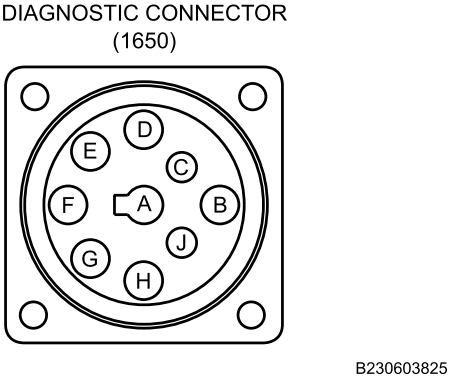


Figure 22. Connector 1650.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 54.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

44. Measure resistance between connector 1650 terminal G and connector 1701 terminal 41 with multimeter. Refer to Figure 24 and Figure 23.

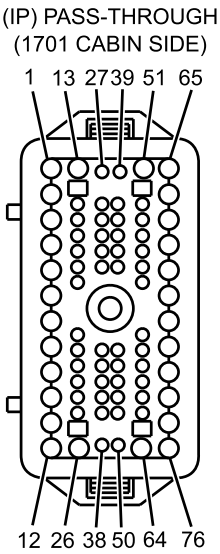


Figure 23. Connector 1701.

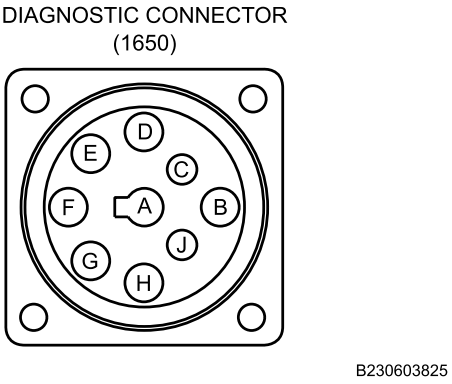


Figure 24. Connector 1650.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 65.
NO Go to next step.

STEP

45. Measure resistance between connector 1701 terminal 41 and connector 4103 terminal 11 with multimeter. Refer to Figure 25 and Figure 26.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

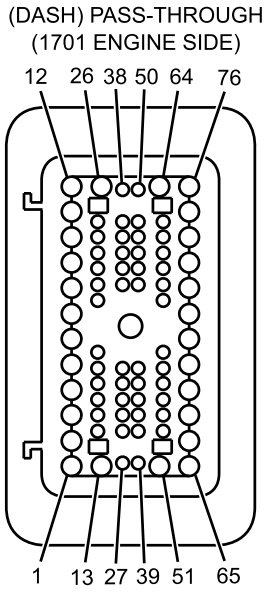


Figure 25. Connector 1701.

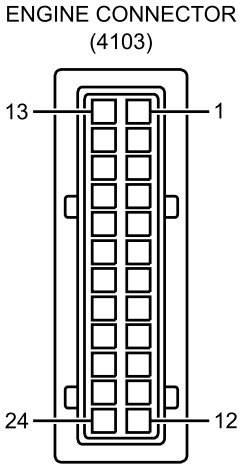


Figure 26. Connector 4103.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 64.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

46. Measure resistance between connector 6007 terminal 17 and connector 4100F terminal 11 with multimeter. Refer to Figure 27 and Figure 28.

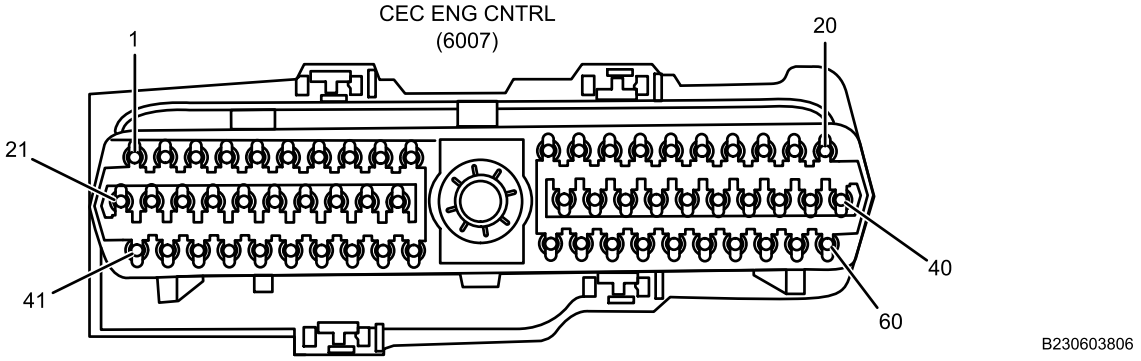


Figure 27. Connector 6007.

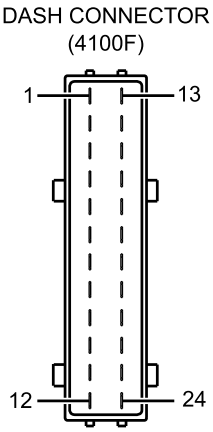


Figure 28. Connector 4100F.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 63.
NO Go to Step 66.

STEP

47. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
48. Disconnect connector 1701. Refer to Figure 29.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

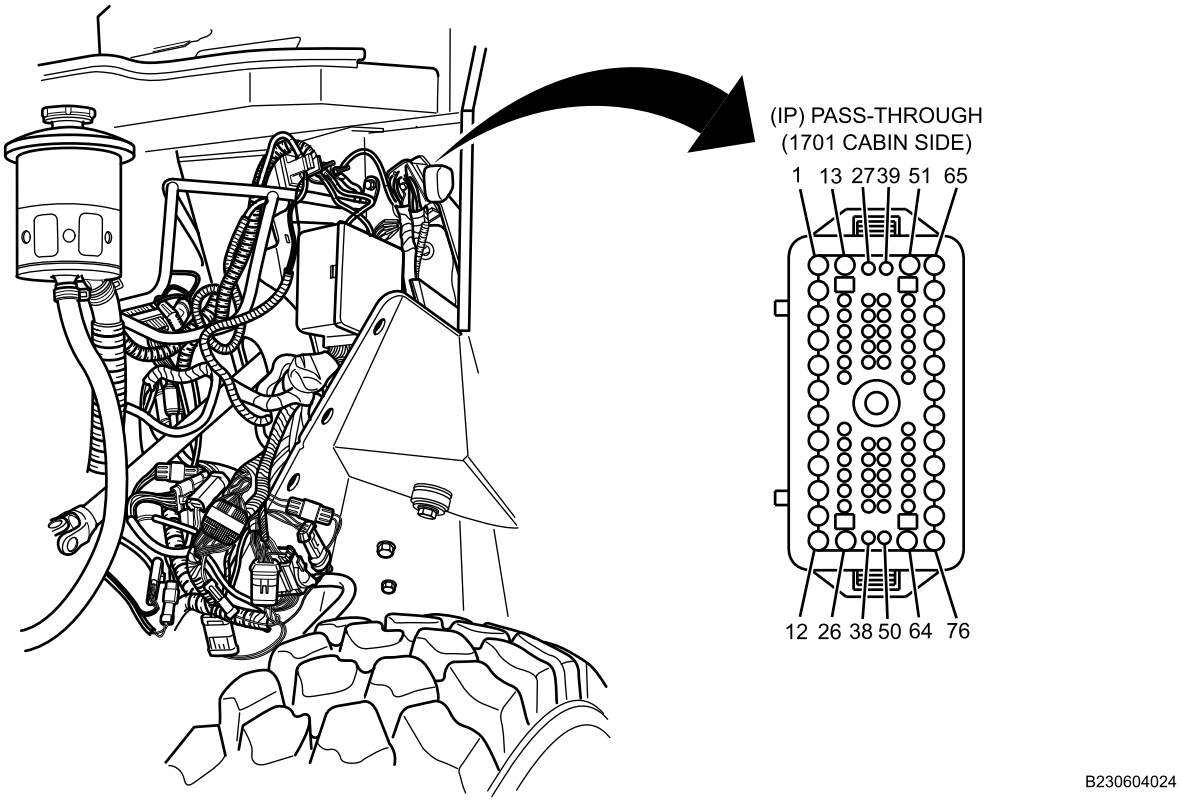


Figure 29. IP Pass-Through Connector Near Power Distribution Center (PDC) Under Hood.

49. Measure resistance between connector 1701 terminal 40 and ground with multimeter. Refer to Figure 29.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 65.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

50. Disconnect connector 4103 (connector with 18 wires). Refer to Figure 30.

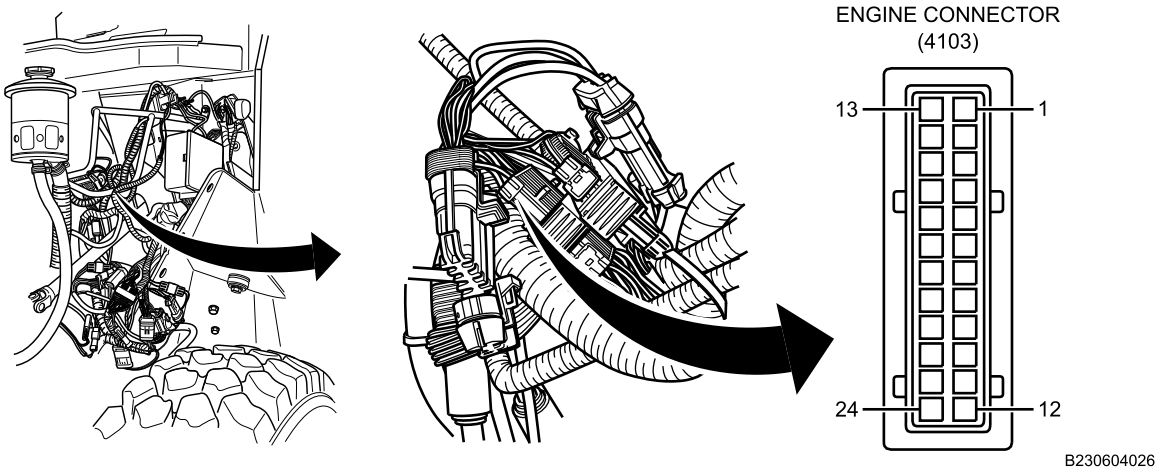


Figure 30. Engine/Dash Connector Under Hood.

51. Measure resistance between connector 4103 terminal 10 and ground with multimeter. Refer to Figure 30.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 64.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

52. Disconnect ECM connector 6007. Refer to Figure 31. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

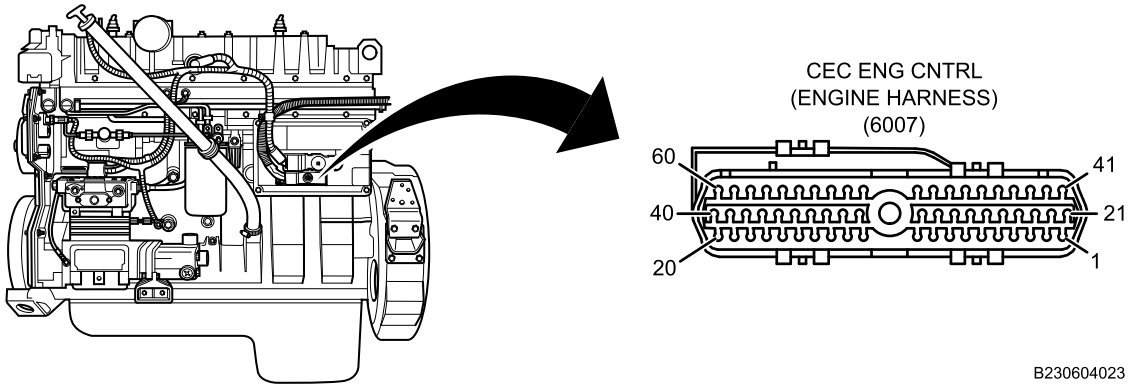


Figure 31. ECM Connector on Left Side of Engine.

53. Measure resistance between connector 6007 terminal 16 and ground with multimeter. Refer to Figure 31.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 63.
NO Go to Step 66.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

54. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
55. Disconnect connector 1701 (connector with 18 wires). Refer to Figure 32.

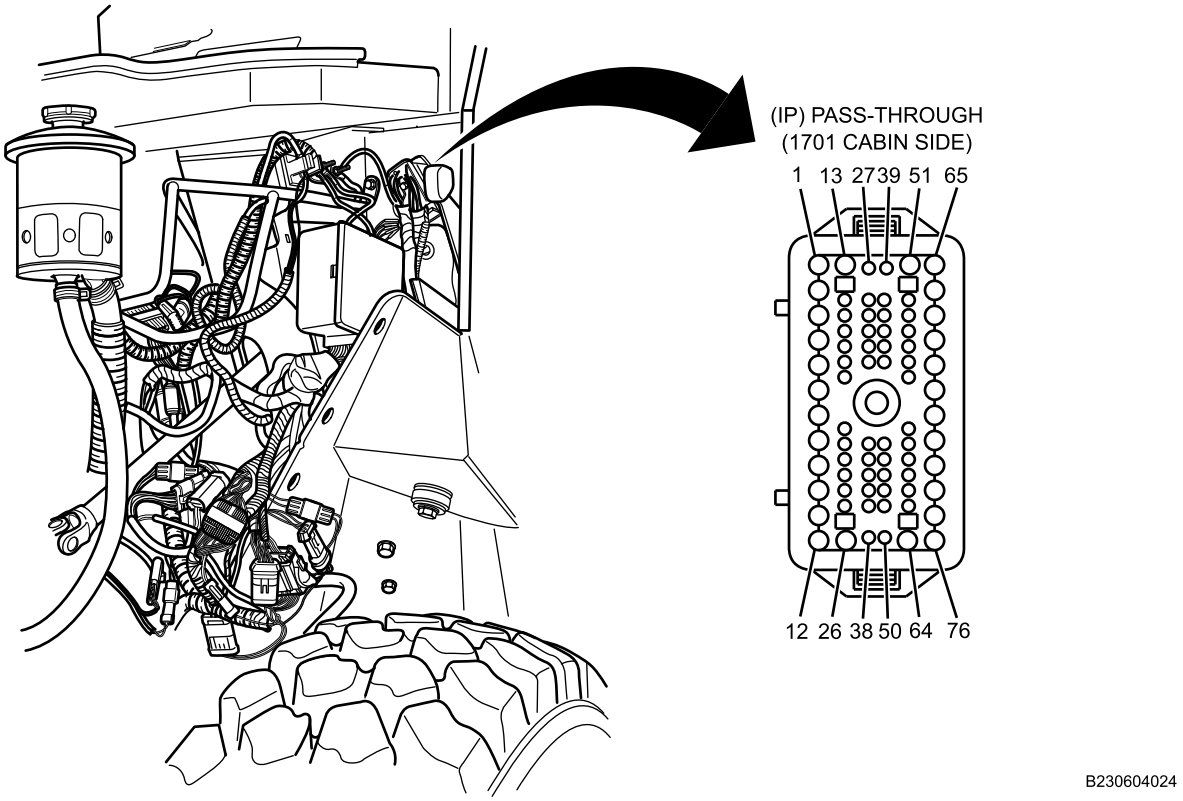


Figure 32. IP Pass-Through Connector Near Power Distribution Center (PDC) Under Hood.

56. Measure resistance between connector 1701 terminal 41 and ground with multimeter. Refer to Figure 32.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 65.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

57. Disconnect connector 4103 (connector with 18 wires). Refer to Figure 33.

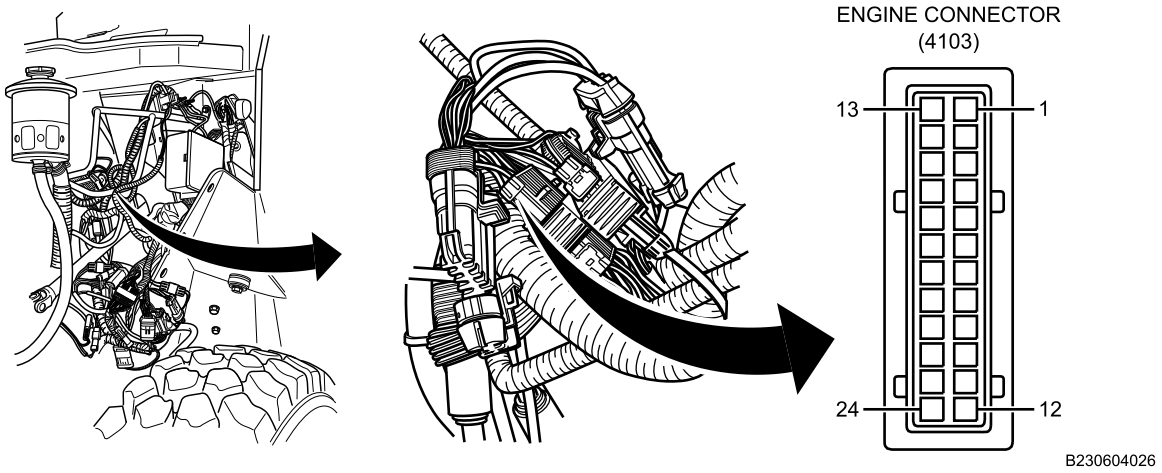


Figure 33. Engine/Dash Connector Under Hood.

58. Measure resistance between connector 4103 terminal 11 and ground with multimeter. Refer to Figure 33.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 64.
NO Go to next step.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

59. Disconnect ECM connector 6007. Refer to Figure 34. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

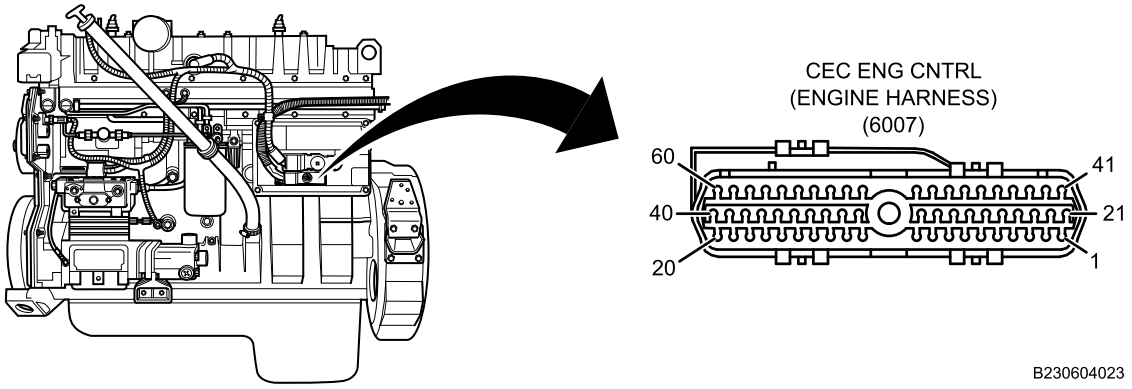


Figure 34. ECM Connector on Left Side of Engine.

60. Measure resistance between connector 6007 terminal 17 and ground with multimeter. Refer to Figure 34.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 63.
NO Go to Step 66.

STEP

61. Measure resistance between connector 6007 terminal 16 and all other connector 6007 terminals with multimeter. Refer to Figure 34.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 63.
NO Go to Step 66.

STEP

62. Measure resistance between connector 6007 terminal 17 and all other connector 6007 terminals with multimeter. Refer to Figure 34.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 63.
NO Go to Step 66.

AMERICAN TRUCKERS ASSOCIATION (ATA) COMMUNICATIONS/DATA LINK COMMUNICATIONS (DLC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 63. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 64. PDC harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 65. IP wiring harness is faulty.

ACTION

Replace IP wiring harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 66. ECM is faulty.

ACTION

Replace ECM. Refer to ECM Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0297
WP 0329
WP 0398
WP 0319
WP 0335
WP 0336
WP 0324
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Air cleaner assembly removed (WP 0257)
Instrument Panel Cluster (IPC) removed (WP 0297)

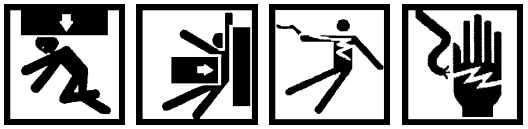
Drawings Required
WP 0789, Figure 68

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 151
- 152

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Disconnect harness connector 1808 at BAP sensor. Refer to Figure 1.

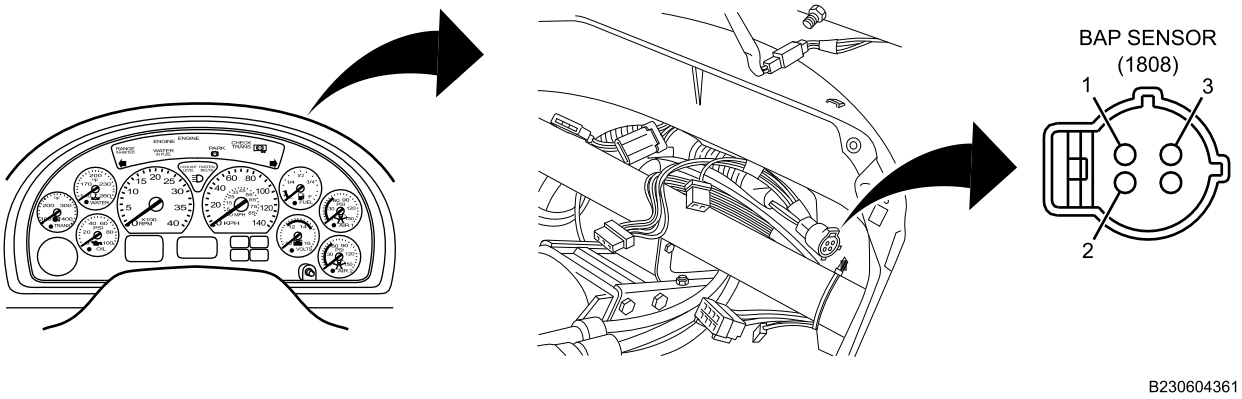


Figure 1. Barometric Pressure (BAP) Sensor.

2. Measure resistance between connector 1808 terminal 1 and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 7.
NO Go to next step.

STEP

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Measure DC voltage between connector 1808 terminal 2 and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 15.
YES Go to next step.

STEP

6. Measure DC voltage between connector 1808 terminal 3 and ground with multimeter. Refer to Figure 1.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 0.01V and 0.25V?

DECISION

YES Go to Step 91.
NO Go to Step 53.

STEP

7. Disconnect harness connector 1800. Refer to Figure 2.

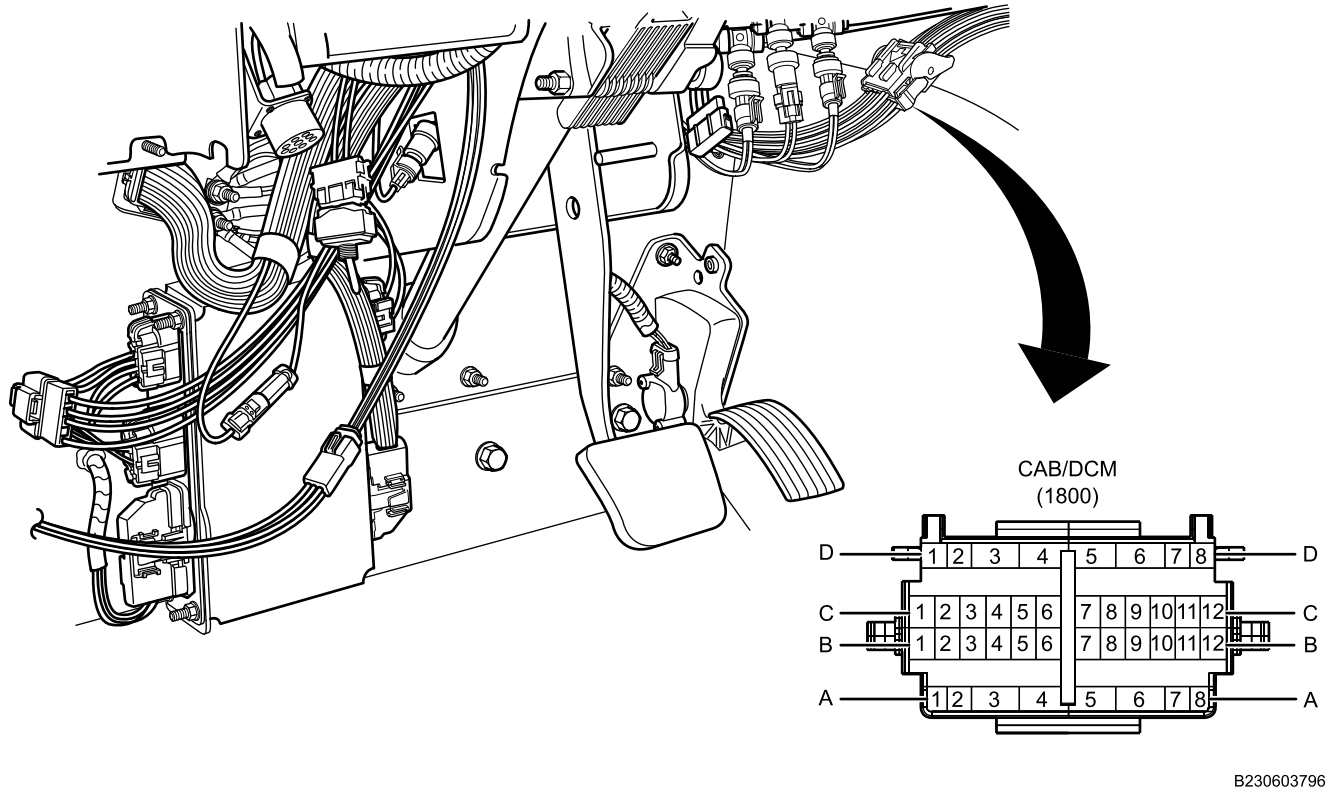


Figure 2. Below Dash.

8. Measure resistance between connector 1800 terminal B4 and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 92.
YES Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

9. Disconnect dash pass-through connector 1701. Refer to Figure 3.

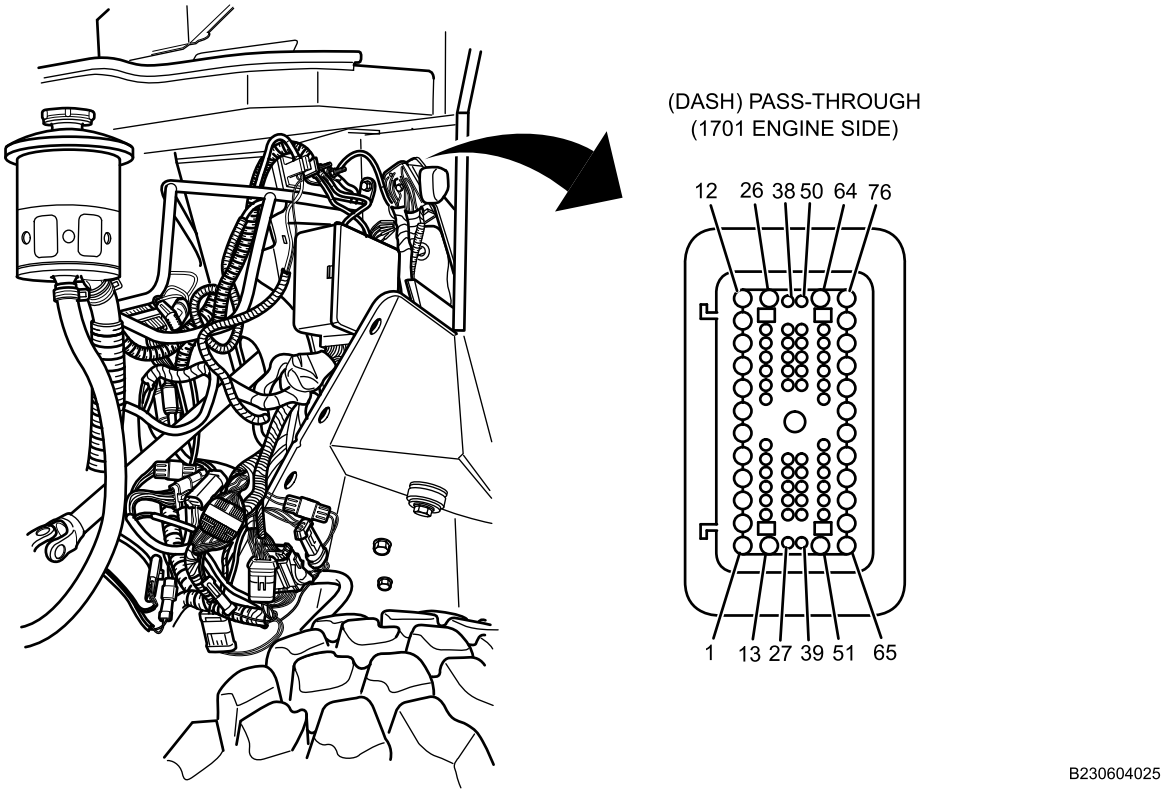


Figure 3. Dash Pass-Through.

10. Measure resistance between dash pass-through connector 1701 terminal 2 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 93.
YES Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

11. Disconnect 18-wire harness connector 4100F. Refer to Figure 4.

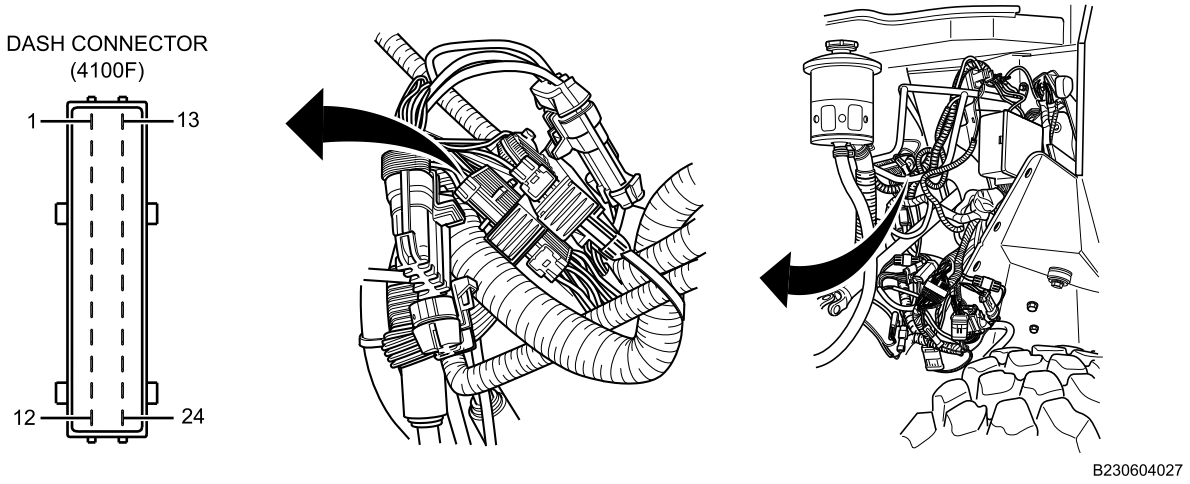


Figure 4. Below Air Filter.

12. Measure resistance between connector 4100F terminal 6 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 93.
YES Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Disconnect connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 5.

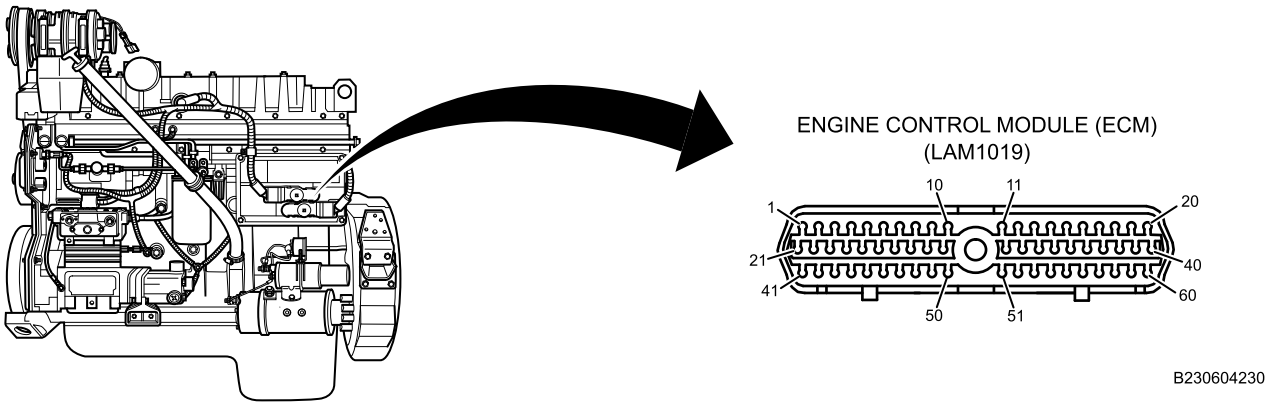


Figure 5. Engine Control Module (ECM).

14. Measure resistance between connector 4100F terminal 6 and connector LAM1019 terminal 11 with multimeter. Refer to Figure 4 and Figure 5.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 95.
NO Go to Step 96.

STEP

15. Turn ignition switch OFF (TM 9-2355-106-10).
16. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
17. Disconnect 18-wire harness connector 4103. Refer to Figure 6.

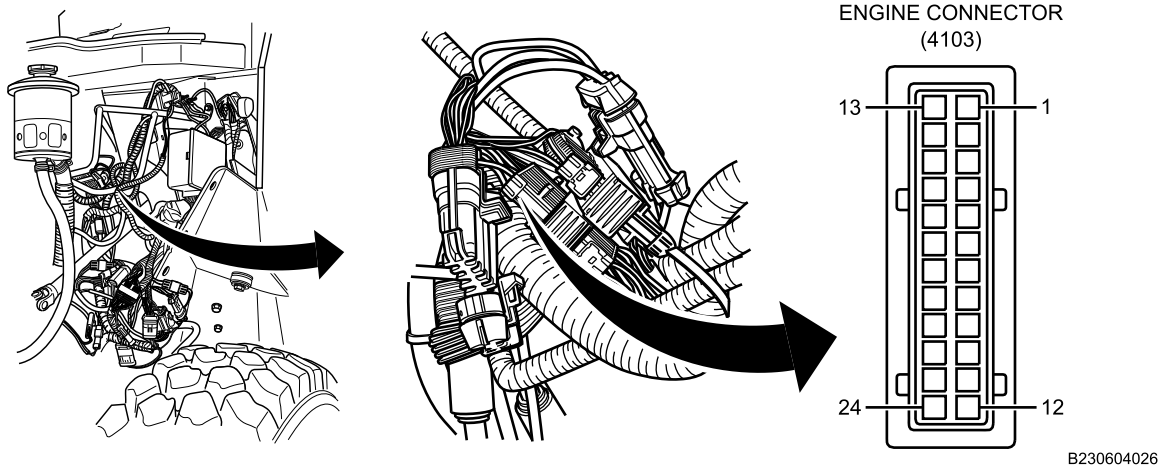


Figure 6. Below Air Filter.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

18. Turn MAIN POWER switch ON (TM 9-2355-106-10).
19. Turn ignition switch ON (TM 9-2355-106-10).
20. Measure DC voltage between connector 4103 terminal 4 and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 33.
YES Go to next step.

STEP

21. Turn ignition switch OFF (TM 9-2355-106-10).
22. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
23. Disconnect harness connector 1800. Refer to Figure 7.

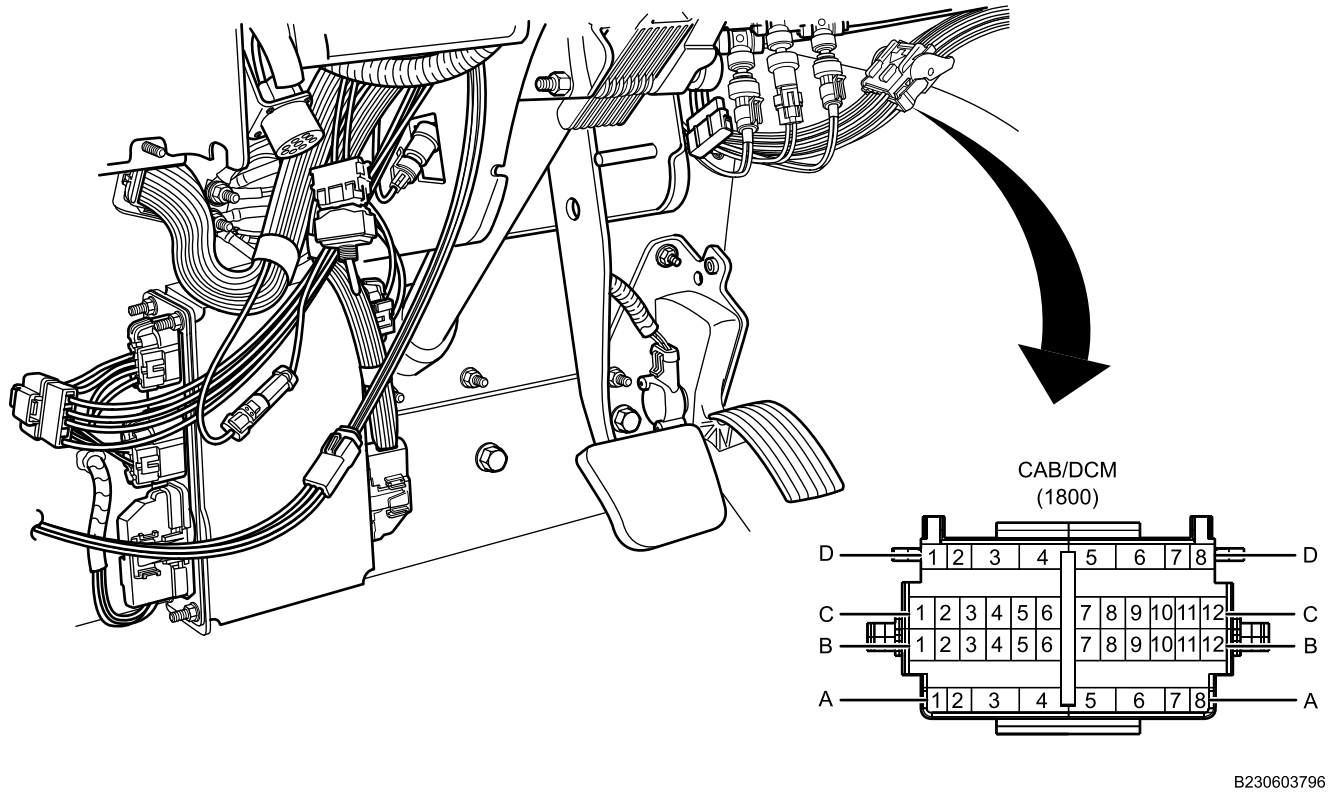


Figure 7. Below Dash.

24. Turn MAIN POWER switch ON (TM 9-2355-106-10).
25. Turn ignition switch ON (TM 9-2355-106-10).
26. Measure DC voltage between connector 1800 terminal C5 and ground with multimeter. Refer to Figure 7.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 92.
YES Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

27. Turn ignition switch OFF (TM 9-2355-106-10).
28. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
29. Disconnect dash pass-through connector 1701. Refer to Figure 8.

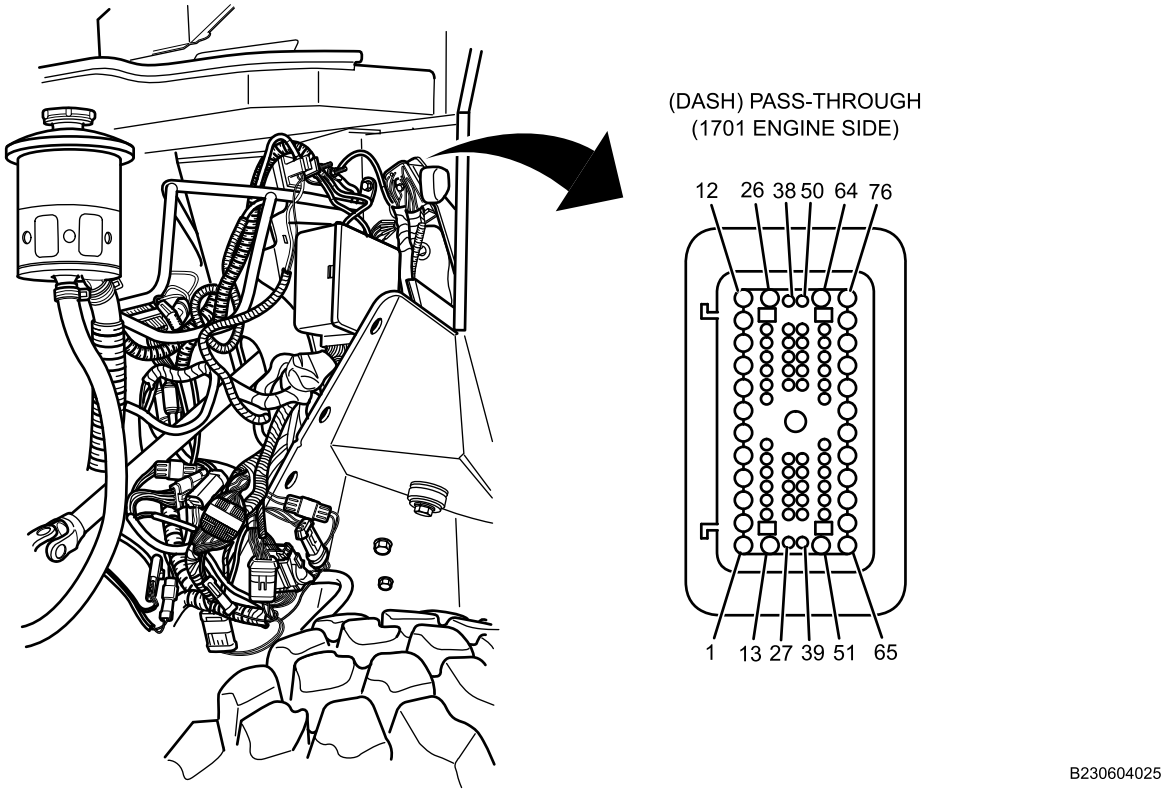


Figure 8. Dash Pass-Through.

30. Turn MAIN POWER switch ON (TM 9-2355-106-10).
31. Turn ignition switch ON (TM 9-2355-106-10).
32. Measure DC voltage between dash pass-through connector 1701 terminal 5 and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 93.
YES Go to Step 94.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

33. Turn ignition switch OFF (TM 9-2355-106-10).
34. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
35. Measure resistance between connector 4103 terminals 4 and 6, and connector 4103 terminal 4 and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read OL in each test?

DECISION

NO Go to Step 37.
YES Go to next step.

STEP

36. Measure resistance between connector 4103 terminal 4 and connector 1808 terminal 2 with multimeter. Refer to Figure 9 and Figure 10.

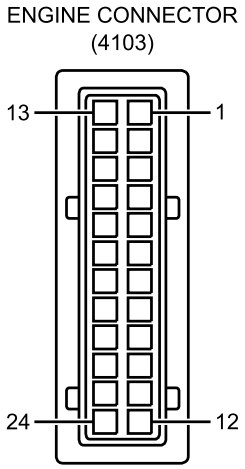


Figure 9. Engine Connector 4103.

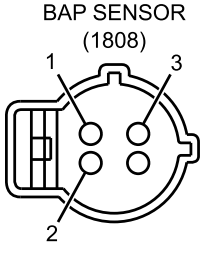


Figure 10. Connector 1808.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 41.
YES Go to Step 45.

STEP

37. Disconnect harness connector 1800. Refer to Figure 11.

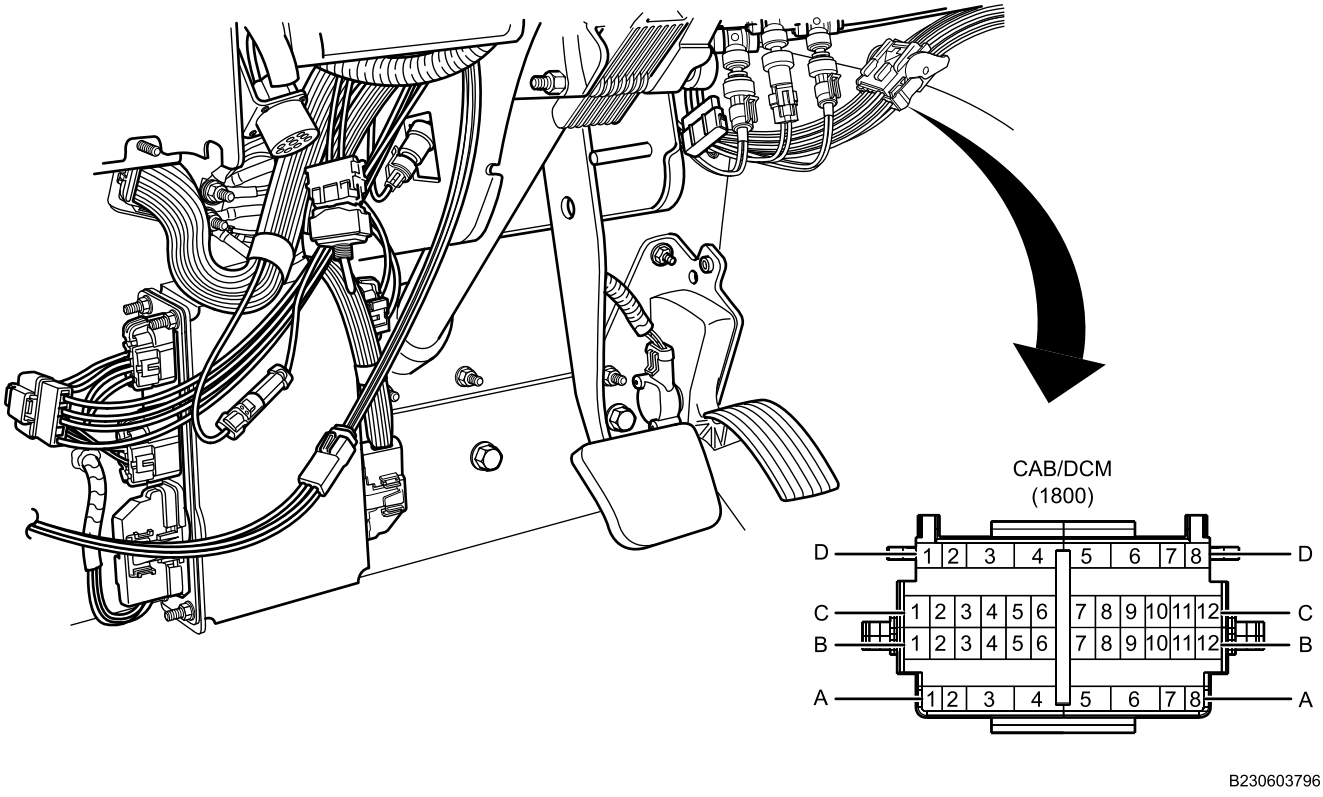


Figure 11. Below Dash.

38. Measure resistance between connector 1800 terminals C5 and B4, and connector 1800 terminal C5 and ground with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read OL in each test?

DECISION

YES Go to Step 92.
NO Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

39. Disconnect dash pass-through connector 1701. Refer to Figure 12.

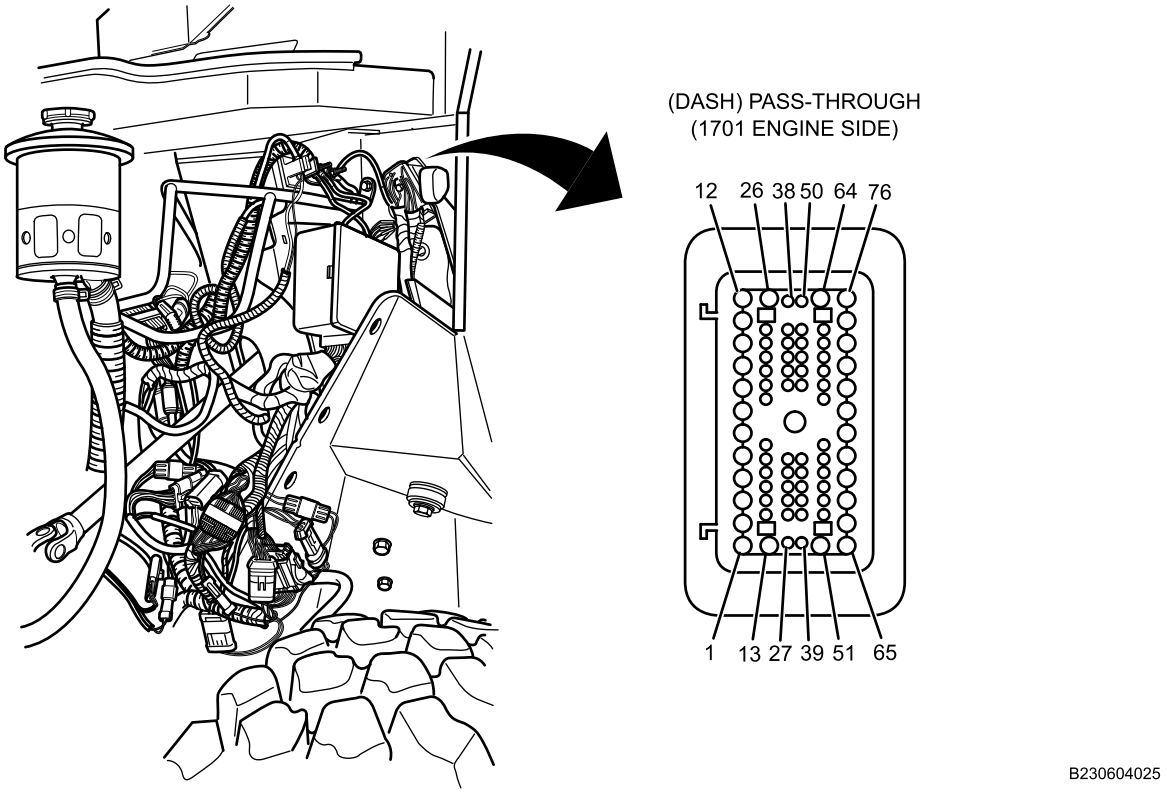


Figure 12. Dash Pass-Through.

40. Measure resistance between dash pass-through 1701 terminals 5 and 2, and dash pass-through 1701 terminal 5 and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read OL in each test?

DECISION

YES Go to Step 93.
NO Go to Step 94.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

41. Disconnect harness connector 1800. Refer to Figure 13.

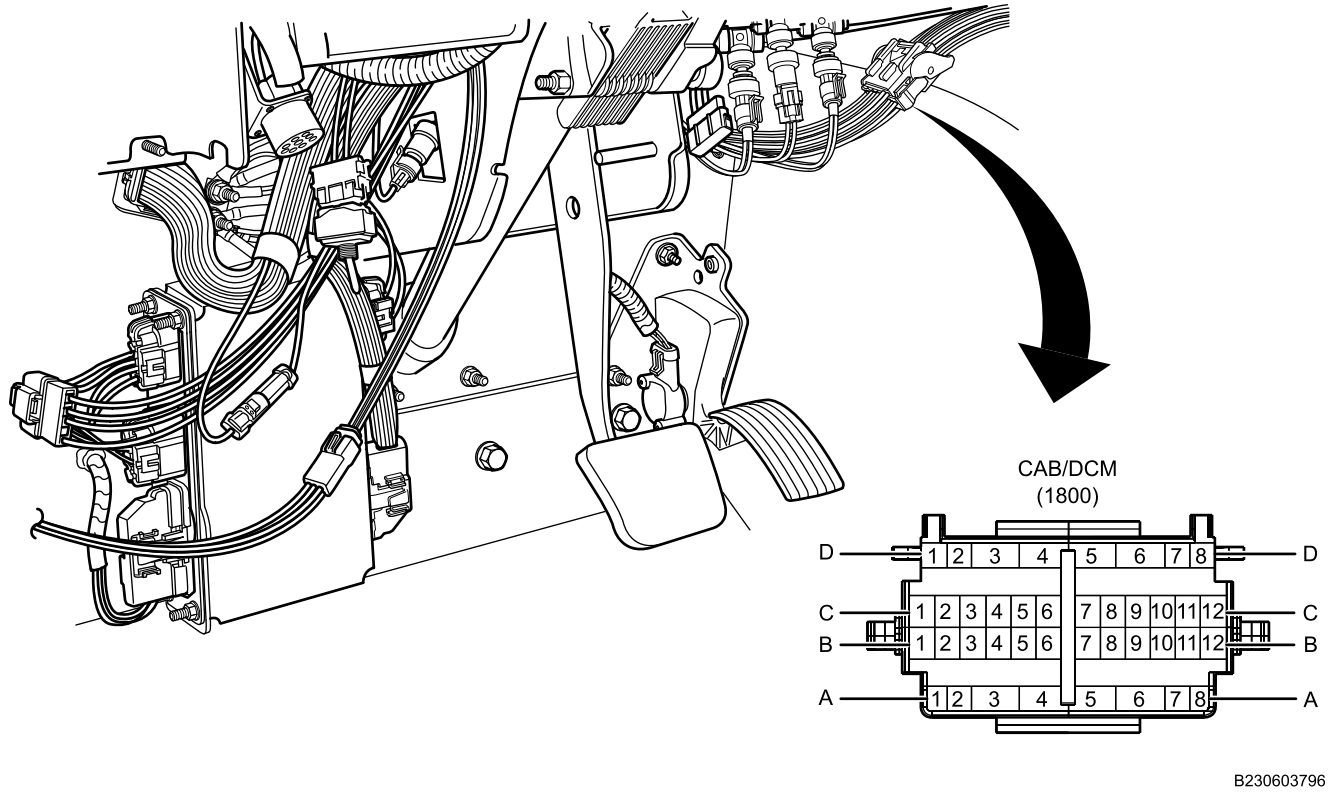


Figure 13. Below Dash.

42. Measure resistance between connector 4103 terminal 4 and connector 1800 terminal C5 with multimeter. Refer to Figure 14 and Figure 13.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

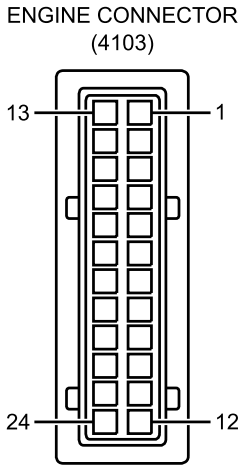


Figure 14. Engine Connector 4103.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 92.
NO Go to next step.

STEP

43. Disconnect dash pass-through connector 1701. Refer to Figure 15.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

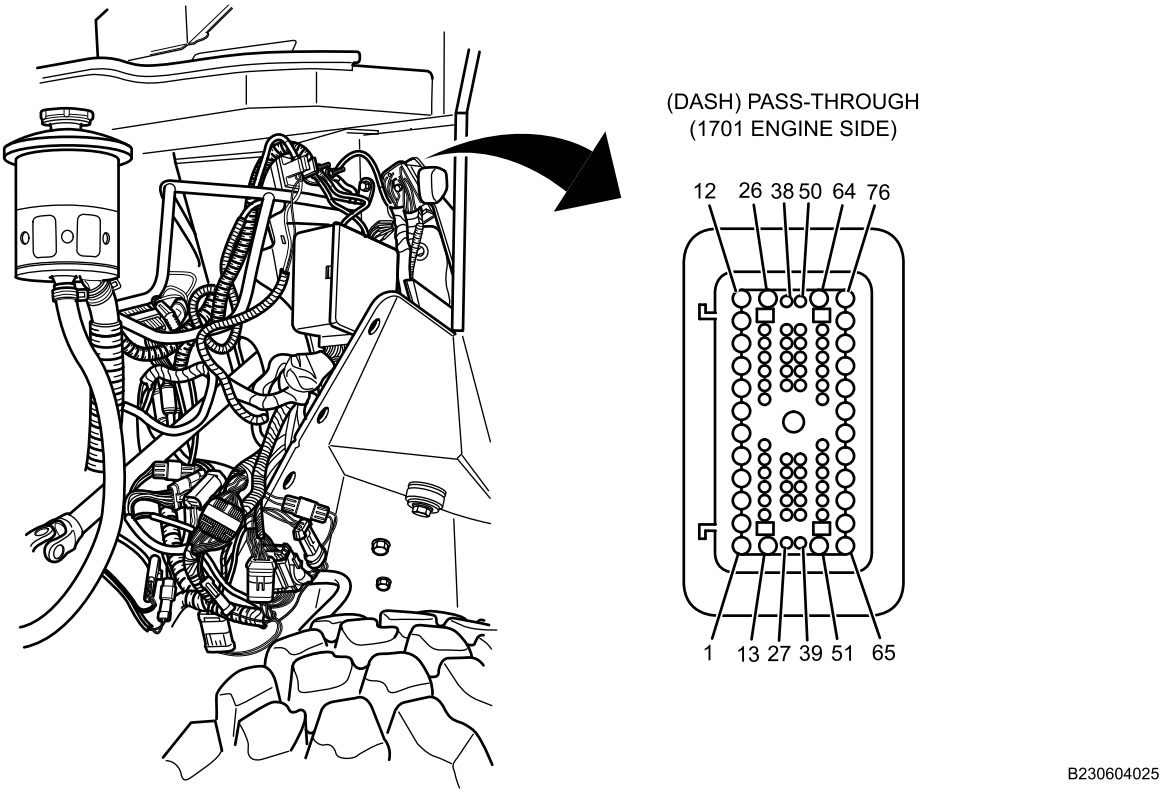


Figure 15. Dash Pass-Through.

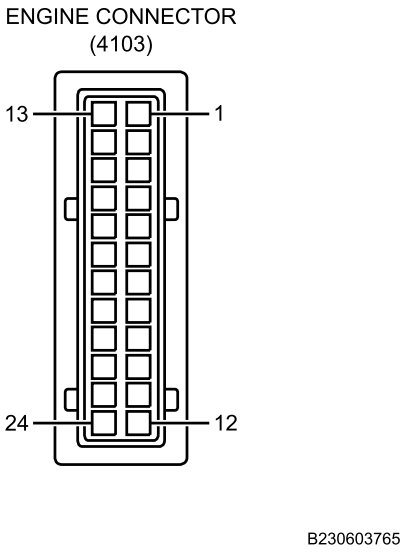


Figure 16. Engine Connector 4103.

44. Measure resistance between dash pass-through connector 1701 terminal 5 and connector 4103 terminal 4 with multimeter. Refer to Figure 15 and Figure 16.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 93.
NO Go to Step 94.

STEP

45. Disconnect connector LAM1019. Refer to Figure 17. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

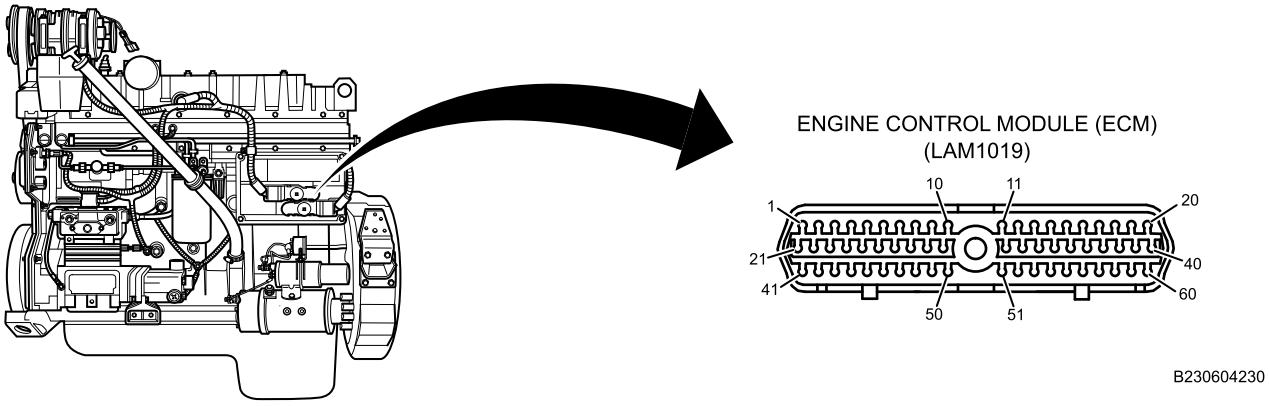


Figure 17. Engine Control Module (ECM).

46. Turn MAIN POWER switch ON (TM 9-2355-106-10).
47. Turn ignition switch ON (TM 9-2355-106-10).
48. Measure DC voltage between 18-wire connector 4100F terminal 4 and ground with multimeter. Refer to Figure 18.

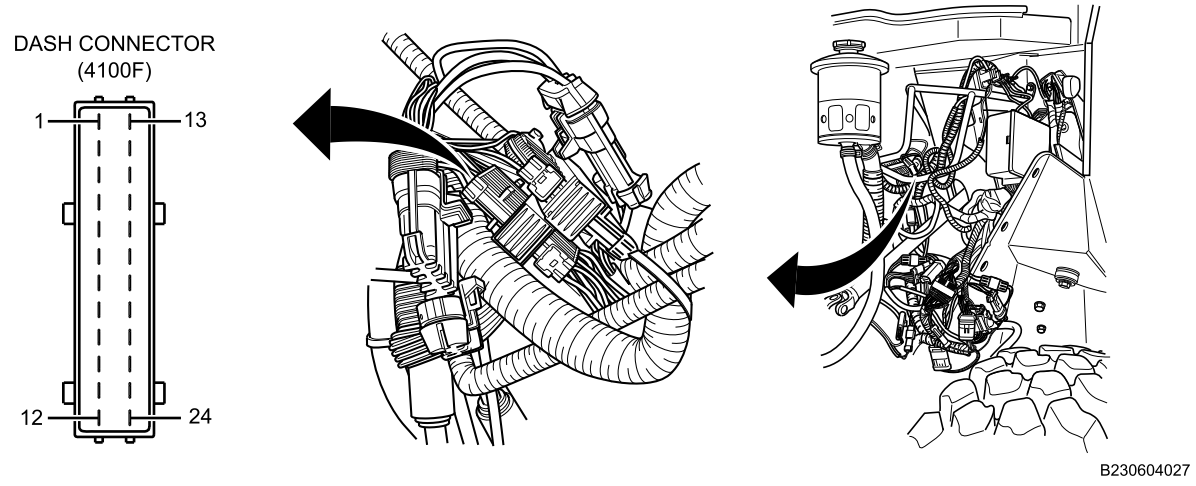


Figure 18. Below Air Filter.

CONDITION/INDICATION

Does multimeter read more than 0V?

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 95.
NO Go to next step.

STEP

49. Turn ignition switch OFF (TM 9-2355-106-10).
50. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
51. Measure resistance between connector 4100F terminals 4 and 6, and connector 4100F terminal 4 and ground with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read OL in each test?

DECISION

NO Go to Step 95.
YES Go to next step.

STEP

52. Measure resistance between connector 4100F terminal 4 and connector LAM1019 terminal 3 with multimeter. Refer to Figure 18 and Figure 19.

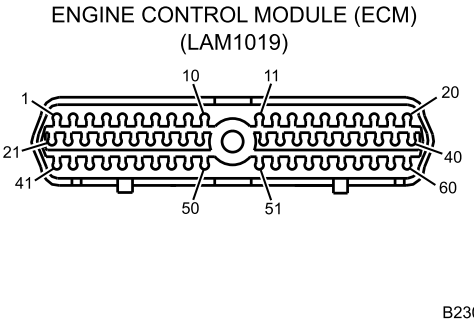


Figure 19. Connector LAM1019.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 95.
YES Go to Step 96.

STEP

53. Turn ignition switch OFF (TM 9-2355-106-10).
54. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
55. Disconnect 18-wire harness connector 4103. Refer to Figure 20.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

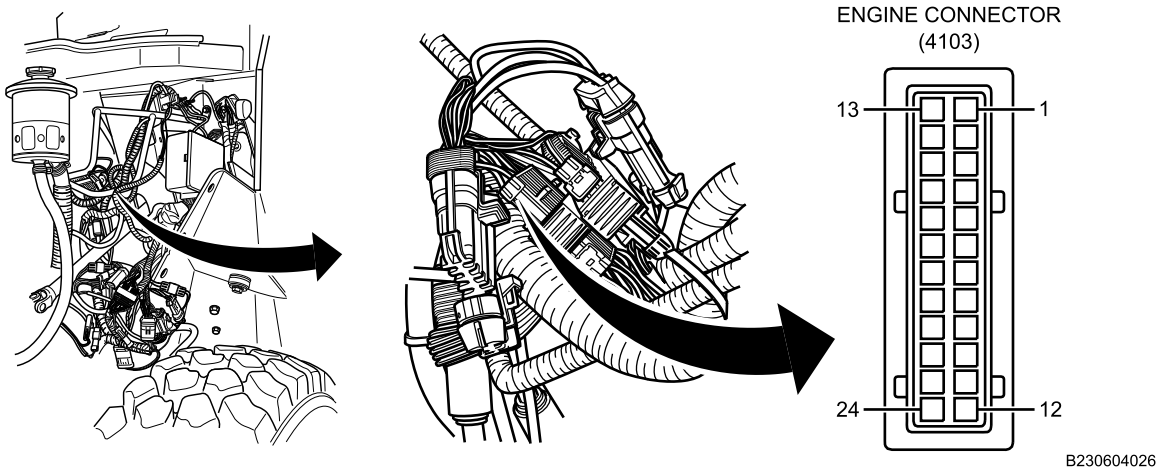


Figure 20. Below Air Filter.

56. Turn MAIN POWER switch ON (TM 9-2355-106-10).
57. Turn ignition switch ON (TM 9-2355-106-10).
58. Measure DC voltage between connector 4103 terminal 3 and ground with multimeter. Refer to Figure 20.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 71.
YES Go to next step.

STEP

59. Turn ignition switch OFF (TM 9-2355-106-10).
60. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

61. Disconnect harness connector 1800. Refer to Figure 21

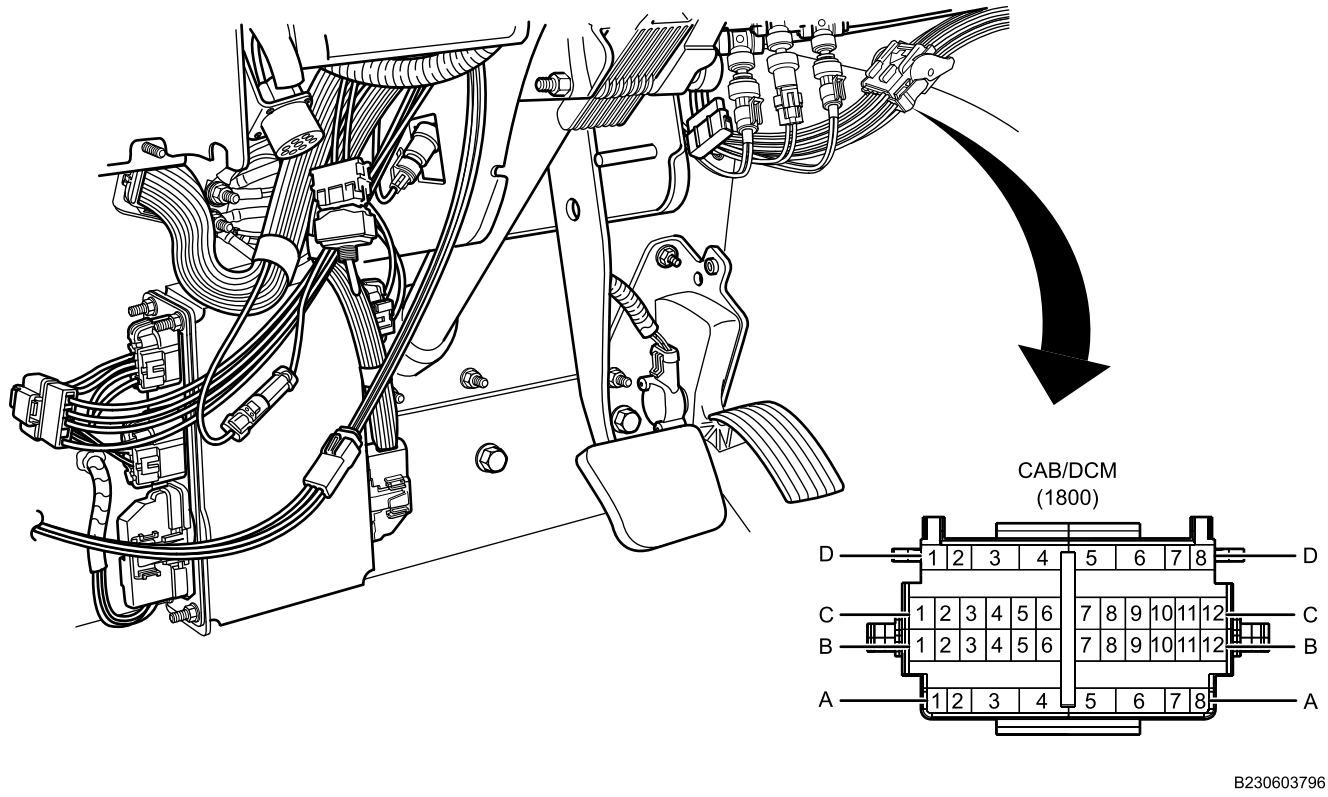


Figure 21. Below Dash.

62. Turn MAIN POWER switch ON (TM 9-2355-106-10).
63. Turn ignition switch ON (TM 9-2355-106-10).

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

64. Measure DC voltage between connector 4103 terminal 3 and ground with multimeter. Refer to Figure 22.

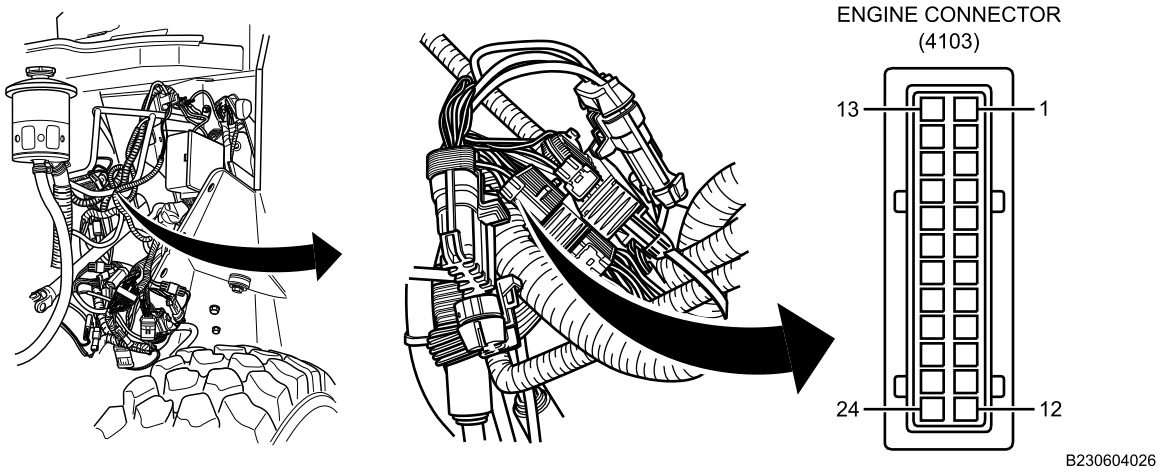


Figure 22. Below Air Filter.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 92.
YES Go to next step.

STEP

65. Turn ignition switch OFF (TM 9-2355-106-10).
66. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

67. Disconnect dash pass-through connector 1701. Refer to Figure 23.

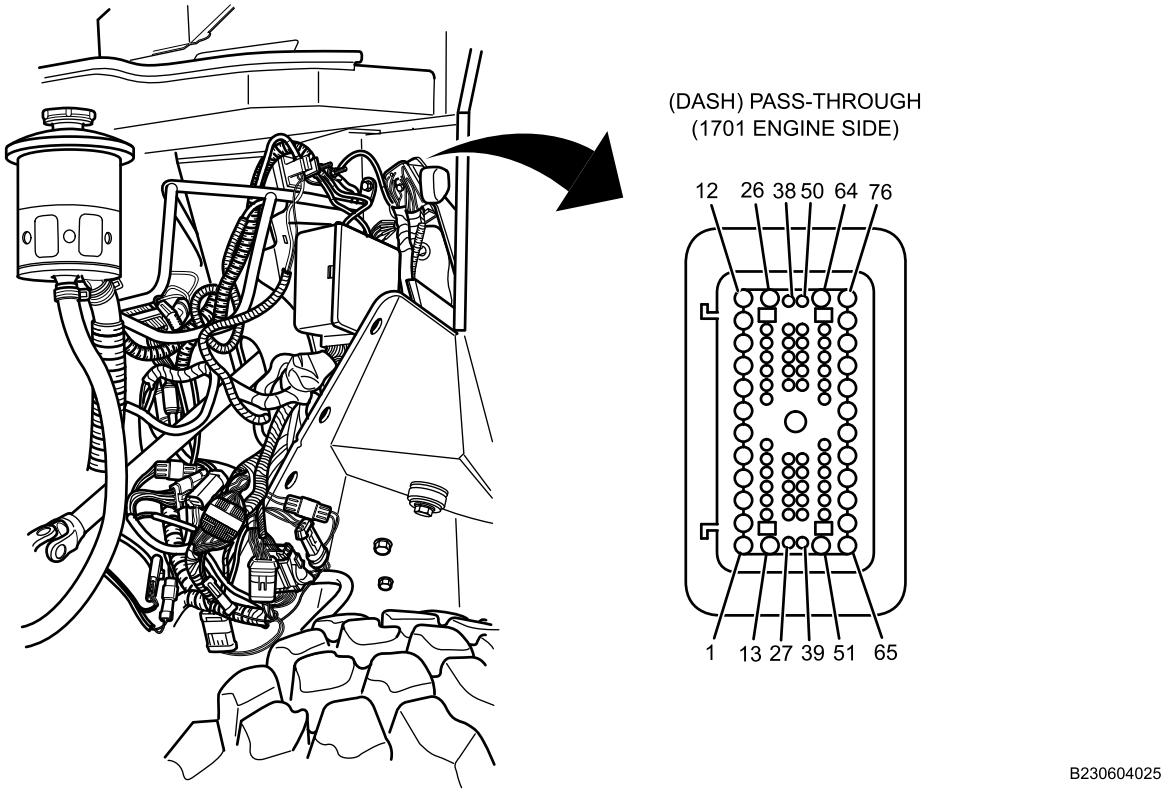


Figure 23. Dash Pass-Through.

68. Turn MAIN POWER switch ON (TM 9-2355-106-10).
69. Turn ignition switch ON (TM 9-2355-106-10).
70. Measure DC voltage between instrument panel connector 1701 terminal 7 and ground with multimeter. Refer to Figure 23.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 94.
YES Go to Step 93.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

71. Turn ignition switch OFF (TM 9-2355-106-10).
72. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
73. Measure resistance between connector 4103 terminals 3 and 6, and 4103 terminal 3 and ground with multimeter. Refer to Figure 24.

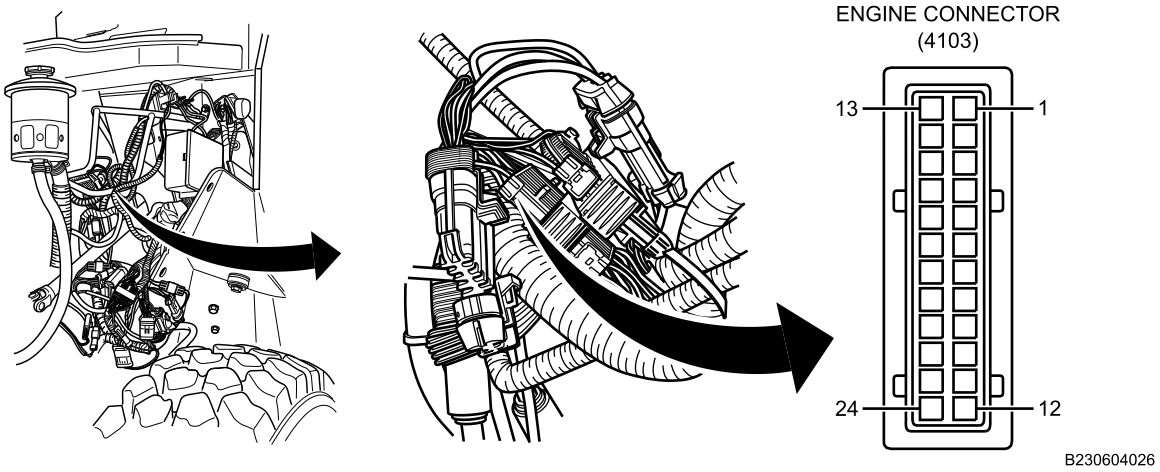


Figure 24. Below Air Filter.

CONDITION/INDICATION

Does multimeter read OL in each test?

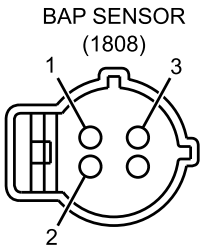
DECISION

NO Go to Step 75.
YES Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

74. Measure resistance between connector 4103 terminal 3 and connector 1808 terminal 3 with multimeter. Refer to Figure 24 and Figure 25.



B230603875

Figure 25. Connector 1808.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 79.
YES Go to Step 83.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

75. Disconnect harness connector 1800. Refer to Figure 26.

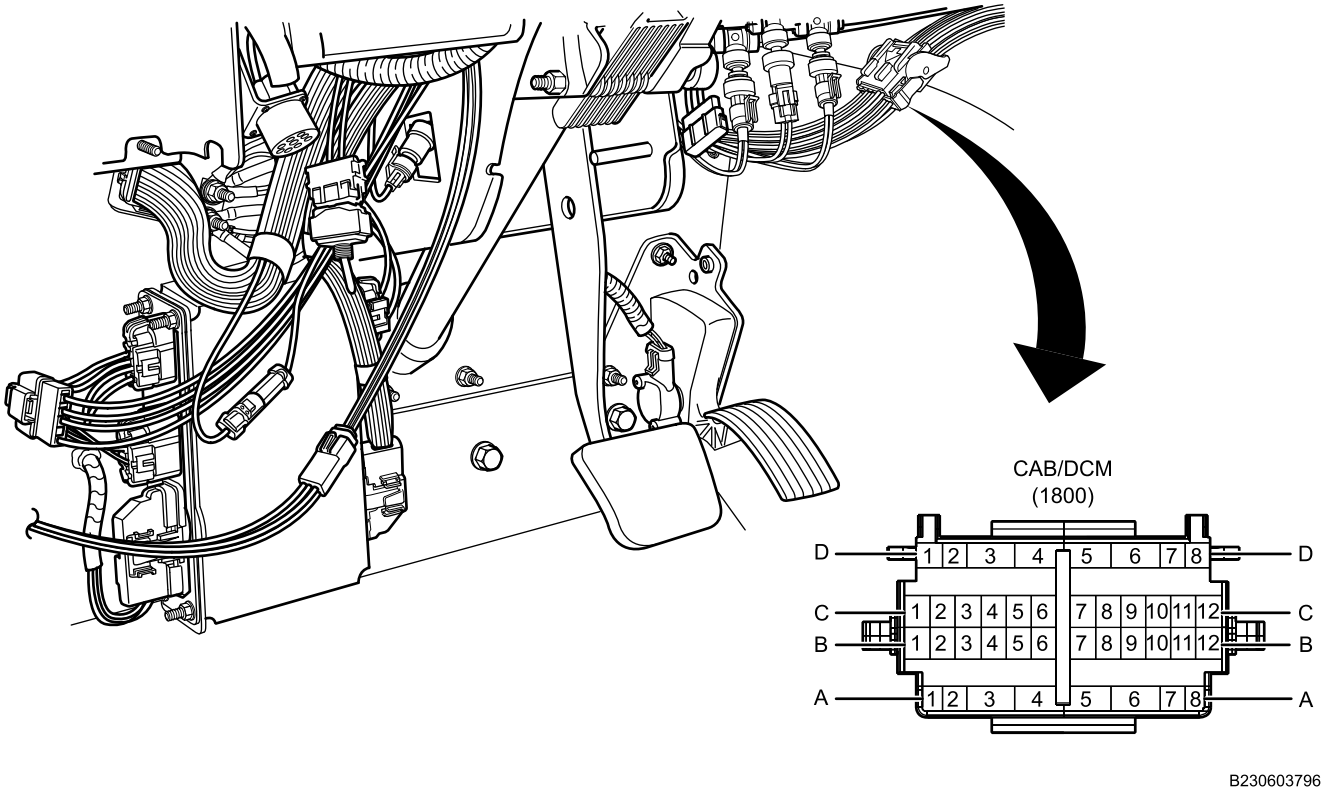


Figure 26. Below Dash.

76. Measure resistance between connector 1800 terminals C10 and B4, and connector 1800 terminal C10 and ground with multimeter. Refer to Figure 26.

CONDITION/INDICATION

Does multimeter read OL in each test?

DECISION

YES Go to Step 92.
NO Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

77. Disconnect dash pass-through connector 1701. Refer to Figure 27.

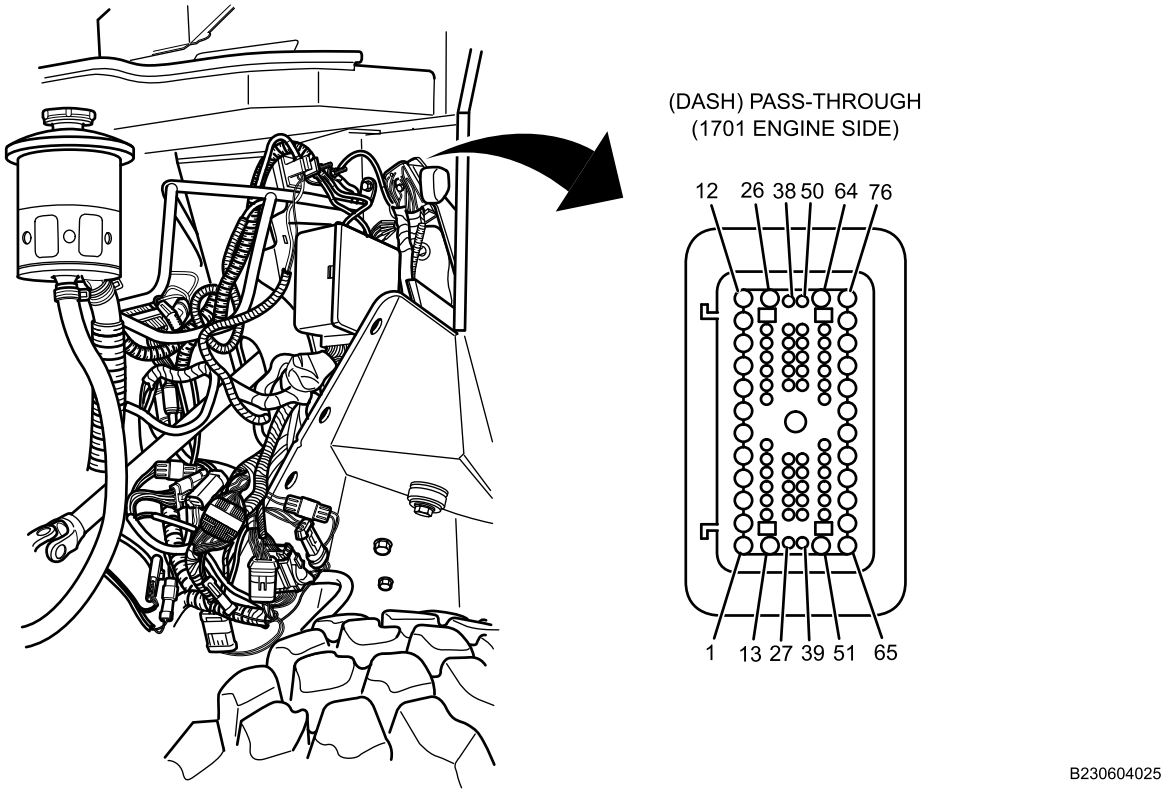


Figure 27. Dash Pass-Through.

78. Measure resistance between dash pass-through 1701 terminals 7 and 2, and dash pass-through 1701 terminal 7 and ground with multimeter. Refer to Figure 27.

CONDITION/INDICATION

Does multimeter read OL in each test?

DECISION

YES Go to Step 93.
NO Go to Step 94.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

79. Disconnect harness connector 1800. Refer to Figure 28.

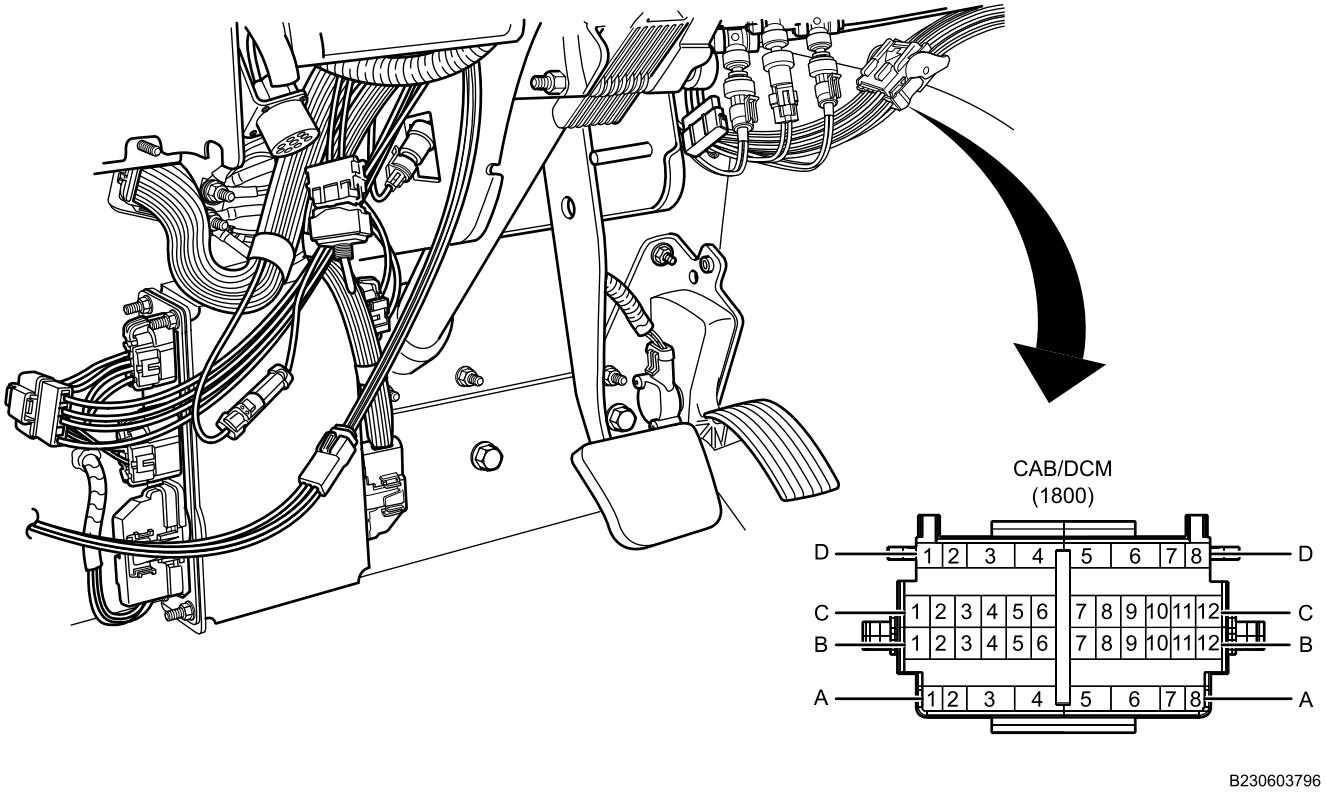


Figure 28. Below Dash.

80. Measure resistance between connector 4103 terminal 3 and connector 1800 terminal C10 with multimeter. Refer to Figure 29 and Figure 28.

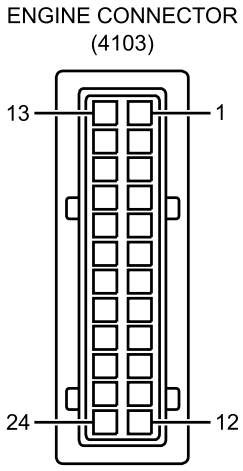


Figure 29. Connector 4103.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 92.
NO Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

81. Disconnect dash pass-through connector 1701. Refer to Figure 30.

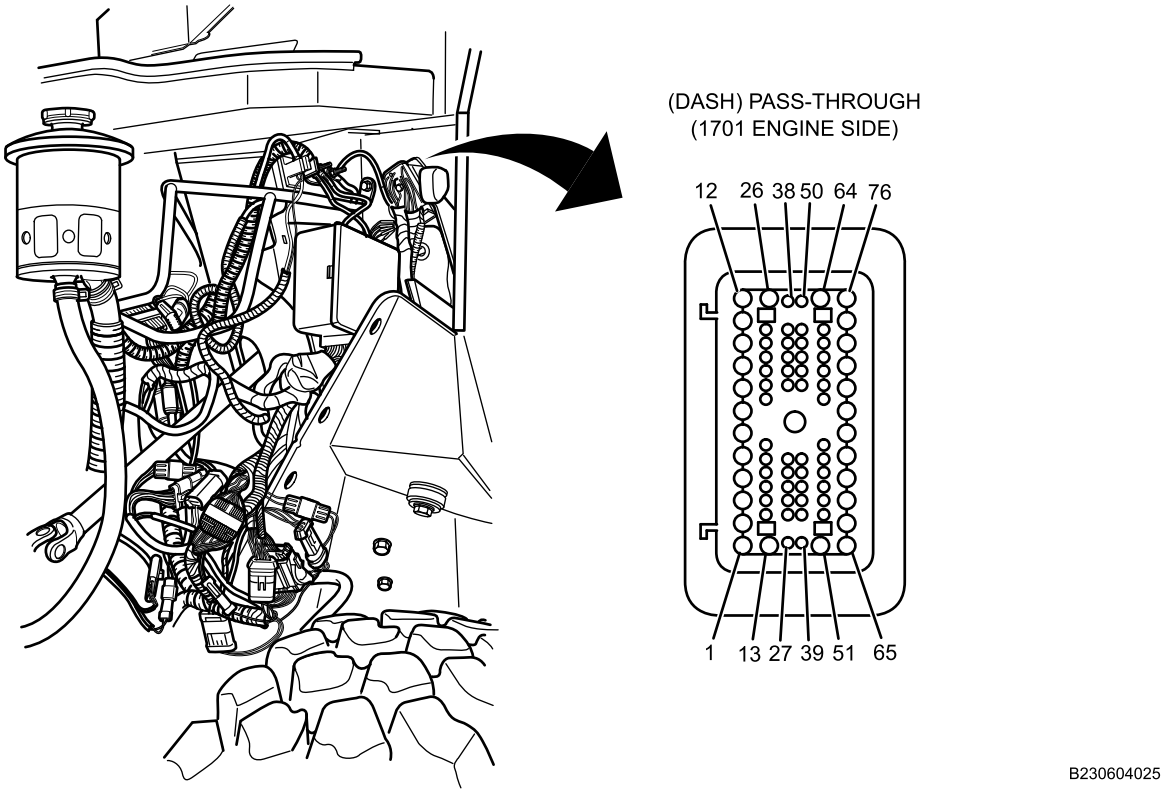


Figure 30. Dash Pass-Through.

82. Measure resistance between dash pass-through connector 1701 terminal 7 and connector 4103 terminal 3 with multimeter. Refer to Figure 30 and Figure 29.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 93.
NO Go to Step 94.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

83. Disconnect connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 31.

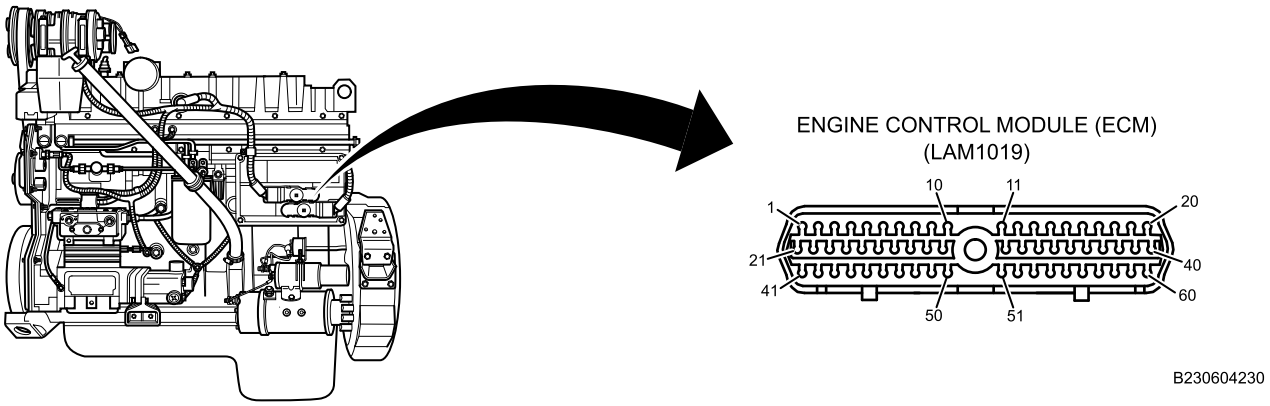


Figure 31. Engine Control Module (ECM).

84. Turn MAIN POWER switch ON (TM 9-2355-106-10).
85. Turn ignition switch ON (TM 9-2355-106-10).
86. Measure DC voltage between connector 4100F terminal 3 and ground with multimeter. Refer to Figure 32.

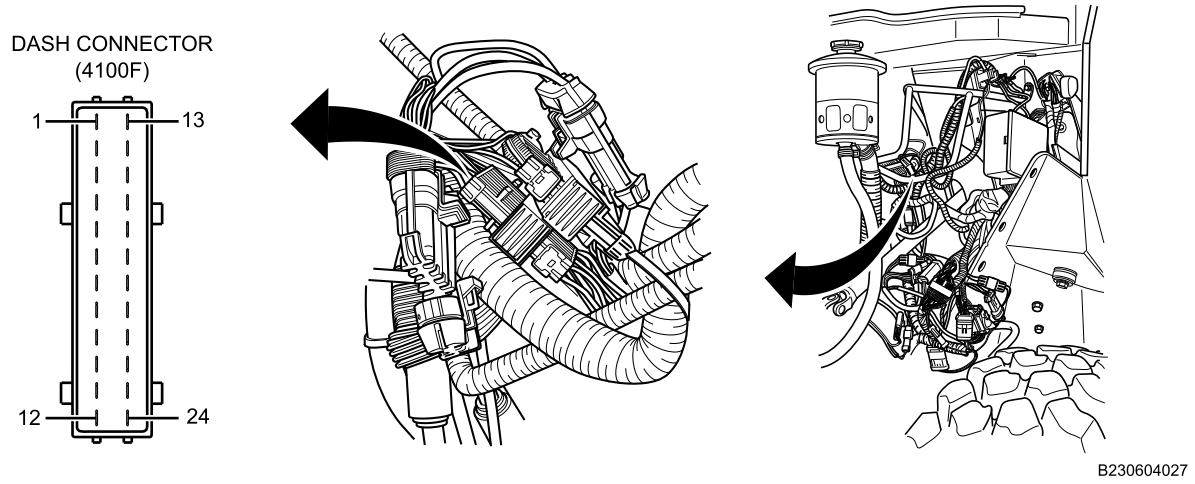


Figure 32. Below Air Filter.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 95.
NO Go to next step.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

87. Turn ignition switch OFF (TM 9-2355-106-10).
88. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
89. Measure resistance between connector 4100F terminals 3 and 6, and connector 4100F terminal 3 and ground with multimeter. Refer to Figure 32.

CONDITION/INDICATION

Does multimeter read OL in each test?

DECISION

NO Go to Step 95.
YES Go to next step.

STEP

90. Measure resistance between connector 4100F terminal 3 and connector LAM1019 terminal 29 with multimeter. Refer to Figure 32 and Figure 31.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 95.
YES Go to Step 96.

MALFUNCTION

- 91. Barometric Pressure (BAP) Sensor is faulty.

ACTION

Replace Barometric Pressure (BAP) Sensor. Refer to Barometric Pressure Sensor Removal and Installation (WP 0398). Return vehicle to service.

END OF TEST

MALFUNCTION

- 92. Steering column wiring harness is faulty.

ACTION

Replace steering column wiring harness. Refer to Steering Column Wiring Harness Removal and Installation (WP 0324). Return vehicle to service.

END OF TEST

MALFUNCTION

- 93. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel Harness Removal and Installation (WP 0319). Return vehicle to service.

BAROMETRIC PRESSURE SENSOR (BAP) TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 94. Power distribution center harness is faulty.

ACTION

Replace power distribution center harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 95. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 96. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE CONTROL MODULE (ECM) SELF-DIAGNOSIS TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0329
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
MAIN POWER switch on (TM 9-2355-106-10)
Ignition switch on (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 525
- 614
- 621
- 622
- 623
- 624
- 631
- 632
- 655
- 661
- 664
- 665

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Retrieve DTCs manually or with MSD. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

One or more of the following DTCs are set:

- 525
- 614
- 621
- 622
- 623
- 624
- 631
- 632
- 655

ENGINE CONTROL MODULE (ECM) SELF-DIAGNOSIS TROUBLESHOOTING PROCEDURE - (CONTINUED)

- 661
- 664
- 665

CORRECTIVE ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Harness, fuel injector test (ZTSE4401) (WP 0795, Item 50)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0012
WP 0228
WP 0249
WP 0329
WP 0336
WP 0330
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Air cleaner assembly removed (WP 0257)

Drawings Required
WP 0789, Figure 79

DIAGNOSTIC TROUBLE CODES AND SYMPTOMS.

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 421–426
- 431–436
- 451–456
- 513
- 514
- 515
- 521

NOTE

For DTCs 421-426, 431-436, 451-456, the last digit refers to affected cylinder number. For example, code 421 indicates cylinder 1 has an open circuit between the ECM high side driver and the low side (signal return) to ECM.

This procedure covers the following symptoms:

- Engine will not start.
- Engine runs rough.
- Engine warning lamp is ON.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal

NOTE

Personnel must read and understand the Troubleshooting Procedure Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Retrieve DTCs. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

Are DTCs 421, 422, 423, 424, 425, or 426 present?

DECISION

YES Go to Step 5.
NO Go to next step.

STEP

2. Refer to results in Step 1.

CONDITION/INDICATION

Are DTCs 431, 432, 433, 434, 435, or 436 present?

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 32.
NO Go to next step.

STEP

3. Refer to results in Step 1.

CONDITION/INDICATION

Are DTCs 451, 452, 453, 454, 455, or 456 present?

DECISION

YES Go to Step 18.
NO Go to next step.

STEP

4. Refer to results in Step 1.

CONDITION/INDICATION

Is trouble code 513 or 514 present?

DECISION

YES Go to Step 44.
NO Go to Step 51.

STEP

5. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
6. Turn ignition switch OFF (TM 9-2355-106-10).

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

7. Disconnect harness connector LAM1020 at valve cover. Refer to Figure 1.

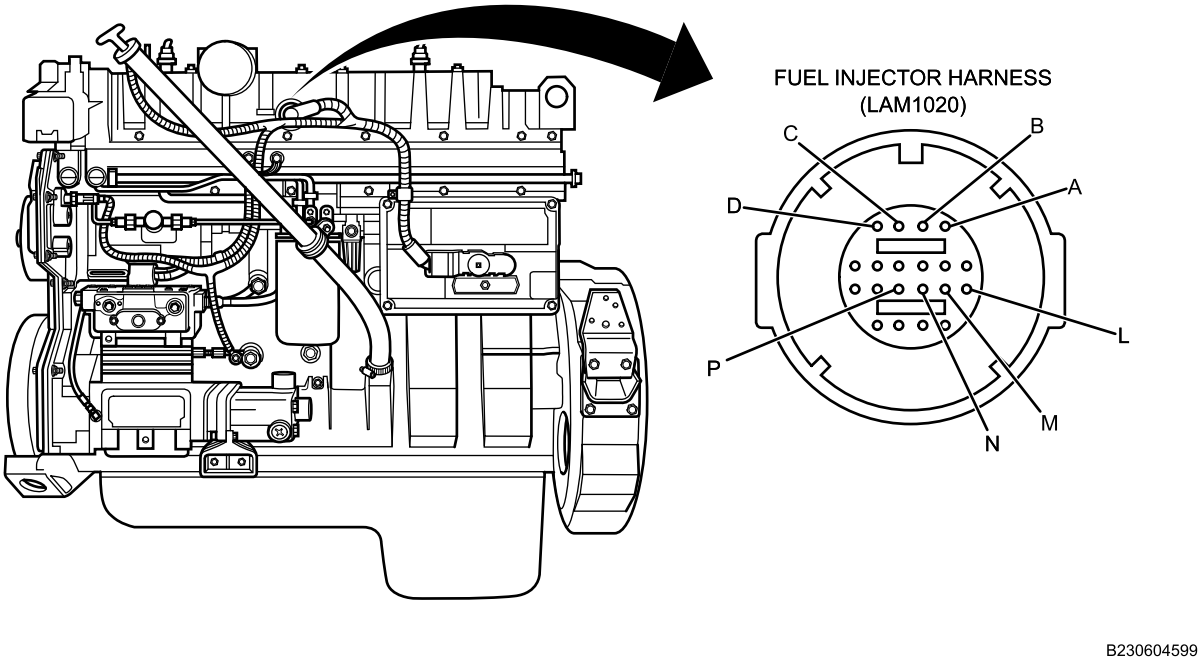


Figure 1. Left Side of Engine Valve Cover.

8. Connect fuel injector test harness (ZTSE4401) (Figure 2, Item 1) to valve cover side of LAM1020.

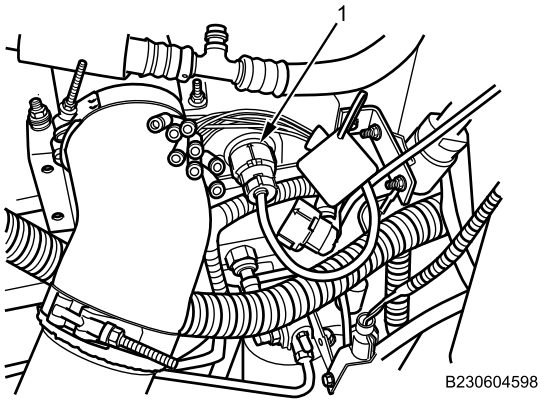


Figure 2. Fuel Injector Test Harness (ZTSE4401).

9. Measure resistance between high side and common terminal on test harness with multimeter. To match the trouble code to the test harness terminal colors, refer to Table 1.

Table 1. Trouble Code and Terminal Identification.

Trouble Code	Test Harness High Side Terminal Color	Test Harness Common Terminal Color
421	Black	Brown
422	Blue	Brown
423	Red	Brown
424	Violet	Yellow
425	Green	Yellow
426	Orange	Yellow

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 16.
NO Go to next step.

STEP

10. Remove fuel injector test harness (ZTSE4401) (Figure 2, Item 1) from valve cover side of LAM1020.
11. Remove rocker cover. Refer to Rocker Cover and Gasket Removal and Installation (WP 0228).
12. Disconnect fuel injector harness connectors (Figure 3, Item 2) from fuel injectors (Figure 3, Item 1).

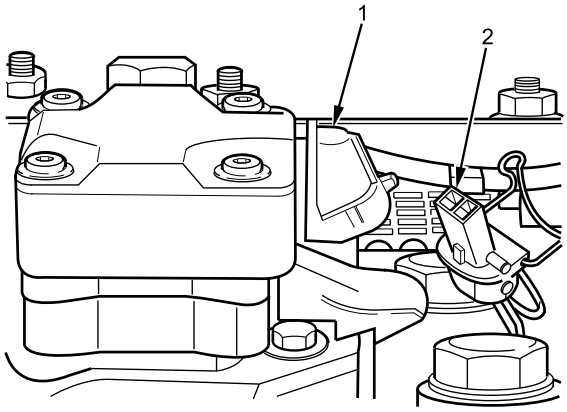


Figure 3. Fuel Injector Disconnected From Harness.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

13. Install fuel injector test harness (ZTSE4401) to fuel injector harness connector (Figure 4, Item 1).

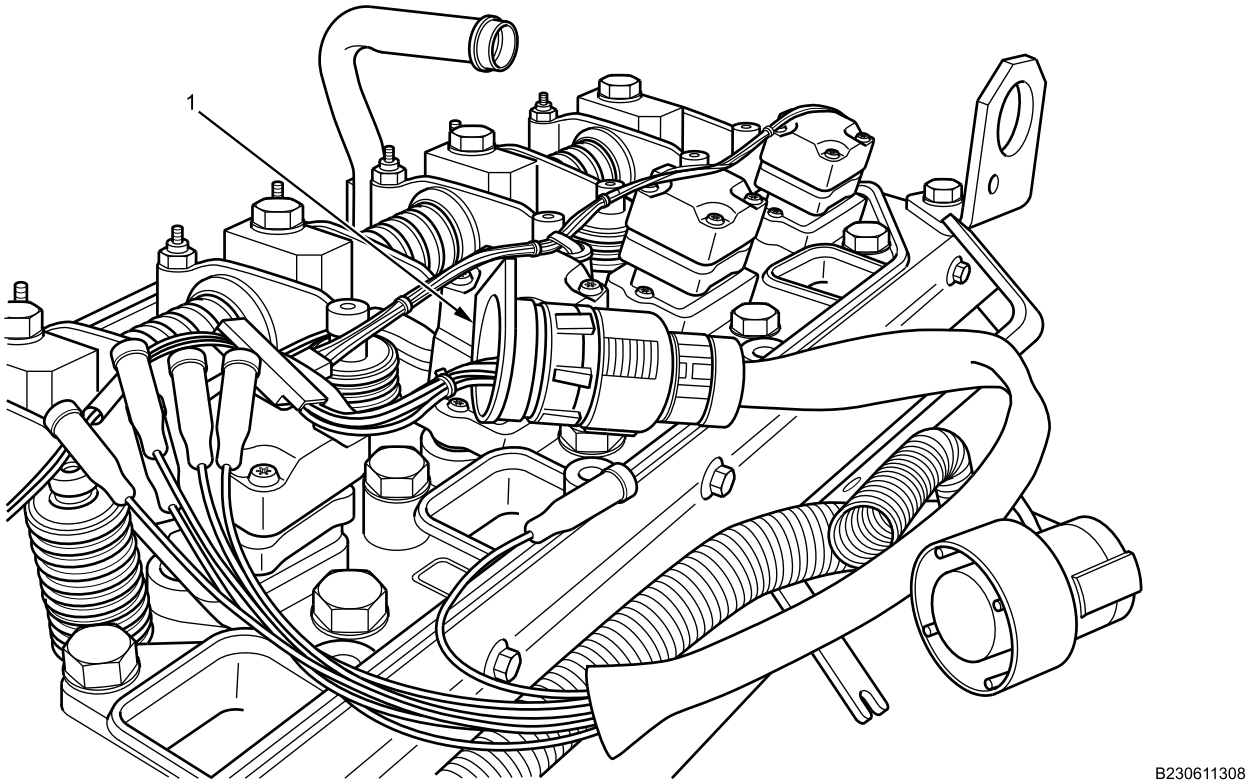


Figure 4. Fuel Injector Harness Connector.

14. Measure resistance between high side terminal on test harness and the injector connector terminal with the same color wire with multimeter. To match the trouble code to the test harness terminal colors, refer to Table 2.

Table 2. Trouble Code and Terminal Identification.

Trouble Code	Test Harness Terminal Color and Injector Connector Terminal Wire Color
421	Black
422	Blue
423	Red
424	Violet
425	Green
426	Orange

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 61.
YES Go to next step.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

15. Measure resistance between low side terminal on test harness and injector connector terminal with same color wire with multimeter. To match the trouble code to the test harness terminal color, refer to Table 3.

Table 3. Trouble Code and Terminal Identification.

Trouble Code	Test Harness Terminal Color and Injector Connector Terminal Wire Color
421	Brown
422	Brown
423	Brown
424	Yellow
425	Yellow
426	Yellow

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 60.
NO Go to Step 61.

STEP

16. Disconnect harness connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 5.

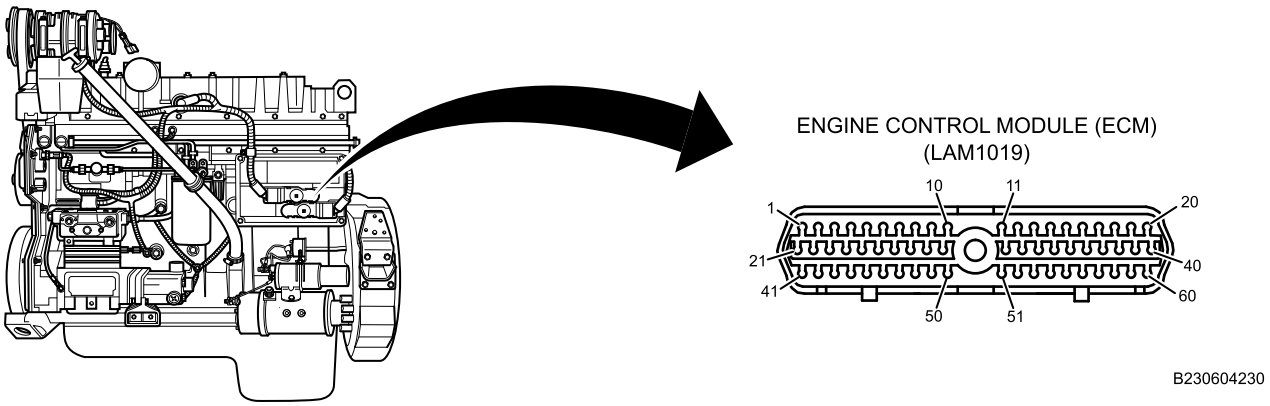


Figure 5. Left Rear of Engine.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

17. Measure resistance between sensor harness side injector harness connector terminal and ECM connector LAM1019 terminal with multimeter. Refer to Figure 7 and Figure 6 To match the trouble code to the terminals, refer to Table 4.

Table 4. Trouble Code and Terminal Identification.

Trouble Code	Injector Harness Connector Terminal (Sensor Harness Side)	ECM Terminal
421	B	43
422	C	21
423	D	41
424	M	46
425	N	25
426	P	44

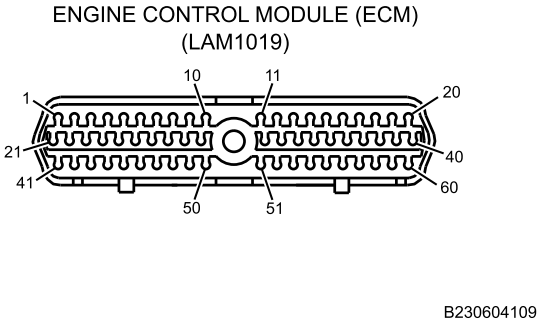


Figure 6. Connector LAM1019.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 62.
NO Go to Step 63.

STEP

18. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
19. Turn ignition switch OFF (TM 9-2355-106-10).

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

20. Disconnect harness connector LAM1020 at valve cover. Refer to Figure 7.

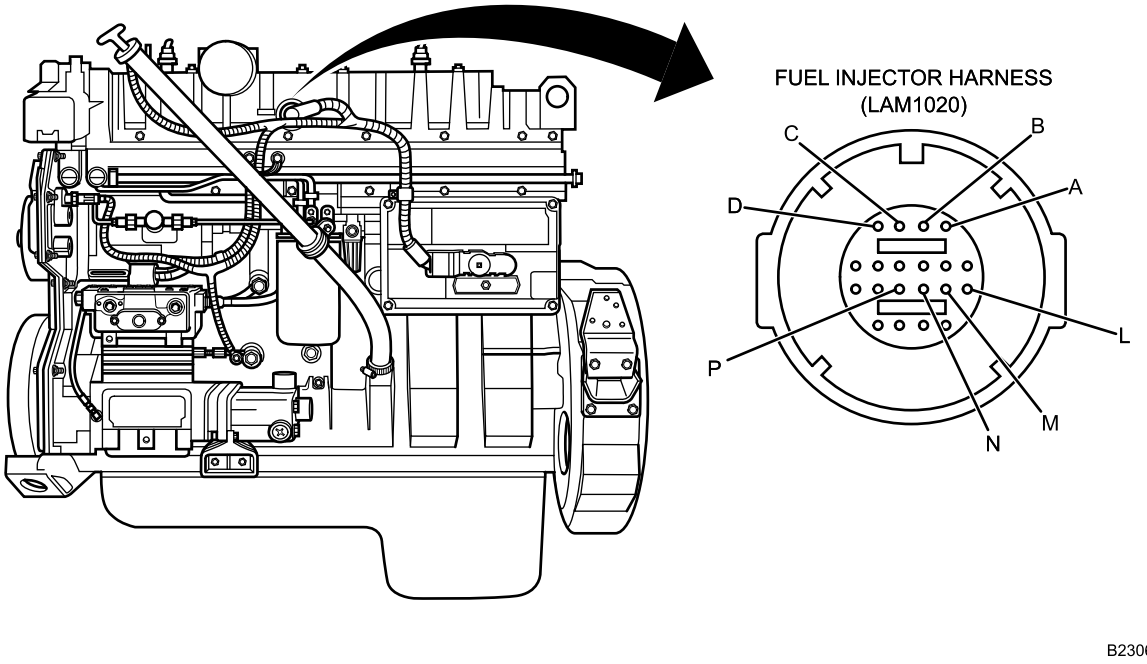


Figure 7. Left Side of Engine Valve Cover.

21. Connect fuel injector test harness (ZTSE4401) (Figure 8, Item 1) to valve cover side of LAM1020.

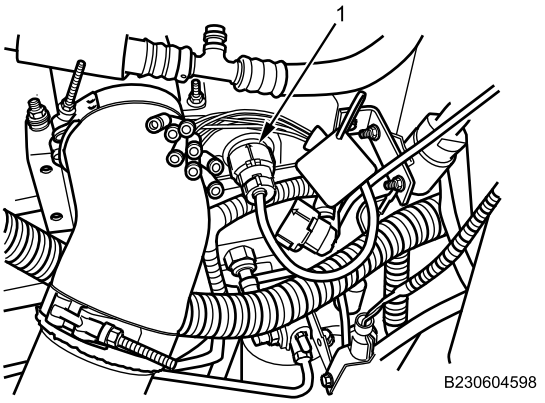


Figure 8. Fuel Injector Test Harness (ZTSE4401).

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

22. Measure resistance between injector high side terminal on test harness and ground with multimeter. To match the trouble code to the terminal, refer to Table 5.

Table 5. Trouble Code and Terminal Identification.

Trouble Code	High Side Test Harness Terminal Color
451	Black
452	Blue
453	Red
454	Violet
455	Green
456	Orange

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 30.
YES Go to next step.

STEP

23. Remove fuel injector test harness (ZTSE4401) (Figure 8, Item 1) from valve cover side of LAM1020.
24. Remove rocker cover. Refer to Rocker Cover and Gasket Removal and Installation (WP 0228).
25. Inspect fuel injector harness for bare or pinched wires.

CONDITION/INDICATION

Are any wires bare or pinched?

DECISION

YES Go to Step 61.
NO Go to next step.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

26. Disconnect fuel injector harness connectors (Figure 9, Item 2) from fuel injectors (Figure 9, Item 1).

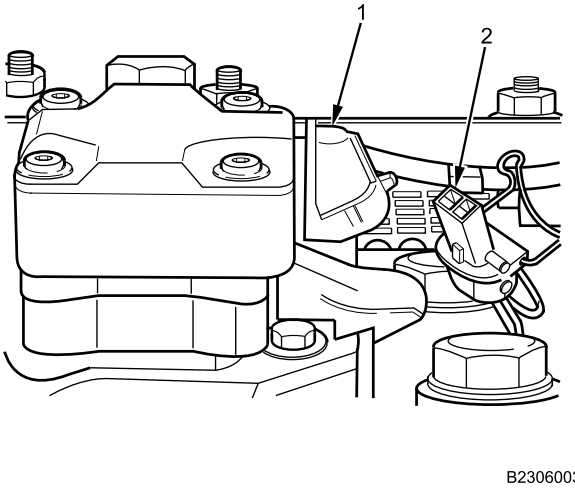


Figure 9. Fuel Injector Disconnected From Harness.

27. Connect fuel injector test harness (ZTSE4401) to fuel injector harness connector (Figure 10, Item 1).

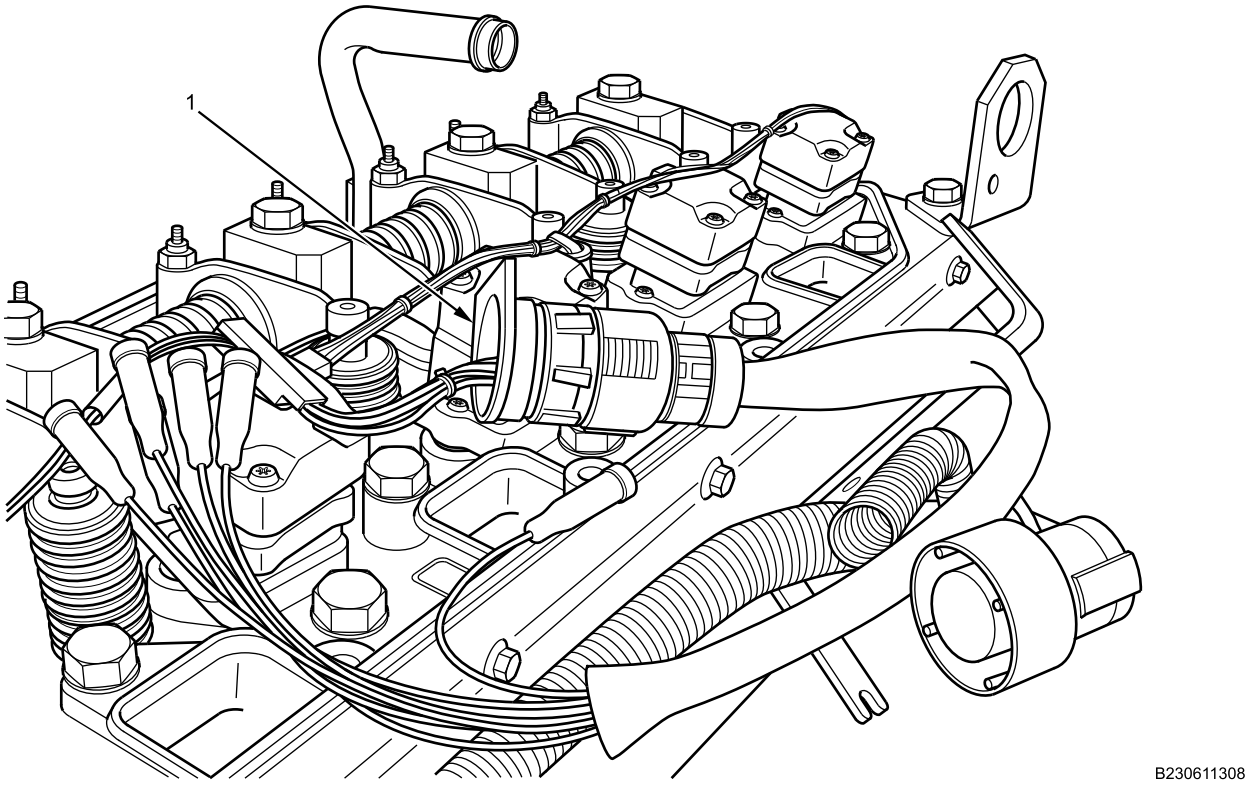


Figure 10. Fuel Injector Harness Connector.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

28. Measure resistance between injector high side terminal on test harness and ground with multimeter. To match the trouble code to the terminal color, refer to Table 6.

Table 6. Trouble Code and Terminal Identification.

Trouble Code	High Side Test Harness Terminal Color
451	Black
452	Blue
453	Red
454	Violet
455	Green
456	Orange

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 61.
NO Go to next step.

STEP

29. Measure resistance between low side test terminal and ground with multimeter. To match the trouble code to the terminal, refer to Table 7.

Table 7. Trouble Code and Terminal Identification.

Trouble Code	Test Harness Color
451	Brown
452	Brown
453	Brown
454	Yellow
455	Yellow
456	Yellow

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 61.
NO Go to Step 60.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

30. Disconnect ECM connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 11.

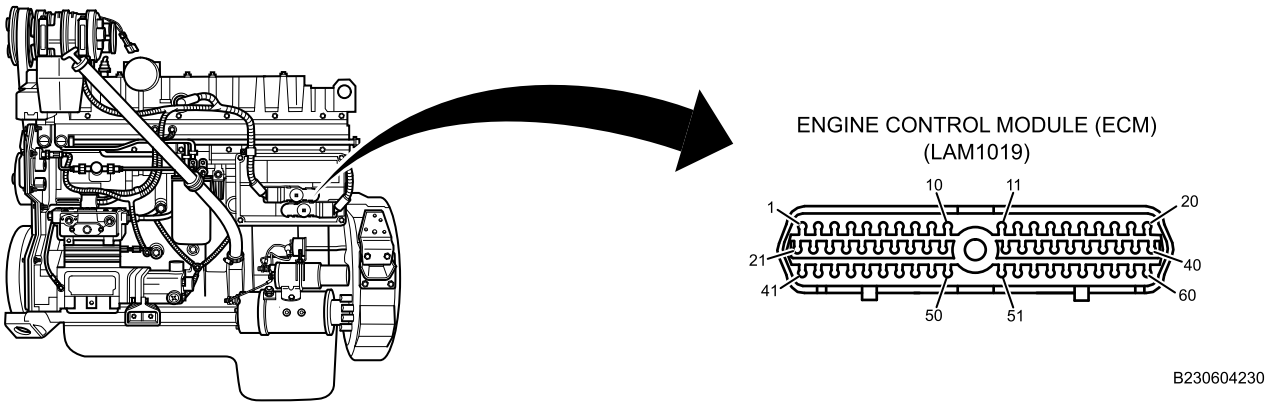


Figure 11. Left Rear of Engine.

31. Measure resistance between (sensor harness side) connector LAM1020 high side terminals and ground with multimeter. Refer to Figure 12. To match the trouble code to the terminal, refer to Table 8.

Table 8. Trouble Code and Terminal Identification.

Trouble Code	Fuel Injector Connector LAM1020 Terminals (Sensor Harness Side)
451	B
452	C
453	D
454	M
455	N
456	P

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 62.
NO Go to Step 63.

STEP

32. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
33. Turn ignition switch OFF (TM 9-2355-106-10).

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

34. Disconnect fuel injector harness connector LAM1020 at valve cover. Refer to Figure 12.

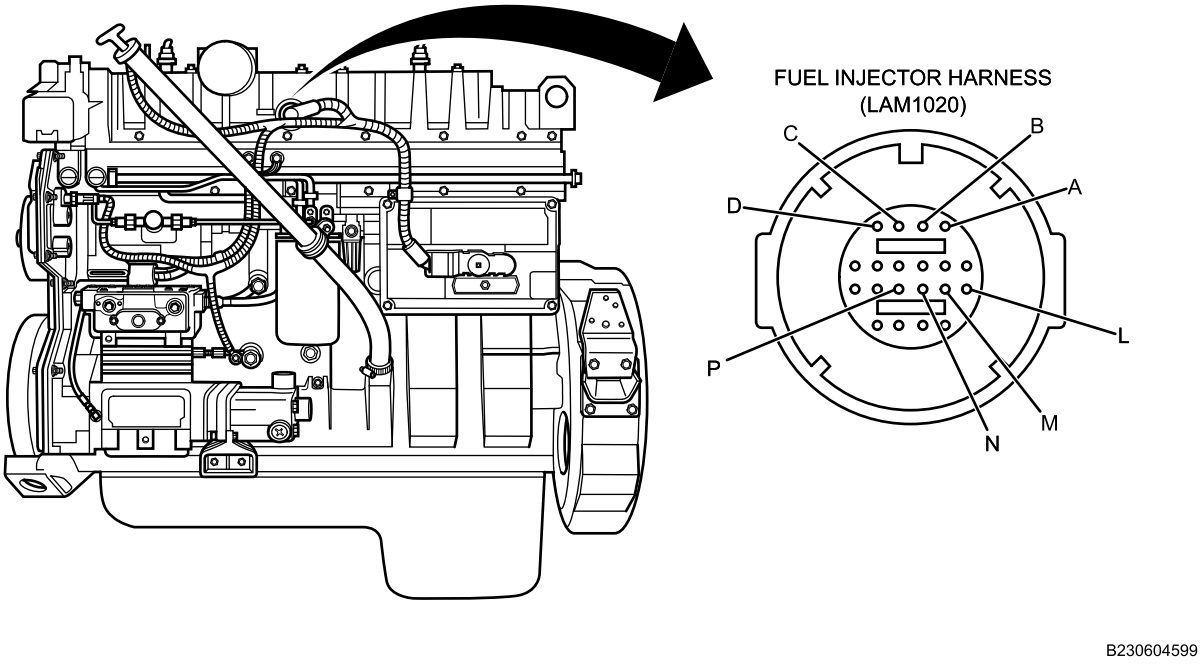


Figure 12. Left Side of Engine Valve Cover.

35. Connect fuel injector test harness (ZTSE4401) (Figure 13, Item 1) to valve cover side of LAM1020.

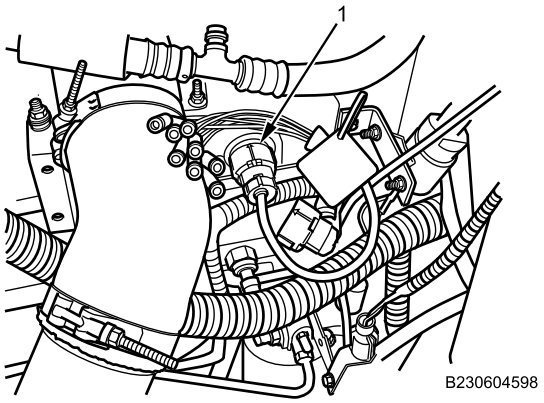


Figure 13. Fuel Injector Test Harness (ZTSE4401).

36. Measure resistance between high side and common terminal on test harness with multimeter. To match the trouble code to the terminals, refer to Table 9.

Table 9. Trouble Code and Terminal Identification.

Trouble Code	High Side Terminal Color	Common Terminal Color
431	Black	Brown
432	Blue	Brown
433	Red	Brown
434	Violet	Yellow
435	Green	Yellow
436	Orange	Yellow

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 2.5 and 3.5 ohms?

DECISION

YES Go to Step 42.
NO Go to next step.

STEP

37. Remove fuel injector test harness (ZTSE4401) (Figure 13, Item 1) from valve cover side of LAM1020.
38. Remove rocker cover. Refer to Rocker Cover and Gasket Removal and Installation (WP 0228).
39. Disconnect fuel injector harness connectors. Refer to Figure 14.

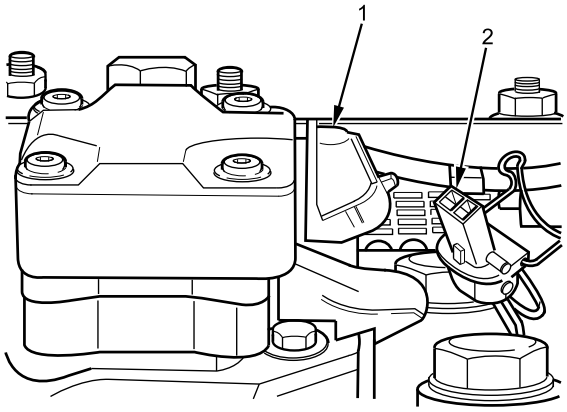


Figure 14. Fuel Injector Disconnected From Harness.

40. Connect fuel injector test harness (ZTSE4401) to fuel injector harness connector (Figure 15, Item 1).

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

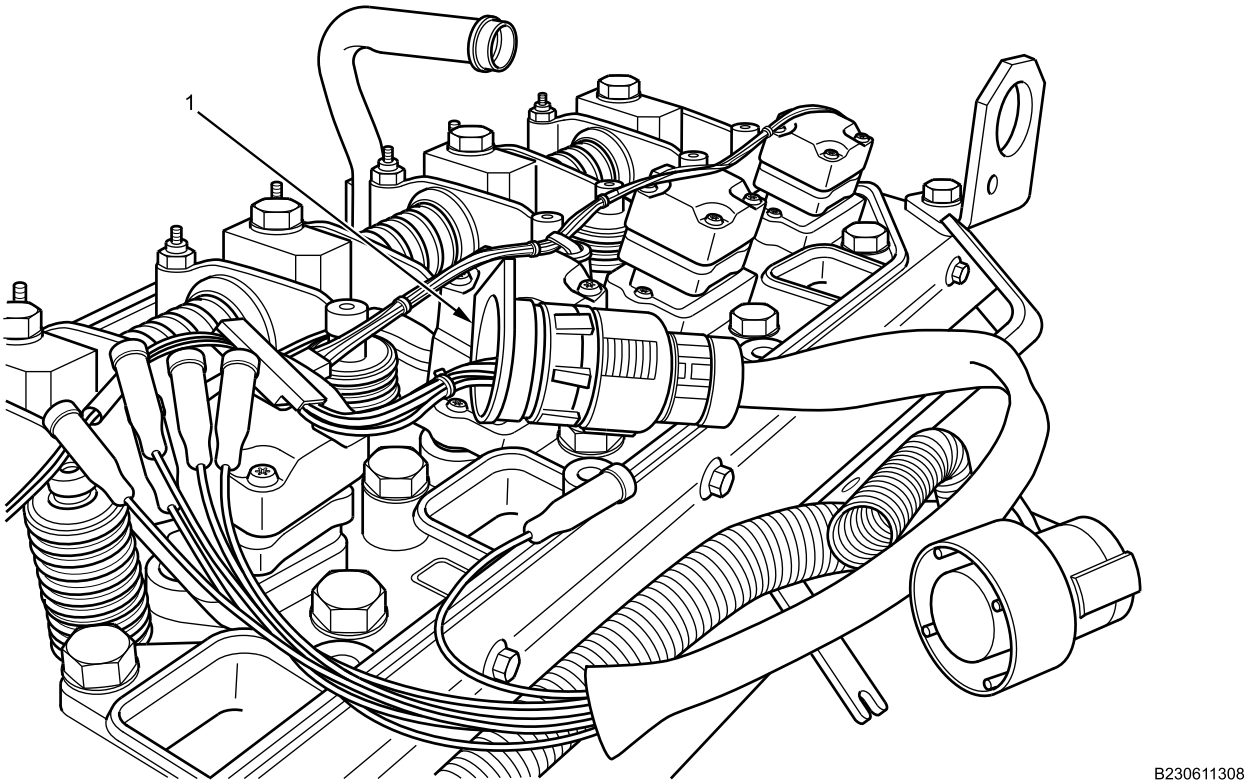


Figure 15. Fuel Injector Harness Connector.

41. Measure resistance between high side and common terminals on test harness with multimeter. To match the trouble code to the terminal color, refer to Table 10.

Table 10. Trouble Code and Terminal Identification.

Trouble Code	High Side Terminal Color	Common Terminal Color
431	Black	Brown
432	Blue	Brown
433	Red	Brown
434	Violet	Yellow
435	Green	Yellow
436	Orange	Yellow

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 61.
YES Go to Step 60.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

42. Disconnect ECM connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 16.

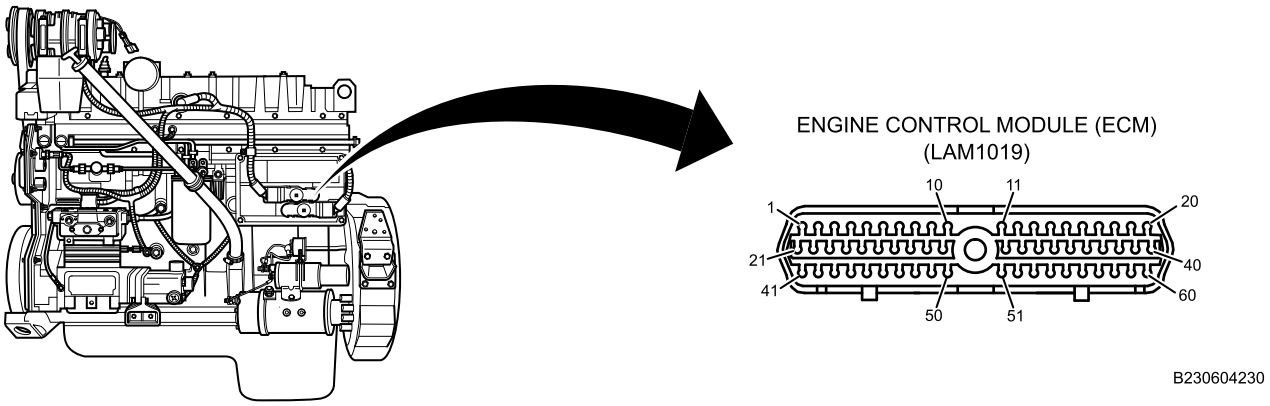


Figure 16. Left Rear of Engine.

43. Measure resistance between (sensor harness side) connector LAM1020 high side and low side terminal with multimeter. Refer to Figure 17. To match the trouble code to the terminals, refer to Table 11.

Table 11. Trouble Code and Terminal Identification.

Trouble Code	Connector LAM1020 High Side Terminal (Sensor Harness Side)	Connector LAM1020 Low Side Terminal (Sensor Harness Side)
431	B	A
432	C	A
433	D	A
434	M	L
435	N	L
436	P	L

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 62.
NO Go to Step 63.

STEP

44. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
45. Turn ignition switch OFF (TM 9-2355-106-10).

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

46. Disconnect fuel injector harness connector LAM1020 at valve cover. Refer to Figure 17.

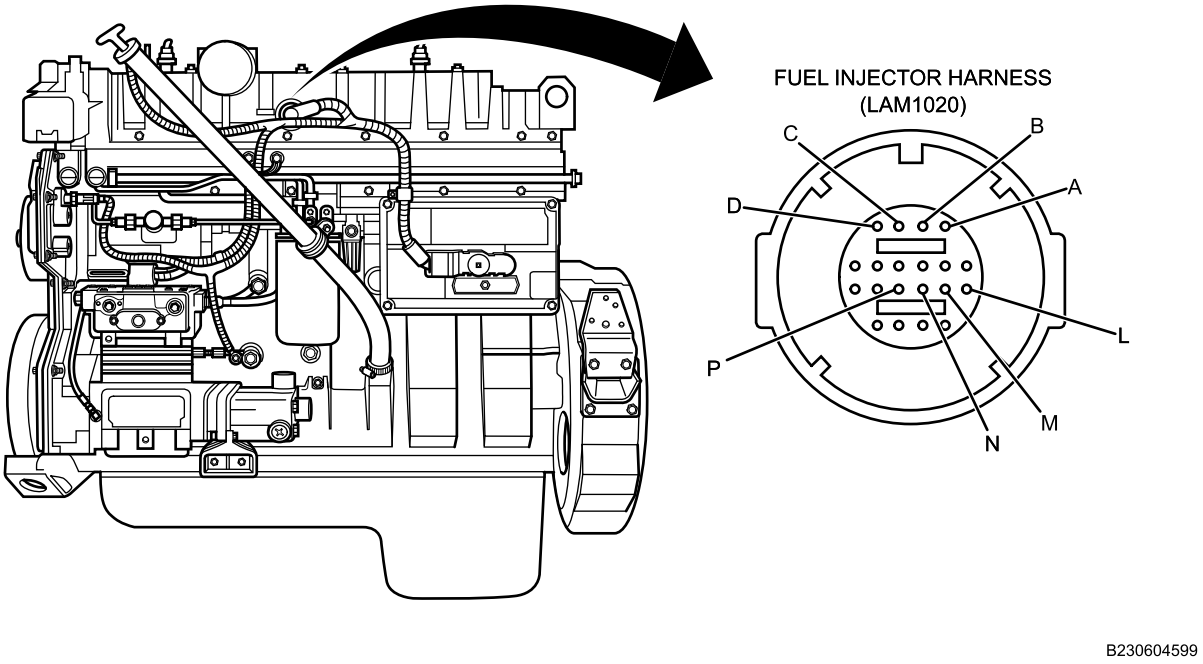


Figure 17. Left Side of Engine Valve Cover.

47. Connect fuel injector test harness (ZTSE4401) (Figure 18, Item 1) to valve cover side of LAM1020.

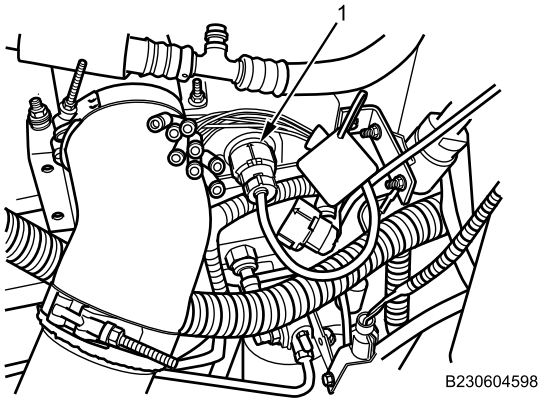


Figure 18. Fuel Injector Test Harness (ZTSE4401).

48. Measure resistance between high side and common terminals on test harness with multimeter. To match the trouble code to the terminal color, refer to Table 12.

Table 12. Trouble Code and Terminal Identification.

Trouble Code	High Side Terminal	Common Terminal
513	Black	Brown
514	Violet	Yellow

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 61.
NO Go to next step.

STEP

49. Disconnect ECM connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 19.

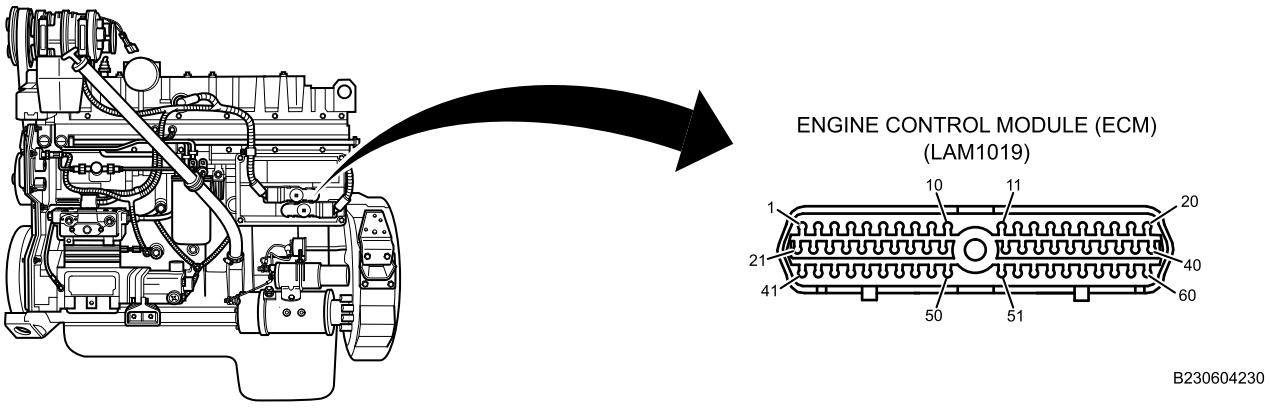


Figure 19. Left Rear of Engine.

50. Measure resistance between ECM connector LAM1019 low side terminal and sensor harness side connector LAM1020 low side terminal with multimeter. Refer to Figure 19 and Figure 20. To match the trouble code to the terminals, refer to Table 13.

Table 13. Trouble Code and Terminal Identification.

Trouble Code	ECM Connector Low Side Terminal	Connector LAM1020 Low Side Terminal (Sensor Harness Side)
513	42	A
514	26	L

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 62.
NO Go to Step 63.

STEP

51. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
52. Turn ignition switch OFF (TM 9-2355-106-10).

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

53. Disconnect harness connector LAM1020. Refer to Figure 20.

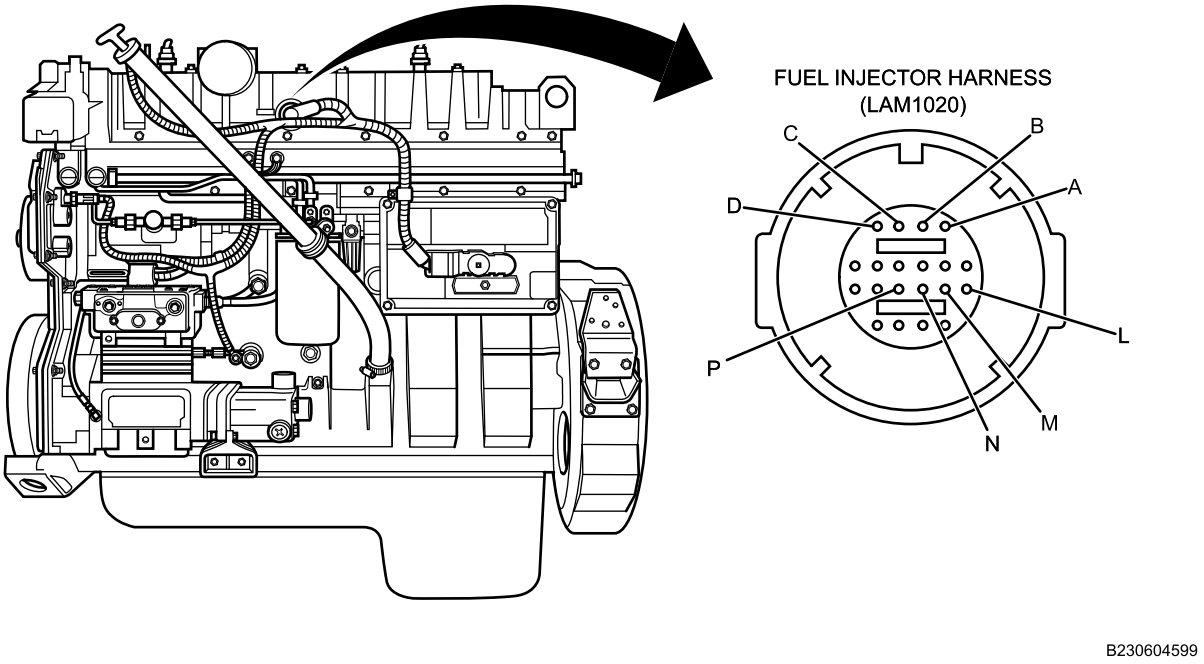


Figure 20. Left Side of Engine Valve Cover.

54. Connect fuel injector test harness (ZTSE4401) (Figure 21, Item 1) to valve cover side of LAM1020.

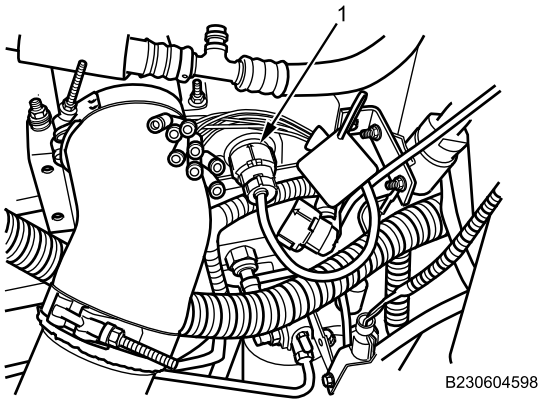


Figure 21. Fuel Injector Test Harness (ZTSE4401).

55. Measure resistance between common terminal on test harness and ground with multimeter. To match the trouble code to the terminal, refer to Table 14.

Table 14. Trouble Code and Terminal Identification.

Trouble Code	ZTSE4401 Test Harness Common Terminal
515	Brown
521	Yellow

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 61.
NO Go to next step.

STEP

56. Disconnect ECM connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 22.

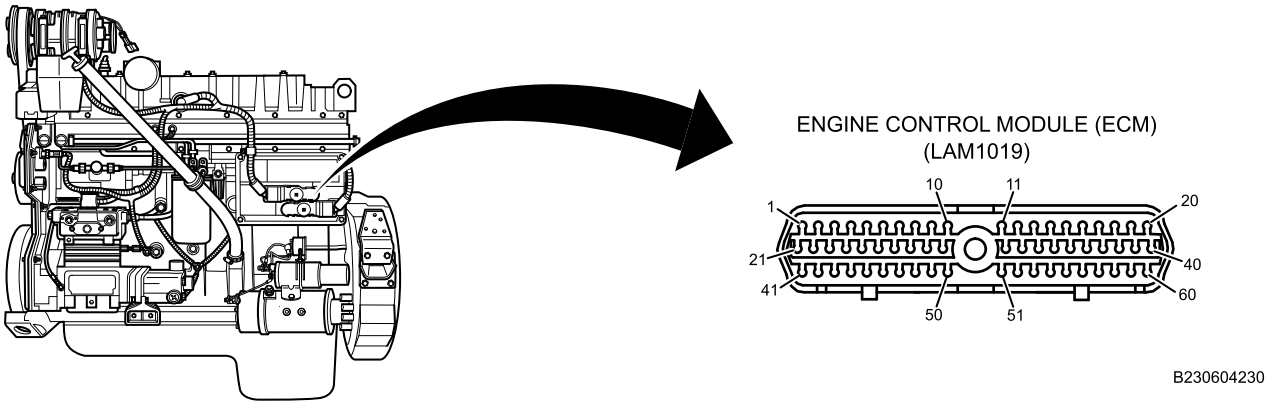


Figure 22. Left Rear of Engine.

57. Measure resistance between sensor harness side connector LAM1020 low side terminal and ground with multimeter. To match the trouble code to the terminal, refer to Table 15.

Table 15. Trouble Code and Terminal Identification.

Trouble Code	Connector LAM1020 Low Side Terminal (Sensor Harness Side)
515	A
521	L

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 62.
NO Go to next step.

STEP

58. Measure resistance between ECM connector LAM1019 terminal 42 and all other LAM1019 terminals with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 62.
NO Go to next step.

STEP

59. Measure resistance between ECM connector LAM1019 terminal 26 and all other LAM1019 terminals with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 62.
NO Go to Step 63.

MALFUNCTION

- 60. Fuel injector is faulty.

ACTION

Replace fuel injector indicated by DTC. Refer to Fuel Injector Removal and Installation (WP 0249). Return vehicle to service.

END OF TEST

MALFUNCTION

- 61. Fuel injector wiring harness is faulty.

ACTION

Replace fuel injector wiring harness. Refer to Fuel Injector Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 62. Engine sensor wiring harness is faulty.

ACTION

Replace engine sensor wiring harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0330). Return vehicle to service.

END OF TEST

MALFUNCTION

- 63.ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

INJECTOR DRIVE CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

INTAKE AIR TEMPERATURE (IAT) SENSOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Tee, 2-way breakout (ZTSE4483) (WP 0795, Item 115)
Terminal Test Kit (ZTSE4435C) (WP 0795, Item 122)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0329
WP 0782

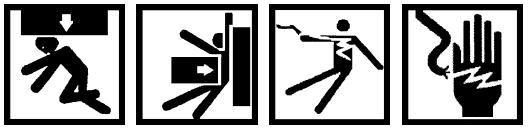
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Code (DTCs):

- DTC 154
- DTC 155

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

INTAKE AIR TEMPERATURE (IAT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

1. Disconnect harness connector 6703 from IAT sensor. Refer to Figure 1.

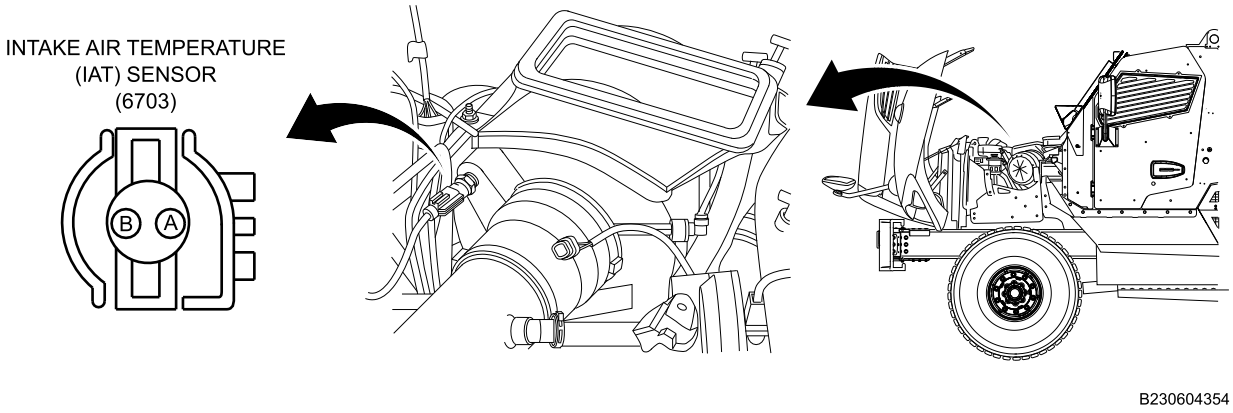


Figure 1. Rear of Air Cleaner Housing Assembly.

2. Measure resistance between harness connector 6703 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 13.
NO Go to next step.

STEP

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Measure DC voltage between IAT signal circuit terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 15.

INTAKE AIR TEMPERATURE (IAT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

YES Go to next step.

STEP

6. Turn ignition switch OFF (TM 9-2355-106-10).

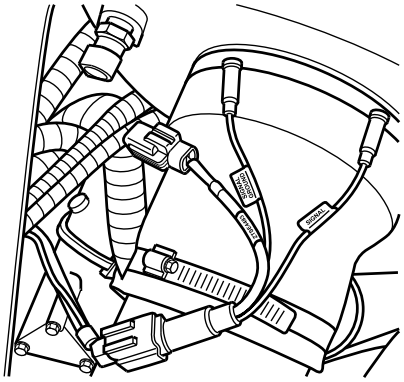


Figure 2. Breakout Tee (ZTSE4483).

7. Install breakout tee (ZTSE4483) in harness connector 6703. Refer to Figure 2.
8. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Turn ignition switch ON (TM 9-2355-106-10).
11. Connect jumper wire from Terminal Test Kit (ZTSE4435C) between breakout tee (ZTSE4483) terminals SIGNAL and SIGNAL GROUND. Refer to Figure 2.
12. Observe IAT signal voltage in continuous monitoring mode with MSD.

CONDITION/INDICATION

Does IAT signal voltage read 0V?

DECISION

NO Go to Step 20.
YES Go to Step 21.

INTAKE AIR TEMPERATURE (IAT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Disconnect harness connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 3.

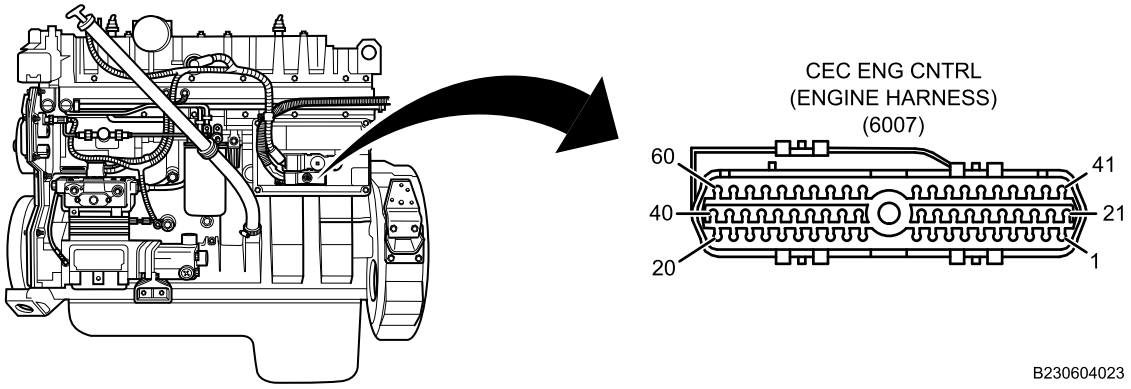


Figure 3. Left Rear of Engine.

14. Measure resistance between harness connector 6703 terminal B and harness connector 6007 terminal 11 with multimeter. Refer to Figure 4 and Figure 3.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

NO Go to Step 20.
YES Go to Step 22.

STEP

15. Turn ignition switch OFF (TM 9-2355-106-10).
16. Disconnect harness connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 3.
17. Measure resistance between harness connector 6703 terminal A and ground with multimeter. Refer to Figure 4.

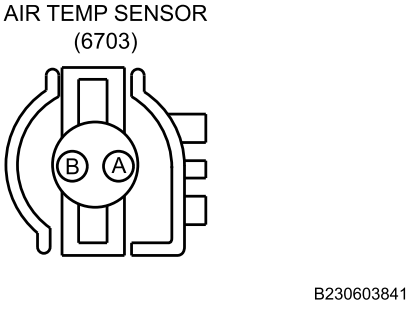


Figure 4. Connector 6703.

CONDITION/INDICATION

Does multimeter read OL?

INTAKE AIR TEMPERATURE (IAT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 22.
YES Go to next step.

STEP

18. Measure resistance between harness connector 6703 terminal A and harness connector 6007 terminal 12 with multimeter. Refer to Figure 4 and Figure 3.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 22.
NO Go to next step.

STEP

19. Measure resistance between harness connector 6007 terminal 12 and all other harness connector 6007 terminals. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 20.
NO Go to Step 22.

MALFUNCTION

- 20. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 21. IAT sensor is faulty.

ACTION

Replace IAT sensor. Refer to Air Cleaner Assembly Removal and Installation (WP 0257). Return vehicle to service.

END OF TEST

MALFUNCTION

- 22. Engine wiring harness is faulty.

INTAKE AIR TEMPERATURE (IAT) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace engine wiring harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Tee, 3-wire pressure sensor breakout (ZTSE4347) (WP 0795, Item 116)
Harness, 500 ohm resistor (ZTSE4497) (WP 0795, Item 48)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0329
WP 0330
WP 0390
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

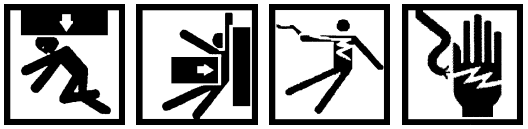
Drawings Required
WP 0789, Figure 79

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 121
- 122
- 123

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Disconnect harness connector LAM1014. Refer to Figure 1.

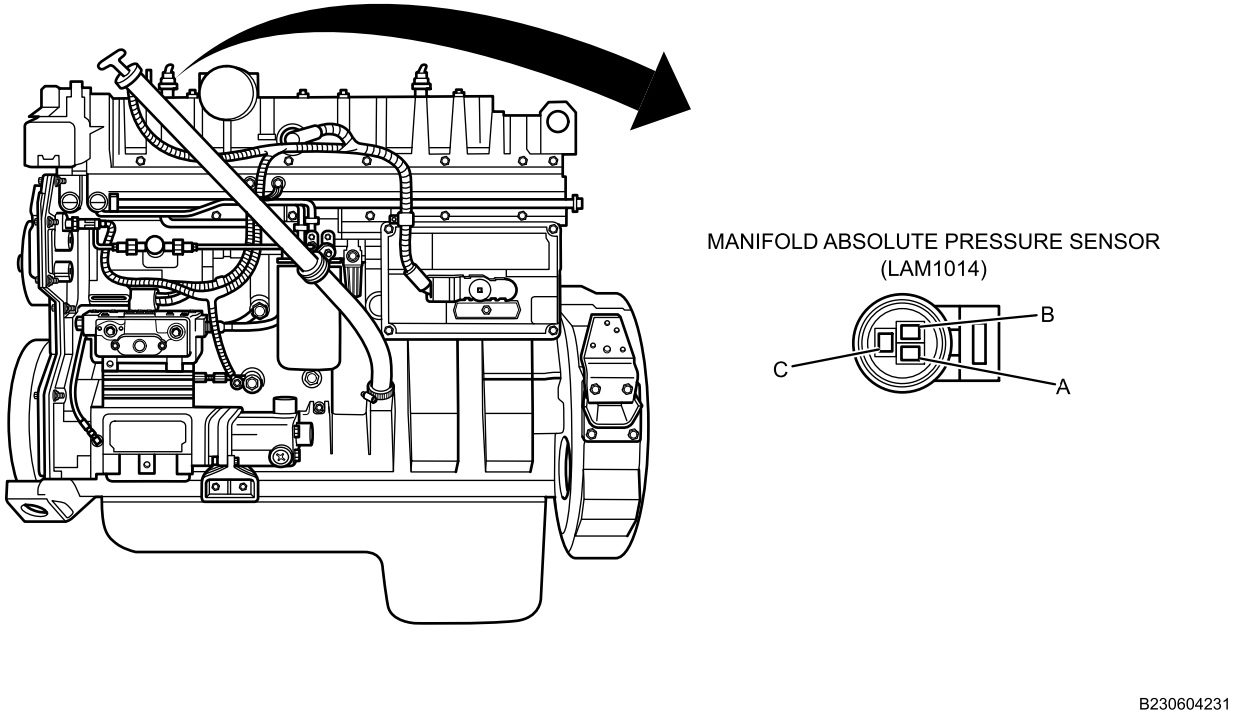


Figure 1. Top of Engine Valve Cover, Front of Engine.

2. Measure resistance between harness connector LAM1014 terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 11.
YES Go to next step.

STEP

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

5. Measure DC voltage between harness connector LAM1014 terminal B and ground with multimeter. Refer to Figure 2.

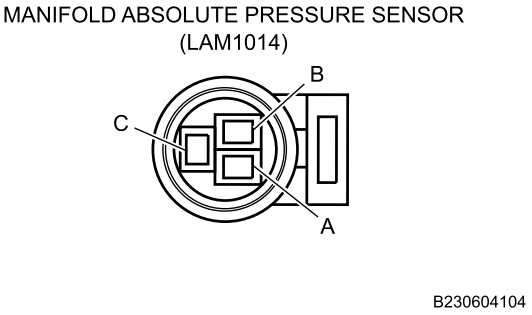


Figure 2. Connector LAM1014.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 13.
YES Go to next step.

STEP

6. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
7. Observe MAP signal voltage in continuous monitoring mode with MSD.

CONDITION/INDICATION

Does MAP signal voltage read 0V?

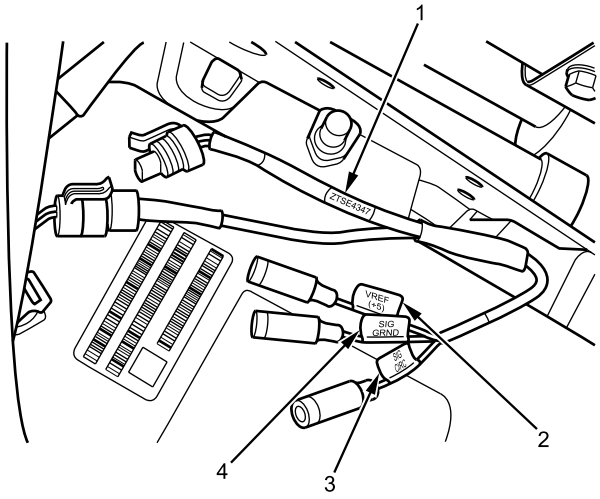
DECISION

NO Go to Step 24.
YES Go to next step.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

8. Connect 3-wire breakout harness to MAP sensor harness connector LAM1014. Refer to Figure 3.



LEGEND

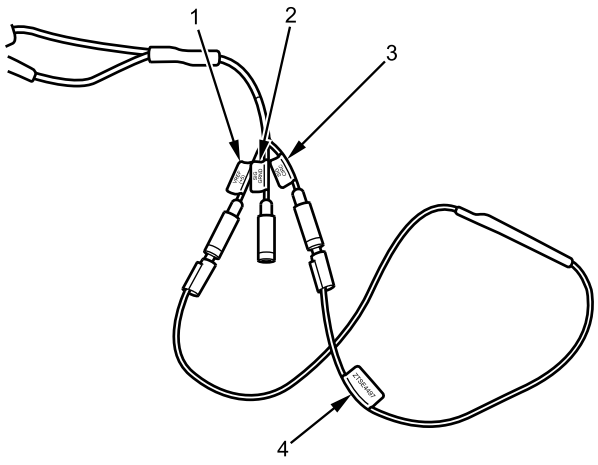
1 ZTSE4347
2 VREF (+5)
3 SIG CIRC
4 SIG GRND

B230604423

Figure 3. 3-Wire Breakout Harness (ZTSE4347).

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

9. Connect 500 ohm jumper wire (ZTSE4497) between 3-wire breakout harness (ZTSE4347) terminals VREF (+5) and SIG CIRC. Refer to Figure 4.



LEGEND

1 VREF (+5)
2 SIG GRND
3 SIG CIRC
4 ZTSE4497

B230604424

Figure 4. 500 Ohm Jumper Wire (ZTSE4497) Connected to 3-Wire Breakout Harness (ZTSE4347).

10. Observe MAP signal voltage in continuous monitoring mode with MSD.

CONDITION/INDICATION

Does MAP signal voltage read between 4.5V and 5.5V?

DECISION

NO Go to Step 33.
YES Go to Step 41.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

11. Disconnect harness connector LAM1019. Refer to Figure 5. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

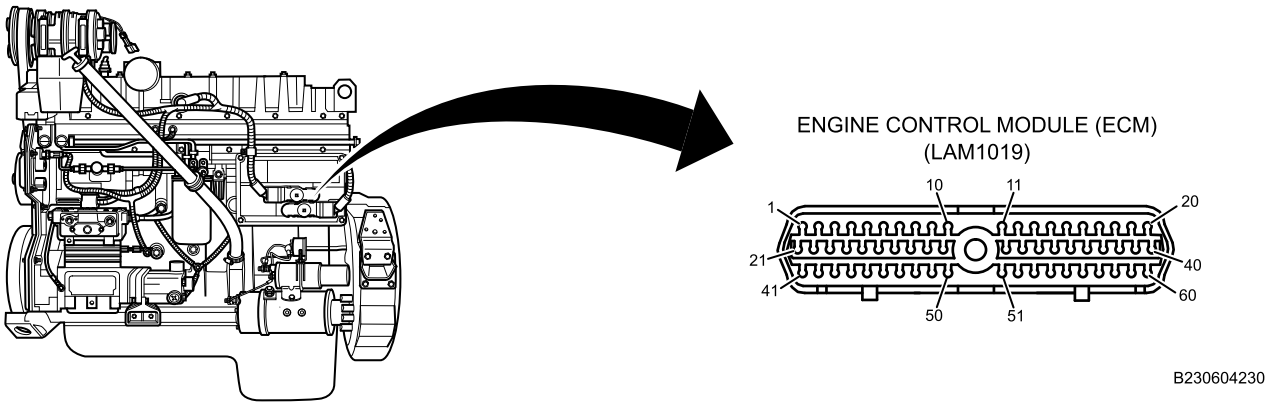


Figure 5. Left Rear of Engine.

12. Measure resistance between harness connector LAM1014 terminal A and harness connector LAM1019 terminal 19 with multimeter. Refer to Figure 6 and Figure 5.

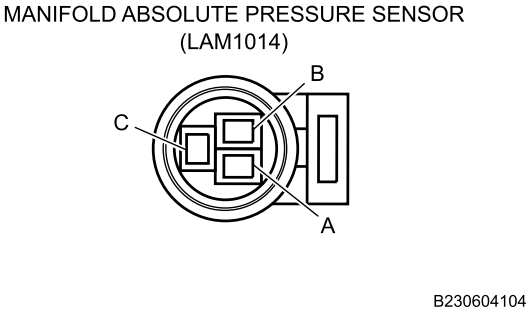


Figure 6. Connector LAM1014.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 42.
NO Go to Step 40.

STEP

13. Turn ignition switch OFF (TM 9-2355-106-10).
14. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

15. Disconnect harness connector LAM1019. Refer to Figure 7. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

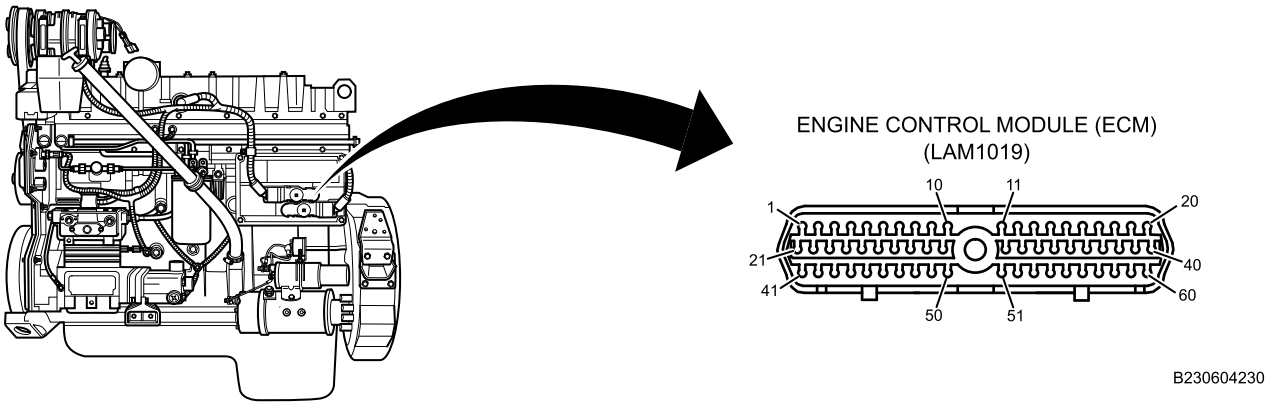


Figure 7. Left Rear of Engine.

16. Turn MAIN POWER switch ON (TM 9-2355-106-10).
17. Turn ignition switch ON (TM 9-2355-106-10).
18. Measure DC voltage between harness connector LAM1014 terminal B and ground with multimeter. Refer to Figure 8.

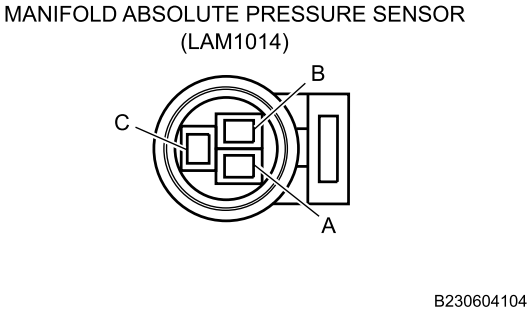


Figure 8. Connector LAM1014.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 40.
NO Go to next step.

STEP

19. Turn ignition switch OFF (TM 9-2355-106-10).
20. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
21. Measure resistance between harness connector LAM1014 terminal B and ground with multimeter. Refer to Figure 8.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 40.
YES Go to next step.

STEP

22. Measure resistance between harness connector LAM1014 terminals B and A with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 40.
YES Go to next step.

STEP

23. Measure resistance between harness connector LAM1014 terminal B and harness connector LAM1019 terminal 40 with multimeter. Refer to Figure 8 and Figure 7.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 42.
NO Go to Step 40.

STEP

24. Turn ignition switch OFF (TM 9-2355-106-10).
25. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
26. Disconnect harness connector LAM1019. Refer to Figure 7. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).
27. Turn MAIN POWER switch ON (TM 9-2355-106-10).
28. Turn ignition switch ON (TM 9-2355-106-10).
29. Measure DC voltage between harness connector LAM1014 terminal C and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 40.
NO Go to next step.

STEP

30. Turn ignition switch OFF (TM 9-2355-106-10).

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

31. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
32. Measure resistance between harness connector LAM1014 terminals B and C with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 40.
YES Go to Step 42.

STEP

33. Turn ignition switch OFF (TM 9-2355-106-10).
34. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
35. Disconnect 500 ohm jumper wire (ZTSE4497) and 3-wire breakout harness (ZTSE4347) from harness connector LAM1014.
36. Measure resistance between harness connector LAM1014 terminal C and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 40.
YES Go to next step.

STEP

37. Disconnect harness connector LAM1019. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Refer to Figure 9.

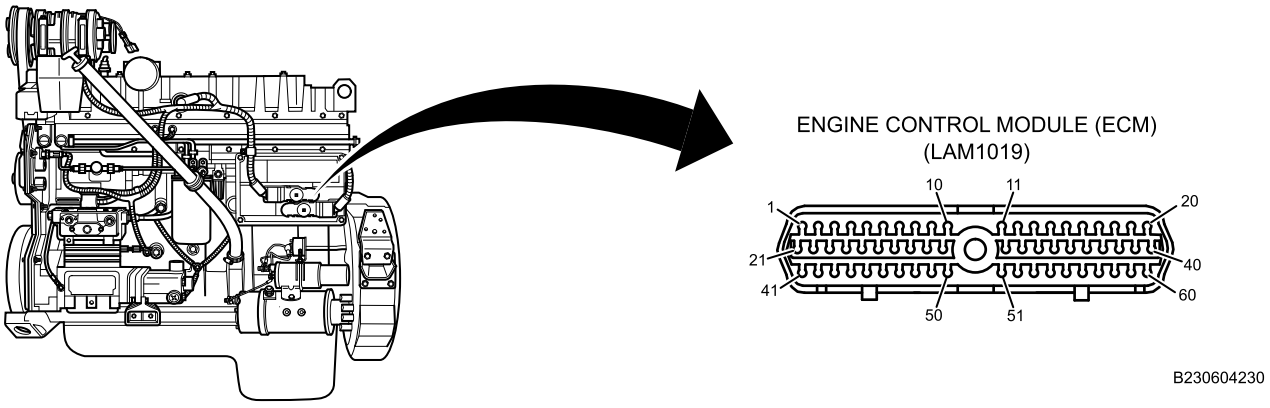


Figure 9. Left Rear of Engine.

38. Measure resistance between harness connector LAM1014 terminals C and A with multimeter. Refer to Figure 10 Refer to Figure 9.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

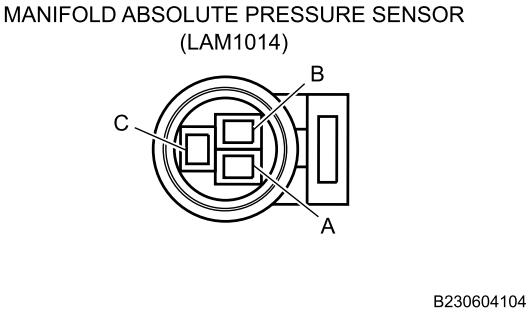


Figure 10. Connector LAM1014.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 40.
YES Go to next step.

STEP

39. Measure resistance between harness connector LAM1014 terminal C and harness connector LAM1019 terminal 30 with multimeter. Refer to Figure 10 and Figure 9.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 42.
NO Go to Step 40.

MALFUNCTION

- 40. Engine sensor wiring harness is faulty.

ACTION

Replace ECM engine harness. Refer to Engine Sensor Wiring Harness Removal and Installation (WP 0330). Return vehicle to service.

END OF TEST

MALFUNCTION

- 41. MAP sensor is faulty.

ACTION

Replace MAP sensor. Refer to Manifold Absolute Pressure (MAP) Sensor Removal and Installation (WP 0390). Return vehicle to service.

END OF TEST

MALFUNCTION

- 42. ECM is faulty.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0565
WP 0403
WP 0316
WP 0353
WP 0319
WP 0324
WP 0534
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

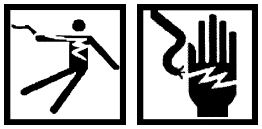
Drawings Required
WP 0789, Figure 69

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 221

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Disconnect Electronic System Controller (ESC) connector 1600. Refer to Figure 1.

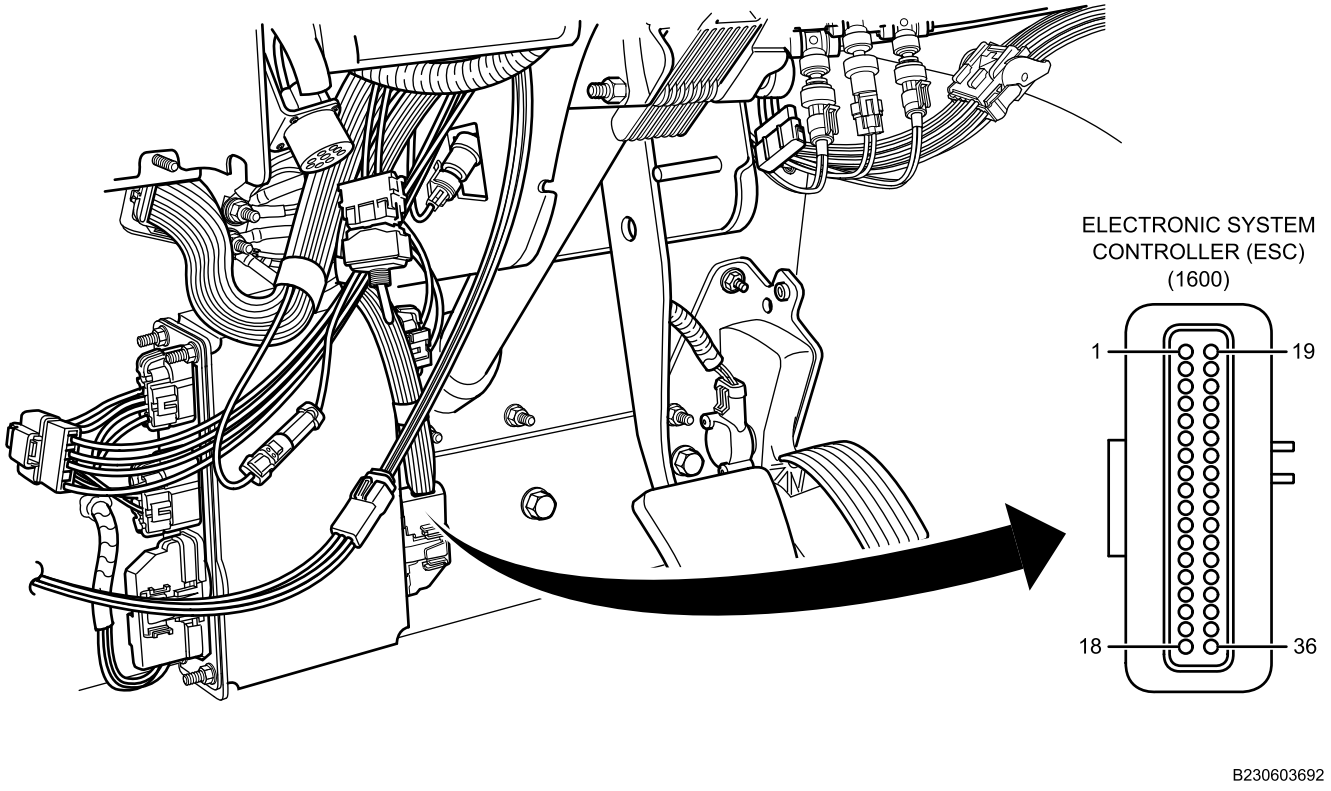


Figure 1. Driver Floor Area.

2. Measure resistance between connector 1600 terminal 3 and 10 with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read more than 100,000 ohms?

DECISION

NO Go to Step 11.
YES Go to next step.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

3. Press and hold CRUISE/THROTTLE ON/OFF switch ON. Refer to Figure 2.

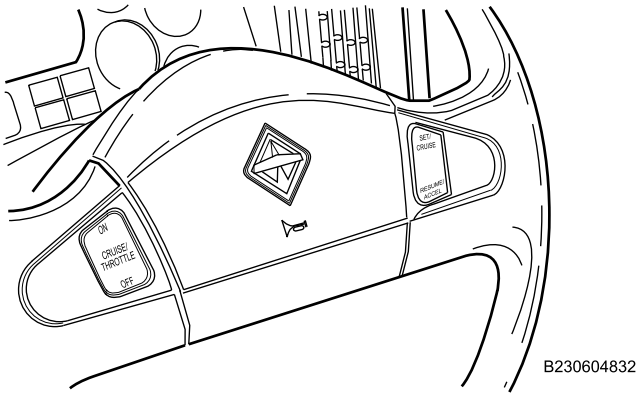


Figure 2. Speed Control Command Switches on Steering Wheel.

4. Measure resistance between connector 1600 terminals 3 and 10 with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 1,260 ohms?

DECISION

NO Go to Step 24.
YES Go to next step.

STEP

5. Press and hold CRUISE/THROTTLE ON/OFF switch OFF. Refer to Figure 2.
6. Measure resistance between connector 1600 terminals 3 and 10 with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 38.
NO Go to next step.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

7. Press and hold cruise control SET/CRUISE switch. Refer to Figure 3.

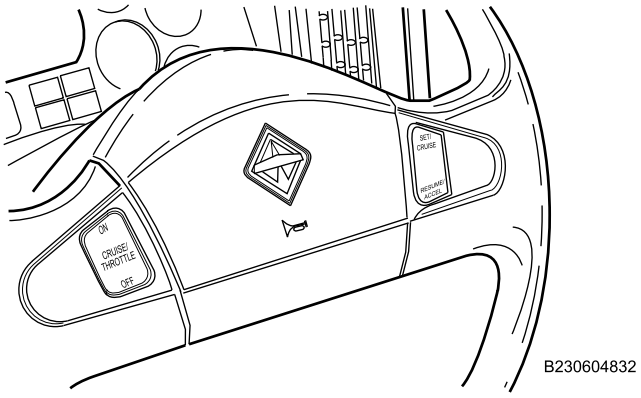


Figure 3. Speed Control Command Switches on Steering Wheel.

8. Measure resistance between connector 1600 terminal 3 and 10 with multimeter. Refer to Figure 4.

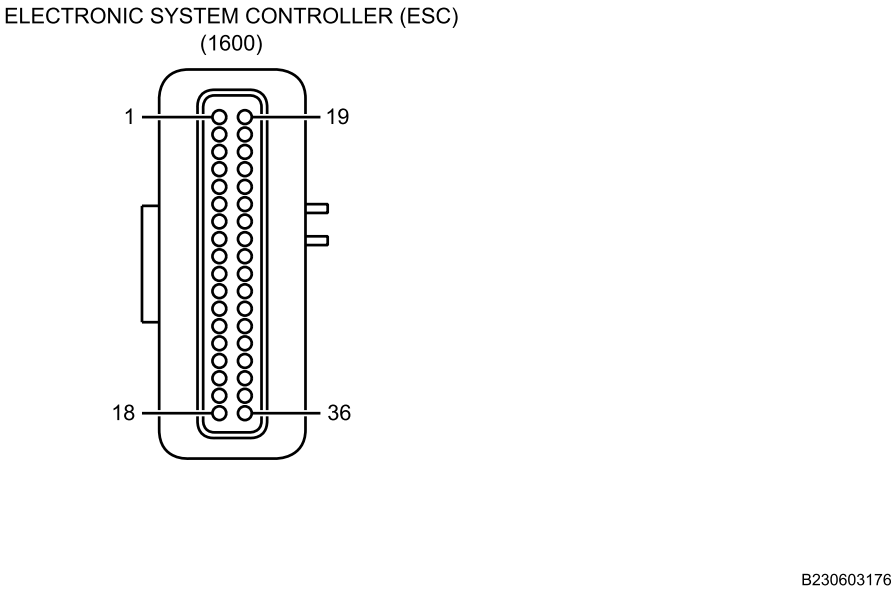


Figure 4. Connector 1600.

CONDITION/INDICATION

Does multimeter read more than 6,240 ohms?

DECISION

NO Go to Step 48.
YES Go to next step.

STEP

9. Press and hold cruise control RESUME/ACCEL switch. Refer to Figure 3.
10. Measure resistance between connector 1600 terminal 3 and 10 with multimeter. Refer to Figure 4.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 2,420 ohms?

DECISION

NO Go to Step 62.
YES Go to Step 76.

STEP

11. Disconnect connector 1805. Refer to Figure 5.

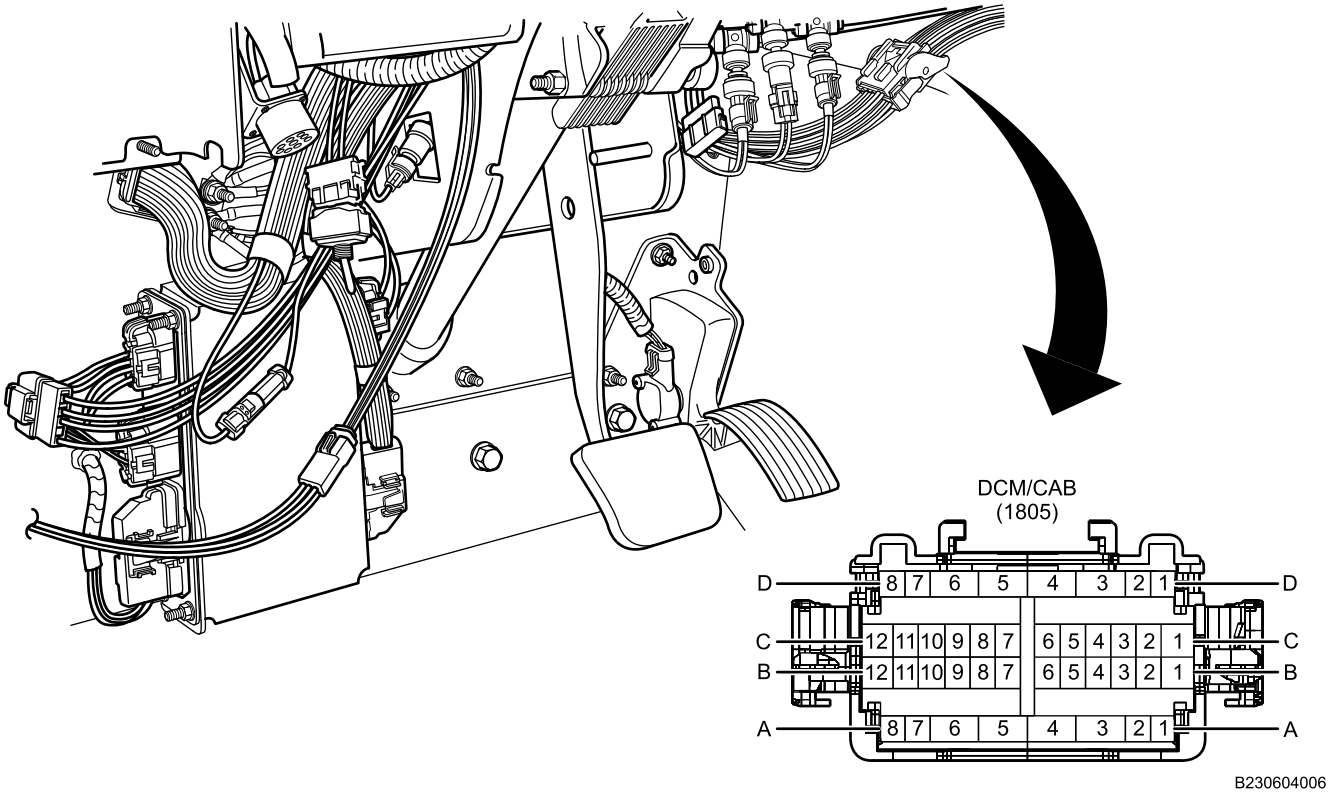


Figure 5. Driver Floor Area.

12. Measure resistance between connector 1805 terminals A4 and B12 with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read more than 100,000 ohms?

DECISION

YES Go to Step 77.
NO Go to next step.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).
14. Disconnect connector 1809. Refer to Figure 6.

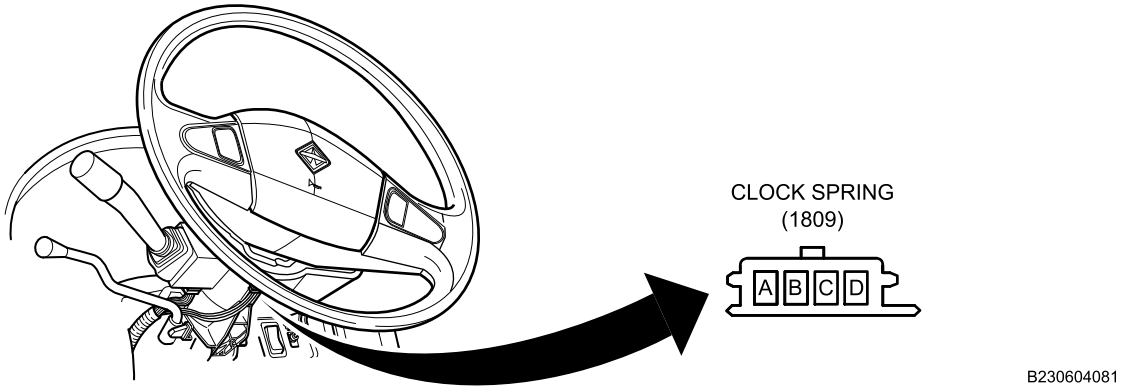


Figure 6. Steering Wheel Clock Spring Connection.

15. Measure resistance between connector 1809 terminals A and B with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read more than 100,000 ohms?

DECISION

YES Go to Step 78.
NO Go to next step.

STEP

16. Remove horn pad. Refer to Horn Button Assembly Removal and Installation (WP 0403).
17. Disconnect harness connector LAM1179. Refer to Figure 7.

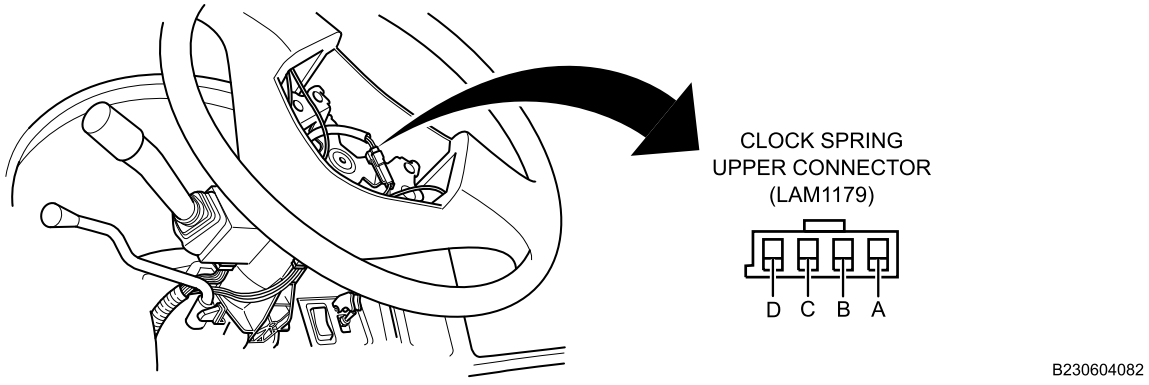


Figure 7. Inside Steering Wheel.

18. Measure resistance between harness connector LAM1179 terminals A and B with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read more than 100,000 ohms?

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 79.
NO Go to next step.

STEP

19. Remove SET/RESUME switch. Refer to Cruise Control Switch Module Removal and Installation (WP 0316).
20. Measure resistance between SET/RESUME switch terminals 1 and 2 with multimeter. Refer to Figure 8.

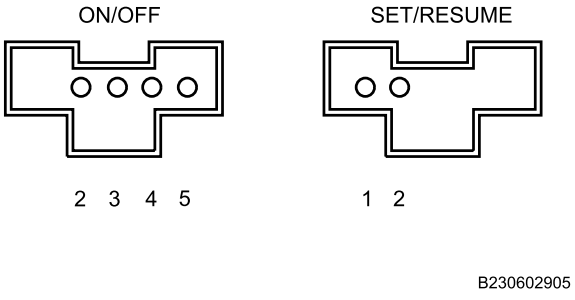


Figure 8. Cruise Control Switch Terminals.

CONDITION/INDICATION

Does multimeter read more than 100,000 ohms?

DECISION

NO Go to Step 80.
YES Go to next step.

STEP

21. Remove CRUISE/THROTTLE ON/OFF switch. Refer to Cruise Control Switch Module Removal and Installation (WP 0316).
22. Measure resistance between CRUISE/THROTTLE ON/OFF switch terminals 2 and 5 with multimeter. Refer to Figure 9.

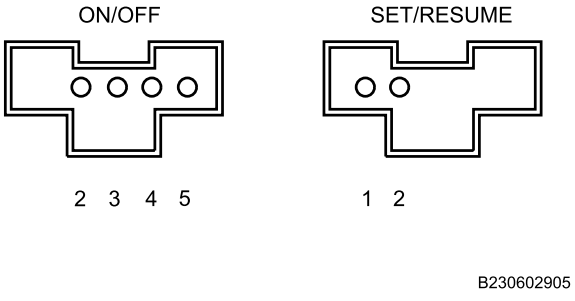


Figure 9. Cruise Control Switch Terminals.

CONDITION/INDICATION

Does multimeter read more than 100,000 ohms?

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 80.
YES Go to next step.

STEP

23. Measure resistance between connector LAM1179 terminals A and B with multimeter. Refer to Figure 10.

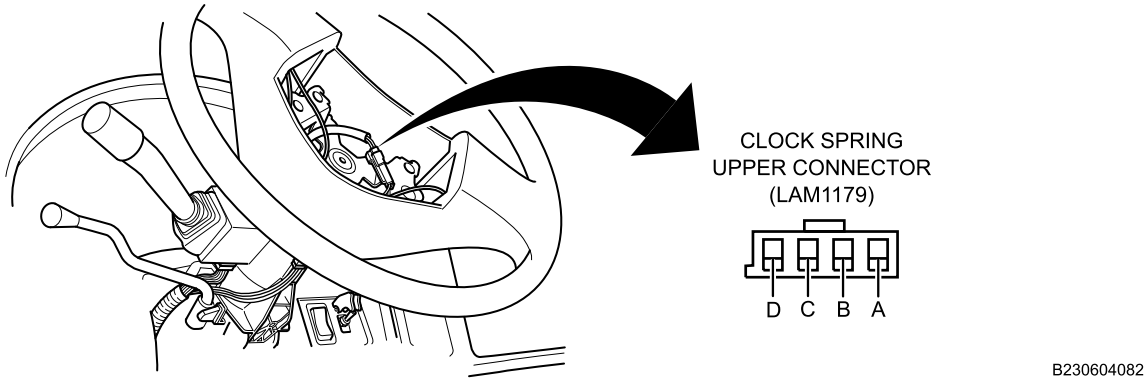


Figure 10. Inside Steering Wheel.

CONDITION/INDICATION

Does multimeter read more than 100,000 ohms?

DECISION

NO Go to Step 77.
NO Go to Step 76.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

24. Disconnect connector 1805. Refer to Figure 11.

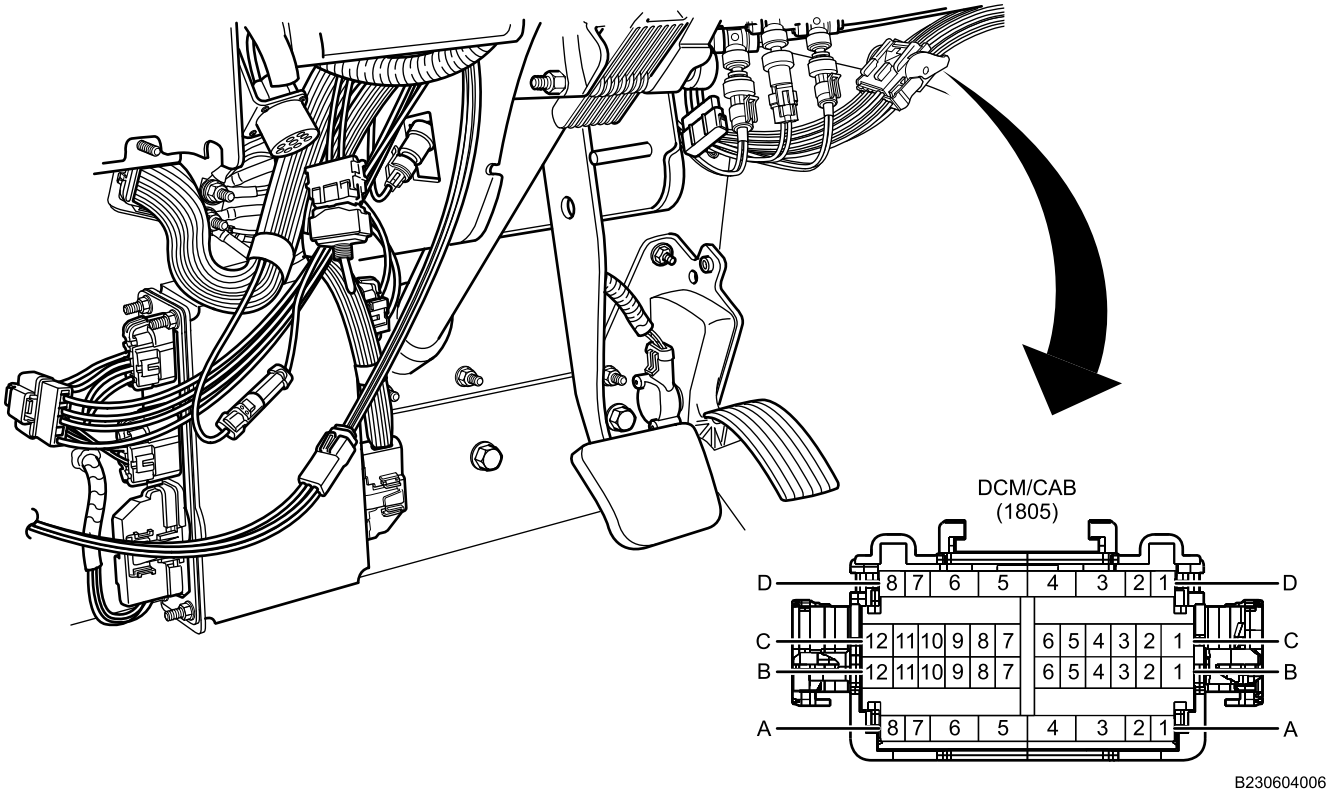


Figure 11. Driver Floor Area.

25. Press and hold CRUISE/THROTTLE ON/OFF switch ON.
26. Measure resistance between connector 1805 terminals A4 and B12 with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read less than 1,260 ohms?

DECISION

YES Go to Step 77.
NO Go to next step.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

27. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).
28. Disconnect connector 1809. Refer to Figure 12.

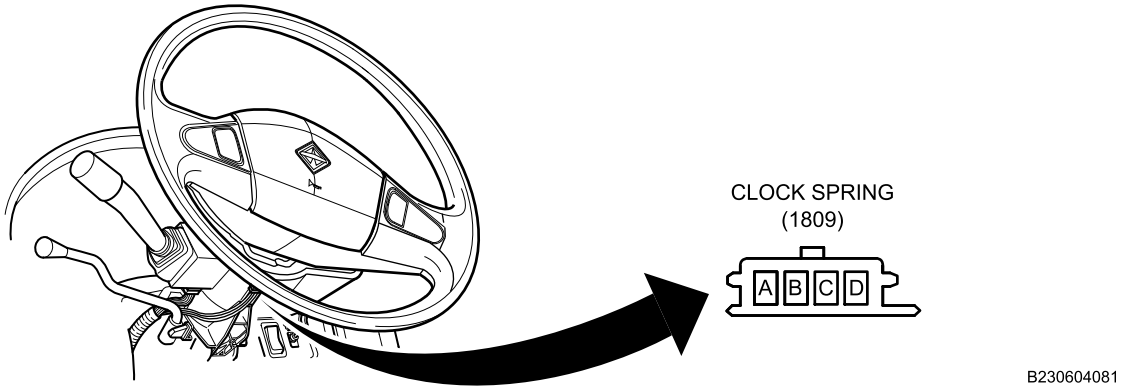


Figure 12. Steering Wheel Area.

29. Press and hold CRUISE/THROTTLE ON/OFF switch ON.
30. Measure resistance between connector 1809 terminal A and B with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read less than 1,260 ohms?

DECISION

YES Go to Step 78.
NO Go to next step.

STEP

31. Remove horn pad. Refer to Horn Button Assembly Removal and Installation (WP 0403).
32. Disconnect clock spring upper connector and steering wheel harness LAM1179. Refer to Figure 13.

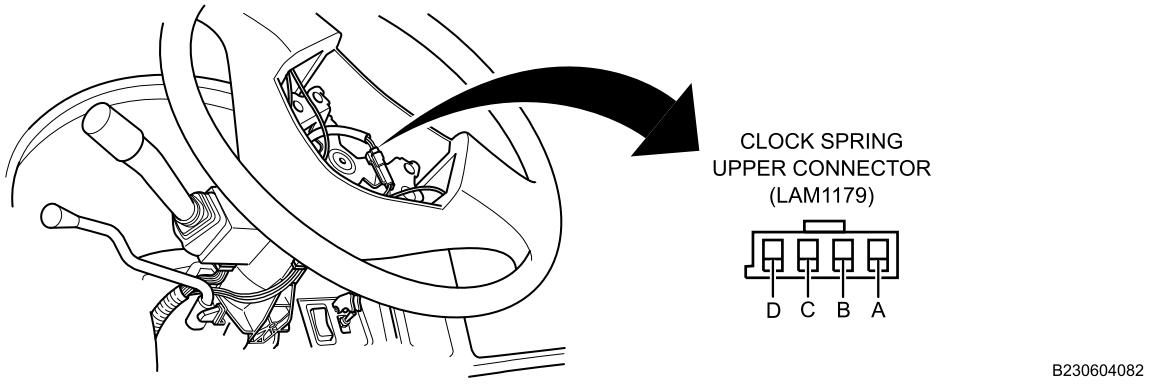


Figure 13. Inside Steering Wheel.

33. Press and hold CRUISE/THROTTLE ON/OFF switch ON.
34. Measure resistance between connector LAM1179 terminals A and B. Refer to Figure 13.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 1,260 ohms?

DECISION

YES Go to Step 79.
NO Go to next step.

STEP

35. Remove CRUISE/THROTTLE ON/OFF switch. Refer to Cruise Control Switch Module Removal and Installation (WP 0316).
36. Press and hold CRUISE/THROTTLE ON/OFF switch ON.
37. Measure resistance between CRUISE/THROTTLE ON/OFF switch terminals 2 and 5 with multimeter. Refer to Figure 14.

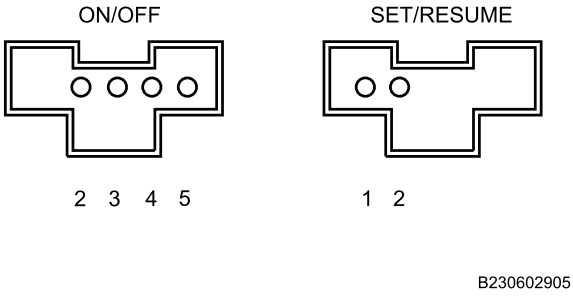


Figure 14. Cruise Control Switch Terminals.

CONDITION/INDICATION

Does multimeter read less than 1,260 ohms?

DECISION

NO Go to Step 80.
YES Go to Step 81.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

38. Disconnect connector 1805. Refer to Figure 15.

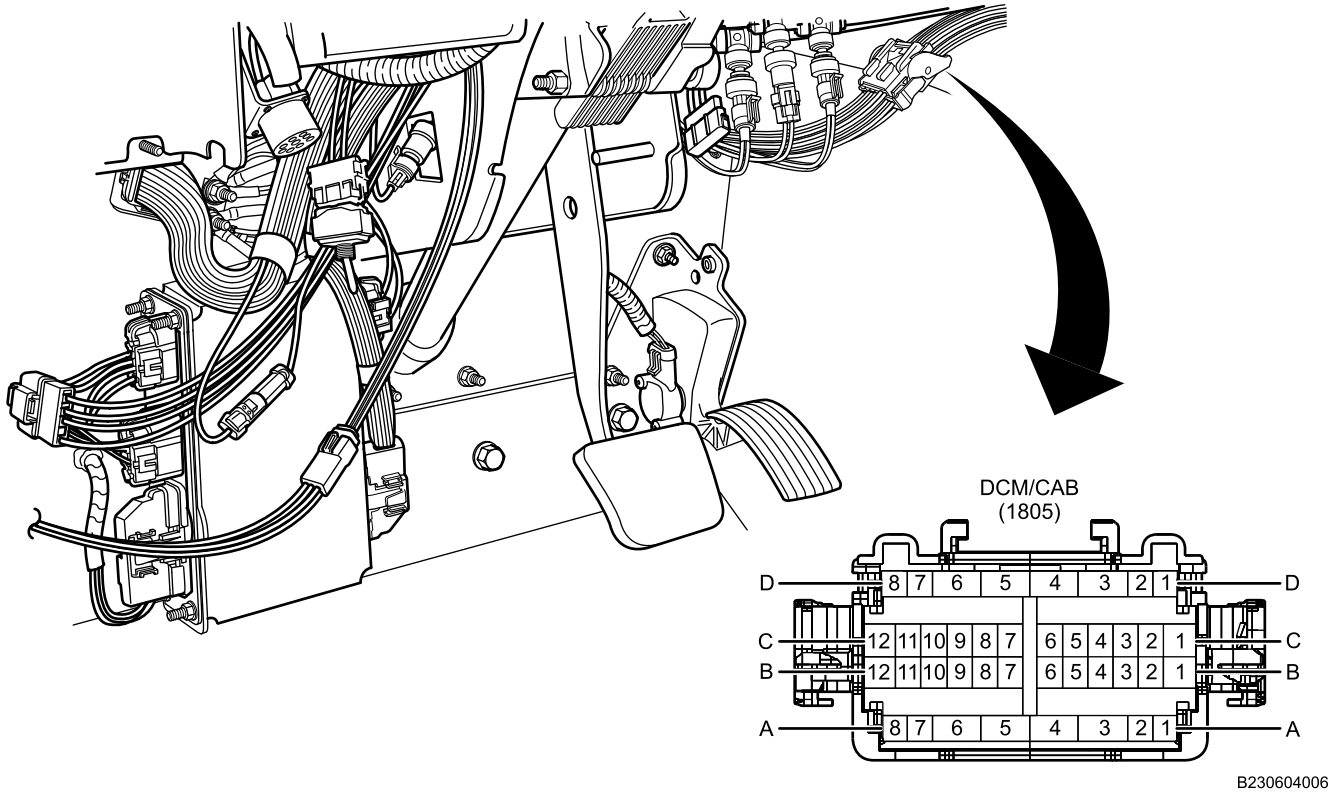


Figure 15. Driver Floor Area.

39. Press and hold CRUISE/THROTTLE ON/OFF switch OFF.
40. Measure resistance between connector 1805 terminals A4 and B12 with multimeter. Refer to Figure 15.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 77.
NO Go to next step.

STEP

41. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

42. Disconnect connector 1809. Refer to Figure 16.

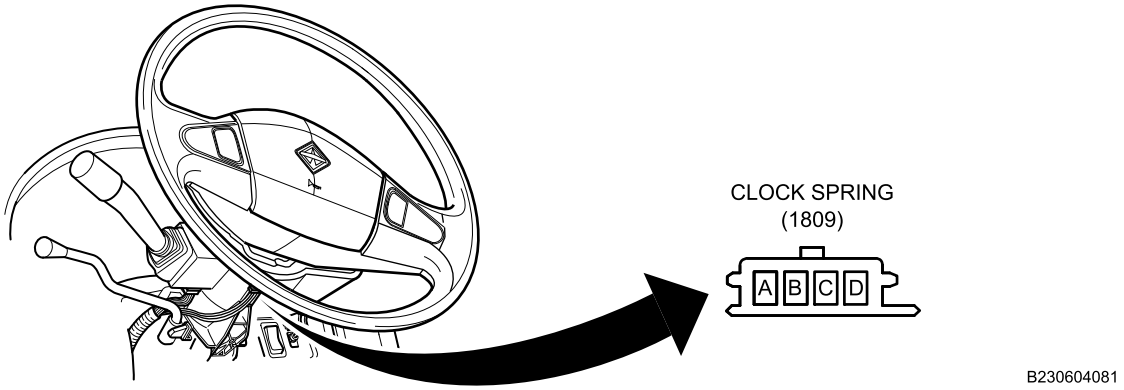


Figure 16. Steering Wheel Area.

43. Press and hold CRUISE/THROTTLE ON/OFF switch OFF.
44. Measure resistance between connector 1809 terminals A and B with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 78.
NO Go to next step.

STEP

45. Remove CRUISE/THROTTLE ON/OFF switch. Refer to Cruise Control Switch Module Removal and Installation (WP 0316).
46. Press and hold CRUISE/THROTTLE ON/OFF switch OFF.
47. Measure resistance between CRUISE/THROTTLE ON/OFF switch terminals 2 and 5 with multimeter. Refer to Figure 17.

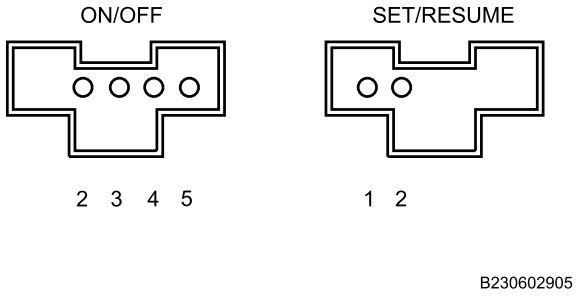


Figure 17. Cruise Control Switch Terminals.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 80.
YES Go to Step 81.

STEP

48. Disconnect connector 1805. Refer to Figure 18.

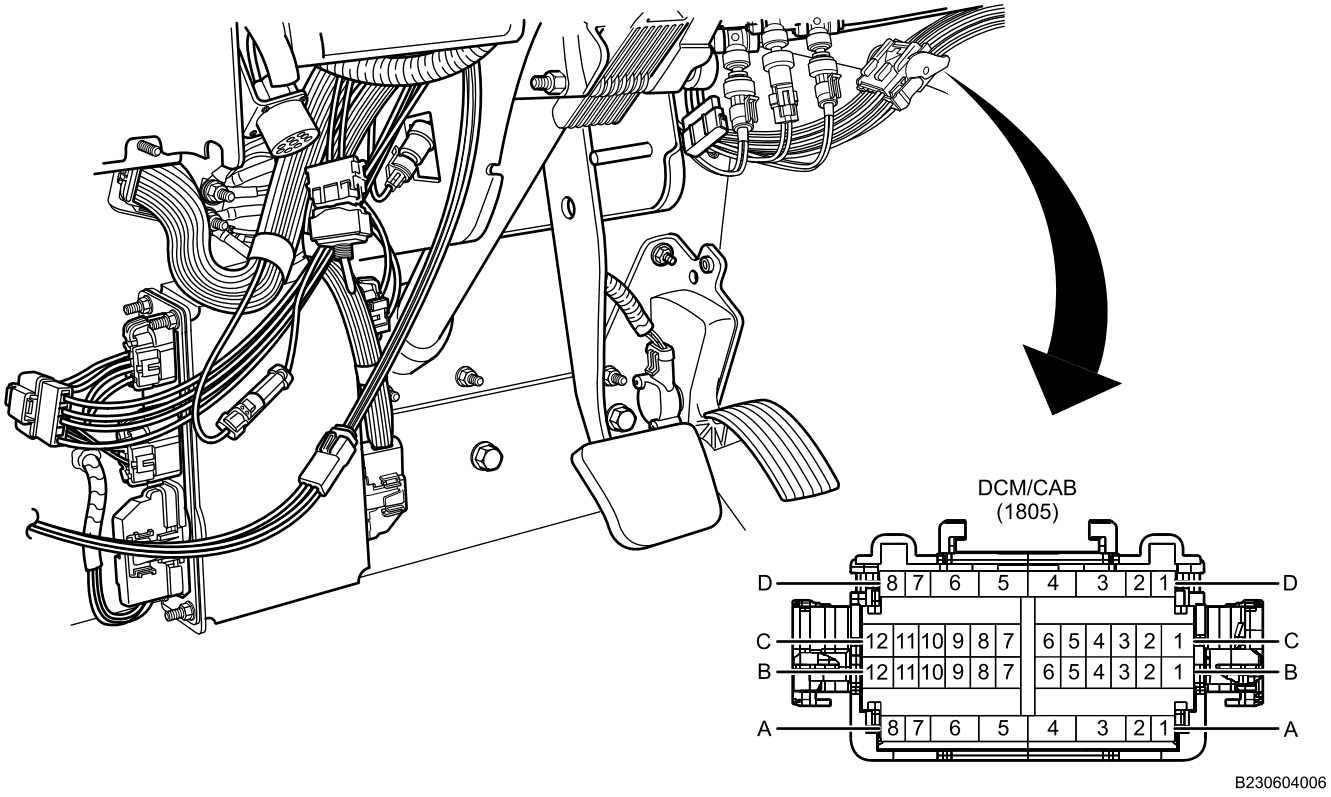


Figure 18. Driver Floor Area.

49. Press and hold SET/CRUISE switch.
50. Measure resistance between connector 1805 terminals A4 and B12 with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read less than 6,240 ohms?

DECISION

YES Go to Step 77.
NO Go to next step.

STEP

51. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

52. Disconnect connector 1809. Refer to Figure 19.

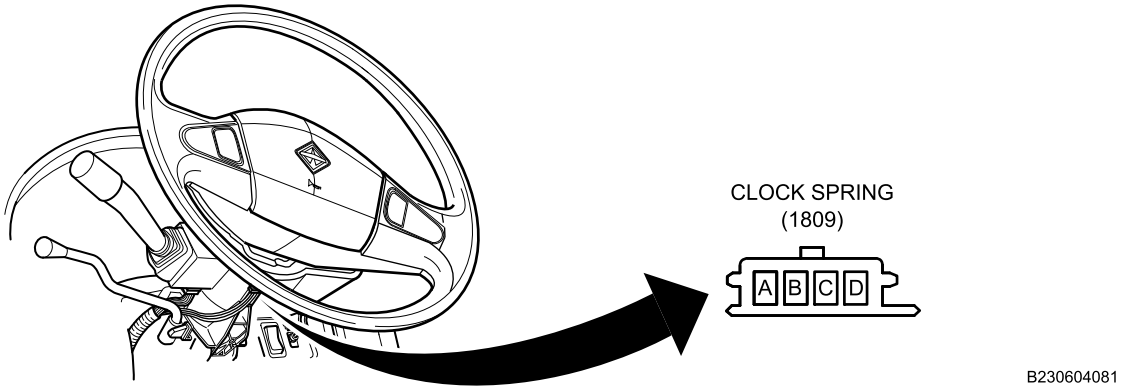


Figure 19. Steering Wheel Area.

53. Press and hold SET/CRUISE switch.
54. Measure resistance between connector 1809 terminals A and B with multimeter. Refer to Figure 19.

CONDITION/INDICATION

Does multimeter read less than 6,240 ohms?

DECISION

YES Go to Step 78.
NO Go to next step.

STEP

55. Remove horn pad. Refer to Horn Button Assembly Removal and Installation (WP 0403).
56. Disconnect connector LAM1179. Refer to Figure 20.

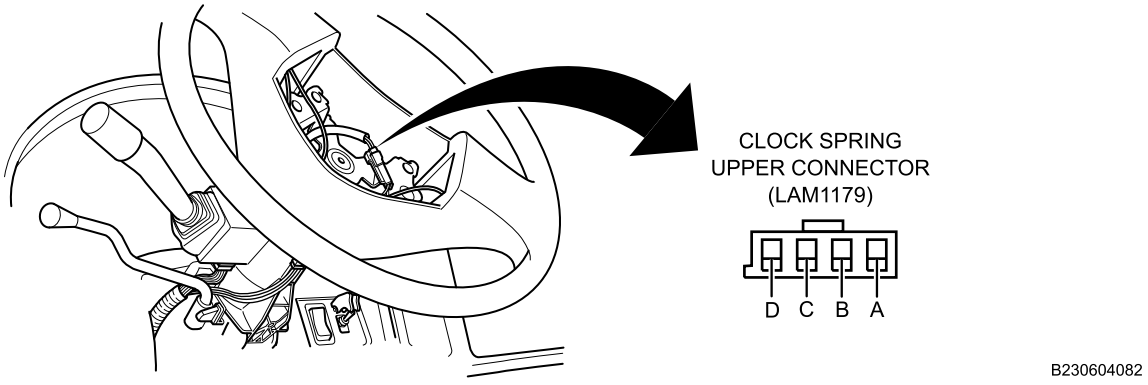


Figure 20. Inside Steering Wheel.

57. Press and hold SET/CRUISE switch.
58. Measure resistance between connector LAM1179 terminals A and B with multimeter. Refer to Figure 20.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 6,240 ohms?

DECISION

YES Go to Step 79.
NO Go to next step.

STEP

59. Remove SET/RESUME switch. Refer to Cruise Control Switch Module Removal and Installation (WP 0316).
60. Press and hold SET/CRUISE switch.
61. Measure resistance between SET/RESUME switch terminals 1 and 2 with multimeter. Refer to Figure 21.

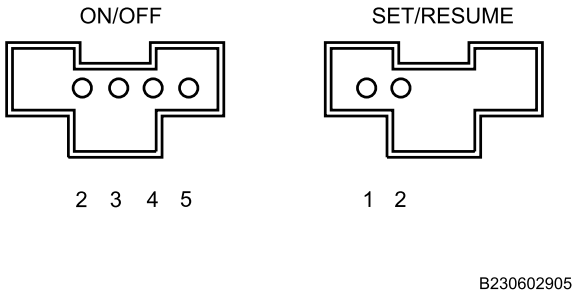


Figure 21. Cruise Control Switch Terminals.

CONDITION/INDICATION

Does multimeter read less than 6,240 ohms?

DECISION

NO Go to Step 80.
YES Go toStep 81.

STEP

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

62. Disconnect connector 1805. Refer to Figure 22.

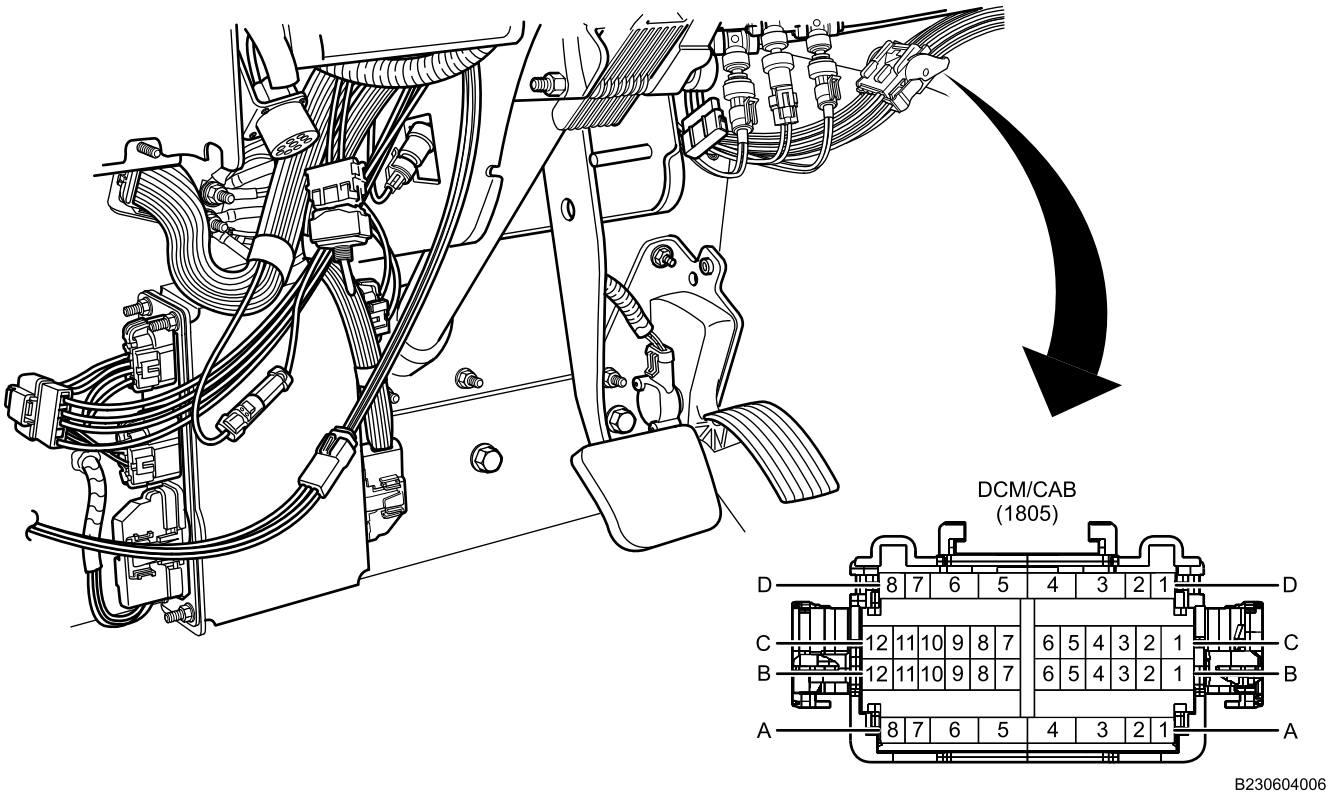


Figure 22. Driver Floor Area.

63. Press and hold RESUME/ACCEL switch.
64. Measure resistance between connector 1805 terminals A4 and B12 with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read less than 2,420 ohms?

DECISION

YES Go to Step 77.
NO Go to next step.

STEP

65. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

66. Disconnect connector 1809. Refer to Figure 23.

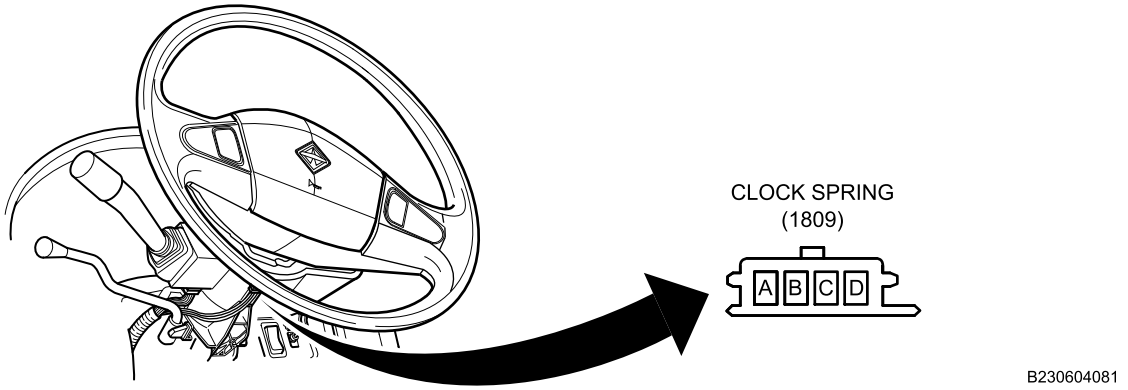


Figure 23. Steering Wheel Area.

67. Press and hold RESUME/ACCEL switch.
68. Measure resistance between connector 1809 terminals A and B with multimeter. Refer to Figure 23.

CONDITION/INDICATION

Does multimeter read less than 2,420 ohms?

DECISION

YES Go to Step 78.
NO Go to next step.

STEP

69. Remove horn pad. Refer to Horn Button Assembly Removal and Installation (WP 0403).
70. Disconnect connector LAM1179. Refer to Figure 24.

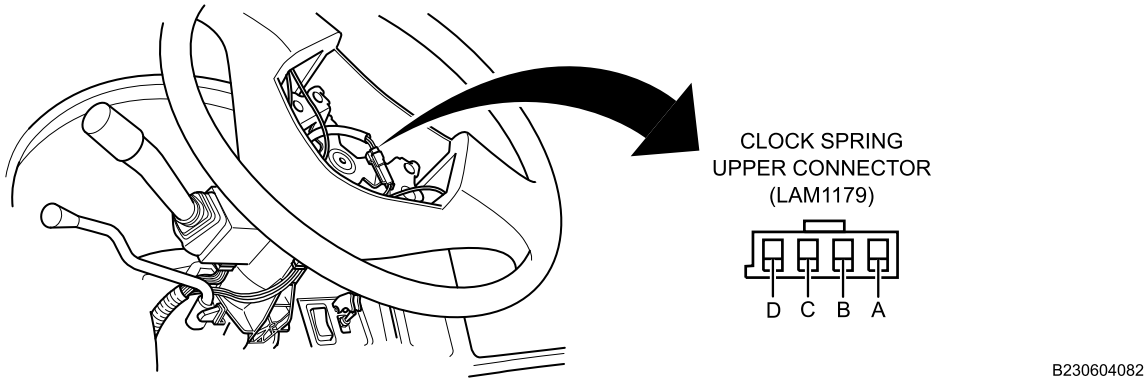


Figure 24. Inside Steering Wheel.

71. Press and hold RESUME/ACCEL switch.
72. Measure resistance between connector LAM1179 terminals A and B with multimeter. Refer to Figure 24.

CONDITION/INDICATION

Does multimeter read less than 2,420 ohms?

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 79.
NO Go to next step.

STEP

73. Remove SET/RESUME switch. Refer to Cruise Control Switch Module Removal and Installation (WP 0316).
74. Press and hold RESUME/ACCEL switch.
75. Measure resistance between SET/RESUME switch terminals 1 and 2 with multimeter. Refer to Figure 25.

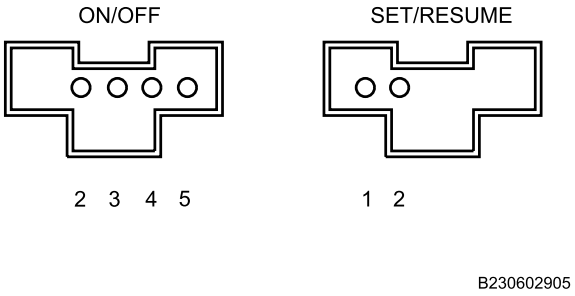


Figure 25. Cruise Control Switch Terminals.

CONDITION/INDICATION

Does multimeter read less than 2,420 ohms?

DECISION

NO Go to Step 80.
YES Go to Step 81.

MALFUNCTION

- 76. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

MALFUNCTION

- 77. Instrument panel harness is faulty.

ACTION

Replace instrument panel harness. Refer to Instrument Panel Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 78. Steering column harness is faulty.

SPEED CONTROL COMMAND SWITCHES (SCCS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace steering column harness. Refer to Steering Column Wiring Harness Removal and Installation (WP 0324). Return vehicle to service.

END OF TEST

MALFUNCTION

- 79. Clock spring harness is faulty.

ACTION

Replace steering wheel. Refer to Steering Wheel and Clock Spring Removal and Installation (WP 0534). Return vehicle to service.

END OF TEST

MALFUNCTION

- 80. Switch is faulty.

ACTION

Replace switch. Refer to Cruise Control Switch Module Removal and Installation (WP 0316). Return vehicle to service.

END OF TEST

MALFUNCTION

- 81. Steering wheel harness is faulty.

ACTION

Replace steering wheel harness. Refer to Steering Wheel Wire Harness Removal and Installation (WP 0325). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0329
WP 0336
WP 0395
WP 0460
WP 0606
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

Drawings Required
Schematic (WP 0789, Figure 69)

DIAGNOSTIC TROUBLE CODES AND SYMPTOMS.

This procedure covers the following DTCs:

- 141
- 142
- 215

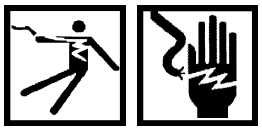
This procedure covers the following symptoms:

Speedometer is inoperative.

TROUBLESHOOTING PROCEDURE

STEP

WARNING



Use extreme caution when testing or working on electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedure Overview in How to Use This Manual before performing any troubleshooting procedures.

1. Disconnect VSS connector 9755. Refer to Figure 1.

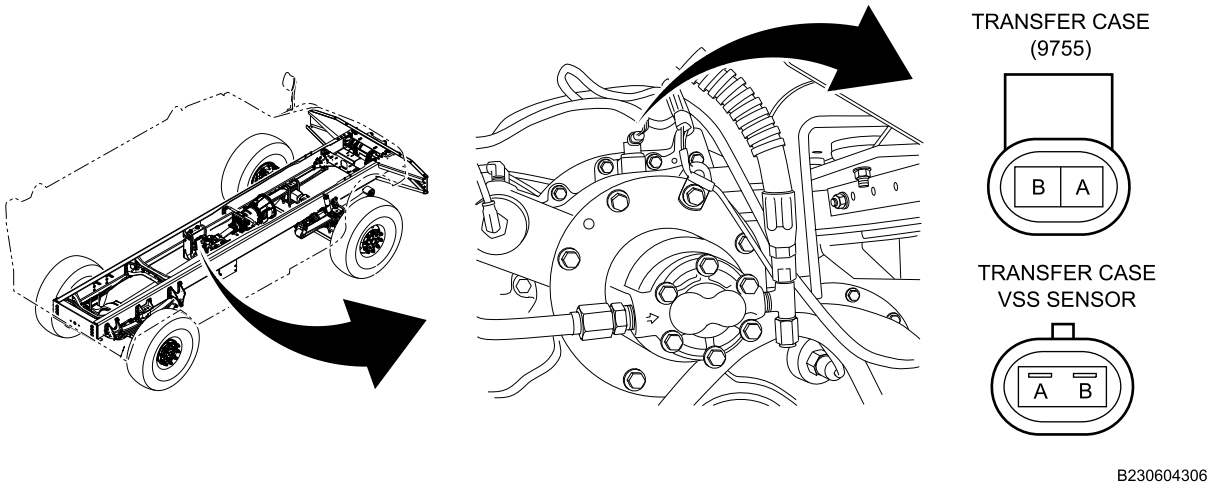


Figure 1. VSS Connector and Sensor Location.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

2. Measure resistance between VSS sensor terminals A and B with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 500 and 1450 ohms?

DECISION

NO Go to Step 58.
YES Go to next step.

STEP

3. Measure resistance between VSS sensor terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 58.
YES Go to next step.

STEP

4. Measure resistance between VSS sensor terminal B and ground with multimeter. Refer to Figure 2.

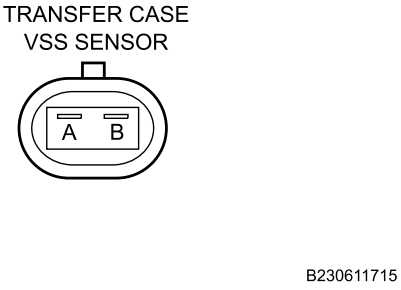


Figure 2. VSS Connector

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 58.
YES Go to next step.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Turn MAIN POWER switch ON (TM 9-2355-106-10).
6. Turn ignition switch ON (TM 9-2355-106-10).
7. Measure DC voltage between connector 9755 terminal A and ground with multimeter. Refer to Figure 3.

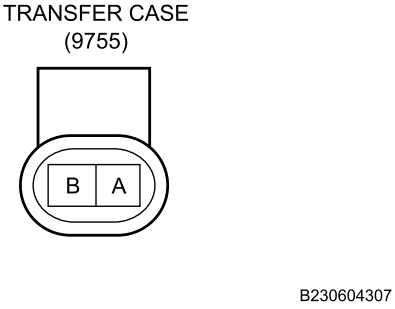


Figure 3. VSS Terminals.

CONDITION/INDICATION

Does multimeter read more than 4.0V?

DECISION

YES Go to Step 15.
NO Go to next step.

STEP

8. Measure DC voltage between connector 9755 terminal A and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read less than 1.0V?

DECISION

YES Go to Step 21.
NO Go to next step.

STEP

9. Measure DC voltage between connector 9755 terminal B and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read more than 4.0V?

DECISION

YES Go to Step 28.
NO Go to next step.

STEP

10. Measure DC voltage between connector 9755 terminal B and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read less than 1.0V?

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 35.
NO Go to next step.

STEP

11. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
12. Turn ignition switch OFF (TM 9-2355-106-10).
13. Measure resistance between connector 9755 terminals A and B with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 43.
NO Go to next step.

STEP

14. Remove vehicle speed sensor from transfer case and inspect surface facing tone wheel for damage. Refer to Vehicle Speed Sensor Removal and Installation (WP 0395).

CONDITION/INDICATION

Is the speed sensor surface damaged?

DECISION

YES Go to Step 62.
NO Go to Step 61.

STEP

15. Remove belly armor. Refer to Belly Armor Removal and Installation (WP 0606).

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

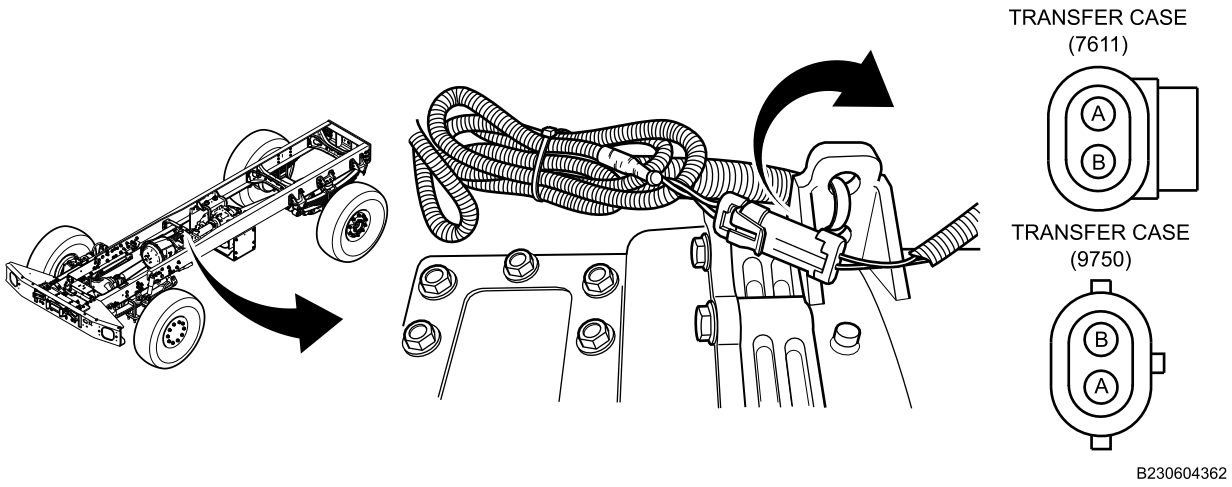


Figure 4. VSS Harness Connector Above Transmission.

16. Disconnect VSS harness connector 9750/7611. Refer to Figure 4.
17. Measure DC voltage between connector 7611 terminal A and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read more than 4.0V?

DECISION

NO Go to Step 60.
YES Go to next step.

STEP

18. Perform engine shut down procedure (TM 9-2355-106-10).

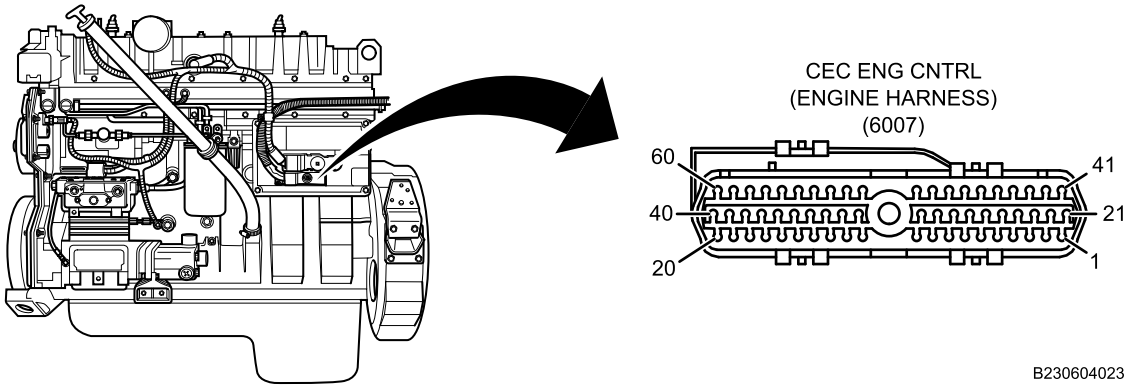


Figure 5. ECM Connector 6007.

19. Disconnect ECM connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).
20. Measure resistance between connector 6007 terminal 39 and remaining terminals with multimeter. Refer to Figure 5.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 59.
NO Go to Step 61.

STEP

21. Perform engine shut down procedure (TM-9-2355-106-10).

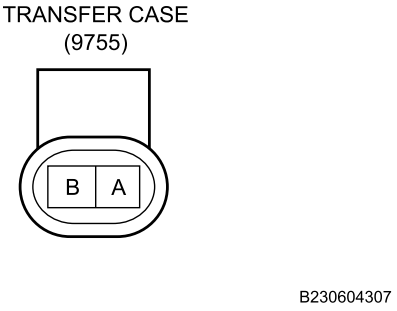


Figure 6. VSS Terminals.

22. Measure resistance between connector 9755 terminal A and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 48.
NO Go to next step.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

23. Remove belly armor. Refer to Belly Armor Removal and Installation (WP 0606).

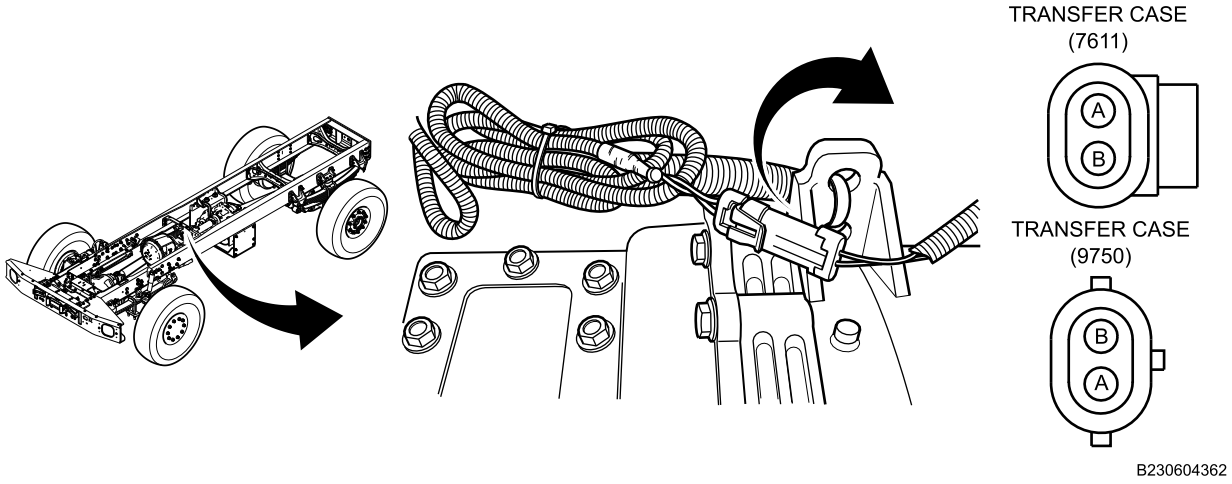


Figure 7. VSS Harness Connector Above Transmission.

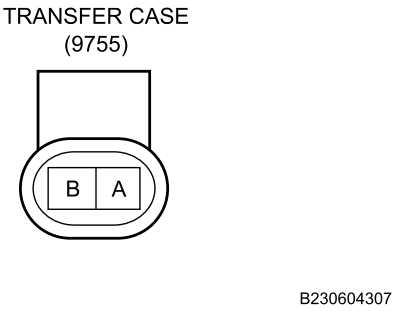


Figure 8. VSS Terminals

24. Disconnect VSS harness connector 9750/7611. Refer to Figure 7.
25. Measure resistance between connector 9750 terminal A and connector 9755 terminal A with multimeter. Refer to Figure 7 and Figure 8.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 60.
NO Go to next step.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

26. Disconnect ECM connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

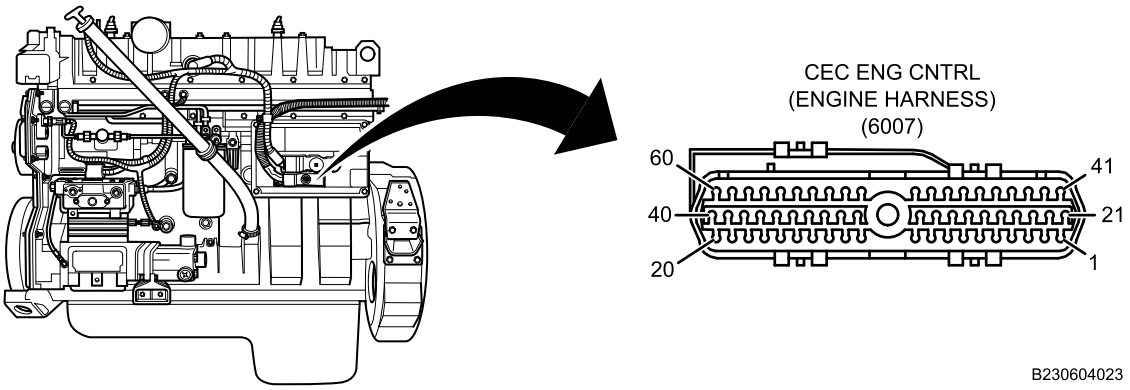


Figure 9. ECM Connector 6007.

27. Measure resistance between connector 6007 terminal 39 and connector 7611 terminal A with multimeter. Refer to Figure 9 and Figure 10.

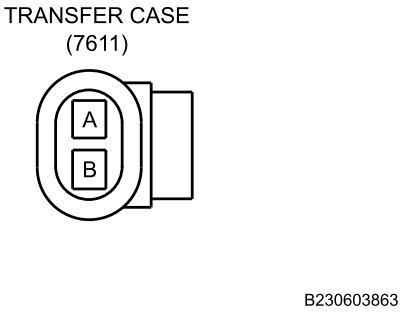


Figure 10. Connector 7611.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 61.
NO Go to Step 59.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Remove belly armor. Refer to Belly Armor Removal and Installation (WP 0606).

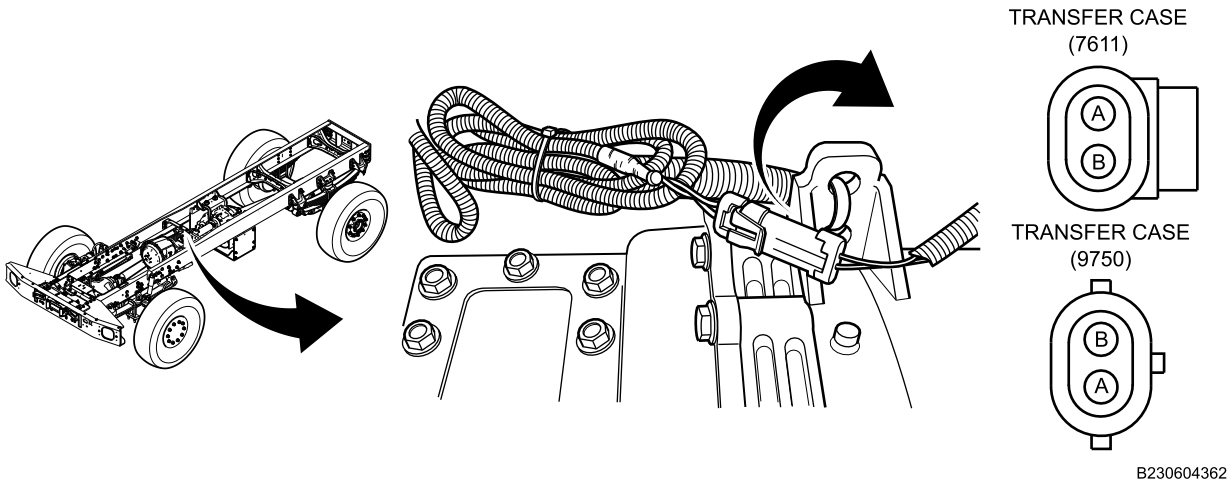


Figure 11. VSS Harness Connector Above Transmission.

29. Disconnect VSS harness connector 9750/7611. Refer to Figure 11.
30. Measure DC voltage between connector 7611 terminal B and ground with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read more than 4.0V?

DECISION

NO Go to Step 60.
YES Go to next step.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

31. Turn ignition switch OFF (TM 9-2355-106-10).
32. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

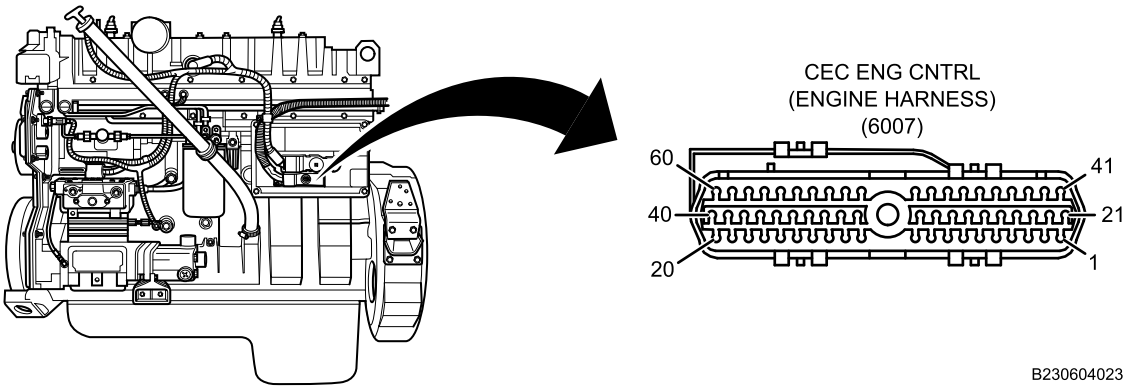


Figure 12. ECM Connector 6007.

33. Disconnect ECM connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).
34. Measure resistance between connector 6007 terminal 40 and remaining terminals with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 59.
NO Go to Step 61.

STEP

35. Turn ignition switch OFF (TM-9-2355-106-10).
36. Turn MAIN POWER switch OFF (TM-9-2355-106-10).

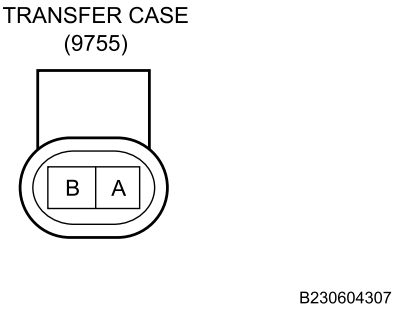


Figure 13. VSS Terminals.

37. Measure resistance between connector 9755 terminal B and ground with multimeter. Refer to Figure 13.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 53.
NO Go to next step.

STEP

38. Remove belly armor. Refer to Belly Armor Removal and Installation (WP 0606).

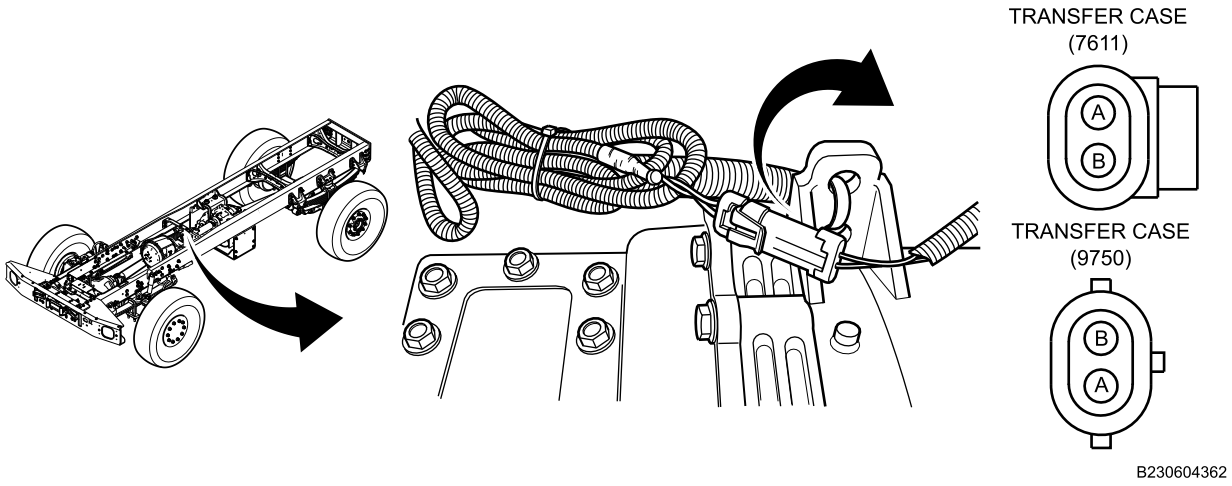


Figure 14. VSS Harness Connector Above Transmission.

39. Disconnect VSS harness connector 9750/7611. Refer to Figure 14.
40. Measure resistance between connector 9755 terminal B and connector 9750 terminal B with multimeter. Refer to Figure 13 and Figure 14.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 60.
NO Go to next step.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

41. Disconnect ECM connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

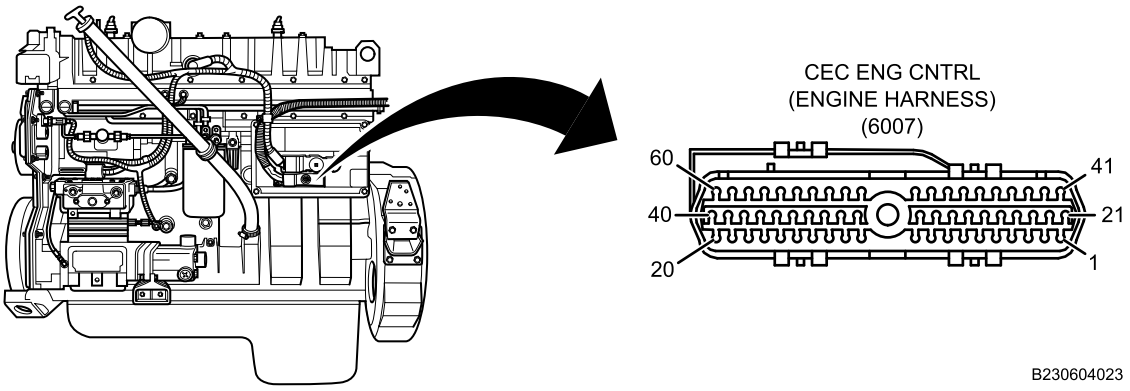


Figure 15. ECM Connector 6007.

42. Measure resistance between connector 6007 terminal 40 and connector 7611 terminal B with multimeter. Refer to Figure 15 and Figure 16.

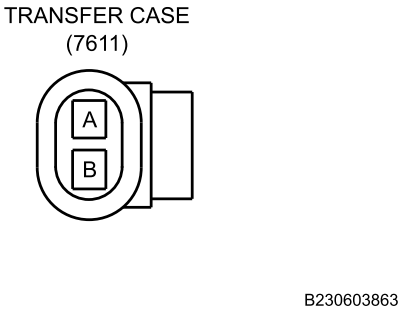


Figure 16. Connector 7611.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 61.
NO Go to Step 59.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

43. Remove belly armor. Refer to Belly Armor Removal and Installation (WP 0606).
44. Disconnect VSS harness connector 9750/7611. Refer to Figure 17.

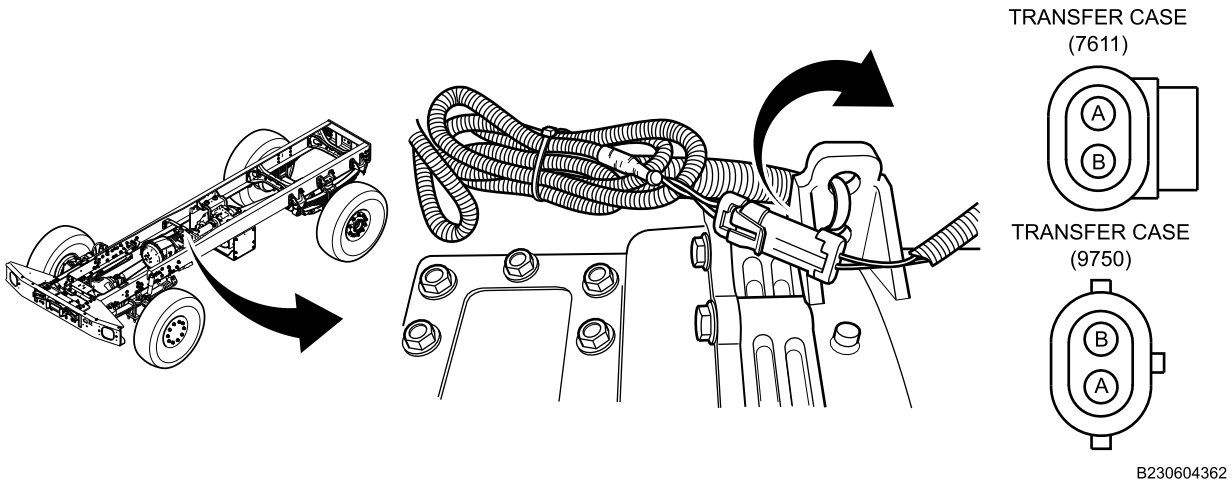


Figure 17. VSS Harness Connector Above Transmission.

45. Measure resistance between connector 7611 terminals A and B with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 60.
YES Go to next step.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

46. Disconnect ECM connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

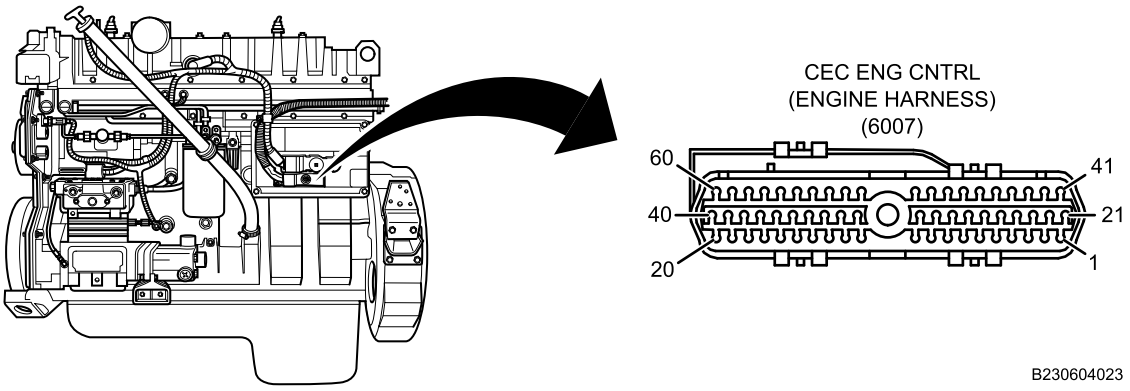


Figure 18. ECM Terminals.

47. Measure resistance between connector 6007 terminals 40 and 39 with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 59.
NO Go to Step 61.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

48. Remove belly armor. Refer to Belly Armor Removal and Installation (WP 0606).
49. Disconnect VSS harness connector 9750/7611. Refer to Figure 19.

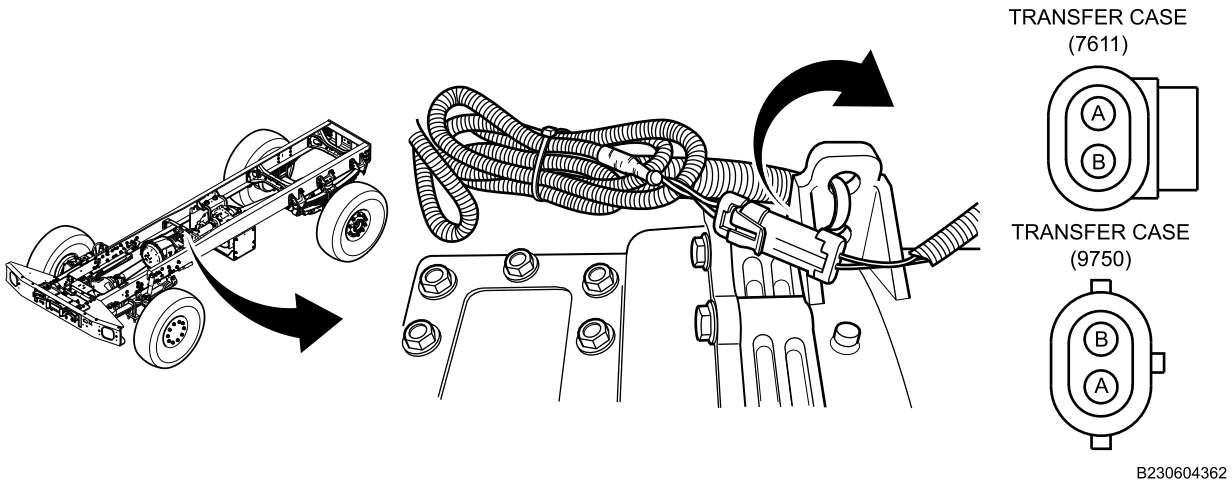


Figure 19. VSS Harness Connector Above Transmission.

50. Measure resistance between connector 9750 terminal A and ground with multimeter. Refer to Figure 19.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 60.
NO Go to next step.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

51. Disconnect ECM connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

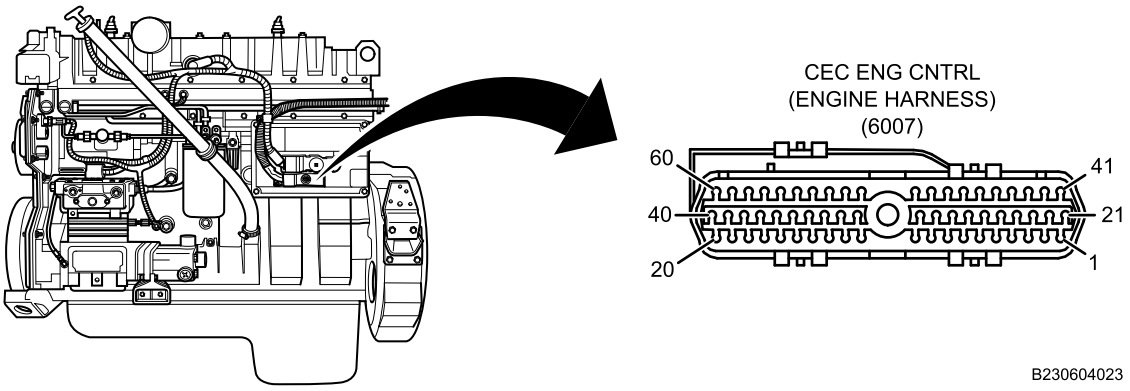


Figure 20. ECM Connector 6007.

52. Measure resistance between connector 6007 terminal 39 and ground with multimeter. Refer to Figure 20.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 59.
NO Go to Step 61.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

53. Remove belly armor. Refer to Belly Armor Removal and Installation (WP 0606).
54. Disconnect VSS harness connector 9750/7611. Refer to Figure 21.

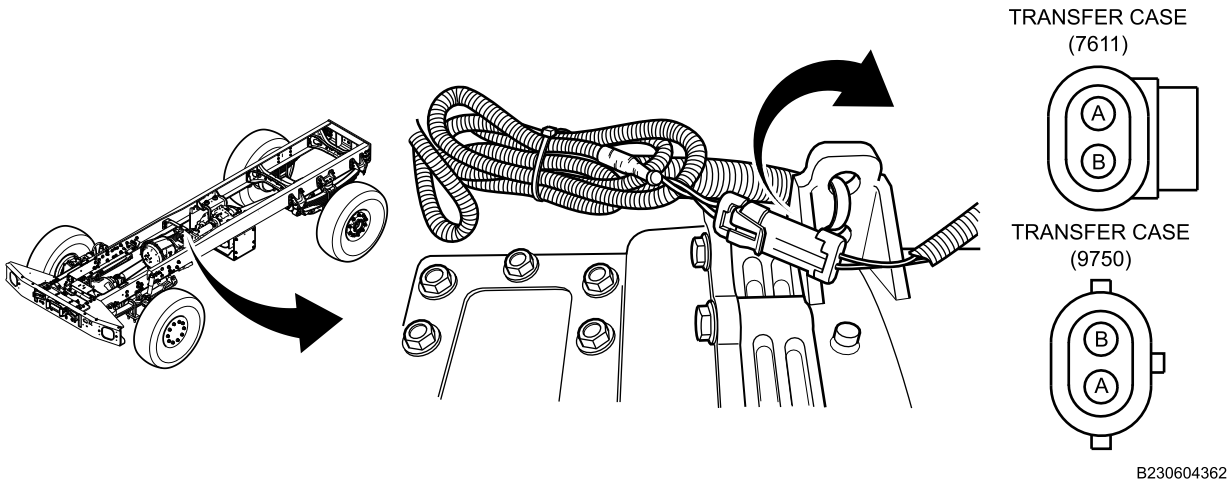


Figure 21. VSS Harness Connector Above Transmission.

55. Measure resistance between connector 9750 terminal B and ground with multimeter. Refer to Figure 21.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 60.
NO Go to next step.

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

56. Disconnect ECM connector 6007. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

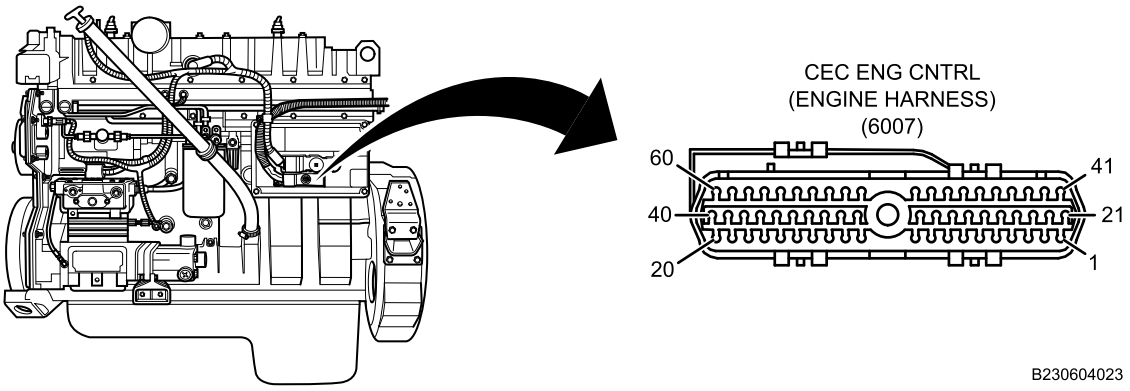


Figure 22. ECM Connector 6007.

57. Measure resistance between connector 6007 terminal 40 and ground with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 59.
NO Go to Step 61.

MALFUNCTION

- 58. VSS is faulty.

ACTION

Replace VSS. Refer to Vehicle Speed Sensor Removal and Installation (WP 0395). Return vehicle to service.

END OF TEST

MALFUNCTION

- 59. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

VEHICLE SPEED SENSOR (VSS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 60. Transfer case wiring from sensor to engine wiring harness is faulty.

ACTION

Replace center chassis wiring harness. Refer Center Chassis Harness Removal and Installation (WP 0426). Return vehicle to service.

END OF TEST

MALFUNCTION

- 61. ECM is faulty.

ACTION

Replace ECM. Refer to ECM Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 62. Transfer case is faulty.

ACTION

Replace transfer case and vehicle speed sensor. Refer to Transfer Case Assembly Removal and Installation (WP 0460) and Vehicle Speed Sensor Removal and Installation (WP 0395). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

POWER DISTRIBUTION TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0061
WP 0062
WP 0063
WP 0064
WP 0065
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

SYMPTOM

Power not available at Instrument Panel Distribution Center fuse block.

MALFUNCTION

No power at one or more sockets in fuse block 1011.

CORRECTIVE ACTION

Go to Cabin Fuse Block 1011 Troubleshooting Procedure (WP 0061).

MALFUNCTION

No power at one or more sockets in fuse block 1012.

CORRECTIVE ACTION

Go to Cabin Fuse Block 1012 Troubleshooting Procedure (WP 0062).

MALFUNCTION

No power at one or more sockets in fuse block 1013.

CORRECTIVE ACTION

Go to Cabin Fuse Block 1013 Troubleshooting Procedure (WP 0063).

MALFUNCTION

No power at one or more sockets in fuse block 1014.

CORRECTIVE ACTION

Go to Cabin Fuse Block 1014 Troubleshooting Procedure (WP 0064).

SYMPTOM

Power not available at Power Distribution Center (PDC).

MALFUNCTION

No power at one or more sockets in fuse block 4001.

CORRECTIVE ACTION

POWER DISTRIBUTION TROUBLESHOOTING PROCEDURE - (CONTINUED)

Go to Power Distribution Center (PDC) Mini Fuse Block 4001 Troubleshooting Procedure (WP 0065).

END OF WORK PACKAGE

FIELD MAINTENANCE

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

Materials/Parts
Goggles, industrial (WP 0794, Item 20)
Face shield, industrial (WP 0794, Item 16)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0443
WP 0348
WP 0437
WP 0341
WP 0407
WP 0346
WP 0347
WP 0319
WP 0296
WP 0351
WP 0335
WP 0411
WP 0353
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Exterior battery box armor door removed (WP 0604)

Drawings Required
WP 0789,
WP 0789, Figure 16

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Wear protective eye goggles, face shield, and long sleeves when working on or near batteries. Batteries contain corrosive acid and can produce explosive gases. Batteries supply electrical current that can cause burns and electrical shock. Always check electrolyte level with engine off. Avoid leaning over or onto battery. Do not wear jewelry and do not smoke or have open flame or spark near battery. Do not allow tools to contact battery box or battery terminals. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Battery acid must not contact eyes, skin, or clothing. If battery acid contacts eyes or skin, flush area with large amounts of water for 15 minutes and seek immediate medical care. If swallowed, do not induce vomiting. Drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Seek immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Measure DC voltage between connector LAM1163 12V terminal (Figure 1, Item 1) and ground with multimeter.

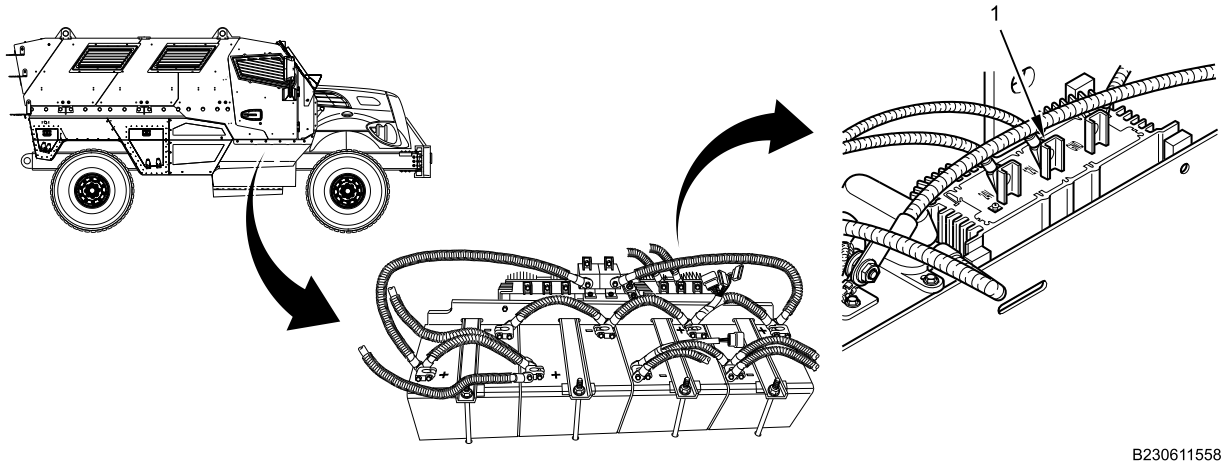


Figure 1. Front Battery Equalizer.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 18.
YES Go to next step.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

4. Measure DC voltage between connector LAM1164 24V terminal (Figure 2, Item 1) and ground with multimeter.

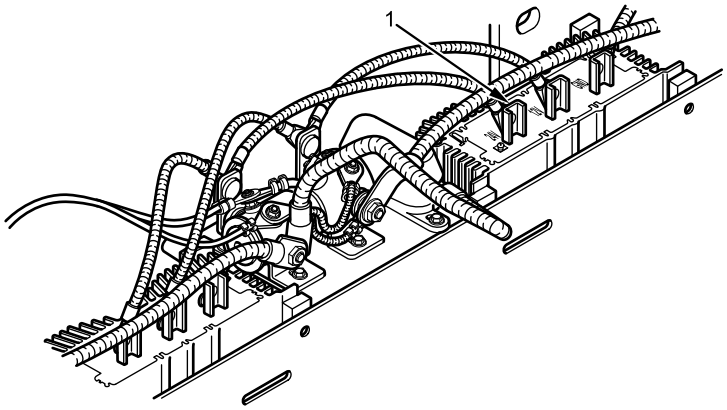


Figure 2. Connector LAM1164.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

NO Go to Step 28.
YES Go to next step.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Measure DC voltage between 12V megafuse (Figure 3, Item 1) terminal (battery side) and ground with multimeter.

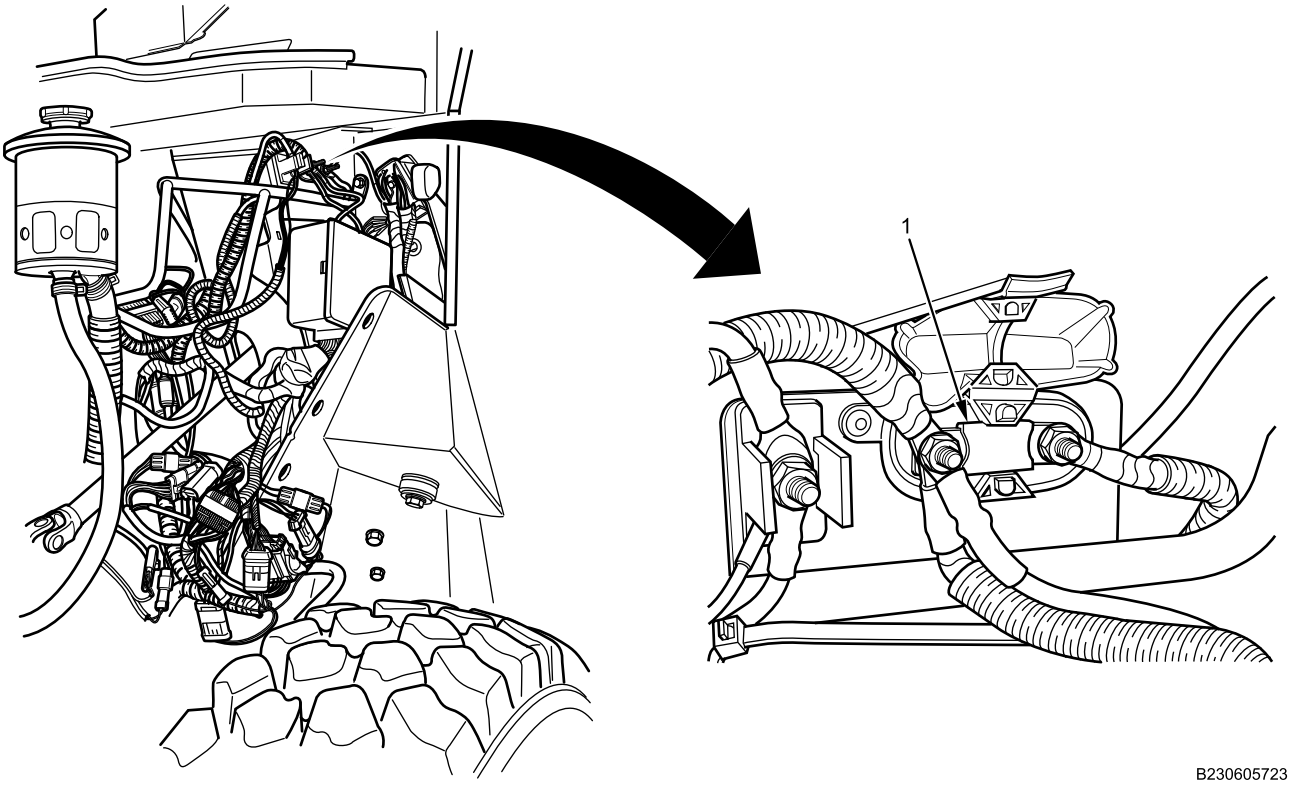


Figure 3. Left Engine, Above Power Distribution Center (PDC).

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 31.
YES Go to next step.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

6. Turn ignition switch OFF (TM 9-2355-106-10).

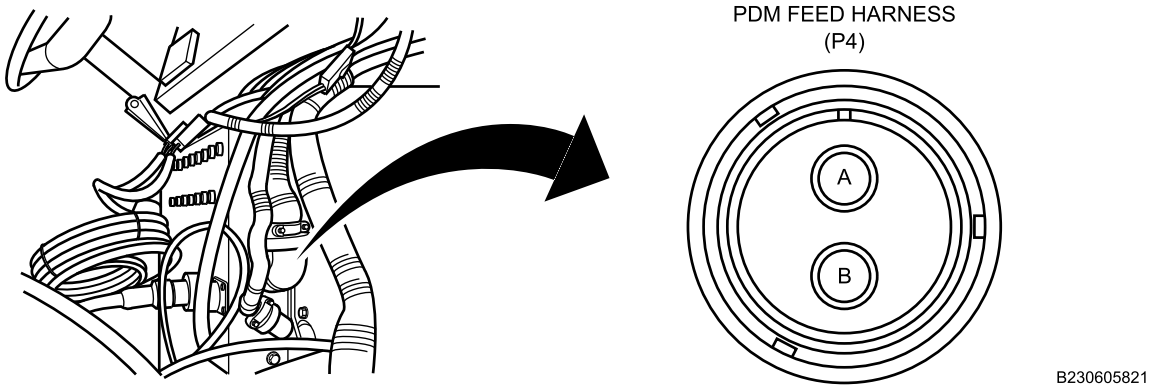


Figure 4. Below Center Instrument Panel (IP).

7. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
8. Disconnect 24V Power Distribution Module (PDM) connector P4. Refer to Figure 4.
9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Turn ignition switch ON (TM 9-2355-106-10).
11. Measure DC voltage between ground and PDM connector P4 terminals A and B with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V at each terminal?

DECISION

YES Go to Step 37.
NO Go to next step.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

12. Turn ignition switch OFF (TM 9-2355-106-10).
13. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
14. Disconnect 24V body feed harness connector LAM1044. Refer to Figure 5.

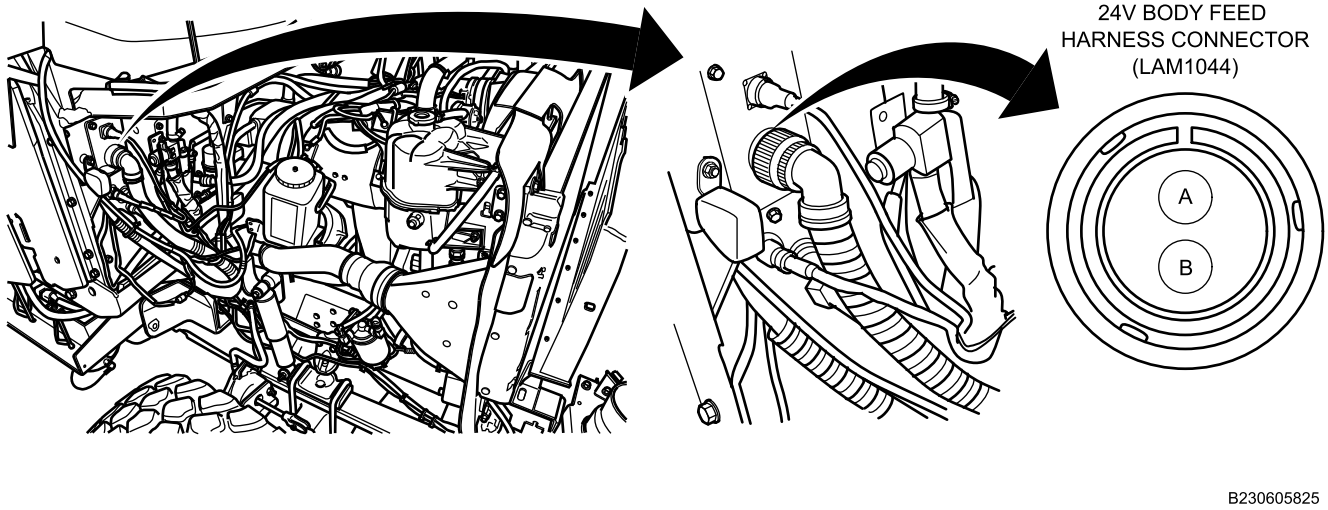


Figure 5. 24V Body Feed, Right Side Dash Pass-Through.

15. Turn MAIN POWER switch ON (TM 9-2355-106-10).
16. Turn ignition switch ON (TM 9-2355-106-10).
17. Measure DC voltage between ground and connector LAM1044 terminals A and B with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V at each terminal?

DECISION

NO Go to Step 38.
YES Go to Step 39.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

18. Measure DC voltage between connector LAM1164 24V terminal (Figure 6, Item 1) and ground with multimeter.

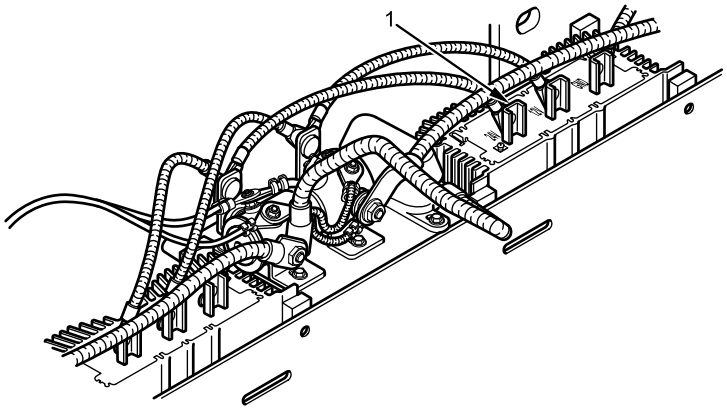


Figure 6. Connector LAM1164.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

YES Go to Step 40.
NO Go to next step.

STEP

19. Measure DC voltage between connector LAM1152 terminal (Figure 7, Item 1) and ground with multimeter.

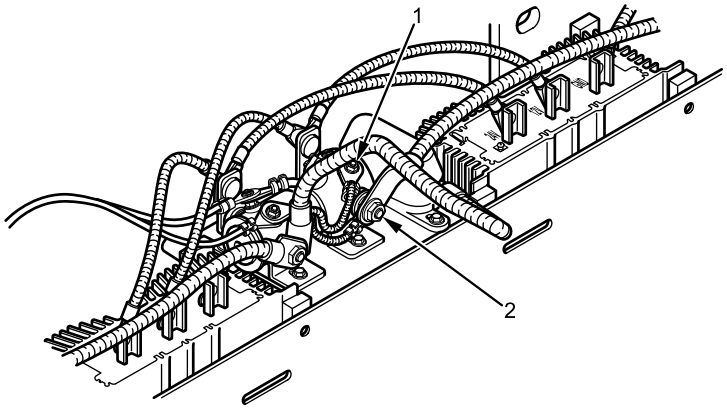


Figure 7. Connector LAM1152 and LAM1187.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 21.
NO Go to next step.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

20. Measure DC voltage between connector LAM1187 terminal (Figure 7, Item 2) and ground with multimeter.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 42.
YES Go to Step 43.

STEP

21. Turn ignition switch OFF (TM 9-2355-106-10).
22. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
23. Disconnect harness connector 1150. Refer to Figure 8.

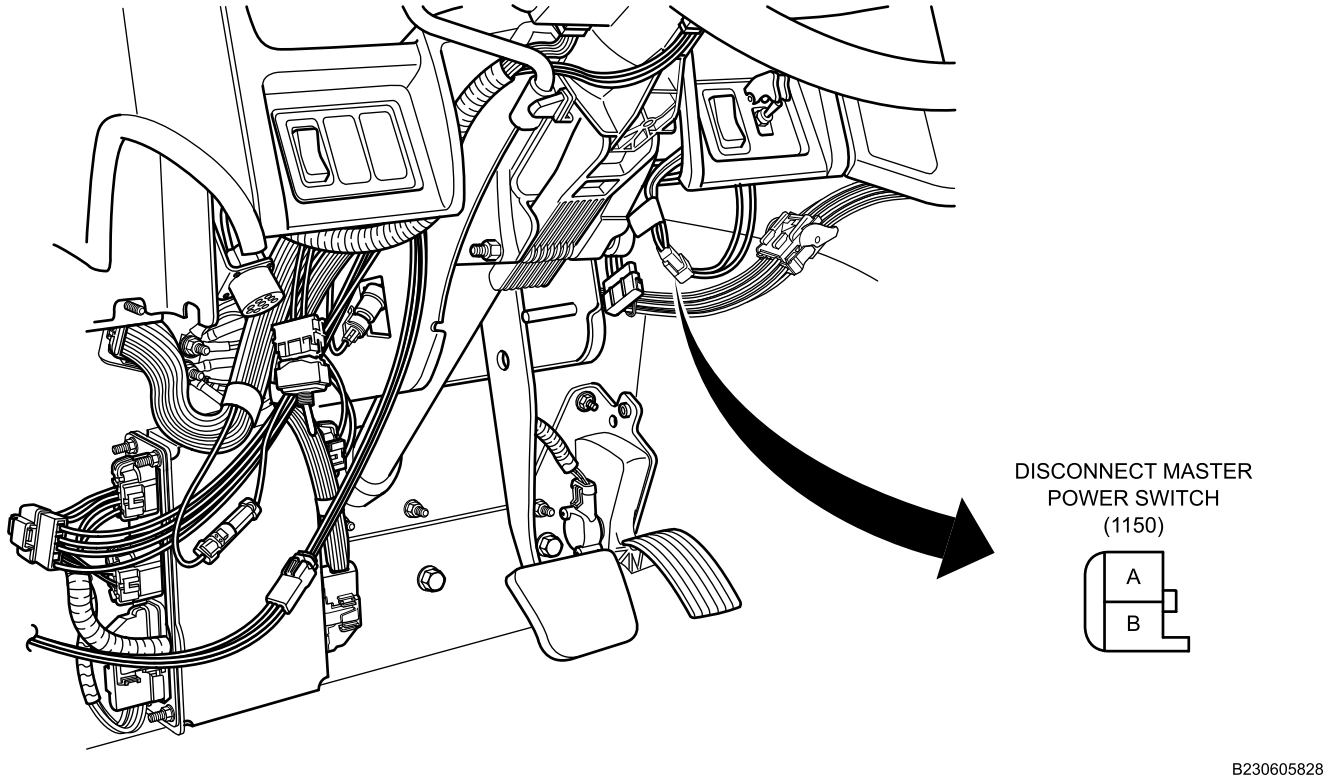


Figure 8. Below IP, Right of Steering Column.

24. Measure resistance between connector 1150 terminal B and ground with multimeter.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 45.
YES Go to next step.

STEP

25. Measure DC voltage between connector 1150 terminal A and ground with multimeter. Refer to Figure 9.

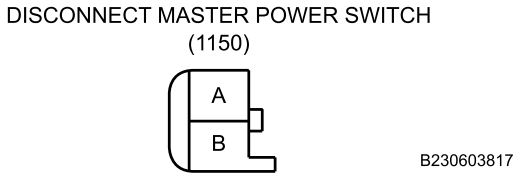


Figure 9. Connector 1150.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 46.
NO Go to next step.

STEP

26. Disconnect dash pass-through harness connector 1701. Refer to Figure 10.

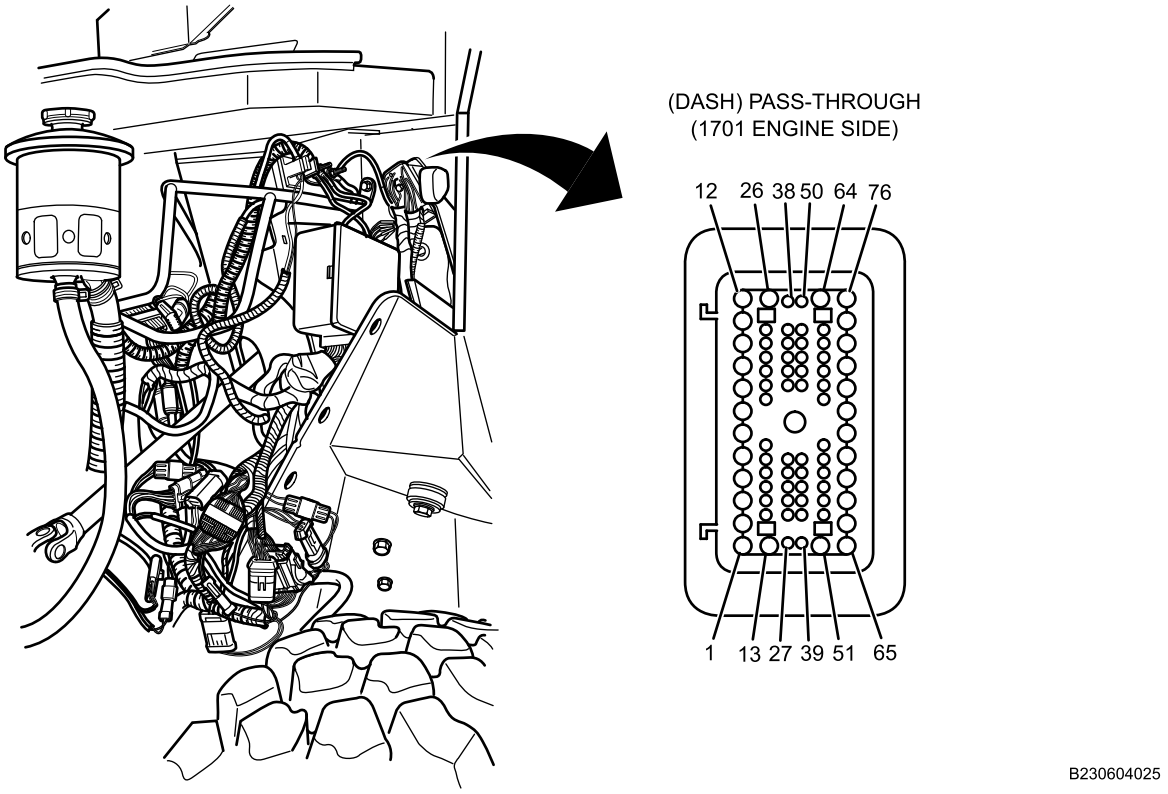


Figure 10. Dash Pass-Through.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

27. Measure DC voltage between connector 1701 terminal 14 and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 45.
NO Go to Step 47.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Measure DC voltage between connector LAM1189 terminal (Figure 11, Item 2) and ground with multimeter.

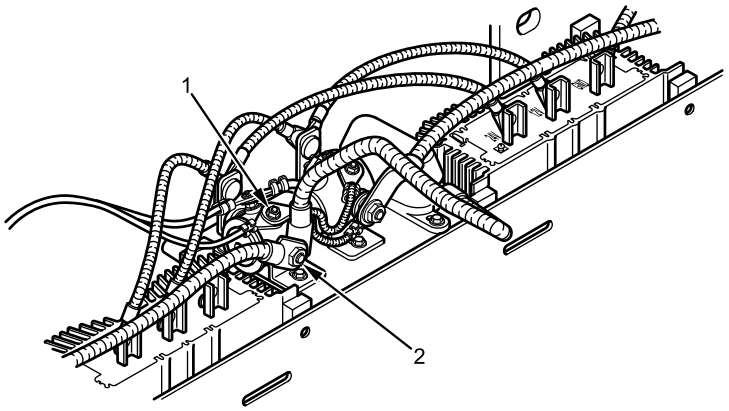


Figure 11. Connector LAM1189 and 1153.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

NO Go to Step 41.
YES Go to next step.

STEP

29. Measure DC voltage between connector LAM1153 terminal (Figure 11, Item 1) and ground with multimeter.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 43.
YES Go to next step.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

30. Measure DC voltage between connector LAM1151 terminal (Figure 12, Item 1) and ground with multimeter.

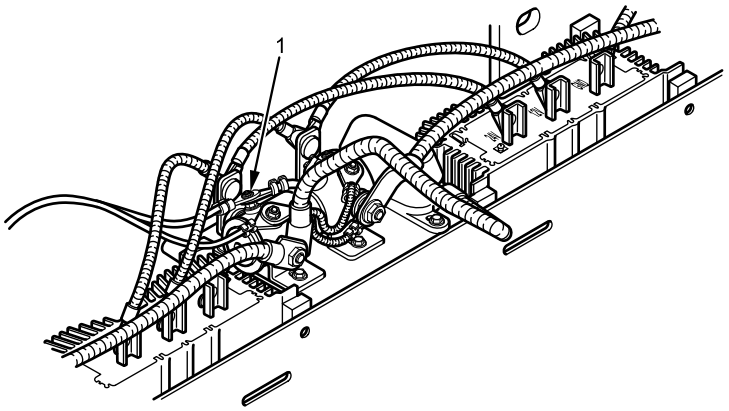


Figure 12. Connector LAM1151.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 48.
YES Go to Step 44.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

NOTE

Three heavy gauge wires connect to the battery side of the 12V megafuse. The wire marked M14Z supplies battery power from the 12V MAIN POWER switch to the megafuse. The wire marked J14H supplies power to fuse block 4001 in the Power Distribution Center (PDC). The wire that supplies power to the Electronic System Controller (ESC) does not have a circuit label.

31. Turn ignition switch OFF (TM 9-2355-106-10).
32. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
33. Disconnect the B+ supply harnesses from the 12V megafuse (Figure 13, Item 1) terminal.

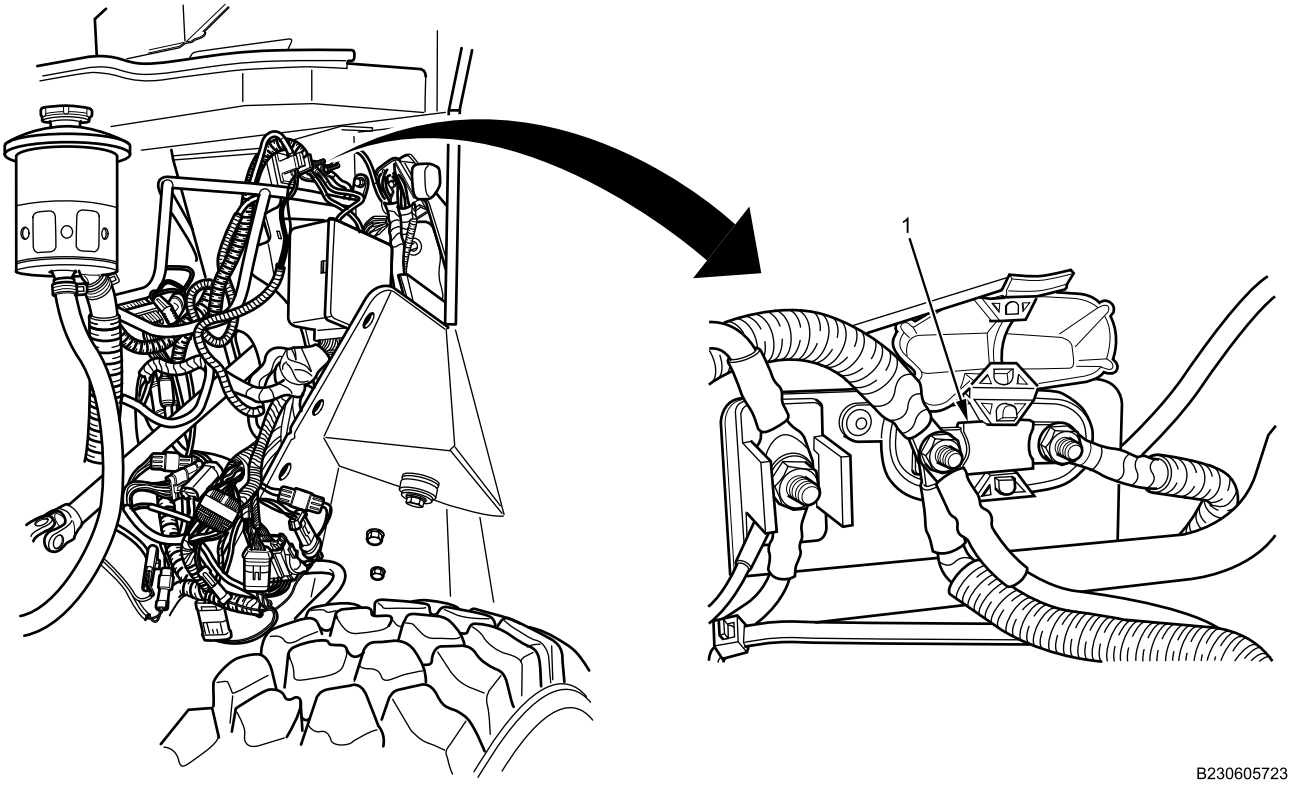


Figure 13. Left Engine, Above Power Distribution Center (PDC).

34. Measure the resistance between B+ supply harness M14Z and ground with multimeter. Refer to Figure 13.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 49.
YES Go to next step.

STEP

36. Measure resistance between ESC B+ terminal and ground with multimeter. Refer to Figure 13.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 1000 ohms?

DECISION

YES Go to Step 51.
NO Go to Step 50.

MALFUNCTION

- 37. 24V Power Distribution Module (PDM) is faulty.

ACTION

Replace 24V PDM. Refer to 24V Power Distribution Module (PDM) Center Removal and Installation (WP 0443).

END OF TEST

MALFUNCTION

- 38. 24V body feed harness is faulty.

ACTION

Replace 24V body feed harness. Refer to 24V Body Feed Harness Removal and Installation (WP 0348). Return vehicle to service.

END OF TEST

MALFUNCTION

- 39. 24V PDM feed harness is faulty.

ACTION

Replace PDC feed harness. Refer to 24V Power Distribution Module (PDM) Feed Harness and Ground Cable Removal and Installation (WP 0437). Return vehicle to service.

END OF TEST

MALFUNCTION

- 40. 12V MAIN POWER switch is faulty.

ACTION

Replace 12V MAIN POWER switch. Refer to 12V and 24V MAIN POWER Switch Removal and Installation (WP 0341). Return vehicle to service.

END OF TEST

MALFUNCTION

- 41. Battery cable to 24V MAIN POWER switch is faulty.

ACTION

Replace battery cable. Refer to Battery Cables Removal and Installation (WP 0407). Return vehicle to service.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 42. Battery cable to 12V MAIN POWER switch is faulty.

ACTION

Replace battery cable. Refer to Battery Cables Removal and Installation (WP 0407). Return vehicle to service.

END OF TEST

MALFUNCTION

- 43. 12V to 24V MAIN POWER switch solenoid feed harness is faulty.

ACTION

Replace V12 to 24V MAIN POWER switch solenoid feed harness. Refer to 12V to 24V Disconnect Battery Switch Solenoid Feed Harness Removal and Installation (WP 0346). Return vehicle to service.

END OF TEST

MALFUNCTION

- 44. 12V to 24V MAIN POWER switch solenoid ground harness is faulty.

ACTION

Replace V12 to 24V disconnect battery switch solenoid ground harness. Refer to 12V to 24V Disconnect Battery Switch Solenoid Ground Harness Removal and Installation (WP 0347). Return vehicle to service.

END OF TEST

MALFUNCTION

- 45. IP harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 46. MAIN POWER switch is faulty.

ACTION

Replace MAIN POWER switch. Refer to MAIN POWER Switch Removal and Installation (WP 0296). Return vehicle to service.

END OF TEST

MALFUNCTION

- 47. Master disconnect harness is faulty.

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace master disconnect harness. Refer to Master Disconnect Harness Removal and Installation (WP 0351). Return vehicle to service.

END OF TEST

MALFUNCTION

- 48. 24V MAIN POWER switch is faulty.

ACTION

Replace 24V MAIN POWER switch. Refer to 12V and 24V MAIN POWER Switch Removal and Installation (WP 0341). Return vehicle to service.

END OF TEST

MALFUNCTION

- 49. IP feed harness is faulty.

ACTION

Replace IP feed harness. Refer to Instrument Panel (IP) Feed Harness Removal and Installation (WP 0411). Return vehicle to service.

END OF TEST

12V AND 24V BATTERY SWITCHES TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 50. PDC and IP feed harnesses are faulty.

ACTION

Replace PDC and IP feed harnesses. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335) and Instrument Panel (IP) Feed Harness Removal and Installation (WP 0411). Return vehicle to service.

END OF TEST

MALFUNCTION

- 51. ESC and IP feed harness are faulty.

ACTION

Replace ESC and IP Feed harness. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353) and Instrument Panel (IP) Feed Harness Removal and Installation (WP 0411). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0060
WP 0302
WP 0317
WP 0319
WP 0333
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Instrument panel (IP) right side closeout removed (WP 0580)

Drawings Required
WP 0789, Figure 8
WP 0789, Figure 10

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

This procedure assumes that cabin fuse block 1011 lacks voltage at a buss bar with MAIN POWER and ignition switches ON.

STEP

1. Remove fuse F5 from cabin fuse block 1011. Refer to Figure 1. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

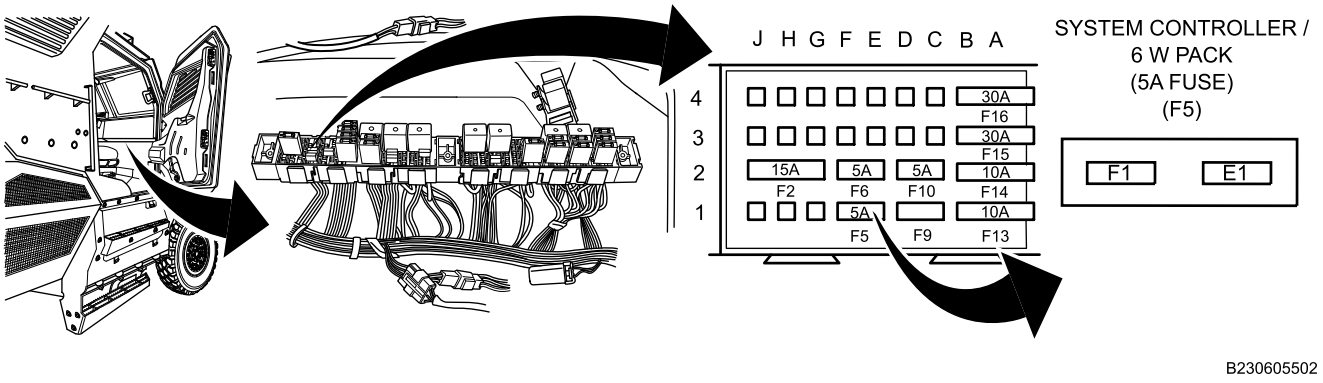


Figure 1. Cabin Fuse Block 1011, Right Side of Instrument Panel (IP).

2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).
4. Measure DC voltage between fuse F5 socket terminal E1 and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 47.
NO Go to next step.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Turn ignition switch OFF (TM 9-2355-106-10).
6. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
7. Remove ACC RELAY from cabin fuse block 1012. Refer to Figure 2. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

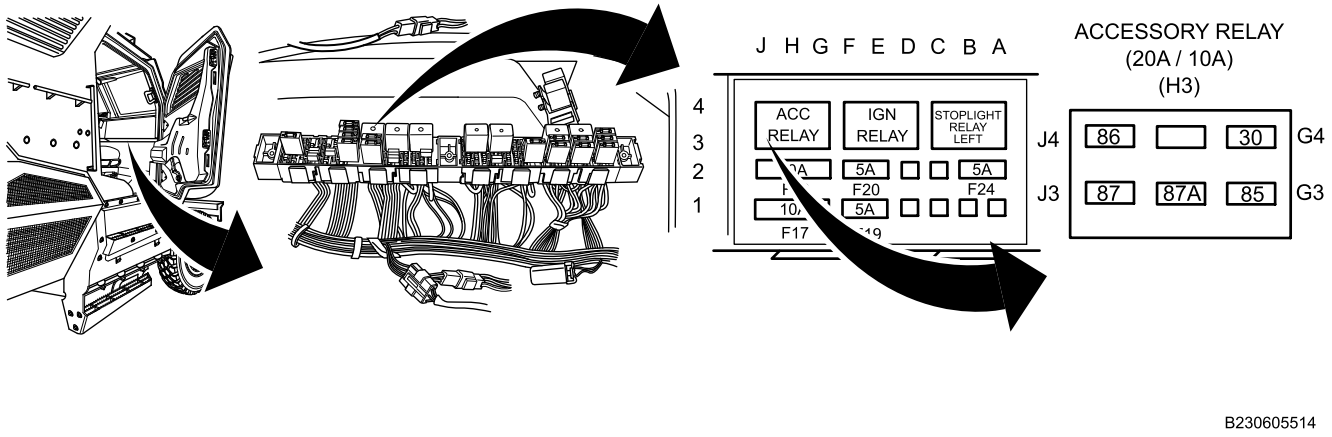


Figure 2. Cabin Fuse Block 1012, Right Side of IP.

8. Measure resistance between ACC RELAY socket terminal 87A and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 47.
YES Go to next step.

STEP

9. Measure resistance between ACC RELAY socket terminal 85 and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 47.
YES Go to next step.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

10. Measure resistance between ACC RELAY terminal 30 and fuse F5 socket terminal E1 with multimeter. Refer to Figure 3. Refer to Figure 4.

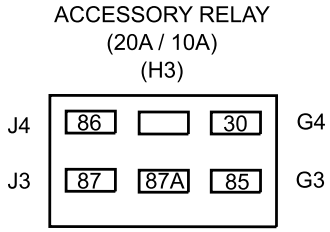


Figure 3. ACC RELAY Socket.

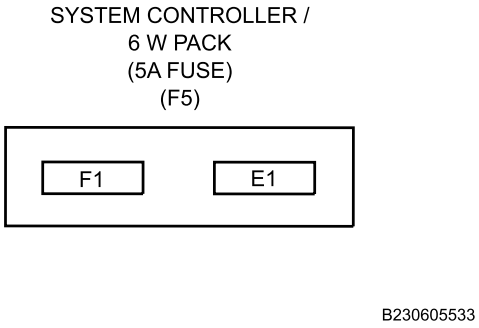


Figure 4. Fuse F5 Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 47.
YES Go to next step.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

11. Turn MAIN POWER switch ON (TM 9-2355-106-10).
12. Turn ignition switch ON (TM 9-2355-106-10).
13. Measure DC voltage between ACC RELAY socket terminal 86 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 15.
YES Go to next step.

STEP

14. Measure DC voltage between ACC RELAY socket terminal 87 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 42.
YES Go to Step 44.

STEP

15. Turn ignition switch OFF (TM 9-2355-106-10).
16. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

17. Disconnect keyless ignition switch connector 1100M. Refer to Figure 5.

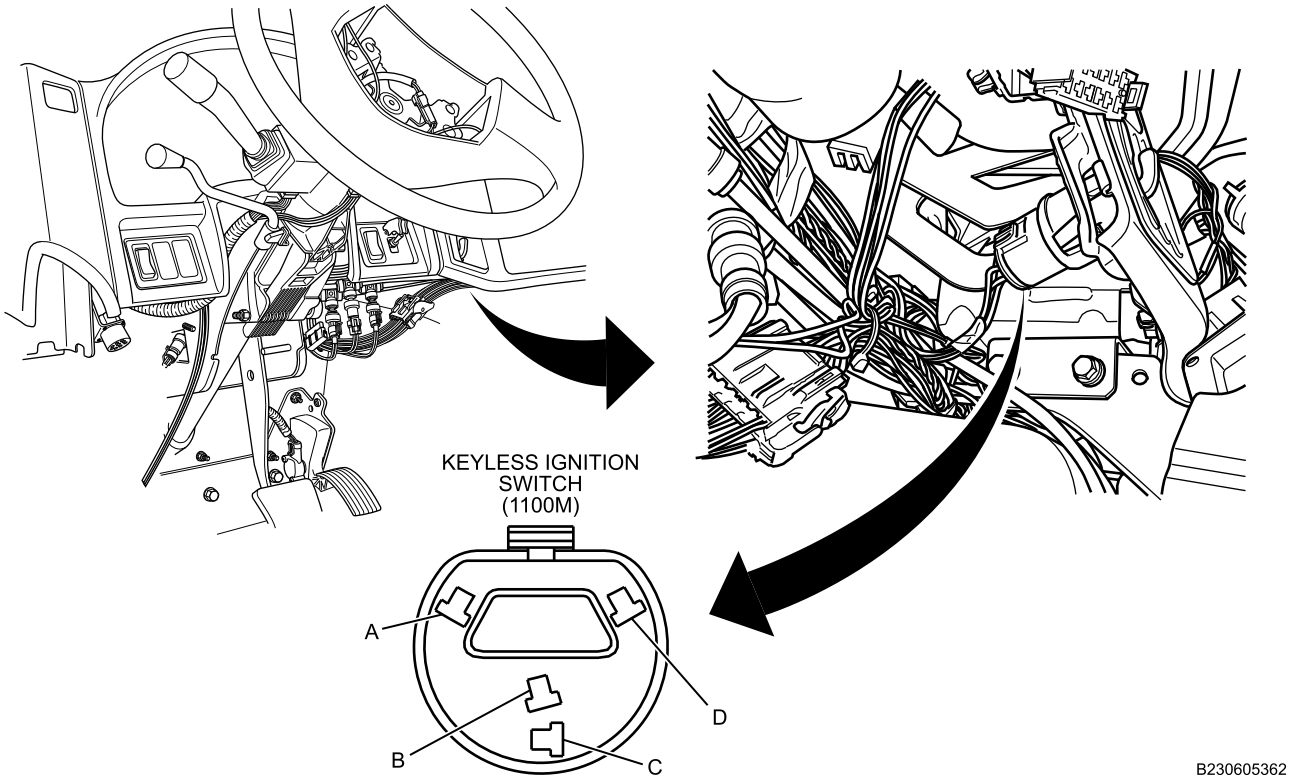


Figure 5. Behind Lower Instrument Cluster.

18. Turn MAIN POWER switch ON (TM 9-2355-106-10).
19. Measure DC voltage between connector 1100M terminal A and ground with multimeter. Refer to Figure 5.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 24.
YES Go to next step.

STEP

20. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
21. Connect jumper wire between connector 1100M terminals A and C. Refer to .
22. Turn MAIN POWER switch ON (TM 9-2355-106-10).
23. Measure DC voltage between ACC RELAY socket terminal 86 and ground with multimeter. Refer to Figure 6.

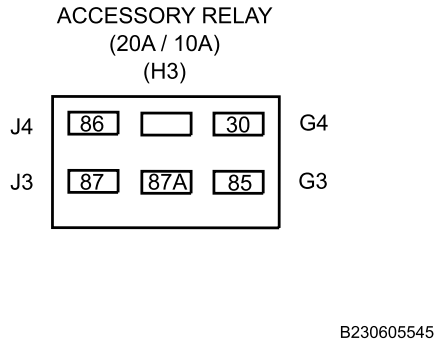


Figure 6. ACC RELAY Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 47.
YES Go to Step 48.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

24. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
25. Remove and inspect fuse F6. Refer to Figure 7. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

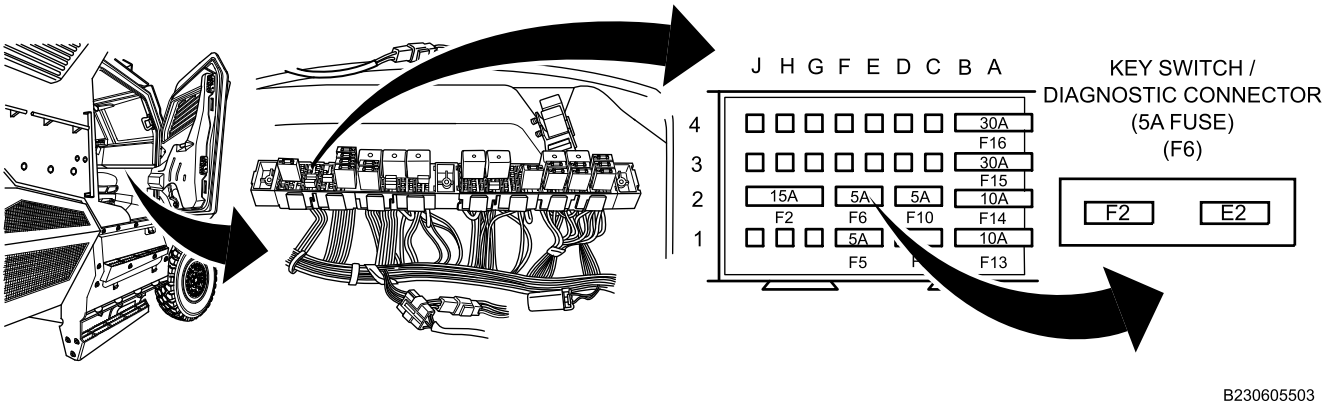


Figure 7. Cabin Fuse Block 1011, Right Side of IP.

CONDITION/INDICATION

Is fuse open?

DECISION

YES Go to Step 28.
NO Go to next step.

STEP

26. Turn MAIN POWER switch ON (TM 9-2355-106-10).
27. Measure DC voltage between ground and fuse F6 socket terminals F2 and E2 with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

YES Go to Step 47.
NO Go to Step 42.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Measure resistance between connector 1100M terminal B and ground with multimeter. Refer to Figure 8.

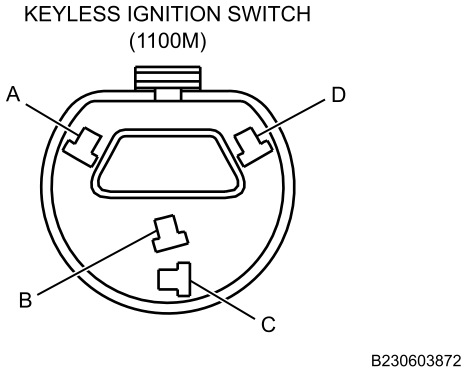


Figure 8. Connector 1100M.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 33.
YES Go to next step.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

29. Install ACC RELAY in cabin fuse block 1012. Refer to Figure 9. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

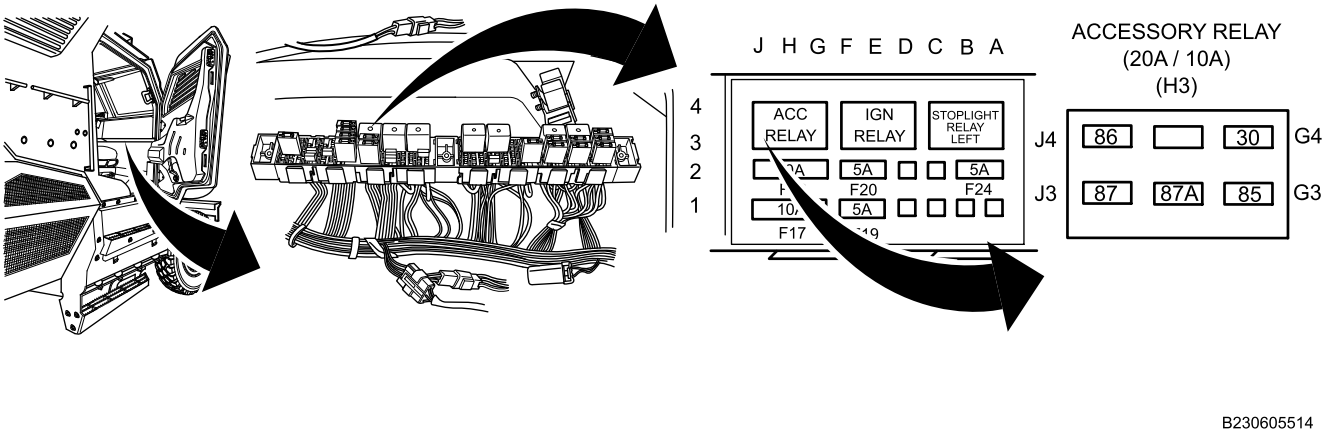


Figure 9. Cabin Fuse Block 1012, Right Side of IP.

30. Measure resistance between connector 1100M terminal C and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 38.
YES Go to next step.

STEP

31. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 10.

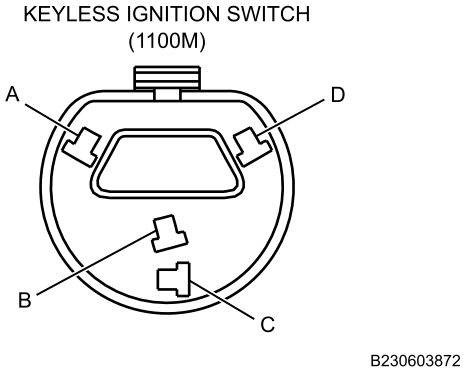


Figure 10. Connector 1100M.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 40.
YES Go to next step.

STEP

32. Measure resistance between keyless ignition switch terminal BAT and ground with multimeter. Refer to Figure 11.

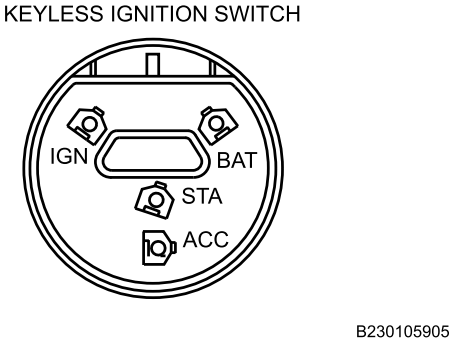


Figure 11. Keyless Ignition Switch.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 47.
NO Go to Step 48.

STEP

33. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
34. Remove STARTER relay from underhood PDC. Refer to Figure 12. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

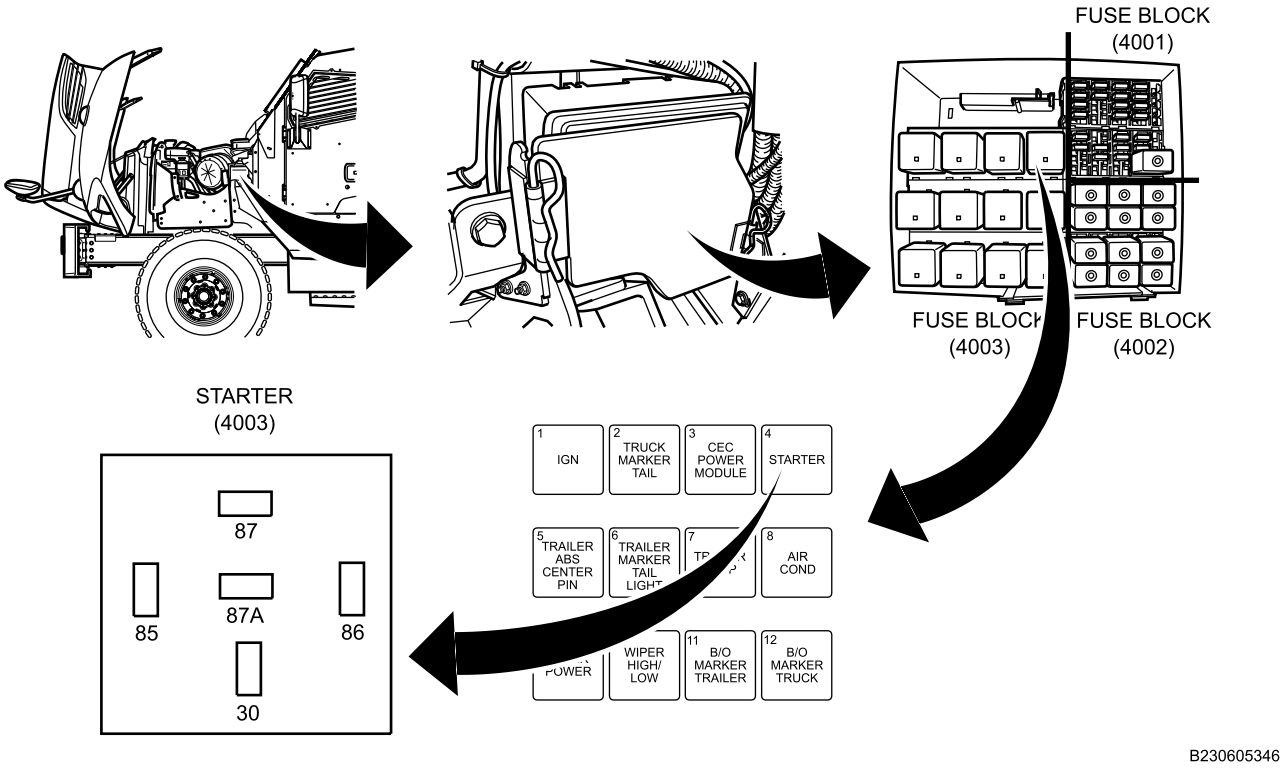


Figure 12. Underhood Power Distribution Center (PDC).

35. Measure resistance between connector 1100M terminal B and ground with multimeter. Refer to Figure 13.

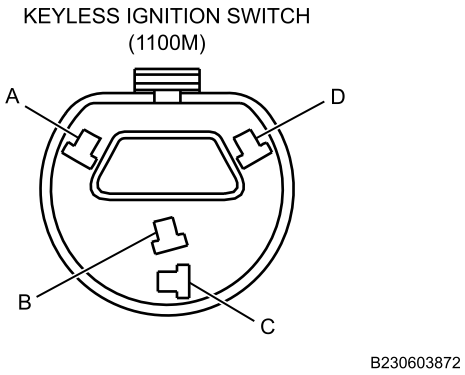


Figure 13. Connector 1100M.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 45.
NO Go to next step.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

36. Disconnect connector 1701. Refer to Figure 14.

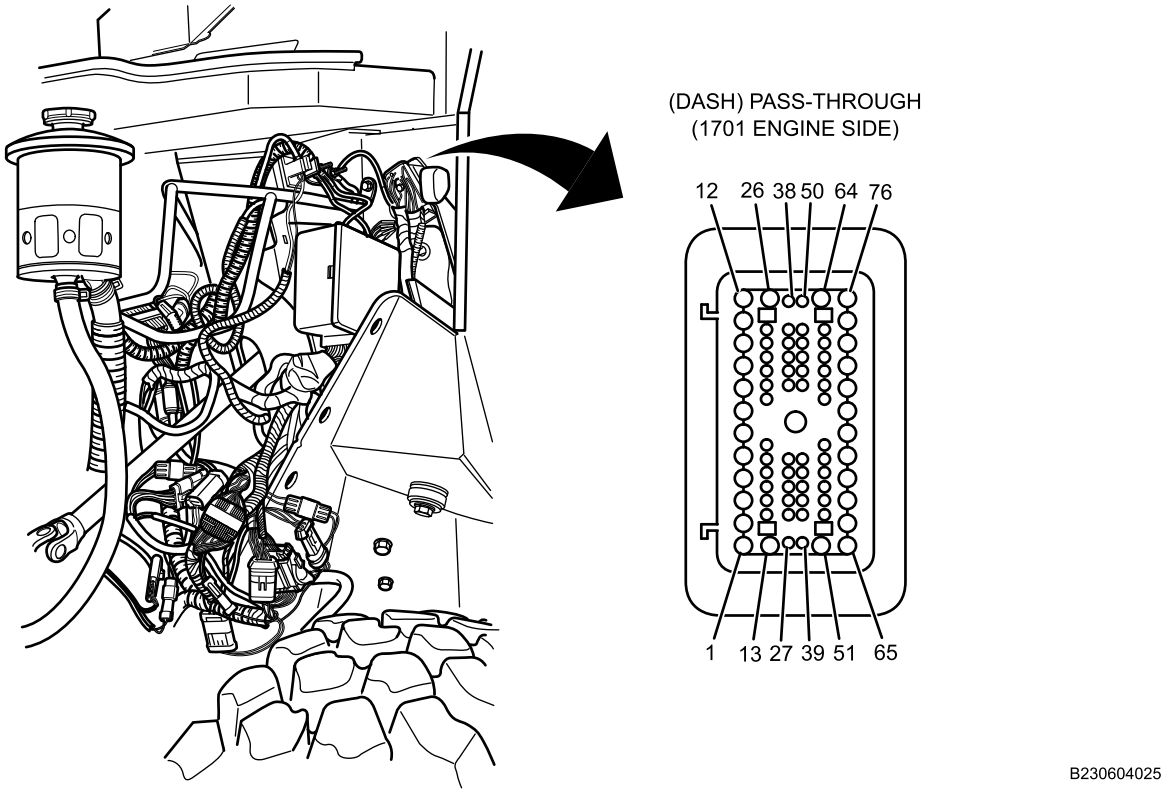


Figure 14. Left Side Engine Compartment Above PDC.

37. Measure resistance between connector 1701 terminal 8 and ground with multimeter. Refer to Figure 14.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 50.
YES Go to Step 47.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

38. Remove ACC RELAY from cabin fuse block 1012. Refer to Figure 15. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

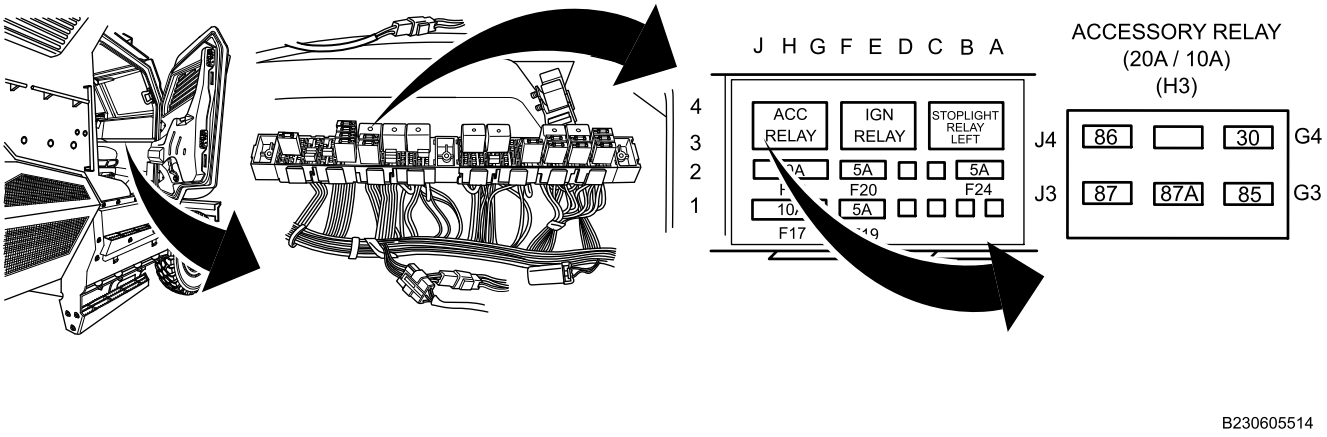


Figure 15. Cabin Fuse Block 1012, Right Side of IP.

39. Measure resistance between connector 1100M terminal C and ground with multimeter. Refer to Figure 16.

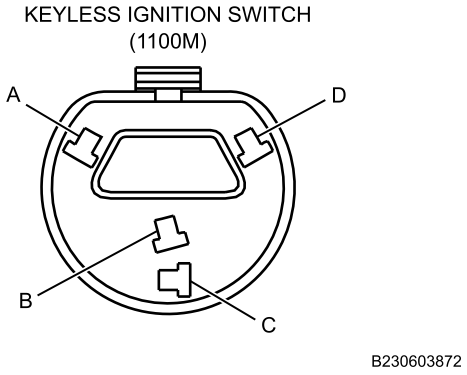


Figure 16. Connector 1100M.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 47.
YES Go to Step 44.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

40. Remove IGN RELAY from cabin fuse block 1012. Refer to Figure 17. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

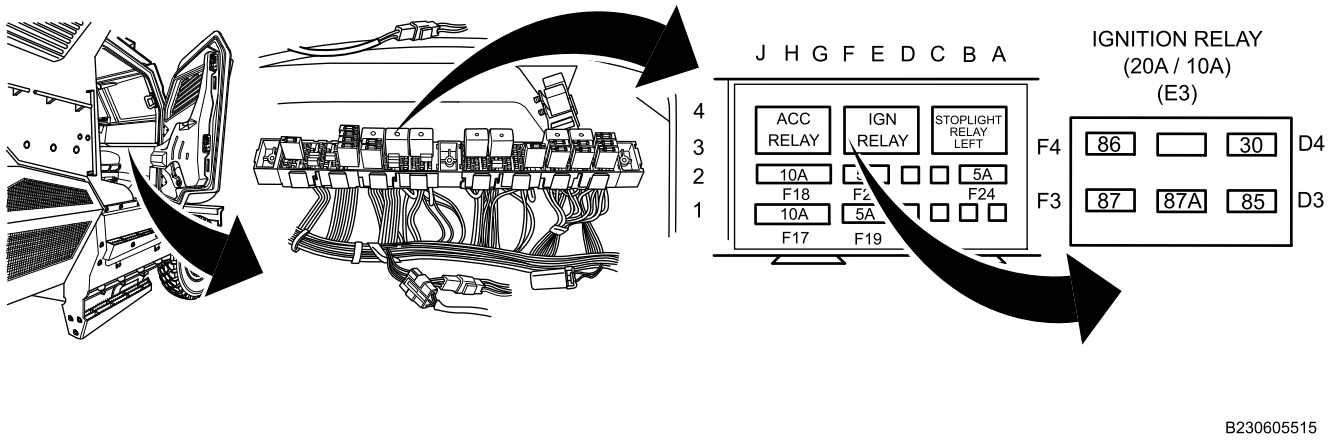


Figure 17. Cabin Fuse Block 1012, Right Side of IP.

41. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 46.
NO Go to Step 47.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

42. Measure DC voltage between ground and each terminal in 12V 100-amp megafuse (Figure 18, Item 1).

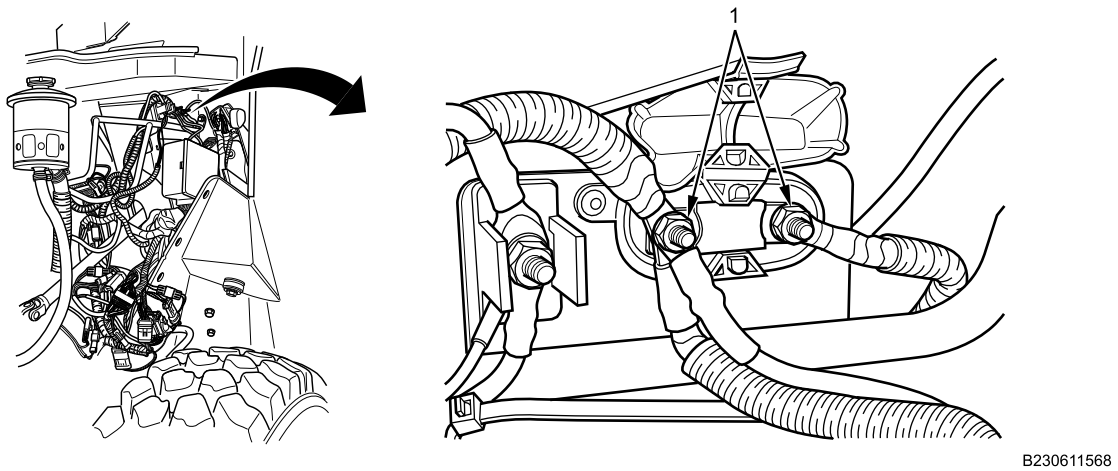


Figure 18. 12V 100-Amp Megafuse.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

YES Go to Step 47.
NO Go to next step.

STEP

43. Refer to results of Step 42.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

NO Go to Step 49.
YES Go to Step 51.

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 44. ACC RELAY is faulty.

ACTION

Replace ACC RELAY. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

END OF TEST

MALFUNCTION

- 45. STARTER relay is faulty.

ACTION

Replace STARTER relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

END OF TEST

MALFUNCTION

- 46. IGN RELAY is faulty.

ACTION

Replace IGN RELAY. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

END OF TEST

MALFUNCTION

- 47. IP harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319).

END OF TEST

CABIN FUSE BLOCK 1011 TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 48. Keyless ignition switch is faulty.

ACTION

Replace keyless ignition switch. Refer to Keyless Ignition Switch Removal and Installation (WP 0302).

END OF TEST

MALFUNCTION

- 49. MAIN POWER switches system is faulty.

ACTION

Diagnose MAIN POWER switches system fault. Refer to 12V and 24V Battery Switches Troubleshooting Procedure (WP 0060).

END OF TEST

MALFUNCTION

- 50. PDC or harness is faulty.

ACTION

Replace PDC. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335).

END OF TEST

MALFUNCTION

- 51. IP harness is faulty.

ACTION

Replace IP harness and 12V 100-amp megafuse. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Refer to 12V Underhood Megafuse and Holder Removal and Installation (WP 0422).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0060
WP 0302
WP 0317
WP 0319
WP 0333
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Instrument panel (IP) right side closeout removed (WP 0580)

Drawings Required
WP 0789, Figure 8
WP 0789, Figure 10

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

This procedure assumes that cabin fuse block 1012 lacks voltage at a buss bar with MAIN POWER and ignition switches ON.

STEP

1. Remove fuse F20 from cabin fuse block 1012. Refer to Figure 1. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

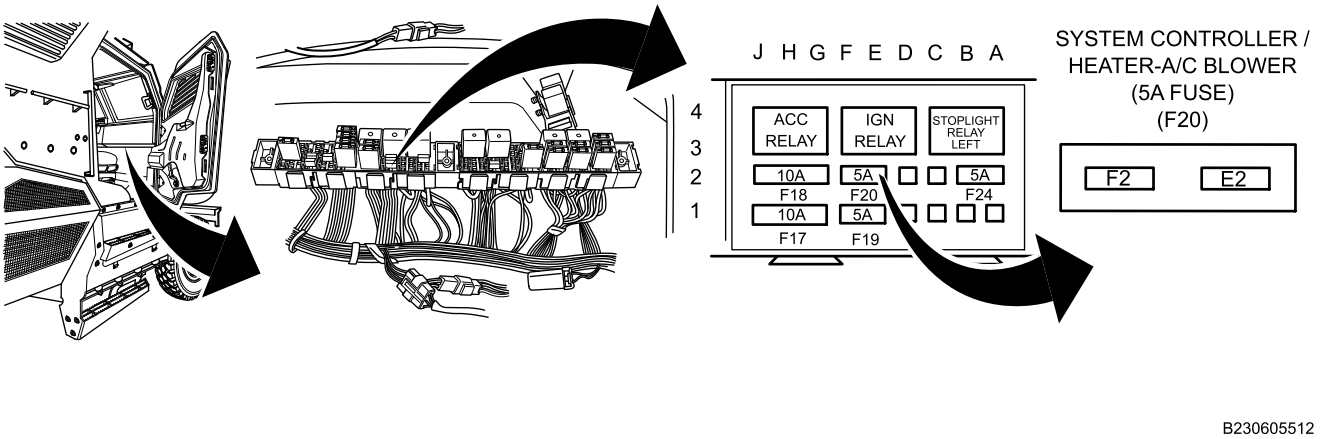


Figure 1. Cabin Fuse Block 1012, Right Side of Instrument Panel (IP).

2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).
4. Measure DC voltage between fuse F20 socket terminal E2 and ground. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 44.
NO Go to next step.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Turn ignition switch OFF (TM 9-2355-106-10).
6. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
7. Remove IGN RELAY from cabin fuse block 1012. Refer to Figure 2. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

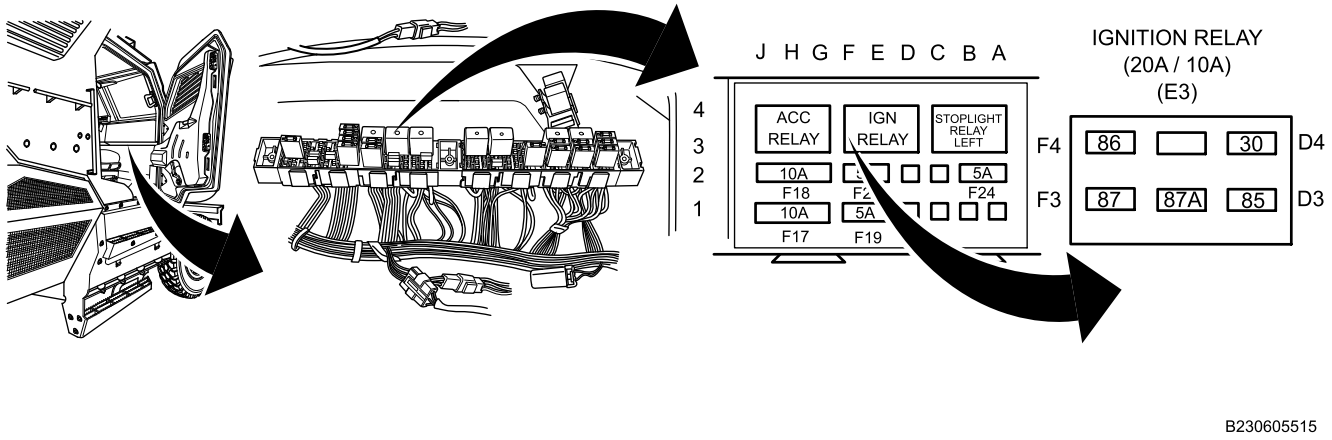


Figure 2. Cabin Fuse Block 1012, Right Side of IP.

8. Measure resistance between IGN RELAY socket terminal 85 and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 44.
YES Go to next step.

STEP

9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Turn ignition switch ON (TM 9-2355-106-10).
11. Measure DC voltage between IGN RELAY socket terminal 86 and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 14.
YES Go to next step.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

12. Measure DC voltage between IGN RELAY socket terminal 87 and ground with multimeter. Refer to Figure 3.

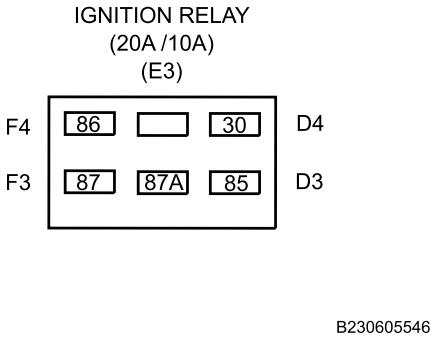


Figure 3. IGN RELAY Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 42.
YES Go to next step.

STEP

13. Measure DC voltage between IGN RELAY socket terminals 87 and 30 with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 44.
YES Go to Step 45.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

14. Turn ignition switch OFF (TM 9-2355-106-10).
15. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
16. Disconnect ignition switch connector 1100M. Refer to Figure 4.

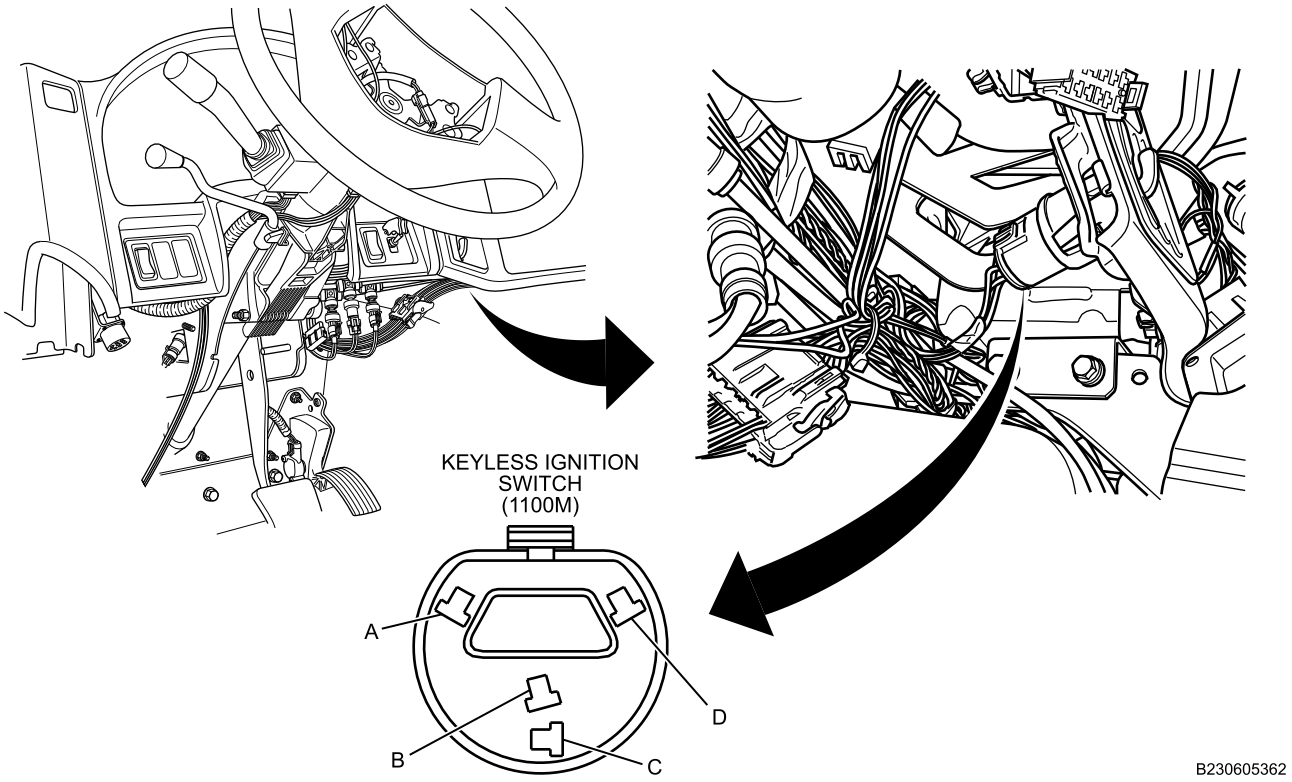


Figure 4. Below IP Cluster, Right Side.

17. Turn MAIN POWER switch ON (TM 9-2355-106-10).
18. Measure DC voltage between connector 1100M terminal A and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 23.
YES Go to next step.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

19. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
20. Connect jumper wire between connector 1100M terminals A and D. Refer to Figure 5.

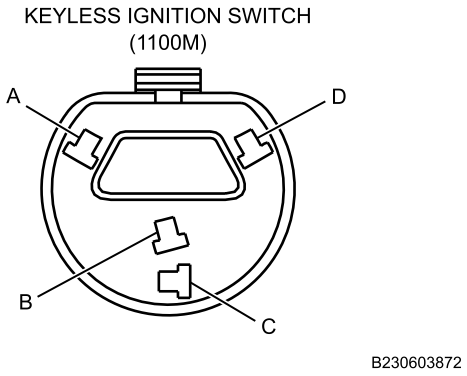


Figure 5. Connector 1100M.

21. Turn MAIN POWER switch ON (TM 9-2355-106-10).
22. Measure DC voltage between IGN RELAY socket terminal 86 and ground with multimeter. Refer to Figure 6.

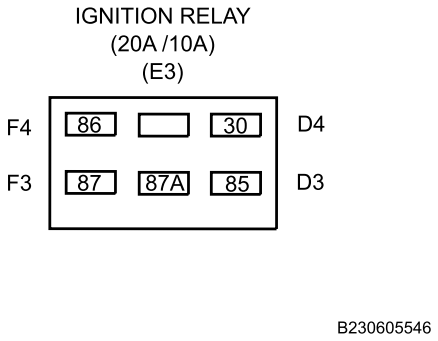


Figure 6. IGN RELAY Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 44.
YES Go to Step 46.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

23. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
24. Remove and inspect fuse F6. Refer to Figure 7. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

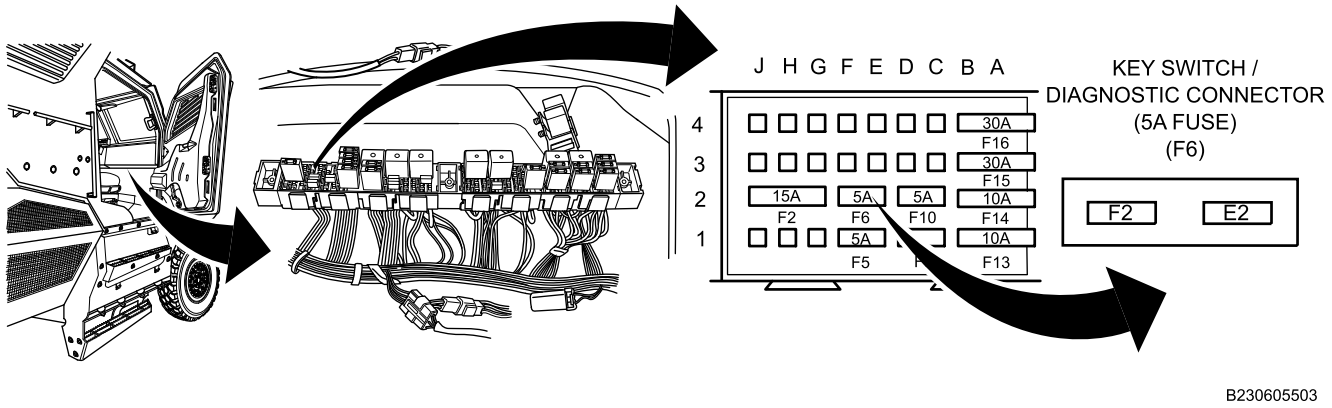


Figure 7. Cabin Fuse Block 1011, Right Side of IP.

CONDITION/INDICATION

Is fuse open?

DECISION

YES Go to Step 27.
NO Go to next step.

STEP

25. Turn MAIN POWER switch ON (TM 9-2355-106-10).
26. Measure DC voltage between fuse F6 socket terminal E2 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 42.
YES Go to Step 44.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

27. Measure resistance between connector 1100M terminal B and ground with multimeter. Refer to Figure 8.

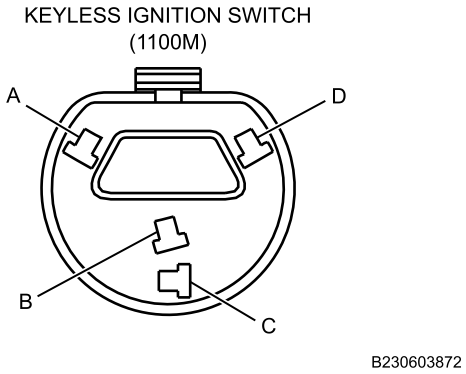


Figure 8. Connector 1100M.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

YES Go to Step 37.
NO Go to next step.

STEP

28. Measure resistance between connector 1100M terminal C and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

YES Go to Step 40.
NO Go to next step.

STEP

29. Measure resistance between connector 1100M terminal A and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

YES Go to Step 44.
NO Go to next step.

STEP

30. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 8.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

NO Go to Step 35.
YES Go to next step.

STEP

31. Remove IGN RELAY from cabin fuse block 1013. Refer to Figure 9. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

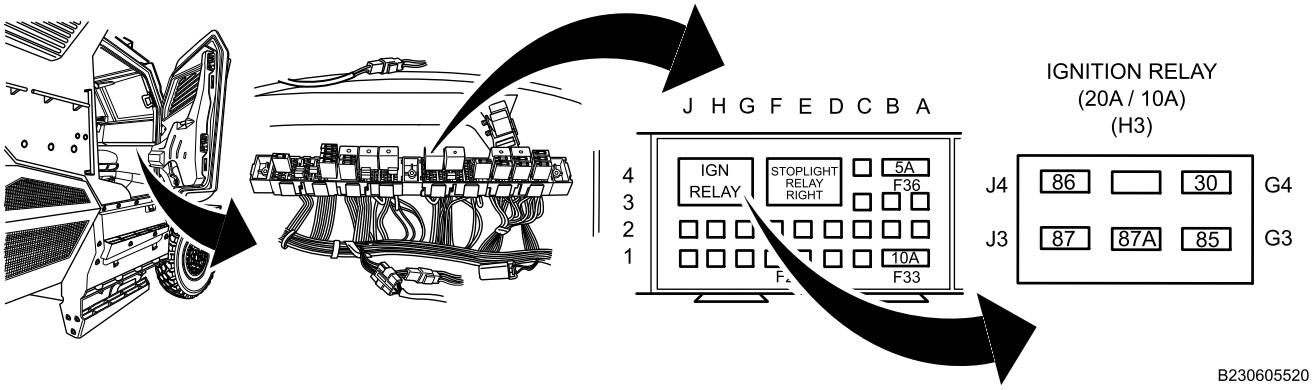


Figure 9. Cabin Fuse Block 1013, Right Side of IP.

32. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

NO Go to Step 45.
YES Go to next step.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

33. Remove IGN RELAY from cabin fuse block 1012. Refer to Figure 10. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

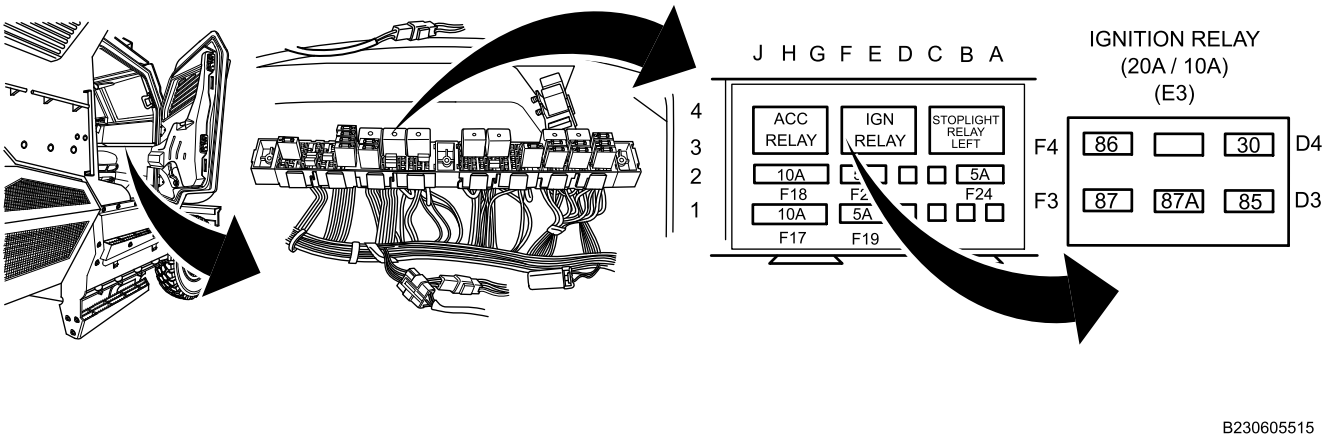


Figure 10. Cabin Fuse Block 1012 Right Side of IP.

34. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 11.

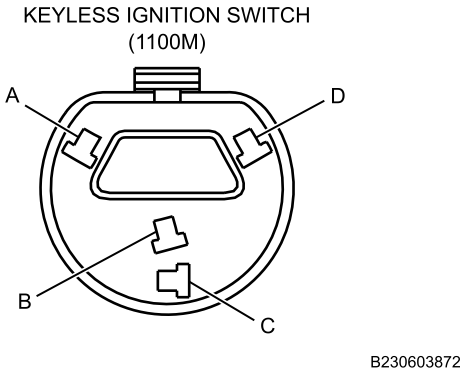


Figure 11. Connector 1100M.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

NO Go to Step 45.
YES Go to Step 44.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

35. Install IGN RELAY in cabin fuse block 1012. Refer to Figure 12. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

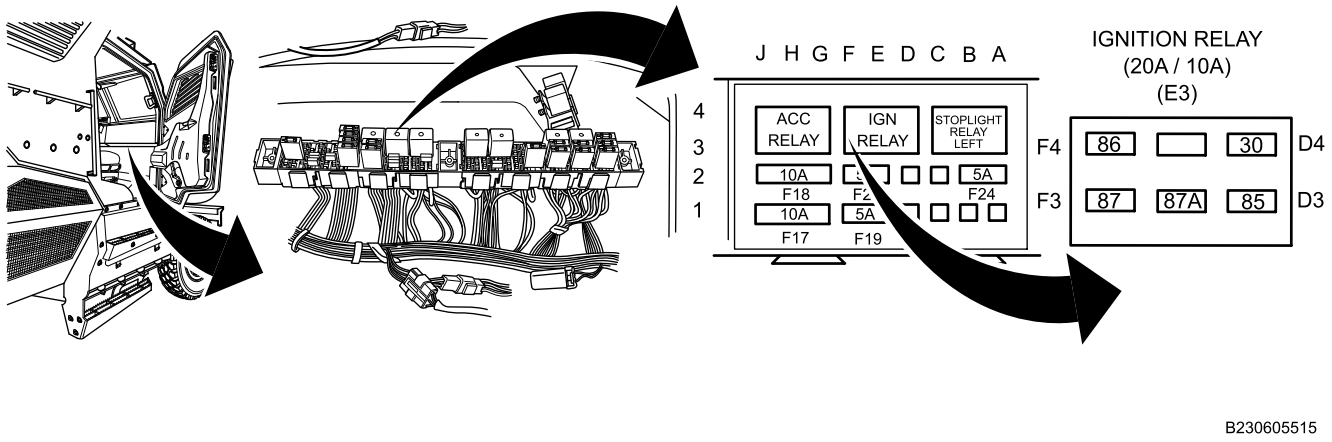


Figure 12. Cabin Fuse Block 1012 Right Side of IP.

36. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

NO Go to Step 46.
YES Go to Step 45.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

37. Remove Power Distribution Center (PDC) armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
38. Remove STARTER relay from underhood PDC. Refer to Figure 13 Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

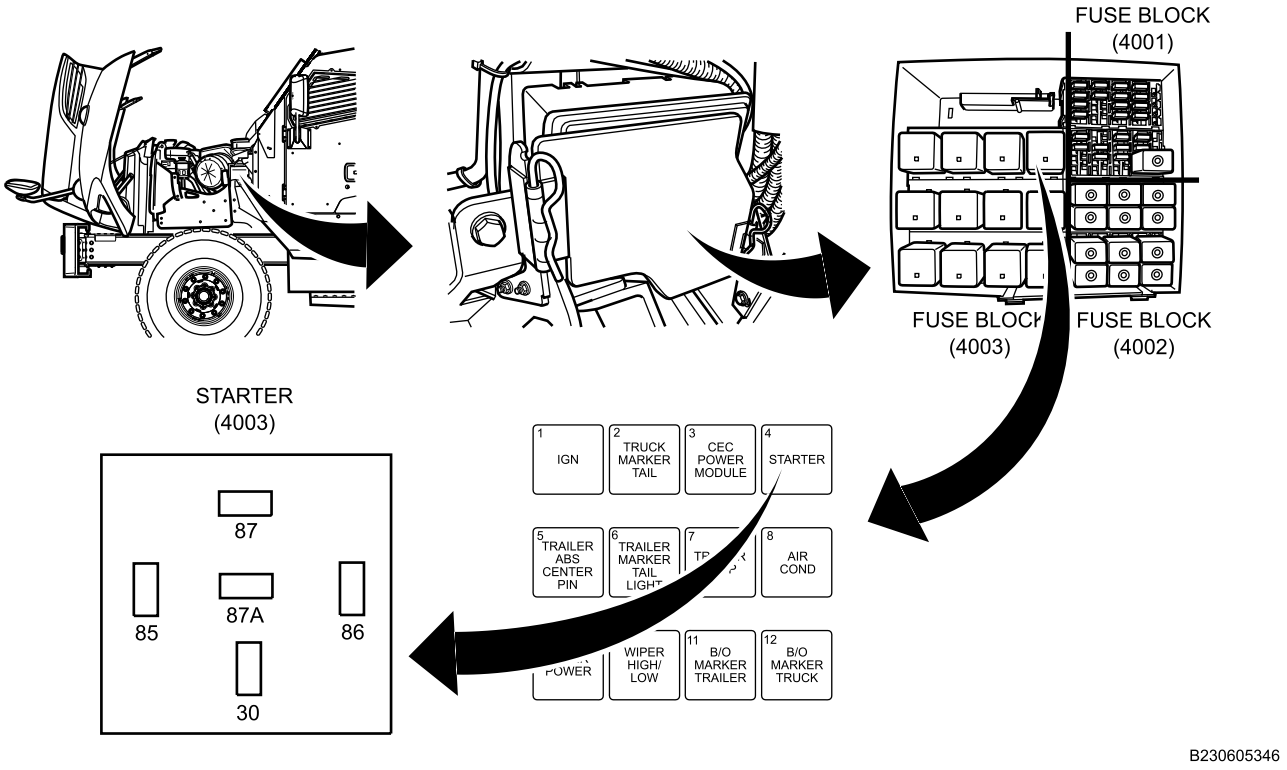


Figure 13. Underhood Power Distribution Center (PDC), Left Side Engine Compartment.

39. Measure resistance between connector 1100M terminal B and ground with multimeter. Refer to Figure 14.

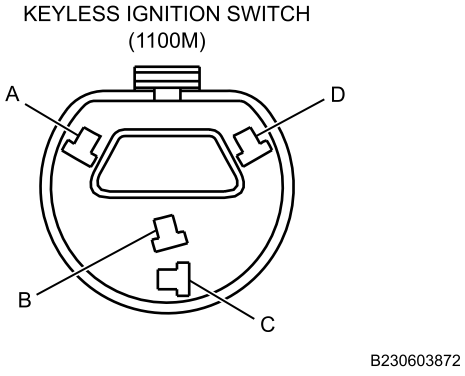


Figure 14. Connector 1100M.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 44.
YES Go to Step 48.

STEP

40. Remove ACC RELAY from cabin fuse block 1012. Refer to Figure 15. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

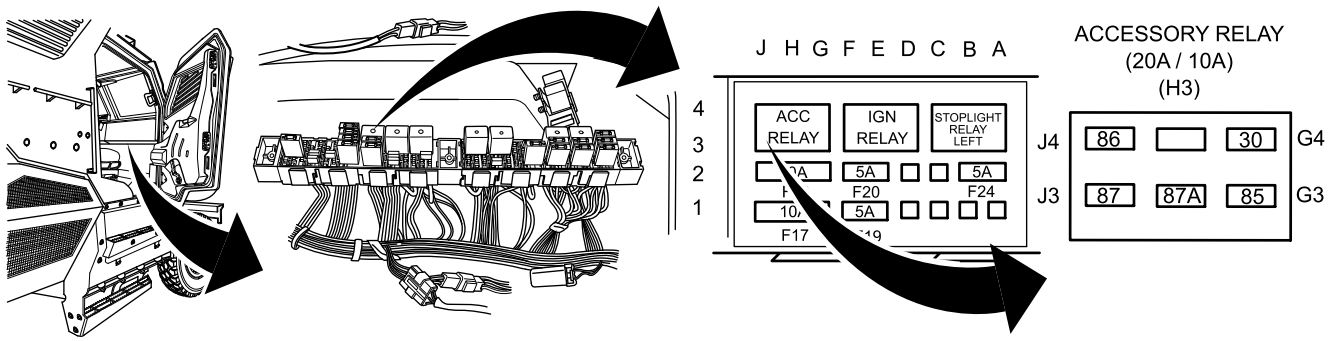


Figure 15. Cabin Fuse Block 1012, Right Side of IP.

41. Measure resistance between connector 1100M terminal C and ground with multimeter. Refer to Figure 14.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 44.
YES Go to Step 49.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

42. Measure voltage between ground and each terminal in 12V 100-amp megafuse (Figure 16, Item 1) with multimeter.

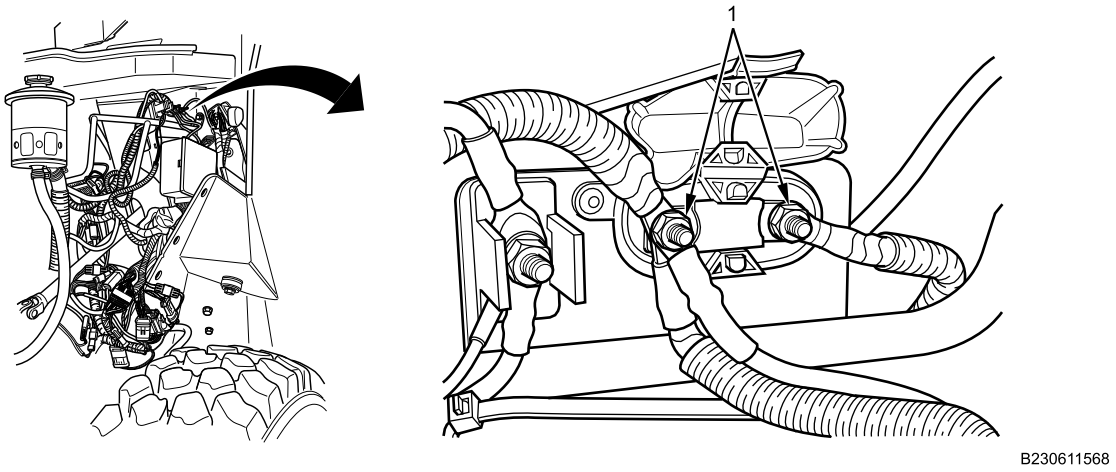


Figure 16. Left Side of Engine Compartment Above Underhood PDC.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

YES Go to Step 44.
NO Go to next step.

STEP

43. Refer to results of previous test.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

NO Go to Step 50.
YES Go to Step 47.

MALFUNCTION

- 44. IP harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319).

END OF TEST

MALFUNCTION

- 45. IGN RELAY is faulty.

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace IGN RELAY. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

END OF TEST

MALFUNCTION

- 46. Keyless iIgnition switch is faulty.

ACTION

Replace keyless ignition switch. Refer to Keyless Ignition Switch Removal and Installation (WP 0302).

END OF TEST

MALFUNCTION

- 47. IP harness is faulty.

ACTION

Replace IP harness and 12V 100-amp megafuse. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Refer to 12V Underhood Megafuse and Holder Removal and Installation (WP 0422).

END OF TEST

MALFUNCTION

- 48. STARTER relay is faulty.

ACTION

Replace STARTER relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

END OF TEST

MALFUNCTION

- 49. ACC RELAY is faulty.

ACTION

Replace ACC RELAY. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

END OF TEST

MALFUNCTION

- 50. Power supply from 12V and 24V battery switches is faulty.

ACTION

Isolate fault with 12V and 24V battery switches. Refer to 12V and 24V Battery Switches Troubleshooting Procedure (WP 0060).

CABIN FUSE BLOCK 1012 TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0060
WP 0302
WP 0317
WP 0319
WP 0333
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Instrument panel right side closeout removed (WP 0580)

Drawings Required
WP 0789, Figure 6

This procedure assumes that cabin fuse block 1013 lacks voltage at one or more buss bars with MAIN POWER and ignition switches ON.

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

This procedure assumes that cabin fuse block 1013 lacks voltage at a buss bar with MAIN POWER and ignition switches ON.

STEP

1. Remove ETHER START circuit breaker from cabin fuse block 1013. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 1.

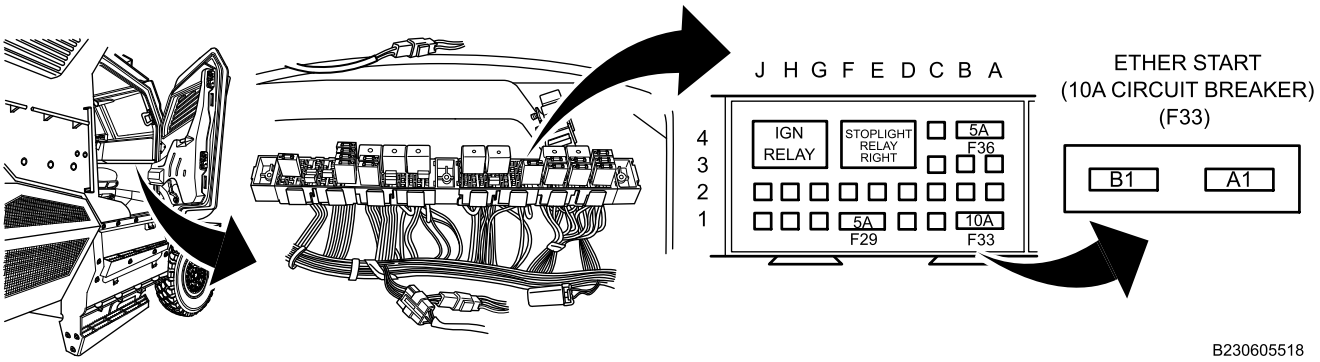


Figure 1. Cabin Fuse Block 1013, Right Side of Instrument Panel (IP).

2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).
4. Measure DC voltage between ground and fuse socket terminal A1 with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 39.
NO Go to next step.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Turn ignition switch OFF (TM 9-2355-106-10).
6. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
7. Remove IGN RELAY from cabin fuse block 1013. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 2.

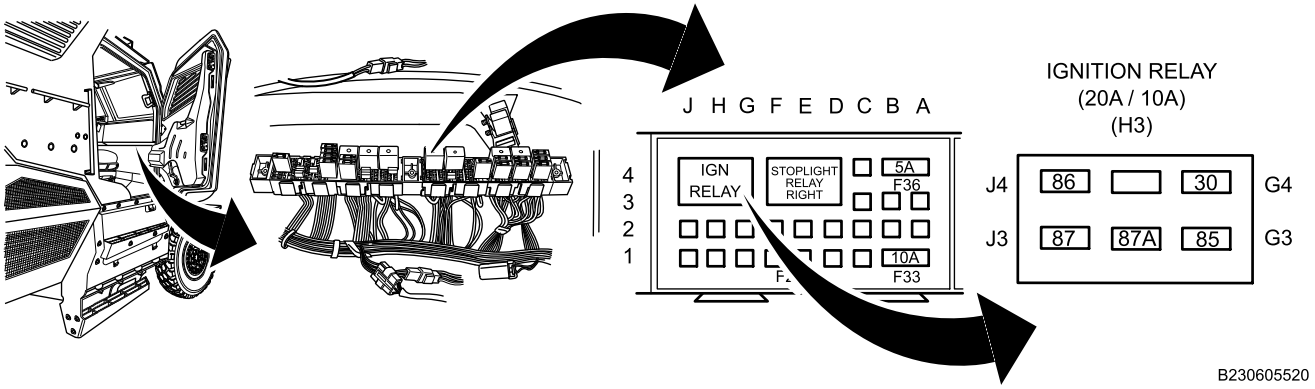


Figure 2. Cabin Fuse Block 1013, Right Side of IP.

8. Measure resistance between relay socket terminal 85 and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 39.
YES Go to next step.

STEP

9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Turn ignition switch ON (TM 9-2355-106-10).
11. Measure DC voltage between relay socket terminal 86 and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 14.
YES Go to next step.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

12. Measure DC voltage between relay socket terminal 30 and ground with multimeter. Refer to Figure 3.

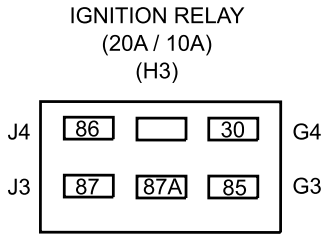


Figure 3. Ignition Relay Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 37.
YES Go to next step.

STEP

13. Measure DC voltage between relay socket terminals 87 and 30 with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 39.
YES Go to Step 40.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

14. Turn ignition switch OFF (TM 9-2355-106-10).
15. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
16. Disconnect keyless ignition switch connector 1100M. Refer to Figure 4.

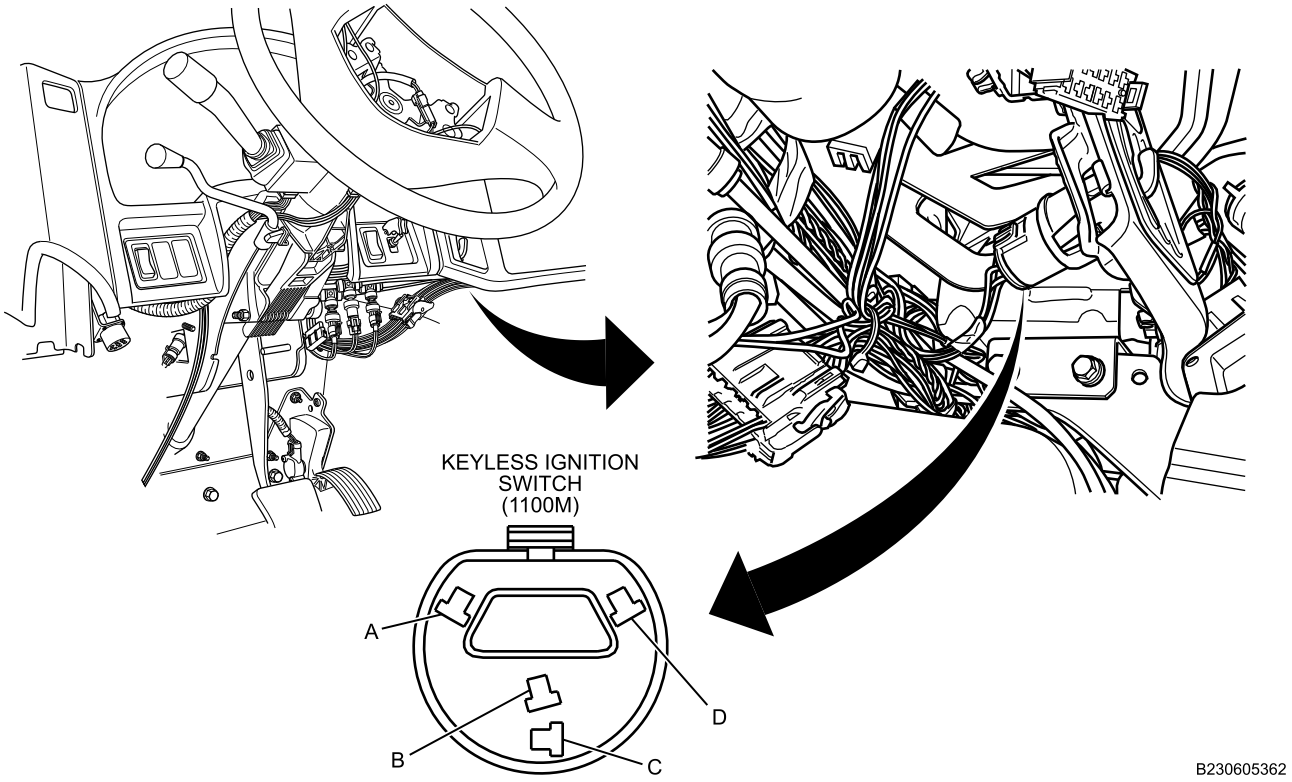


Figure 4. Behind Key Switch.

17. Turn MAIN POWER switch ON (TM 9-2355-106-10).
18. Measure DC voltage between connector 1100M terminal A and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 21.
YES Go to next step.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

19. Connect jumper wire between connector 1100M terminals A and D. Refer to Figure 5.

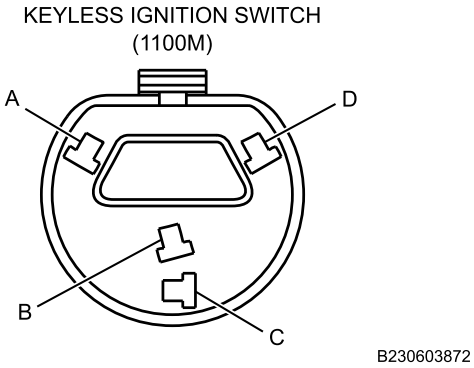


Figure 5. Connector 1100M.

20. Measure DC voltage between relay socket terminal 86 and ground with multimeter. Refer to Figure 6.

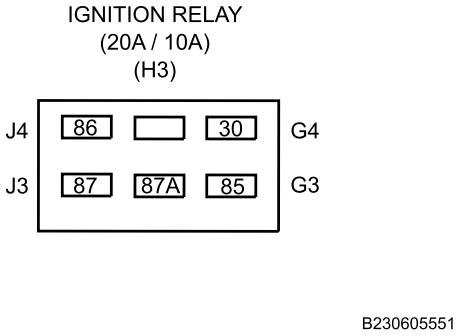


Figure 6. Ignition Relay Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 39.
YES Go to Step 42.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

21. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
22. Remove and inspect KEY SWITCH/DIAGNOSTIC CONNECTOR fuse from cabin fuse block 1011. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 7.

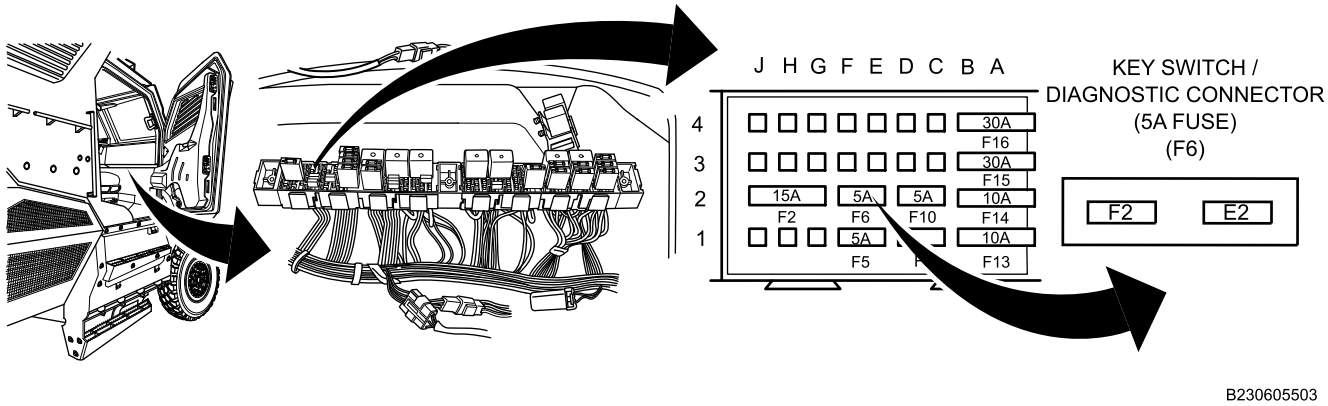


Figure 7. Cabin Fuse Block 1011, Right Side of IP.

CONDITION/INDICATION

Is fuse open?

DECISION

YES Go to Step 25.
NO Go to next step.

STEP

23. Turn MAIN POWER switch ON (TM 9-2355-106-10).
24. Measure DC voltage between fuse F6 socket terminal E2 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 39.
NO Go to Step 37.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

25. Measure resistance between connector 1100M terminal B and ground with multimeter. Refer to Figure 8.

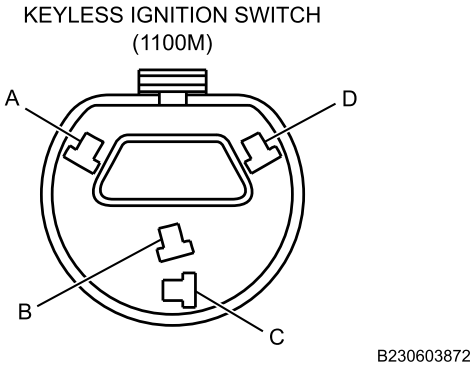


Figure 8. Connector 1100M.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 30.
YES Go to next step.

STEP

26. Measure resistance between connector 1100M terminal C and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 33.
YES Go to next step.

STEP

27. Install IGN RELAY in cabin fuse block 1013. Refer to Figure 9.

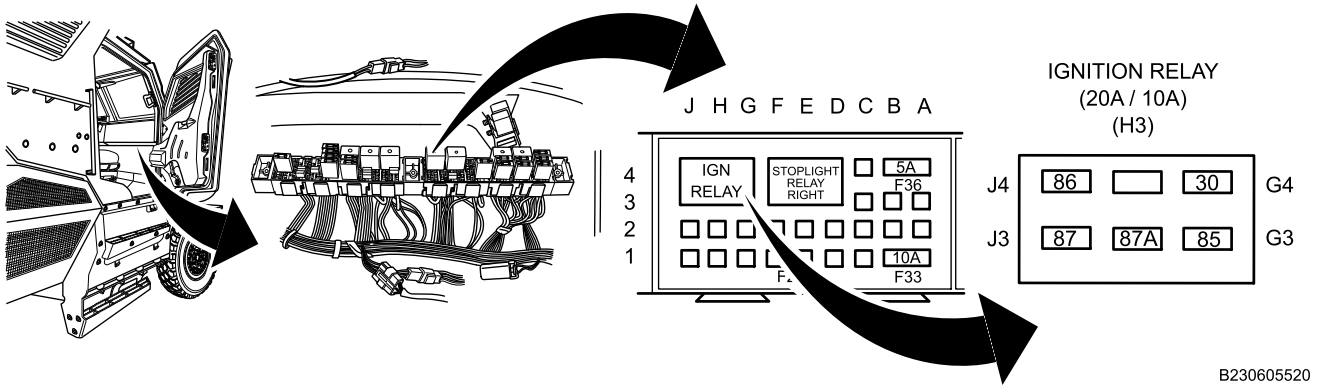


Figure 9. Cabin Fuse Block 1013, Right Side of IP.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

28. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 35.
YES Go to next step.

STEP

29. Measure resistance between ignition switch, not harness connector 1100M, terminal BAT and ground with multimeter. Refer to Figure 10.

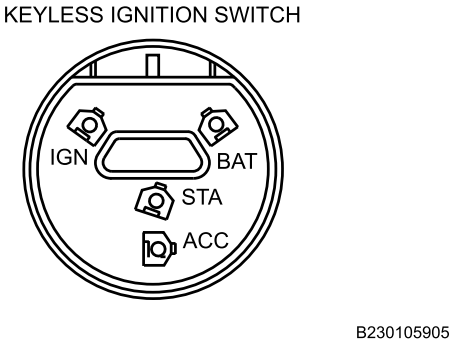


Figure 10. Keyless Ignition Switch.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 39.
YES Go to Step 42.

STEP

30. Remove left engine armor upper plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
31. Remove STARTER relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 11.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

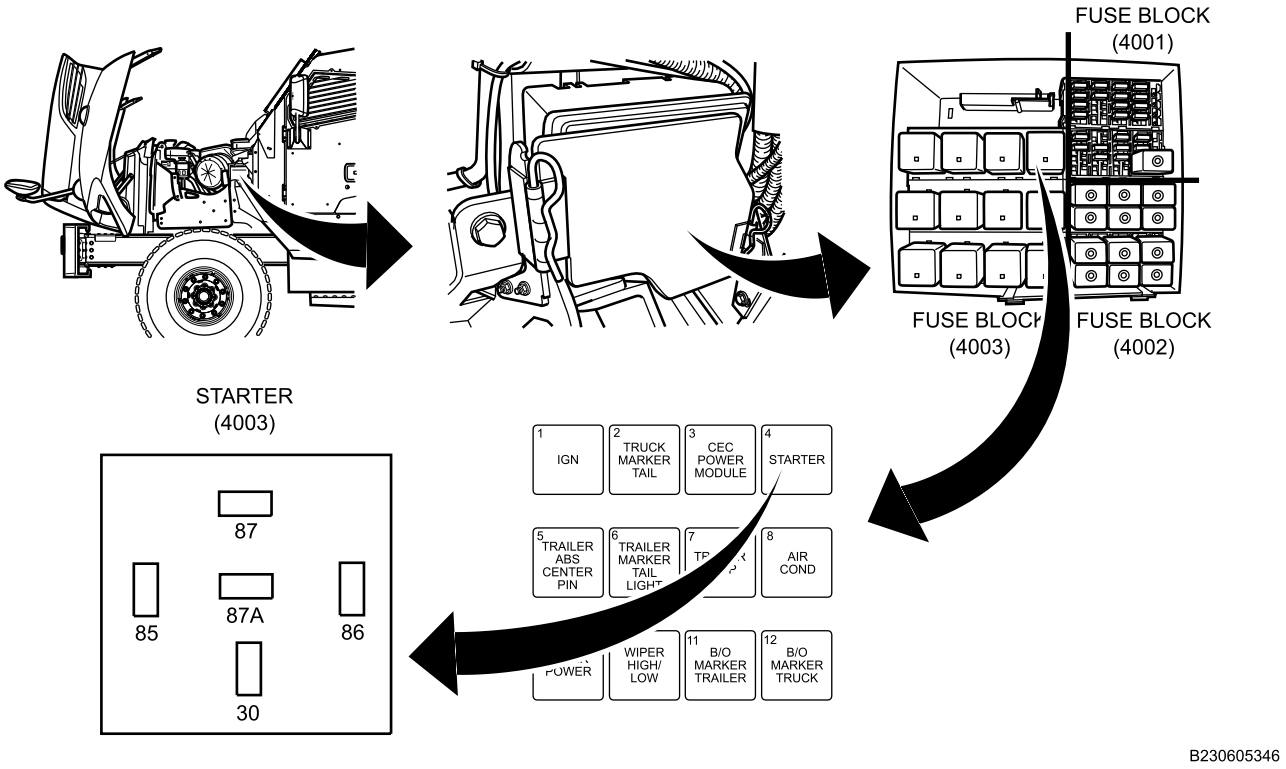


Figure 11. Underhood Power Distribution Center (PDC).

32. Measure resistance between connector 1100M terminal B and ground with multimeter. Refer to Figure 12.

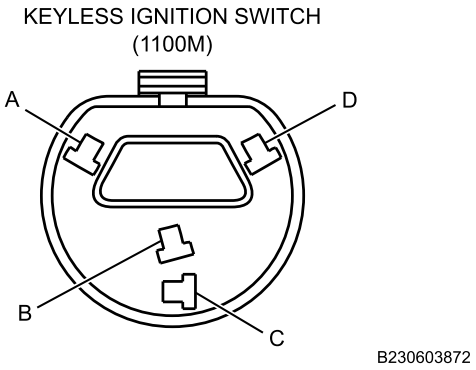


Figure 12. Connector 1100M.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 39.
YES Go to Step 41.

STEP

33. Remove ACC RELAY. Refer to Figure 13.

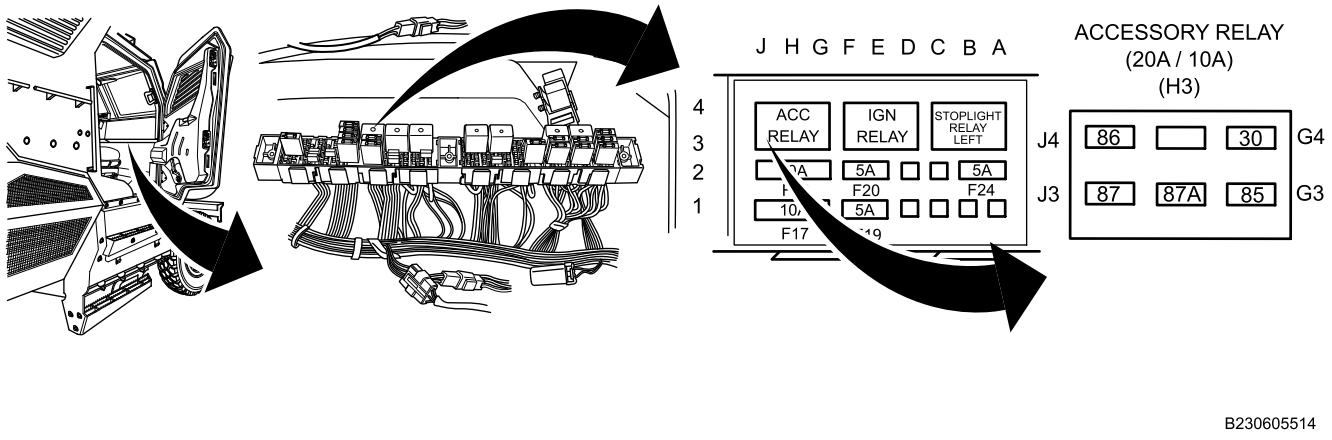


Figure 13. Cabin Fuse Block 1012, Right Side of IP.

34. Measure resistance between connector 1100M terminal C and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 39.
YES Go to Step 40.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

35. Remove IGN RELAY. Refer to Figure 14.

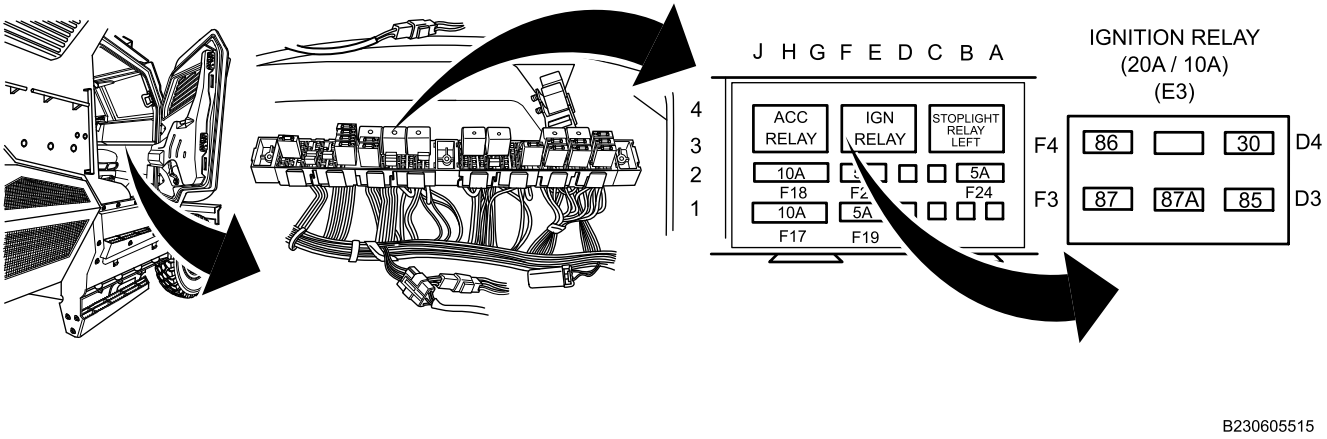


Figure 14. Cabin Fuse Block 1012, Right Side of IP.

36. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 15.

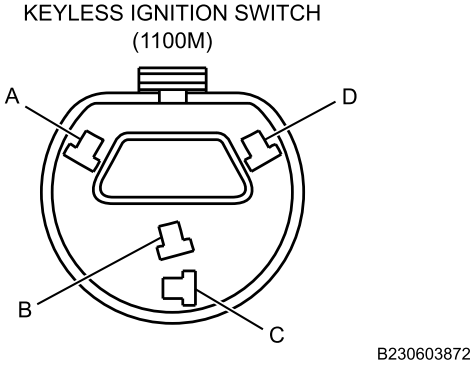


Figure 15. Connector 1100M.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 39.
YES Go to Step 40.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

37. Measure DC voltage between ground and each 12V 100-amp megafuse terminal (Figure 16, Item 1) with multimeter.

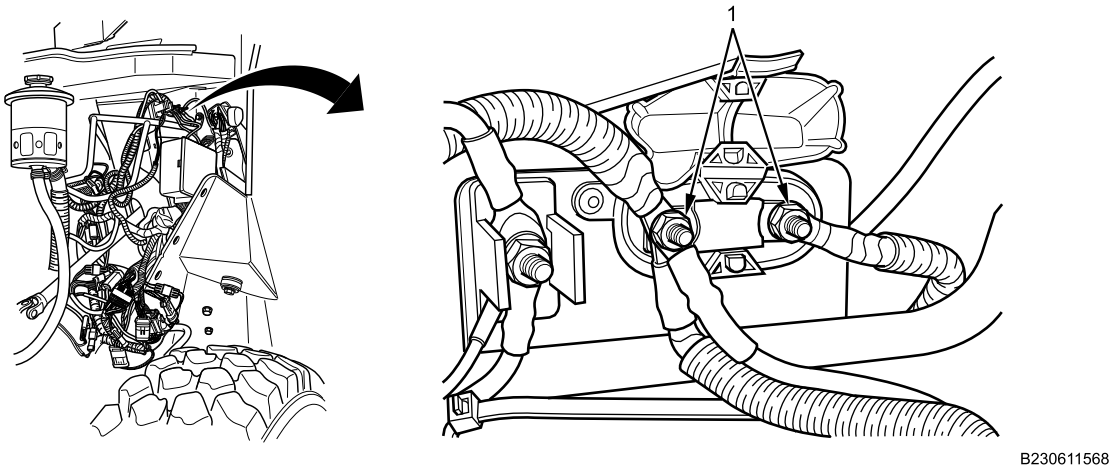


Figure 16. Above Underhood Power Distribution Center (PDC).

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

YES Go to Step 39.
NO Go to next step.

STEP

38. Refer to results of test just performed.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

NO Go to Step 43.
YES Go to Step 44.

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 39. IP harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319).

END OF TEST

MALFUNCTION

- 40. IGN RELAY (H3) is faulty.

ACTION

Replace IGN RELAY (H3). Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

END OF TEST

MALFUNCTION

- 41. STARTER relay is faulty.

ACTION

Replace STARTER relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

END OF TEST

MALFUNCTION

- 42. Keyless ignition switch is faulty.

ACTION

Replace keyless ignition switch. Refer to Keyless Ignition Switch Removal and Installation (WP 0302).

END OF TEST

MALFUNCTION

- 43. Power supply from 12V and 24V battery switches is faulty.

ACTION

Isolate fault with 12V and 24V battery switches. Refer to 12V and 24V Battery Switches Troubleshooting Procedure (WP 0060).

END OF TEST

CABIN FUSE BLOCK 1013 TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 44. IP harness is faulty.

ACTION

Replace IP harness and 12V 100-amp megafuse. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Refer to 12V Underhood Megafuse and Holder Removal and Installation (WP 0422).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

CABIN FUSE BLOCK 1014 TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

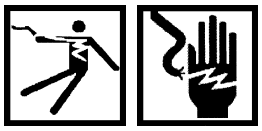
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0319
WP 0436
WP 0437
WP 0443
WP 0060
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Instrument panel right side closeout removed (WP 0580)

Drawings Required
WP 0789, Figure 14

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

This procedure assumes that cabin fuse block 1014 lacks voltage at a buss bar with MAIN POWER and ignition switches ON.

CABIN FUSE BLOCK 1014 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Disconnect connector LAM1041. Refer to Figure 1.

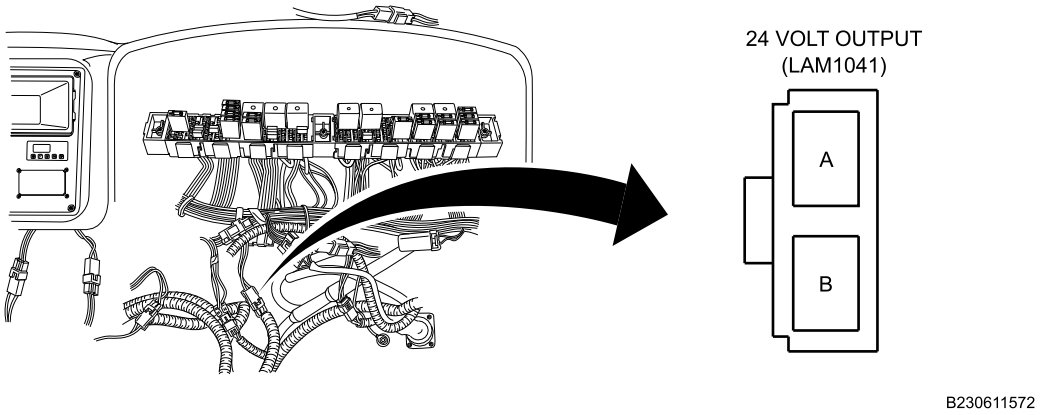


Figure 1. Below Center of Instrument Panel (IP).

2. Reset 70-amp 24V VDC I.P. POWER circuit breaker (Figure 2, Item 1) in 24V PDM.

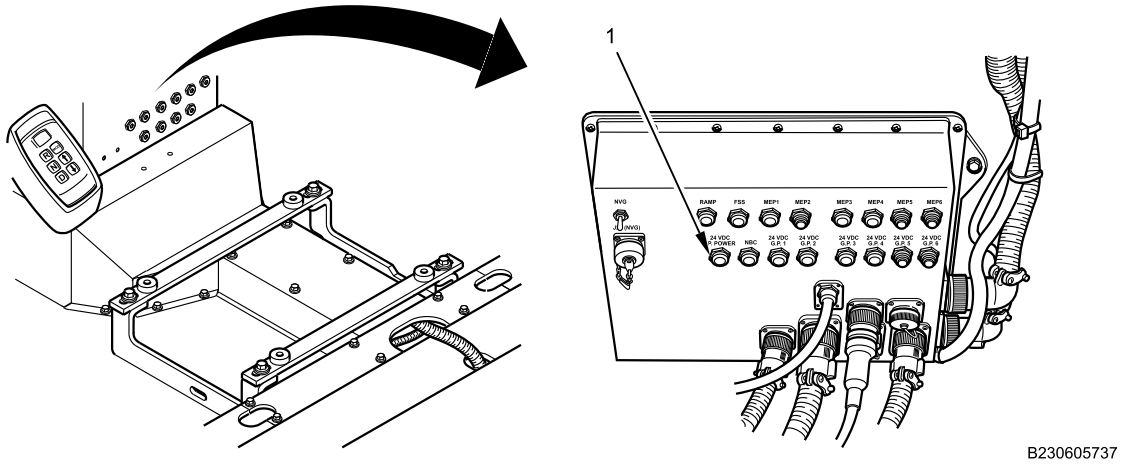


Figure 2. 24V Power Distribution Module (PDM), Below Center of IP.

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Measure DC voltage between ground and connector LAM1041 terminals A and B with multimeter. Refer to Figure 1.

CABIN FUSE BLOCK 1014 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 21V and 27V for each test?

DECISION

YES Go to Step 19.
NO Go to next step.

STEP

6. Turn ignition switch OFF (TM 9-2355-106-10).
7. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
8. Disconnect 24V PDM connector J5 (Figure 3, Item 1).

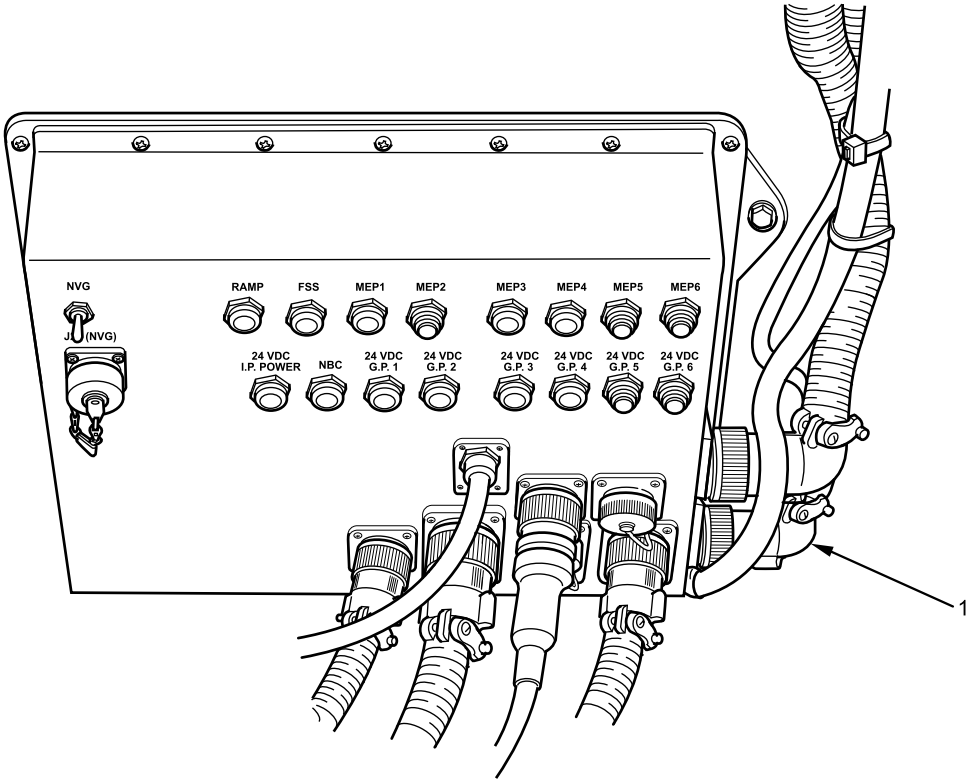


Figure 3. Right Side of 24V PDM.

9. Reset 70-amp 24V VDC I.P. POWER circuit breaker (Figure 4, Item 1) in 24V PDM.

CABIN FUSE BLOCK 1014 TROUBLESHOOTING PROCEDURE - (CONTINUED)

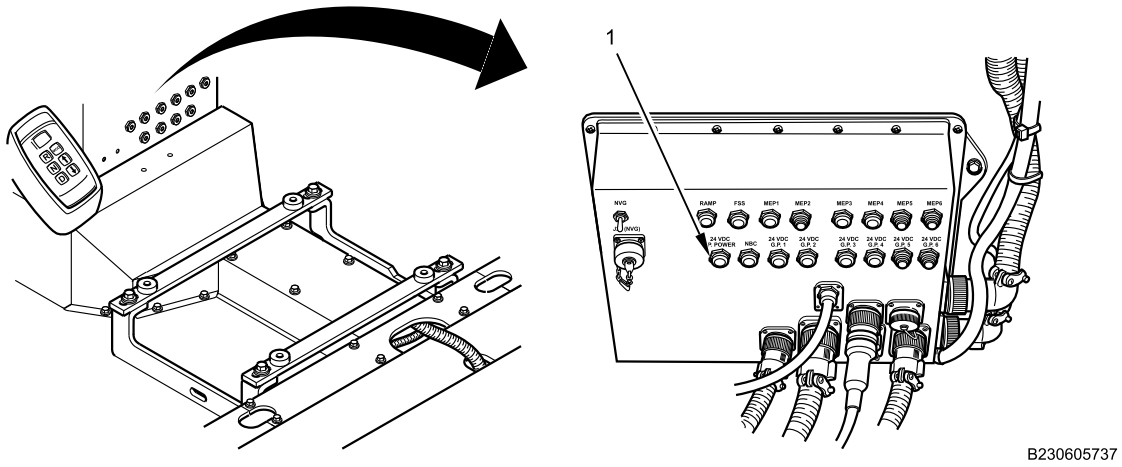


Figure 4. 24V Power Distribution Module (PDM), Below Center of IP.

10. Turn MAIN POWER switch ON (TM 9-2355-106-10).
11. Turn ignition switch ON (TM 9-2355-106-10).
12. Measure DC voltage between ground and 24V PDM connector J5 (connector on PDM) terminals B and C with multimeter. Refer to Figure 5.

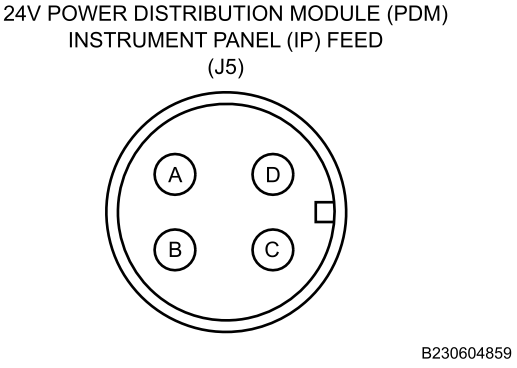


Figure 5. 24V PDM Connector J5.

CONDITION/INDICATION

Does multimeter read between 21V and 27V for each test?

DECISION

YES Go to Step 20.
NO Go to next step.

CABIN FUSE BLOCK 1014 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Turn ignition switch OFF (TM 9-2355-106-10).
14. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
15. Disconnect connector P4. Refer to Figure 6.

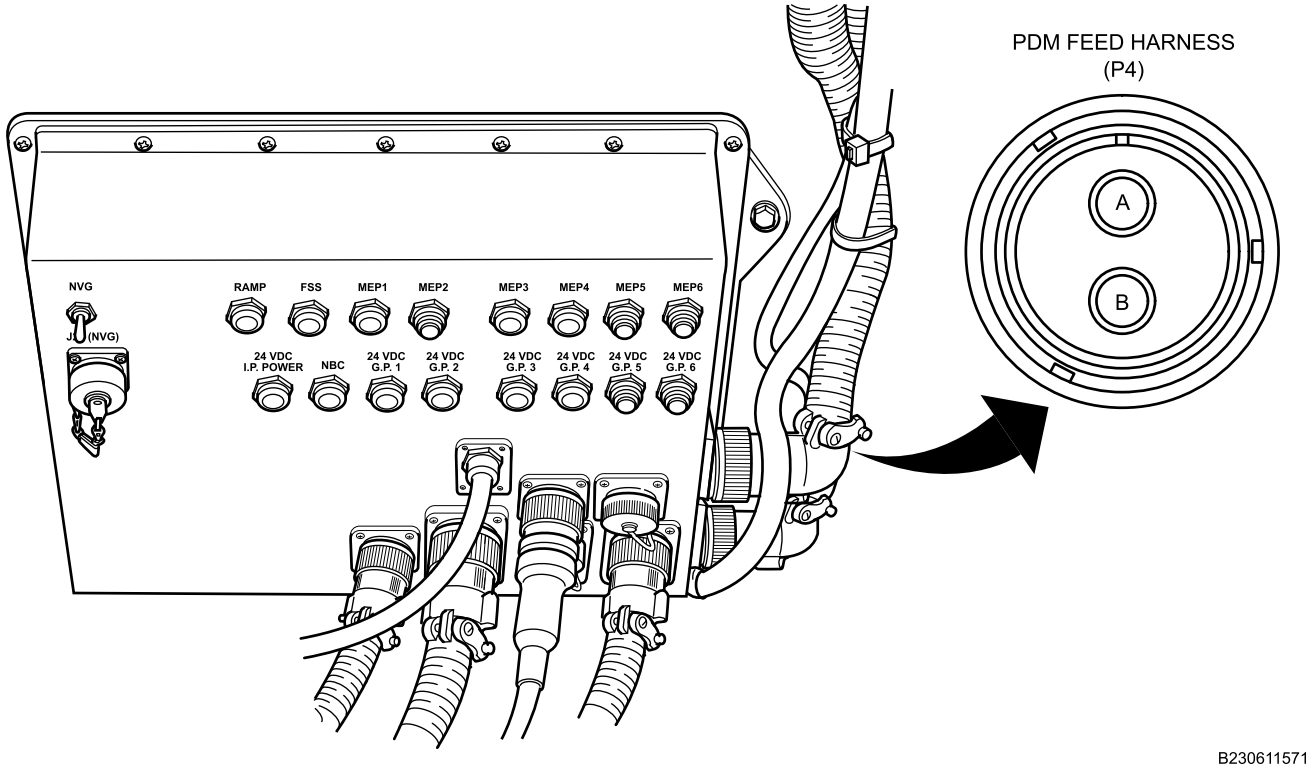


Figure 6. Right Side of 24V PDM.

16. Turn MAIN POWER switch ON (TM 9-2355-106-10).
17. Turn ignition switch ON (TM 9-2355-106-10).
18. Measure DC voltage between ground and connector P4 terminals A and B with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read between 21V and 27V for each test?

DECISION

YES Go to Step 21.
NO Go to Step 22.

CABIN FUSE BLOCK 1014 TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 19. IP harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319).

END OF TEST

MALFUNCTION

- 20. 24V IP feed harness is faulty.

ACTION

Replace 24V IP feed harness. Refer to 24V Instrument Panel (IP) Feed Harness Removal and Installation (WP 0436).

END OF TEST

MALFUNCTION

- 21. 24V PDM is faulty.

ACTION

Replace 24V PDM. Refer to 24V Power Distribution Module (PDM) Removal and Installation (WP 0443).

END OF TEST

MALFUNCTION

- 22. 24V MAIN POWER system is faulty.

ACTION

Diagnose fault in 24V MAIN POWER system. Refer to 12V and 24V Battery Switches Troubleshooting Procedure (WP 0060).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0060
WP 0302
WP 0317
WP 0319
WP 0333
WP 0335
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left side engine armor plate removed (WP 0597)

Drawings Required
WP 0789, Figure 9, WP 0789, Figure 7, WP 0789, Figure 15

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

This procedure assumes that Mini Fuse Block 4001 lacks voltage at a buss bar with MAIN POWER and ignition switches ON.

STEP

1. Remove the following fuses:
   - Fuse 11, 5A REMOTE PWR MDL
   - Fuse 15, 30A AIR ABS

   Refer to Figure 1. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

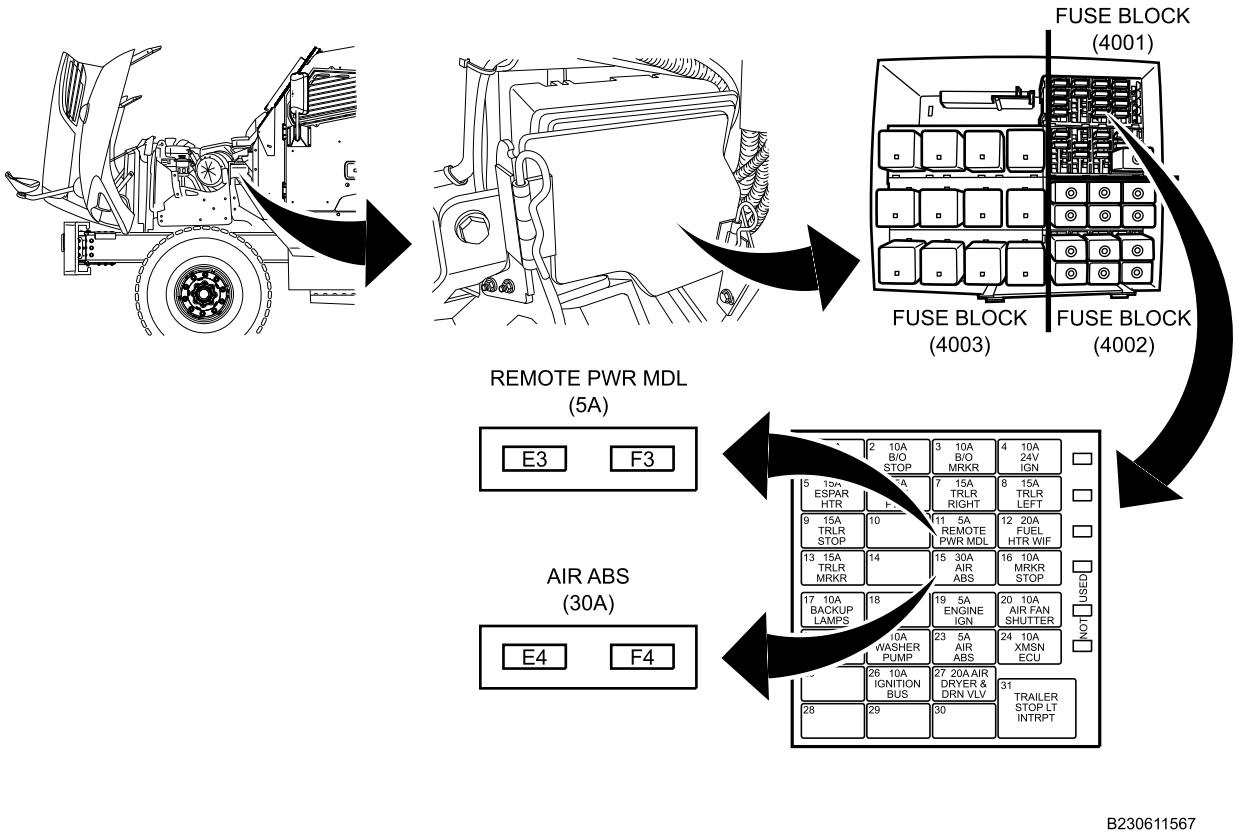


Figure 1. Power Distribution Center (PDC) Under Hood.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Measure DC voltage between ground and each of the following fuse socket terminals with multimeter:
   - E3
   - E4

   Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V at each terminal?

DECISION

NO Go to Step 26.
YES Go to next step.

STEP

6. Turn ignition switch OFF (TM 9-2355-106-10).
7. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
8. Remove the following fuses:
   - Fuse 19, 5A ENGINE IGN
   - Fuse 23, 5A AIR ABS
   - Fuse 27, 20A AIR DRYER & DRN VLV

   Refer to Figure 2. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

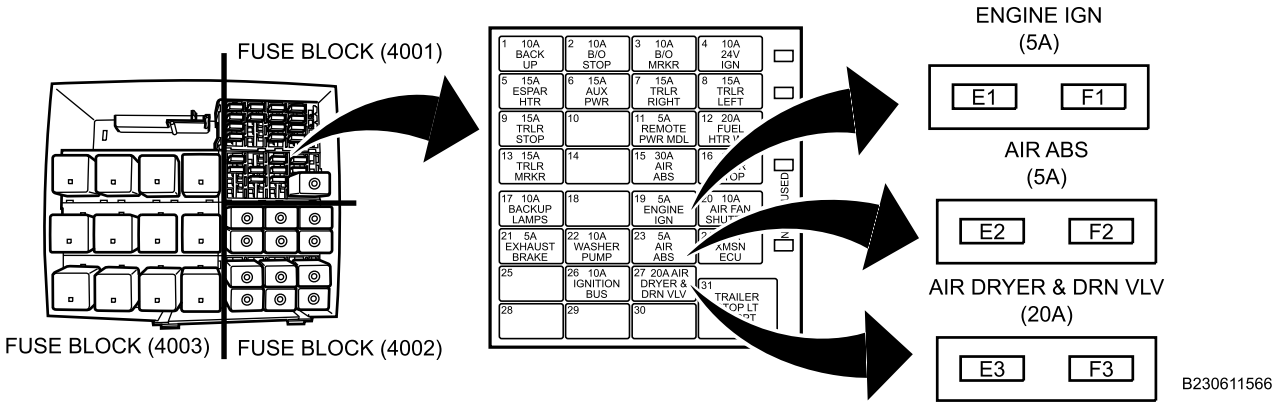


Figure 2. Fuse Block 4001.

9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Turn ignition switch ON (TM 9-2355-106-10).
11. Measure DC voltage between ground and each of the following fuse socket terminals with multimeter:
    - E1
    - E2
    - E3

    Refer to Figure 2.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V at each terminal?

DECISION

NO Go to Step 16.
YES Go to next step.

STEP

12. Turn ignition switch OFF (TM 9-2355-106-10).
13. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
14. Remove the following fuses:
    - Fuse 2, 10A B/O STOP
    - Fuse 6, 15A AUX PWR

    Refer to Figure 3. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

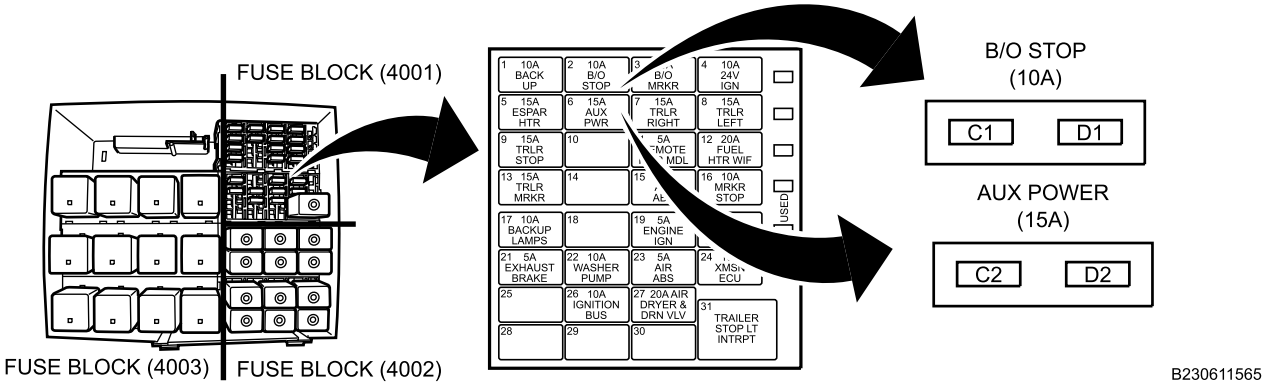


Figure 3. Fuse Block 4001.

15. Measure DC voltage between ground and each of the following fuse socket terminals with multimeter:
    - C1
    - C2

    Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 21V and 27V at each terminal?

DECISION

NO Go to Step 58.
YES Go to Step 65.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

16. Turn ignition switch OFF (TM 9-2355-106-10).
17. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
18. Remove IGN relay. Refer to Figure 4. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

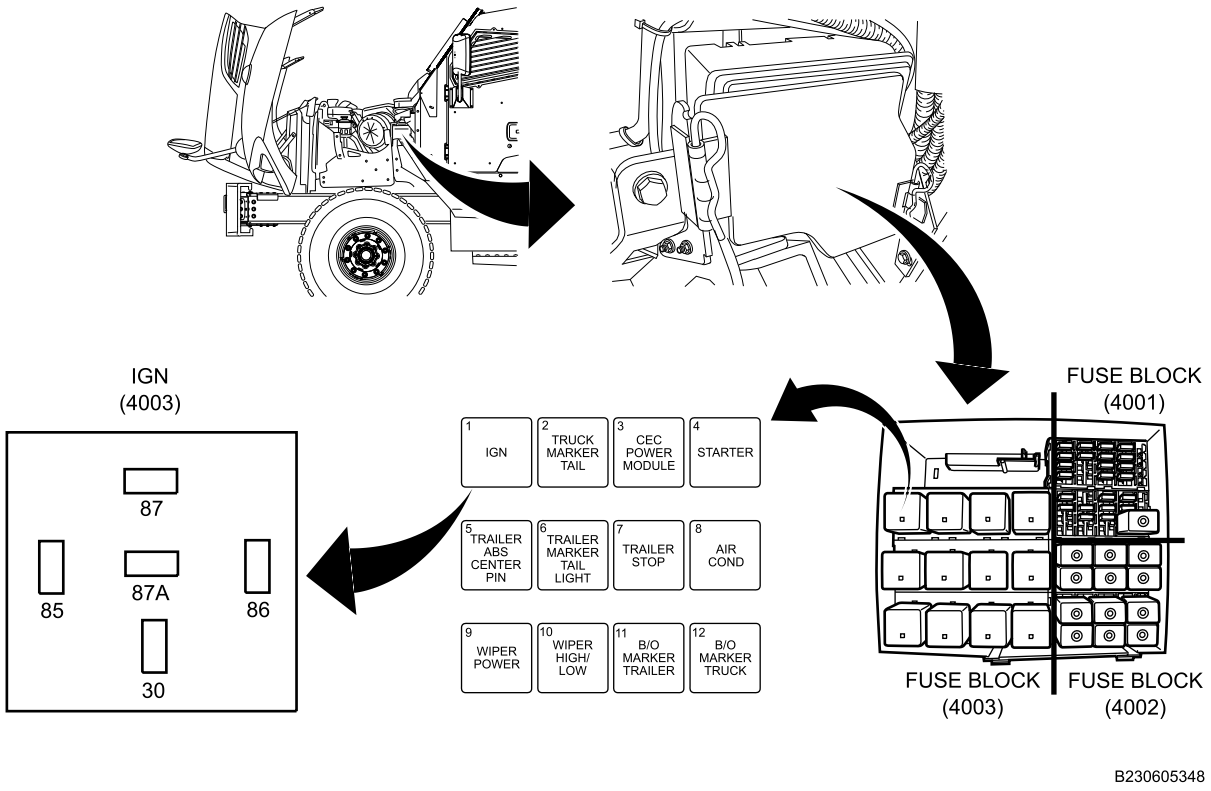


Figure 4. Power Distribution Center (PDC) Under Hood.

19. Measure resistance between IGN relay socket terminal 85 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 65.
YES Go to next step.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

20. Measure resistance between IGN relay socket terminal 87A and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 65.
YES Go to next step.

STEP

21. Turn MAIN POWER switch ON (TM 9-2355-106-10).
22. Turn ignition switch ON (TM 9-2355-106-10).
23. Measure DC voltage between IGN relay socket terminal 86 and ground with multimeter. Refer to Figure 5.

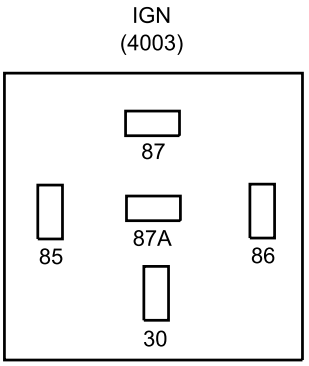


Figure 5. IGN Relay Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 27.
YES Go to next step.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

24. Measure DC voltage between IGN relay socket terminal 87 and ground with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 65.
YES Go to next step.

STEP

25. Measure DC voltage between IGN relay socket terminals 87 and 30 with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 65.
YES Go to Step 60.

STEP

26. Measure DC voltage between ground and each 12-volt 100-amp mega fuse terminal (Figure 6, Item 1) with multimeter.

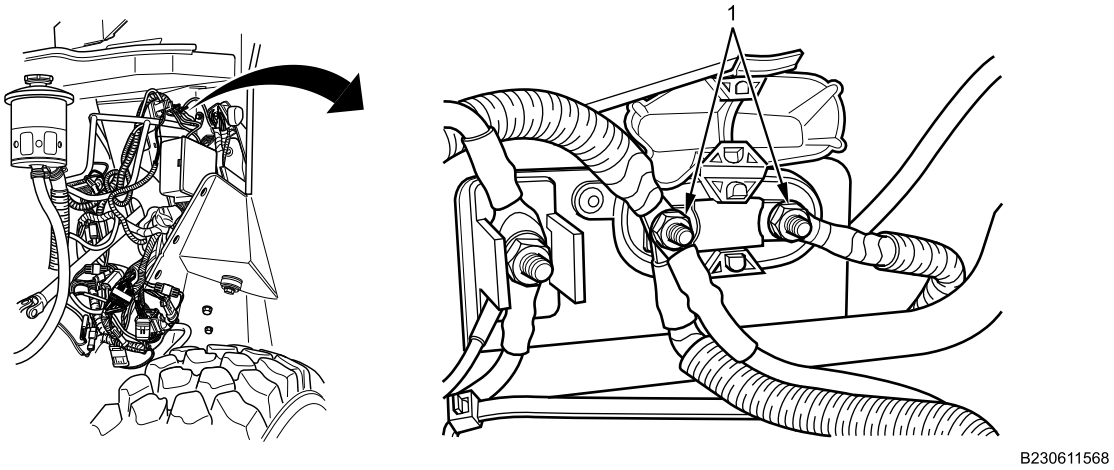


Figure 6. 12V 100-amp Mega Fuse.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

NO Go to Step 66.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

YES Go to Step 65.

STEP

27. Turn ignition switch OFF (TM 9-2355-106-10).
28. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
29. Disconnect keyless ignition switch connector 1100M. Refer to Figure 7.

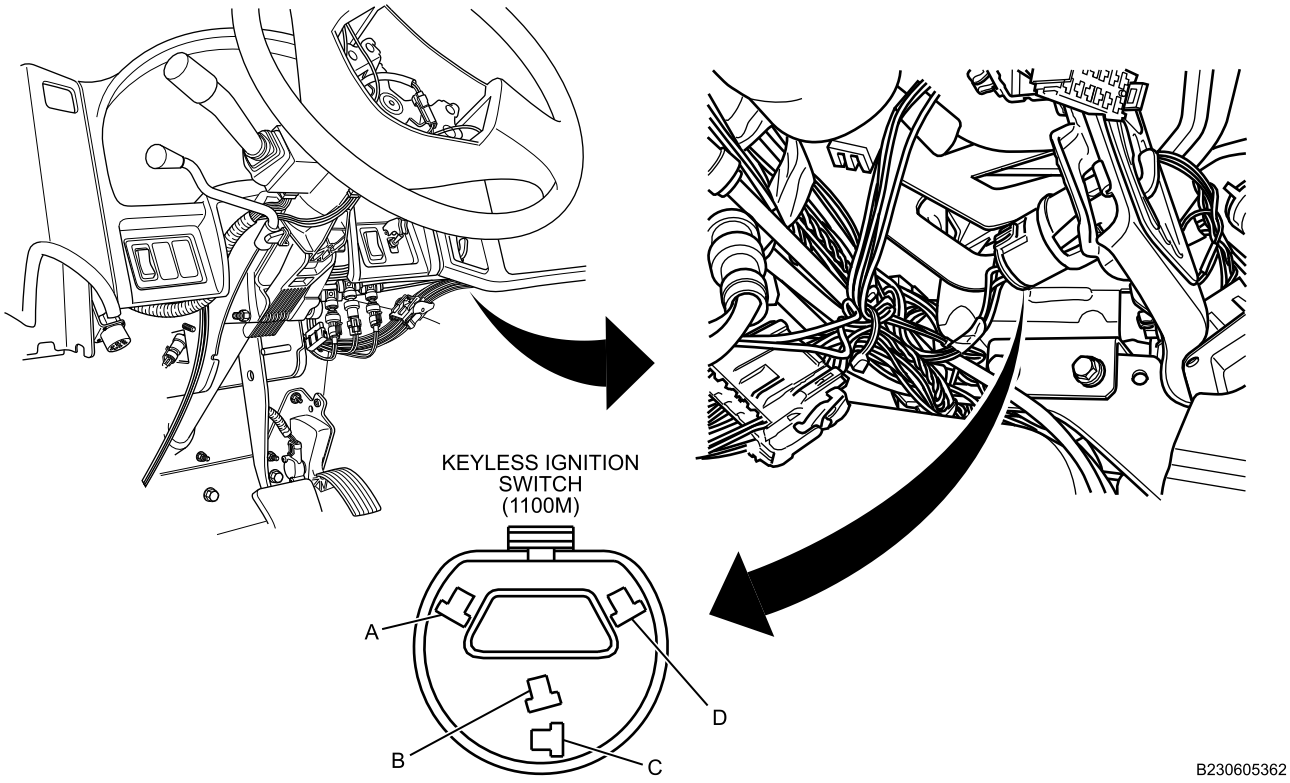


Figure 7. Behind Lower Instrument Cluster.

30. Turn MAIN POWER switch ON (TM 9-2355-106-10).
31. Measure DC voltage between connector 1100M terminal A and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 39.
YES Go to next step.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

32. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
33. Connect jumper wire between connector 1100M terminals A and D. Refer to Figure 7.
34. Turn MAIN POWER switch ON (TM 9-2355-106-10).
35. Measure DC voltage between IGN relay socket terminal 86 and ground with multimeter. Refer to Figure 8.

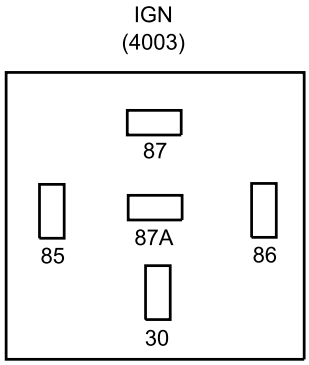


Figure 8. IGN Relay Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 67.
NO Go to next step.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

36. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
37. Disconnect connector 1701. Refer to Figure 9.

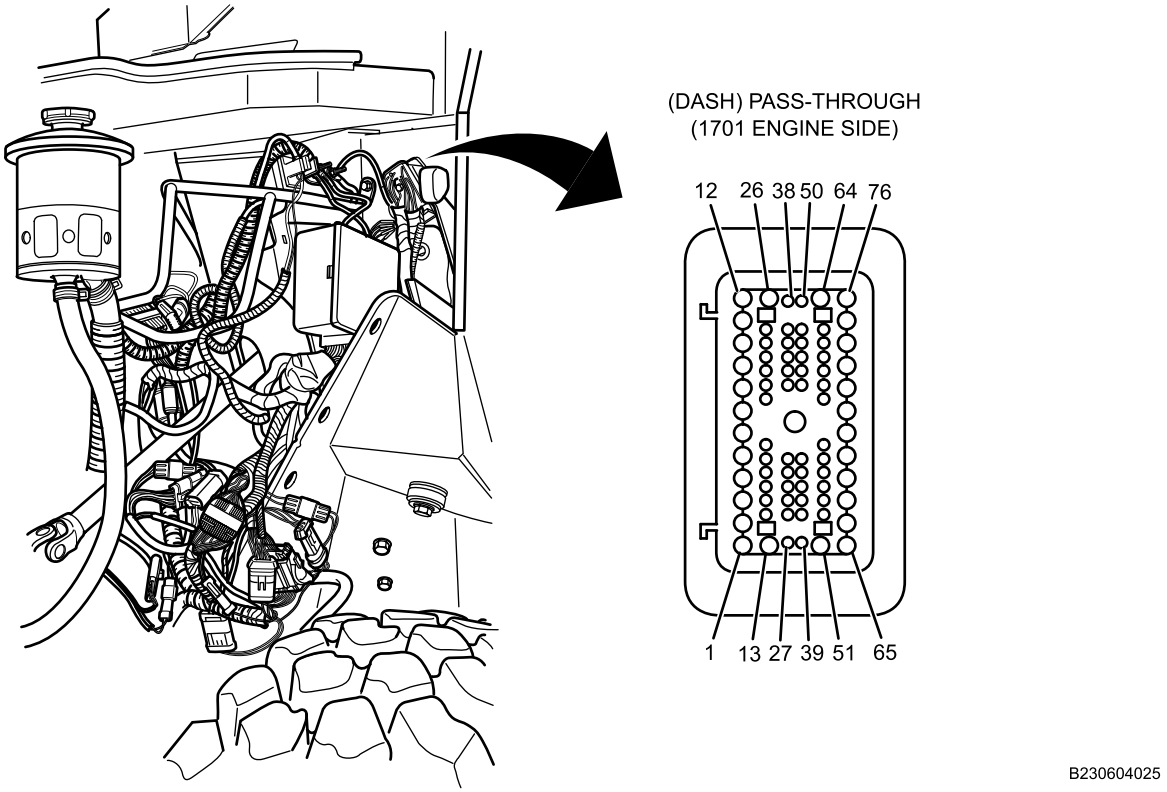


Figure 9. Left Side of Firewall.

38. Measure resistance between connector 1701 (engine side) terminal 11 and IGN relay socket terminal 86 with multimeter. Refer to Figure 10. Refer to Figure 9.

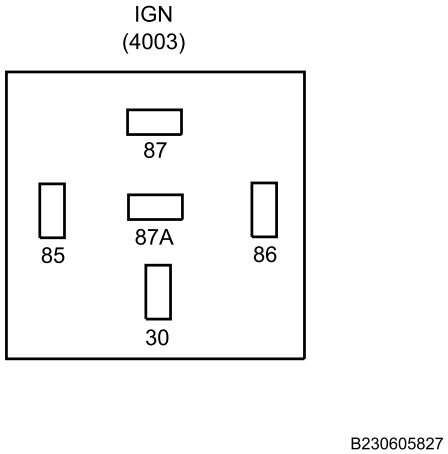


Figure 10. IGN Relay Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 65.
YES Go to Step 68.

STEP

39. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
40. Remove IP closeout. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).
41. Remove and inspect 5A fuse F6. Refer to Figure 11. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

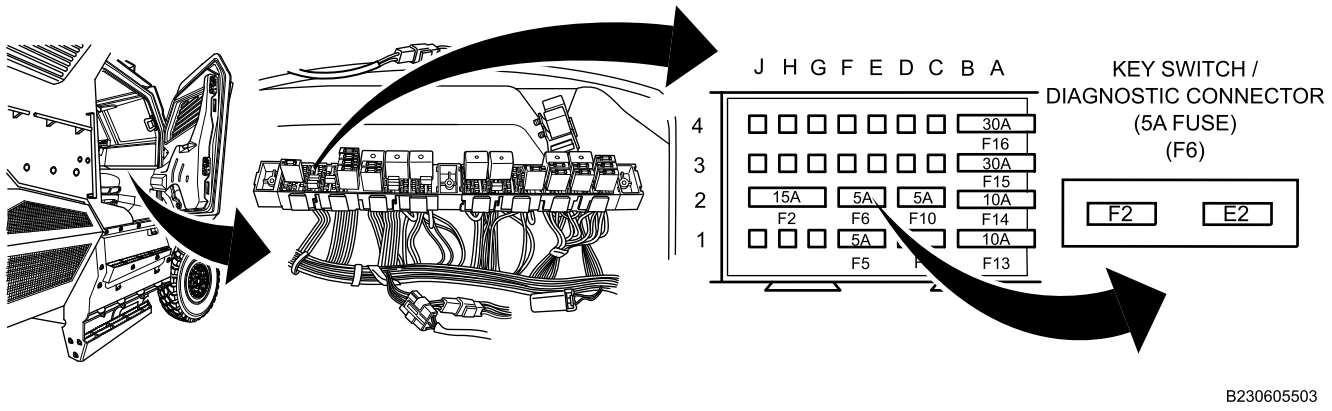


Figure 11. Right Side of Instrument Panel (IP).

CONDITION/INDICATION

Is fuse open?

DECISION

NO Go to Step 68.
YES Go to next step.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

42. Measure resistance between connector 1100M terminal B and ground with multimeter. Refer to Figure 12.

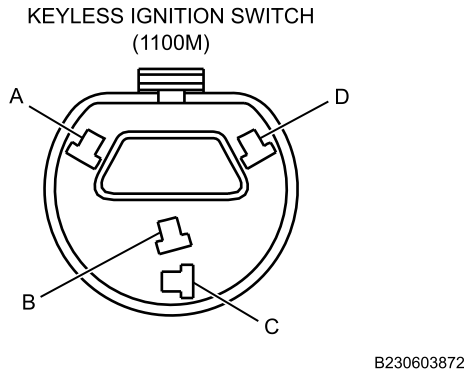


Figure 12. Connector 1100M.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 48.
YES Go to next step.

STEP

43. Measure resistance between connector 1100M terminal C and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 50.
YES Go to next step.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

44. Install IGN relay. Refer to Figure 13. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

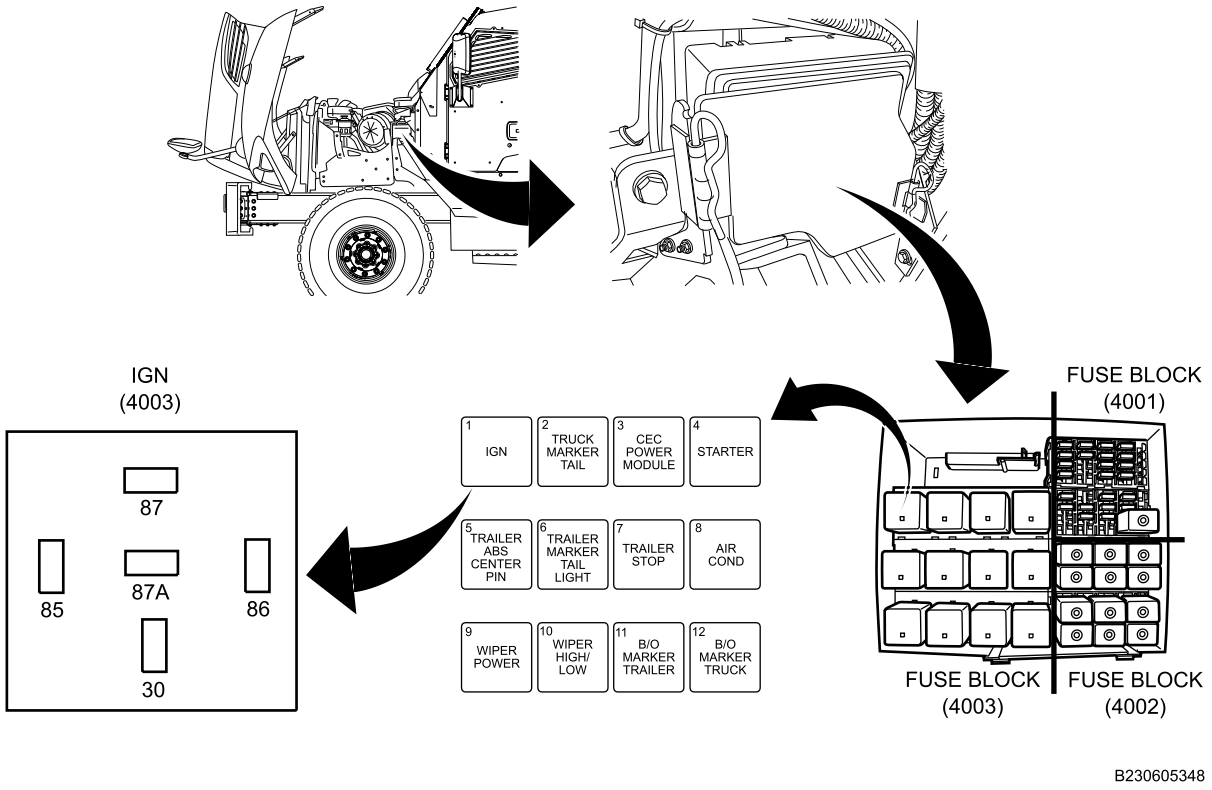


Figure 13. Power Distribution Center (PDC) Under Hood.

45. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 52.
YES Go to next step.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

46. Remove keyless ignition switch. Refer to Engine Start Keyless Ignition Switch Removal and Installation (WP 0302).
47. Measure resistance between keyless ignition switch terminal BAT and ground with multimeter. Refer to Figure 14.

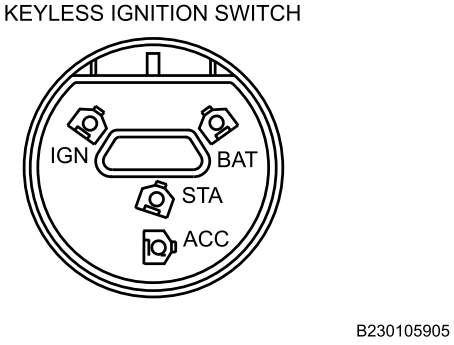


Figure 14. Keyless Ignition Switch.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 68.
NO Go to Step 67.

STEP

48. Remove STARTER relay. Refer to Figure 15. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

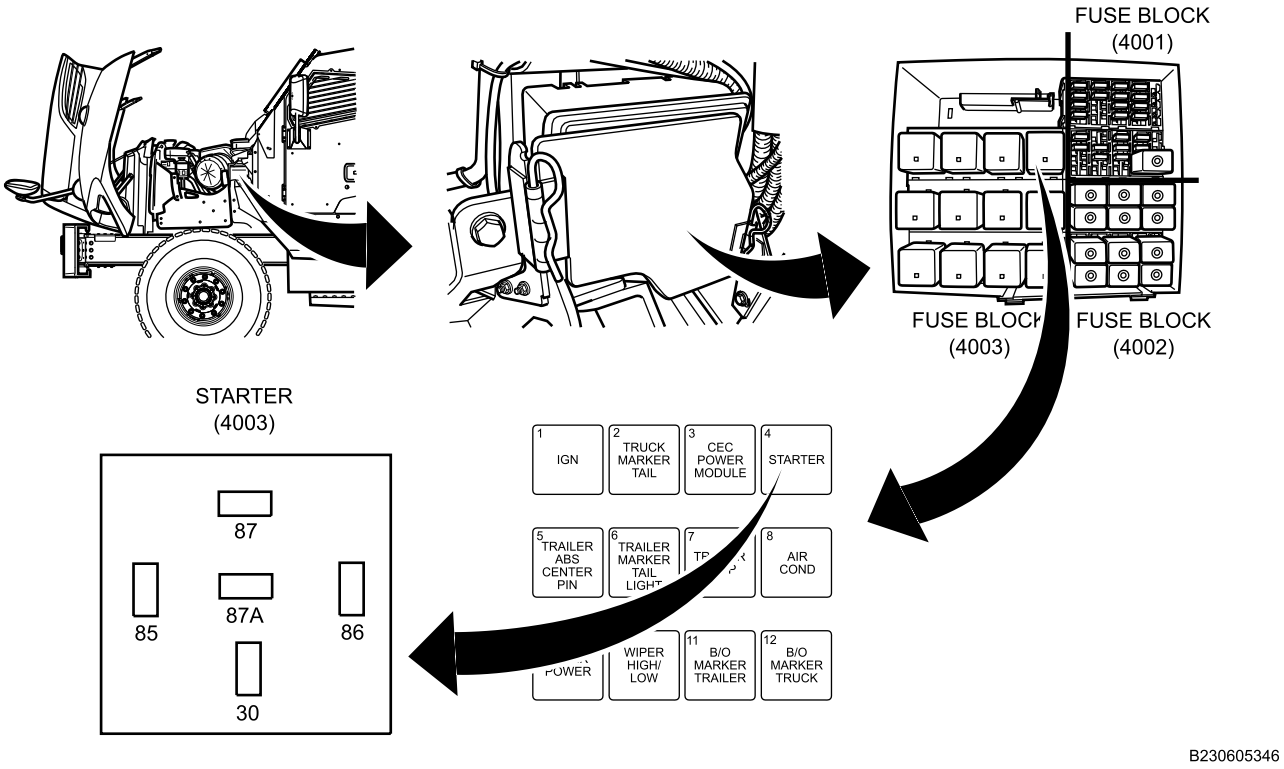


Figure 15. Underhood Power Distribution Center (PDC).

49. Measure resistance between connector 1100M terminal B and ground with multimeter. Refer to Figure 16.

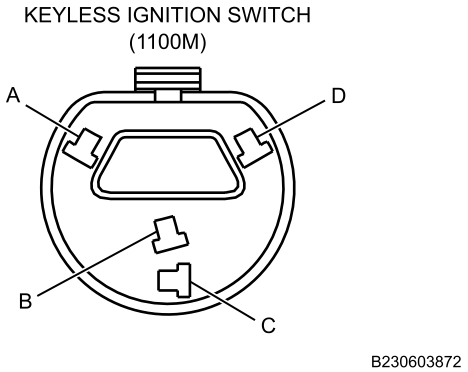


Figure 16. Connector 1100M.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 68.
YES Go to Step 63.

STEP

50. Remove ACC RELAY. Refer to Figure 17. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

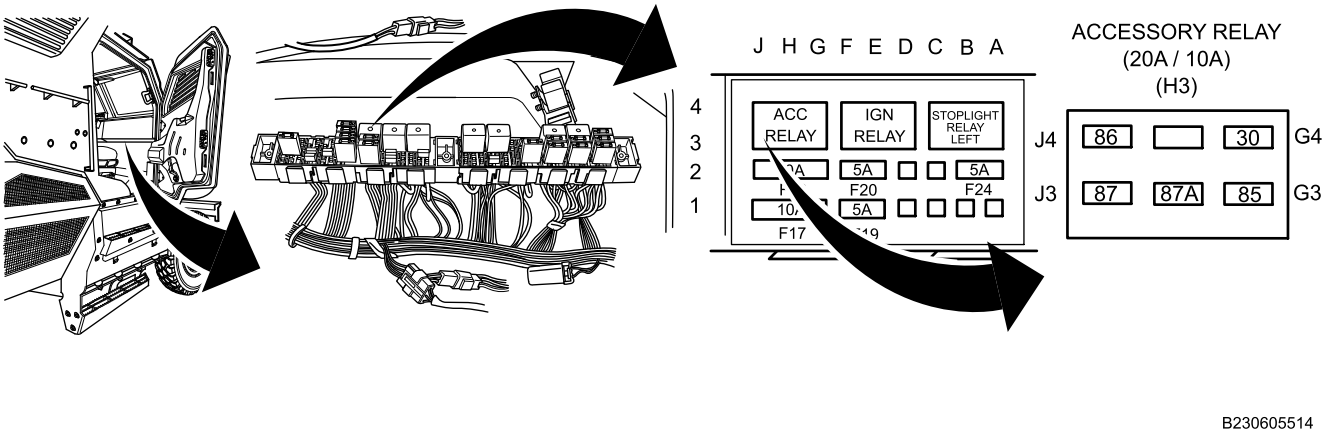


Figure 17. Right Side of Instrument Panel (IP).

51. Measure resistance between connector 1100M terminal C and ground with multimeter. Refer to Figure 18.

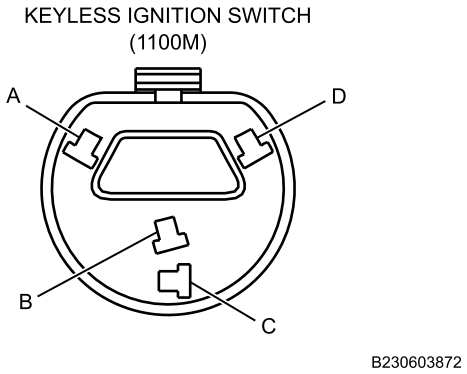


Figure 18. Connector 1100M.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 68.
YES Go to Step 64.

STEP

52. Remove relay IGN from fuse block 4003. Refer to Figure 19. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

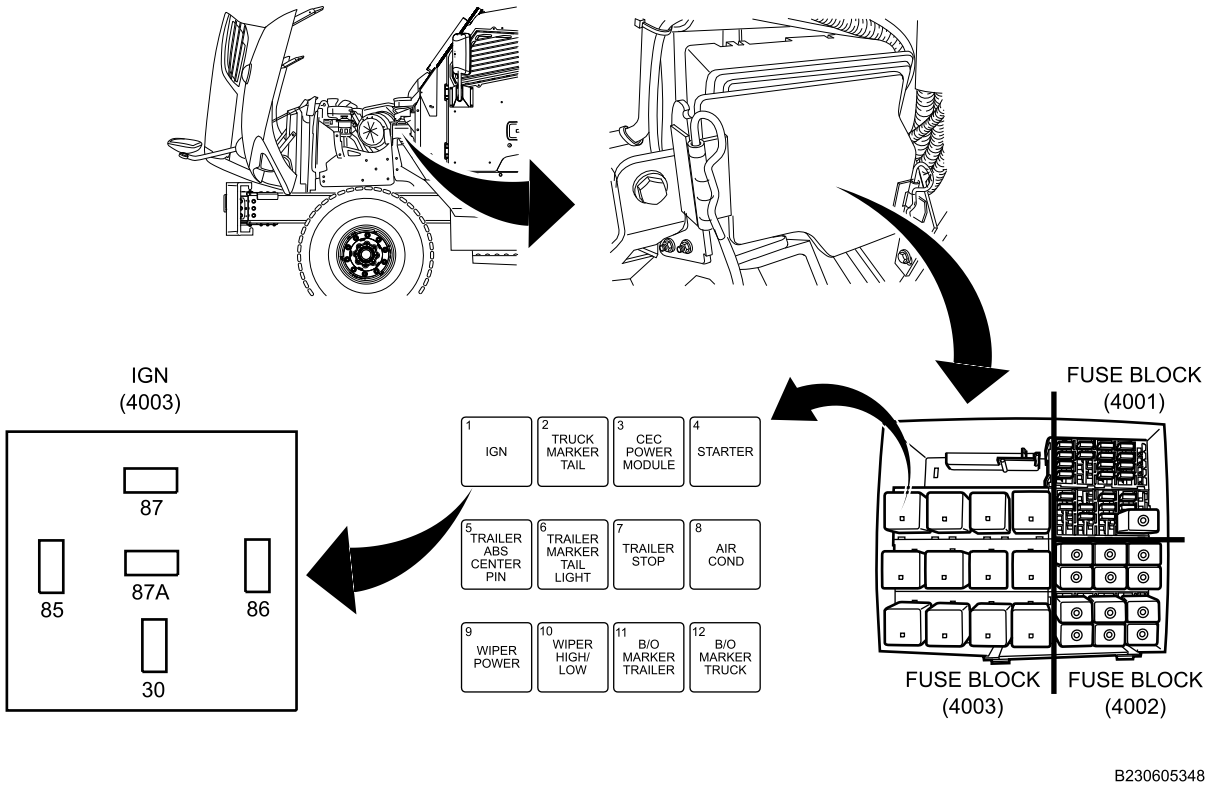


Figure 19. Underhood Power Distribution Center (PDC).

53. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 18.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

YES Go to Step 60.
NO Go to next step.

STEP

54. Remove IGN RELAY from cabin fuse block 1013. Refer to Figure 20. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

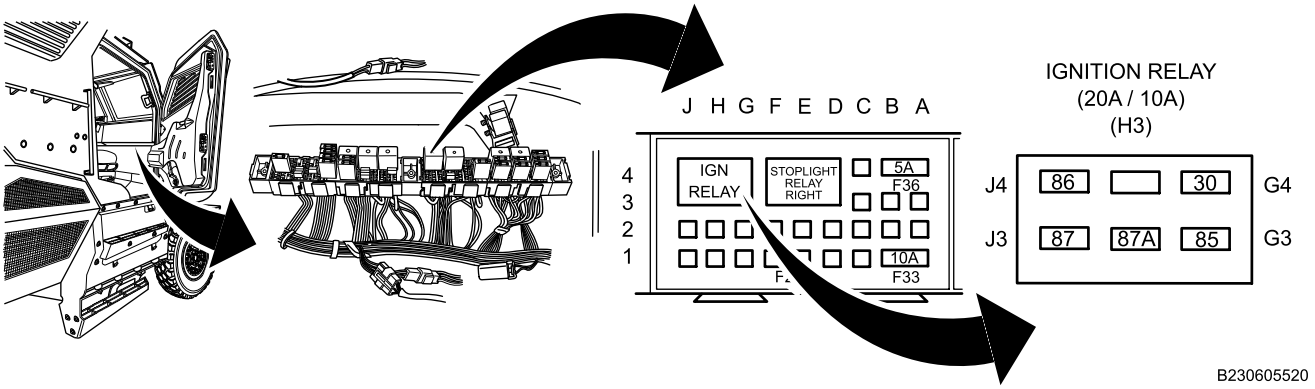


Figure 20. Right Side of Instrument Panel (IP).

55. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 21.

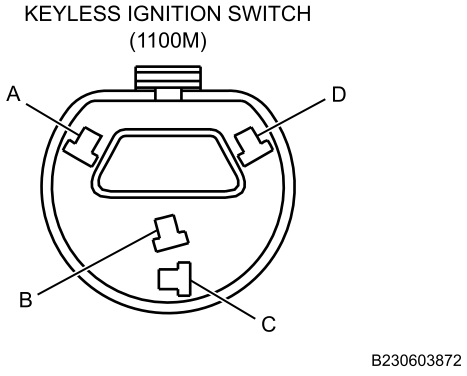


Figure 21. Connector 1100M.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

YES Go to Step 61.
NO Go to next step.

STEP

56. Remove IGN RELAY from fuse block 1012. Refer to Figure 22. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

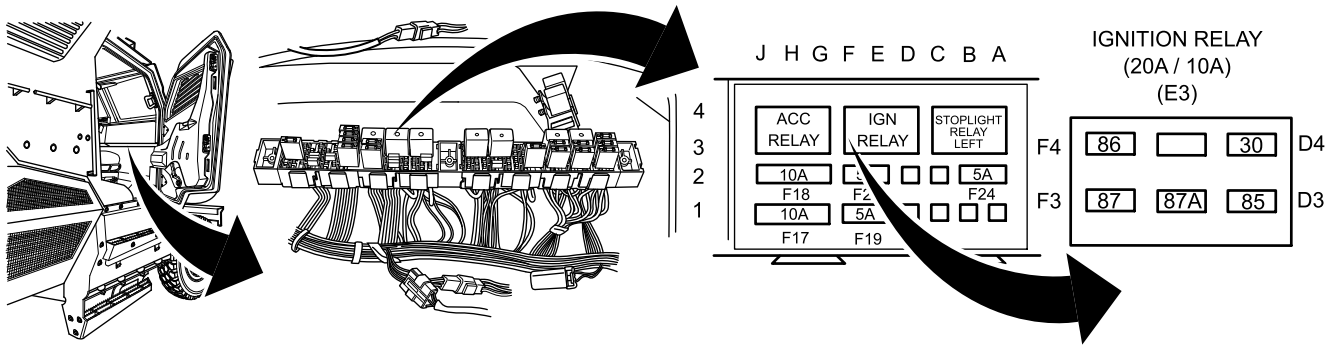


Figure 22. Right Side of Instrument Panel (IP).

57. Measure resistance between connector 1100M terminal D and ground with multimeter. Refer to Figure 21.

CONDITION/INDICATION

Does multimeter read more than 3 ohms?

DECISION

NO Go to Step 68.
YES Go to Step 62.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

58. Measure DC voltage between 24V feed stud and ground with multimeter. Refer to Figure 23.

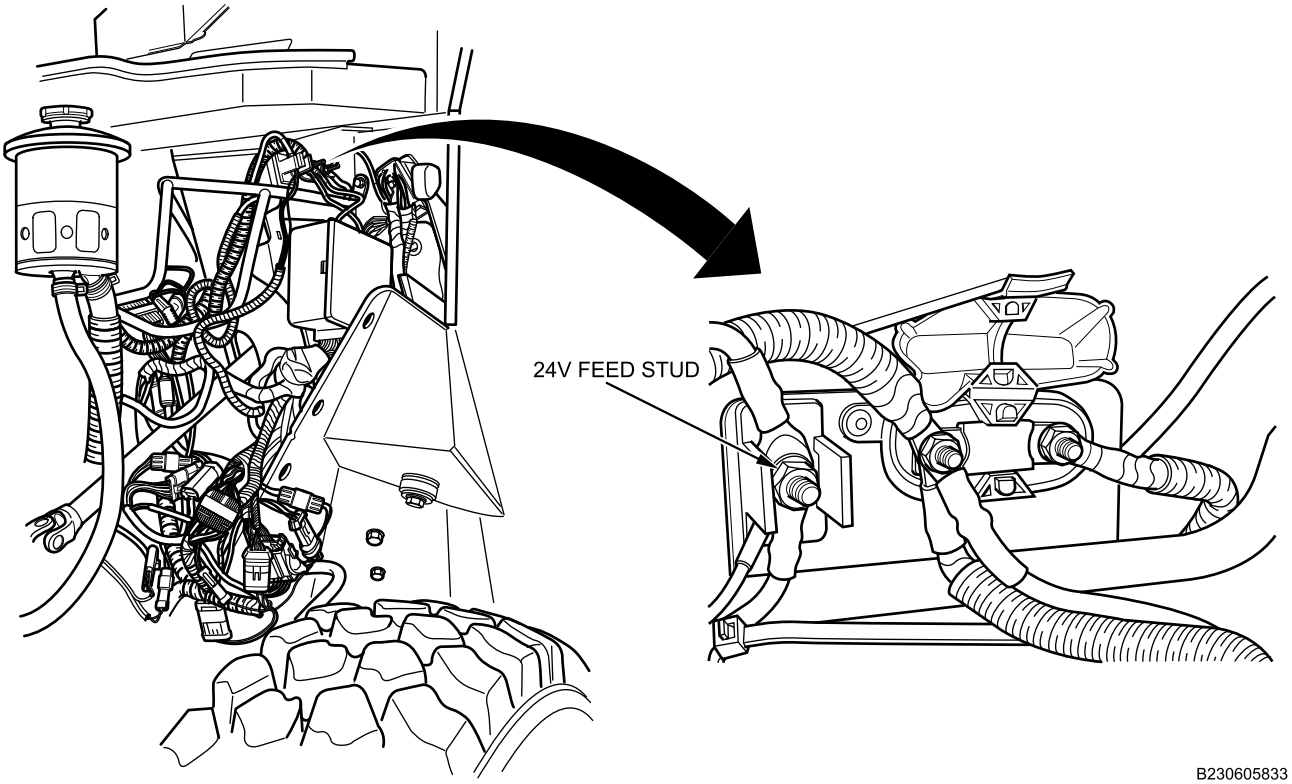


Figure 23. Above Underhood Power Distribution Center (PDC).

CONDITION/INDICATION

Does multimeter read between 21V and 27V?

DECISION

YES Go to Step 65.
NO Go to next step.

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

59. Measure DC voltage between starter solenoid (Figure 24, Item 2) 24V feed stud (Figure 24, Item 1) and ground with multimeter.

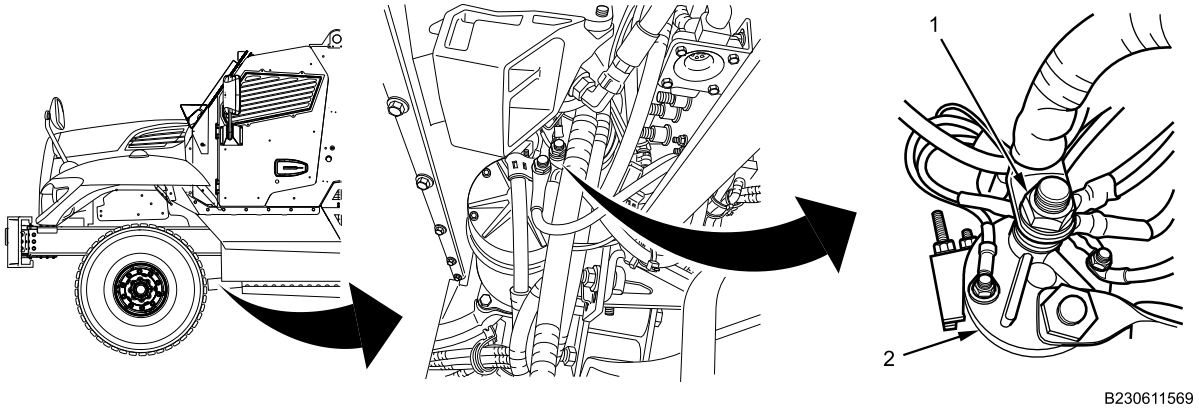


Figure 24. Left Lower Side of Engine.

CONDITION/INDICATION

Does multimeter read between 21V and 27V?

DECISION

NO Go to Step 70.
YES Go to Step 69.

MALFUNCTION

- 60. IGN relay from fuse panel 4003 is faulty.

ACTION

Replace IGN relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

END OF TEST

MALFUNCTION

- 61. IGN RELAY from fuse panel 1013 is faulty.

ACTION

Replace IGN RELAY. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 62. IGN RELAY from fuse panel 1012 is faulty.

ACTION

Replace IGN RELAY. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

END OF TEST

MALFUNCTION

- 63. STARTER relay is faulty.

ACTION

Replace STARTER relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

END OF TEST

MALFUNCTION

- 64. ACC relay is faulty.

ACTION

Replace ACC relay. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

END OF TEST

MALFUNCTION

- 65. Power Distribution Center (PDC) or harness is faulty.

ACTION

Replace PDC. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335).

END OF TEST

MALFUNCTION

- 66. MAIN POWER switches system is faulty.

ACTION

Diagnose MAIN POWER switches system fault. Refer to 12V and 24V Battery Switches Troubleshooting Procedure (WP 0060).

END OF TEST

POWER DISTRIBUTION CENTER (PDC) MINI FUSE BLOCK 4001 TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 67. Keyless ignition switch is faulty.

ACTION

Replace ignition switch. Refer to Keyless Ignition Switch Removal and Installation (WP 0302).

END OF TEST

MALFUNCTION

- 68. Instrument Panel (IP) harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319).

END OF TEST

MALFUNCTION

- 69. Engine harness is faulty.

ACTION

Replace engine harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336).

END OF TEST

MALFUNCTION

- 70. Starter motor feed cable is faulty.

ACTION

Replace starter motor feed cable. Refer to Starter Motor Feed Cable Removal and Installation (WP 0413).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

KEYLESS IGNITION SWITCH TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

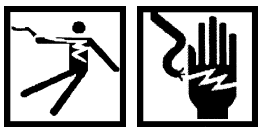
Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0302
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Keyless ignition switch removed (WP 0302)

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

KEYLESS IGNITION SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

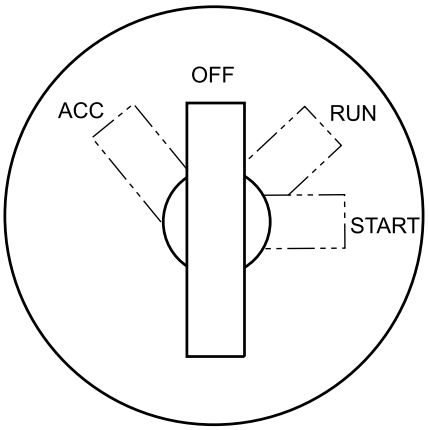


Figure 1. Ignition Switch.

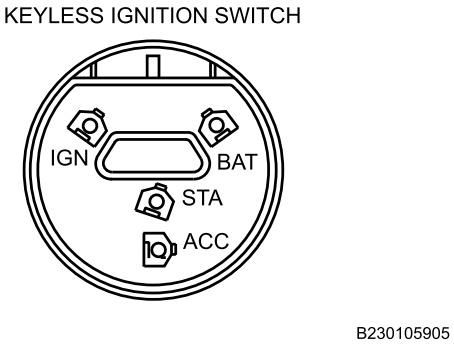


Figure 2. Ignition Switch.

1. While turning switch to START position, measure resistance between switch terminal BAT and all other switch terminals. Refer to Figure 1 and Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms between BAT and STA, and BAT and IGN only?

DECISION

NO Go to Step 5.
YES Go to next step.

STEP

2. Turn key to RUN position and measure resistance between switch terminal BAT and all other terminals. Refer to Figure 1 and Figure 2.

CONDITION/INDICATION

Does multimeter read less than 5 ohms between terminals BAT and IGN, and BAT and ACC only?

DECISION

NO Go to Step 5.
YES Go to next step.

KEYLESS IGNITION SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

3. Turn key to ACCESSORY (ACC) position and measure resistance between switch terminal BAT and all other terminals. Refer to Figure 1 and Figure 2.

CONDITION/INDICATION

Does multimeter read less 5 ohms between BAT and ACC only?

DECISION

NO Go to Step 5.
YES Go to next step.

STEP

4. Turn key to OFF position and measure resistance between switch terminal BAT and all other terminals. Refer to Figure 3 and Figure 4.

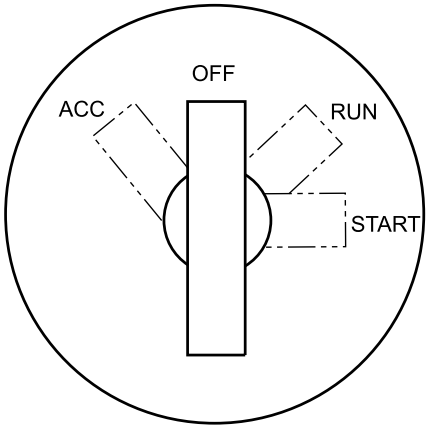


Figure 3. Ignition Switch.

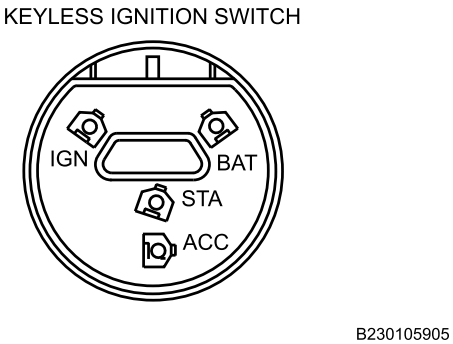


Figure 4. Ignition Switch.

CONDITION/INDICATION

Does multimeter read OL for all tests?

KEYLESS IGNITION SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to next step.
YES Go to Step 6.

MALFUNCTION

- 5. Ignition switch is faulty.

ACTION

Replace ignition switch. Refer to Keyless Ignition Switch Removal and Installation (WP 0302). Return vehicle to service.

END OF TEST

MALFUNCTION

- 6. No malfunction at this time.

ACTION

Return to next step in Hard Start/No Start Operational Checkout Procedure (WP 0014).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0078
WP 0257
WP 0297
WP 0329
WP 0319
WP 0320
WP 0335
WP 0336
WP 0337
WP 0353
WP 0452
WP 0453
WP 0355
WP 0578
WP 0580
WP 0597
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 1
WP 0789, Figure 2
WP 0789, Figure 3

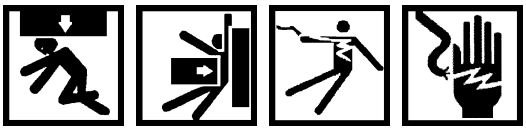
This procedure covers the following symptoms:

- No Instrument Panel Cluster (IPC) information available.
- No communication between modules.

TROUBLESHOOTING PROCEDURE

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedure Overview in How to Use This Manual before performing any troubleshooting procedures.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).

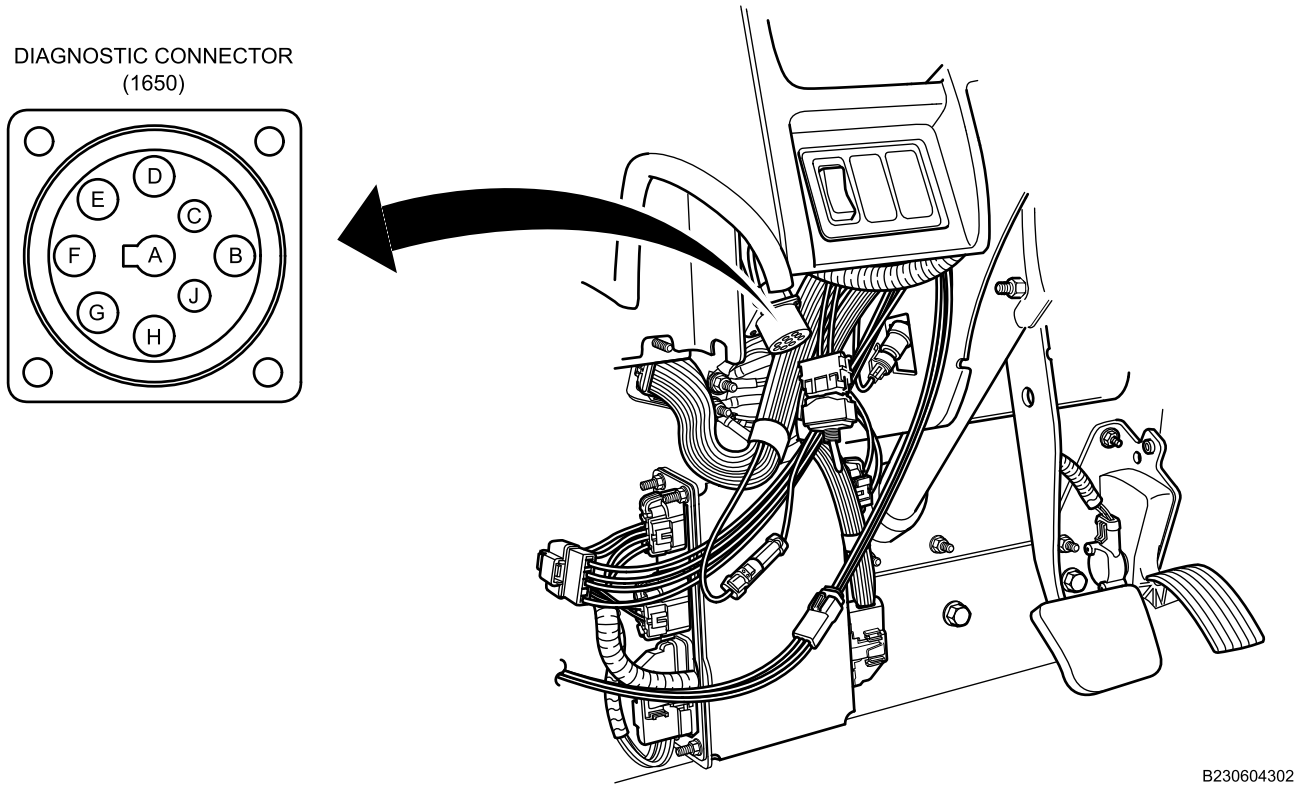


Figure 1. ATA Connector Under Instrument Panel (IP).

3. Measure DC voltage between ATA connector terminal C and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read more than 4.0V?

DECISION

YES Go to Step 45.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

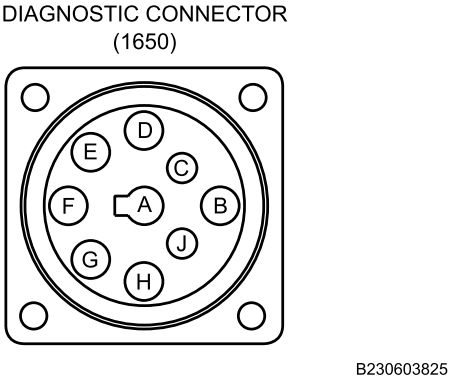


Figure 2. Connector 1650.

4. Measure voltage between ATA connector terminal C and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 1.0V?

DECISION

YES Go to Step 69.
NO Go to next step.

STEP

5. Measure DC voltage between ATA connector terminal D and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read more than 4.0V?

DECISION

YES Go to Step 57.
NO Go to next step.

STEP

6. Measure voltage between ATA connector terminal D and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 1.0V?

DECISION

YES Go to Step 33.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

7. Turn ignition switch OFF (TM 9-2355-106-10).
8. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
9. Measure resistance between ATA connector terminal C and D with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 147.
NO Go to next step.

STEP

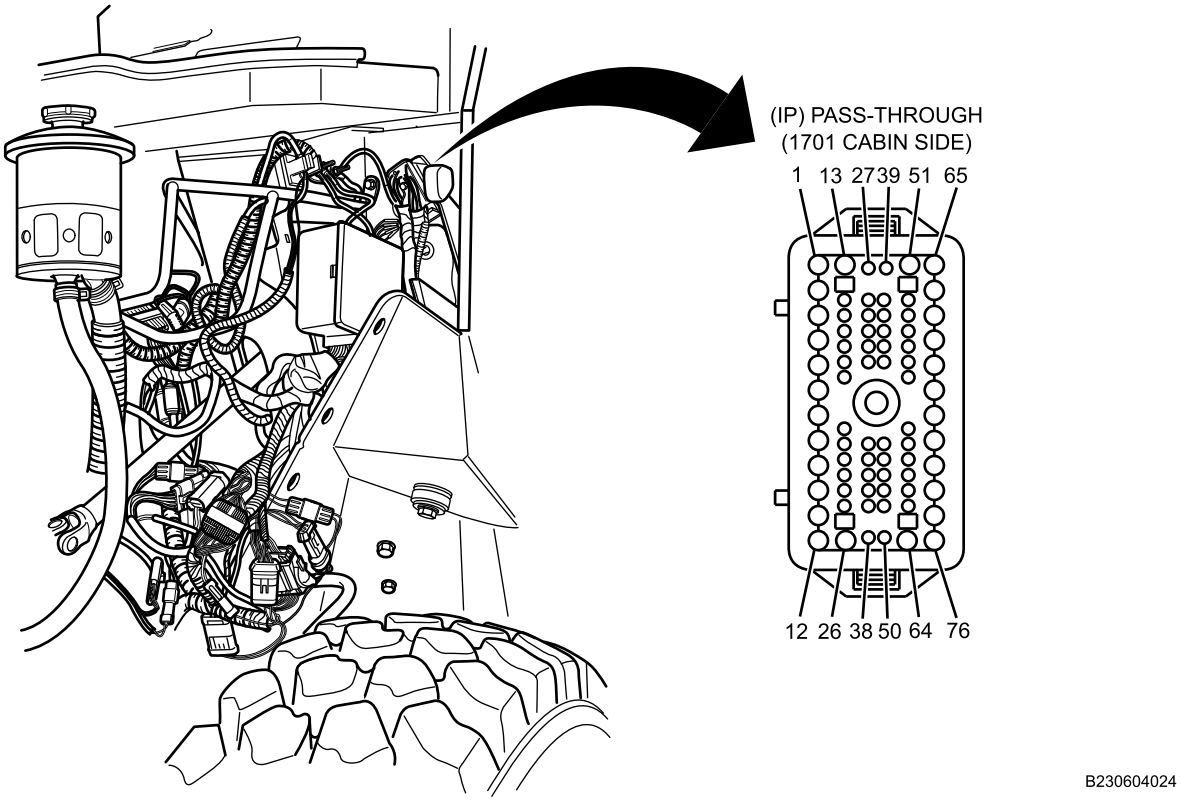


Figure 3. IP Pass-Through Connector Near Power Distribution Center (PDC) Under Hood.

10. Disconnect connector 1701. Refer to Figure 3.
11. Measure resistance between IP harness side of connector 1701 terminal 15 and terminal 16 with multimeter. Refer to Figure 3.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 22.
NO Go to next step.

STEP

12. Remove left side engine armor. Refer to Left Side Engine Armor Removal and Installation (WP 0597).
13. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).

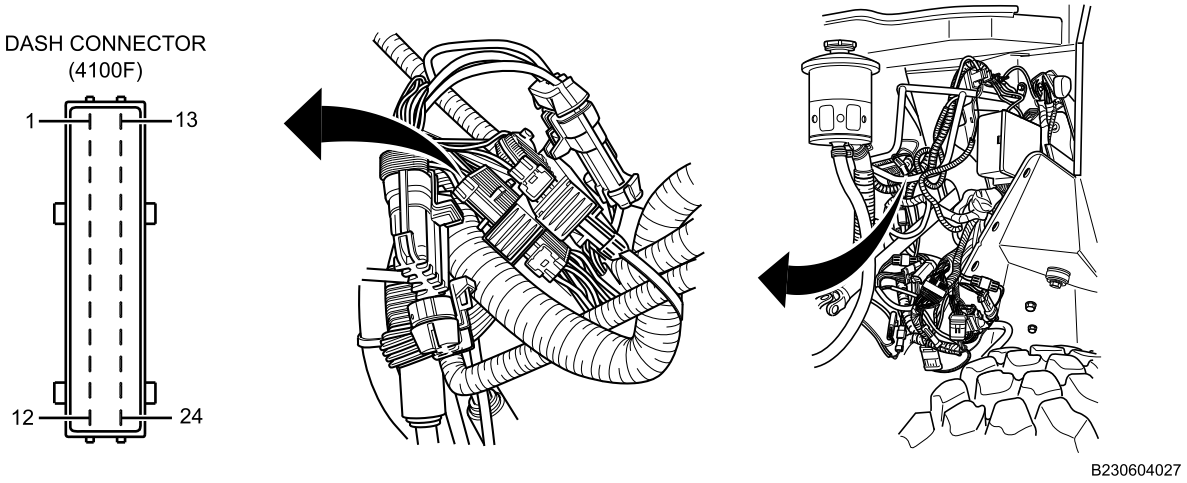


Figure 4. Engine/Dash Connector Under Hood.

14. Disconnect connector 4103/4100F (connector with 18 wires). Refer to Figure 4.
15. Measure resistance between connector 4100F terminal 7 and 8 with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 136.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

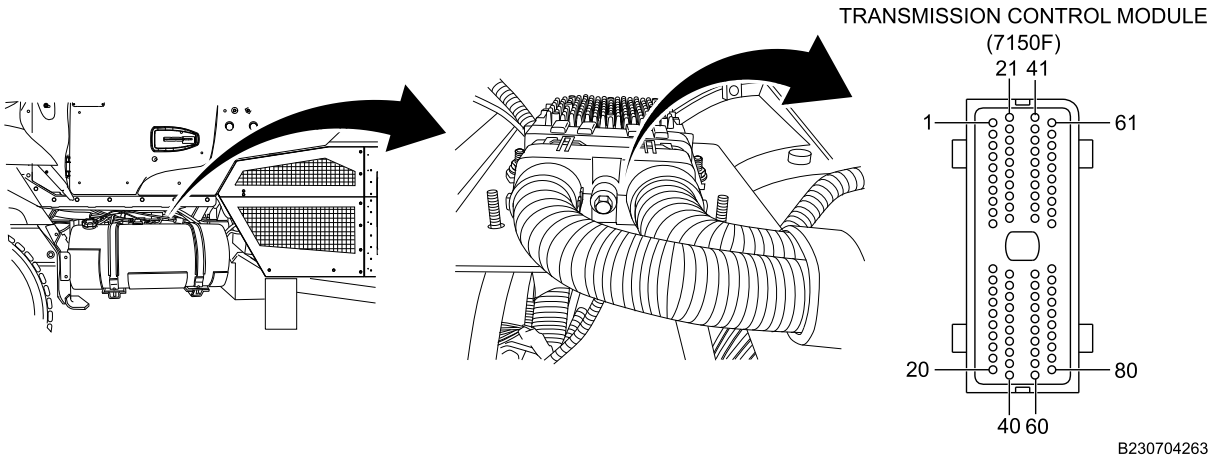


Figure 5. Transmission Control Module (TCM) Connector Under Vehicle on Bracket.

16. Disconnect TCM connector 7150F. Refer to Figure 5. Refer to Transmission Control Unit and Brace Removal and Installation (WP 0453).

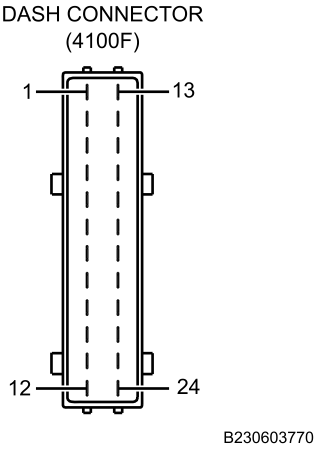


Figure 6. Connector 4100F.

17. Measure resistance between connector 4100F terminal 7 and 8 with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 140.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

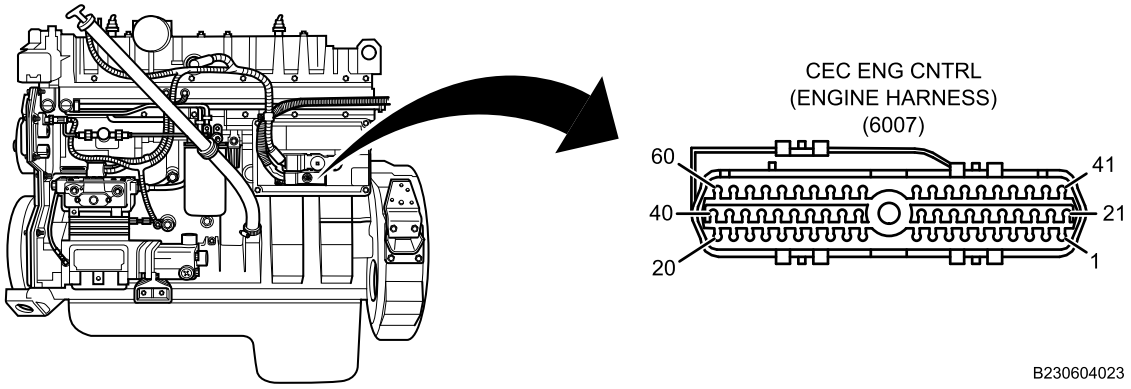


Figure 7. ECM Connector on Left Side of Engine.

18. Disconnect ECM connector 6007. Refer to Figure 7. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

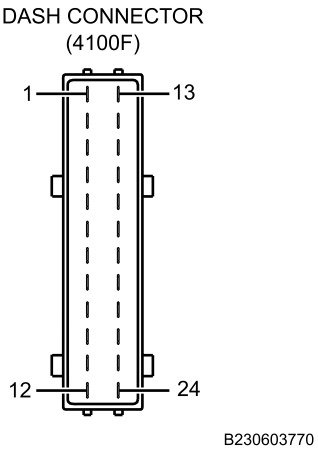


Figure 8. Connector 4100F.

19. Measure resistance between connector 4100F terminal 7 and 8 with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 139.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

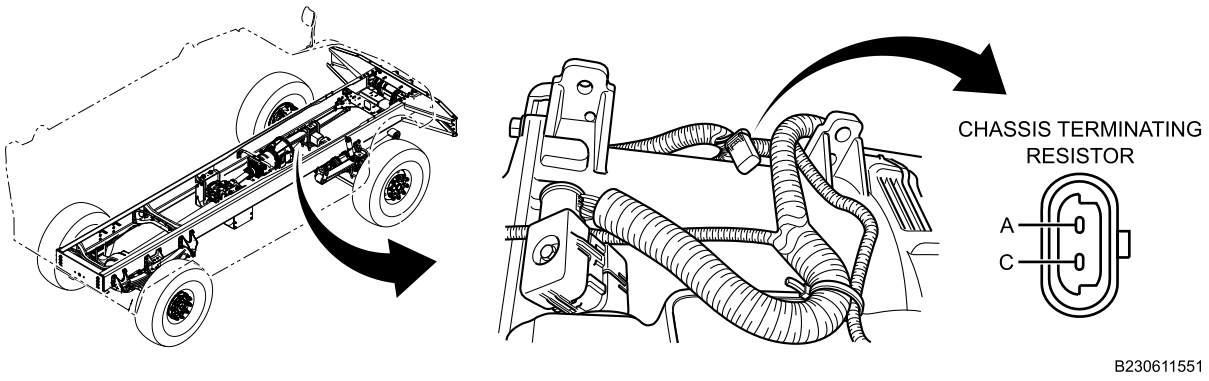


Figure 9. Chassis Terminating Resistor.

20. Disconnect chassis terminating resistor above transmission. Refer to Figure 9.

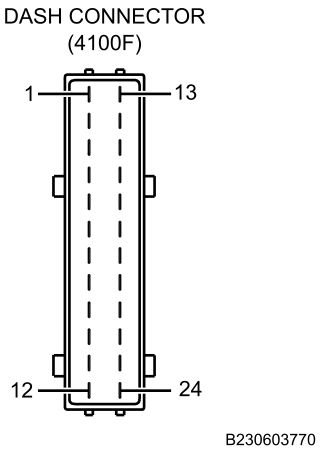


Figure 10. Connector 4100F.

21. Measure resistance between connector 4100F terminal 7 and 8 with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 146.
NO Go to Step 137.

STEP

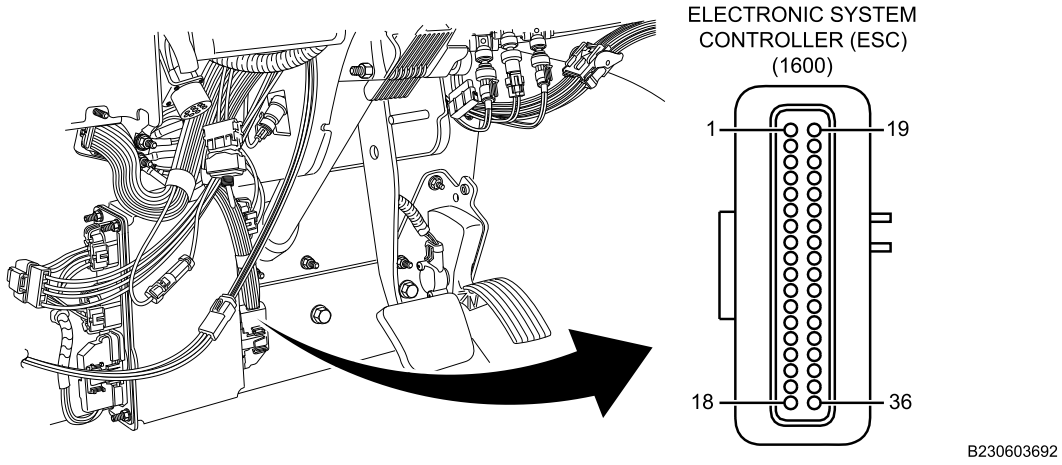


Figure 11. Electronic System Controller (ESC) Connector Under IP.

22. Disconnect ESC connector 1600. Refer to Figure 11.

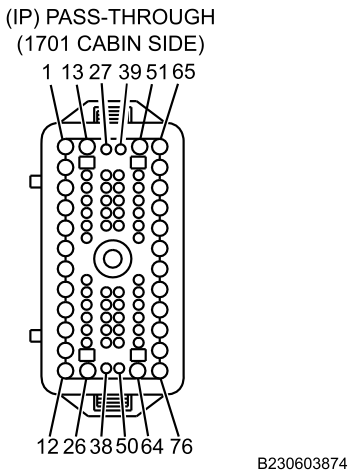


Figure 12. Connector 1701.

23. Measure resistance between connector cabin side 1701 terminal 15 and 16 with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 141.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

24. Remove IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).

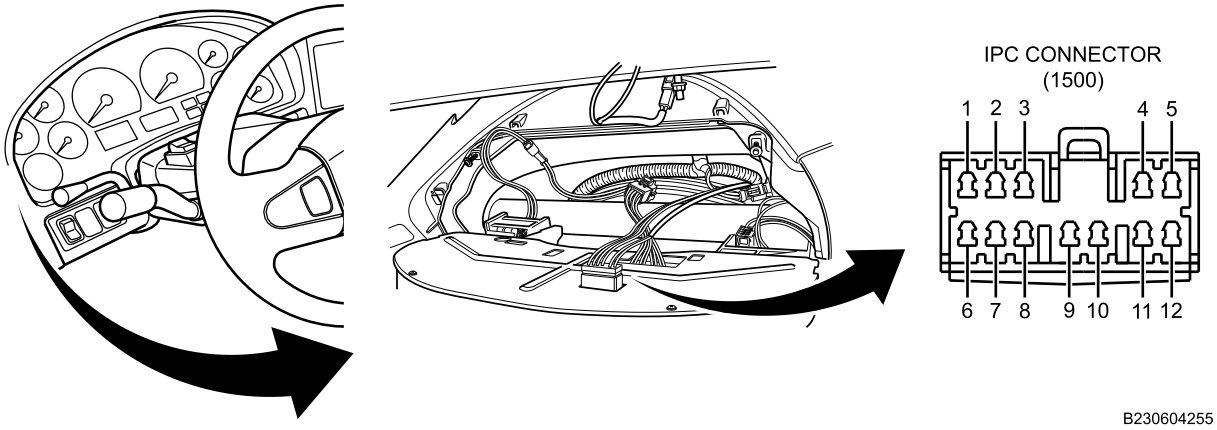


Figure 13. IPC Connector.

25. Disconnect IPC connector 1500. Refer to Figure 13.

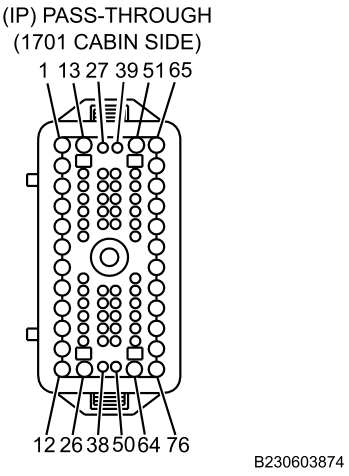


Figure 14. Connector 1701.

26. Measure resistance between connector cabin side 1701 terminal 15 and 16 with multimeter. Refer to Figure 14.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 142.
NO Go to next step.

STEP

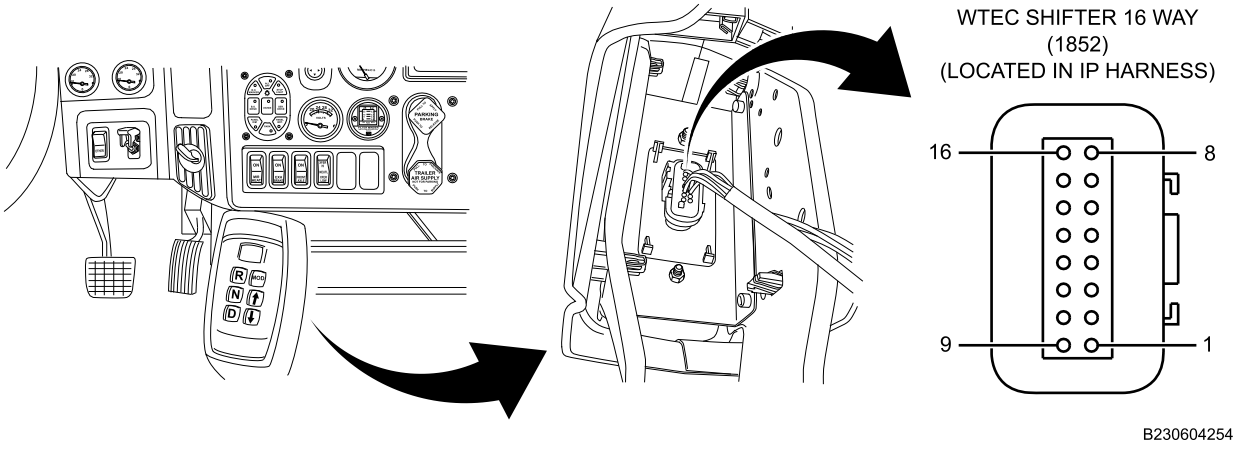


Figure 15. Transmission Auto Shift Control Module Connector.

27. Disconnect transmission auto shift control module connector. Refer to Figure 15. Refer to Transmission Auto Shift Control Module Removal and Installation (WP 0452).

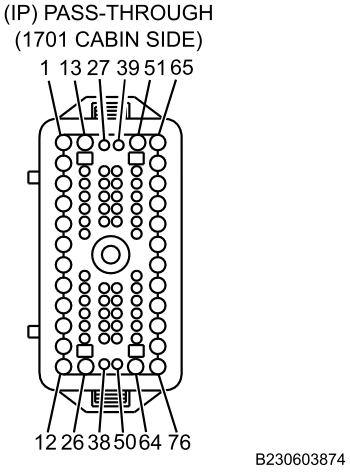


Figure 16. Connector 1701.

28. Measure resistance between connector cabin side 1701 terminal 15 and 16 with multimeter. Refer to Figure 16.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 143.
NO Go to next step.

STEP

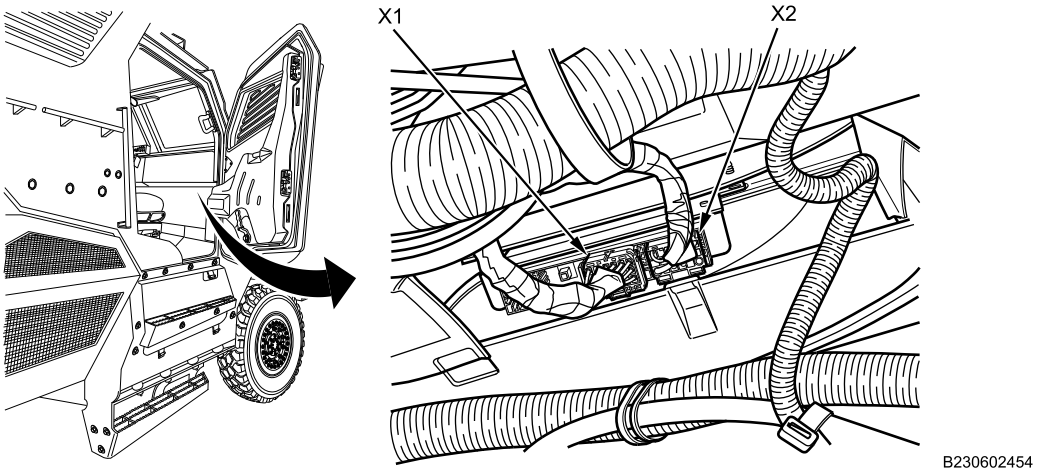


Figure 17. Antilock Brake System (ABS) Control Module Connector Under Right Side IP.

29. Disconnect ABS control module connector X1. Refer to Figure 17.

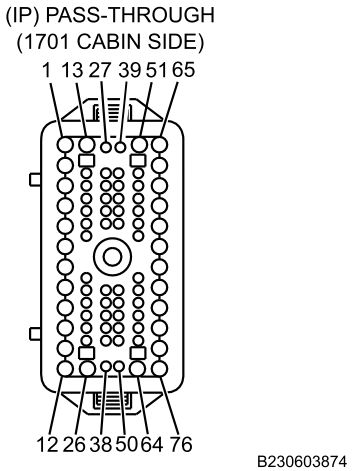


Figure 18. Connector 1701.

30. Measure resistance between connector cabin side 1701 terminal 15 and 16 with multimeter. Refer to Figure 18.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 144.
NO Go to next step.

STEP

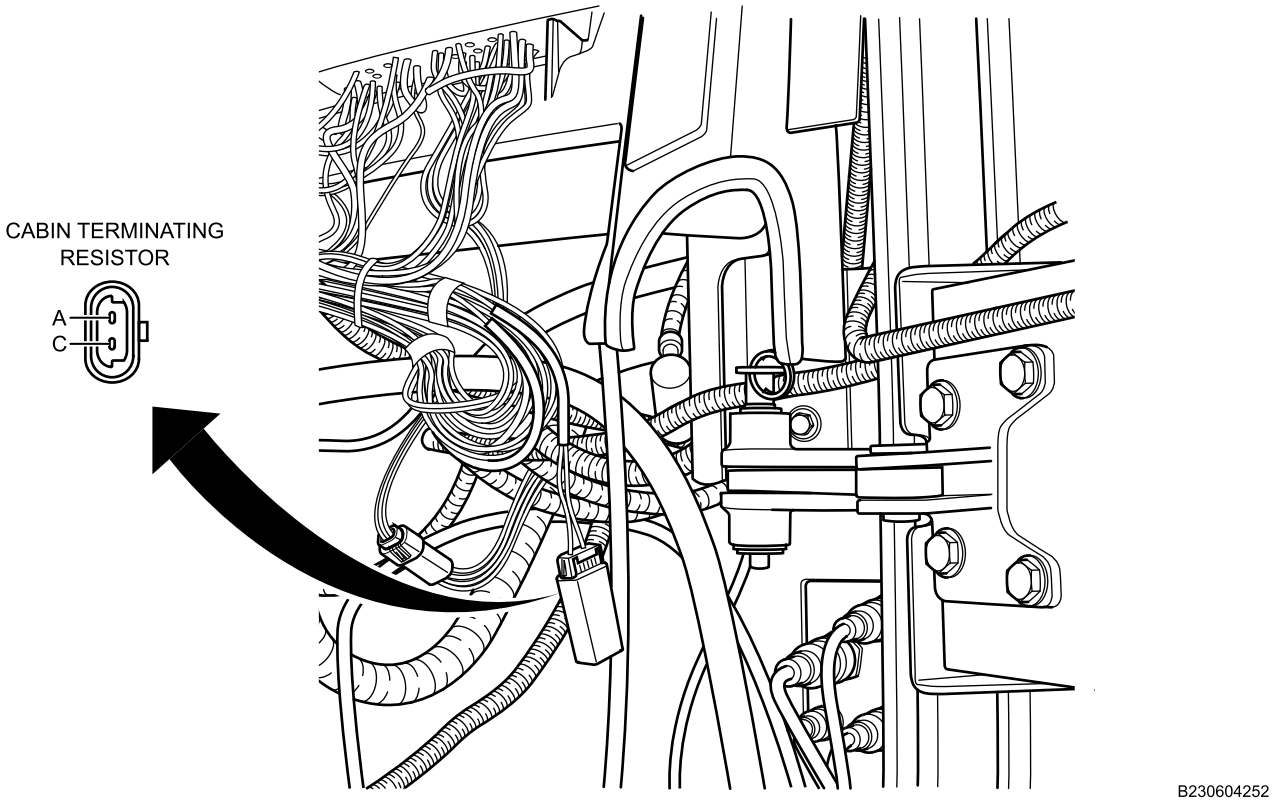


Figure 19. Cabin Terminating Resistor Under Right Side IP.

31. Disconnect cabin terminating resistor under right side IP. Refer to Figure 19.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

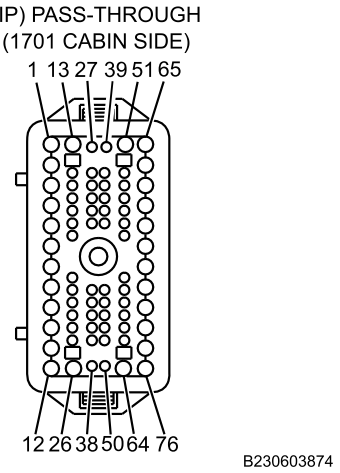


Figure 20. Connector 1701.

32. Measure resistance between IP side connector 1701 terminal 15 and 16 with multimeter. Refer to Figure 20.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 145.
NO Go to Step 138.

STEP

33. Turn ignition switch OFF (TM 9-2355-106-10).
34. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

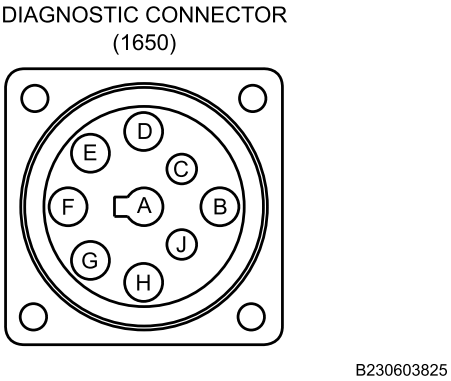


Figure 21. Connector 1650.

35. Measure resistance between ATA connector terminal D and ground with multimeter. Refer to Figure 21.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 86.
NO Go to next step.

STEP

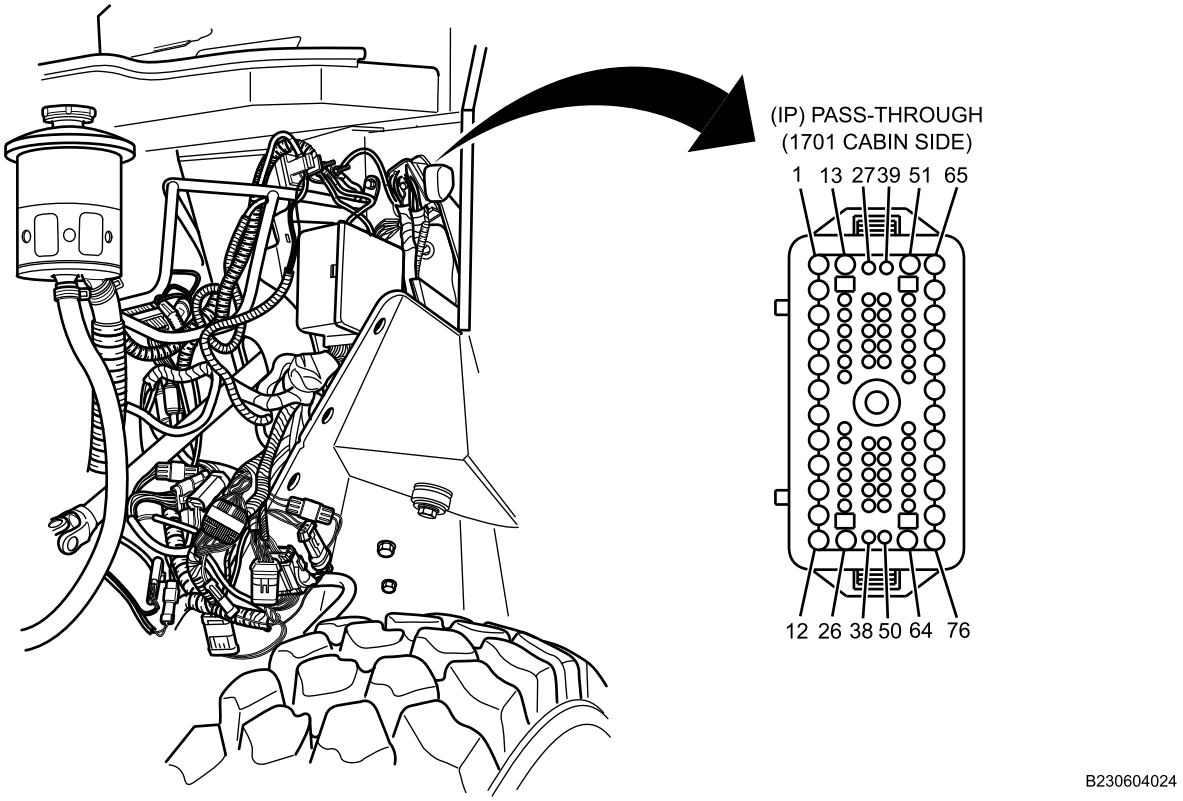


Figure 22. IP Pass-Through Connector Near Power Distribution Center Under Hood.

36. Disconnect connector 1701. Refer to Figure 22.
37. Measure resistance between IP harness side connector 1701 terminal 15 and 16 with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read more than 120 ohms?

DECISION

YES Go to Step 43.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

38. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).

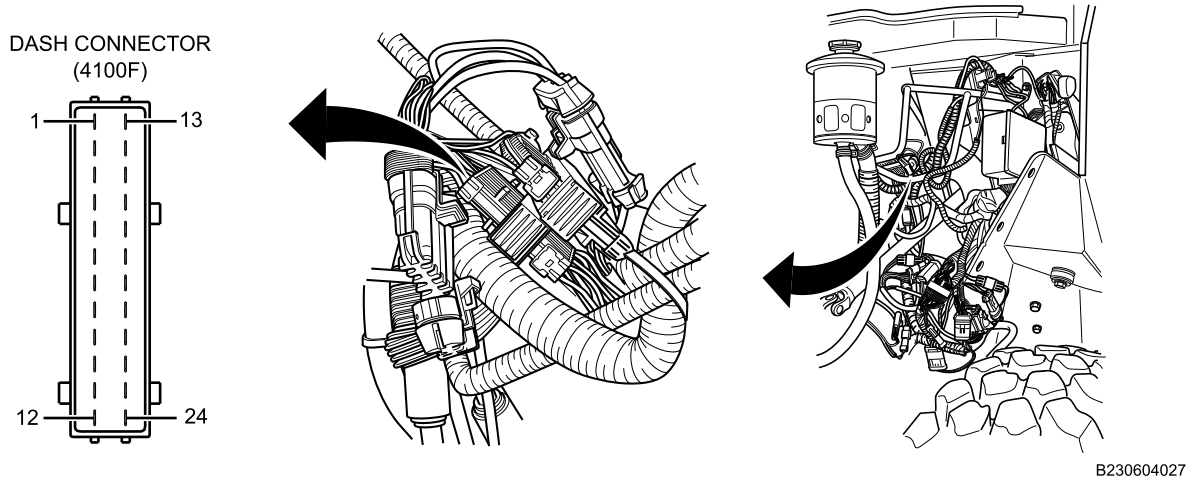


Figure 23. Engine/Dash Connector Under Hood.

39. Disconnect connector 4100F (connector with 18 wires). Refer to Figure 23.
40. Measure resistance between connector 4100F terminal 7 and 8 with multimeter. Refer to Figure 23.

CONDITION/INDICATION

Does multimeter read more than 120 ohms?

DECISION

NO Go to Step 136.
YES Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

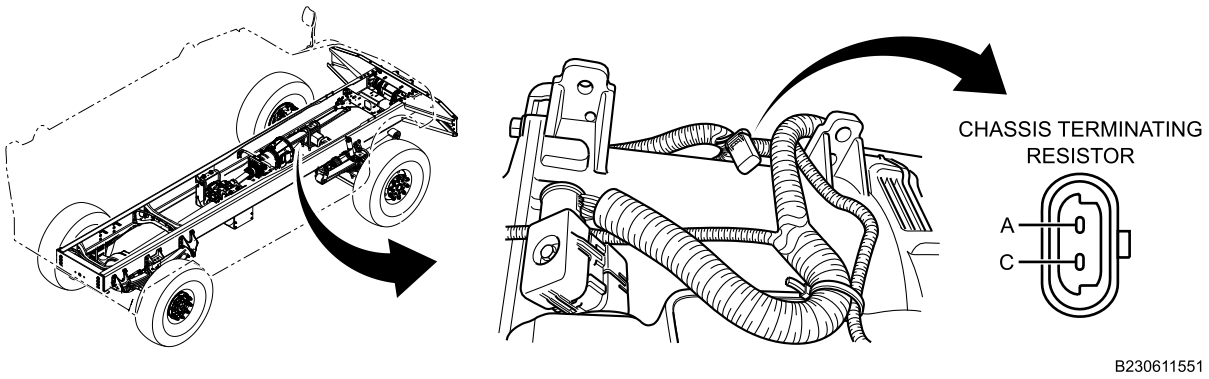


Figure 24. Chassis Terminating Resistor Above Transmission.

41. Disconnect chassis terminating resistor above transmission. Refer to Figure 24. Refer to Belly Armor Removal and Installation (WP 0606).
42. Measure resistance between terminating resistor terminal A and C with multimeter. Refer to Figure 24.

CONDITION/INDICATION

Does multimeter read more than 120 ohms?

DECISION

YES Go to Step 146.
NO Go to Step 137.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

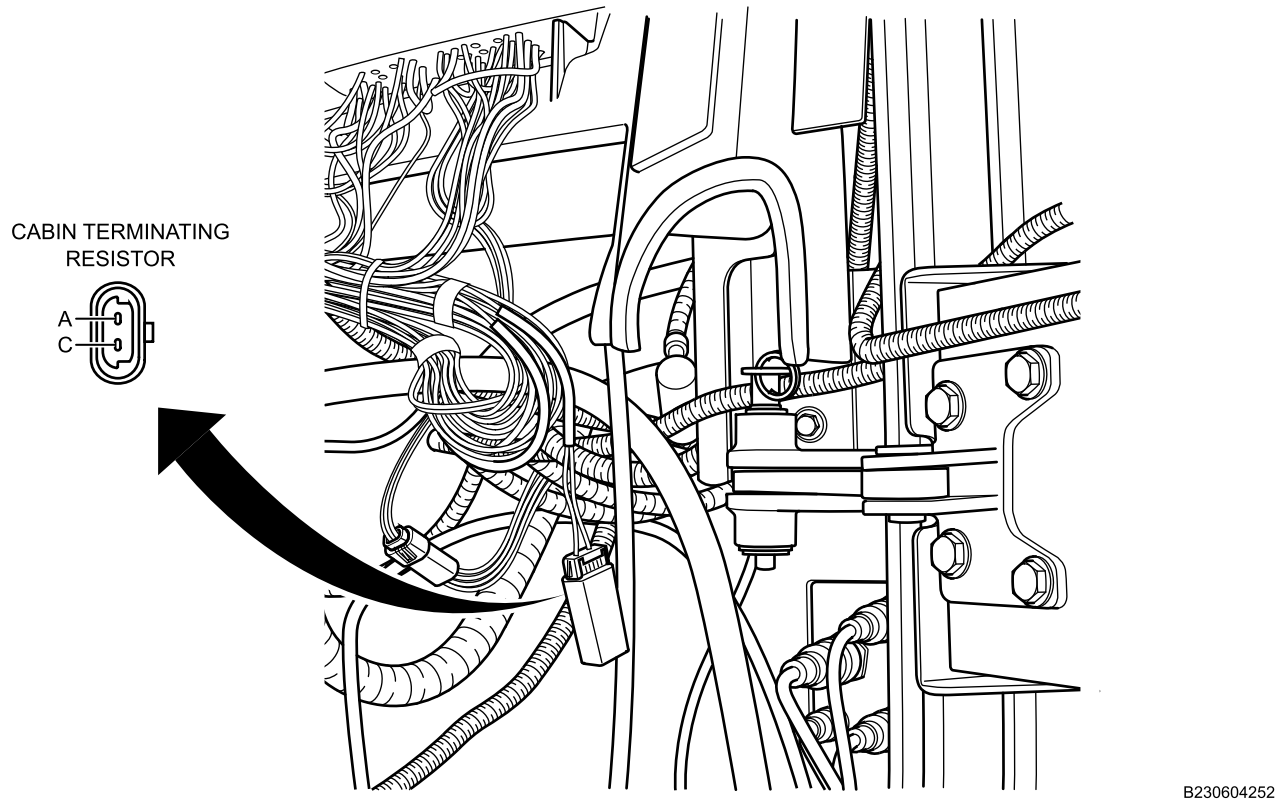


Figure 25. Cabin Terminating Resistor Under Right Side IP.

43. Disconnect cabin terminating resistor under right side IP. Refer to Figure 25. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).
44. Measure resistance between terminating resistor terminal A and C with multimeter. Refer to Figure 25.

CONDITION/INDICATION

Does multimeter read more than 120 ohms?

DECISION

YES Go to Step 145.
NO Go to Step 138.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

45. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
46. Disconnect and reconnect modules one at a time while observing MSD for communication recovery.

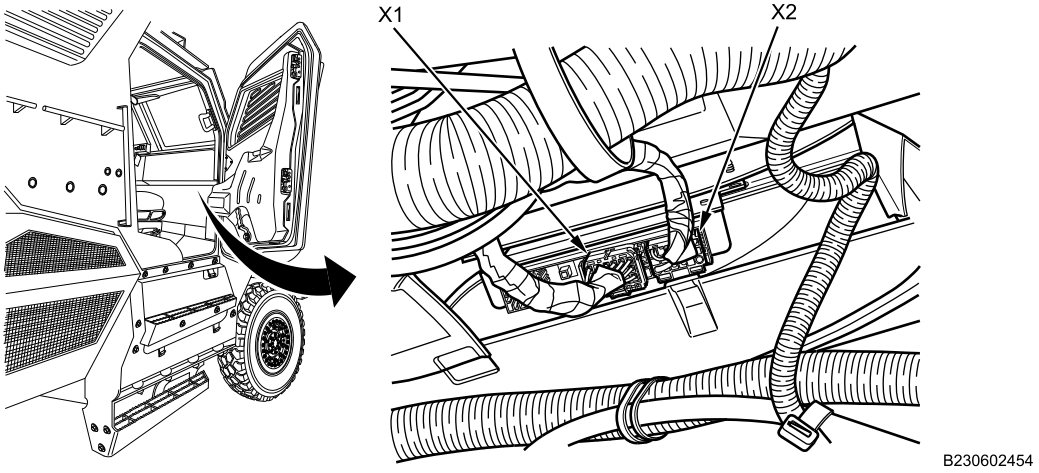


Figure 26. ABS Module Connector.

47. Disconnect and reconnect ABS module connector X1. Refer to Figure 26.

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 130.
NO Go to next step.

STEP

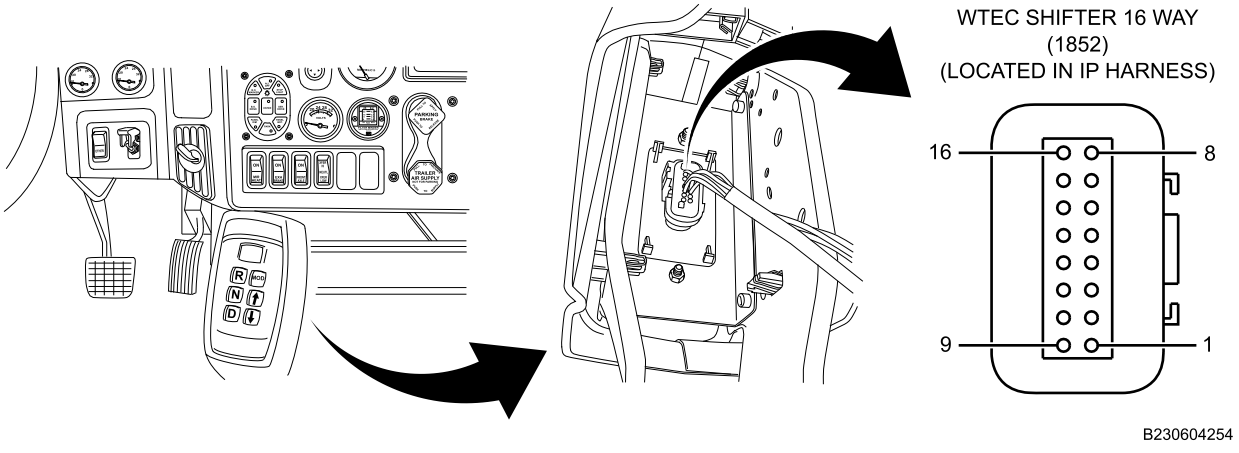


Figure 27. Shift Selector Module Connector.

48. Disconnect and reconnect shift selector module connector 1852. Refer to Figure 27. Refer to Transmission Auto Shift Control Module Removal and Installation (WP 0452).

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 124.
NO Go to next step.

STEP

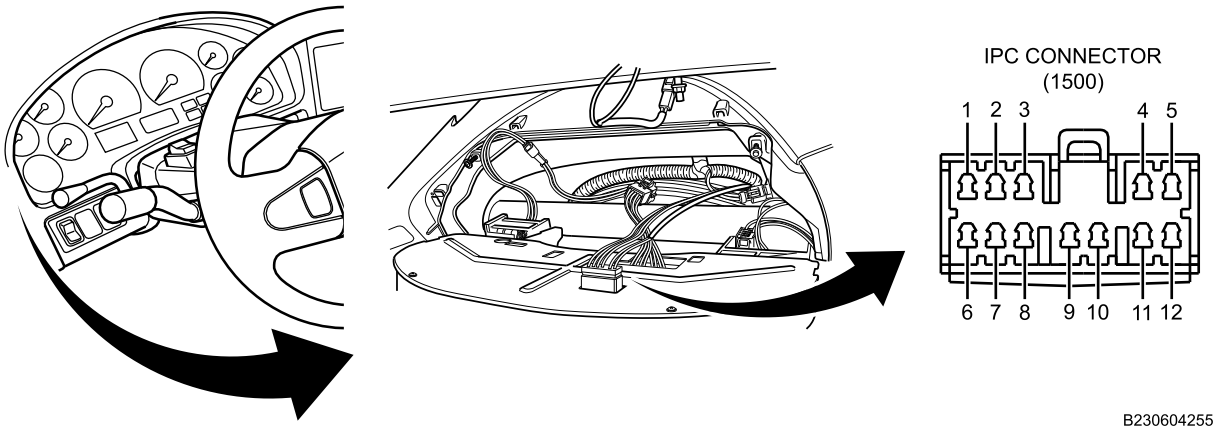


Figure 28. IPC Connector.

49. Disconnect and reconnect IPC connector 1500. Refer to Figure 28. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0578).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 118.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

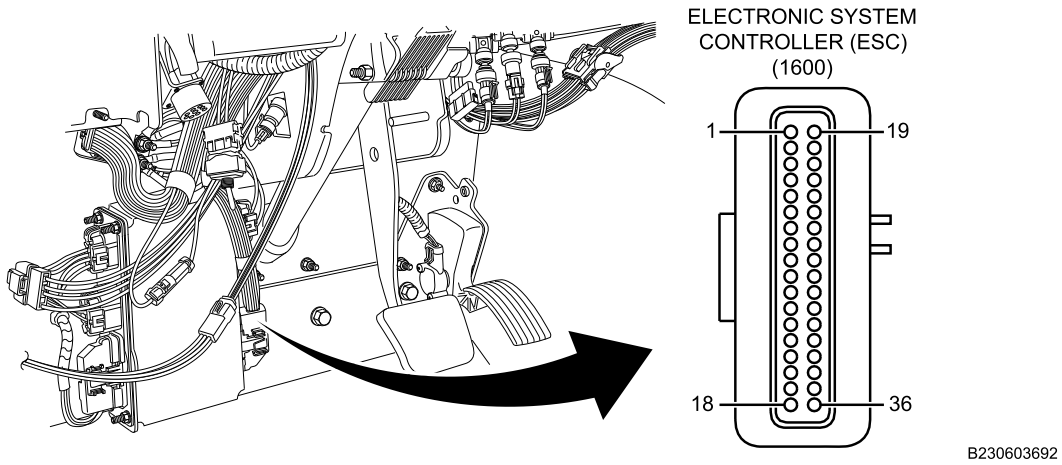


Figure 29. Electronic System Controller (ESC) Connector.

50. Disconnect and reconnect ESC connector 1600. Refer to Figure 29.

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 112.
NO Go to next step.

STEP

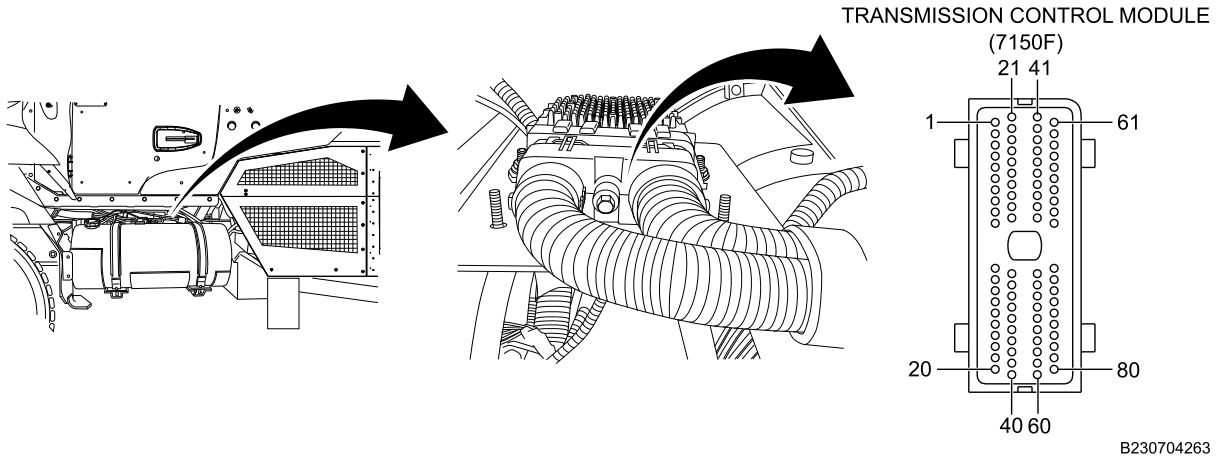


Figure 30. Transmission Control Module (TCM) Connector.

51. Disconnect and reconnect TCM connector 7150F. Refer to Figure 30. Refer to Transmission Control Unit and Brace Removal and Installation (WP 0453).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 100.
NO Go to next step.

STEP

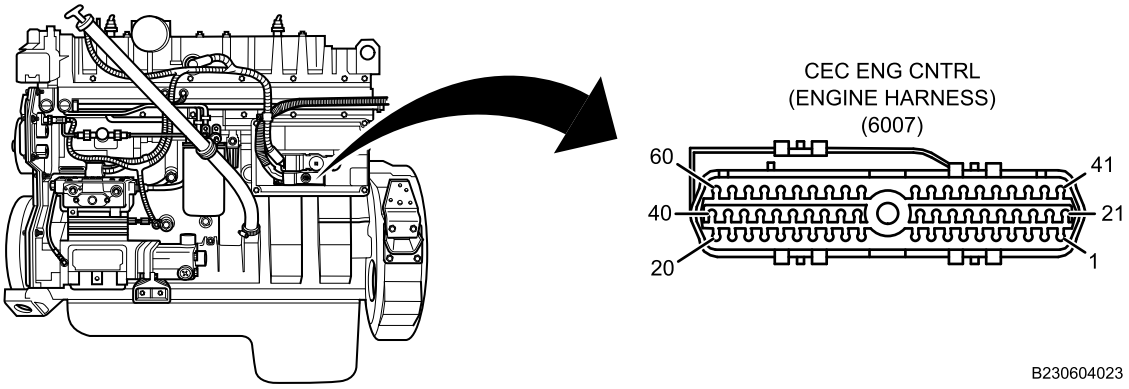


Figure 31. Engine Control Module (ECM) Connector.

52. Disconnect and reconnect ECM connector 6007. Refer to Figure 31. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 106.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

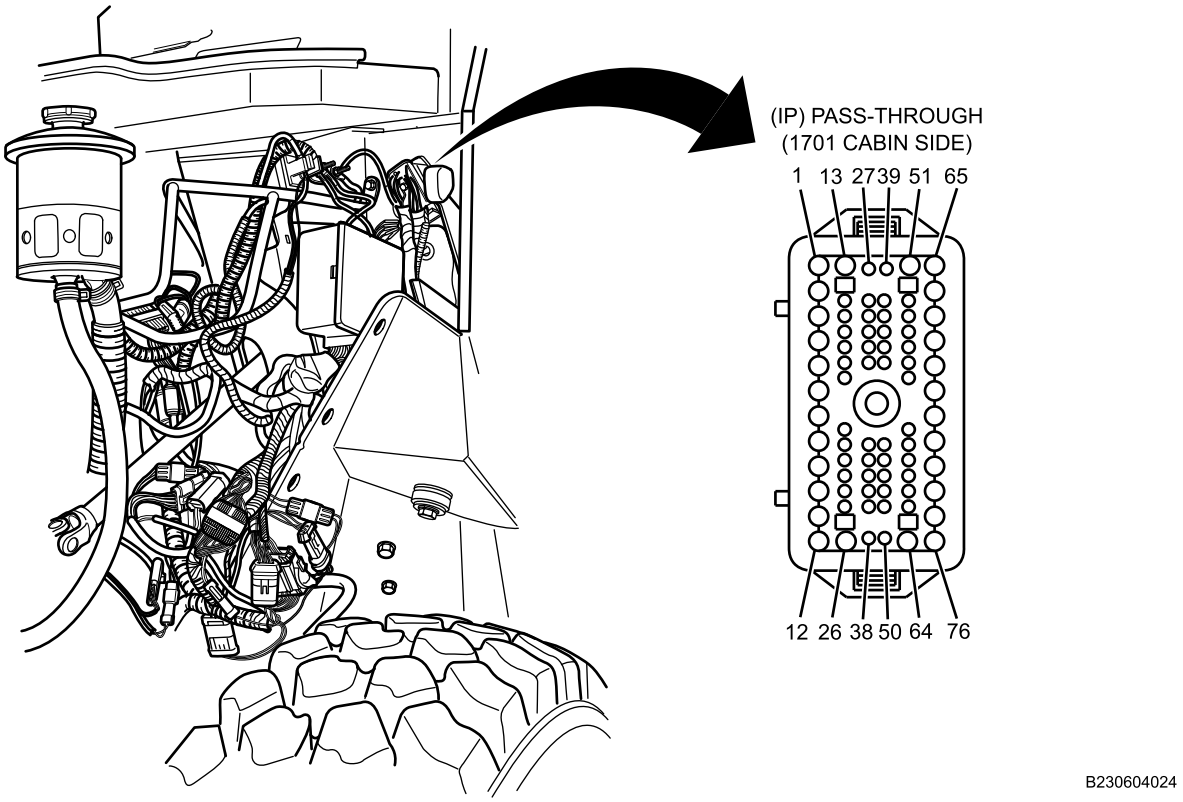


Figure 32. Dash/IP Connector.

53. Disconnect connector 1701. Refer to Figure 32.
54. Measure resistance between IP side connector 1701 terminal 15 and all other terminals with multimeter. Refer to Figure 32.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

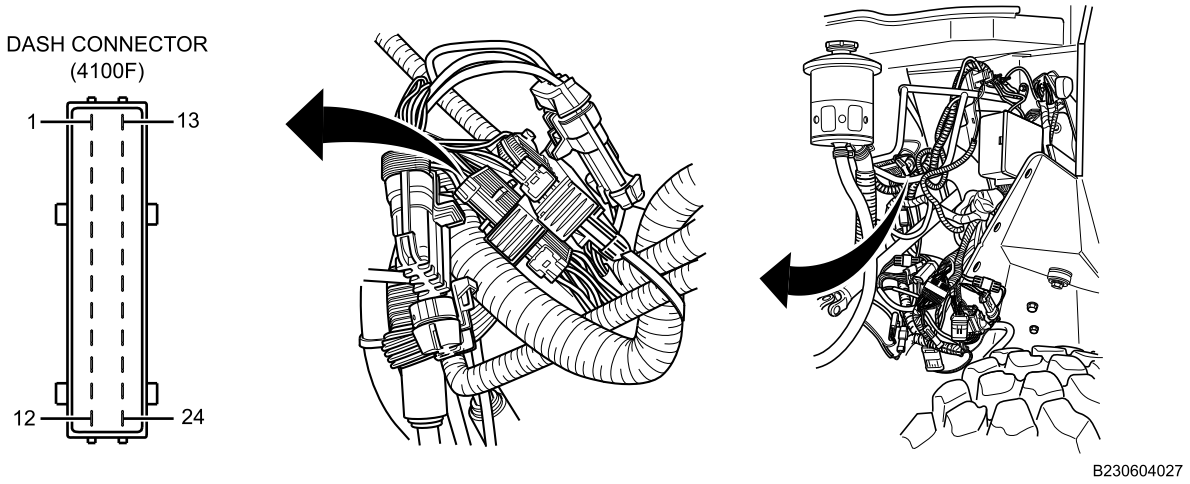


Figure 33. Dash/Engine Connector.

55. Disconnect connector 4100F/4103 (connector with 18 wires). Refer to Figure 33.
56. Measure resistance between connector 4100F terminal 7 and all other terminals with multimeter. Refer to Figure 33.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 137.
NO Go to Step 136.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

57. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
58. Disconnect and reconnect modules one at a time while observing MSD for communication recovery.
59. Disconnect and reconnect ABS module connector X1. Refer to Figure 34. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).

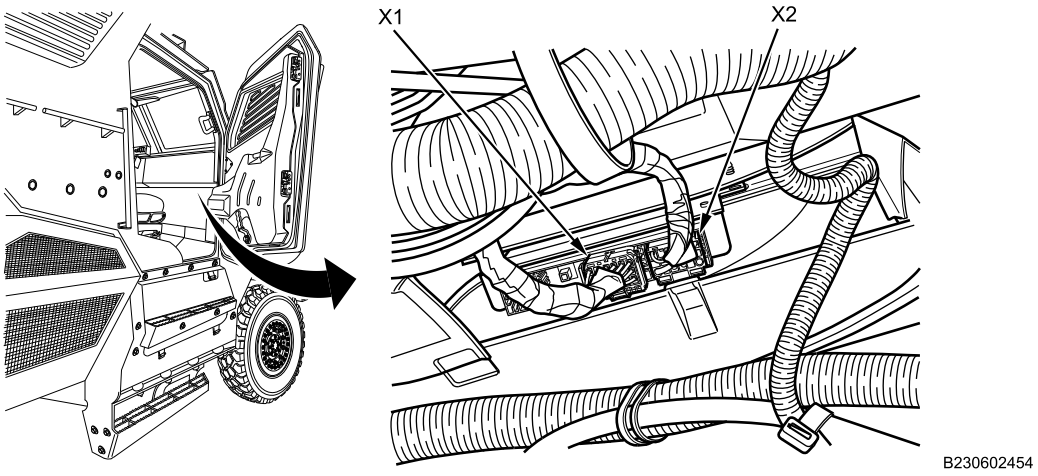


Figure 34. ABS Module Connectors.

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 133.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

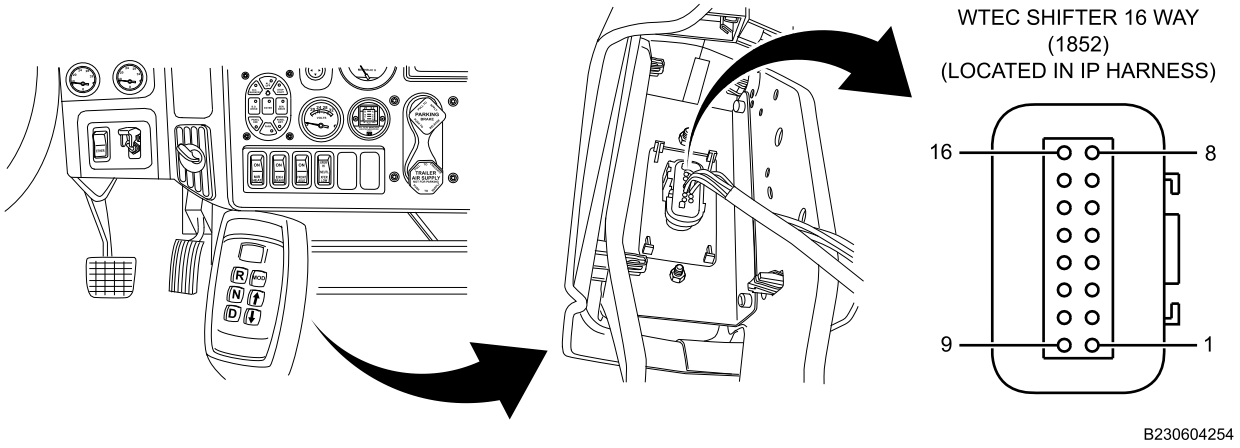


Figure 35. Shift Selector Module Connector.

60. Disconnect and reconnect shift selector module connector 1852. Refer to Figure 35. Refer to Transmission Auto Shift Control Module Removal and Installation (WP 0452).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 127.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

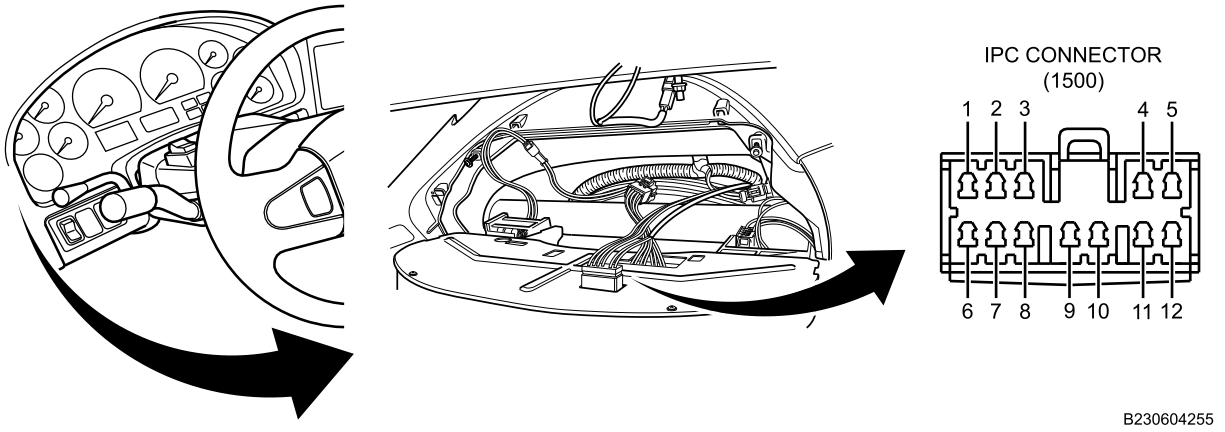


Figure 36. IPC Connector.

61. Disconnect and reconnect IPC connector 1500. Refer to Figure 36. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0578).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 121.
NO Go to next step.

STEP

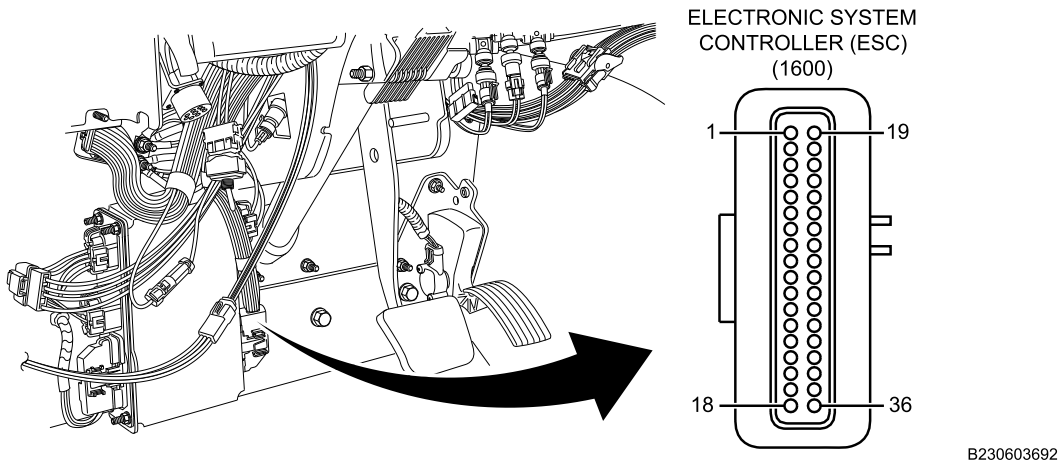


Figure 37. Electronic System Controller (ESC) Connector.

62. Disconnect and reconnect ESC connector 1600. Refer to Figure 37.

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 115.
NO Go to next step.

STEP

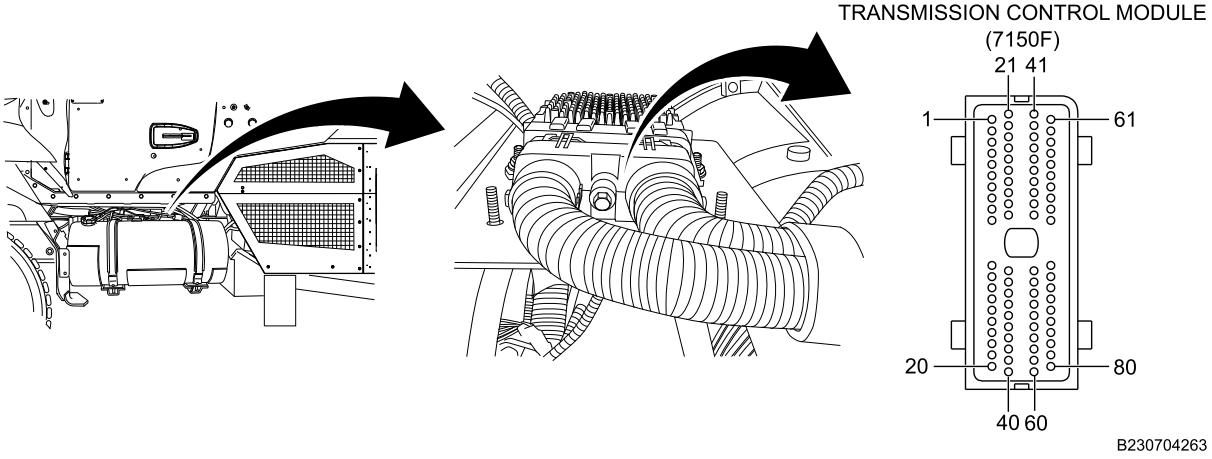


Figure 38. Transmission Control Module (TCM) Connector.

63. Disconnect and reconnect TCM connector 7150F. Refer to Figure 38. Refer to Transmission Control Unit and Brace Removal and Installation (WP 0453).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 103.
NO Go to next step.

STEP

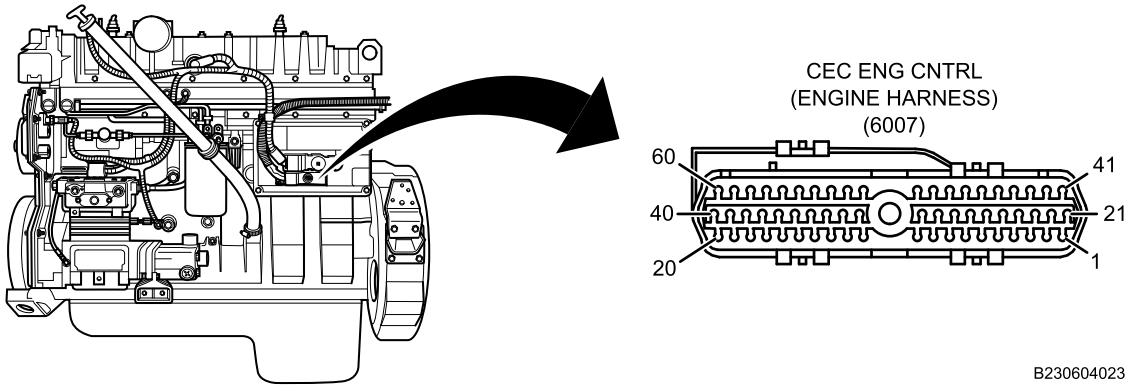


Figure 39. Engine Control Module (ECM) Connector.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

64. Disconnect and reconnect ECM connector 6007. Refer to Figure 39. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 109.
NO Go to next step.

STEP

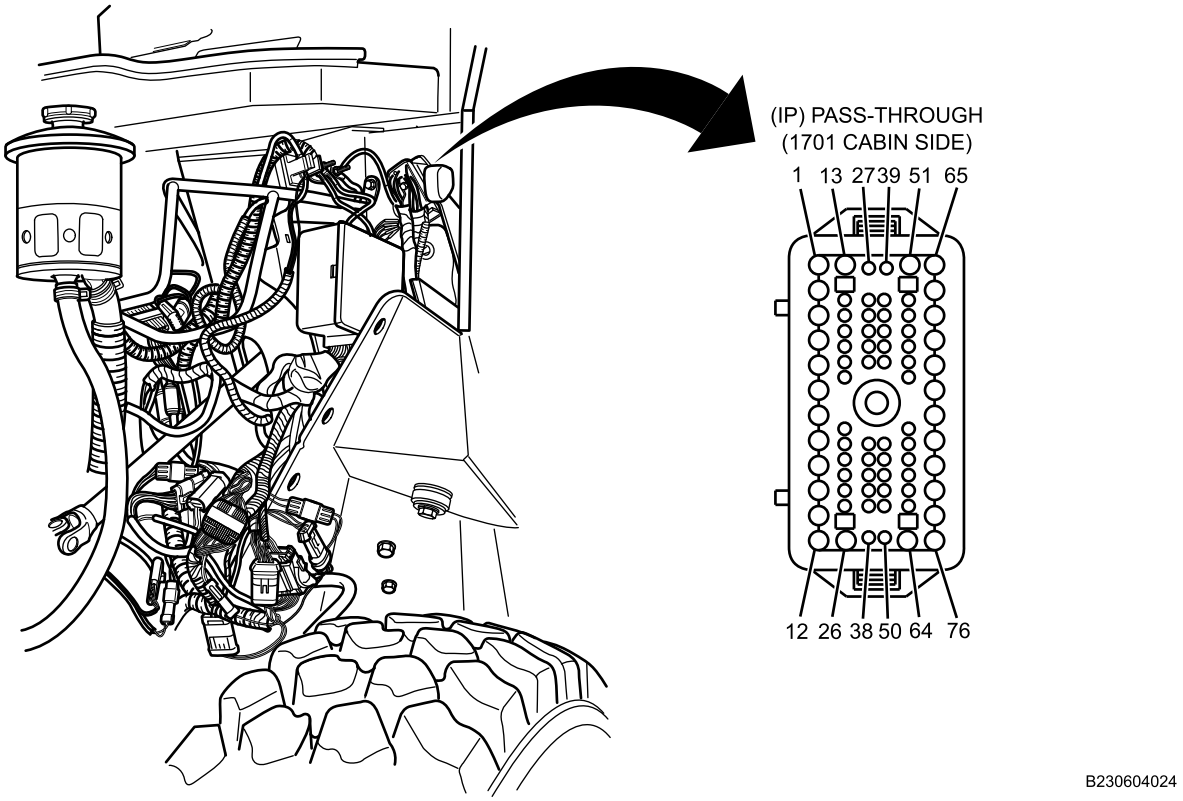


Figure 40. Dash/IP Connector.

65. Disconnect connector 1701. Refer to Figure 40.
66. Measure resistance between IP side connector 1701 terminal 16 and all other terminals with multimeter. Refer to Figure 40.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

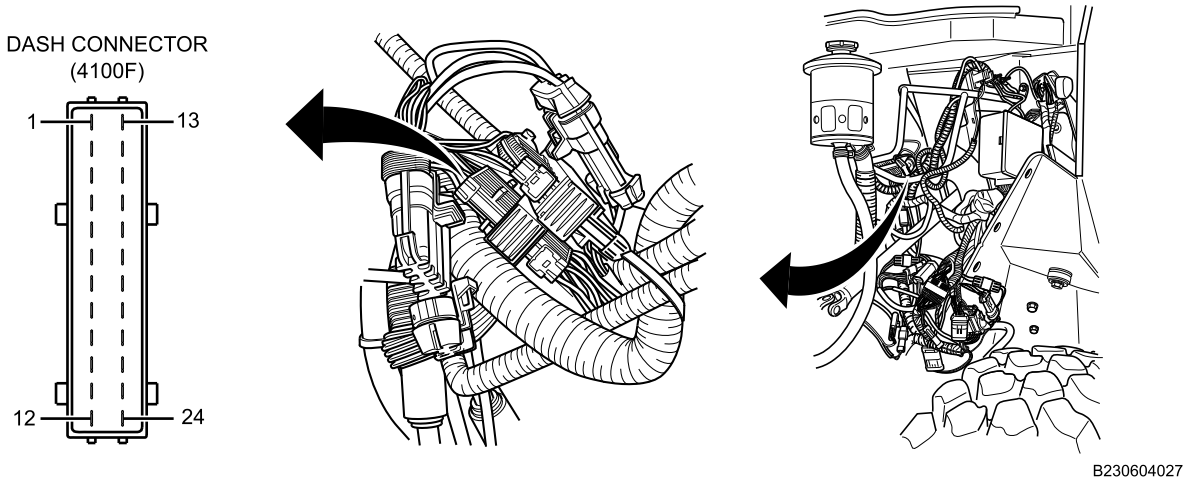


Figure 41. Dash/Engine Connector.

67. Disconnect connector 4100F/4103 (connector with 18 wires). Refer to Figure 41.
68. Measure resistance between connector 4100F terminal 8 and all other terminals with multimeter. Refer to Figure 41.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 137.
NO Go to Step 136.

STEP

69. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
70. Turn ignition switch OFF (TM 9-2355-106-10).

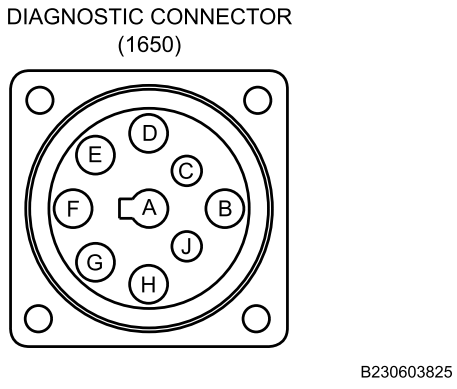


Figure 42. Connector 1650.

71. Measure resistance between connector 1650 terminal C and ground with multimeter. Refer to Figure 42.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 36.
NO Go to next step.

STEP

72. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
73. Disconnect and reconnect modules and resistors one at a time while observing MSD for communication recovery.
74. Disconnect and reconnect ABS module connector X1. Refer to Figure 43. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).

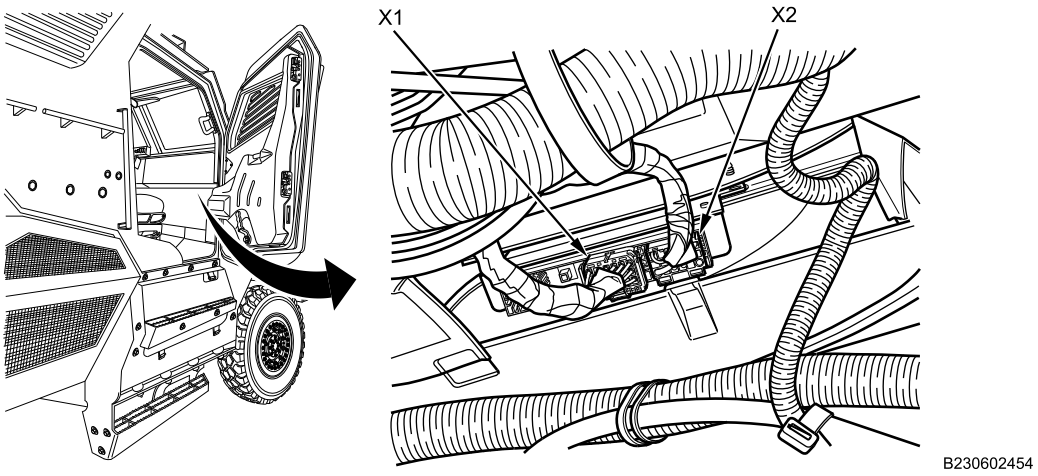


Figure 43. ABS Module Connectors.

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 144.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

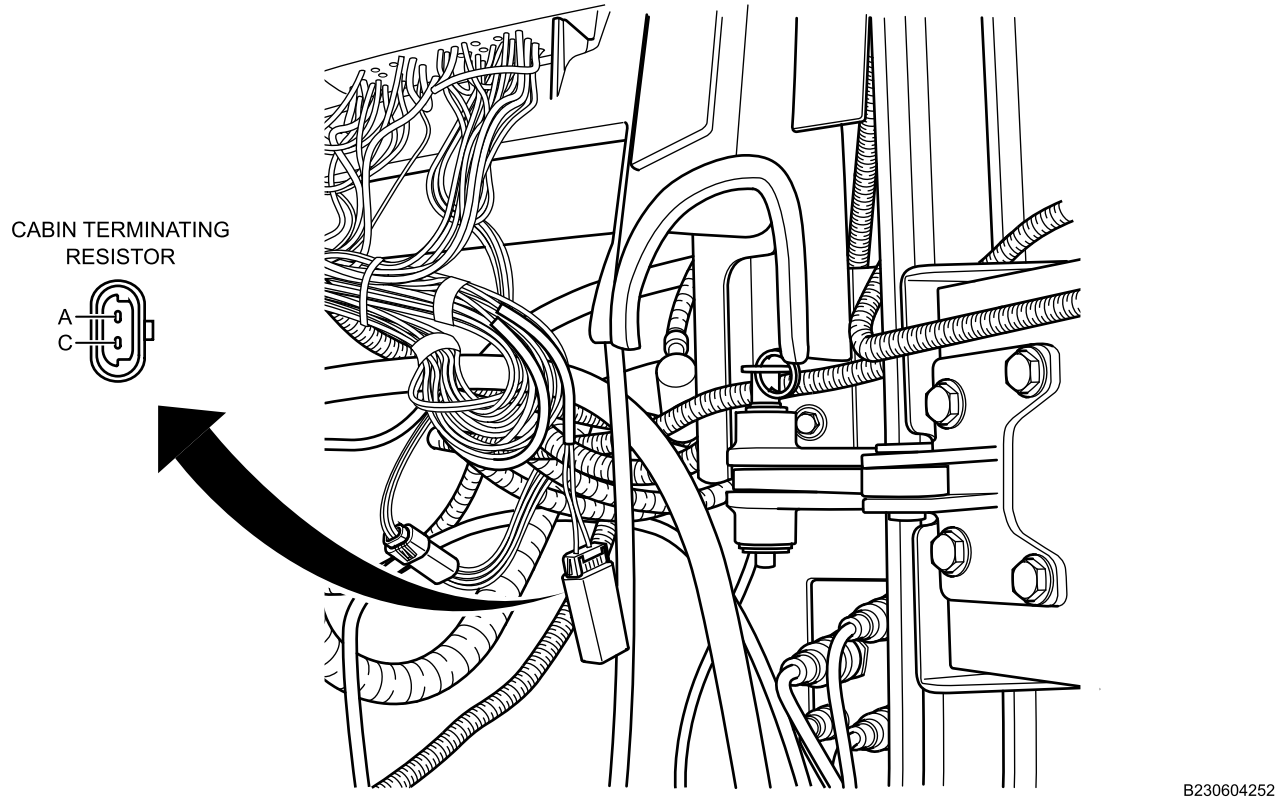


Figure 44. Cabin Terminating Resistor Under Right Side IP.

75. Disconnect cabin terminating resistor above transmission. Refer to Figure 44. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).

CONDITION/INDICATION

Does MSD indicate that communication was restored when resistor was disconnected?

DECISION

YES Go to Step 145.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

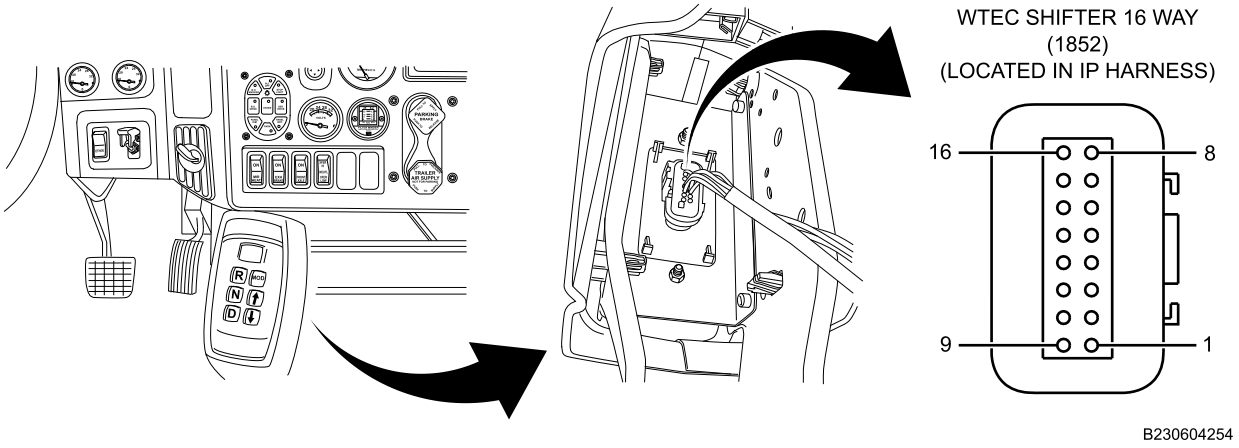


Figure 45. Shift Selector Module Connector.

76. Disconnect and reconnect shift selector module connector 1852. Refer to Figure 45. Refer to Transmission Auto Shift Control Module Removal and Installation (WP 0452).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 143.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

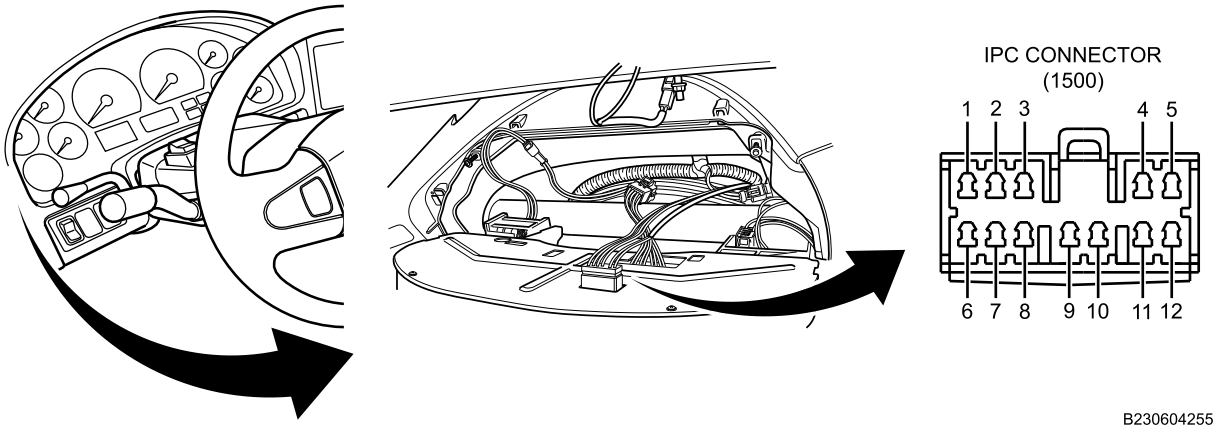


Figure 46. IPC Connector.

77. Disconnect and reconnect IPC connector 1500. Refer to Figure 46. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0578).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 142.
NO Go to next step.

STEP

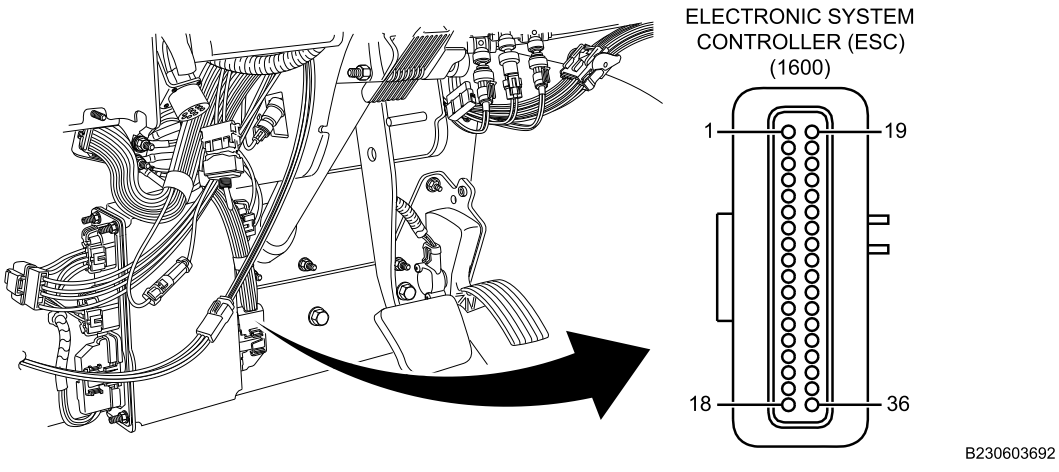


Figure 47. Electronic System Controller (ESC) Connector.

78. Disconnect and reconnect ESC connector 1600. Refer to Figure 47.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 142.
NO Go to next step.

STEP

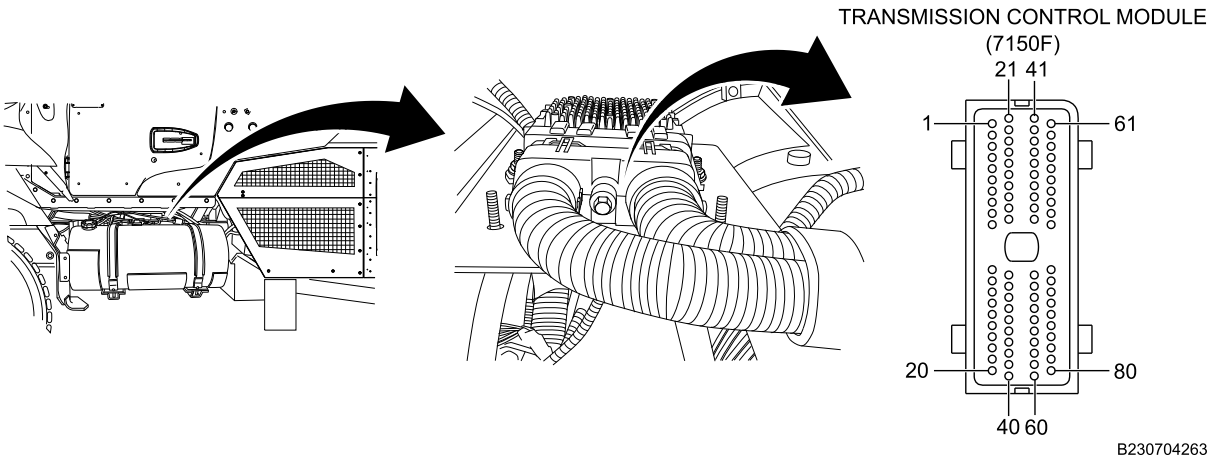


Figure 48. Transmission Control Module (TCM) Connector.

79. Disconnect and reconnect TCM connector 7150F. Refer to Figure 48. Refer to Transmission Control Unit and Brace Removal and Installation (WP 0453).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 141.
NO Go to next step.

STEP

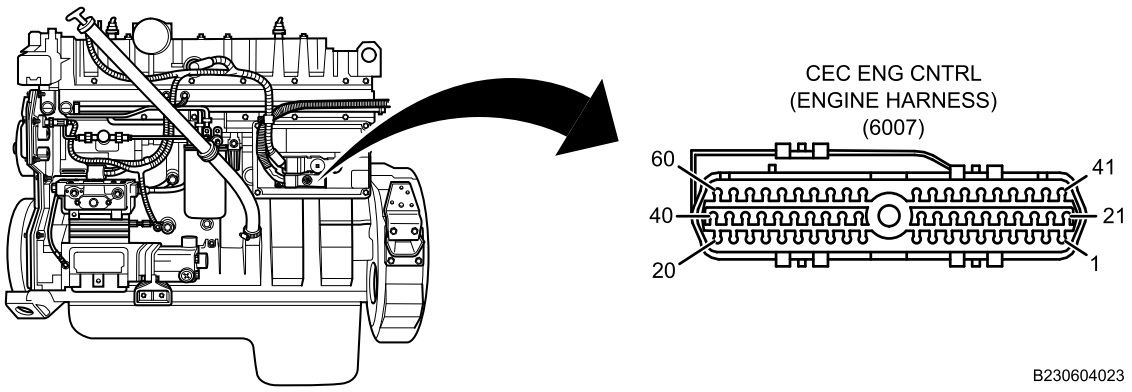


Figure 49. Engine Control Module (ECM) Connector.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

80. Disconnect and reconnect ECM connector 6007. Refer to Figure 49. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 139.
NO Go to next step.

STEP

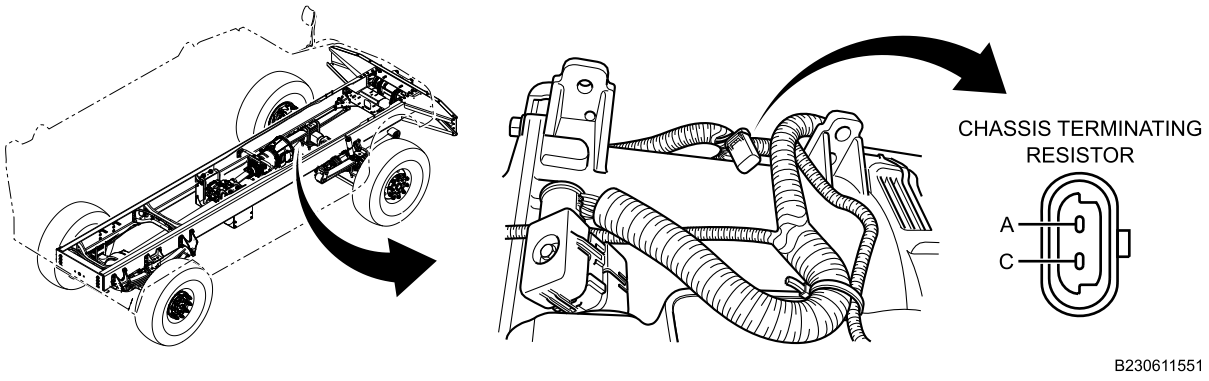


Figure 50. Chassis Terminating Resistor.

81. Disconnect chassis terminating resistor above transmission. Refer to Figure 50. Refer to Belly Armor Removal and Installation (WP 0606).

CONDITION/INDICATION

Does MSD indicate that communication was restored when resistor was disconnected?

DECISION

YES Go to Step 146.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

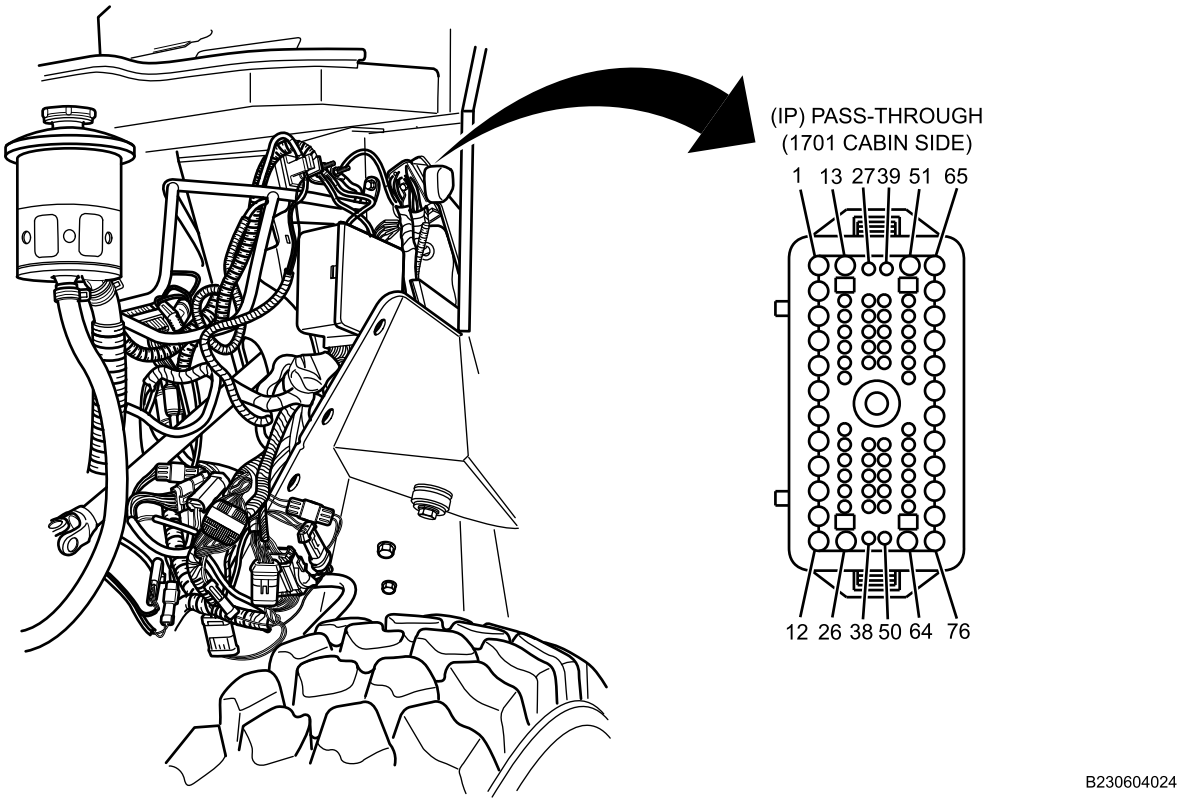


Figure 51. Dash/IP Connector.

82. Disconnect connector 1701. Refer to Figure 51.
83. Measure resistance between IP side connector 1701 terminal 15 and ground with multimeter. Refer to Figure 51.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 138.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

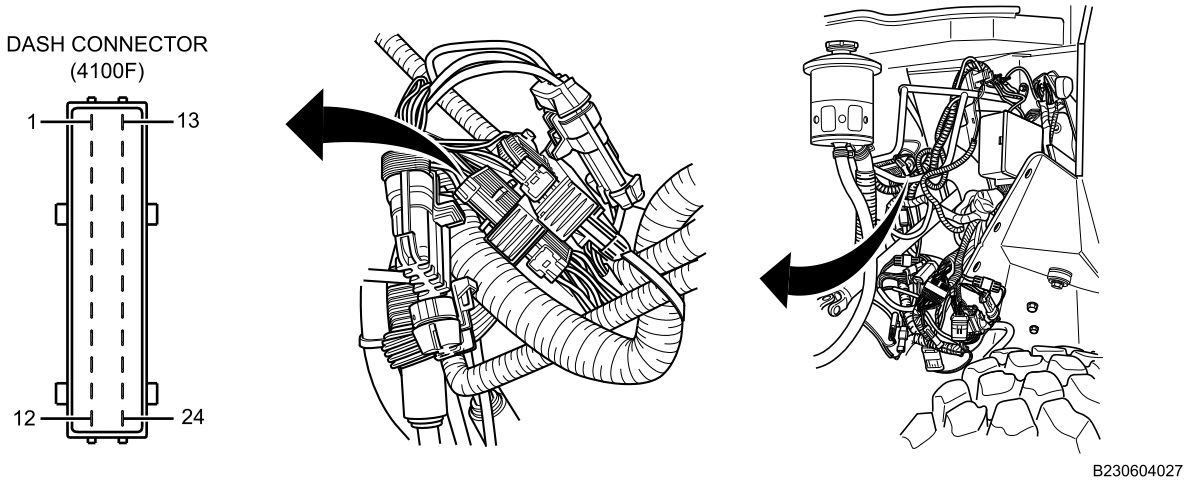


Figure 52. Dash/Engine Connector.

84. Disconnect connector 4100F/4103 (connector with 18 wires). Refer to Figure 52.
85. Measure resistance between connector 4100F terminal 7 and ground with multimeter. Refer to Figure 52.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 137.
NO Go to Step 136.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

86. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
87. Disconnect and reconnect modules and resistors one at a time while observing MSD for communication recovery.

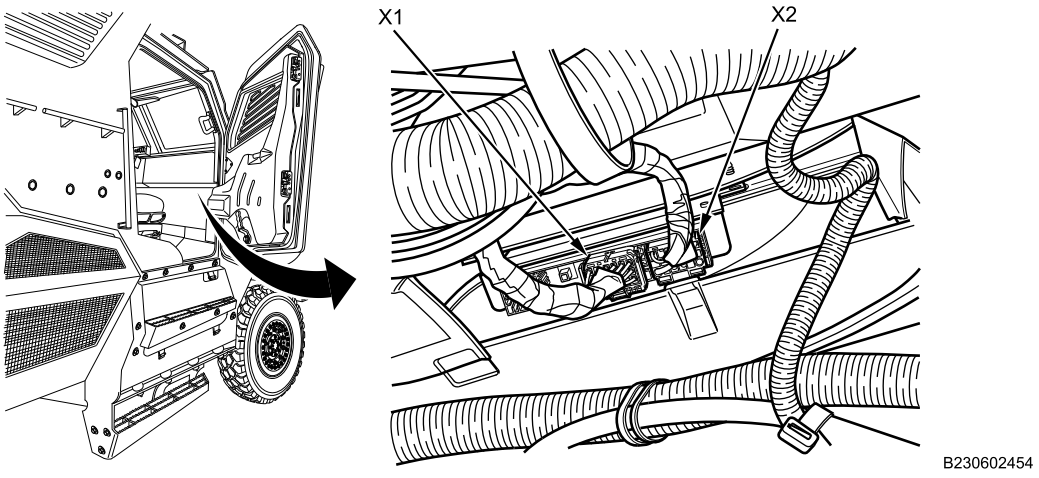


Figure 53. ABS Module Connectors.

88. Disconnect and reconnect ABS module connector X1. Refer to Figure 53. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 144.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

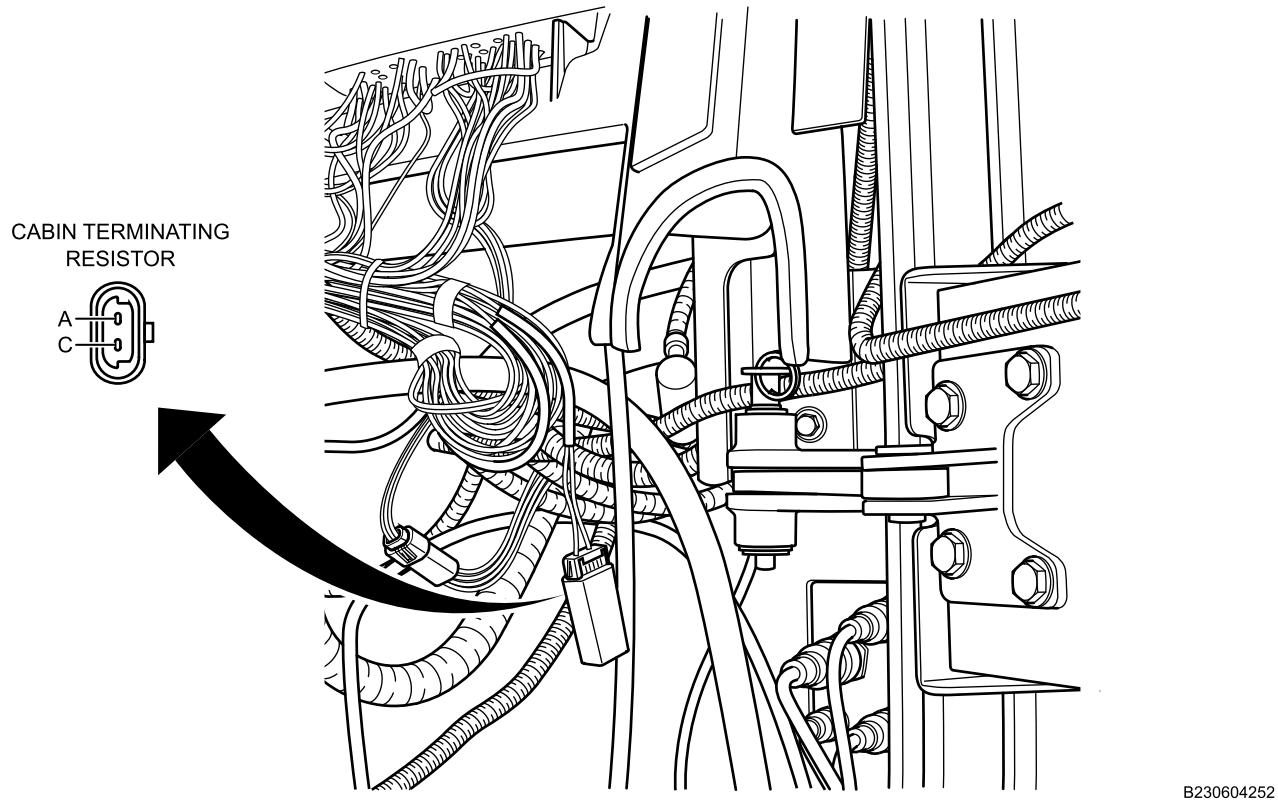


Figure 54. Cabin Terminating Resistor Under Right Side IP.

89. Disconnect cabin terminating resistor above transmission. Refer to Figure 54. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).

CONDITION/INDICATION

Does MSD indicate that communication was restored when resistor was disconnected?

DECISION

YES Go to Step 145.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

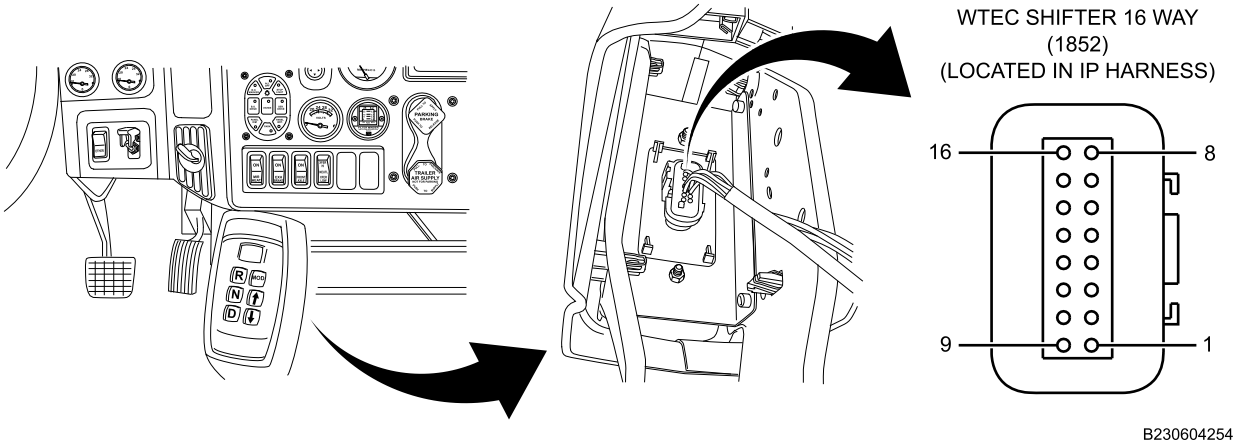


Figure 55. Shift Selector Module Connector.

90. Disconnect and reconnect shift selector module connector 1852. Refer to Figure 55. Refer to Transmission Auto Shift Control Module Removal and Installation (WP 0452).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 143.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

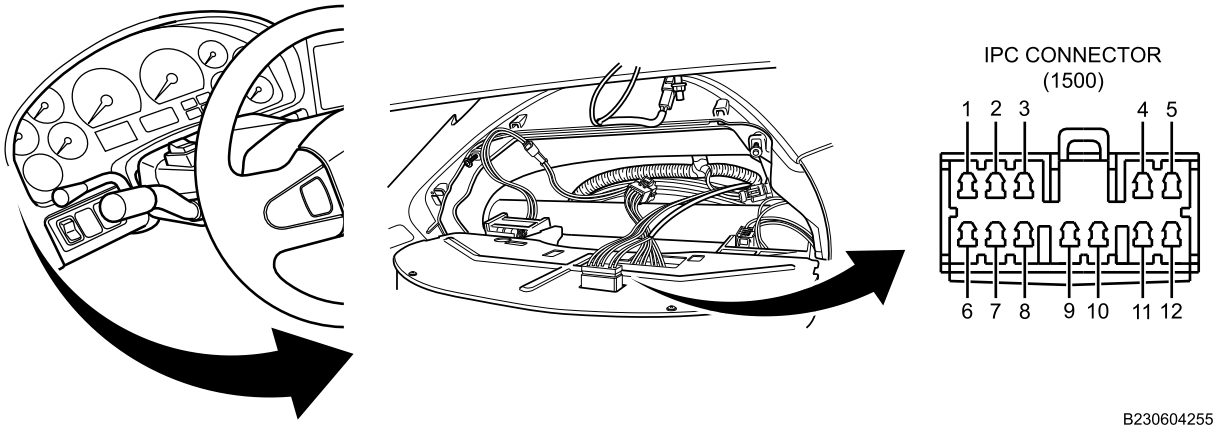


Figure 56. IPC Connector.

91. Disconnect and reconnect IPC connector 1500. Refer to Figure 56. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0578).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 142.
NO Go to next step.

STEP

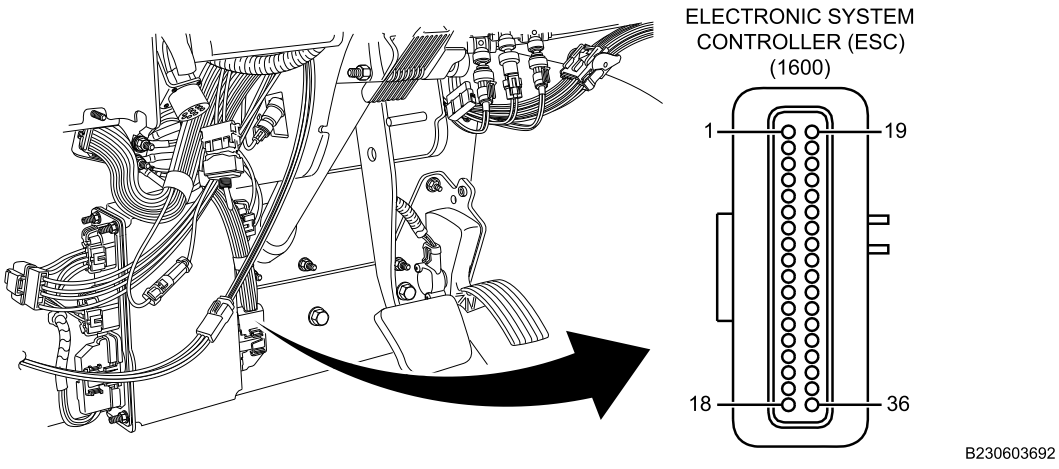


Figure 57. Electronic System Controller (ESC) Connector.

92. Disconnect and reconnect ESC connector 1600. Refer to Figure 57.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 141.
NO Go to next step.

STEP

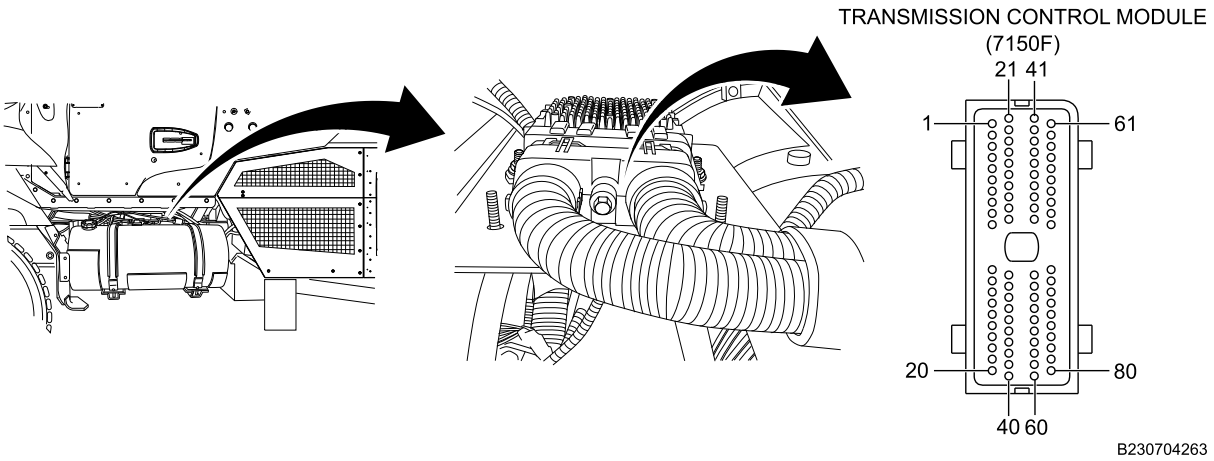


Figure 58. Transmission Control Module (TCM) Connector.

93. Disconnect and reconnect TCM connector 7150F. Refer to Figure 58. Refer to Transmission Control Unit and Brace Removal and Installation (WP 0453).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 140.
NO Go to next step.

STEP

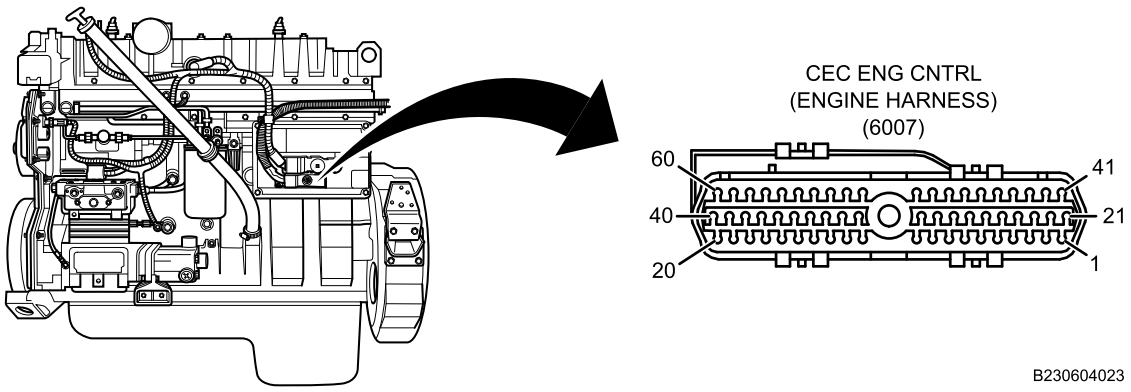


Figure 59. Engine Control Module (ECM) Connector.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

94. Disconnect and reconnect ECM connector 6007. Refer to Figure 59. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329).

CONDITION/INDICATION

Does MSD indicate that communication was restored when module was disconnected?

DECISION

YES Go to Step 139.
NO Go to next step.

STEP

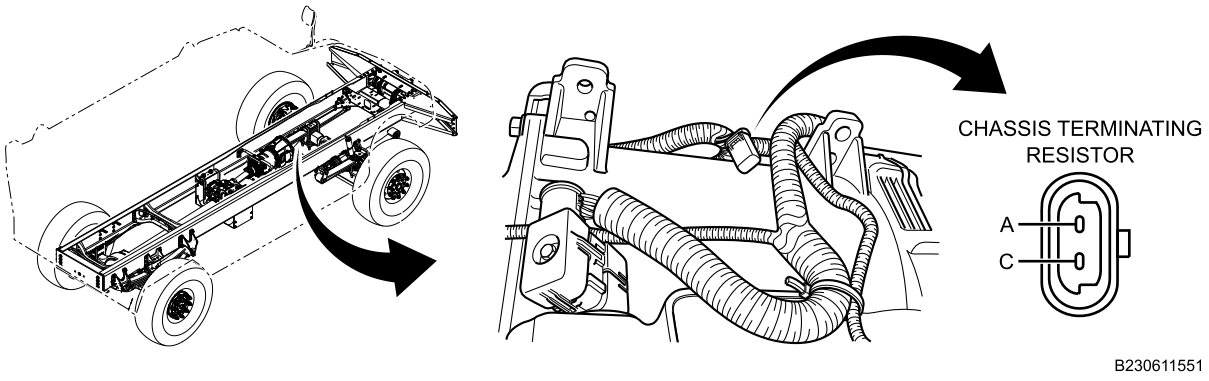


Figure 60. Chassis Terminating Resistor.

95. Disconnect chassis terminating resistor above transmission. Refer to Figure 60. Refer to Belly Armor Removal and Installation (WP 0606).

CONDITION/INDICATION

Does MSD indicate that communication was restored when resistor was disconnected?

DECISION

YES Go to Step 146.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

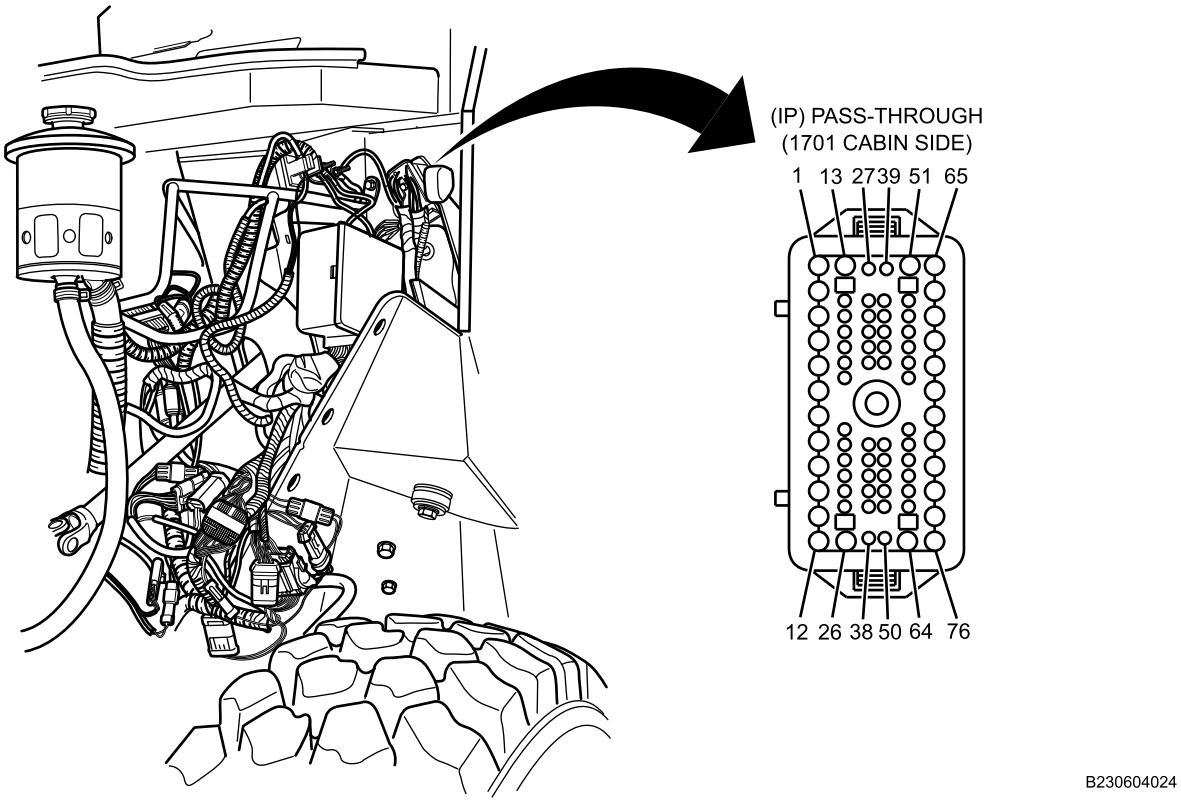


Figure 61. Dash/IP Connector.

96. Disconnect connector 1701. Refer to Figure 61.
97. Measure resistance between IP side connector 1701 terminal 16 and ground with multimeter. Refer to Figure 61.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 138.
NO Go to next step.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

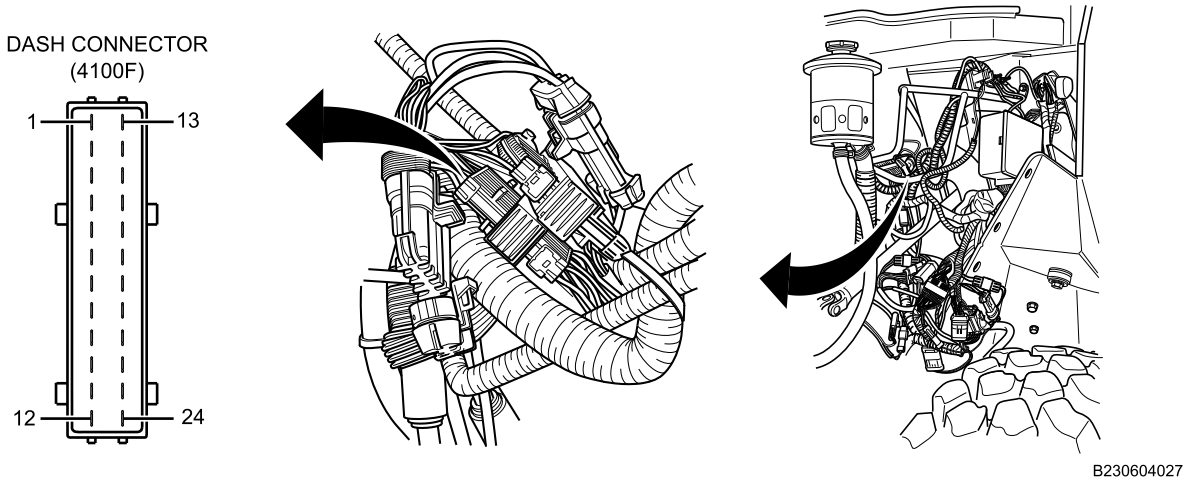


Figure 62. Dash/Engine Connector.

98. Disconnect connector 4100F/4103 (connector with 18 wires). Refer to Figure 62.
99. Measure resistance between connector 4100F terminal 8 and ground with multimeter. Refer to Figure 62.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 137.
NO Go to Step 136.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

100. Turn ignition switch OFF (TM 9-2355-106-10).
101. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

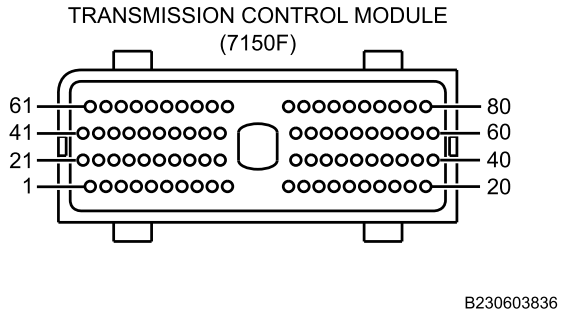


Figure 63. TCM Connector 7150F.

102. Measure resistance between connector 7150F terminal 28 and all other connector 7150F terminals with multimeter. Refer to Figure 63.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 137.
NO Go to Step 140.

STEP

103. Turn ignition switch OFF (TM 9-2355-106-10).
104. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
105. Measure resistance between connector 7150F terminal 8 and all other connector 7150F terminals with multimeter. Refer to Figure 63.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 137.
NO Go to Step 140.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

106. Turn ignition switch OFF (TM 9-2355-106-10).
107. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

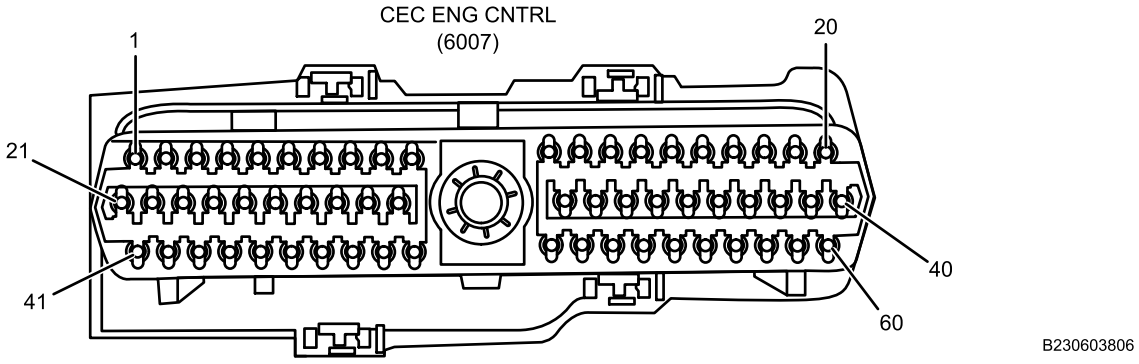


Figure 64. ECM Connector 6007.

108. Measure resistance between connector 6007 terminal 19 and all other connector 6007 terminals with multimeter. Refer to Figure 64.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 137.
NO Go to Step 139.

STEP

109. Turn ignition switch OFF (TM 9-2355-106-10).
110. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
111. Measure resistance between connector 6007 terminal 20 and all other connector 6007 terminals with multimeter. Refer to Figure 64.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 137.
NO Go to Step 139.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

112. Turn ignition switch OFF (TM 9-2355-106-10).
113. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

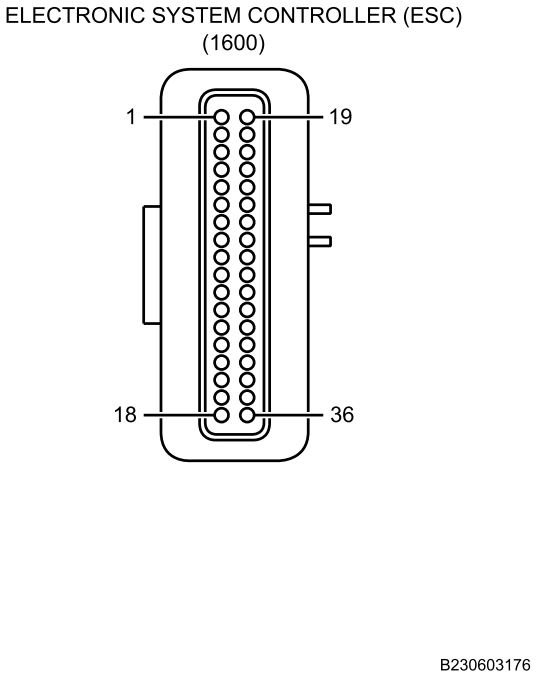


Figure 65. ESC Connector 1600.

114. Measure resistance between connector 1600 terminal 34 and all other connector 1600 terminals with multimeter. Refer to Figure 65.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to Step 141.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

115. Turn ignition switch OFF (TM 9-2355-106-10).
116. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
117. Measure resistance between connector 1600 terminal 35 and all other connector 1600 terminals with multimeter. Refer to Figure 65.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to Step 141.

STEP

118. Turn ignition switch OFF (TM 9-2355-106-10).
119. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

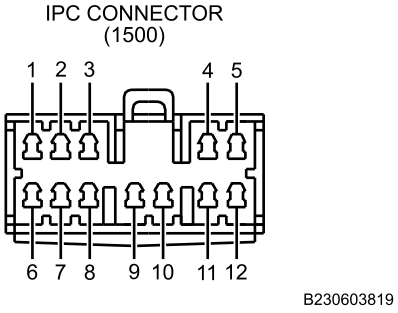


Figure 66. Cluster Connector 1500.

120. Measure resistance between connector 1500 terminal 4 and all other connector 1500 terminals with multimeter. Refer to Figure 66.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to Step 142.

STEP

121. Turn ignition switch OFF (TM 9-2355-106-10).
122. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

123. Measure resistance between connector 1500 terminal 5 and all other connector 1500 terminals with multimeter. Refer to Figure 66.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to Step 142.

STEP

124. Turn ignition switch OFF (TM 9-2355-106-10).
125. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

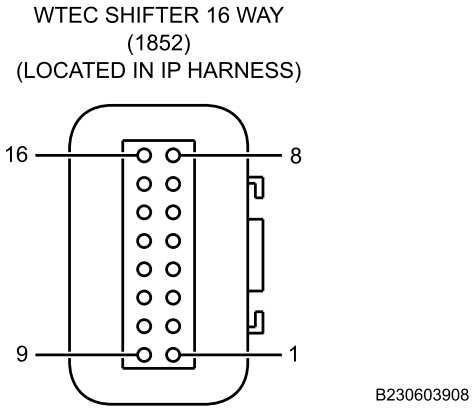


Figure 67. Shift Selector Module Connector 1852.

126. Measure resistance between connector 1852 terminal 8 and all other connector 1852 terminals with multimeter. Refer to Figure 67.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to Step 143.

STEP

127. Turn ignition switch OFF (TM 9-2355-106-10).
128. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
129. Measure resistance between connector 1852 terminal 15 and all other connector 1852 terminals with multimeter. Refer to Figure 67.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to Step 143.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

130. Turn ignition switch OFF (TM 9-2355-106-10).
131. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

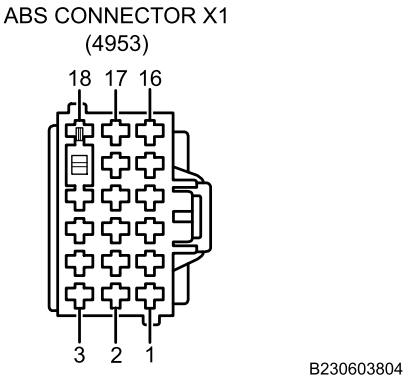


Figure 68. ABS Module Connector X1.

132. Measure resistance between connector X1 terminal 8 and all other connector X1 terminals with multimeter. Refer to Figure 68.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to Step 144.

STEP

133. Turn ignition switch OFF (TM TM 9-2355-106-10).
134. Turn MAIN POWER switch OFF (TM TM 9-2355-106-10).
135. Measure resistance between connector X1 terminal 7 and all other connector X1 terminals with multimeter. Refer to Figure 68.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for any terminal?

DECISION

YES Go to Step 138.
NO Go to Step 144.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 136. Dash wiring harness is faulty.

ACTION

Replace dash harness. Refer to Power Distribution Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 137. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 138. IP wiring harness is faulty.

ACTION

Replace IP wiring harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 139. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 140. TCM is faulty.

ACTION

Replace TCM. Refer to Transmission Control Unit and Brace Removal and Installation (WP 0453). Return vehicle to service.

END OF TEST

MALFUNCTION

- 141. ESC is faulty.

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace ESC. Refer to Electronic Sytem Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

MALFUNCTION

- 142. IPC is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0578). Return vehicle to service.

END OF TEST

MALFUNCTION

- 143. Shift selector module is faulty.

ACTION

Replace shift selector module. Refer to Transmission Auto Shift Control Module Removal and Installation (WP 0452). Return vehicle to service.

END OF TEST

MALFUNCTION

- 144. ABS module is faulty.

ACTION

Replace ABS module. Refer to Antilock Brake System (ABS) Control Module Removal and Installation (WP 0355). Return vehicle to service.

END OF TEST

MULTIPLEXING DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 145. Cabin terminating resistor is faulty.

ACTION

Replace cabin terminating resistor. Refer to Instrument Panel (IP) Harness Terminating Resistor Removal and Installation (WP 0320). Return vehicle to service.

END OF TEST

MALFUNCTION

- 146. Chassis terminating resistor is faulty.

ACTION

Replace chassis terminating resistor. Refer to Engine Wiring Harness Terminating Resistor Removal and Installation (WP 0337). Return vehicle to service.

END OF TEST

MALFUNCTION

- 147. Datalink circuits are operating as designed. Recheck diagnostic connector power and ground (WP 0078). Check MSD connector for missing, corroded, or damaged terminals. If communication failure persists, substitute a known good ECM and ESC and retest.

ACTION

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Box, breakout, Electronic System Controller (ESC) (ZTSE4477) (WP 0795, Item 21)
Terminal Test Kit (WP 0795, Item 122)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0012
WP 0059
WP 0067
WP 0086
WP 0087
WP 0106
WP 0115
WP 0257
WP 0297
WP 0301
WP 0299
WP 0317
WP 0319
WP 0335
WP 0324
WP 0353
WP 0426
WP 0598
WP 0580
WP 0565
WP 0605
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Cabin doors open and secured (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 35
WP 0789, Figure 37
WP 0789, Figure 44

DIAGNOSTIC TROUBLE CODES AND SYMPTOMS.

This procedure addresses the following Diagnostic Trouble Codes (DTCs):

Table 1. Electronic System Controller DTCs.

FAULT CODE	FAULT DESCRIPTION
610 14 1 0	Loss of ignition feed for 10 seconds while the engine is running.
610 14 2 0	Loss of accessory feed for 10 seconds while the engine is running.
612 14 0 1	Ignition out of range low. Short to ground or open circuit.
612 14 0 2	Ignition out of range high. Shorted high.
612 14 30 1	Switched 5V sensor supply out of range low. Short to ground or open circuit.
612 14 30 2	Switched 5V sensor supply out of range high. Shorted high.
625 14 5 0	Switch pack data link fault.
627 14 11	ESC main power and ground interruption.
1542 14 11	ESC main power and ground interruption.
1557 0 1 1	ESC internal fault software main loop time exceeded.
1705 14 150 1	ESC not communicating with the IPC (IPC Version 8.7).
2023 14 150 1	Loss of data link from ESC to primary IPC (150) (IPC Version 9.3 and later).
2023 14 250 1	Loss of data link from ESC to secondary IPC (250) (IPC Version 9.3 and later).

This procedure addresses the following symptoms:

- All ESC features are inoperative. ESC controlled features include:
  - Windshield and mirror heaters
  - Windshield wipers

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

  - Park lamps
  - Turn signals
  - Headlights
  - Brake lamps
  - Transfer case mode
  - Electric horns
  - Water-in-fuel warning lamp
  - Park brake warning lamp
  - Fasten seatbelts warning lamp
  - High beam headlight indicator lamp
  - Turn signal indicator lamps
  - Primary air pressure gauge
  - Secondary air pressure gauge
  - Transmission temperature gauge
  - Fuel level gauge
  - Front axle disconnect
- All ESC dependent Electronic Gauge Cluster (EGC) lamps and gauges are inoperative. ESC dependent EGC lamps and gauges include:
  - Water-in-fuel warning lamp
  - Park brake warning lamp
  - Fasten seatbelts warning lamp
  - High beam headlight indicator lamp
  - Turn signal indicator lamps
  - Primary air pressure gauge
  - Secondary air pressure gauge
  - Transmission temperature gauge
  - Fuel level gauge
- All ESC 5-volt reference dependent features are inoperative. ESC 5-volt reference dependent features include:
  - Primary air pressure gauge pressure transducer
  - Secondary air pressure gauge pressure transducer
- All ESC zero-volt reference dependent features are inoperative. ESC zero-volt reference feature include:
  - Park brake switch
  - Primary air pressure gauge pressure transducer
  - Secondary air pressure gauge pressure transducer
  - Electric horn switch
  - Windshield wiper switch
  - Fuel level sending unit
  - Air conditioner relay AC ON signal to ESC connector 4004
- All switch pack module controlled functions are inoperative. Switch pack module controlled functions include:
  - Mirror and windshield heaters
  - Front axle disconnect

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

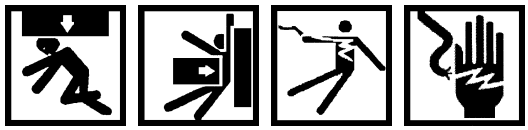
- Transfer case mode

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

STEP

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Cabin door must be secured in the open position by using heavy duty straps to prevent accidental closure during vehicle maintenance. Pull check link retaining pin prior to securing door open. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

1. Retrieve DTCs. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

Is DTC 1557 0 1 1 set?

DECISION

YES Go to Step 146.
NO Go to next step.

STEP

2. Refer to previously accessed DTCs.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Is DTC 625 14 5 0 set?

DECISION

YES Go to Step 47.
NO Go to next step.

STEP

3. Refer to previously accessed DTCs.

CONDITION/INDICATION

Is the DTC any of the following:

- 1705 14 150 1
- 2023 14 150 1
- 2023 14 250 1

DECISION

YES Go to Step 30.
NO Go to next step.

STEP

4. Refer to previously accessed DTCs.

CONDITION/INDICATION

Is the DTC any of the following:

- 610 14 1 0
- 610 14 2 0
- 612 14 0 1
- 612 14 0 2
- 627 14 11
- 1542 14 11

DECISION

YES Go to Step 12.
NO Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Refer to previously accessed DTCs.

CONDITION/INDICATION

Is the DTC any of the following:

- 612 14 30 1
- 612 14 30 2

DECISION

YES Go to Primary Air Pressure Gauge Troubleshooting Procedure (WP 0086) and Secondary Air Pressure Gauge Troubleshooting Procedure (WP 0087).
NO Go to next step.

STEP

6. Operate the following features and observe the response:
   - Windshield and mirror heaters
   - Windshield wipers
   - Park lamps
   - Turn signals
   - Headlights
   - Brake lamps
   - Transfer case mode
   - Electric horns
   - Water-in-fuel warning lamp
   - Park brake warning lamp
   - Fasten seatbelts warning lamp
   - High beam headlight indicator lamp
   - Turn signal indicator lamps
   - Primary air pressure gauge
   - Secondary air pressure gauge
   - Transmission temperature gauge
   - Fuel level gauge
   - Front axle disconnect

CONDITION/INDICATION

Do all features fail to operate?

DECISION

YES Go to Step 12.
NO Go to next step.

STEP

7. Operate the following features and observe the response:
   - Mirror and windshield heaters

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

- Front axle disconnect
- Transfer case mode

CONDITION/INDICATION

Do all of the features fail to operate?

DECISION

YES Go to Step 47.
NO Go to next step.

STEP

8. Operate the vehicle and observe the following EGC lamps and gauges:
   - Water-in-fuel warning lamp
   - Park brake warning lamp
   - Fasten seatbelts warning lamp
   - High beam headlight indicator lamp
   - Turn signal indicator lamps
   - Primary air pressure gauge
   - Secondary air pressure gauge
   - Transmission temperature gauge
   - Fuel level gauge

CONDITION/INDICATION

Do all EGC lamps and gauges fail to operate?

DECISION

YES Go to Step 30.
NO Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

9. Operate the vehicle and observe the following gauges:
   - Primary air pressure gauge
   - Secondary air pressure gauge

CONDITION/INDICATION

Do the primary and secondary air pressure gauges fail to operate correctly?

DECISION

YES Go to Primary Air Pressure Gauge Troubleshooting Procedure (WP 0086) and Secondary Air Pressure Gauge Troubleshooting Procedure (WP 0087).
NO Go to next step.

STEP

10. Operate vehicle and observe the following features:
   - Electric horn switch
   - Park brake switch
   - Windshield wiper switch

CONDITION/INDICATION

Do all features fail to operate correctly?

DECISION

YES Go to Step 69.
NO Go to next step.

STEP

11. Observe the fuel level gauge.

CONDITION/INDICATION

Does the fuel level gauge operate correctly?

DECISION

YES Go to Step 149.
NO Go to Step 102.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

12. Measure voltage between ESC power cable terminal (left) at megafuse and ground with multimeter. Refer to Figure 1.

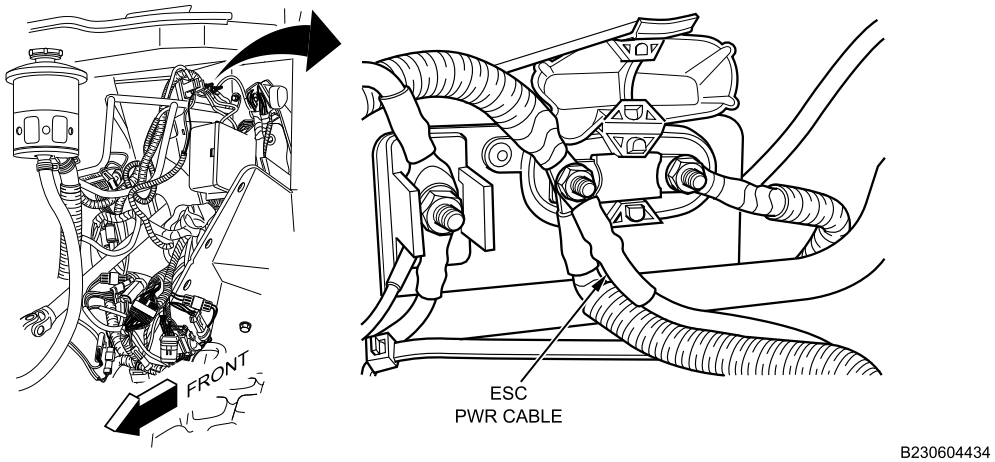


Figure 1. ESC Power Cable Terminal Underhood.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

YES Go to next step.
NO Go to Power Distribution Troubleshooting Procedure (WP 0059).

STEP

13. Turn ignition switch OFF (TM 9-2355-106-10).
14. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
15. Disconnect connector 1600 from ESC. Refer to Figure 2.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

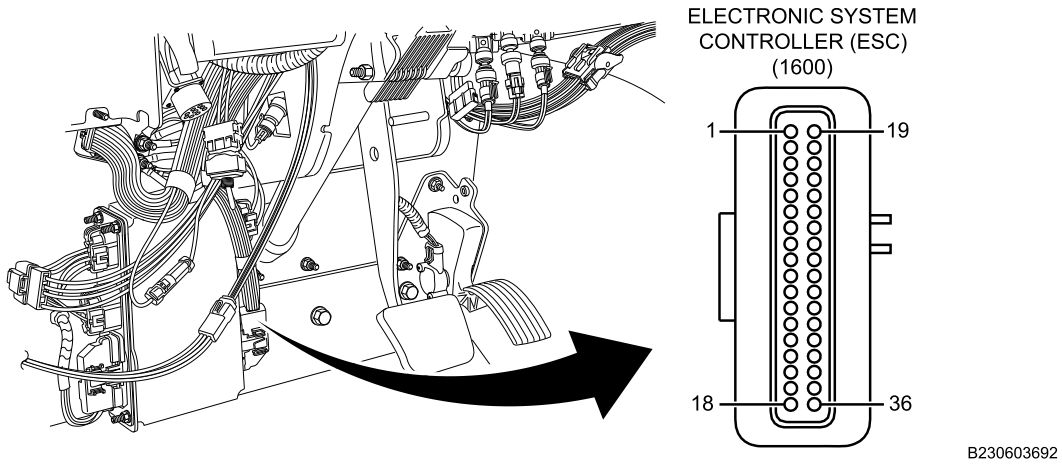


Figure 2. Under Steering Column.

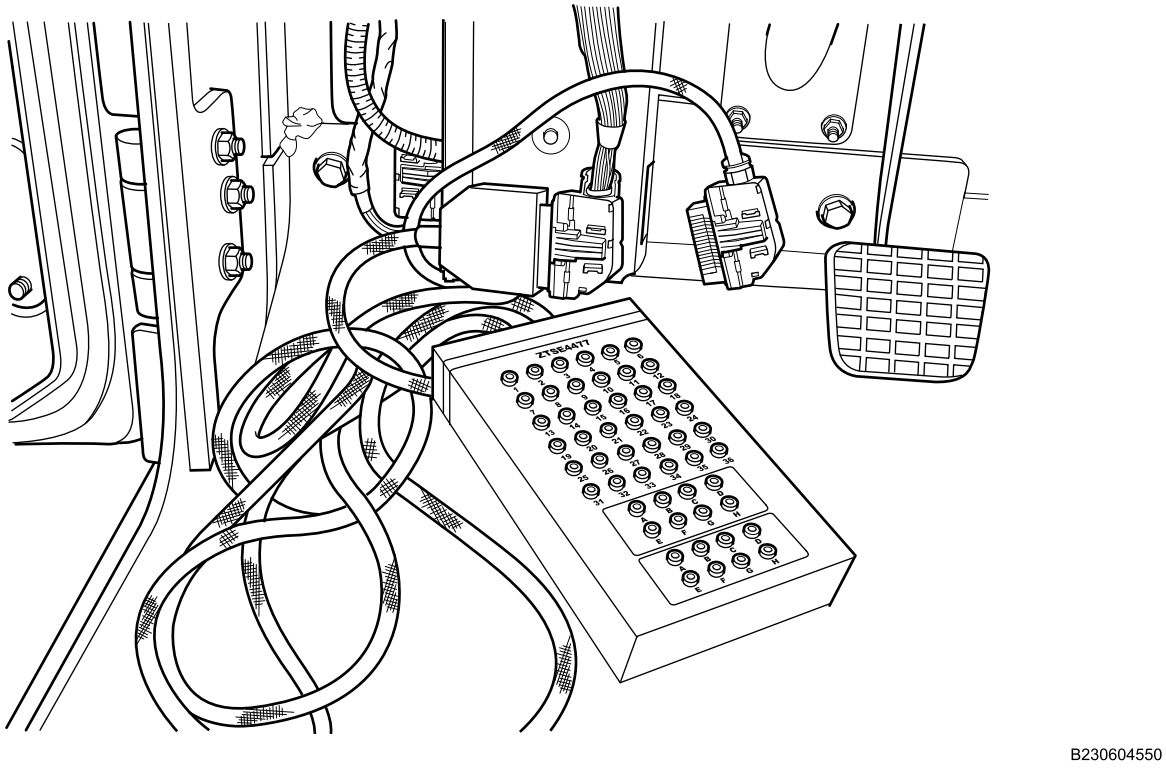


Figure 3. Connector 1600 to Breakout Box Male Connector.

16. Install connector 1600 on ZTSE4477 breakout box male connector. Refer to Figure 3.
17. Turn MAIN POWER switch ON (TM 9-2355-106-10).
18. Turn ignition switch ON (TM 9-2355-106-10).
19. Measure voltage between ZTSE4477 breakout box pin 12 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 22.
YES Go to next step.

STEP

20. Measure voltage between ZTSE4477 breakout box pin 2 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

NO Go to Step 63.
YES Go to next step.

STEP

21. Measure voltage between ZTSE4477 breakout box pin 2 and pin 1 with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

YES Go to Step 146.
NO Go to Step 138.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Remove IP right side closeout. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).
23. Turn ignition switch OFF (TM 9-2355-106-10).

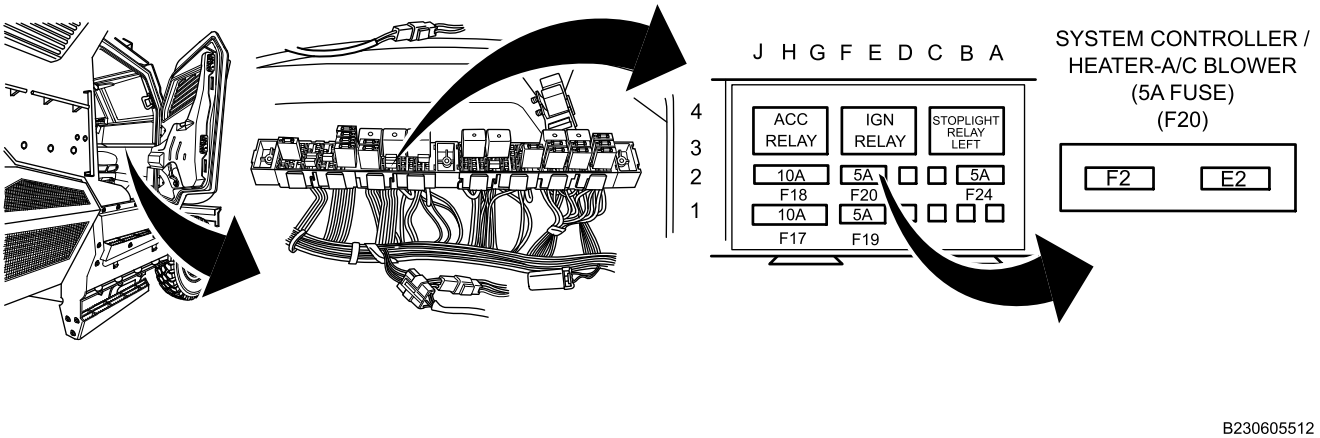


Figure 4. Fuse F20 in Fuse Block 1012.

24. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
25. Remove and inspect fuse F20. Refer to Figure 4. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

CONDITION/INDICATION

Is fuse F20 open?

DECISION

YES Go to Step 29.
NO Go to next step.

STEP

26. Turn MAIN POWER switch ON (TM 9-2355-106-10).
27. Turn ignition switch ON (TM 9-2355-106-10).
28. Measure voltage between fuse F20 socket terminal F2 and ground, and fuse F20 socket terminal E2 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts at either terminal?

DECISION

YES Go to Step 142.
NO Go to Power Distribution Troubleshooting Procedure (WP 0059).

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

29. Measure resistance between ZTSE4477 breakout box pin 12 and ground with multimeter. Refer to Figure 5.

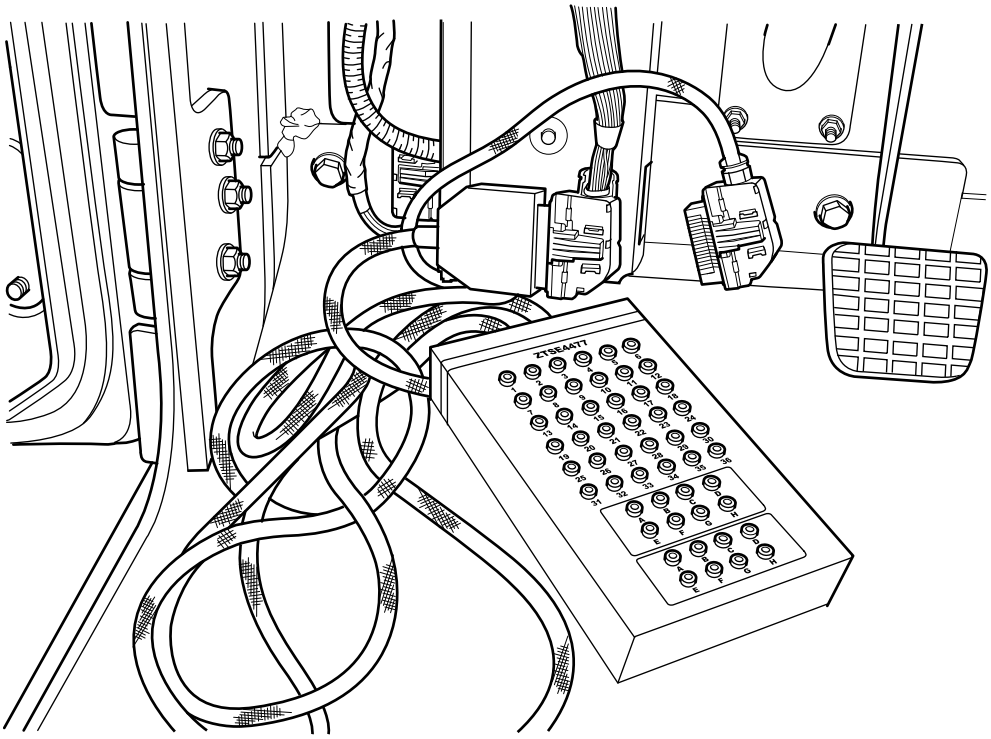


Figure 5. Connector 1600 to Breakout Box Male Connector.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 142.
NO Go to Step 146.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

30. Turn ignition switch OFF (TM 9-2355-106-10).
31. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
32. Disconnect connector 1600 from ESC. Refer to Figure 6.

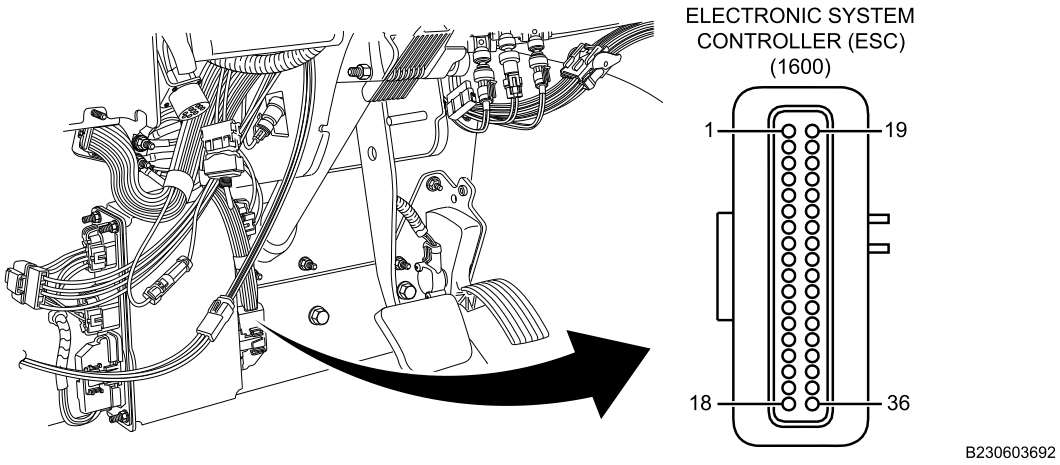


Figure 6. ESC Connector Under Left Side Instrument Panel.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

33. Install connector 1600 on ZTSE4477 breakout box male connector. Refer to Figure 7.

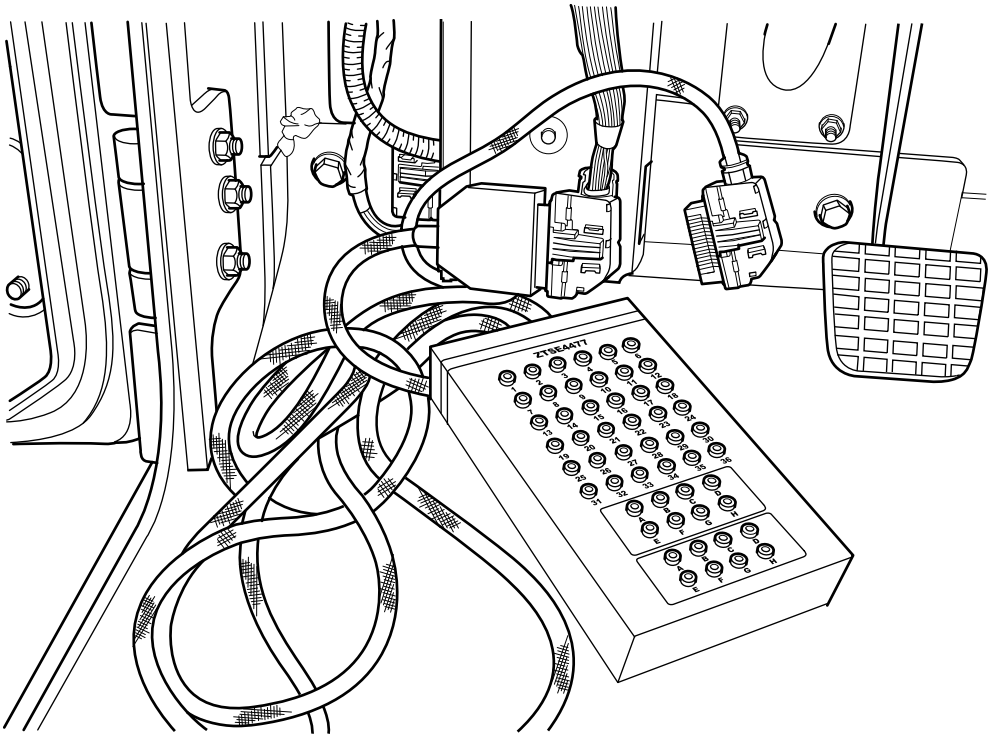


Figure 7. Connector 1600 to Breakout Box Male Connector.

34. Turn MAIN POWER switch ON (TM 9-2355-106-10).
35. Turn ignition switch ON (TM 9-2355-106-10).
36. Measure voltage between ZTSE4477 breakout box pin 2 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

YES Go to next step.
NO Go to Step 63.

STEP

37. Measure voltage between ZTSE4477 breakout box pin 2 and pin 1 with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

YES Go to next step.
NO Go to Step 138.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

38. Remove IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).
39. Disconnect connector 1500 from IPC.
40. Turn MAIN POWER switch ON (TM 9-2355-106-10).
41. Turn ignition switch ON (TM 9-2355-106-10).
42. Measure voltage between connector 1500 terminal 4 and ground with multimeter. Refer to Figure 8.

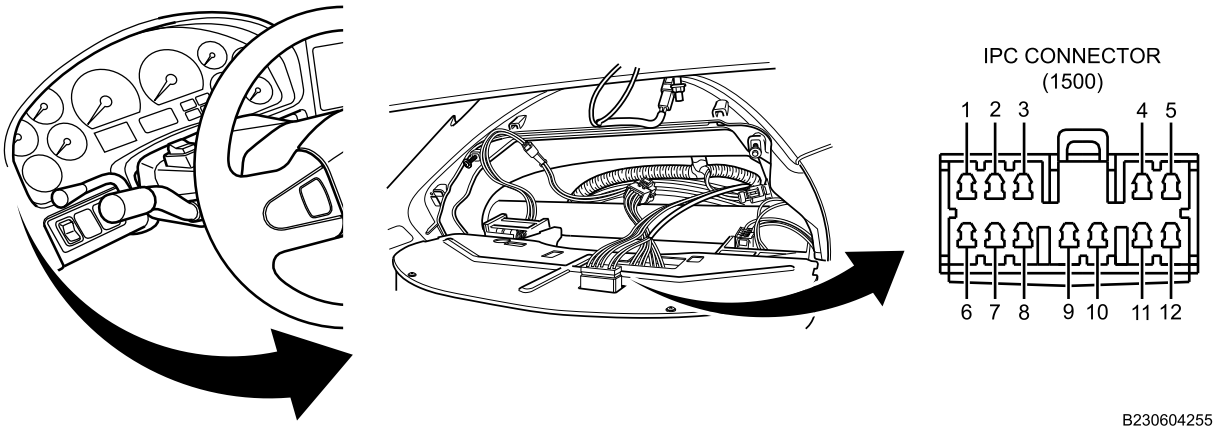


Figure 8. Behind IPC.

CONDITION/INDICATION

Does multimeter read between 1.0 volts and 5.0 volts?

DECISION

YES Go to next step.
NO Go to Multiplexing Data Link Circuits Troubleshooting Procedure (WP 0067).

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

43. Measure voltage between connector 1500 terminals 5 and ground with multimeter. Refer to Figure 9.

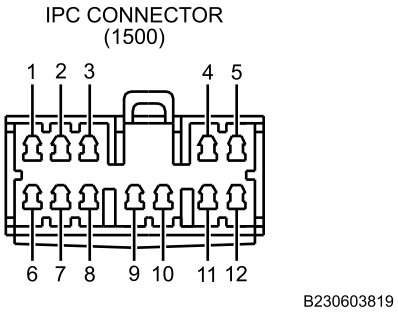


Figure 9. Connector 1500.

CONDITION/INDICATION

Does multimeter read between 1.0 and 5.0 volts?

DECISION

YES Go to next step.
NO Go to Multiplexing Data Link Circuits Troubleshooting Procedure (WP 0067).

STEP

44. Turn ignition switch OFF (TM 9-2355-106-10).
45. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
46. Measure resistance between connector 1500 terminals 4 and 5 with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 148.
NO Go to Multiplexing Data Link Circuits Troubleshooting Procedure (WP 0067).

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

47. Remove switch pack from Instrument Panel (IP). Refer to Rocker Switch Removal and Installation (WP 0301).
48. Disconnect connector 1101M from switch pack module. Refer to Figure 10.

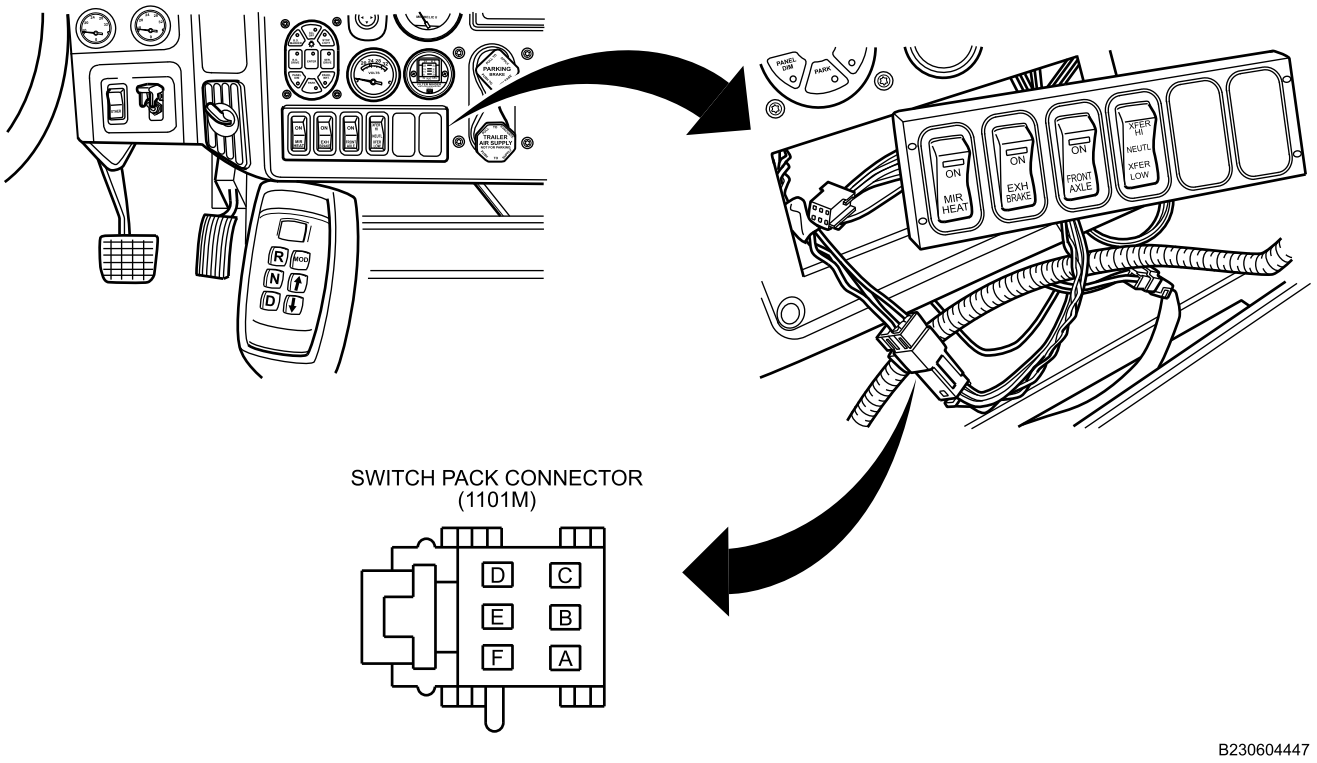


Figure 10. Behind Switch Pack.

49. Turn MAIN POWER switch ON(TM 9-2355-106-10).
50. Turn ignition switch ON (TM 9-2355-106-10).
51. Measure voltage between connector 1101M terminal D and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read between 5.0 and 1.0 volts?

DECISION

YES Go to next step.
NO Go to Step 53.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

52. Measure voltage between connector 1101M terminal E and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read between 5.0 and 1.0 volts?

DECISION

YES Go to Step 141.
NO Go to Step 58.

STEP

53. Turn ignition switch OFF (TM 9-2355-106-10).
54. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
55. Disconnect connector 1600 from ESC. Refer to Figure 11.

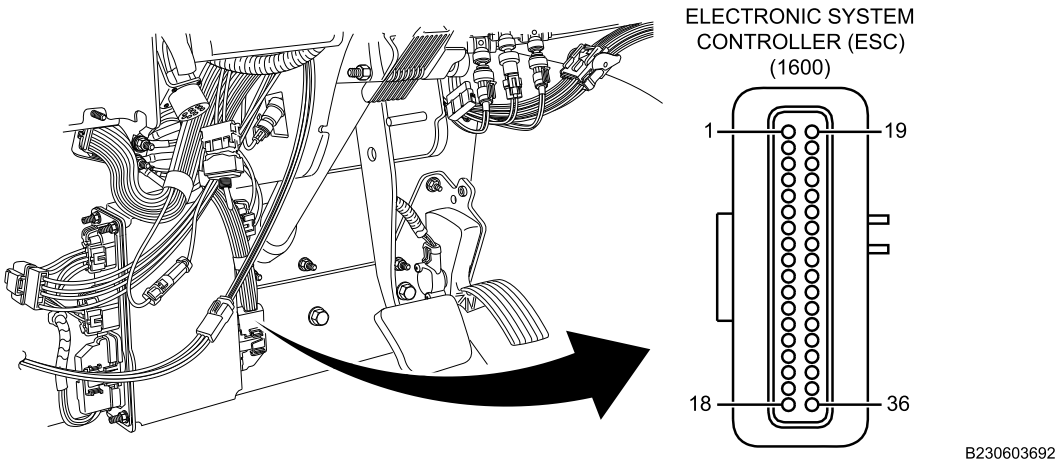


Figure 11. Connector 1600.

56. With assistant, measure resistance between connector 1600 terminal 29 and connector 1101M terminal D with multimeter. Refer to Figure 11 and Figure 12.

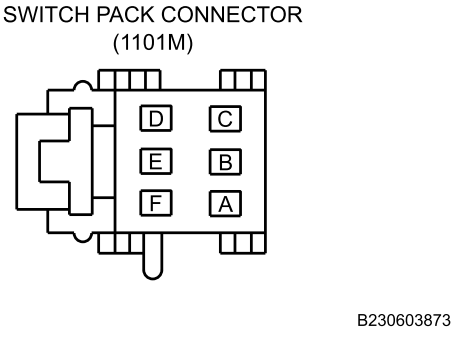


Figure 12. Connector 1101M.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 142

STEP

57. Measure resistance between ESC connector 1600 terminal 29 and all other terminals in connector 1600 with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read OL for every terminal?

DECISION

YES Go to Step 146.
NO Go to Step 142

STEP

58. Turn ignition switch OFF (TM 9-2355-106-10).
59. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
60. Disconnect connector 1600 from ESC. Refer to Figure 11.
61. Measure resistance between connector 1600 terminal 30 and connector 1101M terminal E with multimeter. Refer to Figure 11 and Figure 12.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 142

STEP

62. Measure resistance between ESC connector 1600 terminal 30 and all other terminals in connector 1600 with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read OL for every terminal?

DECISION

YES Go to Step 146.
NO Go to Step 142

STEP

63. Remove IP right side closeout. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).
64. Remove and inspect fuse F5. Refer to Figure 13.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

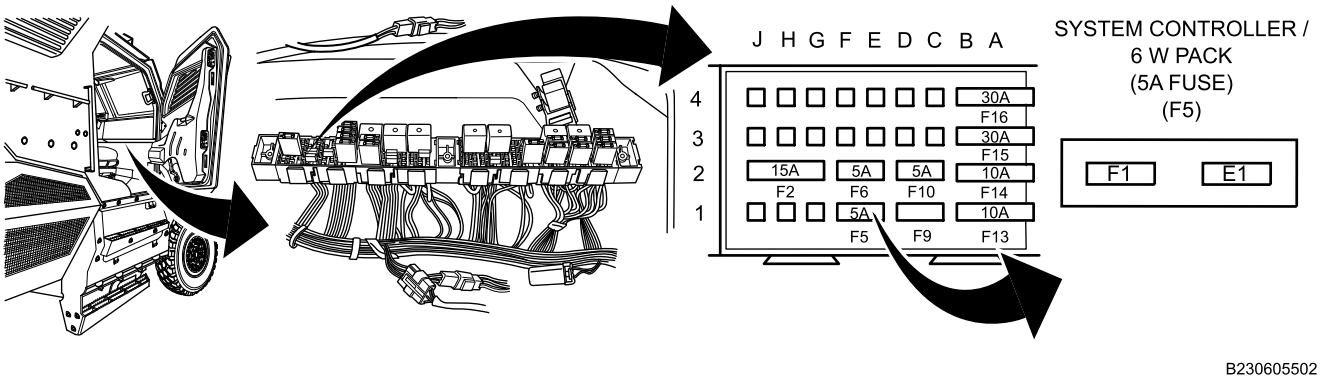


Figure 13. Fuse F5 in Fuse Block 1011.

CONDITION/INDICATION

Is fuse F5 open?

DECISION

YES Go to Step 68.
NO Go to next step.

STEP

65. Turn MAIN POWER switch ON (TM 9-2355-106-10).
66. Turn ignition switch ON (TM 9-2355-106-10).
67. Measure voltage between fuse F5 socket terminal F1 and ground, and fuse F5 socket terminal E1 and ground with multimeter. Refer to Figure 13. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts at either terminal?

DECISION

YES Go to Step 142.
NO Go to Power Distribution Troubleshooting Procedure (WP 0059).

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

68. Measure resistance between ZTSE4477 breakout box pin 2 and ground with multimeter. Refer to Figure 14.

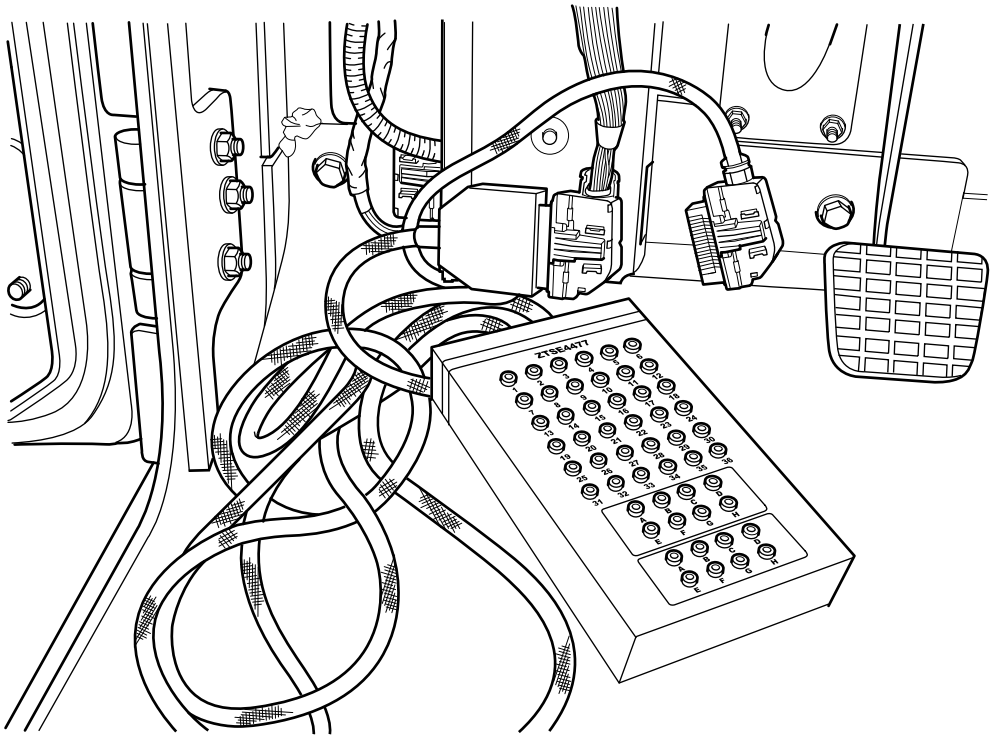


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Figure 14. Connector 1600 to Breakout Box Male Connector.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 146.
NO Go to Step 142.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

69. Turn ignition switch OFF (TM 9-2355-106-10).
70. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
71. Disconnect connector 1600 from ESC. Refer to Figure 15.

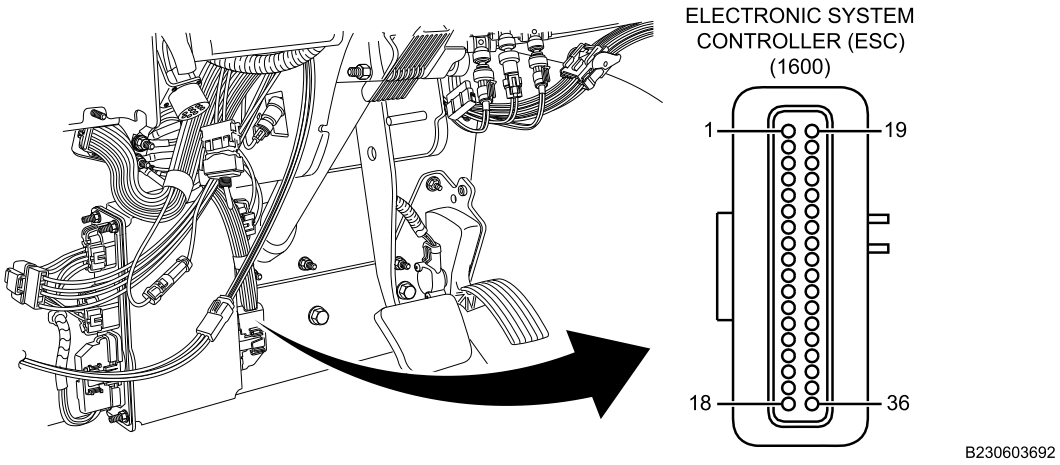

Figure 15. ESC Connector 1600.

72. Install connector 1600 on ZTSE4477 breakout box male connector. Install ZTSE4477 breakout box female connector on ESC. Refer to Figure 16.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

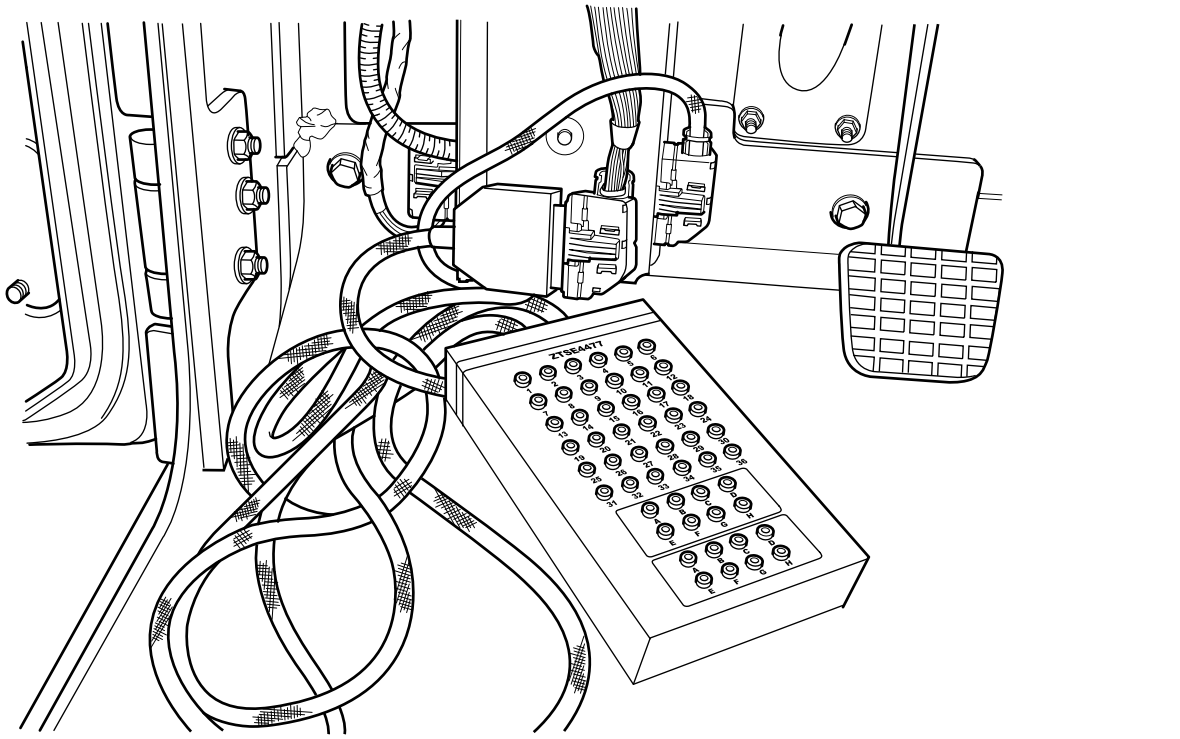

Figure 16. Breakout Box Connected to ESC and Connector 1600.

73. Turn MAIN POWER switch ON (TM 9-2355-106-10).
74. Turn ignition switch ON (TM 9-2355-106-10).
75. Measure voltage between ZTSE4477 breakout box pin 3 and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read more than 0 volts?

DECISION

NO Go to Step 94.
YES Go to next step.

STEP

76. Turn ignition switch OFF (TM 9-2355-106-10).
77. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
78. Disconnect ZTSE4477 breakout box female connector from ESC. Refer to Figure 17.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

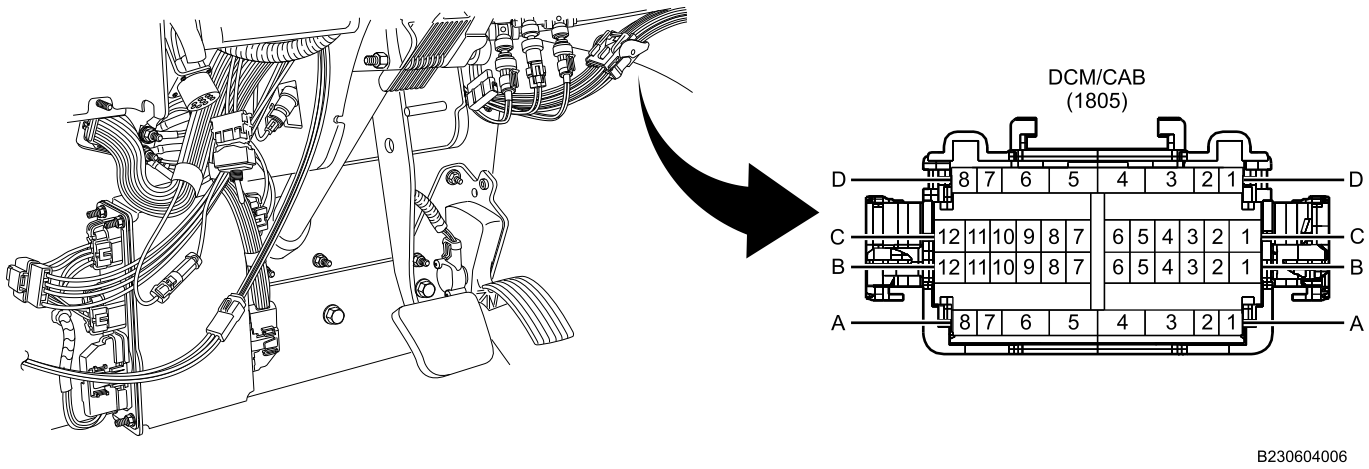

Figure 17. Connector 1600 to Breakout Box Male Connector.

79. Turn MAIN POWER switch ON (TM 9-2355-106-10).
80. Turn ignition switch ON (TM 9-2355-106-10).
81. Measure voltage between ZTSE4477 breakout box pin 3 and ground with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read more than 0 volts?

DECISION

NO Go to Step 146.
YES Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

82. Turn ignition switch OFF (TM 9-2355-106-10).
83. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
84. Disconnect connector 1800/1805 under instrument panel. Refer to Figure 18.

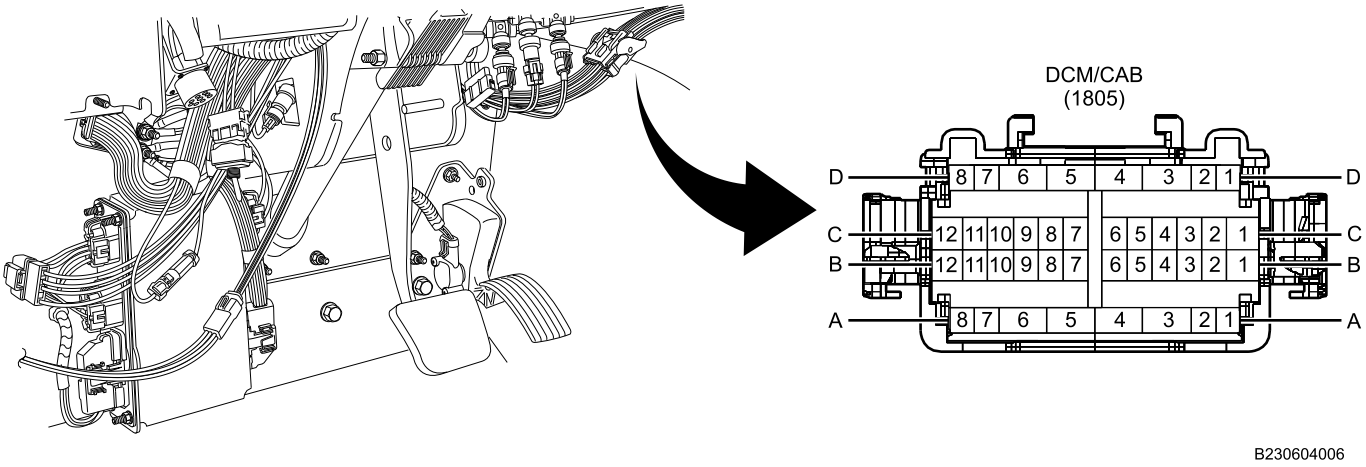

Figure 18. Under Instrument Panel.

85. Turn MAIN POWER switch ON (TM 9-2355-106-10).
86. Turn ignition switch ON (TM 9-2355-106-10).
87. Measure voltage between ZTSE4477 breakout box pin 3 and ground with multimeter. Refer to Figure 19.

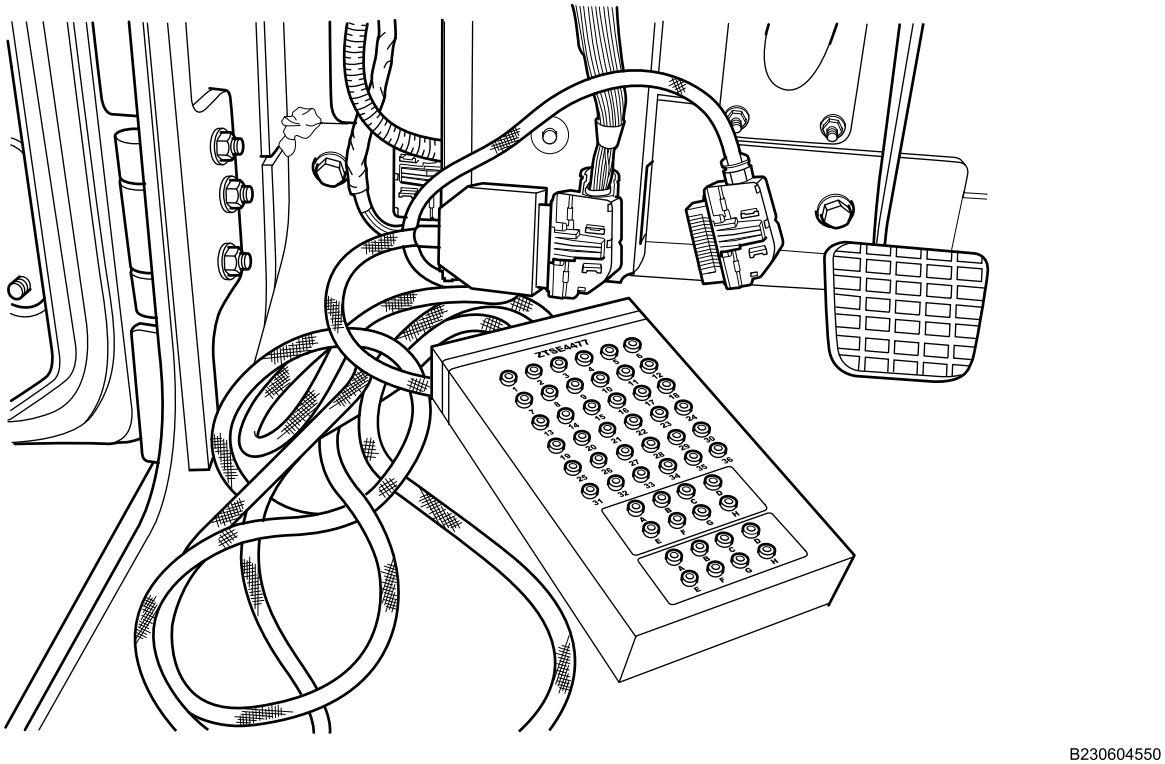

Figure 19. Connector 1600 to Breakout Box Male Connector.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 0 volts?

DECISION

YES Go to Step 142.
NO Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

88. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).

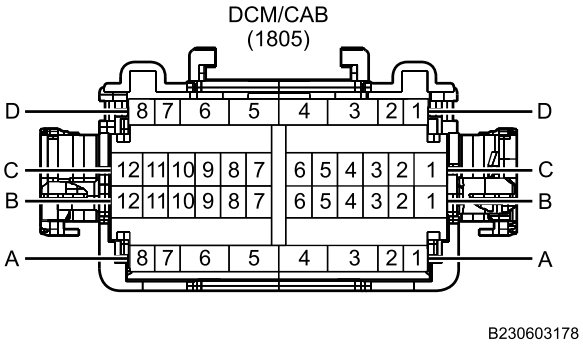

Figure 20. Connector 1805.

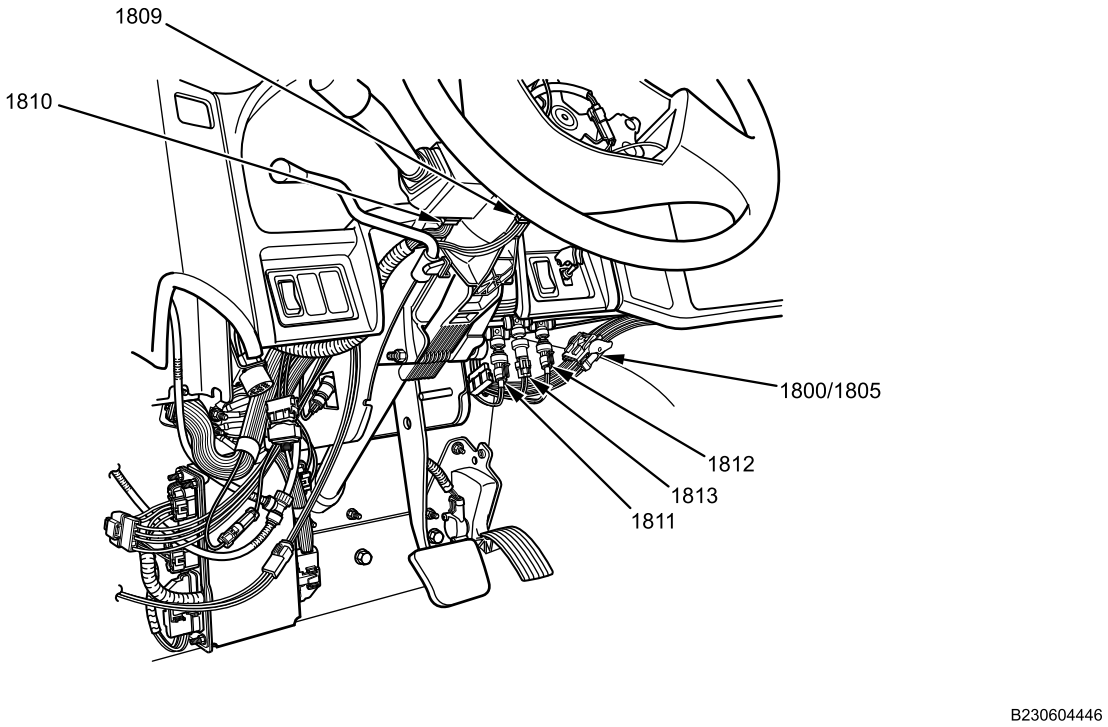

Figure 21. Devices Using Zero-Volt Reference Signal.

89. Turn MAIN POWER switch ON (TM 9-2355-106-10).
90. Turn ignition switch ON (TM 9-2355-106-10).
91. Observe and record voltage between connector 1805 pin A4 and ground with multimeter while disconnecting the following connectors: primary and secondary air pressure transducers (1811 and 1812), clockspring (1809), park brake switch (1813), and wiper control (1810). Refer to Figure 21 and Figure 20.

CONDITION/INDICATION

Did multimeter read 0 volts when any device was disconnected?

DECISION

NO Go to Step 144.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

YES Go to next step.

STEP

92. Refer to recorded results.

CONDITION/INDICATION

Did multimeter read 0 volts when connectors 1811 or 1812 were disconnected?

DECISION

YES Go to AIR 1/Primary Air Pressure Gauge Troubleshooting Procedure (WP 0086).
NO Go to next step.

STEP

93. Refer to recorded results.

CONDITION/INDICATION

Did multimeter read 0 volts when connectors 1809 or 1813 were disconnected?

DECISION

YES Go to Cruise Control Operational Checkout Procedure (WP 0106).
NO Go to Windshield Wiper Switch Inputs to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0115).

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

94. Turn ignition switch OFF (TM 9-2355-106-10).
95. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
96. Disconnect ZTSE4477 breakout box female connector from ESC. Refer to Figure 22.

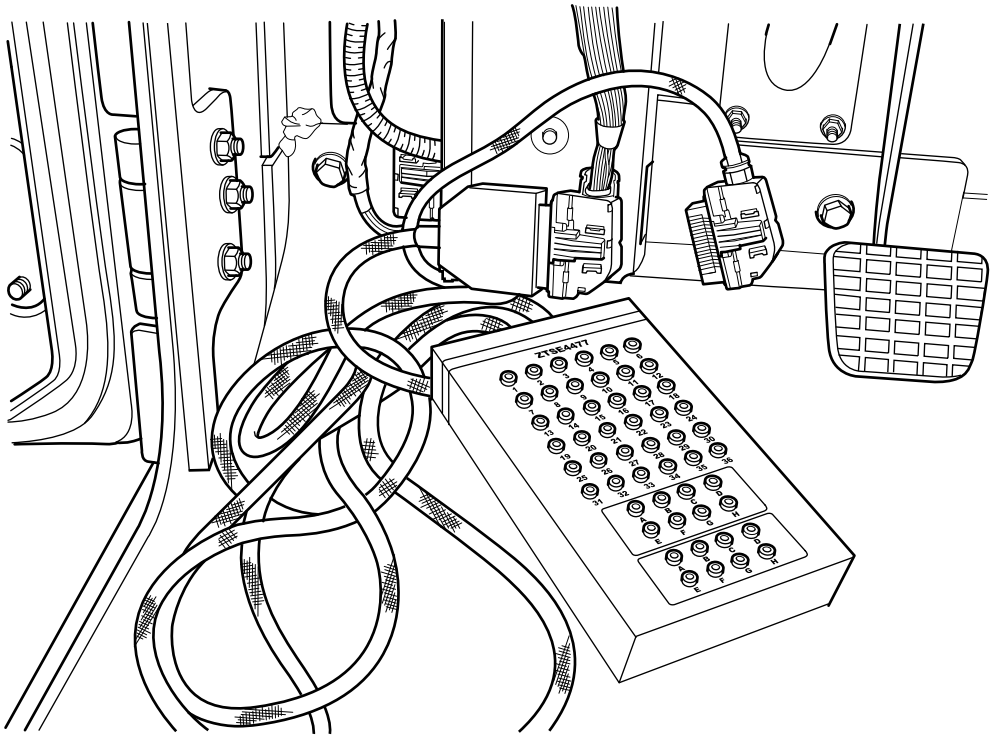

Figure 22. Connector 1600 to Breakout Box Male Connector.

97. Disconnect connector 1800 from 1805 under instrument panel. Refer to Figure 23.

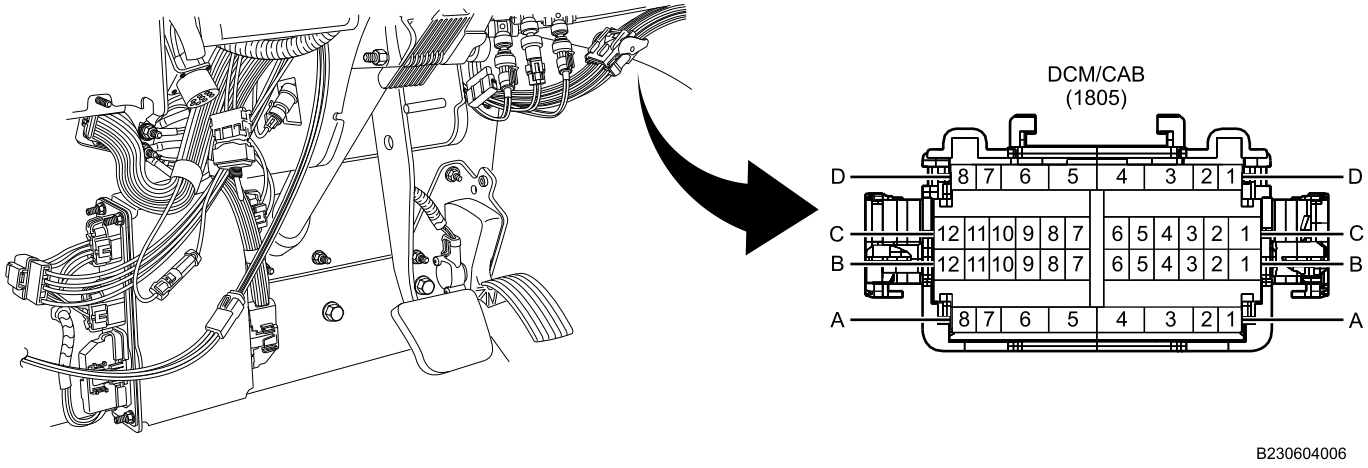

Figure 23. Cab/DCM Connector Under Instrument Panel.

98. Measure resistance between ZTSE4477 breakout box pin 3 and connector 1800 terminal A4 with multimeter. Refer to Figure 24 and Figure 23.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

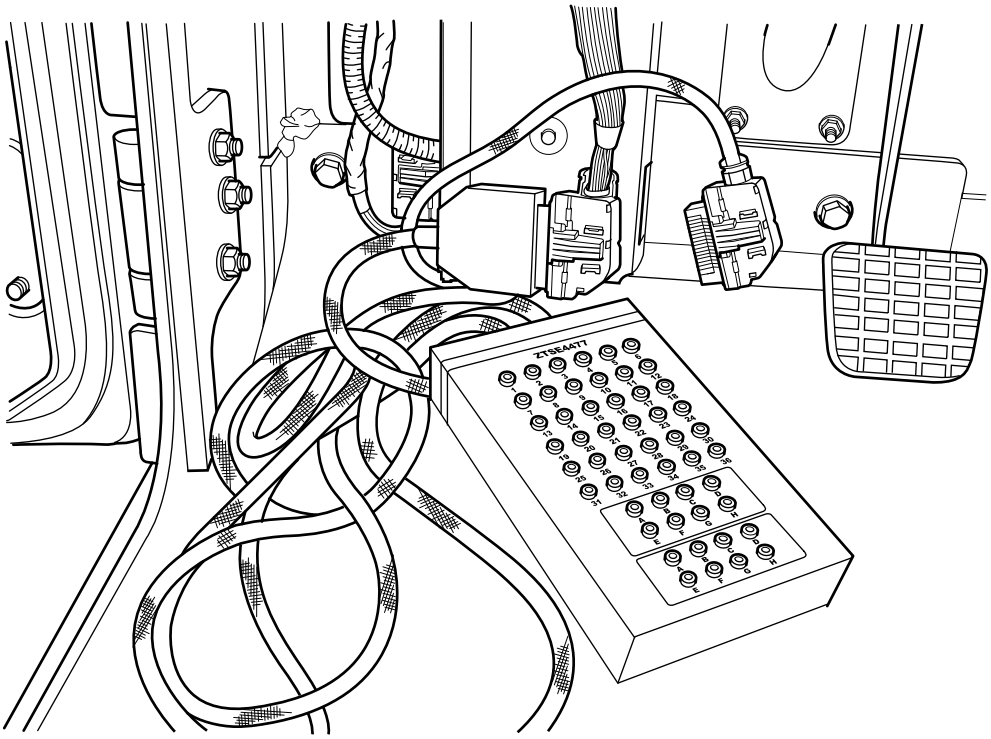

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Figure 24. Connector 1600 to Breakout Box Male Connector.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 142.
NO Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

99. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).
100. Disconnect clockspring connector 1809 under instrument panel. Refer to Figure 25.

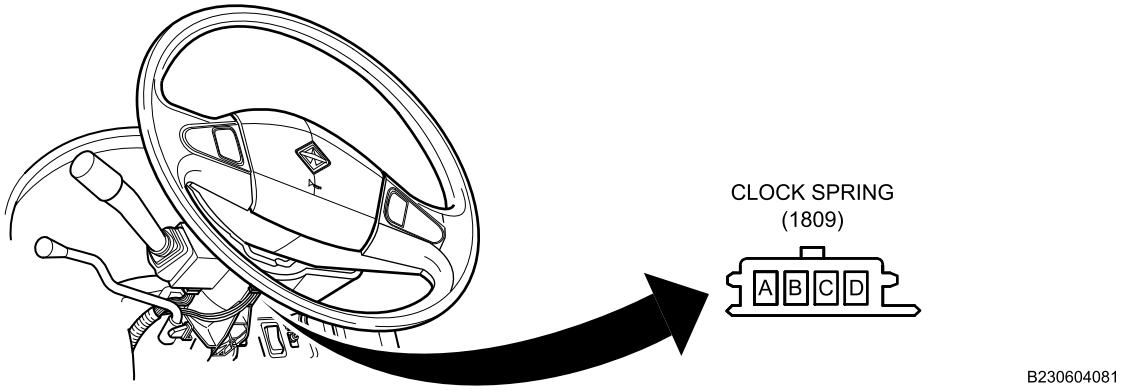


Figure 25. Clockspring Connector 1809.

101. Measure resistance between connector 1805 terminal A4 and connector 1809 terminal A with multimeter. Refer to Figure 26. Refer to Figure 25.

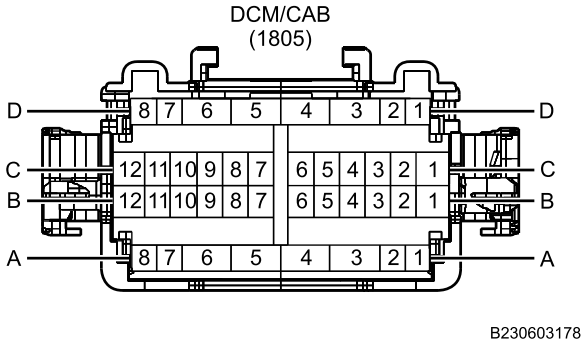


Figure 26. Connector 1800.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 144.
NO Go to Step 146.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

102. Turn ignition switch OFF (TM 9-2355-106-10).
103. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
104. Disconnect connector 4004 at ESC. Refer to Figure 27.

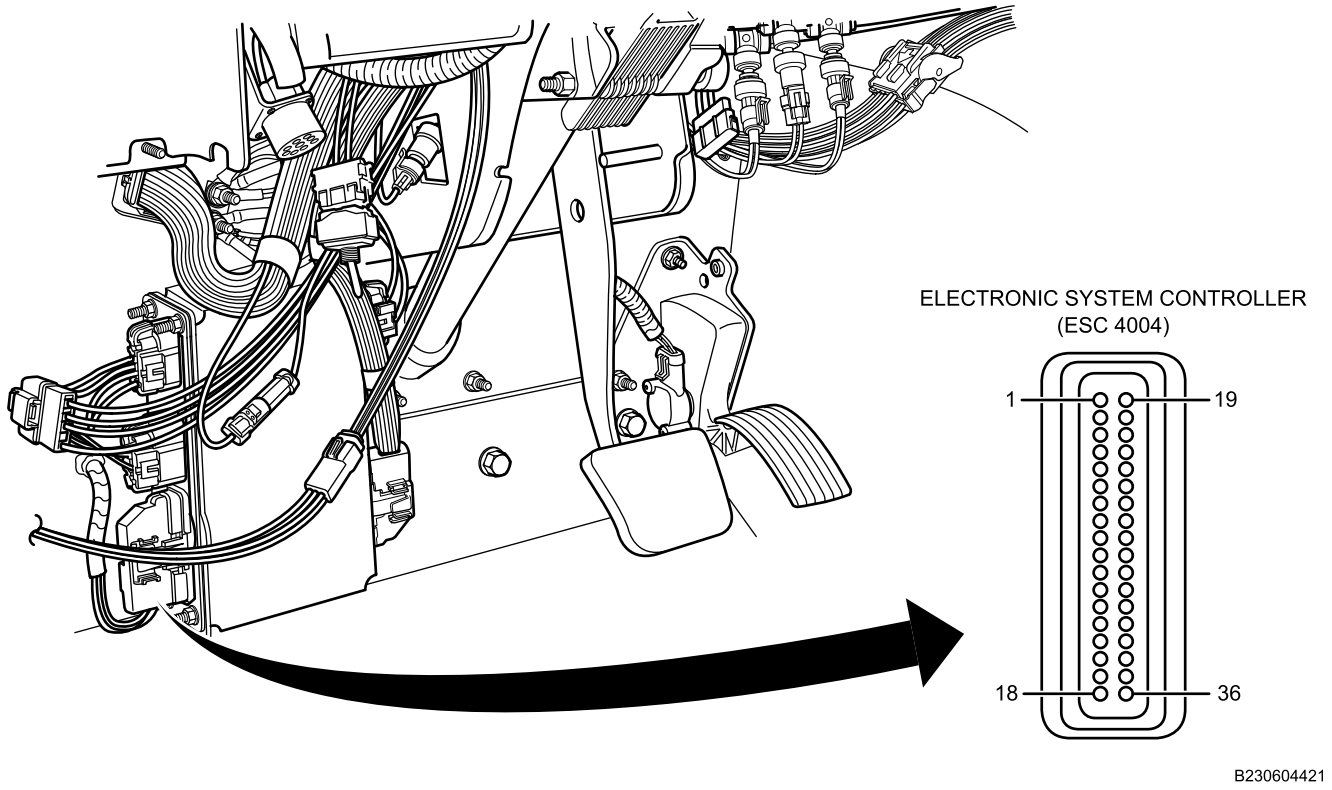


Figure 27. ESC Connector Under Left Side Instrument Panel.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

105. Install connector 4004 on ZTSE4477 breakout box male connector. Install ZTSE4477 breakout box female connector on ESC. Refer to Figure 28.

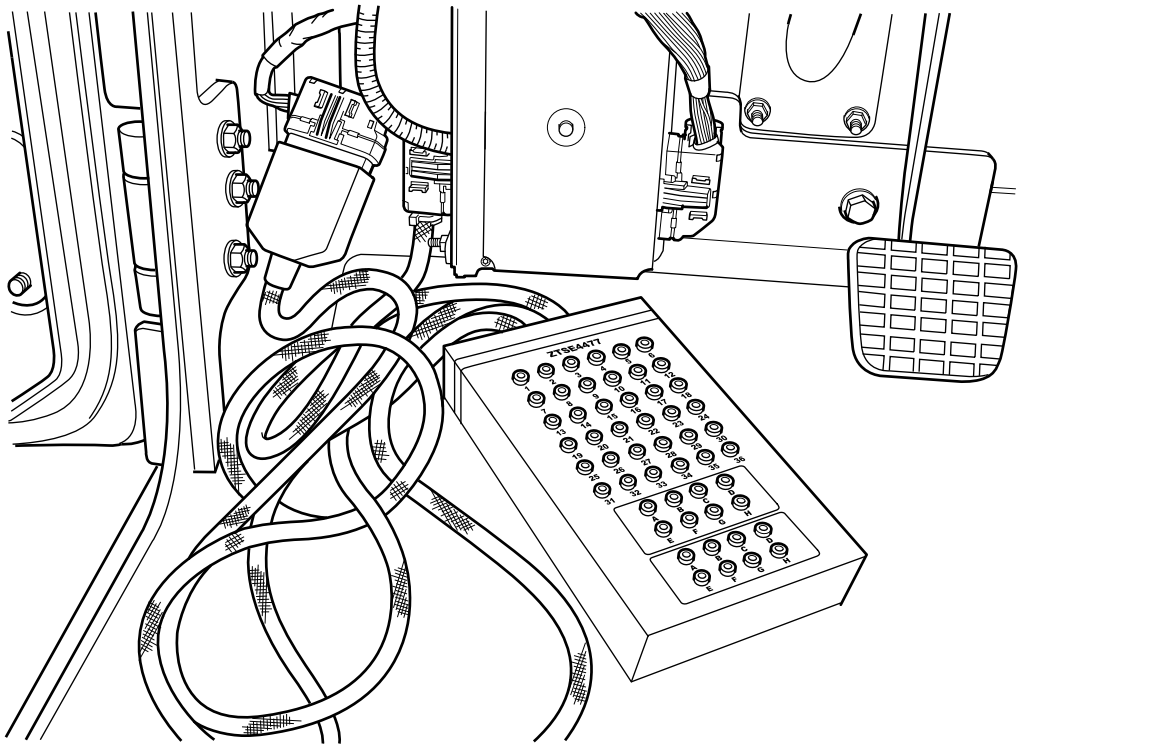


Figure 28. Breakout Box Connected to ESC and Connector 4004.

106. Turn MAIN POWER switch ON (TM 9-2355-106-10).
107. Turn ignition switch ON (TM 9-2355-106-10).
108. Measure voltage between ZTSE4477 breakout box pin 26 and ground with multimeter. Refer to Figure 28.

CONDITION/INDICATION

Does multimeter read more than 0 volts?

DECISION

NO Go to Step 133.
YES Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

109. Turn ignition switch OFF (TM 9-2355-106-10).
110. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
111. Disconnect ZTSE4477 breakout box female connector from ESC. Refer to Figure 29.

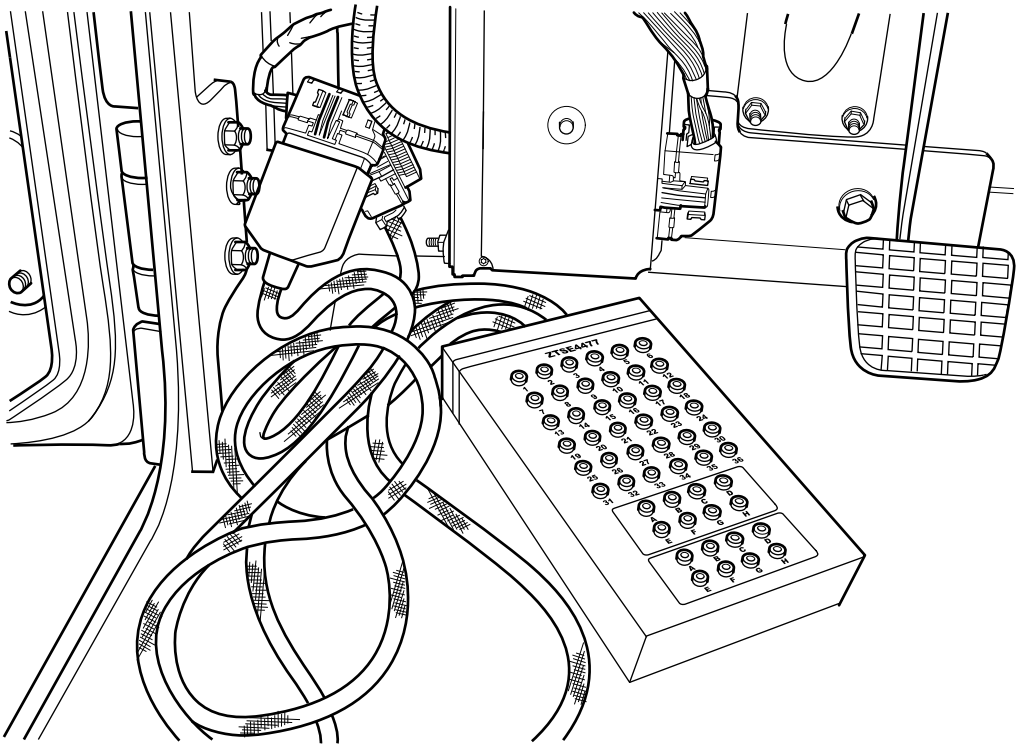


Figure 29. Connector 4004 to Breakout Box Male Connector.

112. Turn MAIN POWER switch ON (TM 9-2355-106-10).
113. Turn ignition switch ON (TM 9-2355-106-10).
114. Measure voltage between ZTSE4477 breakout box pin 26 and ground with multimeter. Refer to Figure 29.

CONDITION/INDICATION

Does multimeter read more than 0 volts?

DECISION

NO Go to Step 146.
YES Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

115. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
116. Remove left engine armor bracket. Refer to Left Engine Armor Plate Bracket Removal and Installation (WP 0598).
117. Disconnect splice block connector 4830 under power distribution center in engine compartment. Refer to Figure 30.

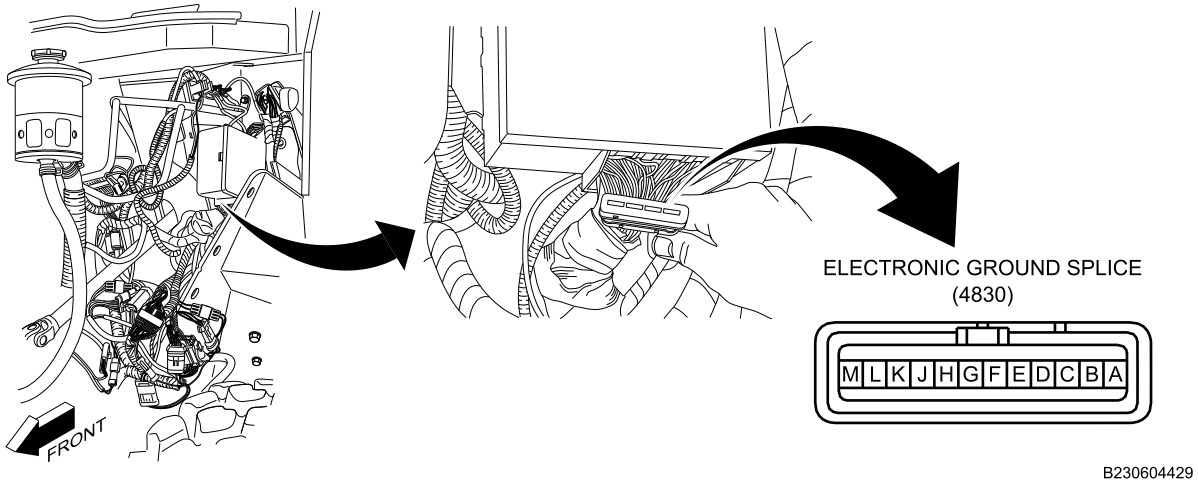


Figure 30. Splice Block Connector Near Power Distribution Center Underhood.

118. Turn MAIN POWER switch ON (TM 9-2355-106-10).
119. Turn ignition switch ON (TM 9-2355-106-10).

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

120. Measure voltage between ZTSE4477 breakout box pin 26 and ground with multimeter. Refer to Figure 31.

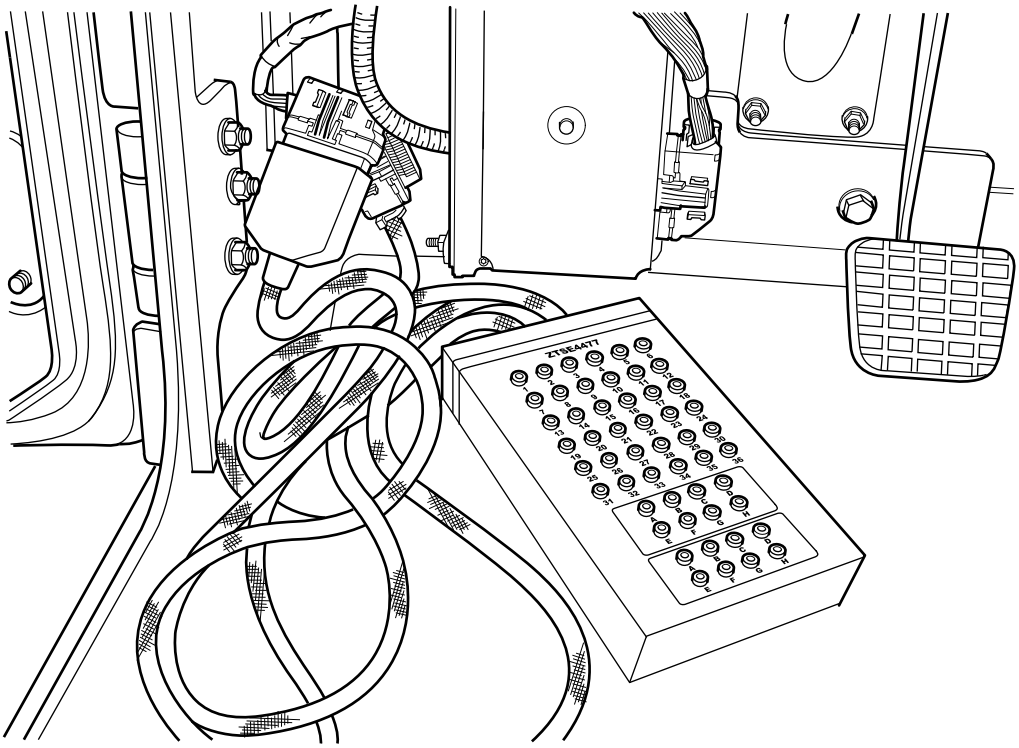


Figure 31. Connector 4004 to Breakout Box Male Connector.

CONDITION/INDICATION

Does multimeter read more than 0 volts?

DECISION

YES Go to Step 143.
NO Go to next step.

STEP

121. Measure voltage between splice block connector 4830 terminal C and ground with multimeter. Refer to Figure 30.

CONDITION/INDICATION

Did multimeter read more than 0 volts?

DECISION

YES Go to Step 143.
NO Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

122. Remove fuel tank armor. Refer to Exterior Fuel Tank Armor Door Removal and Installation (WP 0605).
123. Disconnect fuel level sensor connector 9100 at fuel tank. Refer to Figure 32.

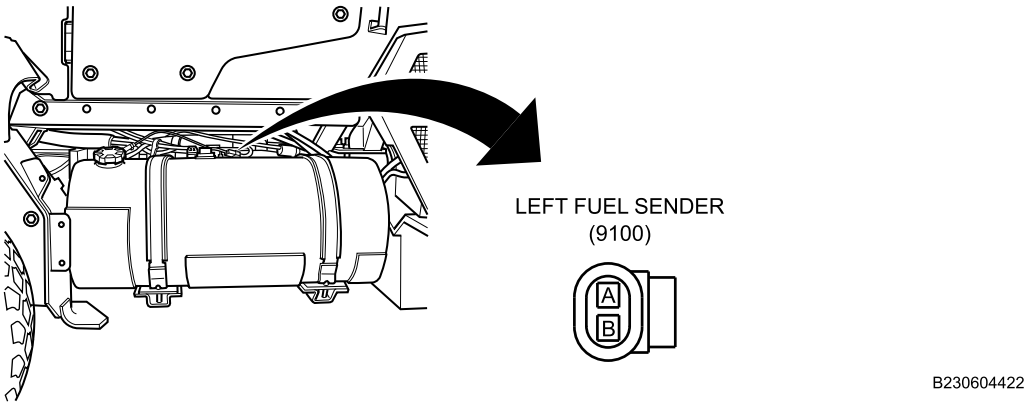


Figure 32. Fuel Level Sender Connector Behind Fuel Tank Armor.

124. Turn MAIN POWER switch ON (TM 9-2355-106-10).
125. Turn ignition switch ON (TM 9-2355-106-10).
126. Measure voltage between splice block connector 4830 terminal A and ground with multimeter. Refer to Figure 33.

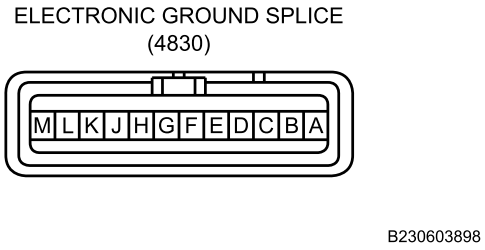


Figure 33. Splice Block Connector 4830.

CONDITION/INDICATION

Does multimeter read more than 0 volts?

DECISION

NO Go to Step 147.
YES Go to next step.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

127. Turn ignition switch OFF (TM 9-2355-106-10).
128. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
129. Disconnect connector 9700/9714 located below power distribution center. Refer to Figure 34.

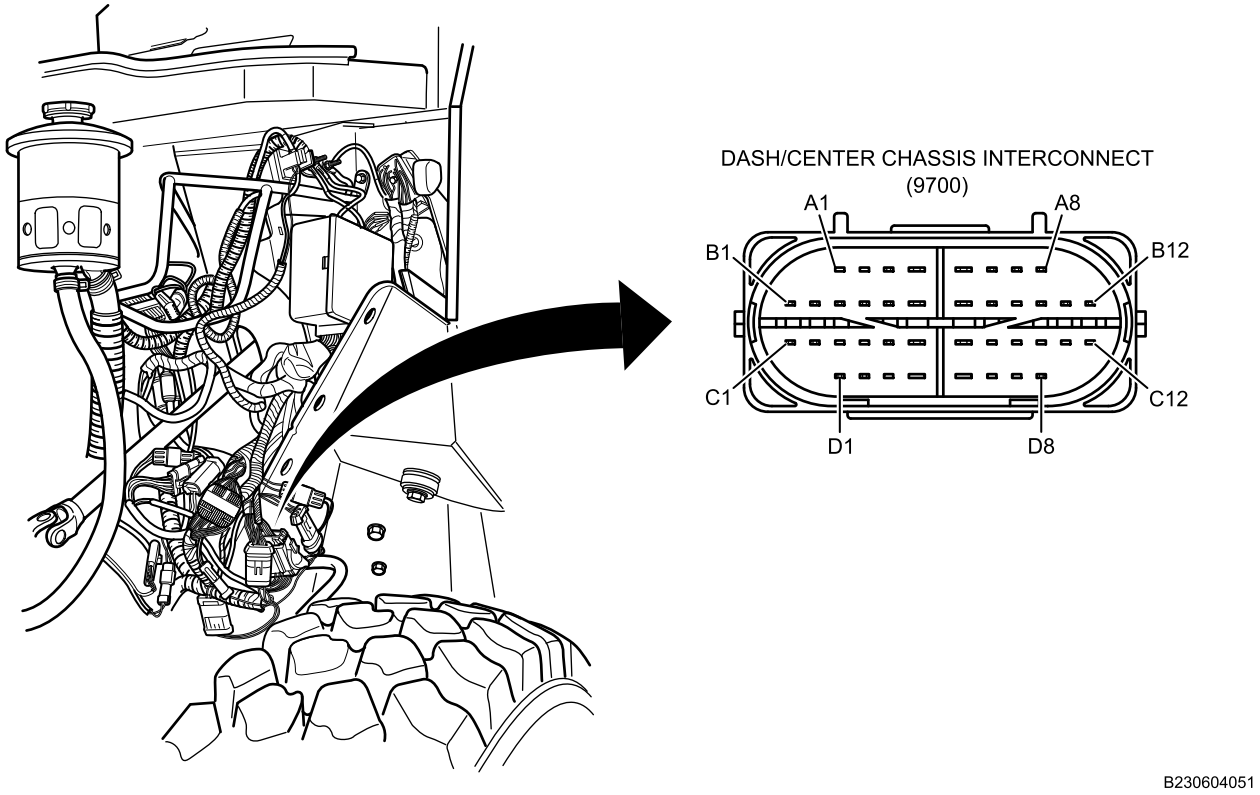


Figure 34. Dash/Center Chassis Interconnect Below Power Distribution Center Underhood.

130. Turn MAIN POWER switch ON (TM 9-2355-106-10).
131. Turn ignition switch ON (TM 9-2355-106-10).
132. Measure voltage between connector 4830 terminal A and ground with multimeter. Refer to Figure 33.

CONDITION/INDICATION

Does multimeter read more than 0 volts?

DECISION

YES Go to Step 143.
NO Go to Step 145.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

133. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
134. Remove left engine armor bracket. Refer to Left Engine Armor Plate Bracket Removal and Installation (WP 0598).
135. Disconnect ZTSE4477 breakout box female connector from ESC. Refer to Figure 35.

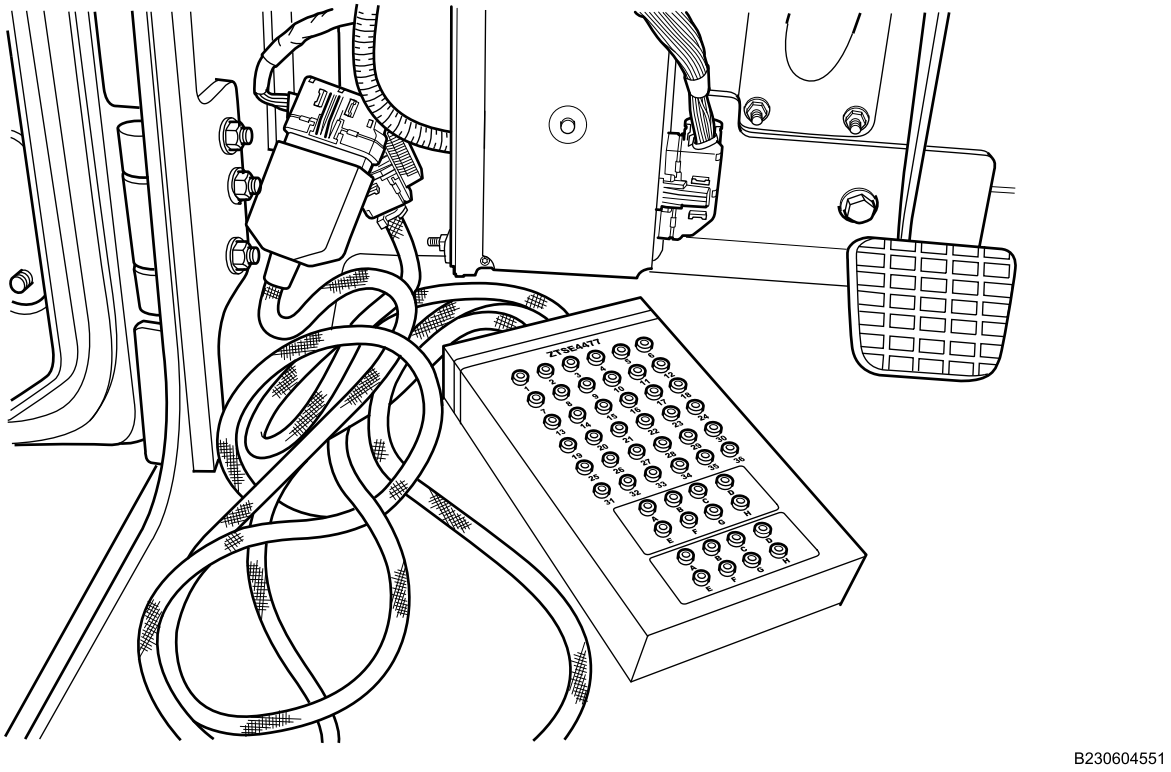


Figure 35. Connector 4004 to Breakout Box Male Connector.

136. Disconnect electronic ground splice connector 4830. Refer to Figure 36.

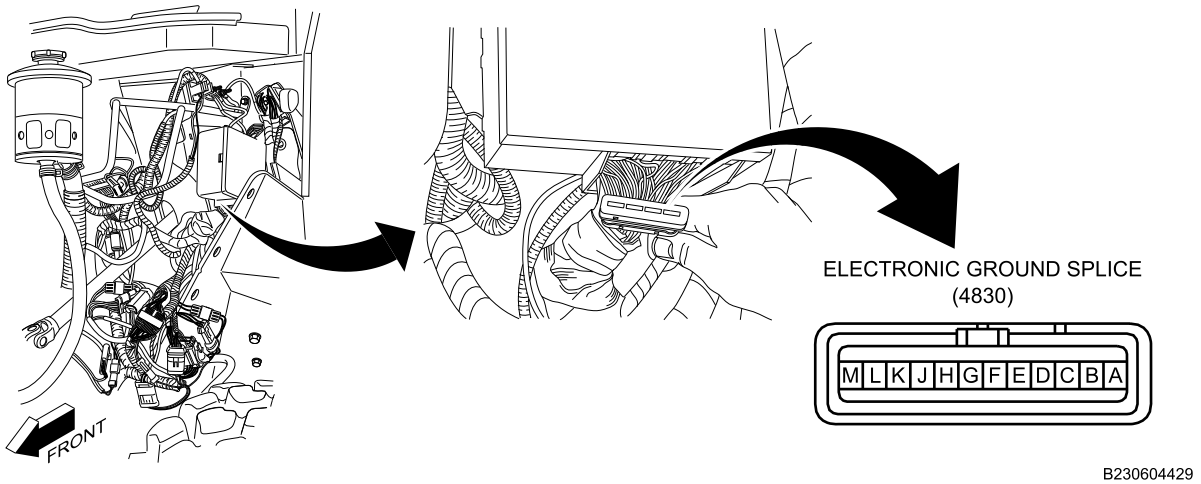


Figure 36. Splice Block Connector 4830.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

137. With assistant, measure resistance between ZTSE4477 breakout box pin 26 and connector 4830 terminal B with multimeter. Refer to Figure 35. Refer to Figure 36.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 146.
NO Go to Step 143.

STEP

138. Turn ignition switch OFF (TM 9-2355-106-10).
139. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
140. Inspect the connections at ground stud 1851 for corrosion or looseness. Refer to Figure 37.

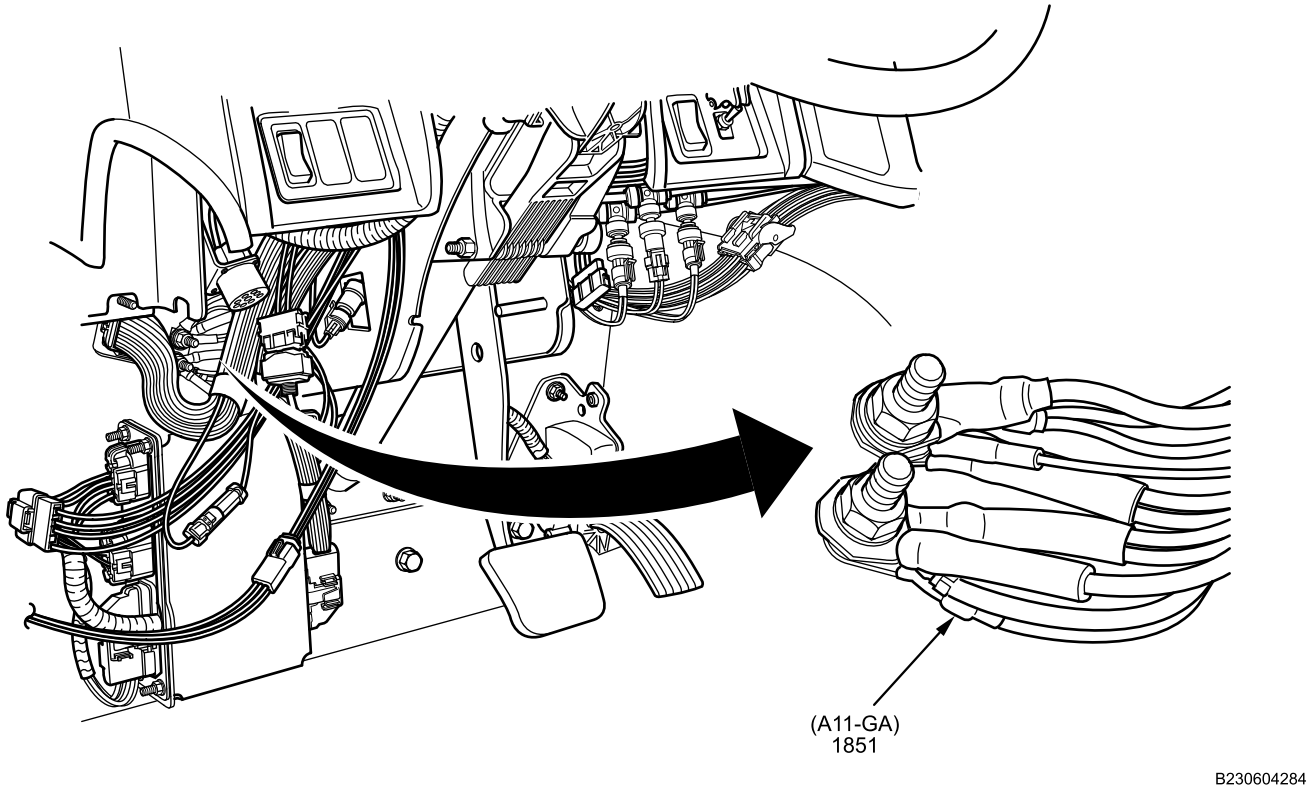


Figure 37. Ground Stud Under Left Side Instrument Panel.

CONDITION/INDICATION

Are connections corrosion-free and secure?

DECISION

YES Go to Step 142.
NO Clean and secure connections. Return vehicle to service.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 141. Switch pack is faulty.

ACTION

Replace switch pack. Refer to Rocker Switch Removal and Installation (WP 0301). Return vehicle to service.

END OF TEST

MALFUNCTION

- 142. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel Wiring Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 143. Power distribution center (PDC) wiring harness is faulty.

ACTION

Replace power distribution center wiring harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 144. Steering column wiring harness is faulty.

ACTION

Replace steering column wiring harness. Refer to Steering Column Wiring Harness Removal and Installation (WP 0324). Return vehicle to service.

END OF TEST

MALFUNCTION

- 145. Center chassis wiring harness is faulty.

ACTION

Replace center chassis wiring harness. Refer to Center Chassis Wiring Harness Removal and Installation (WP 0426). Return vehicle to service.

END OF TEST

MALFUNCTION

- 146. ESC is faulty.

ACTION

Replace ESC. Refer to ESC Removal and Installation (WP 0353). Return vehicle to service.

ELECTRONIC SYSTEM CONTROLLER (ESC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 147. Fuel level sending unit is faulty.

ACTION

Replace fuel level sender. Refer to Fuel Level Sending Unit Removal and Installation (WP 0299). Return vehicle to service.

END OF TEST

MALFUNCTION

- 148. IPC is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

MALFUNCTION

- 149. Condition that resulted in symptom or DTC not present.

ACTION

Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

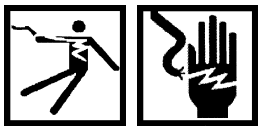
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0005
WP 0006
WP 0059
WP 0068
WP 0301
WP 0319
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 57

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition ON (TM 9-2355-106-10).
3. Turn each rocker switch in switch pack ON and OFF while observing rocker switch lights (TM 9-2355-106-10).

CONDITION/INDICATION

Does each rocker switch light illuminate while switch is ON and go out while switch is OFF?

DECISION

NO Go to Step 8.
YES Go to next step.

STEP

4. Retrieve DTCs. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0006).

CONDITION/INDICATION

Are switch pack DTCs set?

DECISION

NO Go to troubleshooting procedure applicable to feature controlled by inoperative switch. Refer to Vehicle Troubleshooting Symptom Index (WP 0005).
YES Go to next step.

STEP

5. Refer to DTCs retrieved in last test.

CONDITION/INDICATION

Are switch pack communication DTCs set?

DECISION

YES Go to Step 8.
NO Go to next step.

STEP

6. Refer to DTCs retrieved in last test.

CONDITION/INDICATION

Are individual switch fault DTCs set?

DECISION

YES Go to Step 26.
NO Go to next step.

STEP

7. Observe switch pack switches.

CONDITION/INDICATION

Is any rocker switch indicator flashing?

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to troubleshooting procedure applicable to feature controlled by flashing switch. Refer to Vehicle Troubleshooting Symptom Index (WP 0005).
NO Return vehicle to service.

STEP

8. Remove switch pack from instrument panel. Refer to (WP 0301).
9. Disconnect connector 1101M. Refer to Figure 1.

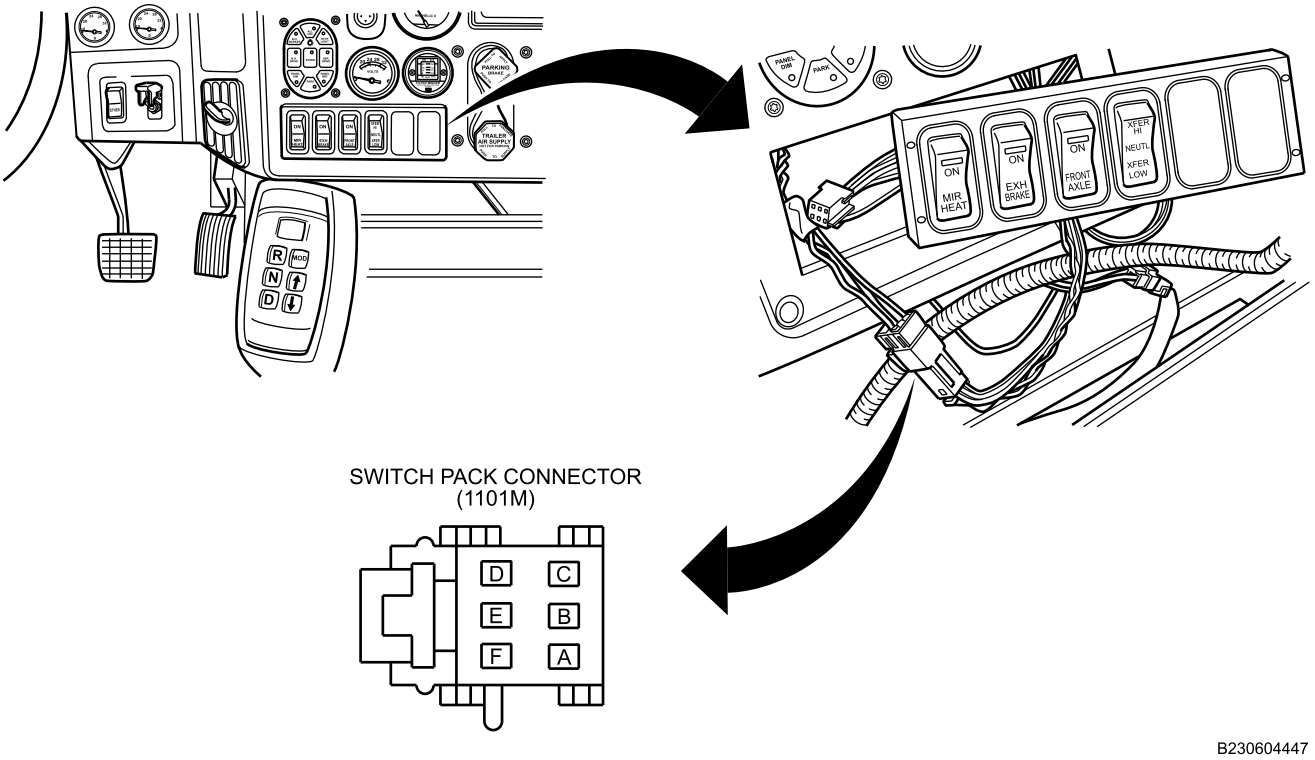


Figure 1. Behind Switch Pack.

10. Measure resistance between connector 1101M terminal A and ground with multimeter. Refer to Figure 1.

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 19.
YES Go to next step.

STEP

11. Turn MAIN POWER switch ON (TM 9-2355-106-10).
12. Turn ignition switch ON (TM 9-2355-106-10).
13. Measure DC voltage between connector 1101M terminal B and ground with multimeter. Refer to Figure 2.

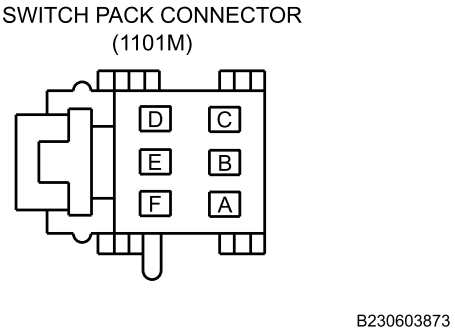


Figure 2. Connector 1101M.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 21.
YES Go to next step.

STEP

14. Measure DC voltage between connector 1101M terminal D and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 3.5V and 5.5V?

DECISION

NO Go to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
YES Go to next step.

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

15. Measure DC voltage between connector 1101M terminal E and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 0.1V and 1.0V?

DECISION

NO Go to Electronic System Controller (ESC) Troubleshooting Procedure (WP 0068).
YES Go to next step.

STEP

16. Turn headlights ON (TM 9-2355-106-10).
17. Adjust panel lights to full brightness (TM 9-2355-106-10).
18. Measure DC voltage between connector 1101M terminal C and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 27.
YES Go to Step 28.

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

19. Disconnect ground eyelet 1851 circuit A11–GA from ground stud. Refer to Figure 3.

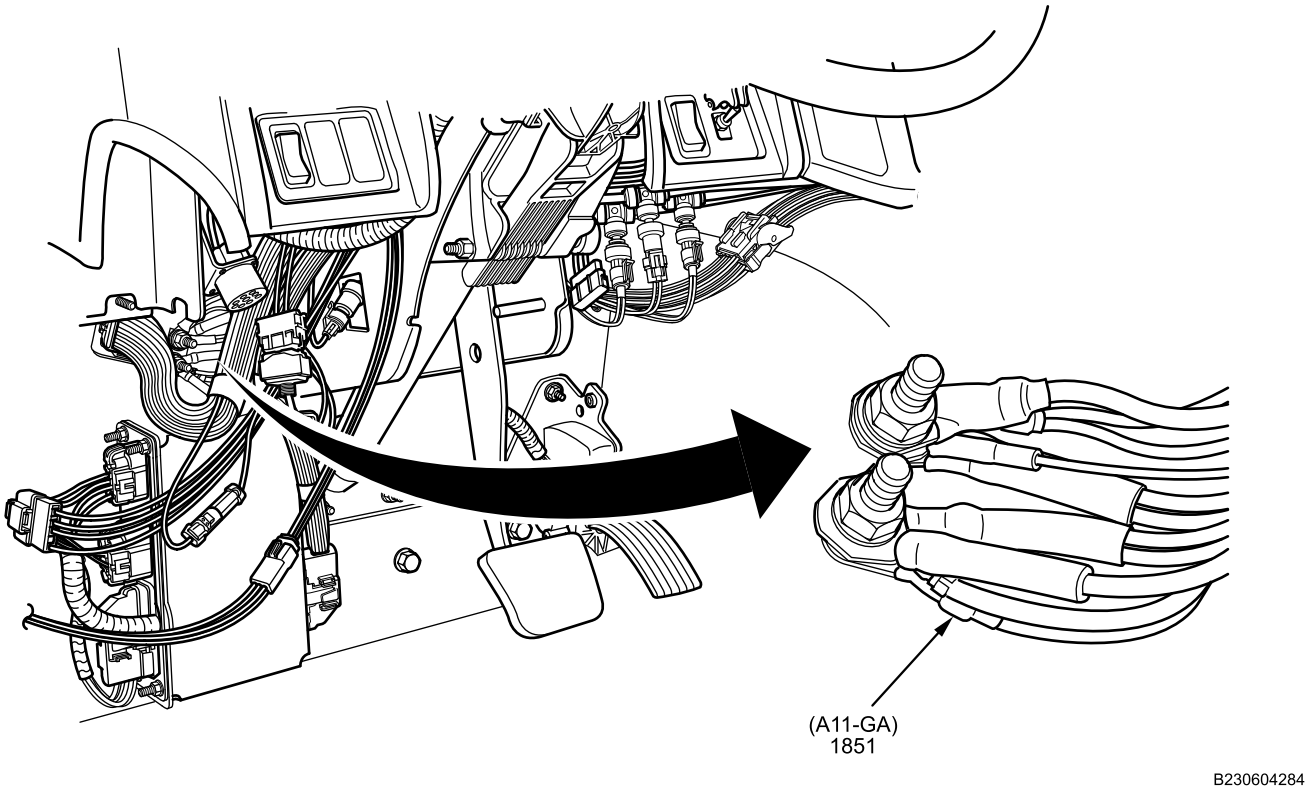


Figure 3. Below Steering Column.

20. Measure resistance between ground eyelet 1851 circuit A11–GA and connector 1101M terminal A with multimeter. Refer to Figure 4 and Figure 5.

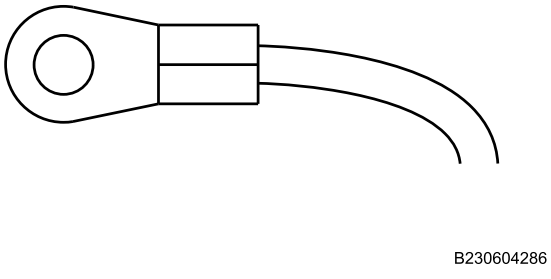


Figure 4. Ground Eyelet 1851.

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE - (CONTINUED)

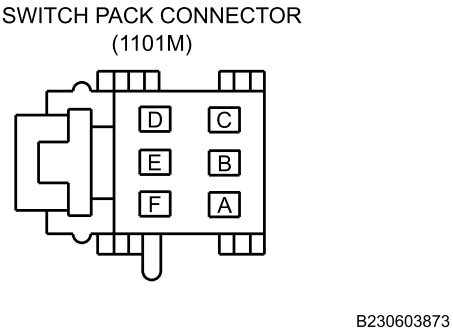


Figure 5. Connector 1101M.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 27.
YES Clean ground eyelet 1851 and connect to ground stud. Return vehicle to service.

STEP

21. Remove and visually inspect fuse F5. Refer to Figure 6.

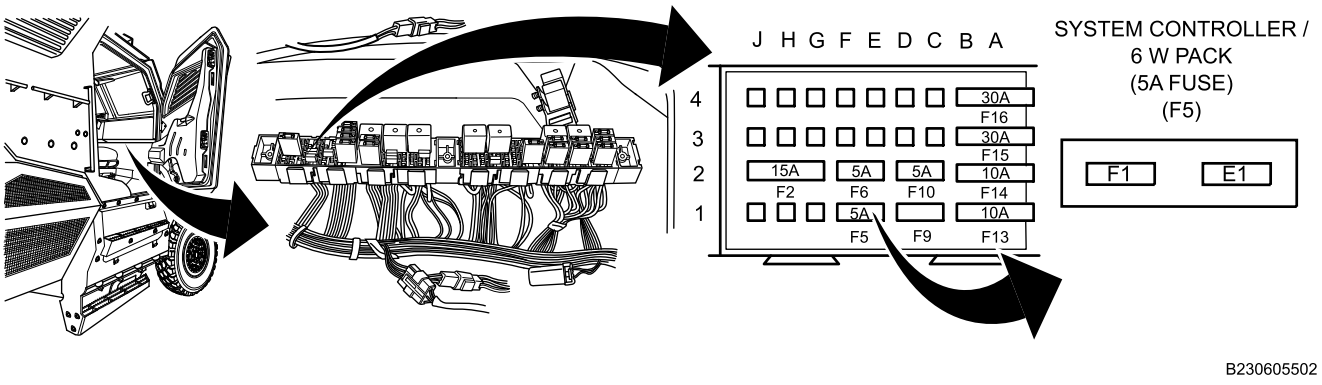


Figure 6. Cabin Fuse Panel.

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Is fuse F5 open?

DECISION

YES Go to Step 25.
NO Go to next step.

STEP

22. Turn ignition switch OFF (TM 9-2355-106-10).
23. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
24. Measure resistance between fuse F5 socket terminal F1 and connector 1101M terminal B, and fuse F5 socket terminal E1 and connector 1101M terminal B with multimeter. Refer to Figure 5 and Figure 6.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for either test?

DECISION

NO Go to Step 27.
YES Go to Power Distribution Troubleshooting Procedure (WP 0059).

STEP

25. Measure resistance between connector 1101M terminal B and ground with multimeter. Refer to Figure 7.

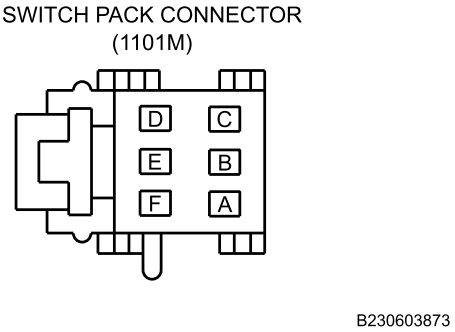


Figure 7. Connector 1101M.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 29.
YES Go to Step 30.

MALFUNCTION

- 26. Individual switch is faulty.

ACTION

Replace switch. Refer to Rocker Switch Removal and Installation (WP 0301). Return vehicle to service.

SWITCH PACK MODULES TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 27. Instrument Panel (IP) wiring harness is faulty.

ACTION

Replace IP wiring harness. Refer to Instrument Panel Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 28. Switch pack is faulty.

ACTION

Replace switch pack. Refer to Rocker Switch Removal and Installation (WP 0301). Return vehicle to service.

END OF TEST

MALFUNCTION

- 29. IP harness is faulty.

ACTION

Replace fuse and IP harness. Refer to Instrument Panel Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 30. Switch pack is faulty.

ACTION

Replace fuse and switch pack. Refer to Rocker Switch Removal and Installation (WP 0301). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

INSTRUMENT PANEL CLUSTER (IPC) OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

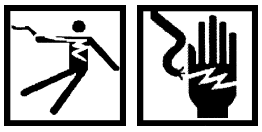
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0005
WP 0071
WP 0072
WP 0088
WP 0092
WP 0097
WP 0297
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine shut off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

Problems with IPC operation can be caused by a lack of power, a malfunctioning IPC, a malfunctioning Electronic System Controller (ESC), a malfunctioning data link, problems in the engine controller, problems in the Antilock Brake System (ABS) controller, problems in the transmission controller, or problems with wiring or sensors feeding the electronic controllers throughout the system.

IPC PRELIMINARY SYSTEM CHECK

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10) while observing IPC. Verify IPC responds to ignition ON.

CONDITION/INDICATION

INSTRUMENT PANEL CLUSTER (IPC) OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

IPC does not respond to ignition ON.

CORRECTIVE ACTION

Go to Instrument Panel Cluster (IPC) Power and Data Link Circuits Troubleshooting (WP 0071).

NOTE

A correct gauge sweep is as follows:

After the ignition is turned on, a gauge sweep of the IPC will be performed. Each gauge must sweep from zero to maximum to zero in unison. All gauge warning lights will illuminate along with panel warning lights applicable to features installed on the vehicle. The YELLOW and RED ENGINE warning lamps should also illuminate. The lights controlled by the panel dimmer in the IPC will also come on during the gauge sweep. Alarms associated with gauge warning lights will not sound. All segments of the IPC Liquid Quartz Display (LCD) should display while the gauges sweep. At the end of the sweep, the LCD will turn off all segments for 5 seconds, display the firmware version number, and then return to operational mode.

1. Turn ignition OFF then ON while observing IPC (TM 9-2355-106-10). Verify IPC gauge sweep.

IPC gauge sweep performs with errors.

Go to Malfunctioning Instrument Panel Cluster (IPC) Troubleshooting Procedure (WP 0072).

1. Turn ignition OFF then ON (TM 9-2355-106-10). Observe IPC after gauge sweep concludes. Verify warning lamps are not illuminated.

Warning lamps are illuminated.

Go to troubleshooting symptom index for specific warning light (WP 0005).

1. Turn ignition OFF then ON (TM 9-2355-106-10). Observe IPC after gauge sweep concludes.

A gauge points to the 6 o'clock position or provides an incorrect reading.

Go to troubleshooting symptom index for specific gauge (WP 0005).

NOTE

Correct Select/Reset button function is as follows:

The Select/Reset switch controls the digital display. The switch allows the user to select modes within each major functional area of the display and perform reset functions. Each time the switch is momentarily depressed, it will scan through a different mode. Depressing the switch for 3 seconds or more will clear the display or toggle between options, depending upon the current mode. The Reset function has no effect if the parameter cannot be reset.

1. Verify Select/Reset button functions correctly.

Select/Reset button functions incorrectly.

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).

1. Turn headlights ON (TM 9-2355-106-10). Verify headlight high/low beam indicator and MVLS panel dimmer controls work correctly (TM 9-2355-106-10).

Headlight indicator or MVLS panel dimmer controls work incorrectly.

Go to Master Vehicle Light Switch (MVLS) Troubleshooting Procedure (WP 0092) and Service Headlights Troubleshooting Procedure (WP 0097).

1. Verify odometer backlight dimmer control works correctly (TM 9-2355-106-10).

Odometer backlight dimmer control does not work correctly.

INSTRUMENT PANEL CLUSTER (IPC) OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).

1. Turn ignition OFF then ON (TM 9-2355-106-10). Turn headlights ON (TM 9-2355-106-10). Pump brakes to reduce air pressure below 70 psi (482.6 kPa). Verify alarm sounds when air pressure is below 70 psi (482.6 kPa).

Alarm does not sound when air pressure is below 70 psi (482.6 kPa).

Go to Audible Alarm Troubleshooting Procedure (WP 0088).

END OF WORK PACKAGE

FIELD MAINTENANCE

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Materials/Parts
Grease (WP 0794, Item 22)
Lockwasher (WP 0796, Item 17)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0067
WP 0059
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Cabin doors open and secured (TM 9-2355-106-10)
IPC removed (WP 0297)

Drawings Required
Schematic (WP 0789, Figure 35)

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Cabin door must be secured in the open position by using heavy duty straps to prevent accidental closure during vehicle maintenance. Pull check link retaining pin prior to securing door open. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-19).
3. Measure DC voltage between connector 1500 terminal 3 and ground with multimeter. Refer to Figure 1.

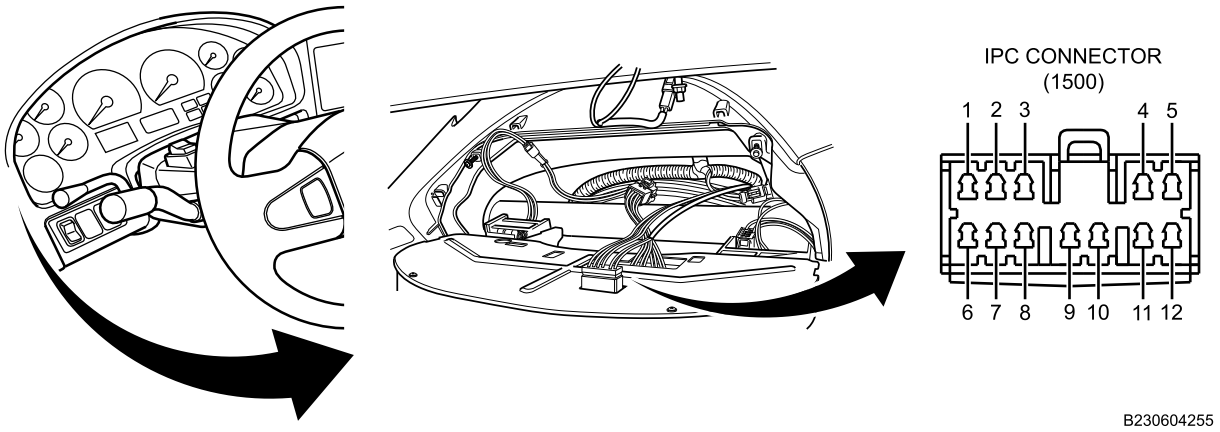


Figure 1. Behind IPC.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 8.
YES Go to next step.

STEP

4. Measure DC voltage between connector 1500 terminal 8 and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 15.
YES Go to next step.

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Turn ignition switch OFF (TM 9-2355-106-19).
6. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
7. Measure resistance between connector 1500 terminal 7 and ground with multimeter. Refer to Figure 2.

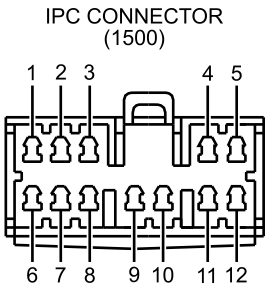


Figure 2. Connector 1500.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 22.
YES Go to Step 26.

STEP

8. Turn ignition switch OFF (TM 9-2355-106-19).
9. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
10. Remove and inspect fuse F2. Refer to Figure 3.

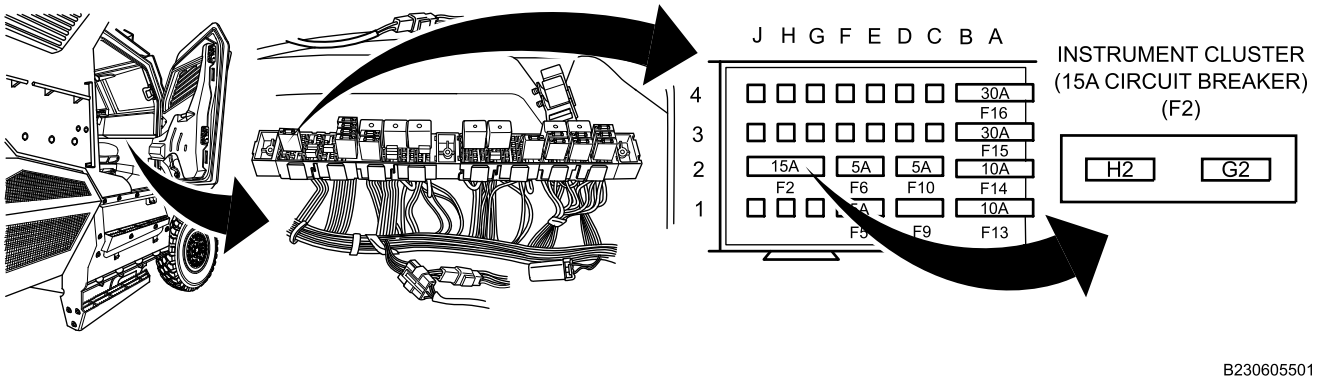


Figure 3. Passenger Side Fuse Box.

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Is fuse F2 open?

DECISION

NO Go to Step 12.
YES Go to next step.

STEP

11. Measure resistance between connector 1500 terminal 3 and ground with multimeter. Refer to Figure 4.

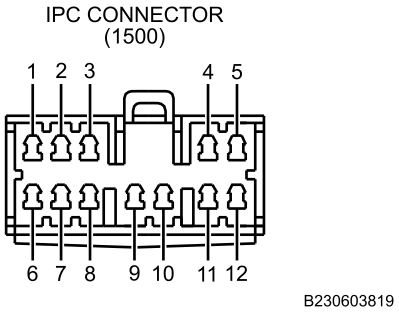


Figure 4. Connector 1500.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 30.
NO Go to Step 31.

STEP

12. Turn MAIN POWER switch ON (TM 9-2355-106-10).
13. Turn ignition switch ON (TM 9-2355-106-19).
14. Measure DC voltage between fuse F2 socket terminal H2 and ground, and fuse F2 socket terminal G2 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

NO Go to Power Distribution Troubleshooting (WP 0059).
YES Go to Step 31.

STEP

15. Turn ignition switch OFF (TM 9-2355-106-19).

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

16. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
17. Remove and inspect fuse F19. Refer to Figure 5.

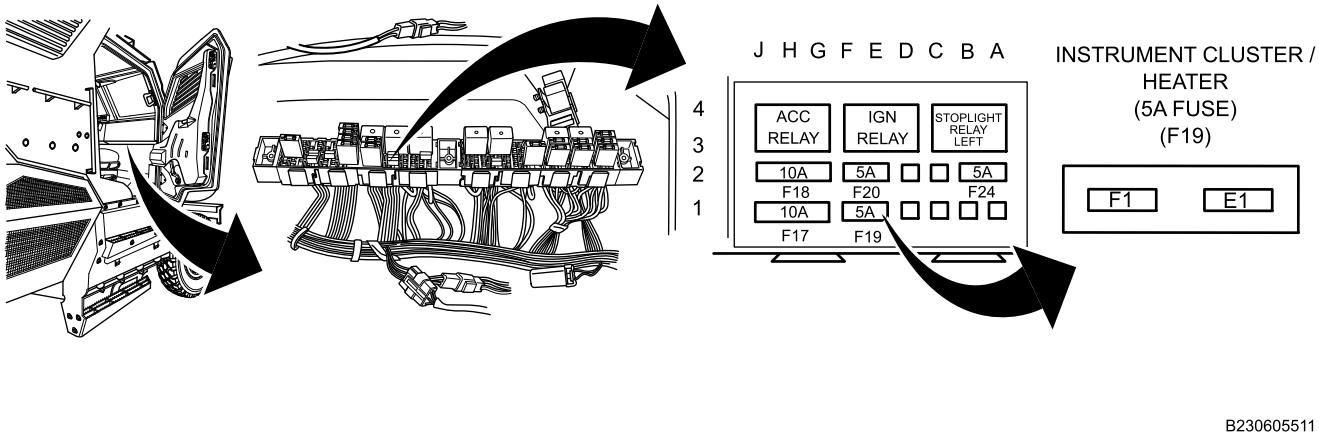


Figure 5. Passenger Side Fuse Box.

CONDITION/INDICATION

Is fuse F19 open?

DECISION

NO Go to Step 19.
YES Go to next step.

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

18. Measure resistance between connector 1500 terminal 8 and ground with multimeter. Refer to Figure 6.

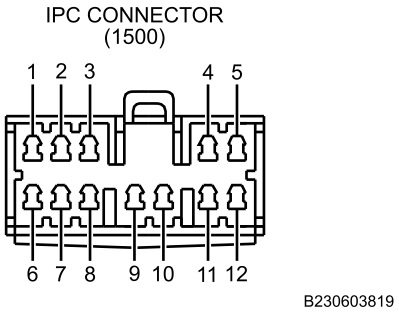


Figure 6. Connector 1500.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 30.
NO Go to Step 31.

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

19. Turn MAIN POWER switch ON (TM 9-2355-106-10).
20. Turn ignition switch ON (TM 9-2355-106-19).
21. Measure DC voltage between fuse F19 socket terminal F1 and ground, and fuse socket F19 terminal E1 and ground with multimeter. Refer to Figure 7.

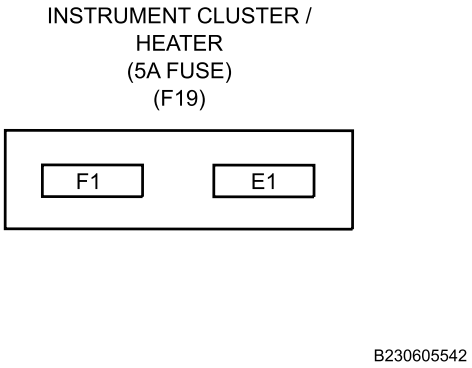


Figure 7. Fuse F19 Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either test?

DECISION

NO Go to Power Distribution Troubleshooting Procedure (WP 0059).
YES Go to Step 31.

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Remove nut (Figure 8, Item 1) and lockwasher (Figure 8, Item 7) from upper interior cabin IP ground stud (Figure 8, Item 2). Discard lockwasher.

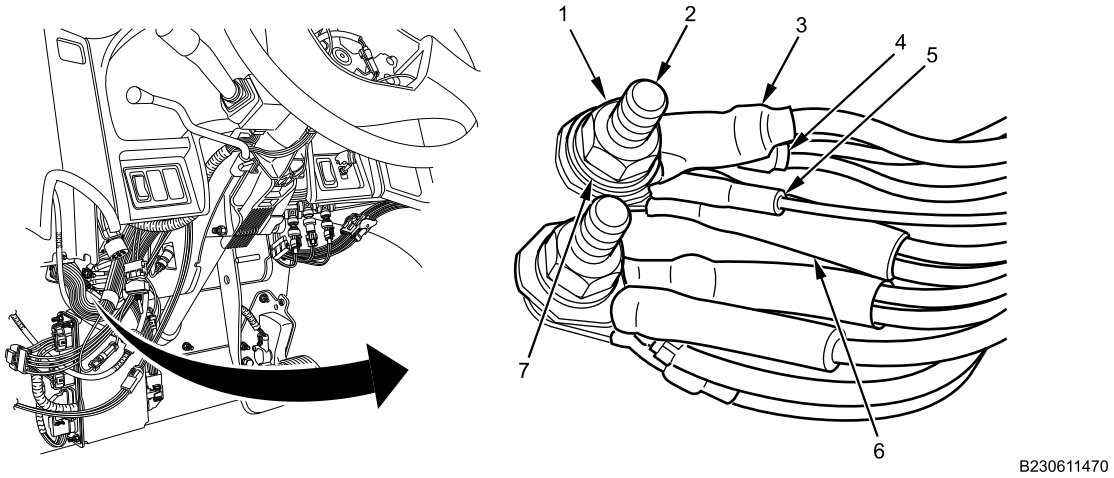


Figure 8. Driver Side IP.

23. Clean four ground wires (Figure 8, Item 3, 4, 5, and 6) at upper interior cabin IP ground stud (Figure 8, Item 2).
24. Secure four ground wires (Figure 8, Item 3, 4, 5, and 6) on ground stud (Figure 8, Item 2) with new lockwasher (Figure 8, Item 7) and nut (Figure 8, Item 1).
25. Measure resistance between connector 1500 terminal 7 and ground with multimeter. Refer to Figure 9.

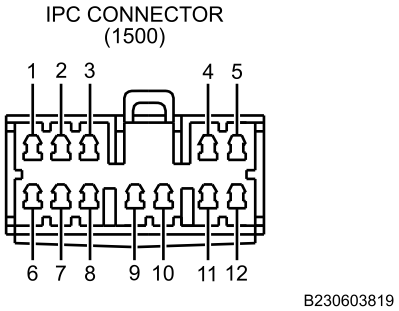


Figure 9. Connector 1500.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 31.
YES Go to next step.

INSTRUMENT PANEL CLUSTER (IPC) POWER AND DATA LINK CIRCUITS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

26. Turn MAIN POWER switch ON (TM 9-2355-106-10).
27. Turn ignition switch ON (TM 9-2355-106-19).
28. Measure DC voltage between connector 1500 terminal 4 and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read between 1V and 4V?

DECISION

NO Go to Multiplexing Data Link Circuits Troubleshooting Procedure (WP 0067).
YES Go to next step.

STEP

29. Measure DC voltage between connector 1500 terminal 5 and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read between 1V and 4V?

DECISION

NO Go to Multiplexing Data Link Circuits Troubleshooting Procedure (WP 0067).
YES Return vehicle to service.

MALFUNCTION

- 30. IPC is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

MALFUNCTION

- 31. IP harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

MALFUNCTIONING INSTRUMENT PANEL CLUSTER (IPC) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

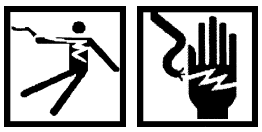
Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0297
WP 0293
WP 0294
WP 0295
WP 0299
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

WARNING



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CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

MALFUNCTIONING INSTRUMENT PANEL CLUSTER (IPC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

A correct gauge sweep is as follows:

After the ignition is turned on, a gauge sweep of the Instrument Panel Cluster (IPC) will be performed. Each gauge must sweep from zero to maximum to zero in unison. All gauge warning lights will illuminate along with panel warning lights applicable to features installed on the vehicle. The YELLOW and RED ENGINE warning lamps should also illuminate. Alarms associated with gauge warning lights will not sound. All segments of the IPC Liquid Crystal Display (LCD) should display while the gauges sweep. At the end of the sweep, the LCD will turn off all segments for 5 seconds, display the firmware version number, and then return to operational mode.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON while observing gauges (TM 9-2355-106-10).

CONDITION/INDICATION

Do all gauges sweep correctly?

DECISION

NO Go to Step 13.
YES Go to next step.

STEP

3. Press PANEL BRT. and then ENTER on the Master Vehicle Light Switch (MVLS) while observing panel lights. The following panel lights should light:
   - Fuel level gauge light
   - Speedometer light
   - Tachometer light
   - Water temperature gauge light
   - Transmission fluid temperature gauge light
   - Oil pressure gauge light
   - Primary air pressure gauge light
   - Secondary air pressure gauge light
   - Voltmeter light

CONDITION/INDICATION

Do all panel lights illuminate?

DECISION

YES Go to Step 9.
NO Go to next step.

MALFUNCTIONING INSTRUMENT PANEL CLUSTER (IPC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

4. Turn ignition switch OFF (TM 9-2355-106-10).
5. Replace the suspect panel light bulb. Refer to Instrument Panel (IP) Light Bulb Removal and Installation (WP 0299).
6. Turn MAIN POWER switch ON (TM 9-2355-106-10).
7. Turn ignition switch ON (TM 9-2355-106-10).
8. Press PANEL BRT. and then ENTER on the MVLS while observing panel lights.

CONDITION/INDICATION

Does previously malfunctioning panel light illuminate?

DECISION

NO Go to Step 22.
YES Go to next step.

STEP

9. Turn ignition switch OFF (TM 9-2355-106-10).
10. Turn ignition switch ON while observing IPC LCD (TM 9-2355-106-10).

CONDITION/INDICATION

Does IPC LCD function properly during gauge sweep?

DECISION

NO Go to Step 22.
YES Go to next step.

STEP

11. Turn ignition switch OFF (TM 9-2355-106-10).
12. Turn ignition switch ON while observing warning lamps (TM 9-2355-106-10).

CONDITION/INDICATION

Are all warning lamps for installed features illuminated during gauge sweep?

DECISION

NO Go to Step 19.
YES Return vehicle to service.

MALFUNCTIONING INSTRUMENT PANEL CLUSTER (IPC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Note which gauge malfunctioned.

CONDITION/INDICATION

Do transmission fluid temperature gauge, primary air pressure gauge, and secondary air pressure gauge sweep correctly?

DECISION

YES Go to Step 22.
NO Go to next step.

STEP

14. Note which gauge malfunctioned.

CONDITION/INDICATION

Is transmission fluid temperature gauge malfunctioning?

DECISION

YES Go to Step 17.
NO Go to next step.

STEP

15. Swap air pressure gauges and jumper harnesses with known good air pressure gauges and harnesses. Refer to Air 1 Pressure Gauge and Harness Removal and Installation (WP 0294) and Air 2 Pressure Gauge and Harness Removal and Installation (WP 0295).
16. Turn ignition switch OFF then ON while observing IPC.

CONDITION/INDICATION

Does previously working gauge also work in new position?

DECISION

NO Go to Step 22.
YES Go to Step 23.

STEP

17. Swap transmission fluid temperature gauge with known-good transmission fluid temperature gauge. Refer to Transmission Fluid Temperature Gauge and Harness Removal and Installation (WP 0293).
18. Turn ignition switch OFF then ON while observing IPC (TM 9-2355-106-10).

MALFUNCTIONING INSTRUMENT PANEL CLUSTER (IPC) TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does transmission fluid temperature gauge sweep correctly?

DECISION

NO Go to Step 22.
YES Return vehicle to service.

STEP

19. Replace inoperative warning lamp bulb. Refer to Instrument Panel (IP) Light Bulb Removal and Installation (WP 0299).
20. Turn ignition switch OFF (TM 9-2355-106-10).
21. Turn ignition switch ON while observing warning lamps (TM 9-2355-106-10).

CONDITION/INDICATION

Are all warning lamps for installed features illuminated during gauge sweep?

DECISION

NO Go to Step 22.
YES Return vehicle to service.

MALFUNCTION

- 22. IPC is faulty.

ACTION

Replace IPC. Go to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

MALFUNCTION

- 23. Gauge is faulty.

ACTION

Replace faulty gauge and jumper harness. Refer to Transmission Fluid Temperature Gauge and Harness Removal and Installation (WP 0293), Air 1 Pressure Gauge and Harness Removal and Installation (WP 0294), or Air 2 Pressure Gauge and Harness Removal and Installation (WP 0295). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

YELLOW ENGINE WARNING LAMP TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

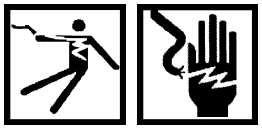
Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0012
WP 0297
WP 0353
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON while observing YELLOW ENGINE warning lamp (TM 9-2355-106-10).

CONDITION/INDICATION

Does YELLOW ENGINE warning lamp illuminate during gauge sweep?

DECISION

NO Go to Step 4.
YES Go to next step.

YELLOW ENGINE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

3. Place vehicle in diagnostic mode while observing YELLOW ENGINE warning lamp. Refer to Diagnostic Trouble Code (DTC) Access Procedure (WP 0012).

CONDITION/INDICATION

Does YELLOW ENGINE warning lamp illuminate while vehicle is in diagnostic mode?

DECISION

NO Go to Step 5.
YES Return vehicle to service.

MALFUNCTION

- 4. Instrument Panel Cluster (IPC) is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).

END OF TEST

MALFUNCTION

- 5. Electronic System Controller (ESC) is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

RED ENGINE WARNING LAMP TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

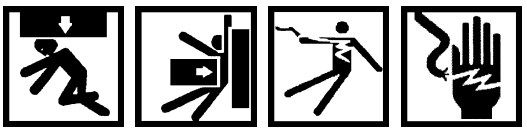
Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0006
WP 0297
WP 0329
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Cabin doors open and secured (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Cabin door must be secured in the open position by using heavy duty straps to prevent accidental closure during vehicle maintenance. Pull check link retaining pin prior to securing door open. Failure to comply may result in serious injury or death to personnel.

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NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

RED ENGINE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).
4. Retrieve DTCs with MSD.

CONDITION/INDICATION

Are engine DTCs set?

DECISION

YES Go to Engine Diagnostic Trouble Code (DTC) Index (WP 0006).
NO Go to next step.

STEP

5. Turn ignition switch OFF (TM 9-2355-106-10).
6. Turn ignition switch ON while observing RED ENGINE warning lamp (TM 9-2355-106-10).

CONDITION/INDICATION

Does RED ENGINE warning lamp illuminate during gauge sweep?

DECISION

NO Go to Step 12.
YES Go to next step.

STEP

7. Disconnect coolant level sensor connector. Refer to Figure 1.

RED ENGINE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

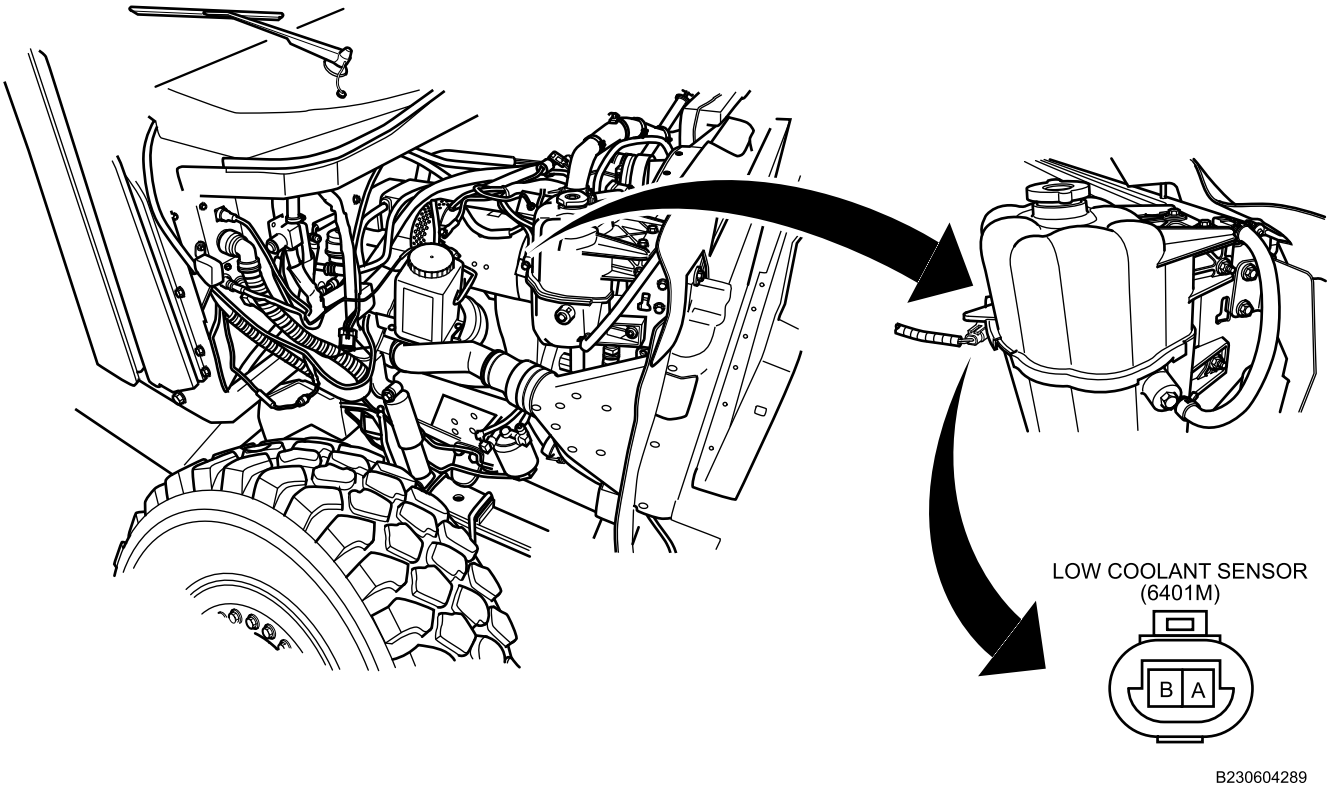


Figure 1. Right Side of Radiator.

8. Install jumper wire between terminal A and B of connector 6401M. Refer to Figure 1.
9. Start engine and let idle (TM 9-2355-106-10).

CONDITION/INDICATION

Does RED ENGINE warning lamp flash?

DECISION

YES Return vehicle to service.
NO Go to next step.

STEP

10. With MSD, verify Engine Control Module (ECM) sends request to flash RED ENGINE warning lamp.

CONDITION/INDICATION

Does ECM send request to flash RED ENGINE warning lamp?

DECISION

NO Go to next step.
YES Go to Step 12.

RED ENGINE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 11. ECM is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

MALFUNCTION

- 12. Instrument Panel Cluster (IPC) is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

CHECK TRANSMISSION LAMP TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

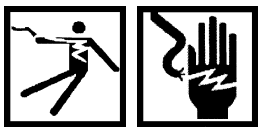
Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0142
WP 0297
WP 0353
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

WARNING



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NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).
4. Retrieve Diagnostic Trouble Code (DTC) data with MSD.

CONDITION/INDICATION

Are transmission DTCs set?

DECISION

YES Go to Transmission Operational Checkout Procedure (WP 0142).
NO Go to next step.

CHECK TRANSMISSION LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Turn ignition switch OFF (TM 9-2355-106-10).
6. Turn ignition switch ON while observing check transmission warning lamp in Instrument Panel Cluster (IPC) (TM 9-2355-106-10).

CONDITION/INDICATION

Does check transmission warning lamp illuminate during gauge sweep and go out after gauge sweep (TM 9-2355-106-10)?

DECISION

NO Go to Step 9.
YES Go to next step.

STEP

7. Command check transmission warning lamp ON and OFF with MSD.

CONDITION/INDICATION

Does check transmission lamp turn ON and OFF when commanded with MSD?

DECISION

YES Return vehicle to service.
NO Go to next step Step 8.

MALFUNCTION

- 8. Electronic System Controller (ESC) is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

MALFUNCTION

- 9. IPC is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

COOLANT LEVEL WARNING LAMP TROUBLESHOOTING PROCEDURE

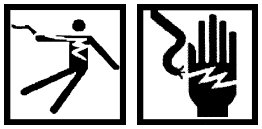
INITIAL SETUP:

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0297
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

TROUBLESHOOTING PROCEDURE

WARNING



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NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON while observing COOLANT LEVEL warning lamp (TM 9-2355-106-10).

CONDITION/INDICATION

Does COOLANT LEVEL warning lamp illuminate during gauge sweep and turn off after gauge sweep?

DECISION

NO Go to Step 3.
YES Return vehicle to service.

COOLANT LEVEL WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 3. IPC is faulty.

ACTION

Replace Instrument Panel Cluster (IPC). Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (ZTSE 4435C) (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0297
WP 0319
WP 0324
WP 0353
WP 0327
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

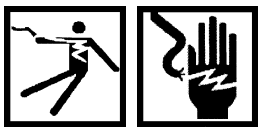
Drawings Required
Schematic (WP 0789, Figure 38),

LAMP FUNCTION

The park brake lamp should light during the IPC gauge sweep after the ignition is turned ON. The lamp will go out when the park brake is released. If the park brake is not engaged when the ignition is turned ON, the lamp should go out after approximately 5 seconds. The light should go out when the park brake is released.

TROUBLESHOOTING PROCEDURE

WARNING



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CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Connect MSD. Refer to Connecting MSD (WP 0011).
2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).

CONDITION/INDICATION

Does park brake warning lamp illuminate during gauge sweep?

DECISION

NO Go to Step 28.
YES Go to next step.

STEP

4. Activate park brake warning lamp with MSD.

CONDITION/INDICATION

Does park brake warning lamp illuminate when activated with MSD?

DECISION

NO Go to Step 29.
YES Go to next step.

STEP

5. Start vehicle and build air pressure to at least 80 psi (3.83 kPa) (TM 9-2355-106-10).
6. Monitor park brake transducer inputs to ESC with MSD.
7. Move park brake control in and out while observing MSD (TM 9-2355-106-10).

CONDITION/INDICATION

Do inputs to MSD correspond correctly with park brake control position?

DECISION

YES Return vehicle to service.
NO Go to next step.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

8. Disconnect Park Brake connector 1813. Refer to Figure 1.

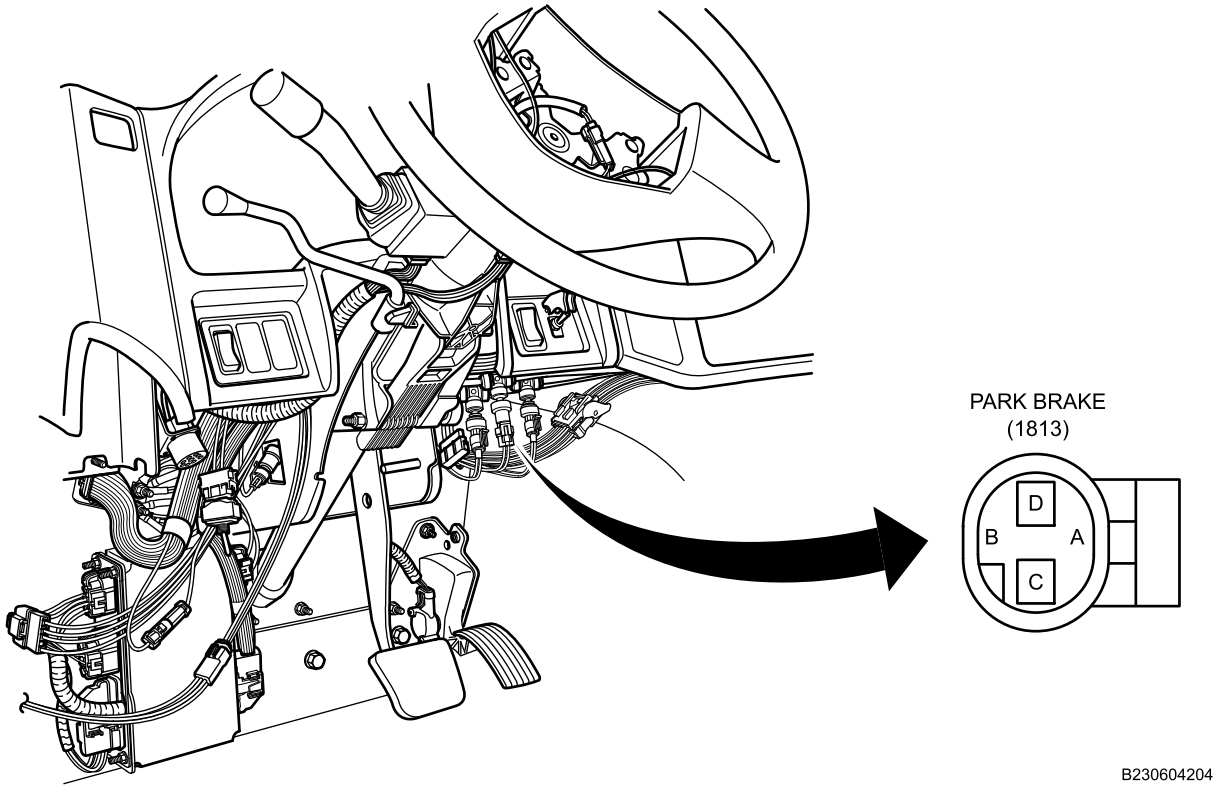


Figure 1. Below Dash.

9. Connect and disconnect jumper wire between connector 1813 terminals C and D while observing MSD. Refer to Figure 1.

CONDITION/INDICATION

Do MSD inputs change as jumper wire is connected and disconnected?

DECISION

YES Go to Step 30.
NO Go to next step.

STEP

10. Turn ignition switch OFF (TM 9-2355-106-10).
11. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
12. Measure resistance between connector 1813 terminal D and ground with multimeter. Refer to Figure 1.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 23.
YES Go to next step.

STEP

13. Turn MAIN POWER switch ON (TM 9-2355-106-10).
14. Turn ignition switch ON (TM 9-2355-106-10).
15. Measure DC voltage between connector 1813 terminal C and ground with multimeter. Refer to Figure 2.

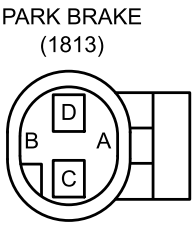


Figure 2. Connector 1813.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

YES Go to Step 29.
NO Go to next step.

STEP

16. Disconnect Cabin (CAB)/Driver Control Module (DCM) connector 1800. Refer to Figure 3.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

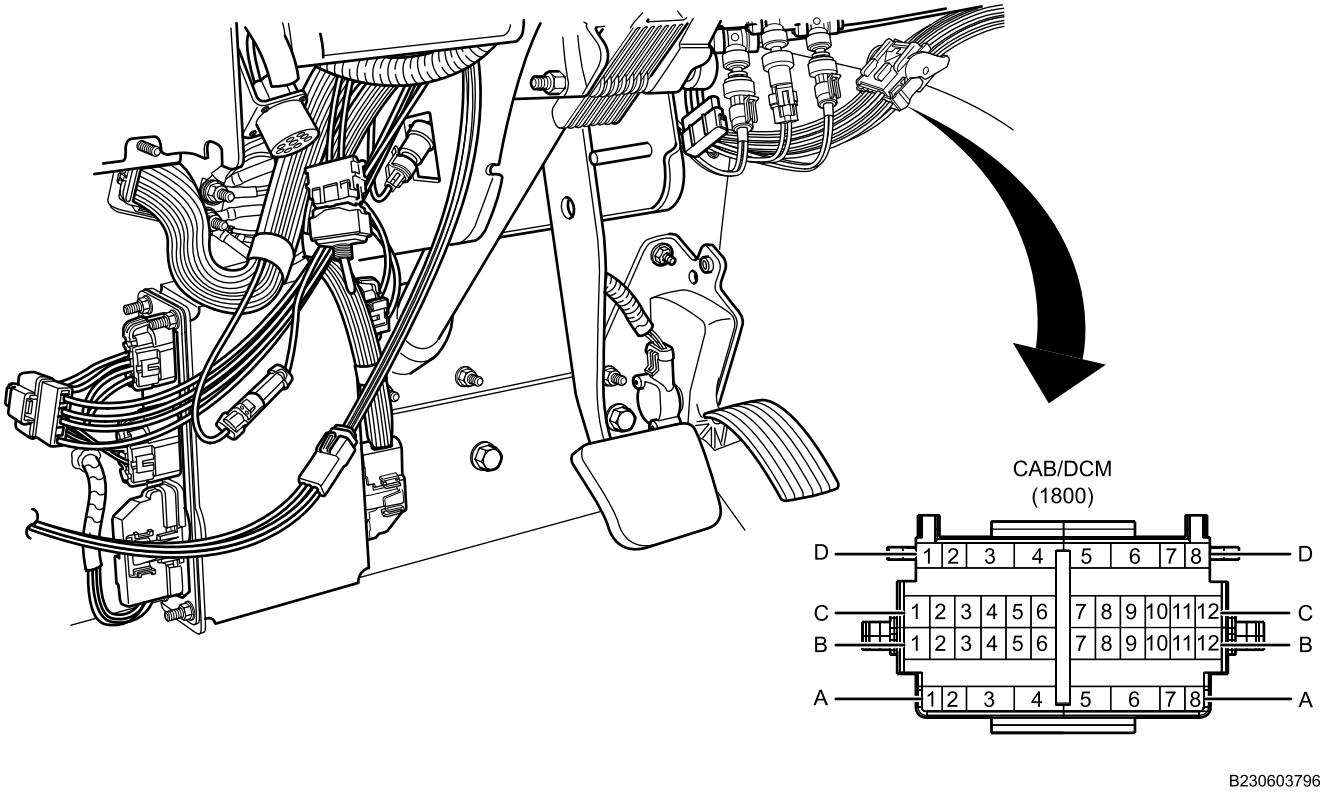


Figure 3. Below Dash.

17. Measure DC voltage between connector 1800 terminal B7 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5 volts and 13.5 volts?

DECISION

YES Go to Step 31.
NO Go to next step.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

18. Turn ignition switch OFF (TM 9-2355-106-10).
19. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
20. Disconnect Electronic System Controller (ESC) connector 1600. Refer to Figure 4.

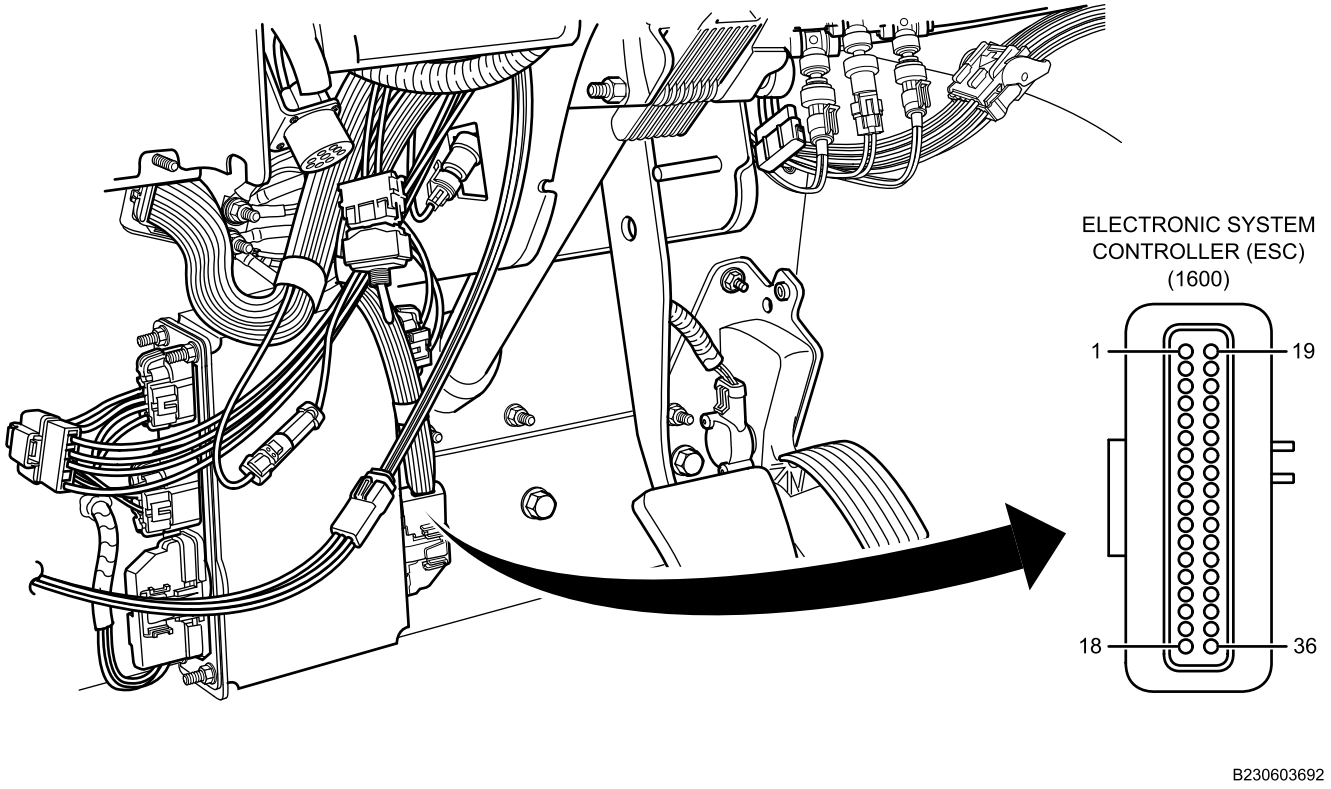


Figure 4. Below Steering Column.

21. Measure resistance between connector 1600 terminal 32 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 27.
YES Go to next step.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Measure resistance between connector 1600 terminal 32 and connector 1800 terminal B7 with multimeter. Refer to Figure 5. Refer to Figure 6.

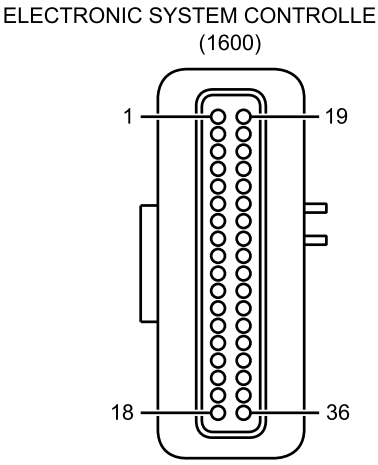


Figure 5. Connector 1600.

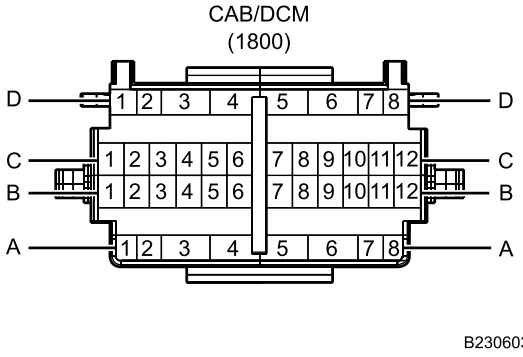


Figure 6. Connector 1800.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 27.
YES Go to Step 29.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

23. Disconnect ESC connector 1600. Refer to Figure 7.

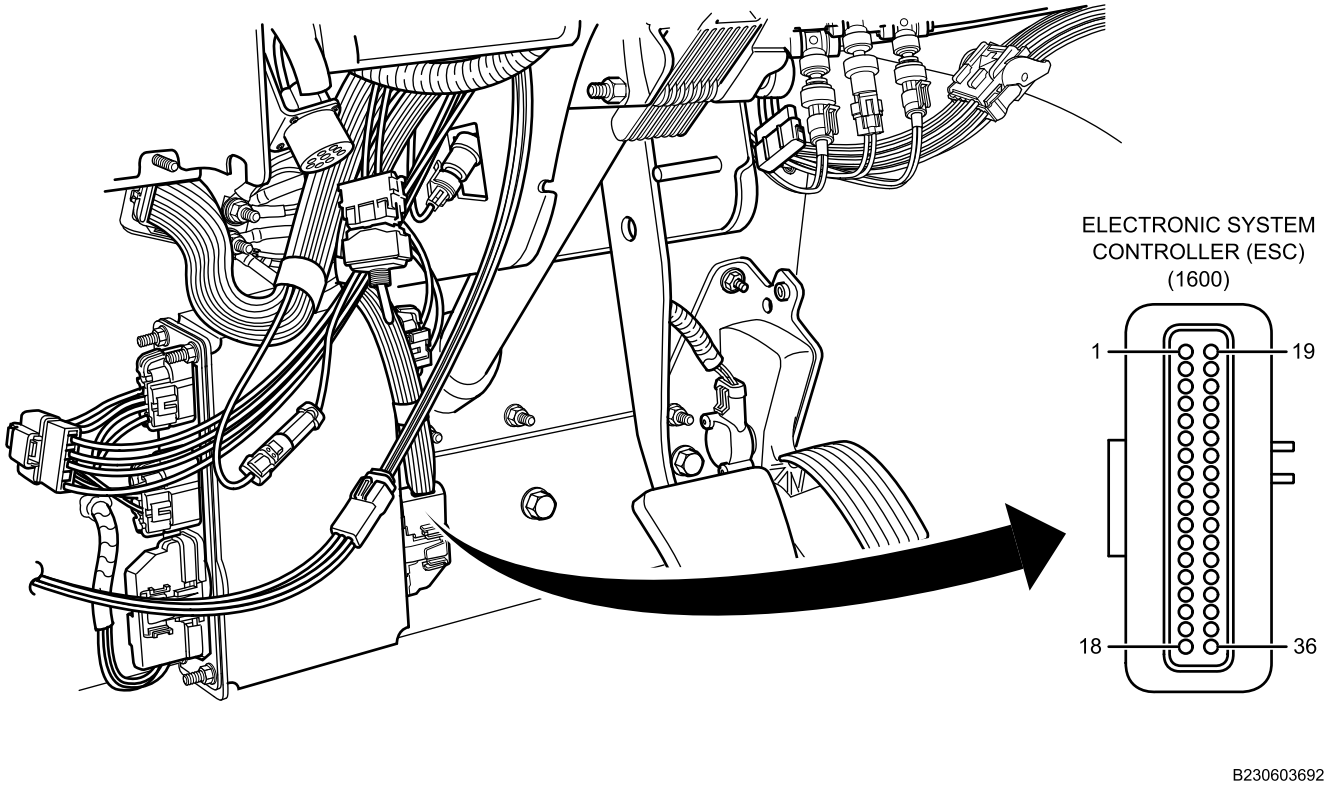


Figure 7. Below Steering Column.

24. Measure resistance between connector 1813 terminal D and connector 1600 terminal 3 with multimeter. Refer to Figure 7. Refer to Figure 8.

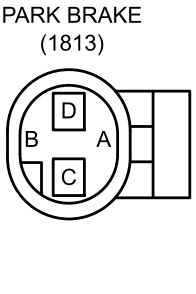


Figure 8. Connector 1813.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 29.
NO Go to next step.

STEP

25. Disconnect connector 1805. Refer to Figure 9.

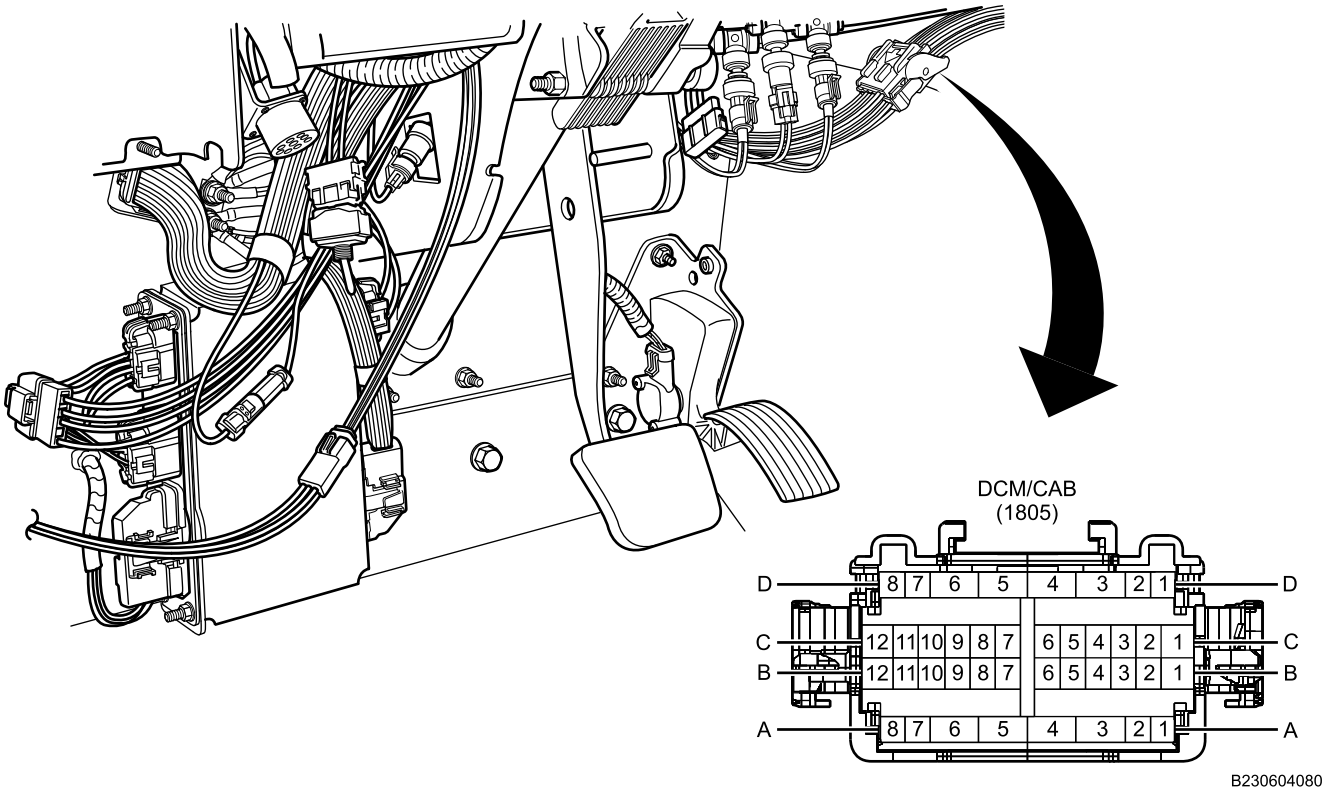


Figure 9. Below Dash.

26. Measure resistance between connector 1805 terminal A4 and connector 1813 terminal D with multimeter. Refer to Figure 9. Refer to Figure 10.

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

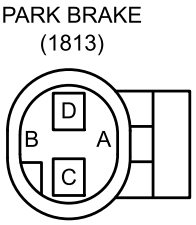


Figure 10. Connector 1813.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 27.
NO Go to Step 31.

MALFUNCTION

- 27. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 28. Instrument Panel Cluster (IPC) is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

MALFUNCTION

- 29. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

PARK BRAKE WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 30. Park brake switch is faulty.

ACTION

Replace park brake switch. Refer to Park Brake Lamp Transducer Removal and Installation (WP 0327). Return vehicle to service.

END OF TEST

MALFUNCTION

- 31. Steering column wiring harness is faulty.

ACTION

Replace steering column wiring harness. Refer to Steering Column Harness Removal and Installation (WP 0324). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

DIAGNOSTIC CONNECTOR TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0321
WP 0067
WP 0051
WP 0317
WP 0319
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

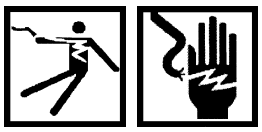
Drawings Required
Schematic (WP 0789, Figure 1)
Schematic (WP 0789, Figure 2)

DIAGNOSTIC TROUBLE CODES (DTCS)

There are no DTCs associated with the diagnostic connector circuits. A fault with the diagnostic connector data link circuits will prevent DTCs from being read.

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

DIAGNOSTIC CONNECTOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Measure resistance between connector 1650 terminal A and cabin ground stud with multimeter. Refer to Figure 1. Refer to Figure 2.

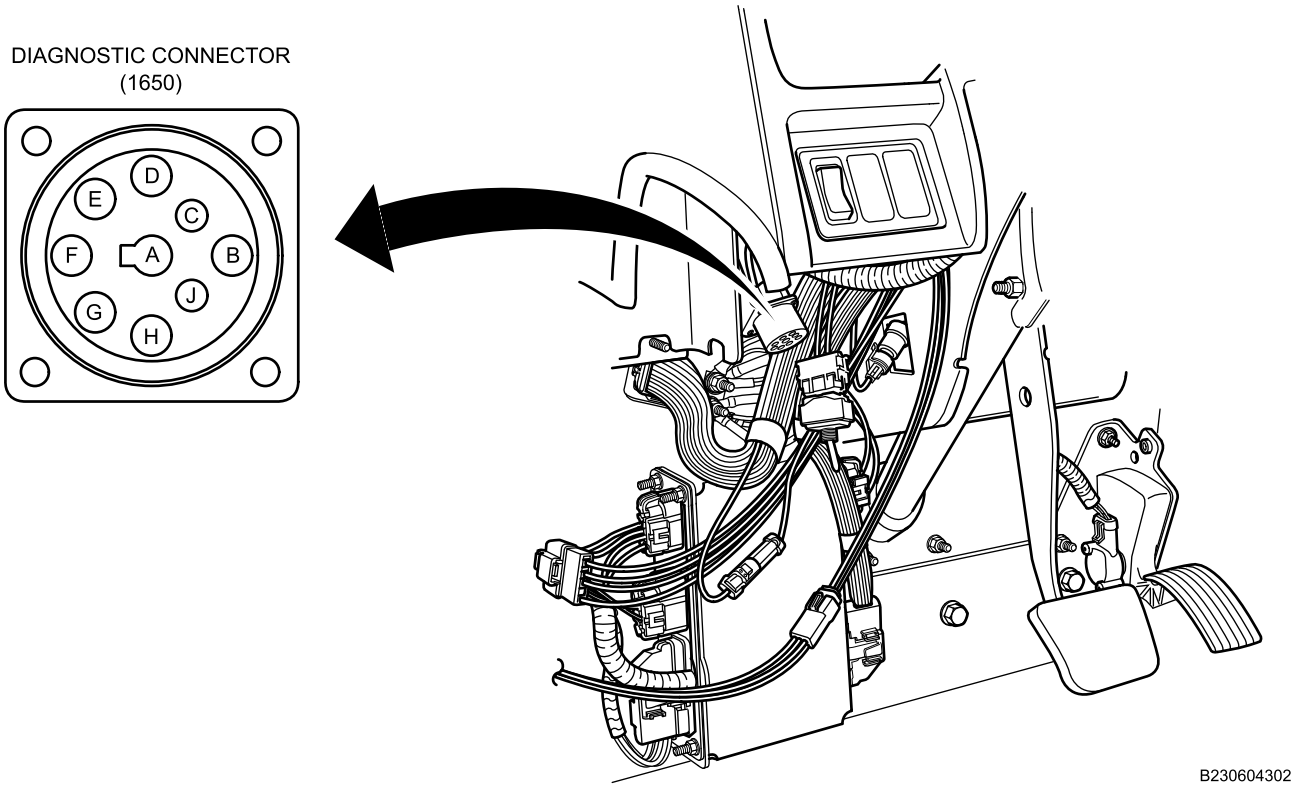


Figure 1. Left of Steering Column.

DIAGNOSTIC CONNECTOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

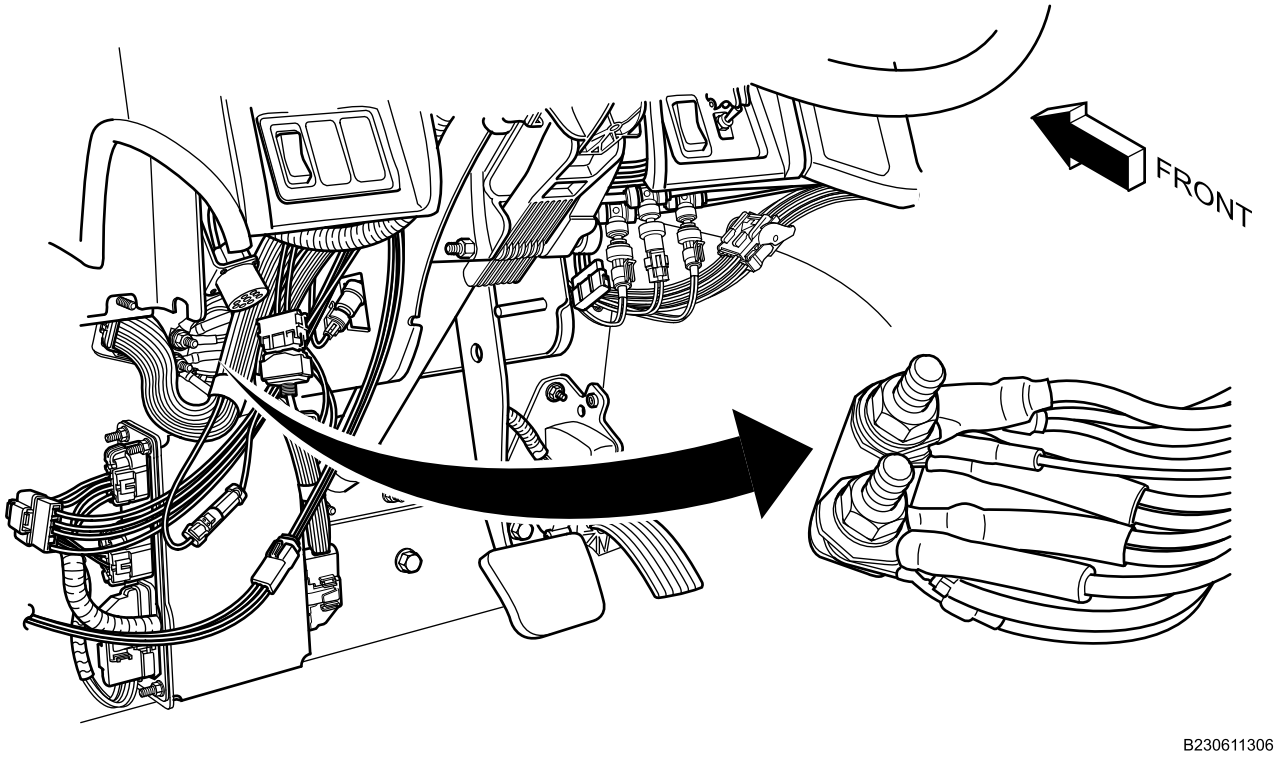


Figure 2. Firewall, Above Electronic System Controller (ESC).

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 6.
NO Go to next step.

STEP

2. Disconnect all ground terminal connectors at ground stud. Refer to Cabin Electrical Ground Stud Plate Removal and Installation (WP 0321). Refer to Figure 2.
3. Clean all connections between ground terminal connectors and ground stud.
4. Connect ground terminal connections at ground stud.

DIAGNOSTIC CONNECTOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

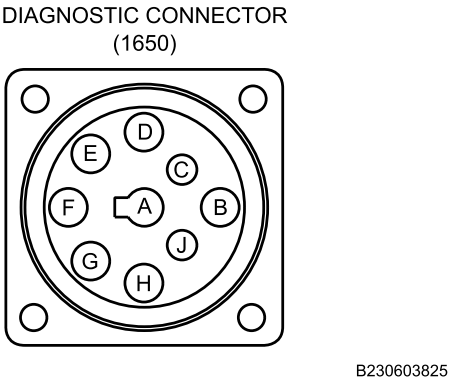


Figure 3. Connector 1650.

5. Measure resistance between connector 1650 terminal A and ground stud. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 33.
YES Go to next step.

STEP

6. Turn MAIN POWER switch ON (TM 9-2355-106-10).
7. Turn ignition switch ON (TM 9-2355-106-10).
8. Measure DC voltage between connector 1650 terminal B and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 13.
YES Go to next step.

STEP

9. Measure DC voltage between 1650 terminals C and A with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 1V and 4V?

DECISION

NO Refer to Multiplexing Data Link Circuits Troubleshooting Procedure (WP 0067).
YES Go to next step.

DIAGNOSTIC CONNECTOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

10. Measure DC voltage between connector 1650 terminals D and A with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read DC voltage between 1V and 4V?

DECISION

NO Refer to Multiplexing Data Link Circuits Troubleshooting Procedure (WP 0067).
YES Go to next step.

STEP

11. Measure DC voltage between connector 1650 terminals F and A with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read DC voltage between 2.5V and 4.5V?

DECISION

NO Refer to American Truckers Association (ATA) Communications/Data Communications Link (DLC) Troubleshooting Procedure (WP 0051).
YES Go to next step.

STEP

12. Measure DC voltage between connector 1650 terminals G and A with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 0.5V and 1.5V?

DECISION

NO Refer to American Truckers Association (ATA) Communications/Data Communications Link (DLC) Troubleshooting Procedure (WP 0051).
YES Return vehicle to service.

DIAGNOSTIC CONNECTOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Turn ignition switch OFF (TM 9-2355-106-10).
14. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
15. Remove and inspect fuse F6. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 4.

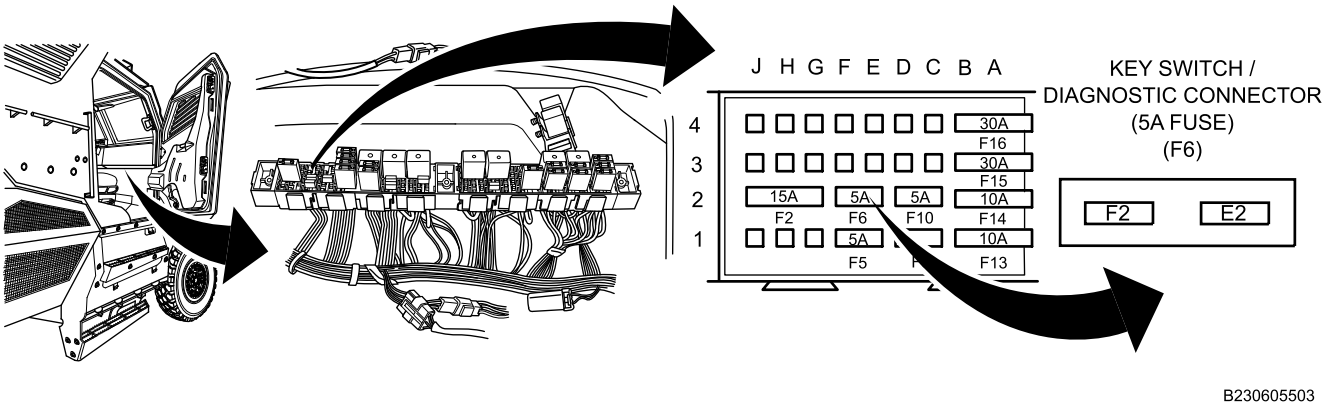


Figure 4. Right Side Instrument Panel.

CONDITION/INDICATION

Is fuse blown?

DECISION

NO Go to Step 23.
YES Go to next step.

STEP

16. Measure resistance between fuse block 1011 terminal F2 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 33.
YES Go to next step.

STEP

17. Install new fuse in fuse block 1011 circuit F6. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 4.
18. Turn MAIN POWER switch ON (TM 9-2355-106-10).
19. Turn ignition switch ON (TM 9-2355-106-10).
20. Turn ignition switch OFF (TM 9-2355-106-10).
21. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
22. Remove and inspect fuse F6 for blown fuse. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 4.

CONDITION/INDICATION

Is fuse blown?

DIAGNOSTIC CONNECTOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 33.
NO Return to service.

STEP

23. Turn ignition switch ON (TM 9-2355-106-10).
24. Turn MAIN POWER switch ON (TM 9-2355-106-10).
25. Measure DC voltage between fuse block 1011 terminal E2 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 33.
YES Go to next step.

STEP

26. Turn ignition switch OFF (TM 9-2355-106-10).
27. Turn MAIN POWER OFF (TM 9-2355-106-10).
28. With assistance, measure resistance between fuse block 1011 terminal F2 and connector 1650 terminal B with multimeter. Refer to Figure 5.

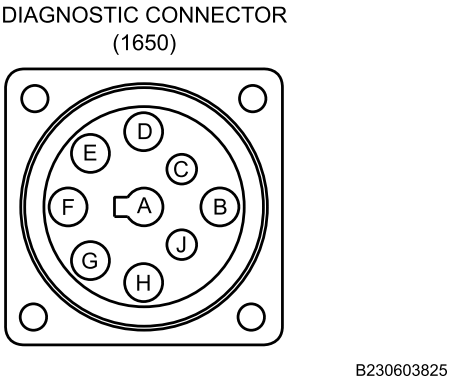


Figure 5. Connector 1650.

DIAGNOSTIC CONNECTOR TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 33.
YES Go to next step.

STEP

29. Install fuse F6 in fuse block 1011. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 4.
30. Turn MAIN POWER switch ON (TM 9-2355-106-10).
31. Turn ignition switch ON (TM 9-2355-106-10).
32. Measure DC voltage between connector 1650 terminals B and A with multimeter. Refer to Figure 6.

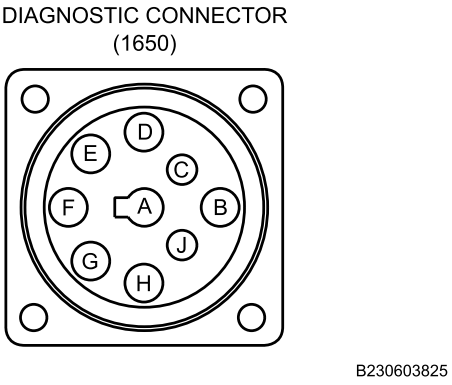


Figure 6. Connector 1650.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Return vehicle to service.
NO Go to Step 33.

MALFUNCTION

- 33. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

ANTILOCK BRAKE SYSTEM (ABS) WARNING LAMP TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0297
WP 0353
WP 0782

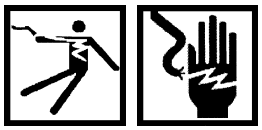
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 2023 14 150 8
- 2023 14 250 8

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

ANTILOCK BRAKE SYSTEM (ABS) WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).

CONDITION/INDICATION

Does ABS warning lamp illuminate during gauge sweep?

DECISION

NO Go to Step 11.
YES Go to next step.

STEP

4. Activate ABS warning lamp with MSD.

CONDITION/INDICATION

Does ABS warning lamp illuminate?

DECISION

YES Return vehicle to service.
NO Go to next step.

STEP

5. Turn ignition OFF (TM 9-2355-106-10).
6. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
7. Substitute known-good Instrument Panel Cluster (IPC). Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).
8. Turn MAIN POWER switch ON (TM 9-2355-106-10).
9. Turn ignition switch ON (TM 9-2355-106-10).
10. Activate ABS warning lamp with MSD.

CONDITION/INDICATION

Does ABS warning lamp illuminate when activated with MSD?

DECISION

YES Go to Step 11.
NO Go to Step 12.

ANTILOCK BRAKE SYSTEM (ABS) WARNING LAMP TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 11. IPC is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

MALFUNCTION

- 12. Electronic System Controller (ESC) is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

12V VOLTMETER OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0297
WP 0353
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch OFF (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 1705 14 109 3
- 1705 14 109 4
- 1705 14 109 5
- 1705 14 109 6
- 2023 14 109 5 or 2023 14 209 5
- 2023 14 109 6 or 2023 14 209 6
- 2023 14 109 7 or 2023 14 209 7

WARNING

Use extreme caution when testing or working on electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON while observing 12-volt gauge (TM 9-2355-106-10). 12-volt gauge should sweep from 10 volts to 16 volts and back to 10 volts.

CONDITION/INDICATION

12V VOLTMETER OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

12-volt gauge does not sweep correctly during gauge sweep.

CORRECTIVE ACTION

Replace Instrument Panel Cluster (IPC). Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

1. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Activate 12-volt gauge with MSD.

12-volt gauge does not perform correctly when activated with MSD.

Replace Electronic System Controller (ESC). Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE COOLANT TEMPERATURE GAUGE OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

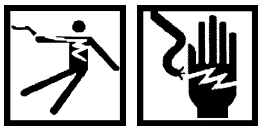
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0071
WP 0297
WP 0353
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- DTC 1705 14 103 3
- DTC 1705 14 103 4
- DTC 1705 14 103 5
- DTC 1705 14 103 6
- DTC 2023 14 103 5 or 2023 14 203 5
- DTC 2023 14 103 6 or 2023 14 203 6
- DTC 2023 14 103 7 or 2023 14 203 7

WARNING



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NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON while observing engine coolant temperature gauge (TM 9-2355-106-10). Engine coolant temperature gauge should sweep from 140°F to 260°F and back to 140°F.

CONDITION/INDICATION

ENGINE COOLANT TEMPERATURE GAUGE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Engine coolant temperature gauge does not sweep correctly during gauge sweep.

CORRECTIVE ACTION

Replace instrument panel cluster. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).

1. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Activate engine coolant temperature gauge with MSD.

Engine coolant temperature gauge does not perform correctly when activated with MSD.

Replace Electronic System Controller. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353).

END OF WORK PACKAGE

FIELD MAINTENANCE

ENGINE OIL PRESSURE GAUGE OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0353
WP 0577
WP 0782

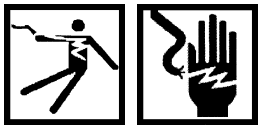
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 1705 14 105 3
- 1705 14 105 4
- 1705 14 105 5
- 1705 14 105 6
- 2023 14 105 5 or 2023 14 205 5
- 2023 14 105 6 or 2023 14 205 6
- 2023 14 105 7 or 2023 14 205 7

ENGINE OIL PRESSURE GAUGE OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON while observing oil pressure gauge (TM 9-2355-106-10). Oil pressure gauge should sweep from 0 psi to 100 psi and back to 0 psi.

CONDITION/INDICATION

Engine oil pressure gauge does not sweep correctly during gauge sweep.

CORRECTIVE ACTION

Replace Instrument Panel Cluster (IPC). Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0577). Return vehicle to service.

1. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Activate engine oil pressure gauge with MSD.

Engine oil pressure gauge does not perform correctly when activated with MSD.

Replace Electronic System Controller (ESC). Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

SPEEDOMETER OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0297
WP 0353
WP 0782

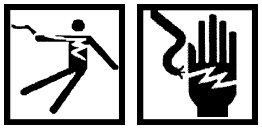
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Code (DTCs):

- 1705 14 102 3
- 1705 14 102 4
- 1705 14 102 5
- 1705 14 102 6
- 2023 14 102 5 or 2023 14 202 5
- 2023 14 102 6 or 2023 14 202 6
- 2023 14 102 7 or 2023 14 202 7

SPEEDOMETER OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON while observing speedometer (TM 9-2355-106-10). Speedometer should sweep from 0 mph (0 km/h) to 85 mph (137 km/h) and back to 0 mph (0 km/h).

CONDITION/INDICATION

Speedometer does not sweep correctly during gauge sweep.

CORRECTIVE ACTION

Replace instrument panel cluster. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).

1. Connect Maintenance Support Device (MSD). Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Activate speedometer with MSD.

Speedometer does not perform correctly when activated with MSD.

Replace electronic system controller. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353).

END OF WORK PACKAGE

FIELD MAINTENANCE

TACHOMETER OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0297
WP 0353
WP 0782

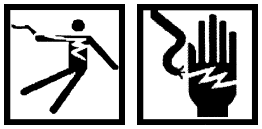
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 1705 14 101 3
- 1705 14 101 4
- 1705 14 101 5
- 1705 14 101 6
- 2023 14 101 5 or 2023 14 201 5
- 2023 14 101 6 or 2023 14 201 6
- 2023 14 101 7 or 2023 14 201 7

TACHOMETER OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON while observing tachometer (TM 9-2355-106-10). Tachometer should sweep from 0 rpm to 4,000 rpm and back to 0 rpm.

CONDITION/INDICATION

Tachometer does not sweep correctly during gauge sweep.

CORRECTIVE ACTION

Replace Instrument Panel Cluster (IPC). Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).

1. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
2. Activate tachometer with MSD.

Tachometer does not perform correctly when activated with MSD.

Replace Electronic System Controller (ESC). Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353).

END OF WORK PACKAGE

FIELD MAINTENANCE

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0071
WP 0085
WP 0297
WP 0335
WP 0353
WP 0400
WP 0397
WP 0426
WP 0597
WP 0605
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Exterior fuel tank armor door removed (WP 0605)

Drawings Required
WP 0789, Figure 37

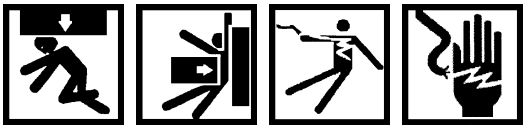
This procedure covers the following Diagnostic Trouble Codes (DTCs):

- 612 14 25 1
- 612 14 25 2
- 612 14 23 1
- 612 14 23 2
- 1705 14 107 3
- 1705 14 107 4
- 1705 14 107 5
- 1705 14 107 6
- 2023 14 107 5 or 2023 207 5
- 2023 14 107 6 or 2023 207 6
- 2023 14 107 7 or 2023 207 7

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

STEP

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

1. Turn MAIN POWER switch ON while observing fuel level gauge (TM 9-2355-106-10).

CONDITION/INDICATION

Does fuel level gauge sweep from empty to full and back to empty?

DECISION

NO Go to Step 28.
YES Go to next step.

STEP

2. Connect MSD. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
3. Activate fuel level gauge with MSD.

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does fuel level gauge perform correctly when activated with MSD?

DECISION

NO Go to Step 29.
YES Go to next step.

STEP

4. Turn ignition switch OFF (TM 9-2355-106-10).
5. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
6. Open fuel door (TM 9-2355-106-10).
7. Disconnect left fuel sender connector 9100. Refer to Figure 1.

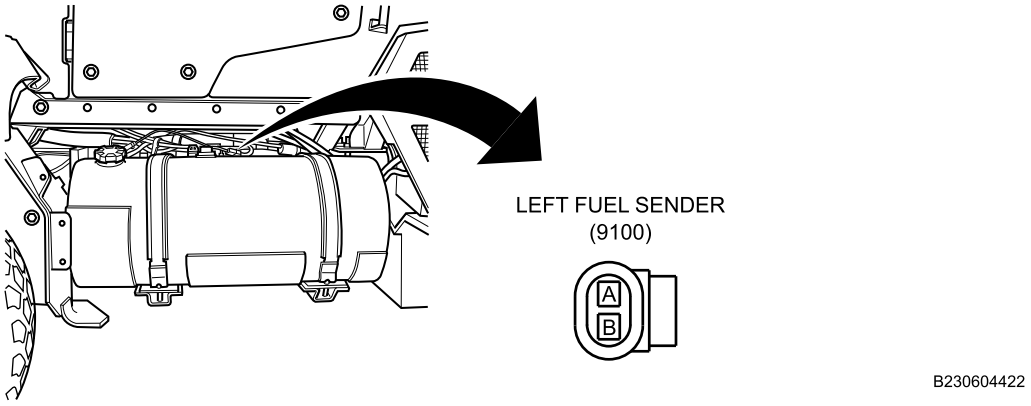


Figure 1. Left Fuel Tank.

8. Measure resistance between connector 9100 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 12.
YES Go to next step.

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Turn ignition switch ON (TM 9-2355-106-10).
11. Measure DC voltage between connector 1900 terminal A and ground with multimeter. Refer to Figure 2.

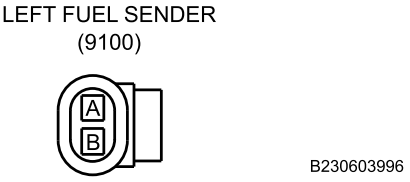


Figure 2. Connector 9100.

CONDITION/INDICATION

Does multimeter read between 9V and 11V?

DECISION

NO Go to Step 17.
YES Go to Step 30.

STEP

12. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
13. Disconnect chassis/dash center connector 9700. Refer to Figure 3.

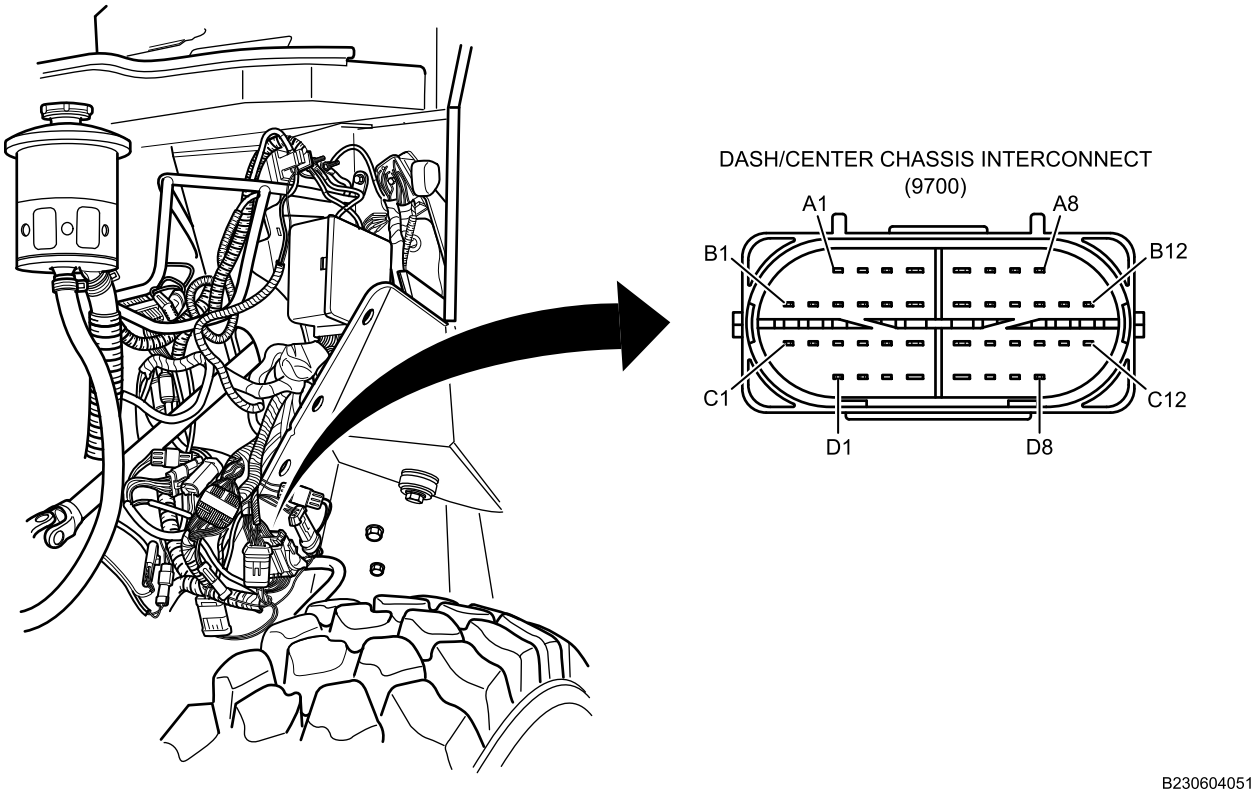


Figure 3. Left Engine Area.

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

14. Measure resistance between connector 9700 terminal D8 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 31.
NO Go to next step.

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

15. Disconnect ESC connector 4004. Refer to Figure 4.

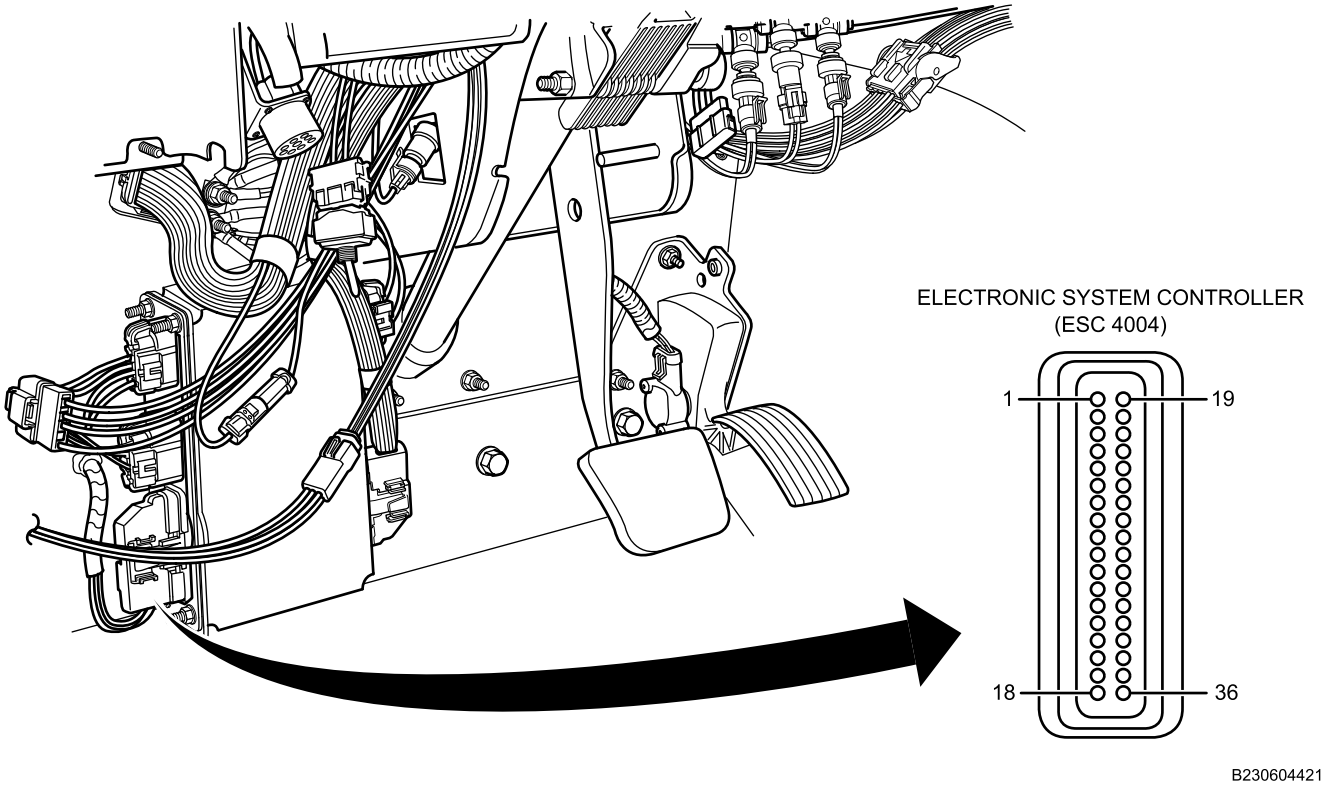


Figure 4. Left Front Cabin Area.

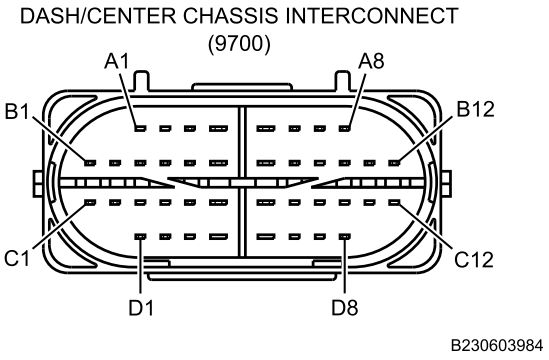


Figure 5. Connector 9700.

16. Measure resistance between connector 9700 Electronic System Controller (ESC) side terminal D8 and connector 4004 terminal 26 with multimeter. Refer to Figure 4 and Figure 5.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 32.
YES Go to Step 29.

STEP

17. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
18. Disconnect chassis/dash center connector 9700. Refer to Figure 6.

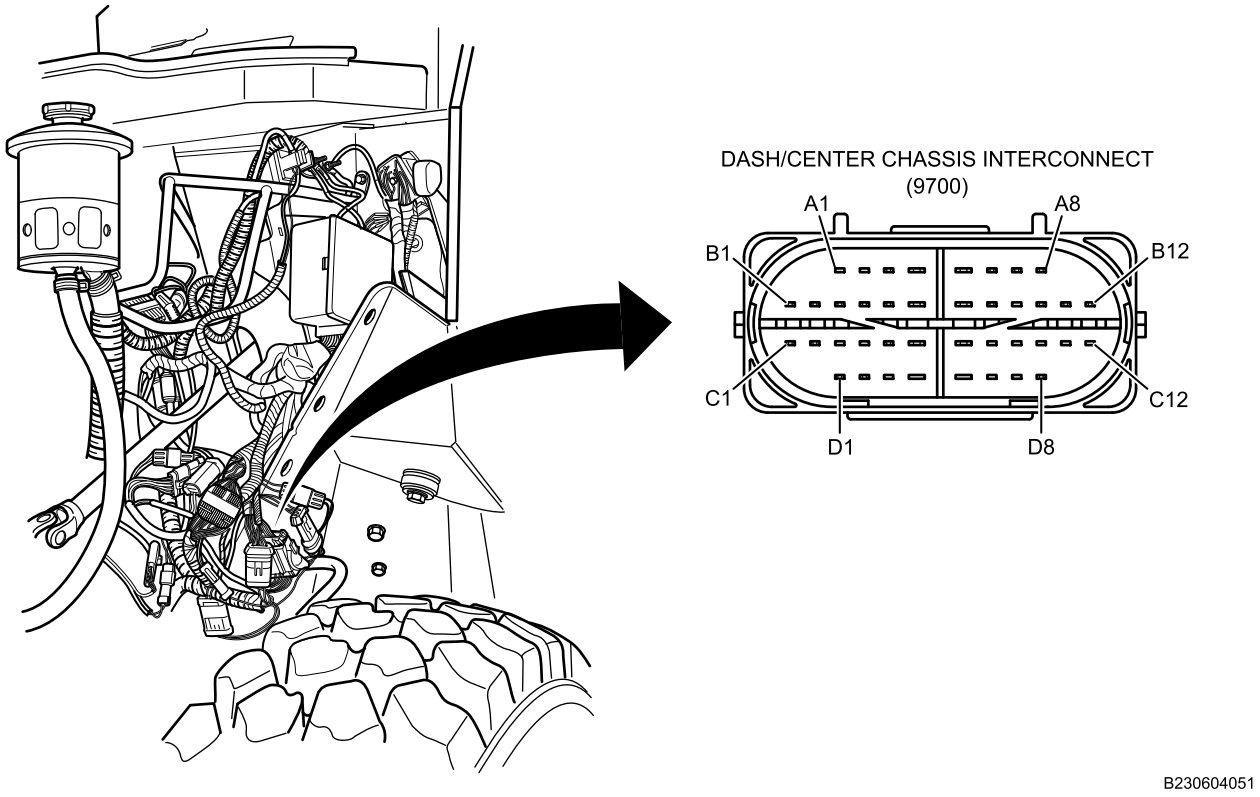


Figure 6. Left Engine Area.

19. Turn MAIN POWER switch ON (TM 9-2355-106-10).
20. Turn ignition ON (TM 9-2355-106-10).
21. Measure DC voltage between connector 9700 (ESC side) terminal B11 and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read between 9V and 11V?

DECISION

YES Go to Step 31.
NO Go to next step.

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Turn ignition OFF (TM 9-2355-106-10).
23. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
24. Disconnect ESC connector 4004. Refer to Figure 7.

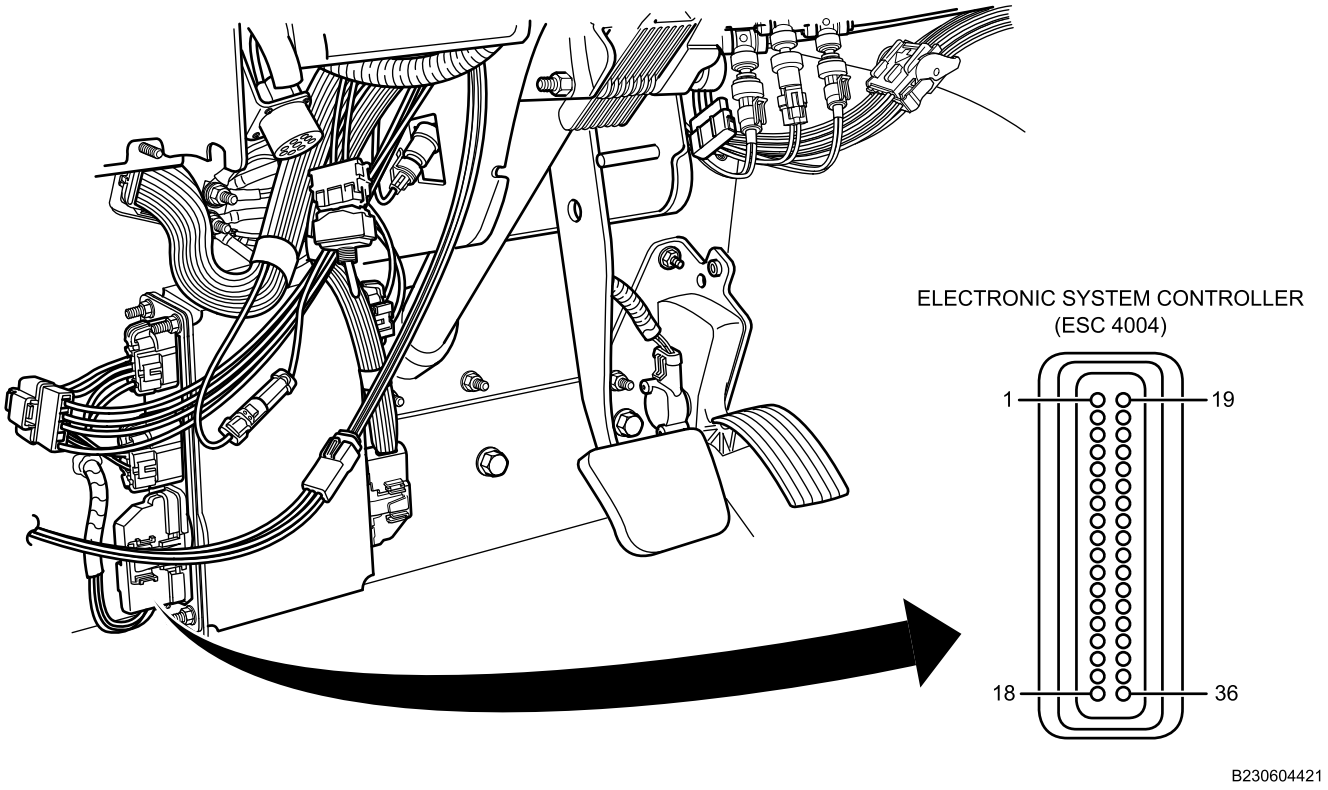


Figure 7. Left Front Cabin Area.

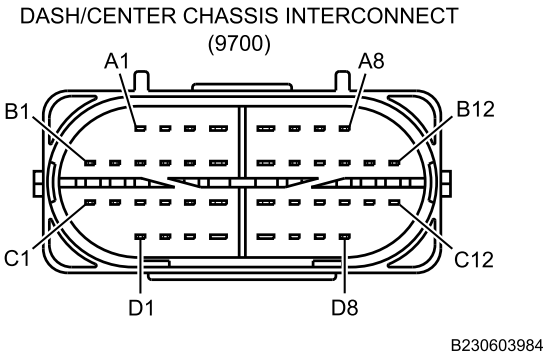


Figure 8. Connector 9700.

25. Measure resistance between connector 9700 (ESC side) terminal B11 and ground with multimeter. Refer to Figure 8.

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 32.
YES Go to next step.

STEP

26. Measure resistance between connector 9700 (ESC side) terminal B11 and connector 4004 terminal 5 with multimeter. Refer to Figure 9 and Figure 10.

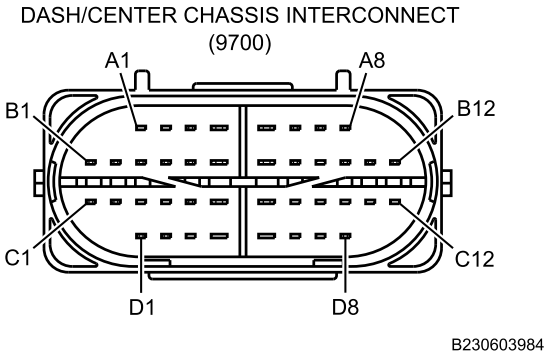


Figure 9. Connector 9700.

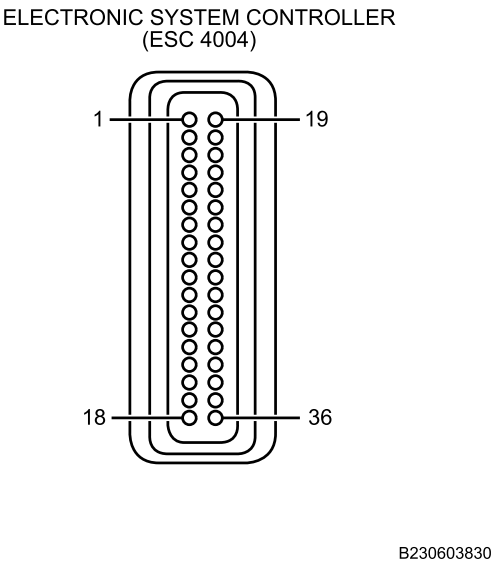


Figure 10. Connector 4004.

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 32.
YES Go to next step.

STEP

27. Measure resistance between connector 4004 terminal 5 and all other terminals in connector 4004 with multimeter. Refer to Figure 11.

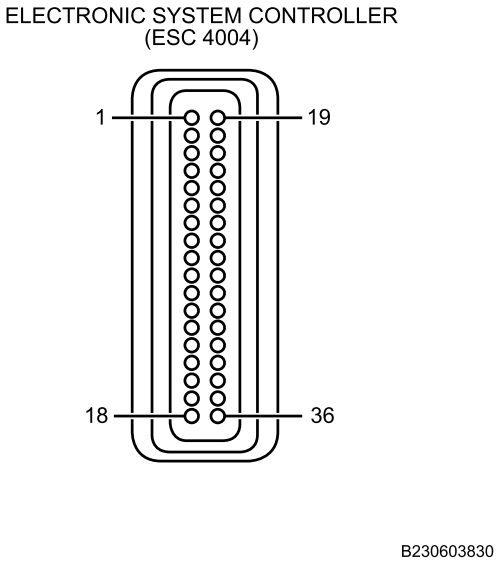


Figure 11. Connector 4004.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 32.
YES Go to Step 29.

MALFUNCTION

- 28. Instrument panel cluster is faulty.

ACTION

Replace instrument panel cluster. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

FUEL LEVEL GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 29. Electronic System Controller (ESC) is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

MALFUNCTION

- 30. Fuel level sensor is faulty.

ACTION

Replace fuel level sensor. Refer to Fuel Level Sensor Removal and Installation (WP 0397). Return vehicle to service.

END OF TEST

MALFUNCTION

- 31. Center chassis harness is faulty.

ACTION

Replace center chassis harness. Refer to Center Chassis Harness Removal and Installation (WP 0426). Return vehicle to service.

END OF TEST

MALFUNCTION

- 32. Power Distribution Center (PDC) harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0294
WP 0353
WP 0322
WP 0297
WP 0324
WP 0319
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Left cabin door open and secured (WP 0608)

This procedure covers the following Electronic System Controller (ESC) Diagnostic Trouble Codes (DTCs):

- 612 14 4 1
- 612 14 4 2
- 612 14 30 1
- 612 14 30 2
- 2023 14 108 5
- 2023 14 110 5 or 2023 14 210 5
- 2023 14 110 6 or 2023 14 210 6
- 2023 14 110 7 or 2023 14 210 7

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Cabin door must be secured in the open position by using heavy duty straps to prevent accidental closure during vehicle maintenance. Pull check link retaining pin prior to securing door open. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition ON (TM 9-2355-106-10) while observing primary air pressure gauge.

CONDITION/INDICATION

Does primary air pressure gauge sweep from 0 psi to 150 psi and back to 0 psi?

DECISION

NO Go to Step 63.
YES Go to next step.

STEP

3. Connect MSD. Refer to Connecting Maintenance Support Device (WP 0011).
4. Activate primary air pressure gauge with MSD.

CONDITION/INDICATION

Does primary air pressure gauge perform correctly when activated with MSD?

DECISION

NO Go to Step 66.
YES Go to next step.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Turn ignition switch OFF (TM 9-2355-106-10).
6. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
7. Disconnect primary air pressure transducer harness connector 1811. Refer to Figure 1.

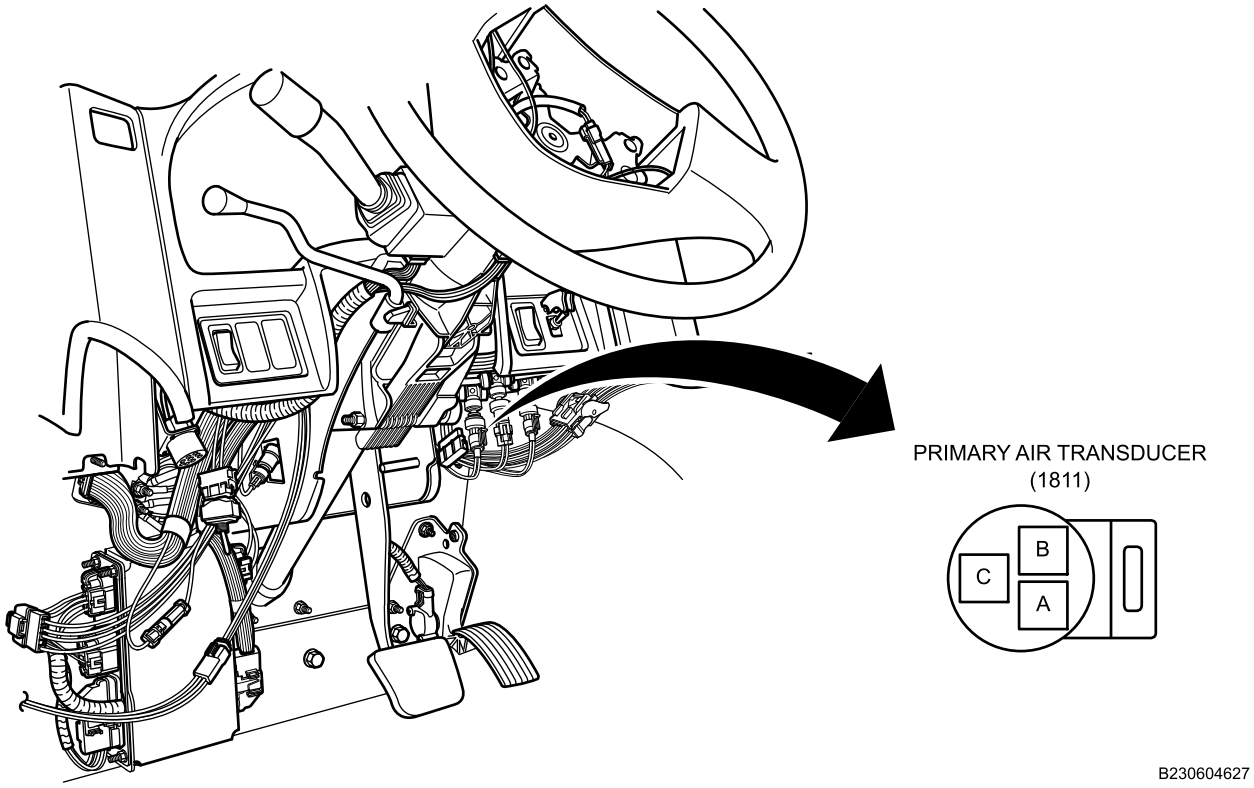


Figure 1. Driver Side Floor Area.

8. Measure resistance between harness connector 1811 terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 13.
YES Go to next step.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Turn ignition switch ON (TM 9-2355-106-10).
11. Measure DC voltage between harness connector 1811 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 17.
YES Go to next step.

STEP

12. Measure DC voltage between harness connector 1811 terminals B and C with multimeter. Refer to Figure 2.

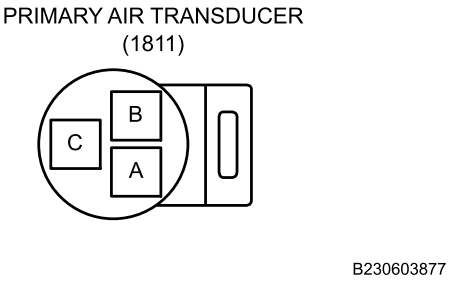


Figure 2. Connector 1811.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 40.
YES Go to Step 67.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Disconnect harness connector 1800. Refer to Figure 3.

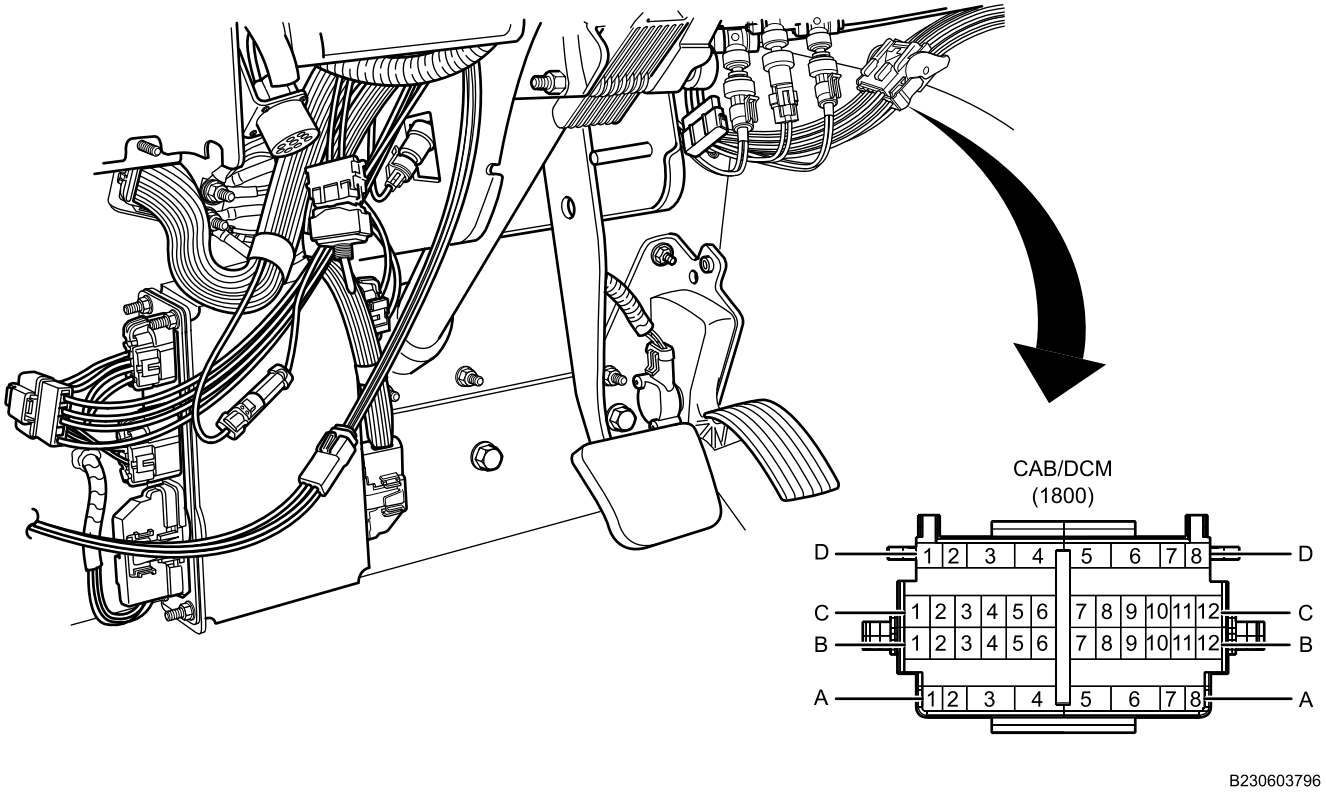


Figure 3. Driver Side Floor Area.

14. Measure resistance between harness connector 1800 terminal A4 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read less then 5 ohms?

DECISION

YES Go to Step 69.
NO Go to next step.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

15. Disconnect harness connector 1600. Refer to Figure 4.

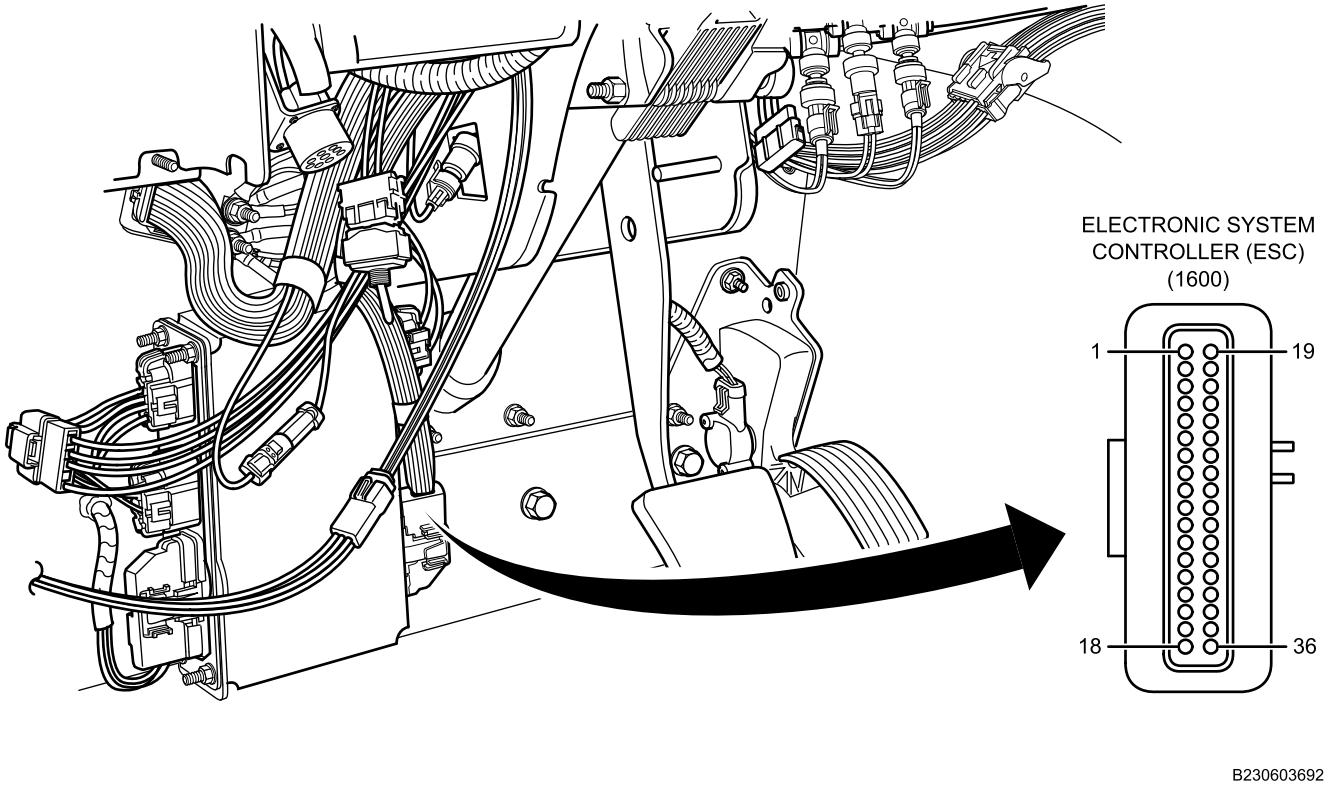


Figure 4. Driver Side Floor Area.

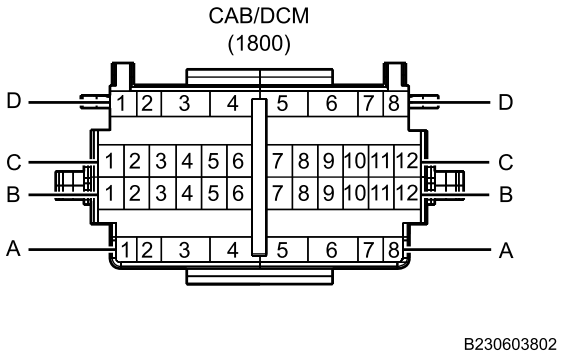


Figure 5. Connector 1800.

16. Measure resistance between harness connector 1800 terminal A4 and harness connector 1600 terminal 3 with multimeter. Refer to Figure 5 and Figure 4.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 70.
YES Go to Step 66.

STEP

17. Turn ignition switch OFF (TM 9-2355-106-10).
18. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
19. Disconnect harness connector 1600. Refer to Figure 4.
20. Turn MAIN POWER switch ON (TM 9-2355-106-10).
21. Turn ignition switch ON (TM 9-2355-106-10).
22. Measure DC voltage between harness connector 1811 terminal B and ground with multimeter. Refer to Figure 6.

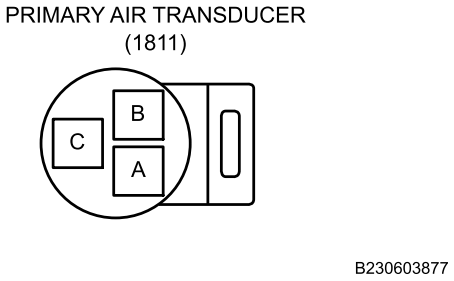


Figure 6. Connector 1811.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 34.
NO Go to next step.

STEP

23. Turn ignition switch OFF (TM 9-2355-106-10).
24. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
25. Measure resistance between harness connector 1811 terminal B and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 28.
NO Go to next step.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

26. Disconnect harness connector 1800. Refer to Figure 7.

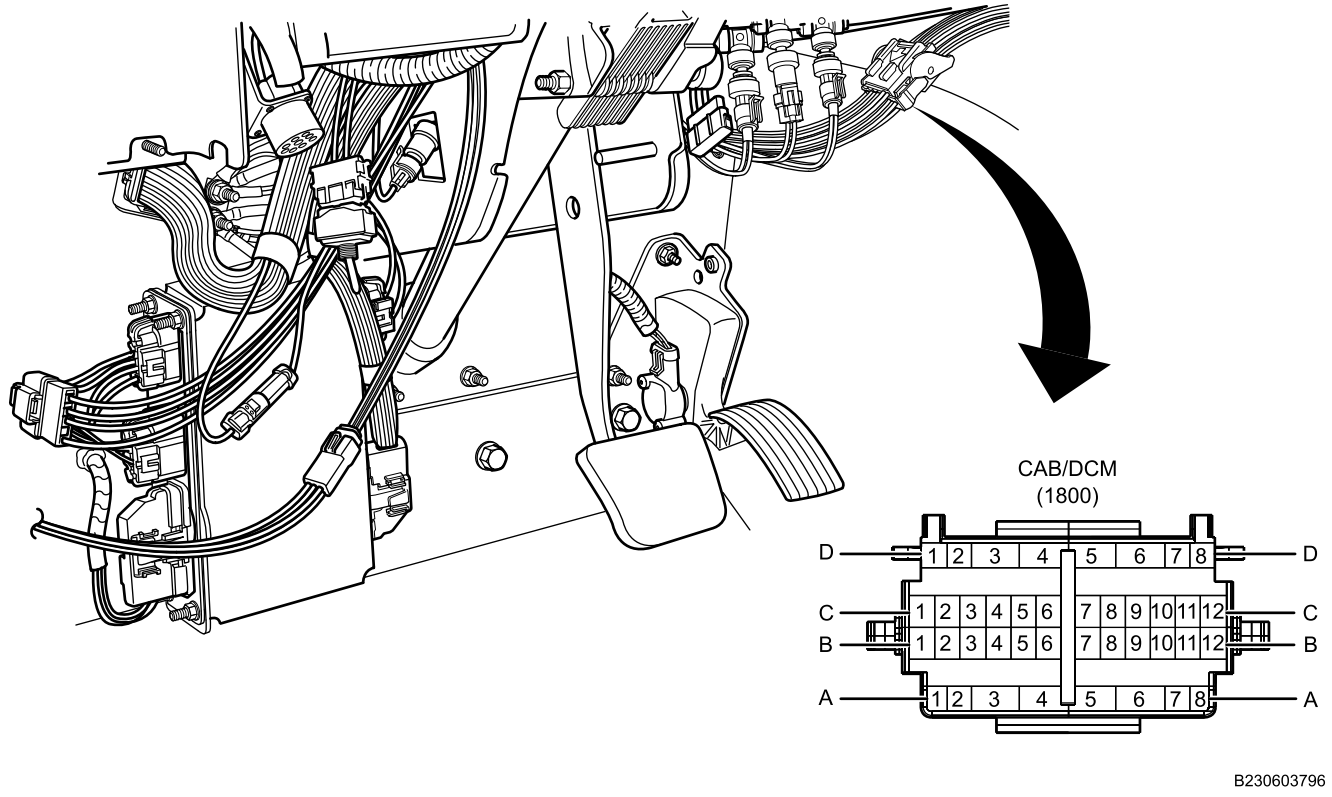


Figure 7. Driver Side Floor Area.

27. Measure resistance between harness connector 1800 terminal B3 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 69.
NO Go to Step 70.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Measure resistance between harness connector 1600 terminal 27 and all other terminals in harness connector 1600 with multimeter. Refer to Figure 8.

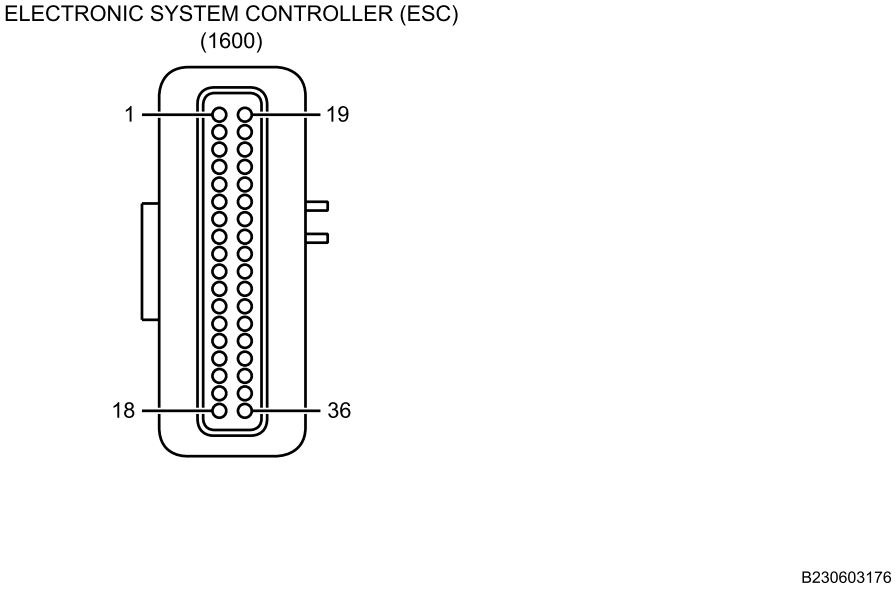


Figure 8. Connector 1600.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 32.
YES Go to next step.

STEP

29. Measure resistance between harness connector 1811 terminal B and harness connector 1600 terminal 27 with multimeter. Refer to Figure 9 and Figure 8.

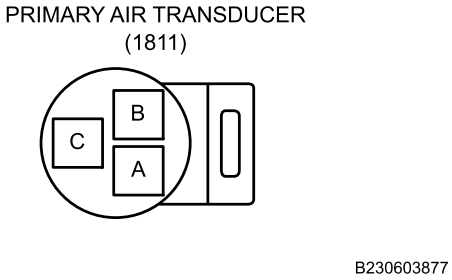


Figure 9. Connector 1811.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 66.
NO Go to next step.

STEP

30. Disconnect harness connector 1800. Refer to Figure 10.

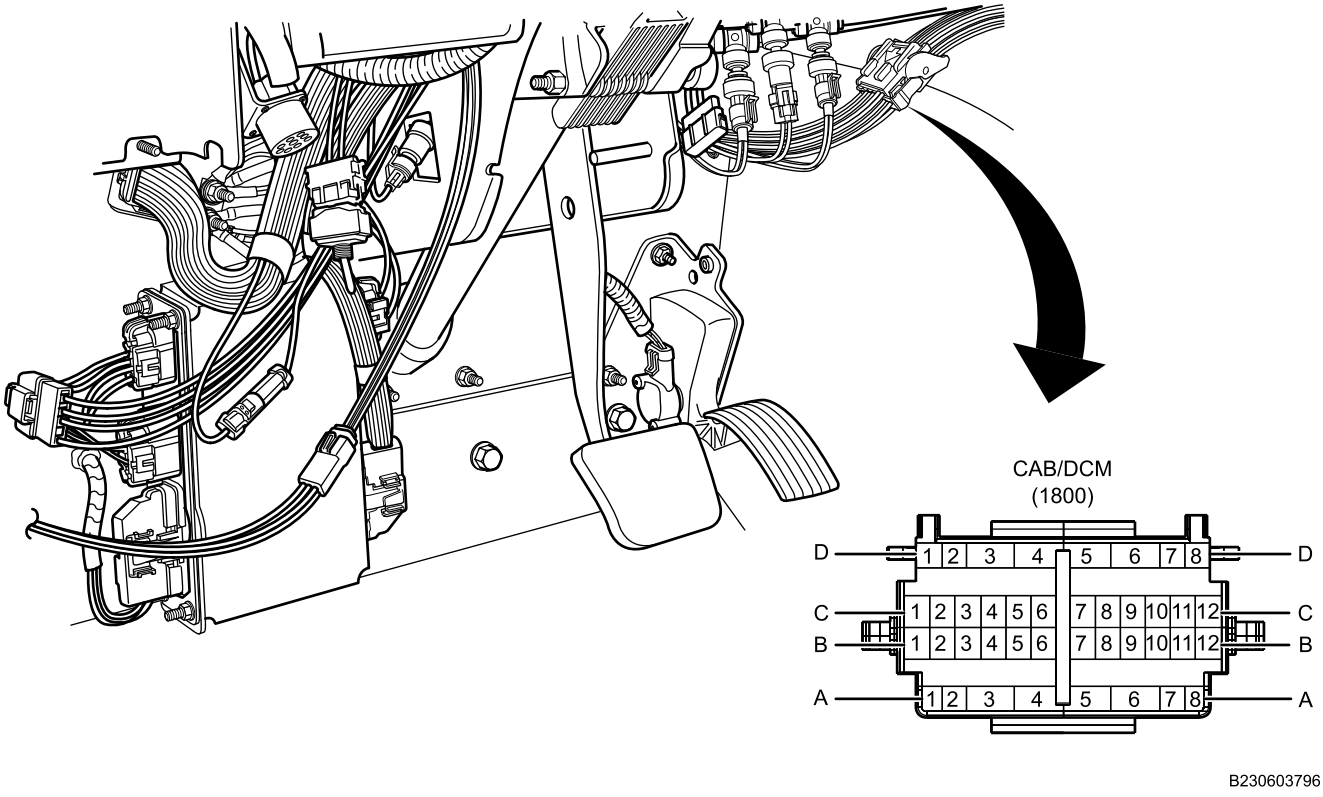


Figure 10. Driver Side Floor Area.

31. Measure resistance between harness connector 1800 terminal B3 and harness connector 1600 terminal 27 with multimeter. Refer to Figure 8 and Figure 10.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

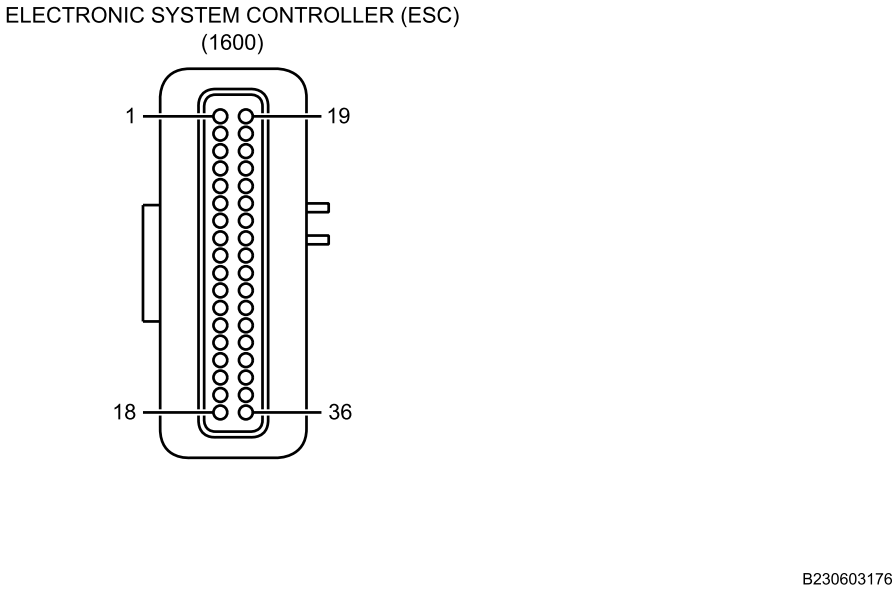


Figure 11. Connector 1600.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 69.
NO Go to Step 70.

STEP

32. Disconnect harness connector 1800. Refer to Figure 10.
33. Measure resistance between ESC harness connector 1600 terminal 27 and all other terminals in harness connector 1600 with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 70.
YES Go to Step 69.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

34. Turn ignition switch OFF (TM 9-2355-106-10).
35. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
36. Disconnect harness connector 1800. Refer to Figure 12.

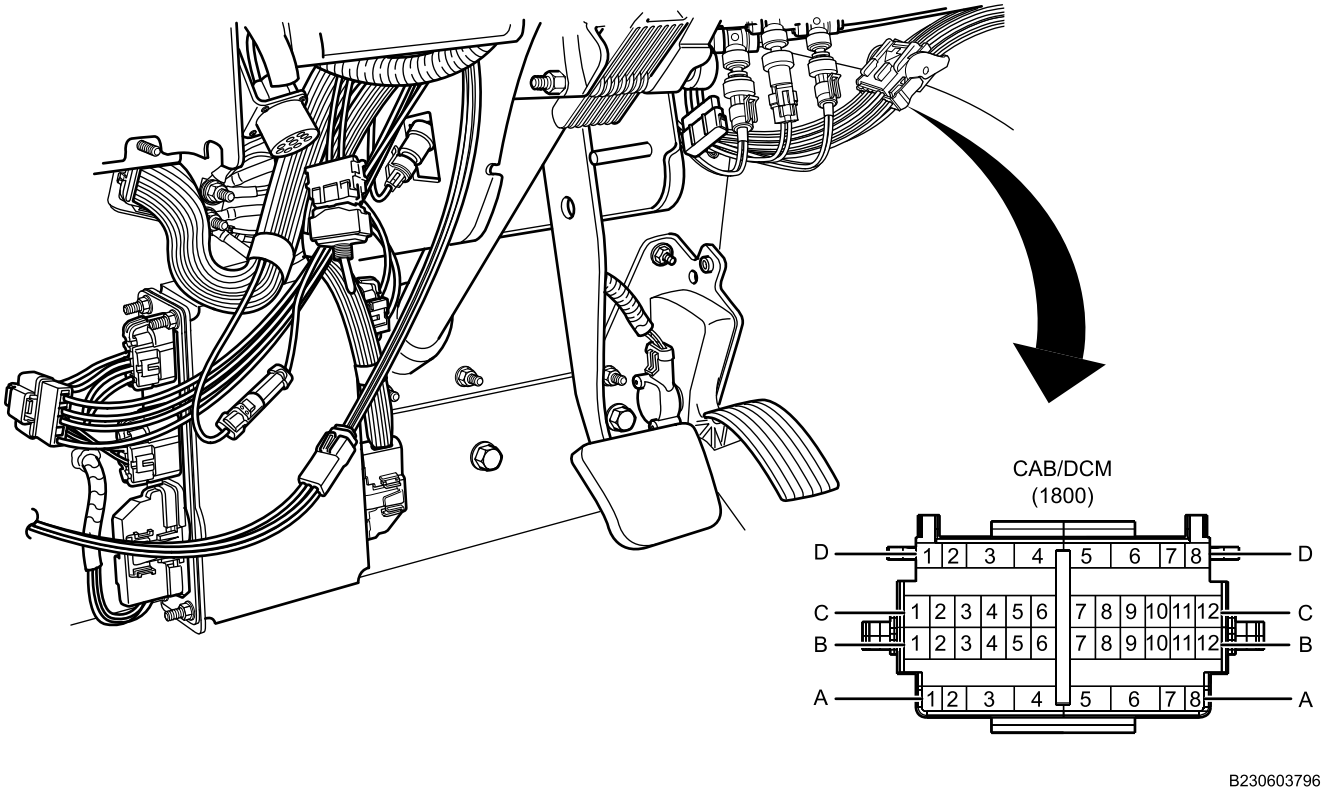


Figure 12. Driver Side Floor Area.

37. Turn MAIN POWER switch ON (TM 9-2355-106-10).
38. Turn ignition switch ON (TM 9-2355-106-10).
39. Measure DC voltage between harness connector 1800 terminal B3 and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 69.
YES Go to Step 70.

STEP

40. Turn ignition switch OFF (TM 9-2355-106-10).
41. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

42. Disconnect harness connector 1600. Refer to Figure 13.

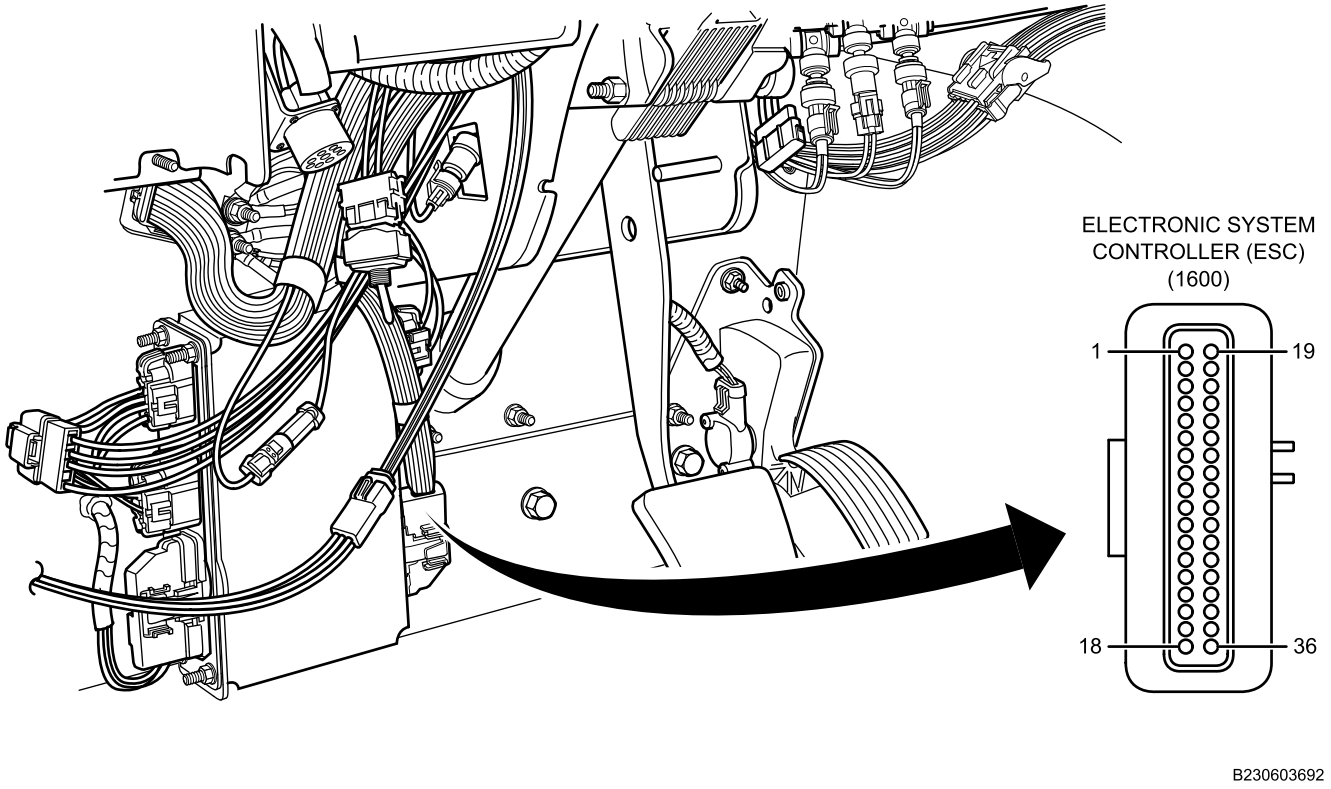


Figure 13. Driver Side Floor Area.

43. Turn MAIN POWER switch ON (TM 9-2355-106-10).
44. Turn ignition switch ON (TM 9-2355-106-10).
45. Measure DC voltage between harness connector 1811 terminal C and ground with multimeter. Refer to Figure 14.

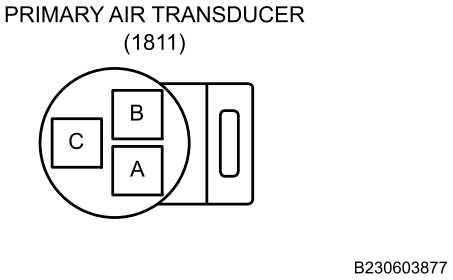


Figure 14. Connector 1811.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 57.
NO Go to next step.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

46. Turn ignition switch OFF (TM 9-2355-106-10).
47. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
48. Measure resistance between harness connector 1811 terminal C and ground with multimeter. Refer to Figure 15.

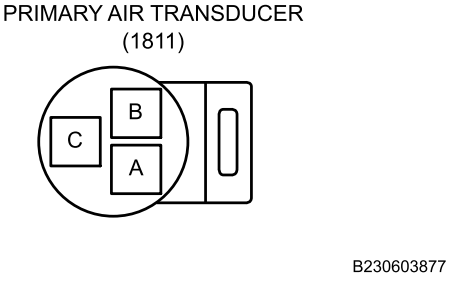


Figure 15. Connector 1811.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 51.
NO Go to next step.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

49. Disconnect harness connector 1800. Refer to Figure 16.

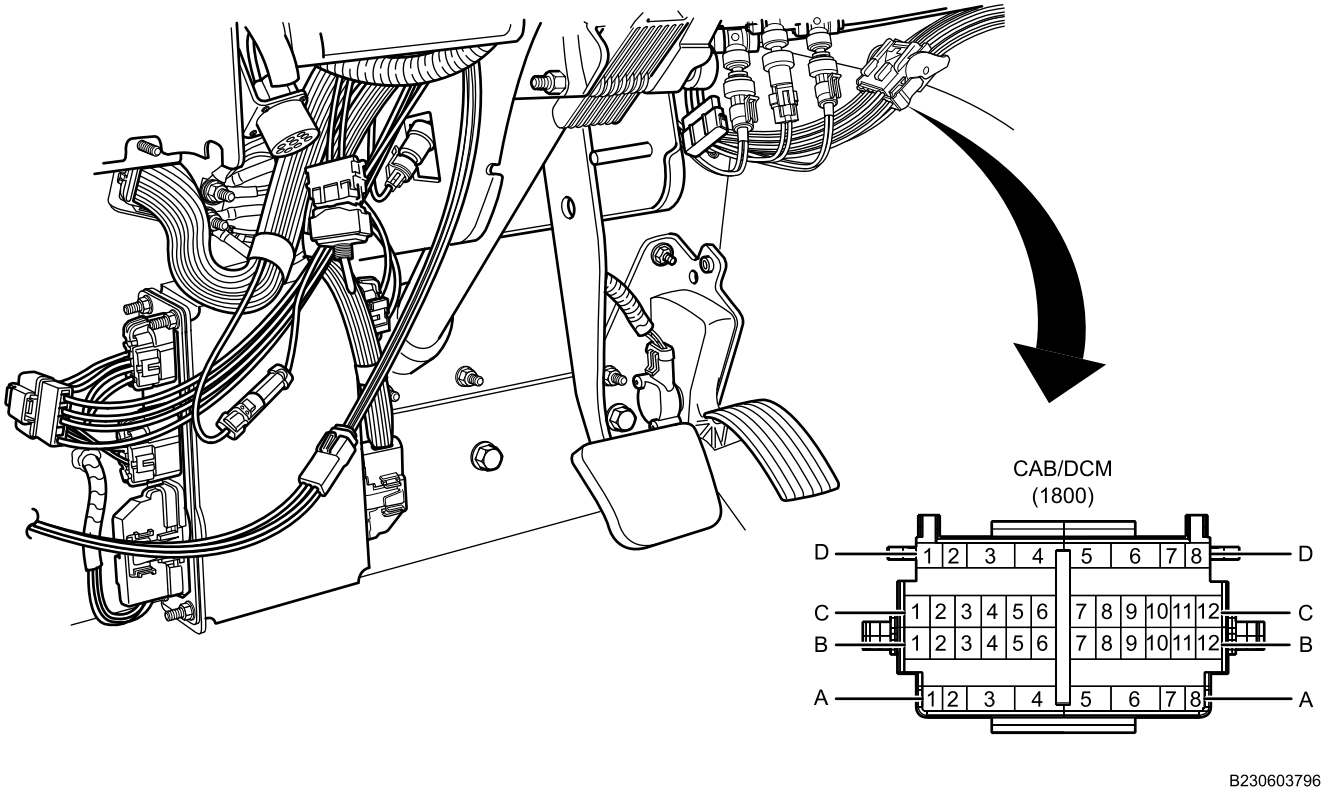


Figure 16. Driver Side Floor Area.

50. Measure resistance between harness connector 1800 terminal C12 and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 70.
YES Go to Step 69.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

51. Measure resistance between harness connector 1600 terminal 15 and all other terminals in harness connector 1600 with multimeter. Refer to Figure 17.

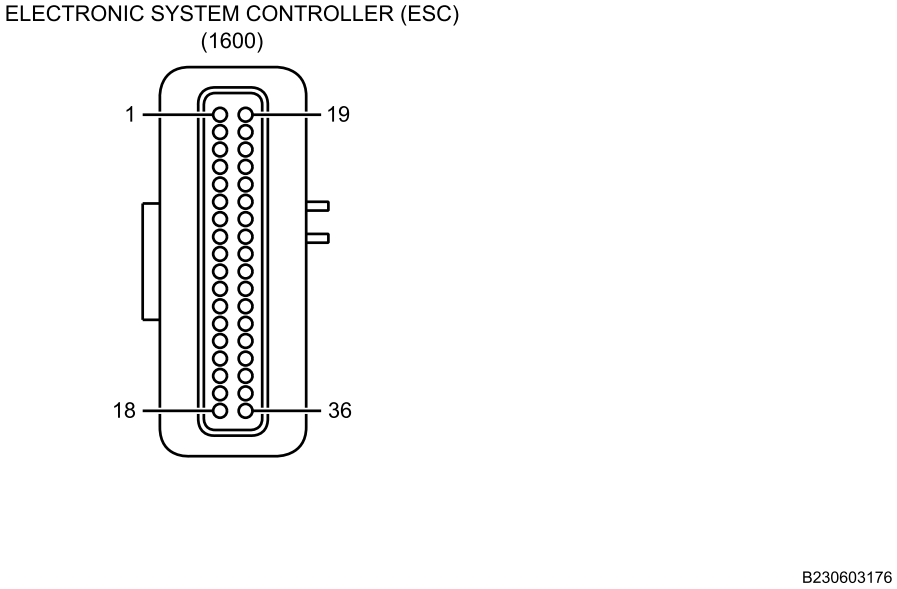


Figure 17. Connector 1600.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 54.
NO Go to next step.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

52. Disconnect harness connector 1800. Refer to Figure 18.

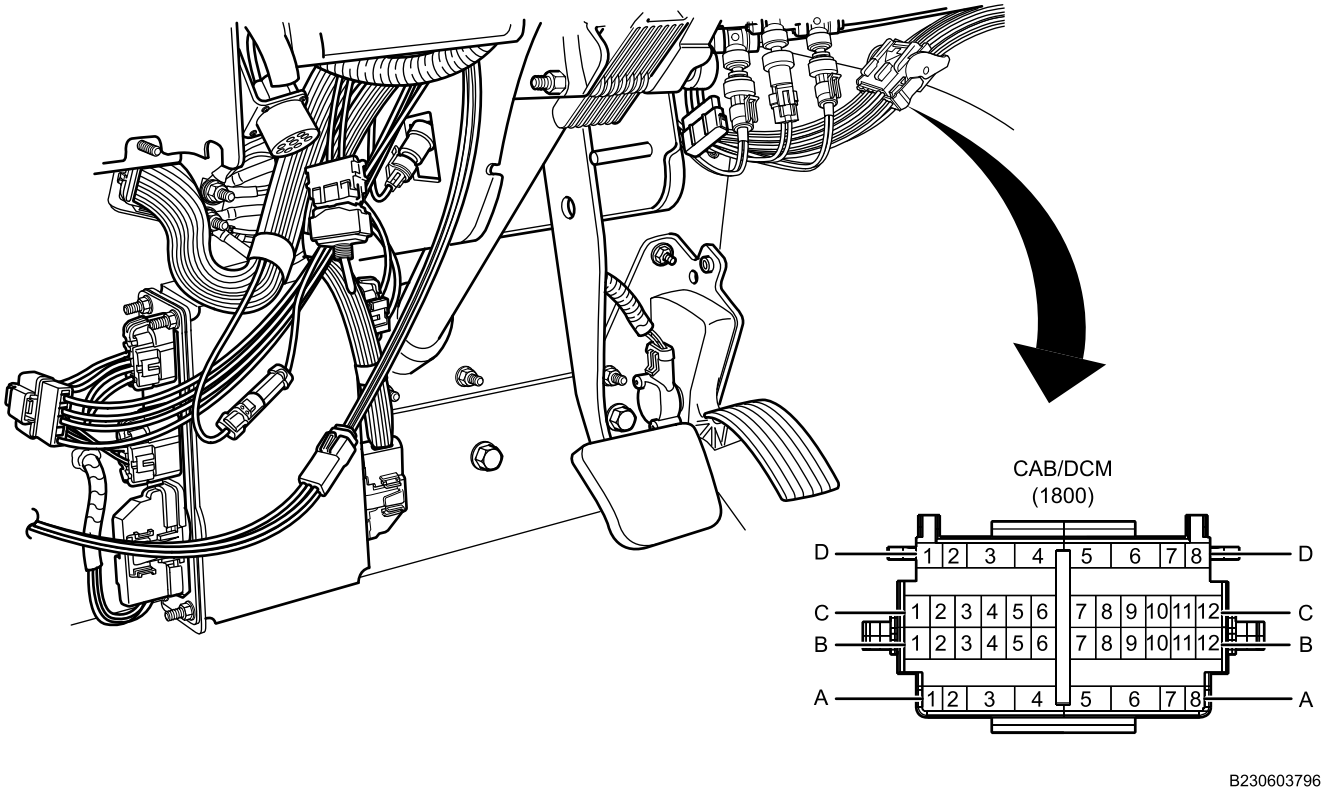


Figure 18. Driver Side Floor Area.

53. Measure resistance between harness connector 1600 terminal 15 and all other terminals in harness connector 1600 with multimeter. Refer to Figure 20.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 69.
NO Go to Step 70.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

54. Measure resistance between harness connector 1811 terminal C and harness connector 1600 terminal 15 with multimeter. Refer to Figure 19 and Figure 20.

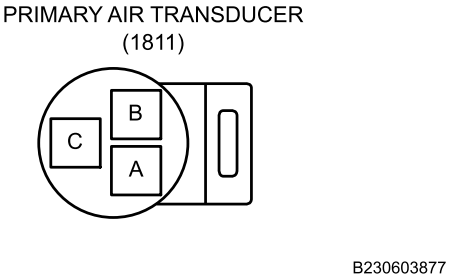


Figure 19. Connector 1811.

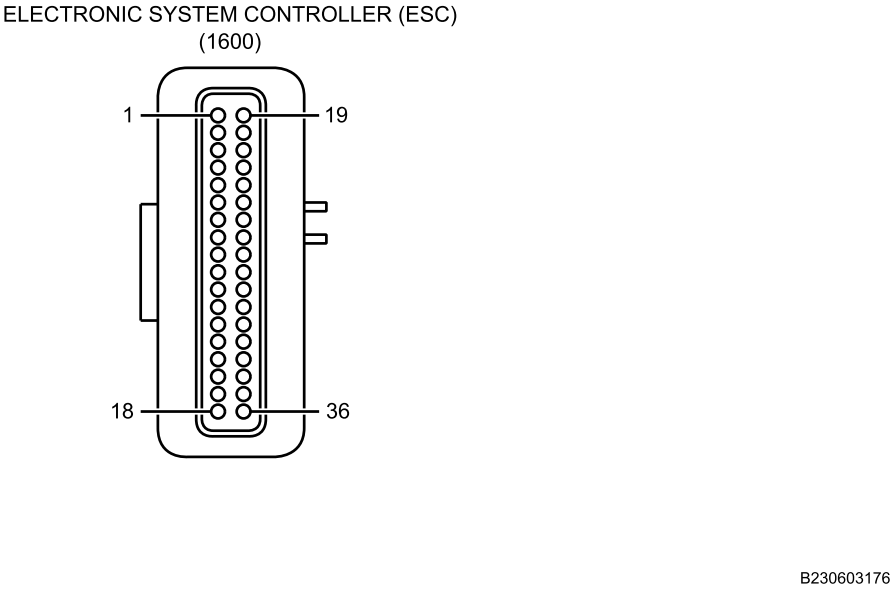


Figure 20. Connector 1600.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 66.
NO Go to next step.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

55. Disconnect harness connector 1800. Refer to Figure 21.

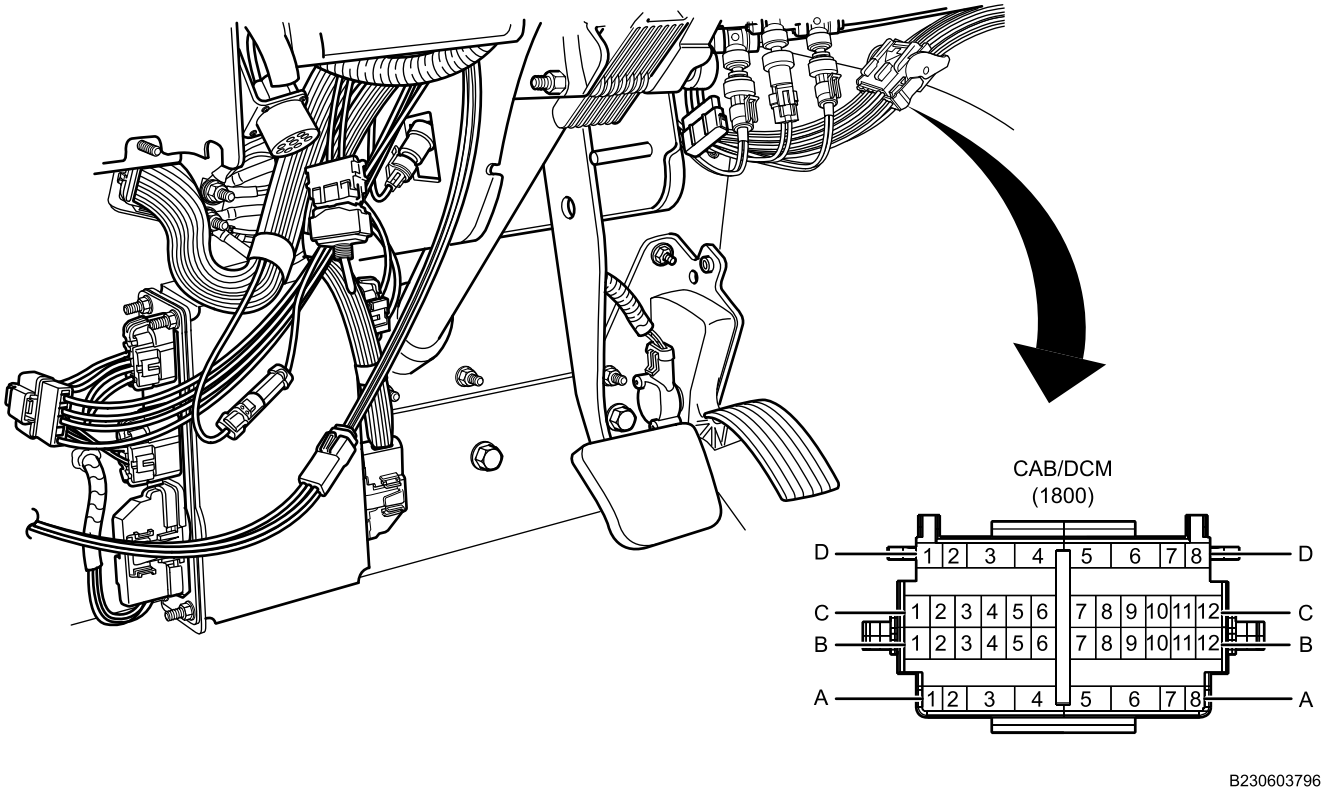


Figure 21. Driver Side Floor Area.

56. Measure resistance between harness connector 1800 terminal C12 and harness connector 1600 terminal 15 with multimeter. Refer to Figure 21 and Figure 20.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 70.
YES Go to Step 69.

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

57. Turn ignition switch OFF (TM 9-2355-106-10).
58. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
59. Disconnect harness connector 1800. Refer to Figure 22.

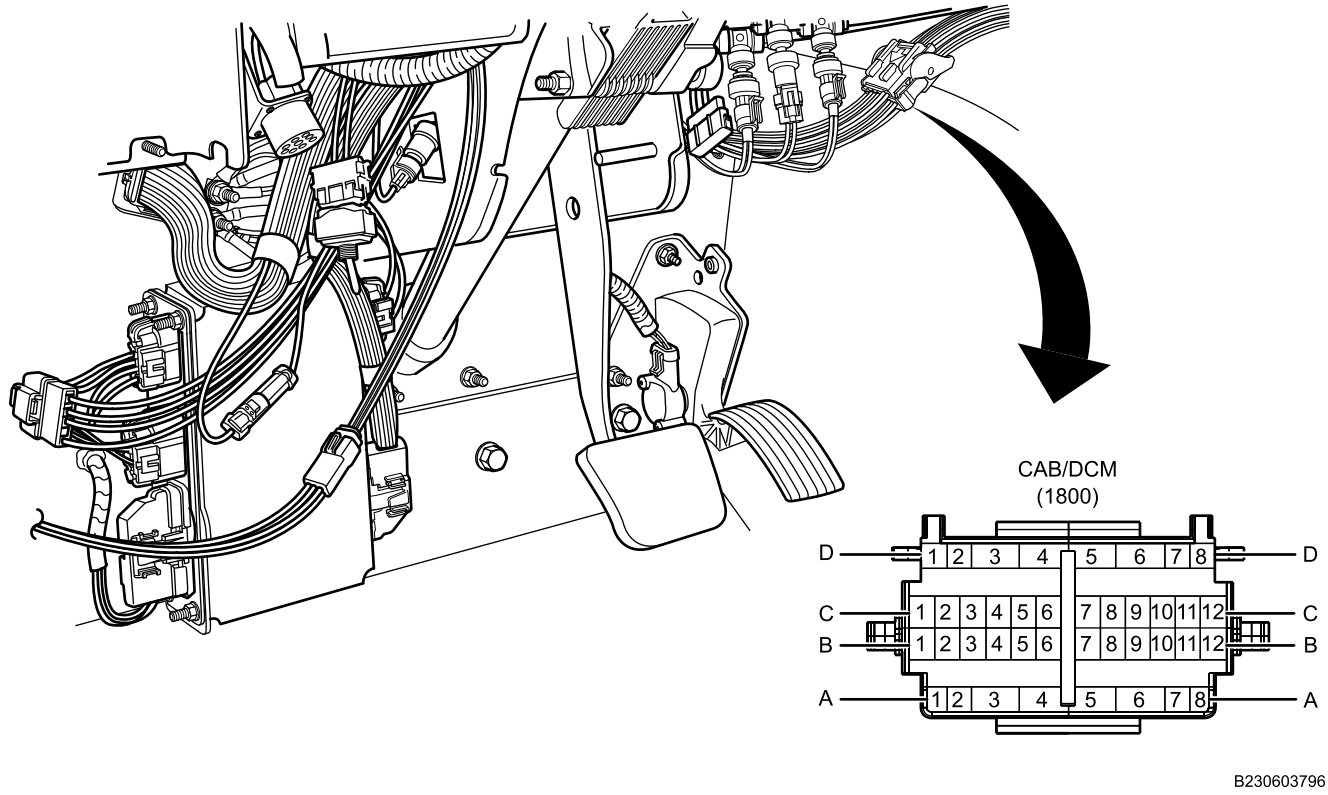


Figure 22. Driver Side Floor Area.

60. Turn MAIN POWER switch ON (TM 9-2355-106-10).
61. Turn ignition switch ON (TM 9-2355-106-10).
62. Measure DC voltage between harness connector 1800 terminal C12 and ground with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 69.
YES Go to Step 70.

STEP

63. Substitute known good primary air pressure gauge. Refer to Air 1 Pressure Gauge and Harness Removal and Installation (WP 0294).

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

64. Turn MAIN POWER switch ON (TM 9-2355-106-10).
65. Turn ignition switch ON while observing primary air pressure gauge (TM 9-2355-106-10). Primary air pressure gauge should sweep from 0 psi to 150 psi and back to 0 psi.

CONDITION/INDICATION

Does primary air pressure gauge sweep correctly during gauge sweep?

DECISION

NO Go to Step 68.
YES Return vehicle to service.

MALFUNCTION

- 66. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

MALFUNCTION

- 67. Primary air pressure transducer is faulty.

ACTION

Replace primary air pressure transducer. Refer to Air Gauge Transducer Removal and Installation (WP 0322). Return vehicle to service.

END OF TEST

MALFUNCTION

- 68. Instrument panel cluster (IPC) is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

AIR 1/PRIMARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 69. Steering column harness is faulty.

ACTION

Replace steering column harness. Refer to Steering Column Wiring Harness Removal and Installation (WP 0324). Return vehicle to service.

END OF TEST

MALFUNCTION

- 70. Instrument panel (IP) harness is faulty.

ACTION

Replace instrument panel harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0295
WP 0353
WP 0322
WP 0297
WP 0324
WP 0319
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Left cabin door open and secured (WP 0608)

This procedure covers the following Electronic System Controller (ESC) Diagnostic Trouble Codes (DTCs):

- 612 14 3 1
- 612 14 3 2
- 612 14 30 1
- 612 14 30 2
- 2023 14 108 5
- 2023 14 110 5 or 2023 14 210 5
- 2023 14 110 6 or 2023 14 210 6
- 2023 14 110 7 or 2023 14 210 7

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Cabin door must be secured in the open position by using heavy duty straps to prevent accidental closure during vehicle maintenance. Pull check link retaining pin prior to securing door open. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition ON (TM 9-2355-106-10) while observing secondary air pressure gauge.

CONDITION/INDICATION

Does secondary air pressure gauge sweep from 0 psi to 150 psi and back to 0 psi?

DECISION

NO Go to Step 63.
YES Go to next step.

STEP

3. Connect MSD. Refer to Connecting Maintenance Support Device (WP 0011).
4. Activate secondary air pressure gauge with MSD.

CONDITION/INDICATION

Does secondary air pressure gauge perform correctly when activated with MSD?

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 66.
YES Go to next step.

STEP

5. Turn ignition switch OFF (TM 9-2355-106-10).
6. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
7. Disconnect secondary air pressure transducer harness connector 1812. Refer to Figure 1.

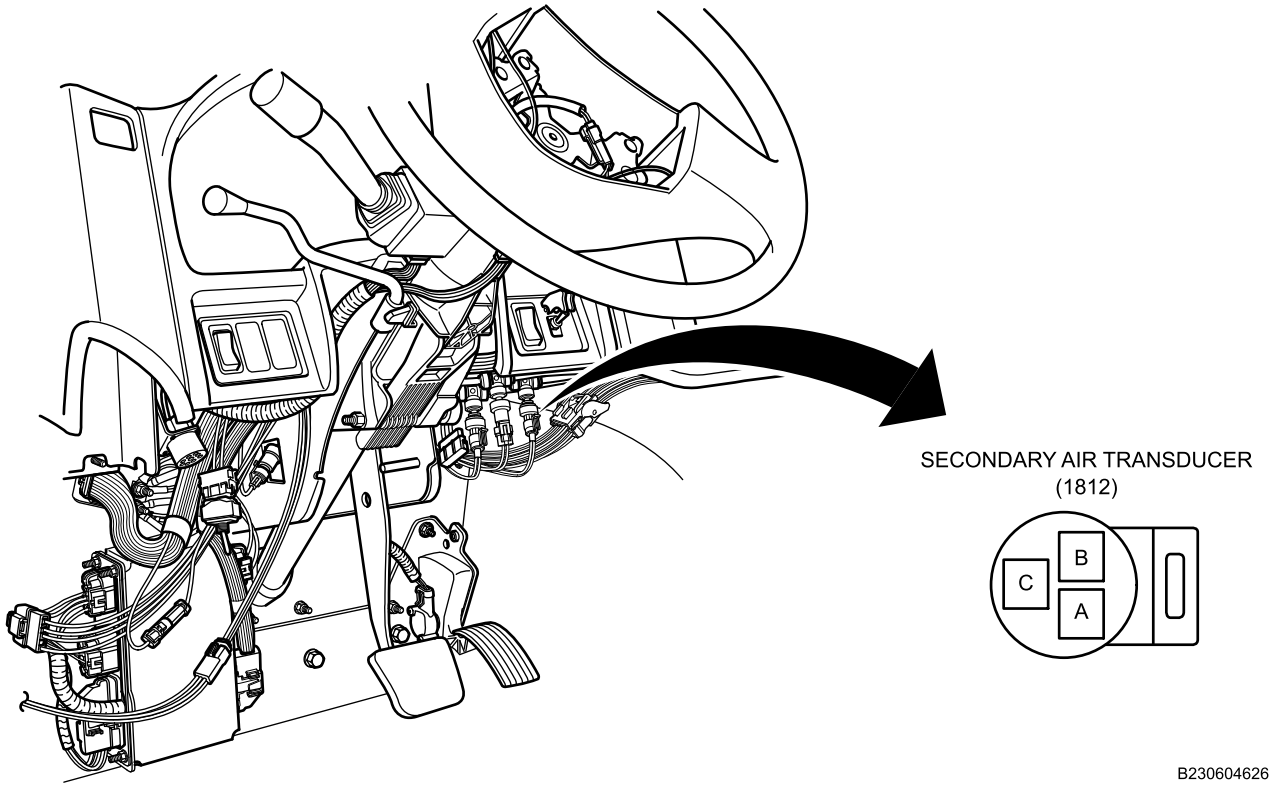


Figure 1. Driver Side Floor Area.

8. Measure resistance between harness connector 1812 terminal A and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 13.
YES Go to next step.

STEP

9. Turn MAIN POWER switch ON (TM 9-2355-106-10).

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

10. Turn ignition switch ON (TM 9-2355-106-10).
11. Measure DC voltage between harness connector 1812 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 17.
YES Go to next step.

STEP

12. Measure DC voltage between harness connector 1812 terminals B and C with multimeter. Refer to Figure 2.

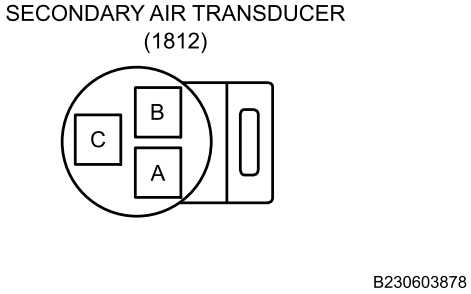


Figure 2. Connector 1812.

CONDITION/INDICATION

Does multimeter read between 4.5V and 5.5V?

DECISION

NO Go to Step 40.
YES Go to Step 67.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

13. Disconnect harness connector 1800. Refer to Figure 3.

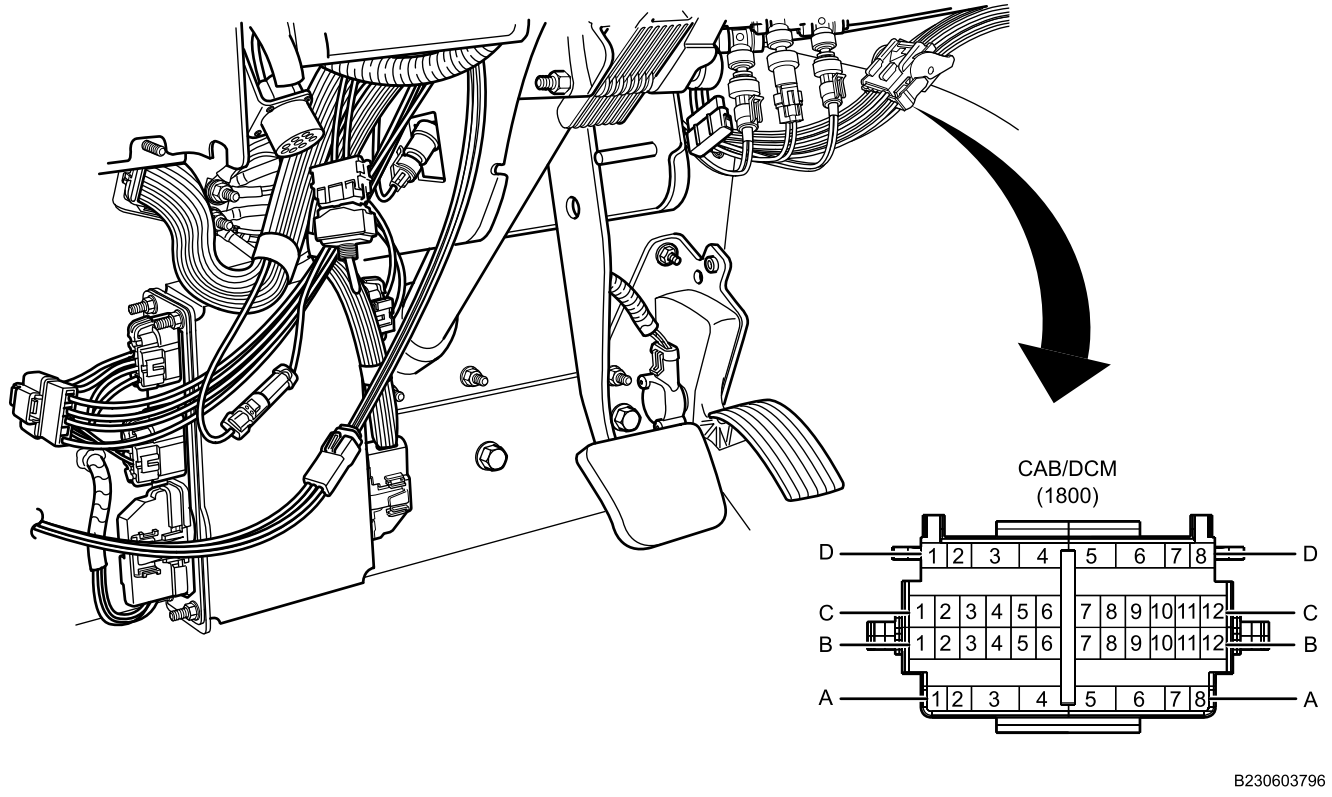


Figure 3. Driver Side Floor Area.

14. Measure resistance between harness connector 1800 terminal A4 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 69.
NO Go to next step.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

15. Disconnect harness connector 1600. Refer to Figure 4.

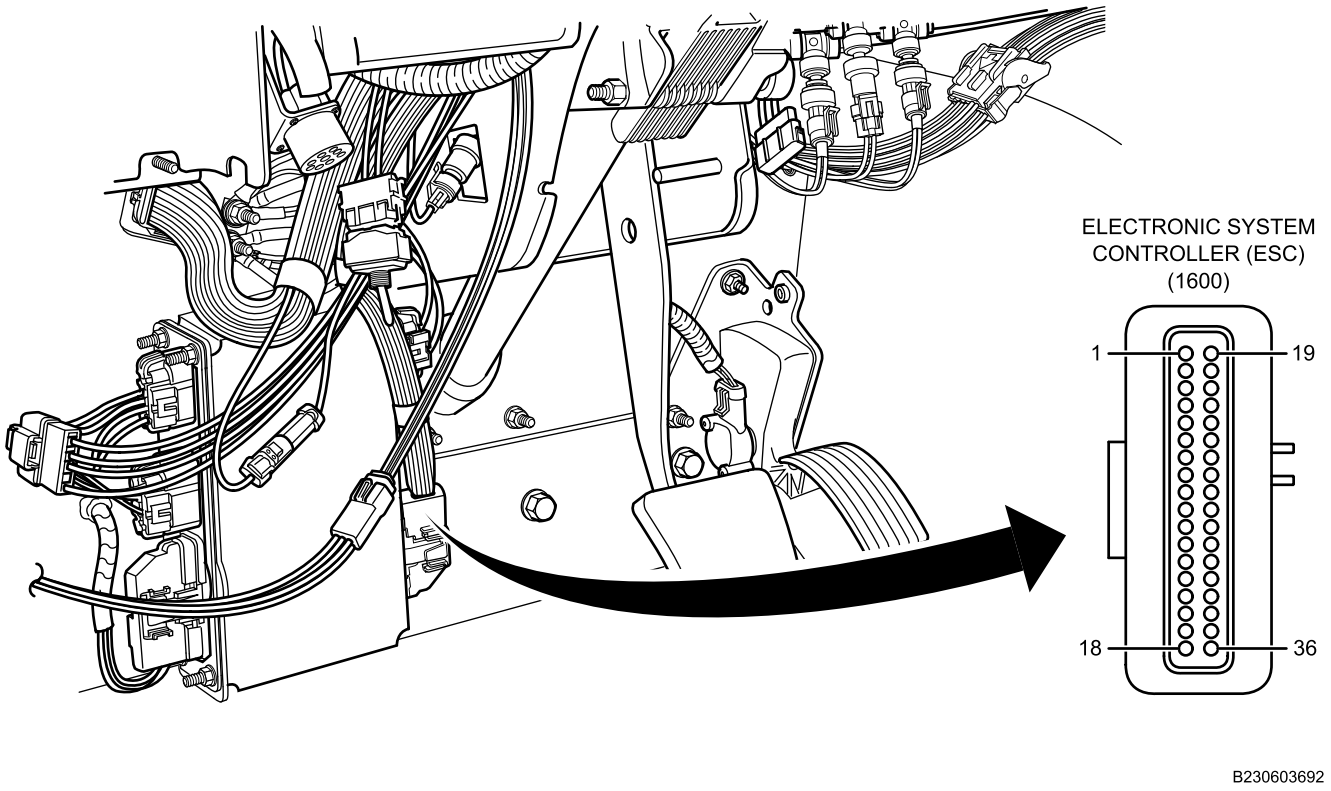


Figure 4. Driver Side Floor Area.

16. Measure resistance between harness connector 1800 terminal A4 and harness connector 1600 terminal 3 with multimeter. Refer to Figure 5 and Figure 4.

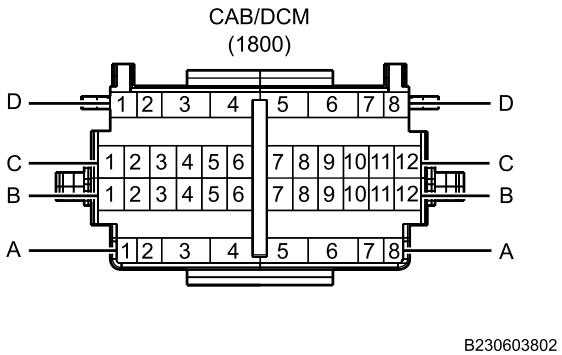


Figure 5. Connector 1800.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 70.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

YES Go to Step 66.

STEP

17. Turn ignition switch OFF (TM 9-2355-106-10).
18. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
19. Disconnect harness connector 1600. Refer to Figure 4.
20. Turn MAIN POWER switch ON (TM 9-2355-106-10).
21. Turn ignition switch ON (TM 9-2355-106-10).
22. Measure DC voltage between harness connector 1812 terminal B and ground with multimeter. Refer to Figure 6.

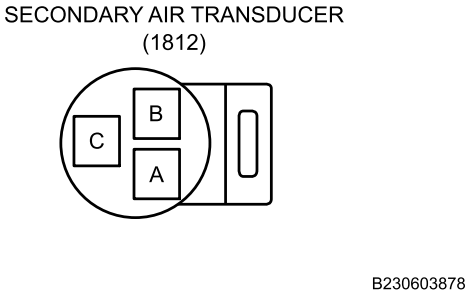


Figure 6. Connector 1812.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 34.
NO Go to next step.

STEP

23. Turn ignition switch OFF (TM 9-2355-106-10).
24. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
25. Measure resistance between harness connector 1812 terminal B and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 28.
NO Go to next step.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

26. Disconnect harness connector 1800. Refer to Figure 7.

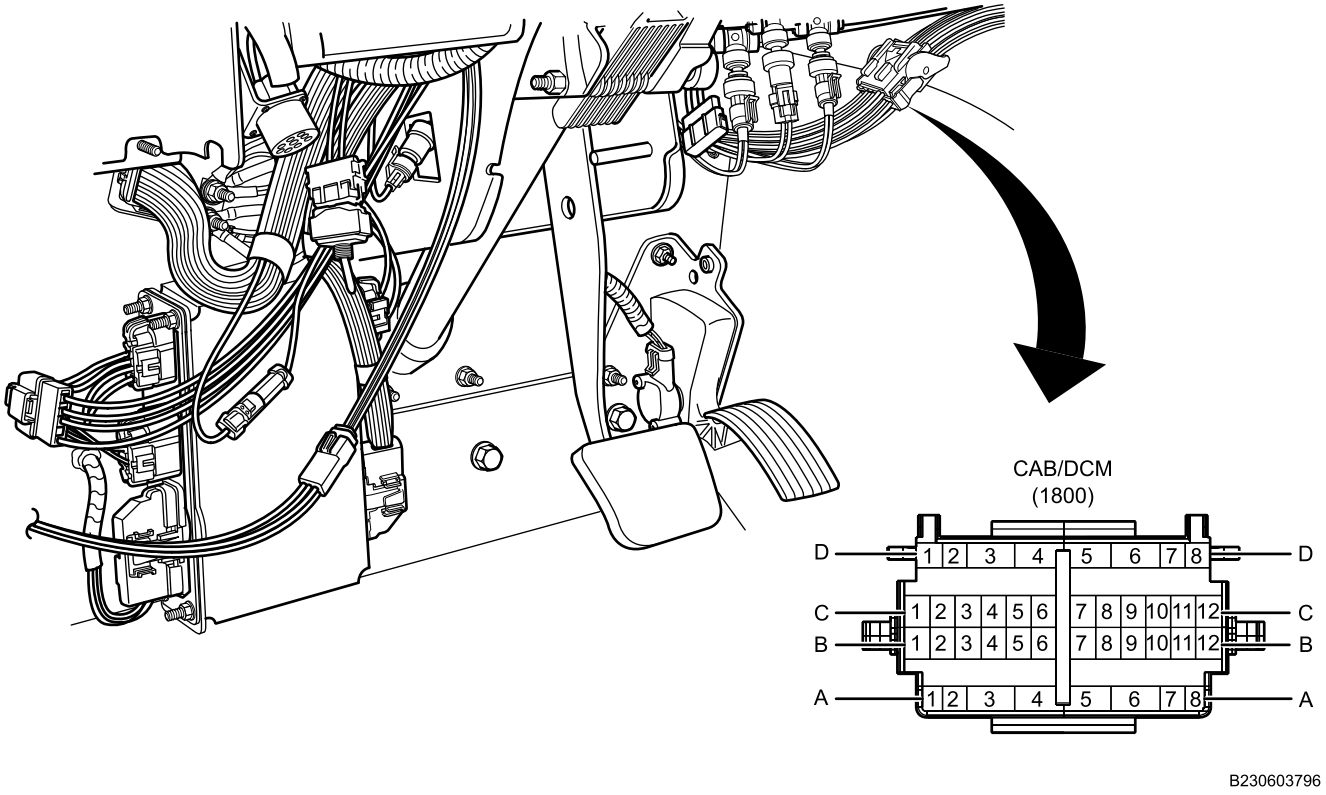


Figure 7. Driver Side Floor Area.

27. Measure resistance between harness connector 1800 terminal B3 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 69.
NO Go to Step 70.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Measure resistance between harness connector 1600 terminal 27 and all other terminals in harness connector 1600 with multimeter. Refer to Figure 8.

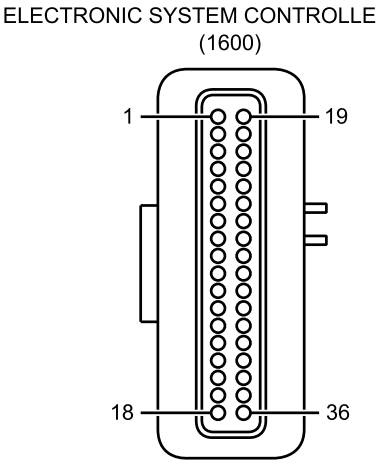


Figure 8. Connector 1600.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 32.
YES Go to next step.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

29. Measure resistance between harness connector 1812 terminal B and harness connector 1600 terminal 27 with multimeter. Refer to Figure 9 and Figure 8.

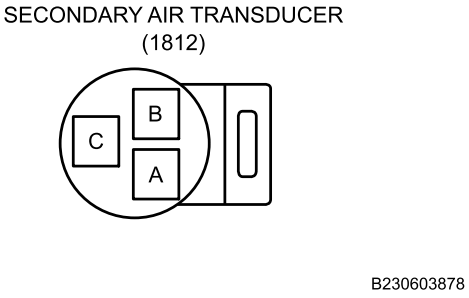


Figure 9. Connector 1812.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 66.
NO Go to next step.

STEP

30. Disconnect harness connector 1800. Refer to Figure 10.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

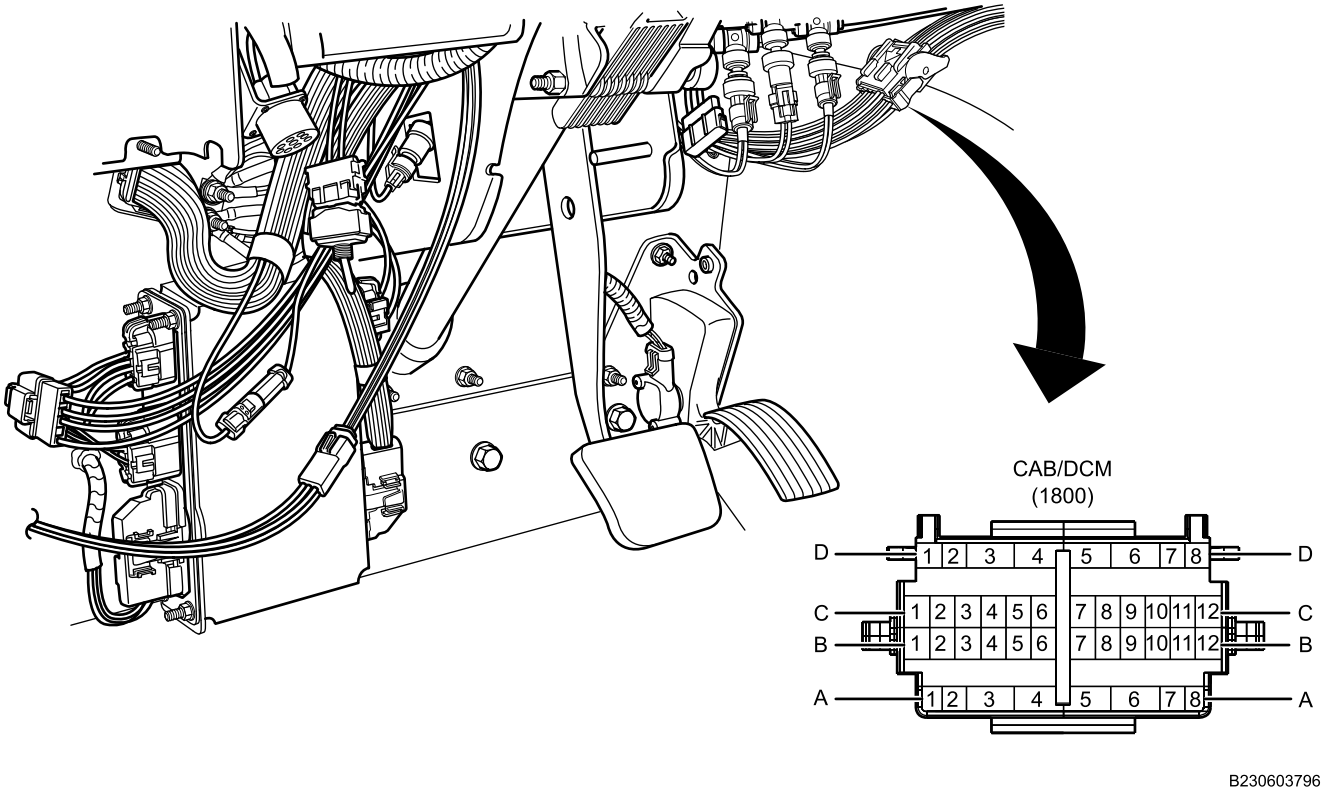


Figure 10. Driver Side Floor Area.

31. Measure resistance between harness connector 1800 terminal B3 and harness connector 1600 terminal 27 with multimeter. Refer to Figure 10 and Figure 11.

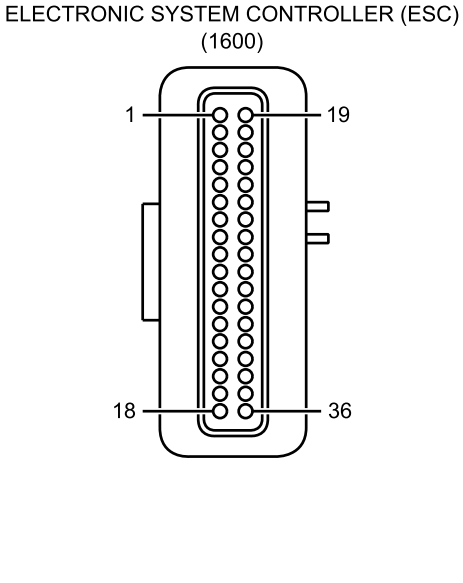


Figure 11. Connector 1600.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 69.
NO Go to Step 70.

STEP

32. Disconnect harness connector 1800. Refer to Figure 10.
33. Measure resistance between harness connector 1600 terminal 27 and all other terminals in harness connector 1600 with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 70.
YES Go to Step 69.

STEP

34. Turn ignition switch OFF (TM 9-2355-106-10).
35. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

36. Disconnect harness connector 1800. Refer to Figure 12.

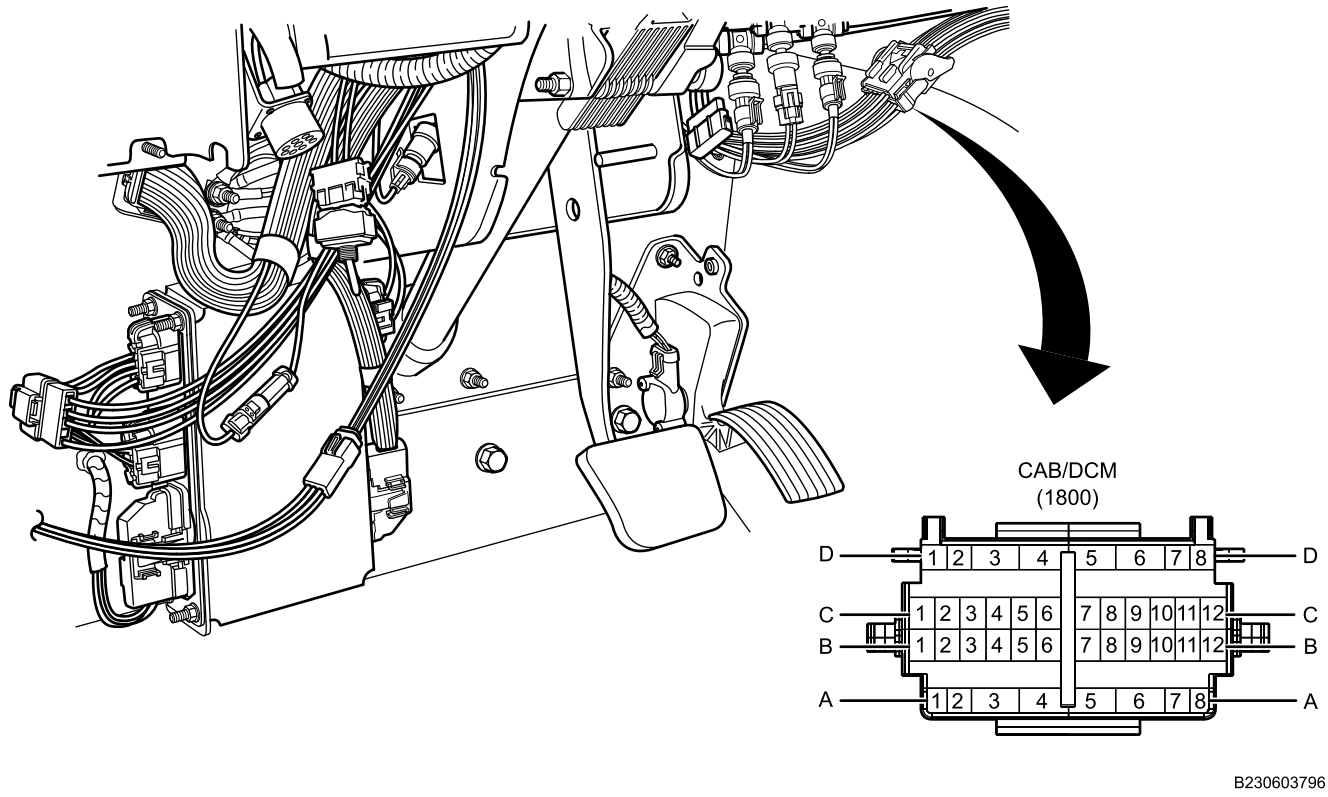


Figure 12. Driver Side Floor Area.

37. Turn MAIN POWER switch ON (TM 9-2355-106-10).
38. Turn ignition switch ON (TM 9-2355-106-10).
39. Measure DC voltage between harness connector 1800 terminal B3 and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 69.
YES Go to Step 70.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

40. Turn ignition switch OFF (TM 9-2355-106-10).
41. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
42. Disconnect harness connector 1600. Refer to Figure 13.

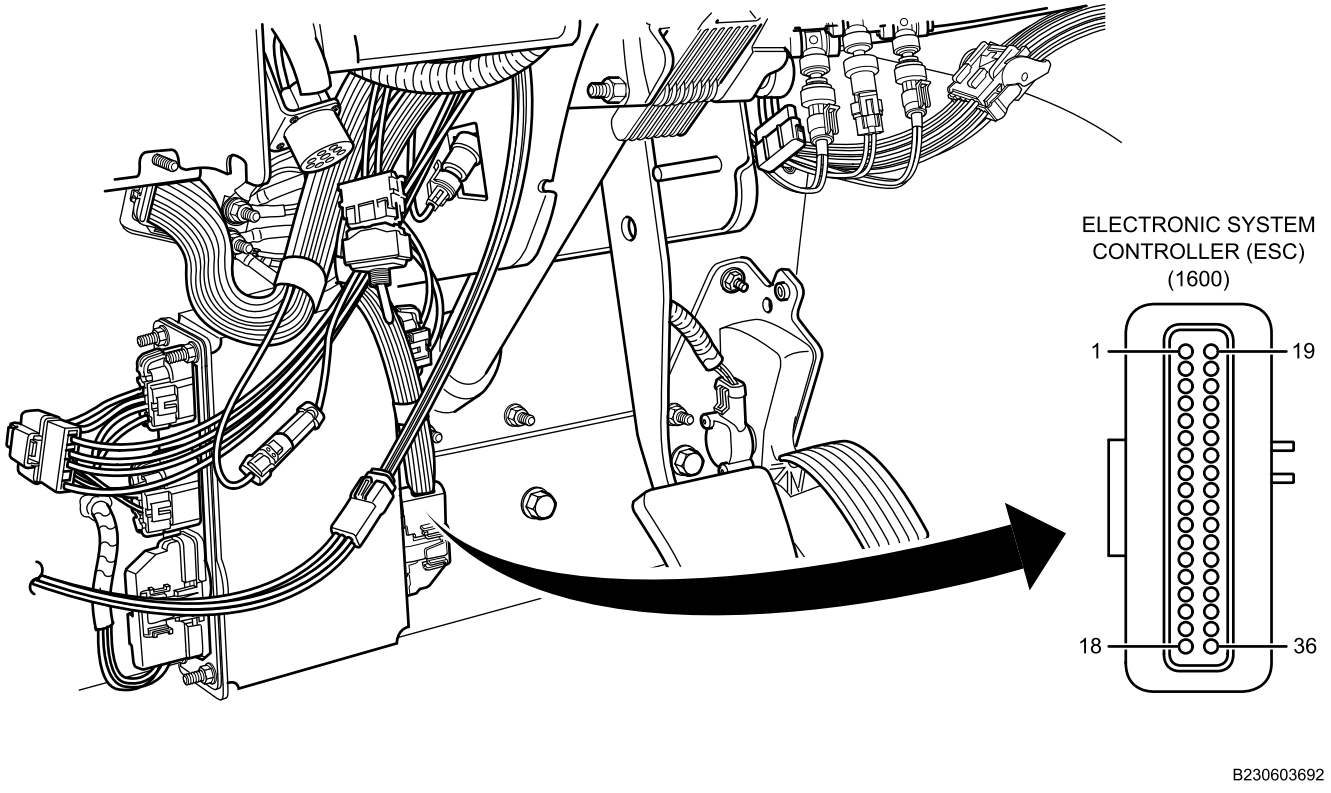


Figure 13. Driver Side Floor Area.

43. Turn MAIN POWER switch ON (TM 9-2355-106-10).
44. Turn ignition switch ON (TM 9-2355-106-10).

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

45. Measure DC voltage between harness connector 1812 terminal C and ground with multimeter. Refer to Figure 14.

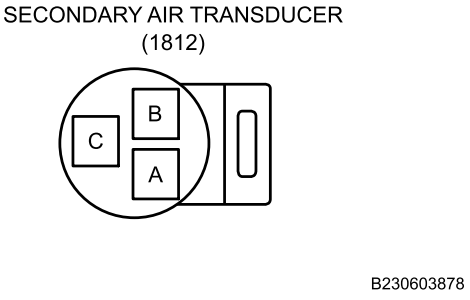


Figure 14. Connector 1812.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

YES Go to Step 57.
NO Go to next step.

STEP

46. Turn ignition switch OFF (TM 9-2355-106-10).
47. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
48. Measure resistance between harness connector 1812 terminal C and ground with multimeter. Refer to Figure 15.

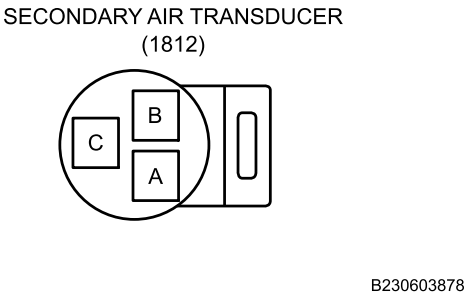


Figure 15. Connector 1812.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 51.
NO Go to next step.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

49. Disconnect harness connector 1800. Refer to Figure 16.

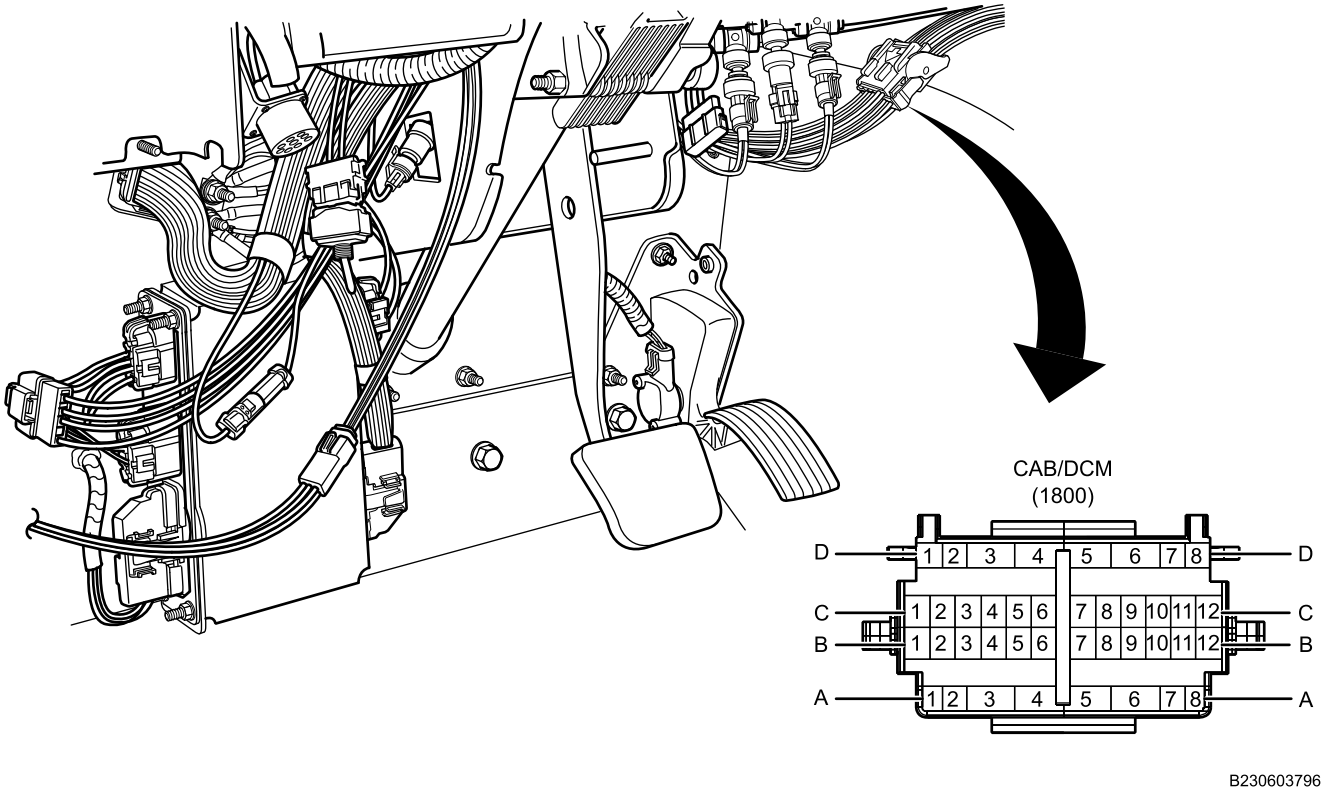


Figure 16. Driver Side Floor Area.

50. Measure resistance between harness connector 1800 terminal B2 and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 70.
YES Go to Step 69.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

51. Measure resistance between harness connector 1600 terminal 16 and all other terminals in harness connector 1600 with multimeter. Refer to Figure 17.

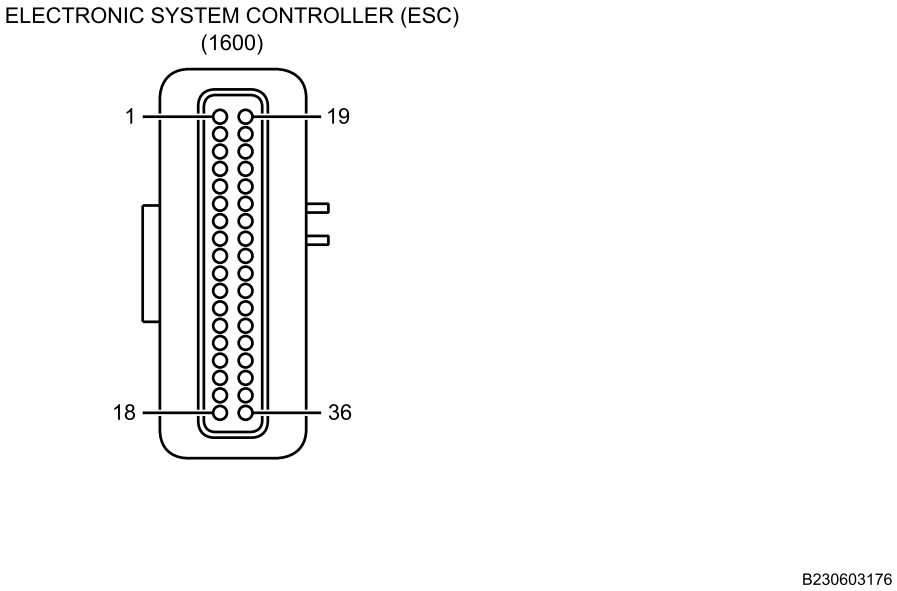


Figure 17. Connector 1600.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 54.
NO Go to next step.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

52. Disconnect harness connector 1800. Refer to Figure 18.

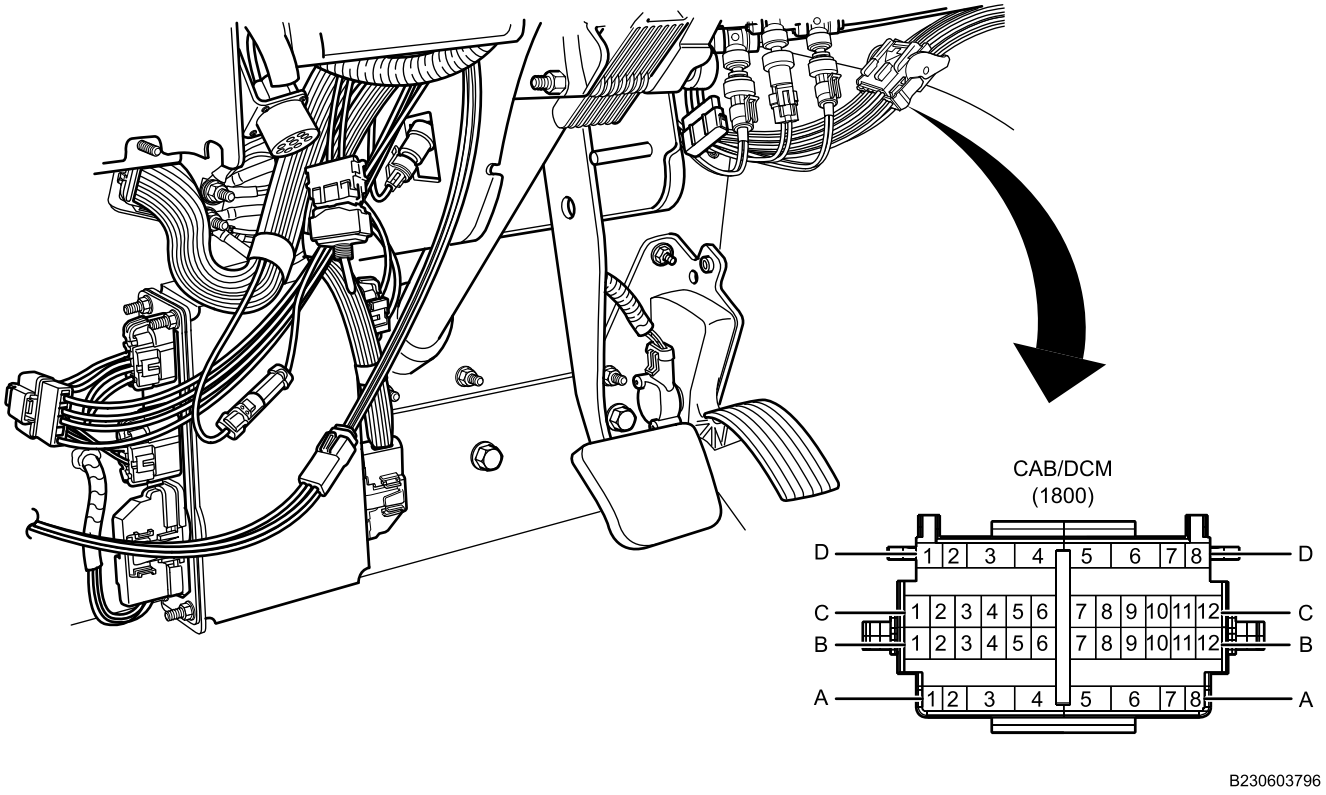


Figure 18. Driver Side Floor Area.

53. Measure resistance between harness connector 1600 terminal 16 and all other terminals in harness connector 1600 with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 69.
NO Go to Step 70.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

54. Measure resistance between harness connector 1812 terminal C and harness connector 1600 terminal 16 with multimeter. Refer to Figure 19 and Figure 20.

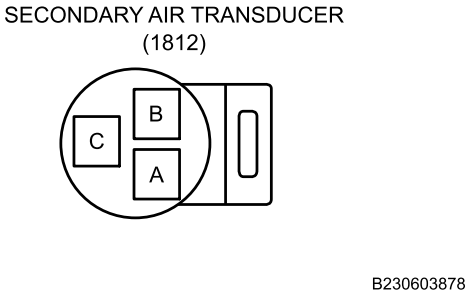


Figure 19. Connector 1812.

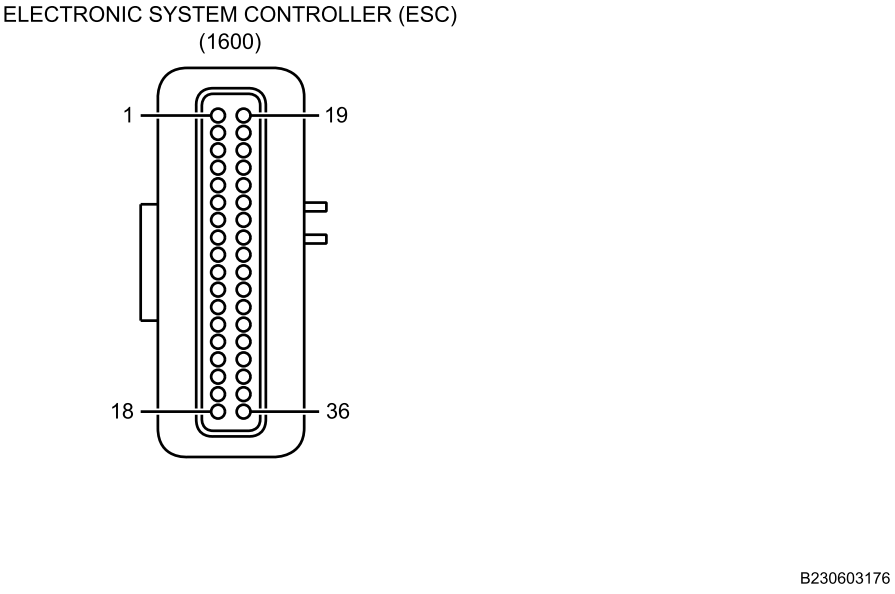


Figure 20. Connector 1600.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 66.
NO Go to next step.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

55. Disconnect harness connector 1800. Refer to Figure 21.

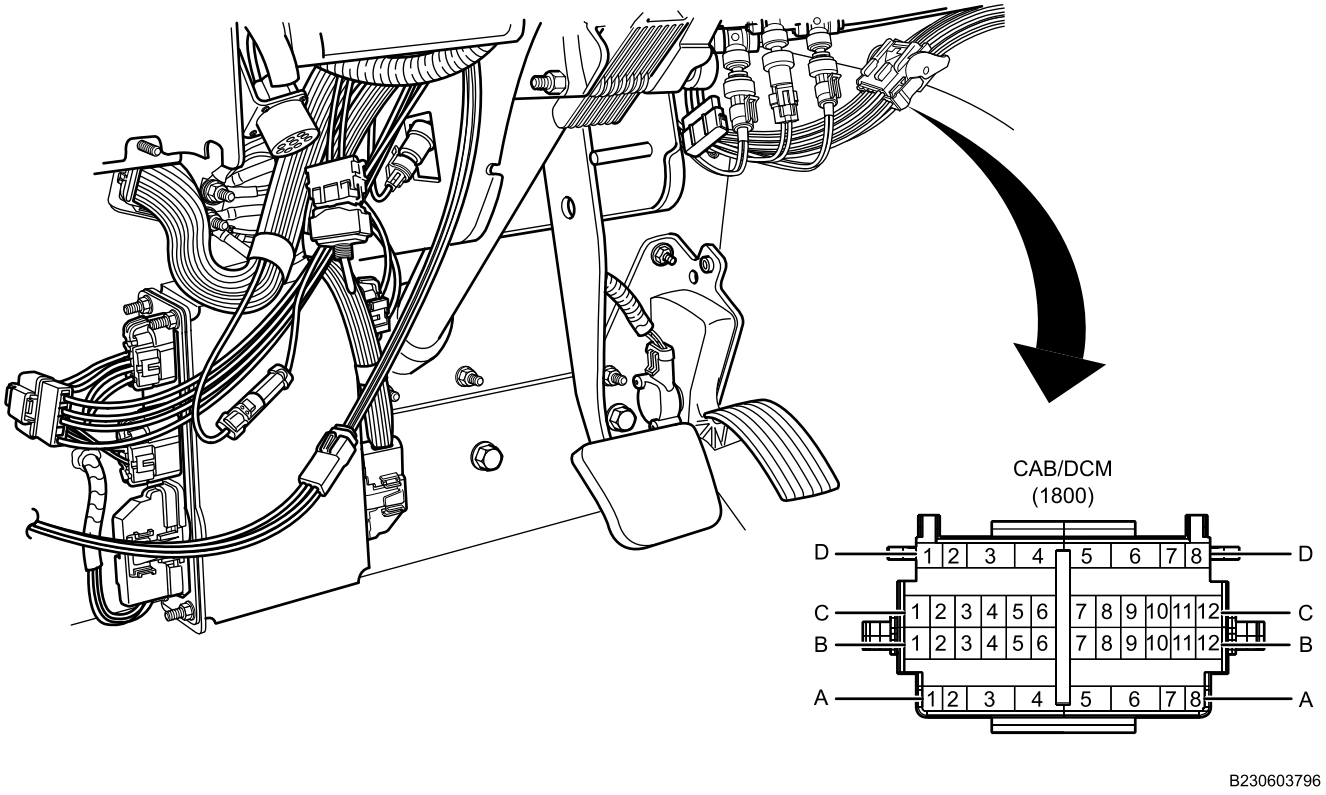


Figure 21. Driver Side Floor Area.

56. Measure resistance between harness connector 1800 terminal B2 and harness connector 1600 terminal 16 with multimeter. Refer to Figure 21 and Figure 20.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 70.
YES Go to Step 69.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

57. Turn ignition switch OFF (TM 9-2355-106-10).
58. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
59. Disconnect harness connector 1800. Refer to Figure 22.

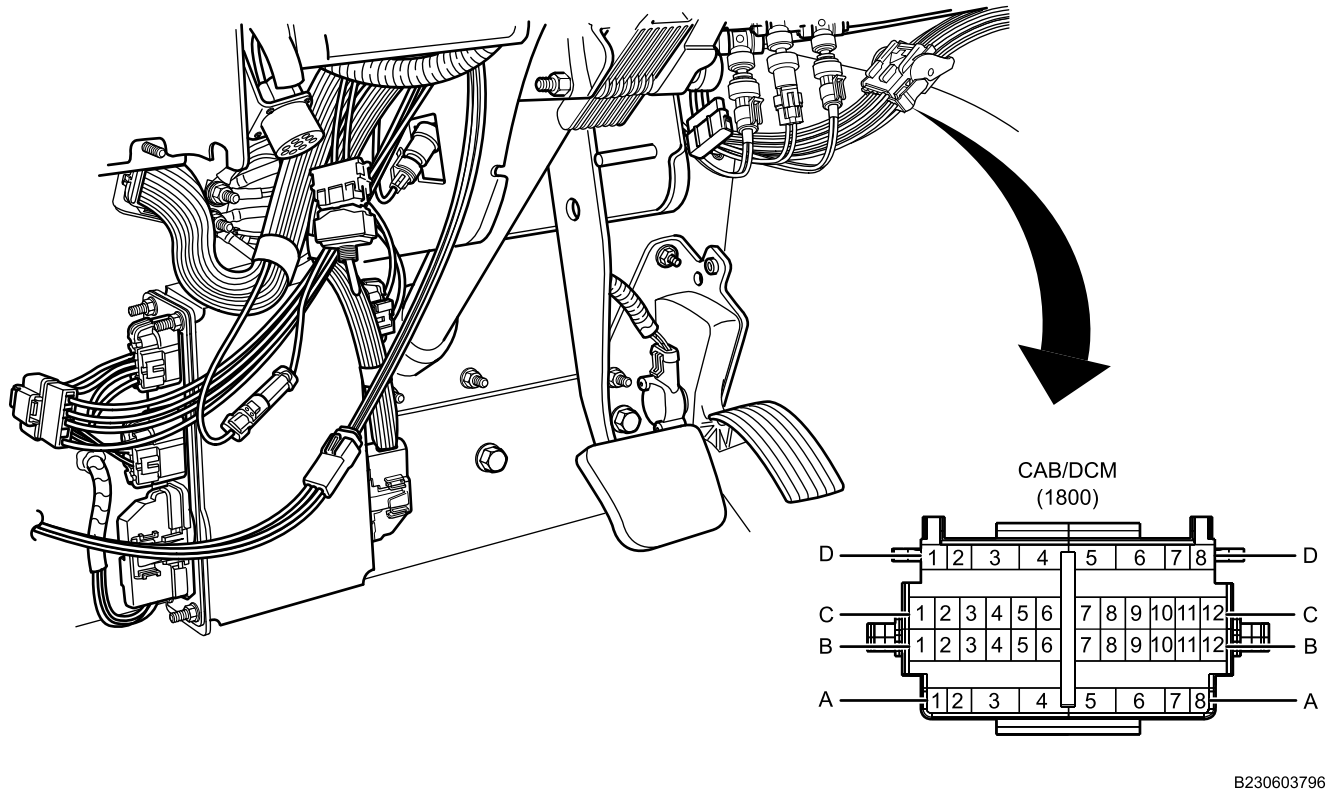


Figure 22. Driver Side Floor Area.

60. Turn MAIN POWER switch ON (TM 9-2355-106-10).
61. Turn ignition switch ON (TM 9-2355-106-10).
62. Measure DC voltage between harness connector 1800 terminal B2 and ground with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read more than 0V?

DECISION

NO Go to Step 69.
YES Go to Step 70.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

63. Substitute known good secondary air pressure gauge. Refer to Air 2 Pressure Gauge and Harness Removal and Installation (WP 0295).
64. Turn MAIN POWER switch ON (TM 9-2355-106-10).
65. Turn ignition switch ON while observing secondary air pressure gauge (TM 9-2355-106-10). Secondary air pressure gauge should sweep from 0 psi to 150 psi and back to 0 psi.

CONDITION/INDICATION

Does secondary air pressure gauge sweep correctly during gauge sweep?

DECISION

NO Go to Step 68.
YES Return vehicle to service.

MALFUNCTION

- 66. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

MALFUNCTION

- 67. Secondary air pressure transducer is faulty.

ACTION

Replace secondary air pressure transducer. Refer to Air Gauge Transducer Removal and Installation (WP 0322). Return vehicle to service.

END OF TEST

MALFUNCTION

- 68. Instrument panel cluster (IPC) is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster Removal and Installation (WP 0297). Return vehicle to service.

END OF TEST

MALFUNCTION

- 69. Steering column harness is faulty.

ACTION

Replace steering column harness. Refer to Steering Column Wiring Harness Removal and Installation (WP 0324). Return vehicle to service.

AIR 2/SECONDARY AIR PRESSURE GAUGE TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 70. Instrument panel (IP) harness is faulty.

ACTION

Replace instrument panel harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

AUDIBLE ALARM OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0297
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Turn service drive lights ON (TM 9-2355-106-10).
4. Push brake pedal repeatedly until air pressure gauges read below 70 psi (TM 9-2355-106-10).

CONDITION/INDICATION

Alarm does not sound.

CORRECTIVE ACTION

Replace Instrument Panel Cluster (IPC). Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

1. Perform engine start procedure (TM 9-2355-106-10).
2. Idle engine until air pressure gauges read over 70 psi (TM 9-2355-106-10).

Alarm does not stop sounding.

Replace Instrument Panel Cluster (IPC). Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Return vehicle to service.

END OF WORK PACKAGE

FIELD MAINTENANCE

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Materials/Parts
Gloves (WP 0794, Item 18)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0059
WP 0257
WP 0272
WP 0273
WP 0274
WP 0300
WP 0317
WP 0319
WP 0335
WP 0336
WP 0424
WP 0597
WP 0782

Equipment Condition
Vehicle parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left side engine armor plate removed (WP 0597)
Air cleaner assembly removed (WP 0257)

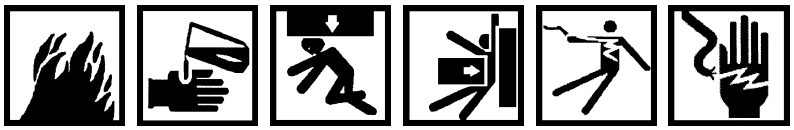
Drawings Required
WP 0789, Figure 71

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

STEP

WARNING



Ether canisters contain hazardous, combustible and flammable materials. Handle with care and dispose of in accordance with standard operating procedures. Use approved respirator with dual organic vapor/mist and particulate cartridge. Avoid contact with skin and eyes, and avoid breathing fumes. If swallowed, do not induce vomiting. Obtain immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Ether canisters are pressurized, combustible and flammable. Keep away from flames and sparks. Do not incinerate or puncture canister. Do not expose to temperatures above 120°F (49°C). Do not store spare canister in vehicle cab. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

1. Install new ether canister and verify system operation (TM 9-2355-106-10). Refer to Ether Canister Removal and Installation (WP 0273).

CONDITION/INDICATION

Is ether start operational (TM 9-2355-106-10)?

DECISION

YES Return vehicle to service.
NO Go to next step.

STEP

2. Turn ignition switch OFF (TM 9-2355-106-10).
3. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
4. Disconnect connectors 6550M/thermostatic switch. Refer to Figure 1.

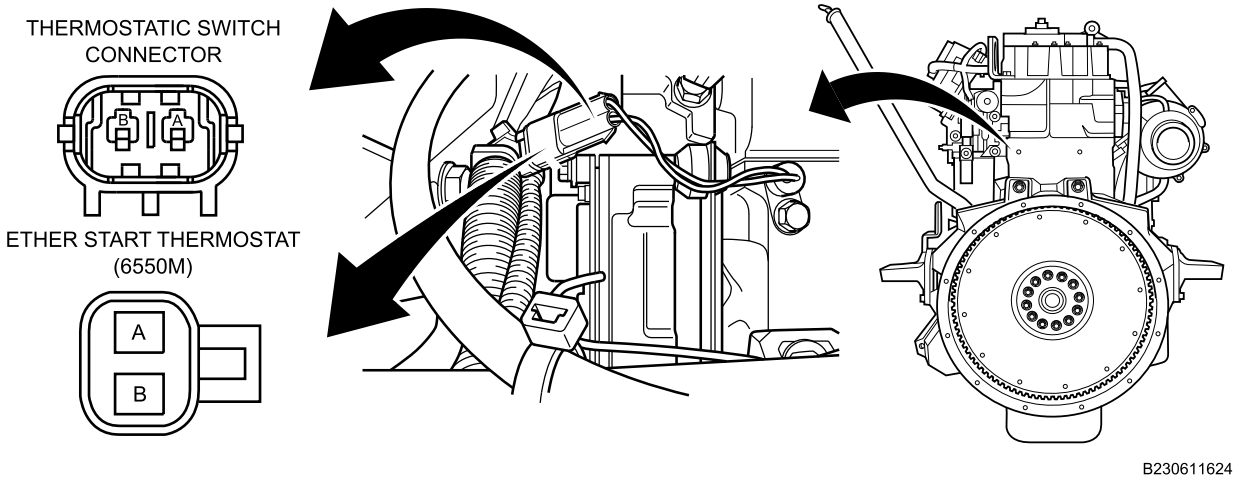


Figure 1. Left Rear Cylinder Head.

5. Install jumper wire between connector 6550M terminals A and B. Refer to Figure 1.
6. Disconnect connector 8400B. Refer to Figure 2.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

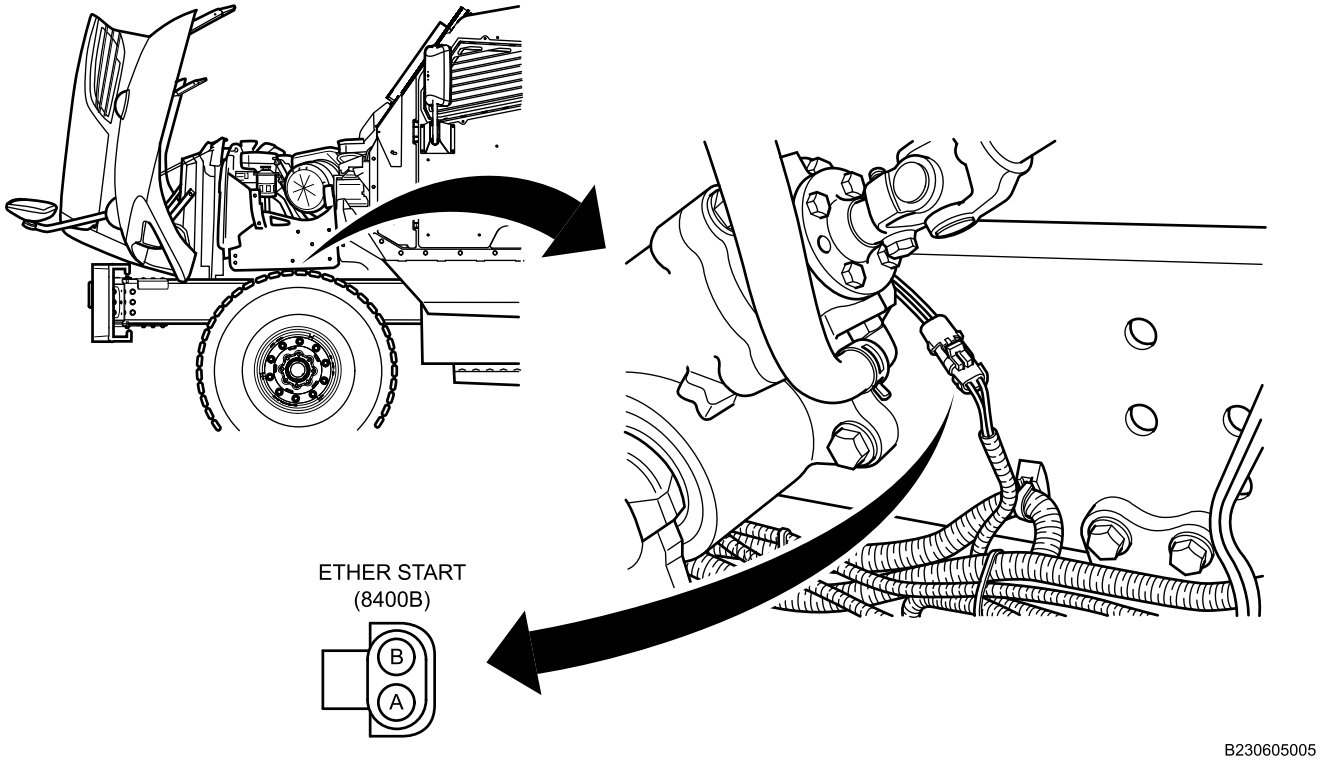


Figure 2. Left Side of Engine Compartment.

7. Turn MAIN POWER switch ON (TM 9-2355-106-10).
8. Turn ignition switch ON (TM 9-2355-106-10).
9. With assistance, measure DC voltage between connector 8400B terminal B and ground with multimeter while ether start switch is activated. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 11.
YES Go to next step.

STEP

10. With assistance, measure DC voltage between connector 8400B terminal B and terminal A with multimeter while ether start switch is activated. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 40.
NO Go to Step 29.

STEP

11. Turn ignition switch OFF (TM 9-2355-106-10).

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

12. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
13. Disconnect connector 4301 from 4300 (22 wires). Refer to Figure 3.

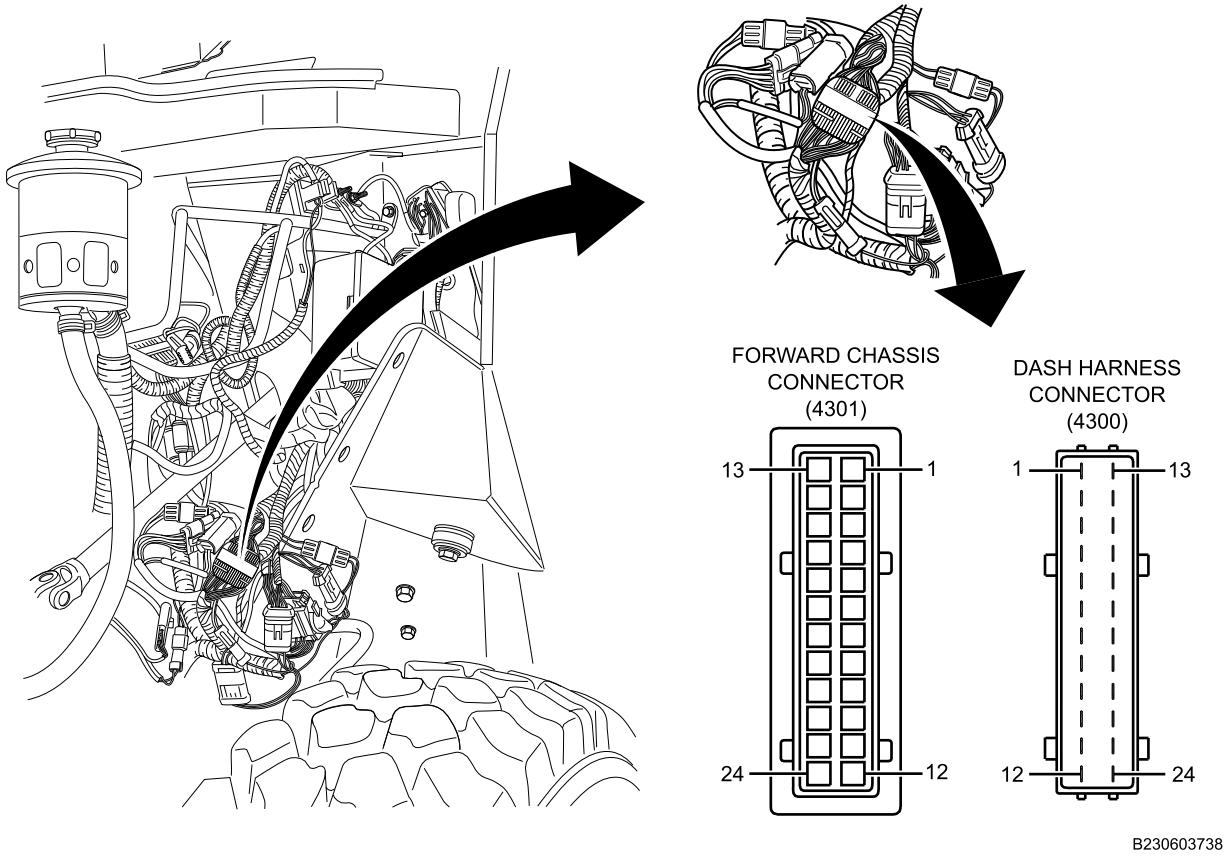


Figure 3. Under Power Distribution Center (PDC).

14. Turn MAIN POWER switch ON (TM 9-2355-106-10).
15. Turn ignition switch ON (TM 9-2355-106-10).
16. With assistance, measure DC voltage between connector 4301 terminal 19 and ground with multimeter while ether start switch is activated. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 47.
NO Go to next step.

STEP

17. Turn ignition switch OFF (TM 9-2355-106-10).

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

18. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
19. Disconnect connector 1010. Refer to Figure 4.

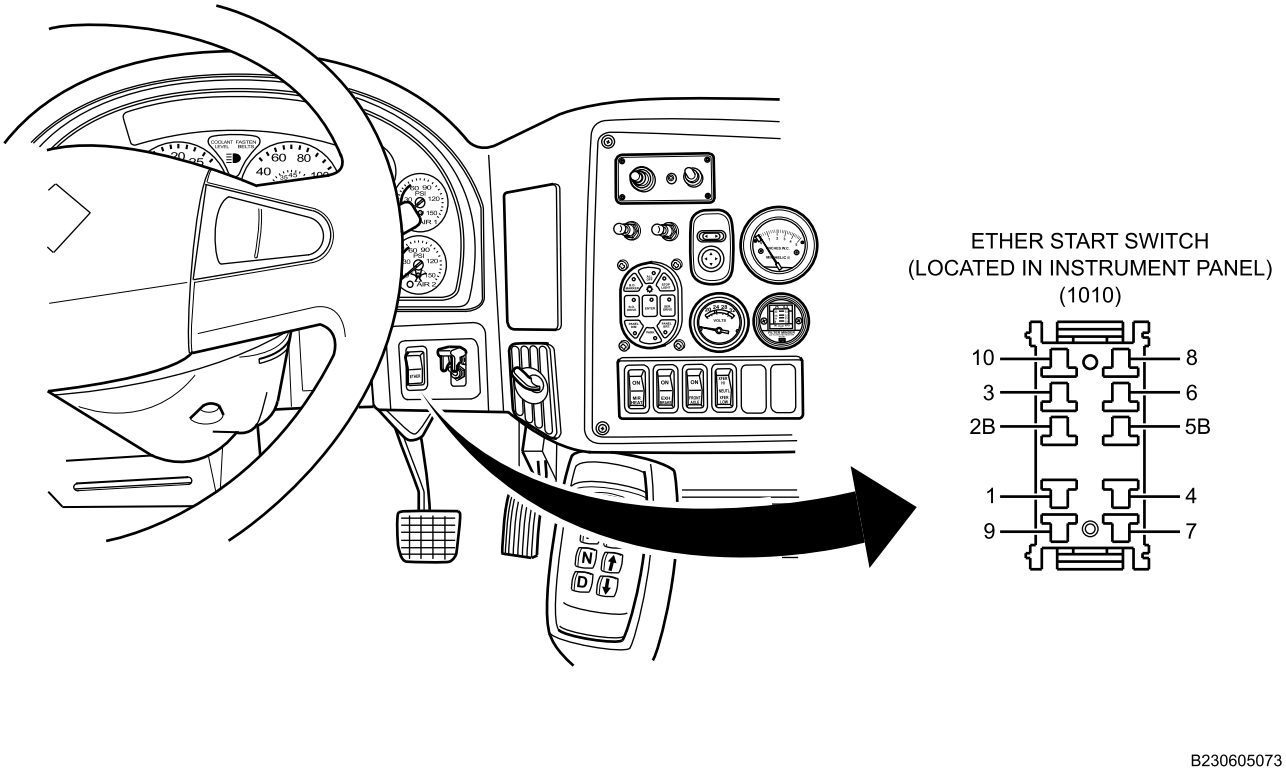


Figure 4. Right Side of Dash.

20. Turn MAIN POWER switch ON (TM 9-2355-106-10).
21. Turn ignition switch ON (TM 9-2355-106-10).
22. Measure DC voltage between connector 1010 terminal 2B and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 35.
NO Go to next step.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

23. Turn ignition switch OFF (TM 9-2355-106-10).
24. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
25. Remove and inspect F33 circuit breaker. Refer to Figure 5. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

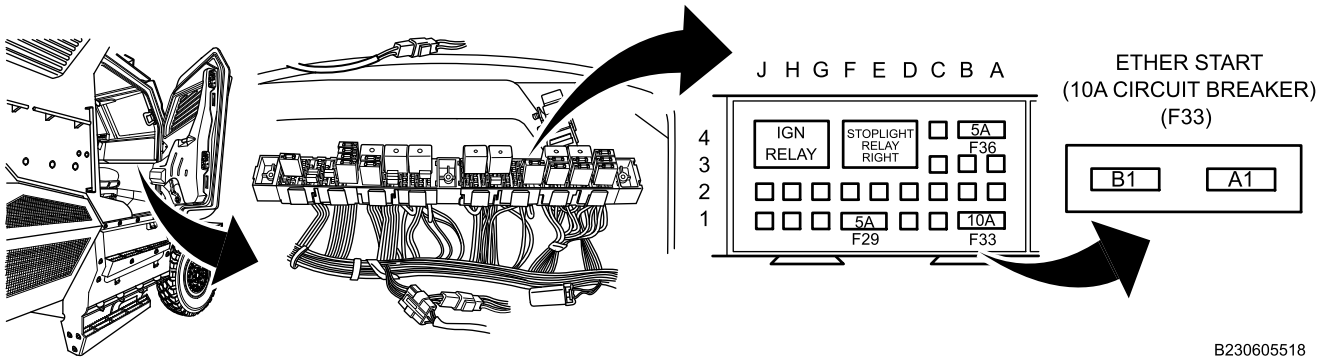


Figure 5. Behind Instrument Panel (IP) Closeout Panel.

CONDITION/INDICATION

Is circuit breaker tripped?

DECISION

YES Go to Step 43.
NO Go to next step.

STEP

26. Turn MAIN POWER switch ON (TM 9-2355-106-10).
27. Turn ignition switch ON (TM 9-2355-106-10).
28. With circuit breaker removed, measure DC voltage between F33 terminal A1 and ground with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Refer to Power Distribution Troubleshooting Procedure (WP 0059).
YES Go to Step 48.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

29. Turn ignition switch OFF (TM 9-2355-106-10).
30. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
31. Disconnect connector 4301 from 4300 (22 wires). Refer to Figure 6.

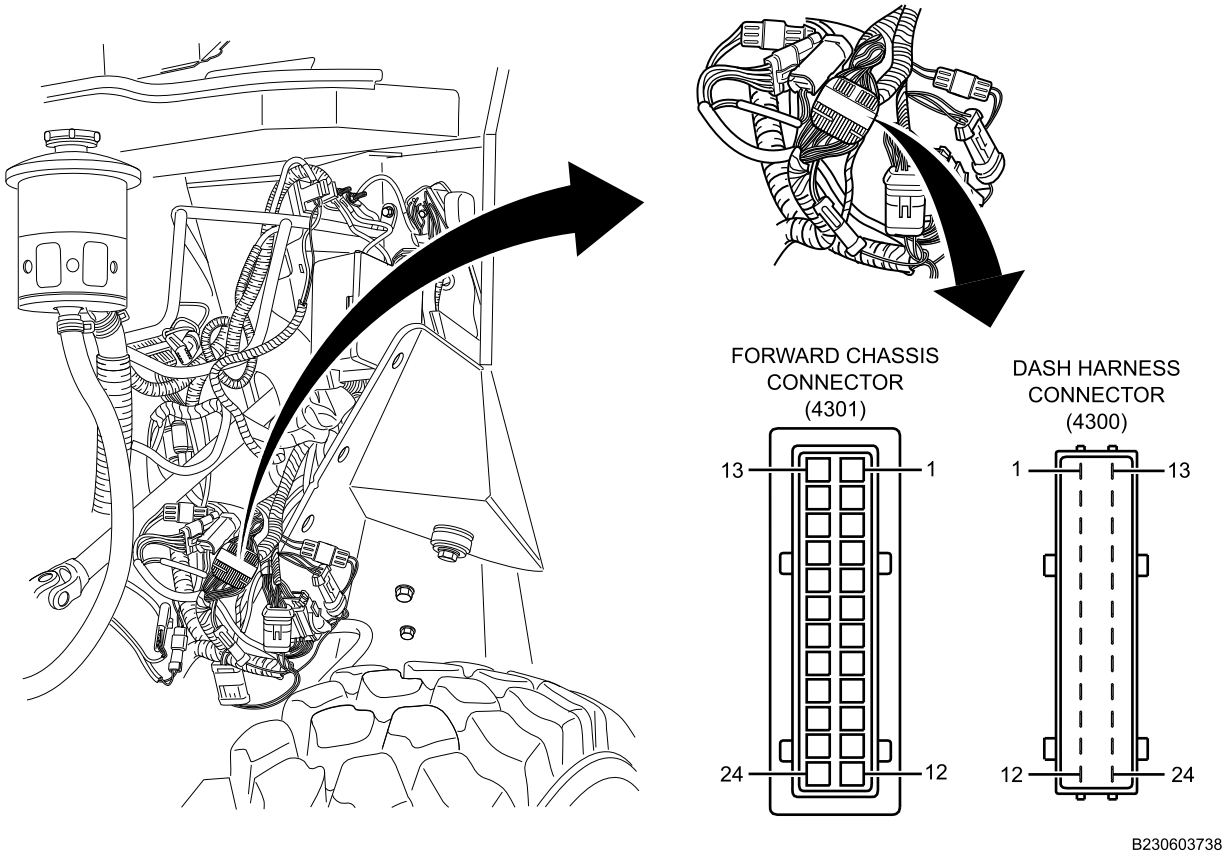


Figure 6. Engine Compartment Under Air Cleaner.

32. Measure resistance between connector 4301 terminal 22 and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 47.
NO Go to next step.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

33. Disconnect connector 4100F (18 wires). Refer to Figure 7.

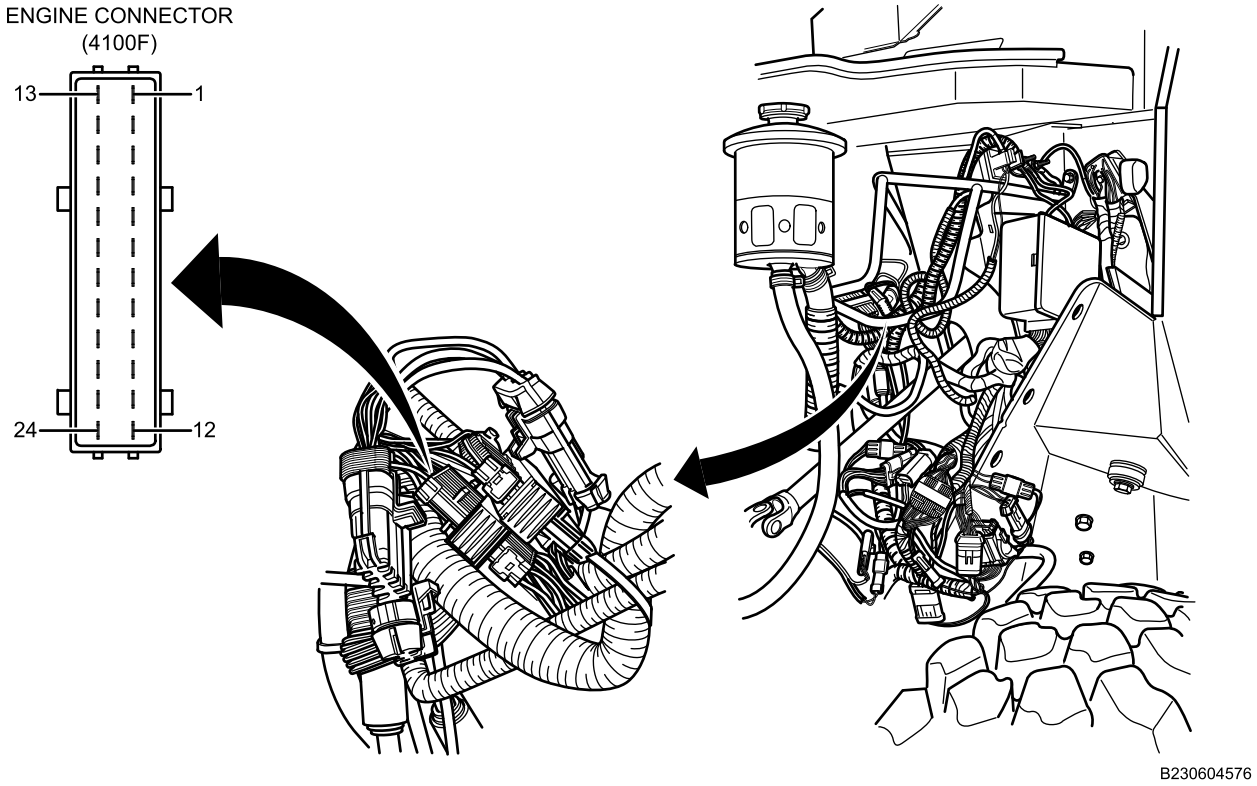


Figure 7. Engine Compartment Under Air Cleaner.

34. Measure resistance between connector 4100F terminal 12 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 47.
NO Go to Step 52.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

35. Turn ignition switch OFF (TM 9-2355-106-10).
36. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
37. With assistance, measure resistance between connector 1010 terminal 3 and connector 4301 terminal 19 with multimeter. Refer to Figure 8. Refer to Figure 9.

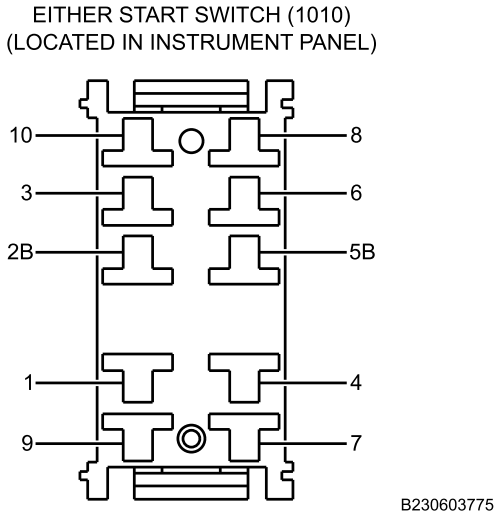


Figure 8. Connector 1010.

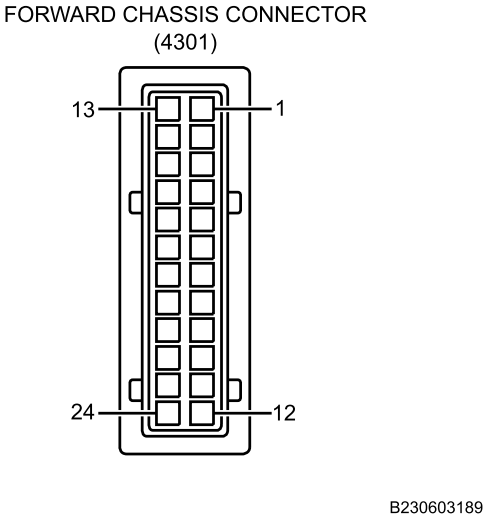


Figure 9. Connector 4301.

CONDITION/INDICATION

Does multimeter read less than 3 ohms?

DECISION

YES Go to Step 50.
NO Go to next step.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

38. Disconnect connector 1701. Refer to Figure 10.

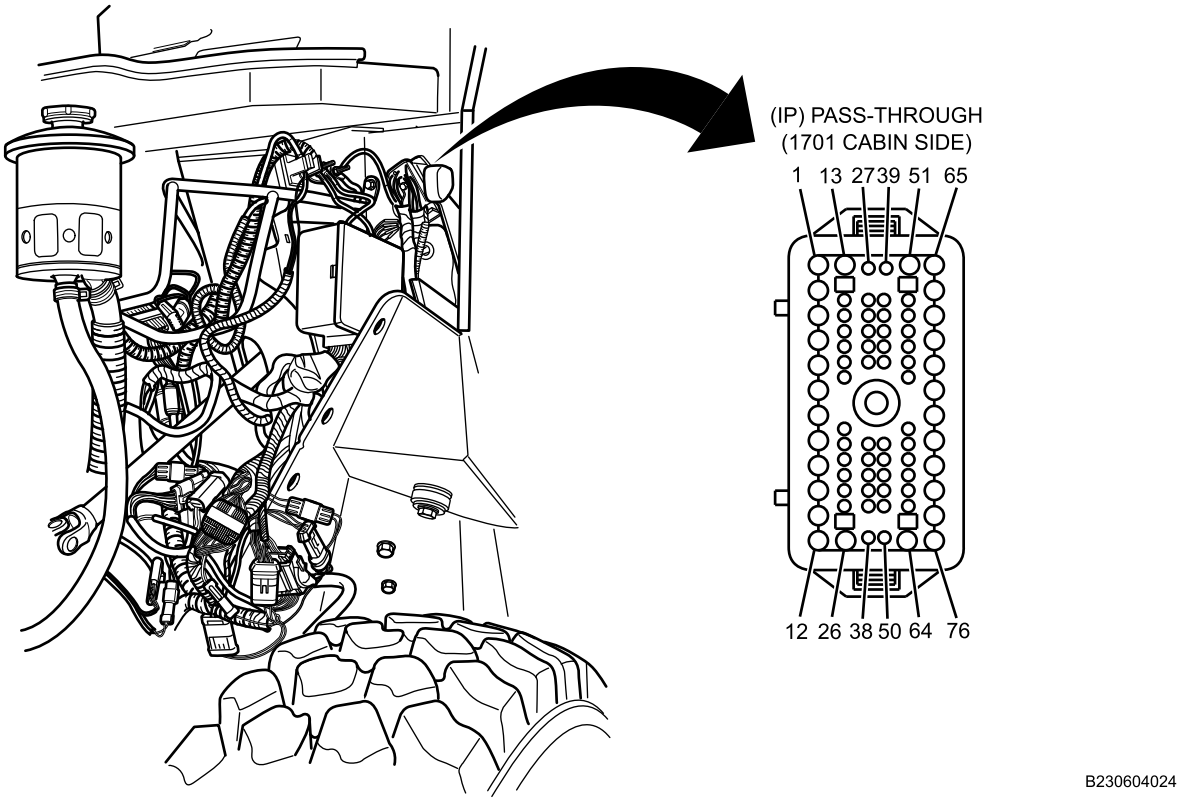


Figure 10. Above Power Distribution Center (PDC) on Bulkhead.

39. With assistance, measure resistance between connector 1701 terminal 29 and connector 1010 terminal 3 with multimeter. Refer to Figure 10 and Figure 8.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 48.
YES Go to Step 49.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

NOTE

Thermal switch must be cooled or ambient temperature must be below 40°F (4.4°C) before test can be performed.

40. Turn ignition switch OFF (TM 9-2355-106-10).
41. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
42. Measure resistance between thermostatic switch connector terminals A and B with multimeter. Refer to Figure 11.

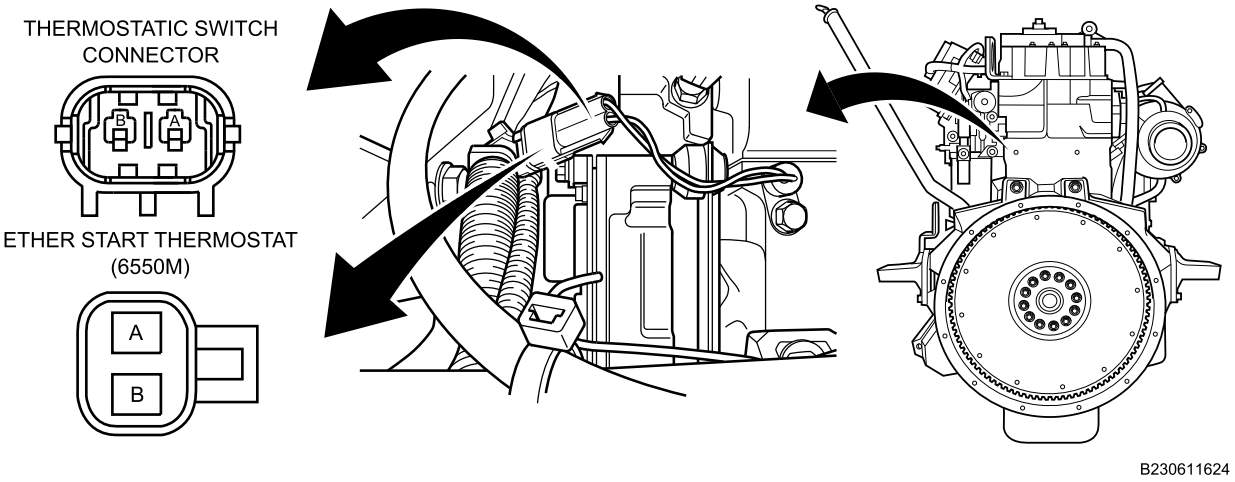


Figure 11. Left Rear Cylinder Head.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 46.
YES Go to Step 51.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

43. Reset and install breaker. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).
44. Turn MAIN POWER switch ON (TM 9-2355-106-10).
45. Turn ignition switch ON (TM 9-2355-106-10).

CONDITION/INDICATION

Did breaker trip?

DECISION

YES Go to Power Distribution Troubleshooting Procedure (WP 0059).
NO Return vehicle to service.

MALFUNCTION

- 46. Ether (cold) start valve is faulty.

ACTION

Replace ether (cold) start valve. Refer to Ether (COLD) Start Valve Removal and Installation (WP 0272). Return vehicle to service.

END OF TEST

MALFUNCTION

- 47. Forward chassis harness is faulty.

ACTION

Replace forward chassis harness. Refer to Forward Chassis Harness Removal and Installation (WP 0424). Return vehicle to service.

END OF TEST

MALFUNCTION

- 48. Instrument panel (IP) harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 49. Power distribution center (PDC) harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

ETHER START CIRCUIT TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 50. Ether start switch is faulty.

ACTION

Replace ether start switch. Refer to Ether Start Switch Removal and Installation (WP 0300). Return vehicle to service.

END OF TEST

MALFUNCTION

- 51. Ether thermal switch is faulty.

ACTION

Replace ether thermal switch. Refer to Ether Thermal Switch Removal and Installation (WP 0274). Return vehicle to service.

END OF TEST

MALFUNCTION

- 52. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
WP 0059
WP 0257
WP 0329
WP 0333
WP 0334
WP 0335
WP 0336
WP 0597
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Left side engine armor removed (WP 0597)

Drawings Required
WP 0789, Figure 68

This procedure covers the following Diagnostic Trouble Code (DTC):

- 265

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING

When the exhaust brake switch is turned on, switch will light but no braking assist is available. The exhaust brake system is disabled and cannot be activated via the switch. Service brake must be primarily used when descending long grades. Use hard pressure braking with applications of 3 to 5 seconds' duration, instead of long, continuous applications. This type of brake application minimizes temperature rise, brake fade, and air consumption by the air brake system. Failure to comply may result in loss of braking ability and serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Remove EXHAUST BRAKE relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0334) and Figure 1.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

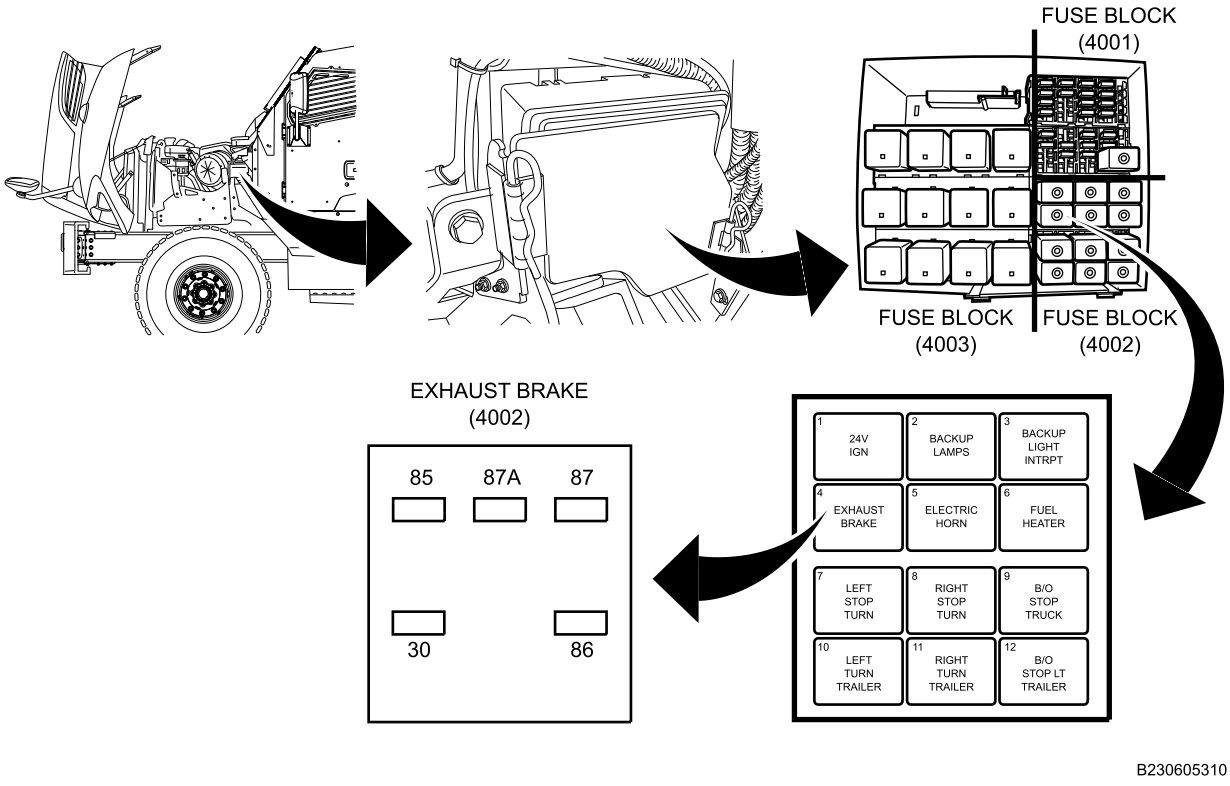


Figure 1. Power Distribution Center.

2. Turn ignition switch ON (TM 9-2355-106-10).
3. Turn MAIN POWER switch ON (TM 9-2355-106-10).
4. Measure DC voltage between EXHAUST BRAKE relay socket terminal 86 and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to next step.
NO Go to Step 25.

STEP

5. Measure DC voltage between EXHAUST BRAKE relay socket terminal 85 and ground with multimeter. Refer to Figure 1.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read 0V?

DECISION

YES Go to next step.
NO Go to Step 13.

STEP

6. Disconnect connector 6007 from ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329) and Figure 2.

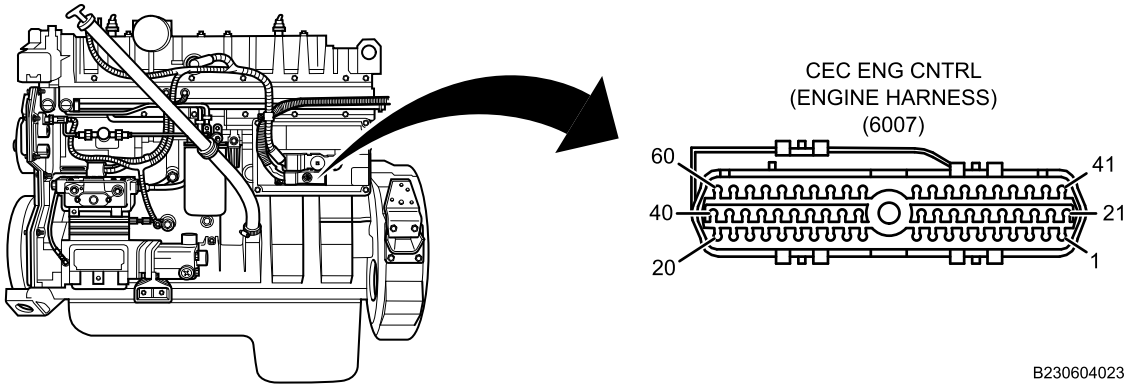


Figure 2. Engine Control Module Area.

7. Measure resistance between EXHAUST BRAKE relay socket terminal 85 and ground with multimeter. Refer to Figure 3.

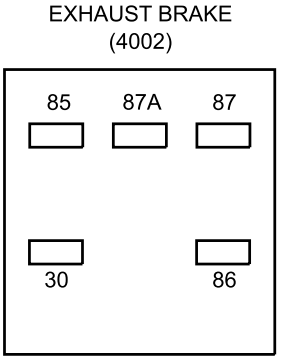


Figure 3. Exhaust Brake Relay Socket.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to next step.
NO Go to Step 22.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

8. Measure resistance between EXHAUST BRAKE relay socket terminal 85 and connector 6007 terminal 47 with multimeter. Refer to Figure 4 and Figure 5.

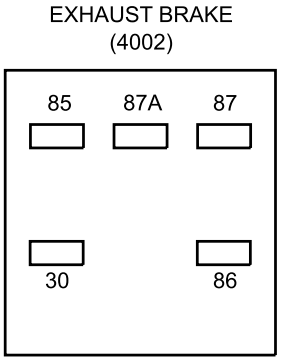


Figure 4. Exhaust Brake Relay Socket.

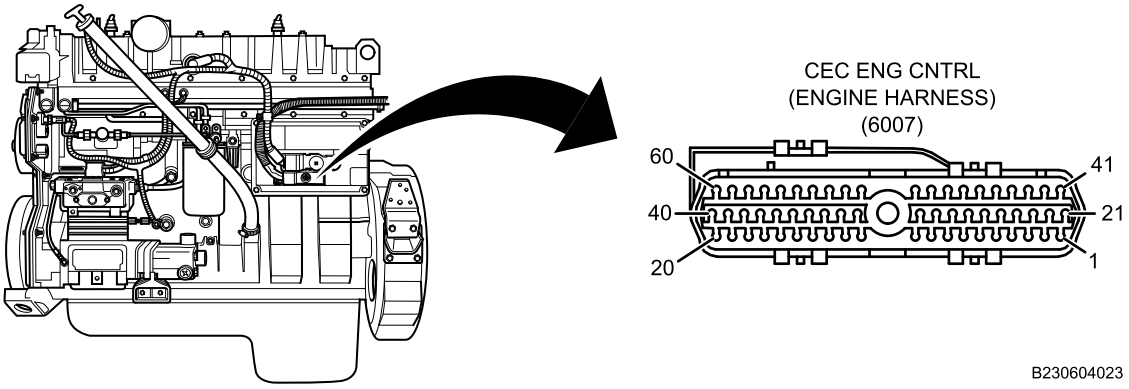


Figure 5. Engine Control Module Area.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 12.
NO Go to next step.

STEP

9. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
10. Disconnect connector 4103 from 4100F (connector with 18 wires). Refer to Figure 6.

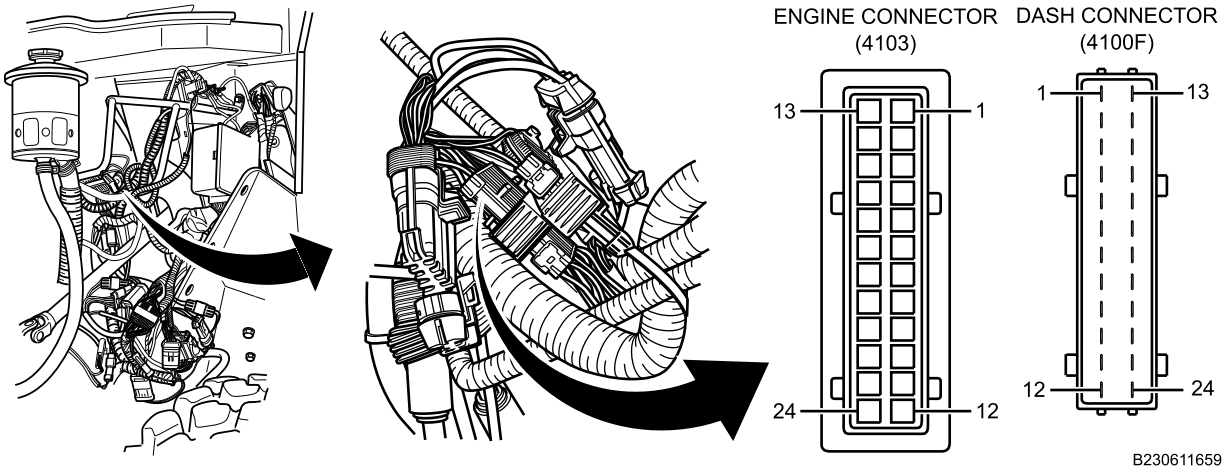


Figure 6. Left Side Engine Compartment.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

11. Measure resistance between connector 4103 terminal 16 and EXHAUST BRAKE relay socket terminal 85 with multimeter. Refer to Figure 7 and Figure 8.

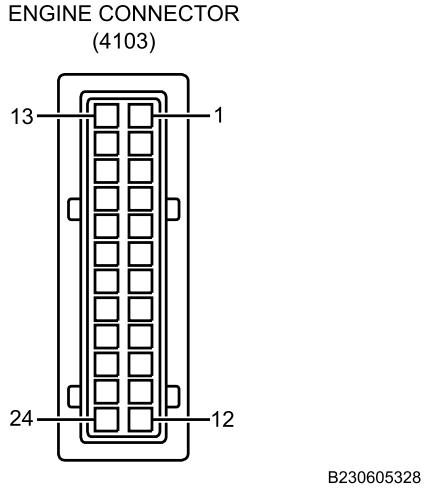


Figure 7. Connector 4103.

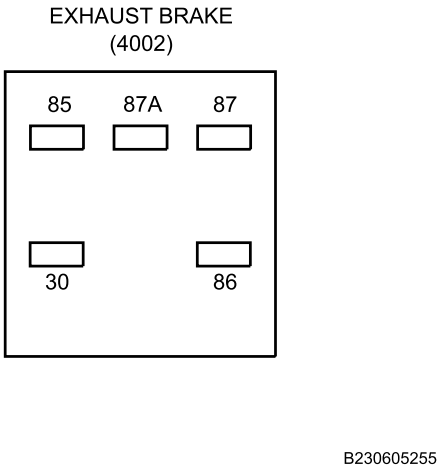


Figure 8. Exhaust Brake Relay Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 32.
NO Go to Step 30.

STEP

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

12. Measure resistance between EXHAUST BRAKE relay terminals 85 and 86 with multimeter. Refer to Figure 9.

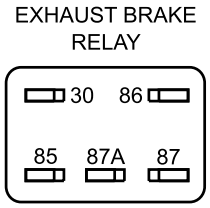


Figure 9. EXHAUST BRAKE Relay.

CONDITION/INDICATION

Does multimeter read between 75 and 95 ohms?

DECISION

YES Go to Step 33.
NO Go to Step 31.

STEP

13. Turn ignition switch OFF (TM 9-2355-106-10).
14. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
15. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
16. Disconnect connector 4103 from 4100F (connector with 18 wires). Refer to Figure 10.

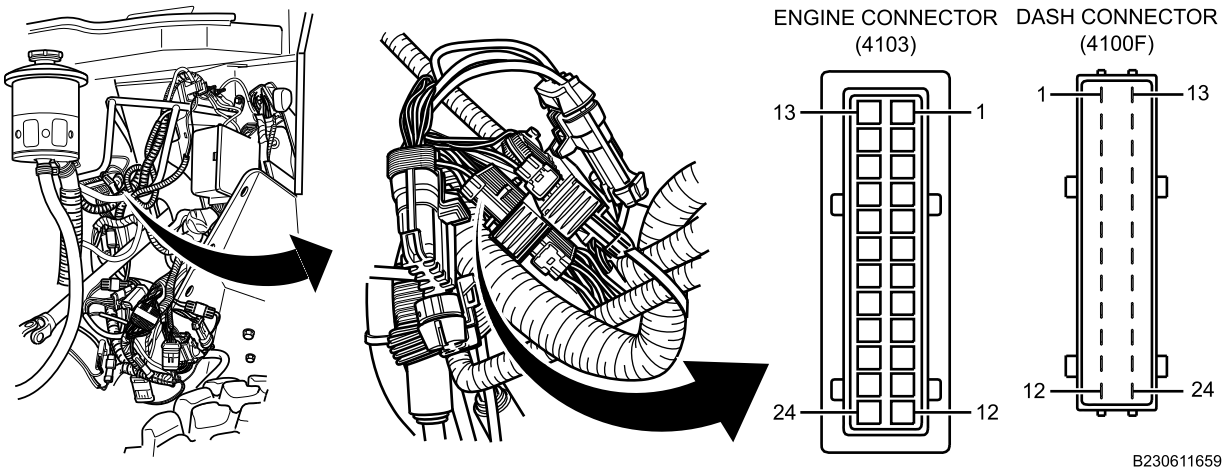


Figure 10. Left Side Engine Compartment.

17. Turn MAIN POWER switch ON (TM 9-2355-106-10).
18. Turn ignition switch ON (TM 9-2355-106-10).
19. Measure DC voltage between connector 4100F terminal 16 and ground with multimeter. Refer to Figure 10.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read 0V?

DECISION

YES Go to Step 30.
NO Go to next step.

STEP

20. Disconnect connector 6007 from ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329) and Figure 11.

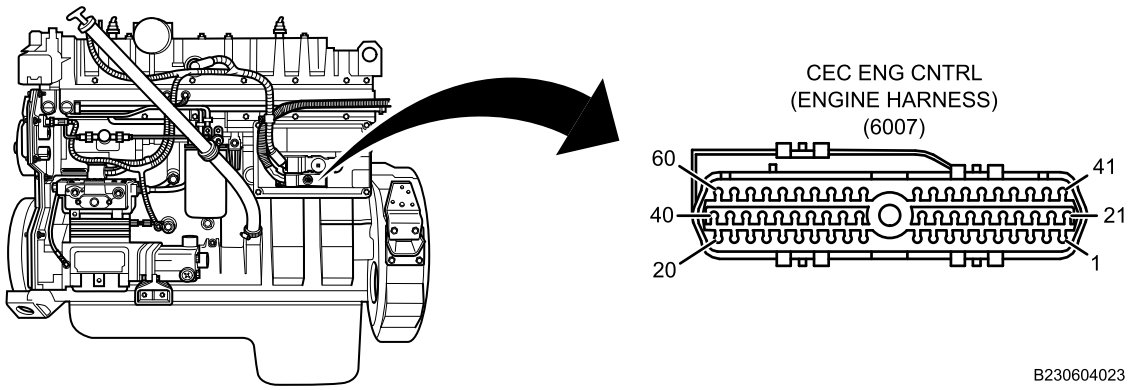


Figure 11. Engine Control Module Area.

21. Measure resistance between connector 6007 terminal 47 and all other terminals on connector 6007 with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Did multimeter read OL for all terminals?

DECISION

YES Go to Step 33.
NO Go to Step 32.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
23. Disconnect connector 4103 from 4100F (connector with 18 wires). Refer to Figure 12.

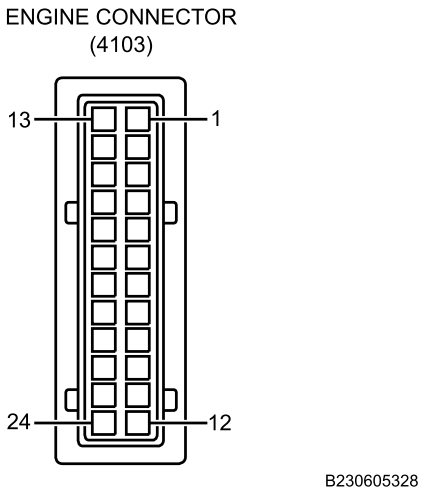


Figure 12. Connector 4103.

24. Measure resistance between connector 4103 terminal 16 and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 32.
NO Go to Step 30.

STEP

25. Remove and test 5-amp EXHAUST BRAKE fuse. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333) and Figure 13.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

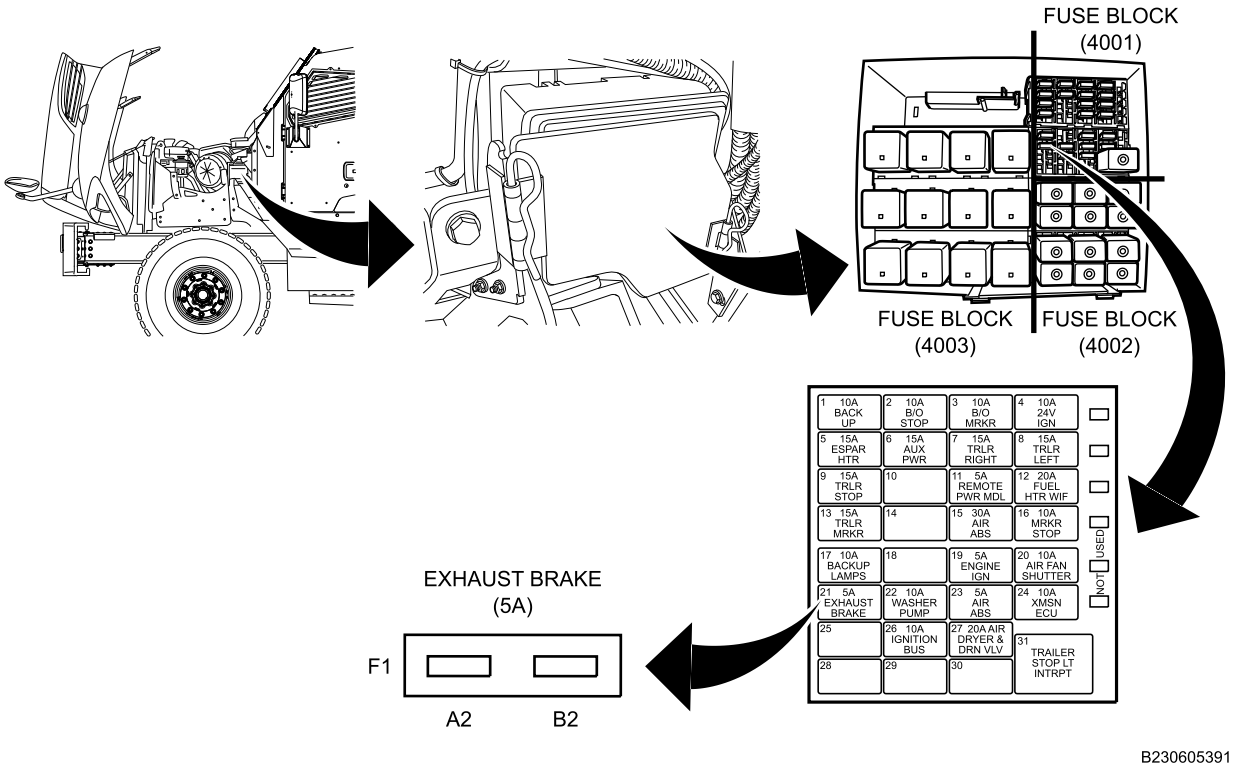


Figure 13. Power Distribution Center.

CONDITION/INDICATION

Is fuse open?

DECISION

YES Go to Step 29.
NO Go to next step.

STEP

26. Turn ignition switch ON (TM 9-2355-106-10).
27. Turn MAIN POWER switch ON (TM 9-2355-106-10).
28. Measure DC voltage between ground and each EXHAUST BRAKE fuse socket terminal (A2 and B2) with multimeter. Refer to Figure 13.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for either terminal?

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 30.
NO Refer to Power Distribution Troubleshooting (WP 0059).

STEP

29. Measure resistance between EXHAUST BRAKE relay socket terminal 86 and ground with multimeter. Refer to Figure 14.

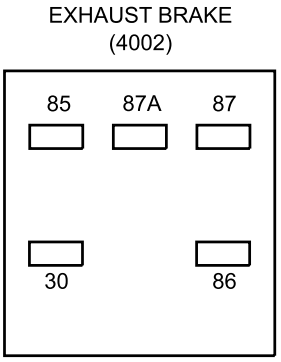


Figure 14. Exhaust Brake Relay Socket.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 31.
NO Go to Step 30.

MALFUNCTION

- 30. Harness is faulty.

ACTION

Replace harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 31. Exhaust brake relay is faulty.

ACTION

Replace exhaust brake relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Return vehicle to service.

EXHAUST BRAKE TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 32. Harness is faulty.

ACTION

Replace harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 33. Engine Control Module (ECM) is faulty.

ACTION

Replace ECM. Refer to Engine Control Module (ECM) Removal and Installation (WP 0329). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Harness, 500 ohm resistor (ZTSE4497) (WP 0795, Item 4)

Materials/Parts
Goggles, industrial (WP 0794, Item 20)
Faceshield, industrial (WP 0794, Item 16)
Lockwasher (WP 0796, Item 9)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0032
WP 0059
WP 0257
WP 0289
WP 0336
WP 0335
WP 0333
WP 0240
WP 0782

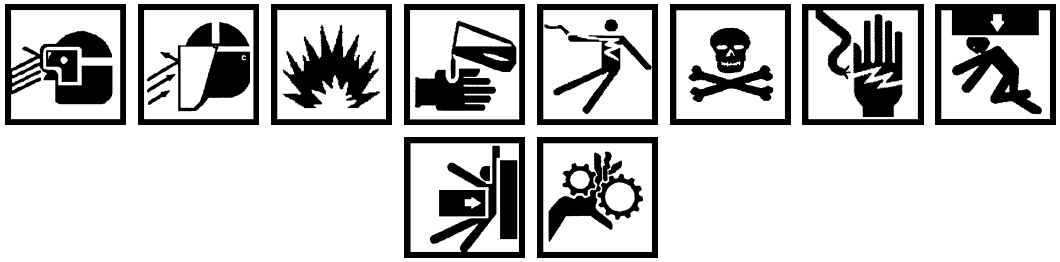
Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)
Perform Battery Operational Checkout Procedure (WP 0032)

Drawings Required
WP 0789, Figure 18

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING



Wear protective eye goggles, face shield, and long sleeves when working on or near batteries. Batteries contain corrosive acid and can produce explosive gases. Batteries supply electrical current that can cause burns and electrical shock. Always check electrolyte level with engine off. Avoid leaning over or onto battery. Do not wear jewelry and do not smoke or have open flame or spark near battery. Do not allow tools to contact battery box or battery terminals. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Battery acid must not contact eyes, skin, or clothing. If battery acid contacts eyes or skin, flush area with large amounts of water for 15 minutes and seek immediate medical care. If swallowed, do not induce vomiting. Drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Seek immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Keep hands and clothing clear of moving parts in the engine compartment. Rotating parts can cause severe injury to personnel. Ensure that all guards are in place and do not wear loose clothing when conducting maintenance. Always check to ensure that the area is clear of personnel and obstructions before starting the engine. Failure to comply may result in injury to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Inspect for loose, worn, or damaged serpentine belt (TM 9-2355-106-10).

CONDITION/INDICATION

Did inspection reveal defective serpentine belt?

DECISION

YES Go to Serpentine Belt Removal and Installation (WP 0240).
NO Go to next step.

STEP

2. Measure DC voltage between the alternator B+ terminals (Figure 1, Item 1 and 2) and ground with multimeter.

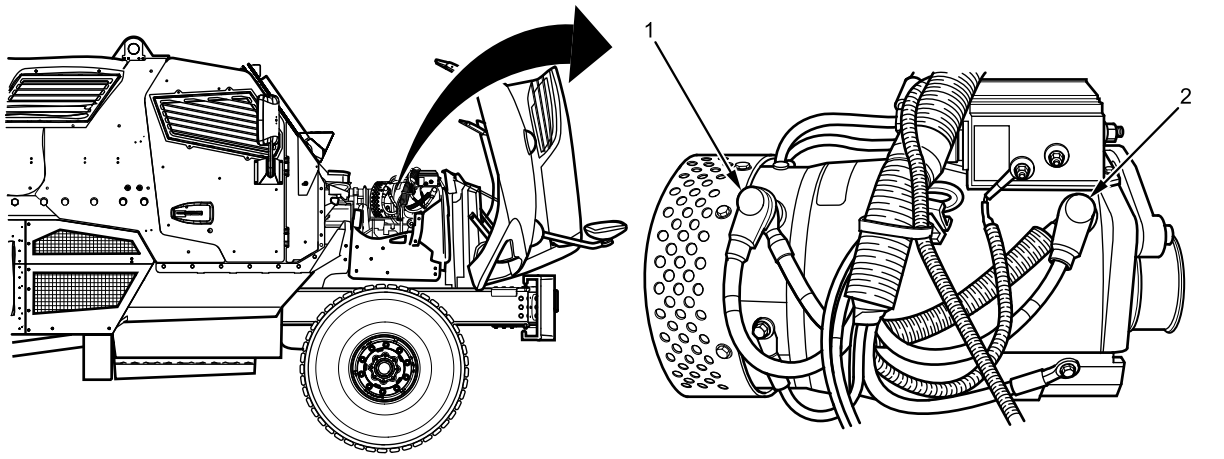


Figure 1. Alternator, Right Side Engine.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

NO Go to Step 53.
YES Go to next step.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

3. Measure resistance between engine ground and each alternator ground terminal (Figure 2, Item 3 and 4) with multimeter.

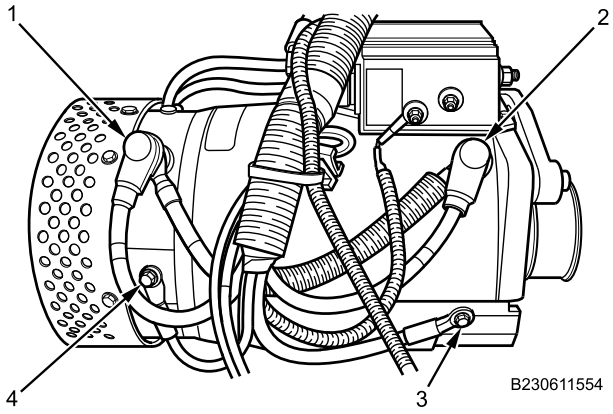


Figure 2. Alternator, Right Side Engine.

CONDITION/INDICATION

Does multimeter read less than 5 ohms for each test?

DECISION

NO Go to Step 53.
YES Go to next step.

STEP

4. Start and idle engine (TM 9-2355-106-10).
5. Measure DC voltage between alternator B+ terminal (Figure 2, Item 1 or 2) and ground with multimeter.

CONDITION/INDICATION

Does multimeter read between 27V and 32V?

DECISION

NO Go to Step 7.
YES Go to next step.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

6. Measure AC voltage between alternator B+ terminal (Figure 2, Item 1 or 2) and ground with multimeter.

CONDITION/INDICATION

Does multimeter read more than 1V?

DECISION

NO Fault is not present. Return vehicle to service.
YES Go to Step 56.

STEP

7. Turn ignition switch OFF (TM 9-2355-106-10).
8. Restart and idle engine (TM 9-2355-106-10).
9. Measure DC voltage between alternator B+ terminal (Figure 2, Item 1 or 2) and ground with multimeter.

CONDITION/INDICATION

Does multimeter read between 27V and 32V?

DECISION

YES Go to Step 55.
NO Go to next step.

STEP

10. Recall results from test just performed.

CONDITION/INDICATION

Does multimeter read more than 32V?

DECISION

YES Go to Step 56.
NO Go to next step.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

11. Measure DC voltage between alternator regulator IGN terminal (Figure 3, Item 1) and ground with multimeter.

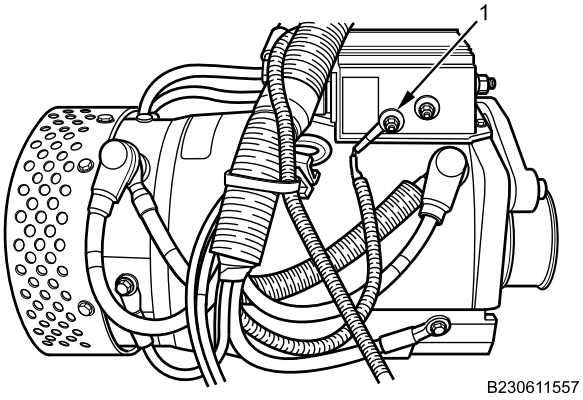


Figure 3. Alternator, Right Side Engine.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

YES Go to Step 56.
NO Go to next step.

STEP

12. Turn ignition switch OFF (TM 9-2355-106-10).
13. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

14. Remove and inspect fuse 4 from fuse block 4001. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 4 and Figure 5.

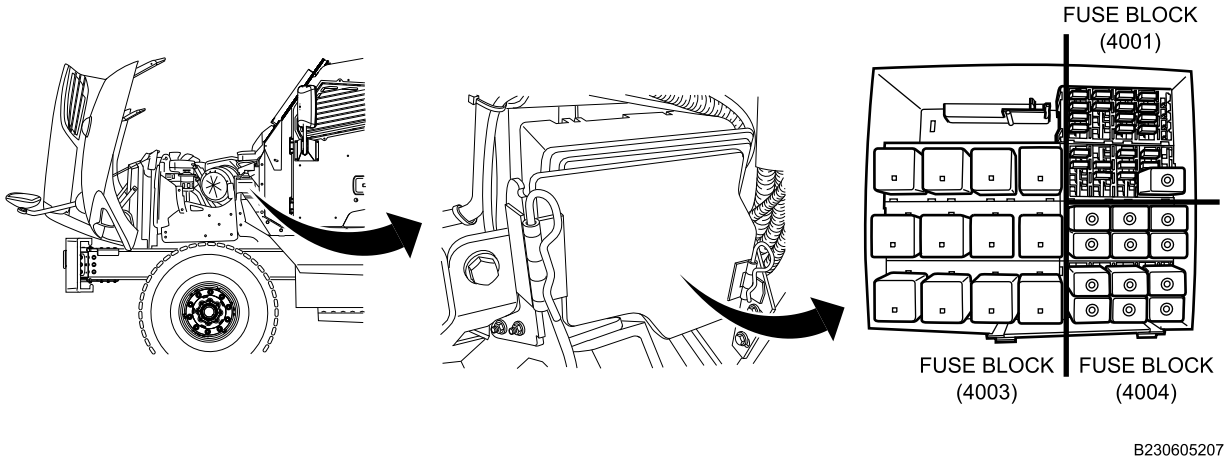


Figure 4. Power Distribution Center.

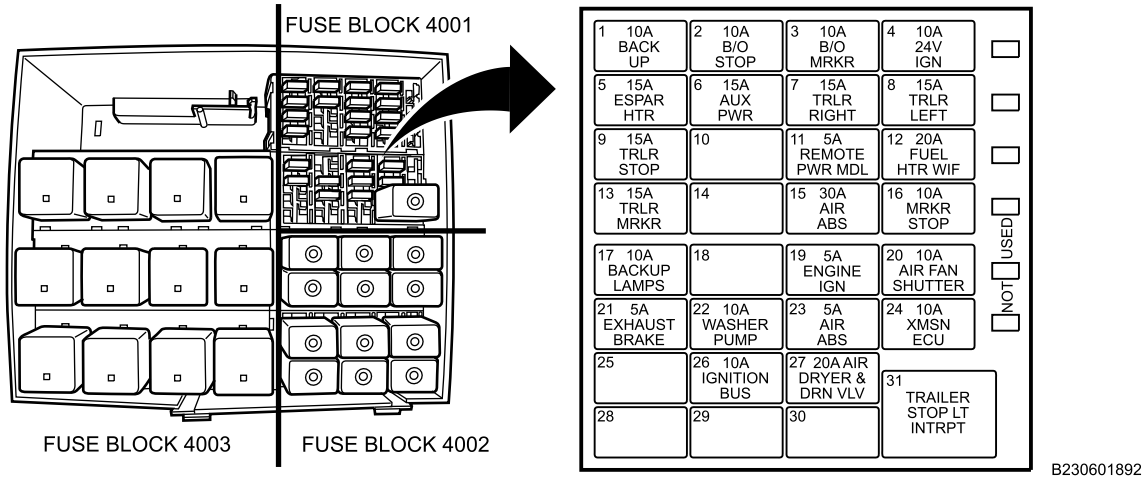


Figure 5. Fuse Block 4001.

CONDITION/INDICATION

Is fuse open?

DECISION

NO Go to Step 24.
YES Go to next step.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

15. Remove relay 1 from fuse block 4002. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 6.

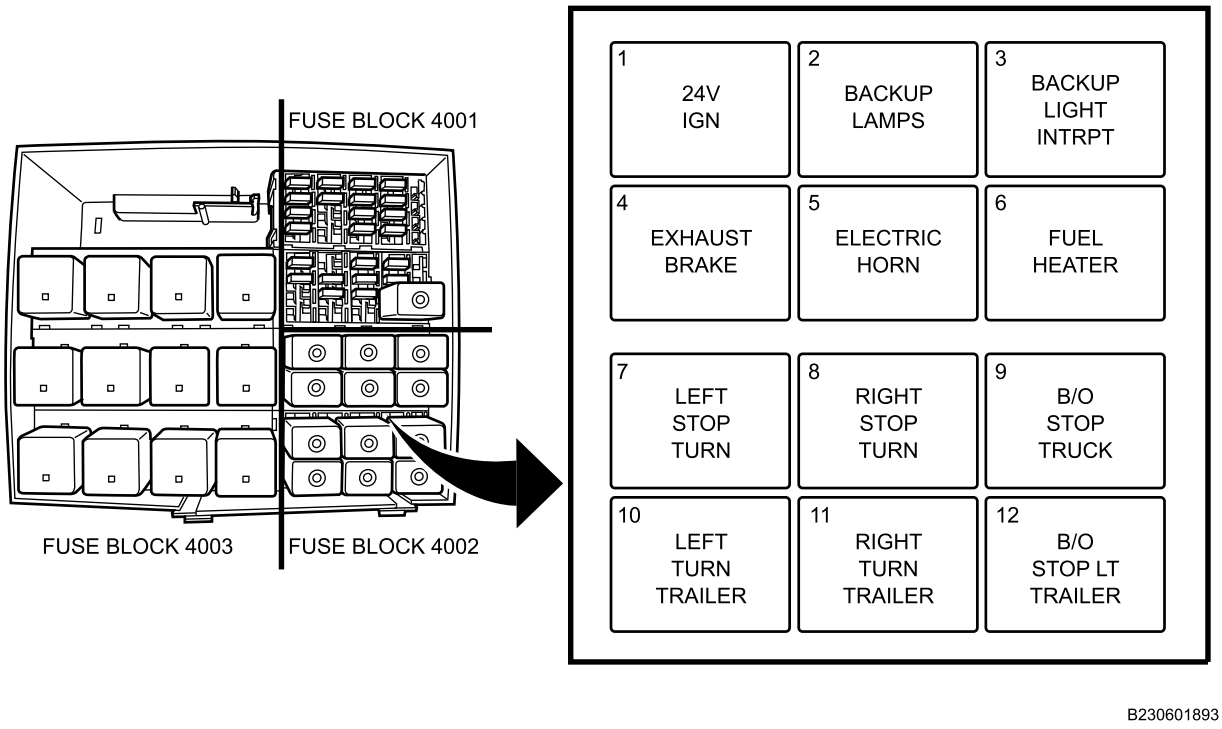


Figure 6. Fuse Block 4002.

16. Install relay breakout harness (ZTSE4674) (Figure 7, Item 1) in place of relay 1 (Figure 7, Item 2) in fuse block 4002.

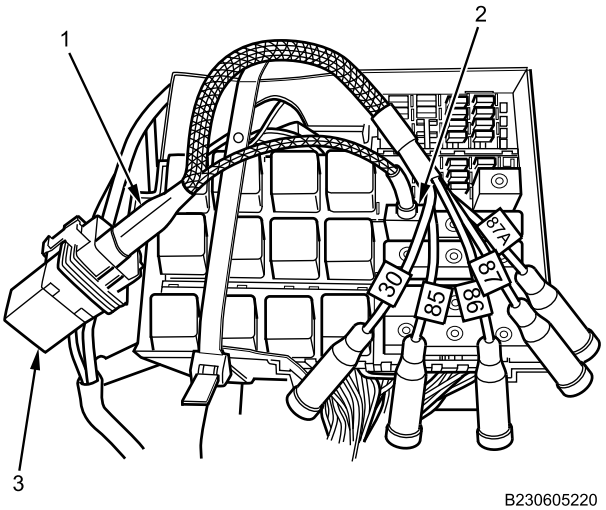


Figure 7. Relay Breakout Harness (ZTSE4674).

17. Install relay 1 (Figure 7, Item 3) in connector of relay breakout harness (ZTSE4674) (Figure 7, Item 1).
18. Measure resistance between relay breakout harness terminal 30 and ground with multimeter. Refer to Figure 7.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 52.
YES Go to next step.

STEP

19. Remove nut, lockwasher, and alternator regulator IGN terminal (Figure 8, Item 1) from voltage regulator. Discard lockwasher.

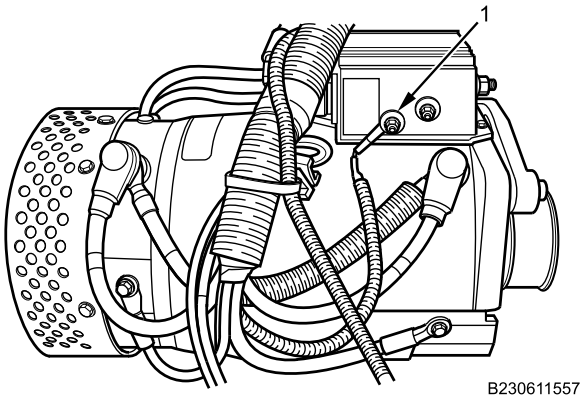


Figure 8. Alternator, Right Side Engine.

20. Measure resistance between IGN terminal (Figure 8, Item 1) and ground with multimeter.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 56.
NO Go to next step.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

21. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
22. Disconnect harness connector 4103 (connector with 18 wires). Refer to Figure 9.

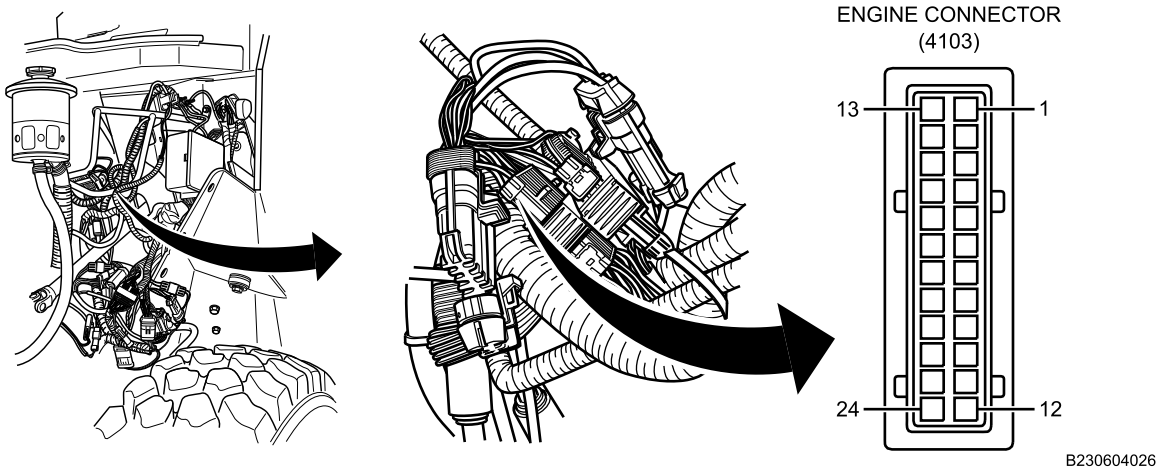


Figure 9. Below Air Filter.

23. Measure resistance between connector 4103 terminal 24 and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 52.
YES Go to Step 53.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

24. Install fuse 4 in fuse block 4001. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 10.

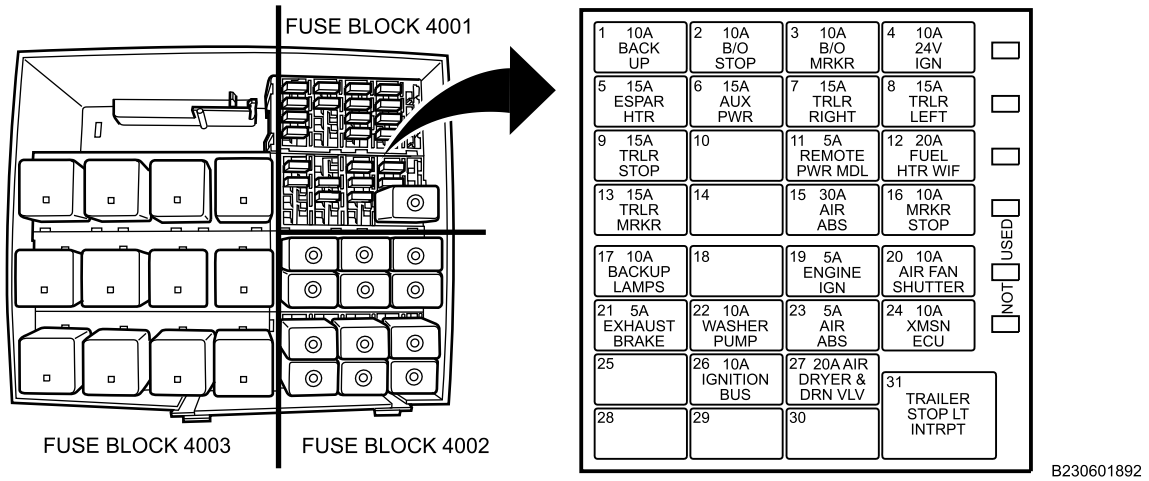


Figure 10. Fuse Block 4001.

25. Remove relay 1 from fuse block 4002. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 11.

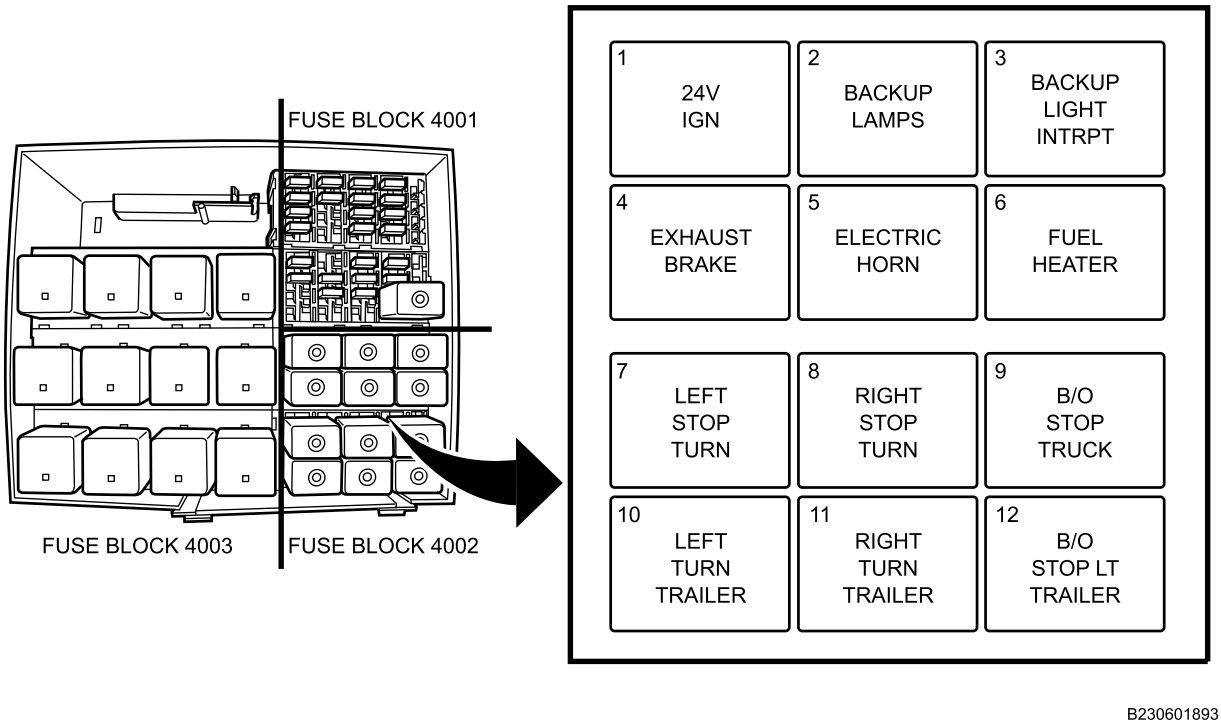


Figure 11. Fuse Block 4002.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

26. Install relay breakout harness (ZTSE4674) (Figure 12, Item 1) in place of relay 1 (Figure 12, Item 2) in fuse block 4002.

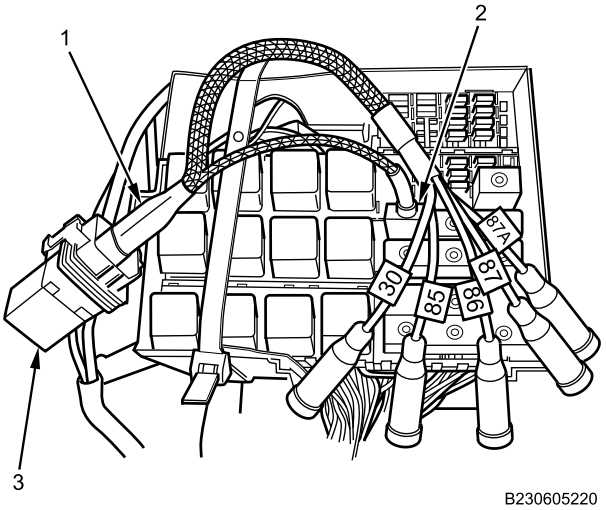


Figure 12. Relay Breakout Harness (ZTSE4674).

27. Install relay 1 (Figure 12, Item 3) in connector of relay breakout harness (ZTSE4674) (Figure 12, Item 1).
28. Turn MAIN POWER switch ON (TM 9-2355-106-10).
29. Turn ignition switch ON (TM 9-2355-106-10).
30. Measure DC voltage between relay breakout harness (ZTSE4674) terminal 30 and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

NO Go to Step 48.
YES Go to next step.

STEP

31. Measure DC voltage between relay breakout harness (ZTSE4674) terminal 85 and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Power Distribution Troubleshooting Procedure (WP 0059).
YES Go to next step.

STEP

32. Turn ignition switch OFF (TM 9-2355-106-10).
33. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
34. Measure resistance between relay breakout harness (ZTSE4674) terminal 86 and ground with multimeter. Refer to Figure 12.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 52.
YES Go to next step.

STEP

35. Connect 500 ohm resistor harness (ZTSE4497) between relay breakout harness (ZTSE4674) terminals 30 and 87. Refer to Figure 13 and Figure 12.

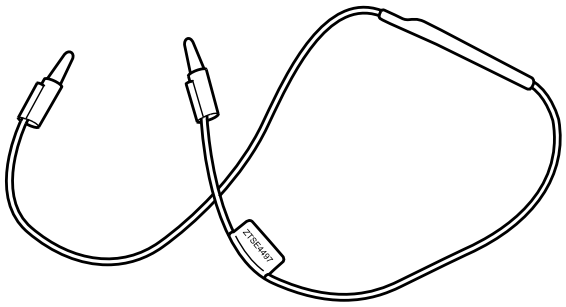


Figure 13. 500 Ohm Resistor Harness (ZTSE4497).

36. Turn MAIN POWER switch ON (TM 9-2355-106-10).
37. Turn ignition switch ON (TM 9-2355-106-10).
38. Measure DC voltage between alternator regulator IGN terminal (Figure 14, Item 1) and ground with multimeter.

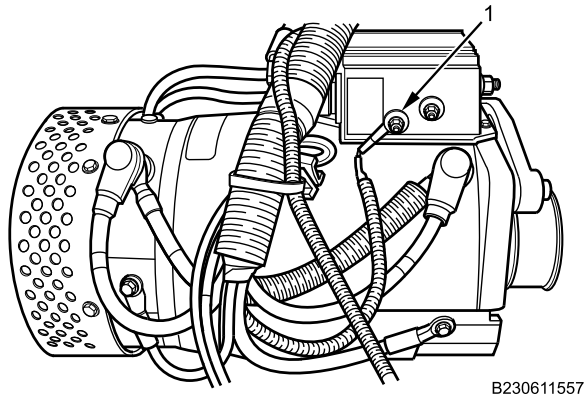


Figure 14. Alternator, Right Side Engine.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 41.
YES Go to next step.

STEP

39. Start and idle engine (TM 9-2355-106-10).
40. Measure DC voltage between alternator regulator IGN terminal (Figure 15, Item 1) and ground with multimeter.

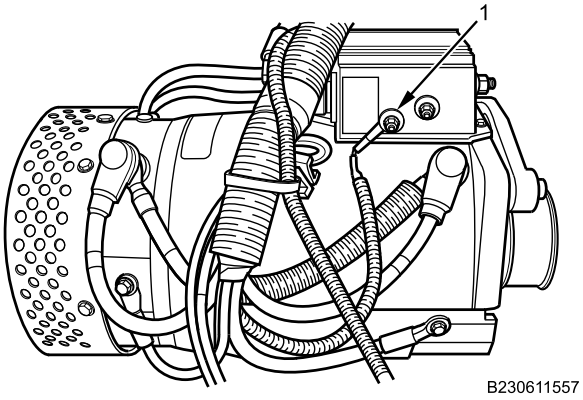


Figure 15. Alternator, Right Side Engine.

CONDITION/INDICATION

Does multimeter read between 27V and 32V?

DECISION

NO Go to Step 56.
YES Go to Step 54.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

41. Turn ignition switch OFF (TM 9-2355-106-10).
42. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
43. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
44. Disconnect harness connector 4103 (connector with 18 wires). Refer to Figure 16.

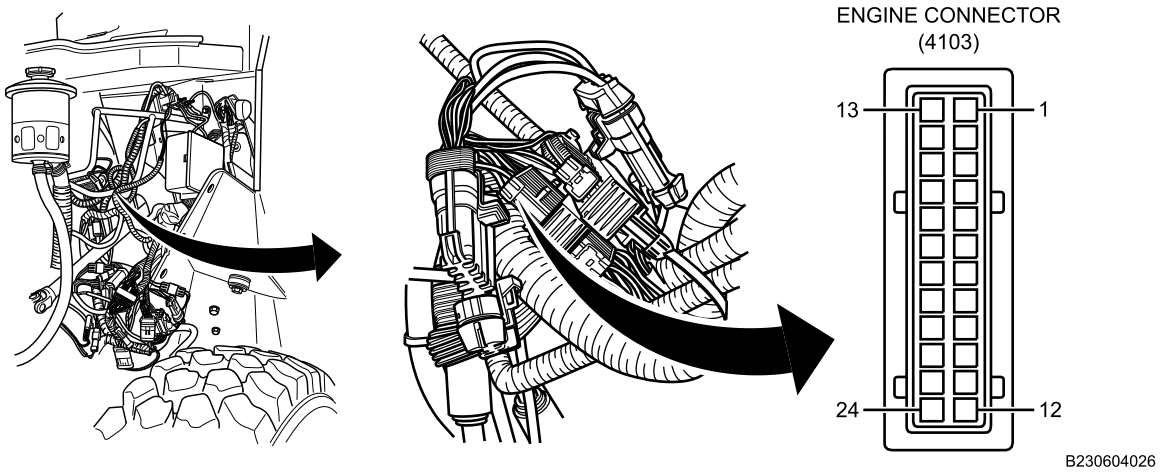


Figure 16. Below Air Filter.

45. Turn MAIN POWER switch ON (TM 9-2355-106-10).
46. Turn ignition switch ON (TM 9-2355-106-10).
47. Measure DC voltage between connector 4103 terminal 24 and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read between 22.5V and 25.5V?

DECISION

NO Go to Step 52.
YES Go to Step 53.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

48. Turn ignition switch OFF (TM 9-2355-106-10).
49. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
50. Remove fuse 4 from fuse block 4001. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 17.

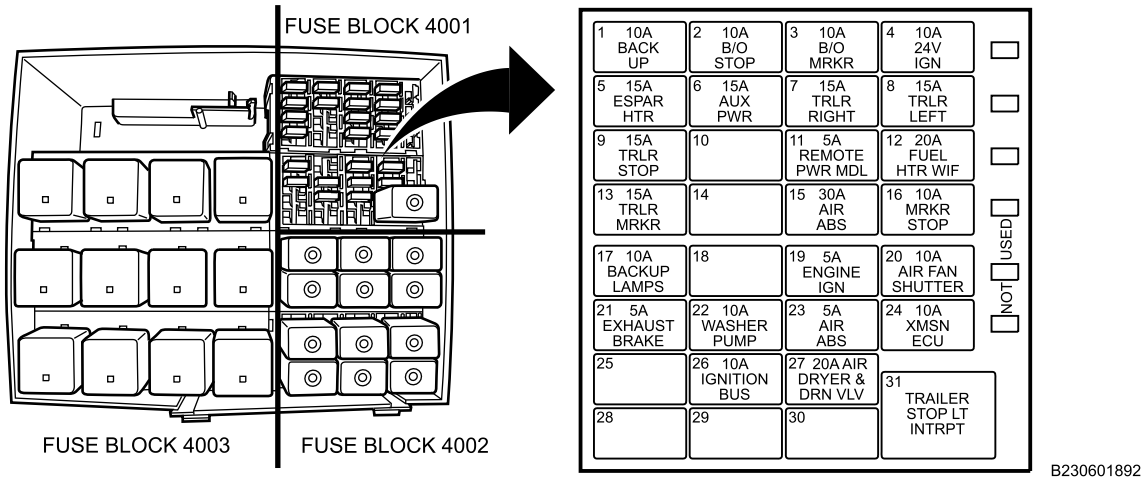


Figure 17. Fuse Block 4001.

51. Measure resistance between relay breakout harness (ZTSE4674) terminal 30 and fuse block 4001 terminal F2H1 with multimeter. Refer to Figure 18 and Figure 19.

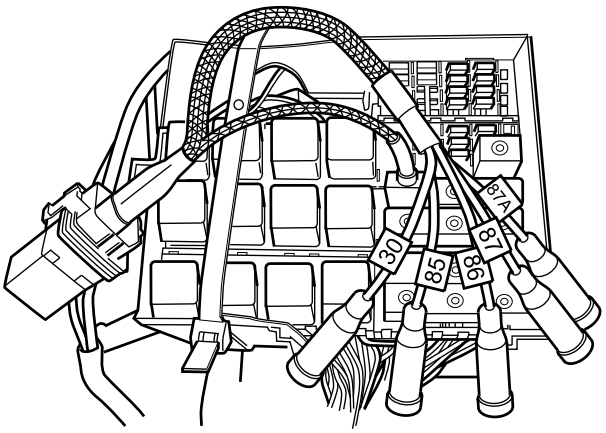


Figure 18. Relay Breakout Harness (ZTSE4674).

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

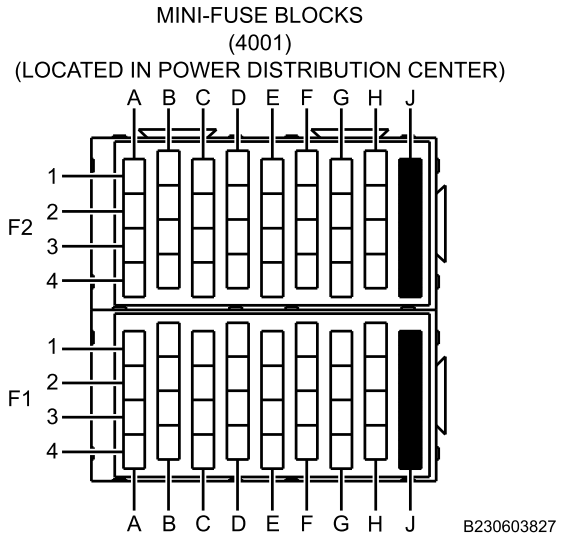


Figure 19. Fuse Block 4001.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 52.
YES Go to Power Distribution Troubleshooting Procedure (WP 0059).

MALFUNCTION

- 52. Power Distribution Center (PDC) wiring harness is faulty.

ACTION

Replace PDC wiring harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 53. Engine wiring harness is faulty.

ACTION

Replace engine wiring harness. Refer to Engine Wiring Harness Removal and Installation (WP 0336). Return vehicle to service.

END OF TEST

MALFUNCTION

- 54. 24V relay is faulty.

CHARGING SYSTEM TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace 24V relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Return vehicle to service.

END OF TEST

MALFUNCTION

- 55. Alternator regulator responded to overvoltage condition.

ACTION

If condition continues, replace alternator. Refer to Alternator Removal and Installation (WP 0289). Return vehicle to service.

END OF TEST

MALFUNCTION

- 56. Alternator is faulty.

ACTION

Replace alternator. Refer to Alternator Removal and Installation (WP 0289). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

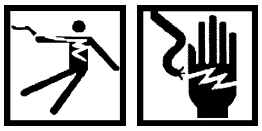
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0098
WP 0099
WP 0100
WP 0101
WP 0104
WP 0303
WP 0307
WP 0411
WP 0581
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Instrument Panel (IP) center trim panel removed (WP 0581)

Drawings Required
WP 0789, Figure 51

TROUBLESHOOTING PROCEDURE

WARNING



Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Press each button on MVLS switch while observing MVLS indicator lights (TM 9-2355-106-10).

CONDITION/INDICATION

Does each light, except for PANEL DIM, PANEL BRT, and ENTER, illuminate momentarily as the corresponding button is pressed?

DECISION

NO Go to Step 30.
YES Go to next step.

STEP

4. Press STOPLIGHT button and then press ENTER button within 5 seconds.

CONDITION/INDICATION

Do stoplights illuminate (TM 9-2355-106-10)?

DECISION

NO Go to Step 38.
YES Go to next step.

STEP

5. Press SER. DRIVE button and then press ENTER button within 5 seconds.

CONDITION/INDICATION

Do driving lights illuminate (TM 9-2355-106-10)?

DECISION

NO Go to Step 46.
YES Go to next step.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

6. Press PARK button and then press ENTER button within 5 seconds.

CONDITION/INDICATION

Do park lights illuminate (TM 9-2355-106-10)?

DECISION

NO Go to Step 58.
YES Go to next step.

STEP

7. Press B.O. DRIVE button and then press ENTER button within 5 seconds.

CONDITION/INDICATION

Do blackout driving lights operate correctly (TM 9-2355-106-10)?

DECISION

NO Go to Step 66.
YES Go to next step.

STEP

8. Press B.O. MARKER button and then press ENTER button within 5 seconds on MVLS switch.

CONDITION/INDICATION

Do blackout marker lights operate correctly (TM 9-2355-106-10)?

DECISION

NO Go to Step 78.
YES Go to next step.

STEP

9. Press PARK button and then press ENTER button within 5 seconds.
10. Press PANEL DIM button and observe instrument panel dimming.
11. Press PANEL BRT button and observe instrument panel brightness.

CONDITION/INDICATION

Does panel light dimming correspond to inputs?

DECISION

YES MVLS is operating correctly.
NO Go to next step.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

12. Turn ignition switch OFF (TM 9-2355-106-10).
13. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
14. Disconnect MVLS switch connector 1954. Refer to Figure 1.

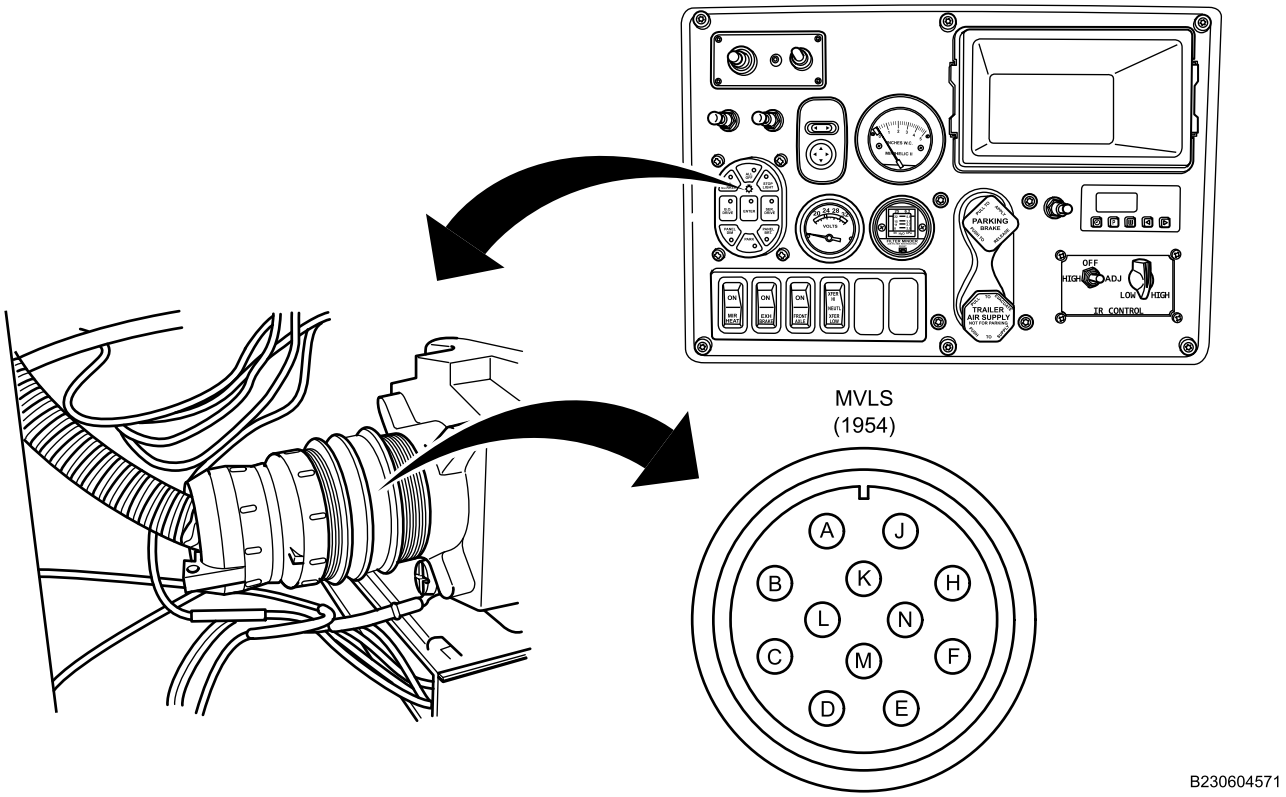


Figure 1. Behind IP Center Trim Panel.

15. Connect jumper wire between connector 1954 terminal F and MVLS switch terminal F. Refer to Figure 1 and Figure 2.

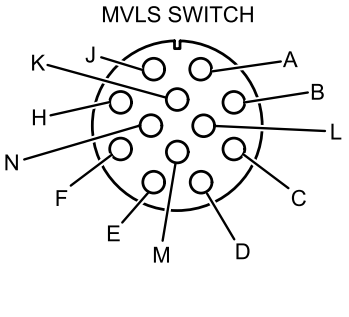


Figure 2. MVLS Switch.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

16. Turn MAIN POWER switch ON (TM 9-2355-106-10).
17. Turn ignition switch ON (TM 9-2355-106-10).
18. Press PANEL DIM button and then press the ENTER button within 5 seconds on MVLS switch.
19. Measure DC voltage between MVLS switch terminal B and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 4V and 6V?

DECISION

NO Go to Step 90.
YES Go to next step.

STEP

20. Press PANEL BRT button and then press the ENTER button within 5 seconds on MVLS switch.
21. Measure DC voltage between MVLS switch terminal B and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 90.
YES Go to next step.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Turn ignition switch OFF (TM 9-2355-106-10).
23. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
24. Remove jumper wire.
25. Connect MVLS switch connector 1954. Refer to Figure 3.

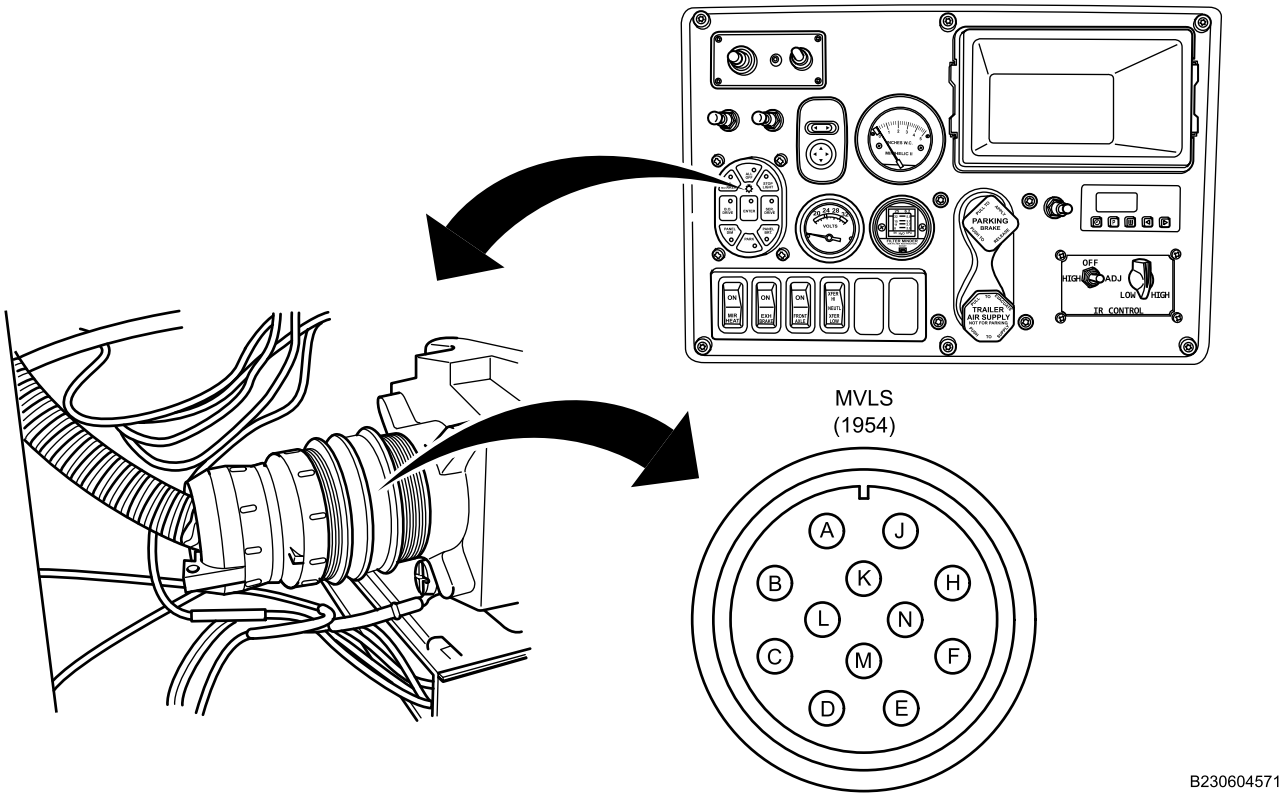


Figure 3. Behind IP Center Trim Panel.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

26. Disconnect panel light adapter splice pack 1002. Refer to Figure 4.

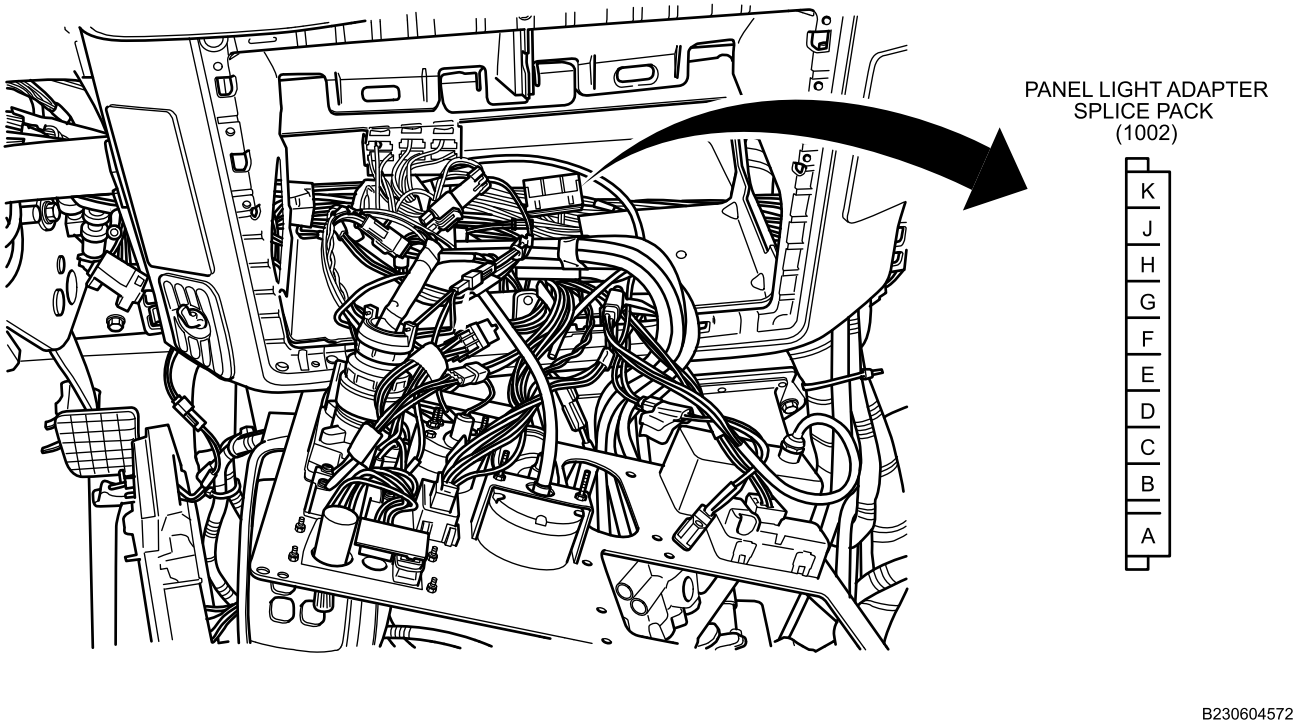


Figure 4. Bottom of IP Center Trim Opening.

27. Turn MAIN POWER switch ON (TM 9-2355-106-10).
28. Turn ignition switch ON (TM 9-2355-106-10).
29. Measure DC voltage from connector 1002 terminal D and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Refer to Instrument Panel Lights Troubleshooting Procedure (WP 0104).
NO Go to Step 91.

STEP

30. Refer to results of test just performed.

CONDITION/INDICATION

Do any MVLS indicator lights illuminate?

DECISION

YES Go to Step 90.
NO Go to next step.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

31. Turn ignition switch OFF (TM 9-2355-106-10).
32. Turn battery switch OFF (TM 9-2355-106-10).
33. Measure resistance between LAM1111 and ground with multimeter. Refer to Figure 5.

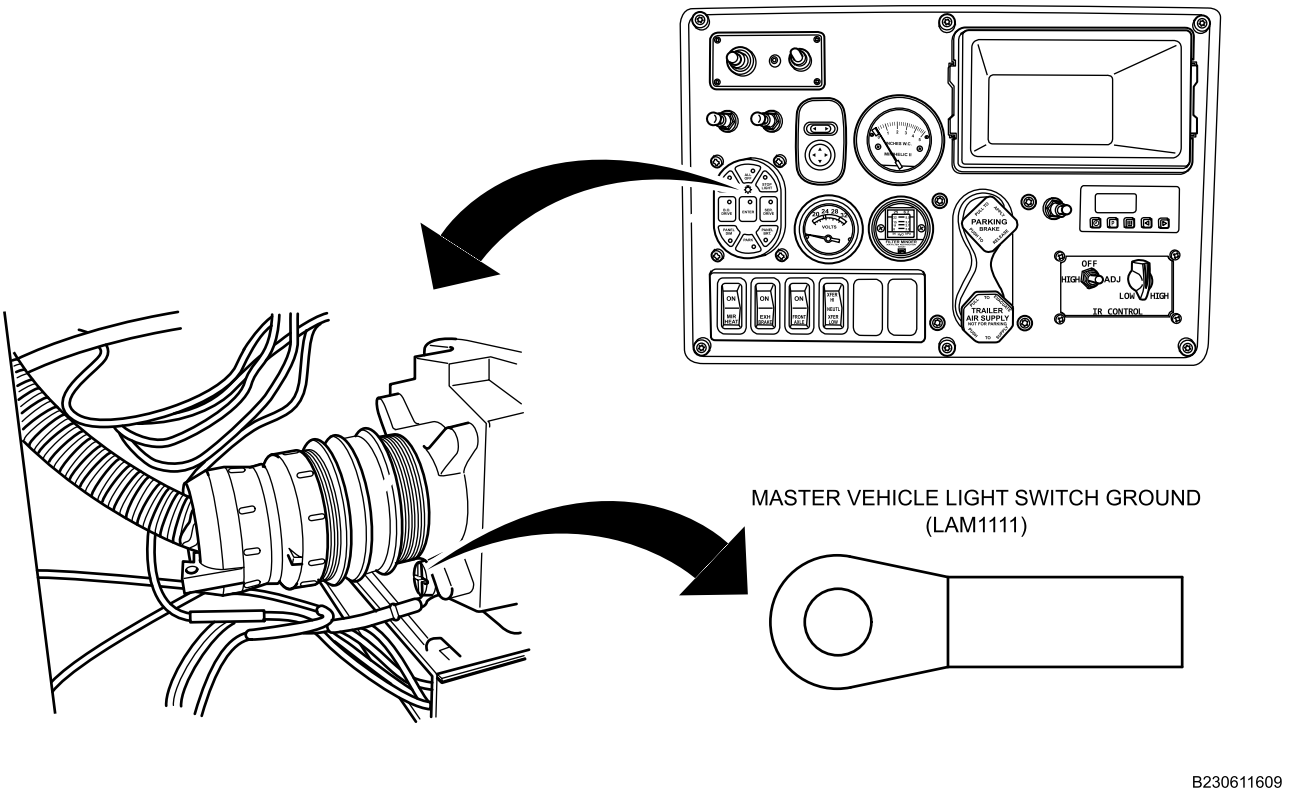


Figure 5. Behind IP Center Trim Panel.

CONDITION/INDICATION

Does multimeter read less than 1 ohm?

DECISION

NO Go to Step 88.
YES Go to next step.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

34. Disconnect MVLS connector 1954. Refer to Figure 6.

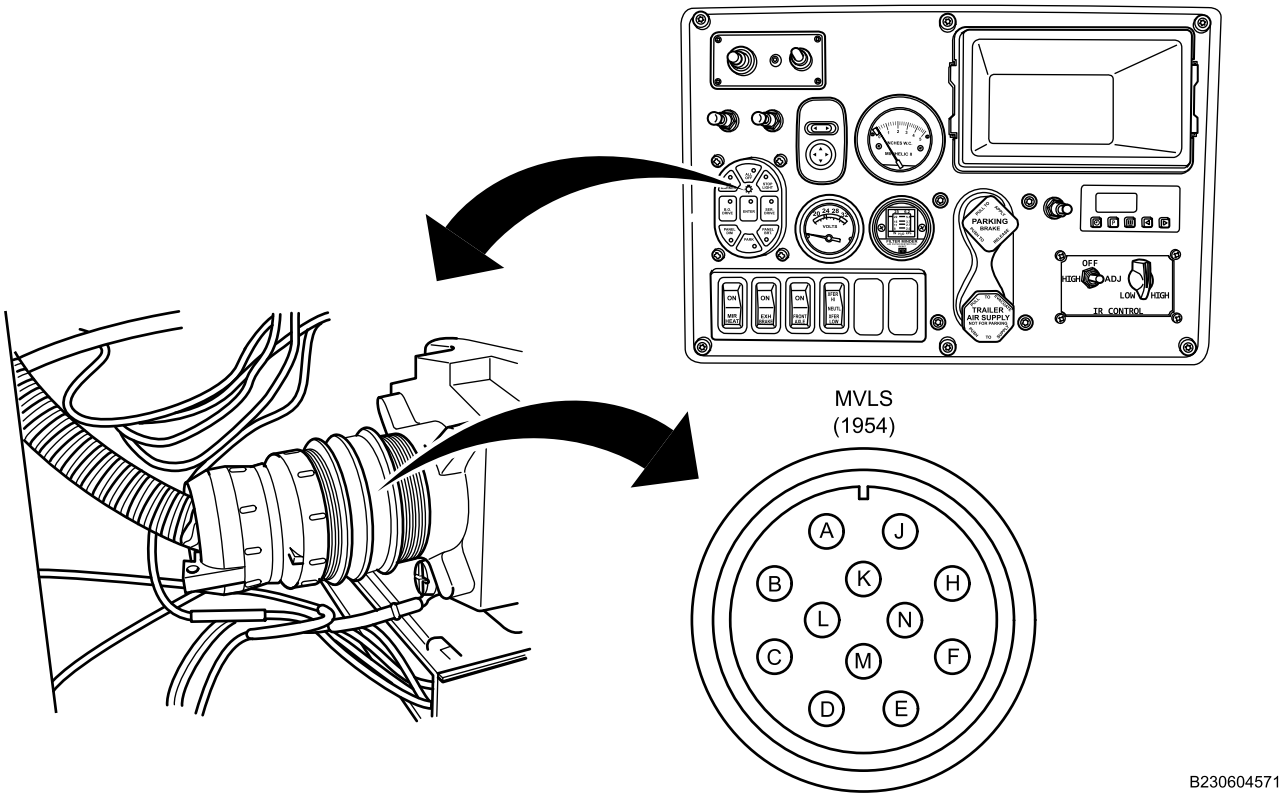


Figure 6. Behind IP Center Trim Panel.

35. Turn MAIN POWER switch ON (TM 9-2355-106-10).
36. Turn ignition switch ON (TM 9-2355-106-10).
37. Measure DC voltage between connector 1954 terminal F and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 91.
YES Go to Step 90.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

38. Turn ignition switch OFF (TM 9-2355-106-10).
39. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
40. Disconnect MVLS connector 1954. Refer to Figure 7.

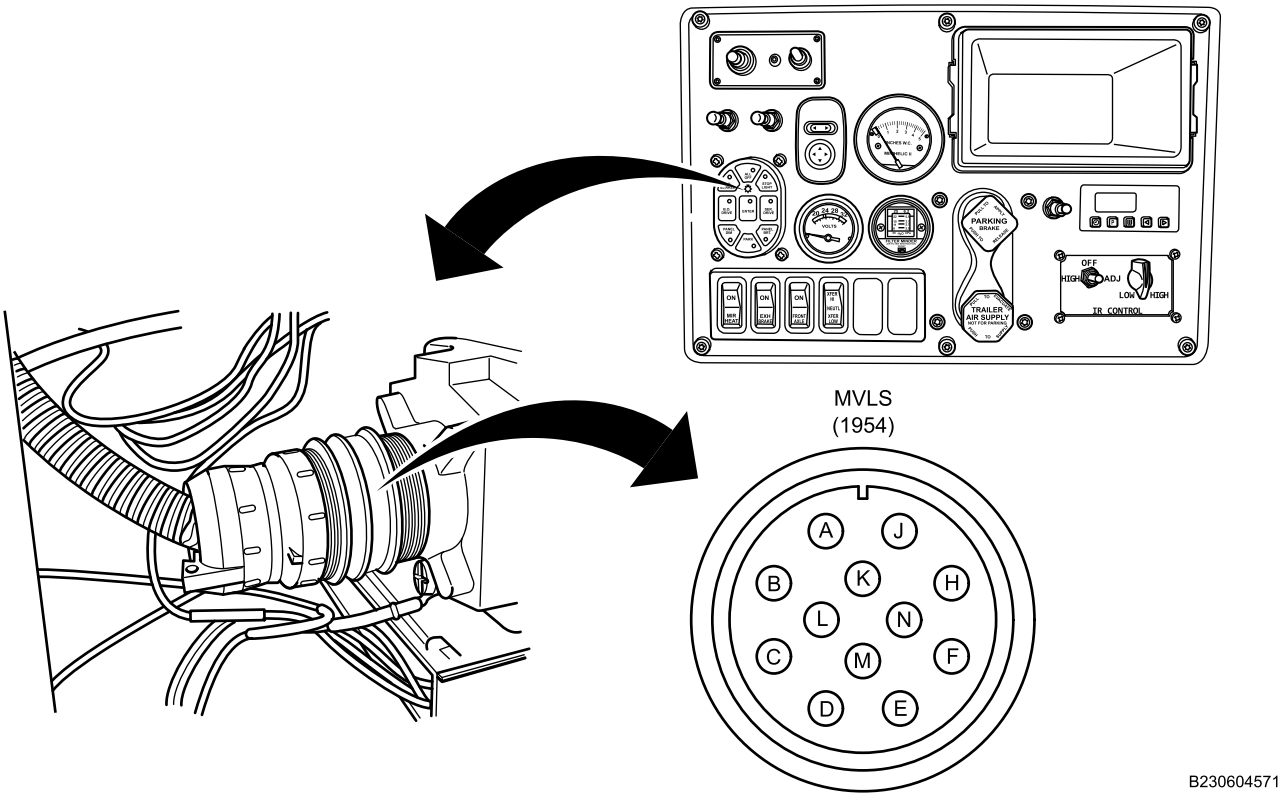


Figure 7. Behind IP Center Trim Panel.

41. Connect jumper wire between connector 1954 terminal F and MVLS switch terminal F. Refer to Figure 7 and Figure 8.

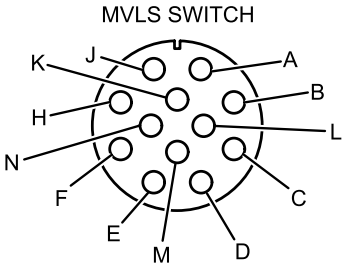


Figure 8. MVLS Switch.

42. Turn MAIN POWER switch ON (TM 9-2355-106-10).
43. Turn ignition switch ON (TM 9-2355-106-10).
44. Press STOPLIGHT switch and then press ENTER within 5 seconds.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

45. Measure DC voltage between connector 1954 terminals H and J to ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

YES Refer to Stoplights Troubleshooting Procedures (WP 0101).
NO Go to Step 90.

STEP

46. Turn ignition switch OFF (TM 9-2355-106-10).
47. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
48. Disconnect MVLS connector 1954. Refer to Figure 9.

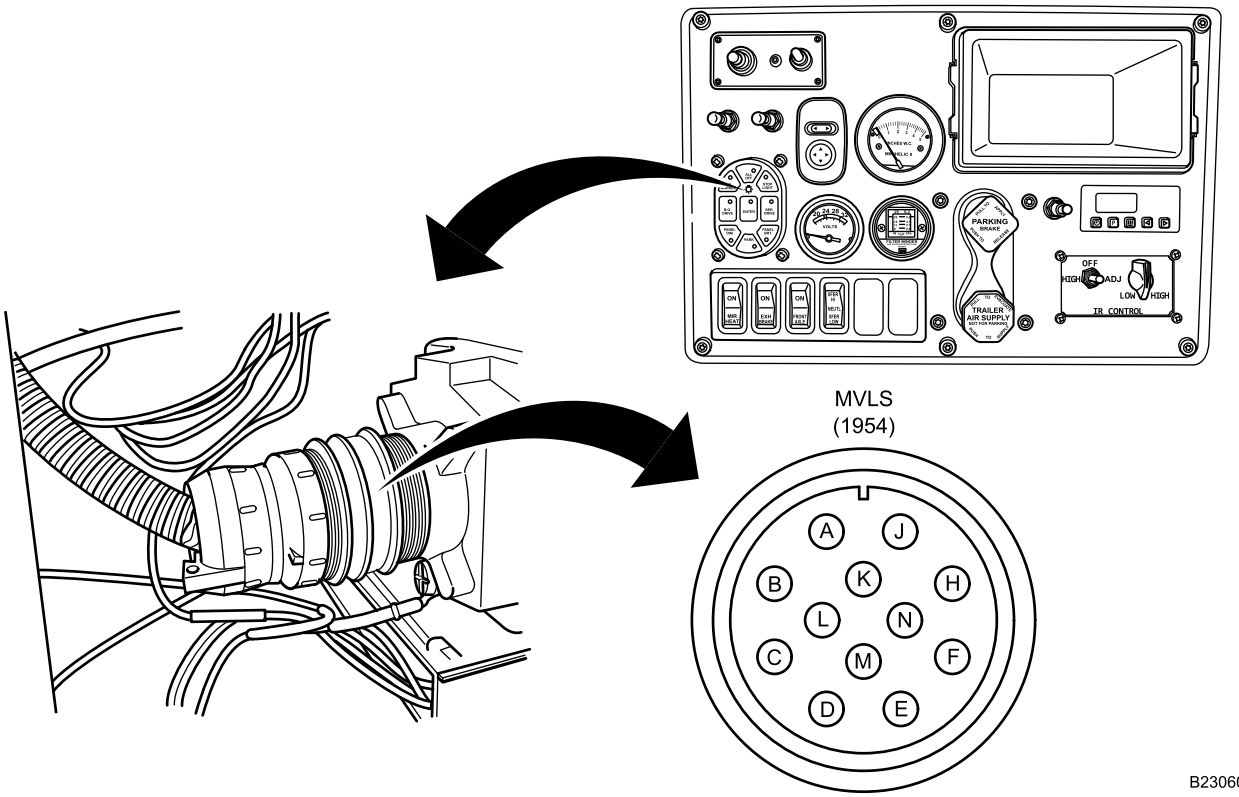


Figure 9. Behind IP Center Trim Panel.

49. Connect jumper wire between connector 1954 terminal F and MVLS switch terminal F. Refer to Figure 9 and Figure 10.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

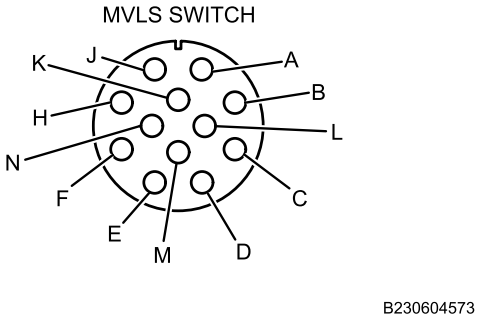


Figure 10. MVLS Switch.

50. Turn MAIN POWER switch ON (TM 9-2355-106-10).
51. Turn ignition switch ON (TM 9-2355-106-10).
52. Press SER DRIVE and then press ENTER within 5 seconds.
53. Measure DC voltage between connector 1954 terminal M and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 90.
YES Go to next step.

STEP

54. Press PARK and then press ENTER within 5 seconds.
55. Measure DC voltage between connector 1954 terminals H and J to ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

NO Go to Step 90.
YES Go to next step.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

56. Press STOPLIGHT and then press ENTER within 5 seconds.
57. Measure DC voltage between connector 1954 terminals H and J to ground with multimeter. Refer to Figure 11.

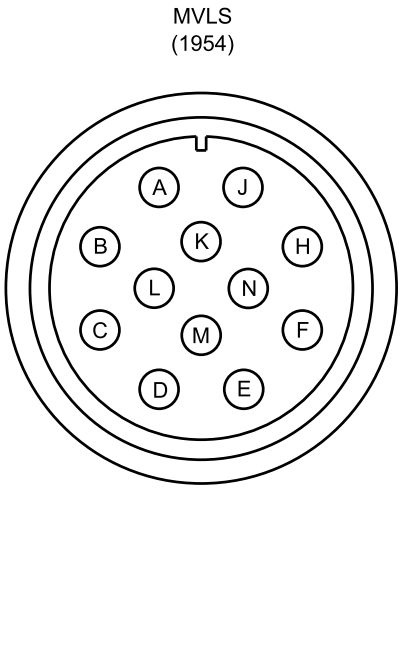


Figure 11. Connector 1954.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

NO Go to Step 90.
YES Refer to Service Driving Lights Troubleshooting Procedure (WP 0097) or Stoplights Troubleshooting Procedure (WP 0101).

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

58. Turn ignition switch OFF (TM 9-2355-106-10).
59. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
60. Disconnect MVLS connector 1954. Refer to Figure 12.

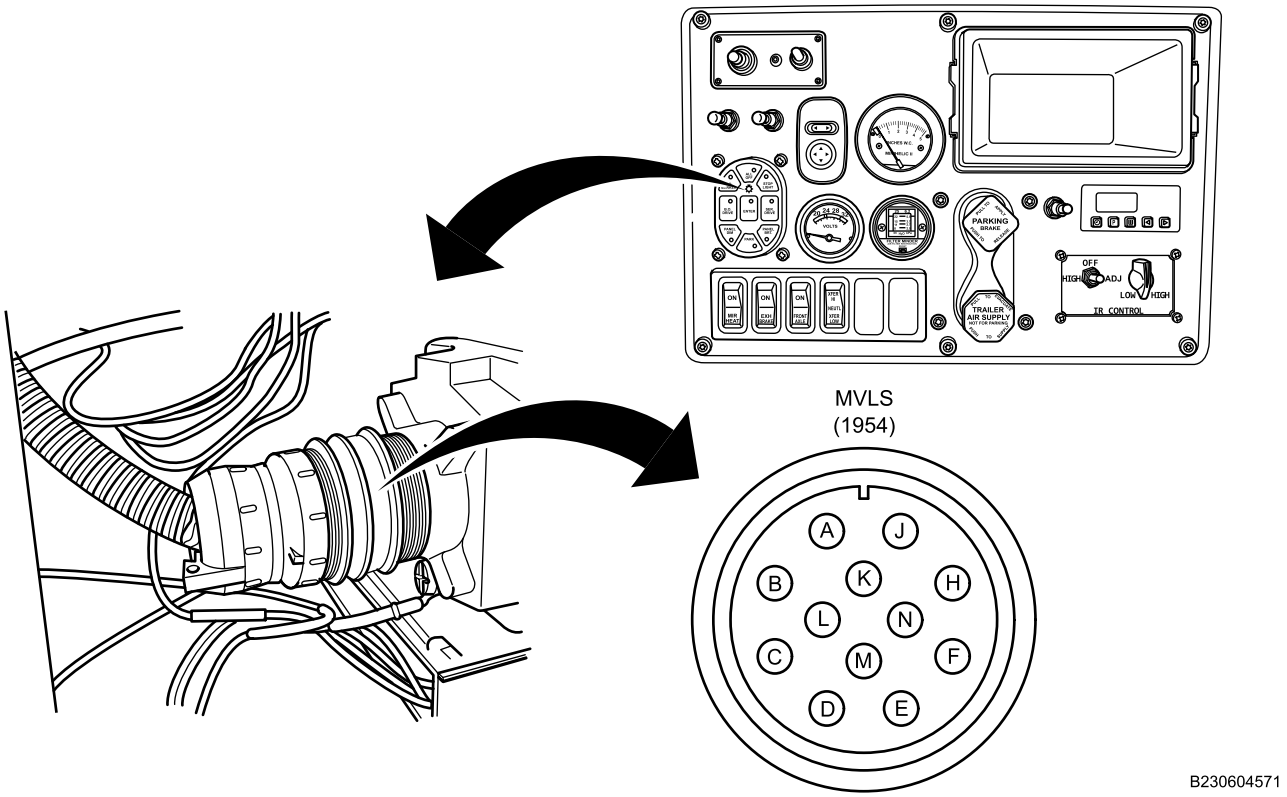


Figure 12. Behind IP Center Trim Panel.

61. Connect jumper wire between connector 1954 terminal F and MVLS switch terminal F. Refer to Figure 12 and Figure 13.

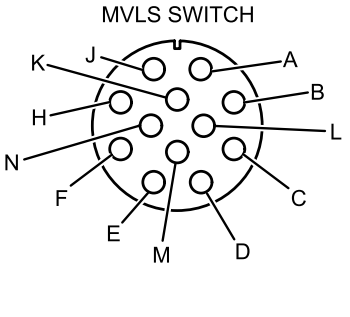


Figure 13. MVLS Switch.

62. Turn MAIN POWER switch ON (TM 9-2355-106-10).
63. Turn ignition switch ON (TM 9-2355-106-10).
64. Press SER DRIVE and then press ENTER within 5 seconds.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

65. Measure DC voltage between connector 1954 terminals H and J and ground with multimeter. Refer to Figure 14.

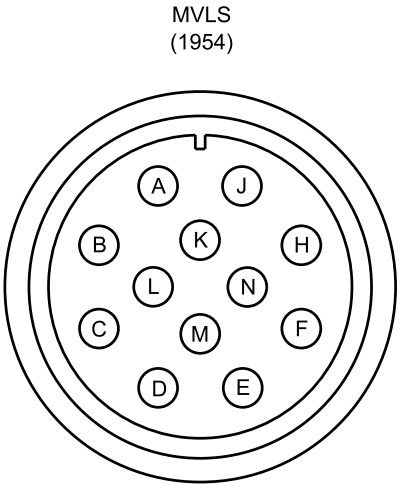


Figure 14. Connector 1954.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

NO Go to Step 90.
YES Refer to Clearance/Marker Lights Troubleshooting Procedure (WP 0098).

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

66. Turn ignition switch OFF (TM 9-2355-106-10).
67. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
68. Disconnect MVLS connector 1954. Refer to Figure 15.

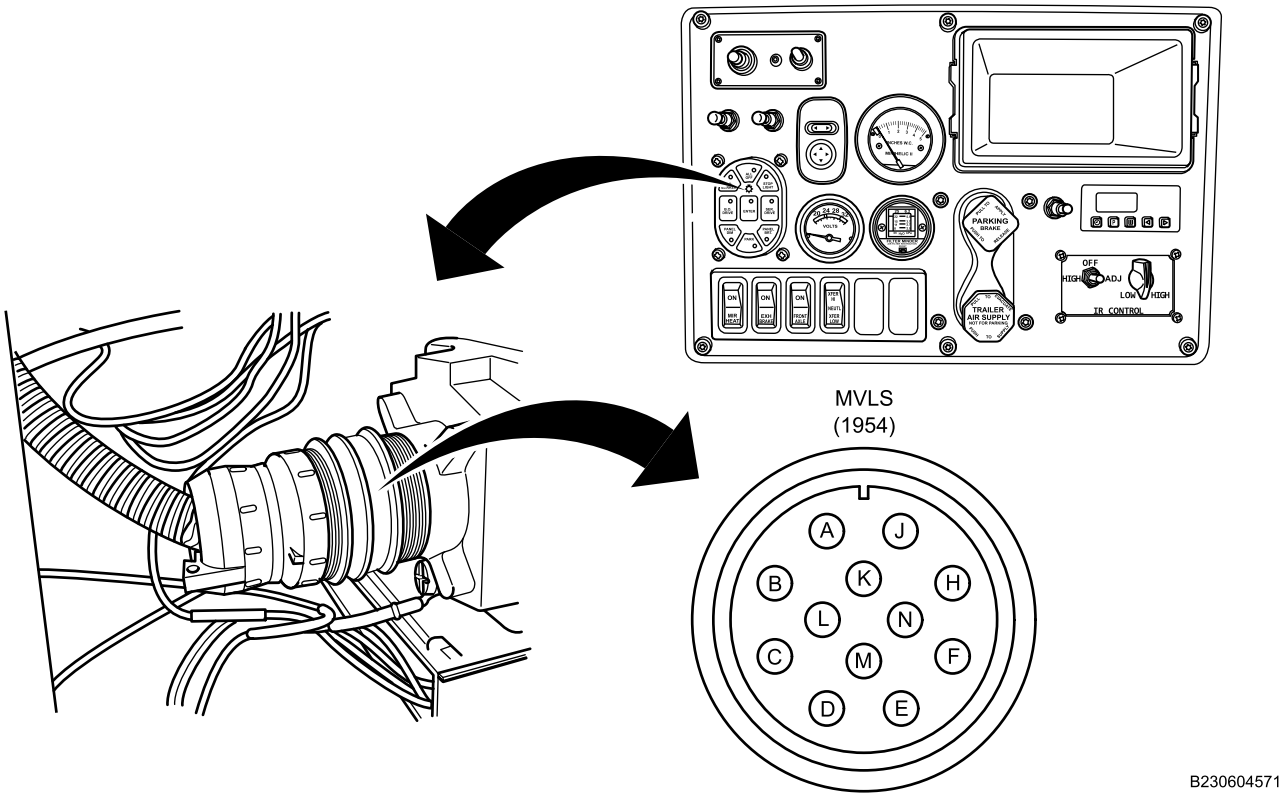


Figure 15. MVLS Switch Connector.

69. Connect jumper wire between connector 1954 terminal F and MVLS switch terminal F. Refer to Figure 15 and Figure 16.

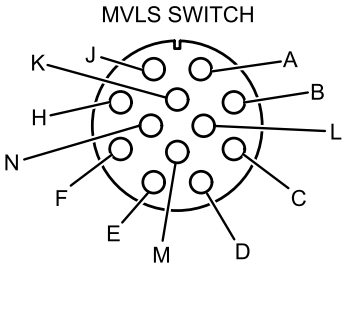


Figure 16. MVLS Switch.

70. Turn MAIN POWER switch ON (TM 9-2355-106-10).
71. Turn ignition switch ON (TM 9-2355-106-10).
72. Press B.O. DRIVE and then press ENTER within 5 seconds.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

73. Measure DC voltage between connector 1954 terminal D and ground with multimeter. Refer to Figure 17.

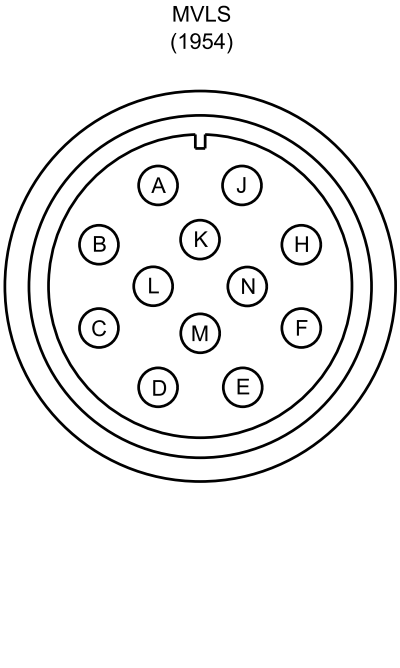


Figure 17. Connector 1954.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 90
YES Go to next step.

STEP

74. Press B.O. MARKER and then press ENTER within 5 seconds.
75. Measure DC voltage between connector 1954 terminal E and ground with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 90.
YES Go to next step.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

76. Press SER DRIVE and then press ENTER within 5 seconds on the MVLS switch.
77. Measure DC voltage between connector 1954 terminals H and J to ground with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

NO Go to Step 90.
YES Refer to Blackout Driving Lights Troubleshooting Procedure (WP 0099).

STEP

78. Turn ignition switch OFF (TM 9-2355-106-10).
79. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
80. Disconnect MVLS connector 1954. Refer to Figure 18.

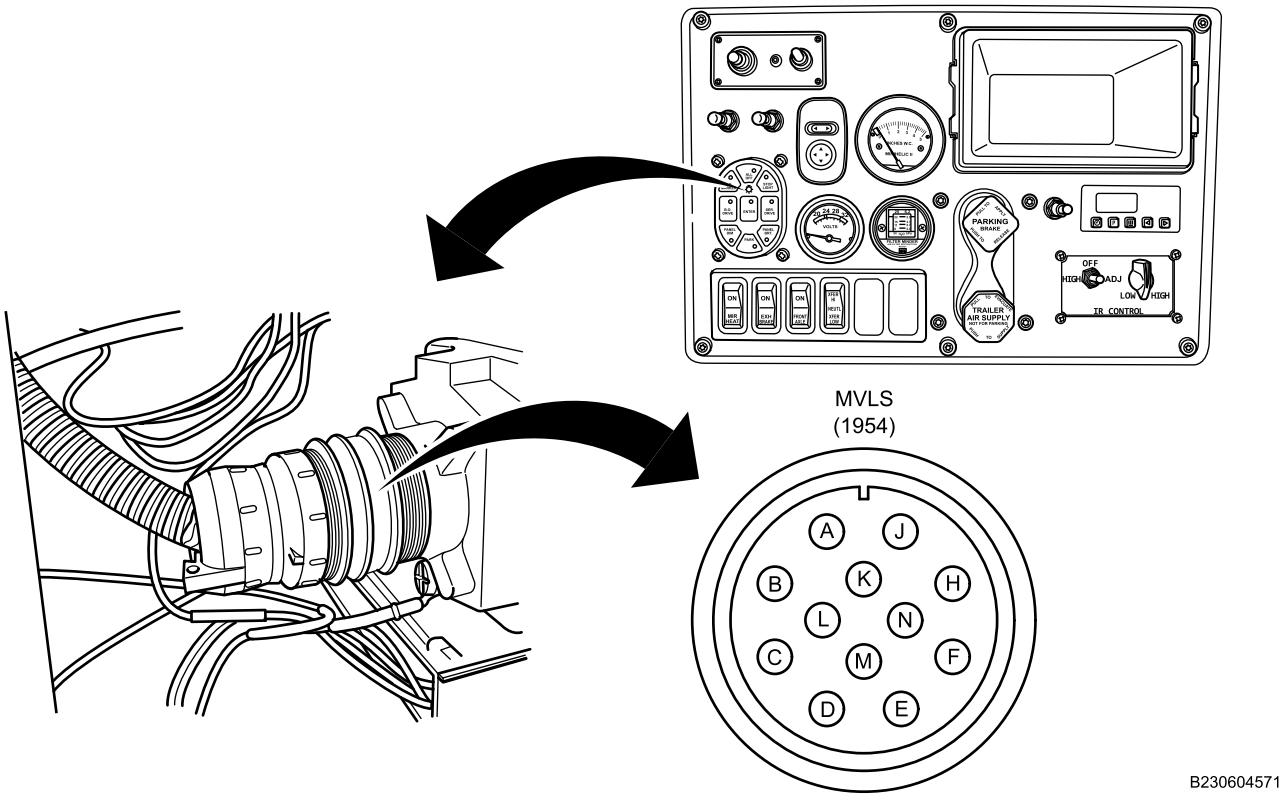


Figure 18. Behind IP Center Trim Panel.

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

81. Connect jumper wire between connector 1954 terminal F and MVLS switch terminal F. Refer to Figure 18 and Figure 19.

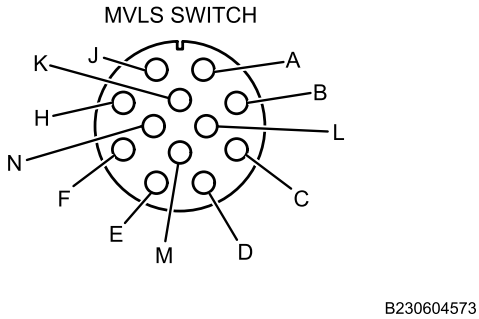


Figure 19. MVLS Switch.

82. Turn MAIN POWER switch ON (TM 9-2355-106-10).
83. Turn battery ignition switch ON (TM 9-2355-106-10).
84. Press B.O. MARKER and then press ENTER within 5 seconds.
85. Measure DC voltage between connector 1954 terminal E and ground with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 90.
YES Go to next step.

STEP

86. Press SER DRIVE and then press ENTER within 5 seconds on the MVLS switch.
87. Measure DC voltage between connector 1954 terminals H and J to ground with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V for each test?

DECISION

NO Go to Step 90.
YES Refer to Blackout Marker Lights Troubleshooting Procedure (WP 0100).

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

88. Disconnect connector LAM1112. Refer to Figure 20.

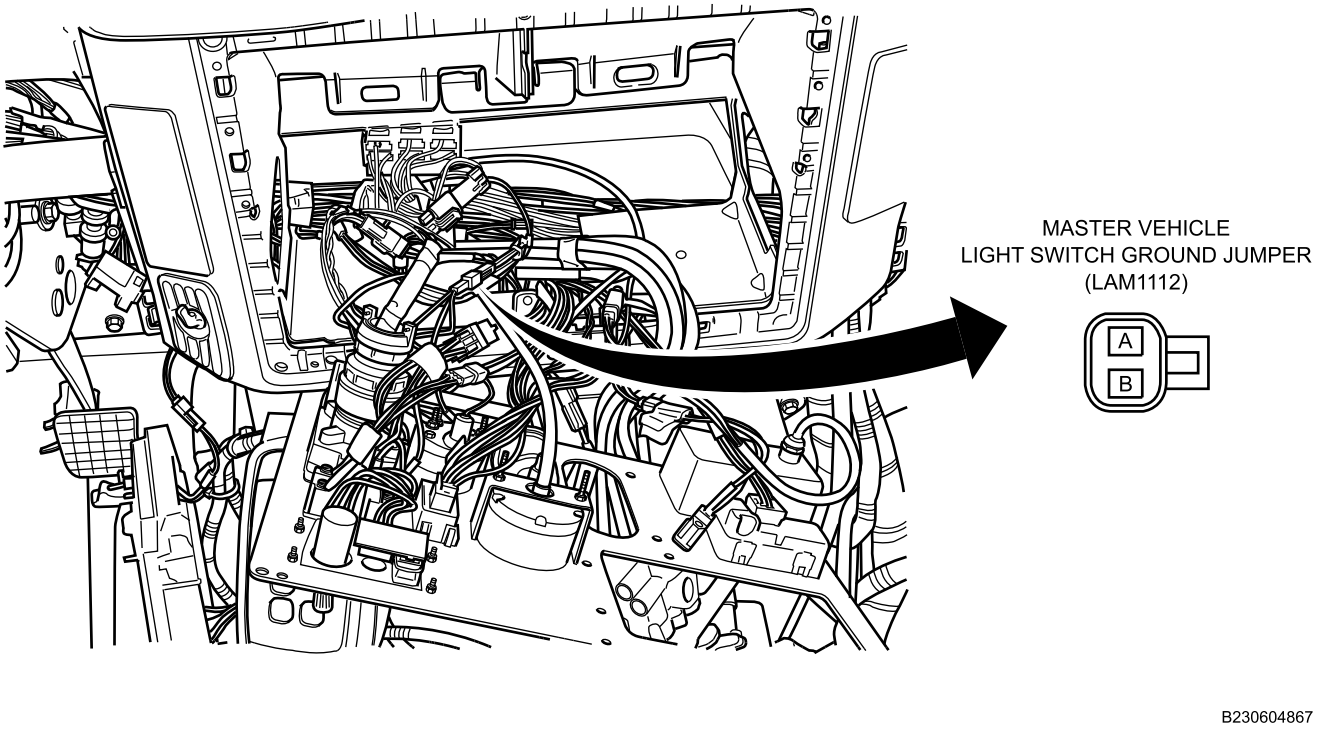


Figure 20. Behind IP Center Trim Panel.

89. Measure resistance between connector LAM1112 and ground with multimeter. Refer to Figure 20.

CONDITION/INDICATION

Does multimeter read less than 1 ohm?

DECISION

YES Go to Step 91.
NO Go to Step 92.

MALFUNCTION

- 90. Faulty MVLS.

ACTION

Replace MVLS. Refer to Master Vehicle Light Switch (MVLS) Removal and Installation (WP 0303). Return vehicle to service.

END OF TEST

MASTER VEHICLE LIGHT SWITCH (MVLS) TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 91. Faulty harness.

ACTION

Replace IP wiring harness. Refer to Instrument Panel (IP) Feed Harness Removal and Installation (WP 0411).

END OF TEST

MALFUNCTION

- 92. Faulty harness.

ACTION

Replace harness. Refer to Master Vehicle Light Switch (MVLS) Ground Harness Removal and Installation (WP 0307).

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Materials/Parts
Wire tags (WP 0794, Item 33)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0092
WP 0317
WP 0319
WP 0333
WP 0372
WP 0361
WP 0373
WP 0374
WP 0375
WP 0379
WP 0367
WP 0424
WP 0580
WP 0598
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch OFF (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

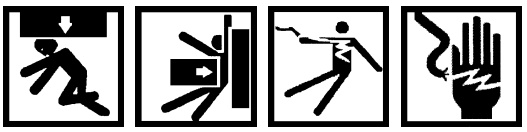
Drawings Required
WP 0789, Figure 58
WP 0789, Figure 13

Before Beginning This Troubleshooting Procedure

Successful diagnosis of turn signal lights depends on performing various procedures in correct sequence. Failure to comply will lead to misdiagnosis. Perform Turn Signal Lights Operational Checkout Procedure (WP 0096) before performing tests in this troubleshooting procedure.

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedure Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Press SER. DRIVE on Master Vehicle Light Switch (MVLS) and then press ENTER within 5 seconds (TM 9-2355-106-10).
4. Activate left turn signals (TM 9-2355-106-10).
5. Observe left front turn signal lights.
6. Activate right turn signals (TM 9-2355-106-10).
7. Observe right front turn signal lights.

CONDITION/INDICATION

Are all front turn signal lights inoperative?

DECISION

YES Go to Step 123.
NO Go to next step.

STEP

8. Activate left turn signals (TM 9-2355-106-10).
9. Observe left front turn signal lights.

CONDITION/INDICATION

Are all 3 left front turn signal lights inoperative?

DECISION

YES Go to Step 50.
NO Go to next step.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

10. Observe left front turn signal lights.

CONDITION/INDICATION

Are turn signal light on left front fender and turn signal light next to left headlight inoperative?

DECISION

YES Go to Step 36.
NO Go to next step.

STEP

11. Observe left front turn signal lights.

CONDITION/INDICATION

Is turn signal light on left front fender inoperative?

DECISION

YES Go to Step 19.
NO Go to next step.

STEP

12. Observe left front turn signal lights.

CONDITION/INDICATION

Is turn signal light next to left front headlight inoperative?

DECISION

YES Go to Step 31.
NO Go to next step.

STEP

13. Observe left front turn signal lights.

CONDITION/INDICATION

Is turn signal light in left front bumper inoperative?

DECISION

YES Go to Step 43.
NO Go to next step.

STEP

14. Activate right turn signals (TM 9-2355-106-10).
15. Observe right front turn signal lights.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Are all 3 right front turn signal lights inoperative?

DECISION

YES Go to Step 102.
NO Go to next step.

STEP

16. Observe right front turn signal lights.

CONDITION/INDICATION

Are turn signal light on right front fender and turn signal light next to right headlight inoperative?

DECISION

YES Go to Step 88.
NO Go to next step.

STEP

17. Observe right front turn signal lights.

CONDITION/INDICATION

Is turn signal light on right front fender inoperative?

DECISION

YES Go to Step 71.
NO Go to next step.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

18. Observe right front turn signal lights.

CONDITION/INDICATION

Is turn signal light next to right headlight inoperative?

DECISION

YES Go to Step 83.
NO Go to Step 95.

STEP

19. Remove turn signal bulb from socket 8154. Refer to Front Fender Light Bulb Removal and Installation (WP 0372). Refer to Figure 1.

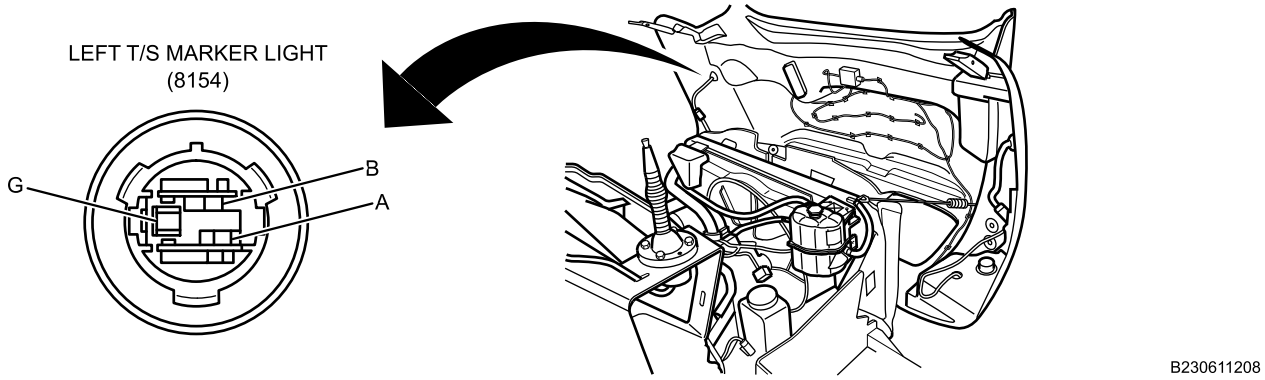


Figure 1. Left Front Fender Turn Signal Bulb Socket.

20. Turn MAIN POWER switch ON (TM 9-2355-106-10).
21. Turn ignition switch ON (TM 9-2355-106-10).
22. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
23. Measure DC voltage between bulb socket 8154 terminal A and terminal G with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 127.
NO Go to next step.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

24. Turn ignition switch OFF (TM 9-2355-106-10).
25. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
26. Disconnect connector LAM1061 from connector 8153F under left front fender. Refer to Figure 2.

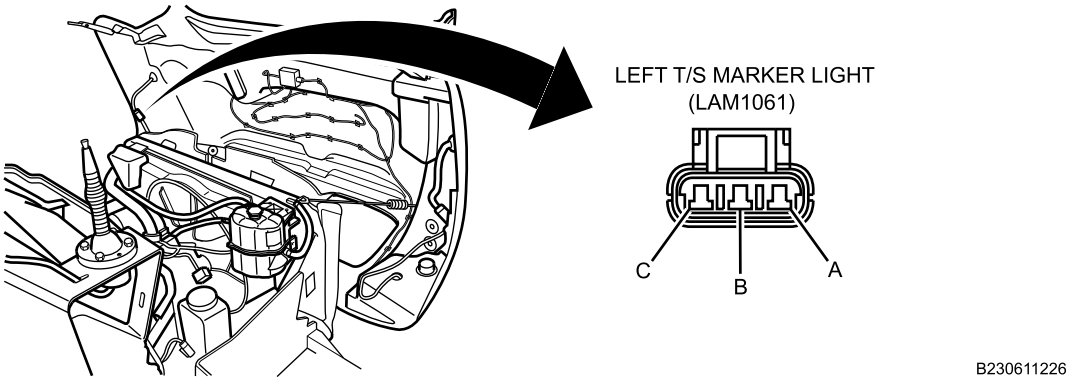


Figure 2. Front Fender Turn Light Connector.

27. Turn MAIN POWER switch ON (TM 9-2355-106-10).
28. Turn ignition switch ON (TM 9-2355-106-10).
29. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
30. Measure DC voltage between harness connector LAM1061 terminal C and A with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 133.
NO Go to Step 134.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

31. Remove turn signal bulb from socket LAM1203. Refer to Front Turn Signal and Parking Light Bulb Removal and Installation (WP 0373). Refer to Figure 3.

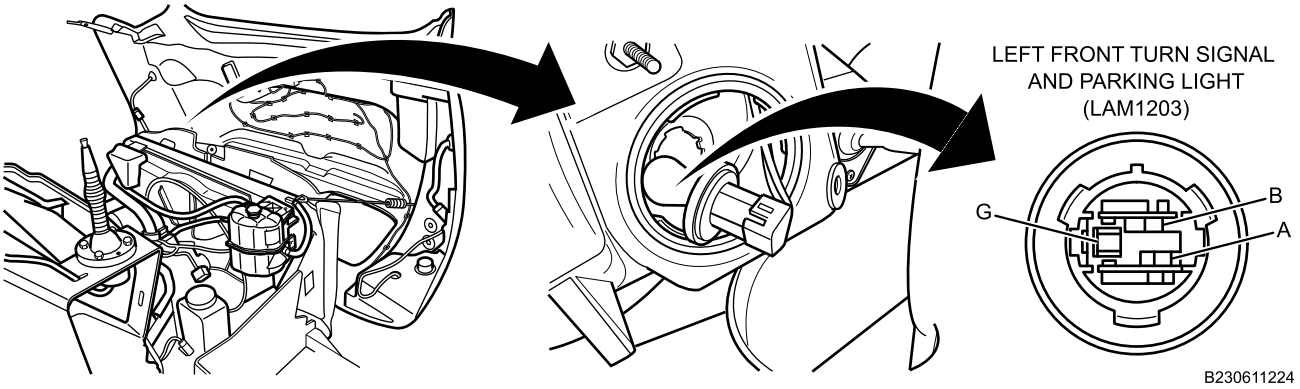


Figure 3. Left Front Turn Signal Bulb Socket (Near Headlight).

32. Turn MAIN POWER switch ON (TM 9-2355-106-10).
33. Turn ignition switch ON (TM 9-2355-106-10).
34. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
35. Measure DC voltage between bulb socket LAM1203 terminal A and G with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 126.
NO Go to Step 134.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

36. Turn ignition switch OFF (TM 9-2355-106-10).
37. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
38. Follow wiring harness down from headlight and disconnect first 5-way harness connector LAM1046. Refer to Figure 4.

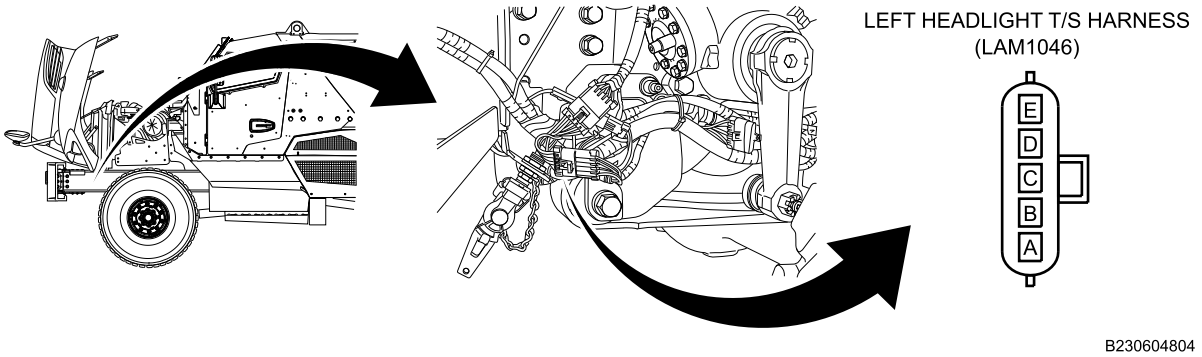


Figure 4. Left Headlight/Turn Signal Harness Connector Near Front Spring Shackle.

39. Turn MAIN POWER switch ON (TM 9-2355-106-10).
40. Turn ignition switch ON (TM 9-2355-106-10).
41. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
42. Measure DC voltage between harness connector LAM1046 terminal B and terminal D with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 134.
NO Go to Step 131.

STEP

43. Turn ignition switch OFF (TM 9-2355-106-10).
44. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

NOTE

Label bullet connectors before disconnecting.

45. Disconnect bullet connectors LAM1103 leading to 460/461 and GND terminals. Refer to Figure 5.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

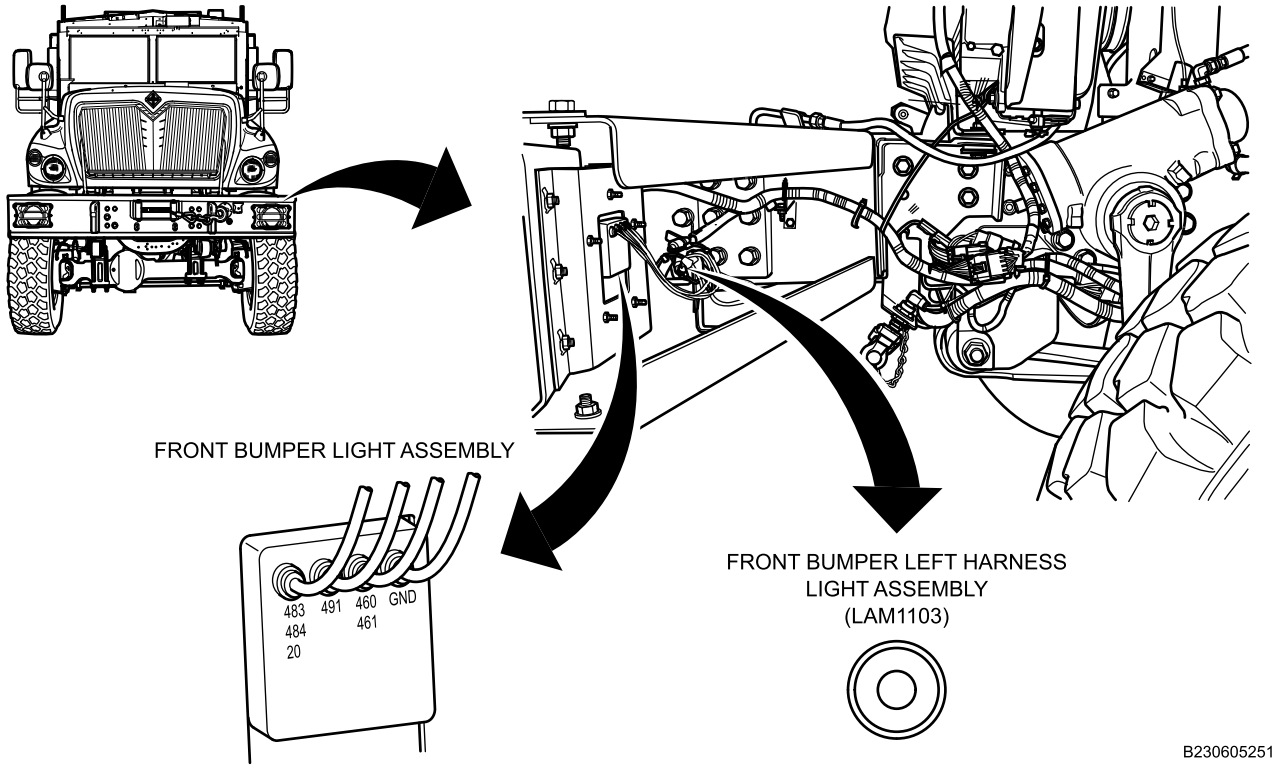


Figure 5. Front Bumper Light Unit Terminal Identification for Bullet Connectors Behind Front Bumper.

46. Turn MAIN POWER switch ON (TM 9-2355-106-10).
47. Turn ignition switch ON (TM 9-2355-106-10).
48. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
49. Measure DC voltage between harness side bullet connector LAM1103 for terminals 460/461 and GND with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 128.
NO Go to Step 131.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

50. Turn ignition switch OFF (TM 9-2355-106-10).
51. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
52. Follow wiring harness down from headlight and disconnect second 5-way harness connector LAM1101. Refer to Figure 6.

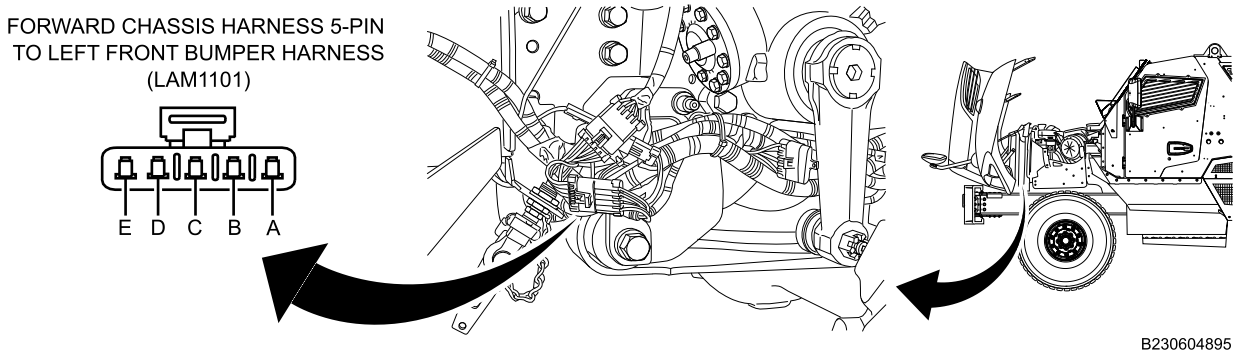


Figure 6. Left Front Bumper/Front Chassis Connector Near Front Spring Shackle.

53. Turn MAIN POWER switch ON (TM 9-2355-106-10).
54. Turn ignition switch ON (TM 9-2355-106-10).
55. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
56. Measure DC voltage between harness connector LAM1101 terminal B and terminal D with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 131.
NO Go to next step.

STEP

57. Turn ignition switch OFF (TM 9-2355-106-10).
58. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
59. Measure resistance between connector LAM1101 terminal B and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

NO Go to Step 130.

STEP

60. Remove left side engine armor plate bracket. Refer to Left Side Engine Armor Plate Bracket Removal and Installation (WP 0598).
61. Disconnect connector 4301/4300 (24 cavities with 22 wires). Refer to Figure 7.

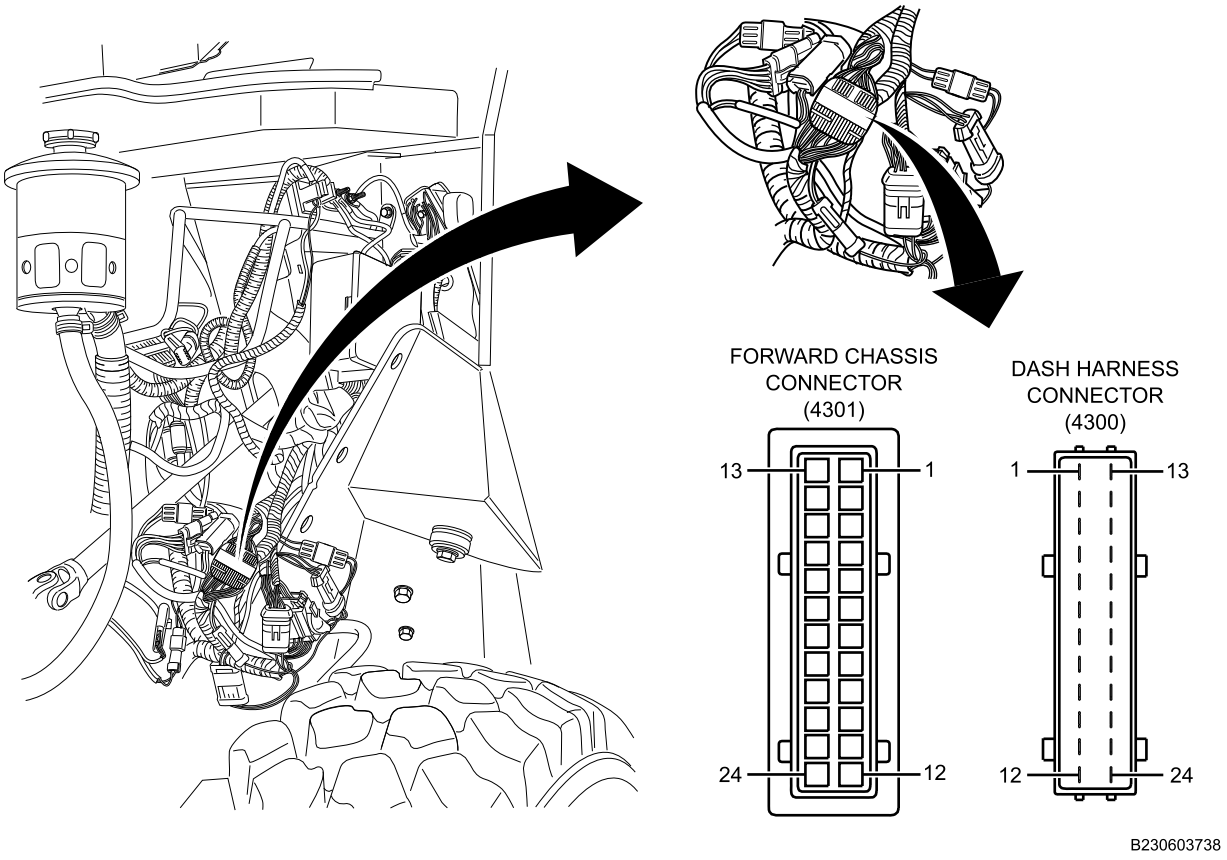


Figure 7. Forward Chassis/PDC Connector in Engine Compartment.

62. Turn MAIN POWER switch ON (TM 9-2355-106-10).
63. Turn ignition switch ON (TM 9-2355-106-10).
64. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
65. Measure DC voltage between harness connector 4301 terminal 9 and 13 with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 130.
NO Go to next step.

STEP

66. Turn ignition switch OFF (TM 9-2355-106-10).
67. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
68. Disconnect ESC connector 4007. Refer to Figure 8.

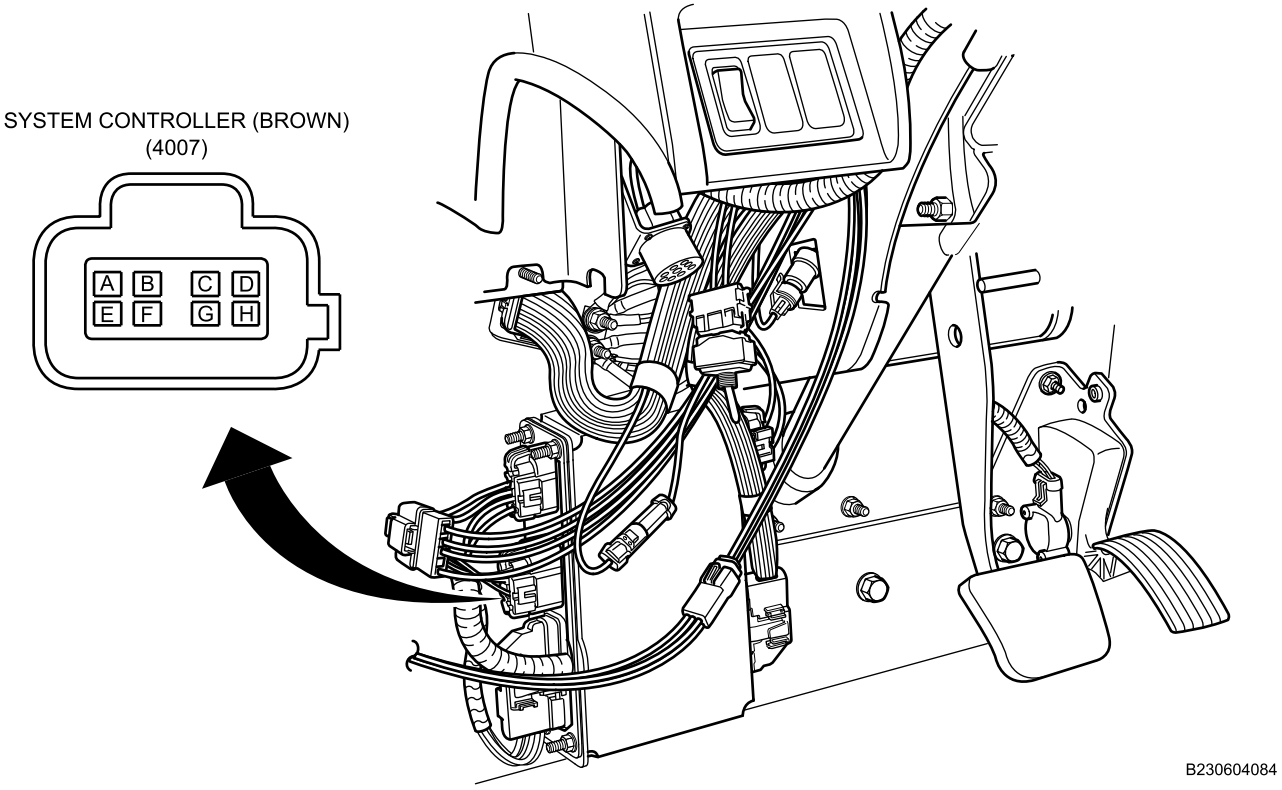


Figure 8. Electronic System Controller (ESC) Connector.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

69. Measure resistance between connector 4301 terminal 9 and ESC connector 4007 terminal C with multimeter. Refer to Figure 10 and Figure 9.

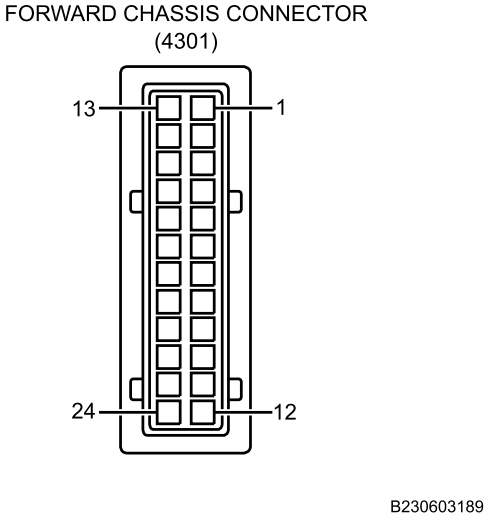


Figure 9. Connector 4301.

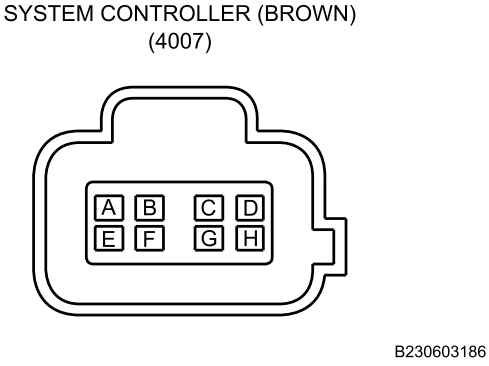


Figure 10. Connector 4007.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 129.

STEP

70. Measure resistance between connector 4301 terminal 9 and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read OL?

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 136.
NO Go to Step 129.

STEP

71. Remove turn signal bulb from socket 8154R. Refer to Front Fender Light Bulb Removal and Installation (WP 0372). Refer to Figure 11,

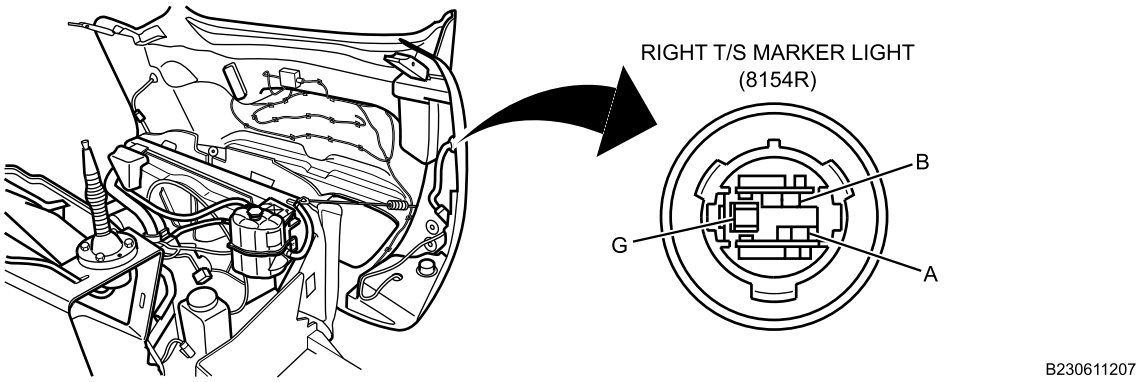


Figure 11. Right Front Fender Turn Signal Bulb Socket.

72. Turn MAIN POWER switch ON (TM 9-2355-106-10).
73. Turn ignition switch ON (TM 9-2355-106-10).
74. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
75. Measure DC voltage between bulb socket 8154R terminal A and terminal G with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 127.
NO Go to next step.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

76. Turn ignition switch OFF (TM 9-2355-106-10).
77. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
78. Disconnect connector LAM1062 from connector 8153FR under right front fender. Refer to Figure 12.

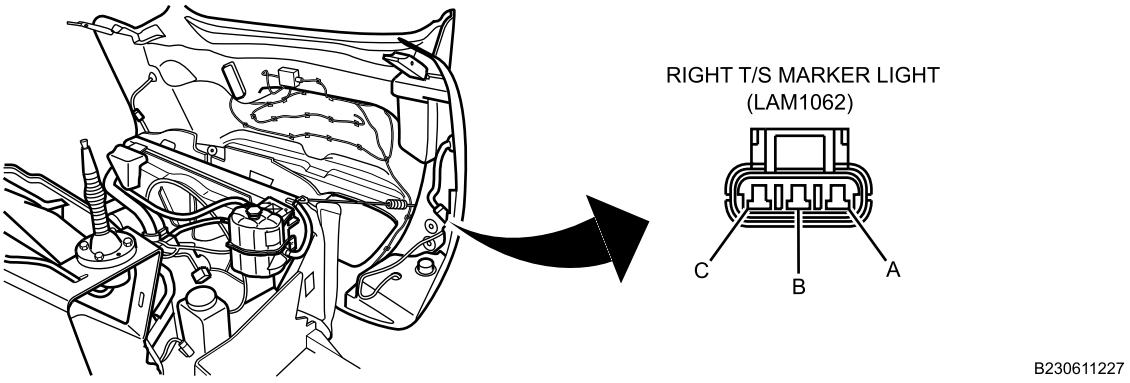


Figure 12. Right Front Fender Turn Light Connector.

79. Turn MAIN POWER switch ON (TM 9-2355-106-10).
80. Turn ignition switch ON (TM 9-2355-106-10).
81. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
82. Measure DC voltage between harness connector LAM1062 terminal C and A with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 133.
NO Go to Step 135.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

83. Remove turn signal bulb from socket LAM1204. Refer to Front Turn Signal and Parking Light Bulb Removal and Installation (WP 0373). Refer to Figure 13.

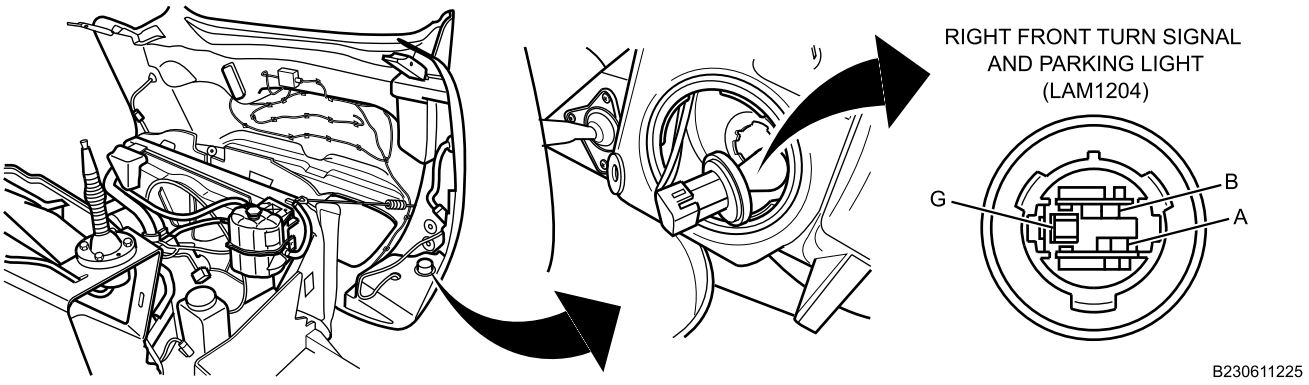


Figure 13. Right Front Turn Signal Bulb Socket (Near Headlight).

84. Turn MAIN POWER switch ON (TM 9-2355-106-10).
85. Turn ignition switch ON (TM 9-2355-106-10).
86. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
87. Measure DC voltage between bulb socket LAM1204 terminal A and G with multimeter. Refer to Figure 13.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 126.
NO Go to Step 135.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

88. Turn ignition switch OFF (TM 9-2355-106-10).
89. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
90. Follow wiring harness down from headlight and disconnect first 5-way harness connector LAM1047. Refer to Figure 14.

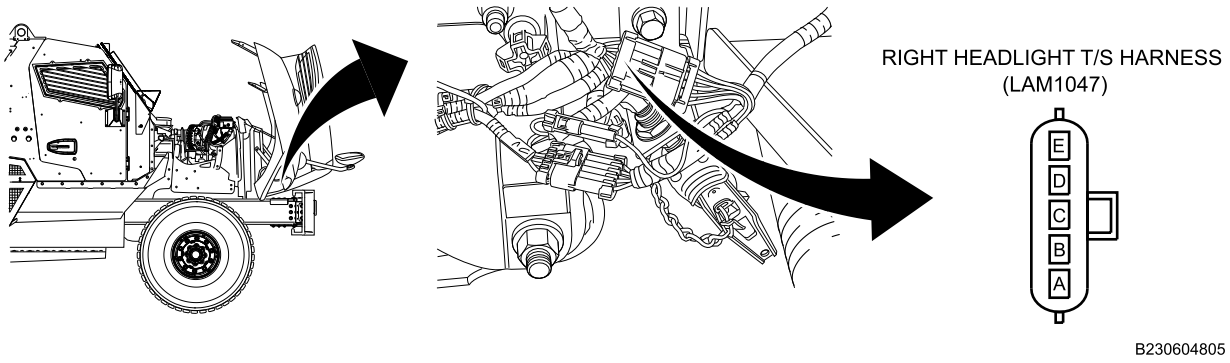


Figure 14. Right Headlight/Turn Signal Harness Connector Near Front Spring Shackle.

91. Turn MAIN POWER switch ON (TM 9-2355-106-10).
92. Turn ignition switch ON (TM 9-2355-106-10).
93. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
94. Measure DC voltage between harness connector LAM1047 terminal B and terminal D with multimeter. Refer to Figure 14.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 135.
NO Go to Step 132.

STEP

95. Turn ignition switch OFF (TM 9-2355-106-10).
96. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

NOTE

Label bullet connectors before disconnecting.

97. Disconnect bullet connectors LAM1104 leading to 460/461 and GND terminals. Refer to Figure 15.

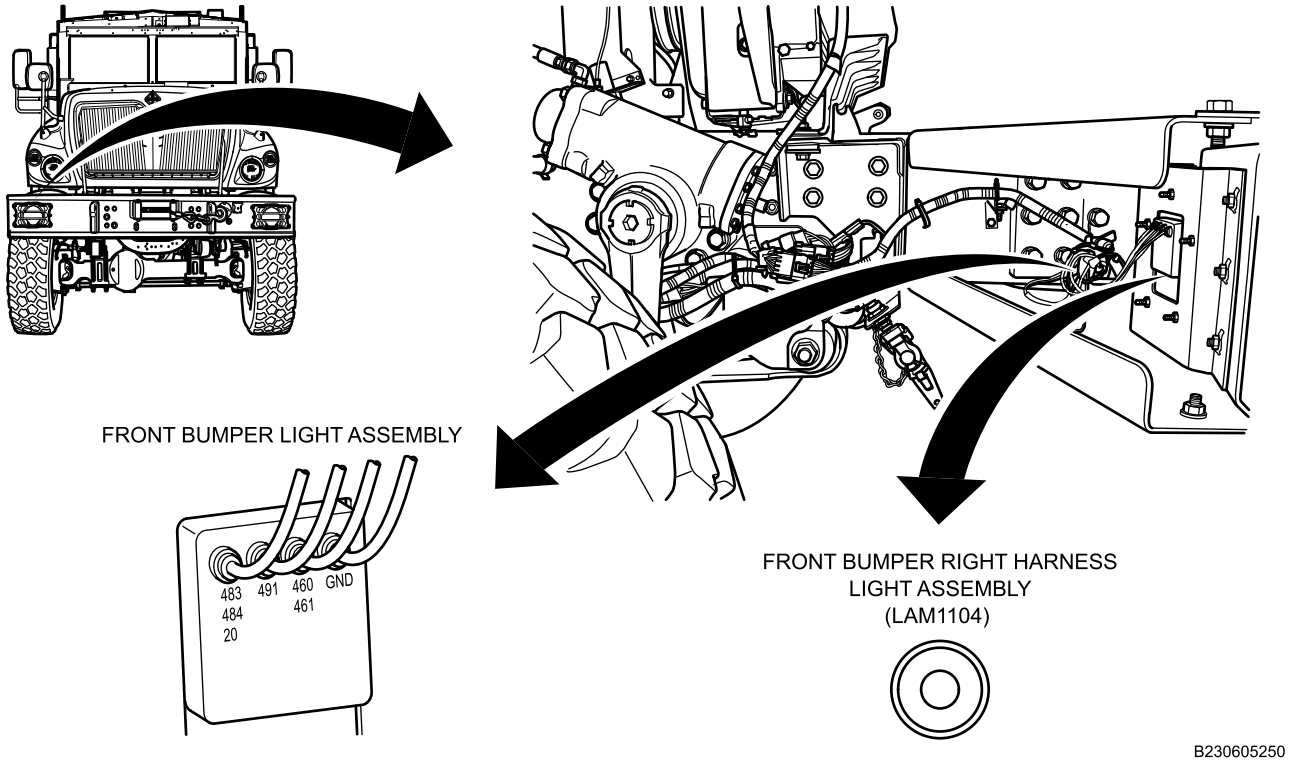


Figure 15. Front Bumper Light Unit Terminal Identification for Bullet Connectors Behind Front Bumper.

98. Turn MAIN POWER switch ON (TM 9-2355-106-10).
99. Turn ignition switch ON (TM 9-2355-106-10).
100. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
101. Measure DC voltage between harness side bullet connector LAM1104 for terminals 460/461 and GND with multimeter. Refer to Figure 15.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 128.
NO Go to Step 132.

STEP

102. Turn ignition switch OFF (TM 9-2355-106-10).
103. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
104. Follow wiring harness down from headlight and disconnect second 5-way harness connector LAM1107. Refer to Figure 16.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

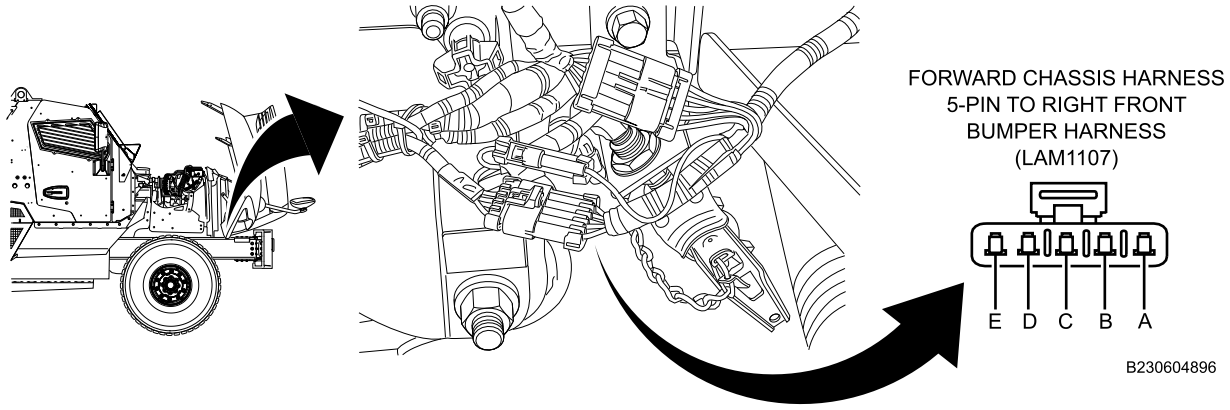


Figure 16. Right Front Bumper/Front Chassis Connector Near Front Spring Shackle.

105. Turn MAIN POWER switch ON (TM 9-2355-106-10).
106. Turn ignition switch ON (TM 9-2355-106-10).
107. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
108. Measure DC voltage between harness connector LAM1107 terminal B and terminal D with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 132.
NO Go to next step.

STEP

109. Turn ignition switch OFF (TM 9-2355-106-10).
110. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
111. Measure resistance between connector LAM1107 terminal B and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 130.

STEP

112. Remove left side engine armor plate bracket. Refer to Left Side Engine Armor Plate Bracket Removal and Installation (WP 0598).
113. Disconnect connector 4301/4300 (24 cavities with 22 wires). Refer to Figure 17.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

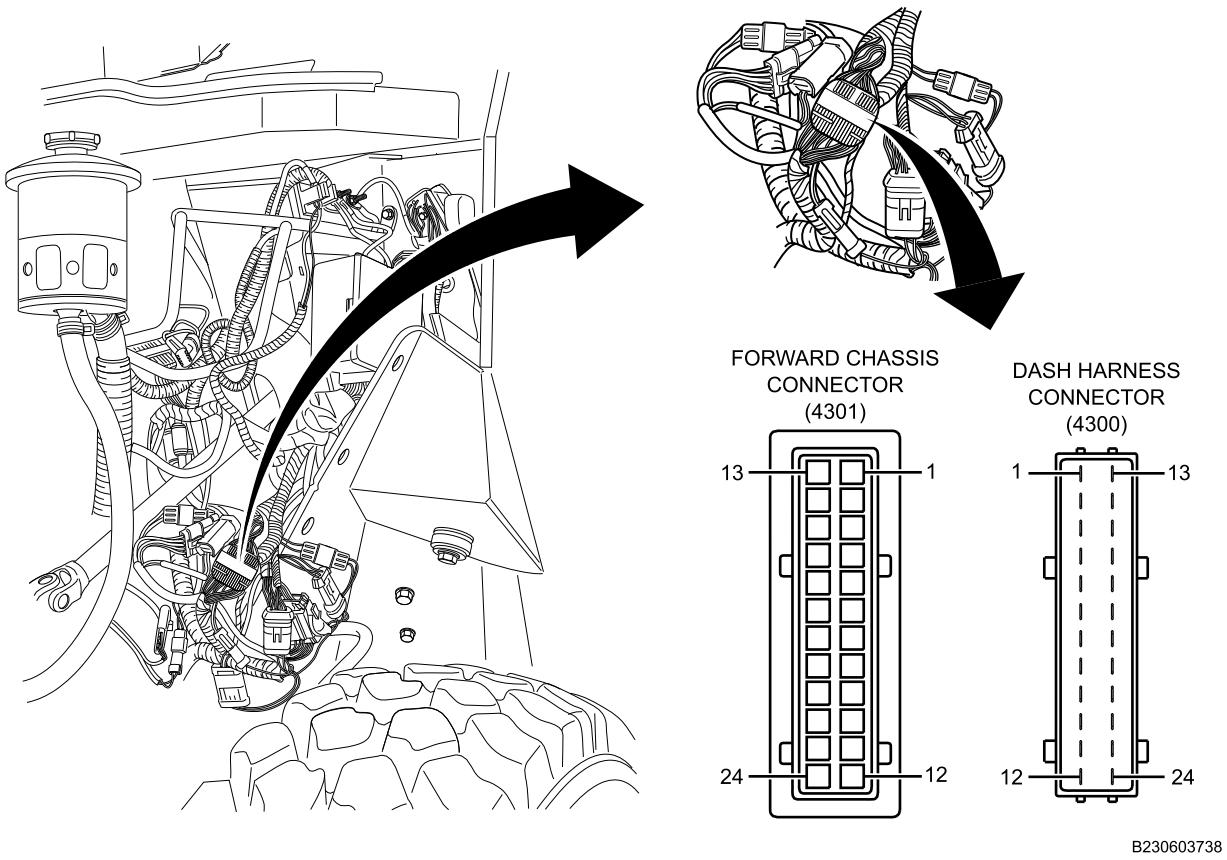


Figure 17. Forward Chassis/PDC Connector in Engine Compartment.

114. Turn MAIN POWER switch ON (TM 9-2355-106-10).
115. Turn ignition switch ON (TM 9-2355-106-10).
116. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
117. Measure DC voltage between harness connector 4301 terminal 11 and 13 with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 130.
NO Go to next step.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

118. Turn ignition switch OFF (TM 9-2355-106-10).
119. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
120. Disconnect ESC connector 4007. Refer to Figure 18.

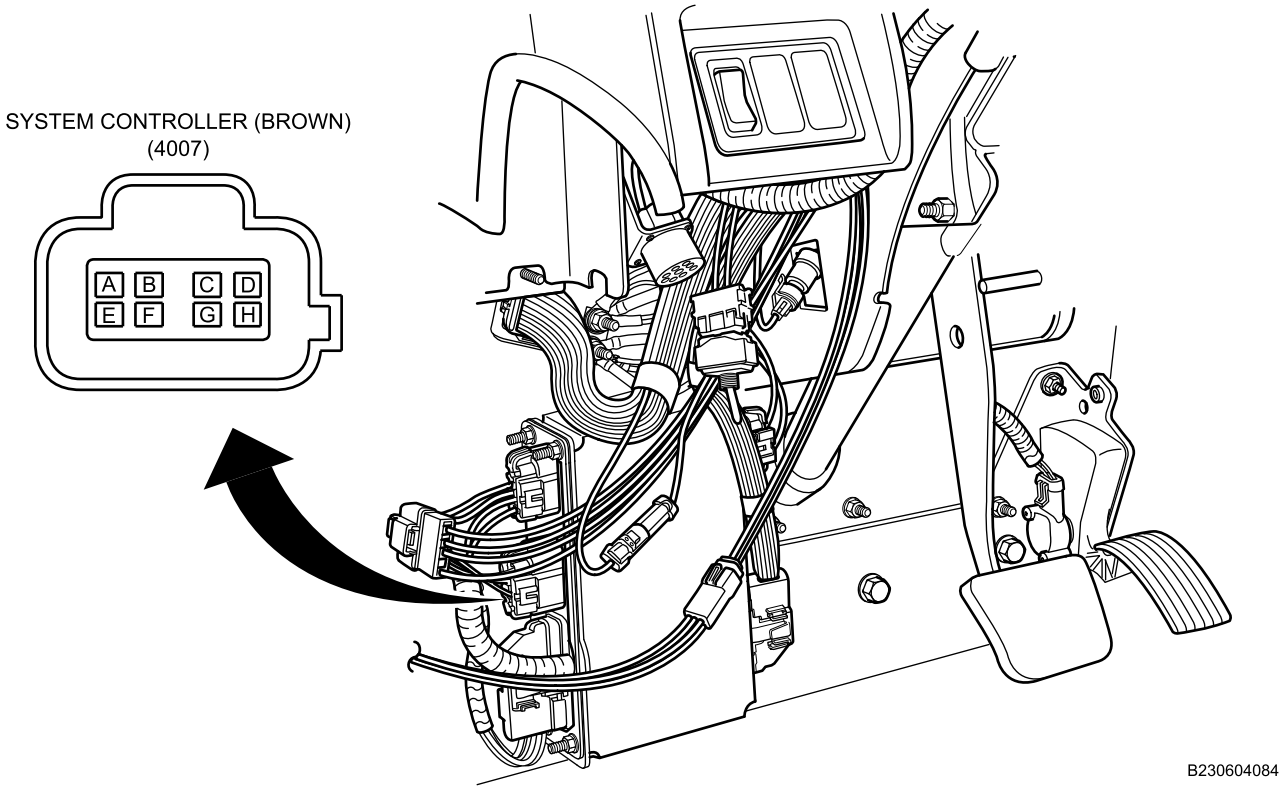


Figure 18. Electronic System Controller (ESC) Connector.

121. With assistance, measure resistance between connector 4301 terminal 11 and ESC connector 4007 terminal B with multimeter. Refer to Figure 18 and Figure 17.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 129.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

122. Measure resistance between connector 4301 terminal 11 and ground with multimeter. Refer to Figure 19.

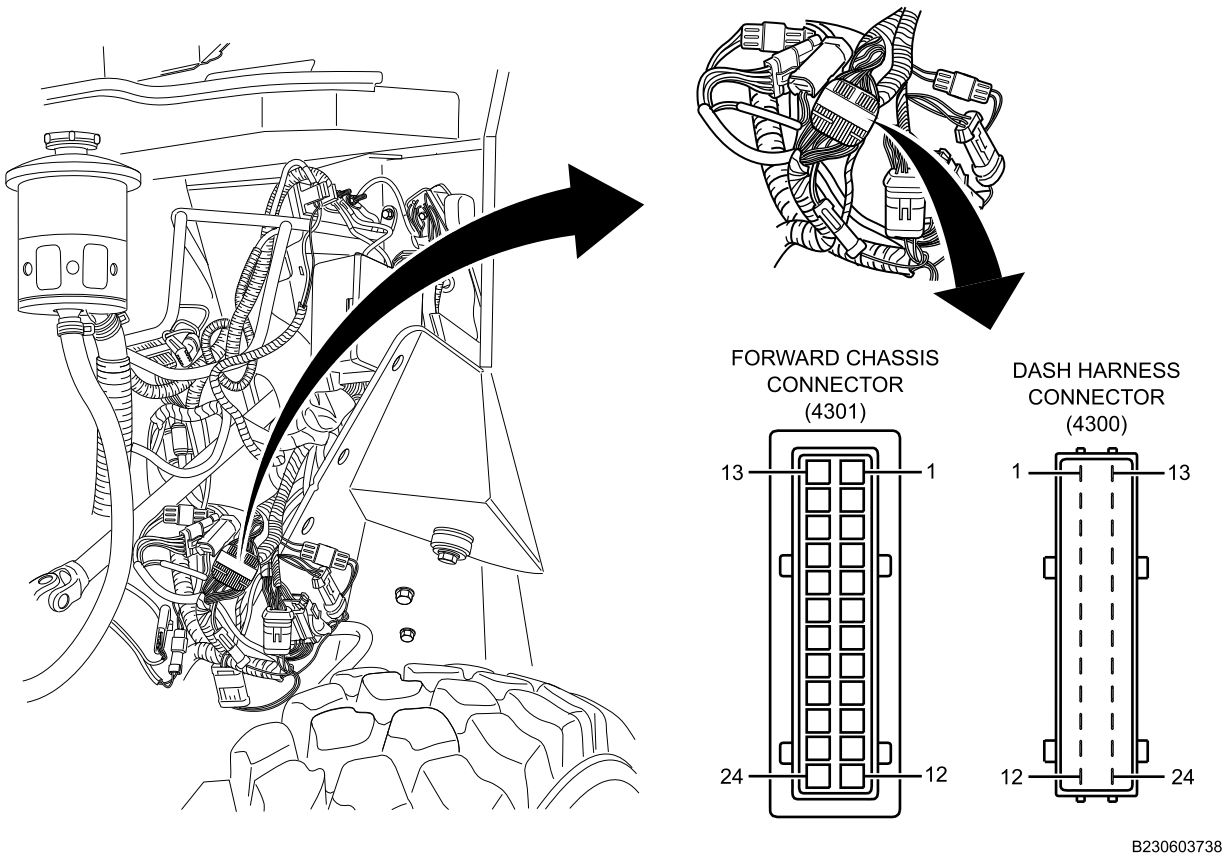


Figure 19. Forward Chassis/PDC Connector in Engine Compartment.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 136.
NO Go to Step 129.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

123. Remove left side engine armor plate bracket. Refer to Left Side Engine Armor Plate Bracket Removal and Installation (WP 0598).
124. Disconnect connector 4301/4300 (24 cavities with 22 wires). Refer to Figure 19.
125. Measure resistance between connector 4301 terminal 13 and ground with multimeter. Refer to Figure 19.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 130.
NO Go to Step 129.

MALFUNCTION

- 126. Front turn signal and parking light bulb is faulty.

ACTION

Replace bulb. Refer to Front Turn Signal and Parking Light Bulb Removal and Installation (WP 0373). Return vehicle to service.

END OF TEST

MALFUNCTION

- 127. Front fender light bulb is faulty.

ACTION

Replace bulb. Refer to Front Fender Light Bulb Removal and Installation (WP 0372). Return vehicle to service.

END OF TEST

MALFUNCTION

- 128. Front bumper lamp unit is faulty.

ACTION

Replace front bumper lamp unit. Refer to Front Bumper Turn Signal and Parking Light Assembly Removal and Installation (WP 0361). Return vehicle to service.

END OF TEST

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 129. PDC harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 130. Forward chassis harness is faulty.

ACTION

Replace forward chassis harness. Refer to Forward Chassis Harness Removal and Installation (WP 0424). Return vehicle to service.

END OF TEST

MALFUNCTION

- 131. Front bumper harness is faulty.

ACTION

Replace front bumper harness. Refer to Front Bumper Left Harness Removal and Installation (WP 0374). Return vehicle to service.

END OF TEST

MALFUNCTION

- 132. Front bumper harness is faulty.

ACTION

Replace front bumper harness. Refer to Front Bumper Right Harness Removal and Installation (WP 0375). Return vehicle to service.

END OF TEST

MALFUNCTION

- 133. Clearance and marker light harness is faulty.

ACTION

Replace clearance and marker light harness. Refer to Clearance and Marker Light Harness Removal and Installation (WP 0367). Return vehicle to service.

END OF TEST

MALFUNCTION

- 134. Headlight and turn signal harness is faulty.

FRONT TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace headlight and turn signal harness. Refer to Left Headlamp and Turn Signal Harness Removal and Installation (WP 0378). Return vehicle to service.

END OF TEST

MALFUNCTION

- 135. Headlight and turn signal harness is faulty.

ACTION

Replace headlight and turn signal harness. Refer to Right Headlamp and Turn Signal Harness Removal and Installation (WP 0379). Return vehicle to service.

END OF TEST

MALFUNCTION

- 136. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Materials/Parts
Wire tags (WP 0794, Item 33)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0257
WP 0317
WP 0319
WP 0333
WP 0335
WP 0353
WP 0383
WP 0384
WP 0426
WP 0427
WP 0517
WP 0581
WP 0598
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

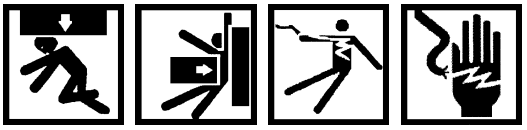
Drawings Required
WP 0789, Figure 59
WP 0789, Figure 60
WP 0789, Figure 51

Before Beginning This Troubleshooting Procedure

Successful diagnosis of turn signal lights depends on performing various procedures in correct sequence. Failure to comply will lead to misdiagnosis. Perform Turn Signal Lights Operational Checkout Procedure (WP 0096) before performing tests in this troubleshooting procedure.

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Press SER. DRIVE on master vehicle light switch (MVLS) and then press ENTER within 5 seconds (TM 9-2355-106-10).
4. Activate left and then right turn signals (TM 9-2355-106-10).
5. Observe rear turn signal lights.

CONDITION/INDICATION

Are both rear turn signal lights inoperative?

DECISION

YES Go to Step 76
NO Go to next step.

STEP

NOTE

Right taillamp shown, left taillamp similar.

6. Remove inoperative rear composite taillamp. Refer to Composite Taillamp Assembly Removal and Installation (WP 0383).

NOTE

Label bullet connectors before disconnecting.

7. Disconnect bullet connectors leading to terminals 22 and GND on inoperative turn signal stoplight. Refer to Figure 1.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

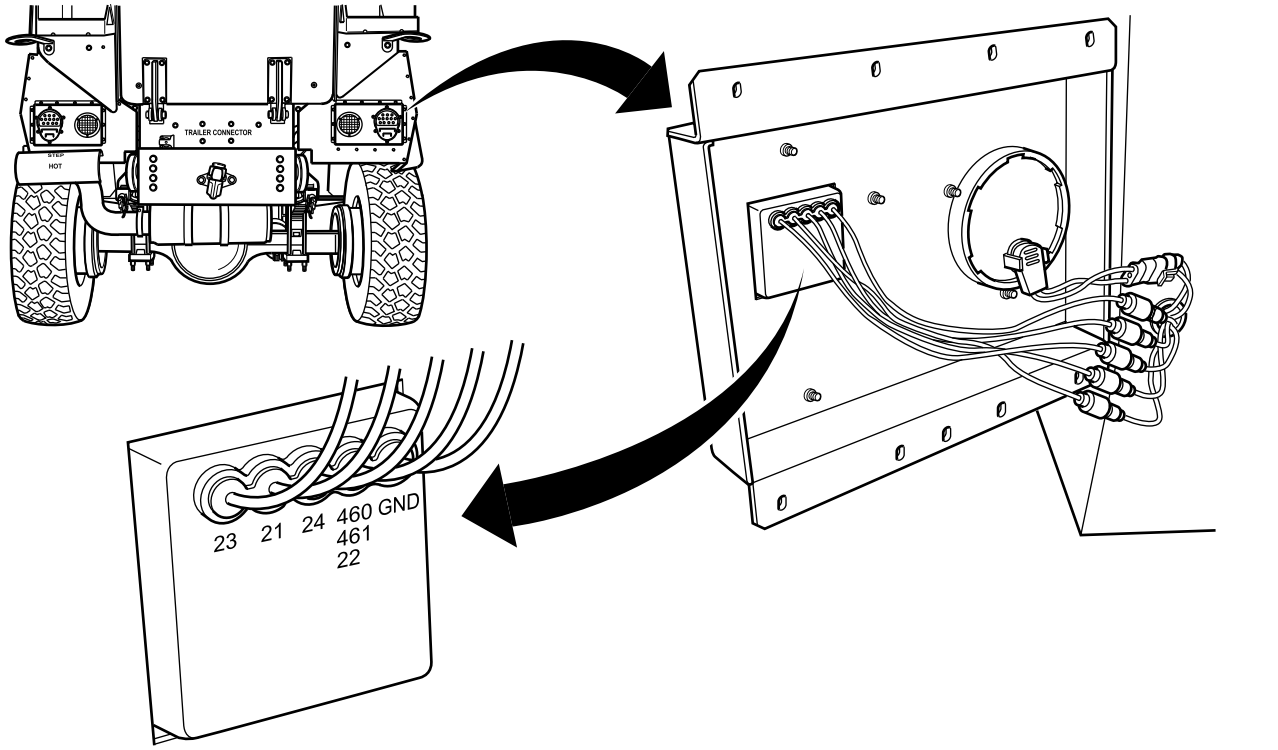


Figure 1. Circuit Identification on Rear Composite Taillamp Assembly for Turn Signal Bullet Connectors.

8. Turn MAIN POWER switch ON (TM 9-2355-106-10).
9. Turn ignition switch ON (TM 9-2355-106-10).
10. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
11. Position turn signal lever to inoperative side (TM 9-2355-106-10).
12. Measure DC voltage between harness side bullet connectors for terminals 22 and GND with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 95.
NO Go to next step.

STEP

13. Turn ignition switch OFF (TM 9-2355-106-10).
14. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
15. Measure resistance between harness side bullet connector terminal GND and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to next step.
NO Go to Step 103.

STEP

16. Disconnect rear chassis harness 5-pin connector 9303A from taillamp harness 5-pin connector LAM1086. Refer to Figure 2.

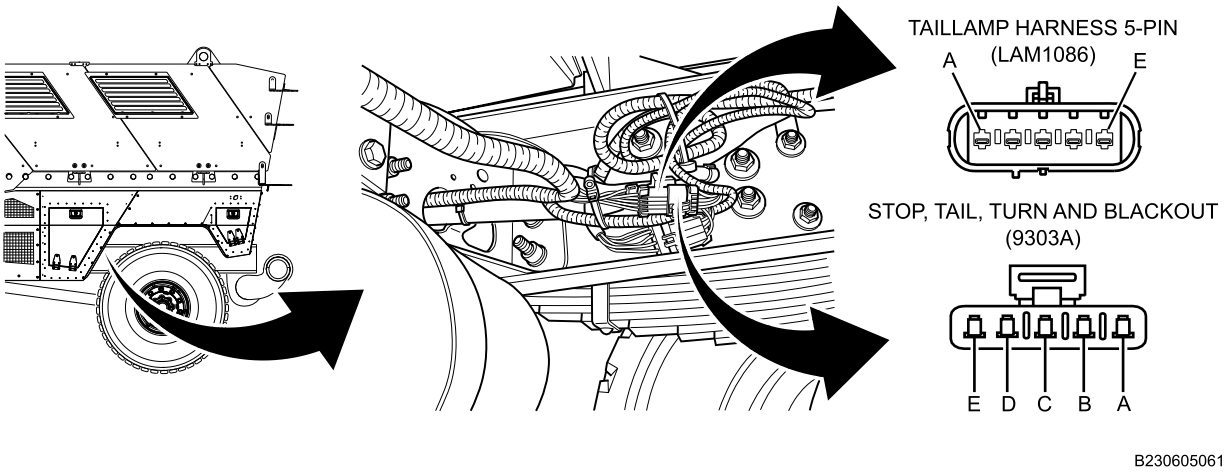


Figure 2. Taillamp/Rear Chassis Harness Connection Inside Left Frame Rail, Near Rear Crossmember.

17. Turn MAIN POWER switch ON (TM 9-2355-106-10).
18. Turn ignition switch ON (TM 9-2355-106-10).
19. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
20. Measure DC voltage between connector 9303A terminal B for left turn signal, or terminal C for right turn signal, and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 103.
NO Go to next step.

STEP

21. Remove LEFT STOP TURN relay if left turn signals are inoperative, or RIGHT STOP TURN relay if right turn signals are inoperative, from Power Distribution Center (PDC). Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).
22. Turn MAIN POWER switch ON (TM 9-2355-106-10).
23. Turn ignition switch ON (TM 9-2355-106-10).
24. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
25. Measure DC voltage between left or right relay socket terminal 87 and ground with multimeter. Refer to Figure 3.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

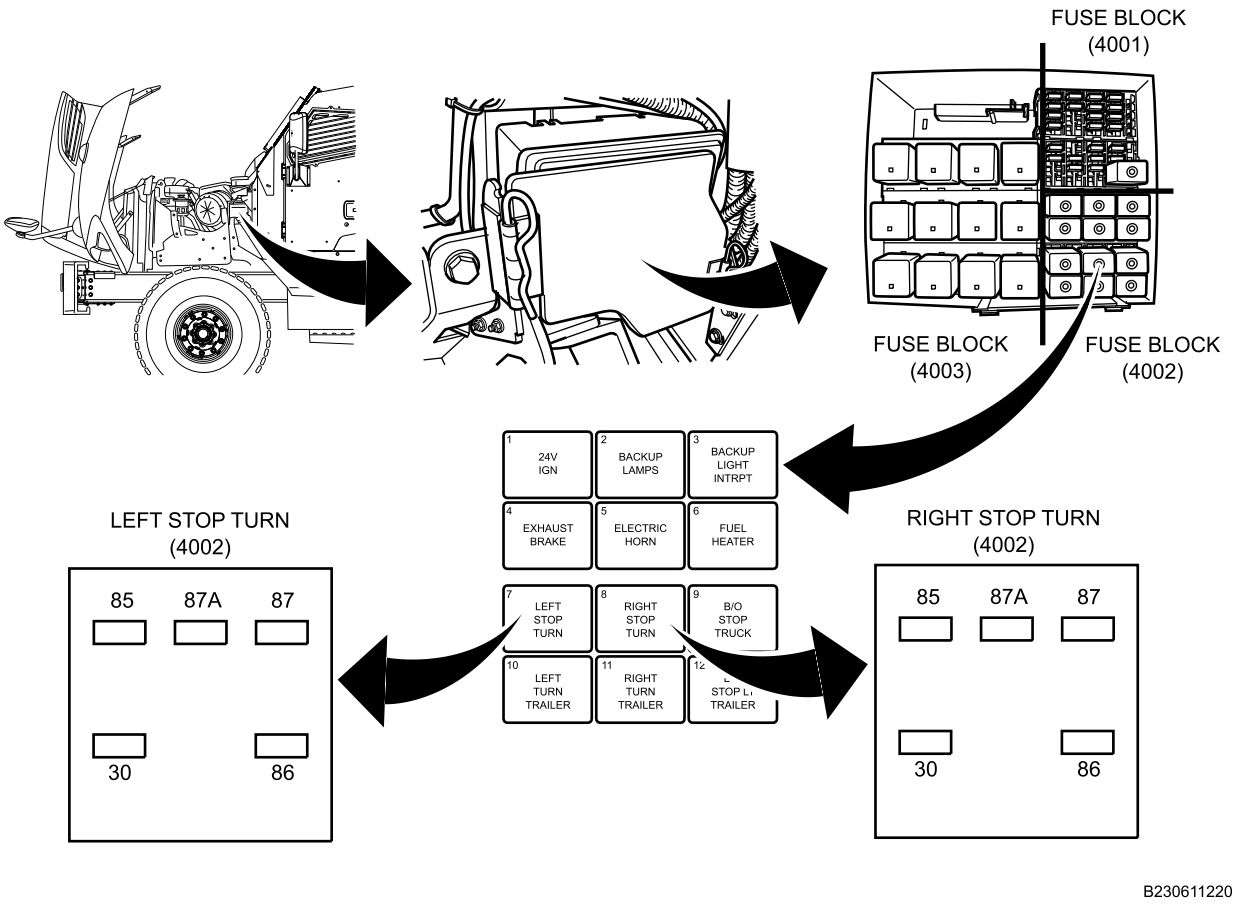


Figure 3. Left or Right Stop/Turn Relay in Engine Compartment PDC.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 56.
NO Go to next step.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

26. Turn ignition switch OFF (TM 9-2355-106-10).
27. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
28. Disconnect connector 1703F from 1703M. Refer to Figure 4.

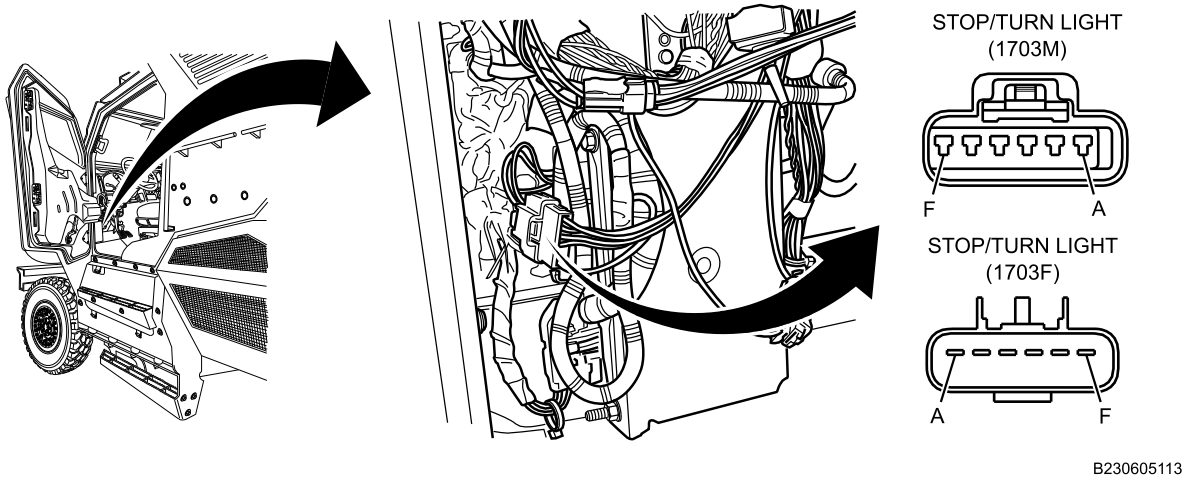


Figure 4. Stop/Turn Light Connector Near Electronic System Controller (ESC).

29. Measure resistance between left or right relay socket terminal 87 and connector 1703M terminal D for left side or terminal A for right side with mutimeter. Refer to Figure 4 and Figure 5.

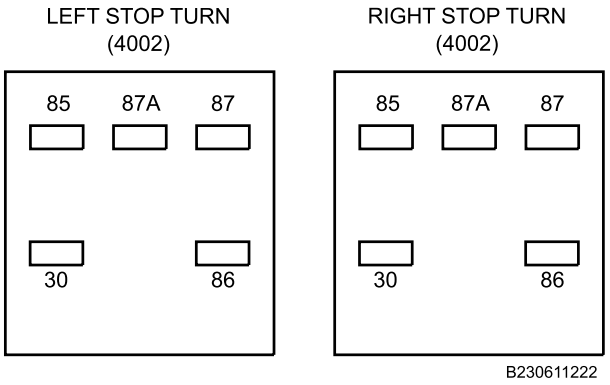


Figure 5. Left or Right Stop/Turn Relay Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 98.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

30. Remove LEFT TURN TRAILER relay or RIGHT TURN TRAILER relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 6.

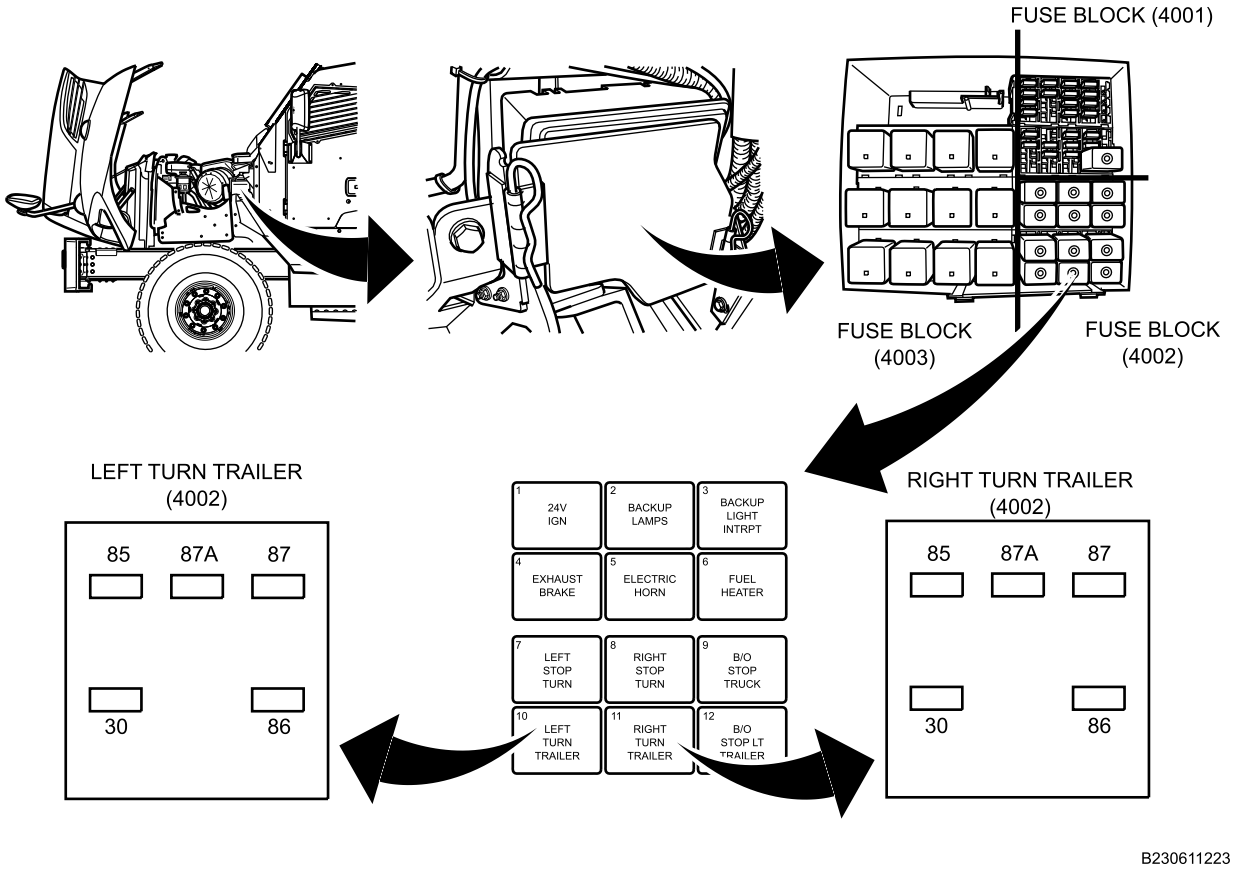


Figure 6. Left or Right Turn Trailer Relay in Engine Compartment PDC.

31. Measure resistance between LEFT or RIGHT STOP TURN relay socket terminal 87 and ground with mutimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to next step.
NO Go to Step 98.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

32. Remove STOPLIGHT RELAY RIGHT or STOPLIGHT RELAY LEFT for inoperative turn signal from cabin relay and fuse center. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Refer to Figure 7.

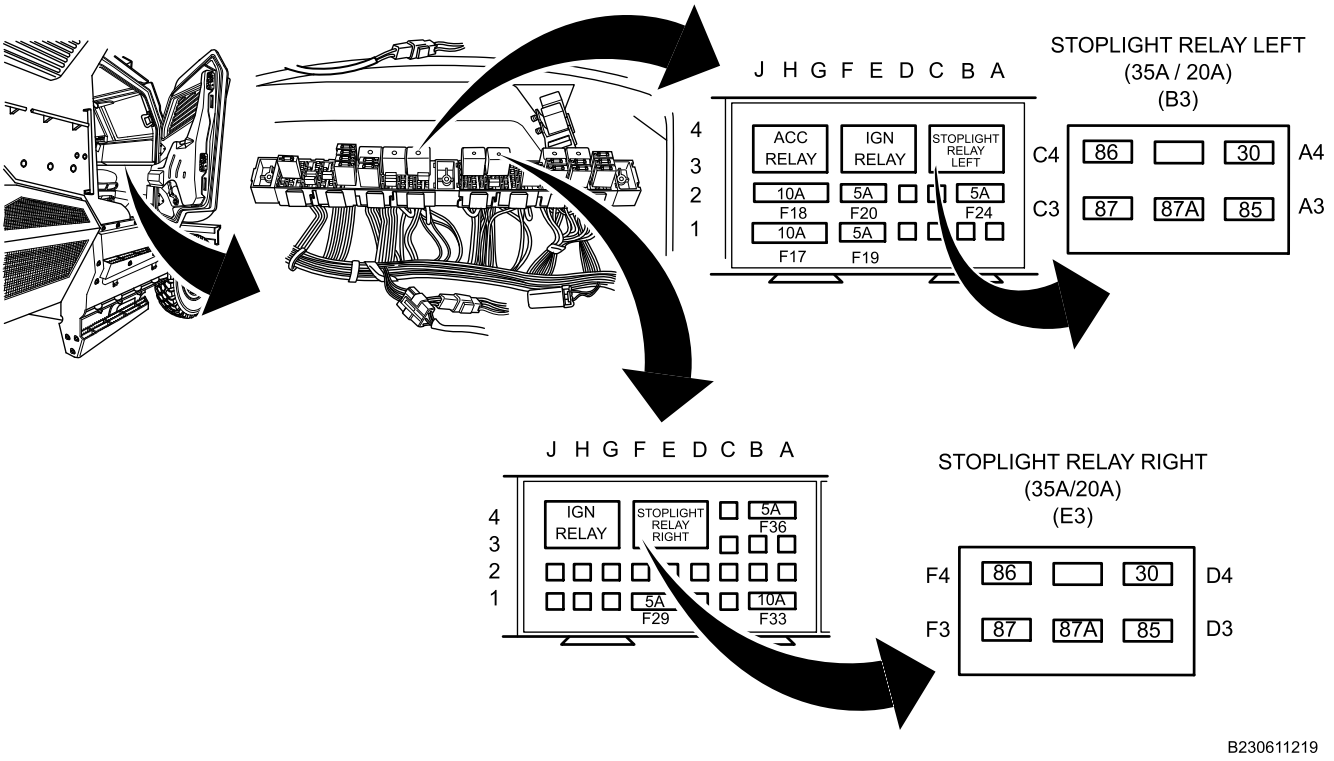


Figure 7. Stoplight Relay Left or Right Socket in Right IP.

33. Measure resistance between left or right relay socket terminal 30 and connector 1703F terminal D for left side or terminal A for right side with multimeter. Refer to Figure 7 and Figure 8.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

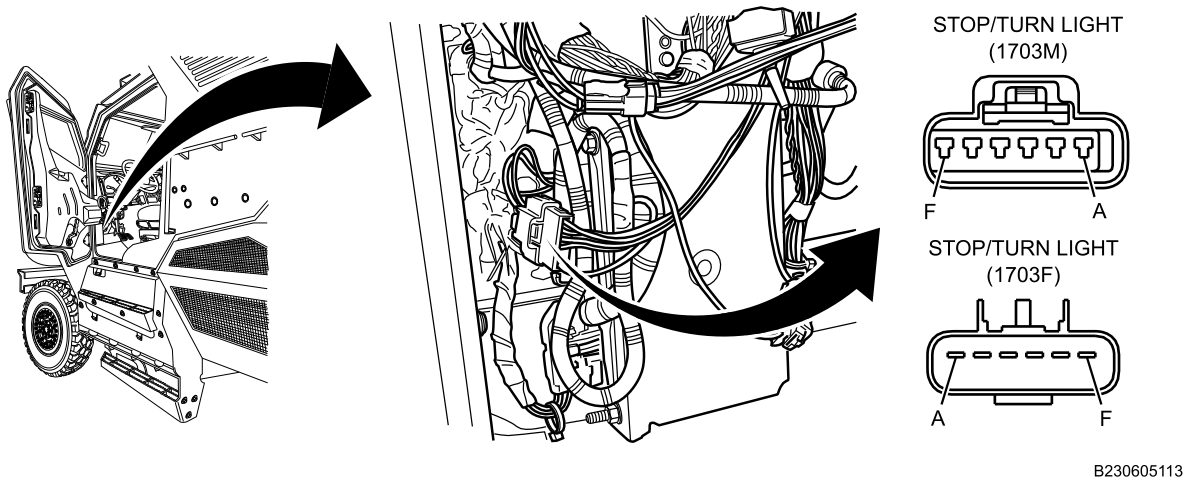


Figure 8. Stop/Turn Light Connector Near ESC.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 96.

STEP

34. Measure resistance between left or right relay socket terminal 30 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to next step.
NO Go to Step 96.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

35. Connect connector 1703F to 1703M. Refer to Figure 9.

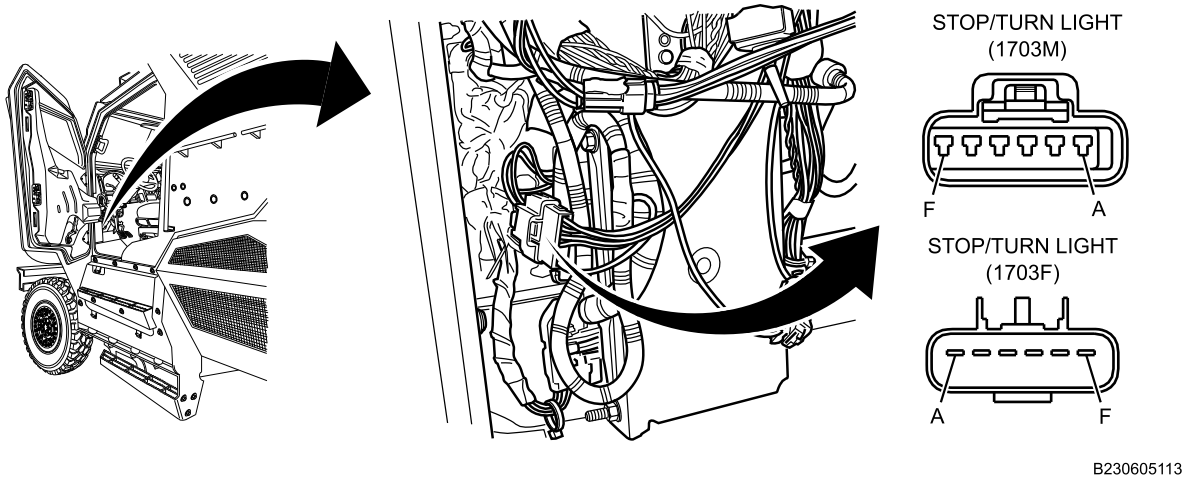


Figure 9. Stop/Turn Light Connector, Near ESC.

36. Turn MAIN POWER switch ON (TM 9-2355-106-10).
37. Turn ignition switch ON (TM 9-2355-106-10).
38. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
39. Measure DC voltage between left or right relay socket terminal 87 and ground with multimeter. Refer to Figure 10.

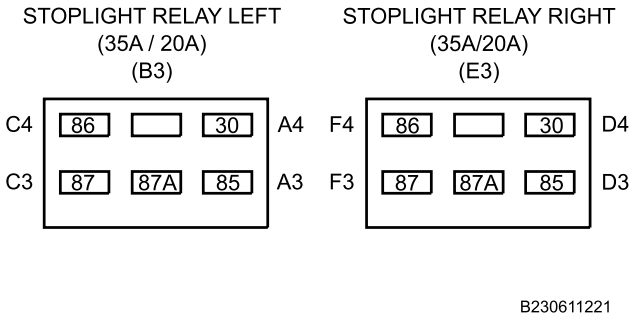


Figure 10. Stoplight Relay Left or Right Socket.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to next step.
NO Go to Step 44.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

40. Measure DC voltage between left or right stoplight relay socket terminal 85 and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read 10.5V to 13.5V?

DECISION

YES Go to next step.
NO Go to Step 96.

STEP

41. Turn ignition switch OFF (TM 9-2355-106-10).
42. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
43. Measure resistance between left or right stoplight relay socket terminal 86 and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 100.
NO Go to Step 96.

STEP

44. Turn ignition switch OFF (TM 9-2355-106-10).
45. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
46. Disconnect connector 1703F from 1703M. Refer to Figure 9.
47. Turn MAIN POWER switch ON (TM 9-2355-106-10).
48. Turn ignition switch ON (TM 9-2355-106-10).
49. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

50. Measure DC voltage between connector 1703M terminal C for left side or terminal B for right side and ground with multimeter. Refer to Figure 11.

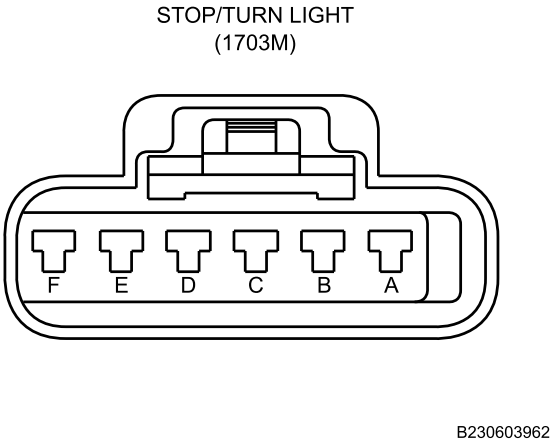


Figure 11. Stop/Turn Light Connector 1703M.

CONDITION/INDICATION

Does multimeter display alternate between voltage readings and OL?

DECISION

YES Go to Step 96.
NO Go to next step.

STEP

51. Turn ignition switch OFF (TM 9-2355-106-10).
52. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
53. Disconnect connector 4008 from ESC. Refer to Figure 12.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

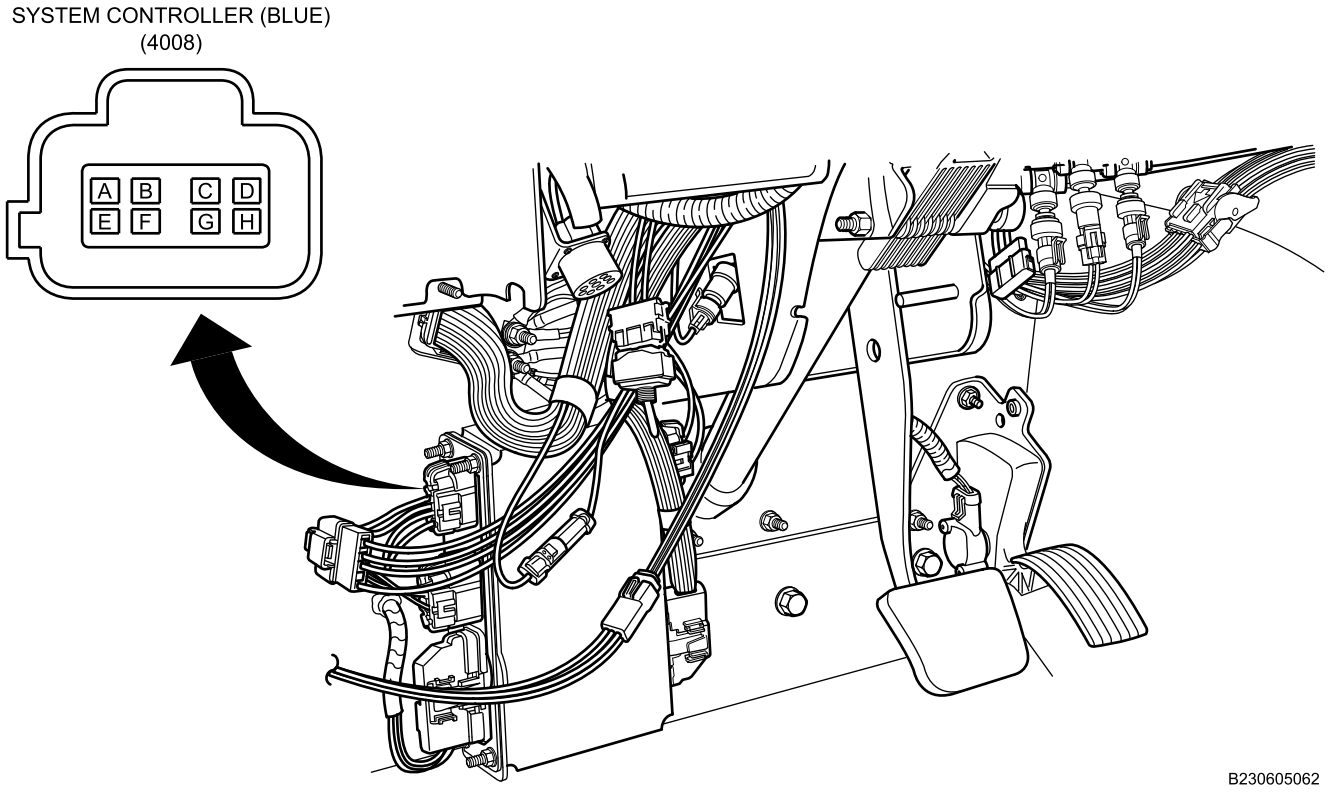


Figure 12. ESC Connector Under Left IP.

54. Measure resistance between connector 1703M terminal C for left side or terminal B for right side and connector 4008 terminal C for left side or terminal B for right side with multimeter. Refer to Figure 12 and Figure 11.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 98.

STEP

55. Measure resistance between connector 1703M terminal C for left side or terminal B for right side and ground with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 97.
NO Go to Step 98.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

56. Measure DC voltage between RIGHT or LEFT STOP TURN relay socket terminal 86 and ground with multimeter. Refer to Figure 13.

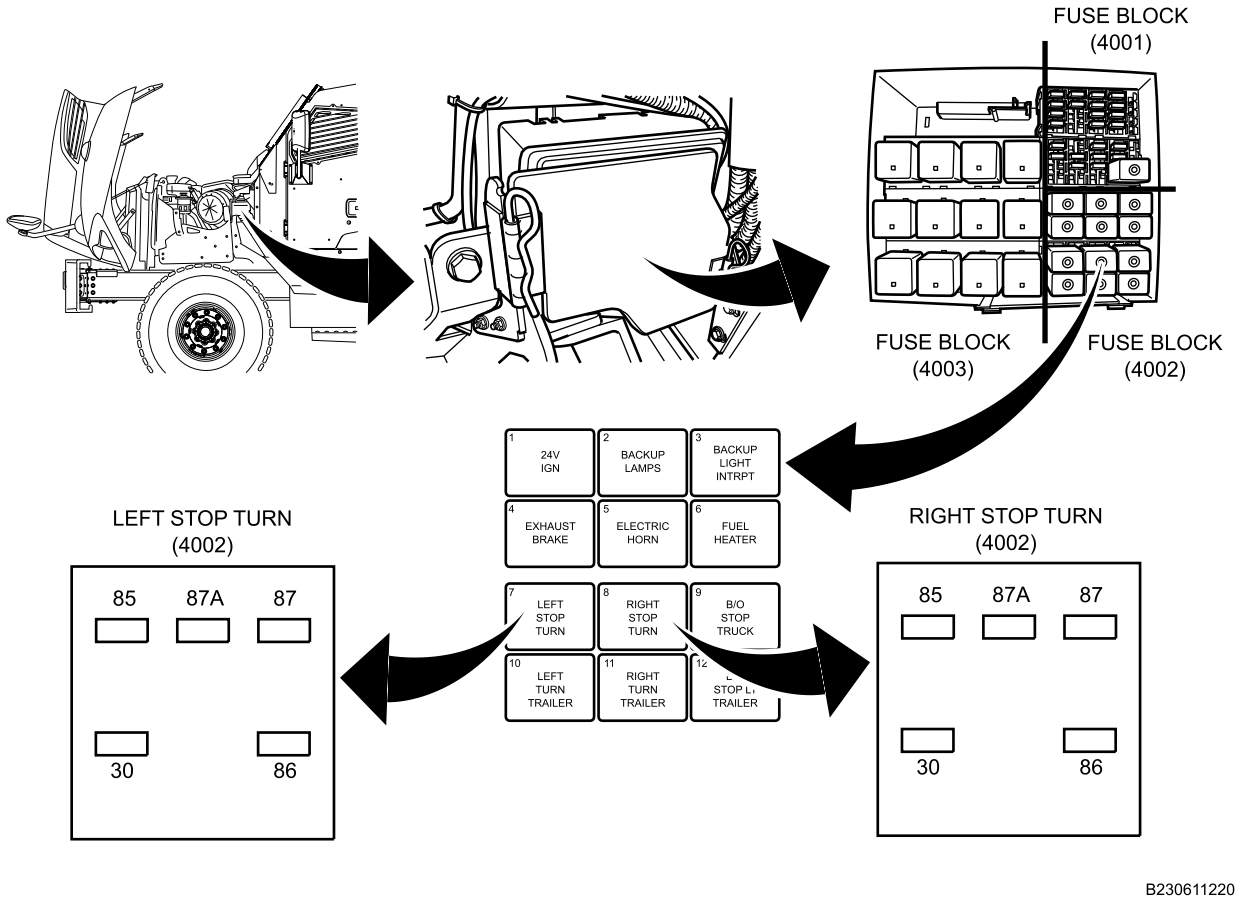


Figure 13. Left or Right Stop/Turn Relay in Engine Compartment PDC.

CONDITION/INDICATION

Does multimeter read 10.5V to 13.5V?

DECISION

YES Go to next step.
NO Go to Step 98.

STEP

57. Turn ignition switch OFF (TM 9-2355-106-10).
58. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
59. Measure resistance between RIGHT or LEFT STOP TURN relay socket terminal 85 and ground with multimeter. Refer to Figure 13.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 98.
YES Go to next step.

STEP

60. Measure resistance between RIGHT or LEFT STOP TURN socket terminal 30 and ground with multimeter. Refer to Figure 13.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to next step.
NO Go to Step 69.

STEP

61. With assistance, measure resistance between RIGHT or LEFT STOP TURN relay socket terminal 30 and connector 9303A terminal B for left side or terminal C for right side with multimeter. Refer to Figure 13 and Figure 14.

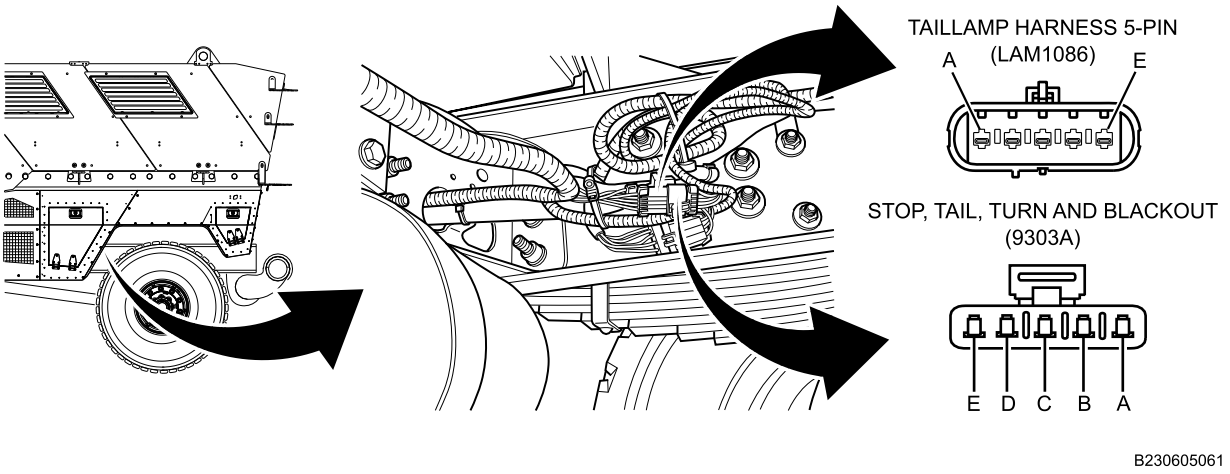


Figure 14. Taillamp/Rear Chassis Harness Connector Inside Left Frame Rail, Near Rear Crossmember.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 99.
NO Go to next step.

STEP

62. Remove air cleaner. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

63. Remove left side engine armor bracket. Refer to Left Engine Armor Plate Bracket Removal and Installation (WP 0598).
64. Disconnect dash/center harness connector 9714/9700 in engine compartment. Refer to Figure 15.

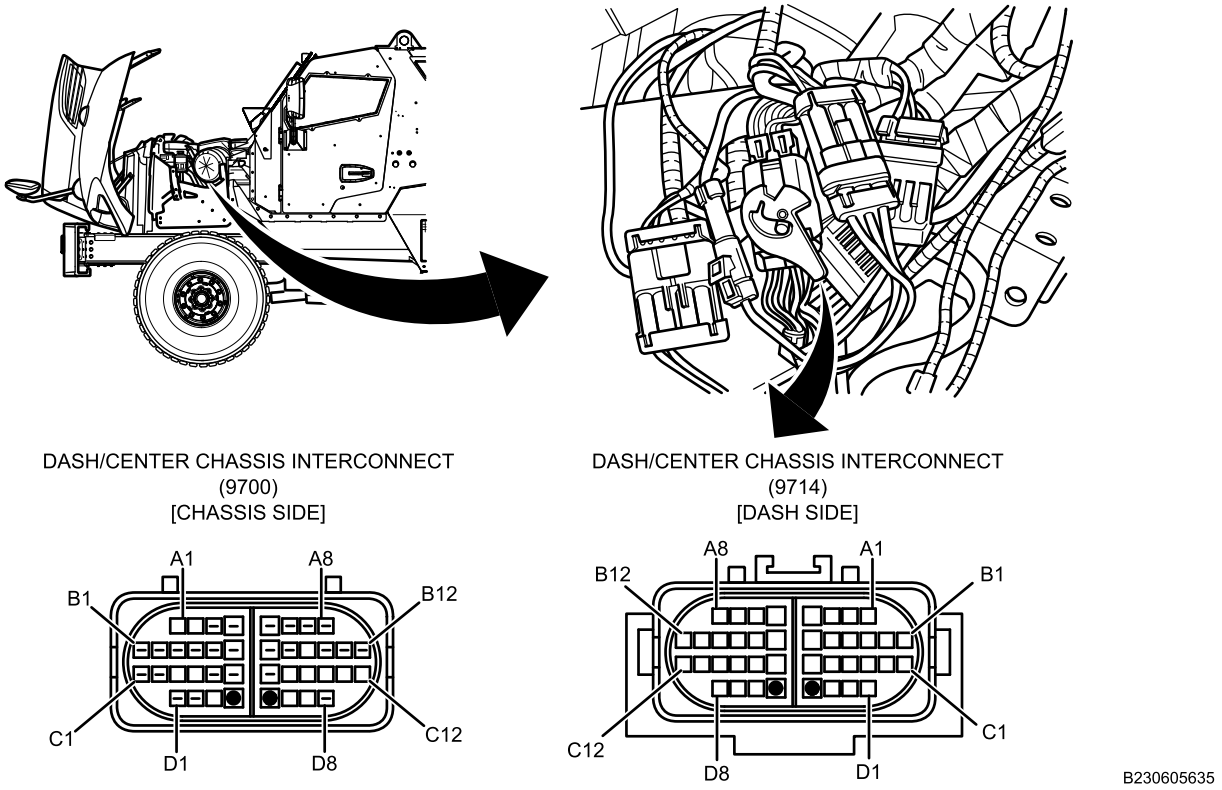


Figure 15. Dash/Center Chassis Harness Connector in Engine Compartment.

65. Measure resistance between RIGHT or LEFT STOP TURN relay socket terminal 30 and connector 9714 terminal A5 for left turn signal or terminal B6 for right turn signal with multimeter. Refer to Figure 15 and Figure 16.

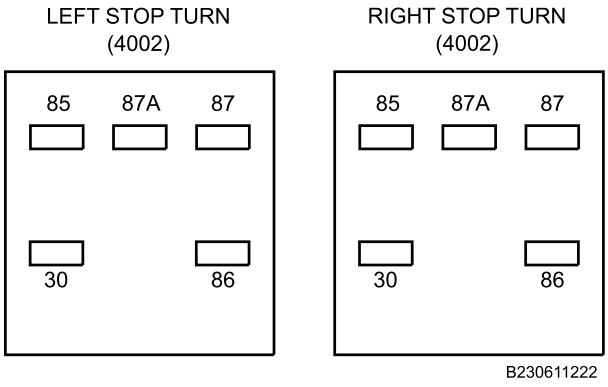


Figure 16. Left or Right Stop/Turn Relay Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to next step.
NO Go to Step 98.

STEP

66. Loosen air dryer mounting bolts and move air dryer to one side to access connectors on left frame rail. Refer to Air Dryer Removal and Installation (WP 0517).
67. Disconnect center chassis harness connector 9800F from rear chassis harness connector 9800M. Refer to Figure 17.

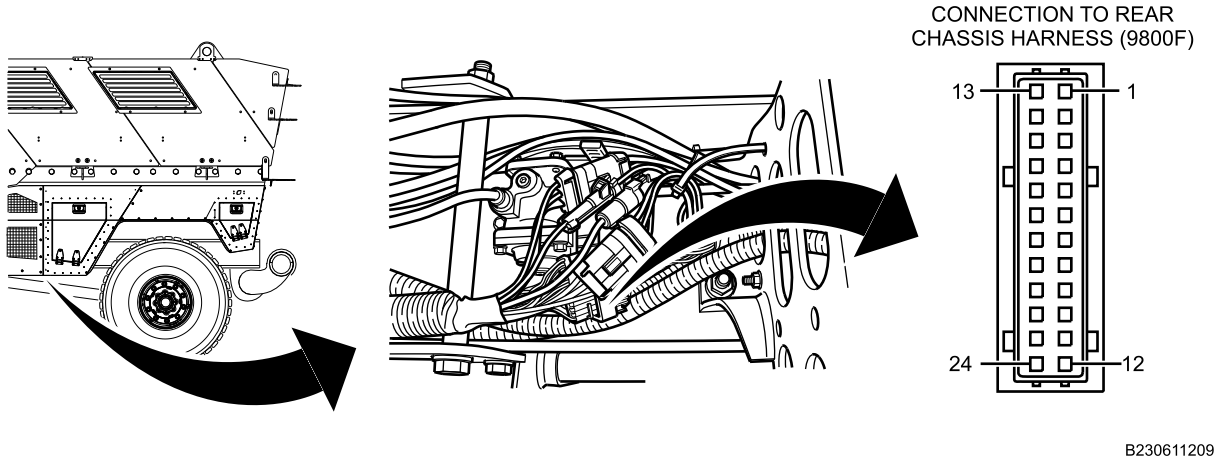


Figure 17. Center/Rear Chassis Harness Connector Inside Left Frame Rail.

68. Measure resistance between connector 9700 terminal A5 for left side or terminal B6 for right side and connector 9800F terminal 2 for left side or terminal 3 for right side with multimeter. Refer to Figure 18 and Figure 17.

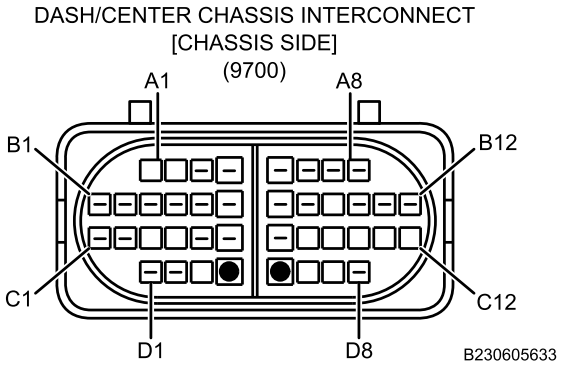


Figure 18. Connector 9700.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 102.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

NO Go to Step 101.

STEP

69. Loosen air dryer mounting bolts and move air dryer to one side to access connectors on left frame rail. Refer to Air Dryer Removal and Installation (WP 0517).
70. Disconnect center chassis harness connector 9800F from rear chassis harness connector 9800M. Refer to Figure 19.

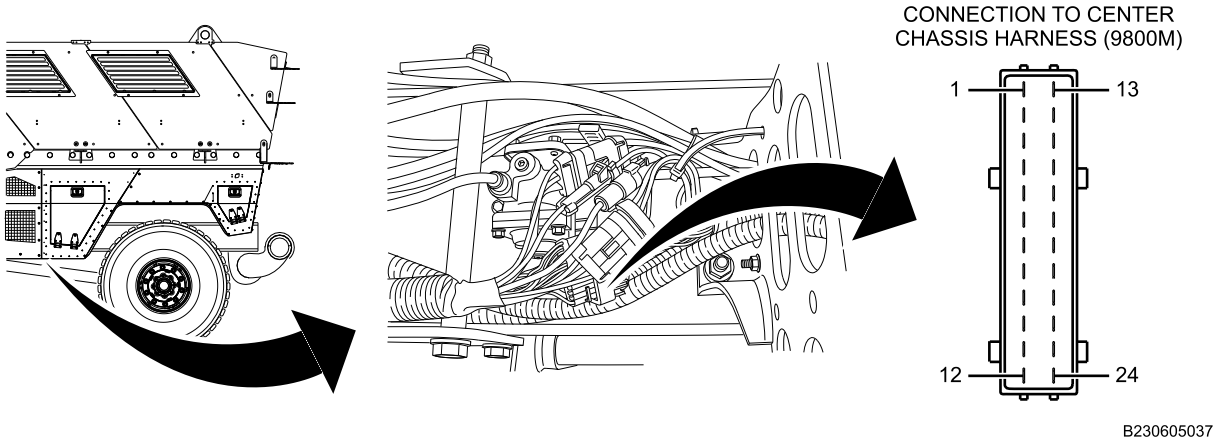


Figure 19. Center/Rear Chassis Harness Connector Inside Left Frame Rail.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

71. Measure resistance between RIGHT or LEFT STOP TURN relay socket terminal 30 and ground with multimeter. Refer to Figure 20.

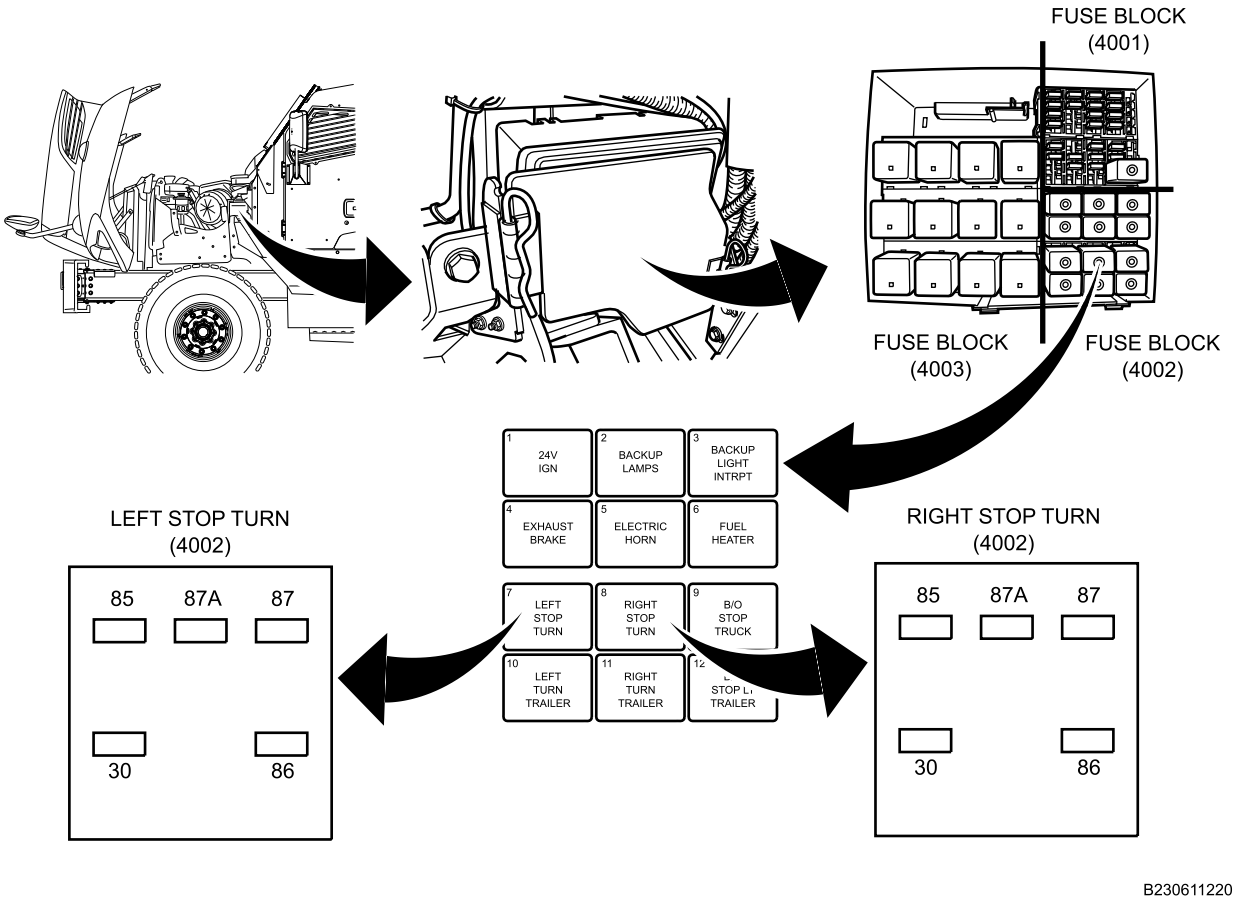


Figure 20. Left or Right Stop/Turn Relay in Engine Compartment PDC.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to next step.
YES Go to Step 102.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

72. Remove left side engine armor bracket. Refer to Left Engine Armor Plate Bracket Removal and Installation (WP 0598).
73. Remove air cleaner. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
74. Disconnect dash/center chassis harness connector 9714/9700. Refer to Figure 21.

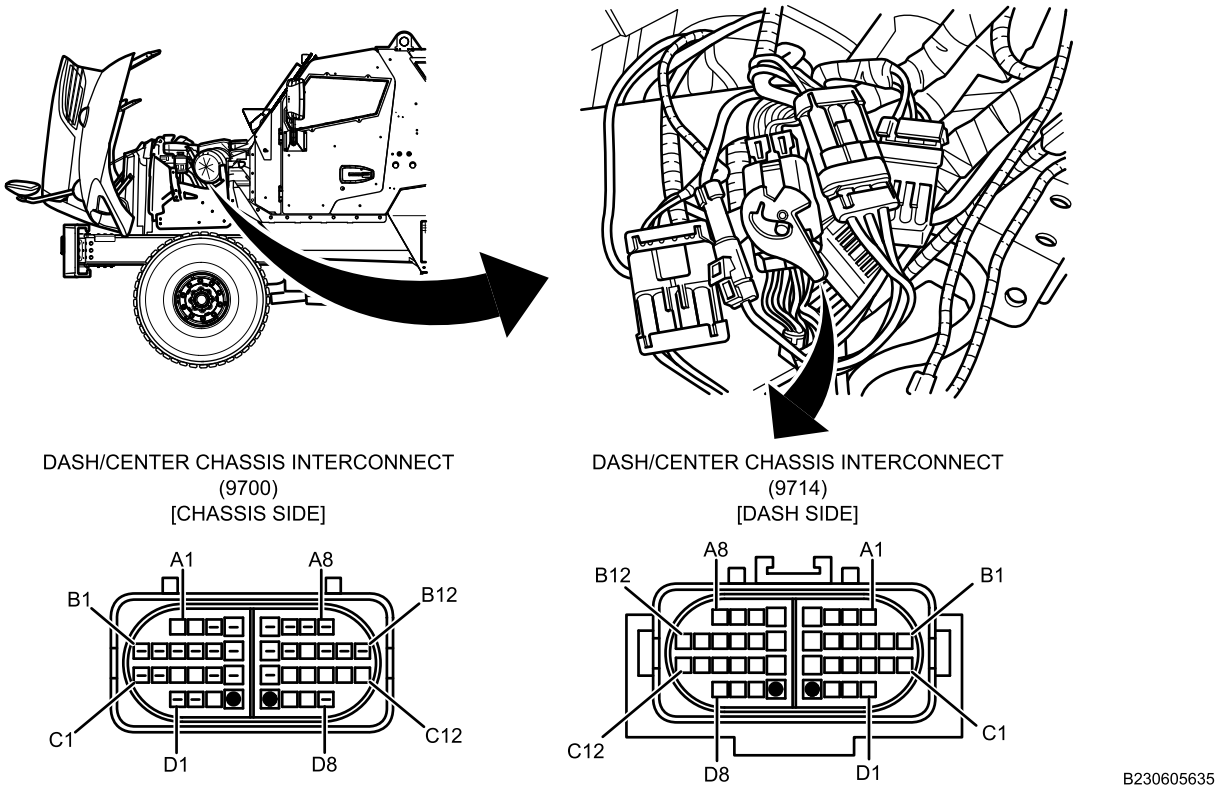


Figure 21. Dash/Center Chassis Harness Connector in Engine Compartment.

75. Measure resistance between RIGHT or LEFT STOP TURN relay socket terminal 30 and ground with multimeter. Refer to Figure 20.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 101.
NO Go to Step 98.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

76. Remove right rear composite taillamp. Refer to Composite Taillamp Assembly Removal and Installation (WP 0383).

NOTE

Label bullet connectors before disconnecting.

77. Disconnect bullet connector leading to GND terminal on right turn signal. Refer to Figure 22.

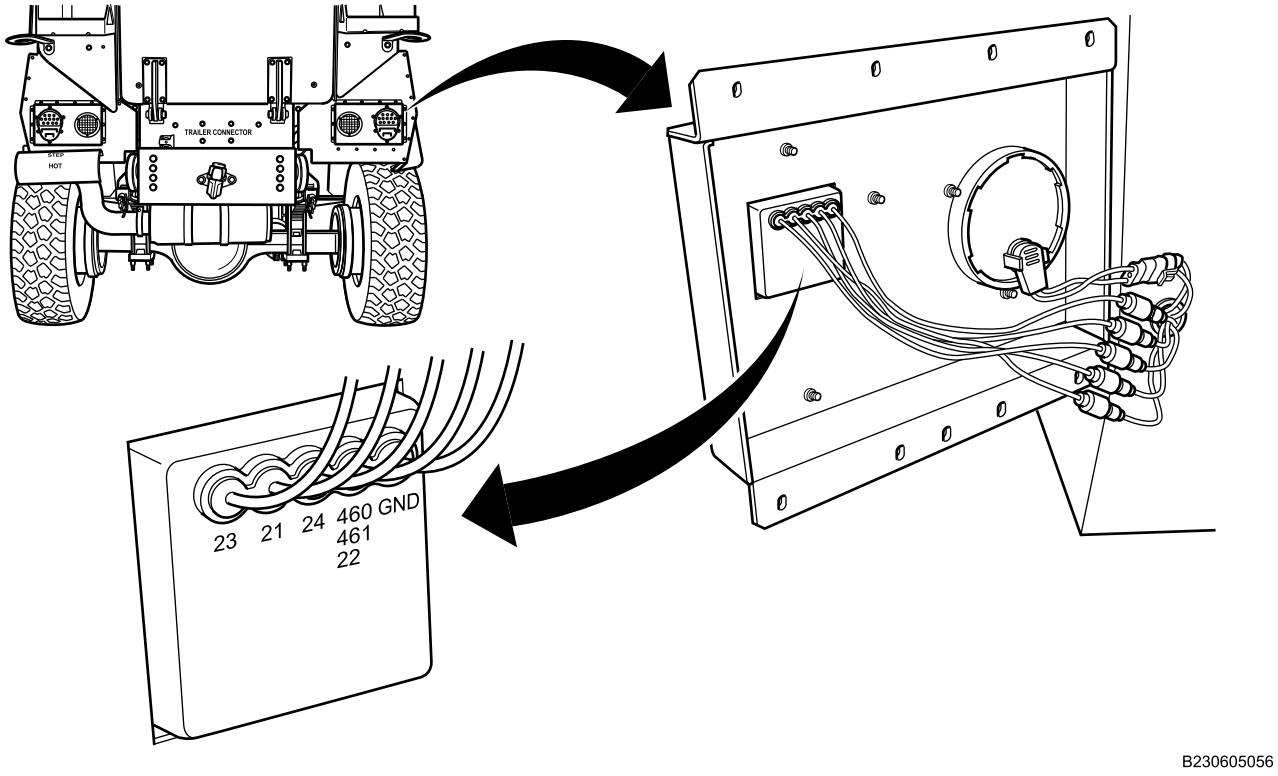


Figure 22. Circuit Identification on Composite Taillamp Assembly, and Turn Signal Bullet Connectors.

78. Measure resistance between harness side bullet connector GND terminal and ground with multimeter.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 86.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

79. Remove STOPLIGHT RELAY RIGHT from right side IP. Refer to Figure 23. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

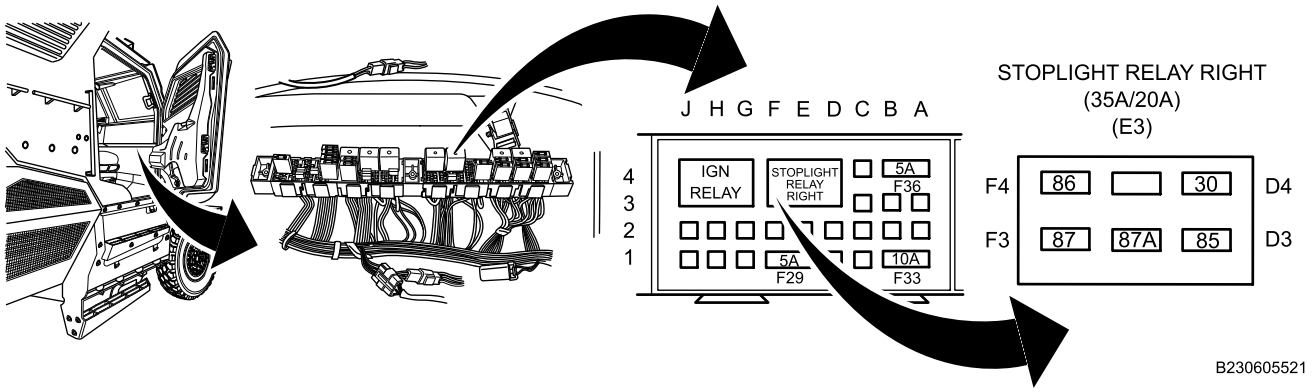


Figure 23. Stoplight Relay Right in Cabin Fuse and Relay Center.

80. Remove IP center trim panel. Refer to IP Center Trim panel Removal and Installation (WP 0581).
81. Remove cap and metal bus bar from blackout mode splice pack connector 1050. Refer to Figure 24.

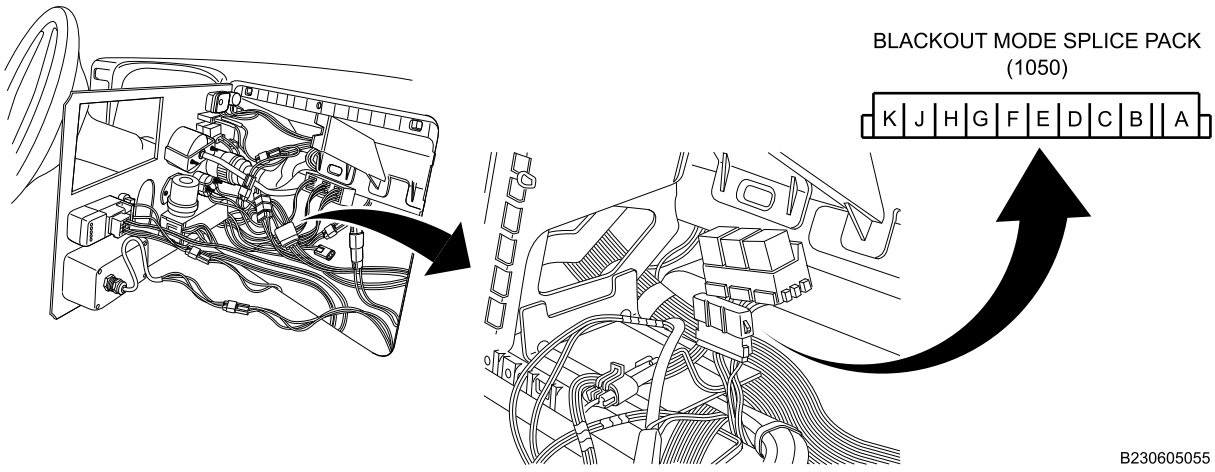


Figure 24. Blackout Mode Splice Pack Connector in Center IP.

82. Measure resistance between STOPLIGHT RELAY RIGHT socket terminal 85 and connector 1050 terminal D with multimeter. Refer to Figure 23 and Figure 24.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 96.
YES Go to next step.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

83. Measure resistance between STOPLIGHT RELAY RIGHT socket 86 and ground with multimeter. Refer to Figure 25.

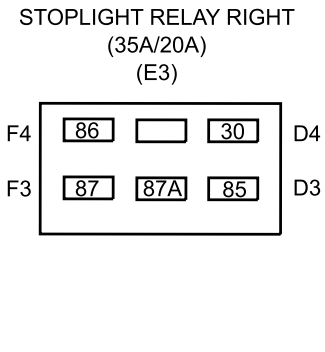


Figure 25. Stoplight Relay Right Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 96.
YES Go to next step.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

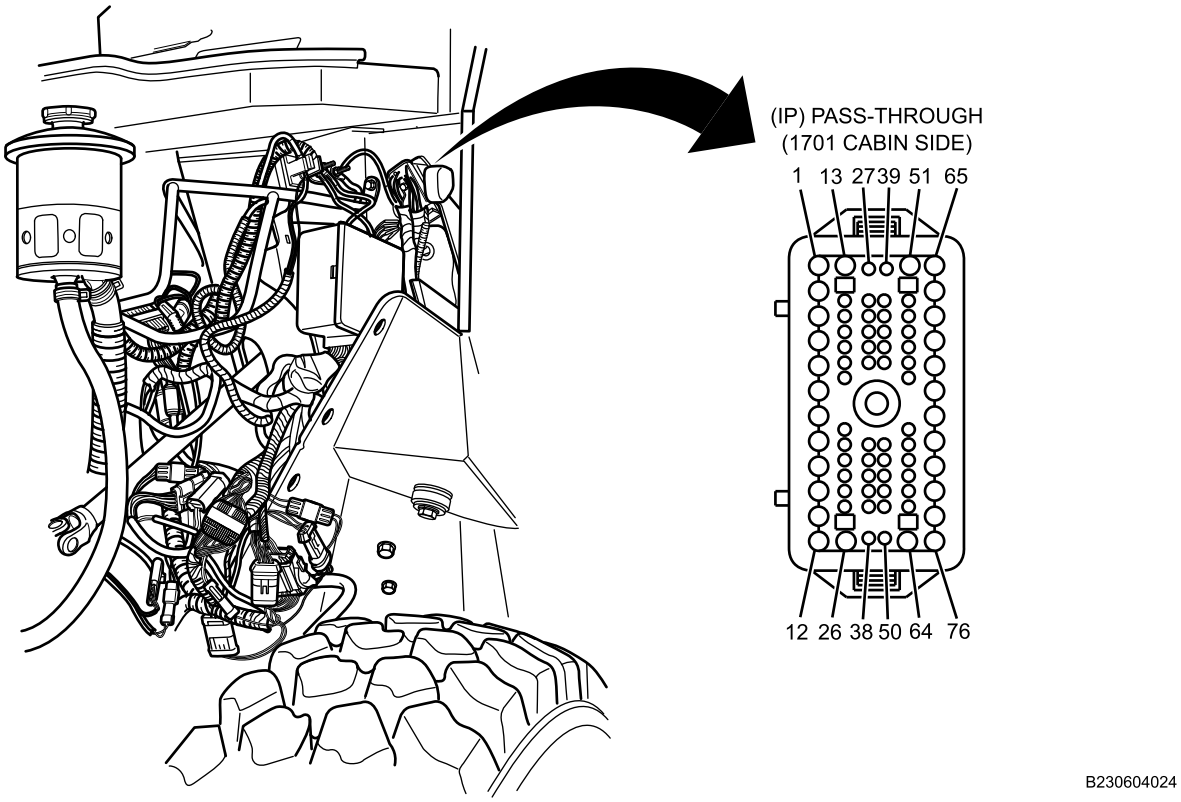


Figure 26. IP/PDC Pass-Through Connector in Engine Compartment.

84. Disconnect connector 1701. Refer to Figure 26.
85. With assistance, measure resistance between connector 1701 (cabin side) terminal 27 and connector 1050 terminal H with multimeter. Refer to Figure 26 and Figure 27.

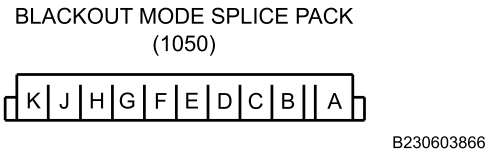


Figure 27. Connector 1050.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 96.
YES Go to Step 98.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

86. Disconnect rear chassis harness 5-pin connector 9303A from taillamp harness 5-pin connector LAM1086. Refer to Figure 28.

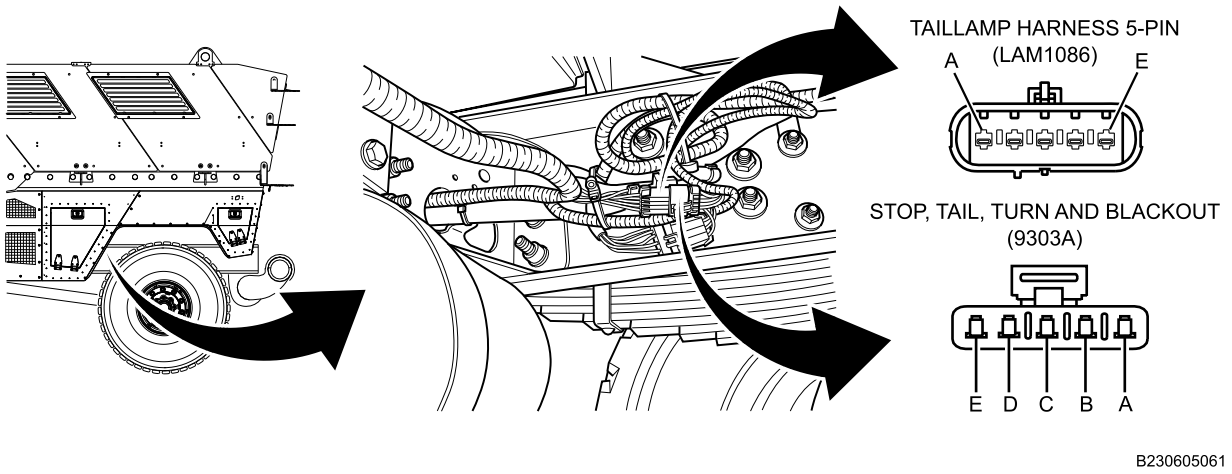


Figure 28. Taillamp/Rear Chassis Harness Inside Left Frame Rail, Near Rear Crossmember.

87. Measure resistance between connector 9303A terminal E and ground with multimeter. Refer to Figure 28.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 103.
NO Go to next step.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

88. Loosen air dryer mounting bolts and move air dryer to one side to access connectors on left frame rail. Refer to Air Dryer Removal and Installation (WP 0517).
89. Disconnect center chassis harness connector 9800F from rear chassis harness connector 9800M. Refer to Figure 29.

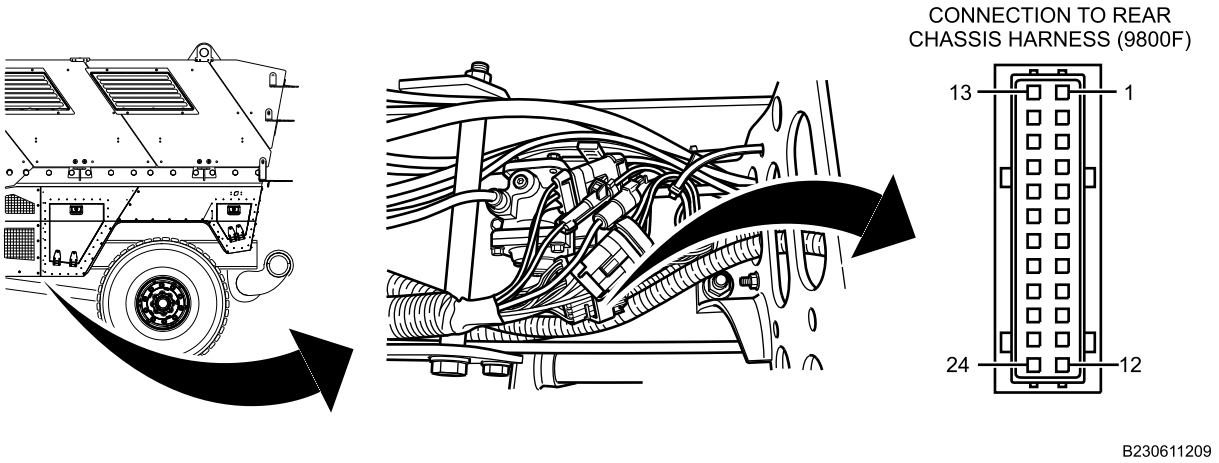


Figure 29. Center/Rear Chassis Connector Inside Left Frame Rail.

90. Measure resistance between connector 9800F terminal 12 and ground with multimeter. Refer to Figure 29.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 102.
NO Go to next step.

STEP

91. Remove air cleaner. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
92. Remove left side engine armor bracket. Refer to Left Engine Armor Plate Bracket Removal and Installation (WP 0598).

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

93. Disconnect PDC harness connector 9714 from center chassis harness connector 9700 in engine compartment. Refer to Figure 30.

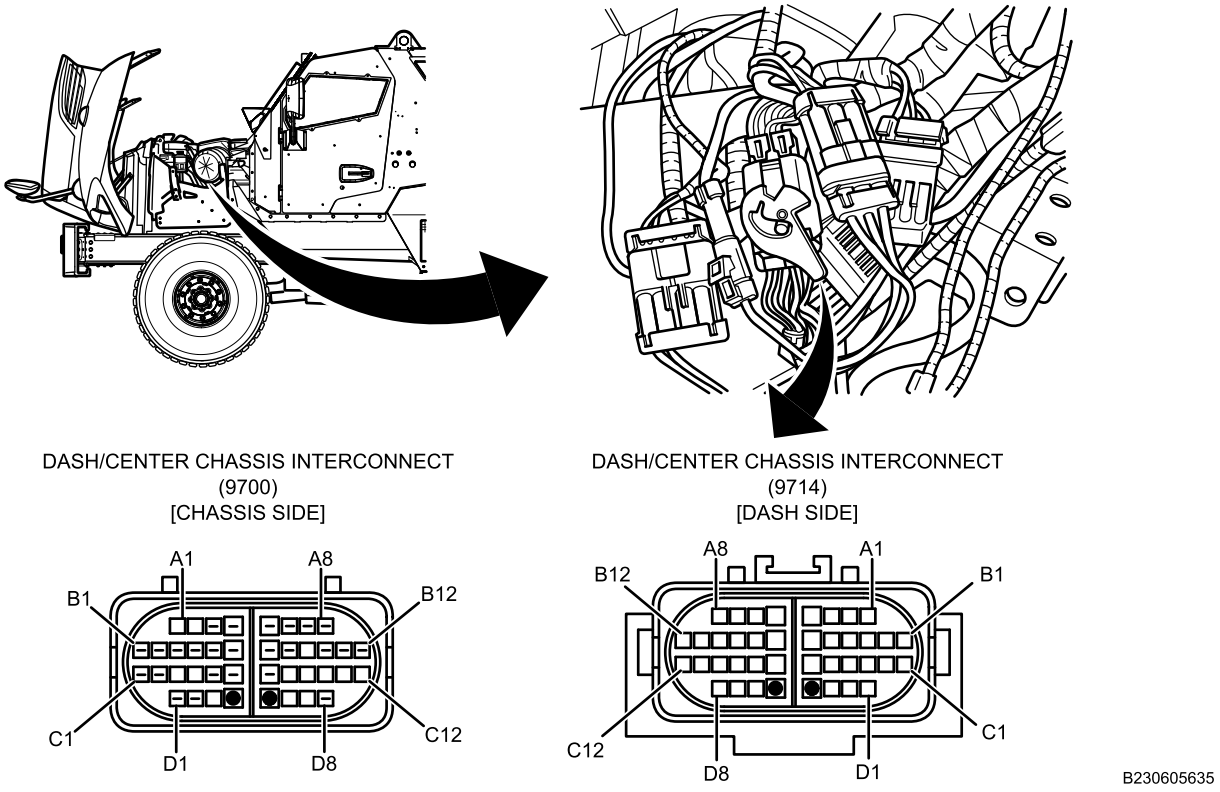


Figure 30. Dash/Center Chassis Connector in Engine Compartment.

94. Measure resistance between connector 9714 terminal C6 and ground with multimeter. Refer to Figure 30.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 101.
NO Go to Step 98.

MALFUNCTION

- 95. Taillamp is faulty.

ACTION

Replace taillamp. Refer to Composite Taillamp Assembly Removal and Installation (WP 0383). Return vehicle to service.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 96. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel (IP) Wiring Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 97. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

MALFUNCTION

- 98. PDC harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 99. Power distribution center relay is faulty.

ACTION

Replace power distribution center relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Return vehicle to service.

END OF TEST

MALFUNCTION

- 100. Instrument panel relay is faulty.

ACTION

Replace instrument panel relay. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Return vehicle to service.

END OF TEST

MALFUNCTION

- 101. Center chassis harness is faulty.

REAR TURN SIGNAL LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace center chassis harness. Refer to Center Chassis Harness Removal and Installation (WP 0426). Return vehicle to service.

END OF TEST

MALFUNCTION

- 102. Rear chassis harness is faulty.

ACTION

Replace rear chassis harness. Refer to Rear Chassis Harness Removal and Installation (WP 0427). Return vehicle to service.

END OF TEST

MALFUNCTION

- 103. Taillamp harness is faulty.

ACTION

Replace taillamp harness. Refer to Taillamp Harness Removal and Installation (WP 0384). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0092
WP 0317
WP 0318
WP 0319
WP 0333
WP 0335
WP 0323
WP 0324
WP 0353
WP 0565
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 57
WP 0789, Figure 11
WP 0789, Figure 51

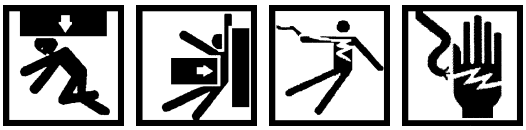
Before Beginning This Troubleshooting Procedure

Successful diagnosis of turn signal lights depends on performing various procedures in correct sequence. Failure to comply will lead to misdiagnosis. Perform Turn Signal Lights Operational Checkout Procedure (WP 0096) before performing tests in this troubleshooting procedure.

TROUBLESHOOTING PROCEDURE

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedure Overview in How to Use This Manual before performing any troubleshooting procedures.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Press SER.DRIVE on Master Vehicle Light Switch (MVLS) and then press ENTER within five seconds (TM 9-2355-106-10).
4. Activate hazard lights (TM 9-2355-106-10).
5. Observe all turn signal lights.
6. Deactivate hazard lights (TM 9-2355-106-10).
7. Activate left and then right turn signal lights (TM 9-2355-106-10).
8. Observe all turn signal lights.

CONDITION/INDICATION

Are all turn signal lights inoperative?

DECISION

YES Go to Step 72.
NO Go to next step.

STEP

9. Activate left turn signal lights (TM 9-2355-106-10).

CONDITION/INDICATION

Are all turn signal lights on left side inoperative?

DECISION

YES Go to next step.
NO Go to Step 41.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

10. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).
11. Disconnect connector 1810 from multifunction turn signal switch. Refer to Figure 1.

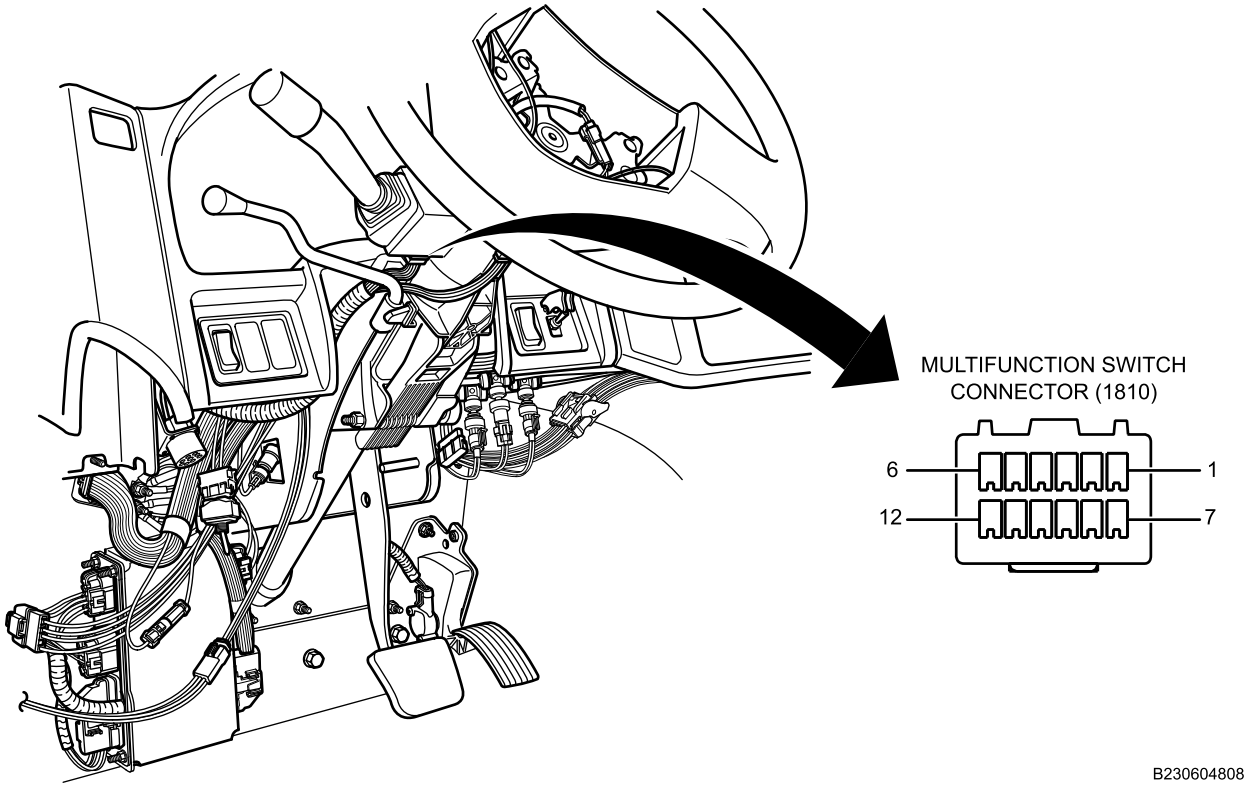


Figure 1. Left Side Steering Column.

12. Turn MAIN POWER switch ON (TM 9-2355-106-10).
13. Turn ignition switch ON (TM 9-2355-106-10).
14. Press SER. DRIVE on MVLS and then press ENTER within five seconds (TM 9-2355-106-10).
15. Measure DC voltage between harness connector 1810 terminal 1 and 7 with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 4V and 5V?

DECISION

YES Go to Step 102.
NO Go to next step.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

16. Turn ignition switch OFF (TM 9-2355-106-10).
17. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
18. Disconnect IP/steering column harness connector 1800 under center instrument panel. Refer to Figure 2.

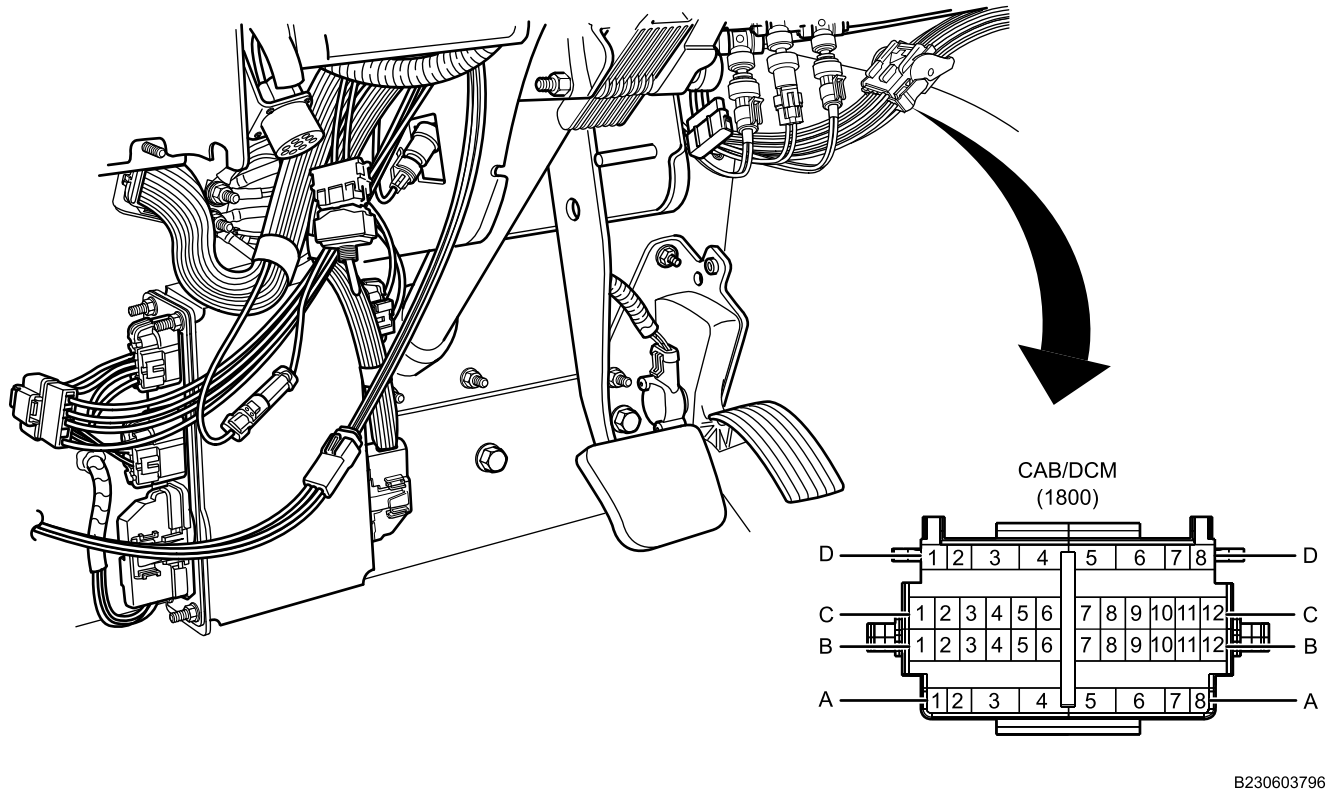


Figure 2. IP/Steering Column Harness Connector Under Center IP.

19. Turn MAIN POWER switch ON (TM 9-2355-106-10).
20. Turn ignition switch ON (TM 9-2355-106-10).
21. Press SER. DRIVE on MVLS and then press ENTER within five seconds (TM 9-2355-106-10).
22. Measure DC voltage between harness connector 1800 terminal A1 and A4 with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 4V and 5V?

DECISION

YES Go to Step 98.
NO Go to next step.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

23. Remove left turn enable relay from center instrument panel relay block. Refer to IP Center Relay Removal and Installation (WP 0318).
24. Turn MAIN POWER switch ON (TM 9-2355-106-10).
25. Turn ignition switch ON (TM 9-2355-106-10).
26. Press SER. DRIVE on MVLS and then press ENTER within five seconds (TM 9-2355-106-10).
27. Measure DC voltage between left turn enable relay socket terminal 30 and ground with multimeter. Refer to Figure 3.

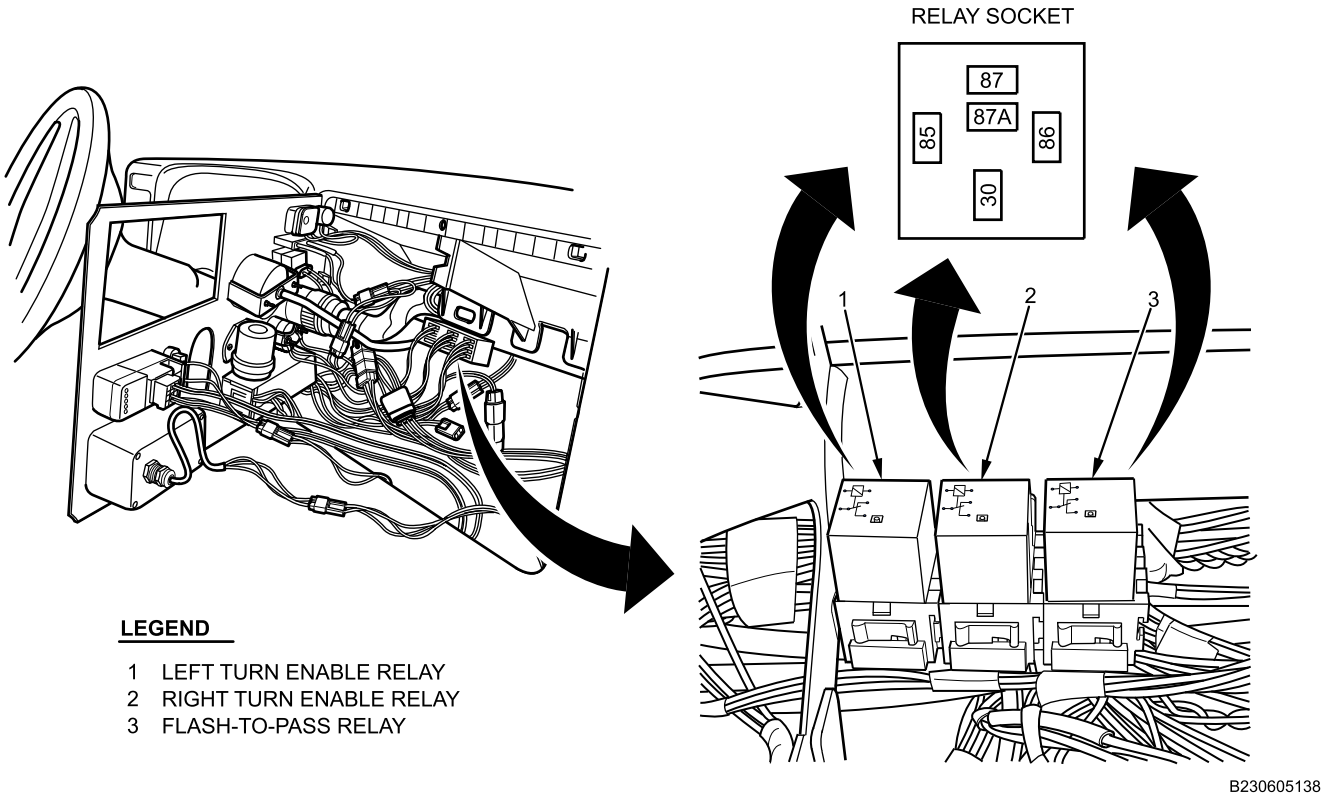


Figure 3. Under Center IP.

CONDITION/INDICATION

Does multimeter read between 4V and 5V?

DECISION

YES Go to Step 34.
NO Go to next step.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Turn ignition switch OFF (TM 9-2355-106-10).
29. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
30. Disconnect ESC connector 1600. Refer to Figure 4.

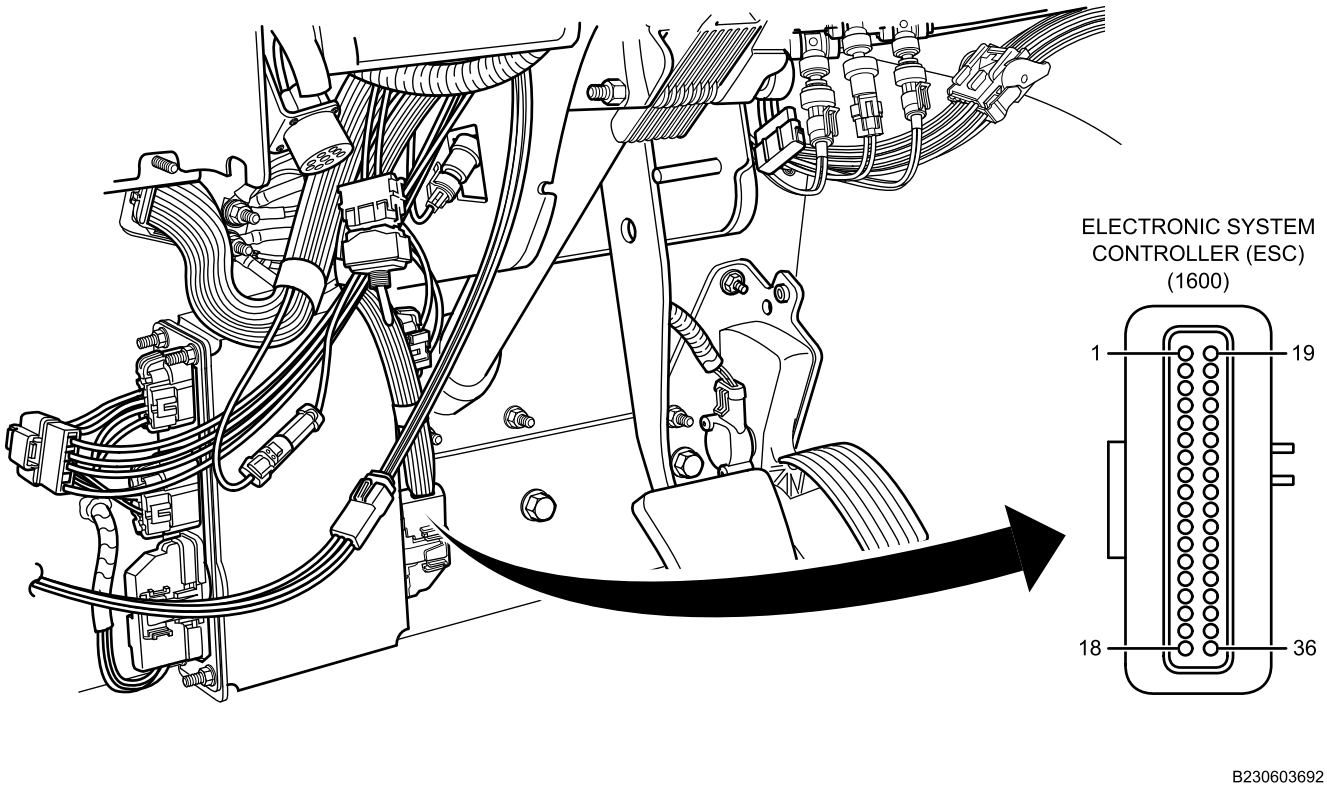


Figure 4. Under Left Side Instrument Panel.

31. Measure resistance between connector 1600 terminal 19 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to next step.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

32. Measure resistance between connector 1600 terminal 19 and left turn enable relay socket terminal 30 with multimeter. Refer to Figure 4 and Figure 5.

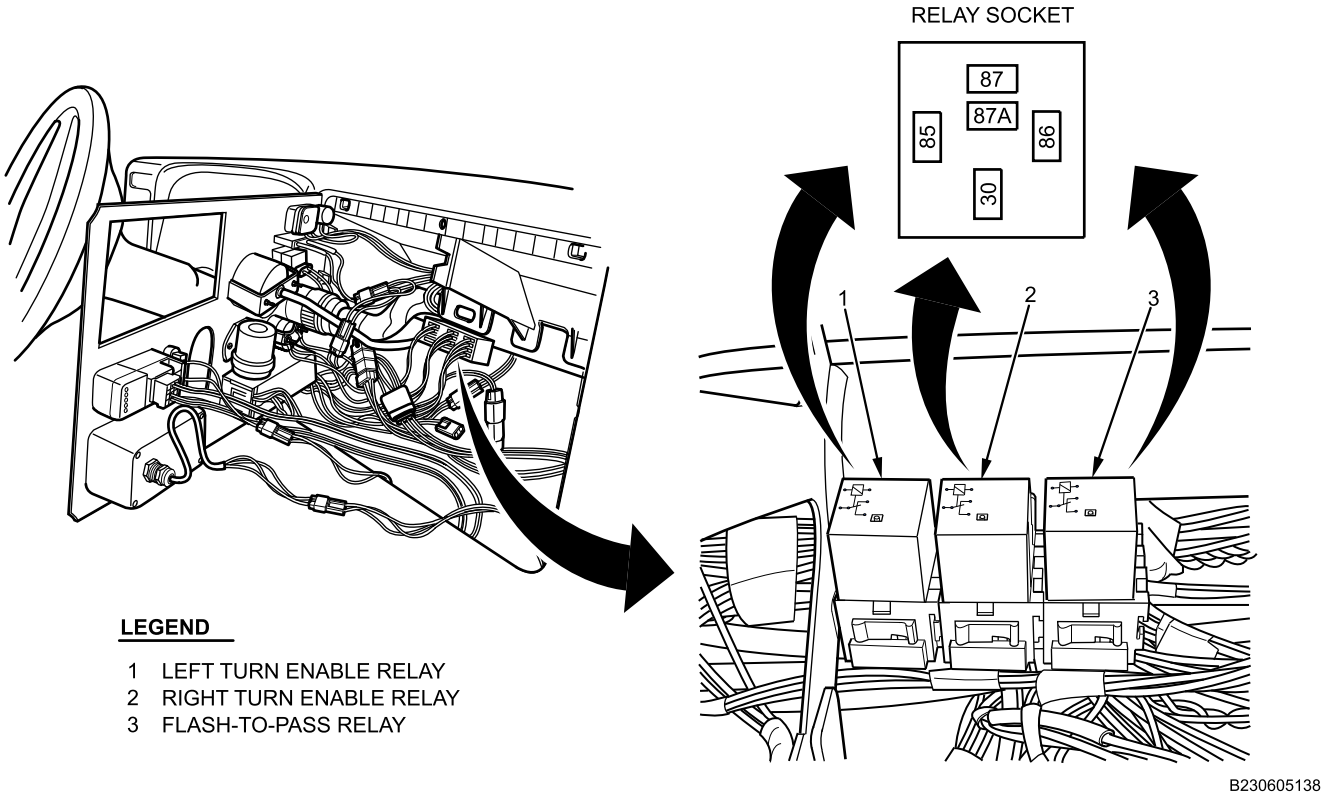


Figure 5. Under Center IP.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

33. Measure resistance between connector 1600 terminal 19 and all other terminals in connector with multimeter. Refer to Figure 6.

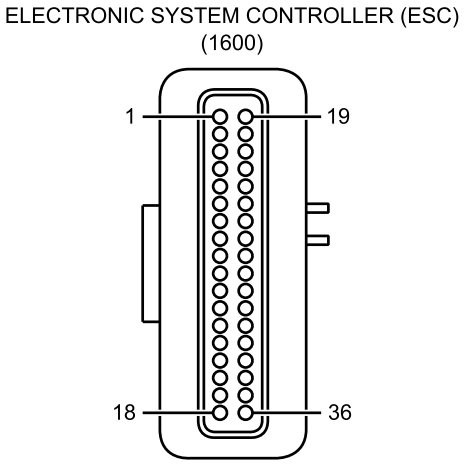


Figure 6. Connector 1600.

CONDITION/INDICATION

Does multimeter read OL for all tests?

DECISION

YES Go to Step 100.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

34. Measure DC voltage between left turn enable relay socket terminal 86 and ground with multimeter. Refer to Figure 7.

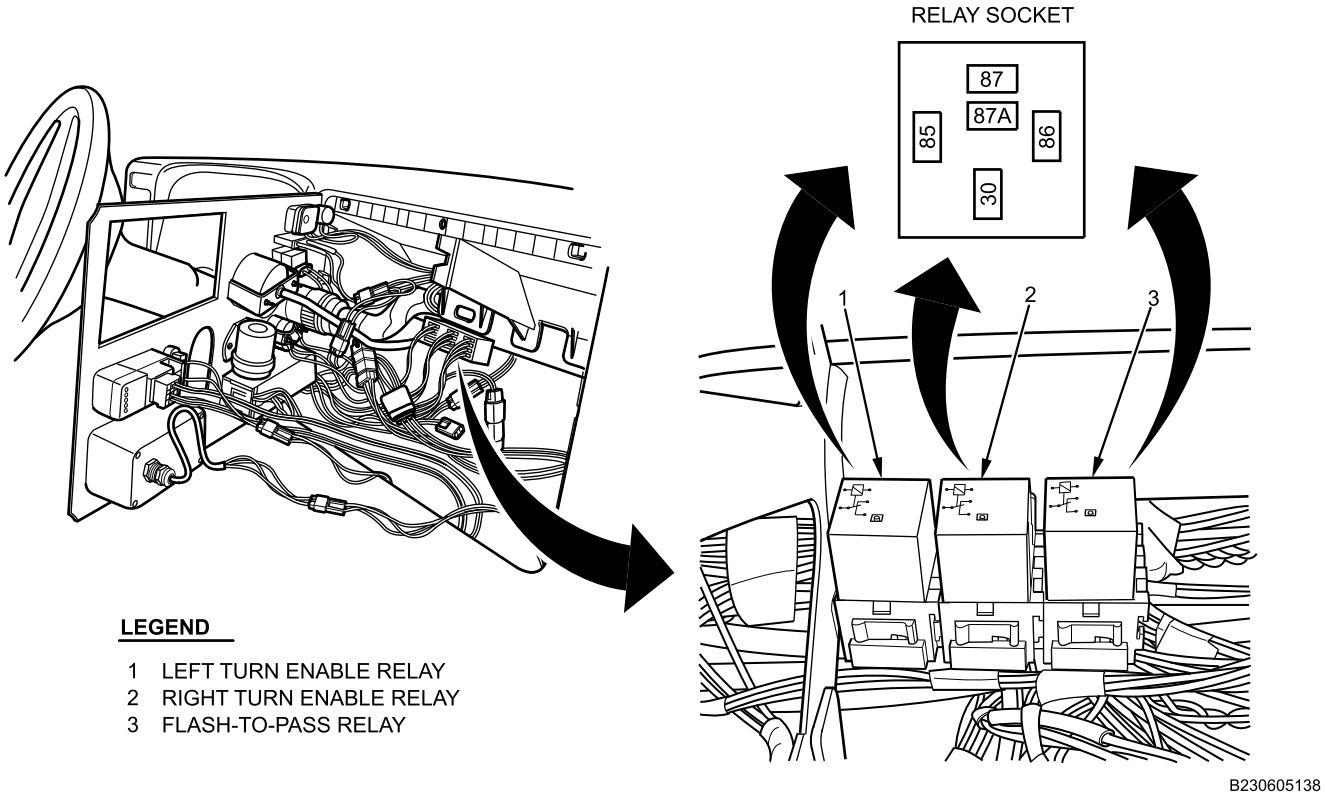


Figure 7. Under Center IP.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to next step.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

35. Turn ignition switch OFF (TM 9-2355-106-10).
36. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
37. Measure resistance between left turn enable relay socket terminal 85 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 99.

STEP

38. Measure resistance between left turn enable relay socket terminal 87 and ground with multimeter. Refer to Figure 8.

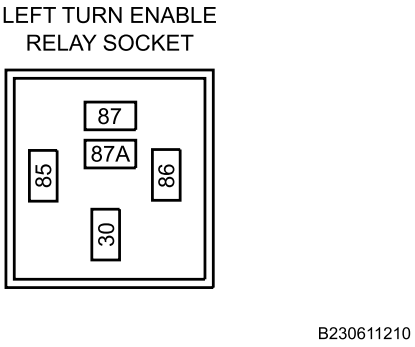


Figure 8. Left Turn Enable Relay Socket.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to next step.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

39. Measure resistance between left turn enable relay socket terminal 87 and connector 1800 terminal A1 with multimeter. Refer to Figure 8. Refer to Figure 9.

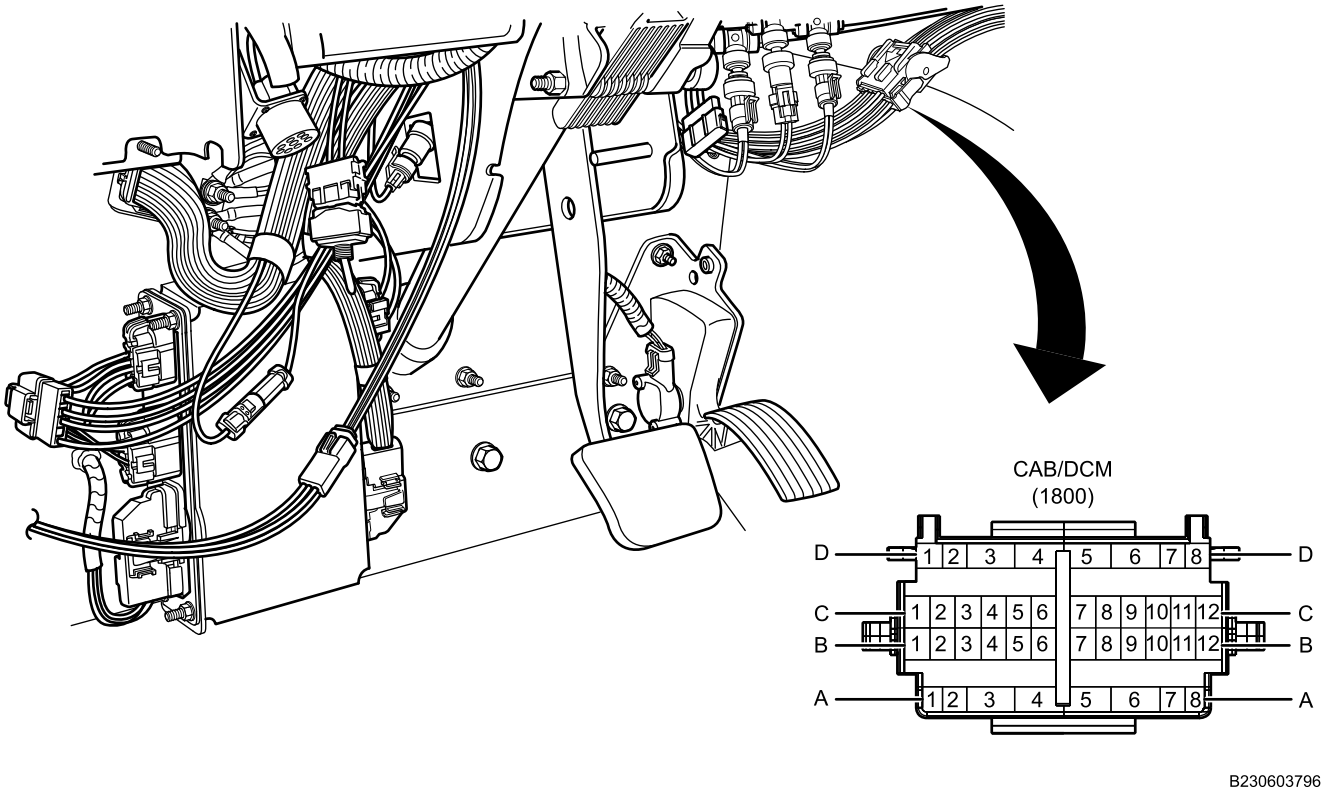


Figure 9. IP/Steering Column Harness Under Center IP.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 99.

STEP

40. Measure resistance between connector 1800 terminal A1 and all other terminals in connector with multimeter. Refer to Figure 9.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 101.
NO Go to Step 99.

STEP

41. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).
42. Disconnect connector 1810 from multifunction turn signal switch. Refer to Figure 10.

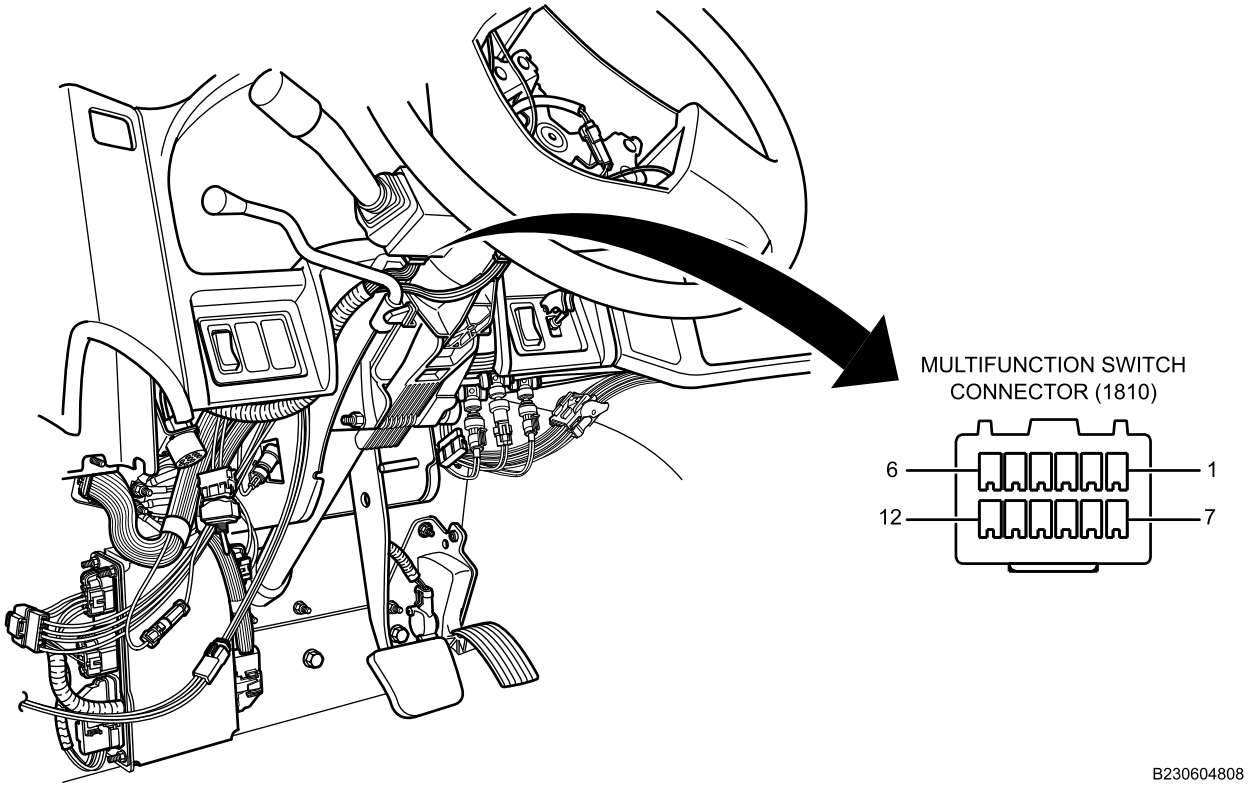


Figure 10. Left Side Steering Column.

43. Turn MAIN POWER switch ON (TM 9-2355-106-10).
44. Turn ignition switch ON (TM 9-2355-106-10).
45. Press SER. DRIVE on MVLS and then press ENTER within five seconds (TM 9-2355-106-10).
46. Measure DC voltage between harness connector 1810 terminal 2 and 7 with multimeter. Refer to Figure 10.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 4V and 5V?

DECISION

YES Go to Step 102.
NO Go to next step.

STEP

47. Turn ignition switch OFF (TM 9-2355-106-10).
48. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
49. Disconnect IP/steering column harness connector 1800 under center instrument panel. Refer to Figure 11.

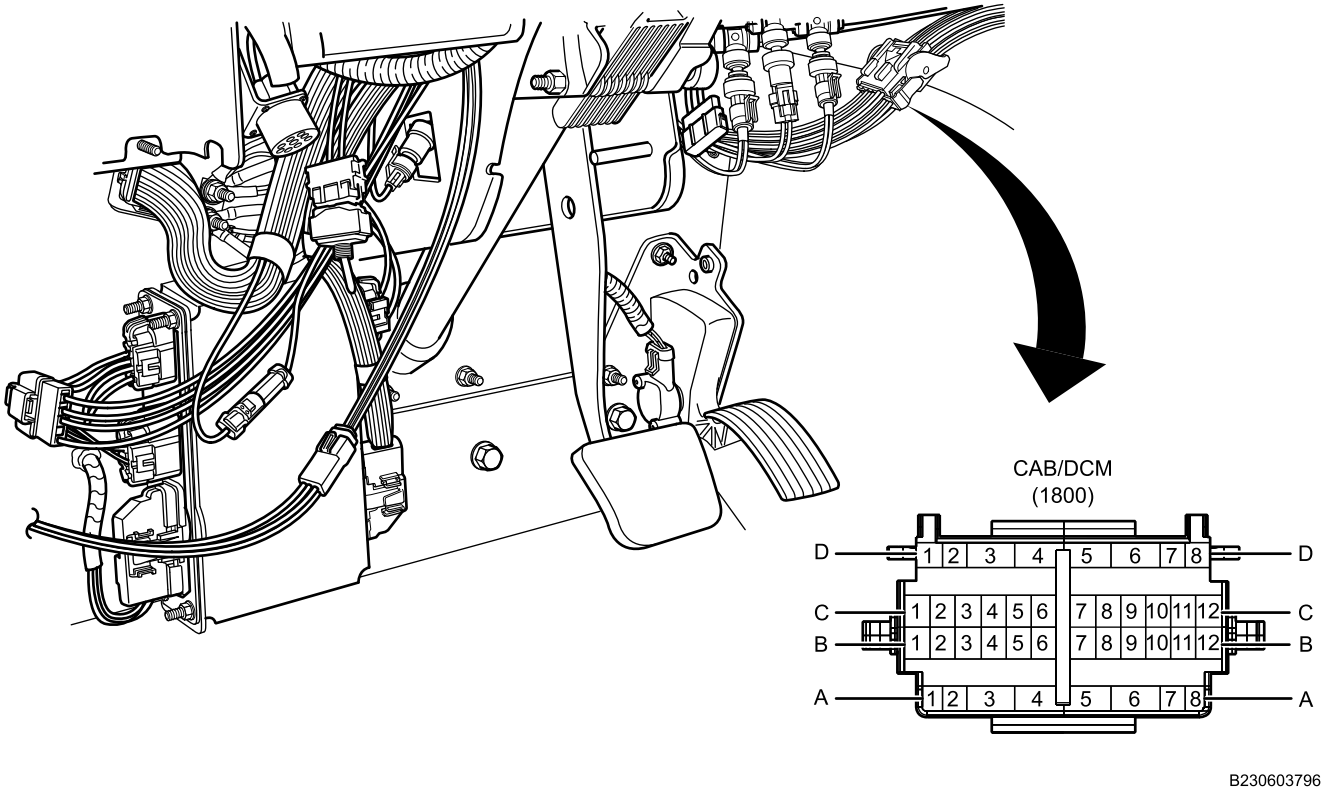


Figure 11. IP/Steering Column Harness Connector Under Center IP.

50. Turn MAIN POWER switch ON (TM 9-2355-106-10).
51. Turn ignition switch ON (TM 9-2355-106-10).
52. Press SER. DRIVE on MVLS switch and then press ENTER within five seconds (TM 9-2355-106-10).
53. Measure DC voltage between harness connector 1800 terminal A2 and A4 with multimeter. Refer to Figure 11.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 4V and 5V?

DECISION

YES Go to Step 98.
NO Go to next step.

STEP

54. Remove right turn enable relay from center instrument panel relay block. Refer to IP Center Relay Removal and Installation (WP 0318).

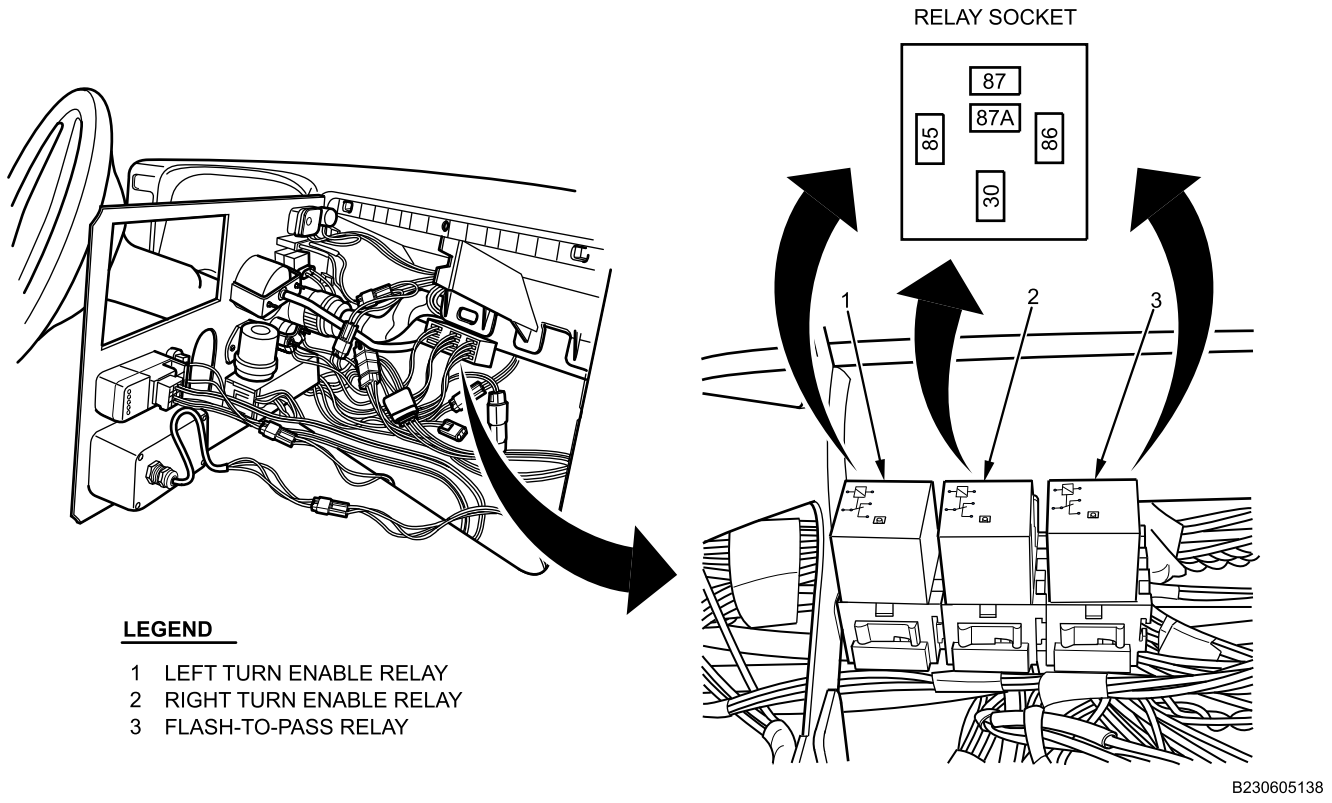


Figure 12. Under Center IP.

55. Turn MAIN POWER switch ON (TM 9-2355-106-10).
56. Turn ignition switch ON (TM 9-2355-106-10).
57. Press SER. DRIVE on MVLS and then press ENTER within five seconds (TM 9-2355-106-10).
58. Measure DC voltage between right turn enable relay socket terminal 30 and ground with multimeter. Refer to Figure 12.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 4V and 5V?

DECISION

YES Go to Step 65.
NO Go to next step.

STEP

59. Turn ignition switch OFF (TM 9-2355-106-10).
60. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
61. Disconnect ESC connector 1600. Refer to Figure 13.

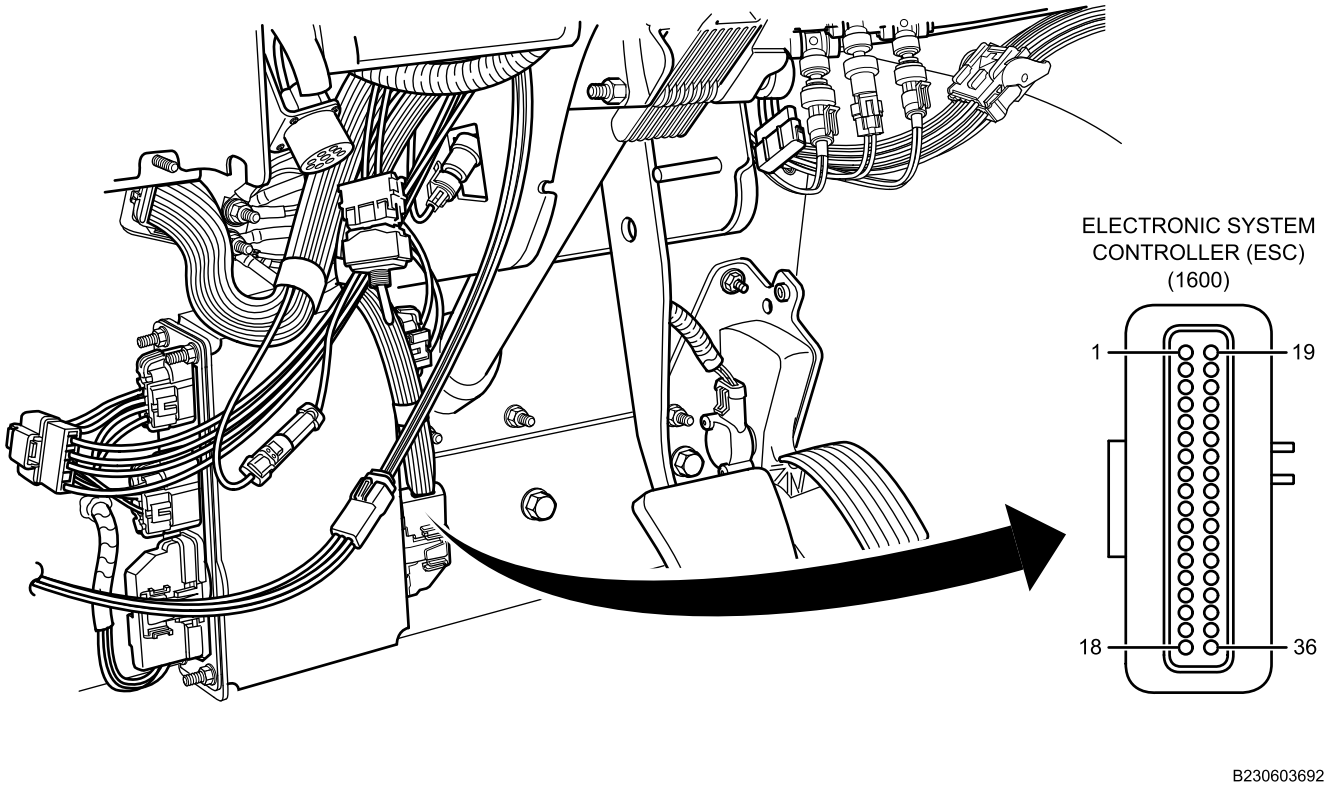


Figure 13. Under Left Side Instrument Panel.

62. Measure resistance between connector 1600 terminal 18 and ground with multimeter. Refer to Figure 13.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to next step.
NO Go to Step 99.

STEP

63. Measure resistance between connector 1600 terminal 18 and right turn enable relay socket terminal 30 with multimeter. Refer to Figure 14. Refer to Figure 15.

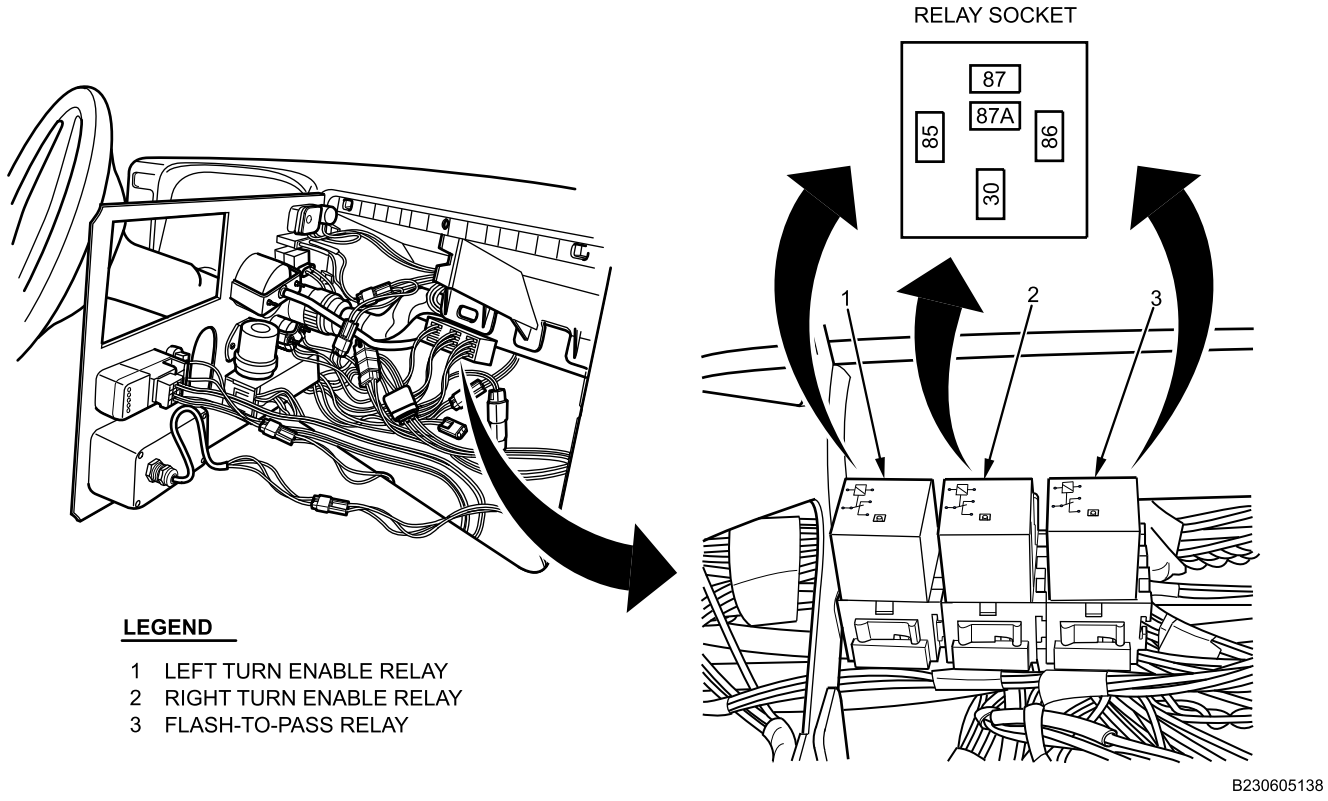


Figure 14. Under Center IP.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

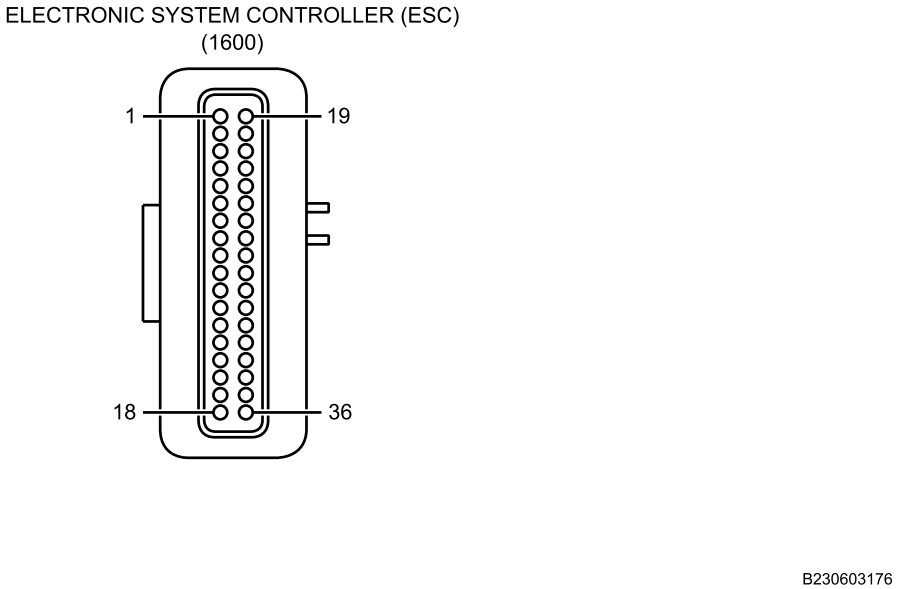


Figure 15. Connector 1600.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 99.

STEP

64. Measure resistance between connector 1600 terminal 18 and all other terminals in connector with multimeter. Refer to Figure 15.

CONDITION/INDICATION

Does multimeter read OL for all tests?

DECISION

YES Go to Step 100.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

65. Measure DC voltage between right turn enable relay socket terminal 86 and ground with multimeter. Refer to Figure 16.

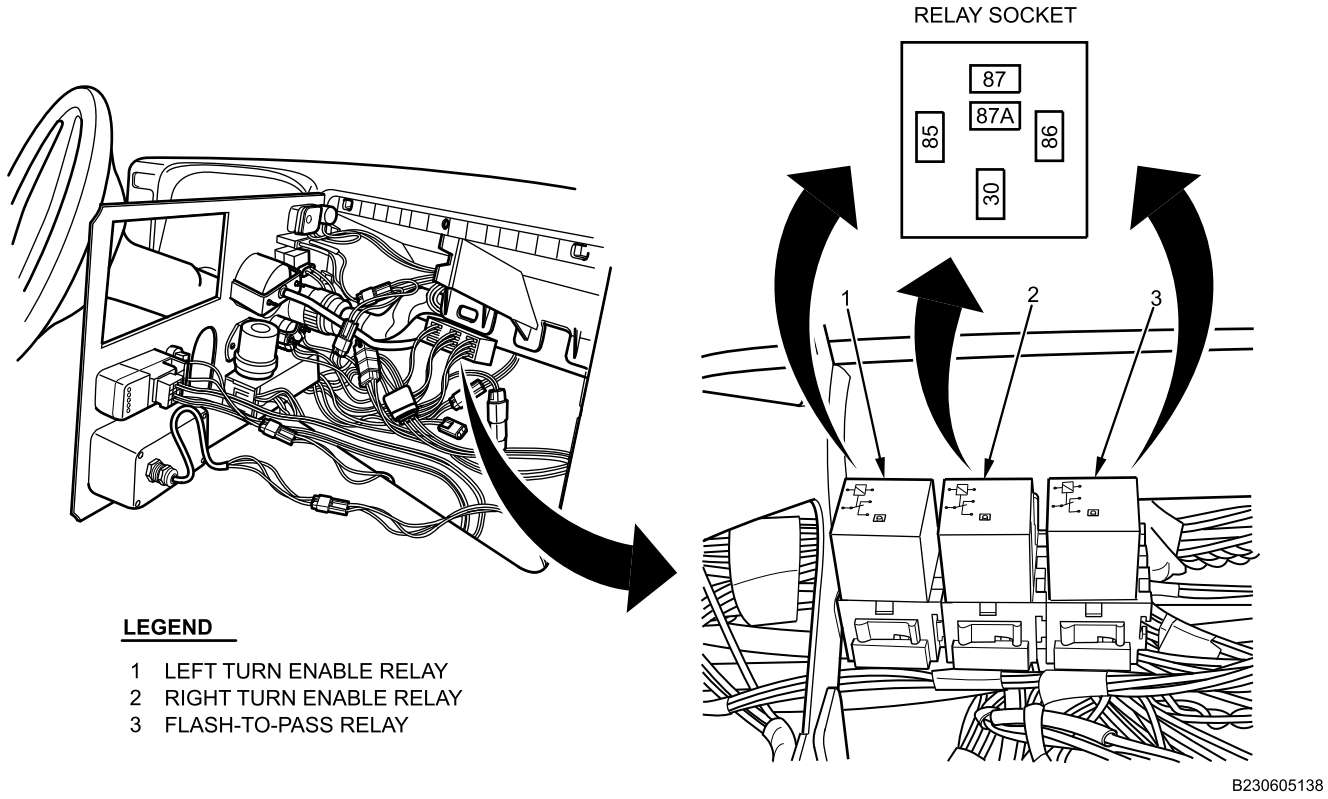


Figure 16. Under Center IP.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to next step.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

66. Turn ignition switch OFF (TM 9-2355-106-10).
67. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
68. Measure resistance between right turn enable relay socket terminal 85 and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 99.

STEP

69. Measure resistance between right turn enable relay socket terminal 87 and ground with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to next step.
NO Go to Step 99.

STEP

70. Measure resistance between right turn enable relay socket terminal 87 and connector 1800 terminal A2 with multimeter. Refer to Figure 17. Refer to Figure 18.

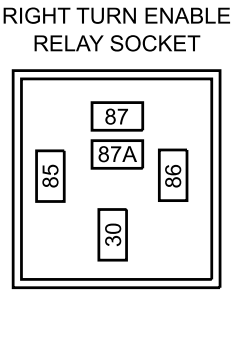


Figure 17. Right Turn Enable Relay Socket.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

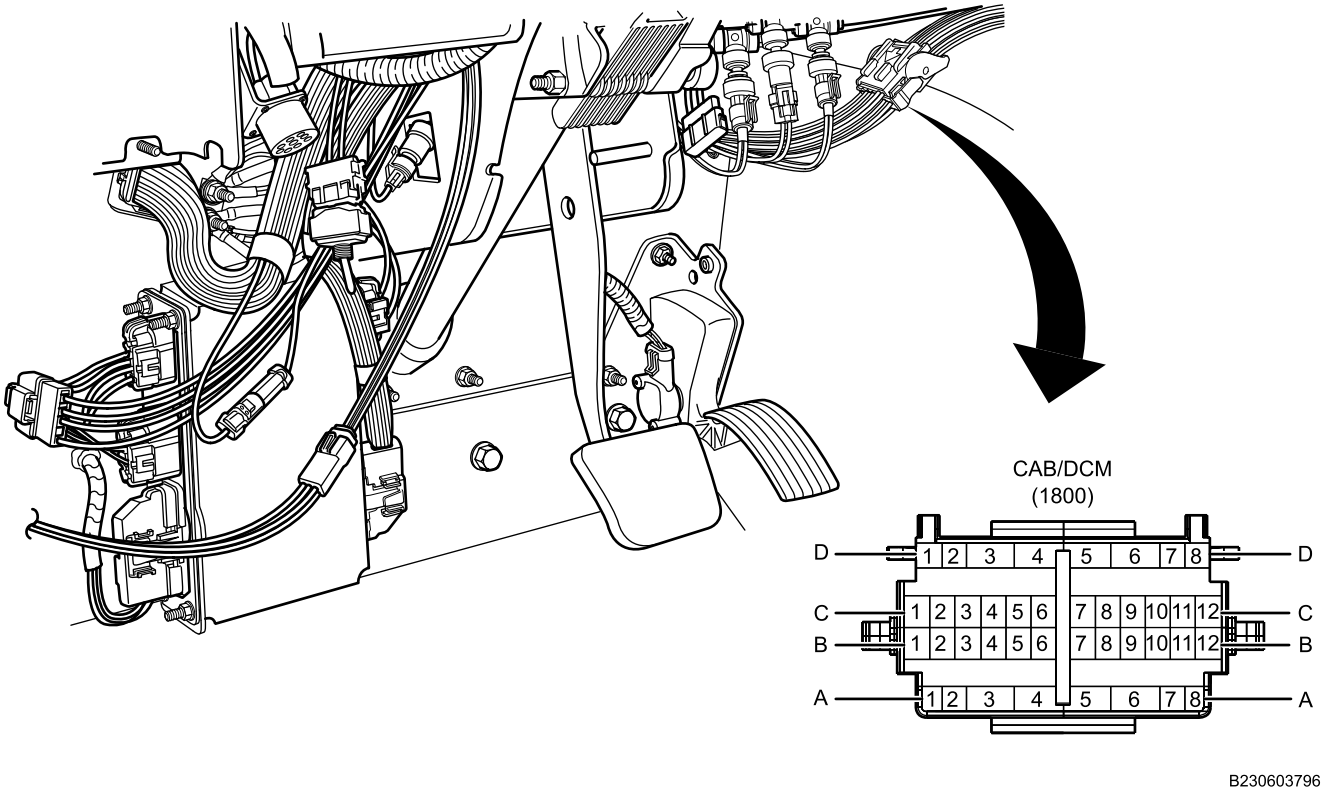


Figure 18. IP/Steering Column Harness Connector Under Center IP.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 99.

STEP

71. Measure resistance between connector 1800 terminal A2 and all other terminals in connector with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 101.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

72. Remove left turn enable relay from center instrument panel relay block. Refer to IP Center Relay Removal and Installation (WP 0318). Refer to Figure 19.

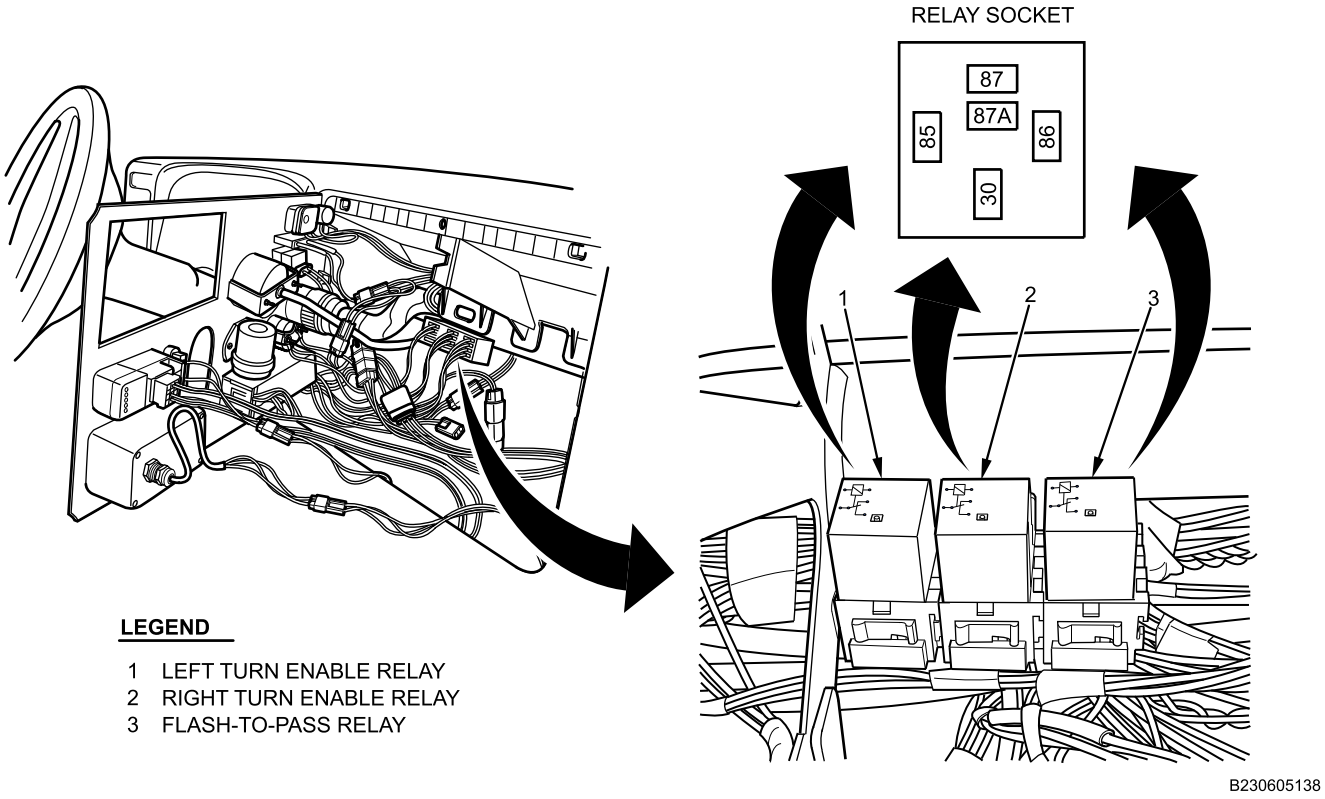


Figure 19. Under Center IP.

73. Turn MAIN POWER switch ON (TM 9-2355-106-10).
74. Turn ignition switch ON (TM 9-2355-106-10).
75. Press SER. DRIVE on MVLS and then press ENTER within five seconds (TM 9-2355-106-10).
76. Measure DC voltage between left turn enable relay socket terminal 86 and ground with multimeter. Refer to Figure 19.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to next step.
NO Go to Step 87.

STEP

77. Turn ignition switch OFF (TM 9-2355-106-10).
78. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
79. Measure resistance between left turn enable relay socket terminal 85 and ground with multimeter. Refer to Figure 19.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 99.

STEP

80. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).
81. Disconnect connector 1810 from multifunction turn signal switch. Refer to Figure 20.

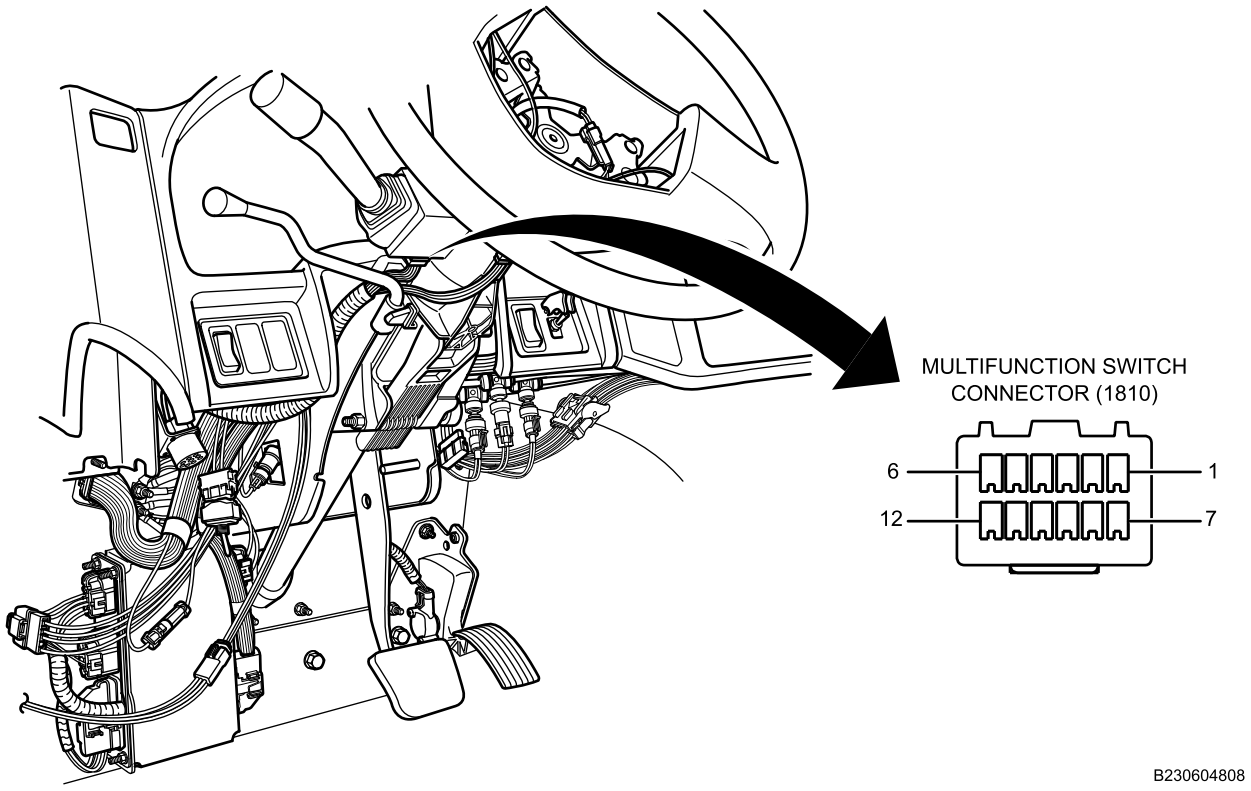


Figure 20. Left Side Steering Column.

82. Measure resistance between connector 1810 terminal 7 and ground with multimeter. Refer to Figure 20.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 102.
NO Go to next step.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

83. Disconnect IP/steering column harness connector 1800 under center instrument panel. Refer to Figure 21.

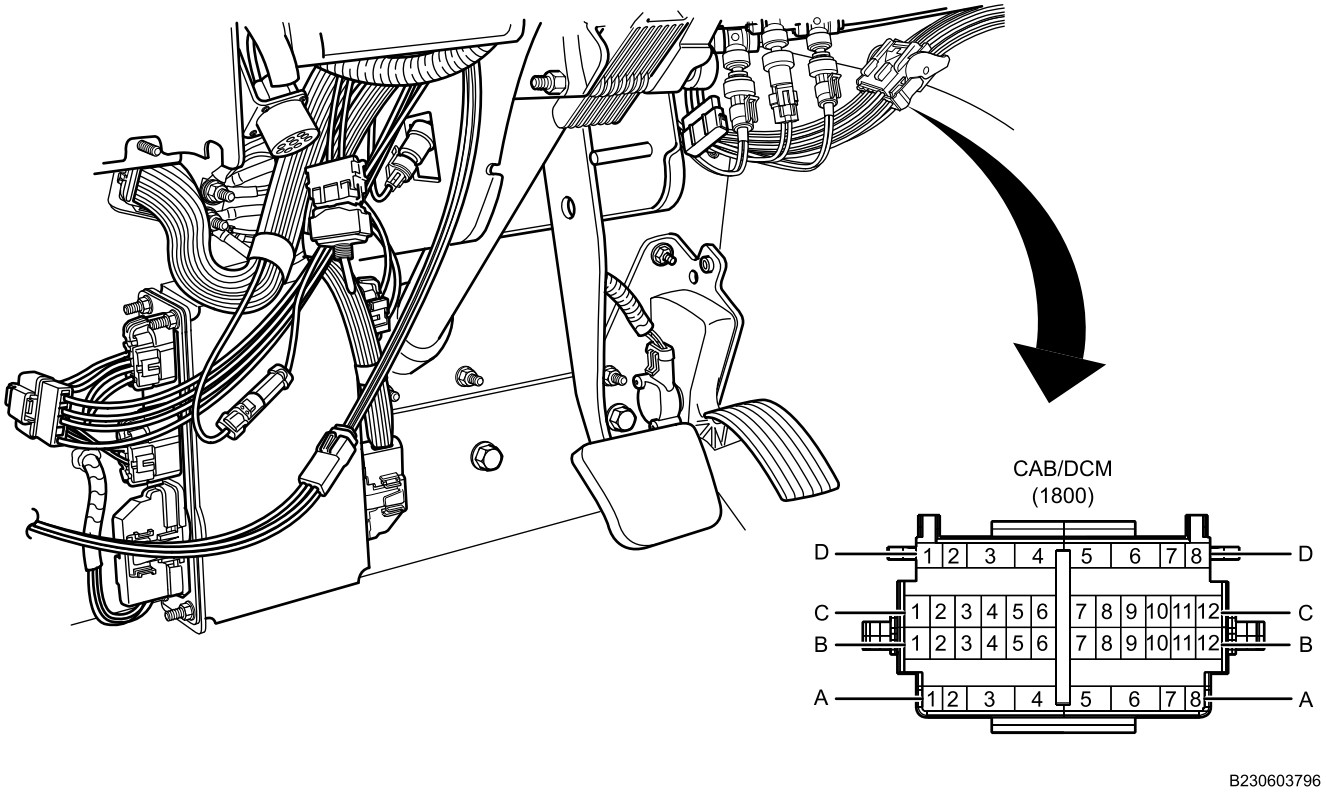


Figure 21. IP/Steering Column Harness Connector Under Center IP.

84. Measure resistance between connector 1800 terminal A4 and ground with multimeter. Refer to Figure 21.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 98.
NO Go to next step.

STEP

85. Disconnect ESC connector 1600. Refer to Figure 22

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

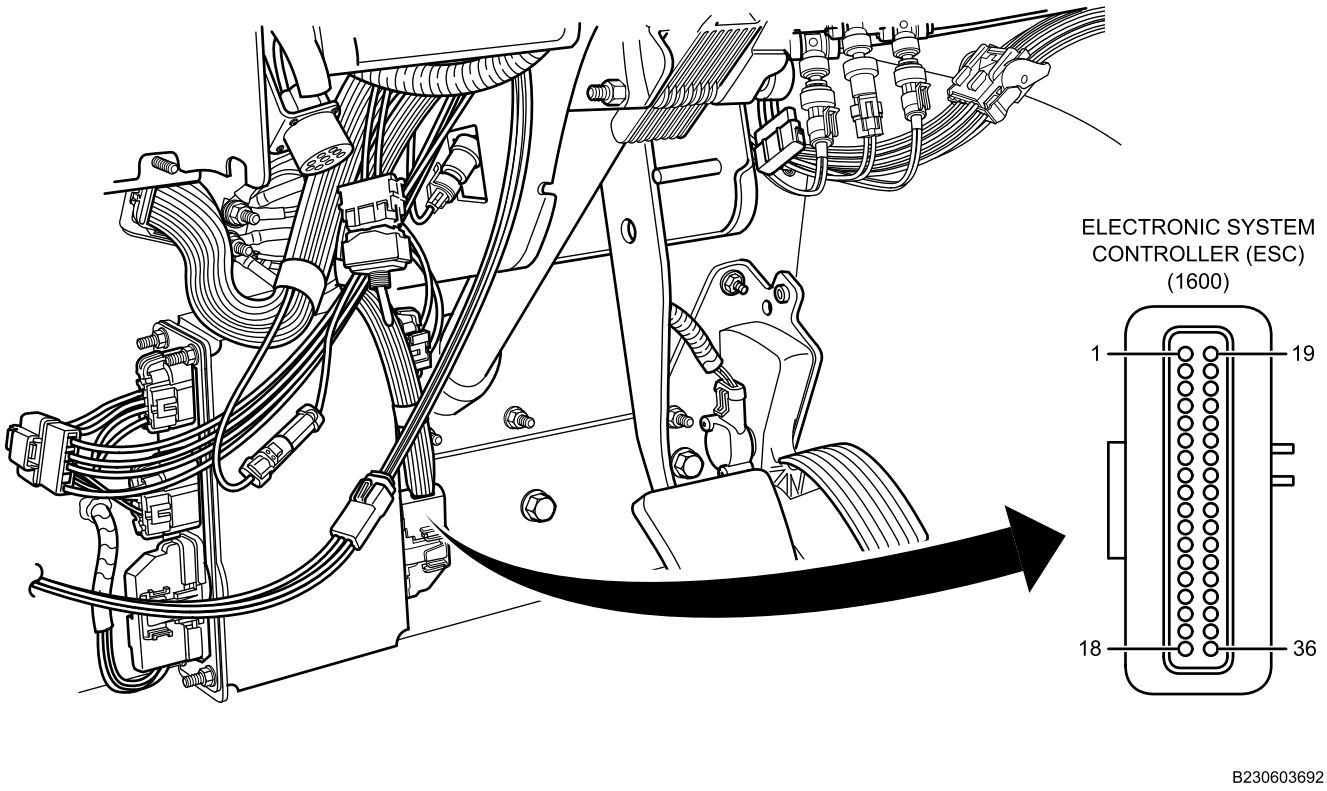


Figure 22. Under Left Side Instrument Panel.

86. Measure resistance between connector 1600 terminal 3 and connector 1800 terminal A4 with multimeter. Refer to Figure 21 and Figure 22.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 100.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

87. Turn ignition switch OFF (TM 9-2355-106-10).
88. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
89. Disconnect Master Vehicle Light Switch (MVLS). Refer to Figure 23.

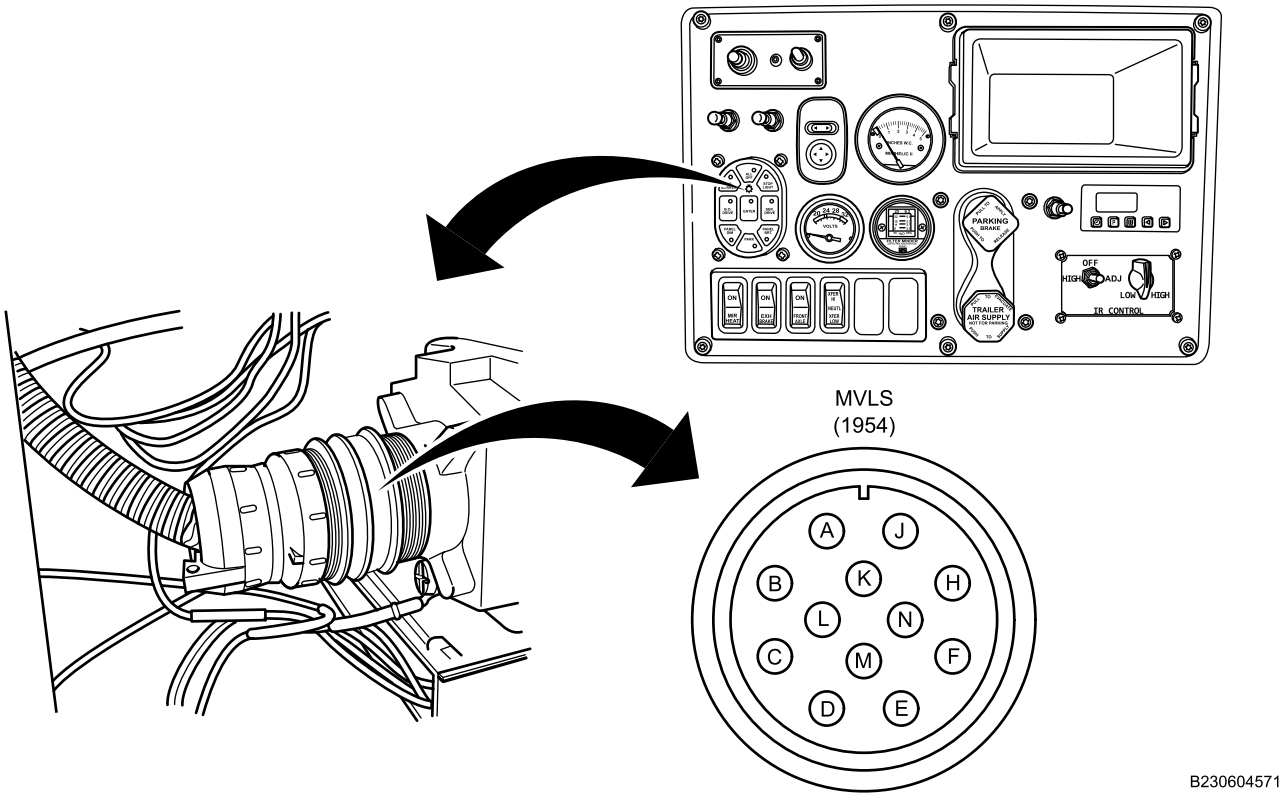


Figure 23. Under Center IP.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

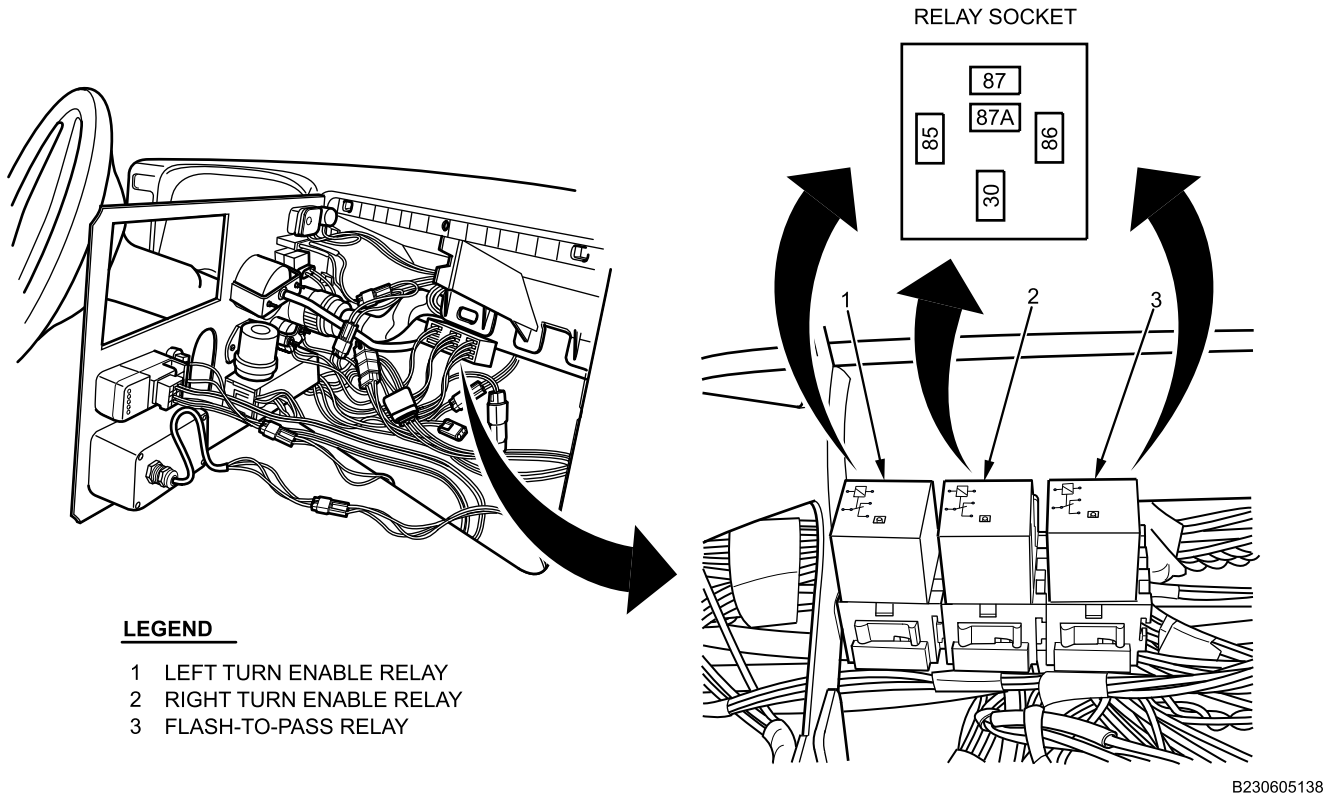


Figure 24. Under Center IP.

90. Measure resistance between connector 1954 terminal J and left turn enable relay socket terminal 86 with multimeter. Refer to Figure 23. Refer to Figure 24.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 99.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

91. Remove RIGHT TURN ENABLE relay and FLASH TO PASS relay from center instrument panel relay block. Refer to Figure 25. Refer to IP Center Relay Removal and Installation (WP 0318).

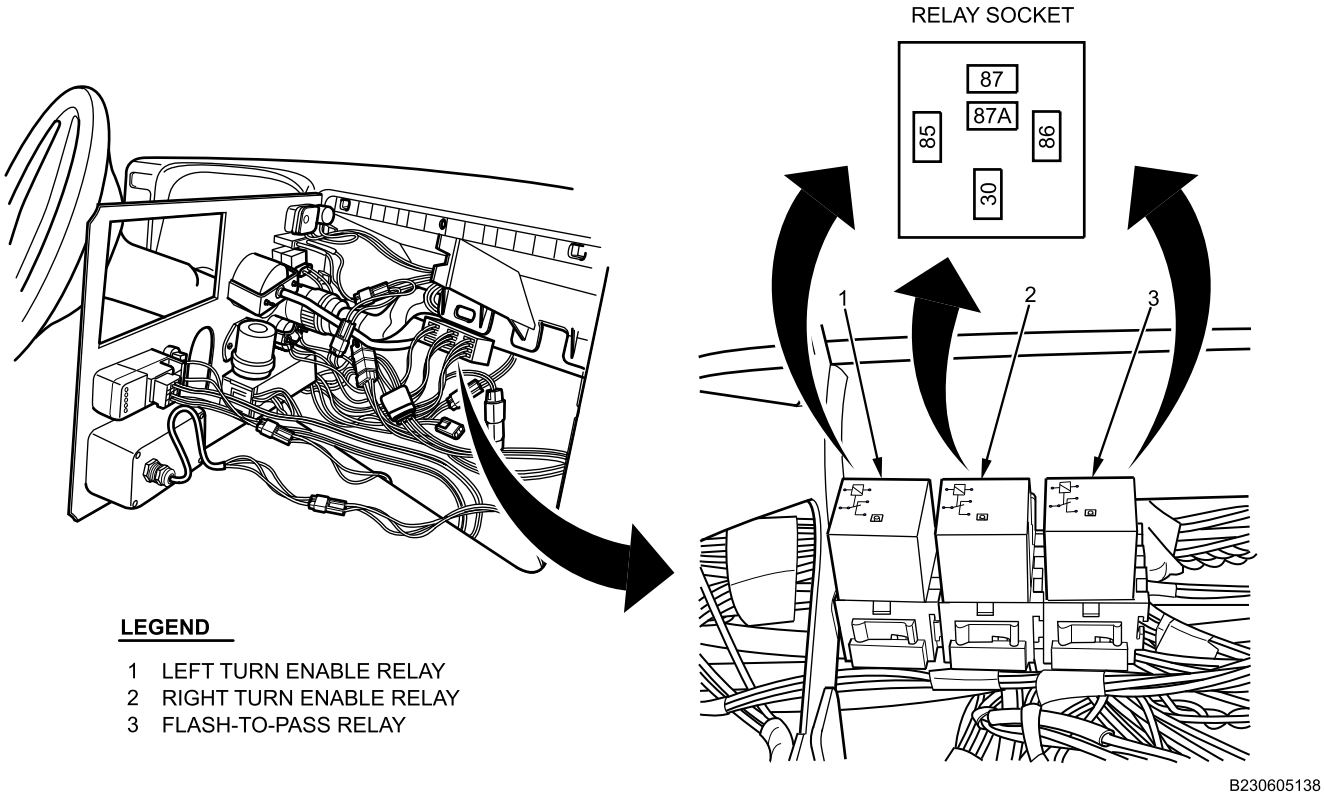


Figure 25. Under Center IP.

92. Remove STOPLIGHT RELAY LEFT from right side instrument panel. Refer to Figure 26. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

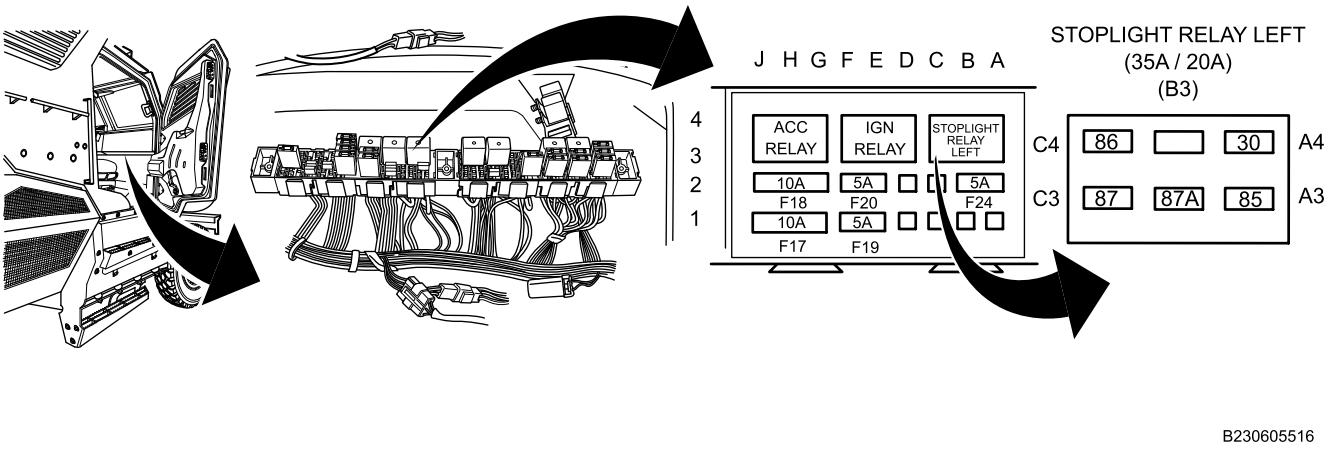


Figure 26. Right Side IP.

93. Remove STOPLIGHT RELAY RIGHT from right side instrument panel. Refer to Figure 27. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

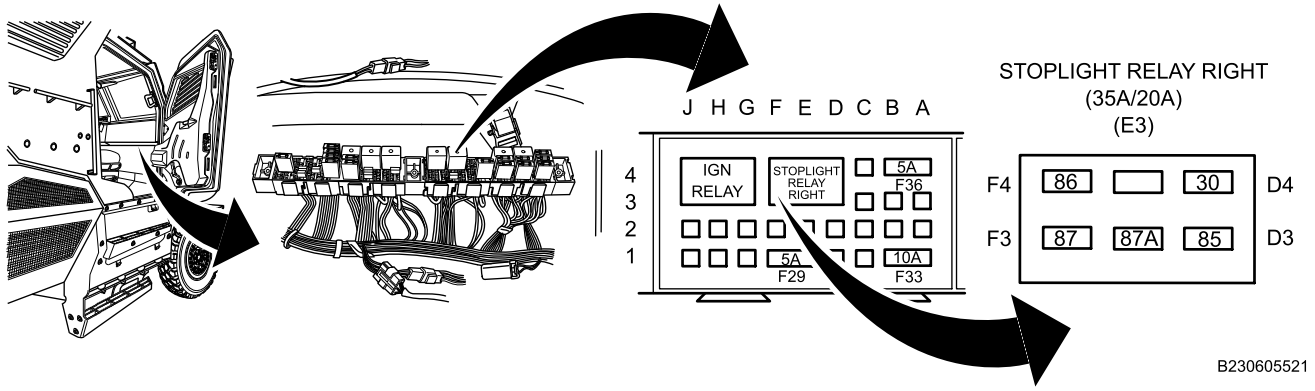


Figure 27. Right Side IP.

NOTE

Instrument panel cluster (IPC) does not need to be removed to access connector 1520. Illustration only shows IPC removed for clarity.

94. Disconnect connector 1520 from instrument panel cluster. Refer to Figure 28.

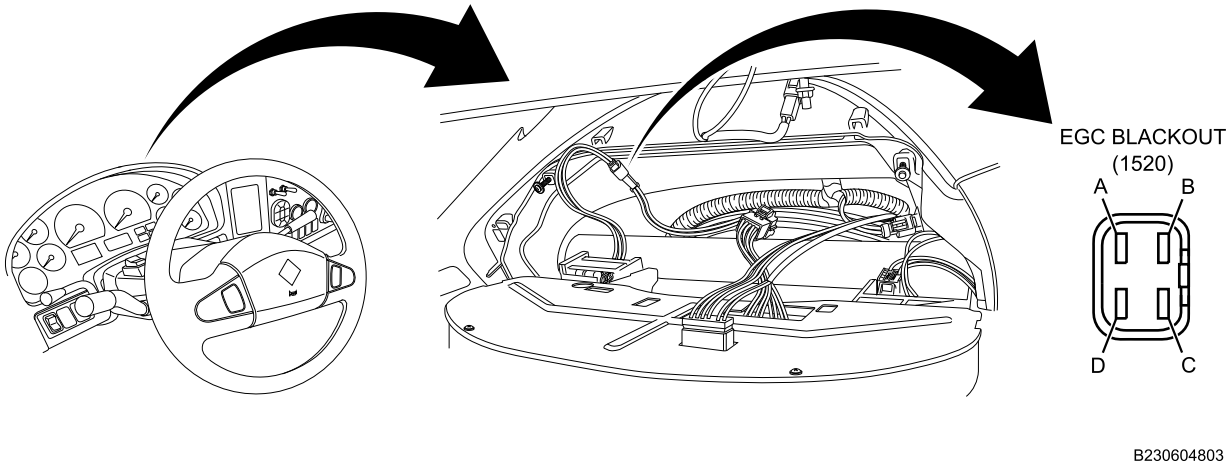


Figure 28. Lower IPC.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

95. Disconnect connector 1701. Refer to Figure 29.

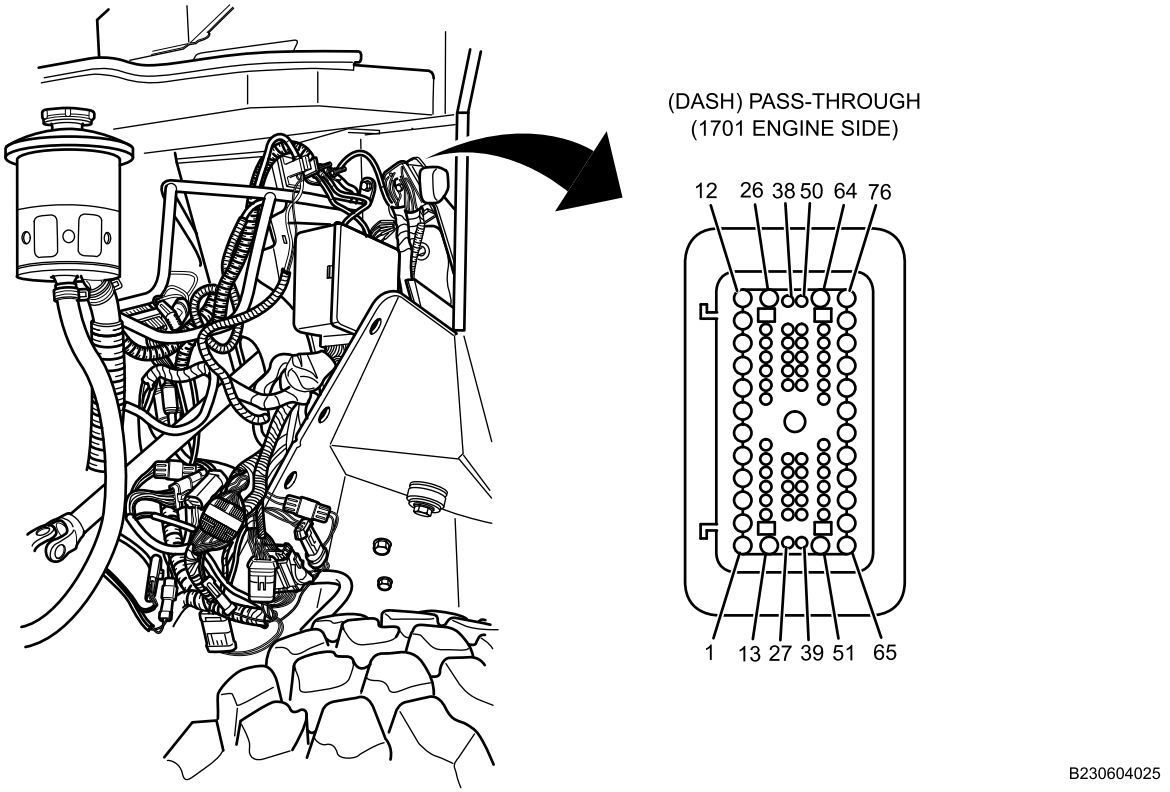


Figure 29. IP/Dash Pass-Through Connector in Engine Compartment.

96. Remove cap and metal bus bar from blackout mode splice pack connector 1050. Refer to Figure 30.

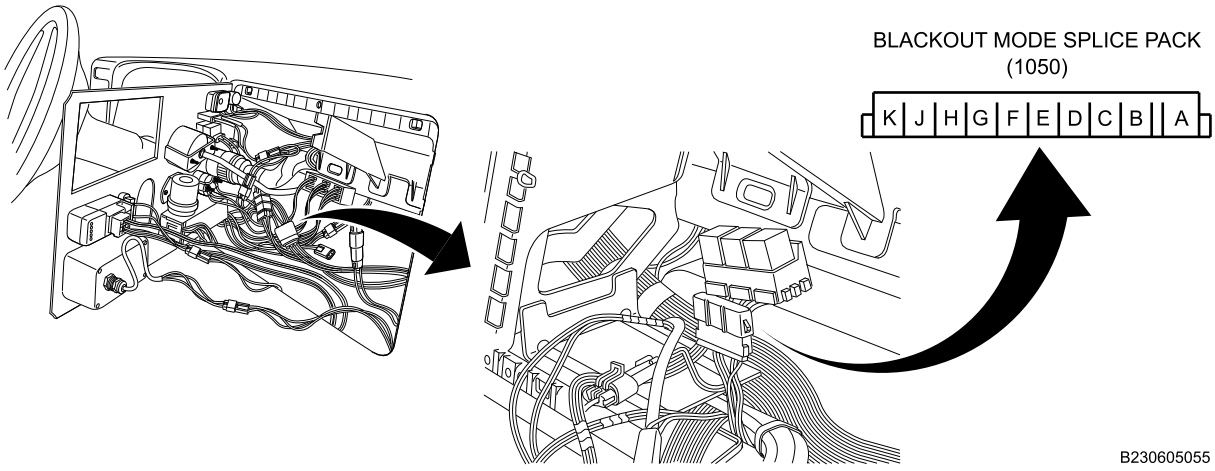


Figure 30. Under Center IP.

97. Measure resistance between connector 1050 terminals A, B, C, D, H, J and ground with multimeter. Refer to Figure 30.

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Go to Master Vehicle Light Switch (MVLS) Troubleshooting Procedures (WP 0092).
NO Go to Step 99.

MALFUNCTION

- 98. Steering column wiring harness is faulty.

ACTION

Replace steering column wiring harness. Refer to Steering Column Wiring Harness Removal and Installation (WP 0324). Return vehicle to service.

END OF TEST

MALFUNCTION

- 99. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel Wiring Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 100. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

TURN SIGNAL AND HAZARD SWITCH TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 101. Center instrument panel relay is faulty.

ACTION

Replace center instrument panel relay. Refer to Instrument Panel Center Relay Removal and Installation (WP 0318). Return vehicle to service.

END OF TEST

MALFUNCTION

- 102. Turn signal switch is faulty.

ACTION

Replace turn signal switch. Refer to Multifunction Turn Signal Switch Assembly Removal and Installation (WP 0323). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

TURN SIGNAL LIGHTS OPERATIONAL CHECKOUT PROCEDURE

INITIAL SETUP:

References
- TM 9-2355-106-10
- TM 9-2355-106-23P
- WP 0093
- WP 0094
- WP 0095
- WP 0782

Equipment Condition
- Parking brake set (TM 9-2355-106-10)
- Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
- Engine off (TM 9-2355-106-10)
- MAIN POWER switch off (TM 9-2355-106-10)
- Wheels chocked (TM 9-2355-106-10)

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Press SER. DRIVE on master vehicle light switch (MVLS) and then press ENTER within 5 seconds (TM 9-2355-106-10).
4. Activate left turn signal lights (TM 9-2355-106-10).
5. Observe left side turn signal lights.
6. Activate right turn signal lights (TM 9-2355-106-10).
7. Observe right side turn signal lights.
8. Activate hazard lights (TM 9-2355-106-10).
9. Observe all turn signal lights.

CONDITION/INDICATION

All hazard or turn signal lights are inoperative.

CORRECTIVE ACTION

TURN SIGNAL LIGHTS OPERATIONAL CHECKOUT PROCEDURE - (CONTINUED)

Go to Turn Signal and Hazard Switch Troubleshooting Procedure (WP 0095).

CONDITION/INDICATION

All front turn signal lights are inoperative.

CORRECTIVE ACTION

Go to Front Turn Signal Lights Troubleshooting Procedure (WP 0093).

CONDITION/INDICATION

Both rear turn signal lights are inoperative.

CORRECTIVE ACTION

Go to Rear Turn Signal Lights Troubleshooting Procedure (WP 0094).

CONDITION/INDICATION

All left side turn signal lights are inoperative.

CORRECTIVE ACTION

Go to Turn Signal and Hazard Switch Troubleshooting Procedure (WP 0095).

CONDITION/INDICATION

All right side turn signal lights are inoperative.

CORRECTIVE ACTION

Go to Turn Signal and Hazard Switch Troubleshooting Procedure (WP 0095).

CONDITION/INDICATION

Any or all left front turn signal lights are inoperative.

CORRECTIVE ACTION

Go to Front Turn Signal Lights Troubleshooting Procedure (WP 0093).

CONDITION/INDICATION

Any or all right front turn signal lights are inoperative.

CORRECTIVE ACTION

Go to Front Turn Signal Lights Troubleshooting Procedure (WP 0093).

CONDITION/INDICATION

Left rear turn signal light is inoperative.

CORRECTIVE ACTION

Go to Rear Turn Signal Lights Troubleshooting Procedure (WP 0094).

CONDITION/INDICATION

Right rear turn signal light is inoperative.

CORRECTIVE ACTION

Go to Rear Turn Signal Lights Troubleshooting Procedure (WP 0094).

END OF WORK PACKAGE

FIELD MAINTENANCE

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0092
WP 0297
WP 0319
WP 0335
WP 0323
WP 0324
WP 0353
WP 0374
WP 0375
WP 0376
WP 0378
WP 0379
WP 0424
WP 0565
WP 0581
WP 0597
WP 0655
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
WP 0789, Figure 52
WP 0789, Figure 51

DIAGNOSTIC TROUBLE CODES AND SYMPTOMS.

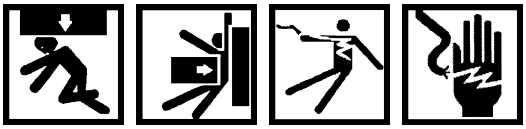
This procedure covers the following symptoms:

- Low-beam driving lights are inoperative.
- High-beam driving lights are inoperative.
- Both low- and high-beam driving lights are inoperative.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Press SER. DRIVE on Master Vehicle Light Switch (MVLS) and then press ENTER within 5 seconds (TM 9-2355-106-10).
4. Activate low- and high-beam driving lights while observing driving lights (TM 9-2355-106-10).

CONDITION/INDICATION

Are both low- and high-beam driving lights inoperative?

DECISION

YES Go to Step 9.
NO Go to next step.

STEP

5. Activate low-beam driving lights (TM 9-2355-106-10).

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

6. Observe service driving lights.

CONDITION/INDICATION

Are both low-beam driving lights illuminated?

DECISION

NO Go to Step 39.
YES Go to next step.

STEP

7. Activate high-beam driving lights (TM 9-2355-106-10).
8. Observe service driving lights.

CONDITION/INDICATION

Are both high-beam driving lights illuminated?

DECISION

NO Go to Step 77.
YES Service lights are operating normally. Return vehicle to service.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

9. Remove headlights. Refer to Headlight Assembly Removal and Installation (WP 0376).
10. Disconnect either headlight connector LAM1048 or LAM1049 (LAM1048 shown). Refer to Figure 1.

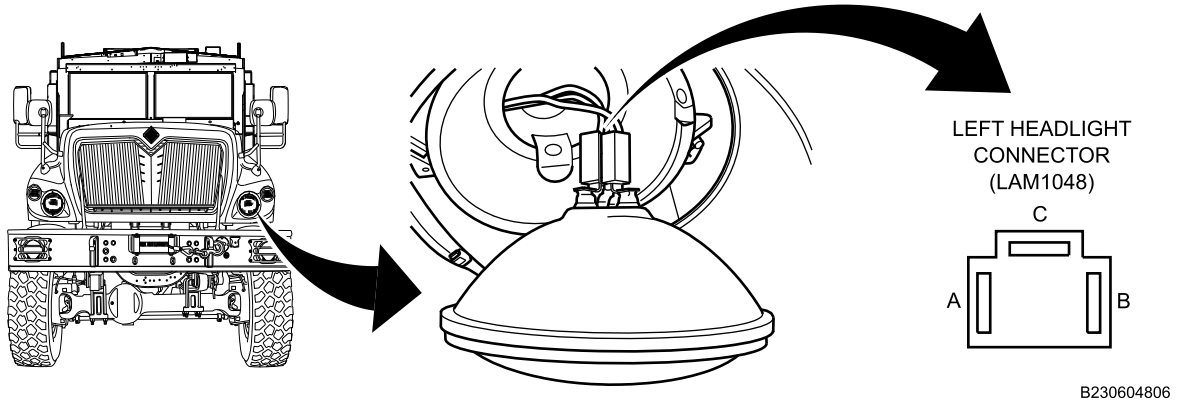


Figure 1. Headlight Connector.

11. Measure resistance between connector LAM1048 or LAM1049 terminal B and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 29.
YES Go to next step.

STEP

12. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
13. Turn MAIN POWER switch ON (TM 9-2355-106-10).
14. Turn ignition switch ON (TM 9-2355-106-10).
15. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).

CONDITION/INDICATION

Is Electronic System Controller (ESC) receiving service lamps input?

DECISION

YES Go to Step 32.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

16. Remove instrument panel cluster. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).
17. Disconnect IPC blackout harness connector 1520. Refer to Figure 2.

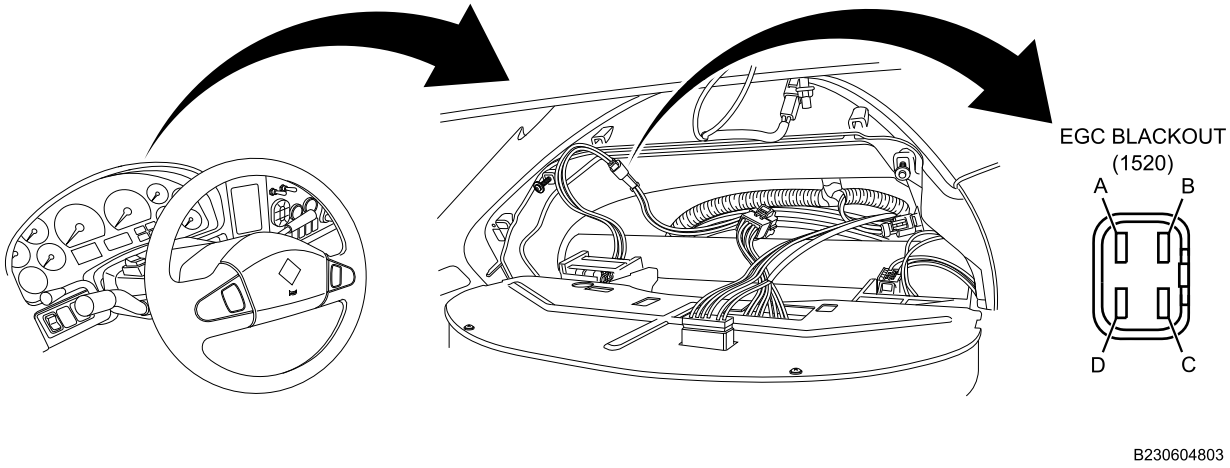


Figure 2. Blackout Harness Connector Behind IPC.

18. Turn MAIN POWER switch ON (TM 9-2355-106-10).
19. Turn ignition switch ON (TM 9-2355-106-10).
20. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
21. Measure DC voltage between connector 1520 terminal A and ground. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 137.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Turn ignition switch OFF (TM 9-2355-106-10).
23. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
24. Remove IP center trim panel. Refer to Instrument Panel (IP) Center Trim Panel Removal and Installation (WP 0581).
25. Disconnect MVLS connector 1954. Refer to Figure 3.

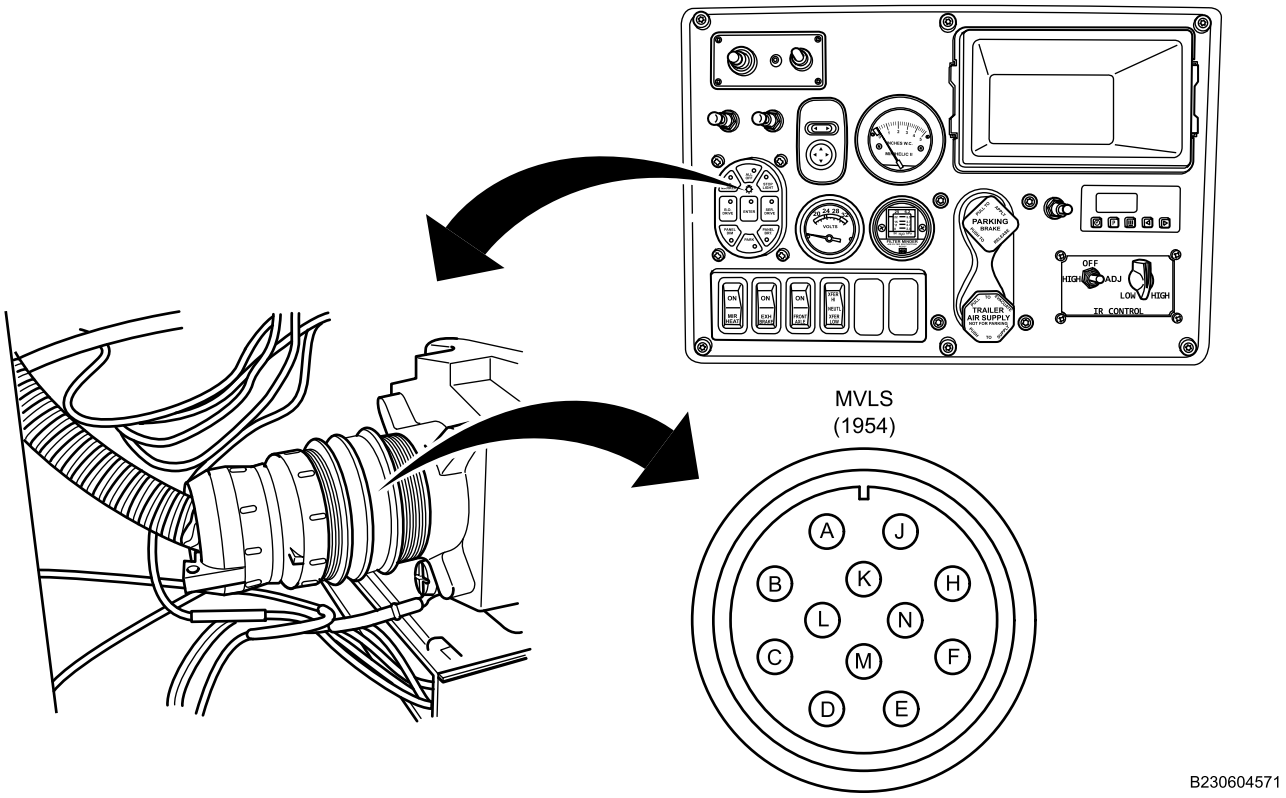


Figure 3. MVLS Connector in IP Center.

26. Measure resistance between connector 1520 terminal A and ground with multimeter. Refer to Figure 4.

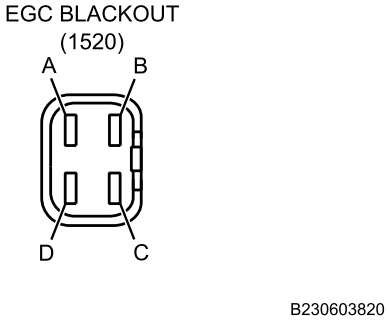


Figure 4. Connector 1520.

CONDITION/INDICATION

Does multimeter read OL?

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 135.
YES Go to next step.

STEP

27. Measure resistance between connector 1520 terminal A and connector 1954 terminal M with multimeter. Refer to Figure 4 and Figure 5.

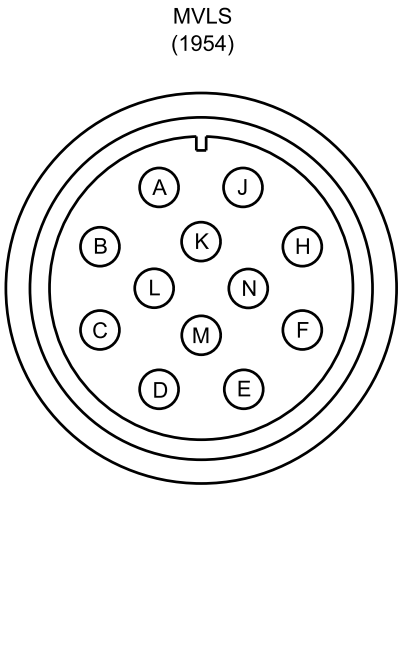


Figure 5. Connector 1954.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 135.
NO Go to next step.

STEP

28. Measure resistance between connector 1954 terminal M and all other connector 1954 terminals with multimeter. Multimeter should read OL for each test. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 135.
YES Go to Master Vehicle Light Switch (MVLS) Troubleshooting Procedures (WP 0092).

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

29. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
30. Disconnect dash/forward chassis harness connector 4301/4300. Refer to Figure 6.

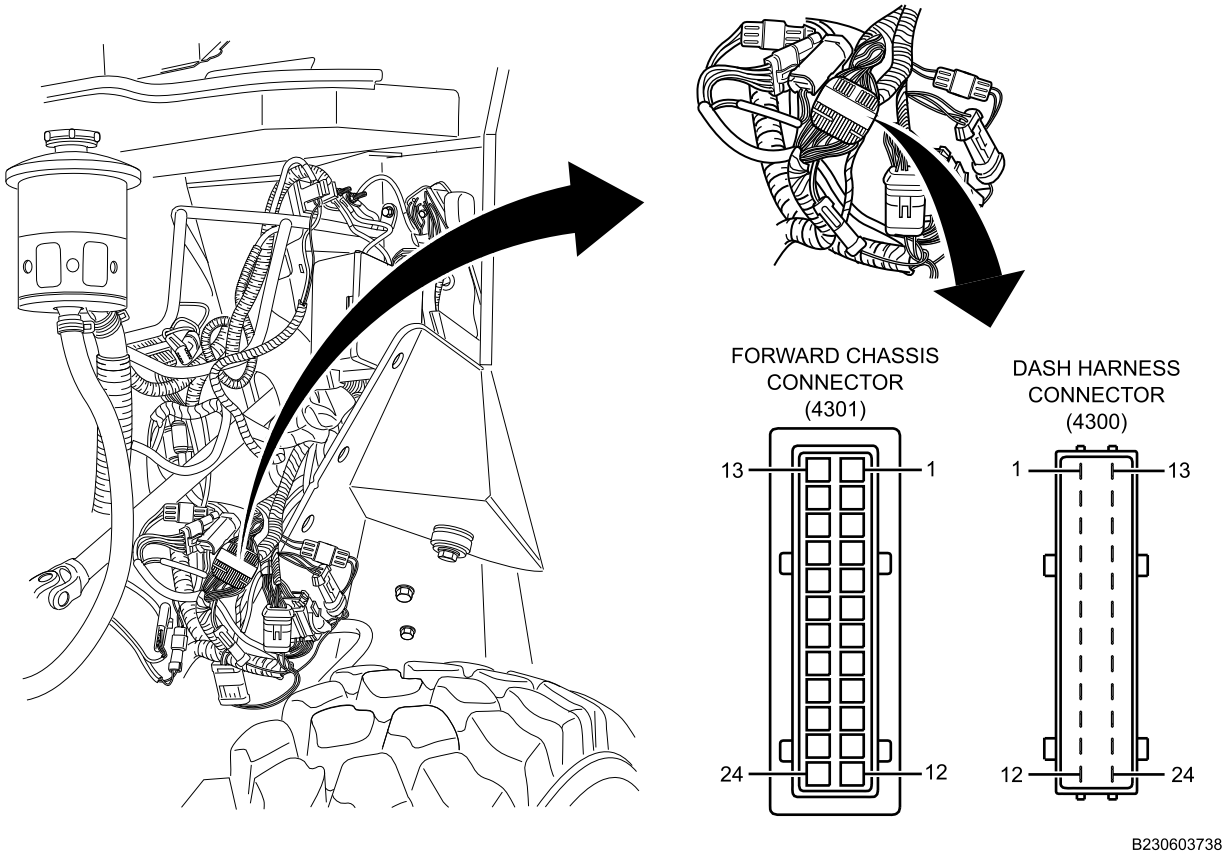


Figure 6. Dash/Forward Chassis Harness Connector Left Side Engine Compartment.

31. Measure resistance between connector 4300 terminal 13 and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 139.
NO Go to Step 138.

STEP

32. Press SER.DRIVE on MVLS switch and then press ENTER within 5 seconds.

CONDITION/INDICATION

Is ESC activating service lamps output?

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 137.
YES Go to next step.

STEP

33. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
34. Disconnect dash/forward chassis harness connector 4301/4300. Refer to Figure 6.
35. Turn MAIN POWER switch ON (TM 9-2355-106-10).
36. Turn ignition switch ON (TM 9-2355-106-10).
37. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
38. Measure DC voltage between connector 4300 terminals 4 and 5 and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 139.
NO Go to Step 138.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

39. Remove headlight. Refer to Headlight Assembly Removal and Installation (WP 0376).
40. Disconnect inoperative headlight connector LAM1048 or LAM 1049 (LAM1048 shown). Refer to Figure 7.

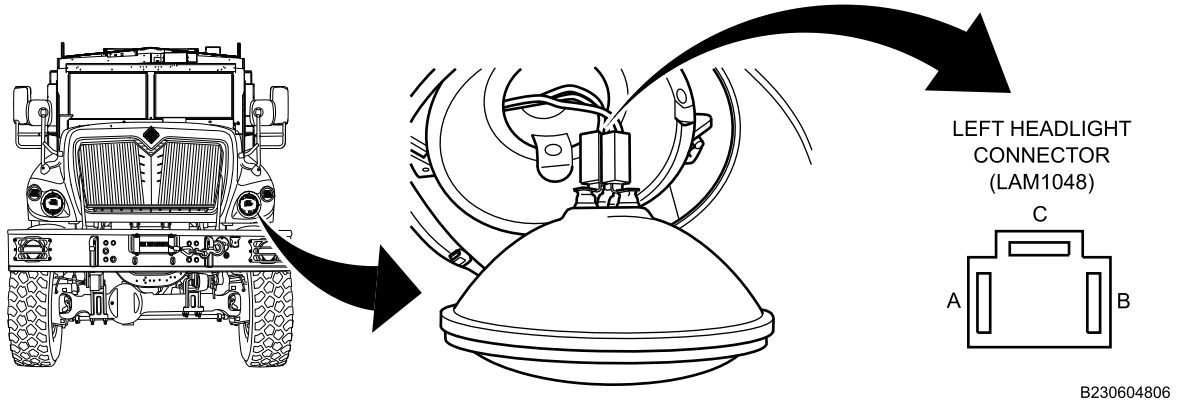


Figure 7. Left Headlight Connector.

41. Turn MAIN POWER switch ON (TM 9-2355-106-10).
42. Turn ignition switch ON (TM 9-2355-106-10).
43. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
44. Measure DC voltage between connector LAM1048 or LAM1049 terminal C and terminal B with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 134.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

45. Turn ignition switch OFF (TM 9-2355-106-10).
46. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
47. Disconnect inoperative headlight harness connector LAM1046 or LAM 1047 (LAM1046 shown). Refer to Figure 8.

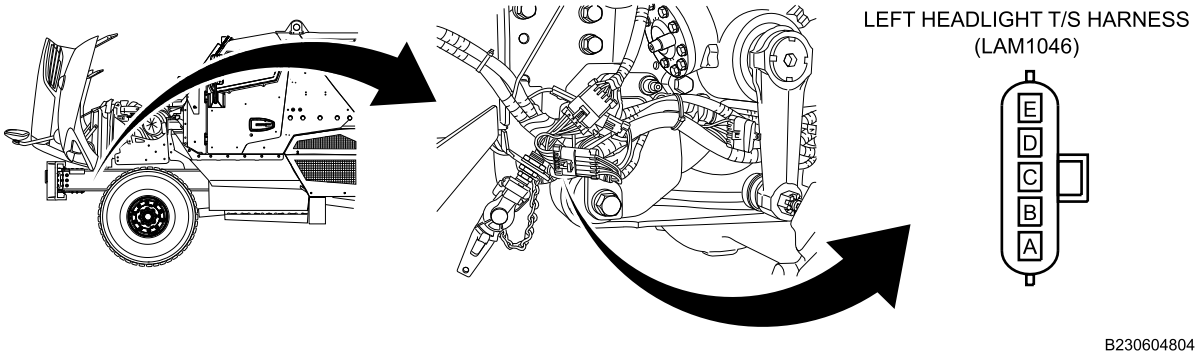


Figure 8. Left Headlight Harness Connector Near Front Spring Shackle.

48. Turn MAIN POWER switch ON (TM 9-2355-106-10).
49. Turn ignition switch ON (TM 9-2355-106-10).
50. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
51. Measure DC voltage between LAM1046 or LAM1047 terminal C and terminal B with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 141.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

52. Turn ignition switch OFF (TM 9-2355-106-10).
53. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
54. Disconnect inoperative headlight forward chassis harness connector LAM1101 or LAM1107 (LAM1101 shown). Refer to Figure 9.

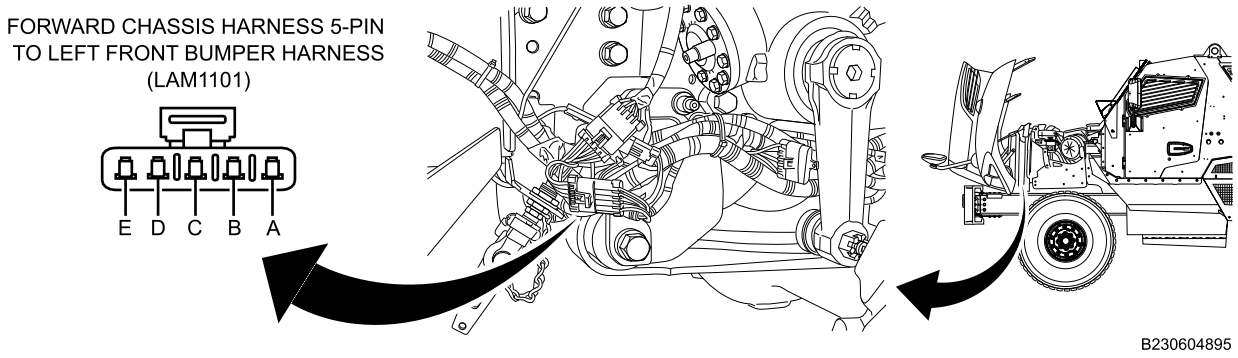


Figure 9. Left Forward Chassis Harness Connector Near Front Spring Shackle.

55. Turn MAIN POWER switch ON (TM 9-2355-106-10).
56. Turn ignition switch ON (TM 9-2355-106-10).
57. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
58. Measure DC voltage between LAM1101 or LAM1107 terminal C and terminal B with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 140.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

59. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
60. Disconnect dash/forward chassis harness connector 4301/4300. Refer to Figure 10.

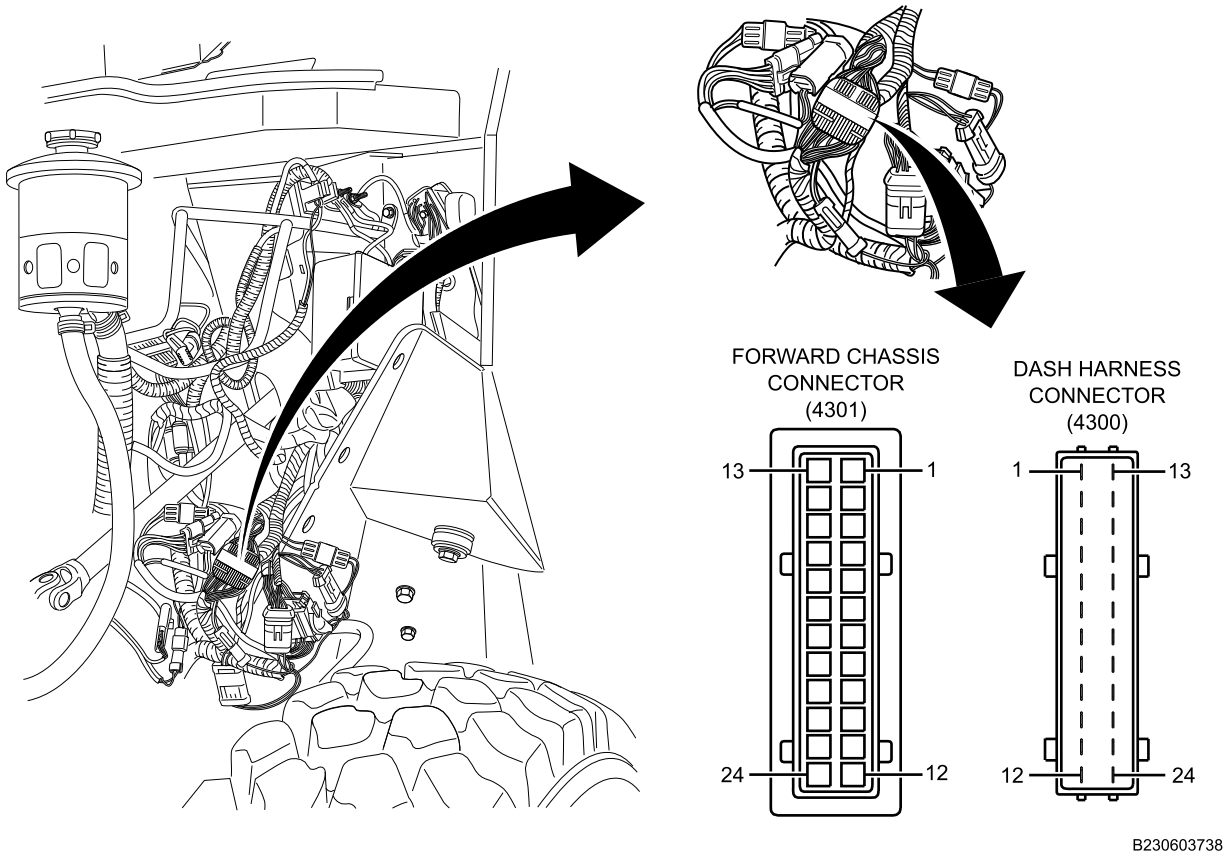


Figure 10. Dash/Forward Chassis Connector Left Side Engine Compartment.

61. Turn MAIN POWER switch ON (TM 9-2355-106-10).
62. Turn ignition switch ON (TM 9-2355-106-10).
63. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
64. Measure DC voltage between connector 4300 terminal 5 and terminal 13 with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 139.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

65. Turn ignition switch OFF (TM 9-2355-106-10).
66. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
67. Disconnect ESC connector 4007. Refer to Figure 11.

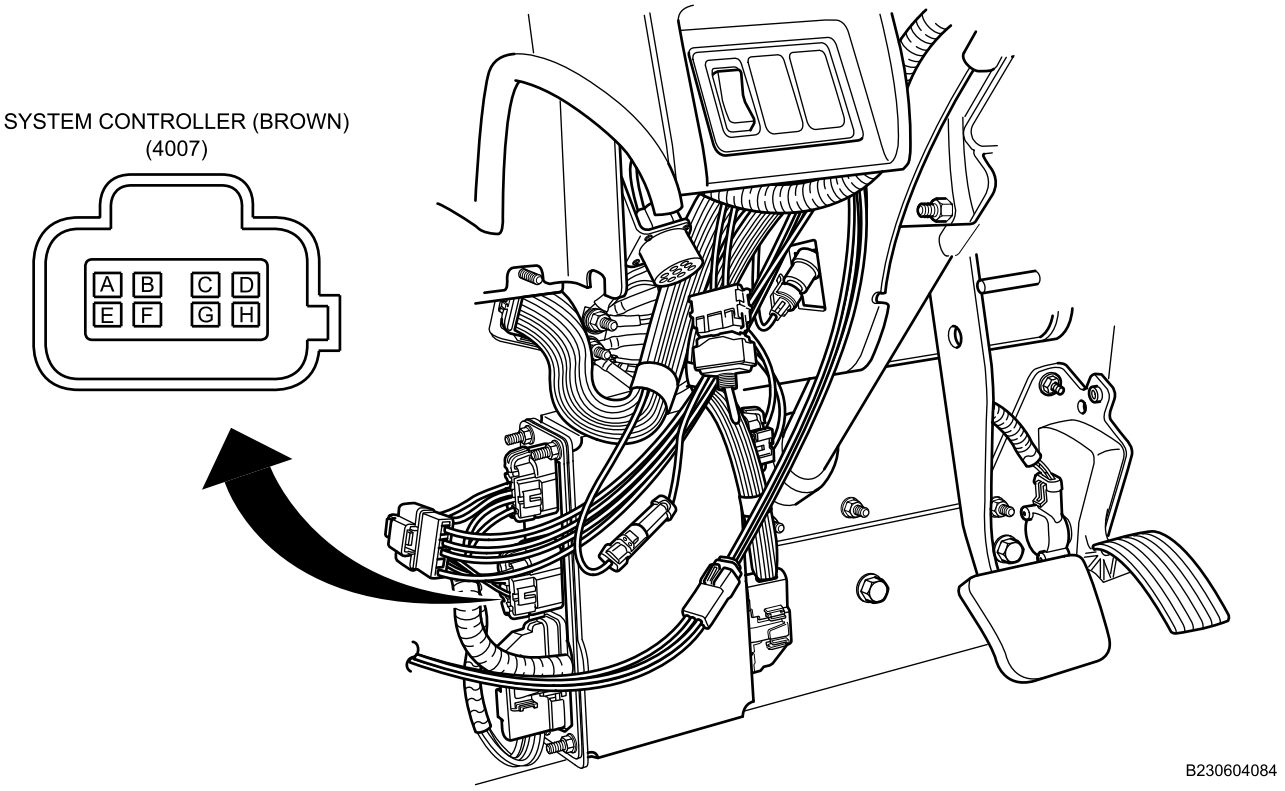


Figure 11. Electronic System Controller (ESC) Connector Under Left Side IP.

68. Measure resistance between connector 4300 terminal 13 and ground with multimeter. Refer to Figure 12.

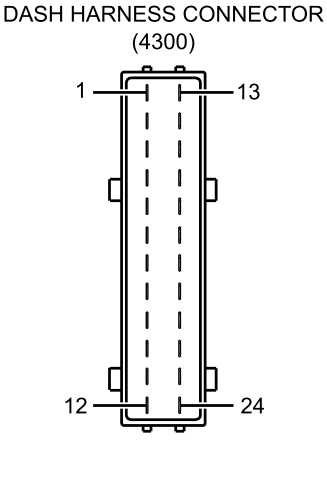


Figure 12. Connector 4300.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 139.
YES Go to next step.

STEP

69. Measure resistance between connector 4300 terminal 5 and ground with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 138.
YES Go to next step.

STEP

70. Measure resistance between connector 4300 terminal 5 and connector 4007 terminal D with multimeter. Refer to Figure 11 and Figure 12.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 138.
YES Go to next step.

STEP

71. Measure resistance between connector 4007 terminal D and all other terminals in connector 4007 with multimeter. Multimeter should read OL for each test. Refer to Figure 13.

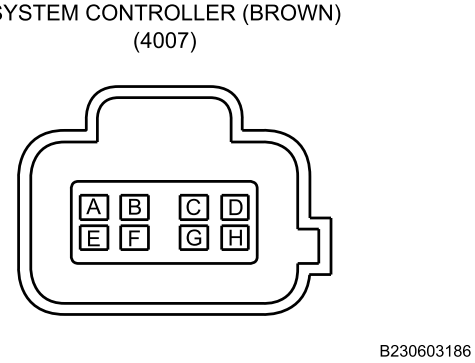


Figure 13. Connector 4007.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 138.
YES Go to next step.

STEP

72. Connect connector 4007.
73. Connect Maintenance Support Device (MSD). Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
74. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
75. Toggle turn signal switch between high- and low-beam headlights while observing MSD.
76. Verify ESC receives high- and low-beam headlight request from turn signal switch with MSD.

CONDITION/INDICATION

Does ESC receive low headlight request?

DECISION

YES Go to Step 137.
NO Go to Master Vehicle Light Switch (MVLS) Troubleshooting Procedures (WP 0092).

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

77. Remove left headlight. Refer to Headlight Assembly Removal and Installation (WP 0376).
78. Disconnect inoperative headlight connector LAM1048 or LAM1049 (LAM1048 shown). Refer to Figure 14.

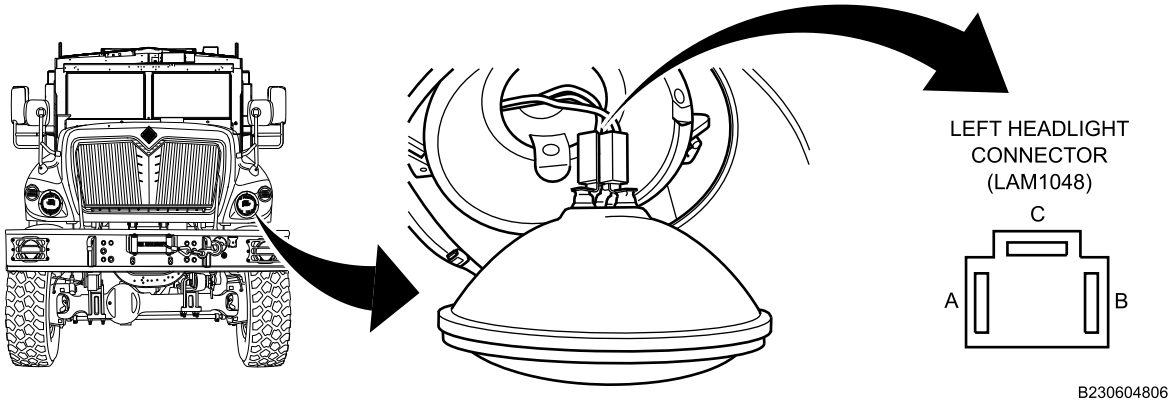


Figure 14. Left Headlight Connector.

79. Turn MAIN POWER switch ON (TM 9-2355-106-10).
80. Turn ignition switch ON (TM 9-2355-106-10).
81. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
82. Measure DC voltage between connector LAM1048 or LAM1049 terminal A and terminal B with multimeter. Refer to Figure 14.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 134.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

83. Turn ignition switch OFF (TM 9-2355-106-10).
84. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
85. Disconnect inoperative headlight harness connector LAM1046 or LAM1047 (LAM1046 shown). Refer to Figure 15.

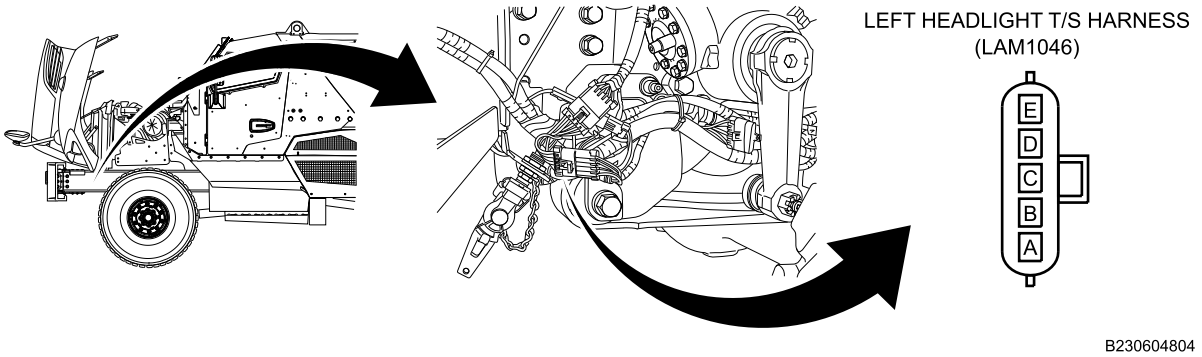


Figure 15. Left Headlight Harness Connector Near Front Spring Shackle.

86. Turn MAIN POWER switch ON (TM 9-2355-106-10).
87. Turn ignition switch ON (TM 9-2355-106-10).
88. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
89. Measure DC voltage between LAM1046 or LAM1047 terminal C and terminal A with multimeter. Refer to Figure 15.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 141.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

90. Turn ignition switch OFF (TM 9-2355-106-10).
91. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
92. Disconnect inoperative headlight forward chassis harness connector LAM1101 or LAM1107 (LAM1101 shown). Refer to Figure 16.

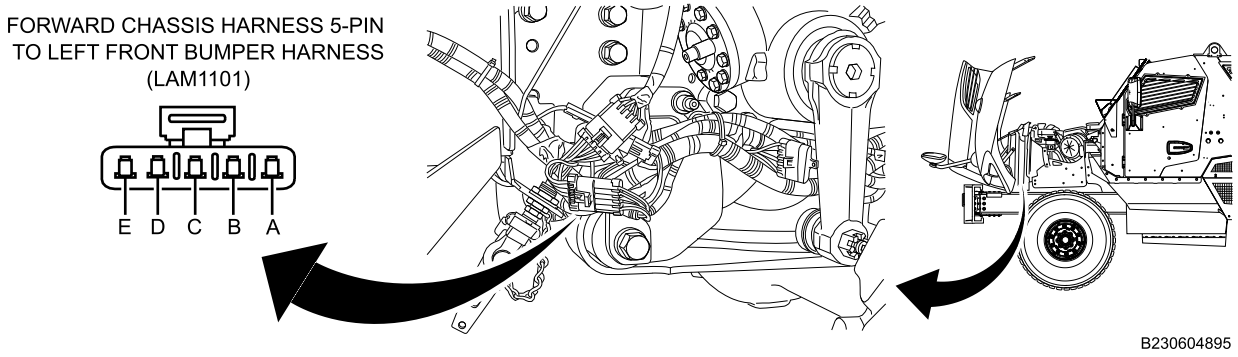


Figure 16. Left Forward Chassis Harness Connector Near Front Spring Shackle.

93. Turn MAIN POWER switch ON (TM 9-2355-106-10).
94. Turn ignition switch ON (TM 9-2355-106-10).
95. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
96. Measure DC voltage between LAM1101 or LAM1107 terminal C and terminal A with multimeter. Refer to Figure 16.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 140.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

97. Remove left side engine armor. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
98. Disconnect dash/forward chassis harness connector 4301/4300. Refer to Figure 17.

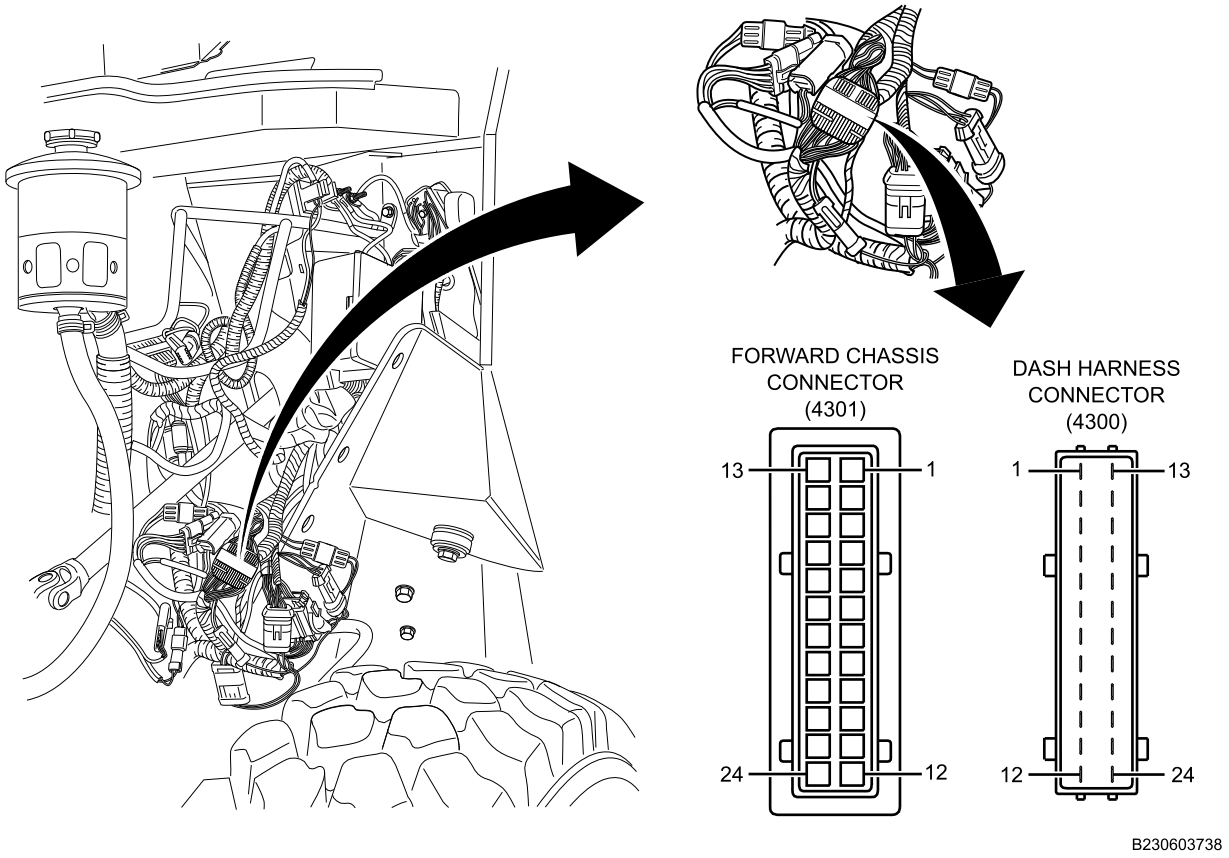


Figure 17. Dash/Forward Chassis Connector Left Side Engine Compartment.

99. Turn MAIN POWER switch ON (TM 9-2355-106-10).
100. Turn ignition switch ON (TM 9-2355-106-10).
101. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
102. Measure DC voltage between connector 4300 terminal 4 and terminal 13 with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 139.
NO Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

103. Turn ignition switch OFF (TM 9-2355-106-10).
104. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
105. Disconnect ESC connector 4007. Refer to Figure 18.

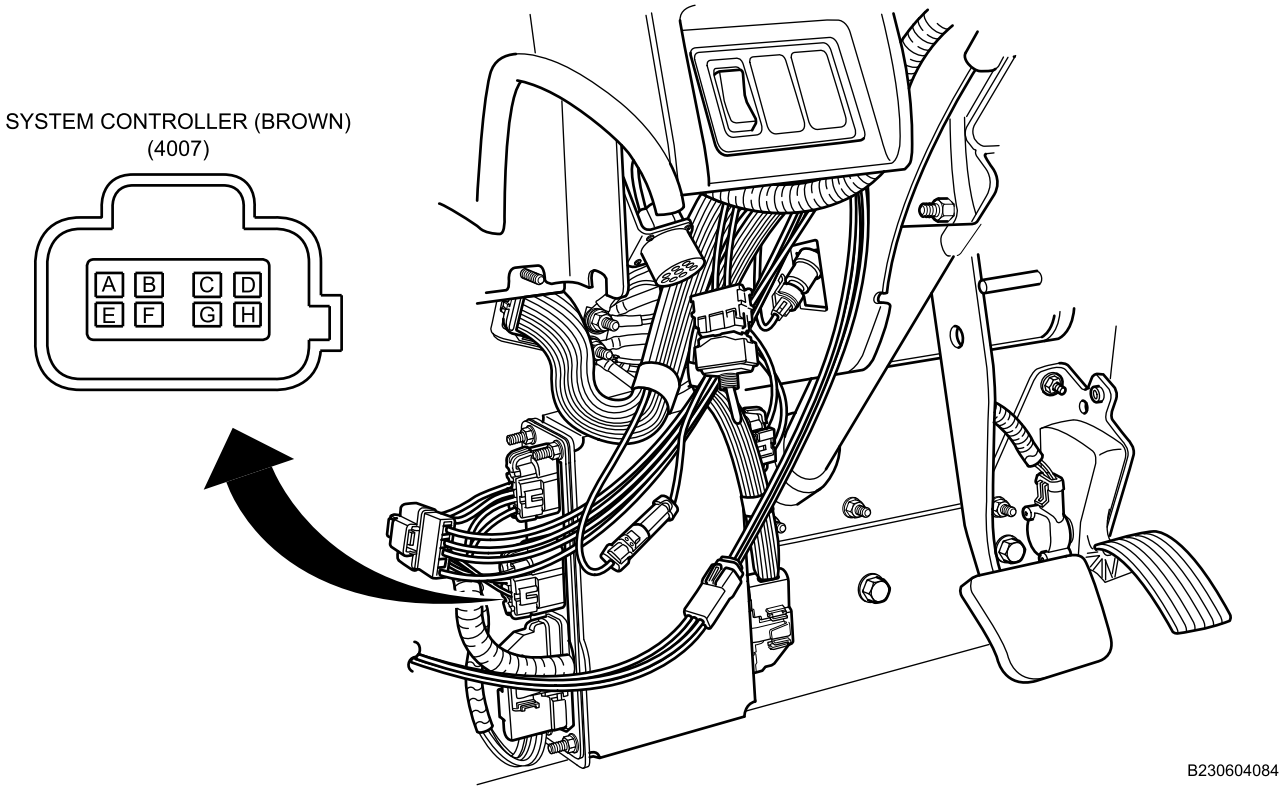


Figure 18. ESC Connector Under Left IP.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

106. Measure resistance between connector 4300 terminal 13 and ground with multimeter. Refer to Figure 19.

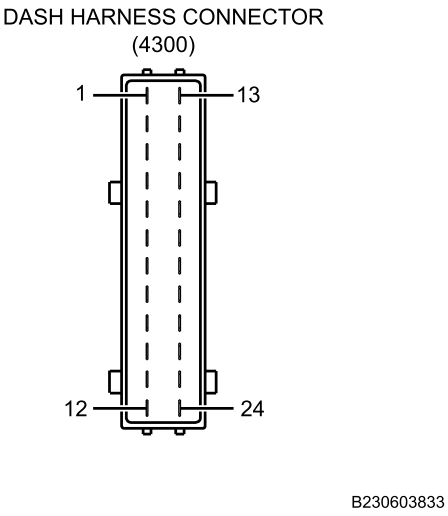


Figure 19. Connector 4300.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 139.
YES Go to next step.

STEP

107. Measure resistance between connector 4300 terminal 4 and ground with multimeter. Refer to Figure 19.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 138.
YES Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

108. Measure resistance between connector 4300 terminal 4 and connector 4007 terminal G with multimeter. Refer to Figure 19 and Figure 20.

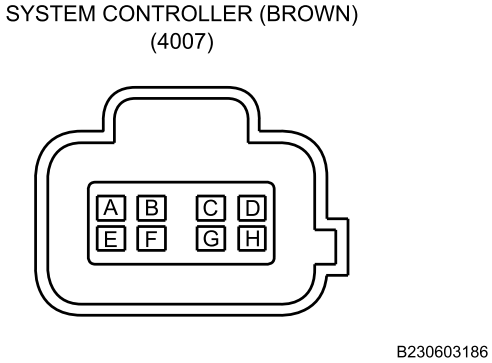


Figure 20. Connector 4007.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 138.
YES Go to next step.

STEP

109. Measure resistance between connector 4007 terminal G and all other terminals in connector 4007 with multimeter. Refer to Figure 20. Multimeter should read OL for each test.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 138.
YES Go to next step.

STEP

110. Connect connector 4007.
111. Connect Maintenance Support Device (MSD). Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
112. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
113. Toggle turn signal switch between high- and low-beam headlights while observing MSD.
114. Verify ESC receives high- and low-beam headlight request from turn signal switch with MSD.

CONDITION/INDICATION

Does ESC receive low-beam headlight request?

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 137.
NO Go to next step.

STEP

115. Remove steering column covers. Refer to Steering Column Covers Removal and Installation (WP 0565).
116. Disconnect turn signal switch connector 1810. Refer to Figure 21.

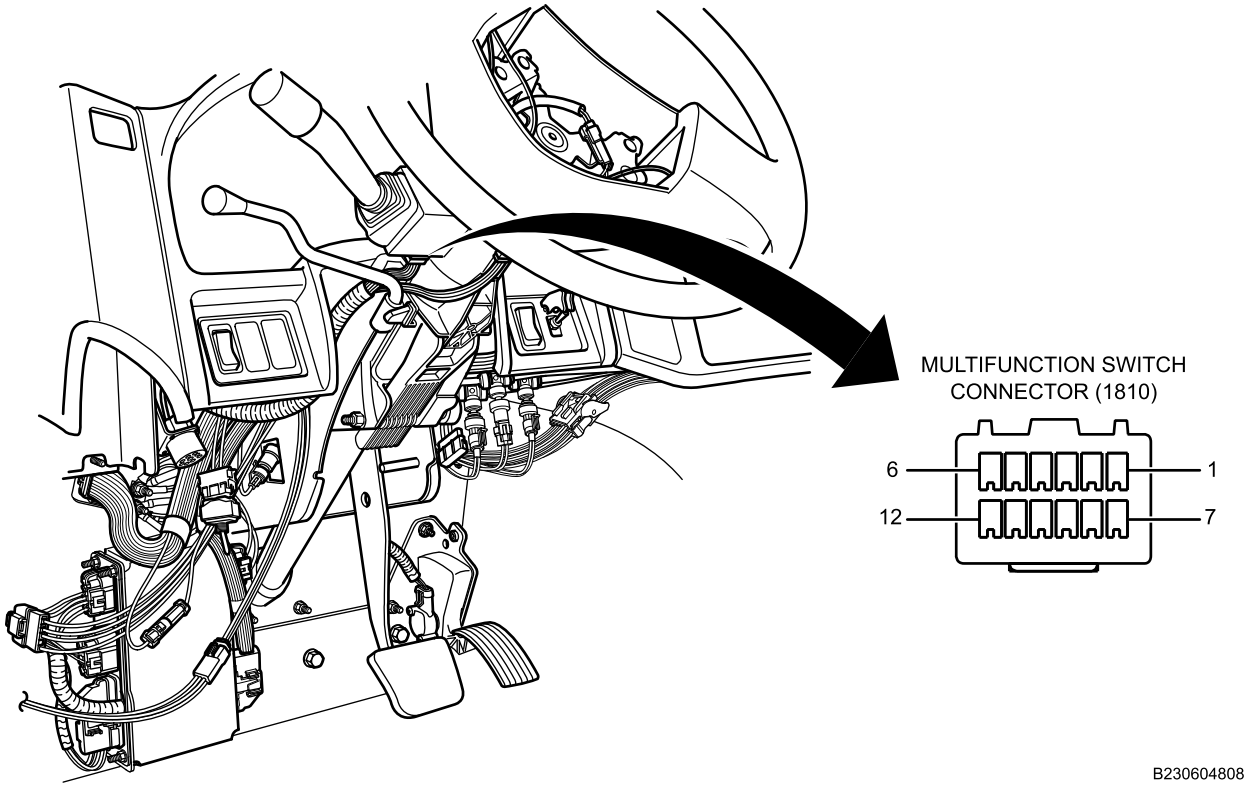


Figure 21. Turn Signal Switch Connector at Left Side of Steering Column.

117. Turn MAIN POWER switch ON (TM 9-2355-106-10).
118. Turn ignition switch ON (TM 9-2355-106-10).
119. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
120. Measure DC voltage between connector 1810 terminals 3 and 7 with multimeter. Refer to Figure 21.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 142.
NO Go to next step.

STEP

121. Turn ignition switch OFF (TM 9-2355-106-10).
122. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
123. Disconnect steering column harness connector 1800/1805. Refer to Figure 22.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

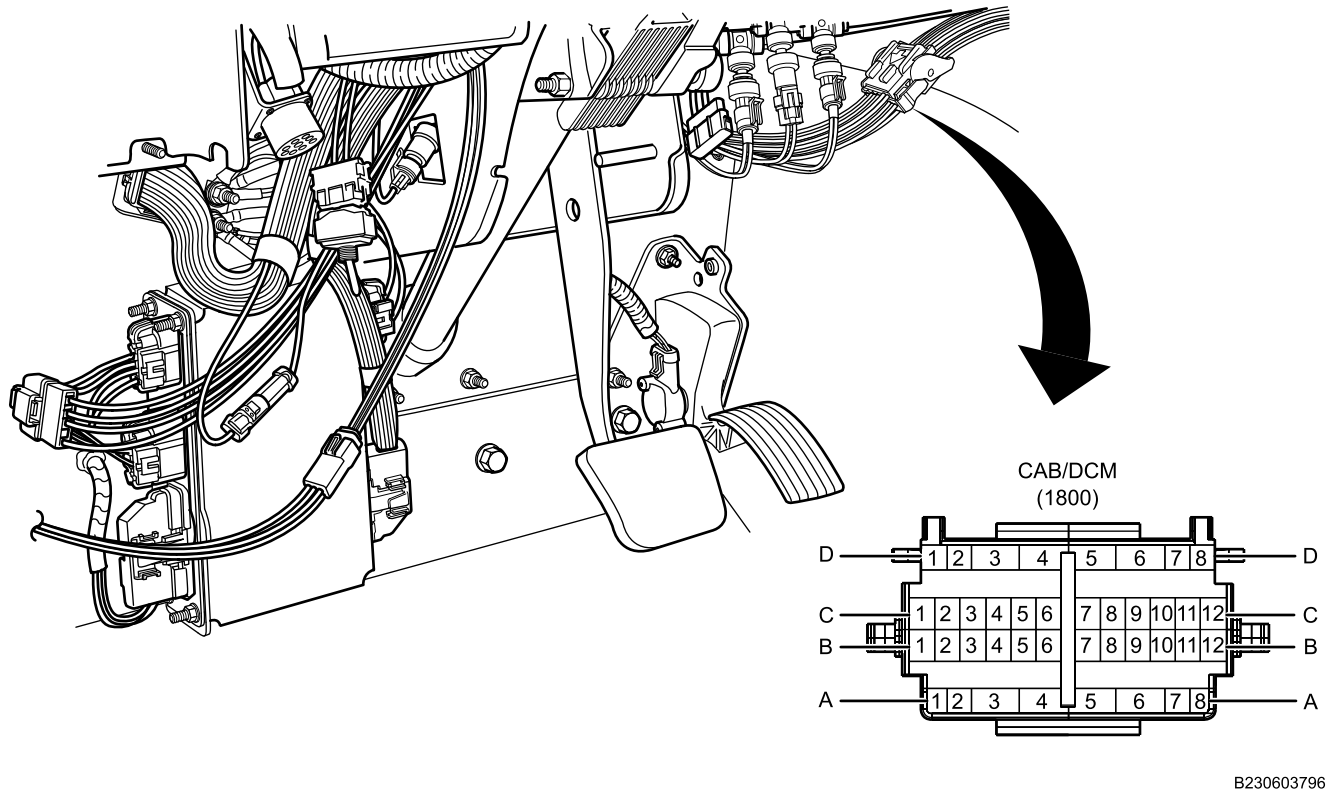


Figure 22. Steering Column Harness Connector Under Center IP.

124. Turn MAIN POWER switch ON (TM 9-2355-106-10).
125. Turn ignition switch ON (TM 9-2355-106-10).
126. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
127. Measure DC voltage between connector 1800 terminal A7 and A4 with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 136.
NO Go to next step.

STEP

128. Turn ignition switch OFF (TM 9-2355-106-10).
129. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
130. Disconnect ESC connector 1600. Refer to Figure 23.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

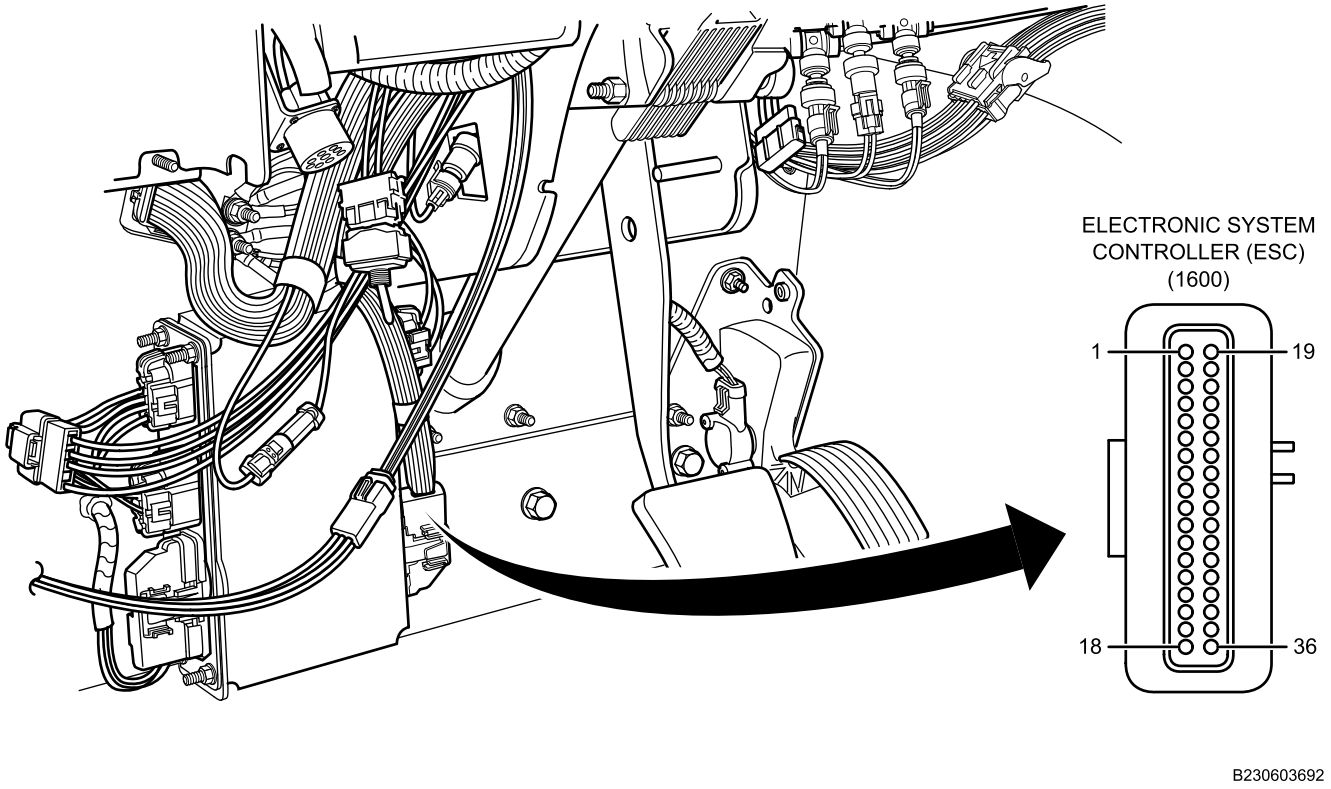


Figure 23. ESC Connector Under Left Side IP.

131. Measure resistance between connector 1800 terminal A4 and connector 1600 terminal 3 with multimeter. Refer to Figure 24.

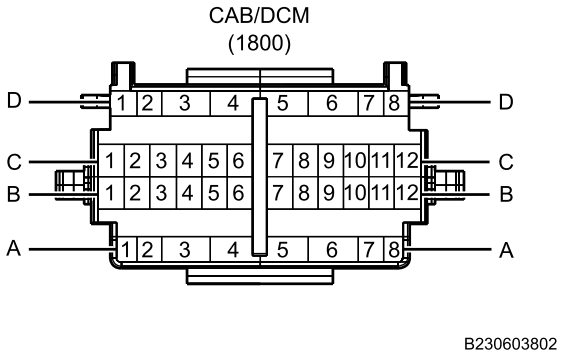


Figure 24. Connector 1800.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 135.
YES Go to next step.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

132. Measure resistance between connector 1800 terminal A7 and ground with multimeter. Refer to Figure 24.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 135.
YES Go to next step.

STEP

133. Measure resistance between connector 1800 terminal A7 and connector 1600 terminal 20 with multimeter. Refer to Figure 25.

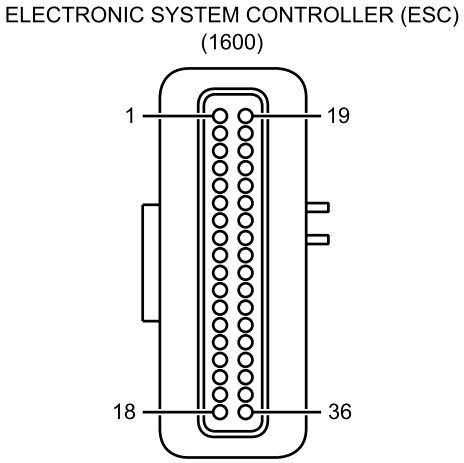


Figure 25. Connector 1600.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 135.
YES Go to Step 137.

MALFUNCTION

- 134. Headlamp is faulty.

ACTION

Replace headlamp. Refer to Headlamp Removal and Installation (WP 0655). Return vehicle to service.

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 135. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel Wiring Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 136. Steering column wiring harness is faulty.

ACTION

Replace steering column wiring harness. Refer to Steering Column Wiring Harness Removal and Installation (WP 0324). Return vehicle to service.

END OF TEST

MALFUNCTION

- 137. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller Removal and Installation (WP 0353). Return vehicle to service.

END OF TEST

MALFUNCTION

- 138. Dash harness is faulty.

ACTION

Replace dash harness. Refer to Dash Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

SERVICE DRIVING LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 139. Forward chassis harness is faulty.

ACTION

Replace forward chassis harness. Refer to Forward Chassis Harness Removal and Installation (WP 0424). Return vehicle to service.

END OF TEST

MALFUNCTION

- 140. Front bumper harness is faulty.

ACTION

Replace front bumper harness. Refer to Front Bumper Left Harness Removal and Installation (WP 0375) or Front Bumper Right Harness Removal and Installation (WP 0374). Return vehicle to service.

END OF TEST

MALFUNCTION

- 141. Headlight and turn signal harness is faulty.

ACTION

Replace headlight and turn signal harness. Refer to Left Headlight and Turn Signal Harness Removal and Installation (WP 0378). Refer to Right Headlight and Turn Signal Harness Removal and Installation (WP 0379). Return vehicle to service.

END OF TEST

MALFUNCTION

- 142. Turn signal switch is faulty.

ACTION

Replace turn signal switch. Refer to Multifunction Turn Signal Switch Removal and Installation (WP 0323). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0059
WP 0092
WP 0257
WP 0303
WP 0297
WP 0333
WP 0335
WP 0323
WP 0324
WP 0353
WP 0372
WP 0361
WP 0383
WP 0384
WP 0373
WP 0374
WP 0375
WP 0378
WP 0379
WP 0367
WP 0385
WP 0386
WP 0369
WP 0370
WP 0387
WP 0441
WP 0442
WP 0424
WP 0426
WP 0427
WP 0517
WP 0580
WP 0597
WP 0598
WP 0782

Equipment Condition
Vehicle parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
(WP 0789, Figure 58)
(WP 0789, Figure 59)
(WP 0789, Figure 60)
(WP 0789, Figure 14)

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Enable lights by pressing SER. DRIVE on Master Vehicle Light Switch (MVLS) and then press ENTER within 5 seconds (TM 9-2355-106-10).

CONDITION/INDICATION

Is one fender marker/turn signal light inoperative?

DECISION

YES Go to Step 18.
NO Go to next step.

STEP

4. Observe marker/turn signal lights next to front headlights.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Is one marker/turn signal light next to front headlight inoperative?

DECISION

YES Go to Step 32.
NO Go to next step.

STEP

5. Observe marker/turn signal lights next to front headlights and fender marker/turn signal light.

CONDITION/INDICATION

Are marker/turn signal light next to front headlight, and fender marker/turn signal light on one side, inoperative?

DECISION

YES Go to Step 37.
NO Go to next step.

STEP

6. Observe front bumper marker/turn signal lights.

CONDITION/INDICATION

Is one front bumper marker/turn signal light inoperative?

DECISION

YES Go to Step 44.
NO Go to next step.

STEP

7. Observe front marker/turn signal lights.

CONDITION/INDICATION

Are all front marker/turn signal lights on one side inoperative?

DECISION

YES Go to Step 51.
NO Go to next step.

STEP

8. Observe all marker/turn signal lights.

CONDITION/INDICATION

Are all front marker/turn signals inoperative?

DECISION

YES Go to Step 58.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

NO Go to next step.

STEP

9. Observe rear marker/turn signal lights.

CONDITION/INDICATION

Is one rear marker/turn signal light inoperative?

DECISION

YES Go to Step 64.
NO Go to next step.

STEP

10. Observe rear side marker lights.

CONDITION/INDICATION

Is one rear side marker light inoperative?

DECISION

YES Go to Step 145.
NO Go to next step.

STEP

11. Observe rear marker/turn signal lights.

CONDITION/INDICATION

Are all rear marker/turn signal lights inoperative?

DECISION

YES Go to Step 70.
NO Go to next step.

STEP

12. Observe all marker/turn signal lights at front and rear.

CONDITION/INDICATION

Are all marker/turn signals lights and clearance lights at front and rear inoperative?

DECISION

YES Go to Step 92.
NO Go to next step.

STEP

13. Observe all marker/turn signal lights at front and rear.

CONDITION/INDICATION

Are rear marker/turn signals lights and all clearance lights inoperative?

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 152.
NO Go to next step.

STEP

14. Observe clearance lights at front and rear.

CONDITION/INDICATION

Is one clearance light inoperative?

DECISION

YES Go to Step 104.
NO Go to next step.

STEP

15. Observe clearance lights at front and rear.

CONDITION/INDICATION

Are both front and rear clearance lights inoperative?

DECISION

YES Go to Step 109.
NO Go to next step.

STEP

16. Observe clearance lights at front and rear.

CONDITION/INDICATION

Are front clearance lights inoperative?

DECISION

YES Go to Step 131.
NO Go to next step.

STEP

17. Observe clearance lights at front and rear.

CONDITION/INDICATION

Are rear clearance lights inoperative?

DECISION

YES Go to Step 138.
NO Marker and clearance lights are operating normally. Return vehicle to service.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

18. Turn ignition switch OFF (TM 9-2355-106-10).
19. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
20. Remove inoperative fender marker/turn signal bulb from socket by disconnecting connector 8154 for left front fender marker/turn signal light, or 8154R for right front fender marker/turn signal light. Refer to Figure 1 or Figure 2. Refer to Front Fender Light Bulb Removal and Installation (WP 0372).

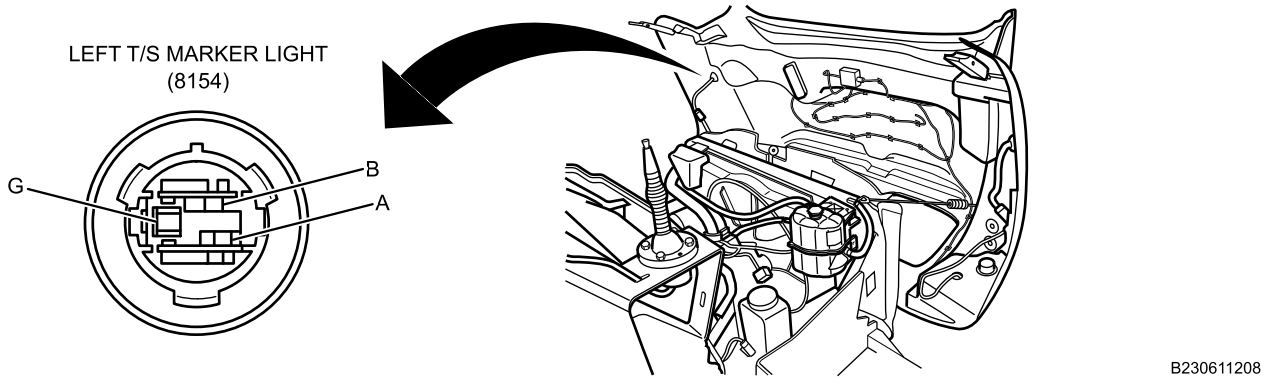


Figure 1. Left Front Fender Turn Signal Bulb Socket.

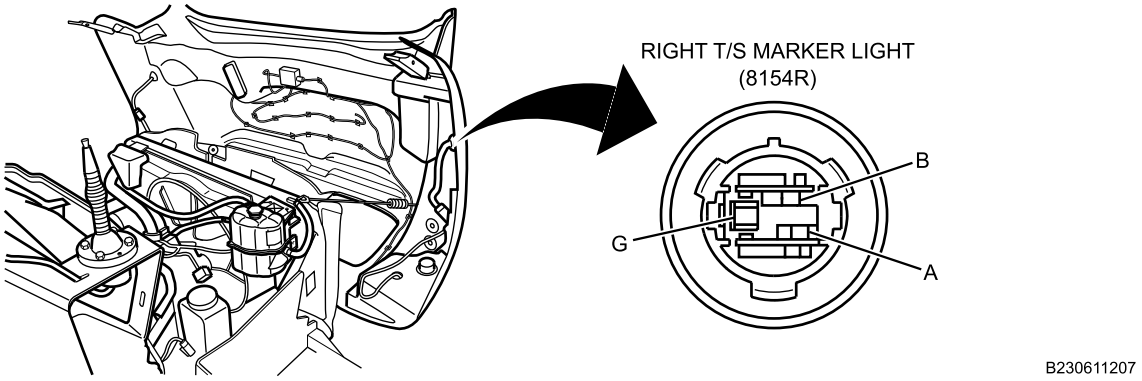


Figure 2. Right Front Fender Turn Signal Bulb Socket.

21. Turn MAIN POWER switch ON (TM 9-2355-106-10).
22. Turn ignition switch ON (TM 9-2355-106-10).
23. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
24. Measure DC voltage between connector 8154 or 8154R terminal B and terminal G with multimeter. Refer to Figure 1 or Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 184.
NO Go to next step.

STEP

25. Turn ignition switch OFF (TM 9-2355-106-10).
26. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

27. Disconnect connector LAM1061 for left front fender marker/turn signal light or LAM1062 for right front fender marker/turn signal light. Refer to Figure 3.

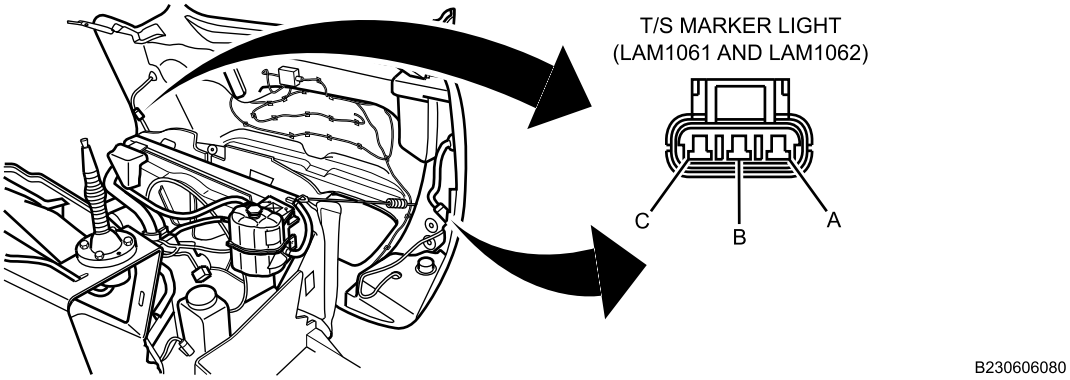


Figure 3. Front Fender Marker/Turn Signal Light Connector.

28. Turn MAIN POWER switch ON (TM 9-2355-106-10).
29. Turn ignition switch ON (TM 9-2355-106-10).
30. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
31. Measure DC voltage between harness connector LAM1061 or LAM1062 terminal C and terminal B with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 192.
NO Go to Step 193.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

32. Remove inoperative marker/turn signal bulb from socket. Refer to Front Turn Signal and Parking Light Bulb Removal and Installation (WP 0373).

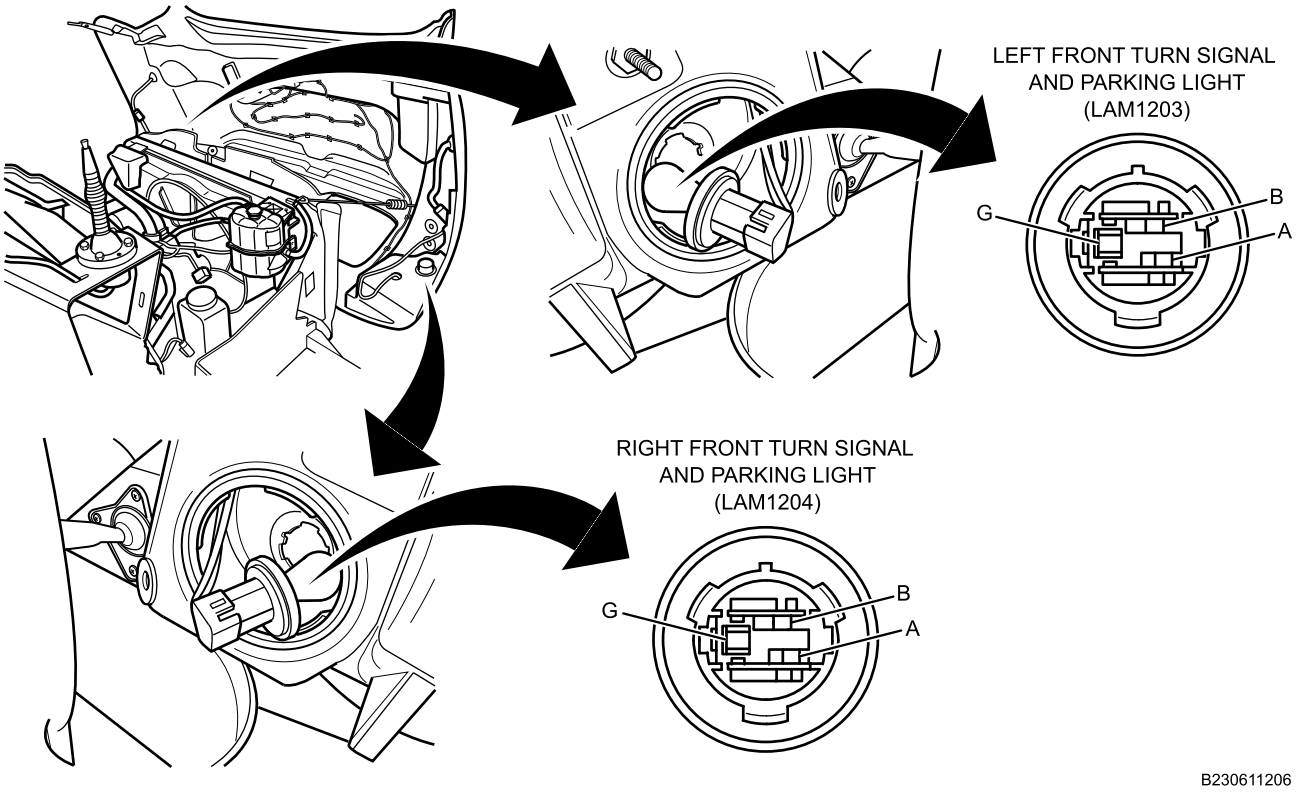


Figure 4. Front Turn Signal Bulb Socket (Near Headlight).

33. Turn MAIN POWER switch ON (TM 9-2355-106-10).
34. Turn ignition switch ON (TM 9-2355-106-10).
35. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
36. Measure DC voltage between bulb socket connector LAM1203 or bulb socket connector LAM1204 terminals B and G with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 183.
NO Go to Step 193.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

37. Turn ignition switch OFF (TM 9-2355-106-10).
38. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
39. Follow wiring harness down from headlight and disconnect first 5-way harness connector LAM1046 for left marker/turn signal or LAM1047 for right marker/turn signal. Refer to Figure 5. Right side similar.

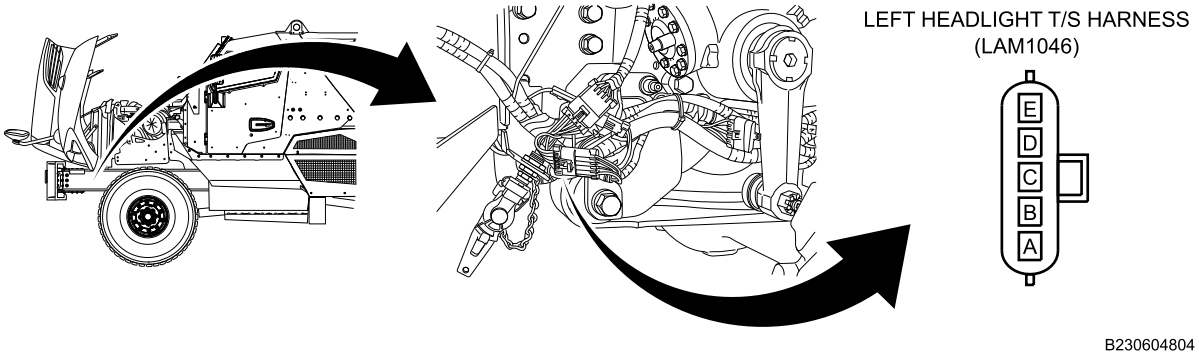


Figure 5. Left Headlight/Turn Signal Harness Connector Near Front Spring Shackle.

40. Turn MAIN POWER switch ON (TM 9-2355-106-10).
41. Turn ignition switch ON (TM 9-2355-106-10).
42. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
43. Measure DC voltage between harness connector LAM1046 or LAM1047 terminal B and terminal E with multimeter. Refer to Figure 5. Right side similar.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 193.
NO Go to Step 191.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

44. Turn ignition switch OFF (TM 9-2355-106-10).
45. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
46. Disconnect connectors LAM1104 for right side or LAM1103 for left side leading to 491 and GND terminals on inoperative front bumper light assembly. Refer to Figure 6 or Figure 7.

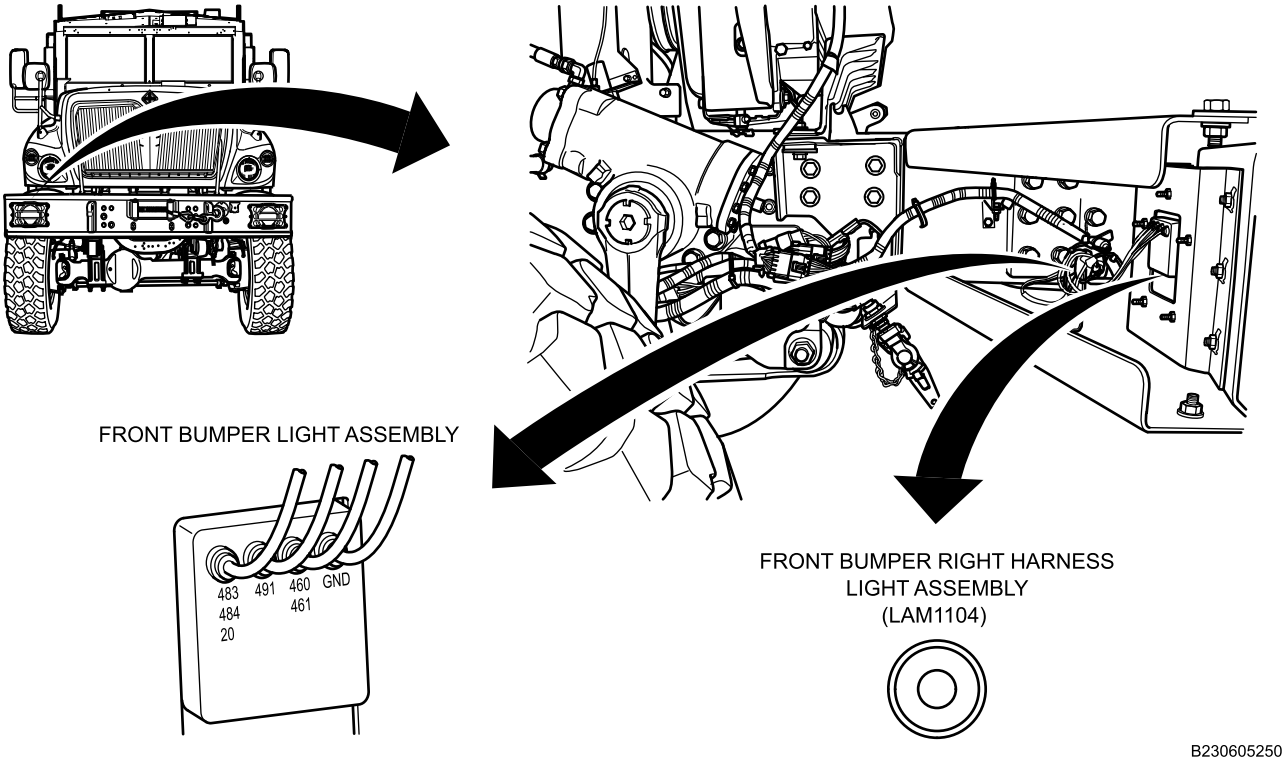


Figure 6. Front Bumper Light Assembly, Right Side.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

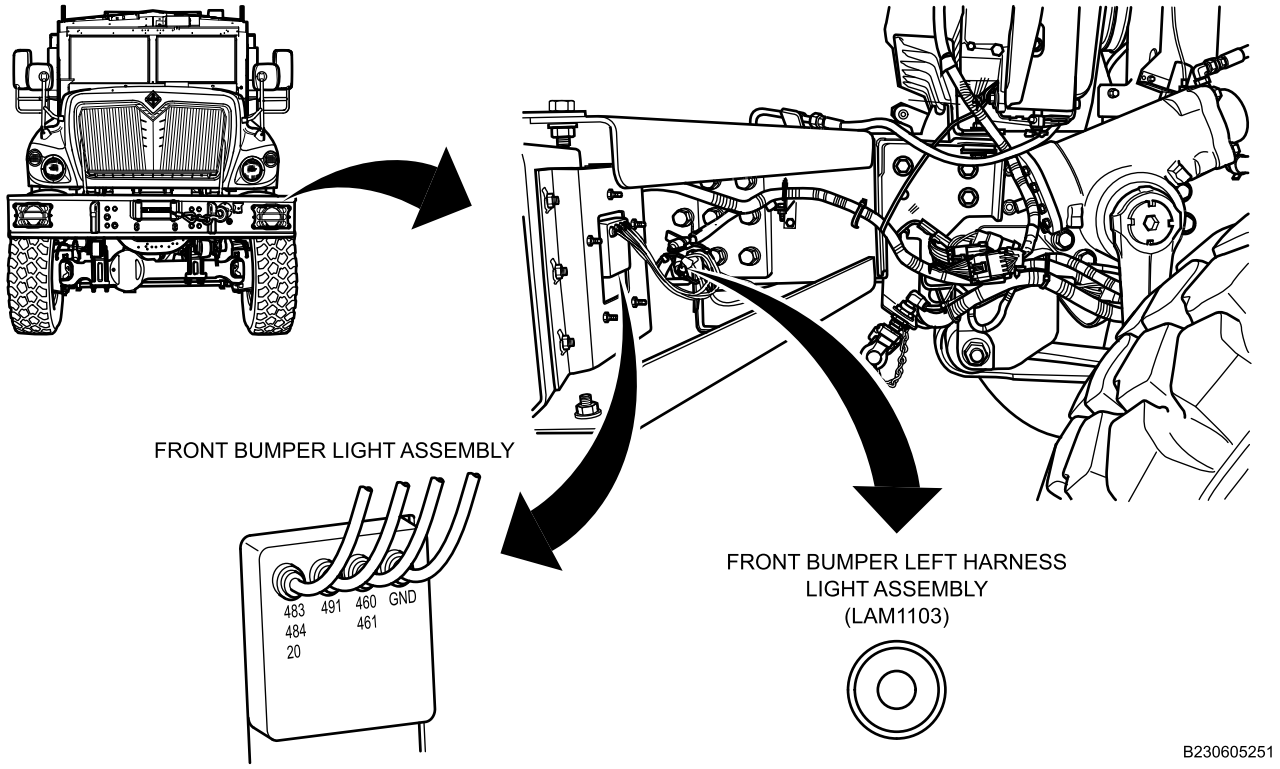


Figure 7. Front Bumper Light Assembly Left Side.

47. Turn MAIN POWER switch ON (TM 9-2355-106-10).
48. Turn ignition switch ON (TM 9-2355-106-10).
49. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
50. Measure DC voltage between harness side connector LAM1104 for right side or LAM1103 for left side for terminals leading to 491 and GND on front bumper light assembly with multimeter. Refer to Figure 6 or Figure 7.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 185.
NO Go to Step 191.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

51. Turn ignition switch OFF (TM 9-2355-106-10).
52. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
53. Follow wiring harness down from headlight and disconnect second 5-way harness connector LAM1101 for left marker/turn signal, or LAM1107 for right marker/turn signal. Refer to Figure 8 or Figure 9.

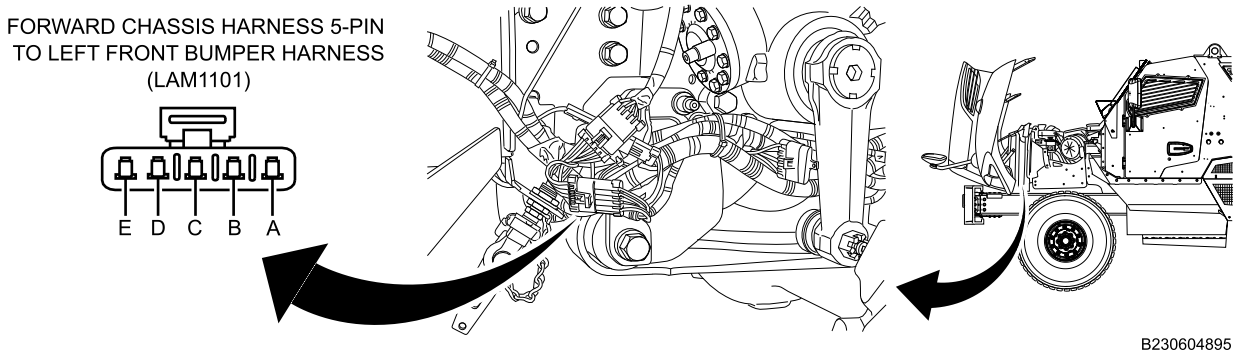


Figure 8. Left Front Bumper/Front Chassis Connector Near Front Spring Shackle.

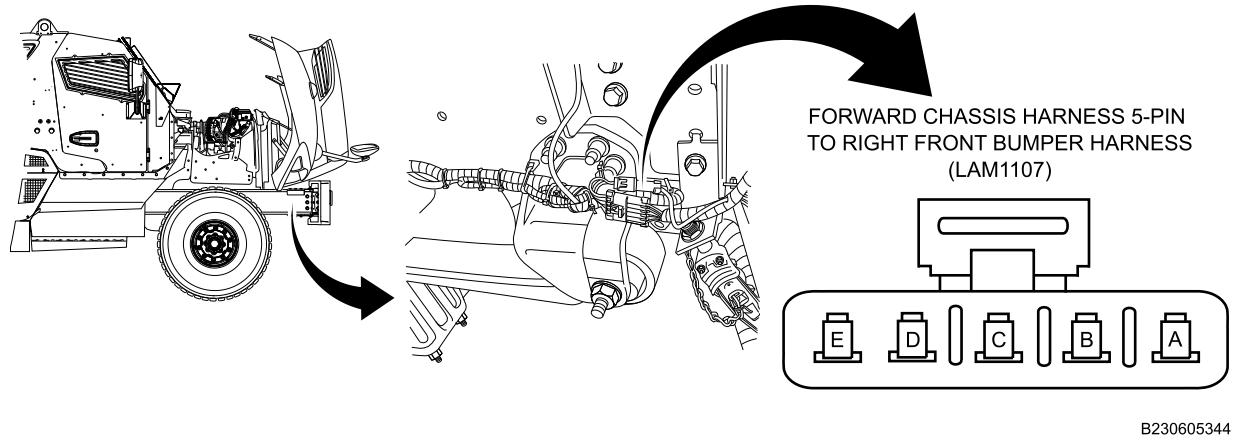


Figure 9. Right Front Bumper/Front Chassis Connector Near Front Spring Shackle.

54. Turn MAIN POWER switch ON (TM 9-2355-106-10).
55. Turn ignition switch ON (TM 9-2355-106-10).
56. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
57. Measure DC voltage between harness connector LAM1101 or LAM1107 terminal E and B with multimeter. Refer to Figure 8 or Figure 9.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.0V?

DECISION

YES Go to Step 191.
NO Go to Step 190.

STEP

58. Remove left side engine armor plate bracket. Refer to Left Engine Armor Plate Bracket Removal and Installation (WP 0598).
59. Disconnect 24-way connector 4301 from 24-way connector 4300. Refer to Figure 10.

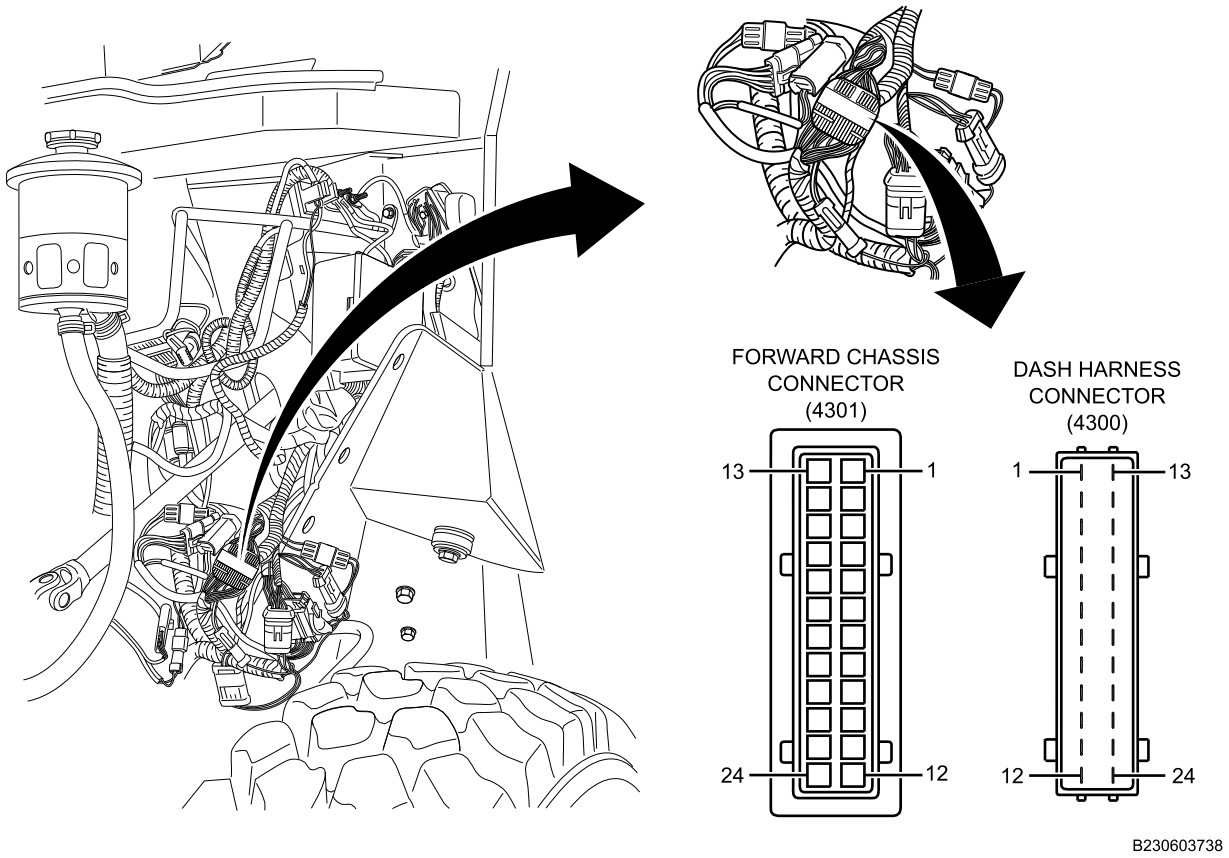


Figure 10. Front Chassis/Dash Connector in Engine Compartment.

60. Turn MAIN POWER switch ON (TM 9-2355-106-10).
61. Turn ignition switch ON (TM 9-2355-106-10).
62. Enable lights by pressing SER. DRIVE on MVLS switch and then press ENTER within 5 seconds (TM 9-2355-106-10).

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

63. Measure DC voltage between harness connector 4301 terminal 12 and terminal 13 with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 190.
NO Go to Step 189.

STEP

64. Remove taillamp assembly. Refer to Composite Taillamp Assembly Removal and Installation (WP 0383).
65. Disconnect connectors leading to 21 and GND terminals on inoperative light. Refer to Figure 11. Right side shown; left side similar.

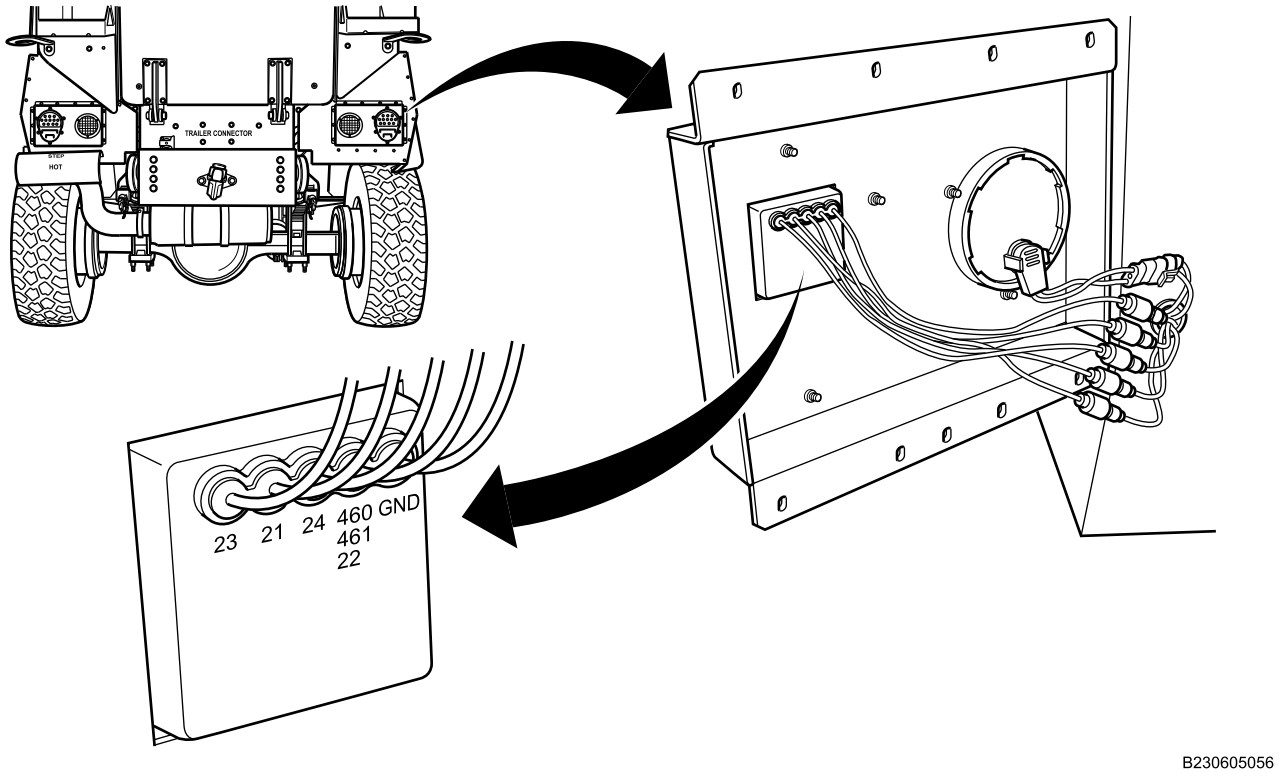


Figure 11. Circuit Identification on Composite Taillamp Assembly for Turn Signal Bullet Connectors.

66. Turn MAIN POWER switch ON (TM 9-2355-106-10).
67. Turn ignition switch ON (TM 9-2355-106-10).
68. Enable lights by pressing SER. DRIVE on MVLS switch and then press ENTER within 5 seconds (TM 9-2355-106-10).
69. Measure DC voltage between harness side connectors for terminals 21 and GND with multimeter. Refer to Figure 11.

CONDITION/INDICATION

Does multimeter read 10.5V to 13.5V?

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 186.
NO Go to Step 197.

STEP

70. Turn ignition switch OFF (TM 9-2355-106-10).
71. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
72. Follow wiring harness down from taillamp and disconnect 5-way harness connector 9303A. Refer to Figure 12.

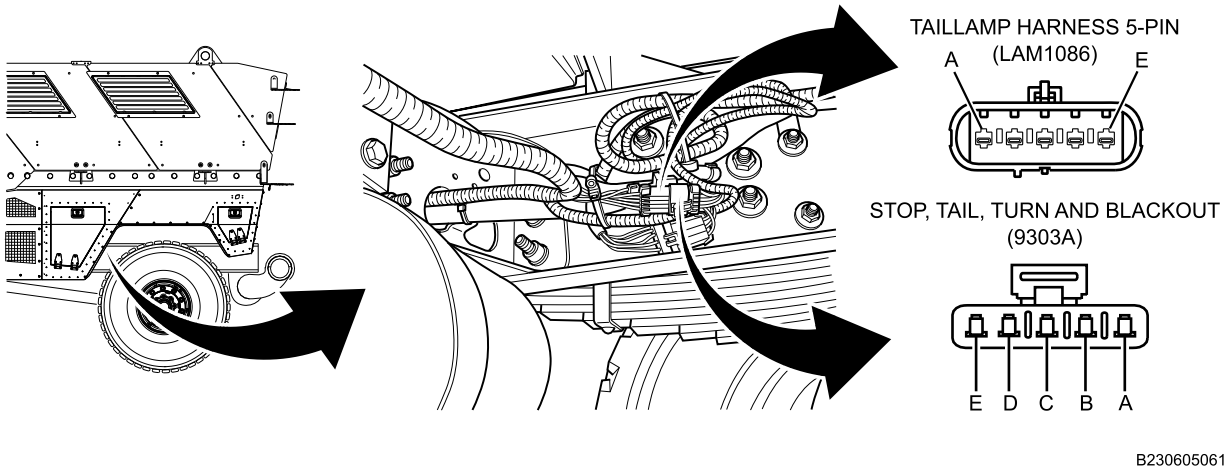


Figure 12. Taillamp/Rear Chassis Harness Inside Left Frame Rail Near Rear Crossmember.

73. Turn MAIN POWER switch ON (TM 9-2355-106-10).
74. Turn ignition switch ON (TM 9-2355-106-10).
75. Enable lights by pressing SER. DRIVE on MVLS switch and then press ENTER within 5 seconds (TM 9-2355-106-10).
76. Measure DC voltage between connector 9303A terminals E and D with multimeter. Refer to Figure 12.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 197.
NO Go to next step.

STEP

77. Turn ignition switch OFF (TM 9-2355-106-10).
78. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
79. Loosen air dryer mounting bolts and move air dryer to one side to access connectors on left frame rail. Refer to Air Dryer Removal and Installation (WP 0517).
80. Disconnect center/rear chassis connector 9800M. Refer to Figure 13.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

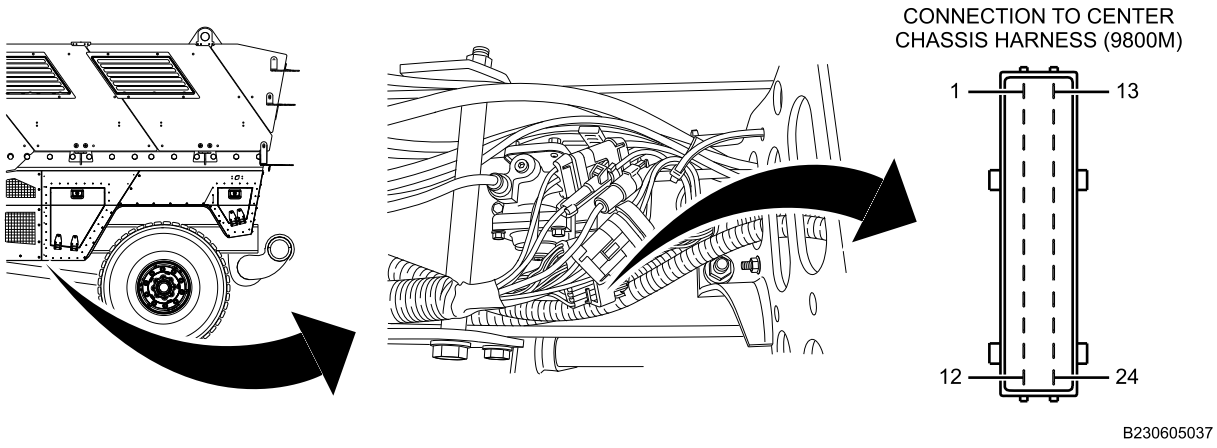


Figure 13. Center/Rear Chassis Connector Inside Left Frame Rail.

81. Turn MAIN POWER switch ON (TM 9-2355-106-10).
82. Turn ignition switch ON (TM 9-2355-106-10).
83. Enable lights by pressing SER. DRIVE on MVLS switch and then press ENTER within 5 seconds (TM 9-2355-106-10).
84. Measure DC voltage between connector 9800M terminals 4 and 12 with multimeter. Refer to Figure 13.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 196.
NO Go to next step.

STEP

85. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
86. Remove air cleaner. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
87. Disconnect connector 9714 from connector 9700 in engine compartment. Refer to Figure 14.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

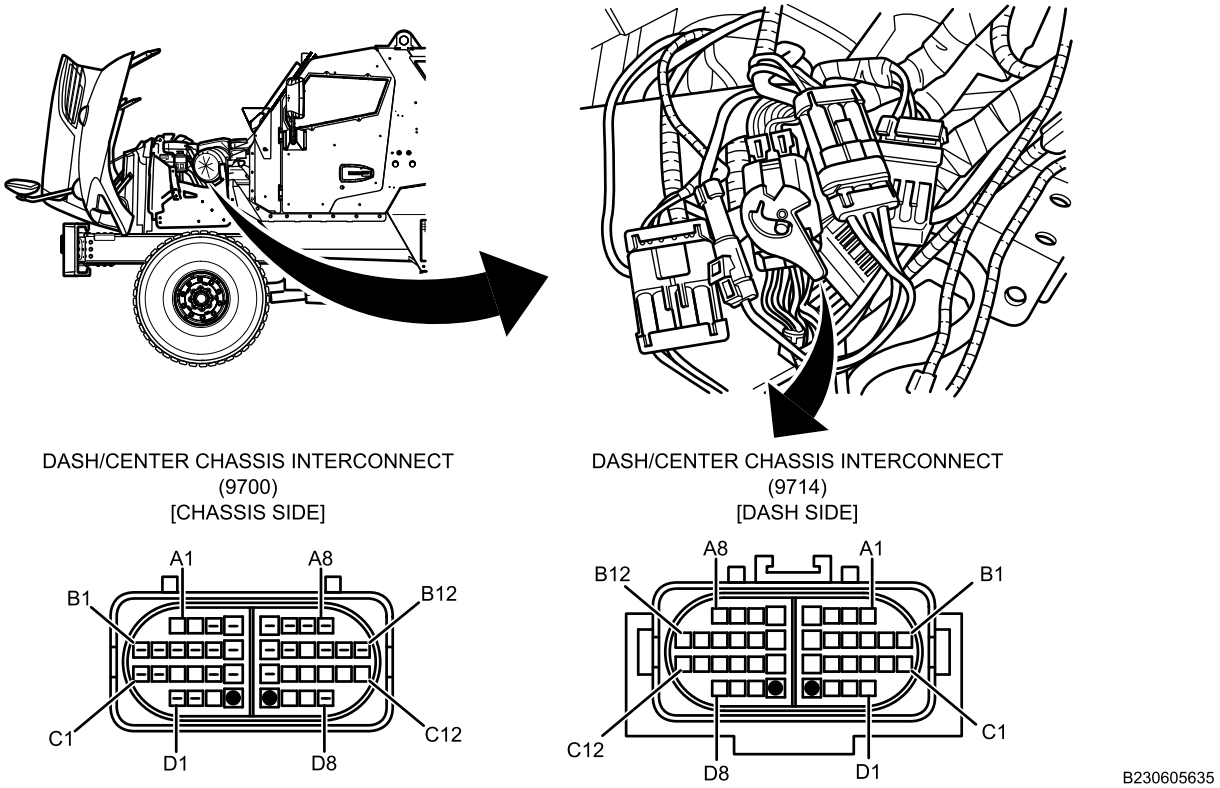


Figure 14. Dash/Center Chassis Connector in Engine Compartment.

88. Turn MAIN POWER switch ON (TM 9-2355-106-10).
89. Turn ignition switch ON (TM 9-2355-106-10).
90. Enable lights by pressing SER. DRIVE on MVLS switch and then press ENTER within 5 seconds (TM 9-2355-106-10).
91. Measure DC voltage between dash side connector 9714 terminal B7 and C6 with multimeter. Refer to Figure 14.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 195.
NO Go to Step 189.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

92. Remove TRUCK MARKER TAIL relay from center instrument panel relay block. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 15.

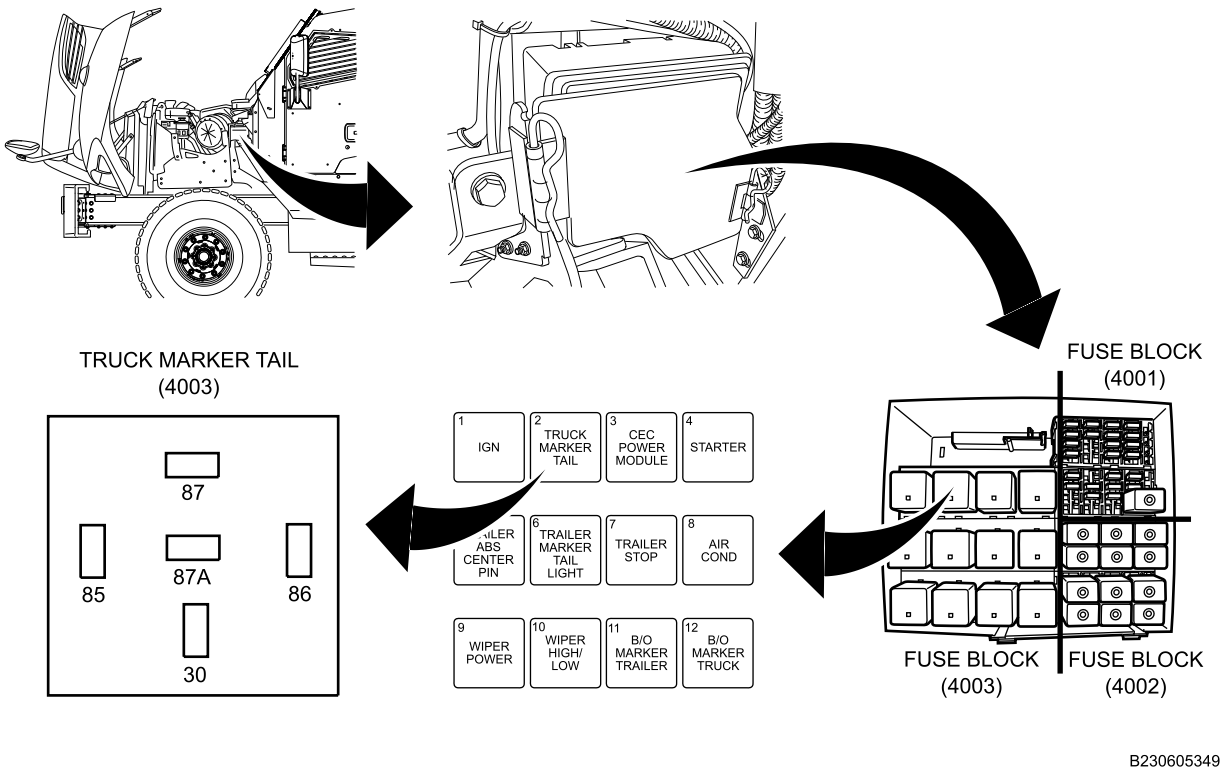


Figure 15. Engine Compartment PDC.

93. Disconnect ESC connector 4007. Refer to Figure 16.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

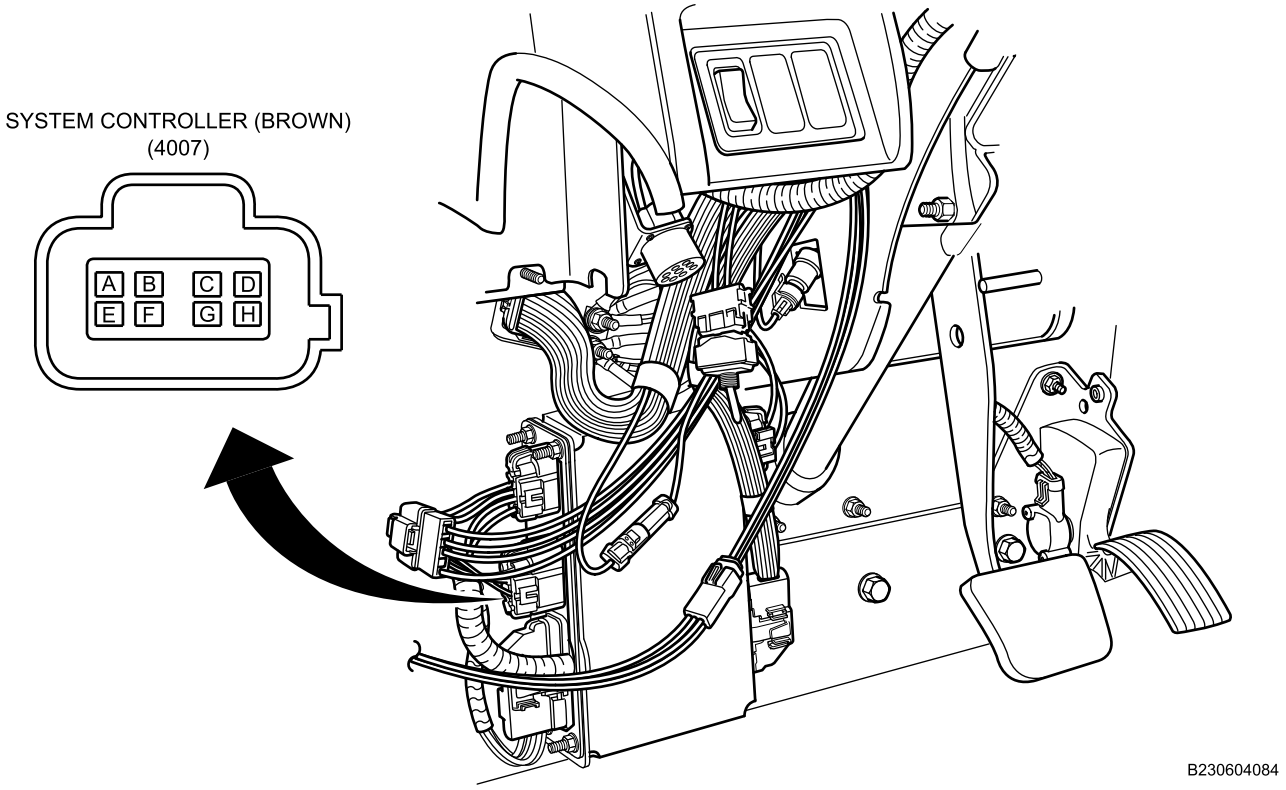


Figure 16. Electronic System Controller (ESC) Connector.

94. Measure resistance between relay socket terminal 87 and connector 4007 terminal H with multimeter. Refer to Figure 15 and Figure 16.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 189.
NO Go to next step.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

95. Disconnect connector 1520. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297). Refer to Figure 17.

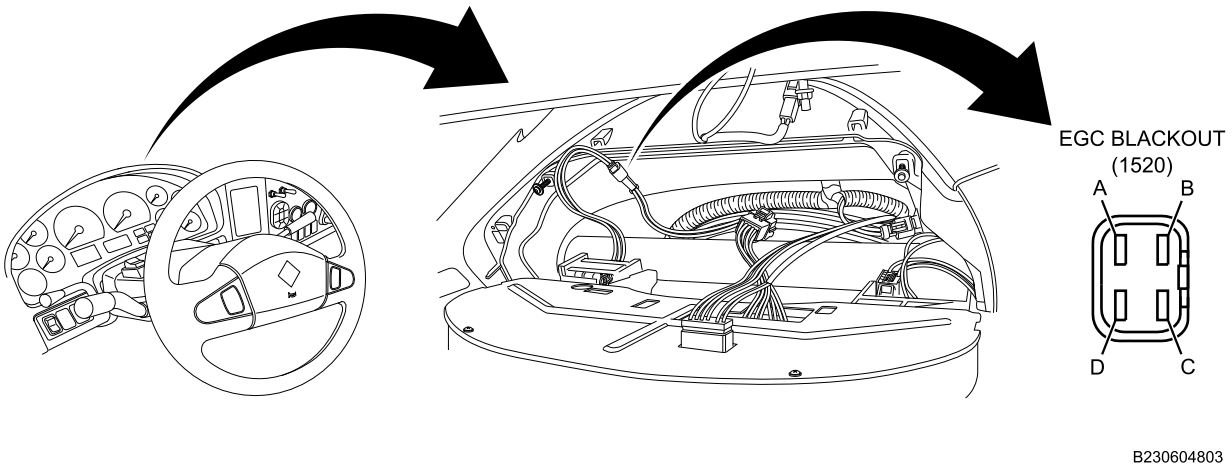


Figure 17. Behind IP.

96. Turn MAIN POWER switch ON (TM 9-2355-106-10).
97. Turn ignition switch ON (TM 9-2355-106-10).
98. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
99. Measure DC voltage between connector 1520 terminal B and ground with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 188.
NO Go to next step.

STEP

100. Turn ignition switch OFF (TM 9-2355-106-10).
101. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
102. Disconnect connector 1954 at MVLS switch. Refer to Master Vehicle Light Switch (MVLS) Removal and Installation (WP 0303).

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

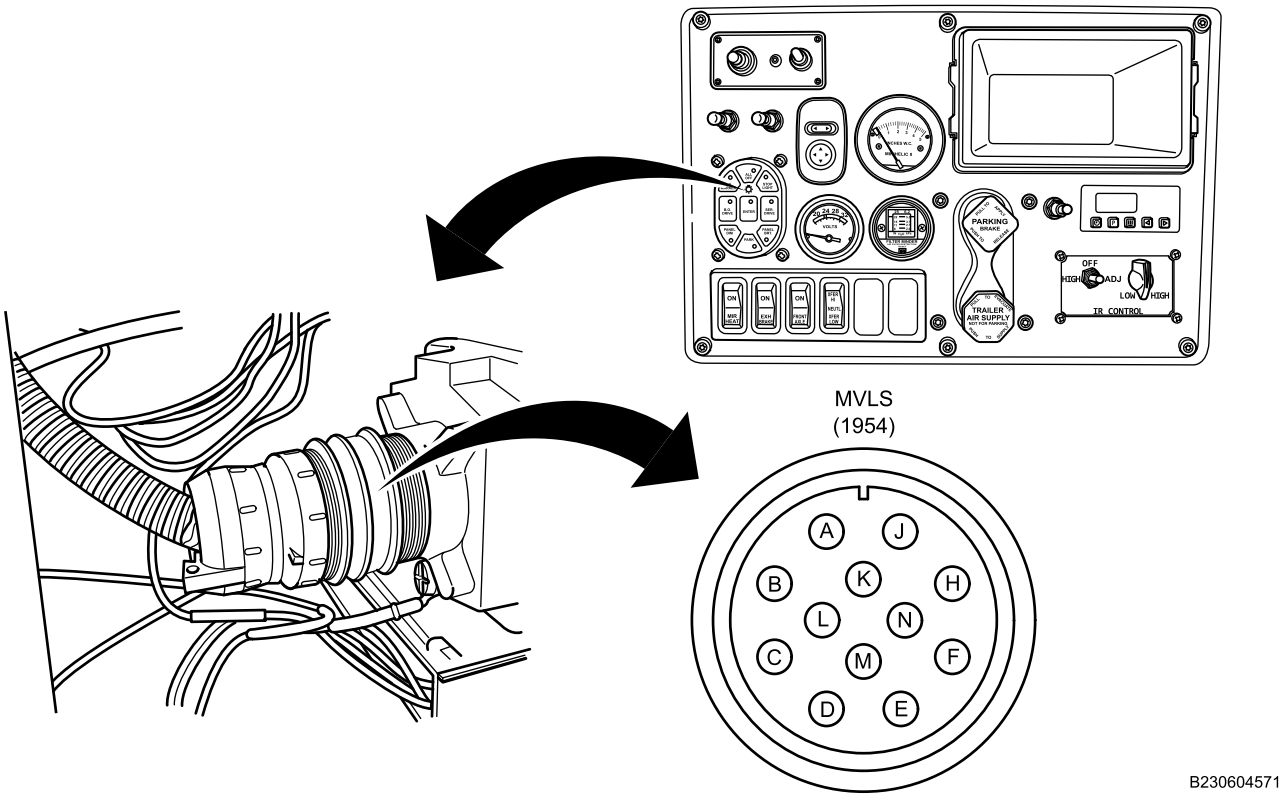


Figure 18. MVLS.

103. Measure resistance between connector 1520 terminal B and connector 1954 terminal H with multimeter. Refer to Figure 17 and Figure 18.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

DECISION

YES Go to Step 187.
NO Go to Step 198.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

104. Remove inoperative clearance light from mounting bar. Refer to Rear Clearance Light Assembly Removal and Installation (WP 0385) or Front Clearance Light Assembly Removal and Installation (WP 0369).
105. Turn MAIN POWER switch ON (TM 9-2355-106-10).
106. Turn ignition switch ON (TM 9-2355-106-10).
107. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
108. Measure DC voltage between inoperative clearance light terminal and ground stud with multimeter. For front clearance lights, refer to Figure 19. For rear clearance lights, refer to Figure 20.

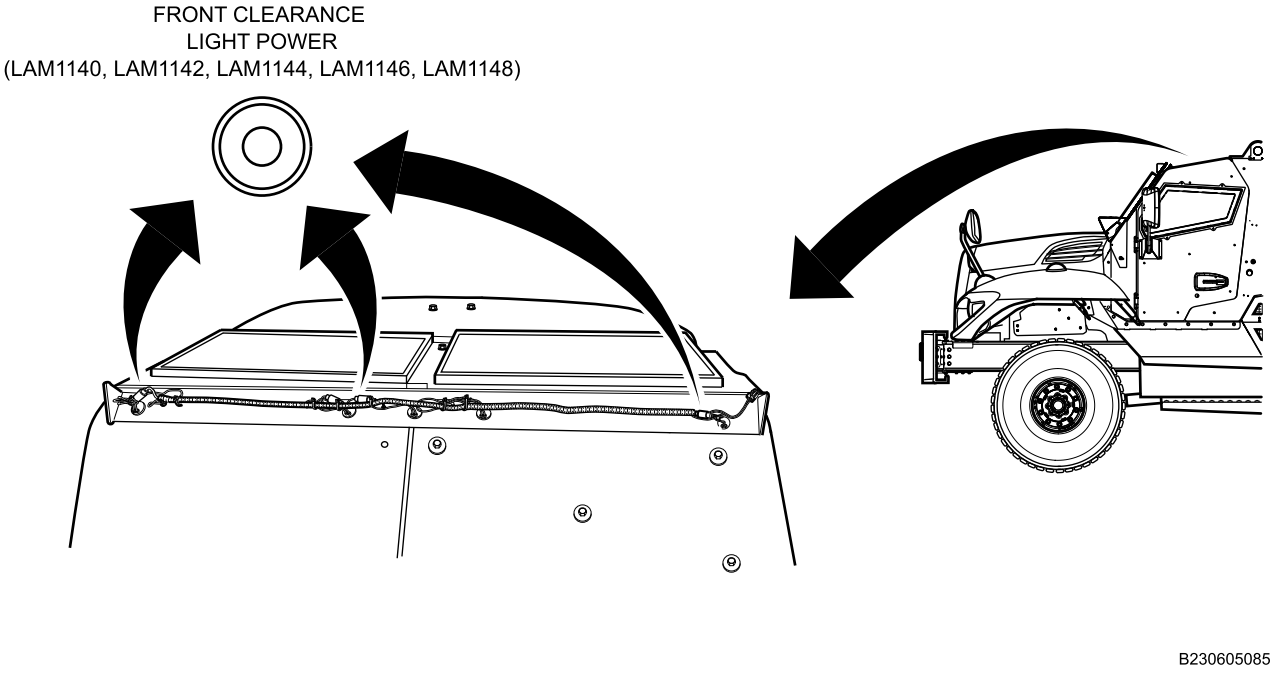


Figure 19. Front Clearance Light Harness.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

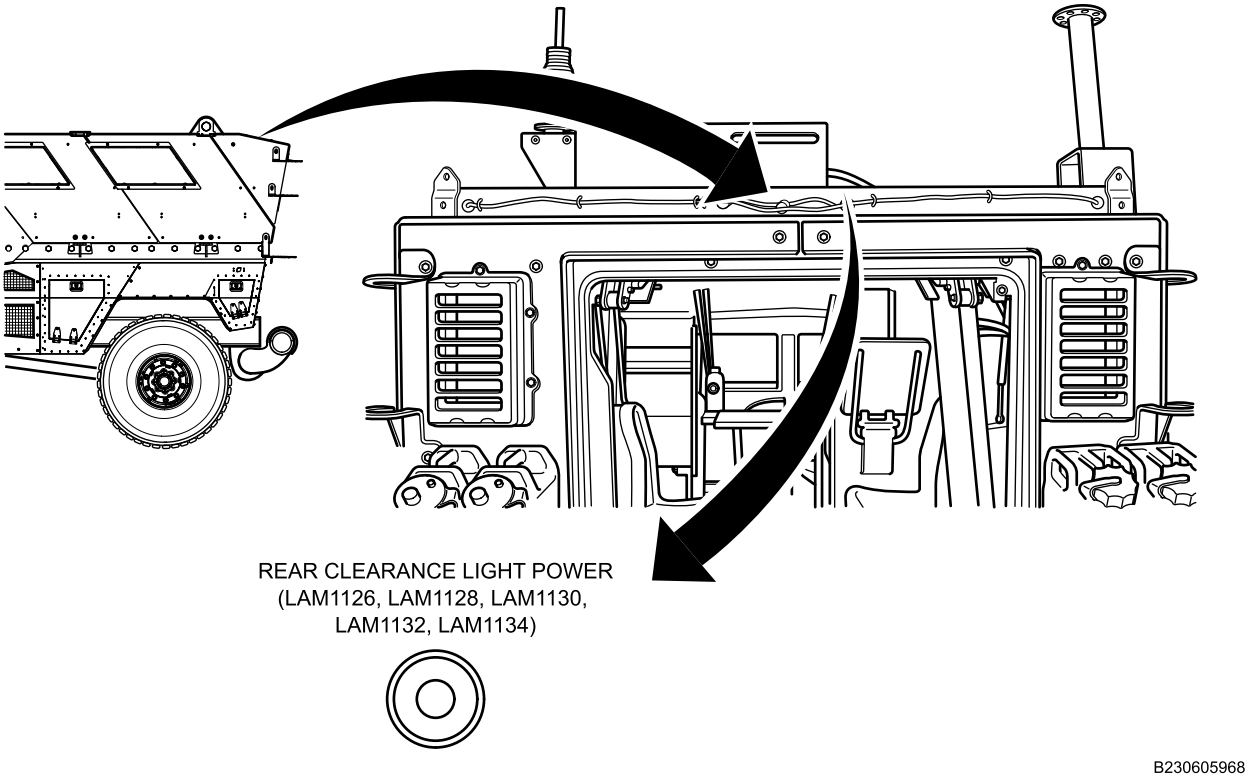


Figure 20. Rear Clearance Light Harness.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 204.
NO Go to Step 206.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

109. Turn ignition switch OFF (TM 9-2355-106-10).
110. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
111. Disconnect connector LAM1171. Refer to Figure 21.

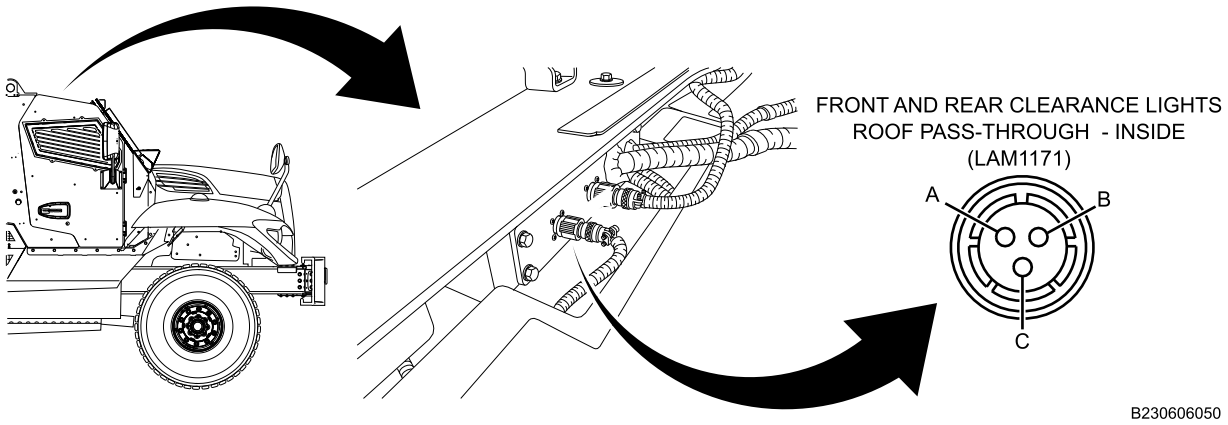


Figure 21. Above Right Side Windshield.

112. Turn MAIN POWER switch ON (TM 9-2355-106-10).
113. Turn ignition switch ON (TM 9-2355-106-10).
114. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
115. Measure DC voltage between connector LAM1171 terminals A and B with multimeter. Refer to Figure 21.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 202.
NO Go to next step.

STEP

116. Remove instrument panel (IP) right side closeout. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).
117. Disconnect connector LAM1039. Refer to Figure 22.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

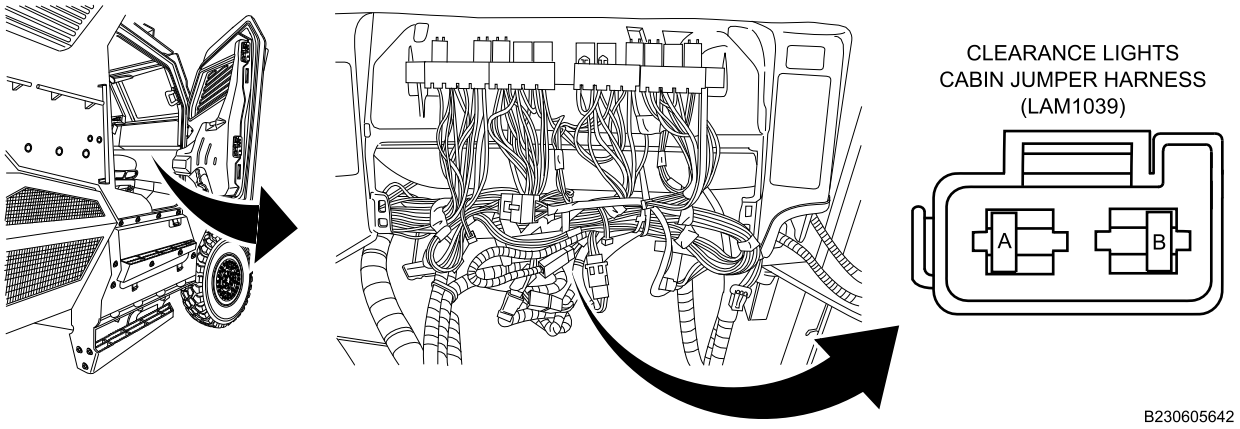


Figure 22. Behind Right Side IP Closeout.

118. Turn MAIN POWER switch ON (TM 9-2355-106-10).
119. Turn ignition switch ON (TM 9-2355-106-10).
120. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
121. Measure DC voltage between connector LAM1039 terminal A and B with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 201.
NO Go to next step.

STEP

122. Measure DC voltage between connector LAM1039 terminal A and ground with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 203.
NO Go to next step.

STEP

123. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
124. Turn ignition switch OFF (TM 9-2355-106-10).
125. Measure resistance between connector LAM1039 (engine side) terminal A and ground with multimeter. Refer to Figure 22.

CONDITION/INDICATION

Does multimeter read OL?

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 128.
NO Go to next step.

STEP

126. Disconnect connector 1701. Refer to Figure 23.

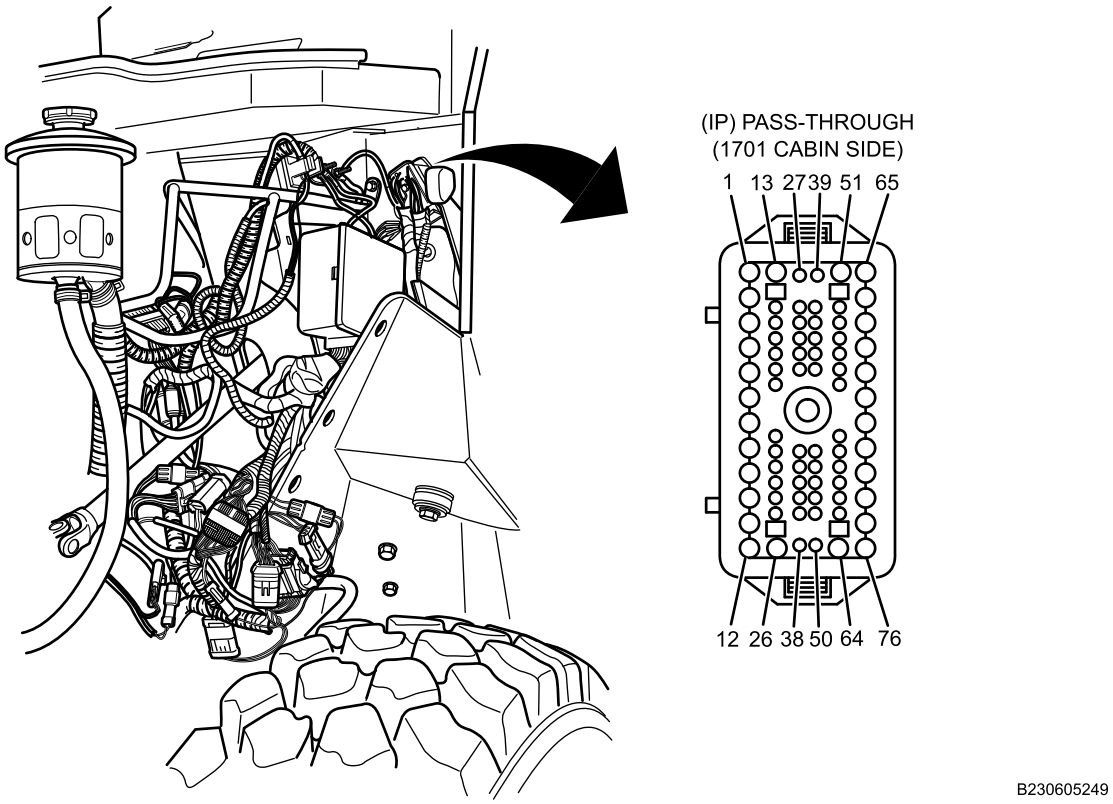


Figure 23. Left Side Engine Compartment on Bulkhead.

127. Measure resistance between connector 1701 (cabin side) terminal 21 and ground with multimeter. Refer to Figure 23.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 189.
YES Go to Step 203.

STEP

128. Remove TRUCK MARKER TAIL relay. Refer to Power Distribution Center Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 24.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

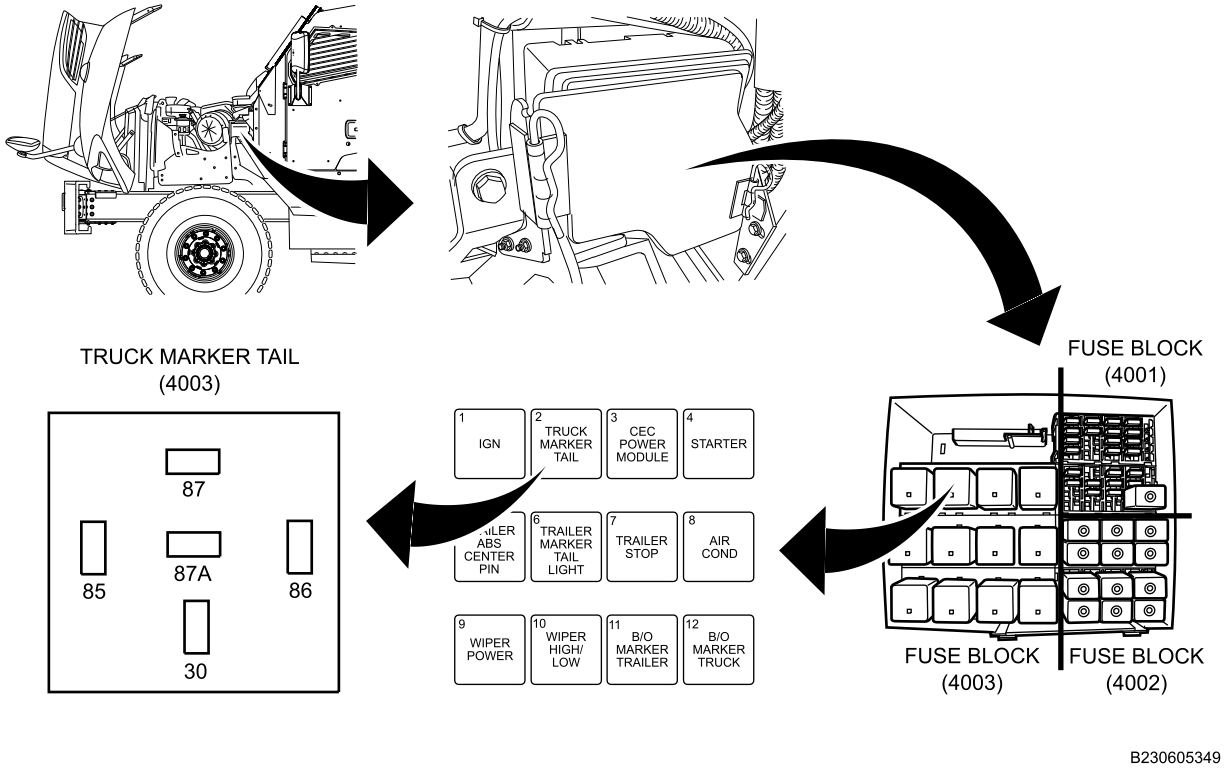


Figure 24. Engine Compartment PDC.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

129. Disconnect connector 1701. Refer to Figure 25.

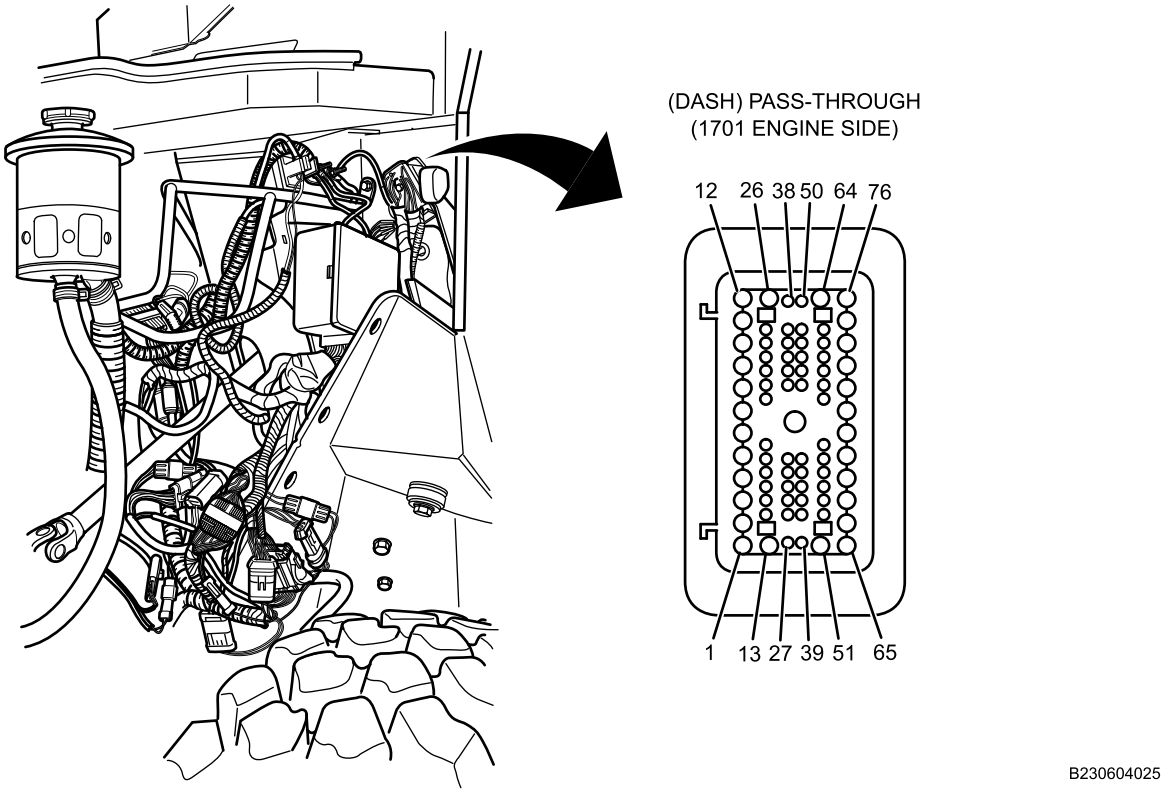


Figure 25. Left Side Engine Compartment on Bulkhead.

130. Measure resistance between connector 1701 (engine side) terminal 21 and relay socket terminal 30 with multimeter. Refer to Figure 25 and Figure 24.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 187.
NO Go to Step 189.

STEP

131. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
132. Turn ignition switch OFF (TM 9-2355-106-10).
133. Disconnect connector LAM1138. Refer to Figure 26.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

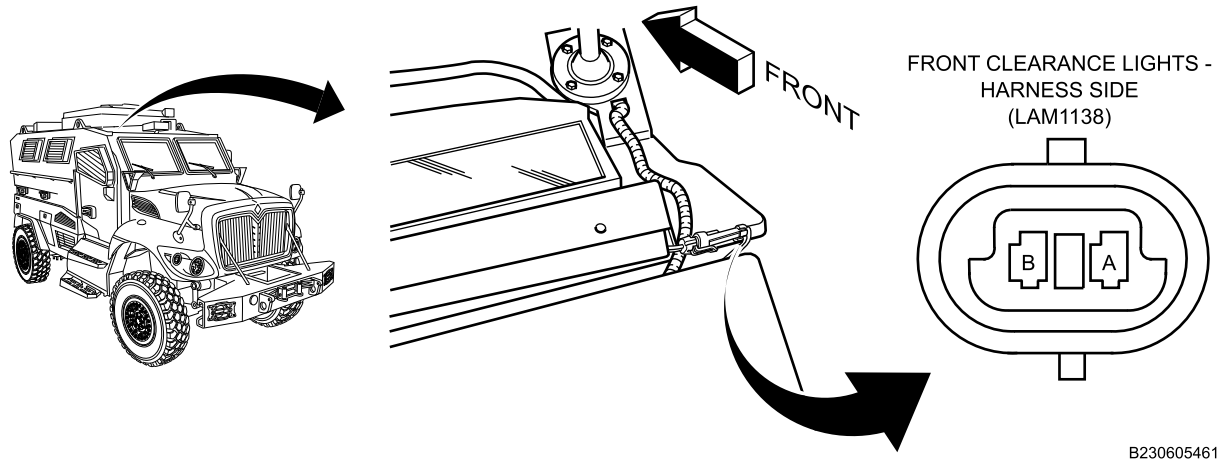


Figure 26. Above Right Side Windshield.

134. Turn MAIN POWER switch ON (TM 9-2355-106-10).
135. Turn ignition switch ON (TM 9-2355-106-10).
136. Enable lights by pressing SER. DRIVE on MVLS and then press ENTER within 5 seconds (TM 9-2355-106-10).
137. Measure DC voltage between connector LAM1138 terminals A and B with multimeter. Refer to Figure 26.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 199.
NO Go to Step 202.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

138. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
139. Turn ignition switch OFF (TM 9-2355-106-10).
140. Disconnect connector LAM1137. Refer to Figure 27.

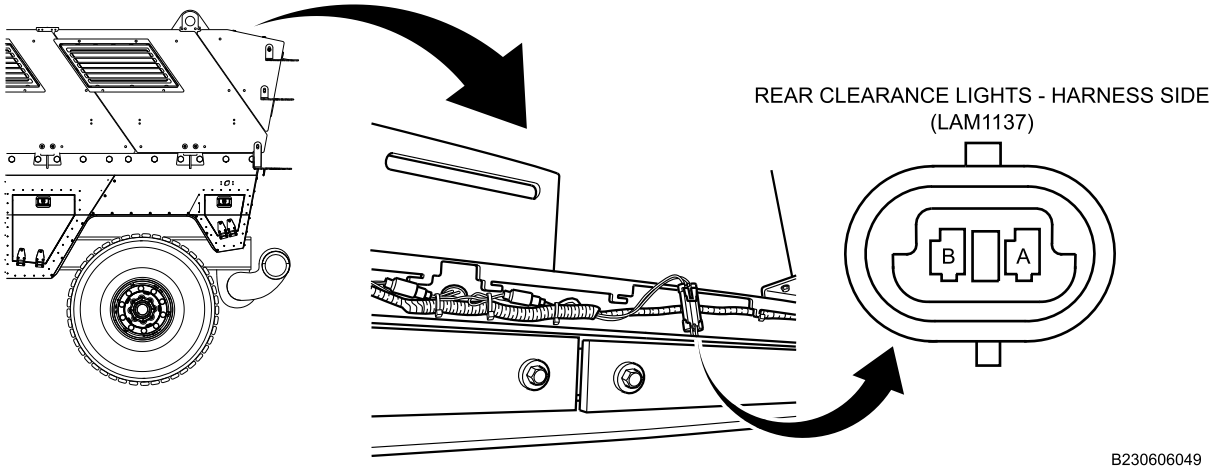


Figure 27. Above Rear Ramp.

141. Turn MAIN POWER switch ON (TM 9-2355-106-10).
142. Turn ignition switch ON (TM 9-2355-106-10).
143. Enable lights by pressing SER. DRIVE on MVLS and then pressing ENTER within 5 seconds (TM 9-2355-106-10).
144. Measure DC voltage between connector LAM1137 terminals A and B with multimeter. Refer to Figure 27.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 200.
NO Go to Step 202.

STEP

145. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
146. Turn ignition switch OFF (TM 9-2355-106-10).
147. Disconnect connector LAM1089 for left side or LAM1090 for right side. Refer to Figure 28 or Figure 29.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

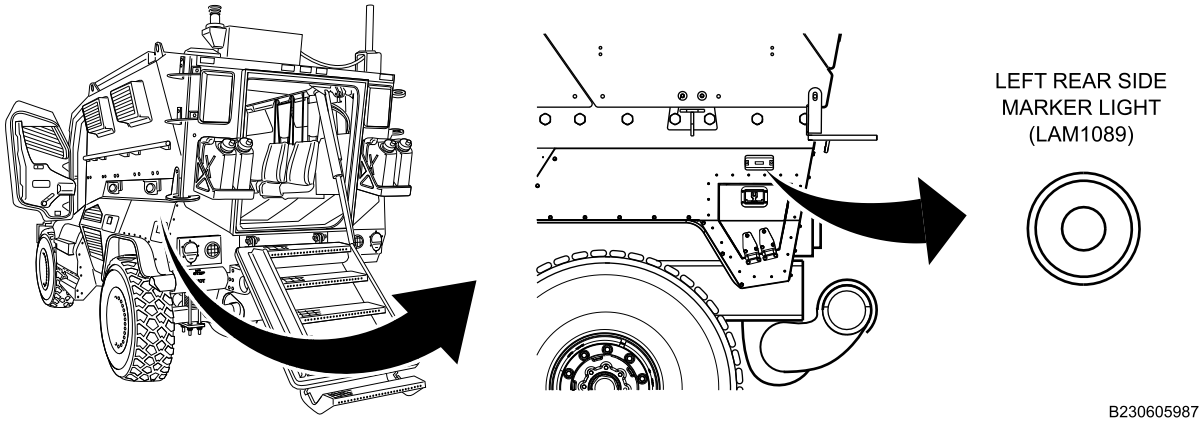


Figure 28. Left Side Rear Stowage Box.

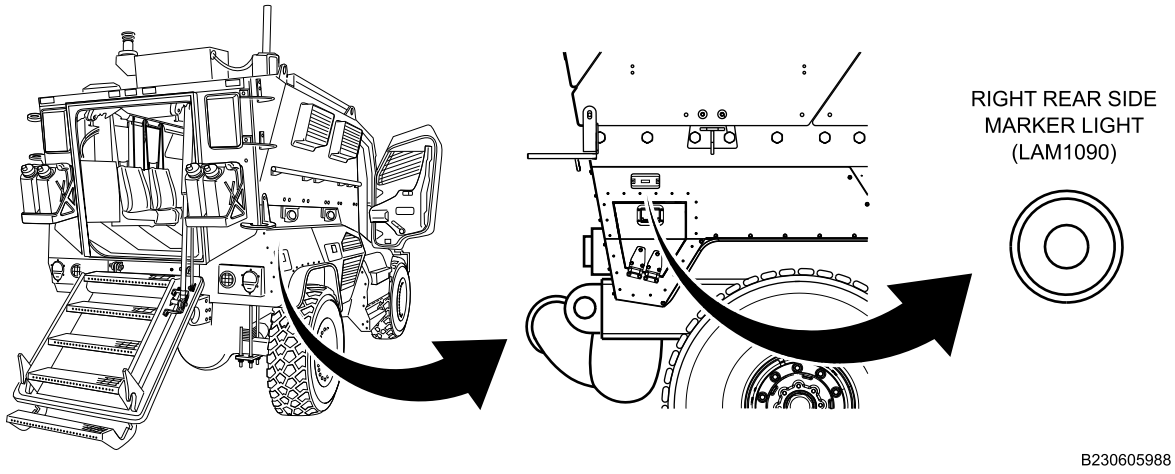


Figure 29. Right Side Rear Stowage Box.

148. Turn MAIN POWER switch ON (TM 9-2355-106-10).
149. Turn ignition switch ON (TM 9-2355-106-10).
150. Enable lights by pressing SER. DRIVE on MVLS and then pressing ENTER within 5 seconds (TM 9-2355-106-10).
151. Measure DC voltage between connector terminal for inoperative light, LAM1089 or LAM1090, and ground with multimeter. Refer to Figure 28 or Figure 29.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 205.
NO Go to Step 197.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

152. Remove TRUCK MARKER/TAIL relay from center instrument panel relay block. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Refer to Figure 30.

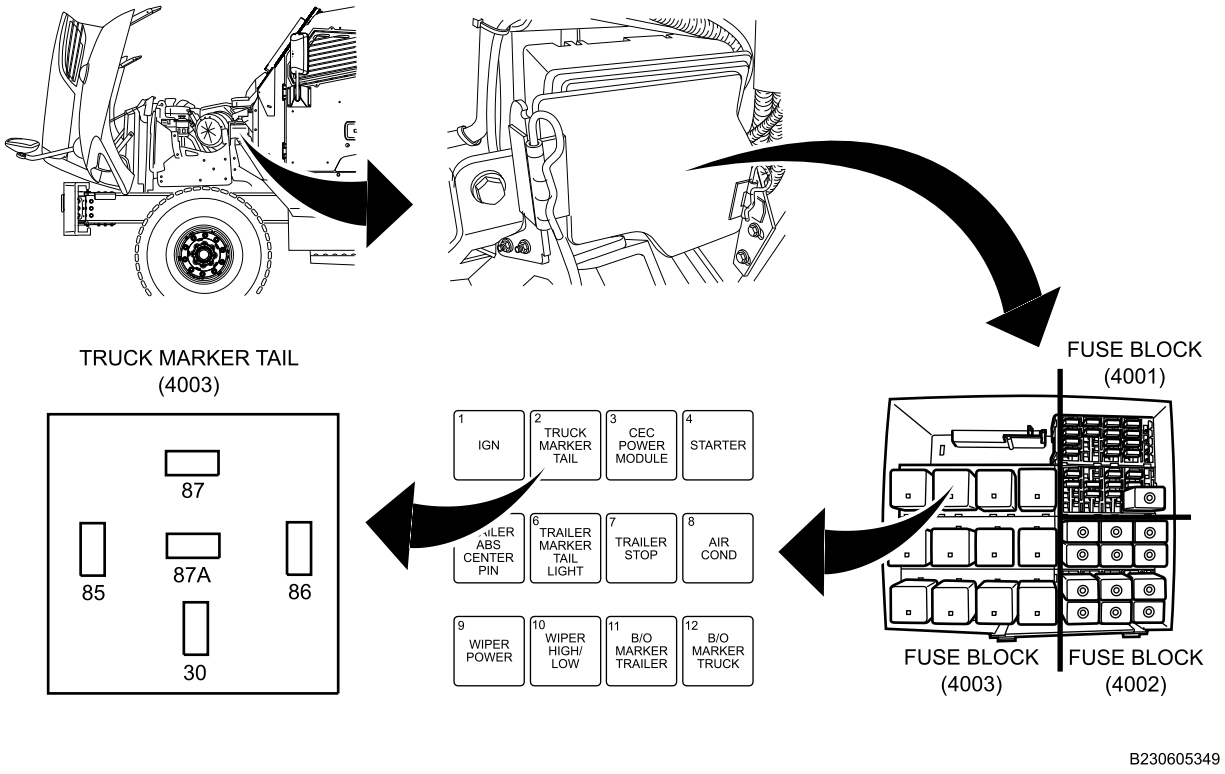


Figure 30. Engine Compartment PDC.

153. Turn MAIN POWER switch ON (TM 9-2355-106-10).
154. Turn ignition switch ON (TM 9-2355-106-10).
155. Enable lights by pressing SER. DRIVE on MVLS and then pressing ENTER within 5 seconds (TM 9-2355-106-10).
156. Measure DC voltage between TRUCK MARKER/TAIL relay socket terminal 87 and ground with multimeter. Refer to Figure 30.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 189.
YES Go to next step.

STEP

157. Turn ignition switch OFF (TM 9-2355-106-10).
158. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
159. Measure resistance between TRUCK MARKER/TAIL relay socket terminal 86 and ground with multimeter. Refer to Figure 31.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

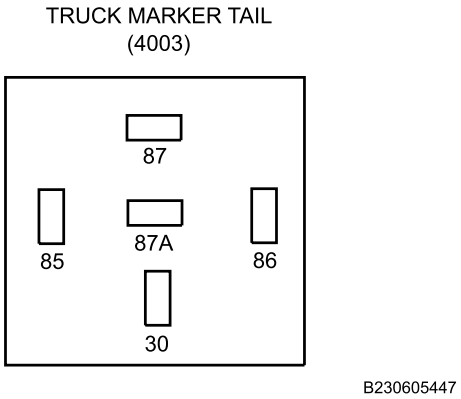


Figure 31. Truck Marker/Tail Relay Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 189.
YES Go to next step.

STEP

160. Turn ignition switch ON (TM 9-2355-106-10).
161. Turn MAIN POWER switch ON (TM 9-2355-106-10).
162. Enable lights by pressing SER. DRIVE on MVLS and then pressing ENTER within 5 seconds (TM 9-2355-106-10).
163. Measure DC voltage between relay socket terminal 85 and ground with multimeter. Refer to Figure 31.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 177.
NO Go to next step.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

164. Turn ignition switch OFF (TM 9-2355-106-10).
165. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
166. Disconnect connector 1701. Refer to Figure 32.

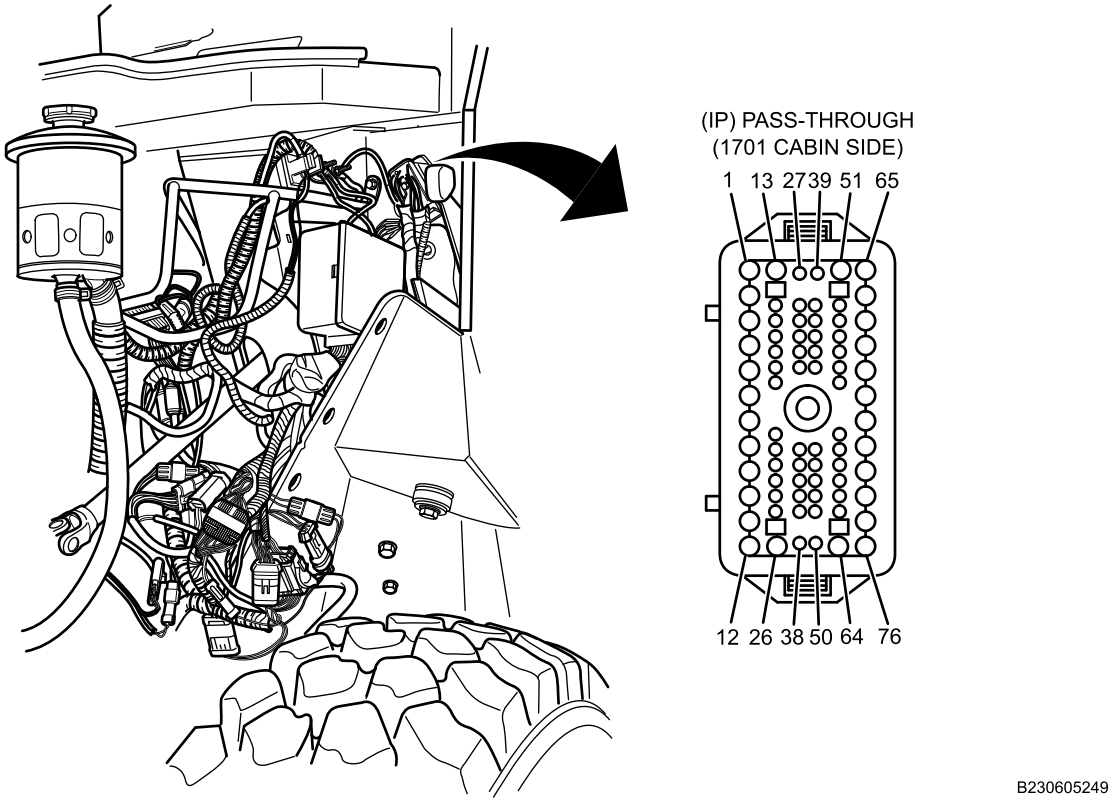


Figure 32. Left Side Engine Compartment Bulkhead.

167. Turn MAIN POWER switch ON (TM 9-2355-106-10).
168. Turn ignition switch ON (TM 9-2355-106-10).
169. Enable lights by pressing SER. DRIVE on MVLS and then pressing ENTER within 5 seconds (TM 9-2355-106-10).
170. Measure DC voltage between connector 1701 (cabin side) terminal 27 and ground with multimeter. Refer to Figure 32.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 203.
NO Go to next step.

STEP

171. Turn ignition switch OFF (TM 9-2355-106-10).
172. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
173. Disconnect connector 1954. Refer to Figure 33. Refer to Master Vehicle Light Switch (MVLS) Removal and Installation (WP 0303).

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

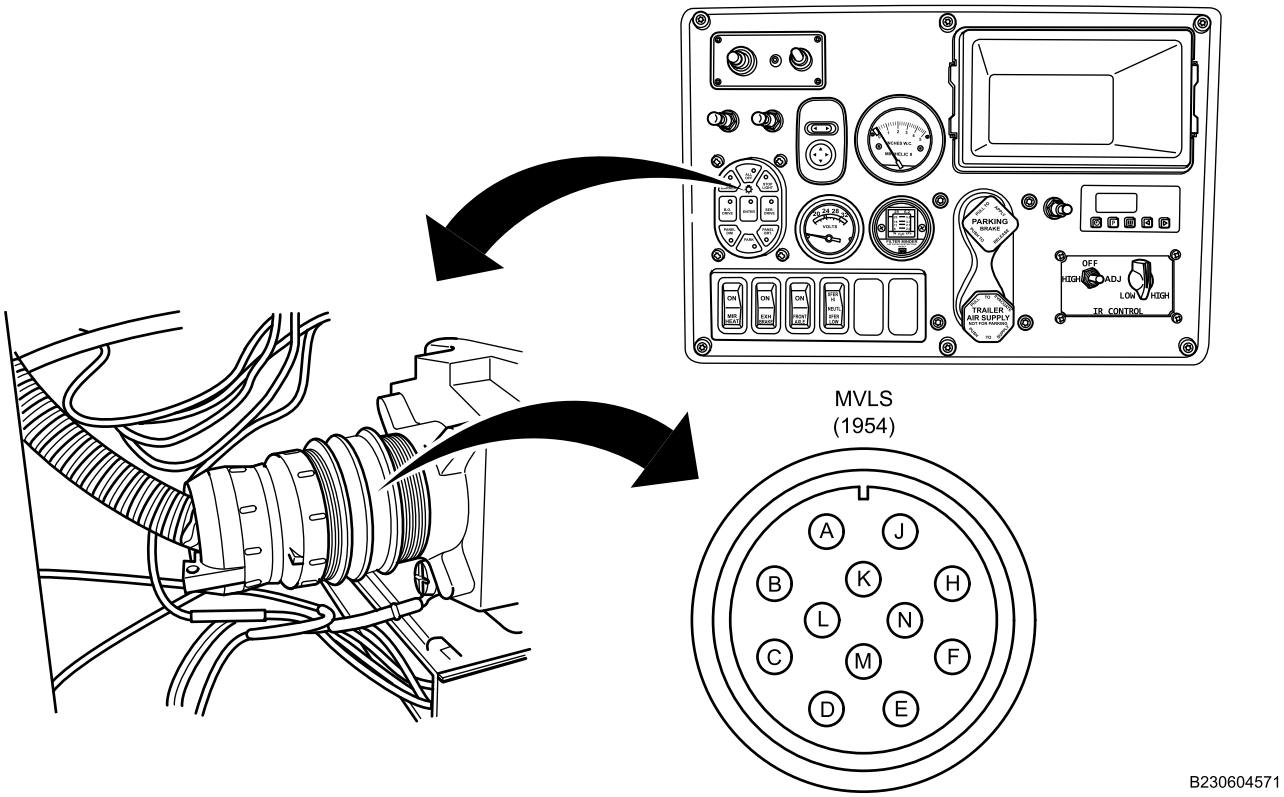


Figure 33. MVLS.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

174. Measure resistance between connector 1701 (cabin side) terminal 27 and ground with multimeter. Refer to Figure 34.

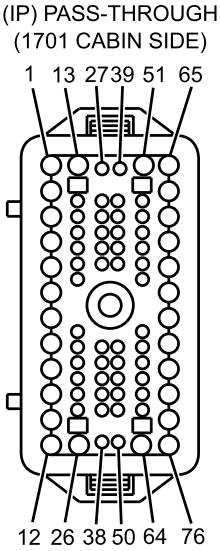


Figure 34. Connector 1701.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

YES Go to Step 203.
NO Go to next step.

STEP

175. Measure resistance between connector 1701 (cabin side) terminal 27 and connector 1954 terminal H with multimeter. Refer to Figure 34 and Figure 33.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 203.
YES Go to next step.

STEP

176. Measure resistance between connector 1954 terminal H and all other connector 1954 terminals with multimeter. Refer to Figure 33.

CONDITION/INDICATION

Does multimeter read OL for each test?

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 203.
YES Go to Step 198.

STEP

177. Turn ignition switch OFF (TM 9-2355-106-10).
178. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
179. Connect a jumper wire from relay socket terminal 87 to terminal 30. Refer to Figure 35.

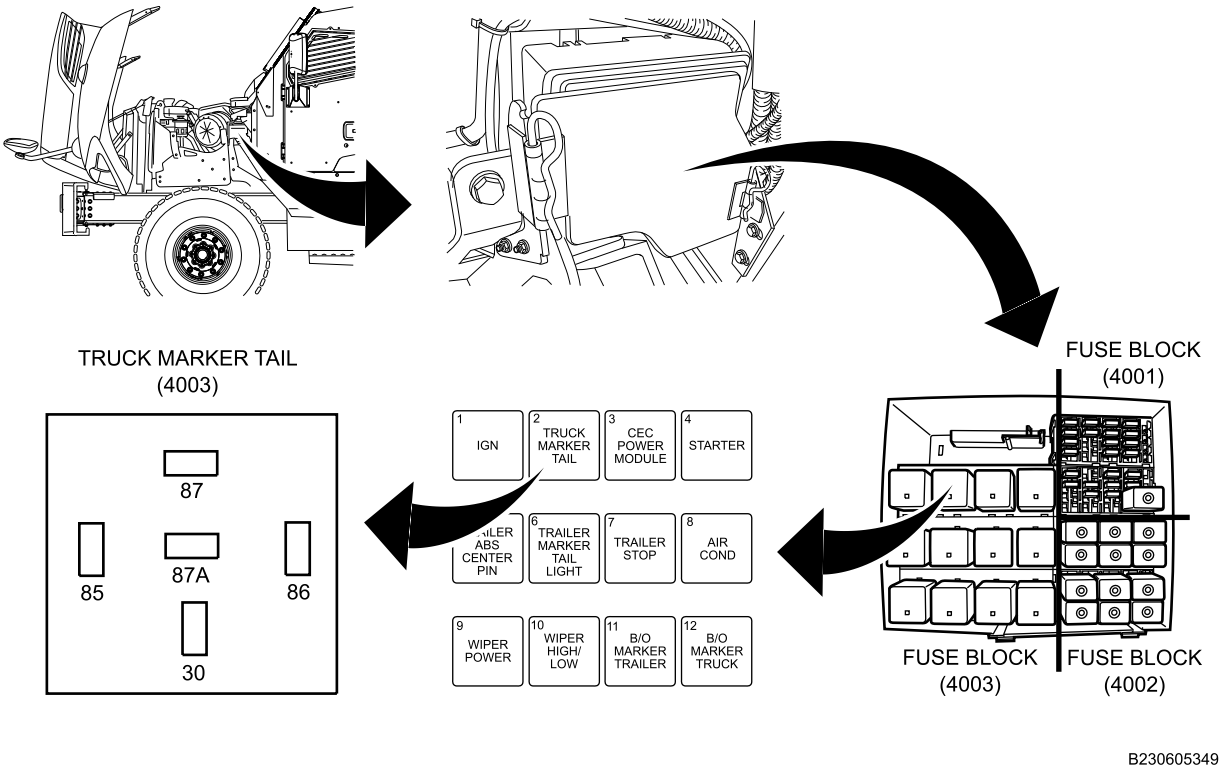


Figure 35. Engine Compartment PDC.

180. Turn MAIN POWER switch ON (TM 9-2355-106-10).
181. Turn ignition switch ON (TM 9-2355-106-10).
182. Enable lights by pressing SER. DRIVE on MVLS and then pressing ENTER within 5 seconds (TM 9-2355-106-10).

CONDITION/INDICATION

Are rear marker/turn signals lights and all clearance lights ON?

DECISION

YES Go to Step 194.
NO Go to Step 189.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 183. Front marker/turn signal bulb is faulty.

ACTION

Replace bulb. Refer to Front Turn Signal and Parking Light Bulb Removal and Installation (WP 0373). Return vehicle to service.

END OF TEST

MALFUNCTION

- 184. Front fender light bulb is faulty.

ACTION

Replace bulb. Refer to Front Fender Light Bulb Removal and Installation (WP 0372). Return vehicle to service.

END OF TEST

MALFUNCTION

- 185. Front bumper lamp unit is faulty.

ACTION

Replace front bumper lamp unit. Refer to Front Bumper Turn Signal and Parking Light Assembly Removal and Installation (WP 0361). Return vehicle to service.

END OF TEST

MALFUNCTION

- 186. Taillamp is faulty.

ACTION

Replace taillamp. Refer to Composite Taillamp Assembly Removal and Installation (WP 0383). Return vehicle to service.

END OF TEST

MALFUNCTION

- 187. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel Wiring Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 188. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller Removal and Installation (WP 0353). Return vehicle to service.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 189. PDC harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 190. Forward chassis harness is faulty.

ACTION

Replace forward chassis harness. Refer to Forward Chassis Harness Removal and Installation (WP 0424). Return vehicle to service.

END OF TEST

MALFUNCTION

- 191. Front bumper harness is faulty.

ACTION

Replace front bumper harness. Refer to Front Bumper Right Harness Removal and Installation (WP 0375) or Front Bumper Left Harness Removal and Installation (WP 0374). Return vehicle to service.

END OF TEST

MALFUNCTION

- 192. Front fender jumper harness is faulty.

ACTION

Replace front fender jumper harness. Refer to Front Fender Jumper Harness Removal and Installation (WP 0375). Return vehicle to service.

END OF TEST

MALFUNCTION

- 193. Headlight and turn signal harness is faulty.

ACTION

Replace headlight and turn signal harness. Refer to Left Headlight and Turn Signal Harness Removal and Installation (WP 0378). Refer to Right Headlight and Turn Signal Harness Removal and Installation (WP 0379). Return vehicle to service.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 194. TRUCK MARKER TAIL relay is faulty.

ACTION

Replace TRUCK MARKER TAIL relay. Refer to Power Distribution Center Fuse and Relay Removal and Installation (WP 0333). Return vehicle to service.

END OF TEST

MALFUNCTION

- 195. Center chassis harness is faulty.

ACTION

Replace center chassis harness. Refer to Center Chassis Harness Removal and Installation (WP 0426). Return vehicle to service.

END OF TEST

MALFUNCTION

- 196. Rear chassis harness is faulty.

ACTION

Replace rear chassis harness. Refer to Rear Chassis Harness Removal and Installation (WP 0427). Return vehicle to service.

END OF TEST

MALFUNCTION

- 197. Taillamp harness is faulty.

ACTION

Replace taillamp harness. Refer to Taillamp Harness Removal and Installation (WP 0384). Return vehicle to service.

END OF TEST

MALFUNCTION

- 198. MVLS switch is faulty.

ACTION

Refer to Master Vehicle Light Switch (MVLS) Troubleshooting Procedures (WP 0092). Return vehicle to service.

END OF TEST

MALFUNCTION

- 199. Front clearance light bar harness is faulty.

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace front clearance light bar harness. Refer to Front Clearance Light Bar Harness Removal and Installation (WP 0370). Return vehicle to service.

END OF TEST

MALFUNCTION

- 200. Rear clearance harness is faulty.

ACTION

Replace rear clearance harness. Refer to Rear Clearance Light Bar Harness Removal and Installation (WP 0386). Return vehicle to service.

END OF TEST

MALFUNCTION

- 201. Clearance lights cabin jumper harness is faulty.

ACTION

Replace clearance lights cabin jumper harness. Refer to Clearance Lights Cabin Jumper Harness Removal and Installation (WP 0442). Return vehicle to service.

END OF TEST

MALFUNCTION

- 202. Front and rear clearance lights harness is faulty.

ACTION

Replace front and rear clearance lights harness. Refer to Front and Rear Clearance Lights Harness Removal and Installation (WP 0441). Return vehicle to service.

END OF TEST

MALFUNCTION

- 203. IP harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 204. Clearance light assembly is faulty.

ACTION

Replace front rear clearance light assembly. Refer to Rear Clearance Light Assembly Removal and Installation (WP 0386) or Front Clearance Light Assembly Removal and Installation (WP 0369).

CLEARANCE AND MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 205. Rear side marker light assembly is faulty.

ACTION

Replace rear sidemarker light assembly. Refer to Rear Sidemarker Light Assembly Removal and Installation (WP 0387).

END OF TEST

MALFUNCTION

- 206. Front or rear clearance light bar harness is faulty.

ACTION

Replace front clearance light bar harness with inoperative light or rear clearance light bar harness with inoperative light. Refer to Rear Clearance Light Bar Harness Removal and Installation (WP 0386) or Front Clearance Light Bar Harness Removal and Installation (WP 0370). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)

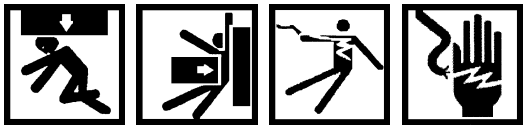
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0303
WP 0319
WP 0335
WP 0366
WP 0424
WP 0597
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
(WP 0789, Figure 63)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Disconnect blackout driving light connector LAM1099. Refer to Figure 1.

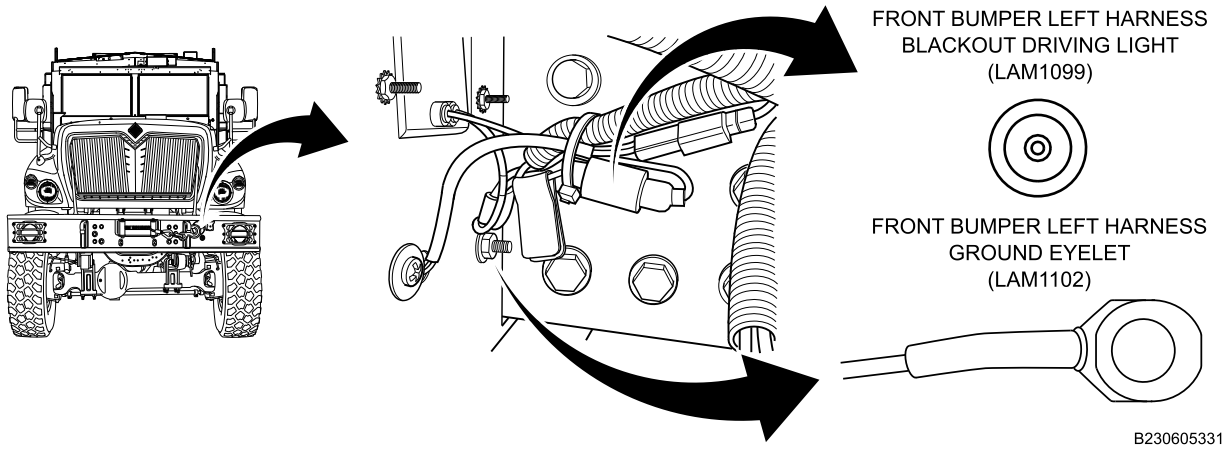


Figure 1. Left Front Bumper Area.

2. Turn MAIN POWER switch ON (TM 9-2355-106-10).
3. Turn ignition switch ON (TM 9-2355-106-10).
4. Press Master Vehicle Light Switch (MVLS) B.O. DRIVE button and then press ENTER within 5 seconds (TM 9-2355-106-10).
5. Measure DC voltage between connector LAM1099 and LAM1102 with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 29.
NO Go to next step.

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

6. Turn ignition switch OFF (TM 9-2355-106-10).
7. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
8. Disconnect blackout lighting connector 9916. Refer to Figure 2.

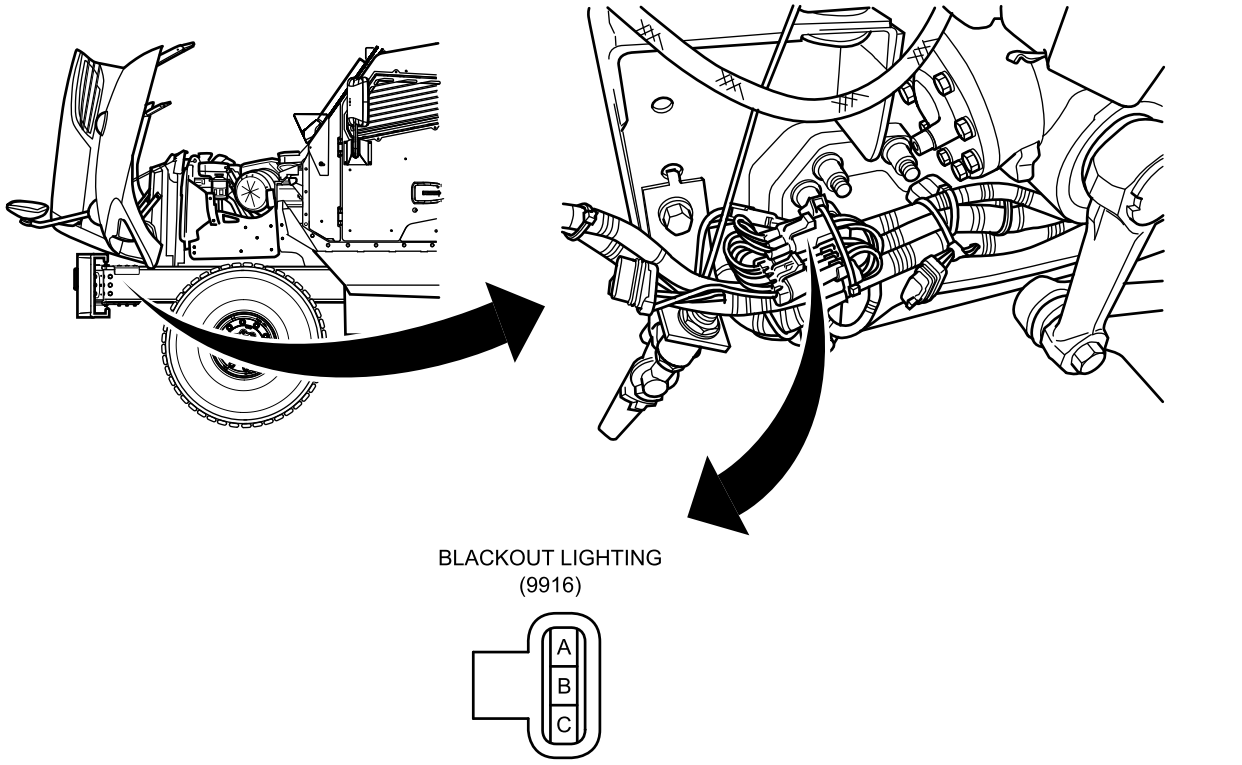


Figure 2. Left Front Bumper Area.

9. Turn MAIN POWER switch ON (TM 9-2355-106-10).
10. Turn ignition switch ON (TM 9-2355-106-10).
11. Measure DC voltage between connector 9916 terminal B and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 30.
NO Go to next step.

STEP

12. Turn ignition switch OFF (TM 9-2355-106-10).
13. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
14. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

15. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
16. Disconnect harness connector 4300/4301 (22 wire). Refer to Figure 3.

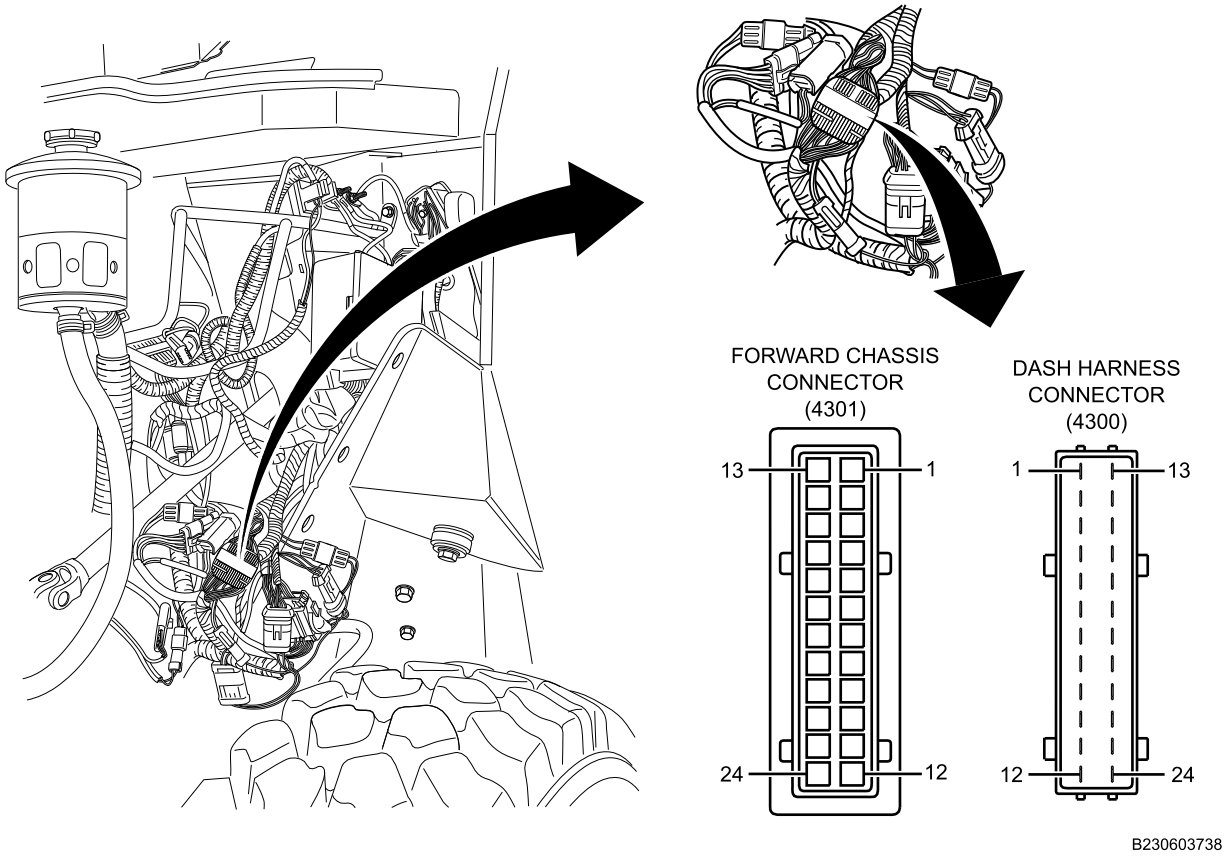


Figure 3. Left Engine Compartment Area.

17. Turn MAIN POWER switch ON (TM 9-2355-106-10).
18. Turn ignition switch ON (TM 9-2355-106-10).
19. Measure DC voltage between connector 4301 terminal 21 and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 31.
NO Go to next step.

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

20. Turn ignition switch OFF (TM 9-2355-106-10).
21. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
22. Disconnect connector 1701. Refer to Figure 4.

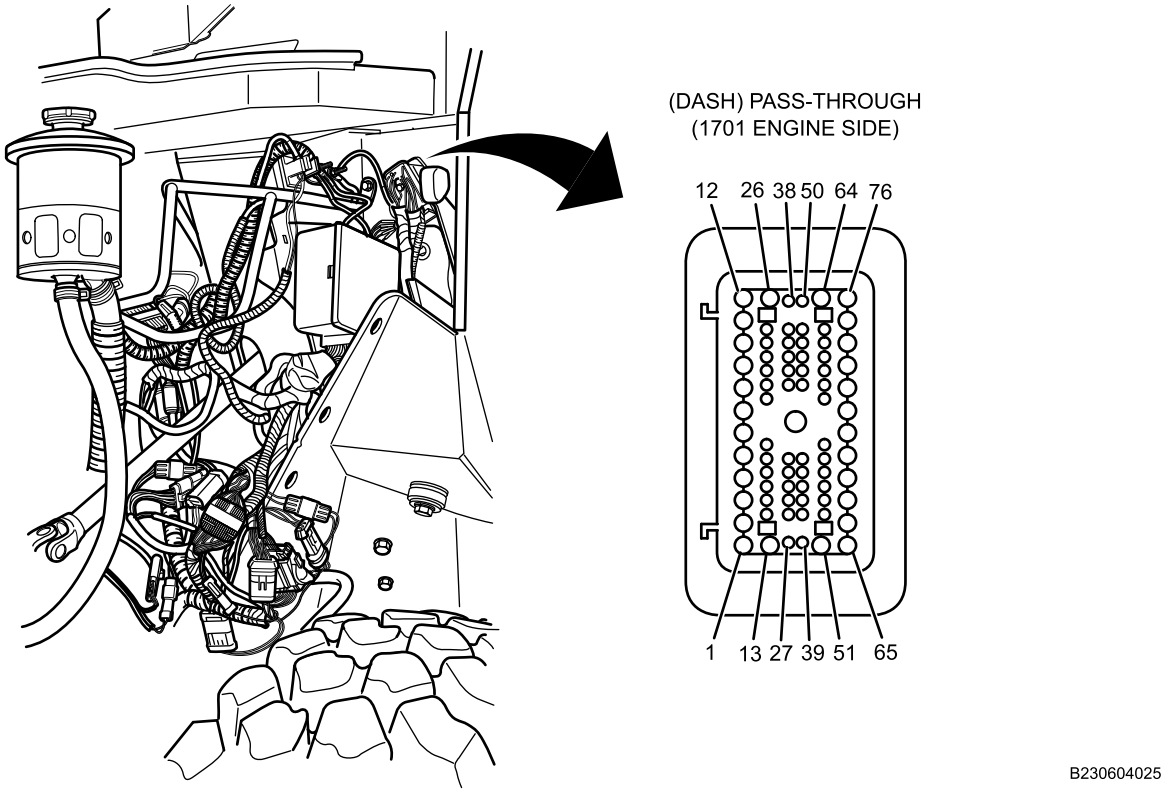


Figure 4. Left Engine Compartment Area.

23. Measure resistance between connector 1701 (engine side) terminal 37 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 32.
YES Go to next step.

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

24. Measure resistance between connector 1701 terminal 37 (engine side) and connector 4301 terminal 21. Refer to Figure 4. Refer to Figure 5.

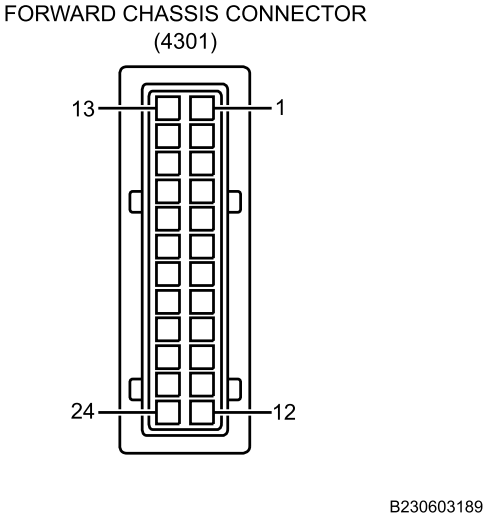


Figure 5. Connector 4301.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 32.
YES Go to next step.

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

25. Disconnect MVLS connector 1954. Refer to Figure 6. Refer to Master Vehicle Light Switch (MVLS) Removal and Installation (WP 0303).

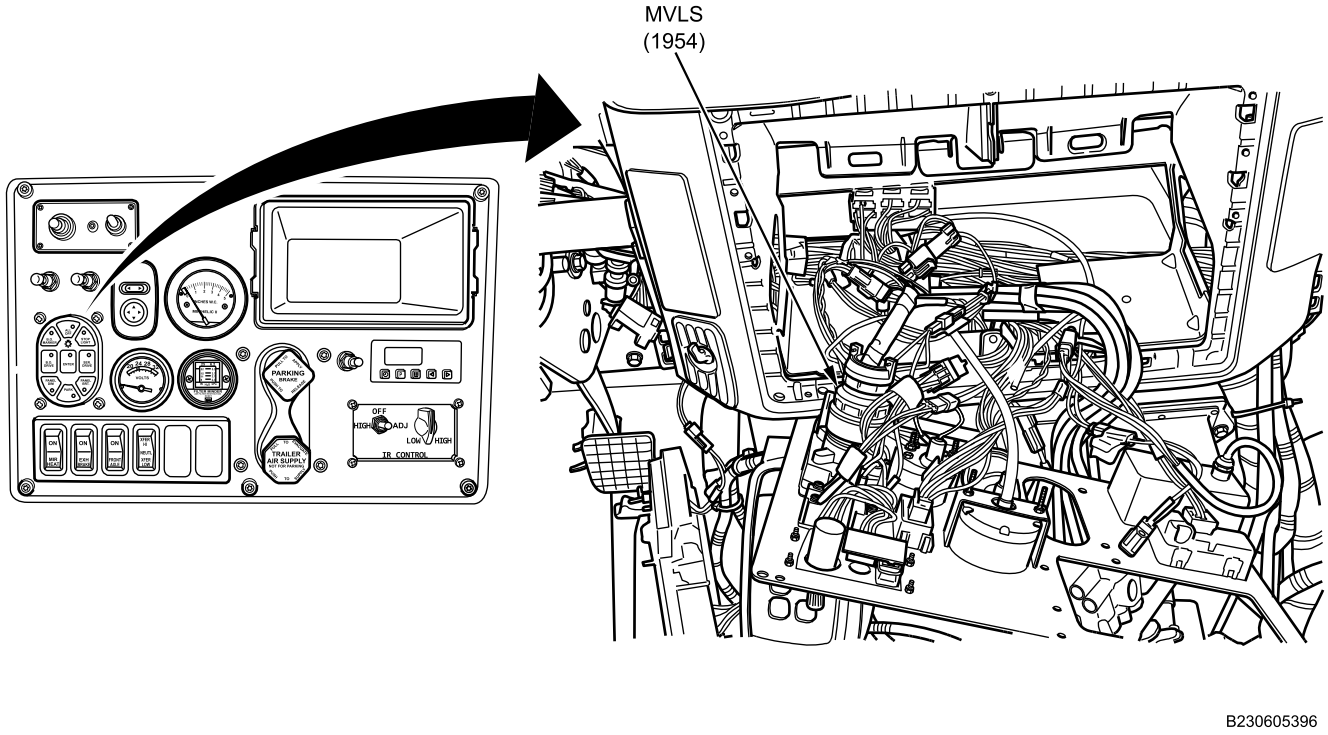


Figure 6. Behind Dash Area.

26. Measure resistance between connector 1701 (cabin side) terminal 37 and ground with multimeter. Refer to Figure 7.

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

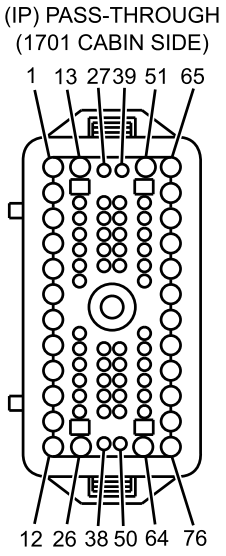


Figure 7. Connector 1701.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

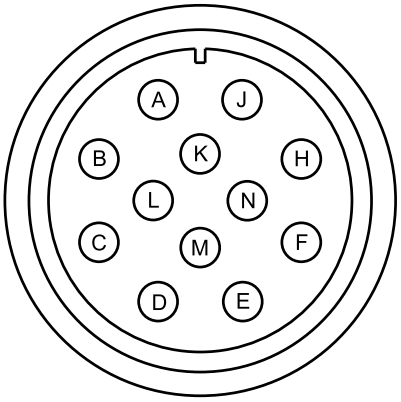
NO Go to Step 33.
YES Go to next step.

STEP

27. With assistance, measure resistance between connector 1701 (cabin side) terminal 37 and connector 1954 terminal D with multimeter. Refer to Figure 7. Refer to Figure 8.

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

MVLS
(1954)



B230603184

Figure 8. Connector 1954.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 33.
YES Go to next step.

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Measure resistance between connector 1954 terminal D and all other connector 1954 terminals with multimeter. Multimeter should read OL for each test. Refer to Figure 9.

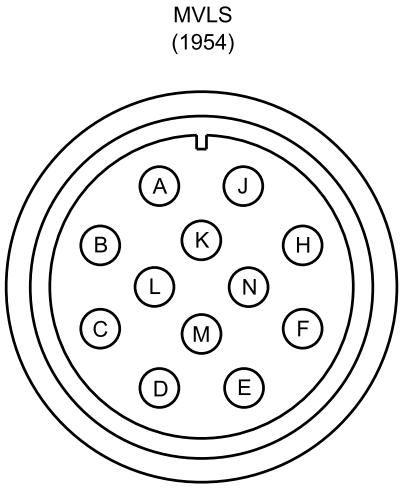


Figure 9. Connector 1954.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 33.
YES Go to Master Vehicle Light Switch (MVLS) Troubleshooting Procedure (WP 0092).

MALFUNCTION

- 29. Blackout light is faulty.

ACTION

Replace blackout light. Refer to Blackout Drive Light Assembly Removal and Installation (WP 0366). Return vehicle to service.

END OF TEST

BLACKOUT DRIVING LIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

MALFUNCTION

- 30. Left bumper wiring harness is faulty.

ACTION

Replace left bumper wiring harness. Refer to Front Bumper Left and Right Harness Removal and Installation (WP 0374). Return vehicle to service.

END OF TEST

MALFUNCTION

- 31. Forward chassis harness is faulty.

ACTION

Replace forward chassis harness. Refer to Forward Chassis Harness Removal and Installation (WP 0424). Return vehicle to service.

END OF TEST

MALFUNCTION

- 32. Power Distribution Center (PDC) wiring harness is faulty.

ACTION

Replace PDC wiring harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 33. Instrument Panel (IP) harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Personnel Required
Maintainer - (2)

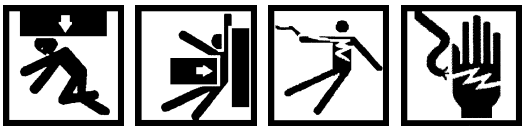
References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0092
WP 0303
WP 0319
WP 0333
WP 0335
WP 0361
WP 0383
WP 0384
WP 0374
WP 0375
WP 0424
WP 0426
WP 0427
WP 0598
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
(WP 0789, Figure 64)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STEP

1. Turn MAIN POWER switch ON (TM 9-2355-106-10).
2. Turn ignition switch ON (TM 9-2355-106-10).
3. Press Master Vehicle Light Switch (MVLS) ALL OFF button, then press ENTER within 5 seconds (TM 9-2355-106-10).
4. Observe blackout marker lights (TM 9-2355-106-10).

CONDITION/INDICATION

Are all blackout marker lights off?

DECISION

NO Go to Step 23.
YES Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

5. Press MVLS B.O. MARKER button, then press ENTER within 5 seconds.
6. Observe blackout marker lights.

CONDITION/INDICATION

Are all blackout marker lights on?

DECISION

YES Return vehicle to service.
NO Go to next step.

STEP

7. Observe blackout marker lights.

CONDITION/INDICATION

Are any blackout marker lights on?

DECISION

YES Go to Step 64.
NO Go to next step.

STEP

8. Turn ignition switch OFF (TM 9-2355-106-10).
9. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

10. Remove B/O MRKR TRUCK 4003 relay. Refer to Figure 1. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

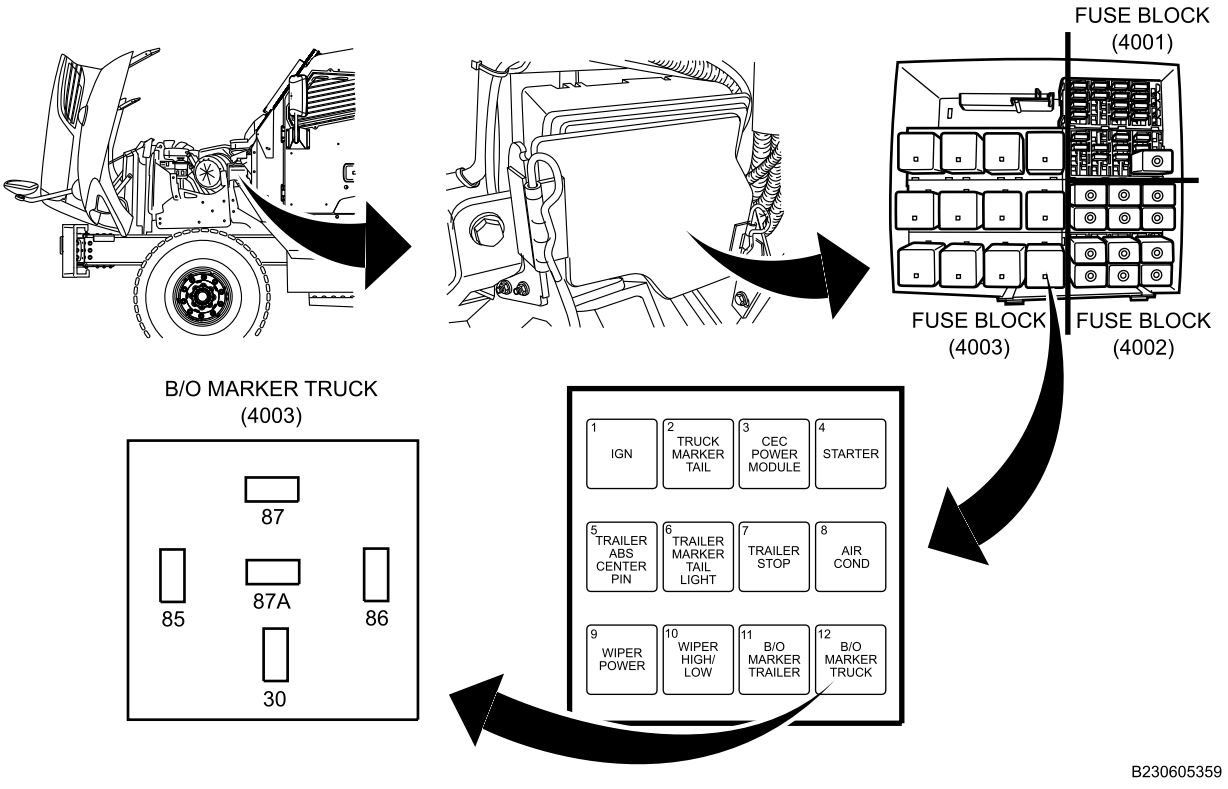


Figure 1. Left Engine Compartment Area.

11. Turn MAIN POWER switch ON (TM 9-2355-106-10).
12. Turn ignition switch ON (TM 9-2355-106-10).
13. Press B.O. MARKER then enter within 5 seconds on MVLS switch.
14. Measure DC voltage between B/O MARKER TRUCK relay socket terminal 86 and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 128.
YES Go to next step.

STEP

15. Measure DC voltage between relay socket terminal 87 and ground with multimeter. Refer to Figure 1.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 128.
YES Go to next step.

STEP

16. Measure DC voltage between relay socket terminal 87 and 85 with multimeter. Refer to Figure 2.

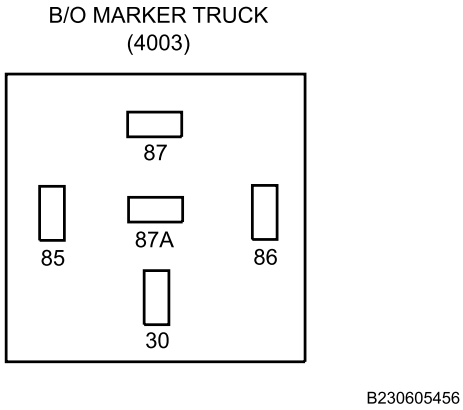


Figure 2. Blackout Relay Terminals.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 150.
YES Go to next step.

STEP

17. Turn ignition switch OFF (TM 9-2355-106-10).
18. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
19. Install jumper wire between relay socket terminals 30 and 87. Refer to Figure 2.
20. Turn MAIN POWER switch ON (TM 9-2355-106-10).
21. Turn ignition switch ON (TM 9-2355-106-10).
22. Observe blackout marker lights.

CONDITION/INDICATION

Are any blackout marker lights on?

DECISION

YES Go to Step 151.
NO Go to Step 150.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

23. Disconnect MVLS connector 1954. Refer to Figure 3. Refer to Master Vehicle Light Switch (MVLS) Removal and Installation (WP 0303).

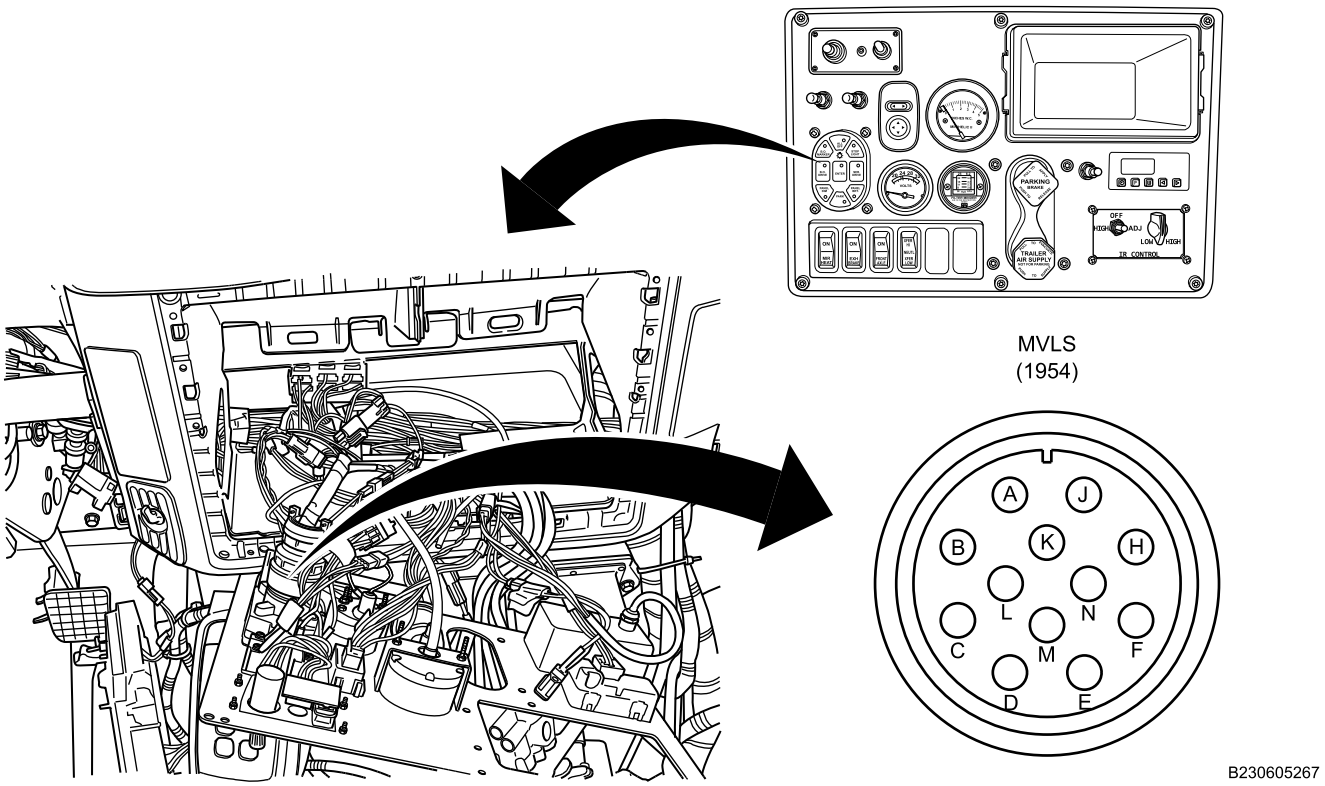


Figure 3. Behind Dash Area.

24. Observe blackout marker lights.

CONDITION/INDICATION

Are blackout marker lights off?

DECISION

YES Go to Master Vehicle Light Switch (MVLS) Troubleshooting Procedure (WP 0092).
NO Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

25. Remove B/O MRKR TRUCK 4003 relay. Refer to Figure 4. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

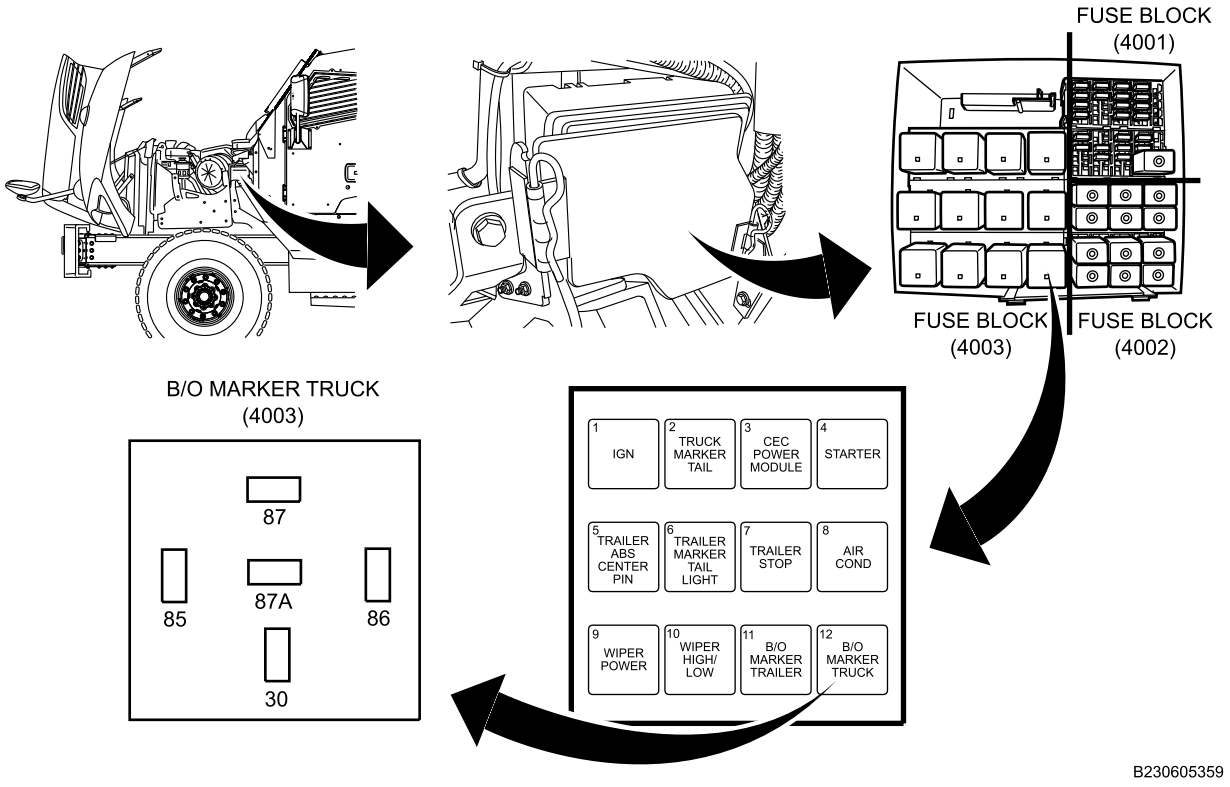


Figure 4. Left Engine Compartment Area.

26. Observe blackout marker lights.

CONDITION/INDICATION

Are blackout marker lights off?

DECISION

NO Go to Step 28.
YES Go to next step.

STEP

27. Measure DC voltage between B/O MARKER TRUCK relay socket terminal 86 and ground with multimeter. Refer to Figure 4.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 54.
NO Go to Step 151.

STEP

28. Turn ignition switch OFF (TM 9-2355-106-10).
29. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
30. Remove left side engine armor plate bracket. Refer to Left Engine Armor Plate Bracket Removal and Installation (WP 0598).
31. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
32. Disconnect harness connector 4301 from 4300 (22-wire). Refer to Figure 5.

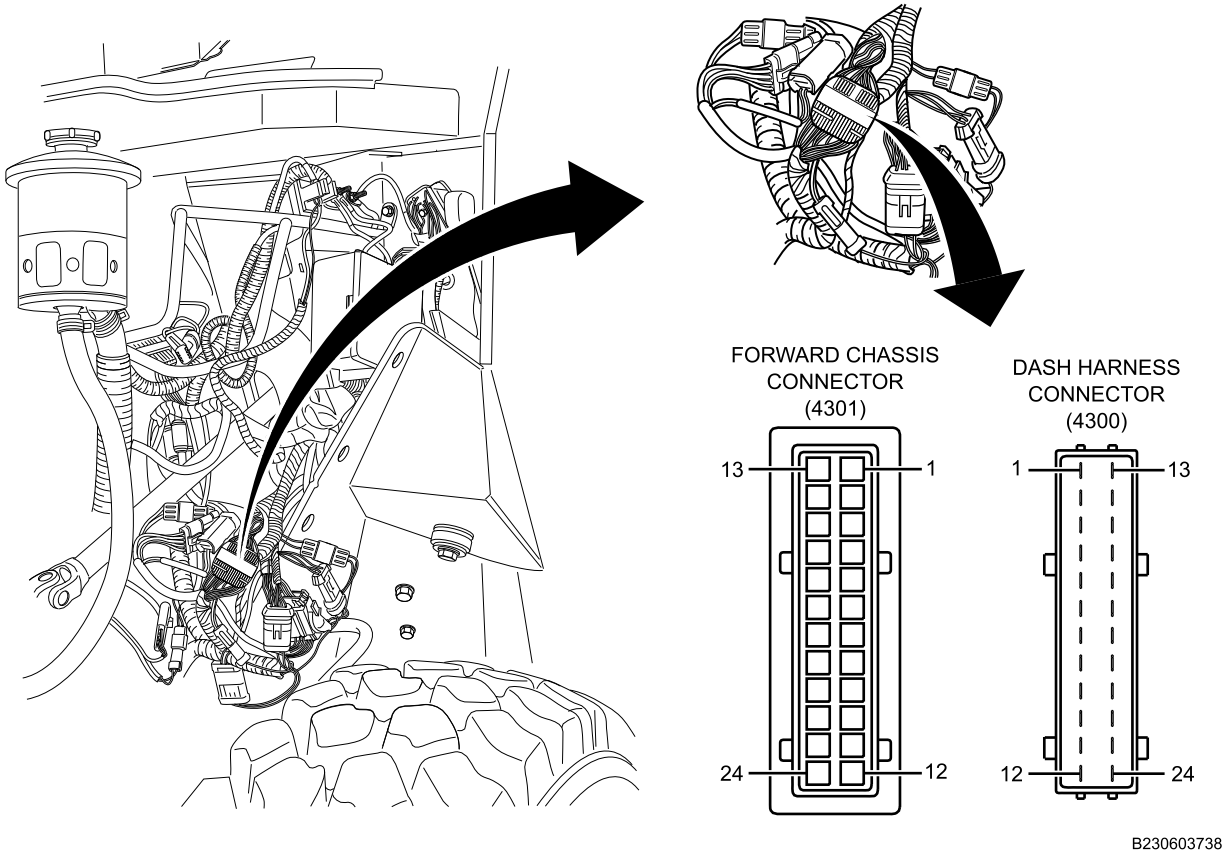


Figure 5. Left Engine Area.

33. Turn MAIN POWER switch ON (TM 9-2355-106-10).
34. Turn ignition switch ON (TM 9-2355-106-10).
35. Measure DC voltage between connector 4301 (22-wire, relay side) terminal 23 and ground with multimeter. Refer to Figure 5.

CONDITION/INDICATION

Does multimeter read more than 5V?

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 58.
YES Go to next step.

STEP

36. Turn ignition switch OFF (TM 9-2355-106-10).
37. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
38. Disconnect harness connector 9700 from 9714. Refer to Figure 6.

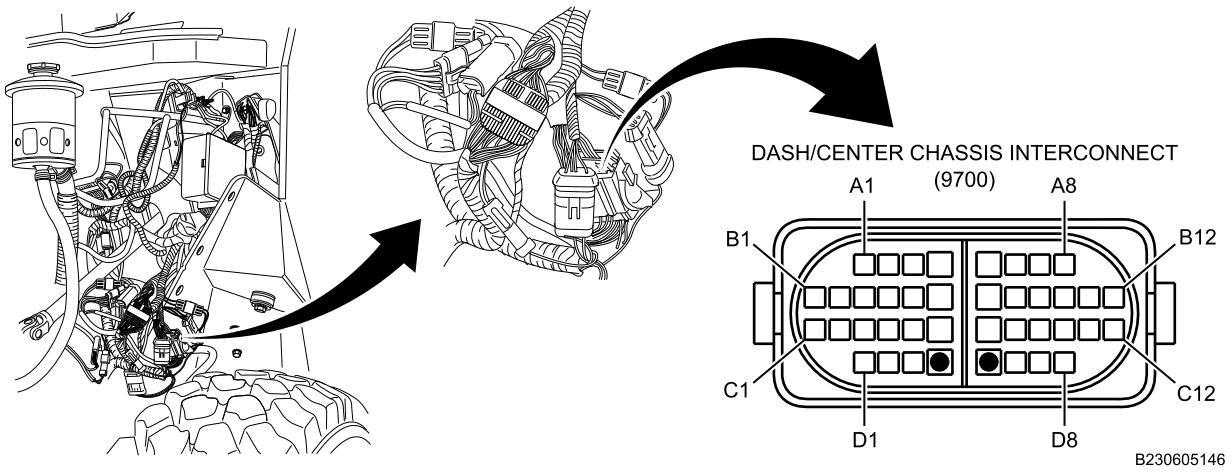


Figure 6. Left Engine Area.

39. Turn MAIN POWER switch ON (TM 9-2355-106-10).
40. Turn ignition switch ON (TM 9-2355-106-10).
41. Measure DC voltage between connector 9700 (relay side) terminal D1 and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read more than 5V?

DECISION

YES Go to Step 150.
NO Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

42. Turn ignition switch OFF (TM 9-2355-106-10).
43. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
44. Disconnect harness connector 9800M from 9800F. Refer to Figure 7.

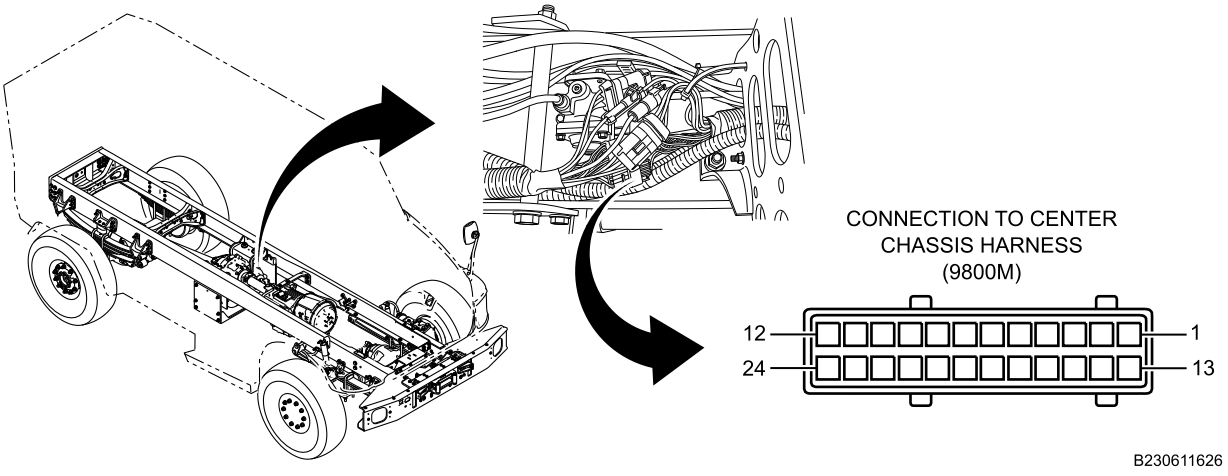


Figure 7. Left Center Frame.

45. Turn MAIN POWER switch ON (TM 9-2355-106-10).
46. Turn ignition switch ON (TM 9-2355-106-10).
47. Measure DC voltage between connector 9800M terminal 5 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read more than 5V?

DECISION

NO Go to Step 152.
YES Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

48. Turn ignition switch OFF (TM 9-2355-106-10).
49. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
50. Disconnect harness connector 9720 from LAM1085. Refer to Figure 8.

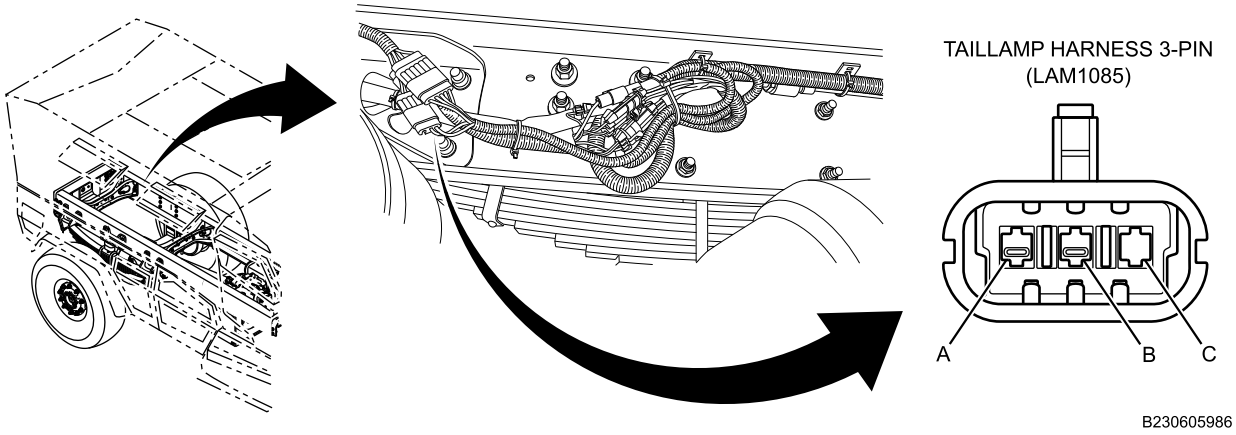


Figure 8. Left Rear Frame.

51. Turn MAIN POWER switch ON (TM 9-2355-106-10).
52. Turn ignition switch ON (TM 9-2355-106-10).
53. Measure DC voltage between connector LAM1085 terminal B and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read more than 5V?

DECISION

NO Go to Step 153.
YES Go to Step 154.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

54. Turn ignition switch OFF (TM 9-2355-106-10).
55. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
56. Disconnect connector 1701. Refer to Figure 9.

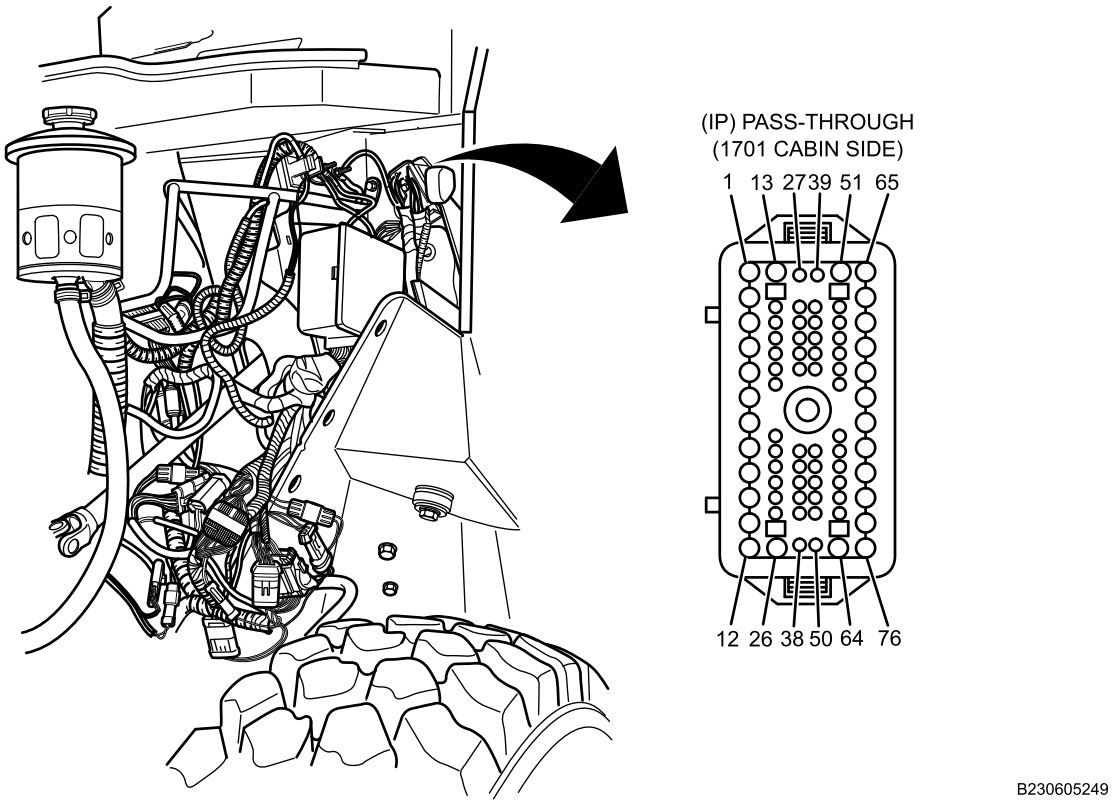


Figure 9. Left Engine Compartment Area.

57. Measure resistance between connector 1701 (cabin side) terminal 24 and all other connector 1701 terminals with multimeter. Multimeter should read OL for each test. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

YES Go to Step 150.
NO Go to Step 155.

STEP

58. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
59. Turn ignition switch OFF (TM 9-2355-106-10).

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

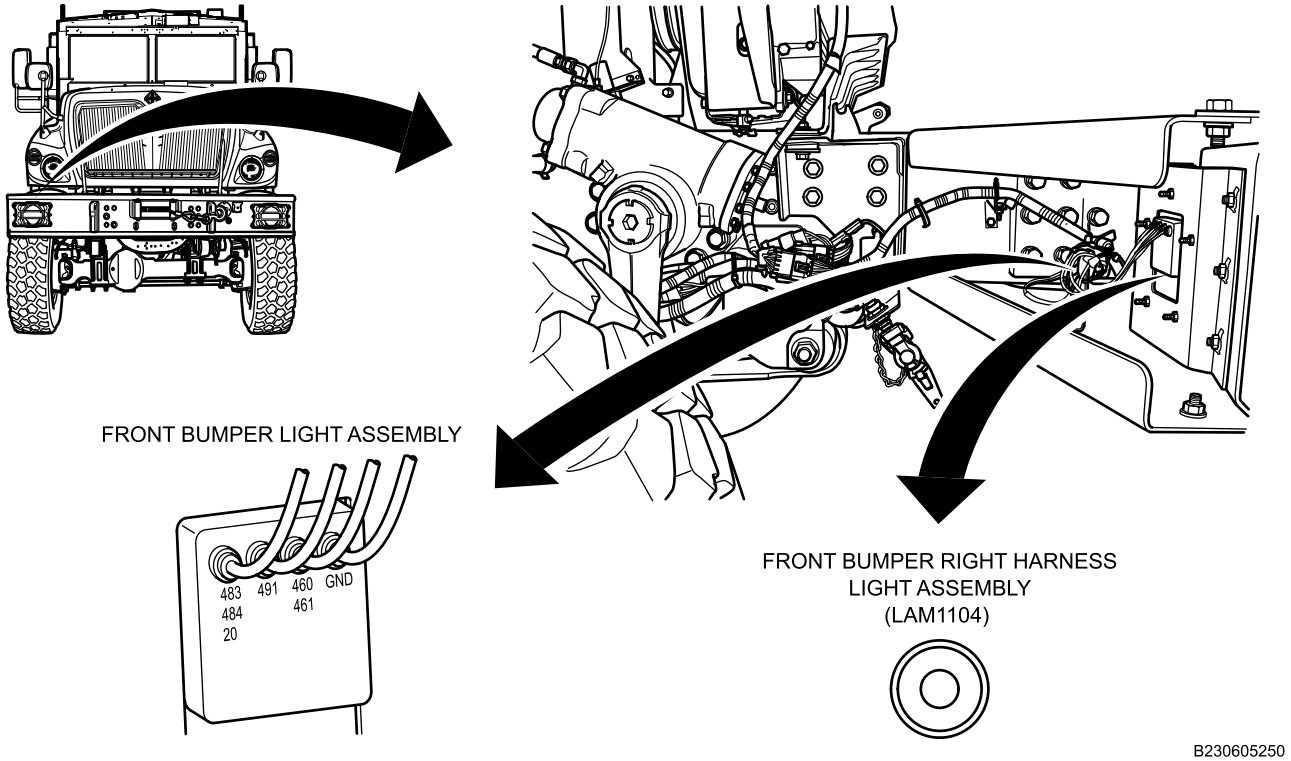


Figure 10. Right Front Bumper Area.

60. Disconnect connector LAM1104 wire 483. Refer to Figure 10.

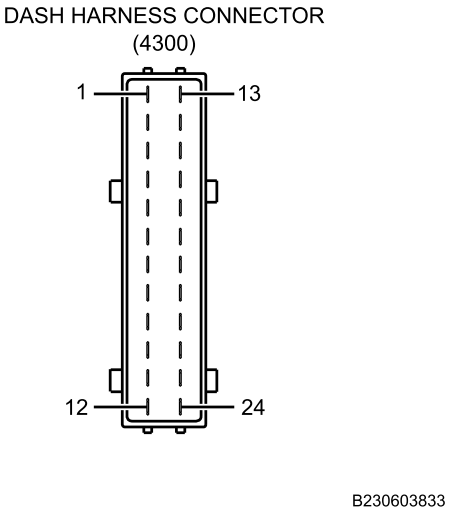


Figure 11. Connector 4300.

61. Turn MAIN POWER switch ON (TM 9-2355-106-10).
62. Turn ignition switch ON (TM 9-2355-106-10).
63. Measure voltage between connector 4300 (22-wire) terminal 23 and ground. Refer to Figure 11.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read more than 5V?

DECISION

NO Go to Step 157.
YES Go to Step 137.

STEP

64. Observe blackout marker lights.

CONDITION/INDICATION

Are all front blackout marker lights on?

DECISION

NO Go to Step 97.
YES Go to next step.

STEP

65. Turn ignition switch OFF (TM 9-2355-106-10).
66. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
67. Remove inoperative taillight assembly. Refer to Composite Taillamp Assembly Removal and Installation (WP 0383).
68. Disconnect inoperative rear blackout (wire 24) connector. Refer to Figure 12 and Figure 13.

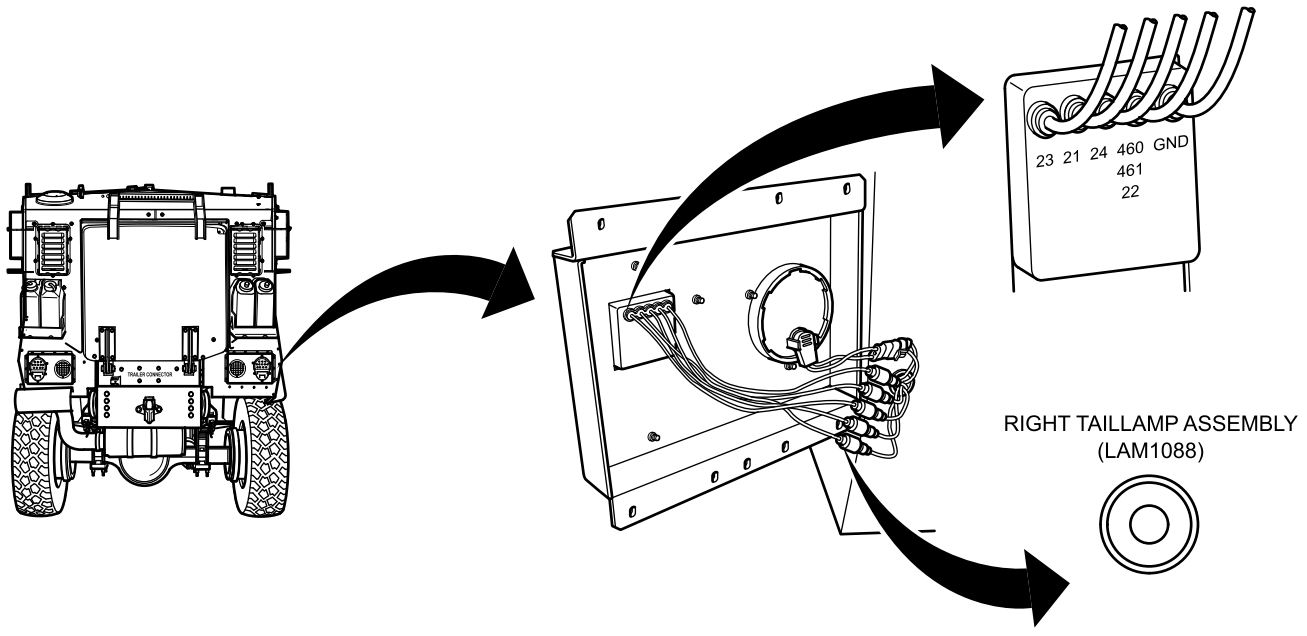


Figure 12. Right Rear of Vehicle Behind Taillight Assembly.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

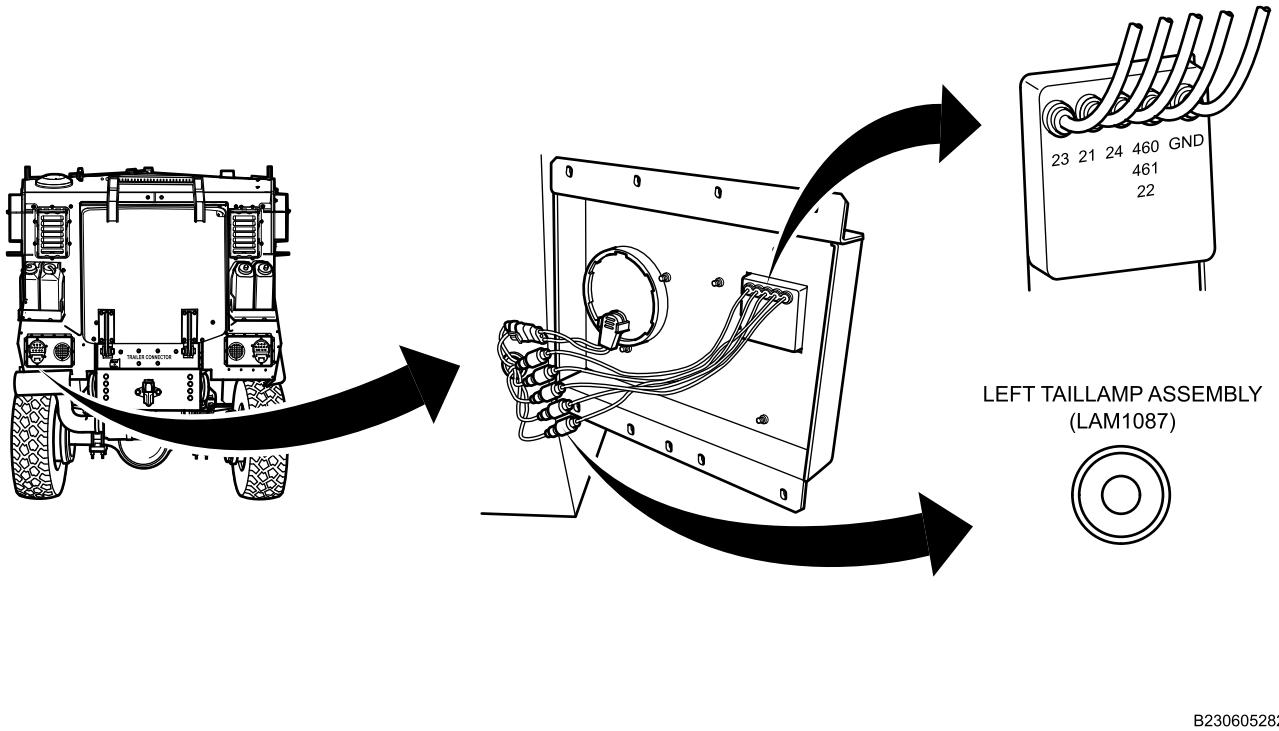


Figure 13. Left Rear of Vehicle Behind Taillight Assembly.

69. Turn MAIN POWER switch ON (TM 9-2355-106-10).
70. Turn ignition switch ON (TM 9-2355-106-10).
71. Turn B/O lights ON (TM 9-2355-106-10).
72. Measure DC voltage between connector LAM1088 or LAM1087 and ground with multimeter. Refer to Figure 12 and Figure 13.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V at inoperative rear blackout light connectors?

DECISION

YES Go to Step 156.
NO Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

73. Turn ignition switch OFF (TM 9-2355-106-10).
74. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
75. Disconnect connector 9303A. Refer to Figure 14.

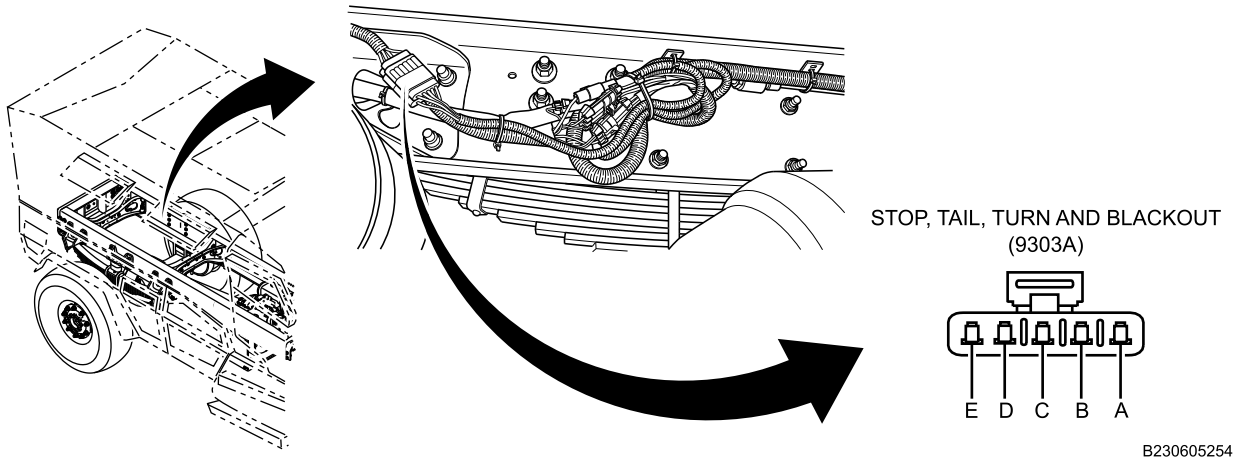


Figure 14. Rear Frame Rail.

76. Disconnect connector 9720. Refer to Figure 15.

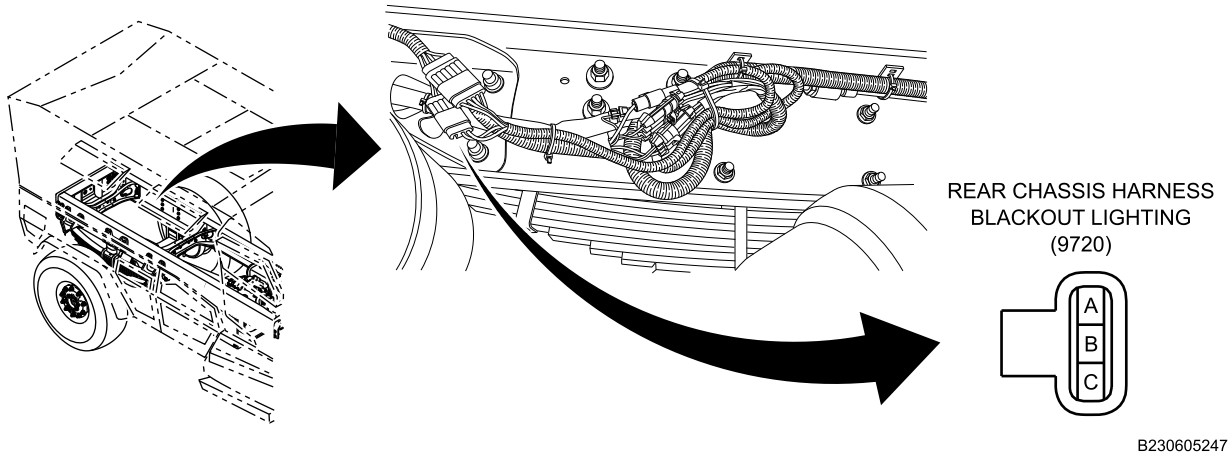


Figure 15. Rear Frame Rail.

77. Turn MAIN POWER switch ON (TM 9-2355-106-10).
78. Turn ignition switch ON (TM 9-2355-106-10).
79. Turn B/O lights ON (TM 9-2355-106-10).
80. Measure DC voltage between connector 9303A terminal E and connector 9720 terminal B with multimeter. Refer to Figure 16 and Figure 15.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

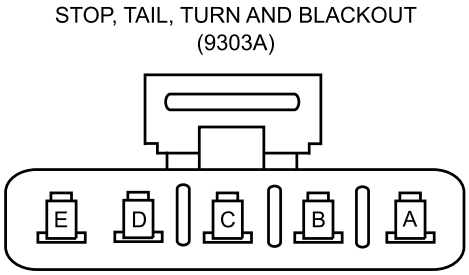


Figure 16. Connector 9303A.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 154.
NO Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

81. Turn ignition switch OFF (TM 9-2355-106-10).
82. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
83. Disconnect harness connector 9800F from 9800M. Refer to Figure 17.

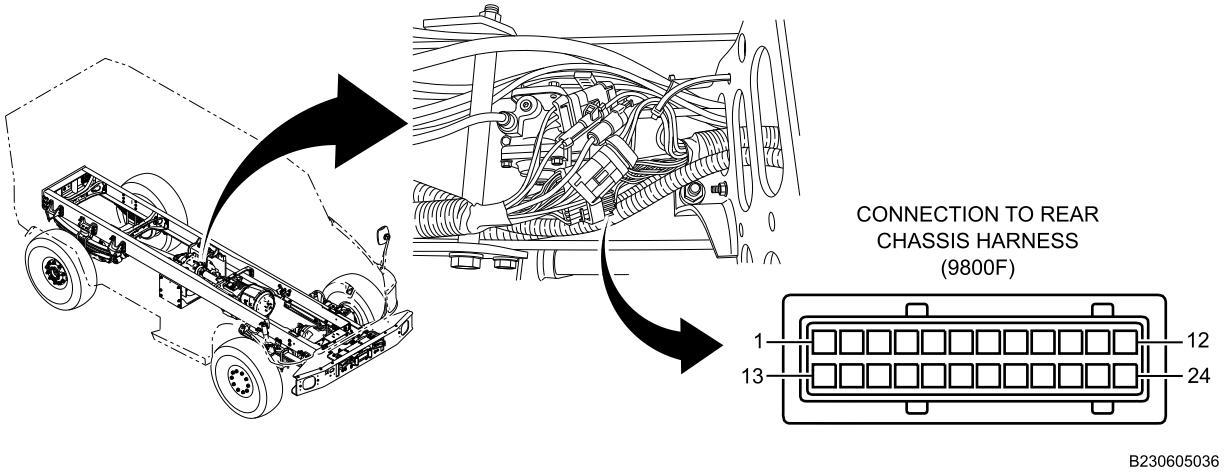


Figure 17. Left Center Frame Rail.

84. Turn MAIN POWER switch ON (TM 9-2355-106-10).
85. Turn ignition switch ON (TM 9-2355-106-10).
86. Turn B/O lights ON (TM 9-2355-106-10).
87. Measure DC voltage between connector 9800F terminals 5 and 12 with multimeter. Refer to Figure 17.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 153.
NO Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

88. Turn ignition switch OFF (TM 9-2355-106-10).
89. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
90. Remove left side engine armor plate bracket. Refer to Left Engine Armor Plate Bracket Removal and Installation (WP 0598).
91. Remove air cleaner assembly. Refer to Air Cleaner Assembly Removal and Installation (WP 0257).
92. Disconnect connectors 9714 from 9700. Refer to Figure 18.

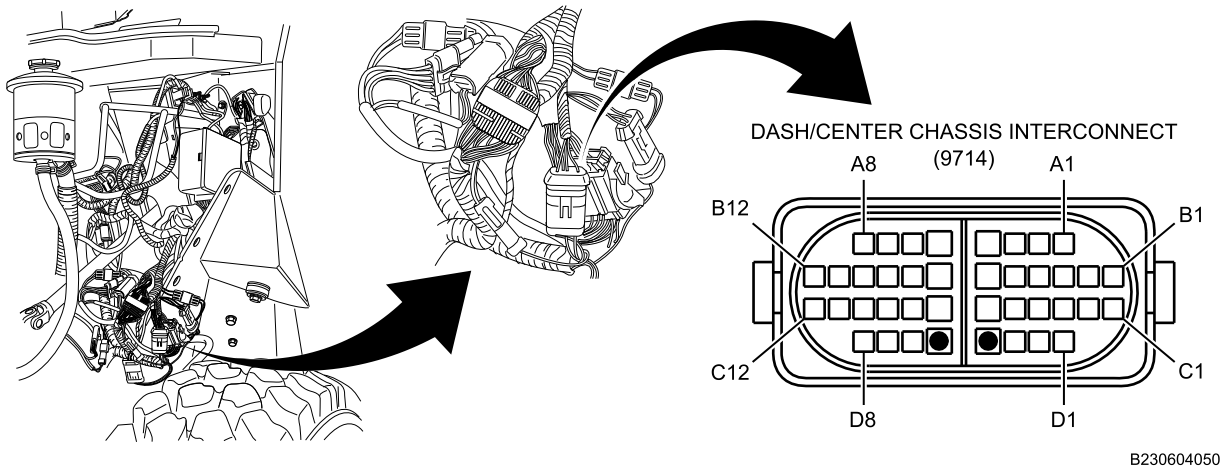


Figure 18. Left Engine Compartment Area.

93. Turn MAIN POWER switch ON (TM 9-2355-106-10).
94. Turn ignition switch ON (TM 9-2355-106-10).
95. Turn B/O lights ON (TM 9-2355-106-10).
96. Measure DC voltage between connector 9714 terminals C6 and D1 with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 152.
NO Go to Step 150.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

97. Observe front blackout marker lights.

CONDITION/INDICATION

Is right front marker light on?

DECISION

YES Go to Step 113.
NO Go to next step.

STEP

98. Turn ignition switch OFF (TM 9-2355-106-10).
99. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
100. Disconnect right front blackout marker light connector LAM1104 wires 483 and GND. Refer to Figure 19.

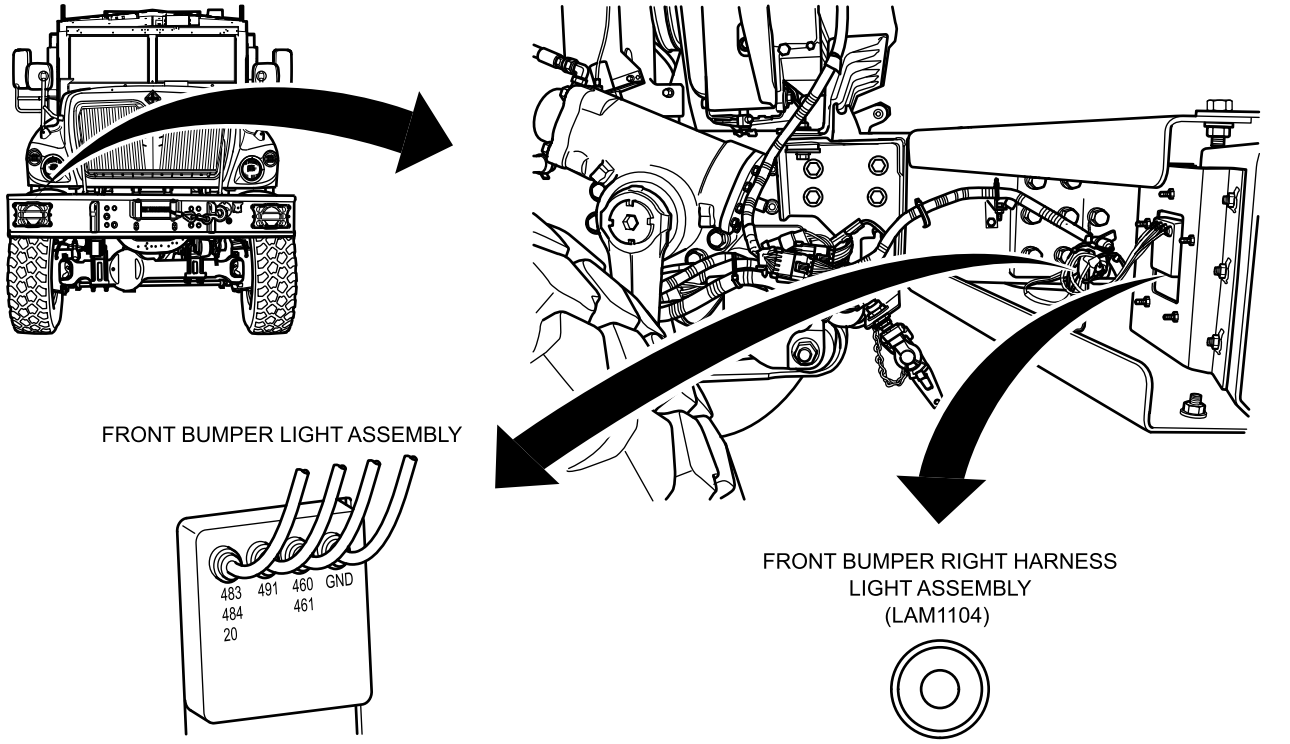


Figure 19. Right Front Bumper Area.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

101. Turn MAIN POWER switch ON (TM 9-2355-106-10).
102. Turn ignition switch ON (TM 9-2355-106-10).
103. Turn B/O marker lights ON (TM 9-2355-106-10).
104. Measure DC voltage between connector LAM1104 wires 483 and GND with multimeter. Refer to Figure 19.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 157.
NO Go to next step.

STEP

105. Turn ignition switch OFF (TM 9-2355-106-10).
106. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
107. Disconnect connector LAM1107 (follow wires from the B/O MARKER light to inline). Refer to Figure 20.

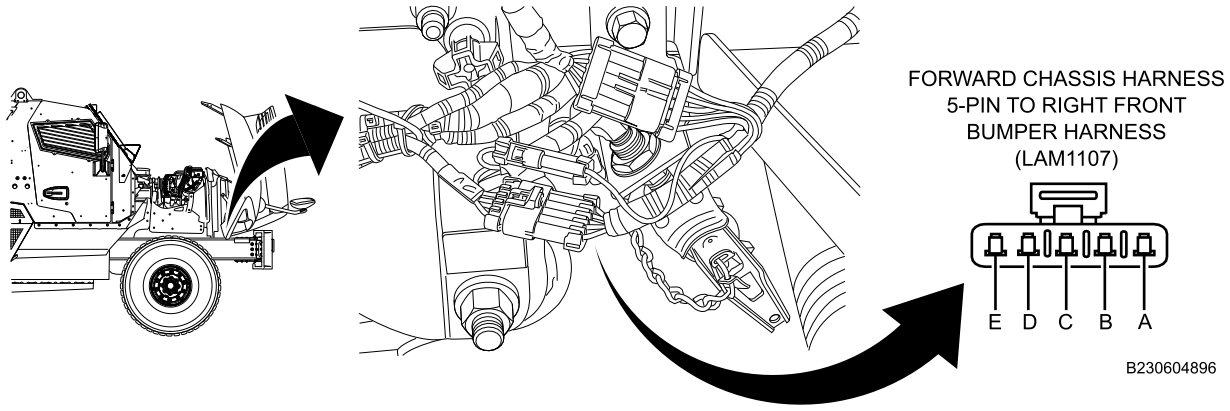


Figure 20. Right Front Bumper Area.

108. Disconnect connector 9917. Refer to Figure 21.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

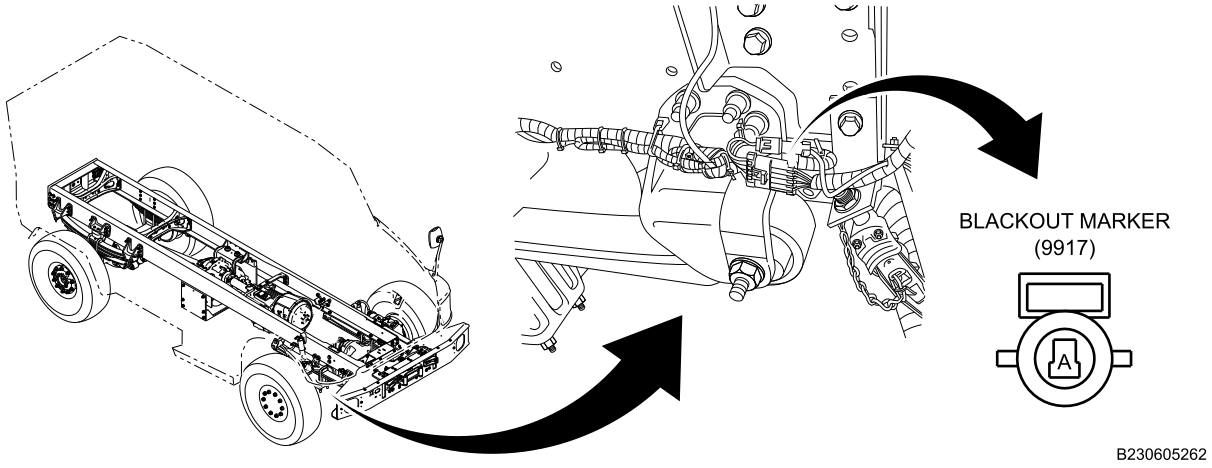


Figure 21. Right Front Bumper Area.

109. Turn MAIN POWER switch ON (TM 9-2355-106-10).
110. Turn ignition switch ON (TM 9-2355-106-10).
111. Press MVLS B.O. MARKER button, then press ENTER within 5 seconds.
112. Measure DC voltage between connector LAM1107 terminal B and connector 9917 terminal A with multimeter. Refer to Figure 22 and Figure 21.

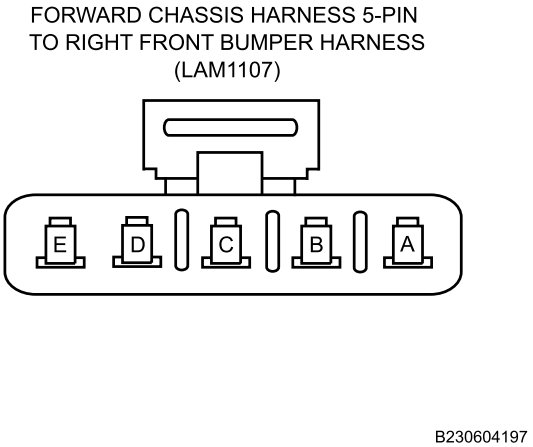


Figure 22. Connector LAM1107.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 158.
NO Go to Step 159.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

113. Turn ignition switch OFF (TM 9-2355-106-10).
114. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
115. Disconnect left front blackout marker light connector LAM1103 wires 483 and GND. Refer to Figure 23.

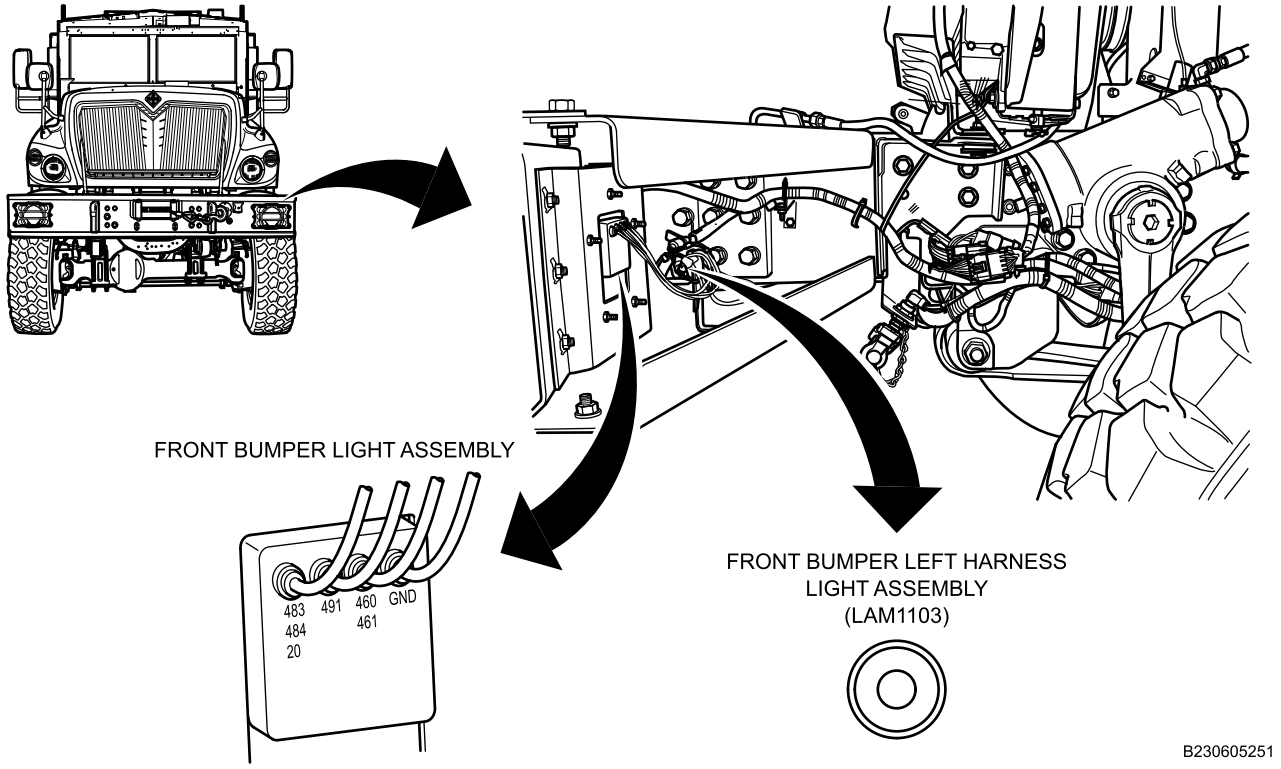


Figure 23. Left Front Bumper Area.

116. Turn MAIN POWER switch ON (TM 9-2355-106-10).
117. Turn ignition switch ON (TM 9-2355-106-10).
118. Turn B/O marker lights ON (TM 9-2355-106-10).
119. Measure DC voltage between connector LAM1103 wires 483 and GND with multimeter. Refer to Figure 23.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 160.
NO Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

120. Turn ignition switch OFF (TM 9-2355-106-10).
121. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
122. Disconnect connector LAM1101 (follow wire harness from B/O MARKER light to inline). Refer to Figure 24.

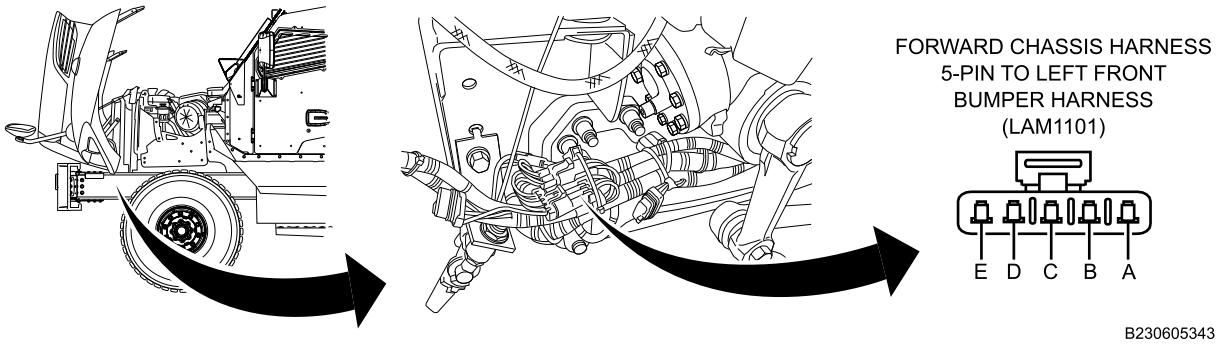


Figure 24. Left Front Bumper Area.

123. Disconnect connector 9916. Refer to Figure 25.

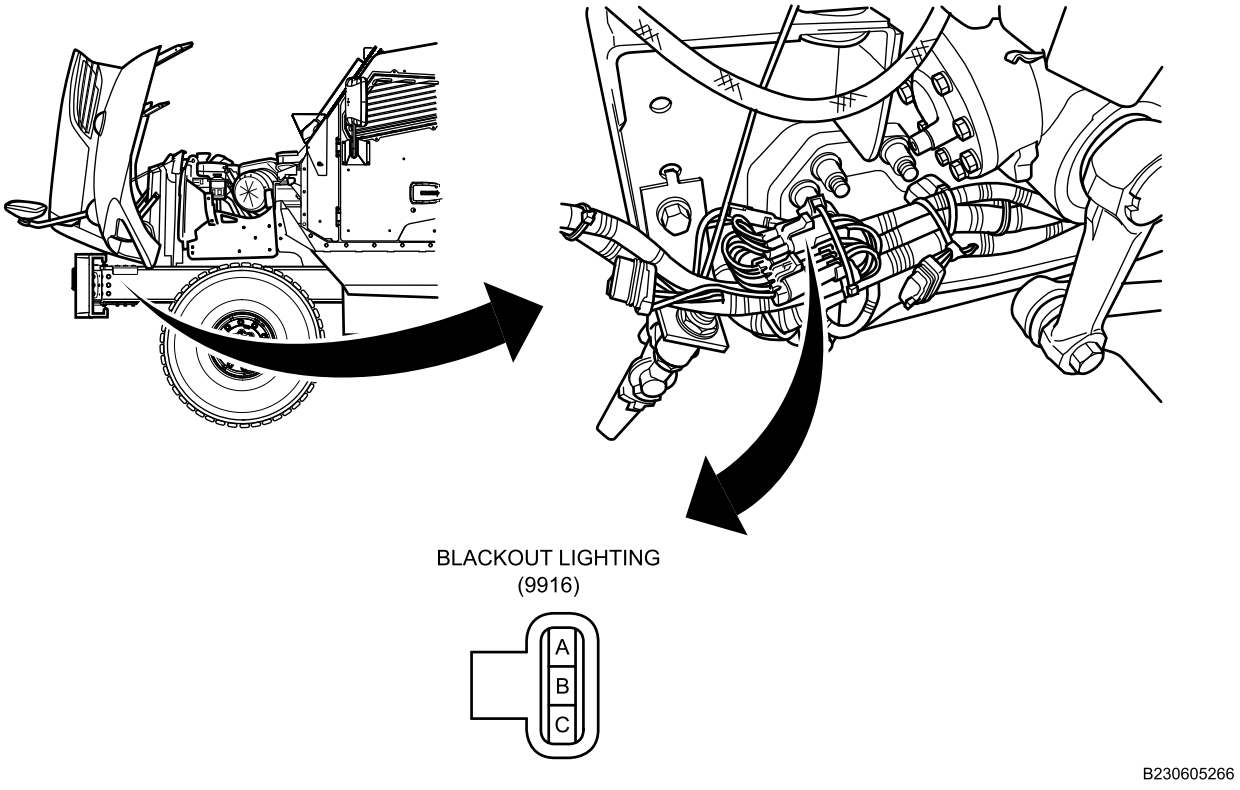


Figure 25. Left Front Bumper Area.

124. Turn MAIN POWER switch ON (TM 9-2355-106-10).
125. Turn ignition switch ON (TM 9-2355-106-10).

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

126. Turn B/O marker lights ON (TM 9-2355-106-10).
127. Measure DC voltage between connector LAM1101 terminal B and connector 9916 terminal A with multimeter. Refer to Figure 24 and Figure 25.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 161.
NO Go to Step 159.

STEP

128. Turn ignition switch OFF (TM 9-2355-106-10).
129. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
130. Disconnect pass-through connector 1701. Refer to Figure 26.

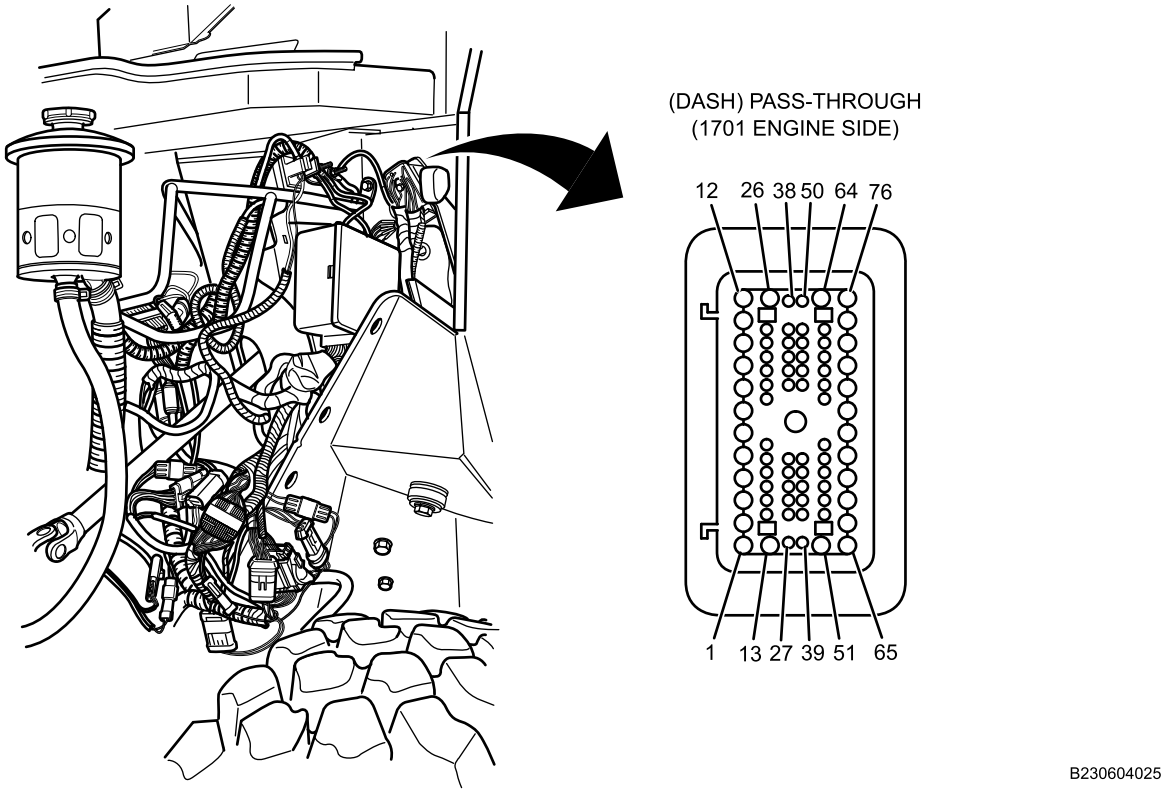


Figure 26. Left Engine Area.

131. Measure resistance between connector 1701 (engine side) terminal 24 and ground with multimeter. Refer to Figure 26.

CONDITION/INDICATION

Does multimeter read OL?

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 150.
YES Go to next step.

STEP

132. Measure resistance between connector 1701 (engine side) terminal 24 and B/O relay socket terminal 86. Refer to Figure 27 and Figure 28.

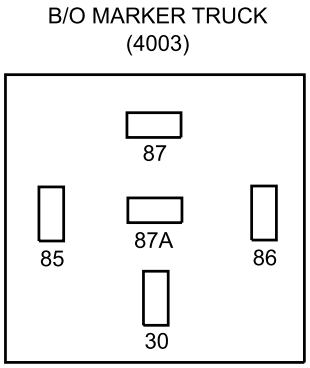


Figure 27. Blackout Relay Terminals.

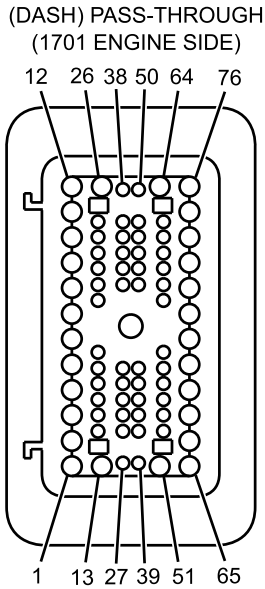


Figure 28. Connector 1701.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 150.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

YES Go to next step.

STEP

133. Disconnect MVLS connector 1954. Refer to Figure 29. Refer to Master Vehicle Light Switch (MVLS) Removal and Installation (WP 0303).

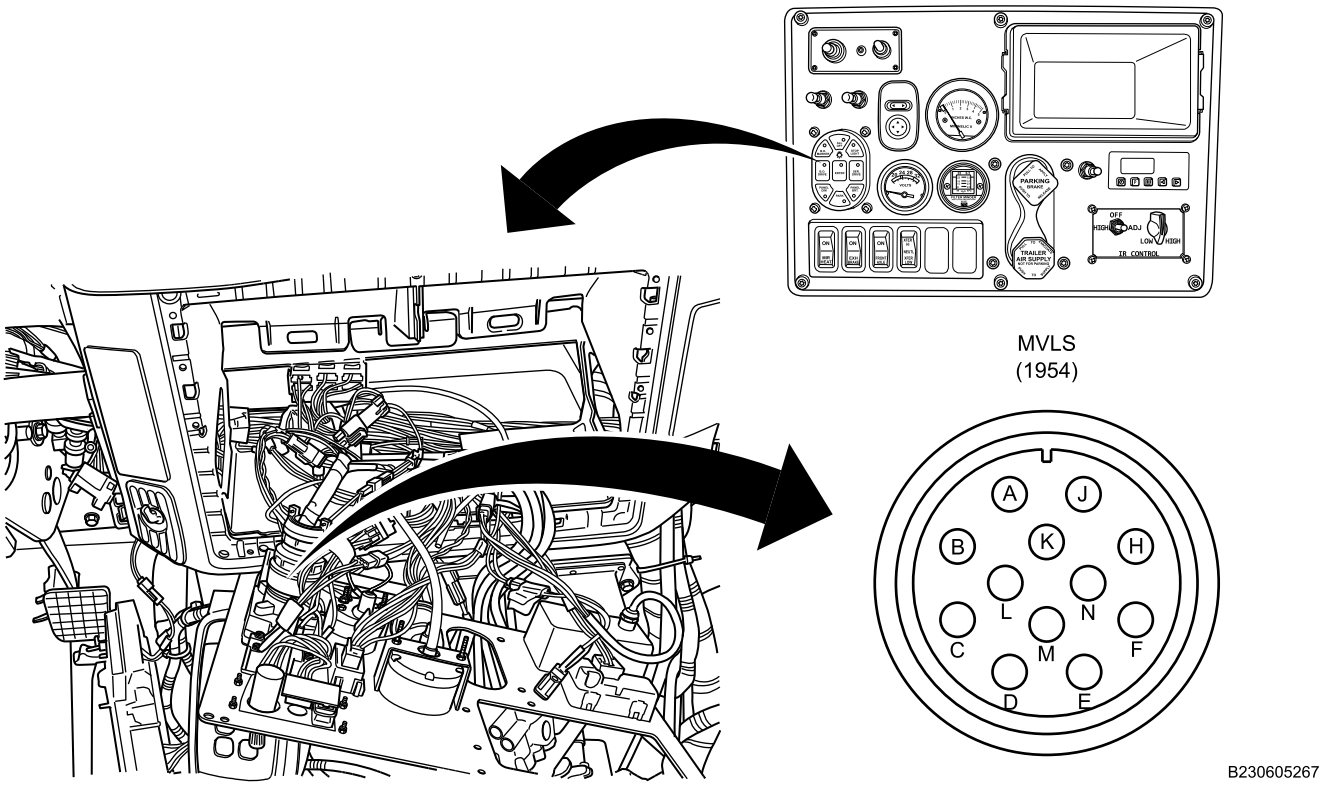


Figure 29. Behind Dash Area.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

134. Measure resistance between connector 1701 terminal 24 and ground with multimeter. Refer to Figure 30.

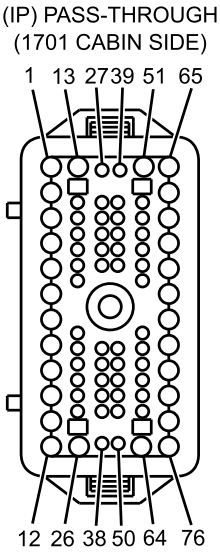


Figure 30. Connector 1701.

CONDITION/INDICATION

Does multimeter read OL?

DECISION

NO Go to Step 155.
YES Go to next step.

STEP

135. With assistance, measure resistance between connector 1701 terminal 24 and connector 1954 terminal E with multimeter. Refer to Figure 30 and Figure 29.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 155.
YES Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

136. Measure resistance between connector 1701 terminal 24 and all other connector 1701 terminals with multimeter. Multimeter should read OL for each test. Refer to Figure 30.

CONDITION/INDICATION

Does multimeter read OL for each test?

DECISION

NO Go to Step 155.
YES Go to Master Vehicle Light Switch (MVLS) Troubleshooting Procedures (WP 0092).

STEP

137. Measure voltage between connector 4301 terminal 23 and ground with multimeter. Refer to Figure 31.

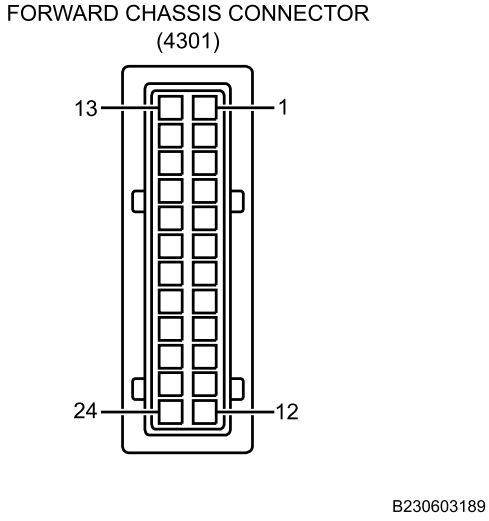


Figure 31. Connector 4301.

CONDITION/INDICATION

Does multimeter read more than 5V?

DECISION

NO Go to Step 158.
YES Go to next step.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

138. Turn ignition switch OFF (TM 9-23555-106-10).
139. Turn MAIN POWER switch OFF (TM 9-23555-106-10).
140. Disconnect connector LAM1103 wires 483. Refer to Figure 32.

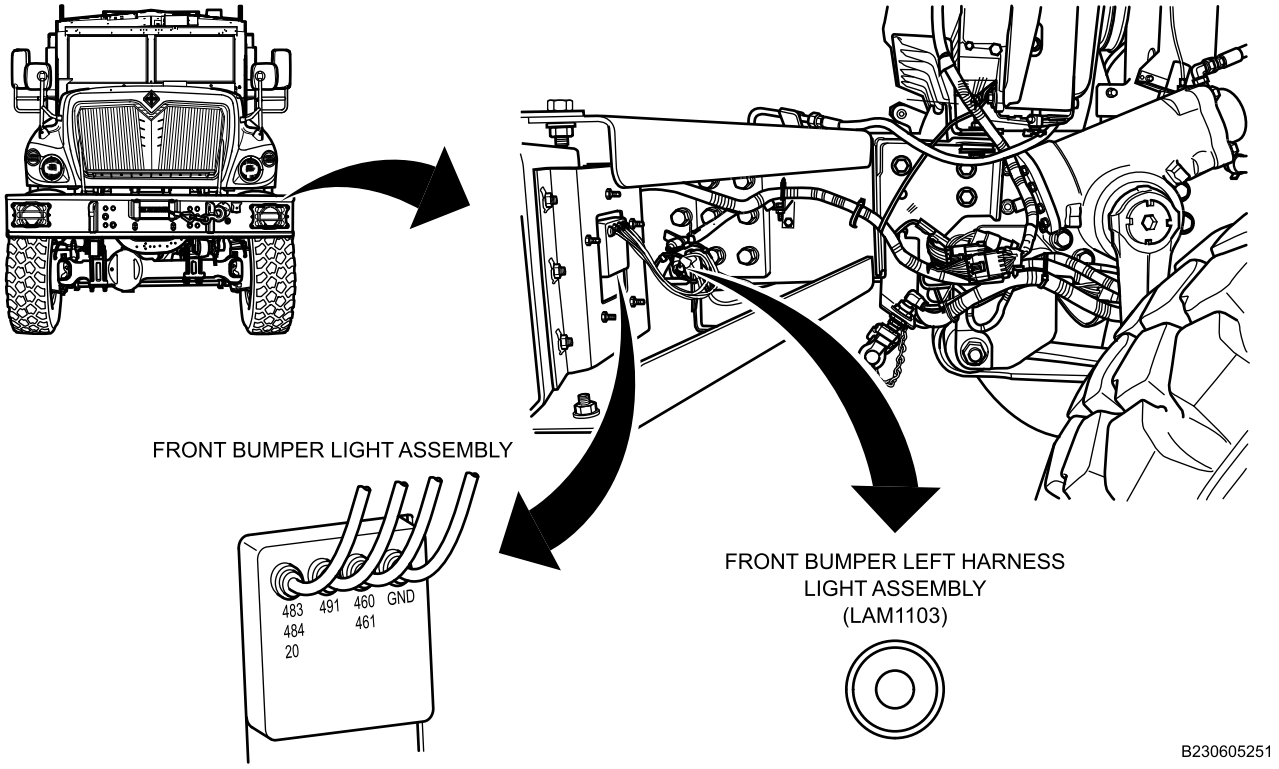


Figure 32. Left Front Bumper Area.

141. Turn MAIN POWER switch ON (TM 9-2355-106-10).
142. Turn ignition switch ON (TM 9-2355-106-10).
143. Measure voltage between connector 4300 (22-wire) terminal 23 and ground with multimeter. Refer to Figure 33.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

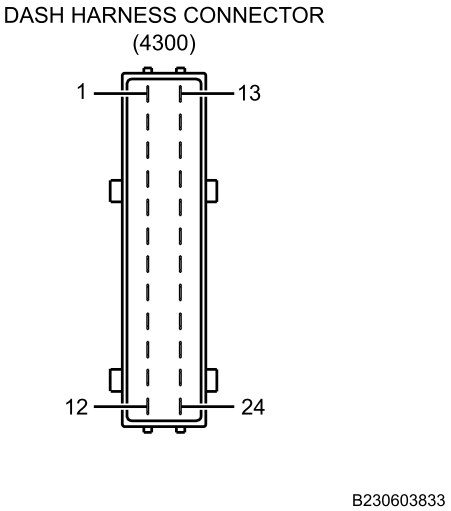


Figure 33. Connector 4300.

CONDITION/INDICATION

Does multimeter read more than 5V?

DECISION

NO Go to Step 160.
YES Go to next step.

STEP

144. Turn ignition switch OFF (TM 9-23555-106-10).
145. Turn MAIN POWER switch OFF (TM 9-23555-106-10).
146. Disconnect connector 9916. Refer to Figure 34.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

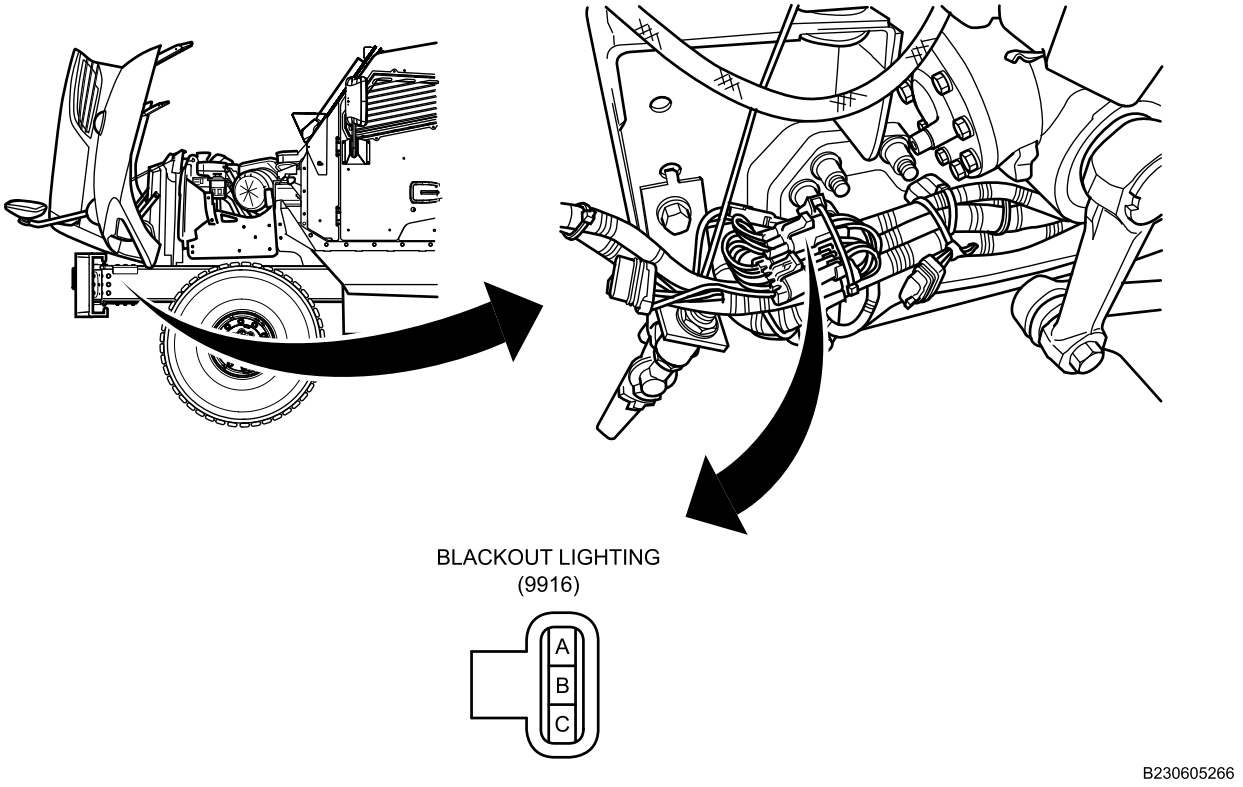


Figure 34. Left Front Bumper Area.

147. Turn MAIN POWER switch ON (TM 9-2355-106-10).
148. Turn ignition switch ON (TM 9-23555-106-10).
149. Measure voltage between connector 4300 (24-cavity 22-wire connector) terminal 23 and ground with multimeter. Refer to Figure 35.

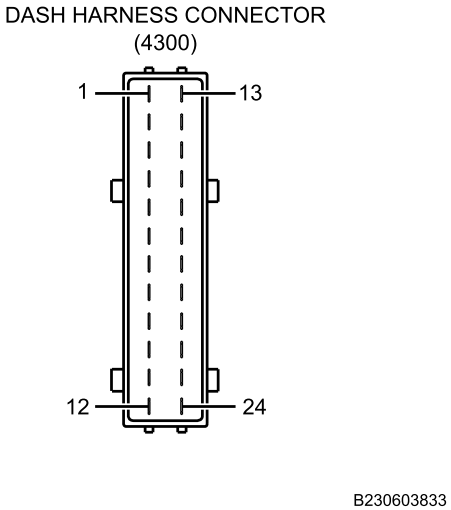


Figure 35. Connector 4300.

CONDITION/INDICATION

Does multimeter read more than 5V?

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 161.
YES Go to Step 159.

MALFUNCTION

- 150. Power Distribution Center (PDC) harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 151. B/O MARKER TRUCK relay is faulty.

ACTION

Replace B/O MARKER TRUCK relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Return vehicle to service.

END OF TEST

MALFUNCTION

- 152. Center chassis harness is faulty.

ACTION

Replace center chassis wiring harness. Refer to Center Chassis Harness Removal and Installation (WP 0426). Return vehicle to service.

END OF TEST

MALFUNCTION

- 153. Rear chassis harness is faulty.

ACTION

Replace rear chassis harness. Refer to Rear Chassis Harness Removal and Installation (WP 0427). Return vehicle to service.

END OF TEST

MALFUNCTION

- 154. Taillamp harness is faulty.

ACTION

Replace taillamp harness. Refer to Taillamp Harness Removal and Installation (WP 0384). Return vehicle to service.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 155. Instrument Panel (IP) harness is faulty.

ACTION

Replace IP harness. Refer to Instrument Panel (IP) Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 156. Rear blackout light is faulty.

ACTION

Replace inoperative rear blackout light. Refer to Composite Taillamp Assembly Removal and Installation (WP 0383). Return vehicle to service.

END OF TEST

MALFUNCTION

- 157. Right front blackout marker light is faulty.

ACTION

Replace blackout light. Refer to Front Bumper Turn Signal and Parking Light Assembly Removal and Installation (WP 0361). Return vehicle to service.

END OF TEST

MALFUNCTION

- 158. Right front bumper harness is faulty.

ACTION

Replace right front bumper harness. Refer to Front Bumper Right Harness Removal and Installation (WP 0375). Return vehicle to service.

END OF TEST

MALFUNCTION

- 159. Forward chassis harness is faulty.

ACTION

Replace forward chassis harness. Refer to Forward Chassis Harness Removal and Installation (WP 0424). Return vehicle to service.

END OF TEST

MALFUNCTION

- 160. Left front blackout marker light is faulty.

BLACKOUT MARKER LIGHTS TROUBLESHOOTING PROCEDURE - (CONTINUED)

ACTION

Replace blackout light. Refer to Front Bumper Turn Signal and Parking Light Assembly Removal and Installation (WP 0361). Return vehicle to service.

END OF TEST

MALFUNCTION

- 161. Left front bumper harness is faulty.

ACTION

Replace left front bumper harness. Refer to Front Bumper Left Harness Removal and Installation (WP 0374). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

FIELD MAINTENANCE

STOPLIGHT TROUBLESHOOTING PROCEDURE

INITIAL SETUP:

Test Equipment
Maintenance Support Device (MSD) (WP 0795, Item 70)

Tools and Special Tools
General Mechanic's Tool Kit (GMTK) (WP 0795, Item 37)
Terminal Test Kit (WP 0795, Item 122)

Personnel Required
Maintainer - (2)

References
TM 9-2355-106-10
TM 9-2355-106-23P
WP 0011
WP 0168
WP 0124
WP 0297
WP 0317
WP 0318
WP 0319
WP 0333
WP 0335
WP 0353
WP 0384
WP 0424
WP 0426
WP 0427
WP 0517
WP 0581
WP 0597
WP 0655
WP 0782

Equipment Condition
Parking brake set (TM 9-2355-106-10)
Transmission set in NEUTRAL (N) (TM 9-2355-106-10)
Engine off (TM 9-2355-106-10)
MAIN POWER switch off (TM 9-2355-106-10)
Wheels chocked (TM 9-2355-106-10)
Engine hood open and secured (TM 9-2355-106-10)

Drawings Required
(WP 0789, Figure 59)
(WP 0789, Figure 60)
(WP 0789, Figure 57)
(WP 0789, Figure 12)
(WP 0789, Figure 13)
(WP 0789, Figure 51)

DIAGNOSTIC TROUBLE CODES AND SYMPTOMS

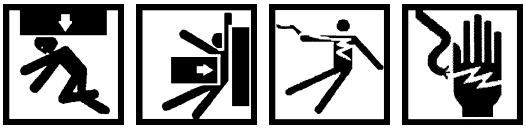
This procedure covers the following symptoms:

- Both right and left stoplights are inoperative.
- Right stoplight is inoperative.
- Left stoplight is inoperative.
- One stoplight stays on.
- Both stoplights stay on.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

TROUBLESHOOTING PROCEDURE

WARNING



Engine hood is extremely heavy and requires two-person lift. Ensure that there is adequate space in front of the vehicle to open hood completely without pinning or pinching personnel between hood and any other structure. Use extreme care when working under hood and make sure it is properly supported. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when testing or working on or around electrical circuits. Always assume that electrical circuits are live. Electrical shock can occur upon contact with voltage high enough to cause current flow through muscles or nerves. On Direct Current (DC) systems, generally 1 milliamp of current can be felt, 5 milliamps can cause severe pain, 15 milliamps can cause loss of muscle control, and 70 milliamps can be fatal. Wear protective clothing; ensure skin, clothing, and surrounding areas are dry; do not wear jewelry; and touch only the insulated, nonmetallic parts of electrical components and testing equipment. To prevent electrical arcing, avoid shorting electrical test probes and jumper wires. Electrical arcing can cause bright flashes of light, capable of causing temporary blindness. If electrical injury occurs, immediately shut off power supply and seek medical assistance. Failure to comply may result in serious injury or death to personnel.

CAUTION

Use light contact when probing connector terminals. Do not force test probe into connector terminal. Failure to comply may result in damage to connector terminal.

NOTE

Personnel must read and understand the Troubleshooting Procedures Overview in How to Use This Manual before performing any troubleshooting procedures.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

1. Start engine (TM 9-2355-106-10).
2. Observe Instrument Panel Cluster (IPC) air pressure gauges and allow air pressure to build to 100 psi (689 kPa).
3. Turn engine OFF (TM 9-2355-106-10).
4. Turn ignition switch ON (TM 9-2355-106-10).
5. Press SER. DRIVE on Master Vehicle Light Switch (MVLS) and then press ENTER within 5 seconds (TM 9-2355-106-10).
6. With assistance, press down brake pedal and observe stoplights.

CONDITION/INDICATION

Are both right and left stoplights inoperative?

DECISION

YES Go to Step 10.
NO Go to next step.

STEP

7. Press down brake pedal and observe stoplights.

CONDITION/INDICATION

Is left or right stoplight inoperative?

DECISION

YES Go to Step 71.
NO Go to next step.

STEP

8. Press and release brake pedal and observe stoplights.

CONDITION/INDICATION

Do both stoplights remain on after pedal is released?

DECISION

YES Go to Step 175.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

9. Press and release brake pedal and observe stoplights.

CONDITION/INDICATION

Does left or right stoplight remain on after pedal is released?

DECISION

YES Go to Step 140.
NO Stoplights are operating normally. Return vehicle to service.

STEP

10. Remove left or right taillight. Refer to Composite Taillamp Assembly Removal and Installation (WP 0383).
11. Disconnect bullet connector leading to terminal GND on left or right stoplight. Refer to Figure 1.

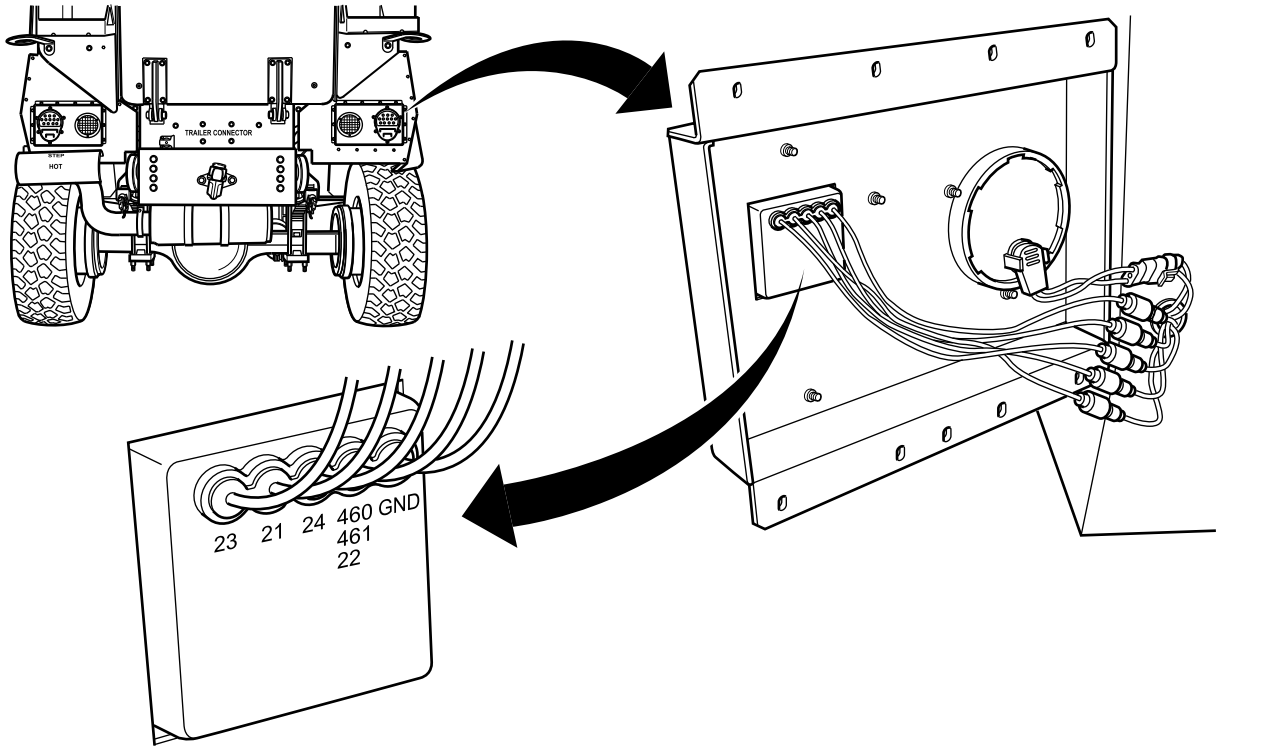


Figure 1. Stoplight Bullet Connectors Inside Composite Taillamp Assembly, and Terminal Identification on Taillamp.

12. Measure resistance between harness side bullet connector terminal GND and ground with multimeter. Refer to Figure 1.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to next step.
NO Go to Step 32.

STEP

13. Connect Maintenance Support Device (MSD) to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
14. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
15. Ensure air pressure is sufficient to operate brakes.
16. Press brake pedal down and observe ESC inputs.
17. With MSD, verify ESC receives brake switch input.

CONDITION/INDICATION

Does Electronic System Controller (ESC) receive brake pressure switch request?

DECISION

NO Go to Brake Pressure Switch Troubleshooting Procedure (WP 0168).
YES Go to next step.

STEP

18. Press brake pedal down and observe ESC outputs with MSD.

CONDITION/INDICATION

Does ESC activate brake outputs?

DECISION

NO Go to Step 179.
YES Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

19. Remove IP center trim panel. Refer to Instrument Panel (IP) Center Trim Panel Removal and Installation (WP 0581).
20. Disconnect MVLS connector 1954. Refer to Figure 2.

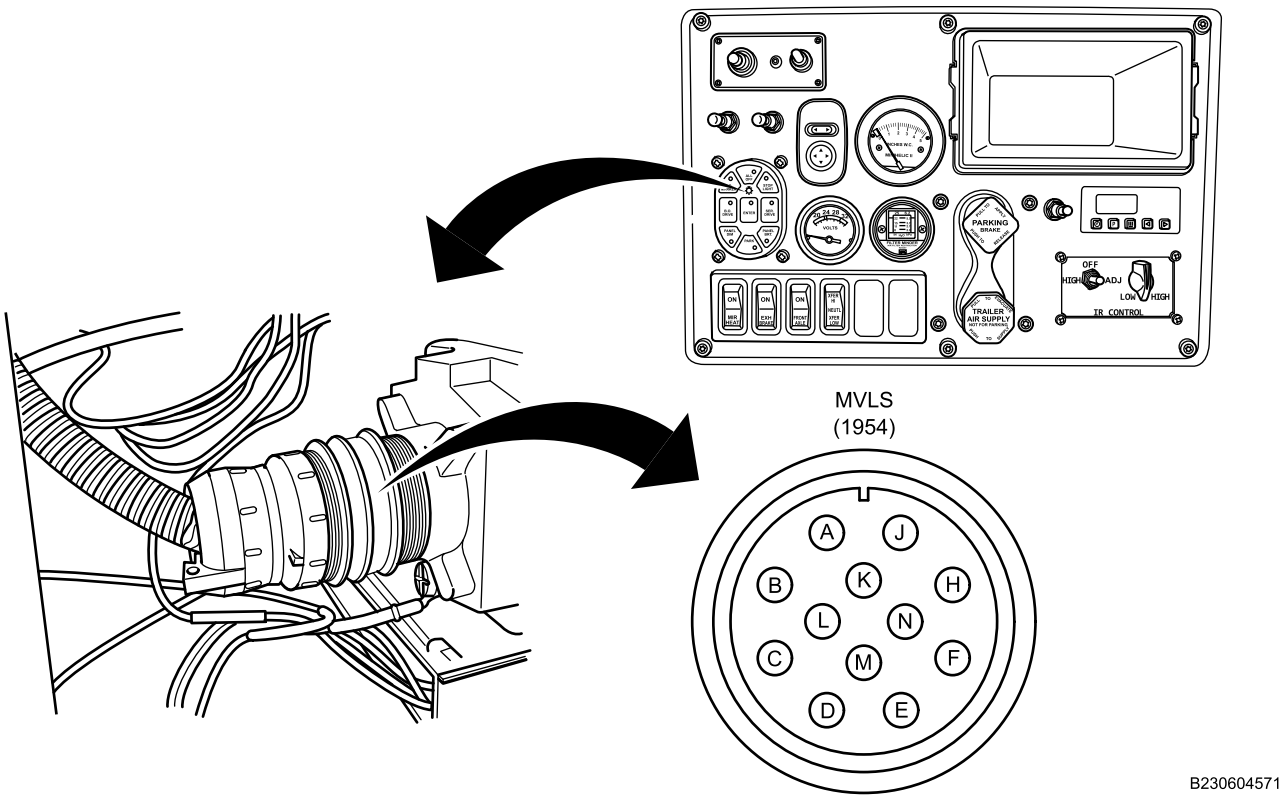


Figure 2. MVLS Connector in Center IP.

21. Measure resistance between connector 1954 terminal J and ground with multimeter. Refer to Figure 2.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

YES Go to Step 40.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

22. Connect MVLS connector 1954.
23. Remove cap and metal bus bar from blackout mode splice pack connector 1050. Refer to Figure 3.

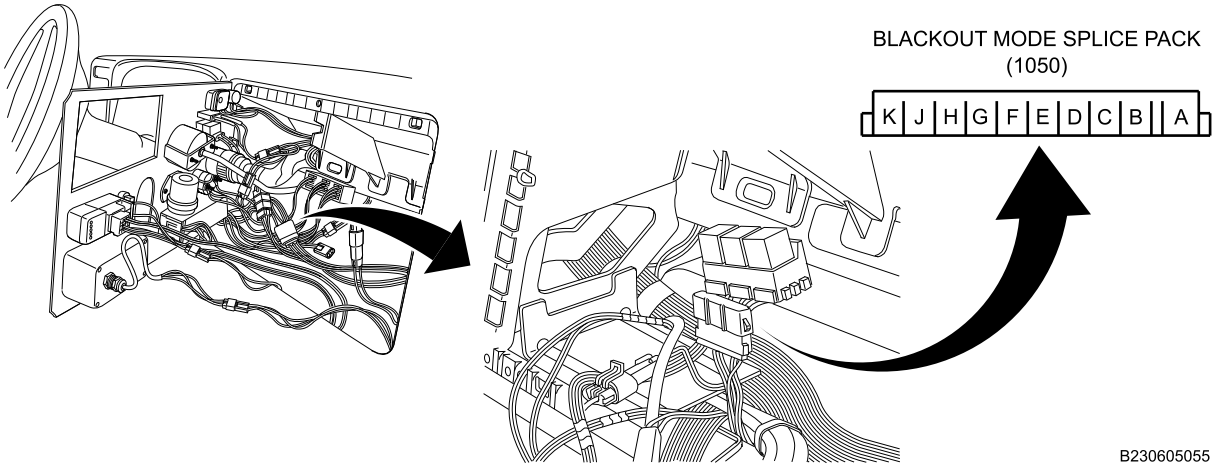


Figure 3. Blackout Mode Splice Pack Connector in Center IP.

24. Turn MAIN POWER switch ON (TM 9-2355-106-10).
25. Turn ignition switch ON (TM 9-2355-106-10).
26. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
27. Measure DC voltage between connector 1050 terminal A and ground with multimeter. Refer to Figure 3.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 66.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

28. Turn ignition switch OFF (TM-9-2355-106-10).
29. Turn MAIN POWER switch OFF (TM-9-2355-106-10).
30. Disconnect MVLS connector 1954. Refer to Figure 4.

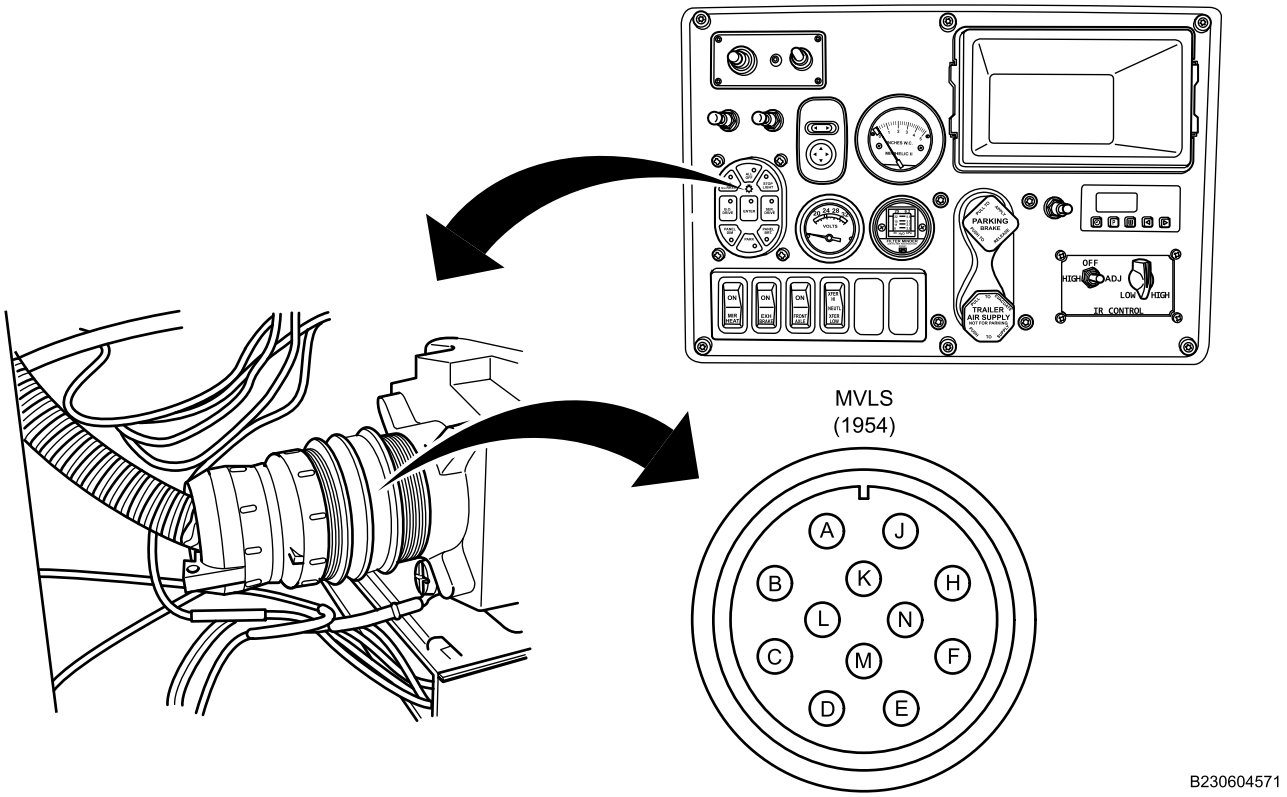


Figure 4. MVLS Connector in Center IP.

31. Measure resistance between connector 1050 terminal A and MVLS connector 1954 terminal J with multimeter. Refer to Figure 5. Refer to Figure 4.

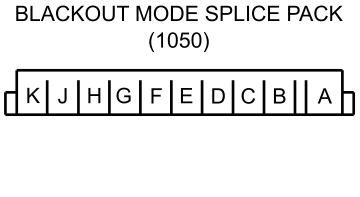


Figure 5. Connector 1050.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 187.
NO Go to Step 178.

STEP

32. Disconnect taillamp/rear chassis connector 9303A. Refer to Figure 6.

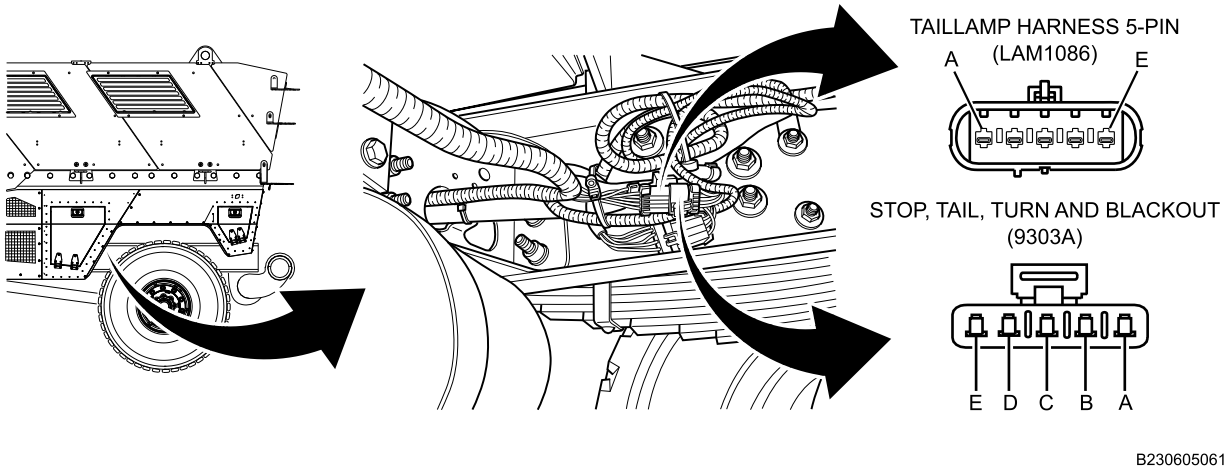


Figure 6. Taillamp/Rear Chassis Harness Connector Inside Left Frame Rail Near Rear Crossmember.

33. Measure resistance between connector 9303A terminal E and ground with multimeter. Refer to Figure 6.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 186.
NO Go to next step.

STEP

34. Loosen air dryer mounting bolts and move air dryer to one side to access connectors on left frame rail. Refer to Air Dryer Removal and Installation (WP 0517).
35. Disconnect connector 9800F from 9800M. Refer to Figure 7.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

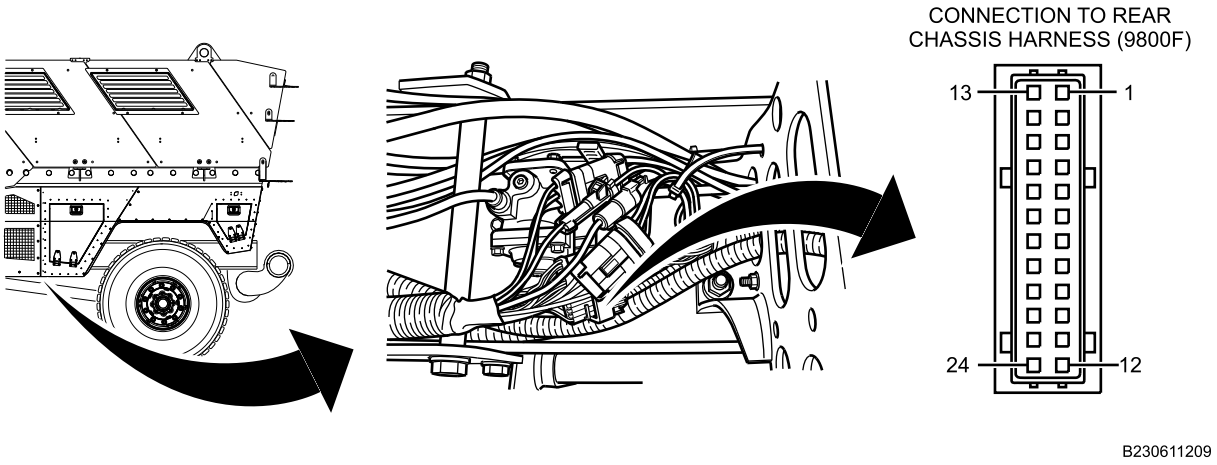


Figure 7. Center/Rear Chassis Connector on Left Frame Rail.

36. Measure resistance between connector 9800F terminal 12 and ground with multimeter. Refer to Figure 7.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 185.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

37. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
38. Disconnect connector 9714. Refer to Figure 8.

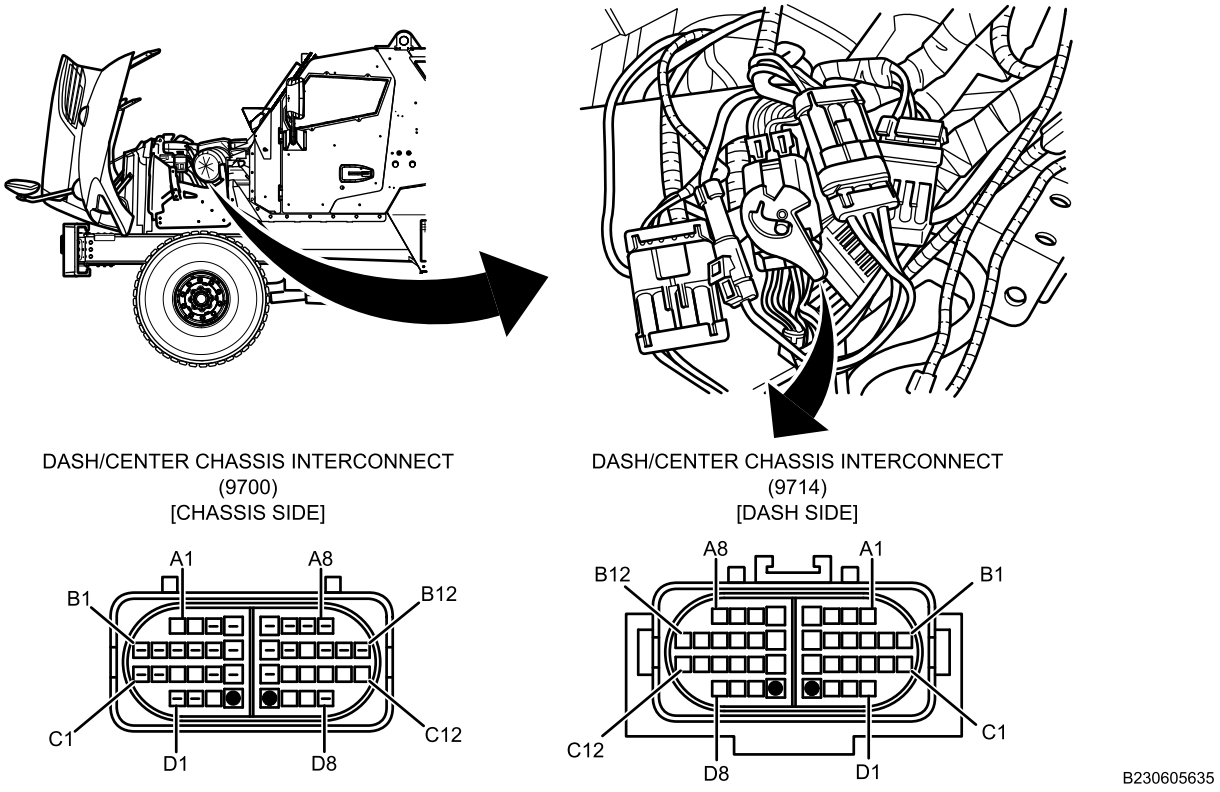


Figure 8. Dash/Center Chassis Connector in Engine Compartment.

39. Measure resistance between dash side connector 9714 terminal C6 and ground with multimeter. Refer to Figure 8.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 184.
NO Go to Step 183.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

40. Remove cap and metal bus bar from blackout mode splice pack connector 1050. Refer to Figure 9.

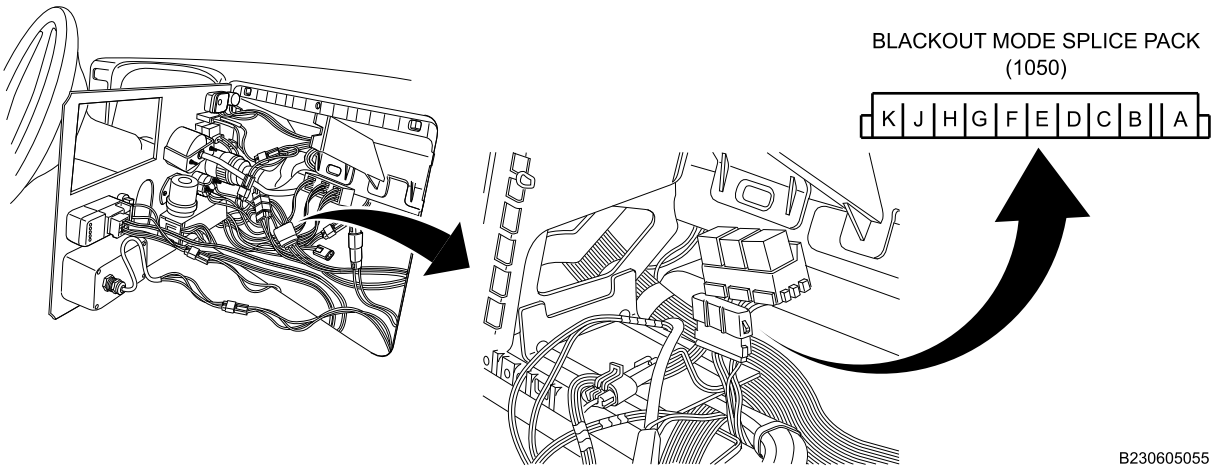


Figure 9. Blackout Mode Splice Pack Connector in Center IP.

41. Measure resistance between connector 1050 terminal A and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

YES Go to Step 178.
NO Go to next step.

STEP

42. Measure resistance between connector 1050 terminal H and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

YES Go to Step 46.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

43. Measure resistance between connector 1050 terminal J and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

YES Go to Step 52.
NO Go to next step.

STEP

44. Measure resistance between connector 1050 terminal B and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

YES Go to Step 55.
NO Go to next step.

STEP

45. Measure resistance between connector 1050 terminal C and ground with multimeter. Refer to Figure 9.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

YES Go to Step 57.
NO Go to Step 59.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

46. Disconnect IP/Dash connector 1701. Refer to Figure 10.

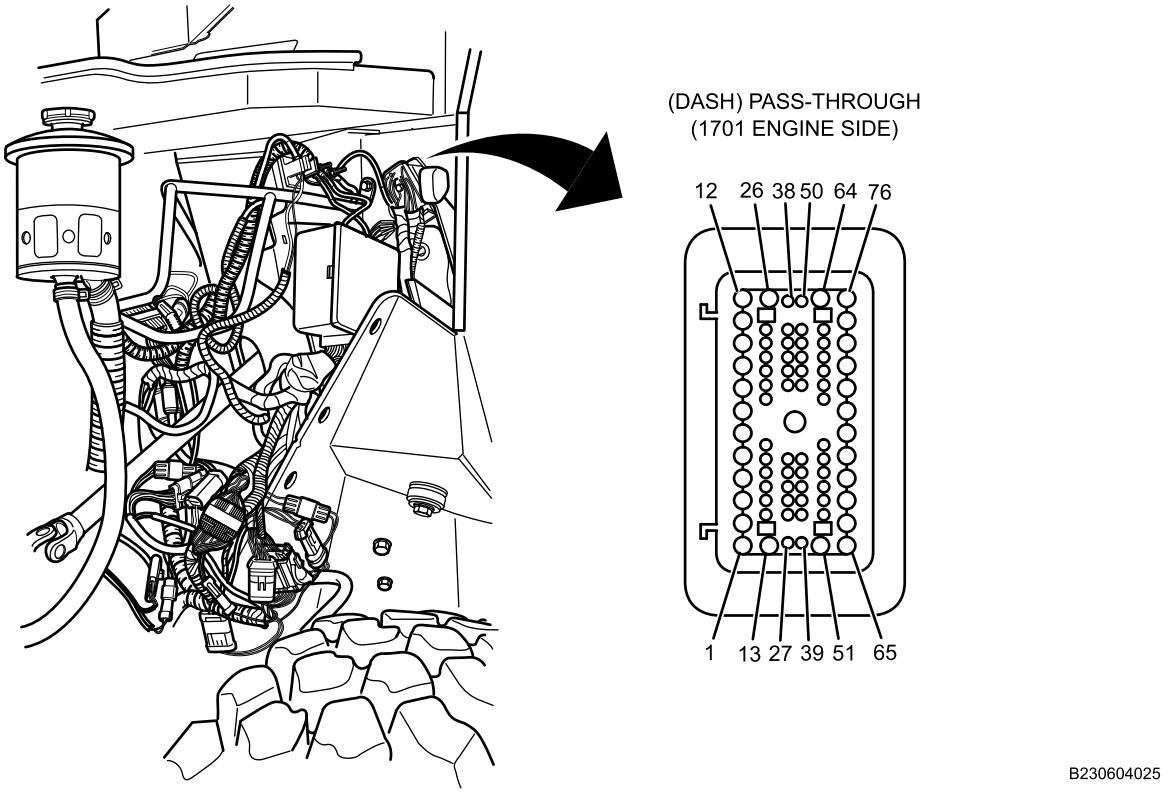


Figure 10. IP/Dash Pass-Through Connector in Engine Compartment.

47. Measure resistance between engine side connector 1701 terminal 27 and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

NO Go to Step 178.
YES Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

48. Remove right stop/turn relay. Refer to Figure 11 Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

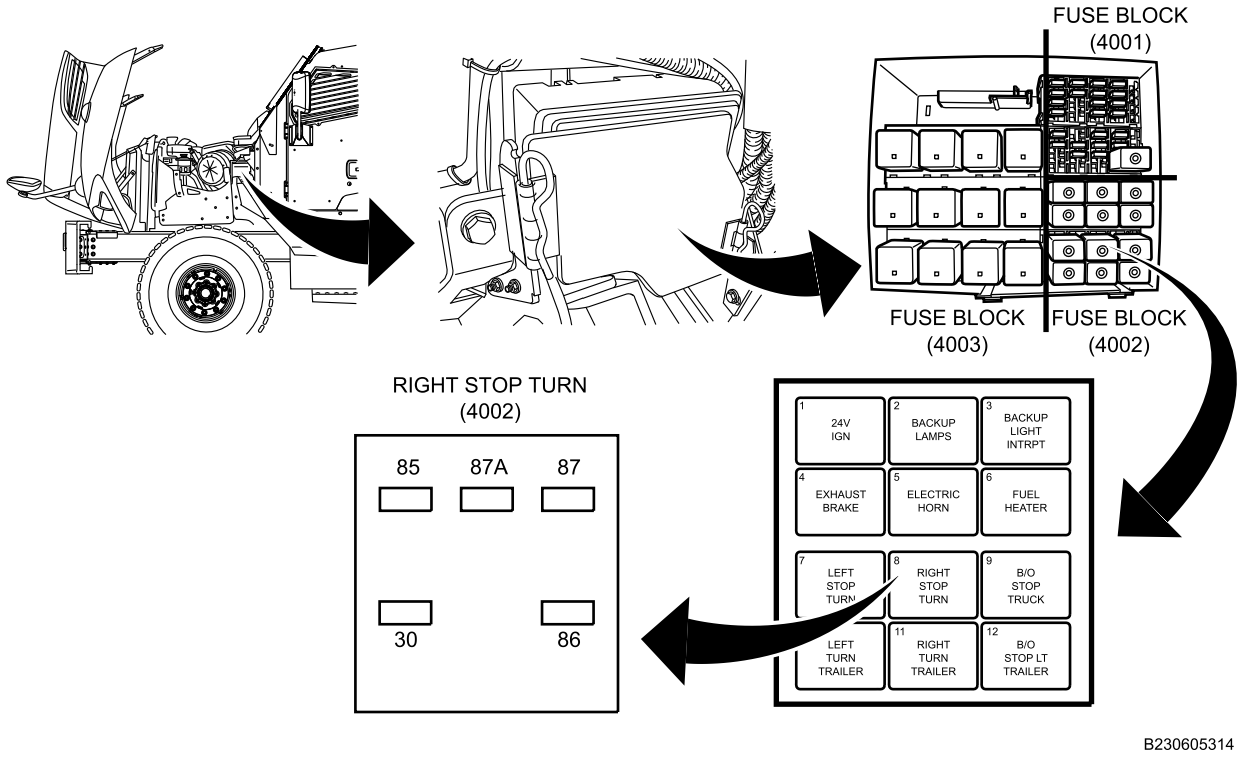


Figure 11. Right Stop/Turn Relay in Engine Compartment Power Distribution Center (PDC).

49. Measure resistance between connector 1701 terminal 27 and ground with multimeter. Refer to Figure 10.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

NO Go to Step 182.
YES Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

50. Remove LEFT STOP TURN relay. Refer to Figure 12. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

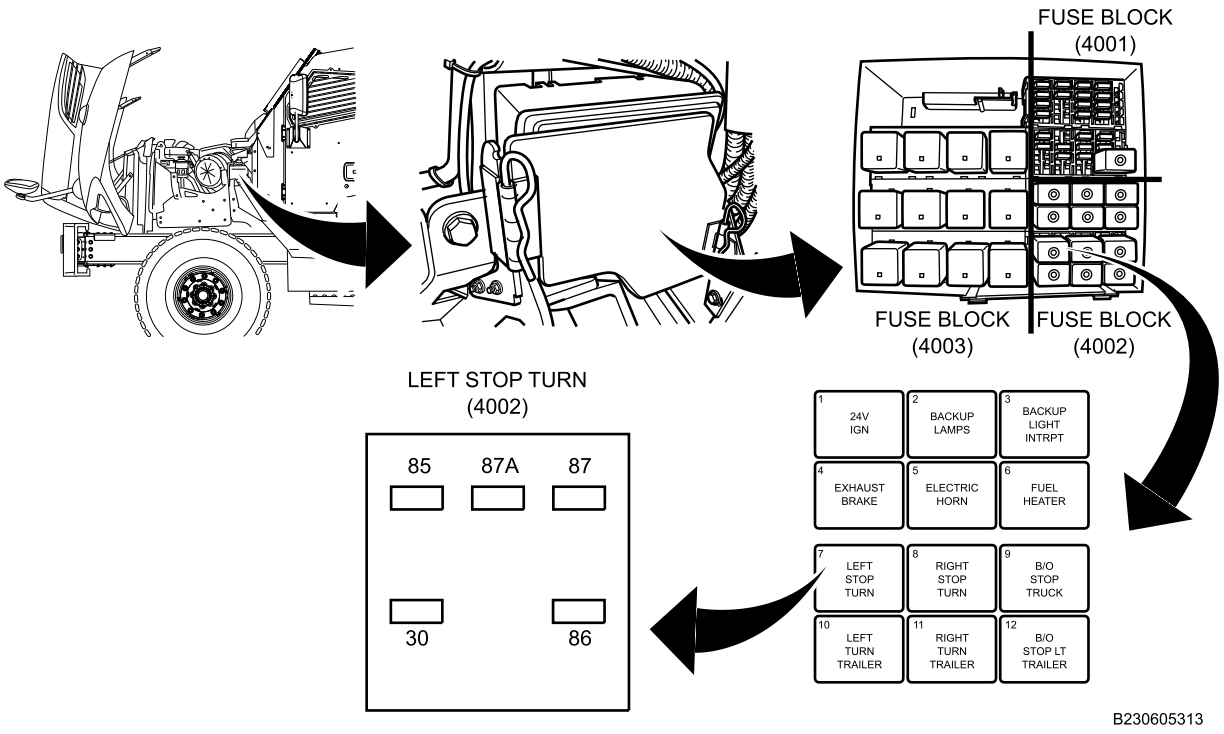


Figure 12. Left Stop/Turn Relay in Engine Compartment PDC.

51. Measure resistance between connector 1701 terminal 27 and ground with multimeter. Refer to Figure 13.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

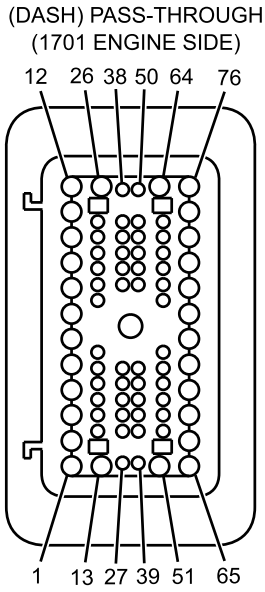


Figure 13. Connector 1701.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

NO Go to Step 182.
YES Go to Step 183.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

52. Remove IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation (WP 0297).
53. Disconnect IPC connector 1500. Refer to Figure 14.

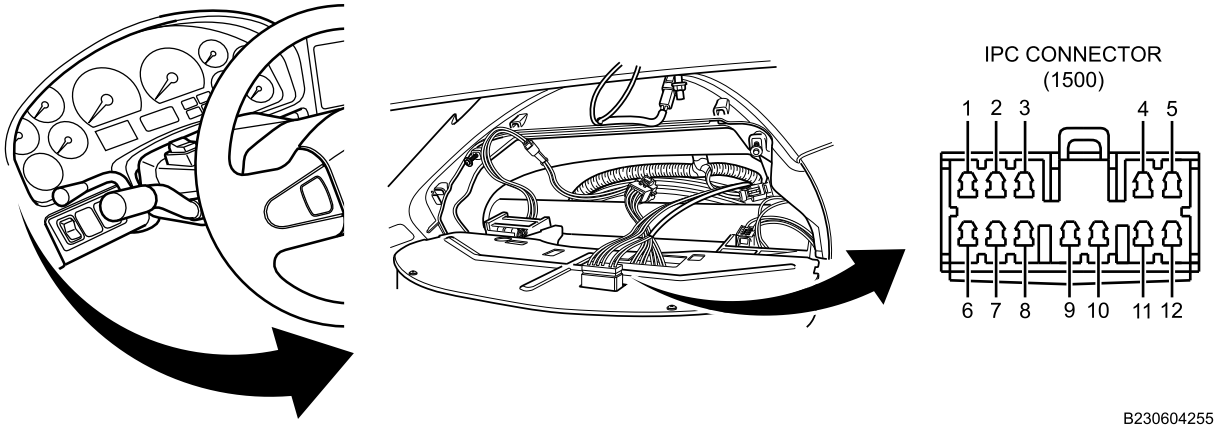


Figure 14. IPC Connector in Left IP.

54. Measure resistance between connector 1050 terminal J and ground with multimeter. Refer to Figure 15.

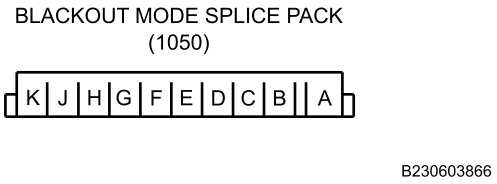


Figure 15. Connector 1050.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

NO Go to Step 188.
YES Go to Step 178.

STEP

55. Remove left turn enable relay. Refer to Figure 16.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

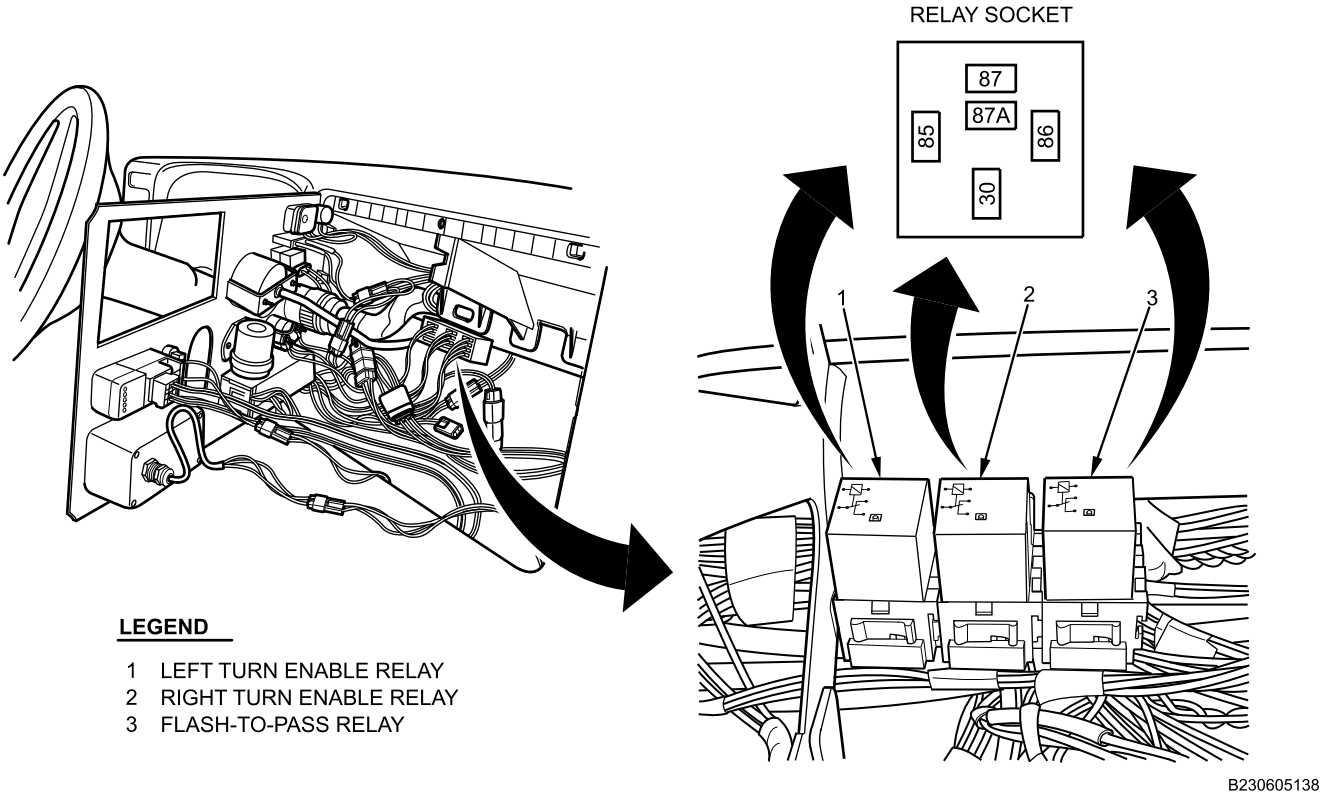


Figure 16. Left Turn Enable Relay in Center IP.

56. Measure resistance between connector 1050 terminal B and ground with multimeter. Refer to Figure 15.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

NO Go to Step 181.
YES Go to Step 178.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

57. Remove right turn enable relay. Refer to Figure 17.

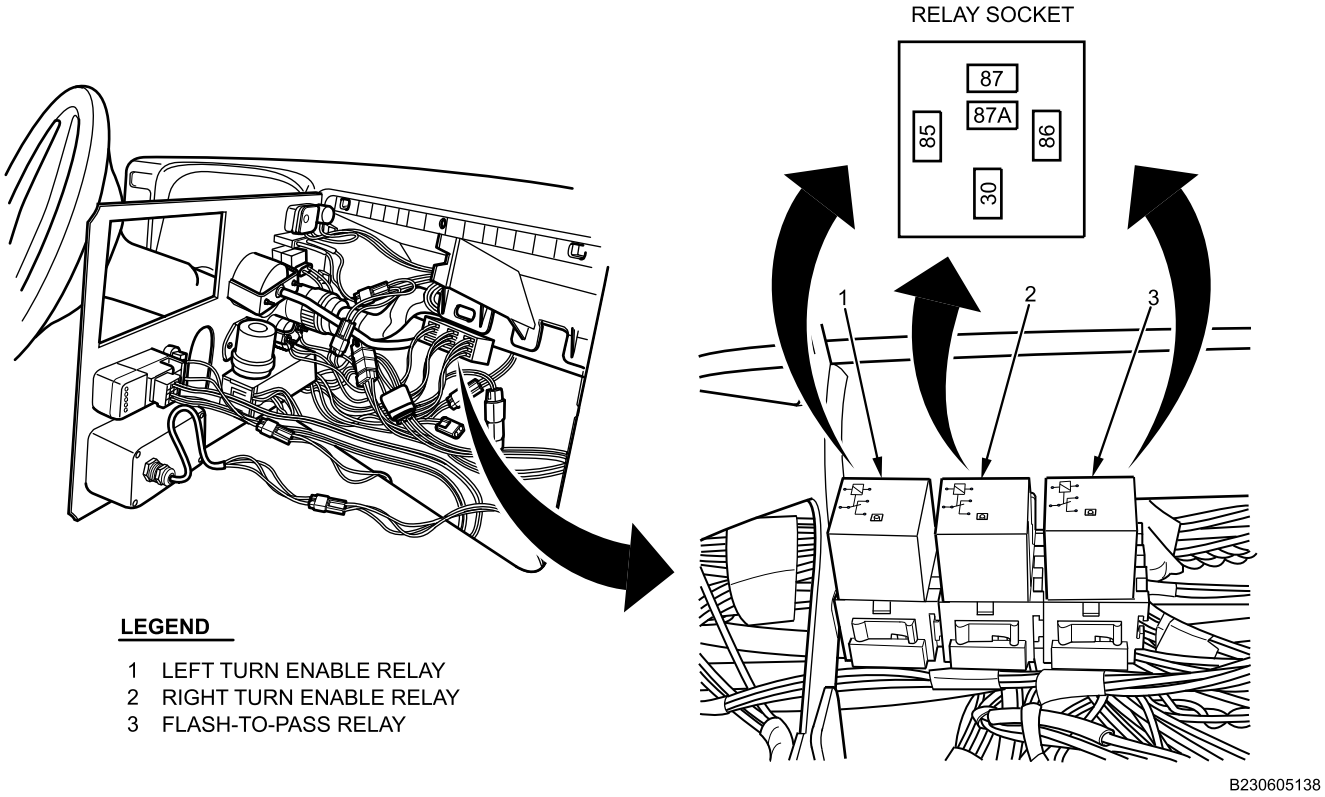


Figure 17. Right Turn Enable Relay in Center IP.

58. Measure resistance between connector 1050 terminal C and ground with multimeter. Refer to Figure 18.

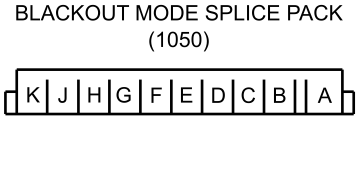


Figure 18. Connector 1050.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 181.
YES Go to Step 178.

STEP

59. Remove STOPLIGHT RELAY LEFT. Refer to Figure 19.

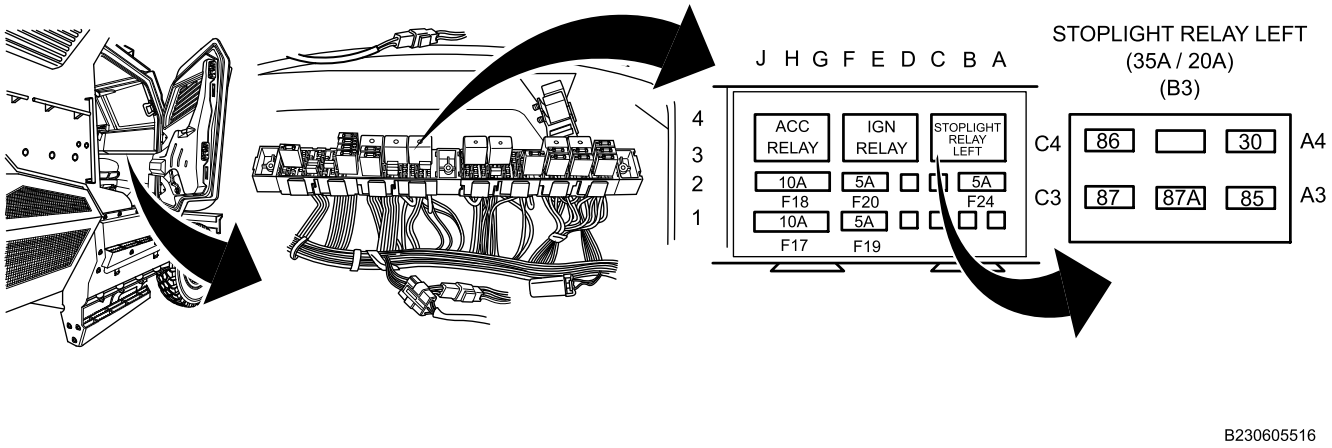


Figure 19. Left Stoplight Relay in Cabin Fuse and Relay Center.

60. Measure resistance between connector 1050 terminal D and ground with multimeter. Refer to Figure 18.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

NO Go to Step 180.
YES Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

61. Remove STOPLIGHT RELAY RIGHT. Refer to Figure 20.

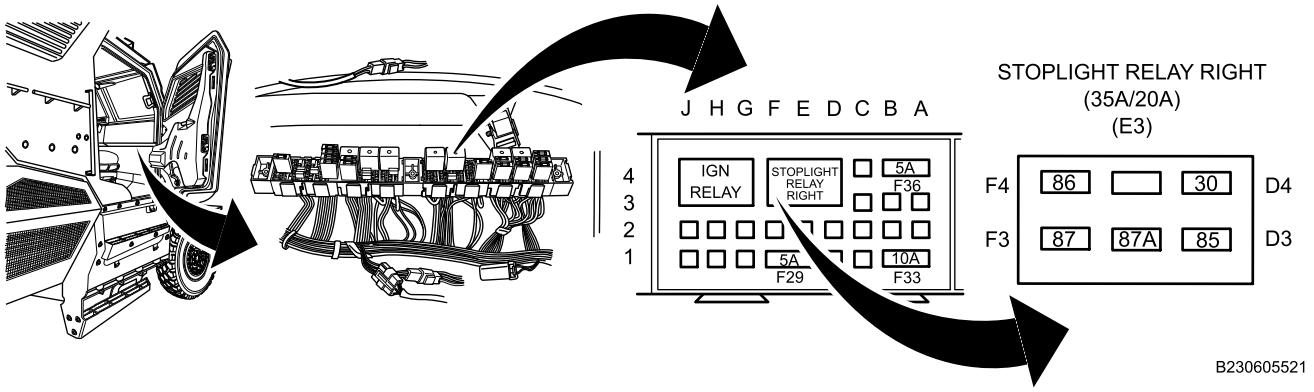


Figure 20. Right Stoplight Relay in Cabin Fuse and Relay Center.

62. Measure resistance between connector 1050 terminal D and ground with multimeter. Refer to Figure 21.

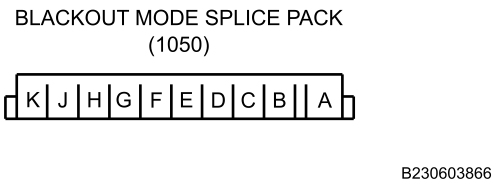


Figure 21. Connector 1050.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

NO Go to Step 180.
YES Go to next step.

STEP

63. Remove FLASH-TO-PASS relay. Refer to Figure 22.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

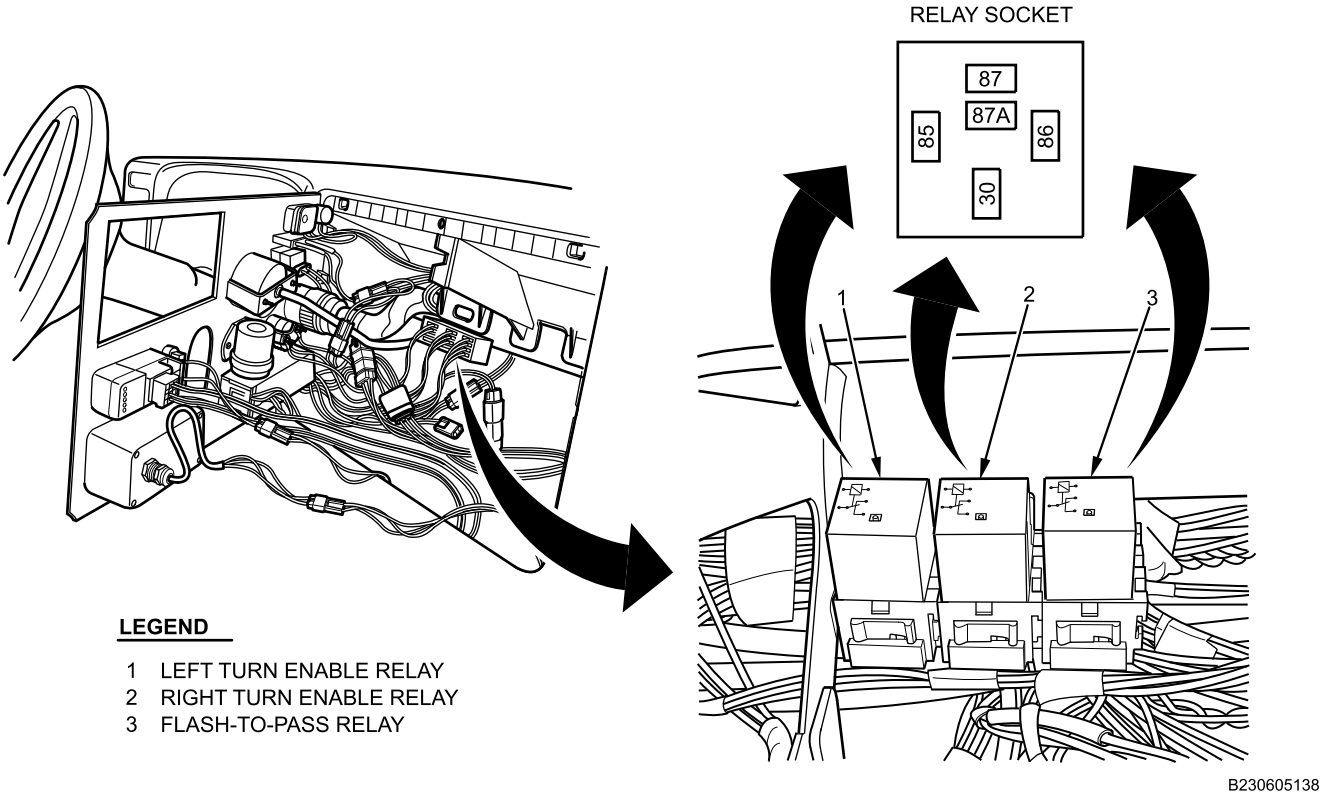


Figure 22. Flash-to-Pass Relay in Center IP.

64. Measure resistance between connector 1050 terminal D and ground with multimeter. Refer to Figure 21.

CONDITION/INDICATION

Does multimeter read less than 0.8 ohms?

DECISION

NO Go to Step 181.
YES Go to Step 178.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

65. Remove right side IP closeout panel. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).
66. Remove STOPLIGHT RELAY LEFT or RIGHT. Refer to Figure 23.

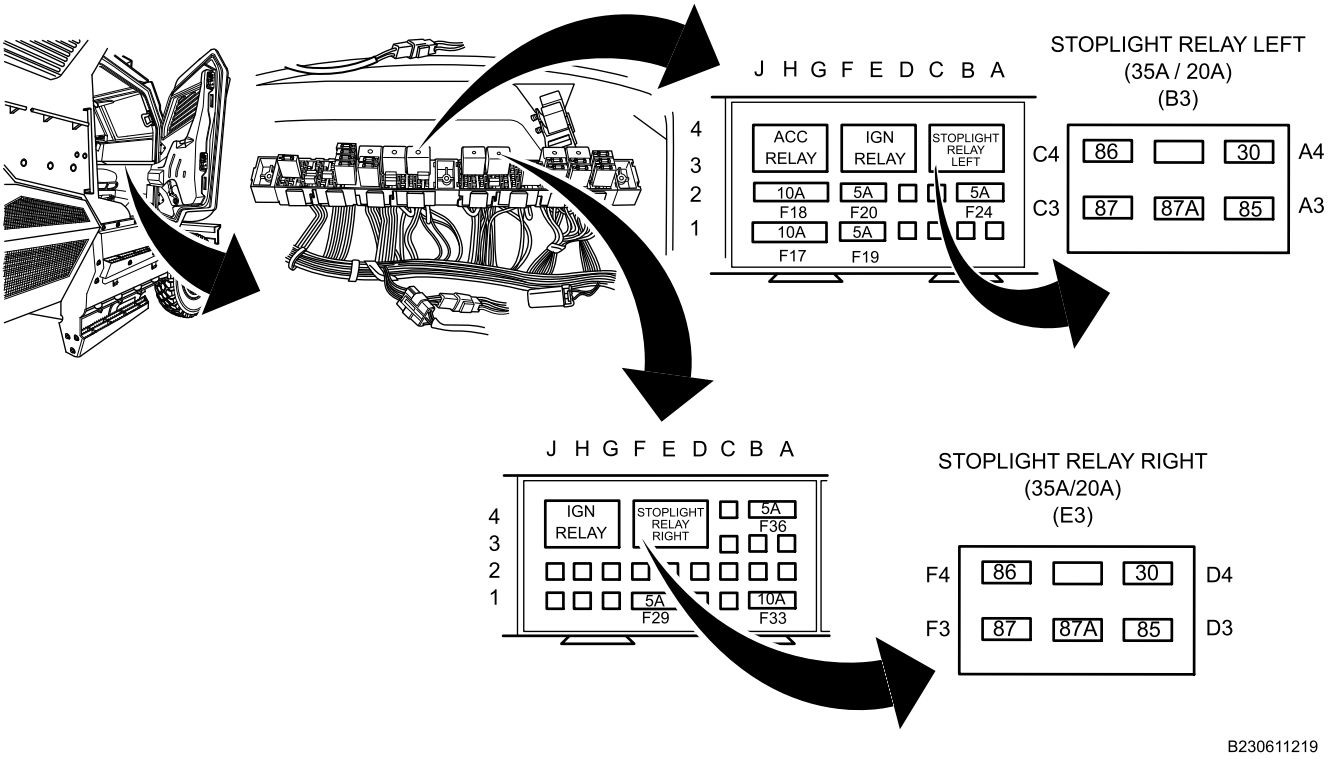


Figure 23. Left or Right Stoplight Relay in Cabin Fuse and Relay Center.

67. Measure resistance between STOPLIGHT RELAY LEFT or RIGHT socket terminal 85 and connector 1050 terminal D with multimeter. Refer to Figure 23. Refer to Figure 21.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 178
YES Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

68. Measure resistance between STOPLIGHT RELAY LEFT or RIGHT relay socket terminal 86 and ground with multimeter. Refer to Figure 24.

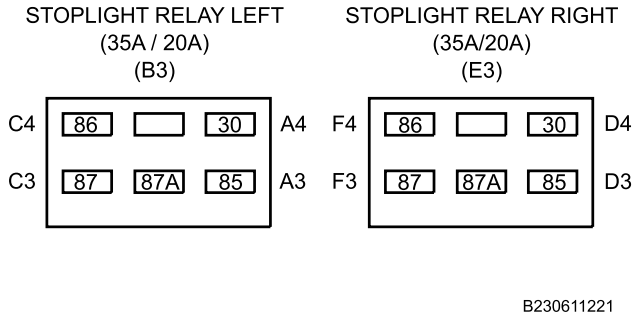


Figure 24. Stoplight Relay Left or Right Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 178.
YES Go to next step.

STEP

69. Disconnect IP/Dash connector 1701. Refer to Figure 25.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

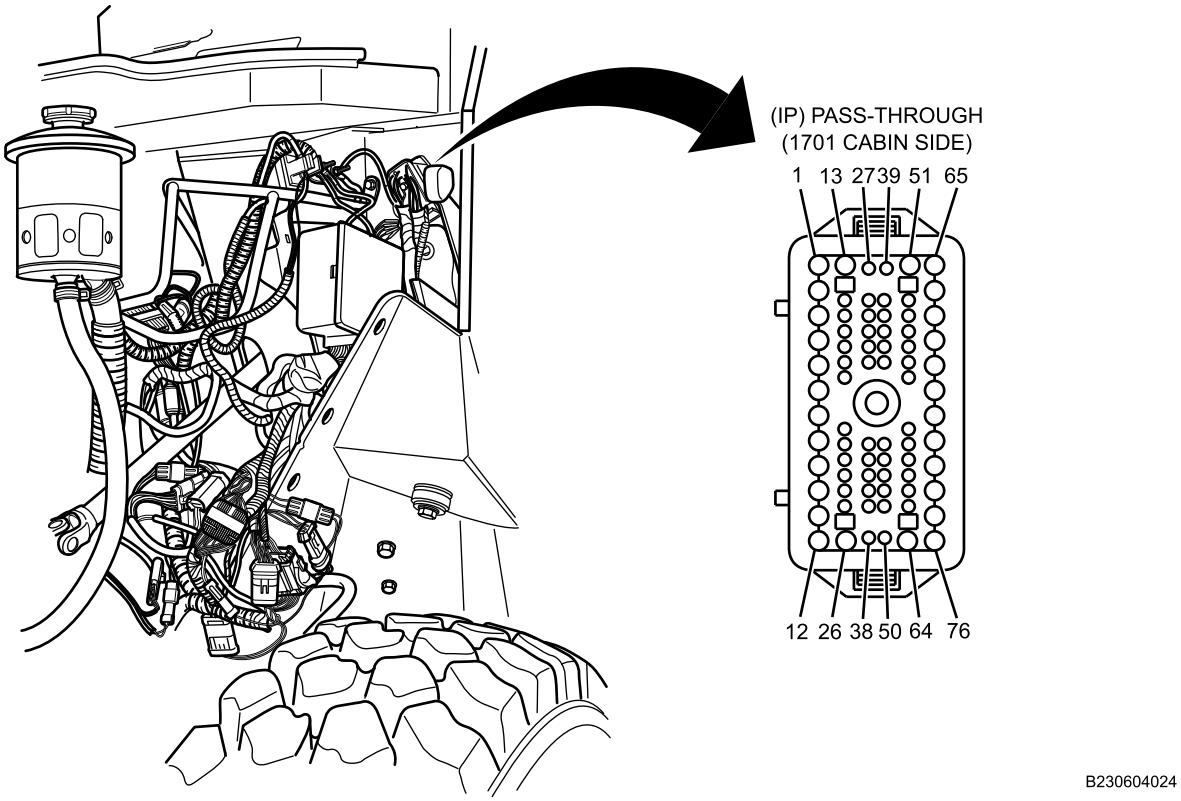


Figure 25. IP/Dash Pass-Through Connector in Engine Compartment.

70. Measure resistance between connector 1701 terminal 27 and connector 1050 terminal H with multimeter. Refer to Figure 25. Refer to Figure 26.

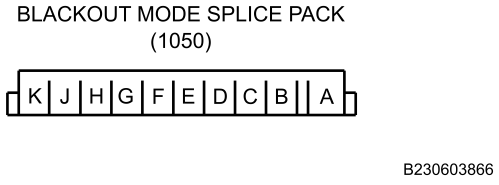


Figure 26. Connector 1050.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 178.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

YES Go to Step 183.

STEP

71. Turn ignition switch OFF (TM 9-2355-106-10).
72. Turn MAIN POWER switch OFF (TM 9-2355-106-10).

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

73. Disconnect bullet connectors leading to stoplight terminals 22 and GND on inoperative stoplight. Refer to Figure 27.

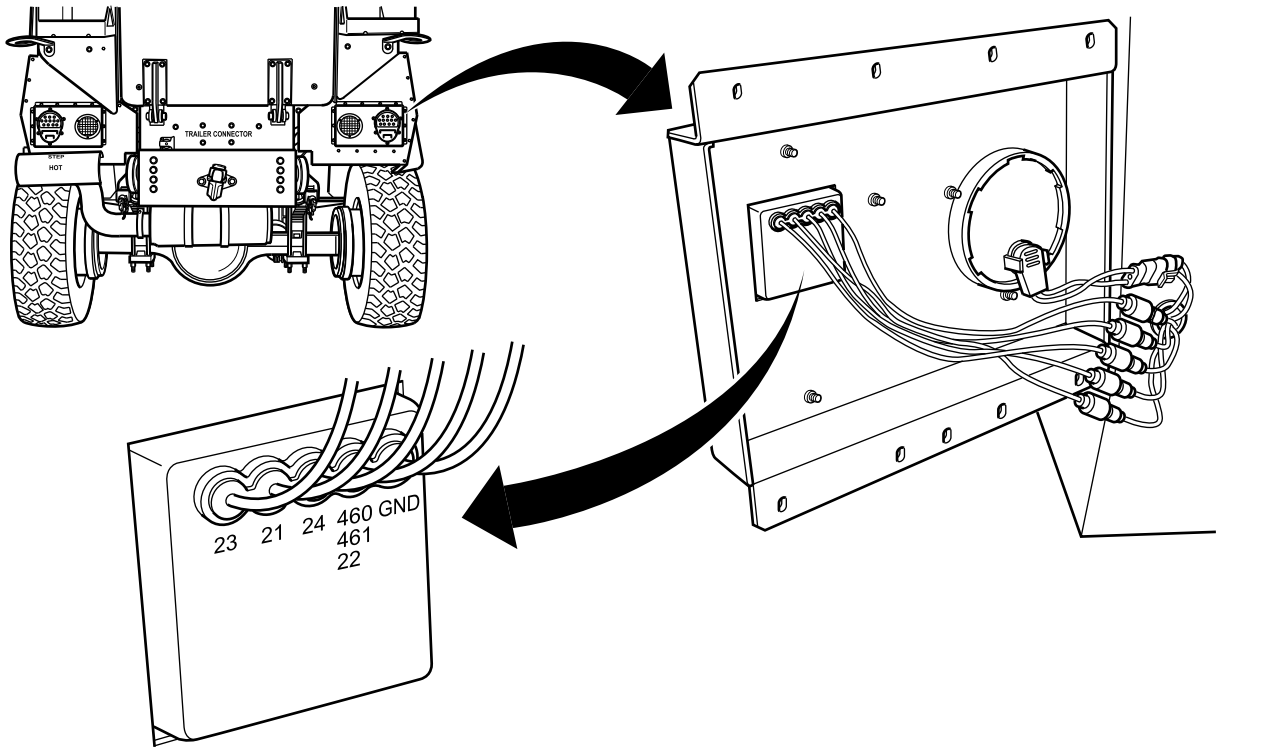


Figure 27. Stoplight Connectors in Composite Taillamp Assembly.

74. Turn MAIN POWER switch ON (TM 9-2355-106-10).
75. Turn ignition switch ON (TM 9-2355-106-10).
76. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
77. Ensure sufficient air pressure to close brake switch.
78. Have assistant press down on brake pedal.
79. Measure DC voltage between harness terminal 22 and GND with multimeter. Refer to Figure 27.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 177.
NO Go to next step.

STEP

80. Turn ignition switch OFF (TM 9-2355-106-10).
81. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
82. Measure resistance between harness side bullet connector terminal GND and ground with multimeter. Refer to Figure 27.

CONDITION/INDICATION

Does multimeter read more than 5 ohms?

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

YES Go to Step 186.
NO Go to next step.

STEP

83. Disconnect taillamp/rear chassis harness connector 9303A. Refer to Figure 28.

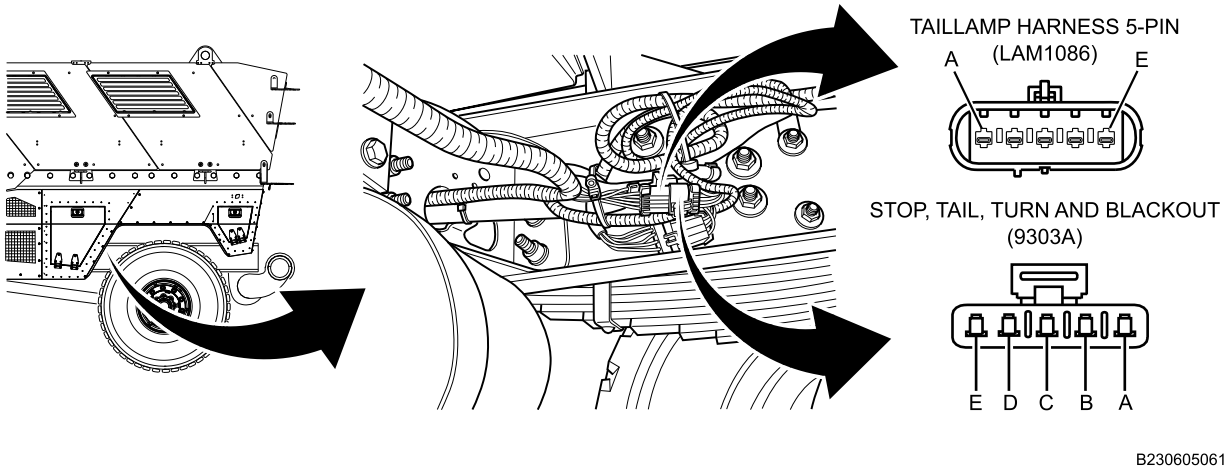


Figure 28. Taillamp/Rear Chassis Harness Connector, Inside Left Frame Rail Near Rear Crossmember.

84. Turn MAIN POWER switch ON (TM 9-2355-106-10).
85. Turn ignition switch ON (TM 9-2355-106-10).
86. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
87. Ensure sufficient air pressure to close brake switch.
88. Have assistant press down on brake pedal.
89. Measure DC voltage between connector 9303A terminal B for left stoplight or terminal C for right stoplight and ground with multimeter. Refer to Figure 28.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 186.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

90. Turn ignition switch OFF (TM 9-2355-106-10).
91. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
92. Remove relay for inoperative stoplight from PDC. Refer to Figure 29.

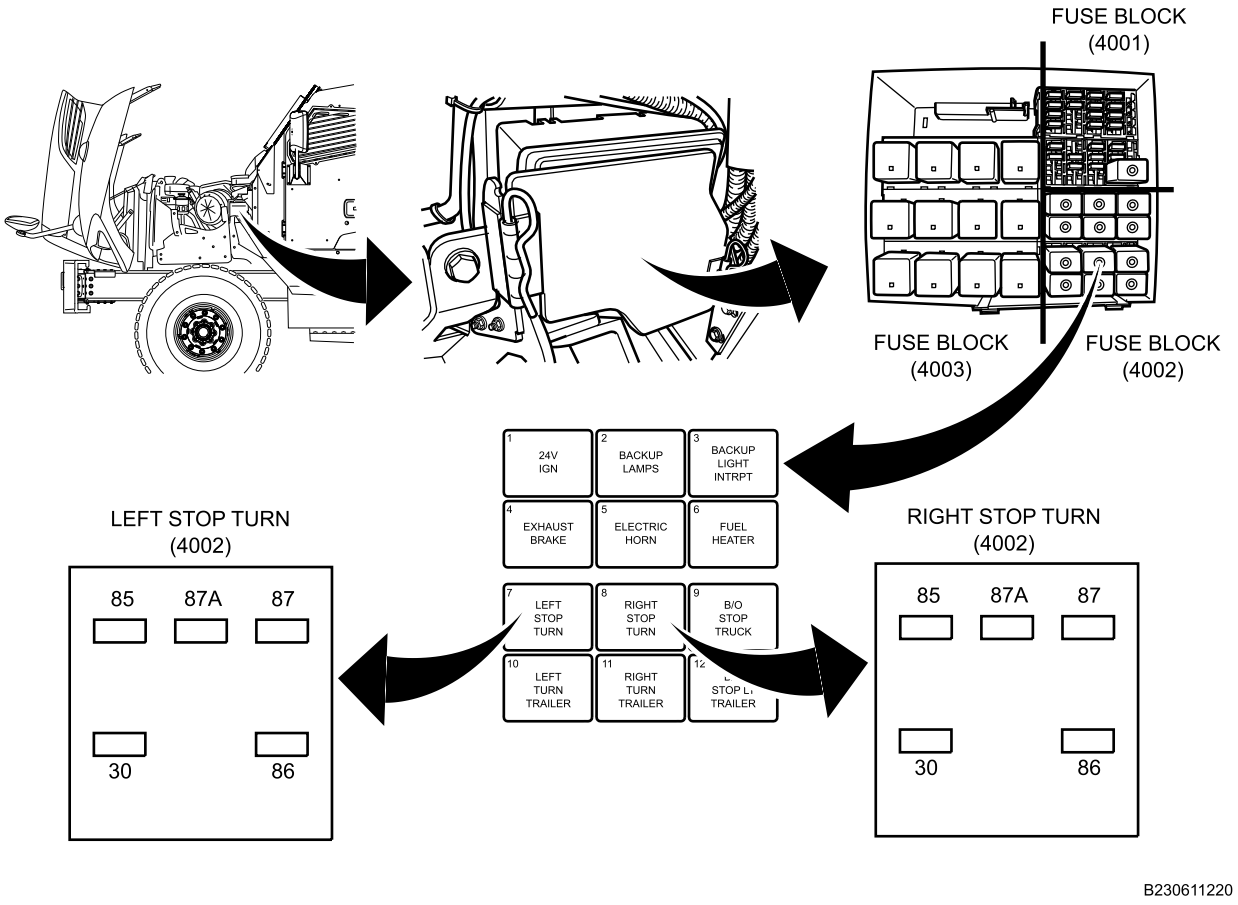


Figure 29. Left or Right Stop/Turn Relay in Engine Compartment PDC.

93. Turn MAIN POWER switch ON (TM 9-2355-106-10).
94. Turn ignition switch ON (TM 9-2355-106-10).
95. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
96. Ensure sufficient air pressure to close brake pressure switch.
97. Have assistant press down on brake pedal.
98. Measure DC voltage between LEFT or RIGHT STOP TURN relay socket terminal 87 and ground with multimeter. Refer to Figure 29.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 122.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

99. Remove right side IP closeout panel. Refer to Instrument Panel (IP) Right Side Closeout Removal and Installation (WP 0580).
100. Remove relay for inoperative stoplight. Refer to Figure 30.

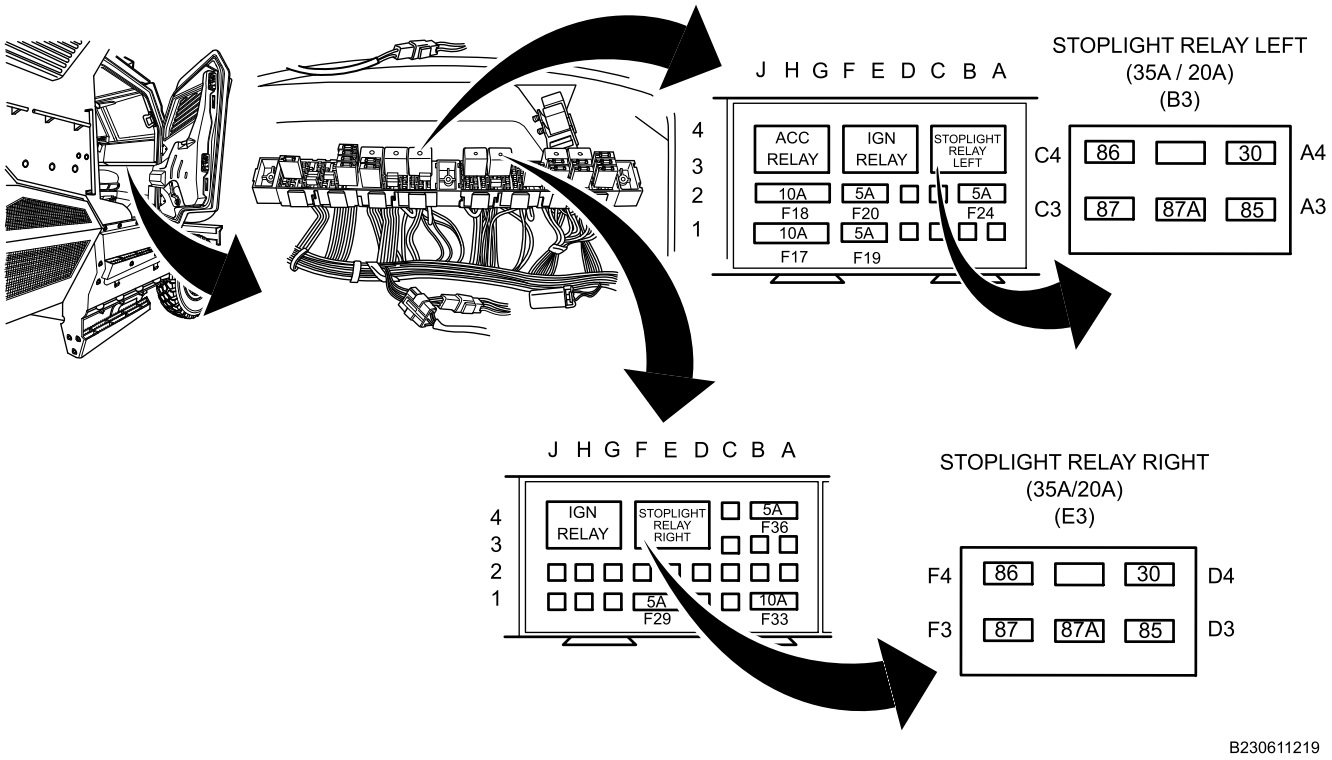


Figure 30. Left or Right Stoplight Relay in Cabin Relay and Fuse Center.

101. Turn MAIN POWER switch ON (TM 9-2355-106-10).
102. Turn ignition switch ON (TM 9-2355-106-10).
103. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
104. Ensure sufficient air pressure to close brake pressure switch.
105. Have assistant press down on brake pedal.
106. Measure DC voltage between STOPLIGHT RELAY LEFT or RIGHT socket terminal 87 and ground with multimeter. Refer to Figure 30.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 113.
YES Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

107. Measure DC voltage between STOPLIGHT RELAY LEFT or RIGHT socket terminal 85 and ground with multimeter. Refer to Figure 31.

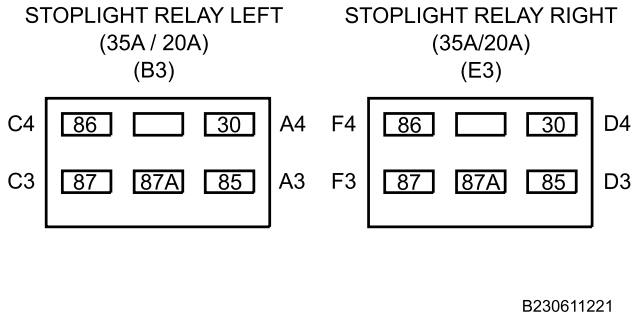


Figure 31. Stoplight Relay Left or Right Socket.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 178.
YES Go to next step.

STEP

108. Turn ignition switch OFF (TM 9-2355-106-10).
109. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
110. Measure resistance between STOPLIGHT RELAY LEFT or RIGHT socket terminal 86 and ground with multimeter. Refer to Figure 31 .

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 178.
YES Go to next step.

STEP

111. Measure resistance between STOPLIGHT RELAY LEFT or RIGHT socket terminal 30 and ground with multimeter. Refer to Figure 31.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 120.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

112. Measure resistance between STOPLIGHT RELAY LEFT or RIGHT socket terminal 30 and LEFT or RIGHT STOP TURN relay socket terminal 87 with multimeter. Refer to Figure 31 and refer to Figure 32.

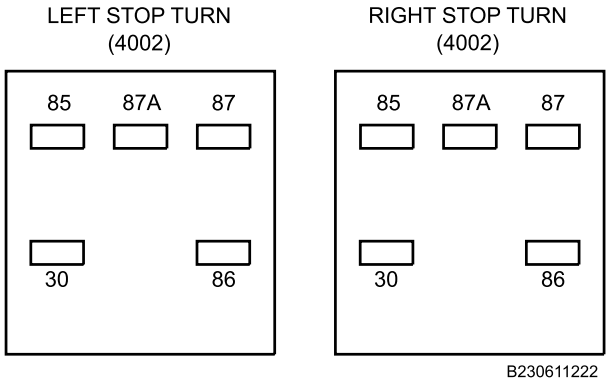


Figure 32. Left or Right Stop/Turn Relay Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 118.
YES Go to Step 180.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

113. Turn ignition switch OFF (TM 9-2355-106-10).
114. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
115. Disconnect ESC connector 4008. Refer to Figure 33.

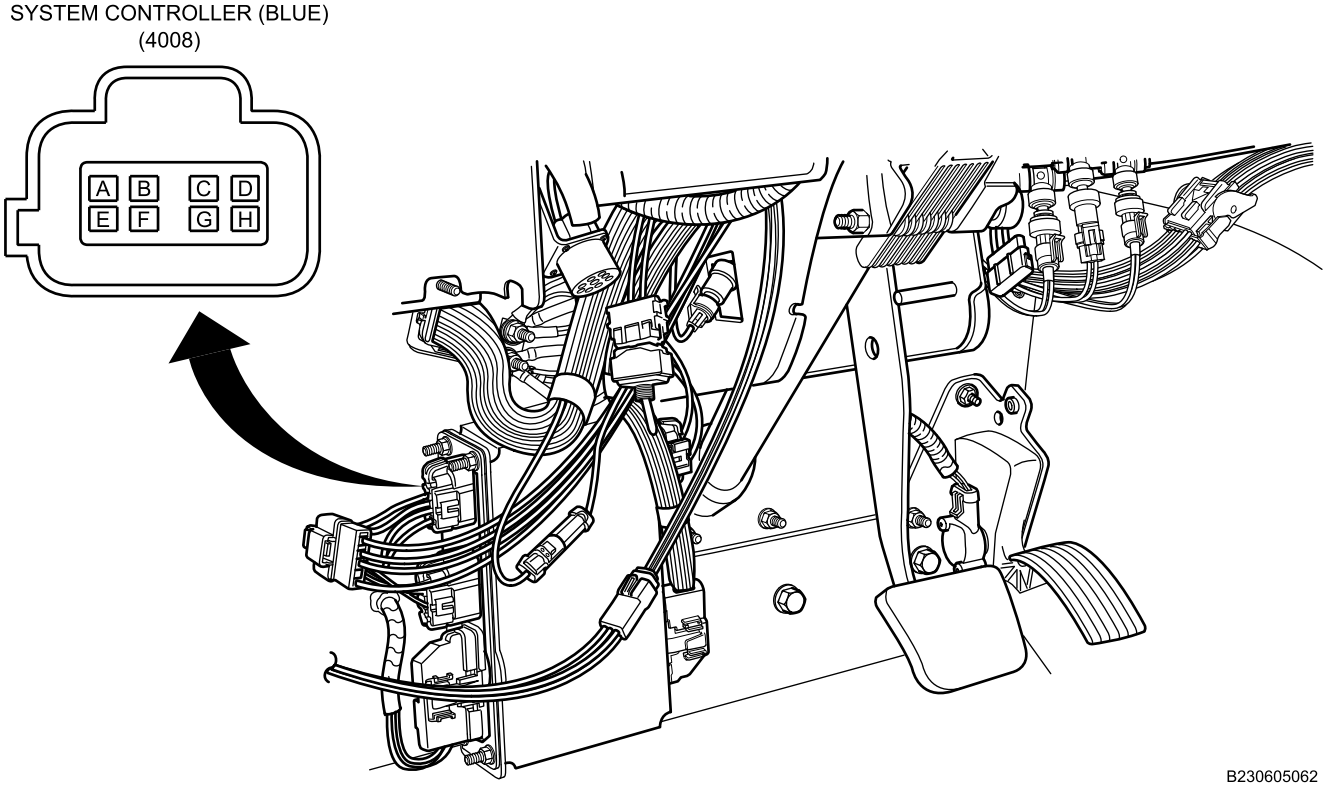


Figure 33. ESC Connector Under Left IP.

116. Measure resistance between STOPLIGHT RELAY RIGHT socket terminal 87 and connector 4008 terminal B or between STOPLIGHT RELAY LEFT socket terminal 87 and connector 4008 terminal C with multimeter. Refer to Figure 33 and Figure 34.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

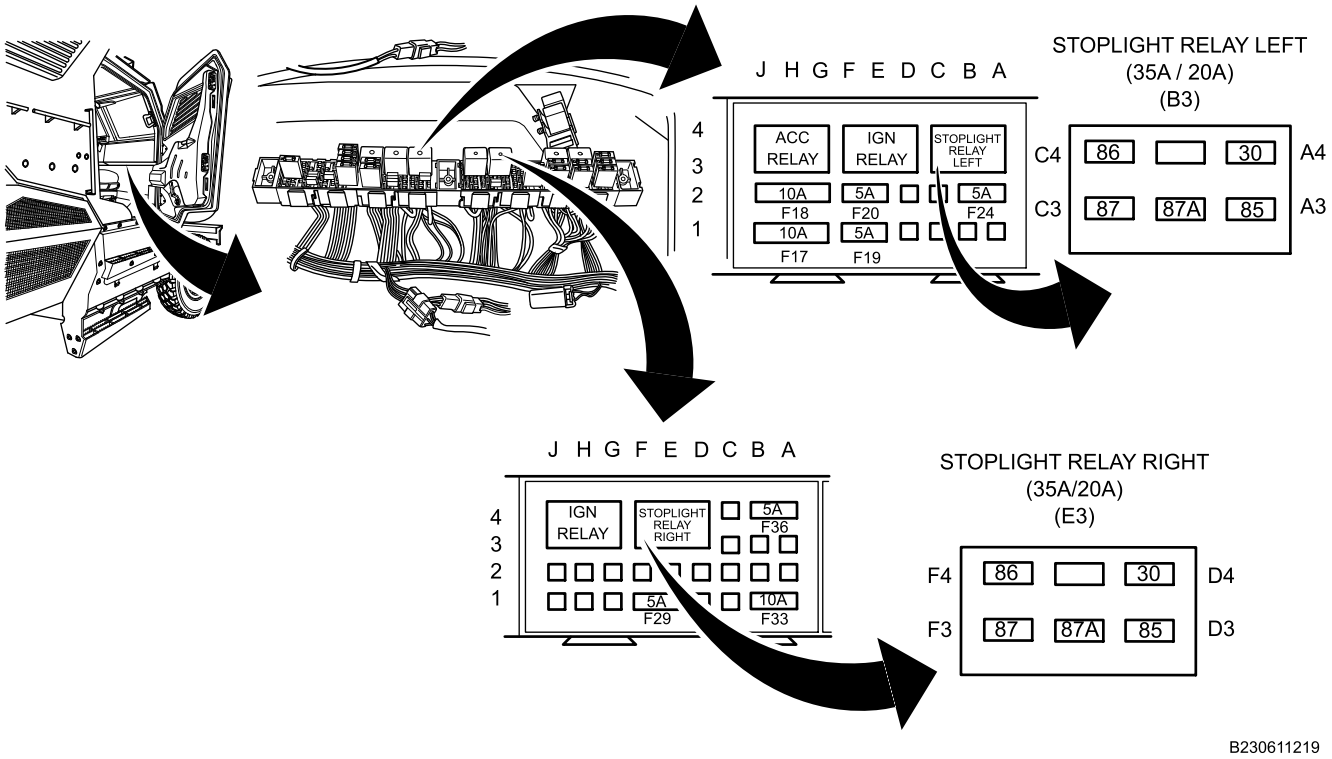


Figure 34. Left or Right Stoplight Relay in Cabin Relay and Fuse Center.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 178.
YES Go to next step.

STEP

117. Measure resistance between STOPLIGHT RELAY LEFT or RIGHT socket terminal 87 and ground with multimeter. Refer to Figure 34.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 179.
YES Go to Step 178.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

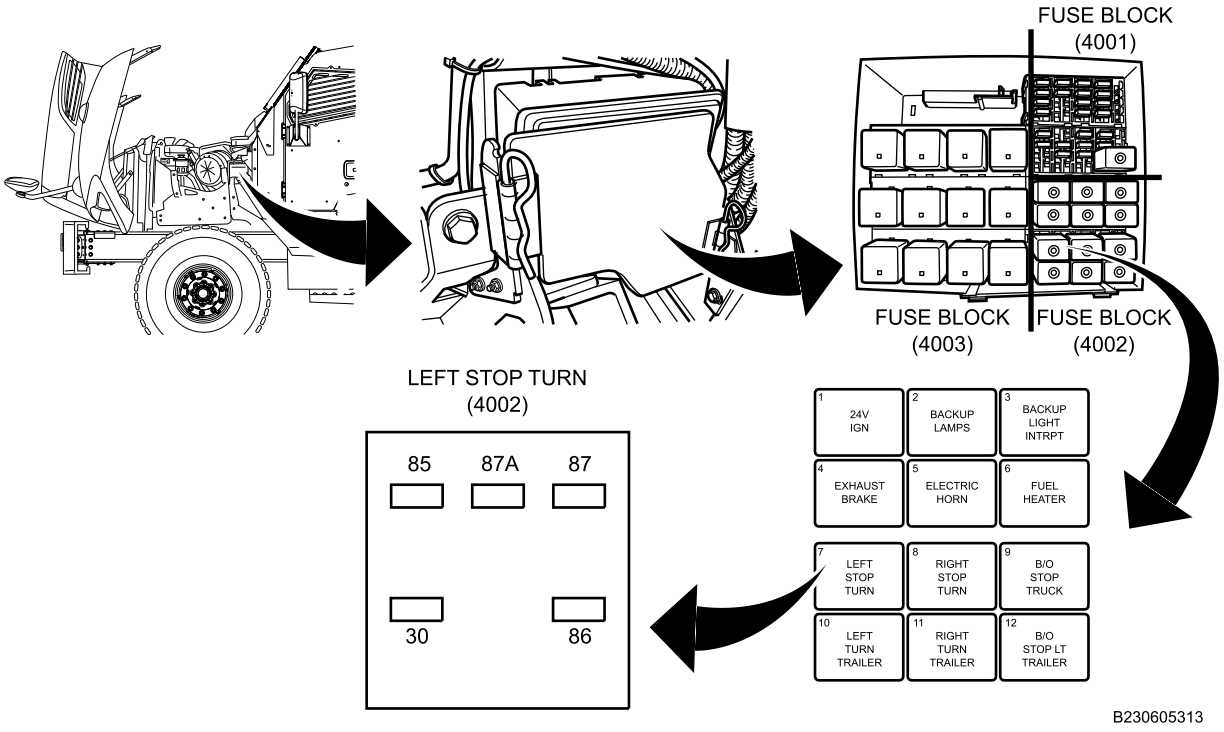


Figure 35. Stop/Turn Light Connector Near ESC.

118. Disconnect connector 1703F from 1703M. Refer to Figure 35.
119. Measure resistance between STOPLIGHT RELAY LEFT or RIGHT socket terminal 30 and connector 1703F terminal A for right stoplight, or 1703F terminal D for left stoplight, with multimeter. Refer to Figure 35 and Figure 36.

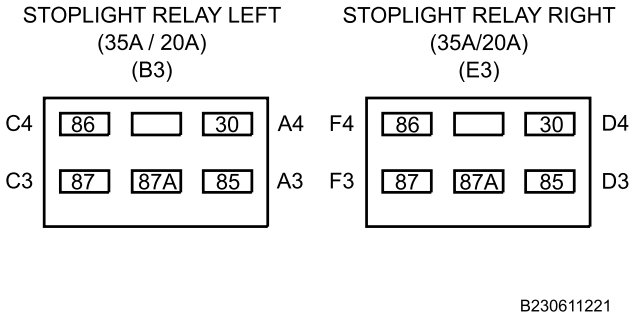


Figure 36. Stoplight Relay Left or Right Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

DECISION

NO Go to Step 178.
YES Go to Step 183.

STEP

120. Disconnect connector 1703F/1703M. Refer to Figure 35
121. Measure resistance between STOPLIGHT RELAY LEFT or RIGHT socket terminal 30 and ground with multimeter. Refer to Figure 36.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 178.
NO Go to Step 183.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

122. Measure DC voltage between LEFT or RIGHT STOP TURN relay socket terminal 86 and ground with multimeter. Refer to Figure 37.

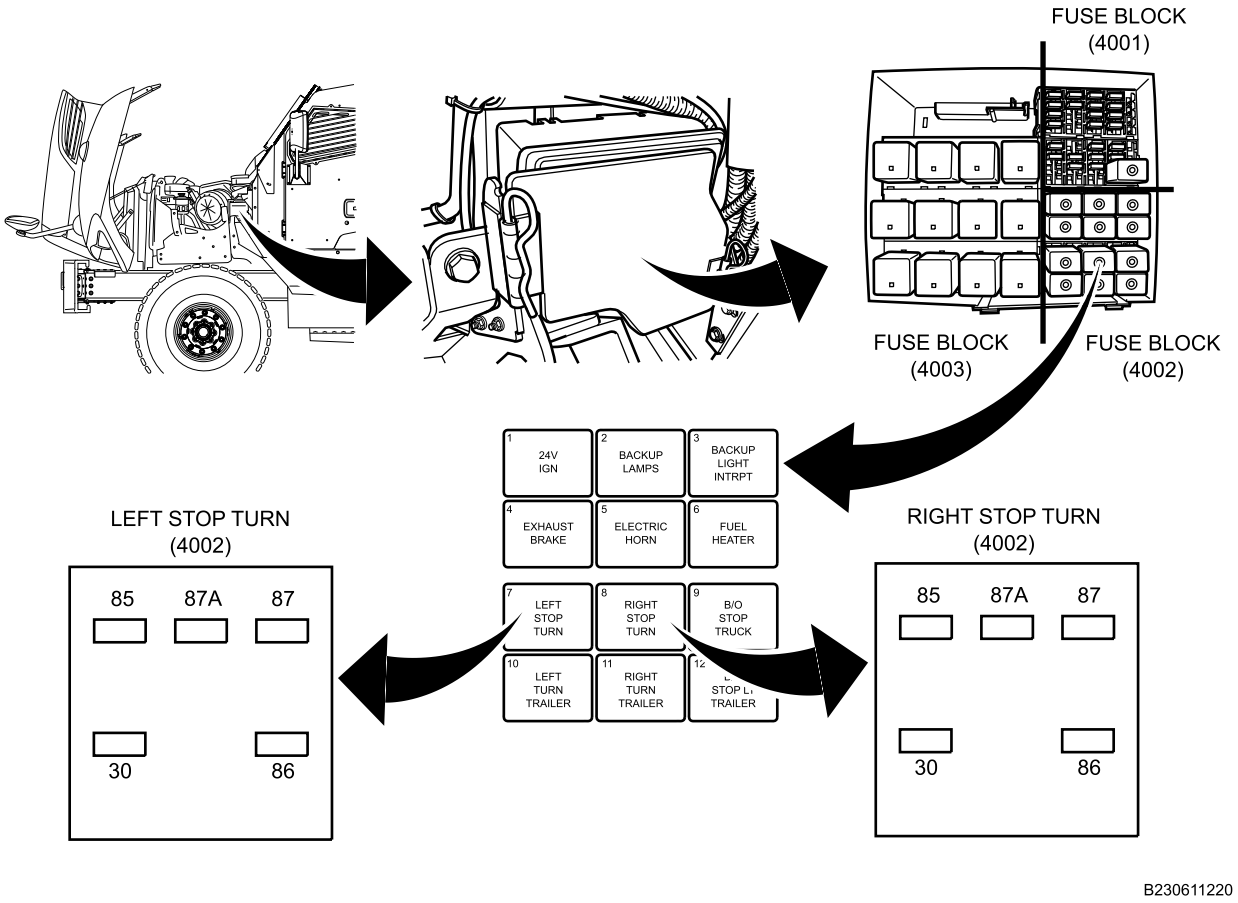


Figure 37. Left or Right Stop/Turn Relay in Engine Compartment PDC.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

NO Go to Step 183.
YES Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

123. Turn ignition switch OFF (TM 9-2355-106-10).
124. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
125. Measure resistance between LEFT or RIGHT STOP TURN relay socket terminal 85 and ground with multimeter. Refer to Figure 38.

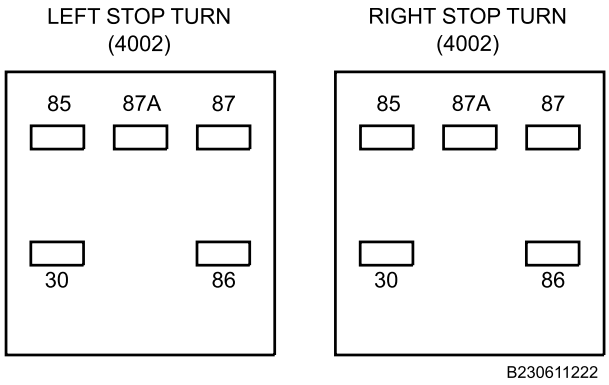


Figure 38. Left or Right Stop/Turn Relay Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 183.
YES Go to next step.

STEP

126. Measure resistance between LEFT or RIGHT STOP TURN relay socket terminal 30 and ground with multimeter. Refer to Figure 38.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 134.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

127. Measure resistance between LEFT or RIGHT STOP TURN relay socket terminal 30 and connector 9303A terminal B for left stoplight, or terminal C for right stoplight, with multimeter. Refer to Figure 38 and refer to Figure 39.

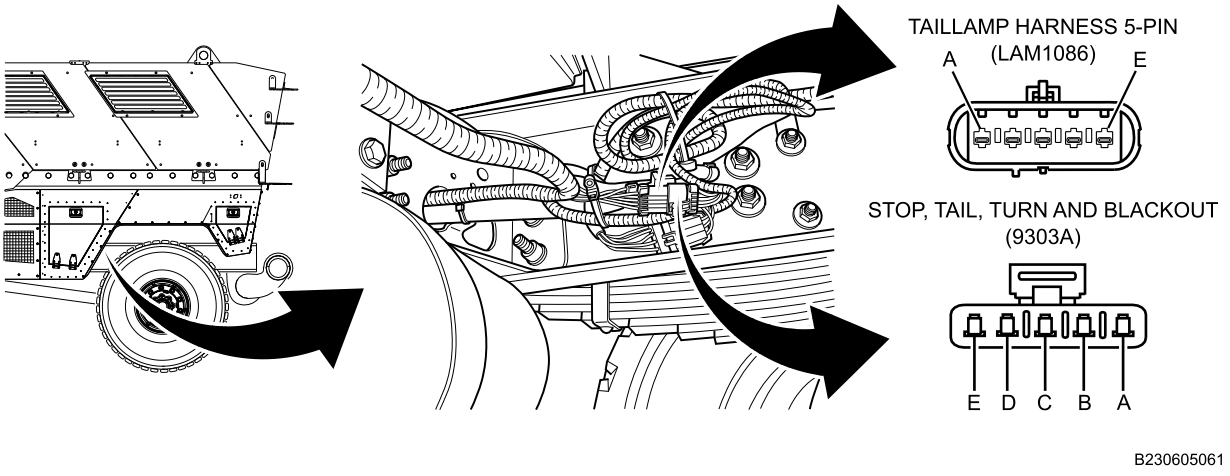


Figure 39. Taillamp/Rear Chassis Harness Connector Inside Left Frame Rail Near Rear Crossmember.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 182.
NO Go to next step.

STEP

128. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate (WP 0597).
129. Disconnect connector 9714 from 9700. Refer to Figure 40.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

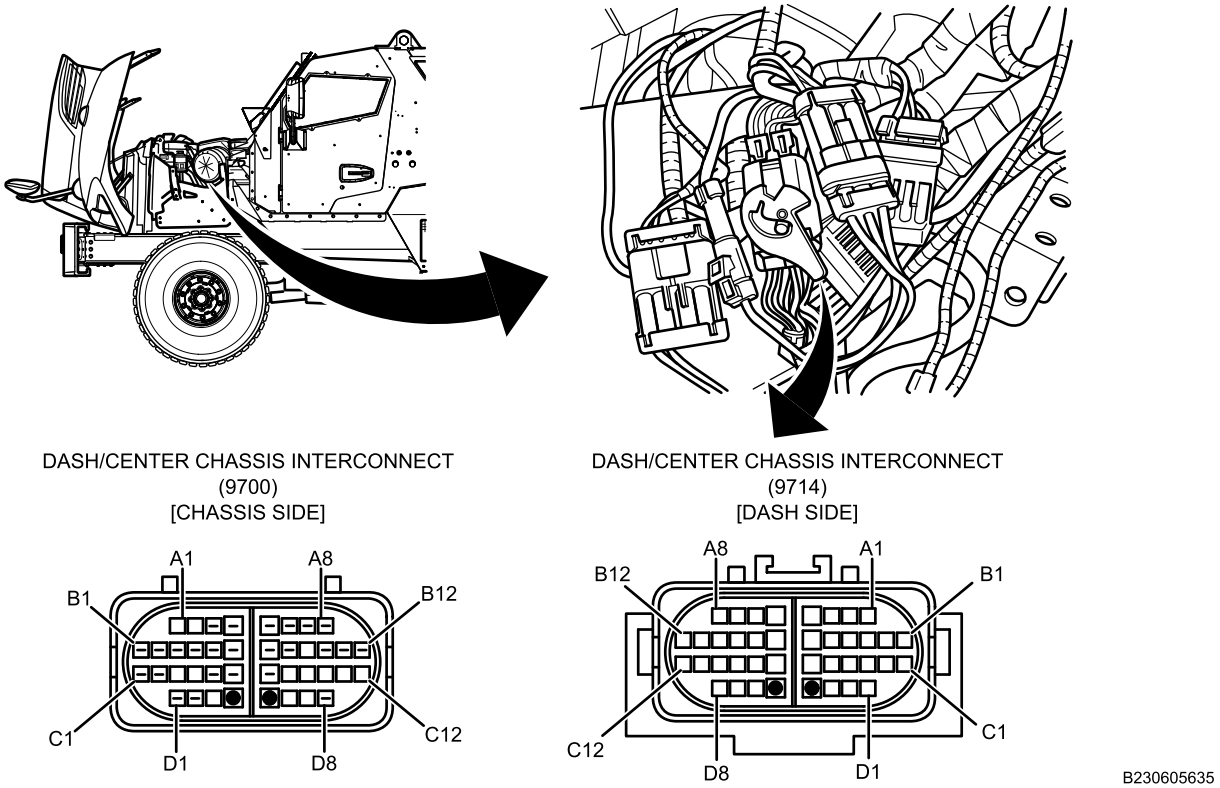


Figure 40. Dash/Center Chassis Harness Connector in Engine Compartment.

130. Measure resistance between LEFT or RIGHT STOP TURN relay socket terminal 30 and dash side connector 9714 terminal A5 for left stoplight, or terminal B6 for right stoplight, with multimeter. Refer to Figure 40 and refer to Figure 41.

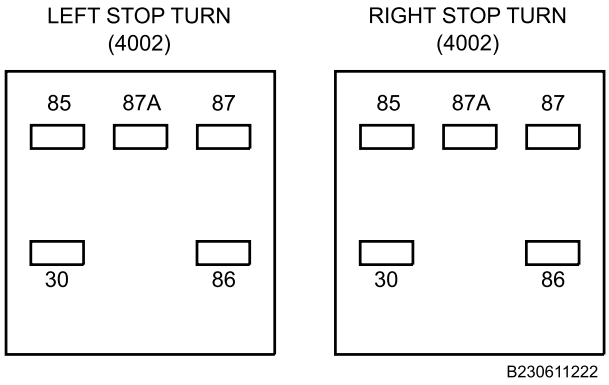


Figure 41. Left or Right Stop/Turn Relay Socket.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 183.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

YES Go to next step.

STEP

131. Loosen air dryer mounting bolts and move air dryer to one side to access connectors on left frame rail. Refer to Air Dryer Removal and Installation (WP 0517).
132. Disconnect connector 9800F from 9800M. Refer to Figure 42.

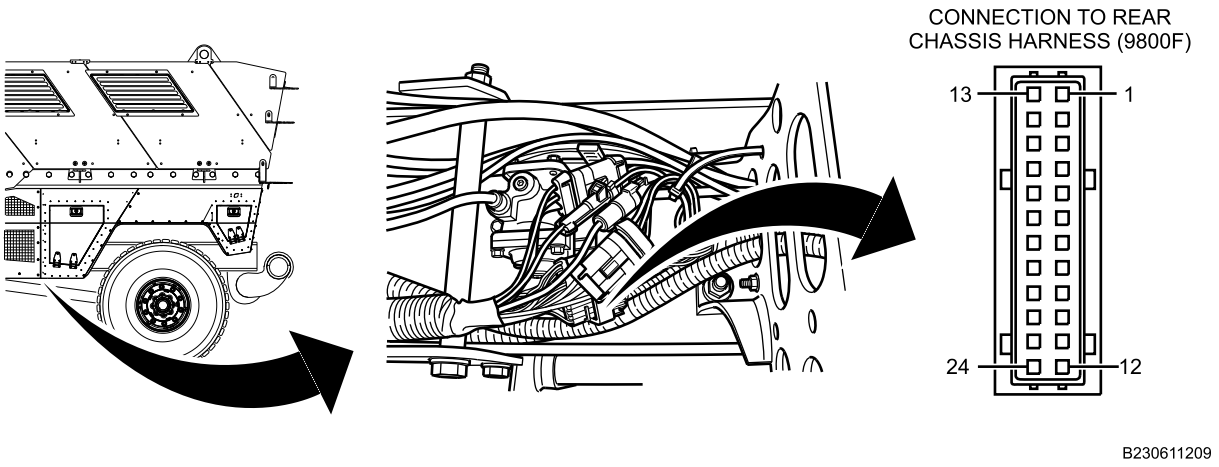


Figure 42. Center/Rear Chassis Harness Connector Inside Left Frame Rail.

133. Measure resistance between chassis side connector 9700 terminal A5 for left stoplight, or terminal B6 for right stoplight, and center/rear chassis connector 9800F terminal 2 for left stoplight, or terminal 3 for right stoplight, with multimeter. Refer to Figure 40. Refer to Figure 42.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 185.
NO Go to Step 184.

STEP

134. Loosen air dryer mounting bolts and move air dryer to one side to access connectors on left frame rail. Refer to Air Dryer Removal and Installation (WP 0517).
135. Disconnect connector 9800M/9800F. Refer to Figure 42.
136. Measure resistance between LEFT or RIGHT STOP TURN relay socket terminal 30 and ground with multimeter. Refer to Figure 43.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

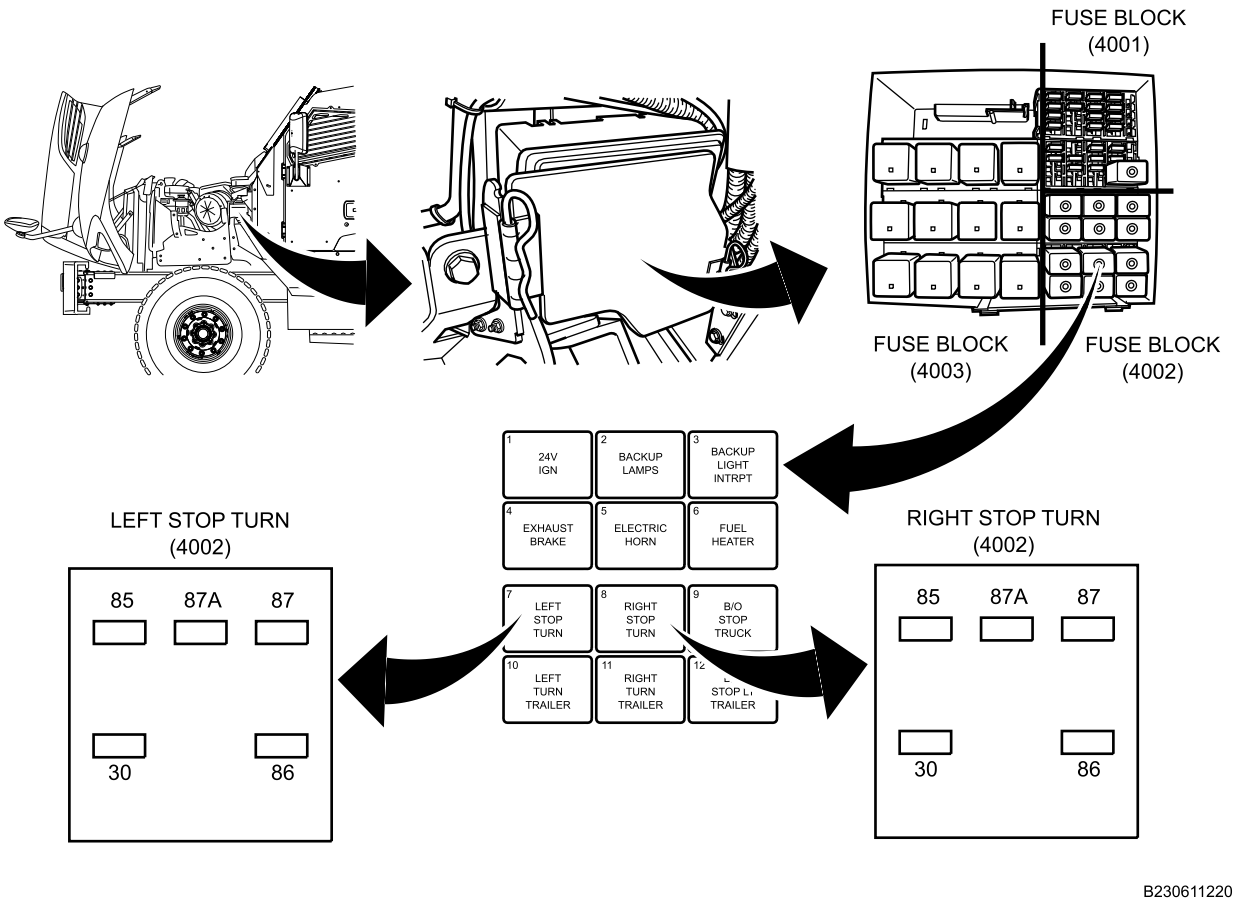


Figure 43. Left or Right Stop/Turn Relay in Engine Compartment PDC.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

NO Go to Step 185.
YES Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

137. Remove left side engine armor plate. Refer to Left Side Engine Armor Plate Removal and Installation (WP 0597).
138. Disconnect connector 9700 from 9714. Refer to Figure 44

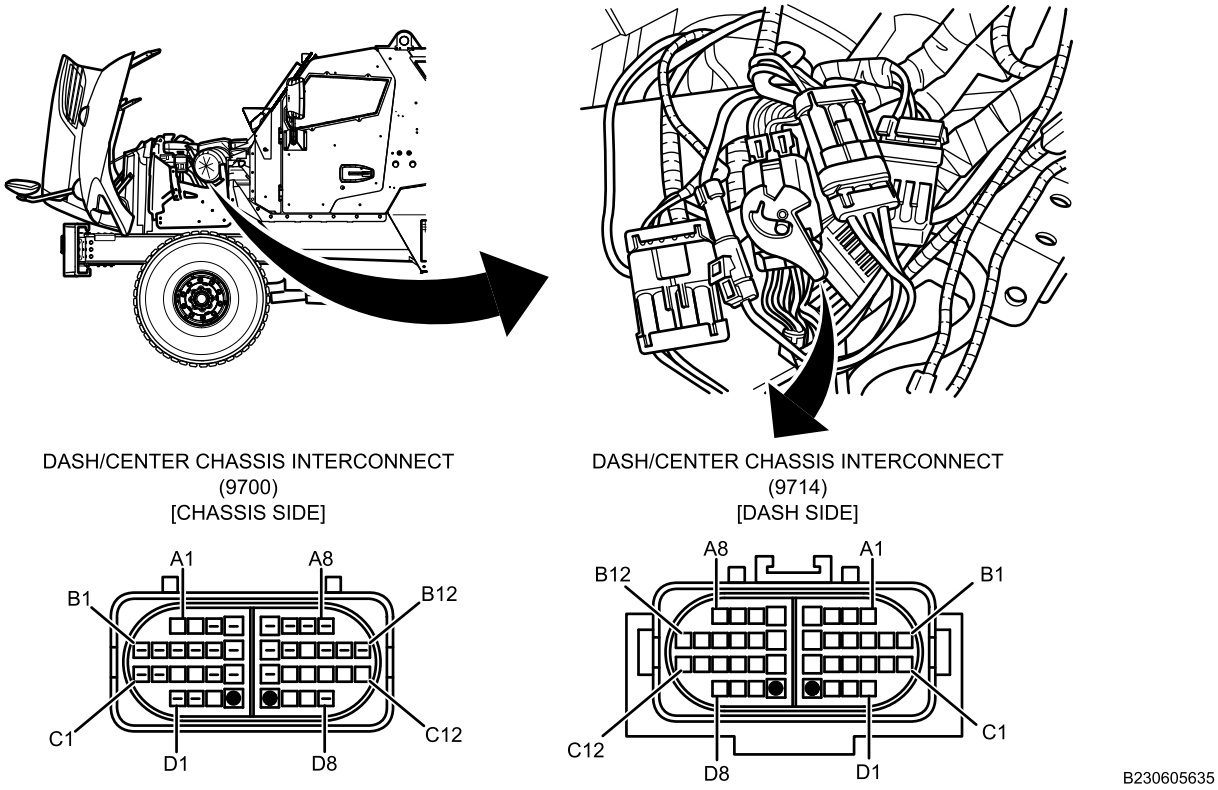


Figure 44. Dash/Center Chassis Harness Connector in Engine Compartment.

139. Measure resistance between LEFT or RIGHT STOP TURN relay socket terminal 30 and ground with multimeter. Refer to Figure 43.

CONDITION/INDICATION

Does multimeter read less than 5 ohms?

DECISION

YES Go to Step 183.
NO Go to Step 184.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

140. Disconnect ESC connector 4008. Refer to Figure 45.

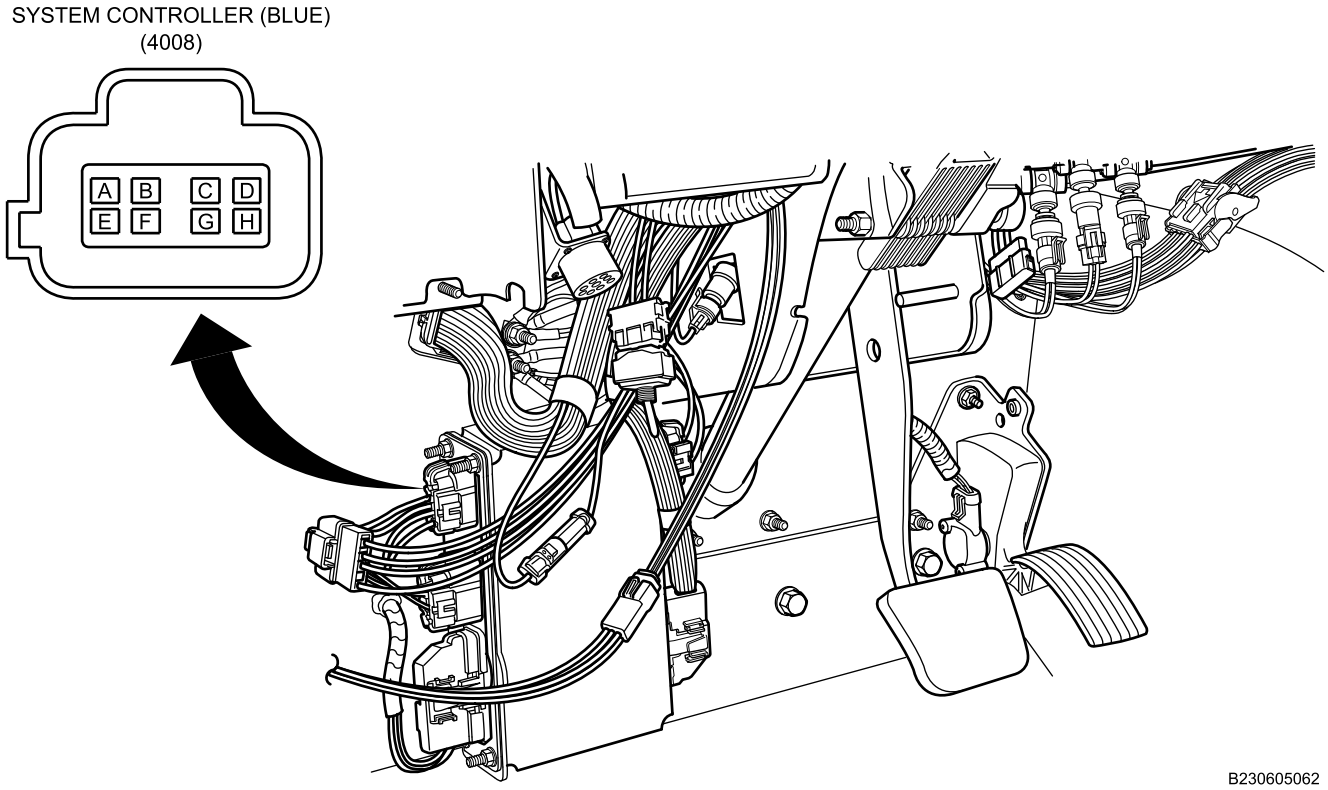


Figure 45. Electronic System Controller (ESC) Connector Under Left Side Instrument Panel.

CONDITION/INDICATION

Does stoplight go out?

DECISION

YES Go to Step 179.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

141. Remove STOPLIGHT RELAY LEFT or RIGHT for stoplight that remains on. Refer to Figure 46. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317).

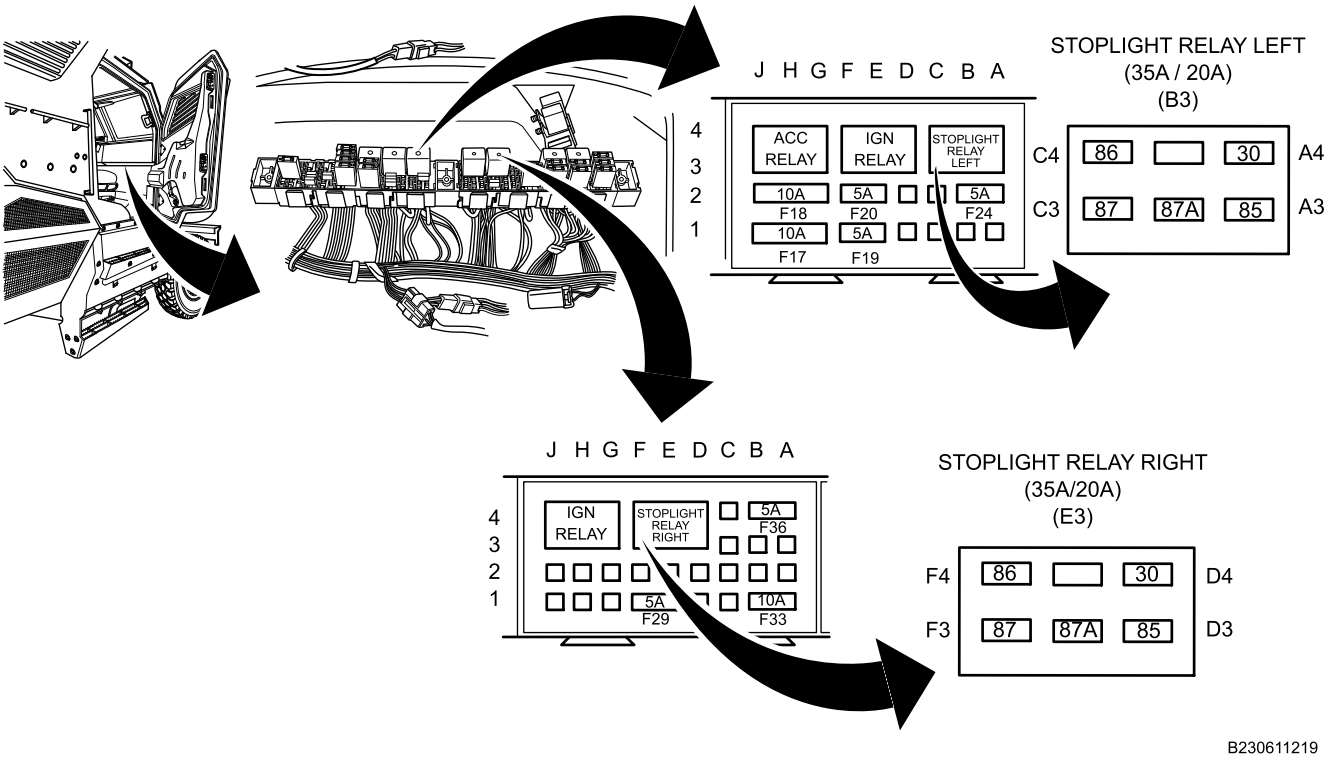


Figure 46. Stoplight Relay Left and Right in Cabin Relay and Fuse Center.

CONDITION/INDICATION

Does taillamp go out?

DECISION

YES Go to Step 166.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

142. Remove RIGHT or LEFT TURN TRAILER relay for stoplight that remains on. Refer to Figure 47.

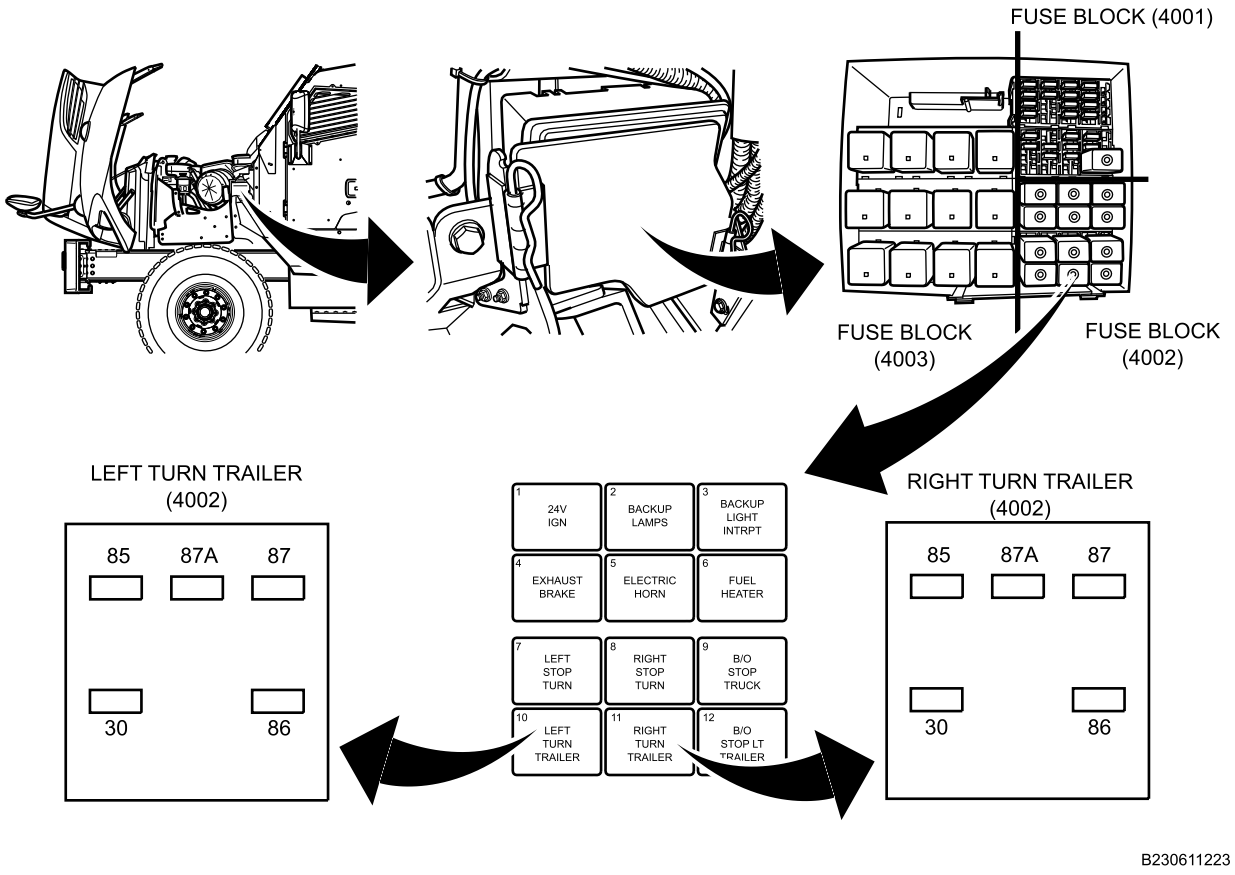


Figure 47. Right or Left Turn Trailer Relay in Engine Compartment PDC.

CONDITION/INDICATION

Does stop lamp go out?

DECISION

YES Go to Front and Rear Trailer Connector Operational Checkout Procedure (WP 0124).
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

143. Remove LEFT or RIGHT STOP TURN relay for stoplight that remains on. Refer to Figure 48. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333).

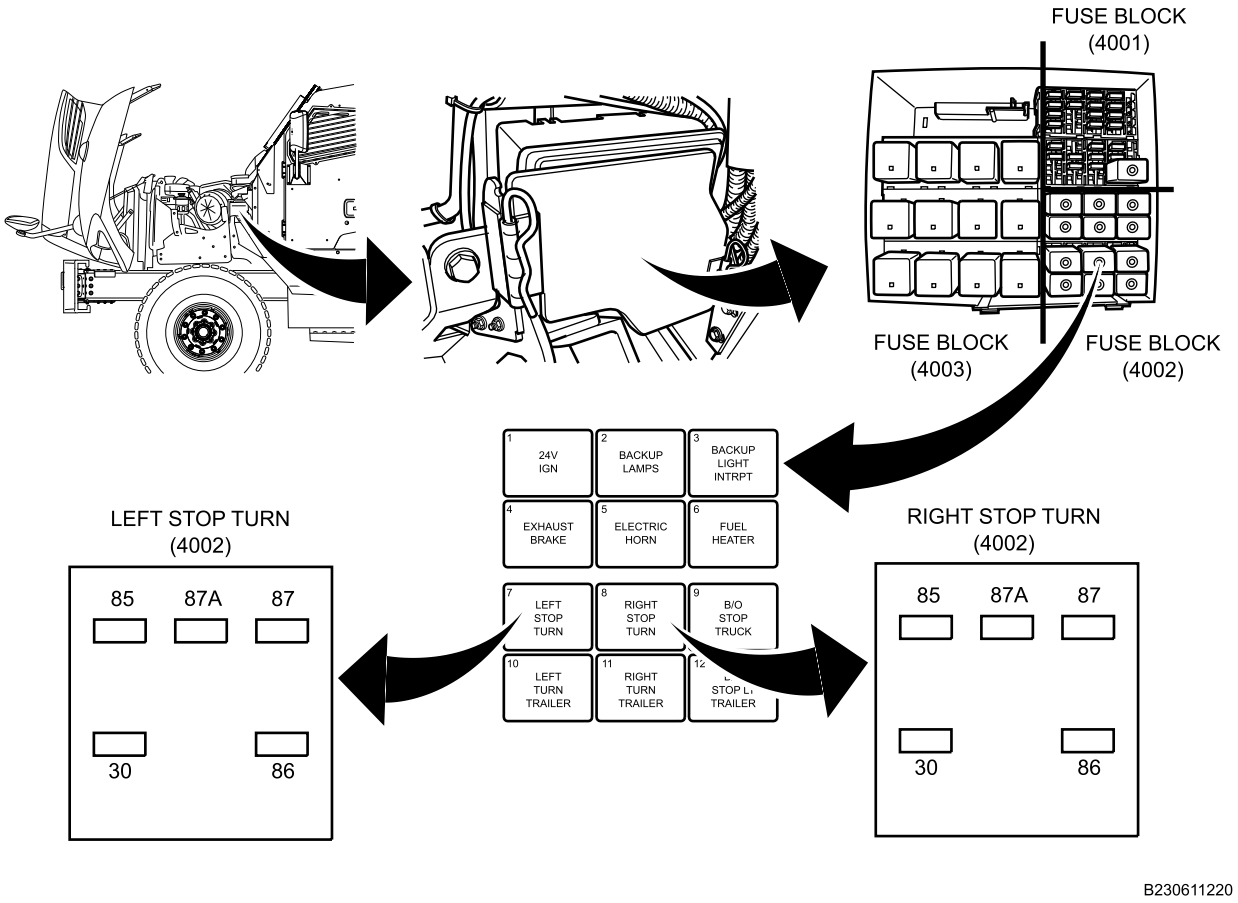


Figure 48. Left and Right Stop/Turn Relay in Engine Compartment PDC.

CONDITION/INDICATION

Does stop lamp go out?

DECISION

YES Go to Step 167.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

144. Remove left side engine armor. Refer to Left Side Engine Armor Removal and Installation (WP 0597).
145. Disconnect connector 9714 from 9700. Refer to Figure 49.

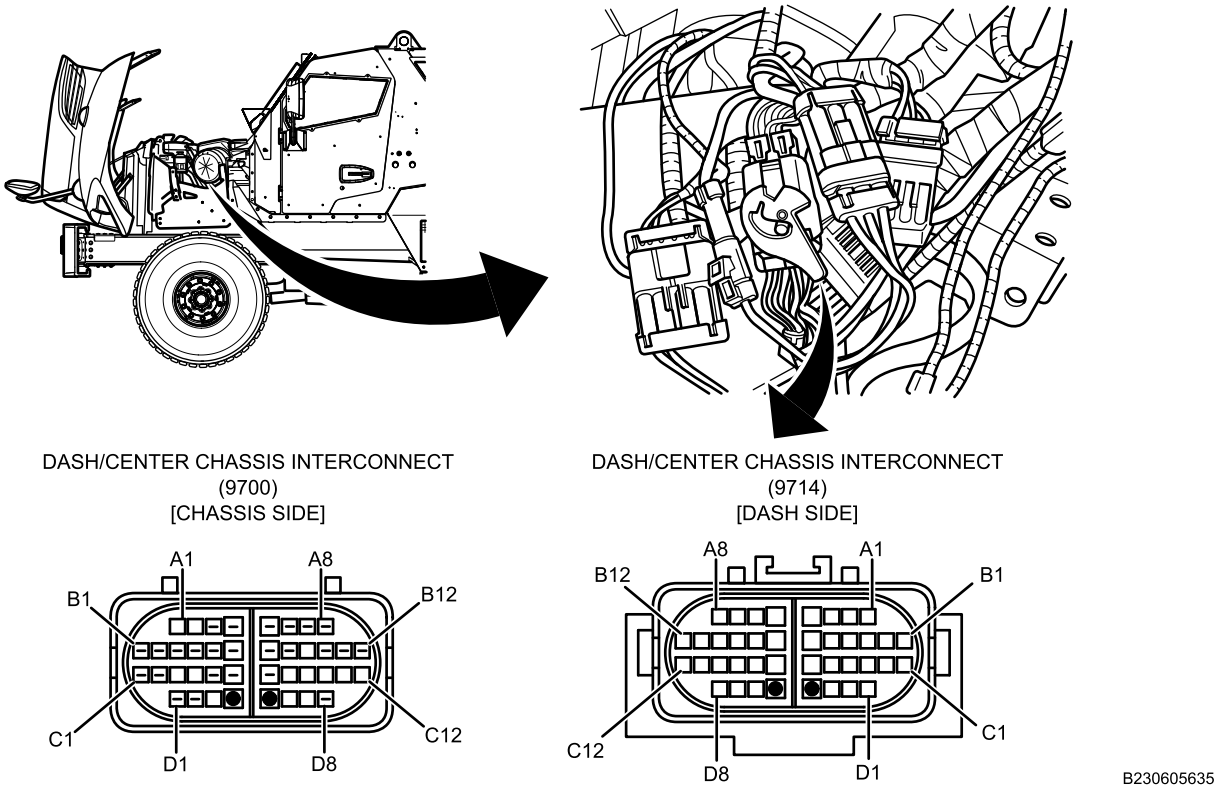


Figure 49. Dash/Center Harness Connector in Engine Compartment.

146. Turn MAIN POWER switch ON (TM 9-2355-106-10).
147. Turn ignition switch ON (TM 9-2355-106-10).
148. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
149. Measure DC voltage between dash side connector 9714 terminal B6 for right stoplight, or terminal A5 for left stoplight, and ground with multimeter. Refer to Figure 49.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 183.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

150. Turn ignition switch OFF (TM 9-2355-106-10).
151. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
152. Connect connector 9700 to 9714. Refer to Figure 49.
153. Loosen air dryer mounting bolts and move air dryer to one side to access connectors on left frame rail. Refer to Air Dryer Removal and Installation (WP 0517).
154. Disconnect connector 9800F from 9800M. Refer to Figure 50.

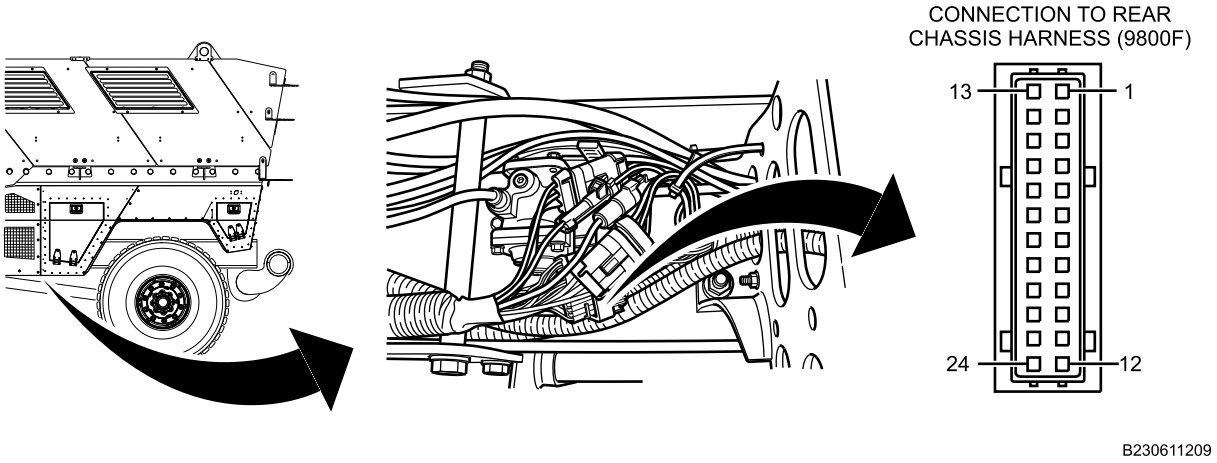


Figure 50. Center/Rear Harness Connector Inside Left Frame Rail.

155. Turn MAIN POWER switch ON (TM 9-2355-106-10).
156. Turn ignition switch ON (TM 9-2355-106-10).
157. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
158. Measure DC voltage between center chassis side connector 9800F terminal 3 for right stoplight, or terminal 2 for left stoplight, and ground with multimeter. Refer to Figure 50.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 184.
NO Go to next step.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

159. Turn ignition switch OFF (TM 9-2355-106-10).
160. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
161. Disconnect harness connector 9303A from LAM1086. Refer to Figure 51.

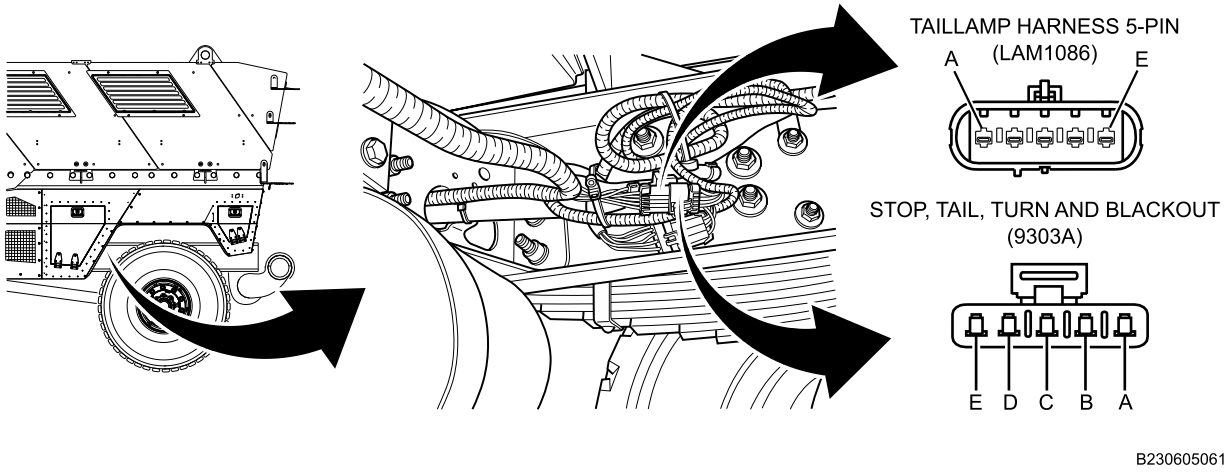


Figure 51. Taillamp/Rear Chassis Harness Connector Inside Left Frame Rail Near Rear Crossmember.

162. Turn MAIN POWER switch ON (TM 9-2355-106-10).
163. Turn ignition switch ON (TM 9-2355-106-10).
164. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
165. Measure DC voltage between connector 9303A terminal B for left stoplight, or C for right stoplight, and ground. Refer to Figure 51.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 185.
NO Go to Step 186.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

166. Measure voltage at STOPLIGHT RELAY LEFT or RIGHT socket terminal 87 of stoplight that was on. Refer to Figure 52.

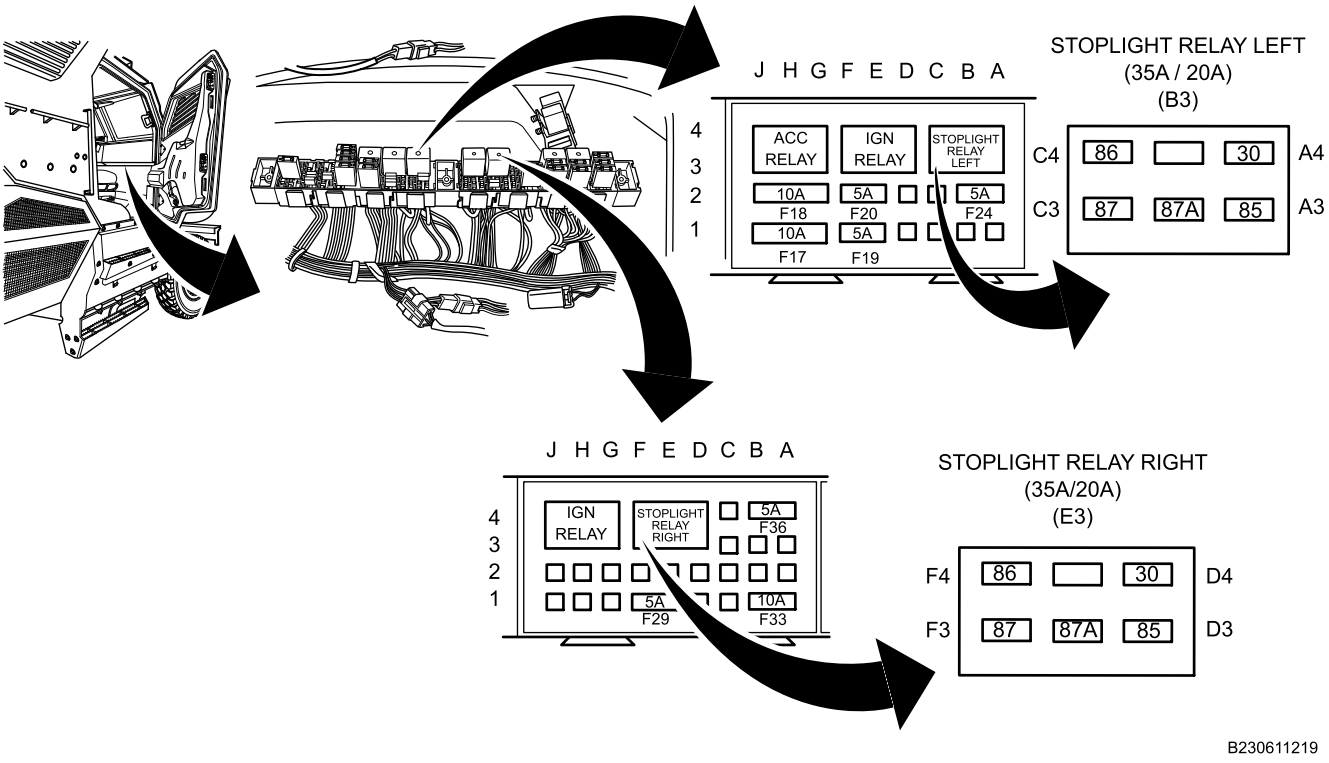


Figure 52. Left or Right Stoplight Relay in Cabin Relay and Fuse Center.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 178.
NO Go to Step 180.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

STEP

167. Turn ignition switch OFF (TM 9-2355-106-10).
168. Turn MAIN POWER switch OFF (TM 9-2355-106-10).
169. Disconnect dash/IP connector 1703F/1703M. Refer to Figure 53.

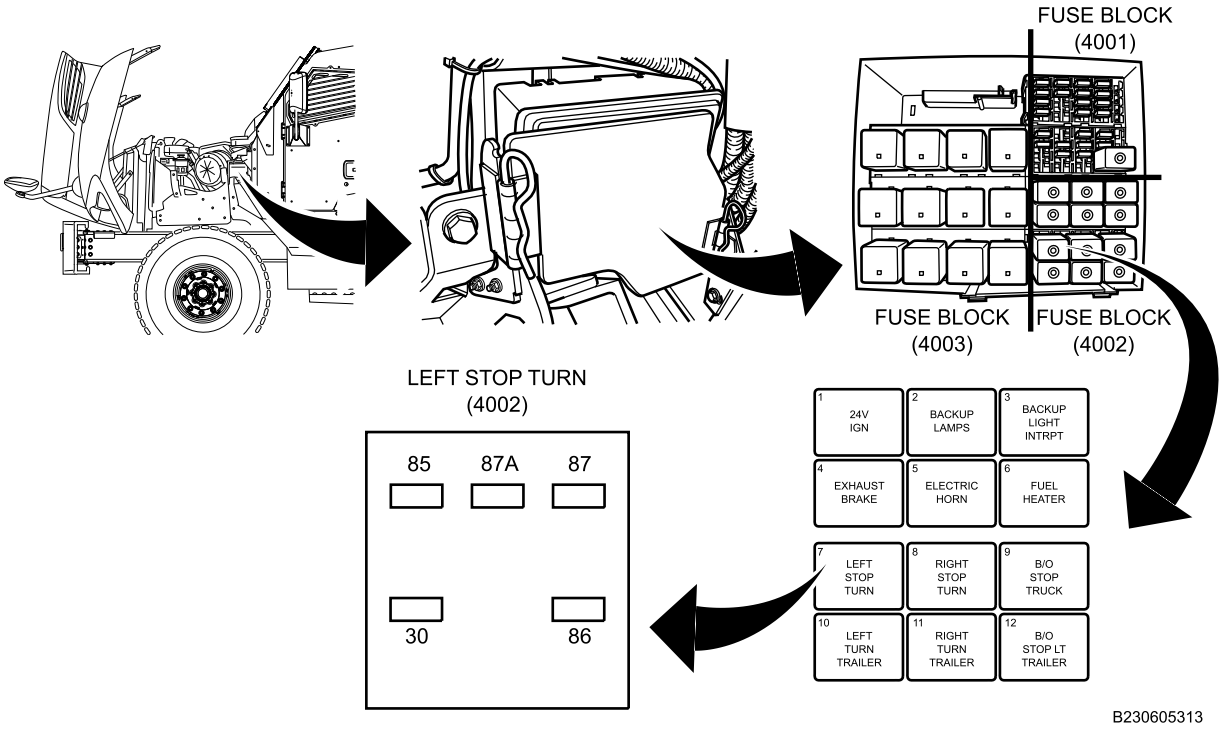


Figure 53. Stop/Turn Light Connector Near ESC.

170. Turn MAIN POWER switch ON (TM 9-2355-106-10).
171. Turn ignition switch ON (TM 9-2355-106-10).
172. Press SER. DRIVE on MVLS and then press ENTER within 5 seconds.
173. Measure voltage on IP side connector 1703F terminal A for right stoplight or D for left stoplight. Refer to Figure 53.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 178.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

NO Go to next step.

STEP

174. Measure voltage on dash side connector 1703M terminal A for right stoplight or D for left stoplight. Refer to Figure 53.

CONDITION/INDICATION

Does multimeter read between 10.5V and 13.5V?

DECISION

YES Go to Step 183.
NO Go to Step 182.

STEP

175. Connect MSD to vehicle. Refer to Connecting Maintenance Support Device (MSD) (WP 0011).
176. Observe brake switch input to MSD with brake pedal released.

CONDITION/INDICATION

Does input show brake switch activated?

DECISION

YES Go to Brake Switch Troubleshooting Procedure (WP 0168).
NO Go to Step 179.

MALFUNCTION

- 177. Taillamp unit is faulty.

ACTION

Replace taillamp unit. Refer to Taillamp Removal and Installation (WP 0655). Return vehicle to service.

END OF TEST

MALFUNCTION

- 178. Instrument panel wiring harness is faulty.

ACTION

Replace instrument panel wiring harness. Refer to Instrument Panel Wiring Harness Removal and Installation (WP 0319). Return vehicle to service.

END OF TEST

MALFUNCTION

- 179. ESC is faulty.

ACTION

Replace ESC. Refer to Electronic System Controller (ESC) Removal and Installation (WP 0353). Return vehicle to service.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 180. Instrument panel (IP) relay is faulty.

ACTION

Replace IP relay. Refer to Instrument Panel (IP) Circuit Breaker, Fuse, and Relay Removal and Installation (WP 0317). Return vehicle to service.

END OF TEST

MALFUNCTION

- 181. Instrument panel center relay is faulty.

ACTION

Replace instrument panel center relay. Refer to Instrument Panel Center Relay Removal and Installation (WP 0318). Return vehicle to service.

END OF TEST

MALFUNCTION

- 182. Power Distribution Center (PDC) relay is faulty.

ACTION

Replace PDC relay. Refer to Power Distribution Center (PDC) Fuse and Relay Removal and Installation (WP 0333). Return vehicle to service.

END OF TEST

MALFUNCTION

- 183. PDC harness is faulty.

ACTION

Replace PDC harness. Refer to Power Distribution Center (PDC) Harness Removal and Installation (WP 0335). Return vehicle to service.

END OF TEST

MALFUNCTION

- 184. Center chassis harness is faulty.

ACTION

Replace center chassis harness. Refer to Center Chassis Harness Removal and Installation (WP 0426). Return vehicle to service.

STOPLIGHT TROUBLESHOOTING PROCEDURE - (CONTINUED)

END OF TEST

MALFUNCTION

- 185. Rear chassis harness is faulty.

ACTION

Replace rear chassis harness. Refer to Rear Chassis Harness Removal and Installation (WP 0427). Return vehicle to service.

END OF TEST

MALFUNCTION

- 186. Taillamp harness is faulty.

ACTION

Replace Taillamp harness. Refer to Taillamp Harness Removal and Installation (WP 0384). Return vehicle to service.

END OF TEST

MALFUNCTION

- 187. MVLS is faulty.

ACTION

Replace MVLS. Refer to MVLS Removal and Installation (WP 0427). Return vehicle to service.

END OF TEST

MALFUNCTION

- 188. Instrument Panel Cluster (IPC) is faulty.

ACTION

Replace IPC. Refer to Instrument Panel Cluster (IPC) Removal and Installation(WP 0297). Return vehicle to service.

END OF TEST

END OF WORK PACKAGE

GLOSSARY

GLOSSARY

ATA Data Link	A serial datalink specified by the American Trucking Association and the SAE.
Continuous Test	A function of the ECM in which ECM inputs and outputs are continuously monitored to ensure that the readings are within set limits.
Drive Train Data Link J1939	Primary communication link for the ECM, ESC, and instrument cluster.
Driver	A transistor in the output section of the ECM to turn various actuators in the system on or off.
Duty Cycle Signal	A type of control signal that has a controlled on/off time measure from 0% to 100%. Normally used to control solenoids.
Fault Detection/ Management	An alternate control strategy devised to reduce adverse effects of a system failure. Should a sensor fail, the ECM substitutes a good sensor signal or assumed sensor value in its place. The AMBER light illuminates to alert the driver that the vehicle requires servicing.
Injection Control Pressure	High lube oil pressure generated by a high pressure pump/pressure regulator to hydraulically actuate the fuel injectors.
Input Conditioner	A device or circuit that conditions or prepares an input signal for use by the microprocessor.
Low Speed Digital Inputs	Switched sensor inputs that generate an on/off (high/low) signal to the ECM. The input supplied to the ECM from the sensor could be from a high input source switch (usually 12 or 5 volts) or a grounding-type switch, which grounds the signal from a current-limiting resistor internal to the ECM, creating a low signal (0 volts).
Normally Closed	Refers to a switch solenoid that remains closed when no control force is acting on it.
Normally Open	Refers to a switch that remains open when no control force is acting on it.
On Demand Test	A self-test the technician initiates that is run from a program in the processor.
Output State Check	An "On Demand" test selected by the technician that forces the processor to activate actuators "High or Low" for additional diagnostics.
Pulse Width	The length of time an actuator, such as an injector, remains energized.
Switch Sensors	Switch sensors are used to indicate position, levels, or pressures. Switch sensors produce a digital signal created by opening or closing a switch. The on or off signal can indicate position as in the case of a clutch switch, level as in the case of a coolant level switch, or pressure as in the case of a low oil pressure switch. A switch sensor normally has two connectors: signal return (grd) and signal. A switch sensor is considered a low speed digital signal input.

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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA.	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE *Date you filled out this form.*
TO *(Forward to proponent of publication or form) (Include ZIP Code)* U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000	**FROM** *(Activity and location) (Include ZIP Code)* *Your mailing address*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM Number	*Date of the TM*	*Title of the TM*

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON (Exact wording of recommended change must be given)
	0007-3					*Figure 2, Item 9 should show a lockwasher. Currently shows a flat washer.*
	0018-2					*Cleaning and inspection, Step 6, reference to governor support pin (14) is wrong reference. Reference should be change to (12).*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your Name	*Your Phone Number*	*Your Signature*

TO *(Forward direct to addressee listed in publication)*	**FROM** *(Activity and location) (Include ZIP Code)*	**DATE**
U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000	*Your Address*	*Date you filled out this form*

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM Number	*Date of the TM*	*Title of the TM*

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS *(Any general remarks, or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your Name	*Your Phone Number*	*Your Signature*

APD V4.00

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	**DATE**
TO *(Forward to proponent of publication or form) (Include ZIP Code)* U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000	**FROM** *(Activity and location) (Include ZIP Code)*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-2355-106-23-1	19 November 2012	MAINTENANCE MANUAL FOR MINE RESISTANT AMBUSH PROTECTED VEHICLE

	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO *(Forward direct to addressee listed in publication)*	**FROM** *(Activity and location) (Include ZIP Code)*	**DATE**
U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000		

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

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APD V4.00

By Order of the Secretary of the Army:

RAYMOND T. ODIERNO
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

1229003

By Order of the Secretary of the Air Force:

JANET C. WOLFENBARGER
General, United States Air Force
Commander, AFMC

MARK A. WELSH, III
General, United States Air Force
Chief of Staff

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 381168 requirements for TM 9-2355-106-23-1.

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 Pounds
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

Liquid Measure

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 = 0.0386 Sq Miles

Cubic Measure

1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

Temperature

9/5 C° +32 = F°
5/9 (°F - 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius

APPROXIMATE CONVERSION FACTORS

To Change	To	Multiply By
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Sq Inches	Sq Centimeters	6.451
Sq Feet	Sq Meters	0.093
Sq Yards	Sq Meters	0.836
Sq Miles	Sq Kilometers	2.590
Acres	Sq 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 per Sq Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

To Change	To	Multiply By
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Sq Centimeters	Sq Inches	0.155
Sq Meters	Sq Feet	10.764
Sq Meters	Sq Yards	1.196
Sq Kilometers	Sq Miles	0.386
Sq Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Sq Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621

PIN: 084302-000