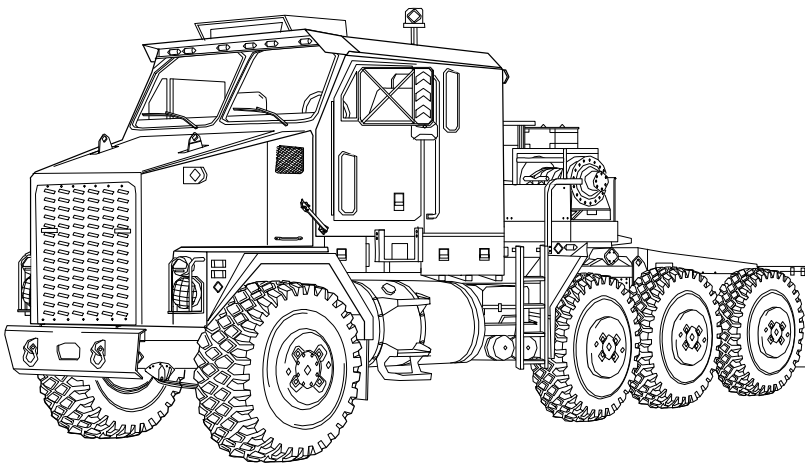


VOLUME NO. 1

**TECHNICAL MANUAL
UNIT MAINTENANCE**



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

NSN 2320-01-318-9902

EIC: B5C

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

* Supersedes TM 9-2320-360-20-1 dated 31 March 1994.

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HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 2007

WARNING**CARBON MONOXIDE (EXHAUST GAS) CAN KILL YOU**

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

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

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

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS GOOD VENTILATION.

WARNING

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

WARNING

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

WARNING

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

WARNING

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

WARNING**SOLVENT CLEANING COMPOUND (DRY CLEANING SOLVENT)**

Solvent cleaning compound MIL-PRF-680 Type II and III may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Use respirator as needed. Accidental ingestion can cause irritation of digestive tract and respiratory tract, may cause lung and central nervous system damage. Can be fatal if swallowed. Inhalation of high/massive concentrations can cause coma or be fatal. First aid for ingestion: do not induce vomiting. Seek immediate medical attention. First aid for skin contact: remove contaminated clothing. Wash skin thoroughly with soap and water. If symptoms persist, seek medical attention. First aid for eye contact: flush with water for 15 minutes or until irritation subsides. If symptoms persist, seek medical attention. First aid for inhalation: move to fresh air. If not breathing, provide artificial respiration. If symptoms persist, seek medical attention. Keep away from open flames and other sources of ignition. Failure to follow this warning may result in injury or death to personnel.

- The flashpoint for type II solvent cleaning compound is 141-198°F (61-92C) and type III is 200-241°F (93-116C).
- Improper cleaning methods and use of unauthorized cleaning solvents may injure personnel and damage equipment.
- Fire extinguishers should be placed nearby when using solvent cleaning compound. Failure to follow this warning may result in injury or death.
- Cloths or rags saturated with solvent cleaning compound must be disposed of IAW authorized facilities' procedures. Failure to follow this warning may result in injury.
- Eye shields must be worn when cleaning with a wire brush. Flying rust and metal particles may cause injury.

WARNING

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

WARNING

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

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

WARNING

Observe the following precautions when working around fuel.

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

WARNING

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

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

WARNING

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

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

WARNING

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

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

WARNING

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

WARNING

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

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

WARNING

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

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

WARNING

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

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

WARNING

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

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

WARNING

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

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

WARNING

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

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

WARNING

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

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

WARNING

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

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

WARNING

Polyurethane Coating (CARC)

Eye and hearing protection must be worn at all times when using power tools for grinding, cutting, sawing and drilling. Failure to do so may result in injury to personnel. Chemical Agent Resistant Coating (CARC) paint contains isocyanate which is highly irritating to skin and respiratory system. High concentrations of isocyanate can produce symptoms of itching and reddening of skin, a burning sensation in the throat and nose, and watering of the eyes. In extreme concentrations, isocyanate can cause cough, shortness of breath, pain during respiration, increased sputum production, and chest tightness. First aid for ingestion: do not induce vomiting. Seek immediate medical attention. First aid for skin contact: remove contaminated clothing. Wash skin thoroughly with soap and water. If symptoms persist, seek medical attention. First aid for eye contact: flush with water for 15 minutes or until irritation subsides. If symptoms persist, seek medical attention. First aid for inhalation: move to fresh air. If not breathing, provide artificial respiration. If symptoms persist, seek medical attention.

The following precautions must be taken whenever using CARC paint:

- Protective equipment (gloves, goggles, ventilation mask) must be worn when using CARC paint.
- NEVER cut CARC-coated materials without high-efficiency, air-purifying respirators in use.
- DO NOT grind or sand painted equipment without high-efficiency, air-purifying respirators in use.
- BE AWARE of CARC paint exposure symptoms; symptoms can occur a few days after initial exposure. Seek medical help immediately if symptoms are detected.
- Use only in well-ventilated areas. Check with local environmental office for methods and locations approved for painting in accordance with local and state environmental regulations.
- ALWAYS use air line respirators when using CARC paint unless air sampling shows exposure to be below standards. Use chemical cartridge respirator if air sampling is below standards.

WARNING

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

See FM 4-25.1 for additional first aid data.

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Pages 2-1 thru 2-993 (2-994 blank)	0
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Technical Manual
TM 9-2320-360-20-1

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

UNIT MAINTENANCE

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

Reporting Errors and Recommending Improvements

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

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HOW TO USE THIS MANUAL

OVERVIEW

This technical manual (TM) is provided to help you maintain the HET Tractor at the unit maintenance level. Because of its size, it is divided into two volumes. Volume 1 contains the following major sections in order of appearance:

- **WARNING SUMMARY.** Provides a summary of the most important warnings that apply throughout the manual.
- **TABLE OF CONTENTS.** Lists, for both volumes, the chapters, sections, appendixes, and indexes with page numbers in order of appearance.
- **CHAPTER 1, INTRODUCTION.** Describes the HET Tractor and provides equipment data.

- **CHAPTER 2, VEHICLE MAINTENANCE.** This chapter contains information for finding tools; special tools; test, measurement, and diagnostic equipment (TMDE); and repair parts. It also contains the preventive maintenance checks and services (PMCS) and troubleshooting tables.
- **SUBJECT INDEX.** Lists important subjects contained in volume 1 in alphabetical order and gives the page numbers on which they are located.

Volume 2 contains the following major sections in order of appearance:

- **WARNING SUMMARY.** Provides a summary of the most important warnings that apply throughout the manual.
- **TABLE OF CONTENTS.** Lists, for volume 2, the chapters, sections, appendixes, and index with page numbers in order of appearance.

The maintenance chapters in volume 2 each concern a specific system or group of components.

- **CHAPTER 3, ENGINE MAINTENANCE**
- **CHAPTER 4, FUEL SYSTEM MAINTENANCE**
- **CHAPTER 5, EXHAUST SYSTEM MAINTENANCE**
- **CHAPTER 6, COOLING SYSTEM MAINTENANCE**
- **CHAPTER 7, ELECTRICAL SYSTEM MAINTENANCE**
- **CHAPTER 8, TRANSMISSION MAINTENANCE**
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- **CHAPTER 18, BODY ACCESSORY ITEMS MAINTENANCE**
- **CHAPTER 19, SPECIAL PURPOSE KITS MAINTENANCE**
- **CHAPTER 20, NON-ELECTRIC GAGES MAINTENANCE**
- **CHAPTER 21, CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL (CBR) EQUIPMENT MAINTENANCE**

The last part of volume 2 contains information which will assist you in the performance of unit maintenance on the HET Tractor.

- **APPENDIX A, REFERENCES.** Lists publications used with the HET Tractor.
- **APPENDIX B, MAINTENANCE ALLOCATION CHART.** The maintenance allocation chart denotes the level of maintenance which performs specific maintenance tasks and the time required. It also lists tools and special tools required for each task.

OVERVIEW (CONT)

- **APPENDIX C, EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST.** Lists expendable and durable items used in the performance of maintenance.
- **APPENDIX D, ILLUSTRATED LIST OF MANUFACTURED ITEMS.** Illustrates and describes items that must be fabricated from bulk materials for repair of the HET Tractor.
- **APPENDIX E, TORQUE VALUES.** Lists the standard torques values for specific attaching hardware.
- **APPENDIX F, COMMON TOOLS, SUPPLEMENTS, AND SPECIAL TOOLS/FIXTURES LIST.** This appendix lists equipment used in the performance of maintenance and references publications which contain information regarding the equipment.
- **APPENDIX G, MANDATORY REPLACEMENT PARTS LIST.** This appendix lists the mandatory replacement parts needed to maintain the HET Tractor.
- **APPENDIX H, DDEC III/IV DIAGNOSTIC TROUBLESHOOTING GUIDE.** This appendix contains the troubleshooting for the DDEC III/IV vehicle.
- **SUBJECT INDEX.** Lists important subjects contained in Volume 2 and 3 in alphabetical order and gives the page numbers on which they are located.

FINDING INFORMATION

There are several ways to find the information you need in this manual. They are as follows:

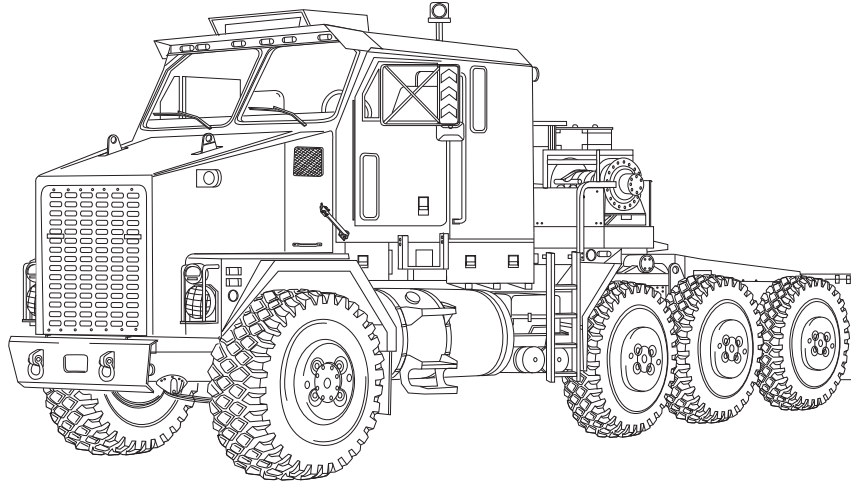
- **FRONT COVER INDEX.** The front cover index contains a list of the most important topics contained in each volume. It features a black box at the right edge of the cover which corresponds with a black box on the page containing the topic. The topics listed on the front cover are highlighted in the table of contents with a box.
- **TABLE OF CONTENTS.** Lists chapters, sections, appendixes, and indexes with page numbers in order of appearance.
- **CHAPTER INDEXES.** List paragraphs contained in the individual chapters with paragraph and page numbers in order of appearance.
- **SYMPTOM INDEX.** Lists malfunctions contained in the troubleshooting table with page numbers in order of appearance.
- **SUBJECT INDEX.** Lists all important topics with page numbers in alphabetical order.

TROUBLESHOOTING

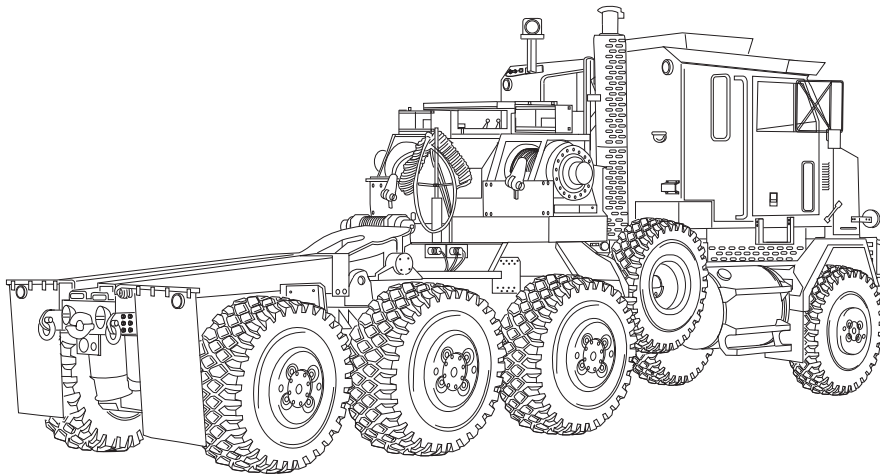
There are two types of troubleshooting tables contained in this manual, DDEC and vehicle. Always consult the vehicle troubleshooting first when an engine malfunction occurs. Refer to the DDEC troubleshooting logic table in chapter 2 to assist you in fault isolation for DDEC III/IV vehicles and to Appendix H to assist in fault isolation for DDEC III/IV vehicles. When a non-engine malfunction occurs, look at the symptom index for the vehicle troubleshooting table (also in chapter 2). Find the malfunction in the index. Turn to the page number listed for the malfunction in the troubleshooting table. Perform the steps required to correct the malfunction. If you can't find the malfunction, or the malfunction is not corrected, notify your supervisor. When troubleshooting electrical circuits refer to the electrical schematics for connectors, routing, wire numbers, etc.

MAINTENANCE

- **SCHEDULED MAINTENANCE.** Your scheduled maintenance is located in table 2-1, PMCS. These checks and services are mandatory at the intervals listed. Always follow the WARNINGS and CAUTIONS.
- **UNSCHEDULED MAINTENANCE.** Unscheduled maintenance is located in chapters 3 thru 21. The PMCS and troubleshooting tables often reference you to these procedures. When you perform maintenance, look over the entire procedure before starting. Make sure you have the necessary tools and materials at hand. Always follow the WARNINGS and CAUTIONS.



Left Front View



Right Rear View

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

CHAPTER 1 INTRODUCTION

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Section I. GENERAL INFORMATION

1-1. SCOPE

- a. Type of Manual. Unit Maintenance Instructions, TM 9-2320-360-20.
- b. Model Number and Equipment Name. Truck, Tractor, M1070, 8 x 8, Heavy Equipment Transporter (HET).
- c. Purpose of Equipment. The HET Tractor and the M1000 Trailer form the Heavy Equipment Transport System (HETS). HETS will be used to load, unload, and transport the M1 Series Main Battle Tank (MBT) during administrative and tactical operations.

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 750-8, The Army Maintenance Management System (TAMMS).

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

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

1-4. PREPARATION FOR STORAGE OR SHIPMENT

Instructions for preparation for storage or shipment are provided in paragraph 2-22 of this manual.

1-5. NOMENCLATURE CROSS-REFERENCE

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

Table 1-1. Nomenclature Cross-Reference

<u>Common Name</u>	<u>Official Nomenclature</u>
DDR	CTS J1708 Application
STE/ICE-R	CTS/ICE
Cable	Wire rope
Cold Start System	Ether quick-start system
Engine Coolant	Antifreeze, ethylene glycol mixture
Gladhand	Quick-disconnect coupling
HET Tractor	Truck, Tractor, M1070, 8 x 8, Heavy Equipment Transporter (HET)
Jacobs Brake	Engine retarder

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your HET Tractor needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Tank-Automotive and Armaments Command, ATTN: AMSTA-QRT, Warren, MI 48397-5000. We'll send you a reply.

1-7. EQUIPMENT IMPROVEMENT REPORT AND MAINTENANCE DIGEST (EIR MD) AND EQUIPMENT IMPROVEMENT REPORT AND MAINTENANCE SUMMARY (EIR MS)

The quarterly EIR MD, TB 43-001-39 series, contains valuable field information on the equipment covered in this manual. It is compiled from some of the Quality Deficiency Reports that have been prepared on the vehicles covered in this manual. Many of these articles result from comments, suggestions, and improvement recommendations that were submitted to the EIR program. It also contains information on equipment improvements, minor alterations, proposed Modification Work Orders (MWOs), warranties, actions taken on some of the DA Form 2028's (Recommended Changes to Publications), and advance information on proposed changes that may affect this manual. In addition, the more maintenance significant articles (including minor alterations, field-fixes, etc.) that have a continuing need in the field are republished in the EIR MS for TACOM equipment (TM 43-1043). Refer to both of these publications periodically, especially the TB 43-001-39 series, for the most current and authoritative information on the equipment. The information will help you to do a better job and will advise of the latest changes to this manual. Also refer to DA Pam 25-30 and Appendix A, References, of this manual.

1-8. WARRANTY INFORMATION

The HET Tractor is warranted by Oshkosh Truck Corporation for 12 months; 4 months additional if placed in storage. (Refer to TB 9-2320-360-14, page 3, paragraph i for details.) Warranty starts on the date found in block 21, DD Form 250, in the logbook. Report all defects in material or workmanship to the supervisor, who will take the appropriate action. For complete information covering warranties, refer to Warranty Technical Bulletin for Truck, Tractor, M1070, 8 x 8, Heavy Equipment Transporter (HET) TB 9-2320-360-14.

1-9. METRIC SYSTEM

The equipment described herein contains metric components and requires metric common and special tools, therefore, Metric units in addition to English units will be used throughout this manual. An English-to-metric conversion table is included inside the back cover of this manual.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-10. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

Refer to TM 9-2320-360-10, for equipment characteristics, capabilities, and features.

1-11. LOCATION AND DESCRIPTION OF COMPONENTS

Refer to TM 9-2320-360-10, for location and description of components.

1-12. EQUIPMENT DATA

Refer to TM 9-2320-360-10, for equipment data.

1-13. SAFETY, CARE, AND HANDLING

Significant Hazards and Safety Recommendations. Significant hazards and safety recommendations are listed in table 1-2.

Table 1-2. Significant Hazards and Safety Recommendations

Operating Hazard	Safety Recommendation or Precaution	Condition*
Low oil pressure/ high coolant temperature	Stop engine operation when CHECK GAUGES and CHECK ENGINE indicators are lit, engine warning alarm sounds, and gages indicate abnormal readings.	Abnormal
Low air pressure	Do not drive HET Tractor while low air pressure alarm is sounding or LOW AIR indicator is lit.	Abnormal
Electric shock	Do not wear watches, rings, or other jewelry while working on or near an electrical circuit.	Abnormal
Refueling vehicle	Fuel is very flammable and can explode easily. To avoid serious injury or death, keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. When working with fuel, post sign that says: NO SMOKING WITHIN 50 FEET OF VEHICLE.	Normal

*Category of hazards as to whether or not they may be expected under normal or abnormal operating conditions.

1-13. SAFETY, CARE, AND HANDLING (CONT)

Table 1-2. Significant Hazards and Safety Recommendations (Cont)

Operating Hazard	Safety Recommendation or Precaution	Condition*
Connecting/Disconnecting trailer.	Make sure that position of assistant is known at all times. Make sure no one is standing directly behind tractor or trailer during connection/disconnection.	Normal
Vehicle instability on a hill.	Avoid driving diagonally across a hill. HET Tractor may roll, causing equipment damage and injury or death to personnel.	Normal
Winching operations.	Do not use winches for lifting personnel. Always wear heavy gloves when handling winch cable. Never let cable run through hands. Frayed cable can cut severely. Do not operate winch without guard in place. Do not place hands or feet near winch during operation. Ensure that both DRIVER SIDE and PASSENGER SIDE WINCH KICKOUT controls are disengaged prior to paying out winch cables. Failure to disengage KICKOUT controls may result in injury to personnel.	Normal
*Category of hazards as to whether or not they may be expected under normal or abnormal operating conditions.		

Section III. PRINCIPLES OF OPERATION

1-14. POWER TRAIN

Power for the HET Tractor is generated by a two-stroke, V-type diesel engine coupled directly to an automatic transmission. The engine is rated at 500 brake horsepower.

The engine is equipped with an electronic control system that regulates fuel delivery to each injector as well as governing engine speed for power takeoff operation. Engine sensors and engine performance can be checked using a plug-in diagnostic reader.

Power from the engine drive shaft transmits torque that is multiplied for greater drive power by a torque converter when needed.

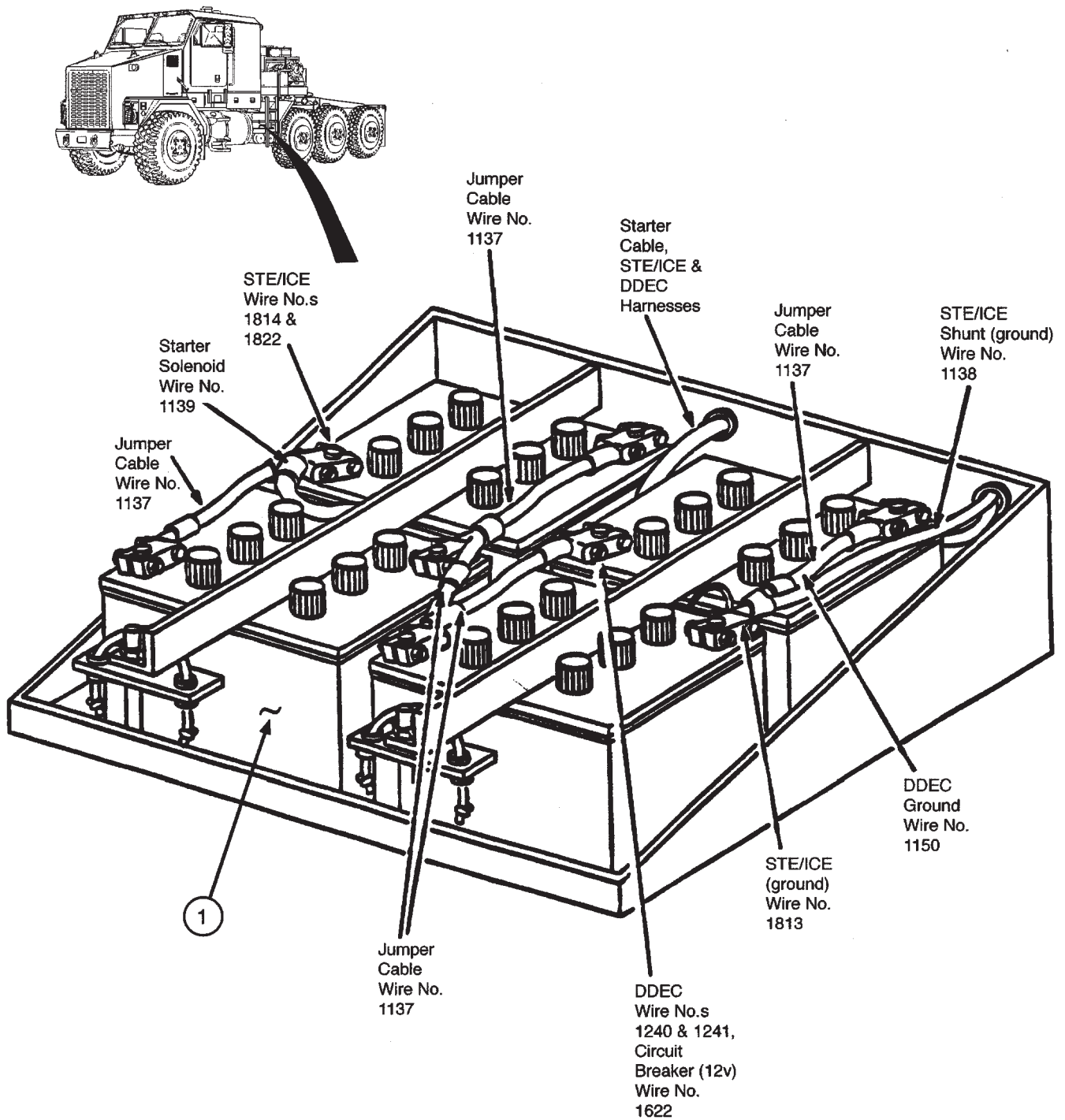
Five forward drive ranges can be manually selected, depending on the terrain and conditions. The transmission will automatically downshift as engine speed and throttle position change.

When the lockup clutch is automatically applied, power is transmitted mechanically through the lockup clutch. A direct drive is engaged from the engine to a converter turbine shaft.

Power from the transmission is directed to the transfer case and propeller shafts forward and rear. The front and rear tridem axles are each equipped with planetary wheel ends. In low range, driver-controlled lockouts in the differentials provide positive drive to all four axles.

1-15. ELECTRICAL SYSTEM

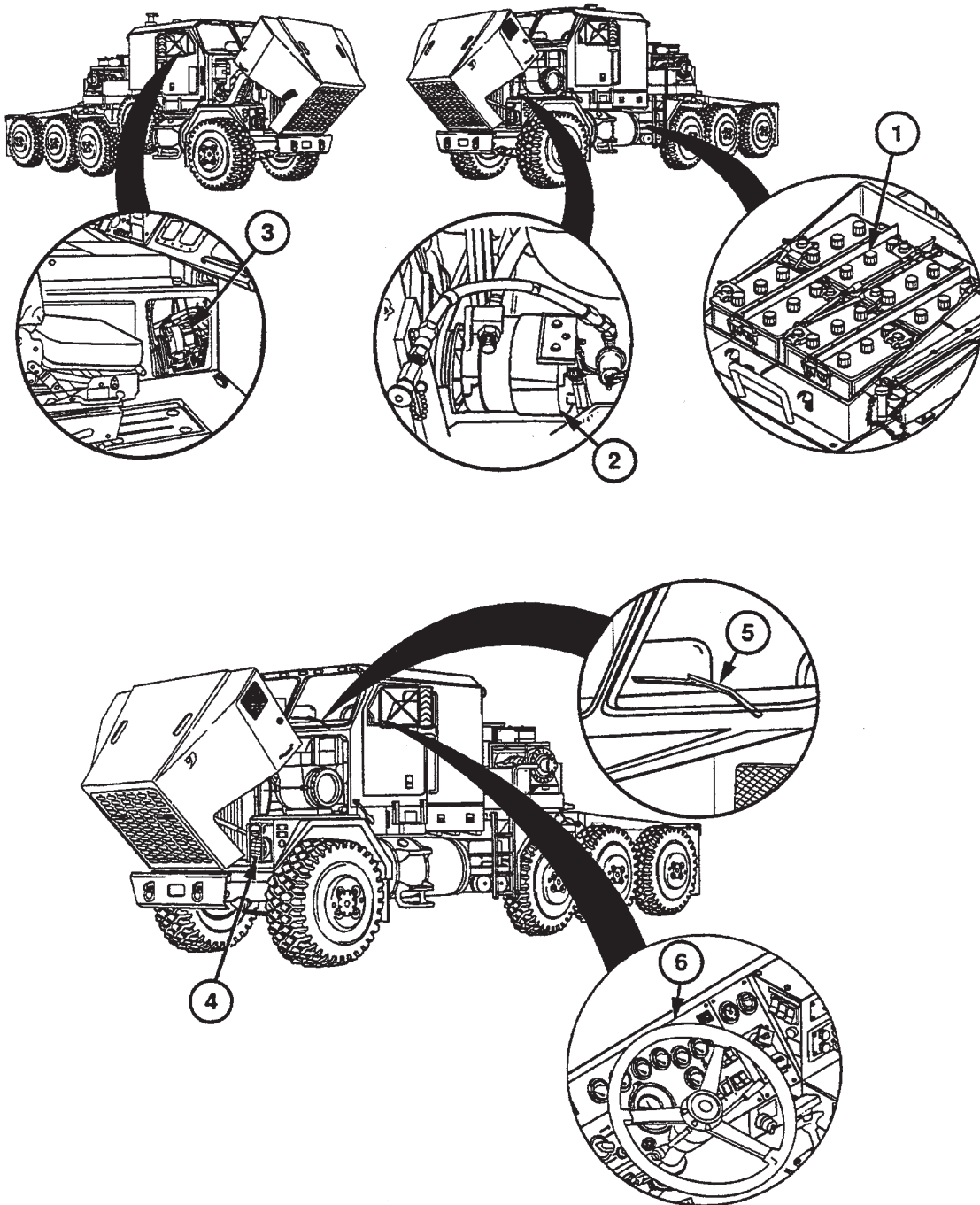
The HET Tractor electrical system consists of two different circuits, 12 Vdc and 24 Vdc. Four 12-volt storage batteries (1) connected in series parallel provide current to both circuits.



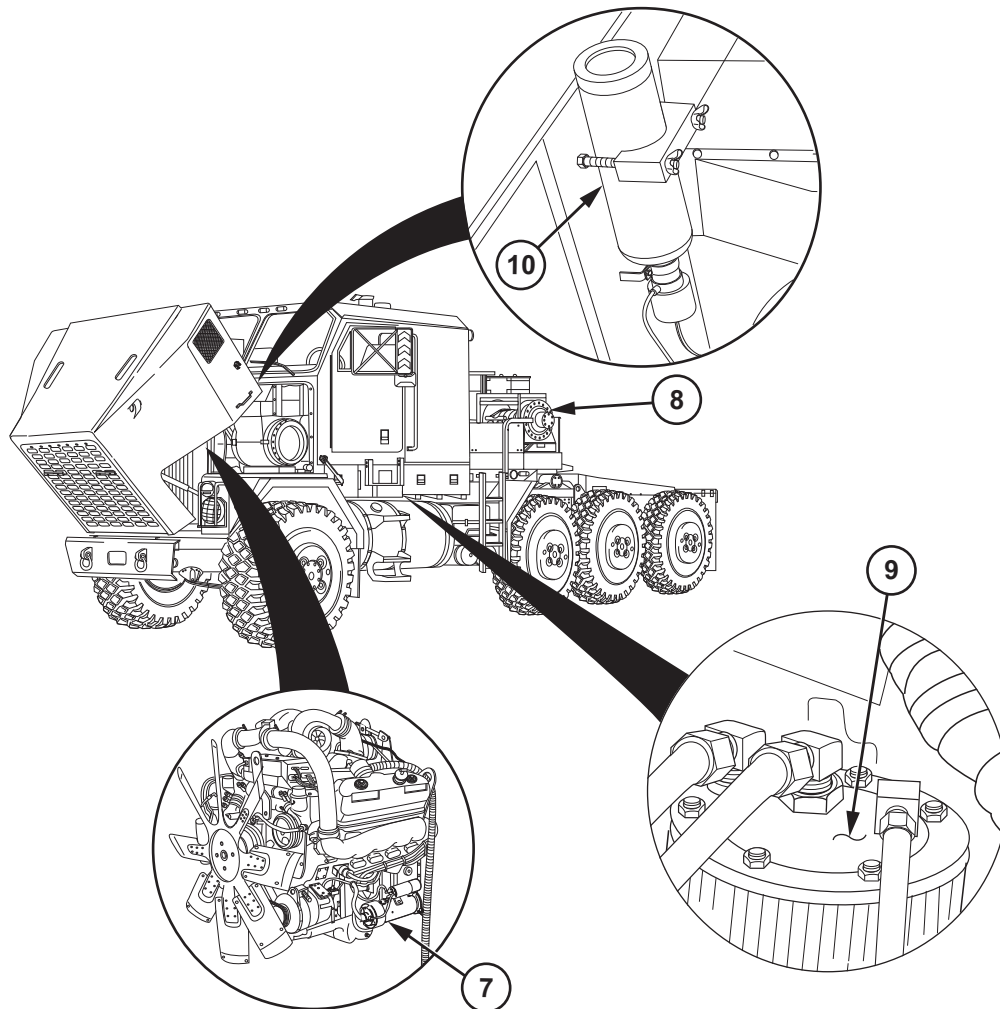
1-15. ELECTRICAL SYSTEM (CONT)

Two belt-driven alternators provide current to the electrical system during normal operation, and recharge the batteries while the engine is operating. The 24 Vdc system utilizes an alternator (2) with 130 amp capacity. The 12 Vdc system utilizes an alternator (3) with 145 amp capacity.

The headlights (4), trailer lights, windshield wipers (5) and washer motors, instrument panel/dash lighting and switches (6), and warning lights and gages inside the cab are operated with the 12 Vdc system.



The starter motor (7), winches (8), Central Tire Inflation System (CTIS), air dryers (9), trailer lights, and ether injection system (10) are operated with the 24 Vdc system.



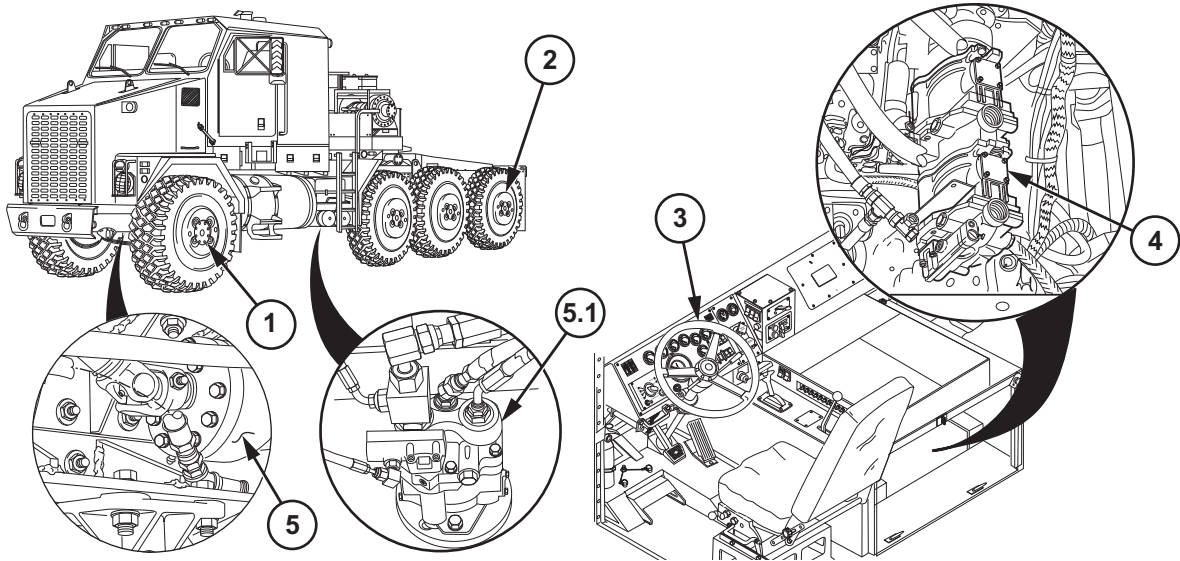
The starter motor solenoid receives 24 Vdc from the storage batteries through the engine starter magnetic switch auxiliary contacts and the neutral start relay. If the transmission range selector is not in the N (neutral) position prior to startup, the engine cannot be started.

Warning lights and gages that indicate system malfunctions include: CHECK GAUGES alarm, CHECK ENGINE indicator, and CHECK GAUGES indicator.

1-16. STEERING SYSTEM

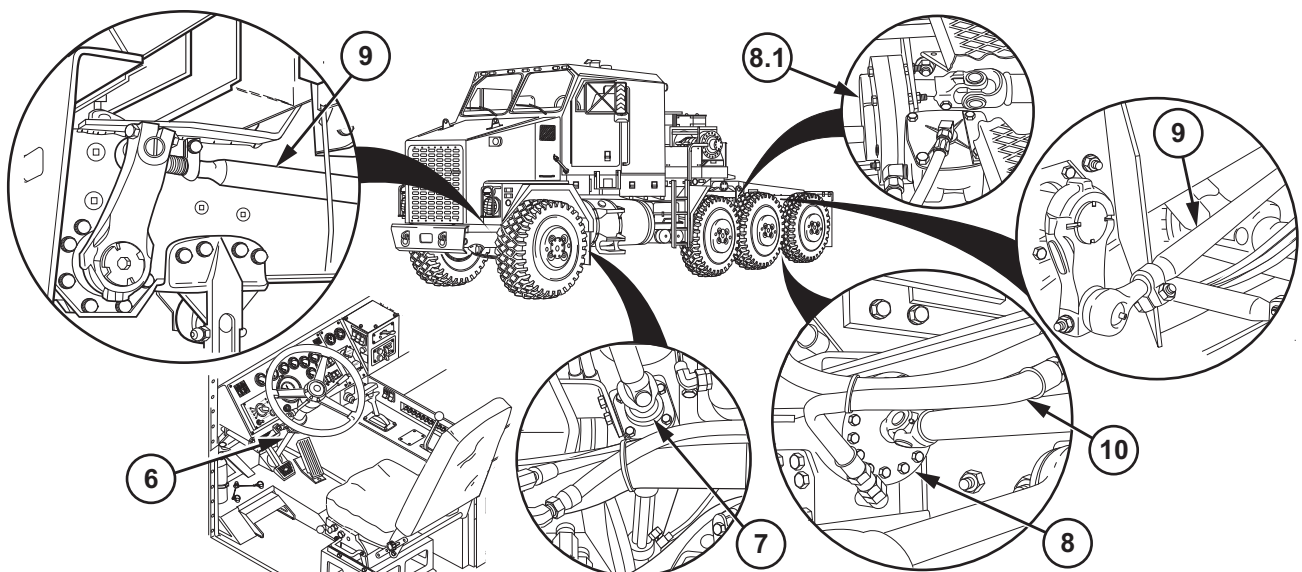
The steering system uses two steering axles, one at the front (No. 1) (1) and one at the rear (No. 4) (2). Each axle turns in response to turning the steering wheel (3) in the cab.

Steering power is generated by a steering pump (4) driven directly at the engine providing pressure to two steering gears (5), one at each steering axle. The steering pump delivers fluid to enable the operator to turn the wheels of a fully-loaded truck. An interconnected series of shaft linkages rotate with hydraulic power assist to turn the two axles. In the event of main steering system failure, an auxiliary steering pump (5.1) connected to the transfer case provides power steering.



As the steering wheel is turned, the rotational motion of the upper steering assembly shafts (6) is translated at a tee gear box (7) below the cab to both the front and rear power steering gears (8). A steering reduction gear (8.1) reduces the steering angle on axle no. 4. The steering gears multiply the rotational force to a pair of drag links (9) and four axle steering arms that apply directional motion to turn the axles.

In the event a steering line (10) to no. 4 steering axle is severed or fluid leaks from the system (Power steering is inoperable.), the truck can be steered for short distances in emergency situations.



1-17. AIR SYSTEM

The air system operates the service and parking brakes, rear suspension system, and the CTIS. The air system also enables operation of the transfer case and interaxle lockups, winch tensioners and kickouts, windshield washer, and horns.

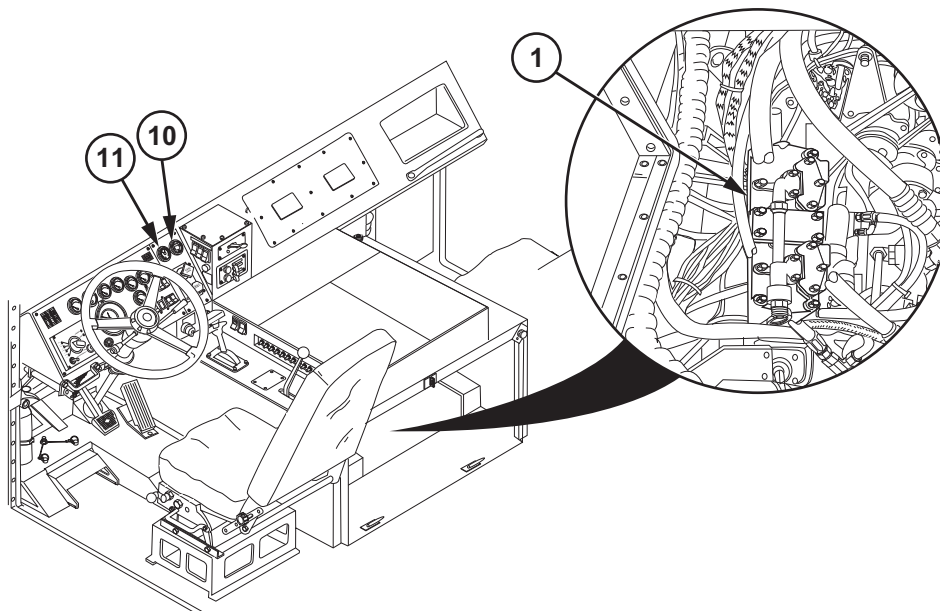
The air system on the HET Tractor consists of an engine-driven air compressor (1), a purge tank (2), and five air reservoirs (3 thru 7). Reservoir (3) supplies air to reservoirs (4 thru 7). Three reservoirs (5 thru 7) are interconnected and separated from reservoir (4) with check valves. Air from reservoir (4) is supplied to service brakes on all four axles and parking brakes on the rear tridem axles, transfer case and interaxle lockups, winch tensioners and kickouts, windshield washer, and horns. The service brakes are actuated by relay valves which are controlled by the operator pressing the brake treadle in the cab. The parking brakes are also actuated by relay valves which are controlled by hand controls. In the event of the loss of system air pressure, the spring brake valve will modulate the parking brakes so the HET Tractor can be stopped safely. Reservoirs (5 thru 7) supply air to operate the CTIS, service and parking brakes on rear tridem axles, and rear suspension system. Air is drawn from the engine air intake and routed to the air compressor (1) where it is pressurized. Air dryers (8 and 9) remove moisture from the pressurized air. Air from the dryers goes to the purge reservoir (2) and air reservoir (3).

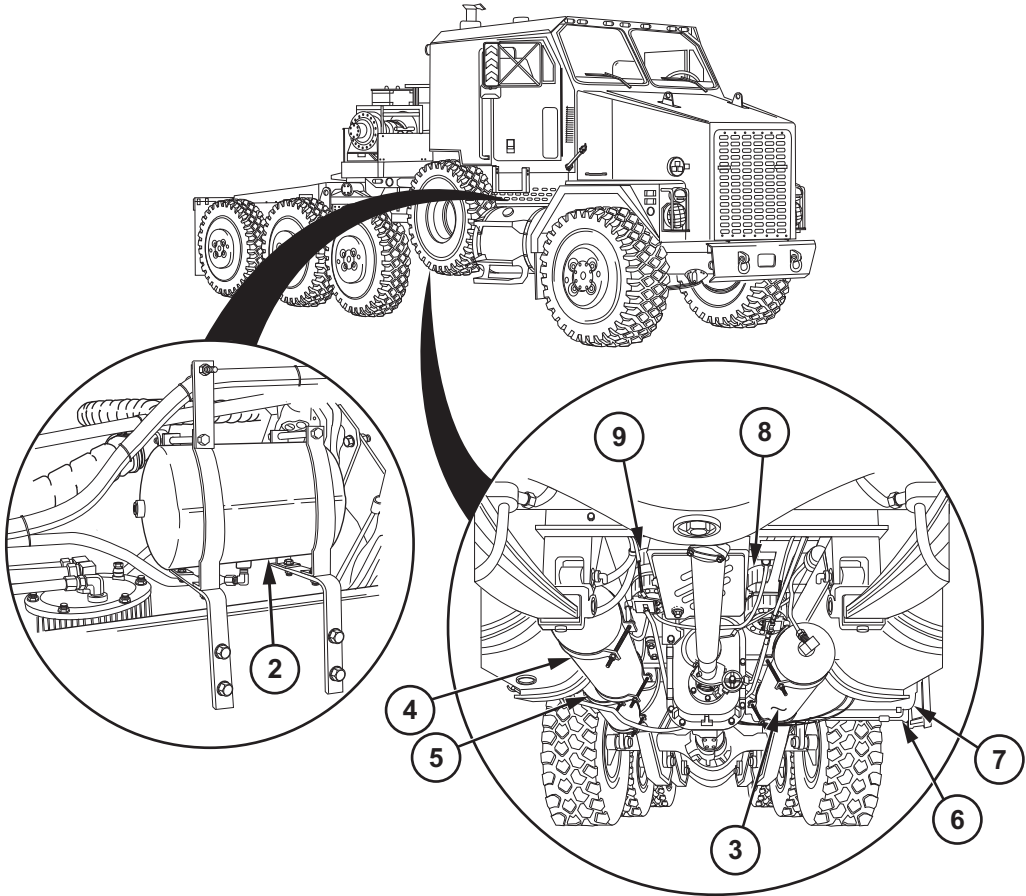
System protection elements include an air cleaner restriction indicator (10) that determines whether air flow through the air cleaner is impeded. In the cab, air pressure in reservoir (4) is indicated by the green needle on the AIR PRESSURE gage (11). The red needle on the gage (11) indicates air pressure in reservoirs (5 thru 7). If air pressure falls below 60 psi (414 kPa) in any of the reservoirs, warning alarm will sound and LOW AIR indicator will light.

The rear suspension system contains a pair of suspension air springs on each rear axle that automatically inflates or deflates according to load. Air to the air springs is regulated by a height control valve.

Purging the air in the air dryers is automatically done when 125 psi (862 kPa) system pressure is reached at the compressor. The compressor cycle is stopped and air from purge tank clears accumulated water through a valve on the bottom of the air dryer.

Air to the transfer case enables engagement of four-wheel drive in high or low gear range. An interaxle lockup pilot valve also prevents the axles from locking up in high ranges.



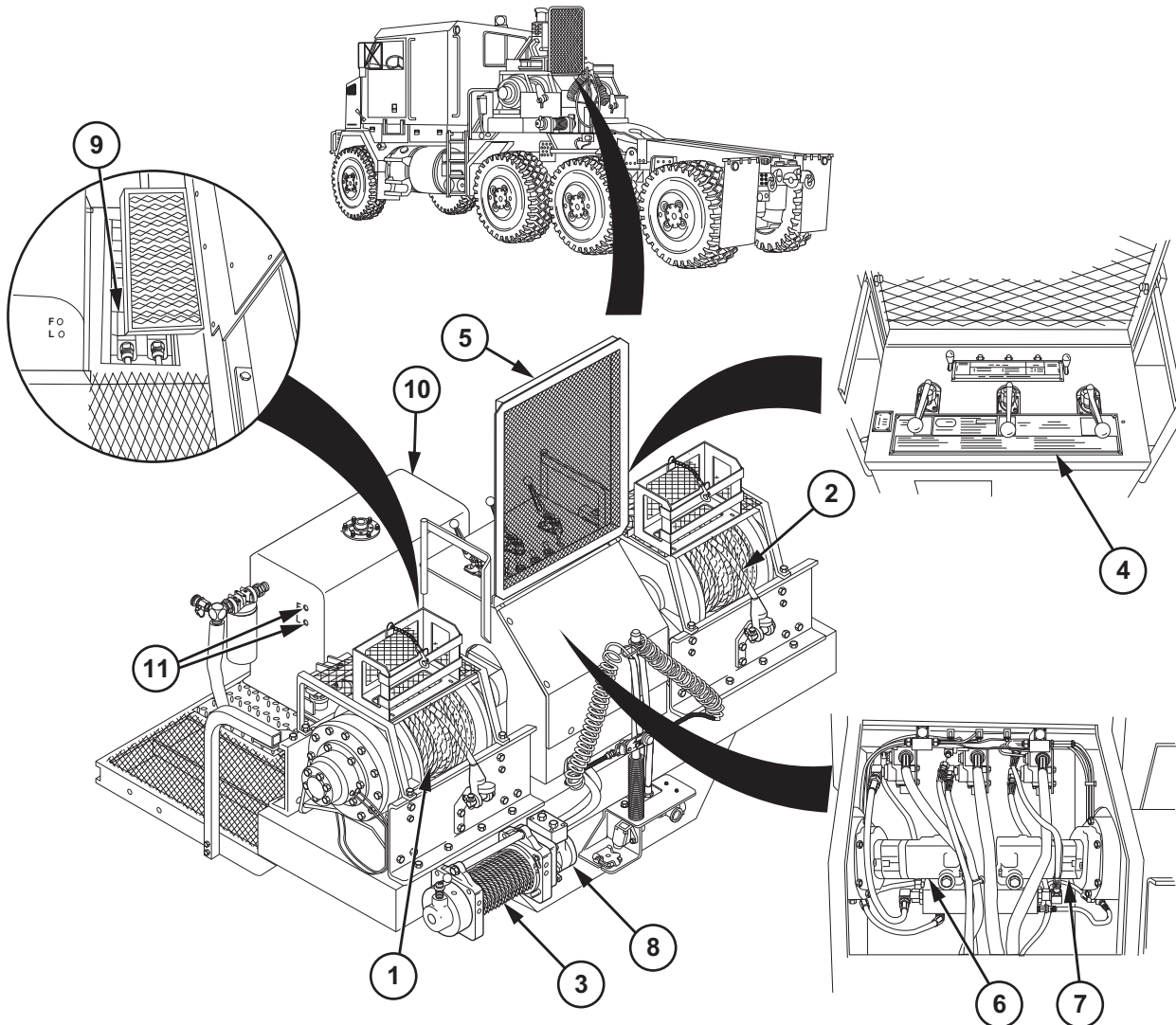


1-18. WINCH SYSTEM

The winch system operates hydraulically and consists of two main winches (1 and 2) and an auxiliary winch (3). The main winches operate independently of each other and are used to recover, load, and unload heavy tracked and wheeled vehicles. The main winches are mounted side-by-side directly to the winch platform. The auxiliary winch is used to pull the main winch cable out to the payload. The auxiliary winch is mounted to the winch platform just below the driver's side main winch.

The winches are controlled from the operator's station (4). The operator is protected by a personnel guard (5) during winch operations. The main winch controls are the winch kickout control, cable hold down lever, engine idle selector switch, engine high idle lock switch, winch speed control switch, and the winch drum control.

Each main winch incorporates a two-speed hydraulic motor (6 and 7). The hydraulic motor is used to provide power. It converts hydraulic horsepower from the pump and control circuitry to rotary mechanical horsepower for driving the gear system. A single-speed motor (8) is used by the auxiliary winch. A Power Take-Off (PTO) driven hydraulic pump (9) supplies the winch system with hydraulic oil from the reservoir (10). A two-piece driveshaft connects the transmission driven PTO to the hydraulic pump (9). A view gage (11) on the reservoir indicates the hydraulic oil level. All winches have a fail-safe brake and winch brake valve for winch load control.



1-19. CENTRAL TIRE INFLATION SYSTEM (CTIS)

The Central Tire Inflation System (CTIS) allows the HET operator to adjust the vehicle tire pressure to one of four predetermined settings. Each tire pressure setting has a vehicle speed limitation. If the average vehicle speed exceeds this limit, the CTIS will activate an overspeed light.

The CTIS consists of five major components. An electronic controller (1), mounted on the dash, contains the switches and indicator lights for system operation. The controller's Read Only Memory (ROM) contains the working instructions for the power manifold (2).

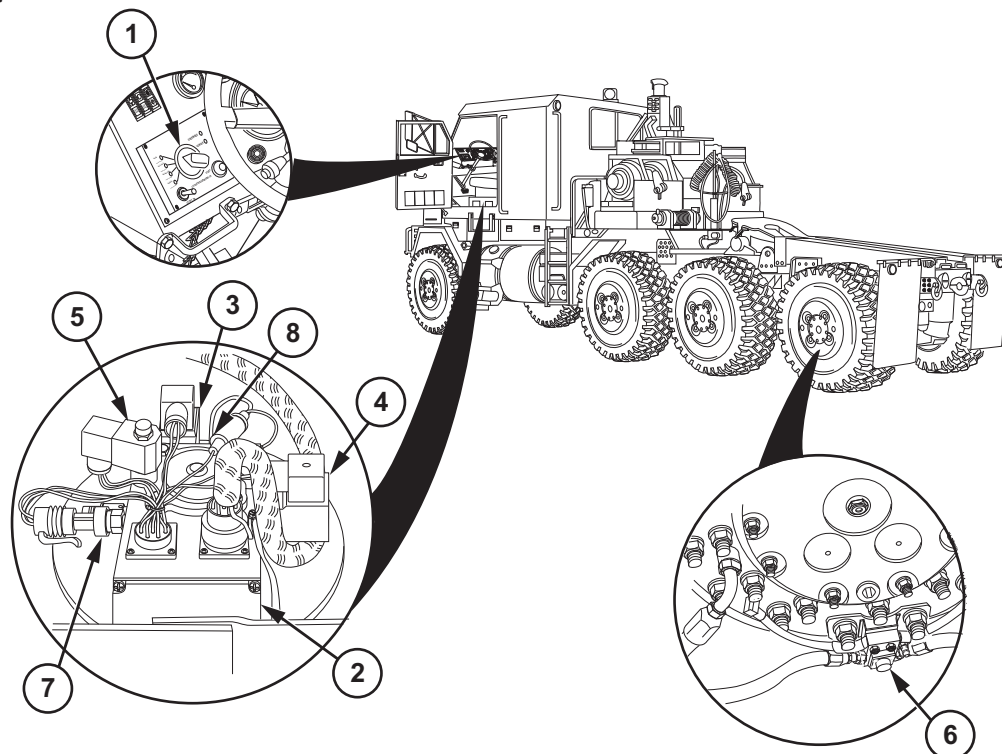
The power manifold (2), located under the driver's seat, contains an inflation valve (3) for increasing tire pressures and a deflation valve (4) to reduce tire pressures. The power manifold's quick-release valve (5) is closed during checking, inflating, and deflating modes. The quick-release valve opens at the end of a cycle to rapidly exhaust all air pressure from the CTIS, which in turn closes all wheel valves (6).

The power manifold (2) has two other components in addition to the valves. They are a pressure transducer (7) that monitors system pressure for the CTI controller and a low air pressure switch (8) used to shut the CTIS off when chassis air pressure is less than 85 psi. 110 psi is required to restart the system.

Directly under the power manifold (2) is the porting block, to which the air lines to the axles are connected. Air pressure passes through these lines and the axle assemblies to the wheel valves (6). Air pressure is present in the CTIS lines only when the system is monitoring (or adjusting) tire pressures. At all other times, the system has no air pressure.

The CTIS has an automatic routine that checks for moderate to large air leaks or air loss. During the initial start of the CTIS, the quick-release valve (5) is closed and the inflation valve (3) opens to attempt to build system pressure. If the transducer fails to sense that the system is capable of maintaining pressure, the CTIS will shut itself off and display a flashing low air light.

When the CTIS has completed a pressure adjustment cycle, the controller (1) starts an internal timer. If no changes occur during the next 15 minutes, a check cycle is automatically activated, during which tire pressures are measured and adjusted if necessary. This provides for improved tire life as hot tire pressures are adjusted and slowly leaking tires are kept inflated.



CHAPTER 2 VEHICLE MAINTENANCE

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

2-1. COMMON TOOLS AND EQUIPMENT

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

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

For a listing of special tools, TMDE, and support equipment, refer to the Maintenance Allocation Chart (MAC), Appendix B, of this manual and to the repair parts and special tools list (RPSTL), TM 9-2320-360-20P.

2-3. REPAIR PARTS

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 9-2320-360-20P, covering Unit maintenance for this equipment.

Section II. SERVICE UPON RECEIPT

2-4. CHECKING UNPACKED EQUIPMENT

- a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packaging Improvement Report.
- b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 750-8.
- c. Check to see whether the equipment has been modified.

2-5. DEPROCESSING UNPACKED EQUIPMENT

Read "Processing and Deprocessing Record of Shipping, Storage, and Issue of Vehicles and Spare Engines," tag (DD Form 1397) and follow all precautions checked. This tag should be attached to the steering wheel, shifting lever, or ENGINE switch.

2-6. HAND RECEIPT MANUAL AND INVENTORY OF EQUIPMENT

When a new HET Tractor is received by the using organization, it is necessary to inventory the equipment. For detailed procedures, refer to Hand Receipt Manual, TM 9-2320-360-10-HR.

2-7. SERVICE BEFORE OPERATION

- a. General
 - (1) Upon receipt of new, used, or reconditioned HET Tractor, the receiving organization must see if it has been properly prepared for service and is in good condition. Inspect all assemblies, subassemblies, and accessories to ensure they are in proper working order. Secure, clean, correctly adjust, and lubricate as needed (TM 9-2320-360-10 and LO 9-2320-360-12).
 - (2) Follow general procedures for all services and inspections given in TM 9-2320-360-10.
 - (3) Refer to TM 9-2320-360-10, for HET Tractor operating instructions.
- b. Inspection and Servicing Equipment
 - (1) General Procedures

NOTE

If HET Tractor has been driven to the using organization, most of the following procedures should have been performed.

- (a) When HET Tractor is received, inspect all items for damage that may have occurred during shipping and unloading operations. Pay close attention to any loose or missing nuts, bolts, screws, access plates, drain plugs, drain cocks, oil plugs, assemblies, subassemblies, or components that may be easily lost or broken in transit. Check Basic Issue Items (BI) against checklist to ensure all items are accounted for and in good condition. Carefully list all discrepancies (TM 9-2320-360-10-HR).

WARNING

Solvent cleaning compound MIL-PRF-680 Type II and III may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Use respirator as needed. Accidental ingestion can cause irritation of digestive tract and respiratory tract, may cause lung and central nervous system damage. Can be fatal if swallowed. Inhalation of high/massive concentrations can cause coma or be fatal. First aid for ingestion: do not induce vomiting. Seek immediate medical attention. First aid for skin contact: remove contaminated clothing. Wash skin thoroughly with soap and water. If symptoms persist, seek medical attention. First aid for eye contact: flush with water for 15 minutes or until irritation subsides. If symptoms persist, seek medical attention. First aid for inhalation: move to fresh air. If not breathing, provide artificial respiration. If symptoms persist, seek medical attention. Keep away from open flames and other sources of ignition. Failure to follow this warning may result in injury or death to personnel.

- The flashpoint for type II solvent cleaning compound is 141 -198°F (61 -92C) and type III is 200 -241°F (93 -116C).
- Improper cleaning methods and use of unauthorized cleaning solvents may injure personnel and damage equipment.
- Fire extinguishers should be placed nearby when using solvent cleaning compound. Failure to follow this warning may result in injury or death.
- Cloths or rags saturated with solvent cleaning compound must be disposed of IAW authorized facilities' procedures. Failure to follow this warning may result in injury.
- Eye shields must be worn when cleaning with a wire brush. Flying rust and metal particles may cause injury.

(b) Clean all exterior surfaces coated with rust-preventive compound with solvent cleaning compound.

(2) Special Procedures

(a) Activate battery if HET Tractor is delivered with dry-charged battery (TM 9-614 0-200 -14) .

(a1) Connect batteries (para 7--61) .

(b) Do the semiannual Preventive Maintenance Checks and Services (PMCS) (para 2--8).

(c) Lubricate specific points shown in LO 9-2320-360-12 regardless of interval. Do not lubricate gear cases or engine. Check processing tag for gear case and engine oil. If tag states the oil is good for 500 mi (805 km) of operation and is of the proper grade for local climatic operation, do not change oil.

(d) Schedule a semi annual service in accordance with DA Pam 750-8.

(e) HET Tractor Body and Sheet Metal

- Inspect body and sheet metal for evidence of damage during shipment.
- Check doors, latches, and hinges on compartments for proper operation.
- Check mounting hardware and tighten as necessary.

(f) HET Tractor Cab

- Inspect cab for evidence of damage during shipment.
- Inspect windshields and window glass for cracks or other damage.
- Check door latches, hinges, and windows for proper operation.
- Check seats and seat belts to see that they are securely installed, and that the operator's seat adjustments are functioning properly.

(g) Engine

- Remove any seals, plugs, or tape used to seal air inlets and ports on the engine during shipping.
- Check crankcase oil level with dipstick.
- Examine air cleaner element for dirty or restricted condition.
- Inspect engine and cooling hose connections for evidence of leakage.
- Clean away any obstruction to cooling air flow to radiator.

2-7. SERVICE BEFORE OPERATION (CONT)

WARNING

Radiator is very hot and pressurized during HET Tractor operation. Let radiator cool before removing cap. Be sure to wear the proper eye protection to avoid personal injury. Failure to comply may result in serious burns.

- Check radiator coolant. Check if solution is adequate for expected climatic conditions. Refer to TB 750-651 for preparation of antifreeze solutions. Put tag near filler cap with type of antifreeze and degree of protection written on tag.
 - Check engine starter wiring for loose connections and condition of wiring insulation.
- (h) Transmission
- Check fluid level with dipstick.
 - Check external lines for evidence of leakage.
- (i) Transfer Case
- Check level of lubricant at fill plug.
 - Inspect lubrication pump and external lines for evidence of leakage.
 - Check operation of two-speed shift mechanism.
 - Operate DRIVELINE control, observe drive power to front axle.
 - Inspect bolts on all driveline U-joints.
- (j) Electrical System
- Inspect battery cable connections, and clean and tighten as necessary.
 - Check all lights for burned out lamps, loose connections, and dirty or broken lenses.
 - Ensure that alternators are charging properly.
 - Ensure all electrical equipment functions.
 - Replace teflon tachograph chart with paper charts (para 7-15).
- (k) Air System
- Drain any water from reservoirs.
 - Inspect all accessible air hose and tubing connections for leakage.
- (l) Steering System
- Check steering hydraulic reservoir for proper fluid level.
 - Examine steering linkage and steering gears for damage incurred during shipment.
 - Examine steering hoses and connections for evidence of leakage.
 - Check steering system for proper operation during road test.
- (m) Chassis and Running-Gear
- Check all lubricant levels.
 - Check axle housing pressure vents to ensure freedom from foreign matter.

(n) Tires

- Check tire inflation.
- Inspect tires for serious cuts, bubbles, cracks, bruises, dry-rot, foreign objects, or exposure of internal cords. Remove foreign objects lodged in between tread.
- Check all wheel mounting nuts for proper torque.
- Check front and rear suspension for broken spring leaves, damaged components, or damaged air springs.
- Check winch hydraulic reservoir sight glass for proper fluid level.

(o) Fuel Systems

- Check fuel level and replenish, if necessary.
- Inspect fuel lines, connections, and filters for evidence of leakage.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-8. PMCS INTRODUCTION

Table 2-1, PMCS has been provided so you can keep your equipment in good operating condition and ready for its primary mission. The PMCS in TM 9-2320-360-10, must be performed before doing unit PMCS. Lubricate in accordance with LO 9-2320-360-12, while performing checks and services. Operator PMCS will include a 10 mile minimum road test.

2-9. EXPLANATION OF COLUMNS

- a. Item Number Column. Numbers in this column shall be used as a source of item numbers for the TM Number Column on DA Form 2404 (Equipment Inspection and Maintenance Worksheet), in recording results of PMCS.
- b. Interval Column. The interval column tells you when to do a certain check or service. Semiannual PMCS must be performed every 6 months, and annual PMCS must be performed every 12 months.
- c. Item to be Inspected Column. This column tells you the item to be checked/serviced.
- d. Procedure Column. The procedure column of your PMCS table tells you how to do the required checks and services.
- e. Not Fully Mission Capable If: Column. This column tells you what faults will keep your HET Tractor from being capable of performing its primary mission. If you perform check and service procedures that show faults listed in this column, do not operate the HET Tractor. Follow standard operating procedures for maintaining the HET Tractor or reporting equipment failure.

2-10. GENERAL MAINTENANCE PROCEDURES

WARNING

Solvent cleaning compound MIL-PRF-680 Type II and III may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Use respirator as needed. Accidental ingestion can cause irritation of digestive tract and respiratory tract, may cause lung and central nervous system damage. Can be fatal if swallowed. Inhalation of high/massive concentrations can cause coma or be fatal. First aid for ingestion: do not induce vomiting. Seek immediate medical attention. First aid for skin contact: remove contaminated clothing. Wash skin thoroughly with soap and water. If symptoms persist, seek medical attention. First aid for eye contact: flush with water for 15 minutes or until irritation subsides. If symptoms persist, seek medical attention. First aid for inhalation: move to fresh air. If not breathing, provide artificial respiration. If symptoms persist, seek medical attention. Keep away from open flames and other sources of ignition. Failure to follow this warning may result in injury or death to personnel.

- The flashpoint for type II solvent cleaning compound is 141-198°F (61-92C) and type III is 200-241°F (93-116C).
 - Improper cleaning methods and use of unauthorized cleaning solvents may injure personnel and damage equipment.
 - Fire extinguishers should be placed nearby when using solvent cleaning compound. Failure to follow this warning may result in injury or death.
 - Cloths or rags saturated with solvent cleaning compound must be disposed of IAW authorized facilities' procedures. Failure to follow this warning may result in injury.
 - Eye shields must be worn when cleaning with a wire brush. Flying rust and metal particles may cause injury.
- a. Cleanliness. Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Use solvent cleaning compound (Item 31, Appendix C) on all metal surfaces and soapy water on rubber.

2-10. GENERAL MAINTENANCE PROCEDURES (CONT)

- b. Bolts, Nuts, and Screws. Check bolts, nuts, and screws for obvious looseness, and missing, bent, or broken conditions. Look for chipped paint, bare metal, or rust around bolt heads. If any part seems loose, tighten it. If any part is broken or missing, replace it.
- c. Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If a bad weld is found, notify your supervisor.
- d. Electric Wires and Connectors. Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and ensure wires are in good shape. If a bad wire or connector is found, notify your supervisor.
- e. Hydraulic Lines and Fittings. Look for wear, damage, and leaks; ensure clamps and fittings are tight. Wet spots show leaks. Stain around a fitting or connector can mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, repair or replace it.
- f. Damage. Damage is defined as any condition that affects safety or would make the HET Tractor unserviceable for mission requirements.

2-11. FLUID LEAKAGE

- a. Leakage Definitions. Fluid leakage is classified and defined as follows:
 - Class I - Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
 - Class II - Leakage of fluid great enough to form drops but not enough to cause drops to fall from item being checked/inspected.
 - Class III - Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

- Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.
- When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.
- Class III leaks should be reported to your supervisor and repaired.

2-12. PMCS TABLE

Refer to table 2-1 for unit PMCS procedures for the HET Tractor. Perform your PMCS (semiannual and annual) starting with the left front and continuing counterclockwise around the HET Tractor.

Table 2-1. Preventive Maintenance Checks and Services

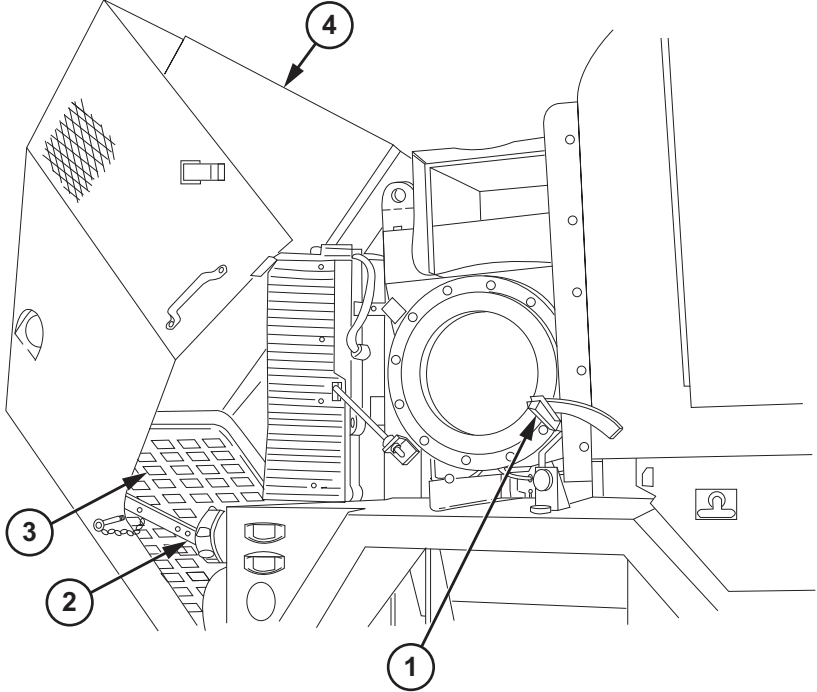
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
1	Semi-annually	EXTERIOR	<p style="text-align: center;">NOTE</p> <p>Road test should be performed first.</p> <ol style="list-style-type: none"> a. Open hood (TM 9-2320-360-10). b. Check that fasteners (1), hinges (2), grille (3), and hood (4) are in place and serviceable. If faults are found, refer to hood repair (para 16-7). c. Check door hinge for damage and loose or missing mounting hardware. If fault is found, refer to door hinge replacement (para 16-5). 	<ol style="list-style-type: none"> b. Hinges or fasteners are broken.
				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
<p>1 (cont)</p>	<p>Semi-annually</p>	<p>EXTERIOR (CONT)</p>	<p>d. Check left rear fender (1) for cracks and loose or missing mounting hardware. If faults are found, refer to left rear fender replacement (para 16-30).</p> <p>e. Check right rear fender (2) for cracks and loose or missing mounting hardware. If faults are found, refer to right rear fender replacement (para 16-31).</p> <p>f. Lubricate doors, side panels, hood hinges, locks, latches, and pivot points.</p>	

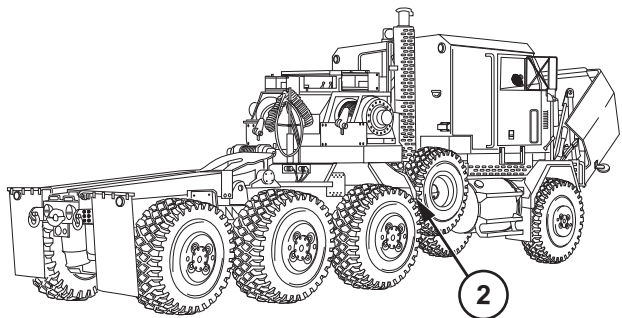
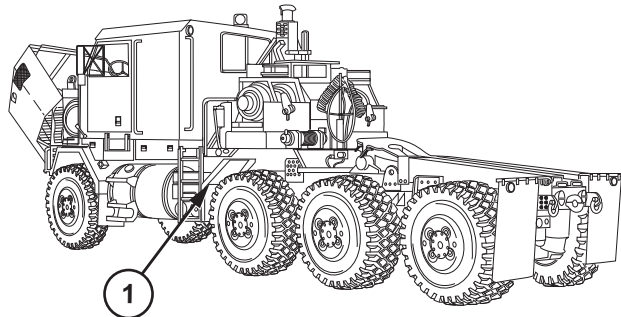


Table 2-1. Preventive Maintenance Checks and Services (Cont)

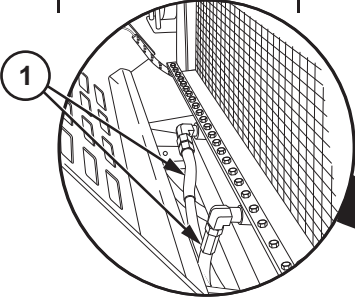
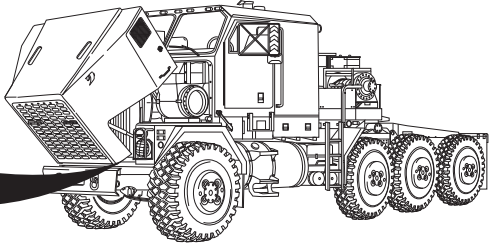
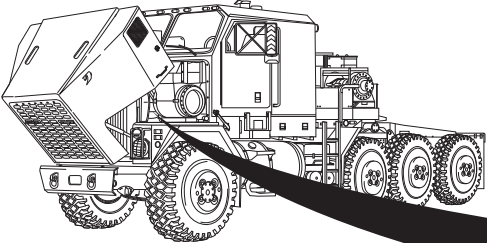
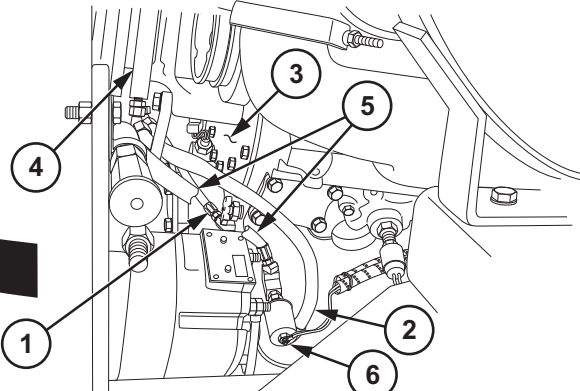
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
2	Semi-annually	TRANSMISSION COOLING HOSES	Check transmission oil cooling hoses no. 2382 and no. 2393 (1) for cracks or leaks. If cooling hose is cracked or leaking, replace faulty part. Refer to transmission hose replacement (para 8-7).	Any class III leak is found. Hoses are cracked or frayed.
			 <p style="text-align: center;">WARNING</p> <p>Ensure engine is cool before performing maintenance. Be sure to wear the proper eye protection to avoid personal injury. Failure to comply may result in severe burns.</p>	
3	Semi-annually	ENGINE	<p>a. Check oil supply hose no. 2758 (1) and oil return hose no. 2761 (2) from engine (3) to fan clutch (4) for cracking or chafing. If faults are found, replace hose. Refer to fan clutch to engine block hose replacement (para 6-12).</p> <p>b. Check supply hose no. 2682 (5) from engine (3) to AOAP sampling valve (6) for cracks, leaks, or chafing. If faults are found, refer to AOAP sampling valve replacement (para 3-7).</p>	<p>a. Hose leaks or cracks or frays are found.</p> <p>b. Hose leaks or cracks or frays are found.</p>
				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

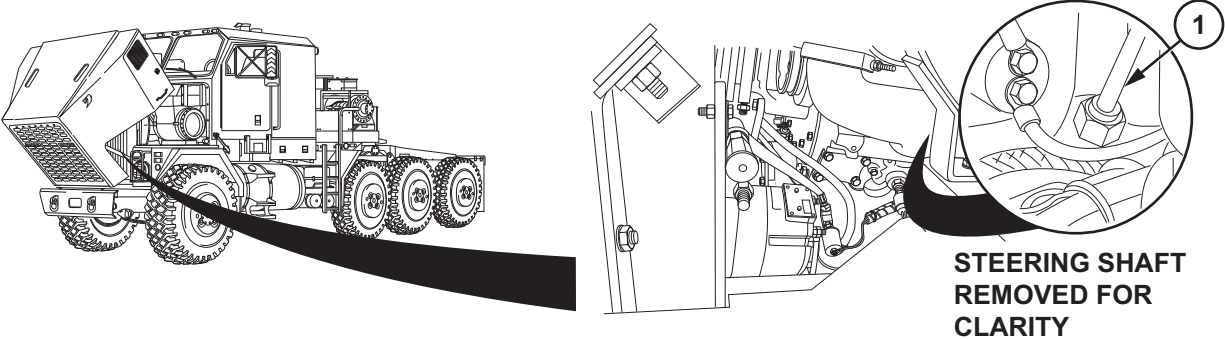
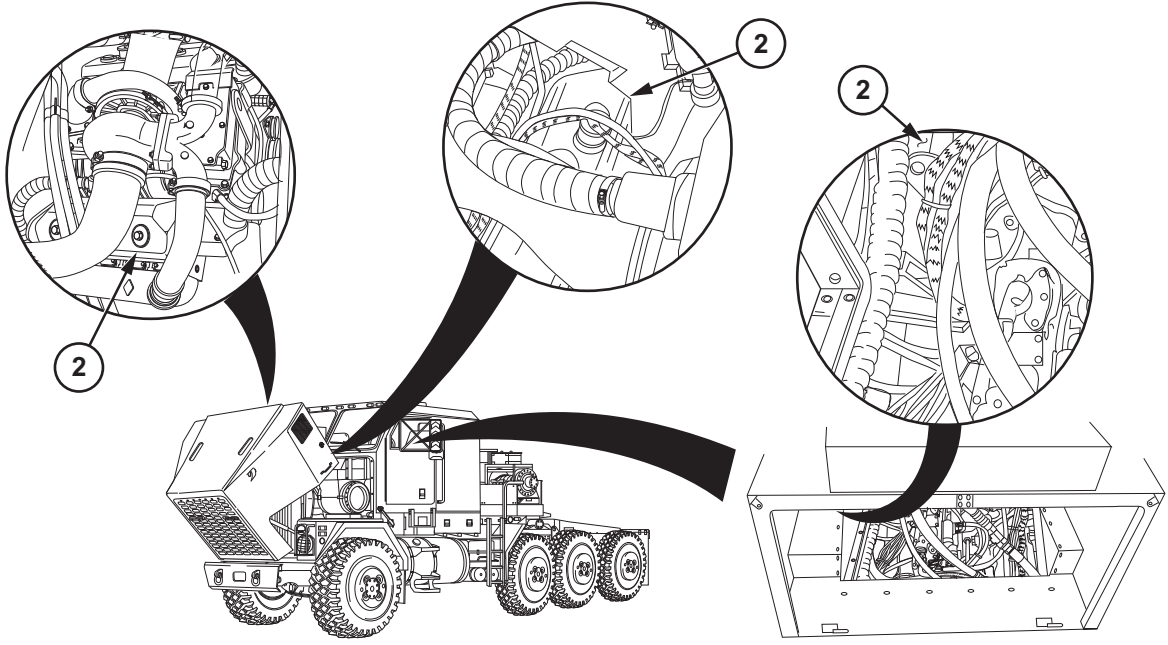
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
3 (cont)	Semi-annually	ENGINE (CONT)	c. Check dipstick tube (1) for damage. If faults are found, replace dipstick tube (para 3-6).	c. Dipstick is broken or missing.
 <p>STEERING SHAFT REMOVED FOR CLARITY</p>				
<p>d. Check rocker covers (2) for leakage.</p>				
				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

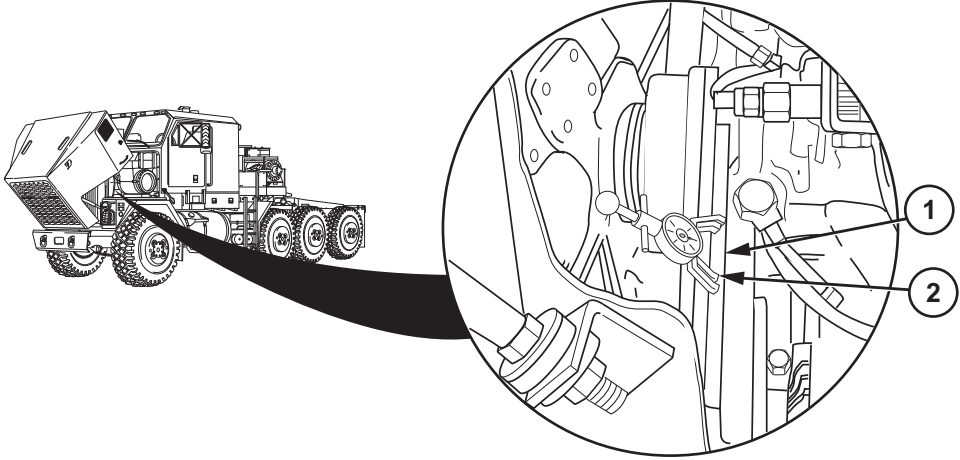
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
3 (cont)	Semi-annually	ENGINE (CONT)	<p style="text-align: center;"><u>WARNING</u></p> <p>Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes. Always wear eye protection when working with batteries.</p> <p>e. Check 24-volt alternator belts (1) for proper tension with belt tension gage (2). Belt tension gage reading should be 70-90 lb (310-400 N). If reading is not correct, adjust belts (para 7-7).</p>	<p>e. Belts are burned, cracked, ripped, frayed, or cut.</p>
				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

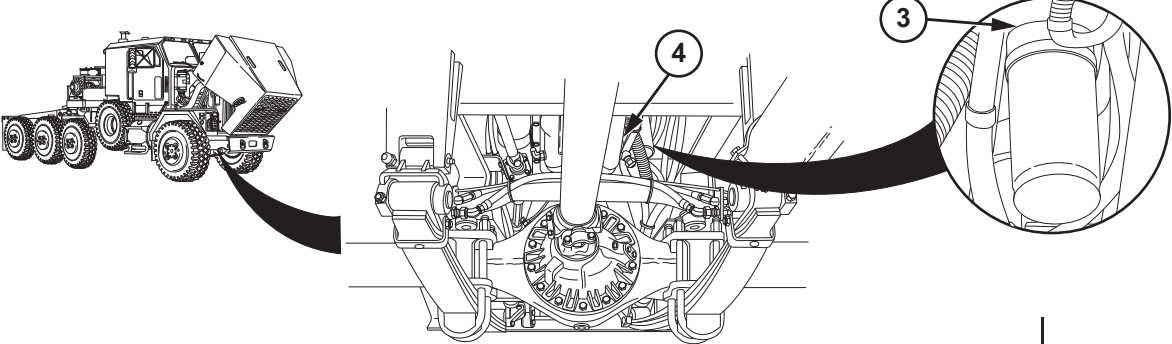
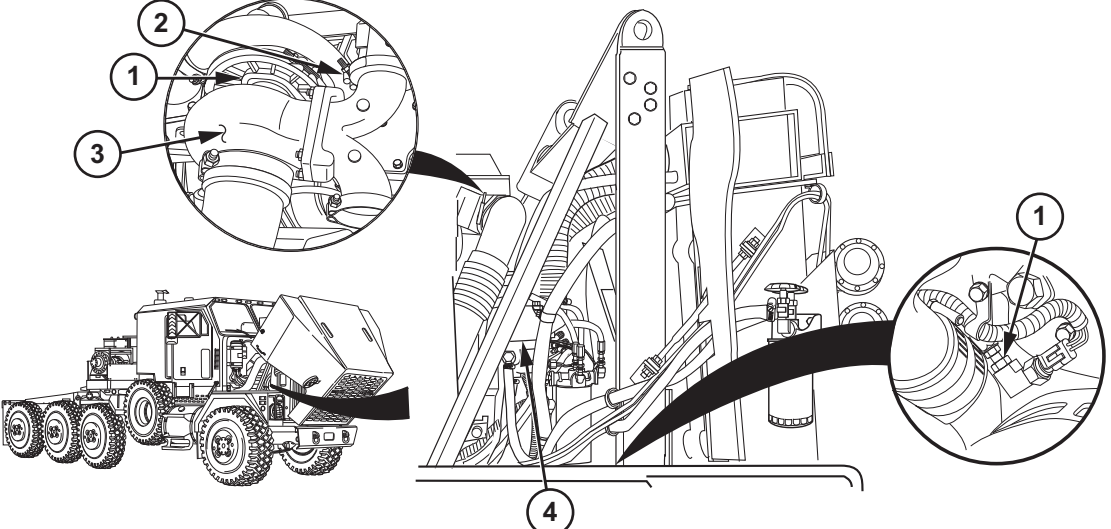
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
3 (cont)	Semi-annually	ENGINE (CONT)	<p>f. Check oil filter adapter (3) for leakage or damage. If fault is found, replace oil filter adapter and/or gasket (para 3-5).</p> <p>g. Check oil pan (4) for leaks or cracks. If faults are found, notify supervisor.</p>	g. Class III leak is found.
				
<p style="text-align: center;">WARNING</p> <p style="text-align: center;">Ensure engine is cool before performing maintenance. Failure to comply may result in severe burns.</p>				
<p>h. Check turbocharger supply hose (1) and clamps (2) from turbocharger (3) to engine (4) for cracks, leaks, or chafing.</p> <p>h. Hose leaks or cracks or frays are found.</p> 				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

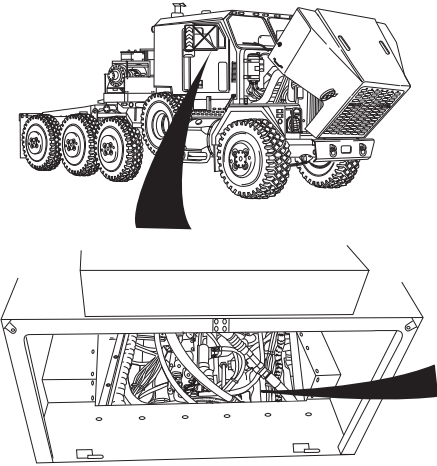
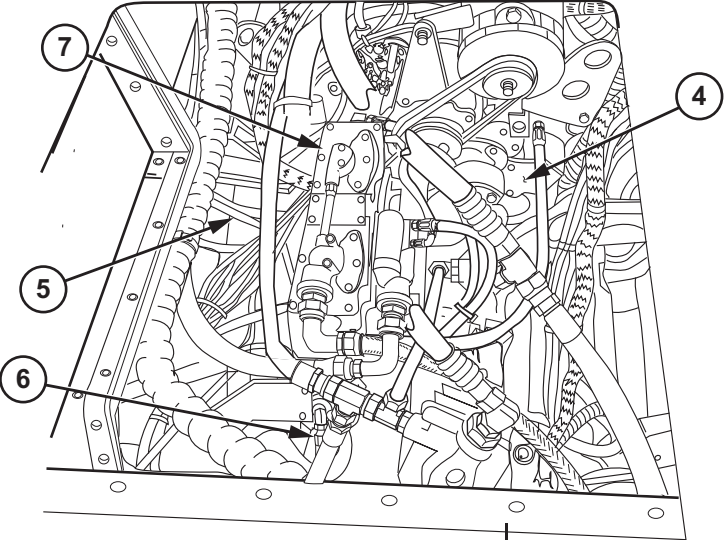
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
<p>3 (cont)</p> 	<p>Semi-annually</p>	<p>ENGINE (CONT)</p>	<p>i. Check oil line no. 2630 (5) and oil line no. 2629 (6) from compressor (7) to engine (4) for cracks, leaks, or chafing. If faults are found, replace oil line (para 11-29).</p>  <p>j. Perform all semiannual lubrications as identified in LO 9-2320-360-12.</p>	<p>i. Oil line leaks or cracks or frays are found.</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

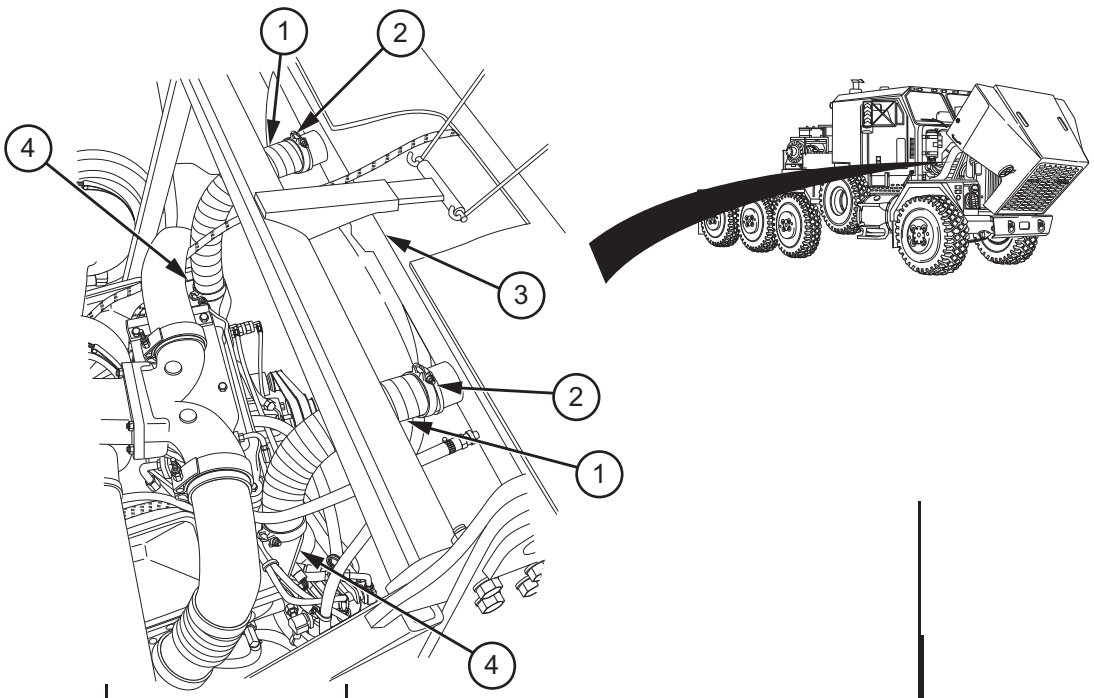
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
4	Semi-annually	COOLING SYSTEM	<p style="text-align: center;"><u>WARNING</u></p> <p>Be sure to wear the proper eye protection to avoid personal injury.</p> <p>a. Check both upper hoses (1) and two clamps (2) from radiator (3) and thermostat covers (4). Tighten clamps to 25–35 lb-in. (2.8–4.0 N·m). If faults are found, replace hose/clamp (para 6-6).</p>	a. Hoses leak or cracks or frays are found.
				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
4 (cont)	Semi-annually	COOLING SYSTEM (CONT)	<p style="text-align: center;"><u>WARNING</u></p> <p>Ensure engine is cool before performing maintenance. Failure to comply may result in severe burns.</p> <p>b. Check hose (1) and two clamps (2) from firewall to pipe (3) for cracks, leaks, or chafing. Tighten loose connections. If faults are found, replace hose/clamp (para 18-14).</p> <p>c. Deleted.</p> <p>d. Deleted.</p>	b. Hose leaks or cracks or frays are found.

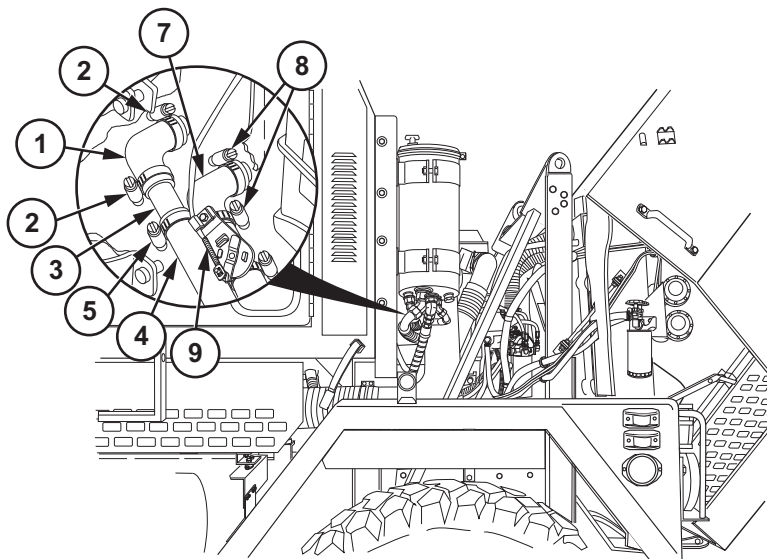


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
<p>4 (cont)</p>	<p>Semi-annually</p>	<p>COOLING SYSTEM (CONT)</p>	<p>e. Check hose (1) and two clamps (2) from control valve to oil cooler (3) for cracks, leaks, or chafing. Tighten loose connections. If fault is found, replace hose/clamp (para 18-14).</p> <p>f. Check hose (4) and two clamps (5) from thermostat (6) to pipe (7) for cracks, leaks, or chafing. Tighten loose connections. If damaged, replace hose/clamp (para 18-14).</p>	<p>e. Hose leaks or cracks or frays are found.</p> <p>f. Hose leaks or cracks or frays are found.</p>

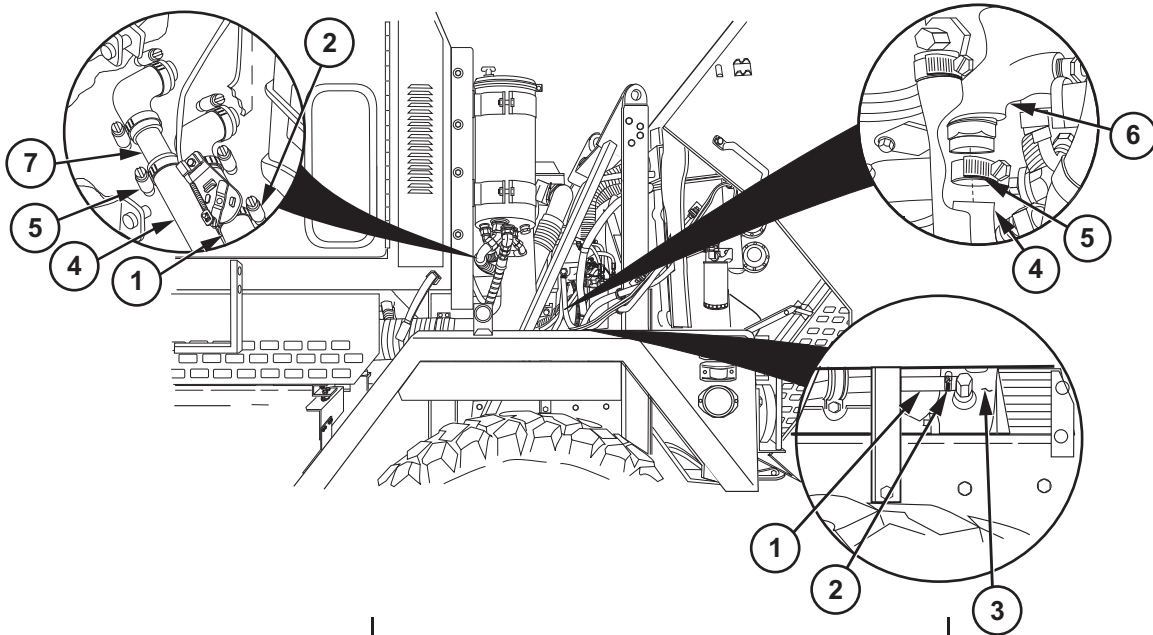


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
4 (cont)	Semi-annually	COOLING SYSTEM (CONT)	<p>g. Check hose (1) and two clamps (2) for cracks, leaks, or chafing. Tighten loose connections. If fault is found, replace hose/clamp (para 6-6).</p> <p>h. Check hose (3) and two clamps (4) on inlet valve (5) of coolant filter mounting head for cracks, leaks, or chafing. Tighten loose connections. If fault is found, replace hose/clamp (para 6-6).</p> <p>i. Check hose (6) and two clamps (7) on outlet valve (8) of coolant filter mounting head for cracks, leaks, or chafing. Tighten loose connections. If fault is found, replace hose/clamp (para 6-6).</p>	<p>g. Hose leaks or cracks or frays are found.</p> <p>h. Hose leaks or cracks or frays are found.</p> <p>i. Hose leaks or cracks or frays are found.</p>

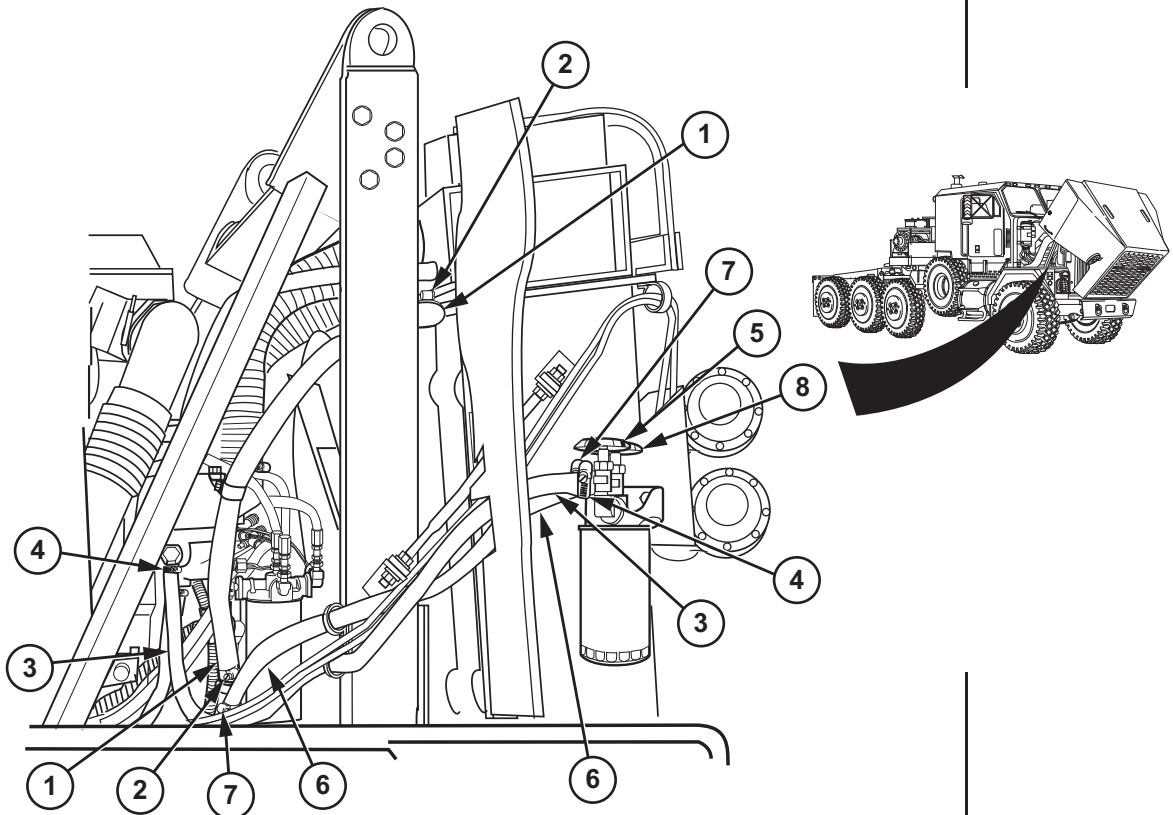


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
4 (cont)	Semi-annually	COOLING SYSTEM (CONT)	<p>j. Check two lower hoses (1 and 2), two clamps (3), coolant tubes (4 and 5), and clamps (6) from water pump (7) and radiator (8) for cracks, leaks, or chafing. Tighten clamps to 25-35 lb-in. (2.8-4.0) N·m. If fault is found, replace hose/clamp (para 6-6).</p>	<p>j. Hoses leak or cracks or frays are found.</p>
			<p>k. Check radiator vent hose (9) and two clamps (10) for cracks, leaks, or chafing. Tighten loosen connections. If fault is found, replace hose/clamp (para 6-6).</p>	<p>k. Hose leaks or cracks or frays are found.</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

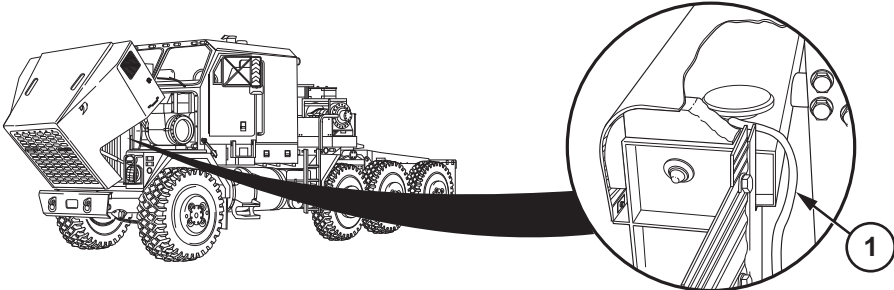
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
4 (cont)	Semi-annually	COOLING SYSTEM (CONT)	<p style="text-align: center;"><u>WARNING</u> Ensure engine is cool before performing maintenance. Failure to comply may result in severe burns.</p> <p>i. Check overflow hose (1) for cracks or leaks. If fault is found, replace hose (para 6-3).</p> <div style="text-align: center;">  </div> <p>m. Test coolant for antifreeze protection, reserve alkalinity (corrosion protection), and cleanliness (para 6-2 and TB 750-651).</p> <p>n. Deleted.</p>	

Table 2-1. Preventive Maintenance Checks and Services (Cont)

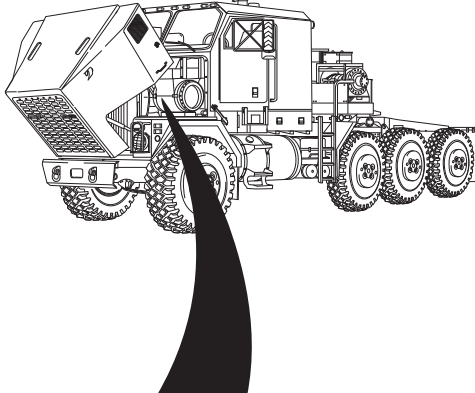
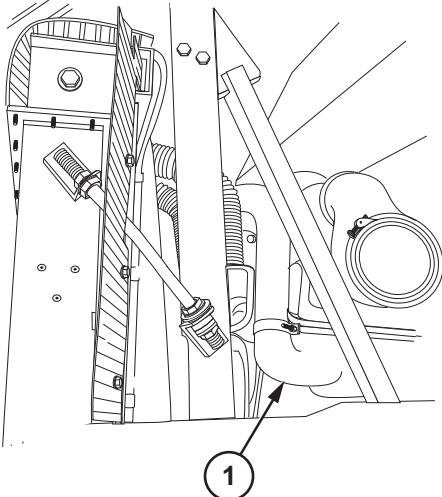
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
<p>4 (cont)</p> <p>5</p>	<p>Semi-annually</p> <p>Semi-annually</p>	<p>COOLING SYSTEM (CONT)</p> <p>EXHAUST SYSTEM</p>	<p>o. Perform all semiannual lubrications as identified in LO 9-2320-360-12.</p> <p style="text-align: center;"><u>WARNING</u></p> <p>Engine is hot. Use caution when inspecting exhaust system. Failure to comply may result in severe burns.</p> <p>a. Check both exhaust manifolds (1) for leaks, cracks, and loose or missing mounting hardware.</p> <div style="text-align: center;">   </div>	<p>a. Any exhaust leaks are found.</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
5 (cont)	Semi-annually	EXHAUST SYSTEM (CONT)	<p style="text-align: center;"><u>WARNING</u></p> <p>The exhaust pipe and muffler can become very hot during HET Tractor operation. Do not touch these parts with bare hands or allow body to come in contact with pipe or muffler. Failure to comply may result in serious injury to personnel.</p> <p>b. Check exhaust pipes (1), muffler (2), and tail pipe (3) for cracks or leaks. If cracks or leaks are found, refer to chapter 5.</p> <p>c. Check mounting clamps (4) for looseness. Tighten loose clamps.</p> <p>d. Check rain cap (5) to ensure it operates freely and closes when engine is not running. If fault is found, replace rain cap (para 5-4).</p>	<p>b. Any leaks are found.</p> <p>d. Rain cap is missing.</p>

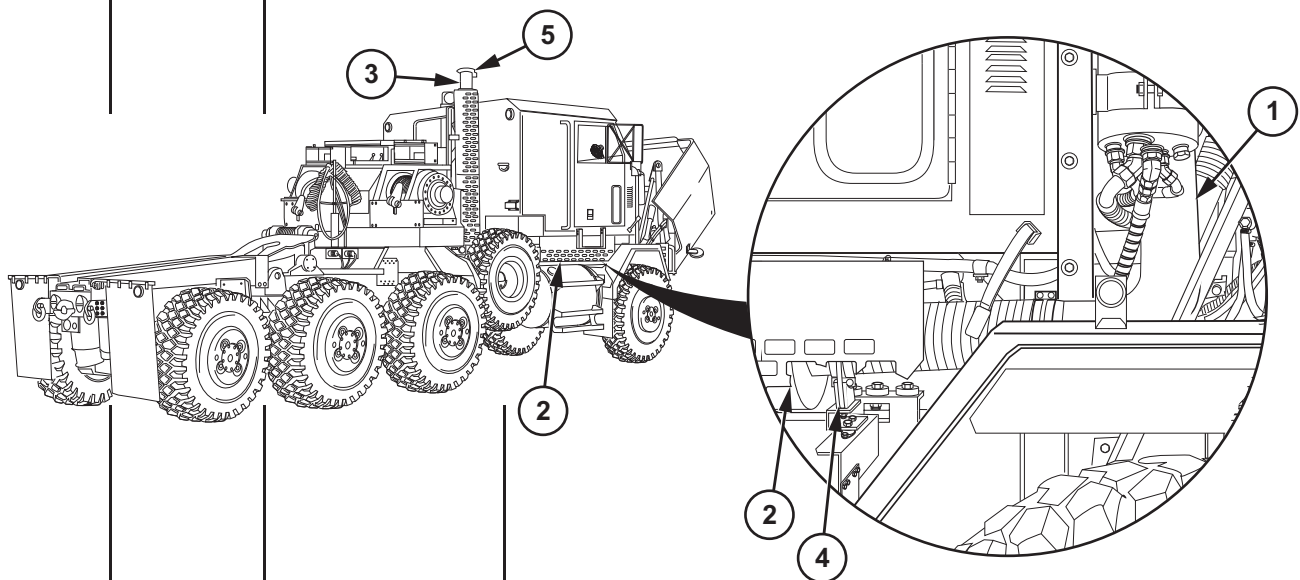


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
6	Semi-annually	AIR INTAKE	<p style="text-align: center;">NOTE</p> <p>Engine must be running to perform this test.</p> <p>a. Check AIR CLEANER RESTRICTION indicator (1). Press reset button if indicator reads greater than 15. Service air cleaner (2) (para 4-2) if indicator still reads greater than 15 and will not reset.</p> <p>b. Check hoses (3) and ducting (4) for cracks, leaks, or chafing and loose or missing mounting hardware. Tighten loose connections. Replace damaged parts (para 4-3/4-4).</p>	<p>b. Any cracks or tears are in ducting or hose. Any hardware is missing.</p>

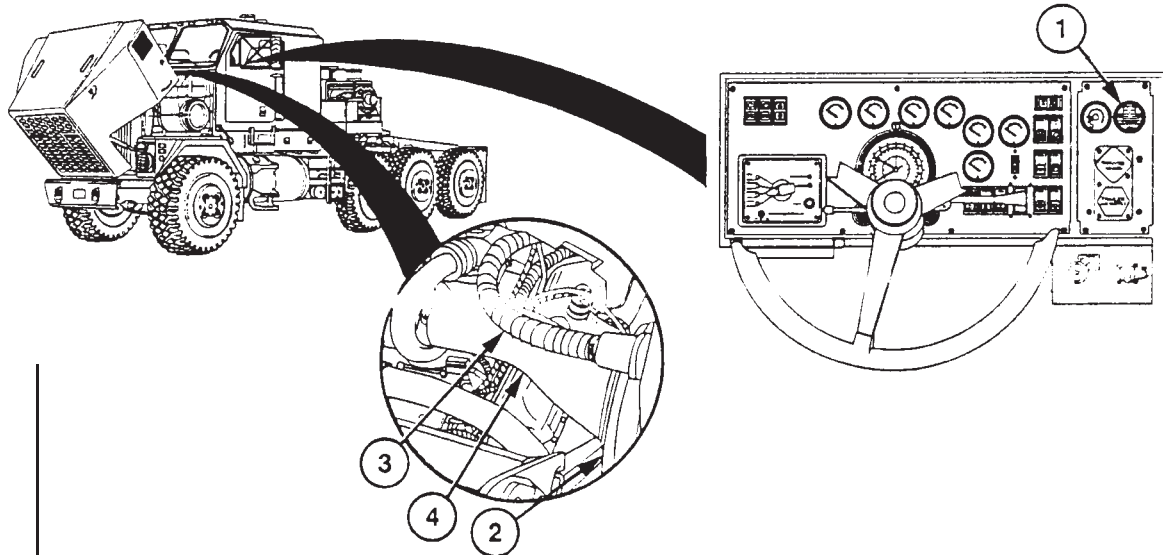


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
7	Semi-annually	WHEELS AND TIRES	<p>a. Inspect for nicks, cuts, and gouges on tread and sidewalls. If tire is badly damaged, replace it (para 12-5).</p> <p style="text-align: center;">NOTE</p> <ul style="list-style-type: none"> • Tread depth measurements should be made at center of tread between the blocks that do not contain bridging. Bridging is a raised portion of rubber at the bottom of the groove that connects two or more blocks. • Three separate measurements must be taken. Measure depth across tread at outside edge, center, and inside edge. <p>b. Check tire (1) for wear using tire depth gage. Tread depth should not be less than 1/8 in. (3.2 mm).</p>	<p>a. Any two tires are missing. Tire out of round, flat, or cords are exposed.</p> <p>b. Tread depth is less than 1/8 in. (3.2 mm).</p>

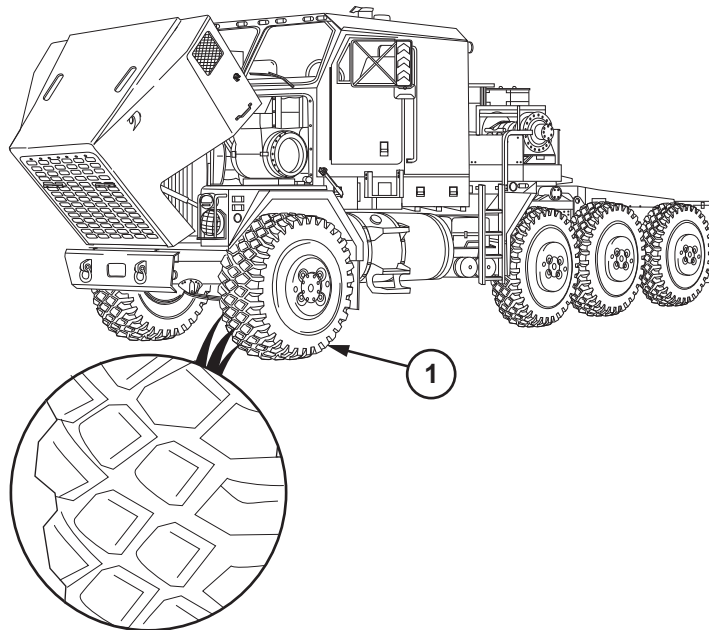


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
7 (cont)	Semi-annually	WHEELS AND TIRES (CONT)	<p>c. Check wheels:</p> <ol style="list-style-type: none"> (1) Remove four nuts (1) and wheel cover (2) from wheel (3). <p style="text-align: center;"><u>WARNING</u></p> <p>Tire must be completely deflated before attempting to loosen nuts if any bolts are found loose or broken after removing wheel cover. Failure to comply may result in injury to personnel.</p> <ol style="list-style-type: none"> (2) Check wheels (3) and CTIS valves (4) for damage. (3) Tighten nuts (5) to 450–550 lb-ft (610–746 N·m). (4) Install wheel cover (2) on wheel (3) with four nuts (1). 	c. Nuts are missing.

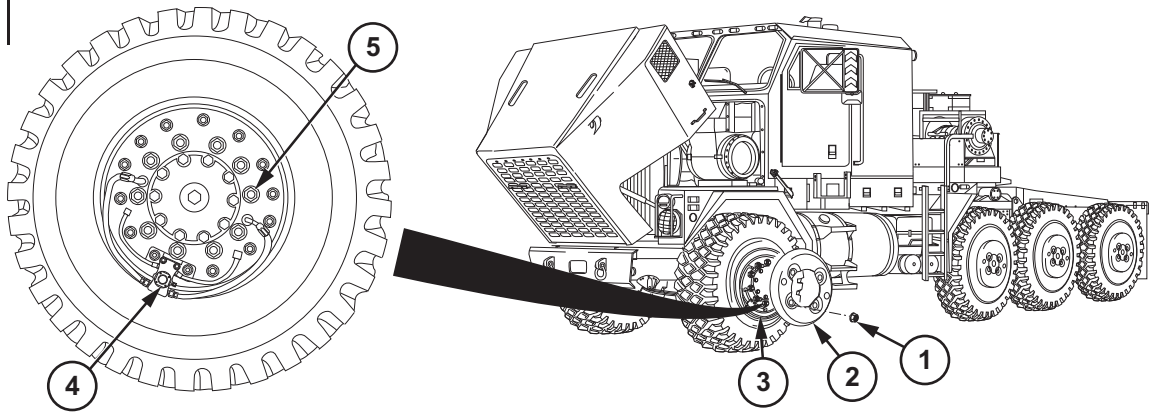


Table 2-1. Preventive Maintenance Checks and Services (Cont)

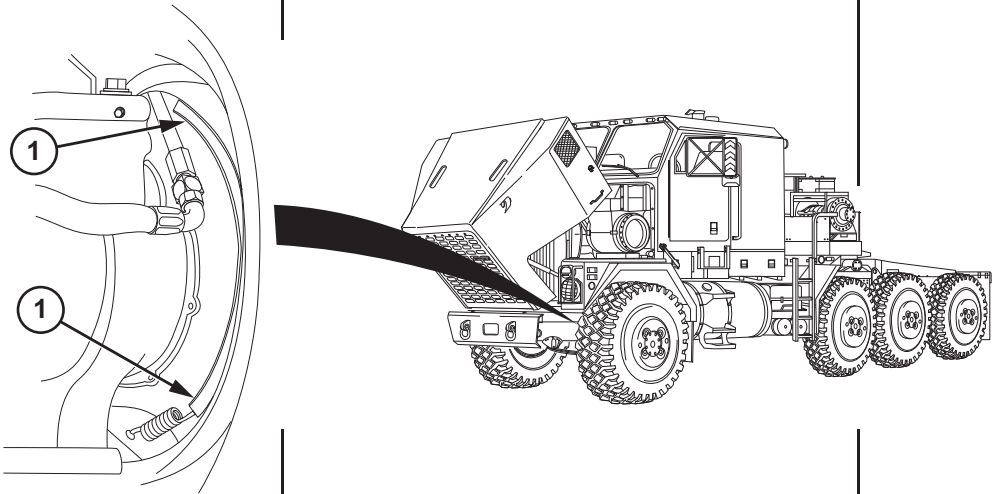
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
8	Semi-annually	BRAKE SYSTEM	<p style="text-align: center;">NOTE</p> <p>Brake shoes, drums, and brake adjustment mechanisms must be cleaned of dirt, mud, and debris before inspection.</p> <p>a. Measure lining thickness of brake shoe (1). If brake lining is less than 9/32 in. (7 mm) at thinnest point, replace all brake shoes on axle (para 11-3).</p>  <p>b. Start engine and build system air pressure to 120-125 psi (827-862 kPa) (TM 9-2320-360-10).</p> <p>c. Shut off engine (TM 9-2320-360-10).</p>	<p>a. Brake linings are less than 9/32 in. (7 mm).</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

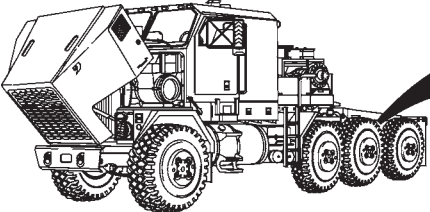
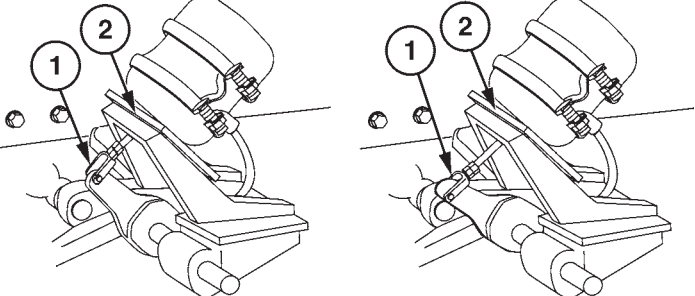
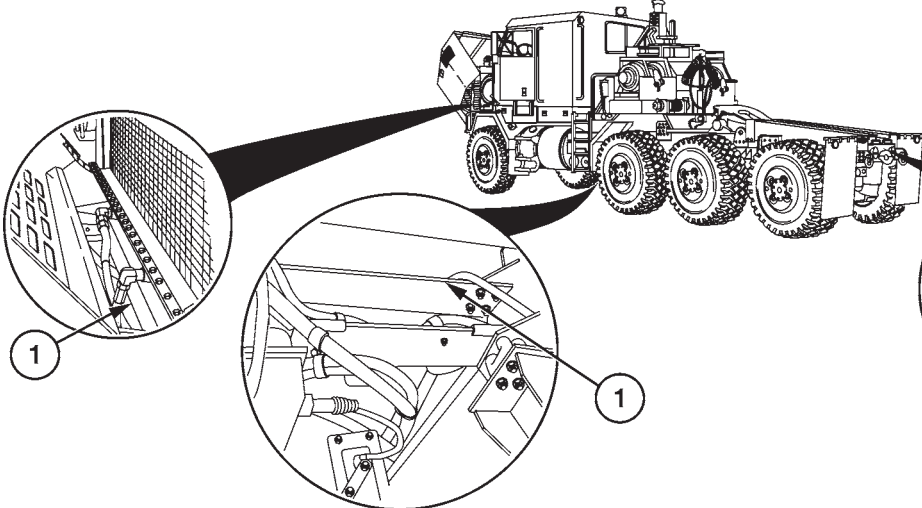
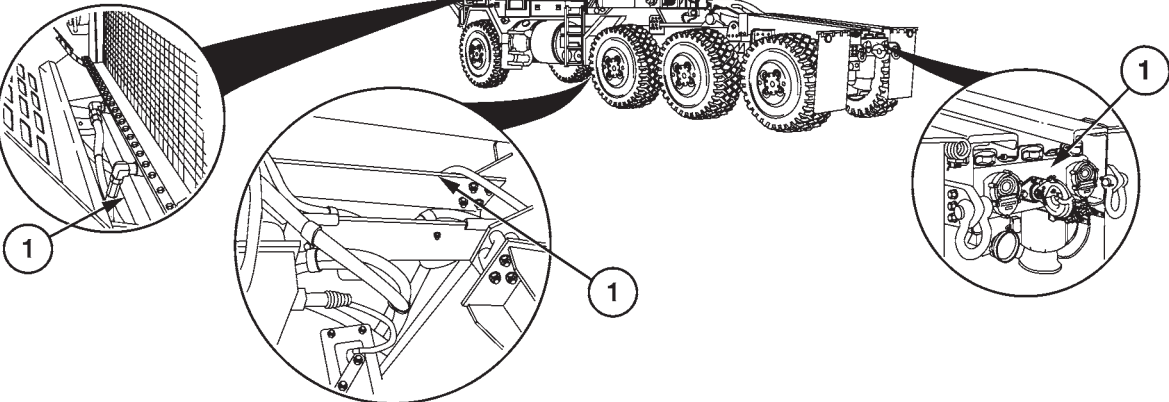
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
8 (cont)	Semi-annually	BRAKE SYSTEM (CONT)	<p>d. Measure distance A between center of yoke pin (1) and chamber bracket (2) with brake treadle released. Record measurement.</p> <p>e. Measure distance B between center of yoke pin (1) and chamber bracket (2) while assistant holds brake treadle down. Record measurement.</p> <p>f. Subtract measurement A from measurement B. If difference is 2 in. (50 mm) or more, adjust manual slack adjuster (para 11-2) or troubleshoot automatic slack adjuster.</p>	f. Brakes are inoperative or cannot be adjusted.
				
9	Semi-annually	FRAME	Check frame crossmembers (1) for cracks, and loose or missing mounting hardware. If faults are found, notify supervisor.	Crossmembers are broken, loose, bent, or cracked or mounting hardware is
				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

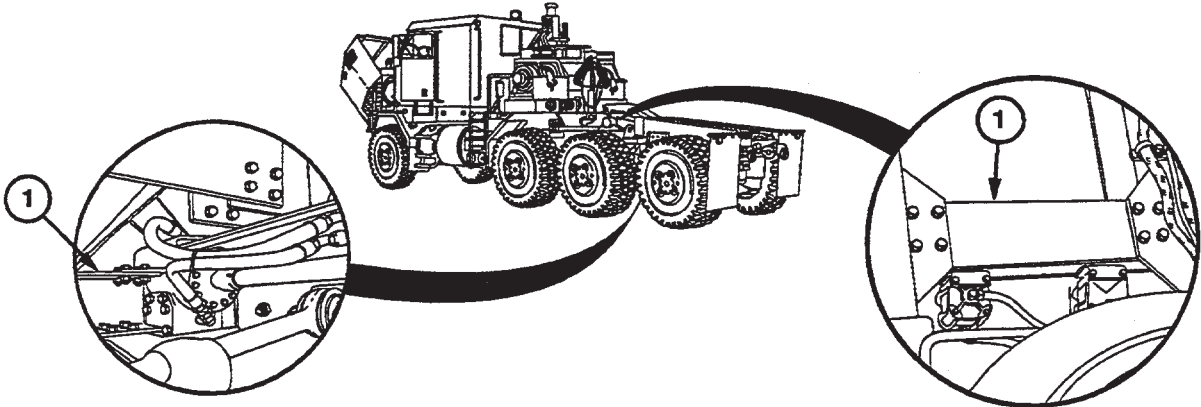
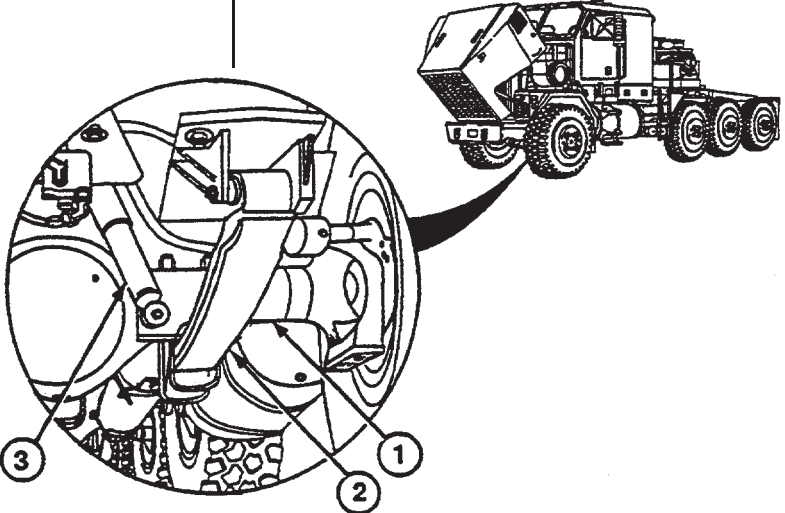
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
9 (cont)	Semi-annually	FRAME (CONT)		
10	Semi-Annually	AXLES/ SUSPENSION	<p>a. Check front axle (1) for loose or missing mounting hardware.</p> <p style="text-align: center;">NOTE</p> <p>Some looseness of the front spring clip is permissible. The clip may rotate on the rivet.</p> <p>b. Check spring (2) for cracked or broken leaves or missing spring clips.</p> <p>c. Check shock absorber (3) for cracks, leaks, and loose or missing mounting hardware. If faults are found, replace shock absorber (para 15-3).</p> 	<p>a. Mounting hardware is missing.</p> <p>c. Shock absorber is cracked or broken or mounting hardware is missing.</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
10 (cont)	Semi-annually	AXLES/ SUSPENSION (CONT)	<p>d. Check no. 2, no. 3, and no. 4 axles (1) for loose or missing mounting hardware.</p> <p>e. Check air springs (2) for rips or tears.</p> <p>f. Check torque rods (3) for cracks and loose or missing mounting hardware. If faults are found, notify your supervisor.</p> <p>g. Check input and output shaft seals (4) for leakage (para 2-11).</p> <p>h. Check input and output yoke nuts (5) for looseness and proper staking. Both staked points or nuts should be in slots of pinion shafts.</p>	<p>d. Mounting hardware is missing.</p> <p>e. Air springs are ripped or torn.</p> <p>f. Torque rod or hardware is missing.</p> <p>g. Class III leak is found.</p> <p>h. Yoke nut(s) are loose, missing or not staked.</p>

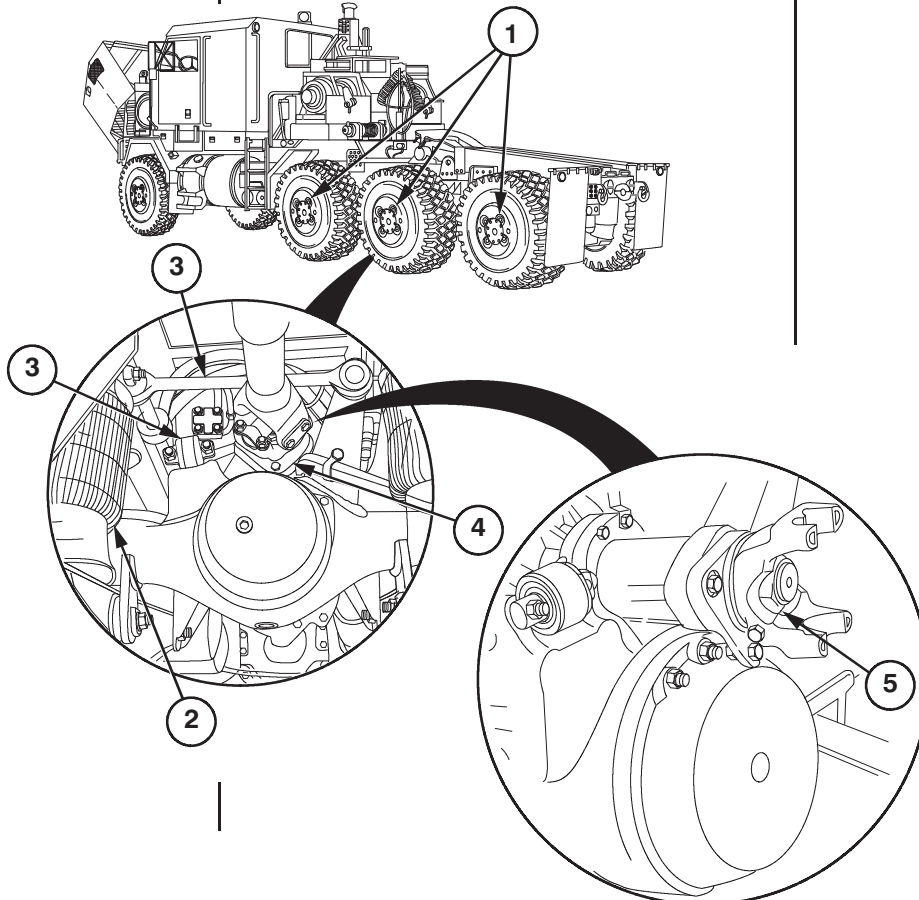
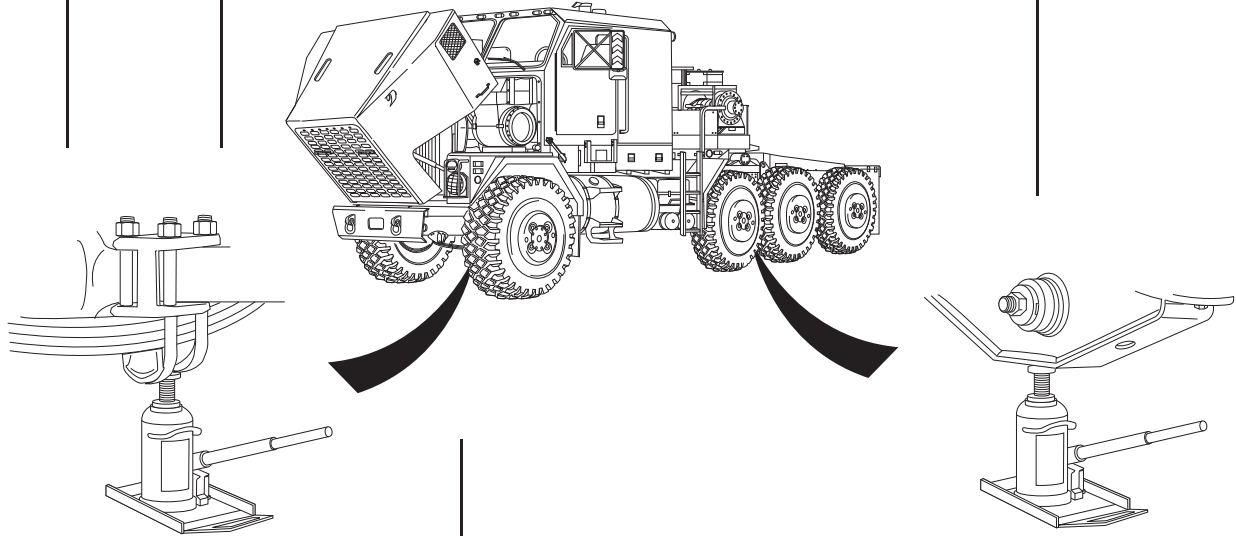


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
10 (cont)	Semi-annually	AXLES/ SUSPENSION (CONT)	<p>h. Check wheel bearings for looseness:</p> <ol style="list-style-type: none"> (1) Raise vehicle from ground with suitable lifting device far enough to position crow bar between tire and ground. <p style="text-align: center;">NOTE</p> <p>Wheel should not be loose on hub.</p> <ol style="list-style-type: none"> (2) Brace crow bar on ground and push against tire. (3) If there is any wheel bearing play, notify your supervisor. 	<p>h. Wheel bearings are frozen, binding, or loose.</p> <p>Wheel bearing play is present. Any parts are missing.</p>



The diagram shows a side view of a heavy-duty vehicle with a crane. Two curved arrows point from the text in the procedure column to specific parts of the vehicle: the front axle/suspension area and the rear axle/suspension area. Below the vehicle, there are two detailed technical drawings of axle and suspension components. The drawing on the left shows a hub assembly with a crown wheel and a shaft. The drawing on the right shows a different view of a hub and axle assembly, possibly illustrating a different component or a specific adjustment point.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
10 (cont)	Semi-annually	AXLES/ SUSPENSION (CONT)	<p>i. Service axle breather:</p> <p style="text-align: center;">NOTE</p> <p>All axle breathers are serviced in a similar way. No. 2 axle breather is located at end of nylon tube coming from axle housing.</p> <p>(1) Check inside axle breather (1) for contamination. Ensure cap moves in and out freely.</p> <p style="text-align: center;">CAUTION</p> <p>Do not attempt to separate breather from adapter. Failure to comply may result in damage to breather.</p> <p style="text-align: center;">NOTE</p> <p>Do steps (2) thru (6) if axle breather is contaminated, stuck, or binding.</p> <p>(2) Remove axle breather (1) with adapter (1.1) from axle housing (2).</p>	i. Any breather missing or unservice-able.

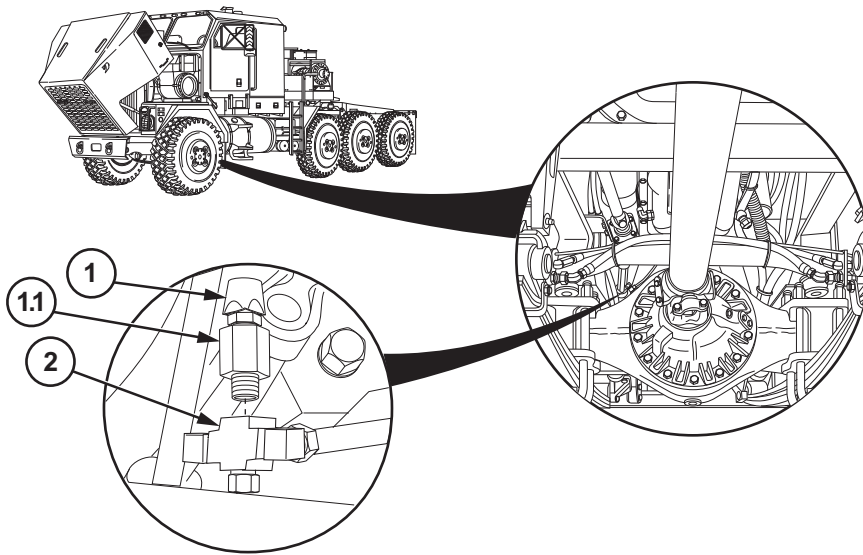


Table 2-1. Preventive Maintenance Checks and Services (Cont)

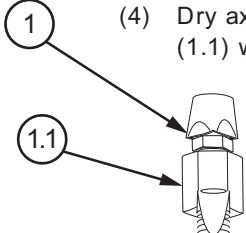
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
10 (cont)	Semi-annually	AXLES/ SUSPENSION (CONT)	<p style="text-align: center;"><u>WARNING</u></p> <p>Solvent cleaning compound MIL-PRF 680 Type II and III may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Use respirator as needed. Accidental ingestion can cause irritation of digestive tract and respiratory tract, may cause lung and central nervous system damage. Can be fatal if swallowed. Inhalation of high/massive concentrations can cause coma or be fatal. First aid for ingestion: do not induce vomiting. Seek immediate medical attention. First aid for skin contact: remove contaminated clothing. Wash skin thoroughly with soap and water. If symptoms persist, seek medical attention. First aid for eye contact: flush with water for 15 minutes or until irritation subsides. If symptoms persist, seek medical attention. First aid for inhalation: move to fresh air. If not breathing, provide artificial respiration. If symptoms persist, seek medical attention. Keep away from open flames and other sources of ignition. Failure to follow this warning may result in injury or death to personnel.</p> <ul style="list-style-type: none"> •The flashpoint for type II solvent cleaning compound is 141-198°F (61-92C) and type III is 200-241°F (93-116C) •Improper cleaning methods and use of unauthorized cleaning solvents may injure personnel and damage equipment. •Fire extinguishers should be placed nearby when using solvent cleaning compound. Failure to follow this warning may result in injury or death. •Cloths or rags saturated with solvent cleaning compound must be disposed of IAW authorized facilities' procedures. Failure to follow this warning may result in injury. •Eye shields must be worn when cleaning with a wire brush. Flying rust and metal particles may cause injury <p>(3) Clean axle breather (1) and adapter (1.1) with solvent cleaning compound.</p>	
			<p style="text-align: center;"><u>WARNING</u></p> <p>Compressed air for cleaning purposes will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).</p> <p>(4) Dry axle breather (1) and adapter (1.1) with compressed air.</p> 	

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
10 (cont)	Semi-annually	AXLES/ SUSPENSION (CONT)	<p style="text-align: center;">NOTE</p> <p>Do steps (4.1) and 4.2) only if breather or adapter are damaged.</p> <p>(4.1) Remove breather (1) from adapter (1.1).</p> <p style="text-align: center;"><u>WARNING</u></p> <p>Pipe thread sealing compound may burn or give off harmful vapors. It is harmful to skin and clothing. To avoid injury or death, keep away from open flame and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.</p> <p style="text-align: center;"><u>CAUTION</u></p> <p>Use pipe thread sealing compound sparingly only on pipe threads. Do not apply compound to hose connections. Failure to comply may result in component failure.</p> <p>(4.2) Coat threads of breather (1) with pipe thread sealing compound and install in adapter (1.1).</p> <p>(5) Coat threads of adapter (1.1) with pipe thread sealing compound.</p> <p>(6) Install breather (1) with adapter (1.1) in axle housing (2).</p>	

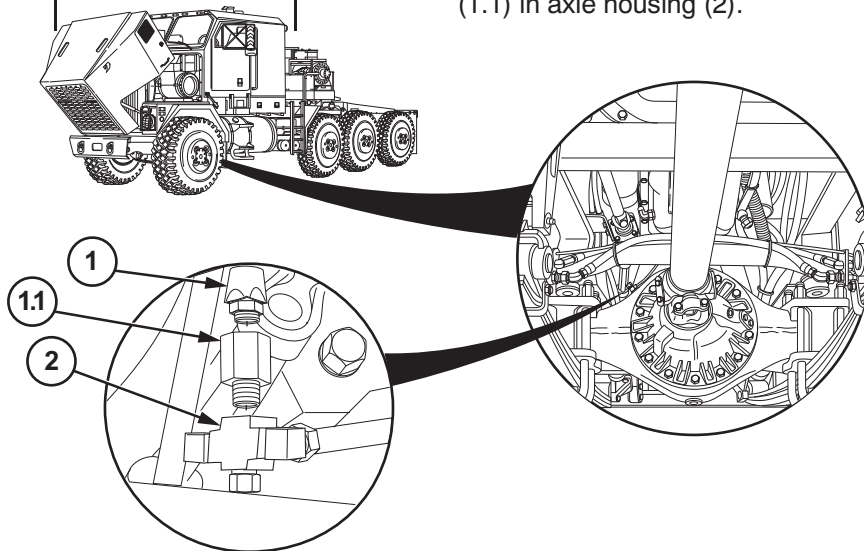


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
11	Semi-annually	PROPELLER SHAFTS	<p>a. Check propeller shafts (1) for missing weights, grease fittings, screws, lock tabs, and leaking seals. If damage is found, repair propeller shaft (para 10-2).</p> <p style="text-align: center;">CAUTION</p> <p>Do not pry on grease fittings. Damage to equipment may result.</p> <p style="text-align: center;">NOTE</p> <p>To check universal joint play, position pry bar between yoke and propeller shaft. Apply pressure to pry bar and look for movement in universal joint.</p> <p>b. Check universal joints (2) for bearing play. If bearing play is found, repair propeller shaft (para 10-2).</p> <p>c. Perform all semiannual lubrications as identified in LO 9-2320-360-12.</p>	<p>a. Propeller shafts are loose. Weights, grease fittings, or screws are missing.</p>

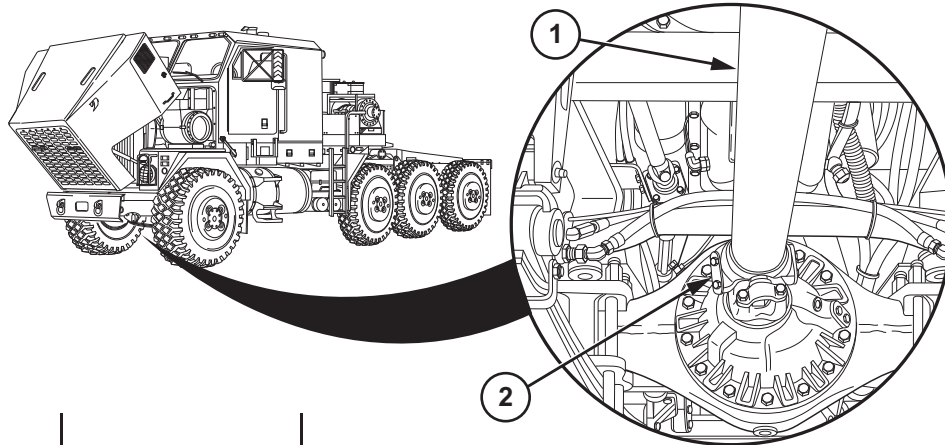


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
12	Semi-annually	TRANSMISSION	<ul style="list-style-type: none"> a. Check transmission (1) and oil pan (2) for loose mounting hardware or leakage. b. Check drain plug (3) for looseness. c. Check output shaft oil seal (4) for leakage (para 2-11). d. Check transmission shift cable (5) for kinks, frays, or broken linkage. If faults are found, replace shift cable (para 2-11). e. Perform all semiannual lubrications as identified in LO 9-2320-360-12. 	<ul style="list-style-type: none"> a. Class III leaks are present or mounting hardware is missing. c. Class III leaks are present. d. Cable is broken, kinked, or frayed, or linkage is broken.

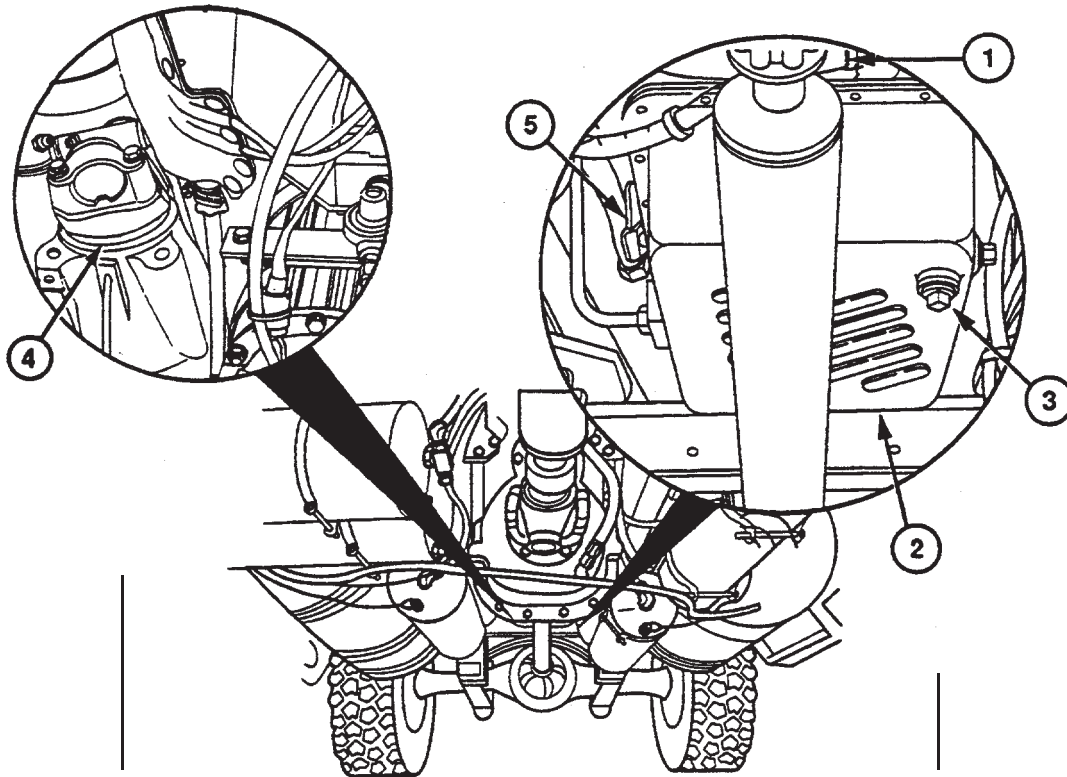


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
13	Semi-annually	TRANSFER CASE	<ul style="list-style-type: none"> a. Check transfer case (1) for cracks and loose or missing mounting hardware. b. Check transfer case input and output shaft seals (2) for leaks (para 2-11). c. Check transfer case shift cable (3) for kinks, frays, or broken linkage. If faults are found, replace shift linkage (para 9-2). d. Perform all semiannual lubrication as identified in LO 9-2320-360-12. 	<ul style="list-style-type: none"> a. Mounting hardware is missing. b. Any class III leaks are found. c. Cable is broken, kinked, or frayed, or linkage is broken.

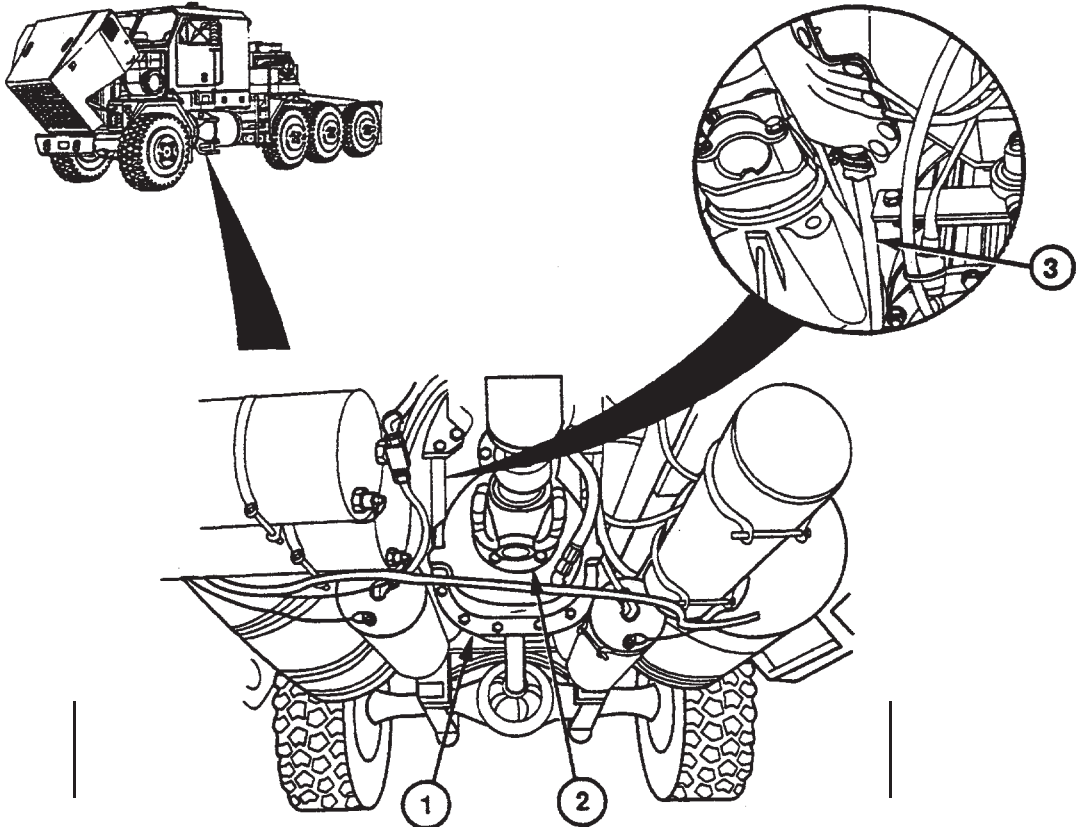


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
14	Semi-annually	AIR SYSTEM	<ul style="list-style-type: none"> a. Start engine and build up air pressure to 120-125 psi (827-862 psi). b. Shut off engine (TM 9-2320-360-10). c. Coat fittings with soapy water. d. Check air reservoirs (1), valves (2), and air lines (3) for cracks or leaks. Tighten loose connections. e. Drain air reservoirs (1). Check for presence of oil. If oil is present, notify supervisor. 	<ul style="list-style-type: none"> d. Any leaks are found. e. Oil is present.
15	Semi-annually	STEERING SYSTEM	<ul style="list-style-type: none"> a. Check front steering gear (1) for leaks and loose or missing mounting hardware. b. Check front steering shafts (2) and U-joints (3) for cracks and loose or missing mounting hardware. If fault is found, refer to steering shaft repair (para 13-6). 	<ul style="list-style-type: none"> a. Class III leaks are found or mounting hardware is missing. b. U-joints are loose. Bearing caps are cracked or missing.

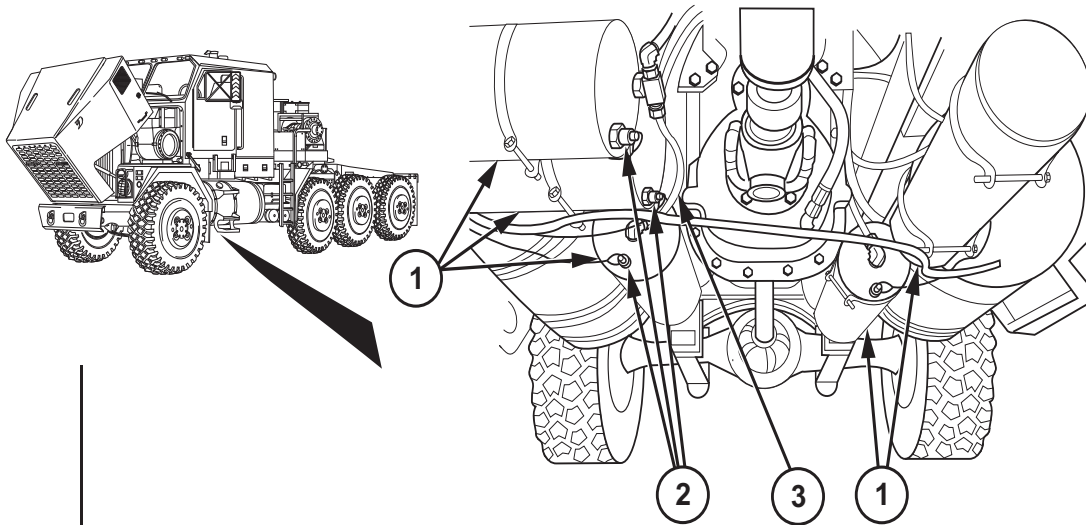


Table 2-1. Preventive Maintenance Checks and Services (Cont)

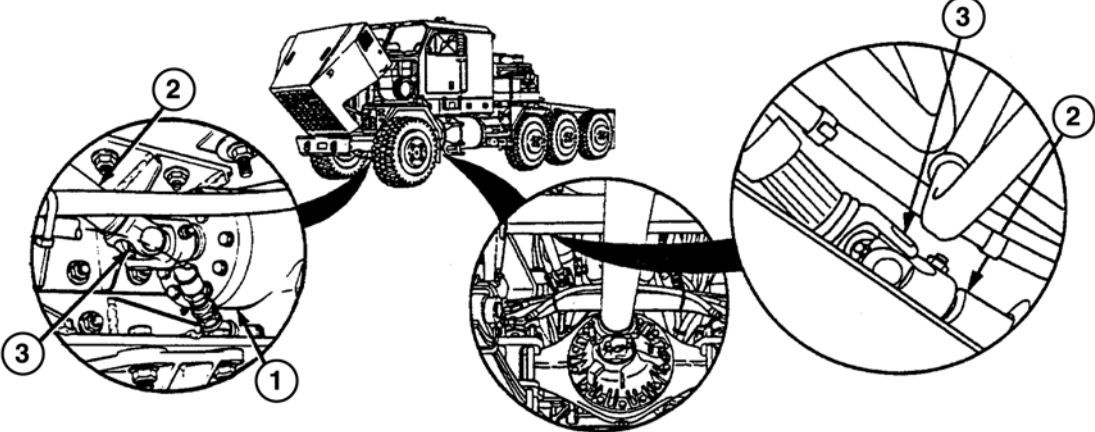
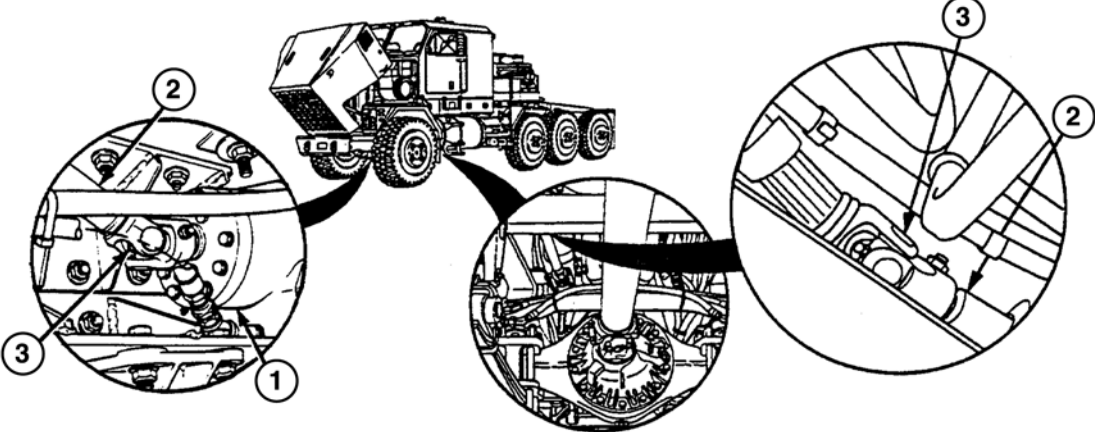
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
15 (cont)	Semi-annually	STEERING SYSTEM (CONT)	 <p>b.1. Check front drag link ends (1) for excessive wear, refer to drag link inspection (para 13-14.1).</p> <p>c. Check front drag link (1) and pitman arm (2) for cracks and loose or missing mounting hardware.</p> <p>d. Check tee gear box (3) for cracks and loose or missing mounting hardware. If fault is found, refer to tee gear box replacement (para 13-8).</p>	 <p>b.1. Excessive wear on drag link ends.</p> <p>c. Pitman arm is cracked or ripped or mounting hardware is missing.</p> <p>d. Tee gear box is cracked or mounting hardware is missing.</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)


ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
15 (cont)	Semi-annually	STEERING SYSTEM (CONT)	<p>d.1. Check front tie rod ends (1) for excessive wear, refer to tie rod inspection (para 13-4.1).</p> <p>e. Check front tie rod (1) for cracks and loose or missing mounting hardware. If fault is found, refer to tie rod replacement (para 13-4).</p> <p>f. Check front steering lines and hoses (2) for cracks, leaks, or rotting. If faults are found, replace faulty part (para 13-9/13-10).</p>	<p>d.1. Excessive wear on tie rod ends.</p> <p>e. Cracks are found or mounting hardware is missing.</p> <p>f. Any leaks are found.</p>
			<p>g. Check rear steering gear (1) for leaks and loose or missing mounting hardware.</p> <p>h. Check rear steering shafts (2) and U-joints (3) for cracks and loose or missing mounting hardware. If damage is found, repair steering system shaft (para 13-7).</p> <p>i. Check rear steering lines (4) and hoses (5) for cracks, leaks, or rotting. If faults are found, replace faulty part (para 13-9/13-10).</p>	<p>g. Class III leaks are found or mounting hardware is missing.</p> <p>h. U-joints are loose. Bearing caps are cracked or missing.</p> <p>i. Any leaks are found.</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
<p>15 (cont)</p>	<p>Semi-annually</p>	<p>STEERING SYSTEM (CONT)</p>	<p>i.1. Check rear drag link ends (6) for excessive wear, refer to drag link inspection (para 13-4.1).</p> <p>j. Check rear drag link (6) and pitman arm (7) for cracks and loose or missing mounting hardware.</p> <p>j.1. Check rear tie rod ends (8) for excessive wear, refer to tie rod inspection (para 13-4.1).</p> <p>k. Check rear tie rod (8) for cracks and loose or missing mounting hardware. If fault is found, refer to tie rod replacement (para 13-4).</p> <p>l. Perform semiannual lubrication as identified in LO 9-2320-360-12.</p>	<p>i.1. Excessive wear on drag link ends.</p> <p>j. Pitman arm is cracked or ripped or mounting hardware is missing.</p> <p>j.1. Excessive wear on tie rod ends.</p> <p>k. Cracks are found or mounting hardware is missing.</p>

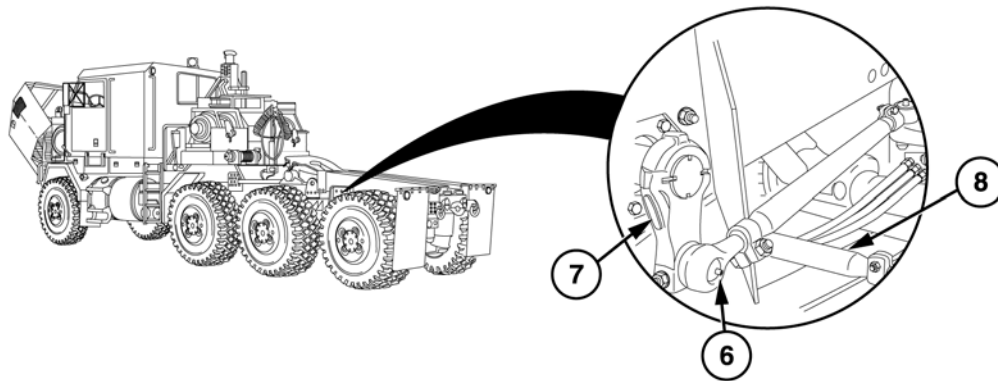
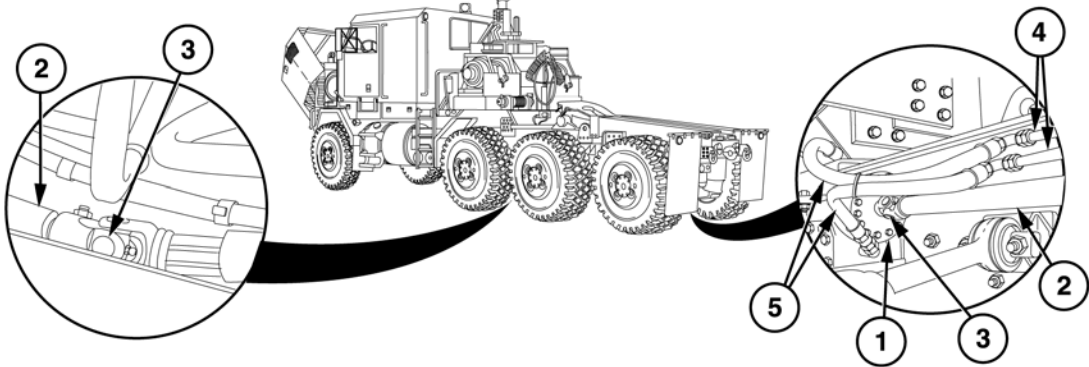


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
16	Semi-annually	FUEL SYSTEM	a. Service fuel/water separator (para 4-11). b. Replace secondary fuel filter (para 4-13).	a. Class III leak is found.
17	Semi-annually	BATTERIES	<p style="text-align: center;">WARNING</p> <p>Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes. Always wear eye protection when working with batteries.</p> <p>a. Open battery box (TM 9-2320-360-10).</p> <p style="text-align: center;">NOTE</p> <p>Make a separate test for each battery cell.</p> <p>b. Check and record specific gravity of each cell using antifreeze and battery tester (Item 49, Appendix F):</p> <ol style="list-style-type: none"> (1) Using black dipstick, place a few drops of electrolyte on exposed portion of measuring window. (2) Point tester toward a bright light source. 	b. Any cell gravity reading is below 1.225 (tropical batteries, 1.180).

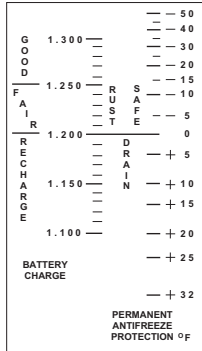
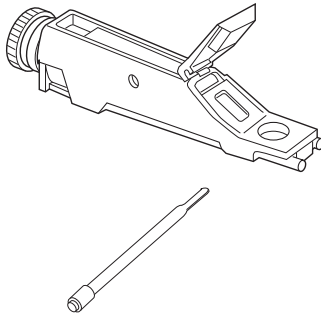
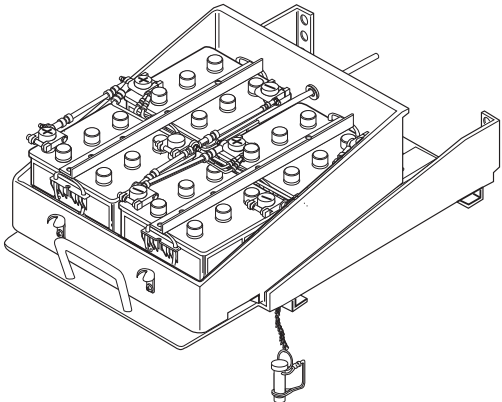


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
17 (cont)	Semi-annually	BATTERIES (CONT)	<p style="text-align: center;">NOTE</p> <ul style="list-style-type: none"> • Batteries prepared for a tropical climate will have a 1 in. (25 mm) diameter white spot painted on battery top. • Full charge is 1.225 specific gravity for tropical batteries and 1.280 specific gravity for all others. <ul style="list-style-type: none"> (3) Record specific gravity of each cell. (4) Test alternator output (para 7-2) if specific gravity is below 1.180 for tropical batteries and 1.225 for all others. c. Remove batteries (1) from battery box (2) (para 7-57). Replace battery if specific gravity is below 1.180 for tropical batteries and 1.225 for all others d. Check battery box (2) for cracks and debris. Clean battery box (para 2-17). If damaged, replace battery box (para 7-57). 	

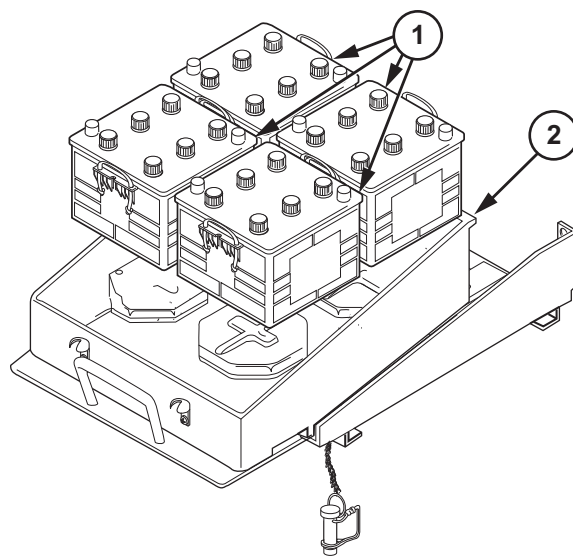


Table 2-1. Preventive Maintenance Checks and Services (Cont)

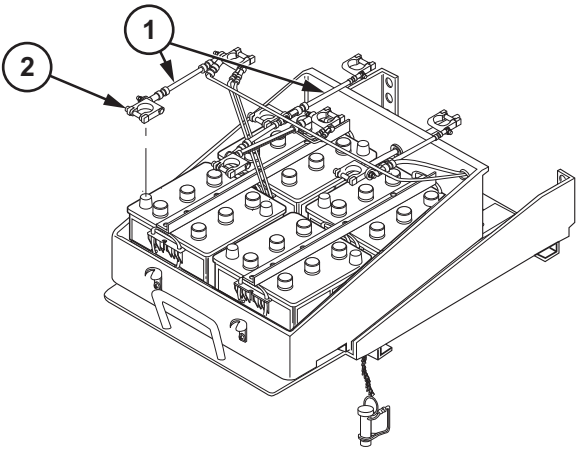
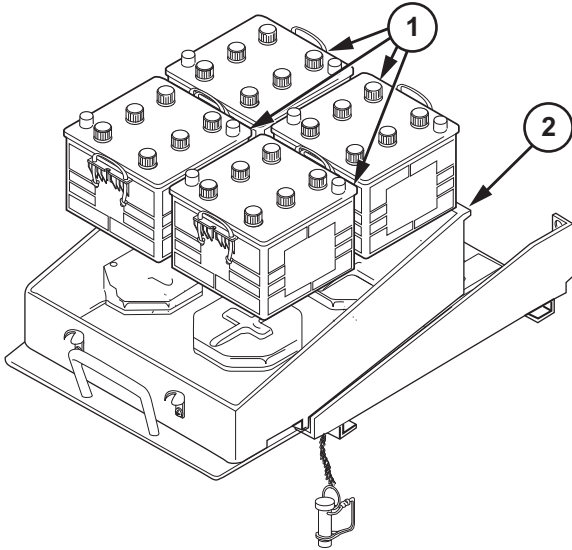
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
17 (cont)	Semi-annually	BATTERIES (CONT)	<p>e. Check battery cables (1) for frays and splits. Check terminals (2) for looseness. Clean and apply anticorrosion grease to battery connections. If faults are found, replace battery cables and terminals (para 7-57).</p>  <p>f. Install batteries (1) in battery box (2) (para 7-57).</p> <p>g. Close battery box (TM 9-2320-360-10).</p> 	e. Cables are frayed or split.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
18	Semi-annually	WINCH AND WINCH HYDRAULICS	<p style="text-align: center;"><u>WARNING</u></p> <p>Be sure to wear the proper eye protection to avoid personal injury.</p> <ol style="list-style-type: none"> a. Check main winches (1) for leaks (para 2-11). b. Check auxiliary winch (2) for leaks. If leak is found, replace auxiliary winch (para 17-13). c. Tighten main winch mounting screws (3) to 600 lb-ft (814 N·m). d. Tighten auxiliary winch mounting screws (4) to 45 lb-ft (61 N·m). e. Remove winch control console panels (para 17-8). f. Check hoses (5) and control valves (6) for leaks, chafing, or cracks. If fault is found, notify supervisor. 	<ol style="list-style-type: none"> b. Any leak is found. f. Hoses leak or chafes or cracks are found.

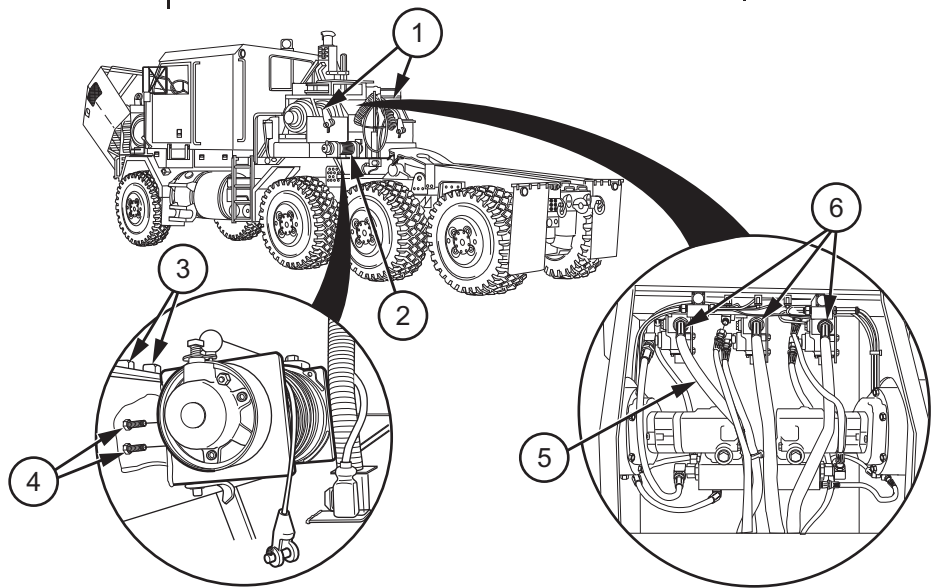


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
<p>18 (cont)</p>	<p>Semi-annually</p>	<p>WINCH AND WINCH HYDRAULICS (CONT)</p>	<p>g. Check hydraulic reservoir (1) and hoses (2) for leaks, chafing, or cracks.</p> <p>h. Install winch control console panels (para 17-8).</p> <p>i. Perform all semiannual lubrication as identified in LO 9-2320-360-12.</p> <div> </div> <p style="text-align: center;"><u>WARNING</u></p> <ul style="list-style-type: none"> • Wire rope can become frayed or contain broken wires. Wear heavy leather-palmed work gloves when handling wire rope. Frayed or broken wires can injure hands. • Never let moving wire rope slide through hands, even when wearing gloves. A broken wire may cut through glove and cut hand. <p>j. Individually unwind winch cables (1) completely and check for kinks, broken</p>	<p>g. Hoses leak or chafes or cracks are found.</p> <p>j. Winch cable has more than three</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

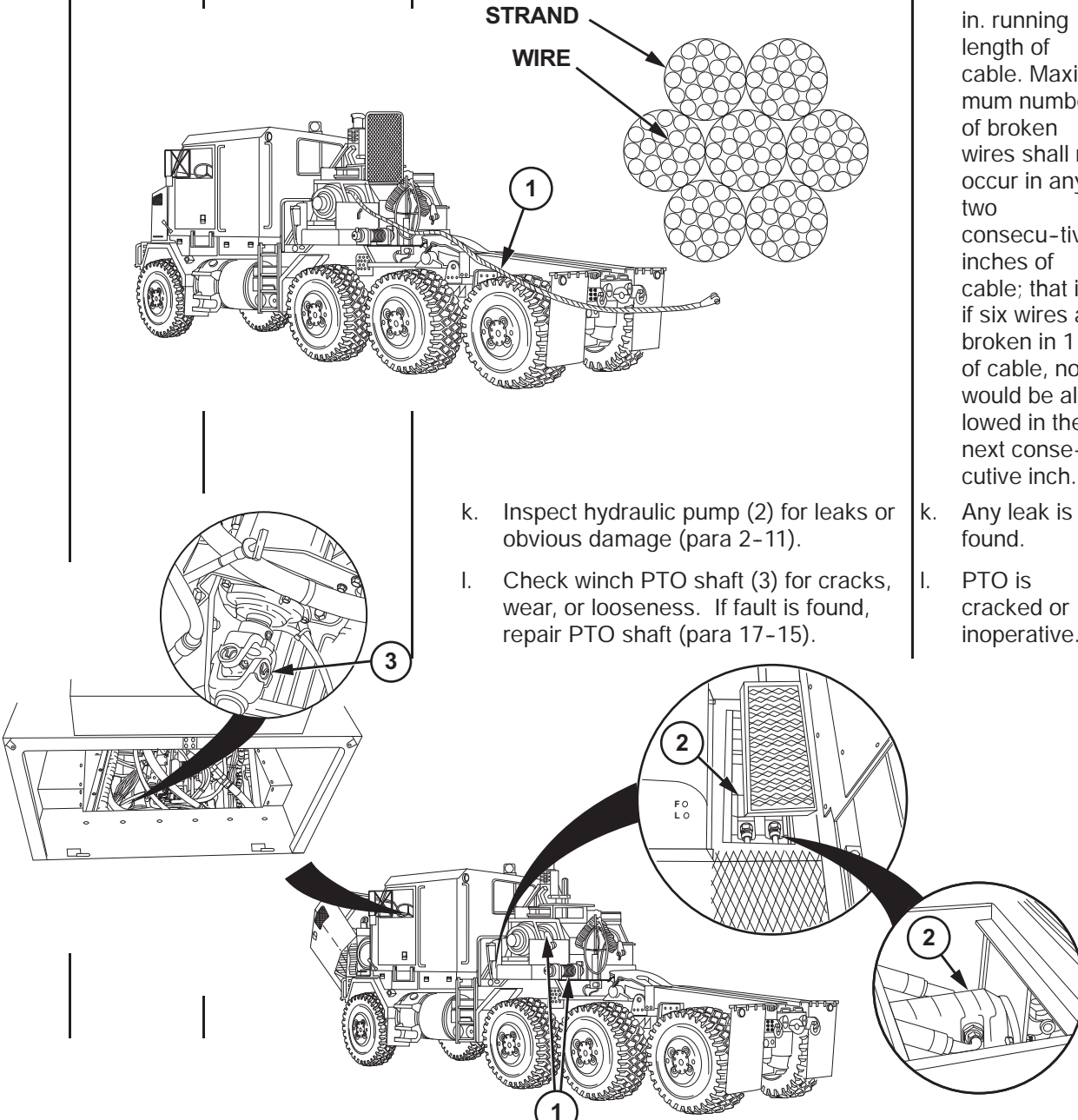
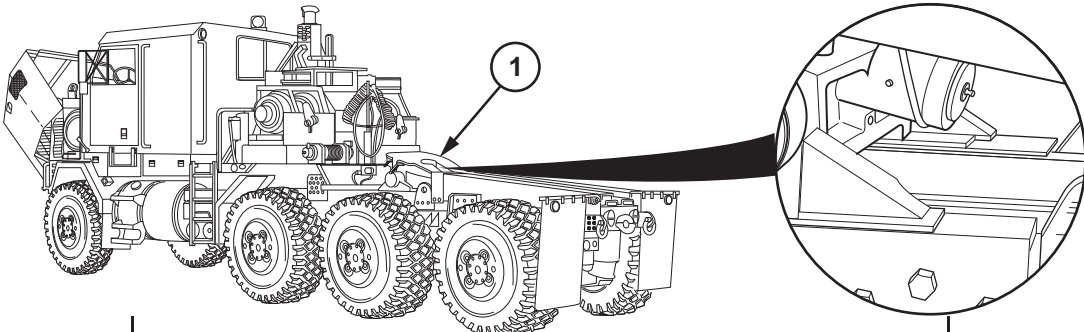
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
18 (cont)	Semi-annually	WINCH AND WINCH HYDRAULICS (CONT)	<p>strands, and wear. If damaged or worn, replace cable (para 17-5/17-13).</p>  <p>k. Inspect hydraulic pump (2) for leaks or obvious damage (para 2-11).</p> <p>l. Check winch PTO shaft (3) for cracks, wear, or looseness. If fault is found, repair PTO shaft (para 17-15).</p>	<p>broken wires per inch on same strand or more than six broken wires on all strands in a 1 in. running length of cable. Maximum number of broken wires shall not occur in any two consecutive inches of cable; that is, if six wires are broken in 1 in. of cable, none would be allowed in the next consecutive inch.</p> <p>k. Any leak is found.</p> <p>l. PTO is cracked or inoperative.</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
19	Semi-annually	FIFTH WHEEL	a. Check fifth wheel (1) for gouges or loose or missing mounting hardware. b. Adjust fifth wheel (para 14-3).	a. Fifth wheel or mounting hardware is missing.
20	Semi-annually	AUXILIARY EQUIPMENT ARCTIC KIT BATTERIES (IF EQUIPPED)	a. Remove two rubber latches (1) from brackets (2). Remove battery box cover (3).	



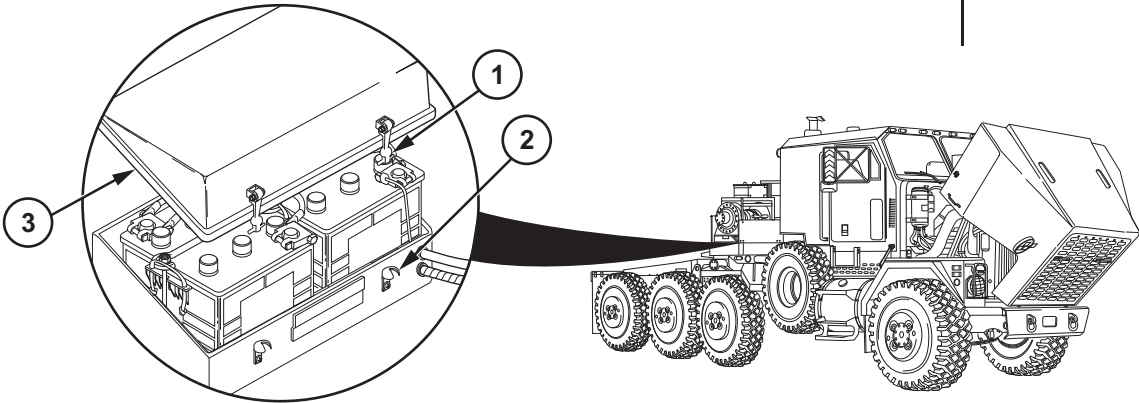


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
20 (cont)	Semi-annually	ARCTIC KIT BATTERIES (IF EQUIPPED) (CONT)	<p>b. Remove batteries (1) from battery box (2) (para 19-3).</p> <p>c. Check battery box (2) for damage and debris. Clean battery box. If damaged, replace battery box (para 19-3).</p> <p>d. Check batteries (1) for damage. If damaged, replace battery (para 19-3).</p>	d. Battery cracked or missing.

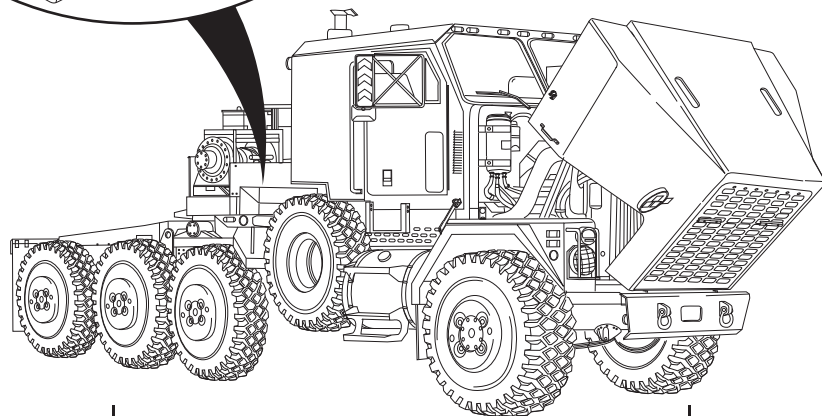
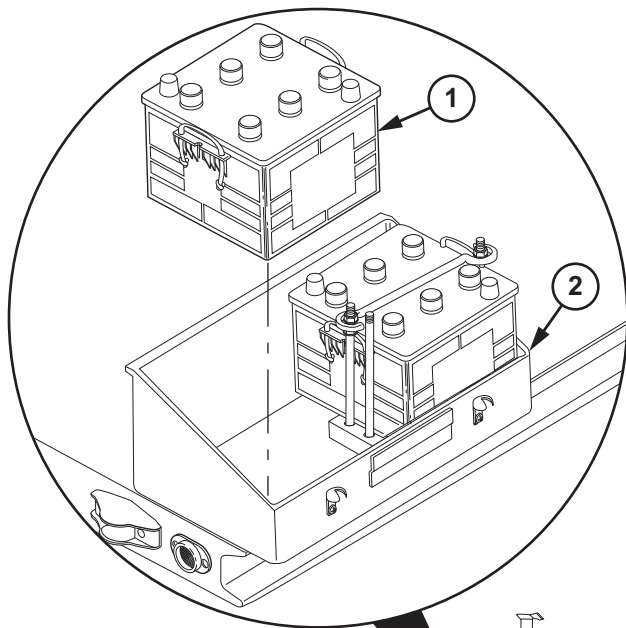


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
20 (cont)	Semi-annually	ARCTIC KIT BATTERIES (IF EQUIPPED) (CONT)	<p style="text-align: center;"><u>WARNING</u></p> <p>Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes. Always wear eye protection when working with batteries.</p> <p style="text-align: center;"><u>NOTE</u></p> <p>Make a separate test for each battery cell.</p> <p>e. Check and record specific gravity of each cell using antifreeze and battery tester (Item 49, Appendix F):</p> <ol style="list-style-type: none"> (1) Using black dipstick, place a few drops of electrolyte on exposed portion of measuring window. (2) Point tester toward a bright light source. <p style="text-align: center;"><u>NOTE</u></p> <p>Full charge is 1.280 specific gravity.</p> <ol style="list-style-type: none"> (3) Record specific gravity of each cell. (4) Replace battery if specific gravity is below 1.225 (para 19-3). 	<p>e. Any battery has one cell below 1.225 specific gravity.</p>

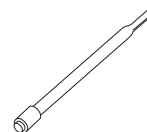
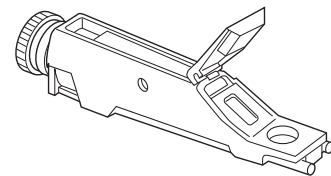
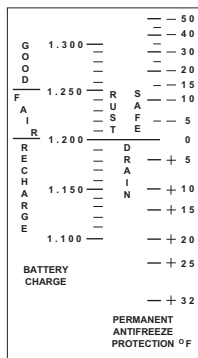


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
20 (cont)	Semi-annually	ARCTIC KIT BATTERIES (IF EQUIPPED) (CONT)	<p>f. Check battery cables (1) for frays and splits. Check terminals (2) for looseness. Clean and grease battery connections. If damaged, replace battery cables and terminals (para 7-57).</p> <p>g. Install batteries (3) in battery box (4) (para 19-3).</p> <p>h. Install battery box cover (5). Install two rubber latches (6) in brackets (7).</p>	f. Cable frayed or split.

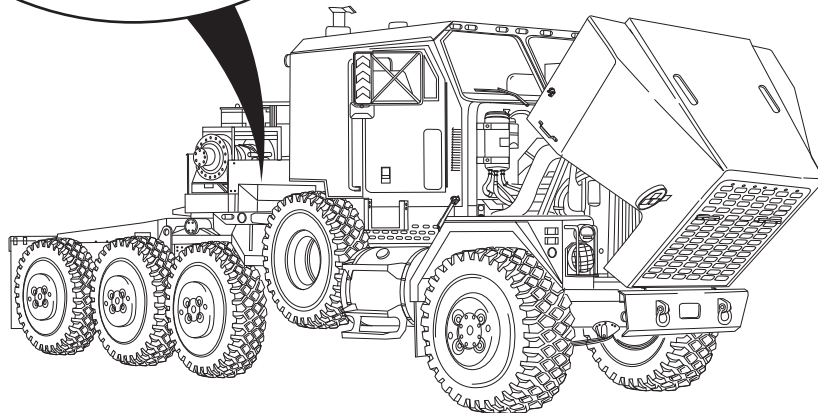
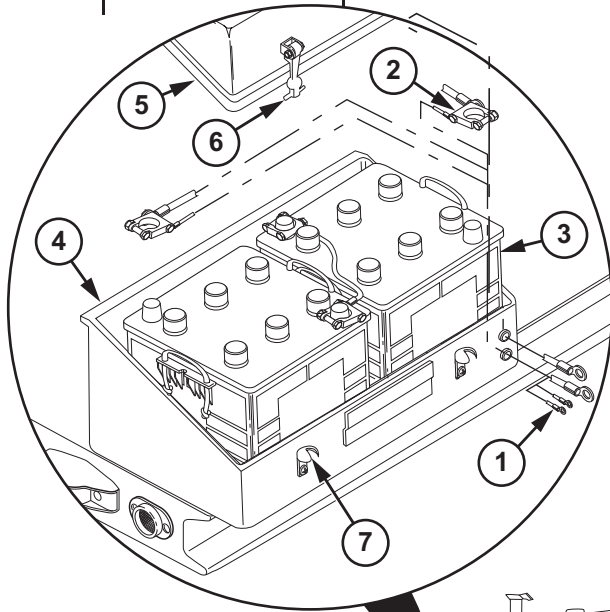


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
21	Semi-annually	INSIDE DOGHOUSE AIR SYSTEM	Remove engine access panels (para 16-2). a. Build system air pressure to 120-125 psi (827-862 kPa) (TM 9-2320-360-10). b. Check air compressor (1) and hoses (2) for leaks, chafing, or cracks. Tighten loose connections. Replace damaged hoses (para 11-29).	b. Air leaks or presence of oil in air system is found.
22	Semi-annually	STEERING SYSTEM	Check steering pump (1) and hoses (2) for leaks and loose or missing mounting hardware.	Class III oil leaks are found.

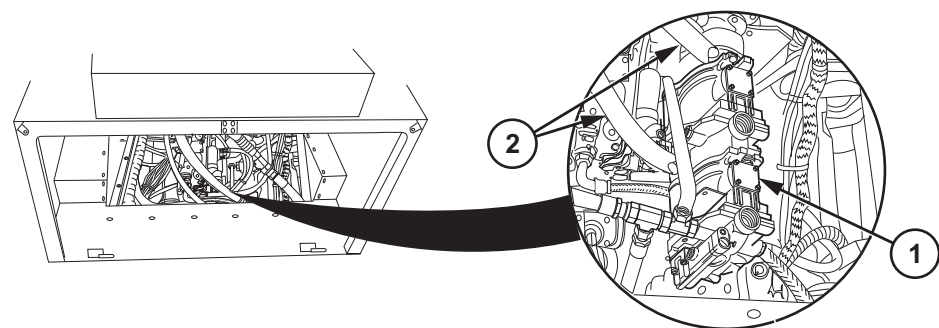
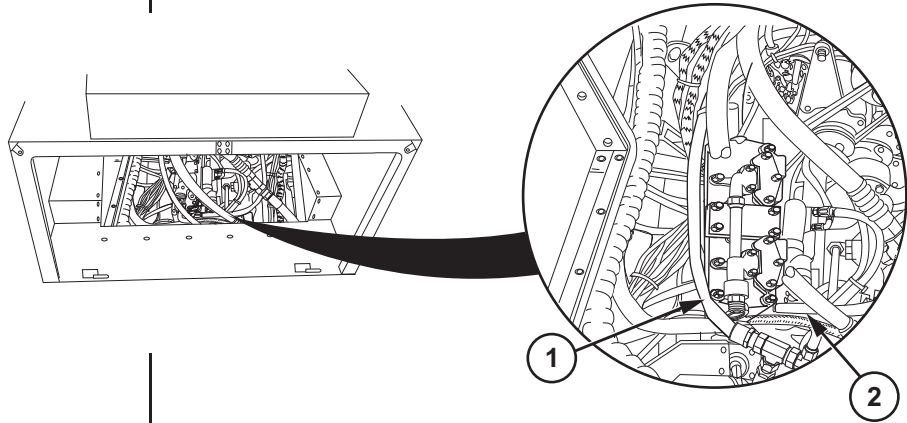


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
23	Semi-annually	ENGINE	<p>Check 12-volt belts (1) for proper tension with belt tension gage (2). Belt tension gage reading should be 70-90 lb (310-400 N). If gage reading is not correct, adjust belts (para 7-6).</p>	Belts are burned, cracked, ripped, frayed, or cut.

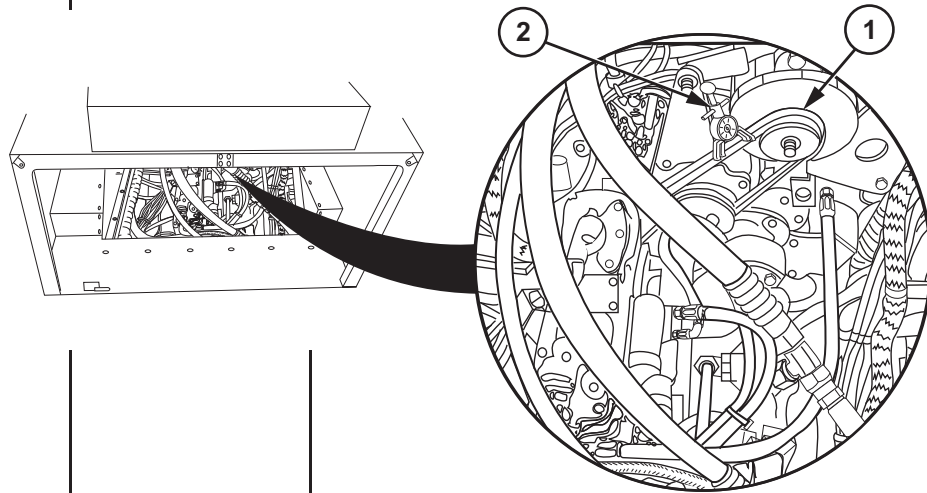


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
24	Semi-annually	GAS PARTICULATE FILTER UNIT (GPFU)	<p style="text-align: center;">NOTE</p> <p>Replace precleaners and particulate filter if any of the following conditions exist: physical damage or water immersion, clogged filter resulting in insufficient air flow, or if the filters exceed criteria established in FM 3-4.</p> <ol style="list-style-type: none"> a. Inspect and replace, if required, precleaners and particulate filter in accordance with FM 3-4 and local climatic conditions. b. Check operation of GPFU (TM 9-2320-360-10). <ol style="list-style-type: none"> (1) Listen for gas particulate filter motor operation. (2) Disconnect five air duct breakaway sockets (1) from mounts (2) and feel for steady air flow. 	

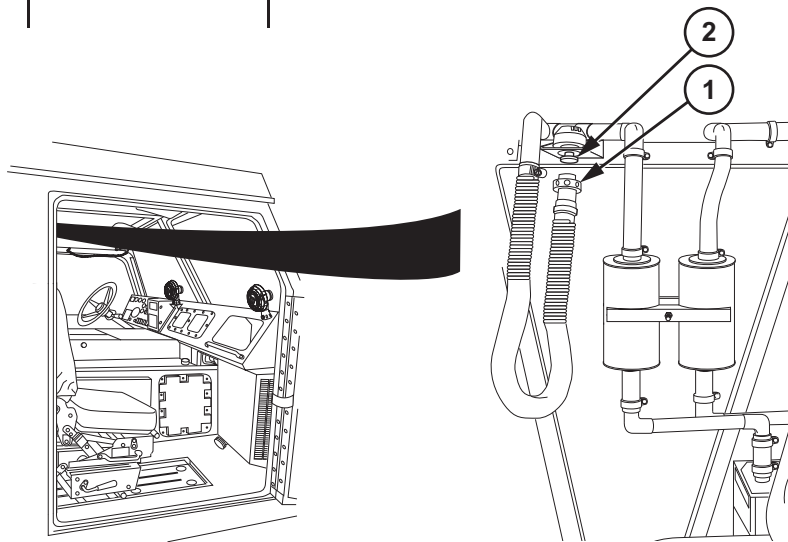


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
25	Semi-annually	STEERING	<p style="text-align: center;">NOTE</p> <ul style="list-style-type: none"> • HET Tractor must be driven a minimum of 10 miles (16 kilometers) during road test. • Items 25 and 26 will be performed during road test. <p style="text-align: center;">NOTE</p> <p>Do not turn tires when turning wheel to check for free play.</p> <p>a. Turn steering wheel (1) to right until resistance is felt (A). Note location of one of the steering wheel spokes (2). Turn steering wheel (1) to left until resistance is felt (B). Measure distance the noted steering wheel spoke (2) has travelled. Free play is measured at outside edge of steering wheel and should not be more than 2-1/2 in. (6.4 cm).</p>	

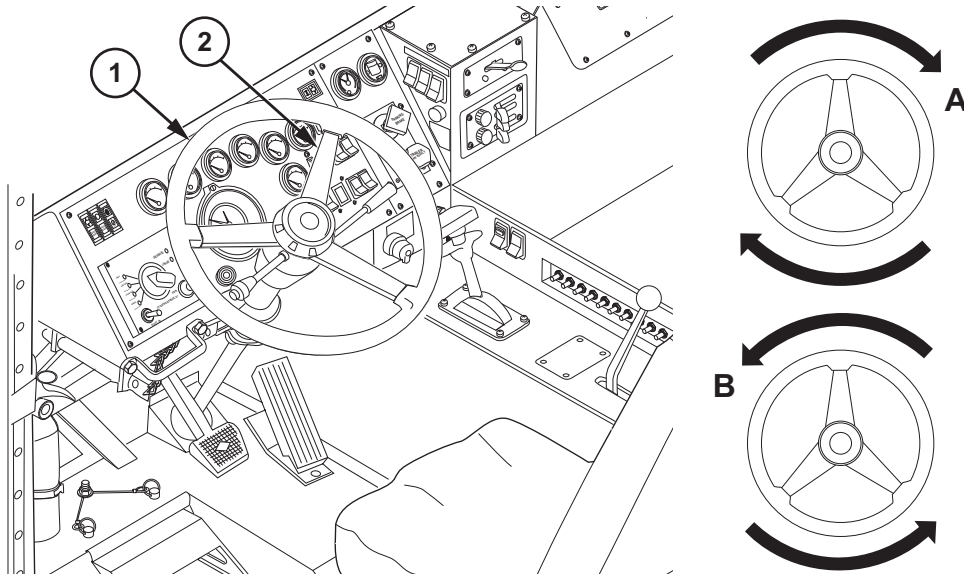


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
25 (cont)	Semi-annually	STEERING (CONT)	<p>b. With HET Tractor on straight, level road, lightly hold steering wheel (1) to check for pull or wander.</p> <p style="text-align: center;">CAUTION</p> <p>Do not hold steering wheel at full right or left position for more than 10 seconds. Failure to comply may result in oil overheating and pump damage.</p> <p>c. With HET Tractor stopped, transmission in N (neutral), and parking brake applied, turn steering wheel (1) all the way right and then left to check for hard steering. If steering wheel does not operate properly, refer to troubleshooting (para 2-13).</p>	

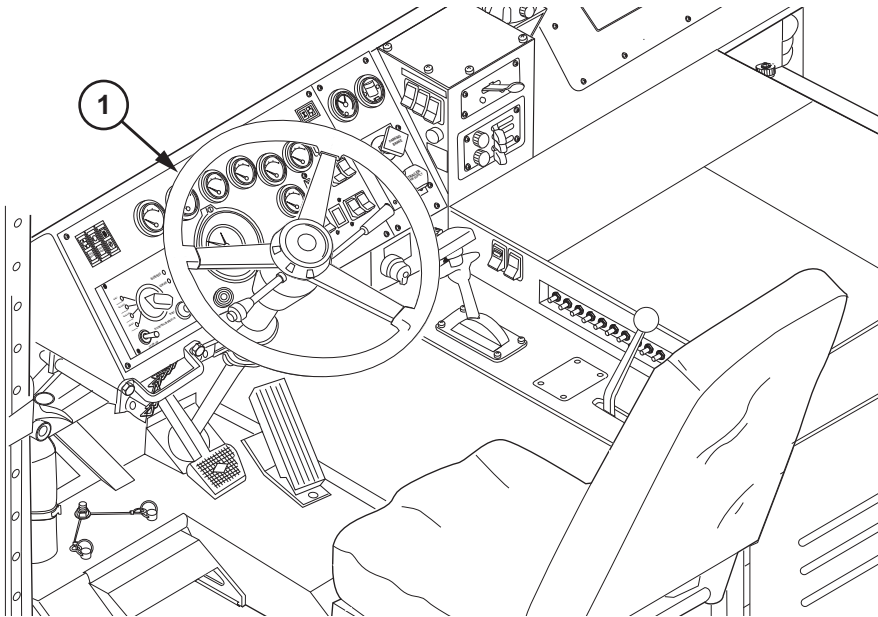


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
26	Semi-annually	ENGINE	<p style="text-align: center;">CAUTION</p> <p>At full throttle, engine must not exceed 2225 rpm. Failure to comply may result in damage to equipment.</p> <ol style="list-style-type: none"> a. Press accelerator pedal (electronic throttle) (1) and check engine operation (TM 9-2320-360-10). If engine overspeeds (2225 rpm maximum), notify supervisor. b. Press engine brake retarder ON/OFF switch (2) to ON position. Press engine brake retarder HI/LO switch (3) to LO position. Fully press accelerator pedal (1), then release. There should be low engine braking. Press engine brake retarder HI/LO switch (3) to HI position. Fully press accelerator pedal, then release. There should be high engine braking. If engine brake retarder does not operate properly, refer to troubleshooting (para 2-13). 	<ol style="list-style-type: none"> a. Engine overspeeds. b. Engine overspeeds.

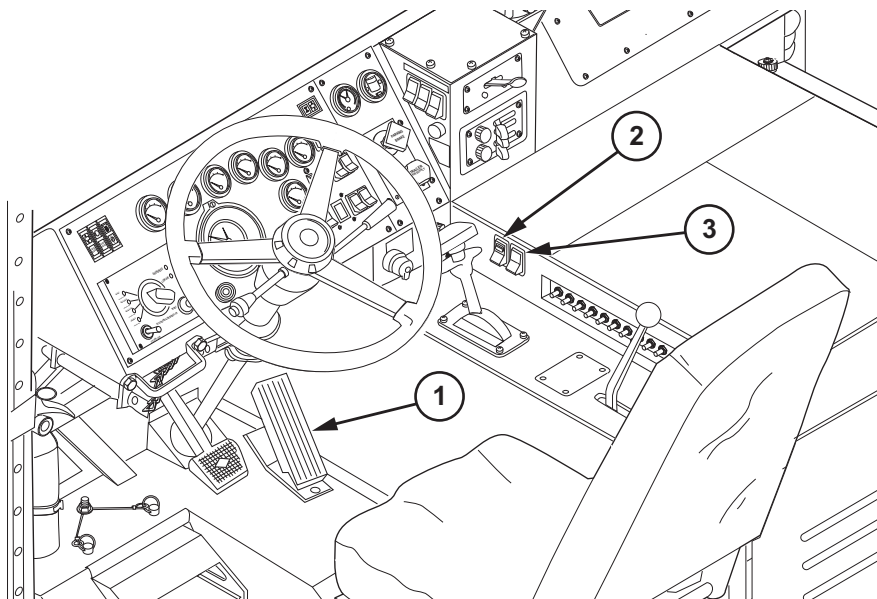


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
26.1	Semi-annually	SEAT BELTS	<p style="text-align: center;"><u>WARNING</u></p> <ul style="list-style-type: none"> • Failure to properly inspect and maintain seat belts can cause serious injury or loss of life. • If the replacement of any part of the seat belt is required, the entire seat belt assembly must be replaced. <ol style="list-style-type: none"> a. Check for worn webbing (1) at the latch (2) and D-loop (3) areas. b. Check D-loop (3) for free rotation, deformation, cracks or damage. c. Check comfort latch (4) for proper operation, cracks and damage. 	<p>Webbing is cut, frayed, or excessively worn.</p> <p>D-loop does not rotate freely or is deformed, cracked or broken.</p> <p>Comfort latch is broken, or does not lock in place easily and does not release by tugging down on webbing.</p>

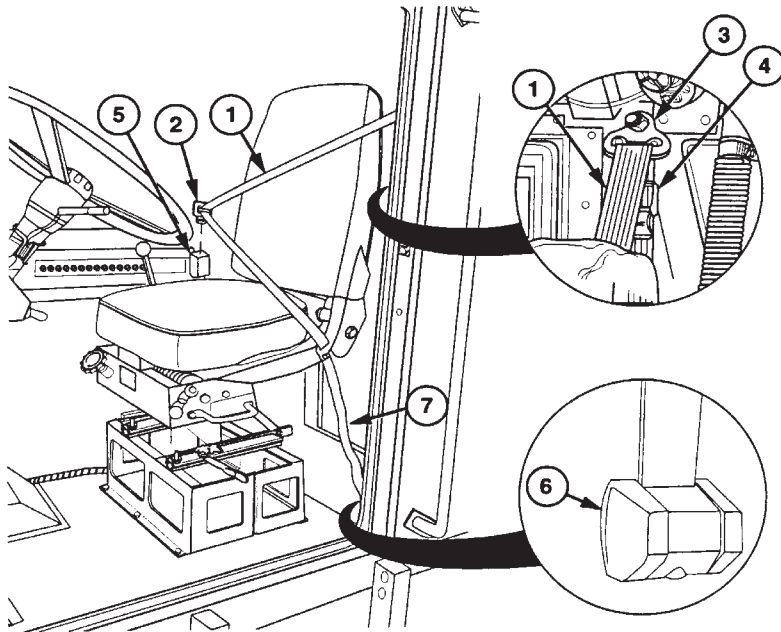


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
26.1 (cont)	Semi-annually	SEAT BELTS (CONT)	<ul style="list-style-type: none"> d. Check latch (2) and buckle (5) for wear, deformation, damage or broken casing. e. Check latch (2) and buckle (5) for proper operation. f. Check that retractor (6) is not locked up and spools out/retracts webbing (1) properly. g. Check tethers (7) for proper attachment to seat. h. Check all seat belt mounting hardware for looseness and other damage. 	<p>Molded plastic around buckle/latch is deformed, cracked or broken.</p> <p>Buckle/latch does not engage with a solid sounding "click" and/or does not release freely when button is pushed.</p> <p>Retractor does not operate properly or retractor cover is cracked/broken.</p> <p>Tethers are loose or missing.</p> <p>Hardware is loose, missing, rusted, corroded or damaged.</p>

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
27	Annually	EXTERIOR	<p>a. Check mud flap (1) for rips and loose or missing mounting hardware. If fault is found, refer to mud flap replacement (para 16-6).</p> <p>b. Check winch personnel guard (2) for cracks, bends, and loose or missing mounting hardware. If faults are found, refer to personnel guard replacement (para 17-8).</p>	
<p>The diagram shows a side view of a heavy-duty vehicle. A circular callout '1' points to a mud flap mounted on the front wheel. Another circular callout '2' points to a personnel guard located behind the winch mechanism on the side of the vehicle.</p>				
27.1	Annually	COOLING SYSTEM	<p style="text-align: center;">NOTE</p> <p>Fan clutch checks must be done when the engine coolant temperature is less than 195°F (91°C).</p> <p>a. Pull fan blade forward and then toward engine. There should be no forward or rearward movement of fan mounting hub (1). If fault is found, replace fan clutch (para 6-9).</p> <p>b. Push tip of a fan blade with light force clockwise, then counterclockwise. If rotational movement exceeds 1/2 in. (12.7 mm), replace fan clutch (para 6-9).</p>	

2-57 Table 2-1. Preventive Maintenance Checks and Services (Cont)

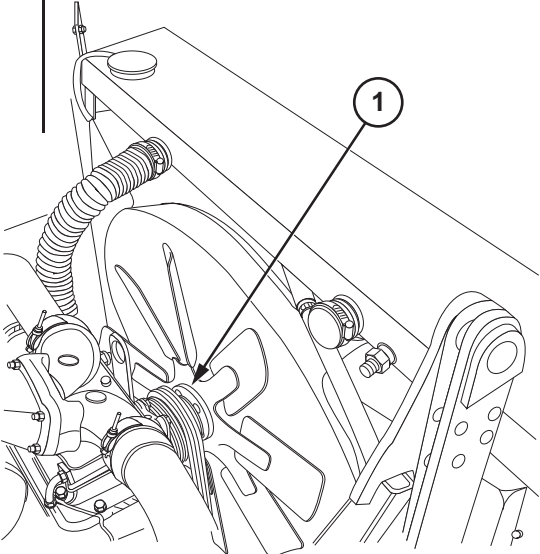
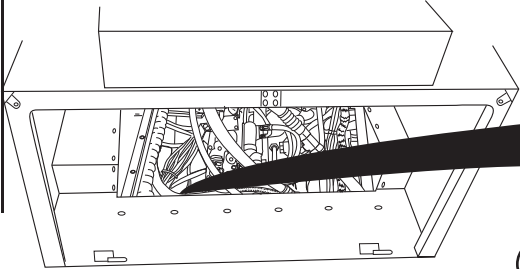
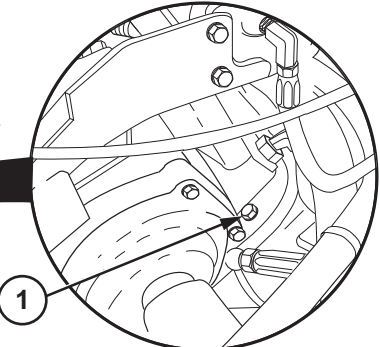
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
27.1 (cont)	Annually	COOLING SYSTEM (CONT)		
28	Annually	TRANSMISSION	<p>a. Disconnect batteries (para 7-61).</p> <p>WARNING Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes. Always wear eye protection when working with batteries.</p> <p>b. Check PTO (1) for loose mounting hardware, leakage, or cracks.</p>	b. Leaks are found.
				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
28 (cont)	Annually	TRANSMISSION (CONT)	<p>c. Service transmission breather:</p> <p style="text-align: center;">NOTE</p> <p>Transmission breather can be accessed by reaching under power steering pump, between air compressor and power steering pump.</p> <p>(1) Remove transmission breather (2) from reducer (3).</p> <p style="text-align: center;"><u>WARNING</u></p> <p>Solvent cleaning compound MIL-PRF 680 Type II and III may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Use respirator as needed. Accidental ingestion can cause irritation of digestive tract and respiratory tract, may cause lung and central nervous system damage. Can be fatal if swallowed. Inhalation of high/massive concentrations can cause coma or be fatal. First aid for ingestion: do not induce vomiting. Seek immediate medical attention. First aid for skin contact: remove contaminated clothing. Wash skin thoroughly with soap and water. If symptoms persist, seek medical attention. First aid for eye contact: flush with water for 15 minutes or until irritation subsides. If symptoms persist, seek medical attention. First aid for inhalation: move to fresh air. If not breathing, provide artificial respiration. If symptoms persist, seek medical attention. Keep away from open flames and other sources of ignition. Failure to follow this warning may result in injury or death to personnel.</p> <ul style="list-style-type: none"> •The flashpoint for type II solvent cleaning compound is 141-198°F (61-92C) and type III is 200-241°F (93-116C). •Improper cleaning methods and use of unauthorized cleaning solvents may injure personnel and damage equipment. •Fire extinguishers should be placed nearby when using solvent cleaning compound. Failure to follow this warning may result in injury or death. •Cloths or rags saturated with solvent cleaning compound must be disposed of IAW authorized facilities' procedures. Failure to follow this warning may result in injury. •Eye shields must be worn when cleaning with a wire brush. Flying rust and metal particles may cause injury. <p>(2) Clean transmission breather (2) with solvent cleaning compound.</p>	

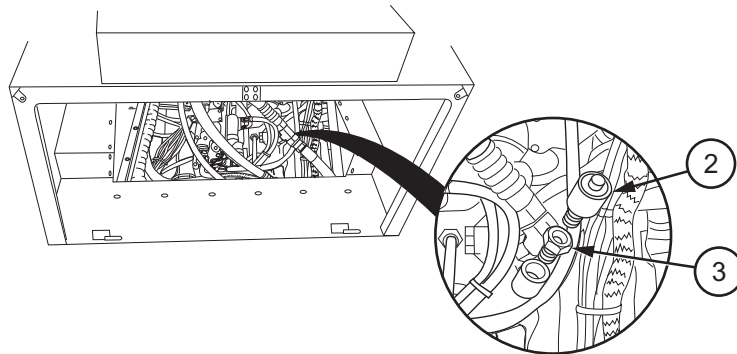


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
28 (cont)	Annually	TRANSMISSION (CONT)	<p style="text-align: center;"><u>WARNING</u></p> <p>Compressed air for cleaning purposes will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).</p> <ul style="list-style-type: none"> (3) Dry transmission breather (2) with compressed air. (4) Check inside transmission breather (2) for contamination. Ensure cap moves in and out freely. <p style="text-align: center;"><u>WARNING</u></p> <p>Pipe thread sealing compound may burn or give off harmful vapors. It is harmful to skin and clothing. To avoid injury or death, keep away from open flame and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.</p> <p style="text-align: center;"><u>CAUTION</u></p> <p>Use pipe thread sealing compound sparingly only on pipe threads. Do not apply compound to hose connections. Failure to comply may result in component failure.</p> <ul style="list-style-type: none"> (5) Coat threads of breather (2) with pipe thread sealing compound. (6) Install breather (2) in reducer (3). 	

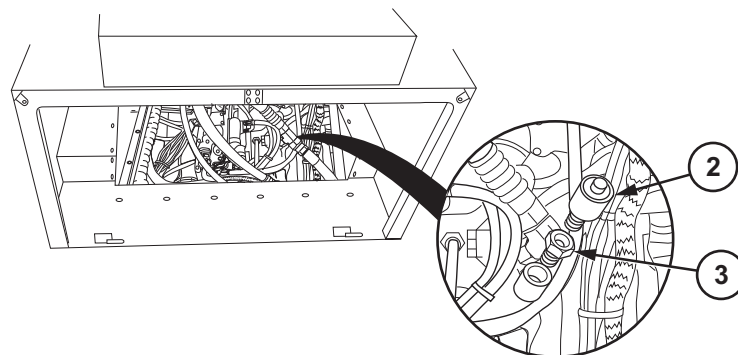


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
29	Annually	TRANSFER CASE	<p>a. Service transfer case breather.</p> <p>(1) Remove transfer case breather (1) from elbow (2). Discard breather.</p> <p>WARNING</p> <p>Pipe thread sealing compound may burn or give off harmful vapors. It is harmful to skin and clothing. To avoid injury or death, keep away from open flame and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.</p> <p>CAUTION</p> <p>Use pipe thread sealing compound sparingly only on pipe threads. Do not apply compound to hose connections. Failure to comply may result in component failure.</p> <p>(2) Coat threads of new breather (1) with pipe thread sealing compound.</p> <p>(3) Install new breather (1) in elbow (2).</p>	

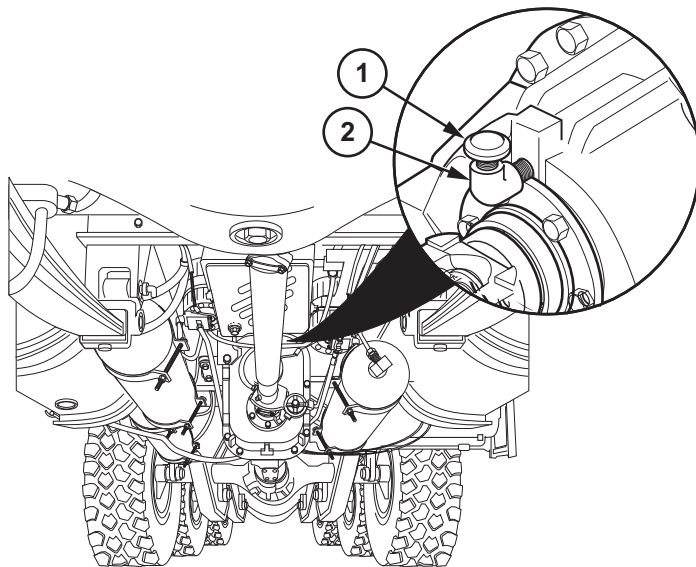


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
30	Annually	AIR SYSTEM	<ul style="list-style-type: none"> a. Check air governor adjustment (para 11-30). If not correct, adjust air governor. b. Service both air dryers (para 11-32). c. Service aftercooler (para 11-34.3). d. Service coalescing filter (para 11-34.2). 	a. Air governor cannot be adjusted.
31	Annually	AUXILIARY EQUIPMENT ARCTIC KIT (IF EQUIPPED)	Check water jacket (1) and coolant pump (2) for cracks, leaks, and missing mounting hardware. If faults are found, refer to arctic kit water jacket replacement (para 19-9) or arctic kit coolant pump replacement (para 19-6).	Any leaks are found.

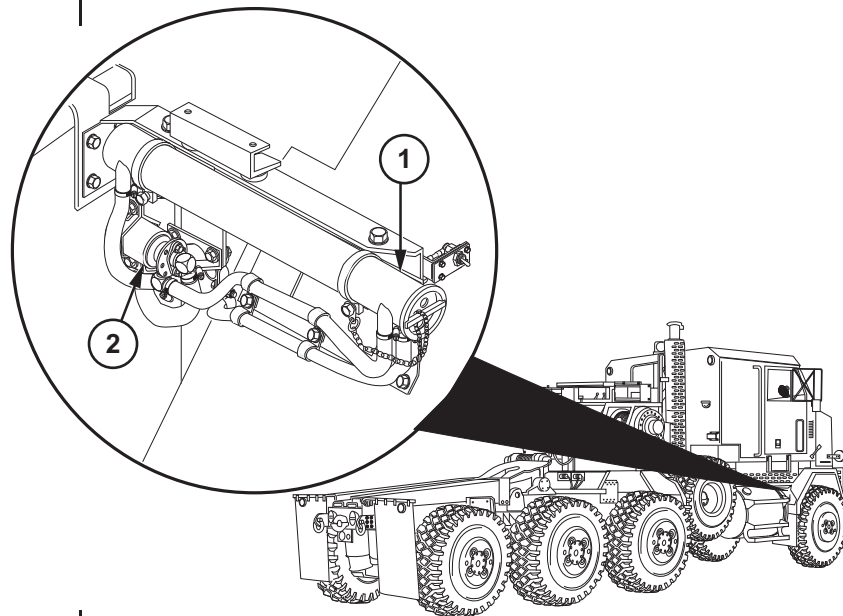


Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
32	Annually	STEERING	<p style="text-align: center;"><u>WARNING</u></p> <ul style="list-style-type: none"> • Auxiliary steering pump is driven by transfer case center shaft. To test operation of auxiliary steering pump, transfer case shafts must be turned by running the engine. Propeller shafts must be disconnected to prevent movement of HET Tractor. Failure to comply may result in injury to personnel. • Never disconnect any hydraulic hose while engine is running. Allow several minutes after engine is shut off for pressure to drop. Failure to comply may result in injury to personnel. <p style="text-align: center;">NOTE</p> <p>Propeller shafts only have to be disconnected from transfer case end. Leave propeller shafts attached at axle end.</p> <ol style="list-style-type: none"> a. Remove transfer case to axle no. 1 propeller shaft and transfer case to axle no. 2 propeller shaft from transfer case yokes (para 10-2). 	

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
32 (cont)	Annually	STEERING (CONT)	<p>b. Remove hose no. 2879 (1) from auxiliary steering pump manifold (2).</p> <p style="text-align: center;">NOTE</p> <p>Fluid will drip from fitting during test. Do not cap manifold fitting. Auxiliary steering will be intermittent if fitting is capped.</p> <p>c. Install plug (Item 28.1, Appendix F) in hose no. 2879 (1).</p> <p>d. Position drain pan under auxiliary steering pump manifold (2).</p>	
			<p style="text-align: center;">WARNING</p> <p>Keep out from under vehicle during test. Transfer case output yokes will rotate during test. Failure to comply may result in injury to personnel.</p> <p>e. Place transfer case shift lever in HIGH range (TM 9-2320-360-10).</p> <p>f. Start engine (TM 9-2320-360-10).</p> <p>g. Place transmission range selector in 2-5 position (TM 9-2320-360-10).</p>	

Table 2-1. Preventive Maintenance Checks and Services (Cont)

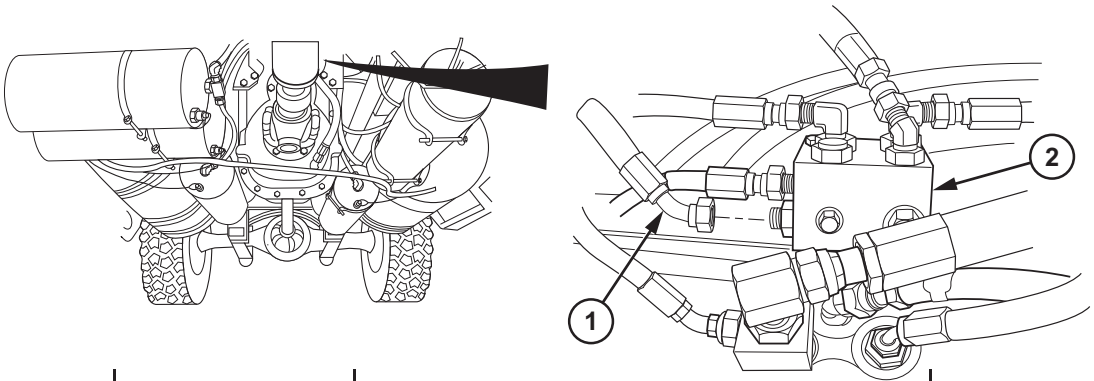
ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
32 (cont)	Annually	STEERING (CONT)	<p style="text-align: center;">NOTE</p> <p>Transmission must shift from 2nd to 3rd gear before accurate test results can be obtained.</p> <p>h. Increase engine speed until tachograph indicates approximately 20 mph.</p> <p style="text-align: center;">NOTE</p> <p>If steering wheel cannot be turned, refer to direct support maintenance for troubleshooting.</p> <p>i. Turn steering wheel several times from full right to full left position.</p> <p>j. Shut off engine (TM 9-2320-360-10).</p> <p>k. Remove plug from hose no. 2879 (1).</p> <p>l. Install hose no. 2879 (1) on steering pump manifold (2).</p> <p>m. Install transfer case to axle no. 1 propeller shaft and transfer case to axle no. 2 propeller shaft (para 10-2).</p>	i. Steering wheel cannot be turned during test.
				

Table 2-1. Preventive Maintenance Checks and Services (Cont)

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
32 (cont)	Annually	STEERING (CONT)	<p>n. Check steering stops on no. 1 and no. 4 axles.</p> <p>(1) Apply parking brake (TM 9-2320-360-10).</p> <p>(2) Chock wheels.</p> <p>(3) Start engine (TM 9-2320-360-10).</p> <div style="text-align: center;"> <p>The diagram shows a side view of a truck with a callout circle. Inside the callout, a steering stop (1) is shown as a bolt-like component, and the axle housing (2) is shown as a cylindrical component. Arrows point from the callout to the corresponding parts on the truck's front end.</p> </div> <p>WARNING Keep out from under vehicle when assistant turns steering wheel. Failure to comply may result in injury to personnel.</p> <p>(4) Turn steering wheel to full right position.</p> <p>(5) Inspect for 1/16-1/8 in. (1.6-3.2 mm) clearance between steering stop (1) and axle housing (2).</p> <p>(6) Turn steering wheel to full left position and repeat inspection of left steering stop.</p> <p>(7) Shut off engine (TM 9-2320-360-10).</p>	<p>n. Steering stop to axle housing clearance is not 1/16-1/8 in. (1.6-3.2 mm). Contact direct support maintenance for steering stop adjustment.</p>

Section IV. TROUBLESHOOTING

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING

a. Page Layout The troubleshooting is divided into symptoms peculiar to a vehicle system or component (for example, air system or fifth wheel). This manual cannot list all malfunctions that may occur, nor all tests, inspections, or corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify supervisor.

First, determine the symptom or condition that indicates a problem or failure. Refer to Table 2-5. Engine Electronic Controls (DDEC) Troubleshooting or Table 2-7. Vehicle Troubleshooting following this introduction arranged by major vehicle system.

Go to the referenced page to begin troubleshooting. Open the manual flat so that both the right and left hand pages are displayed before you. The information on all facing pages is important.

All diagnostic logic and flowcharts are on the left hand page, with supporting information, warnings, cautions, notes, and test instructions on the right. (See figure on next page.) Pages are set up so you do not need any more than the necessary information, notes, warnings and cautions about a particular question. The experienced technician can generally read just left hand pages and refer to information on the right page when needed. All critical information for decisions is on the left page. Do the tests and inspections in the order listed, and try to return the vehicle or component to operation after each test, inspection, and corrective action has been performed.

b. How To Begin Troubleshooting

- (1) Identify the symptom or fault. Select the applicable symptom (grouped by systems). Follow Vehicle Troubleshooting BEFORE going to DDEC Troubleshooting.
- (2) Follow the diagnostic procedure. Answer question no 1. on the left hand page and follow the YES or NO path to either the remedy or the next question. Helpful information about the problem is also on the left page. Look on the right page for additional specific instructions and help.
- (3) Observe warnings, cautions, and notes. **WARNING** is the symbol for a warning statement. If you see this block above a question on the left page, look on the right page for the text of the message. The **WARNING** message on the right page will also have the symbol above it. **CAUTION** is the symbol for a caution statement. If you see this block above a question on the left page, look on the right hand page for the text of the message. The **CAUTION** message on the right hand page will also have the symbol above it. Examples:

WARNING

The ENGINE switch should always be OFF before the harness connectors are disconnected or reconnected. Failure to comply may result in electrical shock.

CAUTION

When disconnecting harness connectors, apply pulling force to the connectors themselves and not the wires extending from them. Failure to comply will damage wire.

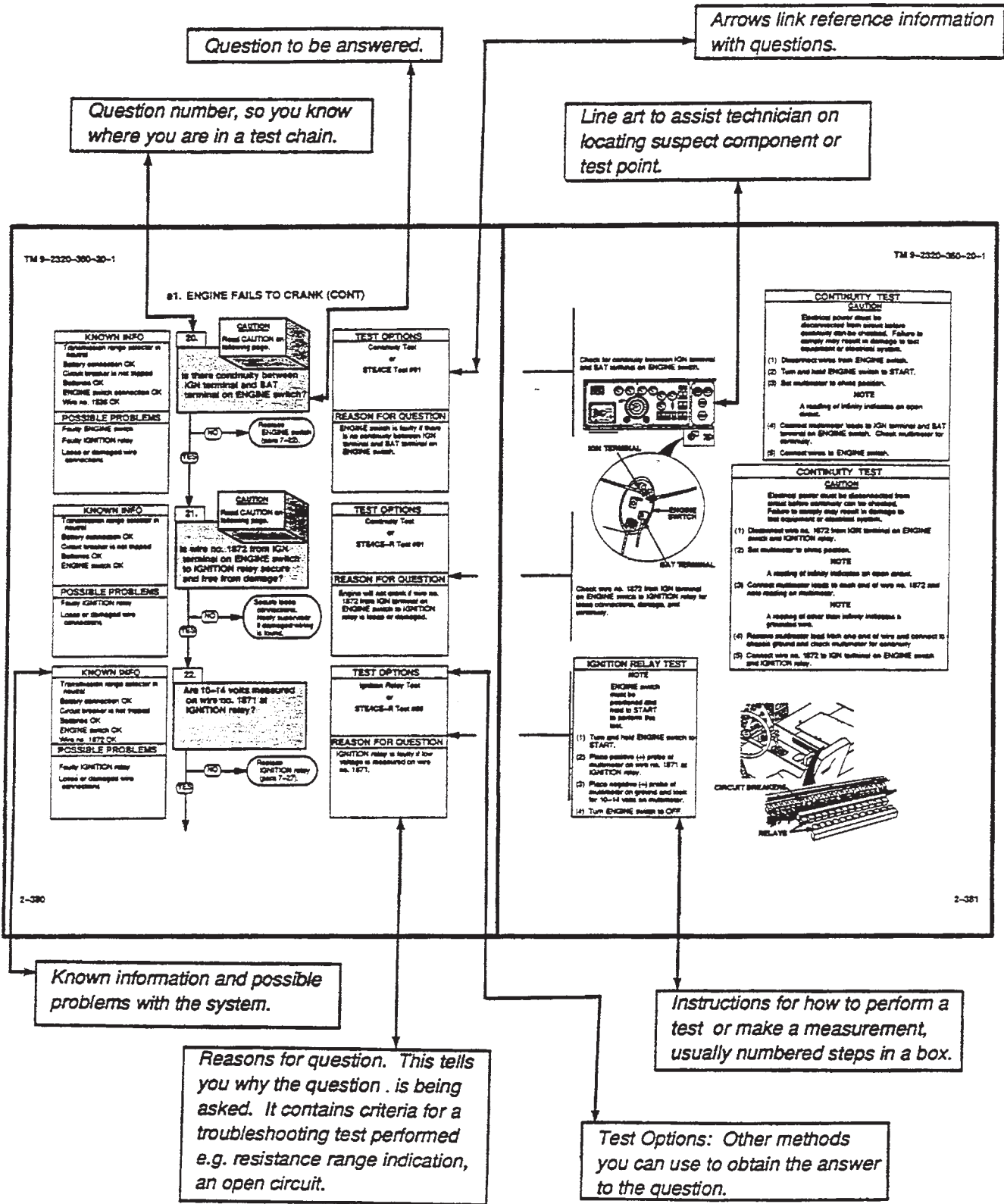
NOTE

After harness connectors are reconnected to the DDEC system, the computer diagnostics should be ignored and cleared.

c. Measurements Required for Troubleshooting

- (1) Resistance Measurements
 - (a) Connect the red test lead to the volt-ohm input connector and black lead to the Common (COM) input connector on the meter.

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)



- (b) Set the function/range switch to the desired ohm position. If the magnitude of the resistance is not known, set the switch to the highest range, then reduce until a satisfactory reading is obtained.
- (c) If the resistance being measured is connected to a circuit, turn ENGINE switch OFF.
- (d) Connect test leads to the circuit being measured. When measuring high resistance, be careful not to contact adjacent points, even if they are insulated. Some insulators have a relatively low insulation resistance which can affect the resulting measurement.
- (e) Read the resistance value on the digital display.

(2) Continuity Checks

- (a) Place the function/range switch in any ohm range.

NOTE

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

- (b) Connect the red lead to the volt-ohm connector and black lead to COM input connector on the meter. With the test leads separated or measuring an out-of-range resistance, the digital display will indicate 'OL' (overlimit).
- (c) Put one test lead probe at one end of the wire or circuit to be tested. Use the other test lead to trace the circuit. When continuity is established, an ohm symbol will appear in the upper left corner of the digital display. If contact in the wire is maintained long enough (about 1/4 of a second), the OL will disappear and the resistance value of the wire or circuit will appear next to the symbol.

(3) Voltage Measurements

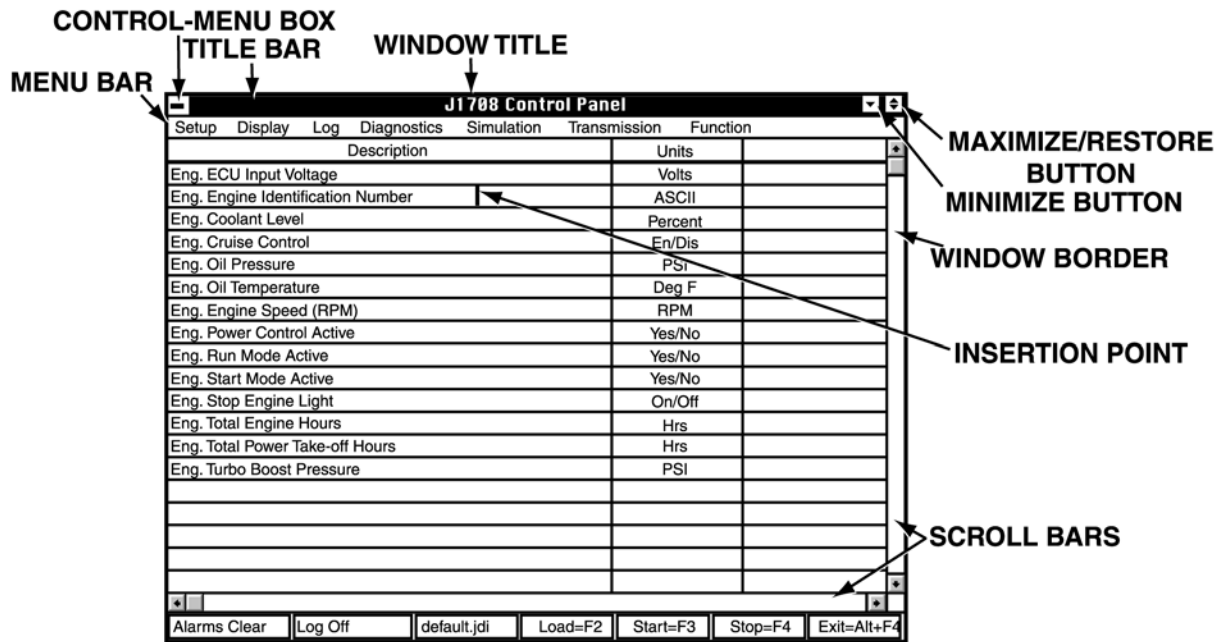
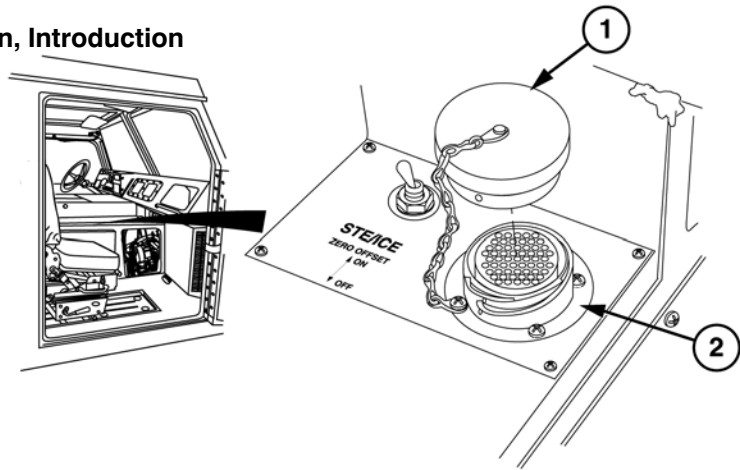
- (a) Connect the red test lead to the volt-ohm input connector and the black lead to the COM input on the meter. If a DC-AC switch is present, make sure it is switched to the DC position.
- (b) Set the function/range switch to the desired volts position. If the magnitude of the voltage is not known, set the switch to highest DC voltage range (50VDC). Then reduce the range until a satisfactory reading is obtained.
- (c) Connect the test leads to the circuit being measured. Voltage measurements are always taken at pins, sockets, Battery + or ground. Following the voltage measurement point, the color test lead used is given in parenthesis (red is volt-ohm connection, and black is the COM connection).

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)

d. Contact Test Set (CTS), J1708 Application, Introduction

(1) Connecting CTS to HET M1070

- (a) Remove cover (1) from diagnostic connector assembly (DCA) (2) by turning counterclockwise.
- (b) Install DCA cable on DCA (2).
- (c) Prepare CTS for operation (TM - X-XXXX-XXX-XX).

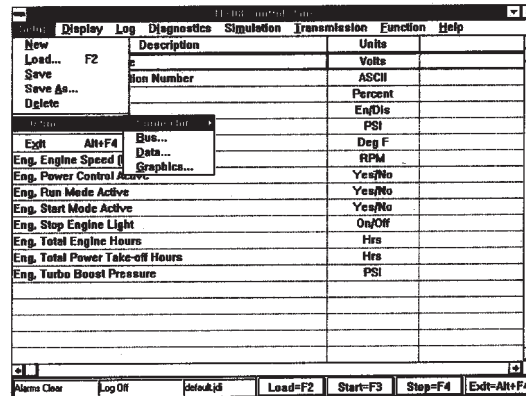


(2) Parts of the Display Window

- (a) Control-Menu Box. Located in the upper-left corner of each window. Used to re-size, move, maximize, minimize, and close windows, and to switch to other applications.
- (b) Title Bar.
- (c) Window Title. The name of the application - J1708 Control Panel.
- (d) Menu Bar. Lists the available menus. A menu consists of a list of commands, or actions you can carry out.
- (e) Scroll Bars. You can move parts of document into view when the entire document does not fit in the window.
- (f) Maximize/Minimize Buttons. Maximize is used to enlarge the window so it fills the entire desktop, Minimize is used to reduce the window to an icon.

- (g) Restore Button. After you enlarge a window, the maximize button is replaced by the restore button. Clicking the restore button will restore the window to its original size.
- (h) Window Border. The outside edge of a window. Used to lengthen or shorten the border on each side of the window. The window corner can be used to shorten or lengthen two sides of the border at the same time.
- (i) Insertion Point. Where you are at in the document. The mouse pointer changes position on the screen when you move the tracker ball.

(3) J1708 Menu Commands



- (a) Setup Menu Commands. The commands in this section allow the operator to customize to main display area of the program. The operator has the option of selecting a previously displayed format and save a new display format.
 1. New. The New command will delete all items that are on the Data Display Window. This includes all display setups and data. Do not use this command if you wish to delete only data information.
 2. Load. The Load command allows the user to select and load a Display Setup File which has been previously saved. These file names will be listed on the display and will be identified by the extension “_____ .jdi”. Only files with the “.jdi” extension are allowed to load.
 3. Save. The Save command allows the user to save a custom display as a new Display Setup File. The new file name must contain no more than eight characters, followed by the “.jdi” extension.
 4. Save As. The Save As command allows the user to save a Display Setup File under a different file name. With this command, the operator can copy a frequently used Display Setup so it can be modified for a new need. The new file name must contain no more than eight characters, followed by the “.jdi” extension.
 5. Delete. The Delete command allows the user to delete a Display Setup File. Only a file with a “.jdi” extension is allowed to be deleted.
 6. Define. The Define command allows define CTS J1708 options. When Define is selected, four choices are given:
 - Connector. Allow user to select the DCA connector or the diagnostic data link (DDL) connector located inside the electrical control box (ECB).
 - Bus. Not applicable.
 - Data. Allows the user to select and deselect the data lines displayed on the main display area of the screen. The information will be displayed in a text format.
 - Graphics. The operator can select between three types of graphics readouts: digital readout, bar graph readout, or gage readout.

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)

HET M1070 Control Panel							
Setup	Display	Log	Diagnostics	Simulation	Transmission	Function	Help
Eng. ECU Input Voltage	Stop F4		Description			Units	
Eng. Engine Identification Number	Clear					Volts	
Eng. Coolant Level			ion Number			ASCII	
Eng. Cruise Control						Percent	
Eng. Oil Pressure						En/Dis	
Eng. Oil Temperature						PSI	
Eng. Engine Speed (RPM)						Deg F	
Eng. Power Control Active						RPM	
Eng. Run Mode Active						Yes/No	
Eng. Start Mode Active						Yes/No	
Eng. Stop Engine Light						On/Off	
Eng. Total Engine Hours						Hrs	
Eng. Total Power Take-off Hours						Hrs	
Eng. Turbo Boost Pressure						PSI	

Alarms Clear Log Off default.id Load=F2 Start=F3 Stop=F4 Exit=Alt+F4

- (b) Display Menu Commands. The commands in this section allow the operator to control the data that is being displayed.
 1. Start. The start F4 command allows the user to start the display data after it has been stopped for viewing. The command only affects the data which is being displayed.
 2. Stop. The Stop command allows the user to stop the constantly changing display data. This allows the operator to freeze the display and study the data.
 3. Clear. The Clear command allows the operator to clear the data values from the various readouts. New data will be displayed as it becomes available.
- (c) Log Menu Commands. The commands in this section allow the operator to control the various log functions. The operator may play back a previously recorded log, or may create a new log to store incoming data. This function is not used in the HET M1070 troubleshooting.

HET M1070 Control Panel							
Setup	Display	Log	Diagnostics	Simulation	Transmission	Function	Help
Eng. ECU Input Voltage			Alarms			Units	
Eng. Engine Identification Number						Volts	
Eng. Coolant Level						ASCII	
Eng. Cruise Control						Percent	
Eng. Oil Pressure						En/Dis	
Eng. Oil Temperature						PSI	
Eng. Engine Speed (RPM)						Deg F	
Eng. Power Control Active						RPM	
Eng. Run Mode Active						Yes/No	
Eng. Start Mode Active						Yes/No	
Eng. Stop Engine Light						On/Off	
Eng. Total Engine Hours						Hrs	
Eng. Total Power Take-off Hours						Hrs	
Eng. Turbo Boost Pressure						PSI	

Alarms Clear Log Off default.id Load=F2 Start=F3 Stop=F4 Exit=Alt+F4

- (d) Diagnostics Menu Commands. The commands in this section allow the operator to view the alarms (active codes) and work the status diagnostics.
 1. Alarms (Active Codes). The Alarms command allows the operator to view all the systems alarms (active codes). When this command is selected, the Current Alarms window is displayed. This window will display all alarms (active codes) that have been detected since system start up or the last time this window was cleared. From this window, the operator can also set the alarm priority for both the Pop-up Window and the Beep Alarm.
 2. Status. Not applicable.

- (e) Simulation Menu Commands. The commands in this section allow the J1708 unit to be used as a training simulator. This application is not used during troubleshooting of the HET M1070.
- (f) Transmission Menu Commands. The commands in this section allow the operator to select the modes for ATEC Transmission Data. This application is not used on the HET M1070 Tractor.

J1708 Computer Control			
Setup	Display	Log	Diagnostics
Simulation	Transmission	Function	Help
Description	Unit	Reset	
Eng. ECU Input Voltage	V _{dc}	Restart Data Time-Out	
Eng. Engine Identification Number	AS	DDEC-II Options	
Eng. Coolant Level	Percent		
Eng. Cruise Control	En/Dis		
Eng. Oil Pressure	PSI		
Eng. Oil Temperature	Deg F		
Eng. Engine Speed (RPM)	RPM		
Eng. Power Control Active	Yes/No		
Eng. Run Mode Active	Yes/No		
Eng. Start Mode Active	Yes/No		
Eng. Stop Engine Light	On/Off		
Eng. Total Engine Hours	Hrs		
Eng. Total Power Take-off Hours	Hrs		
Eng. Turbo Boost Pressure	PSI		

Alarms Clear Log Off Help=H,Id Load=F2 Start=F3 Stop=F4 Exit=Alt+F4

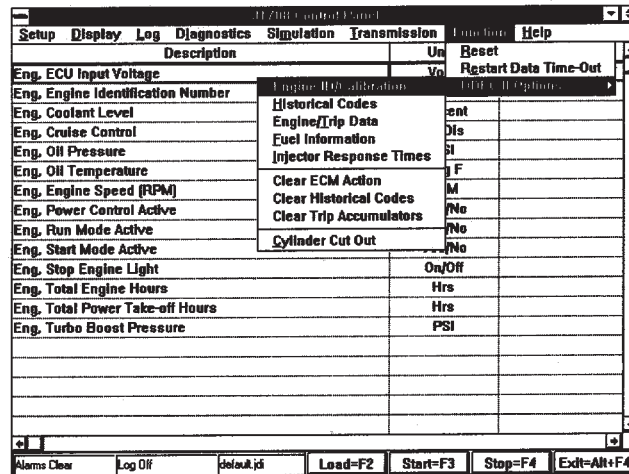
- (g) Function Menu Commands. The commands in this section allow the operator to reset the J1708 computer board and to choose various DDEC options.
 1. Reset. The Reset command is used to reset the J1708 board. When this command is used, all board functions will be reset to zero (0) and the Electronic Control Module (ECM) will run through a self test.
 2. Restart Data Time-out. This selection is used to re-start the time-out test sequence for the presence of J1708 data when the "No J1708 Input Data" message is displayed.
 3. DDEC-II Option Commands. Refer to paragraph (4) for details.

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)

Description	Units
Eng. ECU Input Voltage	Volts
Eng. Engine Identification Number	ASCII
Eng. Coolant Level	Percent
Eng. Cruise Control	En/Dis
Eng. Oil Pressure	PSI
Eng. Oil Temperature	Deg F
Eng. Engine Speed (RPM)	RPM
Eng. Power Control Active	Yes/No
Eng. Run Mode Active	Yes/No
Eng. Start Mode Active	Yes/No
Eng. Stop Engine Light	On/Off
Eng. Total Engine Hours	Hrs
Eng. Total Power Take-off Hours	Hrs
Eng. Turbo Boost Pressure	PSI

- (h) Help Menu Commands. The commands in this section allow the user to access the on-line help topics.
 1. Contents. This section lists the Help items that are available to the operator from this program. These items may be selected directly from this list or from the Help Menu Commands window.
 2. Commands. This section allows the operator to access descriptions of the commands found in this program. When the operator selects one of the menu selections listed below, the screen will display descriptions for the commands found under that menu. For instructions on how to use the commands, the operator should go back to the Main Help Menu and select "PROCEDURES".
 3. Procedures. This menu allows the user to select the procedures to perform various tasks within the J1708 User Interface program.
 4. Using Help. If you are new to Help, choose Help Basics. Use the scroll bar to view information not visible in the Help window. Click on the underlined topic you want to view, or press tab to select a topic, and then press ENTER.
 5. About. Information about the J1708 application, such as copyright, version, and application name; the mode Windows is running in; and the amount of memory available on your computer.

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)



- (4) DDEC-II Option Menu. Click on "OK" to return to the main window from the DDEC-II Options Menu.
 - (a) Engine ID/Calibration. Click on "Engine ID/Calibration". A pop up window will be displayed with the following information:
 1. Engine ID (Identification).
 2. ECM S/N (Electronic Control Module Serial Number).
 3. No. of Cyl (Number of Cylinders).
 4. EPA Cert. No. (EPA Certification Number).
 5. SW Level (ECM Software Version).
 6. Box Type (indicates whether ECM supports 6 or 8 cylinders).
 7. Pk Trq (Peak Torque in lb-ft).
 8. Spd Pk Trq (RPM at which peak torque is obtained).
 9. Option Word Window (status of options).
 10. Shutdown Word Window (status of shutdown words).
 - (b) View Historical Codes. Click on "Historical Codes". If historical codes are present, they will be displayed in a pop up window. The only codes displayed are those stored by the ECM since the last time the historical codes were cleared. If no codes are stored in the ECM, "No Historical Codes" will be displayed in the pop up window.
 - (c) Engine/Trip Data. Click on "Engine/Trip Data". A pop up window will be displayed with the following information:
 1. Fuel GPH (estimated fuel consumption rate in gallons per hour).
 2. Total GAL (estimated total fuel used in gallons).
 3. Eng Hours (total hours of engine operation).
 4. PTO Hours (total hours of PTO operation).
 5. Instant MPG (estimated instantaneous miles per gallon).
 6. Ave MPG (estimated average miles per gallon).
 7. Trip Miles (total distance since reset).

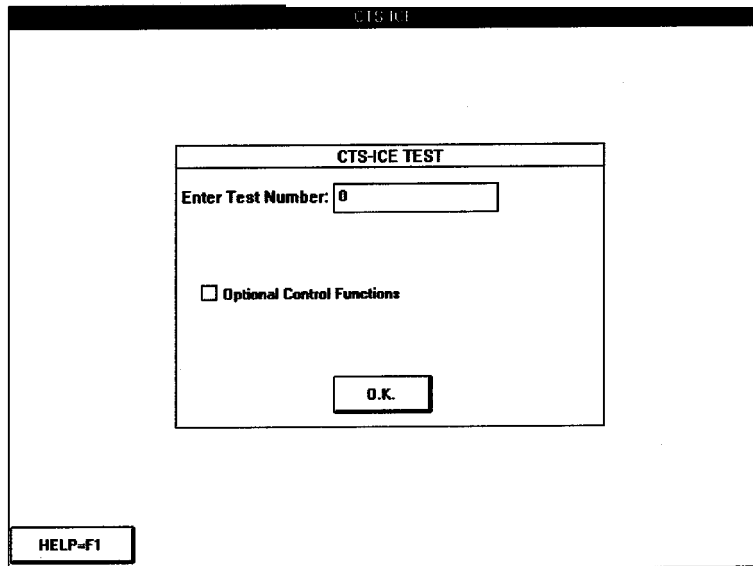
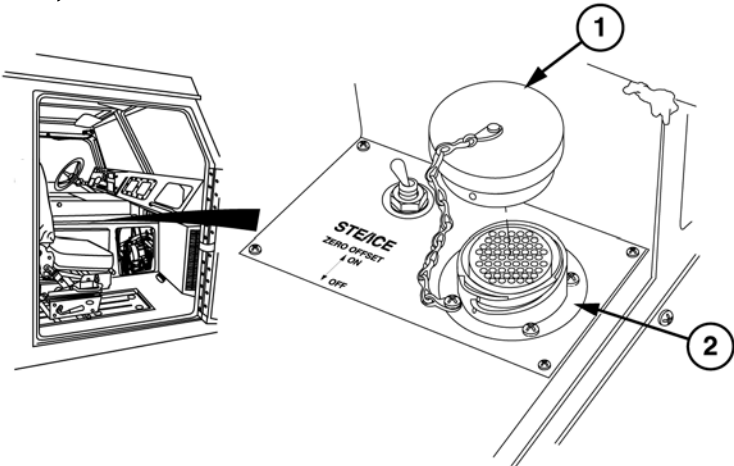
8. Trip GAL (estimated total fuel used since reset).
- (d) Fuel Information. Not applicable.
 - (e) Injector Response Times. Click on "Injector Response Times". The DDEC Injector Response Time Window will be displayed.
 - (f) Clear ECM Actions. Click on "Clear ECM Action". A pop up window will be displayed verifying the step. Click on "OK" to clear all ECM actions, click on "CANCEL" to return to the main window.
 - (g) Clear Historical Codes. Click on "Clear Historical Codes". A pop up window will be displayed verifying the step. Click on "OK" to erase all historical codes, click on "CANCEL" to return to the main window.
 - (h) Clear Trip Accumulators. Not applicable.
 - (i) Cylinder Cutout Function.
 1. Click on "Cylinder Cutout".
 2. Click on "Auto" or "1000 RPM". If "AUTO" is selected, the ECM will automatically cutout one cylinder at a time and the test results will be displayed as they occur. If "MANUAL" is selected, the operator must select the individual cylinder to be cutout.
 3. Click on "Idle" or "1000 RPM".
 4. Click on "Start", "Stop" or "Cancel". Selecting "Start" will change display to "Re-Start", and function will run until either "Stop" or "Cancel" is selected. If "Stop" is selected, the function will stop and "Re-Start" will change back to "Start". If "Cancel" is selected, the function will stop and the operator will be returned to the main menu.

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)

d.1. Contact Test Set (CTS), CTS-ICE Application, Introduction

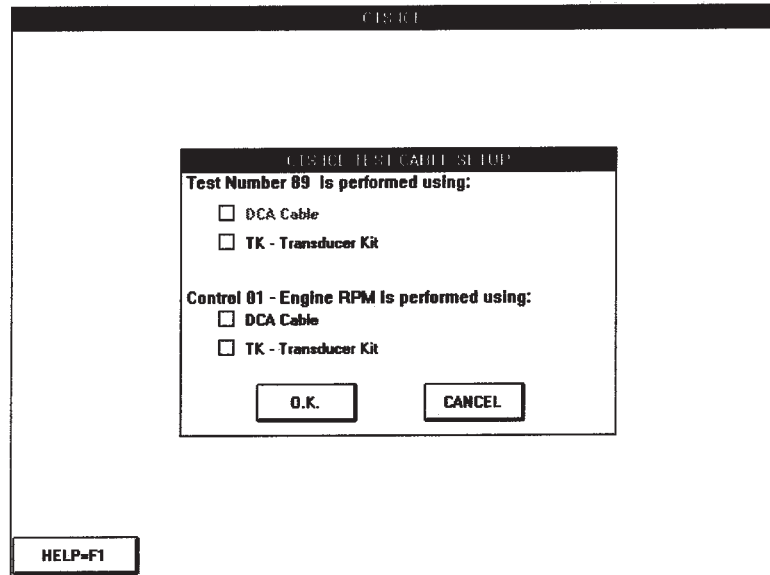
(1) Connecting CTS to HET M1070

- (a) Remove cover (1) from diagnostic connector assembly (DCA) (2) by turning counterclockwise.
- (b) Install DCA cable on DCA (2).
- (c) Prepare CTS for operation (TM - X-XXXX-XXX-XX).



(2) CTS-ICE Menu

- (a) Enter Test Number. Allows the user to enter the desired STE/ICE-R test number. CTS-ICE will display a message if any invalid test numbers are selected.
- (b) Optional Control Functions. CTS-ICE has the capability to perform two STE/ICE-R tests during a single session. For example, if a voltage reading is desired at a specific engine RPM, both STE/ICE-R test #10 (Engine RPM) and test #89 (voltage) can be conducted at the same time. To activate this function, click on the Optional Control Function Box. A message will be displayed if invalid test combinations are selected.
- (c) Click on "O.K." to proceed.



- (d) CTS-ICE Test Cable Set-up. Some STE/ICE-R tests can be conducted using either the DCA connector or external leads and transducers. This screen tells the CTS-ICE unit where to look for the test information. Click on "DCA Cable" for all tests except STE/ICE-R tests #45-51, #89 and #91. For these tests, select "TK - Transducer Kit".
 - (e) Click on "O.K." to proceed with the CTS-ICE test(s).
 - (f) Diagnostics. The selected CTS-ICE test(s) will be performed with detailed procedures specific to those tests selected. Follow instructions given by the CTS-ICE program.
- (3) On-Line Help. Click on "HELP=F1" or press "F1" to access the on-line help portion of the CTS-ICE program. Provides a quick way to find information, such as how to perform a particular task. Highlighted tasks indicate a topic with additional information. This additional information can be viewed by clicking on the highlighted area.
- (a) Using Help. Information on how to use CTS-ICE help.
 - (b) CTS-ICE System Table Of Contents. An alphabetical list of all CTS-ICE help topics available.
 - (c) Alphabetical List of CTS-ICE Tests.
 - (d) Numerical List of CTS-ICE Tests.

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)

e. Abbreviations And Commonly Used Terms

- (1) A/D - Analog to Digital: The computer inside the ECM uses an A/D converter to convert a sensor voltage into a number with which the computer can work.
- (2) Active Codes - These are the codes that currently keep the CHECK ENGINE indicator on. They are read using the Diagnostic Data Reader.
- (3) BAT - Battery
- (4) CEL - CHECK ENGINE indicator: mounted on the instrument dash and used as panel. It has two functions:
 - (a) a warning lamp to tell the driver that a problem has occurred, and that the vehicle should be taken in for service as soon as possible.
 - (b) as a light bulb check and system check the CHECK ENGINE indicator will come on for about five seconds when the ENGINE switch is turned ON. If the CEL remains on, the self-diagnostic system has detected a problem. If the problem goes away, the light will go out, but the (HISTORICAL) trouble code will be stored in the ECM. (See General Diagnostic Information)
- (5) CKT - Circuit
- (6) CLS - Coolant Level Sensor: Monitors coolant level at the radiator tank top.
- (7) COM - Common
- (8) CTS - CONTACT TEST SET: Tool used for troubleshooting DDEC and for STE/ICE-R tests.
- (9) DCA - Diagnostic Connector Assembly: An electrical harness on the vehicle which allows the STE/ICE-R to be powered and to make measurements of key vehicle signals from a single connection. In addition to many basic electrical signals such as starter voltage and current, it includes engine speed and fuel supply pressure. The STE/ICE-R can make TK measurements at the same time that it is connected to the DCA.
- (10) DDEC - Second generation Engine Electronic Controls
- (11) DDL - Diagnostic Data Link: The lines (wires) over which the ECM communicates information to be read by a Diagnostic Data Reader.
- (12) Diagnostics: Troubleshooting by following an exact procedure.
- (13) DL+ - Data Link, positive side. Used for communications to the Diagnostic Data Reader, as well as other applications.
- (14) DL - Data Link, negative side (See above).
- (15) DREQ - Diagnostic Request Terminal: The pin on the DDL connector which must be grounded to obtain diagnostic codes (pin M).
- (16) ECM - Electronic Control Module: The brains of DDEC. It reads the DDEC sensors and switches, calculates injector firing times and duration (using a built-in computer), and fires the injectors at the appropriate times.
- (17) EEPROM - Electronically Erasable Programmable Read Only Memory. Contains the engine calibration.
- (18) EFPA - Electronic Foot Pedal Assembly: contains the Throttle Positions Sensor
- (19) Erratic: intermittent
- (20) EUI - Electronic Unit Injector: replaces the Mechanical Unit Injector (MUI)

- (21) Historical Codes – All codes kept in ECM memory (may not turn the CHECK ENGINE indicator). These codes can be cleared by using the Diagnostic Data Reader.
- (22) OPS – Oil Pressure Sensor: monitors oil pressure at the main oil gallery.
- (23) OTS – Oil Temperature Sensor: monitors oil temperature in the turbo oil supply line.
- (24) PCB – Protective Control Box: Located on the firewall above the brake pedal.
- (25) PW – Pulsewidth: the amount of time in crank degrees that the ECM is requesting the injectors to be turned on.
- (26) SEL – CHECK GAUGES Indicator: mounted on the dash, it lights to warn the driver when a potential engine damaging condition has been detected (low oil pressure, low coolant, or engine over temperature). As a light bulb check and system check, the CHECK GAUGES indicator will come on for about five seconds when ignition takes place.
- (27) SRS – Synchronous Reference Sensor: detects when the first cylinder in the firing order is about to be fired.
- (28) STE/ICE-R – Simplified Test Equipment for Internal Combustion Engines –Reprogrammable: A testing system used for performing tests and measurements on the vehicle. In addition to acting as a conventional digital multimeter to measure voltage, current and resistance, it is also capable of measuring pressure, speed, compression unbalance, engine power, and some specialized battery and starter evaluations. It is powered from the vehicle batteries. The complete system includes a vehicle test meter (VTM), a transducer kit (TK), cables, transit case, and technical publications. STE/ICE tests are referenced.
- (29) System: A collection of devices which are all related to each other because they depend on each other to do some function or job. For example, the function of the fuel system is to inject fuel into the cylinders at the correct time in the correct quantity. The collection of devices that are required to do this include the fuel pump, fuel lines, lift pump, fuel filter, injection pump, and injectors.
- (30) TBS – Turbo Boost Sensor: used to monitor turbo boost pressure. The sensor generates a voltage (from 0 to 5 volts) which is proportional to pressure.
- (31) Test Chain: A series of tests to be followed in a particular order or sequence(numbered).
- (32) TPS –Throttle Position Sensor: used to detect throttle request.
- (33) Troubleshooting: The process of making measurements and observing the operation of the vehicle to find out if and where any problems exist.
- (34) TRS – Timing Reference Sensor: detects whenever any cylinder is about to be fired.
- (35) VIN – Vehicle Identification Number
- (36) VTM – Vehicle Test Meter: A box which performs the measurement and analysis functions of the STE/ICE-R systems.

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)

Table 2-5. DDEC Troubleshooting

KEY SYMPTOM		
A. CHECK ENGINE indicator comes on and stays on.		
SECONDARY SYMPTOMS	PAGE	
A1 CHECK ENGINE indicator on and code 25 on DDR	2-94	
A2 CHECK ENGINE indicator always on, no data link, codes not flashing.	2-98	
A3 DDR display blank or random.	2-102	
A4 DDR reads active code other than code 25, and does not read any historic codes.		
Flash Codes:	SAE Codes:	
Code 11	P187 4 Vernier Control Signal Voltage Low	2-106
Code 12	P187 3 Vernier Control Signal Voltage High	2-116
Code 13	P111 4 Coolant Level Sensor (CLS) Signal Voltage Low	2-122
Code 14	P175 3 Oil Temperature Sensor (OTS) Signal Voltage High	2-126
Code 15	P175 4 Oil Temperature Sensor (OTS) Signal Voltage Low	2-130
Code 16	P111 3 Two Piece Coolant Level Sensor (CLS) Signal Voltage High	2-134
Code 21	P091 3 Throttle Position Sensor (TPS) Signal Voltage High	2-142
Code 22	P091 4 Throttle Position Sensor (TPS) Signal Voltage Low	2-148
Code 23	P174 3 Fuel Temperature Sensor (FTS) Signal Voltage High	2-158
Code 24	P174 4 Fuel Temperature Sensor (FTS) Signal Voltage Low	2-162
Code 31	Fault on Auxiliary Output	2-166
Code 32	ECM Backup System Failure	2-172
Code 33	P102 3 Turbo Boost Sensor (TBS) Signal Voltage High	2-174
Code 34	P102 4 Turbo Boost Sensor (TBS) Signal Voltage Low	2-180
Code 35	P100 3 Oil Pressure Sensor (OPS) Signal Voltage High	2-188
Code 36	P100 4 Oil Pressure Sensor (OPS) Signal Voltage Low	2-194
Code 41	S021 0 Timing Reference Sensor (TRS)	2-204
Code 42	S021 1 Synchronous Reference Sensor (SRS)	2-216
Code 43	P111 1 Low Coolant Level	2-228
Code 44	P175 0 High Oil Temperature	2-234
Code 45	P100 0 Low Oil Pressure	2-236
Code 46	P168 1 Low Battery Voltage	2-238
Code 51	Check Engine Light Comes On and Stays On	2-244
Code 52	S254 12 ECM - Analog to Digital Failure	2-246
Code 53	S253 12 EEPROM Failure Affecting Code Memory	2-248
Code 56	ECM - Analog to Digital Failure	2-250
Codes 61-68	Sxxx 0 Injector Response Times Too Long	2-252
Codes 71-78	Sxxx 1 Injector Response Times Too Short	2-264
Code 85	P190 0 Engine Overspeed	2-265.1
A4A	Check Vehicle Harness +5 Volt Supply	2-266
A4B	Check Engine Harness +5 Volt Supply	2-274

Table 205. DDEC Troubleshooting (Cont)

<u>KEY SYMPTOM</u>	
B. CHECK ENGINE indicator is out	
<u>SECONDARY SYMPTOMS</u>	<u>PAGE</u>
<u>B. CHECK ENGINE light is off when ENGINE switch is turned ON.</u>	<u>2-282</u>

<u>KEY SYMPTOM</u>	
C. CHECK ENGINE indicator comes on for up to five seconds after ENGINE switch is turned to ON, then goes out	
<u>SECONDARY SYMPTOMS</u>	<u>PAGE</u>
<u>C1 Engine cranks but will not start.</u>	<u>2-292</u>
<u>C2 No DATA link and bulb check OK</u>	<u>2-314</u>

<u>KEY SYMPTOM</u>	
D. CHECK ENGINE indicator is erratic or intermittent	
<u>SECONDARY SYMPTOMS</u>	<u>PAGE</u>
<u>D1 CHECK ENGINE indicator flashing valid code.</u>	<u>2-324</u>
<u>D2 DDR displays intermittent code.</u>	<u>2-326</u>
<u>D3 CHECK GAUGES indicator always on and Code 25 on DDR</u>	<u>2-330</u>
<u>D4 CHECK GAUGES indicator does not light when ENGINE switch is turned ON.</u>	<u>2-334</u>
<u>D5 Power take-off high idle does not operate.</u>	<u>2-340</u>
<u>D6 Engine brake always enabled.</u>	<u>2-348</u>
<u>D7 Engine brake does not operate.</u>	<u>2-352</u>

2-13. INTRODUCTION TO LOGIC TREE TROUBLESHOOTING (CONT)

NOTE

Chart is used only when a DDEC problem is suspected but no codes are displayed on DDR or codes are intermittent.

Table 2-6. DDEC Troubleshooting (No Codes on DDR)

<u>KEY SYMPTOM</u> No codes on DDR	
<u>SECONDARY SYMPTOMS</u>	<u>PAGE</u>
<u>CHECK ENGINE indicator on and code 25 on DDR</u>	2-94
<u>CHECK ENGINE indicator always on, no data link, codes not flashing.</u>	2-98
<u>CHECK ENGINE indicator does not light when ENGINE switch is positioned to ON.</u>	2-282
<u>Engine cranks but will not start.</u>	2-292
<u>No DATA link and bulb check OK</u>	2-314
<u>DDR displays intermittent code.</u>	2-326
<u>CHECK GAUGES indicator always on and code 25 on DDR.</u>	2-330
<u>No CHECK GAUGES indicator during bulb check</u>	2-334
<u>Power take off high idle not working.</u>	2-340
<u>Engine brake is always on.</u>	2-348
<u>Engine brake not working.</u>	2-354

f. Contact Test Set (CTS)

The troubleshooting for the HET M1070 Tractor was developed utilizing the Digital Data Reader (DDR) and Simplified Test Equipment for Internal Combustion Engines (STE/ICE-R). Since the initial publication of this manual, the Contact Test Set (CTS) has been developed for use as the primary Test, Measurement, and Diagnostic Equipment (TMDE) for the HET M1070, in place of the DDR and STE/ICE-R.

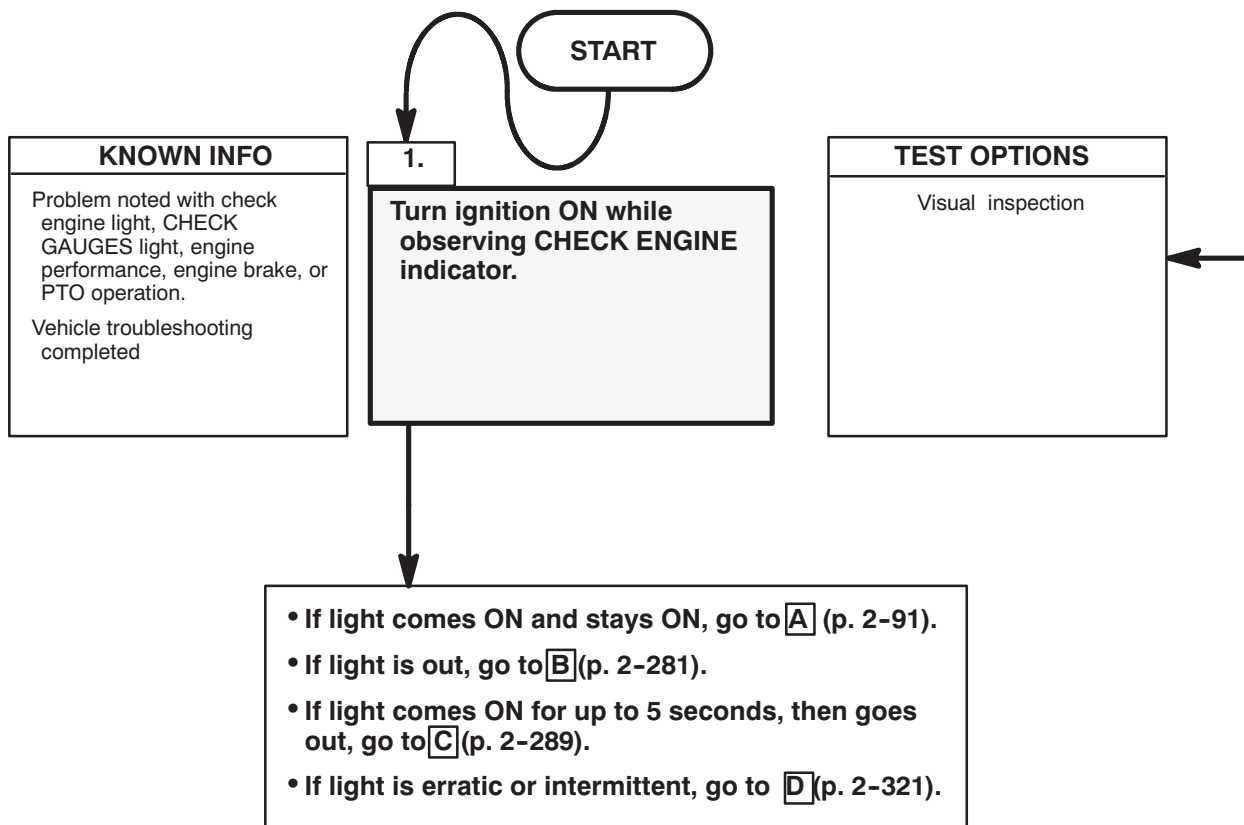
The CTS J1708 programming performs the same function as the DDR and the CTS/ICE programming performs the same tests as the STE/ICE-R unit. The procedural steps contained within this manual still reflect the original test equipment, however, the CTS can be used to troubleshoot the vehicle. The same test results will be obtained using either piece of test equipment.

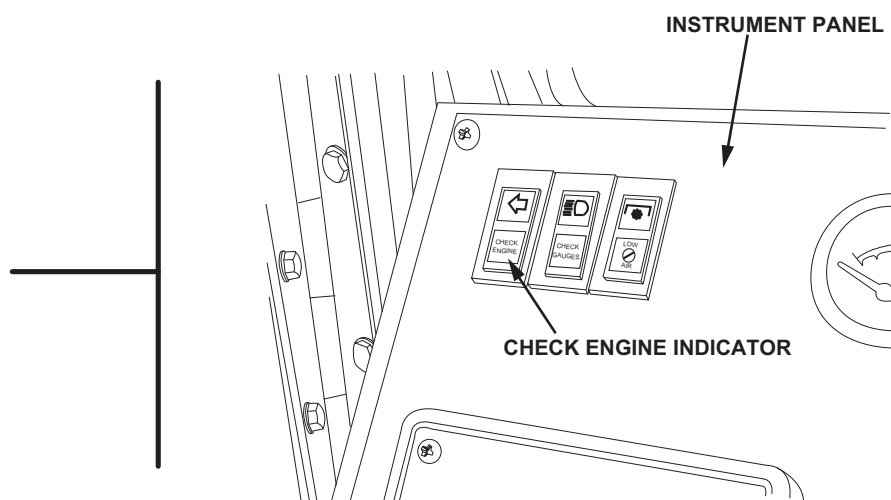
Some of the detailed test procedures shown on the right-hand pages of the troubleshooting will deviate slightly from the steps required to operate the CTS. For additional information on CTS operating procedures and individual test instructions, refer to the information provided with the CTS unit.

DDEC II TROUBLESHOOTING

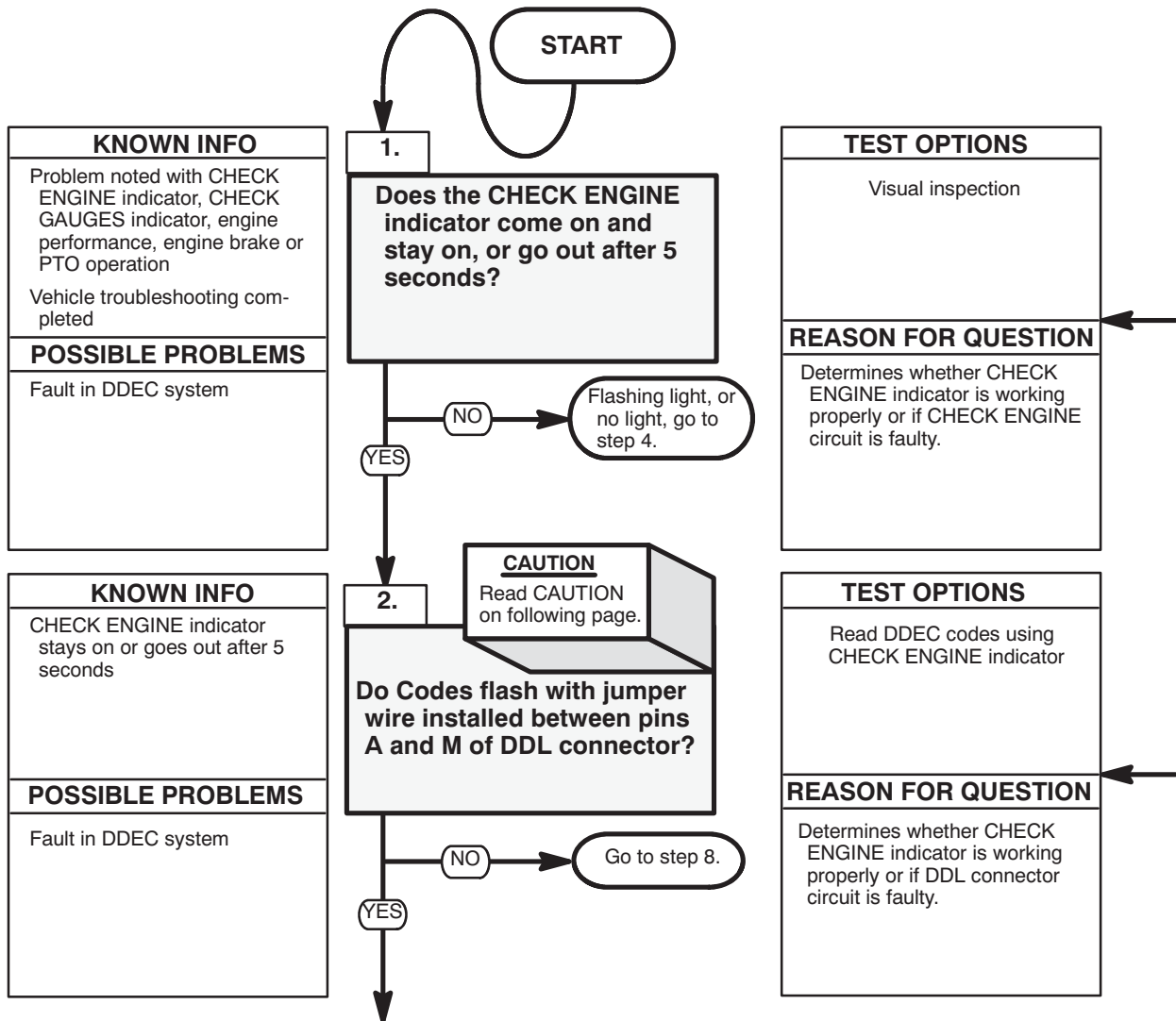
**TRUCK, TRACTOR, M1070
HEAVY EQUIPMENT TRANSPORTER (HET)**

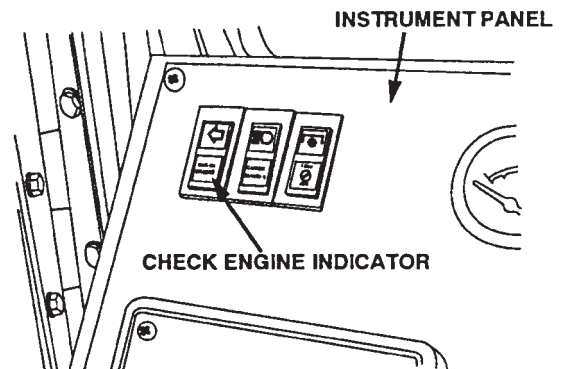
FIRST CHART FOR DIAGNOSIS OF DDEC USING DIAGNOSTIC DATA READER (DDR)	
INITIAL SETUP	
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Contact Test Set, (Item 3.1, Appendix F) Jumper Wire (Figure D-20, Appendix D) TRS/SRS Alignment Tool, (Item 55, Appendix F) Multimeter (Item 20, Appendix F)</p>





FIRST CHART FOR DIAGNOSIS OF DDEC WHEN NO DIAGNOSTIC DATA READER (DDR) IS AVAILABLE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Jumper Wire (Figure D-20, Appendix D) Multimeter (Item 20, Appendix F)

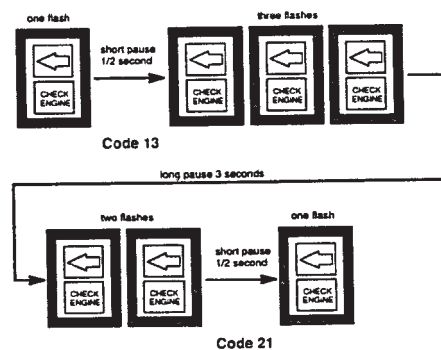




NOTE

DDEC Troubleshooting was intended to be used with a Diagnostic Data Reader. Should you need to read out codes, however, and a reader is not available, the following steps will allow you to read codes using the CHECK ENGINE indicator. However, later sections of the DDEC Troubleshooting may require the use of a reader.

- (4) Turn engine switch to ON position (TM 9-2320-360-10).
- (5) Note operation of CHECK ENGINE indicator.
- (6) Turn engine switch to OFF position (TM 9-2320-360-10).



Example:

READ DDEC CODES USING CHECK ENGINE INDICATOR

- (1) Remove eight screws and cover from electronic control box assembly.

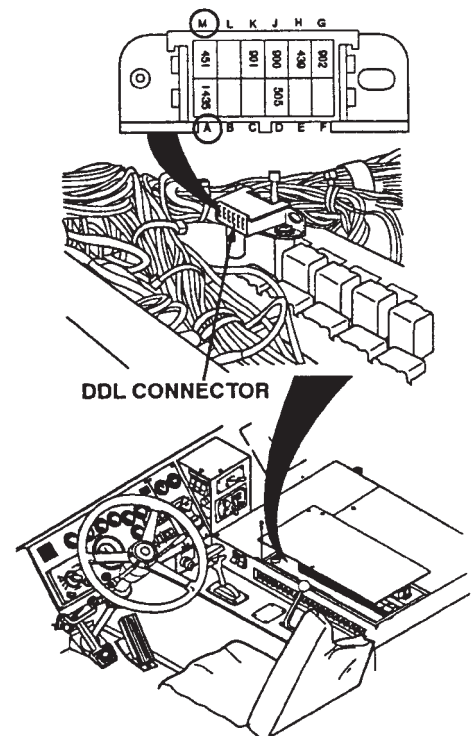
CAUTION

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

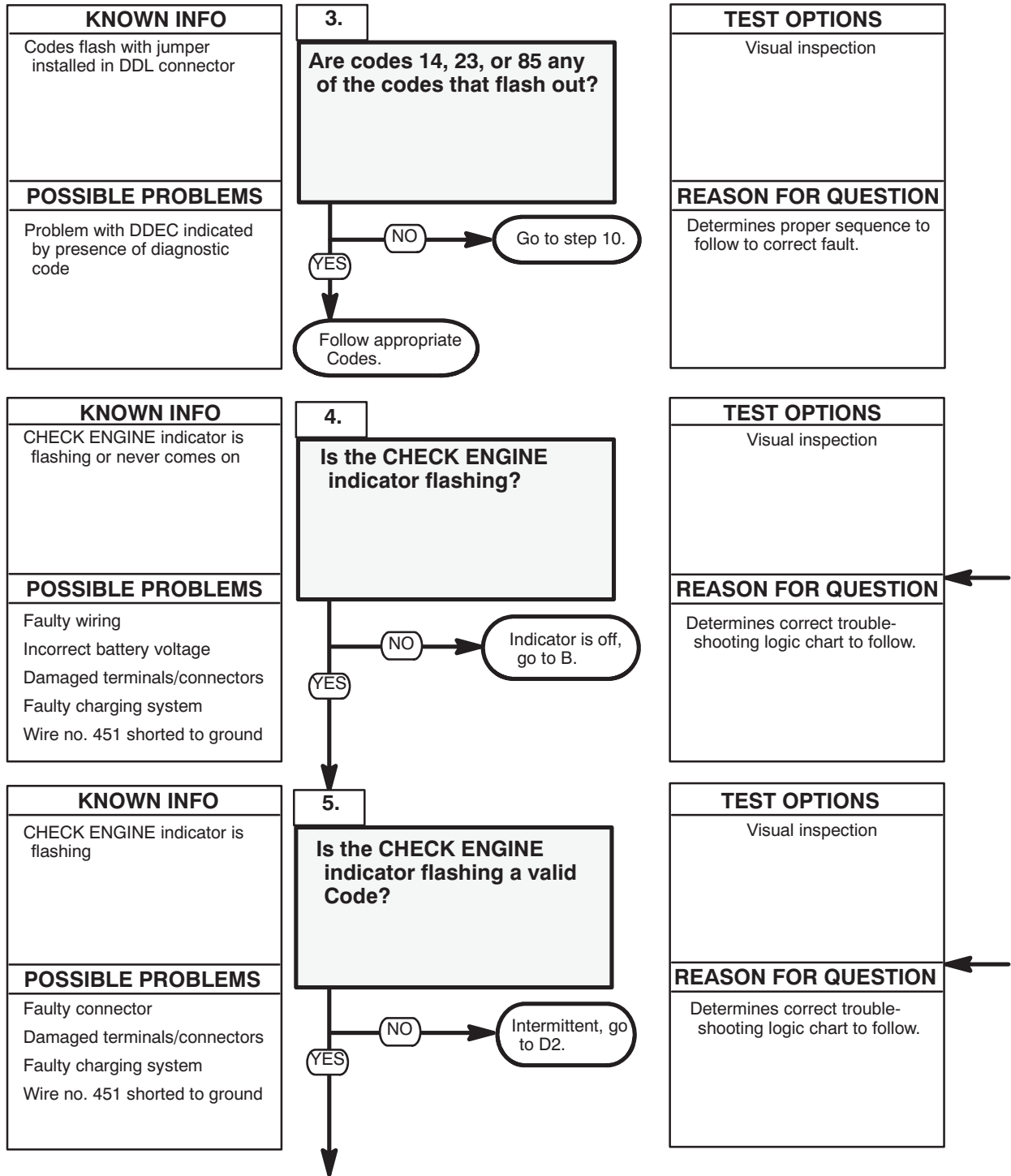
- (2) Install suitable wire (paper clip) between pins A and M of the 12 pin, DDL connector.
- (3) Turn ENGINE SWITCH to ON position (TM 9-2320-360-10).

NOTE

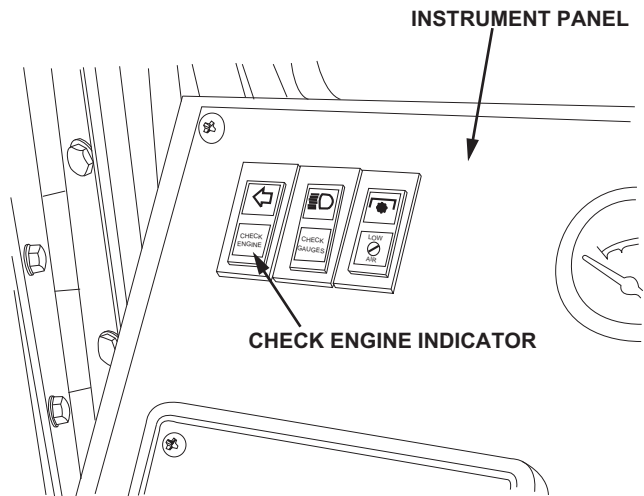
- Indicator will flash the first digit of code, followed by a short 1/2 second pause, then the second digit. There will be a long three second pause between codes.
 - Indicator will flash all codes in Historic memory, before repeating all codes.
 - Indicator will continue to flash as long as pins are jumped and ENGINE switch is in the ON position.
- (4) Note operation of CHECK ENGINE indicator.
 - (5) Turn engine switch to OFF position.



FIRST CHART FOR DIAGNOSIS OF DDEC WHEN NO DIAGNOSTIC DATA READER (DDR) IS AVAILABLE (CONT)

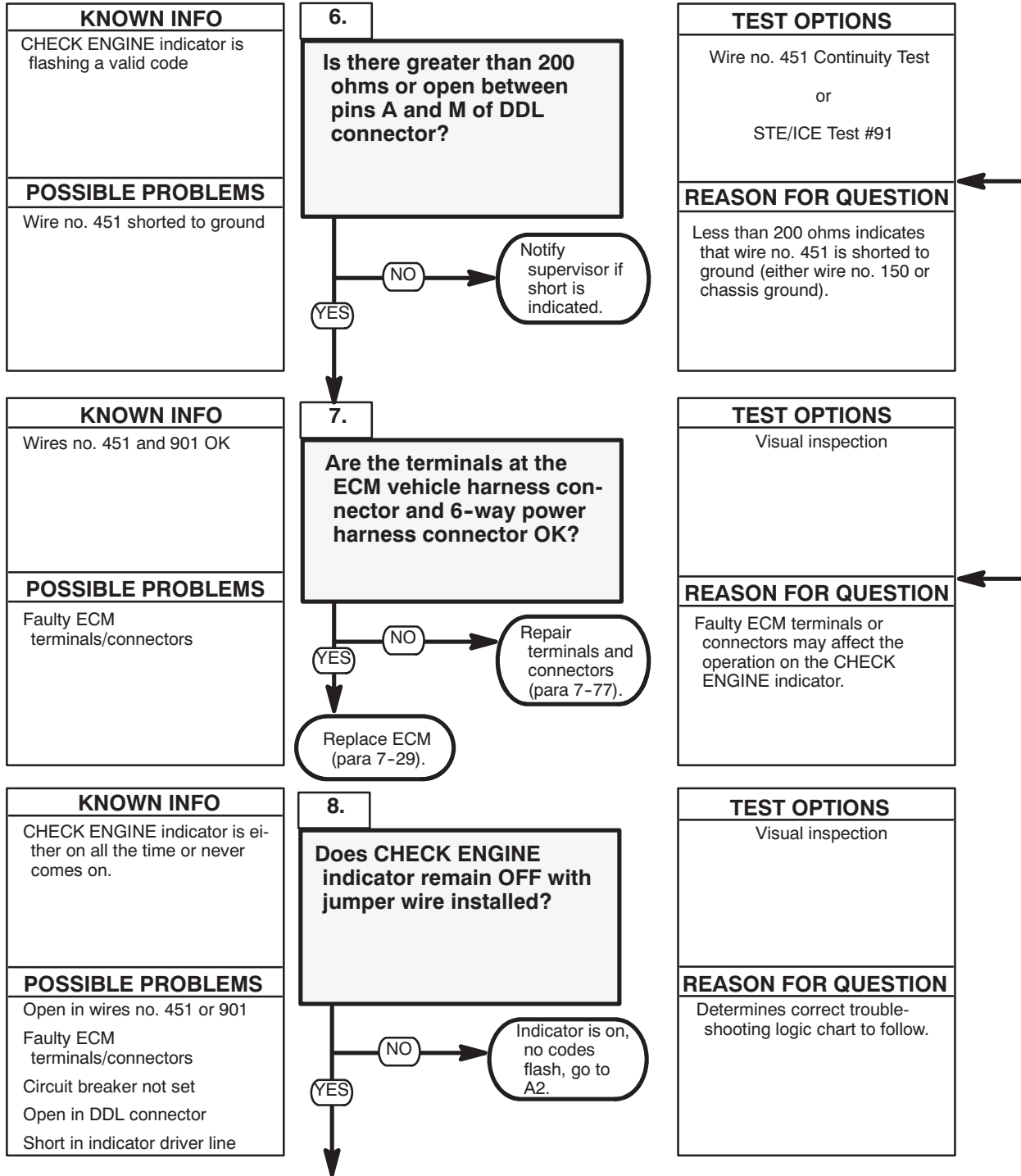


Note whether the CHECK ENGINE indicator is flashing or never comes on.



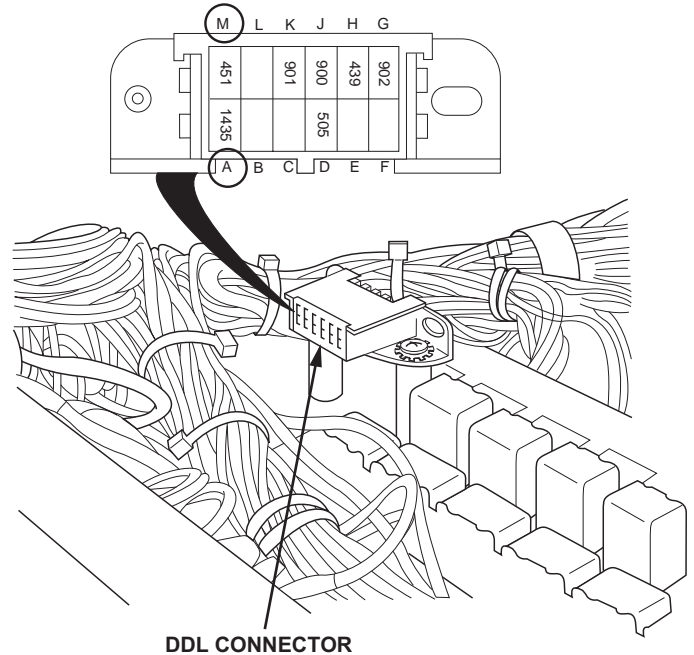
Note whether flashing CHECK ENGINE indicator is displaying a valid code or if it's just erratic or intermittent.

FIRST CHART FOR DIAGNOSIS OF DDEC WHEN NO DIAGNOSTIC DATA READER (DDR) IS AVAILABLE (CONT)



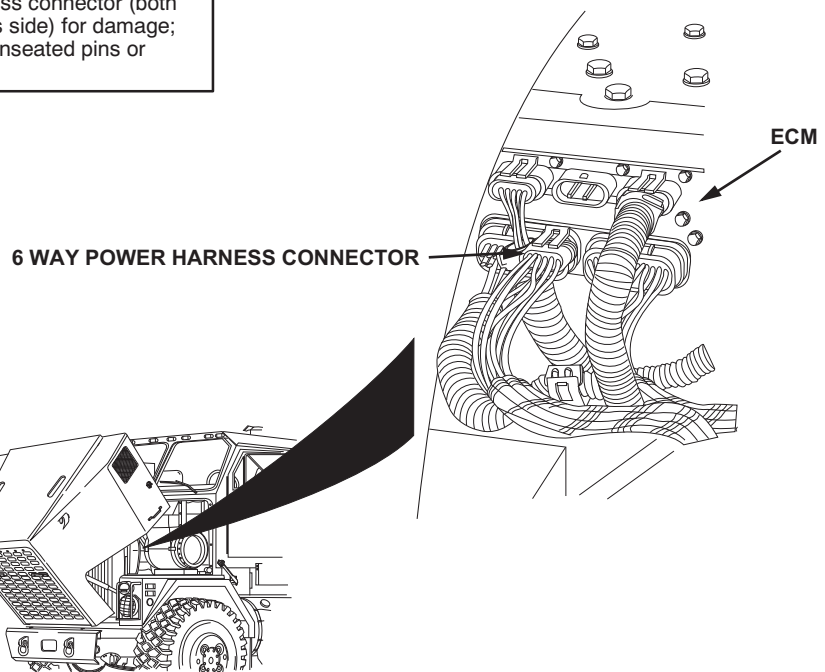
WIRE # 451 CONTINUITY TEST

- (1) Turn ENGINE switch to OFF position (TM 9-2320-360-10).
- (2) Remove the vehicle harness connector from the ECM.
- (3) Place positive (+) probe of multimeter on pin A of DDL connector.
- (4) Place negative (-) probe of multimeter on pin M of DDL connector and note reading on multimeter.

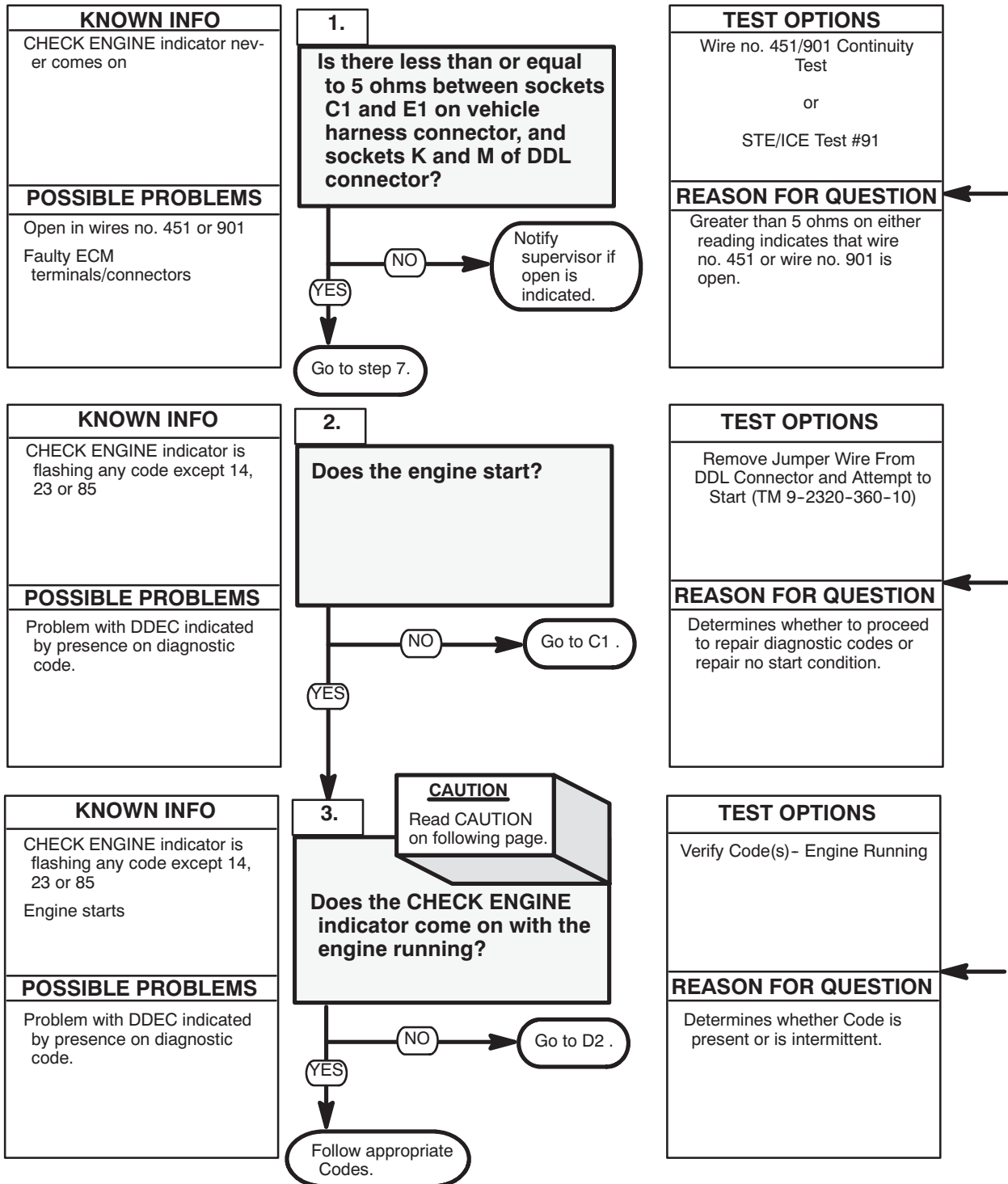


DDL CONNECTOR

- (1) Remove the 6-way power harness from the ECM.
- (2) Check the 6-way power harness connector and the vehicle harness connector (both the ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.

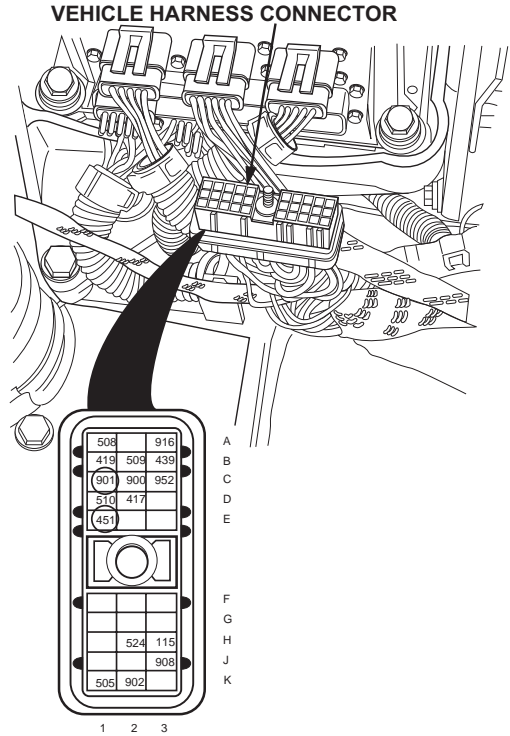


FIRST CHART FOR DIAGNOSIS OF DDEC WHEN NO DIAGNOSTIC DATA READER (DDR) IS AVAILABLE (CONT)

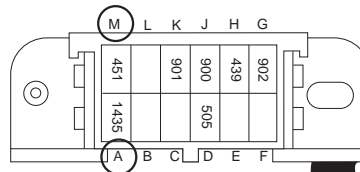


WIRE # 451/901 CONTINUITY TEST

- (1) Turn engine switch to OFF position (TM 9-2320-360-10).
- (2) Remove vehicle harness connector from ECM.
- (3) Install jumper wire between sockets C1 and E1 on the vehicle harness connector.
- (4) Place positive (+) probe of multimeter on pin K of the 12 pin DDL connector.
- (5) Place negative (-) probe of multimeter on pin M of the DDL connector and note reading on multimeter.
- (6) Place positive (+) probe of multimeter on pin A of DDL connector.
- (7) Place negative (-) probe of multimeter on known good ground and note reading on multimeter.



- (1) Remove jumper wire from between pins A and M of the DDL connector.
- (2) Attempt to start and run the engine (TM 9-2320-360-10).



VERIFY CODE(S) - ENGINE RUNNING

- (1) Try to get the CHECK ENGINE indicator to come on by warming up the engine and increasing the engine speed from idle speed to 2100 RPM.
- (2) Run engine for one minute or until CHECK ENGINE indicator comes on.
- (3) Shut off engine (TM 9-2320-360-10).

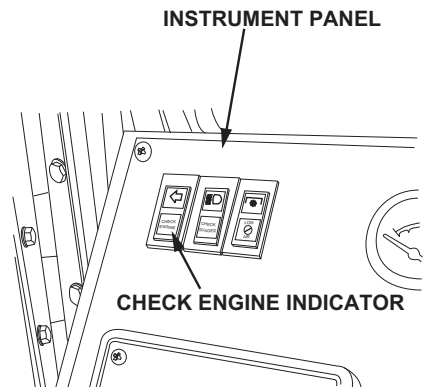
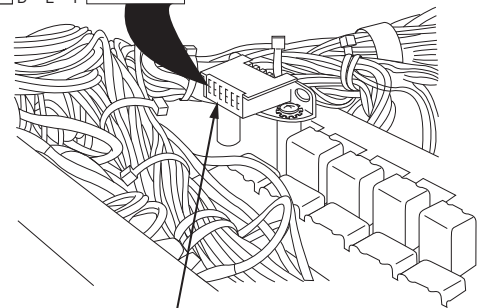
CAUTION

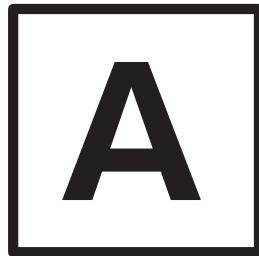
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

NOTE

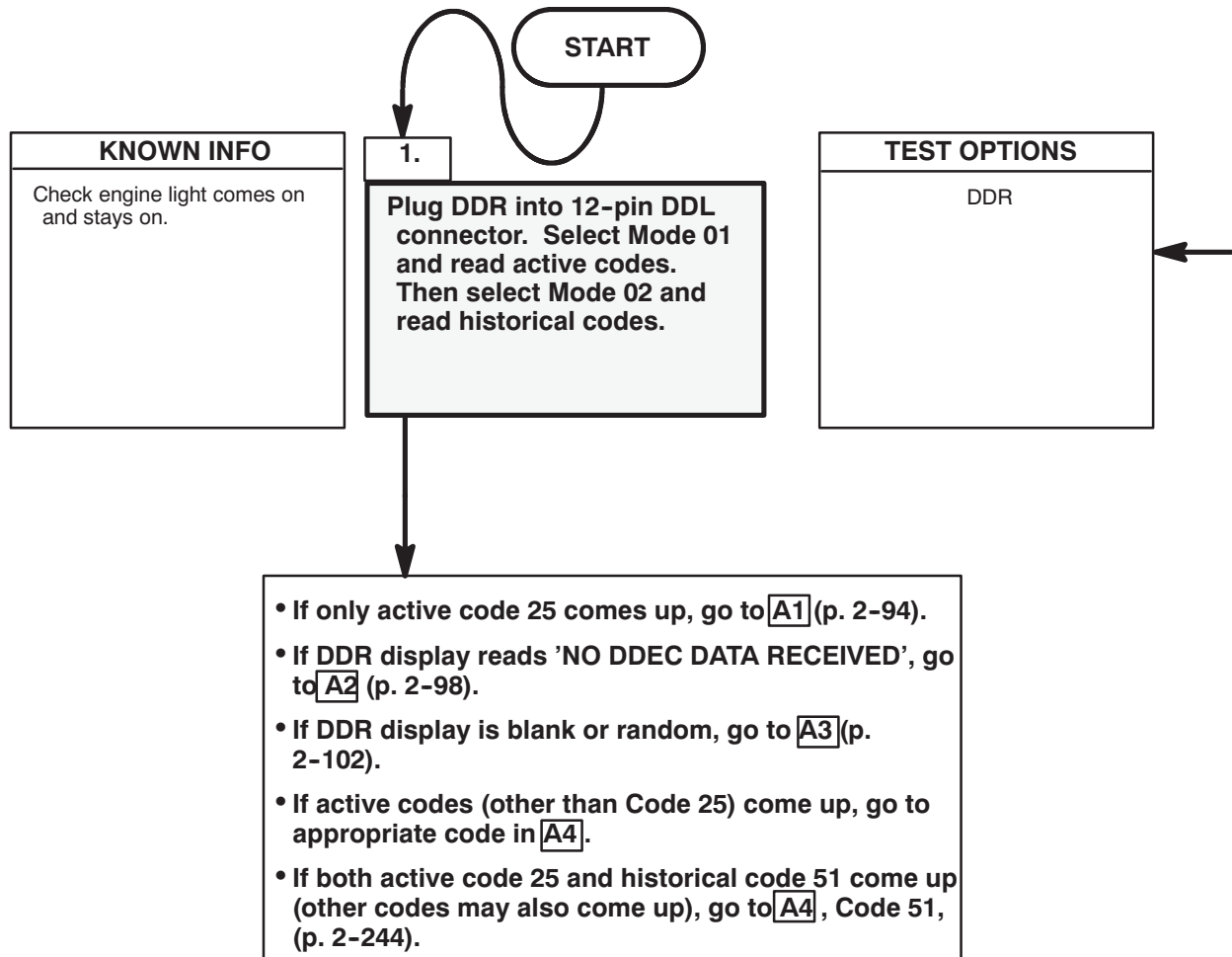
If CHECK ENGINE indicator came on, do steps (4) through (7).

- (4) Install suitable wire (paper clip) between pins A and M of the 12 pin, DDL connector.
- (5) Turn ENGINE SWITCH to ON position (TM 9-2320-360-10).
- (6) Note operation of CHECK ENGINE indicator to read codes.
- (7) Turn ENGINE SWITCH to OFF position (TM 9-2320-360-10).





A CHECK ENGINE LIGHT COMES ON AND STAYS ON

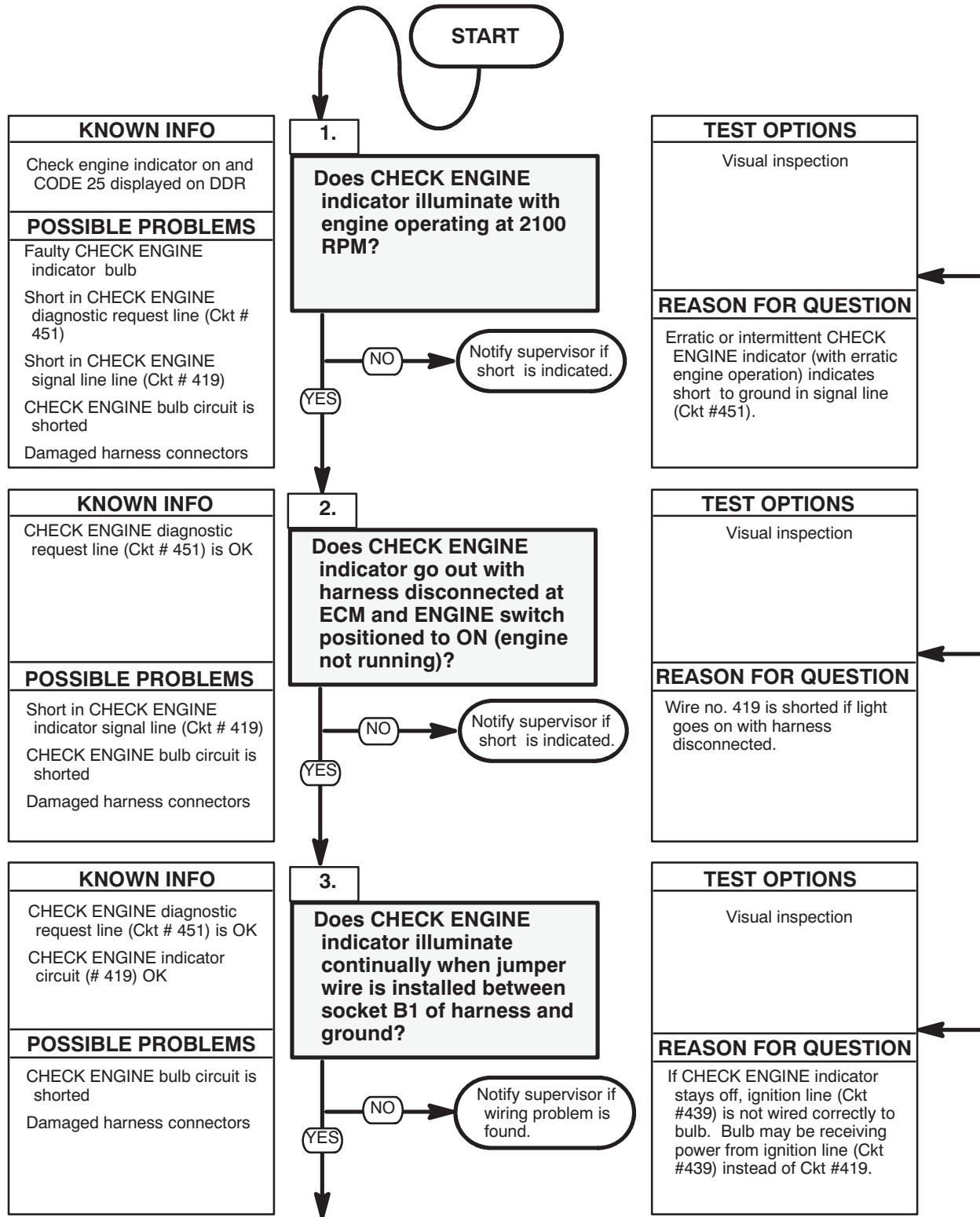




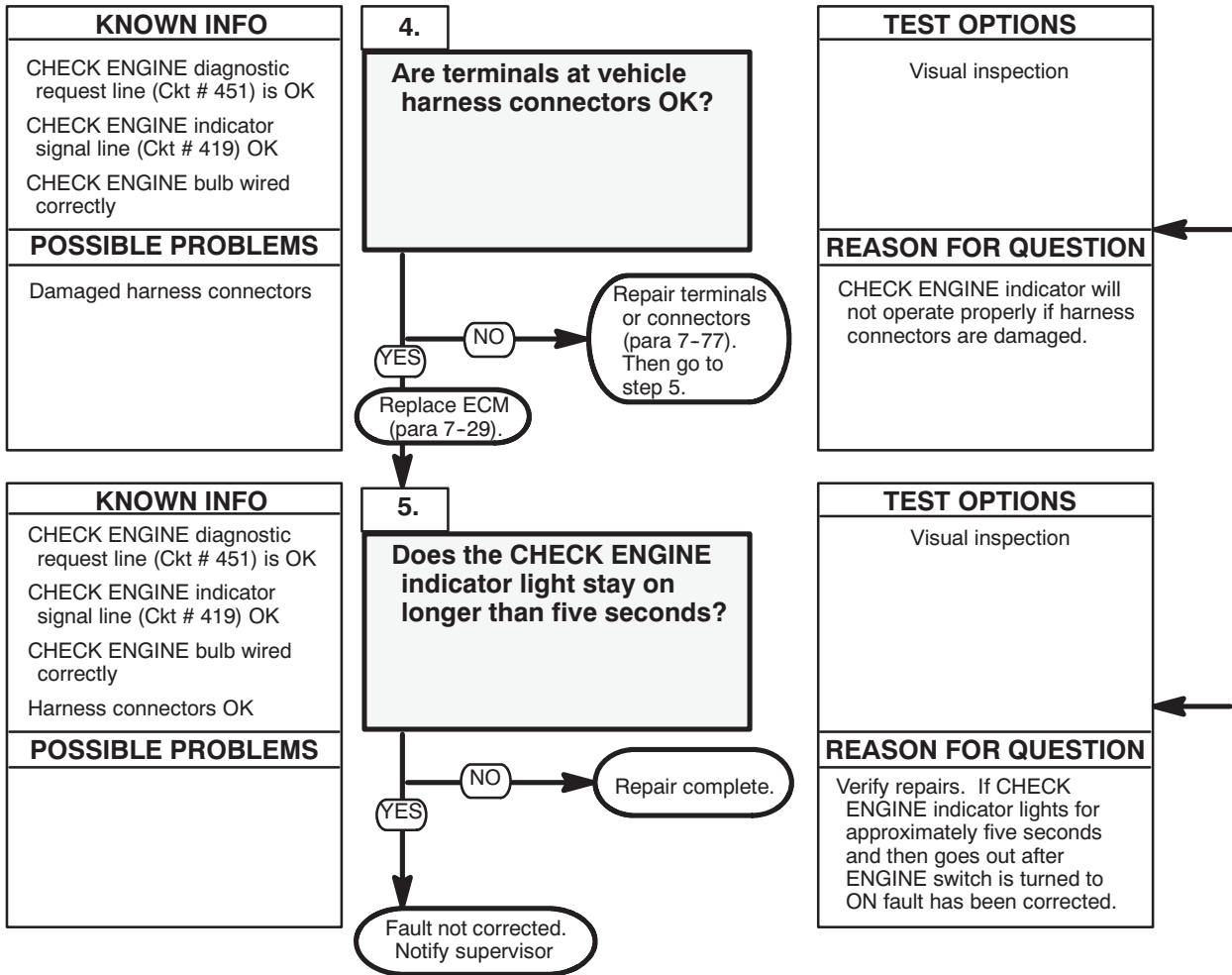
NOTE

The following flow chart should be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

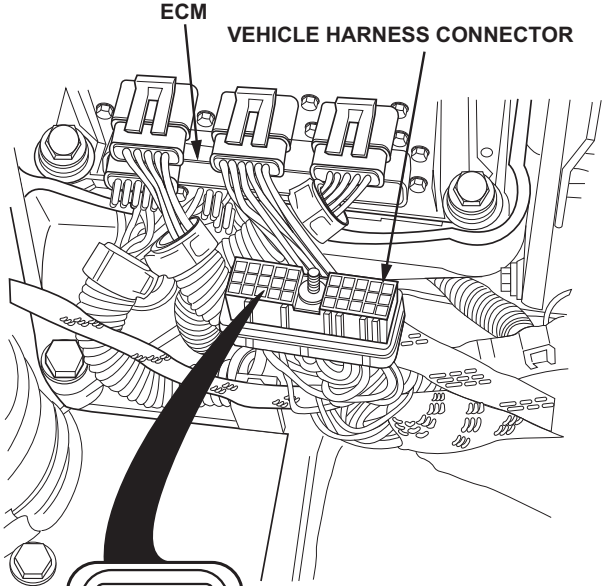
A1 'CHECK ENGINE' INDICATOR ON AND CODE 25 ON DDR



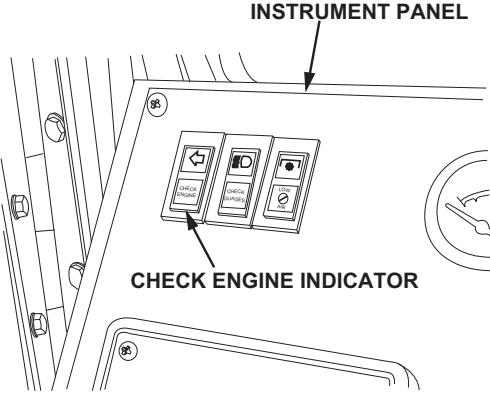
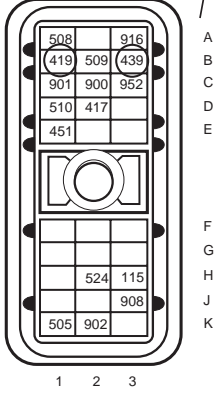
A1 'CHECK ENGINE' INDICATOR ON AND CODE 25 ON DDR (CONT)



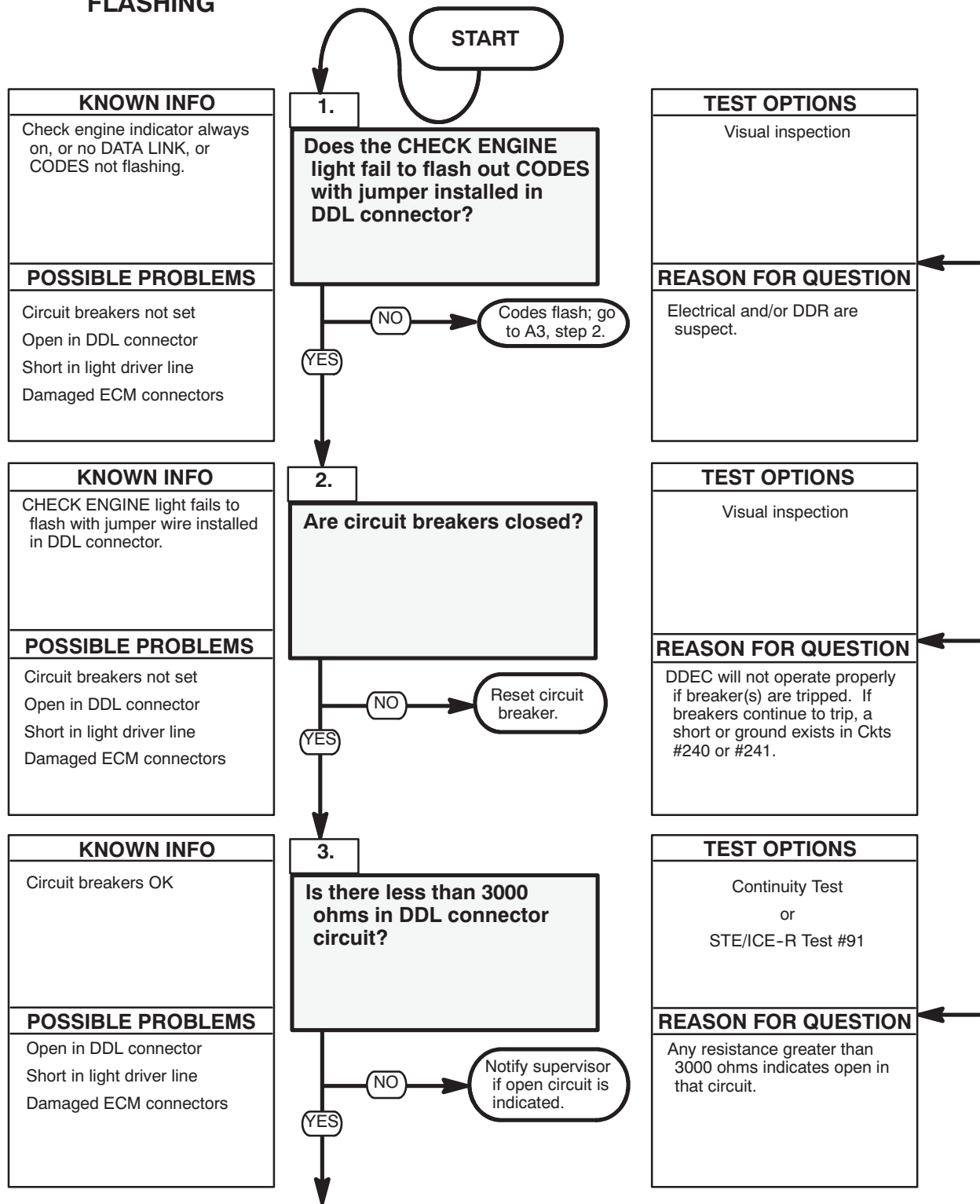
- (1) Turn ENGINE switch OFF.
- (2) Check terminals at vehicle harness connectors for damage (bent, corroded, and unseated pins or sockets).
- (3) Check terminals in connector to be sure wire no. 419 is in socket B1 and wire no. 439 is in socket B3.

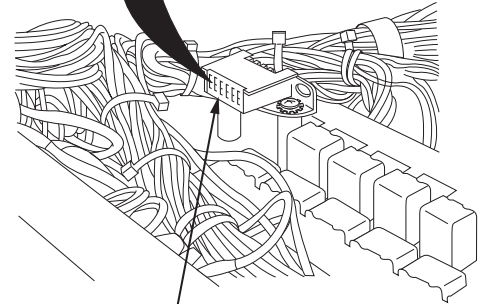
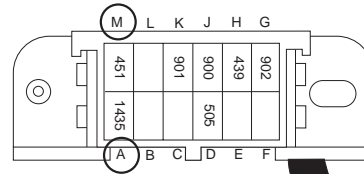


- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A2 'CHECK ENGINE' INDICATOR ALWAYS ON, NO DATA LINK, CODES NOT FLASHING



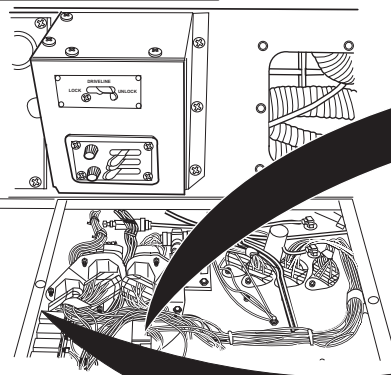


DDL CONNECTOR

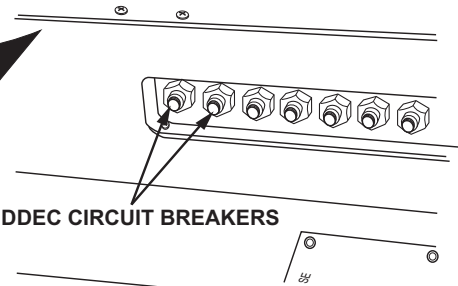
NOTE

The following flow chart should be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

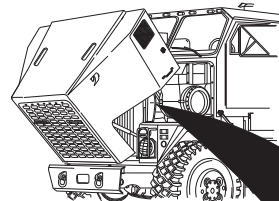
- (1) Unplug DDR.
- (2) Short pin A to Pin M on 12- pin DDL connector.



Check circuit breakers to ECM and reset if needed.



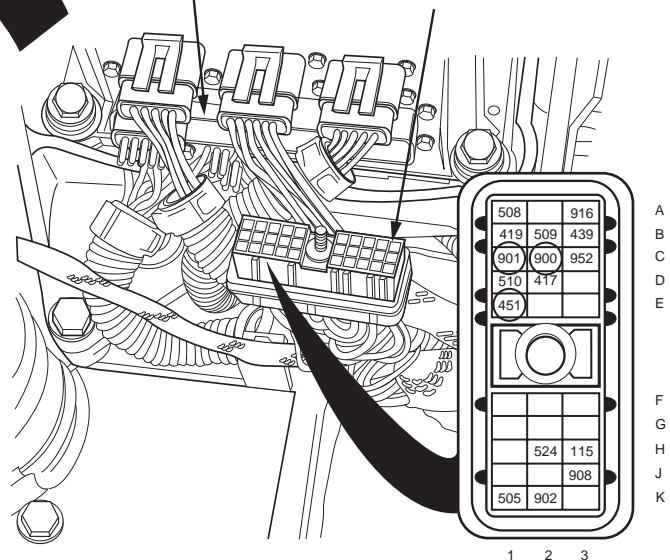
DDEC CIRCUIT BREAKERS



ECM
VEHICLE HARNESS CONNECTOR

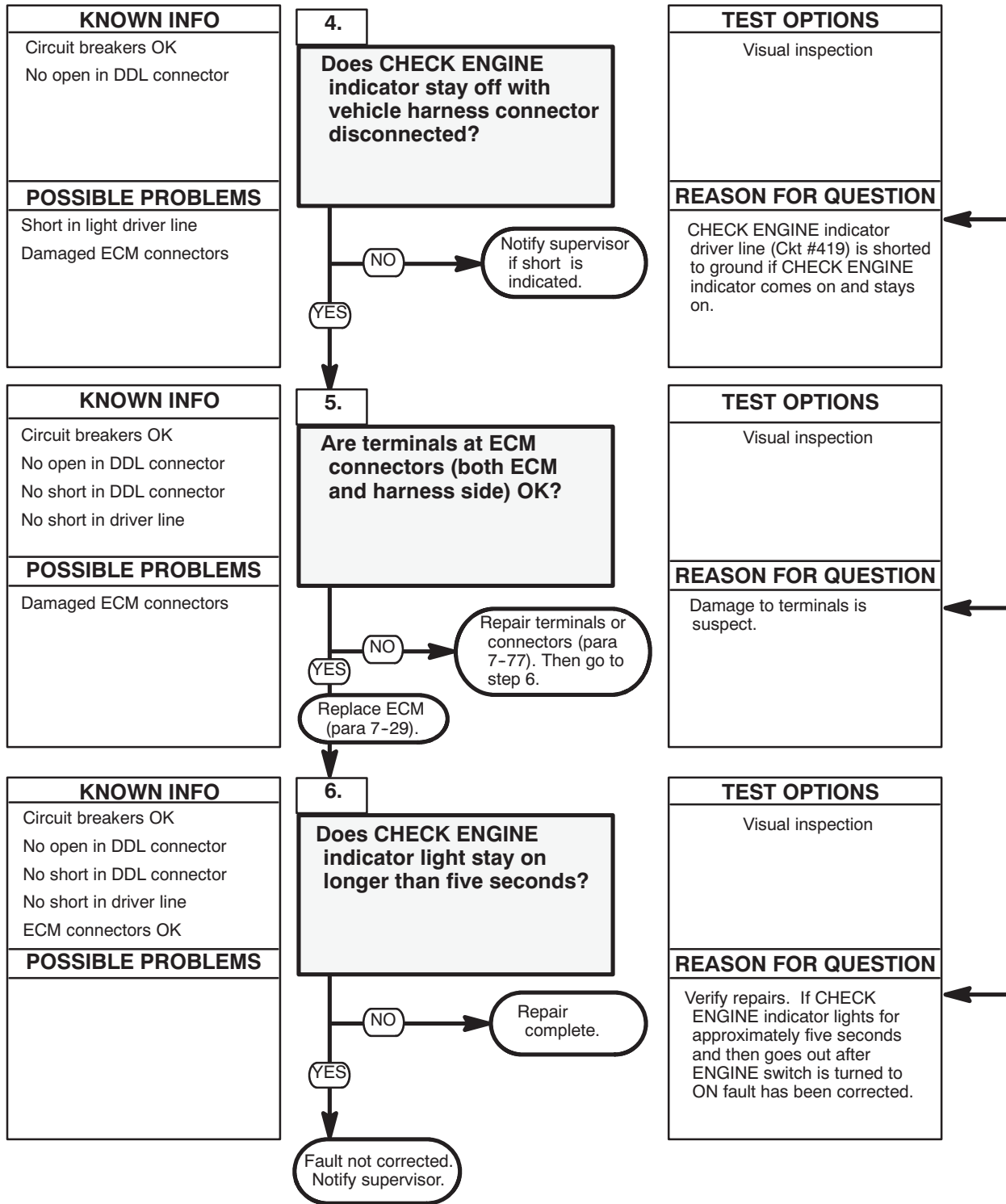
CONTINUITY TEST

- (1) Check resistance between cavity A of DDL connector and a known good ground.
- (2) Disconnect vehicle harness connector at ECM. Check resistance between pin M of DDL and cavity E1 of ECM 30-pin connector.
- (3) Check resistance between pin J of DDL connector and cavity C2 of ECM 30-pin connector.
- (4) Check resistance between pin K of DDL connector and cavity C1 of ECM 30-pin connector.

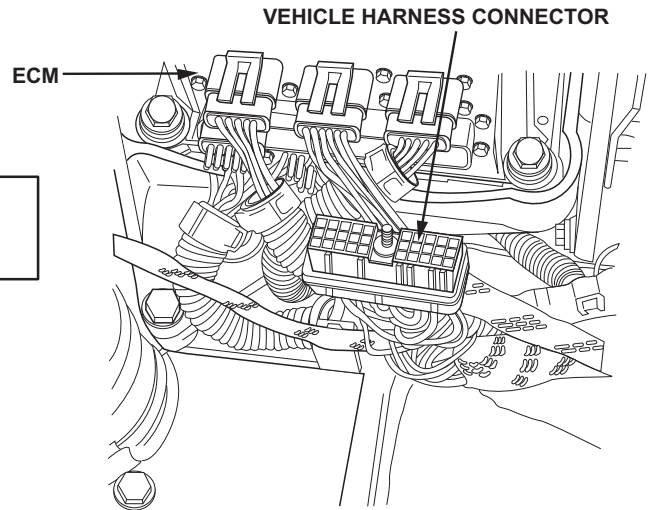


1 2 3

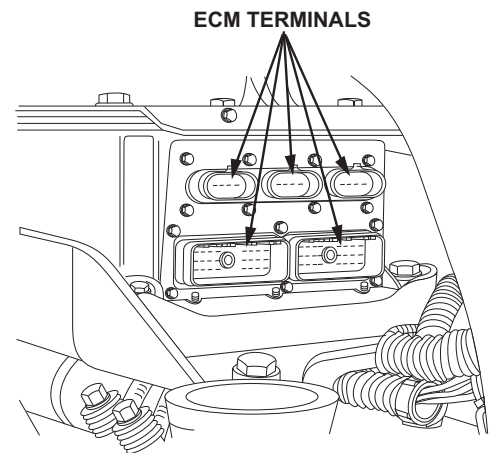
A2 'CHECK ENGINE' INDICATOR ALWAYS ON, NO DATA LINK, CODES NOT FLASHING (CONT)



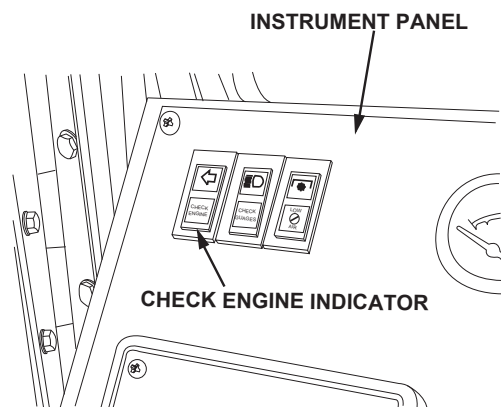
- (1) Disconnect vehicle harness connector at ECM.
- (2) Turn ENGINE switch ON (engine not running) while observing CHECK ENGINE indicator.



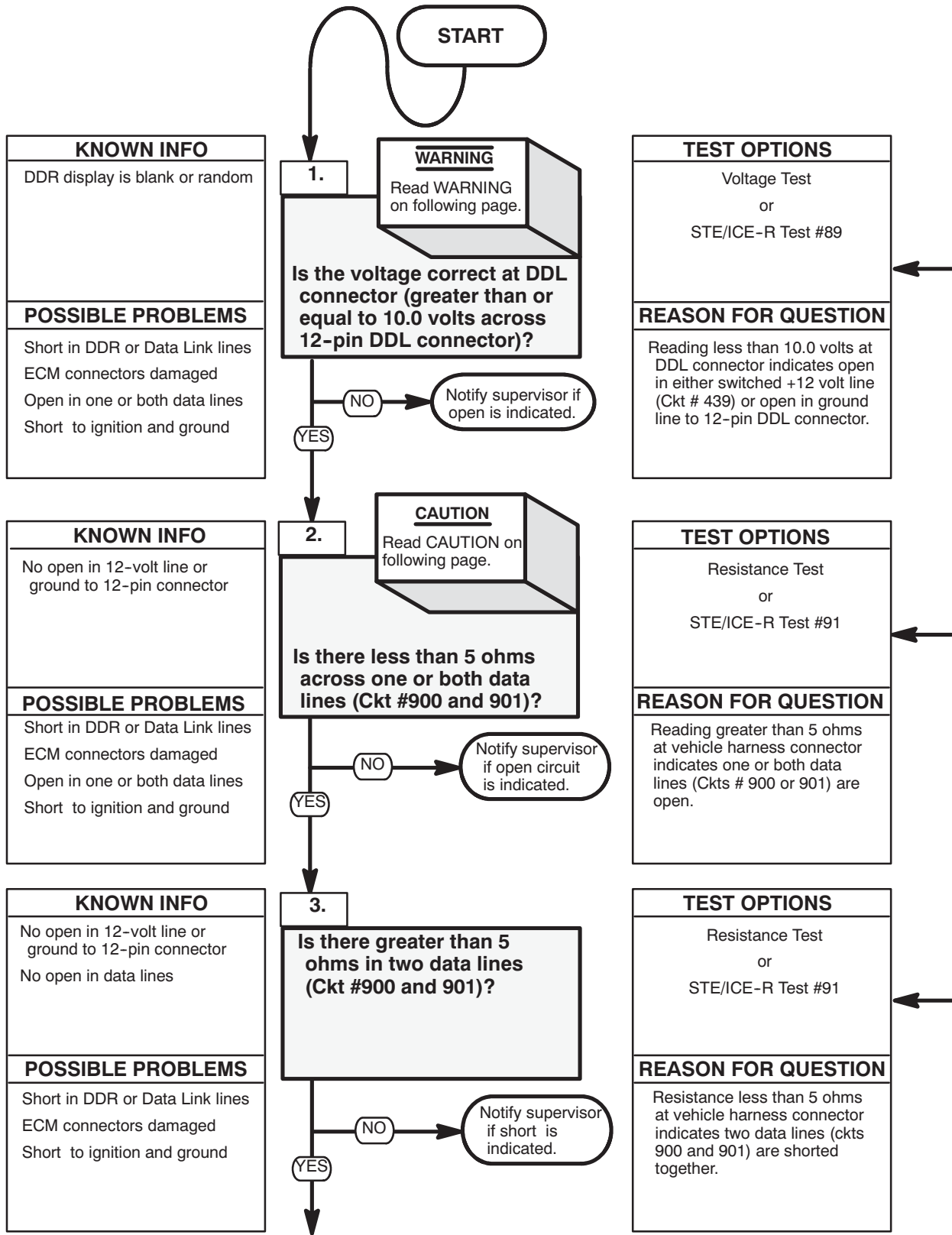
- NOTE**
- Pay special attention to terminals and sockets in 6-pin power connector and sockets B1 and B3 of 30-pin vehicle harness.
- (1) Turn ENGINE switch OFF.
 - (2) Check terminals at vehicle connectors (both ECM and harness side) for damage; bent, corroded and unseated pins or sockets.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A3 DDR DISPLAY IS BLANK OR RANDOM



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

The following flow chart should be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

VOLTAGE TEST

- (1) Turn ENGINE switch ON.
- (2) Read voltage at 12-pin DDL connector from pin H (red lead) to pin A (black lead).

CAUTION

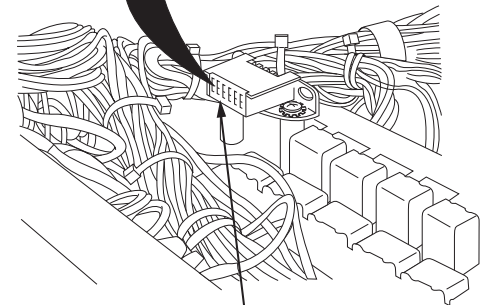
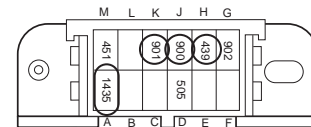
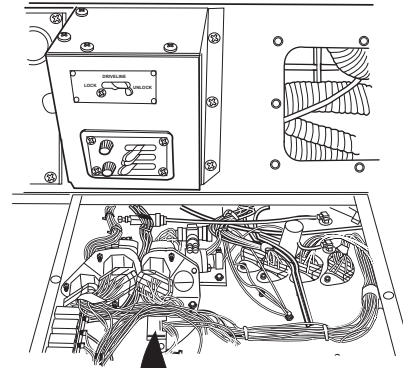
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

RESISTANCE TEST

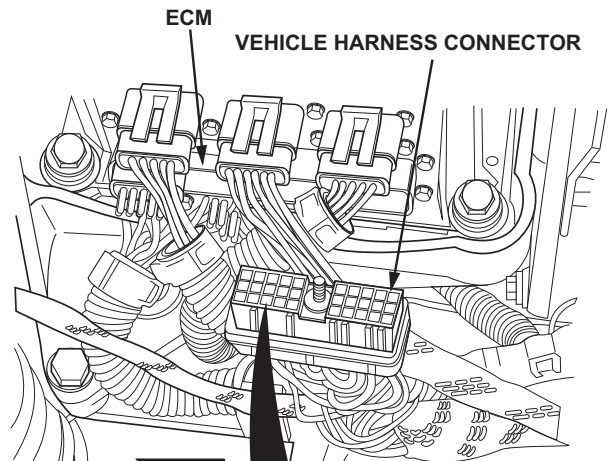
- (1) Turn ENGINE switch OFF and remove jumpers from 12-pin DDL connector.
- (2) Place jumper across pins J and K on 12-pin connector.
- (3) Unplug vehicle harness connector and measure resistance between sockets C1 and C2.

RESISTANCE TEST

- (1) Remove jumpers from 12-pin DDL connector.
- (2) Read resistance between sockets C1 and C2 of vehicle harness connector.

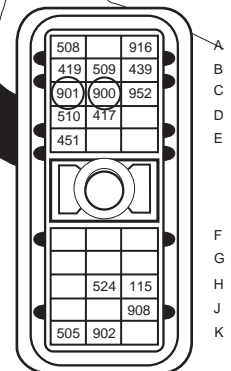


DDL CONNECTOR

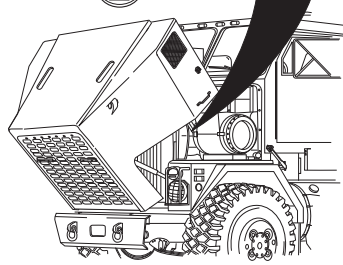


ECM

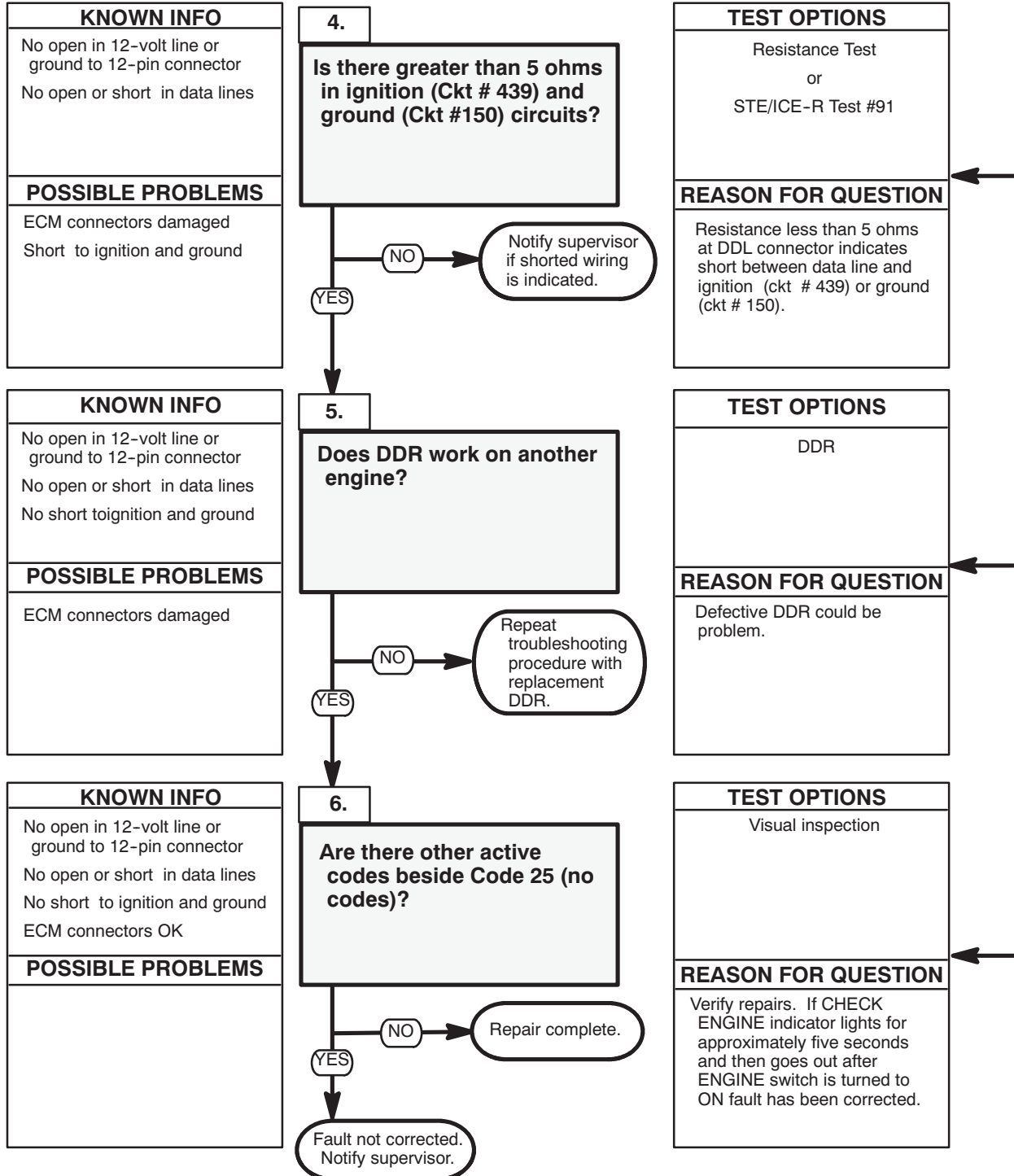
VEHICLE HARNESS CONNECTOR



1 2 3

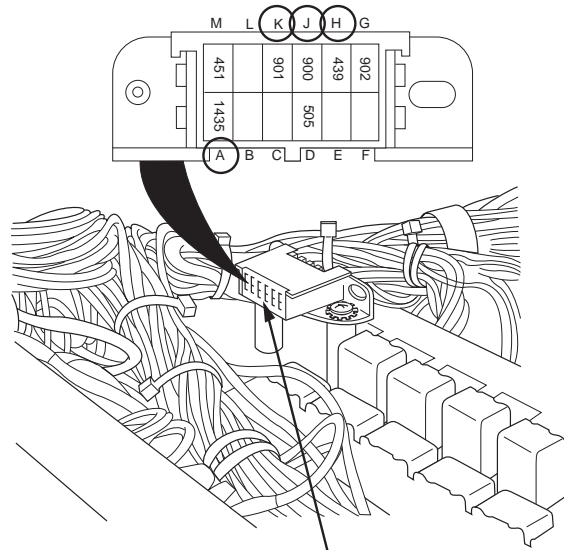


A3 DDR DISPLAY IS BLANK OR RANDOM (CONT)



RESISTANCE TEST

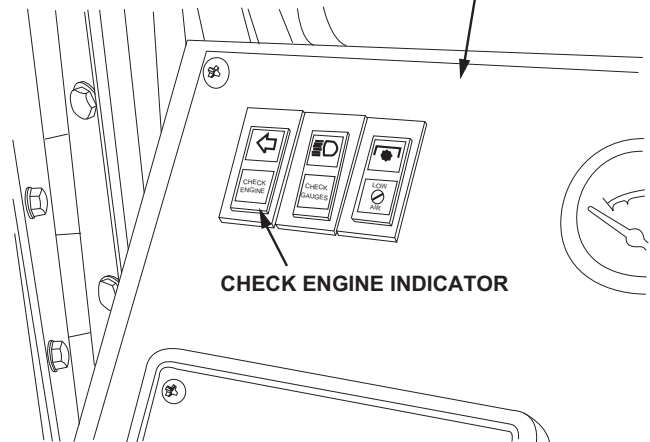
- (1) Remove all jumpers from 12-pin DDL connector.
- (2) Measure resistance between sockets J and A, then J and H next. Measure resistance between sockets K and A, then K and H of DDL connector.



DDL CONNECTOR

- (1) Connect DDR to another engine
- (2) Read PROM ID or any other parameter in menu.

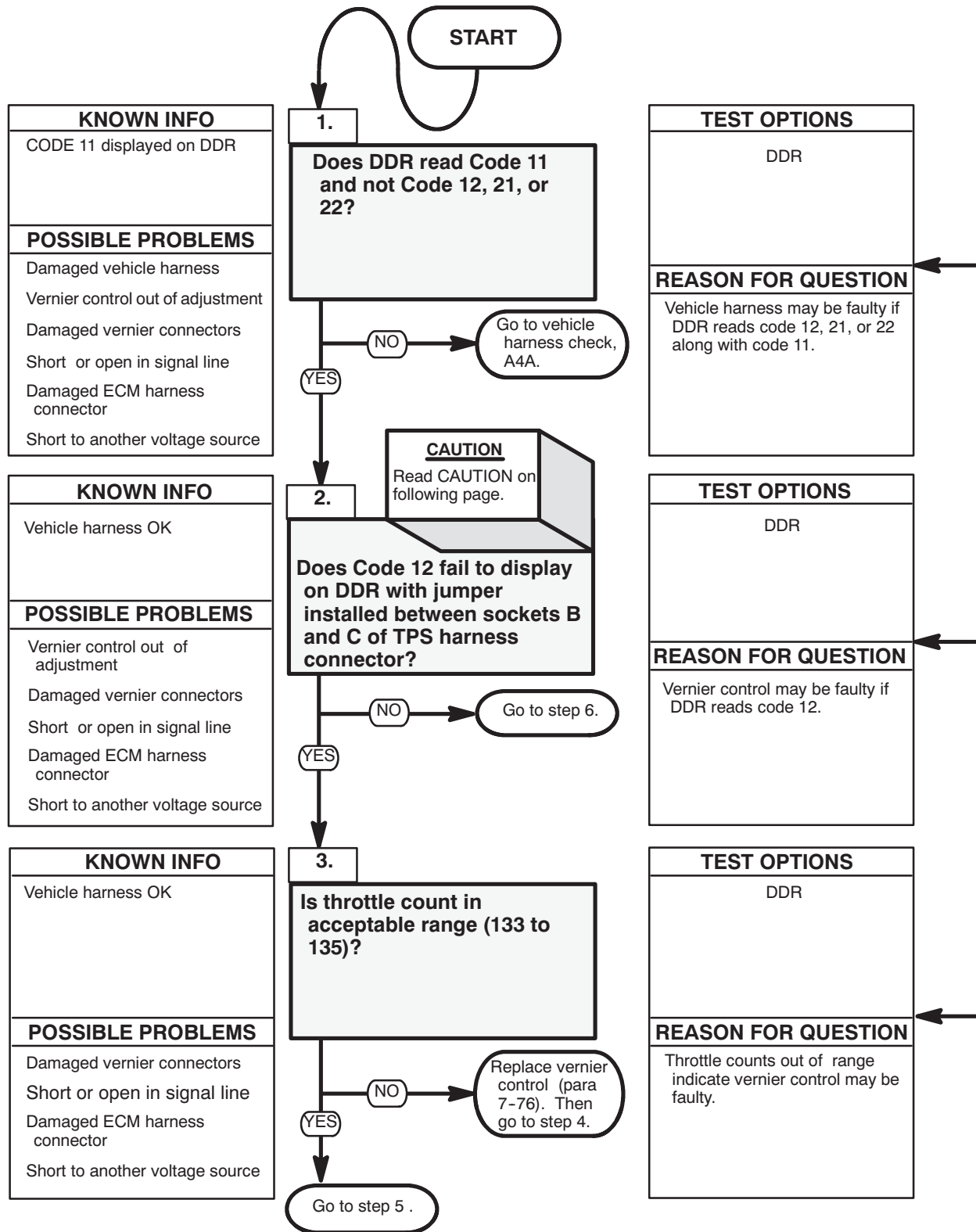
INSTRUMENT PANEL



CHECK ENGINE INDICATOR

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.

A4 Code 11-VERNIER CONTROL SIGNAL VOLTAGE LOW



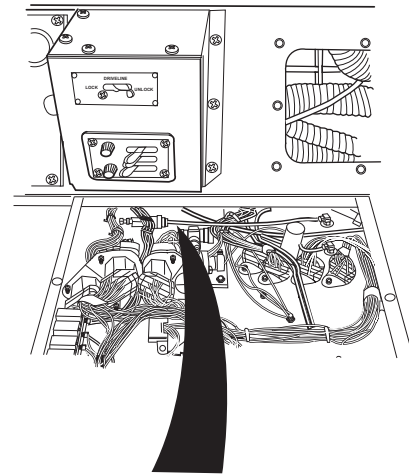
NOTE

The following flow chart should be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

CAUTION

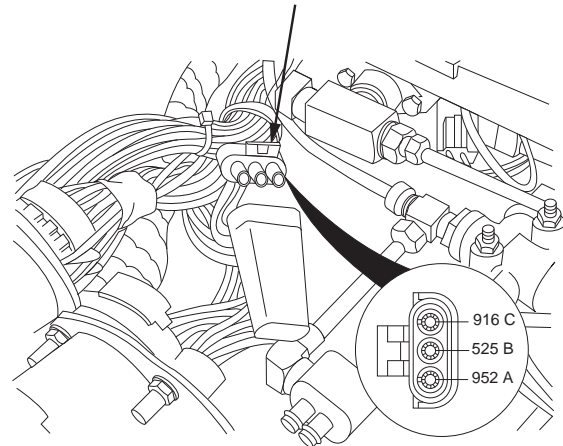
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

- (1) Turn ENGINE switch OFF.
- (2) Disconnect vernier control connector.
- (3) Install jumper wire between sockets B and C of TPS harness connector.
- (3.1) Click on "Alarms Clear" to clear alarms screen.
- (4) Turn ENGINE switch to ON and read active codes on DDR.

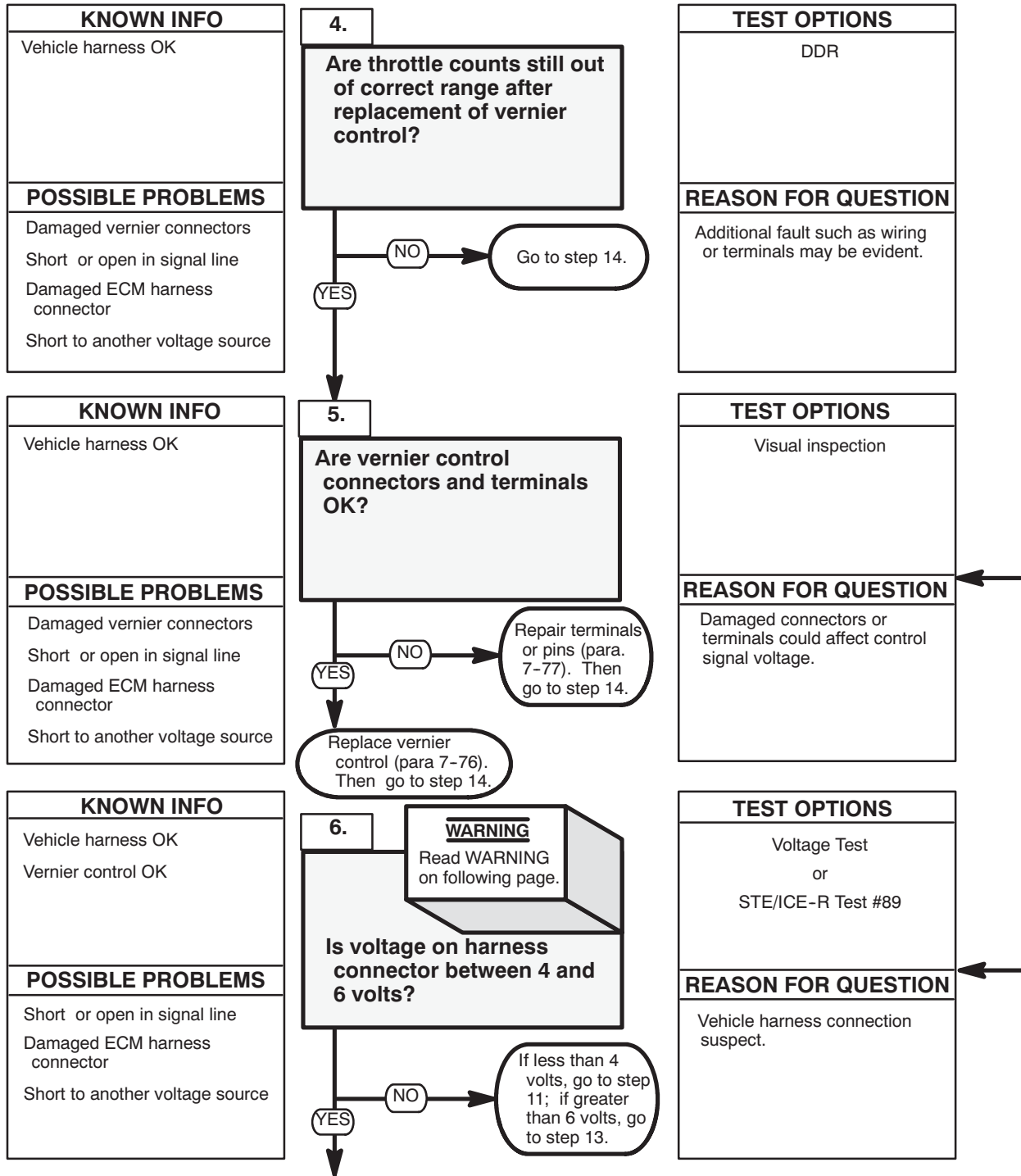


VERNIER CONTROL HARNESS CONNECTOR

- (1) Remove jumper and reconnect vernier control.
- (2) Hook DDR to 12-pin DDL connector and select PTO counts (Mode 21).
- (3) Read PTO counts.



A4 Code 11-VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT)



Inspect terminals at vernier control connector (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets

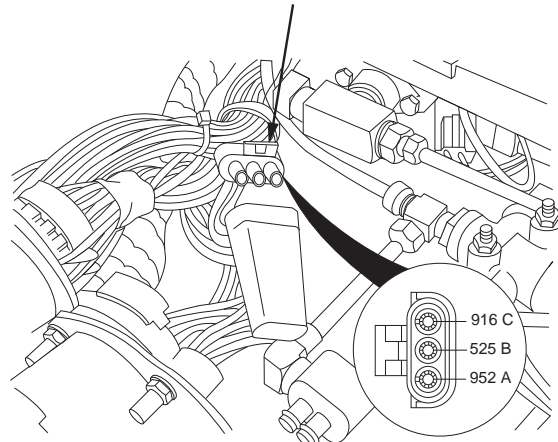
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

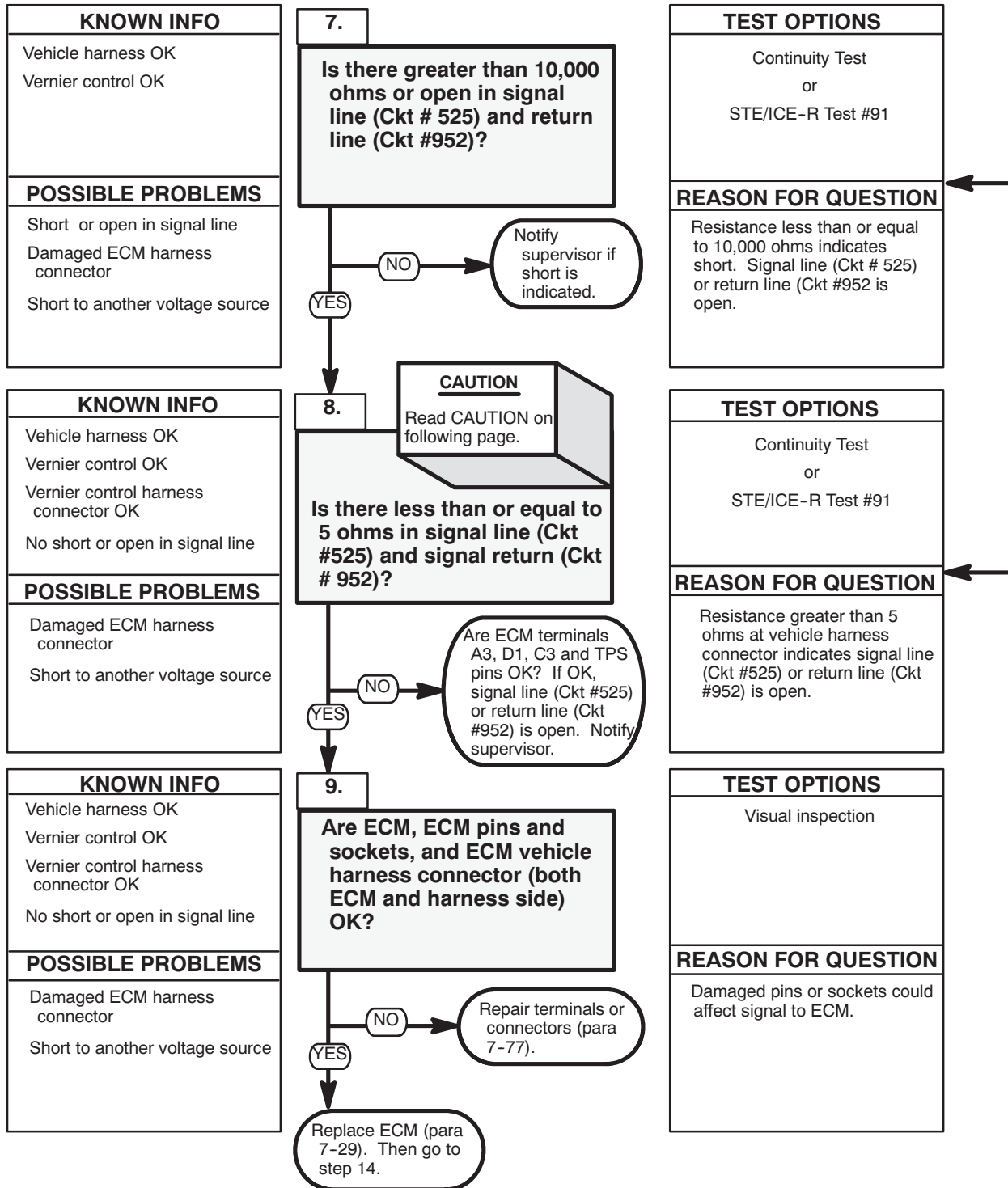
VOLTAGE TEST

- (1) Remove jumper.
- (2) Turn ENGINE switch ON.
- (3) Read voltage on vernier control harness connector between sockets C and A.

VERNIER CONTROL HARNESS CONNECTOR



A4 Code 11-VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT)



CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect vehicle harness connector at ECM.
- (3) Read resistance between sockets A and B on the vernier control harness connector.

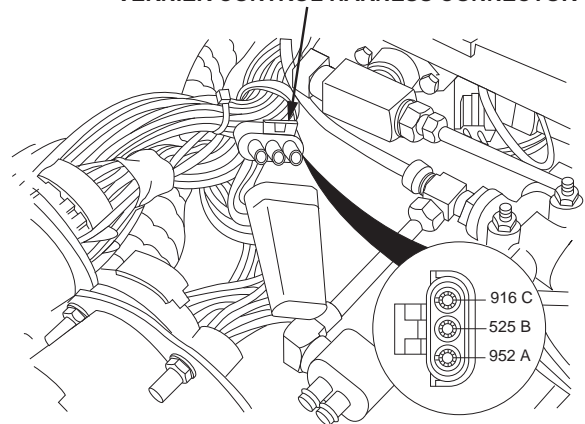
CAUTION

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

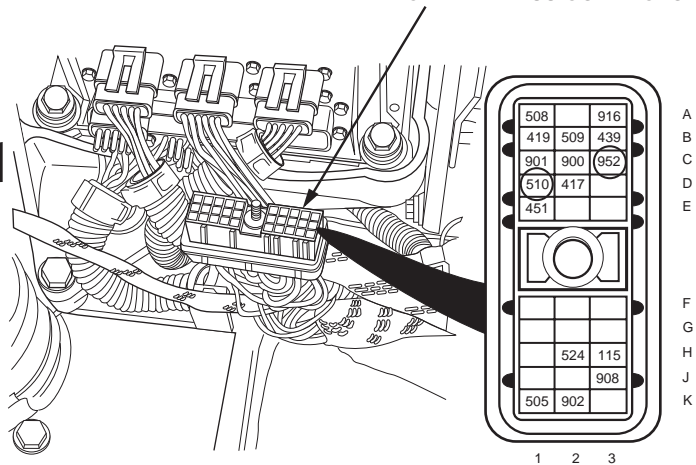
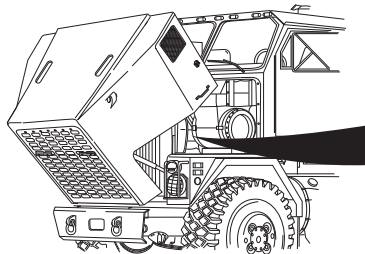
CONTINUITY TEST

- (1) Install a jumper wire between sockets A and B of Vernier Control harness connector.
- (2) Read resistance between sockets D1 and C3 on vehicle harness connector.

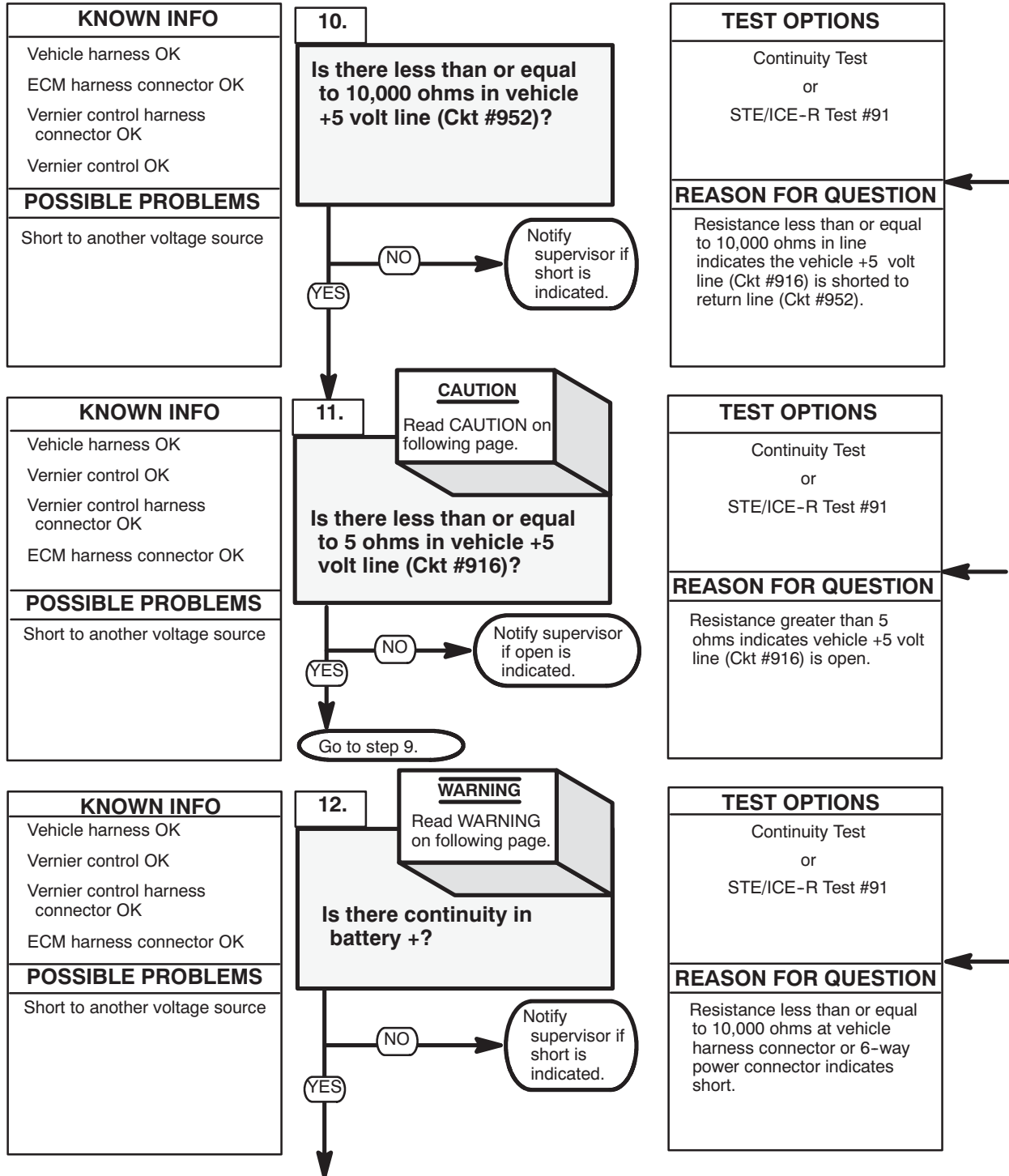
VERNIER CONTROL HARNESS CONNECTOR

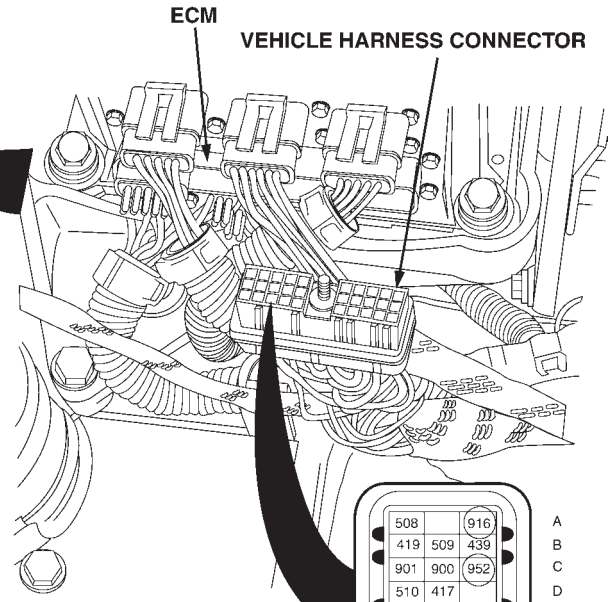
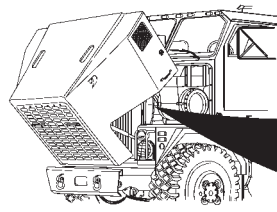


VEHICLE HARNESS CONNECTOR



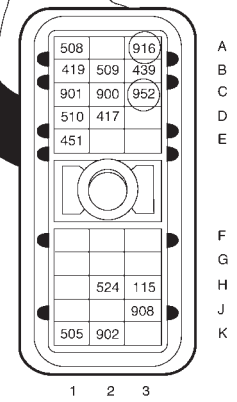
A4 - Code 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT)





CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect vehicle harness connector at ECM.
- (3) Read resistance between sockets A and C on vernier control harness connector.



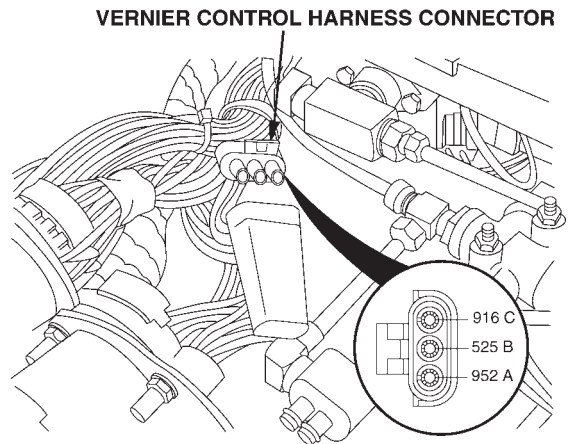
CAUTION
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

- (1) Install a jumper wire between sockets A and C of Vernier Control harness connector.
- (2) Read resistance between sockets A3 and C3 on vehicle harness connector.

WARNING

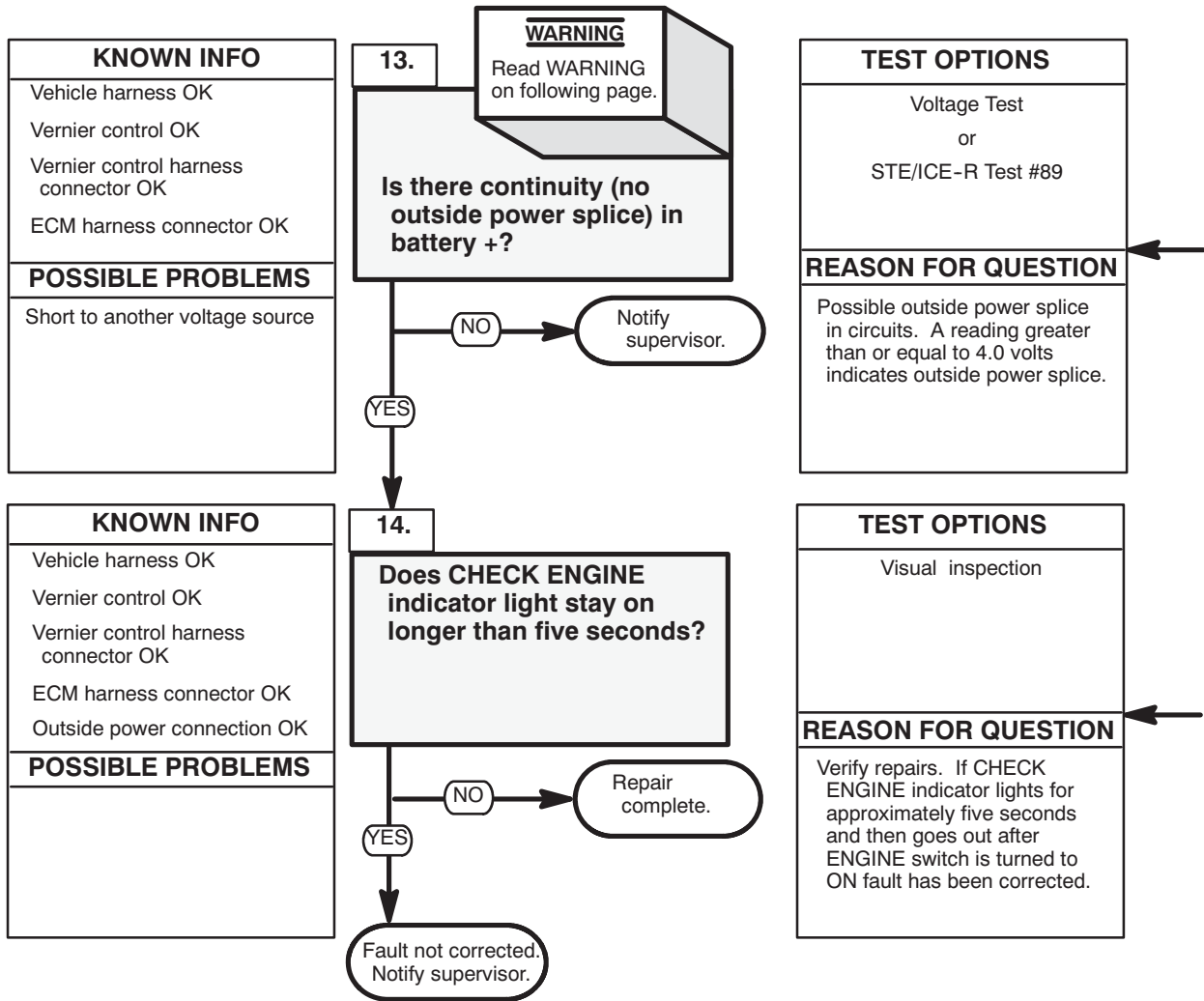
- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.



CONTINUITY TEST

- (1) Turn ENGINE switch OFF and disconnect batteries (para 7-61).
- (2) Disconnect 6-way power connector at ECM.
- (3) Read resistance between sockets D1 and B3 on vehicle harness connector.
- (4) Read resistance between socket D1 on vehicle harness connector and sockets C, D, E, and F on 6-way power harness connector.
- (5) Connect batteries (para 7-61).

A4 - Code 11 VERNIER CONTROL SIGNAL VOLTAGE LOW (CONT)



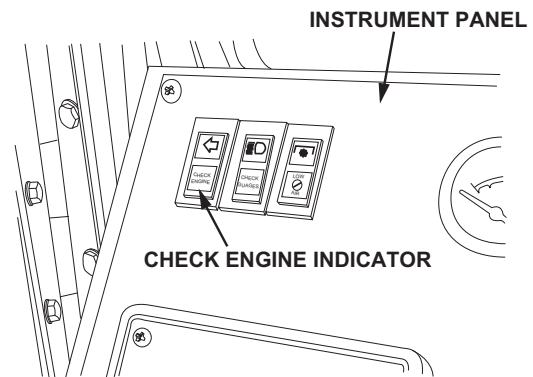
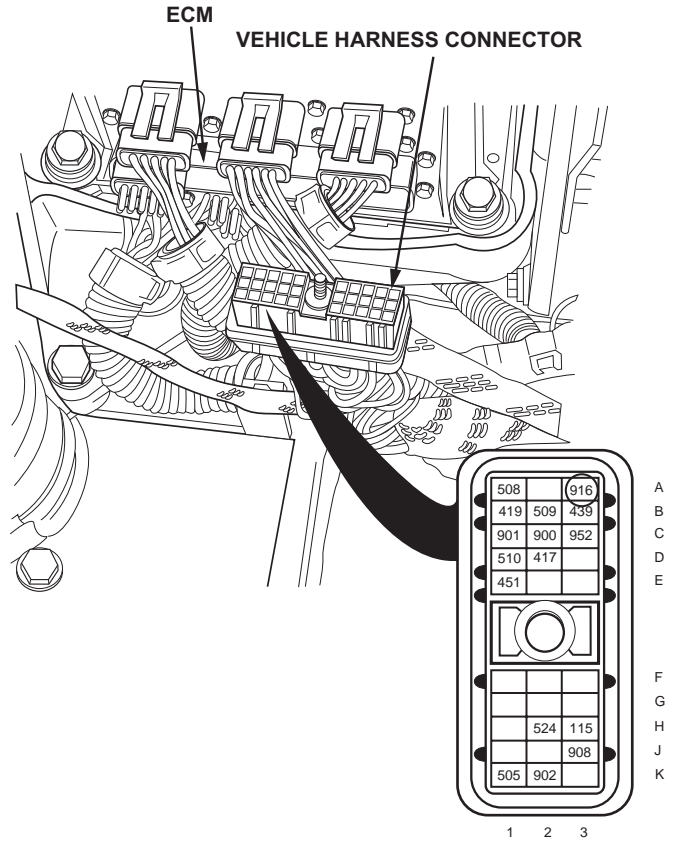
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

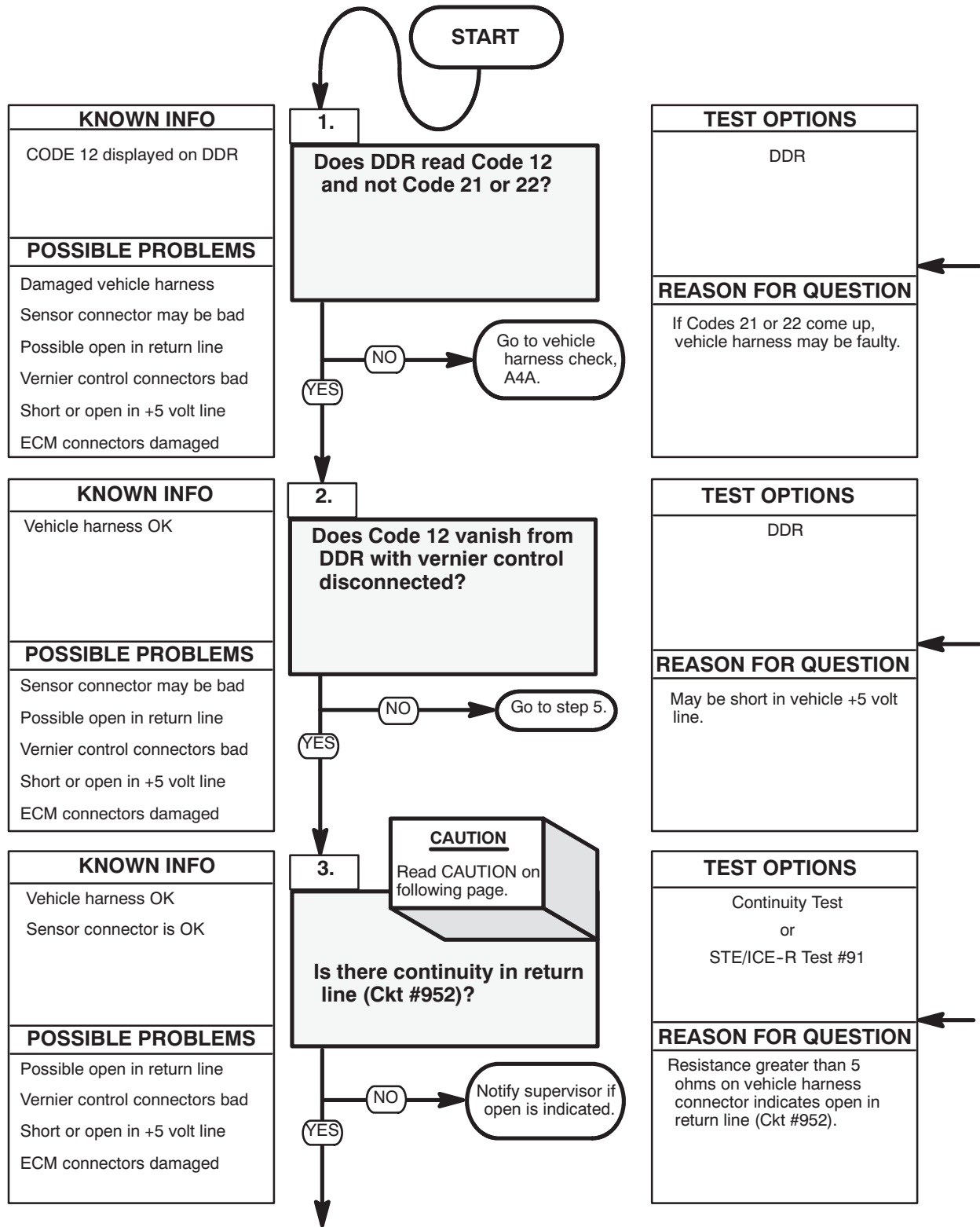
VOLTAGE TEST

- (1) Turn ENGINE switch ON.
- (2) Read voltage A3 (red lead) to a good ground (black lead).
- (3) Read voltage C3 (red lead) to good ground (black lead).

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.

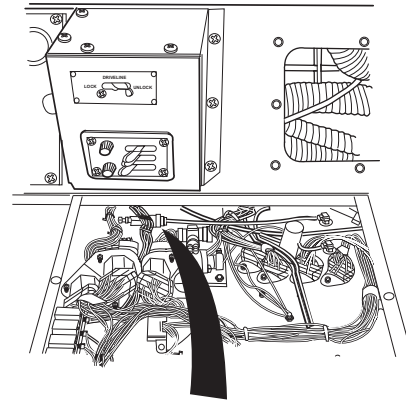


A4 - CODE 12 VERNIER CONTROL SIGNAL VOLTAGE HIGH

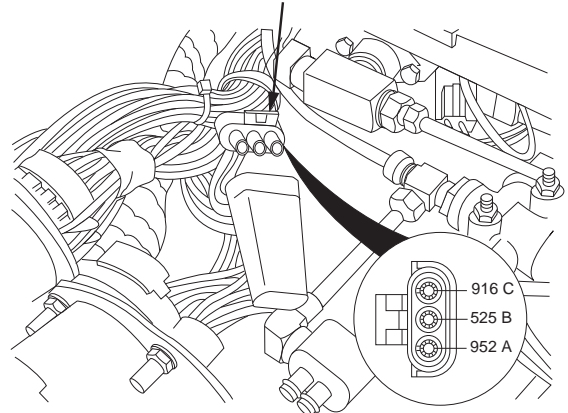


NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.



VERNIER CONTROL HARNESS CONNECTOR



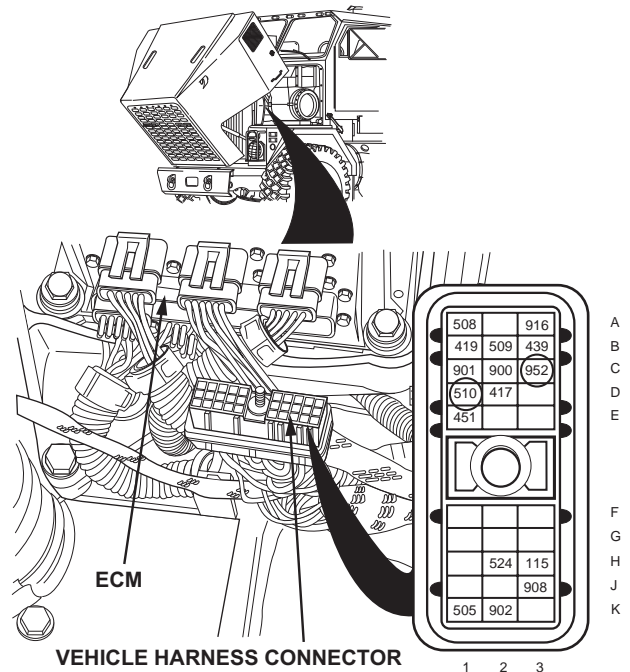
- (1) Turn ENGINE switch OFF and unplug vernier control sensor connector.
- (1.1) Click on "Alarms Clear" to clear alarms screen.
- (2) Turn ENGINE switch ON and read active codes.

CAUTION

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

CONTINUITY TEST

- (1) With transmission in neutral, turn ENGINE switch OFF.
- (2) Install a jumper wire between pin A and pin B of vernier control harness connector.
- (3) Disconnect vehicle harness connector at ECM.
- (3.1) Turn engine switch ON.
- (3.2) Push ENGINE SPEED CONTROL switch to ENGINE HIGH IDLE position (TM 9-2320-360-10).
- (3.3) Push and release ENGINE SPEED CONTROL switch forward to engage DDEC HI IDLE relay (TM 9-2320-360-10).
- (4) Read resistance between sockets C3 and D1 on the vehicle harness connector.
- (5) Turn engine switch OFF.

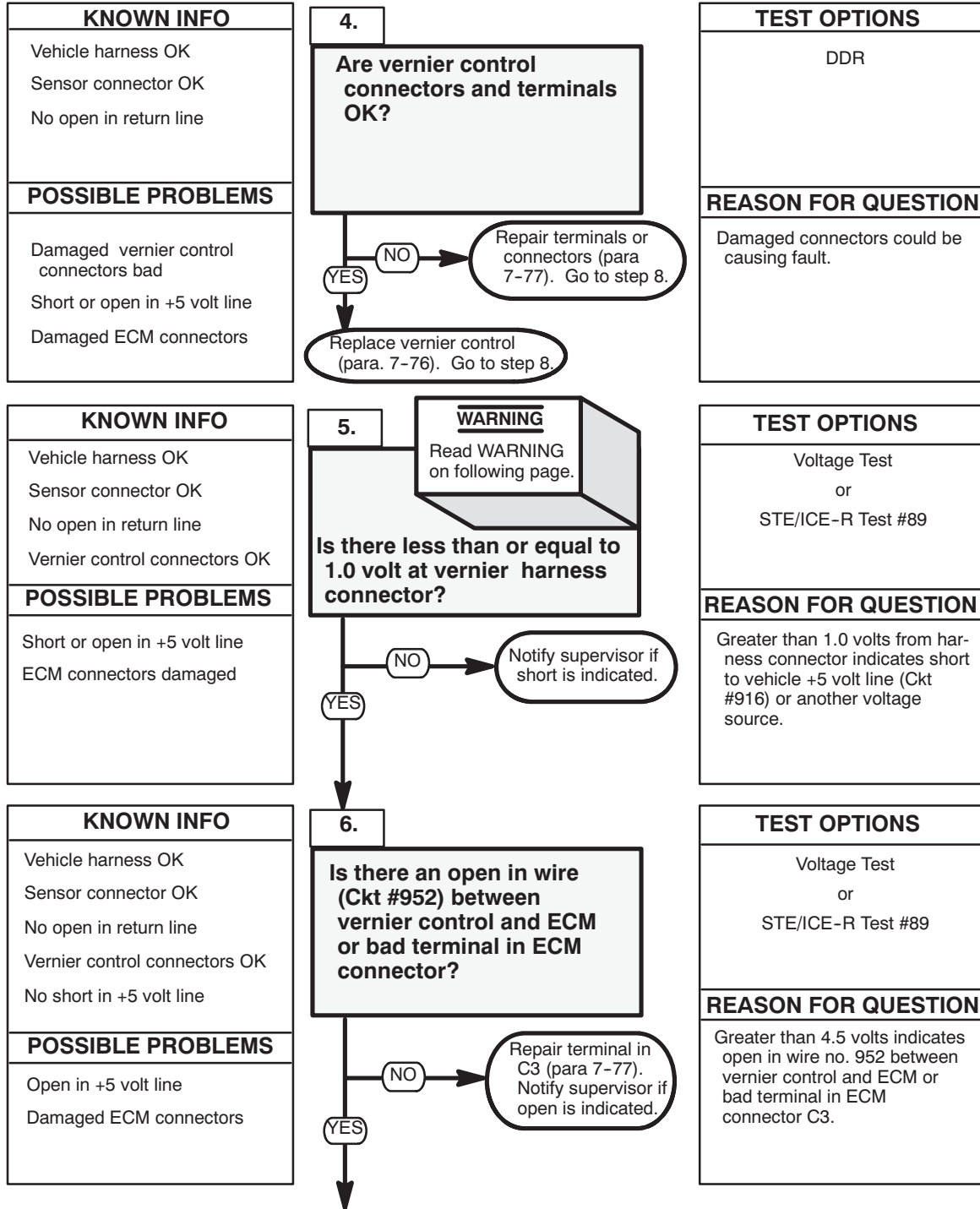


VEHICLE HARNESS CONNECTOR

508	916	A	
419	509	439	B
901	900	952	C
510	417		D
451			E
			F
			G
			H
			J
			K
505	902		

1 2 3

A4 - CODE 12 VERNIER CONTROL SIGNAL VOLTAGE HIGH (CONT)



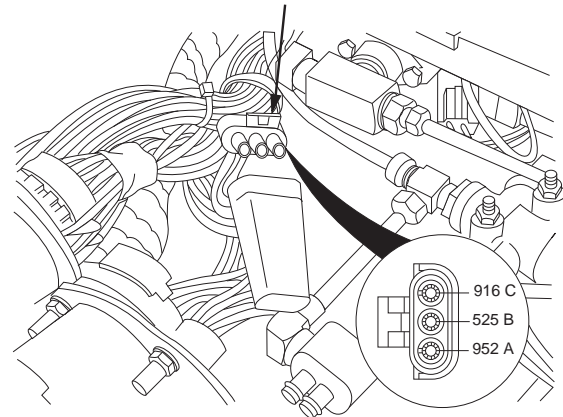
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

- (1) Connect all connectors to ECM.
- (2) Turn ENGINE switch ON.
- (3) Read voltage from vernier control harness connector pin B (red lead) to pin A (black lead).

VERNIER CONTROL HARNESS CONNECTOR



VOLTAGE TEST

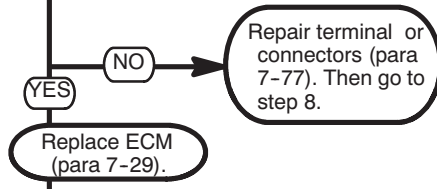
- (1) Connect all connectors to ECM.
- (2) Read voltage on vernier control harness at pin B (red lead) and pin A (black lead) with ENGINE switch ON

A4 - CODE 12 VERNIER CONTROL SIGNAL VOLTAGE HIGH (CONT)

KNOWN INFO
Vehicle harness OK
Sensor connector OK
No open in return line
Vernier control connectors OK
No short or open in +5 volt line
POSSIBLE PROBLEMS
Damaged ECM connectors

7.

Are ECM vehicle harness connectors (both ECM and harness side) OK?

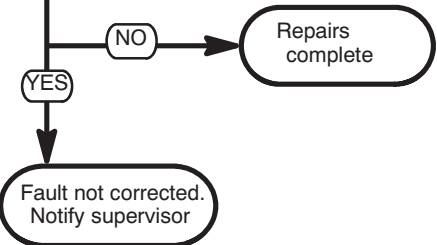


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Terminal and connectors may be damaged.

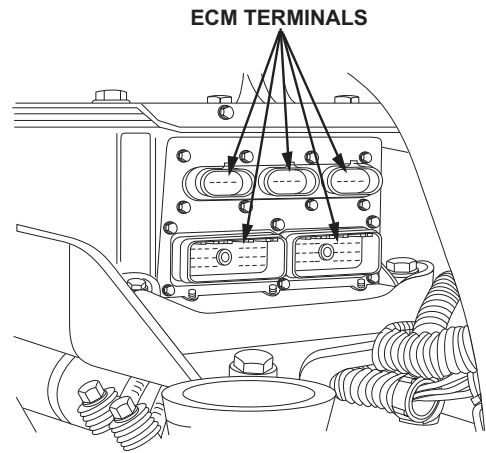
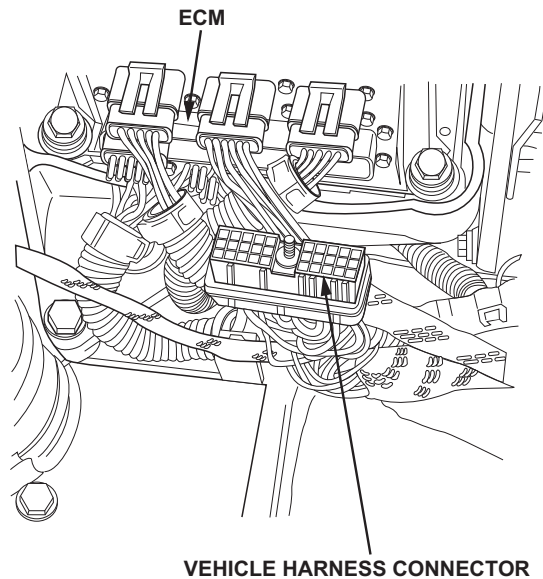
KNOWN INFO
Vehicle harness OK
Sensor connector OK
No open in return line
Vernier control connectors OK
No short or open in +5 volt line
ECM connectors OK
POSSIBLE PROBLEMS
None

8.

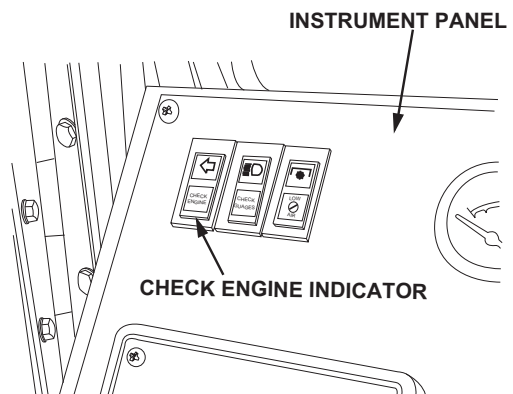
Does CHECK ENGINE indicator light stay on longer than five seconds?



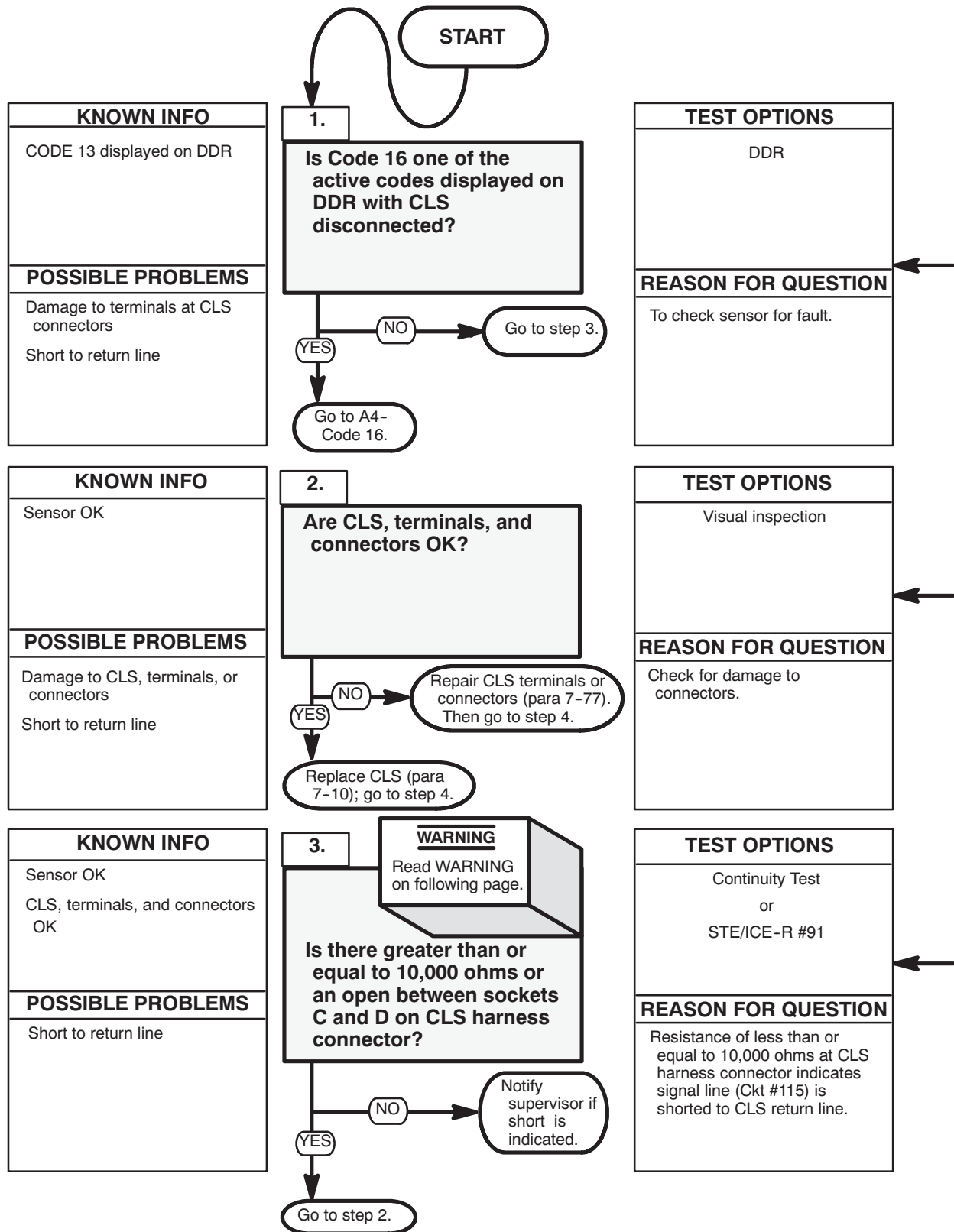
TEST OPTIONS
Visual Inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned to ON fault has been corrected.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - CODE 13 COOLANT LEVEL SENSOR (CLS) SIGNAL VOLTAGE LOW



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

- | |
|---|
| <ol style="list-style-type: none"> (1) Turn ENGINE switch OFF and disconnect CLS. (2) Start engine (TM 9-2320-360-10). (3) Read active codes. (4) Stop engine (TM 9-2320-360-10). |
|---|

Inspect CLS and terminals at CLS connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets.

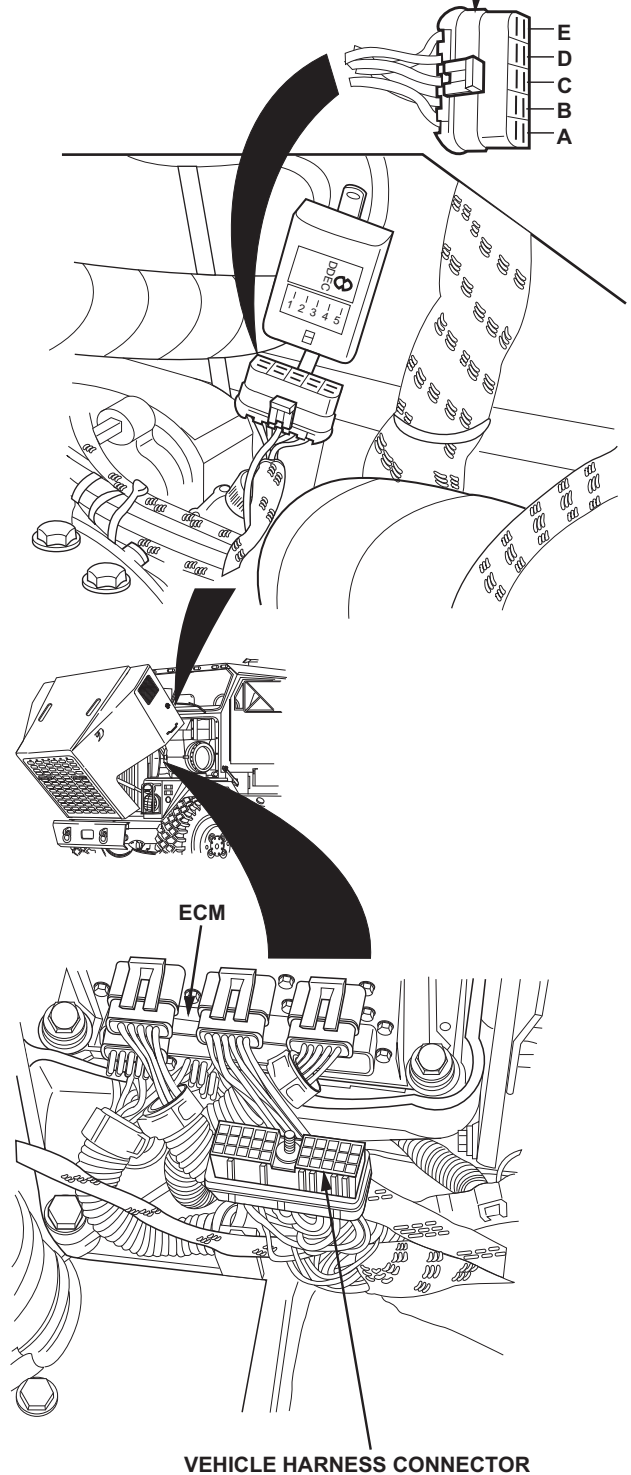
WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

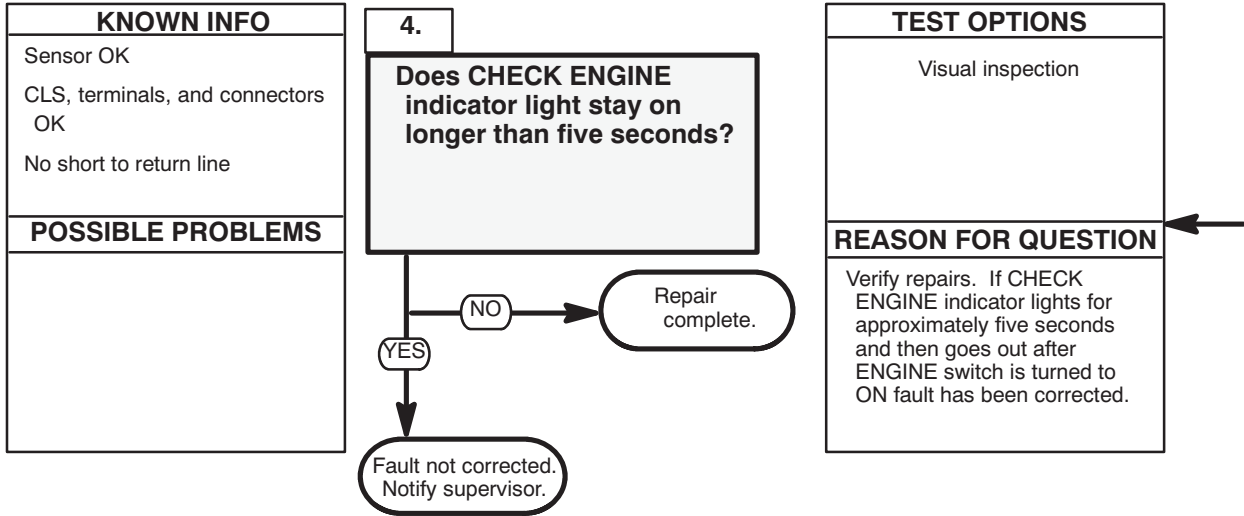
CONTINUITY TEST

- | |
|--|
| <ol style="list-style-type: none"> (1) Turn ENGINE switch OFF. (2) Disconnect vehicle harness connector at ECM. (3) Read resistance between sockets C and D on ECM side of CLS harness connector. |
|--|

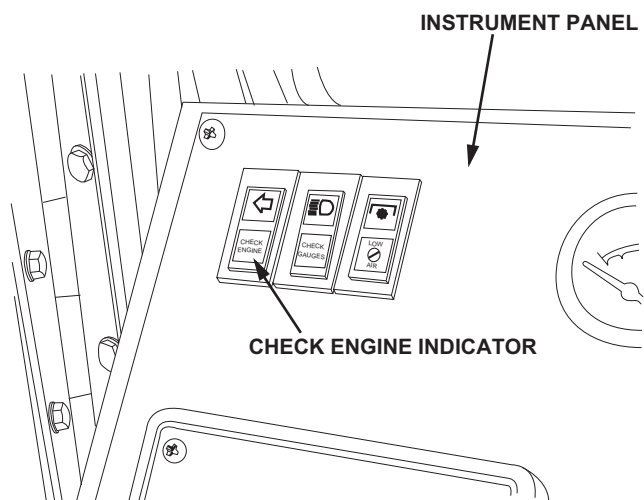
CLS HARNESS CONNECTOR



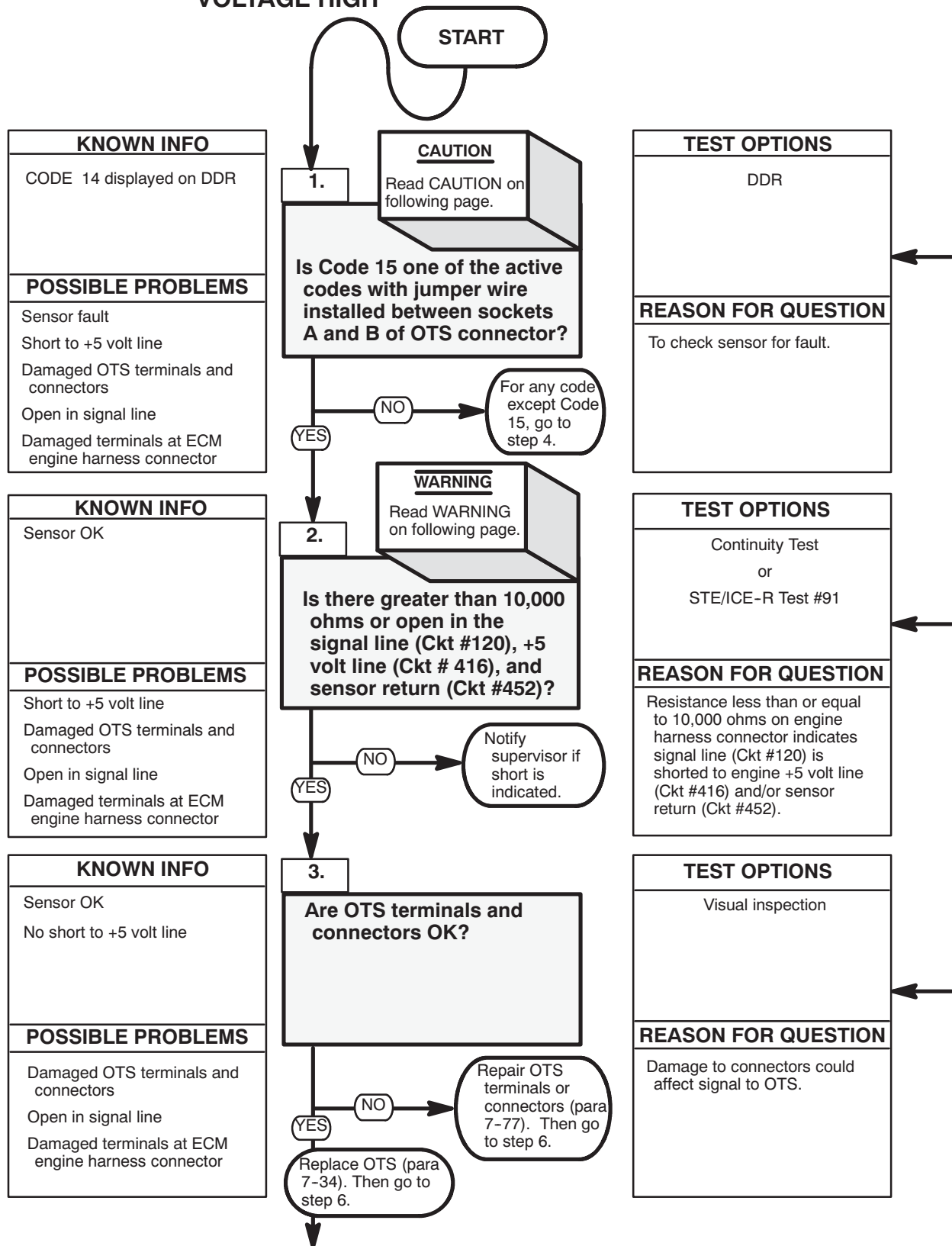
A4 - CODE 13 COOLANT LEVEL SENSOR (CLS) SIGNAL VOLTAGE LOW (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 14 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE HIGH

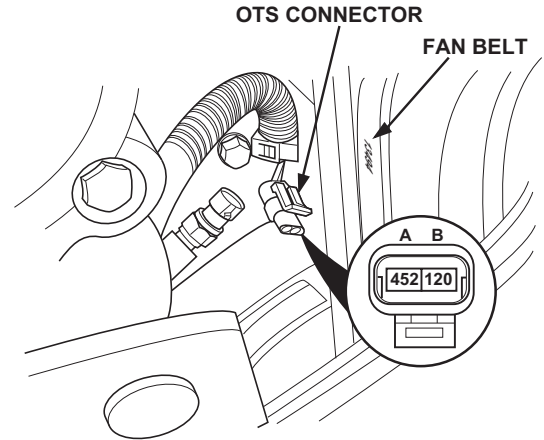


CAUTION

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

NOTE

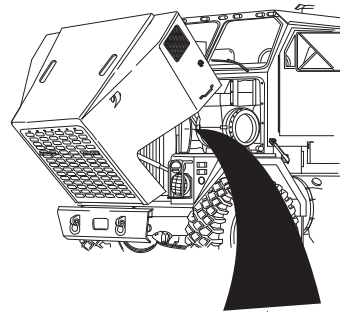
- The following chart should be used only if DDEC troubleshooting was started on pg. 2-80 and you were referred here.
- A false DDEC historical Code 14 may be logged during cold starts in extremely cold environments, -50 to -26F° (-46 to -32°C). Typically, the CHECK ENGINE light will come on 8 minutes after starting and go out 2-3 minutes later. If the vehicle has been operated under these conditions, clear the historical codes and return the vehicle to service.



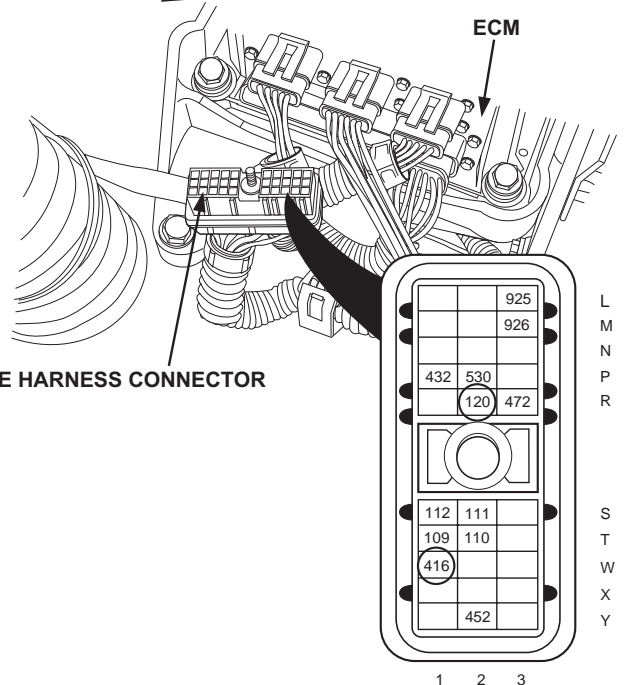
- (1) Turn ENGINE switch OFF.
- (2) Disconnect OTS and install a jumper between OTS connector sockets A and B.
- (2.1) Click on "Alarms Clear" to clear alarms screen.
- (3) Turn ENGINE switch ON and read active codes.

WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

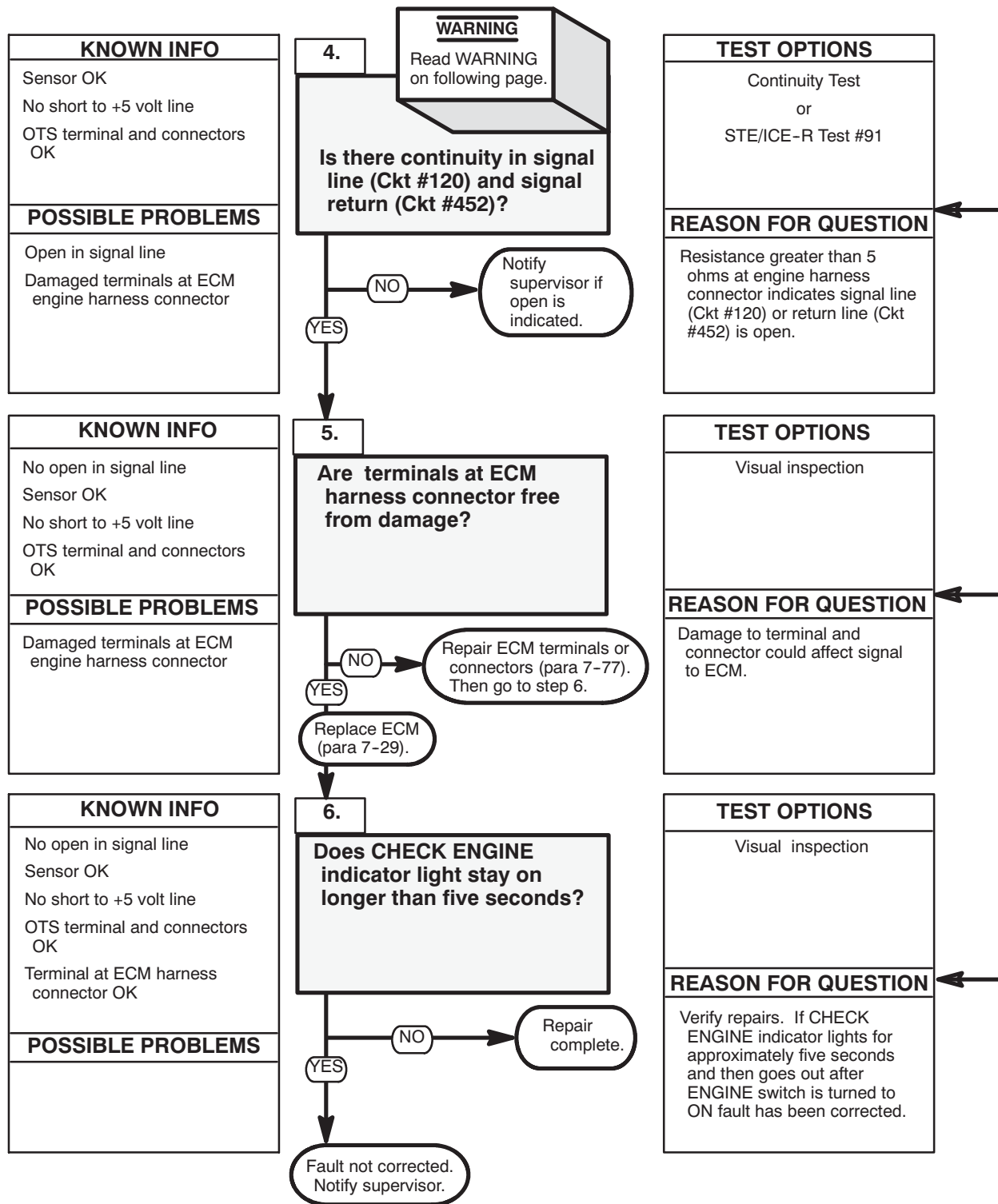


- CONTINUITY TEST**
- (1) Turn ENGINE switch OFF and remove jumper.
 - (2) Disconnect engine harness connector at ECM.
 - (3) Read resistance between sockets R2 and W1 on engine harness connector.



Inspect OTS and terminals at OTS connectors (both sensor and harness sides) for damage; bent, corroded, and unseated pins or sockets

A4 - Code 14 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE HIGH (CONT)

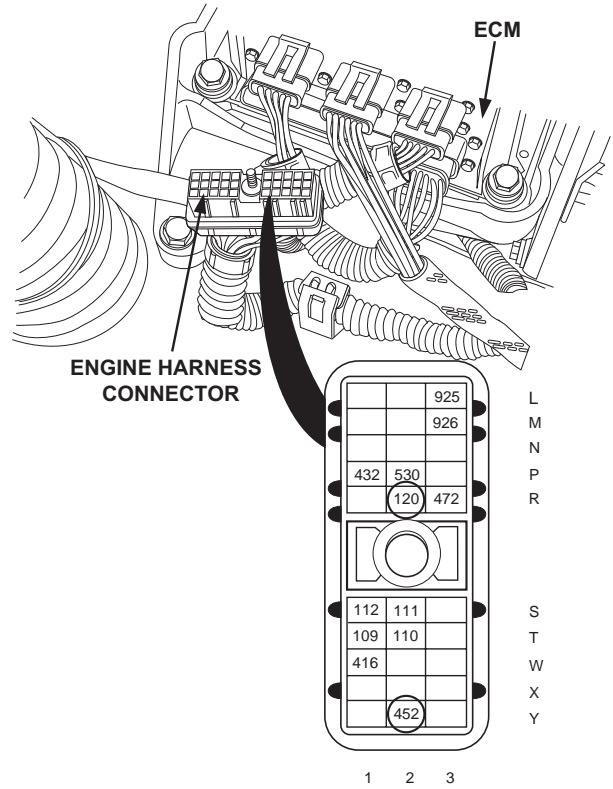


WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

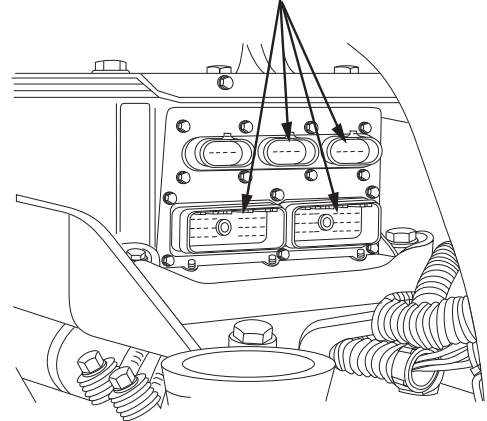
CONTINUITY TEST

- (1) Turn ENGINE switch OFF and disconnect engine harness connector at ECM.
- (2) Read resistance between sockets R2 and Y2 on engine harness connector.



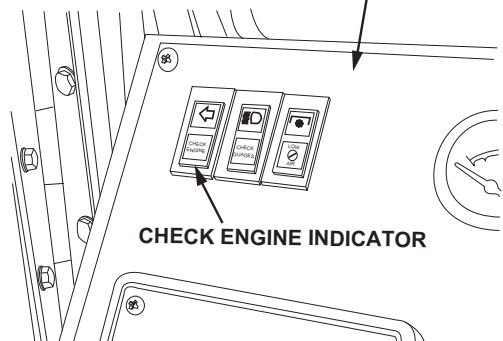
Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.

ECM TERMINALS

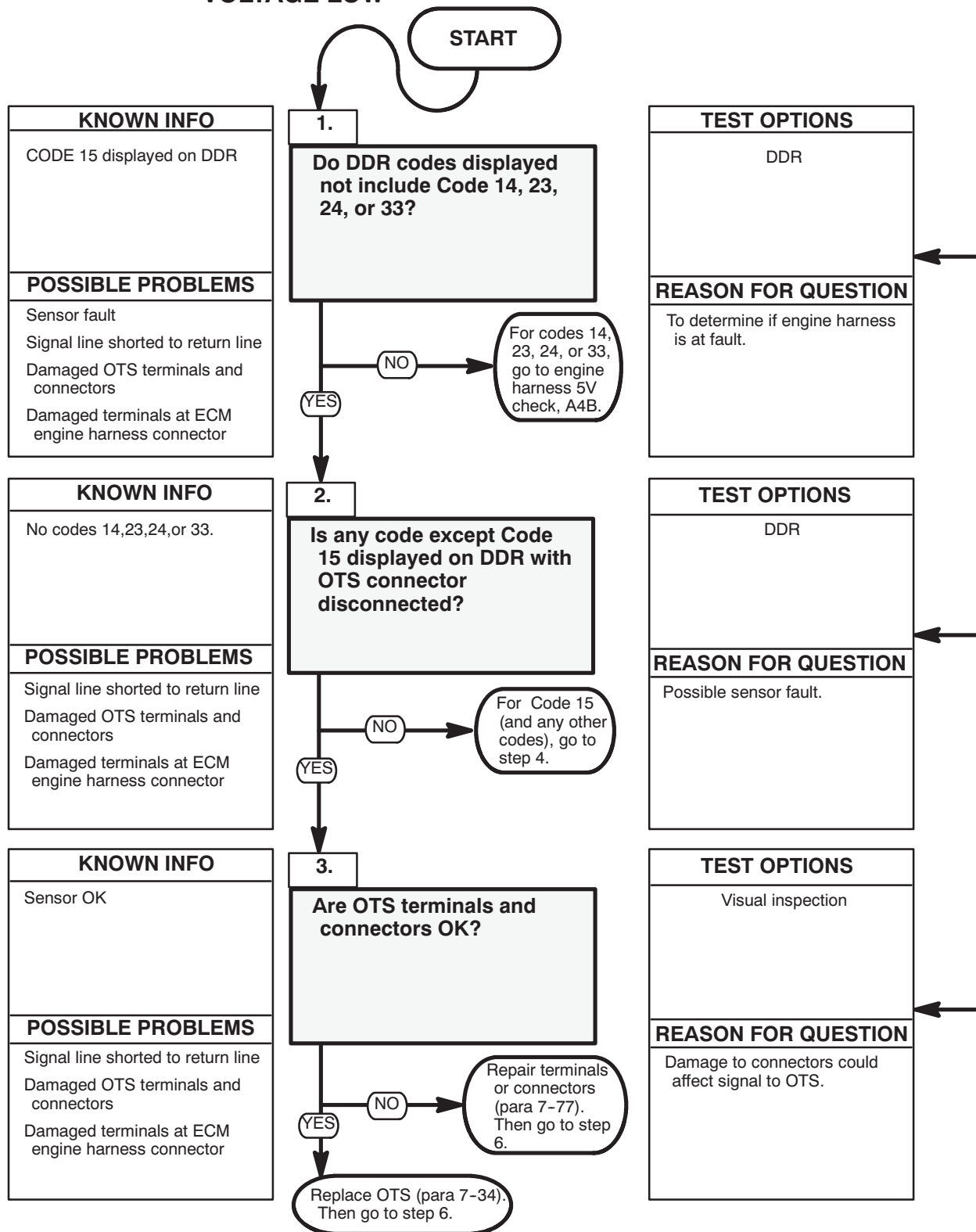


- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.

INSTRUMENT PANEL



A4 - Code 15 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE LOW

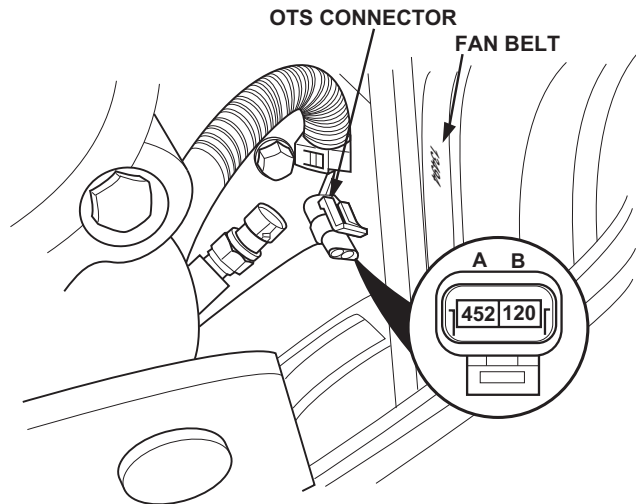


NOTE

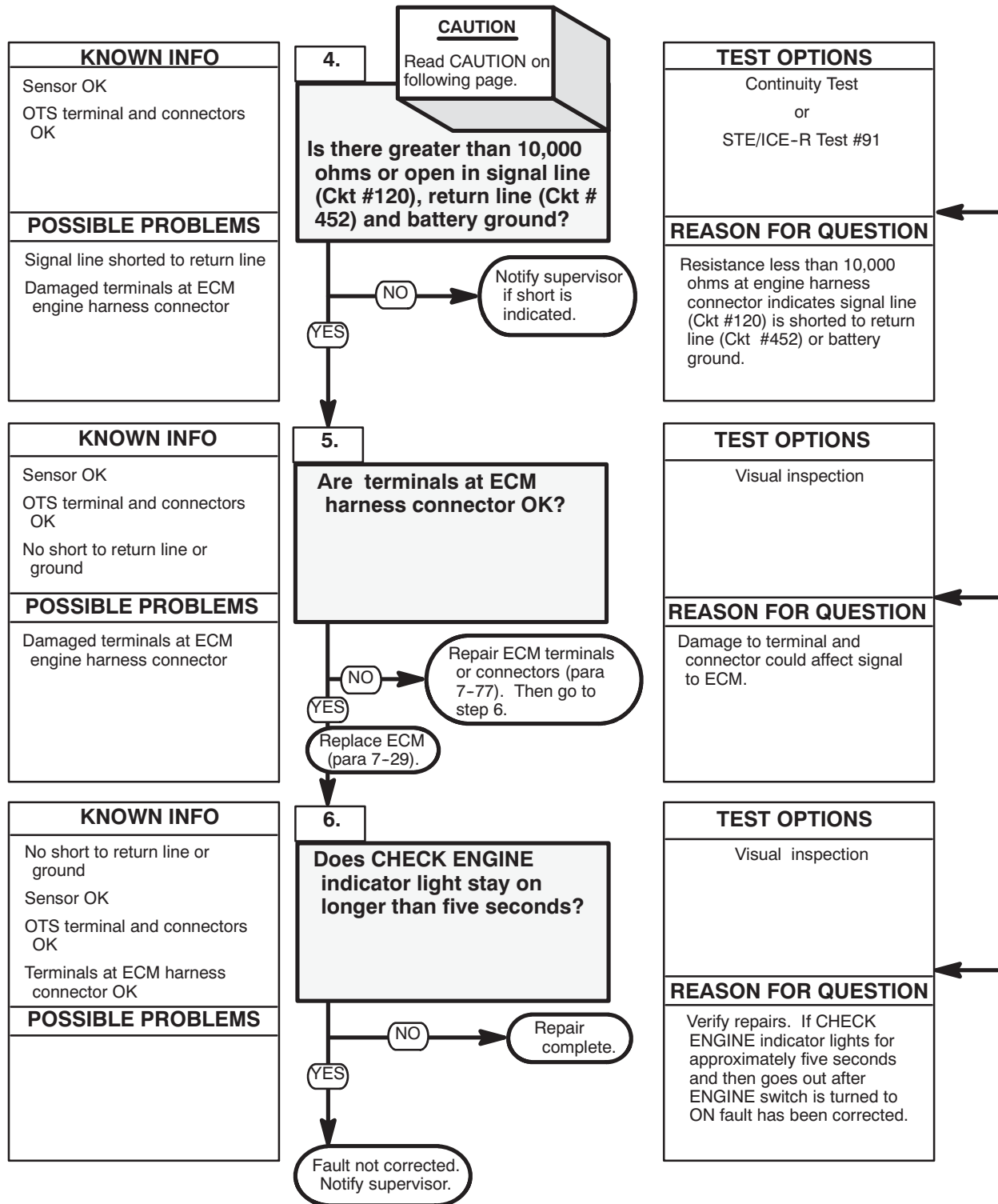
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

- (1) Turn ENGINE switch OFF and disconnect OTS connector.
- (1.1) Click on "Alarms Clear" to clear alarms screen.
- (2) Start engine and run until CHECK ENGINE light comes on or after 8 minutes.
- (3) Read active codes with engine still running.

Check terminals at OTS connectors (both sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.



A4 - Code 15 OIL TEMPERATURE SENSOR (OTS) SIGNAL VOLTAGE LOW (CONT)



CAUTION

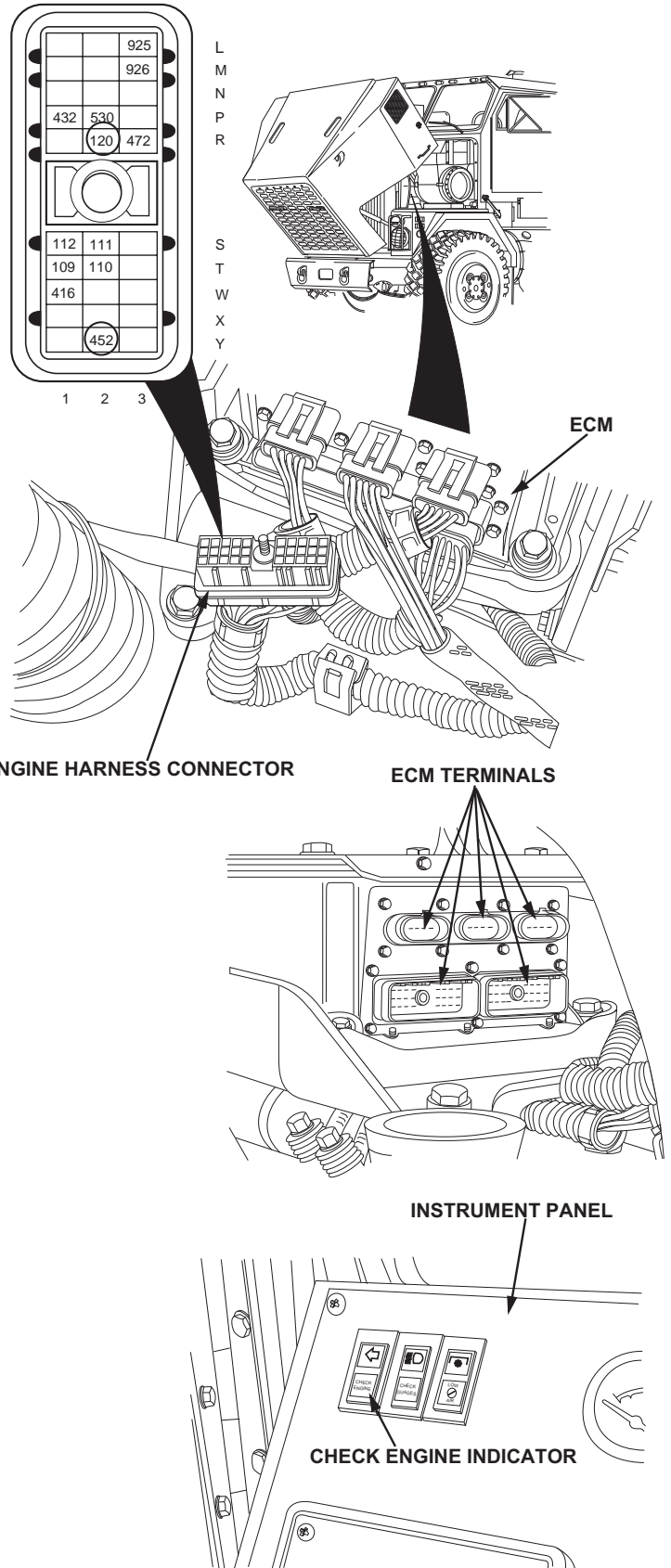
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

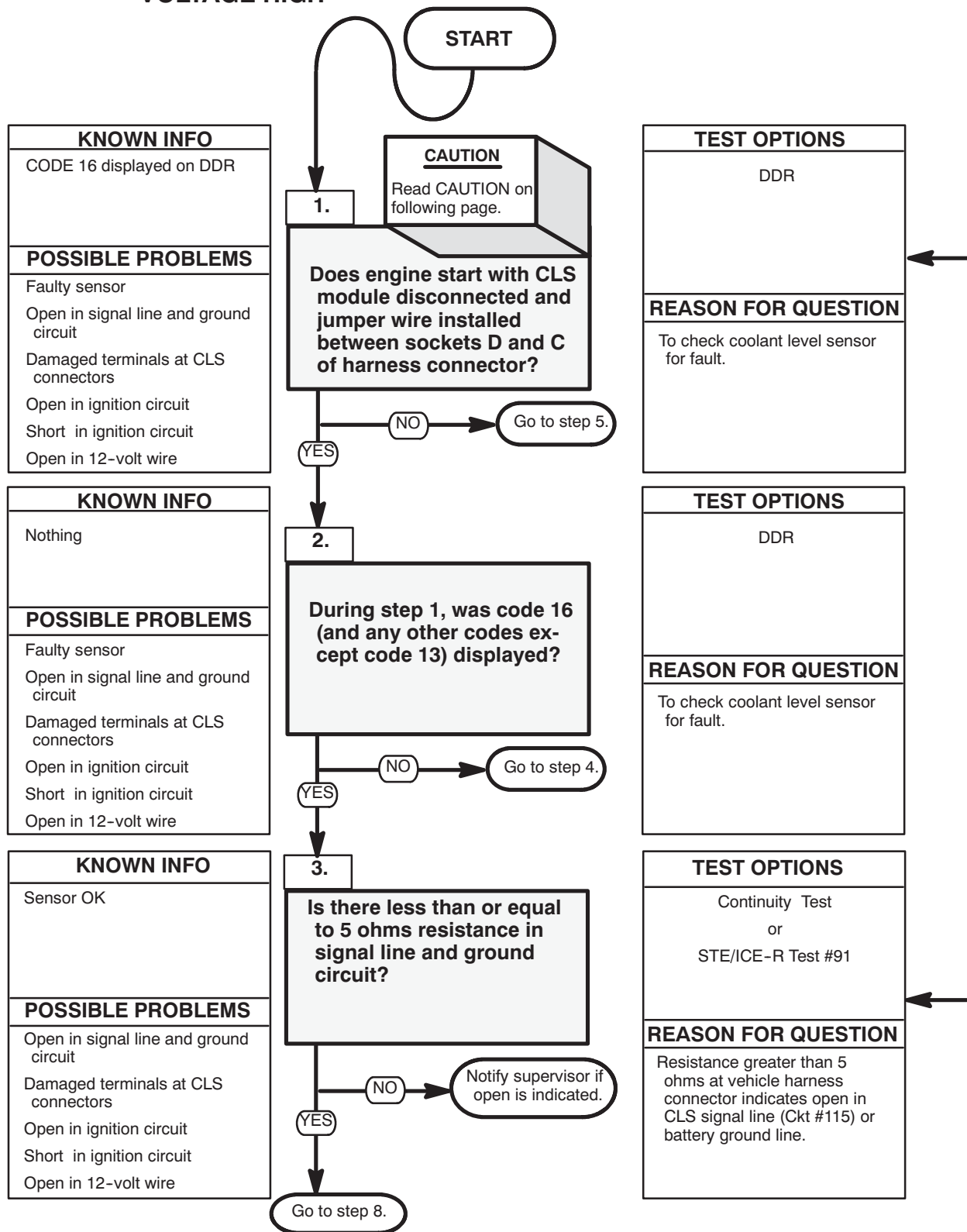
- (1) Turn ENGINE switch OFF and disconnect engine harness connector at ECM.
- (2) Read resistance between sockets R2 and Y2 on engine harness connector. Also read resistance between socket B of OTS connector and a good ground.

Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 16 TWO PIECE COOLANT LEVEL SENSOR (CLS) SIGNAL VOLTAGE HIGH



CAUTION

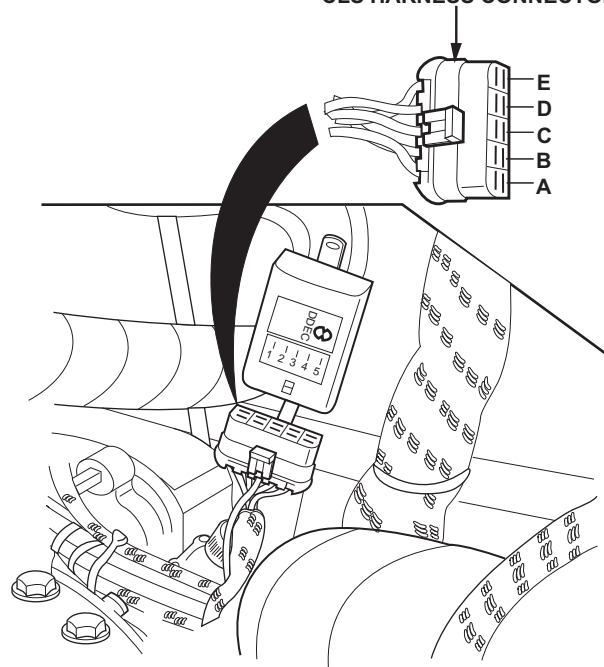
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

NOTE

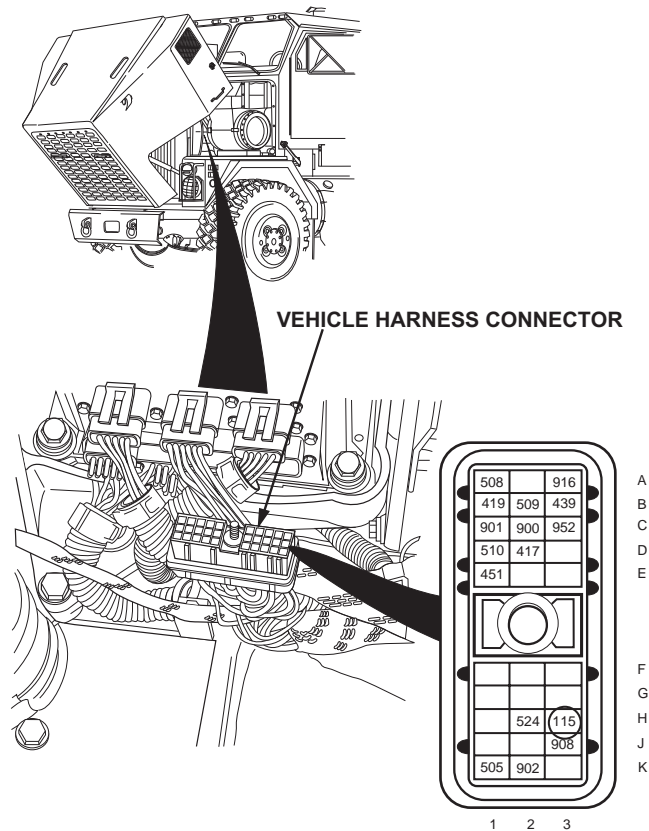
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-82 and you were referred here.

- (4) Turn ENGINE switch OFF.
- (5) Disconnect CLS module and install a jumper between sockets D and C of CLS harness connector.
- (6) Attempt to start and run engine at idle.
- (7) Read active codes.
- (8) Stop engine.

CLS HARNESS CONNECTOR



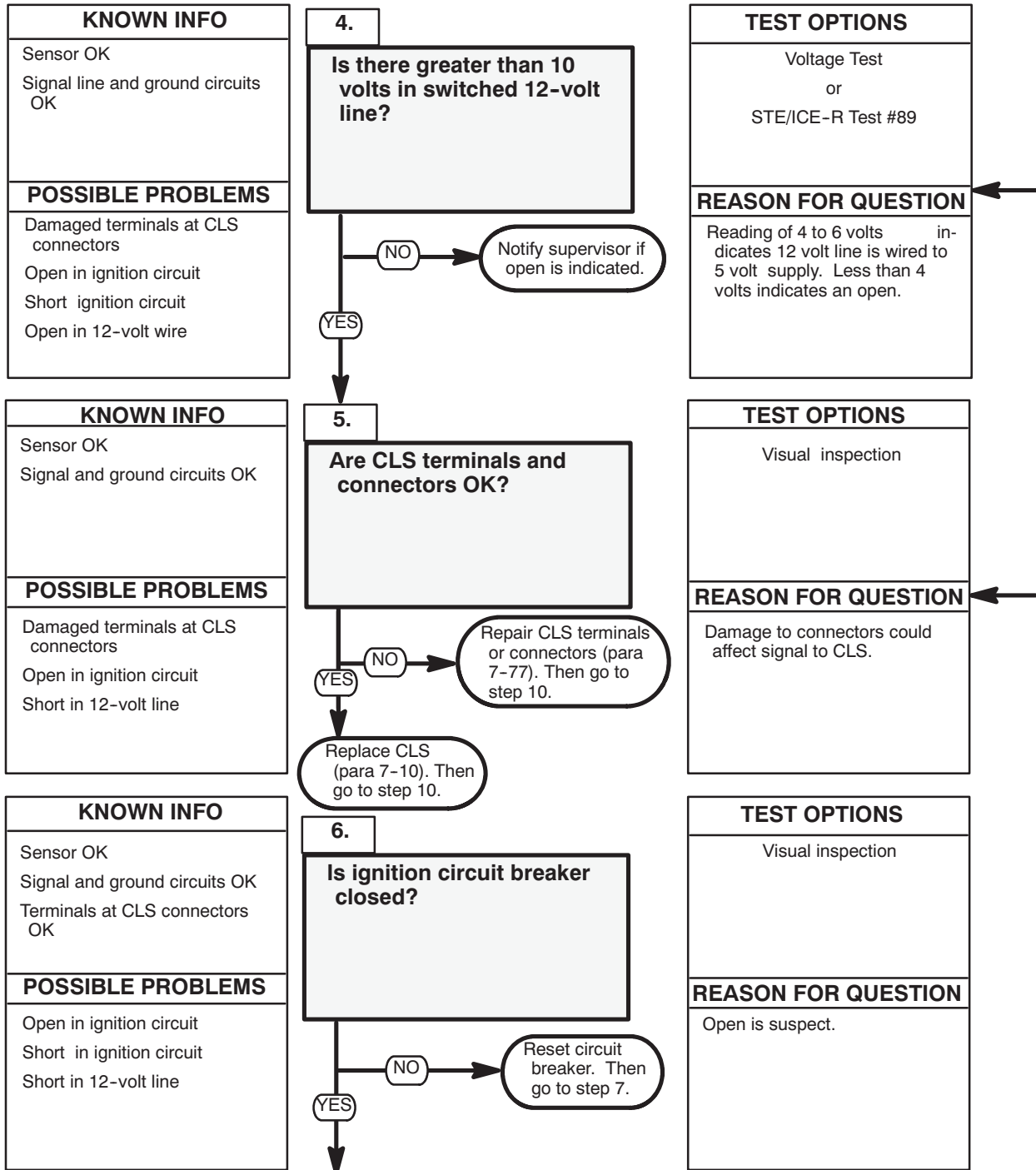
VEHICLE HARNESS CONNECTOR



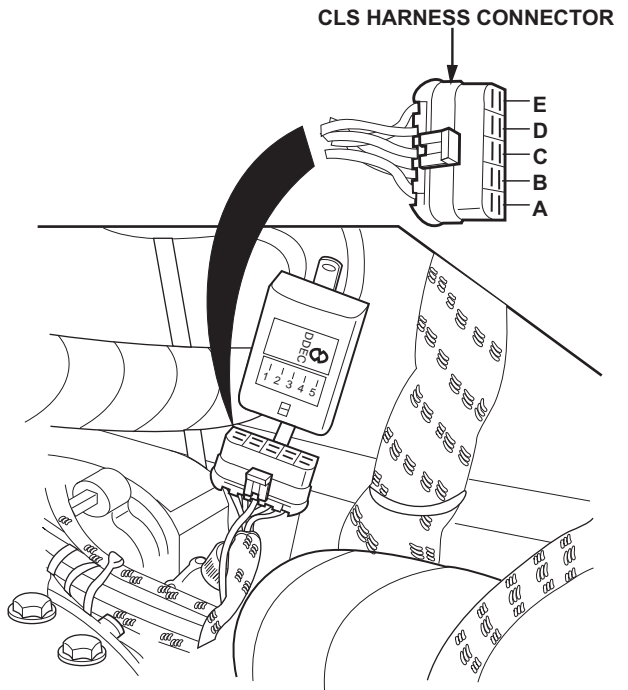
CONTINUITY TEST

- (1) Turn ENGINE switch OFF and disconnect vehicle harness connector.
- (2) Read resistance between socket H3 on vehicle harness connector and a good ground.

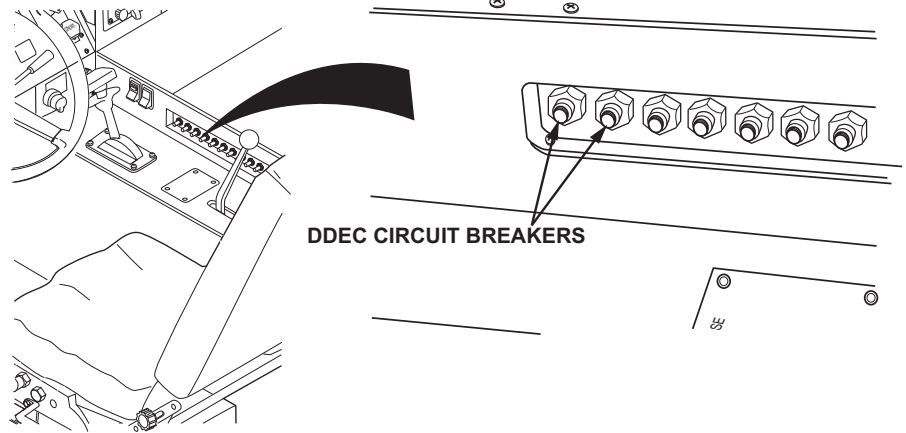
A4 - Code 16 TWO PIECE COOLANT LEVEL SENSOR (CLS) SIGNAL VOLTAGE HIGH (CONT)



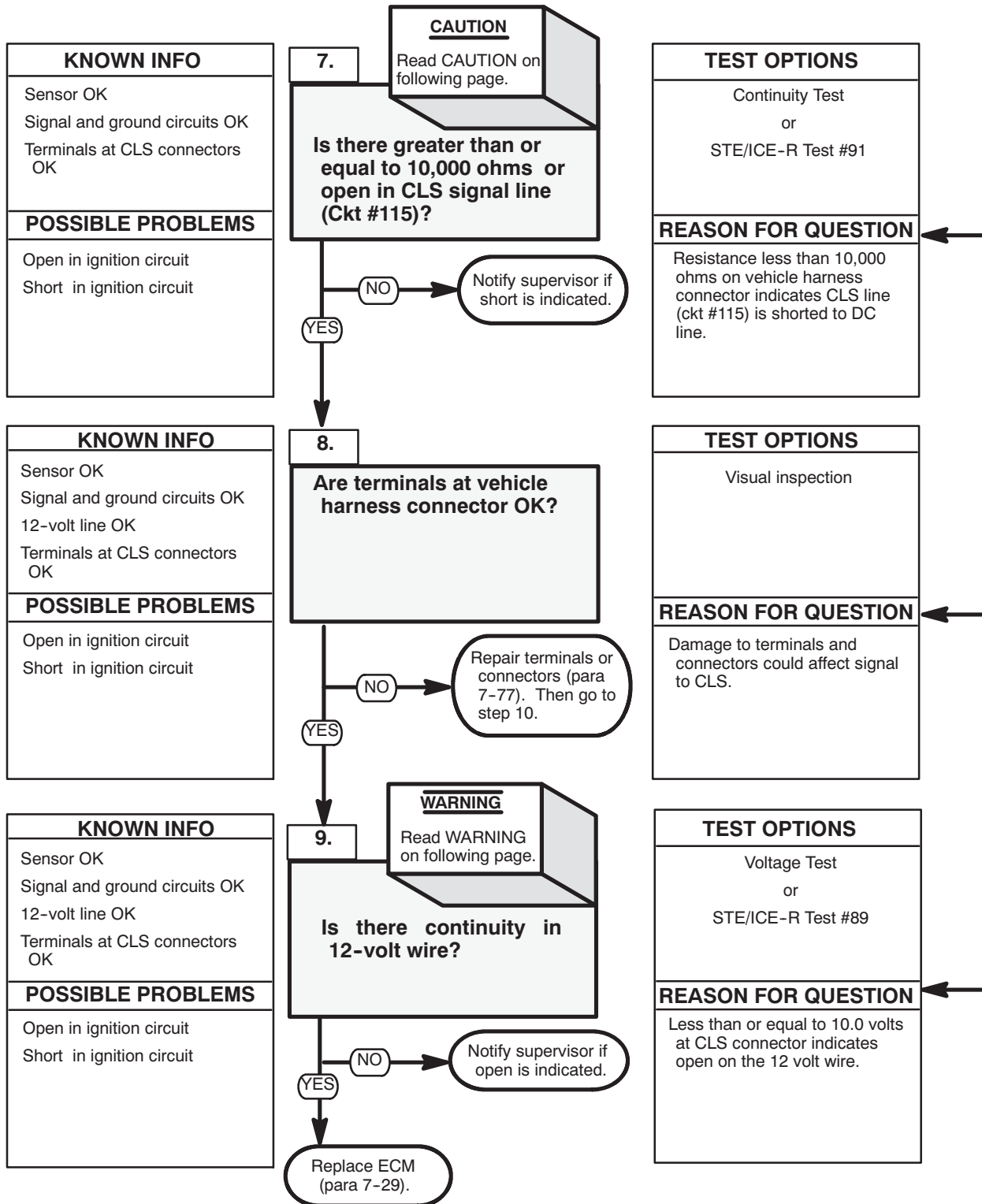
VOLTAGE TEST
 (1) Remove jumper wire.
 (2) Turn ENGINE switch ON and read voltage at CLS connector, socket E (red lead) to socket C (black lead).



Inspect CLS and terminals at CLS connectors (sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.



A4 - Code 16 TWO PIECE COOLANT LEVEL SENSOR (CLS) SIGNAL VOLTAGE HIGH (CONT)



CAUTION

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

CONTINUITY TEST

- (1) Disconnect vehicle harness connector at ECM
- (2) Remove jumper at CLS harness connector
- (3) Read resistance between sockets D and E of CLS connector on vehicle harness.

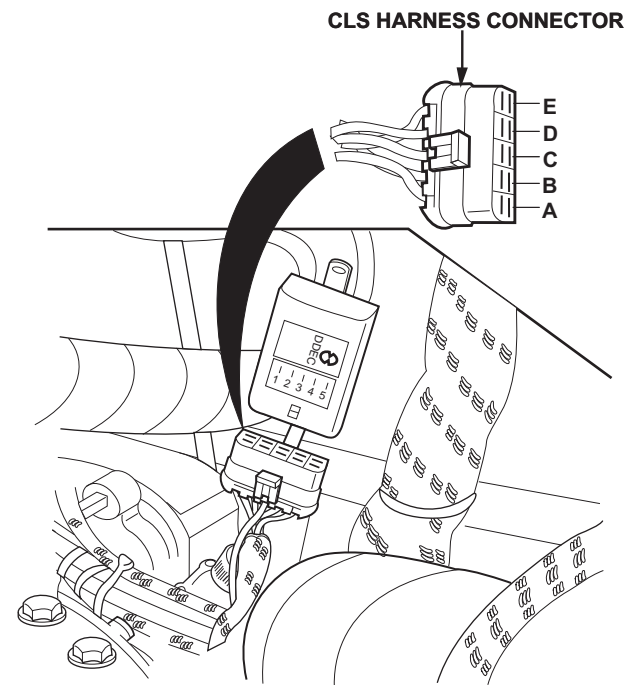
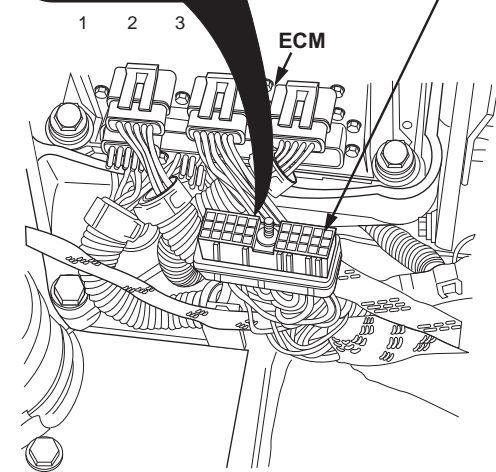
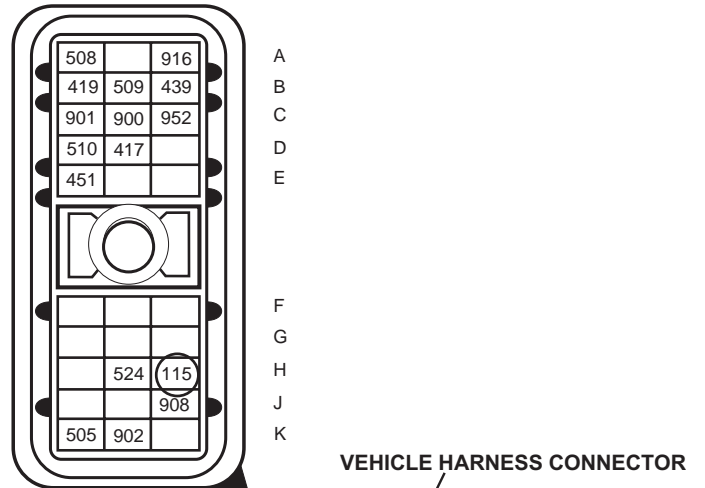
- (1) Check terminals at vehicle harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.
- (2) Check terminal and pin H3 at ECM and all terminals and pins in CLS module connectors for damage; bent, corroded, and unseated pins or sockets.

WARNING

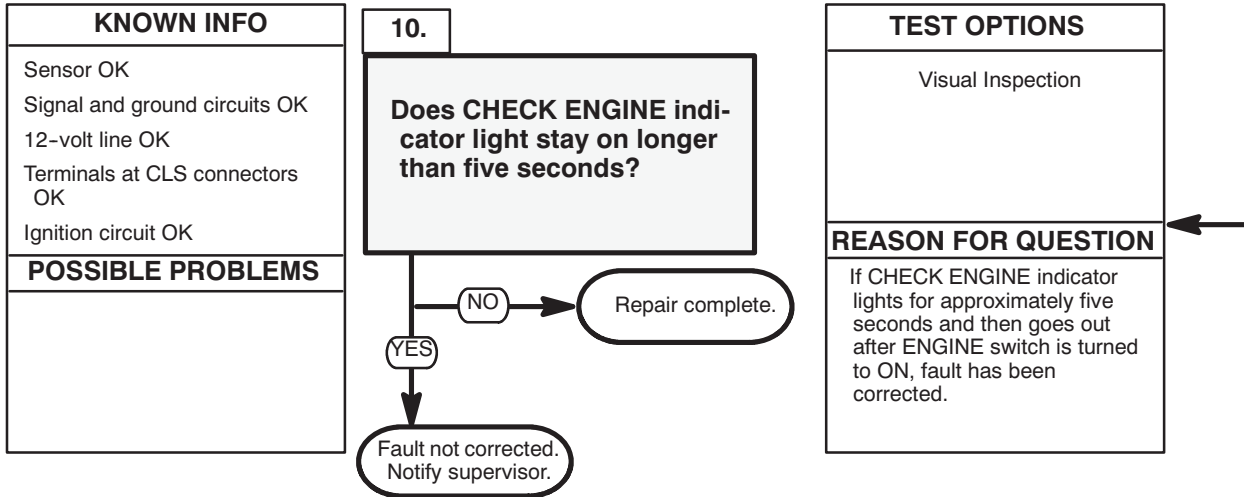
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

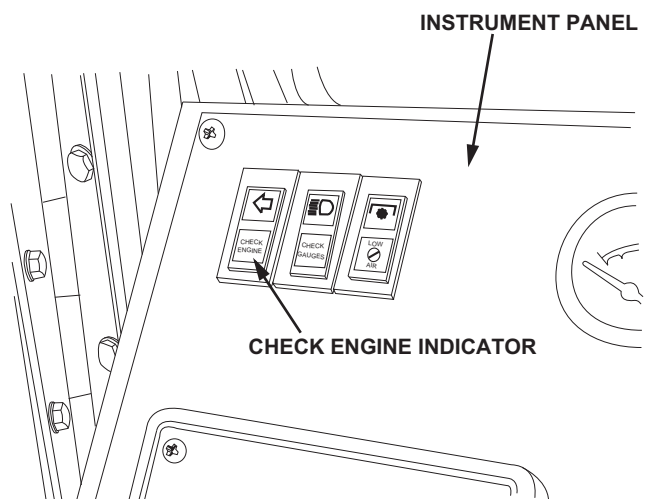
- (1) Turn ENGINE switch OFF and disconnect CLS module connector.
- (2) Place red lead of a voltmeter into terminal E of CLS connector vehicle harness side.
- (3) Connect black lead to terminal C of CLS connector vehicle harness side
- (4) Turn ENGINE switch ON and read voltage.



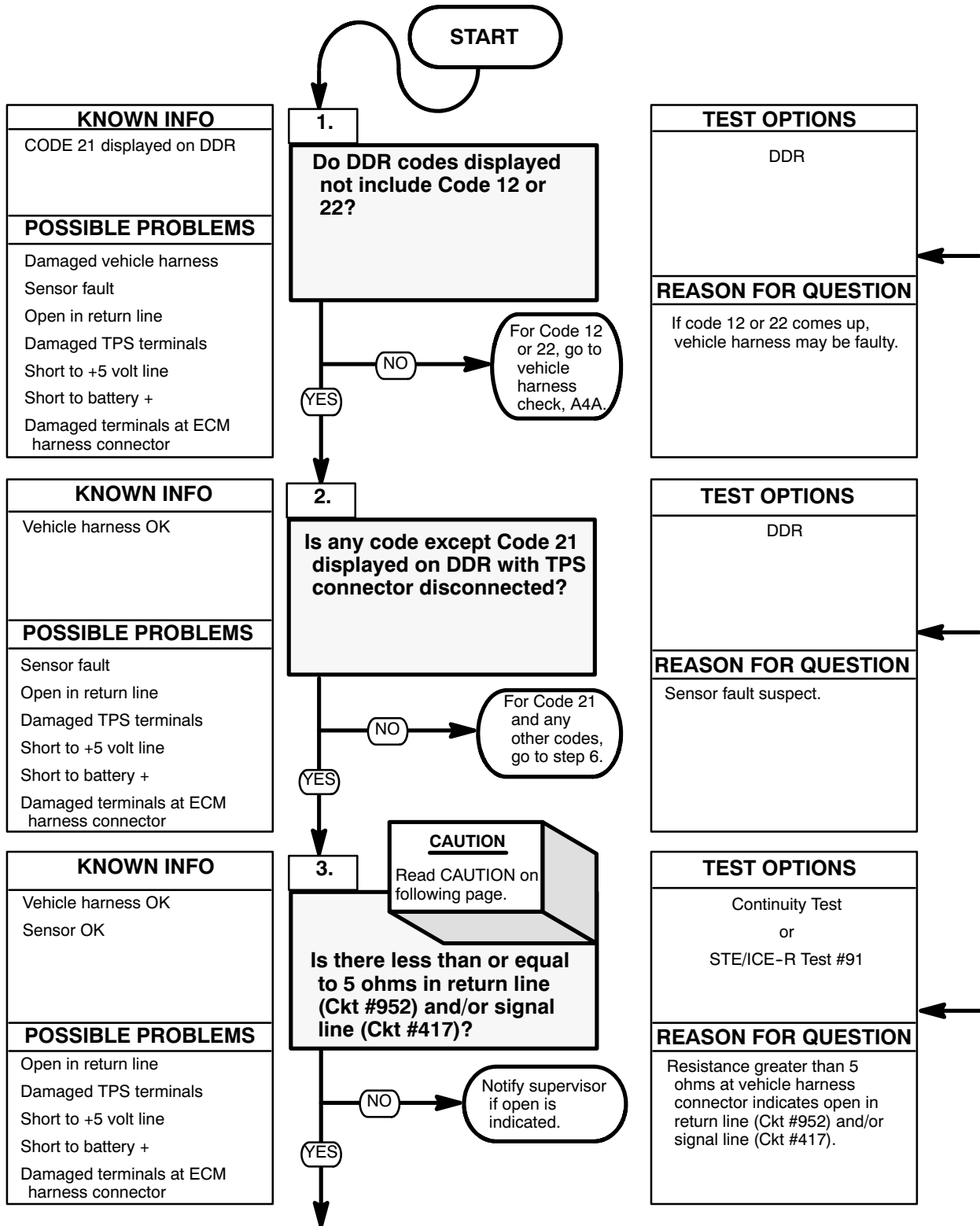
A4 - Code 16 TWO PIECE COOLANT LEVEL SENSOR (CLS) SIGNAL VOLTAGE HIGH (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



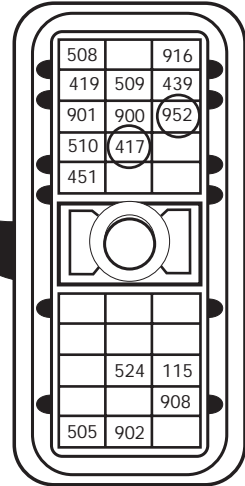
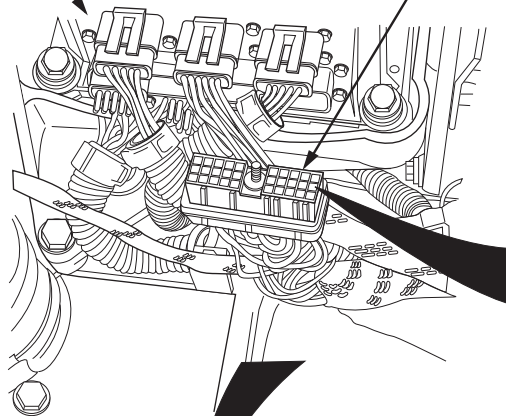
A4 - Code 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH



ECM VEHICLE HARNESS CONNECTOR

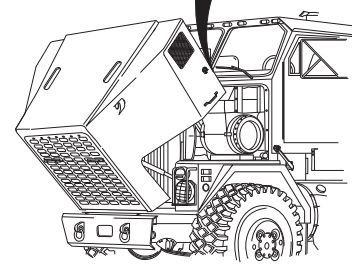
NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.



A
B
C
D
E
F
G
H
J
K

- (1) Turn ENGINE switch OFF and disconnect TPS connector.
- (1.1) Click on "Alarms Clear" to clear alarms screen.
- (2) Turn ENGINE switch ON and read active codes.



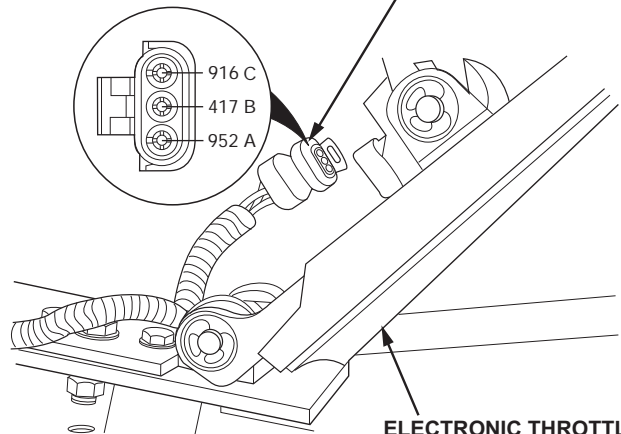
CAUTION

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

CONTINUITY TEST

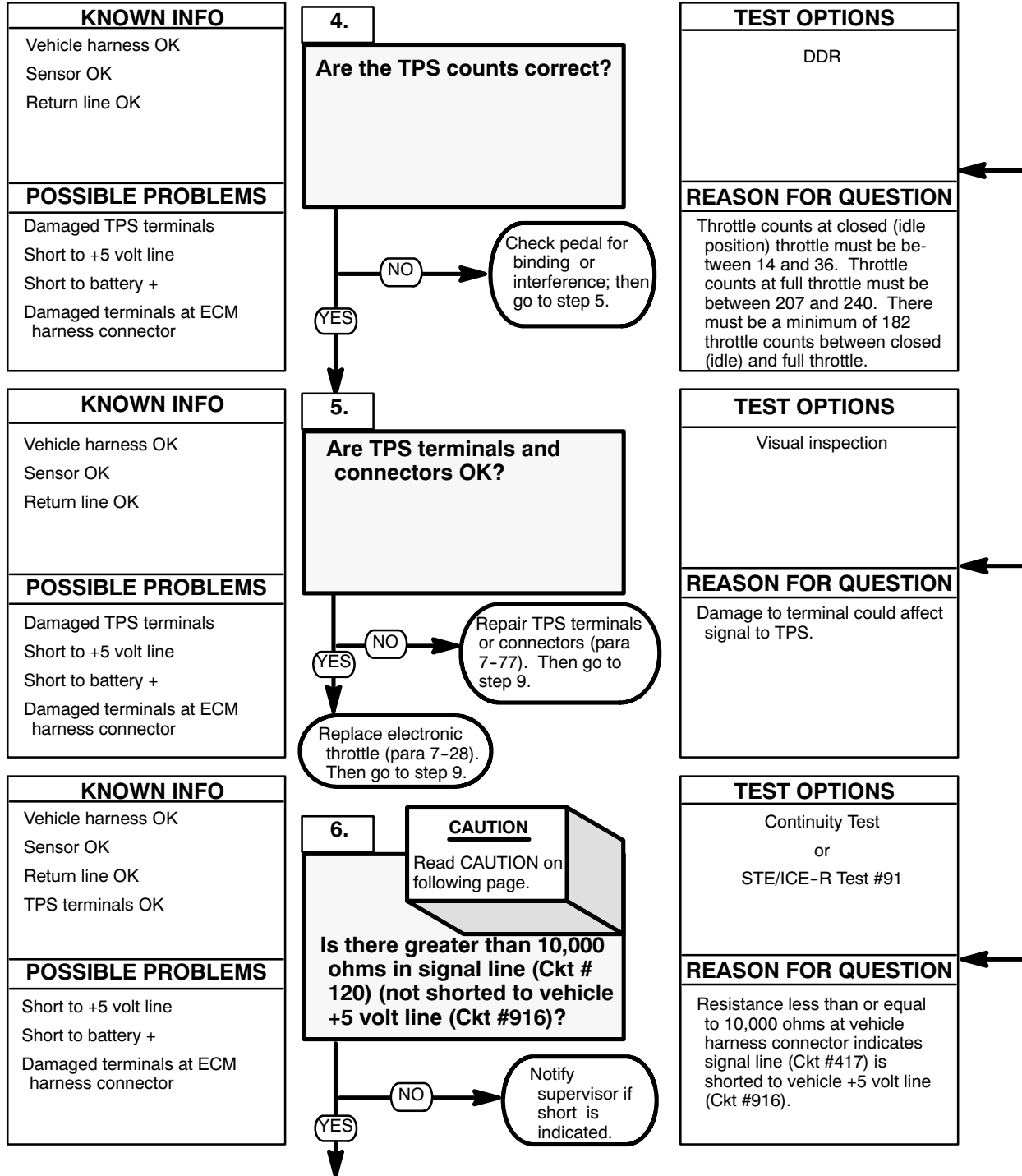
- (1) Turn ENGINE switch OFF.
- (2) Install a jumper wire between pins A and B of TPS harness connector at ECM.
- (3) Read resistance between sockets D2 and C3 on vehicle harness connector.

TPS HARNESS CONNECTOR



ELECTRONIC THROTTLE

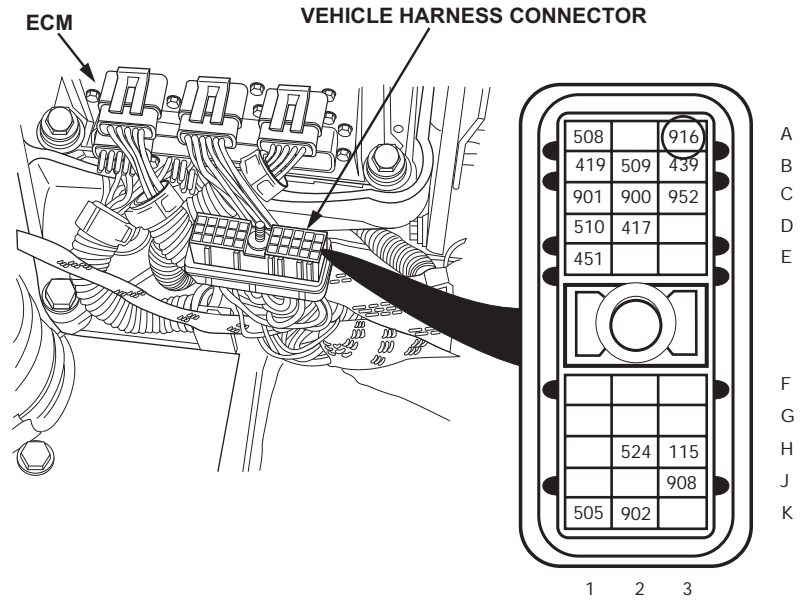
A4 - Code 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH (CONT)



CAUTION

Never attempt to adjust the electronic throttle by bending the pedal mechanism. Bending can cause internal linkages to bind or extend motion beyond the built-in pedal stops.

- (1) Reconnect vehicle harness connector and plug TPS back in.
- (2) Hook up DDR to 12-pin DDL connector and select Throttle Sensor Display.
- (3) Read throttle counts at both no throttle and at full throttle



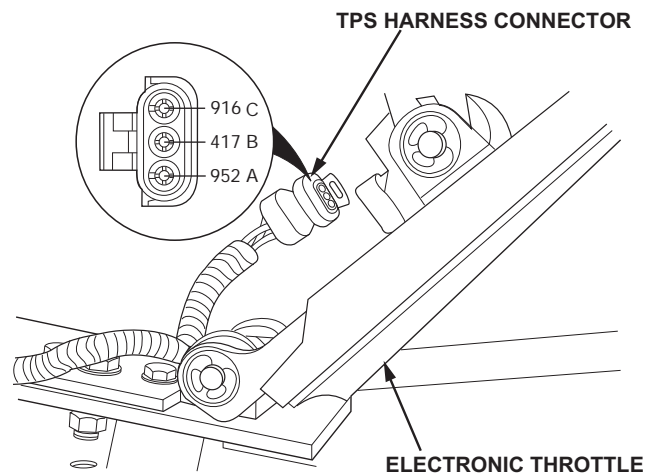
Inspect TPS and terminals at TPS connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets.

CAUTION

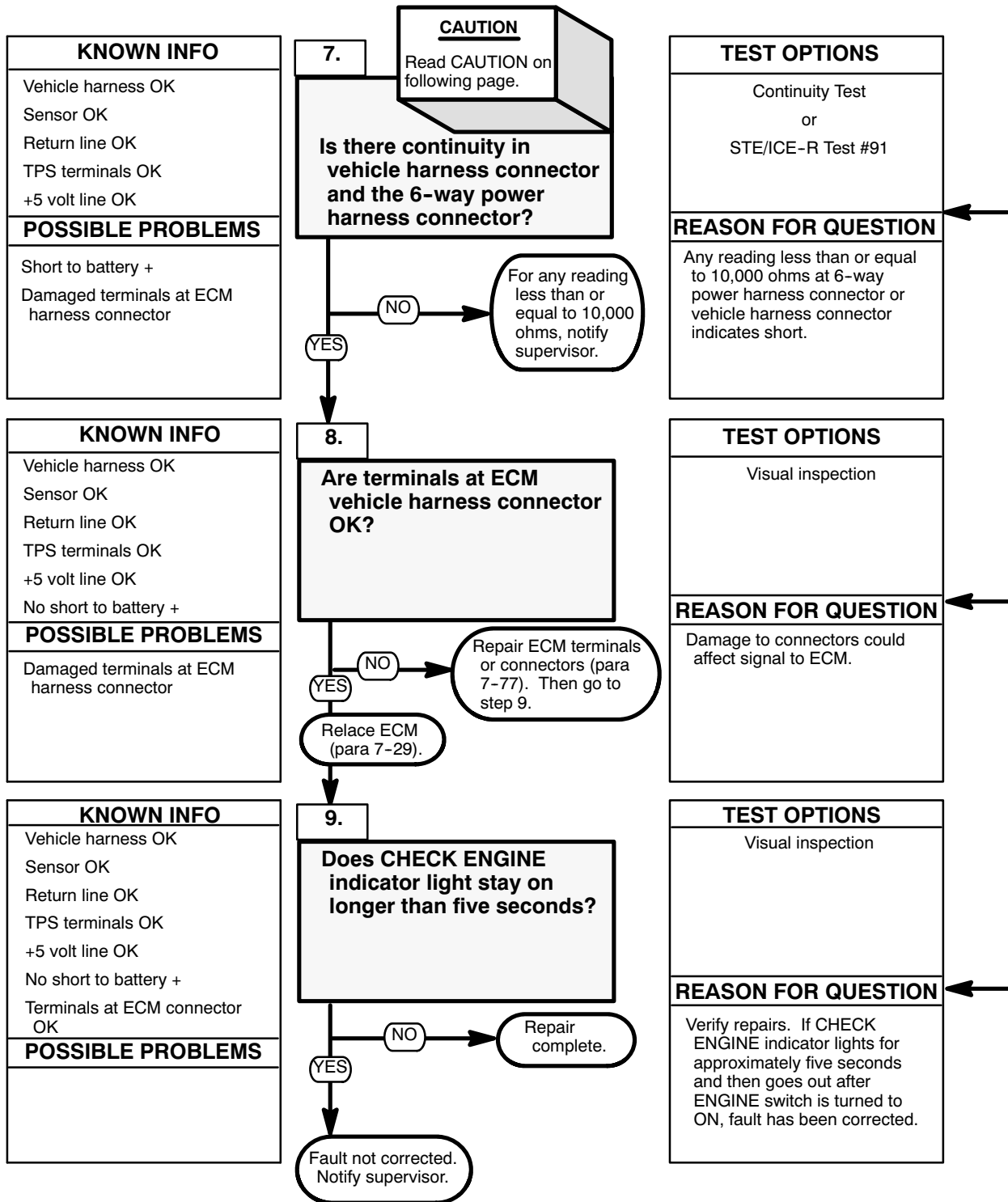
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

- (1) Turn ENGINE switch OFF and disconnect vehicle harness connector at ECM.
- (2) Read resistance between sockets D2 and A3 on vehicle harness connector.



A4 - Code 21 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE HIGH (CONT)



CAUTION

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

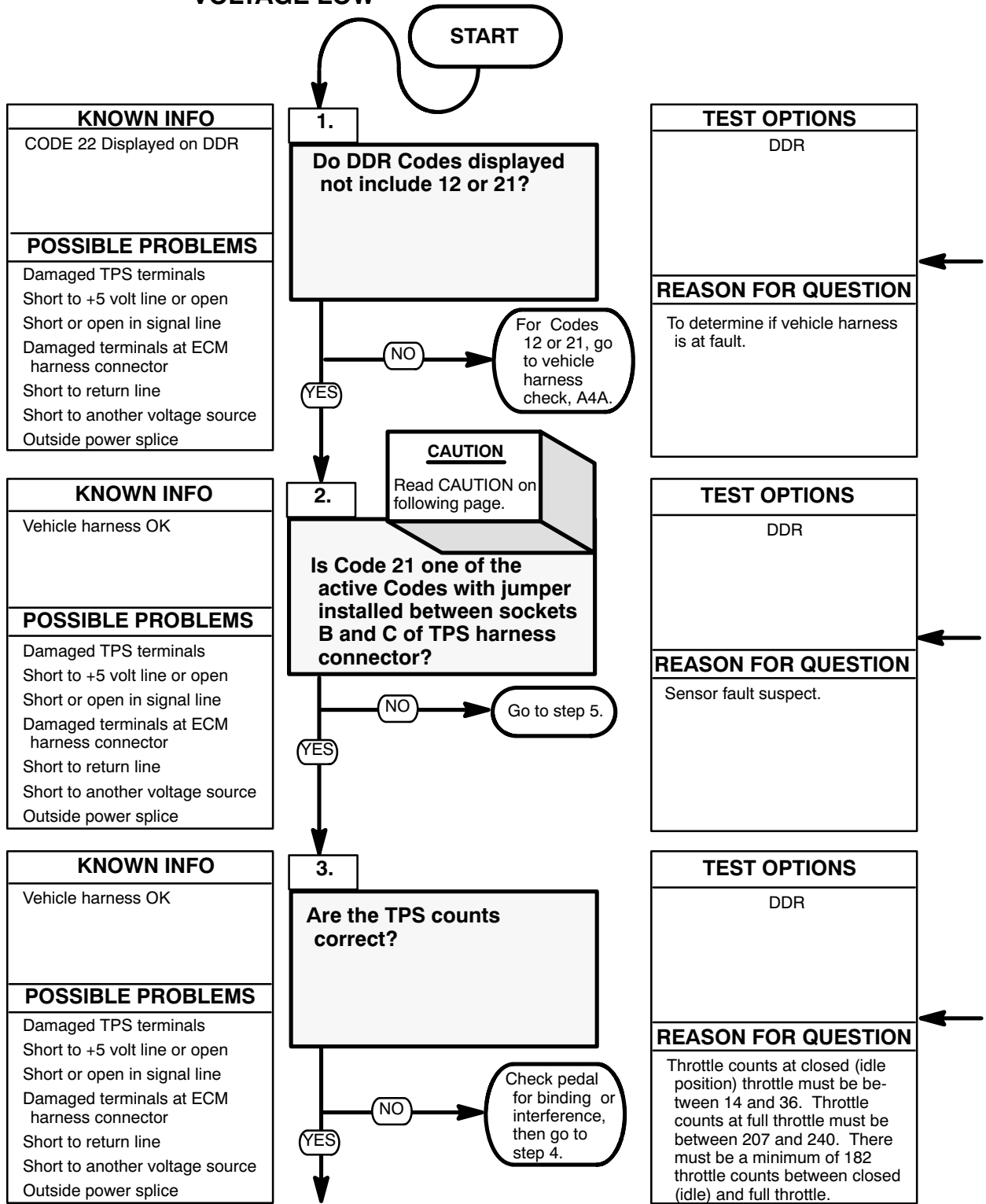
CONTINUITY TEST

- (1) Disconnect batteries (para 7-61).
- (2) Disconnect vehicle harness and 6-way power harness connectors at ECM.
- (3) Read resistance between sockets D2 and B3 of vehicle harness connector.
- (4) Read resistance between socket D2 on vehicle harness connector and sockets A, B, E, and F on 6-way power harness connector.
- (5) Connect batteries (para 7-61).

Check terminals at ECM vehicle harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins and sockets.

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.

A4 - Code 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

CAUTION

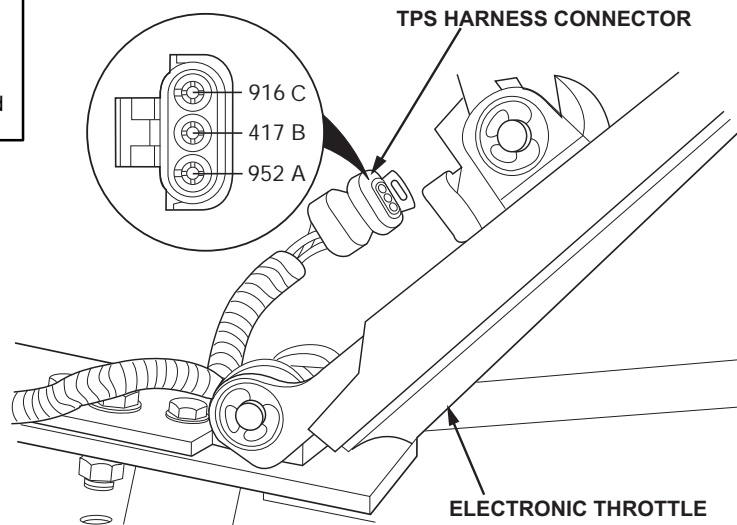
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

- (1) Turn ENGINE switch OFF and disconnect TPS connector.
- (2) Install a jumper wire between sockets B and C of TPS harness connector.
- (3) Click on "Alarms Clear" to clear alarms screen.
- (4) Turn ENGINE switch ON and read active codes.

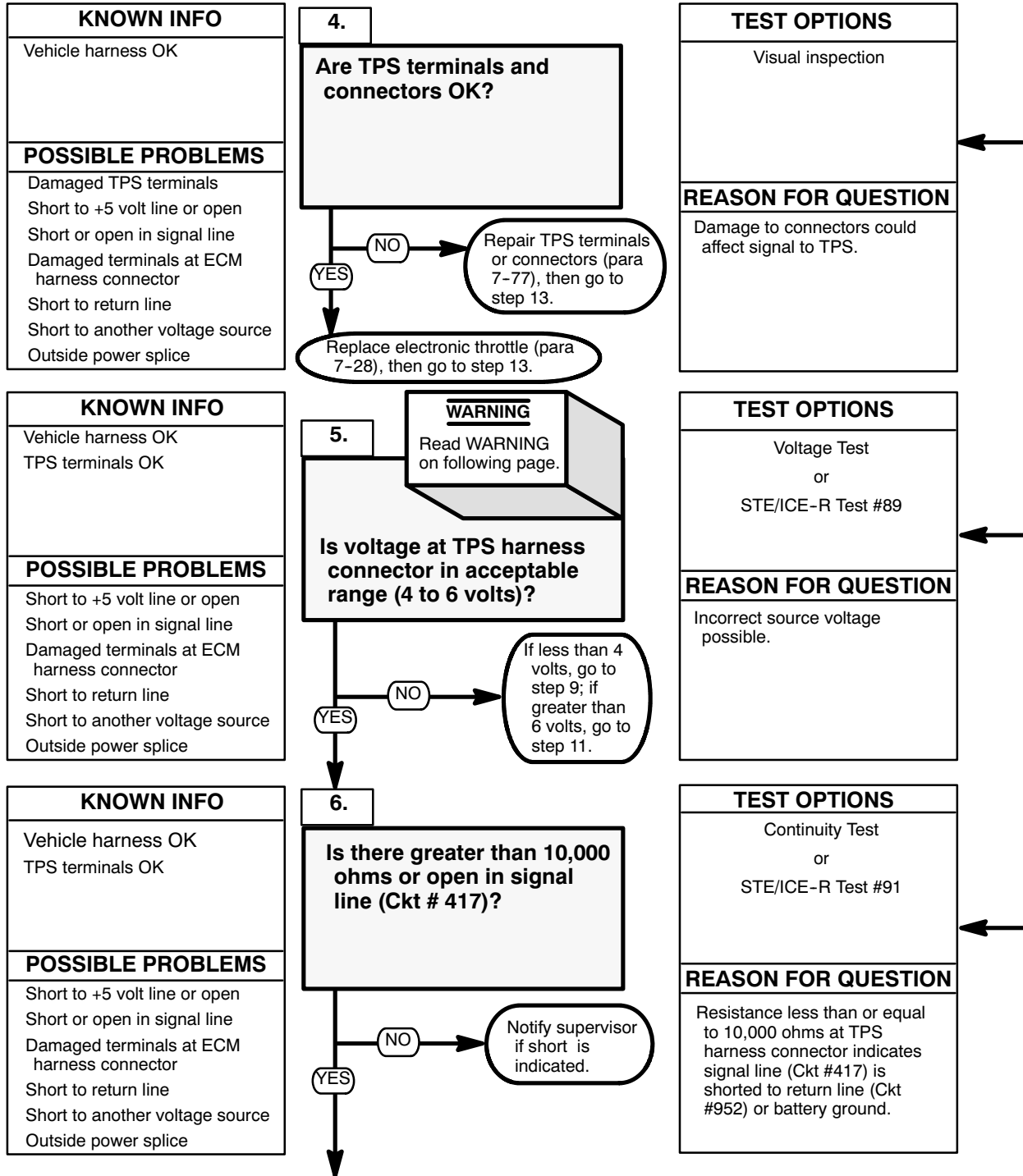
CAUTION

Never attempt to adjust the electronic throttle by bending the pedal mechanism. Bending can cause internal linkages to bind or extend motion beyond the built-in pedal stops.

- (1) Remove jumper and reconnect TPS.
- (2) Hook up DDR to 12-pin DDL connector and select throttle sensor display.
- (3) Read throttle counts at both no throttle and full throttle.



A4 - Code 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW (CONT)



Inspect TPS and terminals at TPS connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets.

WARNING

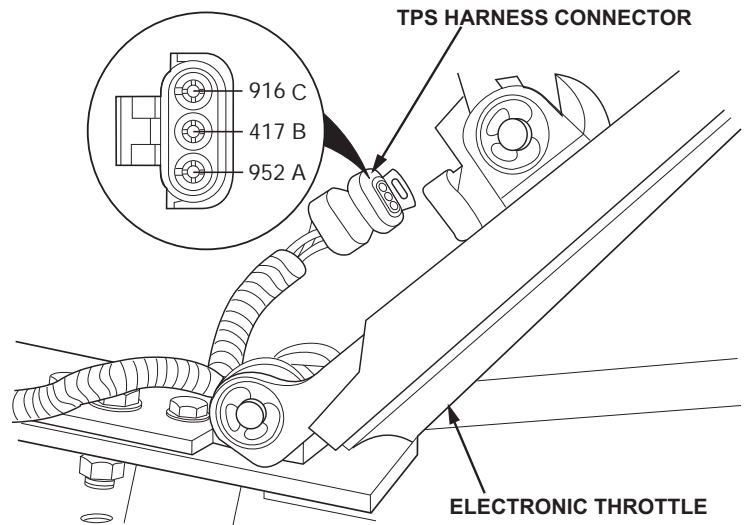
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

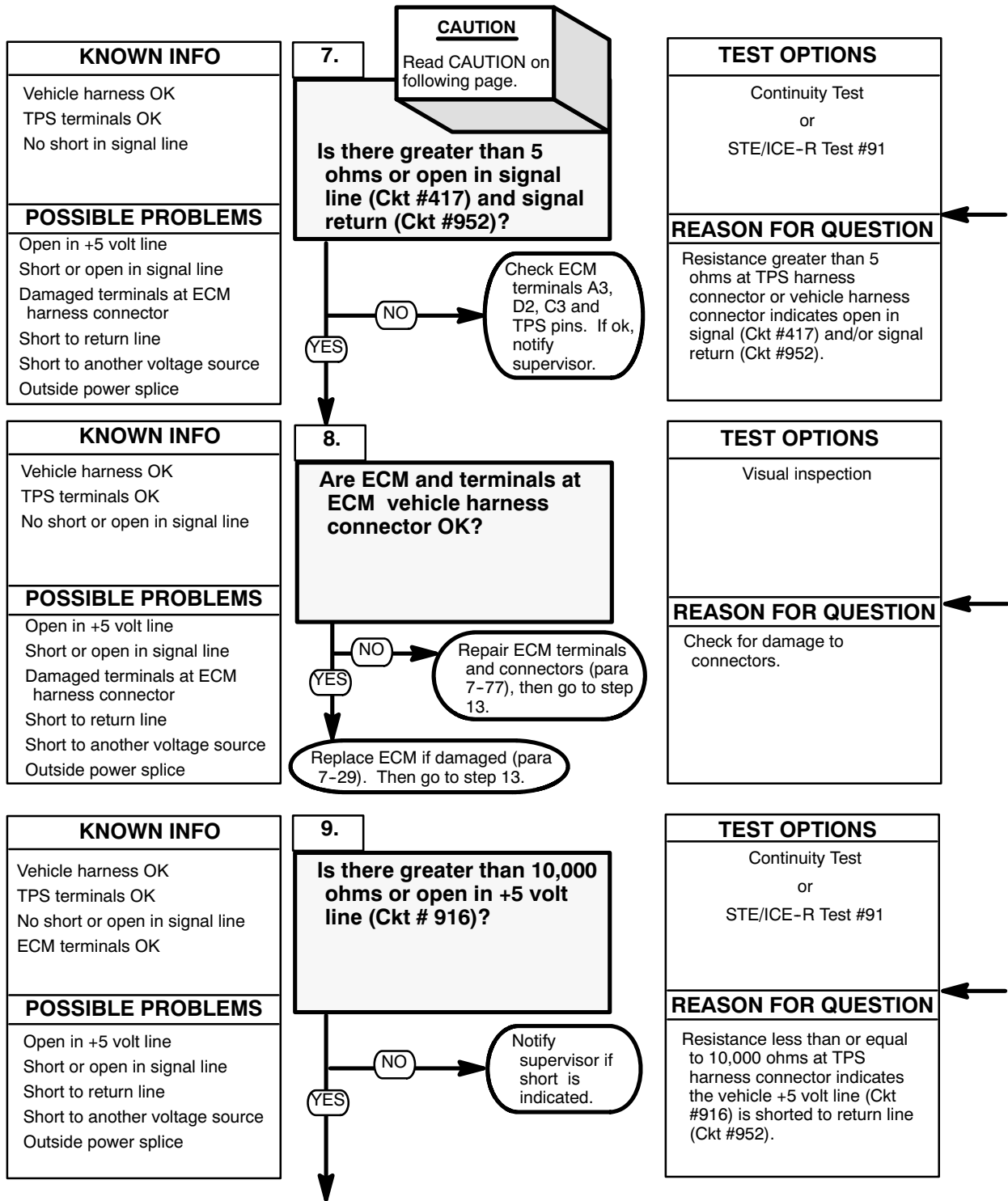
- (1) Remove jumper and turn ENGINE switch ON.
- (2) Read voltage on TPS harness connector, socket C (red lead) to socket A (black lead).

CONTINUITY TEST

- (1) Turn ENGINE switch OFF and disconnect vehicle harness connector at ECM.
- (2) Read resistance between sockets A and B on TPS harness connector.
- (3) Read resistance between Socket B and a good ground.



A4 - Code 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW (CONT)



KNOWN INFO
Vehicle harness OK TPS terminals OK No short or open in signal line ECM terminals OK
POSSIBLE PROBLEMS
Open in +5 volt line Short or open in signal line Short to return line Short to another voltage source Outside power splice

9.

Is there greater than 10,000 ohms or open in +5 volt line (Ckt # 916)?

NO → Notify supervisor if short is indicated.

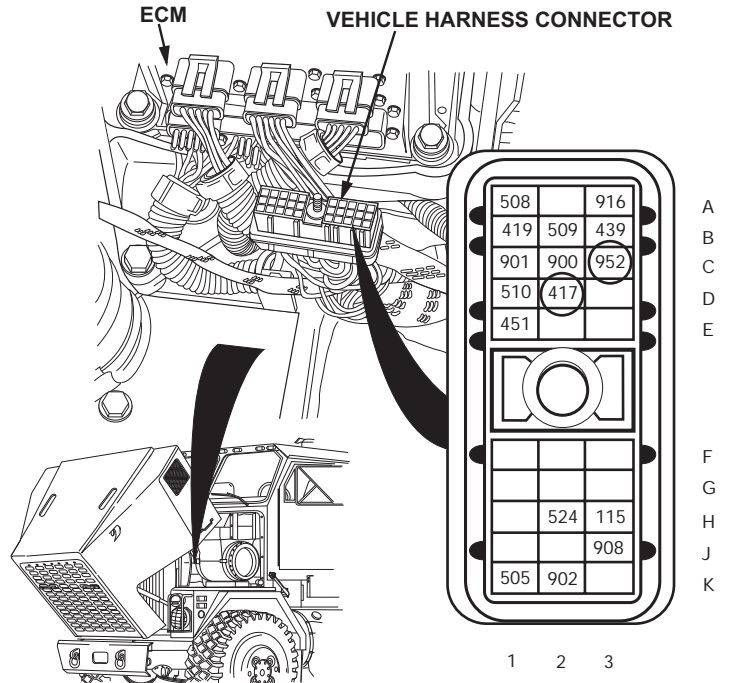
YES →

TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance less than or equal to 10,000 ohms at TPS harness connector indicates the vehicle +5 volt line (Ckt #916) is shorted to return line (Ckt #952).

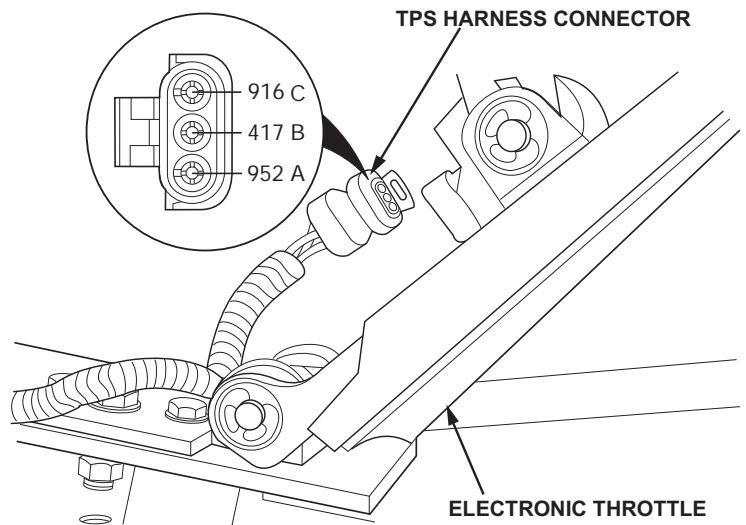
CAUTION
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

- (1) Install a jumper wire between sockets A and B of the TPS harness connector.
- (2) Read resistance between sockets D2 and C3 on vehicle harness connector.

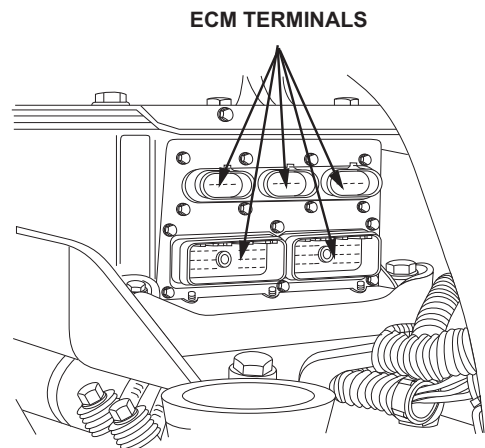


Check ECM and terminals at ECM vehicle harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins and sockets.

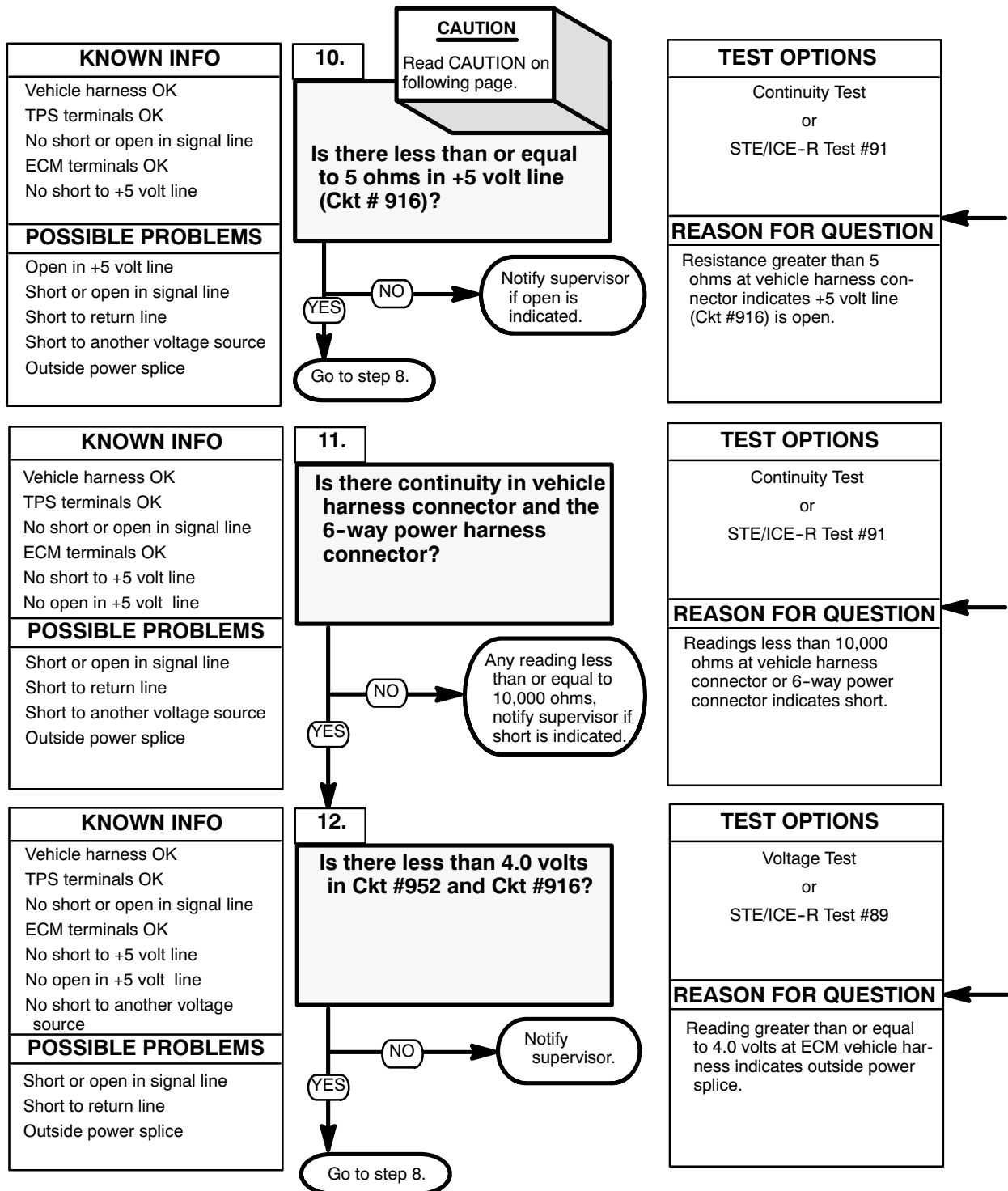


CONTINUITY TEST

- (1) Turn ENGINE switch OFF and disconnect vehicle harness connector at ECM.
- (2) Read resistance between sockets A and C on TPS harness connector.



A4 - Code 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW (CONT)

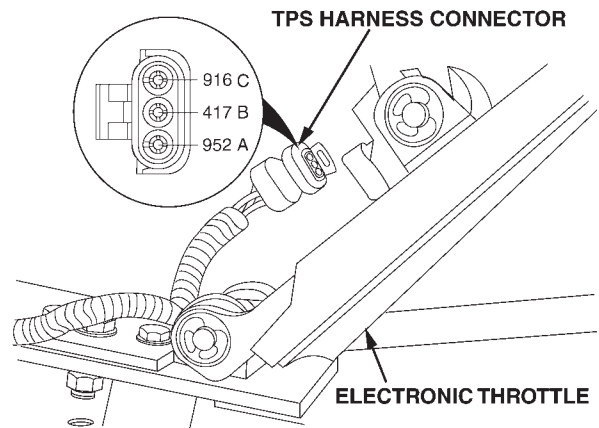
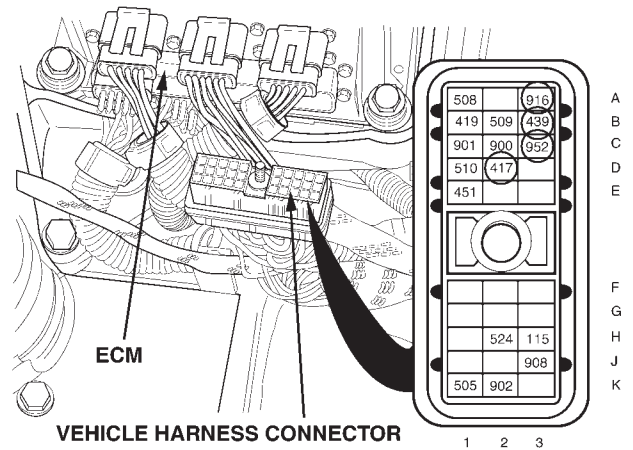


CAUTION

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

CONTINUITY TEST

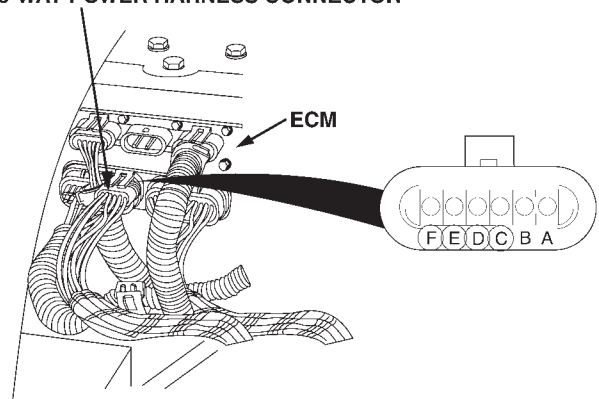
- (1) Install a jumper wire between sockets A and C of the TPS harness connector.
- (2) Read resistance between sockets A3 and C3 on vehicle harness connector.



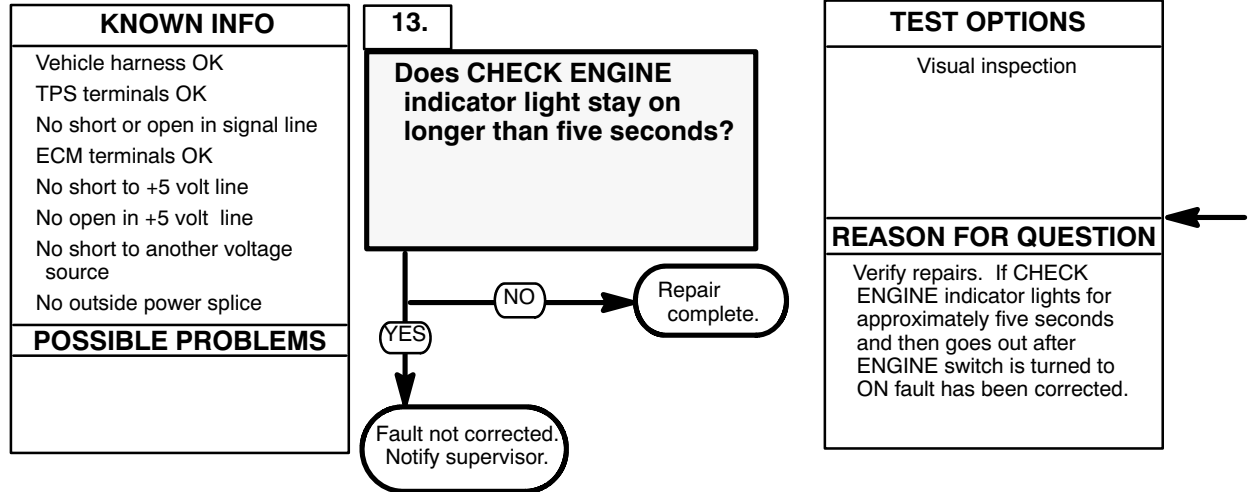
6-WAY POWER HARNESS CONNECTOR

VOLTAGE TEST

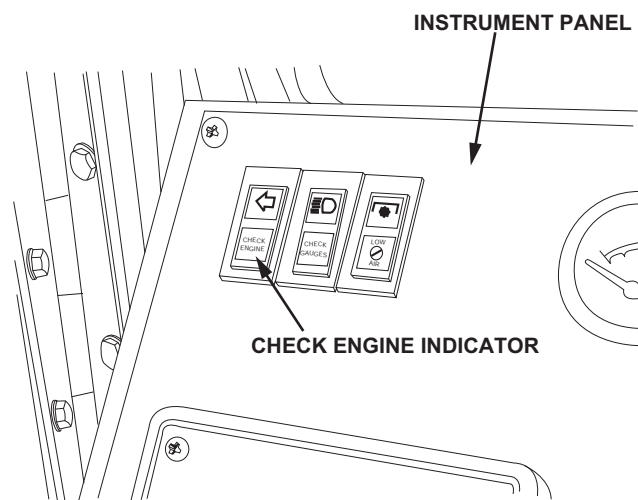
- (1) Turn ENGINE switch ON and read voltage A3 (red lead) to a good ground (black lead).
- (2) Read voltage C3 (red lead) to a good ground (black lead)



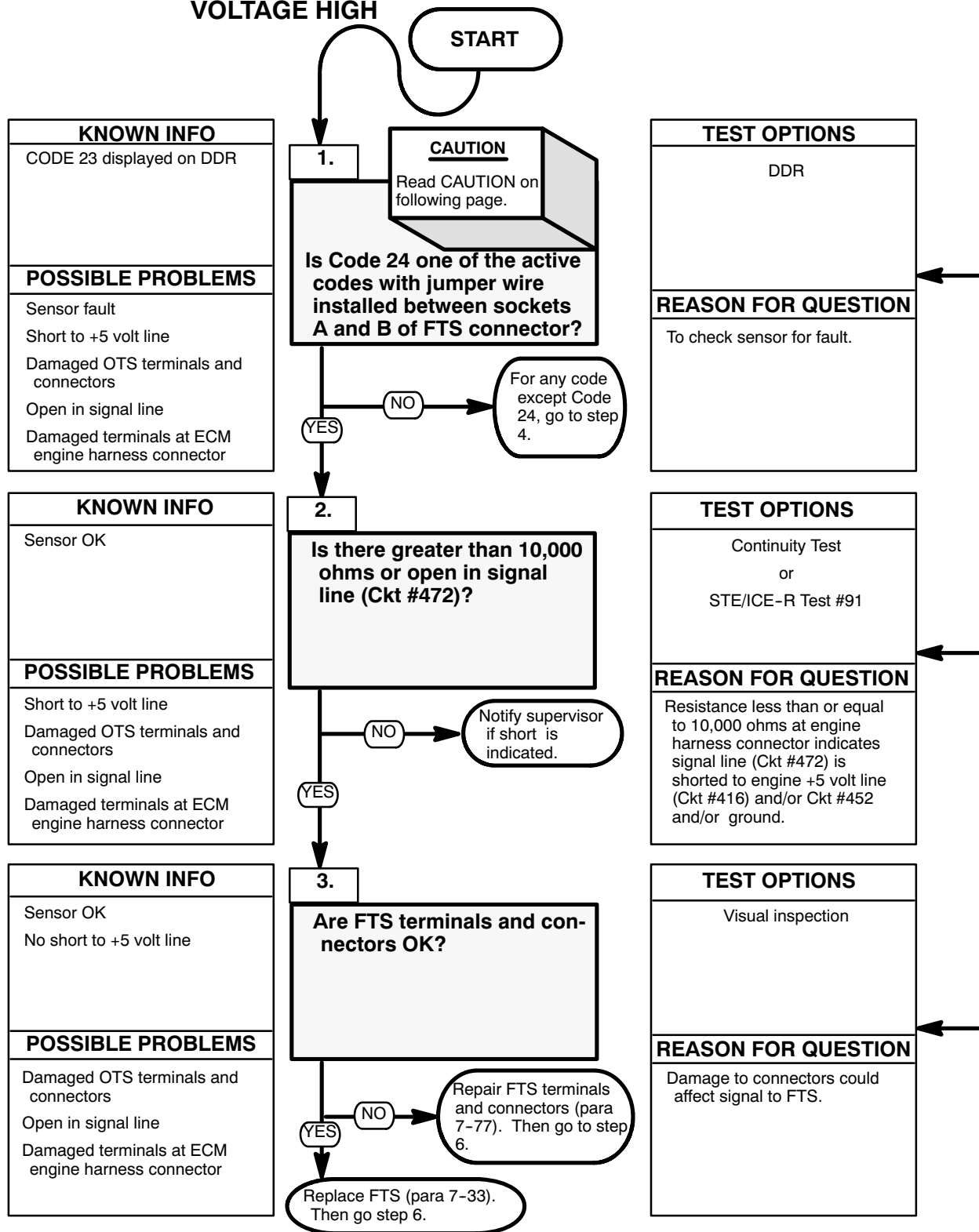
A4 - Code 22 THROTTLE POSITION SENSOR (TPS) SIGNAL VOLTAGE LOW (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 23 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE HIGH



CAUTION

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

NOTE

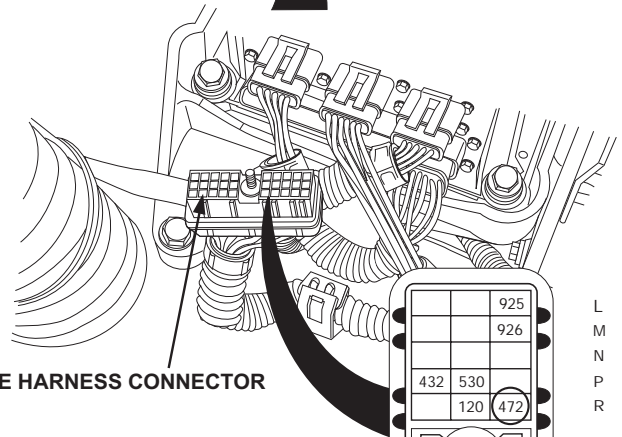
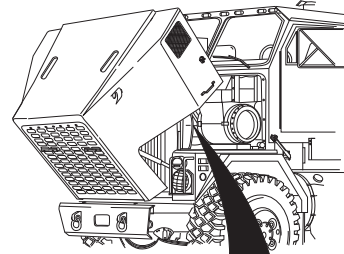
- The following chart should be used only if DDEC troubleshooting was started on pg. 2-80 and you were referred here.
- A false DDEC historical Code 23 may be logged during cold starts in extremely cold environments, -50 to -26F° (-46 to -32°C). Typically, the CHECK ENGINE light will come on 8 minutes after starting and go out 2-3 minutes later. If the vehicle has been operated under these conditions, clear the historical codes and return the vehicle to service.

- (1) Turn ENGINE switch OFF.
- (2) Disconnect FTS and install jumper between FTS and connector sockets A and B.
- (2.1) Click on "Alarms Clear" to clear alarms screen.
- (3) Turn ENGINE switch ON and read active codes.

CONTINUITY TEST

- (1) Turn ENGINE switch OFF and remove jumper wire.
- (2) Disconnect engine harness connector at ECM.
- (3) Read resistance between sockets R3 and W1 on engine harness connector.

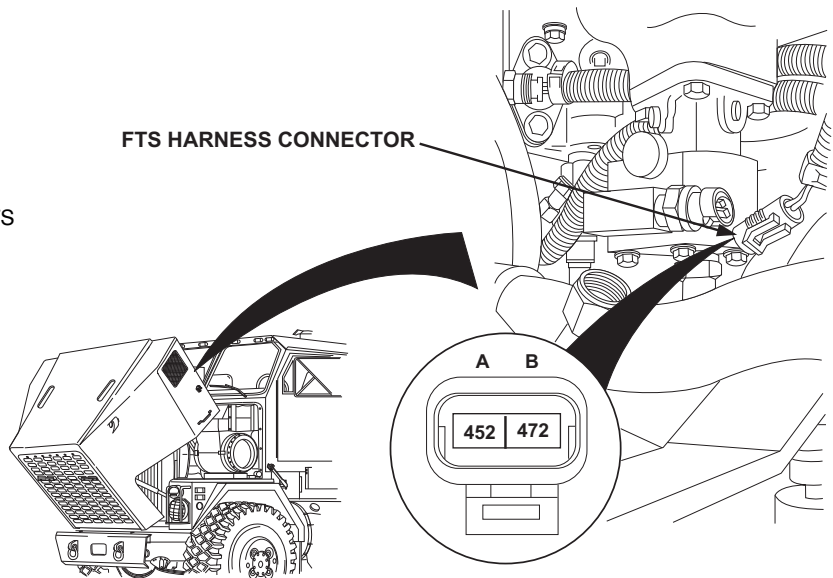
Inspect FTS and terminals at FTS connectors (both sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.



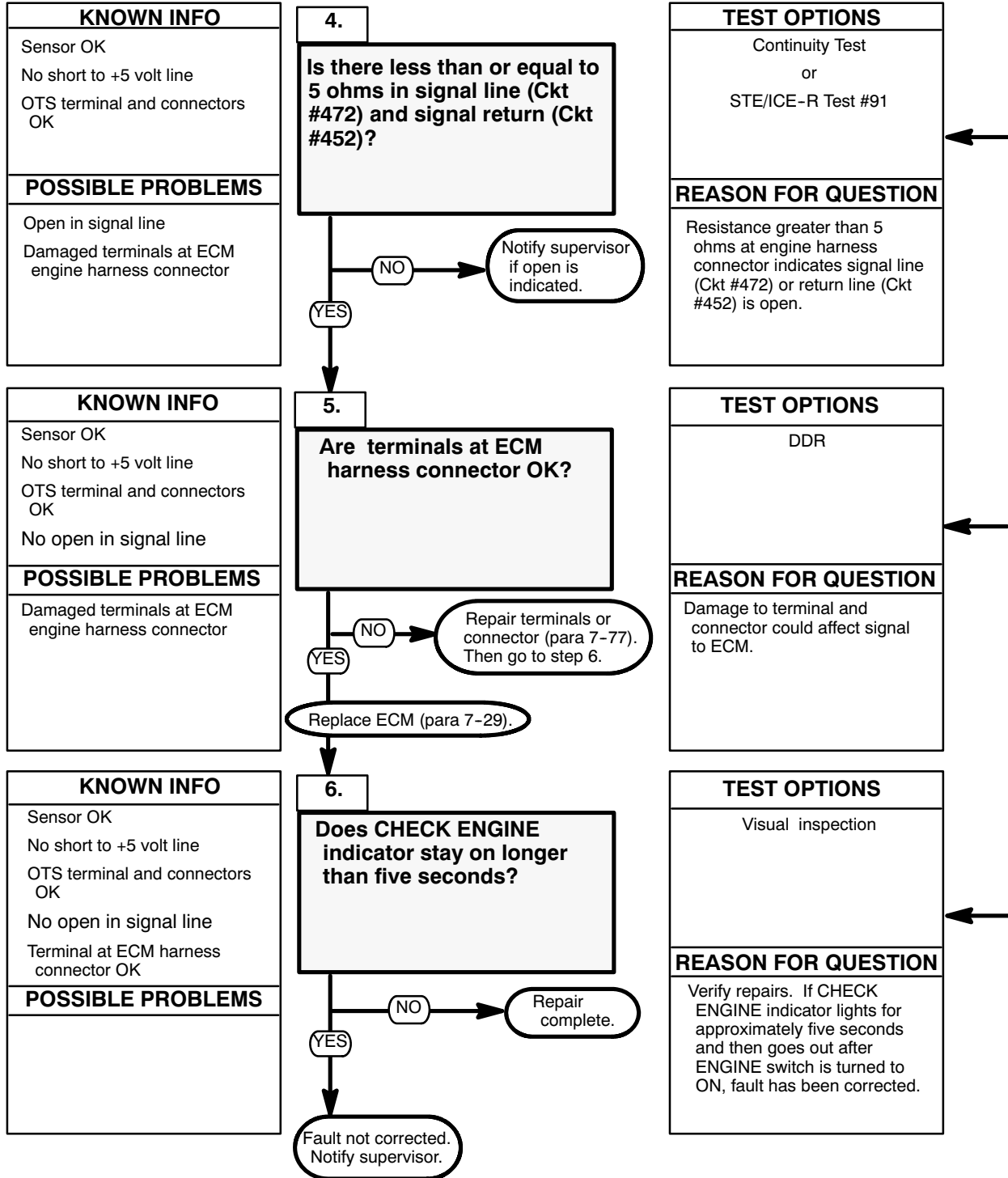
ENGINE HARNESS CONNECTOR

1 2 3

FTS HARNESS CONNECTOR



A4 - Code 23 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE HIGH (CONT)

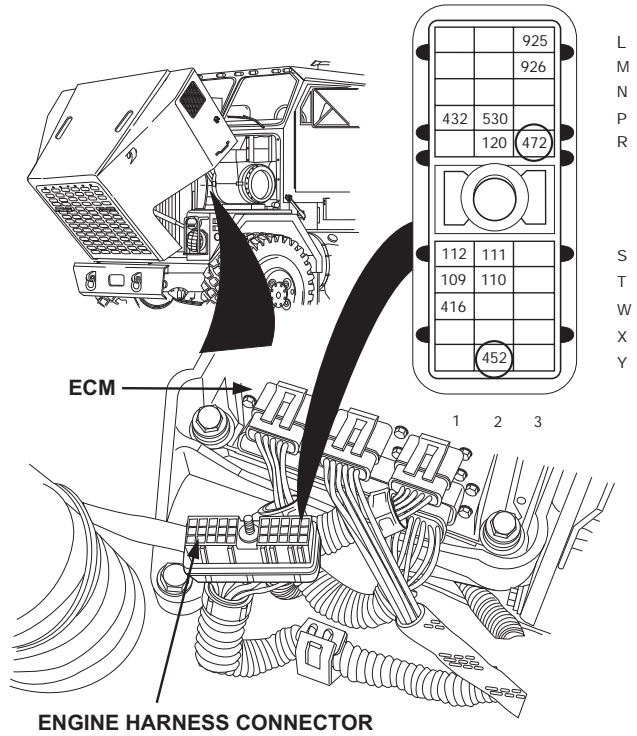


CONTINUITY TEST

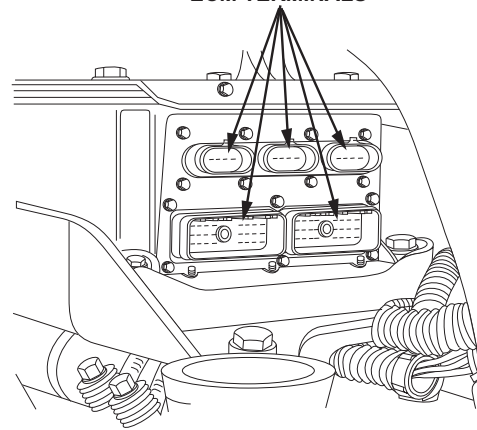
- (1) Turn ENGINE switch OFF and disconnect engine harness connector at ECM.
- (2) Read resistance between sockets R3 and Y2 on engine harness connector.

Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.

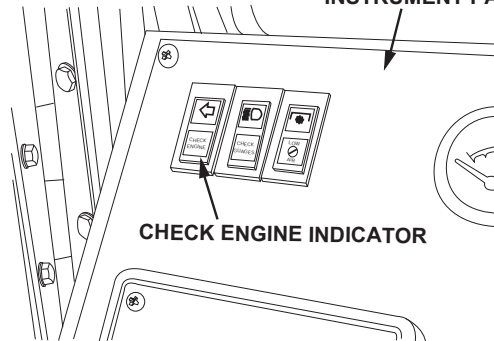
- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



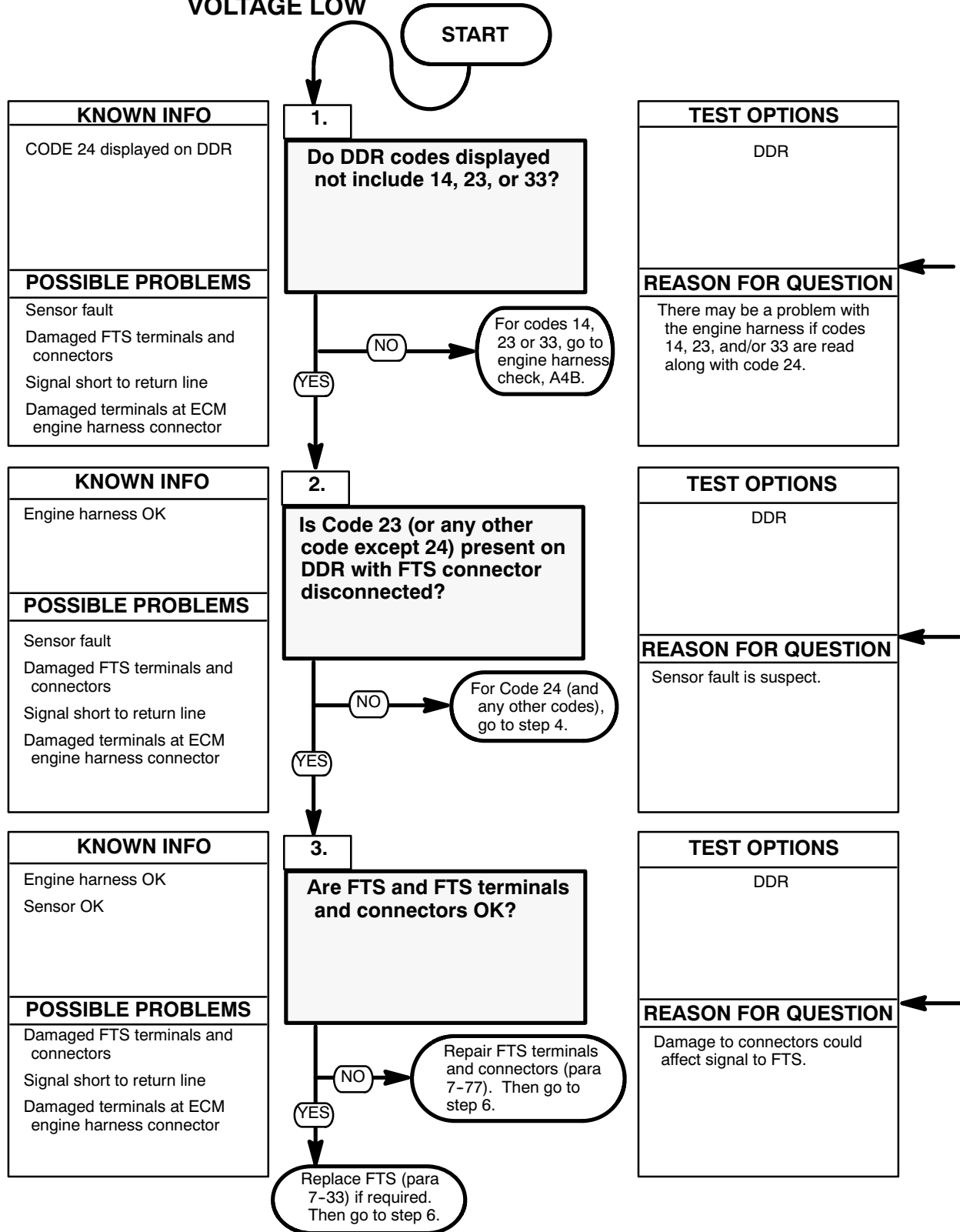
ECM TERMINALS



INSTRUMENT PANEL



A4 - Code 24 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE LOW



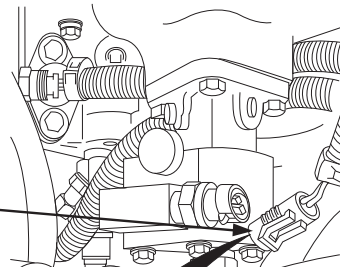
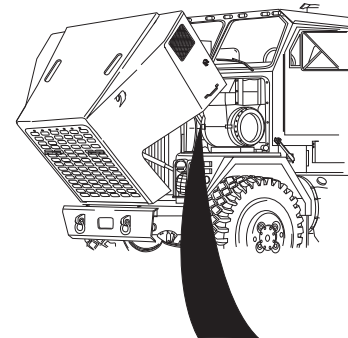
NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

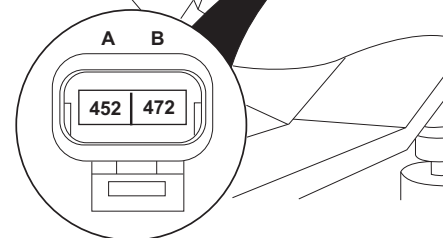
- (1) Turn ENGINE switch OFF and disconnect FTS connector.
- (1.1) Click on "Alarms Clear" to clear alarms screen.
- (2) Start engine and run until CHECK ENGINE light comes on or for 8 minutes.
- (3) Read active codes with engine still running.

- (1) Turn ENGINE switch OFF and disconnect FTS connector.
- (1.1) Click on "Alarms Clear" to clear alarms screen.
- (2) Start engine and run until CHECK ENGINE light comes on or for 8 minutes.
- (3) Read active codes with engine still running.

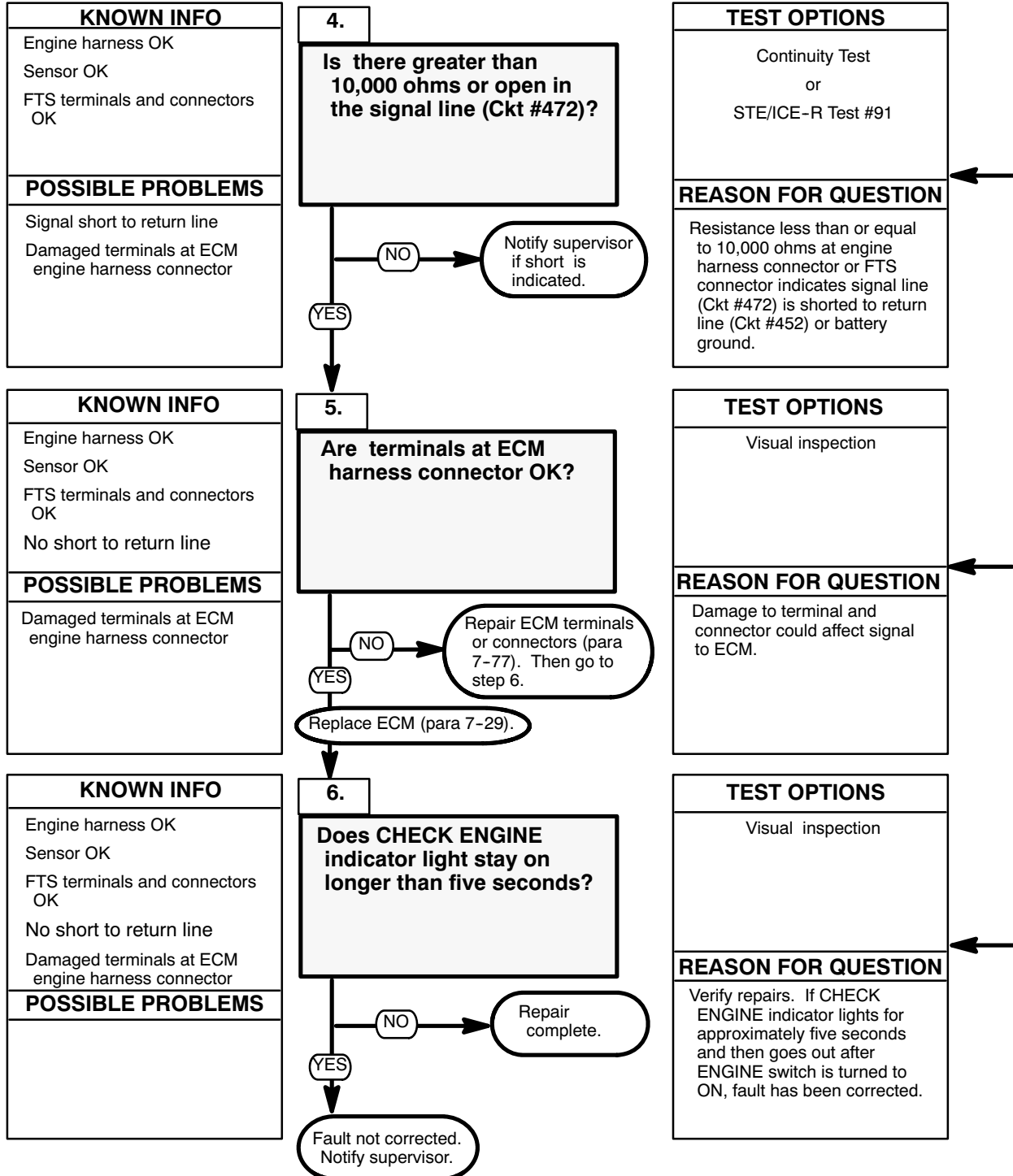
Inspect FTS and terminals at FTS connectors (both sensor and harness side) for damage; bent, corroded, and unseated pins or sockets.



FTS HARNESS CONNECTOR



A4 - Code 24 FUEL TEMPERATURE SENSOR (FTS) SIGNAL VOLTAGE LOW (CONT)

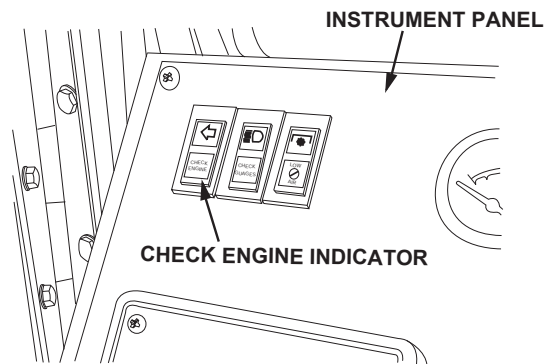
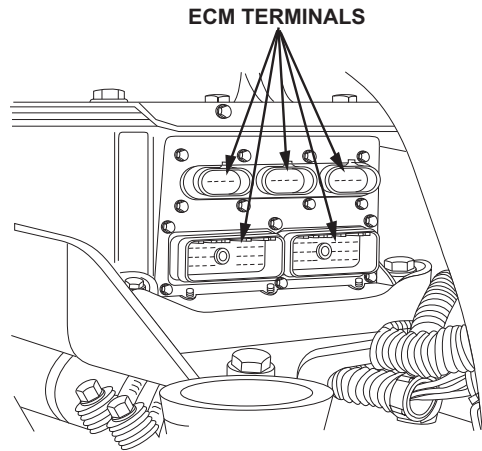
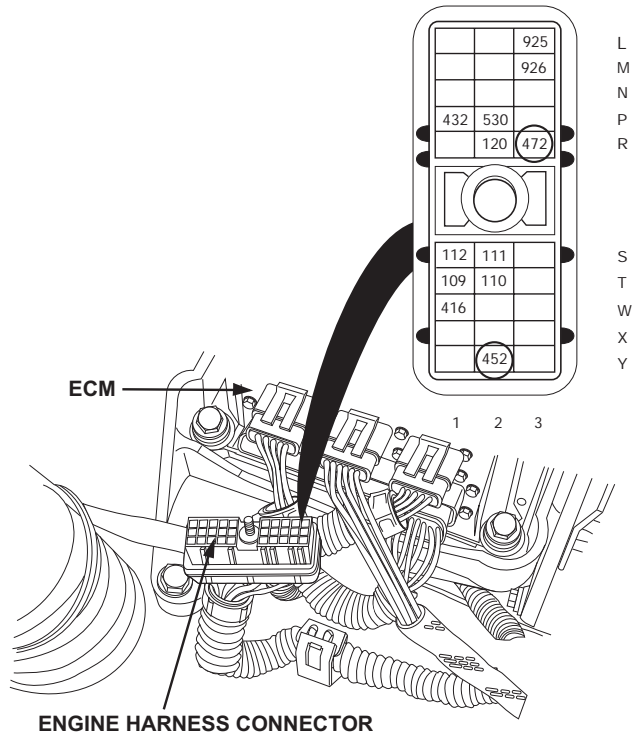


CONTINUITY TEST

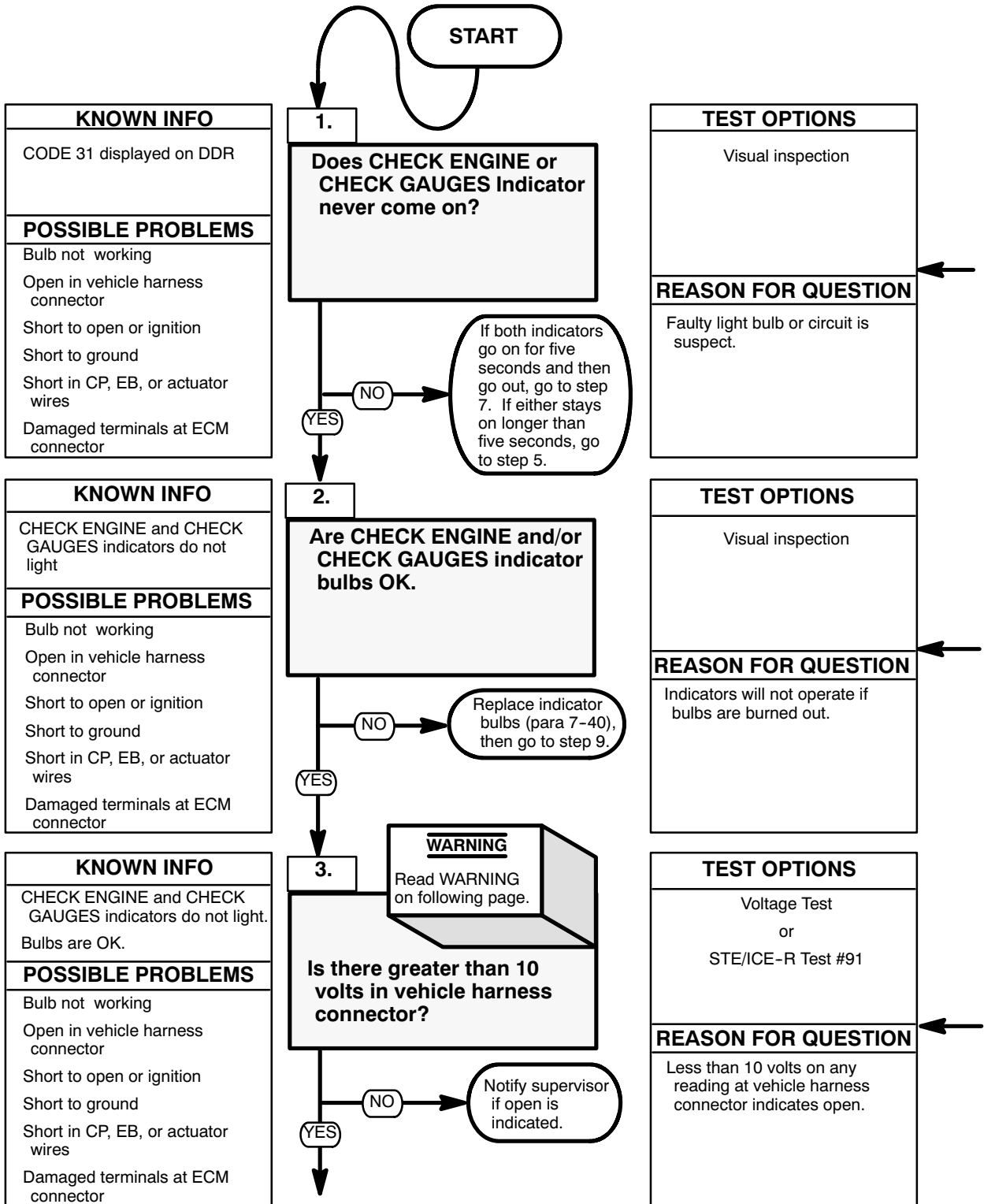
- (1) Turn ENGINE switch OFF and disconnect engine harness connector at ECM.
- (2) Read resistance between sockets R3 and Y2 on engine harness connector.
- (3) Read resistance between socket B on FTS connector and a good ground.

Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



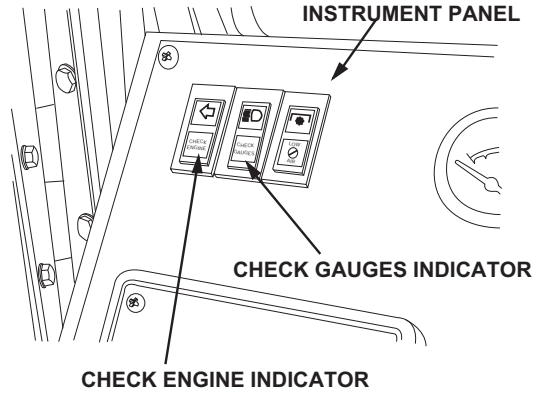
A4 - Code 31 FAULT ON AUXILIARY OUTPUT



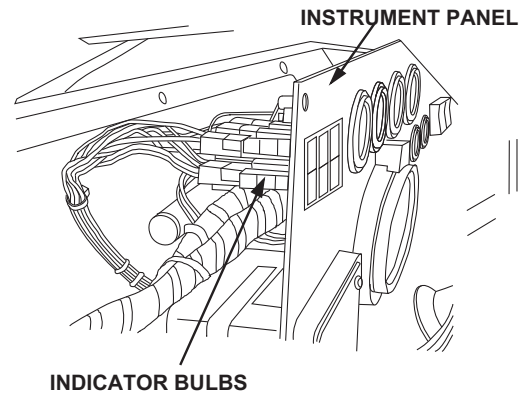
NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

- (1) Turn ENGINE switch OFF.
- (2) Turn ENGINE switch ON (engine not running).
- (3) Inspect CHECK ENGINE and CHECK GAUGES indicators.



- (1) Turn ENGINE switch OFF.
- (2) Remove bulbs that did not turn ON.
- (3) Check whether bulb (s) is burned out or otherwise damaged.

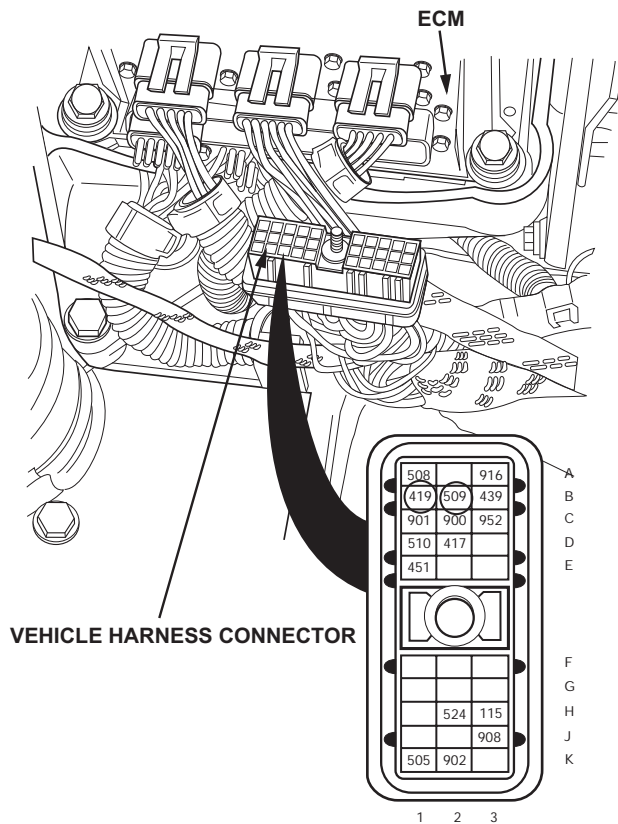


WARNING

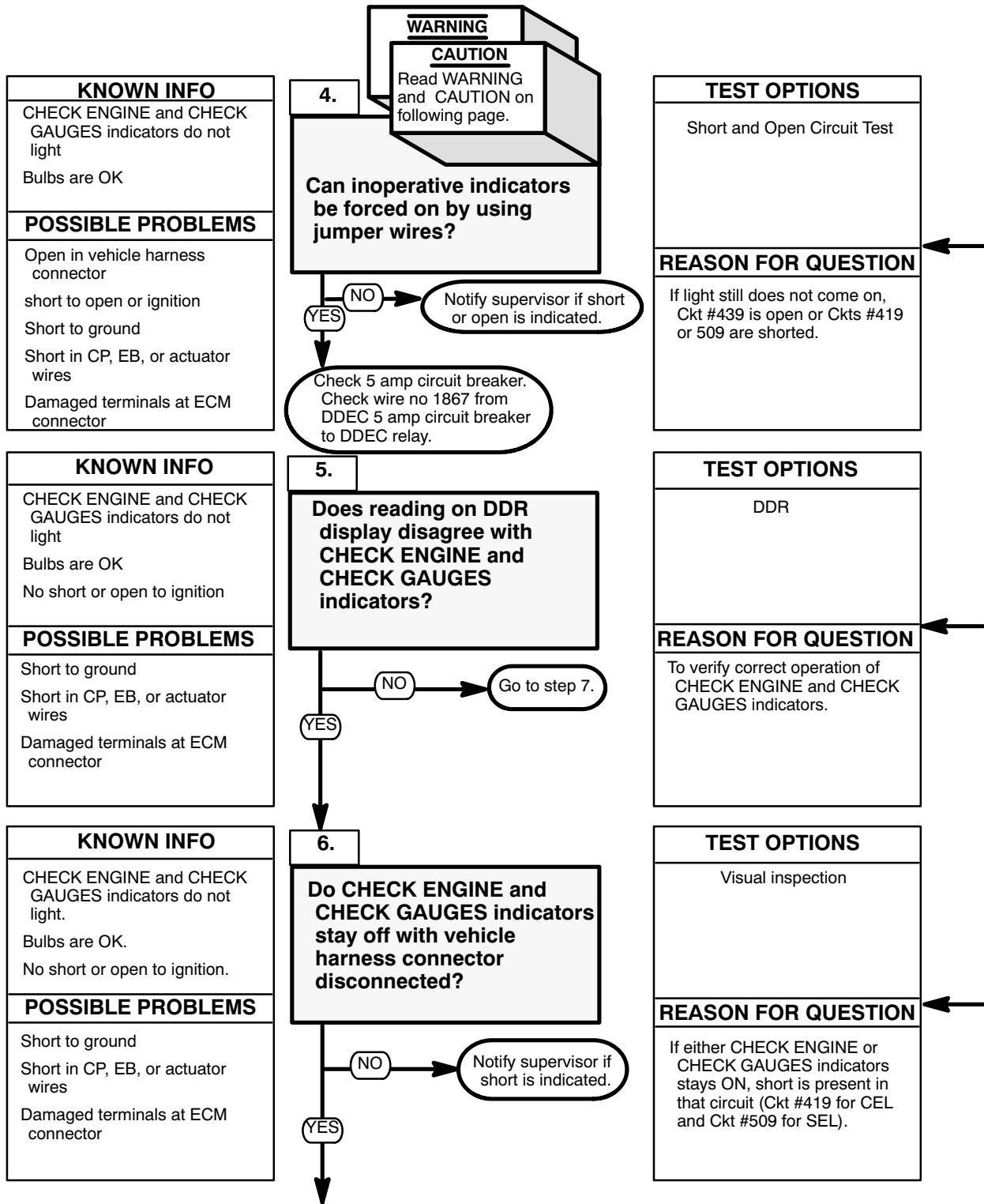
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

- (1) Disconnect vehicle harness connector at ECM.
- (2) Turn ENGINE switch ON.
- (3) Read voltage on vehicle harness connector, keeping the black lead on a good battery ground and probing both the B1 (CHECK ENGINE indicator) and B2 (CHECK GAUGES indicator) sockets with the red lead.



A4 - Code 31 FAULT ON AUXILIARY OUTPUT (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CAUTION

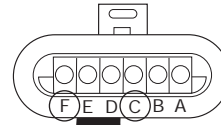
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

SHORT AND OPEN CIRCUIT TEST

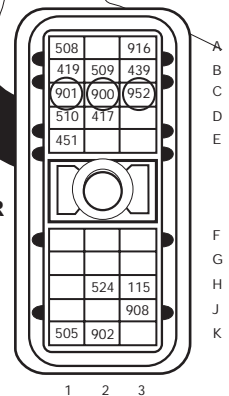
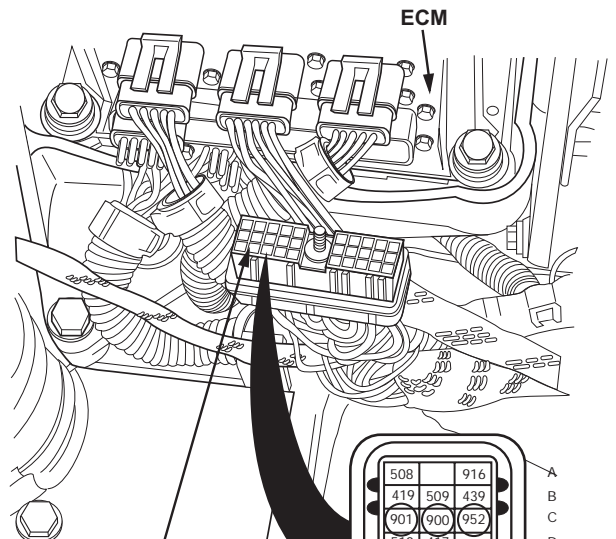
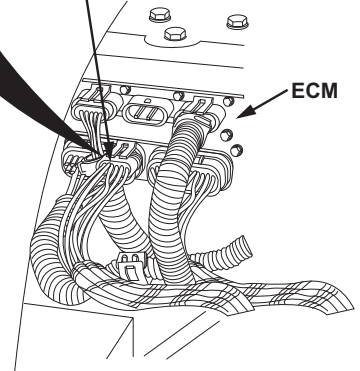
- (1) Turn ENGINE switch OFF.
- (2) Disconnect 6-way power harness connector.
- (3) Install a jumper between socket F on the 6-way power connector and socket B3 on the vehicle harness connector.
- (4) Install a second jumper between socket C on the 6-way power connector and the following socket on the vehicle harness connector: Socket B1 (if the CEL didn't turn ON); socket B2 (if SEL didn't turn ON).
- (5) Observe CHECK ENGINE and CHECK GAUGES indicators.

- (1) Plug in DDR.
- (2) Press (down) key until Mode 30 comes up.
- (3) Observe if DDR display agrees with the CEL-SEL.

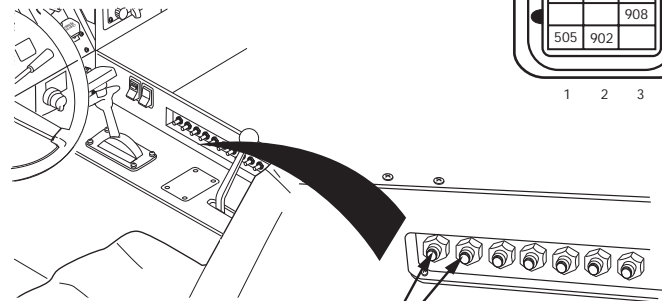
- (1) Unplug DDR.
- (2) Turn ENGINE switch to OFF and disconnect vehicle harness connector at the ECM.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE and CHECK GAUGES lights.



6-WAY POWER HARNESS CONNECTOR

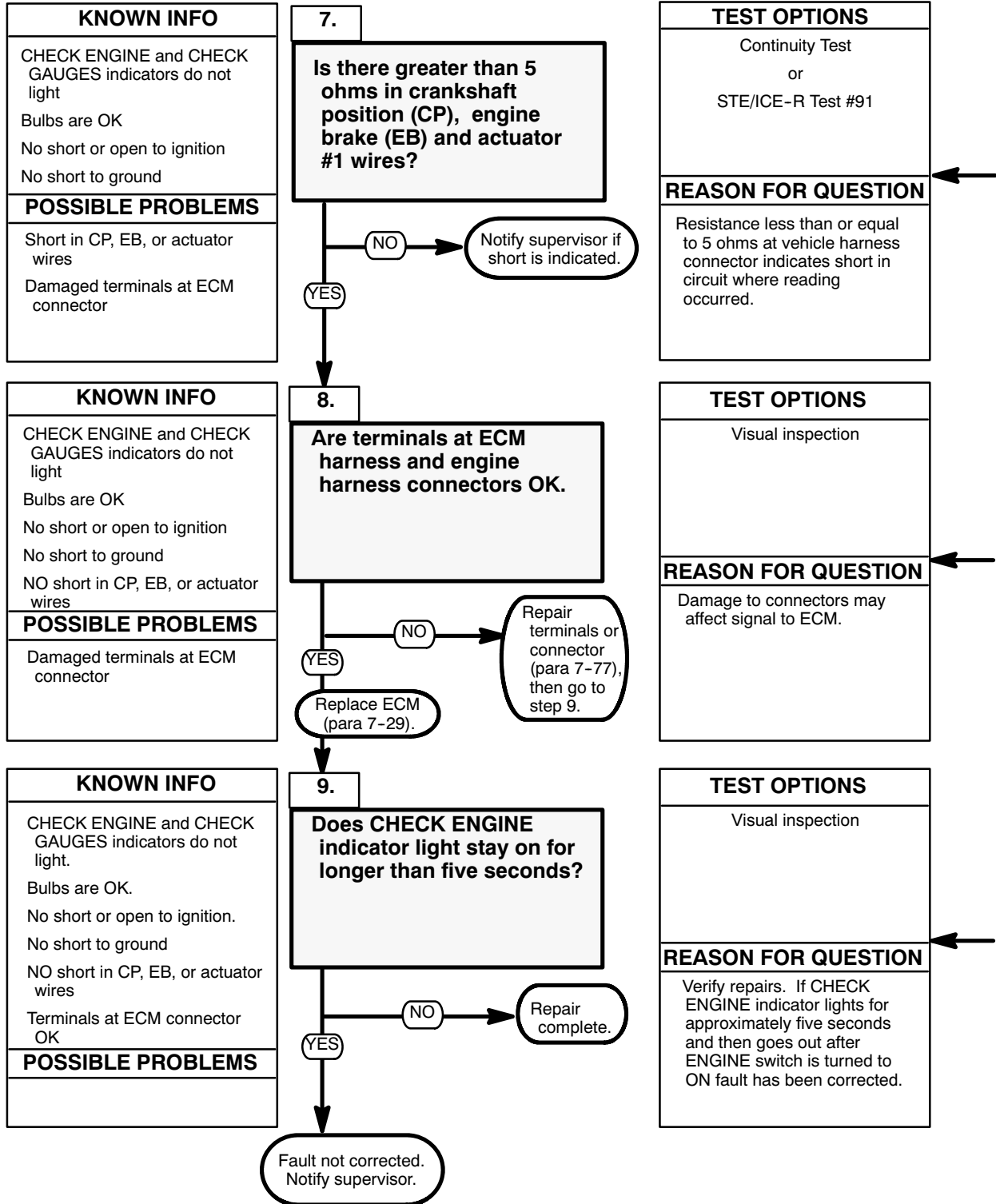


VEHICLE HARNESS CONNECTOR



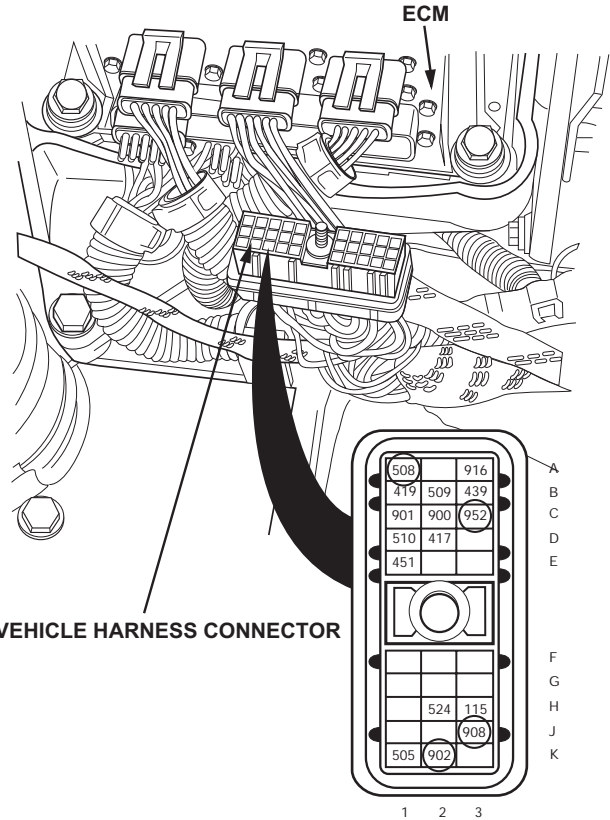
DDEC CIRCUIT BREAKERS

A4 - Code 31 FAULT ON AUXILIARY OUTPUT (CONT)

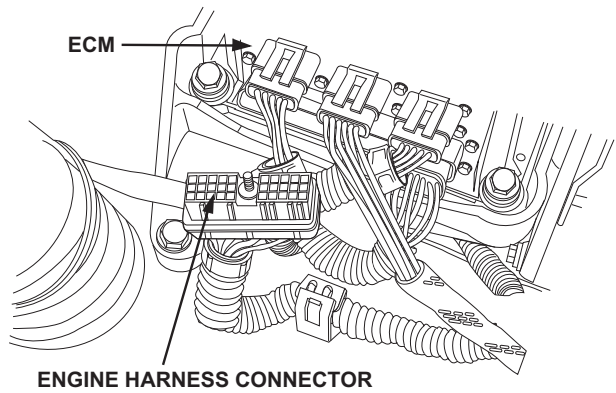


CONTINUITY TEST

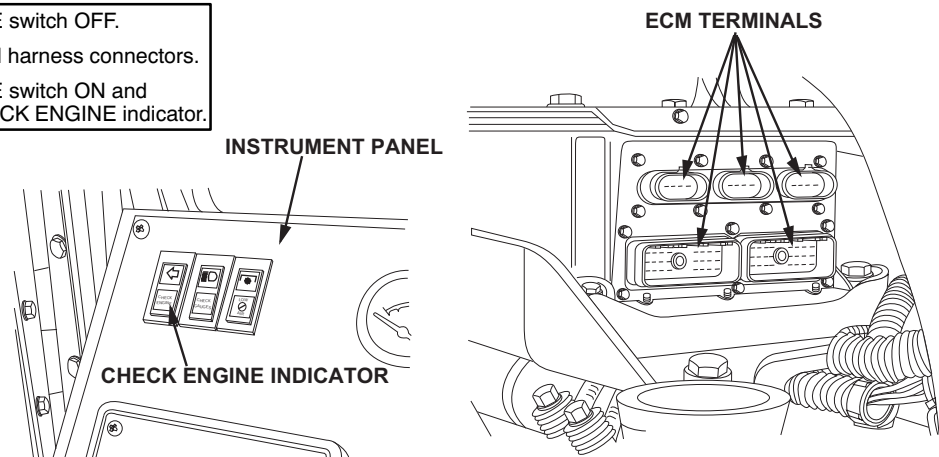
- (1) Turn ENGINE switch OFF.
- (2) Disconnect vehicle harness connector at ECM
- (3) Read resistance between socket C3 and sockets A1, K2, and J3.
- (4) Repeat resistance check between known good ground and sockets A1, K2, and J3.



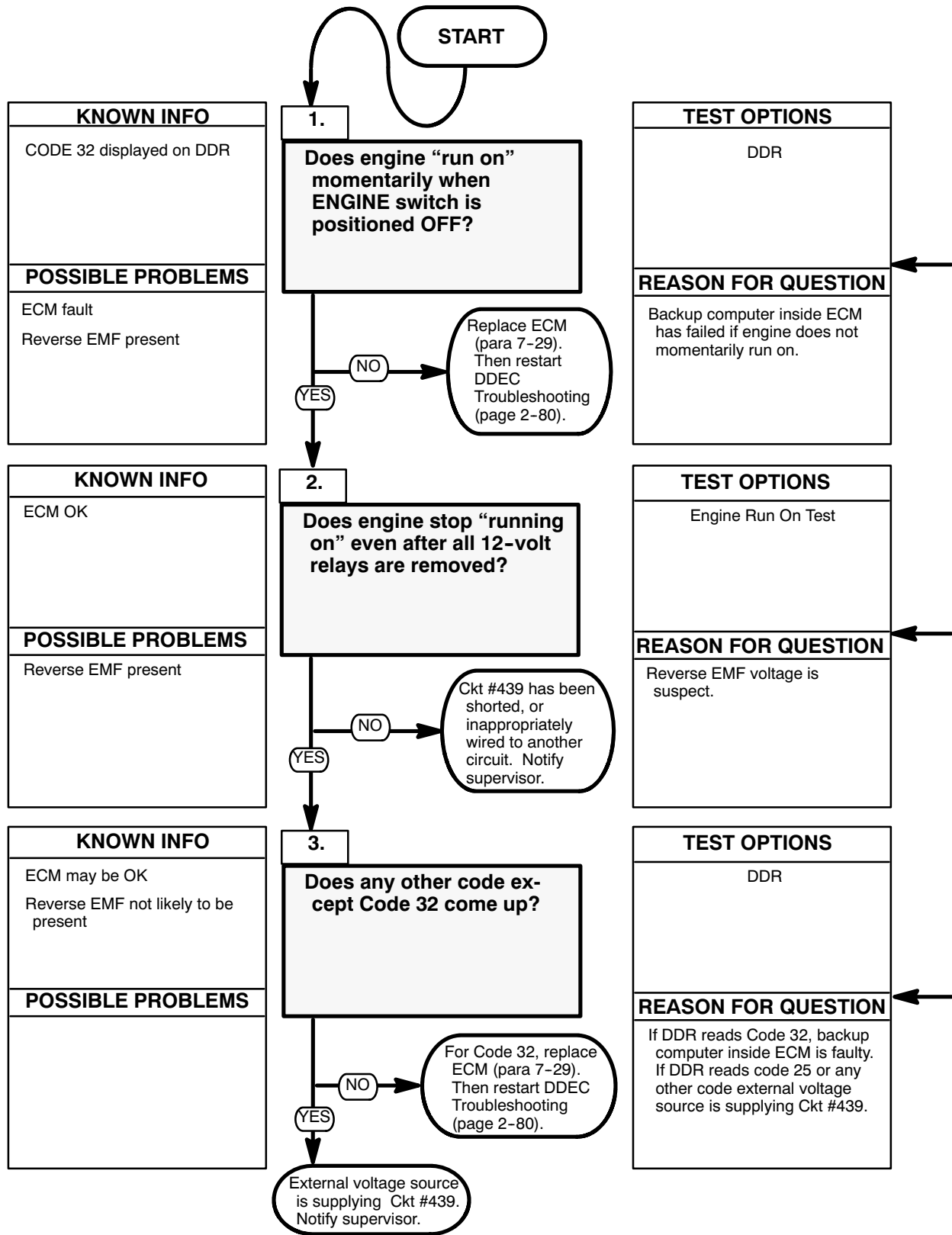
- (1) Disconnect engine harness connector.
- (2) Check terminals at ECM vehicle harness and engine harness connectors (both ECM and harness side) for damaged, bent, corroded, and unseated pins or sockets.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 32 ECM BACKUP SYSTEM FAILURE



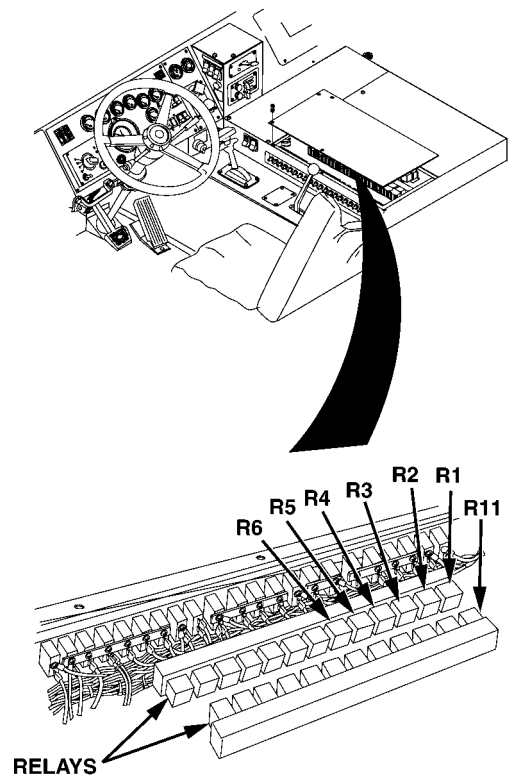
NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

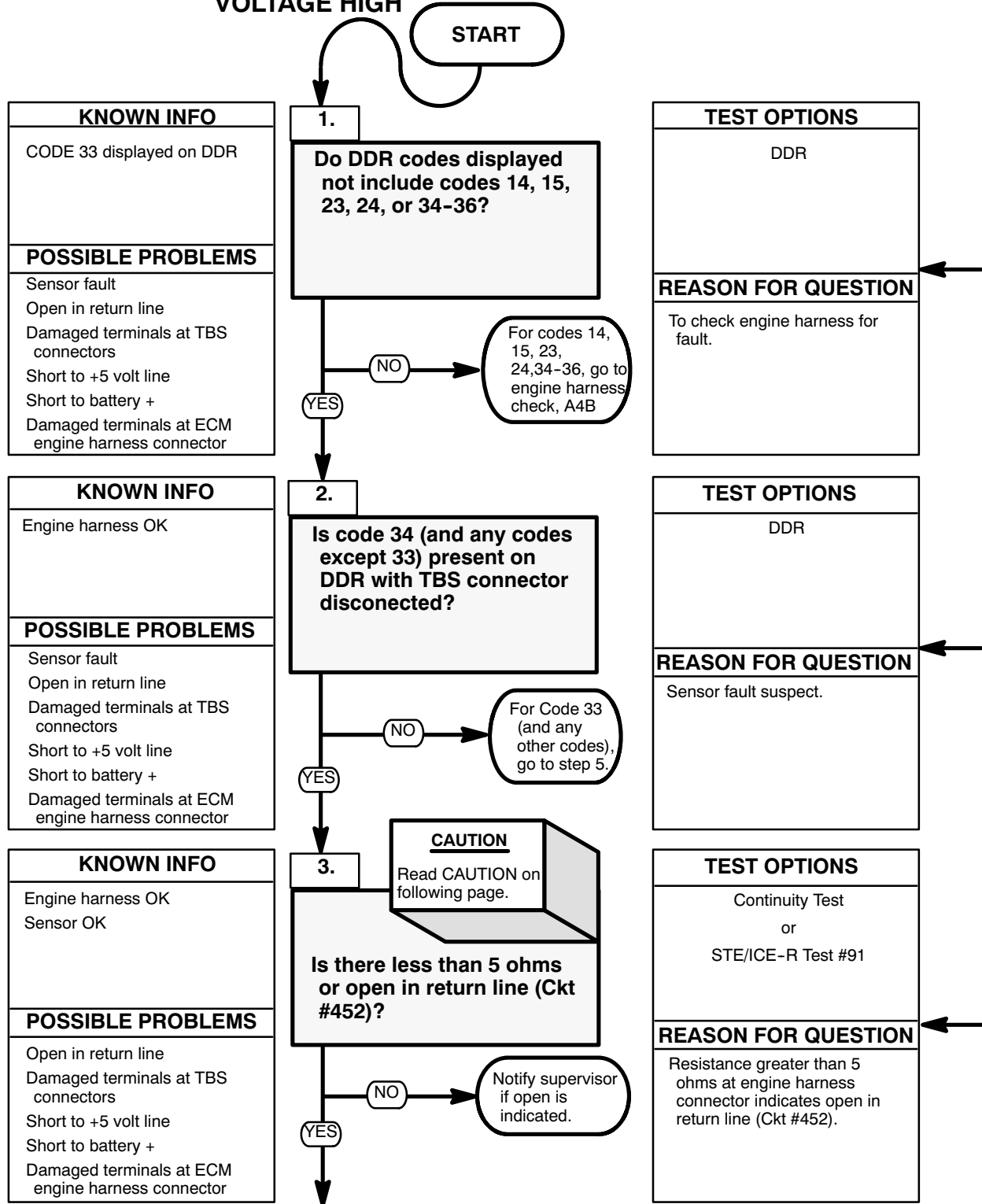
ENGINE RUN ON TEST

- (1) Remove relays R1-R6 and R11 (para 7-27).
- (2) Turn ENGINE switch ON and clear codes.
- (3) Restart engine.
- (4) Turn ENGINE switch OFF.
- (5) Reinstall relays (para 7-27).

Turn ENGINE switch ON and read active codes.

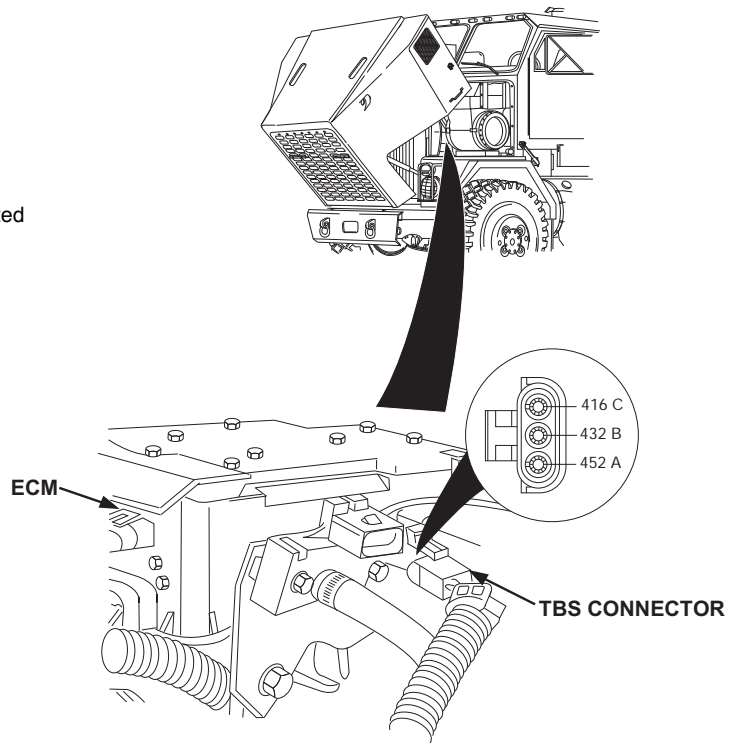


A4 - Code 33 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE HIGH



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.



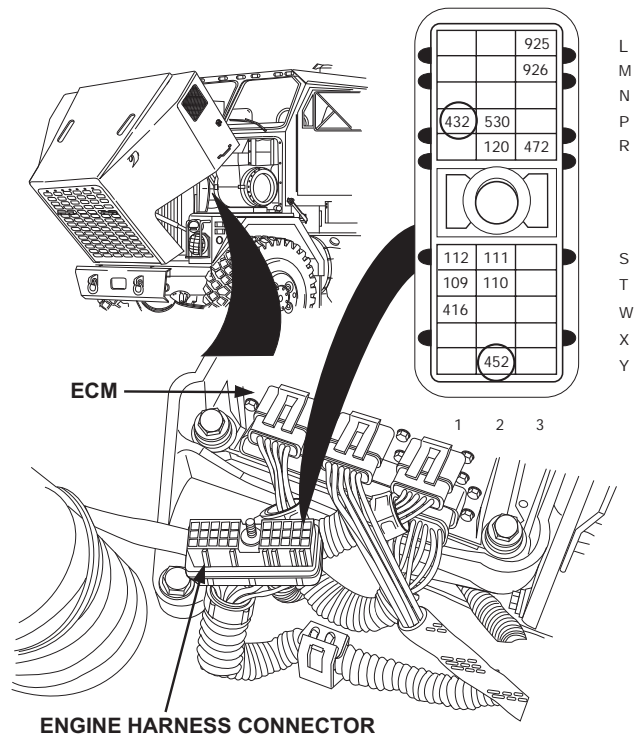
- (1) Turn ENGINE switch OFF and disconnect TBS connector.
- (1.1) Click on "Alarms Clear" to clear alarms screen.
- (2) Start and run engine at idle.
- (3) Read active codes.

CAUTION

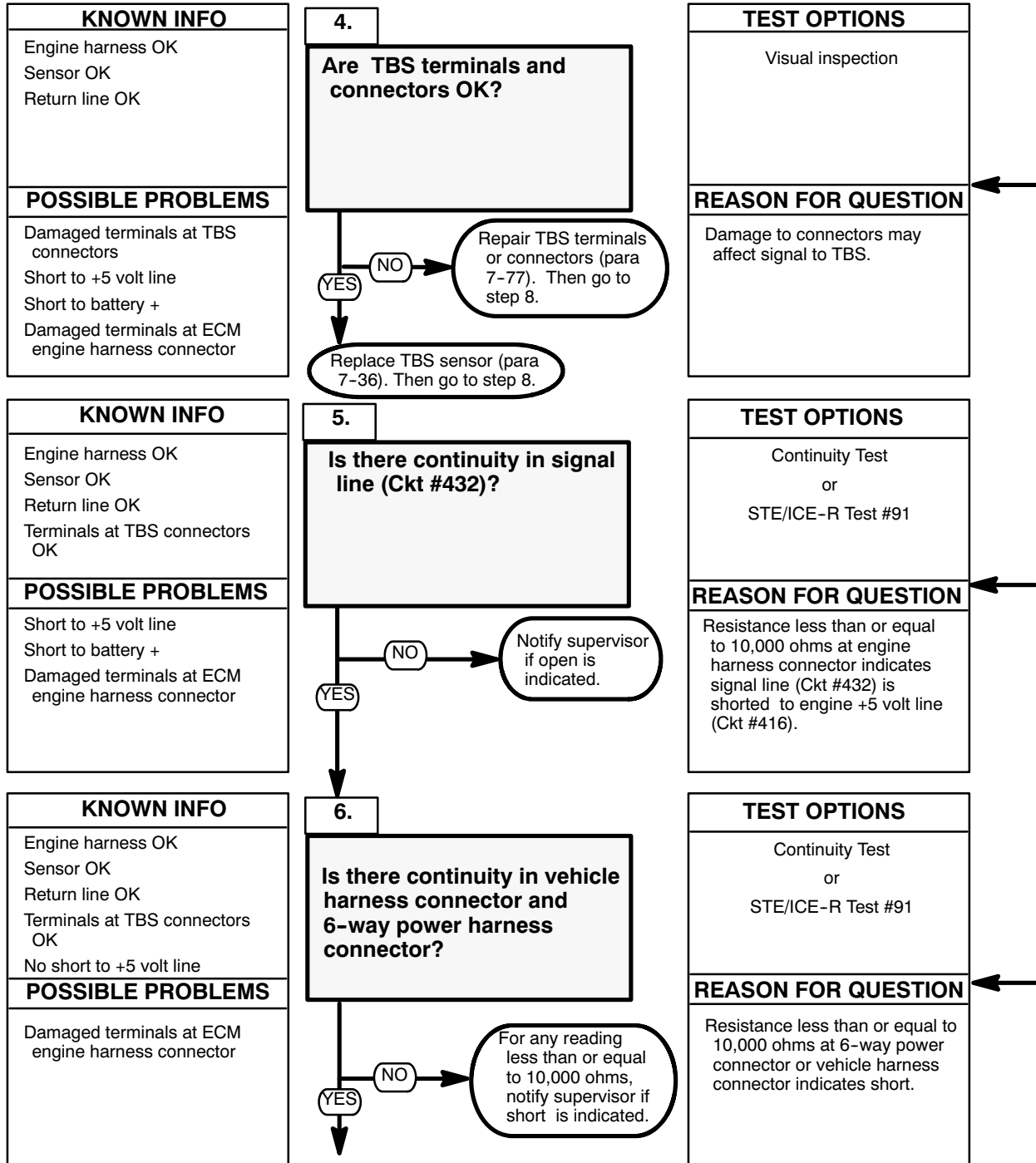
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

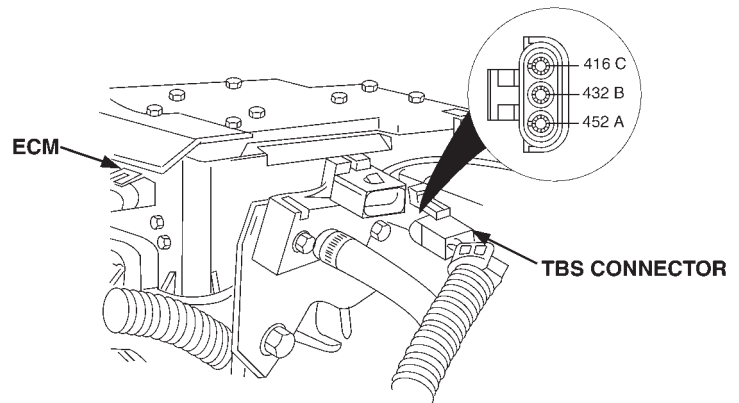
- (1) Turn ENGINE switch OFF
- (2) Install a jumper wire between pins A and B of TBS harness connector
- (3) Disconnect engine harness connector at ECM.
- (4) Read resistance between sockets P1 and Y2 on engine harness connector.



A4 - Code 33 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE HIGH (CONT)



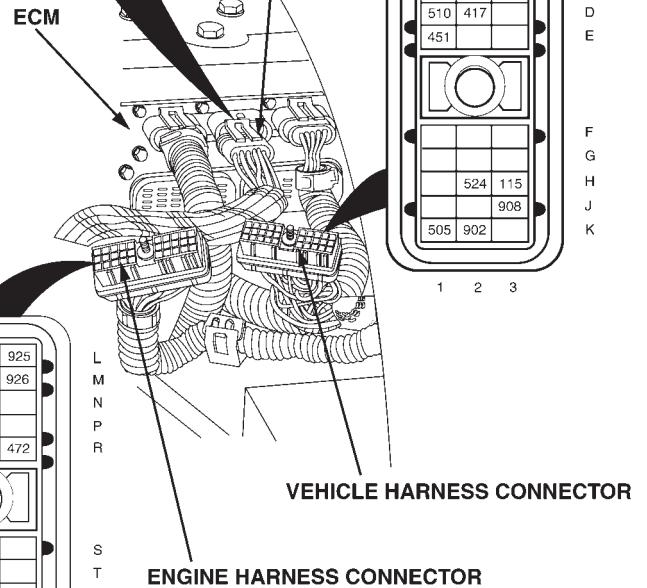
Inspect terminals at TBS connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets.



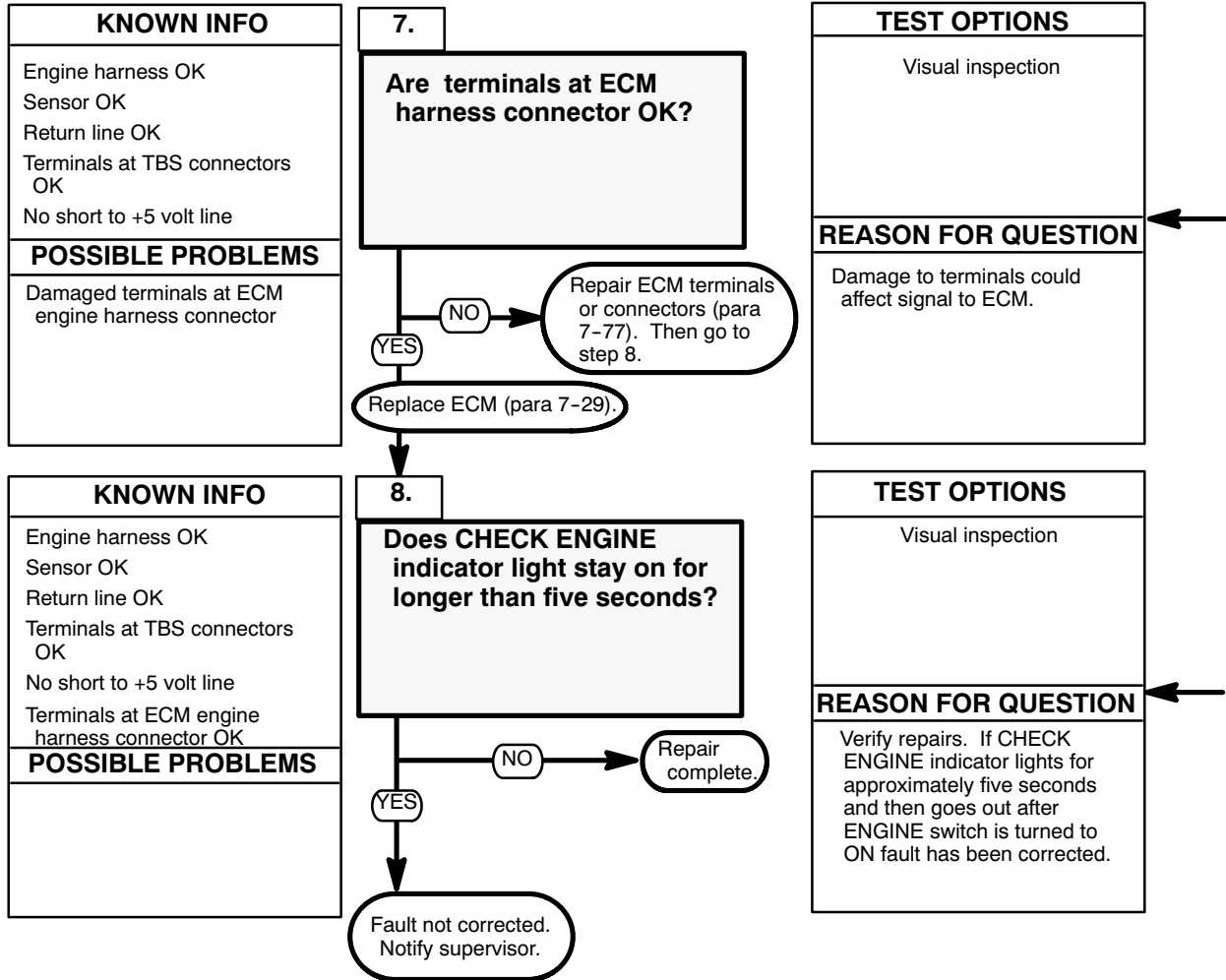
- CONTINUITY TEST**
- (1) Turn ENGINE switch OFF.
 - (2) Disconnect engine harness connector at ECM.
 - (3) Read resistance between sockets W1 and P1 on engine harness connector.



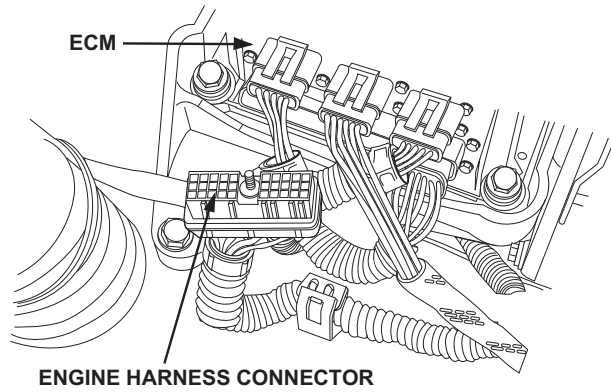
- CONTINUITY TEST**
- (1) Disconnect batteries (para 7-61).
 - (2) Disconnect vehicle harness and 6-way power harness connectors at ECM.
 - (3) Read resistance between sockets P1 of the engine harness and socket B3 on vehicle harness connector.
 - (4) Also read resistance between socket P1 on engine harness connector and sockets A, B, E, and F on 6-way power connector.
 - (5) Connect batteries (para 7-61).



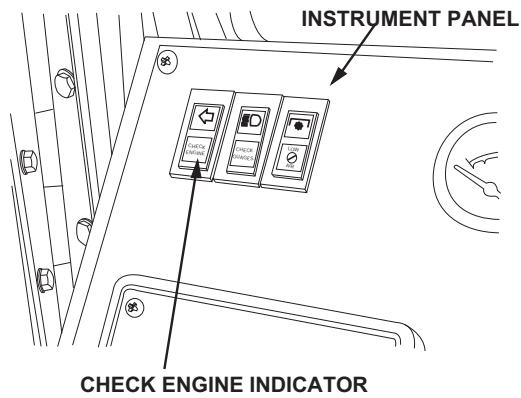
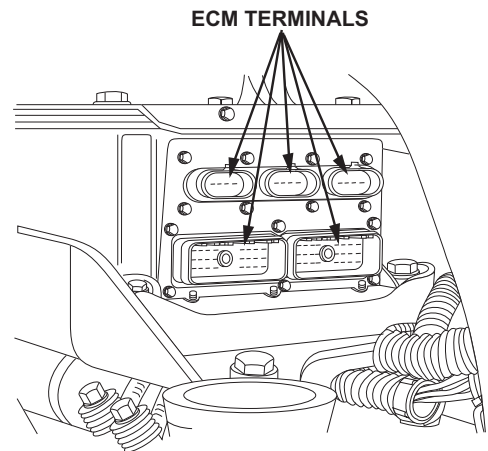
A4 - Code 33 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE HIGH (CONT)



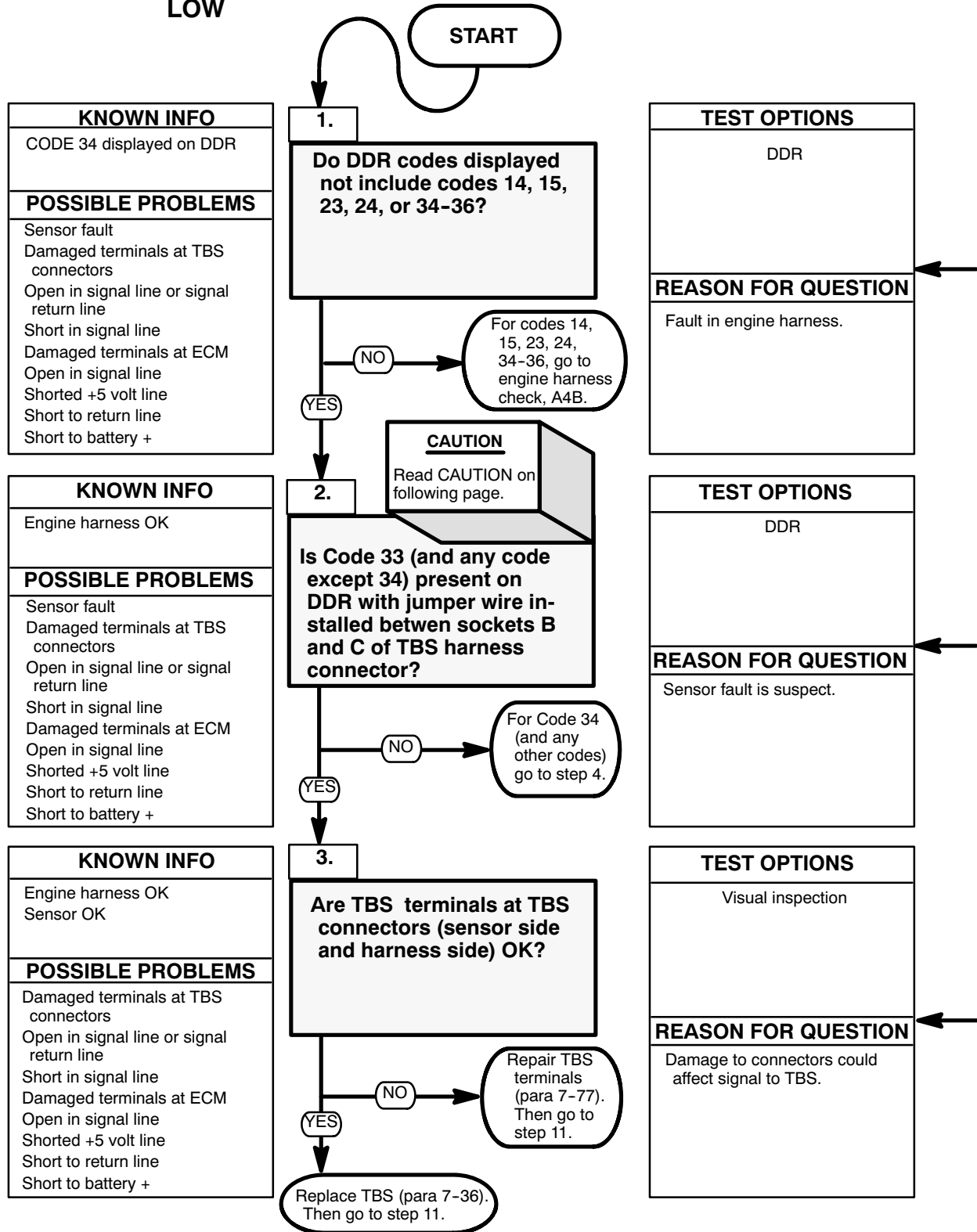
Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW



NOTE

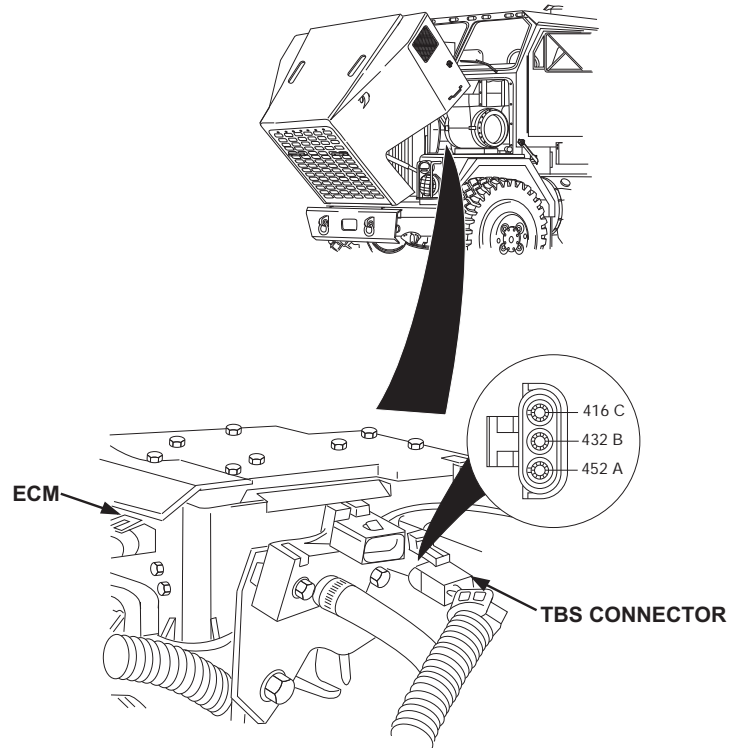
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

CAUTION

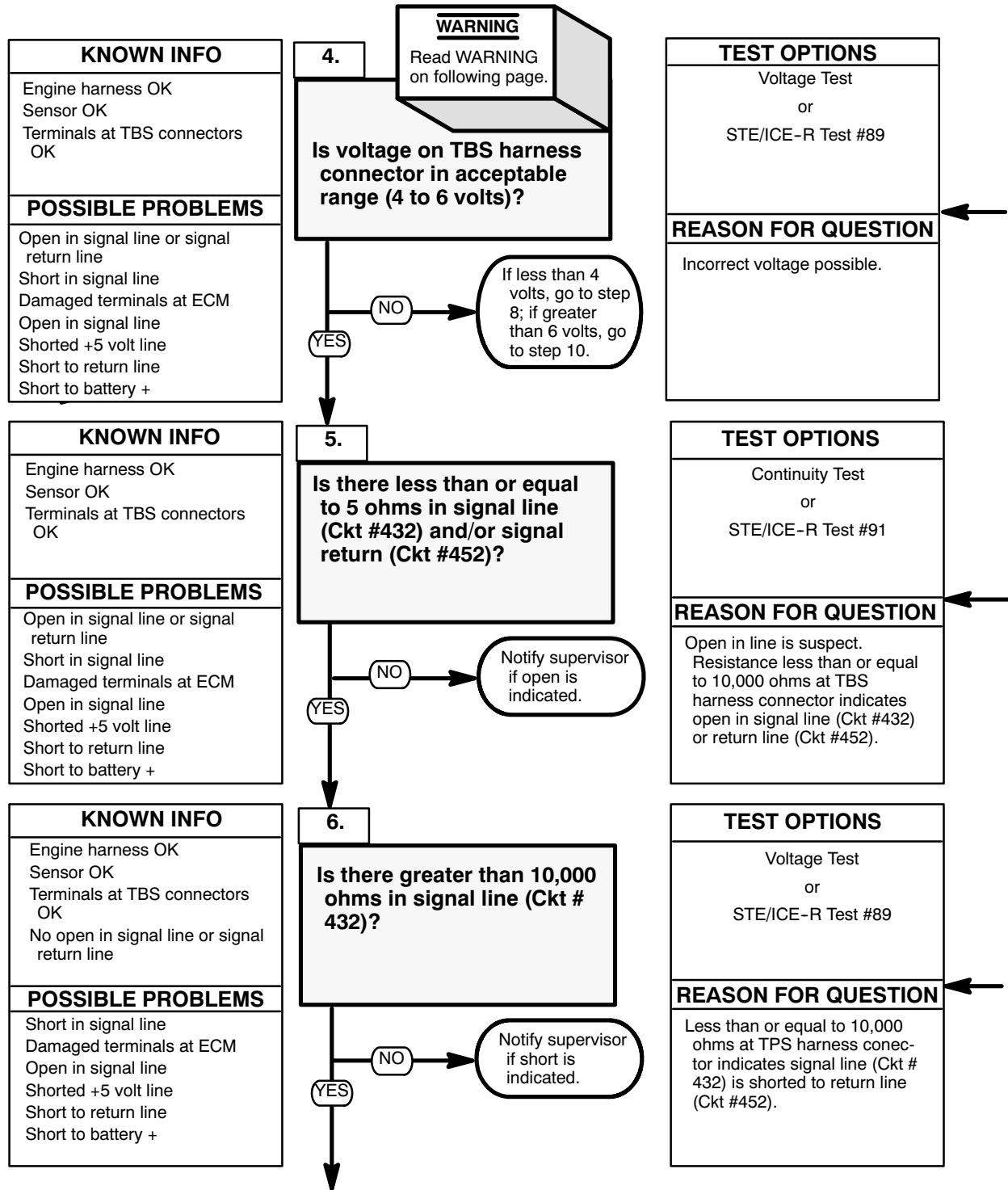
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

- (1) Turn ENGINE switch OFF and disconnect TBS connector.
- (2) Install a jumper wire between sockets B and C of TBS harness connector.
- (2.1) Click on "Alarms Clear" to clear alarms screen.
- (3) Turn ENGINE switch ON and read active codes.
- (4) Start engine and run until either the CHECK ENGINE indicator comes ON or the engine has been running warm for at least one minute at greater than 1,000 rpm.
- (5) Read active codes.

Inspect terminals at TBS connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets.



A4 - Code 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW (CONT)

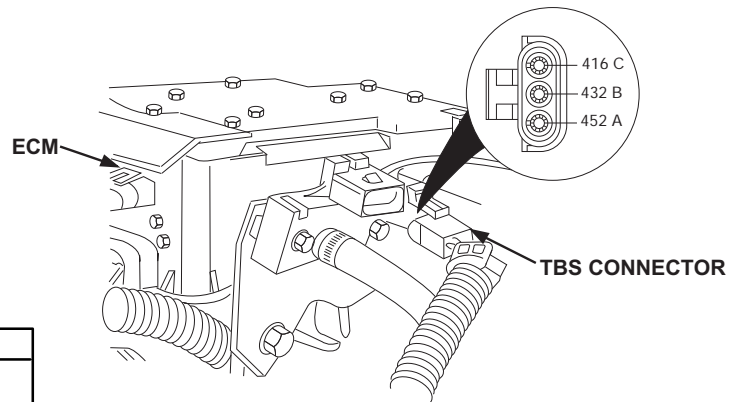


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

- (1) Remove jumper and turn ENGINE switch ON.
- (2) Read voltage on TBS harness connector, pin C (red lead) to pin A (black lead).



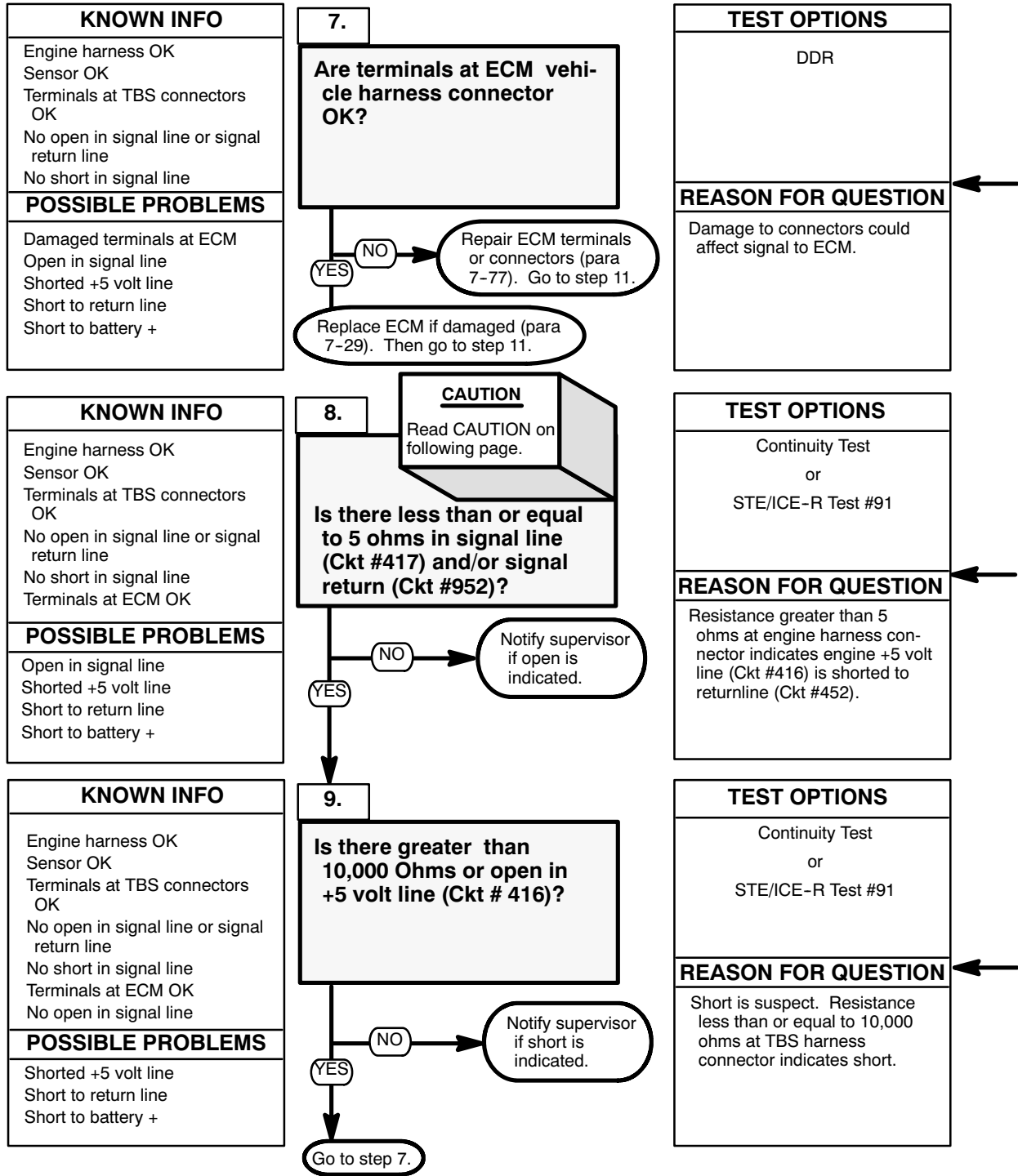
CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Read resistance between sockets A and B on TBS harness connector.
- (3) Read resistance between Socket B and a good ground.

VOLTAGE TEST

- (1) Turn ENGINE switch ON.
- (2) Read voltage on TPS harness connector, socket C (red lead to socket A (black lead)).

A4 - Code 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW (CONT)



Check terminals at ECM vehicle harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins and sockets.

CAUTION

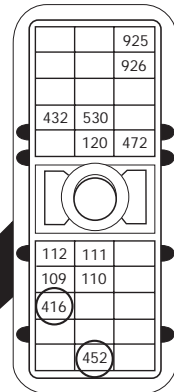
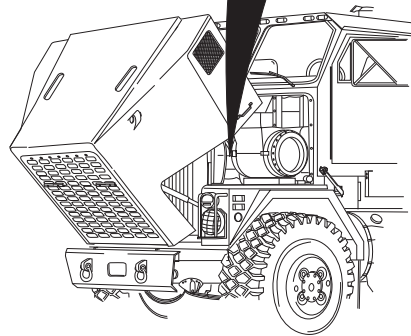
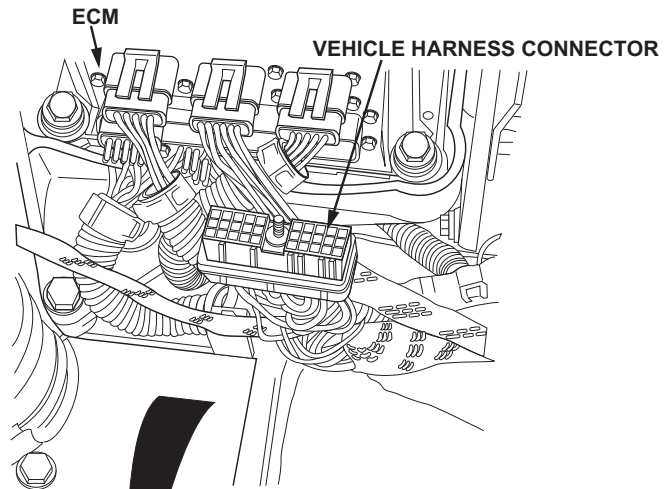
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

- (1) Turn ENGINE switch OFF and disconnect engine harness connector at ECM.
- (2) Install a jumper wire between pins A and C of the TBS harness connector.
- (3) Read resistance between socket W1 and Y2 on engine harness connector.

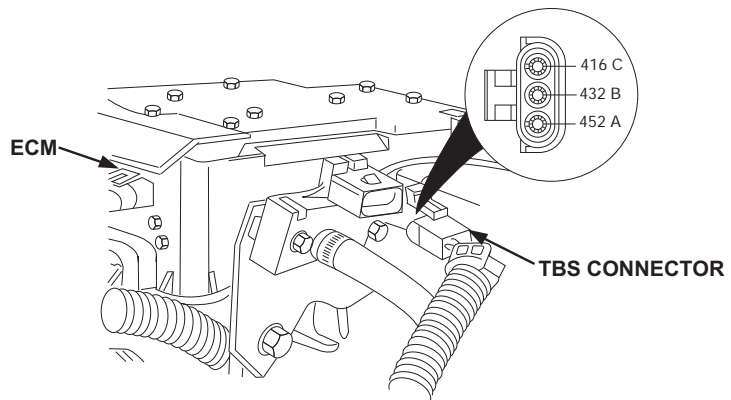
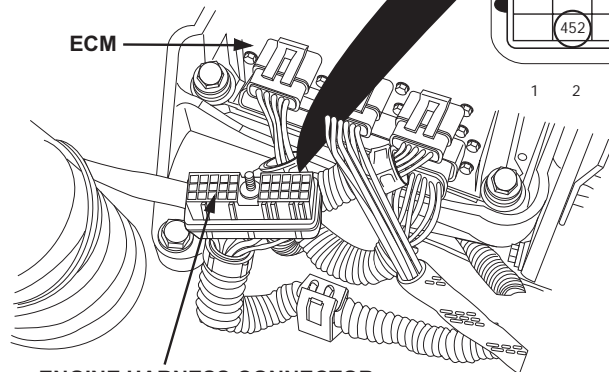
CONTINUITY TEST

- (1) Remove jumper wire.
- (2) Read resistance between pins A and C on TBS harness connector.



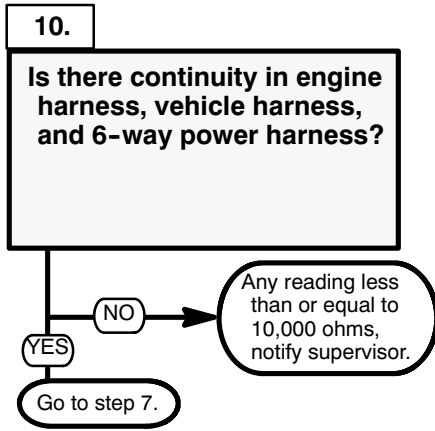
L
M
N
P
R

S
T
W
X
Y



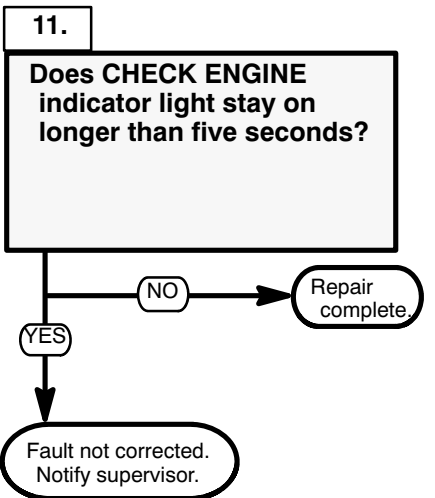
A4 - Code 34 TURBO BOOST SENSOR (TBS) SIGNAL VOLTAGE LOW (CONT)

KNOWN INFO
Engine harness OK Sensor OK Terminals at TBS connectors OK No open in signal line or signal return line No short in signal line Terminals at ECM OK No open in signal line No short in +5 volt line
POSSIBLE PROBLEMS
Short to battery +



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Short is suspect. Resistance less than or equal to 10,000 ohms at TBS, vehicle harness, or 6-way power connector indicates short.

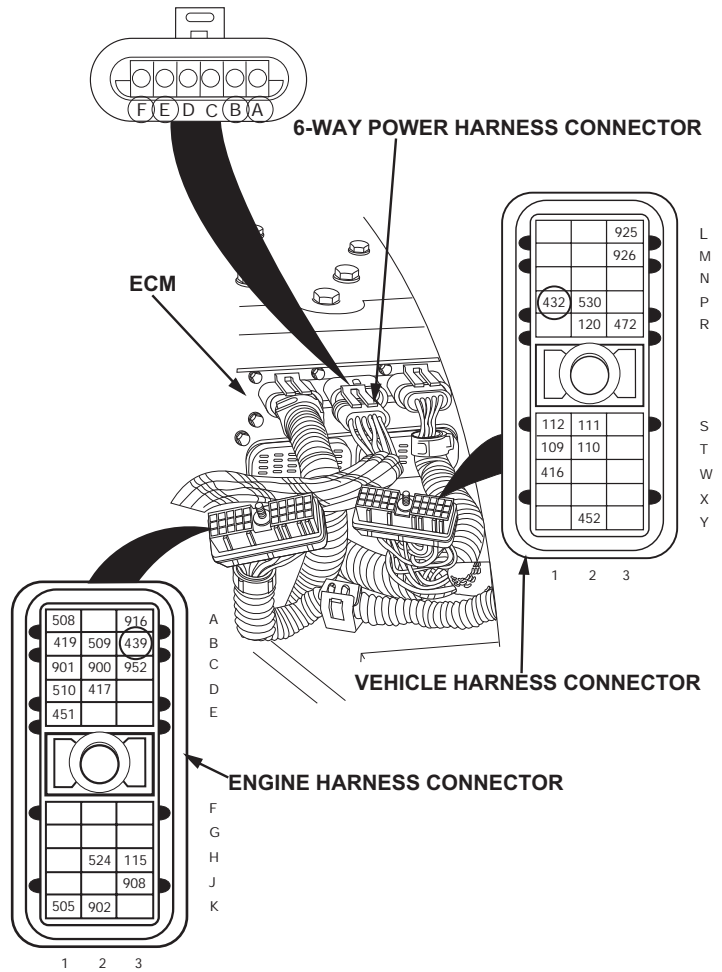
KNOWN INFO
Engine harness OK Sensor OK Terminals at TBS connectors OK No open in signal line or signal return line No short in signal line Terminals at ECM OK No open in signal line No short in +5 volt line No short in battery +
POSSIBLE PROBLEMS



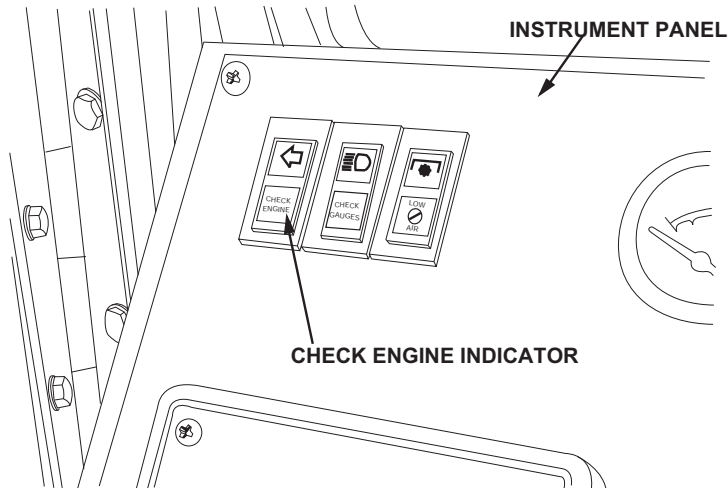
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned to ON fault has been corrected.

CONTINUITY TEST

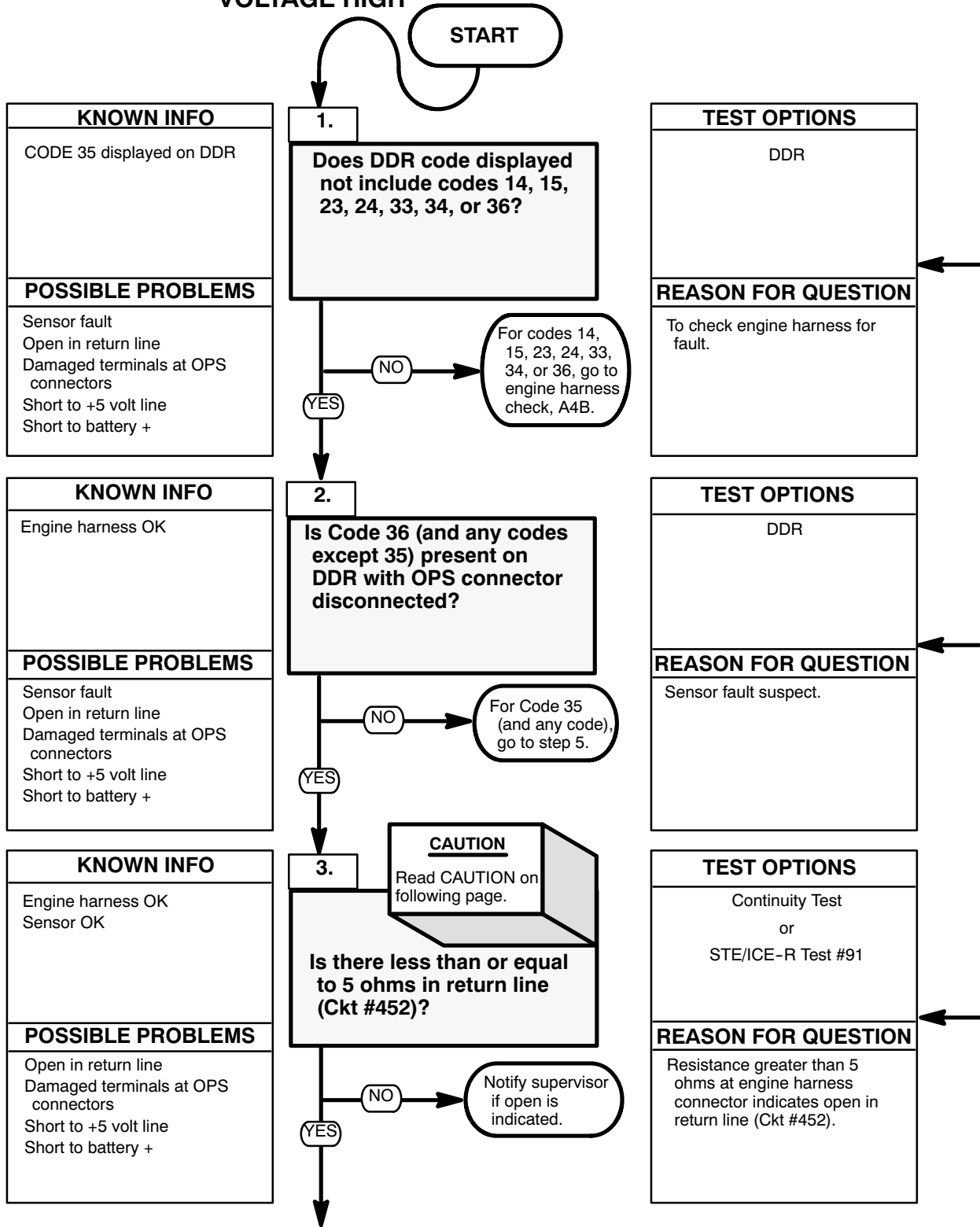
- (1) Turn ENGINE switch OFF and pull out both DDEC circuit breakers.
- (2) Disconnect engine harness, vehicle harness, and 6-way power harness connectors at ECM. Read resistance between sockets A and C on TBS harness connector.
- (3) Read resistance between socket P1 of engine harness connector and socket B3 of vehicle harness connector.
- (4) Read resistance between socket P1 on engine harness connector and sockets A, B, E, and F on 6-way power connector.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 35 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE HIGH



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

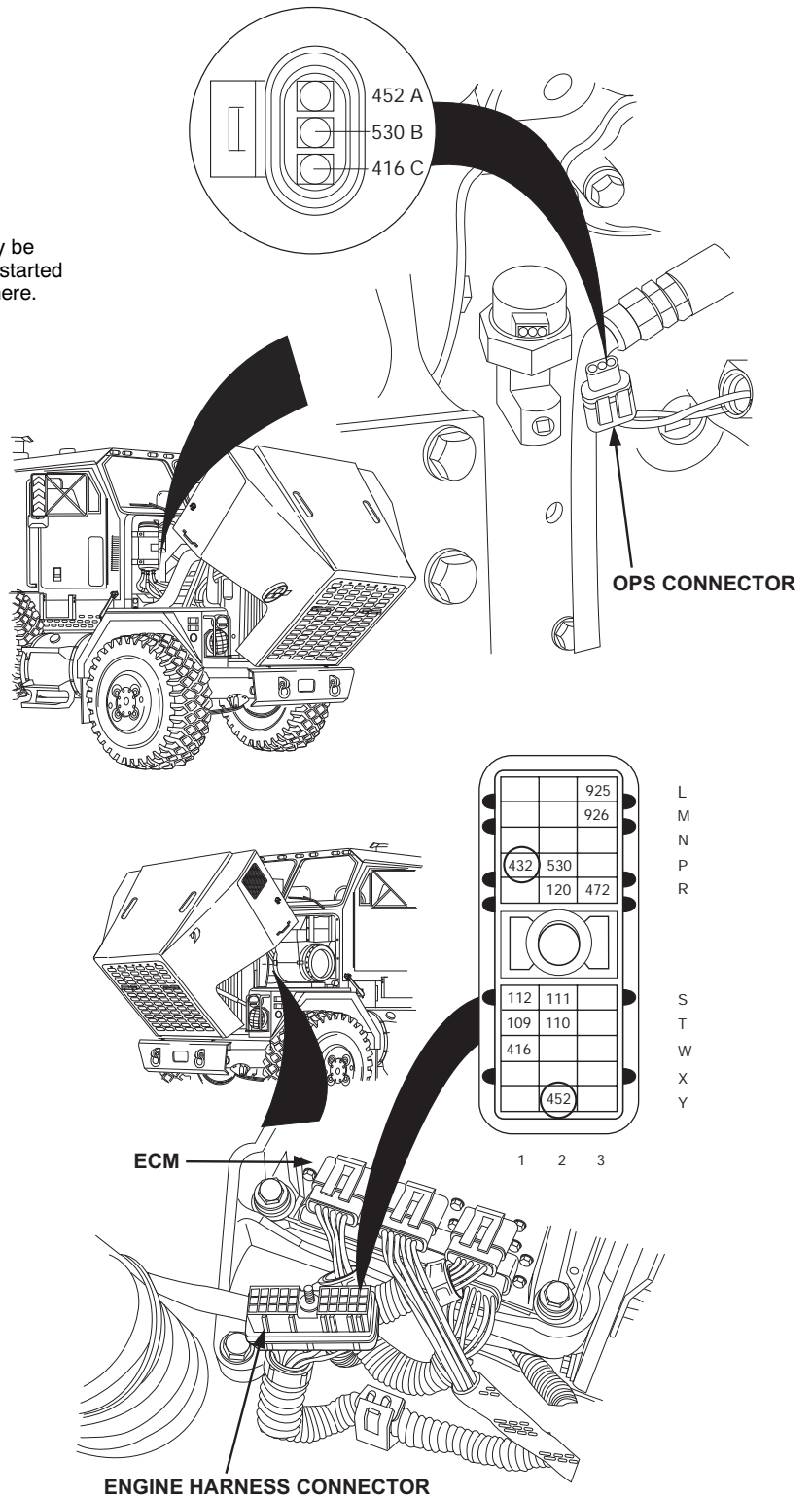
- (1) Turn ENGINE switch OFF.
- (1.1) Remove right inner fender (para 16-34).
- (1.2) Disconnect OPS connector.
- (2) Start engine (TM 9-2320-360-10).
- (3) Select Engine Temperature (OIL TEMP) on DDR.
- (4) Warm up engine until engine temperature reading is greater than 140° F (60° C).
- (4.1) Click on "Alarms Clear" to clear alarms screen.
- (5) Read active codes at idle.

CAUTION

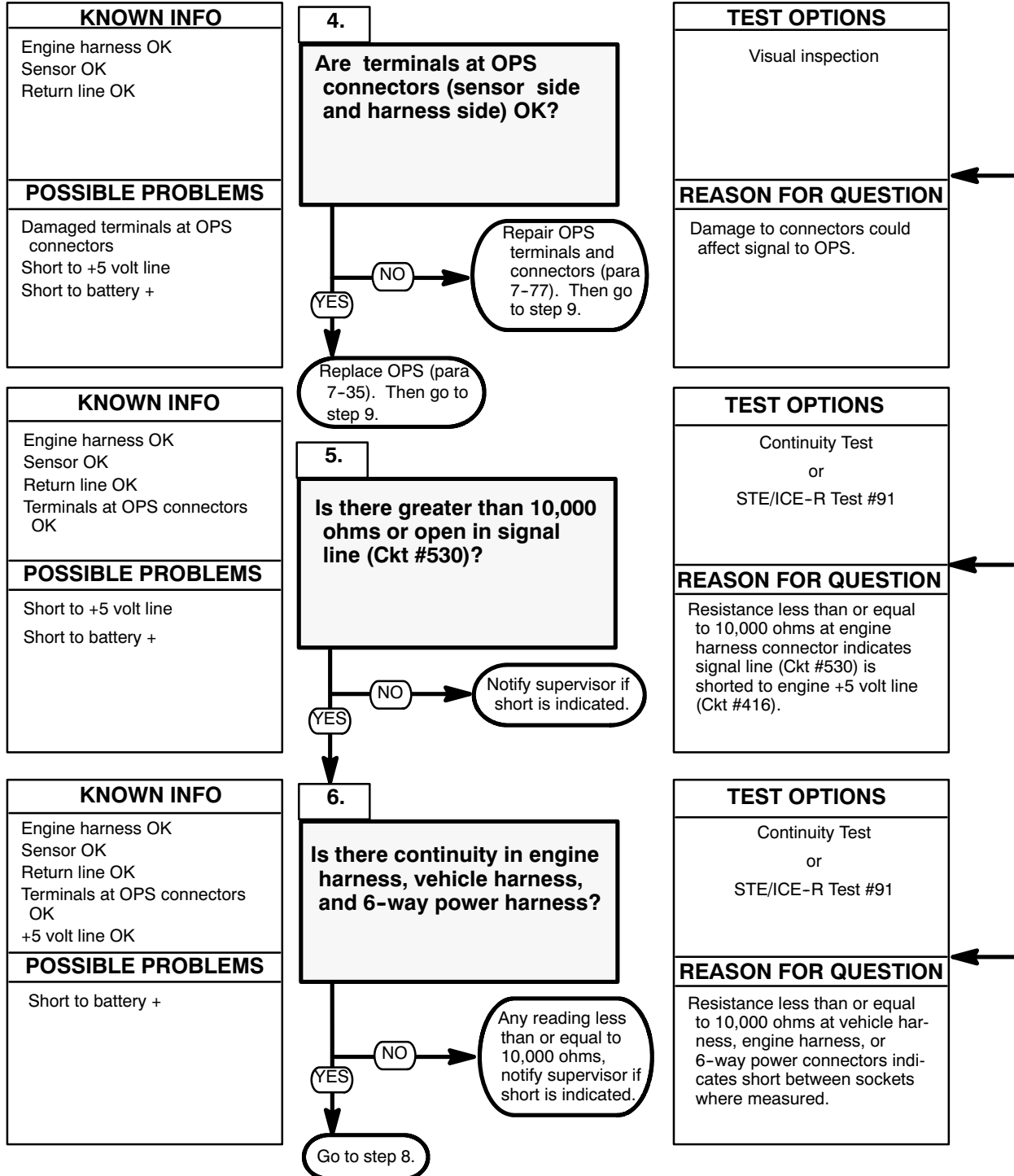
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

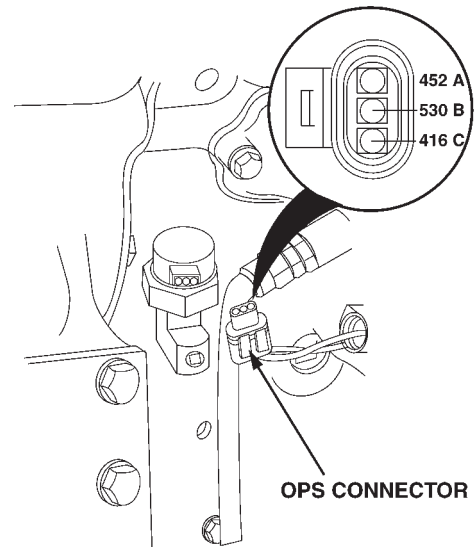
- (1) Turn ENGINE switch OFF and disconnect engine harness connector at ECM.
- (2) Install a jumper wire between pins A and B of OPS harness connector.
- (3) Read resistance between sockets P1 and Y2 on engine harness connector.



A4 - Code 35 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE HIGH (CONT)



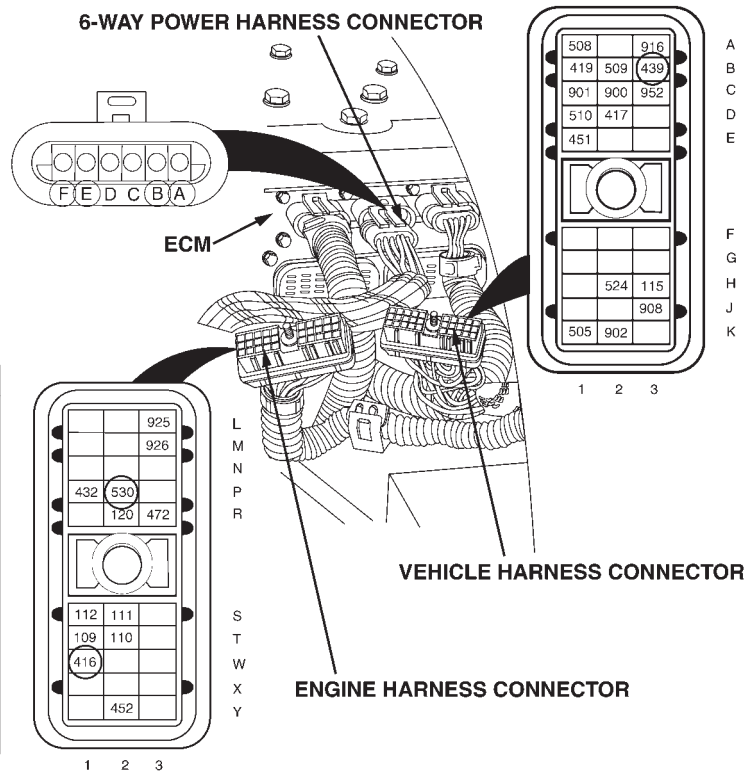
Inspect terminals at OPS connectors (sensor side and harness side) for damage; bent, corroded, and unseated pins or sockets.



CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect engine harness connector at ECM.
- (3) Read resistance between sockets W1 and P2 on engine harness connector.

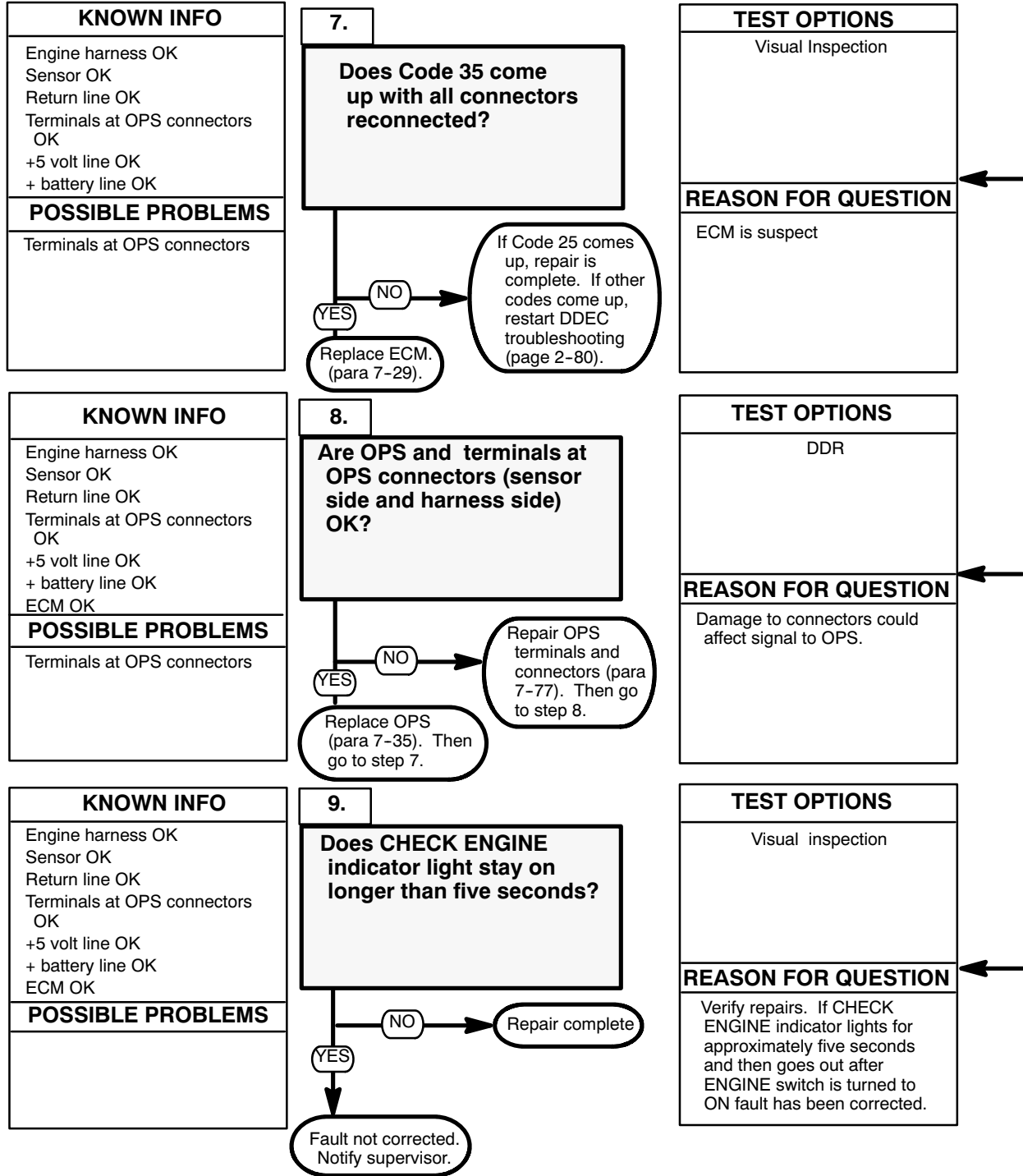
6-WAY POWER HARNESS CONNECTOR



CONTINUITY TEST

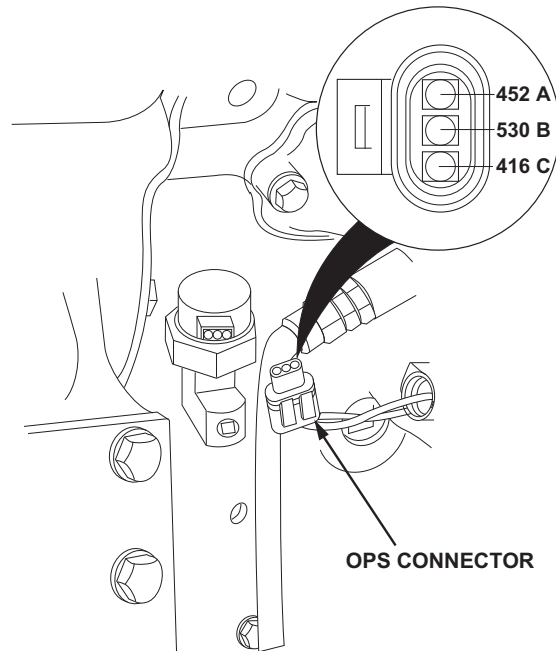
- (1) Disconnect batteries (para 7-61).
- (2) Disconnect vehicle harness and 6-way power harness connectors at ECM.
- (3) Read resistance between sockets P2 of the engine harness and socket B3 on vehicle harness connector.
- (4) Also read resistance between socket P2 on engine harness connector and sockets A, B, E, and F on 6-way power connector.
- (5) Connect batteries (para 7-61).

A4-Code 35 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE HIGH (CONT)

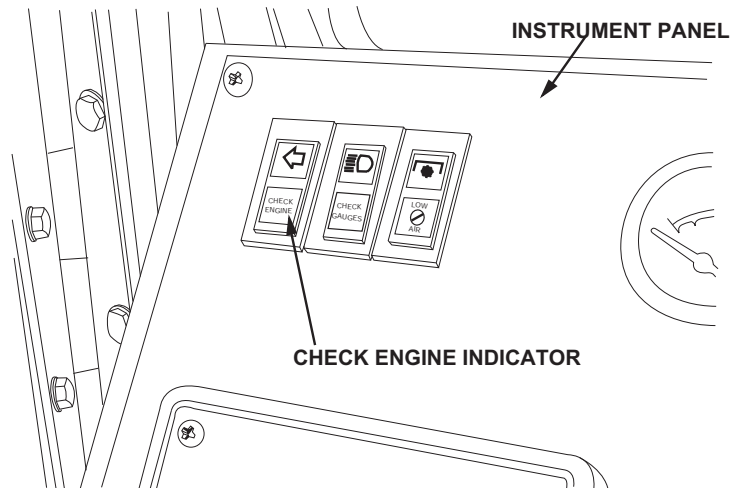


- (1) Reconnect all connectors.
- (2) Turn ENGINE switch ON and clear codes.
- (3) Start engine.
- (4) Run engine for one minute or until CHECK ENGINE indicator comes ON
- (5) Stop engine and read active codes.

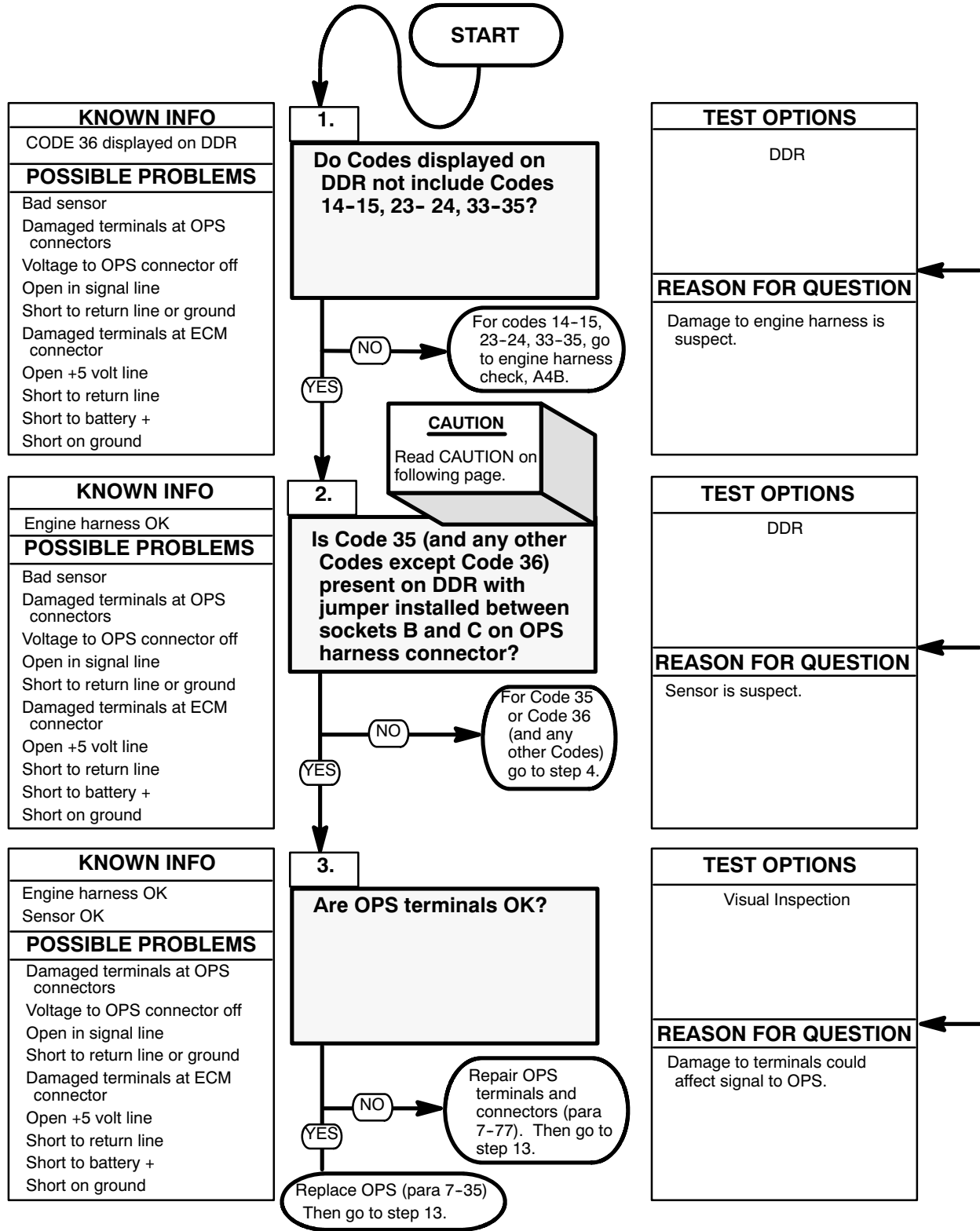
Inspect OPS and terminals at OPS connectors (sensor side and harness side) form damage; bent, corroded, and unseated pins or sockets.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW



NOTE

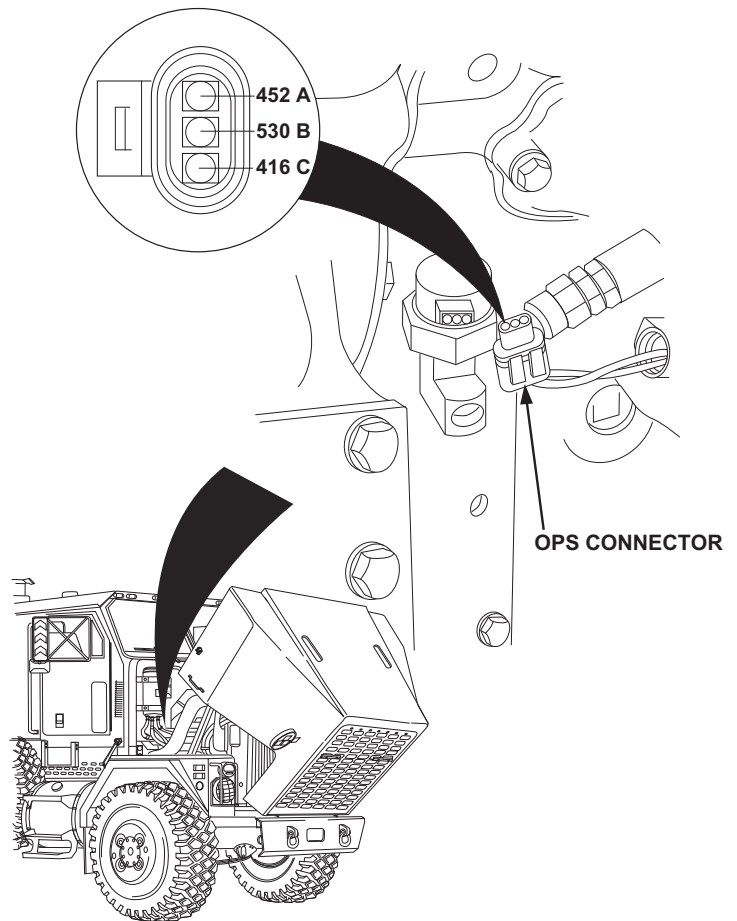
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

CAUTION

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

- (1) Turn ENGINE switch OFF.
- (1.1) Remove right inner fender (para 16-34).
- (2) Disconnect OPS connector and install a jumper wire between sockets B and C of the OPS harness connector.
- (2.1) Click on "Alarms Clear" to clear alarms screen.
- (3) Turn ENGINE switch ON and read active codes. If active codes 35 or 36 do not exist, start and run engine until either active Code 35 or 36 appears or until engine temperature (Mode 18 OIL TEMP on DDR) is greater than 140° F (60° C) for more than 1 minute.

- (1) Turn ENGINE switch OFF.
- (2) Inspect terminals at the OPS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or sockets.



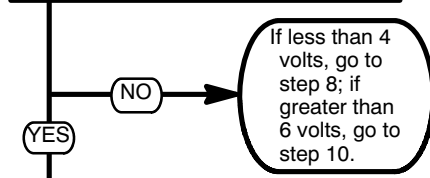
A4 - Code 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT)

KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK
POSSIBLE PROBLEMS
Voltage to OPS connector off Open in signal line Short to return line or ground Damaged terminals at ECM connector Open +5 volt line Short to return line Short to battery + Short on ground

4.

Is voltage in OPS harness connector in acceptable range (4 to 6 volts)?

TEST OPTIONS
Voltage Test or STE/ICE-R Test #89
REASON FOR QUESTION
Incorrect voltage possible.



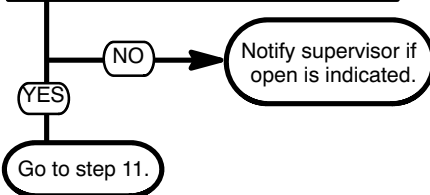
KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK Voltage to OPS connector OK
POSSIBLE PROBLEMS
Open in signal line Short to return line or ground Damaged terminals at ECM connector Open +5 volt line Short to return line Short to battery + Short on ground

5.

Is there less than or equal to 5 ohms in signal line (Ckt #530)?



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance greater than 5 ohms at OPS harness connector indicates open in signal line (Ckt #530).

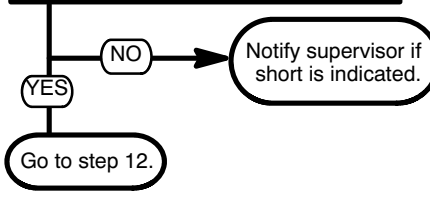


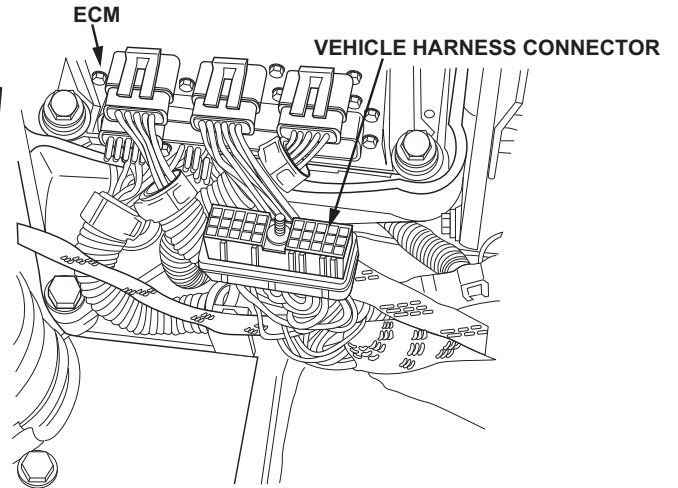
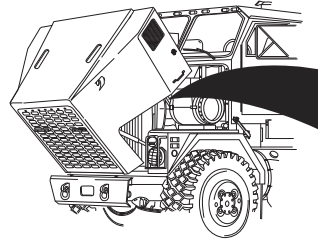
KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK Voltage to OPS connector OK No open in signal line
POSSIBLE PROBLEMS
Short to return line or ground Damaged terminals at ECM connector Open +5 volt line Short to return line Short to battery + Short on ground

6.

Is there greater than 10,000 ohms or open in signal line (Ckt #530) and return line (Ckt #452) or battery ground?

TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance less than or equal to 10,000 ohms at OPS harness connector indicates signal line (Ckt #530) is shorted to return line (Ckt #452) or battery ground.



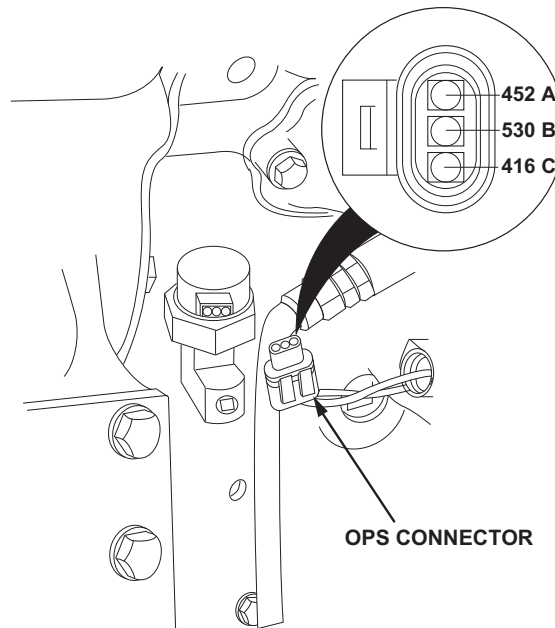


- VOLTAGE TEST**
- (1) Turn ENGINE switch OFF.
 - (2) Remove jumper wire.
 - (3) Connect vehicle harness to OPS connector.
 - (4) Turn ENGINE switch ON and read voltage on OPS harness connector, socket C (red lead) to socket A (black lead).

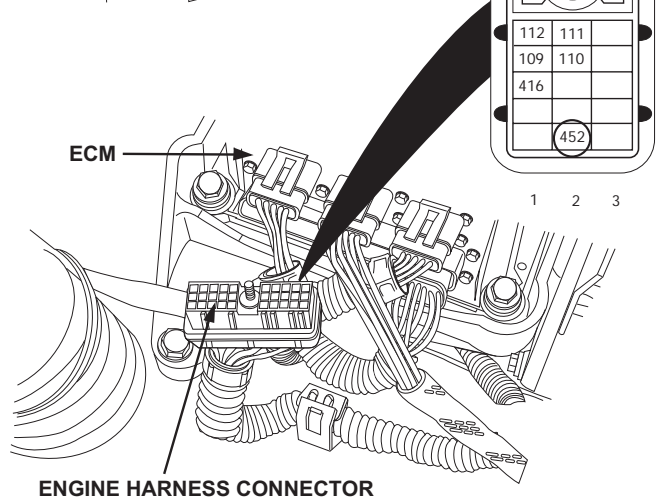
CAUTION

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

- CONTINUITY TEST**
- (1) Turn ENGINE switch OFF.
 - (2) Disconnect engine harness connector at the ECM.
 - (3) Install a jumper wire between sockets A and B of the OPS harness connector.
 - (4) Read resistance between sockets P2 and Y2 on the engine harness connectors.



- CONTINUITY TEST**
- (1) Remove jumper wire.
 - (2) Disconnect the engine harness connector at the ECM.
 - (3) Read resistance between sockets A and B on the OPS harness connector. Also read resistance between socket B and a good ground.



		925	
		926	
432	530		
	120	472	
OPS CONNECTOR			
112	111		
109	110		
416			
		452	

L
M
N
P
R

S
T
W
X
Y

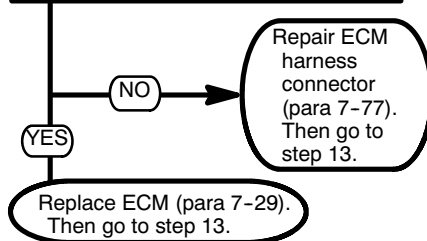
1 2 3

A4-Code 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT)

KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK Voltage to OPS connector OK No open in signal line No short to return line or ground
POSSIBLE PROBLEMS
Damaged terminals at ECM connector Open +5 volt line Short to return line Short to battery + Short on ground

7.

Are terminals at ECM engine harness connector OK?



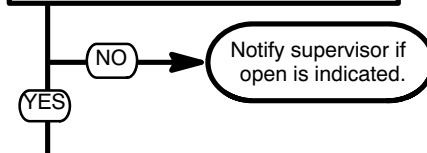
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damage to terminals could affect signal to ECM.

KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK Voltage to OPS connector OK No open in signal line No short to return line or ground ECM connector OK
POSSIBLE PROBLEMS
Open +5 volt line Short to return line Short to battery + Short on ground

8.

CAUTION
 Read CAUTION on following page.

Is there less than or equal to 5 ohms in +5 volt line (Ckt #416)?

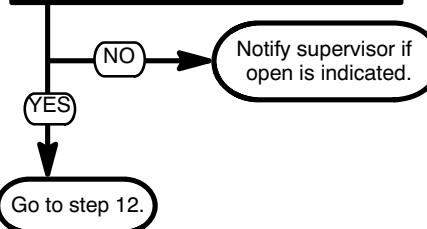


TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance greater than 5 ohms at engine harness connector indicates +5 volt line (Ckt #416) is open.

KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK Voltage to OPS connector OK No open in signal line No short to return line or ground ECM connector OK No open in +5 volt line
POSSIBLE PROBLEMS
Short to return line Short to battery + Short on ground

9.

Is there greater than 10,000 ohms or open in +5 volt line (Ckt #416) and return line (Ckt #452)?



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance less than or equal to 10,000 ohms at OPS harness connector indicates +5 volt line (Ckt #416) is shorted to return line (Ckt #452).

Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded and unseated pins or sockets, especially W1, P2 and Y2 terminals and pins at ECM

CAUTION

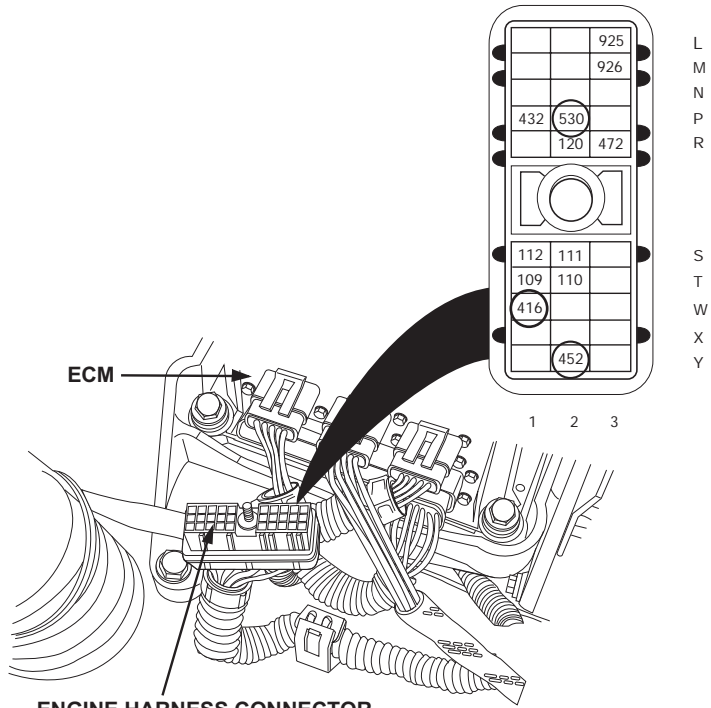
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

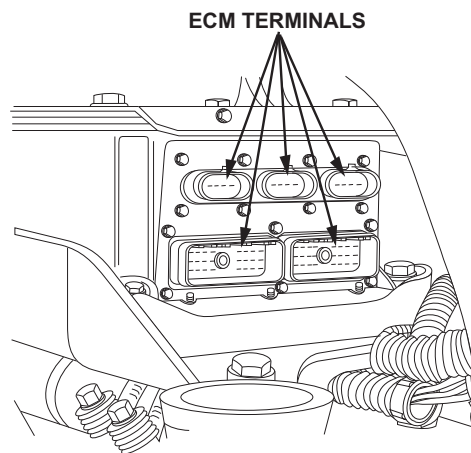
- (1) Turn ENGINE switch OFF.
- (2) Disconnect engine harness connector at ECM
- (3) Install a jumper wire between sockets A and C of the OPS harness connector.
- (4) Read resistance between sockets W1 and Y2 on engine harness connector.

CONTINUITY TEST

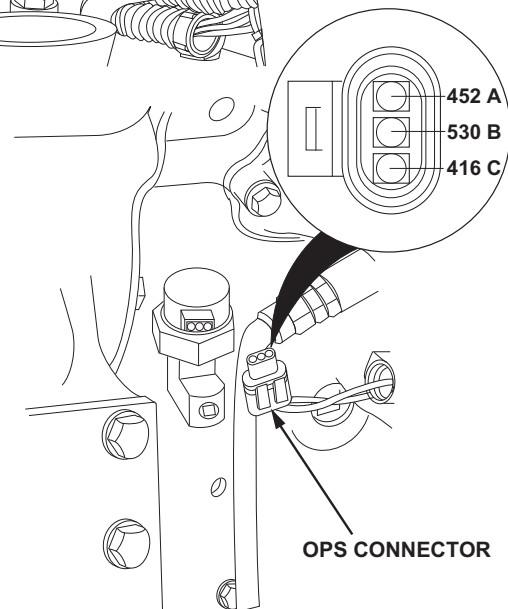
- (1) Remove jumper wire.
- (2) Read resistance between sockets A and C of the OPS harness connector.



ENGINE HARNESS CONNECTOR



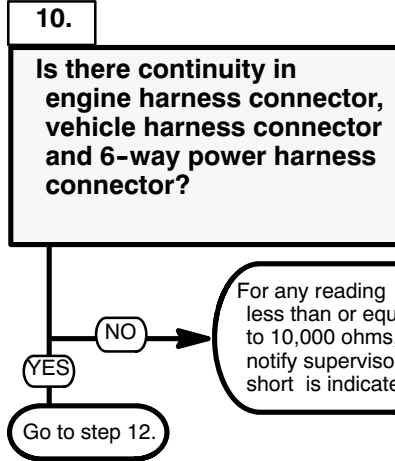
ECM TERMINALS



OPS CONNECTOR

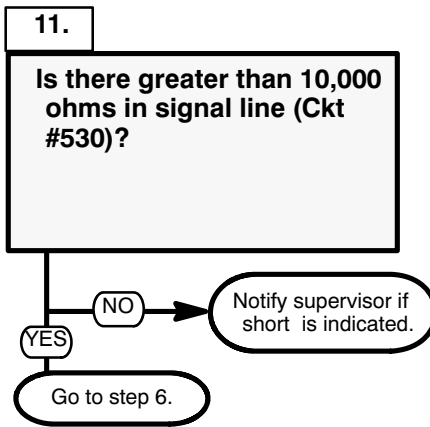
A4 - Code 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT)

KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK Voltage to OPS connector OK No open in signal line No short to return line or ground ECM connector OK No open in +5 volt line No short to return line
POSSIBLE PROBLEMS
Short to battery + Short on ground



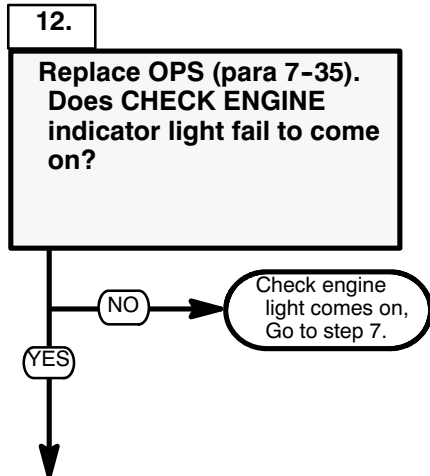
TEST OPTIONS
Continuity Test or STE/ICE Test #91
REASON FOR QUESTION
Resistance less than or equal to 10,000 ohms between engine harness, vehicle harness and 6-way power harness connectors indicates short where measured.

KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK Voltage to OPS connector OK No open in signal line No short to return line or ground ECM connector OK No open in +5 volt line No short to return line No short on ground
POSSIBLE PROBLEMS
Short on ground



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance less than or equal to 10,00 ohms at engine harness indicates signal line (Ckt #530) and return line (Ckt #452) are shorted together.

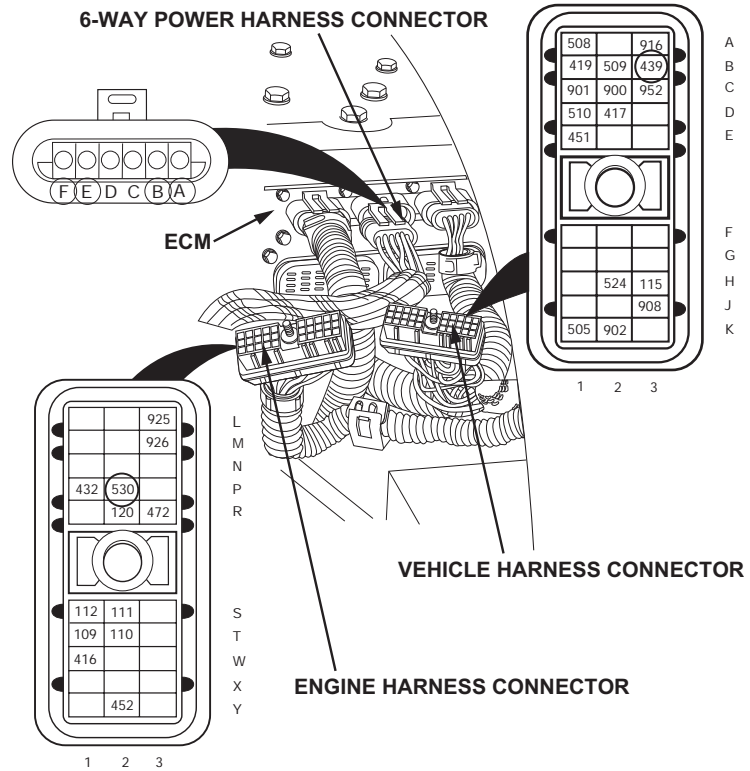
KNOWN INFO
Engine harness OK Sensor OK Terminals at OPS connectors OK Voltage to OPS connector OK No open in signal line No short to return line or ground ECM connector OK No open in +5 volt line No short to return line No short on ground
POSSIBLE PROBLEMS



TEST OPTIONS
Visual Inspection
REASON FOR QUESTION
OPS is suspect.

CONTINUITY TEST

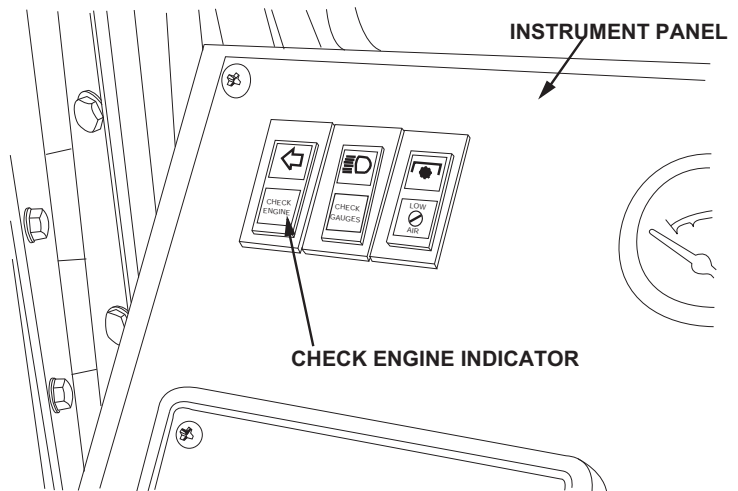
- (1) Pull out both circuit breakers to ECM.
- (2) Disconnect vehicle harness and 6-way power harness connectors at ECM.
- (3) Read resistance between socket P2 of engine harness connector and socket B3 of vehicle harness connector. Also read resistance between socket P2 on the engine harness connector and sockets A, B, E, and F on the 6-way power harness connector.



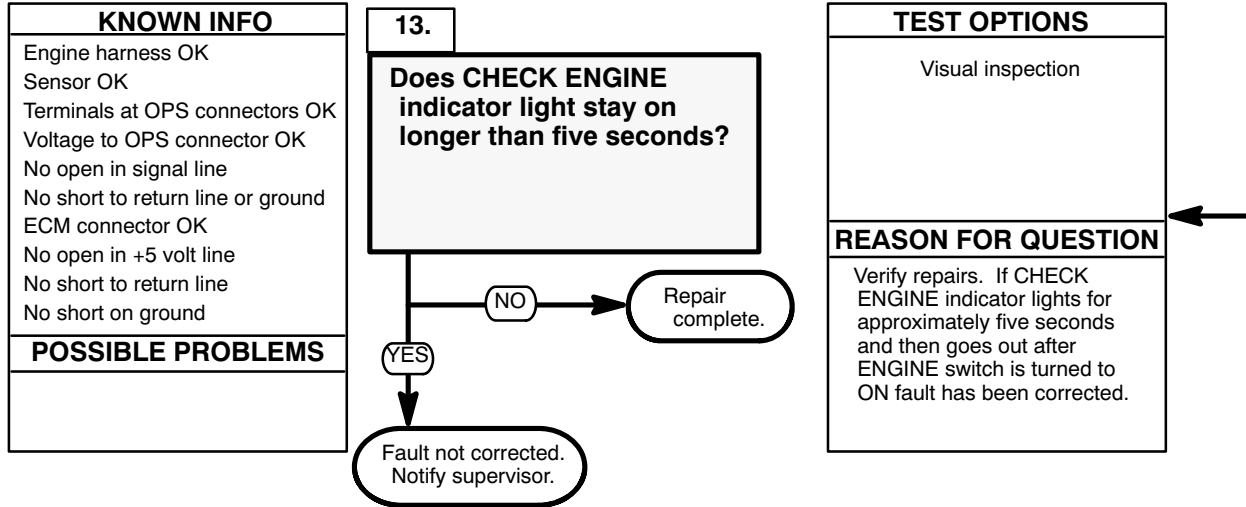
CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Remove jumper wires and measure resistance between sockets P2 and Y2 on engine harness.

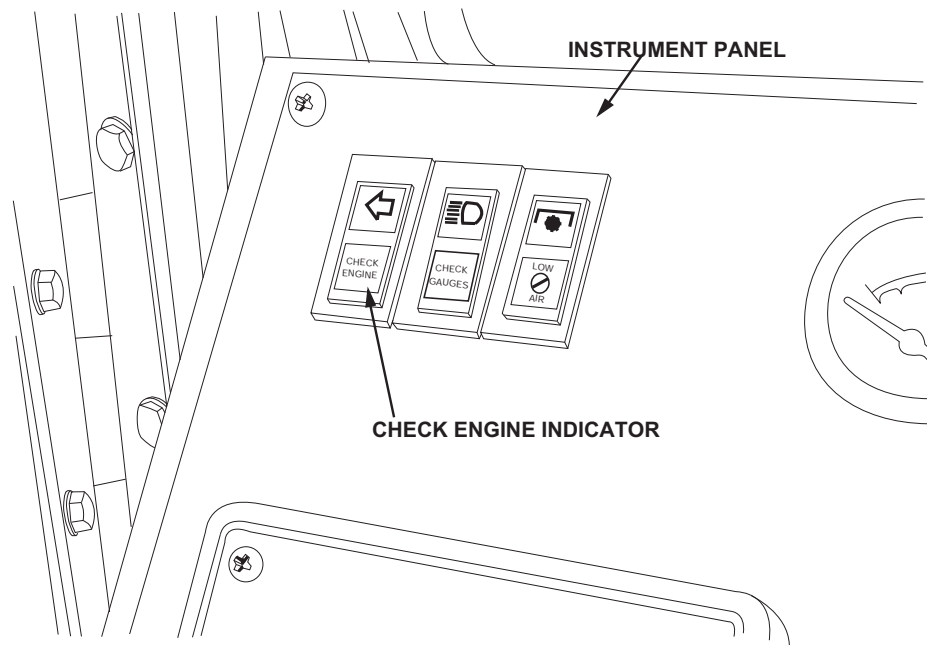
- (1) Turn ENGINE switch OFF.
- (2) Replace OPS (para 7-35).
- (3) Reconnect all connectors.
- (4) Turn ENGINE switch ON
- (5) Start engine. Run until CHECK ENGINE light comes on or for 1 minute.



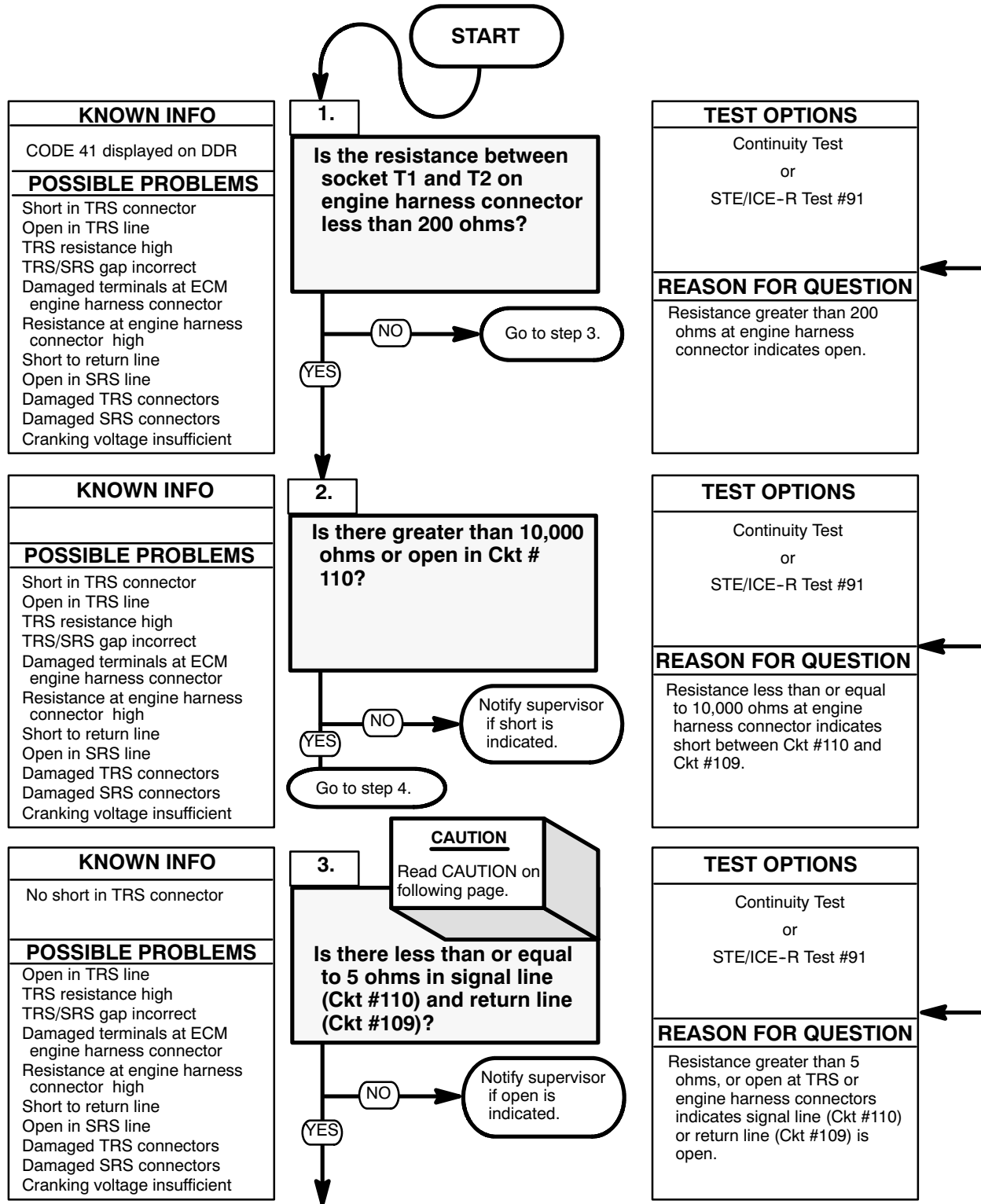
A4-Code 36 OIL PRESSURE SENSOR (OPS) SIGNAL VOLTAGE LOW (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 41 TIMING REFERENCE SENSOR (TRS)



NOTE

- The following chart should be used only if DDEC troubleshooting was started on pg. 2-80 and you were referred here.
- A false DDEC historical Code 41 may be logged during cold starts in extremely cold environments, -50 to -26F° (-46 to -32°C). Typically, the CHECK ENGINE light will come on 8 minutes after starting and go out 2-3 minutes later. If the vehicle has been operated under these conditions, clear the historical codes and return the vehicle to service.

CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect engine harness connector at ECM.
- (3) Read resistance between sockets T1 and T2 of engine harness connector.

CONTINUITY TEST

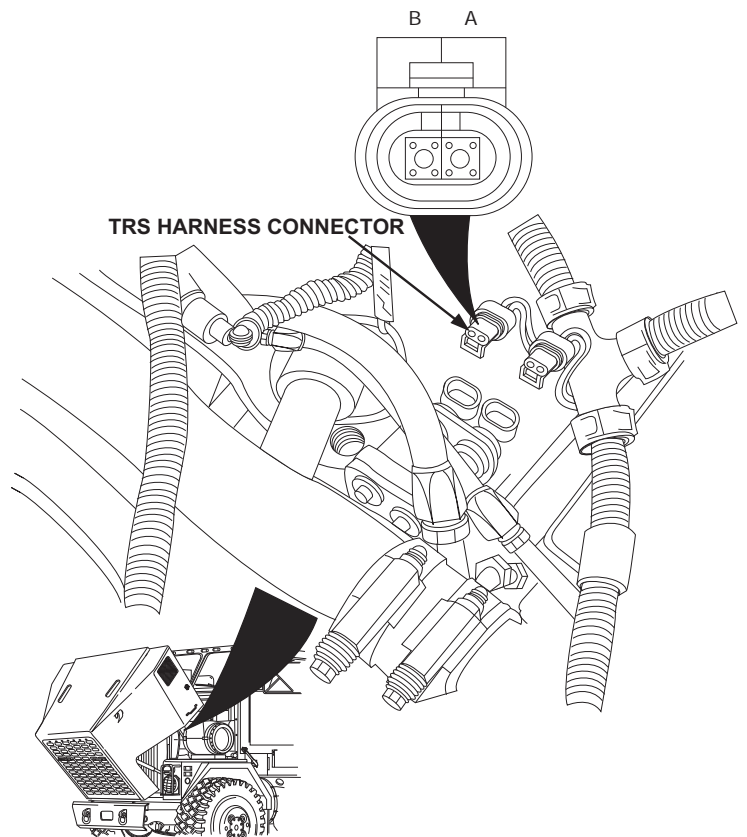
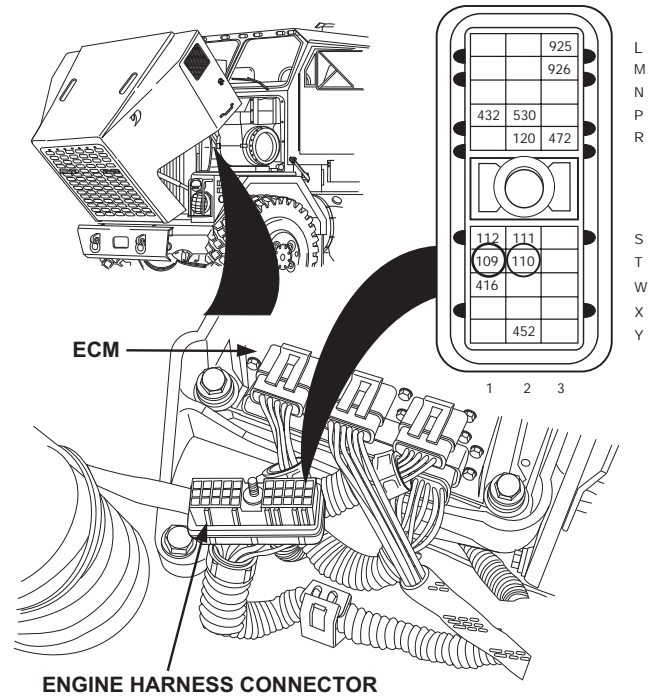
- (1) Remove ECM (para 7-29).
- (2) Disconnect TRS connector.
- (3) Read resistance between sockets T1 and T2 on engine harness connector.
- (4) Read resistance between sockets T1 and ground, then between socket T2 and ground.

CAUTION

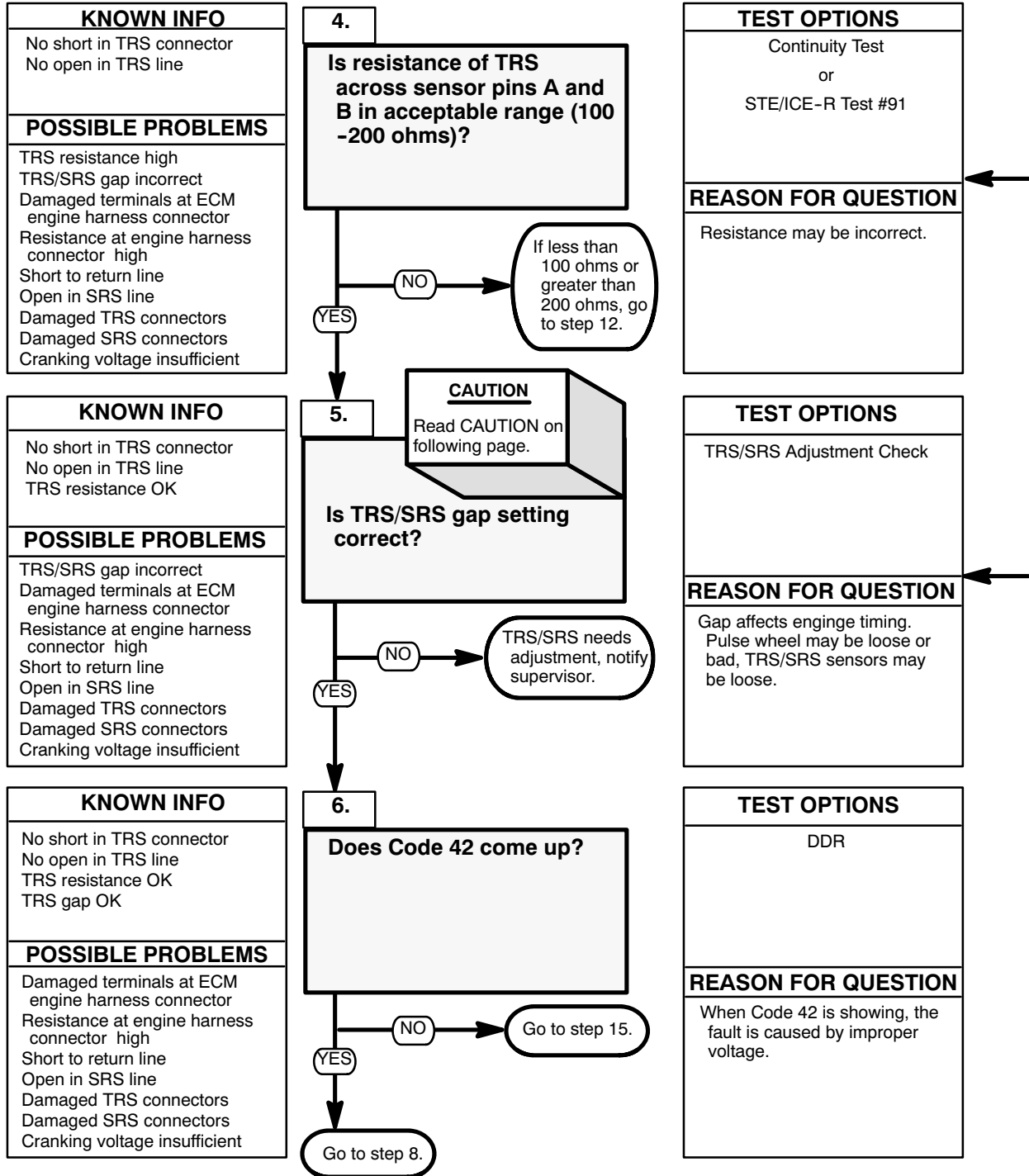
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

- (1) Disconnect TRS connector and install a jumper wire between sockets A and B of TRS harness connector.
- (2) Read resistance between sockets T1 and T2 on engine harness connector.



A4 - Code 41 TIMING REFERENCE SENSOR (TRS) (CONT)



CONTINUITY TEST

Read resistance of the TRS across sensor pins A and B.

TRS/SRS ADJUSTMENT CHECK

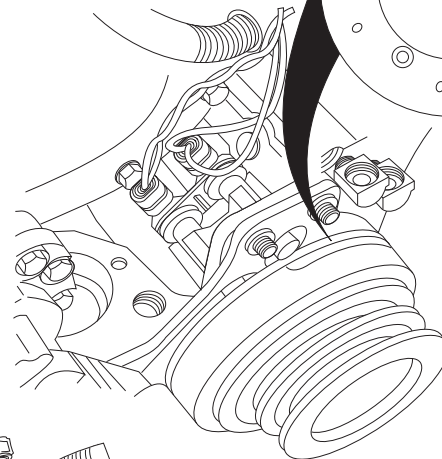
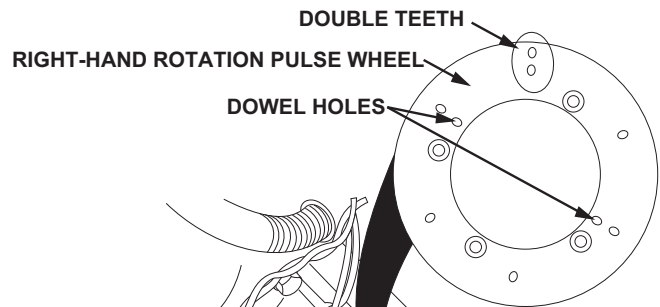
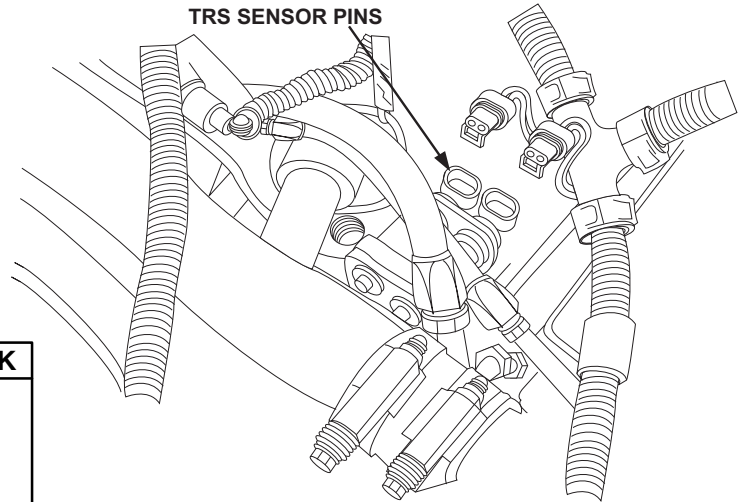
CAUTION

- Do not touch two screws that go into block from front end plate.
- Only turn the camshaft pulley clockwise. Failure to comply may cause engine damage.

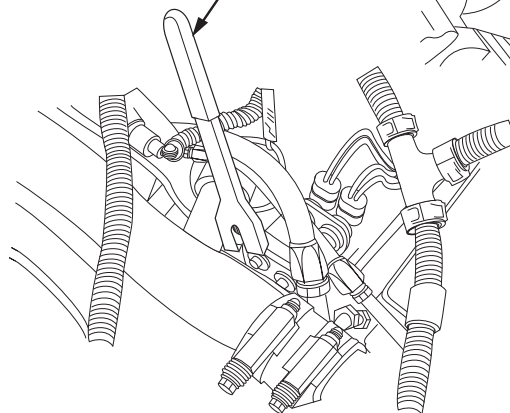
NOTE

The TRS tooth is the double tooth of pulse wheel.

- (1) Using the front camshaft pulley, bar the engine over until the TRS tooth of the pulse wheel is in line with the TRS.
- (2) Tap front of camshaft rearward with a soft hammer to remove camshaft end play.
- (3) Install alignment tool (J-34729) and check that nominal gap of 0.02" (0.5mm) exists.

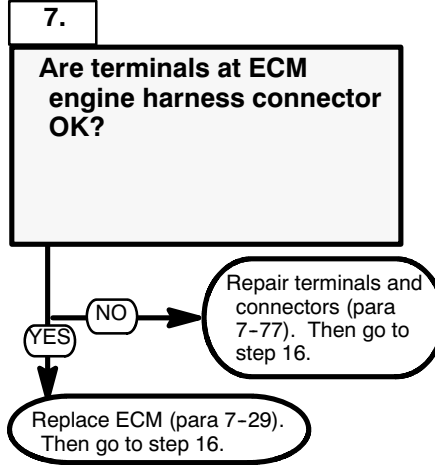


ALIGNMENT TOOL



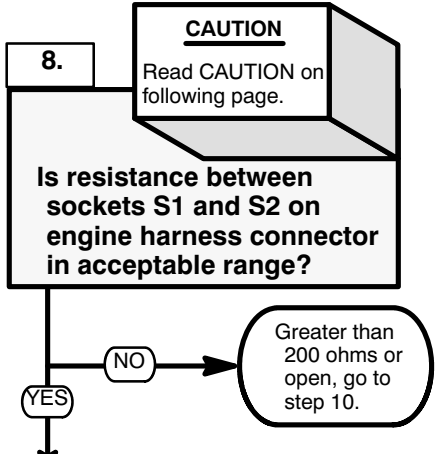
A4 - Code 41 TIMING REFERENCE SENSOR (TRS) (CONT)

KNOWN INFO
No short in TRS connector No open in TRS line TRS resistance OK TRS gap OK
POSSIBLE PROBLEMS
Damaged terminals at ECM engine harness connector Resistance at engine harness connector high Short to return line Open in SRS line Damaged TRS connectors Damaged SRS connectors Cranking voltage insufficient



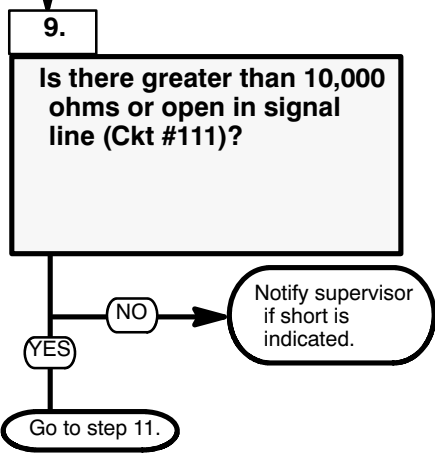
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damage to terminals could affect signal to ECM.

KNOWN INFO
No short in TRS connector No open in TRS line TRS resistance OK TRS gap OK Terminals at ECM engine harness connector OK
POSSIBLE PROBLEMS
Resistance at engine harness connector high Short to return line Open in SRS line Damaged TRS connectors Damaged SRS connectors Cranking voltage insufficient



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance less than or equal to 200 ohms at engine harness connector is acceptable.

KNOWN INFO
No short in TRS connector No open in TRS line TRS resistance OK TRS gap OK Terminals at ECM engine harness connector OK Resistance at engine harness connector OK
POSSIBLE PROBLEMS
Short to return line Open in SRS line Damaged TRS connectors Damaged SRS connectors Cranking voltage insufficient



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance less than or equal to 10,000 ohms at engine harness connector indicates signal line (Ckt #111) is shorted to return line (Ckt #112).

Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.

CAUTION

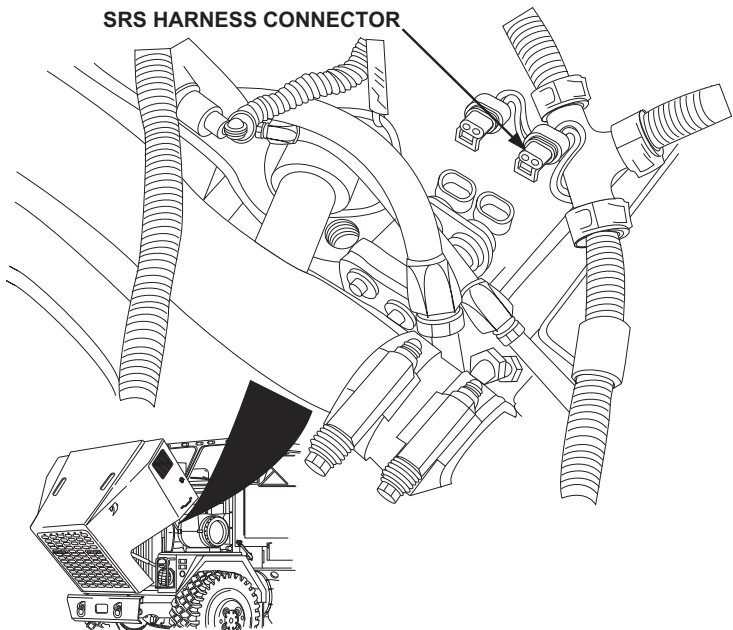
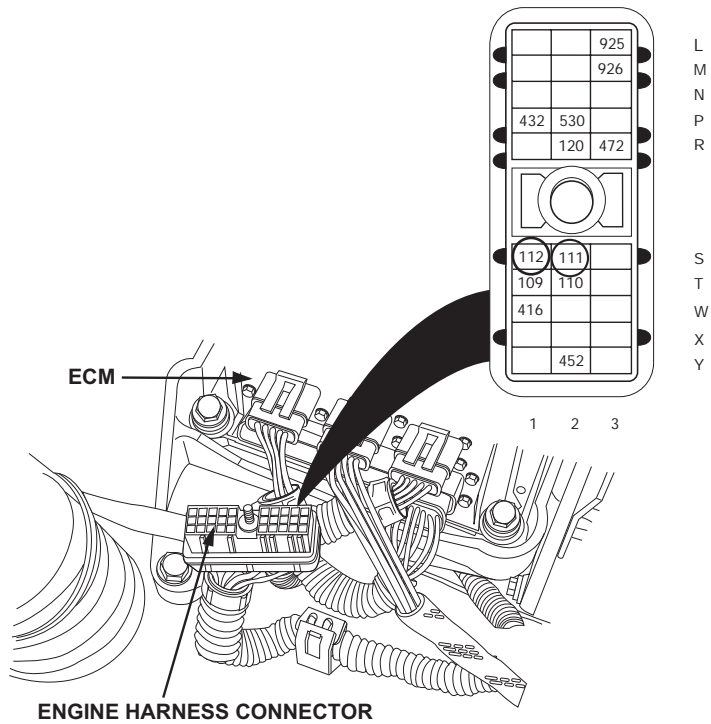
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

CONTINUITY TEST

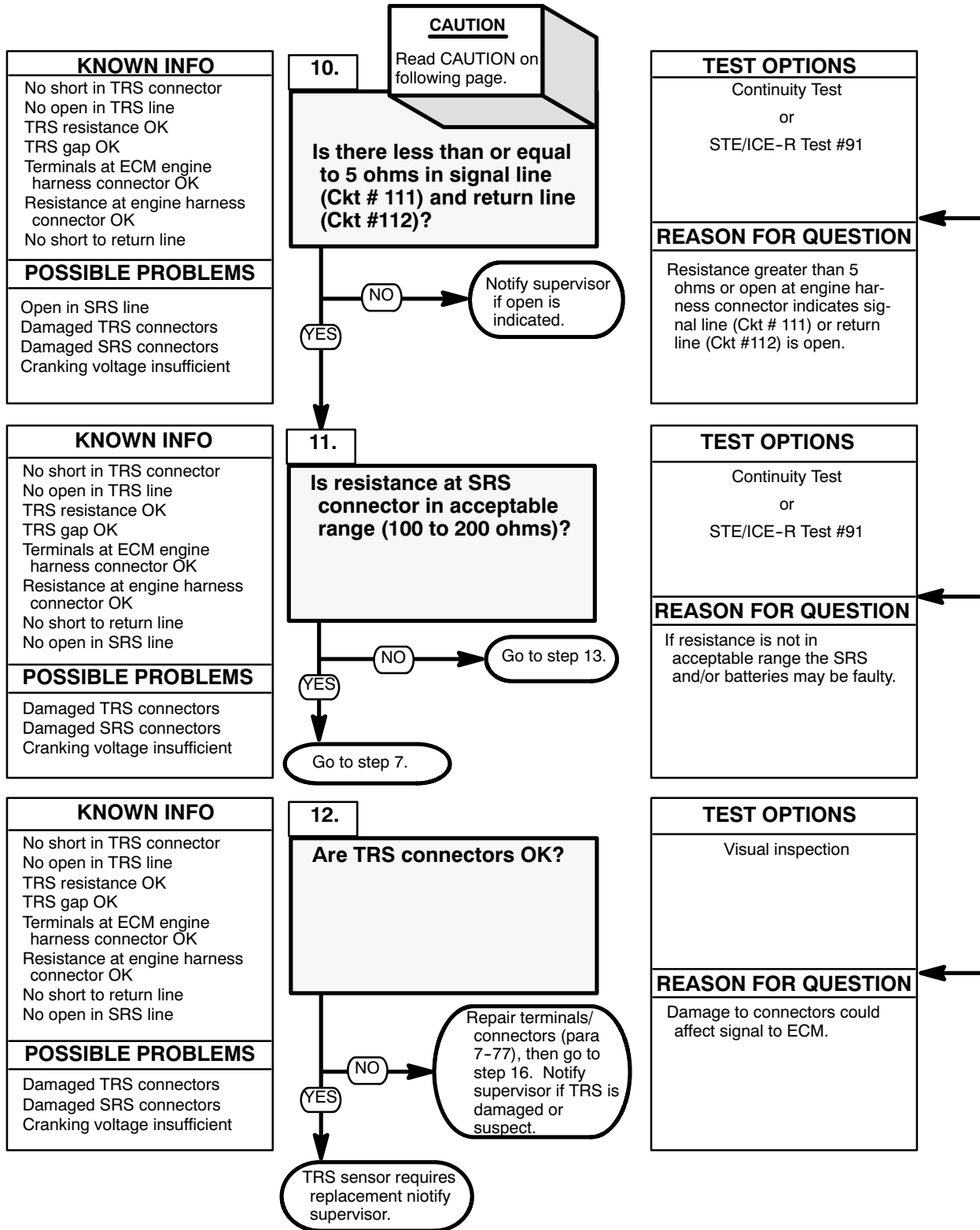
- (1) Disconnect SRS connector.
- (2) Read resistance between sockets S1 and S2 on engine harness connector.

CONTINUITY TEST

- (1) Disconnect SRS connector.
- (2) Read resistance between sockets S1 and S2 on engine harness connector.



A4 - Code 41 TIMING REFERENCE SENSOR (TRS) (CONT)

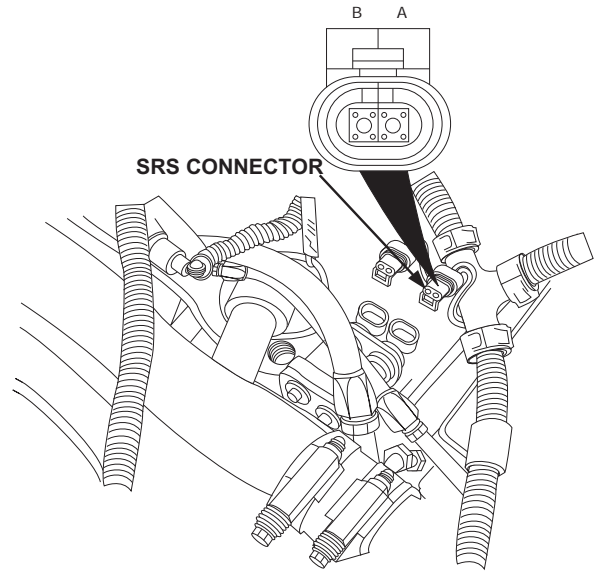


CAUTION

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

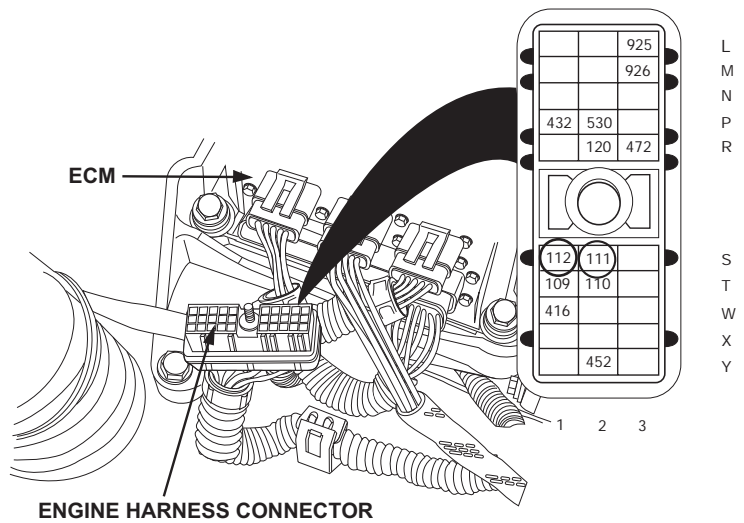
CONTINUITY TEST

- (1) Install a jumper wire between sockets A and B of SRS harness connectors.
- (2) Read resistance between sockets S1 and S2 of engine harness connector.

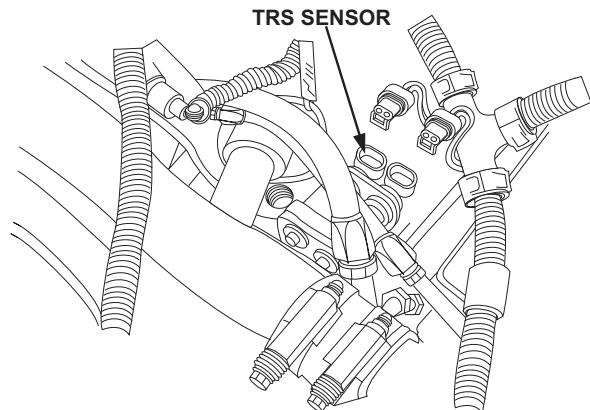


CONTINUITY TEST

Read resistance of SRS across sensor pins A and B.



Check connectors at TRS (both harness side and TRS side) for damage; bent, corroded, and unseated pins or sockets, or bad contacts.

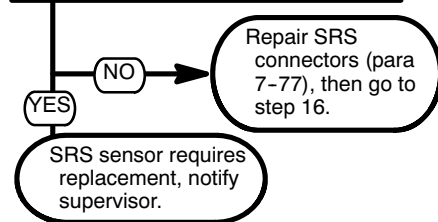


A4 - Code 41 TIMING REFERENCE SENSOR (TRS) (CONT)

KNOWN INFO
No short in TRS connector No open in TRS line TRS resistance OK TRS gap OK Terminals at ECM engine harness connector OK Resistance at engine harness connector OK No short to return line No open in SRS line TRS connectors OK
POSSIBLE PROBLEMS
Damaged SRS connectors Cranking voltage insufficient

13.

Are SRS connectors OK?

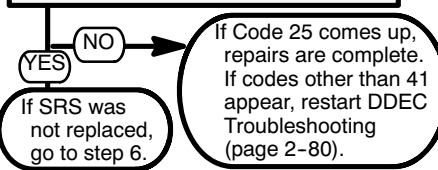


TEST OPTIONS
Visual Inspection
REASON FOR QUESTION
Damaged connectors could affect signal to SRS.

KNOWN INFO
No short in TRS connector No open in TRS line TRS resistance OK TRS gap OK Terminals at ECM engine harness connector OK Resistance at engine harness connector OK No short to return line No open in SRS line TRS connectors OK
POSSIBLE PROBLEMS
Cranking voltage insufficient

14.

Does Code 41 reappear after replacement of sensor?

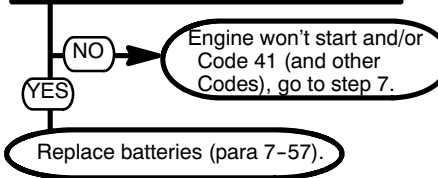


TEST OPTIONS
DDR
REASON FOR QUESTION
To verify SRS/TRS.

KNOWN INFO
No short in TRS connector No open in TRS line TRS resistance OK TRS gap OK Terminals at ECM engine harness connector OK Resistance at engine harness connector OK No short to return line No open in SRS line TRS connectors OK SRS connectors OK
POSSIBLE PROBLEMS
Cranking voltage insufficient

15.

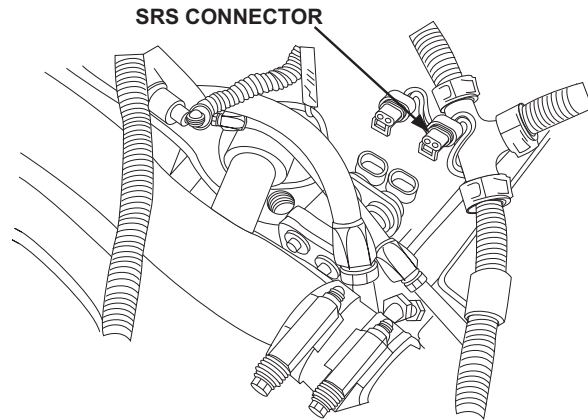
With jumper wires connected to 6-pin power connector, does engine start and no Code 41 come up?



TEST OPTIONS
DDR
REASON FOR QUESTION
Check cranking voltage.

WARNING
CAUTION
Read WARNING and CAUTION on following page.

Check connectors at SRS (both harness side and SRS side) for damage; bent, corroded, and unseated pins or sockets, or bad contacts.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all connectors.
- (3) Turn ENGINE switch ON and clear codes.
- (4) Start and run engine until, CHECK ENGINE indicator comes ON for 1 minute
- (5) Stop engine and read historical codes.

WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CAUTION

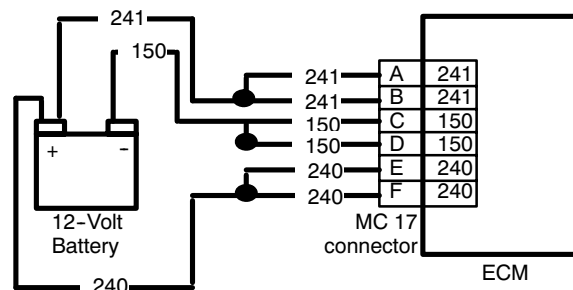
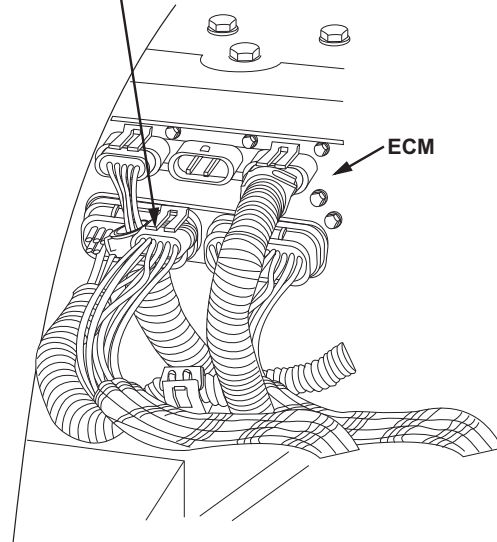
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

NOTE

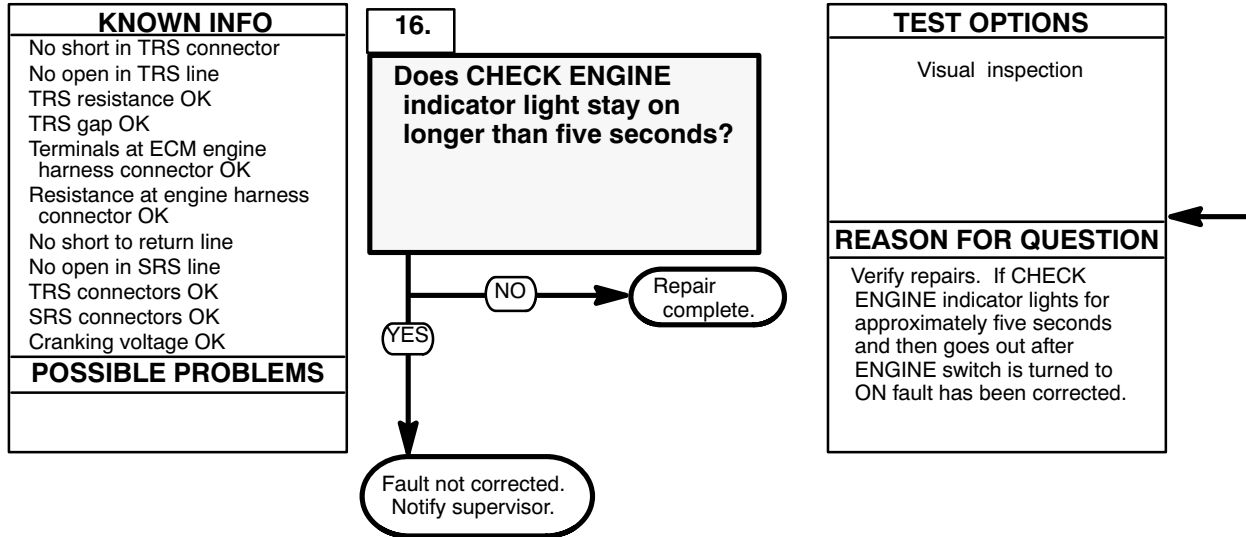
Refer to Appendix D, Illustrated List of Manufactured Items for fabrication of jumper harness.

- (1) Turn ENGINE switch OFF.
- (2) Connect 12 volts from a fully charged battery to 6-pin power connector
- (3) Connect other connector.
- (4) Turn ENGINE switch ON and clear codes.
- (5) Start engine and run until CEL appears or for one minute.
- (6) Stop engine and read active codes.

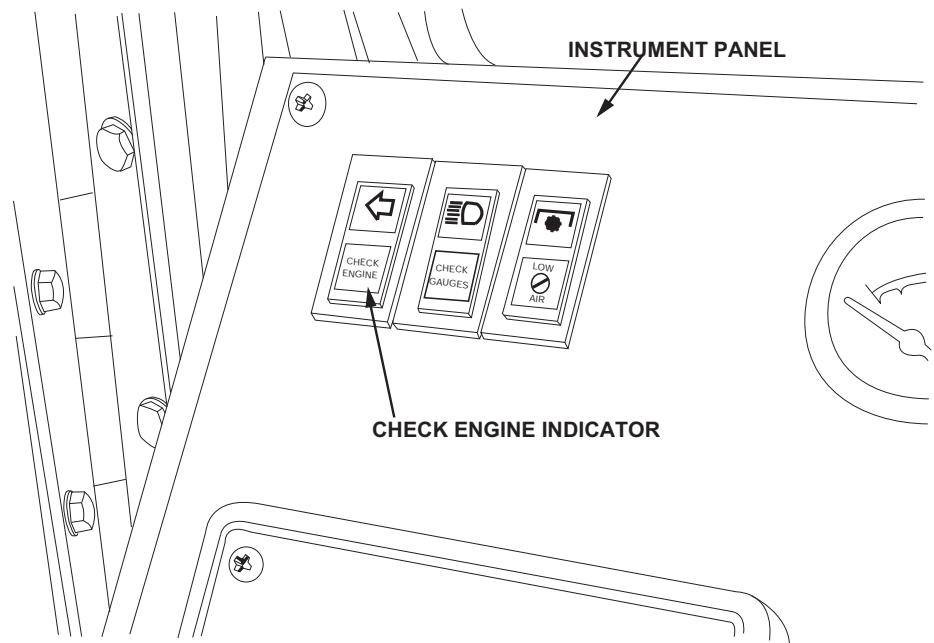
6-WAY POWER HARNESS CONNECTOR



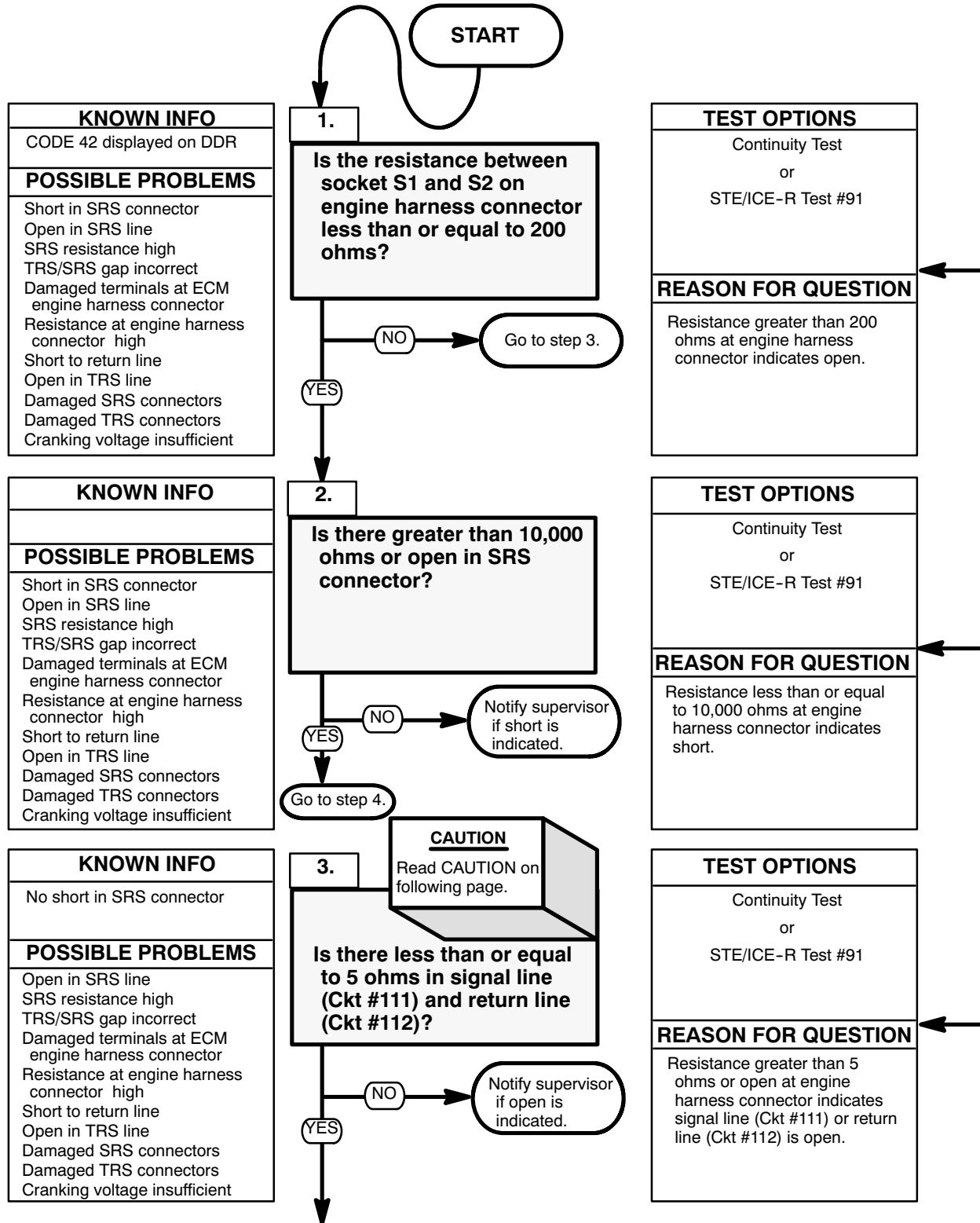
A4 - Code 41 TIMING REFERENCE SENSOR (TRS) (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Install ECM (para 7-29).
- (4) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 42 SYNCHRONOUS REFERENCE SENSOR (SRS)

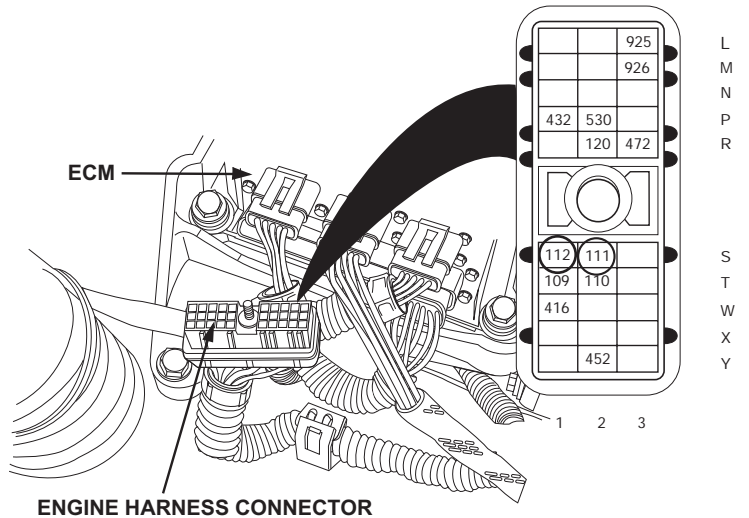


NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

CONTINUITY TEST

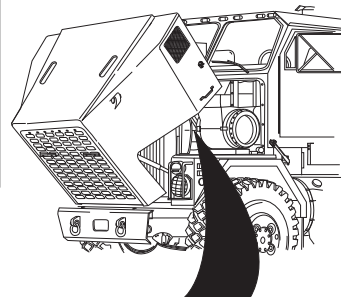
- (1) Turn ENGINE switch OFF.
- (2) Disconnect engine harness connector at ECM.
- (3) Read resistance between sockets S1 and S2 of engine harness connector.



ENGINE HARNESS CONNECTOR

CONTINUITY TEST

- (1) Remove ECM (para 7-29)
- (2) Disconnect SRS connector.
- (3) Read resistance between sockets S1 and S2 on engine harness connector.
- (4) Read resistance between sockets S1 and ground, then between S2 and ground.



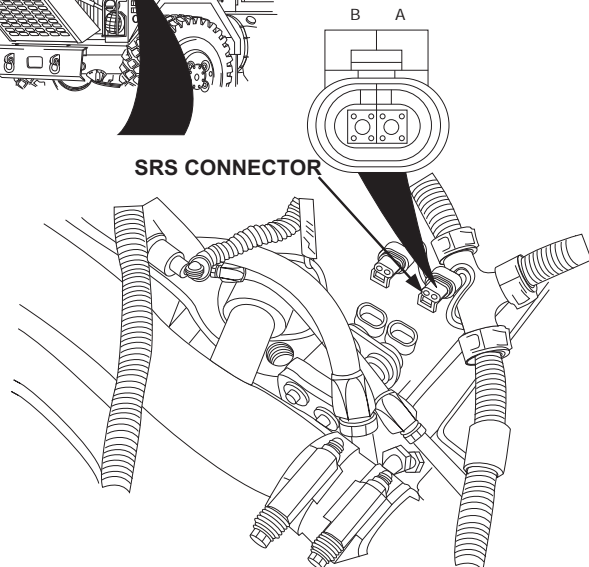
SRS CONNECTOR

CAUTION

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

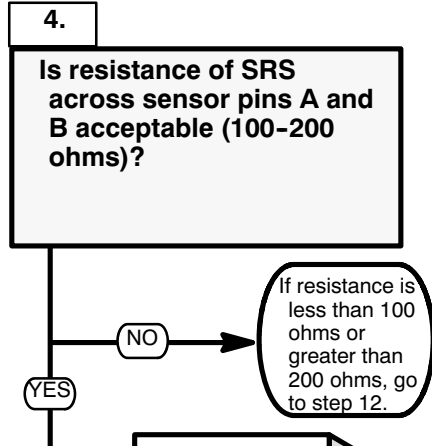
CONTINUITY TEST

- (1) Disconnect SRS connector and install a jumper wire between sockets A and B of SRS harness connector.
- (2) Read resistance between sockets S1 and S2 on engine harness connector.



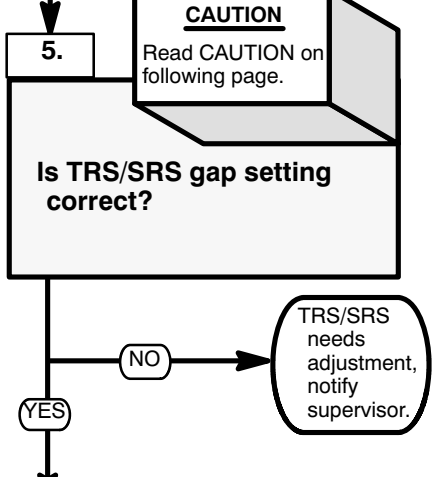
A4 - Code 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT)

KNOWN INFO
No short in SRS connector No open in SRS line
POSSIBLE PROBLEMS
SRS resistance high TRS/SRS gap incorrect Damaged terminals at ECM engine harness connector Resistance at engine harness connector high Short to return line Open in TRS line Damaged SRS connectors Damaged TRS connectors Cranking voltage insufficient



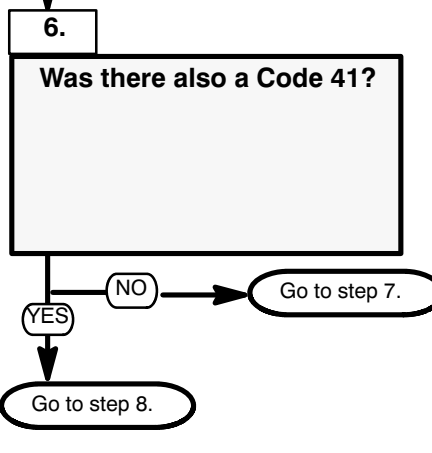
TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance may be off.

KNOWN INFO
No short in SRS connector No open in SRS line SRS resistance OK
POSSIBLE PROBLEMS
TRS/SRS gap incorrect Damaged terminals at ECM engine harness connector Resistance at engine harness connector high Short to return line Open in TRS line Damaged SRS connectors Damaged TRS connectors Cranking voltage insufficient



TEST OPTIONS
TRS/SRS Adjustment Check
REASON FOR QUESTION
Gap affects engine timing. Pulse wheel may be loose or bad, TRS/SRS sensors may be loose.

KNOWN INFO
No short in SRS connector No open in SRS line SRS resistance OK TRS/SRS gap OK
POSSIBLE PROBLEMS
Damaged terminals at ECM engine harness connector Resistance at engine harness connector high Short to return line Open in TRS line Damaged SRS connectors Damaged TRS connectors Cranking voltage insufficient



TEST OPTIONS
DDR
REASON FOR QUESTION
Fault is isolated to improper cranking voltage if code 42 comes up.

CONTINUITY TEST

Read resistance of the SRS across sensor pins A and B.

TRS/SRS ADJUSTMENT CHECK

CAUTION

Only turn the camshaft pulley clockwise. Failure to comply may cause engine damage.

NOTE

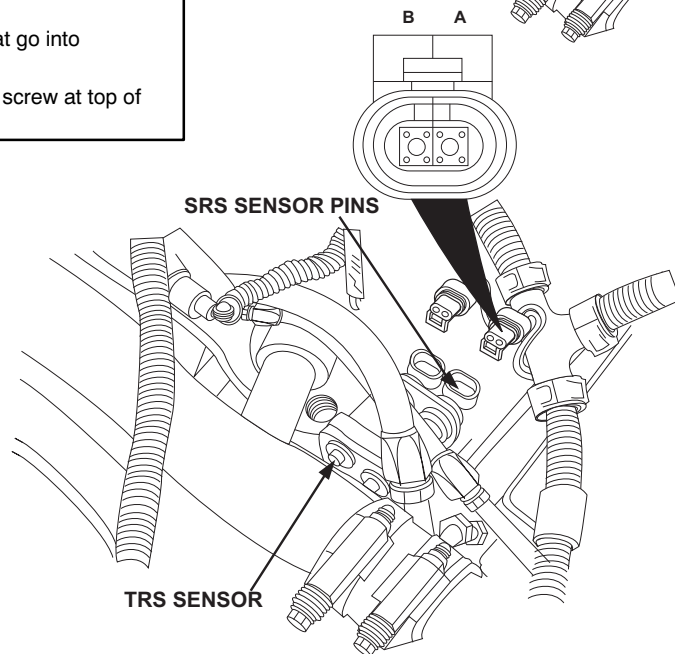
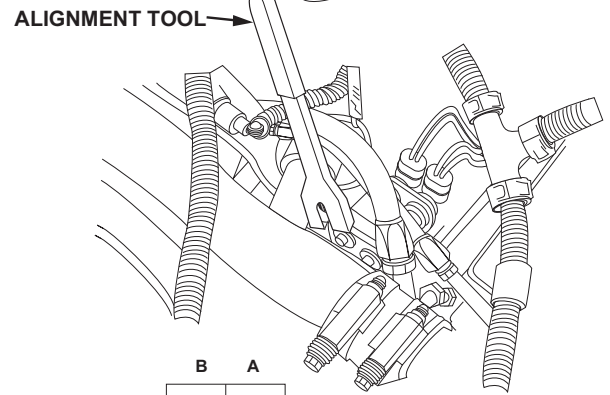
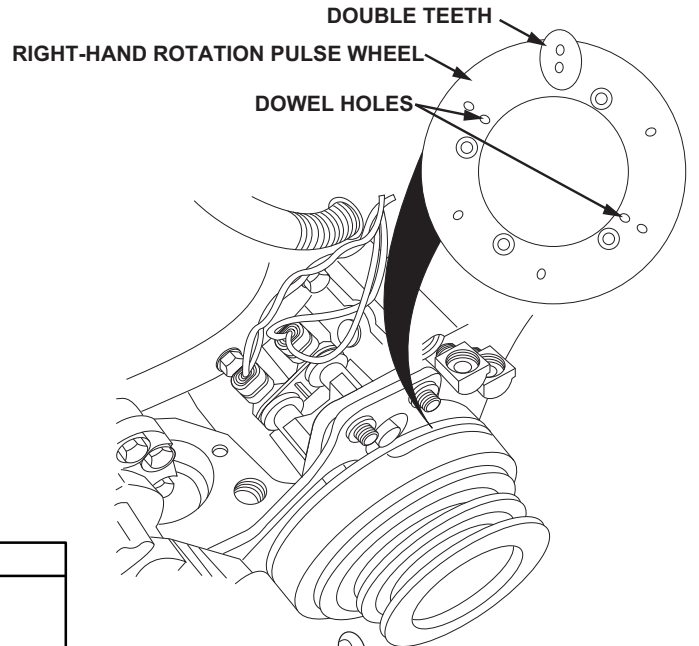
The TRS tooth is the double tooth of pulse wheel.

- (1) Using the front camshaft pulley, bar the engine over until the TRS tooth of the pulse wheel is in line with the TRS.
- (2) Tap front of camshaft rearward with a soft hammer to remove camshaft and play.
- (3) Install alignment tool (J-34729) and check that nominal gap of 0.02" (0.5mm) exists.

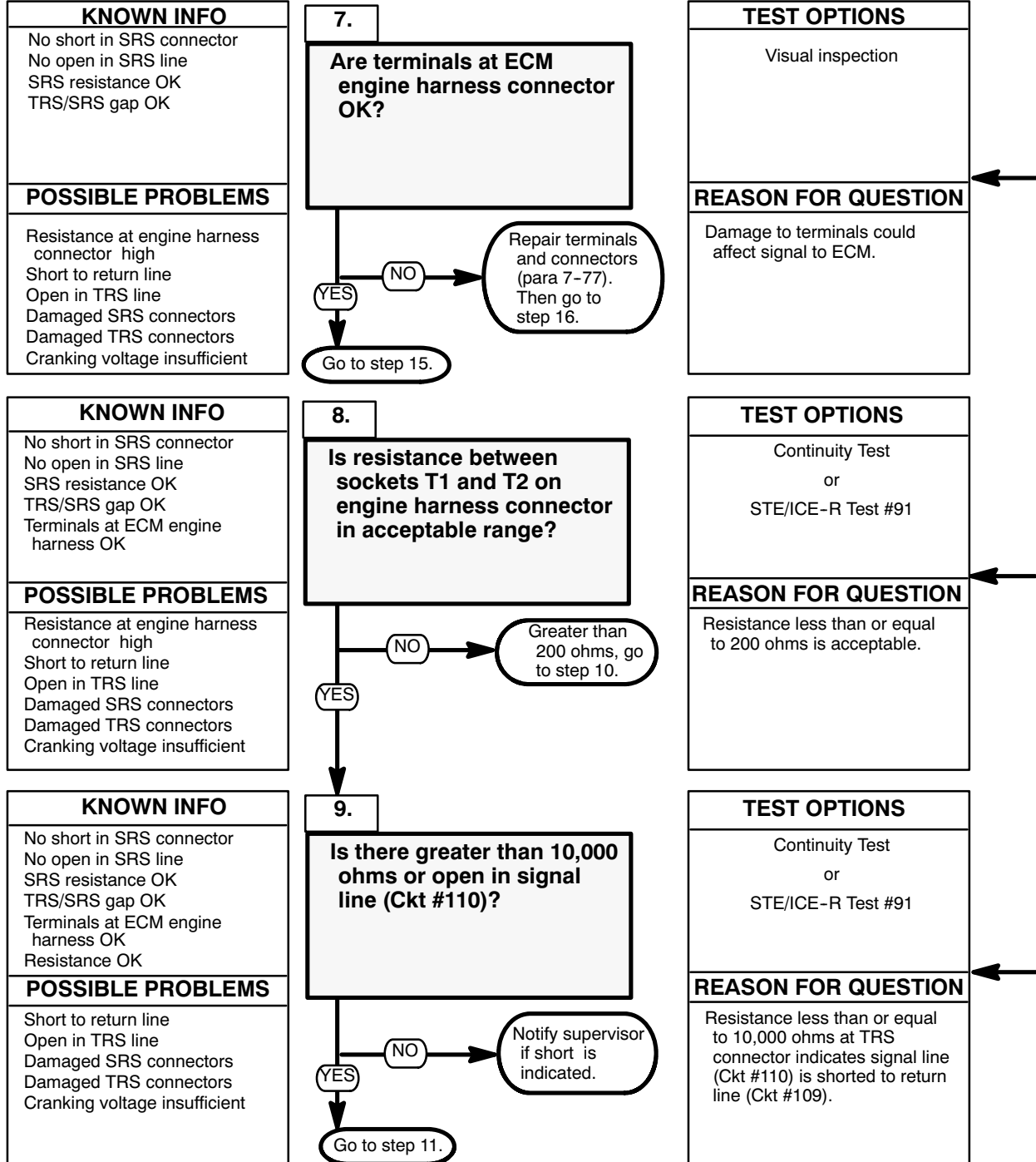
CAUTION

Do not touch two screws that go into block front end plate.

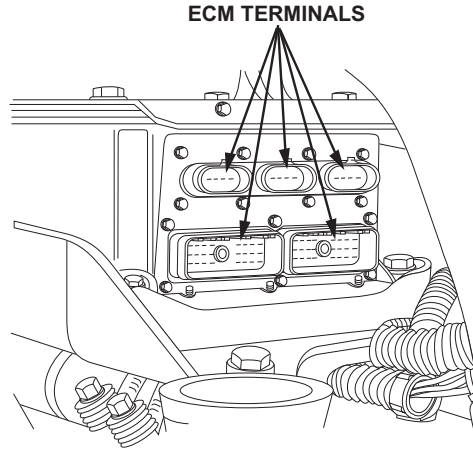
- (4) Adjust gap by loosening adjusting screw at top of TRS/SRS mounting bracket.



A4 - Code 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT)

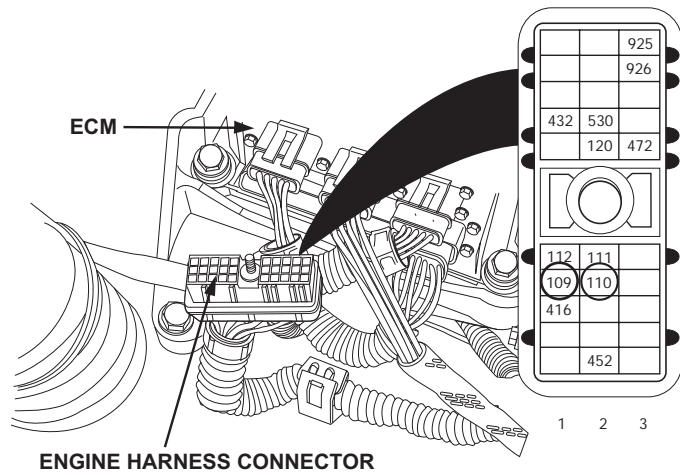


Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.



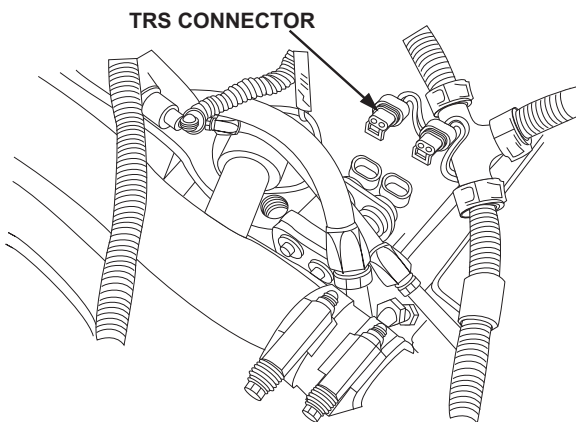
CONTINUITY TEST

- (1) Read resistance between sockets T1 and T2 on engine harness connector.

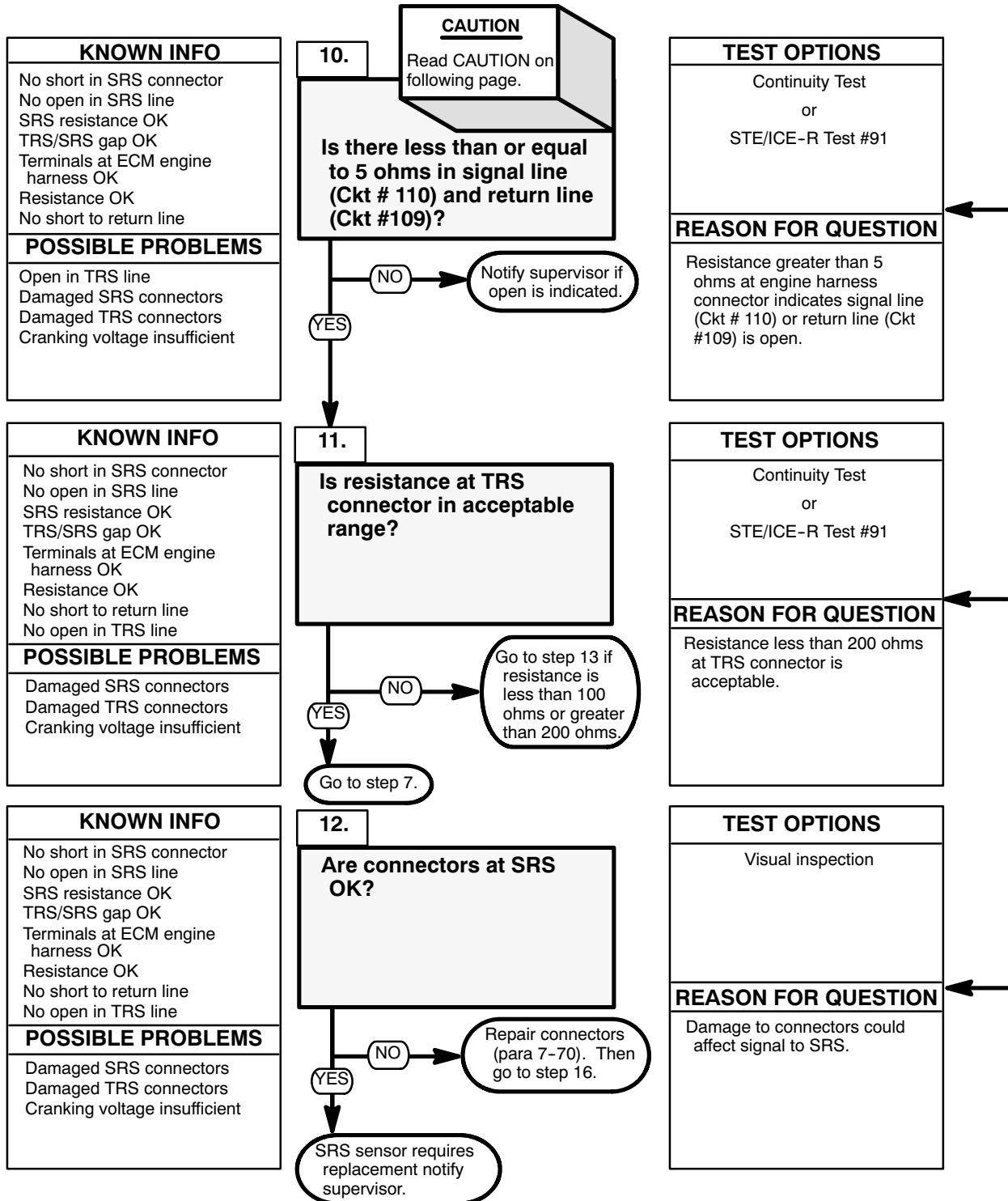


CONTINUITY TEST

- (1) Disconnect TRS connector.
- (2) Read resistance between sockets T1 and T2 on engine harness connector.



A4 - Code 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT)



KNOWN INFO
No short in SRS connector No open in SRS line SRS resistance OK TRS/SRS gap OK Terminals at ECM engine harness OK Resistance OK No short to return line No open in TRS line
POSSIBLE PROBLEMS
Damaged SRS connectors Damaged TRS connectors Cranking voltage insufficient

12.

Are connectors at SRS OK?

NO → Repair connectors (para 7-70). Then go to step 16.

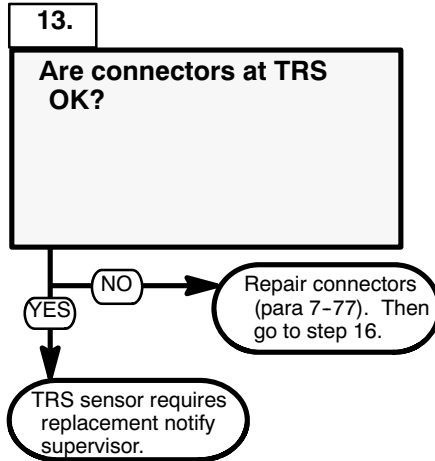
YES ↓

SRS sensor requires replacement notify supervisor.

TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damage to connectors could affect signal to SRS.

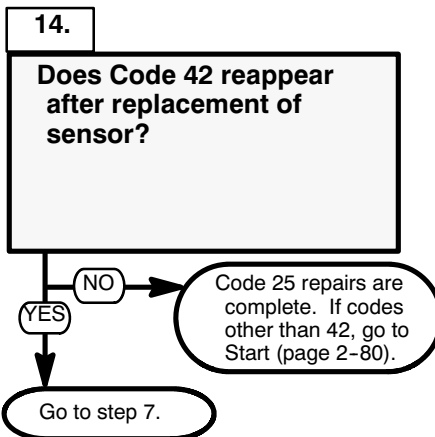
A4 - Code 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT)

KNOWN INFO
No short in SRS connector No open in SRS line SRS resistance OK TRS/SRS gap OK Terminals at ECM engine harness OK Resistance OK No short to return line No open in TRS line SRS connectors OK
POSSIBLE PROBLEMS
Damaged TRS connectors Cranking voltage insufficient



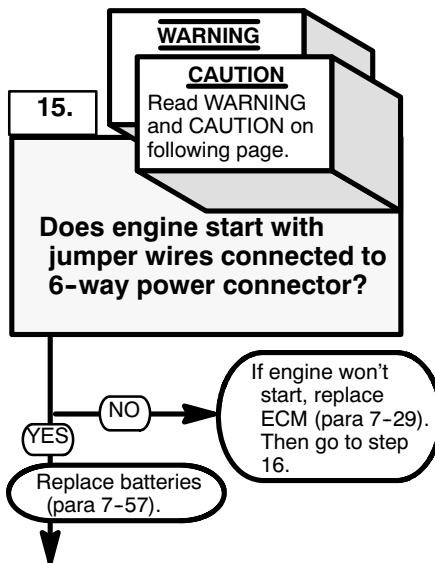
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damaged connectors could affect signal to TRS.

KNOWN INFO
No short in SRS connector No open in SRS line SRS resistance OK TRS/SRS gap OK Terminals at ECM engine harness OK Resistance OK No short to return line No open in TRS line SRS connectors OK TRS connectors OK
POSSIBLE PROBLEMS
Cranking voltage insufficient



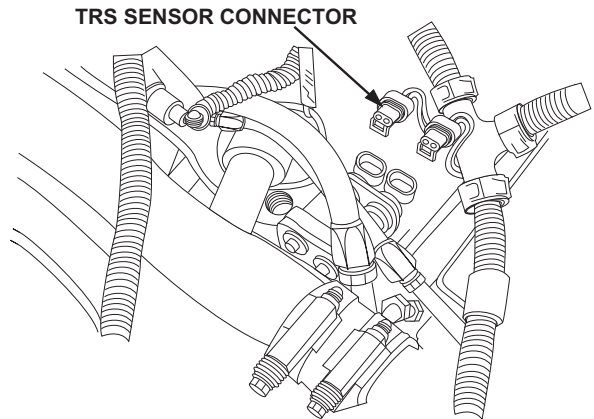
TEST OPTIONS
DDR
REASON FOR QUESTION
To verify SRS/TRS.

KNOWN INFO
No short in SRS connector No open in SRS line SRS resistance OK TRS/SRS gap OK Terminals at ECM engine harness OK Resistance OK No short to return line No open in TRS line SRS connectors OK TRS connectors OK
POSSIBLE PROBLEMS
Cranking voltage insufficient



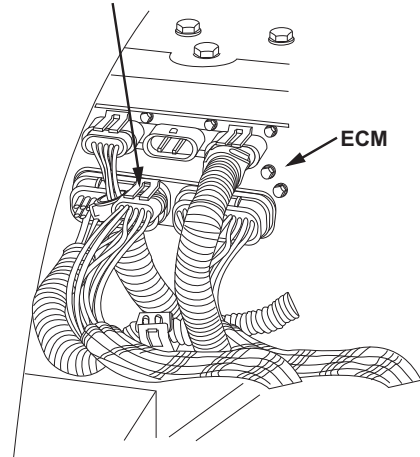
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Check cranking voltage.

Check connectors at TRS (both harness side and SRS side) for damage; bent, corroded, and unseated pins or sockets, or bad contacts.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all connectors.
- (3) Turn ENGINE switch ON.
- (4) Start and run engine until, CHECK ENGINE LIGHT comes ON for 1 minute
- (5) Stop engine and read historical codes.

6-WAY POWER HARNESS CONNECTOR



WARNING

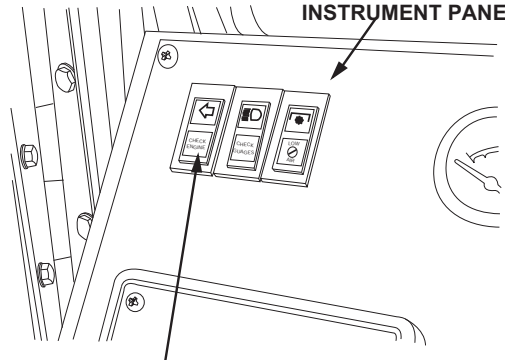
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CAUTION

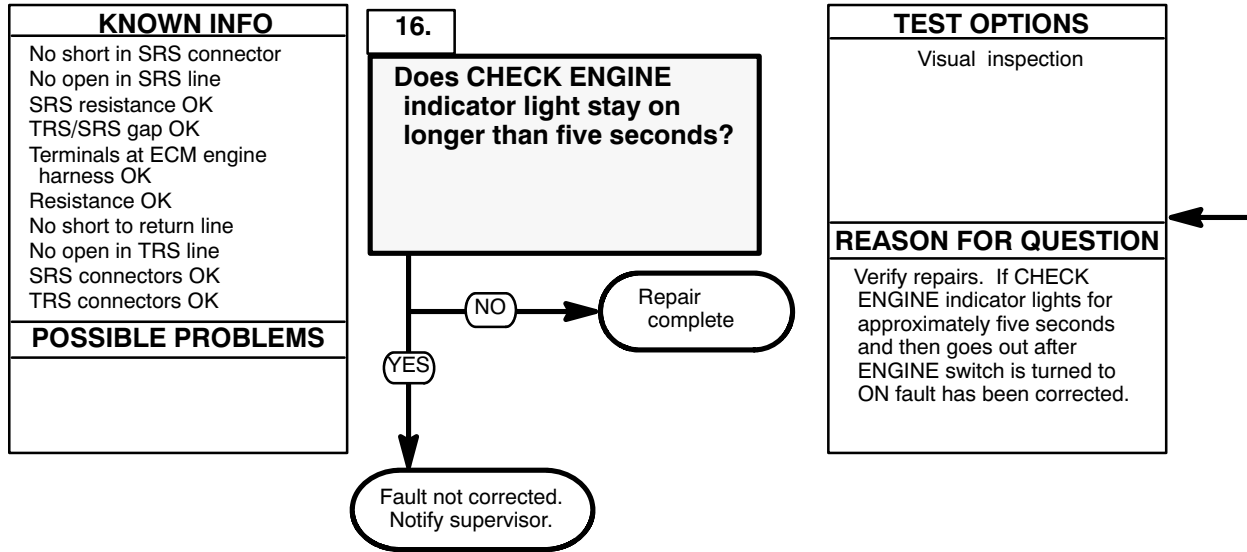
Use jumper wire only between terminals indicated. Failure to comply may result in damage to DDEC components or wiring.

- (1) Turn ENGINE switch OFF.
- (2) Connect all connectors.
- (3) Wire 6-pin power connector to a fully charged battery (12 volt).
- (4) Connect to ECM and try to start engine.

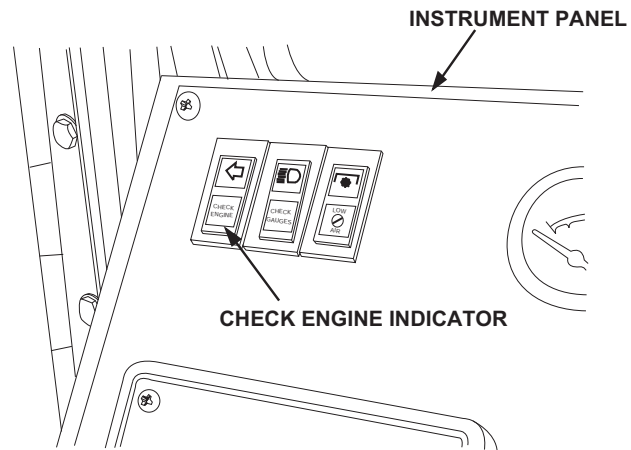
INSTRUMENT PANEL



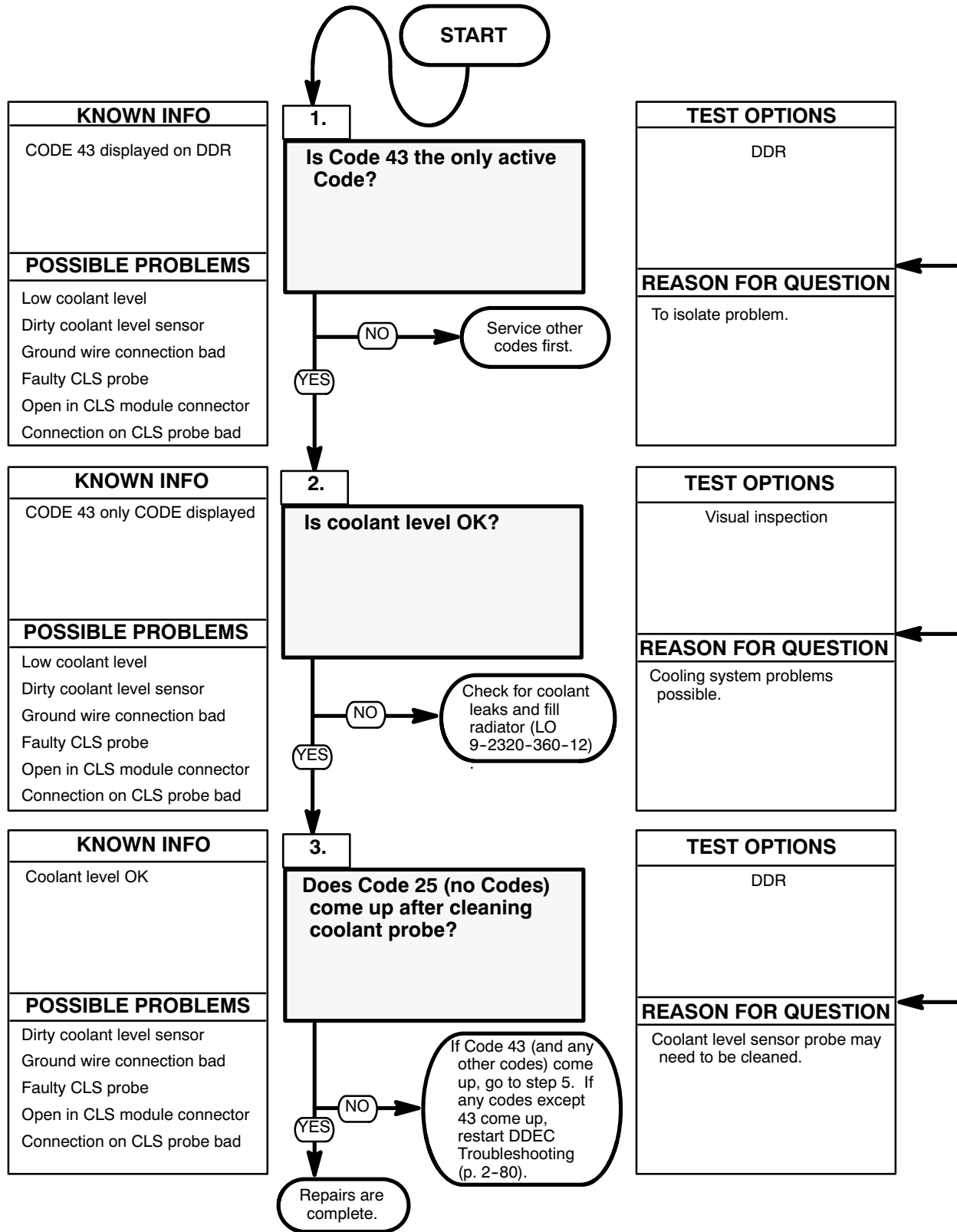
A4 - Code 42 SYNCHRONOUS REFERENCE SENSOR (SRS) (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Install ECM (para 7-29).
- (4) Turn ENGINE switch ON and observe CHECK ENGINE indicator.

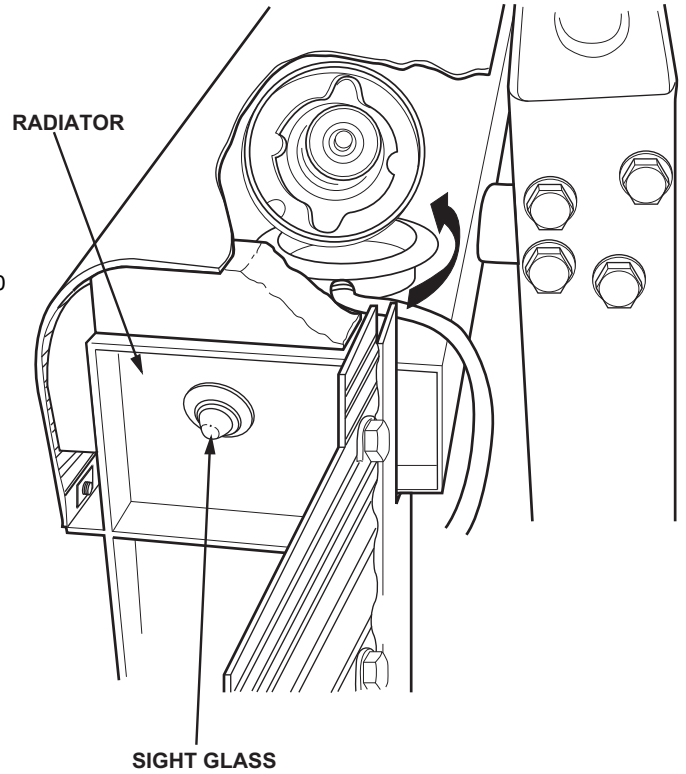


A4 - Code 43 LOW COOLANT LEVEL

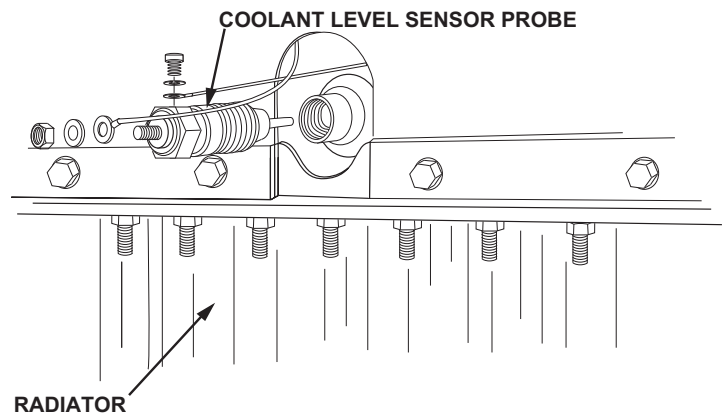


NOTE

- The following chart should be used only if DDEC troubleshooting was started on pg. 2-80 and you were referred here.
- A false DDEC historical Code 43 may be logged during cold starts in extremely cold environments, -50 to -26F° (-46 to -32°C). Typically, the CHECK ENGINE light will come on 8 minutes after starting and go out 2-3 minutes later. If the vehicle has been operated under these conditions, clear the historical codes and return the vehicle to service.



Check coolant level at sight glass. Sight glass will show green when coolant level is full.



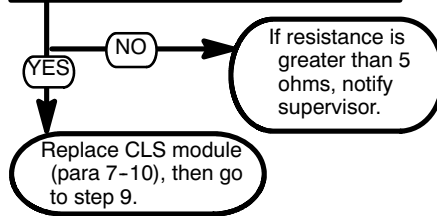
- (1) Turn ENGINE switch OFF.
- (2) Disconnect wires to Coolant Level Sensor probe.
- (3) Remove CLS probe (para 7-10).
- (4) Wipe probe clean with a clean rag.
- (5) Install CLS probe (para 7-10).
- (6) Turn ENGINE switch ON.
- (7) Start engine (TM 9-2320-360-10) and run for one minute, or until SEL comes on.
- (8) Stop engine and read historical codes.

A4 - Code 43 LOW COOLANT LEVEL (CONT)

KNOWN INFO
Coolant level OK Coolant level sensor clean
POSSIBLE PROBLEMS
Ground wire connection bad Faulty CLS probe Open in CLS module connector Connection on CLS probe bad

4.

Is there less than or equal to 5 ohms in the Coolant Level Sensor?

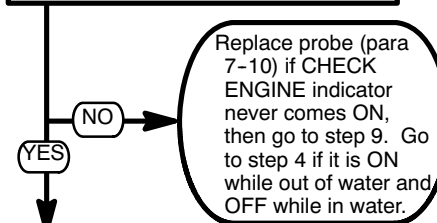


TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance at CLS harness connector of greater than 5 ohms or open indicates bad connection or open.

KNOWN INFO
Coolant level OK Coolant level sensor clean Ground wire connection is OK
POSSIBLE PROBLEMS
Faulty CLS probe Open in CLS module connector Connection on CLS probe bad

5.

Is the CHECK ENGINE indicator light always on when CLS probe is placed in a cup of water?

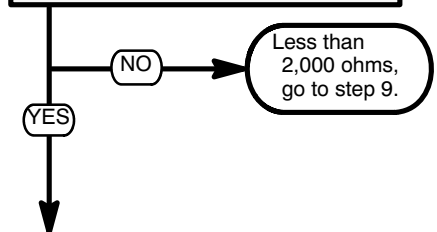


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
CLS probe is suspect.

KNOWN INFO
Coolant level OK Coolant level sensor clean Ground wire connection is OK CLS probe is OK
POSSIBLE PROBLEMS
Open in CLS module connector Connection on CLS probe bad

6.

Is there greater than or equal to 2,000 ohms in CLS module connector?



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Open is present if a resistance of 2000 ohms or greater is measured.

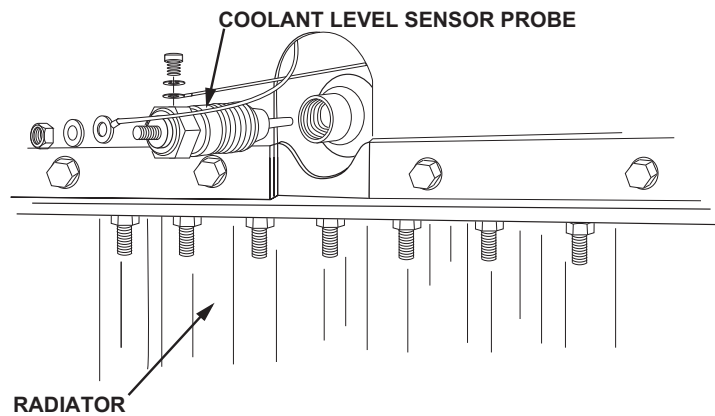
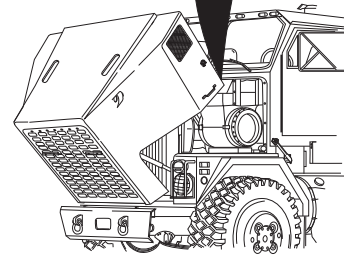
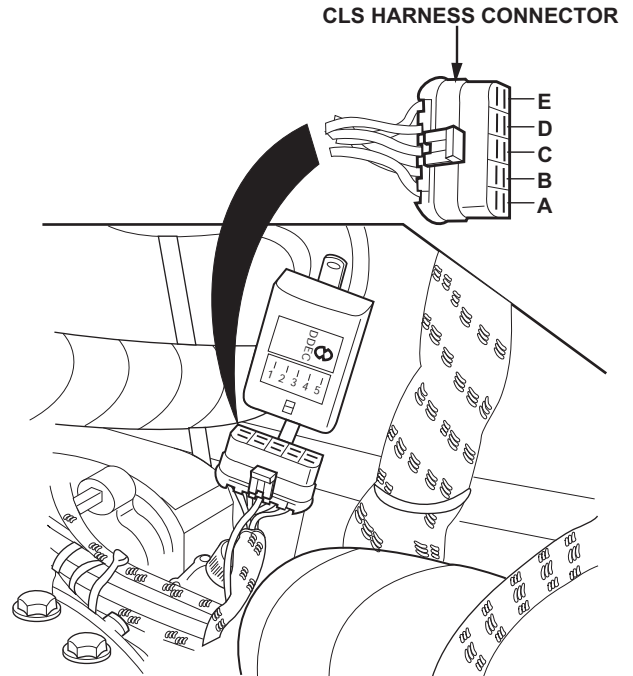
CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect CLS connector.
- (3) Read resistance between socket C or CLS harness connector and a good battery ground. Try shaking the wire while reading resistance.

- (1) Turn ENGINE switch OFF and remove CLS probe (para 7-10).
- NOTE
- Engine wiring harness must be connected to sensor.
- (2) Place CLS probe in a cup of water, covering threads and probe.
 - (3) Turn ENGINE switch ON.
 - (4) Start engine (TM 9-2320-360-10) and run for one minute or until Engine Stop Light comes ON.
 - (5) If SEL is not ON, remove probe from water.
 - (6) After 30 seconds, stop engine.

CONTINUITY TEST

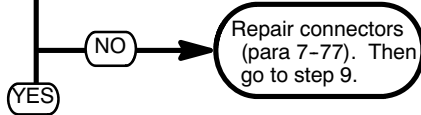
- (1) Turn ENGINE switch OFF and disconnect CLS module connector.
- (2) Measure resistance between pins A and B on the vehicle harness side while probe is in coolant.



A4 - Code 43 LOW COOLANT LEVEL (CONT)

KNOWN INFO
Coolant level OK Coolant level sensor clean Ground wire connection is OK CLS probe is OK No open in CLS module connector
POSSIBLE PROBLEMS
Connection on CLS probe bad

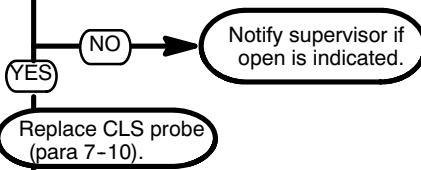
7.
Is the connection on CLS probe and terminals on connector OK?



TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Bad connection is suspect.

KNOWN INFO
Coolant level OK Coolant level sensor clean Ground wire connection is OK CLS probe is OK No open in CLS module connector Connection on CLS probe OK
POSSIBLE PROBLEMS
Open in CLS probe

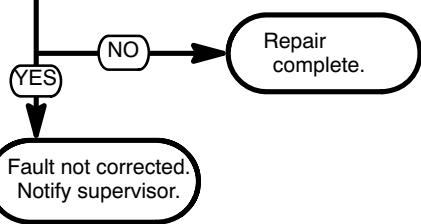
8.
Is there less than 5 ohms in CLS probe?



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Either reading greater than 5 ohms indicates open.

KNOWN INFO
Coolant level OK Coolant level sensor clean Ground wire connection is OK CLS probe is OK No open in CLS module connector Connection on CLS probe OK No open in CLS probe
POSSIBLE PROBLEMS

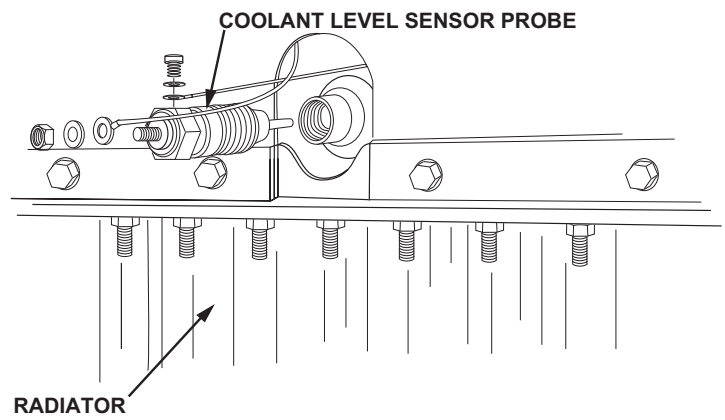
9.
Does CHECK ENGINE indicator light stay on longer than five seconds?



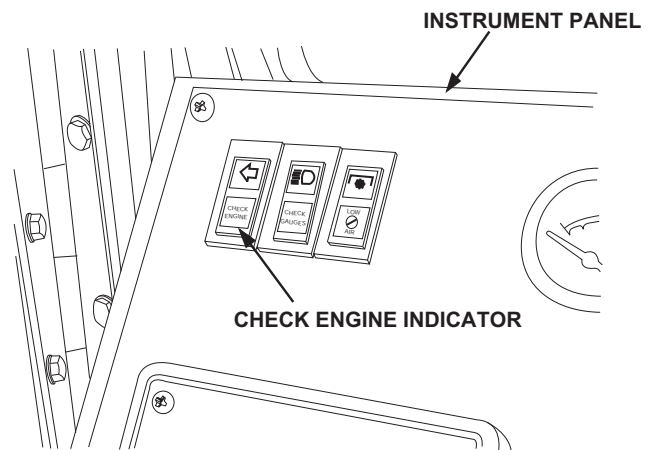
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned to ON fault has been corrected.

CONTINUITY TEST

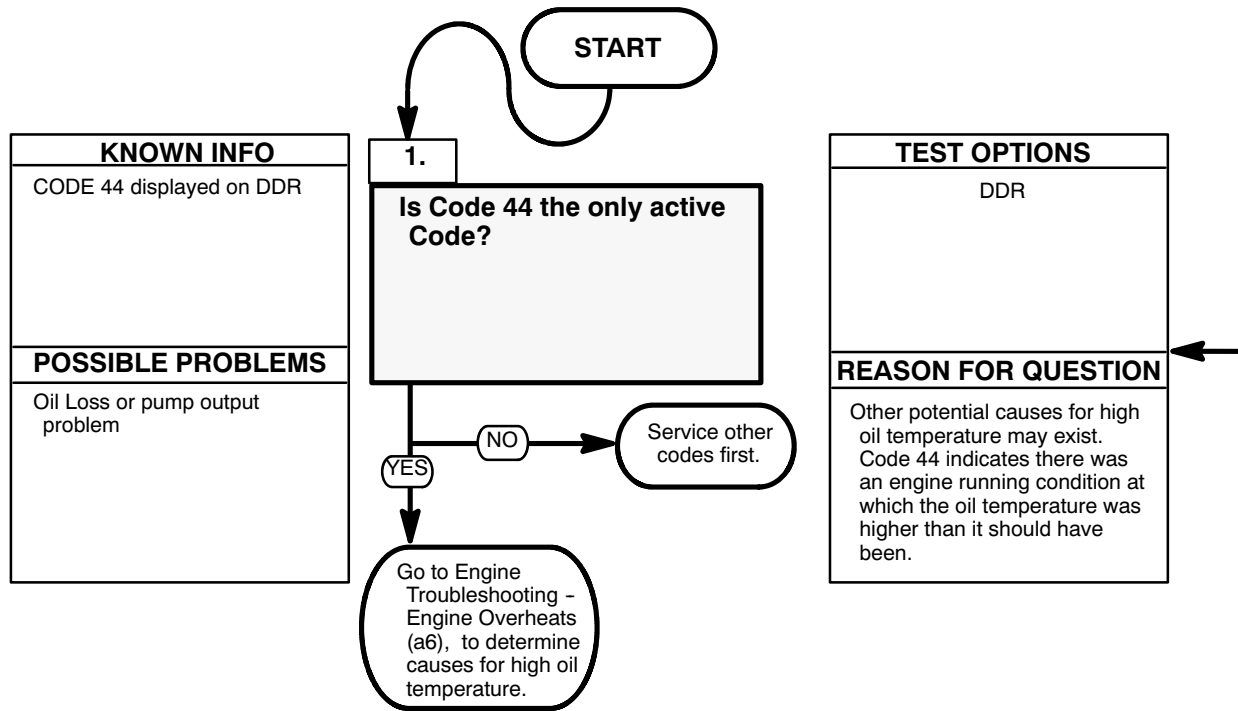
- (1) Measure resistance between Pin A on CLS module connector and center screw on probe.
- (2) Repeat step 1 for Pin B on CLS module connector and screw on side of probe.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code 44 HIGH OIL TEMPERATURE

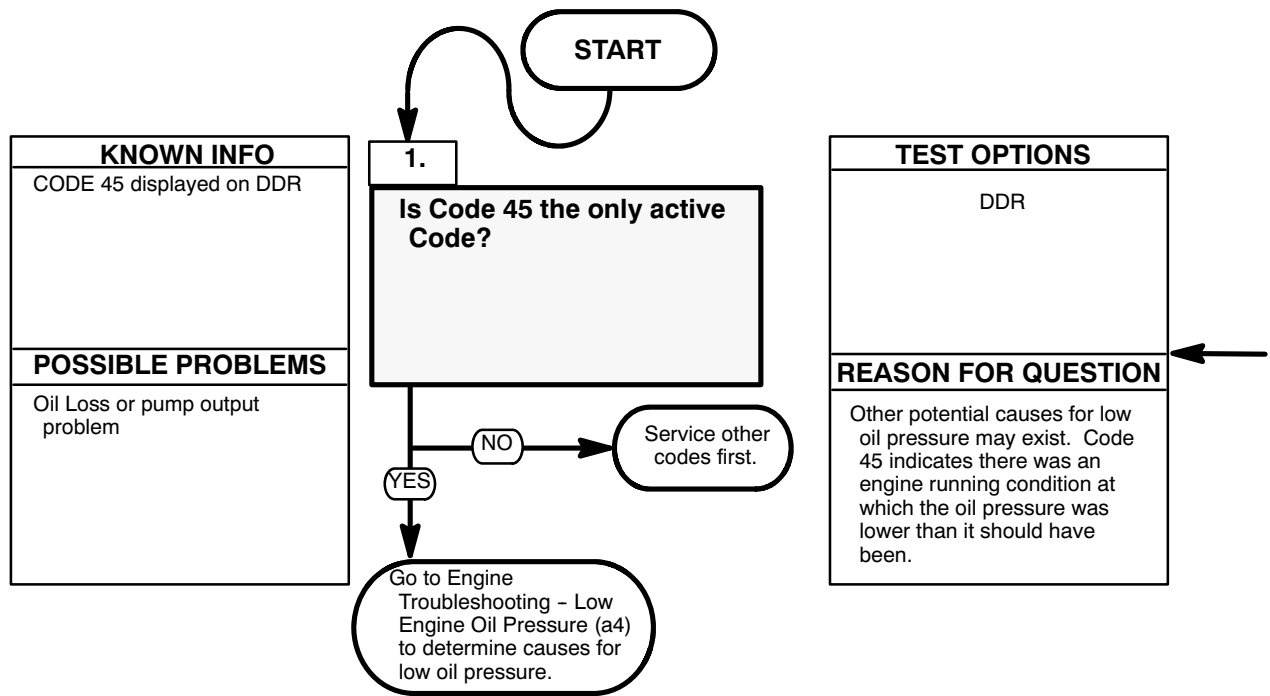




NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

A4 - Code 45 LOW OIL PRESSURE

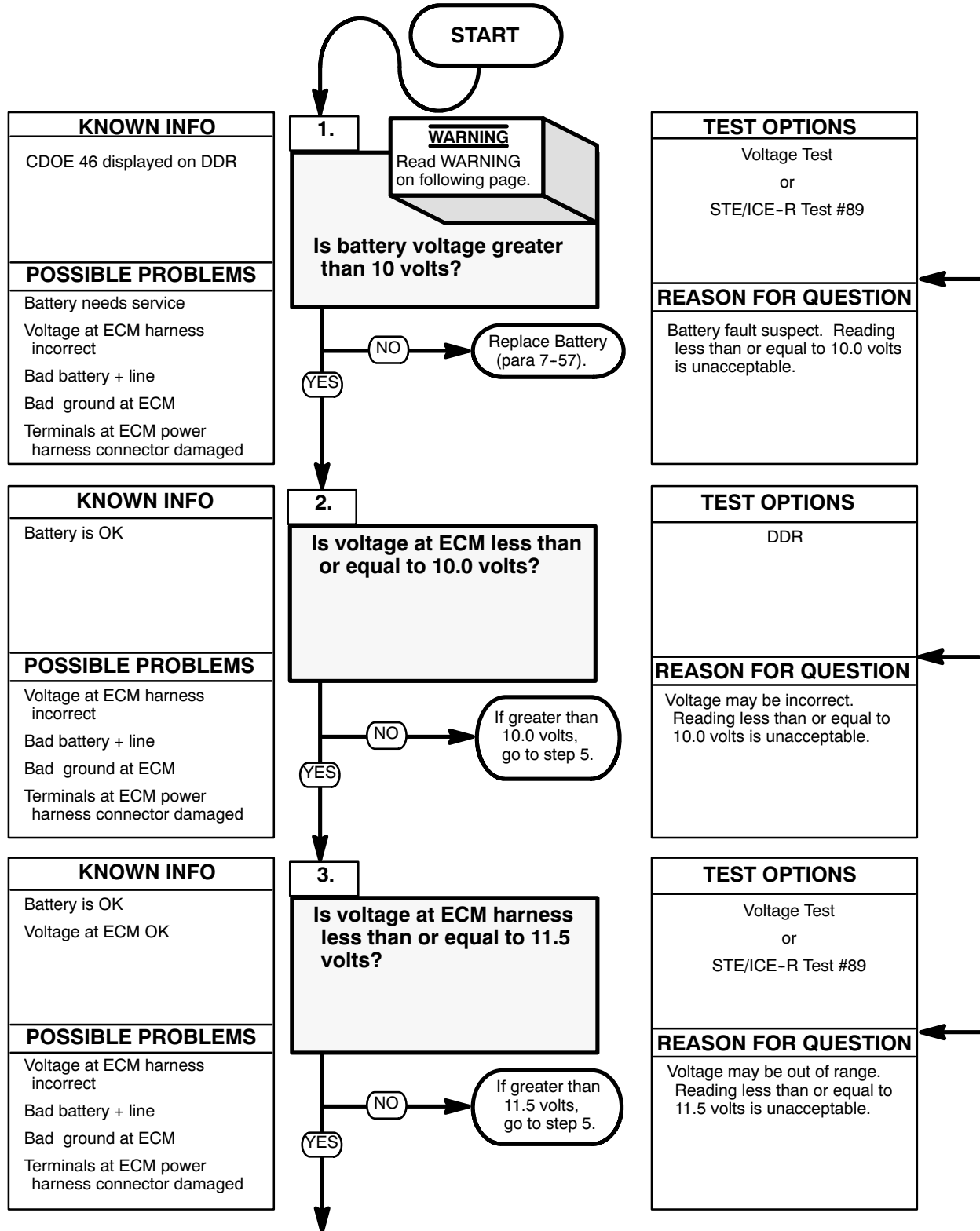




NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

A4 - Code 46 LOW BATTERY VOLTAGE



NOTE

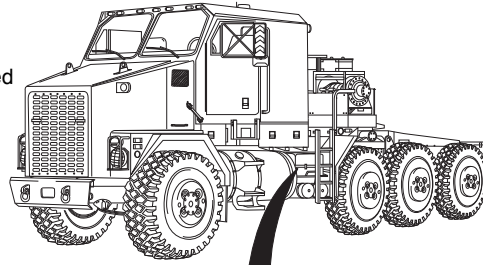
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

WARNING

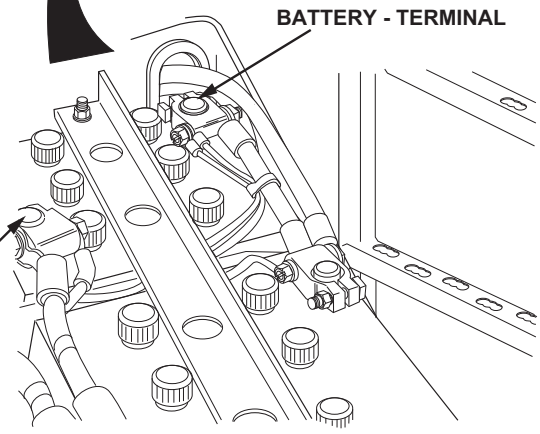
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around Het Tractor.

NOTE

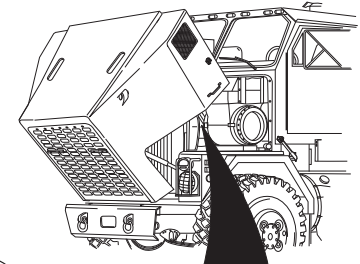
DDEC is powered only by right rear battery.



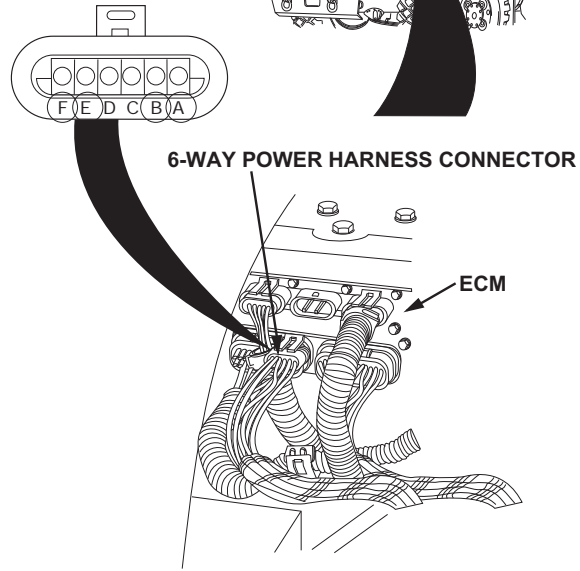
VOLTAGE TEST
 (5) Start and run engine for one minute.
 (6) Measure voltage on battery + terminal (red lead) to battery - terminal (black lead)



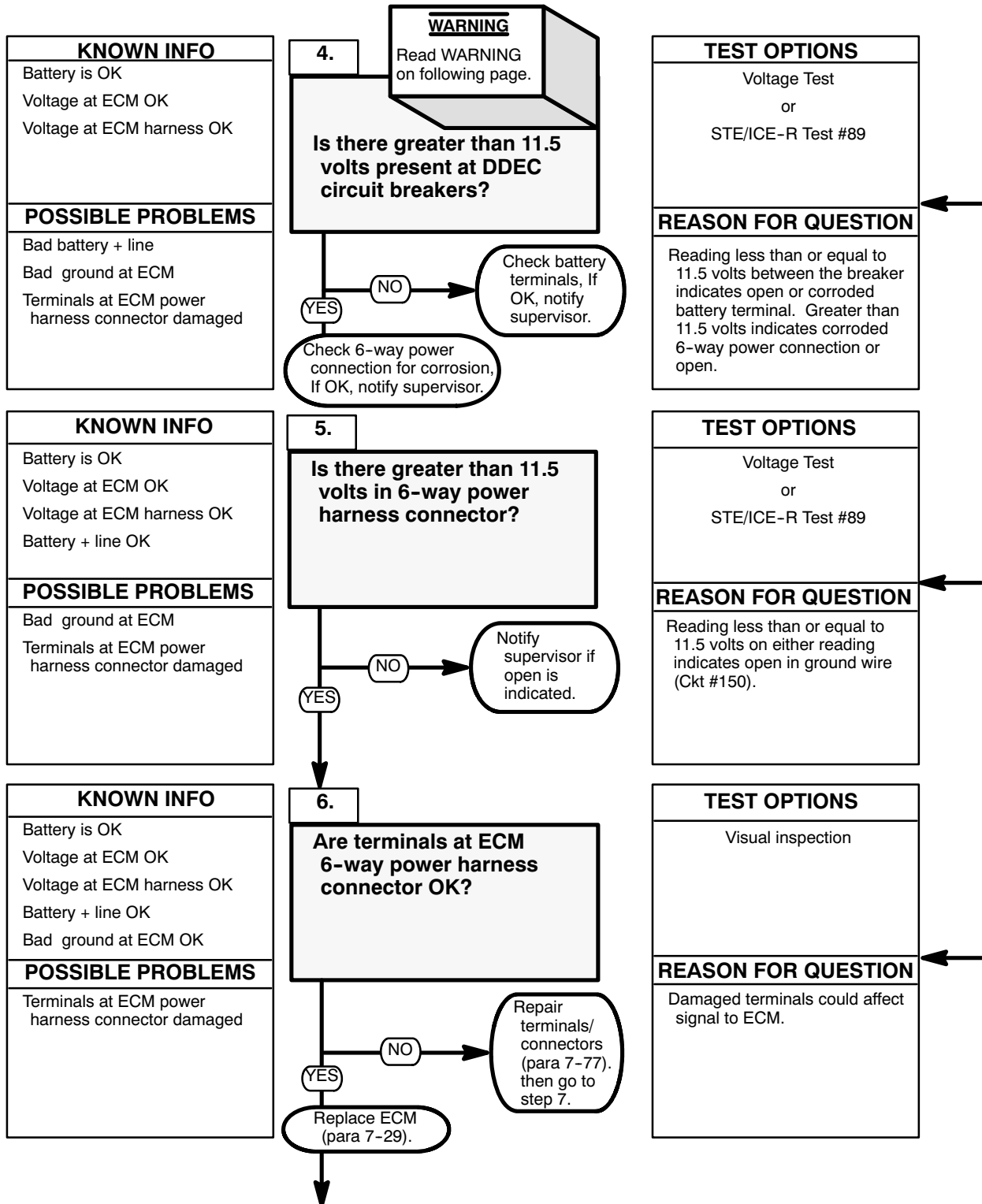
VOLTAGE TEST
 (1) Keep engine running.
 (2) Select ECM INPUT VOLT on DDR for display.
 (3) Observe ECM voltage reading on DDR.



VOLTAGE TEST
 (1) Turn ENGINE switch OFF.
 (2) Disconnect 6-way power connector at ECM.
NOTE
 Don't use CKT #150 as ground reference.
 (3) Read voltage from socket E, F, A, and B (red lead) of 6-way power harness connector and a good battery ground (black lead).



A4 - Code 46 LOW BATTERY VOLTAGE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around Het Tractor.

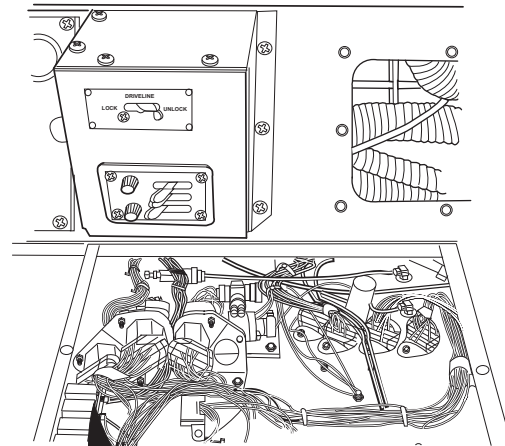
VOLTAGE TEST

- (1) Read voltage at lower breaker terminal to a good ground (black lead).
- (2) Repeat voltage reading at other breaker.

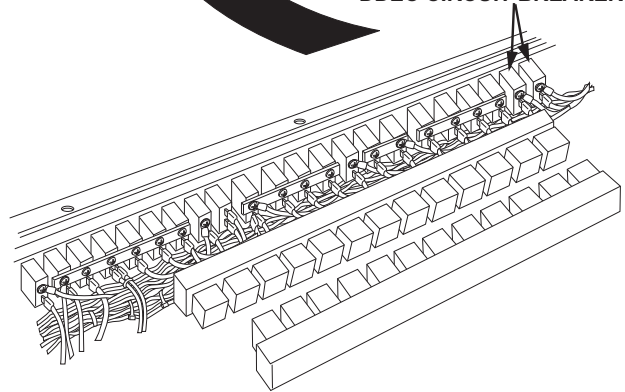
OPEN CIRCUIT TEST

- (1) Disconnect 6-way power harness connector at ECM.
- (2) Read voltage on socket E of harness connector (red lead) to socket D (black lead).
- (3) Read voltage on socket A (red lead) to socket C (black lead).

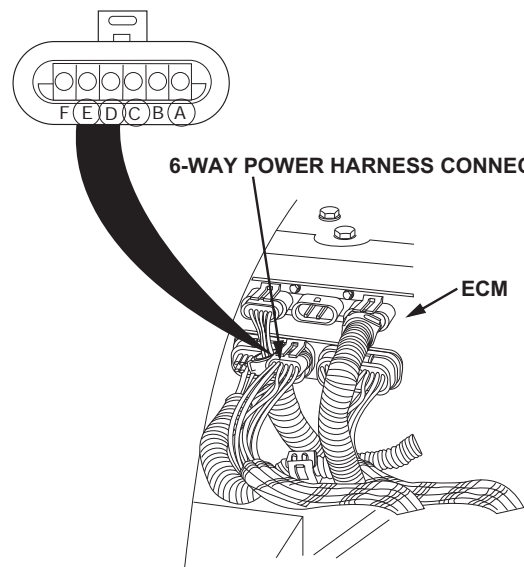
Check terminals at ECM 6-way power harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.



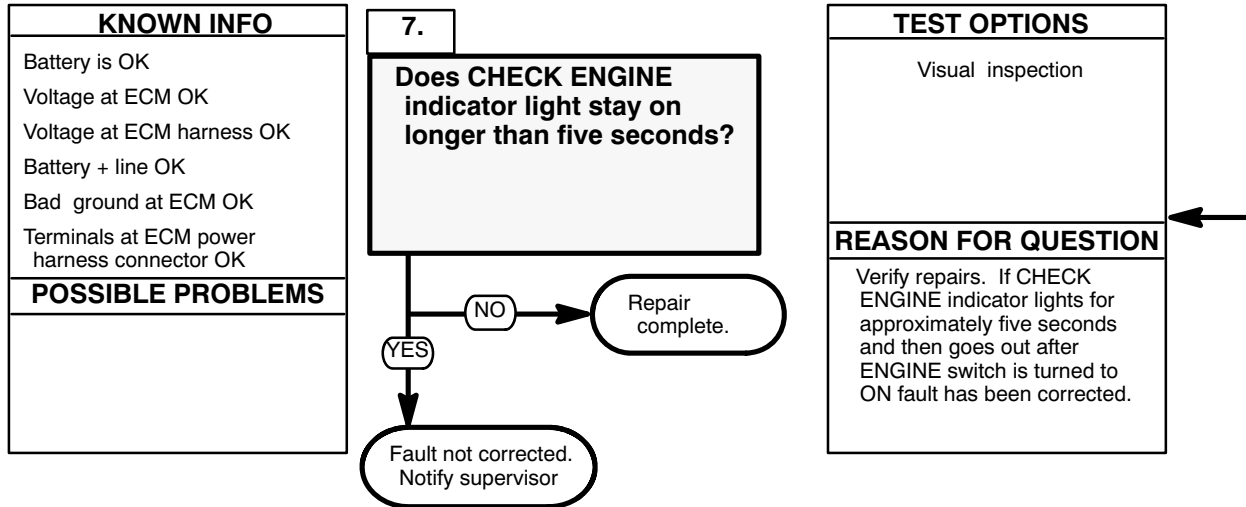
DDEC CIRCUIT BREAKERS



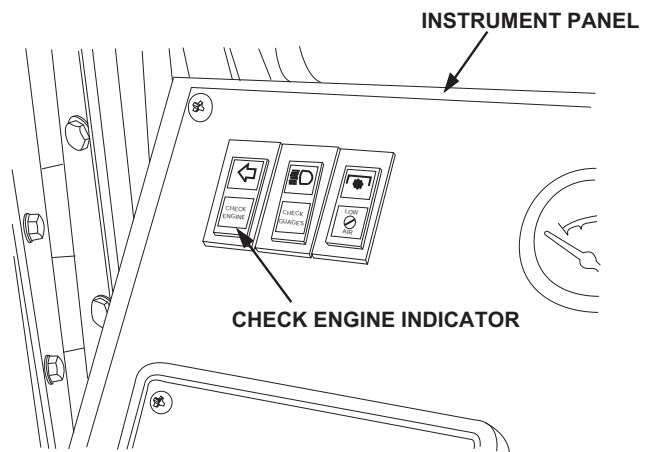
6-WAY POWER HARNESS CONNECTOR



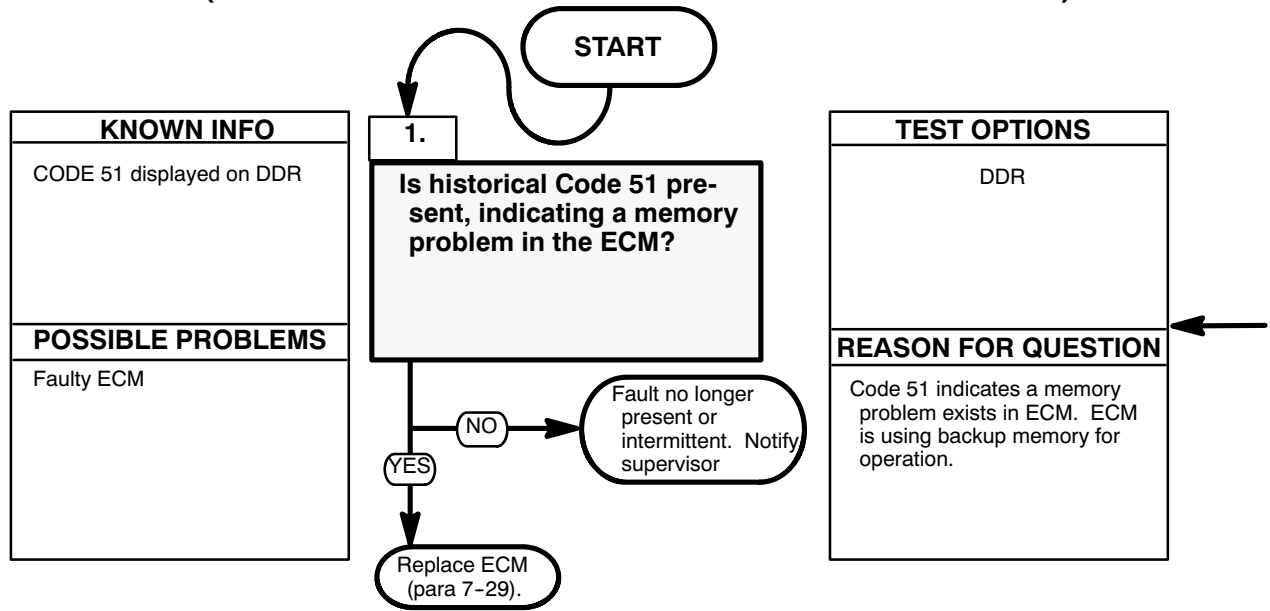
A4 - Code 46 LOW BATTERY VOLTAGE (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



**A4 - Code 51 CHECK ENGINE LIGHT COMES ON AND STAYS ON
(ACTIVE CODE 25 AND HISTORICAL CODE 51 COME UP)**

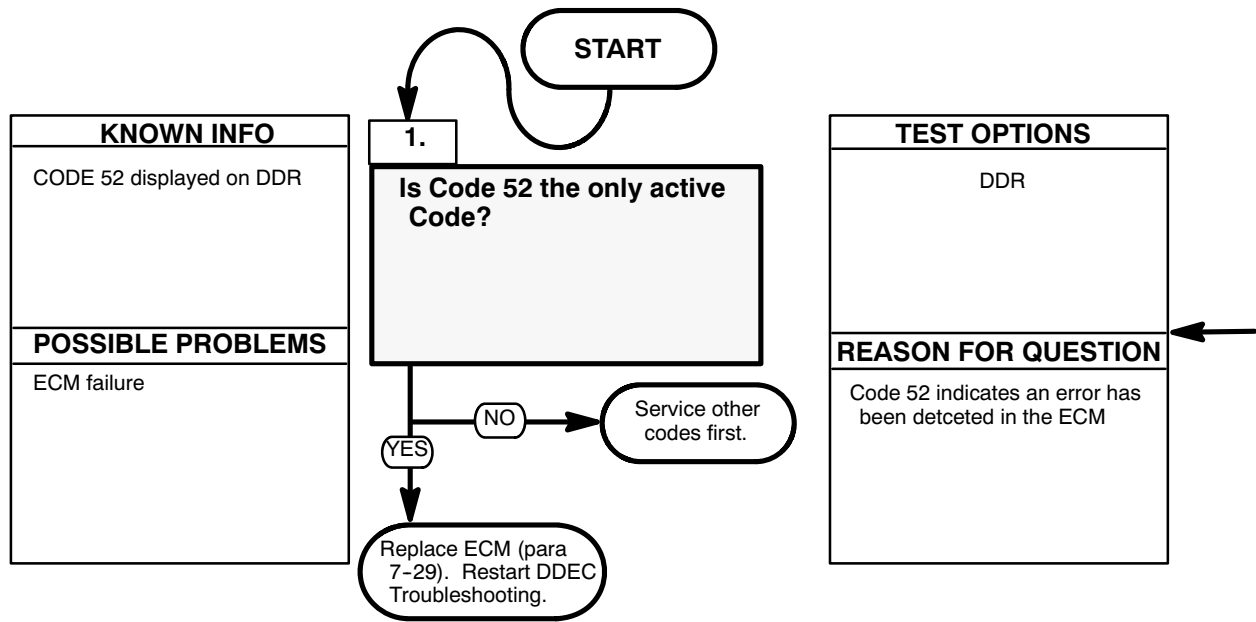




NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

A4 - Code 52 ECM - ANALOG TO DIGITAL FAILURE

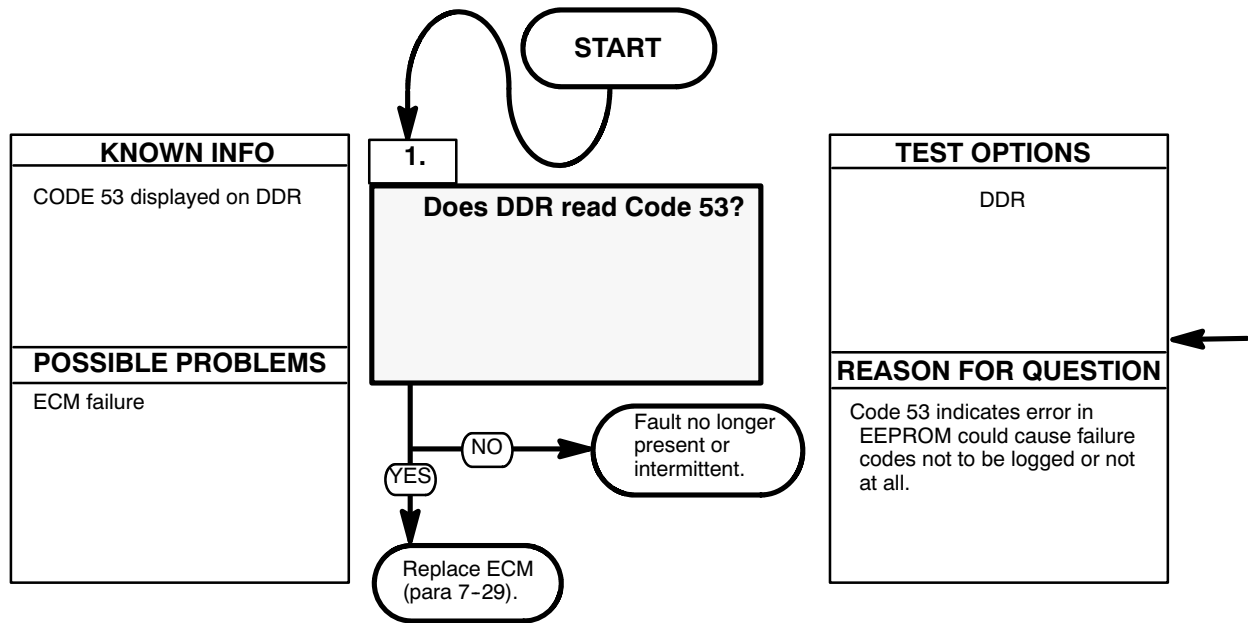


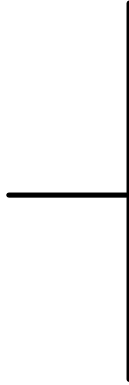


NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

A4 - Code 53 ELECTRONICALLY ERASABLE PROGRAMMABLE READ-ONLY MEMORY (EEPROM) FAILURE AFFECTING CODE MEMORY

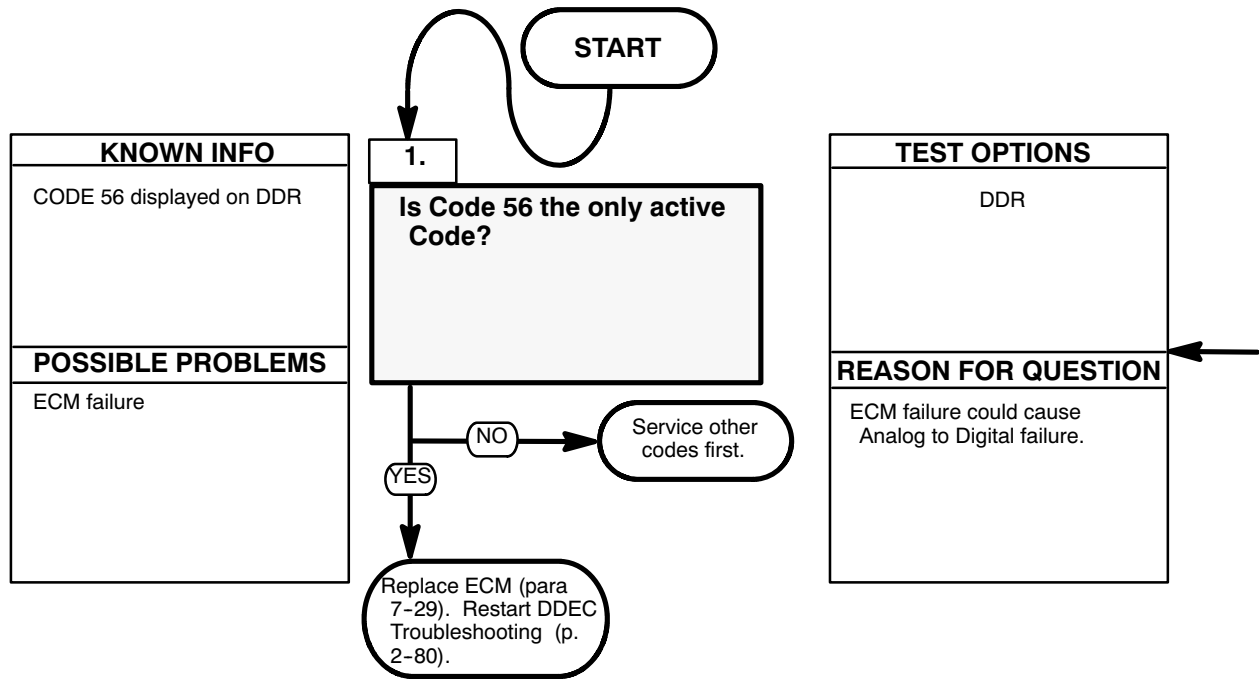




NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

A4 - Code 56 ECM - ANALOG TO DIGITAL FAILURE

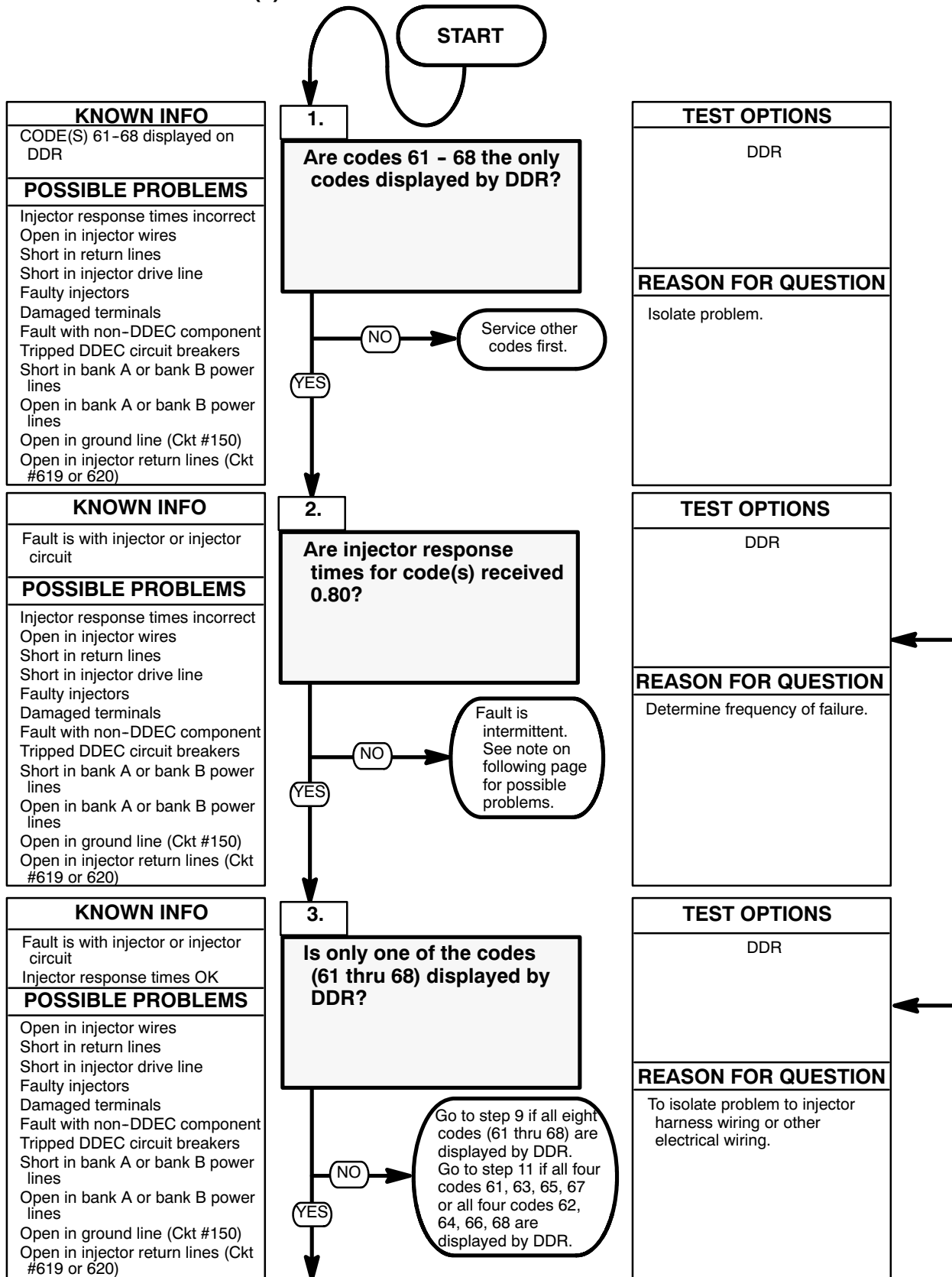




NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

A4 - Code(s) 61-68 INJECTOR RESPONSE TIME TOO LONG



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

NOTE

Table 2-7 shows which injector is associated with each of the failure codes.

Table 2-7. Injector Identification

FIRING		
CODE	ORDER	CYLINDER
61	1	1 Left
62	2	3 Right
63	3	3 Left
64	4	4 Right
65	5	4 Left
66	6	2 Right
67	7	2 Left
68	8	1 Right

(1) Start and warm engine to operating temperature (at least 86° F) (30° C).

(2) Plug in DDR and select INJ RESP TIMES (Mode 10).

NOTE

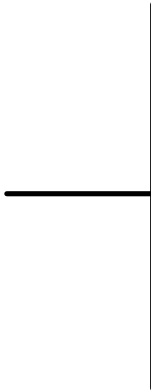
Table 2-7 gives the firing sequence in relation to the code received.

(3) Read DDR display of injector response time (in firing order) through several cycles. Note response time(s) of cylinder by number in fault code.

NOTE

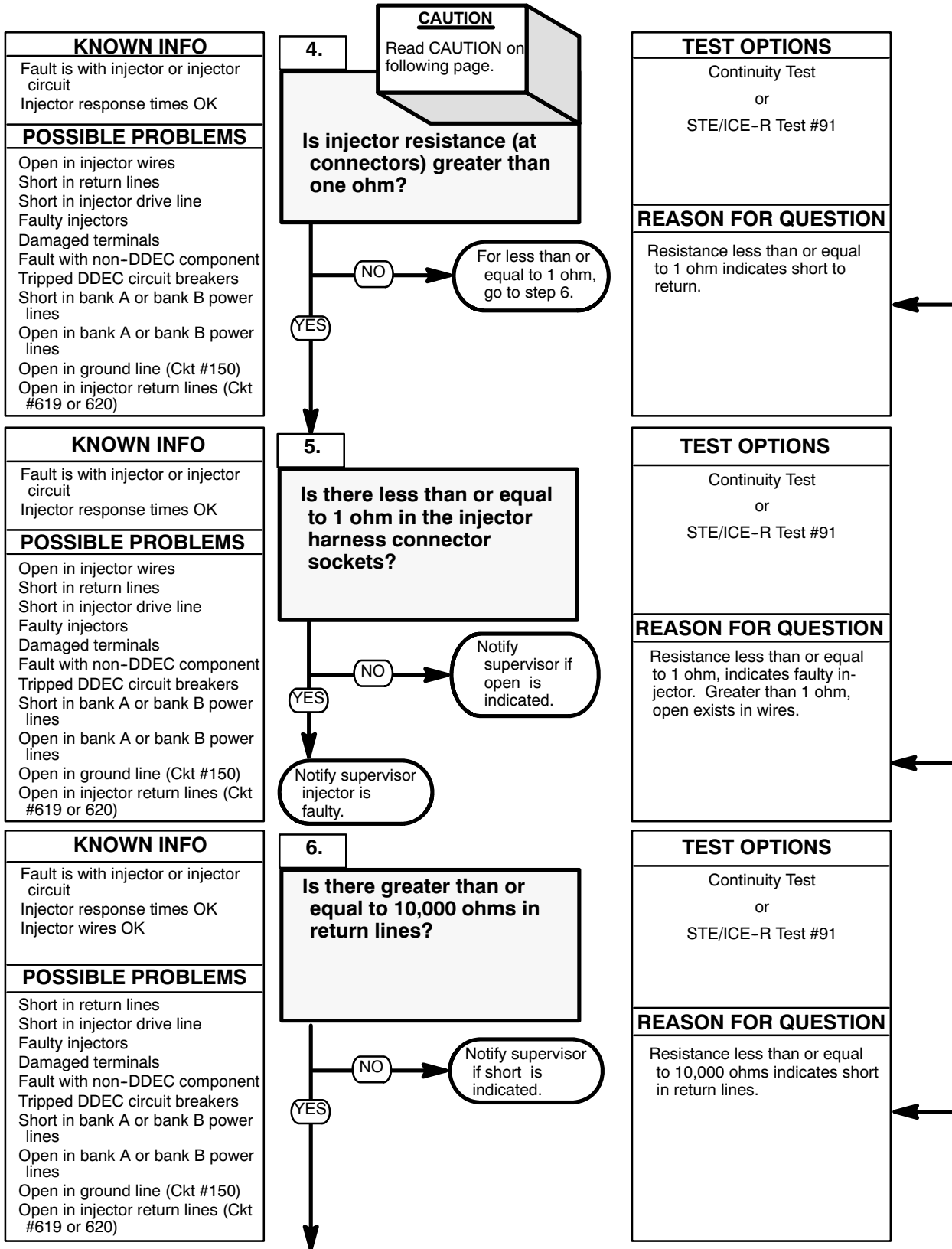
If response time(s) is not 0.80 the following may be causing intermittent failures:

- a. sticky valve (notify supervisor)
- b. air in fuel (refer to fuel system troubleshooting (b))
- c. low battery charge (refer to electrical system troubleshooting (e))
- d. broken spring or armature on the injector (notify supervisor)
- e. problems in the charging system (loose alternator belt, bad grounds, etc.) (refer to electrical system troubleshooting (e))
- f. signs of insulation wear on injector harness (remove rocker cover (para 3-2))



Check which codes (61-68) are displayed by DDR.

A4 - Code(s) 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT)



CAUTION

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

Table 2-8. Injector Harness Connector Identification

CODE	INJECTOR HARNESS CONNECTOR SOCKET	INJECTOR HARNESS CONNECTOR SOCKET
61	L	G
62	A	E
63	K	G
64	B	E
65	H	G
66	D	E
67	J	G
68	C	E

CONTINUITY TEST

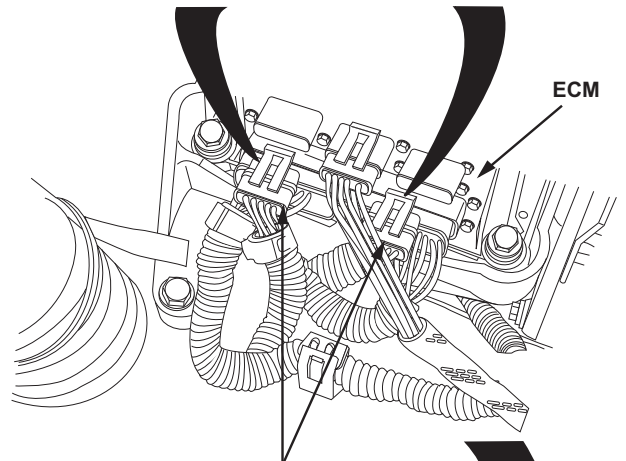
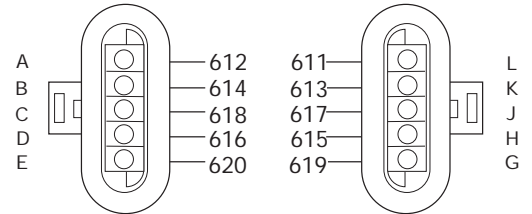
- (1) Turn ENGINE switch OFF and unplug DDR.
- (2) Disconnect both 5-way injector harness connectors at the ECM.
- (3) Referring to Table 2-8, read resistance between the 5-way injector harness connector sockets associated with the 61-68 code received. (Example: read resistance between sockets G and L for Code 61.)

CONTINUITY TEST

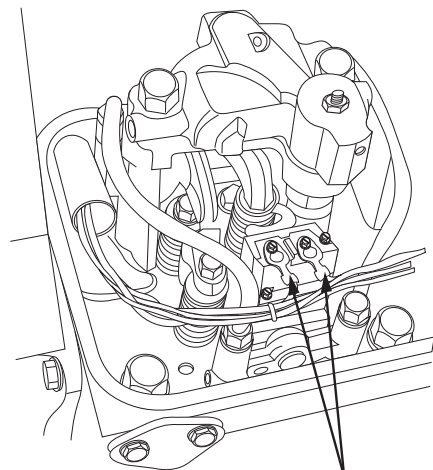
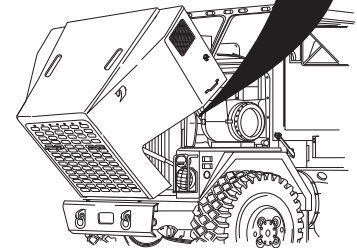
- (1) Remove rocker arm cover (para 3-2) corresponding to injector identified by Table 2-7.
- (2) Disconnect the two wires of the injector identified. Short these two wires together.
- (3) Referring to Table 2-8, read the resistance between the 5-way injector harness connector sockets associated with the faulty injector.

CONTINUITY TEST

- (1) Remove rocker arm cover (para 3-2) corresponding to injector identified by Table 2-7.
- (2) Disconnect two wires of injector indicated.
- (3) Referring to Table 2-8, read the resistance between 5-way injector harness connector sockets associated with faulty injector.



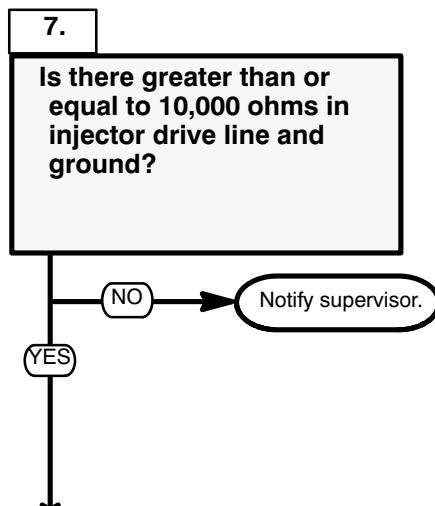
5-WAY INJECTOR HARNESS CONNECTORS



INJECTOR WIRES

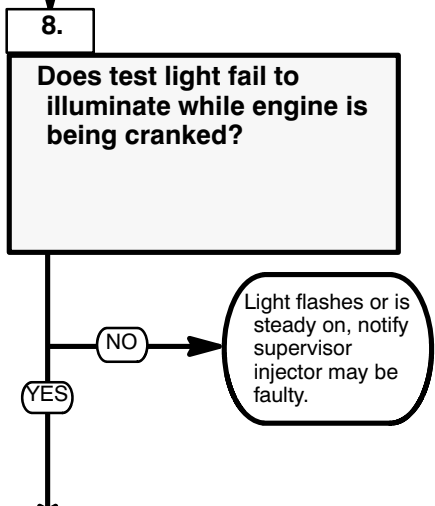
A4 - Code(s) 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT)

KNOWN INFO
Fault is with injector or injector circuit Injector response times OK Injector wires OK Return lines OK
POSSIBLE PROBLEMS
Short in injector drive line Faulty injectors Damaged terminals Fault with non-DDEC component Tripped DDEC circuit breakers Short in bank A or bank B power lines Open in bank A or bank B power lines Open in ground line (Ckt #150) Open in injector return lines (Ckt #619 or 620)



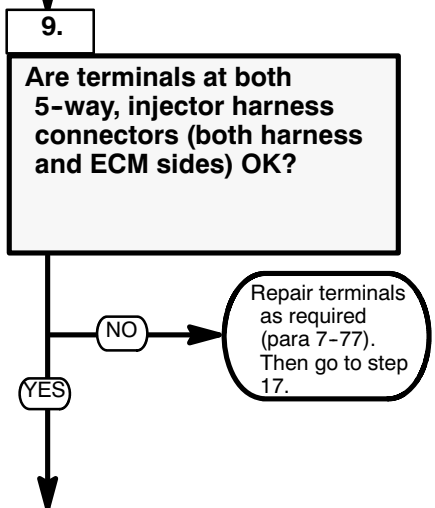
TEST OPTIONS
Continuity Test or STE/ICE Test #91
REASON FOR QUESTION
Resistance less than 10,000 ohms between injector drive and ground indicates injector drive wire is shorted to ground. Resistance less than 10,000 ohms from injector to ground indicates short or faulty injector.

KNOWN INFO
Fault is with injector or injector circuit Injector response times OK Injector wires OK Return lines OK Injector drive line OK
POSSIBLE PROBLEMS
Faulty injectors Damaged terminals Fault with non-DDEC component Tripped DDEC circuit breakers Short in bank A or bank B power lines Open in bank A or bank B power lines Open in ground line (Ckt #150) Open in injector return lines (Ckt #619 or 620)

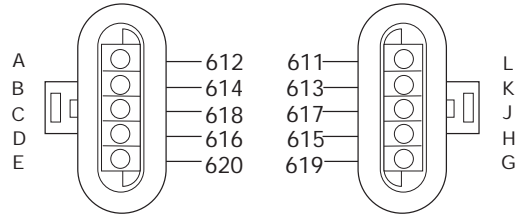


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Injector may be faulty if test light fails to illuminate while engine is being cranked.

KNOWN INFO
Fault is with injector or injector circuit Injector response times OK Injector wires OK Return lines OK Injector drive line OK Injectors OK
POSSIBLE PROBLEMS
Damaged terminals Fault with non-DDEC component Tripped DDEC circuit breakers Short in bank A or bank B power lines Open in bank A or bank B power lines Open in ground line (Ckt #150) Open in injector return lines (Ckt #619 or 620)

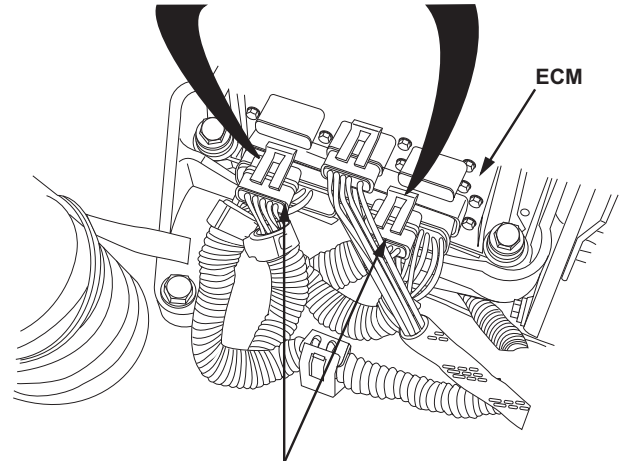


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Possible damage to terminals.



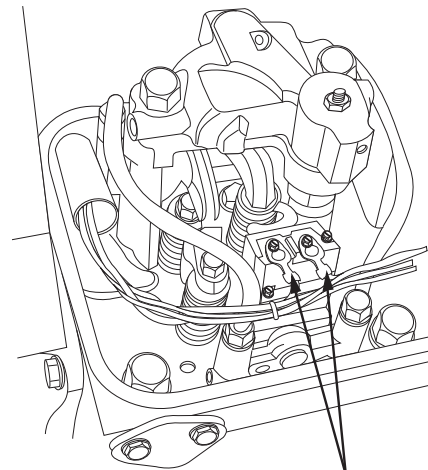
CONTINUITY TEST

- (1) Check for short to ground. Working with injector that has its two wires disconnected, measure the resistance between injector drive wire (injector drive wire is number in the range 611-618) and a good ground.
- (2) Measure resistance between one of terminals of injector (injector with disconnected wires) and a good ground.



5-WAY INJECTOR HARNESS CONNECTORS

- (1) With a 6-volt test light, monitor injector on return side (where no wire is attached) with respect to ground while cranking engine.
- (2) Reconnect both 5-way injector harness connectors at ECM.
- (3) Looking at injector with disconnected wires, reattach injector drive wire.

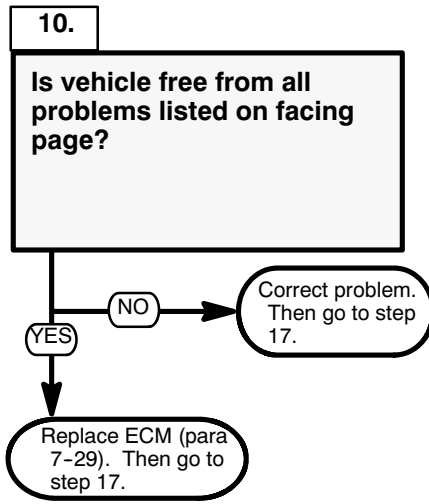


INJECTOR WIRES

Check terminals at both 5-way, injector harness connectors (both harness and ECM sides) for damage; bent, corroded and unseated pins or sockets.

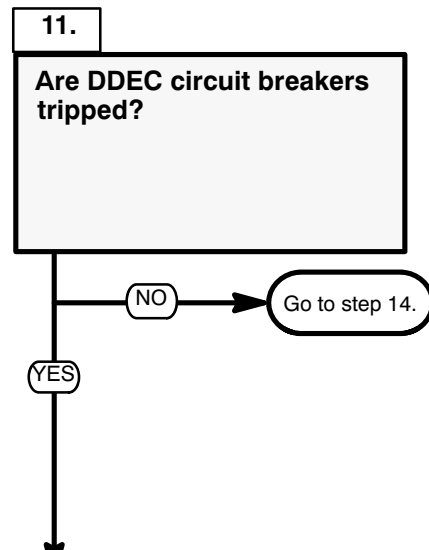
A4 - Code(s) 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT)

KNOWN INFO
Fault is with injector or injector circuit Injector response times OK Injector wires OK Return lines OK Injector drive line OK Injectors OK Terminals OK
POSSIBLE PROBLEMS
Fault with non-DDEC component Tripped DDEC circuit breakers Short in bank A or bank B power lines Open in bank A or bank B power lines Open in ground line (Ckt #150) Open in injector return lines (Ckt #619 or 620)



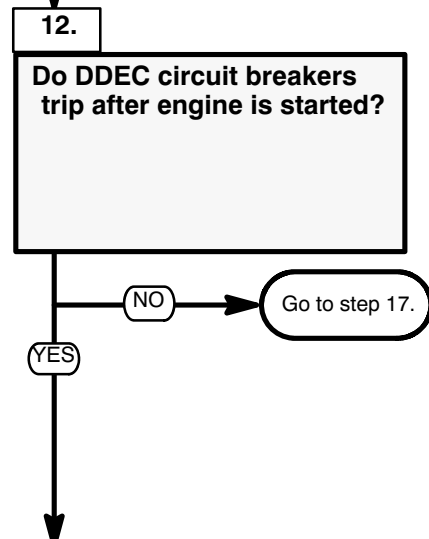
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Fault may be caused by non-DDEC engine or chassis component.

KNOWN INFO
Fault is with injector or injector circuit Injector response times OK Injector wires OK Return lines OK Injector drive line OK Injectors OK Terminals OK Fault caused by DDEC component
POSSIBLE PROBLEMS
Tripped DDEC circuit breakers Short in bank A or bank B power lines Open in bank A or bank B power lines Open in ground line (Ckt #150) Open in injector return lines (Ckt #619 or 620)



TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Open is suspect.

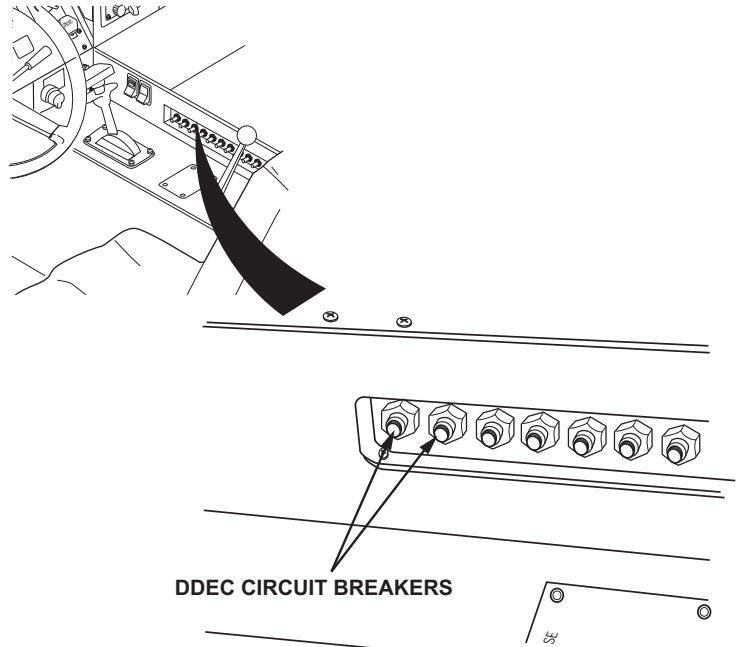
KNOWN INFO
Fault is with injector or injector circuit Injector response times OK Injector wires OK Return lines OK Injector drive line OK Injectors OK Terminals OK Fault caused by DDEC component
POSSIBLE PROBLEMS
Tripped DDEC circuit breakers Short in bank A or bank B power lines Open in bank A or bank B power lines Open in ground line (Ckt #150) Open in injector return lines (Ckt #619 or 620)



TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Short is suspect.

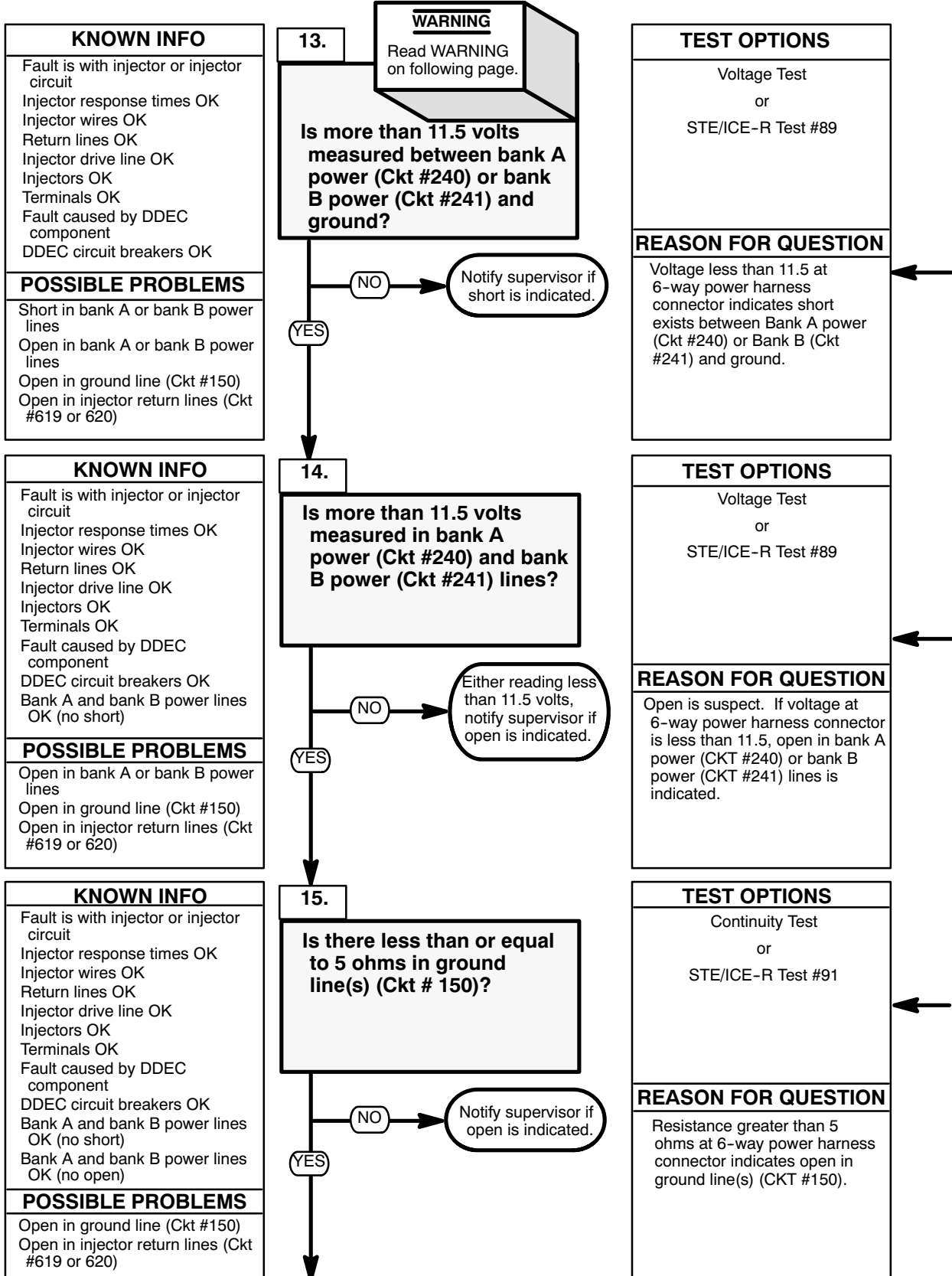
Check for any of the following problems:

- Air in fuel or low fuel pressure
- Sticky valve
- Cold fuel
- Low battery charge
- Broken spring or armature on the injector
- Problems in the charging system (loose alternator belt, etc.) or bad grounds
- Signs of insulation wear on injector harness.



Reset breaker(s). Start engine (TM 9-2320-360-10) and check to see if circuit breakers trip again.

A4 - Code(s) 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

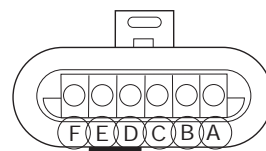
- (1) Turn ENGINE switch OFF.
- (2) Disconnect 6-way power harness connector.
- (3) Read voltage on socket A (red lead) to a good ground (black lead).
- (4) Also read voltage on sockets B, E, and F (red lead) to a good ground.

VOLTAGE TEST

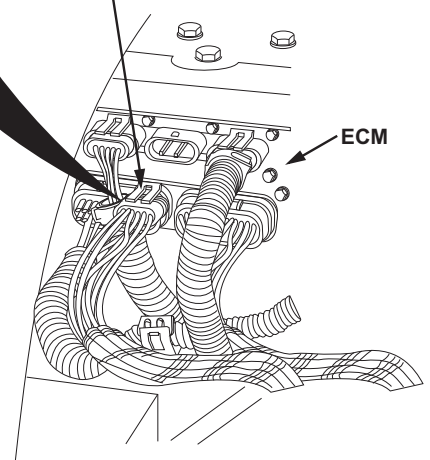
- (1) Read voltage on socket E or F (red lead) to socket C or D (black lead) of 6-way power harness connector.
- (2) Also read voltage on socket A or B (red lead) to socket C or D (black lead) of 6-way power harness connector.

CONTINUITY TEST

- (1) Read resistance between socket C of 6-way power harness connector and a good ground.
- (2) Also read resistance between socket D of 6-way power harness connector and a good ground.

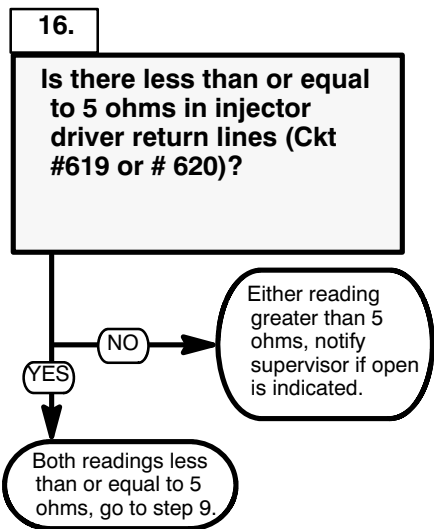


6-WAY POWER HARNESS CONNECTOR



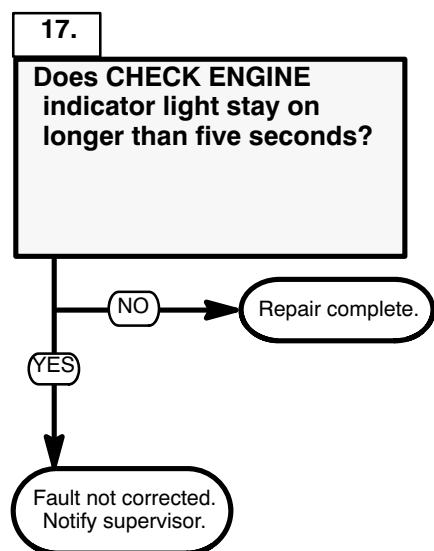
A4 - Code(s) 61-68 INJECTOR RESPONSE TIME TOO LONG (CONT)

KNOWN INFO
Fault is with injector or injector circuit
Injector response times OK
Injector wires OK
Return lines OK
Injector drive line OK
Injectors OK
Terminals OK
Fault caused by DDEC component
DDEC circuit breakers OK
Bank A and bank B power lines OK (no short)
Bank A and bank B power lines OK (no open)
Ground line (Ckt #150) OK
POSSIBLE PROBLEMS
Open in injector return lines (Ckt #619 or 620)



TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Open is suspect. If resistance is greater than 5 ohms at 5-way injector harness connector, there is an open in injector driver return line (CKT #619 or CKT #620).

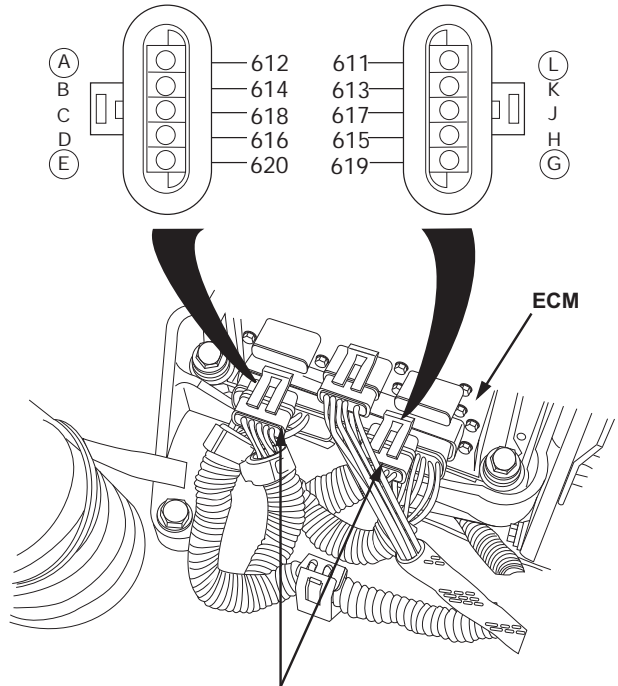
KNOWN INFO
Fault is with injector or injector circuit
Injector response times OK
Injector wires OK
Return lines OK
Injector drive line OK
Injectors OK
Terminals OK
Fault caused by DDEC component
DDEC circuit breakers OK
Bank A and bank B power lines OK (no short)
Bank A and bank B power lines OK (no open)
Ground line (Ckt #150) OK
POSSIBLE PROBLEMS



TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned to ON fault has been corrected.

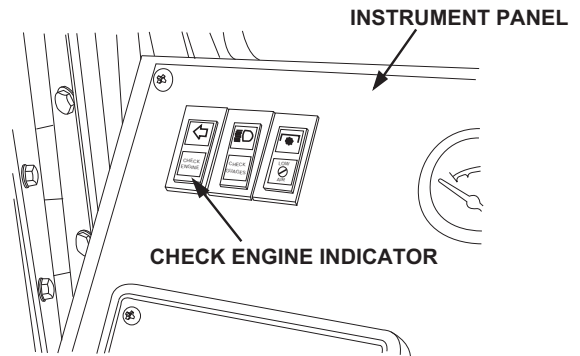
CONTINUITY TEST

- (1) Disconnect both 5-way injector harness connectors at ECM.
- (2) Read resistance between sockets G and L on 5-way injector harness connector.
- (3) Also read resistance between sockets A and E of other 5-way injector harness connector.

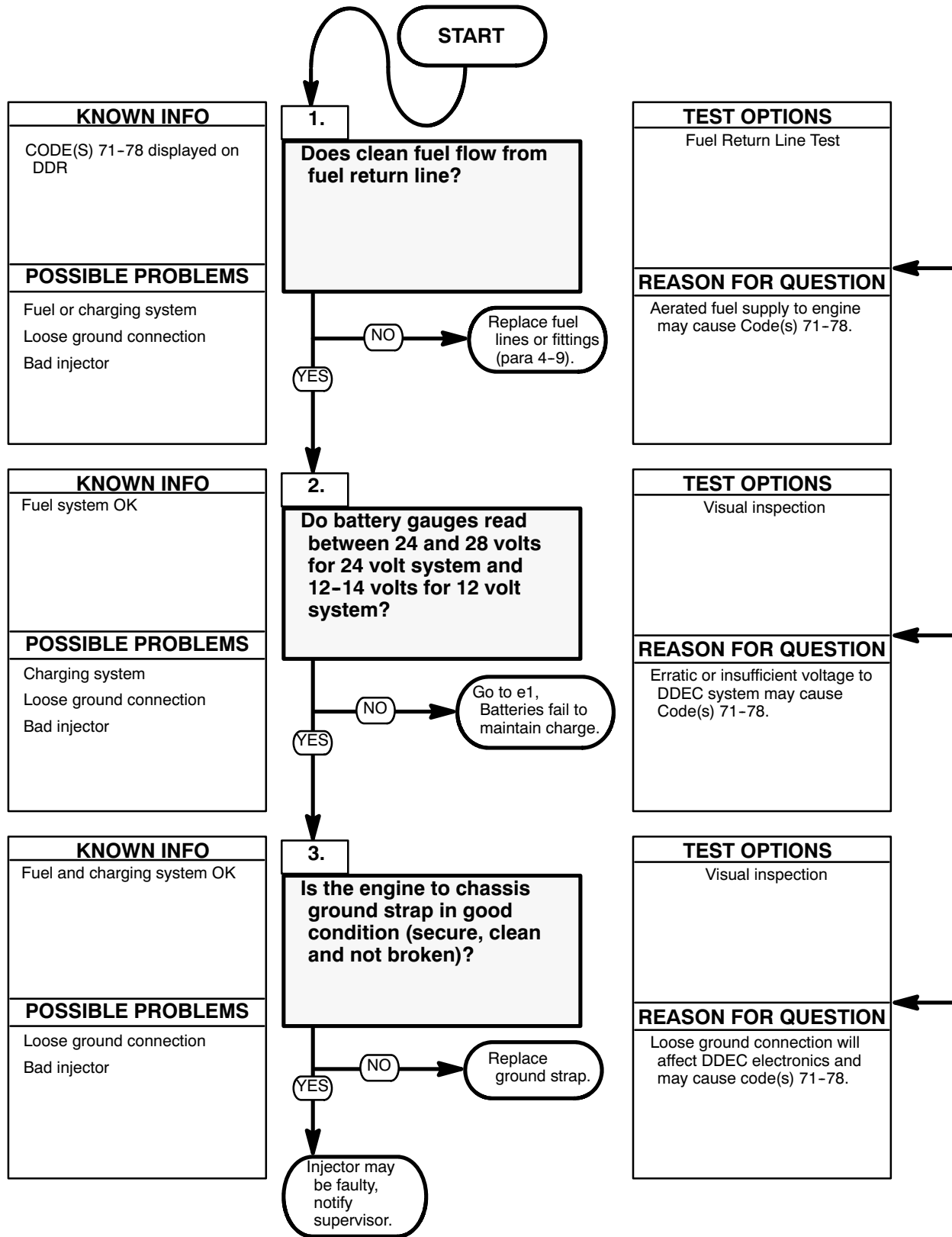


5-WAY INJECTOR HARNESS CONNECTORS

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



A4 - Code(s) 71 - 78 INJECTOR RESPONSE TIME TOO SHORT

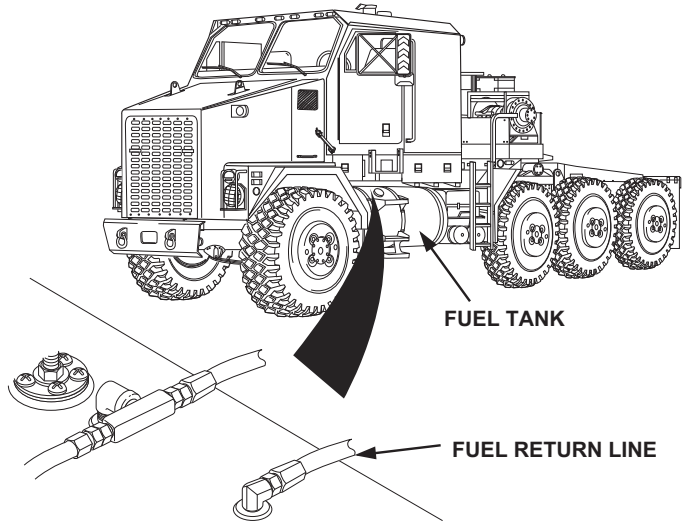


NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

FUEL RETURN LINE TEST

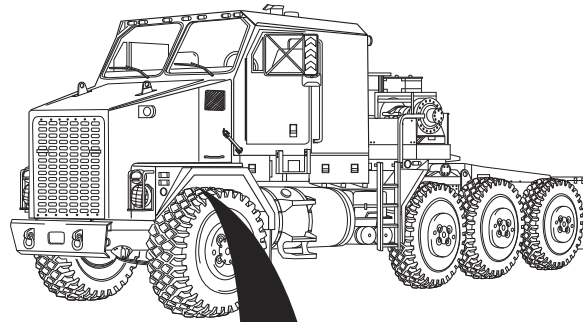
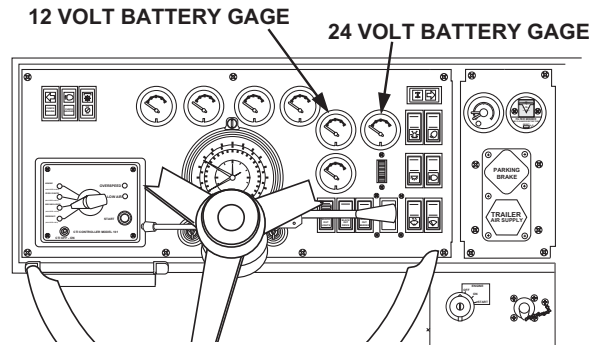
- (4) Remove fuel return line from left side fuel tank.
- (5) Place fuel line in suitable container.
- (6) Attempt to start engine (TM 9-2320-360-10).
- (7) Inspect fuel for air contamination.
- (8) Install fuel return line on left side fuel tank.



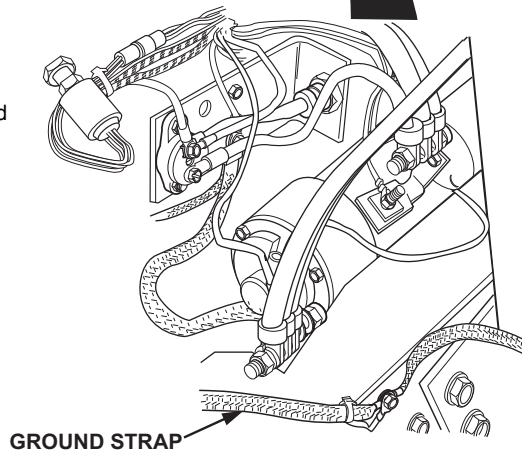
NOTE

Engine must be running to perform this test.

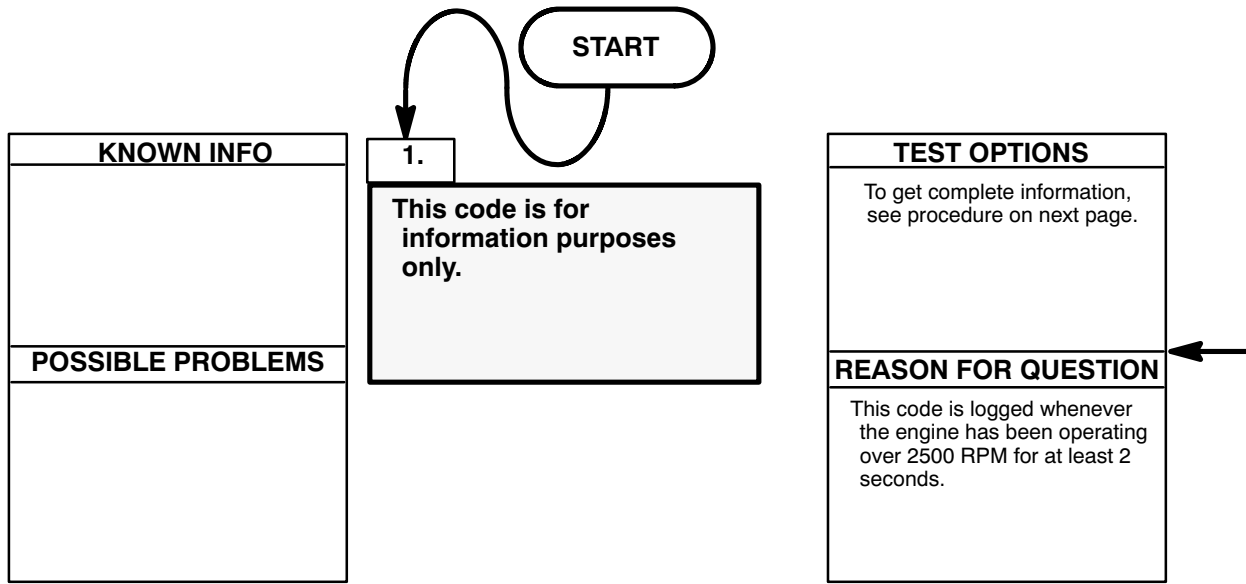
- (1) Check 24 volt battery gage for 24-28 volts dc.
- (2) Check 12 volt battery gage for 12-14 volts dc.



- (1) Remove left inner fender (para 16-34).
- (2) Inspect ground cable for loose hardware, breaks and clean connections.



A4 - Code 85 ENGINE OVERSPEED



- (1) Plug in DDR (p. 2-66).
- (2) Turn ENGINE switch to ON (TM 9-2320-360-10).
- (3) Select Modes 02 (Historical codes) and 38 (Engine Hours) for display.
- (4) At least part of the display will look like the following example (there will be more display if more codes are logged in addition to code 85):

Line 1 =	85 ENG OVERSPEED	02
Line 2 =	352 START HR	02
Line 3 =	15 SECONDS	02
Line 4 =	1 OCCUR	02
Line 5 =	368 ENG HOURS	38

This is what the display means:

Line 1 = A Code 85, engine overspeed, was logged. It is being displayed as part of the Mode 02 display.

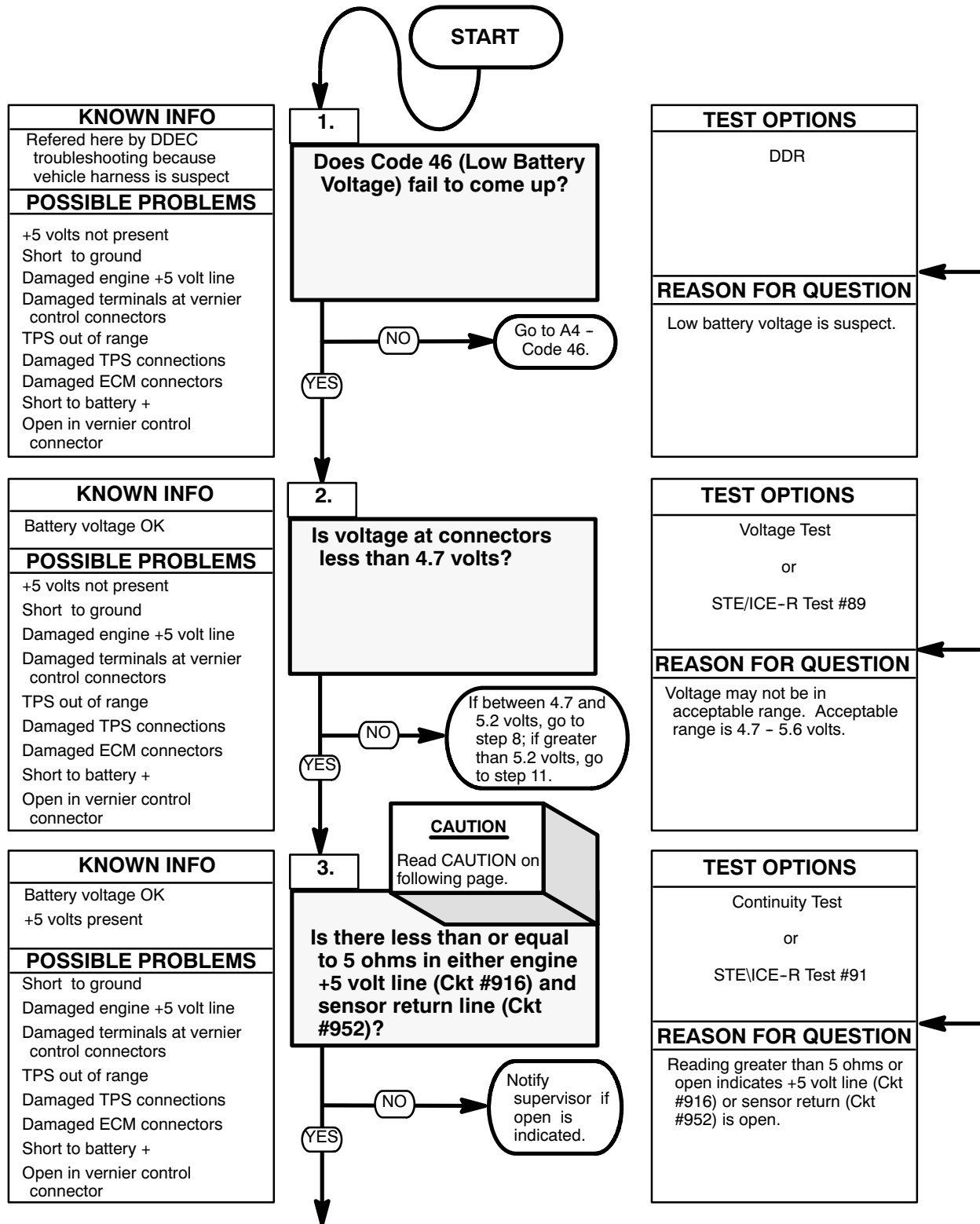
Line 2 = The Code 85 condition was first seen at 352 engine hours (the number of hours the engine has been in use since coming off the assembly line).

Line 3 = The total duration of Code 85 conditions logged was 15 seconds.

Line 4 = Only 1 continuous occurrence of Code 85 took place.

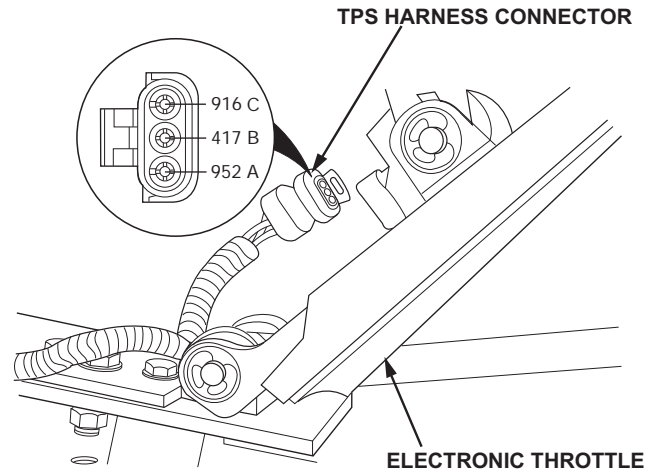
Line 5 = The total number of engine hours at this time is 368. Subtracting line 2 from line 5 ($368 - 352 = 16$), means that the first Code 85 condition occurred 16 engine hours ago.

A4A CHECK VEHICLE HARNESS +5 VOLT SUPPLY



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.



VOLTAGE TEST

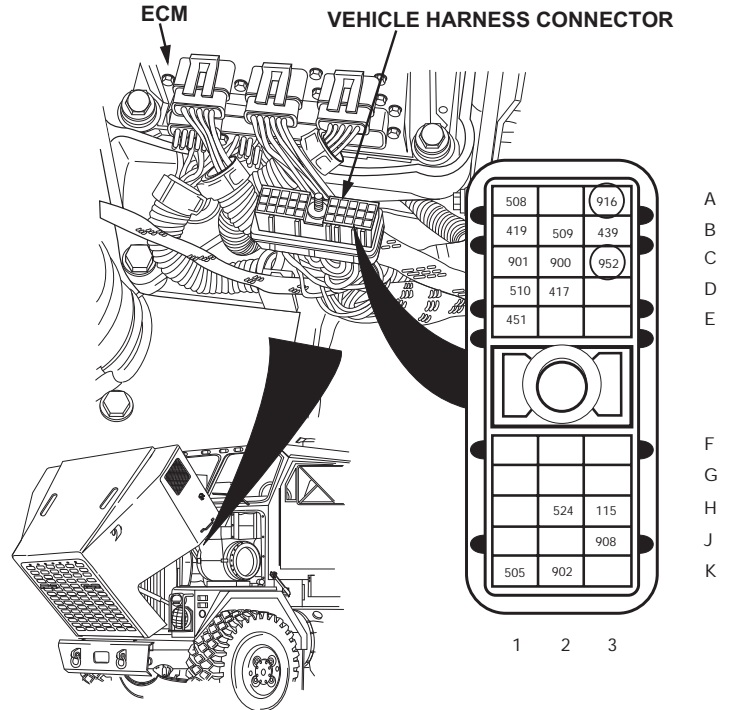
- (5) Turn ENGINE switch OFF and disconnect the Throttle Position Sensor (TPS)
- (6) Turn ENGINE switch ON and read voltage on the TPS harness connector, pin C (red lead) to pin A (black lead).

CAUTION

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

CONTINUITY TEST

- (1) Turn ENGINE switch OFF and disconnect vehicle harness connector at ECM.
- (2) Install a jumper wire between pins A and C of TPS harness connector.
- (3) Read resistance between sockets A3 and C3 of vehicle harness connector.

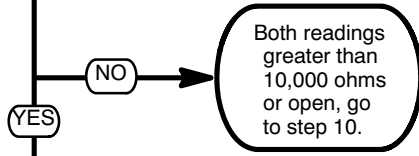


A4A CHECK VEHICLE HARNESS +5 VOLT SUPPLY (CONT)

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return
POSSIBLE PROBLEMS
Short to ground Damaged engine +5 volt line Damaged terminals at vernier control connectors TPS out of range Damaged TPS connections Damaged ECM connectors Short to battery + Open in vernier control connector

4.

Is there less than or equal to 10,000 ohms in engine +5 volt (no short to ground)?

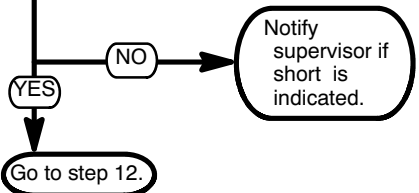


TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance less than or equal to 10,000 ohms at TPS harness connector indicates short.

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return No short to ground
POSSIBLE PROBLEMS
Damaged engine +5 volt line Damaged terminals at vernier control connectors TPS out of range Damaged TPS connections Damaged ECM connectors Short to battery + Open in vernier control connector

5.

Is there greater than or equal to 4.7 volts in engine +5 volt line (Ckt #916) (not shorted to either sensor return line (Ckt #952) or to chassis ground)?

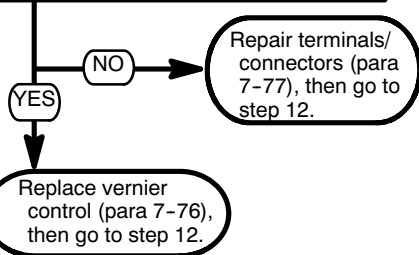


TEST OPTIONS
Voltage Test or STE/ICE-R Test #89
REASON FOR QUESTION
Reading less than 4.7 volts at Vernier Control harness connector indicates +5 volt line (Ckt #916) is shorted to return (Ckt #952) or ground.

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return No short to ground Engine +5 volt line OK
POSSIBLE PROBLEMS
Damaged terminals at vernier control connectors TPS out of range Damaged TPS connections Damaged ECM connectors Short to battery + Open in vernier control connector

6.

Are vernier control and vernier control terminals and connectors (sensor side and harness side) OK?

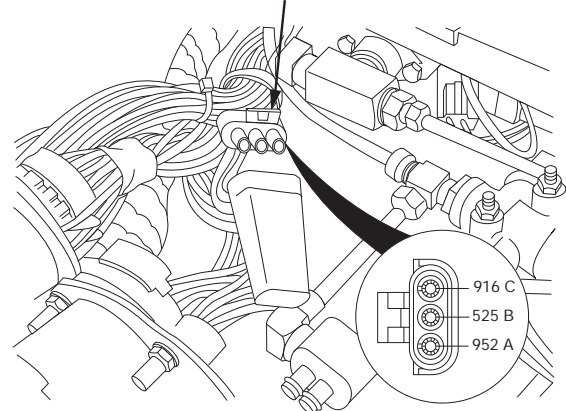


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damage to terminals could affect signal to Vernier Control.

CONTINUITY TEST

- (1) Check for +5 volt short to ground.
- (2) Remove jumper wire and disconnect Vernier Control.
- (3) Read resistance between pins A and C of TPS harness connector.
- (4) Also read resistance between pin C or TPS harness connector and a good ground.

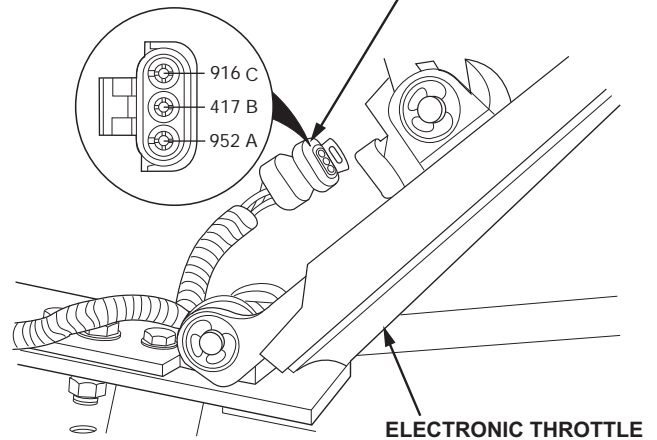
VERNIER CONTROL HARNESS CONNECTOR



VOLTAGE TEST

- (1) Turn ENGINE switch OFF.
- (2) Remove Vernier Control (para 7-76).
- (3) Turn ENGINE switch ON.
- (4) Read voltage on Vernier Control harness connector, socket C (red lead) to socket A (black lead).

TPS HARNESS CONNECTOR



Inspect terminals at the Vernier Control connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or sockets.

A4A CHECK VEHICLE HARNESS +5 VOLT SUPPLY (CONT)

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return No short to ground Engine +5 volt line OK Damaged terminals at vernier control connectors
POSSIBLE PROBLEMS
TPS out of range Damaged TPS connections Damaged ECM connectors Short to battery + Open in vernier control connector

7.

Is the TPS adjustment counts incorrect?

NO → If getting proper counts, go to step 9.

YES ↓

TEST OPTIONS
DDR
REASON FOR QUESTION
TPS adjustment may be off. 20-30 counts at no throttle and no more than 235 counts at full throttle is acceptable.

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return No short to ground Engine +5 volt line OK Damaged terminals at vernier control connectors TPS adjustment OK
POSSIBLE PROBLEMS
Damaged TPS connections Damaged ECM connectors Short to battery + Open in vernier control connector

8.

Are TPS and TPS terminals and connectors (sensor side and harness side) OK?

NO → Repair terminals or connectors (para 7-77). Then go to step 12.

YES ↓

Replace TPS (para 7-28), then go to step 12.

TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damage to terminals could affect signal to TPS.

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return No short to ground Engine +5 volt line OK Damaged terminals at vernier control connectors TPS adjustment OK TPS connections OK
POSSIBLE PROBLEMS
Damaged ECM connectors Short to battery + Open in vernier control connector

9.

Are ECM and ECM terminals and connectors (sensor side and harness side) OK?

NO → Repair terminals or connectors. (para 7-77). Then go to step 12.

YES ↓

Replace ECM (para 7-29), then go to step 12.

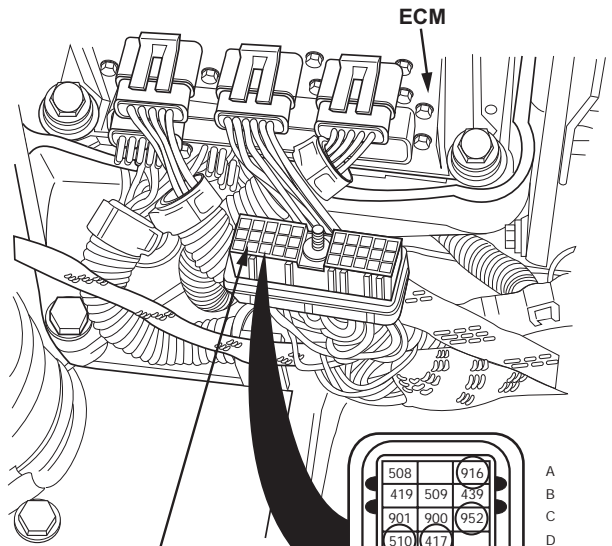
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damage to terminals could affect signal to ECM.

- (1) Turn ENGINE switch OFF and reconnect the Throttle Position Sensor (TPS) connector.
- (2) Turn ENGINE switch ON and select Throttle Sensor for display on the DDR.

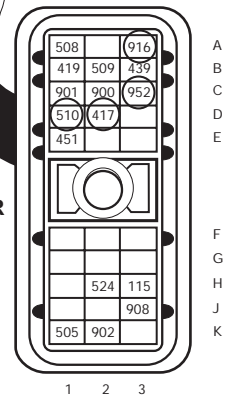
NOTE

Engine does not need to be running to check throttle count reading.

- (3) Check throttle count reading on DDR with accelerator pedal in idle position and with accelerator pedal fully depressed.
- (4) Turn ENGINE switch to OFF.

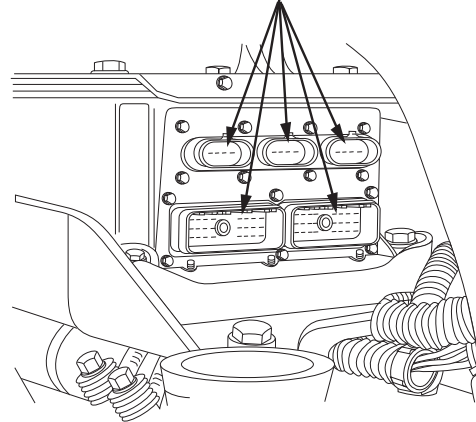


VEHICLE HARNESS CONNECTOR



Disconnect the Throttle Position Sensor (TPS). Check terminals at the TPS connectors (sensor side and harness side) for damage; bent, corroded and unseated pins or sockets.

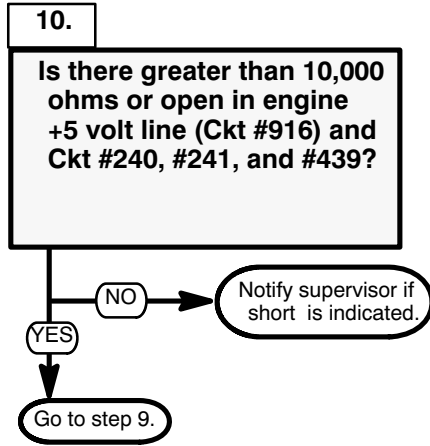
ECM TERMINALS



Disconnect vehicle harness connector at ECM. Check terminals at ECM vehicle harness connector (both ECM and harness side) for damage; bent, corroded and unseated pins or sockets, especially terminals #952, #916, #417, and #510.

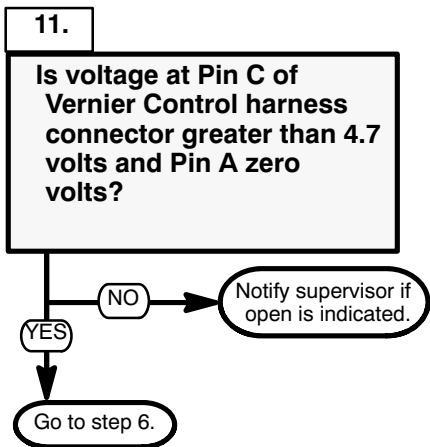
A4A CHECK VEHICLE HARNESS +5 VOLT SUPPLY (CONT)

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return No short to ground Engine +5 volt line OK Damaged terminals at vernier control connectors TPS adjustment OK TPS connections OK ECM connectors OK
POSSIBLE PROBLEMS
Short to battery + Open in vernier control connector



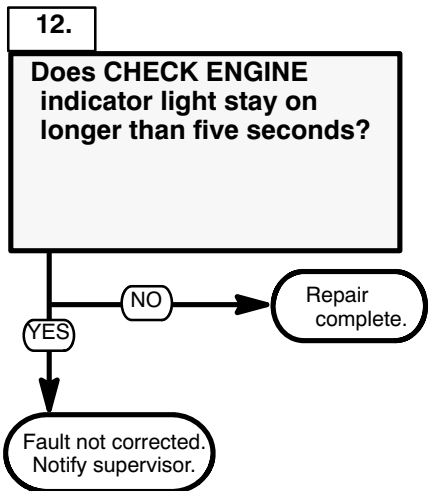
TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Resistance less than 10,000 ohms at 6-way power or vehicle harness connectors indicates short where measured.

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return No short to ground Engine +5 volt line OK Damaged terminals at vernier control connectors TPS adjustment OK TPS connections OK ECM connectors OK No short to battery +
POSSIBLE PROBLEMS
Open in vernier control connector



TEST OPTIONS
Voltage Test or STE/ICE-R Test #89
REASON FOR QUESTION
Readings of 4.7 - 5.2 volts at 6-way power and vehicle harness connectors indicates open from Ckt #952 to ECM.

KNOWN INFO
Battery voltage OK +5 volts present No open in +5 volt or return No short to ground Engine +5 volt line OK Damaged terminals at vernier control connectors TPS adjustment OK TPS connections OK ECM connectors OK No short to battery + No open in vernier control connector
POSSIBLE PROBLEMS

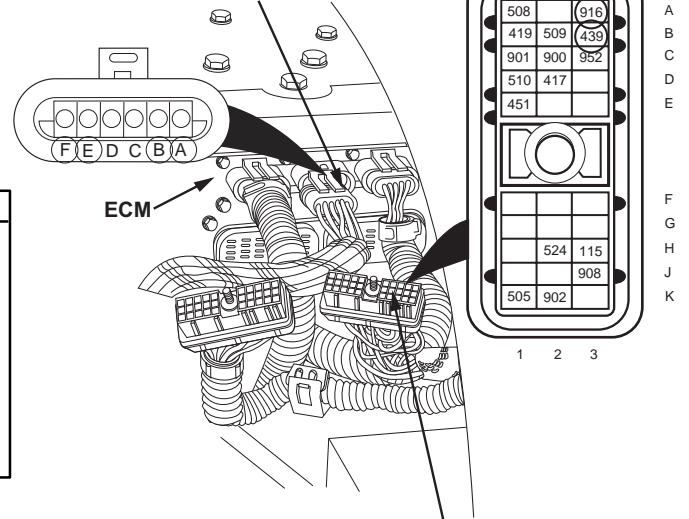


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned ON fault has been corrected.

CONTINUITY TEST

- (1) Turn ignition off and trip both circuit breakers to ECM.
- (2) Disconnect vehicle harness and 6-way power harness connectors at ECM.
- (3) Read resistance between sockets A3 and B3 on vehicle harness connector.
- (4) Also read resistance between socket A3 on vehicle harness connector and sockets A, B, E, and F on 6-way power harness connector.

6-WAY POWER HARNESS CONNECTOR

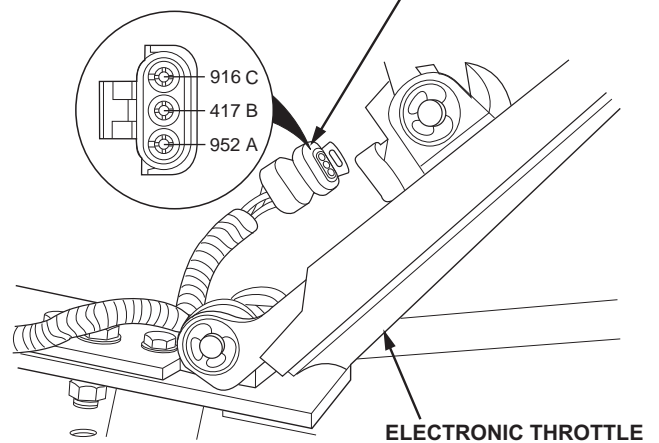


VEHICLE HARNESS CONNECTOR

VOLTAGE TEST

- (1) Connect Throttle Position Sensor and turn ENGINE switch ON.
- (2) Read voltage on Vernier Control harness connector, socket C (red lead) to a good ground (black lead).
- (3) Repeat step 2 only place red lead in socket A of Vernier Control connector.

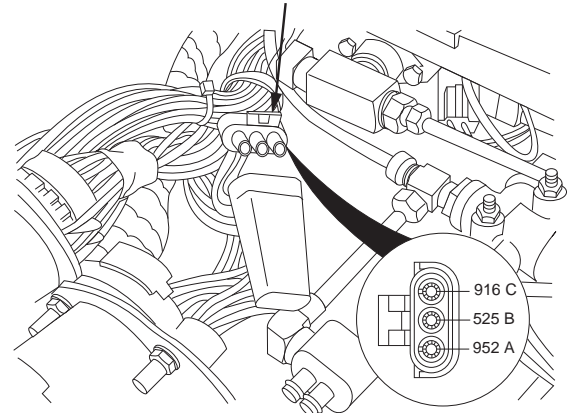
TPS HARNESS CONNECTOR



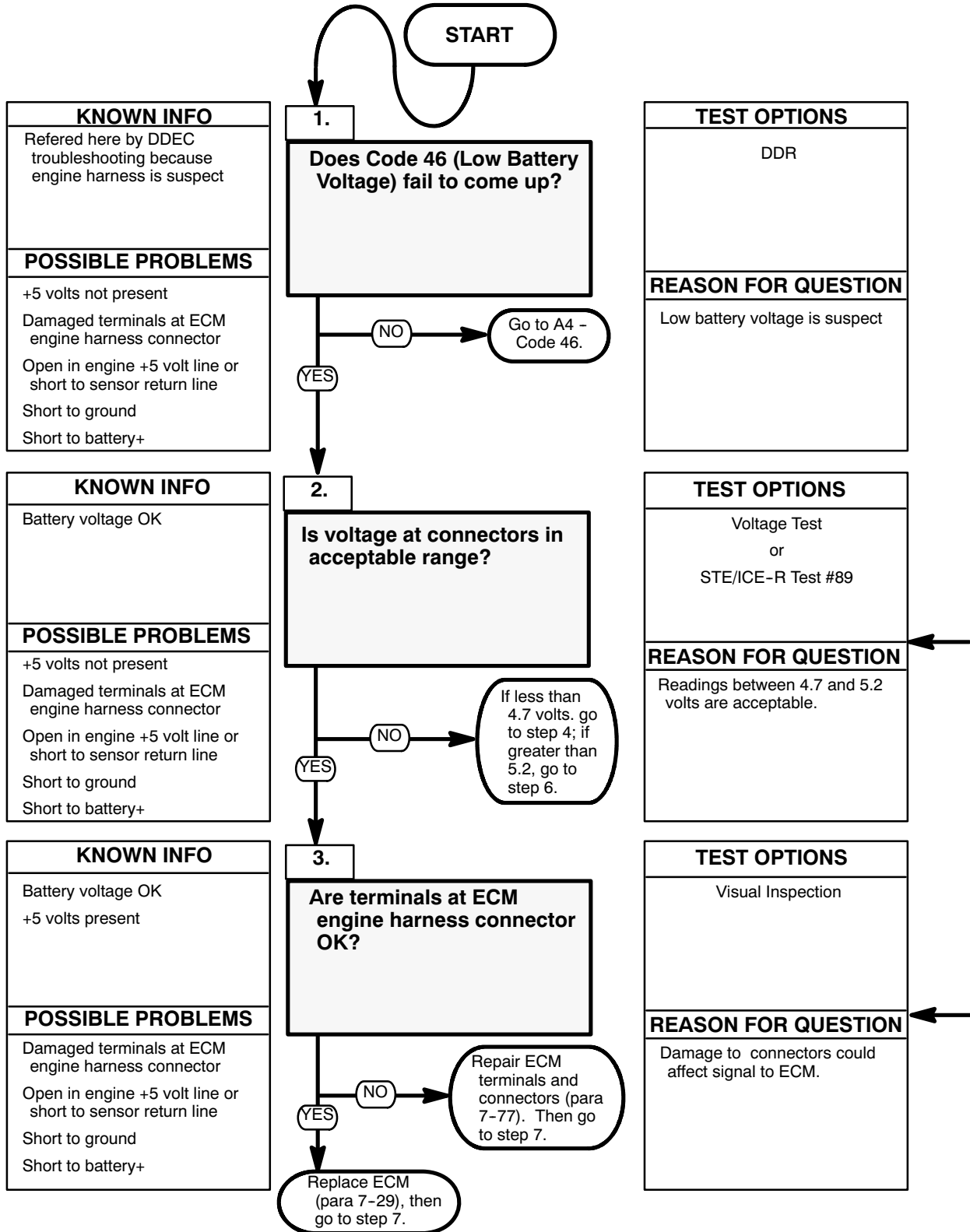
ELECTRONIC THROTTLE

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.

VERNIER CONTROL HARNESS CONNECTOR

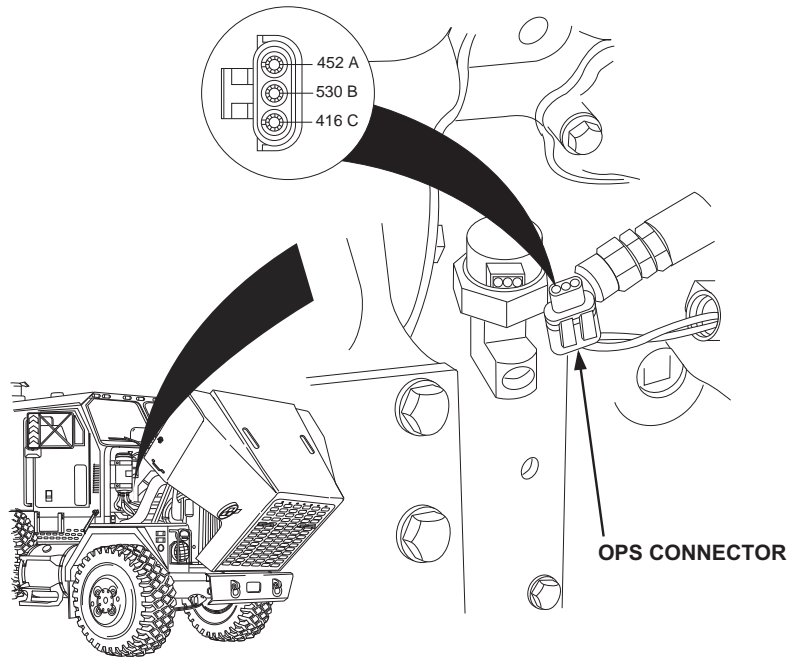


A4B CHECK ENGINE HARNESS +5 VOLT SUPPLY



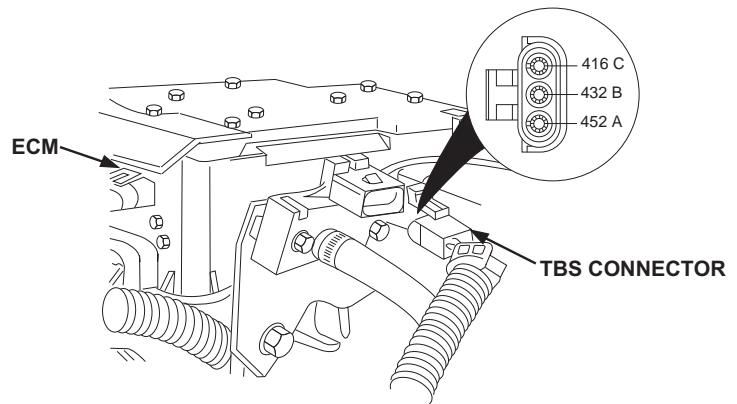
NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

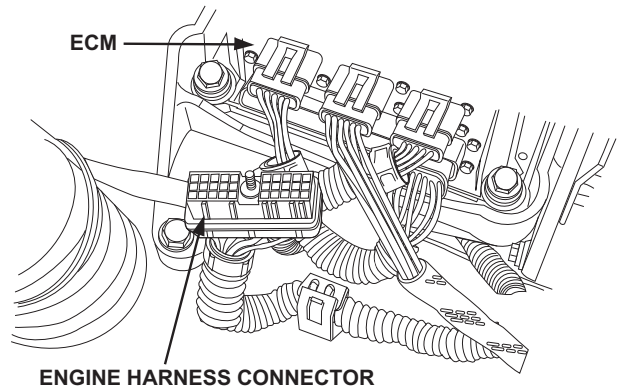
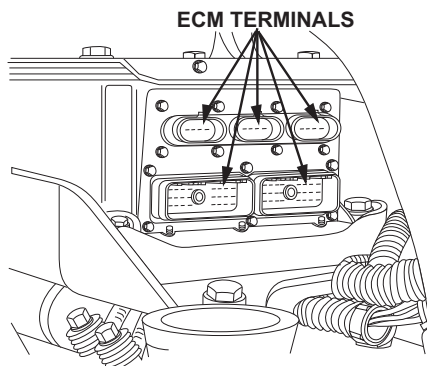


VOLTAGE TEST

- (1) Turn ENGINE switch OFF.
- (1.1) Remove right inner fender (para 16-34).
- (2) Disconnect oil pressure sensor (OPS) and turbo boost sensor (TBS) connectors.
- (3) Turn ENGINE switch ON.
- (4) At each sensor harness connector, read voltage between socket C (red lead) and socket A (black lead).

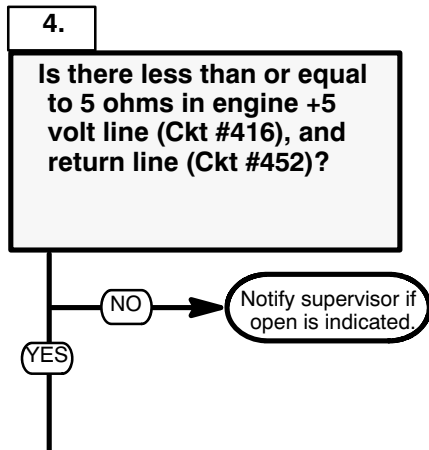


Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.



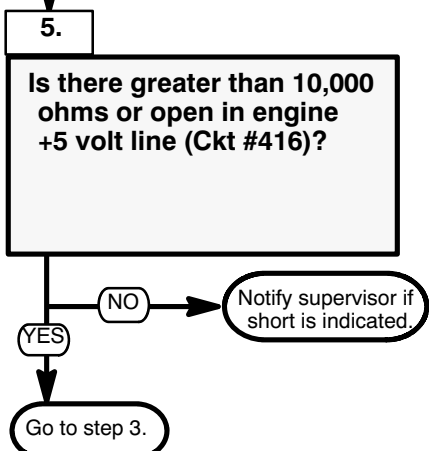
A4B CHECK ENGINE HARNESS +5 VOLT SUPPLY (CONT)

KNOWN INFO
Battery voltage OK +5 volts present Terminals at ECM engine harness connector OK
POSSIBLE PROBLEMS
Open in engine +5 volt line or short to sensor return line Short to ground Short to battery+



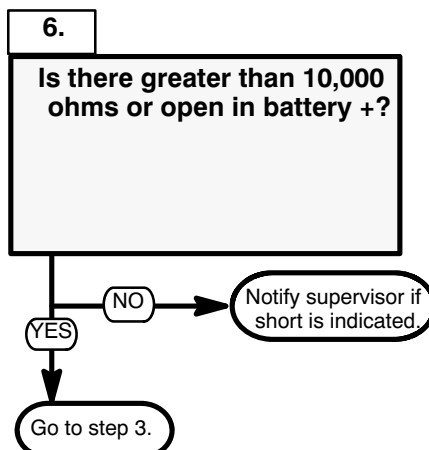
TEST OPTIONS
DDR
REASON FOR QUESTION
Resistance greater than 5 ohms indicates open in +5 volt line (Ckt #416) or sensor return (Ckt #452).

KNOWN INFO
Battery voltage OK +5 volts present Terminals at ECM engine harness connector OK No open in engine +5 volt line
POSSIBLE PROBLEMS
Short to ground Short to battery+

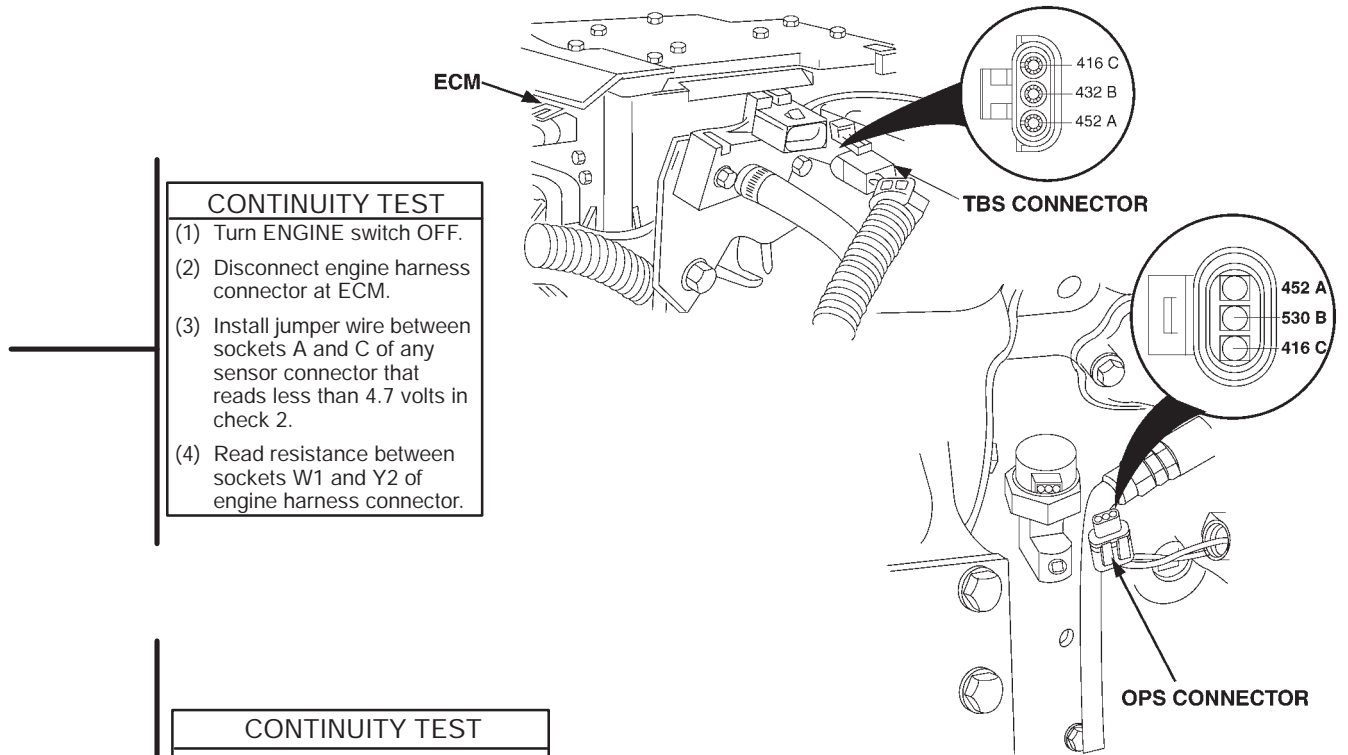


TEST OPTIONS
DDR
REASON FOR QUESTION
Resistance less than or equal to 10,000 ohms at sensor connector indicates +5 volt line (Ckt #416), is shorted to return line (Ckt #452) or ground.

KNOWN INFO
Battery voltage OK +5 volts present Terminals at ECM engine harness connector OK No open in engine +5 volt line No short to ground
POSSIBLE PROBLEMS
Short to battery+



TEST OPTIONS
DDR
REASON FOR QUESTION
Resistance less than or equal to 10,000 ohms on the 6-pin power harness connector indicates short between sockets where measured.

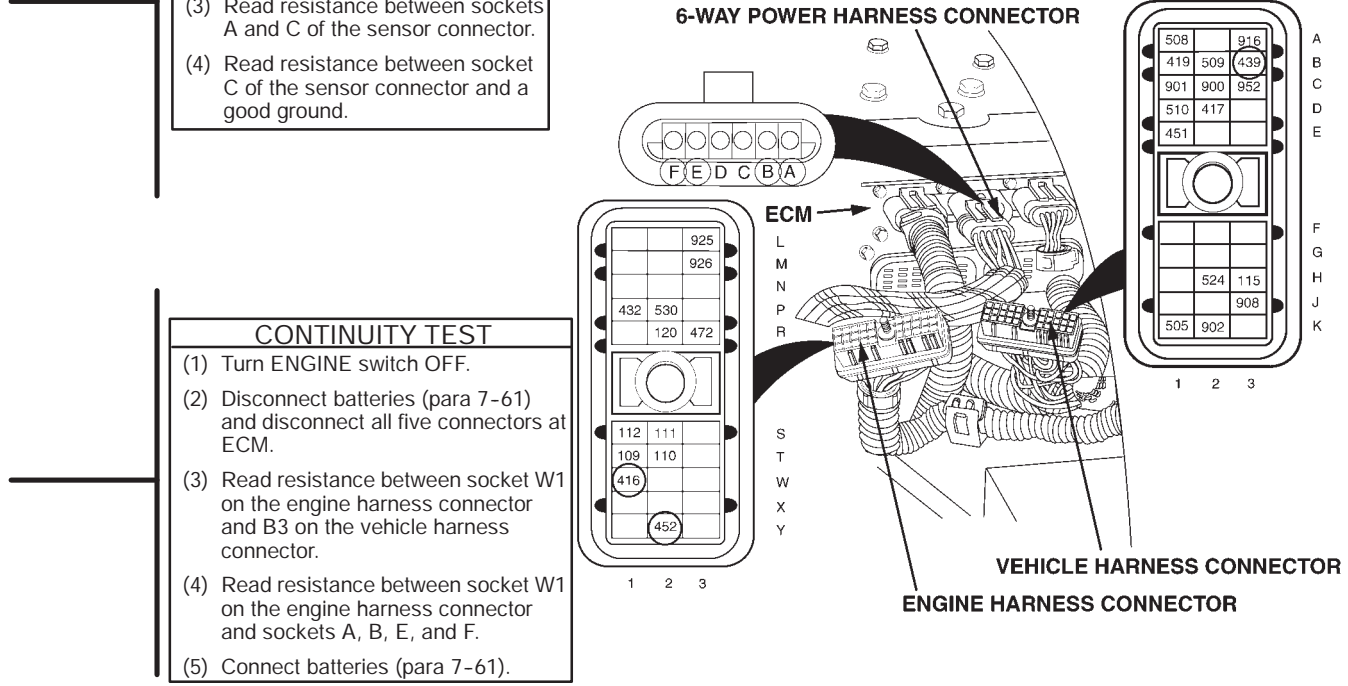


CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect engine harness connector at ECM.
- (3) Install jumper wire between sockets A and C of any sensor connector that reads less than 4.7 volts in check 2.
- (4) Read resistance between sockets W1 and Y2 of engine harness connector.

CONTINUITY TEST

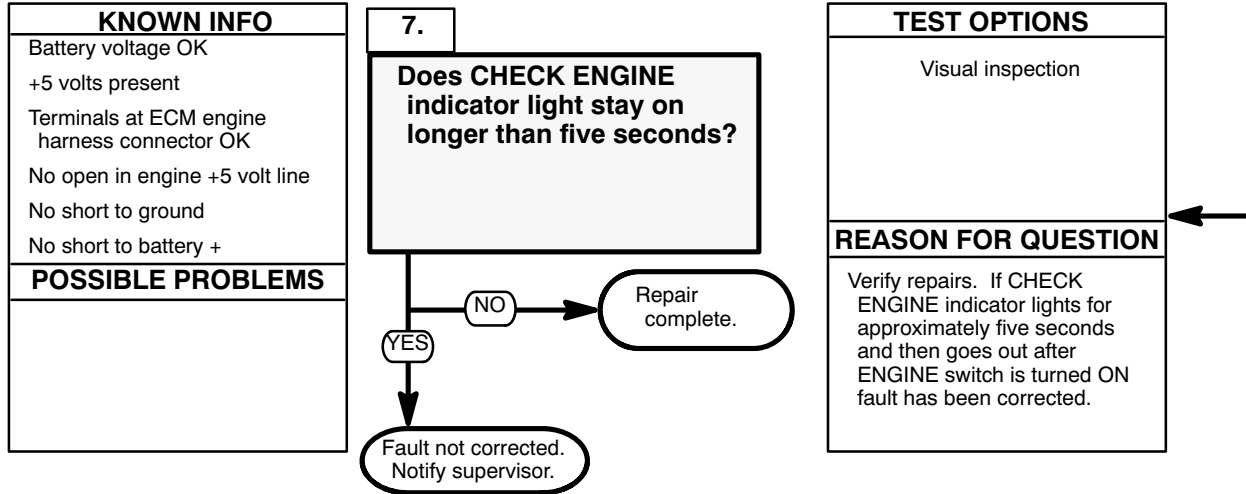
- (1) Turn ENGINE switch OFF.
- (2) Remove jumper wire.
- (3) Read resistance between sockets A and C of the sensor connector.
- (4) Read resistance between socket C of the sensor connector and a good ground.



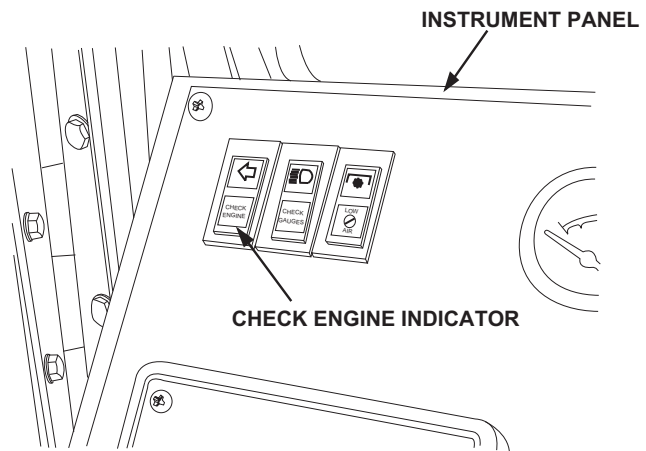
CONTINUITY TEST

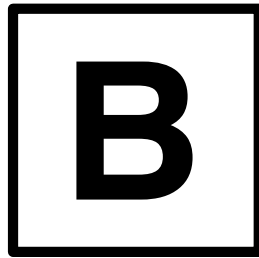
- (1) Turn ENGINE switch OFF.
- (2) Disconnect batteries (para 7-61) and disconnect all five connectors at ECM.
- (3) Read resistance between socket W1 on the engine harness connector and B3 on the vehicle harness connector.
- (4) Read resistance between socket W1 on the engine harness connector and sockets A, B, E, and F.
- (5) Connect batteries (para 7-61).

A4B CHECK ENGINE HARNESS +5 VOLT SUPPLY (CONT)

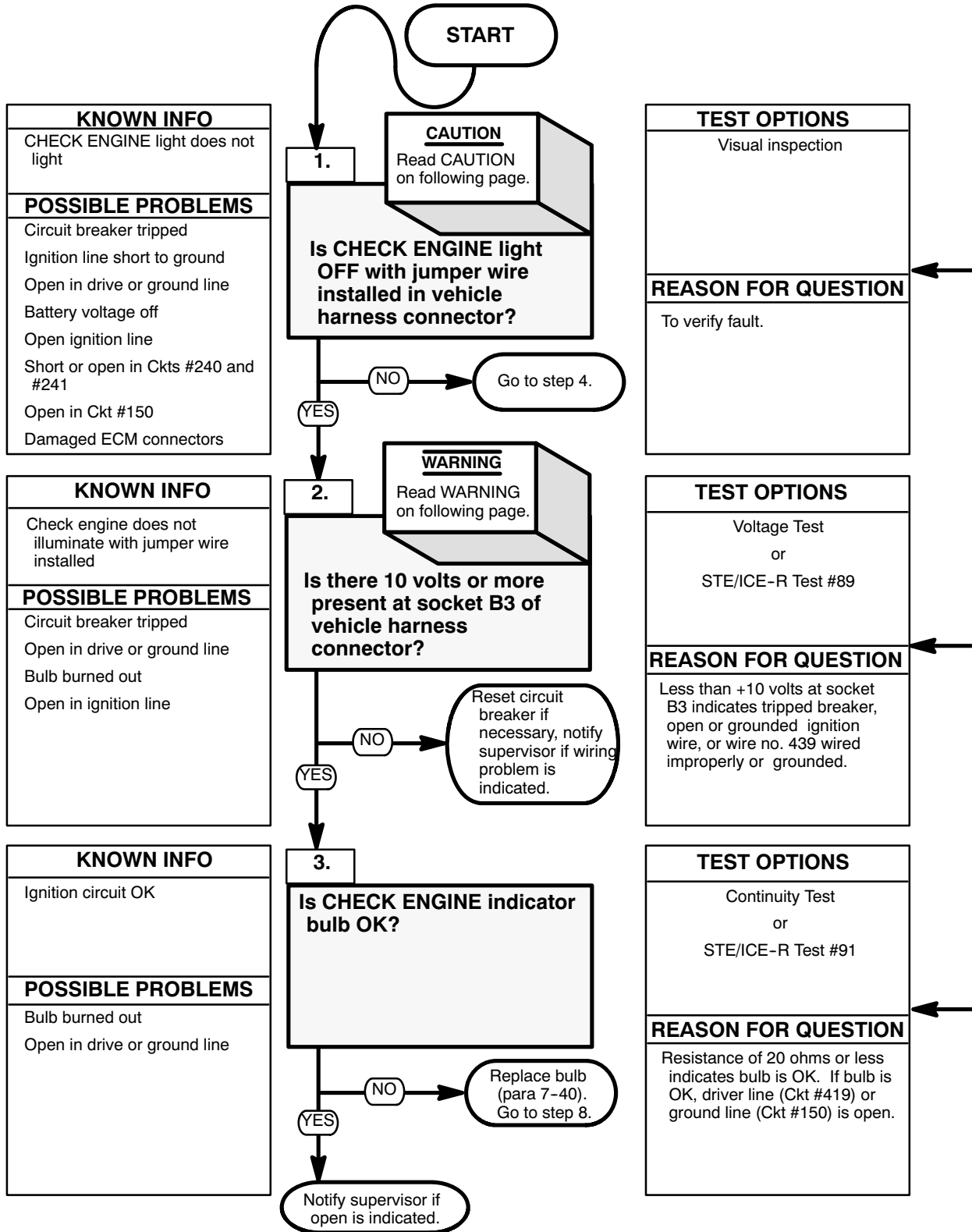


- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.





B CHECK ENGINE LIGHT IS OFF WHEN IGNITION IS TURNED ON



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

CAUTION

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

- (1) Turn ENGINE switch OFF and disconnect vehicle harness connector at ECM.
- (2) Install a jumper wire between socket B1 on vehicle harness connector and a good ground.
- (3) Turn ENGINE switch ON (engine not running).

WARNING

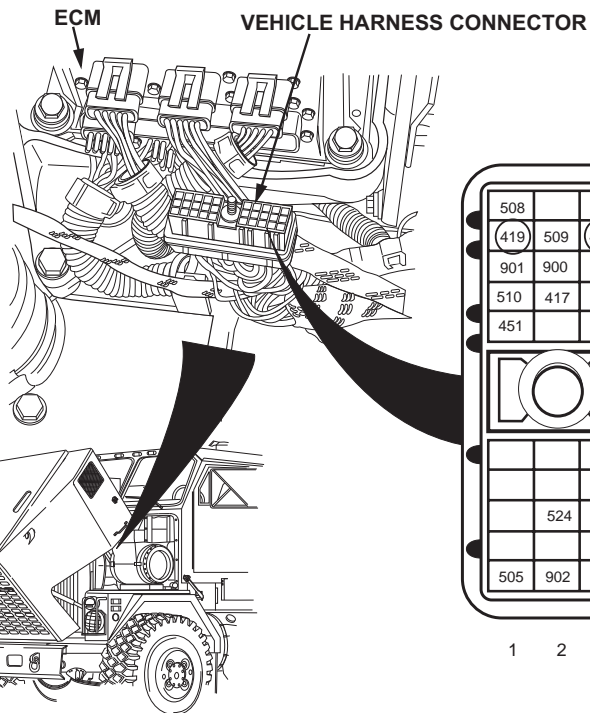
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

Check for ignition by removing jumper wire and reading voltage on vehicle harness connector, socket B3 (red lead) to a good ground (black lead) with the ignition on and engine off.

CONTINUITY TEST

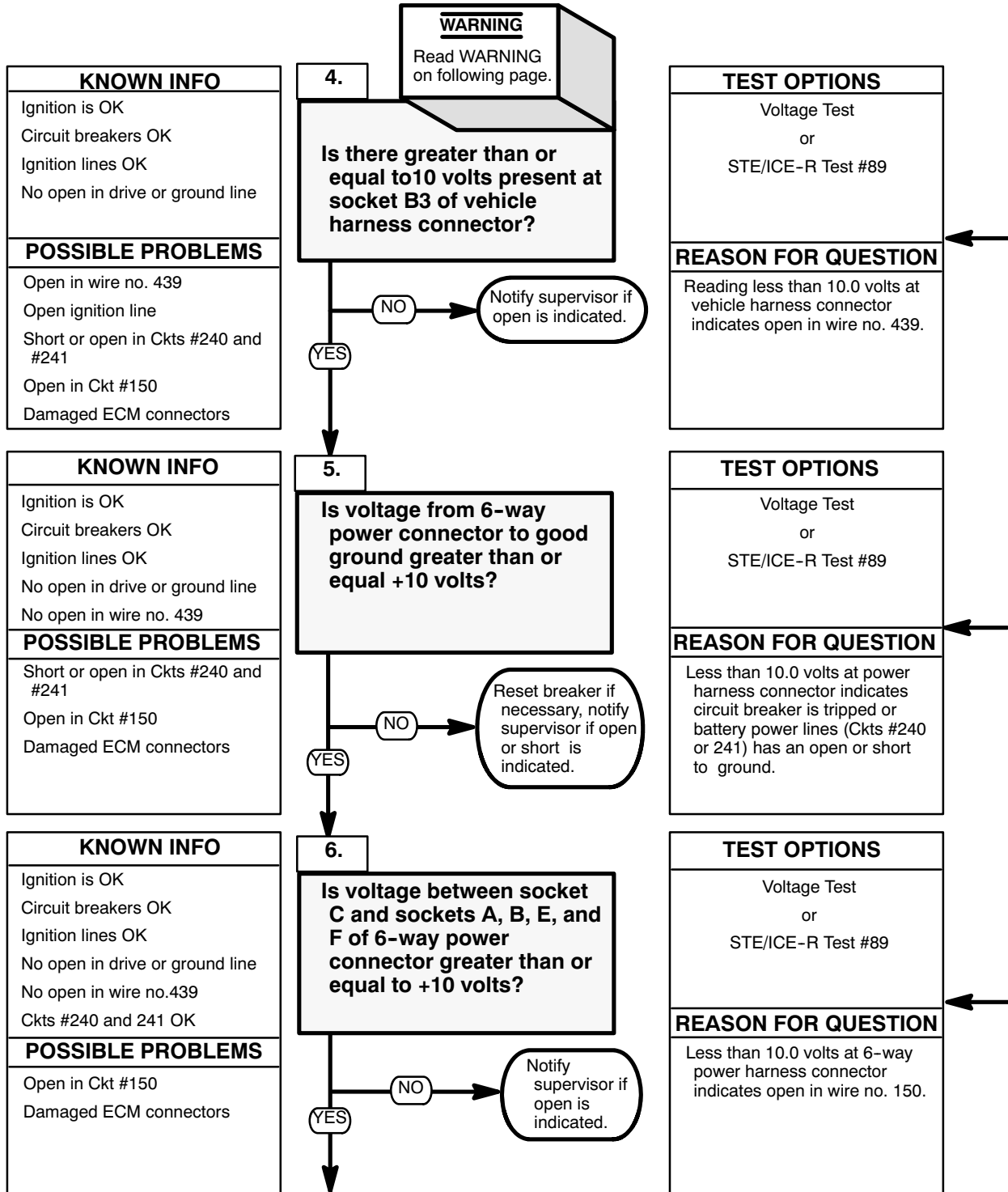
- (1) Turn ignition OFF.
- (2) Remove CHECK ENGINE light bulb (para 7-40).
- (3) Read resistance between terminals of light bulb.



A
B
C
D
E

F
G
H
J
K

B CHECK ENGINE LIGHT IS OFF WHEN IGNITION IS TURNED ON (CONT)



KNOWN INFO
Ignition is OK Circuit breakers OK Ignition lines OK No open in drive or ground line No open in wire no.439 Ckts #240 and 241 OK
POSSIBLE PROBLEMS
Open in Ckt #150 Damaged ECM connectors

6.

Is voltage between socket C and sockets A, B, E, and F of 6-way power connector greater than or equal to +10 volts?

NO → Notify supervisor if open is indicated.

YES ↓

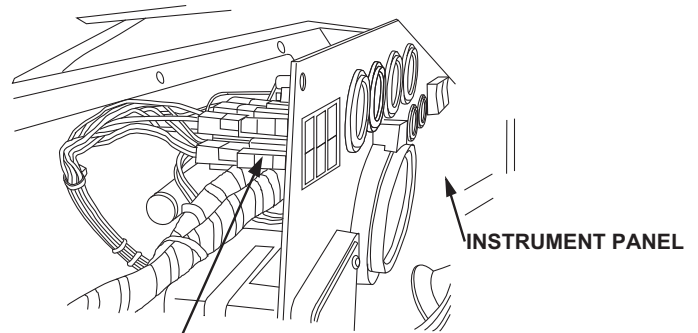
TEST OPTIONS
Voltage Test or STE/ICE-R Test #89
REASON FOR QUESTION
Less than 10.0 volts at 6-way power harness connector indicates open in wire no. 150.

WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

- (1) Remove jumper wire.
- (2) With ENGINE switch ON, read voltage on vehicle harness connector, socket B3 (red lead) to a good ground (black lead)

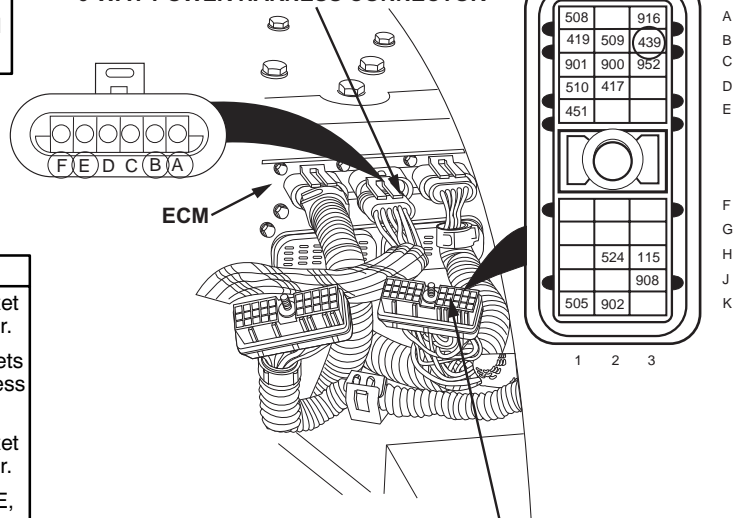


CHECK ENGINE INDICATOR BULB

VOLTAGE TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect 6-way power harness connector.
- (3) Read voltage at power harness connector socket A (red lead) to a good ground (black lead).
- (4) Read voltage at same connector keeping black lead to a good ground and red lead to sockets B, E, and F.

6-WAY POWER HARNESS CONNECTOR



ECM

VEHICLE HARNESS CONNECTOR

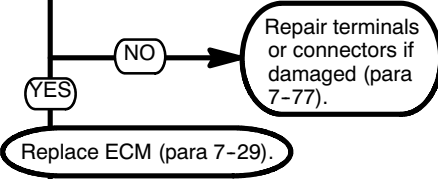
VOLTAGE TEST

- (1) Move black lead of voltmeter to socket C of 6-way power harness connector.
- (2) Read voltage using red lead at sockets A, B, E, and F of 6-way power harness connector.
- (3) Move black lead of voltmeter to socket D of 6-way power harness connector.
- (4) Again read voltage at sockets A, B, E, and F of power harness connector.

B CHECK ENGINE LIGHT IS OFF WHEN IGNITION IS TURNED ON (CONT)

KNOWN INFO
Ignition is OK
Circuit breakers OK
Ignition lines OK
No open in drive or ground line
Ckt #150 is OK
No open in wire no.439
Ckts #240 and 241 OK
POSSIBLE PROBLEMS
Damaged ECM connectors

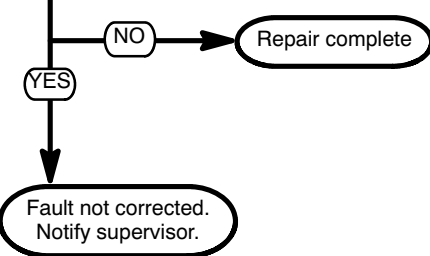
7.
Are terminals at vehicle harness (especially B3 and B1) and all terminals in 6-way power harness connectors (both ECM and harness side) OK?



TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damage to connectors could affect signal to ECM.

KNOWN INFO
Ignition is OK
Circuit breakers OK
Ignition lines OK
No open in drive or ground line
No open in wire no.439
Ckts #240 and 241 OK
Ckt #150 is OK
ECM connectors OK
POSSIBLE PROBLEMS

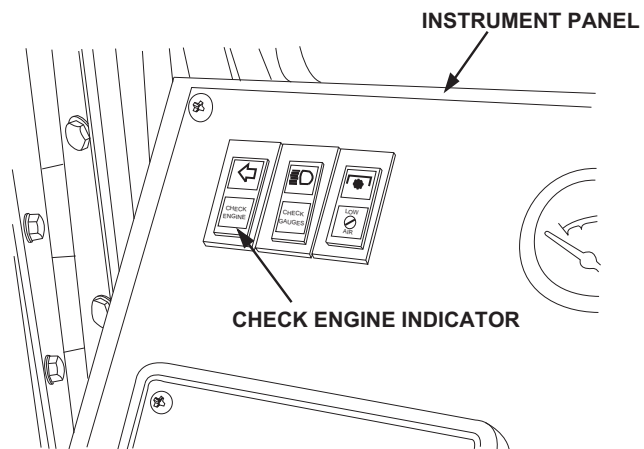
8.
Does CHECK ENGINE indicator light stay on longer than five seconds?

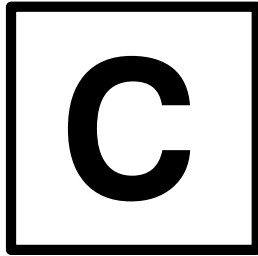


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned to ON fault has been corrected.

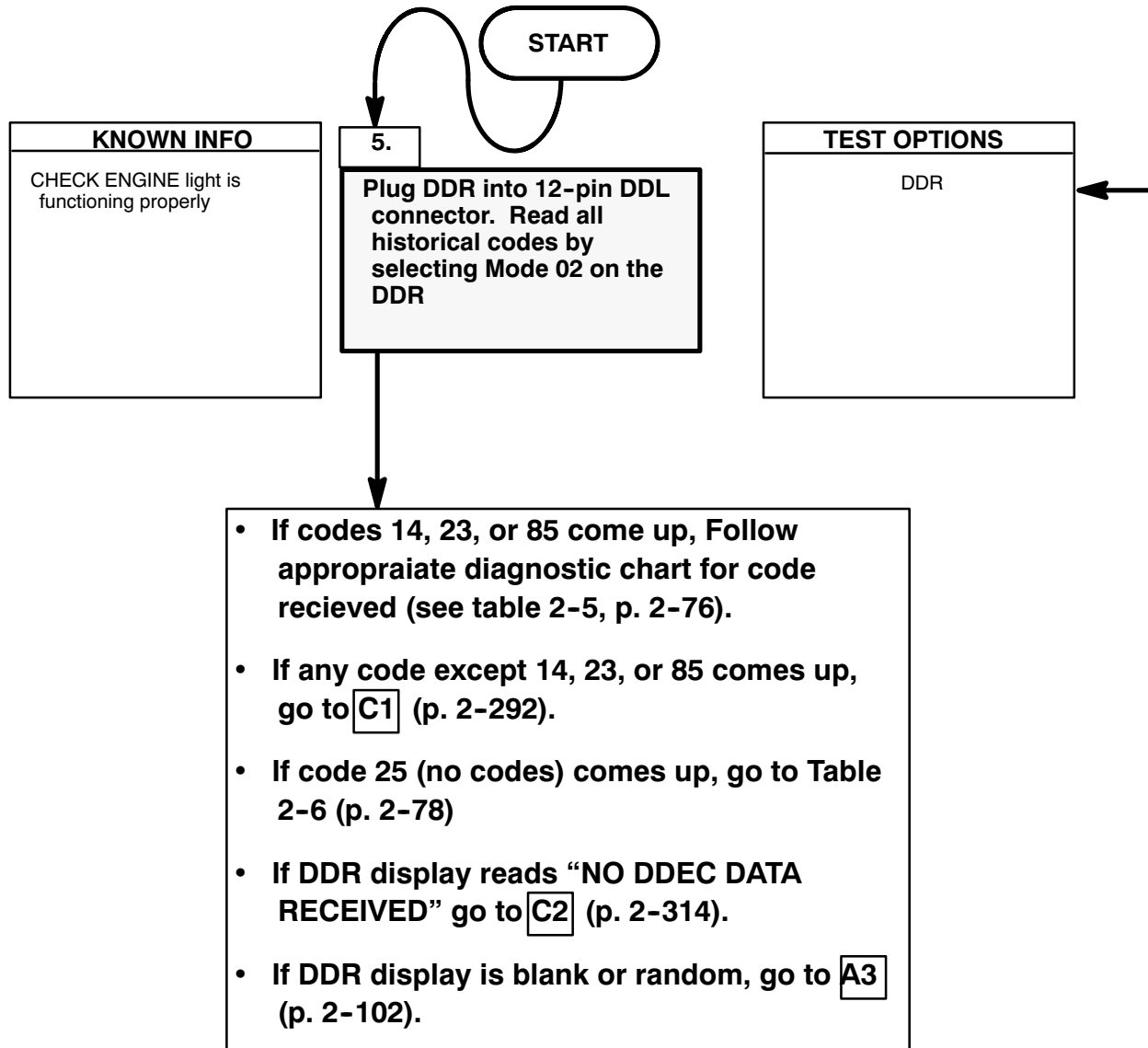
Check terminals at vehicle harness (especially B3 and B1) and all the terminals in 6-way power harness connectors (both the ECM and harness side) for damage; bent, corroded and unseated pins or sockets.

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.





C CHECK ENGINE INDICATOR COMES ON FOR UP TO 5 SECONDS AFTER IGNITION, THEN GOES OUT



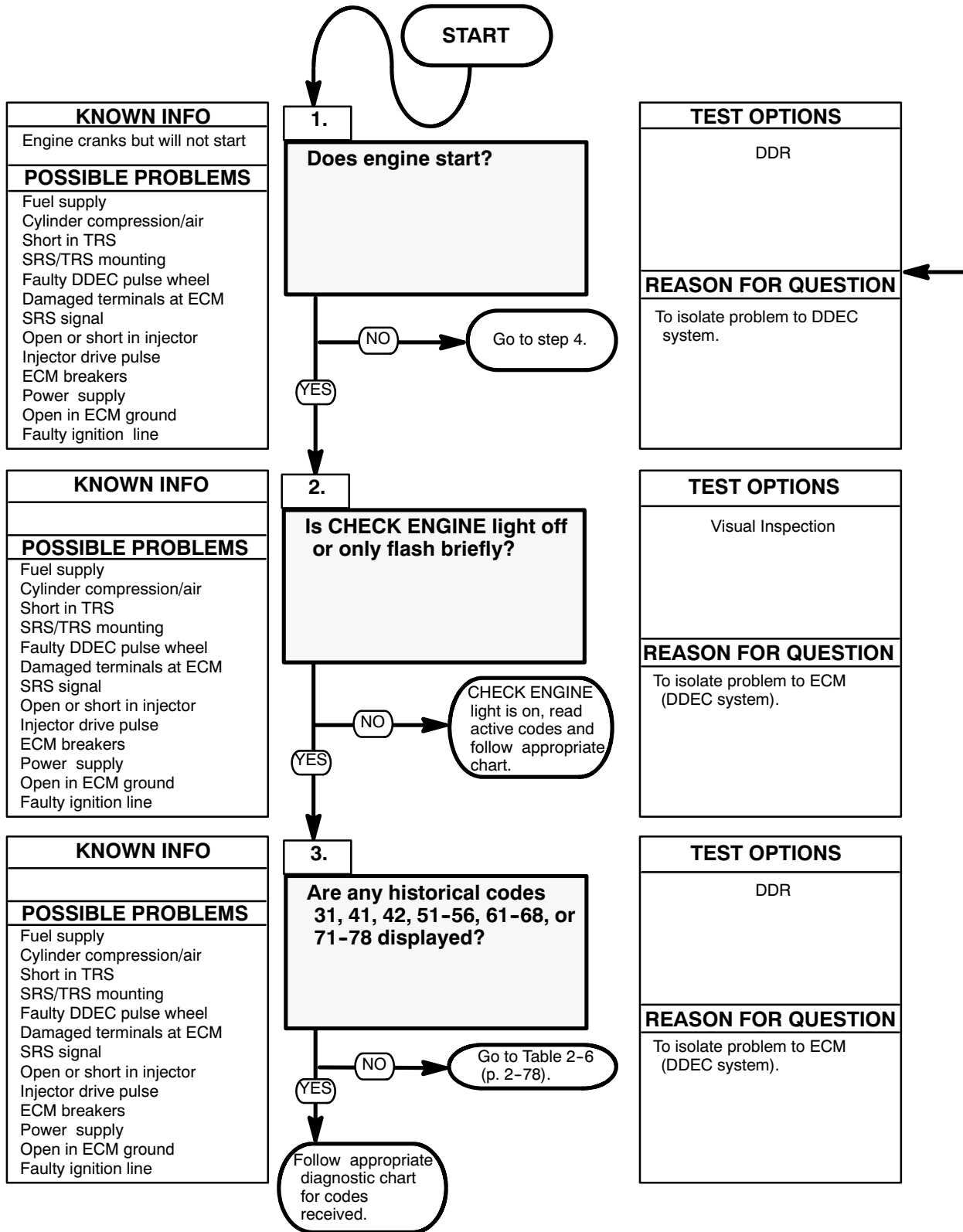
NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

NOTE

Be sure there is no jumper between pins A and M of the DDL connector.

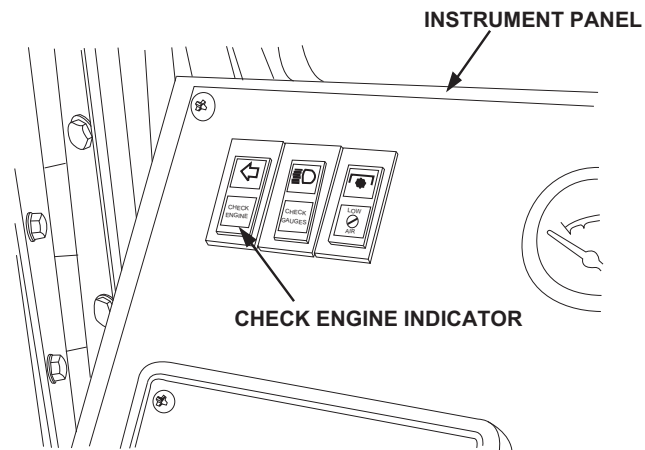
C1 - ENGINE CRANKS BUT WILL NOT START



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

- (4) Attempt to start and run engine and get CHECK ENGINE light ON by warming up engine and slowly changing RPM from idle to full throttle.
- (5) Run engine for 1 minute or until CHECK ENGINE light comes ON.

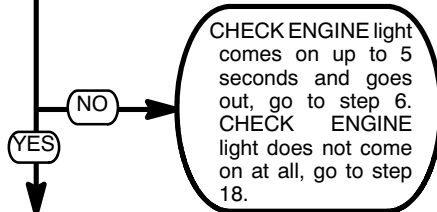


C1 - ENGINE CRANKS BUT WILL NOT START (CONT)

KNOWN INFO
POSSIBLE PROBLEMS
Fuel supply Cylinder compression/air Short in TRS SRS/TRS mounting Faulty DDEC pulse wheel Damaged terminals at ECM SRS signal Open or short in injector Injector drive pulse ECM breakers Power supply Open in ECM ground Faulty ignition line

4.

Does CHECK ENGINE light come on and stay on?

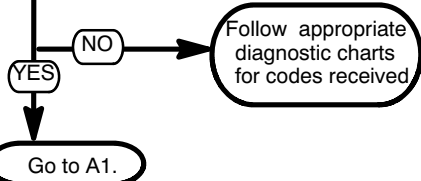


TEST OPTIONS
Visual Inspection
REASON FOR QUESTION
To isolate problem to DDEC system.

KNOWN INFO
POSSIBLE PROBLEMS
Fuel supply Cylinder compression/air Short in TRS SRS/TRS mounting Faulty DDEC pulse wheel Damaged terminals at ECM SRS signal Open or short in injector Injector drive pulse ECM breakers Power supply Open in ECM ground Faulty ignition line

5.

Does DDR read an active code 25?

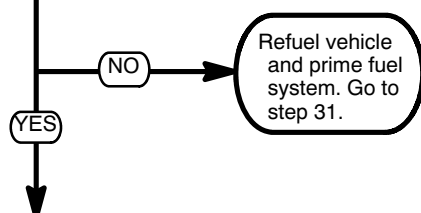


TEST OPTIONS
DDR
REASON FOR QUESTION
To isolate problem to ECM (DDEC system).

KNOWN INFO
POSSIBLE PROBLEMS
Fuel supply Cylinder compression/air Short in TRS SRS/TRS mounting Faulty DDEC pulse wheel Damaged terminals at ECM SRS signal Open or short in injector Injector drive pulse ECM breakers Power supply Open in ECM ground Faulty ignition line

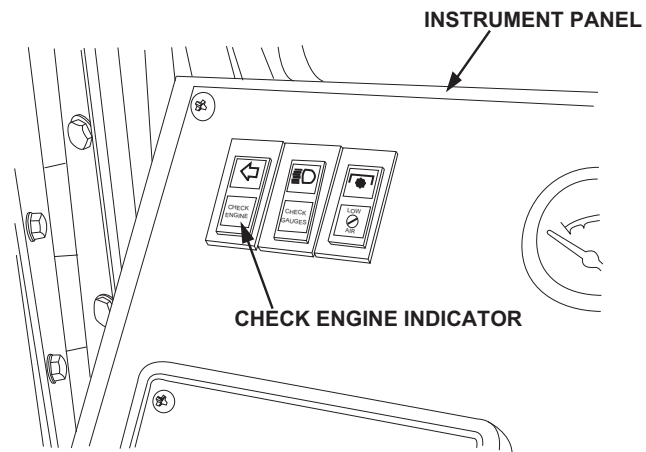
6.

Is fuel supply adequate?

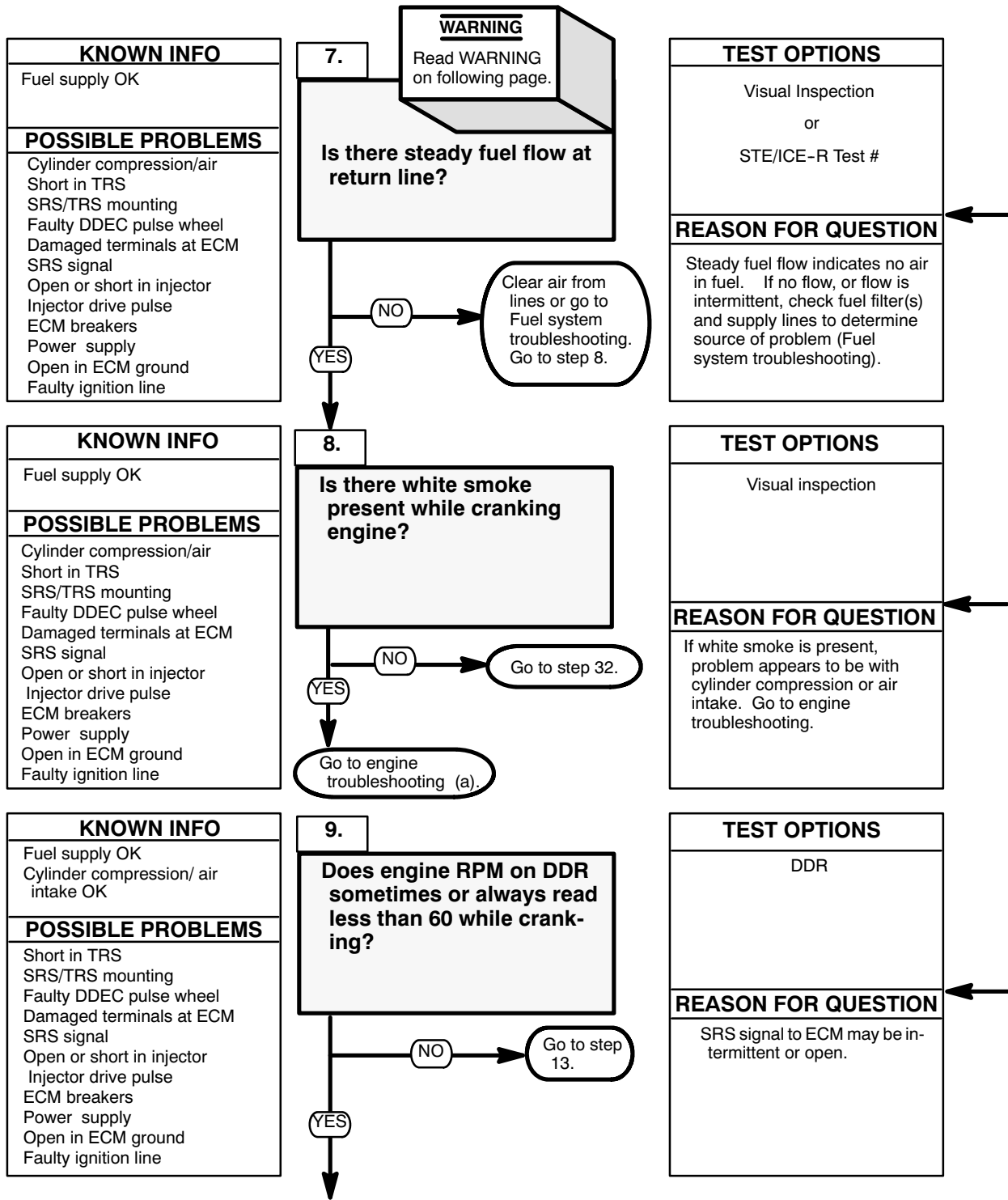


TEST OPTIONS
Visual Inspection
REASON FOR QUESTION
Fuel level suspect.

- (1) Turn Engine switch to ON position.
- (2) Observe CHECK ENGINE light.



C1 - ENGINE CRANKS BUT WILL NOT START (CONT)

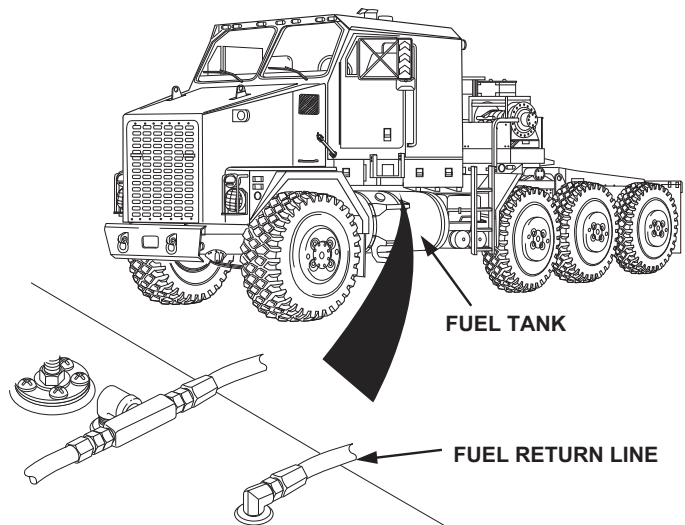


WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death, keep fuel away from open fire and keep fire extinguisher within easy reach when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. When working with fuel, post signs that read **NO SMOKING WITHIN 50 FEET OF VEHICLE.**

- (1) Remove fuel return line from left fuel tank.
- (2) Direct fuel into a suitable container.
- (3) Observe fuel flow out of line while cranking.
- (4) Reconnect fuel line.

Check for white smoke from exhaust while cranking the engine.



NOTE

Battery voltage surges while cranking with electric starters may blank out or reset DDR.

- (1) Check TRS status via RPM read-out.
- (2) Select ENGINE RPM on DDR.
- (3) Crank engine while observing DDR display.

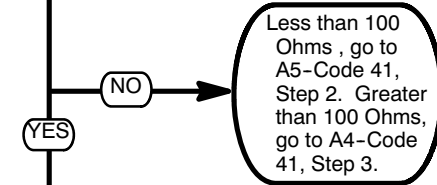
C1 - ENGINE CRANKS BUT WILL NOT START (CONT)

KNOWN INFO
Fuel supply OK Cylinder compression/ air intake OK
POSSIBLE PROBLEMS
Short in TRS SRS/TRS mounting Faulty DDEC pulse wheel Damaged terminals at ECM SRS signal Open or short in injector Injector drive pulse ECM breakers Power supply Open in ECM ground Faulty ignition line

10.

Is there between 100-200 ohms between sockets T1 and T2 at engine harness connector?

TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
TRRS fault is suspect. Resistance less than 100 ohms indicates short between circuit #110 and #109 or elsewhere. Resistance greater than 200 ohms indicates open in circuit #110.

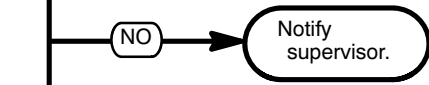


KNOWN INFO
Fuel supply OK Cylinder compression/ air intake OK No short in TRS SRS/TRS mounting OK
POSSIBLE PROBLEMS
Faulty DDEC pulse wheel Damaged terminals at ECM SRS signal Open or short in injector Injector drive pulse ECM breakers Power supply Open in ECM ground Faulty ignition line

11.

Are SRS/TRS gap and pulse wheel OK?

TEST OPTIONS
Visual Inspection
REASON FOR QUESTION
Pulse wheel damage is suspect.

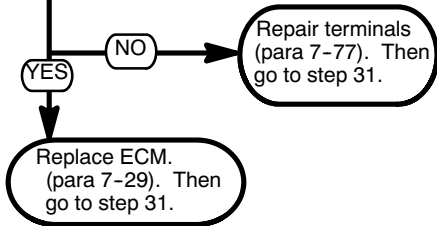


KNOWN INFO
Fuel supply OK Cylinder compression/ air intake OK No short in TRS SRS/TRS mounting OK DDEC pulse wheel OK
POSSIBLE PROBLEMS
Damaged terminals at ECM SRS signal Open or short in injector Injector drive pulse ECM breakers Power supply Open in ECM ground Faulty ignition line

12.

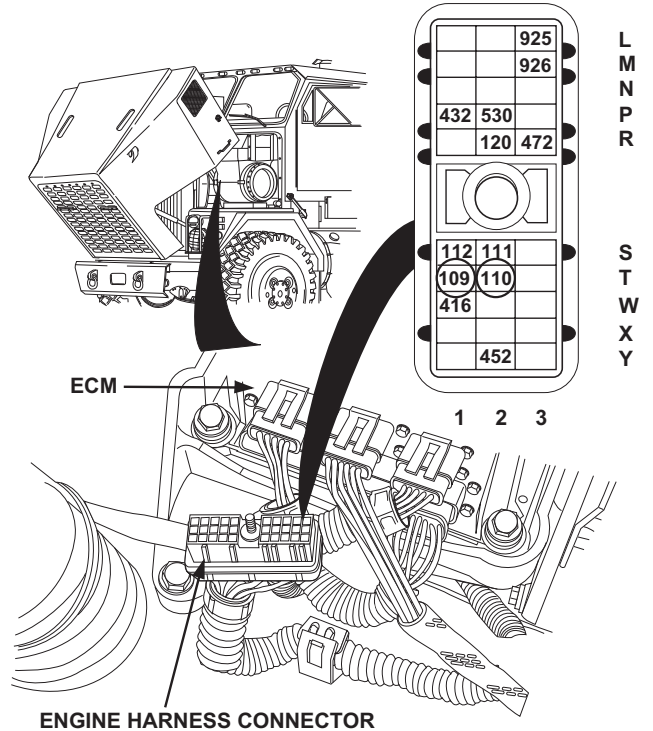
Are terminals at ECM connectors OK?

TEST OPTIONS
Visual Inspection
REASON FOR QUESTION
Damaged terminals are suspect.

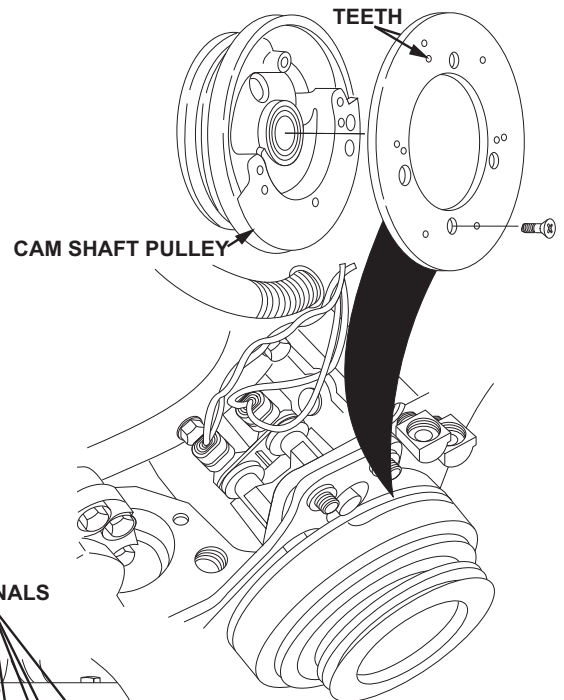


CONTINUITY TEST

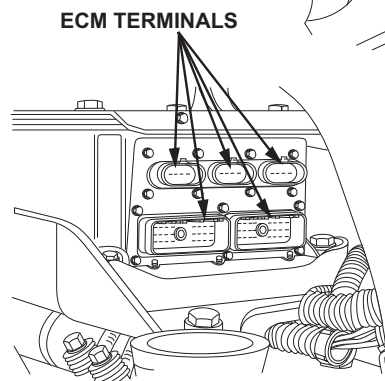
- (1) Turn ENGINE switch OFF.
- (2) Disconnect engine harness at ECM connector.
- (3) Read resistance between sockets T1 and T1 engine harness connector.



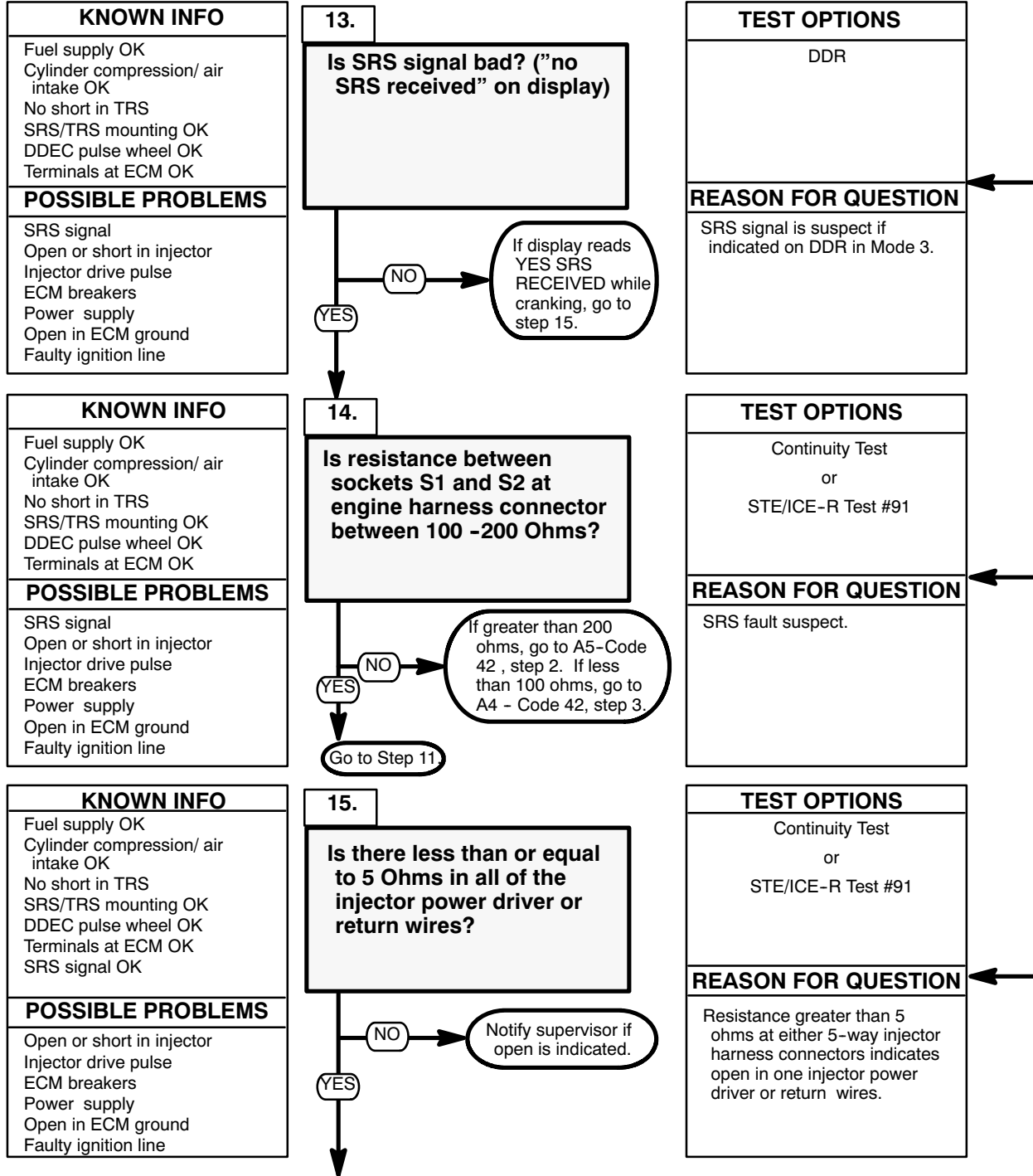
Inspect DDEC pulse wheel for tightness, as well as for chipped or missing teeth.



- (1) Disconnect all connectors at ECM.
- (2) Check terminals at all ECM connectors (both the ECM and harness side) for damaged, bent, corroded and unseated pins or sockets.

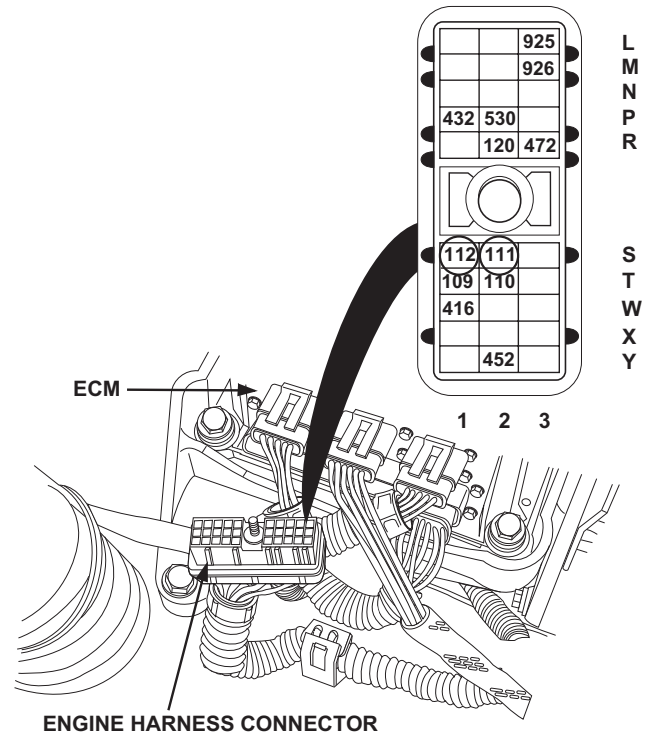


C1 - ENGINE CRANKS BUT WILL NOT START (CONT)



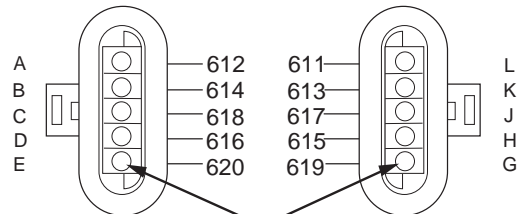
NOTE
 Battery voltage surges while cranking may blank out or reset DDR.

- (1) Check for proper SRS signal.
- (2) Select MISC STATUS on DDR (MODE 31).
- (3) Crank engine while observing DDR display of "SRS RECEIVED".



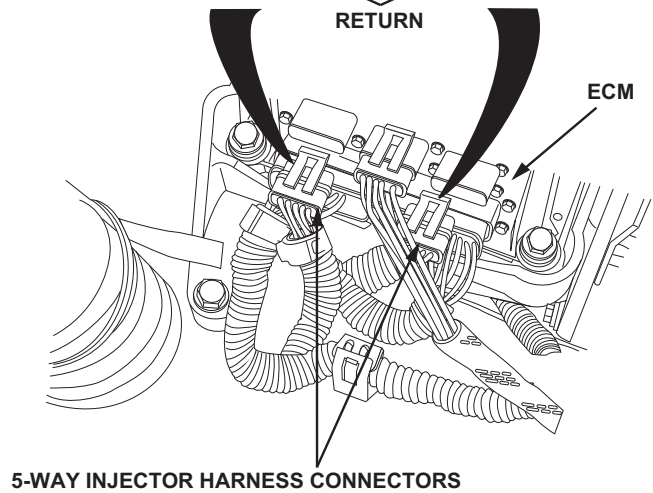
CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect engine harness connector at ECM.
- (3) Read resistance between sockets S1 and S2 at engine harness connector.

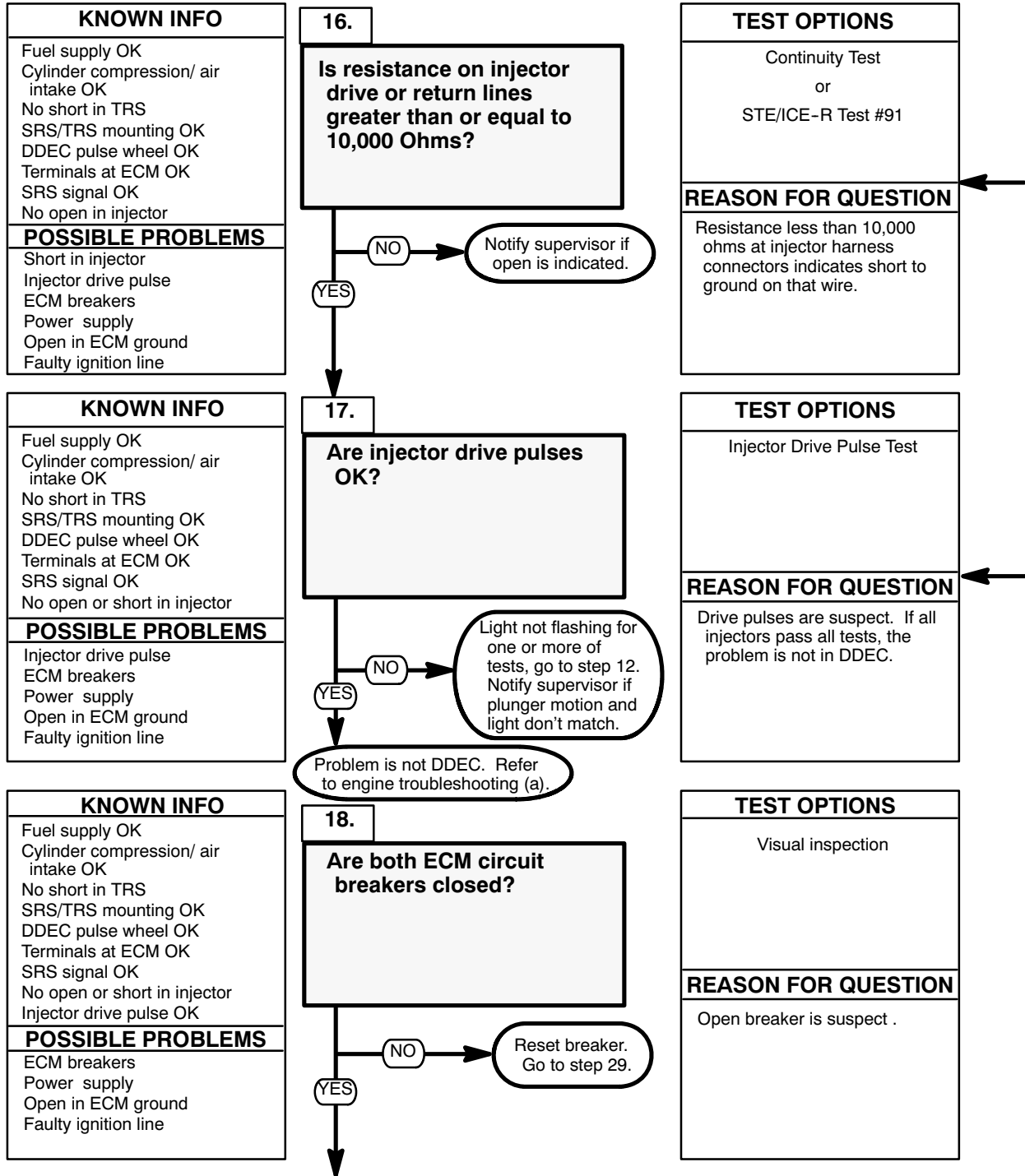


CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect both 5-way injector harnesses at ECM connector.
- (3) Read resistance between injector return pin and all the power driver pins on both harness connectors. (example: G-L, and E-A)

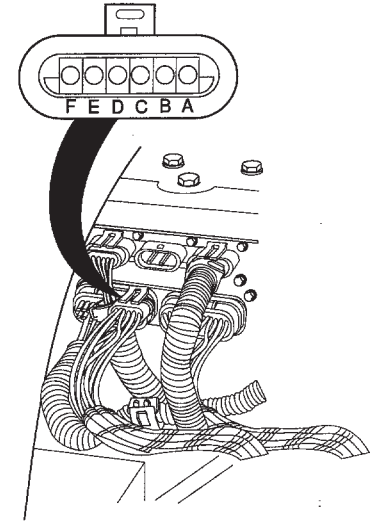


C1 - ENGINE CRANKS BUT WILL NOT START (CONT)



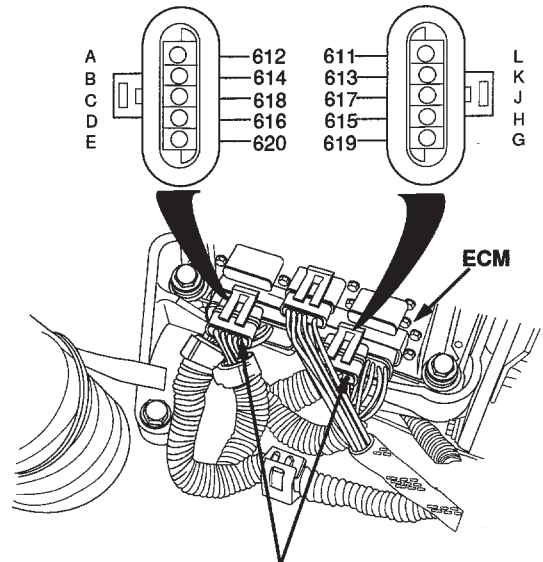
CONTINUITY TEST

- (1) Disconnect 6-way power harness connector at ECM.
- (2) Read resistance between socket C of 6-way power harness connector to sockets A, B, C, D, E, G, H, J, K, and L on injector harness connectors.

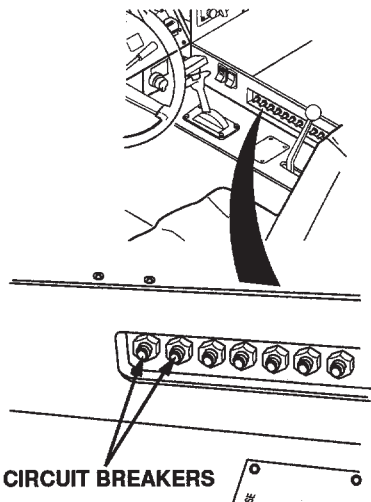


INJECTOR DRIVE PULSE TEST

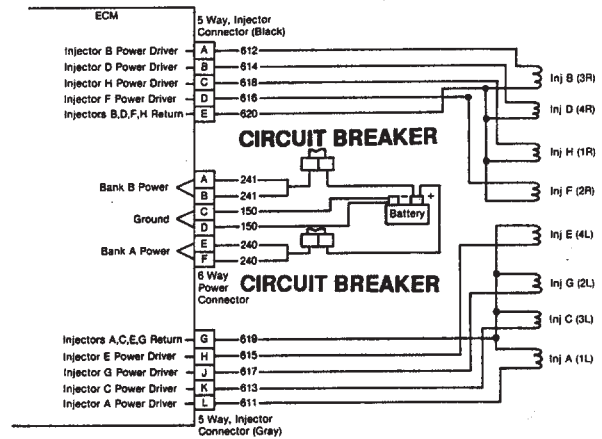
- (1) Turn ENGINE switch OFF.
- (2) Reconnect all ECM connectors.
- (3) Remove rocker arm cover(s) (para 3-2).
- (4) Disconnect return wire one injector (return wire #619 or #620).
- (5) Place a 6-volt test light across injector return side (where wire was just removed) and a good ground.
- (6) Crank engine and note both test light and whether start of plunger motion coincides with light.
- (7) Reconnect return wire.
- (8) Repeat steps 2 through 8 with all other injectors until all have been tested or until one test fails. If light and start of plunger motion do not coincide, a mechanical timing adjustment may be required (see engine maintenance).



5-WAY INJECTOR HARNESS CONNECTORS

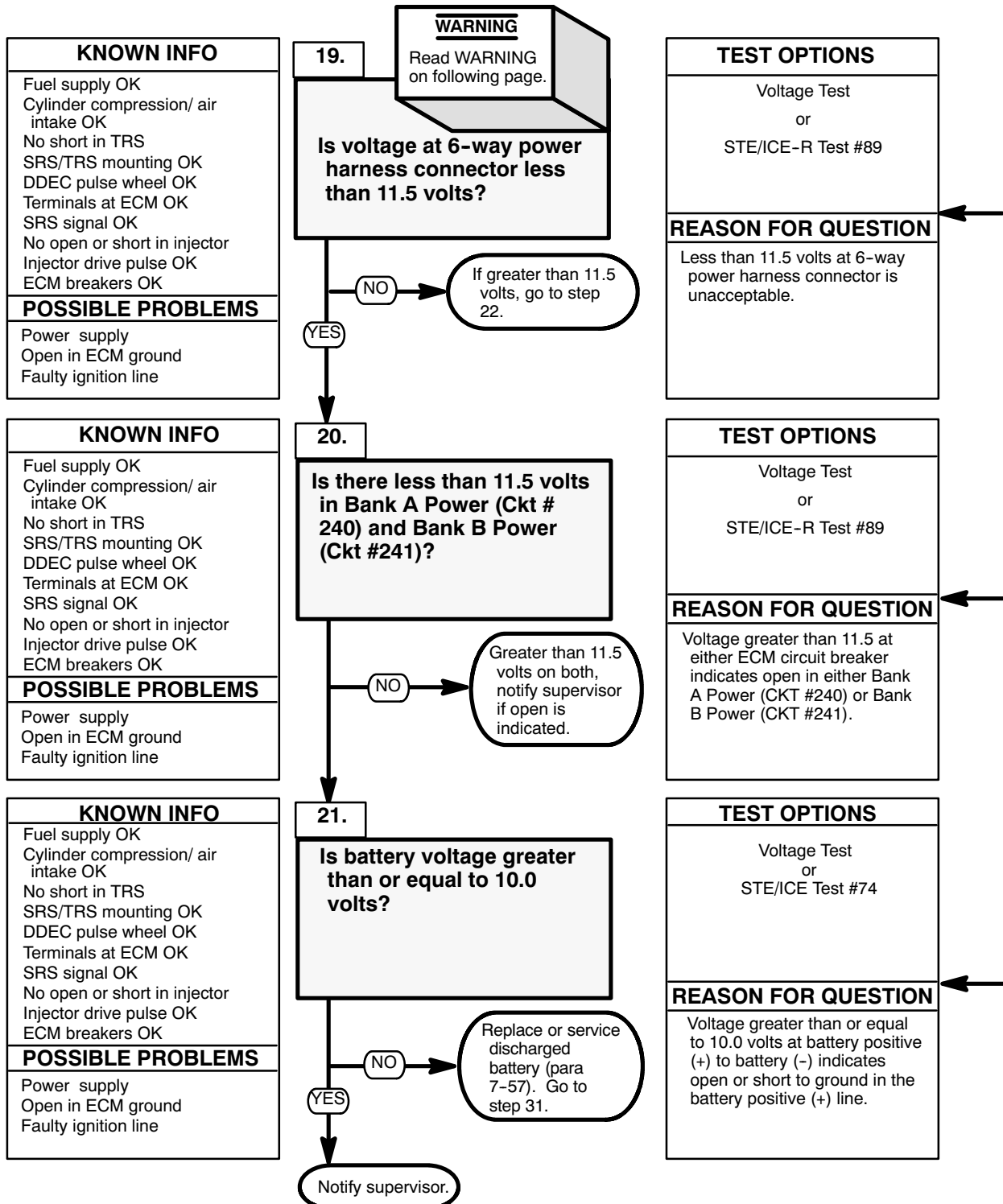


DDEC CIRCUIT BREAKERS



ECM POWER AND INJECTOR CIRCUITS

C1 - ENGINE CRANKS BUT WILL NOT START (CONT)

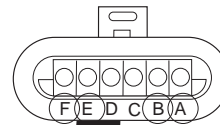


WARNING

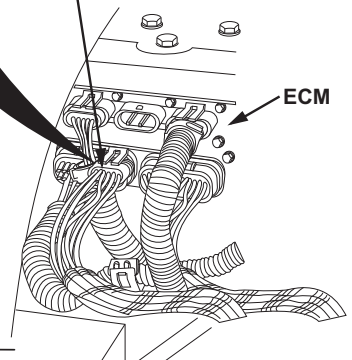
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

- (1) Check for 12 volts at 6-way, power harness connector.
- (2) Turn ENGINE switch OFF.
- (3) Disconnect 6-way power harness connector.
- (4) Read voltage from socket A and B (red lead) of 6-way power harness connector to a good ground (black lead).
- (5) Also read voltage from socket E and F (red lead) to a good ground (black lead).



6-WAY POWER HARNESS CONNECTOR



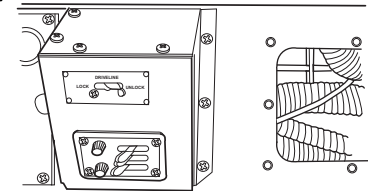
ECM

VOLTAGE TEST

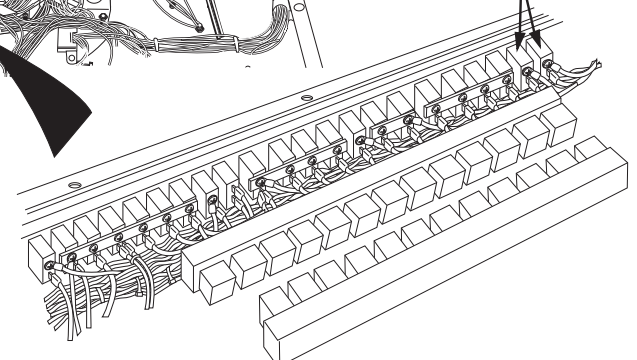
NOTE

The battery side does not contain the #240 or #241 wires.

- (1) Read voltage between battery side of one ECM circuit breaker (red lead) and a good ground (black lead).
- (2) Read voltage reading at other ECM circuit breaker.



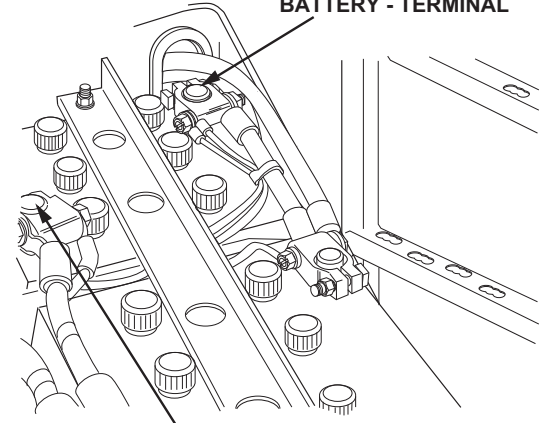
ECM CIRCUIT BREAKERS



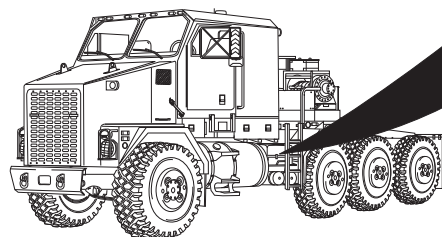
VOLTAGE TEST

- (1) Connect all connectors.
- (2) Turn ENGINE switch ON.
- (3) Try to start engine.
- (4) Read voltage at battery + terminal (red lead) to battery - terminal (black lead).

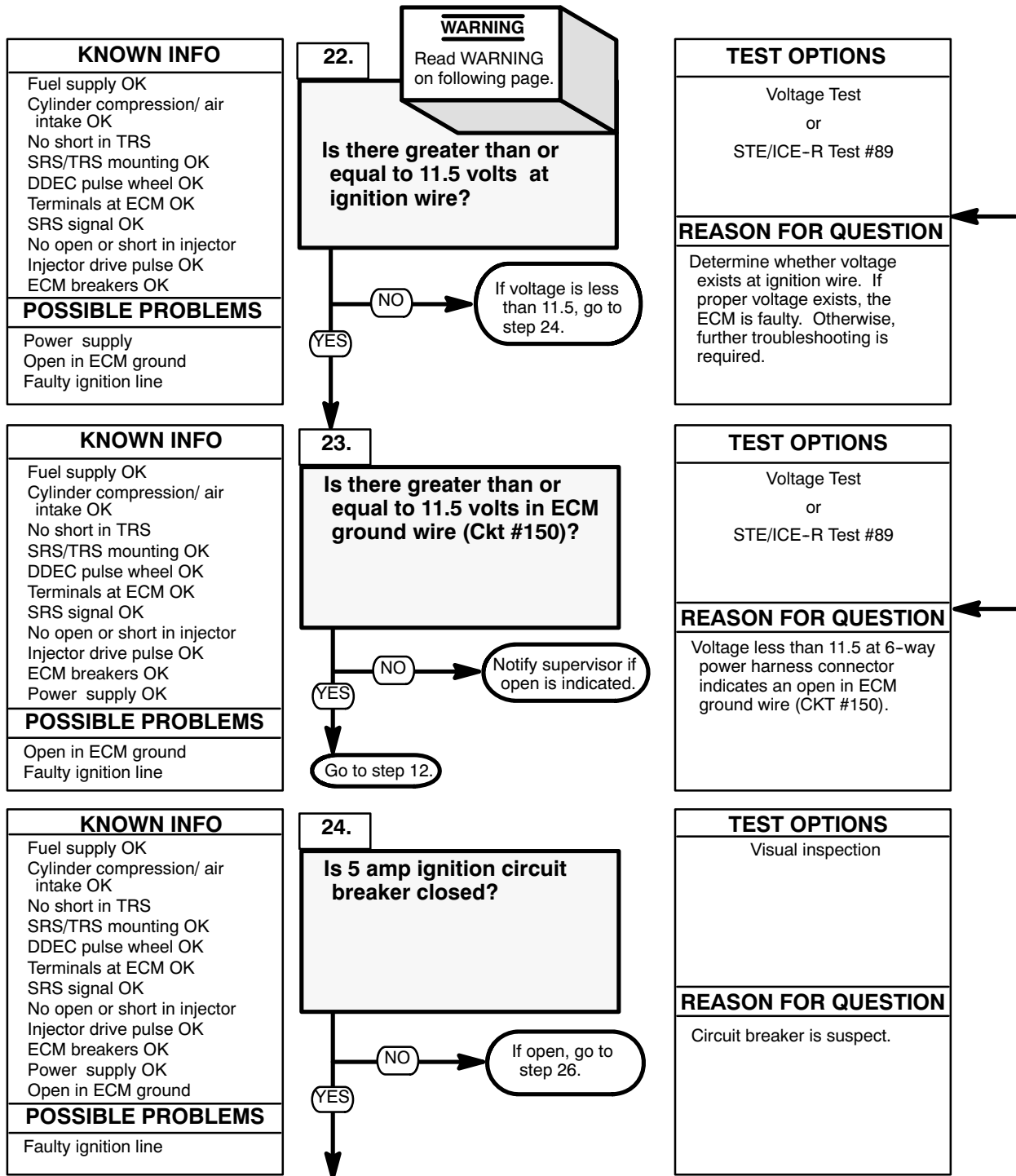
BATTERY - TERMINAL



BATTERY + TERMINAL



C1 - ENGINE CRANKS BUT WILL NOT START (CONT)



WARNING

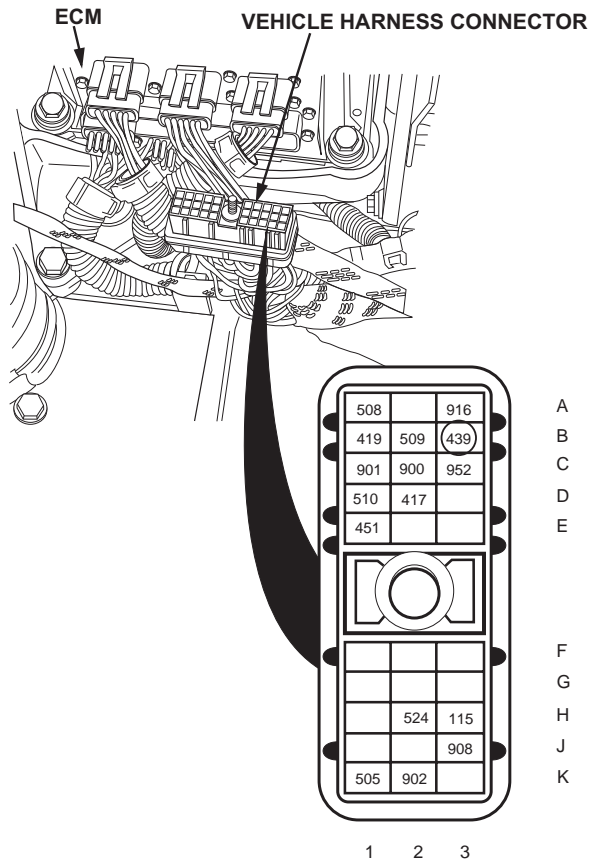
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

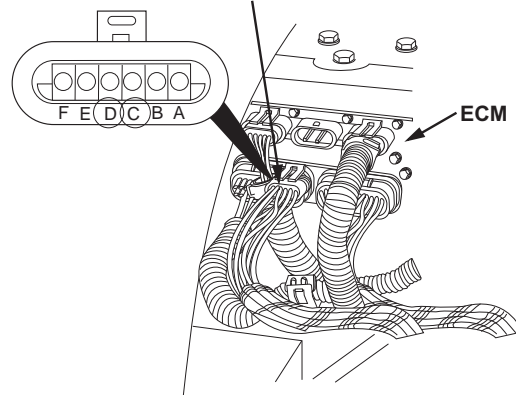
- (1) Turn ENGINE switch OFF.
- (2) Disconnect vehicle harness connector at ECM.
- (3) Turn ENGINE switch ON.
- (4) Read voltage between socket B3 on vehicle harness connector (red lead) and a good ground (black lead).

VOLTAGE TEST

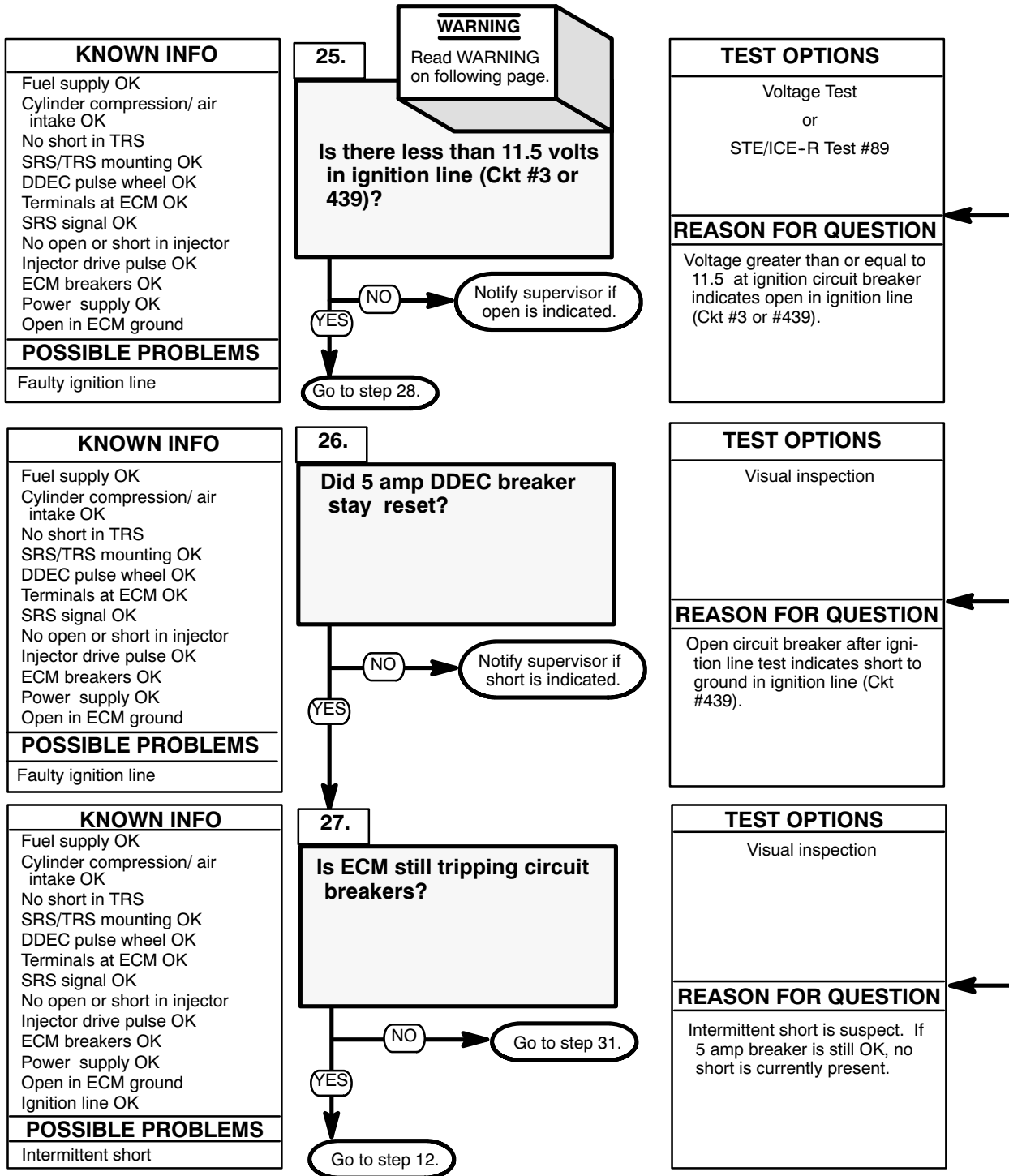
- (1) Read voltage between socket B3 on vehicle harness connector (red lead) and socket C and D on 6-way, power harness connector (black lead).



6-WAY POWER HARNESS CONNECTOR



C1 - ENGINE CRANKS BUT WILL NOT START (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

Read voltage between battery side (hot side) of the 5 amp ignition circuit breaker (red lead) and a good ground (black lead).

- (1) Reset open circuit breaker.
- (2) Turn ignition on for at least 10 seconds. Turn ignition off.
- (3) Check 5 amp ignition circuit breaker again.

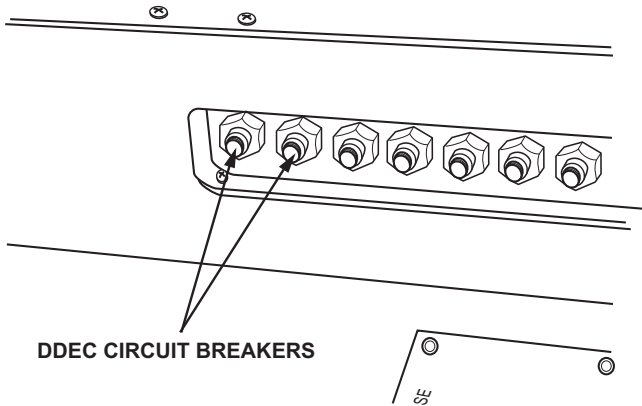
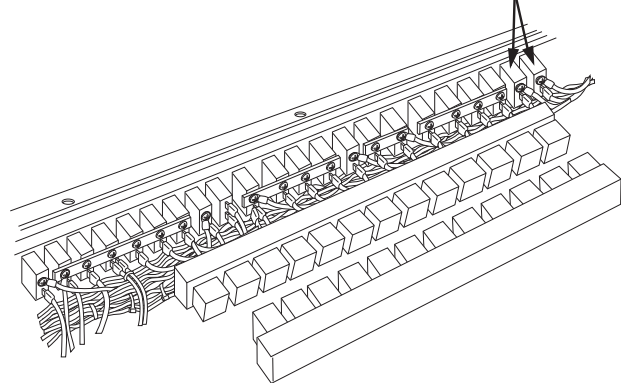
CONTINUITY TEST

NOTE

With an intermittent short, the engine will shut down again. Also note that the circuit breaker may have opened due to temporary reverse voltage at battery.

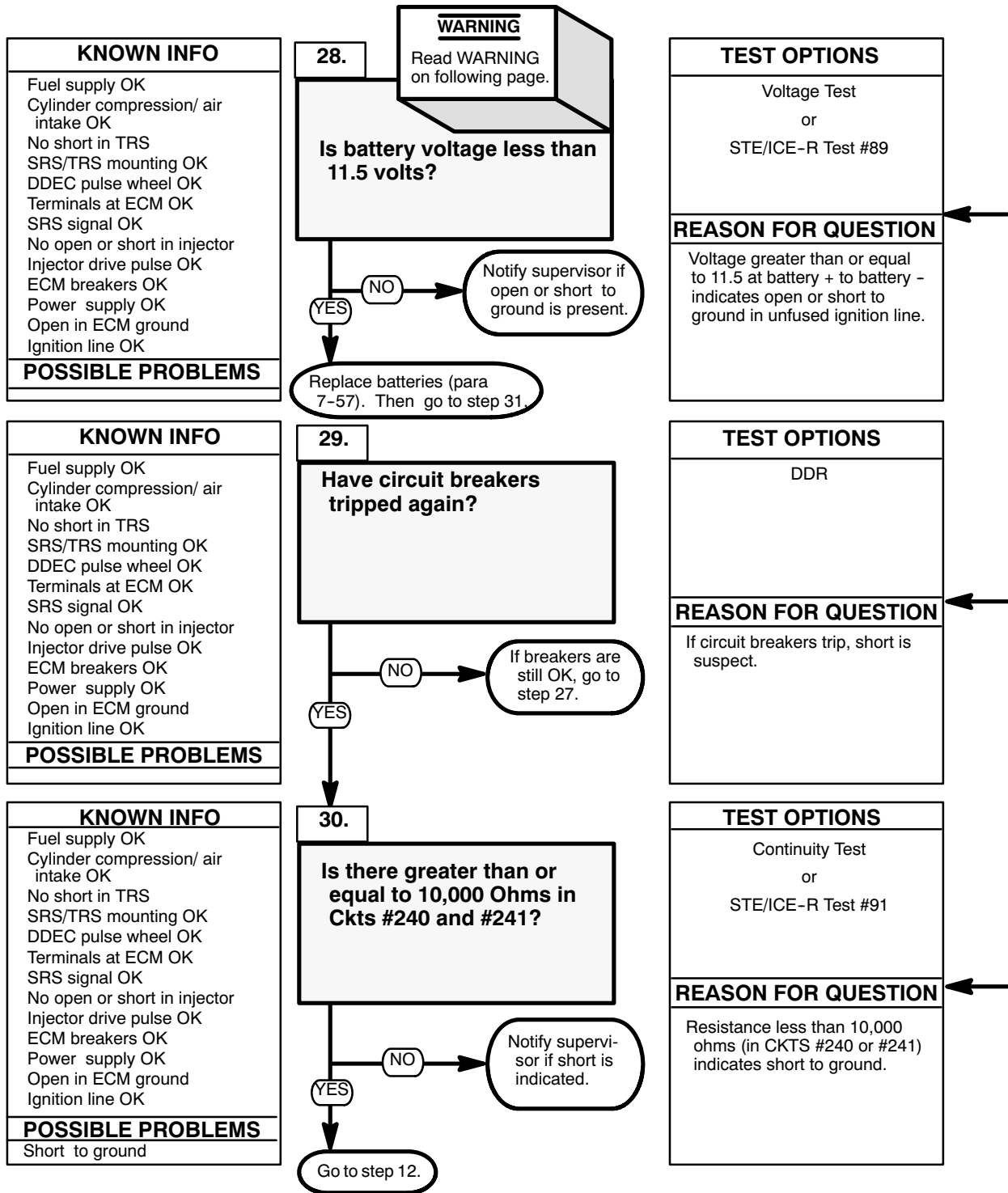
- (1) Reconnect all harness connectors at ECM.
- (2) Attempt to start engine. If engine starts, run engine for at least one minute.
- (3) Turn ENGINE switch OFF.
- (4) Check 5 amp ignition circuit breaker.

DDEC IGNITION CIRCUIT BREAKERS



DDEC CIRCUIT BREAKERS

C1 - ENGINE CRANKS BUT WILL NOT START (CONT)



WARNING

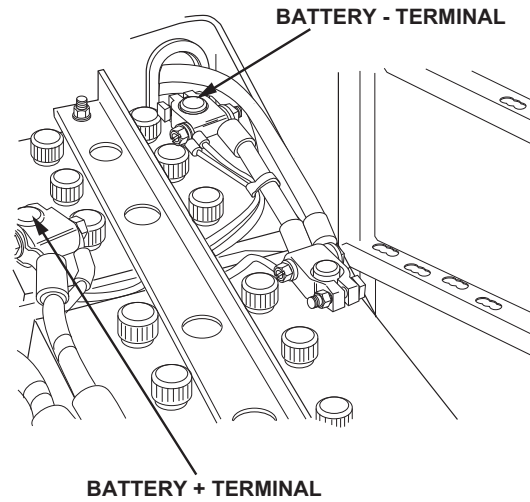
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

VOLTAGE TEST

NOTE

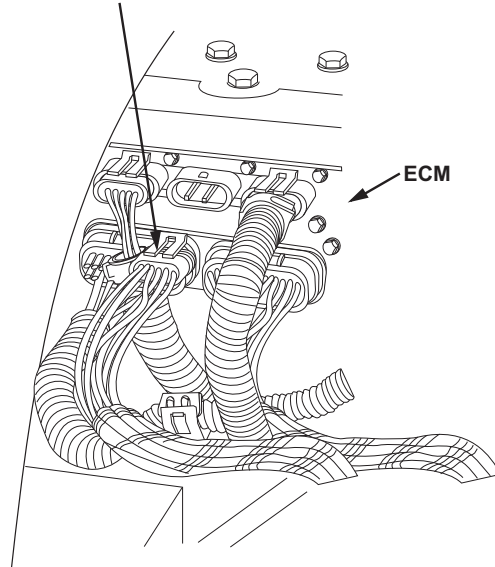
If a short to ground exists anywhere in a battery + circuit, vehicle will shut down again if not repaired.

- (1) Disconnect battery cables at 12-volt battery.
- (2) Read voltage at the battery + terminal (red lead) to battery - terminal (black lead). If voltage is less than 11.5, service discharged battery.



- (1) Turn ENGINE switch OFF.
- (2) Disconnect 6-way power harness connector at ECM.
- (3) Reset circuit breaker(s).
- (4) Wait 10 seconds. Check if circuit breaker(s) have tripped or opened again.

6-WAY POWER HARNESS CONNECTOR

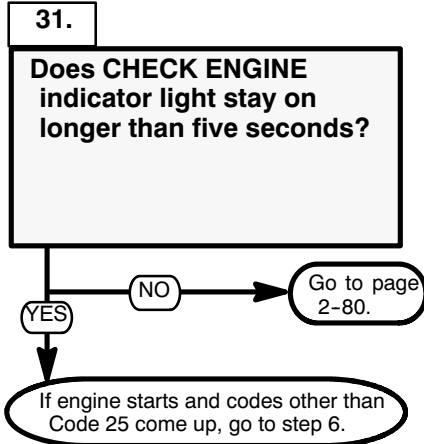


CONTINUITY TEST

- (1) Read resistance between Bank B power (circuit #240) and a good ground.
- (2) Read resistance between Bank A power (circuit #241) and a good ground.

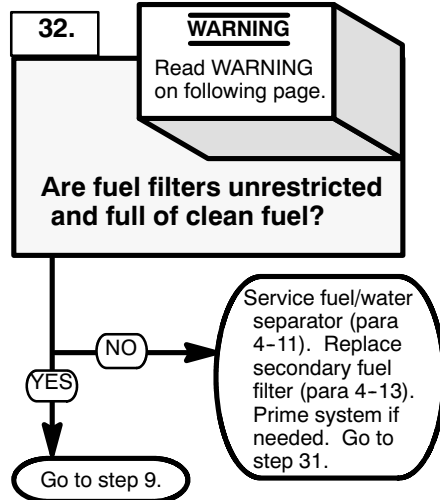
C1 - ENGINE CRANKS BUT WILL NOT START (CONT)

KNOWN INFO
Fuel supply OK Cylinder compression/ air intake OK No short in TRS SRS/TRS mounting OK DDEC pulse wheel OK Terminals at ECM OK SRS signal OK No open or short in injector Injector drive pulse OK ECM breakers OK Power supply OK Open in ECM ground Ignition line OK
POSSIBLE PROBLEMS



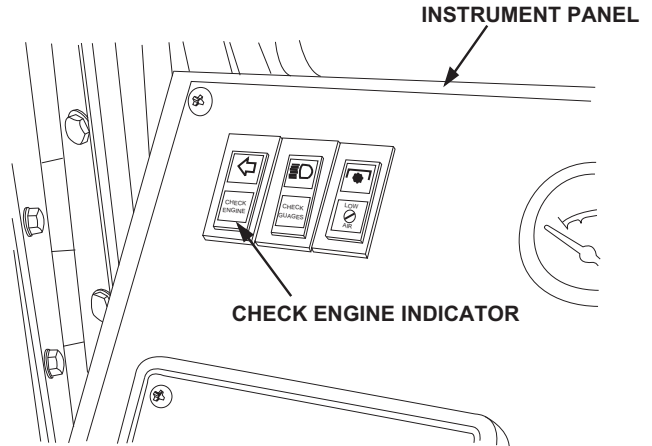
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned to ON fault has been corrected.

KNOWN INFO
Fuel supply OK Cylinder compression/ air intake OK No short in TRS SRS/TRS mounting OK DDEC pulse wheel OK Terminals at ECM OK SRS signal OK No open or short in injector Injector drive pulse OK ECM breakers OK Power supply OK Open in ECM ground Ignition line OK
POSSIBLE PROBLEMS
Fuel filters clogged



TEST OPTIONS
Visual inspection
or
STE/ICE Test #26
REASON FOR QUESTION
Contaminated fuel/water separator or secondary fuel filter will restrict fuel to engine.

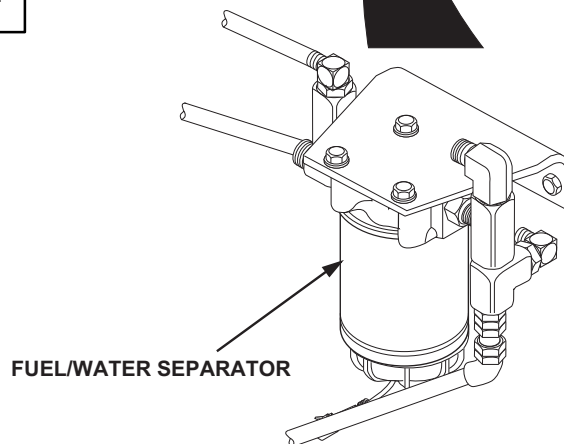
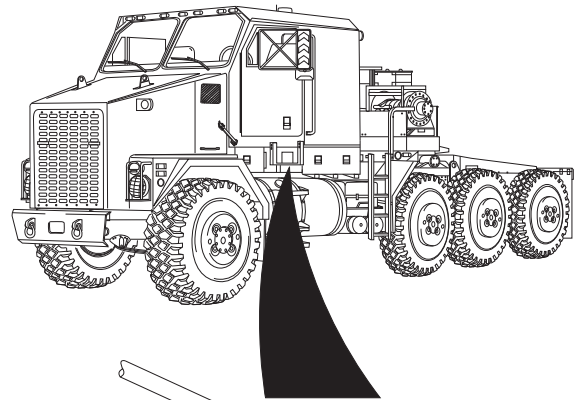
- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



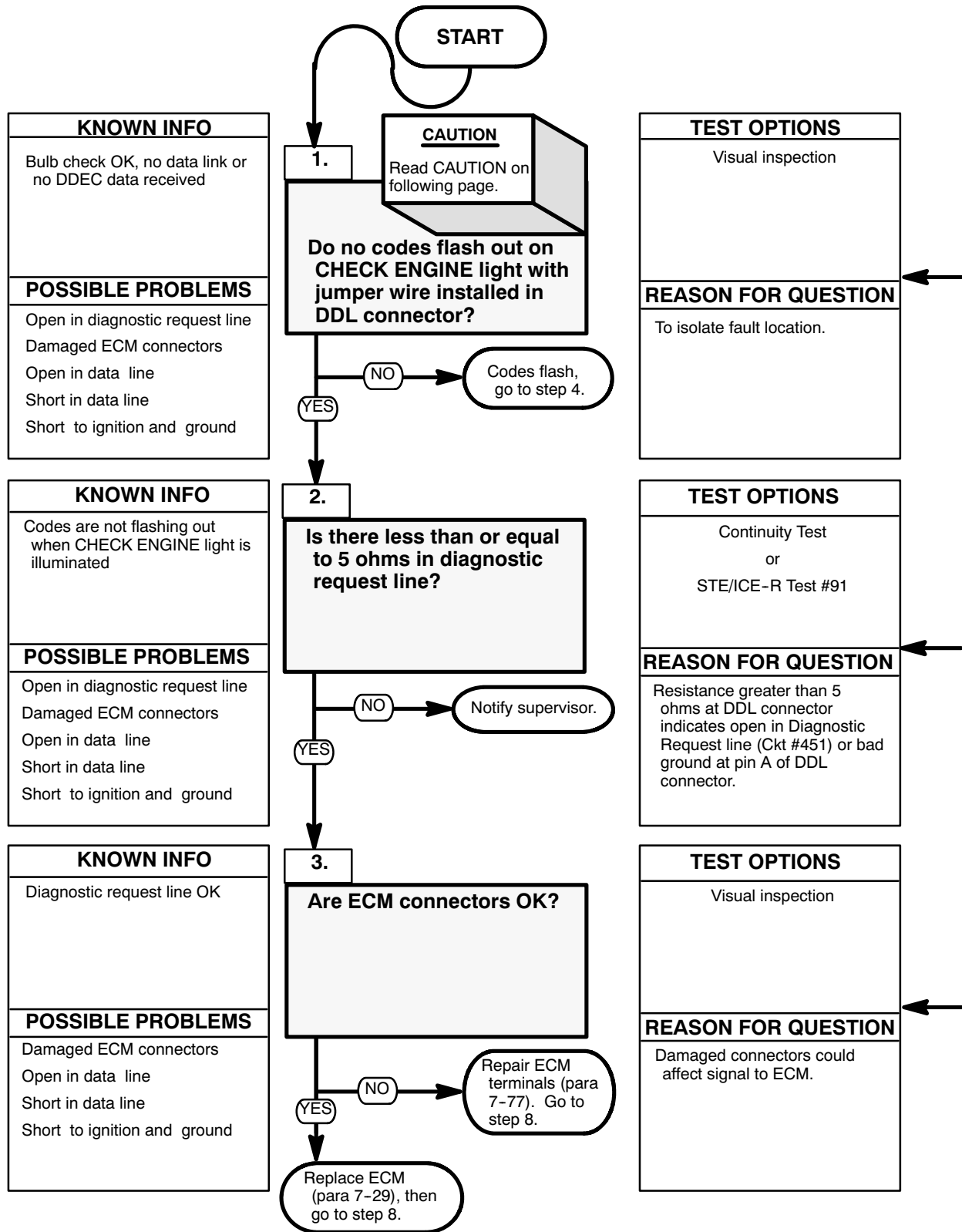
WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death, keep fuel away from open fire and keep fire extinguisher within easy reach when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET OF VEHICLE.

- (1) Turn ENGINE switch OFF.
- (2) Check the fuel/water separator and the secondary fuel filters to be sure they are not clogged and that they are full of clean fuel.



C2 NO DATA LINK AND BULB CHECK OK



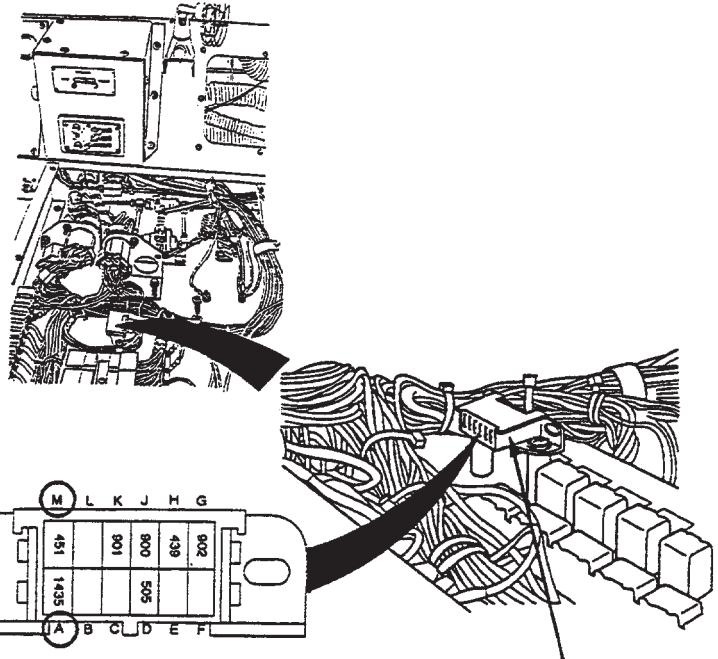
CAUTION

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

NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

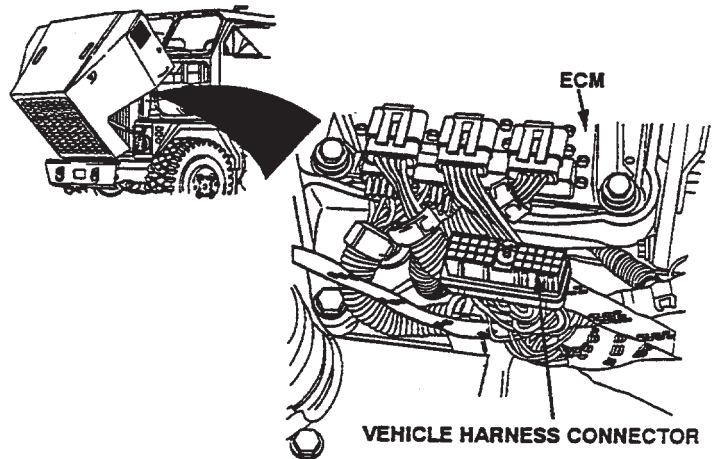
- (1) First unplug DDR.
- (2) Short pin A to pin M on 12-pin DDL connector and read codes flashing out on the CHECK ENGINE light.



DDL CONNECTOR

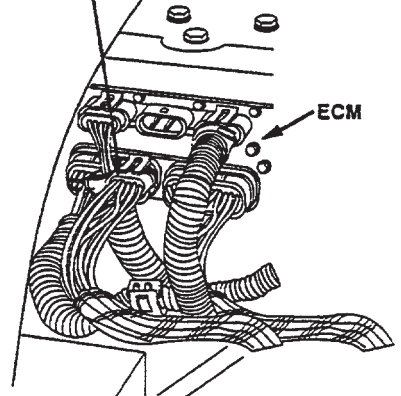
CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect both vehicle harness and 6-way power connector.
- (3) Install jumper wire between E1 of vehicle harness connector and socket D of 6-way power harness connector.
- (4) Read resistance between sockets A and M on 12-pin, DDL connector.



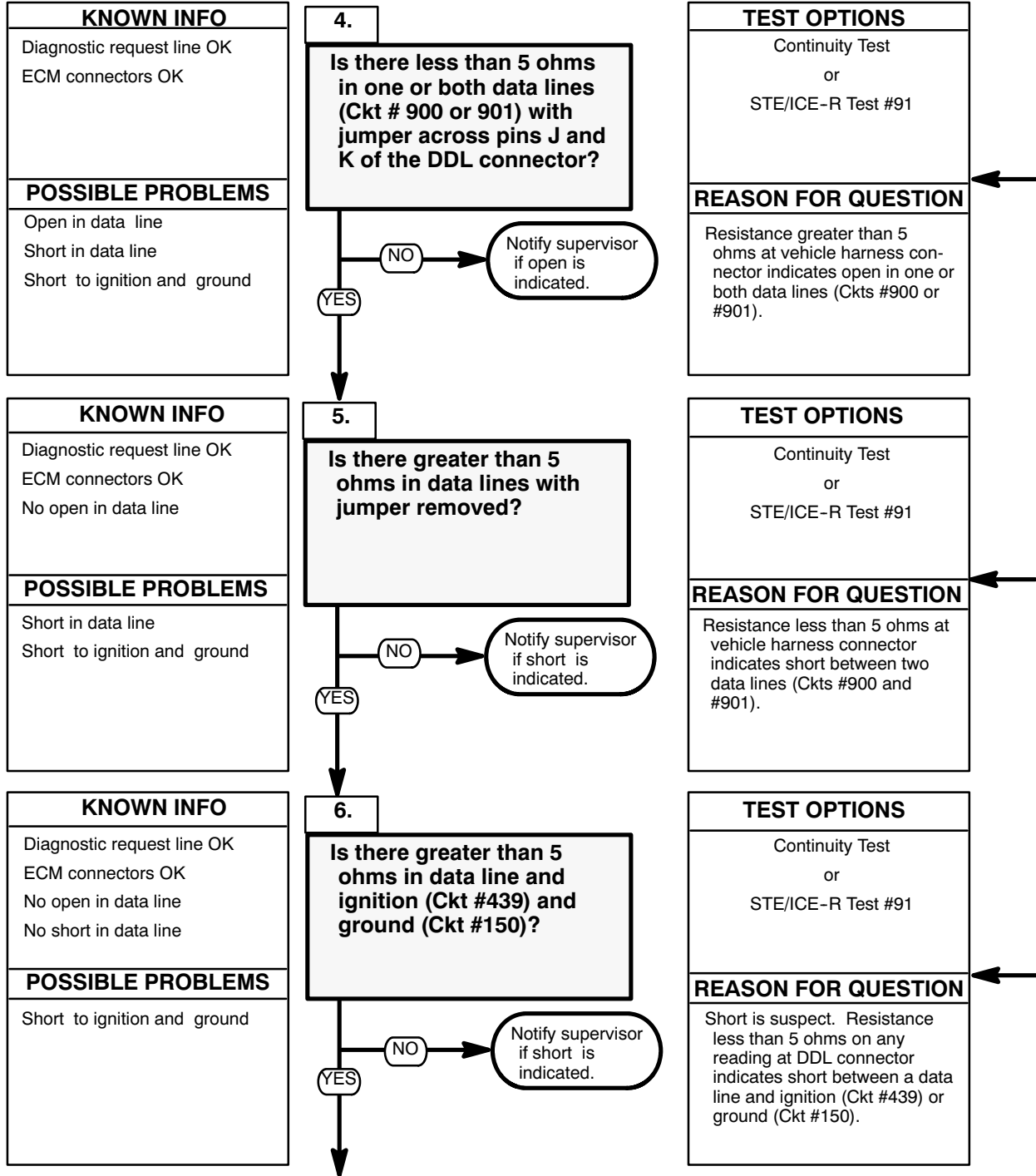
VEHICLE HARNESS CONNECTOR

6-WAY POWER HARNESS CONNECTOR



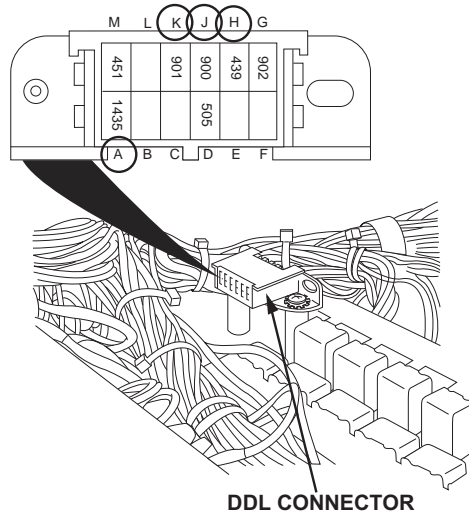
Check terminals at both vehicle harness and 6-way power harness connectors (both the ECM and harness side) for damage; bent, corroded and unseated pins or sockets.

C2 NO DATA LINK AND BULB CHECK OK (CONT)



CONTINUITY TEST

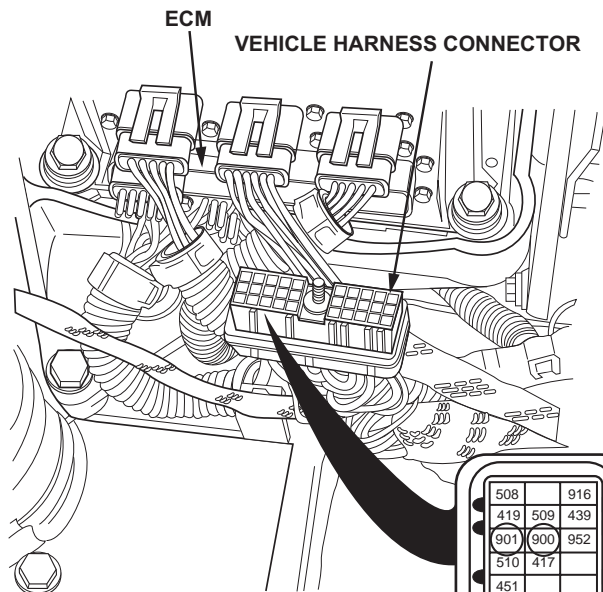
- (1) Turn ENGINE switch OFF and remove all jumpers from 12-pin DDL connector.
- (2) Place jumper across pins J and K on 12-pin DDL connector.
- (3) Unplug vehicle harness connector and measure resistance between sockets C1 and C2.



DDL CONNECTOR

CONTINUITY TEST

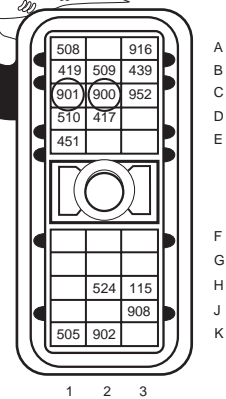
- (1) Remove jumper wires from 12-pin DDL connector.
- (2) Read resistance between sockets C1 and C2 of vehicle harness connector.



ECM
VEHICLE HARNESS CONNECTOR

CONTINUITY TEST

- (1) Remove all jumpers from 12-pin DDL connector.
- (2) Measure resistance between sockets J and A, then J and H next.
- (3) Measure resistance between sockets K and A, then K and H of DDL connector.



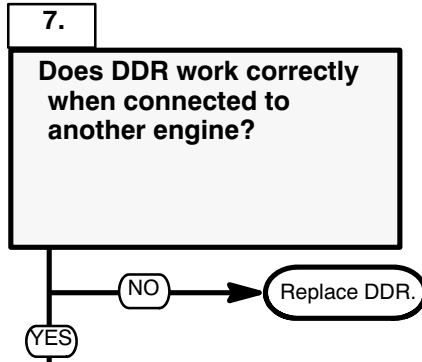
1 2 3

A
B
C
D
E

F
G
H
J
K

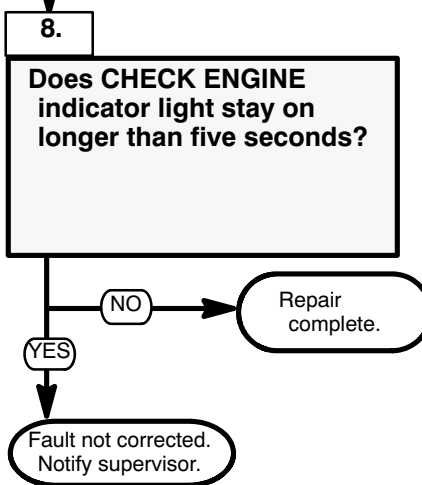
C2 NO DATA LINK AND BULB CHECK OK

KNOWN INFO
Diagnostic request line OK ECM connectors OK No open in data line No short in data line No short to ignition and ground
POSSIBLE PROBLEMS
Faulty DDR



TEST OPTIONS
DDR
REASON FOR QUESTION
Faulty DDR will also cause this symptom, even if there is no problem with DDEC.

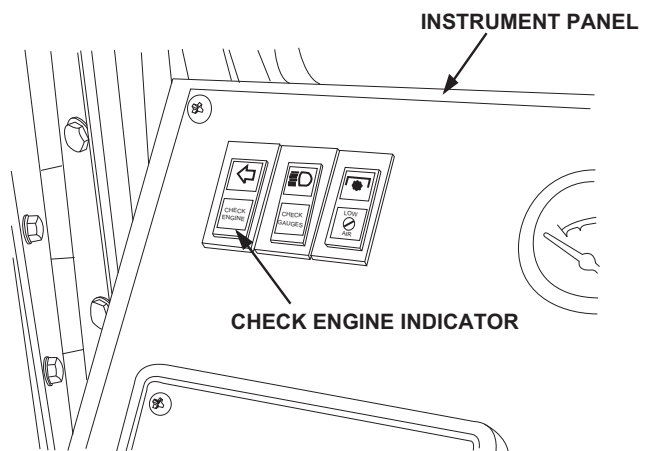
KNOWN INFO
Diagnostic request line OK ECM connectors OK No open in data line No short in data line No short to ignition and ground
POSSIBLE PROBLEMS

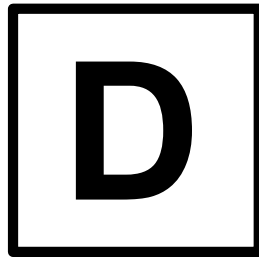


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned to ON fault has been corrected.

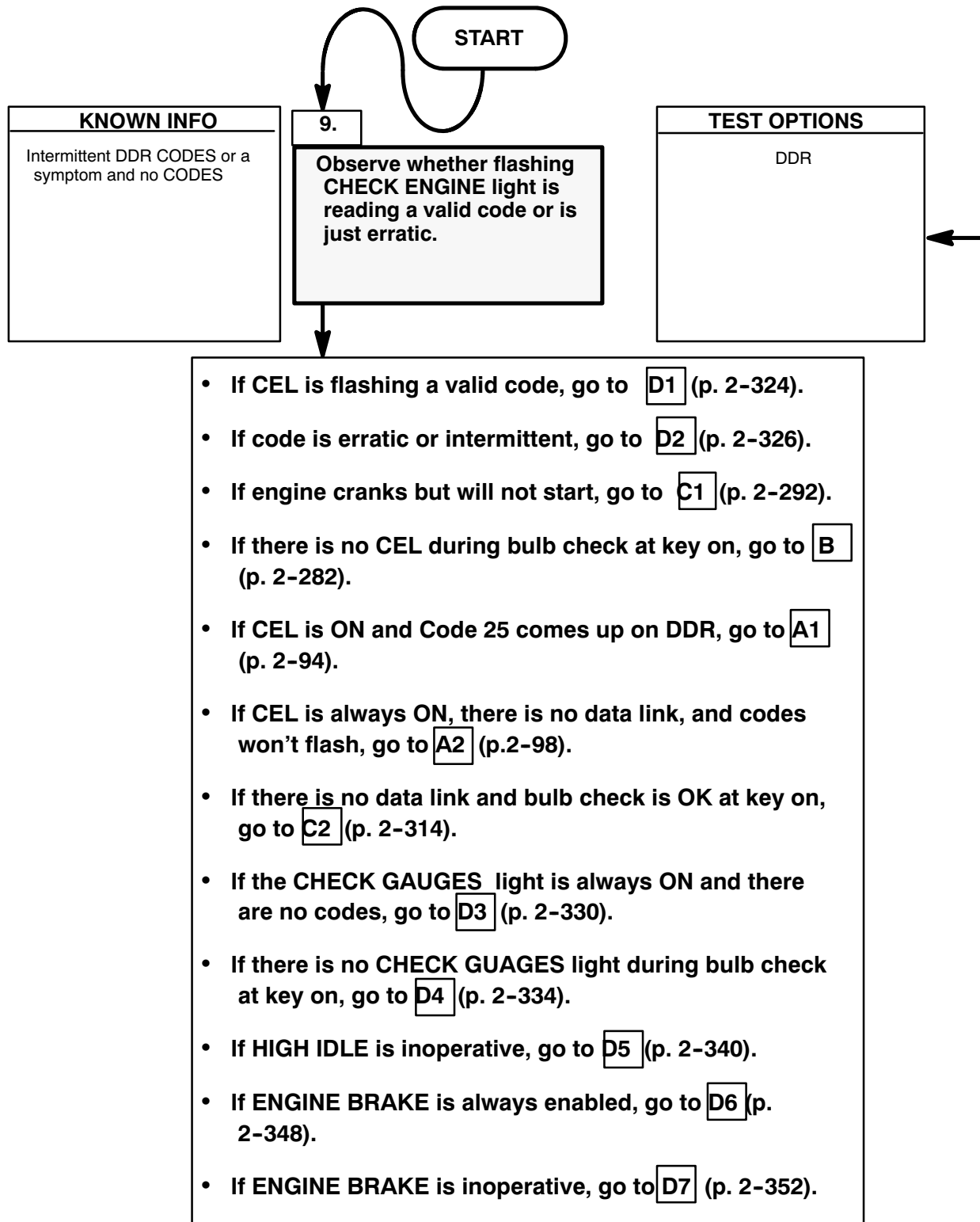
Connect DDR to another engine and read PROM ID or any other parameter in the menu.

- (1) Turn ENGINE switch OFF
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.





D INTERMITTENT CODE OR A SYMPTOM AND NO CODE

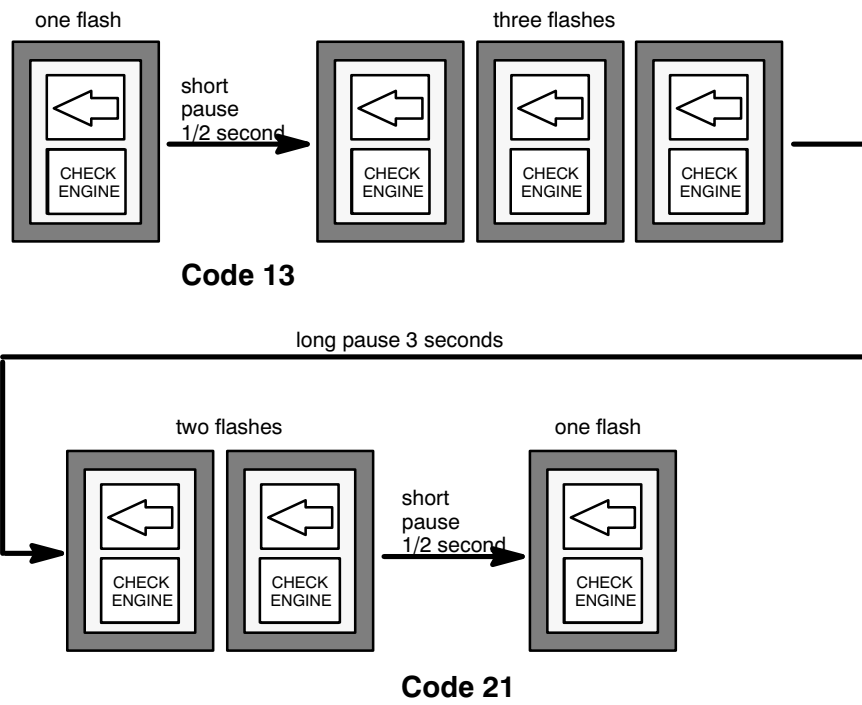


NOTE

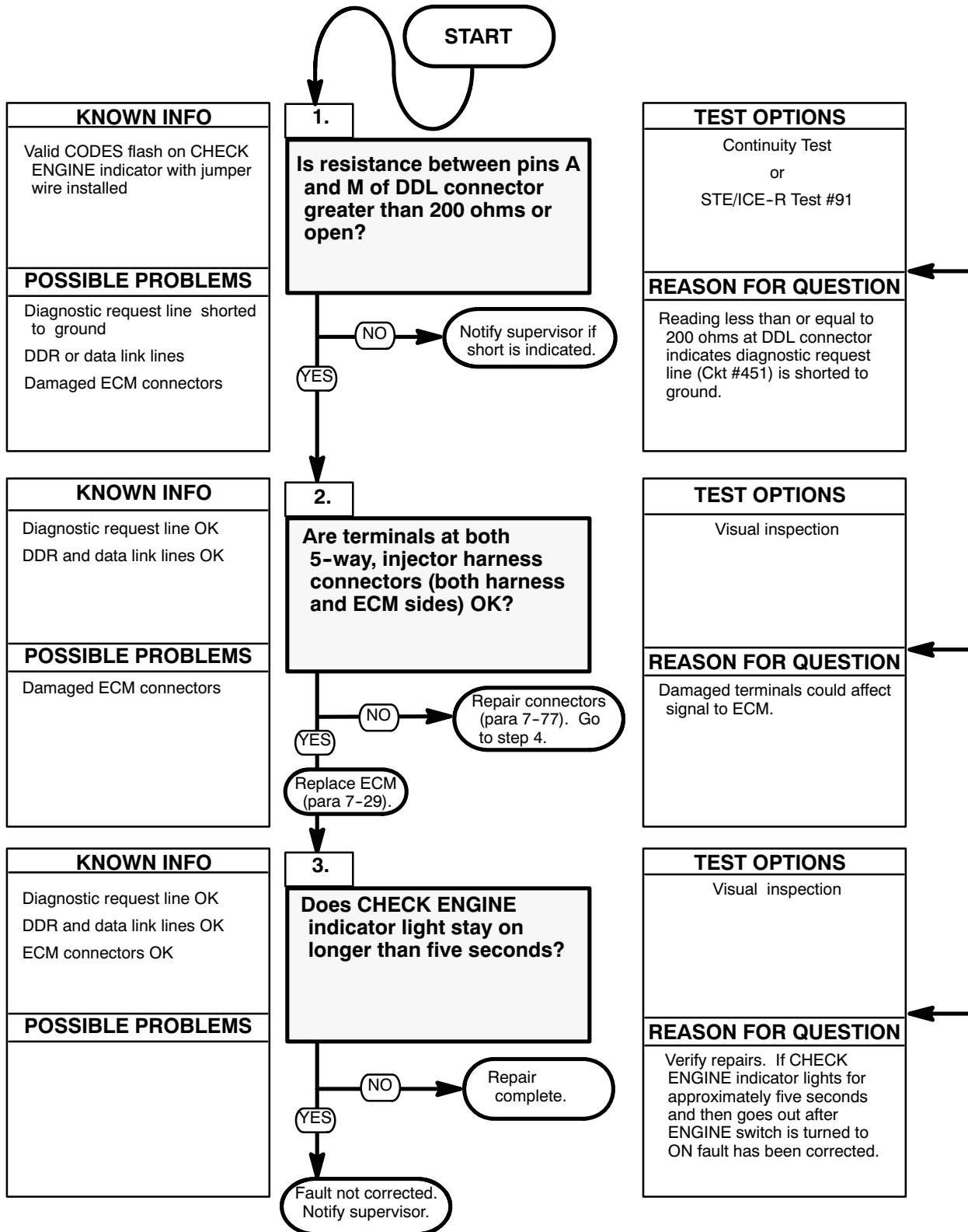
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

NOTE

Check engine light may flash valid codes at times. Codes may be read as follows:



D1 VALID CODE IS FLASHING

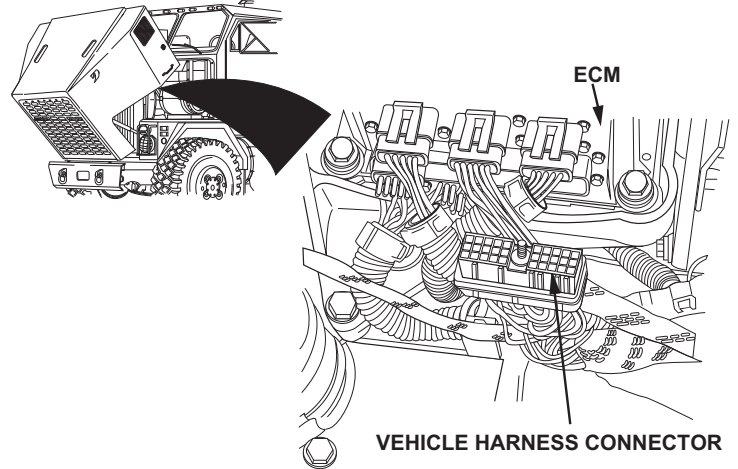


NOTE

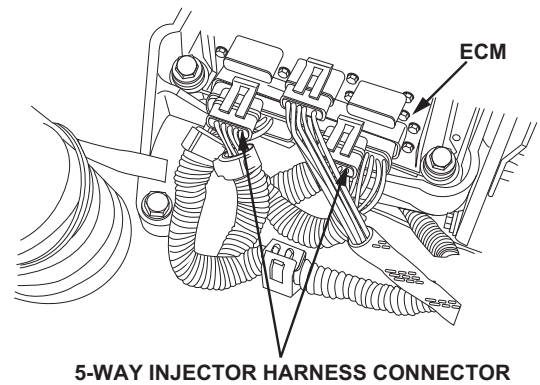
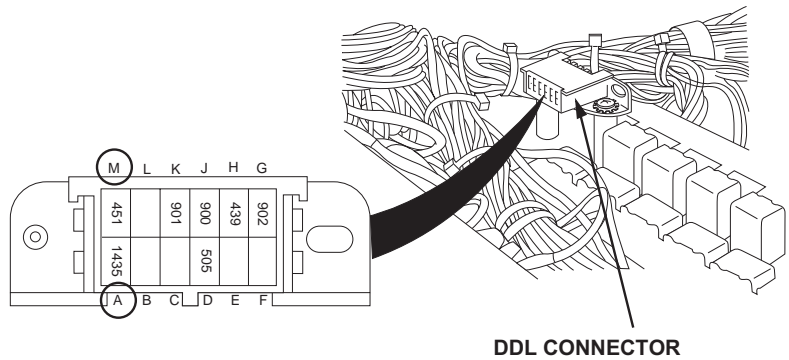
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

CONTINUITY TEST

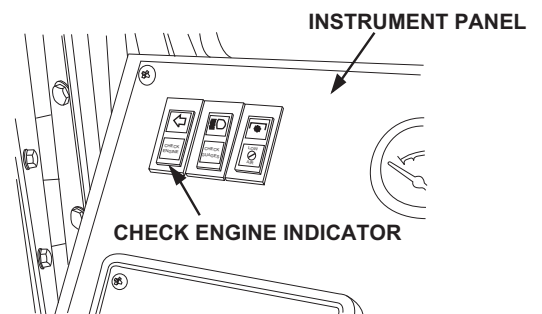
- (4) Turn ENGINE switch OFF.
- (5) Disconnect vehicle harness connector at ECM.
- (6) Read resistance between pins A and M of 12-pin DDL connector.



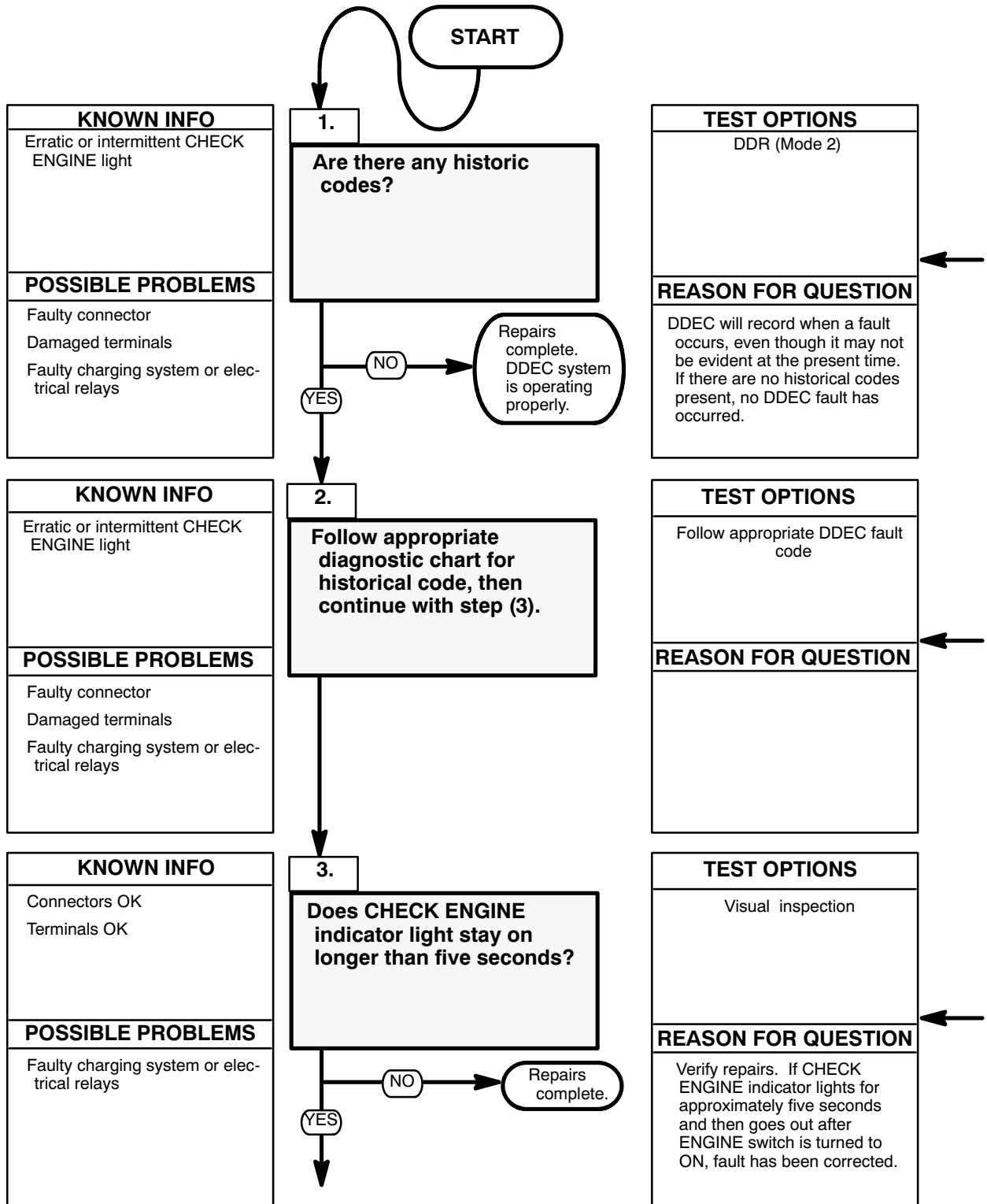
Check terminals at both 5-way, injector harness connectors (both harness and ECM sides) for damaged, bent, corroded, and unseated pins or sockets.



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.

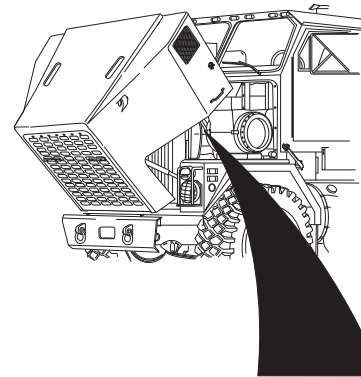


D2 INTERMITTENT CODE



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-82 and you were referred here.



- (1) When following appropriate Historic Codes, check for:
 - a.) Poor mating of connector halves or terminals not fully seated in the connector body.
 - b.) Improperly formed or damaged terminals. All connectors in problem circuit should be checked.
- (2) Carefully inspect all wiring in the affected circuit.
- (3) Do not replace any components unless you have followed the procedure to completion and have found no faults.
- (4) After repairs have been made, clear codes (mode 40) and proceed to question (3).

HARNESS CONNECTORS

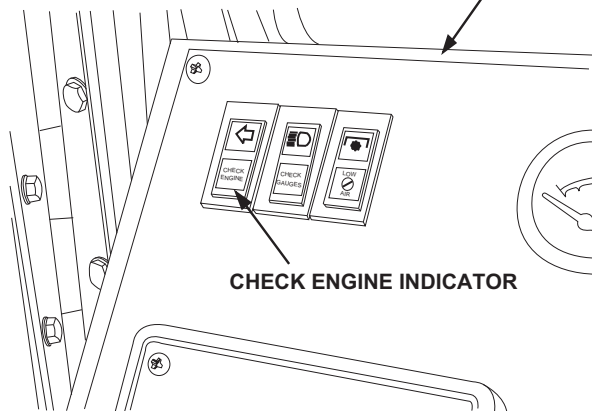
ECM

HARNESS CONNECTORS

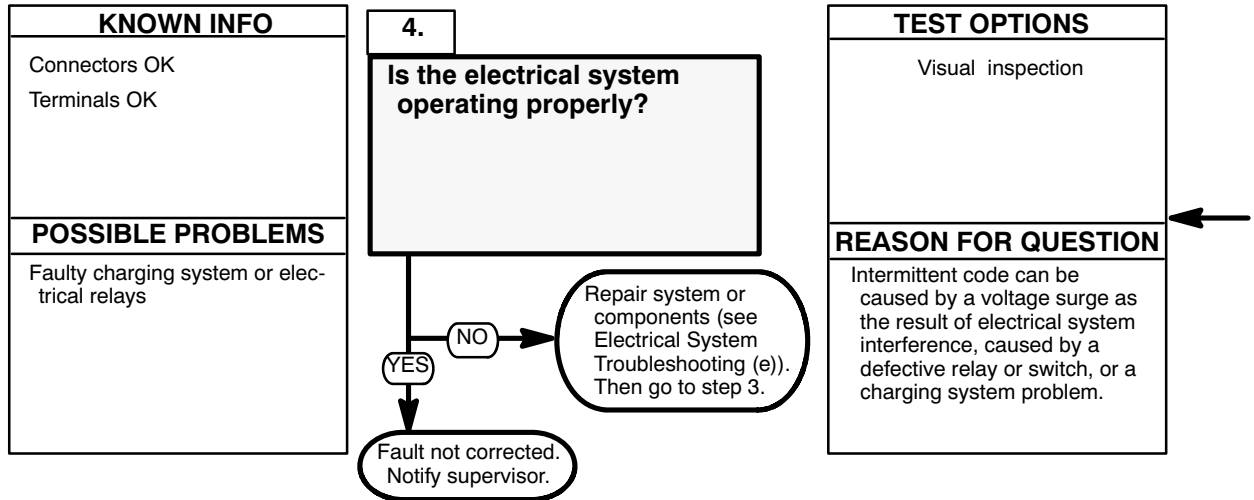
INSTRUMENT PANEL

Turn ENGINE switch ON and observe CHECK ENGINE indicator.

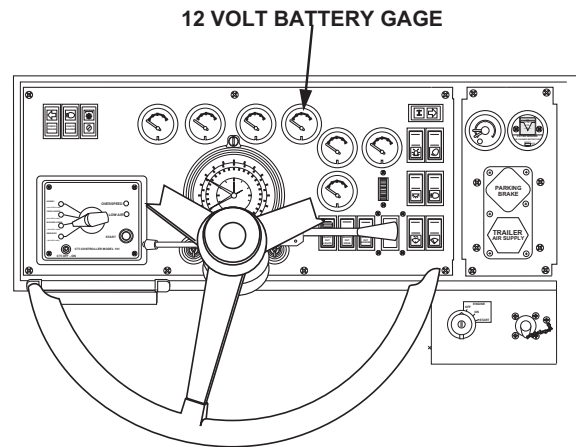
CHECK ENGINE INDICATOR



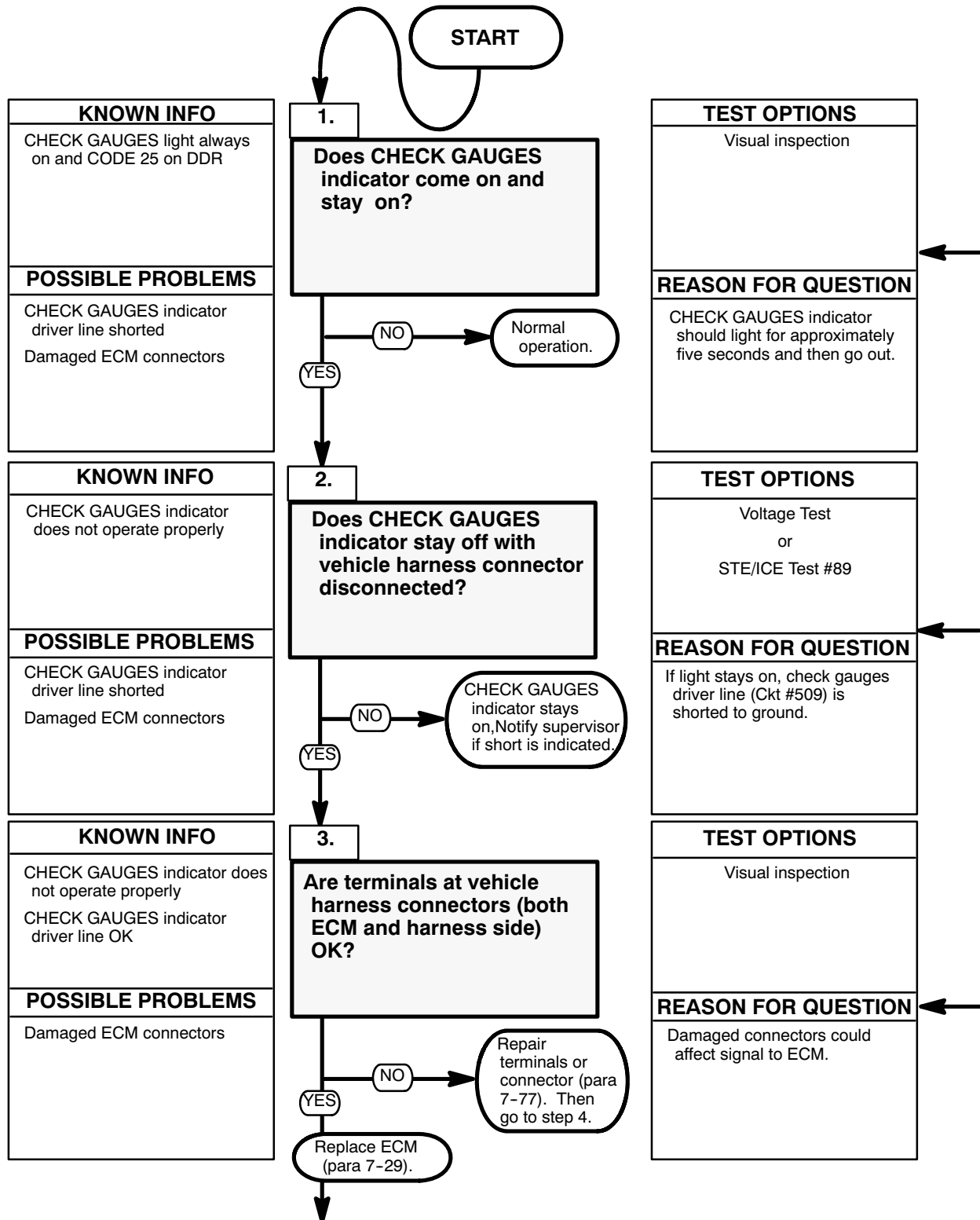
D2 INTERMITTENT CODE (CONT)



- (1) Check 12 volt battery gage for 12-14 volts with engine running.
- (2) Check for defective relays, ECM driven solenoid, or switch that may be causing system interference. In some cases the problem can be recreated when the faulty component is operated.



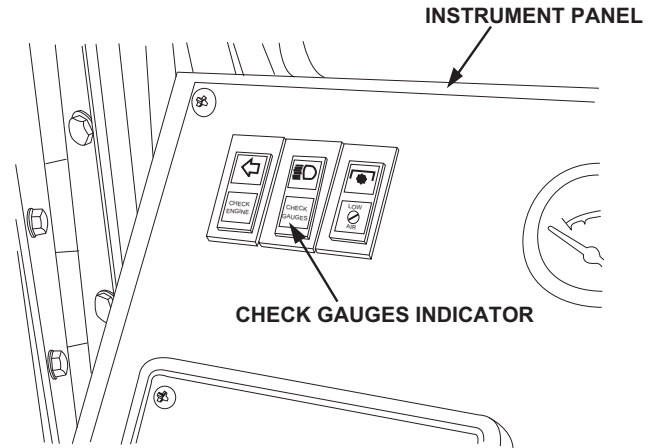
D3 CHECK GAUGES LIGHT ALWAYS ON AND CODE 25 ON DDR



NOTE

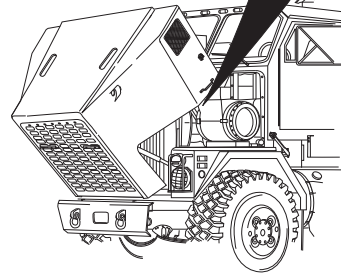
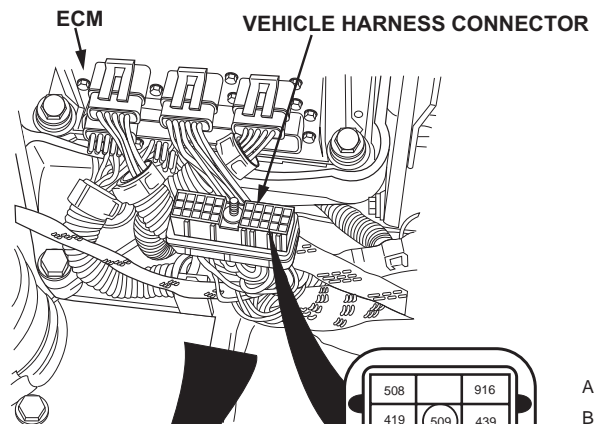
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

Turn ENGINE switch ON (engine not running) and observe CHECK GAUGES indicator.



VOLTAGE TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect vehicle harness connector at ECM.
- (3) Turn ENGINE switch ON (engine not running) while observing CHECK GAUGES indicator.



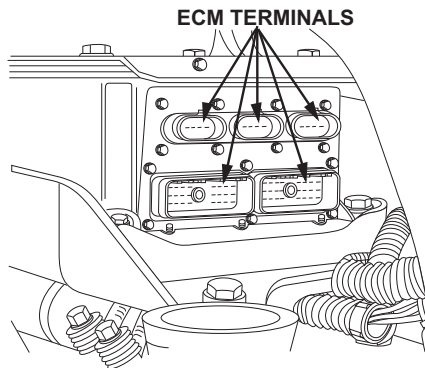
508	916	
419	509	439
901	900	952
510	417	
451		
	524	115
		908
505	902	

A
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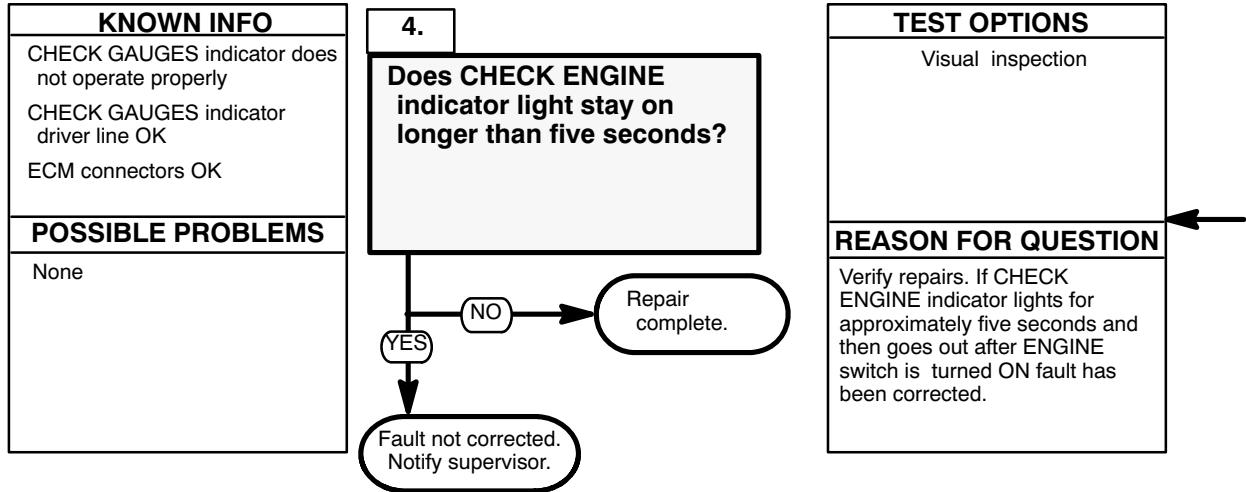
F
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1 2 3

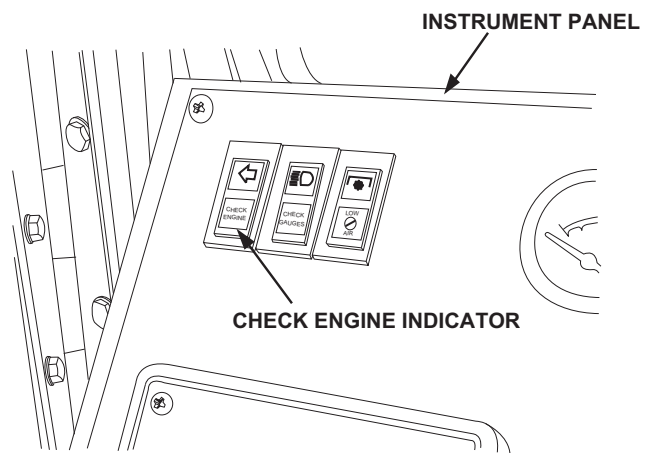
Check terminals especially at vehicle harness connectors (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets. Pay close attention to B2 and B3.



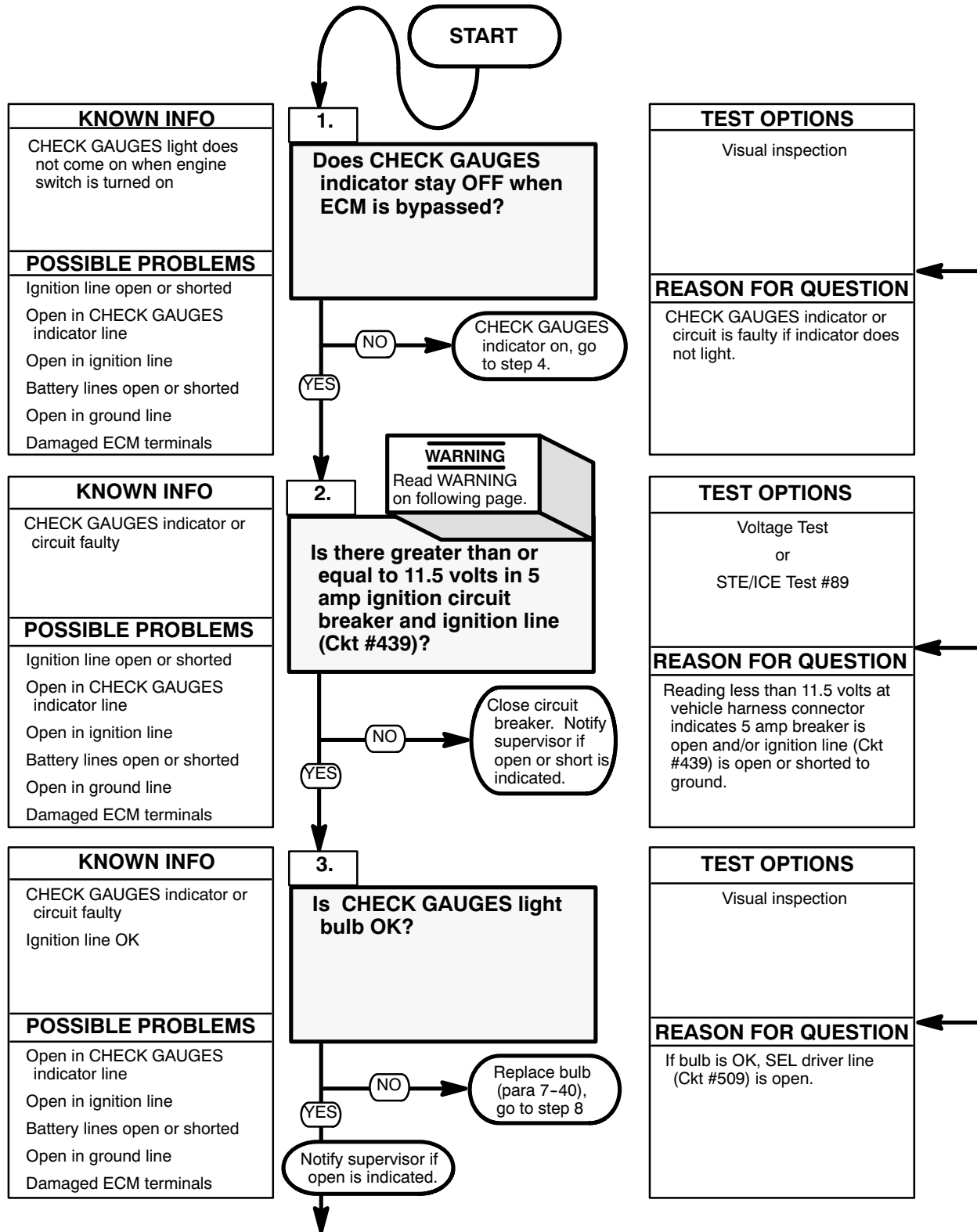
D3 CHECK GAUGES LIGHT ALWAYS ON AND CODE 25 ON DDR (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



D4 NO CHECK GAUGES LIGHT DURING BULB CHECK



NOTE

The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

- (1) Turn ENGINE switch OFF.
- (2) Disconnect vehicle harness connector at ECM.
- (3) Install a jumper wire between socket B2 on the vehicle harness connector and a good ground.
- (4) Turn ENGINE switch ON (engine not running) and note STOP ENGINE light status.

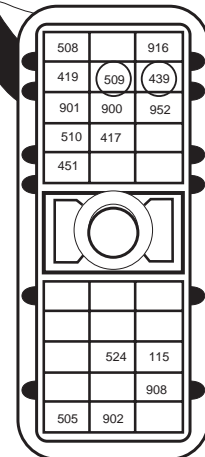
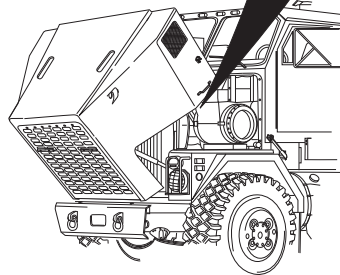
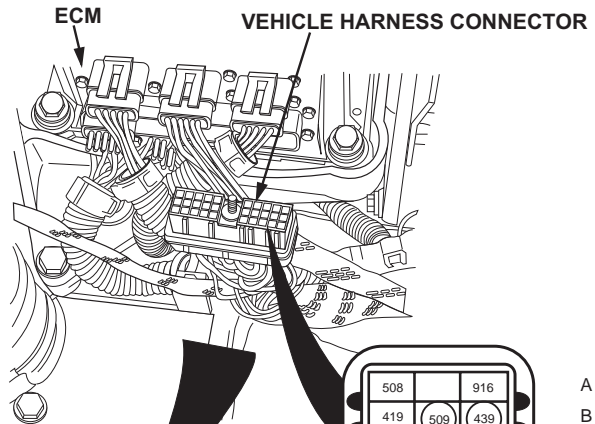
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

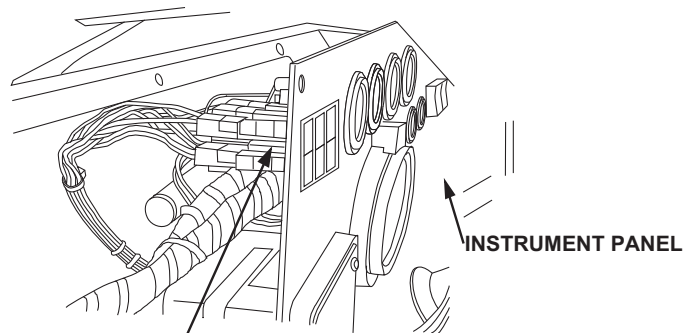
VOLTAGE TEST

- (1) Remove jumper wire.
- (2) Read voltage on vehicle harness connector, socket B3 (red lead) to a good ground.

Remove CHECK GAUGES light bulb (para 7-38) and check if burned out or damaged

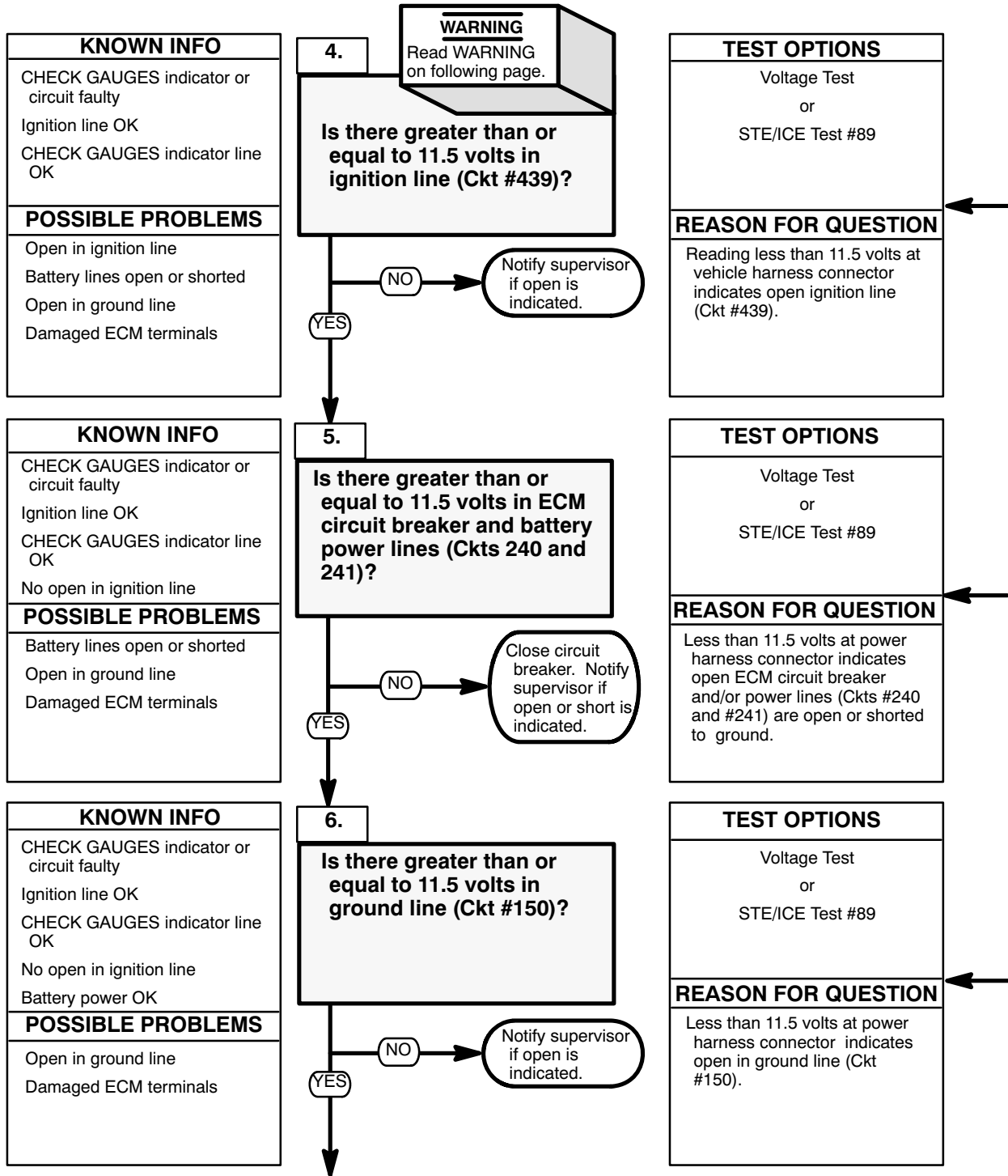


1 2 3



CHECK GAUGES INDICATOR BULB

D4 NO CHECK GAUGES LIGHT DURING BULB CHECK (CONT)

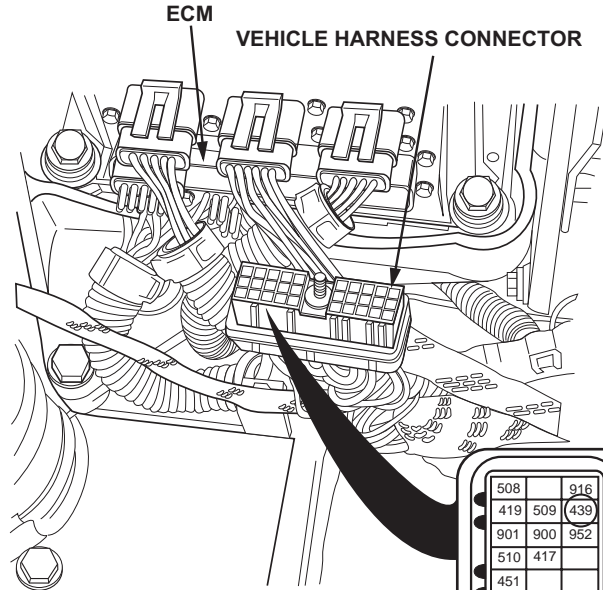


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

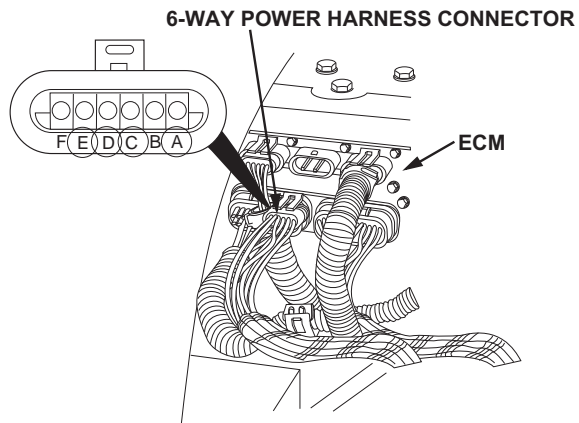
VOLTAGE TEST

- (1) Remove jumper wire.
- (2) Read voltage on vehicle harness connector, socket B3 (red lead) to a good ground (black lead).



VOLTAGE TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect 6-way power harness connector at ECM.
- (3) Read voltage on 6-way power harness connector socket A (red lead) to a good ground (black lead).
- (4) Also read voltage on socket E (red lead) to socket D (black lead).



VOLTAGE TEST

- (1) Read voltage on 6-way power harness connector, socket A (red lead) to socket C (black lead).
- (2) Read voltage on 6-way power harness connector, socket E (red lead) to socket D (black lead)..

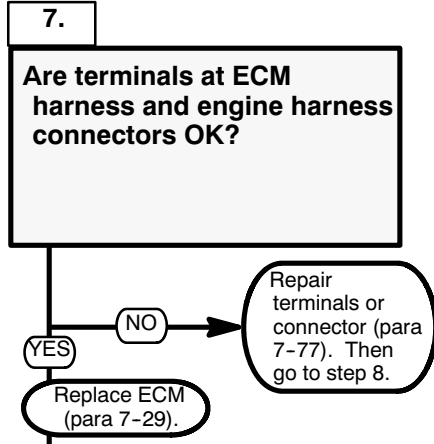
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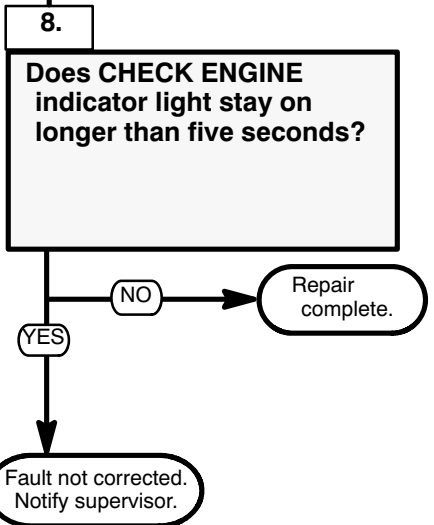
D4 NO CHECK GAUGES LIGHT DURING BULB CHECK (CONT)

KNOWN INFO
CHECK GAUGES indicator or circuit faulty
Ignition line OK
CHECK GAUGES indicator line OK
No open in ignition line
Battery power OK
No open in ground line
POSSIBLE PROBLEMS
Damaged ECM terminals



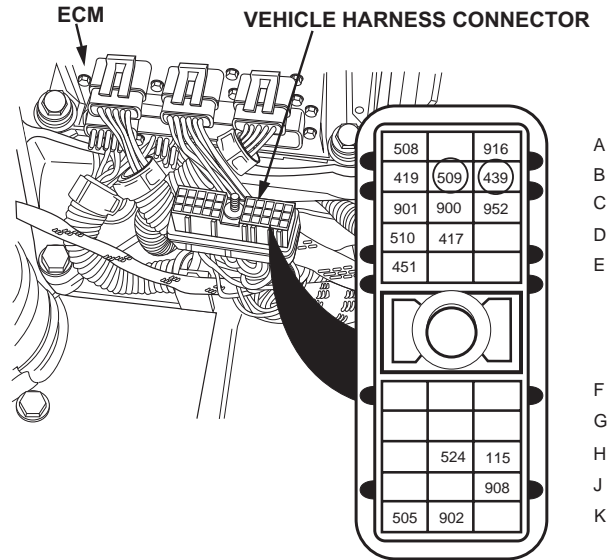
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damaged ECM connectors could affect signal to ECM.

KNOWN INFO
CHECK GAUGES indicator or circuit faulty
Ignition line OK
CHECK GAUGES indicator line OK
No open in ignition line
Battery power OK
No open in ground line
Damaged ECM terminals
POSSIBLE PROBLEMS



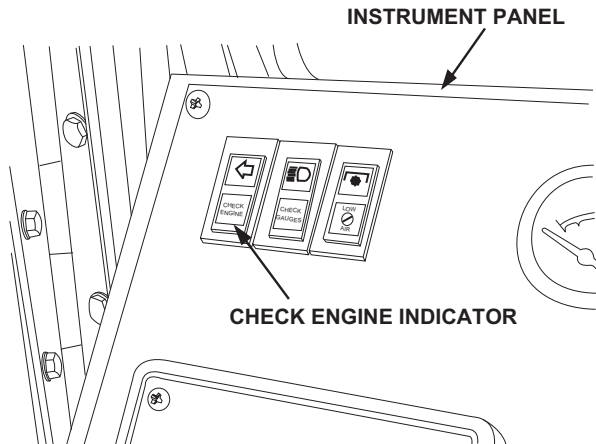
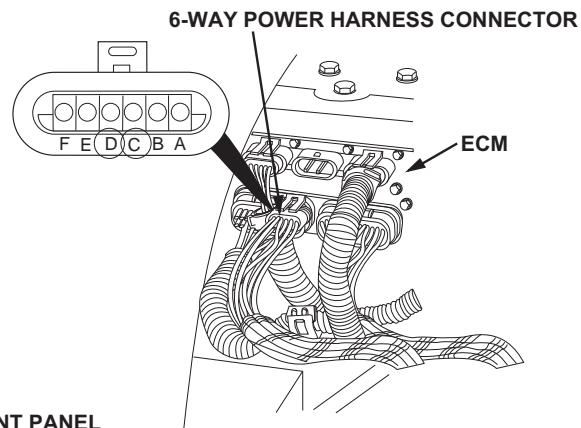
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Verify repairs. If CHECK ENGINE indicator lights for approximately five seconds and then goes out after ENGINE switch is turned ON fault has been corrected.

- (1) Check terminals for damaged, bent, corroded, and unseated pins or sockets.
- (2) Pay attention to terminals B2 and B3 of the vehicle harness connector and C and D of the power harness.

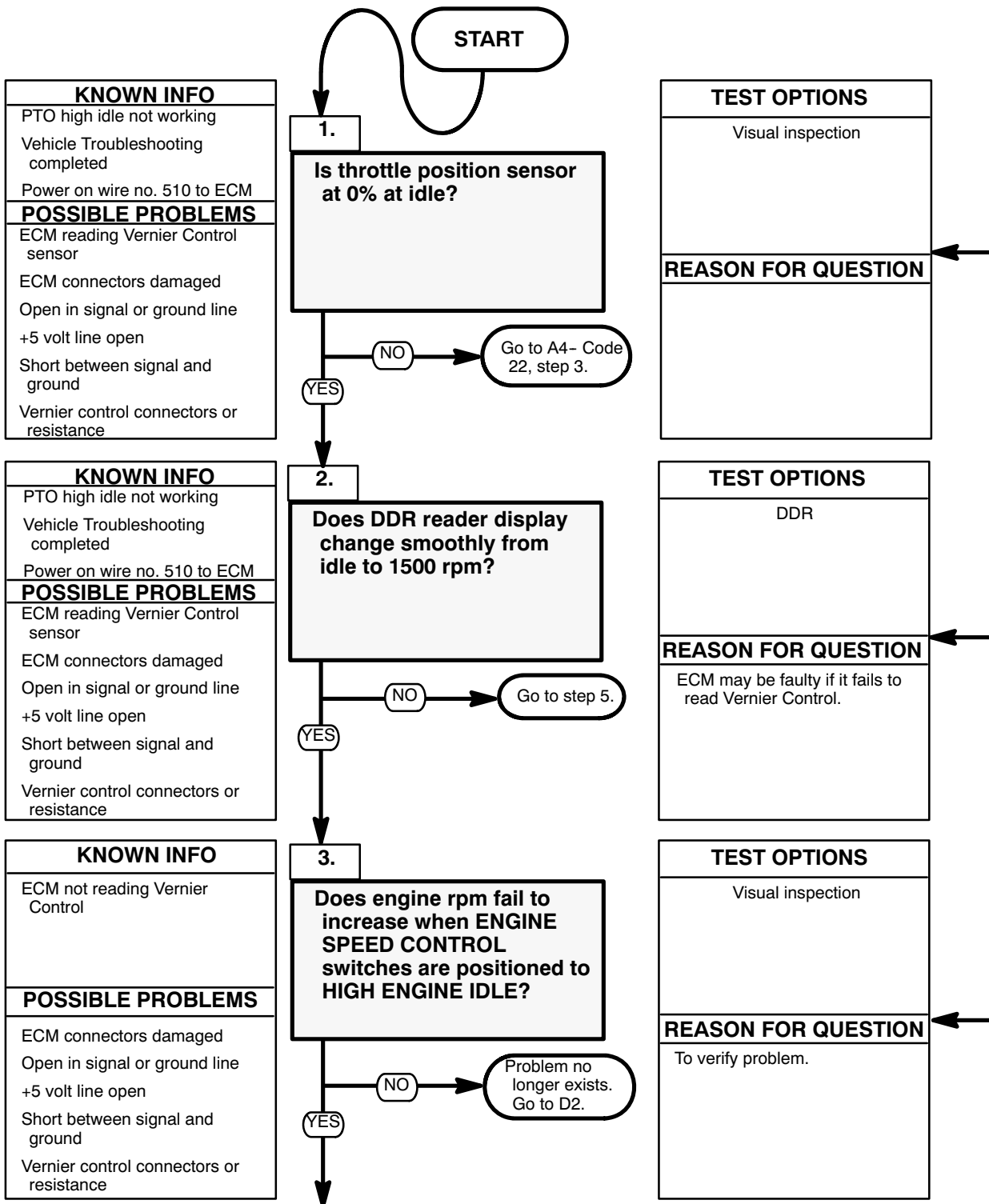


1 2 3

- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



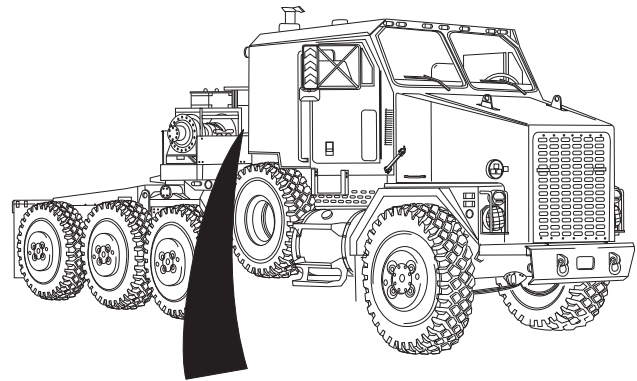
D5 POWER TAKE-OFF (PTO) HIGH IDLE NOT WORKING



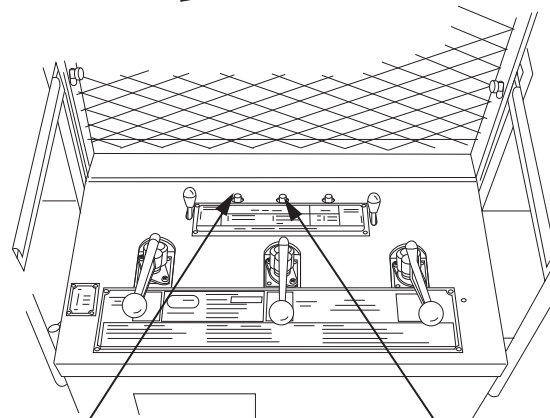
NOTE

- Vehicle troubleshooting must be performed first, before attempting to use this chart.
- The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

- (1) Turn ENGINE switch ON.
- (2) Plug in DDR into the 12-pin DDL connector.
- (3) Read throttle % at idle using the DDR.



- (1) Start engine (TM 9-2320-360-10).
- (2) Position transmission range selector to N (neutral).
- (3) Select the PTO RPM on the DDR reader.
- (4) Position left ENGINE SPEED CONTROL switch to HIGH ENGINE IDLE and press PUSH TO LOCK ENGINE @ HIGH IDLE switch. Note reading on DDR.
- (5) Shut off engine (TM 9-2320-360-10).

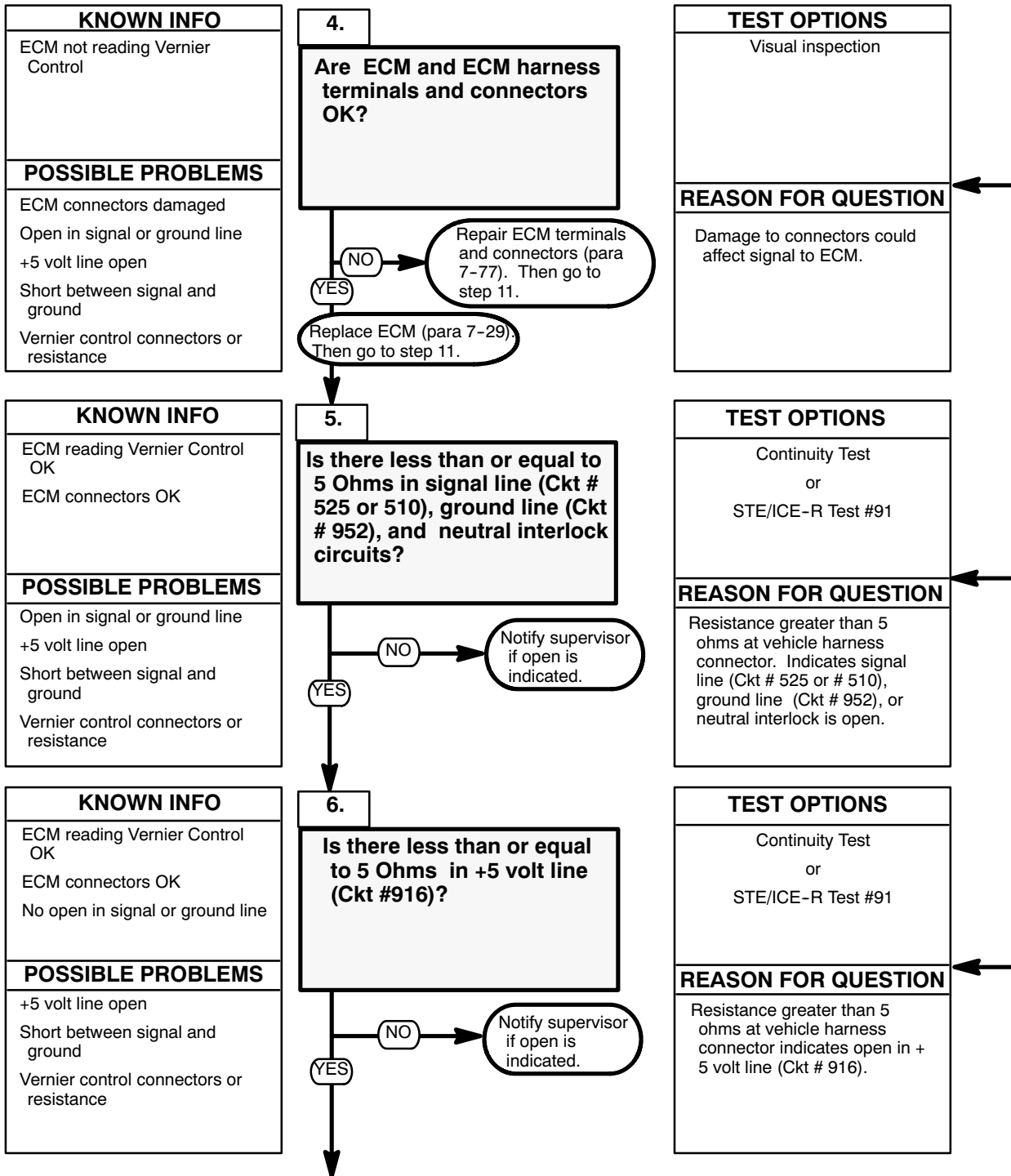


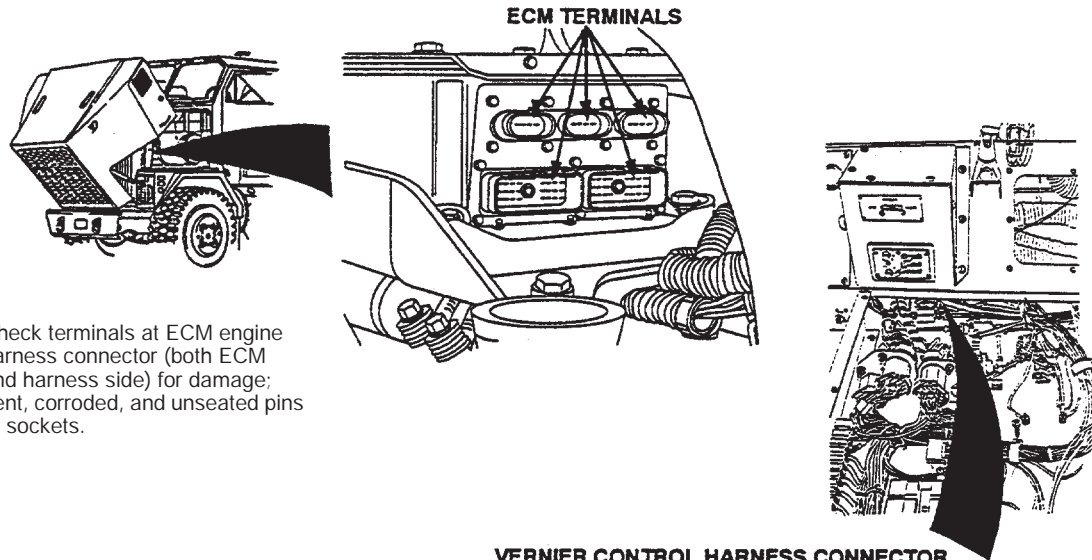
LEFT ENGINE SPEED CONTROL SWITCH

PUSH TO LOCK ENGINE @ HIGH IDLE SWITCH

- (1) Start engine (TM 9-2320-360-10) and run at idle.
- (2) Using the DDR reader, make sure that vehicle speed is less than 5 mph and % throttle is 0.
- (3) Position left ENGINE SPEED CONTROL switch to HIGH ENGINE IDLE and press PUSH TO LOCK ENGINE @ HIGH IDLE switch. Note reading on DDR and tachograph.

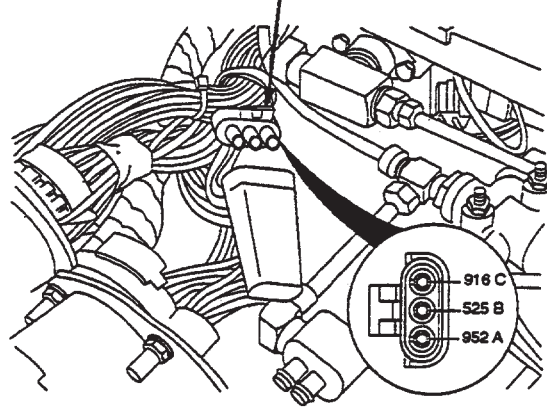
D5 POWER TAKE-OFF (PTO) HIGH IDLE NOT WORKING (CONT)





Check terminals at ECM engine harness connector (both ECM and harness side) for damage; bent, corroded, and unseated pins or sockets.

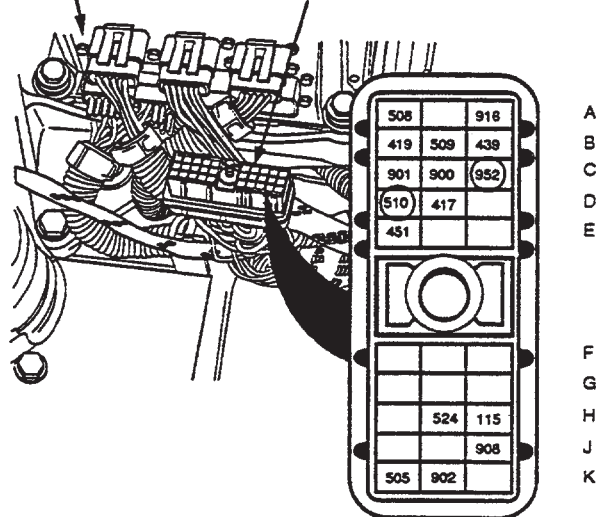
VERNIER CONTROL HARNESS CONNECTOR



CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Position transmission range selector to N (neutral).
- (3) Disconnect vehicle harness connector at ECM.
- (4) Disconnect vernier control connector.
- (5) Install a jumper between pins A and B of vernier control harness connector.
- (6) Read resistance between sockets D1 and C3 on vehicle harness connector.

ECM VEHICLE HARNESS CONNECTOR



CONTINUITY TEST

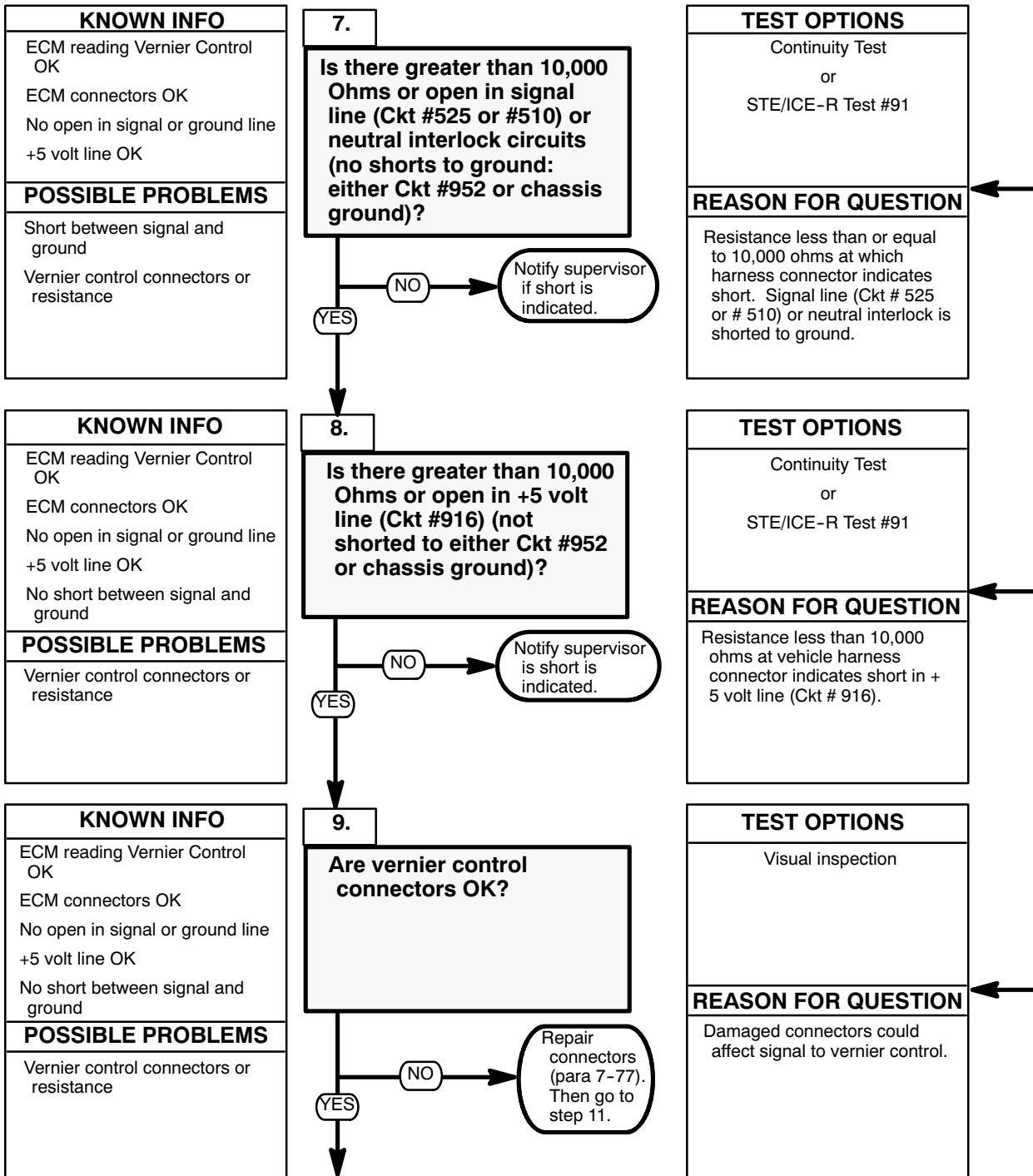
- (1) Move jumper to between pins C and A of vernier control harness connector.
- (2) Read resistance between sockets A3 and C3 on vehicle harness connector.

1 2 3

A
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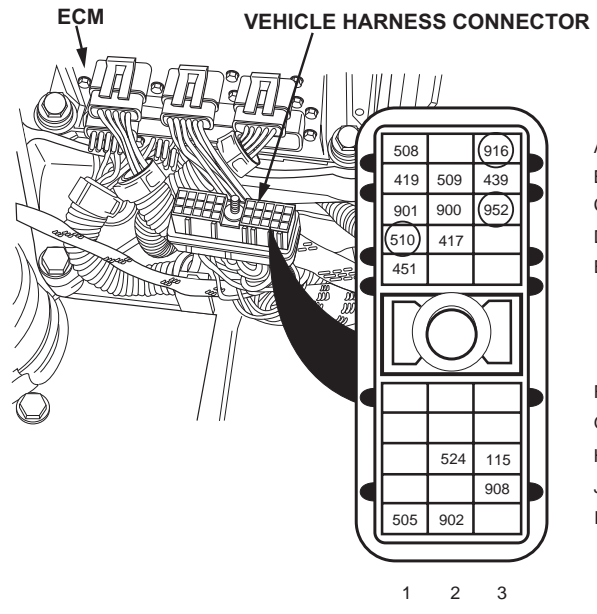
F
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D5 POWER TAKE-OFF (PTO) HIGH IDLE NOT WORKING (CONT)



CONTINUITY TEST

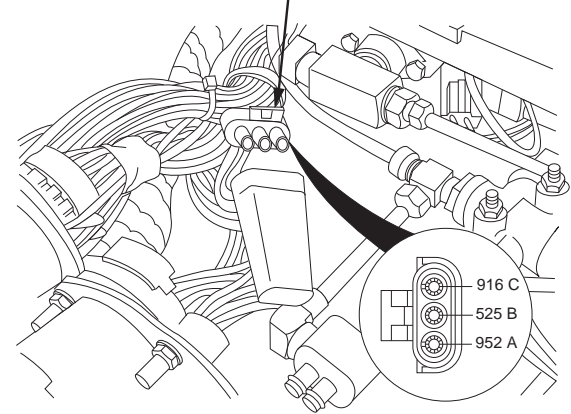
- (1) Remove jumper wire.
- (2) Read resistance between sockets D1 and C3 on vehicle harness connector.
- (3) Read resistance between socket D1 and a good ground.



CONTINUITY TEST

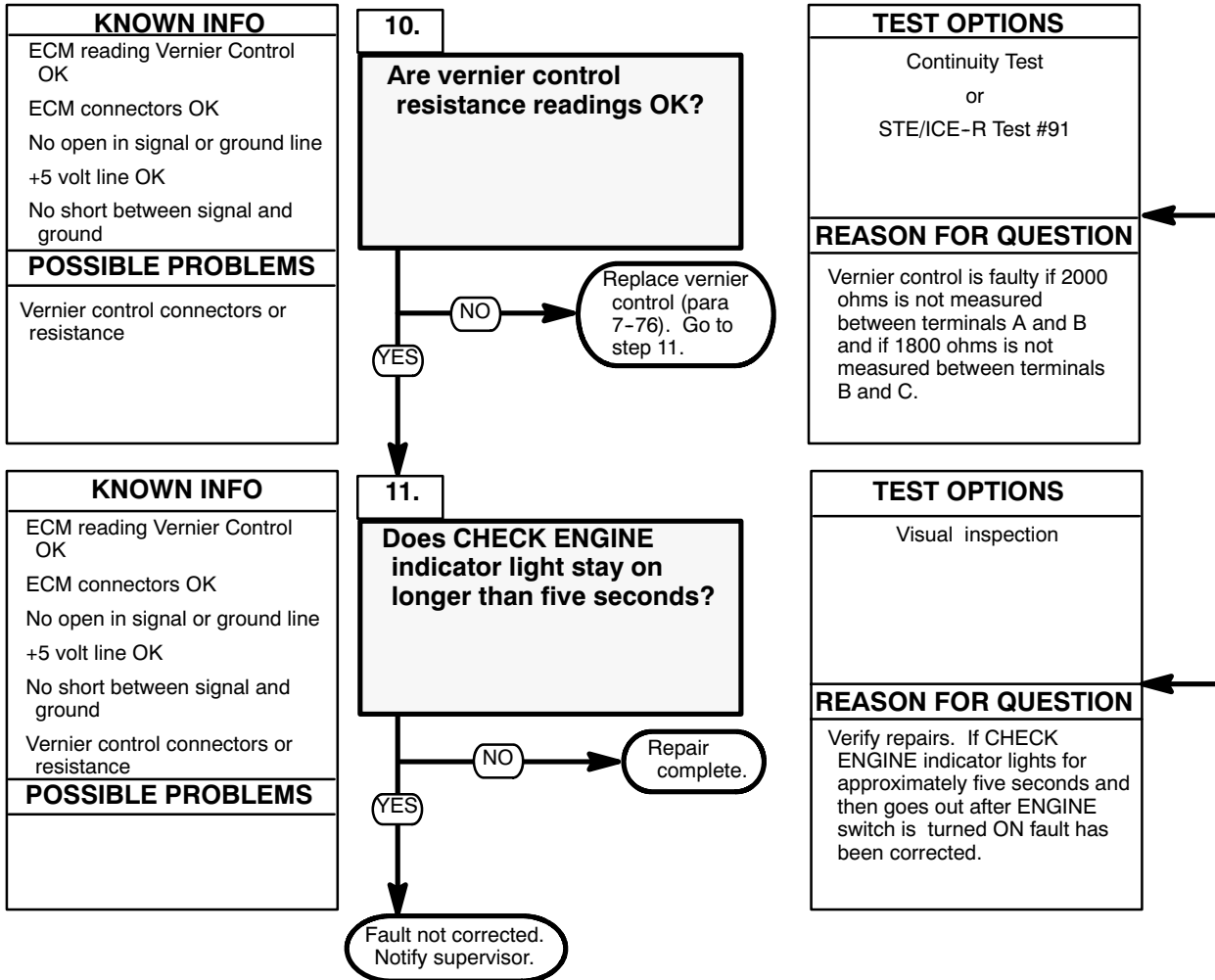
- (1) Disconnect vernier control.
- (2) Read resistance between sockets A3 and C3 on vehicle harness connector.
- (3) Read resistance between socket A3 and a good ground.

VERNIER CONTROL HARNESS CONNECTOR



Check terminals (sensor side and harness side) for damaged, bent, corroded, and unseated pins or sockets

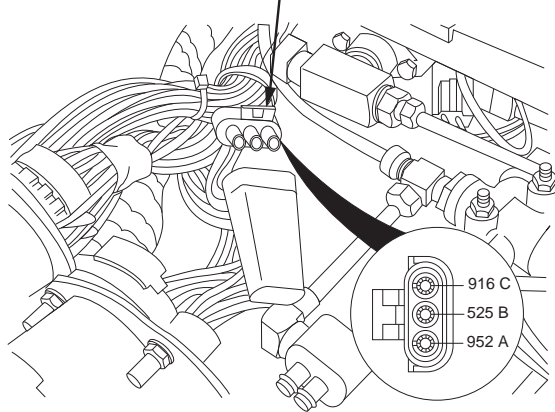
D5 POWER TAKE-OFF (PTO) HIGH IDLE NOT WORKING (CONT)



CONTINUITY TEST

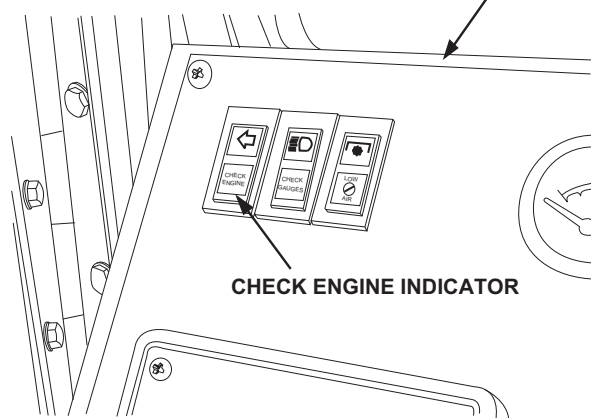
- (1) Read resistance between terminals A and B on vernier control.
- (2) Read resistance between terminals B and C on vernier control.

VERNIER CONTROL HARNESS CONNECTOR

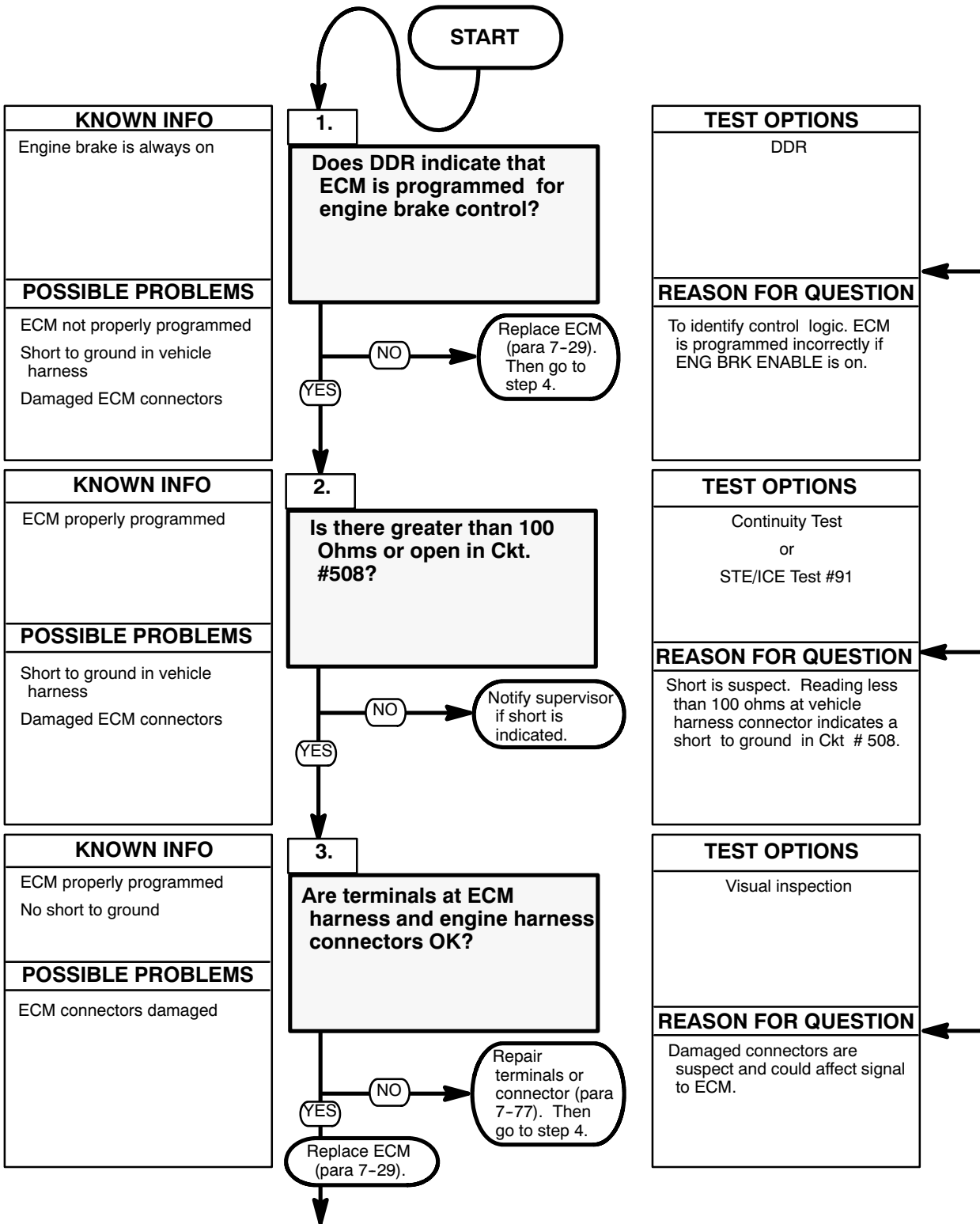


- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.

INSTRUMENT PANEL



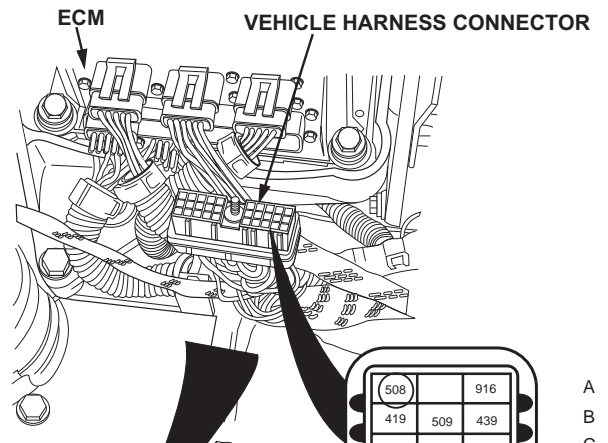
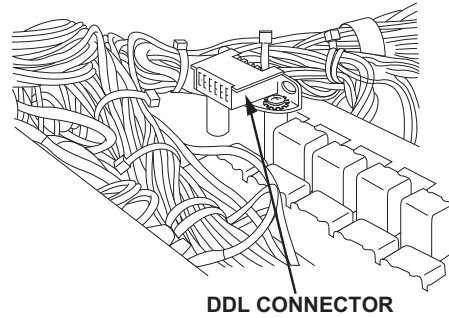
D6 ENGINE BRAKE IS ALWAYS ON



NOTE

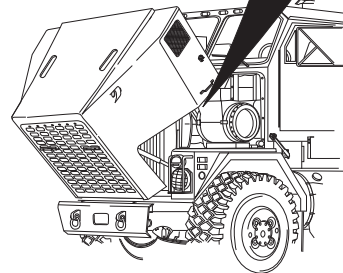
The following flow chart should only be used if DDEC troubleshooting was started on p. 2-80 and you were referred here.

- (1) Start engine (TM 9-2320-360-10) and run at idle.
- (2) Plug in DDR and select MISC OUTPUTS.
- (3) Observe DDR display labeled ENG BRK ENABLE.
- (4) If display reads OFF, ECM is programmed for engine brake control; if display reads ON, ECM programmed for transmission retarder control.



CONTINUITY TEST

- (1) Turn ENGINE switch OFF.
- (2) Disconnect vehicle harness at ECM connector.
- (3) Read resistance between socket A1 of vehicle harness connector and a good ground.



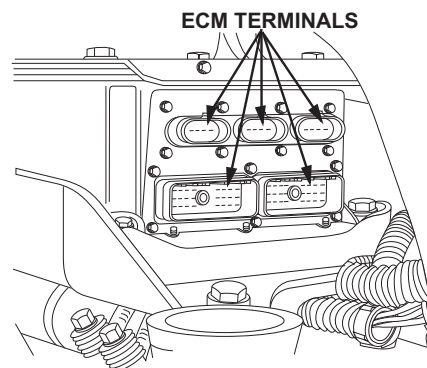
508		916
419	509	439
901	900	952
510	417	
451		
	524	115
		908
505	902	

A
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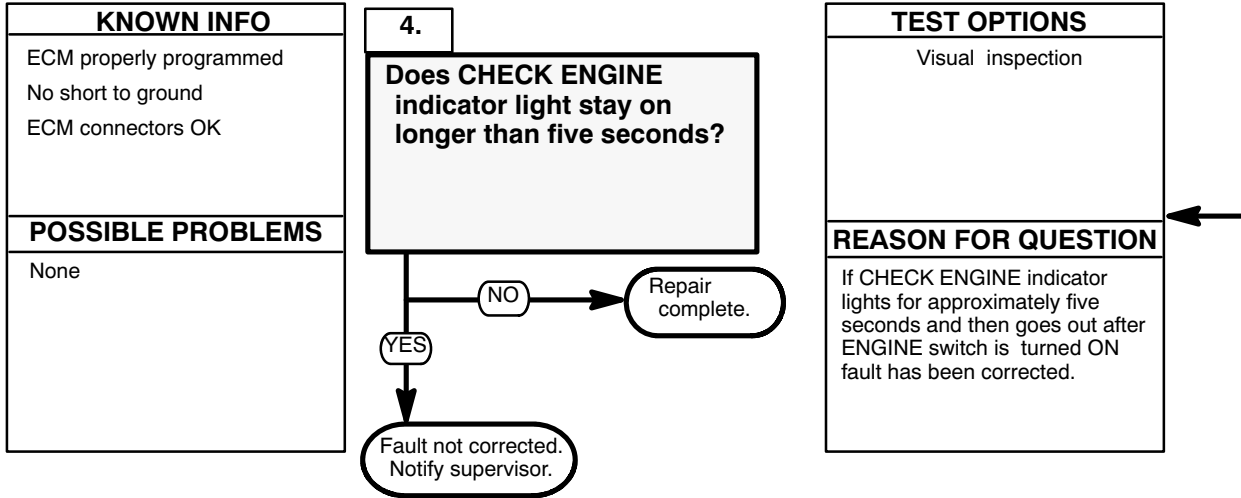
F
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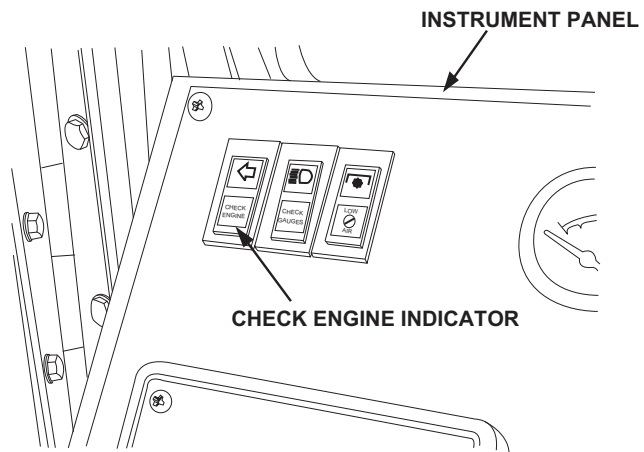
Check terminals and connectors (both ECM and harness side) for damage; bent, corroded, or unseated pins or sockets, especially terminal A1 (Ckt #508).



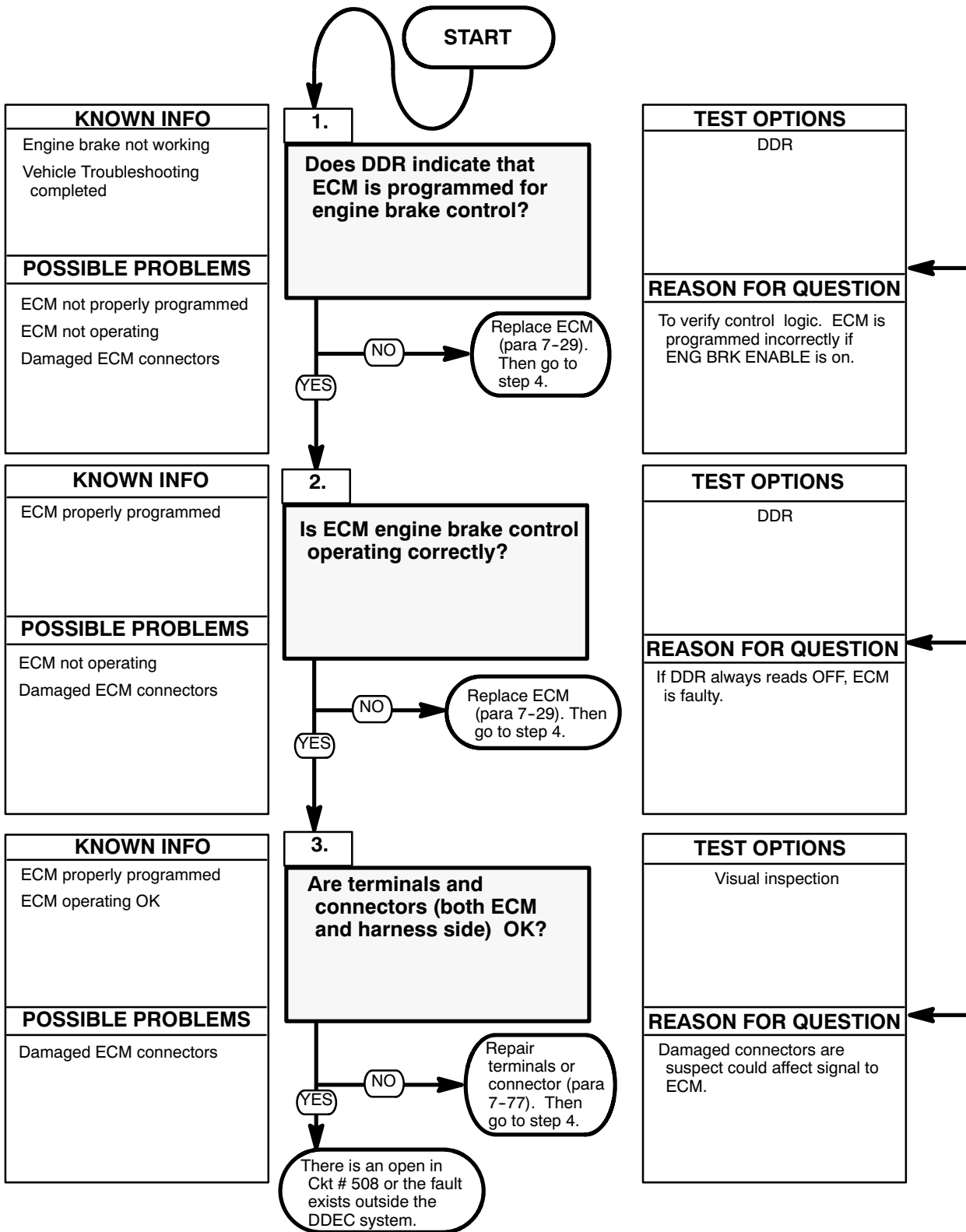
D6 ENGINE BRAKE IS ALWAYS ON (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



D7 ENGINE BRAKE NOT WORKING



NOTE

- Vehicle troubleshooting must be performed first, before attempting to use this chart.
- The following flow chart should only be used if DDEC troubleshooting was started on p. 2-82 and you were referred here.

- (1) Start engine (TM 9-2320-360-10) and run at idle.
- (2) Plug in DDR and select MISC OUTPUTS.
- (3) Observe DDR display labeled ENG BRK ENABLE.
- (4) If display reads OFF, ECM is programmed for engine brake control; if display reads ON, ECM programmed for transmission retarder control.

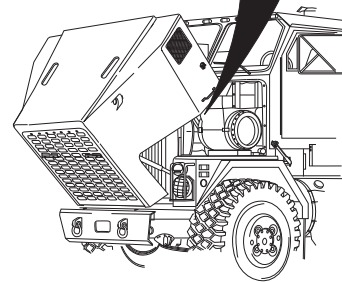
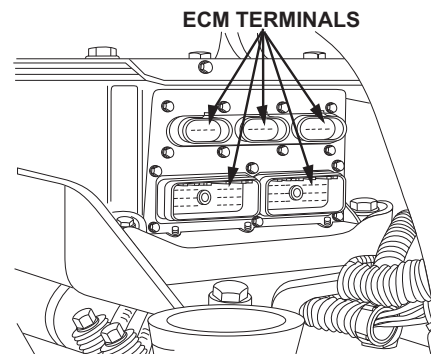
- (1) Rev up the engine, then quickly take foot off throttle.

NOTE

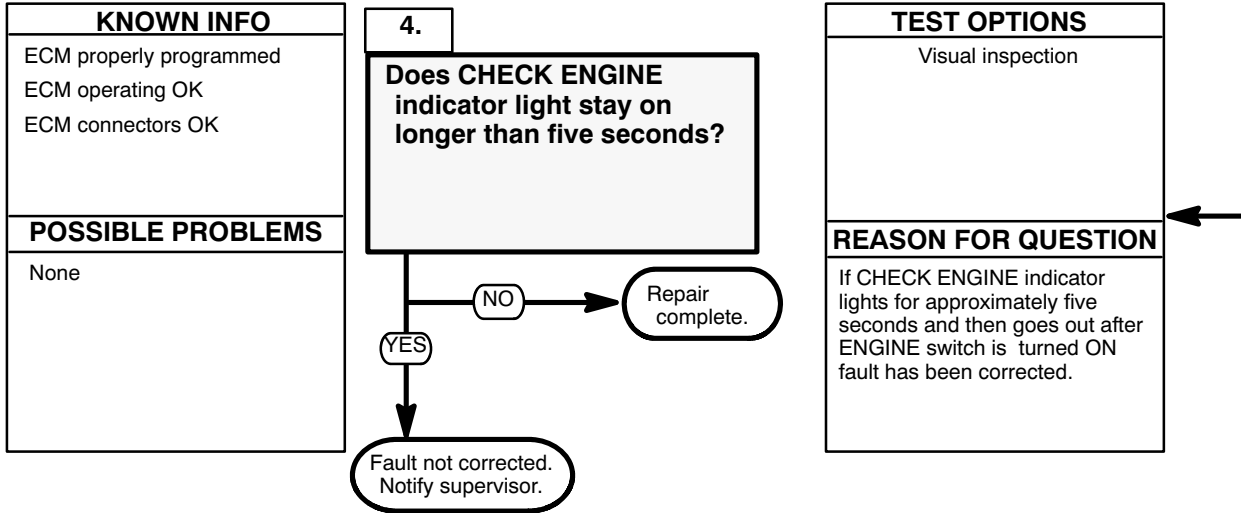
DDR should read OFF when engine is started and while increasing or holding throttle. When throttle is released, display should change to ON. When engine returns to idle, DDR should read OFF.

- (2) Observe DDR display line labeled ENG BRK ENBLE.

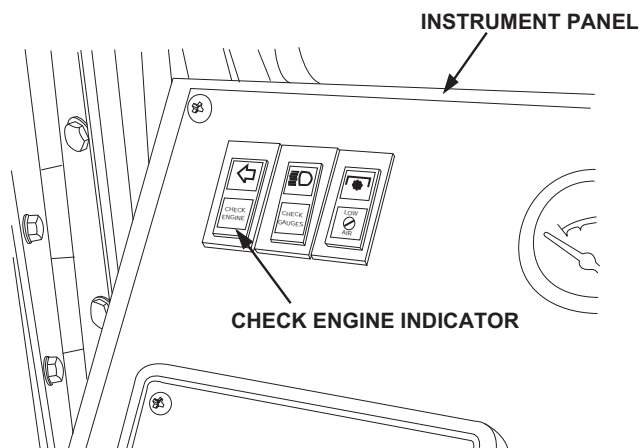
Check terminals and connectors at vehicle harness connector (both ECM and harness side) for damage; bent, corroded, or unseated pins or sockets, especially terminal A1 (Ckt #508).



D7 ENGINE BRAKE NOT WORKING (CONT)



- (1) Turn ENGINE switch OFF.
- (2) Reconnect all harness connectors.
- (3) Turn ENGINE switch ON and observe CHECK ENGINE indicator.



VEHICLE TROUBLESHOOTING

TRUCK, TRACTOR, M1070
HEAVY EQUIPMENT TRANSPORTER (HET)

Table 2-7. Vehicle Troubleshooting

<u>Malfunction</u>	Troubleshooting Procedure (Page)
a. ENGINE	
a1. Engine fails to crank	2-366
a2. Engine cranks but fails to start	2-386
a3. Engine does not develop full power	2-390
a4. Low engine oil pressure	2-392
a5. Excessive engine oil consumption	2-396
a6. Engine overheats (WATER TEMP gage continuously reads over 230°F (110°C))	2-400
a7. Excessive black or gray exhaust smoke (engine at normal operating temperature)	2-402
a8. Blue exhaust smoke (engine at normal operating temperature)	2-404
a9. White exhaust smoke (engine at normal operating temperature)	2-406
a10. Deleted	
b. FUEL SYSTEM	
b1. Engine cranks but fails to start or engine stalls after starting	2-414
b2. Engine starts but misfires, runs rough, or lacks power	2-418
b3. Ether starting aid does not operate	2-422
c. EXHAUST SYSTEM	
c1. Exhaust system unusually noisy or vibrates excessively during engine operation	2-428
c2. Exhaust fumes in cab	2-432
d. COOLING SYSTEM	
d1. Engine overheats (WATER TEMP gage continuously reads over 230 °F (110 °C))	2-438

Table 2-7. Vehicle Troubleshooting (Cont)

<u>Malfunction</u>	<u>Troubleshooting Procedure (Page)</u>
e. ELECTRICAL SYSTEM	
e1. Alternator(s) undercharging	2-460
e1.1. Alternator(s) overcharging	2-466
e2. Electrical components (12 volt and 24 volt) do not operate	2-468
e3. 12 volt electrical components do not operate	2-472
e4. All 12 volt electric gages do not operate	2-476
e5. One electric gage does not operate or is inaccurate	2-480
e6. Ether starting aid does not operate	2-484
e7. Horn (city) does not operate	2-490
e8. Instrument panel gage and switch lights do not operate	2-498
e9. Windshield wipers do not operate	2-502
e10. Windshield wipers do not operate in high speed	2-506
e11. Windshield washer does not operate	2-510
e12. Low air indicator light and/or alarm do not operate when air pressure is below 65 psi (448 kPa)	2-514
e13. Headlights do not operate	2-520
e14. Headlight low/high beam does not operate	2-528
e15. Turn signal light does not operate	2-534
e15.1. Turn signal indicator light does not operate	2-545.1
e16. Clearance, marker, parking, or tail light does not operate	2-546
e17. All blackout lights do not operate	2-554
e18. Blackout clearance, marker, or tail lights does not operate	2-558
e19. Blackout drive light does not operate	2-564
e20. Trailer blackout tail lights do not operate (Blackout lights on HET Tractor operate)	2-568
e21. Stop lights do not operate	2-576
e22. Blackout stop lights do not operate	2-582
e23. Engine brake does not operate	2-586
e24. Dome light does not operate	2-594
e25. Map light(s) do not operate	2-598
e26. Beacon light does not operate	2-602
e27. Backup light/alarm do not operate	2-610
e28. Speedometer does not operate	2-616
e29. Tachometer does not operate	2-620
e30. Clock does not operate	2-624
e31. All trailer lights do not operate (lights on HET Tractor operate)	2-628
e32. Ventilator does not operate	2-628.2

Table 2-7. Vehicle Troubleshooting (Cont)

<u>Malfunction</u>	Troubleshooting Procedure (Page)
f. TRANSMISSION	
f1. Transmission overheats (TRANS TEMP gage continuously reads over 250 °F (121 °C))	2-630
f2. Transmission unusually noisy when operating	2-634
f3. Transmission will not shift into gear, slips out of gear, or operates erratically	2-638
f4. Vehicle moves in neutral	2-640
f5. Transmission shifts rough	2-642
f6. Transmission slips in all forward gears	2-646
f7. Automatic shifts occur at too high or low a speed	2-648
f8. Engine stalls at idle when in gear	2-652
g. TRANSFER CASE	
g1. Transfer case unusually noisy when operating.	2-656
g2. Transfer case does not shift into HIGH or LOW, or slips out of gear.	2-660
g3. Transfer case overheats. (T-CASE TEMP gage continuously reads over 250 °F (121 °C).)	2-662
g4. Transfer case does not engage front axle when transfer case shift lever is positioned to LOW.	2-666
g5. Transfer case does not engage front axle when transfer case shift lever is in HIGH position, and DRIVELINE control is positioned to LOCK.	2-670
h. PROPELLER SHAFTS AND UNIVERSAL JOINTS	
h1. Propeller shafts or universal joints unusually noisy when operating.	2-676
h2. Propeller shafts do not supply torque to axles or hydraulic pump.	2-680
i. POWER TAKEOFF (PTO)	
i1. PTO does not engage	2-684
i2. PTO makes excessive or unusual noise during operation	2-694
i3. PTO indicator does not light when PTO is engaged	2-696
j. AIR BRAKE SYSTEM	
j1. Spring brake(s) will not release	2-706
j2. Service brake(s) will not respond properly.	2-712
j3. Uneven braking (pulling)	2-714
j4. Service brake(s) fail to release/release slowly	2-718
j5. Service brake(s) grabbing	2-722
j6. Excessive loss of air pressure when braking	2-724
j7. Brake(s) overheat	2-728
j8. Spring brakes will not apply	2-732
j9. Automatic slack adjuster does not operate	2-736

Table 2-7. Vehicle Troubleshooting (Cont)

<u>Malfunction</u>	Troubleshooting Procedure (Page)
k. AIR SYSTEM	
k1. Air system loses pressure during operation or air pressure buildup is slow . . .	2-750
k2. Large quantity of moisture expelled from reservoirs	2-758
k3. Air dryer(s) continually purge	2-762
k3.1. Air dryer(s) fail to purge	2-762.4
k4. Relief valve on air dryer releasing air	2-764
k4.1. Relief valve on aftercooler releasing air	2-765.1
k5. Compressor fails to unload. (Air system pressure builds up to more than 125 psi (862 kPa))	2-766
k6. Noisy air compressor operation	2-768
k7. Coolant and/or lubricant leaks from compressor	2-772
k8. Air pressure drops rapidly after engine shutdown	2-776
k9. Windshield washer does not operate	2-780
k10. Horn (country) does not operate	2-786
k11. Horn (city) does not operate	2-790
k12. Transfer case does not engage front axle when transfer case shift lever is positioned to LOW	2-796
k13. Transfer case does not engage front axle when transfer case shift lever is positioned to HIGH and driveline control is positioned to LOCK	2-800
m. WHEELS, TIRES, AND HUBS	
m1. Tires wear unevenly or excessively	2-806
m2. Wheel wobbles or shimmies	2-808
n. CENTRAL TIRE INFLATION SYSTEM	
n1. One tire will not inflate	2-812
n2. Excess inflation time, CTI indicator flashes too long or continually	2-816
n3. CTIS inoperative	2-826
n4. Tires do not deflate to lower pressure setting	2-830
n5. Tire pressures do not agree with CTI settings	2-836
n6. Power manifold clicks continually	2-840
n7. Deleted	
n8. Tires deflate upon completion of adjustment cycle	2-852
n9. CTI low air indicator stays on over 90 psi (621 kPa)	2-858
n10. Overspeed light does not function	2-862
n11. Deleted	
p. AXLES	
p1. Axle unusually noisy when operating	2-876
p2. Interaxle lockup does not engage	2-882

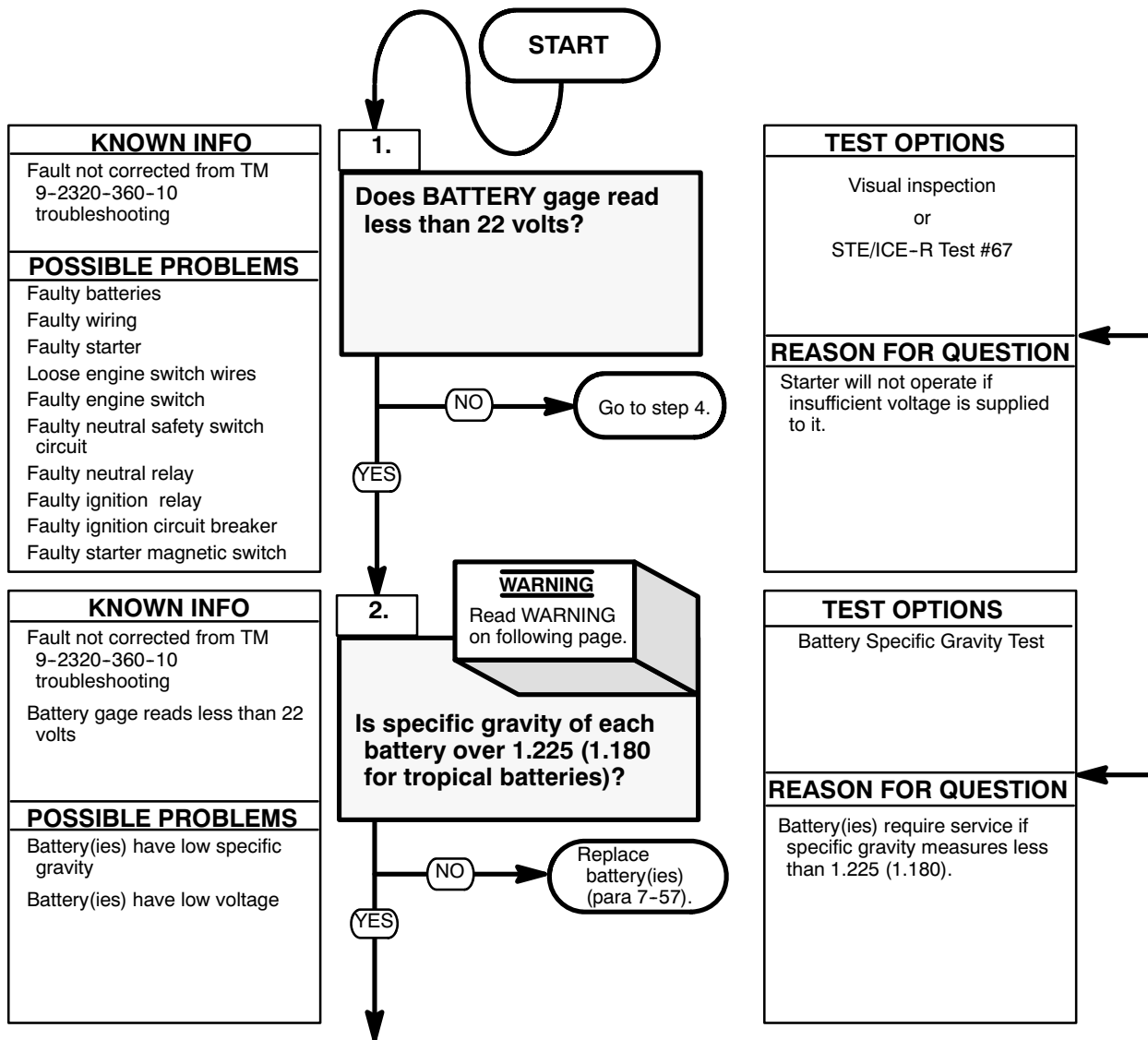
Table 2-7. Vehicle Troubleshooting (Cont)

<u>Malfunction</u>	Troubleshooting Procedure (Page)
q. STEERING SYSTEM	
q1. Hard to steer	2-888
q2. Wanders, pulls to one side, or shimmies	2-896
q3. Excessive play when turning steering wheel	2-902
q4. No response when turning steering wheel	2-906
q5. No response at no. 1 axle when turning steering wheel	2-908
q6. No response at no. 4 axle when turning steering wheel	2-912
q7. Steering binds, does not return to straight ahead after turns	2-916
r. FIFTH WHEEL	
r1. Fifth wheel will not lock when coupling trailer to HET Tractor	2-918
r2. Excessive movement of trailer king pin in fifth wheel	2-922
r3. Fifth wheel will not unlock when disconnecting trailer from HET Tractor	2-924
s. SUSPENSION SYSTEM	
s1. Wanders, pulls to one side, or shimmies	2-928
s2. Leans to one side, or rear of vehicle sags	2-934
t. WINCH SYSTEM	
t1. Both main winches and auxiliary winch do not operate	2-940
t2. One main winch does not operate in either direction	2-944
t3. Both main winches do not operate	2-948
t4. Auxiliary winch does not operate	2-950
t5. Cable hold down does not operate	2-954
t6. Main winch high speed will not work	2-958
t7. Engine does not operate at high idle when engine speed control switches are properly positioned	2-962
t8. Main winch or auxiliary winch makes excessive or unusual noise operates slowly, or jerks	2-970
t9. One main winch will not pull load	2-974
t10. One main winch will not pay out (using control valve)	2-976
u. ARCTIC KIT	
u.1 Arctic kit coolant pump does not operate	2-978

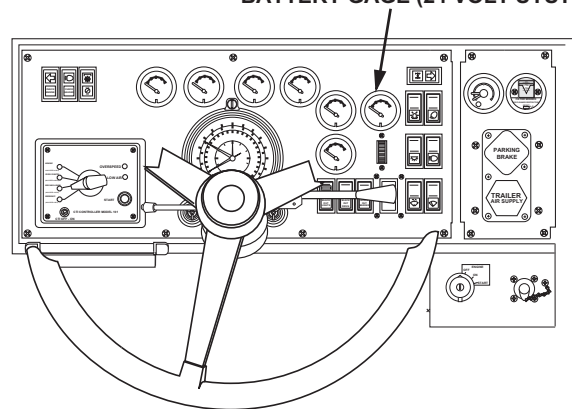
a. ENGINE

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>a1. Engine fails to crank</u>	2-366
<u>a2. Engine cranks but fails to start</u>	2-386
<u>a3. Engine does not develop full power</u>	2-390
<u>a4. Low engine oil pressure</u>	2-392
<u>a5. Excessive engine oil consumption</u>	2-396
<u>a6. Engine overheats (WATER TEMP gage continuously reads over 230⁰F (110⁰C)</u>	2-400
<u>a7. Excessive black or gray exhaust smoke (engine at normal operating temperature)</u>	2-402
<u>a8. Blue exhaust smoke (engine at normal operating temperature)</u>	2-404
<u>a9. White exhaust smoke (engine at normal operating temperature)</u>	2-406
a10. Deleted	

a1. ENGINE FAILS TO CRANK	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (Item 47, Appendix F) Tester, Battery (Item 49, Appendix F)



BATTERY GAGE (24 VOLT SYSTEM)



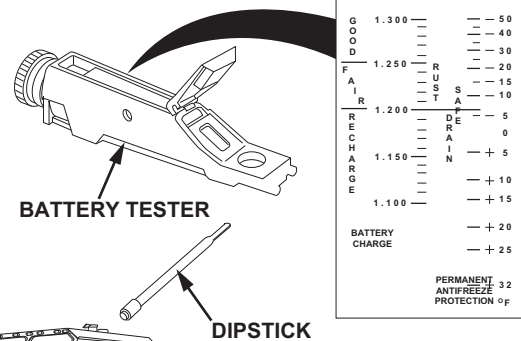
NOTE

ENGINE switch must be positioned to ON to perform this test.

Check BATTERY gage (24 volt system). BATTERY gage should read greater than 22 volts.

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes. Always wear eye protection when working with batteries.

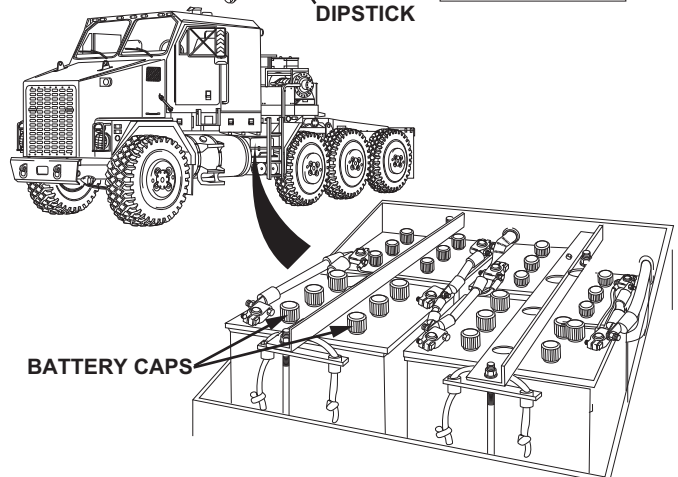


BATTERY SPECIFIC GRAVITY TEST

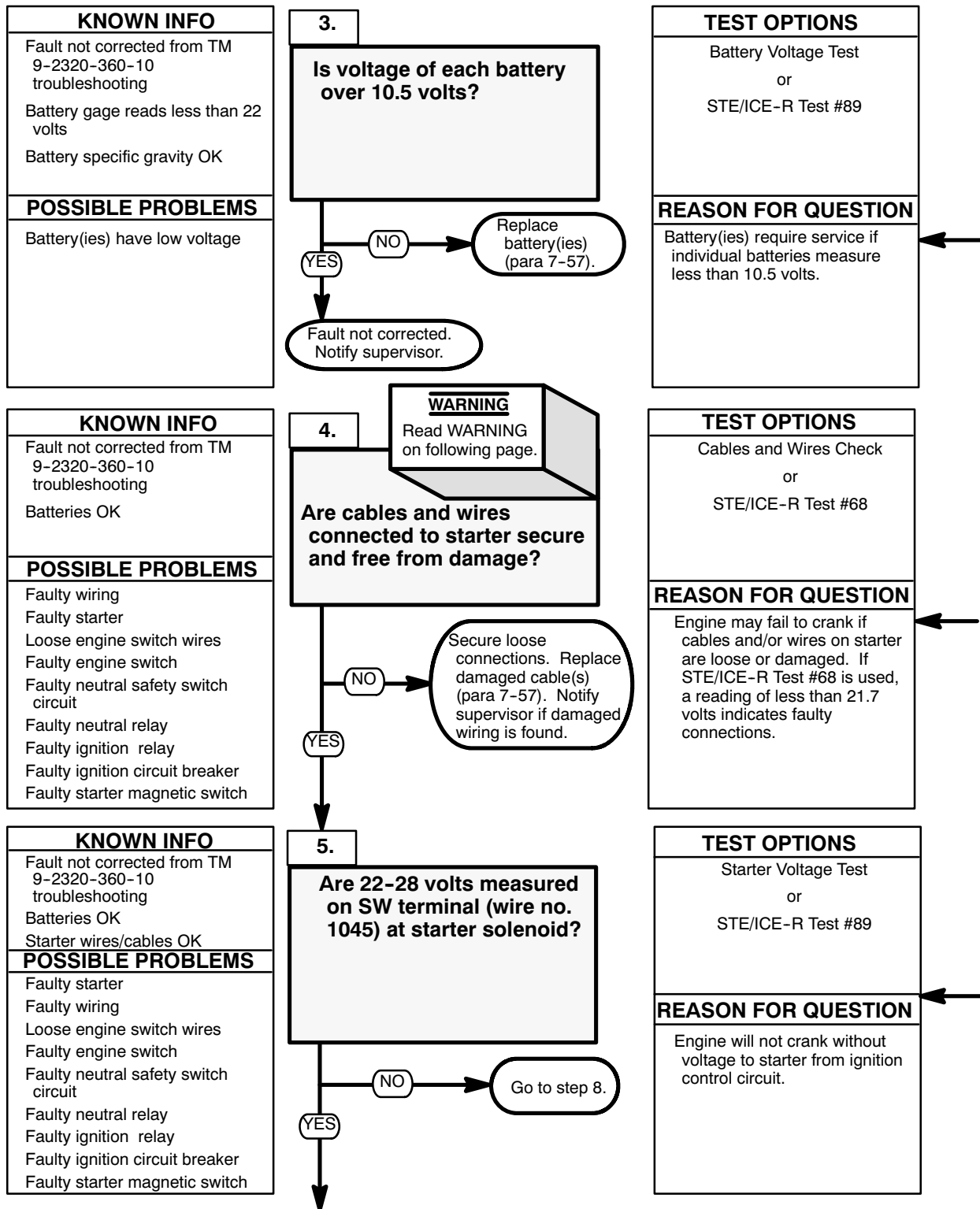
NOTE

Separate test for each battery cell must be made.

- (1) Remove caps from battery.
- (2) Place a few drops of electrolyte on exposed portion of measuring window using black dipstick.
- (3) Point tester toward light source and note reading.
- (4) Install caps on battery.
- (5) Repeat steps (1) thru (4) for remaining battery(ies).

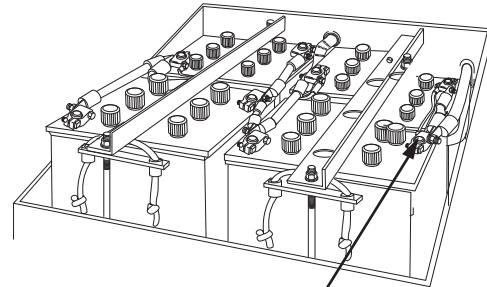


a1. ENGINE FAILS TO CRANK (CONT)



BATTERY VOLTAGE TEST

- (1) Place positive (+) probe of multimeter on positive (+) terminal of battery.
- (2) Place negative (-) probe of multimeter on negative (-) terminal of battery and look for over 10.5 volts on multimeter.
- (3) Repeat steps (1) and (2) for remaining battery(ies).



BATTERY TERMINALS

CABLES AND WIRES CHECK

WARNING

Batteries must be disconnected before checking cables and wires on starter. Failure to comply may result in personnel injury.

- (1) Disconnect batteries (para 7-57).
 - (1.1) Remove left inner fender (para 16-34).
- (2) Check cables and wires on starter for loose connections or damage.
- (3) Connect batteries (para 7-57).

STE/ICE TEST #68

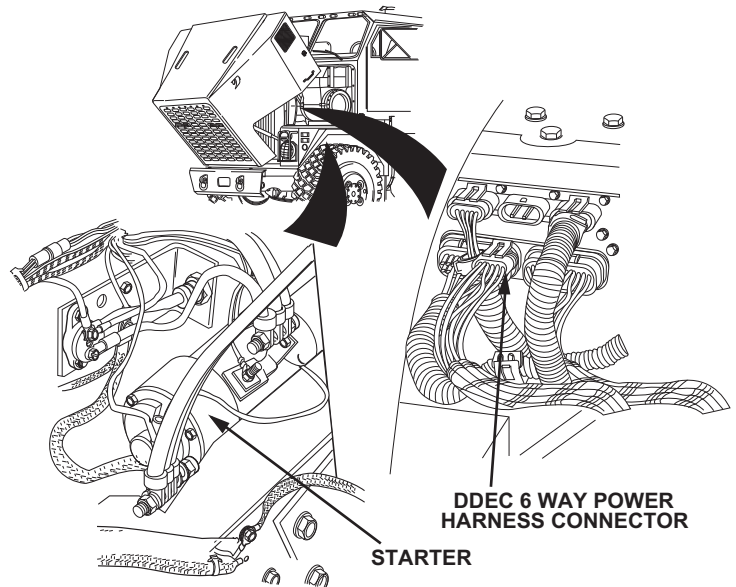
- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "68".
- (3) Remove DDEC 6-way power harness connector from ECM.
- (4) Press and release TEST button.
- (5) Attempt to crank engine while observing STE/ICE display for test results.
- (6) Install DDEC 6-way power harness connector on ECM.

STARTER VOLTAGE TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1045 at starter.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.

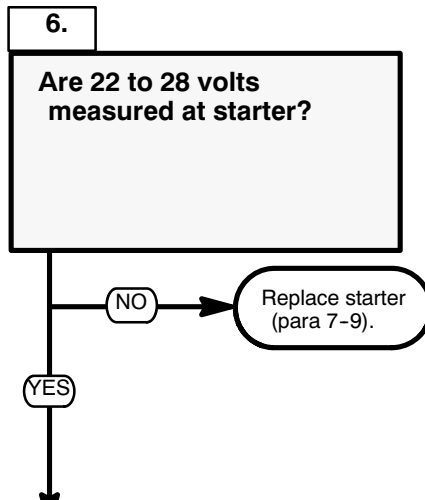


DDEC 6 WAY POWER HARNESS CONNECTOR

STARTER

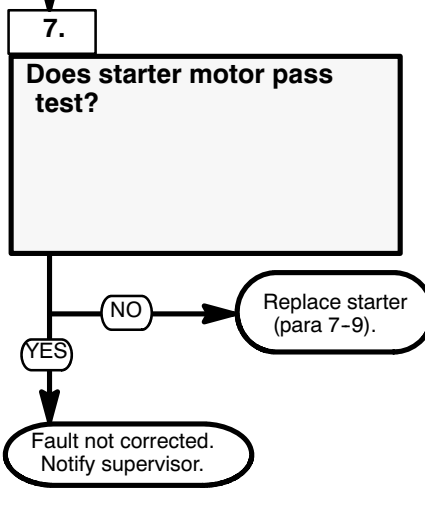
a1. ENGINE FAILS TO CRANK (CONT)

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Neutral relay OK
Ignition relay OK
Ignition circuit breaker OK
Starter magnetic switch OK
POSSIBLE PROBLEMS
Faulty starter solenoid switch
Faulty starter



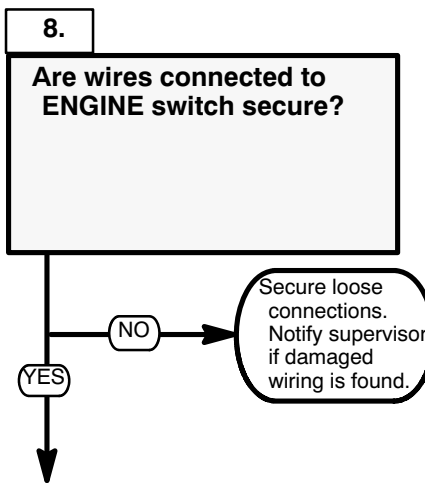
TEST OPTIONS
Solenoid Switch Test or STE/ICE-R Test #70
REASON FOR QUESTION
Starter solenoid switch is faulty if low voltage is measured on wire no. 1819.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Neutral relay OK
Ignition relay OK
Ignition circuit breaker OK
Starter magnetic switch OK
Starter solenoid switch OK
POSSIBLE PROBLEMS
Faulty starter



TEST OPTIONS
STE/ICE-R Test #71 or STE/ICE-R Test #72
REASON FOR QUESTION
Starter is faulty if greater than 330 amps are measured when using STE/ICE-R Test #71, or if greater than 1561 amps are measured when using STE/ICE-R Test #72.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
POSSIBLE PROBLEMS
Loose engine switch wires
Faulty engine switch
Faulty neutral safety switch circuit
Faulty neutral relay
Faulty ignition relay
Faulty ignition circuit breaker
Faulty starter magnetic switch
Faulty wiring



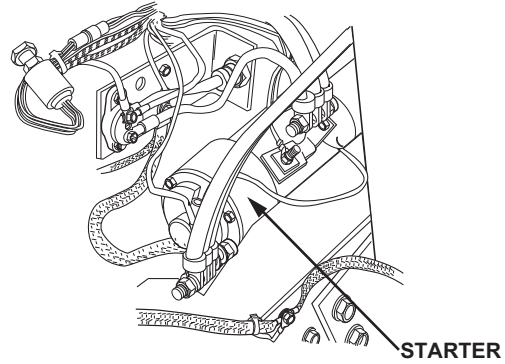
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Engine may not crank if wires connected to ENGINE switch are loose or damaged.

SOLENOID SWITCH TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1819 at starter solenoid.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Check wire no. 1819 on starter solenoid for loose connections or damage if no voltage is measured.

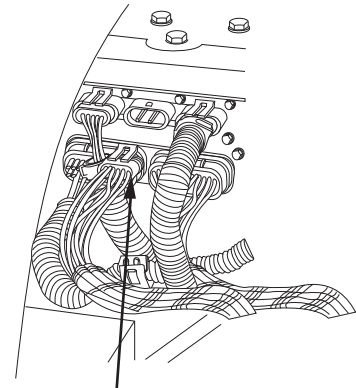


STE/ICE TEST #70

- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "70".
- (3) Remove DDEC 6-way power harness connector from ECM.
- (4) Press and release TEST button.
- (5) Attempt to crank engine while observing STE/ICE display for test results.
- (6) Install DDEC 6-way power harness connector on ECM.

STE/ICE TEST #71

- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "71".
- (3) Remove DDEC 6-way power harness connector from ECM.
- (4) Press and hold TEST button until "CAL" appears in display.
- (5) Release TEST button and wait for offset value to appear in display.
- (6) Press and release TEST button.
- (7) Attempt to crank engine while observing STE/ICE display for test results.
- (8) Install DDEC 6-way power harness connector on ECM.

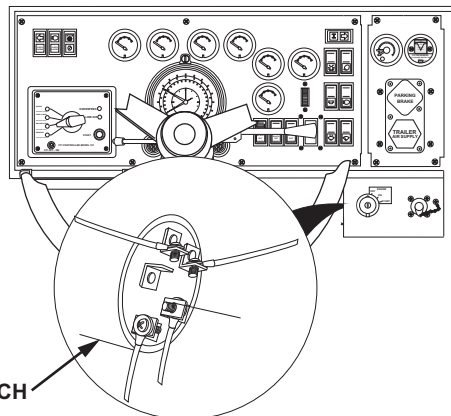


DDEC 6 WAY POWER HARNESS CONNECTOR

STE/ICE TEST #72

- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "72".
- (3) Remove DDEC 6-way power harness connector from ECM.
- (4) Press and hold TEST button until "CAL" appears in display.
- (5) Release TEST button and wait for offset value to appear in display.
- (6) Press and release TEST button.
- (7) Crank engine until "OFF" appears on STE/ICE display.
- (8) Install DDEC 6-way power harness connector on ECM.

Check wires on ENGINE switch for loose connections.



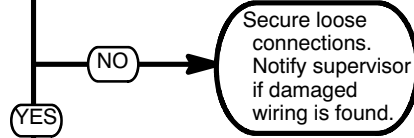
ENGINE SWITCH

a1. ENGINE FAILS TO CRANK (CONT)

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting Batteries OK
POSSIBLE PROBLEMS
Loose engine switch wires Faulty engine switch Faulty neutral safety switch circuit Faulty neutral relay Faulty ignition relay Faulty ignition circuit breaker Faulty starter magnetic switch Faulty wiring

9.

Are 22-28 volts measured at BAT terminal (wire no. 1431) on ENGINE switch?

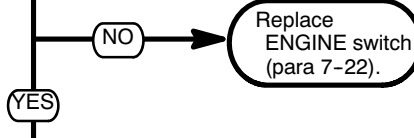


TEST OPTIONS
Engine Switch Feed Test or STE/ICE Test #89
REASON FOR QUESTION
Engine will not crank if low voltage is measured at BAT terminal (wire no. 1431) on ENGINE switch.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting Batteries OK Engine switch wires OK
POSSIBLE PROBLEMS
Faulty engine switch Faulty neutral safety switch circuit Faulty neutral relay Faulty ignition relay Faulty ignition circuit breaker Faulty starter magnetic switch Faulty wiring

10.

Are 22-28 volts measured on IGN terminal (wire no. 1872) on ENGINE switch?

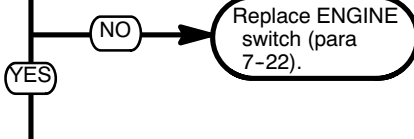


TEST OPTIONS
Engine Switch Test or STE/ICE Test #89
REASON FOR QUESTION
ENGINE switch is faulty if low voltage is measured at IGN terminal (wire no 1872).

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting Batteries OK Engine switch wires OK
POSSIBLE PROBLEMS
Faulty engine switch Faulty neutral safety switch circuit Faulty neutral relay Faulty ignition relay Faulty ignition circuit breaker Faulty starter magnetic switch Faulty wiring

11.

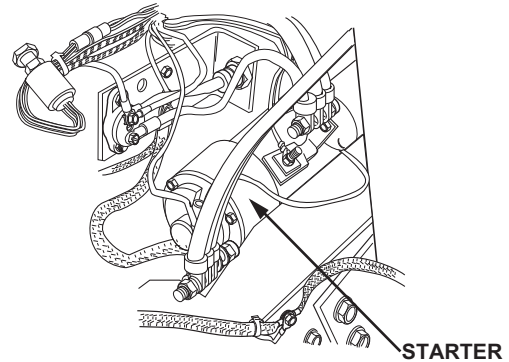
Are 22-28 volts measured at ST terminal (wire no. 1021) on ENGINE switch?



TEST OPTIONS
Engine Switch Test or STE/ICE Test #89
REASON FOR QUESTION
ENGINE switch is faulty if low voltage is measured at ST terminal (wire no. 1021).

ENGINE SWITCH FEED TEST

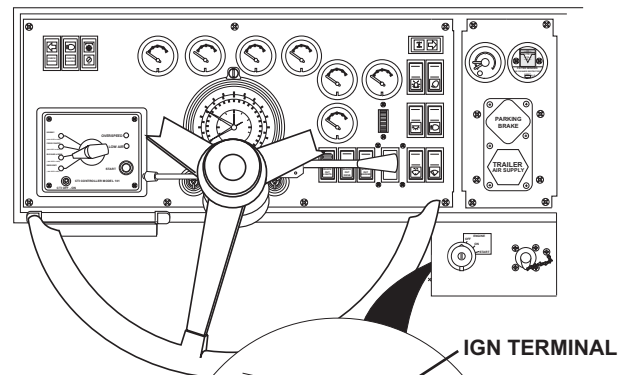
- (1) Turn ENGINE switch to OFF.
- (2) Place positive (+) probe of multimeter on BAT terminal (wire no. 1431) at ENGINE switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Check for voltage at the following points if no voltage is measured at BAT terminal (wire no. 1431) of ENGINE switch.
 - (a) Check wire no. 1431 at 150 amp, 24 V circuit breaker. If no voltage is measured, circuit breaker is faulty.
 - (b) Check wire no. 1274 at 150 amp, 24 V circuit breaker. If no voltage is measured, circuit breaker is faulty.
 - (c) Check wire no. 1274 at starter motor. If no voltage is measured, there is an open in wire no. 1274.



ENGINE SWITCH TEST
NOTE

ENGINE switch must be positioned to ON to perform this test.

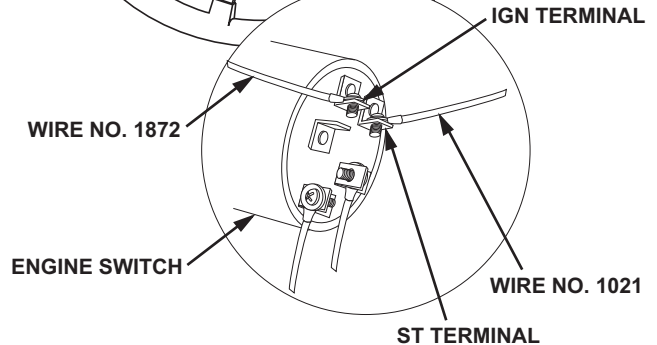
- (1) Turn ENGINE switch to ON.
- (2) Place positive (+) probe of multimeter on wire no. 1872 at IGN terminal of ENGINE switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.



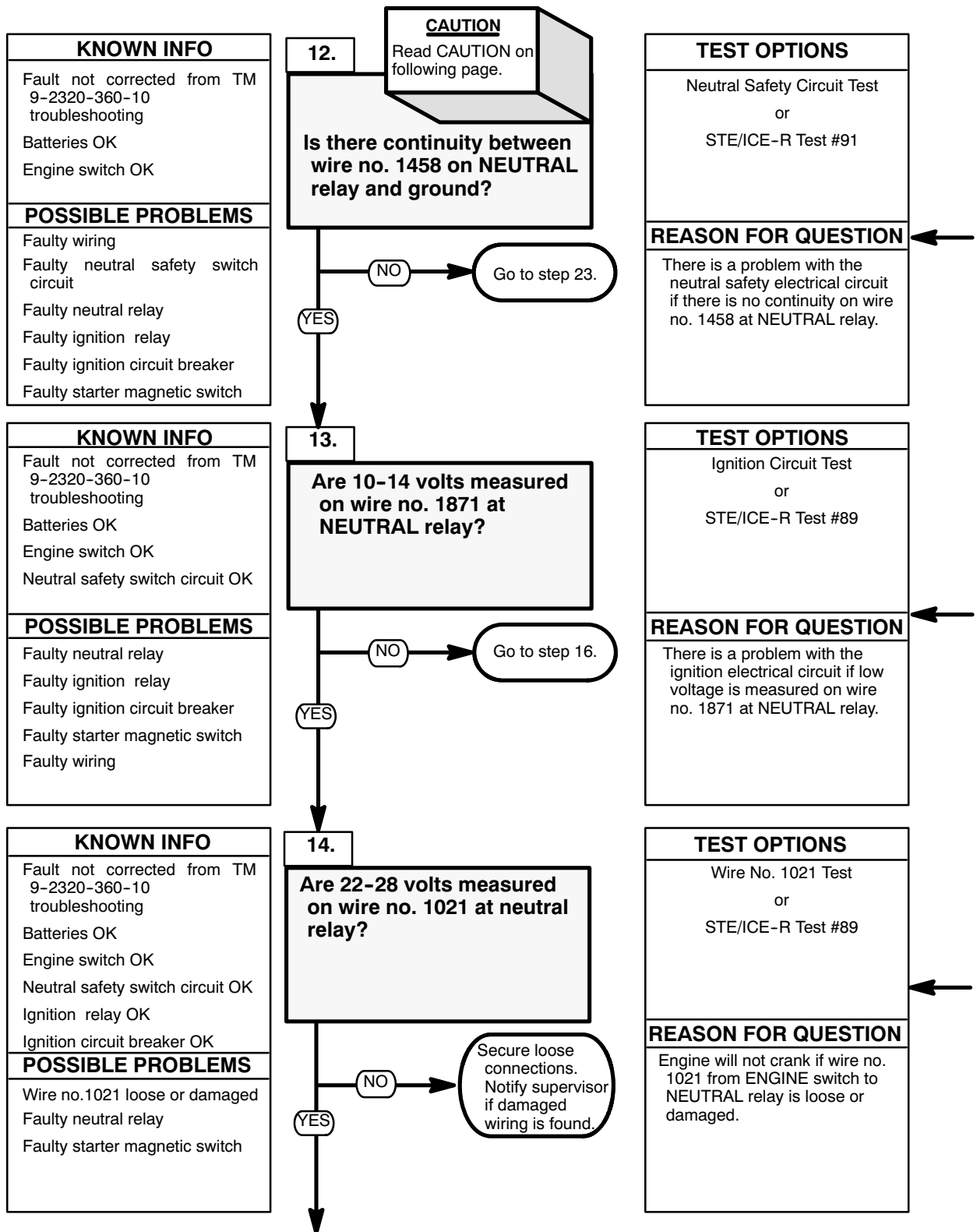
ENGINE SWITCH TEST
NOTE

ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1021 at ST terminal of ENGINE switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.



a1. ENGINE FAILS TO CRANK (CONT)



**NEUTRAL SAFETY SWITCH
CIRCUIT TEST**

CAUTION

ENGINE switch must be positioned to OFF to perform this test. Failure to comply may result in damage to test equipment.

NOTE

Relay can be pulled out of socket slightly to provide easier access for test.

- (1) Turn ENGINE switch to OFF.
- (2) Set multimeter to ohms position.
- (3) Place positive (+) probe of multimeter on wire no. 1458 at NEUTRAL relay.
- (4) Place negative (-) probe of multimeter on ground and check multimeter for continuity.

IGNITION CIRCUIT TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

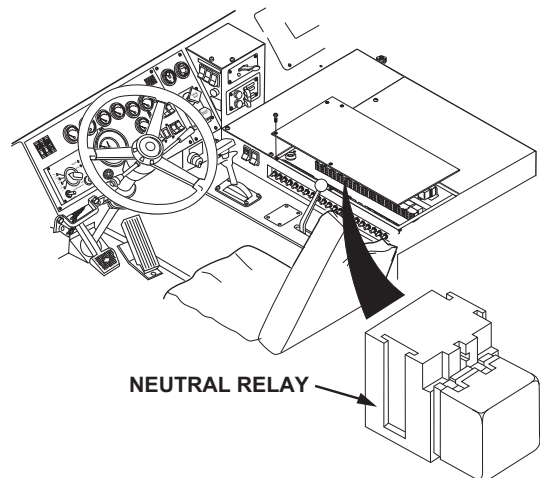
- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1871 at NEUTRAL relay.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF.

WIRE NO. 1021 TEST

NOTE

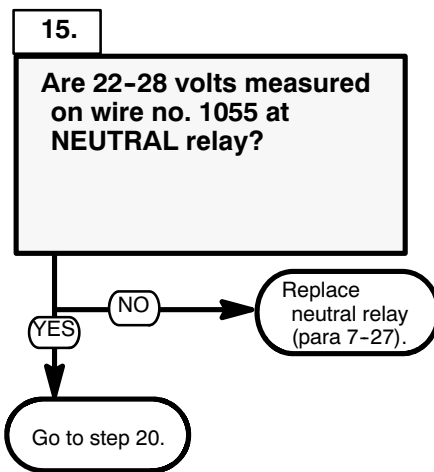
ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1021 at NEUTRAL relay.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.
- (5) Inspect wire no. 1021 between neutral relay and engine switch if no voltage is measured.



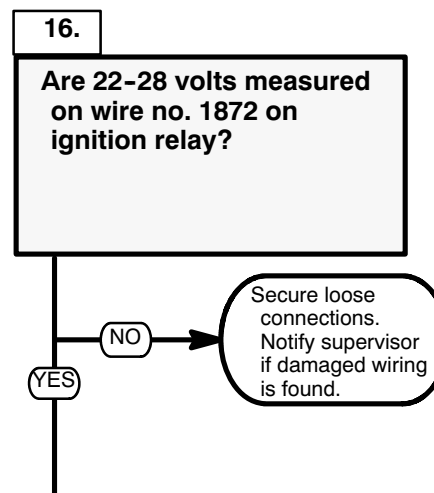
a1. ENGINE FAILS TO CRANK (CONT)

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Ignition relay OK
Ignition circuit breaker OK
Wire no. 1021 OK
POSSIBLE PROBLEMS
Wires no. 1055 or 1284 loose or damaged
Faulty neutral relay
Faulty starter magnetic switch



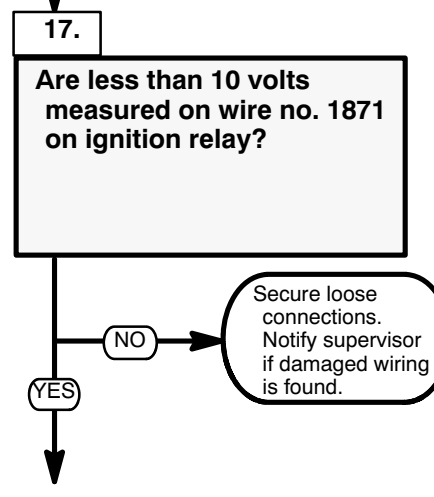
TEST OPTIONS
NEUTRAL Relay Test or STE/ICE-R Test #89
REASON FOR QUESTION
NEUTRAL relay is faulty if low voltage is measured on wire no. 1055.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
POSSIBLE PROBLEMS
Faulty ignition relay
Faulty ignition circuit breaker
Faulty wiring



TEST OPTIONS
Wire no. 1872 Test or STE/ICE-R Test #89
REASON FOR QUESTION
Engine will not crank if wire no. 1872 from IGN terminal on ENGINE switch to IGNITION relay is loose or damaged.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Wire no. 1872 OK
POSSIBLE PROBLEMS
Faulty ignition relay
Faulty ignition circuit breaker
Wires no. 1871 or 1536 loose or damaged



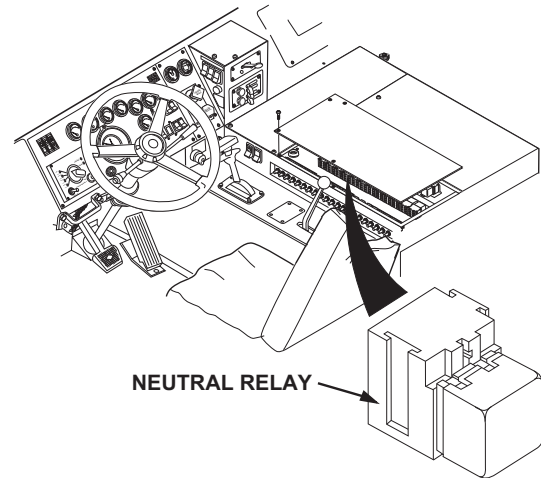
TEST OPTIONS
Wire no. 1871 Test or STE/ICE-R Test #89
REASON FOR QUESTION
Engine will not crank if wire no. 1871 from IGNITION relay to NEUTRAL relay is loose or damaged.

NEUTRAL RELAY TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1055 at NEUTRAL relay.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.



WIRE NO. 1872 TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

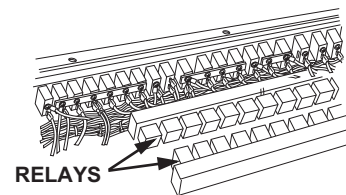
- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1872 at IGNITION relay.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.
- (5) Inspect wire no. 1872 between ignition relay and ignition switch if no voltage is measured.

WIRE NO. 1871 TEST

NOTE

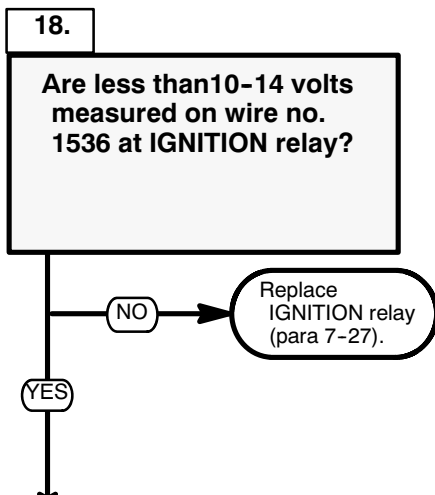
ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1871 at IGNITION relay.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.
- (5) Inspect wire no. 1871 between ignition relay and ignition switch if no voltage is measured.



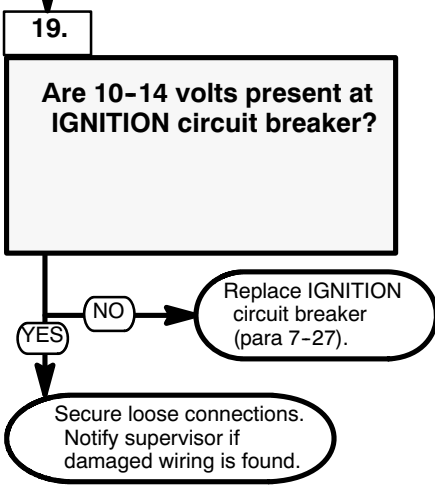
a1. ENGINE FAILS TO CRANK (CONT)

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Wires no. 1871 and 1872 OK
POSSIBLE PROBLEMS
Faulty ignition relay
Wire no 1536 loose or damaged
Faulty ignition circuit breaker



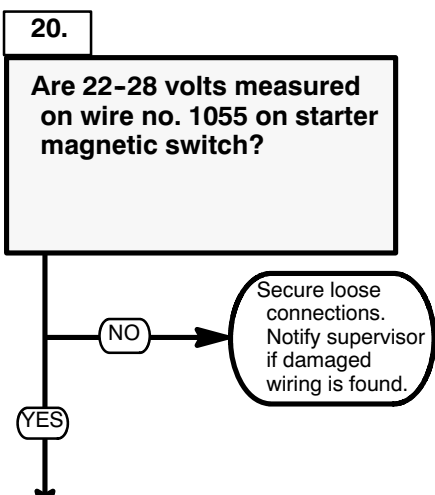
TEST OPTIONS
Ignition Relay Test or STE/ICE-R Test #89
REASON FOR QUESTION
IGNITION relay is faulty if 10-14 volts are measured on wire no. 1536.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Ignition relay OK
POSSIBLE PROBLEMS
Wire no 1536 loose or damaged
Faulty ignition circuit breaker



TEST OPTIONS
Circuit Breaker Test
REASON FOR QUESTION
IGNITION control circuit will not function if low voltage is present at lower terminal of IGNITION circuit breaker. Engine will not crank if wire no. 1536 from IGNITION circuit breaker to IGNITION relay is loose or damaged.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Ignition relay OK
Ignition circuit breaker OK
POSSIBLE PROBLEMS
Wires no. 1055 or 1284 loose or damaged
Faulty starter magnetic switch



TEST OPTIONS
Wire no. 1055 Test or STE/ICE-R Test #89
REASON FOR QUESTION
Engine will not crank if wire no. 1055 from NEUTRAL relay to starter magnetic switch is loose or damaged.

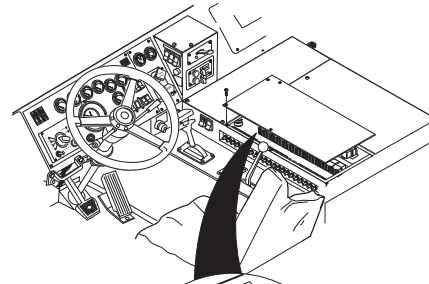
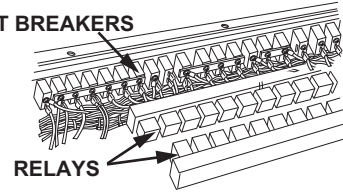
IGNITION RELAY TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1536 at IGNITION relay.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.
- (5) Inspect wire no. 1536 between ignition relay and ignition circuit breaker if no voltage is measured.

CIRCUIT BREAKERS



CIRCUIT BREAKER

CIRCUIT BREAKER TEST

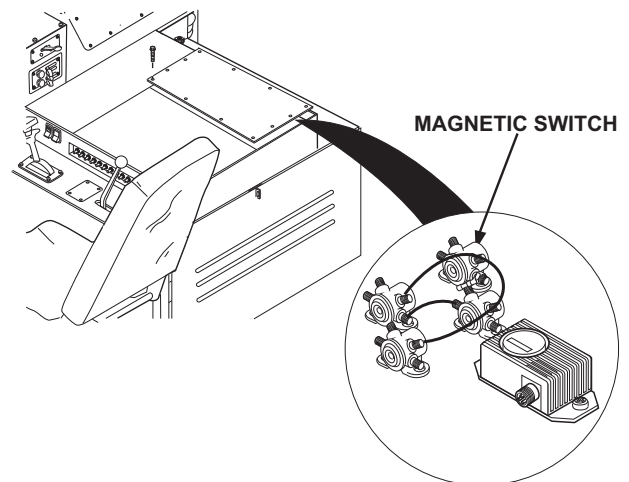
- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

WIRE NO. 1055 VOLTAGE TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1055 at starter magnetic switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.
- (5) Inspect wire no. 1055 between magnetic switch and neutral relay for loose connections and damage if voltage is measured.

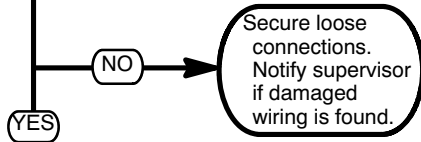


a1. ENGINE FAILS TO CRANK (CONT)

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Ignition relay OK
Ignition circuit breaker OK
Wire no. 1055 OK
POSSIBLE PROBLEMS
Wire no. 1284 loose or damaged
Faulty starter magnetic switch

21.

Are 22-28 volts measured on wire no. 1284 at starter magnetic switch?

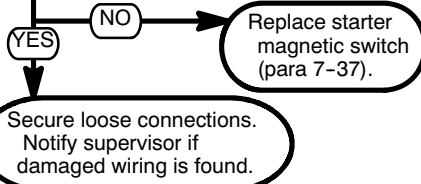


TEST OPTIONS
Wire No. 1284 Voltage Test or STE/ICE-R Test #89
REASON FOR QUESTION
Engine will not crank if wire no. 1284 from starter magnetic switch to 24 volt magnetic switch is loose or damaged.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
Neutral safety switch circuit OK
Ignition relay OK
Ignition circuit breaker OK
POSSIBLE PROBLEMS
Faulty starter magnetic switch

22.

Are 22-28 volts measured on wire no. 1045 at starter magnetic switch?

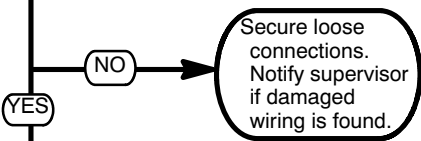


TEST OPTIONS
Starter Magnetic Switch Test or STE/ICE-R Test #89
REASON FOR QUESTION
Starter magnetic switch is faulty if low voltage is measured on wire no. 1045. Engine will not crank if wire no. 1045 from starter magnetic switch to starter is loose or damaged.

KNOWN INFO
Fault not corrected from TM 9-2320-360-10 troubleshooting
Batteries OK
Engine switch OK
POSSIBLE PROBLEMS
Faulty wire no. 1458
Faulty neutral safety switch
Faulty ground wire no. 1435

23.

Is wire no. 1458 from neutral safety switch to NEUTRAL relay secure and free from damage?



CAUTION
Read CAUTION on following page.

TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Engine will not crank if wire no. 1458 from neutral safety switch to NEUTRAL relay is loose or damaged.

WIRE NO. 1284 VOLTAGE TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1284 at starter magnetic switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.
- (5) Inspect wire no. 1284 between magnetic switches for loose connections and damage if no voltage is measured.

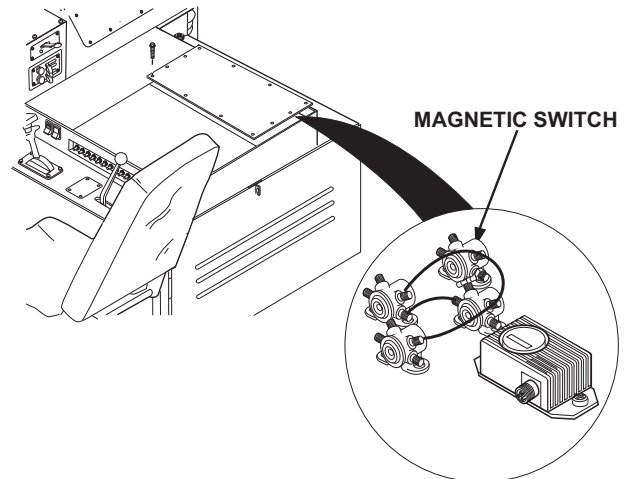
STARTER MAGNETIC SWITCH TEST

NOTE

ENGINE switch must be positioned and held to START to perform this test.

- (1) Turn and hold ENGINE switch to START.
- (2) Place positive (+) probe of multimeter on wire no. 1045 at starter magnetic switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF.
- (5) Inspect wire no. 1045 between magnetic switch and starter solenoid for loose connections and damage if voltage is measured.

Check wire no. 1458 from neutral safety switch to NEUTRAL relay for loose connections, damage, and continuity.



CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wire no. 1458 from neutral safety switch and NEUTRAL relay.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

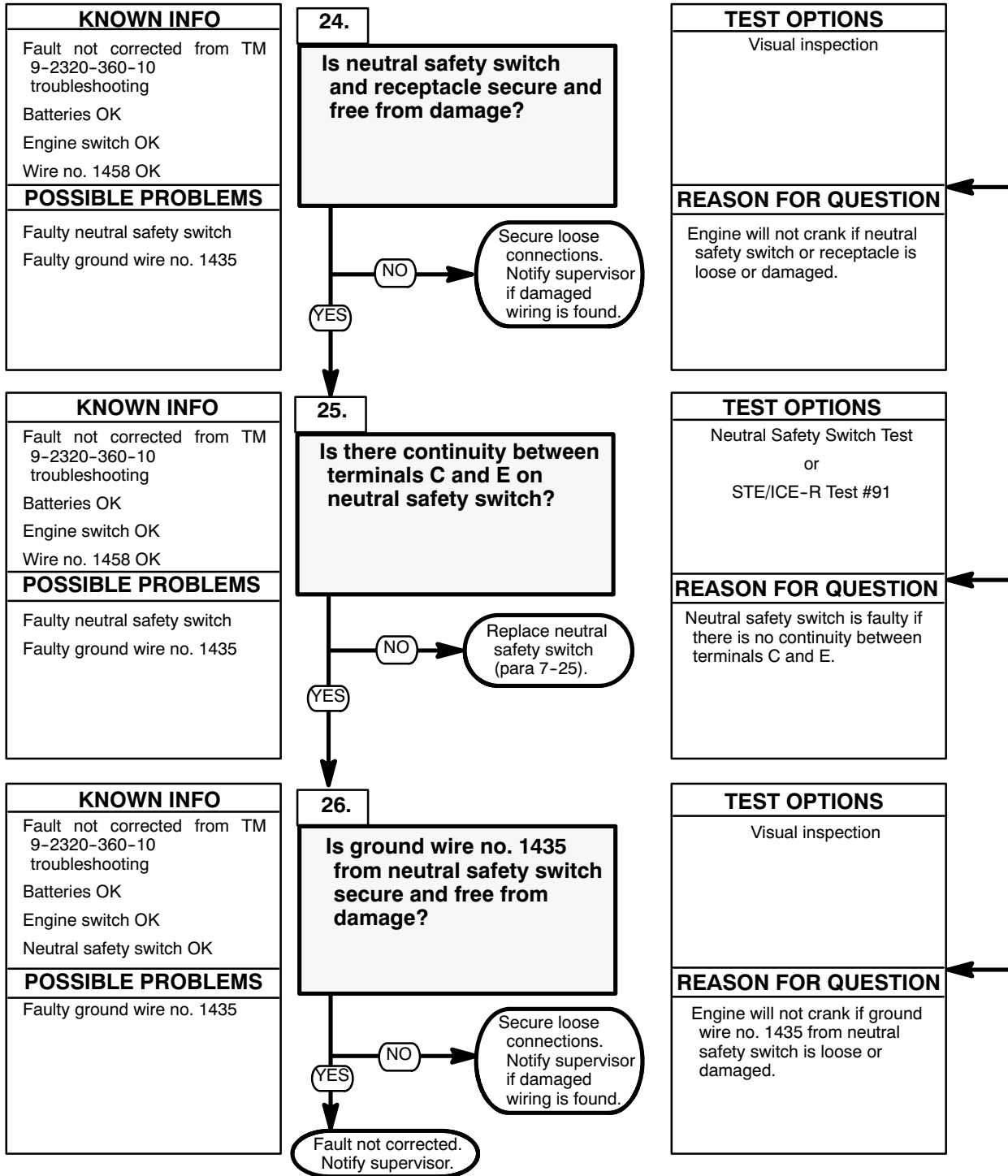
- (3) Connect multimeter leads to each end of wire no. 1458 and note reading on multimeter.

NOTE

A reading of other than infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground and check multimeter for continuity.
- (5) Connect wire no. 1458 to neutral safety switch and NEUTRAL relay.

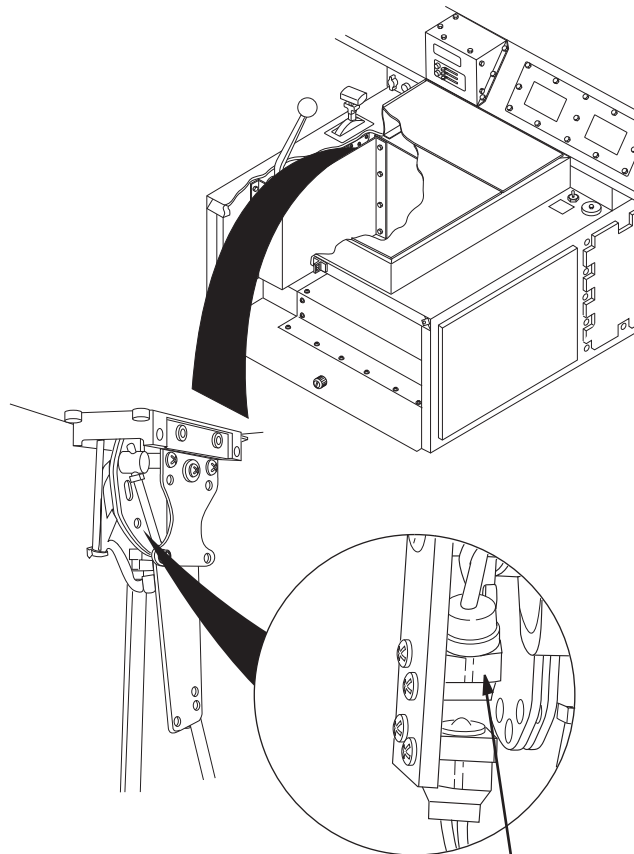
a1. ENGINE FAILS TO CRANK (CONT)



Check neutral safety switch and receptacle for loose connections or damage.

NEUTRAL SAFETY SWITCH TEST

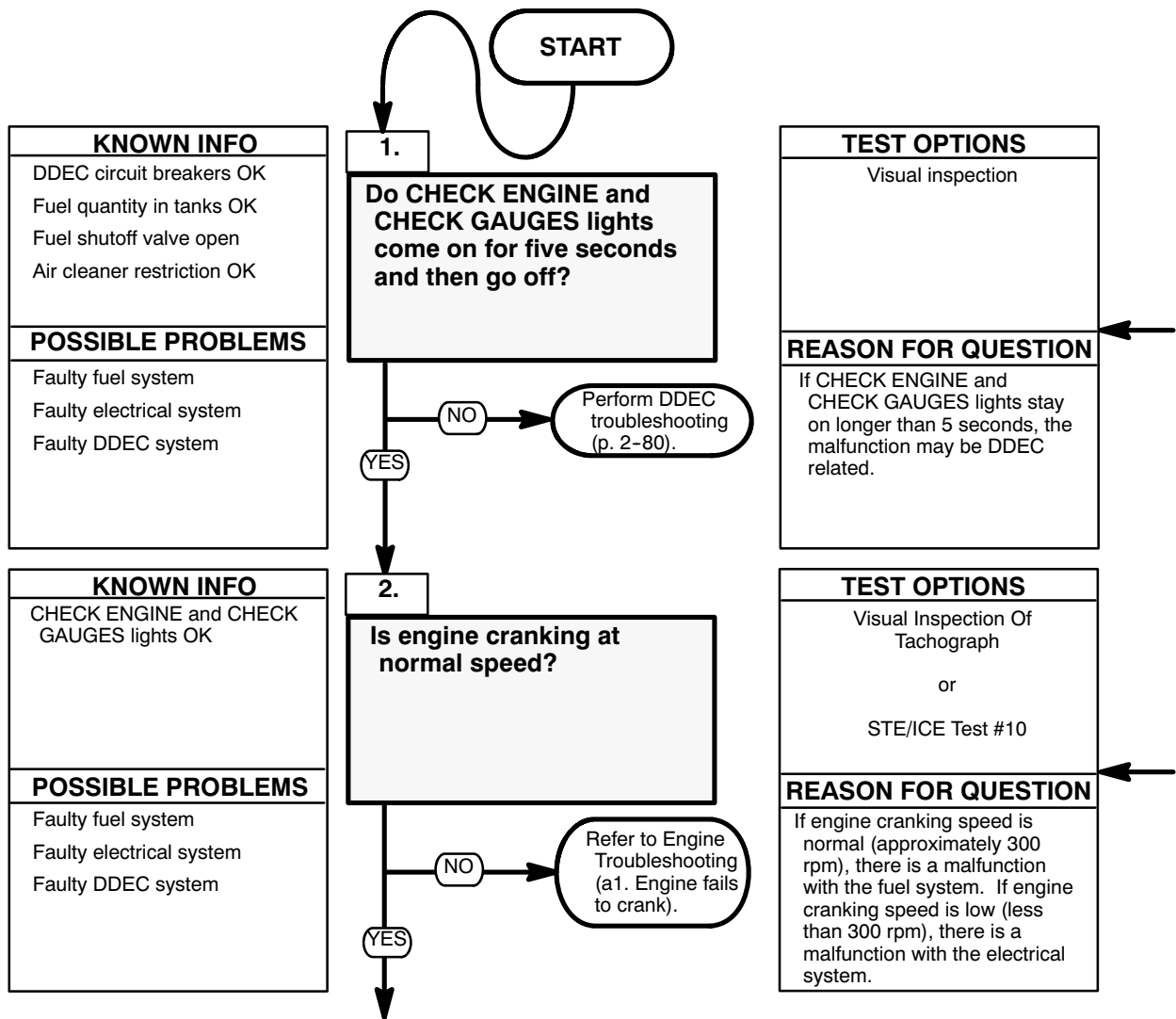
- (1) Disconnect neutral safety switch from receptacle at transmission shift linkage.
- (2) Set multimeter to ohms position.
- (3) Place positive (+) probe of multimeter on terminal C at neutral safety switch.
- (4) Place negative (-) probe of multimeter on terminal E at neutral safety switch, and check multimeter for continuity.
- (5) Connect neutral safety switch to receptacle if there is continuity between terminals C and E.



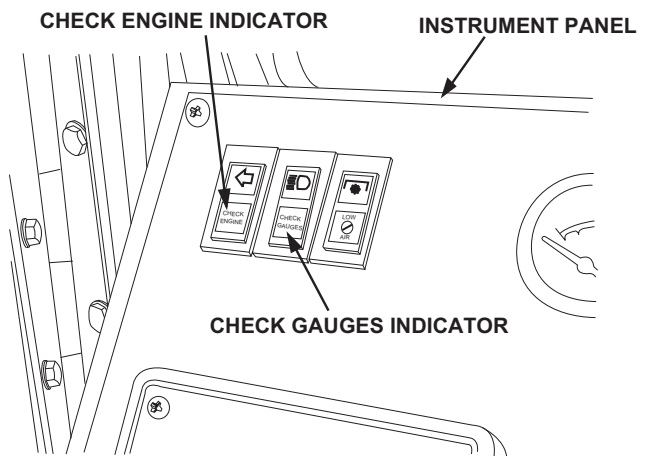
NEUTRAL SAFETY SWITCH

Check ground wire no. 1435 from neutral safety switch to ground for loose connections and damage.

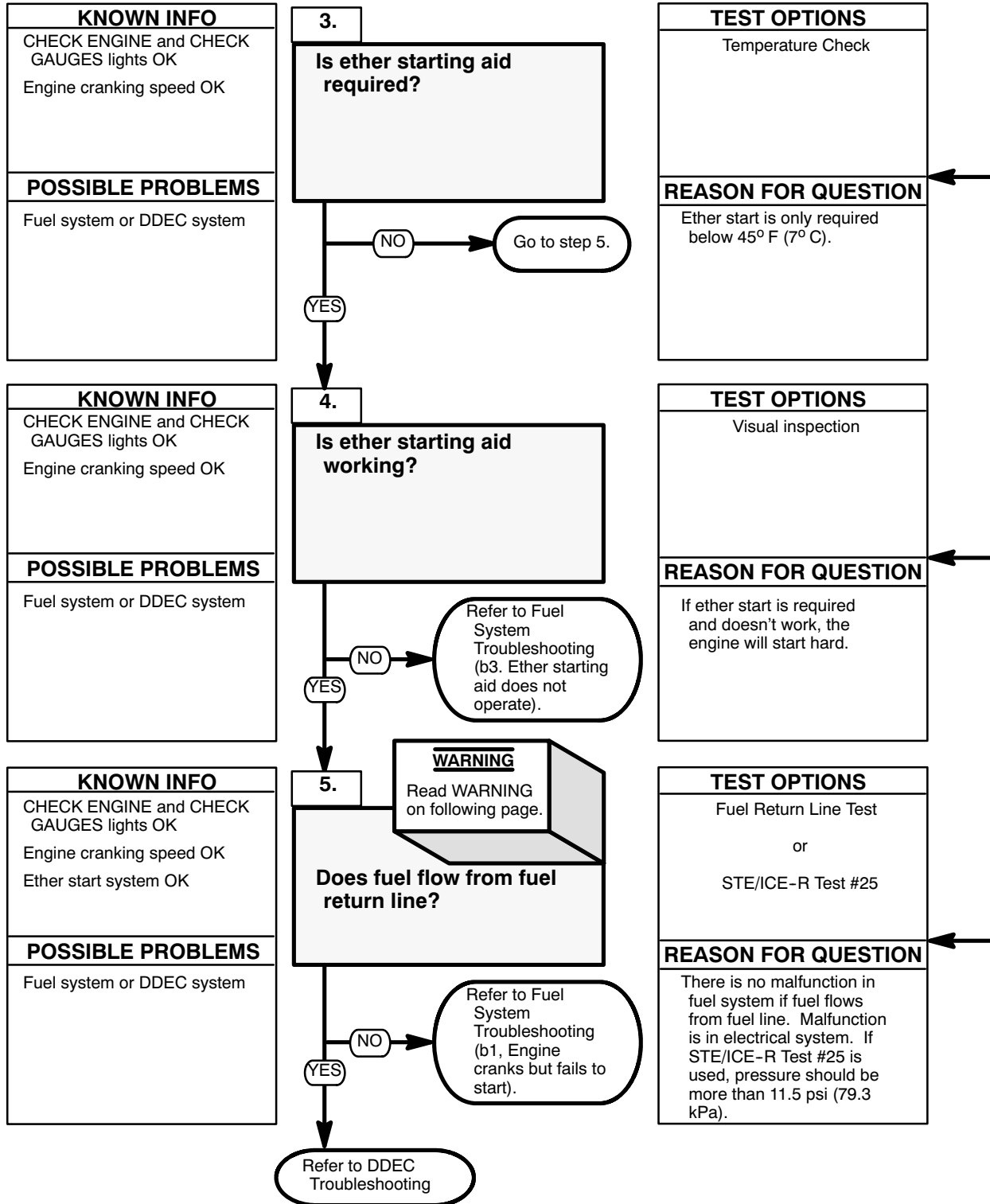
a2. ENGINE CRANKS BUT FAILS TO START	
INITIAL SETUP	
<p>Equipment Conditions</p> <p>Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools</p> <p>Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)</p> <p>Personnel required</p> <p>Two</p>



Turn ENGINE switch ON and observe CHECK ENGINE and CHECK GAUGES indicator lights.



a2. ENGINE CRANKS BUT FAILS TO START



NOTE

- The ether start system has a thermostatic switch that will not let the system work if the engine is above 55° F (12° C).
- Ether start is only required below 45° F (7° C). If outside temperature is over 45° F (7° C) go to step (5).

Attempt to start the engine using the cold engine starting procedure (TM 9-2320-360-10).

WARNING

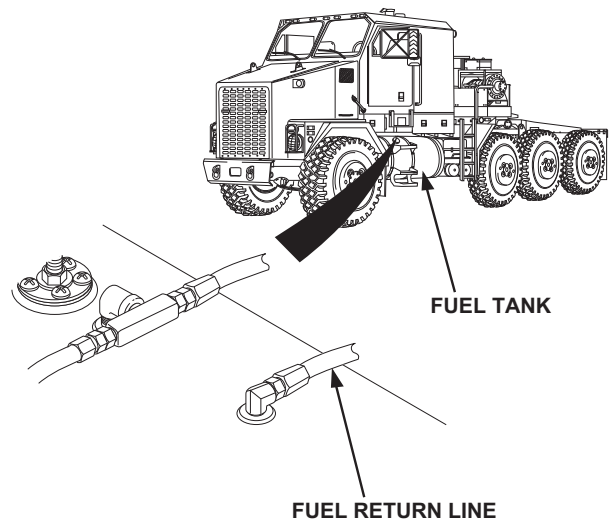
Fuel is very flammable and can explode easily. To avoid serious injury or death keep flame away from fuel and keep fire extinguisher within easy reach. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET OF VEHICLE.

FUEL RETURN LINE TEST

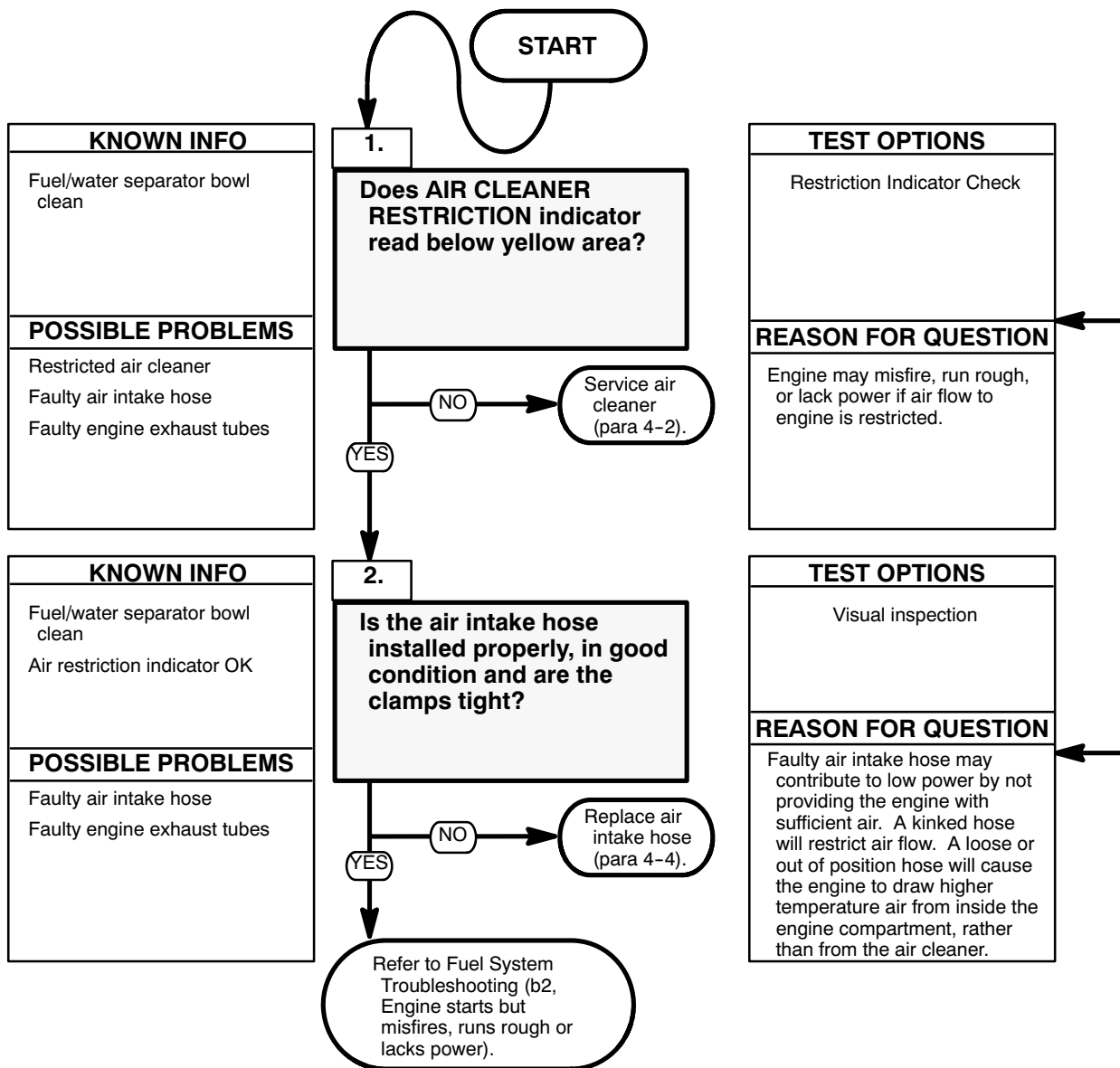
- (1) Remove fuel return line from left side fuel tank.
- (2) Place fuel line in suitable container.
- (3) While assistant attempts to start engine (TM 9-2320-360-10), observe fuel flow from fuel return line.
- (4) Install fuel return line on left side fuel tank.

STE/ICE TEST #25

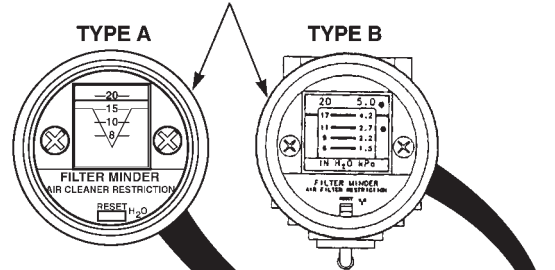
- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "25".
- (3) Press and hold TEST button until "CAL" appears in display.
- (4) Release TEST button and wait for offset value to appear in display.
- (5) Press and release TEST button.
- (6) Start engine (TM 9-2320-360-10) and observe STE/ICE display for test results.
- (7) Shut off engine (TM 9-2320-360-10).



a3. ENGINE DOES NOT DEVELOP FULL POWER	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

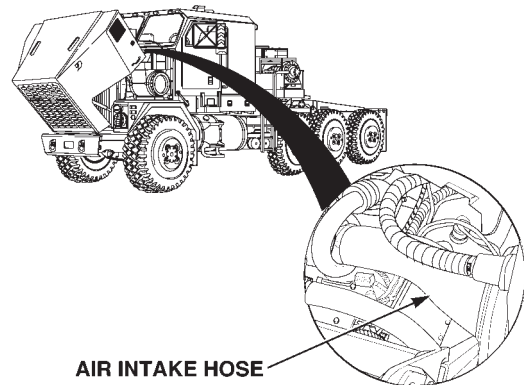
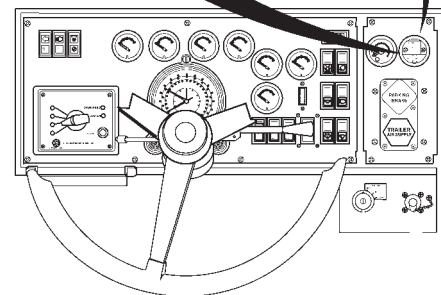


AIR CLEANER RESTRICTION INDICATOR



RESTRICTION INDICATOR CHECK

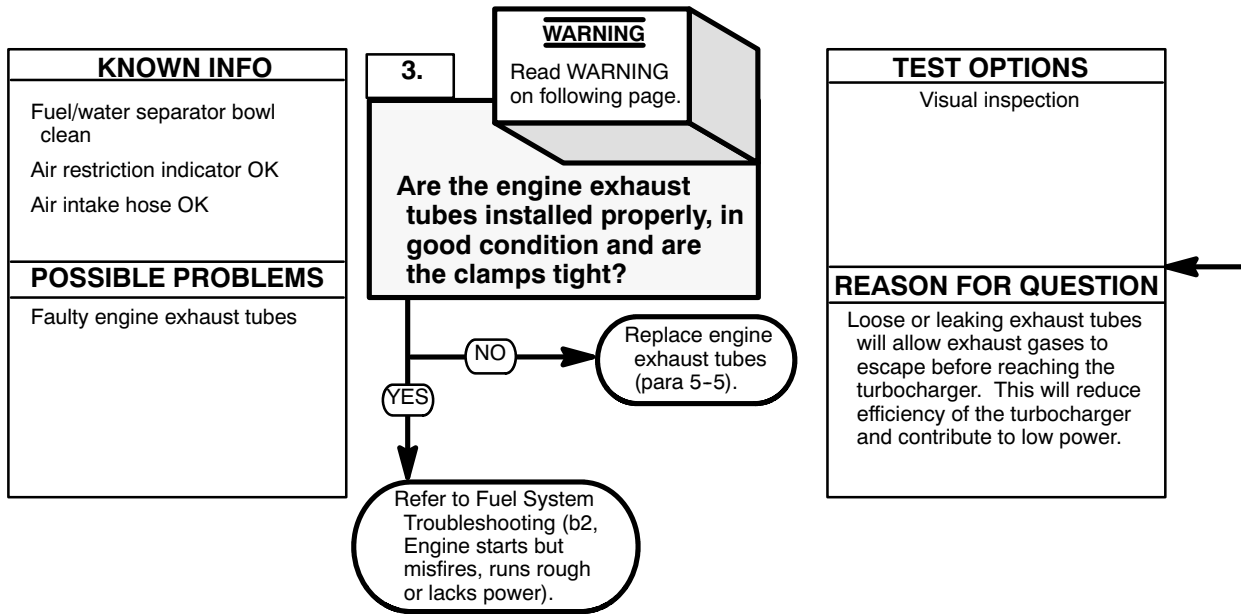
- (1) Check reading on AIR CLEANER RESTRICTION INDICATOR.
- (2) Press RESET button on AIR CLEANER RESTRICTION indicator if reading is above 15.
- (3) Start engine (TM 9-2320-360-10) and check AIR CLEANER RESTRICTION INDICATOR again.



- (1) Check air intake hose for proper positioning. There should be no kinks anywhere on the hose.
- (2) Check the hose for chaffing, cuts, holes, tears, etc.
- (3) Check the clamps for proper positioning on hose.
- (4) Check for loose clamps. If loose, torque to 75-80 lb-in. (8-9 N·m).

AIR INTAKE HOSE

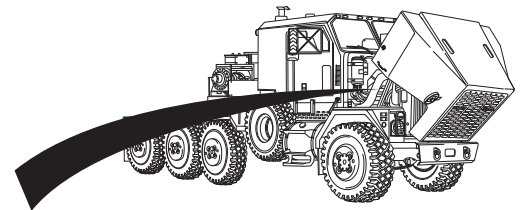
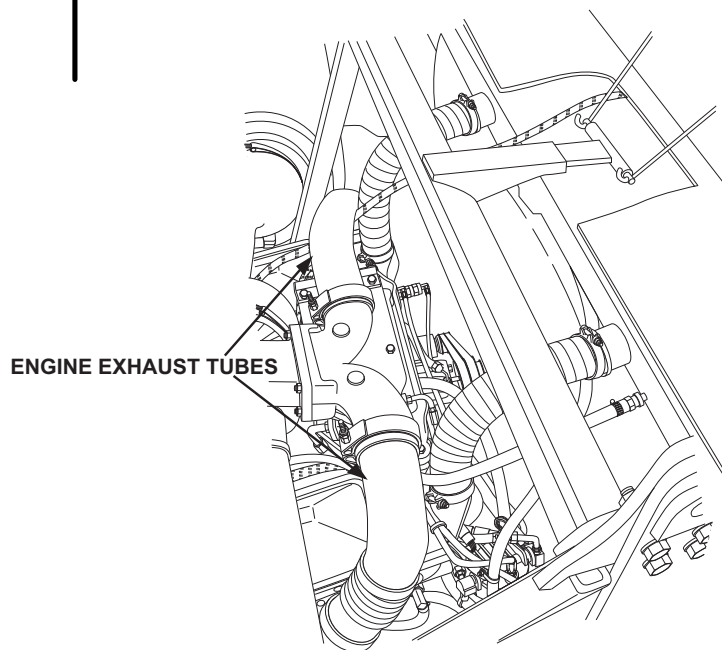
a3. ENGINE DOES NOT DEVELOP FULL POWER (CONT)



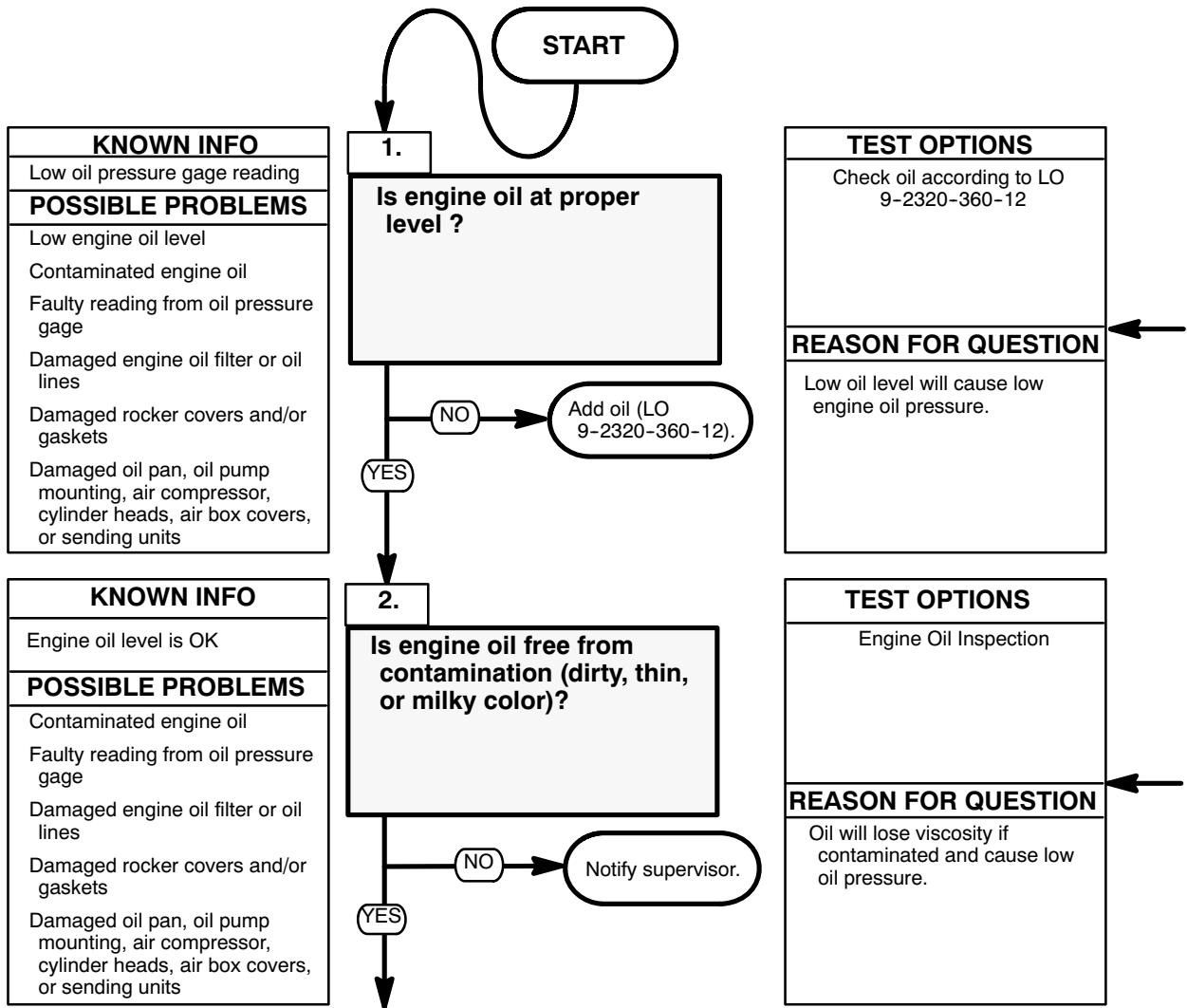
WARNING

Ensure exhaust tubes are cool before performing maintenance. Failure to comply may result in serious personal injury.

- (1) Inspect engine exhaust tubes for proper positioning.
- (2) Inspect for bent flanges at ends of tubes.
- (3) Check clamps for proper positioning around tubes.
- (4) Check for loose clamps. Tighten loose clamps.

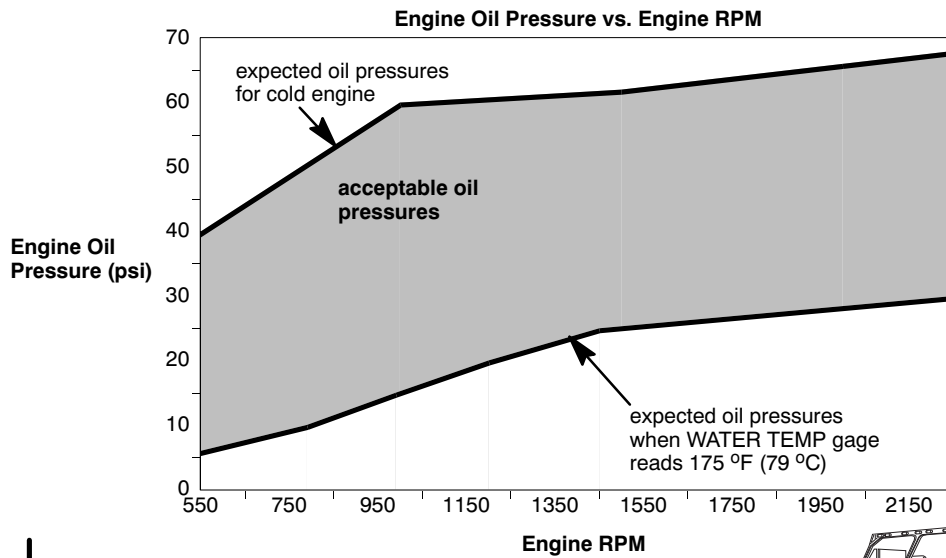


a4. LOW ENGINE OIL PRESSURE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F) Wrench, Torque, 0-175 Lb-Ft (Item 73, Appendix F)



NOTE

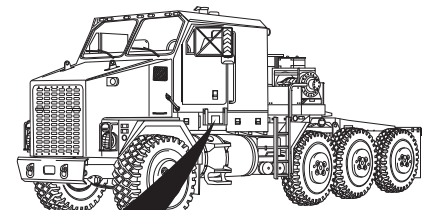
Engine oil pressures may be slightly lower when engine is at maximum operating temperature (WATER TEMP gage reads 210 °F (100 °C)).



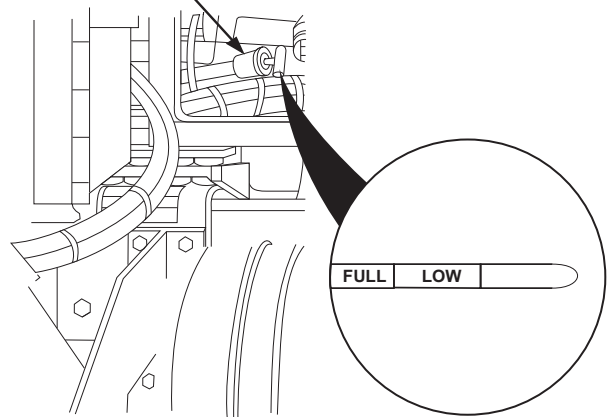
NOTE

Oil pressure can go as low as 5 psi (34 kPa) at engine idle.

Check engine oil level on dipstick. Proper oil level is between LOW mark and FULL mark.



DIPSTICK

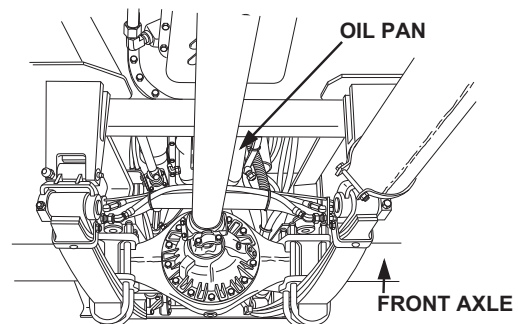


ENGINE OIL CHECK

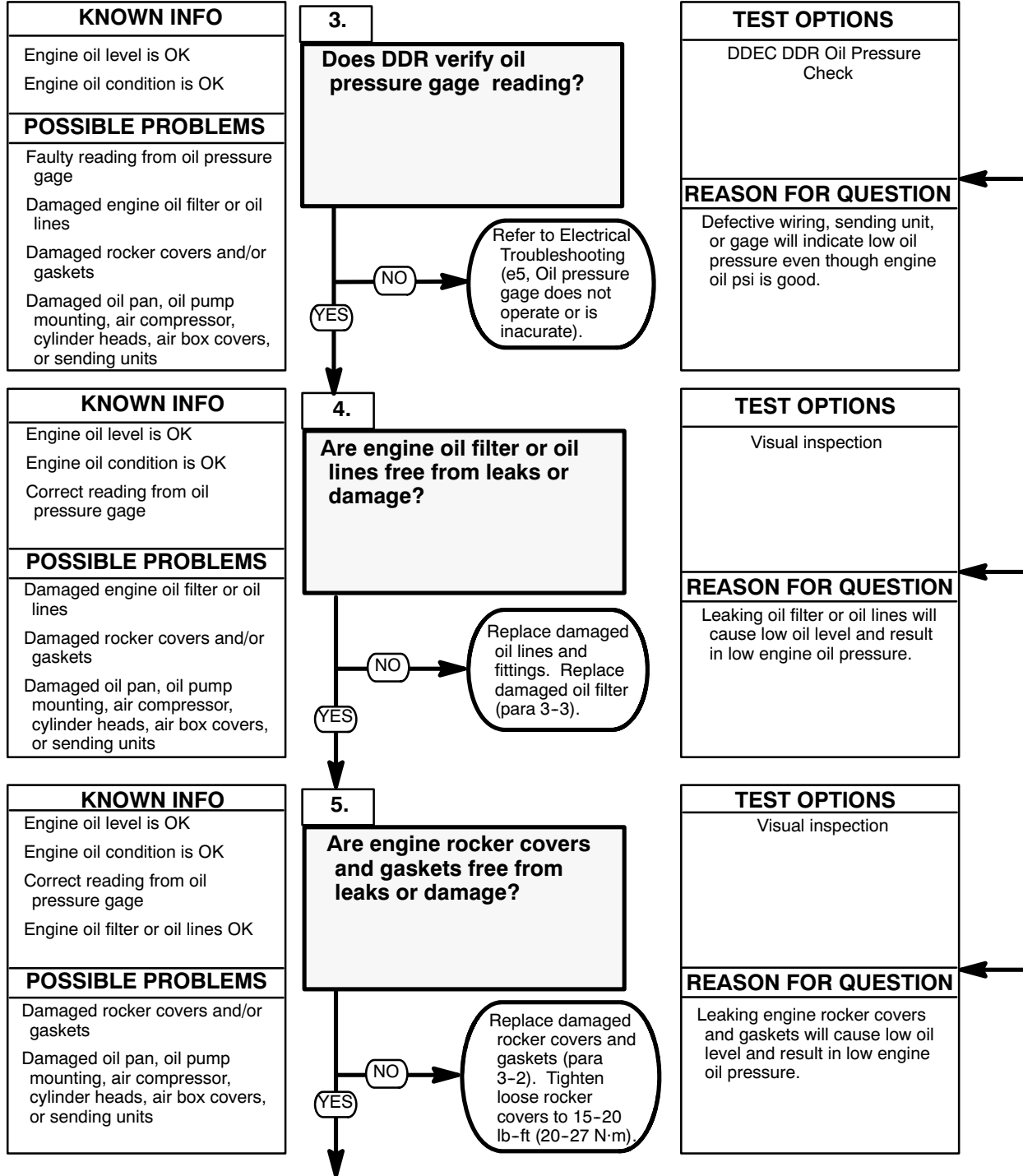
NOTE

Capacity of engine oil pan is approximately 28 qt (26.5 L).

- (1) Position drain pan under engine oil pan.
- (2) Remove drain plug from engine oil pan.
- (3) Drain engine oil into drain pan.
- (4) Observe condition of engine oil.
- (5) Install drain plug in engine oil pan.
- (6) Refill engine oil (LO 9-2320-360-12).



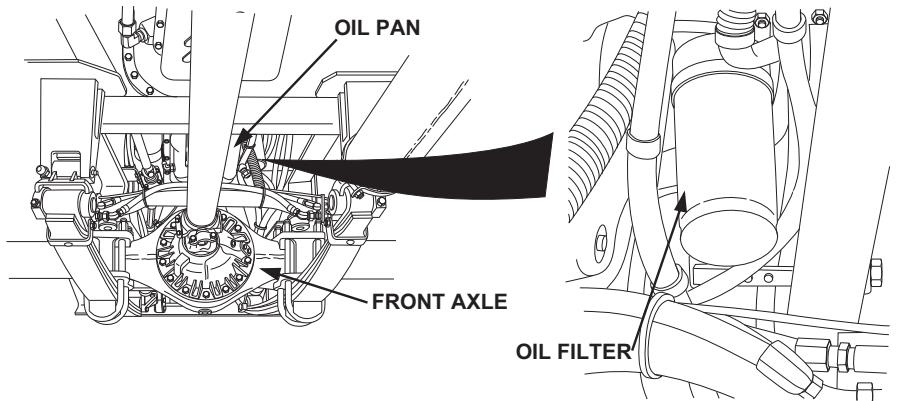
a4. LOW ENGINE OIL PRESSURE (CONT)



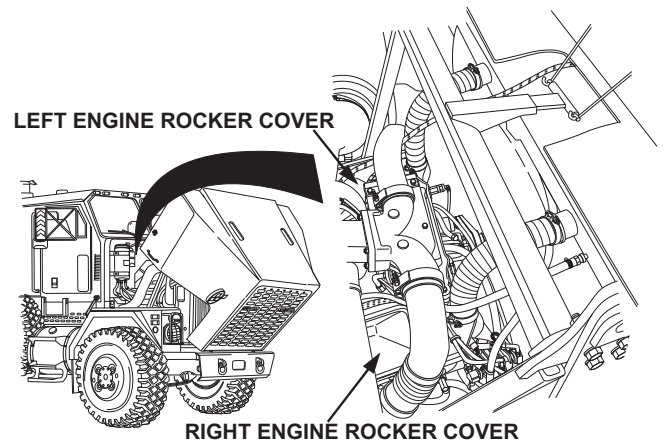
**DDEC DDR OIL
PRESSURE CHECK**

- (1) Refer to para 2-13d for DDR installation and usage instructions
- (2) Check DDEC mode 17.

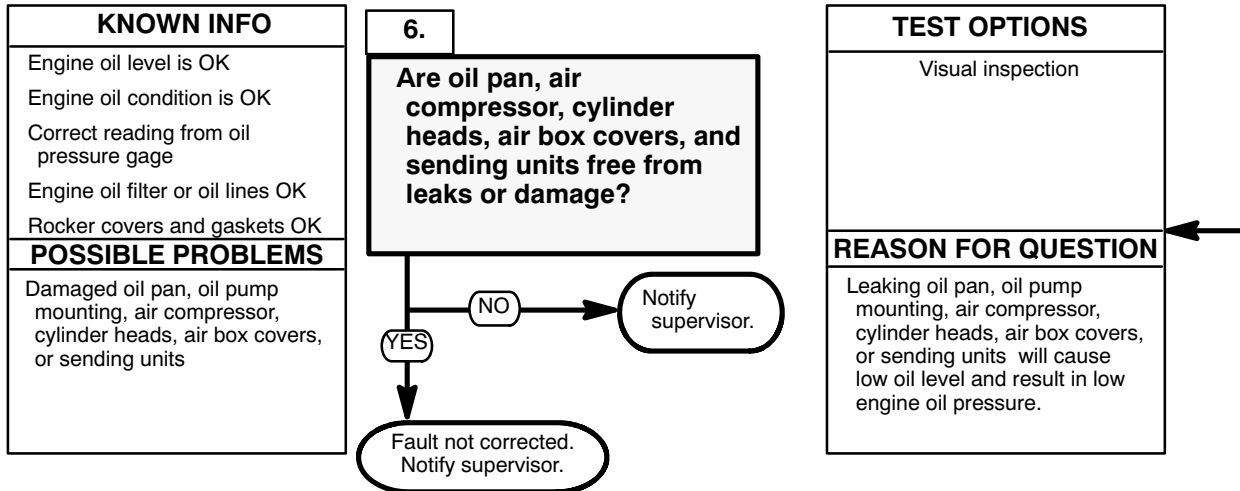
Check engine oil filter and oil lines for leakage or damage.



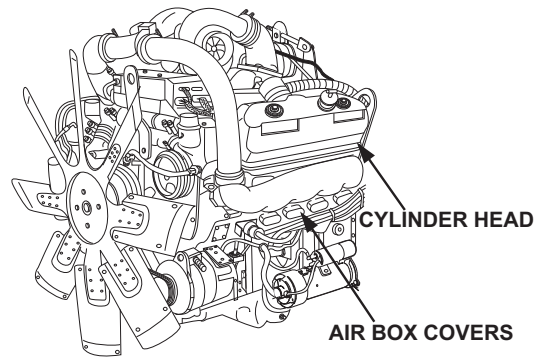
Check engine rocker covers and gaskets for leakage or damage.



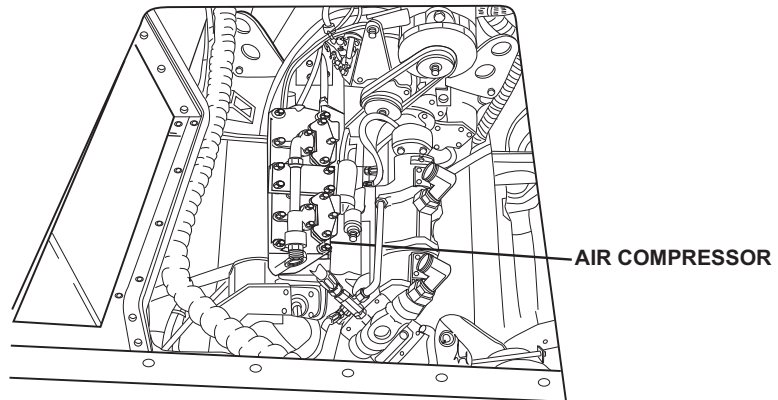
a4. LOW ENGINE OIL PRESSURE (CONT)



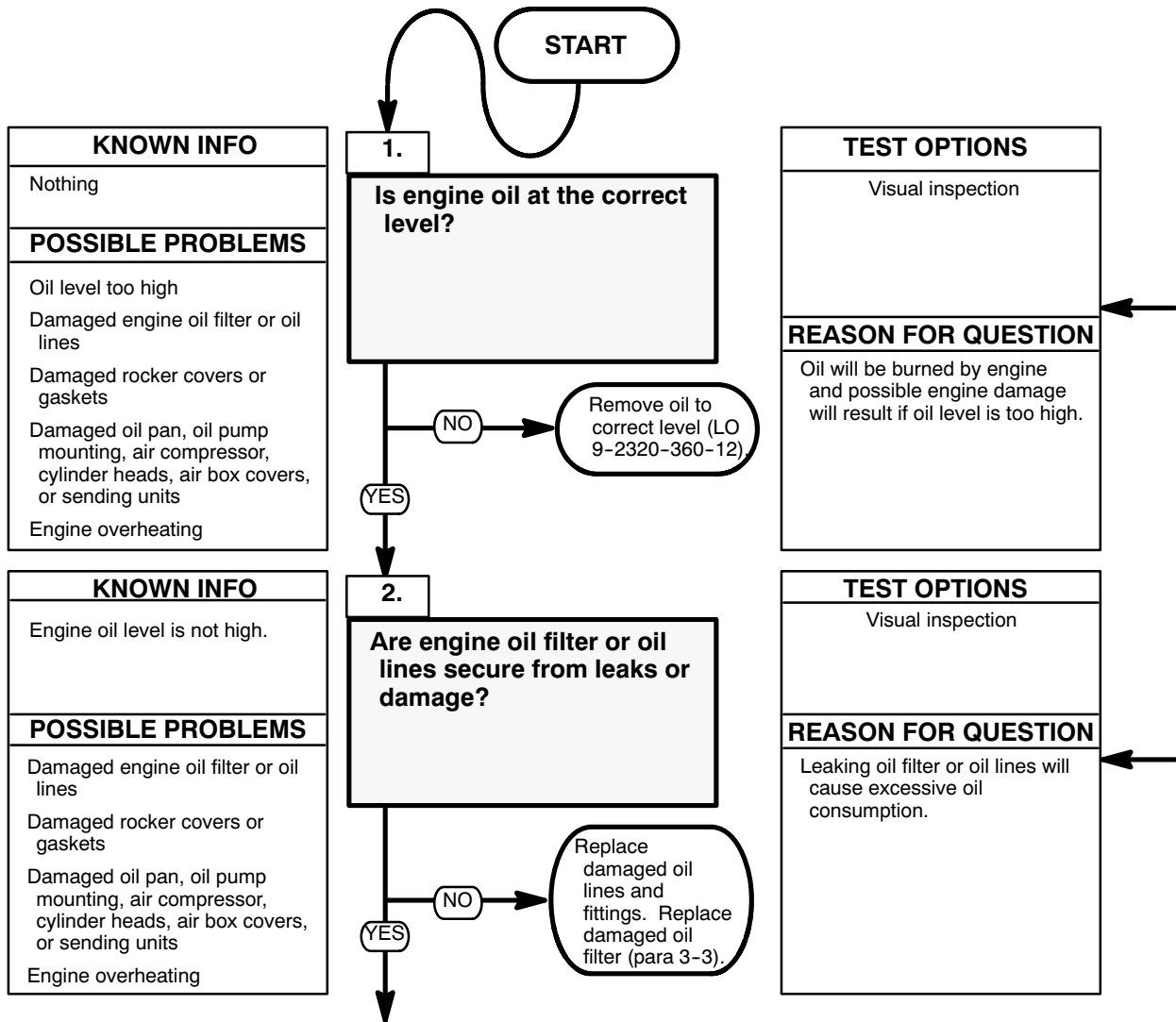
Check oil pan, air compressor,
cylinder heads, air box covers,
and sending units for leakage
or damage.

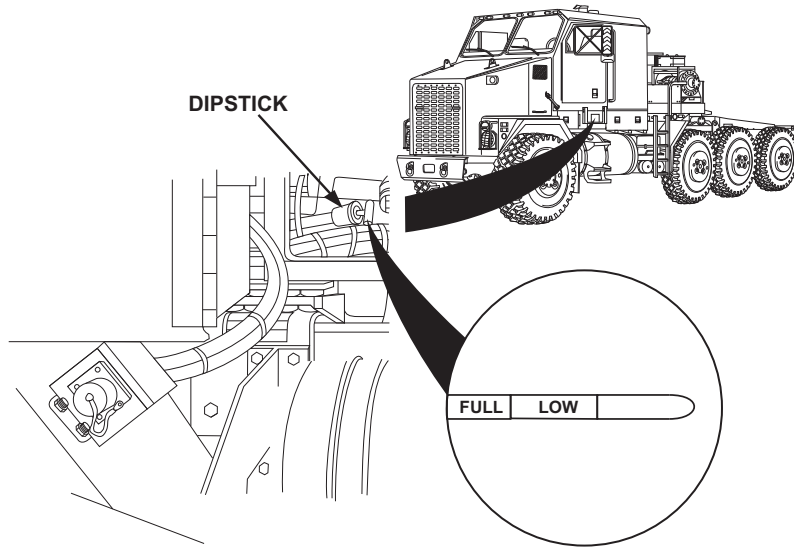


ENGINE REMOVED FOR CLARITY



a5. EXCESSIVE ENGINE OIL CONSUMPTION	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F) Wrench, Torque, 0-175 Ft-Lb (Item 73, Appendix F)

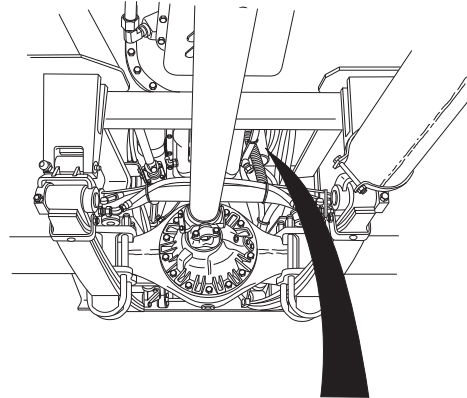
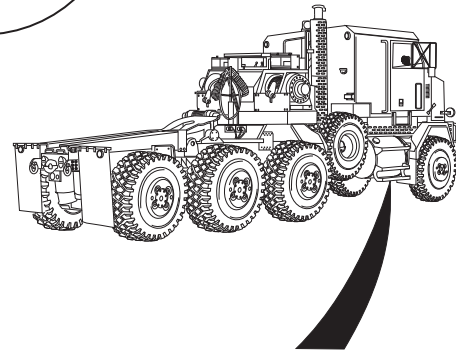




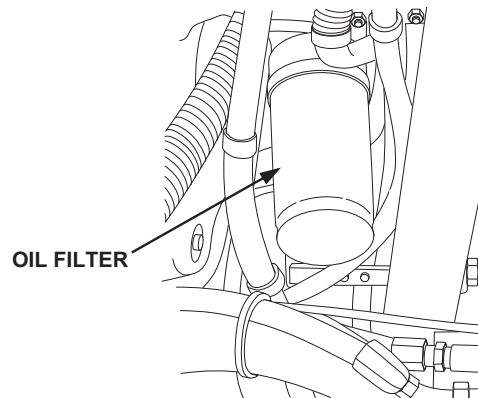
NOTE

Oil consumption is normal if engine uses less than 10 qt (9 L) of oil in 1000 mi (1609 km) of operation.

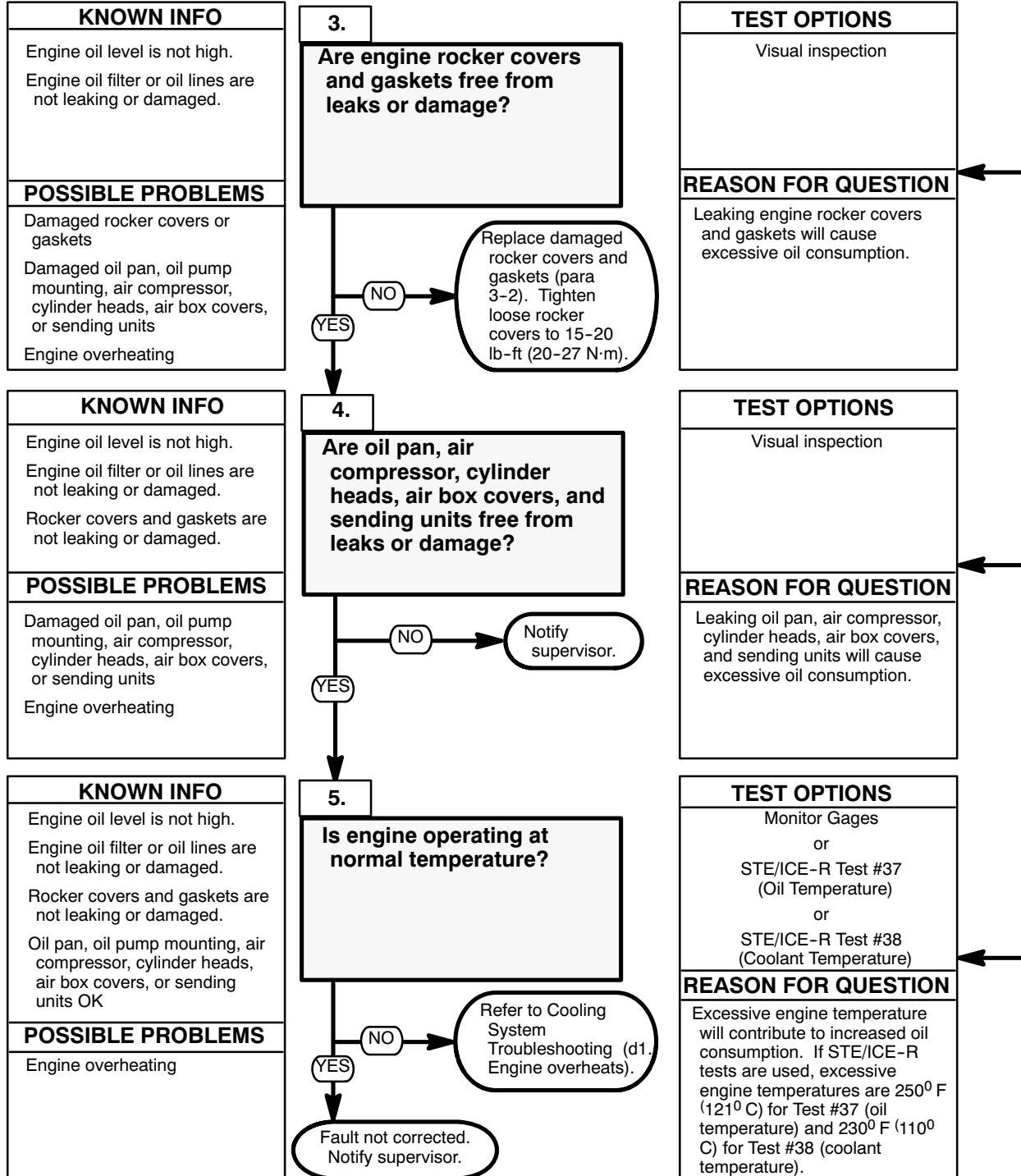
Check engine oil level on dipstick. Correct oil level is between LOW mark and FULL mark.



Check engine oil filter and oil lines for leakage or damage.

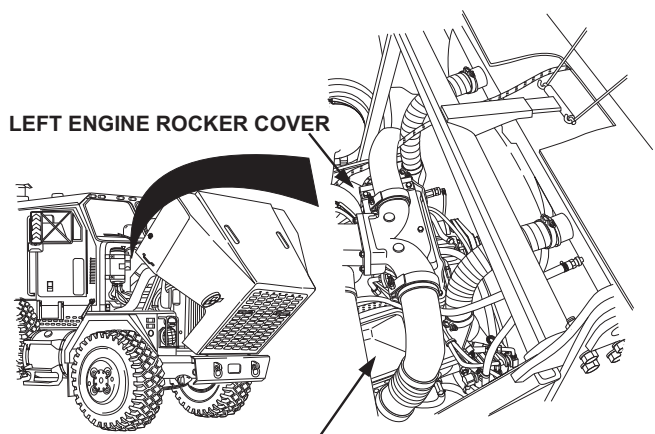


a5. EXCESSIVE ENGINE OIL CONSUMPTION (CONT)



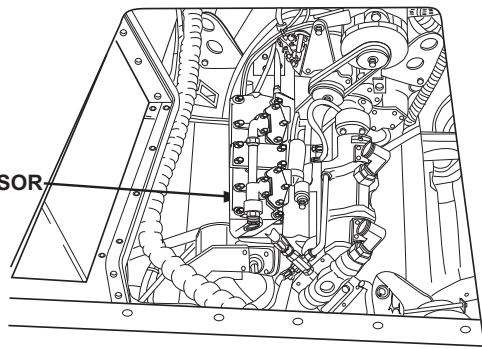
Check engine rocker covers and gaskets for leakage or damage.

LEFT ENGINE ROCKER COVER

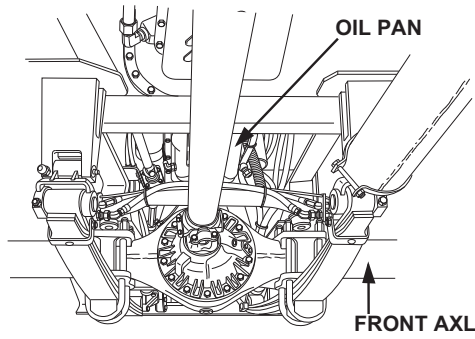


RIGHT ENGINE ROCKER COVER

AIR COMPRESSOR

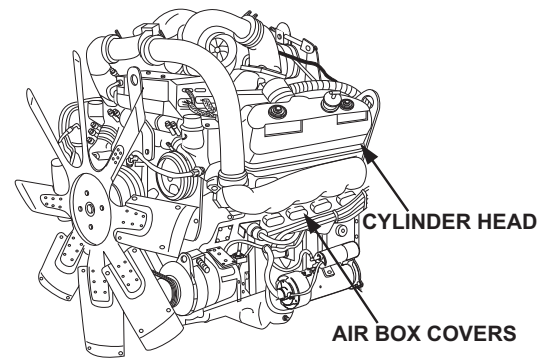


OIL PAN



FRONT AXLE

Check oil pan, air compressor, cylinder heads, air box covers, and sending units for leakage or damage.



CYLINDER HEAD

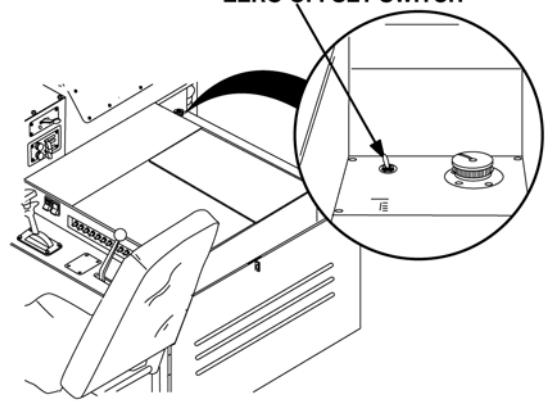
AIR BOX COVERS

STE/ICE TEST #37/38

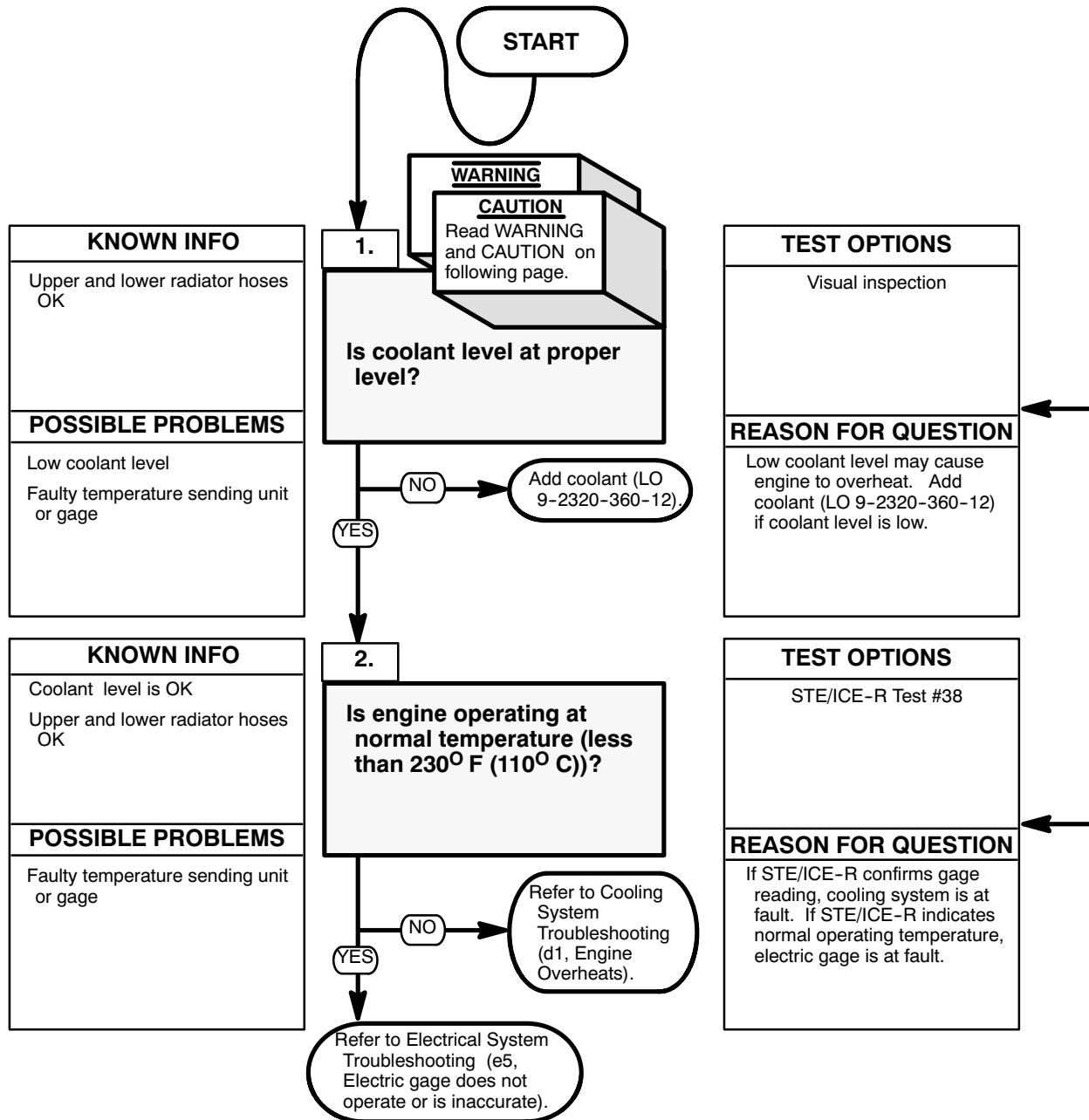
- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "37" (oil temperature) or "38" (coolant temperature).
- (3) Start engine (TM 9-2320-360-10).
- (4) Move STE/ICE Zero Offset switch to ON position.
- (5) Press and hold TEST button until "CAL" appears in display.
- (6) Release TEST button and wait for offset value to appear in display.
- (7) Move STE/ICE Zero Offset switch to OFF position.
- (8) Press and release TEST button to obtain test results.
- (9) Shut off engine (TM 9-2320-360-10).

ENGINE REMOVED FOR CLARITY

ZERO OFFSET SWITCH



a6. ENGINE OVERHEATS (WATER TEMP GAGE CONTINUOUSLY READS OVER 230°F (110°C))	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

Antifreeze may be very hot and under pressure from engine operation. Be sure to wear the proper eye protection and ensure the engine is cool before performing maintenance. Failure to comply may cause serious personnel injury.

CAUTION

Engine oil must be changed whenever there is evidence of oil breakdown or contamination. Oil breakdown or contamination may be caused from overheating engine and is indicated by discoloration, strong odor, and oil analysis.

Coolant should be visible in sight glass.

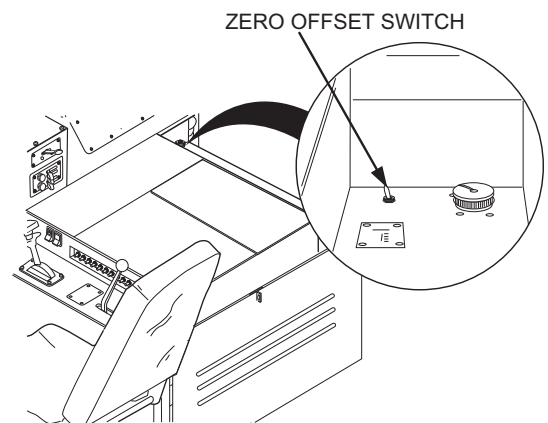
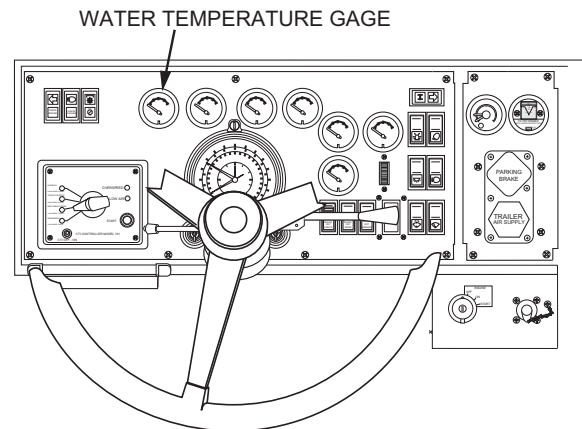
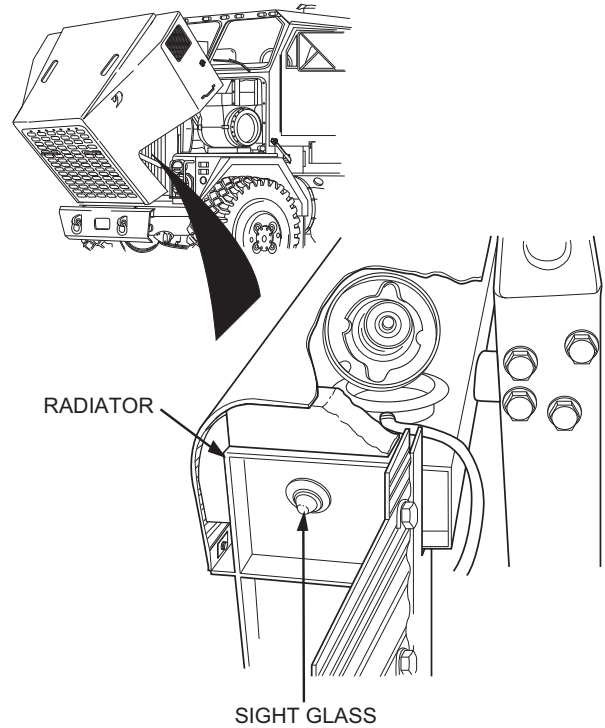
NOTE

STE/ICE-R Test #37 measures oil temperature; STE/ICE-R Test #38 measures engine coolant temperature

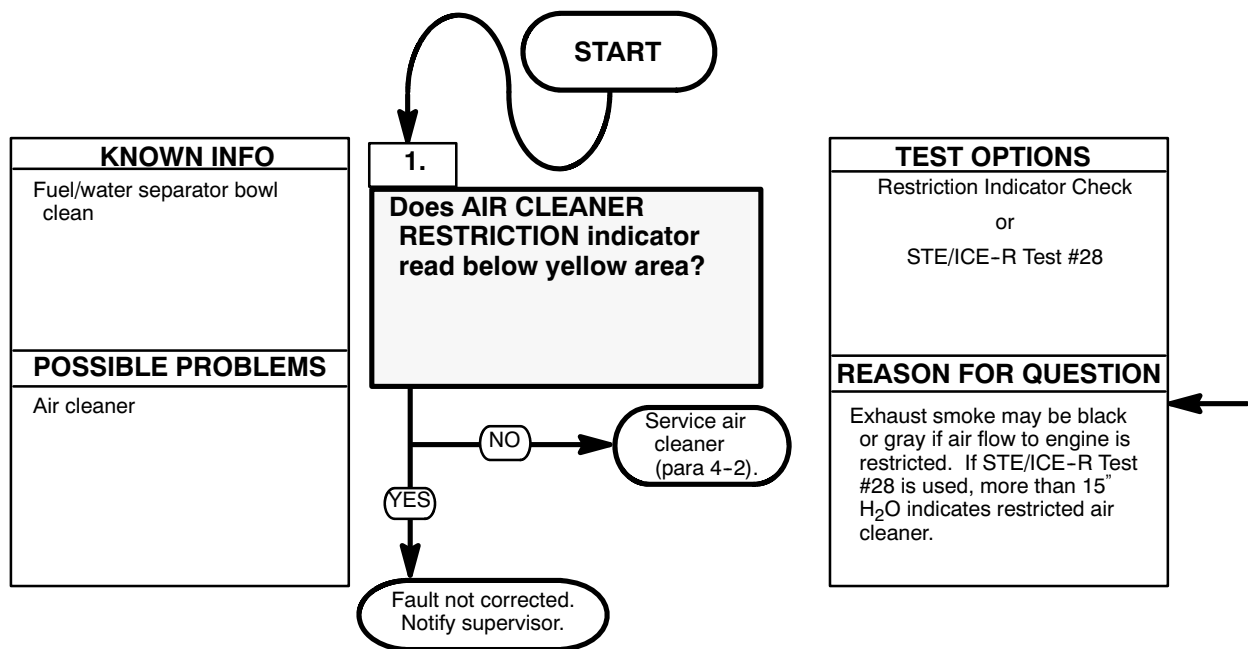
Verify water temperature gage reading with STE/ICE-R Test #38.

STE/ICE TEST #38

- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "38".
- (3) Start engine (TM 9-2320-360-10).
- (4) Move STE/ICE Zero Offset switch to ON position.
- (5) Press and hold TEST button until "CAL" appears in display.
- (6) Release TEST button and wait for offset value to appear in display.
- (7) Move STE/ICE Zero Offset switch to OFF position.
- (8) Press and release TEST button to obtain test results.
- (9) Shut off engine (TM 9-2320-360-10).



a7. EXCESSIVE BLACK OR GRAY EXHAUST SMOKE (ENGINE AT NORMAL OPERATING TEMPERATURE)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



NOTE

Results for STE/ICE-R Test #28 must be obtained at 2100 rpm.

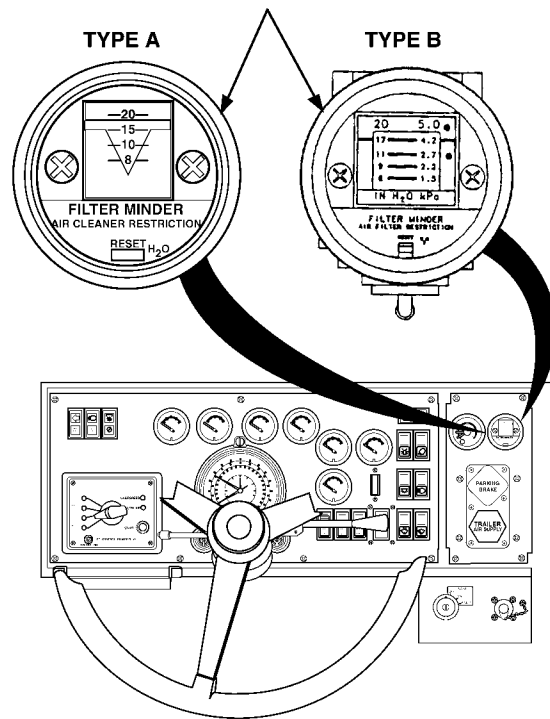
RESTRICTION INDICATOR CHECK

- (1) Check reading on AIR CLEANER RESTRICTION INDICATOR.
- (2) Press RESET button on AIR CLEANER RESTRICTION indicator if reading is above 15.
- (3) Start engine (TM 9-2320-360-10) and check AIR CLEANER RESTRICTION INDICATOR again.

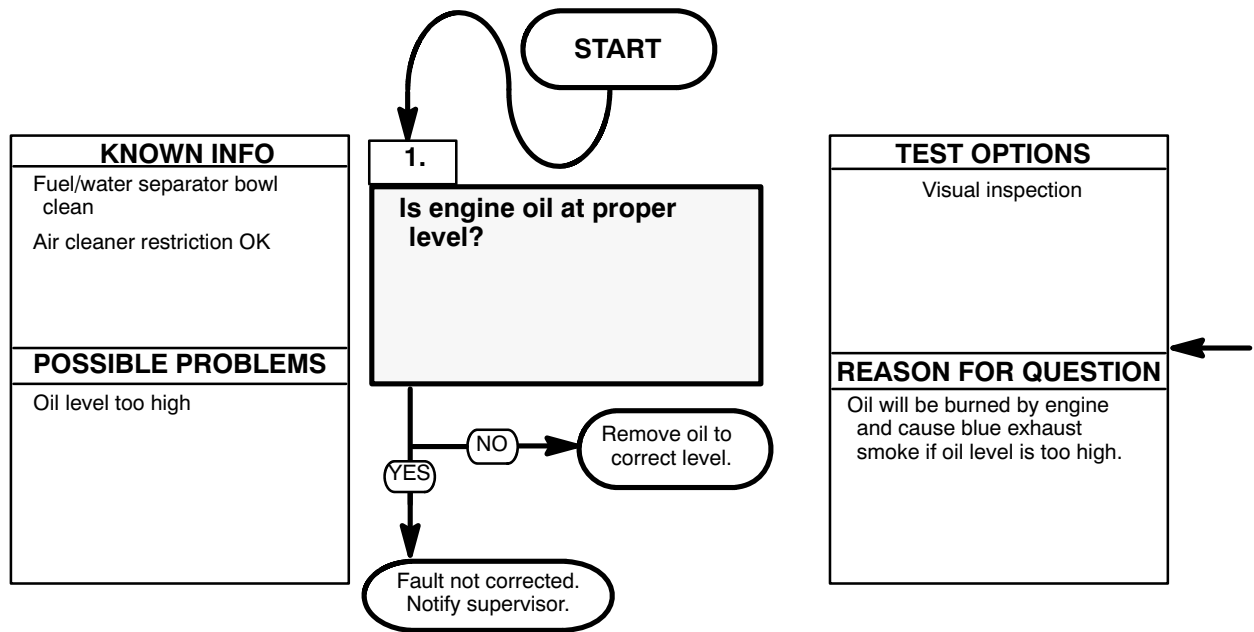
STE/ICE TEST #28

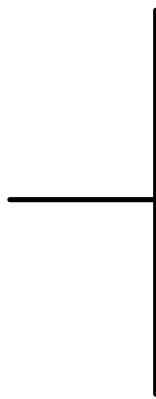
- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "28".
- (3) Start engine (TM 9-2320-360-10).
- (4) Press and hold TEST button until "CAL" appears in display.
- (5) Release TEST button and wait for offset value to appear in display.
- (6) Increase engine speed to approximately 2100 rpm.
- (7) Press and release TEST button to obtain test results.
- (8) Shut off engine (TM 9-2320-360-10).

AIR CLEANER RESTRICTION INDICATOR

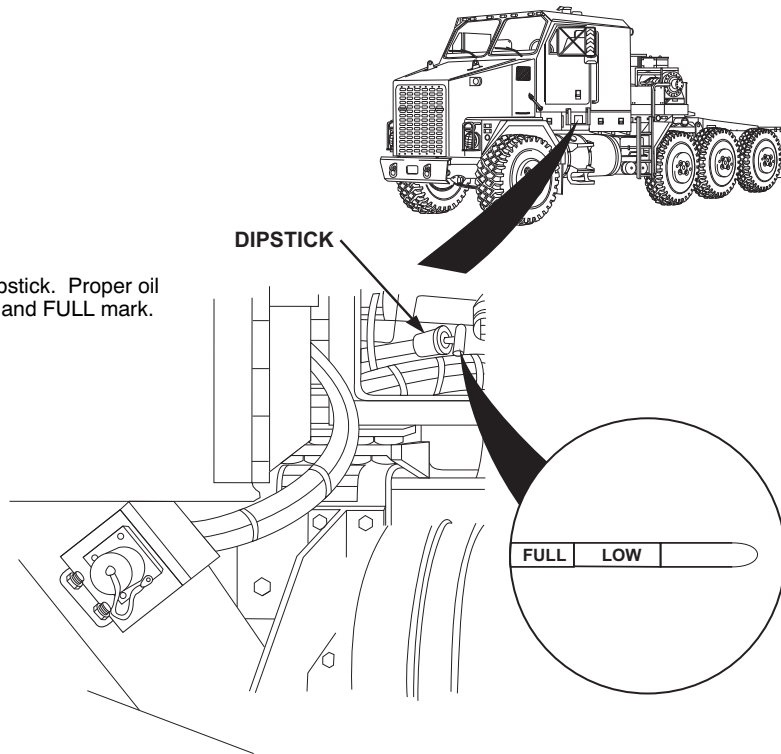


a8. BLUE EXHAUST SMOKE (ENGINE AT NORMAL OPERATING TEMPERATURE)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

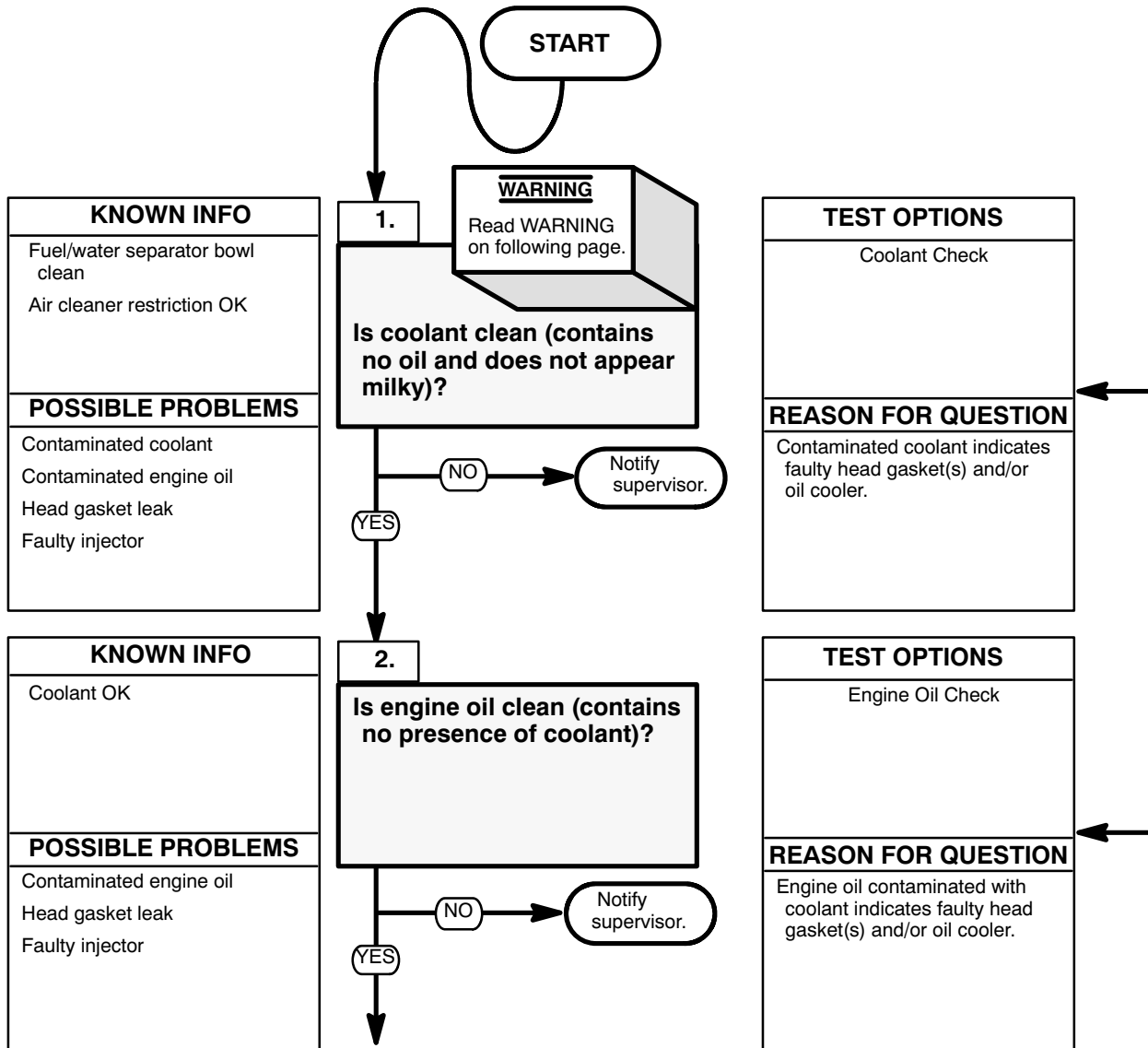


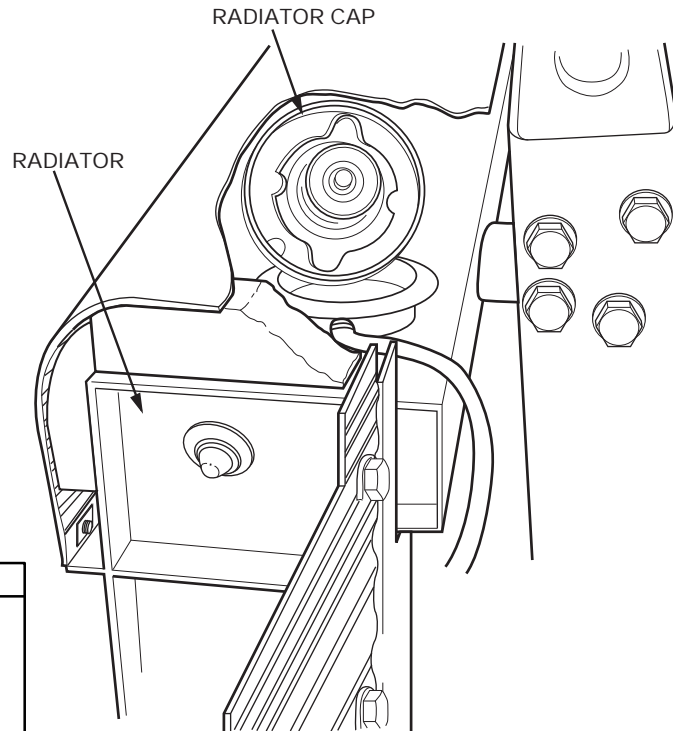


Check engine oil level on dipstick. Proper oil level is between LOW mark and FULL mark.



a9. WHITE EXHAUST SMOKE (ENGINE AT NORMAL OPERATING TEMPERATURE)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)





COOLANT CHECK

WARNING

Do not remove radiator cap when engine is warm. Coolant may be very hot and under pressure. Be sure to wear the proper eye protection to avoid personal injury. Failure to comply may result in injury to personnel.

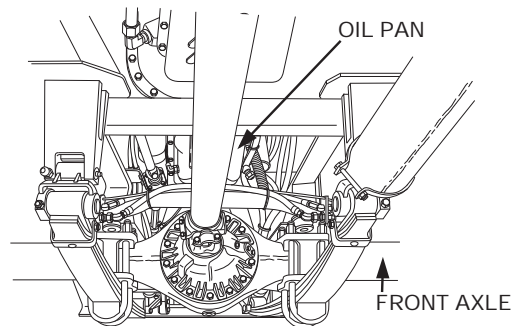
- (1) Open hood (TM 9-2320-360-10).
- (2) Remove radiator cap from radiator.
- (3) Observe condition of coolant inside radiator.
- (4) Install radiator cap on radiator.

ENGINE OIL CHECK

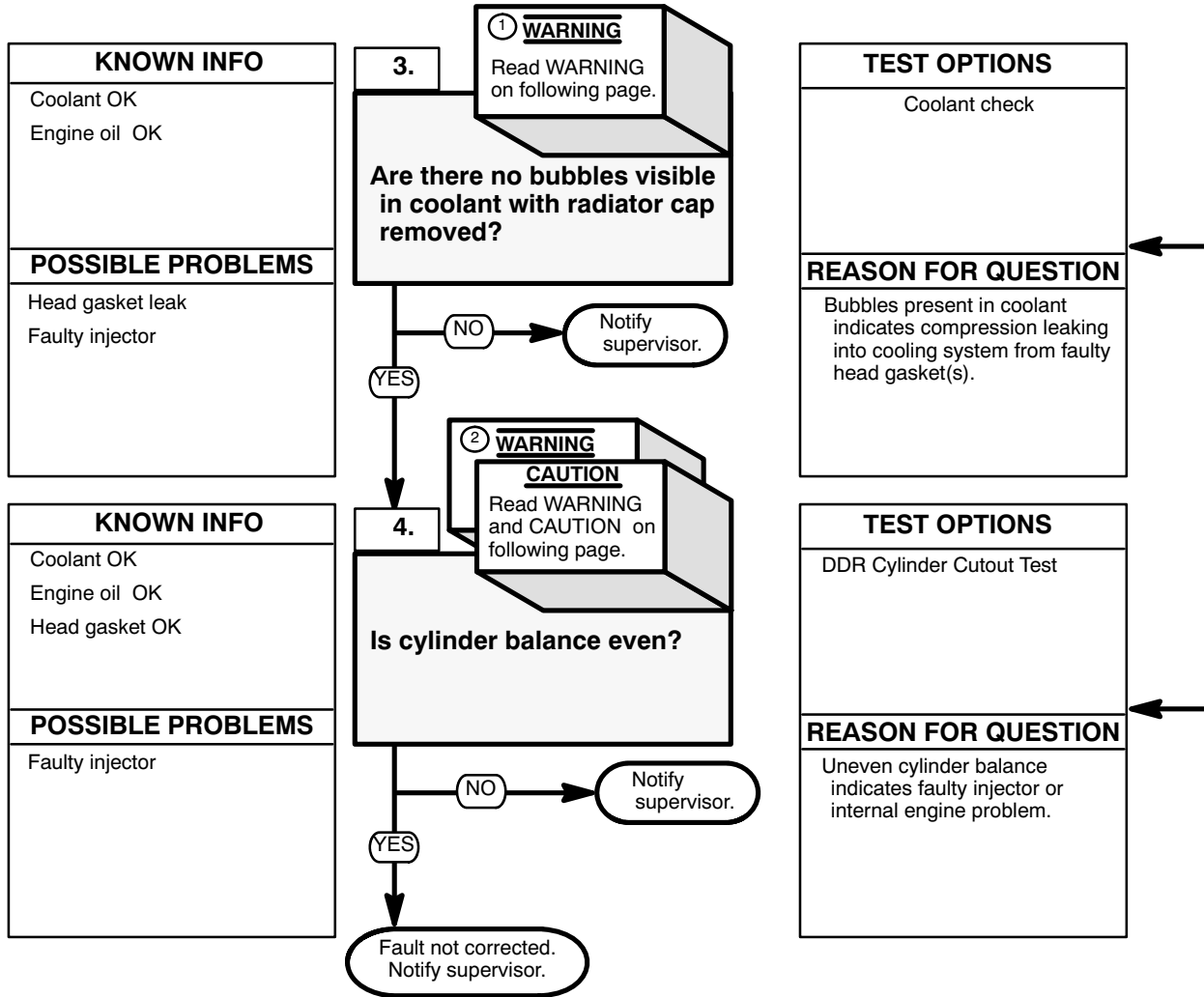
NOTE

Capacity of engine oil pan is approximately 28 qt (26.5 L).

- (1) Position drain pan under engine oil pan.
- (2) Remove drain plug from engine oil pan.
- (3) Drain engine oil into drain pan.
- (4) Observe condition of engine oil.
- (5) Install drain plug in engine oil pan.
- (6) Refill engine oil (LO 9-2320-360-12).



a9. WHITE EXHAUST SMOKE (ENGINE AT NORMAL OPERATING TEMPERATURE) (CONT)

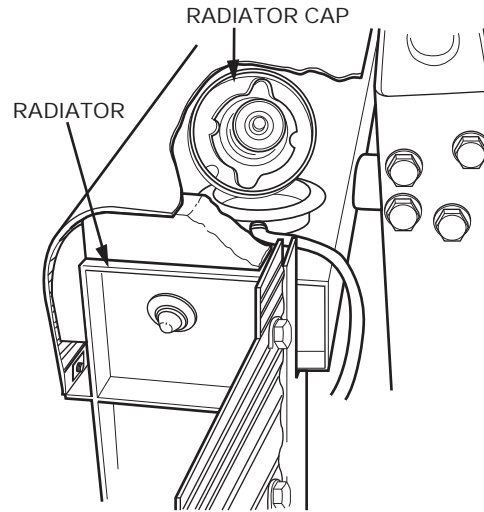


COOLANT CHECK

WARNING

Do not remove radiator cap when engine is warm. Be sure to wear the proper eye protection to avoid personal injury. Coolant may be very hot and under pressure. Failure to comply may result in injury to personnel.

- (1) Remove radiator cap from radiator.
- (2) Start engine (TM 9-2320-360-10) and allow engine to reach operating temperature.
- (3) Observe coolant circulating in radiator.
- (4) Shut off engine (TM 9-2320-360-10).
- (5) Install radiator cap on radiator.



DDR CYLINDER CUTOUT TEST

WARNING

Parking brake must be applied, with transmission range selector and transfer case in neutral before starting this test. Failure to comply may result in vehicle moving unexpectedly and injury to personnel.

NOTE

Detailed instructions on the use of the DDR can be found in para 2-13.

- (1) Remove eight screws and cover from electronic control box assembly.
- (2) Connect data cable to DDR with two thumb screws.
- (3) Connect data cable to vehicle adapter.

CAUTION

Vehicle adapter can only be installed on connector one way. Installing adapter backward will result in damage to vehicle and test equipment.

NOTE

Vehicle adapter must be connected to DDL connector with slot facing down.

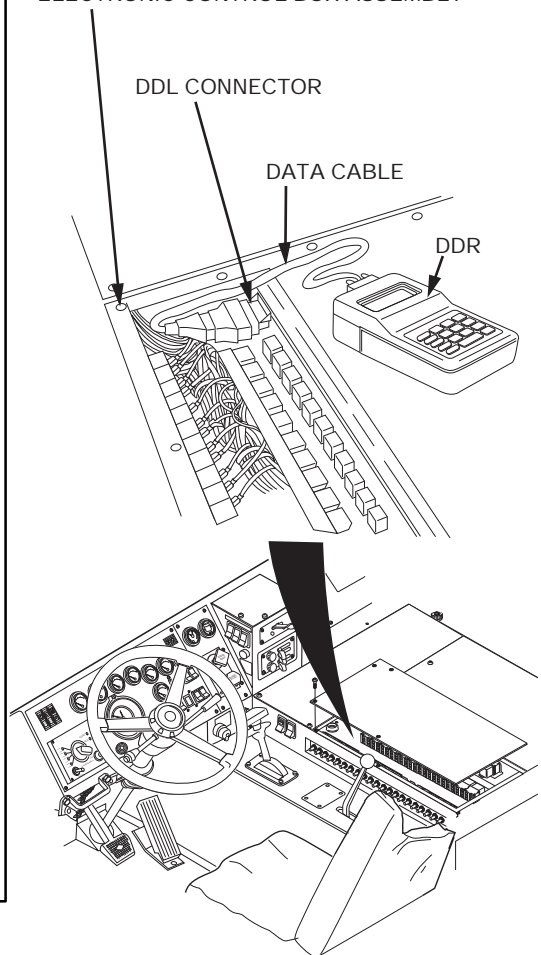
- (4) Connect vehicle adapter with data cable to DDL connector.
- (5) Start engine (TM 9-2320-360-10).
- (6) Select mode 11 (Cylinder Cutout) on DDR.
- (7) Shut off engine (TM 9-2320-360-10).
- (8) Disconnect data cable with vehicle adapter from DDL connector.
- (9) Disconnect data cable from vehicle adapter.
- (10) Disconnect data cable from DDR.
- (11) Install cover on electronic control box assembly with eight screws.

ELECTRONIC CONTROL BOX ASSEMBLY

DDL CONNECTOR

DATA CABLE

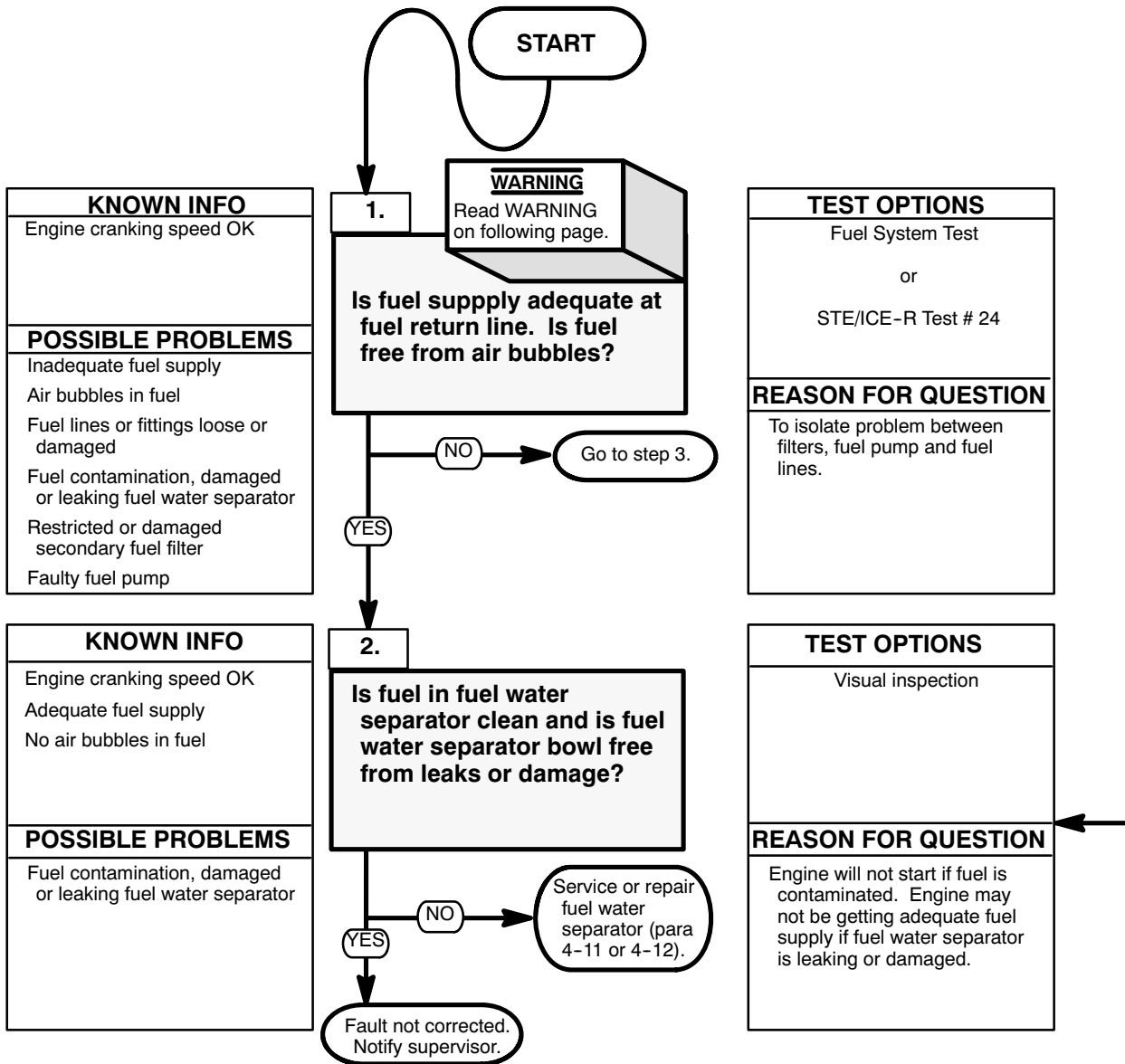
DDR



b. FUEL SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>b1. Engine cranks but fails to start or engine stalls after starting</u>	<u>2-414</u>
<u>b2. Engine starts but misfires, runs rough, or lacks power</u>	<u>2-418</u>
<u>b3. Ether starting aid does not operate</u>	<u>2-422</u>

b1. ENGINE CRANKS BUT FAILS TO START OR ENGINE STALLS AFTER STARTING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)
Personnel Required Two	



WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death keep flame away from fuel and keep fire extinguisher within easy reach. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET OF VEHICLE.

NOTE

Perform Engine Troubleshooting (a2, Engine Cranks but Fails to Start) before starting here.

FUEL SYSTEM TEST

- (1) Remove fuel return line from left fuel tank.
- (2) Place fuel line in suitable container.

NOTE

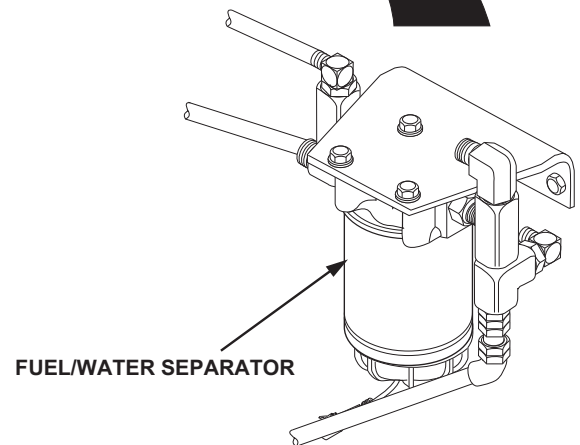
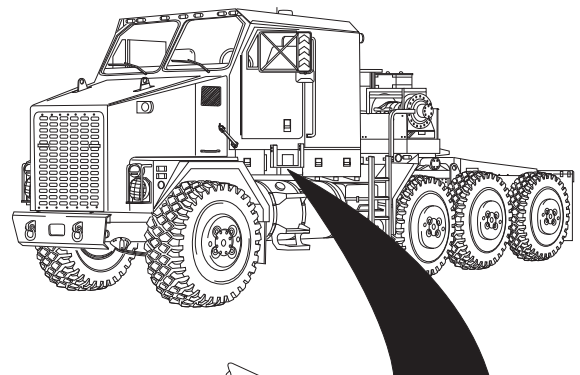
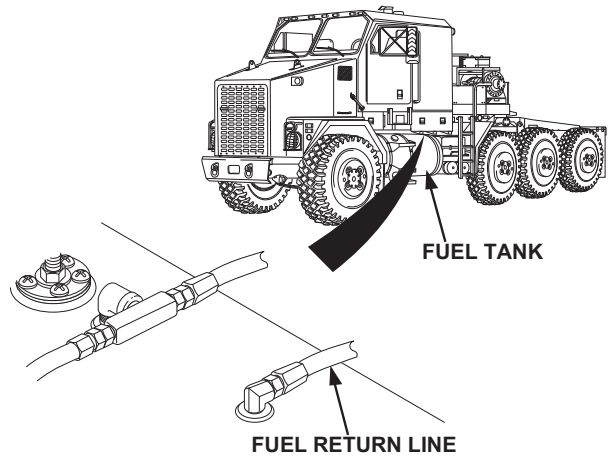
Fuel pump should deliver approximately 6 oz (177cc) of fuel in 15 seconds at cranking speed.

- (3) Observe fuel flow from return line while assistant attempts to start engine (TM 9-2320-360-10).
- (4) Install fuel return line on left fuel tank.

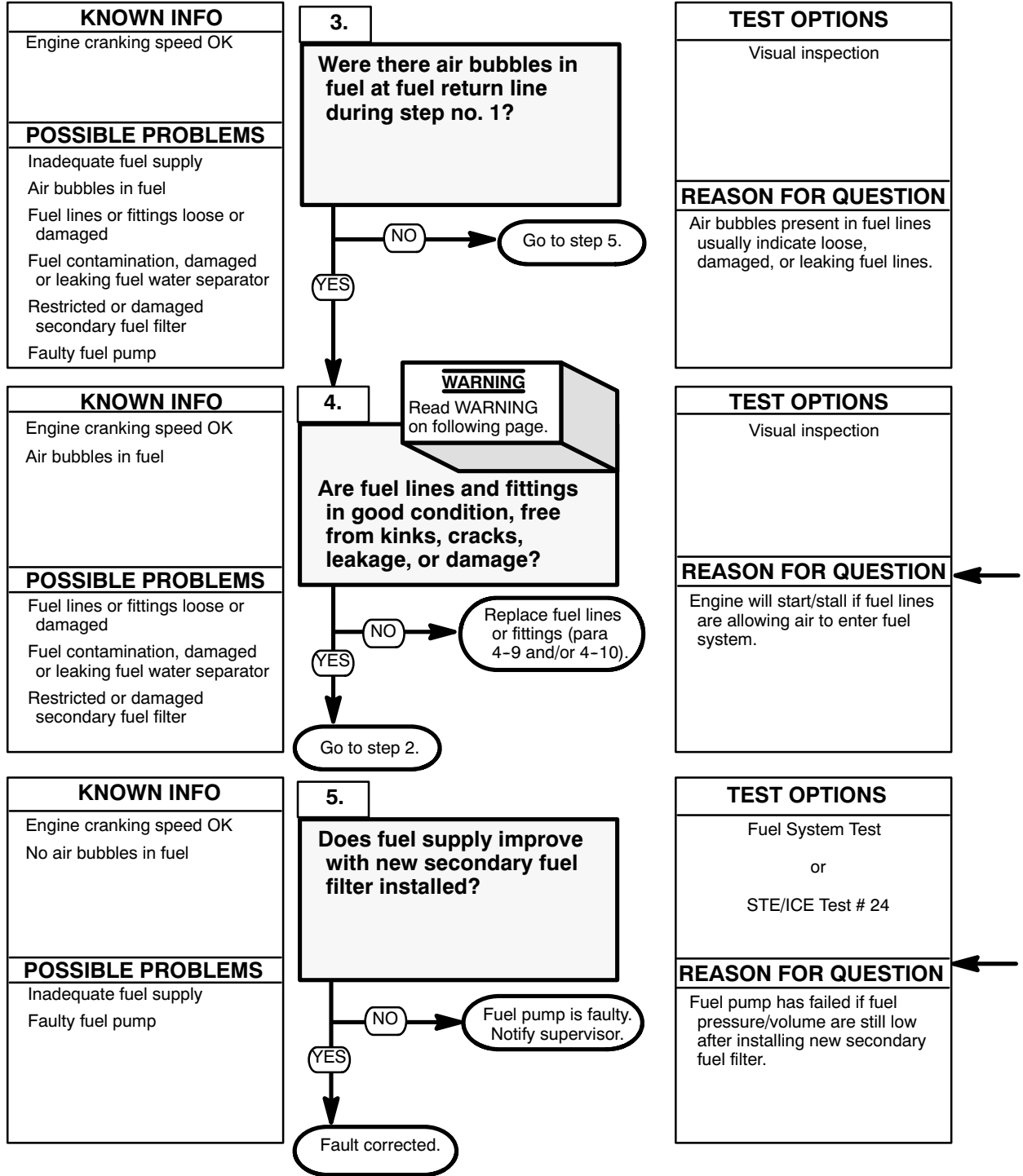
STE/ICE TEST #24

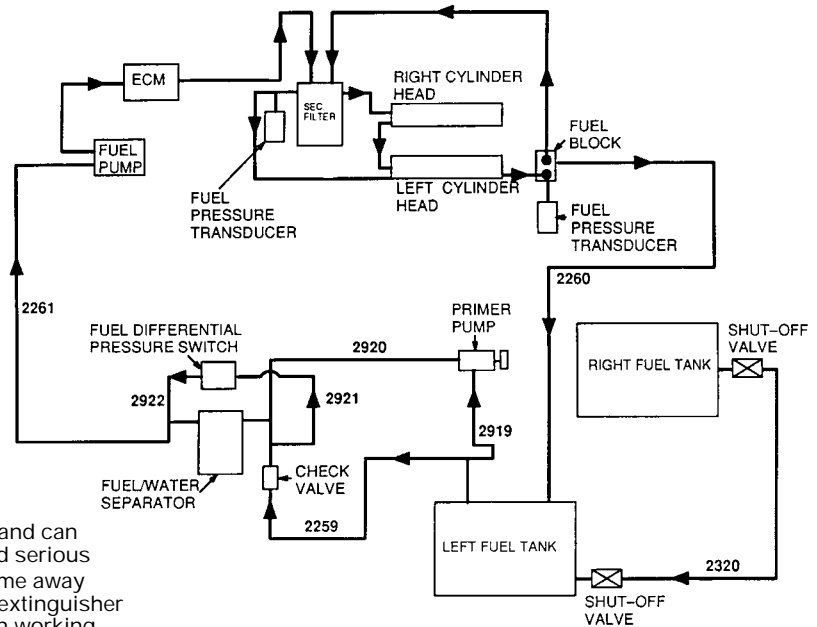
- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "24".
- (3) Press and hold TEST button until "CAL" appears in display.
- (4) Release TEST button and wait for offset value to appear in display.
- (5) Press and release TEST button.
- (6) Start engine (TM 9-2320-360-10) and observe test results on STE/ICE display.
- (7) Shut off engine (TM 9-2320-360-10).

Check for clean fuel in fuel water separator and separator bowl for leaks or damage.



b1. ENGINE CRANKS BUT FAILS TO START OR ENGINE STALLS AFTER STARTING (CONT)





Fuel System Diagram

WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death keep flame away from fuel and keep fire extinguisher within easy reach. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET OF VEHICLE. Be sure to wear the proper eye protection to avoid personal injury.

NOTE

Fuel lines and fittings may be loose allowing air to be drawn into fuel system.

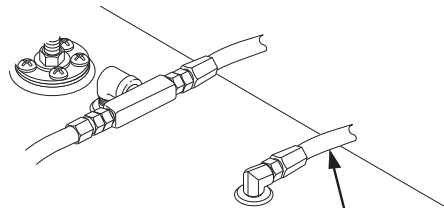
Check fuel lines and fittings for leaks and damage.

FUEL SYSTEM TEST

- (1) Remove fuel return line from left fuel tank.
 - (2) Place fuel line in suitable container.
- NOTE**
- Fuel pump should deliver approximately 6 oz (177cc) of fuel in 15 seconds at cranking speed.
- (3) Observe fuel flow from return line while assistant attempts to start engine (TM 9-2320-360-10).
 - (4) Install fuel return line on left fuel tank.

STE/ICE TEST #24

- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "24".
- (3) Press and hold TEST button until "CAL" appears in display.
- (4) Release TEST button and wait for offset value to appear in display.
- (5) Press and release TEST button.
- (6) Start engine (TM 9-2320-360-10) and observe test results on STE/ICE display.
- (7) Shut off engine (TM 9-2320-360-10).

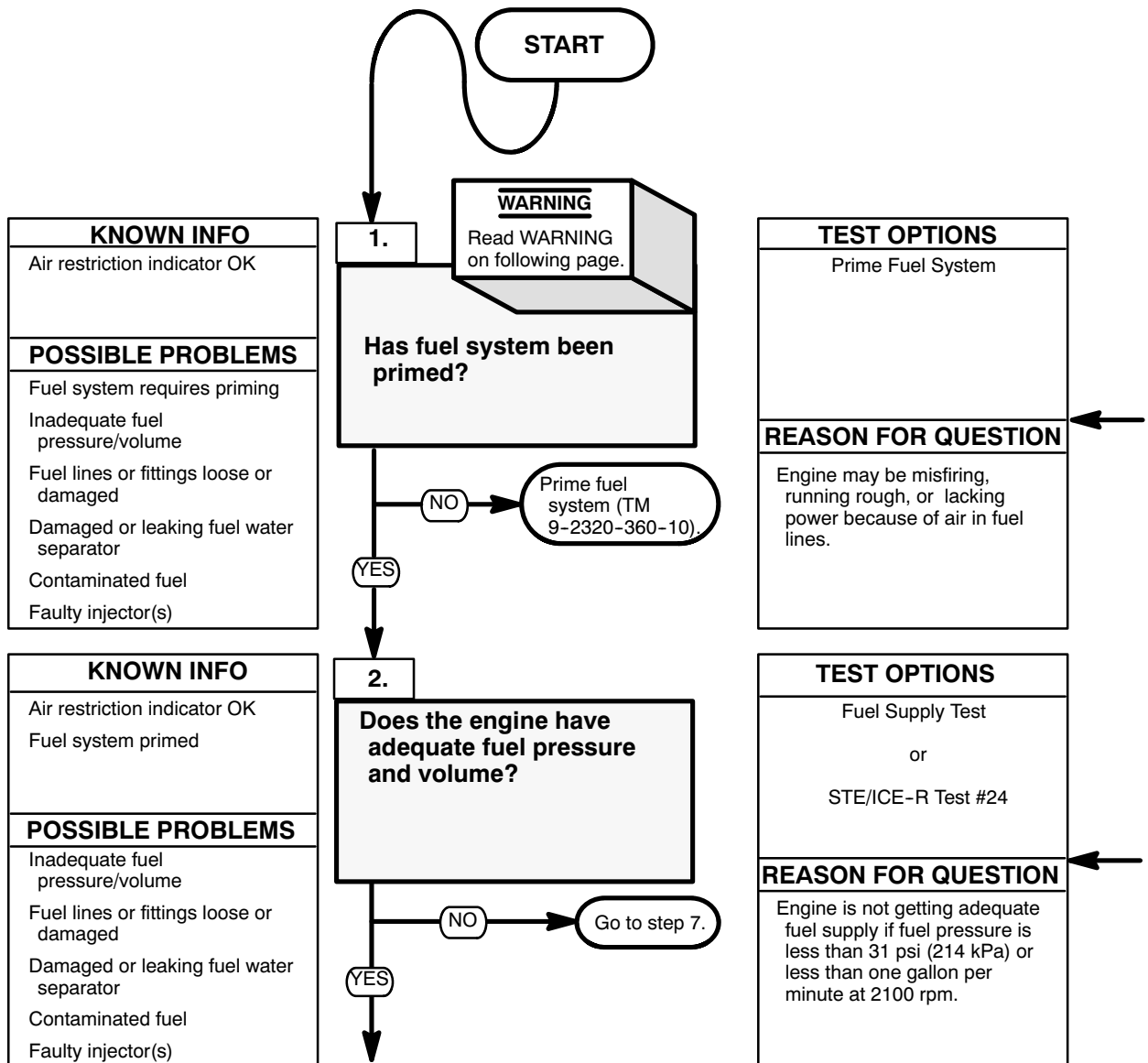


FUEL RETURN LINE

b2. ENGINE STARTS BUT MISFIRES, RUNS ROUGH, OR LACKS POWER

INITIAL SETUP

Equipment Conditions	Tools and Special Tools
Engine shut off (TM 9-2320-360-10).	Tool Kit, Genl Mech (Item 54, Appendix F)
Parking brake on (TM 9-2320-360-10).	STE/ICE-R (optional) (Item 47, Appendix F)
Wheels chocked.	



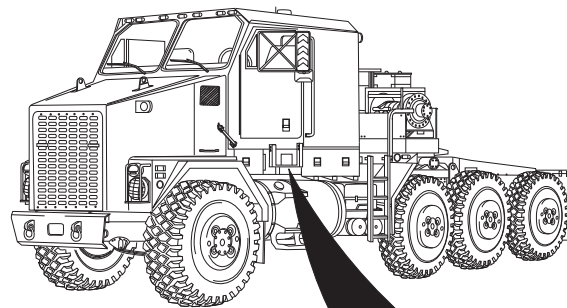
WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death keep flame away from fuel and keep fire extinguisher within easy reach. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET OF VEHICLE.

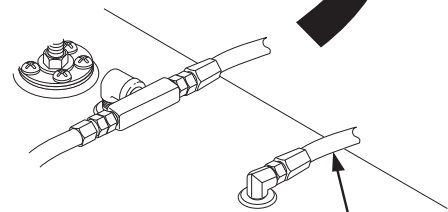
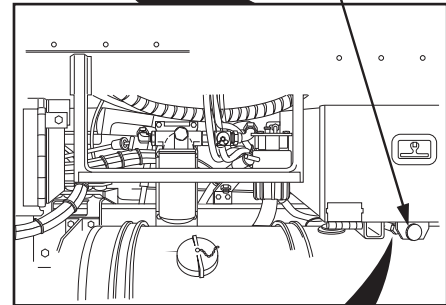
NOTE

Perform Engine Troubleshooting (a3, ENGINE STARTS BUT MISFIRES, RUNS ROUGH, OR LACKS POWER) before starting here.

Push in and turn fuel primer pump 1/4 turn in either direction to release. Pump fuel primer pump until resistance is felt to purge air from fuel system. Push in and turn fuel primer pump 1/4 turn in either direction to lock.



FUEL PRIMER PUMP



FUEL RETURN LINE

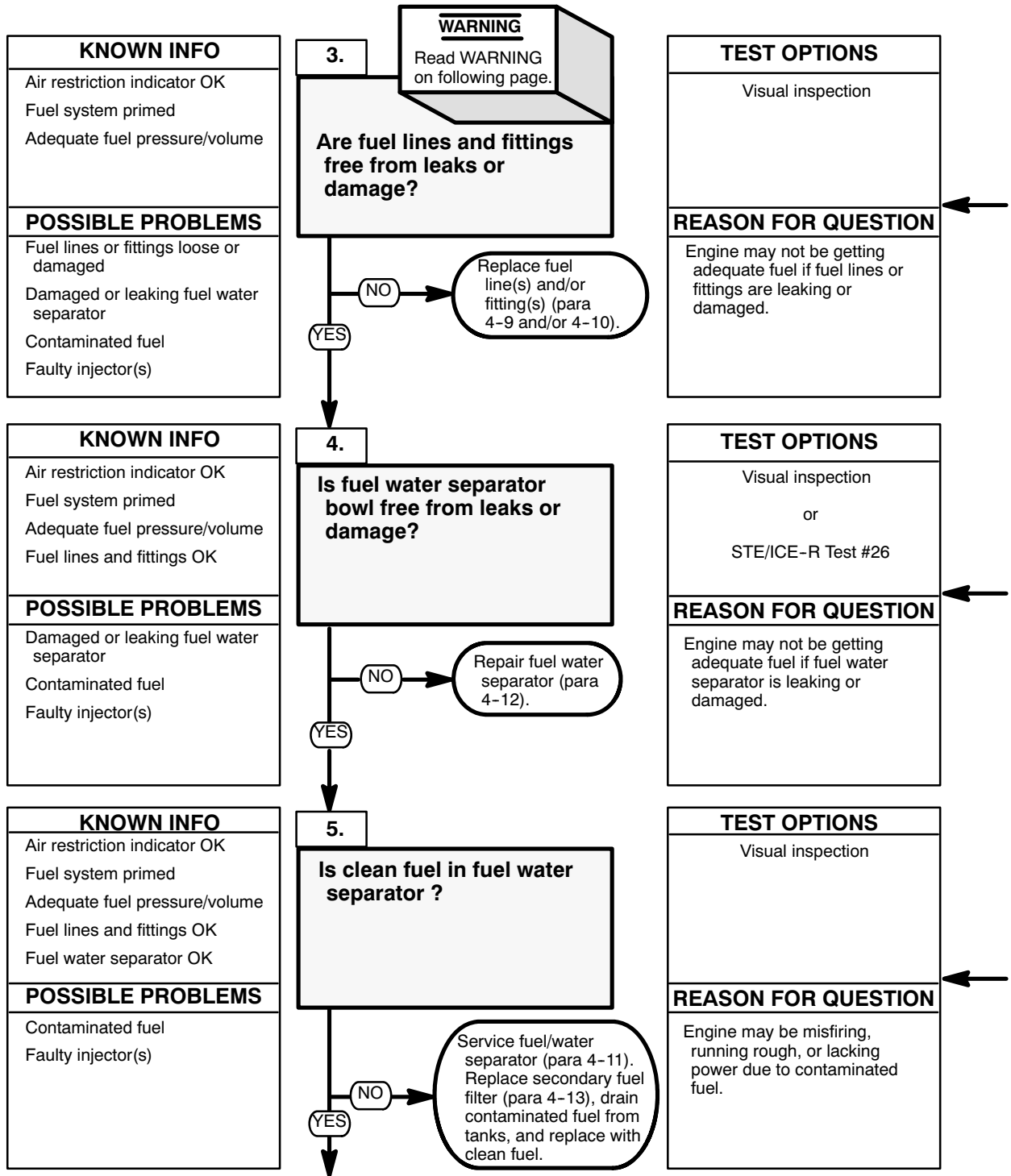
FUEL SUPPLY TEST

- (1) Remove fuel return line from left side fuel tank.
- (2) Place fuel line in suitable container.
- (3) Start engine (TM 9-2320-360-10).
- (4) Observe fuel flow into container while assistant operates engine at 2100 rpm.
- (5) Shut off engine (TM 9-2320-360-10).
- (6) Install fuel return line from left side fuel tank.

STE/ICE TEST #24

- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "24".
- (3) Press and hold TEST button until "CAL" appears in display.
- (4) Release TEST button and wait for offset value to appear in display.
- (5) Press and release TEST button.
- (6) Start engine (TM 9-2320-360-10) and observe test results on STE/ICE display.
- (7) Shut off engine (TM 9-2320-360-10).

b2. ENGINE STARTS BUT MISFIRES, RUNS ROUGH, OR LACKS POWER (CONT)

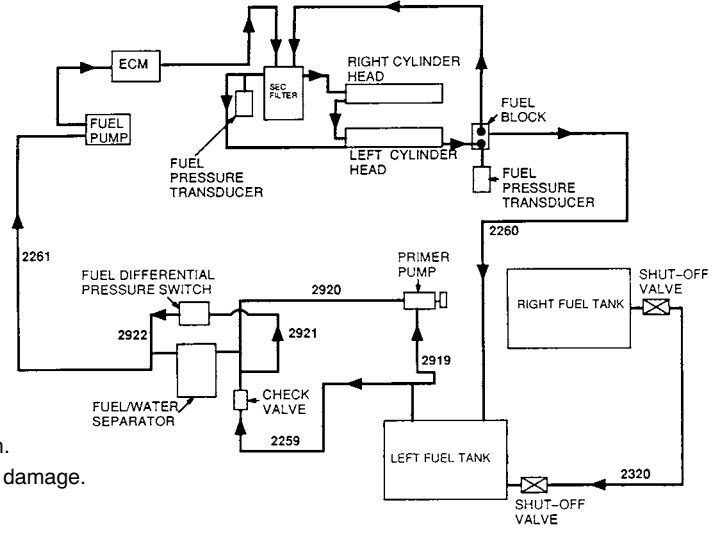


WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death keep flame away from fuel and keep fire extinguisher within easy reach. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET OF VEHICLE.

NOTE

Fuel tank lines and fittings may be loose and allow air to be drawn into fuel system. Check fuel tank lines and fittings for leaks and damage.

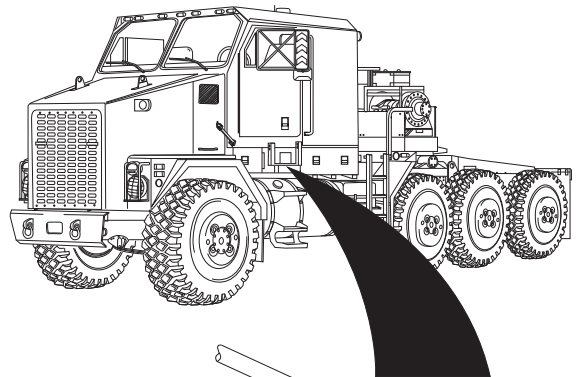


Fuel System Diagram

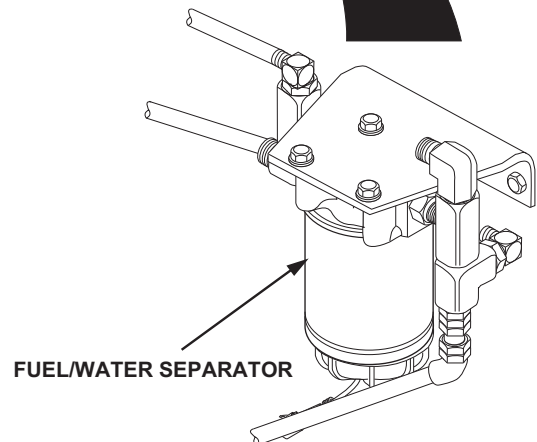
Check fuel water separator bowl for leaks, or damage.

STE/ICE TEST #26

- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "26".
- (3) Start engine (TM 9-2320-360-10).
- (4) Press and release TEST button and wait for "PASS" or "FAIL" appears in display.
- (5) Shut off engine (TM 9-2320-360-10).

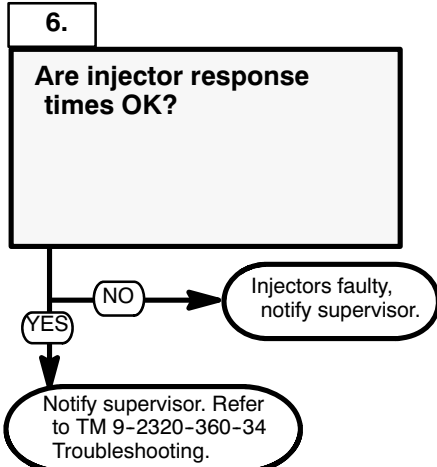


Check for presence of contaminants in bowl of fuel water separator.



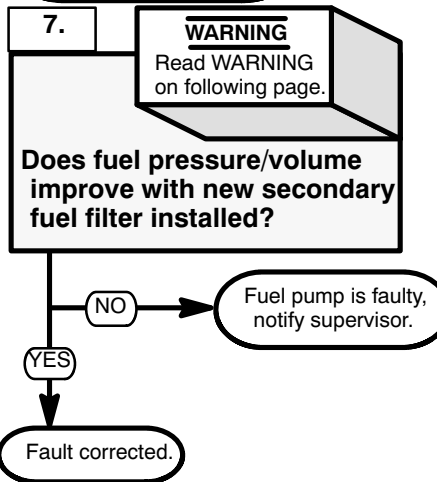
b2. ENGINE STARTS BUT MISFIRES, RUNS ROUGH, OR LACKS POWER (CONT)

KNOWN INFO
Air restriction indicator OK
Fuel system primed
Adequate fuel pressure/volume
Fuel lines and fittings OK
Fuel water separator OK
Contaminated fuel
POSSIBLE PROBLEMS
Faulty injector(s)



TEST OPTIONS
Injector Response Time Test
REASON FOR QUESTION
Faulty injector will be indicated by a response time that is less than the others. A response time of .80 millisecond indicates a faulty injector.

KNOWN INFO
Air restriction indicator OK
Fuel system primed
Inadequate fuel pressure/volume
POSSIBLE PROBLEMS
Faulty fuel pump



TEST OPTIONS
Fuel Supply Test
or
STE/ICE-R Test #24
REASON FOR QUESTION
Fuel pump is faulty if fuel pressure remains less than 31 psi (214 kPa) or less than one gallon per minute at 2100 rpm.

INJECTOR RESPONSE TIME TEST

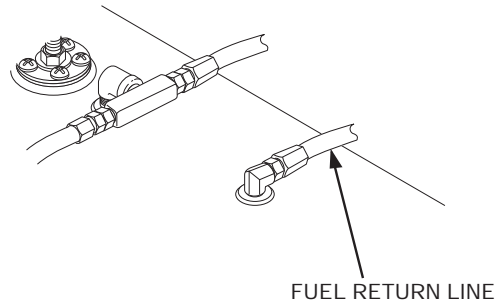
- (1) Connect DDR to DDL connector (page 2-67).
- (2) Start engine (TM 9-2320-360-10).
- (3) Select Fuel Injector Response Times on DDR.
- (4) Compare injector response times of all eight injectors.
- (5) Shut off engine (TM 9-2320-360-10).
- (6) Disconnect DDR from DDL connector.

WARNING

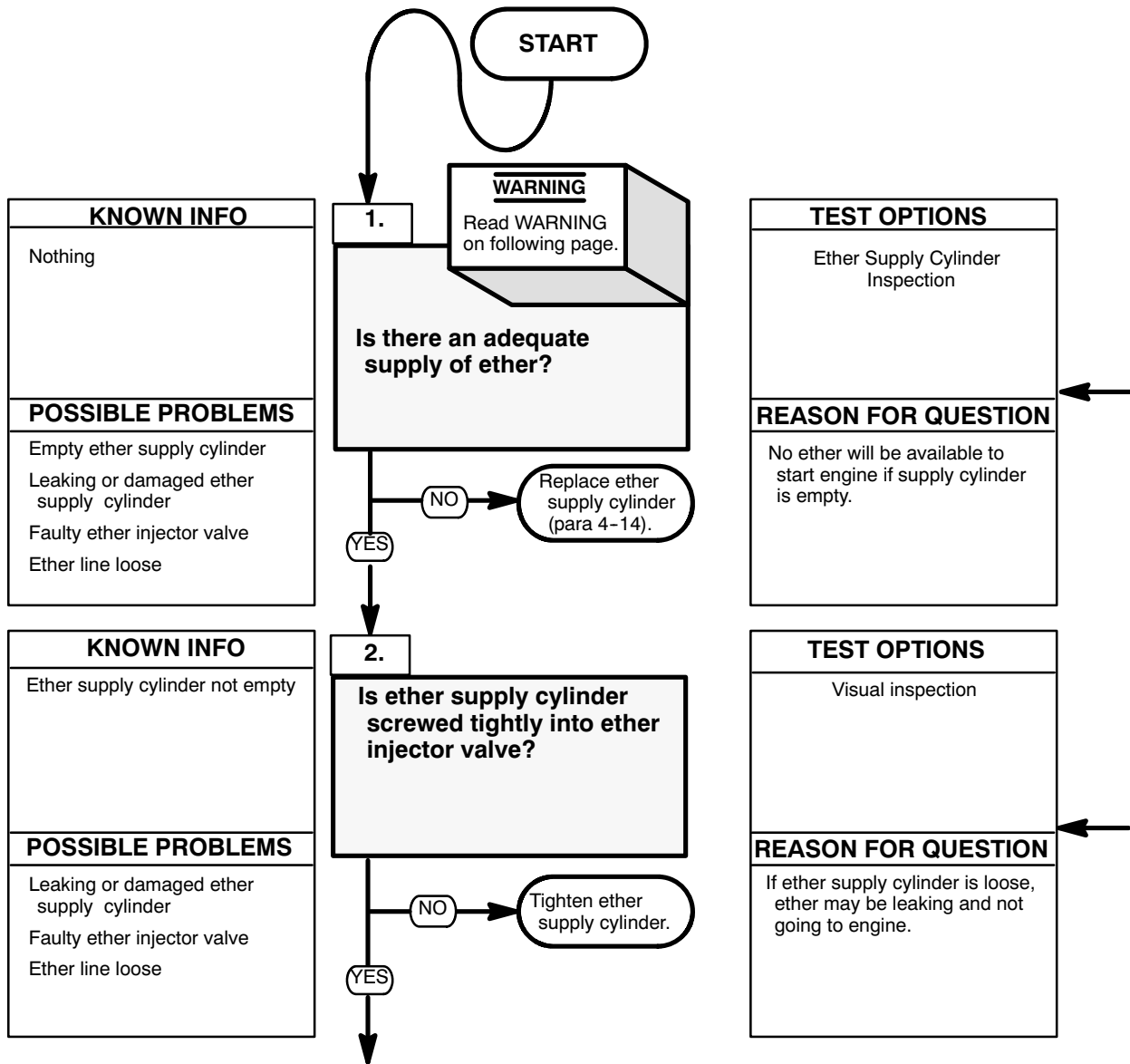
Fuel is very flammable and can explode easily. To avoid serious injury or death keep flame away from fuel and keep fire extinguisher within easy reach. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET OF VEHICLE. Be sure to wear the proper eye protection to avoid personal injury.

FUEL SUPPLY TEST

- (1) Remove fuel return line from left side fuel tank.
- (2) Place fuel line in suitable container.
- (3) Start engine (TM 9-2320-360-10).
- (4) Observe fuel flow into container while assistant operates engine at 2100 rpm.
- (5) Shut off engine (TM 9-2320-360-10).
- (6) Install fuel return line from left side fuel tank.



b3. ETHER STARTING AID DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



WARNING

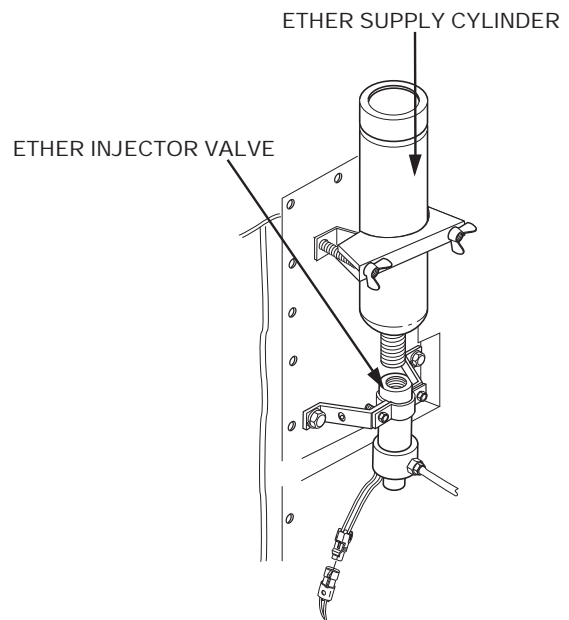
Ether is very flammable and could explode causing serious injury or death. Keep cylinder away from heat and open flame. Be sure to wear the proper eye protection to avoid personal injury.

NOTE

Temperature at engine block must be below 55 °F (13 °C) before ether starting aid will work

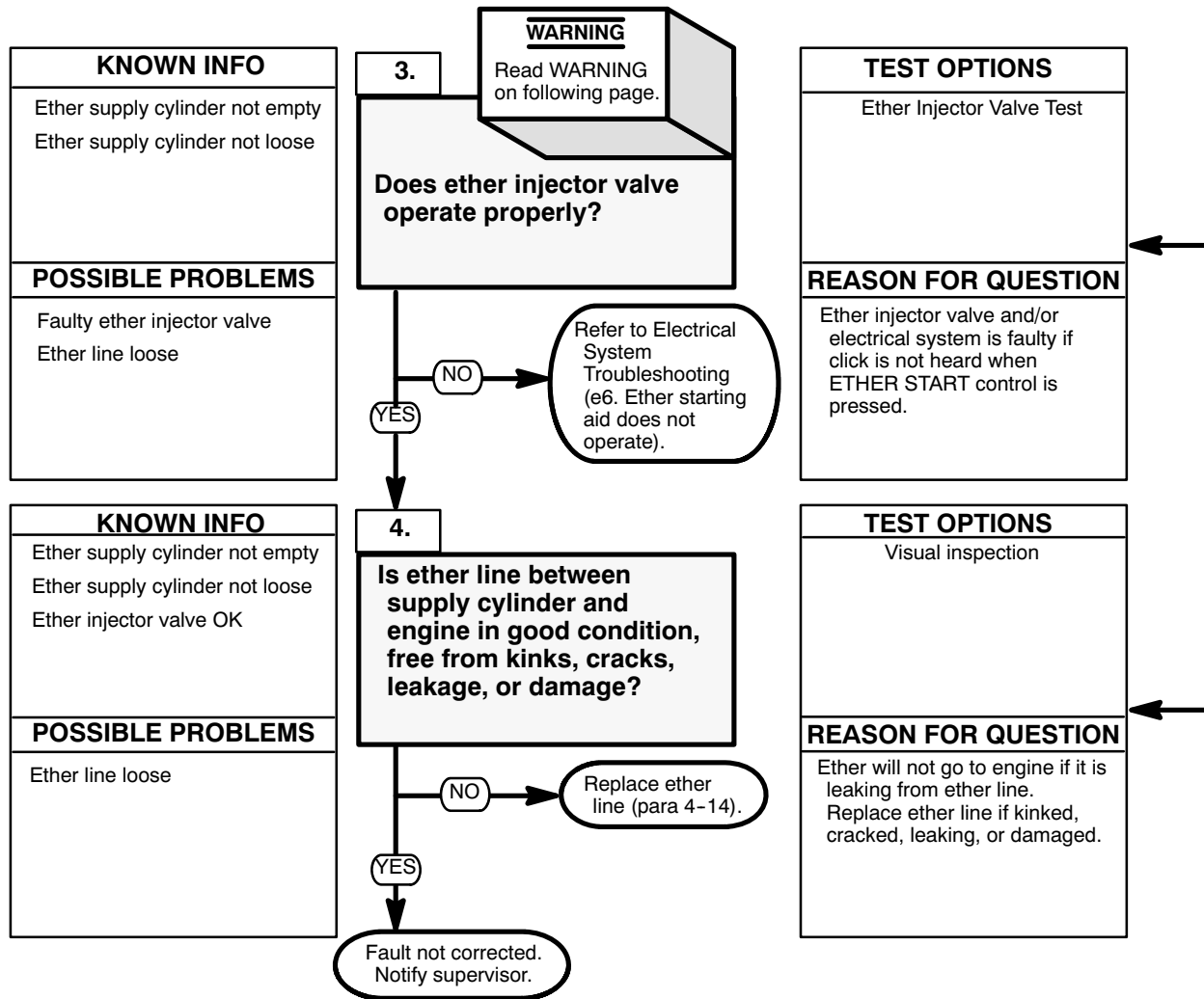
ETHER SUPPLY CYLINDER INSPECTION

- (1) Remove ether supply cylinder (para 4-14).
- (2) Shake ether supply cylinder to determine if ether is present.



Check that ether supply cylinder is screwed securely into ether injector valve.

b3. ETHER STARTING AID DOES NOT OPERATE (CONT)



WARNING

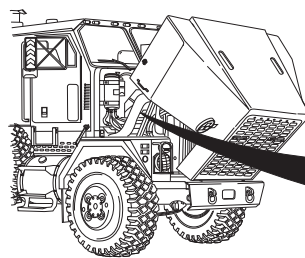
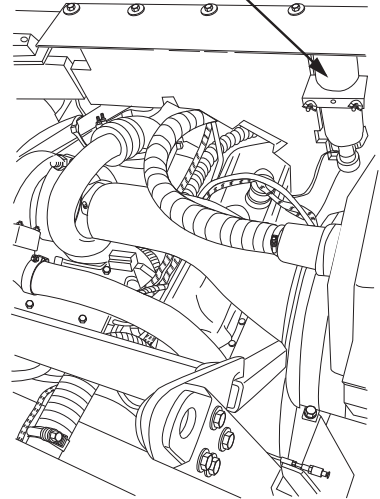
Ether is very flammable and could explode causing serious injury or death. Keep cylinder away from heat and open flame.

ETHER INJECTOR VALVE TEST

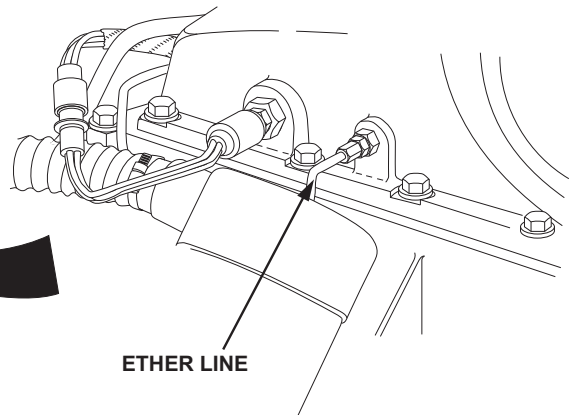
- (1) Turn ENGINE switch to ON position.
- (2) Press ETHER START control and listen for ether injector valve to click.
- (3) Turn ENGINE switch to OFF position.

Check ether line between supply cylinder and engine for leaks and damage.

ETHER SUPPLY CYLINDER



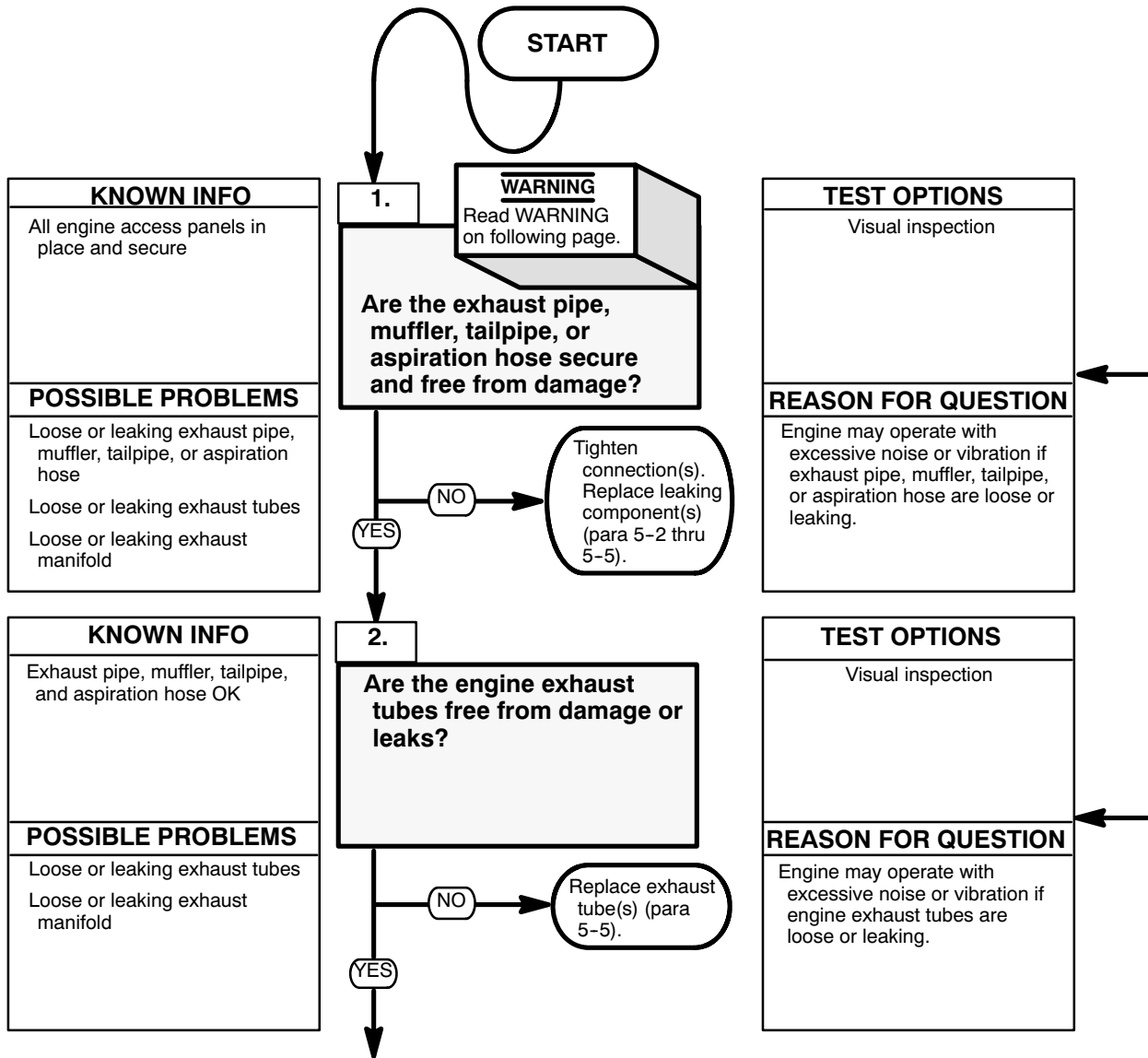
ETHER LINE

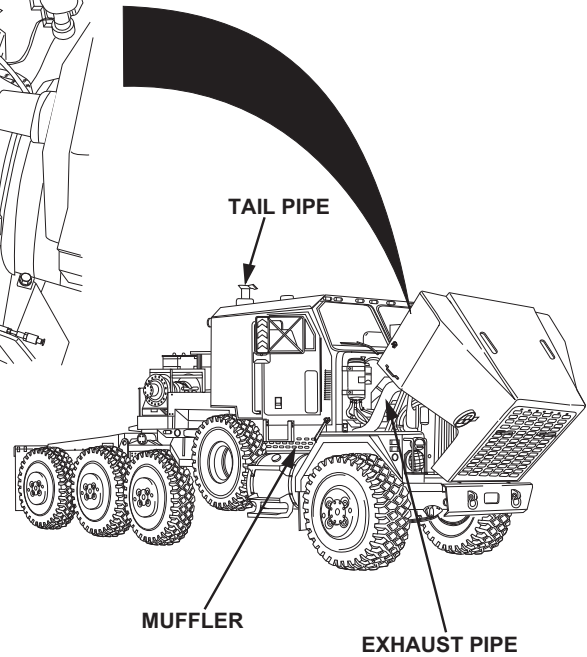
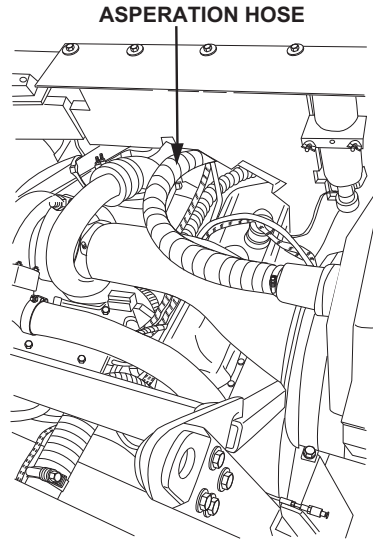


c. EXHAUST SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>c1. Exhaust system unusually noisy or vibrates excessively during engine operation</u>	<u>2-428</u>
<u>c2. Exhaust fumes in cab</u>	<u>2-432</u>

c1. EXHAUST SYSTEM UNUSUALLY NOISY OR VIBRATES EXCESSIVELY DURING ENGINE OPERATION	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



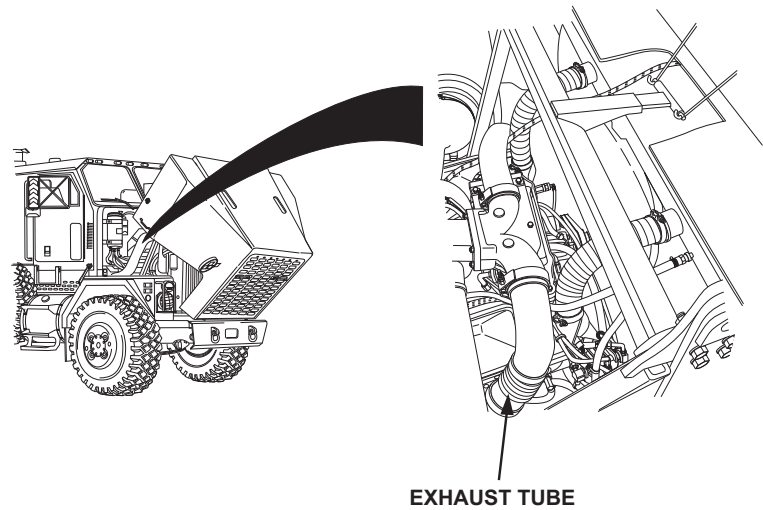


WARNING

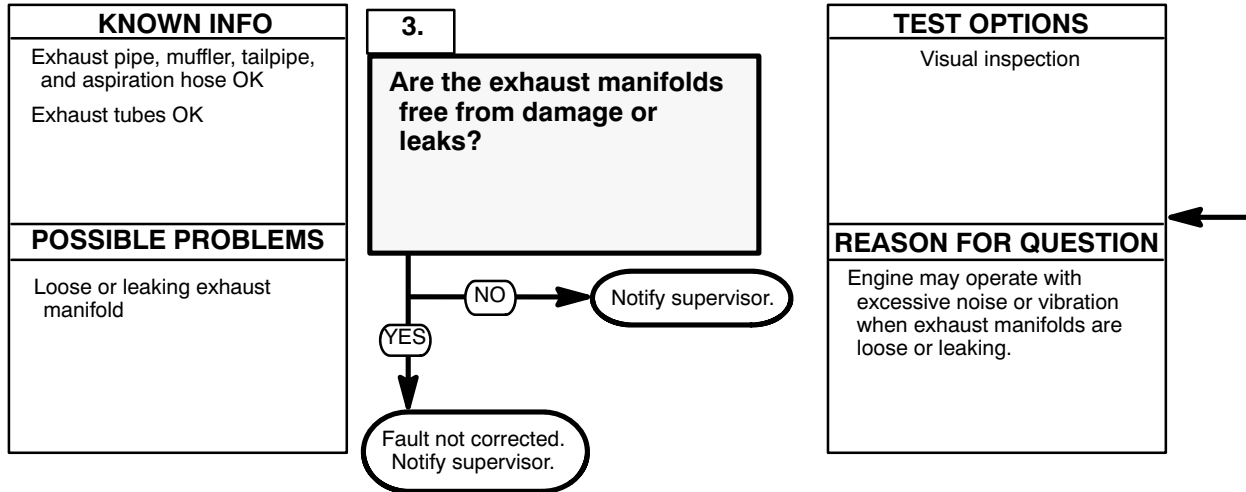
Make sure exhaust pipe and muffler are cool before performing troubleshooting checks. Failure to comply may result in serious personnel injury.

Check exhaust pipe, muffler, tailpipe, and aspiration hose for loose connections and leaks.

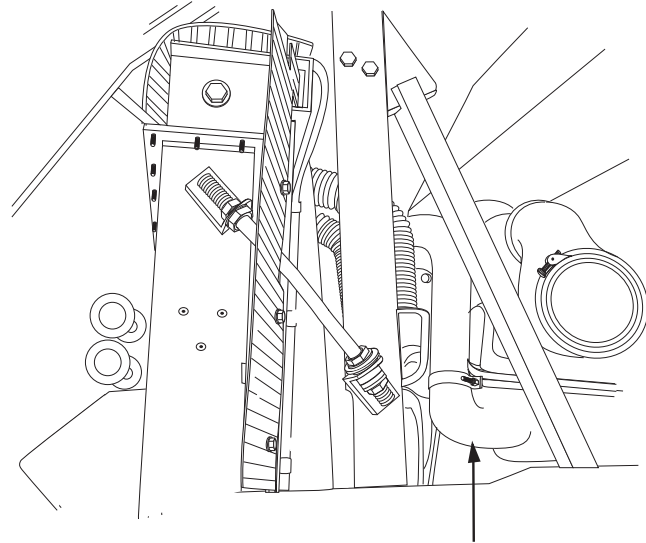
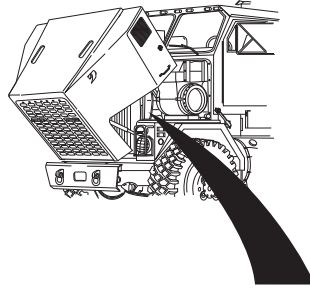
Check engine exhaust tubes for loose connections or leaks.



c1. EXHAUST SYSTEM UNUSUALLY NOISY OR VIBRATES EXCESSIVELY DURING ENGINE OPERATION (CONT)

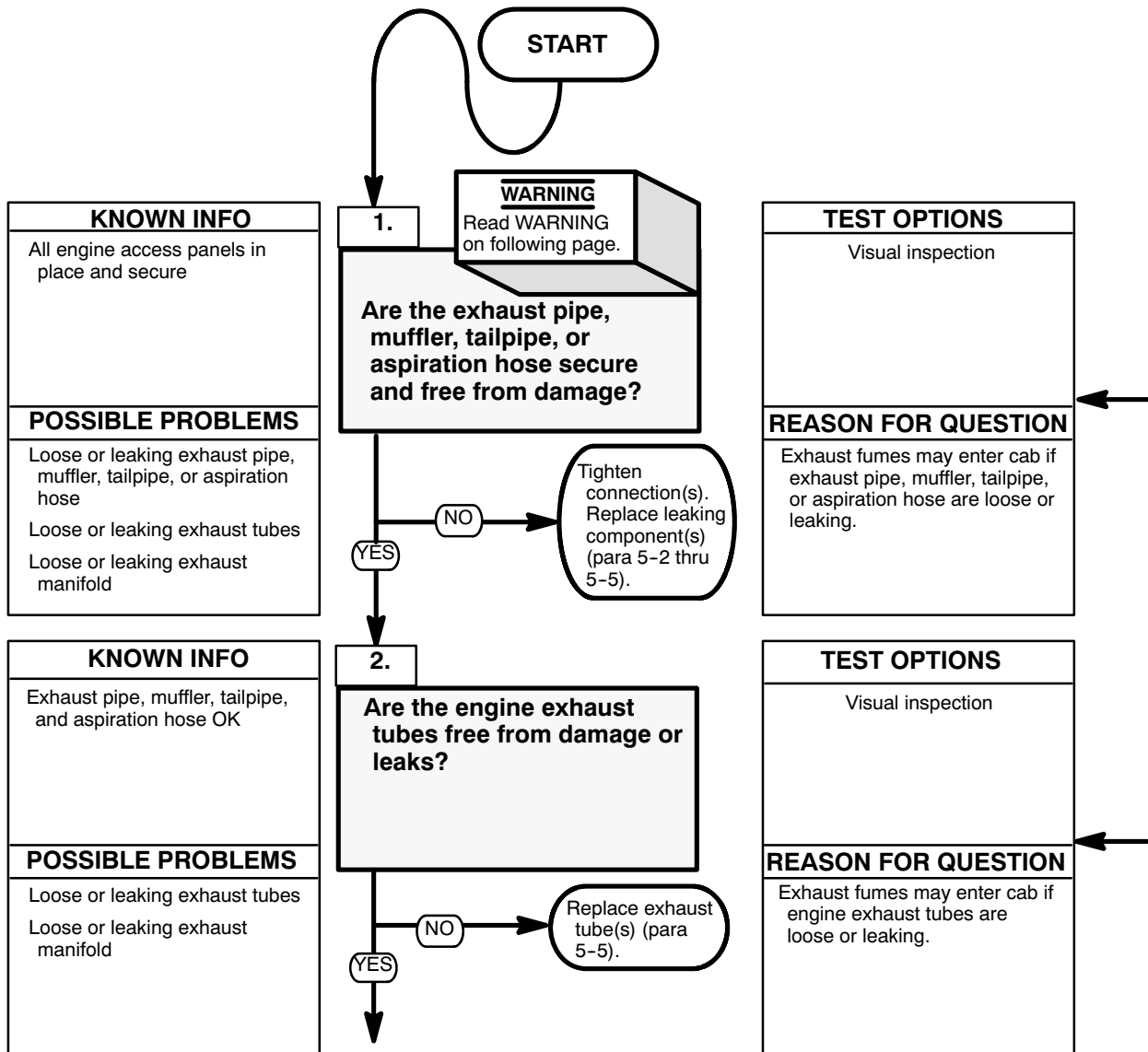


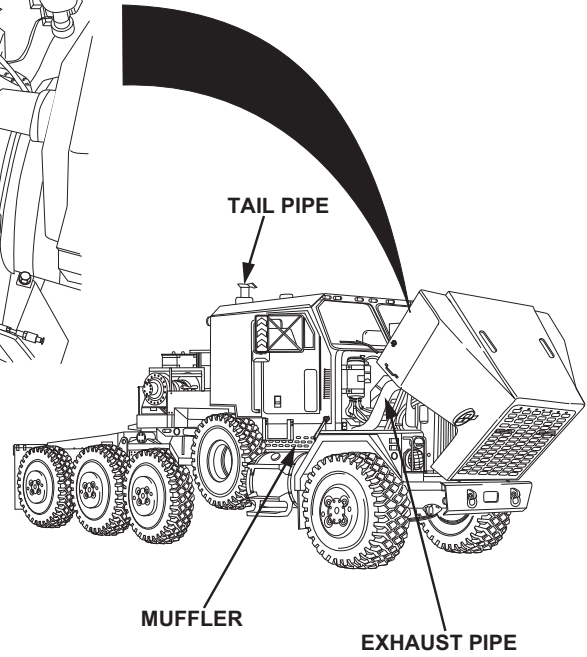
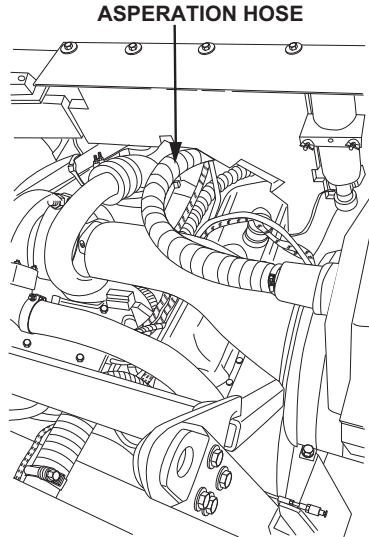
Check exhaust manifold
for looseness or leaks.



EXHAUST MANIFOLD

c3. EXHAUST FUMES IN CAB	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

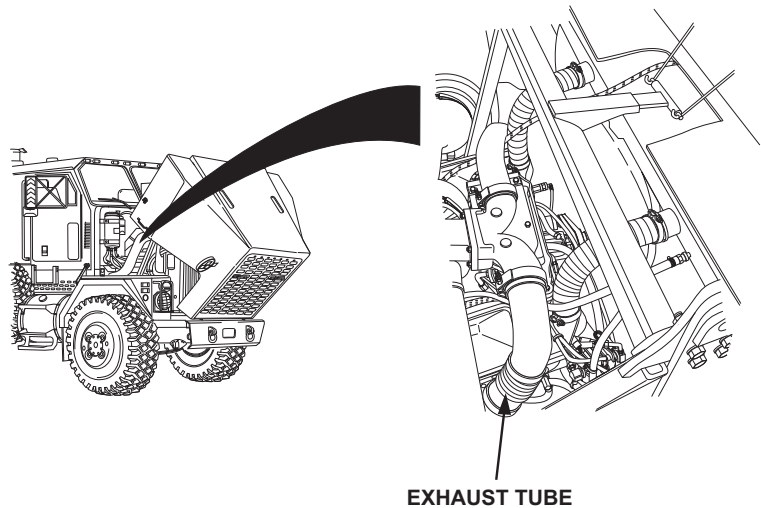




WARNING

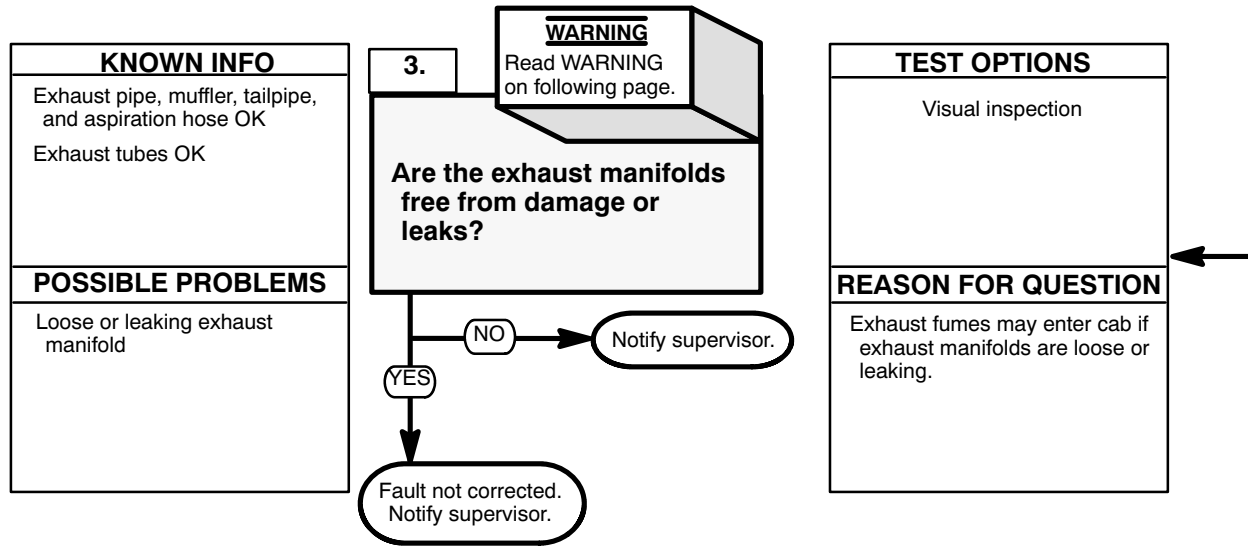
Make sure exhaust pipe and muffler are cool before performing troubleshooting checks. Failure to comply may result in serious personnel injury.

Check exhaust pipe, muffler, tailpipe, and aspiration hose for loose connections and leaks.



Check engine exhaust tubes for loose connections or leaks.

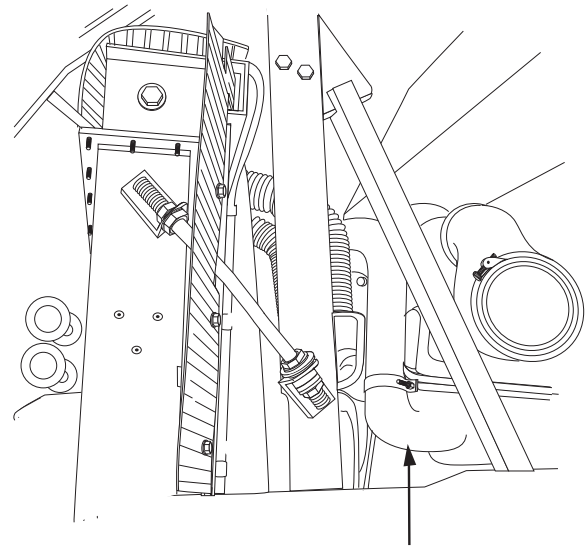
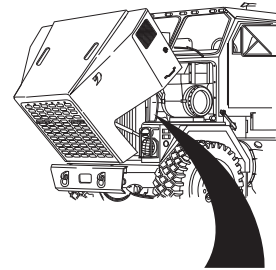
c2. EXHAUST FUMES IN CAB (CONT)



WARNING

Make sure exhaust pipe and muffler are cool before performing troubleshooting checks. Failure to comply may result in serious personnel injury.

Check exhaust manifold for looseness or leaks.



EXHAUST MANIFOLD

d. COOLING SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>d1. Engine overheats (WATER TEMP gage continuously reads over 230 °F (110 °C))</u>	<u>2-438</u>

d1. ENGINE OVERHEATS (WATER TEMP GAGE CONTINUOUSLY READS OVER 230 °F (110 °C))

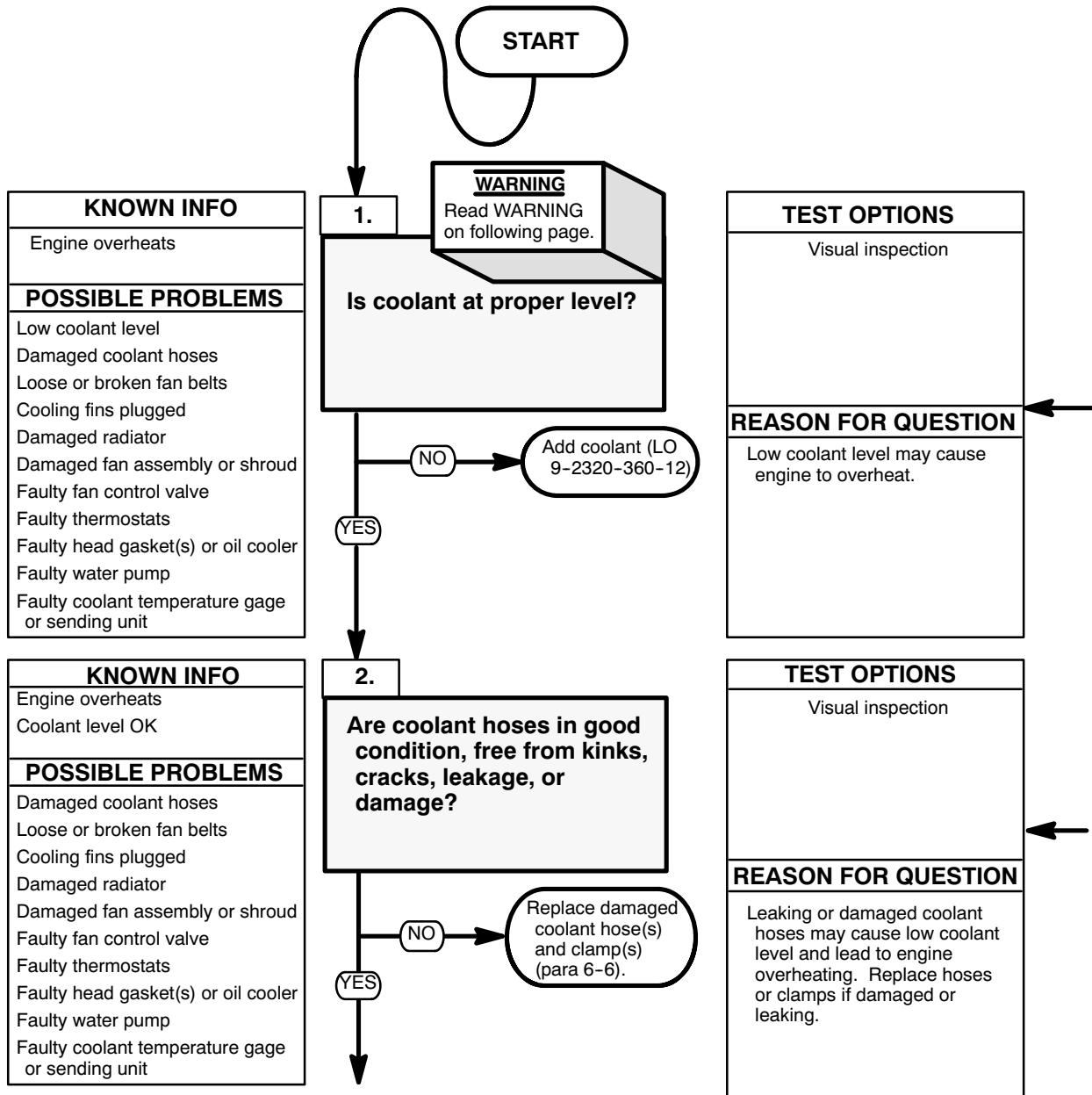
INITIAL SETUP

Equipment Conditions

Engine shut off (TM 9-2320-360-10).
 Parking brake on (TM 9-2320-360-10).
 Wheels chocked.

Tools and Special Tools

Tool Kit, Genl Mech (Item 54, Appendix F)
 STE/ICE-R (Item 47, Appendix F)
 Gage, Belt Tension (Item 12, Appendix F)
 Pressure Tester (Item 32, Appendix F)
 Adapter, Radiator (Item 1, Appendix F)



WARNING

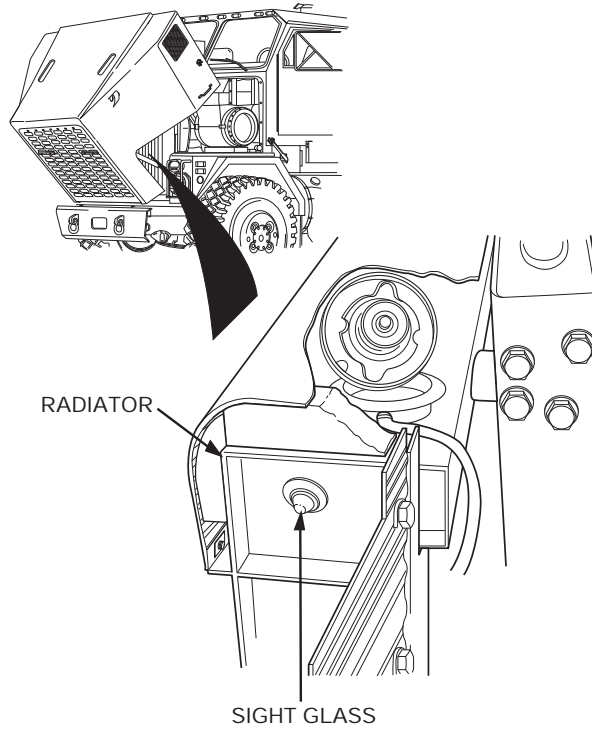
Antifreeze may be very hot and under pressure from engine operation. Be sure to wear the proper eye protection and ensure engine is cool before performing maintenance. Failure to comply may cause serious personnel injury.

NOTE

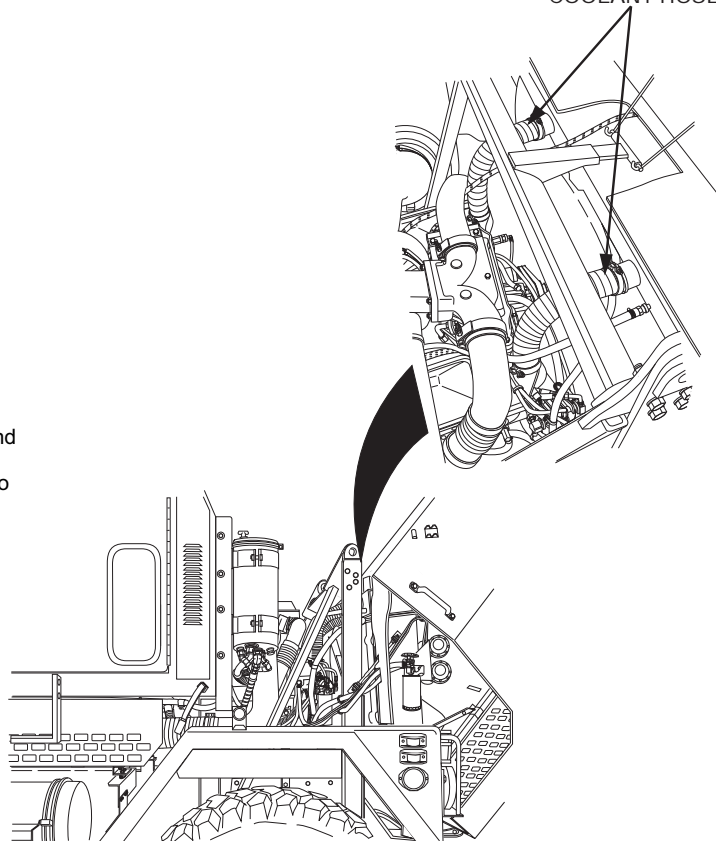
The following flow chart should only be used if Engine Troubleshooting a6. was started on p. 2-400 and you were referred here.

Coolant should be visible in sight glass.

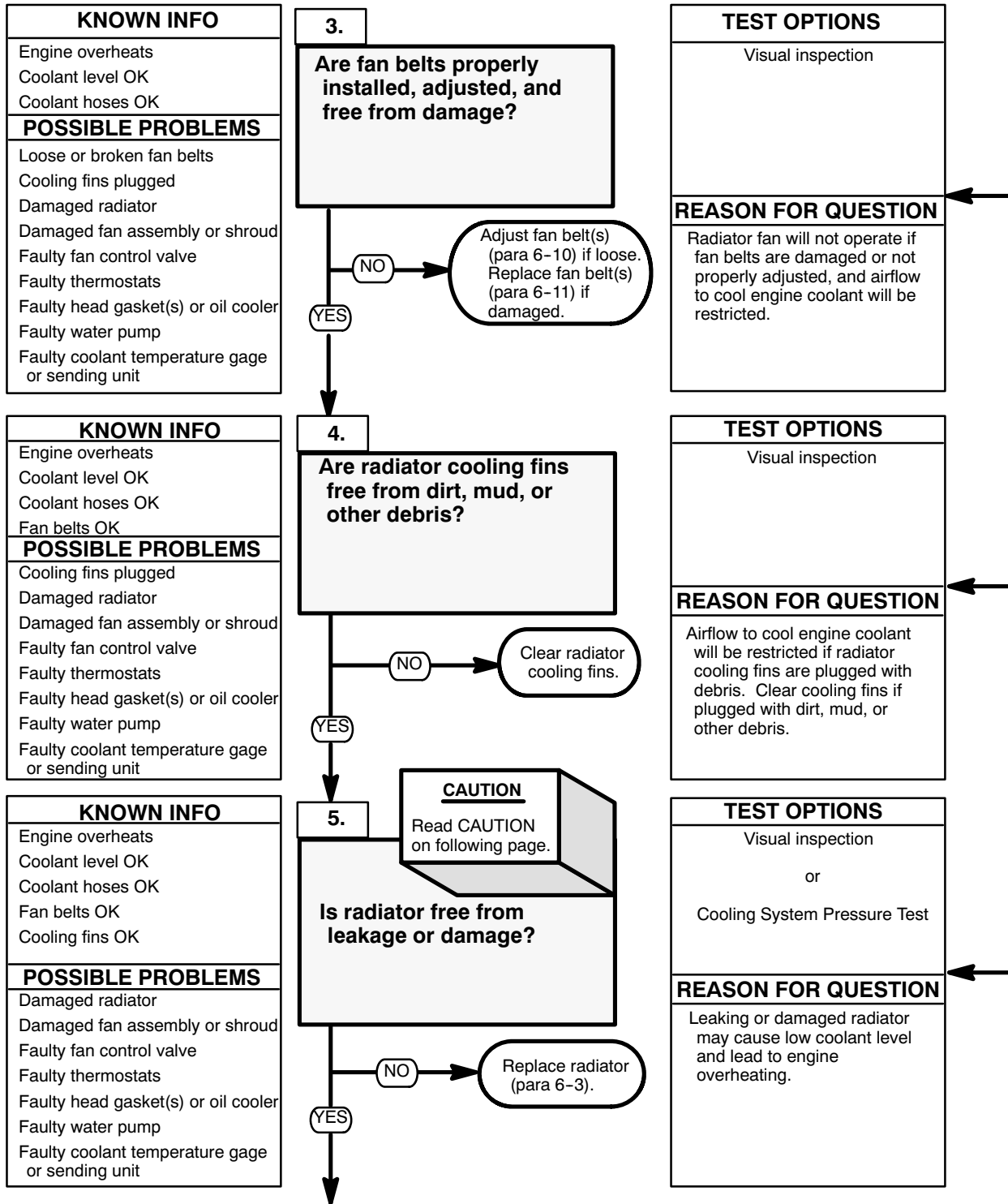
Check all coolant hoses and clamps for leakage and damage, including hoses to heaters and coolant filter.



COOLANT HOSES



d1. ENGINE OVERHEATS (WATER TEMP GAGE CONTINUOUSLY READS OVER 230 °F (110 °C)) (CONT)



Using a belt tension gauge, check that fan belt tension is 70– 90 lb (310–400 N). Visually check for damaged or worn fan belts.

FAN ASSEMBLY

BELT TENSION GAGE

Check if radiator cooling fins are plugged with dirt, mud, or other debris.

SHROUD

PRESSURE TESTER

ADAPTER

Check radiator for leaks or damage.

COOLING SYSTEM PRESSURE TEST

- (1) Remove radiator cap from radiator.
- (2) Install adapter on radiator.
- (3) Install radiator tester on adapter.

CAUTION

Do not pressurize over 10 psi (69 kPa). Failure to comply may result in damage to cooling system.

- (4) Pressurize radiator, using tester, to 10 psi.
- (5) Observe radiator and hoses for coolant leaks.

NOTE

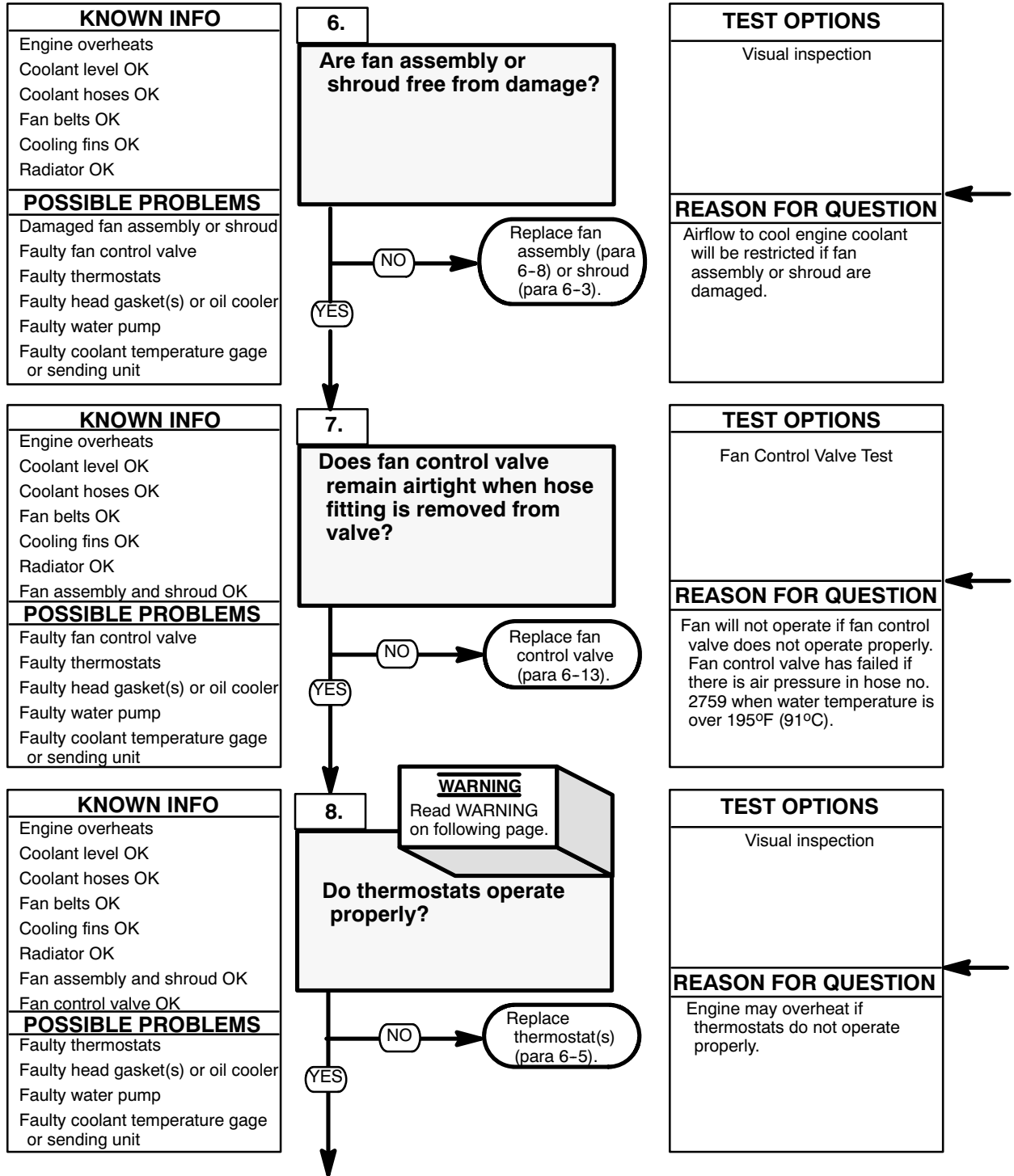
Pressure loss without external leaks indicates internal coolant leaks.

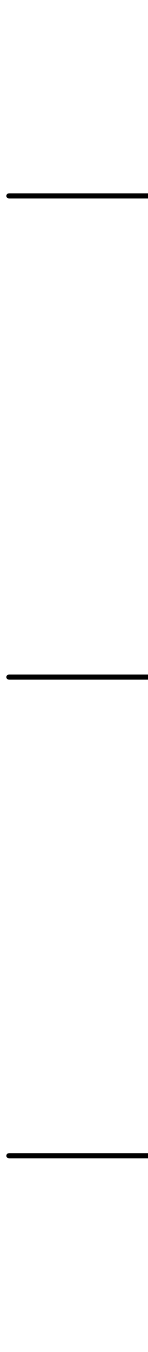
- (6) Observe radiator tester for loss of pressure.
- (7) Remove tester and adapter from radiator.
- (8) Install radiator cap on radiator.

RADIATOR CAP

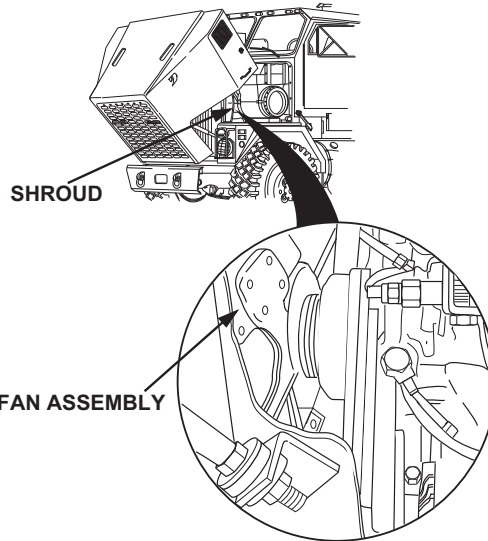
RADIATOR

d1. ENGINE OVERHEATS (WATER TEMP GAGE CONTINUOUSLY READS OVER 230 °F (110 °C)) (CONT)





Check fan assembly and shroud for damage.



FAN CONTROL VALVE TEST

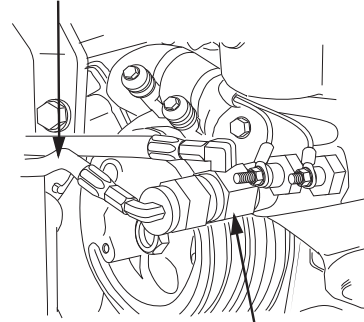
NOTE

WATER TEMP gage must read approximately 195 °F (91 °C) and AIR PRESS gage read between 100-120 psi (690-827 kPa) before fan control valve can be checked.

- (1) Start engine (TM 9-2320-360-10).
- (2) Run engine until WATER TEMP gage reads 195 °F (91 °C) and AIR PRESS gage reads between 100-120 psi (690-827 kPa).
- (3) Shut off engine (TM 9-2320-360-10).
- (4) Loosen air hose no. 2759 on fan control valve.
- (5) Check if air is coming out of fitting on fan control valve.
- (6) Tighten air hose no. 2759 on fan control valve.



AIR HOSE NO. 2759



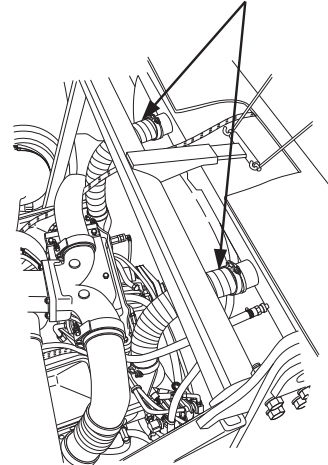
FAN CONTROL VALVE

WARNING

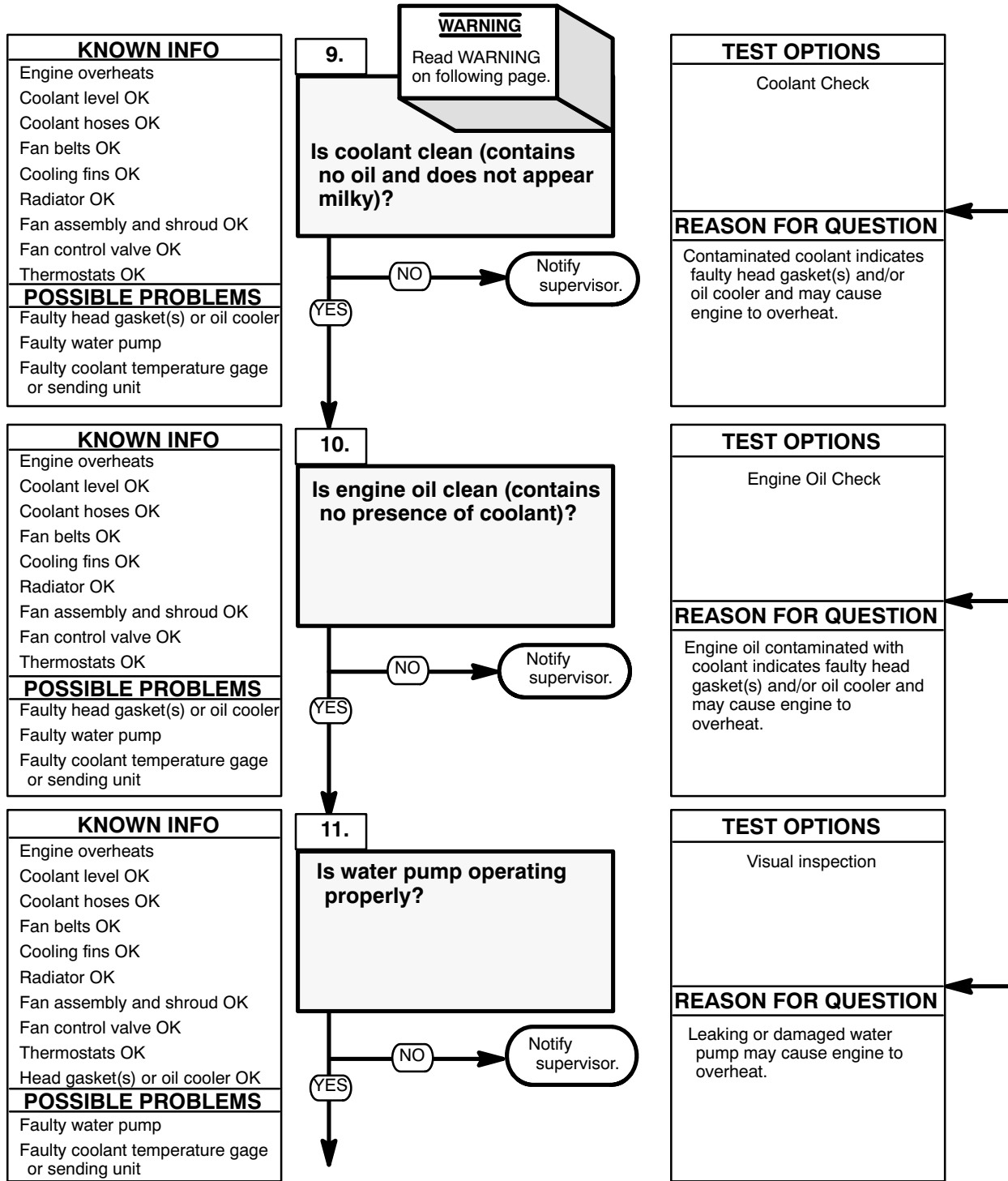
Always use caution when approaching a hot engine. Failure to do so may result in serious burns.

Feel upper radiator hoses when engine is hot. Thermostats are working properly if hoses feel warm.

RADIATOR HOSES



d1. ENGINE OVERHEATS (WATER TEMP GAGE CONTINUOUSLY READS OVER 230 °F (110 °C)) (CONT)

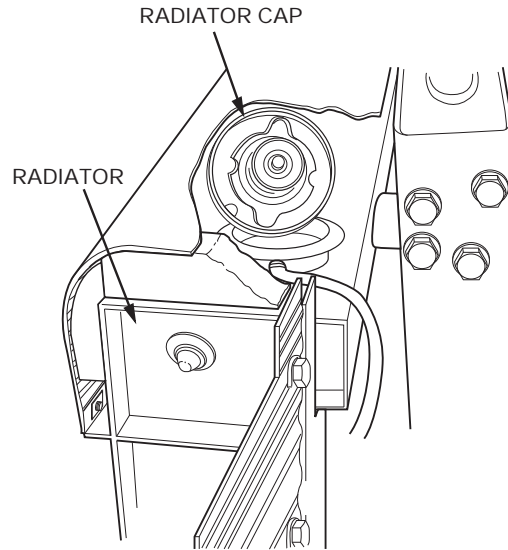


COOLANT CHECK

WARNING

Do not remove radiator cap when engine is warm. Coolant may be very hot and under pressure. Be sure to wear the proper eye protection to avoid personal injury. Failure to comply may result in injury to personnel.

- (1) Open hood (TM 9-2320-360-10).
- (2) Remove radiator cap from radiator.
- (3) Observe condition of coolant inside radiator.
- (4) Install radiator cap on radiator.

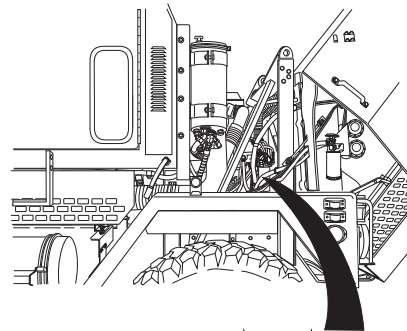
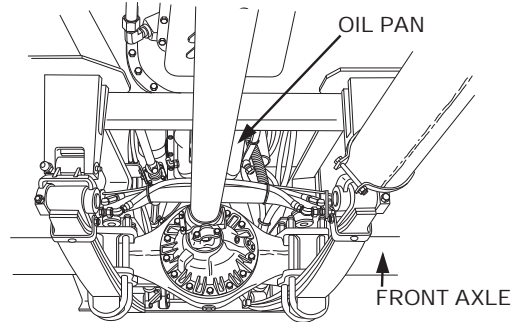


ENGINE OIL CHECK

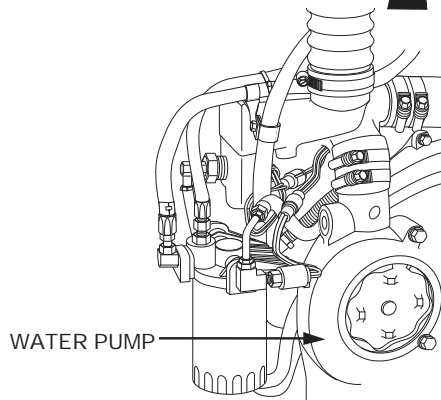
NOTE

Capacity of engine oil pan is approximately 28 qt (26.5 L).

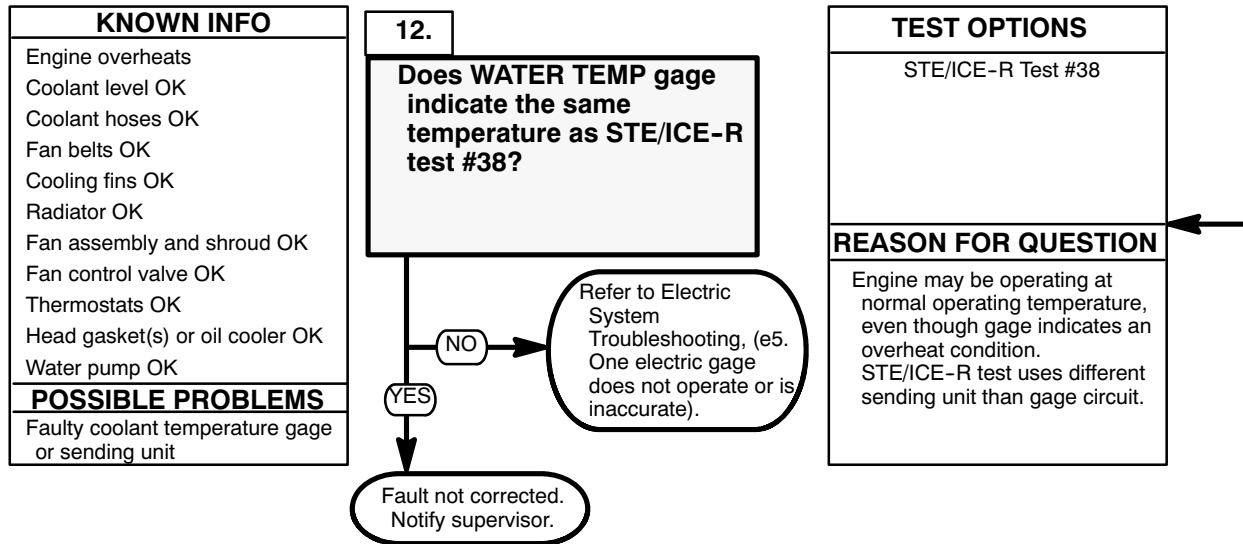
- (1) Position drain pan under engine oil pan.
- (2) Remove drain plug from engine oil pan.
- (3) Drain engine oil into drain pan.
- (4) Observe condition of engine oil.
- (5) Install drain plug in engine oil pan.
- (6) Refill engine oil (LO 9-2320-360-12).



Check water pump for leaks or damage.



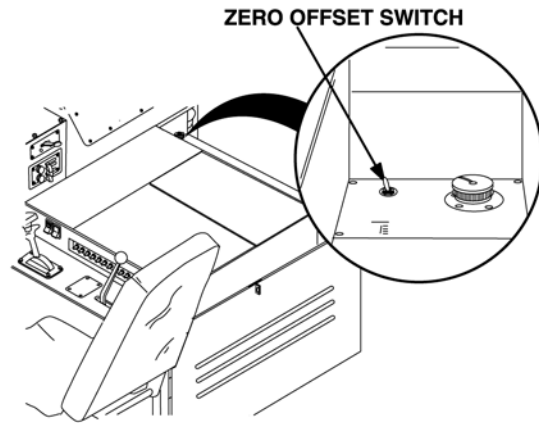
d1. ENGINE OVERHEATS (WATER TEMP GAGE CONTINUOUSLY READS OVER 230 °F (110 °C)) (CONT)



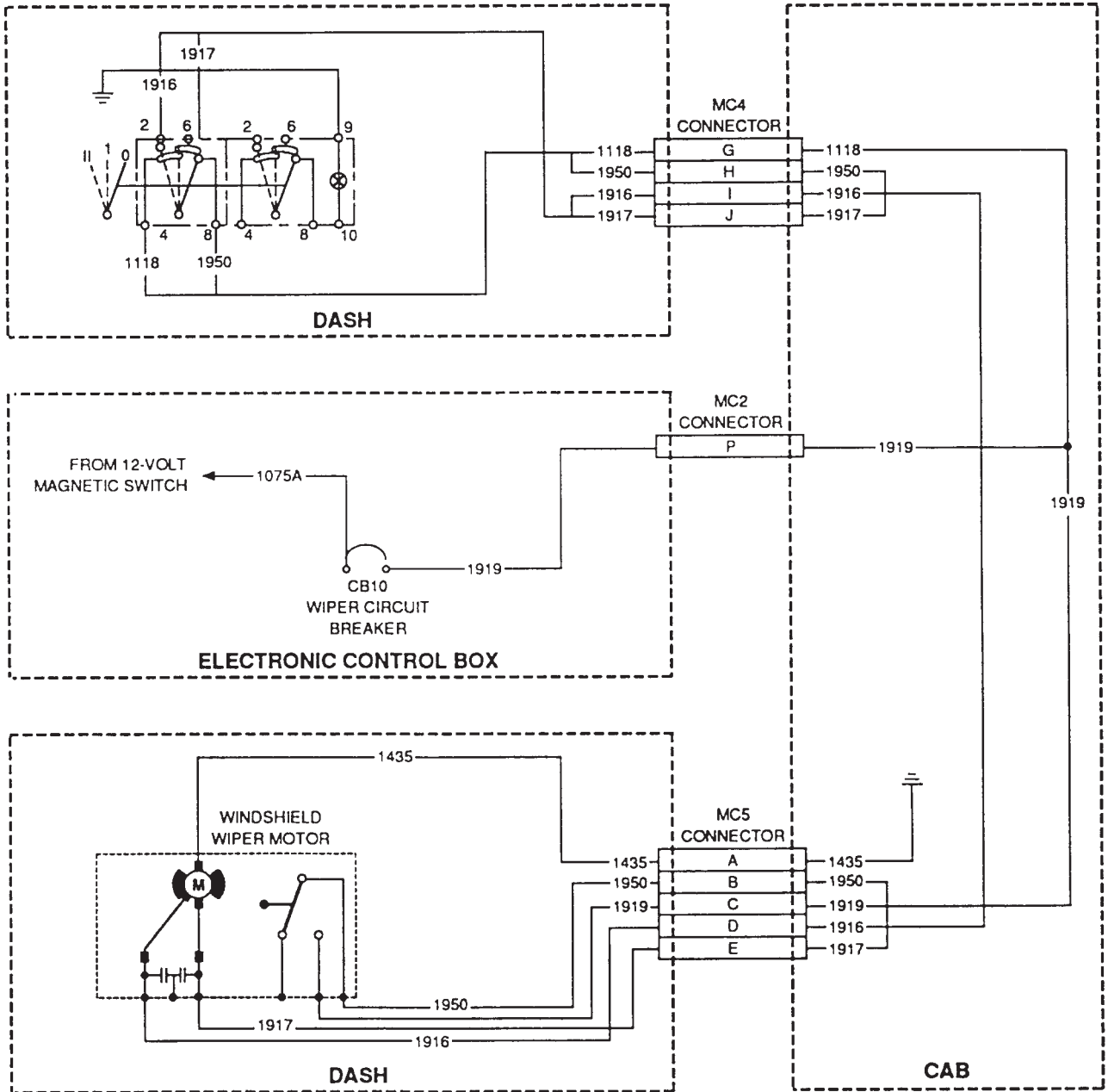
Verify WATER TEMP gage reading by comparing it to results from STE/ICE-R Test #38.

STE/ICE TEST #38

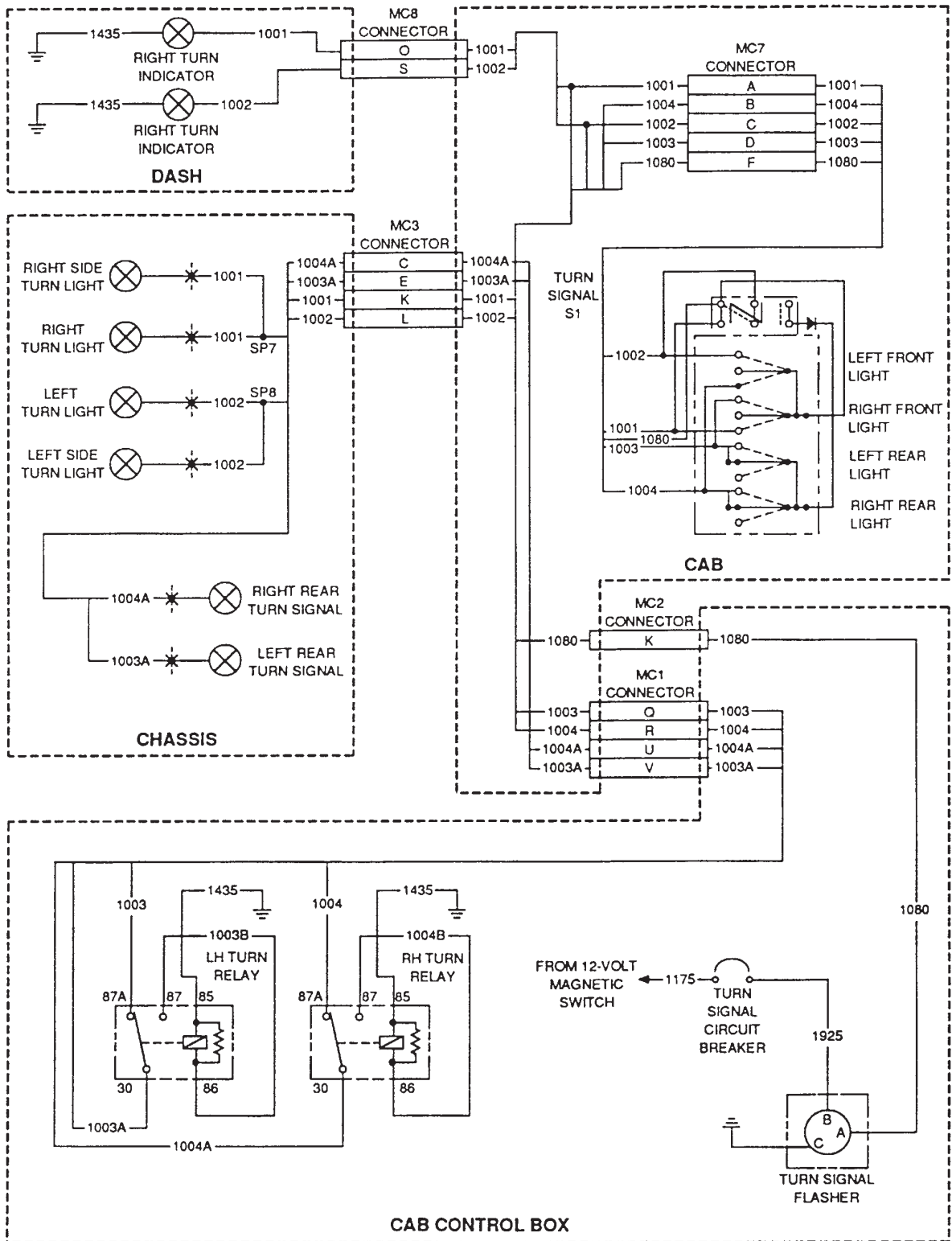
- (1) Connect STE/ICE test cable to STE/ICE receptacle in cab.
- (2) Set STE/ICE test select switch to "38".
- (3) Start engine (TM 9-2320-360-10).
- (4) Move STE/ICE Zero Offset switch to ON position.
- (5) Press and hold TEST button until "CAL" appears in display.
- (6) Release TEST button and wait for offset value to appear in display.
- (7) Move STE/ICE Zero Offset switch to OFF position.
- (8) Press and release TEST button to obtain test results.
- (9) Shut off engine (TM 9-2320-360-10).



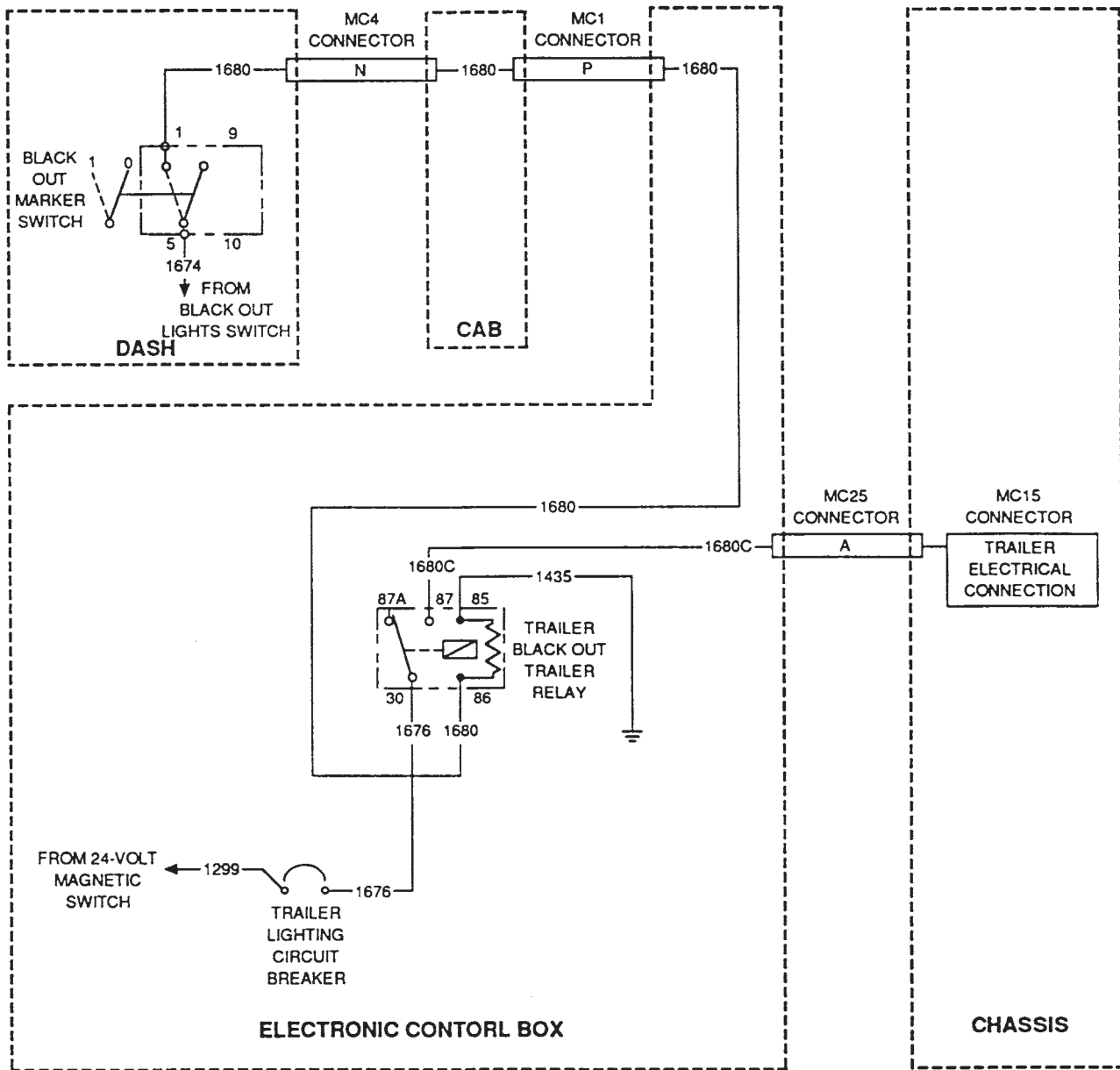
WINDSHIELD WIPER CIRCUIT



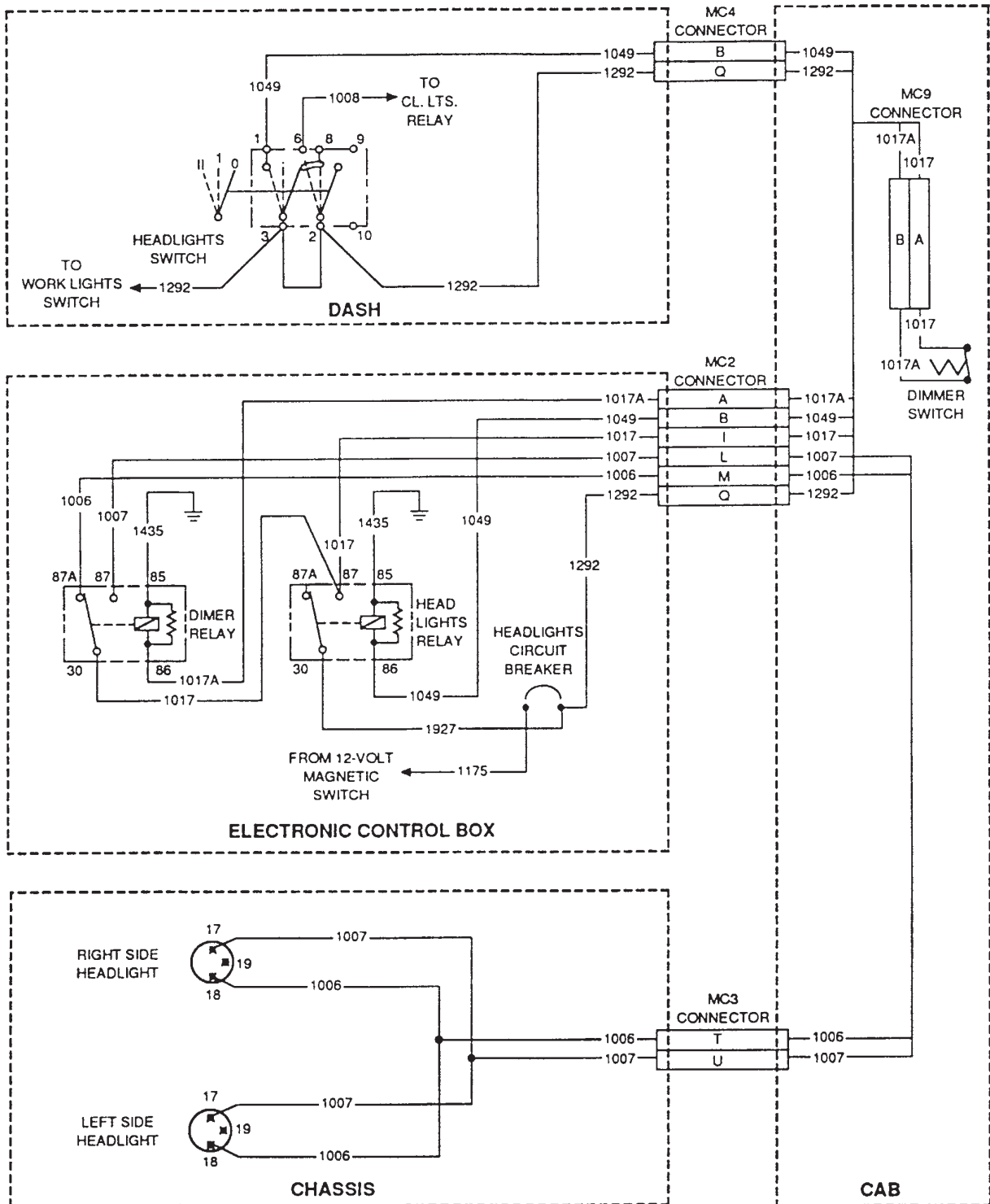
TURN SIGNAL CIRCUIT



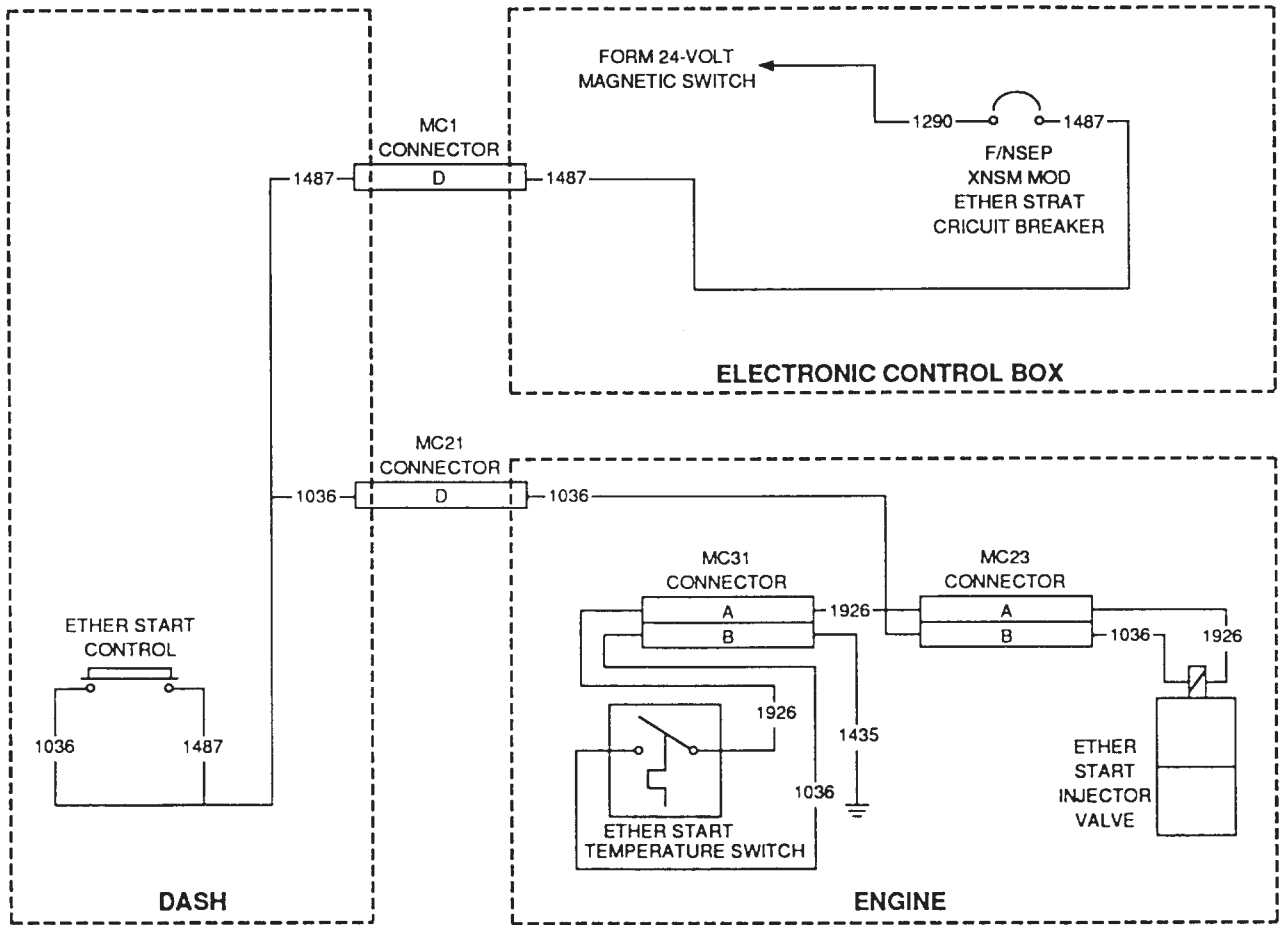
TRAILER BLACK OUT LIGHTS CIRCUIT



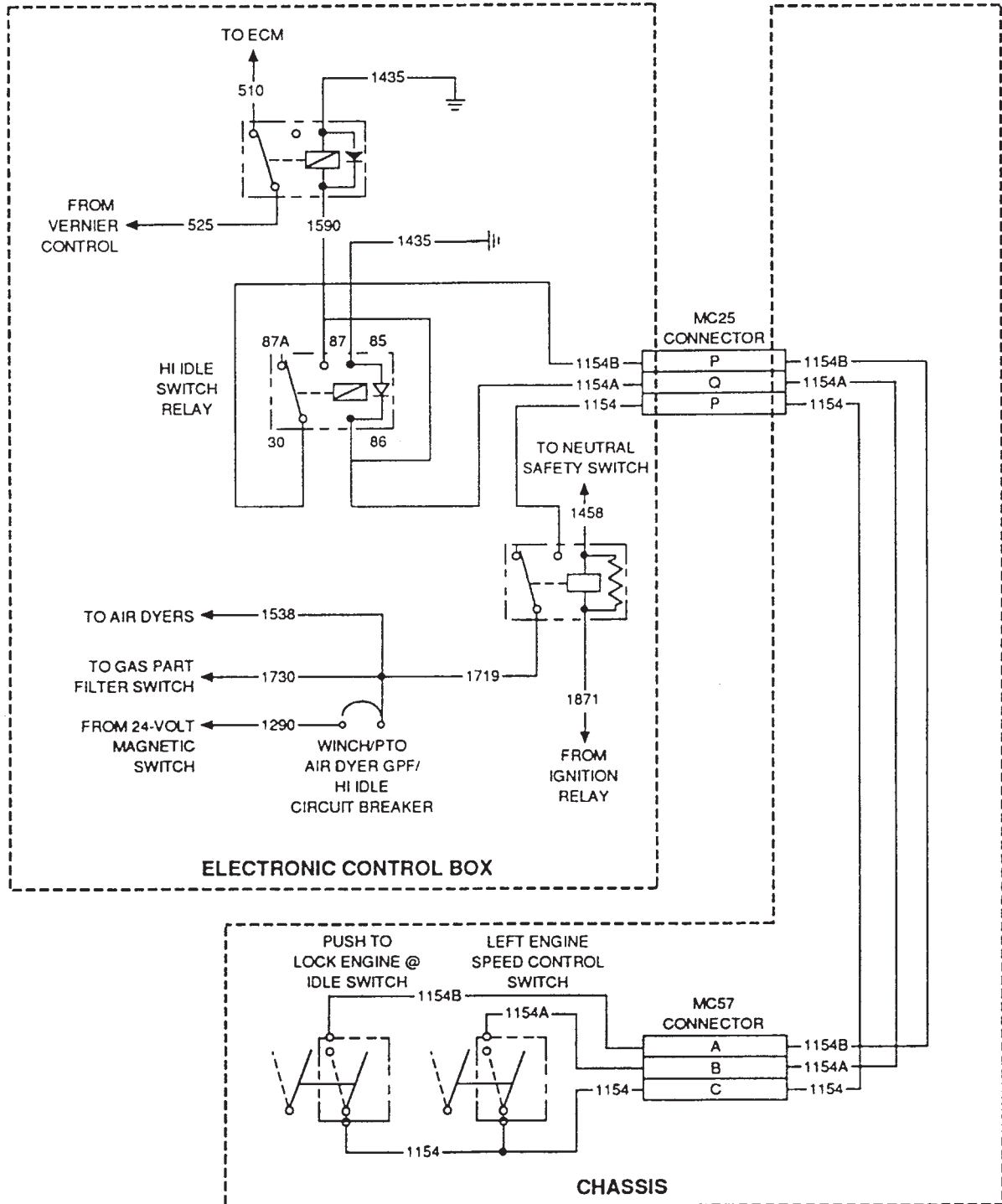
HEADLIGHT CIRCUIT



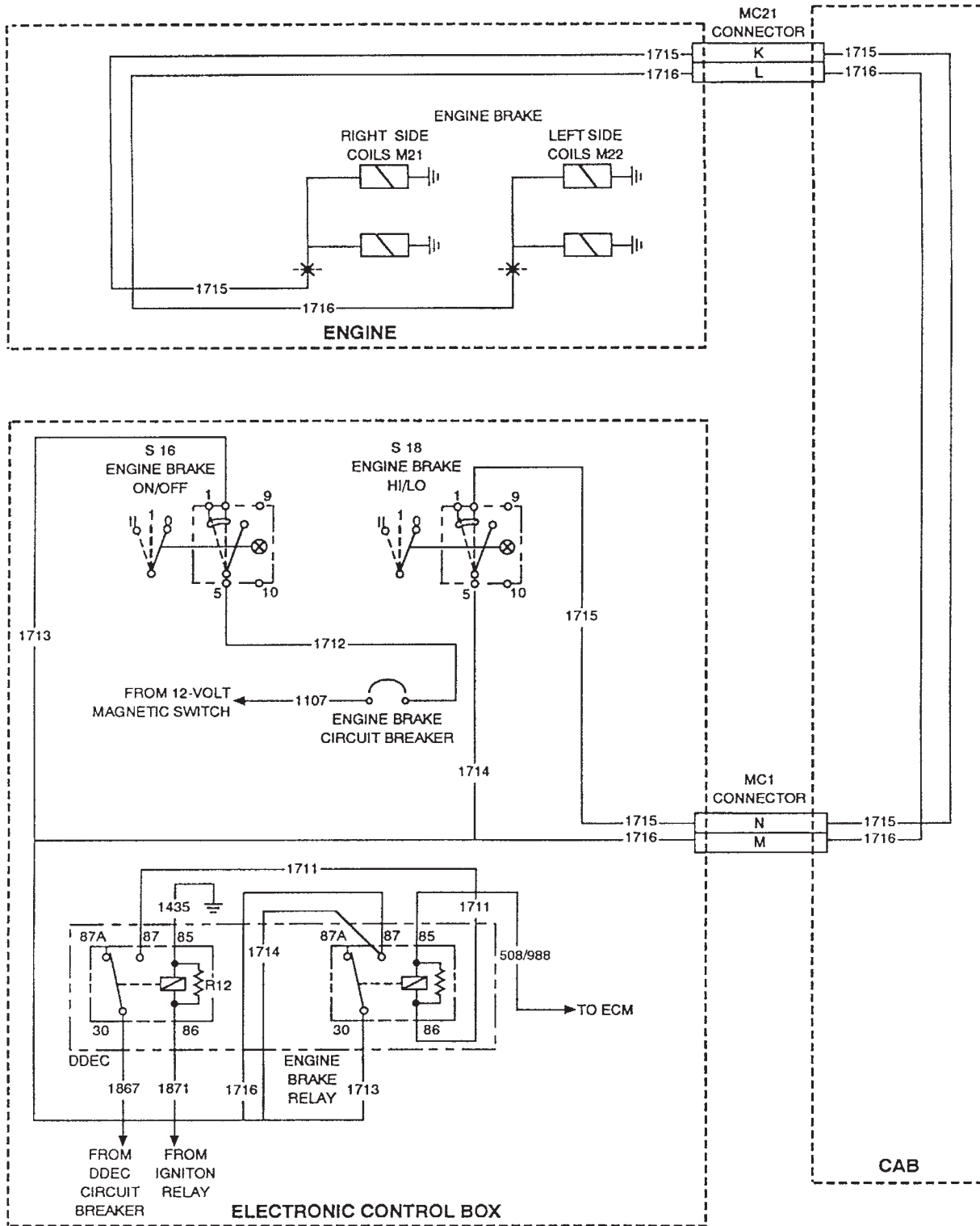
ETHER STRATING SYSTEM CIRCUIT

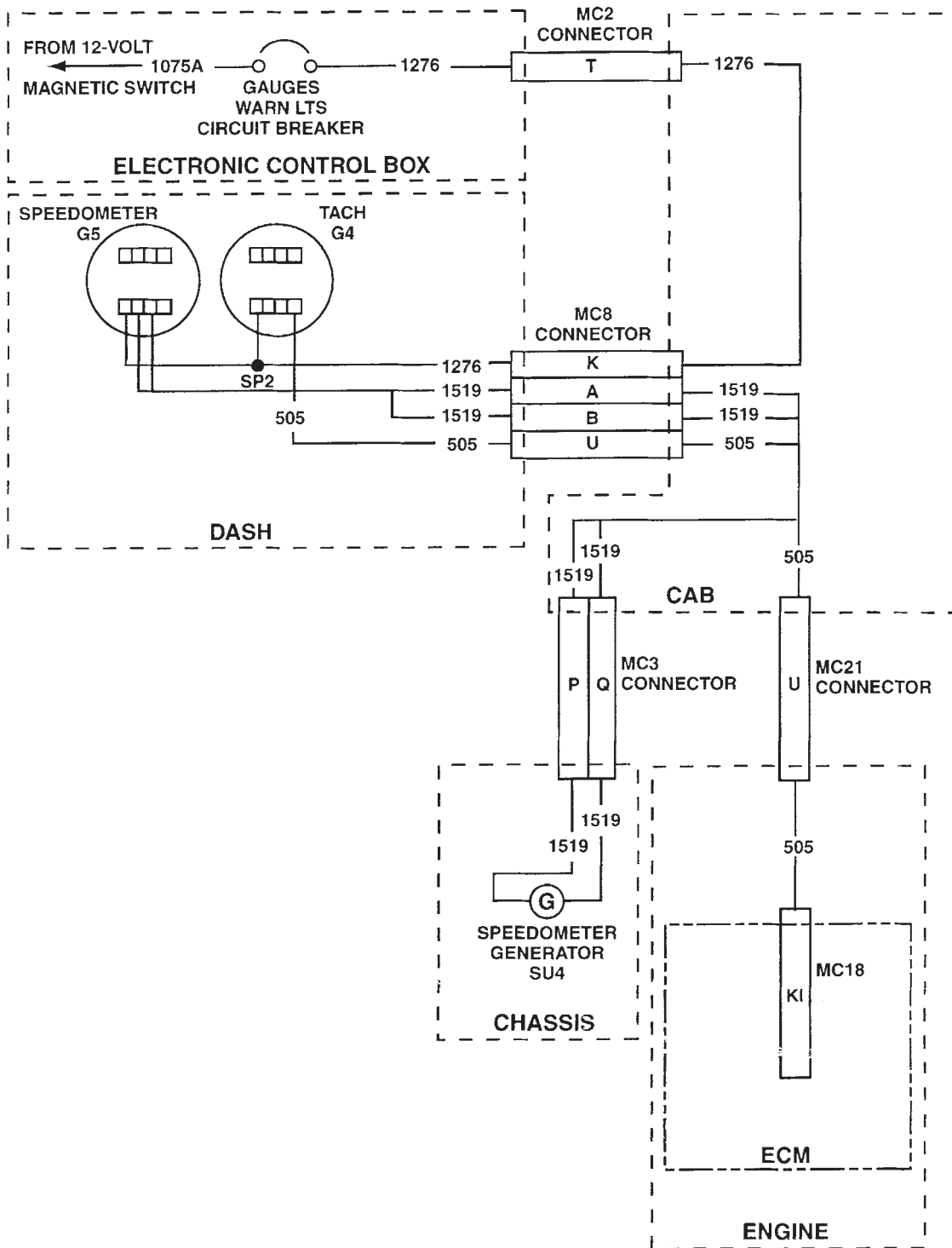


ENGINE SPEED CONTROL CIRCUIT

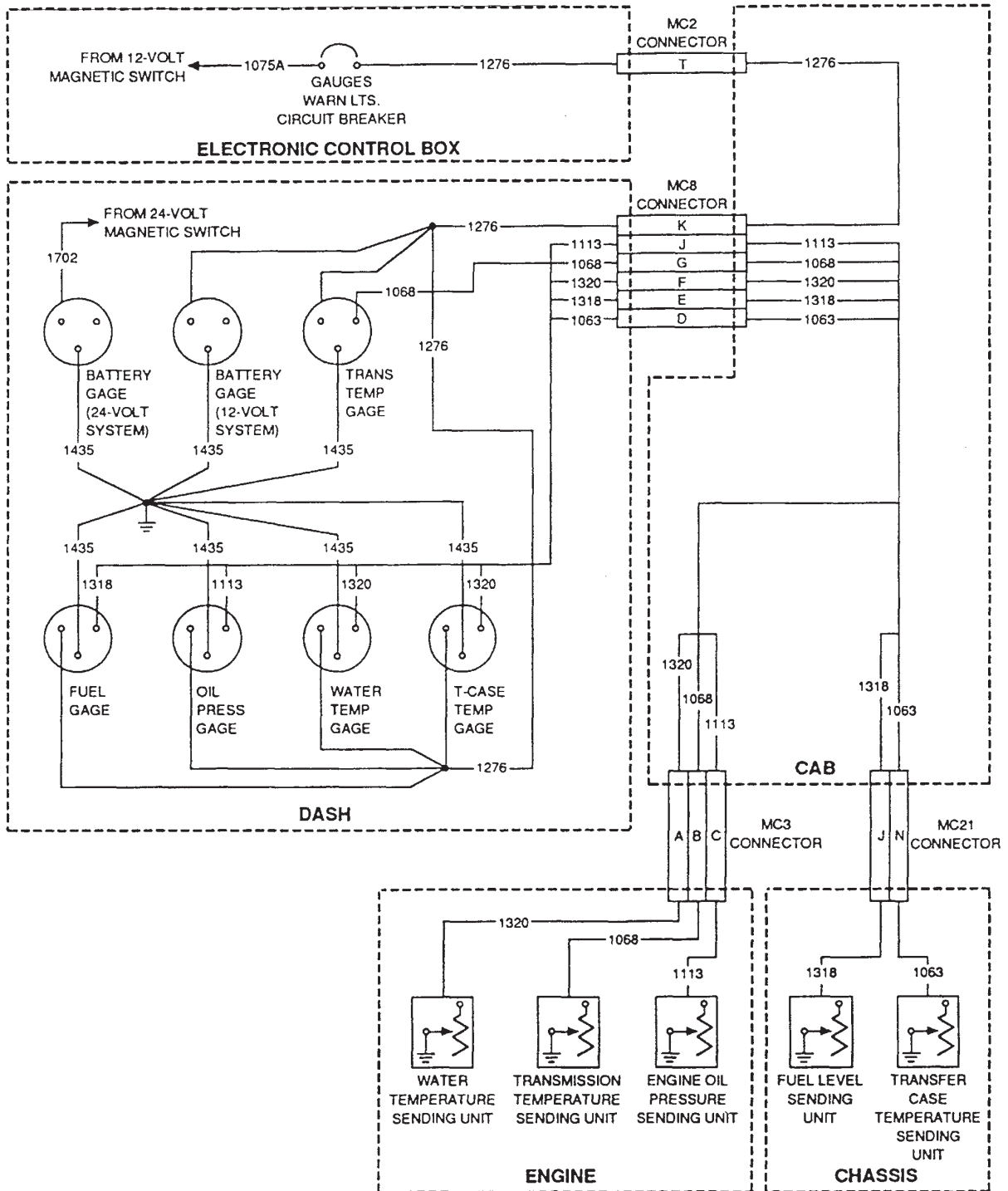


ENGINE BRAKE CIRCUIT

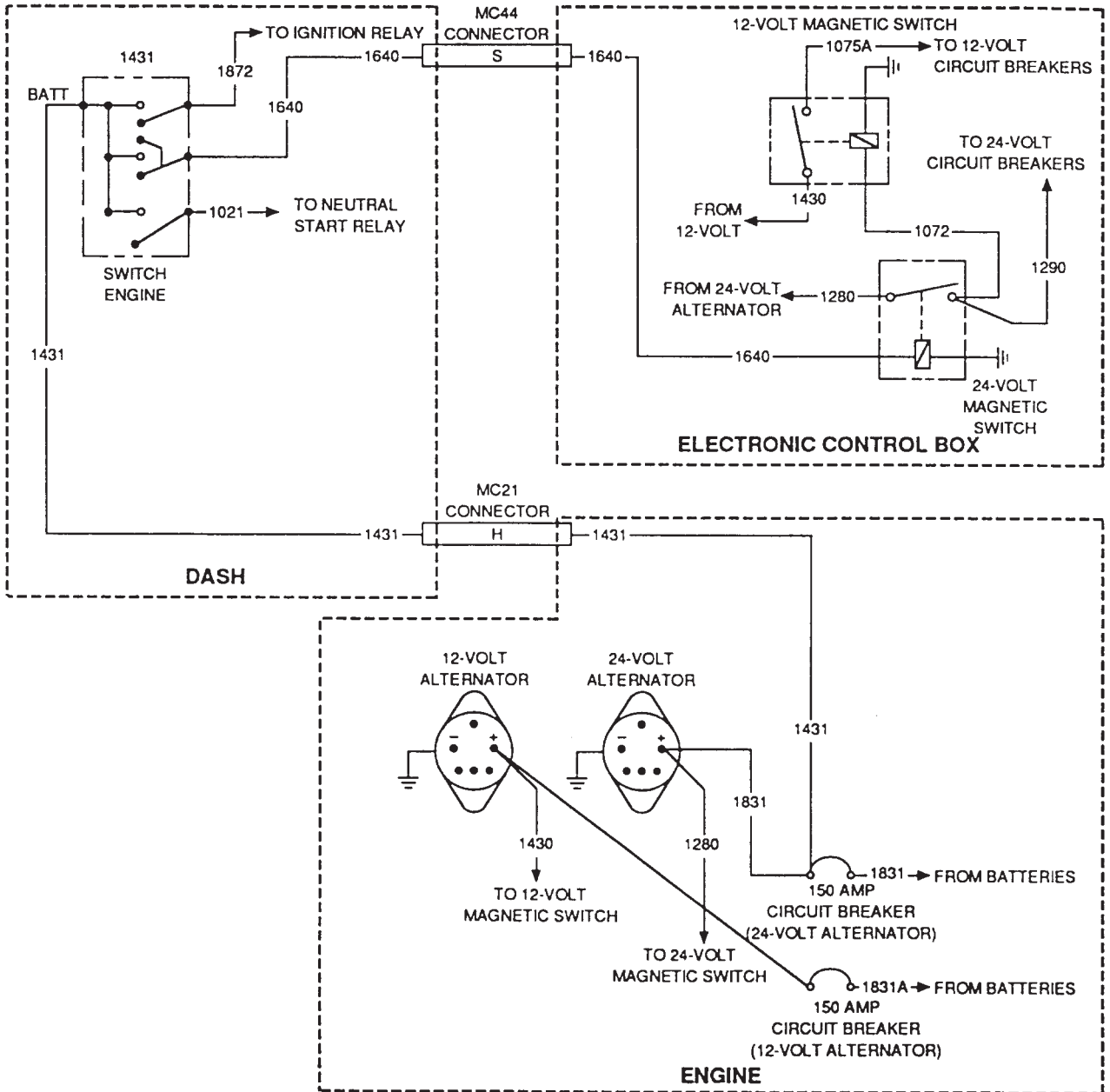




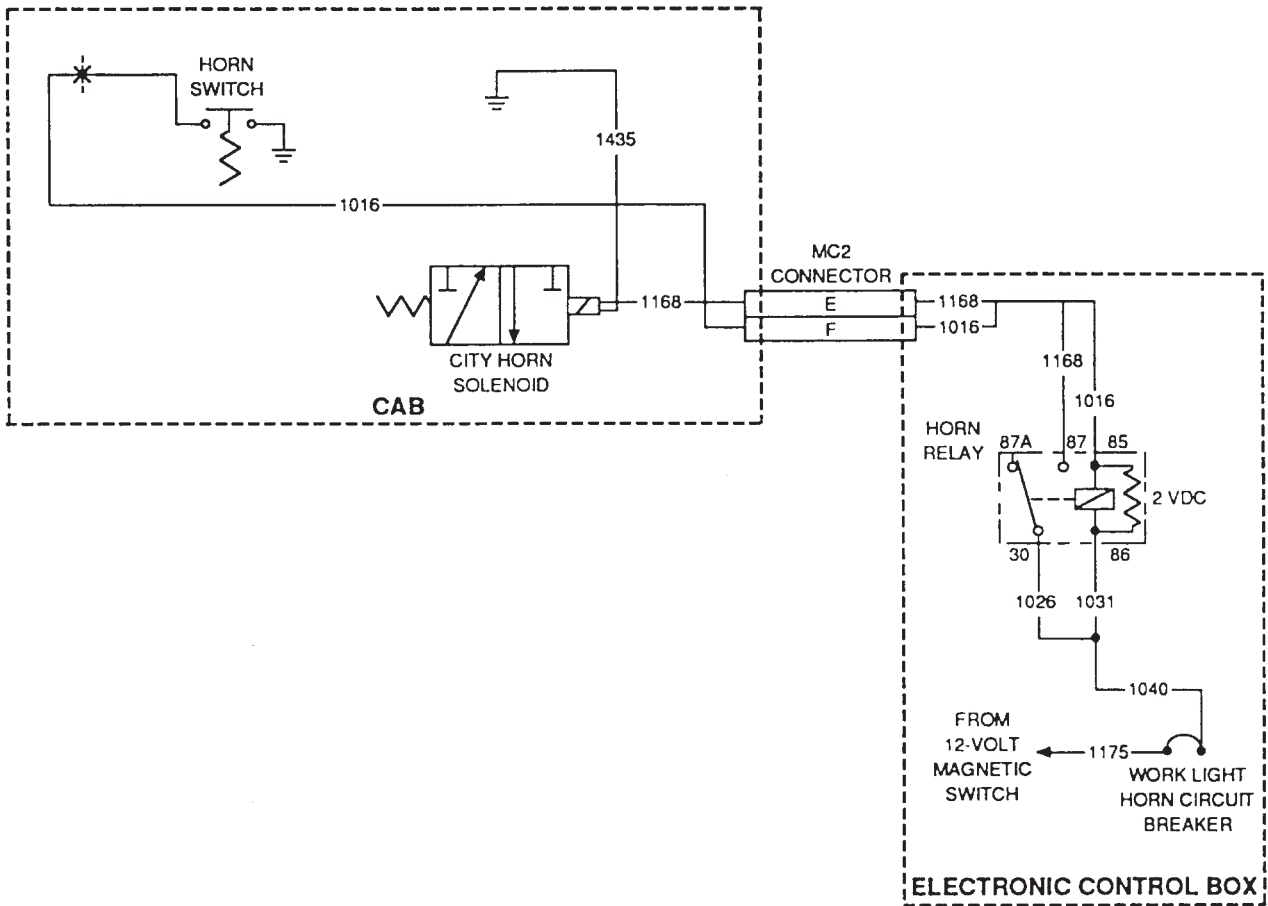
ELECTRIC GAGE CIRCUIT



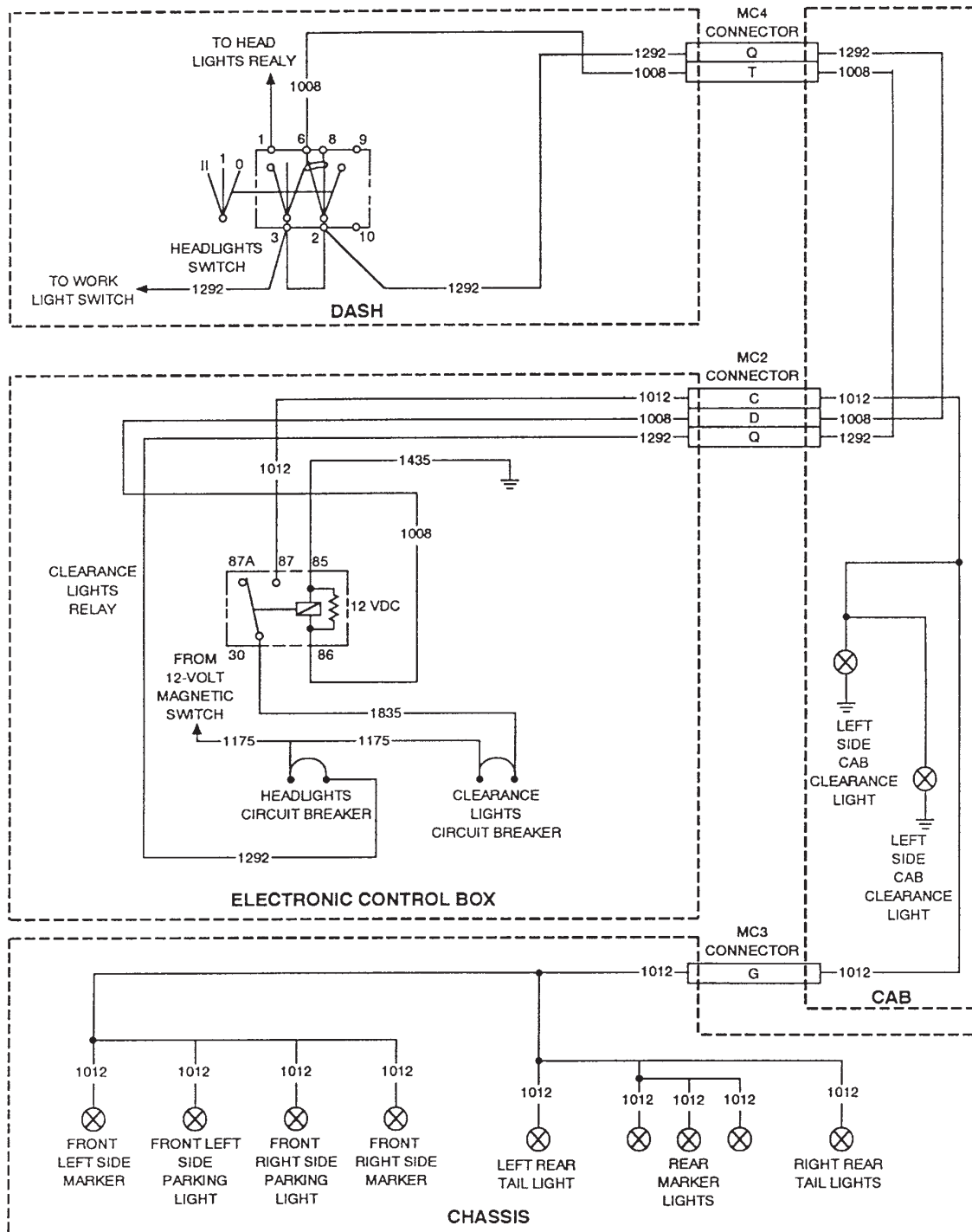
ELECTRICAL SYSTEM (COMMON TO ALL COMPONENTS)



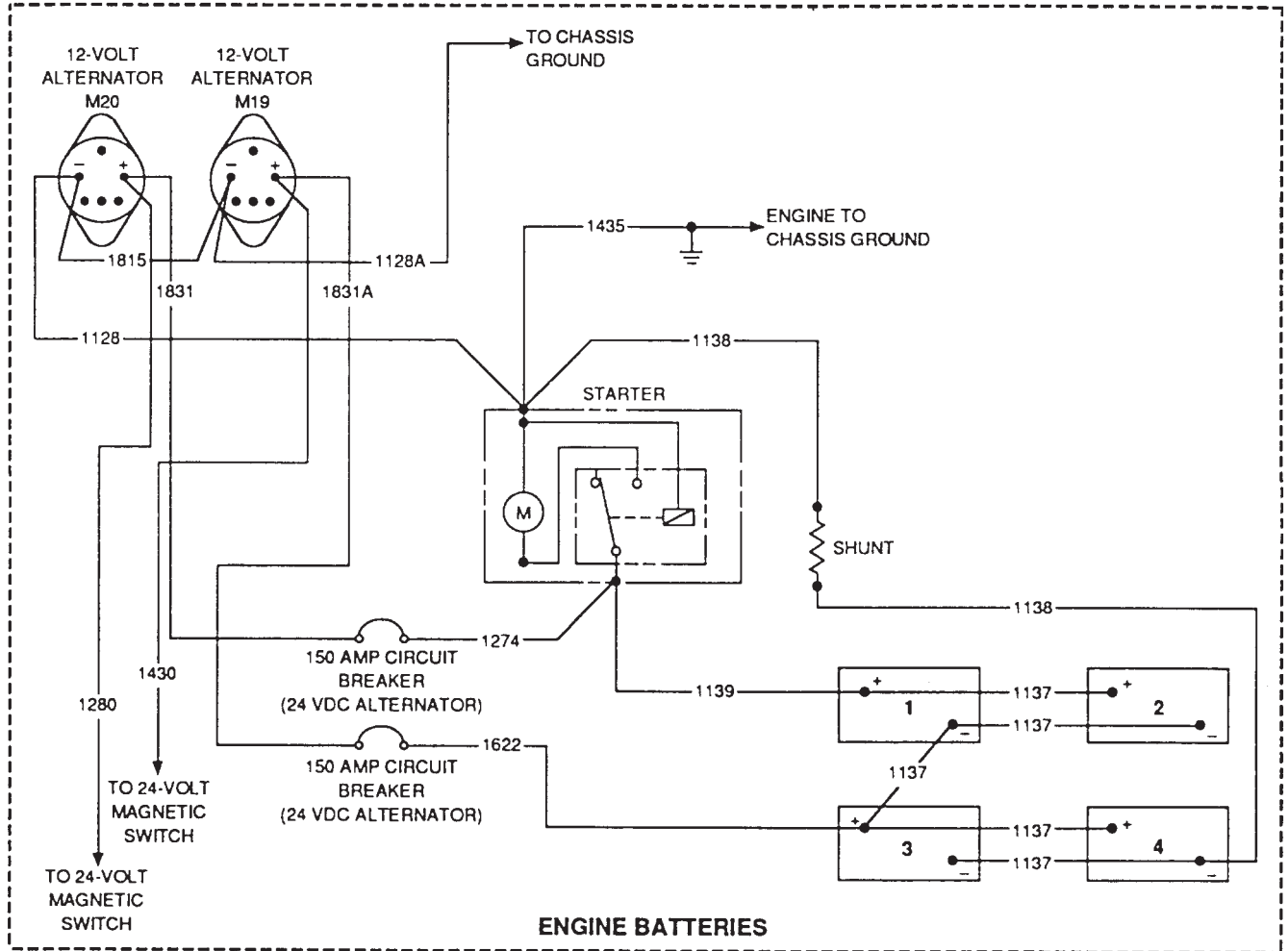
ELECTRIC HORN CIRCUIT

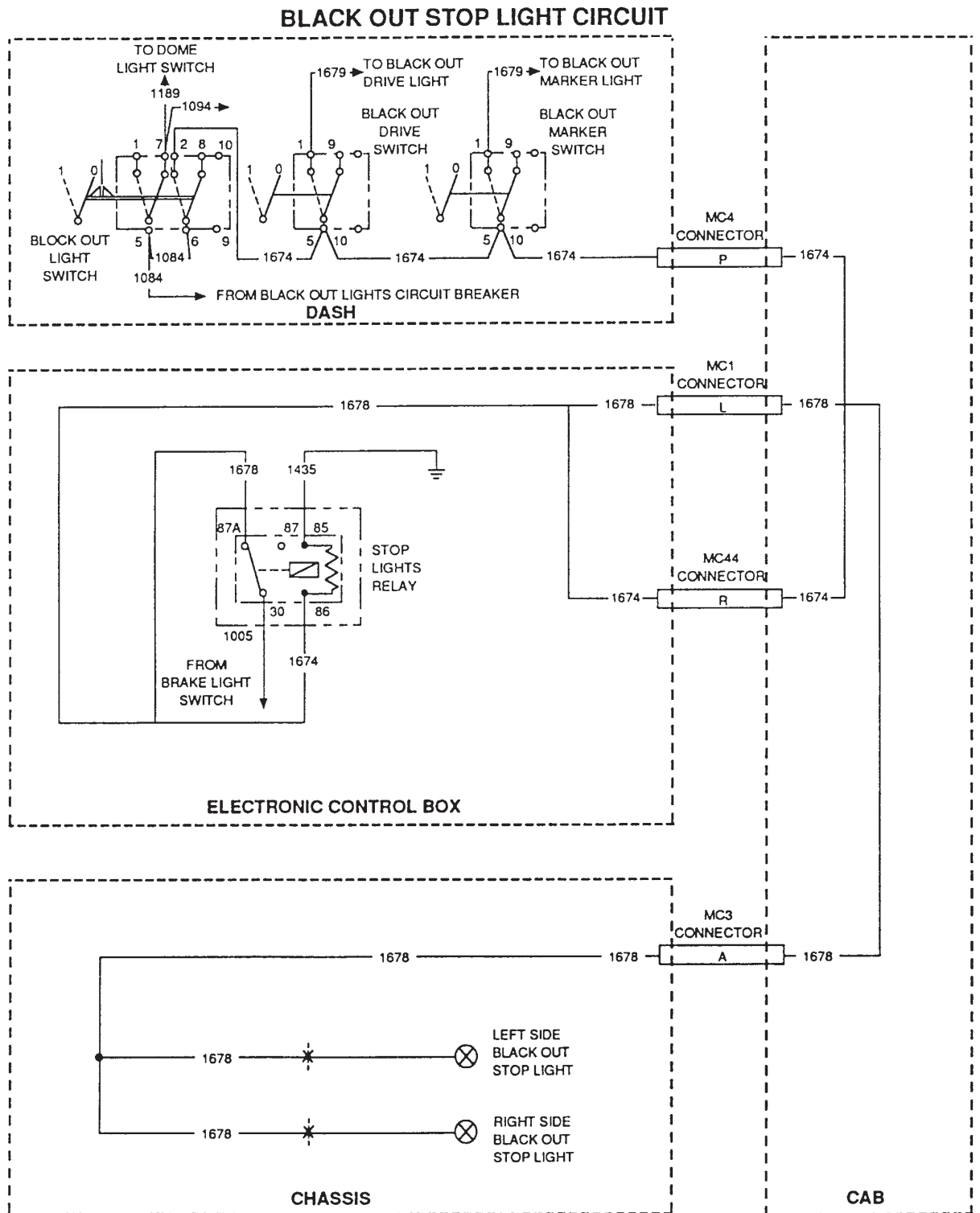


CLEARANCE, MARKER, PARKING, AND TAIL LIGHT CIRCUIT



CHARGING SYSTEM



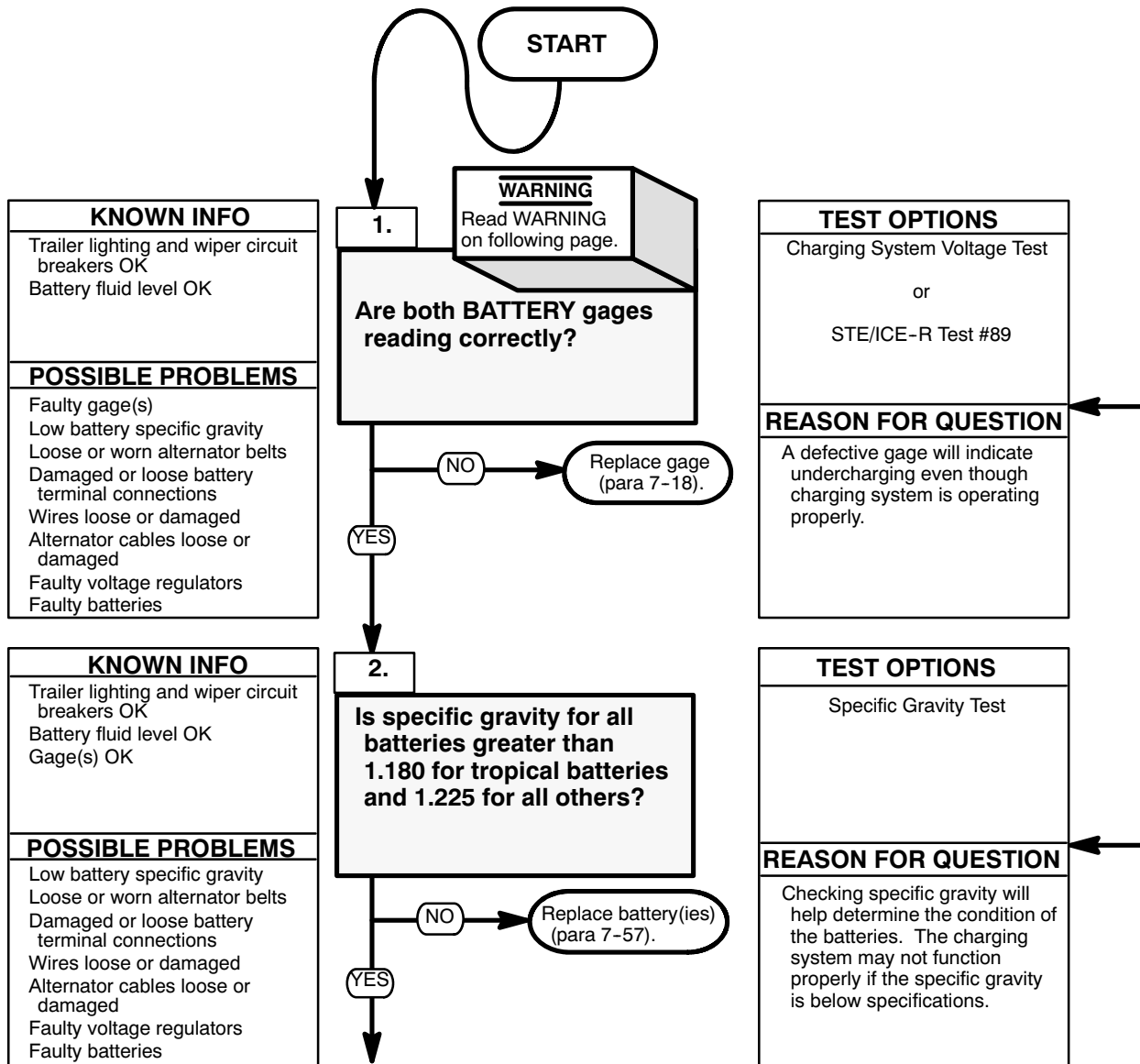


e. ELECTRICAL SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>e1. Alternator(s) undercharging</u>	2-460
<u>e1.1. Alternator(s) overcharging</u>	2-466
<u>e2. Electrical components (12 volt and 24 volt) do not operate</u>	2-468
<u>e3. 12 volt electrical components do not operate</u>	2-472
<u>e4. All 12 volt electric gages do not operate</u>	2-476
<u>e5. One electric gage does not operate or is inaccurate</u>	2-480
<u>e6. Ether starting aid does not operate</u>	2-484
<u>e7. Horn (city) does not operate</u>	2-490
<u>e8. Instrument panel gage and switch lights do not operate</u>	2-498
<u>e9. Windshield wipers do not operate</u>	2-502
<u>e10. Windshield wipers do not operate in high speed</u>	2-506
<u>e11. Windshield washer does not operate</u>	2-510
<u>e12. Low air indicator light and/or alarm do not operate when air pressure is below 65 psi (448 kPa)</u>	2-514
<u>e13. Headlights do not operate</u>	2-520
<u>e14. Headlight low/high beam does not operate</u>	2-528
<u>e15. Turn signal light does not operate</u>	2-534
<u>e15.1. Turn signal indicator light does not operate</u>	2-545.1
<u>e16. Clearance, marker, parking, or tail light does not operate</u>	2-546
<u>e17. All blackout lights do not operate</u>	2-554
<u>e18. Blackout clearance, marker, or tail lights does not operate</u>	2-558
<u>e19. Blackout drive light does not operate</u>	2-564
<u>e20. Trailer blackout tail lights do not operate (Blackout lights on HET Tractor operate)</u>	2-568
<u>e21. Stop lights do not operate</u>	2-576
<u>e22. Blackout stop lights do not operate</u>	2-582
<u>e23. Engine brake does not operate</u>	2-586
<u>e24. Dome light does not operate</u>	2-594
<u>e25. Map light(s) do not operate</u>	2-598
<u>e26. Beacon light does not operates</u>	2-602
<u>e27. Backup light/alarm do not operate</u>	2-610
<u>e28. Tachograph Speedometer does not operate</u>	2-616
<u>e28.1. Speedometer does not operate</u>	2-618.2
<u>e29. Tachograph Tachometer does not operate</u>	2-620
<u>e29.1. Tachometer does not operate</u>	2-622.2
<u>e30. Clock does not operate</u>	2-624
<u>e31. All trailer lights do not operate (lights on HET Tractor operate)</u>	2-628
<u>e32. Ventilator does not operate</u>	2-628.2

*

e1. ALTERNATOR(S) UNDERCHARGING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Gage, Belt Tension, (Item 12, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)
Personnel Required Two	



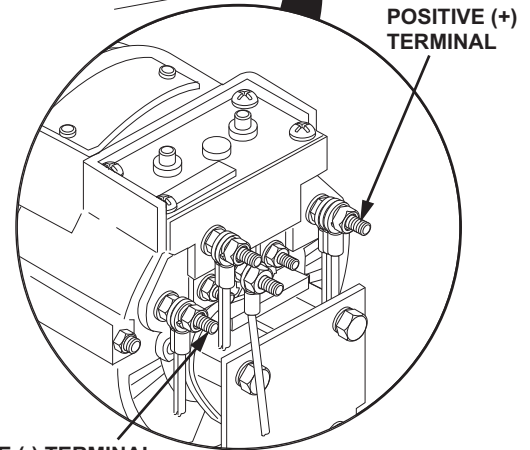
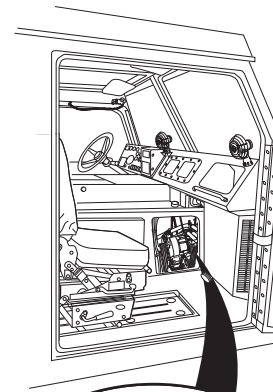
CHARGING SYSTEM VOLTAGE TEST

WARNING

Use extreme care when measuring voltage while engine is running. Rotating fan blade and hot engine parts may cause injury.

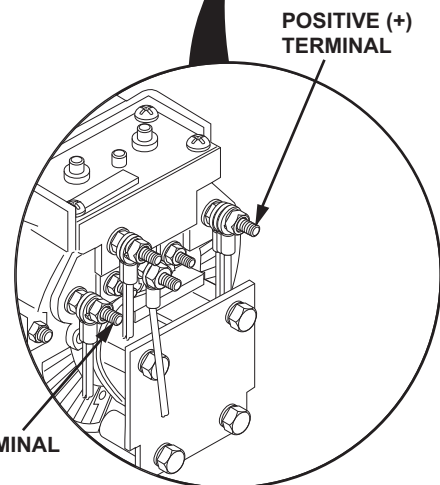
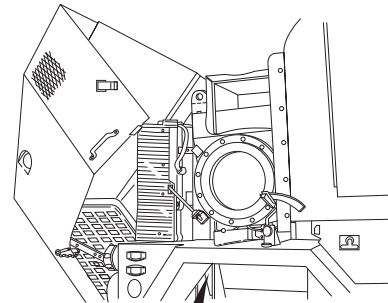
- (1) Connect multimeter leads across positive (+) terminal and negative (-) terminals of 12 volt alternator.
- (2) Start and operate engine at idle with aid of assistant (TM 9-2320-360-10).
- (3) Record voltage reading displayed on multimeter and compare with voltage reading on 12 volt BATTERY gage.
- (4) Shut off engine (TM 9-2320-360-10).
- (5) Connect multimeter leads across positive (+) terminal and negative (-) terminals of 24 volt alternator.
- (6) Start and operate engine at idle with aid of assistant (TM 9-2320-360-10).
- (7) Record voltage reading displayed on multimeter and compare with voltage reading on 24 volt BATTERY gage.
- (8) Shut off engine (TM 9-2320-360-10).

Refer to Table 2-1, Item 17 (PMCS) to check specific gravity of each battery cell.



NEGATIVE (-) TERMINAL

12 VOLT ALTERNATOR

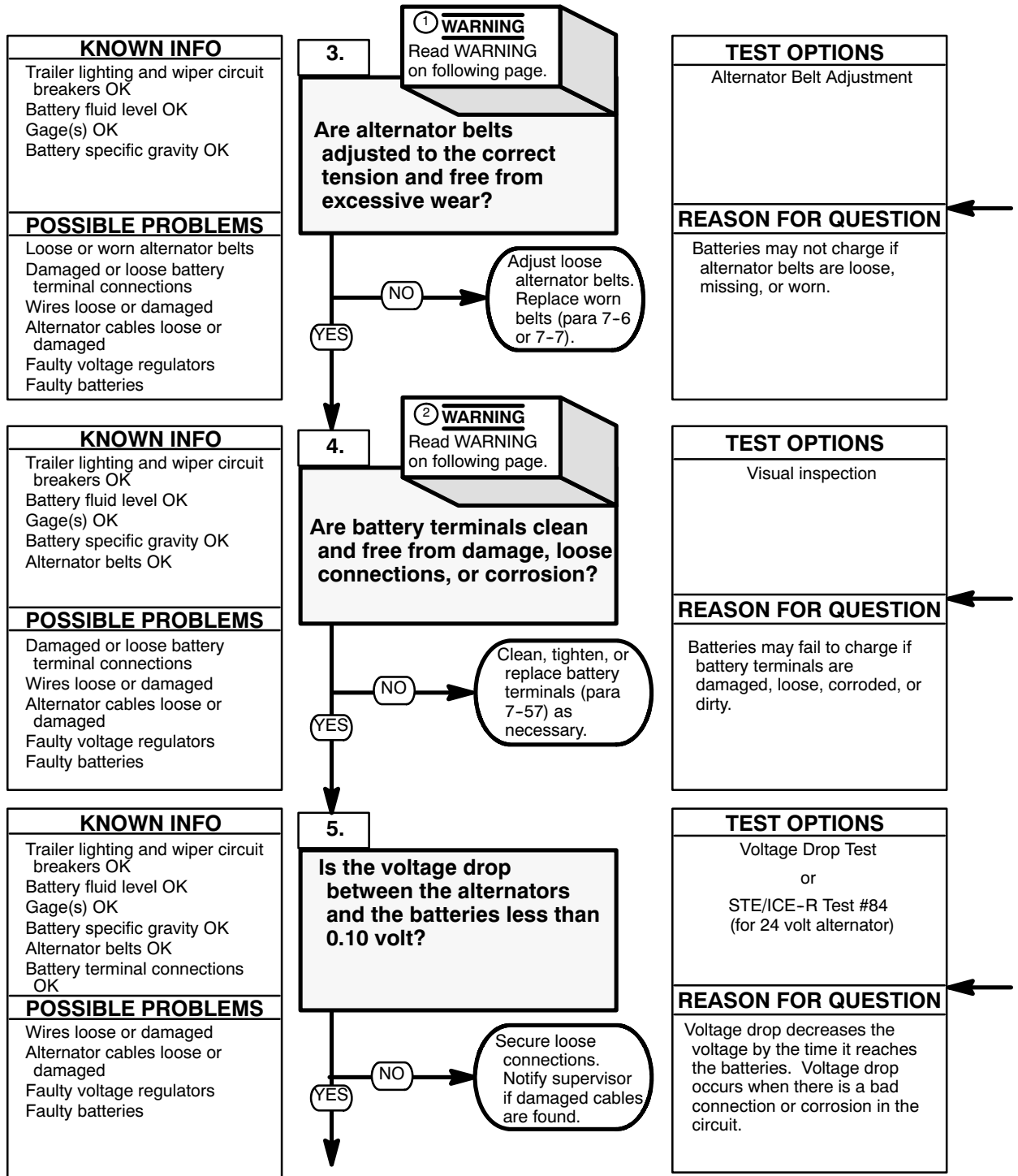


POSITIVE (+) TERMINAL

NEGATIVE (-) TERMINAL

24 VOLT ALTERNATOR

e1. ALTERNATOR(S) UNDERCHARGING (CONT)



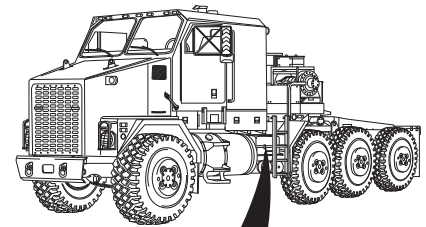
① WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

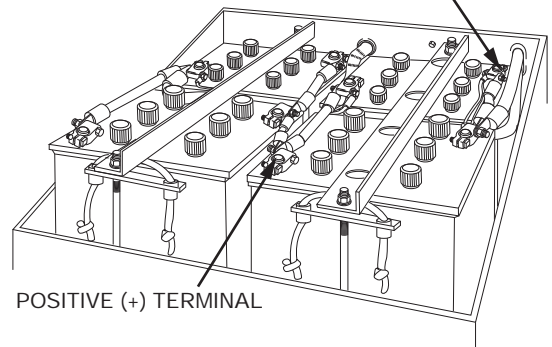
Refer to para 7-6 or 7-7 to adjust alternator belt.

② WARNING

Batteries can explode from a spark. Battery acid is harmful to skin and eyes. Be sure to wear the proper eye protection to avoid personal injury. If skin is exposed to battery electrolyte, flush with cold water, and seek immediate medical attention. Check battery terminals for damaged, loose, corroded, or dirty connections.

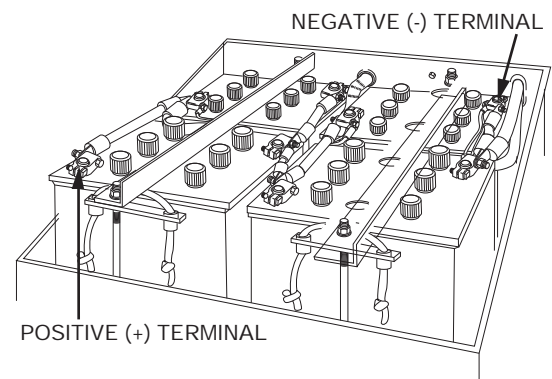


NEGATIVE (-) TERMINAL



POSITIVE (+) TERMINAL

12 VOLT READING



NEGATIVE (-) TERMINAL

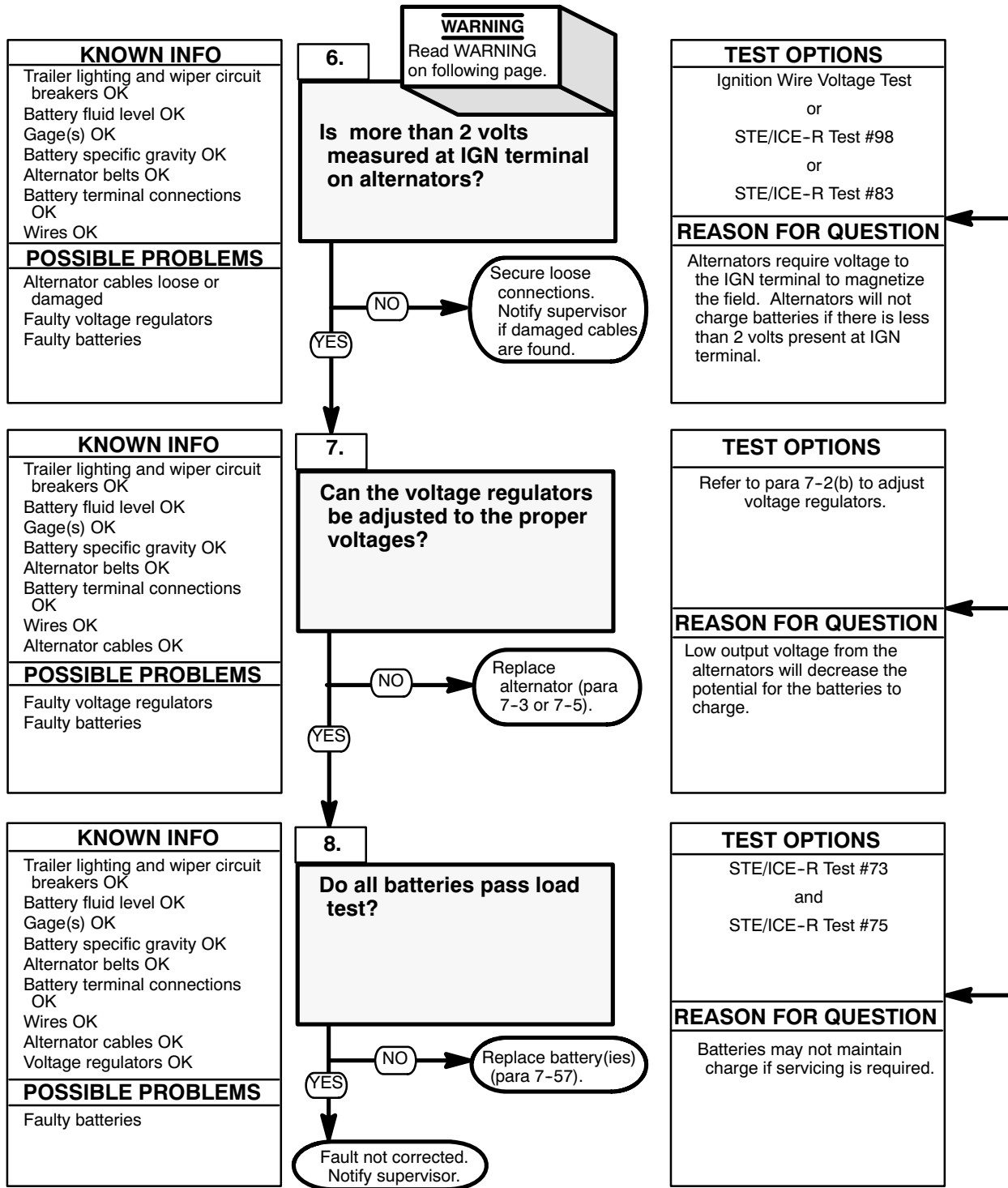
POSITIVE (+) TERMINAL

24 VOLT READING

VOLTAGE DROP TEST

- (1) Start and operate engine at idle with aid of assistant (TM 9-2320-360-10).
- (2) Connect multimeter leads to positive (+) terminal and negative (-) terminals of 12 volt batteries. Record voltage displayed on multimeter.
- (3) Connect multimeter leads to positive (+) terminal and negative (-) terminals of 24 volt batteries. Record voltage displayed on multimeter.
- (4) Shut off engine (TM 9-2320-360-10).
- (5) Subtract voltage measured at alternators (step 1) from voltage measured at batteries. The difference is the voltage drop.
- (6) If the voltage drop is greater than 0.10 volt, check the following cables for loose or corroded connections:
 - Cable no. 1831 from positive (+) terminal on 24 volt alternator to 24 volt alternator circuit breaker.
 - Cable no. 1274 from 24 volt alternator circuit breaker to positive (+) terminal on starter.
 - Cable no. 1139 from positive (+) terminal on starter to batteries.
 - Cable no. 1831A from positive (+) terminal on 12 volt alternator to 12 volt alternator circuit breaker.
 - Cable no. 1622 from 12 volt alternator circuit breaker to batteries.

e1. ALTERNATOR(S) UNDERCHARGING (CONT)



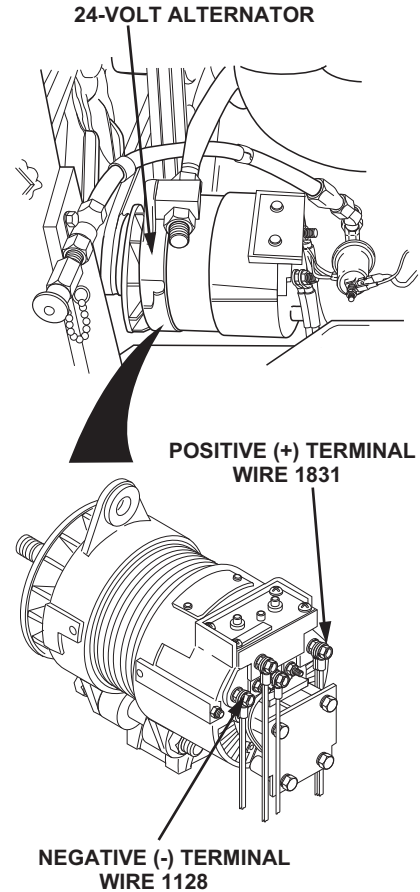
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

- STE/ICE-R Test #98 measures voltage to 12-volt regulator.
- STE/ICE-R Test #83 measures voltage to 24-volt regulator.

IGNITION WIRE VOLTAGE TEST	STE/ICE TEST #98/83
<ol style="list-style-type: none"> (1) Turn ENGINE switch to ON position. (2) Place positive (+) probe of multimeter on IGN terminal of alternator. (3) Place negative (-) probe of multimeter on ground and check for over 2 volts on multimeter. (4) Turn ENGINE switch to OFF position. 	<ol style="list-style-type: none"> (1) Connect STE/ICE test cable to STE/ICE receptacle in cab. (2) Set STE/ICE test select switch to "98" or "83". (3) Start engine (TM 9-2320-360-10). (4) Press and release TEST button to obtain test results. (5) Shut off engine (TM 9-2320-360-10).



NOTE

- The operation of the 12 volt and 24 volt alternators are related. It is possible for one of the alternators to influence the gage reading of the other. During normal operation the BATTERY gages should read 14 volts and 28 volts.
- A reading of 25 volts and 14 volts indicates that the 24 volt system has failed.
- If readings appear normal but the batteries on the 12 volt side are low, the 12 volt system is not charging enough to keep up with the loads applied. The gages are appearing normal because of the operation of the 24 volt alternator.

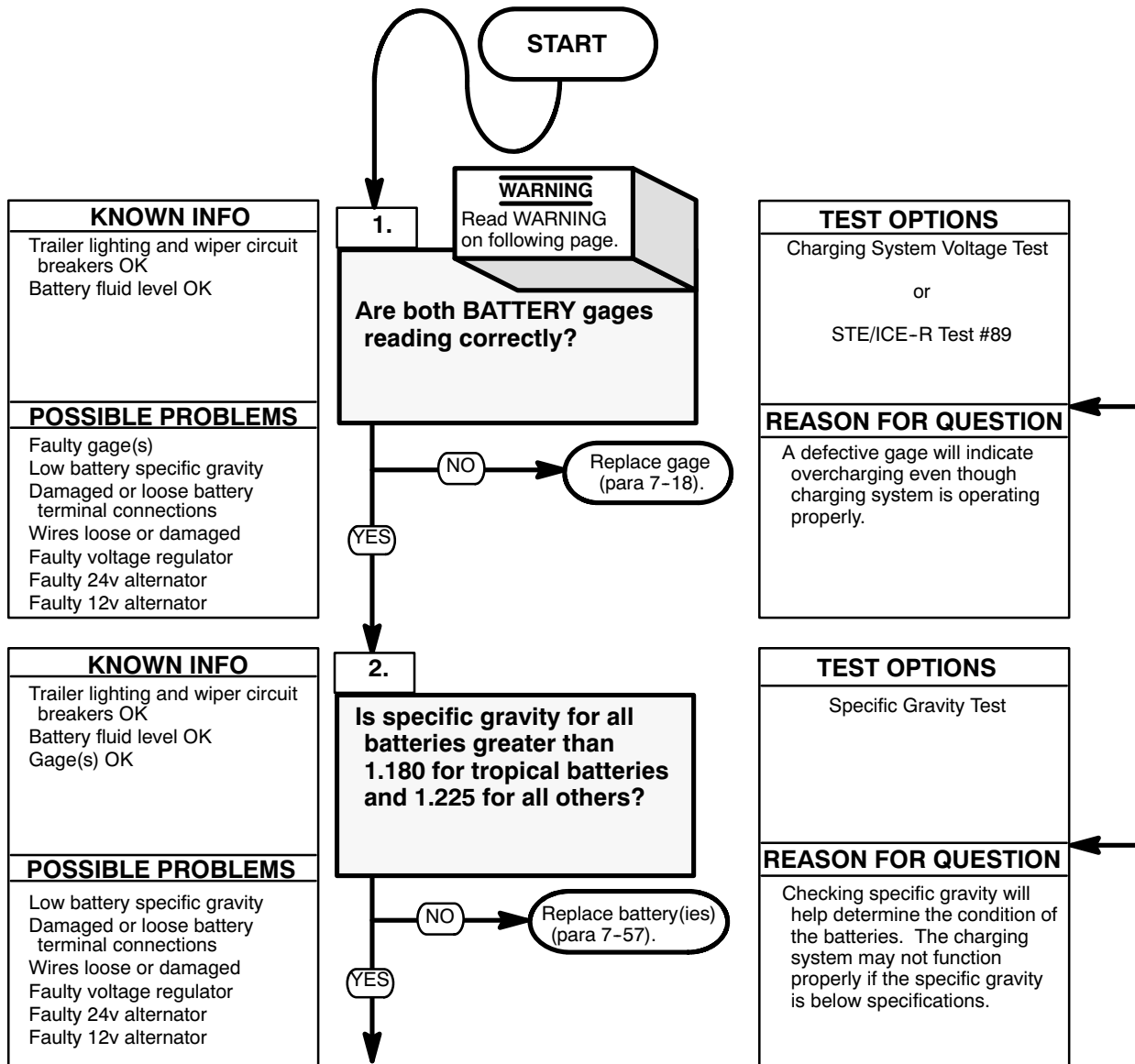
Refer to para 7-2b to adjust voltage regulators.

NOTE

- Results of STE/ICE-R Tests #73 and #75 must both be obtained in order to determine condition of battery.
- Engine must be capable of cranking to perform STE/ICE-R Tests #73 and 75.

STE/ICE TEST #73/75
<ol style="list-style-type: none"> (1) Connect STE/ICE test cable to STE/ICE receptacle in cab. (2) Set STE/ICE test select switch to "73" or "75". (3) Remove DDEC 6-way power harness connector from ECM. (4) Press and hold TEST button until "CAL" appears in display. (5) Release TEST button and wait for offset value to appear in display. (6) Press and release TEST button. (7) Attempt to crank engine while observing STE/ICE display for test results. (8) Install DDEC 6-way power harness connector on ECM.

e1.1. ALTERNATOR(S) OVERCHARGING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F) Tape, Insulation, Electrical (Item 33, Appendix C)
Personnel Required Two	



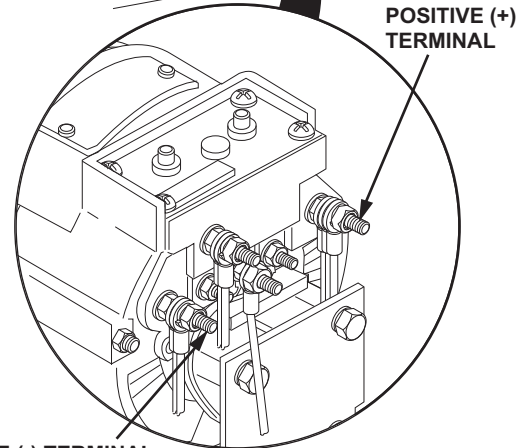
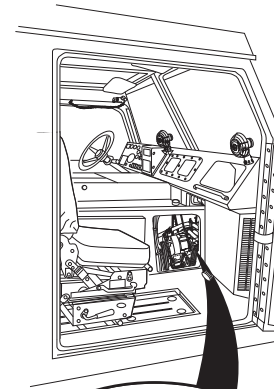
CHARGING SYSTEM VOLTAGE TEST

WARNING

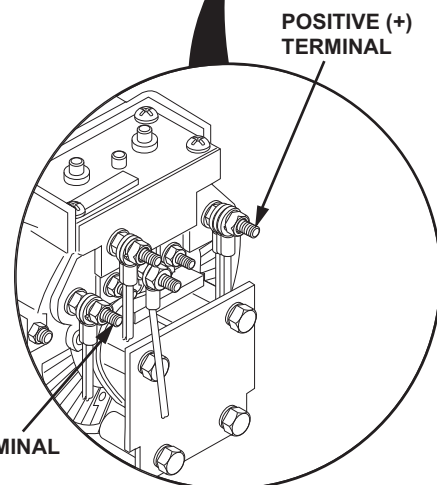
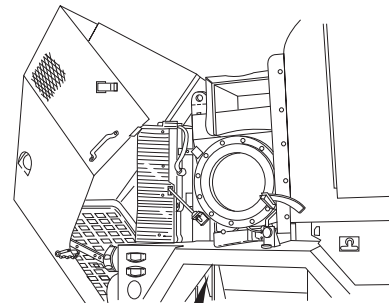
Use extreme care when measuring voltage while engine is running. Rotating fan blade and hot engine parts may cause injury.

- (1) Connect multimeter leads across positive (+) terminal and negative (-) terminals of 12 volt alternator.
- (2) Start and operate engine at idle with aid of assistant (TM 9-2320-360-10).
- (3) Record voltage reading displayed on multimeter and compare with voltage reading on 12 volt BATTERY gage.
- (4) Shut off engine (TM 9-2320-360-10).
- (5) Connect multimeter leads across positive (+) terminal and negative (-) terminals of 24 volt alternator.
- (6) Start and operate engine at idle with aid of assistant (TM 9-2320-360-10).
- (7) Record voltage reading displayed on multimeter and compare with voltage reading on 24 volt BATTERY gage.
- (8) Shut off engine (TM 9-2320-360-10).

Refer to Table 2-1, Item 17 (PMCS) to check specific gravity of each battery cell.

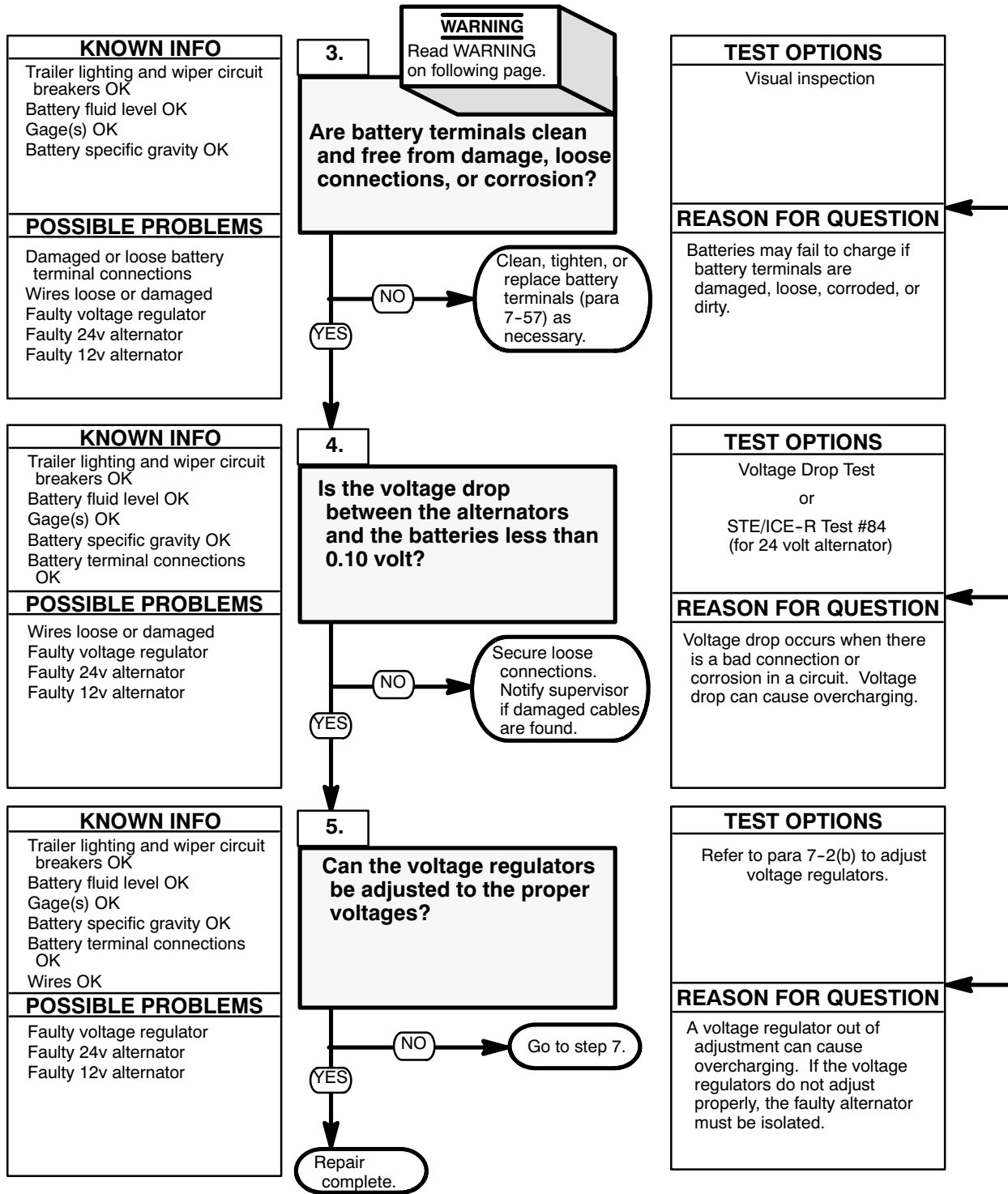


12 VOLT ALTERNATOR



24 VOLT ALTERNATOR

e1.1. ALTERNATOR(S) OVERCHARGING (CONT)



WARNING

- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.
- Batteries can explode from a spark. Battery acid is harmful to skin and eyes. If skin is exposed to battery electrolyte, flush with cold water, and seek immediate medical attention. Be sure to wear the proper eye protection to avoid personal injury.

Check battery terminals for damaged, loose, corroded, or dirty connections.

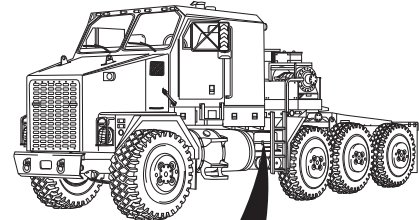
VOLTAGE DROP TEST

- (1) Start and operate engine at idle with aid of assistant (TM 9-2320-360-10).
- (2) Connect multimeter leads to positive (+) terminal and negative (-) terminals of 12 volt batteries. Record voltage displayed on multimeter.
- (3) Connect multimeter leads to positive (+) terminal and negative (-) terminals of 24 volt batteries. Record voltage displayed on multimeter.
- (4) Shut off engine (TM 9-2320-360-10).
- (5) Subtract voltage measured at alternators (step 1) from voltage measured at batteries. The difference is the voltage drop.
- (6) If the voltage drop is greater than 0.10 volt, check the following cables for loose or corroded connections:
 - Cable no. 1831 from positive (+) terminal on 24 volt alternator to 24 volt alternator circuit breaker.
 - Cable no. 1274 from 24 volt alternator circuit breaker to positive (+) terminal on starter.
 - Cable no. 1139 from positive (+) terminal on starter to batteries.
 - Cable no. 1831A from positive (+) terminal on 12 volt alternator to 12 volt alternator circuit breaker.
 - Cable no. 1622 from 12 volt alternator circuit breaker to batteries.

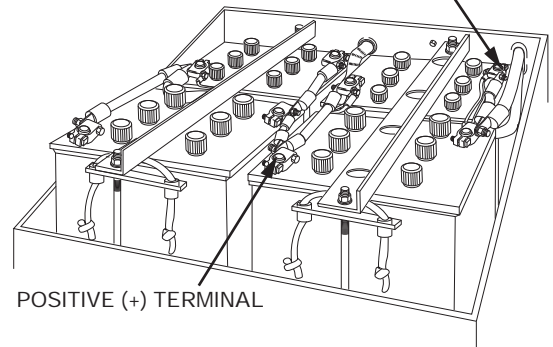
NOTE

Do not replace either alternator until the faulty alternator has been isolated in steps 6, 7, and 8. It is unlikely that both alternators have failed.

Refer to para 7-2b to adjust voltage regulators.

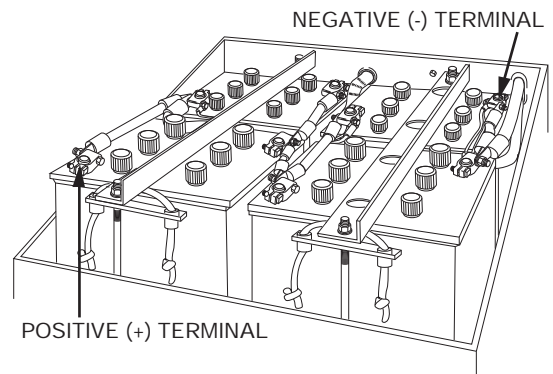


NEGATIVE (-) TERMINAL



POSITIVE (+) TERMINAL

12 VOLT READING

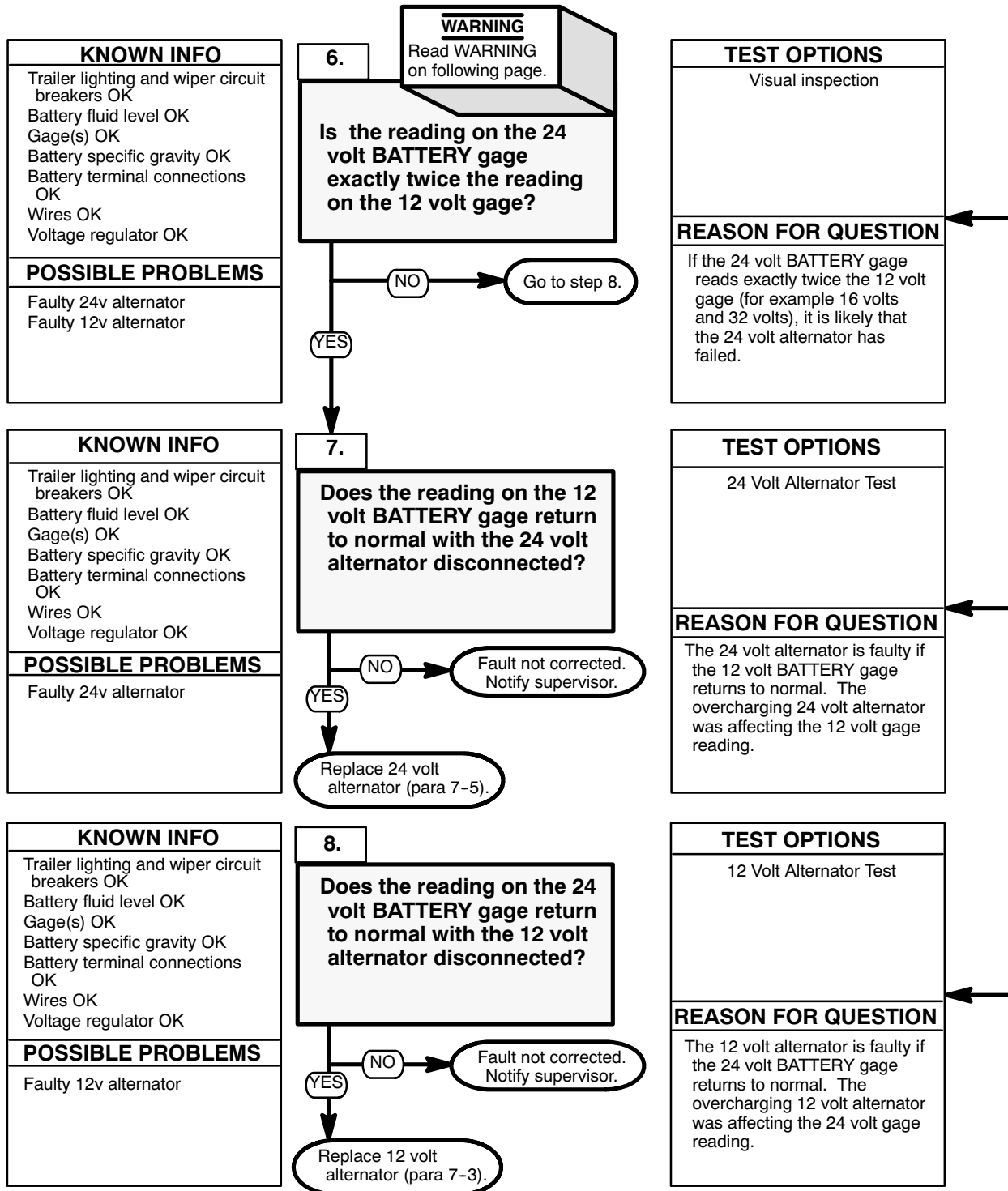


NEGATIVE (-) TERMINAL

POSITIVE (+) TERMINAL

24 VOLT READING

e1.1. ALTERNATOR(S) OVERCHARGING (CONT)

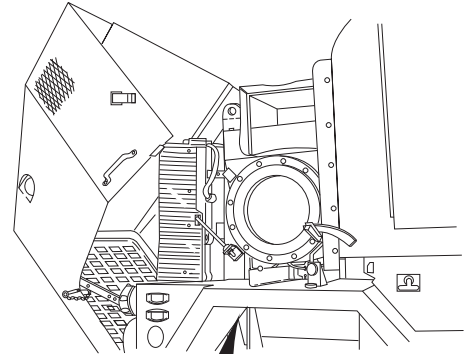


WARNING

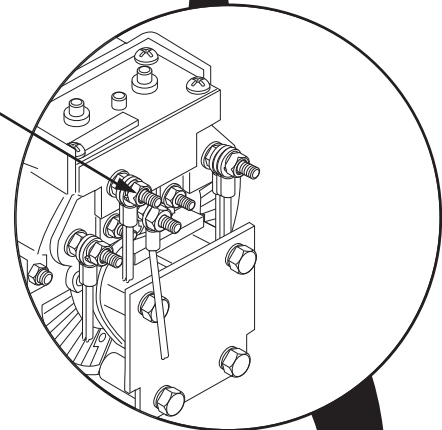
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

- The operation of the 12 volt and 24 volt alternators are related. It is possible for one of the alternators to influence the gage reading of the other. During normal operation the BATTERY gages should read 14 volts and 28 volts
- It is likely that the 24 alternator has failed if the 24 volt BATTERY gage reads exactly twice the 12 volt gage, for example: 16 volts and 32 volts. The amount of overcharge on the 24 volt gage is twice the overcharge on the 12 volt gage.
- It is likely that the 12 alternator has failed if the 24 volt BATTERY gage does not read exactly twice the 12 volt gage. For example: 16 volts and 30 volts. The amount of overcharge is equal for both the 12 volt and the 24 volt gages.



IGN TERMINAL



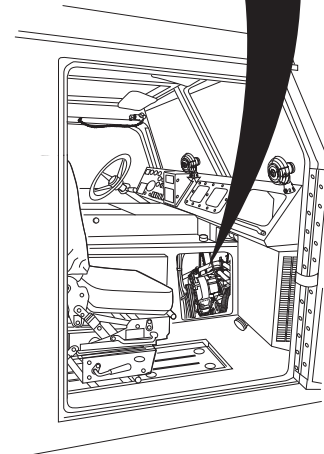
ALTERNATOR TEST

- (1) Remove wire no. 1020 from IGN terminal of alternator.

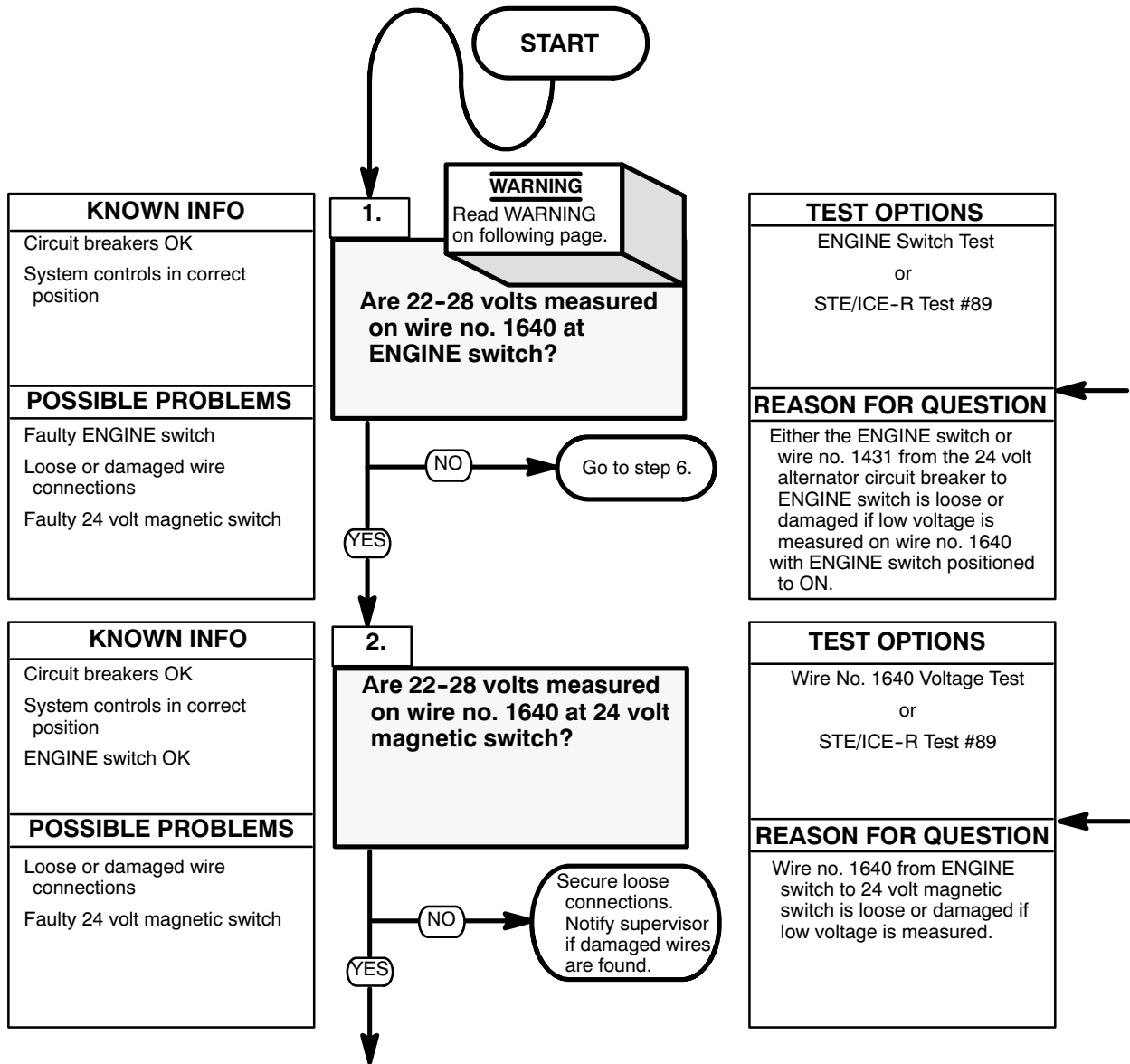
CAUTION

IGN wire must be secured and insulated prior to starting engine. Failure to comply will result in damage to wire harness and equipment.

- (2) Secure and insulate wire no. 1020 with electrical tape.
- (3) Start and operate engine at idle (TM 9-2320-360-10).
- (4) Record the 12 volt and 24 volt BATTERY gage readings.
- (5) Shut off engine (TM 9-2320-360-10).
- (6) Install wire no. 1020 on IGN terminal of alternator.



e2. ELECTRICAL COMPONENTS (12 VOLT AND 24 VOLT) DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

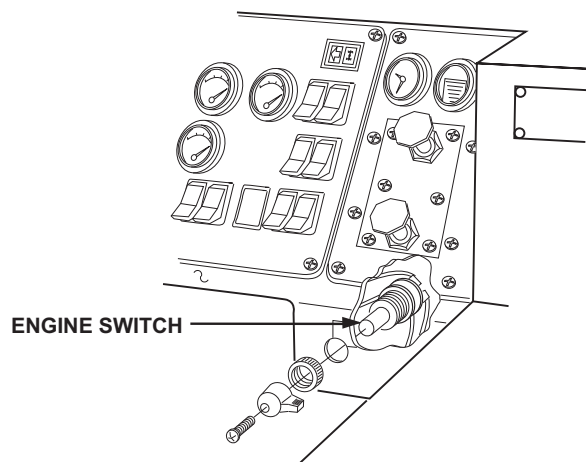
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

Batteries must be fully charged before performing the following checks.

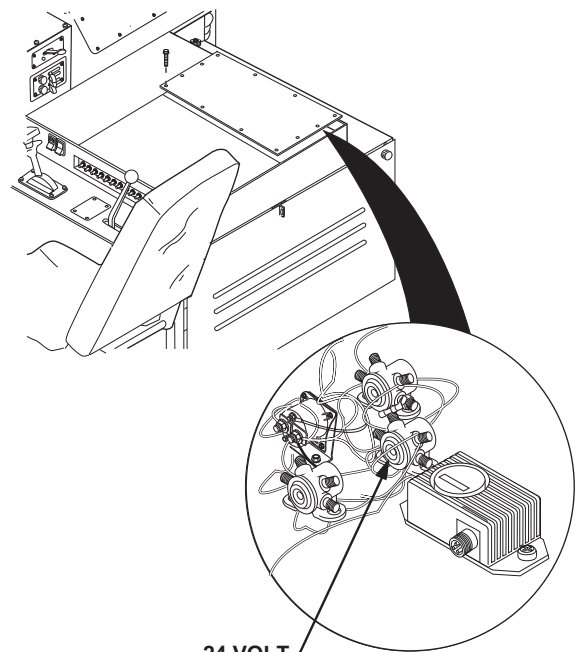
ENGINE SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1640 at ENGINE switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



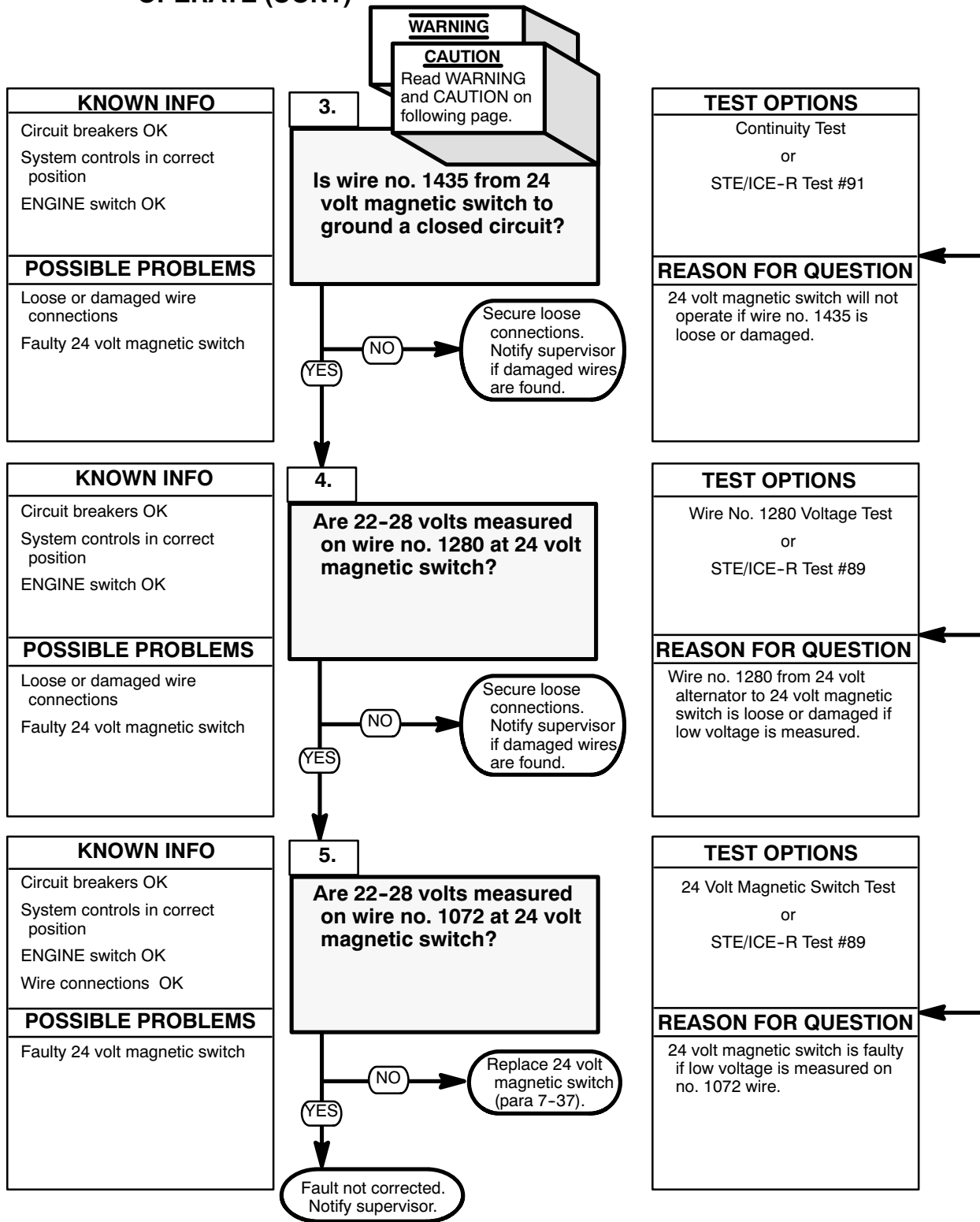
WIRE NO. 1640 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1640 at 24 volt magnetic switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



**24 VOLT
MAGNETIC SWITCH**

e2. ELECTRICAL COMPONENTS (12 VOLT AND 24 VOLT) DO NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from 24 volt magnetic switch for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

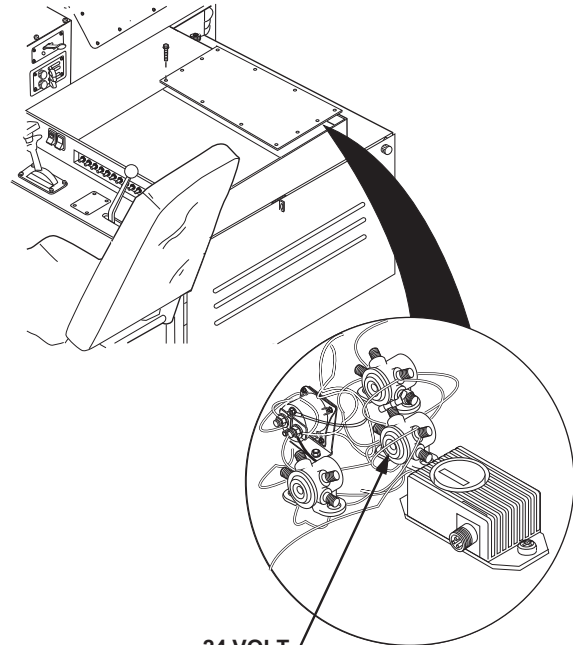
NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

WIRE NO. 1280 VOLTAGE TEST

- (1) Place positive (+) probe of multimeter on wire no. 1280 at 24 volt magnetic switch.
- (2) Place negative (-) probe of multimeter on ground and check for 22-28 volts on multimeter.

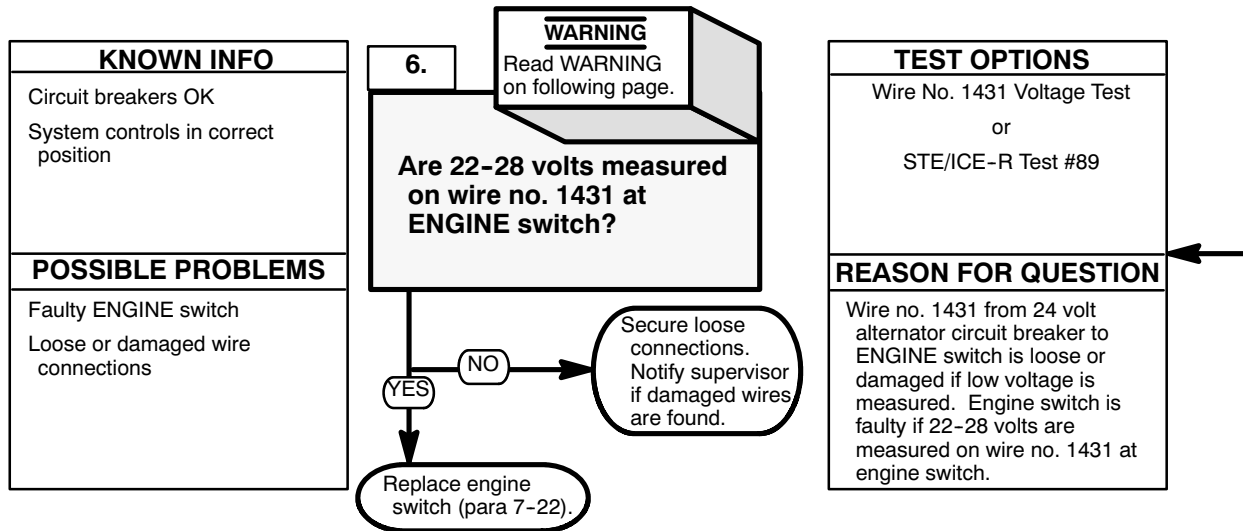


**24 VOLT
MAGNETIC SWITCH**

24 VOLT MAGNETIC SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1072 at 24 volt magnetic switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

e2. ELECTRICAL COMPONENTS (12 VOLT AND 24 VOLT) DO NOT OPERATE (CONT)

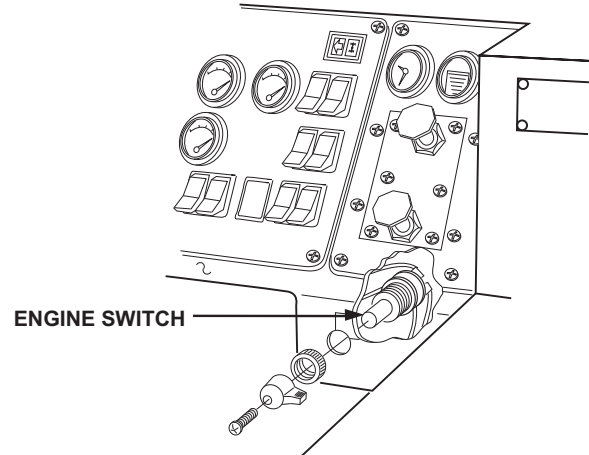


WARNING

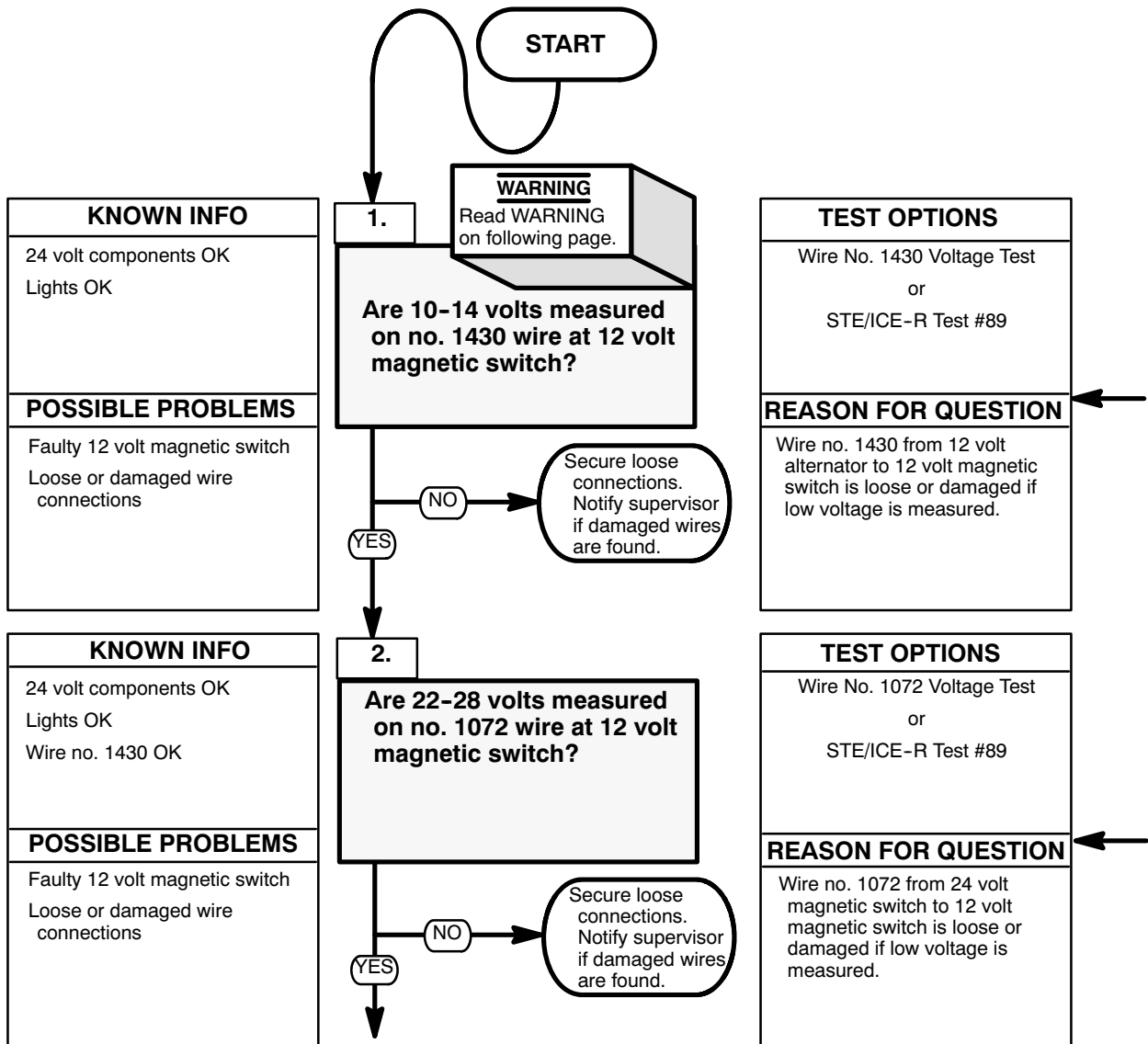
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1431 VOLTAGE TEST

- (1) Place positive (+) probe of multimeter on wire no. 1431 at ENGINE switch.
- (2) Place negative (-) probe of multimeter on ground and check for 22-28 volts on multimeter.



e3. 12 VOLT ELECTRICAL COMPONENTS DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

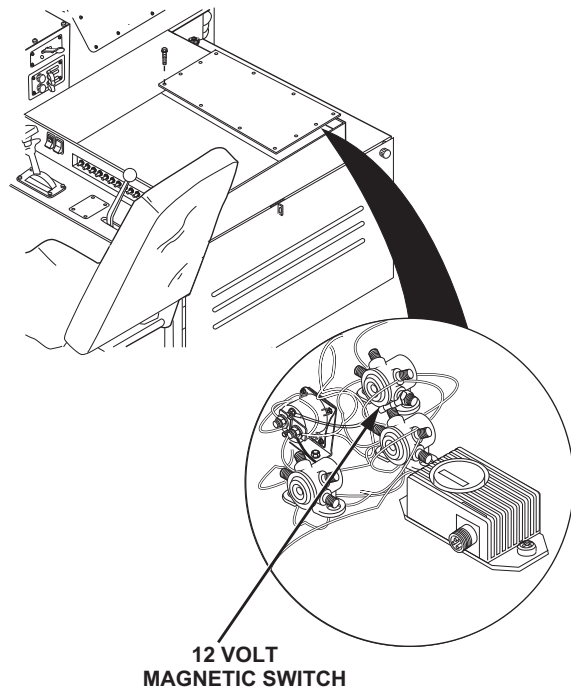
Batteries must be fully charged before performing the following checks.

WIRE NO. 1430 VOLTAGE TEST

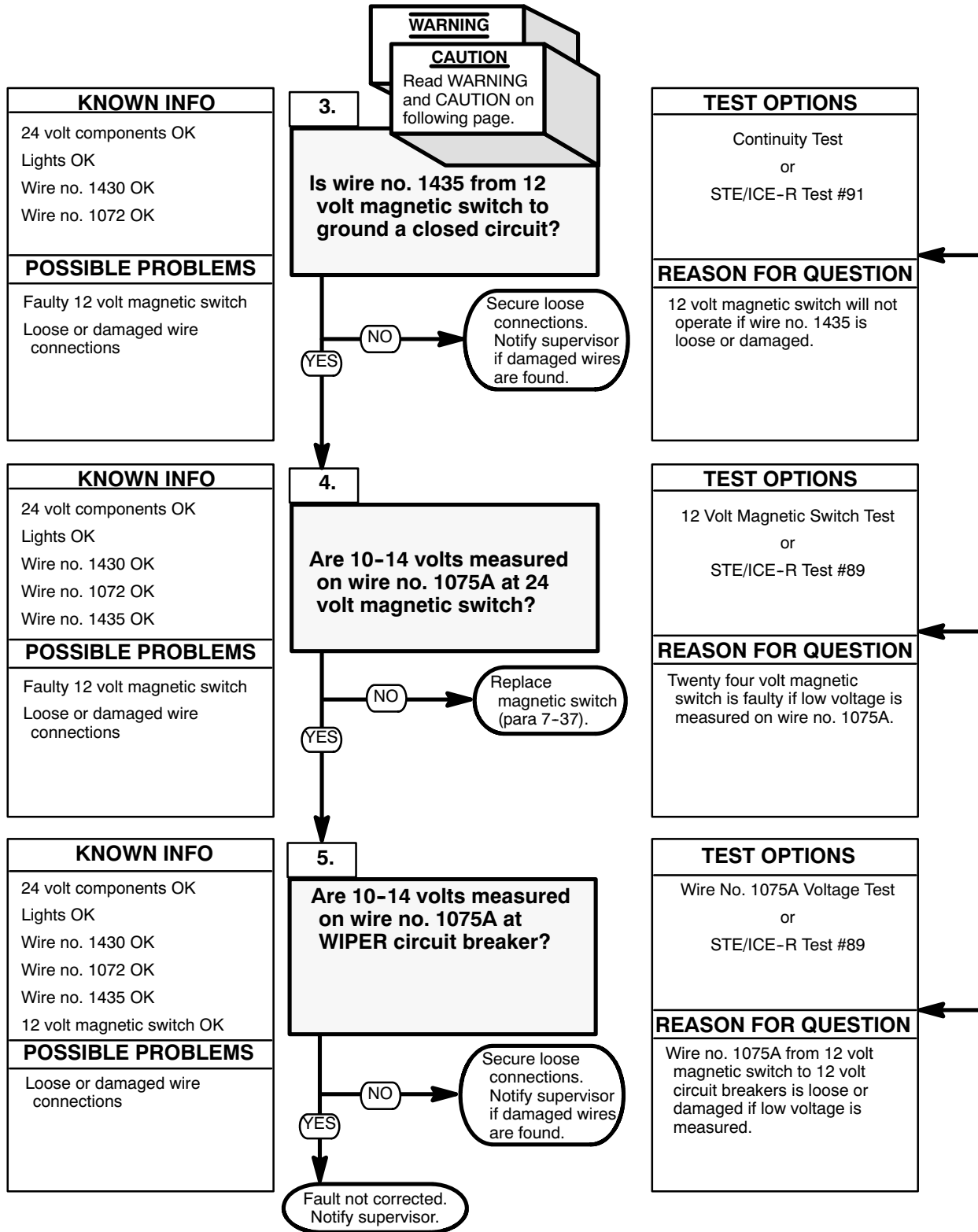
- (1) Remove thirteen screws and three panels from console.
- (2) Place positive (+) probe of multimeter on wire no. 1430 at 12 volt magnetic switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.

WIRE NO. 1072 VOLTAGE TEST

- (1) Position ENGINE switch to ON.
- (2) Place positive (+) probe of multimeter on wire no. 1072 at 12 volt magnetic switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Position ENGINE switch to OFF.



e3. 12 VOLT ELECTRICAL COMPONENTS DO NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from 12 volt magnetic switch for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

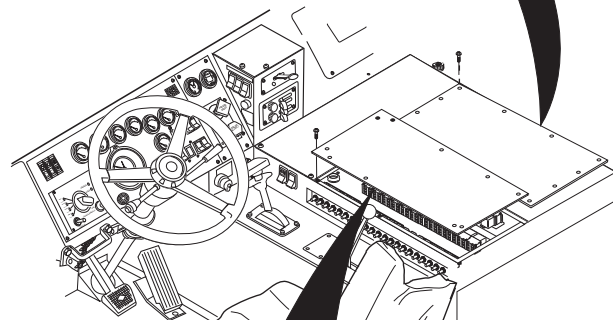
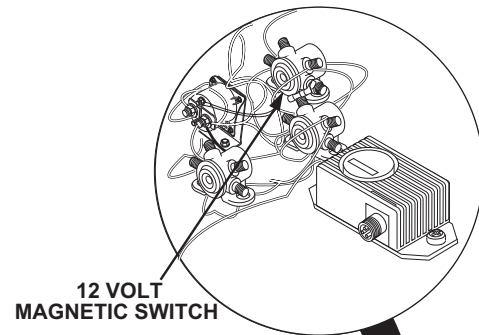
NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

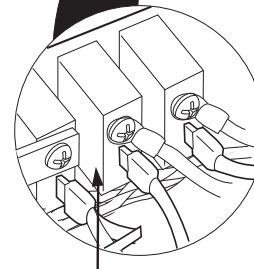
12 VOLT MAGNETIC SWITCH TEST

- (1) Remove thirteen screws and three panels from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on no. 1075A wire at 12 volt magnetic switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.

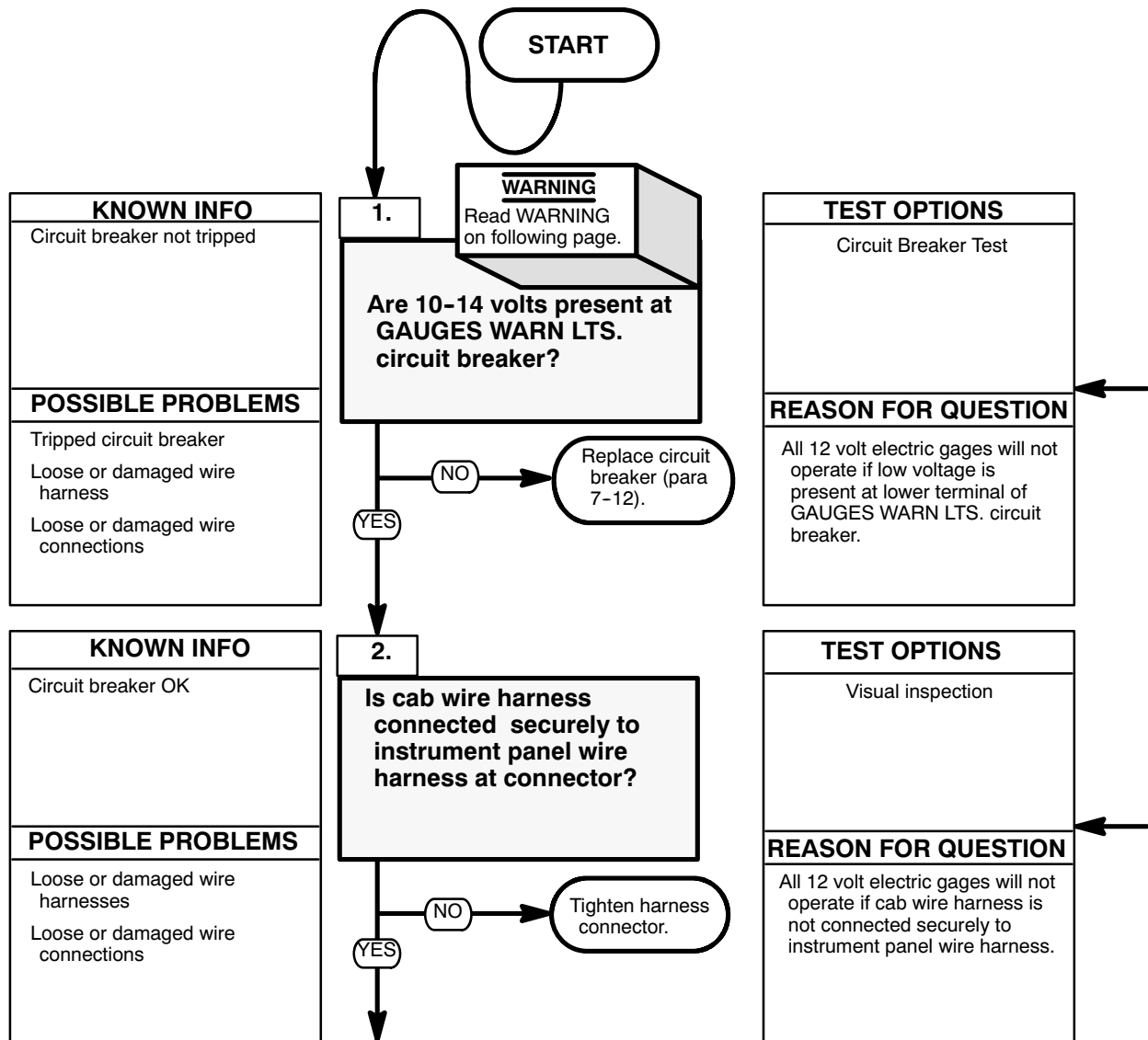


WIRE NO. 1075A VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1075A at WIPER circuit breaker.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



e4. ALL 12 VOLT ELECTRIC GAGES DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

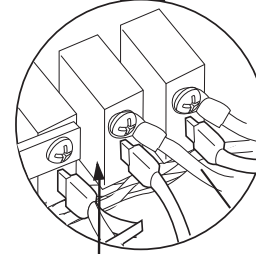
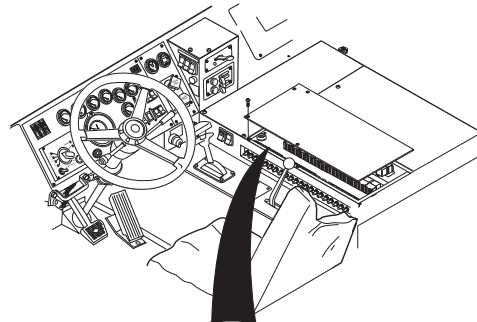
NOTE

WATER TEMP gage, OIL PRESS gage, TRANS TEMP gage, T-CASE TEMP gage, BATTERY gage (12 volt system), and FUEL gage are 12 volt electric gages.

CIRCUIT BREAKER TEST

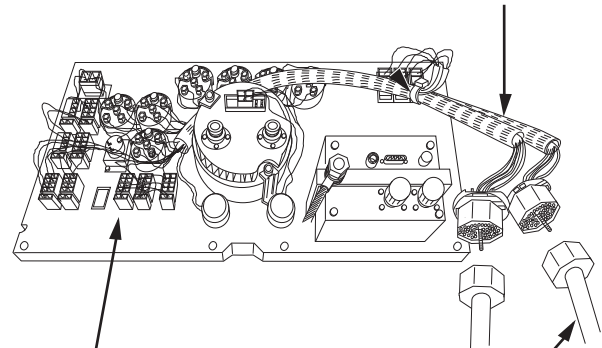
- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.

Remove instrument panel (para 7-13) and check if cab wire harness is connected securely to instrument panel wire harness.



CIRCUIT BREAKER

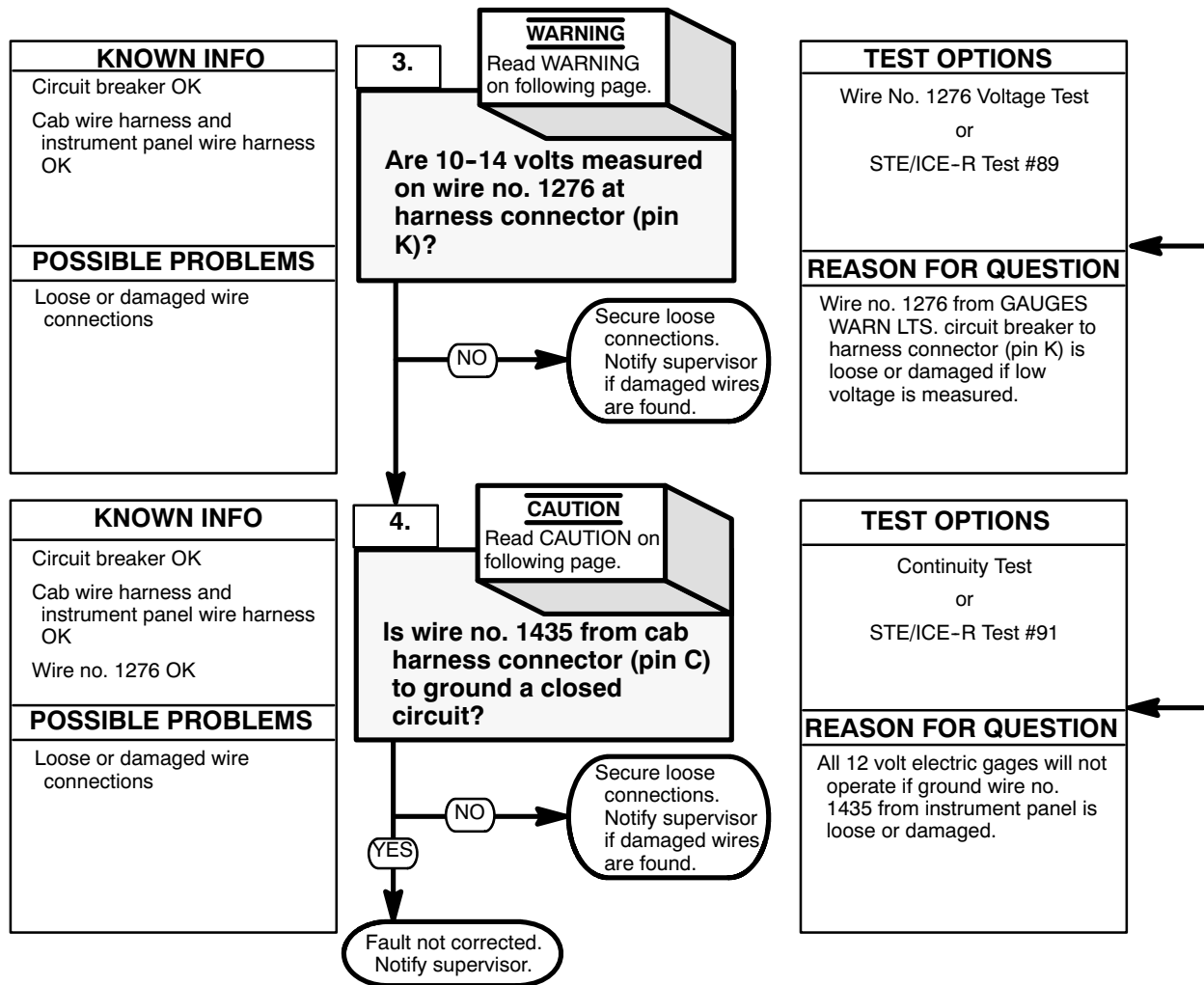
INSTUMENT PANEL WIRE HARNESS



INSTRUMENT PANEL

CAB WIRE HARNESS

e4. ALL 12 VOLT ELECTRIC GAGES DO NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1276 VOLTAGE TEST

- (1) Remove instrument panel (para 7-14).
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on wire no. 1276 (pin K) at cab harness connector.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.

Check ground wire no. 1435 from instrument panel for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

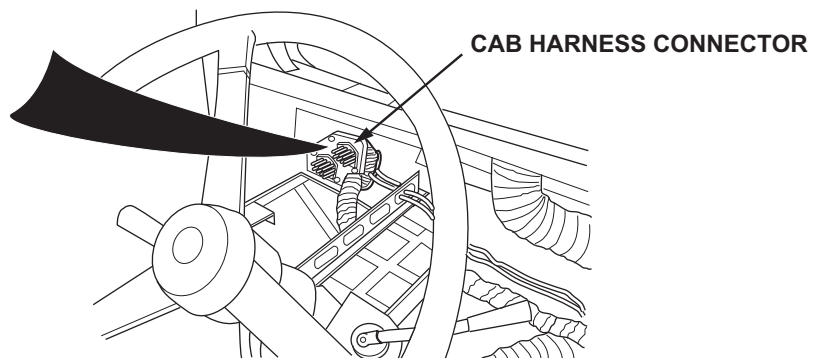
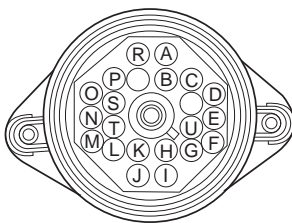
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

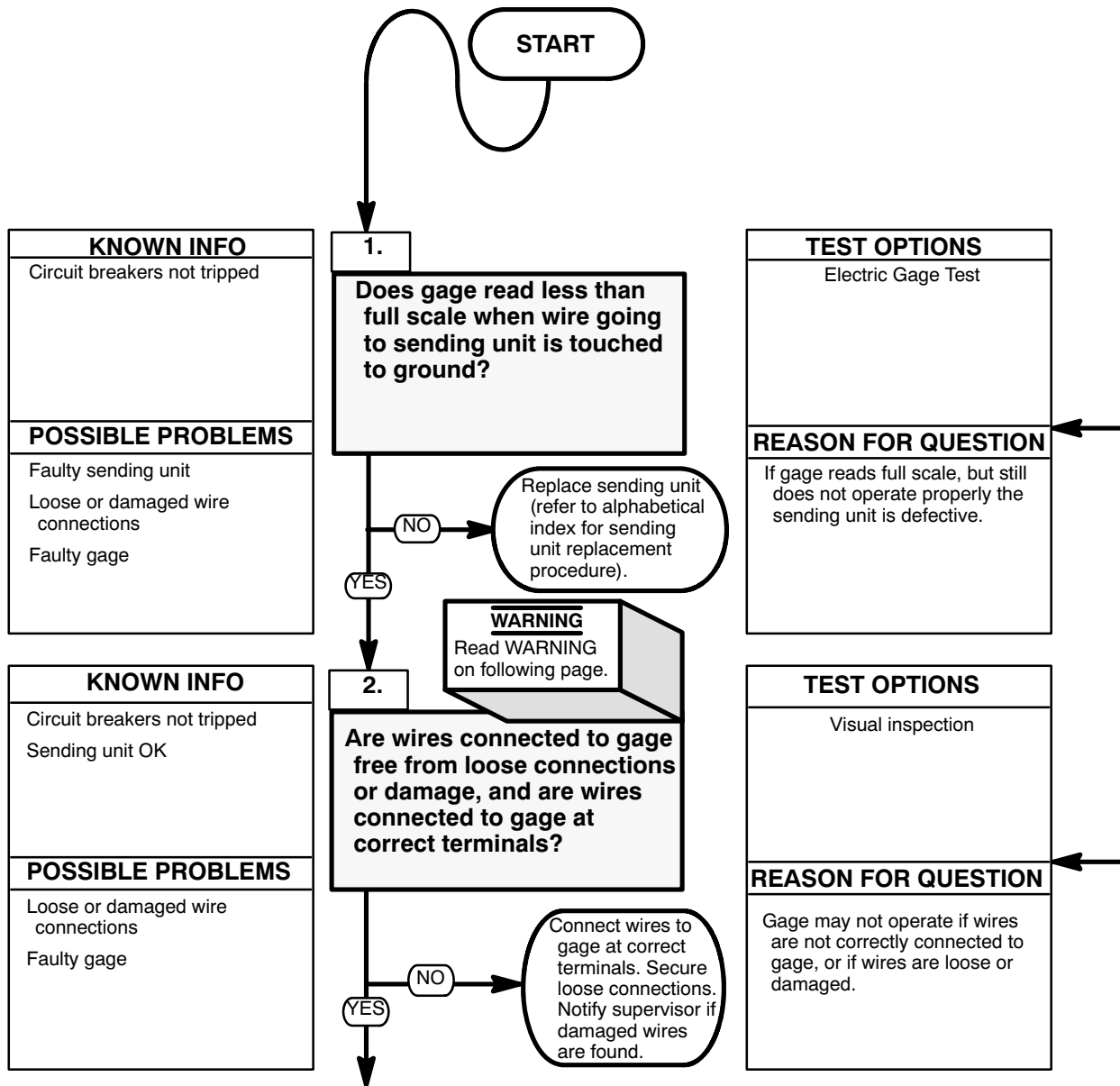
NOTE

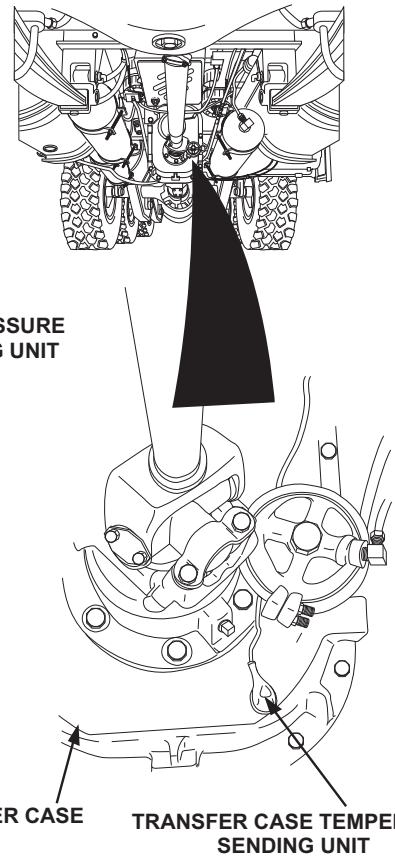
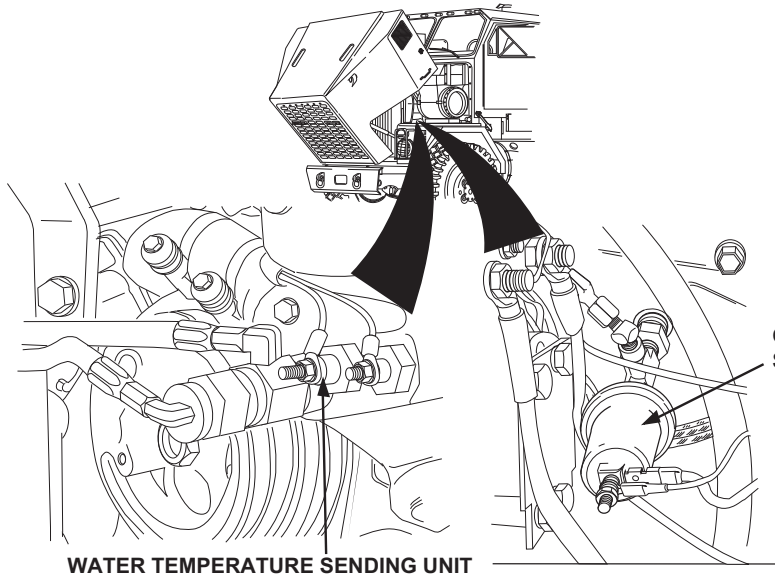
Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.



e5. ONE ELECTRIC GAGE DOES NOT OPERATE OR IS INACCURATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)





ELECTRIC GAGE TEST

- (1) Remove wire from sending unit of defective gage and secure to ground.

NOTE

Gage should read full scale when wire is touched to ground.

- (2) Turn ENGINE switch to ON position and note reading on gage.
- (3) Turn ENGINE switch to OFF position.

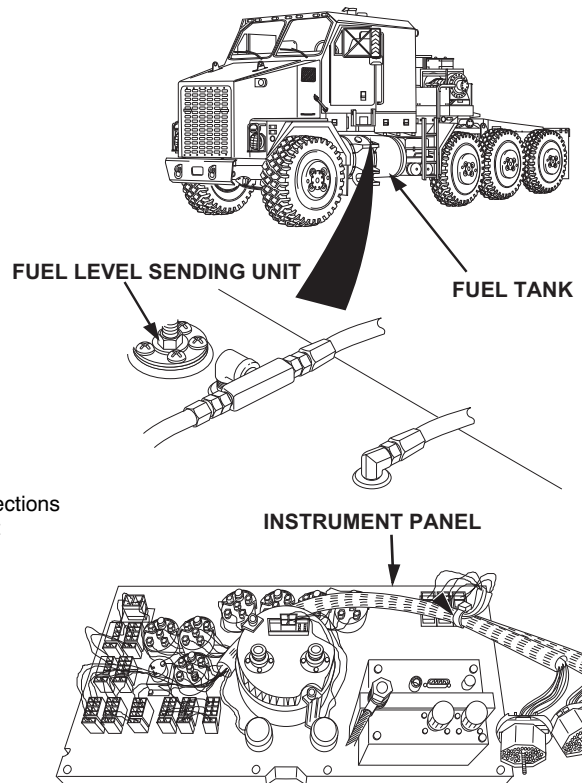
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

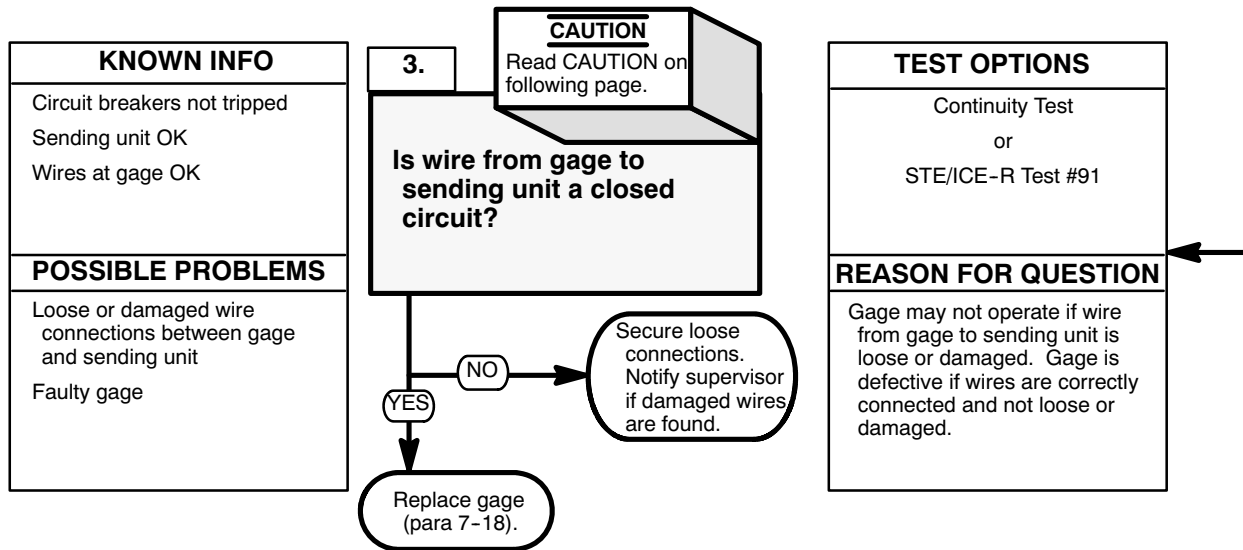
NOTE

Refer to FO-4 (p. FP-21) Electric Dash Panel wiring diagram of instruments.

Check wires connected to electric gages for loose connections or damage. Check that wires are connected to gages at correct terminals.



e5. ONE ELECTRIC GAGE DOES NOT OPERATE OR IS INACCURATE (CONT)



NOTE
 BATTERY gages do not have sending units.

Check wire from gage to sending unit for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

(1) Disconnect wiring from components at each end of wire.
 (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

(3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

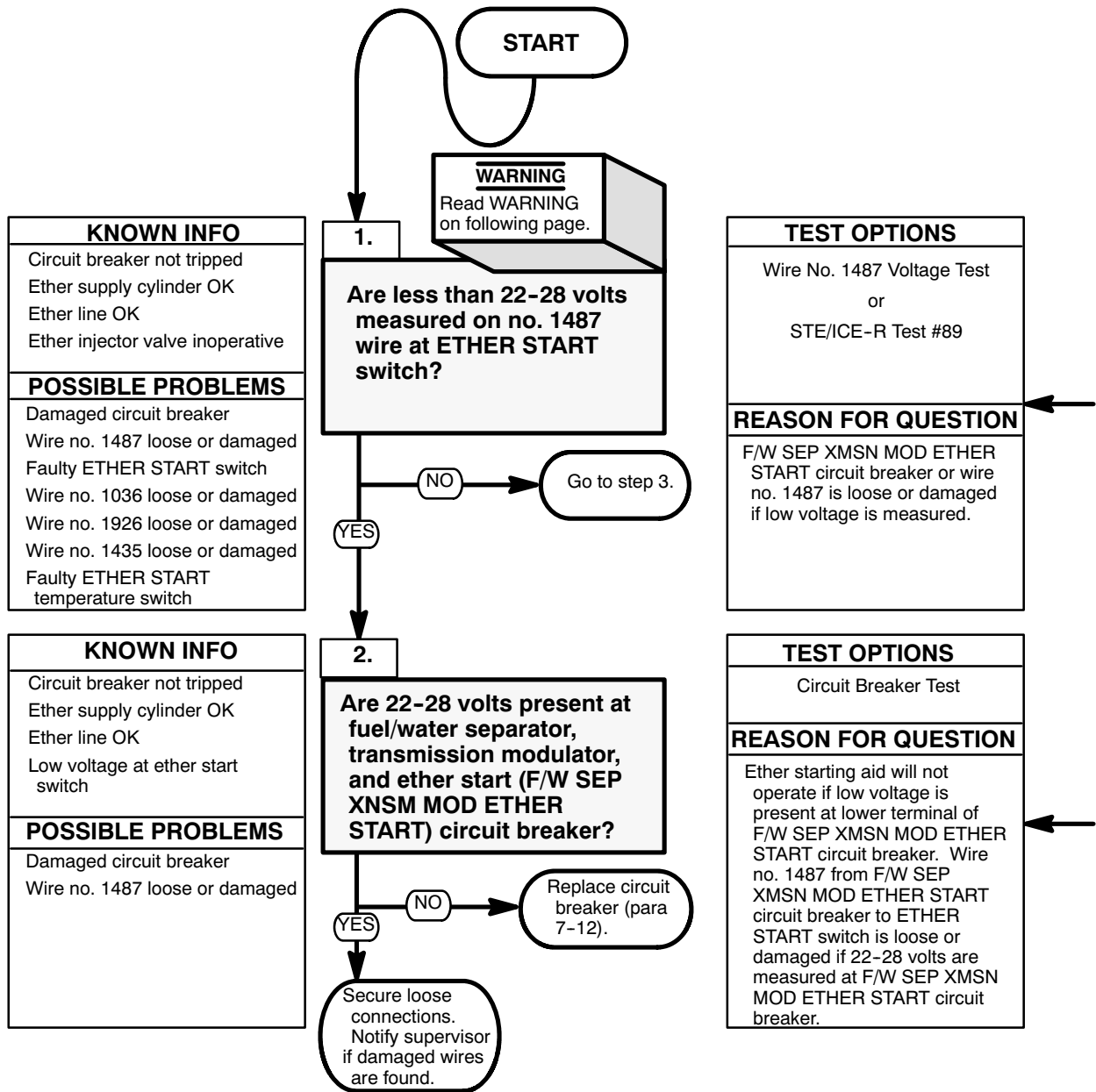
Any reading besides infinity indicates a grounded wire.

(4) Remove multimeter lead from one end of wire and connect to chassis ground.

Table 2-9. Electric Gage Sending Unit Location

ELECTRIC GAGE	WIRE NO.	SENDING UNIT LOCATION
WATER TEMP gage	1320	in left thermostat housing
OIL PRESS gage	1113	near rear of 24 volt alternator
TRANS TEMP gage	1068	on top right of transmission (next to transmission breather)
T-CASE TEMP gage	1063	on front of transfer case (lower left side)
FUEL gage	1318	in left fuel tank

e6. ETHER STARTING AID DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

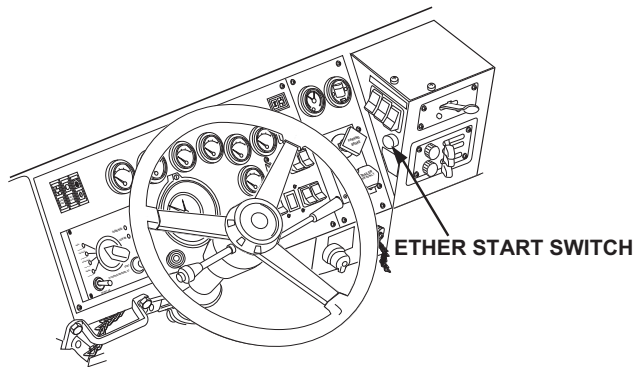
- **Ether is very flammable and could explode causing serious injury or death. Keep cylinder away from heat and open flame.**
- **Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.**

NOTE

- Perform Fuel System Troubleshooting (b3, Ether starting aid does not operate) before starting steps given below.
- Temperature at engine block must be less than 55 °F (13° C) before ether starting aid will work.

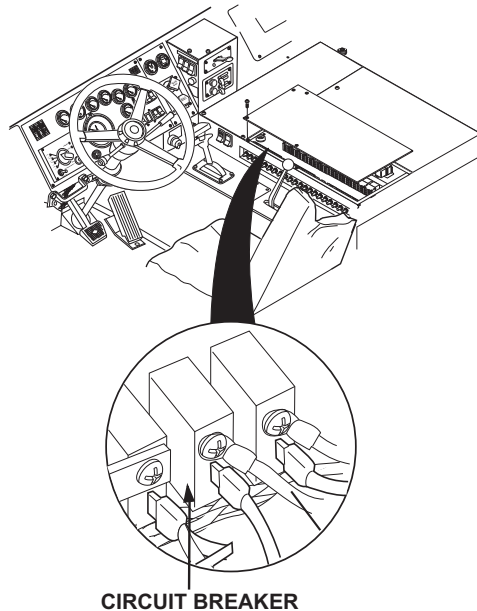
WIRE NO. 1487 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1487 at ETHER START switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

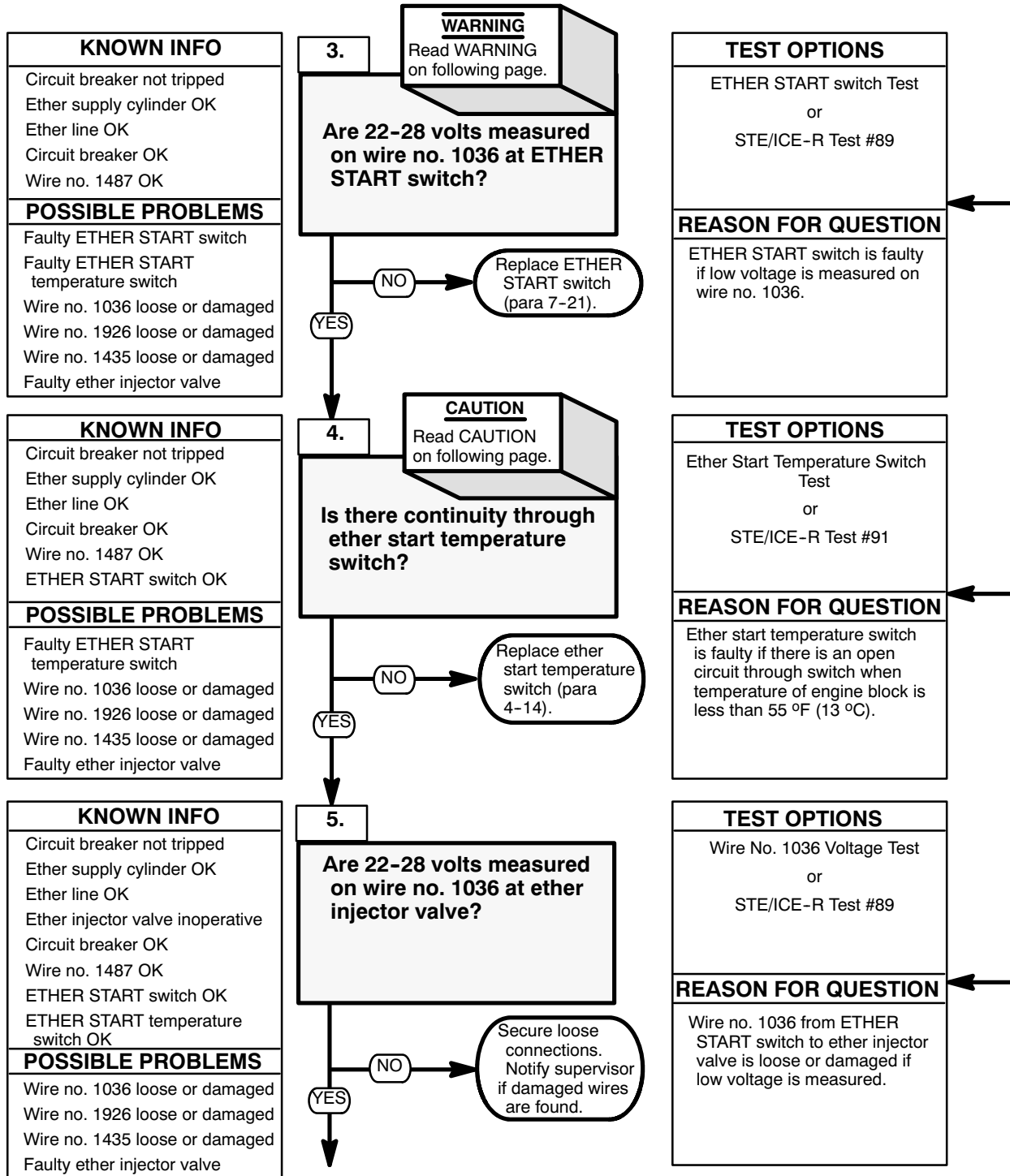


CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (3) Turn ENGINE switch to ON position.
- (4) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



e6. ETHER STARTING AID DOES NOT OPERATE (CONT)



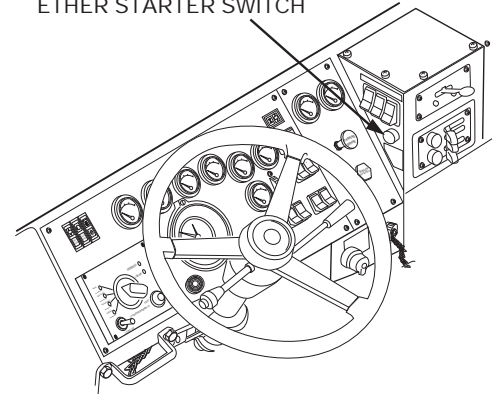
WARNING

- Ether is very flammable and could explode causing serious injury or death. Keep cylinder away from heat and open flame. Be sure to wear the proper eye protection to avoid personal injury.
- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

ETHER START SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1036 at ETHER START switch.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Press and hold ETHER START switch and check for 22-28 volts on multimeter.
- (5) Release ETHER START switch.
- (6) Turn ENGINE switch to OFF position.

ETHER START SWITCH



ETHER START TEMPERATURE SWITCH TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

NOTE

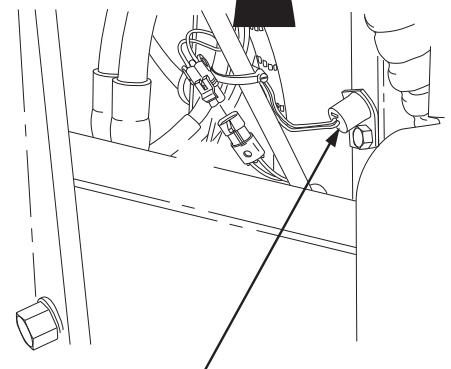
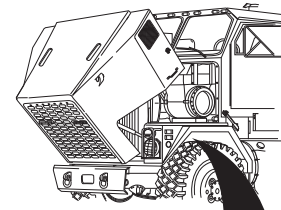
Temperature at engine block must be less than 55 °F (13 °C) to perform this test .

- (1) Set multimeter to ohms position.
- (2) Connect multimeter lead to end of wire no. 1926 on ether start temperature switch.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter lead to end of wire no. 1435 on ether start temperature switch and check multimeter for continuity.

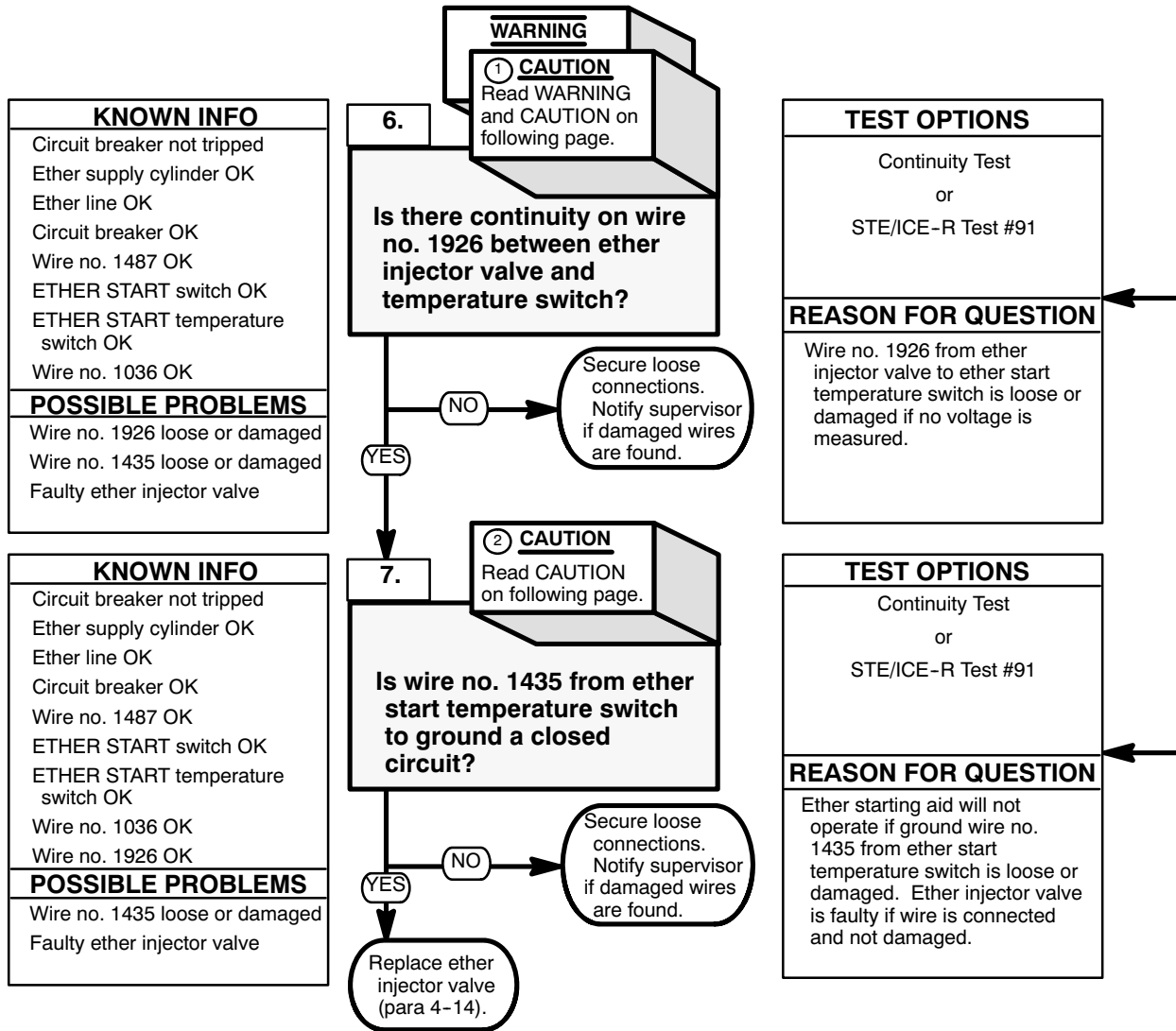


ETHER START TEMPERATURE SWITCH

WIRE NO. 1036 VOLTAGE TEST

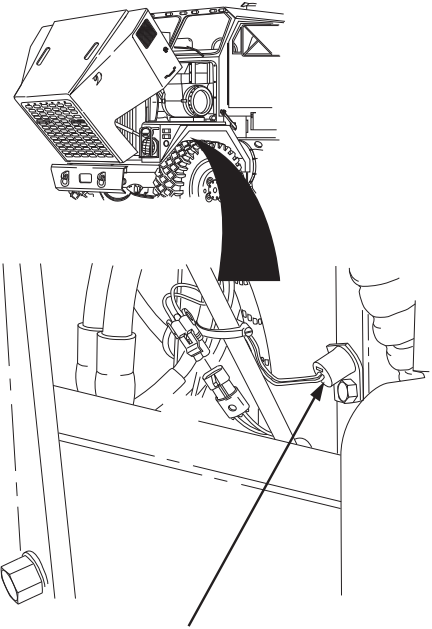
- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1036 at ether injector valve.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Press and hold ETHER START switch and check for 22-28 volts on multimeter.
- (5) Release ETHER START switch.
- (6) Turn ENGINE switch to OFF position.

e6. ETHER STARTING AID DOES NOT OPERATE (CONT)



WARNING

- Ether is very flammable and could explode causing serious injury or death. Keep cylinder away from heat and open flame. Be sure to wear the proper eye protection to avoid personal injury.
- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.



ETHER START TEMPERATURE SWITCH

CONTINUITY TEST

① **CAUTION**

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Remove left inner fender (para 16-34).
- (1.1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

Check ground wire no. 1435 from ether start temperature switch for loose connections or damage.

CONTINUITY TEST

② **CAUTION**

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

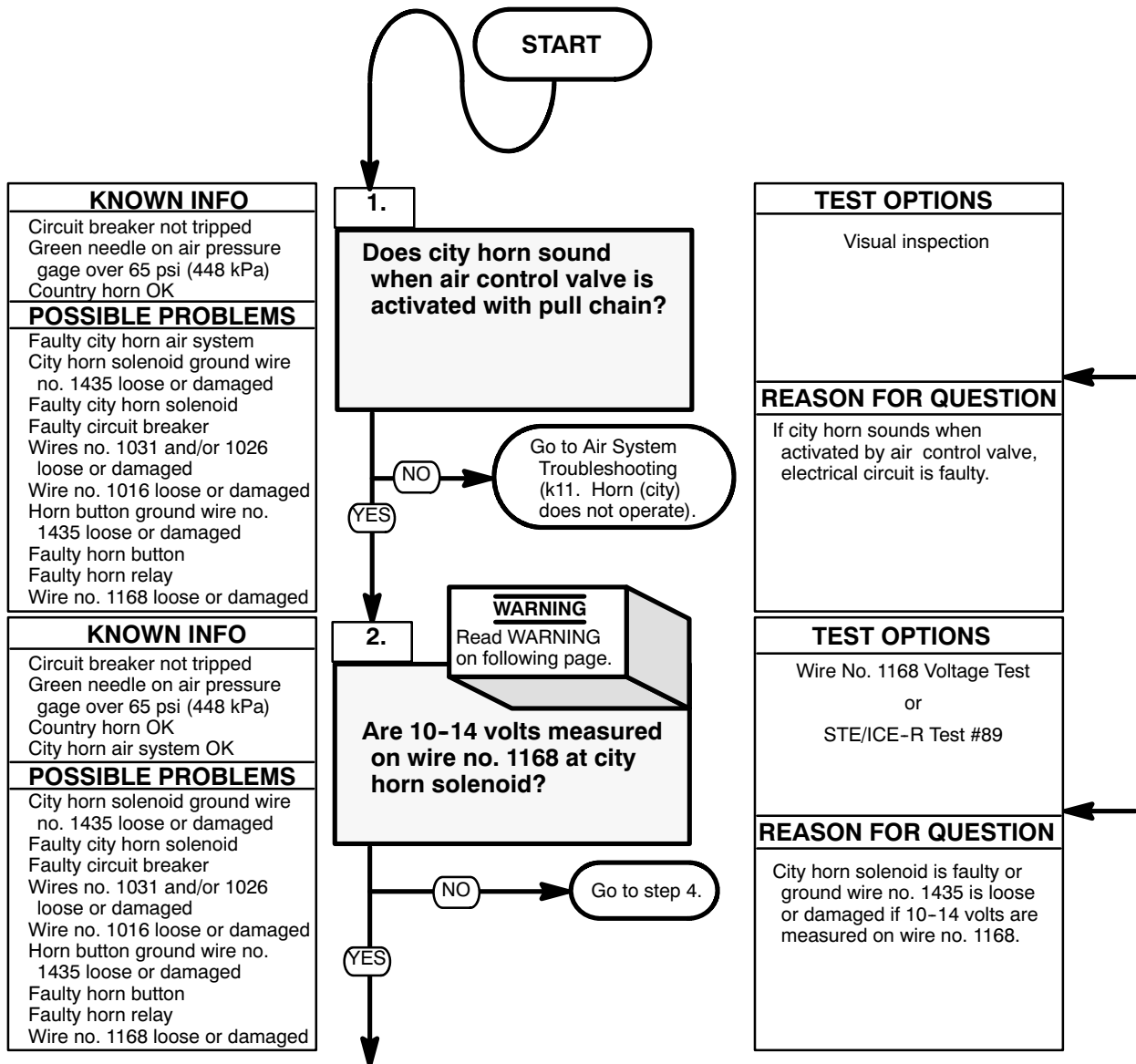
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

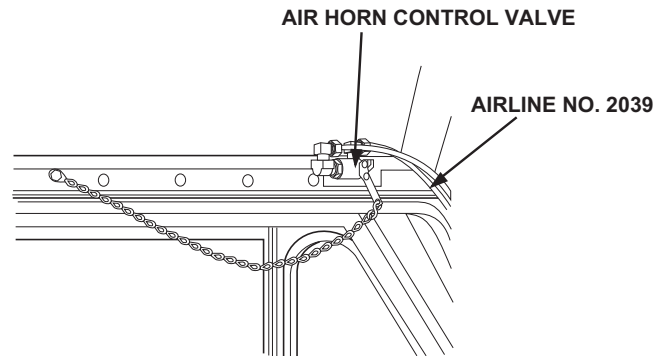
NOTE

Any reading besides infinity indicates a grounded wire.

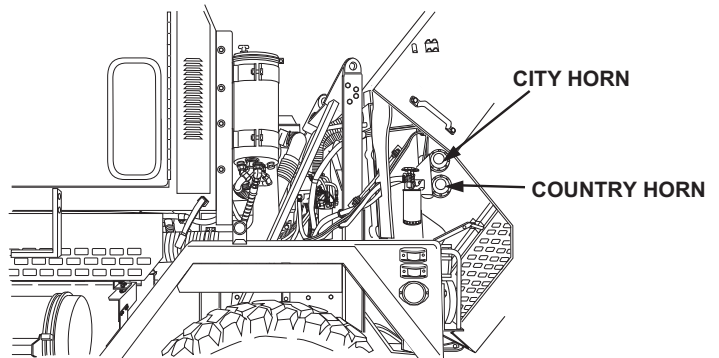
- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e7. HORN (CITY) DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)
Personnel Required Two	





- (1) Activate air horn control valve with pull chain.
- (2) Have assistant see if city horn sounds.

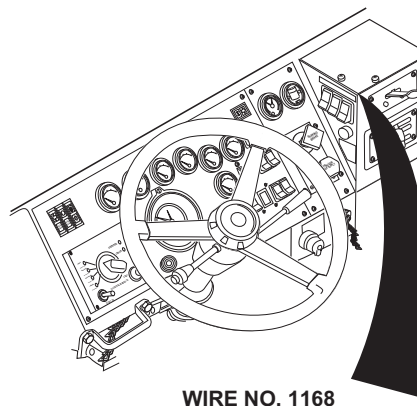


WARNING

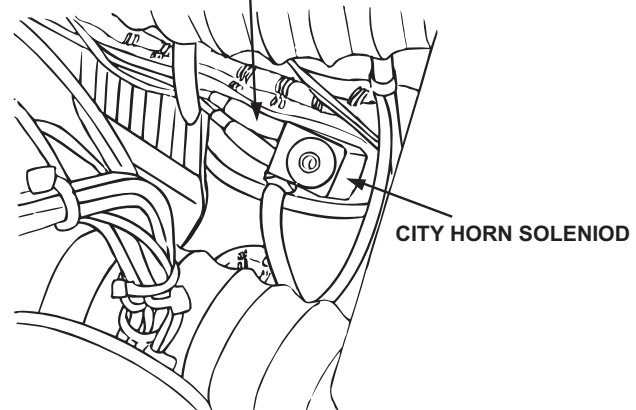
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

**WIRE NO. 1168
VOLTAGE TEST**

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1168 at city horn solenoid.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Press horn button and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.

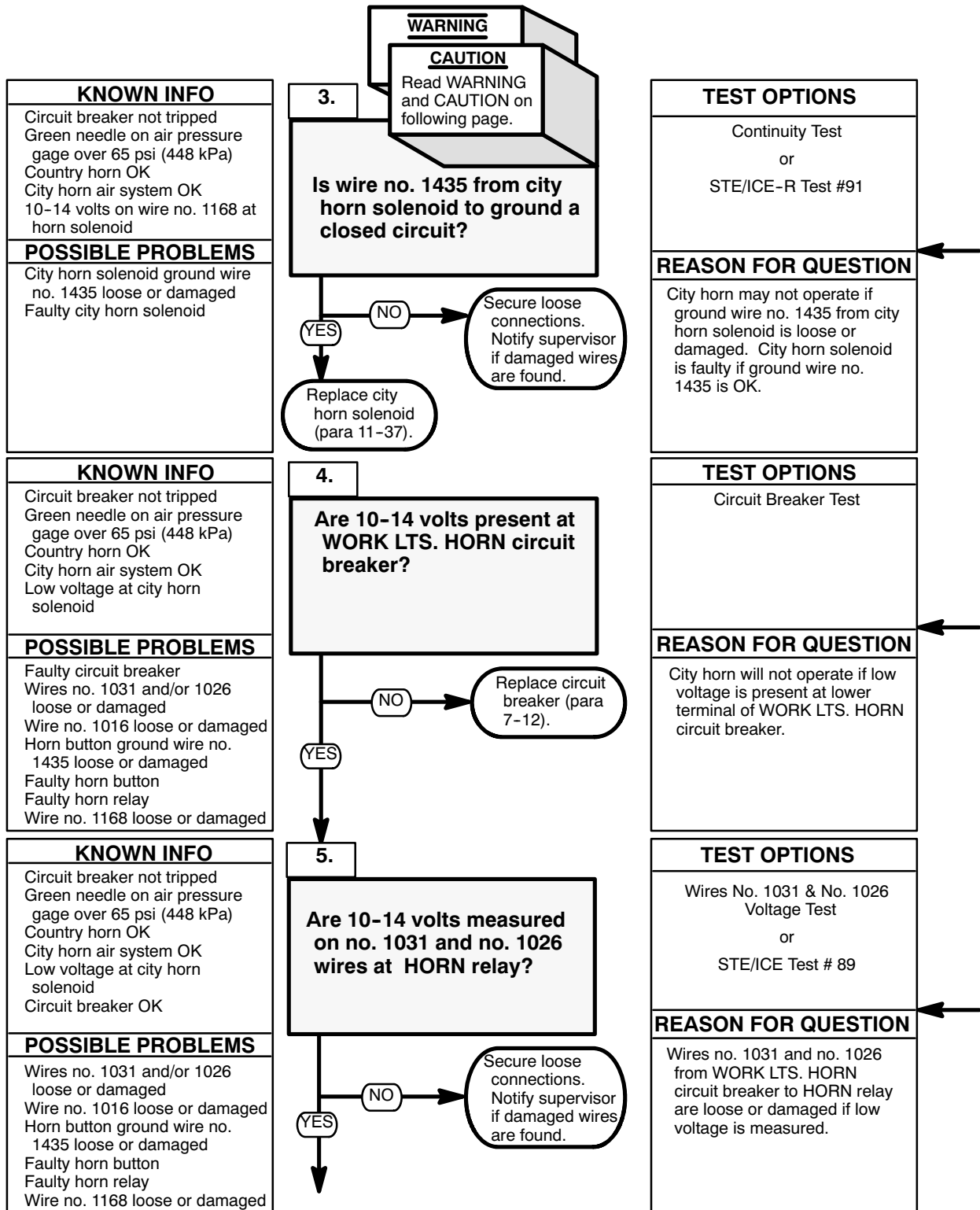


WIRE NO. 1168



CITY HORN SOLENIOD

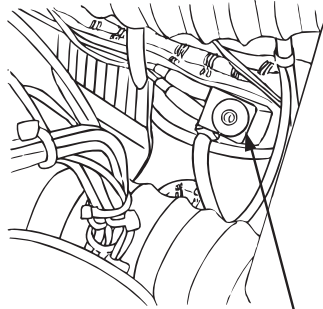
e7. HORN (CITY) DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from city horn solenoid for loose connections or damage.



CITY HORN SOLENIOD

CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

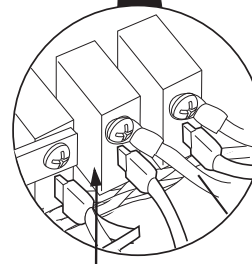
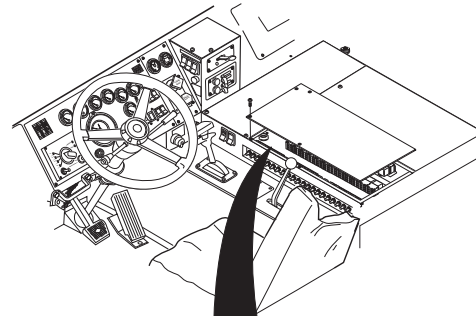
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

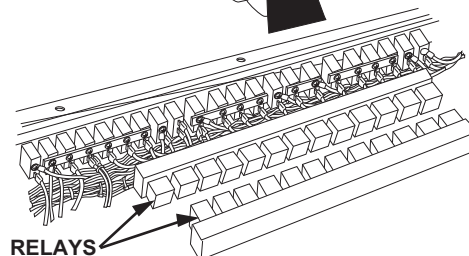
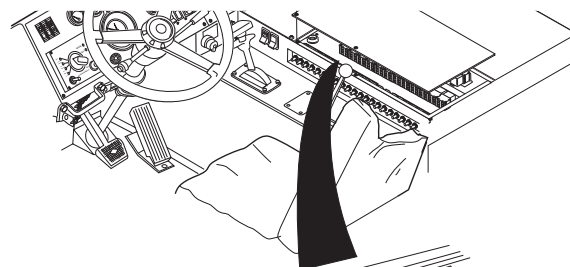
- (4) Remove multimeter lead from one end of wire and connect to chassis ground.



CIRCUIT BREAKER

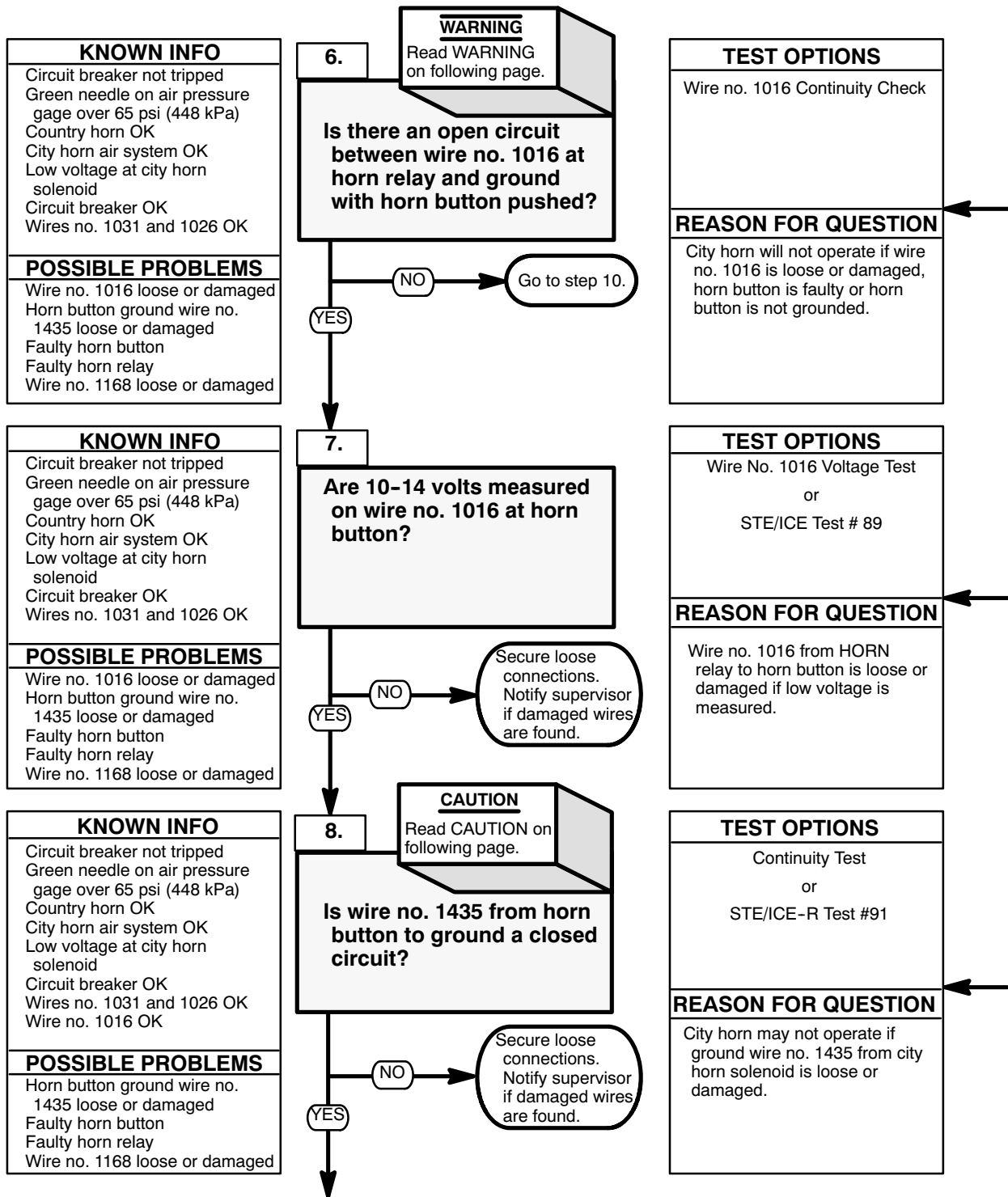
WIRES NO. 1031 & NO. 1026 VOLTAGE TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on wire no. 1031 at HORN relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place positive (+) probe of multimeter on wire no. 1026 at HORN relay and note reading on multimeter.
- (6) Turn ENGINE switch to OFF position.



RELAYS

e7. HORN (CITY) DOES NOT OPERATE (CONT)



WARNING

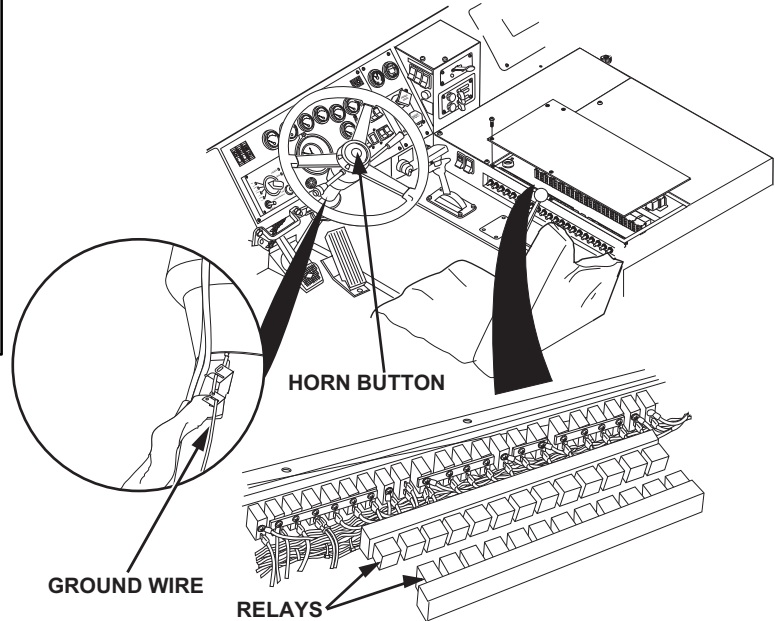
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1016 CONTINUITY TEST

- (1) Unplug horn relay.
- (2) Disconnect horn button ground wire no. 1435 from ground.
- (3) Set multimeter to ohms.
- (4) Place positive (+) probe of multimeter on wire no. 1016 at HORN relay.
- (5) Place negative (-) probe of multimeter on wire no. 1435.
- (6) Press horn button and check multimeter for continuity.
- (7) Connect horn button ground wire no. 1435 to ground.
- (8) Plug in horn relay

WIRE NO. 1016 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1016 at horn button.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Press horn button and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



Check ground wire no. 1435 from horn button for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

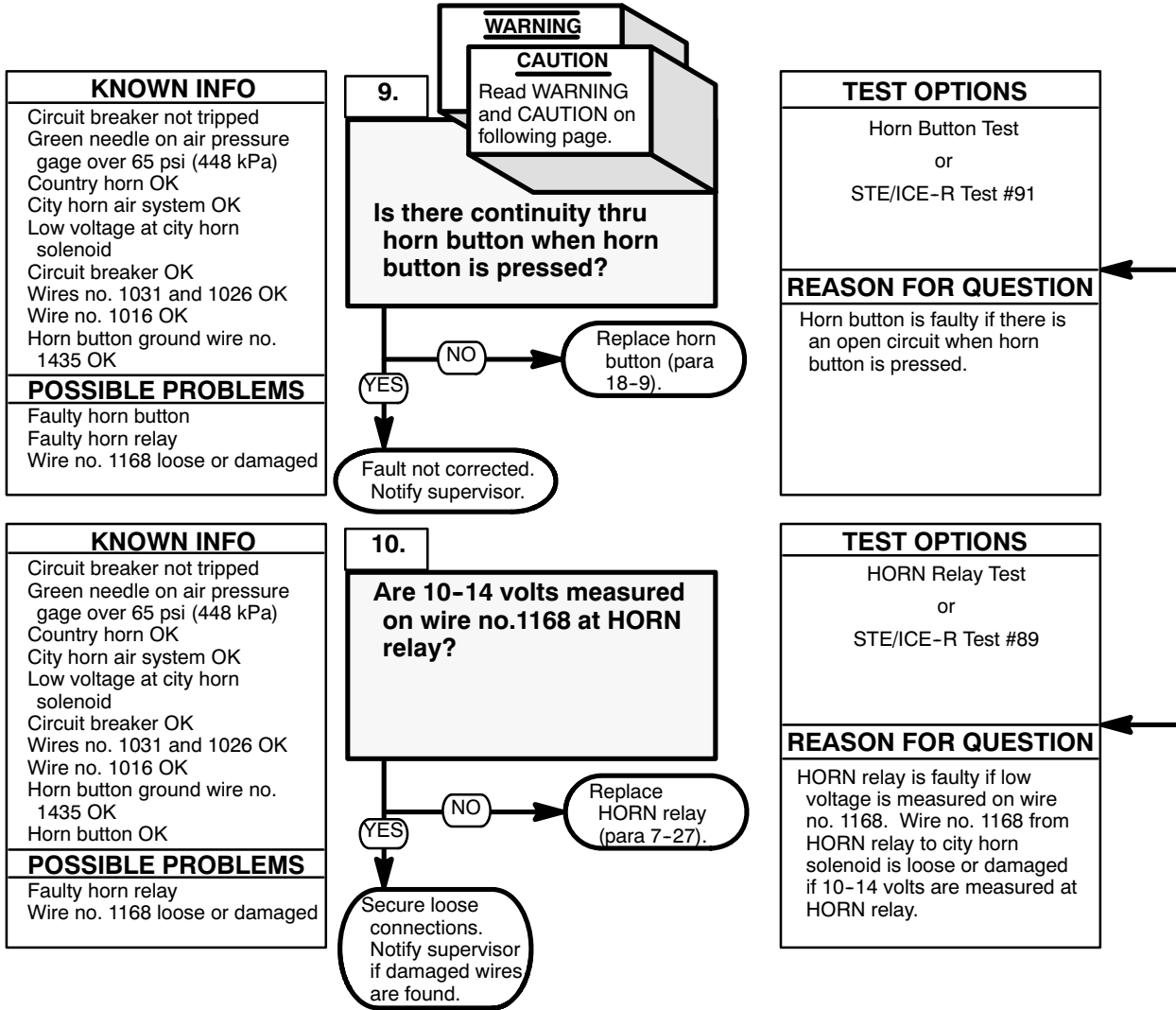
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e7. CITY HORN DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CAUTION

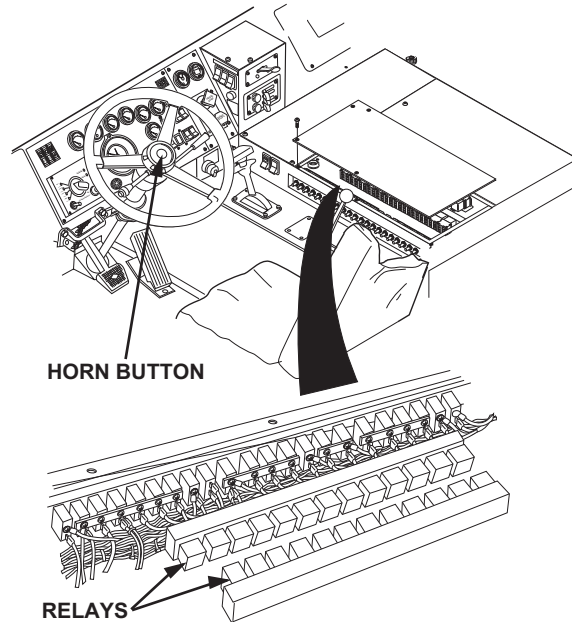
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

HORN BUTTON TEST

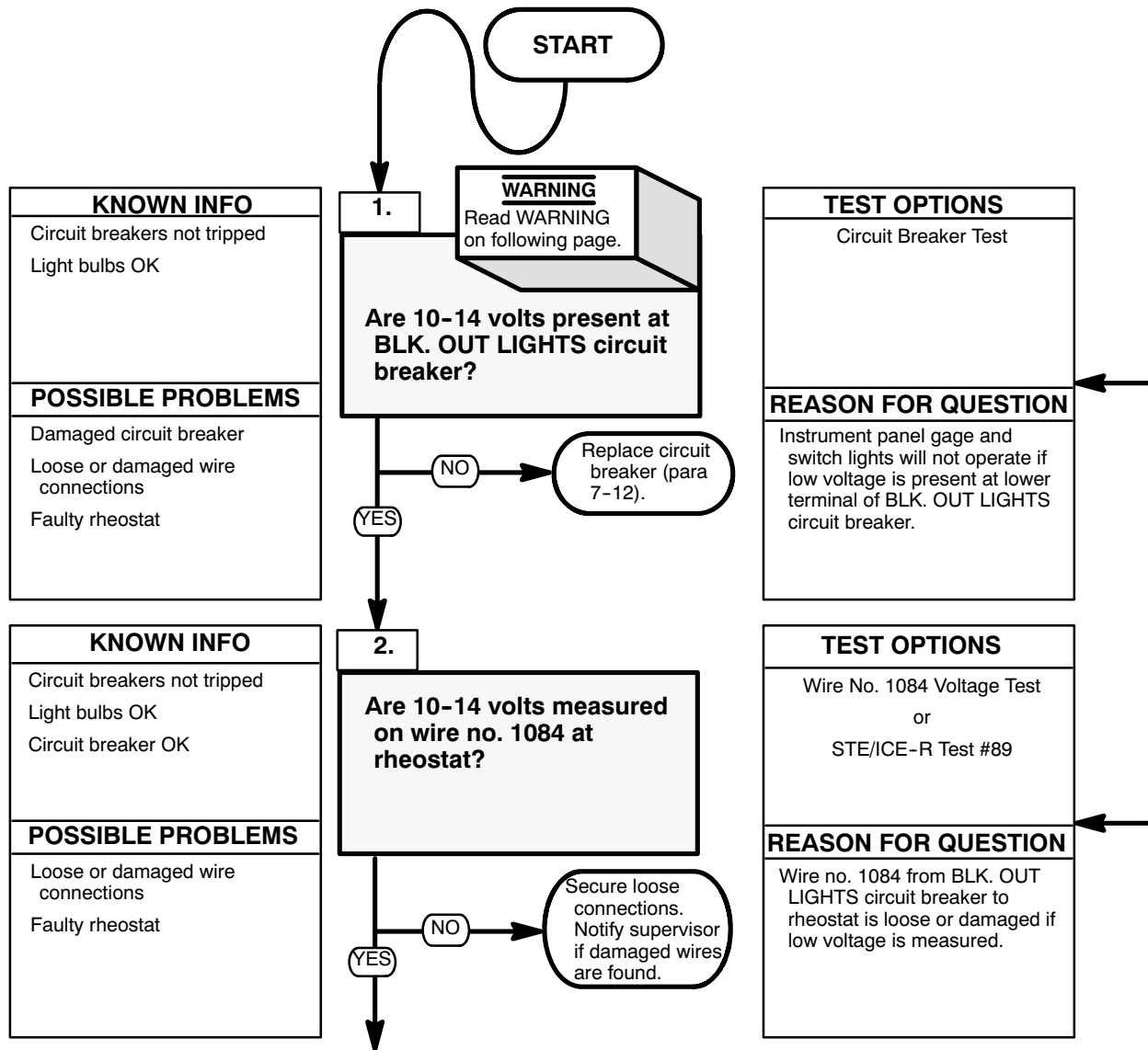
- (1) Disconnect horn switch connector at steering column.
- (2) Set multimeter to ohms position.
- (3) Connect multimeter leads to each pin in connector.
- (4) Press horn button and check multimeter for continuity.

HORN RELAY TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1168 at HORN relay.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Press horn button and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



e8. INSTRUMENT PANEL GAGE AND SWITCH LIGHTS DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)

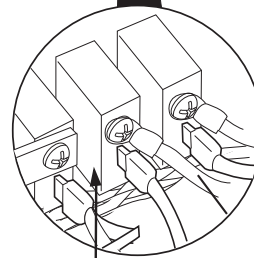
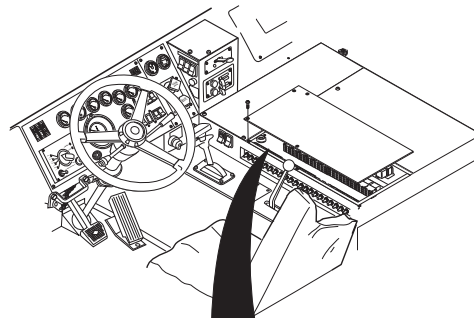


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.

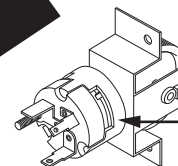
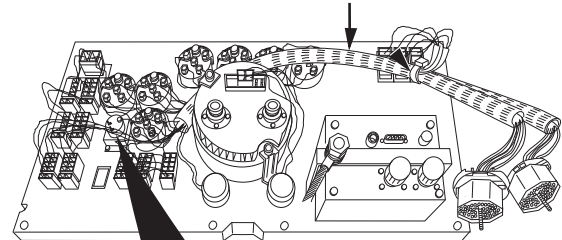


CIRCUIT BREAKER

WIRE NO. 1084 VOLTAGE TEST

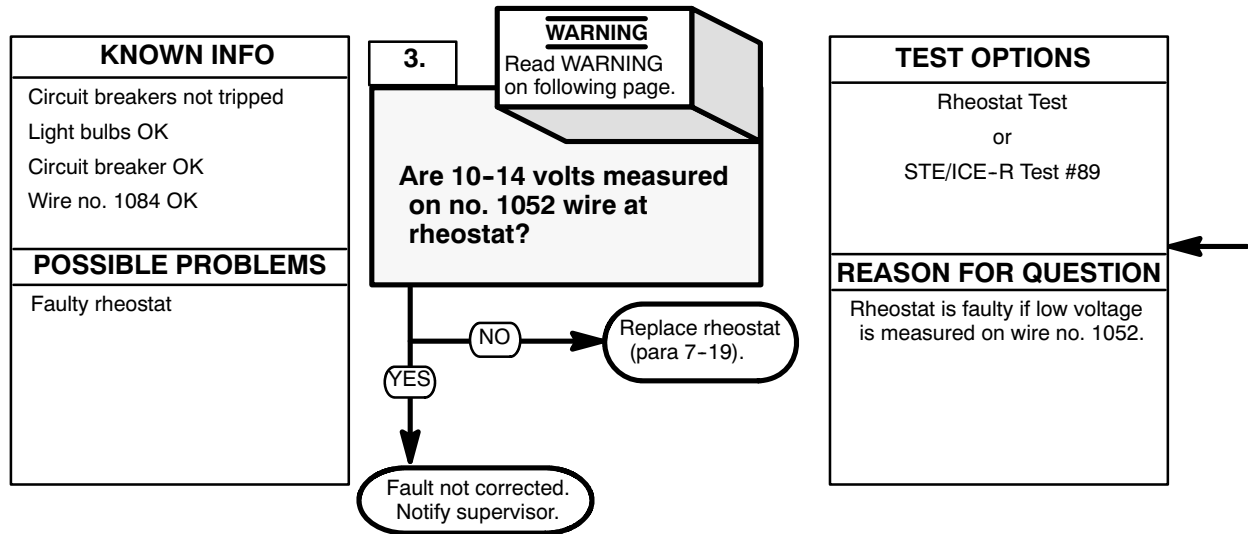
- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1084 at rheostat.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

INSTRUMENT PANEL



INSTRUMENT LIGHT RHEOSTAT

e8. INSTRUMENT PANEL GAGE AND SWITCH LIGHTS DO NOT OPERATE (CONT)

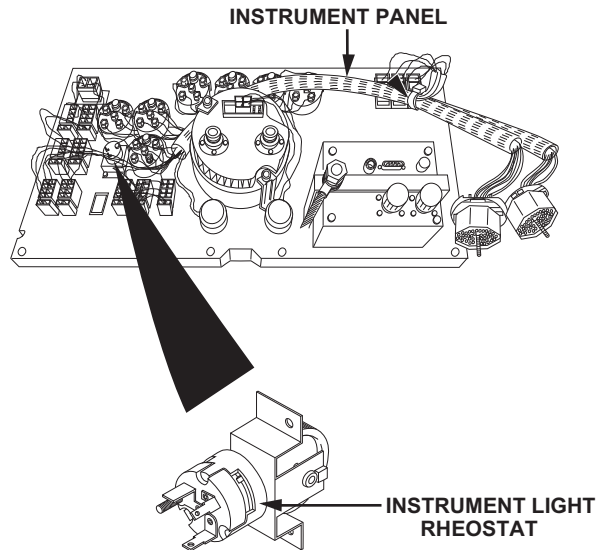


WARNING

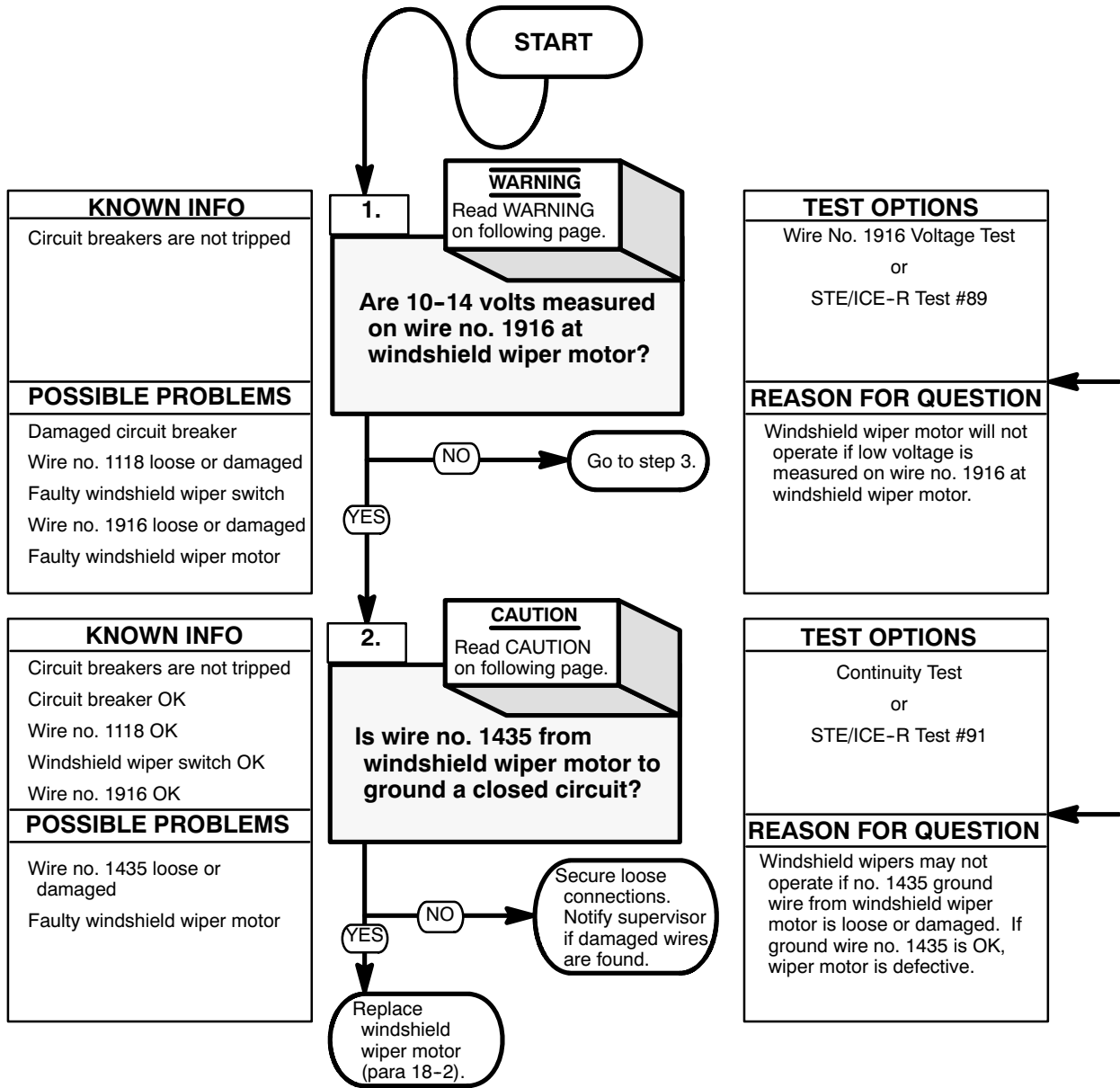
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

RHEOSTAT TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1052 at rheostat.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



e9. WINDSHIELD WIPERS DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)

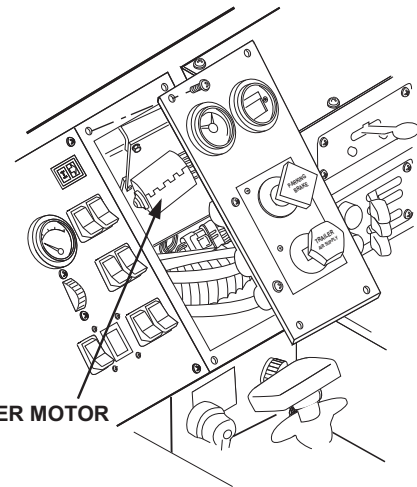


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1916 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place windshield wiper switch in the intermediate speed position.
- (3) Place positive (+) probe of multimeter on wire no. 1916 at windshield wiper motor.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place windshield wiper switch in the off position.
- (6) Turn ENGINE switch to OFF position.



WINDSHIELD WIPER MOTOR

Check ground wire no. 1435 from windshield wiper motor for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

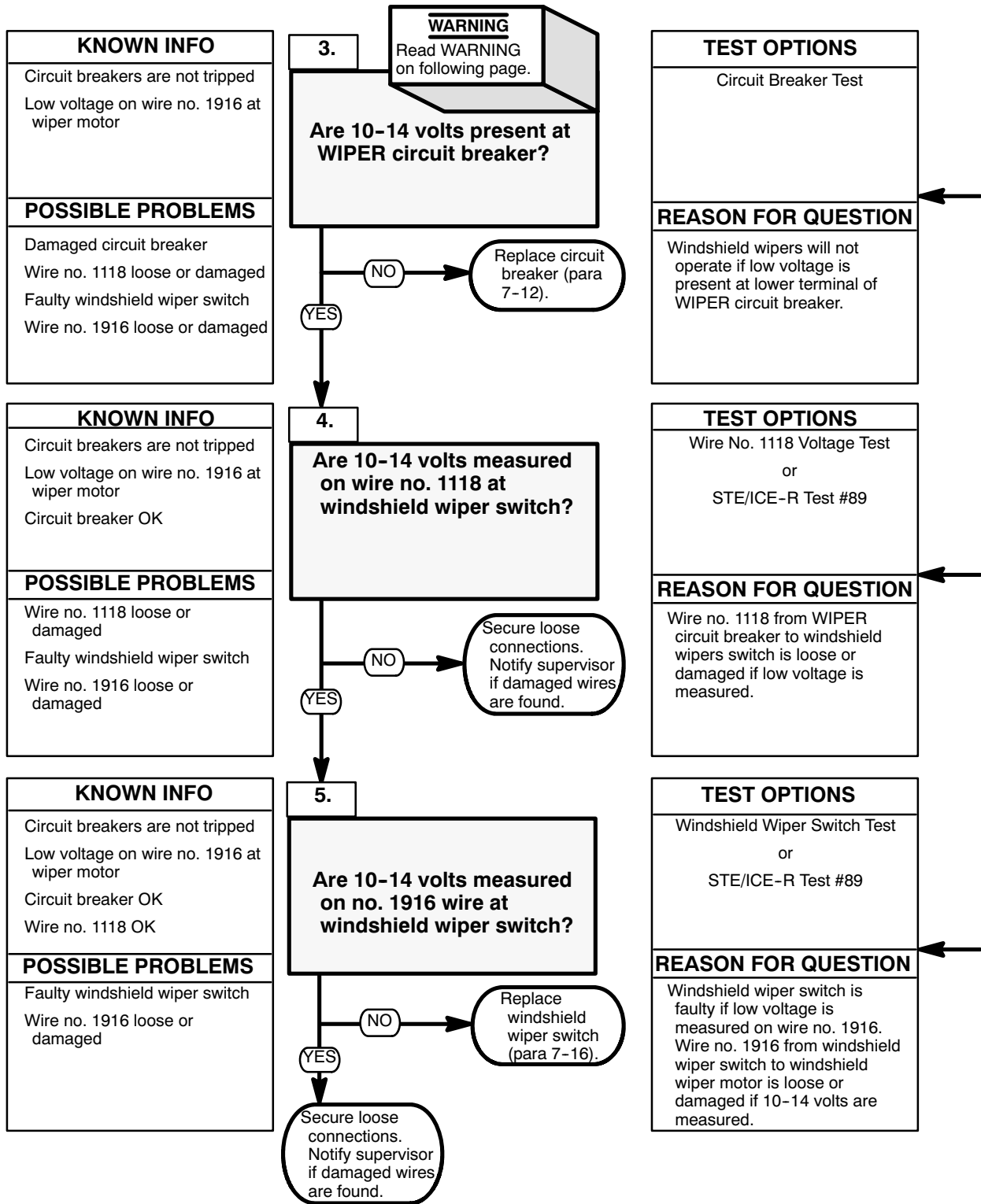
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e9. WINDSHIELD WIPERS DO NOT OPERATE (CONT)

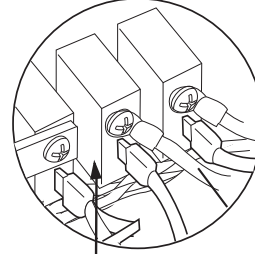
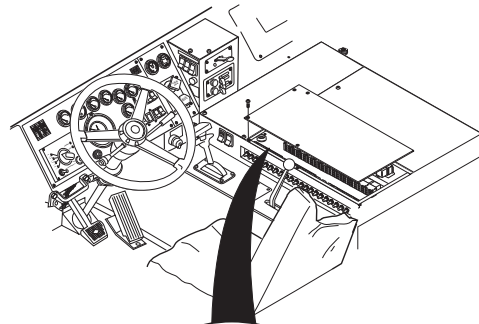


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



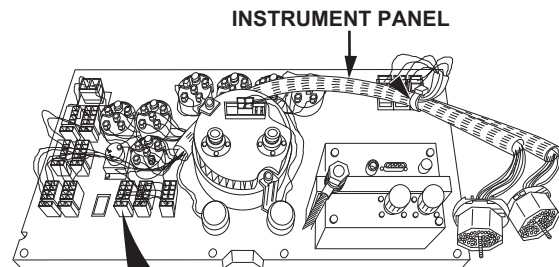
CIRCUIT BREAKER

NOTE

Wire no. 1118 is spliced with wire no. 1919.

WIRE NO. 1118 VOLTAGE TEST

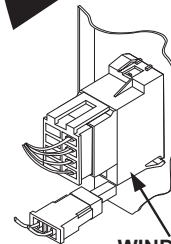
- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1118 at windshield wiper switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



INSTRUMENT PANEL

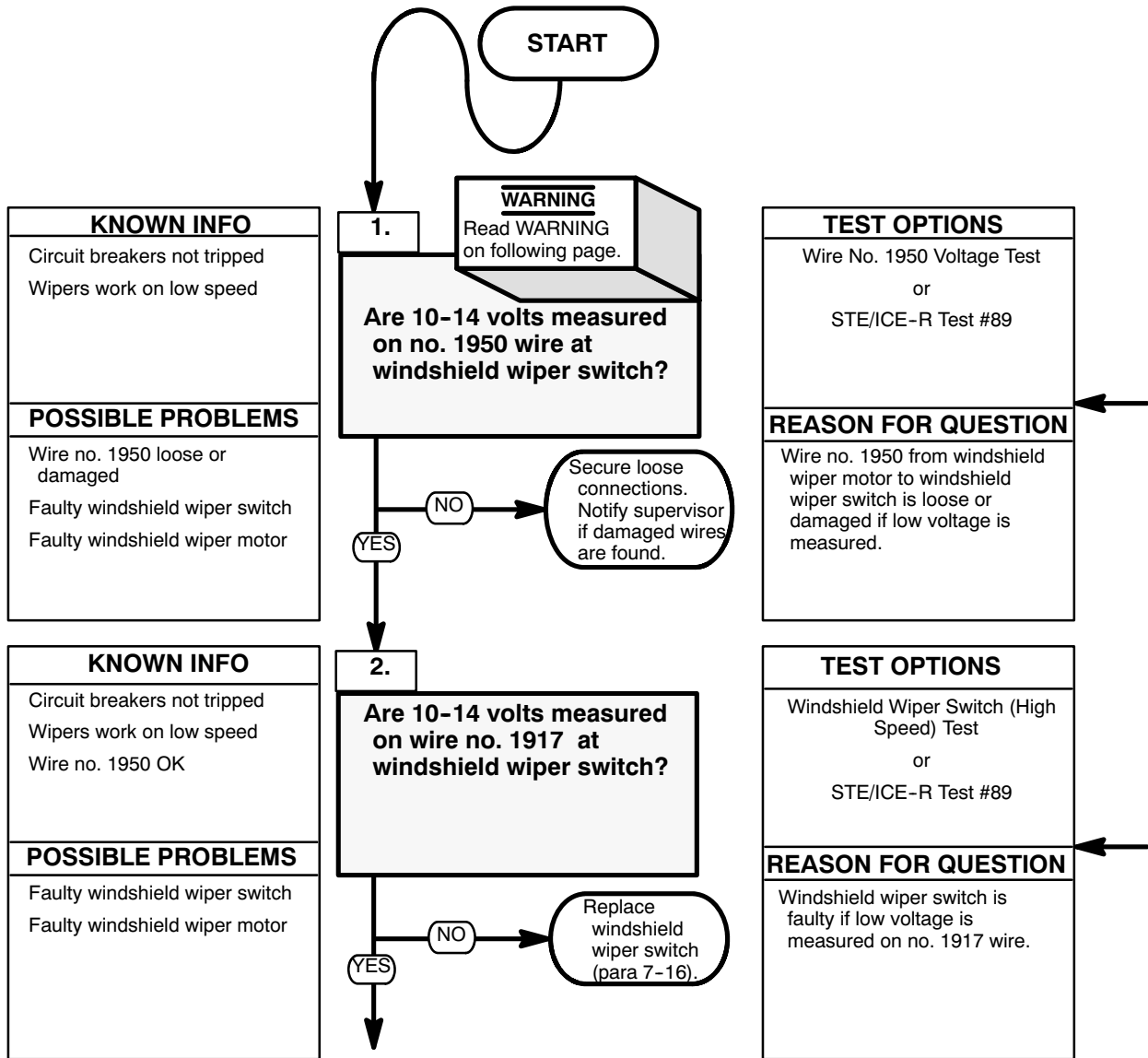
WINDSHIELD WIPER SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place windshield wiper switch in the intermediate speed position.
- (3) Place positive (+) probe of multimeter on wire no. 1916 at windshield wiper switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place windshield wiper switch in the off position.
- (6) Turn ENGINE switch to OFF position.



WINDSHIELD WIPER SWITCH

e10. WINDSHIELD WIPERS DO NOT OPERATE IN HIGH SPEED	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

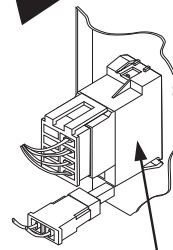
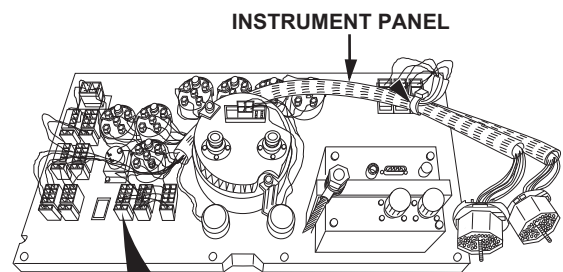
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1950 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Position windshield wiper switch in the high speed position.
- (3) Place positive (+) probe of multimeter on wire no. 1950 at windshield wiper switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Position windshield wiper switch in the off position.
- (6) Turn ENGINE switch to OFF position.

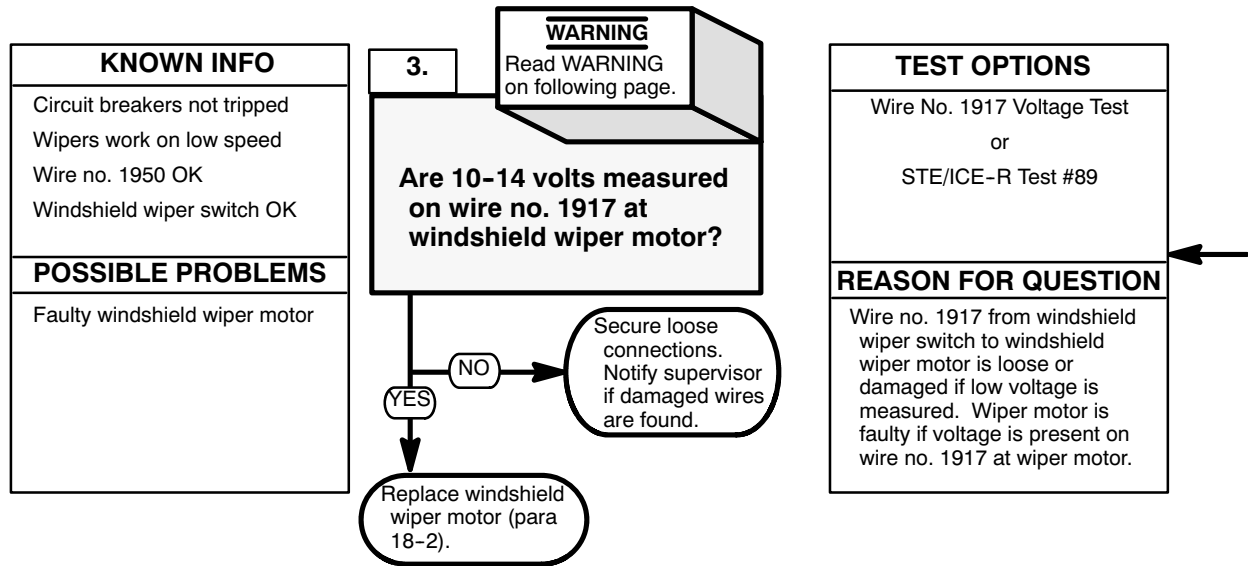
WINDSHIELD WIPER SWITCH (HIGH SPEED) TEST

- (1) Turn ENGINE switch to ON position.
- (2) Position windshield wiper switch in the high speed position.
- (3) Place positive (+) probe of multimeter on wire no. 1917 at windshield wiper switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Position windshield wiper switch in the off position.
- (6) Turn ENGINE switch to OFF position.



WINDSHIELD WIPER SWITCH

**e10. WINDSHIELD WIPERS DO NOT OPERATE IN HIGH SPEED
(CONT)**

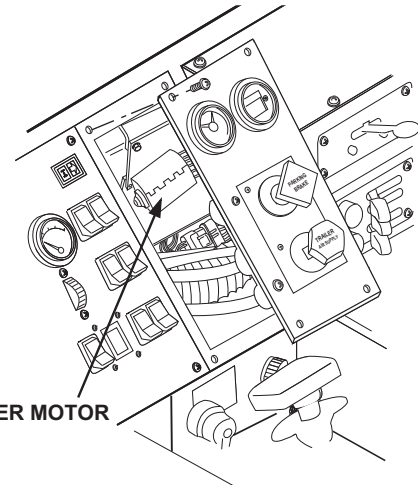


WARNING

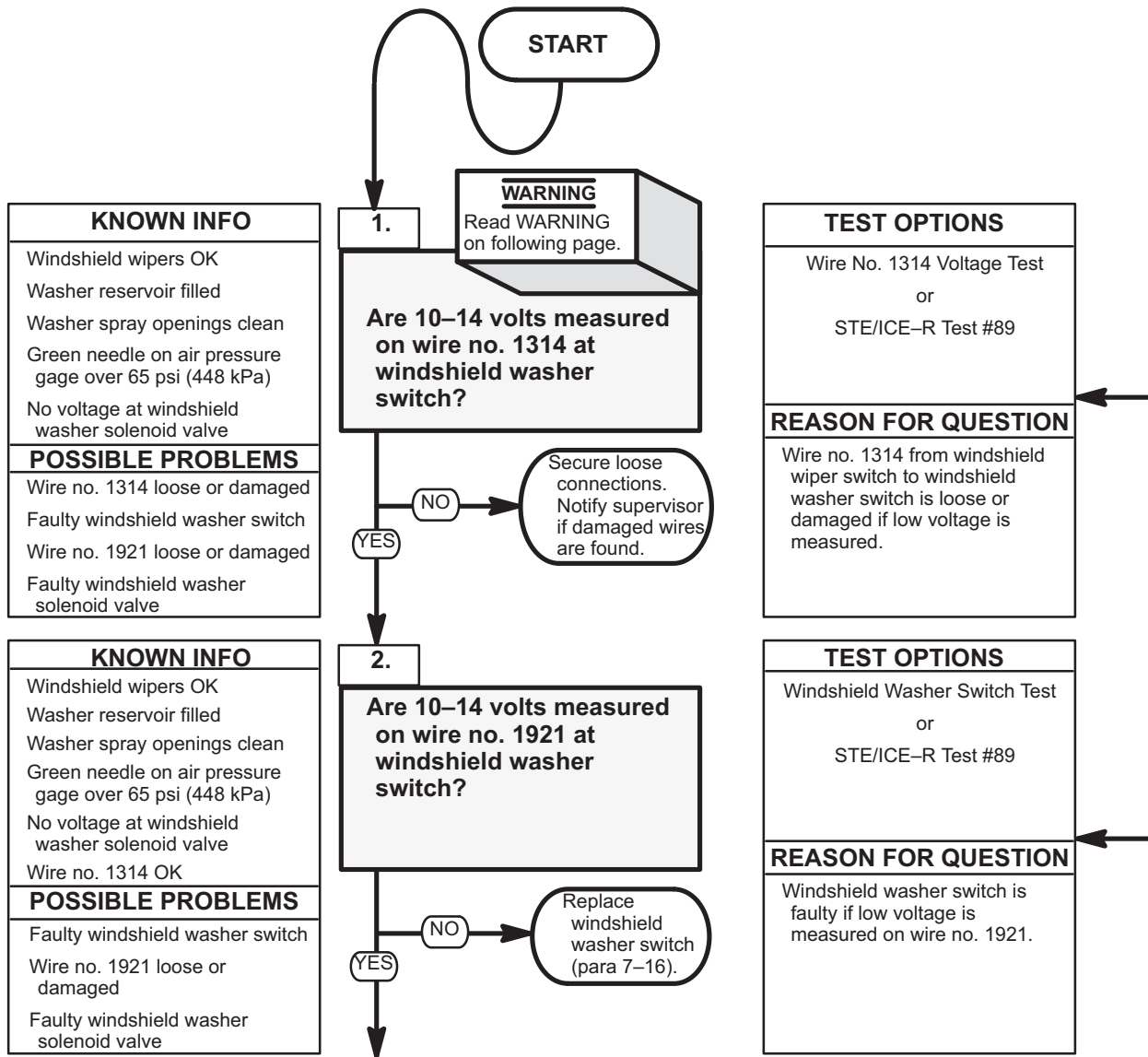
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1917 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Position windshield wiper switch in the high speed position.
- (3) Place positive (+) probe of multimeter on wire no. 1917 at windshield wiper motor.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Position windshield wiper switch in the off position.
- (6) Turn ENGINE switch to OFF position.



e11. WINDSHIELD WASHER DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

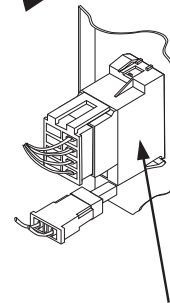
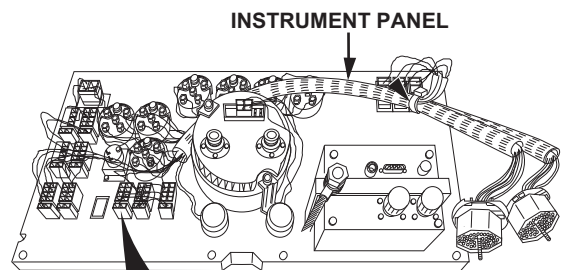
- Perform Air System Troubleshooting (k9, Windshield washer does not operate) before performing steps given below.
- Windshield wipers must be on for washers to operate.

WIRE NO. 1314 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1314 at windshield washer switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

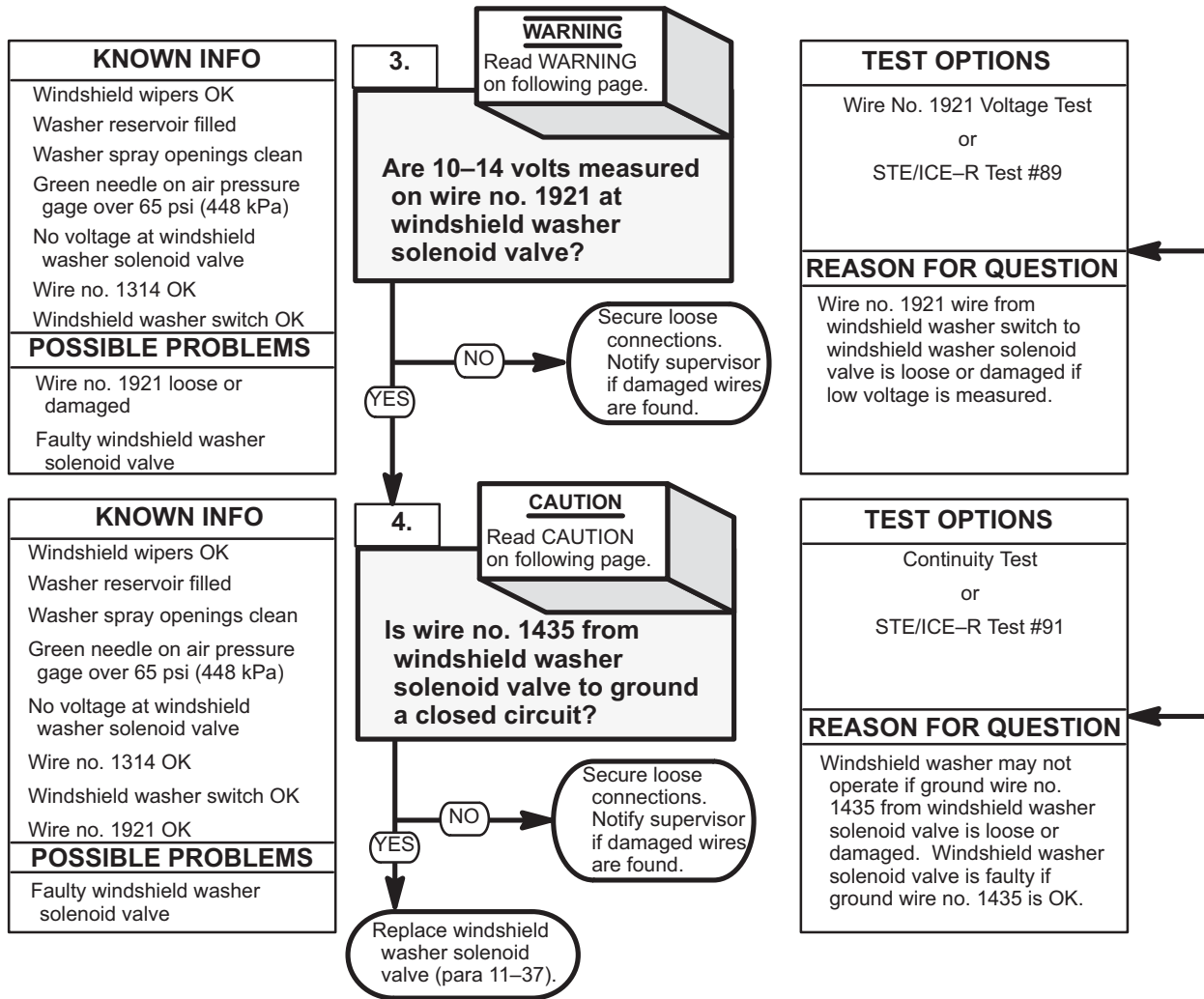
WINDSHIELD WASHER SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1921 at windshield washer switch.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Press windshield washer switch and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



WINDSHIELD WIPER SWITCH

e11. WINDSHIELD WASHER DOES NOT OPERATE (CONT)

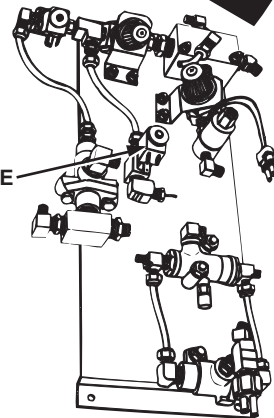
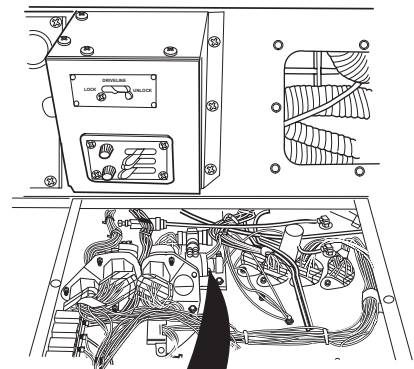


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

**WIRE NO. 1921
VOLTAGE TEST**

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1921 at windshield washer solenoid valve.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Press windshield washer switch and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



WASHER SOLENOID VALVE

Check ground wire no. 1435 from washer control valve for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

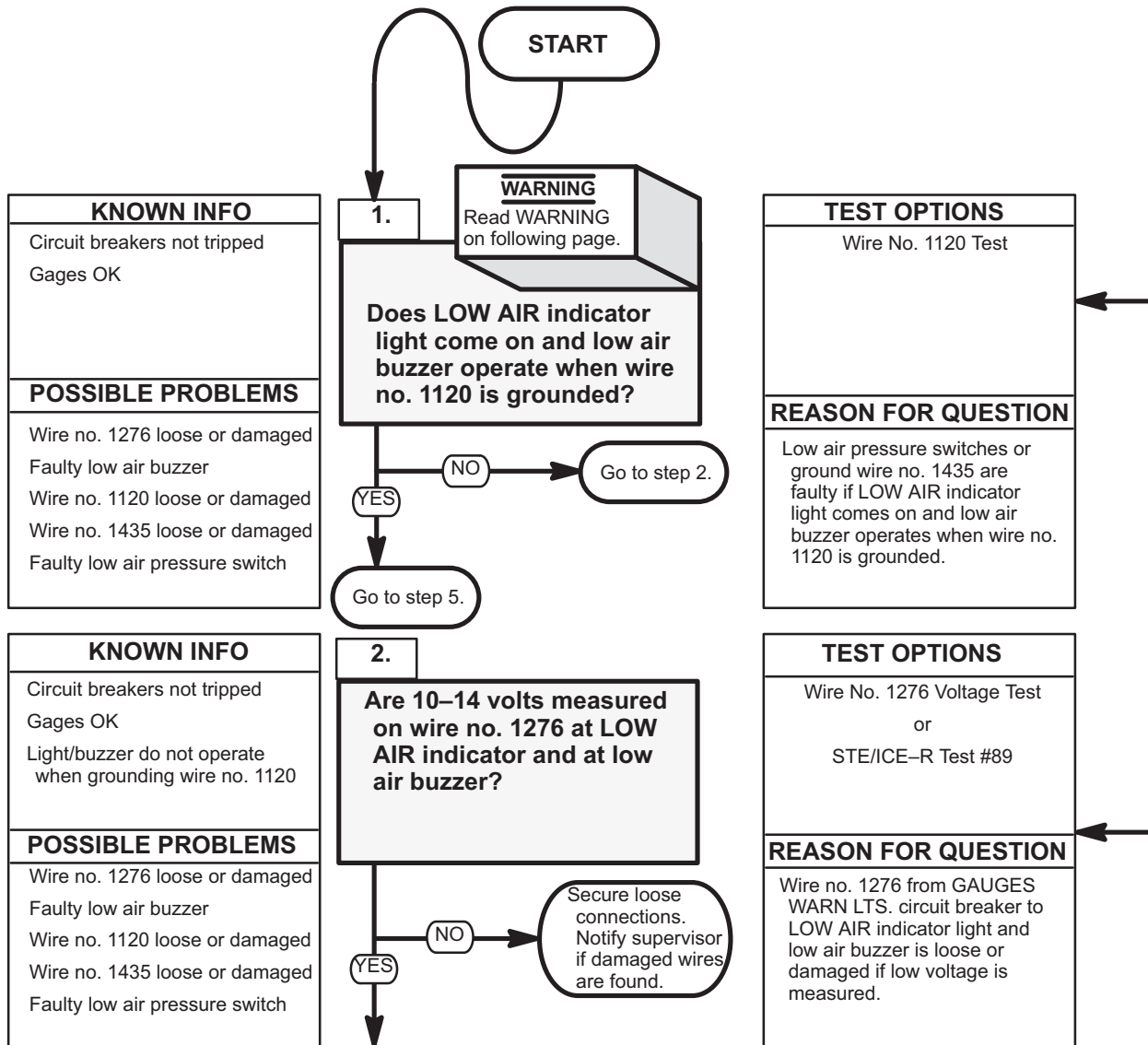
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e12. LOW AIR INDICATOR LIGHT AND/OR BUZZER DO NOT OPERATE WHEN AIR PRESSURE IS BELOW 65 PSI (448 KPA)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

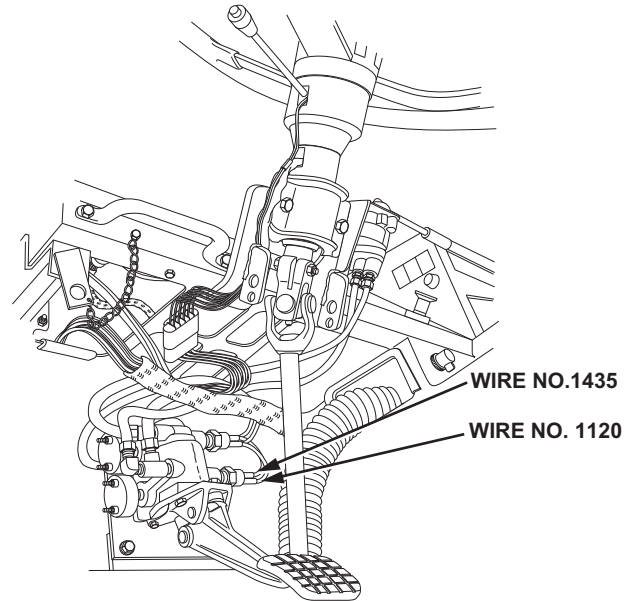
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1120 TEST

NOTE

Air system pressure must be below 65 psi (448 kPa) to perform test.

- (1) Drain air system (TM 9-2320-360-10) until AIR PRESS gage reads less than 65 psi (448 kPa) if necessary.
- (2) Turn ENGINE switch to ON position.
- (3) Remove wire no. 1120 from low air pressure switches.
- (4) Place wire no. 1120 on ground and see if LOW AIR indicator and low air buzzer operate
- (5) Turn ENGINE switch to OFF position.
- (6) Install wire no. 1120 on low air switches.

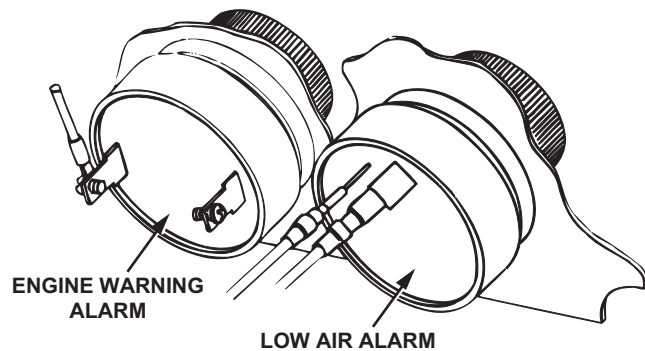
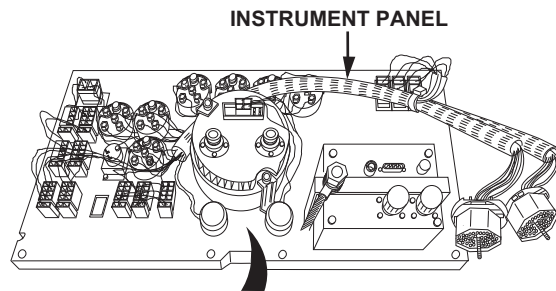


WIRE NO. 1276 VOLTAGE TEST

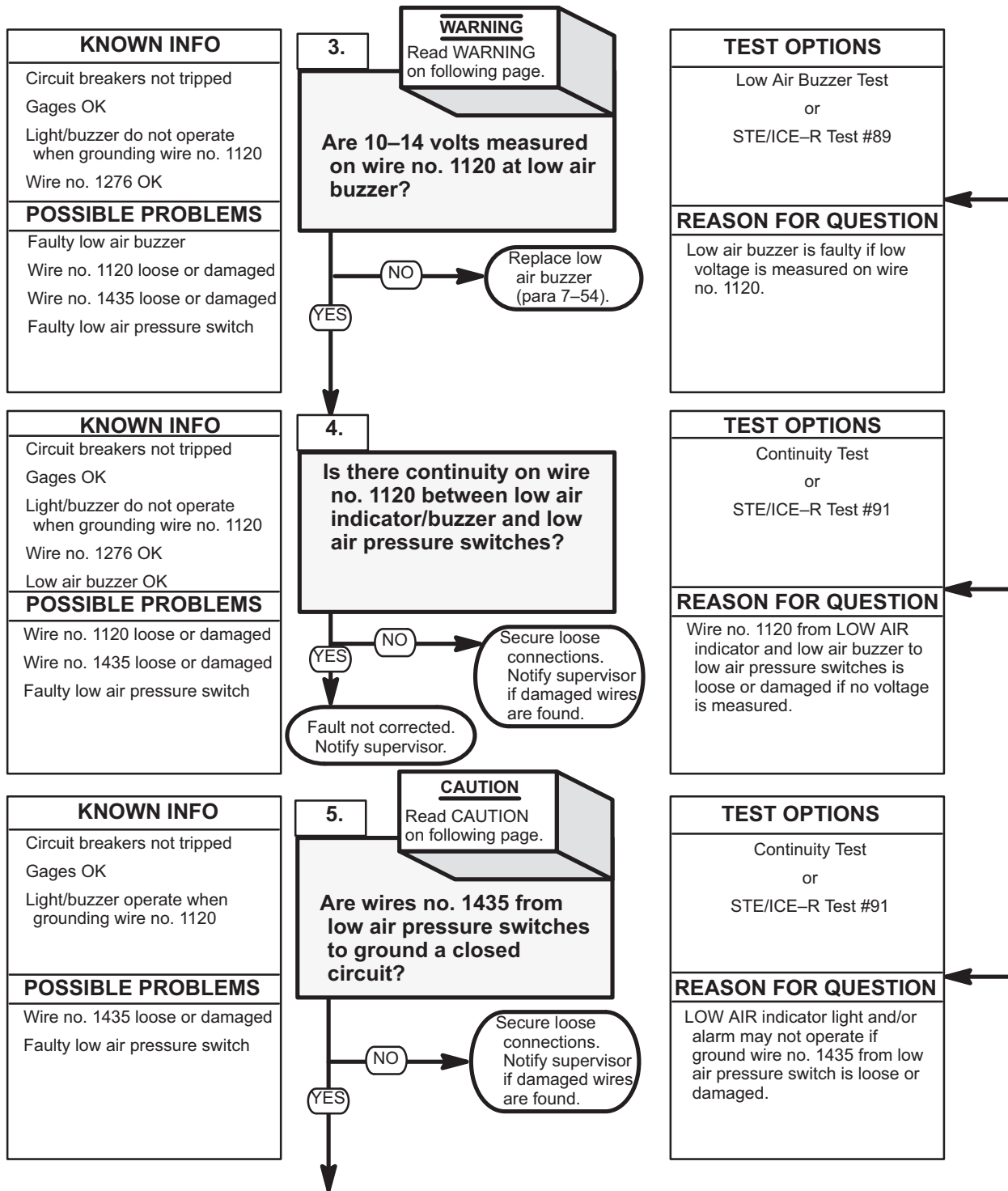
NOTE

Air system pressure must be below 65 psi (448 kPa) to perform test.

- (1) Drain air system (TM 9-2320-360-10) until AIR PRESS gage reads less than 65 psi (448 kPa) if necessary.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on wire no. 1276 at LOW AIR indicator.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place positive (+) probe of multimeter on wire no. 1276 at low air buzzer and note reading on multimeter.
- (6) Turn ENGINE switch to OFF position.



e12. LOW AIR INDICATOR LIGHT AND/OR BUZZER DO NOT OPERATE WHEN AIR PRESSURE IS BELOW 65 PSI (448 KPA) (CONT)



WARNING

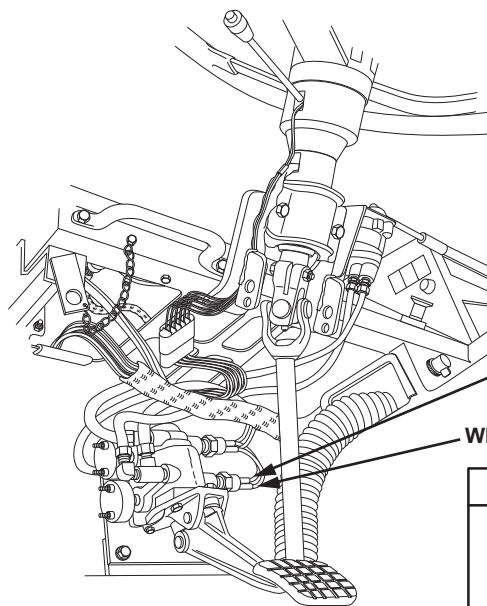
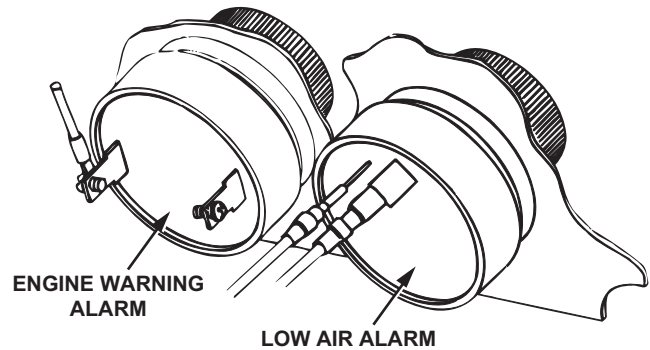
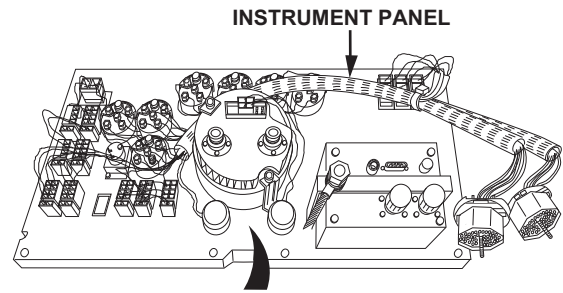
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

LOW AIR BUZZER TEST

NOTE

Air system pressure must be below 65 psi (448 kPa) to perform test.

- (1) Drain air system (TM 9-2320-360-10) until AIR PRESS gage reads less than 65 psi (448 kPa) if necessary.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on wire no. 1120 at low air buzzer.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



Check ground wire no. 1435 from low air pressure switches for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

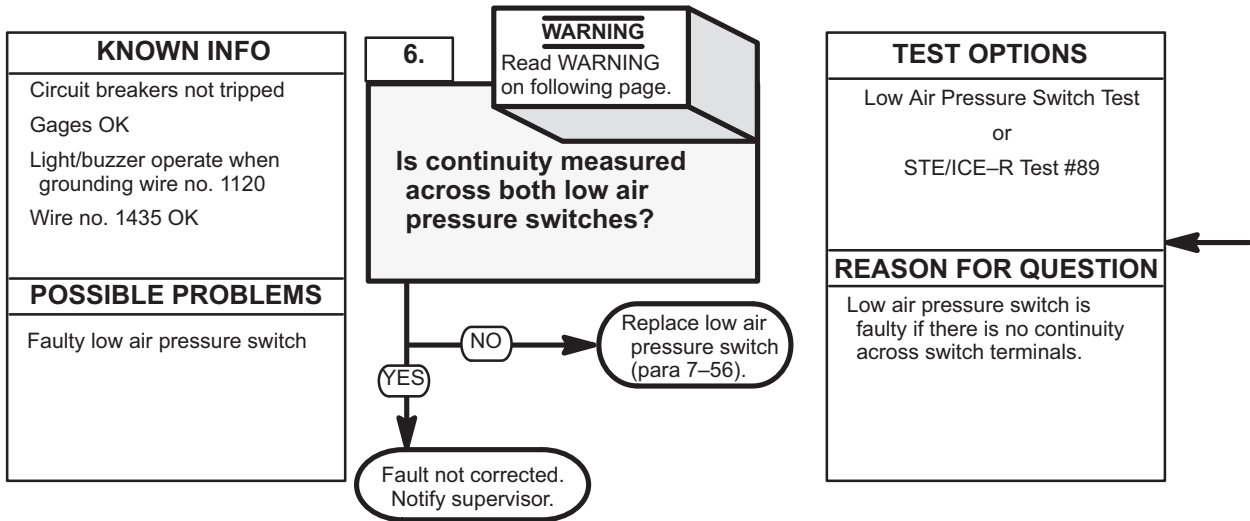
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e12. LOW AIR INDICATOR LIGHT AND/OR BUZZER DO NOT OPERATE WHEN AIR PRESSURE IS BELOW 65 PSI (448 KPA) (CONT)



WARNING

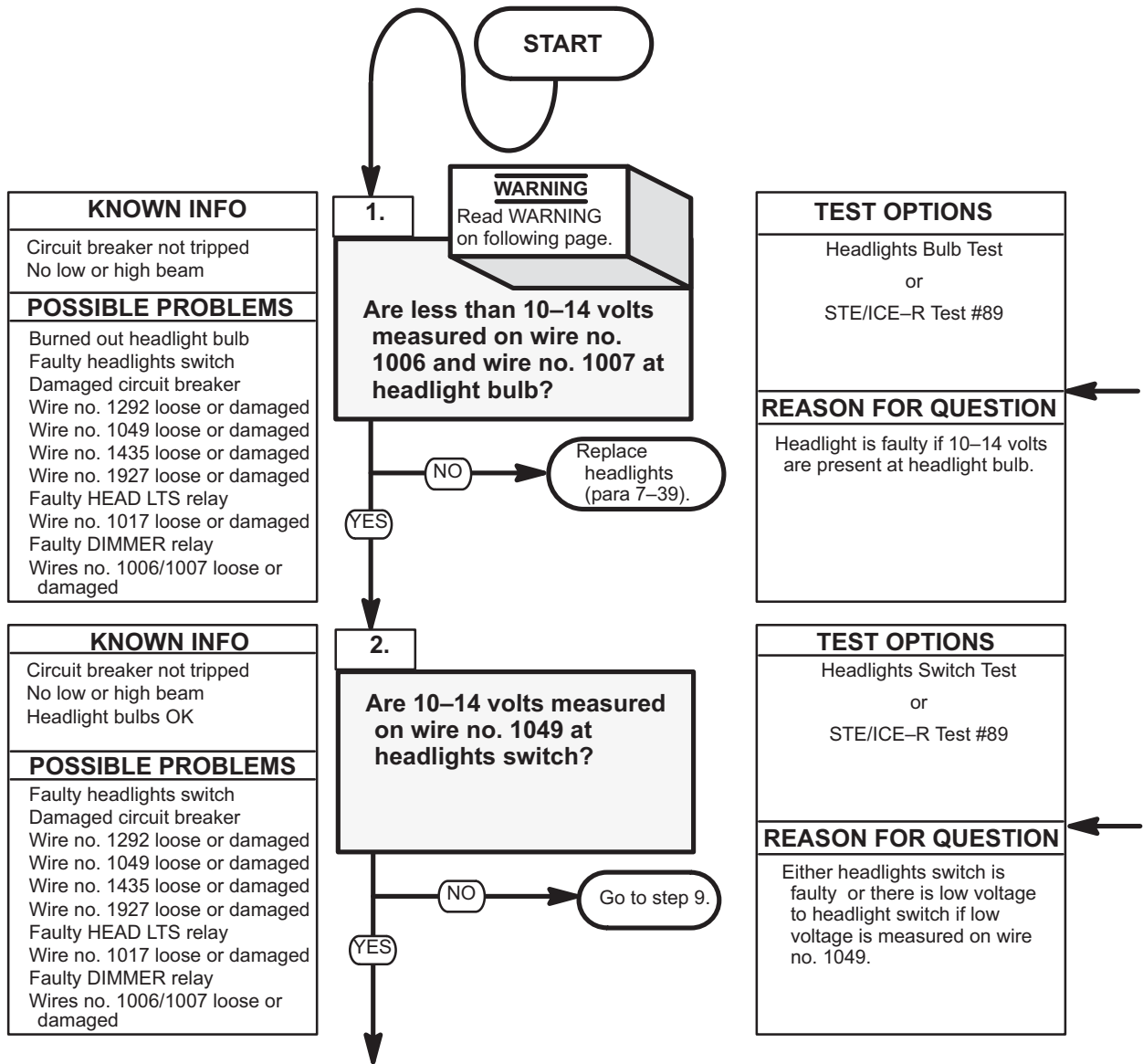
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

LOW AIR PRESSURE SWITCH TEST**NOTE**

Air system pressure must be below 65 psi (448 kPa) to perform test.

- (1) Drain air system (TM 9-2320-360-10) until AIR PRESS gage reads less than 65 psi (448 kPa) if necessary.
- (2) Set multimeter to ohms position.
- (3) Place positive (+) probe of multimeter on wire no. 1435 at low air pressure switch.
- (4) Place negative (-) probe of multimeter on ground and check multimeter for continuity.
- (5) Repeat steps (3) and (4) for other low air pressure switch.

e13. HEADLIGHTS DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

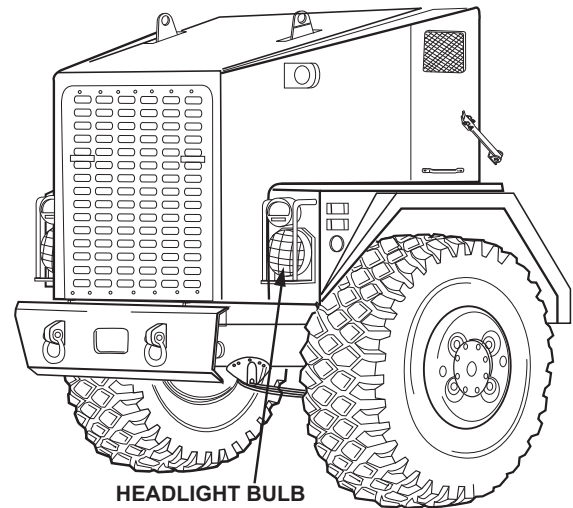
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

Headlights will not operate if BLACK OUT LIGHTS switch is in the on position.

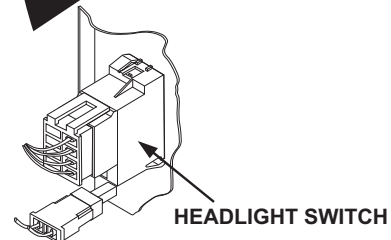
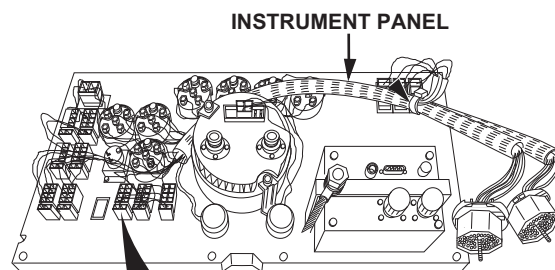
HEADLIGHT BULB TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place HEADLIGHT switch in the ON position.
- (3) Place HEADLIGHT DIMMER switch in the low beam position (TM 9-2320-360-10).
- (4) Place positive (+) probe of multimeter on wire no. 1006 at headlight bulb.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place HEADLIGHT DIMMER switch in the high beam position (TM 9-2320-360-10).
- (7) Place positive (+) probe of multimeter on wire no. 1007 at headlight bulb.
- (8) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (9) Place HEADLIGHT switch in the OFF position.
- (10) Turn ENGINE switch to OFF position.

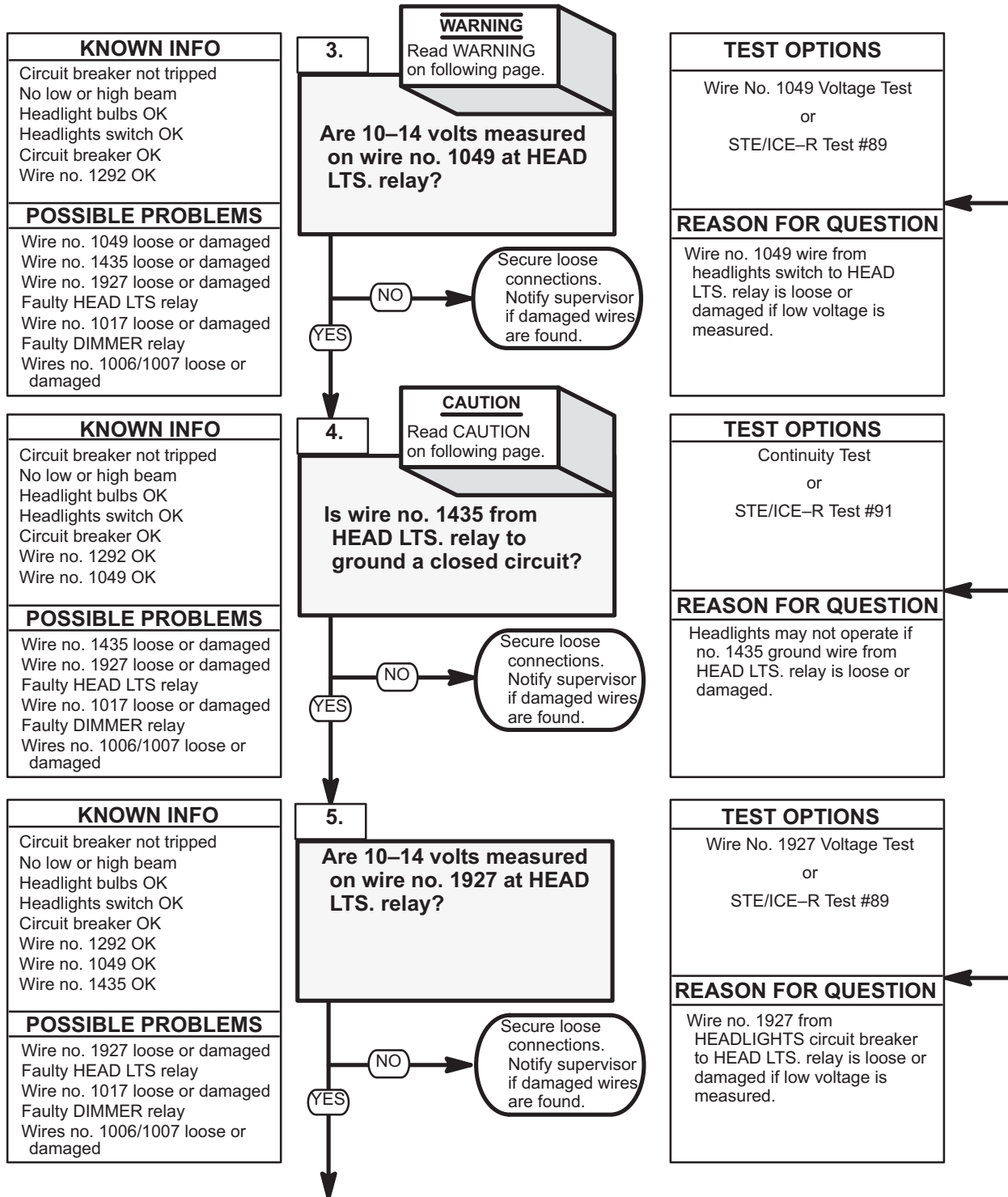


HEADLIGHTS SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1049 at headlights switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in the off position.
- (6) Turn ENGINE switch to OFF position.



e13. HEADLIGHTS DO NOT OPERATE (CONT)

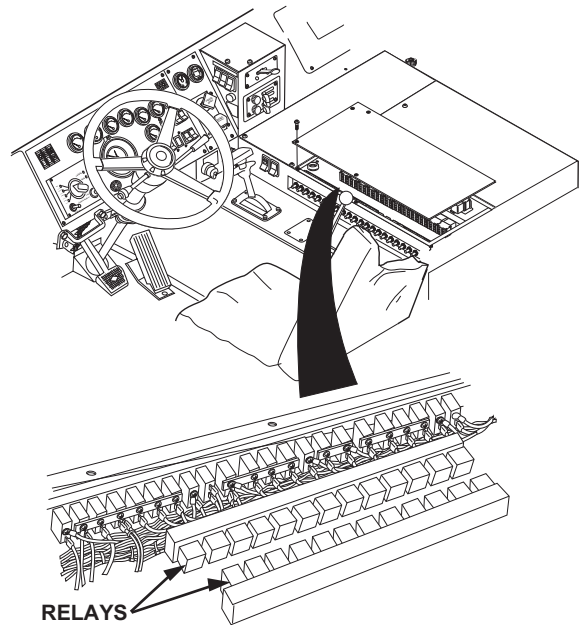


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1049 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1049 at HEAD LTS relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in the off position.
- (6) Turn ENGINE switch to OFF position.



Check ground wire no. 1435 from HEAD LTS. relay for loose connections or damage.

WIRE NO. 1927 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1927 at HEAD LTS. relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in the off position.
- (6) Turn ENGINE switch to OFF position.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

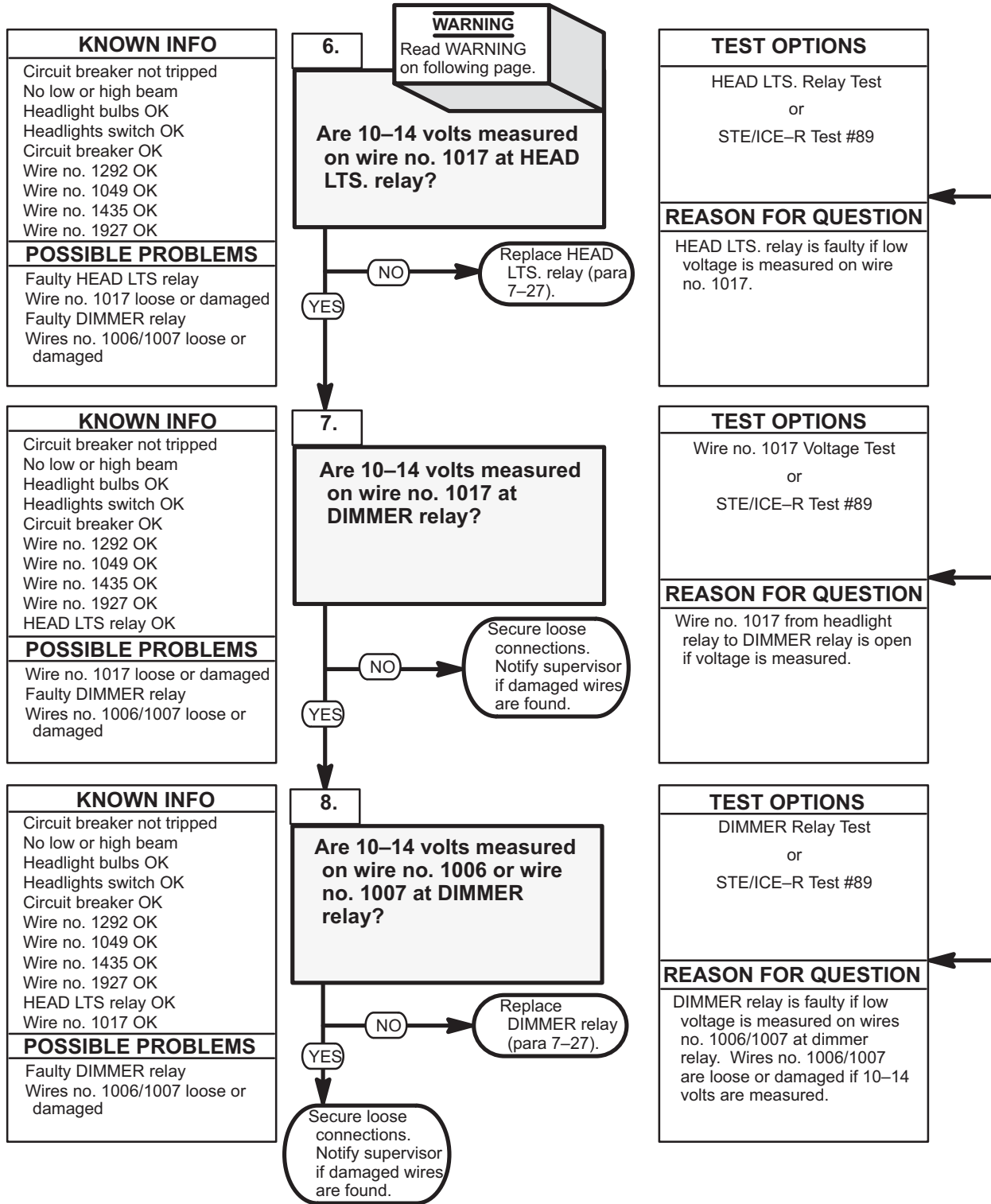
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e13. HEADLIGHTS DO NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

HEAD LTS. RELAY TEST

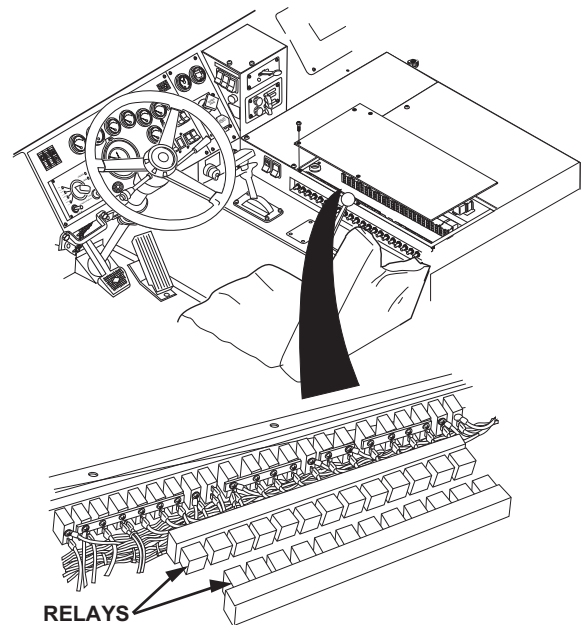
- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1017 at HEAD LTS. relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in the off position.
- (6) Turn ENGINE switch to OFF position.

WIRE NO. 1017 VOLTAGE TEST

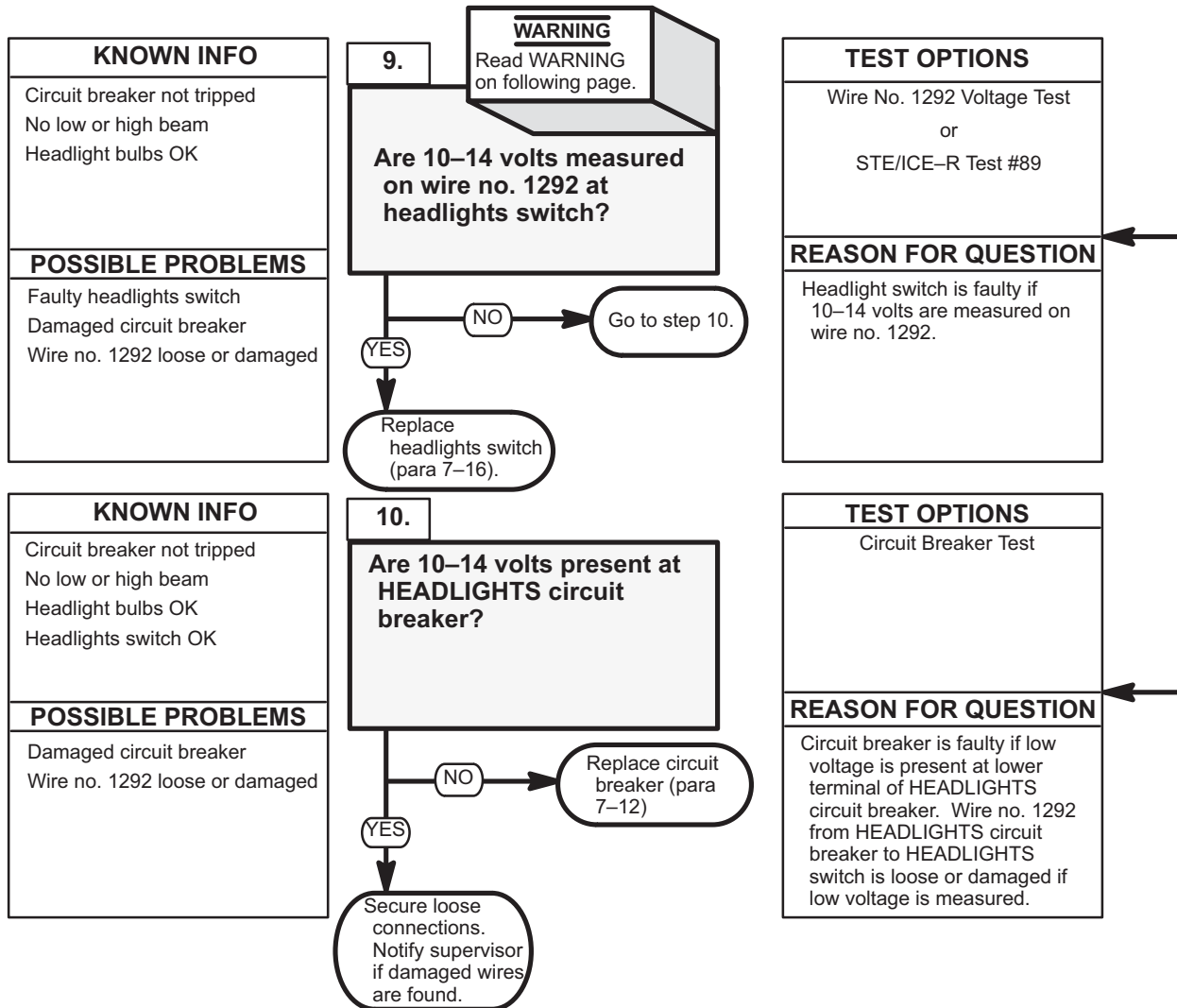
- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1017 at DIMMER relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in the off position.
- (6) Turn ENGINE switch to OFF position.

DIMMER RELAY TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place HEADLIGHT switch in the ON position.
- (3) Place HEADLIGHT DIMMER switch in the low beam position.
- (4) Place positive (+) probe of multimeter on wire no. 1006 at DIMMER relay.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place HEADLIGHT DIMMER switch in the high beam position.
- (7) Place positive (+) probe of multimeter on wire no. 1007 at DIMMER relay.
- (8) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (9) Place HEADLIGHT switch in the OFF position.
- (10) Turn ENGINE switch to OFF position.



e13. HEADLIGHTS DO NOT OPERATE (CONT)

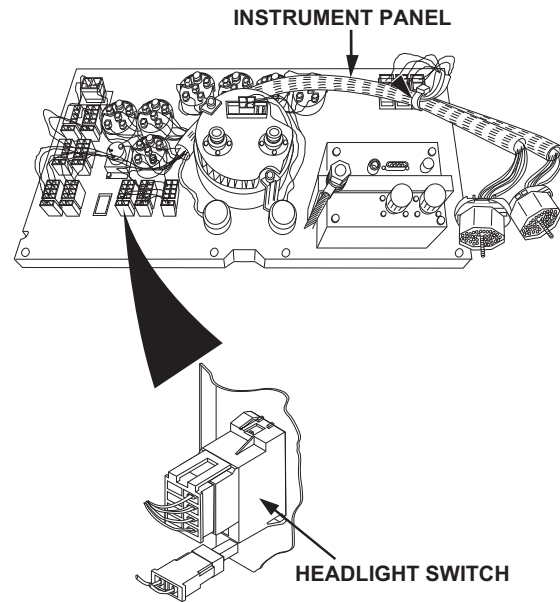


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

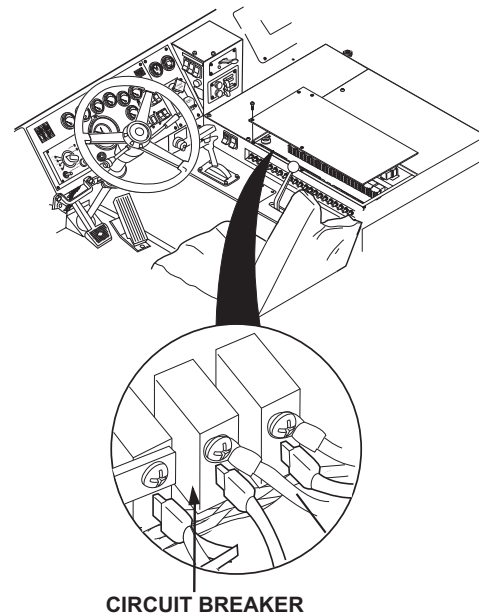
WIRE NO. 1292 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1292 at headlights switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

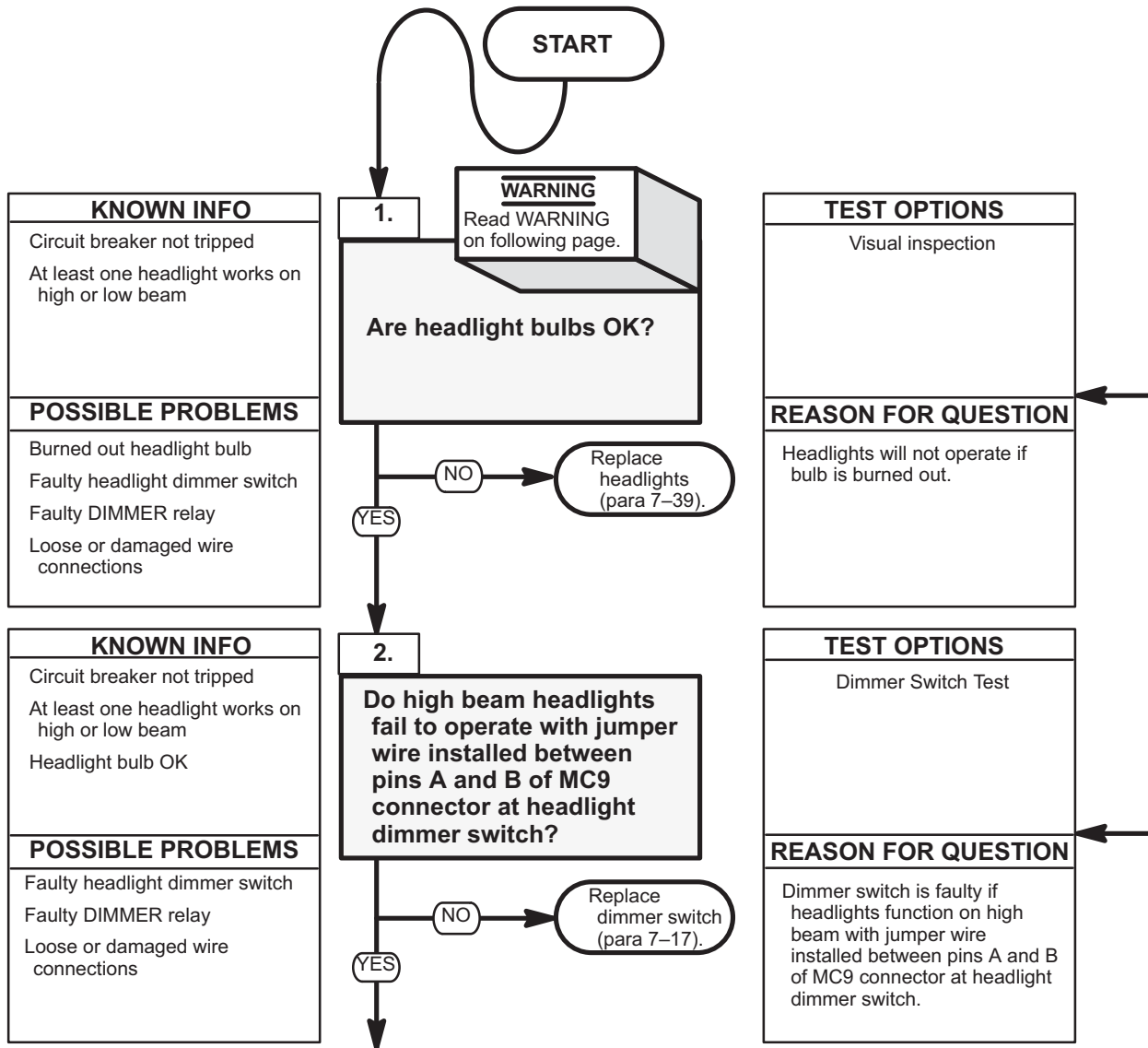


CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



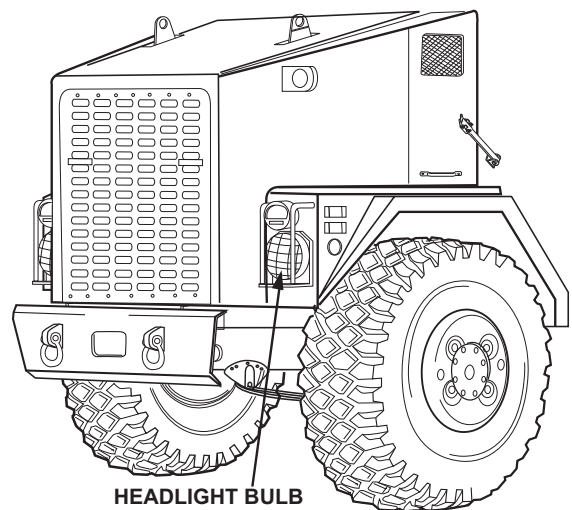
e14. HEADLIGHTS LOW/HIGH BEAM DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

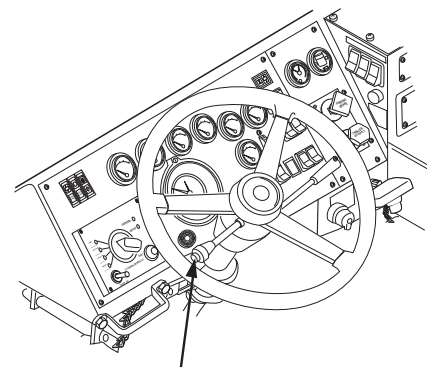
Check headlights for burned out bulb if only one headlight does not operate.



HEADLIGHT BULB

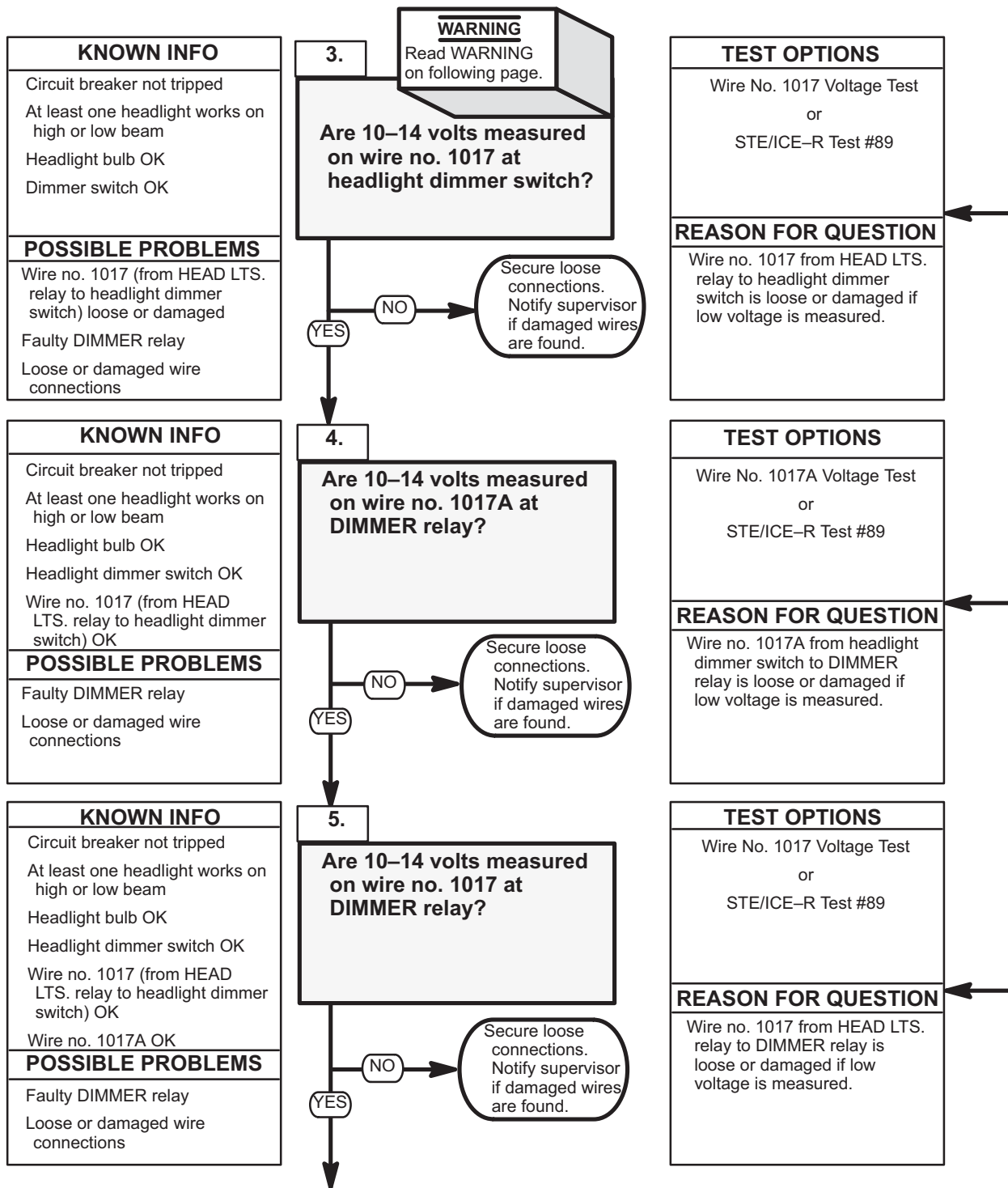
DIMMER SWITCH TEST

- (1) Unplug MC9 connector at headlight dimmer switch.
- (2) Install jumper wire between pins A and B of MC9 connector.
- (3) Turn ENGINE switch to ON position.
- (4) Place headlights switch in the ON position.
- (5) Observe to see if headlights operate on high beam.
- (6) Place headlights switch in the off position.
- (7) Turn ENGINE switch to OFF position.
- (8) Remove jumper wire and plug in MC9 connector.



HEADLIGHT DIMMER SWITCH

e14. HEADLIGHTS LOW/HIGH BEAM DOES NOT OPERATE (CONT)

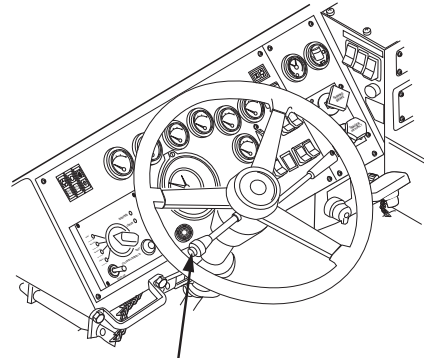


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1017 VOLTAGE TEST

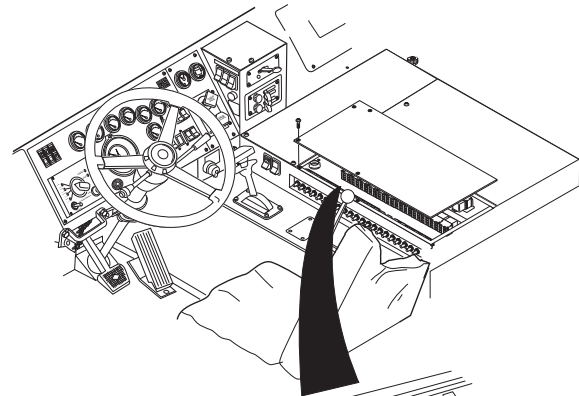
- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1017 at headlight dimmer switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in the off position.
- (6) Turn ENGINE switch to OFF position.



HEADLIGHT DIMMER SWITCH

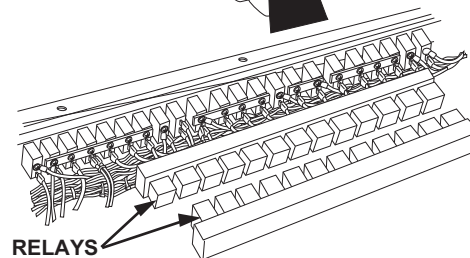
WIRE NO. 1017A VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place headlight dimmer switch in the high beam position.
- (4) Place positive (+) probe of multimeter on wire no. 1017A at DIMMER relay.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place headlights switch in the off position.
- (7) Turn ENGINE switch to OFF position.



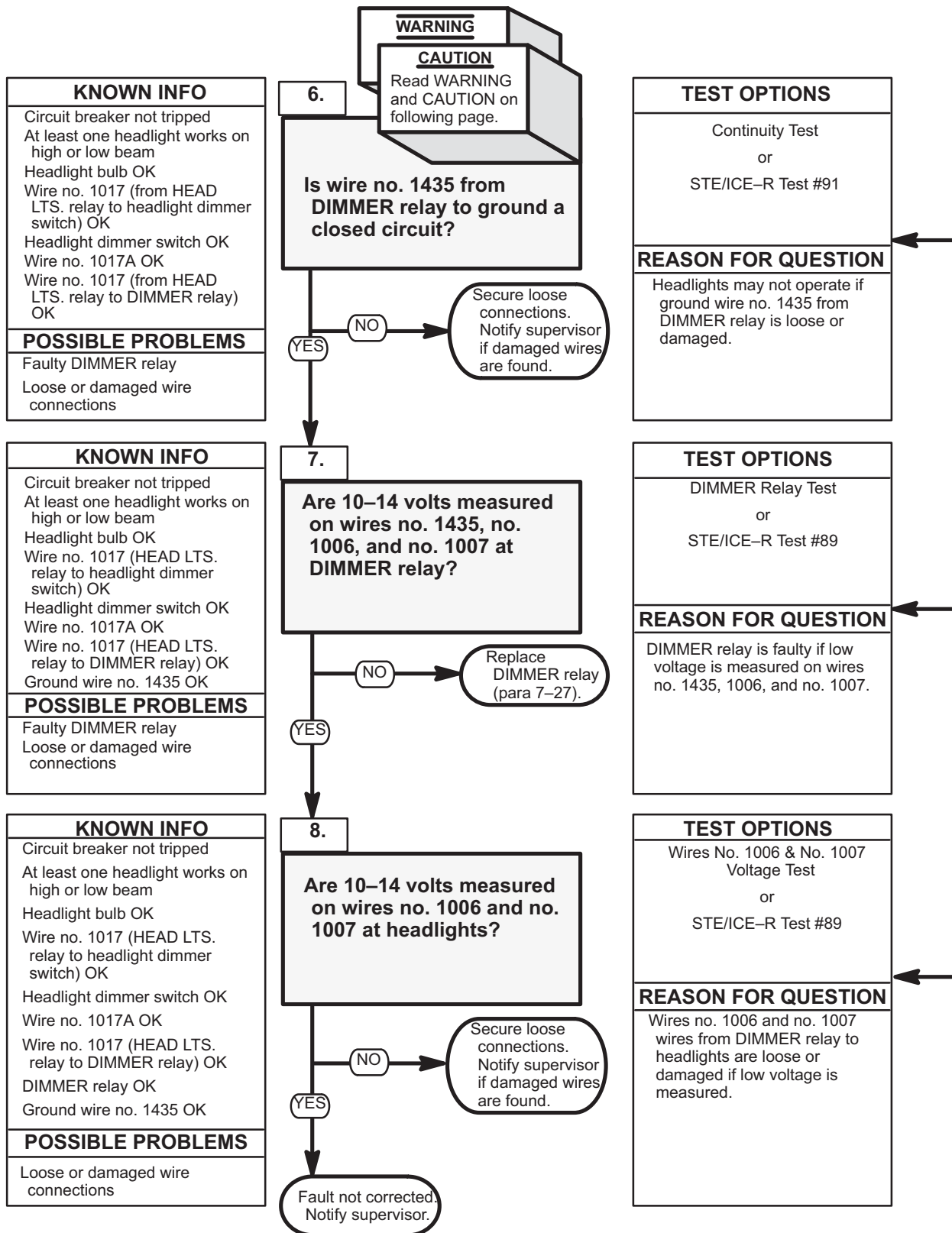
WIRE NO. 1017 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place headlight dimmer switch in the high beam position.
- (4) Place positive (+) probe of multimeter on wire no. 1017 at DIMMER relay.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place headlights switch in the off position.
- (7) Turn ENGINE switch to OFF position.



RELAYS

e14. HEADLIGHTS LOW/HIGH BEAM DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from HEAD LTS. relay for loose connections or damage.

DIMMER RELAY TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place headlight dimmer switch in the low beam position.
- (4) Place positive (+) probe of multimeter on wire no. 1435 at DIMMER relay.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place positive (+) probe of multimeter on wire no. 1006 at DIMMER relay.
- (7) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (8) Place headlight dimmer switch in the high beam position.
- (9) Place positive (+) probe of multimeter on wire no. 1007 at DIMMER relay.
- (10) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (11) Place headlights switch in the off position.
- (12) Turn ENGINE switch to OFF position.

WIRES NO. 1006 & NO. 1007 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in the on position.
- (3) Place headlight dimmer switch in the low beam position.
- (4) Place positive (+) probe of multimeter on wire no. 1006 at headlights.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place headlight dimmer switch in the high beam position.
- (7) Place positive (+) probe of multimeter on wire no. 1007 at headlights.
- (8) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (9) Place headlights switch in the off position.
- (10) Turn ENGINE switch to OFF position.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

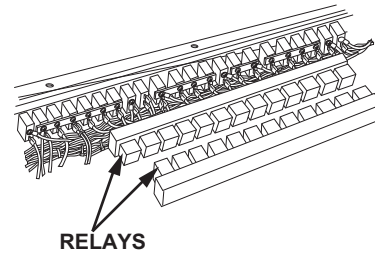
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

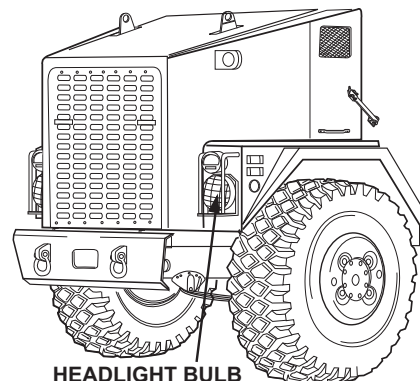
NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

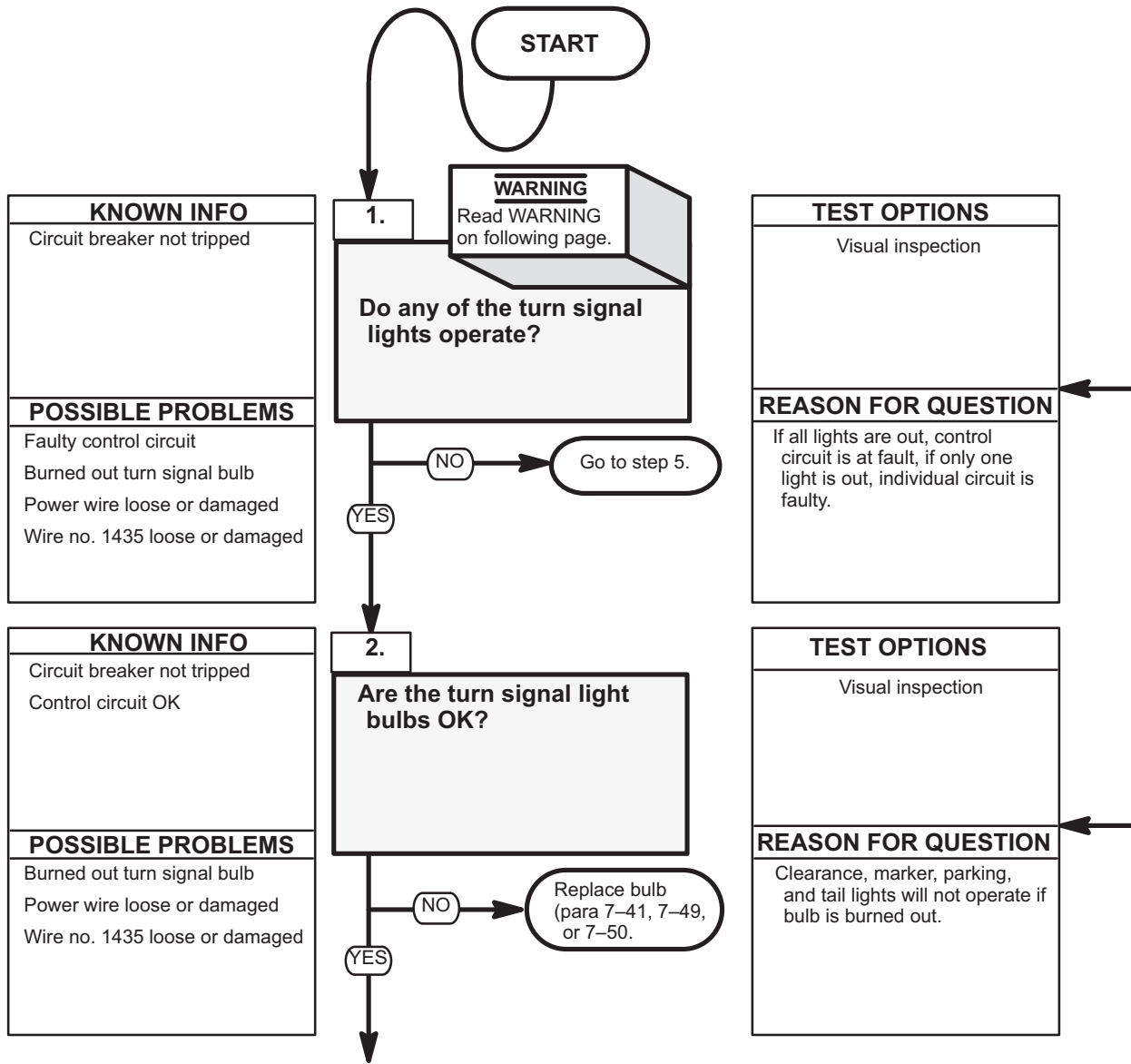


RELAYS



HEADLIGHT BULB

e15. TURN SIGNAL LIGHT DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



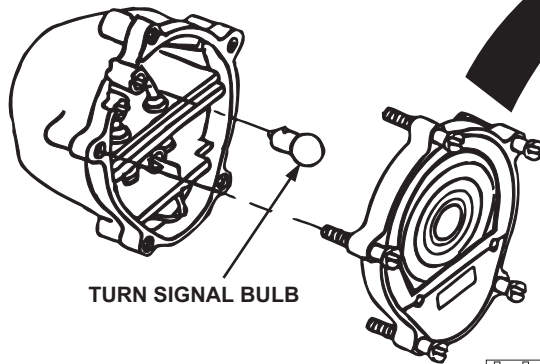
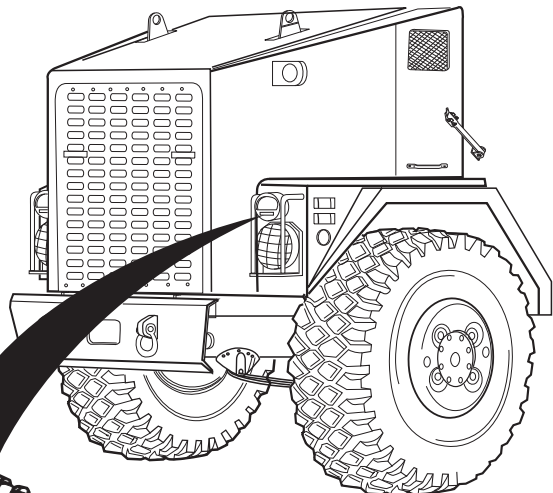
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

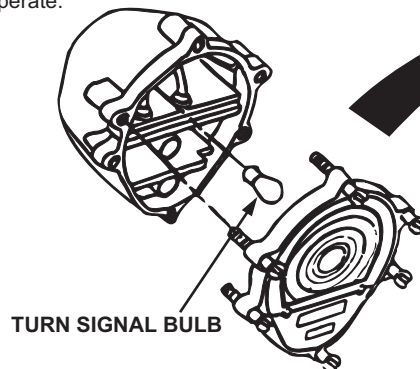
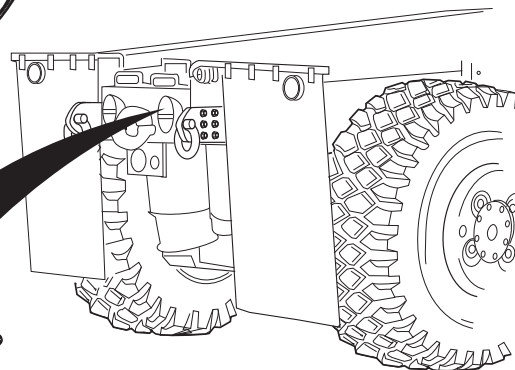
NOTE

Turn signal will not operate if BLACK OUT LIGHTS switch is in the on position.

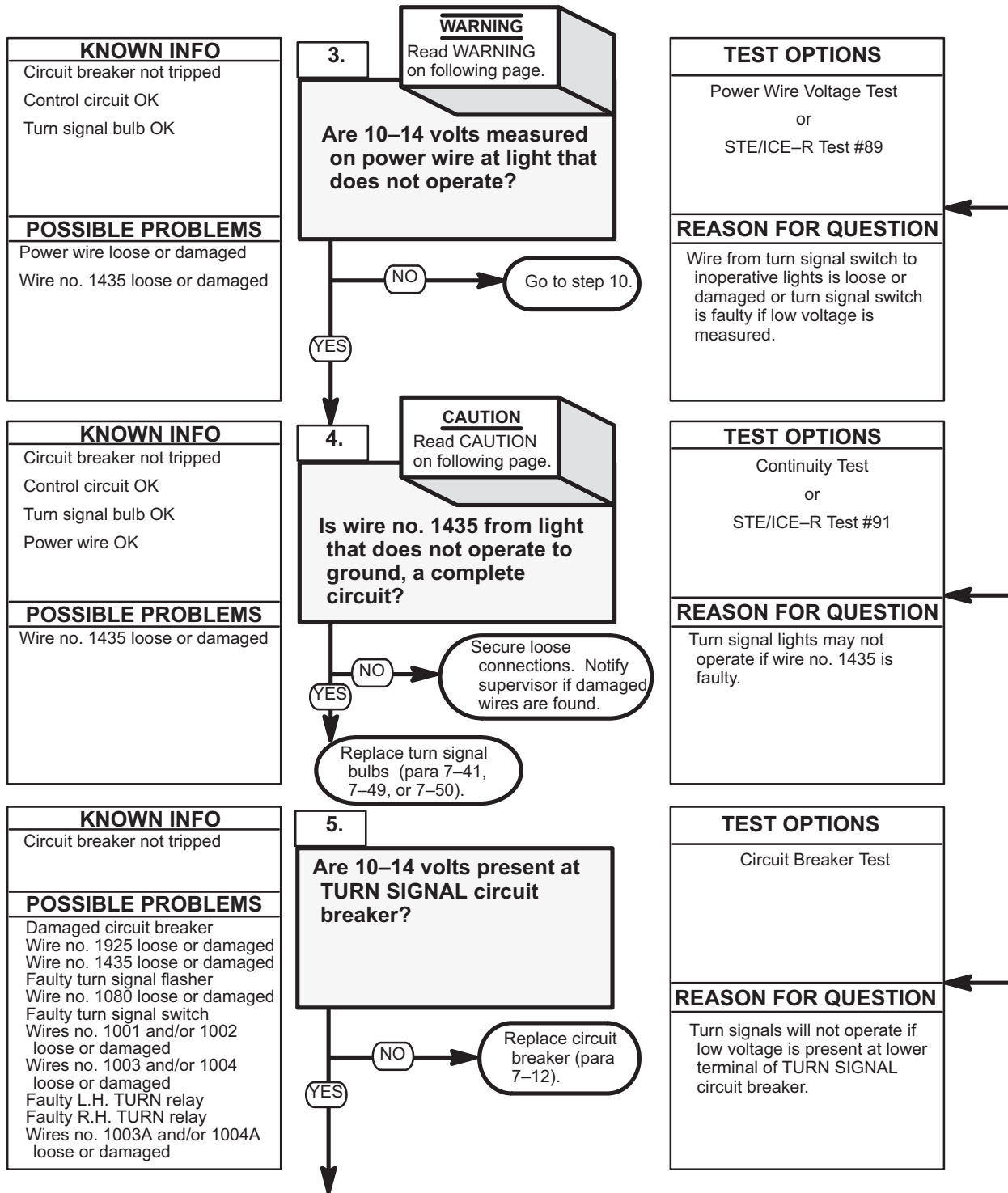
Check turn signal lights for operation (TM 9-2320-360-10).



Check turn signals for burned out bulb if only one turn signal does not operate.



e15. TURN SIGNAL LIGHT DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

Power wire for right front turn signal is wire no. 1001, left front is wire no. 1002, right rear is wire no. 1004A, and left rear is wire no. 1003A.

WIRE NO. 1012 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place turn signal switch in left or right position.
- (3) Place positive (+) probe of multimeter on power wire at inoperative light.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place turn signal switch in center position.
- (6) Turn ENGINE switch to OFF position.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

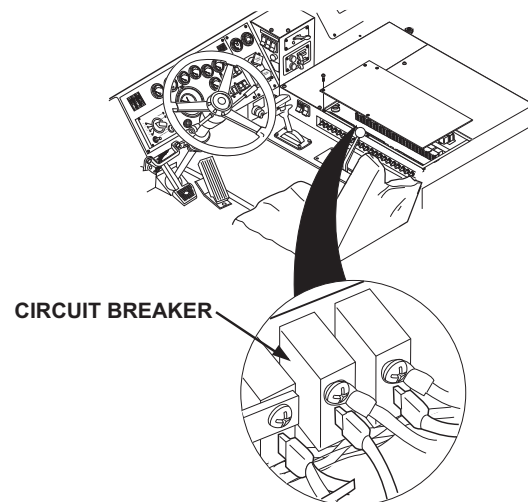
NOTE

Any reading besides infinity indicates a grounded wire.

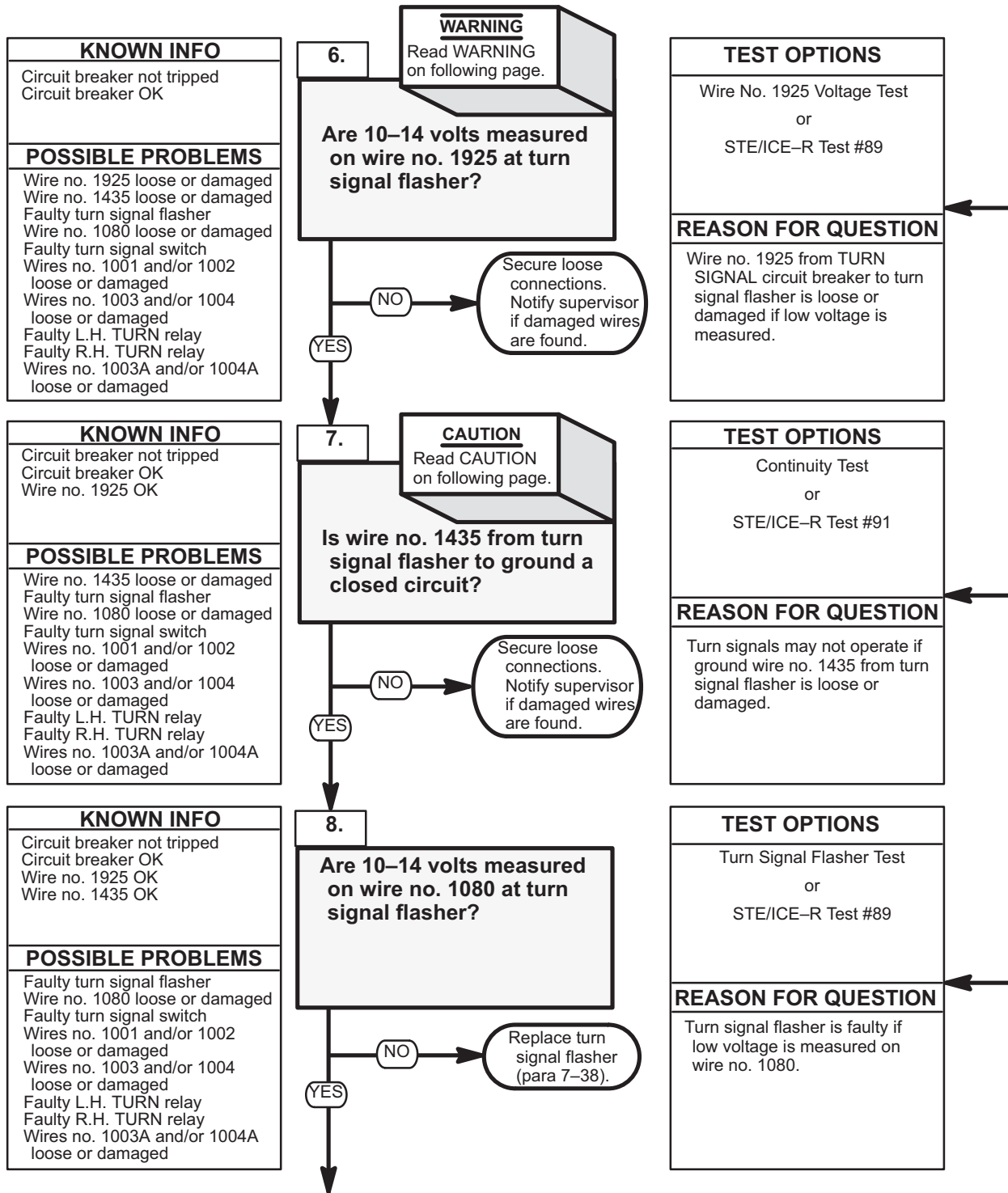
- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



e15. TURN SIGNAL LIGHT DOES NOT OPERATE (CONT)

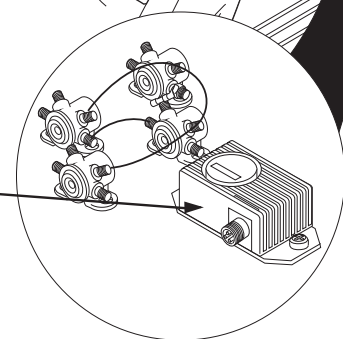
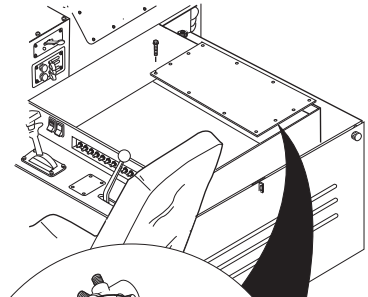


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1925 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1925 at turn signal flasher.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



TURN SIGNAL FLASHER

Check ground wire no. 1435 from turn signal flasher for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

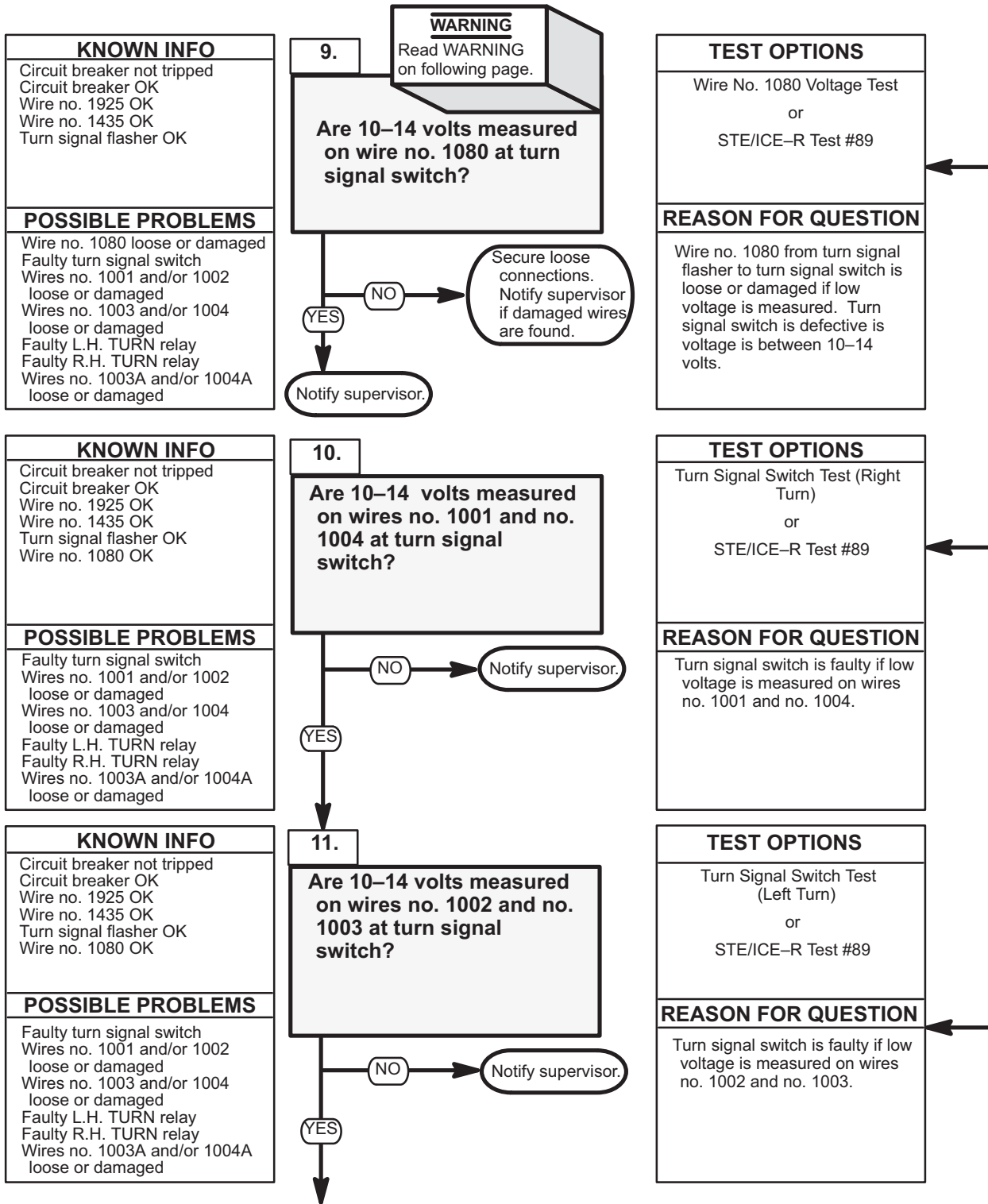
Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

TURN SIGNAL FLASHER TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1080 at turn signal flasher.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

e15. TURN SIGNAL LIGHT DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1080 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1080 at turn signal switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

TURN SIGNAL SWITCH TEST (RIGHT TURN)

- (1) Turn ENGINE switch to ON position.
- (2) Place turn signal switch in right turn position.

NOTE

Wire no. 1001 operates right turn signal indicator and right front turn signal.

- (3) Place positive (+) probe of multimeter on wire no. 1001 at turn signal switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.

NOTE

Wire no. 1004 operates right rear turn signal.

- (5) Place positive (+) probe of multimeter on wire no. 1004 at turn signal switch.
- (6) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (7) Place turn signal switch in off position.
- (8) Turn ENGINE switch to OFF position.

TURN SIGNAL SWITCH TEST (LEFT TURN)

- (1) Turn ENGINE switch to ON position.
- (2) Place turn signal switch in left turn position.

NOTE

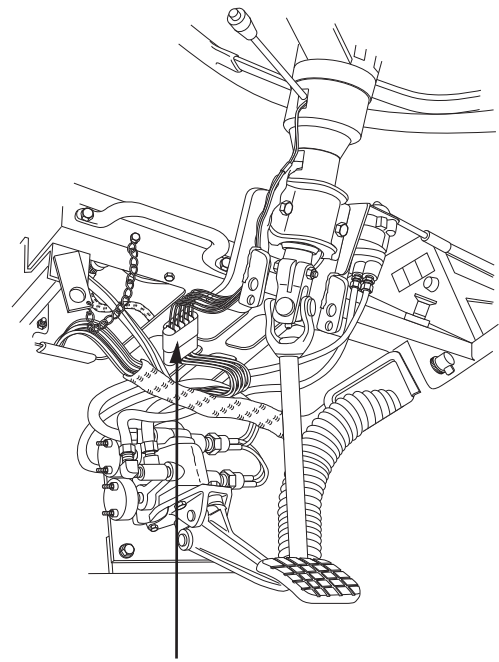
Wire no. 1002 operates left turn signal indicator and left front turn signal.

- (3) Place positive (+) probe of multimeter on wire no. 1002 at turn signal switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.

NOTE

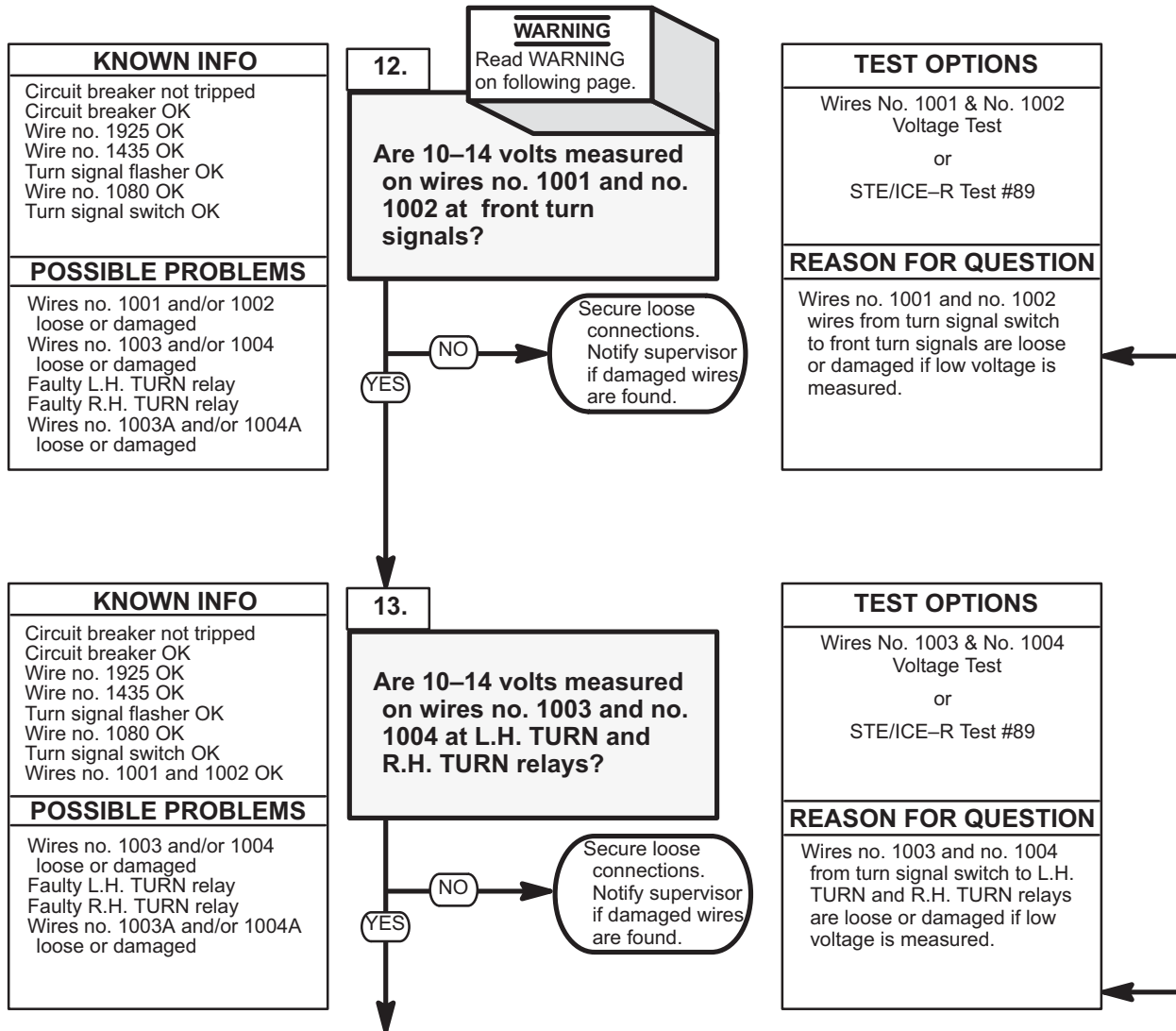
Wire no. 1003 operates left rear turn signal.

- (5) Place positive (+) probe of multimeter on wire no. 1003 at turn signal switch.
- (6) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (7) Place turn signal switch in off position.
- (8) Turn ENGINE switch to OFF position.



TURN SIGNAL SWITCH CONNECTOR

e15. TURN SIGNAL LIGHT DOES NOT OPERATE (CONT)

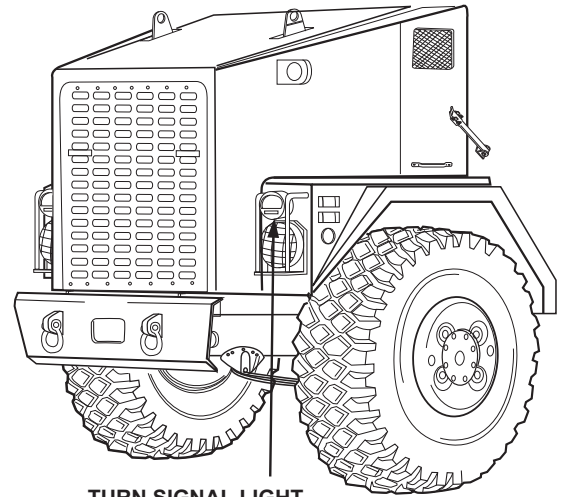


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

**WIRES NO. 1001 & NO. 1002
VOLTAGE TEST**

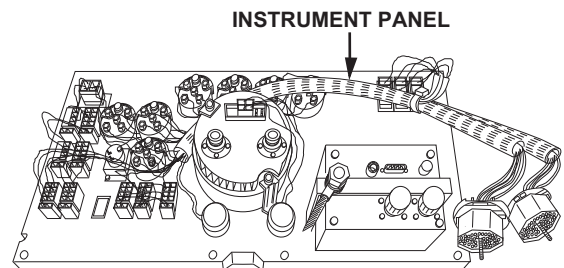
- (1) Turn ENGINE switch to ON position.
- (2) Place turn signal switch in left turn position.
- (3) Place positive (+) probe of multimeter on wire no. 1002 at left front turn signal.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place turn signal switch in right turn position.
- (6) Place positive (+) probe of multimeter on wire no. 1001 at right front turn signal.
- (7) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (8) Place turn signal switch in off position.
- (9) Turn ENGINE switch to OFF position.



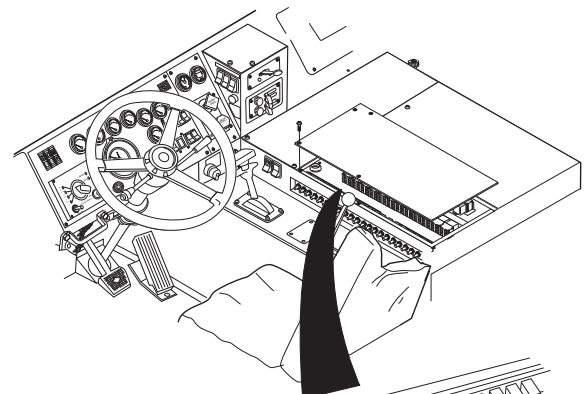
TURN SIGNAL LIGHT

**WIRES NO. 1003 & NO. 1004
VOLTAGE TEST**

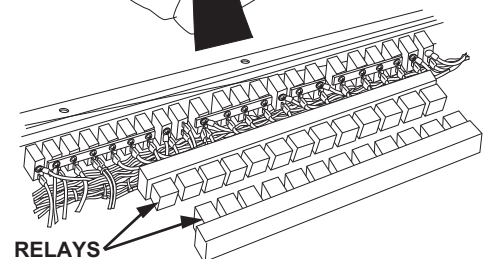
- (1) Turn ENGINE switch to ON position.
- (2) Place turn signal switch in left turn position.
- (3) Place positive (+) probe of multimeter on wire no. 1003 at L.H. TURN relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place turn signal switch in right turn position.
- (6) Place positive (+) probe of multimeter on wire no. 1004 at R.H. TURN relay.
- (7) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (8) Place turn signal switch in off position.
- (9) Turn ENGINE switch to OFF position.



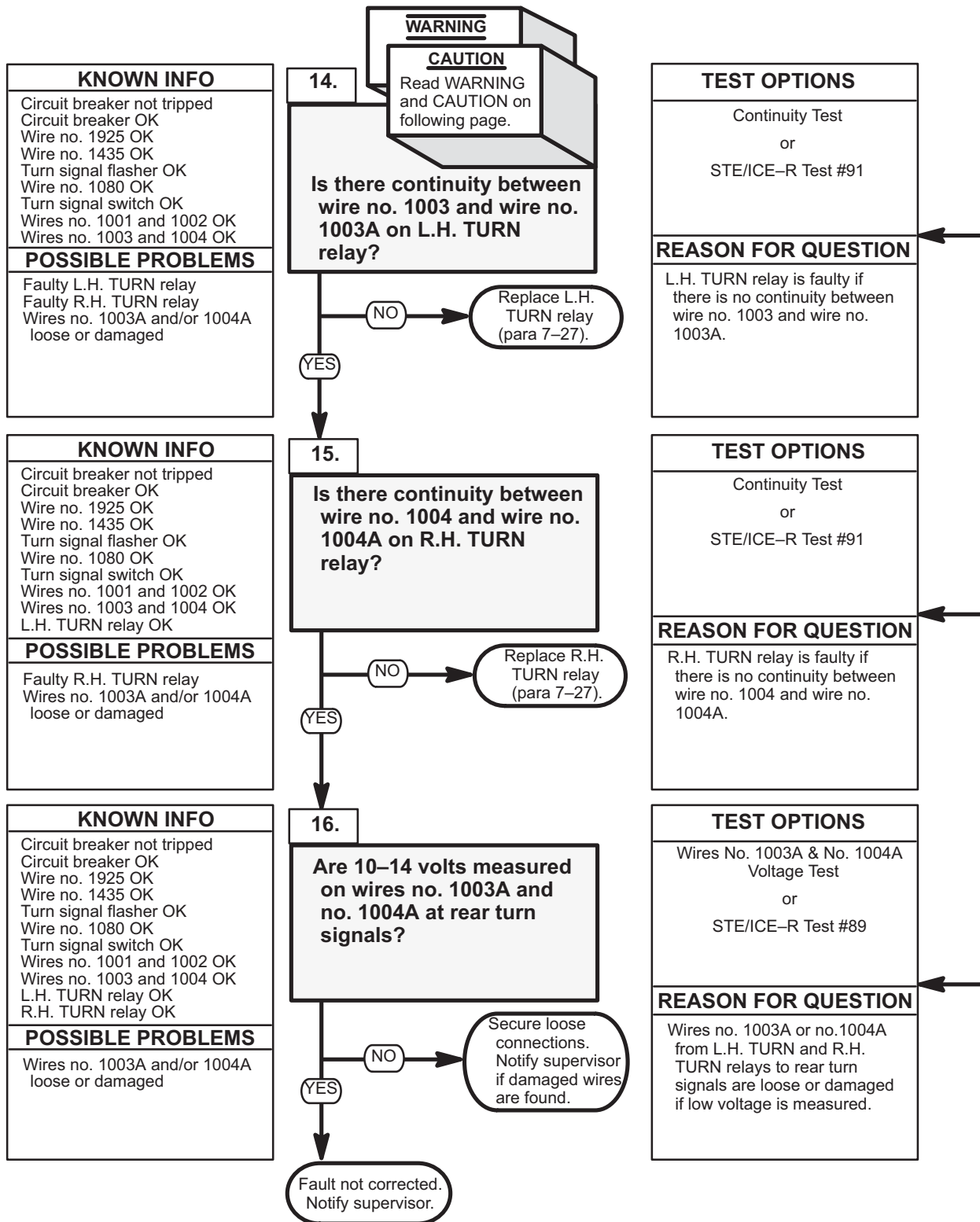
INSTRUMENT PANEL



RELAYS



e15. TURN SIGNAL LIGHT DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check for continuity between terminal 30 and terminal 87A on L.H. TURN relay.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

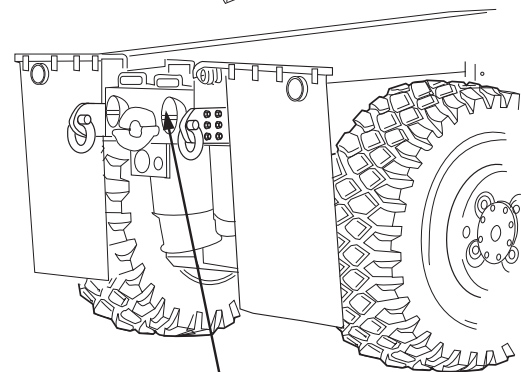
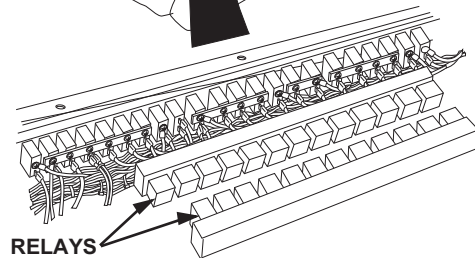
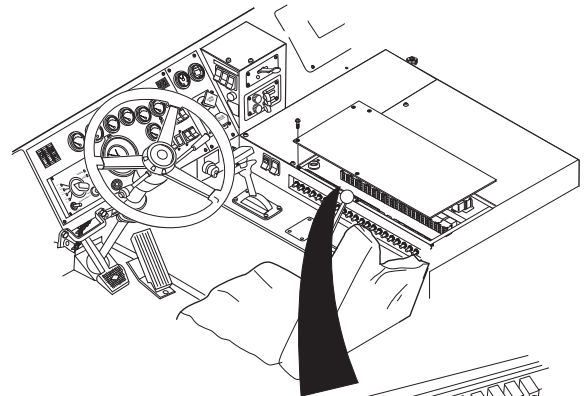
- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to terminal 30 and terminal 87A and check multimeter for continuity.

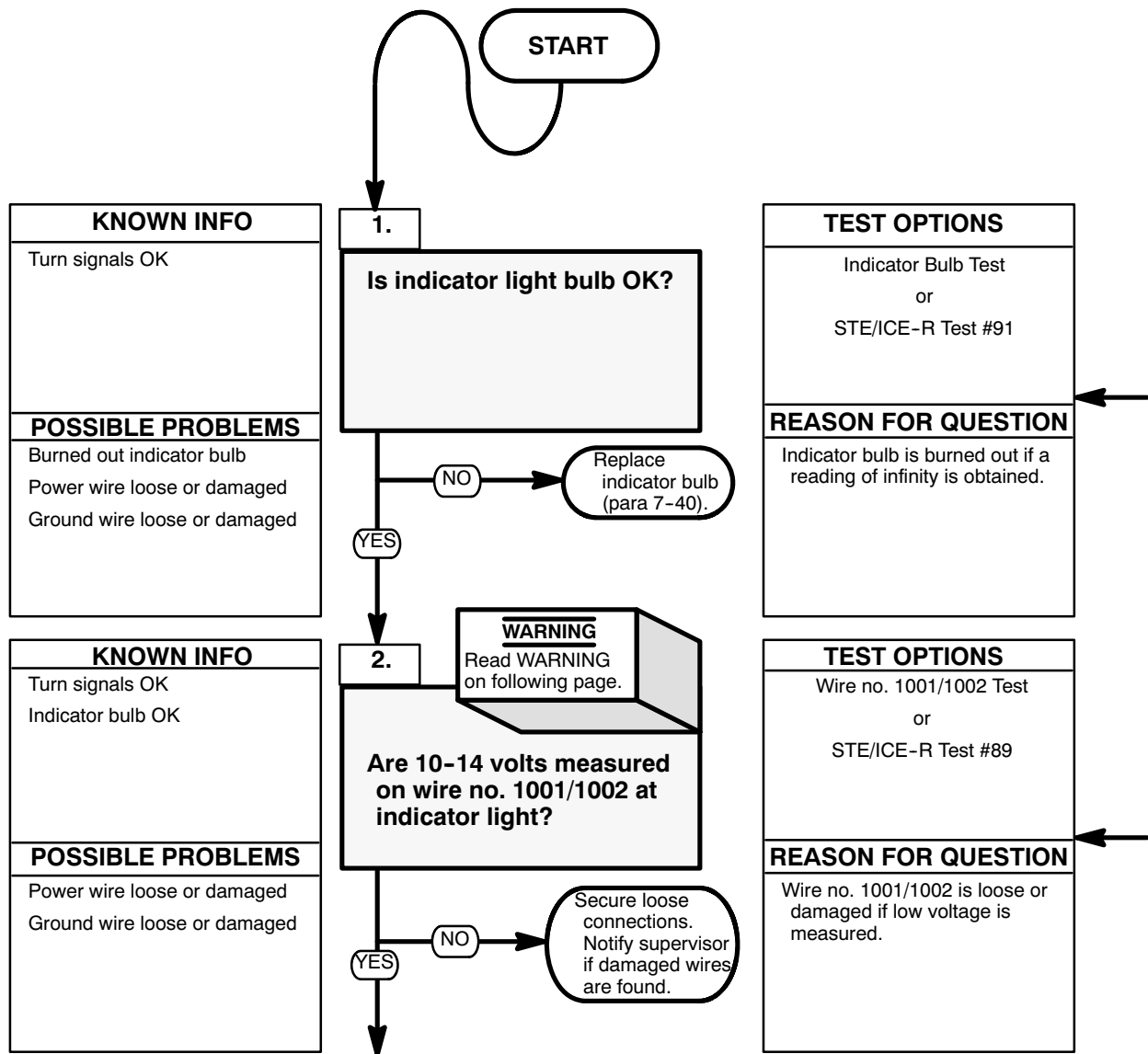
Check for continuity between terminal 30 and terminal 87A on R.H. TURN relay.



**WIRES NO. 1003A & NO. 1004A
VOLTAGE TEST**

- (1) Turn ENGINE switch to ON position.
- (2) Place turn signal switch in left turn position.
- (3) Place positive (+) probe of multimeter on wire no. 1003A at left rear turn signal.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place turn signal switch in right turn position.
- (6) Place positive (+) probe of multimeter on wire no. 1004A at right rear turn signal.
- (7) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (8) Place turn signal switch in off position.
- (9) Turn ENGINE switch to OFF position.

e15.1. TURN SIGNAL INDICATOR LIGHT DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



INDICATOR BULB TEST

- (1) Unplug right/left indicator bulb from socket.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

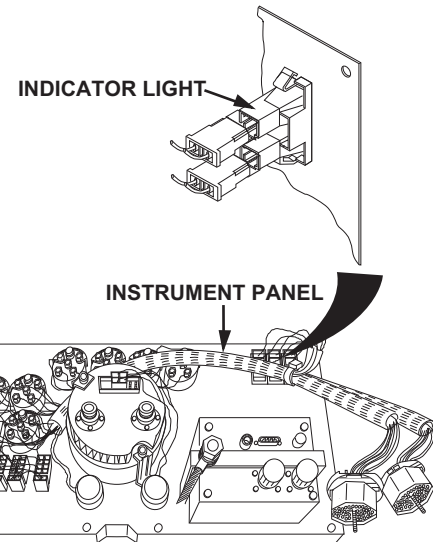
- (3) Connect multimeter leads to bulb terminals and check multimeter for continuity.

WARNING

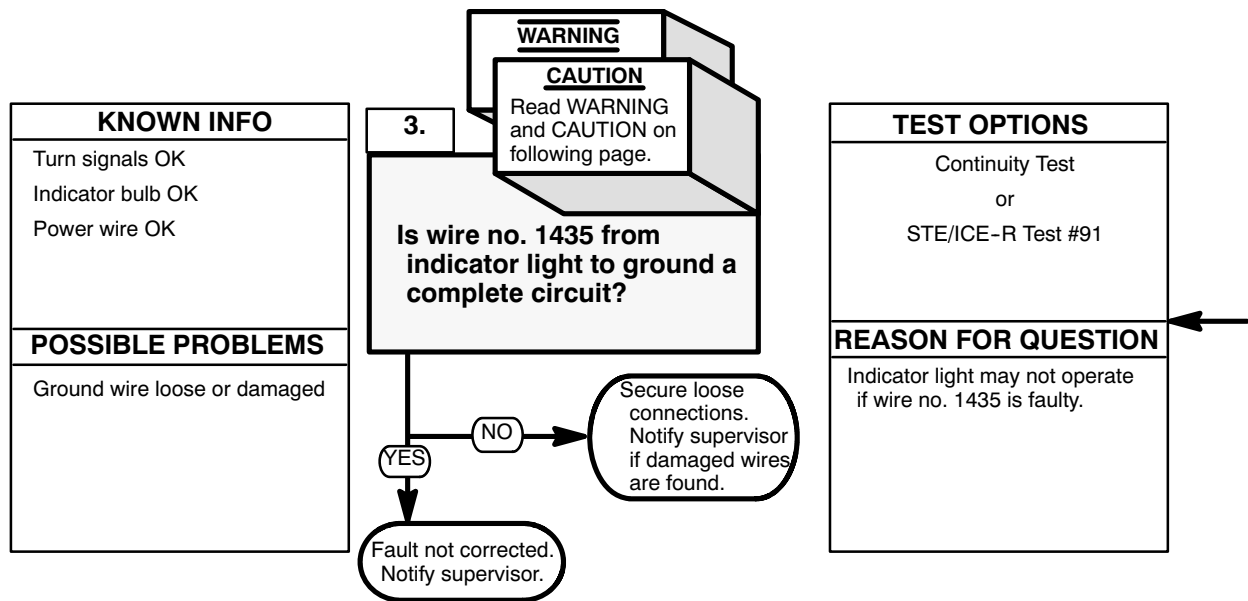
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1001/1002 TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place turn signal switch in right/left turn position.
- (3) Place positive (+) probe of multimeter on wire no. 1001/1002 at indicator light.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place turn signal in off position.
- (6) Turn ENGINE switch to OFF position.



e15.1. TURN SIGNAL INDICATOR LIGHT DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from indicator light for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

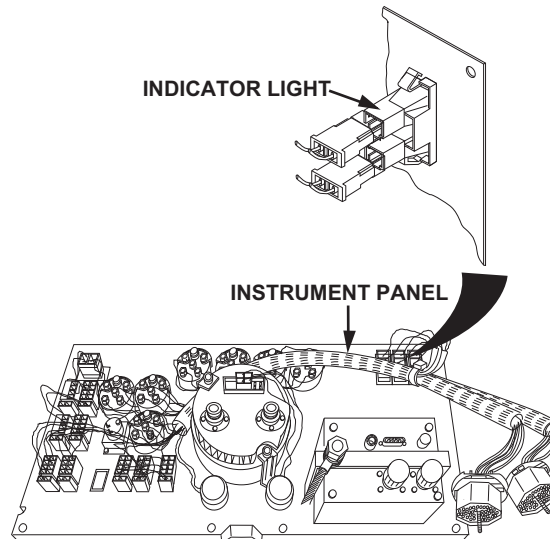
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

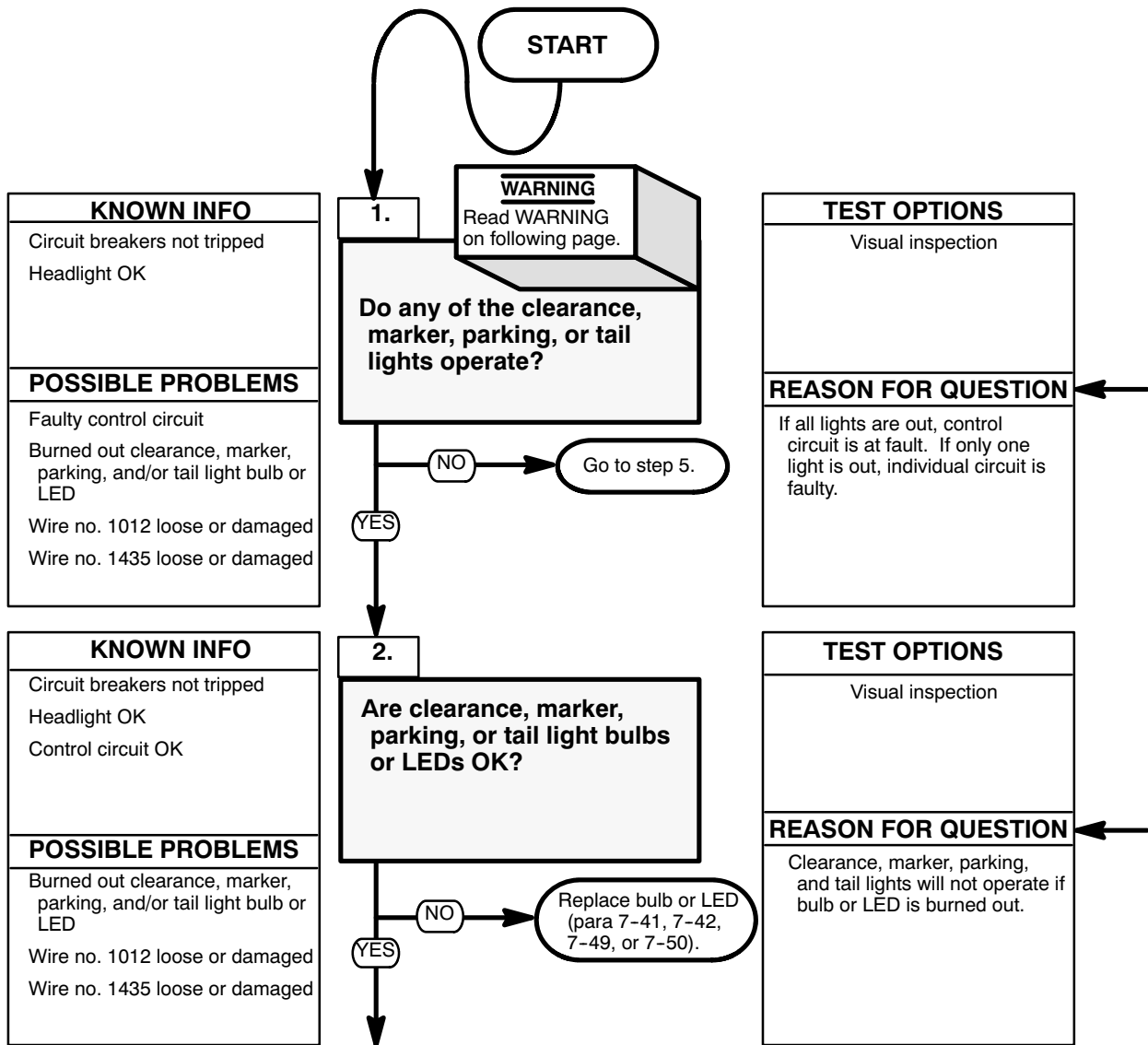
NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.



e16. CLEARANCE, MARKER, PARKING, OR TAIL LIGHT DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



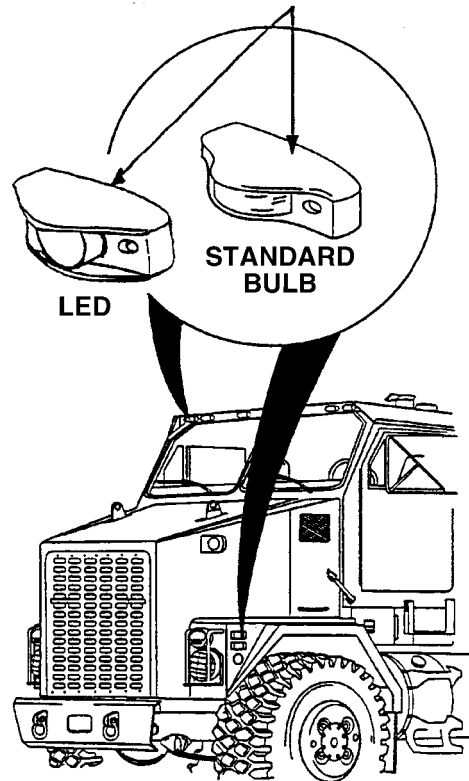
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

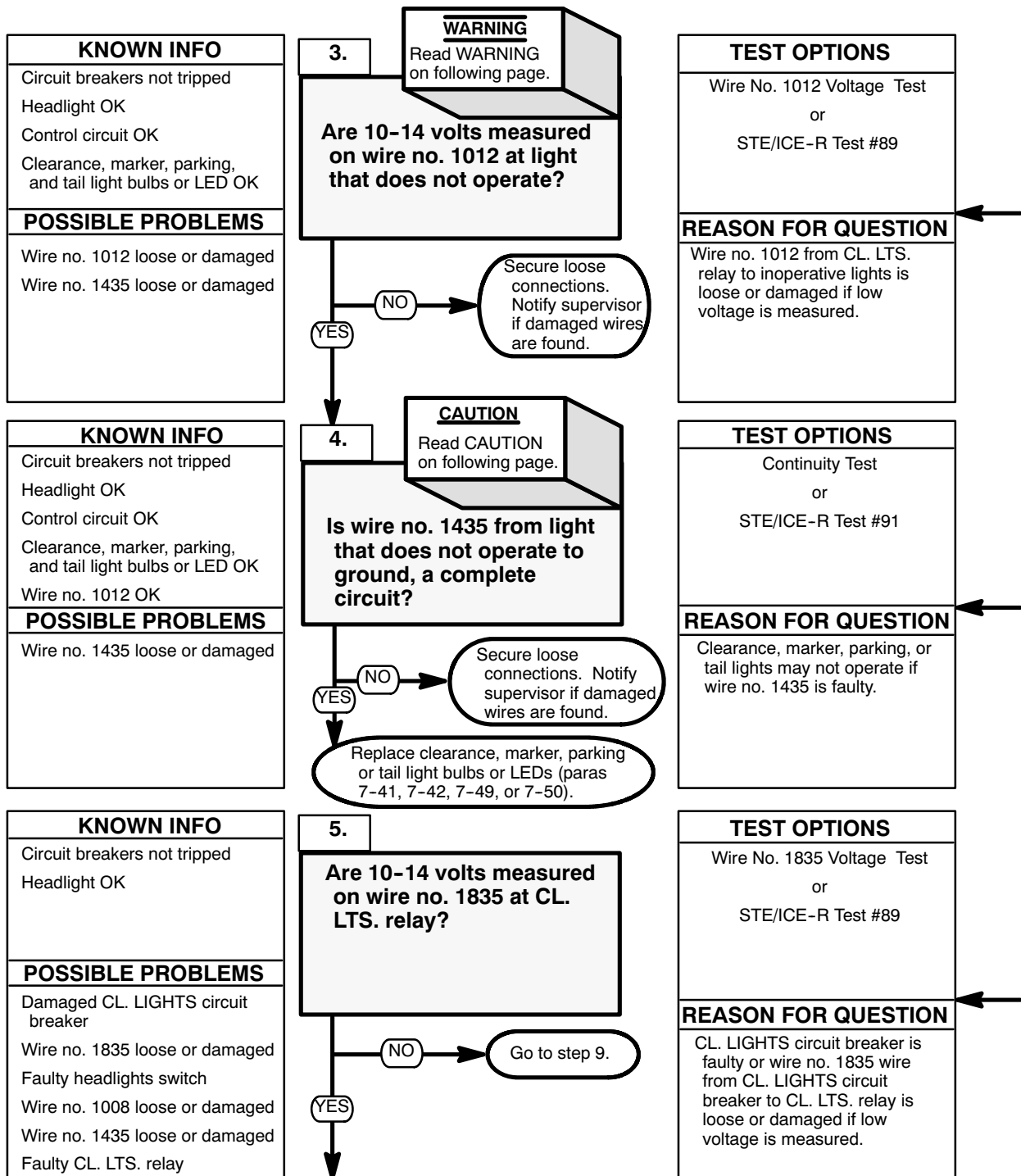
Check clearance, marker, parking, and tail lights for operation (TM 9-2320-360-10).

Check clearance, marker, parking, or tail lights for burned out bulb or LED if only one light does not operate.

CLEARANCE AND MARKER LIGHT



e16. CLEARANCE, MARKER, PARKING, OR TAIL LIGHT DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1012 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in center position.
- (3) Place positive (+) probe of multimeter on wire no. 1012 at inoperative light.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in off position.
- (6) Turn ENGINE switch to OFF position.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

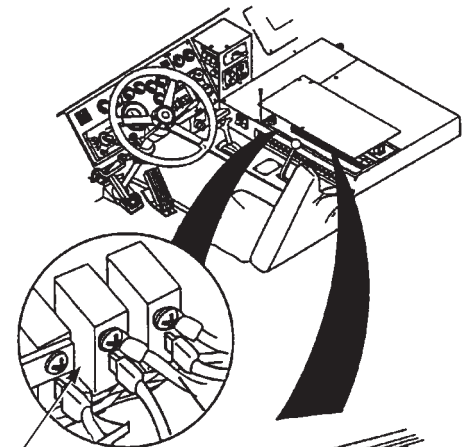
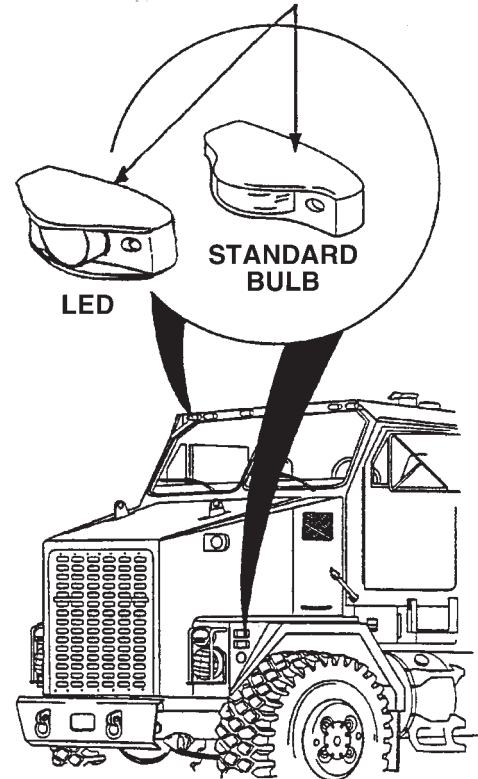
Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

WIRE NO. 1835 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in center position.
- (3) Place positive (+) probe of multimeter on wire no. 1835 at CL. LTS. relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in off position.
- (6) Turn ENGINE switch to OFF position.

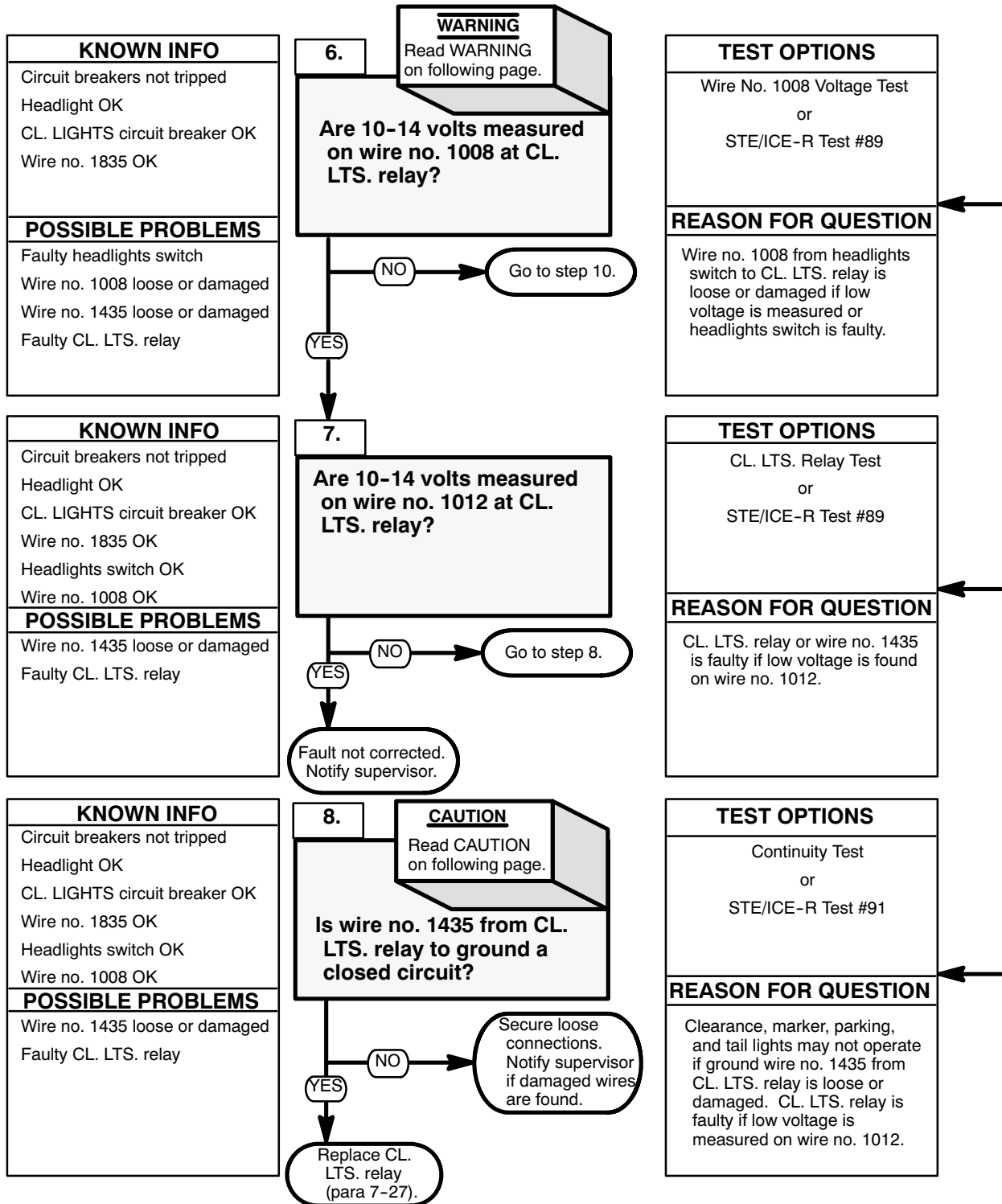
CLEARANCE AND MARKER LIGHT



CIRCUIT BREAKER

RELAYS

e16. CLEARANCE, MARKER, PARKING, OR TAIL LIGHT DOES NOT OPERATE (CONT)

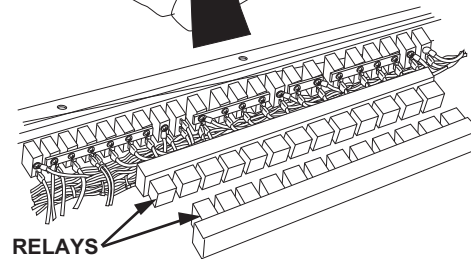
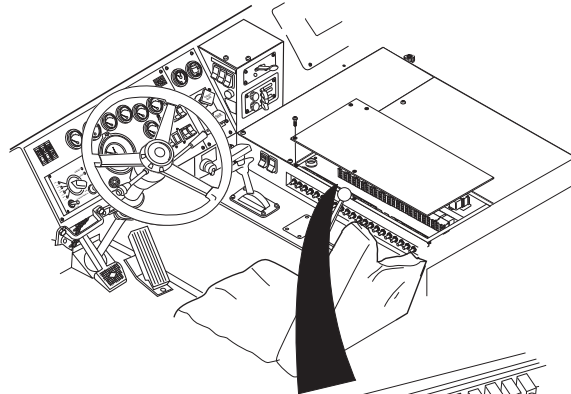


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1008 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in center position.
- (3) Place positive (+) probe of multimeter on wire no. 1008 at CL. LTS. relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in off position.
- (6) Turn ENGINE switch to OFF position.



CL. LTS. RELAY TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in center position.
- (3) Place positive (+) probe of multimeter on wire no. 1012 at CL. LTS. relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in off position.
- (6) Turn ENGINE switch to OFF position.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

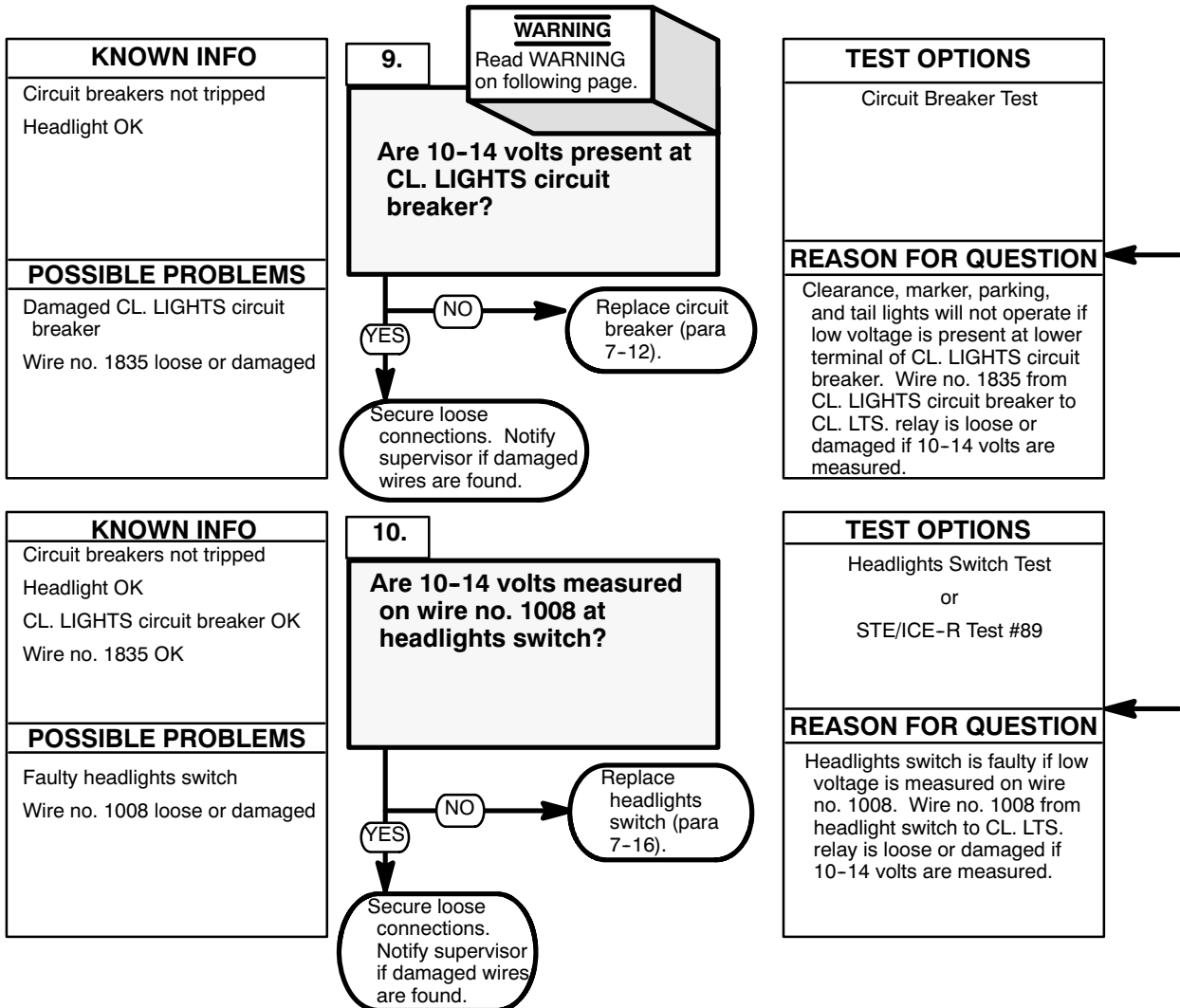
NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

Check ground wire no. 1435 from CL. LTS. relay for loose connections or damage.

e16. CLEARANCE, MARKER, PARKING, OR TAIL LIGHT DOES NOT OPERATE (CONT)

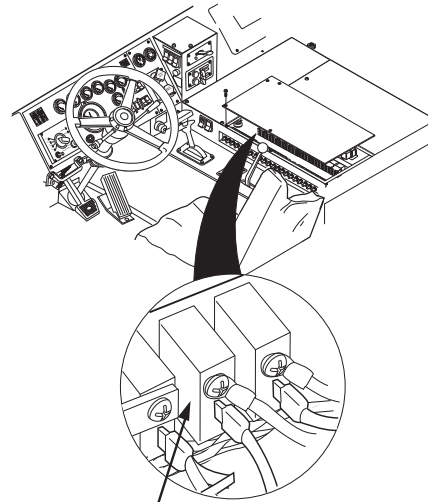


WARNING

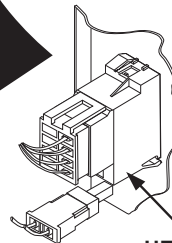
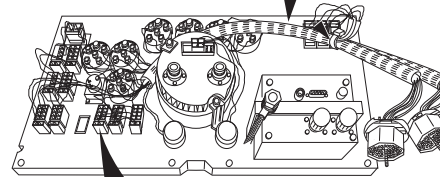
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



**CIRCUIT BREAKER
INSTRUMENT PANEL**

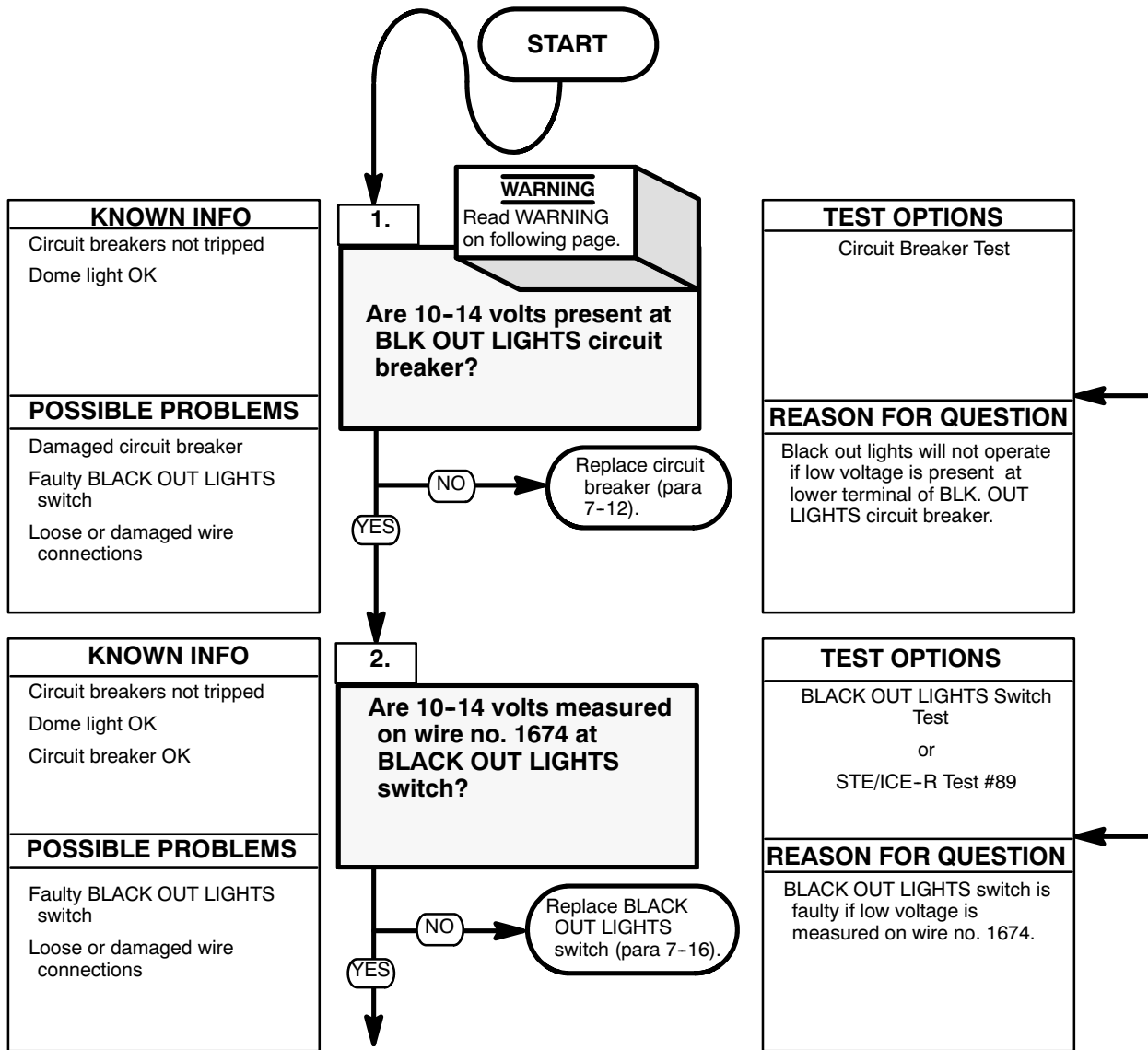


HEADLIGHT SWITCH

HEADLIGHT SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place headlights switch in center position.
- (3) Place positive (+) probe of multimeter on wire no. 1008 at headlights switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place headlights switch in off position.
- (6) Turn ENGINE switch to OFF position.

e17. ALL BLACKOUT LIGHTS DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)

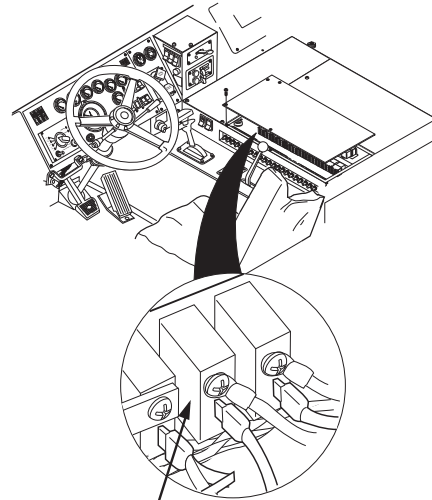


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CIRCUIT BREAKER TEST

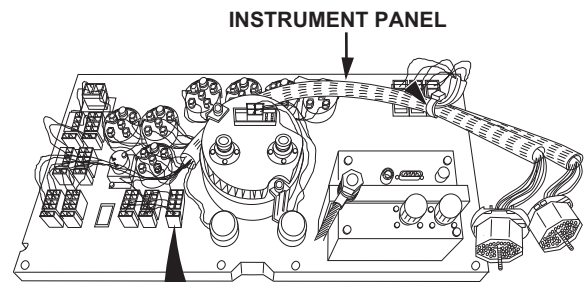
- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



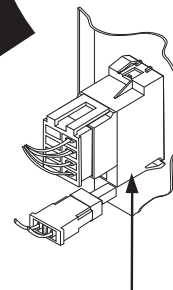
CIRCUIT BREAKER

BLACK OUT LIGHTS SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch to on position.
- (3) Place positive (+) probe of multimeter on wire no. 1674 at BLACK OUT LIGHTS switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place BLACK OUT LIGHTS switch to off position.
- (6) Turn ENGINE switch to OFF position.

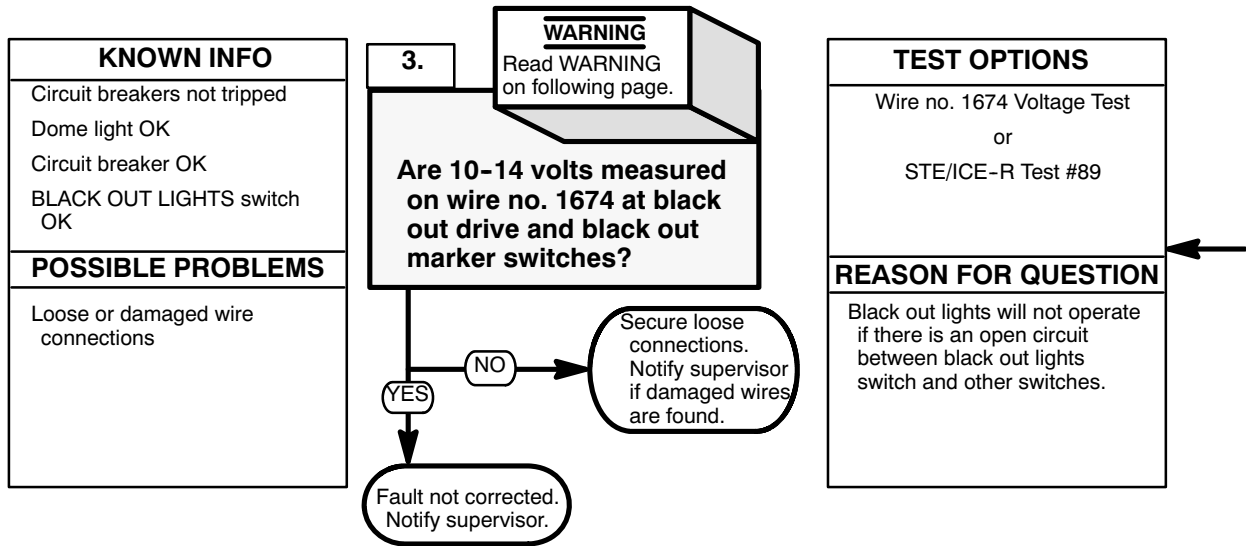


INSTRUMENT PANEL



BLACKOUT LIGHT SWITCH

e17. ALL BLACKOUT LIGHTS DO NOT OPERATE (CONT)

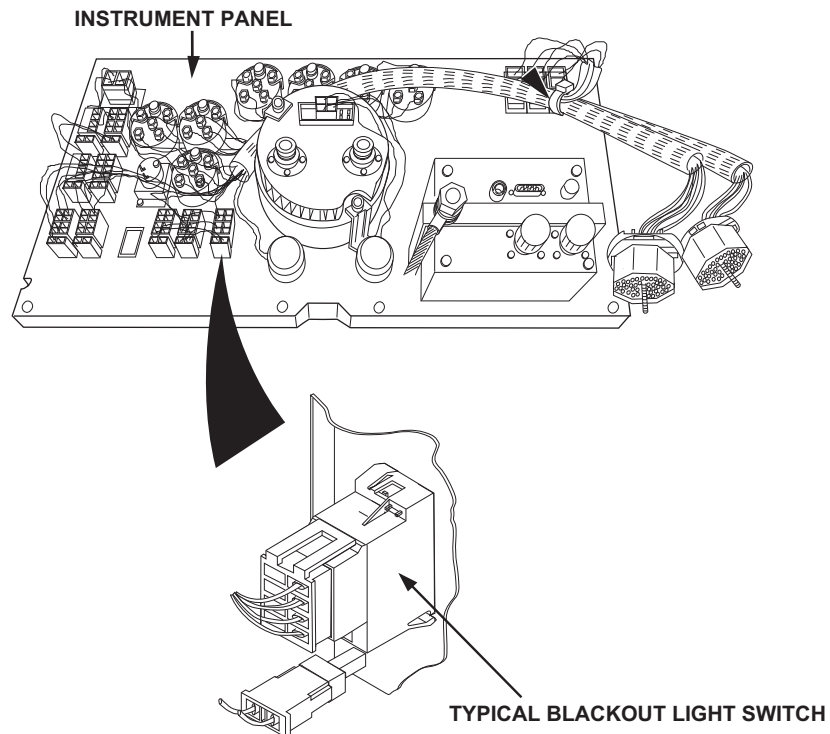


WARNING

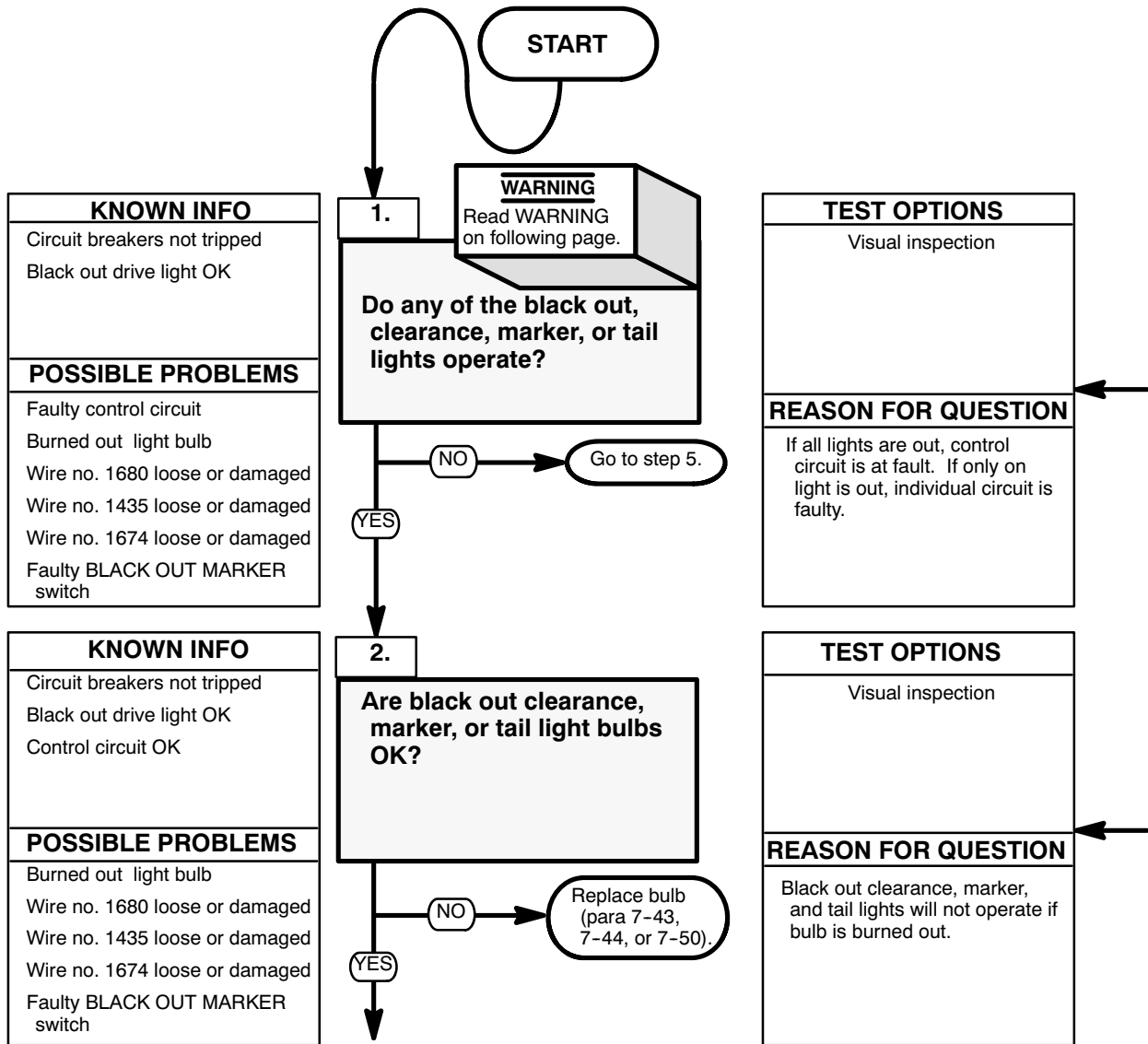
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

BLACK OUT LIGHTS SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch to on position.
- (3) Place positive (+) probe of multimeter on wire no. 1674 at BLACK OUT DRIVE switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place positive (+) probe of multimeter on wire no. 1674 at BLACK OUT MARKER switch.
- (6) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (7) Place BLACK OUT LIGHTS switch to off position.
- (8) Turn ENGINE switch to OFF position.



e18. BLACK OUT CLEARANCE, MARKER, OR TAIL LIGHT DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)

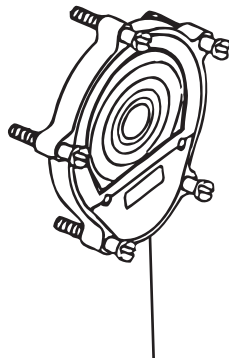


BLACKOUT CLEARANCE AND MARKER LIGHTS

WARNING

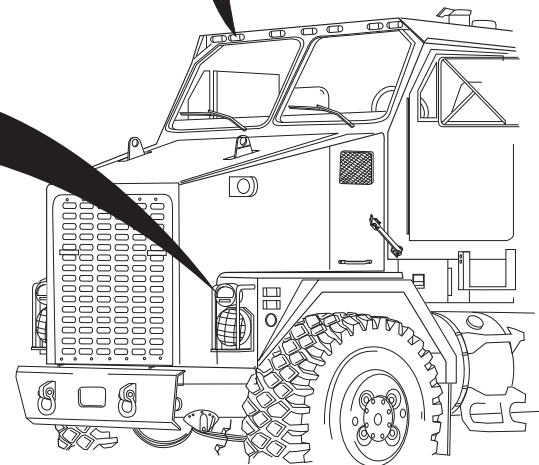
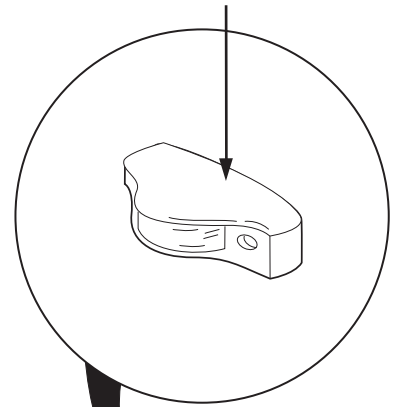
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check black out, clearance, marker, or tail lights for operation (TM 9-2320-360-10).

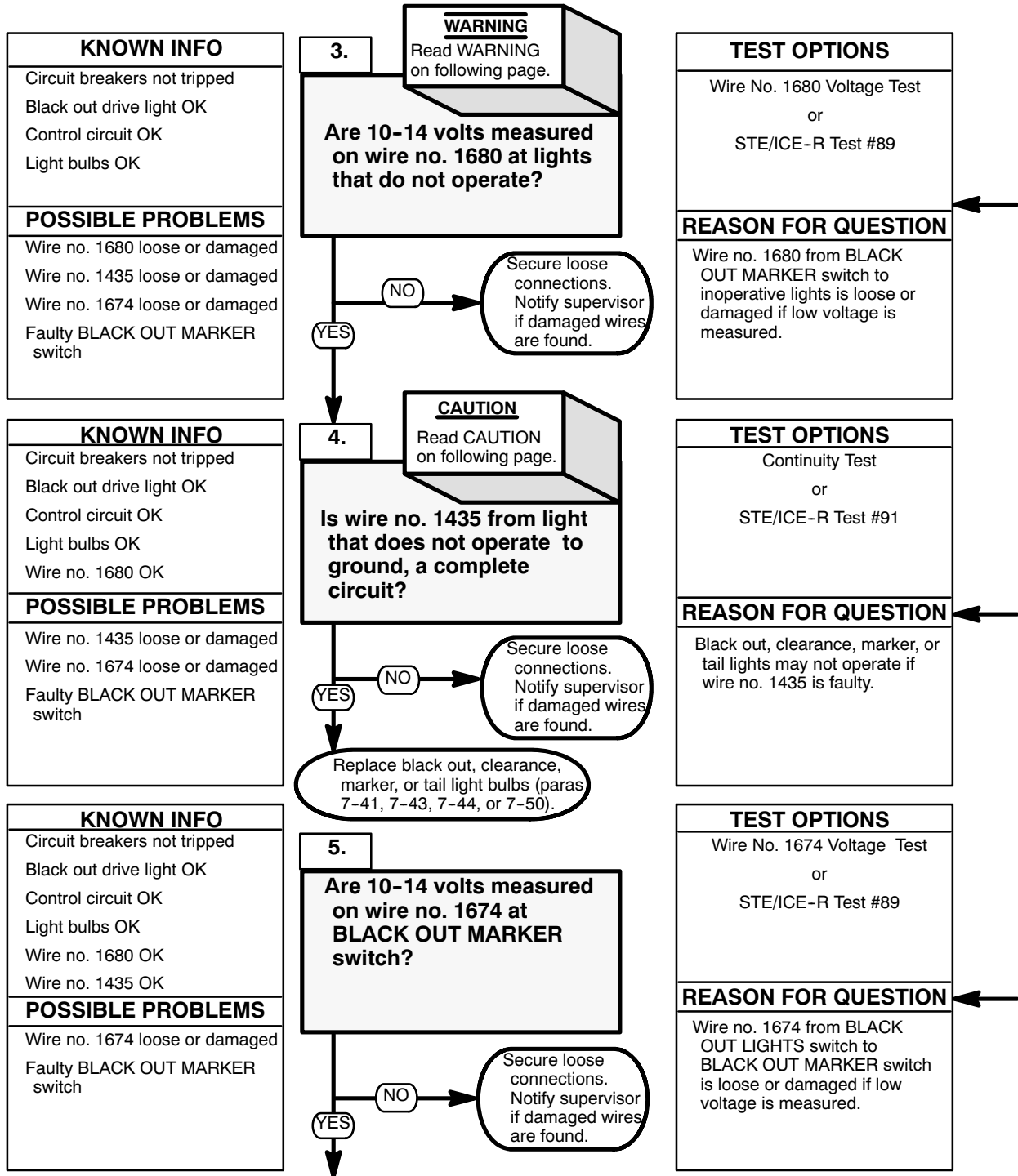


BLACKOUT MARKER LIGHT

Check black out, clearance, marker, or tail lights for burned out bulb if only one light does not operate.



e18. BLACK OUT CLEARANCE, MARKER, OR TAIL LIGHT DOES NOT OPERATE (CONT)

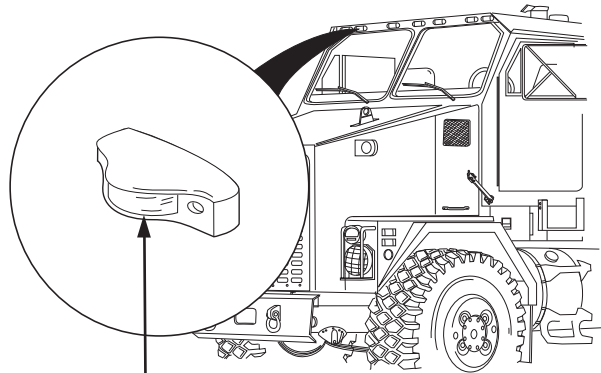


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1680 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch to on position.
- (3) Place BLACK OUT MARKER switch to on position.
- (4) Place positive (+) probe of multimeter on wire no. 1680 at inoperative light.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place BLACK OUT MARKER switch to off position.
- (7) Place BLACK OUT LIGHTS switch to off position.
- (8) Turn ENGINE switch to OFF position.



BLACKOUT CLEARANCE AND MARKER LIGHTS

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

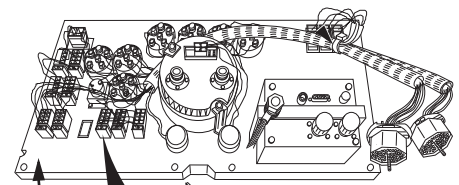
NOTE

Any reading besides infinity indicates a grounded wire.

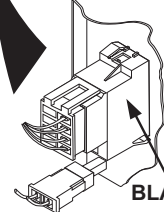
- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

WIRE NO. 1674 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch to on position.
- (3) Place positive (+) probe of multimeter on wire no. 1674 at BLACK OUT MARKER switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place BLACK OUT LIGHTS switch to off position.
- (6) Turn ENGINE switch to OFF position.

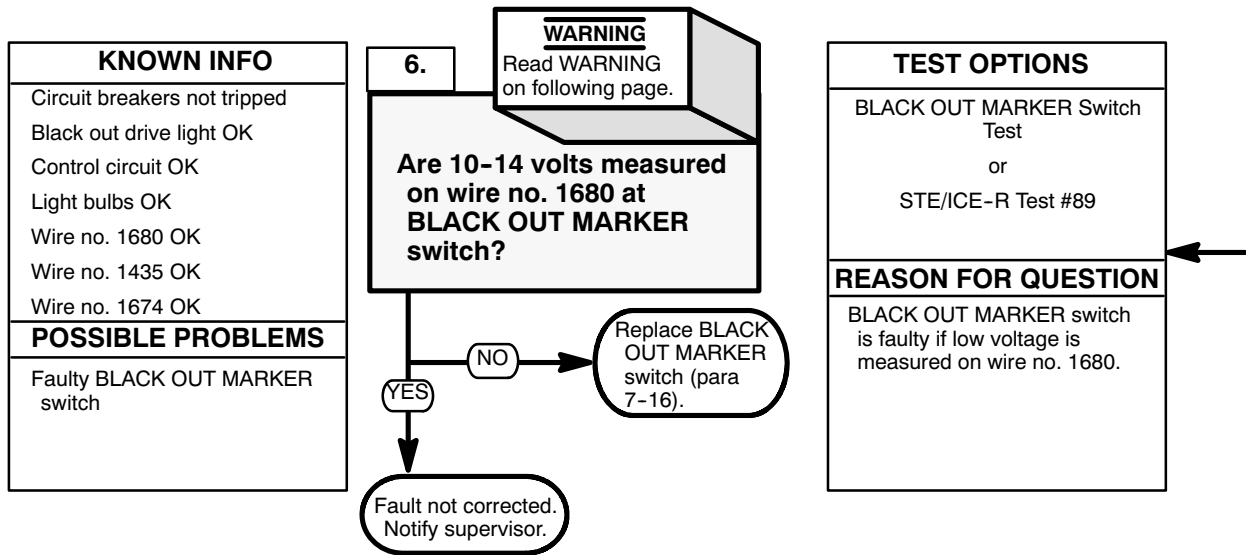


INSTRUMENT PANEL



BLACKOUT MARKER SWITCH

e18. BLACK OUT CLEARANCE, MARKER, OR TAIL LIGHT DOES NOT OPERATE (CONT)

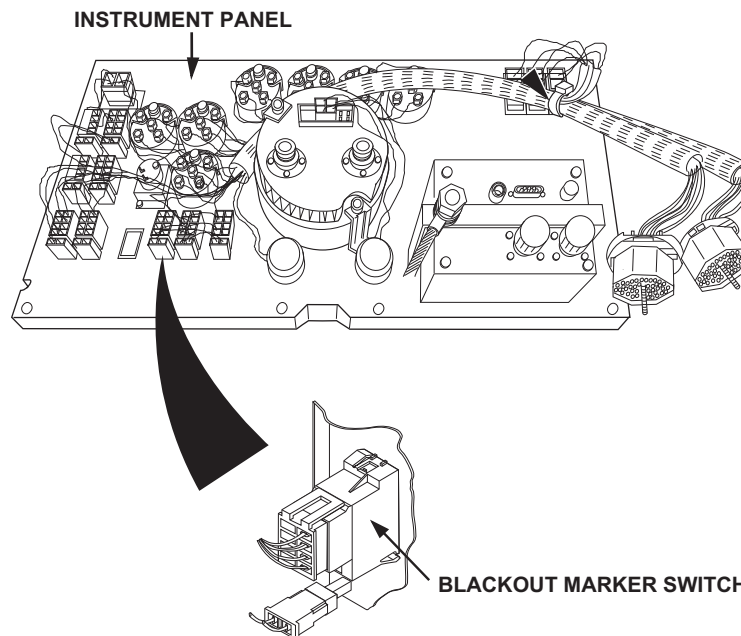


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

BLACK OUT MARKER SWITCH TEST

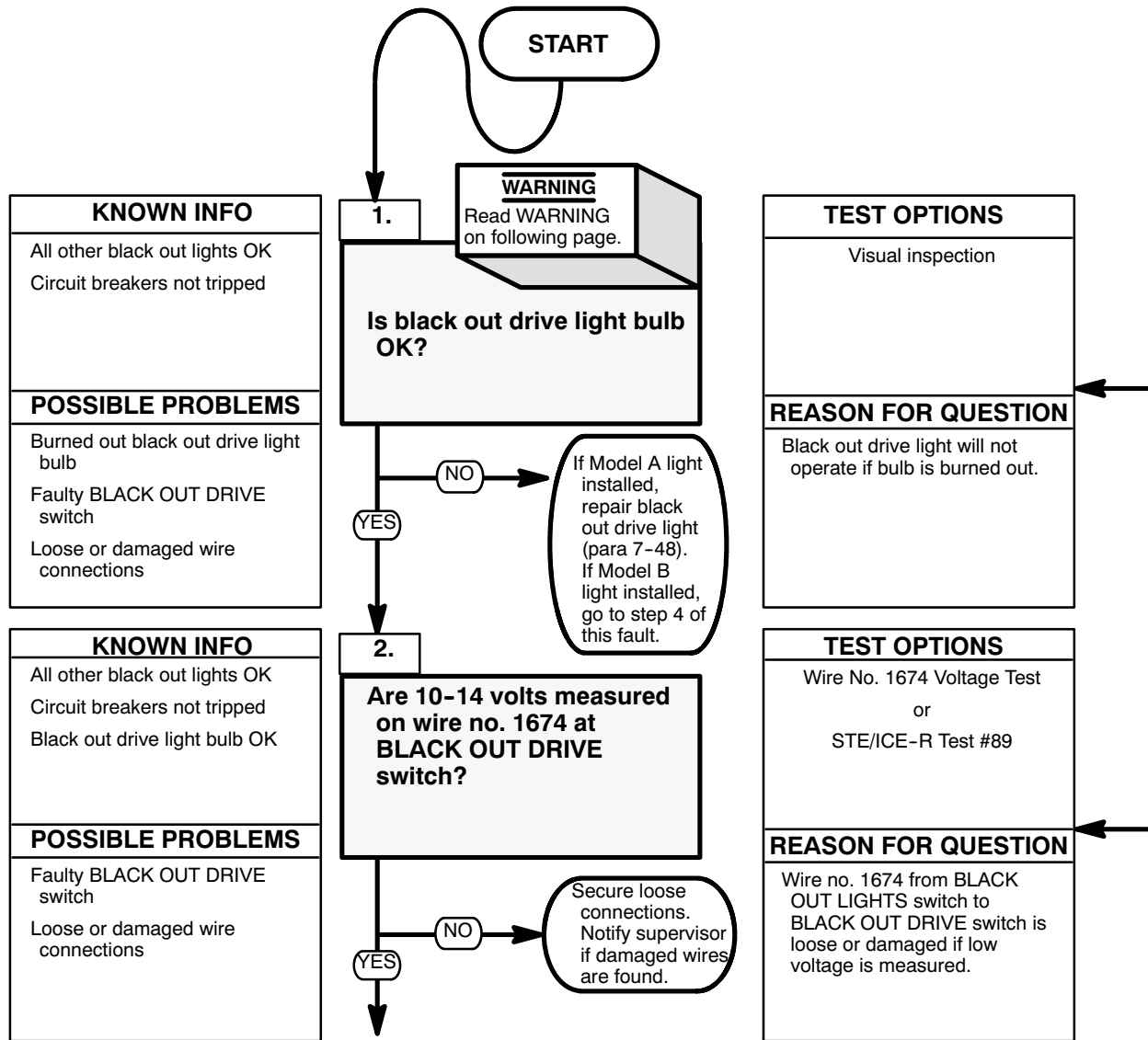
- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch to on position.
- (3) Place BLACK OUT MARKER switch to on position.
- (4) Place positive (+) probe of multimeter on wire no. 1680 at BLACK OUT MARKER switch.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place BLACK OUT MARKER switch to off position.
- (7) Place BLACK OUT LIGHTS switch to off position.
- (8) Turn ENGINE switch to OFF position.



e19. BLACK OUT DRIVE LIGHT DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)

NOTE

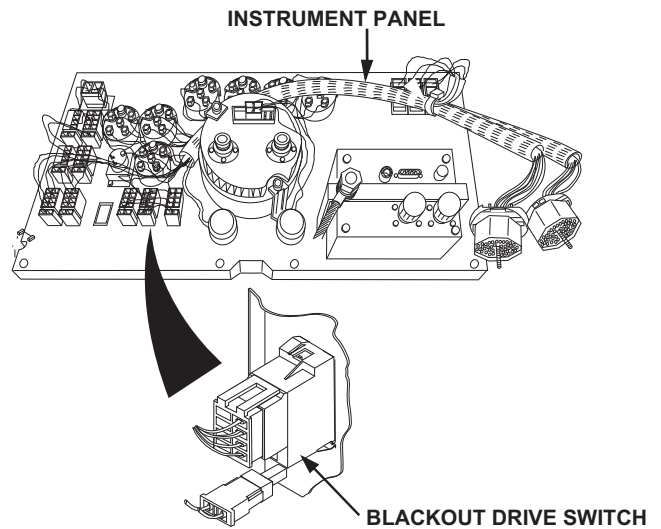
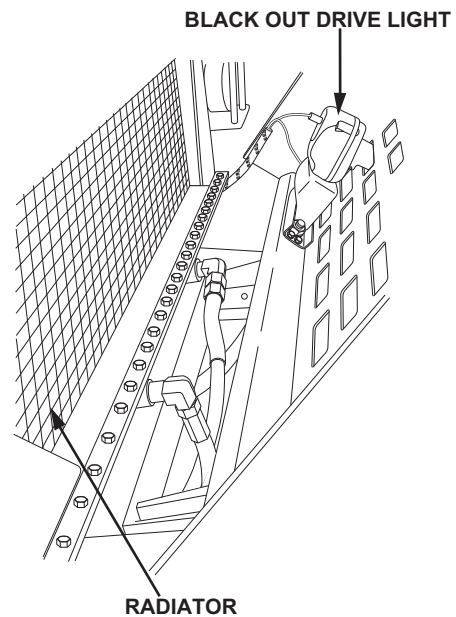
Model A, bulb type, or Model B, LED type, blackout drive light may be installed on vehicle.



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

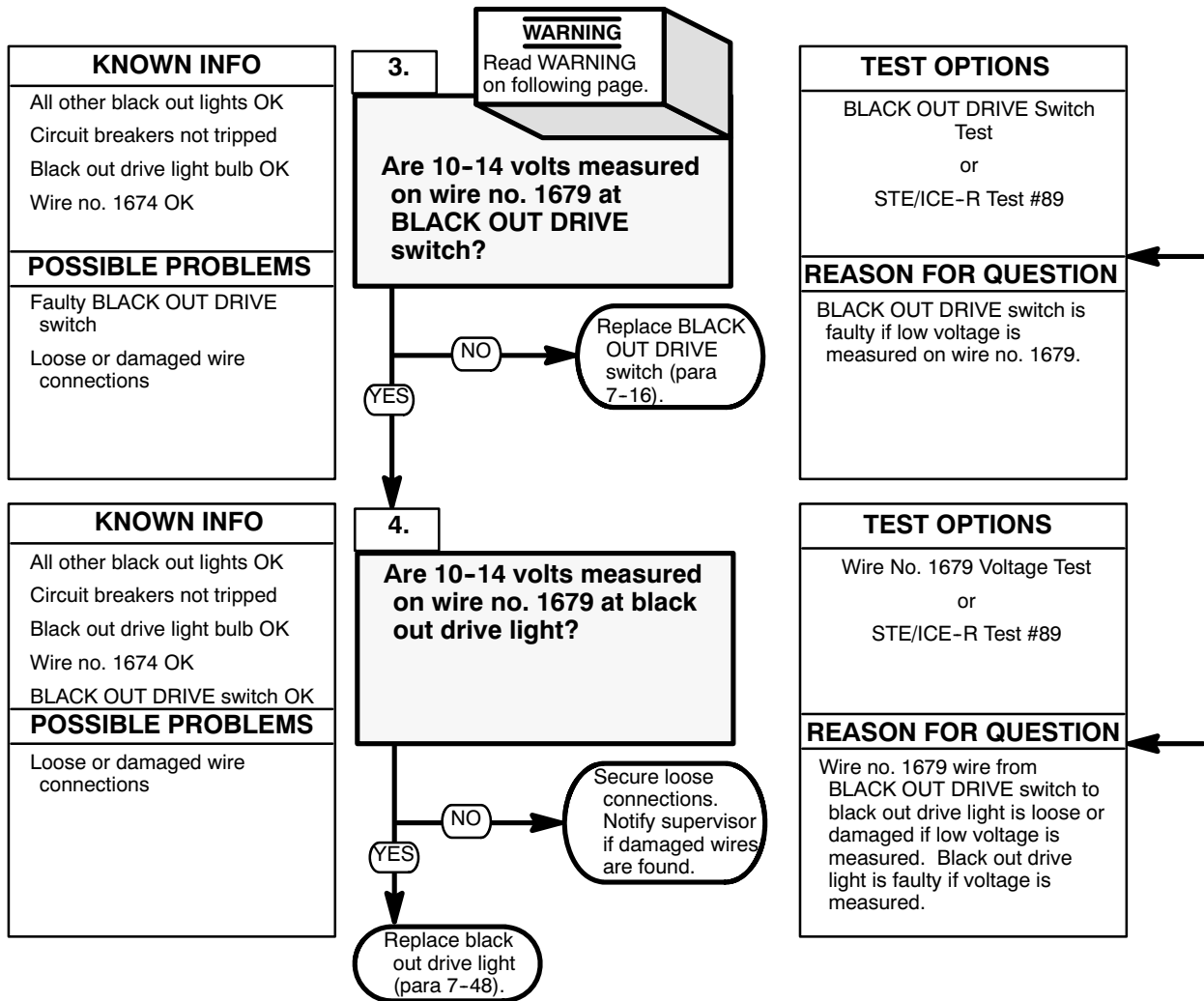
If Model A, light installed, check black out drive light for burned out bulb. If Model B light installed, go to step 4 of this fault.



**WIRE NO. 1674
VOLTAGE TEST**

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch to on position.
- (3) Place positive (+) probe of multimeter on wire no. 1674 at BLACK OUT DRIVE switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place BLACK OUT LIGHTS switch to off position.
- (6) Turn ENGINE switch to OFF position.

e19. BLACK OUT DRIVE LIGHT DOES NOT OPERATE (CONT)



WARNING

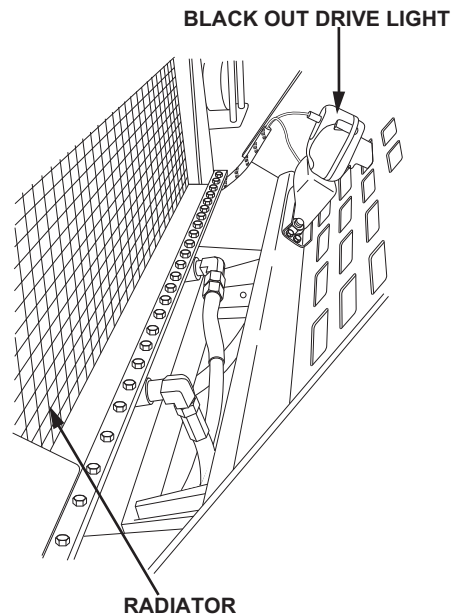
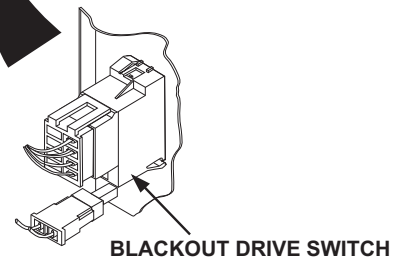
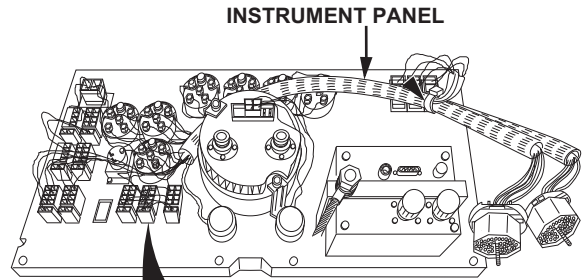
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

BLACK OUT DRIVE SWITCH TEST

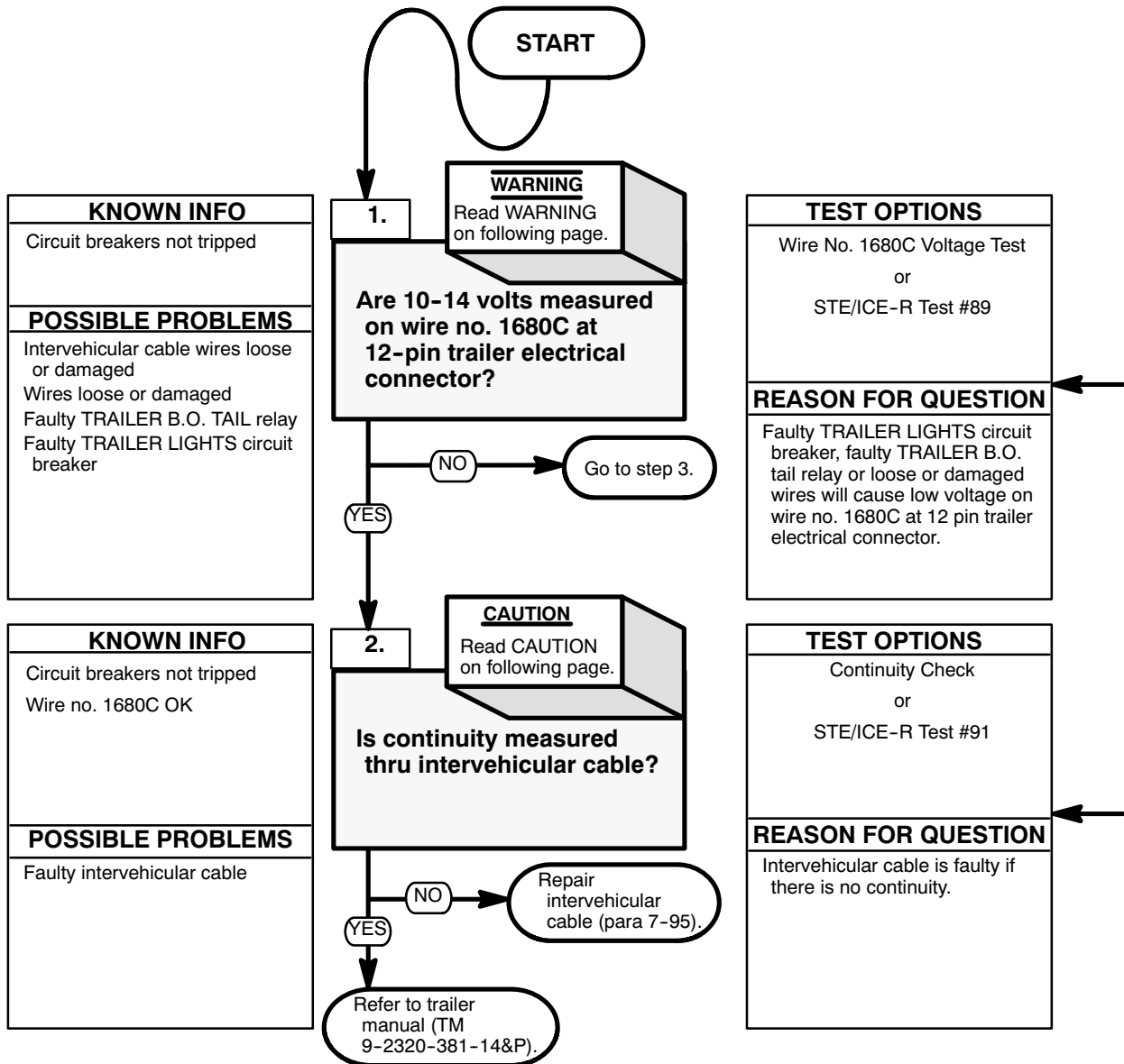
- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch to on position.
- (3) Place BLACK OUT DRIVE switch to on position.
- (4) Place positive (+) probe of multimeter on wire no. 1679 at BLACK OUT DRIVE switch.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place BLACK OUT DRIVE switch to off position.
- (7) Place BLACK OUT LIGHTS switch to off position.
- (8) Turn ENGINE switch to OFF position.

WIRE NO. 1679 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch to on position.
- (3) Place BLACK OUT DRIVE switch to on position.
- (4) Place positive (+) probe of multimeter on wire no. 1679 at black out drive light.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place BLACK OUT DRIVE switch to off position.
- (7) Place BLACK OUT LIGHTS switch to off position.
- (8) Turn ENGINE switch to OFF position.

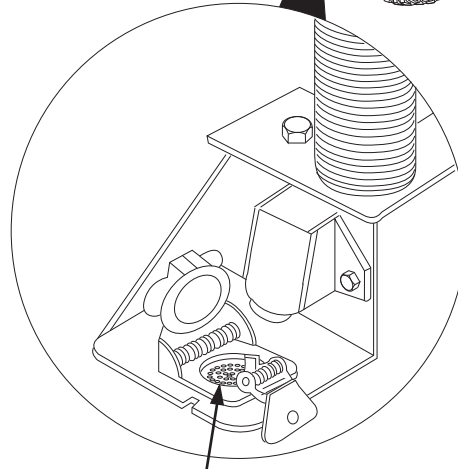
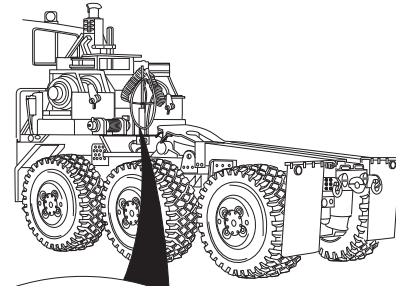


e20. TRAILER BLACK OUT TAIL LIGHTS DO NOT OPERATE (BLACK OUT LIGHTS ON HET TRACTOR OPERATE)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.



12-PIN ELECTRICAL CONNECTOR

WIRE NO. 1680C VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch in the on position.
- (3) Place BLACK OUT MARKER switch in the on position.
- (4) Place positive (+) probe of multimeter on wire no. 1680C at 12-pin trailer electrical connector.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place BLACK OUT LIGHTS switch in the off position.
- (7) Place BLACK OUT MARKER switch in the off position.
- (8) Turn ENGINE switch to OFF position.

_____ Check intervehicular cable for continuity.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Unplug trailer cable from HET Tractor and trailer.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

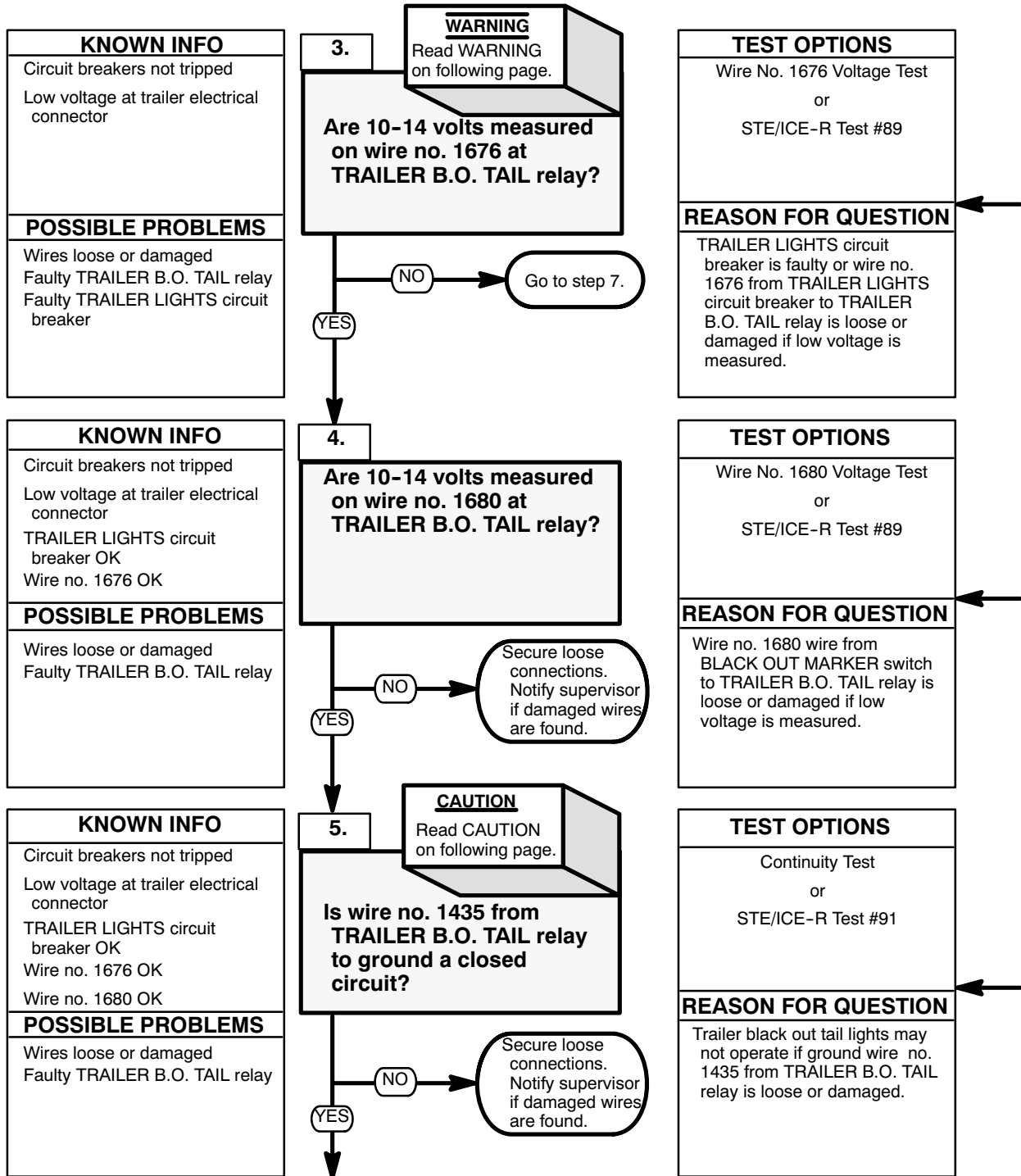
- (3) Connect multimeter leads to each end of wires and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e20. TRAILER BLACK OUT TAIL LIGHTS DO NOT OPERATE (BLACK OUT LIGHTS ON HET TRACTOR OPERATE) (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

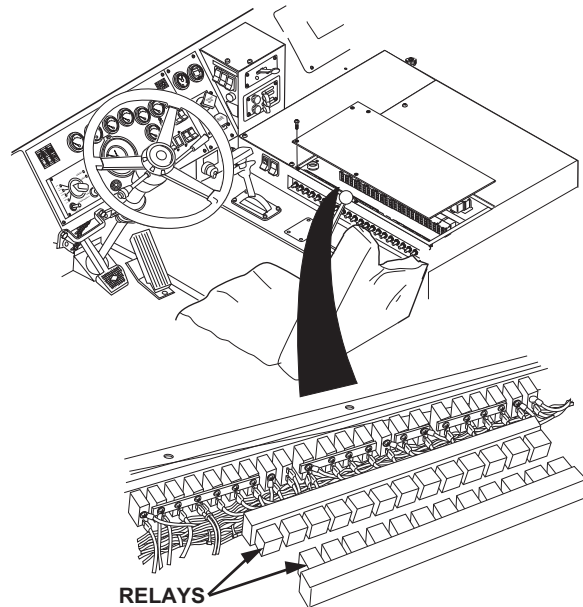
WIRE NO. 1676 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1676 at TRAILER B.O. TAIL relay.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

WIRE NO. 1680 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch in the on position.
- (3) Place BLACK OUT MARKER switch in the on position.
- (4) Place positive (+) probe of multimeter on wire no. 1680 at TRAILER B.O. TAIL relay.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place BLACK OUT LIGHTS switch in the off position.
- (7) Place BLACK OUT MARKER switch in the off position.
- (8) Turn ENGINE switch to OFF position.

Check ground wire no. 1435 from TRAILER B.O. TAIL relay for loose connections or damage.



CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

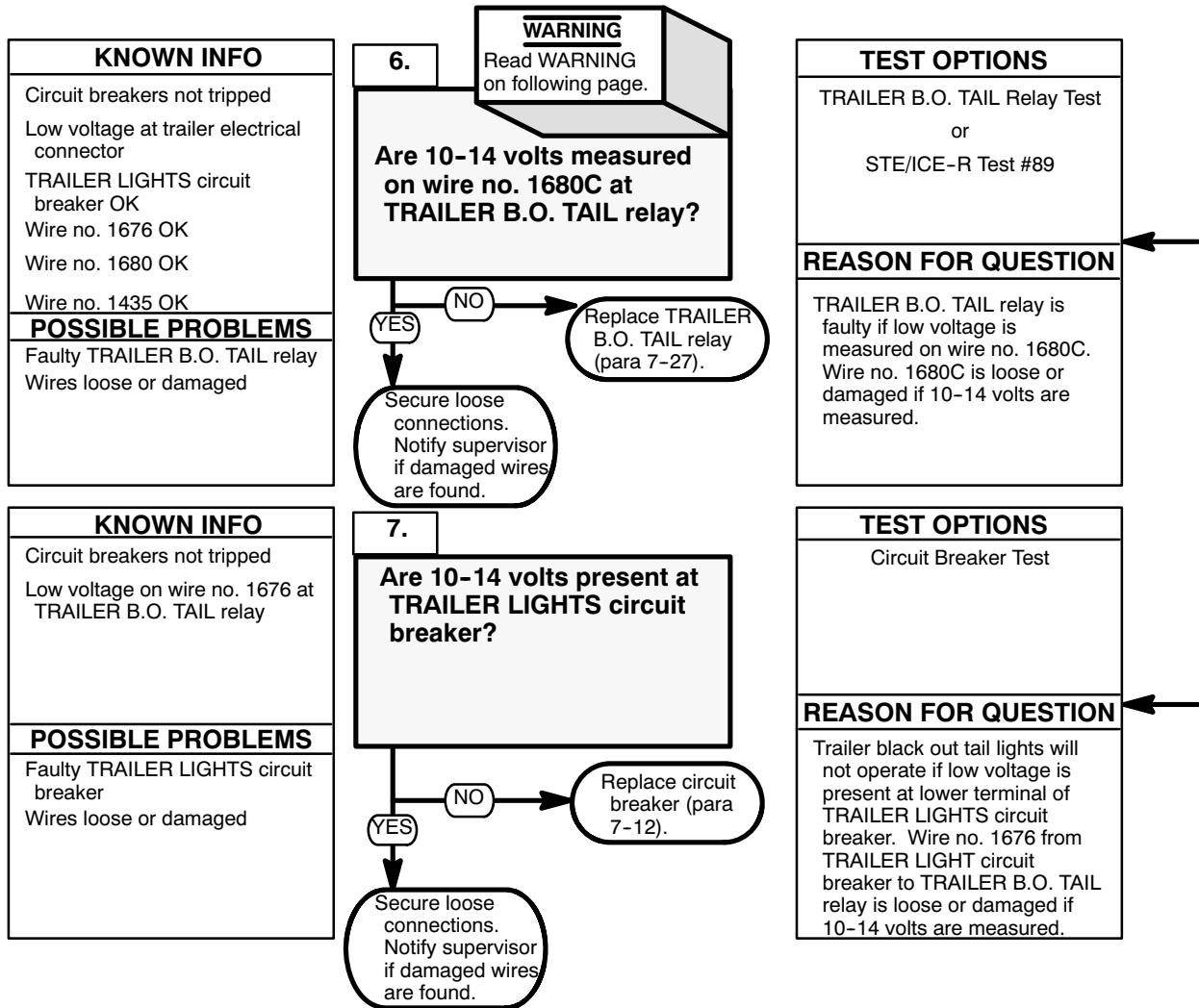
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e20. TRAILER BLACK OUT TAIL LIGHTS DO NOT OPERATE (BLACK OUT LIGHTS ON HET TRACTOR OPERATE) (CONT)



WARNING

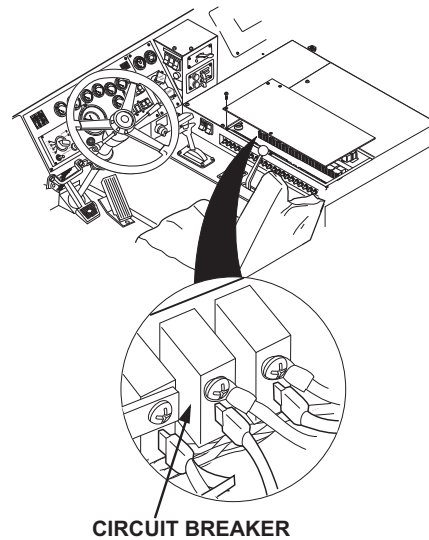
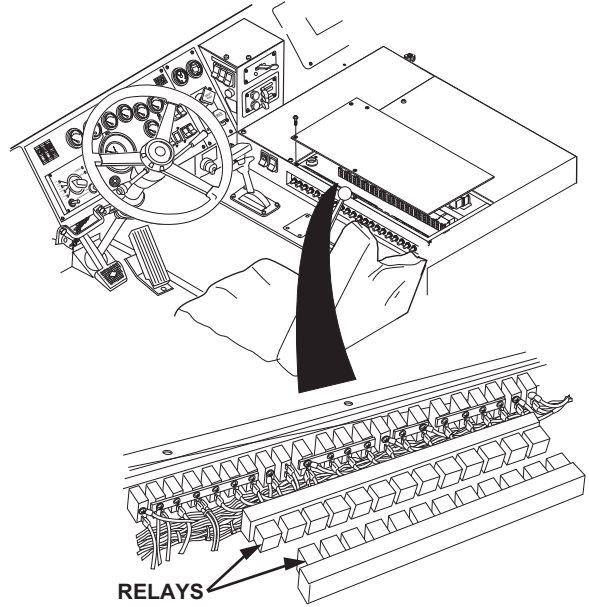
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

TRAILER B.O. TAIL RELAY TEST

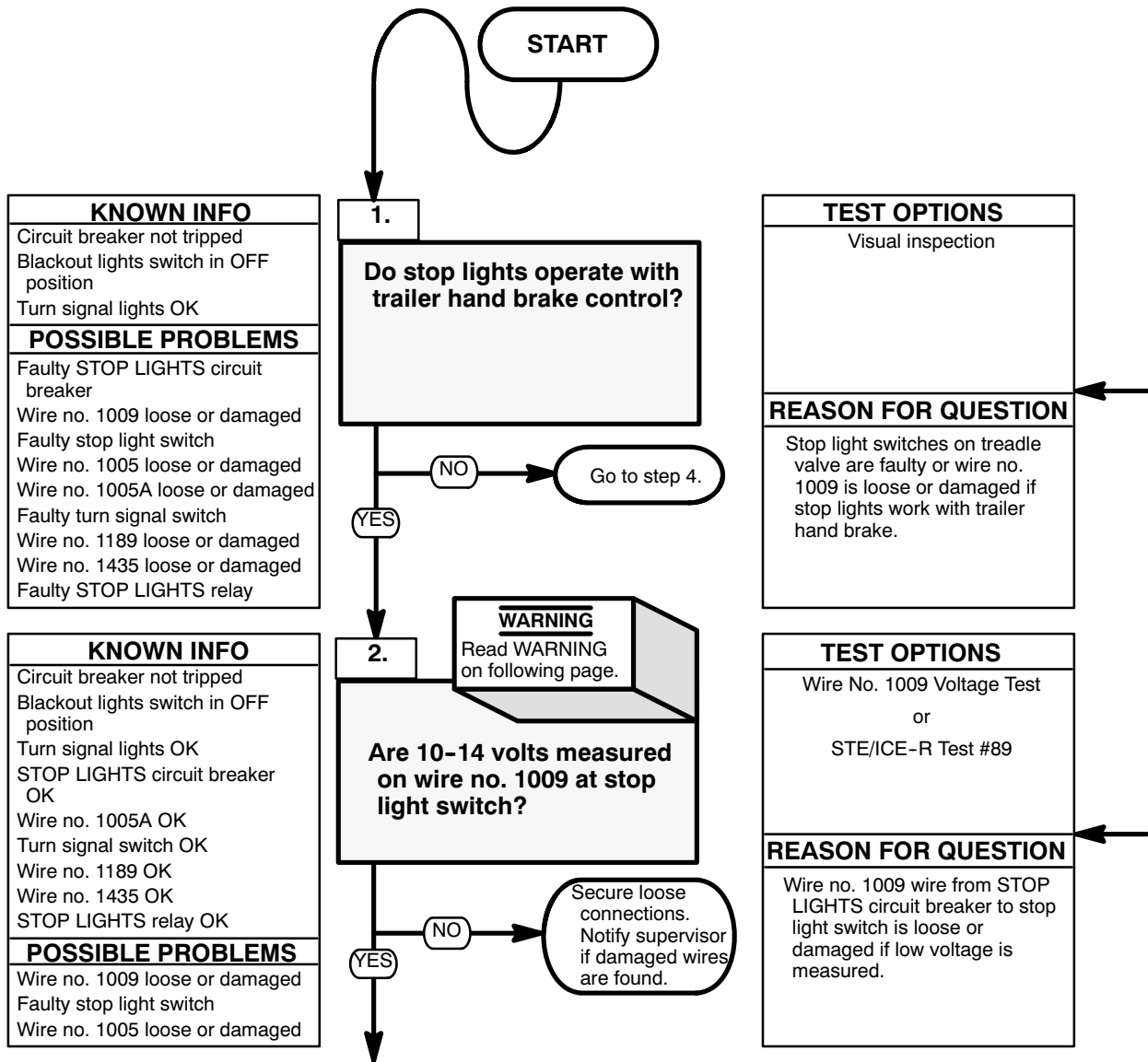
- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch in the on position.
- (3) Place BLACK OUT MARKER switch in the on position.
- (4) Place positive (+) probe of multimeter on wire no. 1680C at TRAILER B.O. TAIL relay.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Place BLACK OUT LIGHTS switch in the off position.
- (7) Place BLACK OUT MARKER switch in the off position.
- (8) Turn ENGINE switch to OFF position.

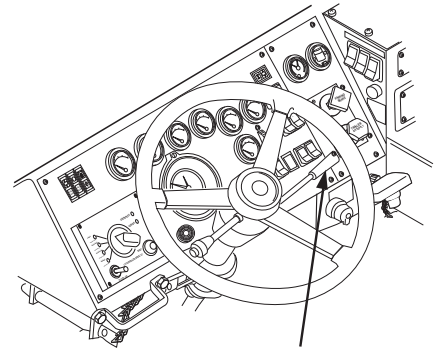
CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



e21. STOP LIGHTS DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked. Air system pressure at 90-125 psi (652-862 kPa) (TM 9-2320-360-10).	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)
Personnel Required Two	





STOP LIGHTS TRAILER HAND BRAKE CONTROL

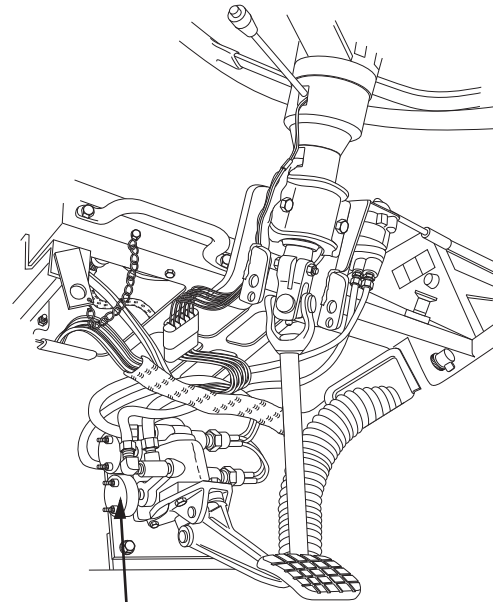
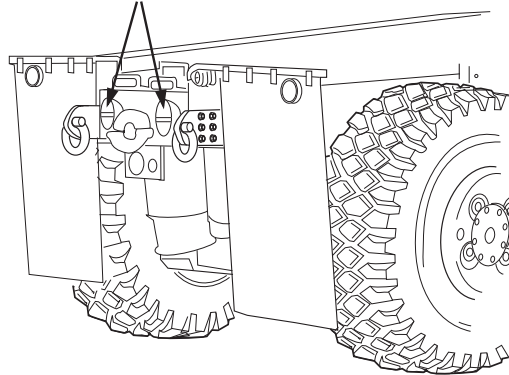
- (1) Turn ENGINE switch to ON position.
- (2) Apply trailer hand brake control and release while assistant checks stop light operation.
- (3) Turn ENGINE switch to OFF position.

WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

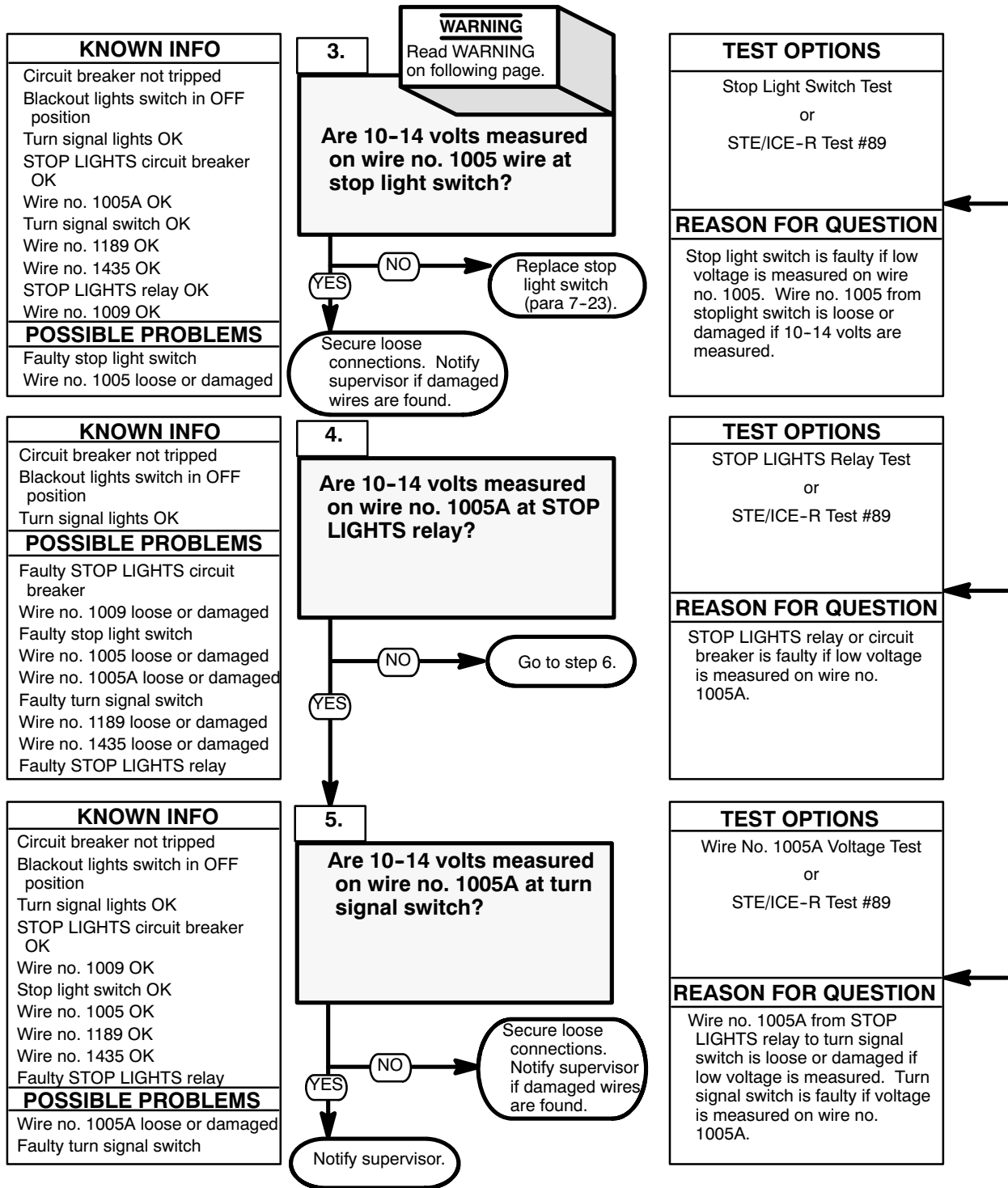
WIRE NO. 1009 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1009 at stop light switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



STOP LIGHT SWITCH

e21. STOP LIGHTS DO NOT OPERATE (CONT)



WARNING

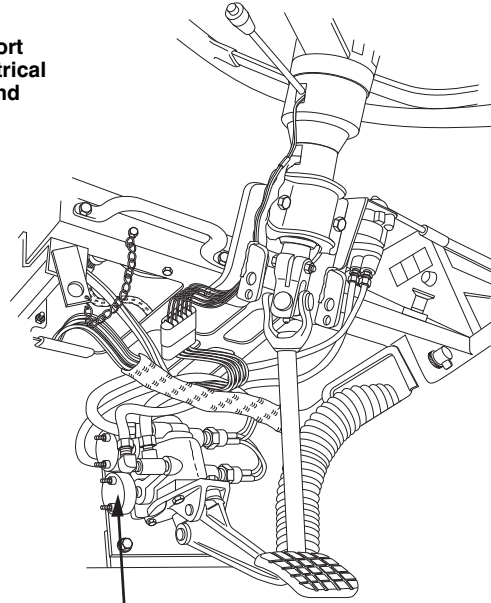
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

STOP LIGHT SWITCH TEST

NOTE

There are two stop light switches. One stop light switch is for the front brakes, and the other is for the rear brakes.

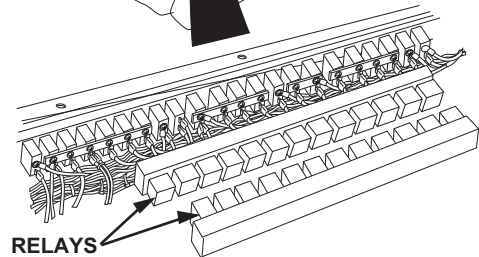
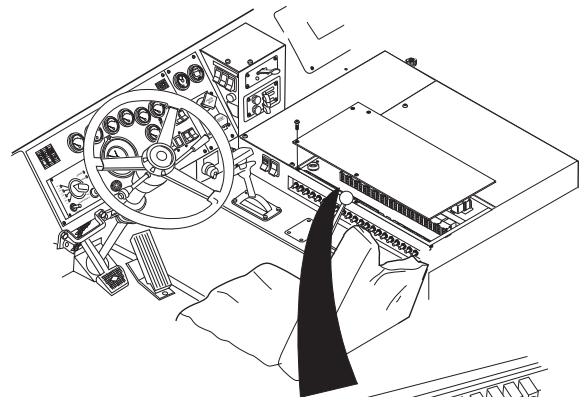
- (1) Turn ENGINE switch to ON position.
- (2) Press and hold brake pedal with aid of assistant.
- (3) Place positive (+) probe of multimeter on wire no. 1005 at stop light switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Repeat steps (3) and (4) for other stop light switch.
- (6) Release brake pedal.
- (7) Turn ENGINE switch to OFF position.



STOP LIGHT SWITCH

STOP LIGHTS RELAY TEST

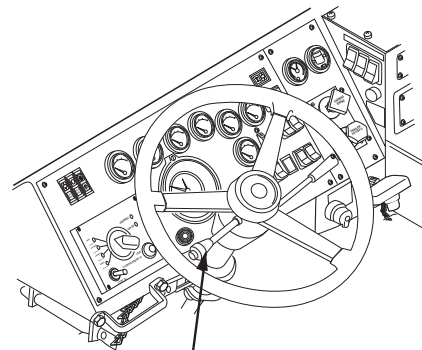
- (1) Turn ENGINE switch to ON position.
- (2) Press and hold brake pedal with aid of assistant.
- (3) Place positive (+) probe of multimeter on wire no. 1005A at STOP LIGHTS relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Release brake pedal.
- (6) Turn ENGINE switch to OFF position.



RELAYS

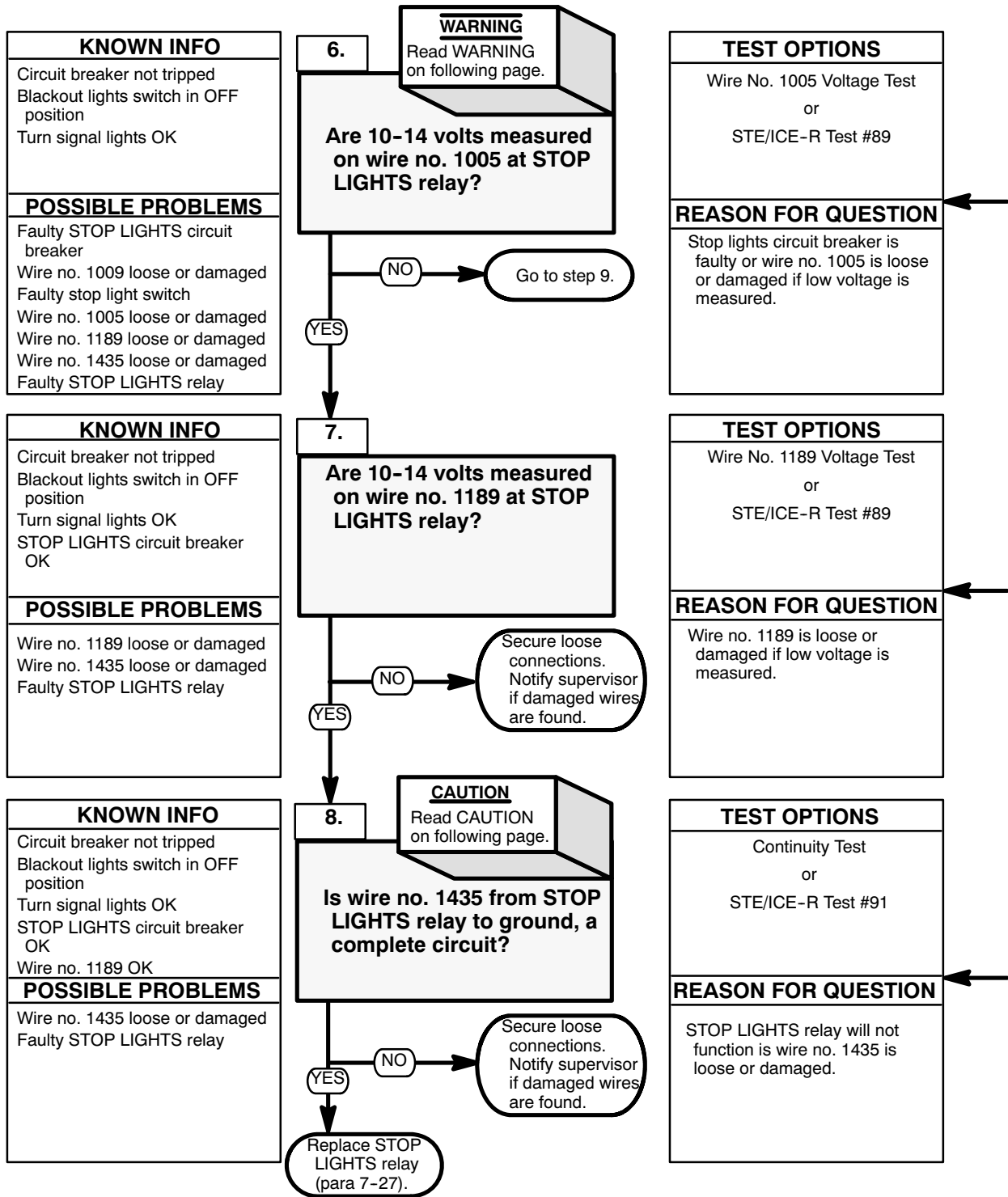
WIRE NO. 1005A VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Press and hold brake pedal with aid of assistant.
- (3) Place positive (+) probe of multimeter on wire no. 1005A at turn signal switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Release brake pedal.
- (6) Turn ENGINE switch to OFF position.



TURN SIGNAL SWITCH

e21. STOP LIGHTS DO NOT OPERATE (CONT)

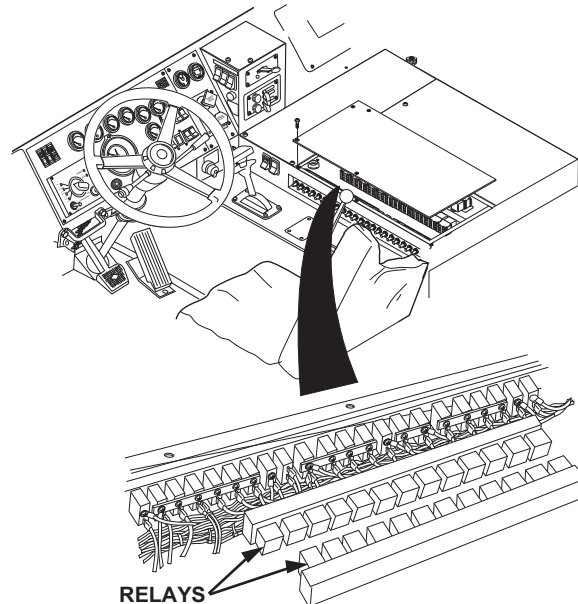


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1005 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Press and hold brake pedal with aid of assistant.
- (3) Place positive (+) probe of multimeter on wire no. 1005 at STOP LIGHTS relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Release brake pedal.
- (6) Turn ENGINE switch to OFF position.



WIRE NO. 1189 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Press and hold brake pedal with aid of assistant.
- (3) Place positive (+) probe of multimeter on wire no. 1189 at STOP LIGHTS relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Release brake pedal.
- (6) Turn ENGINE switch to OFF position.

Check ground wire no. 1435 from STOP LIGHTS relay for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

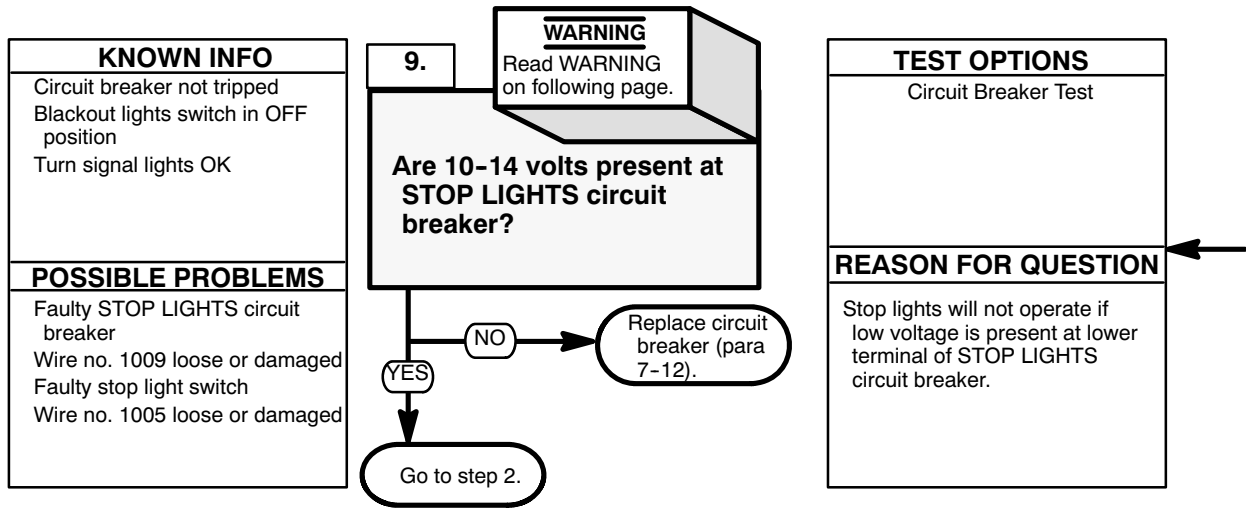
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

e21. STOP LIGHTS DO NOT OPERATE (CONT)

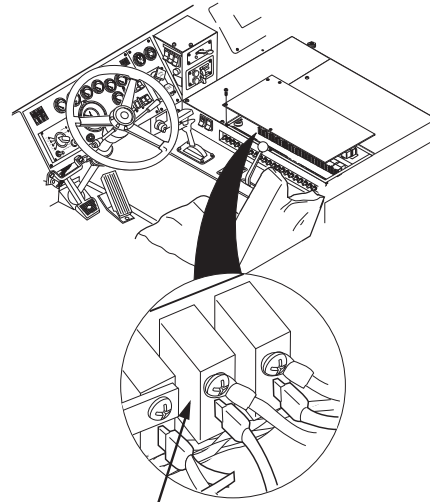


WARNING

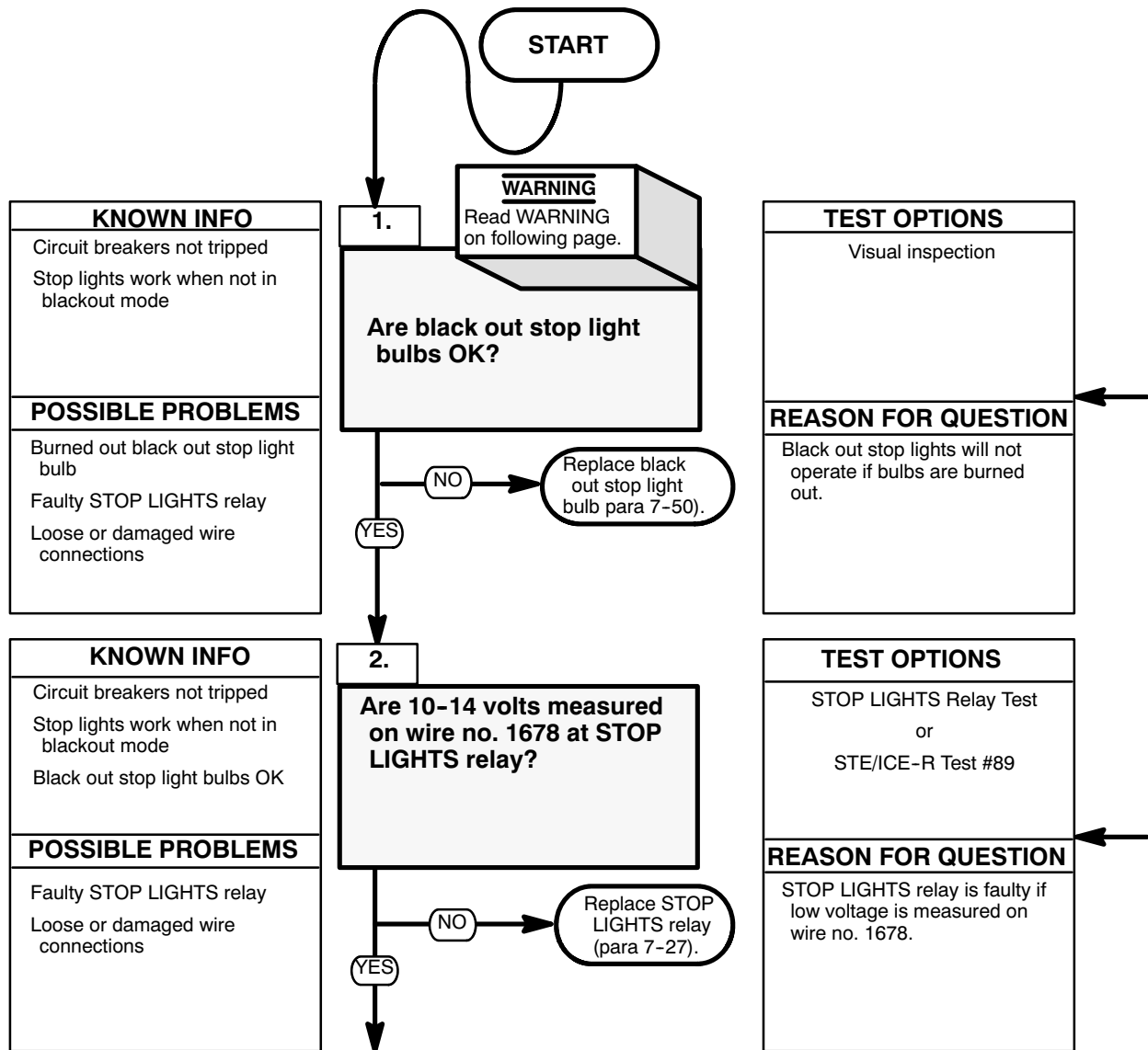
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

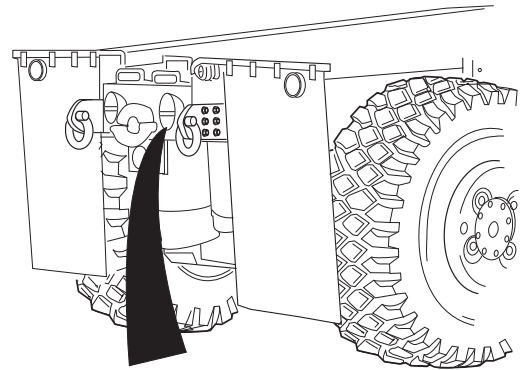
CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.

**CIRCUIT BREAKER**

e22. BLACK OUT STOP LIGHTS DO NOT OPERATE (STOP LIGHTS AND OTHER BLACK OUT LIGHTS OPERATE)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)
Personnel Required Two	

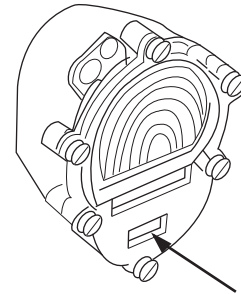




WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

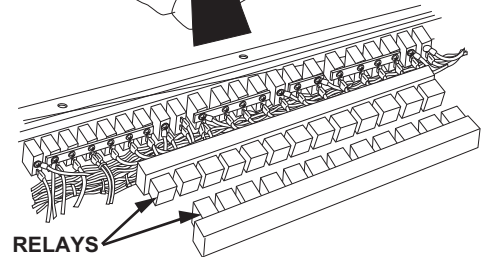
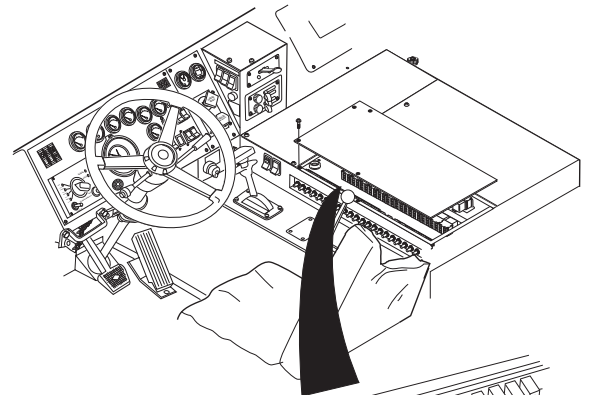
Check black out stop light for burned out bulb if only one black out stop light does not operate.



BLACK OUT STOP LIGHT

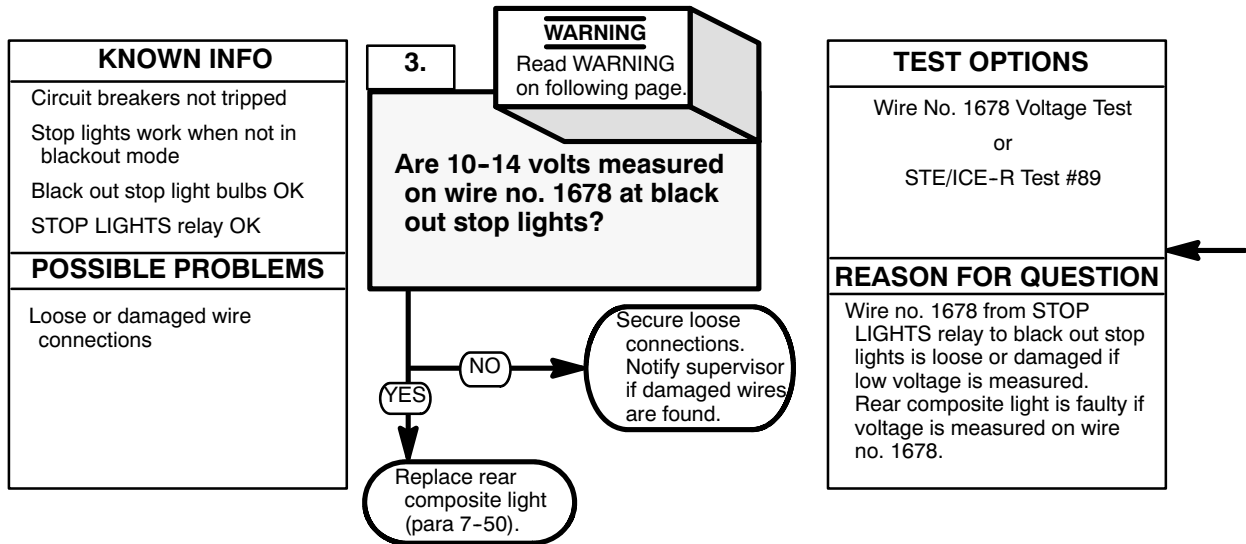
STOP LIGHTS RELAY TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch in the on position.
- (3) Press and hold brake pedal with aid of assistant.
- (4) Place positive (+) probe of multimeter on wire no. 1678 at STOP LIGHTS relay.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Release brake pedal.
- (7) Place BLACK OUT LIGHTS switch in the off position.
- (8) Turn ENGINE switch to OFF position.



RELAYS

e22. BLACK OUT STOP LIGHTS DO NOT OPERATE (STOP LIGHTS AND OTHER BLACK OUT LIGHTS OPERATE)

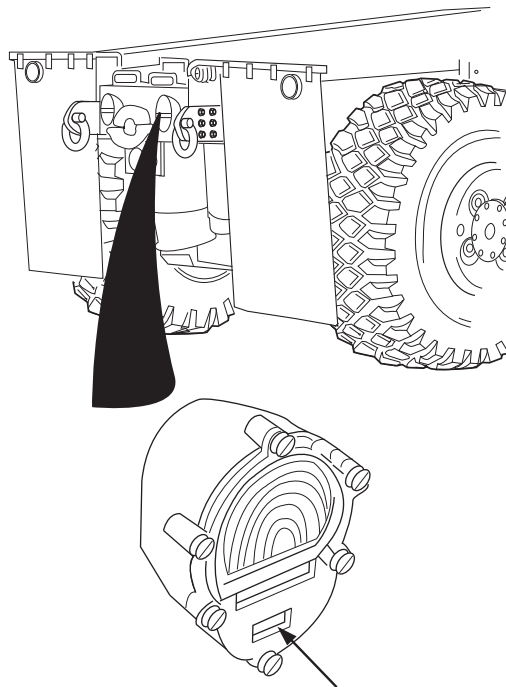


WARNING

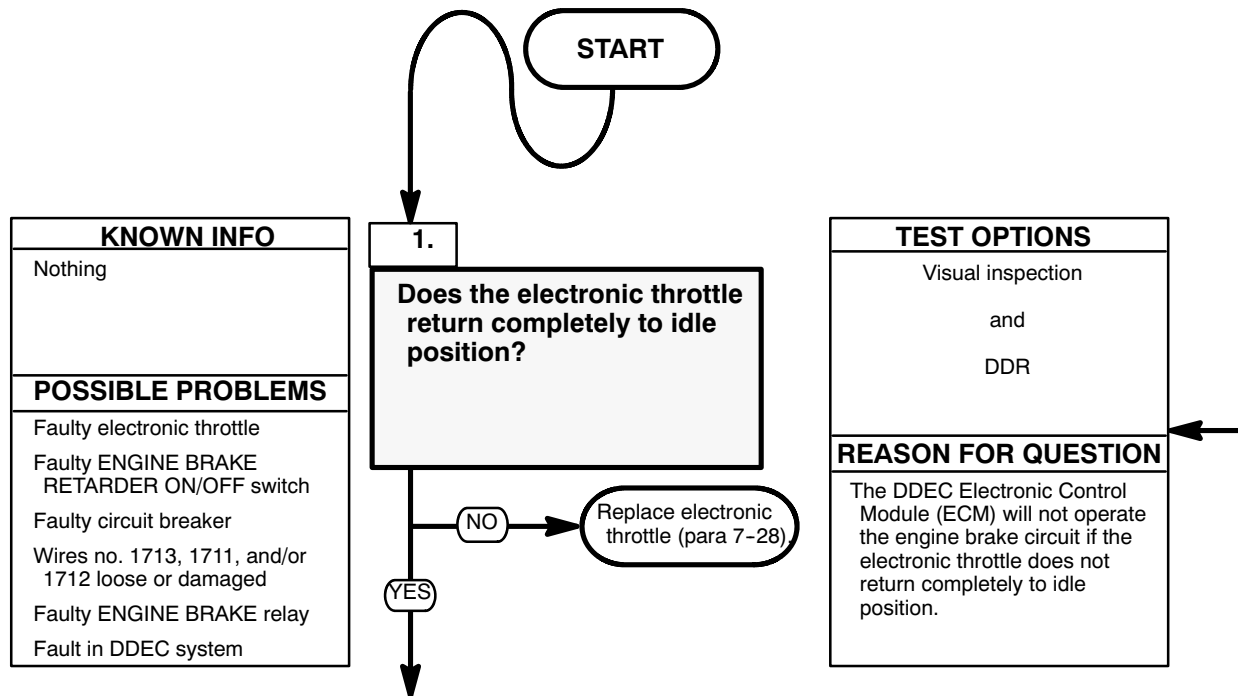
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1678 VOLTAGE TEST

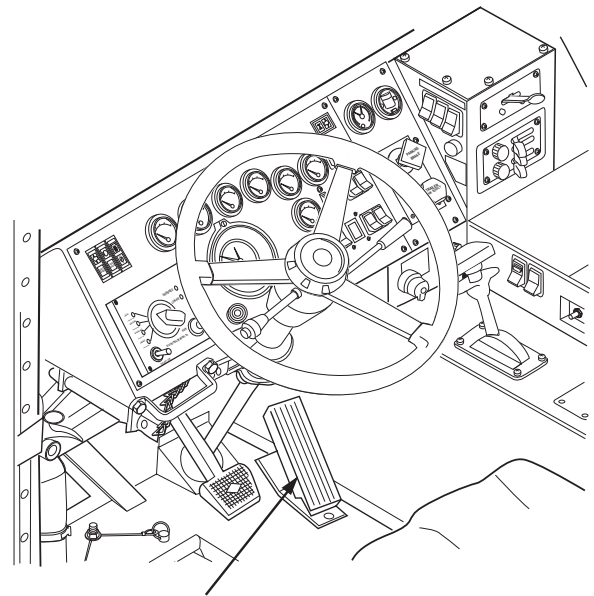
- (1) Turn ENGINE switch to ON position.
- (2) Place BLACK OUT LIGHTS switch in the on position.
- (3) Press and hold brake pedal with aid of assistant.
- (4) Place positive (+) probe of multimeter on wire no. 1678 at black out stop lights.
- (5) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (6) Release brake pedal.
- (7) Place BLACK OUT LIGHTS switch in the off position.
- (8) Turn ENGINE switch to OFF position.

**BLACK OUT STOP LIGHT**

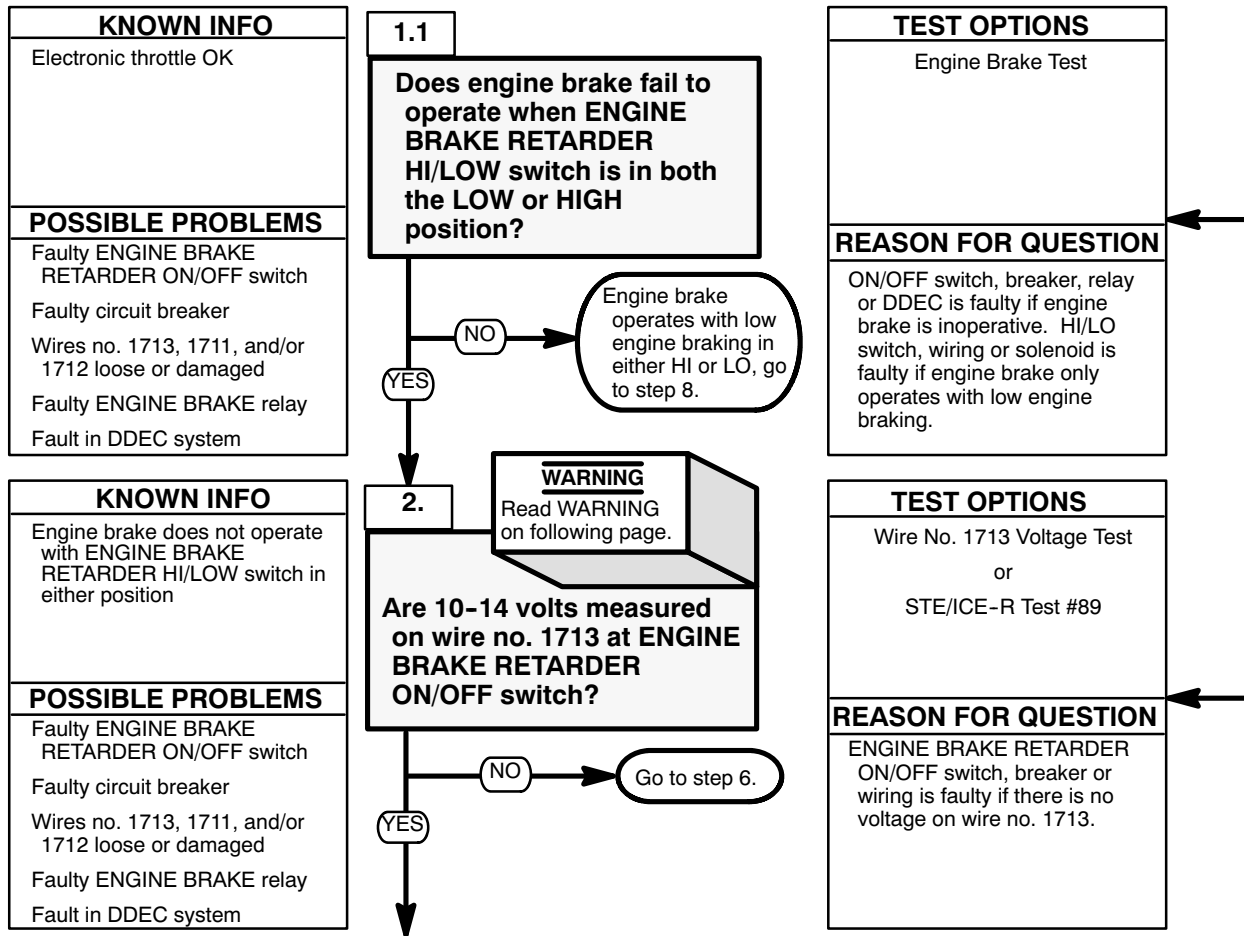
e23. ENGINE BRAKE DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Data Reader, Diagnostic (Item 7, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



- (1) Visually inspect the throttle pedal for proper operation. Note any differences when pedal is released to idle position quickly or slowly.
- (2) Connect Diagnostic Data Reader (DDR) (para 2-13).
- (3) Select throttle sensor display on DDR.
- (4) Fully depress throttle pedal and then let pedal quickly return to idle. Record throttle counts at idle.
- (5) Fully depress throttle pedal and then let pedal slowly return to idle. Record throttle counts at idle.
- (6) Throttle counts should be between 14 and 36 at idle. A significant difference between throttle counts taken in steps (4) and (5) indicates that electronic throttle is faulty.

**ELECTRONIC THROTTLE PEDAL**

e23. ENGINE BRAKE DOES NOT OPERATE (CONT)



ENGINE BRAKE TEST

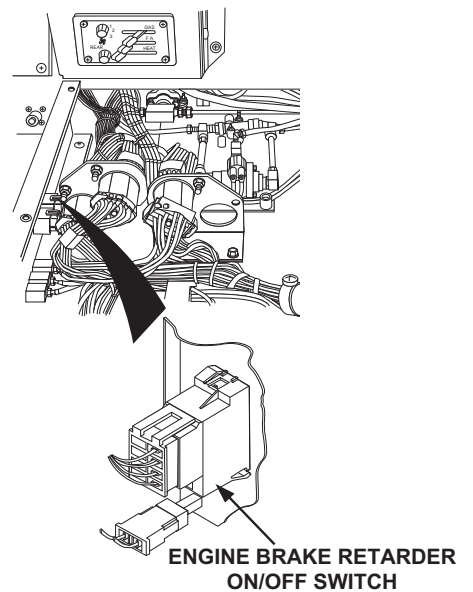
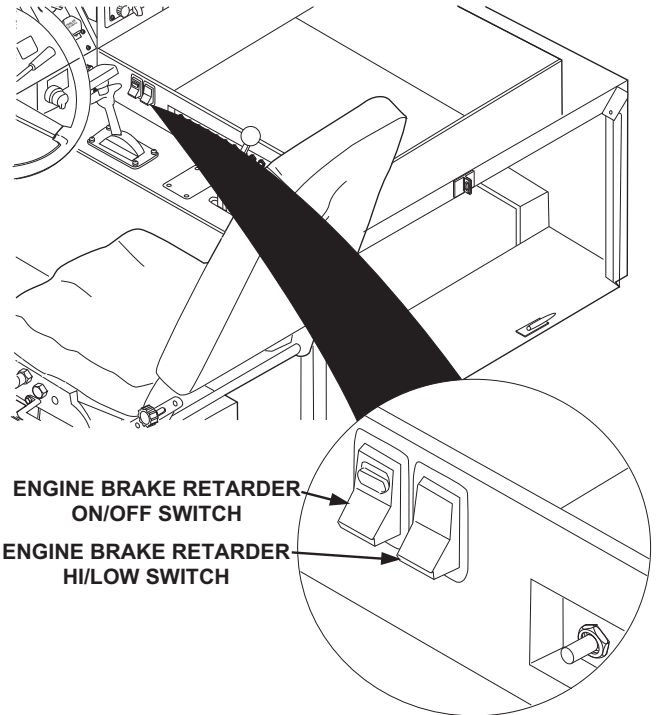
- (1) Start engine (TM 9-2320-360-10).
- (2) Press accelerator pedal to floor and release.
- (3) Place ENGINE BRAKE RETARDER ON/OFF switch in the ON position.
- (4) Place ENGINE BRAKE RETARDER HI/LOW switch in the LO position.
- (5) Press accelerator pedal to floor and release. Listen for engine brake to engage.
- (6) Place ENGINE BRAKE RETARDER HI/LOW switch in the HI position.
- (7) Press accelerator pedal to floor and release. Listen for engine brake to engage.
- (8) Place ENGINE BRAKE RETARDER ON/OFF switch in the OFF position.
- (9) Shut off engine (TM 9-2320-360-10).

WARNING

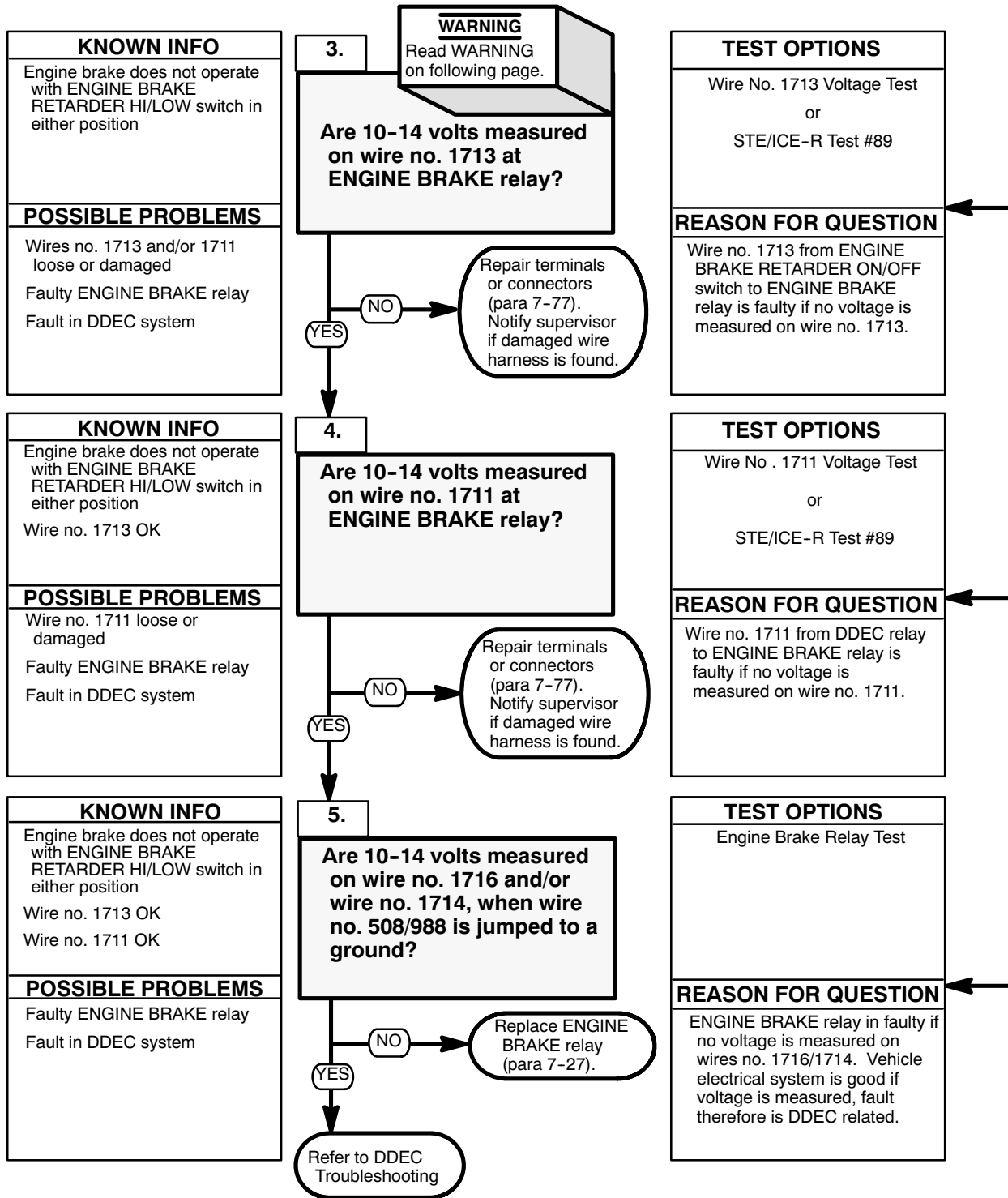
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1713 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place ENGINE BRAKE RETARDER ON/OFF switch in the ON position.
- (3) Place positive (+) probe of multimeter on wire no. 1713 at ENGINE BRAKE RETARDER ON/OFF switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place ENGINE BRAKE RETARDER ON/OFF switch in the OFF position.
- (6) Turn ENGINE switch to OFF position.



e23. ENGINE BRAKE DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1713 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place ENGINE BRAKE RETARDER ON/OFF switch in the ON position.
- (3) Place positive (+) probe of multimeter on wire no. 1713 at ENGINE BRAKE relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place ENGINE BRAKE RETARDER ON/OFF switch in the OFF position.
- (6) Turn ENGINE switch to OFF position.

WIRE NO. 1711 VOLTAGE TEST

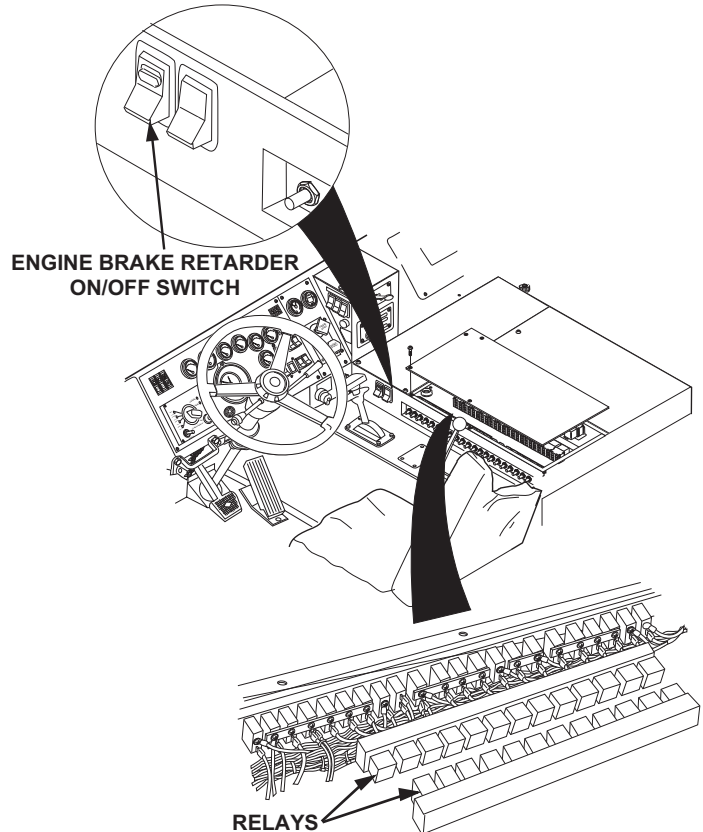
- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1711 at ENGINE BRAKE relay.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

ENGINE BRAKE RELAY TEST

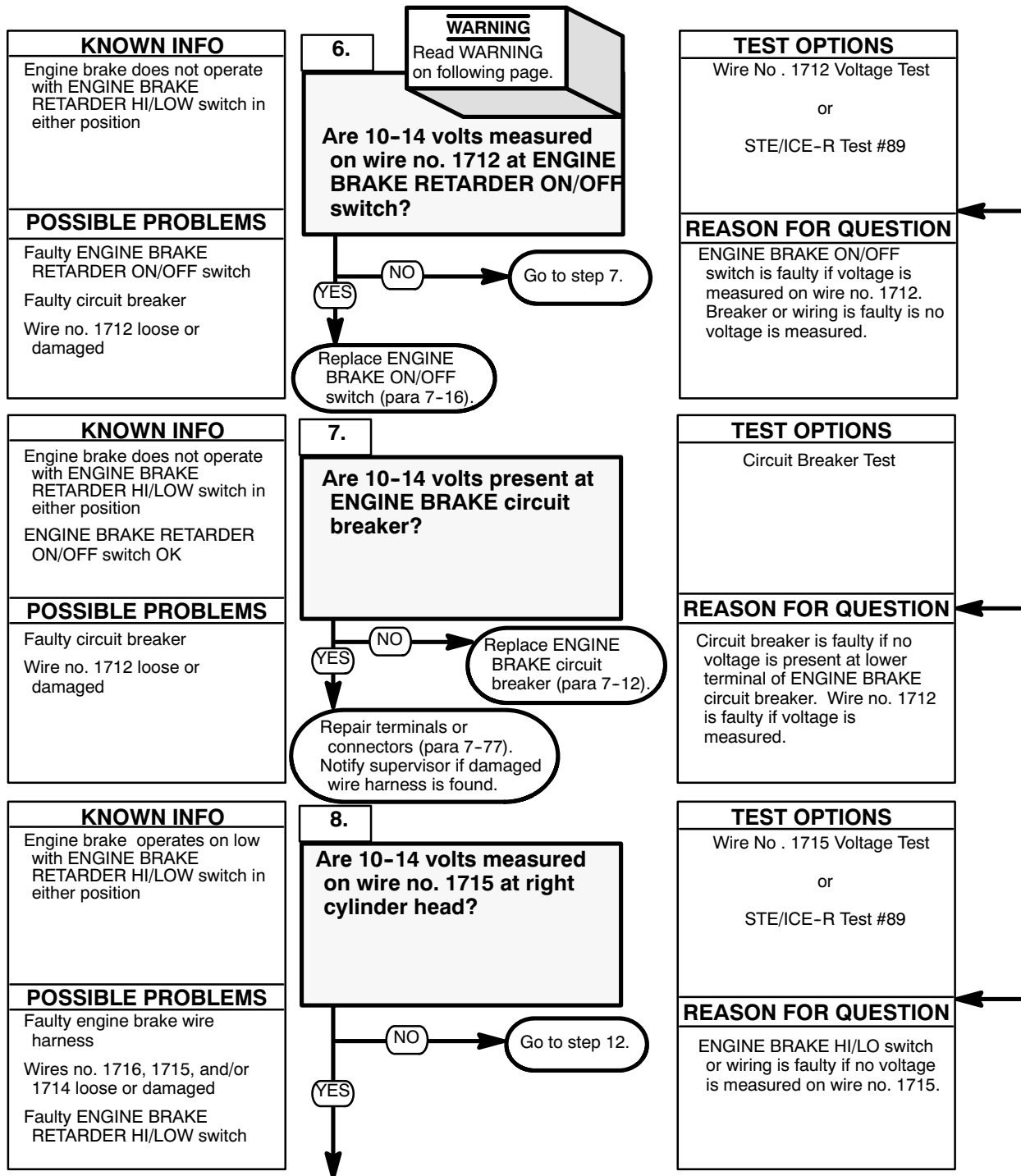
NOTE

Wire No. 508 is for DDEC II vehicles; wire No. 988 is for DDEC III/IV vehicles.

- (1) Remove wire no. 508/988 from ENGINE BRAKE relay.
- (2) Install jumper wire from terminal 85 on ENGINE BRAKE relay to known good ground.
- (3) Turn ENGINE switch to ON position.
- (4) Place ENGINE BRAKE RETARDER ON/OFF switch in the ON position.
- (5) Place positive (+) probe of multimeter on wire no. 1716/1714 at ENGINE BRAKE relay.
- (6) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (7) Place ENGINE BRAKE RETARDER ON/OFF switch in the OFF position.
- (8) Turn ENGINE switch to OFF position.
- (9) Remove jumper wire from ENGINE BRAKE relay.
- (10) Install wire no. 508/988 on ENGINE BRAKE relay.



e23. ENGINE BRAKE DOES NOT OPERATE (CONT)

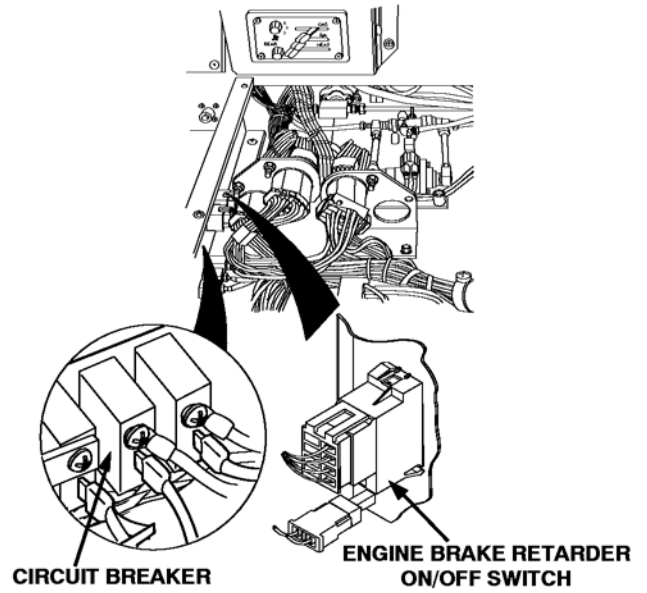


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

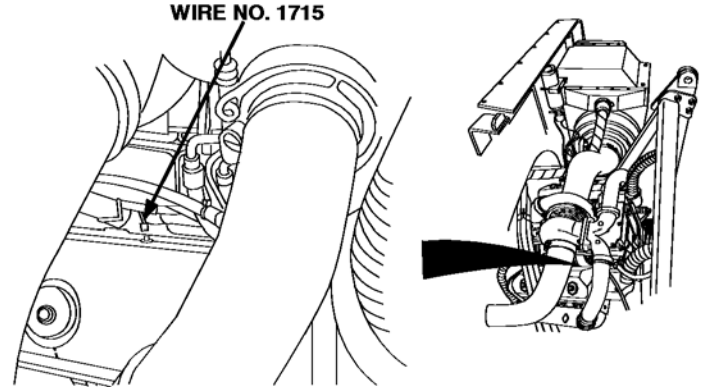
WIRE NO. 1712 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1712 at ENGINE BRAKE RETARDER ON/OFF switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



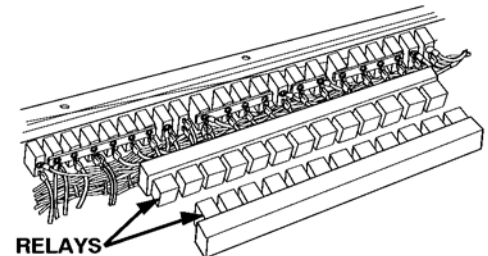
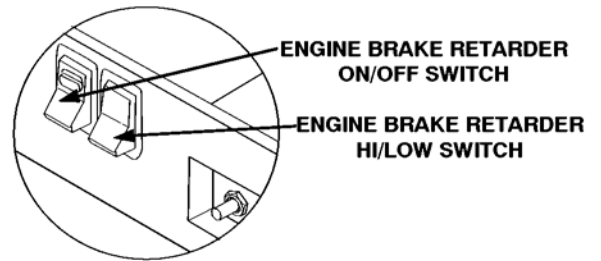
WIRE NO. 1715 VOLTAGE TEST

- (1) Remove wire no. 1715 from connector on right cylinder head.

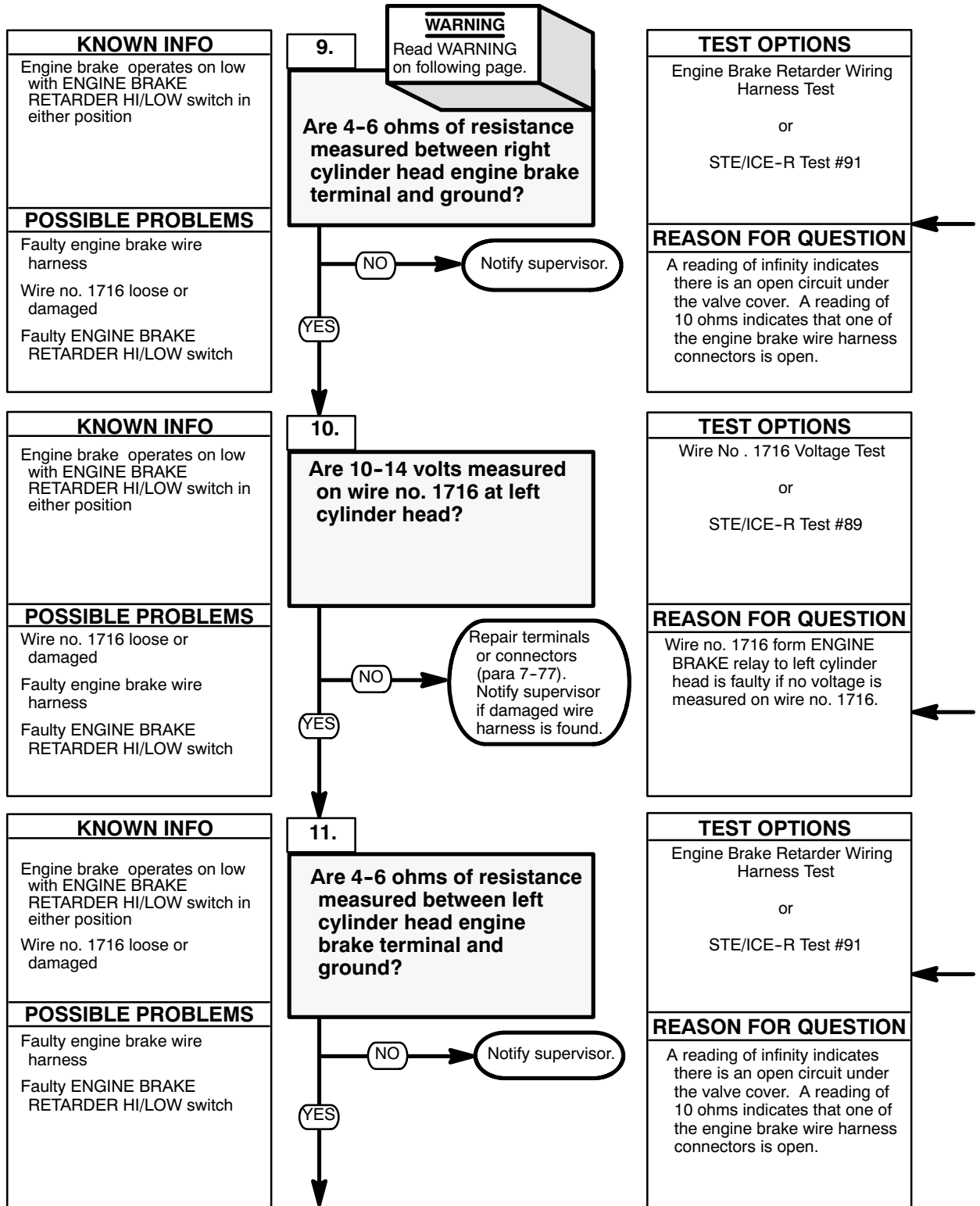
NOTE

Wire No. 508 is for DDEC II vehicles; wire No. 988 is for DDEC III/IV vehicles.

- (2) Remove wire no. 508/988 from ENGINE BRAKE relay.
- (3) Install jumper wire from terminal 85 on ENGINE BRAKE relay to known good ground.
- (4) Turn ENGINE switch to ON position.
- (5) Place ENGINE BRAKE RETARDER ON/OFF switch in the ON position.
- (6) Place ENGINE BRAKE RETARDER HI/LOW switch in the HI position.
- (7) Place positive (+) probe of multimeter on wire no. 1715 at right cylinder head.
- (8) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (9) Place ENGINE BRAKE RETARDER ON/OFF switch in the OFF position.
- (10) Turn ENGINE switch to OFF position.
- (11) Remove jumper wire from ENGINE BRAKE relay.
- (12) Install wire no. 508/988 on ENGINE BRAKE relay.
- (13) Install wire no. 1715 on connector at right cylinder head.



e23. ENGINE BRAKE DOES NOT OPERATE (CONT)

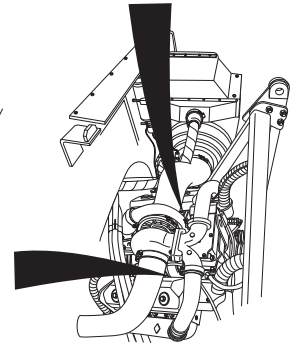
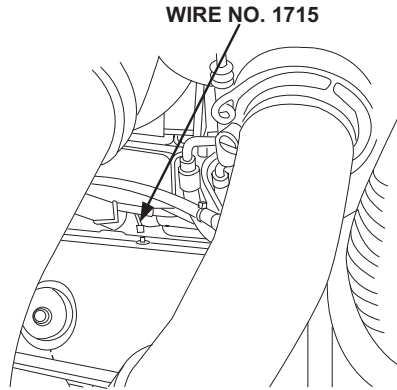
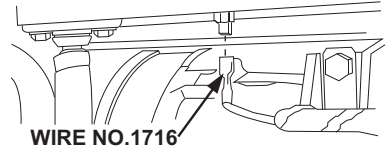


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

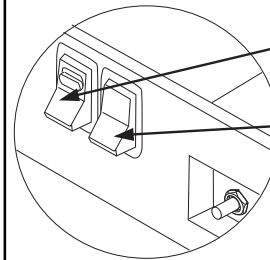
ENGINE BRAKE RETARDER WIRING HARNESS TEST

- (1) Remove wire no. 1715 from connector on right cylinder head.
- (2) Set multimeter to ohms position.
- (3) Connect multimeter leads to connector terminal and known good ground.
- (4) Observe resistance reading displayed on multimeter.
- (5) Remove multimeter leads from terminal and ground.
- (6) Install wire no. 1715 on connector at right cylinder head.



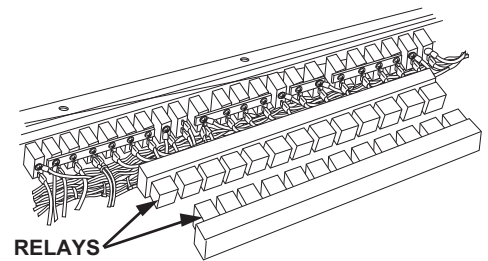
WIRE NO. 1716 VOLTAGE TEST

- (1) Remove wire no. 1716 from connector on left cylinder head.
- (2) Remove wire no. 508/988 from ENGINE BRAKE relay.
- (3) Install jumper wire from terminal 85 on ENGINE BRAKE relay to known good ground.
- (4) Turn ENGINE switch to ON position.
- (5) Place ENGINE BRAKE RETARDER ON/OFF switch in the ON position.
- (6) Place positive (+) probe of multimeter on wire no. 1716 at left cylinder head.
- (7) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (8) Place ENGINE BRAKE RETARDER ON/OFF switch in the OFF position.
- (9) Turn ENGINE switch to OFF position.
- (10) Remove jumper wire from ENGINE BRAKE relay.
- (11) Install wire no. 508/988 on ENGINE BRAKE relay.
- (12) Install wire no. 1716 on connector at left cylinder head.

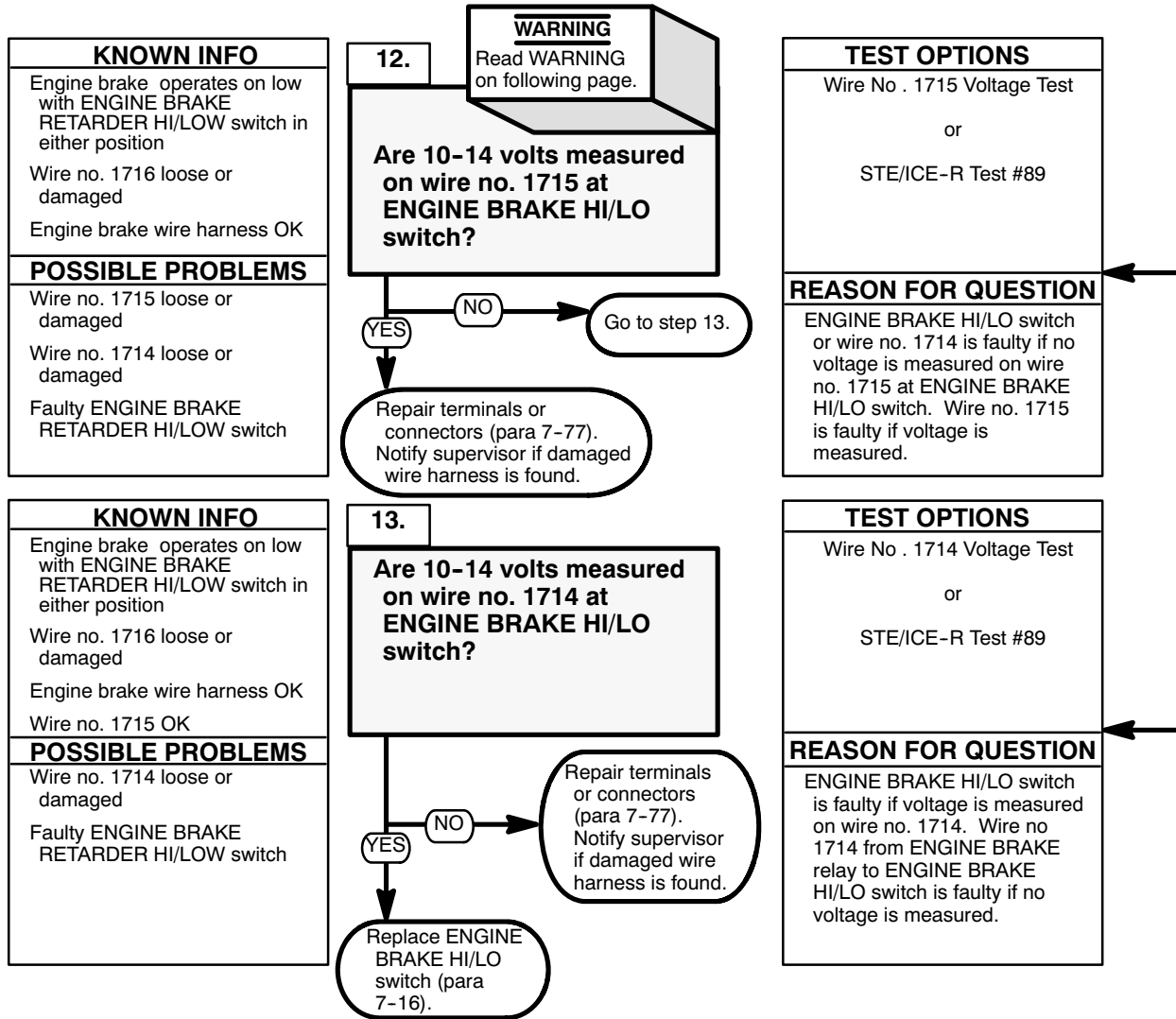


ENGINE BRAKE RETARDER WIRING HARNESS TEST

- (1) Remove wire no. 1715 from connector on right cylinder head.
- (2) Set multimeter to ohms position.
- (3) Connect multimeter leads to connector terminal and known good ground.
- (4) Observe resistance reading displayed on multimeter.
- (5) Remove multimeter leads from terminal and ground.
- (6) Install wire no. 1715 on connector at right cylinder head.



e23. ENGINE BRAKE DOES NOT OPERATE (CONT)

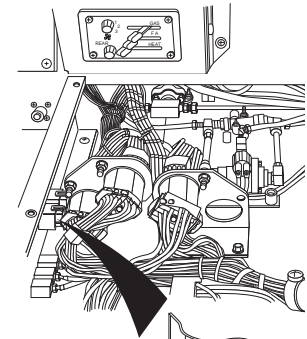


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1715 VOLTAGE TEST

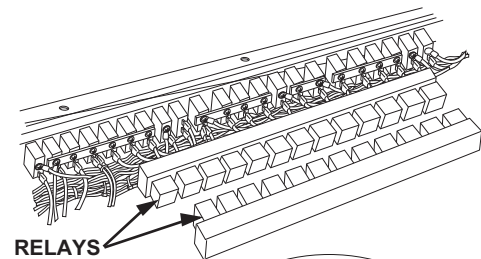
- (1) Remove wire no. 508/988 from ENGINE BRAKE relay.
- (2) Install jumper wire from terminal 85 on ENGINE BRAKE relay to known good ground.
- (3) Turn ENGINE switch to ON position.
- (4) Place ENGINE BRAKE RETARDER ON/OFF switch in the ON position.
- (5) Place ENGINE BRAKE RETARDER HI/LOW switch in the HI position.
- (6) Place positive (+) probe of multimeter on wire no. 1715 at ENGINE BRAKE RETARDER HI/LOW switch.
- (7) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (8) Place ENGINE BRAKE RETARDER ON/OFF switch in the OFF position.
- (9) Turn ENGINE switch to OFF position.
- (10) Remove jumper wire from ENGINE BRAKE relay.
- (11) Install wire no. 508/988 on ENGINE BRAKE relay.



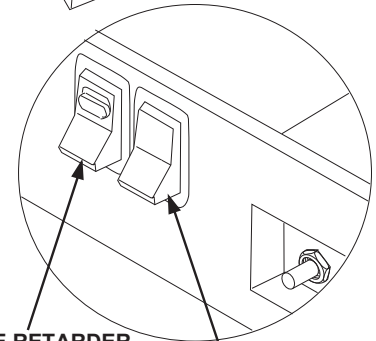
ENGINE BRAKE RETARDER HI/LOW SWITCH

WIRE NO. 1714 VOLTAGE TEST

- (1) Remove wire no. 508/988 from ENGINE BRAKE relay.
- (2) Install jumper wire from terminal 85 on ENGINE BRAKE relay to known good ground.
- (3) Turn ENGINE switch to ON position.
- (4) Place ENGINE BRAKE RETARDER ON/OFF switch in the ON position.
- (5) Place ENGINE BRAKE RETARDER HI/LOW switch in the HI position.
- (6) Place positive (+) probe of multimeter on wire no. 1714 at ENGINE BRAKE RETARDER HI/LOW switch.
- (7) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (8) Place ENGINE BRAKE RETARDER ON/OFF switch in the OFF position.
- (9) Turn ENGINE switch to OFF position.
- (10) Remove jumper wire from ENGINE BRAKE relay.
- (11) Install wire no. 508/988 on ENGINE BRAKE relay.



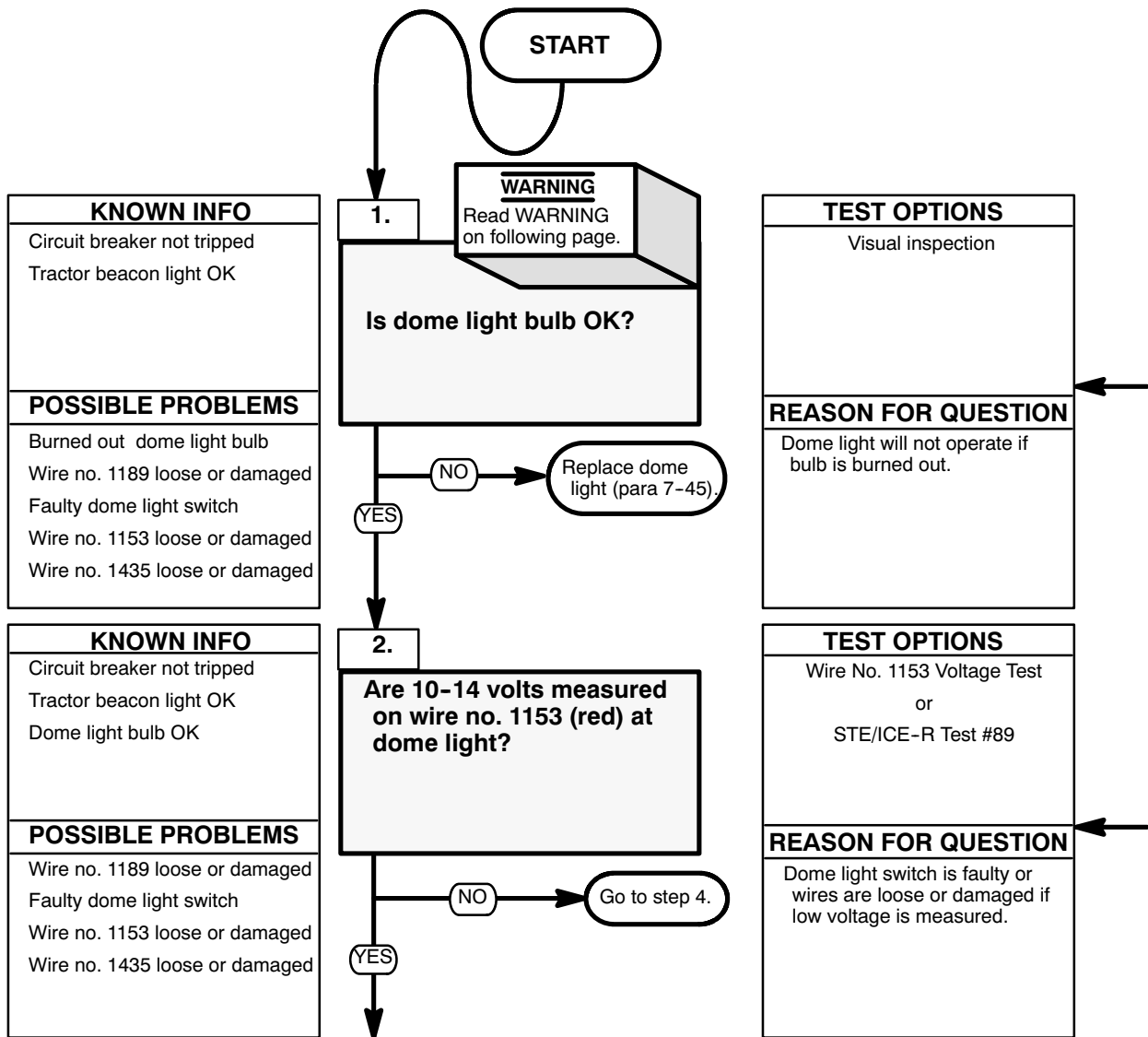
RELAYS



ENGINE BRAKE RETARDER ON/OFF SWITCH

ENGINE BRAKE RETARDER HI/LOW SWITCH

e24. DOME LIGHT DOES NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)</p>



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

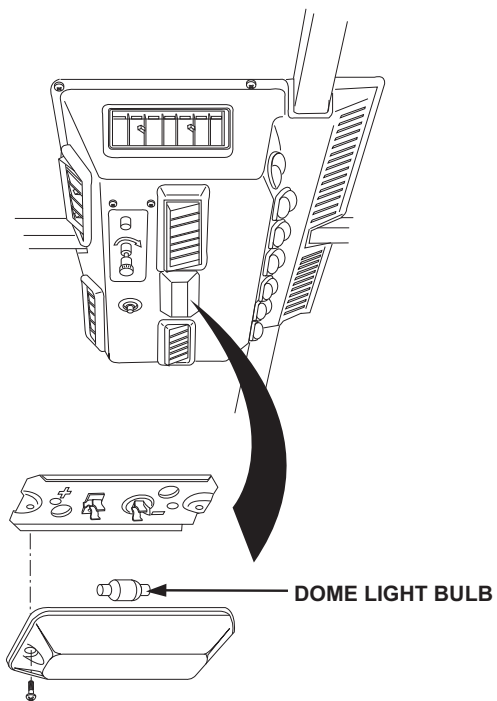
NOTE

BLACK OUT LIGHTS switch must be in the off position for dome light to operate.

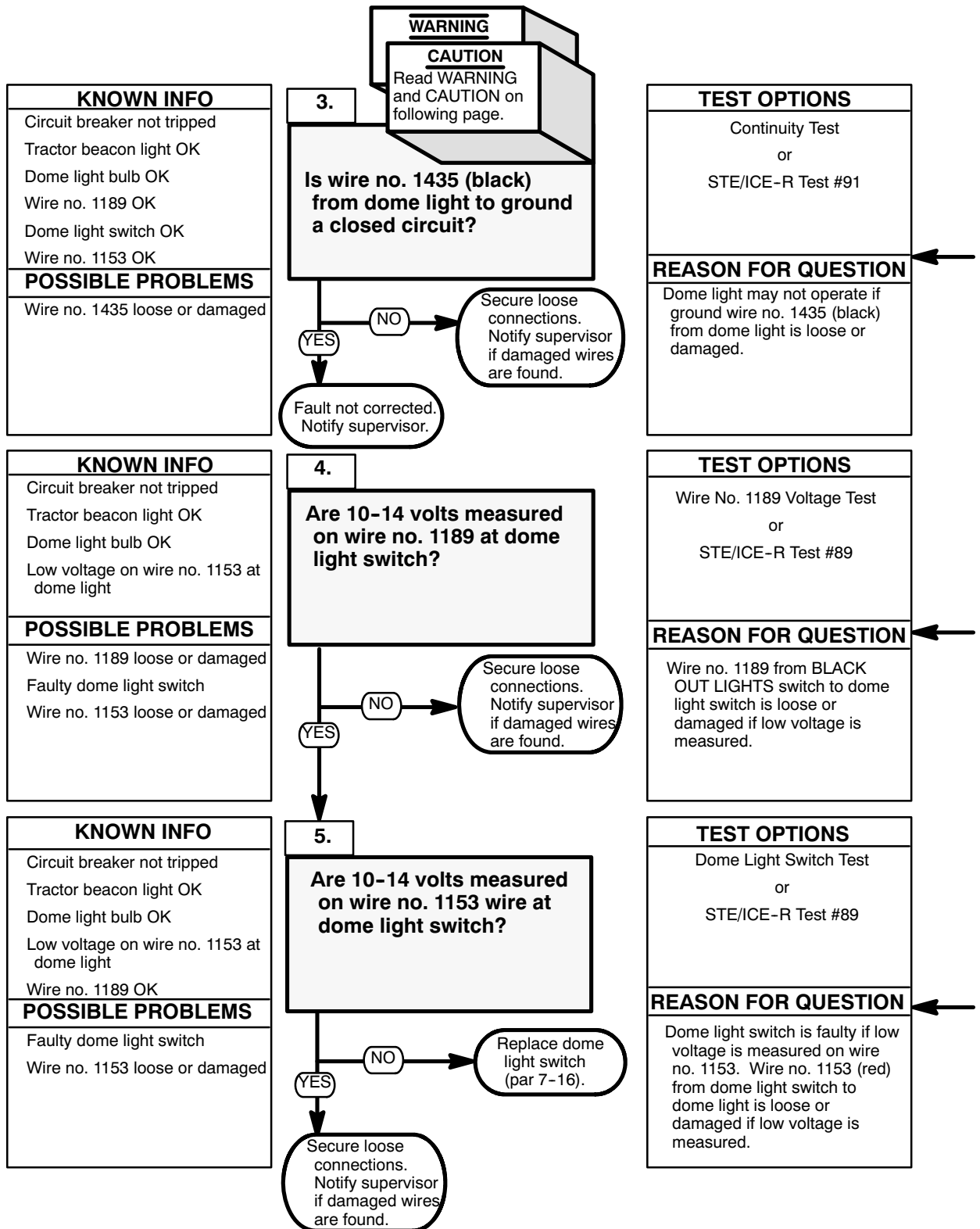
Check dome light for burned out bulb.

WIRE NO. 1153 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place dome light switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1153 (red) at dome light.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place dome light switch in the off position.
- (6) Turn ENGINE switch to OFF position.



e24. DOME LIGHT DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 (black) from dome light for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

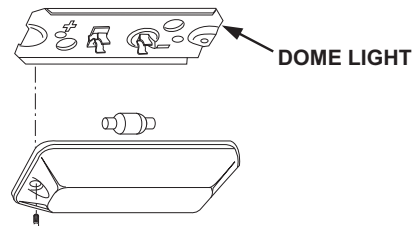
NOTE

Any reading besides infinity indicates a grounded wire.

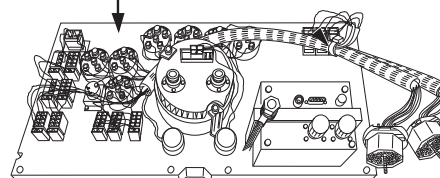
- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

WIRE NO. 1189 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1189 at dome light switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

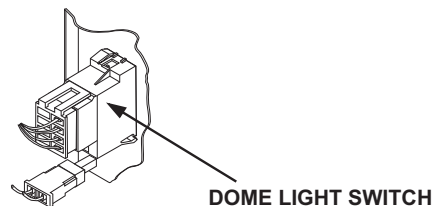


INSTRUMENT PANEL

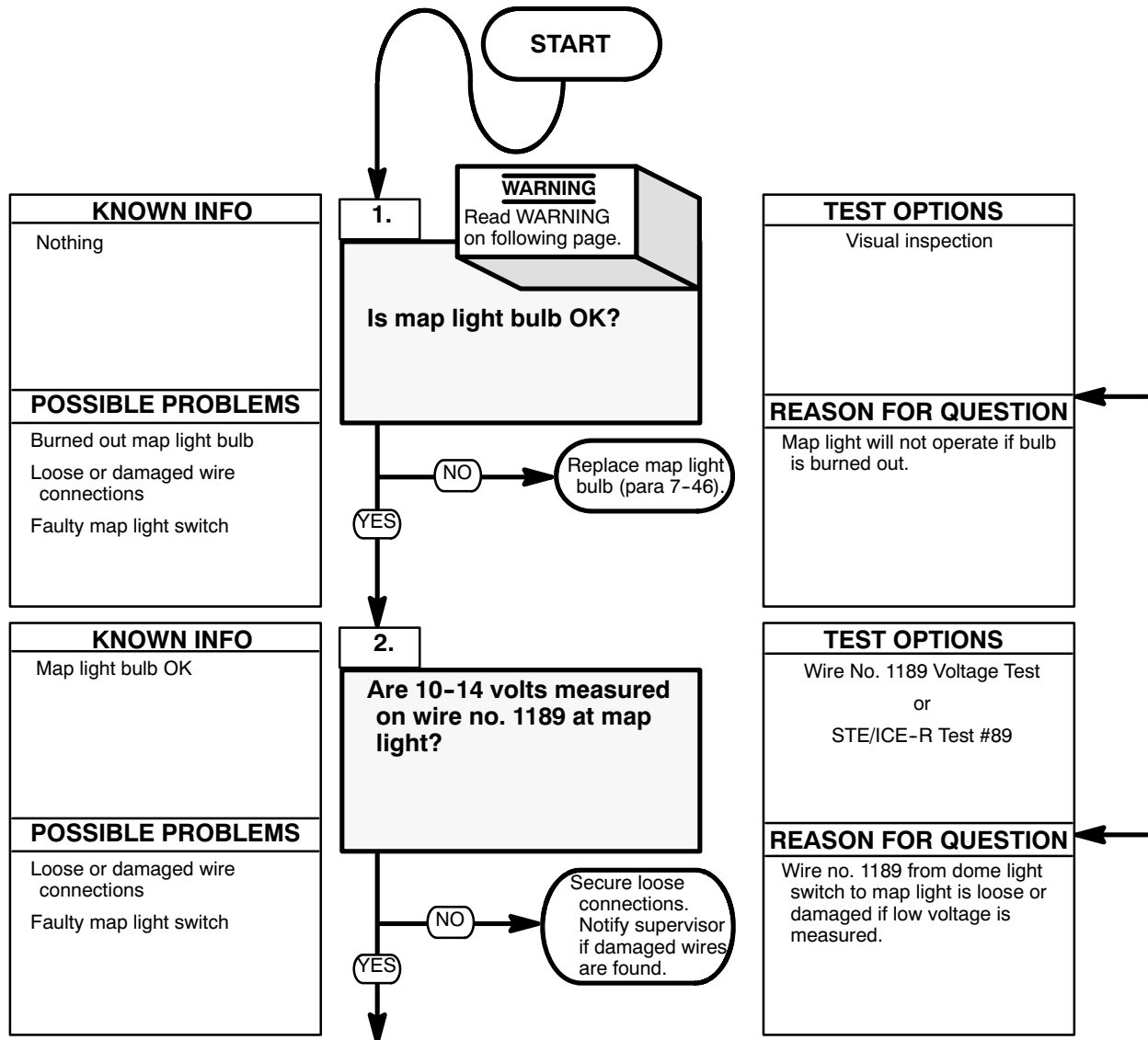


DOME LIGHT SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place dome light switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1153 at dome light switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place dome light switch in the off position.
- (6) Turn ENGINE switch to OFF position.



e25. MAP LIGHT(S) DO NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)</p>



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

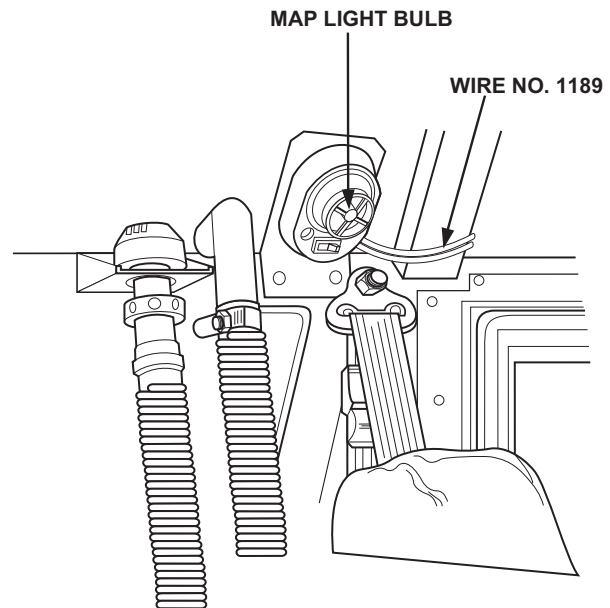
NOTE

- BLACK OUT LIGHTS switch must be in the off position for map light to operate.
- Troubleshooting procedures are the same for the right side and left side map lights.

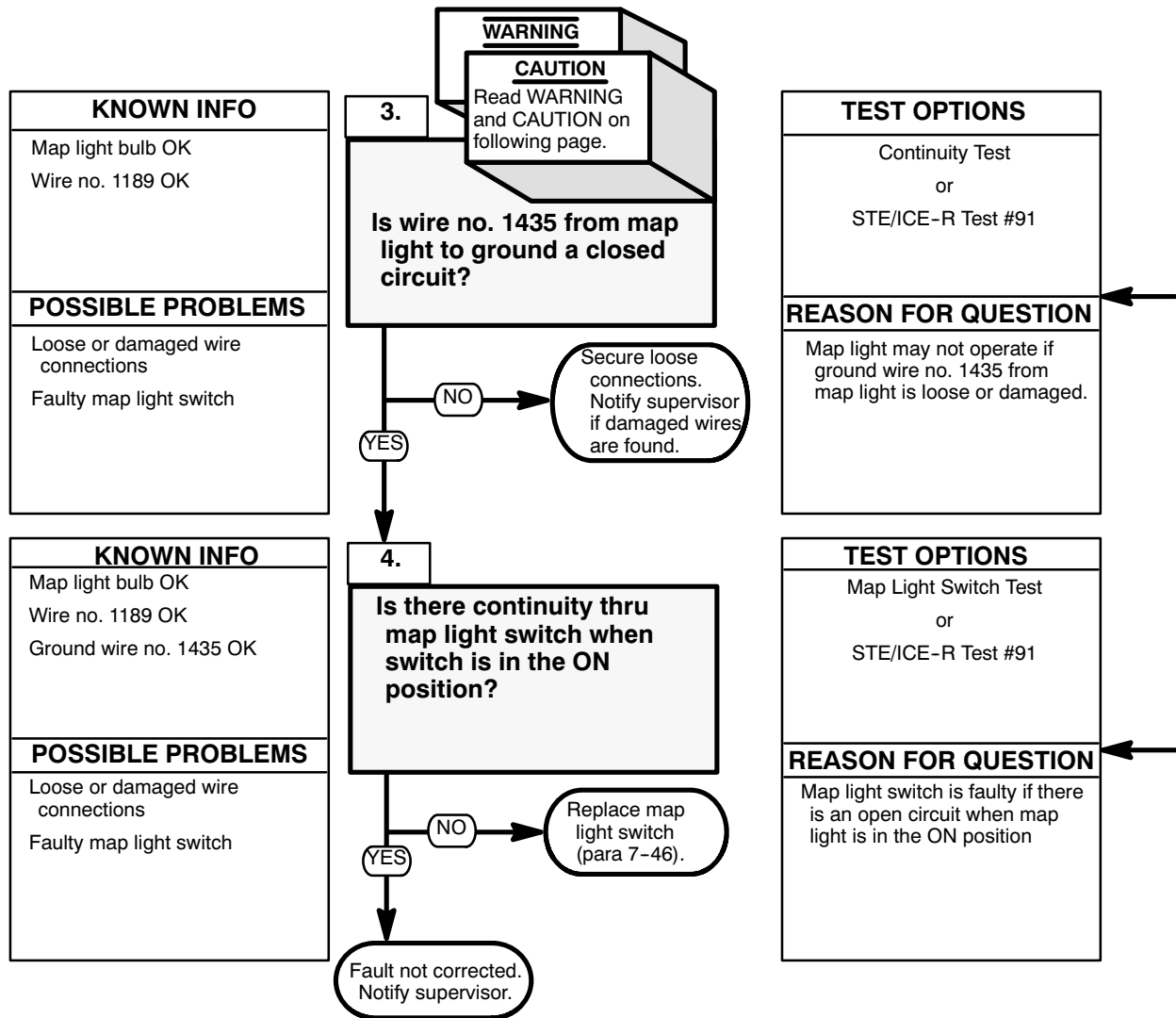
Check map light for burned out bulb.

WIRE NO. 1189 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1189 at map light.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



e25. MAP LIGHT(S) DO NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from map light for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

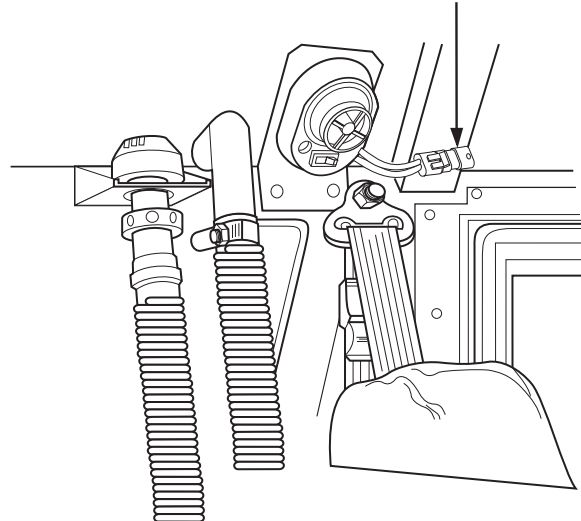
Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

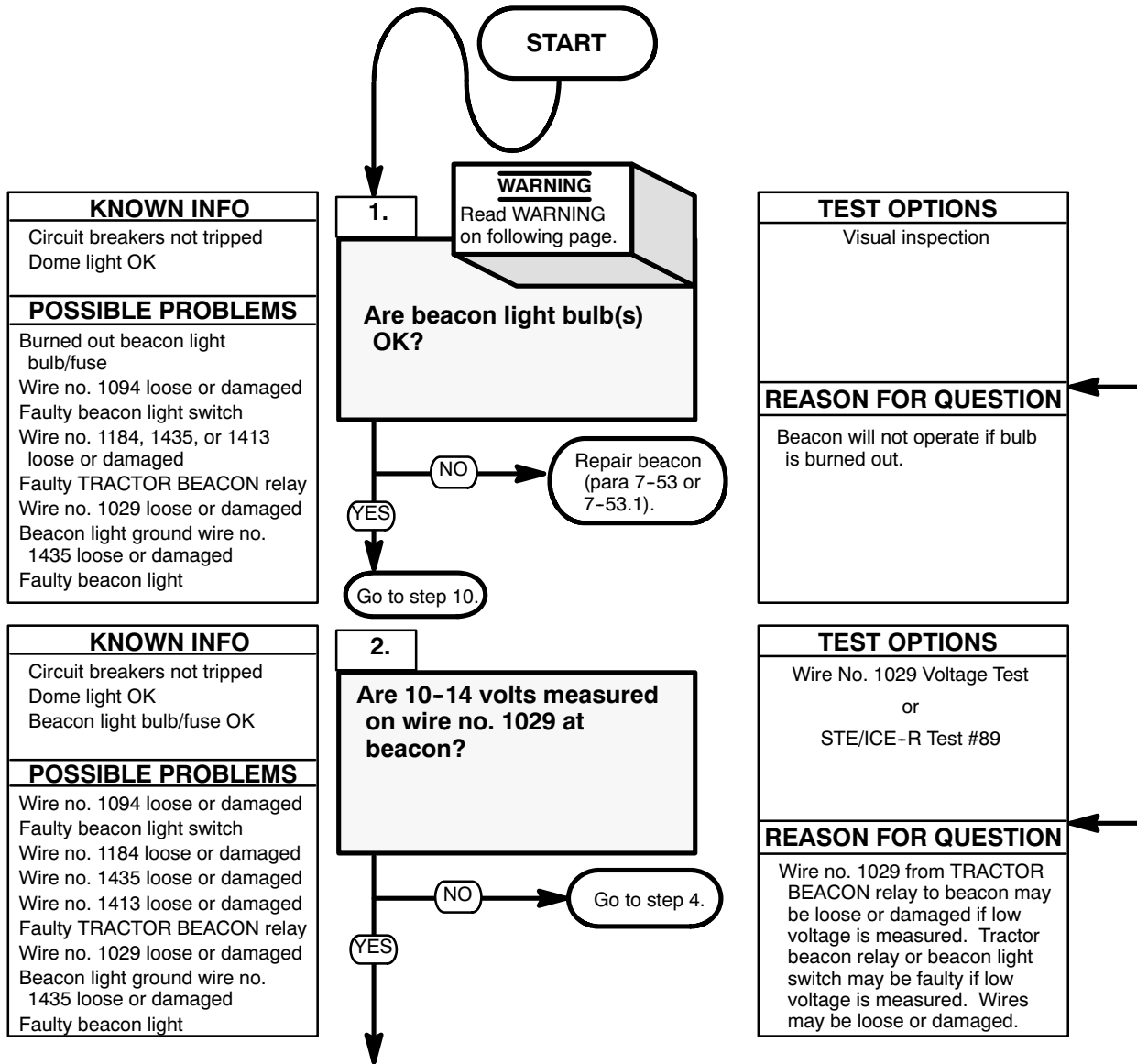
MAP LIGHT SWITCH TEST

- (1) Disconnect map light connector.
- (2) Set multimeter to ohms position.
- (3) Connect multimeter leads to each pin in connector.
- (4) Turn map light on and check multimeter for continuity.

MAP LIGHT CONNECTOR



e26. BEACON LIGHT DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



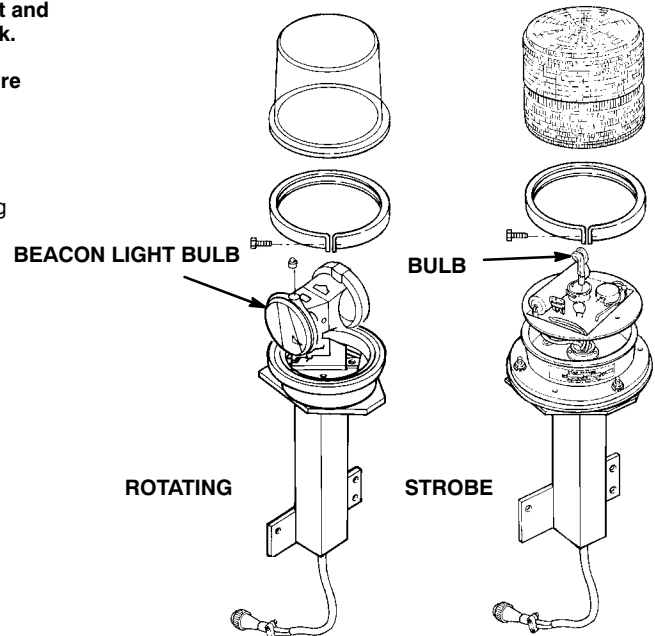
WARNING

- **Capacitor inside strobe-type beacon light assembly may contain high voltage. Ensure light has been turned off for at least five minutes before servicing. Failure to comply may result in injury to personnel.**
- **Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.**

NOTE

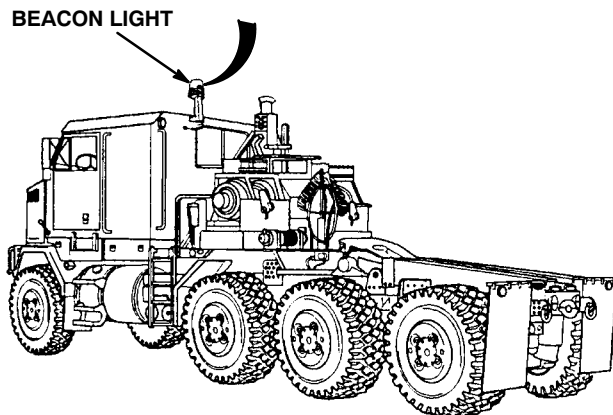
HET M1070's are equipped with either a rotating or strobe type beacon light. Rotating beacons have two light bulbs, strobe beacons have one.

Check beacon light for burned out bulb.

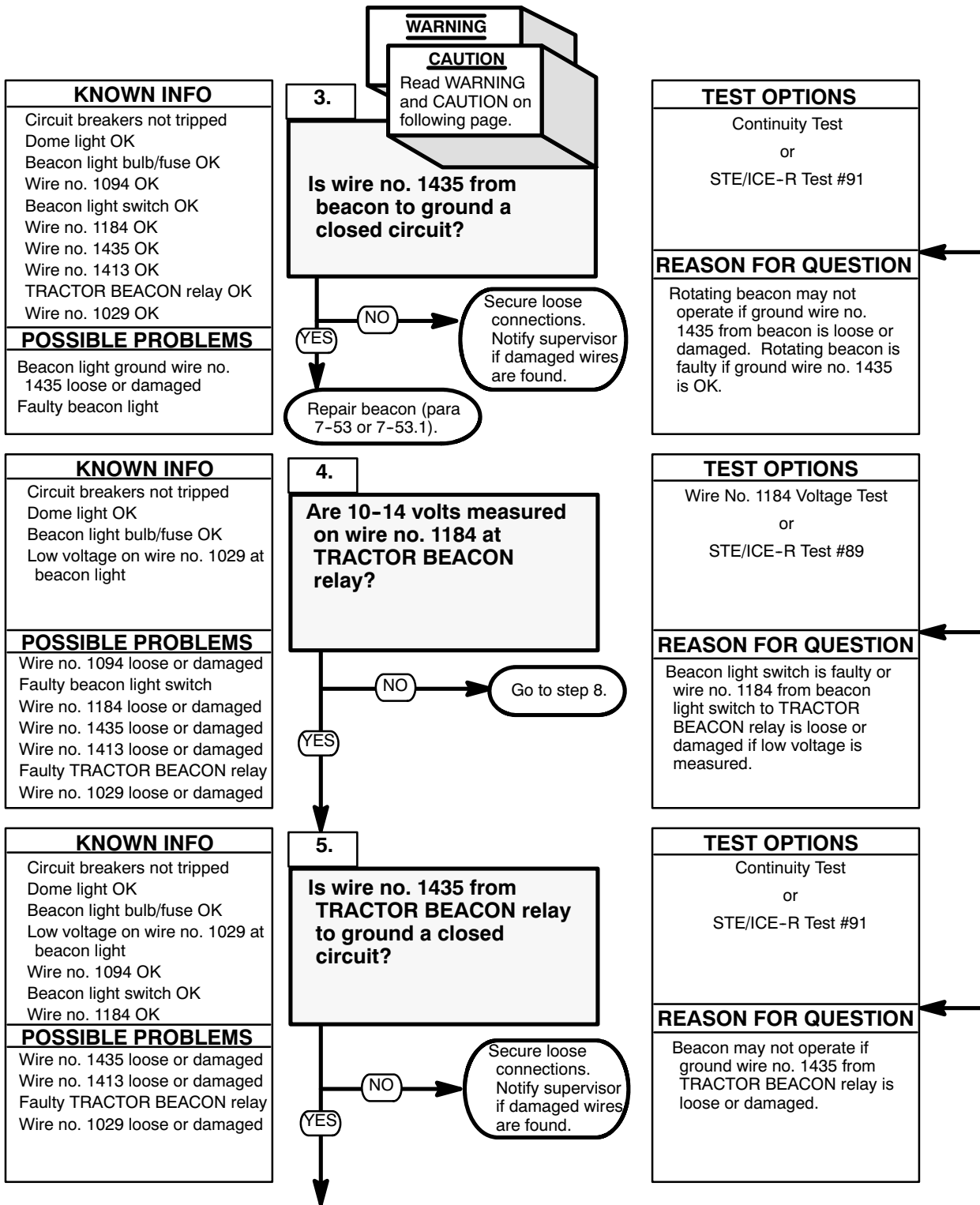


WIRE NO. 1029 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place beacon light switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1029 at beacon.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place beacon light switch in the off position.
- (6) Turn ENGINE switch to OFF position.



e26. BEACON LIGHT DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from beacon for loose connections or damage.

WIRE NO. 1184 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place beacon light switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1184 at TRACTOR BEACON relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place beacon light switch in the off position.
- (6) Turn ENGINE switch to OFF position.

Check ground wire no. 1435 from TRACTOR BEACON relay for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

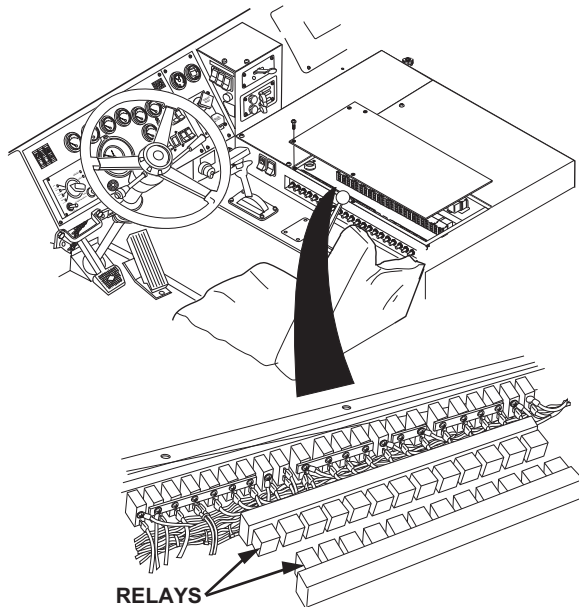
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

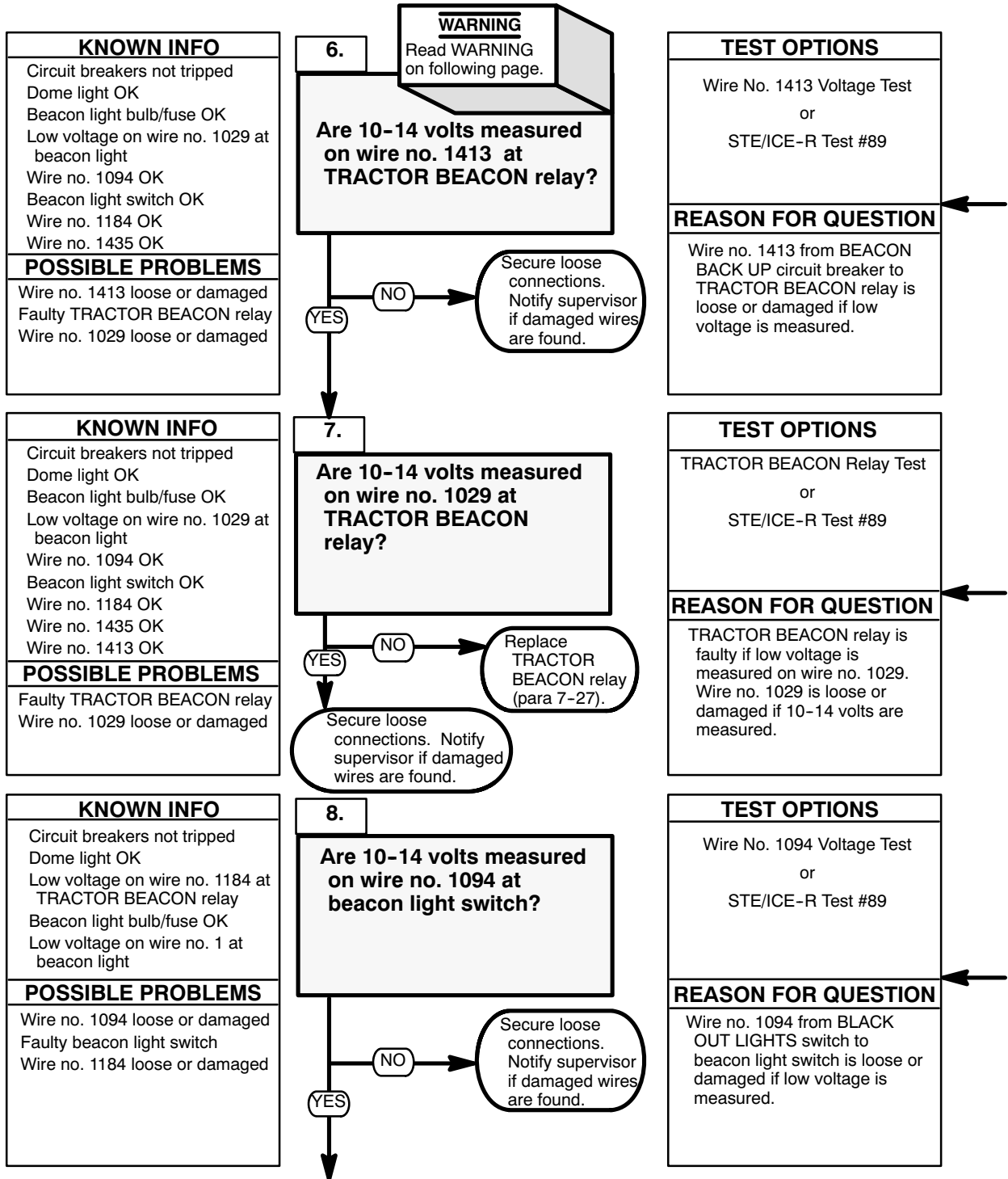
NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.



e26. BEACON LIGHT DOES NOT OPERATE (CONT)

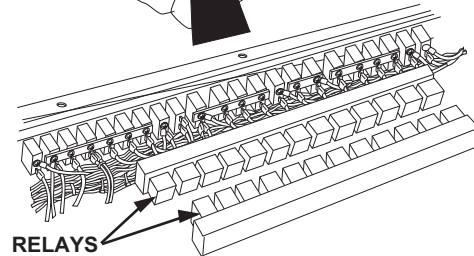
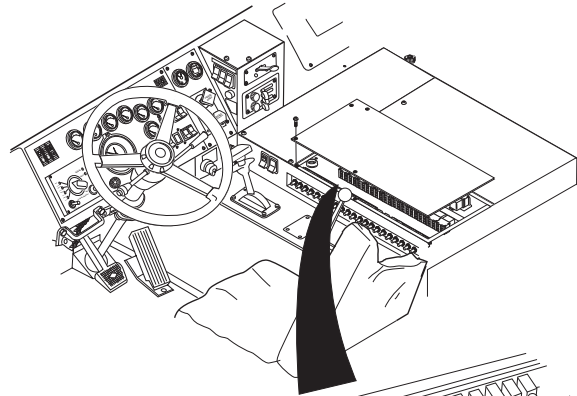


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1413 VOLTAGE TEST

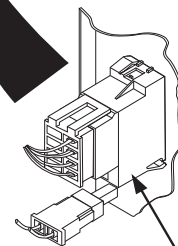
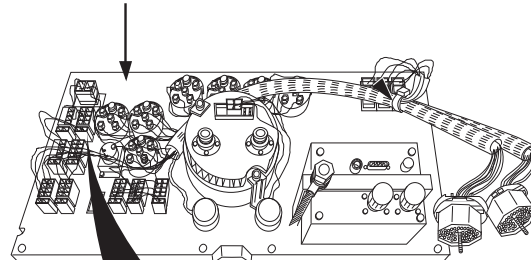
- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1413 at TRACTOR BEACON relay.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



TRACTOR BEACON RELAY TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place beacon light switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1029 at TRACTOR BEACON relay.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place beacon light switch in the off position.
- (6) Turn ENGINE switch to OFF position.

INSTRUMENT PANEL

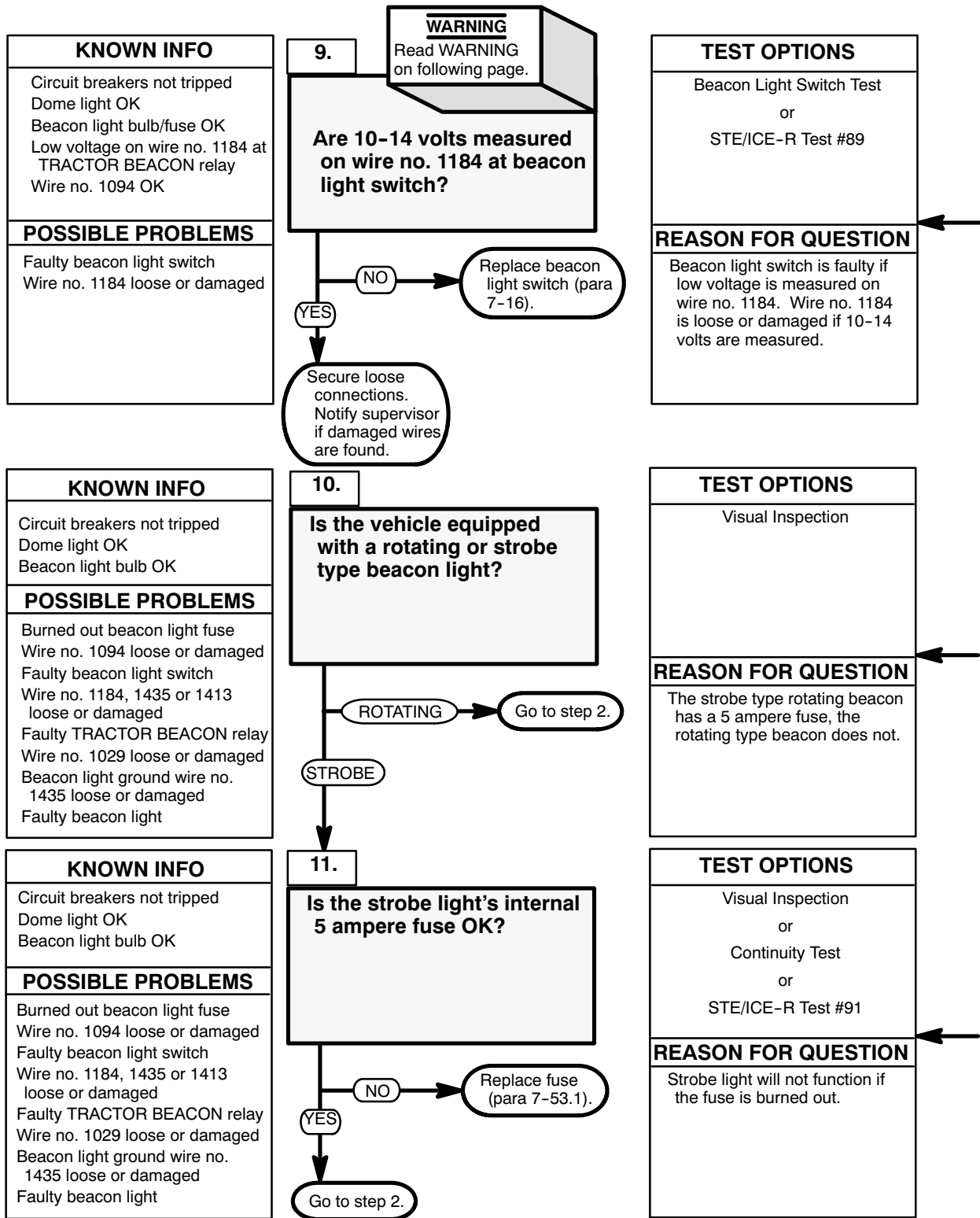


BEACON LIGHT SWITCH

WIRE NO. 1094 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1094 at beacon light switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.

e26. BEACON LIGHT DOES NOT OPERATE (CONT)

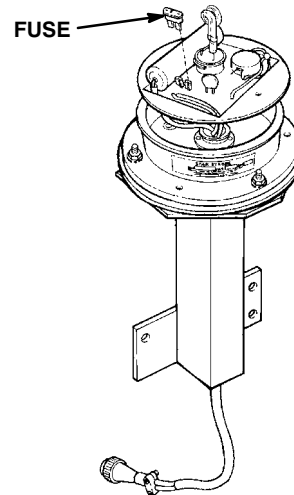
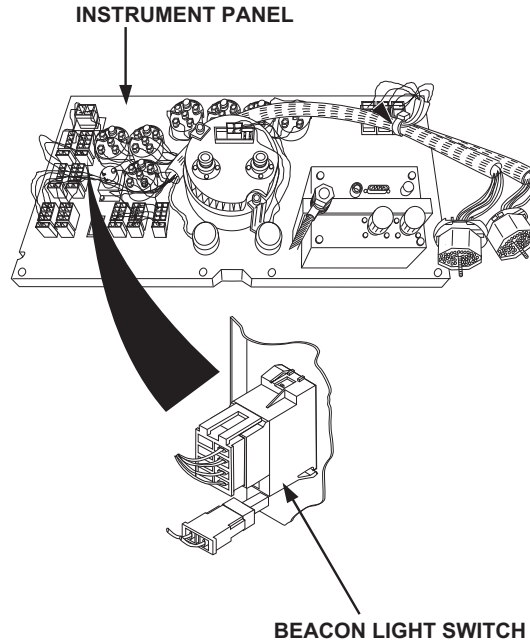


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

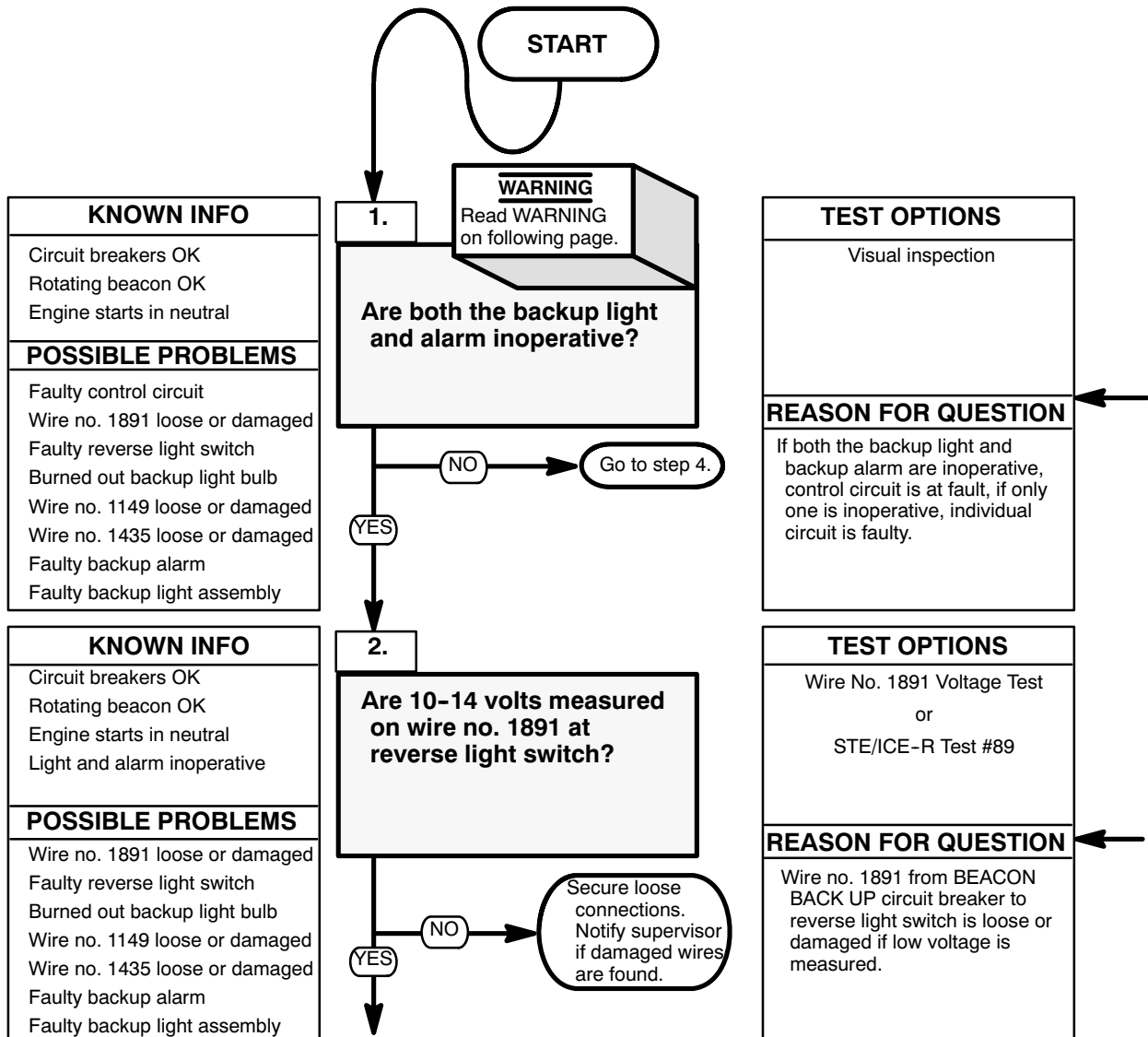
BEACON LIGHT SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place beacon light switch in the on position.
- (3) Place positive (+) probe of multimeter on wire no. 1184 at beacon light switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place beacon light switch in the off position.
- (6) Turn ENGINE switch to OFF position.



Remove fuse from strobe type beacon light and visually inspect. A fuse will usually "blow" in the center, at the inverted U-shape area. Fuse can also be checked with a multimeter.

e27. BACKUP LIGHT/ALARM DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)



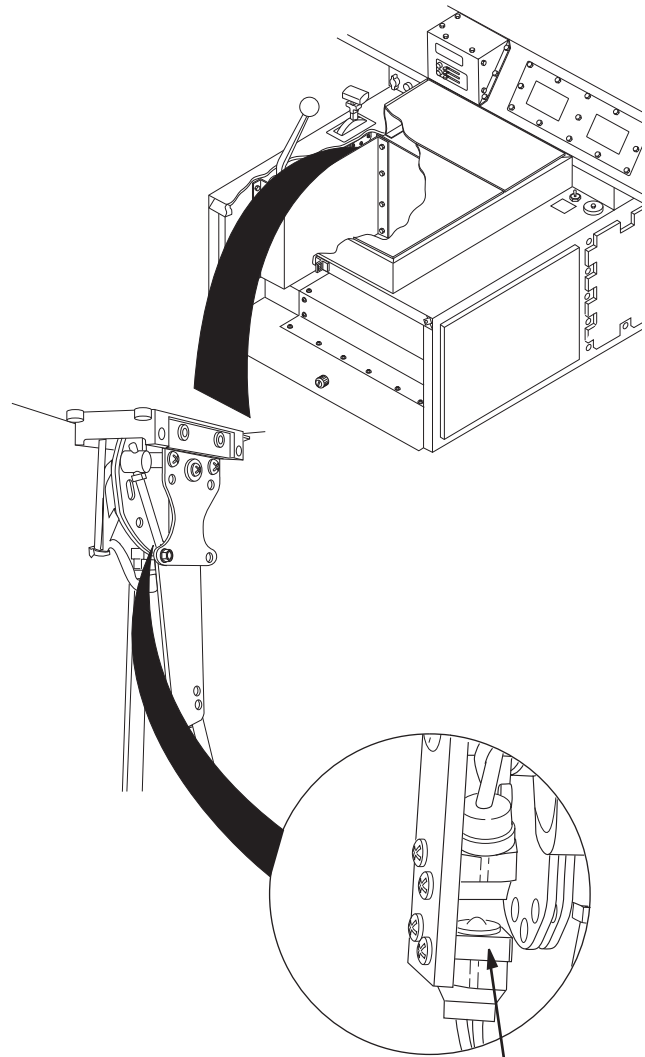
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check backup light and alarm for operation (TM 9-2320-360-10).

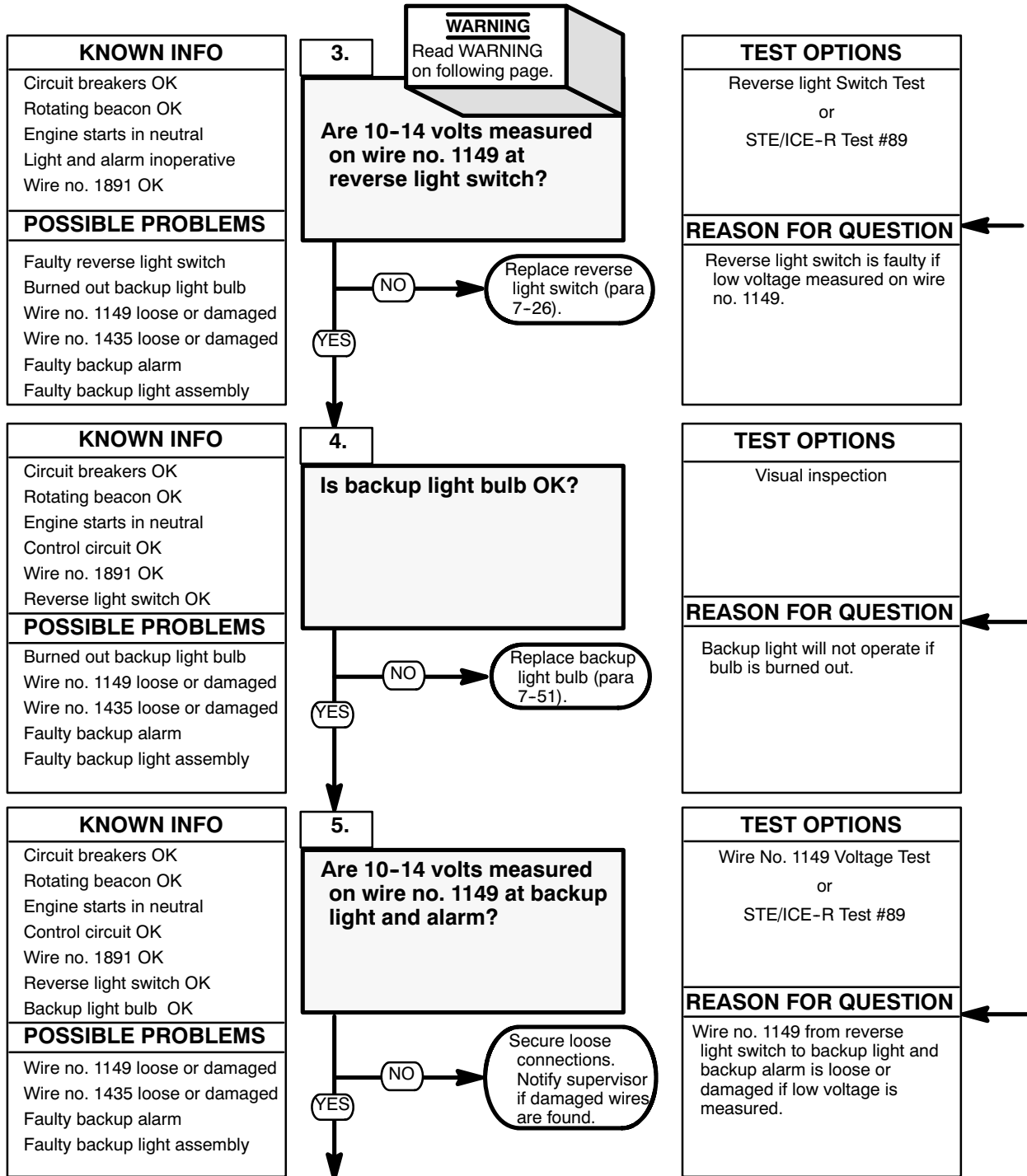
WIRE NO. 1891 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1891 at reverse light switch.
- (3) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (4) Turn ENGINE switch to OFF position.



REVERSE SAFETY SWITCH

e27. BACKUP LIGHT/ALARM DO NOT OPERATE (CONT)

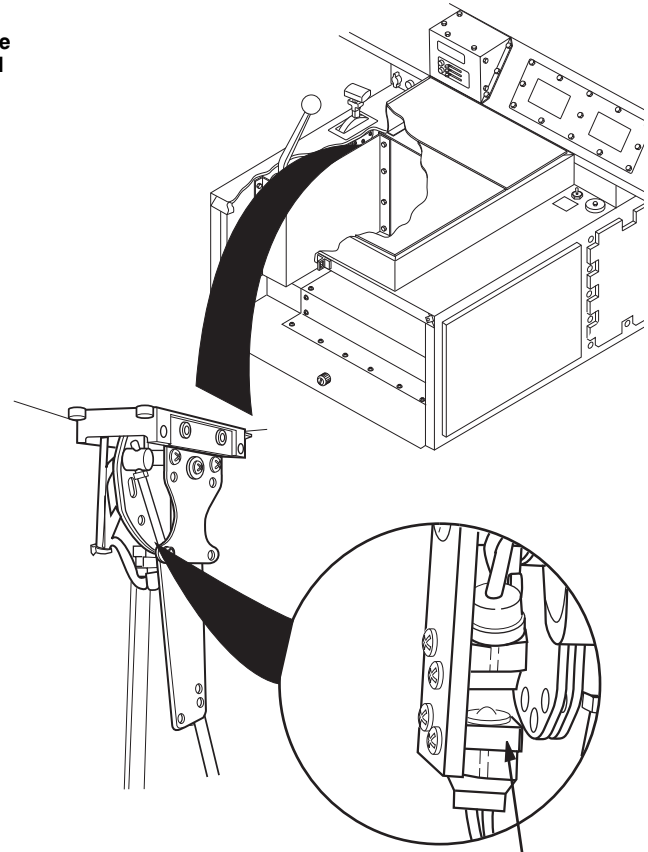


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

REVERSE LIGHT SWITCH TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place transmission range selector to reverse (R).
- (3) Place positive (+) probe of multimeter on wire no. 1149 at reverse light switch.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place transmission range selector to neutral (N).
- (6) Turn ENGINE switch to OFF position.

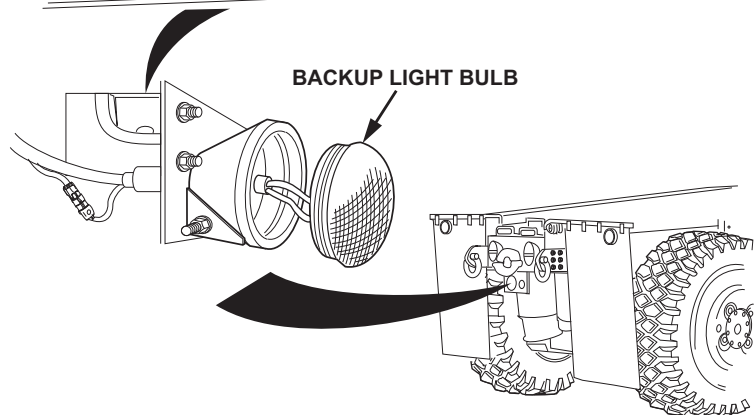
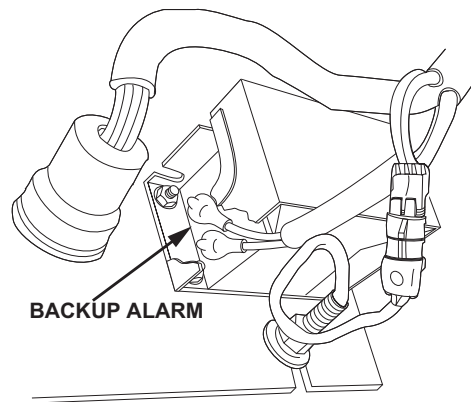


REVERSE SAFETY SWITCH

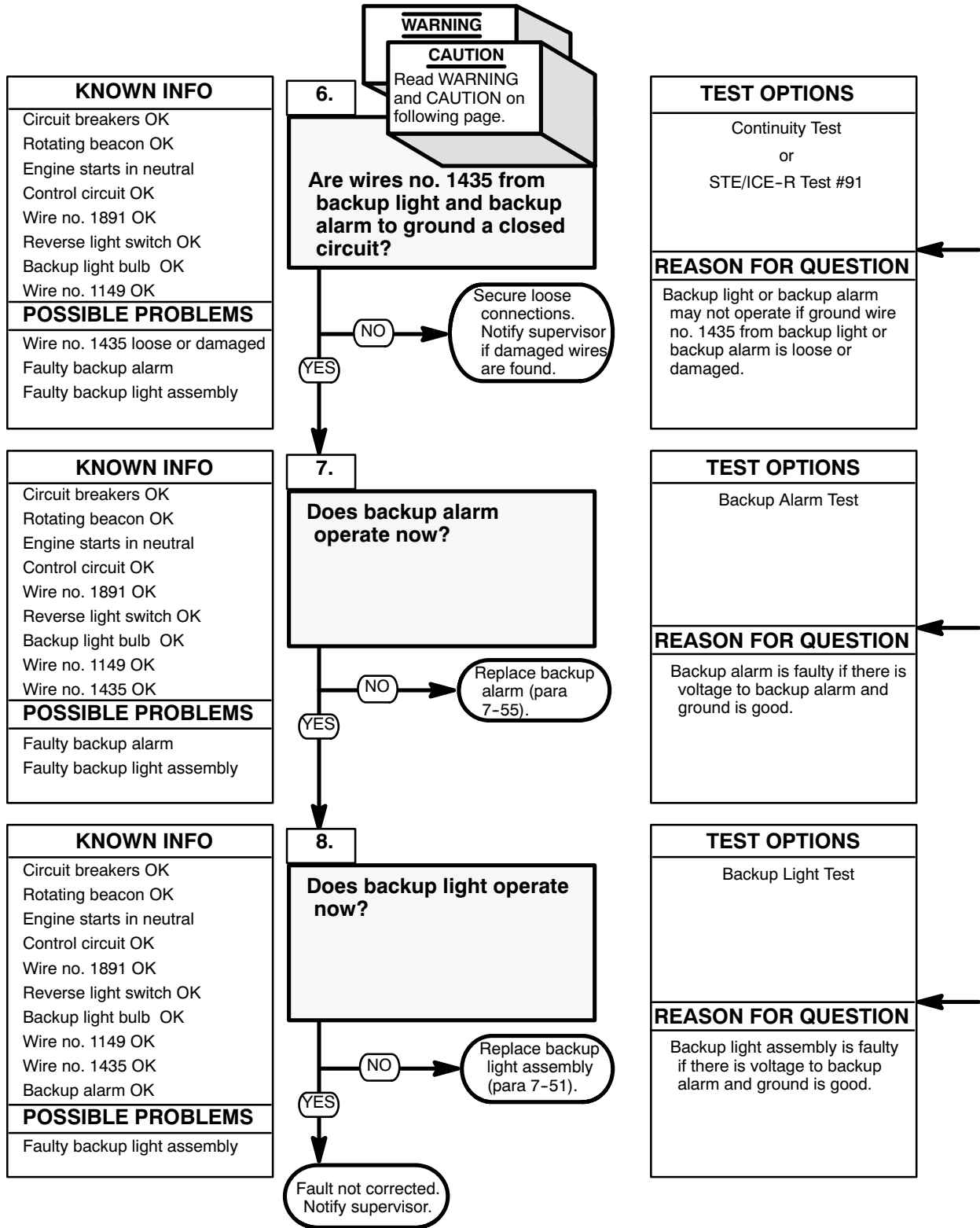
Check backup light for burned out bulb if backup light does not operate, but backup alarm sounds.

WIRE NO. 1149 VOLTAGE TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place transmission range selector to reverse (R).
- (3) Place positive (+) probe of multimeter on wire no. 1149 at backup light.
- (4) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (5) Place positive (+) probe of multimeter on wire no. 1149 at backup alarm.
- (6) Place negative (-) probe of multimeter on ground and look for 10-14 volts on multimeter.
- (7) Place transmission range selector to neutral (N).
- (8) Turn ENGINE switch to OFF position.



e27. BACKUP LIGHT/ALARM DO NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from backup light and backup alarm for loose connections or damage.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

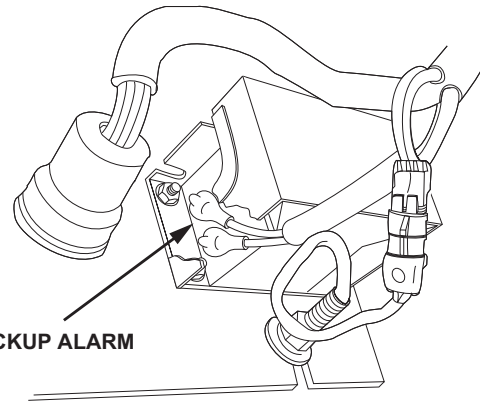
NOTE

Any reading besides infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

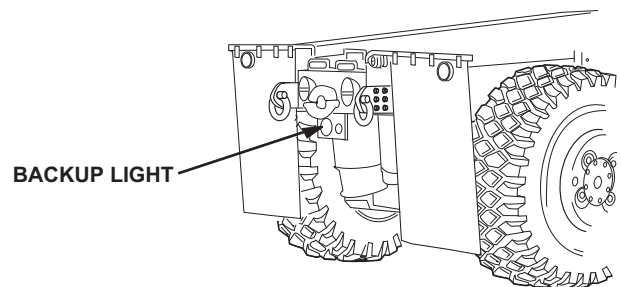
BACKUP ALARM TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place transmission range selector in reverse (R) position.
- (3) Listen for operation of backup alarm.
- (4) Place transmission range selector in neutral (N) position.
- (5) Turn ENGINE switch to OFF position.

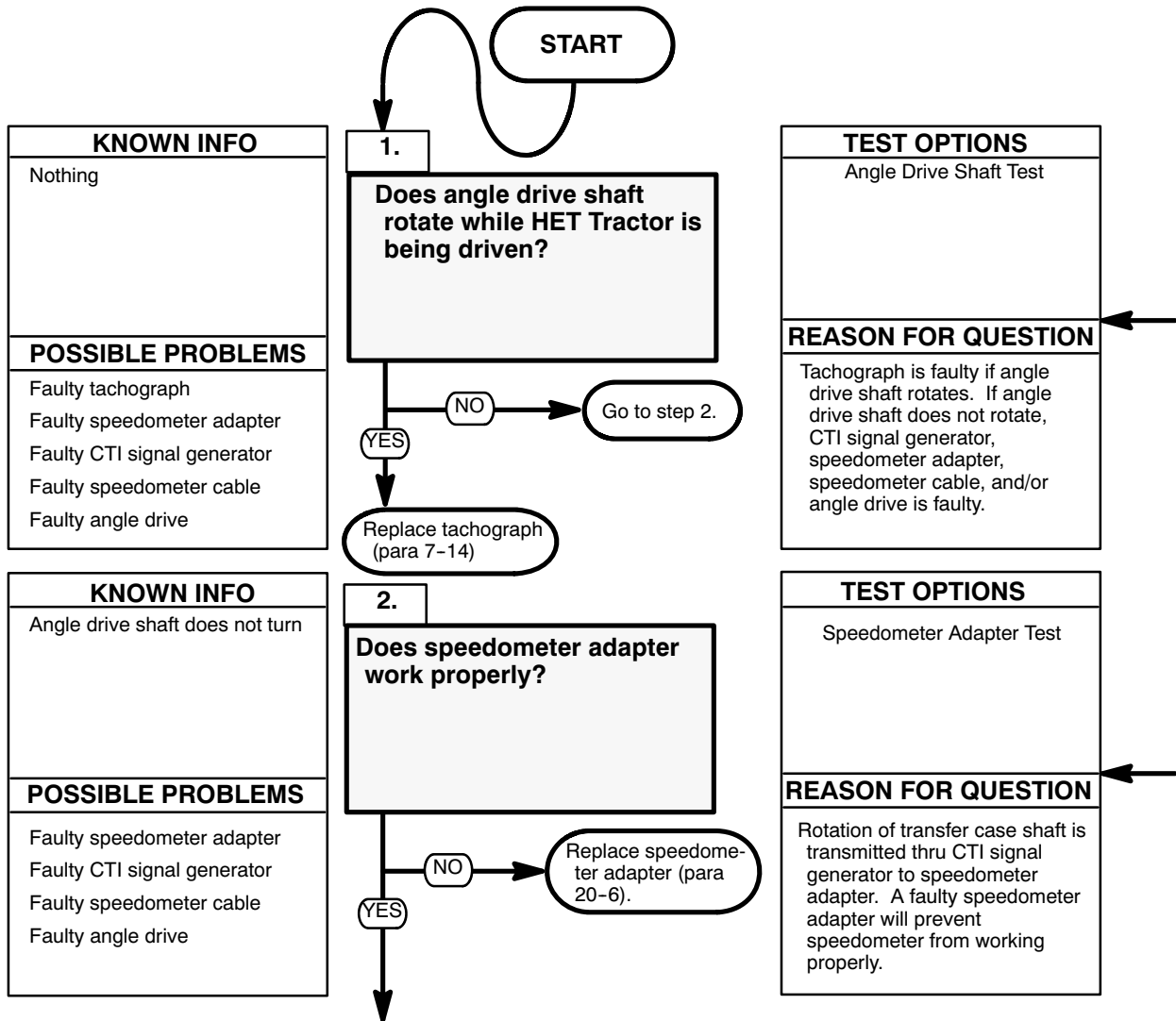


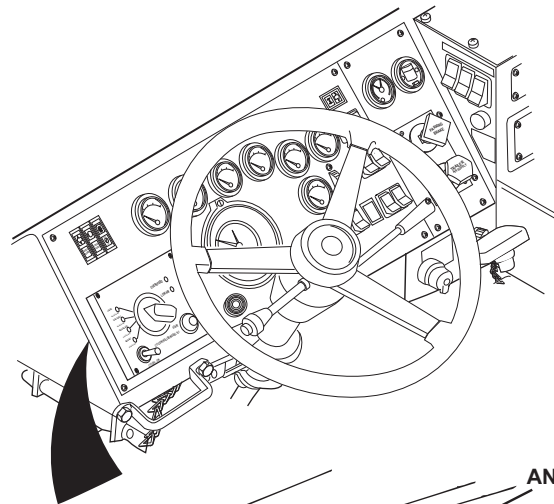
BACKUP LIGHT TEST

- (1) Turn ENGINE switch to ON position.
- (2) Place transmission range selector in reverse (R) position.
- (3) Check for operation of backup light.
- (4) Place transmission range selector in neutral (N) position.
- (5) Turn ENGINE switch to OFF position.

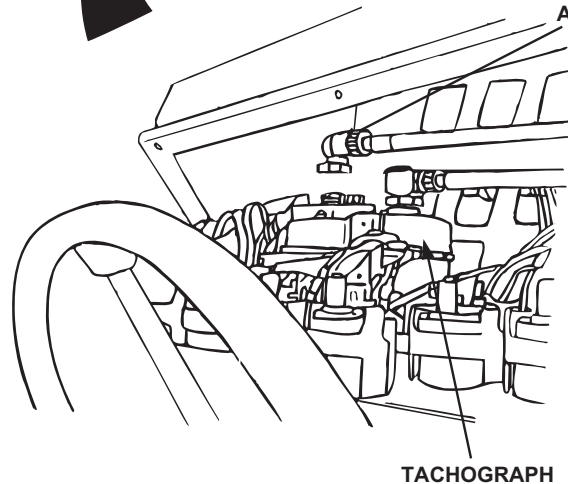


e28. SPEEDOMETER DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)
Personnel Required: Two	





ANGLE DRIVE



TACHOGRAPH

ANGLE DRIVE SHAFT TEST

- (1) Remove seven screws from instrument panel.
- (2) Remove angle drive from tachograph.
- (3) Start engine (TM 9-2320-360-10).
- (4) Drive HET Tractor for 10 ft. (3.05 m) while watching angle drive shaft for rotation.
- (5) Shut off engine (TM 9-2320-360-10).

SPEEDOMETER ADAPTER TEST

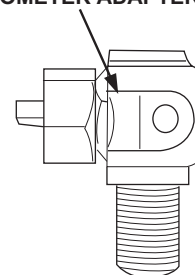
- (1) Remove speedometer adapter (para 20-6).

NOTE

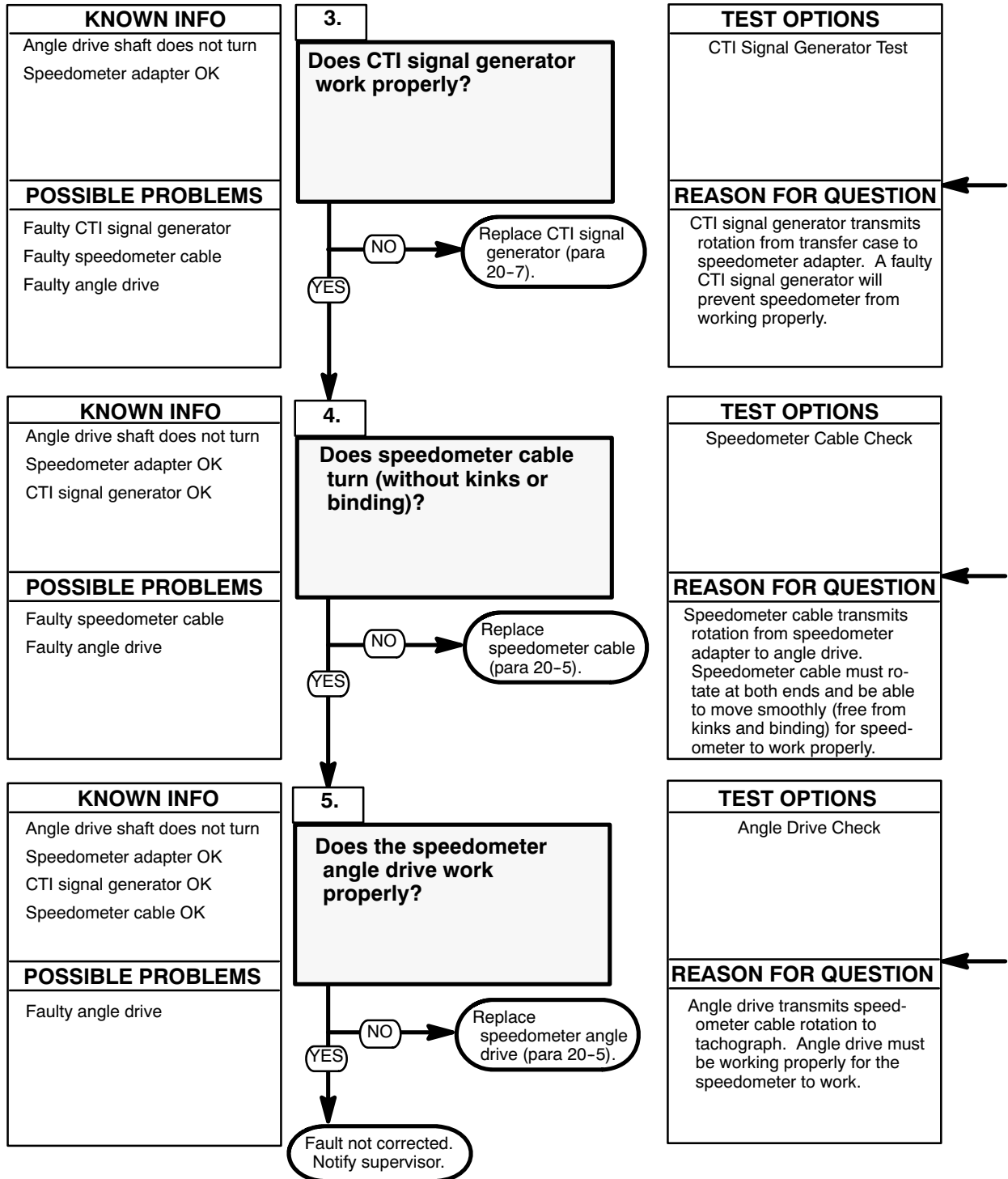
Ends of speedometer adapter should be square, not rounded off.

- (2) Inspect ends of adapter for damage or worn parts.
- (3) Turn one end of adapter while checking to see if other end turns.
- (4) Install speedometer adapter (para 20-6).

SAPEEDOMETER ADAPTER



e28. SPEEDOMETER DOES NOT OPERATE (CONT)



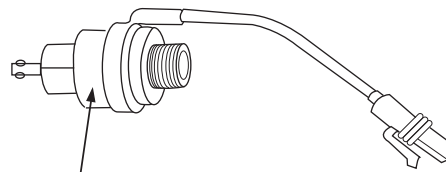
CTI SIGNAL GENERATOR TEST

- (1) Remove CTI signal generator (para 20-7).

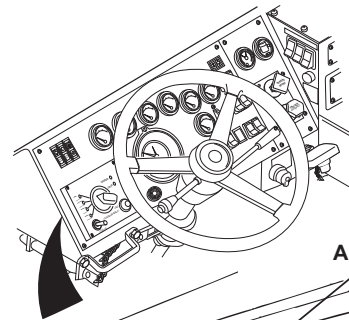
NOTE

Ends of CTI signal generator should be square, not rounded off.

- (2) Inspect ends of CTI signal generator for damage or worn parts.
- (3) Turn one end of generator while checking to see if other end turns.
- (4) Install CTI signal generator (para 20-7).



CTI SIGNAL GENERATOR



ANGLE DRIVE

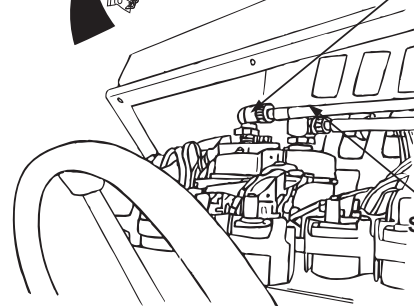
SPEEDOMETER CABLE CHECK

- (1) Remove speedometer cable from angle drive.
- (2) Remove speedometer cable from speedometer adapter.

NOTE

Ends of speedometer cable should be square, not rounded off.

- (3) Inspect ends of speedometer cable for damage or worn parts.
- (4) Turn one end of speedometer cable while assistant checks other end.
- (5) Install speedometer cable on speedometer adapter.



SPEEDOMETER CABLE

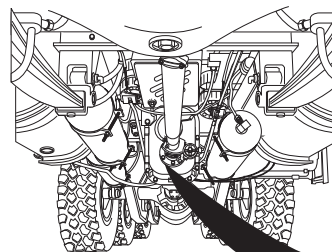
SPEEDOMETER ANGLE DRIVE CHECK

- (1) Remove speedometer angle drive (para 20-5).

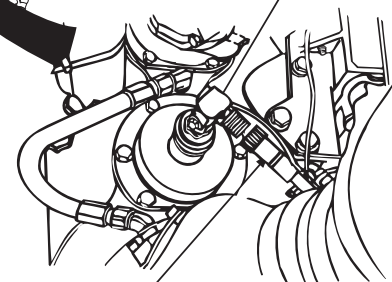
NOTE

Ends of speedometer angle drive should be square, not rounded off.

- (2) Inspect ends of speedometer angle drive for damage or worn parts.
- (3) Turn one end of speedometer angle drive while checking to see if other end turns.
- (4) Install speedometer angle drive (para 20-5).

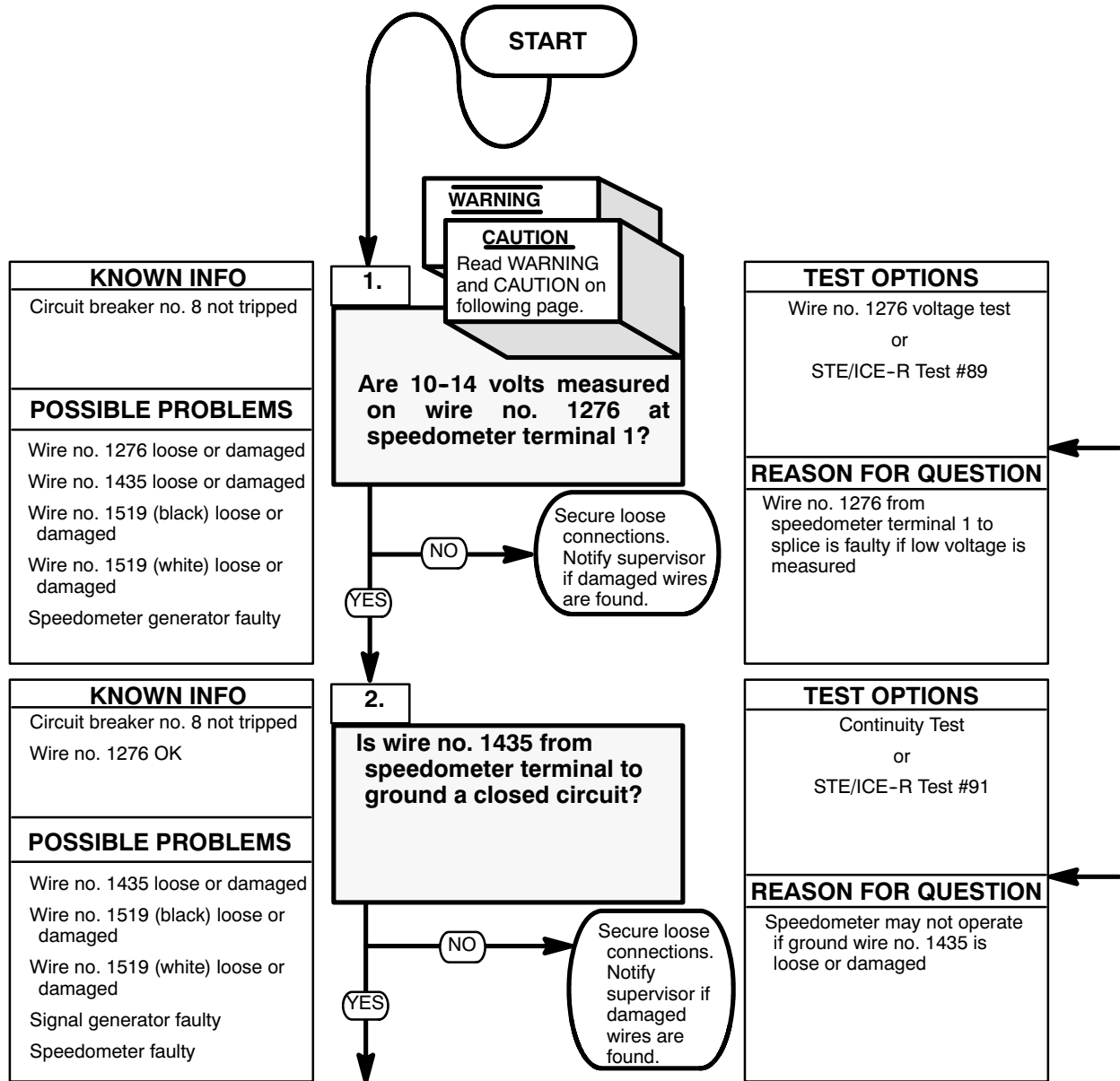


SPEEDOMETER ADAPTER



SPEEDOMETER CABLE

e28.1. SPEEDOMETER DOES NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)</p>

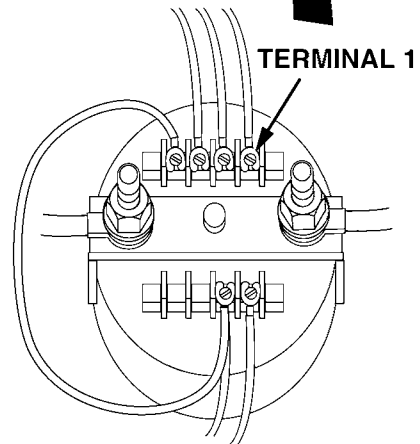
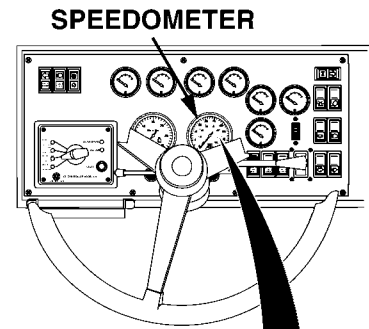


WARNING

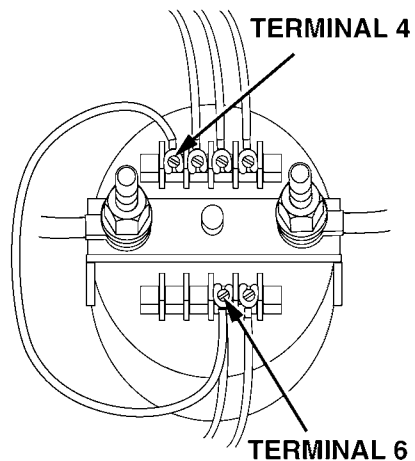
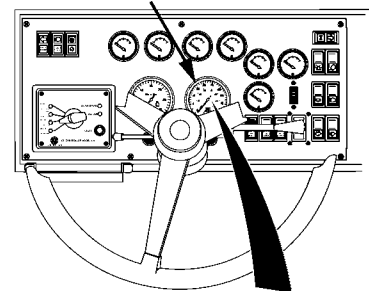
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1276 VOLTAGE TEST

- (1) Remove seven screws from instrument panel and tilt instrument panel towards steering wheel.
- (2) Place positive (+) probe of multimeter on wire no. 1276 at speedometer terminal 1.
- (3) Place negative (-) probe of multimeter on a known good ground.
- (4) Turn ENGINE switch to ON position.
- (5) Look for 10-14 volts on multimeter.
- (6) Turn ENGINE switch to OFF position.



SPEEDOMETER



CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

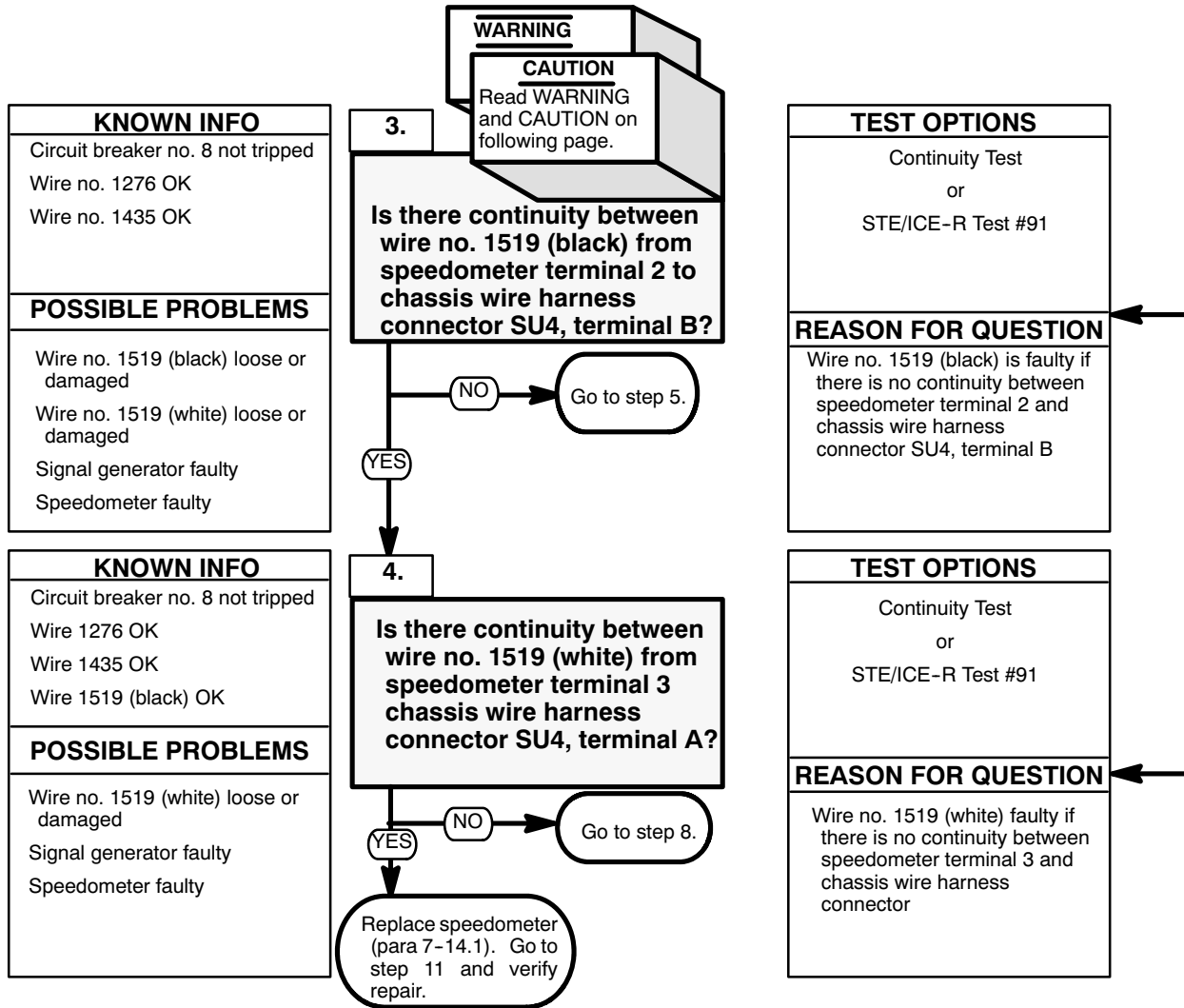
- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to speedometer terminal 4 and known good ground and check multimeter for continuity.

e28.1. SPEEDOMETER DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to speedometer terminal 2 and chassis wire harness connector SU4, terminal B, and check multimeter for continuity.

CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

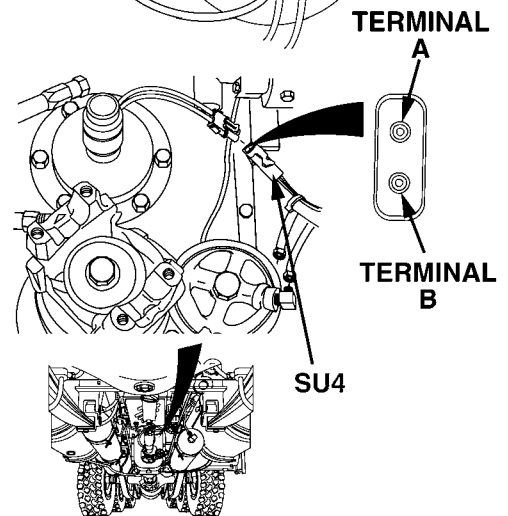
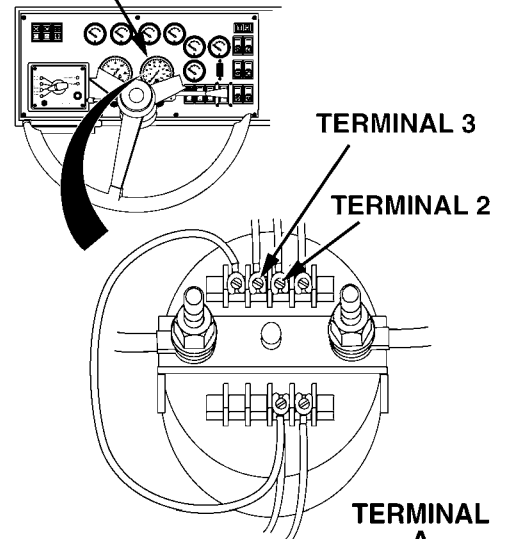
- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

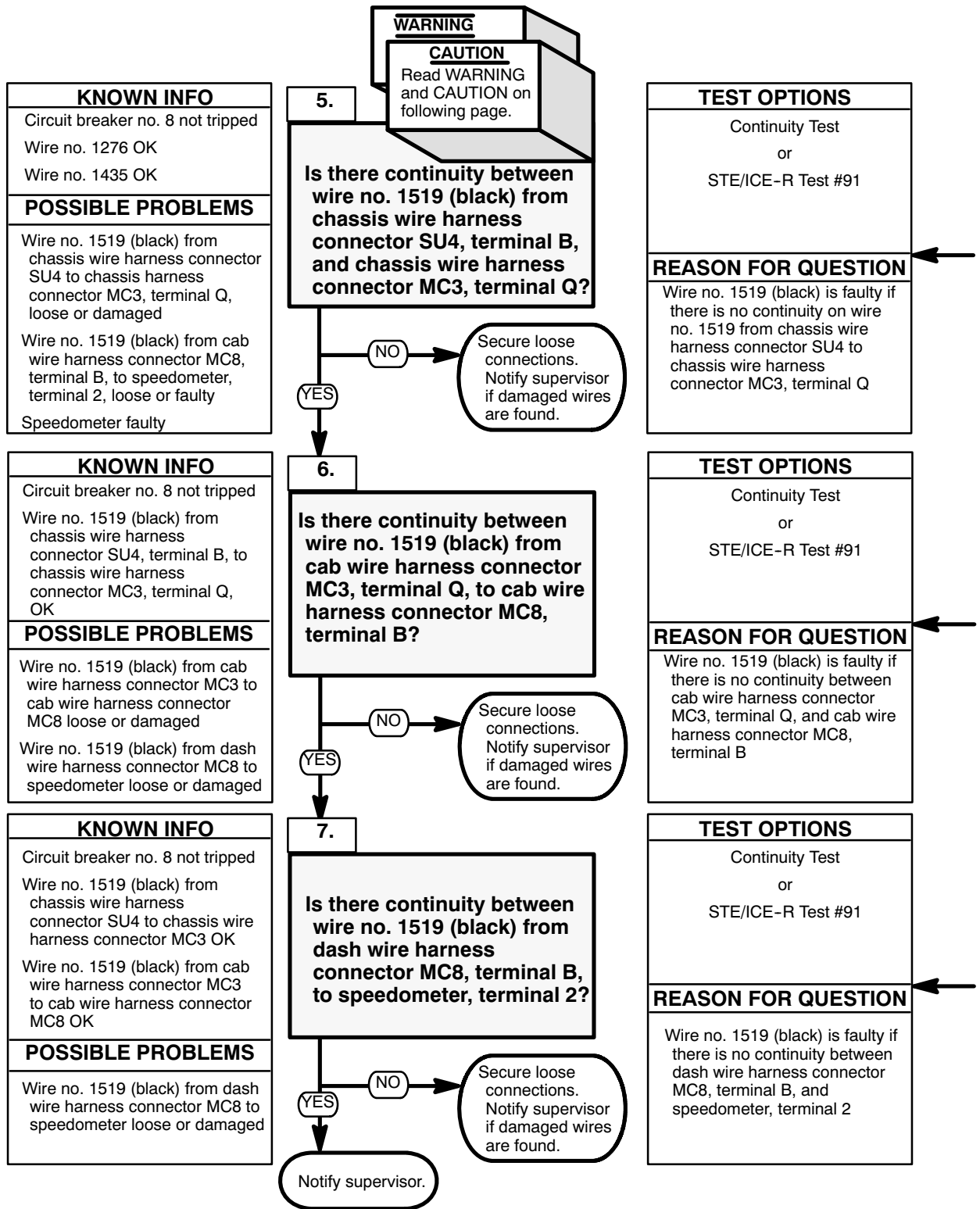
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to speedometer terminal 3 and chassis wire harness connector SU4, terminal A, and check multimeter for continuity.

SPEEDOMETER



e28.1. SPEEDOMETER DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CONTINUITY TEST

CAUTION

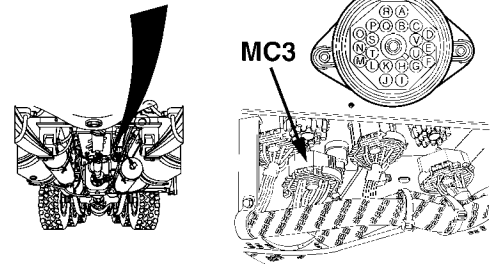
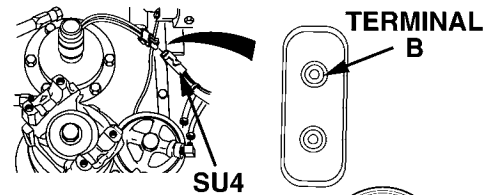
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to chassis wire harness connector, terminal B, and chassis wire harness connector MC3, terminal SU4 and check multimeter for continuity.



CONTINUITY TEST

CAUTION

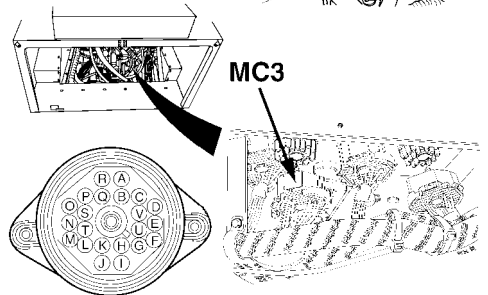
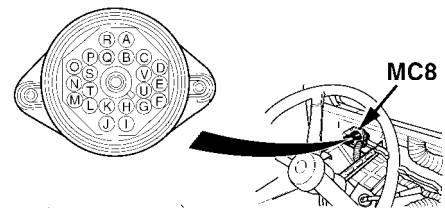
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to cab wire harness connector MC3, terminal Q, and cab wire harness connector MC8, terminal B, and check multimeter for continuity.



CONTINUITY TEST

CAUTION

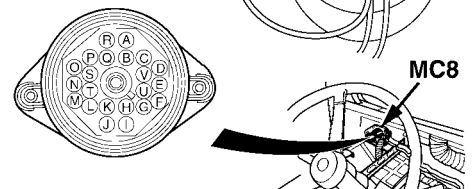
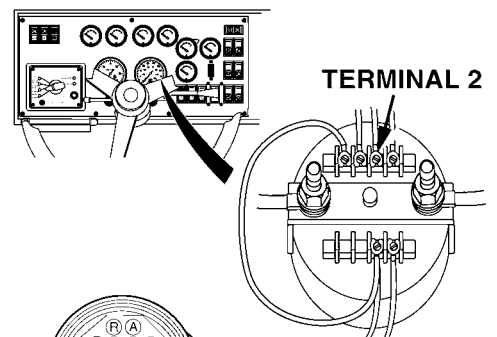
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

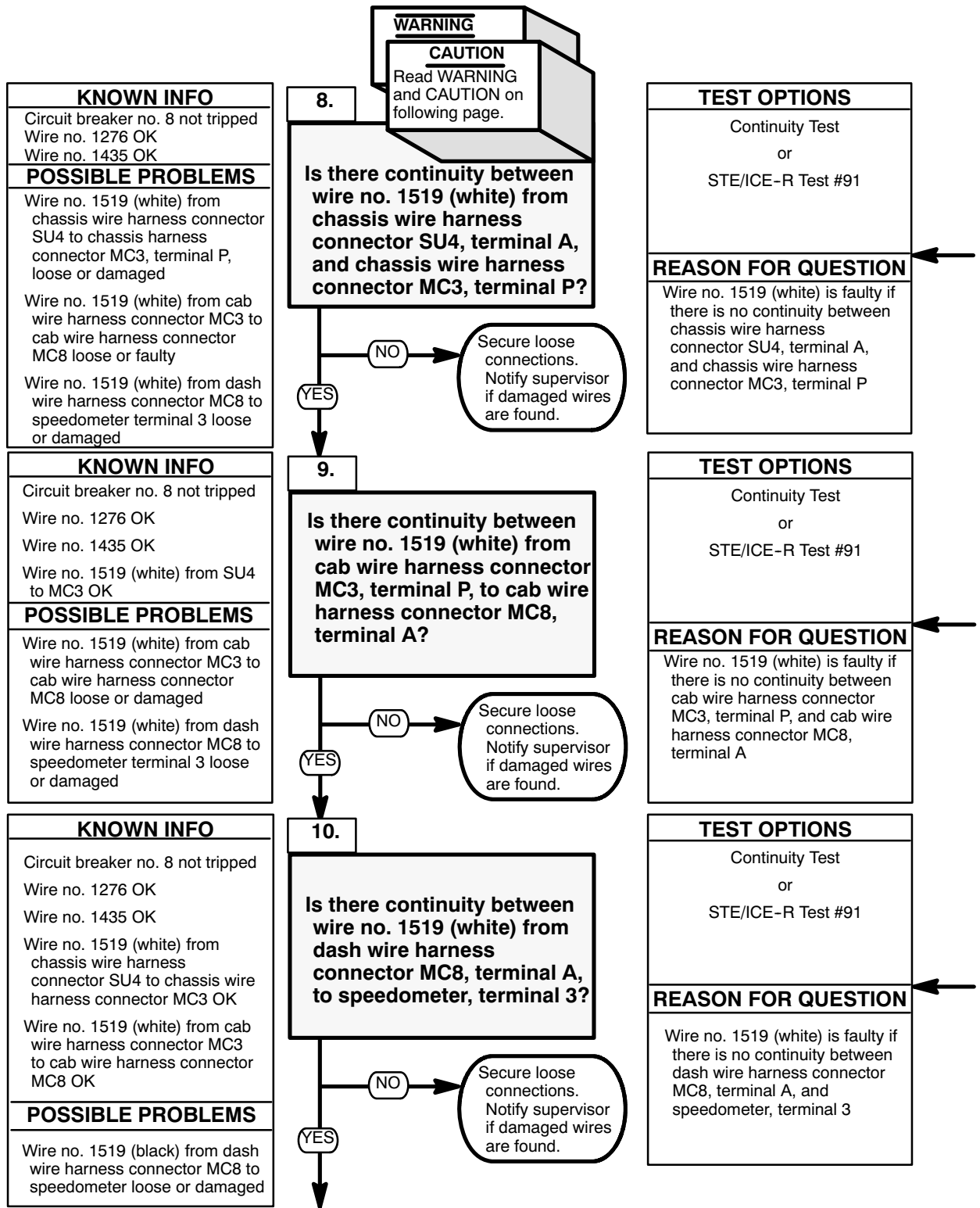
NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to dash wire harness connector MC8, terminal B, and speedometer, terminal 2, and check multimeter for continuity.



e28.1. SPEEDOMETER DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CONTINUITY TEST

CAUTION

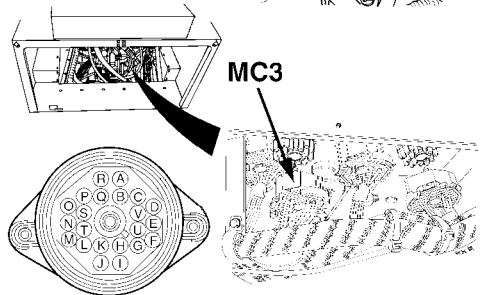
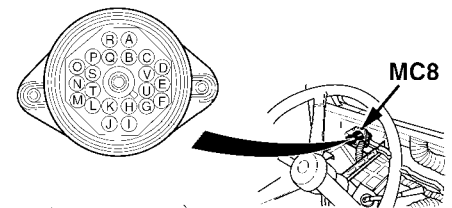
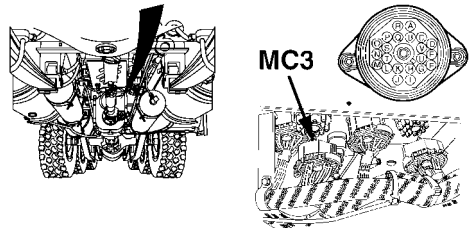
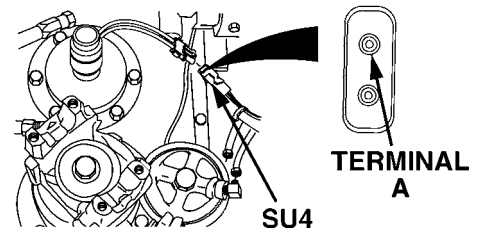
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to chassis wire harness connector SU4, terminal A, and chassis wire harness connector MC3, terminal P, and check multimeter for continuity.



CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to cab wire harness connector MC3, terminal P, and cab wire harness connector MC8, terminal A, and check multimeter for continuity.

CONTINUITY TEST

CAUTION

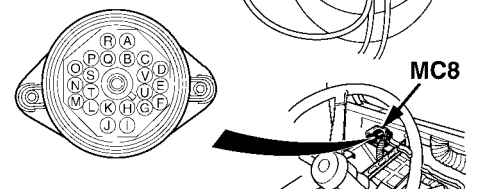
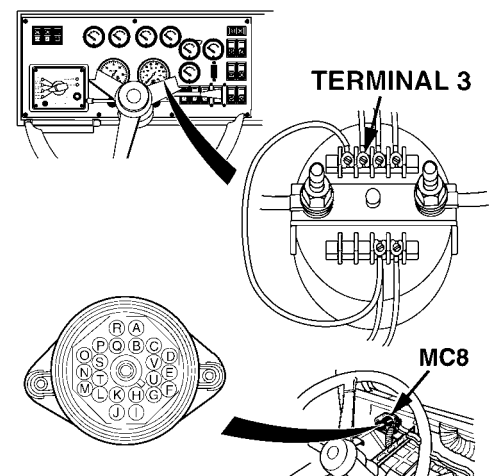
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

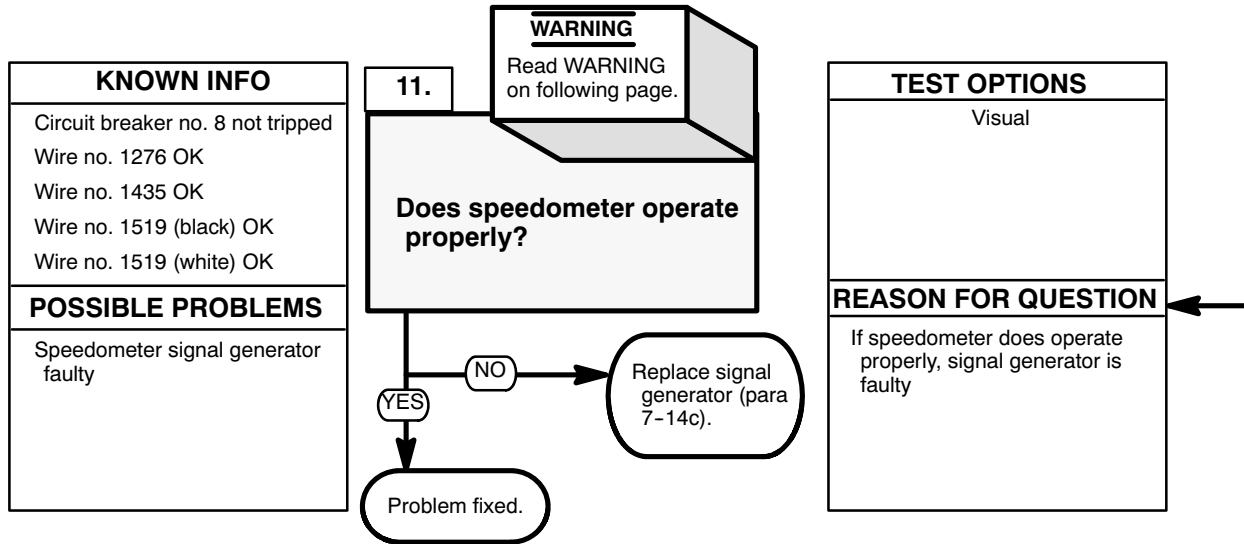
NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to dash wire harness connector MC8, terminal A, and speedometer, terminal 3, and check multimeter for continuity.



e28.1. SPEEDOMETER DOES NOT OPERATE (CONT)



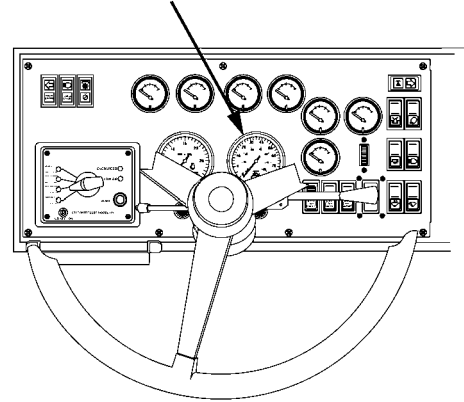
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

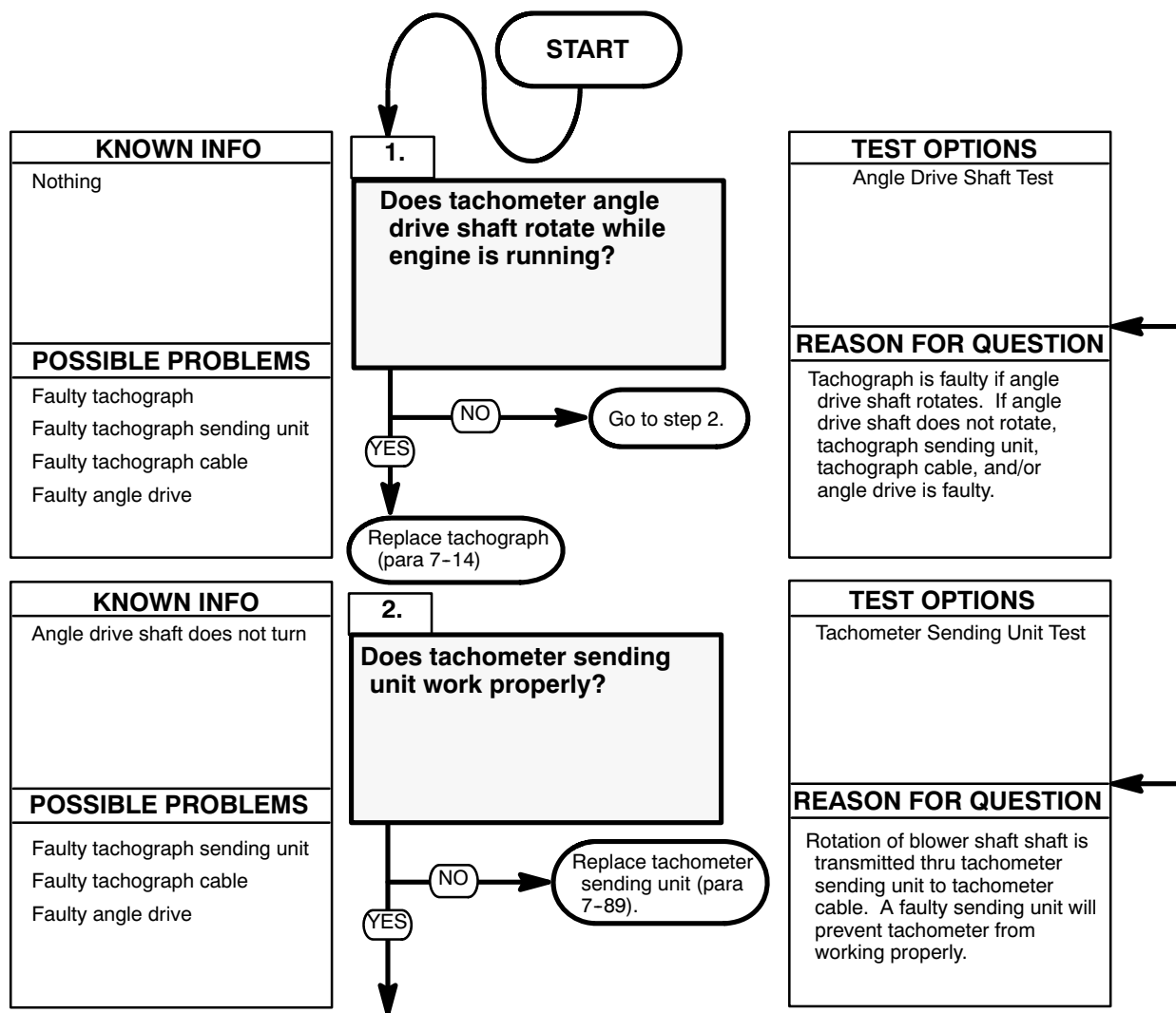
SPEEDOMETER TEST

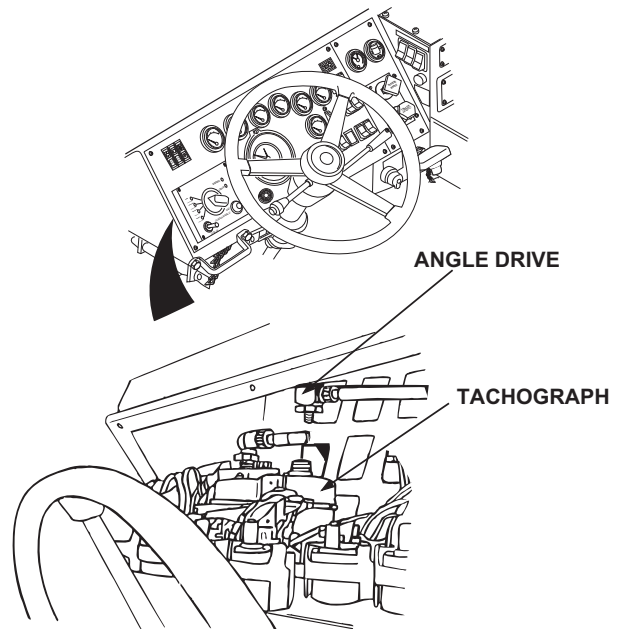
- (1) Ensure vehicle is in proper operating condition.
- (2) Start engine (TM 9-2320-260-10).
- (3) Operate vehicle and observe speedometer for proper operation.
- (4) Shut OFF engine (TM 9-2320-360-10).

SPEEDOMETER



e29. TACHOMETER DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)
Personnel Required: Two	





ANGLE DRIVE SHAFT TEST

- (1) Remove seven screws from instrument panel.
- (2) Remove angle drive from tachograph.
- (3) Start engine (TM 9-2320-360-10).
- (4) Watch angle drive shaft for rotation.
- (5) Shut off engine (TM 9-2320-360-10).

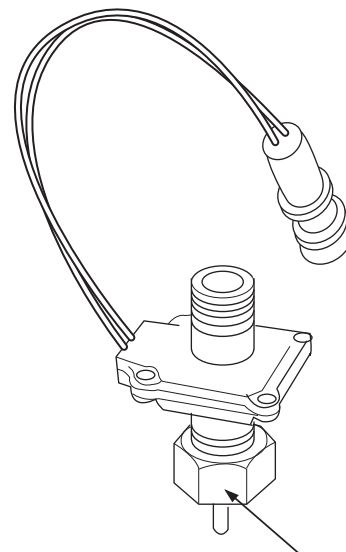
TACHOMETER SENDING UNIT TEST

- (1) Remove tachometer sending unit (para 7-89).

NOTE

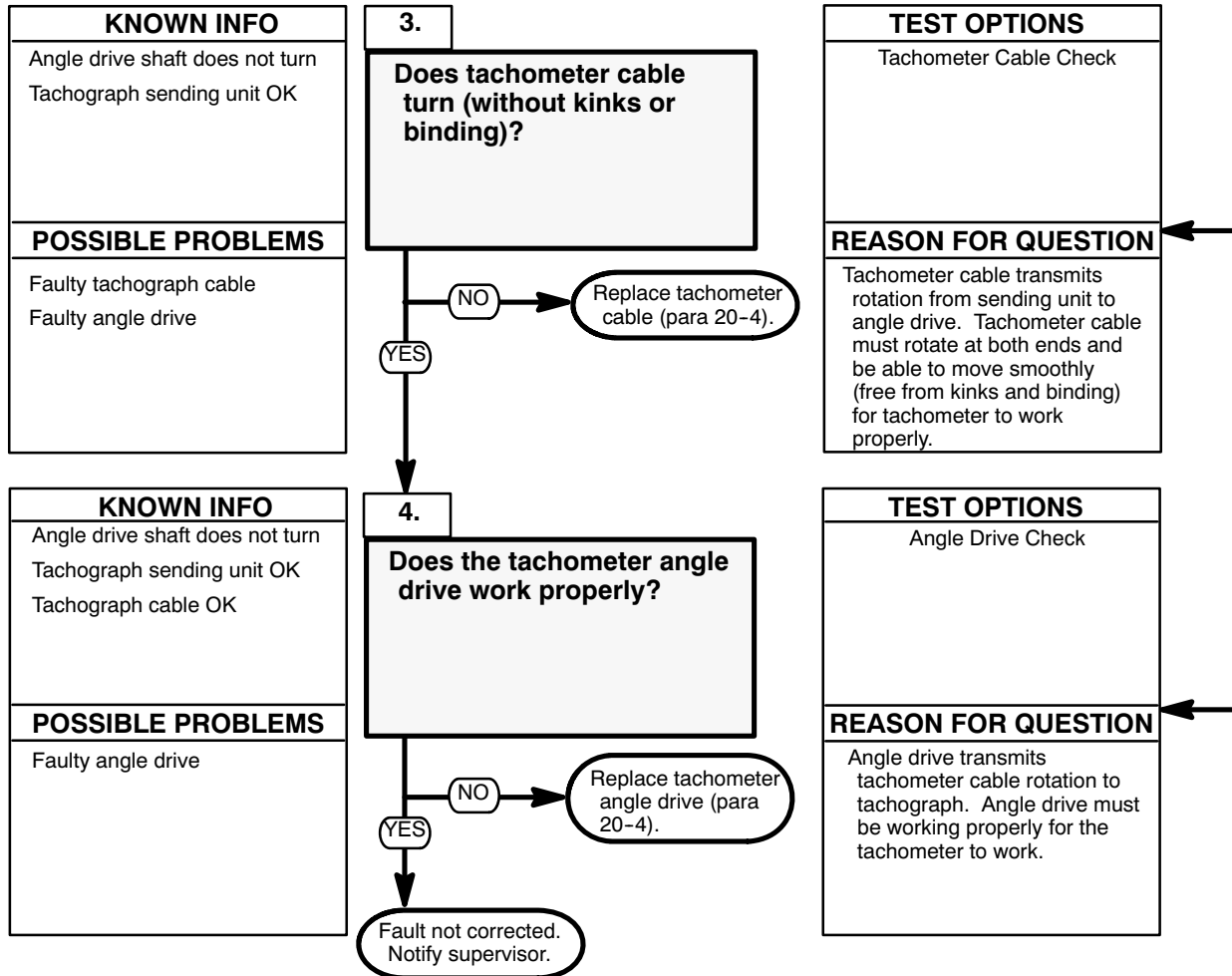
Ends of speedometer adapter should be square, not rounded off.

- (2) Inspect ends of adapter for damage or worn parts.
- (3) Turn one end of sending unit while checking to see if other end turns.
- (4) Install tachograph sending unit (para 7-89).



TACHOMETER SENDING UNIT

e29. TACHOMETER DOES NOT OPERATE (CONT)



TACHOMETER CABLE CHECK

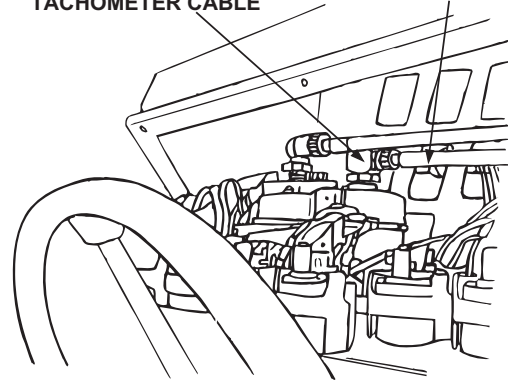
- (1) Remove tachometer cable from angle drive.
- (2) Remove tachometer cable from tachometer sending unit.

NOTE

Ends of tachometer cable should be square, not rounded off.

- (3) Inspect ends of tachometer cable for damage or worn parts.
- (4) Turn one end of tachometer cable while assistant checks other end.
- (5) Install tachometer cable on tachometer adapter.

TACHOMETER CABLE ANGLE DRIVE



TACHOMETER ANGLE DRIVE CHECK

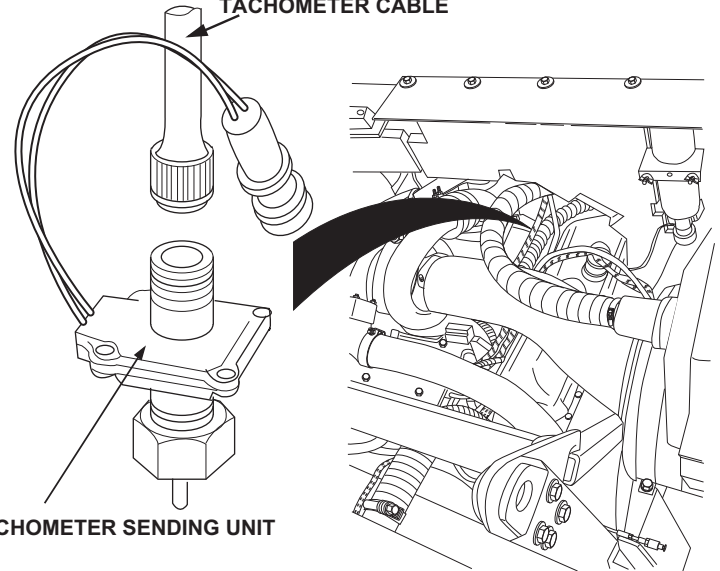
- (1) Remove tachometer angle drive (para 20-4).

NOTE

Ends of tachometer angle drive should be square, not rounded off.

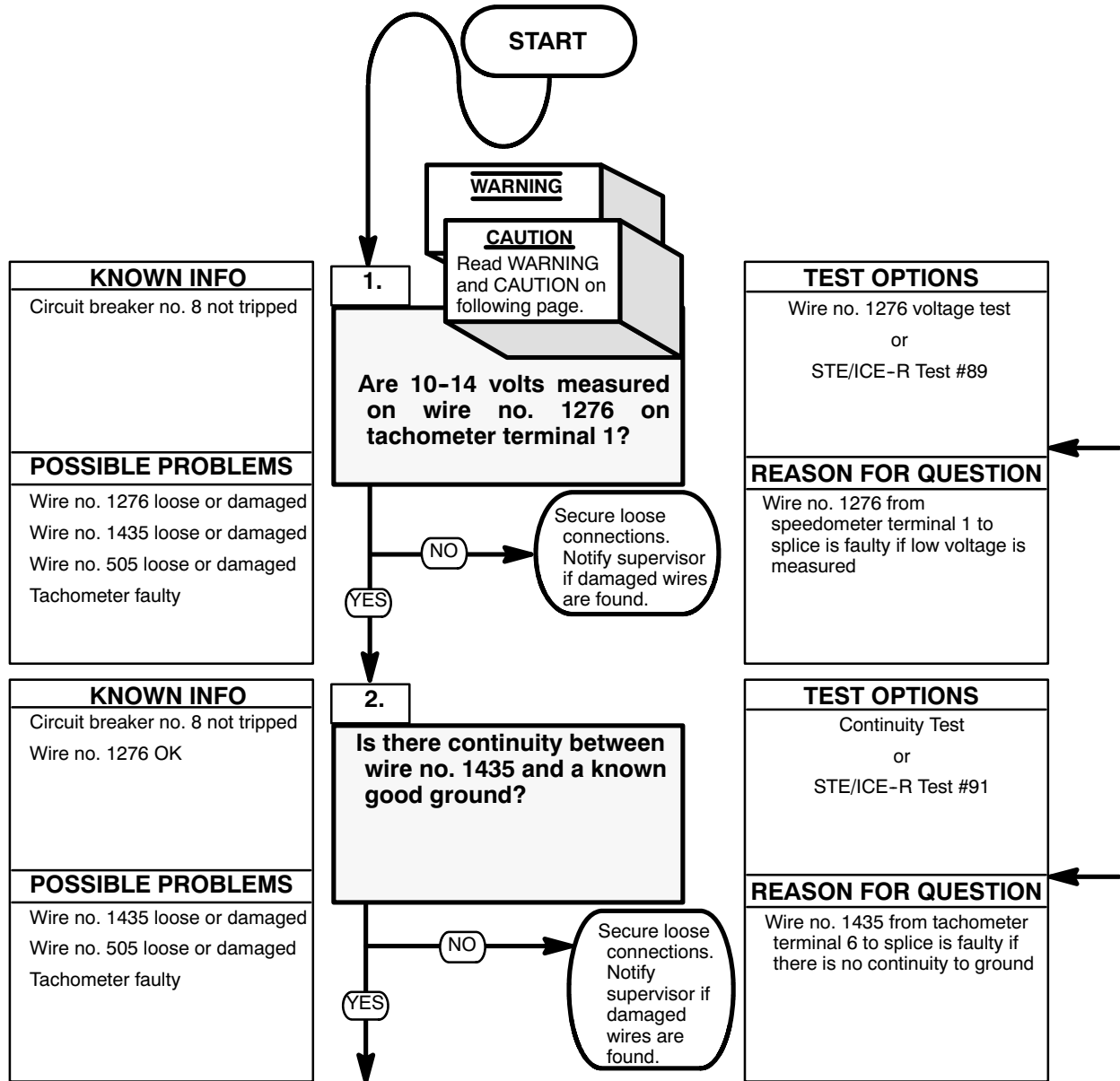
- (2) Inspect ends of tachometer angle drive for damage or worn parts.
- (3) Turn one end of tachometer angle drive while checking to see if other end turns.
- (4) Install tachometer angle drive (para 20-4).

TACHOMETER CABLE



TACHOMETER SENDING UNIT

e29.1. TACHOMETER DOES NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)</p>

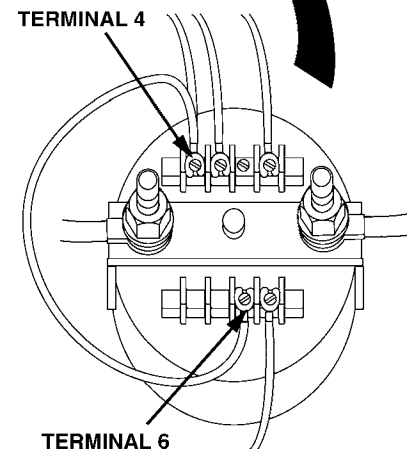
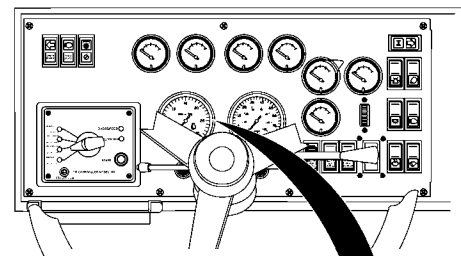
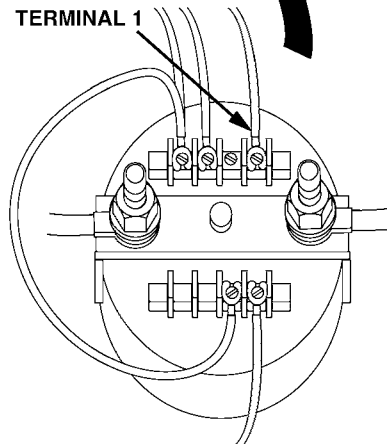
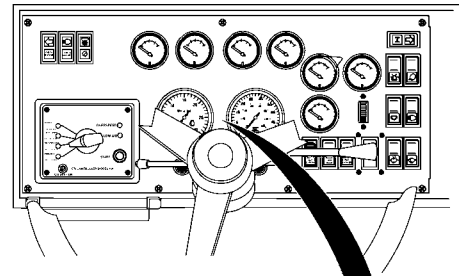


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1276 VOLTAGE TEST

- (1) Remove seven screws from instrument panel and tilt instrument panel towards steering wheel.
- (2) Place positive (+) probe of multimeter on wire no. 1276 at speedometer terminal 1.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Turn ENGINE switch to ON position.
- (5) Look for 10-14 volts on multimeter.
- (6) Turn ENGINE switch to OFF position.



CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

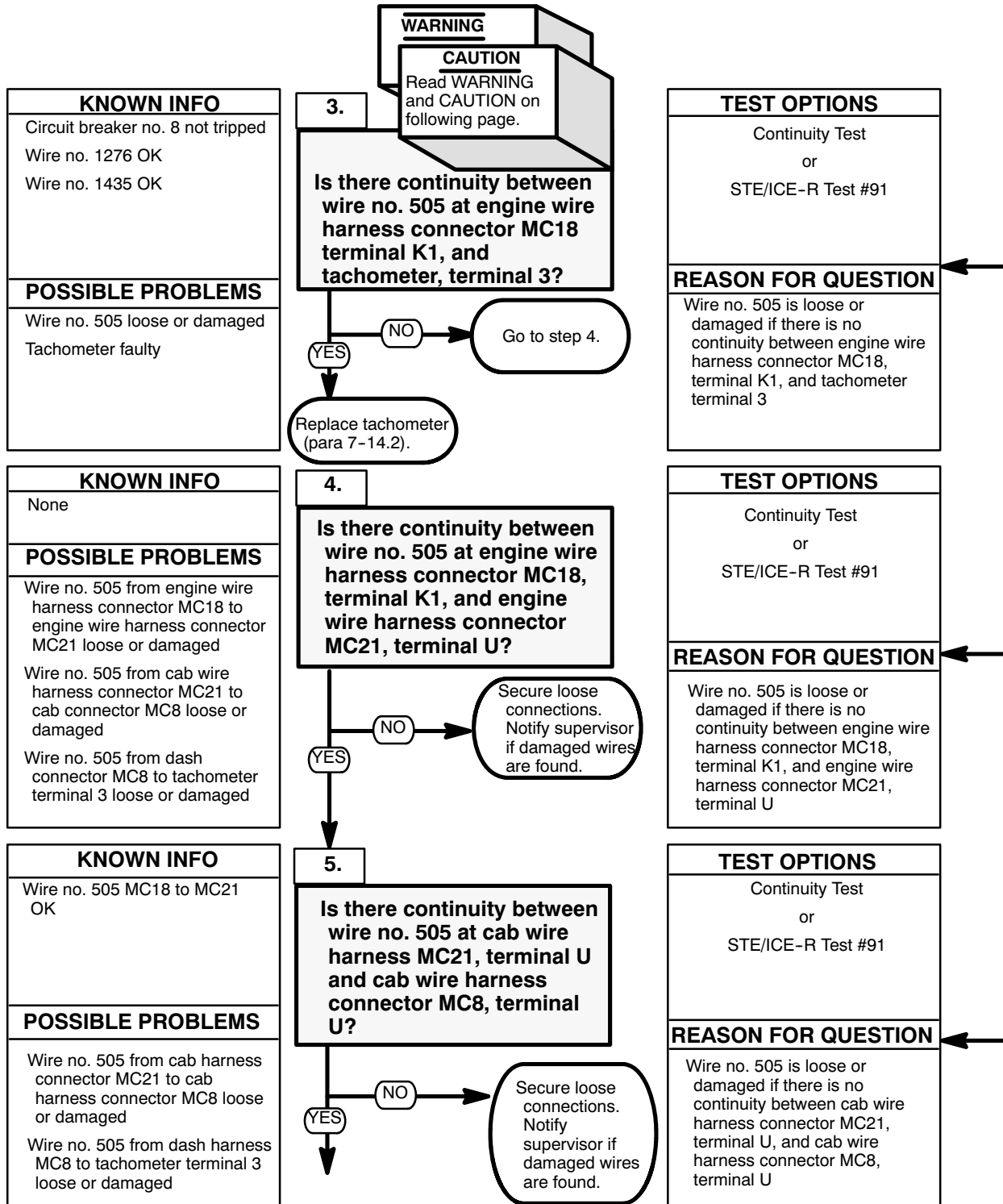
- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to tachometer terminal no. 6 and ground and check multimeter for continuity.

e29.1. TACHOMETER DOES NOT OPERATE (CONT)



KNOWN INFO
Wire no. 505 MC18 to MC21 OK
POSSIBLE PROBLEMS
Wire no. 505 from cab harness connector MC21 to cab harness connector MC8 loose or damaged Wire no. 505 from dash harness MC8 to tachometer terminal 3 loose or damaged

5.

Is there continuity between wire no. 505 at cab wire harness MC21, terminal U and cab wire harness connector MC8, terminal U?

NO → Secure loose connections. Notify supervisor if damaged wires are found.

YES →

TEST OPTIONS
Continuity Test or STE/ICE-R Test #91
REASON FOR QUESTION
Wire no. 505 is loose or damaged if there is no continuity between cab wire harness connector MC21, terminal U, and cab wire harness connector MC8, terminal U

WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CONTINUITY TEST

CAUTION

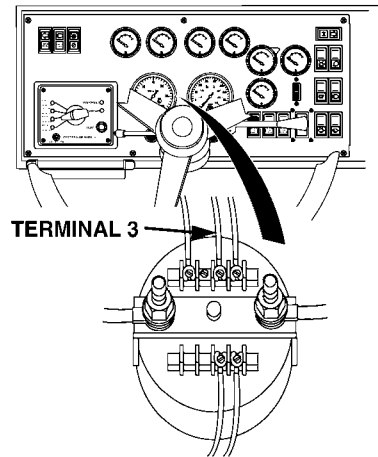
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to engine wire harness connector MC18, terminal K1, and tachometer, terminal 3, and check multimeter for continuity.



CONTINUITY TEST

CAUTION

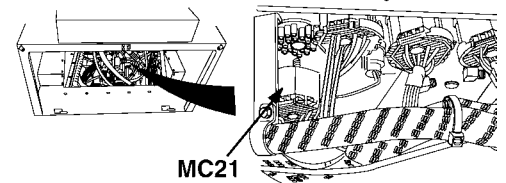
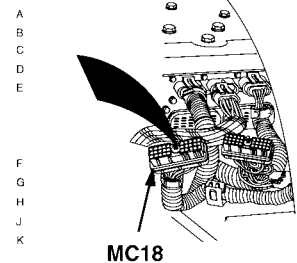
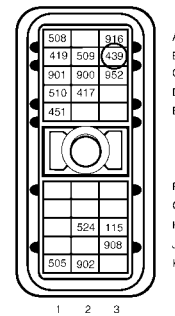
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to engine wire harness connector MC18, terminal K1, and engine wire harness connector MC21, terminal U, and check multimeter for continuity.



CONTINUITY TEST

CAUTION

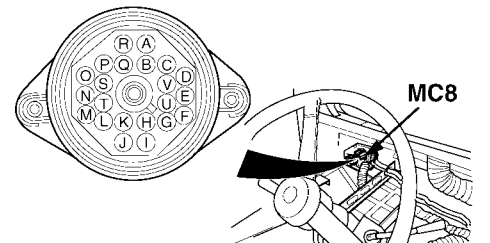
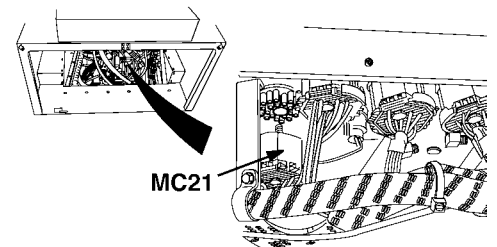
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

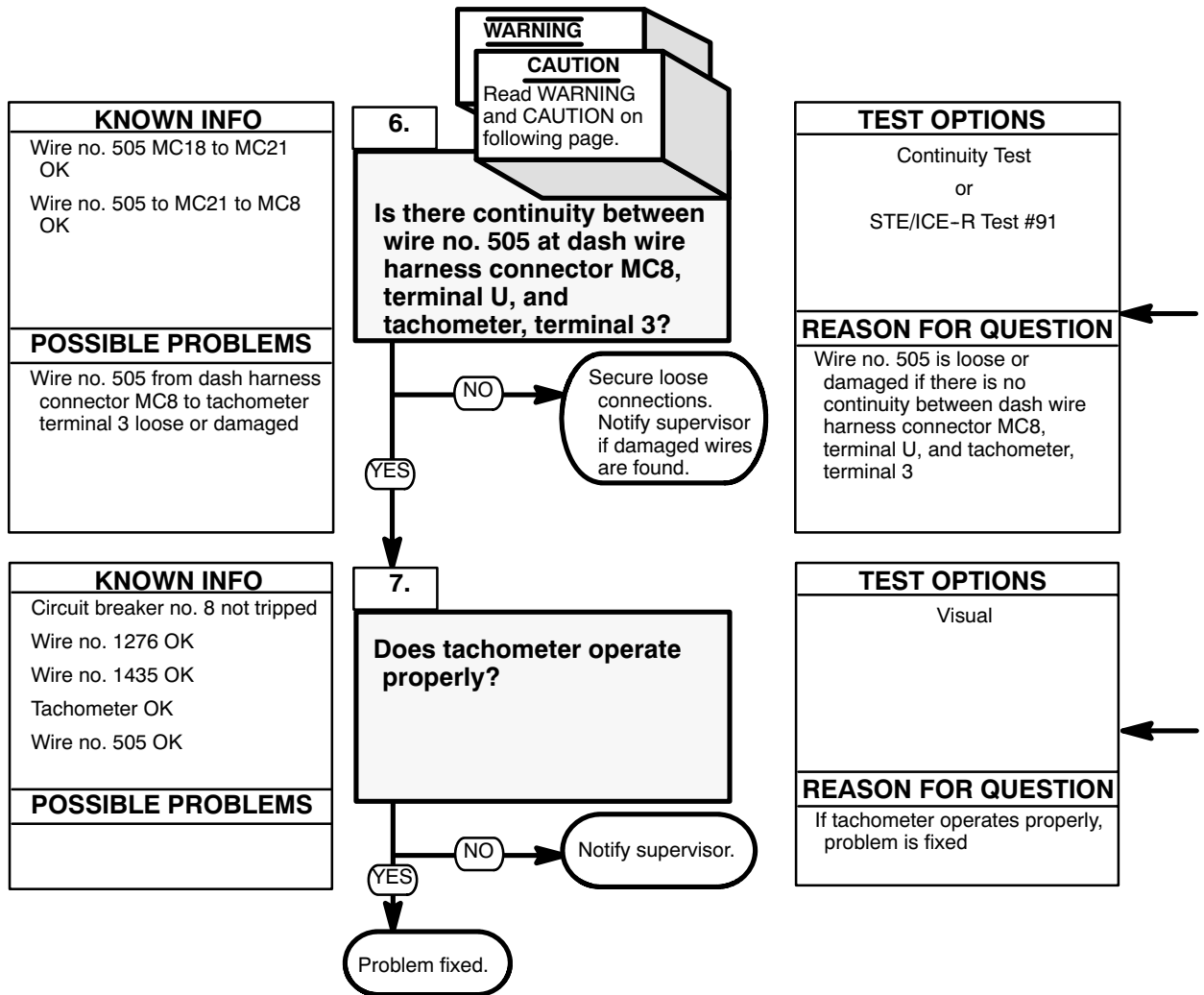
NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to cab wire harness connector MC21, terminal U, and cab wire harness connector MC8, terminal U, and check multimeter for continuity.



e29.1. TACHOMETER DOES NOT OPERATE (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CONTINUITY TEST

CAUTION

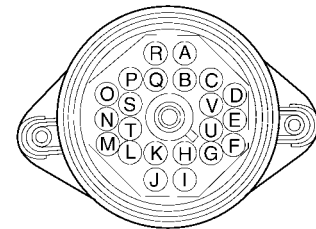
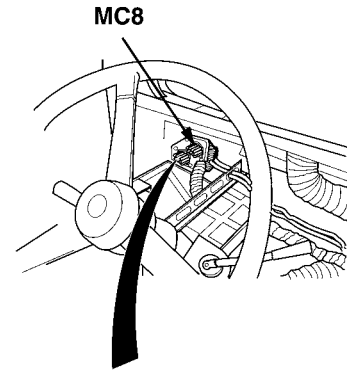
Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

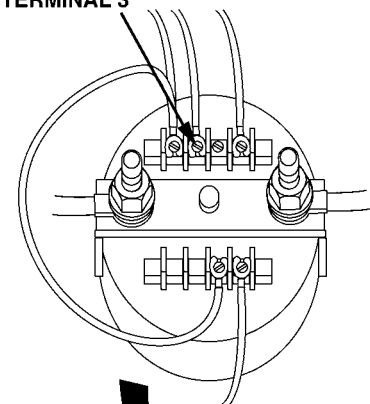
NOTE

A reading of infinity indicates an open circuit.

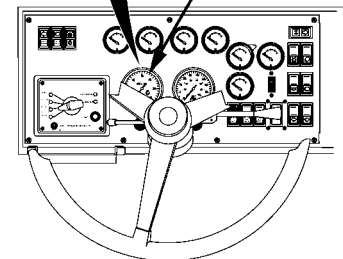
- (3) Connect multimeter leads to dash wire harness connector MC8, terminal U, and tachometer, terminal 3, and check multimeter for continuity.



TERMINAL 3



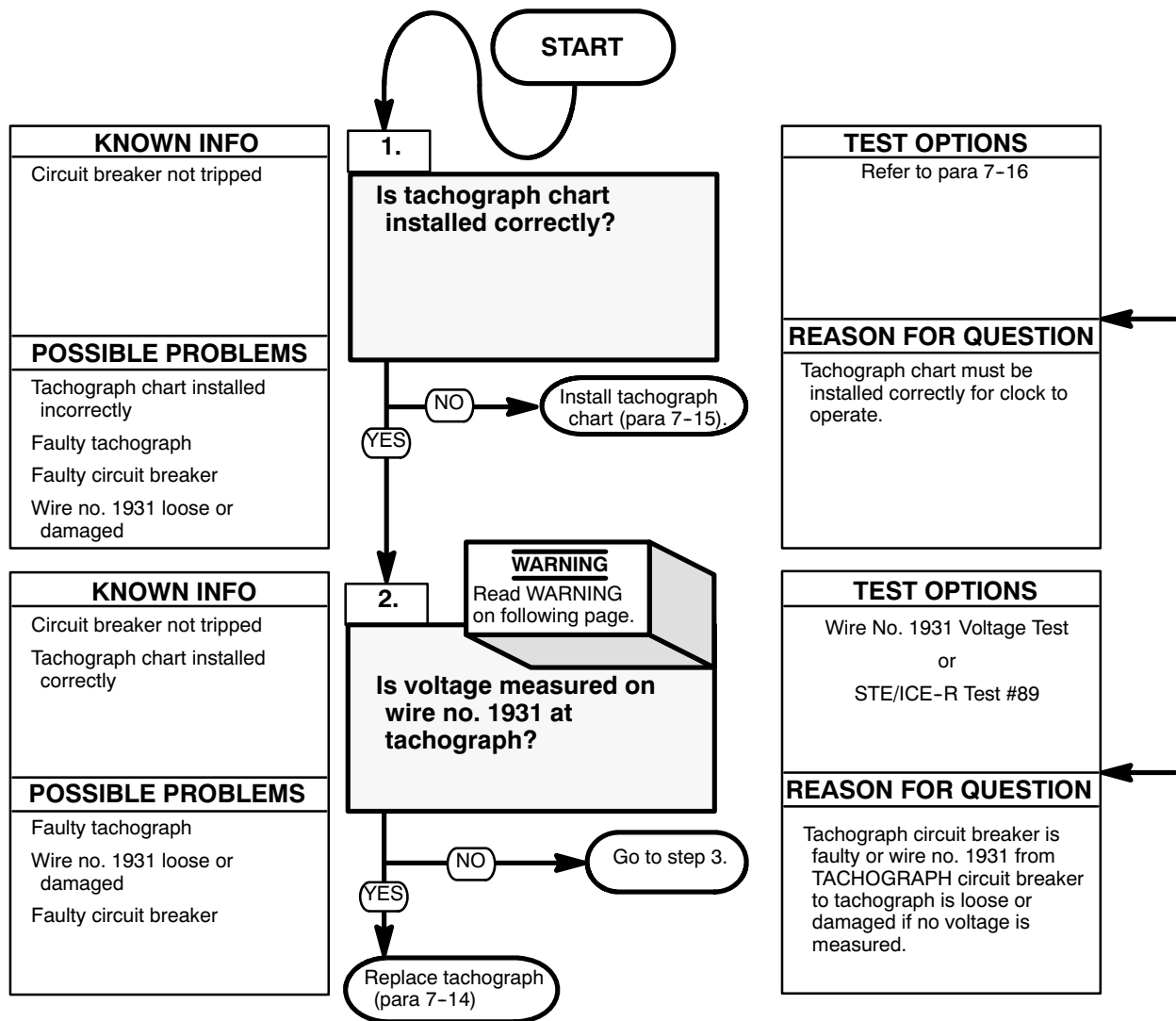
TACHOMETER



TACHOMETER TEST

- (1) Ensure vehicle is in proper operating condition.
- (2) Start engine (TM 9-2320-260-10).
- (3) Observe tachometer for proper operation.
- (4) Shut OFF engine (TM 9-2320-360-10).

e30. CLOCK DOES NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions</p> <p>Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools</p> <p>Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)</p>



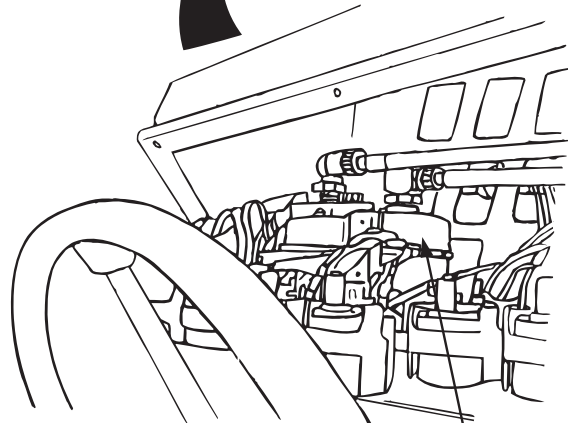
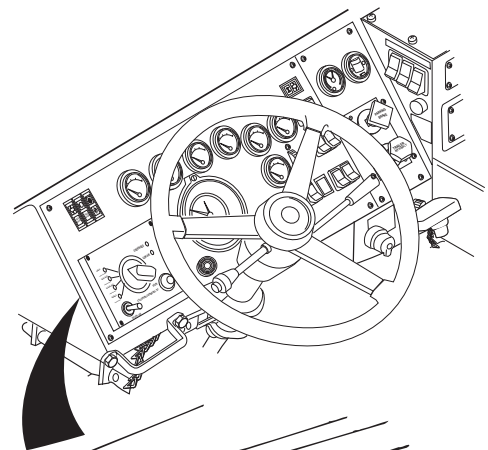
Refer to paragraph 7-15 for tachograph chart installation.

WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

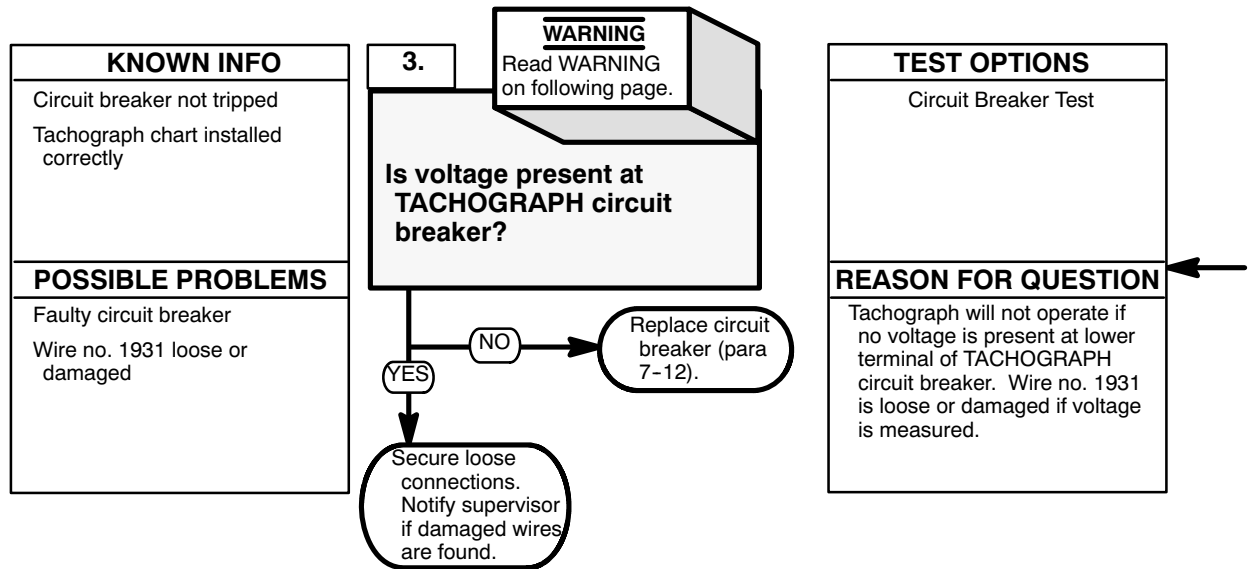
WIRE NO. 1931 VOLTAGE TEST

- (1) Remove seven screws and tilt instrument panel toward steering wheel
- (2) Place positive (+) probe of multimeter on wire no. 1931 at tachograph.
- (3) Place negative (-) probe of multimeter on ground and note reading on multimeter.



TACHOGRAPH

e30. CLOCK DOES NOT OPERATE (CONT)

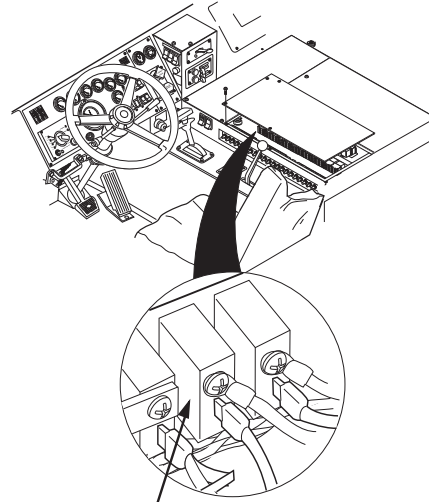


WARNING

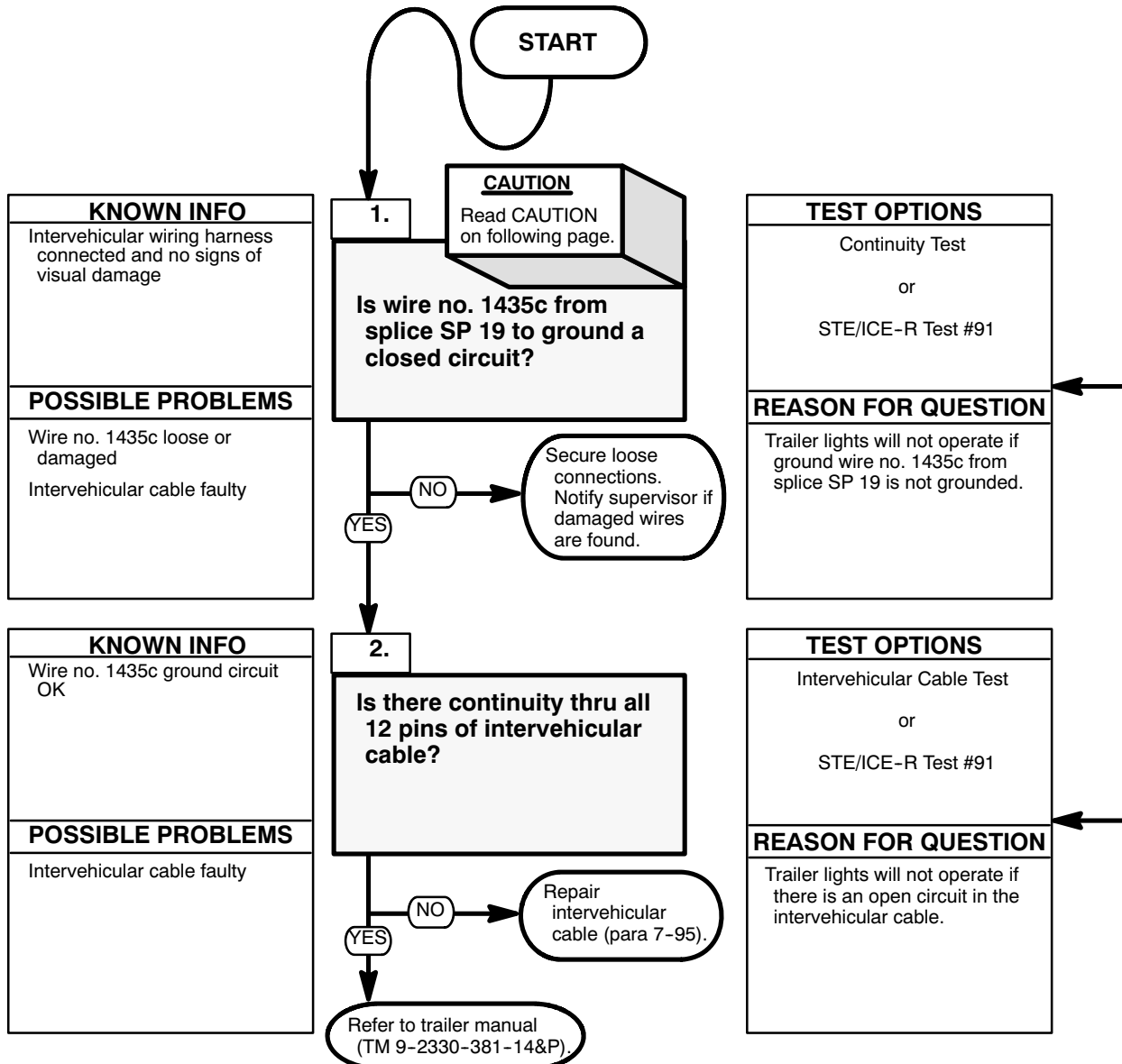
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (3) Place negative (-) probe of multimeter on ground and note reading on multimeter.

**CIRCUIT BREAKER**

e31. ALL TRAILER LIGHTS DO NOT OPERATE (LIGHTS ON HET TRACTOR OPERATE)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F)



CONTINUITY TEST

CAUTION

Electrical power must be disconnected from circuit before continuity can be checked. Failure to comply may result in damage to test equipment or electrical system.

- (1) Disconnect intervehicular wire harness from 12 pin electrical connector.
- (2) Set multimeter to ohms position.
- (3) Connect one multimeter leads to pin D on 12 pin electrical connector.

NOTE

A reading of infinity indicates an open circuit.

- (4) Connect other multimeter lead to known good ground and check reading on multimeter.

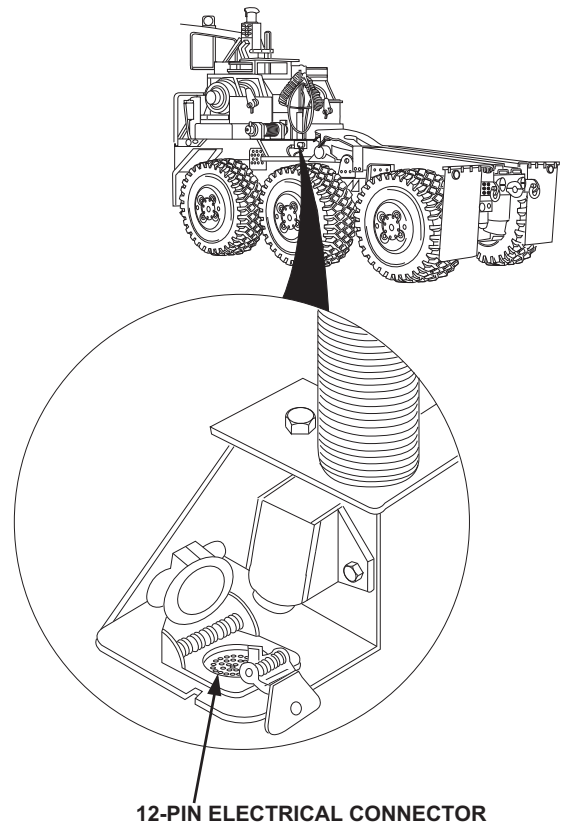
INTERVEHICULAR CABLE TEST

- (1) Set multimeter to ohms position.
- (2) Connect one multimeter leads to pin A of intervehicular cable.

NOTE

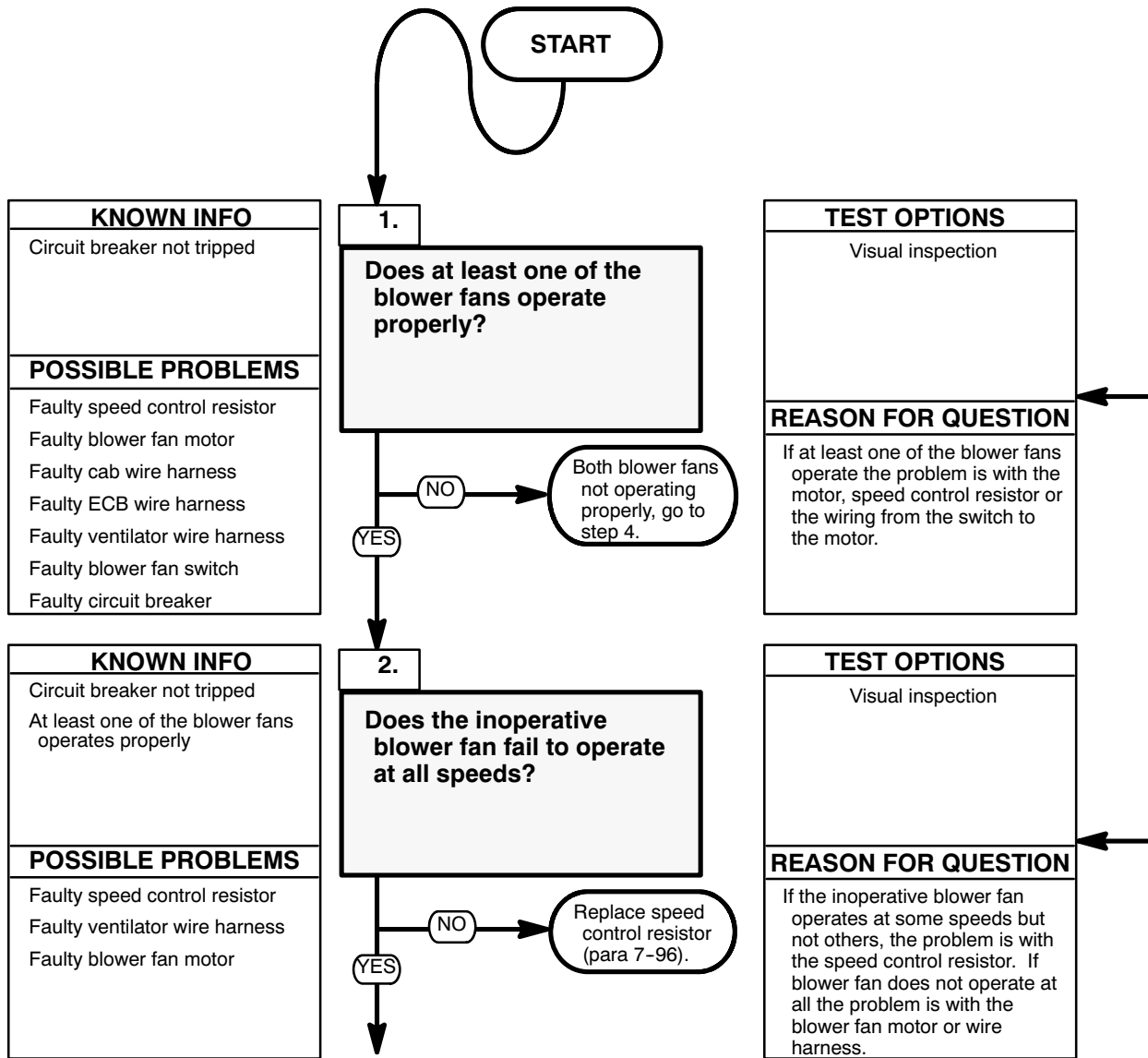
A reading of infinity indicates an open circuit.

- (3) Connect other multimeter lead to socket A at other end of intervehicular cable.
- (4) Repeat steps (2) and (3) for remaining pins and sockets B thru N.



12-PIN ELECTRICAL CONNECTOR

e32. VENTILATOR DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F)



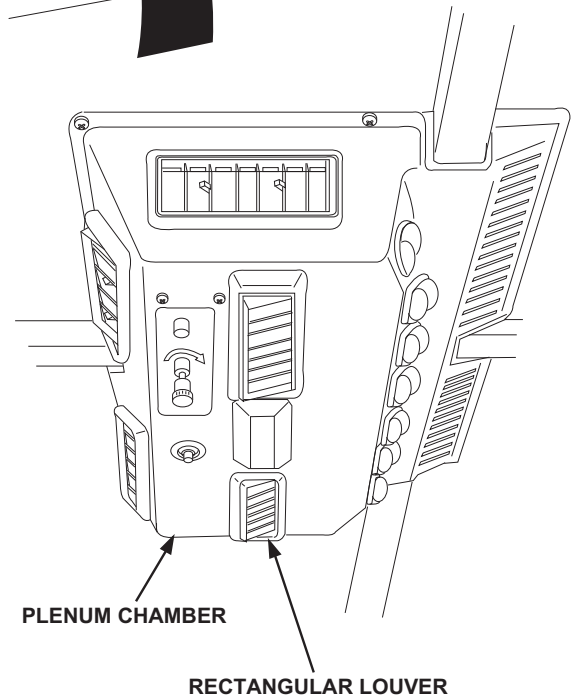
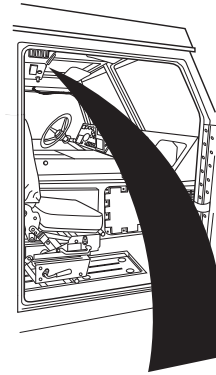
VISUAL INSPECTION

NOTE

- There are two blower fan motors contained within the ventilator. One motor operates the two blower wheels on the driver's side, the other motor operates the two blower wheels on the passenger's side.
- The rectangular louvers are removed for access to troubleshooting test points, while allowing the ventilator to remain operational.

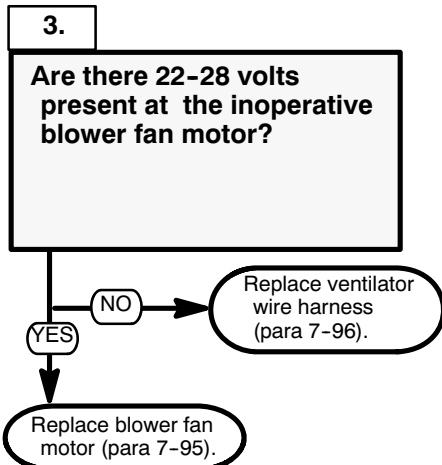
- (1) Remove six rectangular louvers from plenum chamber.
- (2) Turn engine switch to ON position.
- (3) Operate ventilator on high (H), medium (M), and low (L) (TM 9-2320-360-10) and check the operation of the passenger and driver side blower wheels.
- (4) Turn engine switch to OFF position.

- (1) Turn engine switch to ON position.
- (2) Operate ventilator on high (H), medium (M), and low (L) (TM 9-2320-360-10) and check the operation of the faulty blower fan motor.
- (3) Turn engine switch to OFF position.



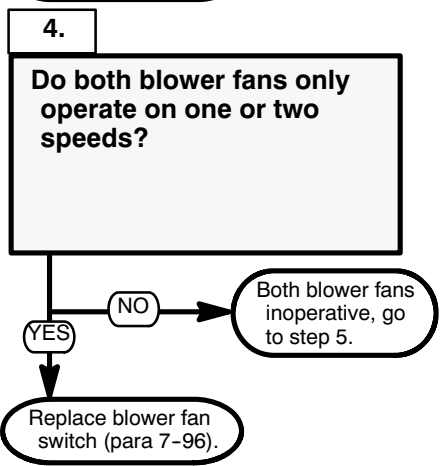
e32. VENTILATOR DOES NOT OPERATE (CONT)

KNOWN INFO
Circuit breaker not tripped At least one of the blower fans operates properly Other blower fan does not work at any speed
POSSIBLE PROBLEMS
Faulty ventilator wire harness Faulty blower fan motor



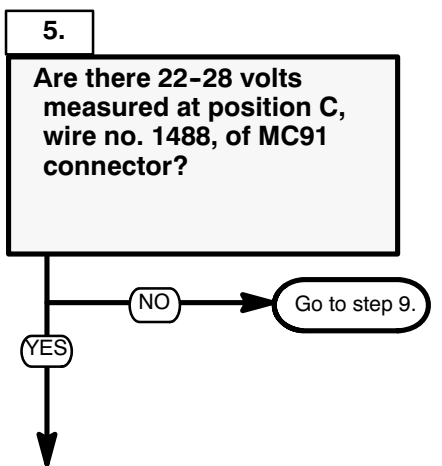
TEST OPTIONS
Blower Fan Motor Test or STE/ICE-R Test #89
REASON FOR QUESTION
Blower fan motor has failed if voltage is present. If no voltage is measured there is an open in the wire harness from the blower fan switch to the motor.

KNOWN INFO
Circuit breaker not tripped Problem is present with both blower fans
POSSIBLE PROBLEMS
Faulty cab wire harness Faulty ECB wire harness Faulty ventilator wire harness Faulty blower fan switch Faulty circuit breaker



TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Both blower fan motors have separate speed control resistors past the speed control switch. If both blower fans don't work on all speeds, the problem is with the switch which is common to both motors.

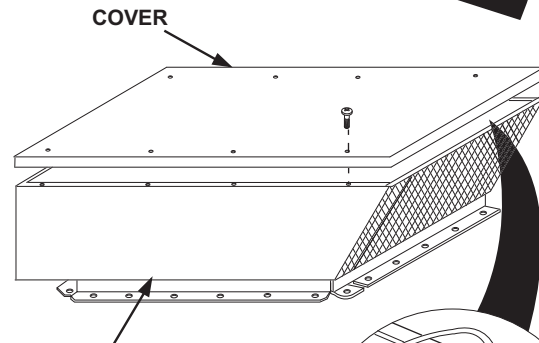
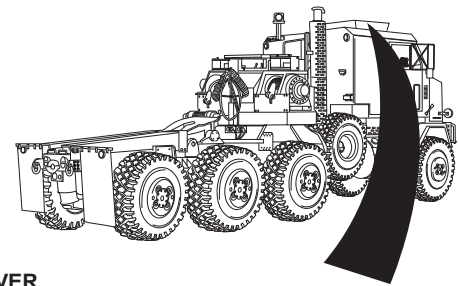
KNOWN INFO
Circuit breaker not tripped Both blower fans inoperative
POSSIBLE PROBLEMS
Faulty cab wire harness Faulty ECB wire harness Faulty ventilator wire harness Faulty blower fan switch Faulty circuit breaker



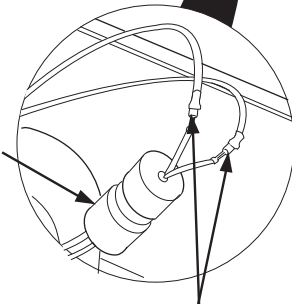
TEST OPTIONS
Cab Wire Harness Voltage Test or STE/ICE-R Test #89
REASON FOR QUESTION
If there is no voltage measured at MC91 connector there is an open circuit in the Electronic Control Box (ECB), cab or cab rear wire harnesses. If voltage is present the problem is within the electrical components of the ventilator.

BLOWER FAN MOTOR TEST

- (1) Remove eight screws and cover from upper case.
- (2) Remove electrical tape from spade connectors of fan motor wire harness.
- (3) Turn engine switch to ON position.
- (4) Operate ventilator on high (H), medium (M), and low (L) (TM 9-2320-360-10).
- (5) Place positive (+) probe of multimeter on orange spade connector.
- (6) Place negative (-) probe of multimeter on black spade connector and look for 22-28 volts on multimeter.
- (7) Turn engine switch to OFF position.



FAN MOTOR WIRE HARNESS



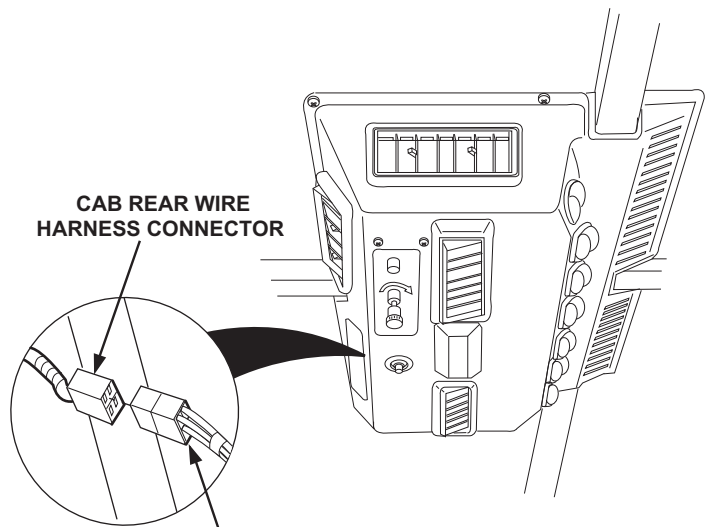
SPADE CONNECTORS

- (1) Turn engine switch to ON position.
- (2) Operate ventilator (TM 9-2320-360-10) and check the operation of the faulty blower fan motors.
- (3) Turn engine switch to OFF position.

CAB WIRE HARNESS VOLTAGE TEST

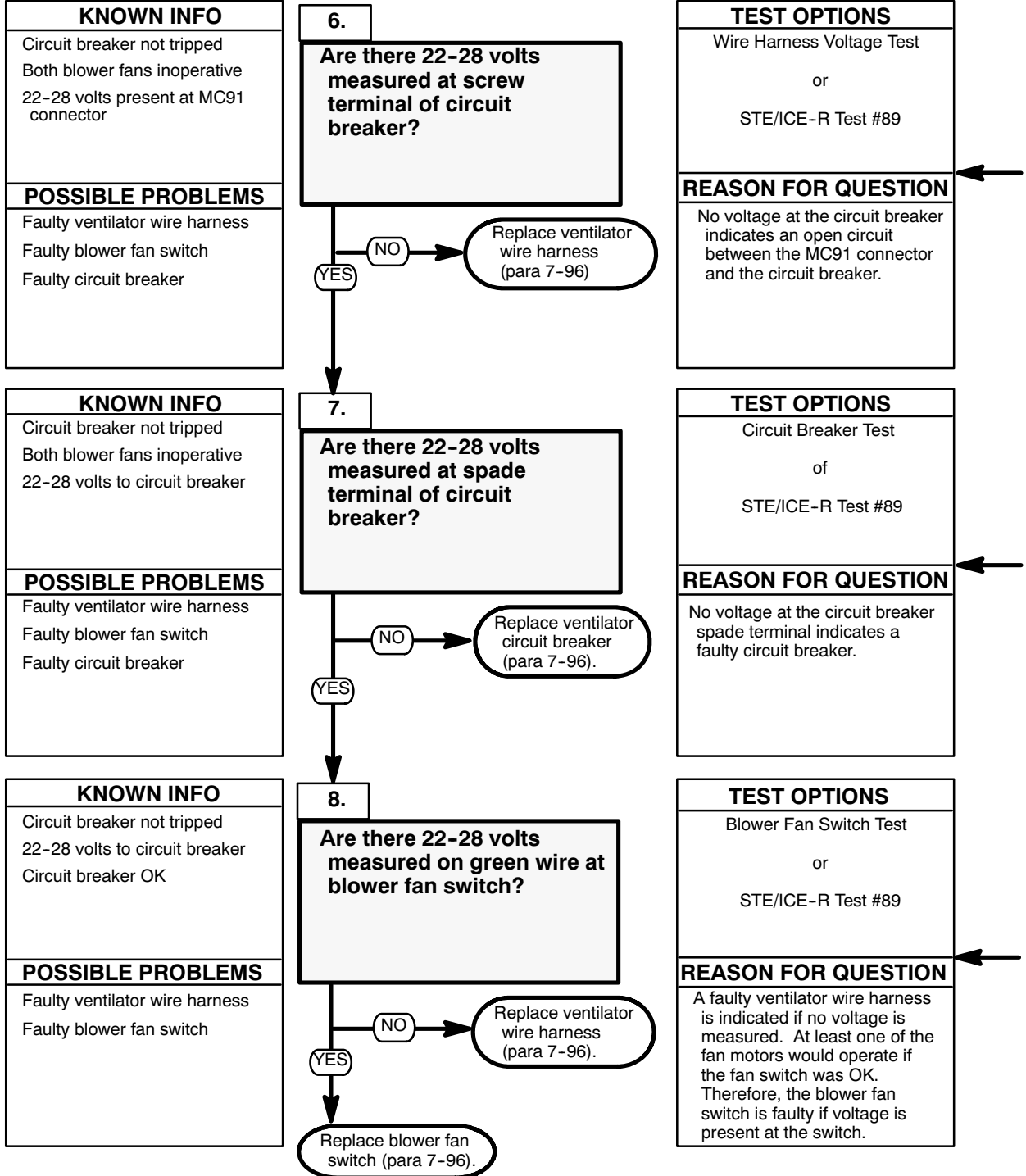
- (1) Remove cab rear wire harness connector from ventilator wire harness connector.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on position C of cab rear wire harness MC91 connector.
- (4) Place negative (-) probe of multimeter on known good ground and look for 22-28 volts.

CAB REAR WIRE HARNESS CONNECTOR



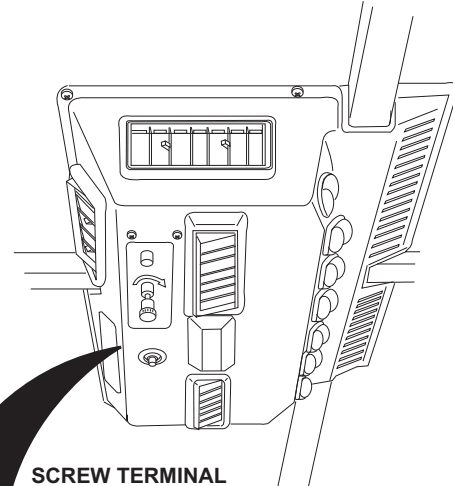
VENTILATOR WIRE HARNESS CONNECTOR

e32. VENTILATOR DOES NOT OPERATE (CONT)



**WIRE HARNESS
VOLTAGE TEST**

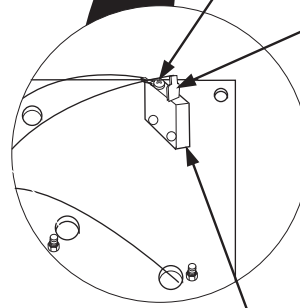
- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on screw terminal of circuit breaker.
- (3) Place negative (-) probe of multimeter on known good ground and look for 22-28 volts.
- (4) Turn ENGINE switch to OFF position.



SCREW TERMINAL

**CIRCUIT BREAKER
TEST**

- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on spade terminal of circuit breaker.
- (3) Place negative (-) probe of multimeter on known good ground and look for 22-28 volts.
- (4) Turn ENGINE switch to OFF position.

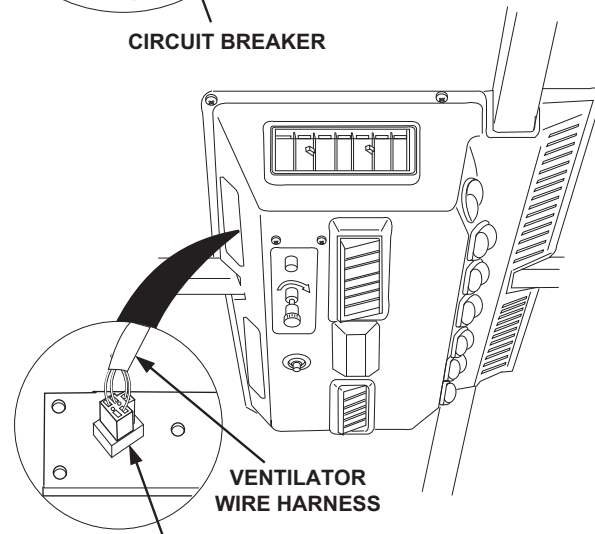


SPADE TERMINAL

CIRCUIT BREAKER

**BLOWER FAN SWITCH
TEST**

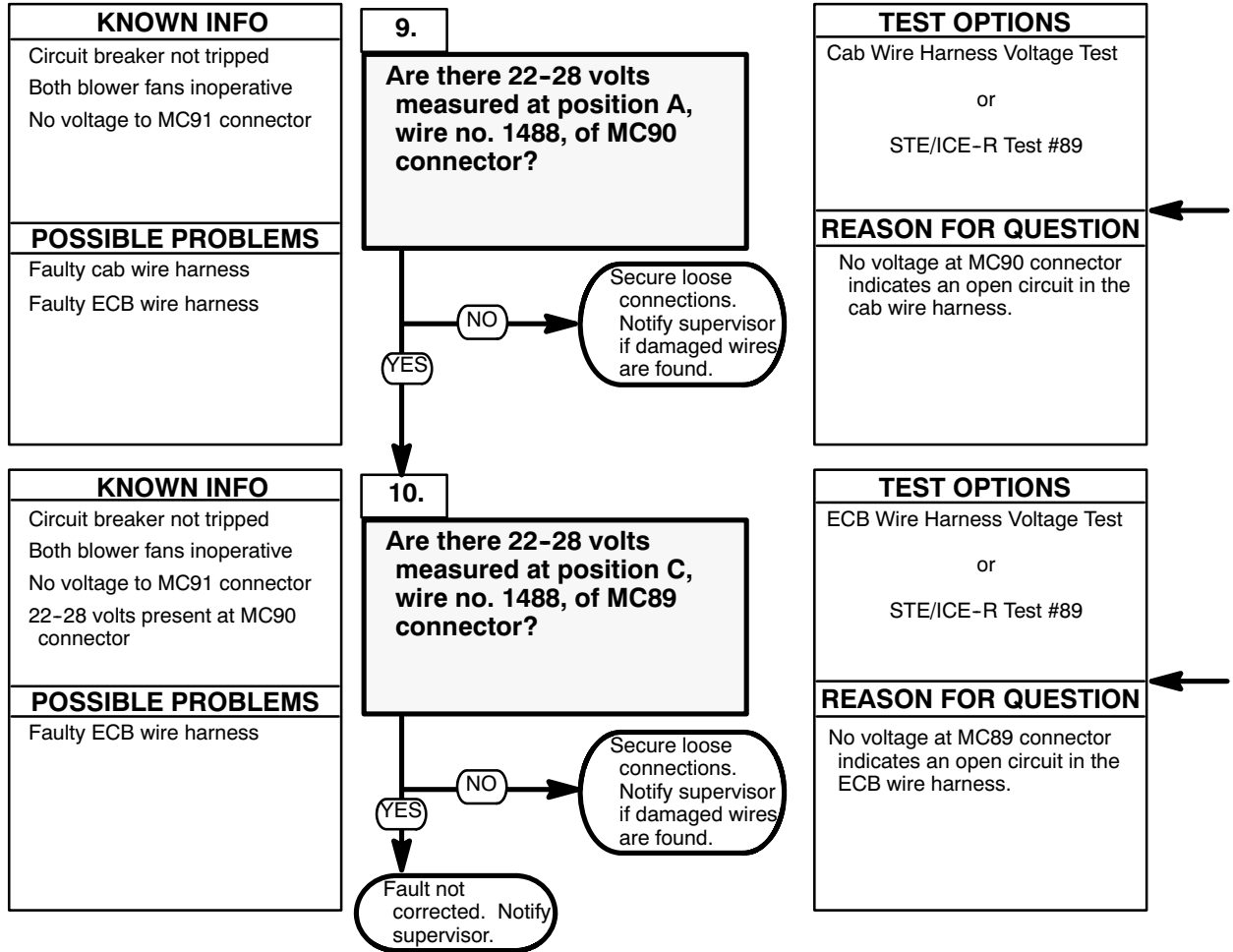
- (1) Turn ENGINE switch to ON position.
- (2) Place positive (+) probe of multimeter on green wire terminal of ventilator wire harness at blower fan switch.
- (3) Place negative (-) probe of multimeter on known good ground and look for 22-28 volts.
- (4) Turn ENGINE switch to OFF position.



VENTILATOR
WIRE HARNESS

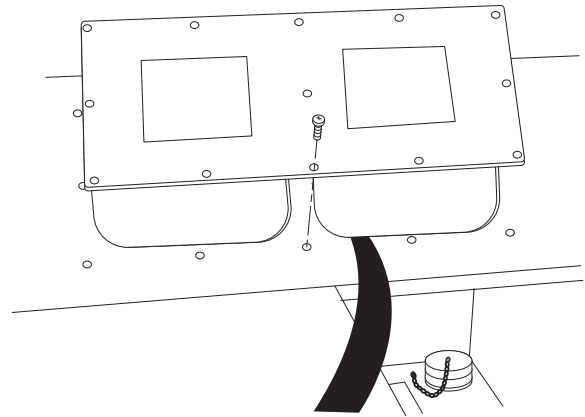
BLOWER FAN SWITCH

e32. VENTILATOR DOES NOT OPERATE (CONT)

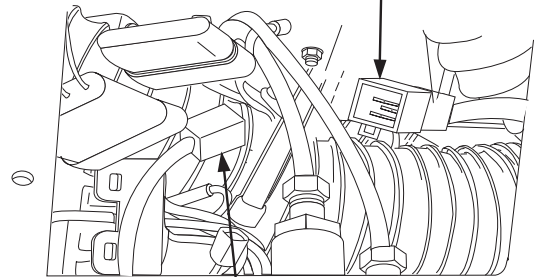


**CAB WIRE HARNESS
VOLTAGE TEST**

- (1) Remove 13 screws and panel from dash.
- (2) Remove rear cab harness MC90 connector from cab wire harness.
- (3) Turn ENGINE switch to ON position.
- (4) Place positive (+) probe of multimeter on position A of MC90 connector.
- (5) Place negative (-) probe of multimeter on known good ground and look for 22-28 volts.
- (6) Turn ENGINE switch to OFF position.



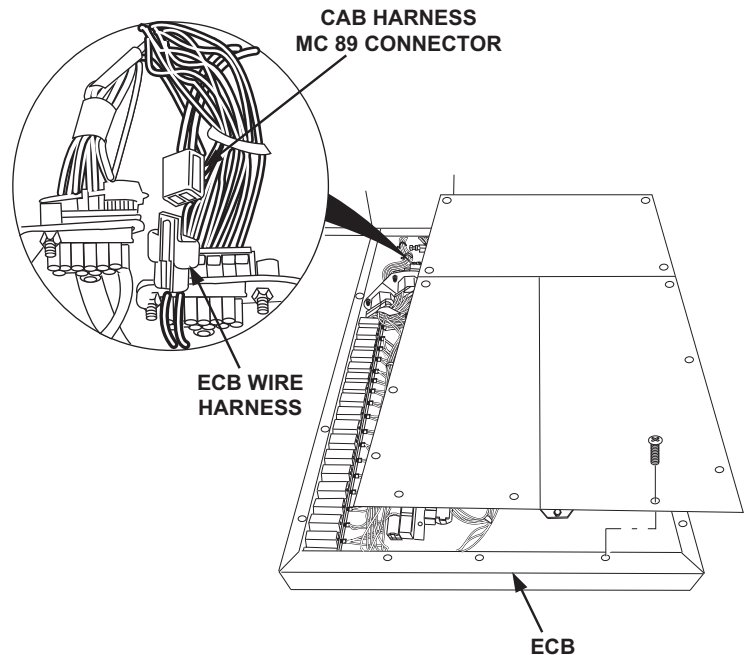
**REAR CAB HARNESS
MC90 CONNECTOR**



CAB WIRE HARNESS

**ECB WIRE HARNESS
VOLTAGE TEST**

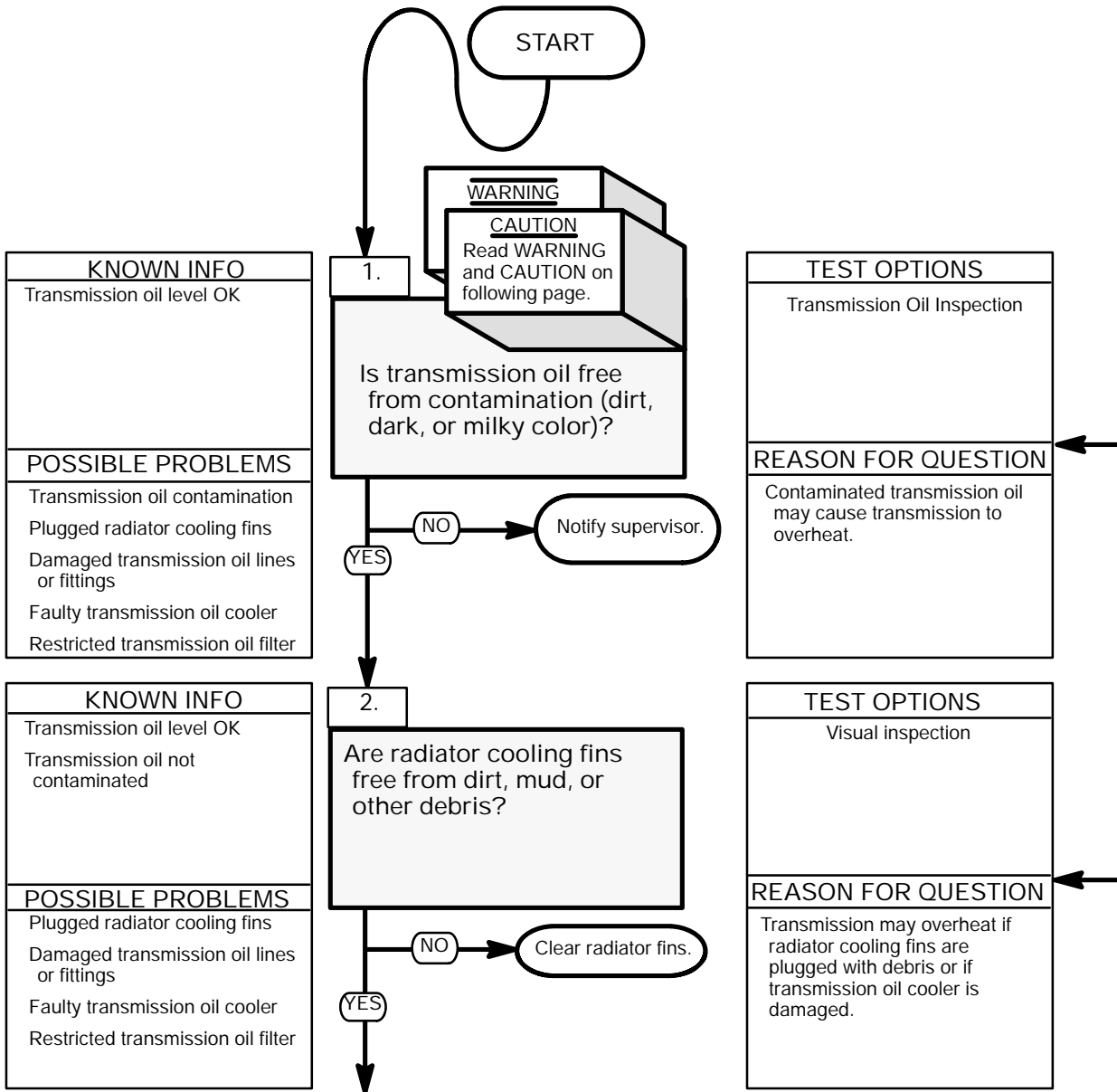
- (1) Remove 19 screws and three panels from electronic control box (ECB).
- (2) Remove cab harness MC89 connector from ECB wire harness.
- (3) Turn ENGINE switch to ON position.
- (4) Place positive (+) probe of multimeter on position C of MC89 connector.
- (5) Place negative (-) probe of multimeter on known good ground and look for 22-28 volts.
- (6) Turn ENGINE switch to OFF position.



f. TRANSMISSION

<u>Malfunction</u>	Troubleshooting Procedure (Page)
f1. Transmission overheats (TRANS TEMP gage continuously reads over 250 ⁰ F (121 ⁰ C))	2-630
f2. Transmission unusually noisy when operating	2-634
f3. Transmission will not shift into gear, slips out of gear, or operates erratically	2-638
f4. Vehicle moves in neutral	2-640
f5. Transmission shifts rough	2-642
f6. Transmission slips in all forward gears	2-646
f7. Automatic shifts occur at too high or low a speed	2-648
f8. Engine stalls at idle when in gear	2-652

f1. TRANSMISSION OVERHEATS (TRANS TEMP GAGE CONTINUOUSLY READS OVER 250 °F (121 °C))	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



TRANSMISSION OIL INSPECTION

WARNING

Do not drain transmission oil when transmission is hot. Severe injury to personnel may result.

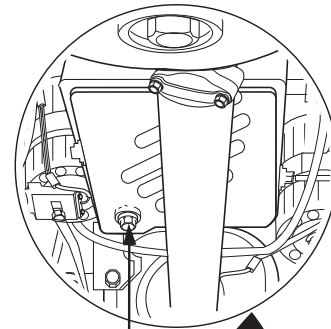
CAUTION

Transmission oil must be changed whenever there is evidence of oil breakdown or contamination. Oil breakdown or contamination may be caused from overheating transmission and is indicated by discoloration, strong odor, or oil analysis.

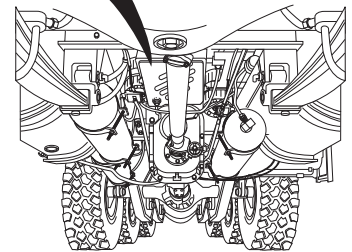
NOTE

Transmission fluid capacity is 33 qt (31 L).

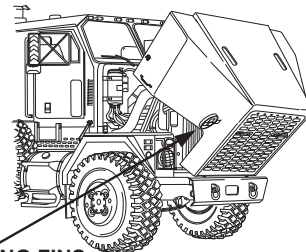
- (1) Place suitable container under transmission drain plug.
- (2) Remove drain plug from transmission and allow approximately 1 qt (0.9 L) of oil to drain into container.
- (3) Install drain plug on transmission.
- (4) Inspect oil for contaminants.
- (5) Fill transmission (LO 9-2320-360-12).



TRANSMISSION DRAIN PLUG

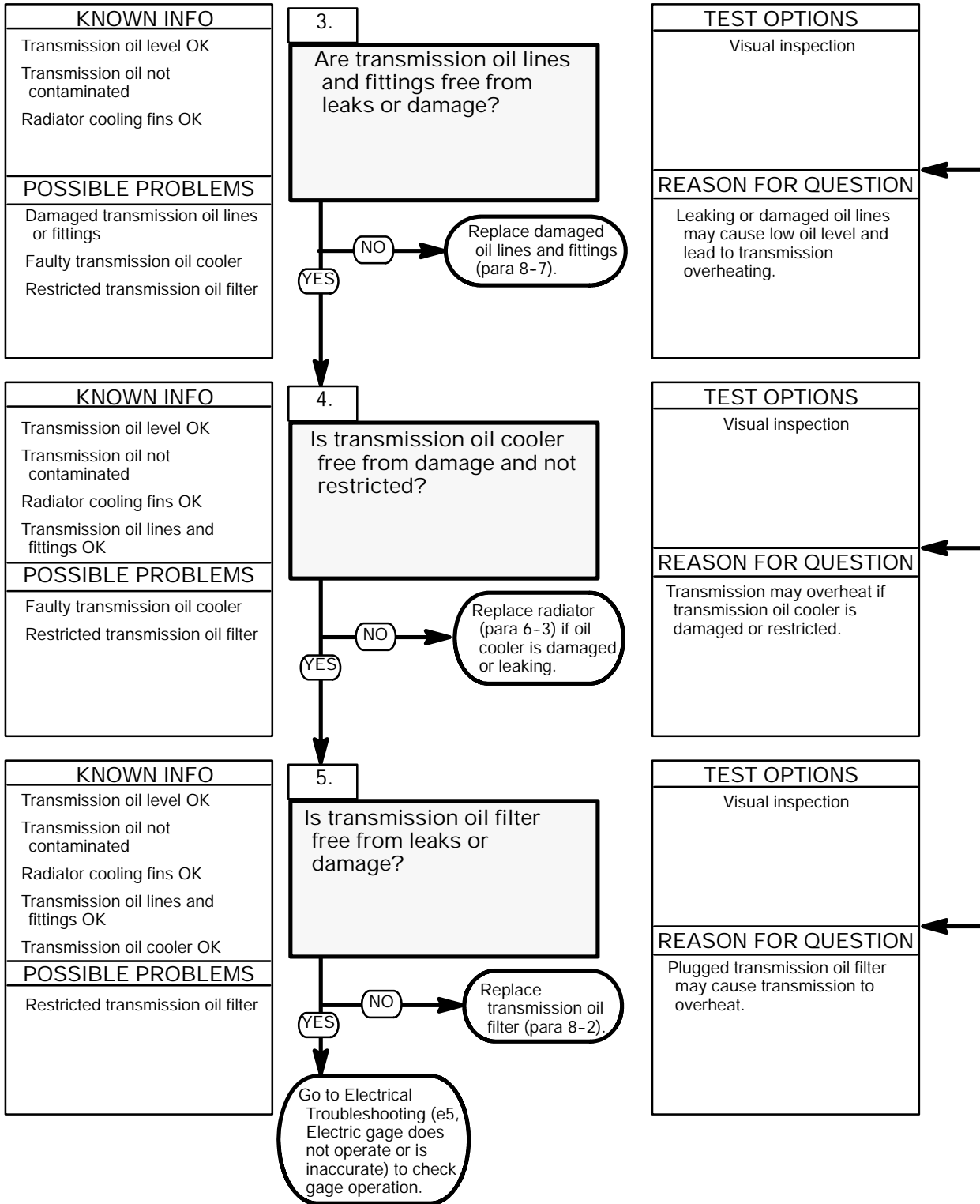


Check if radiator cooling fins are plugged with dirt, mud, or other debris.



RADIATOR COOLING FINS

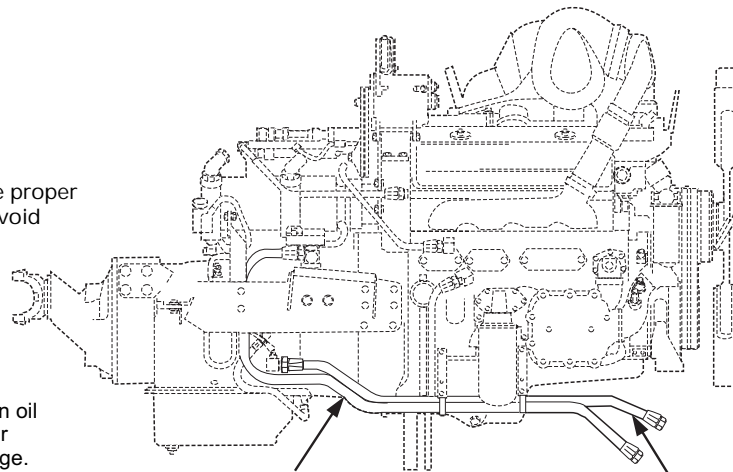
f1. TRANSMISSION OVERHEATS (TRANS TEMP GAGE CONTINUOUSLY READS OVER 250 °F (121 °C)) (CONT)



WARNING

Be sure to wear the proper eye protection to avoid personal injury.

Check transmission oil lines and fittings for leakage and damage.



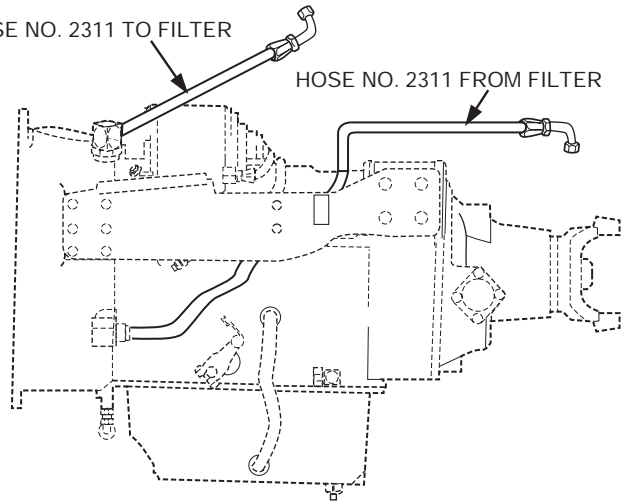
HOSE NO. 2382 TO RADIATOR

HOSE NO. 2393 FROM RADIATOR

TRANSMISSION/ENGINE REMOVED FOR CLARITY

HOSE NO. 2311 TO FILTER

HOSE NO. 2311 FROM FILTER



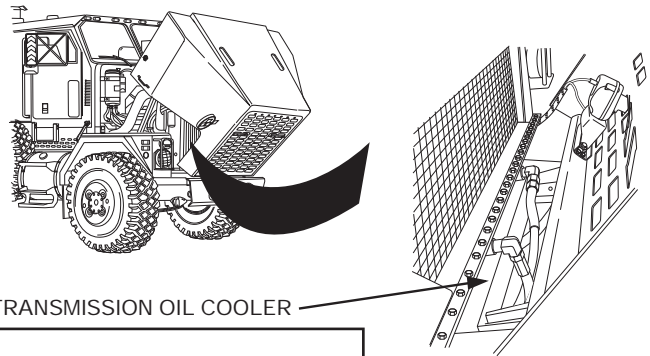
TRANSMISSION REMOVED FOR CLARITY

NOTE

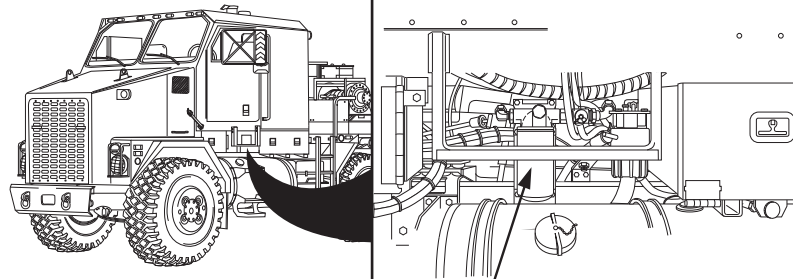
Transmission oil cooler is contained inside radiator bottom tank

- (1) Check radiator bottom tank for obvious damage.
- (2) Remove transmission oil cooler hoses and elbows (para 8-7).
- (3) Inspect oil cooler passages for restrictions.
- (4) Replace elbows and transmission oil cooler hoses (para 8-7).
- (5) Fill transmission (LO 9-2320-360-12).

Check transmission oil filter for leaks and damage.

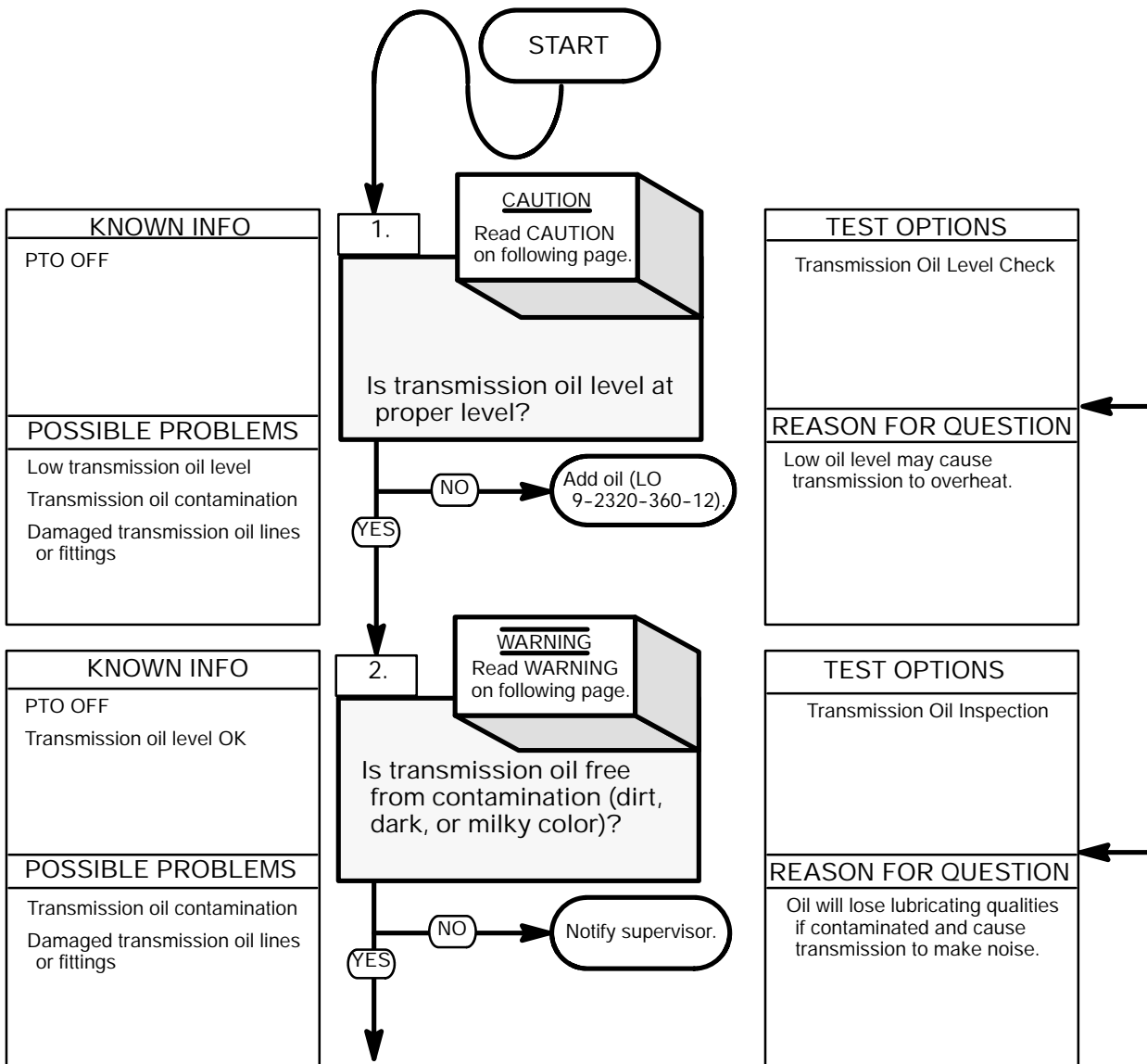


TRANSMISSION OIL COOLER



TRANSMISSION OIL FILTER

f2. TRANSMISSION UNUSUALLY NOISY WHEN OPERATING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

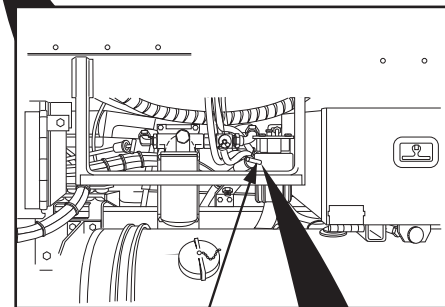
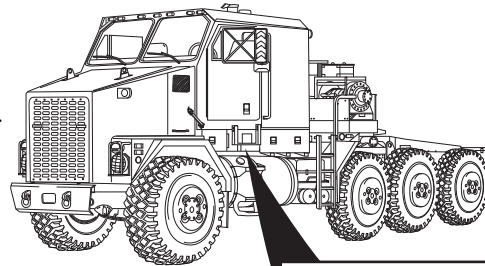


WARNING

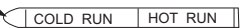
Be sure to wear the proper eye protection to avoid personal injury.

CAUTION

Transmission oil must be changed whenever there is evidence of oil breakdown or contamination. Oil breakdown or contamination may be caused from overheating transmission and is indicated by discoloration, strong odor, or oil analysis.



TRANSMISSION DIPSTICK



TRANSMISSION OIL LEVEL CHECK

With engine running and transmission in neutral (N), check transmission fluid level on dipstick.

- a. If transmission fluid temperature is below 160 °F (71 °C), fluid level should be within COLD RUN area.
- b. If transmission fluid temperature is above 160 °F (71 °C), fluid level should be within HOT RUN area.

TRANSMISSION OIL INSPECTION

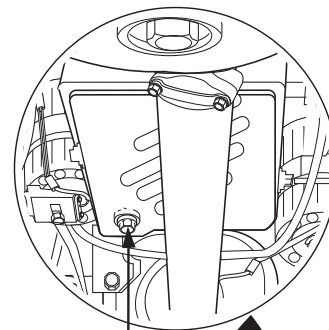
WARNING

Do not drain transmission oil when transmission is hot. Severe injury to personnel may result. Be sure to wear the proper eye protection to avoid personal injury.

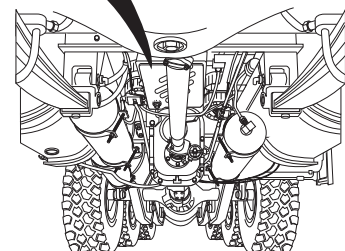
NOTE

Transmission fluid capacity is 33 qt (31 L).

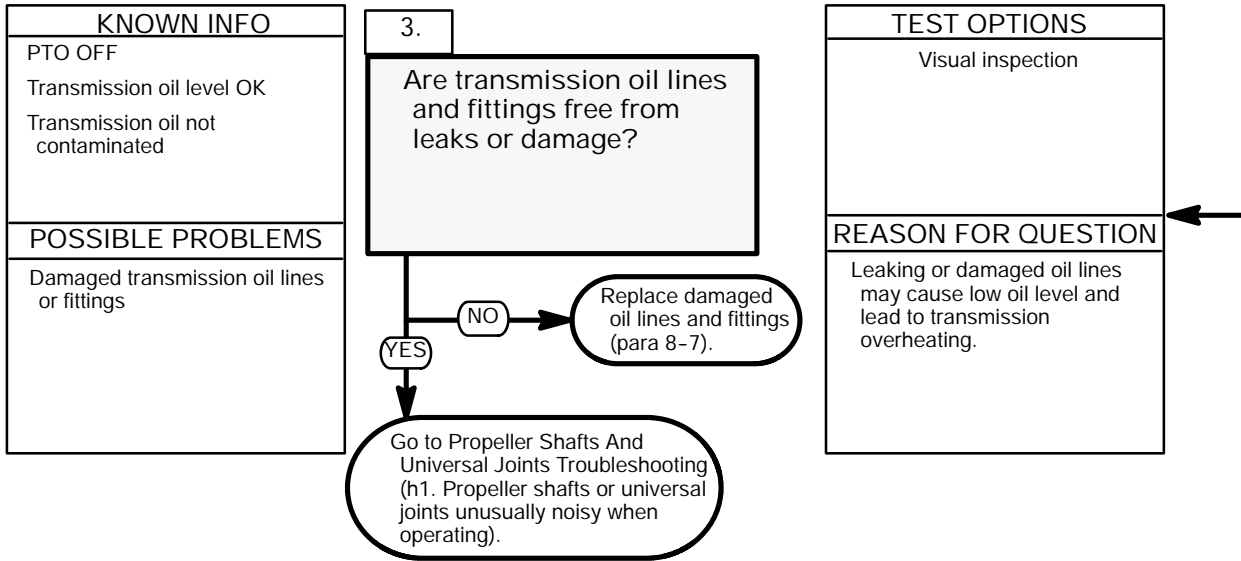
- (1) Place suitable container under transmission drain plug.
- (2) Remove drain plug from transmission and allow approximately 1 qt (0.9 L) of oil to drain into container.
- (3) Install drain plug on transmission.
- (4) Inspect oil for correct type and for contaminants.
- (5) Fill Transmission (LO 9-2320-360-12).



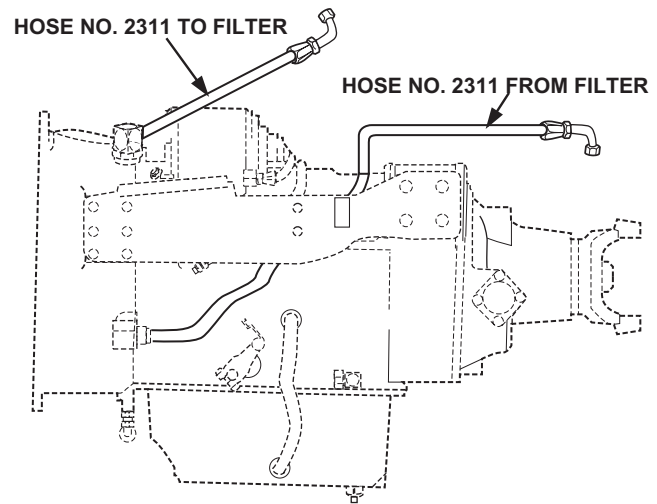
TRANSMISSION DRAIN PLUG



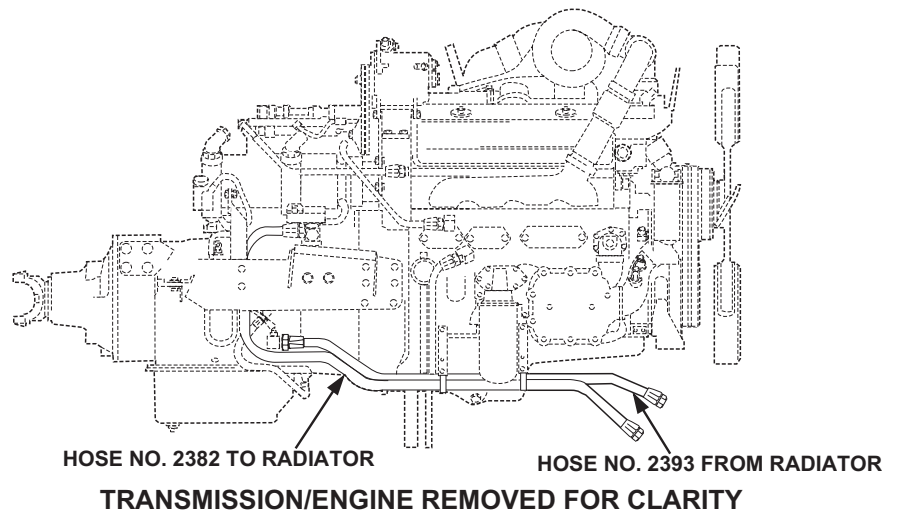
f2. TRANSMISSION UNUSUALLY NOISY WHEN OPERATING (CONT)



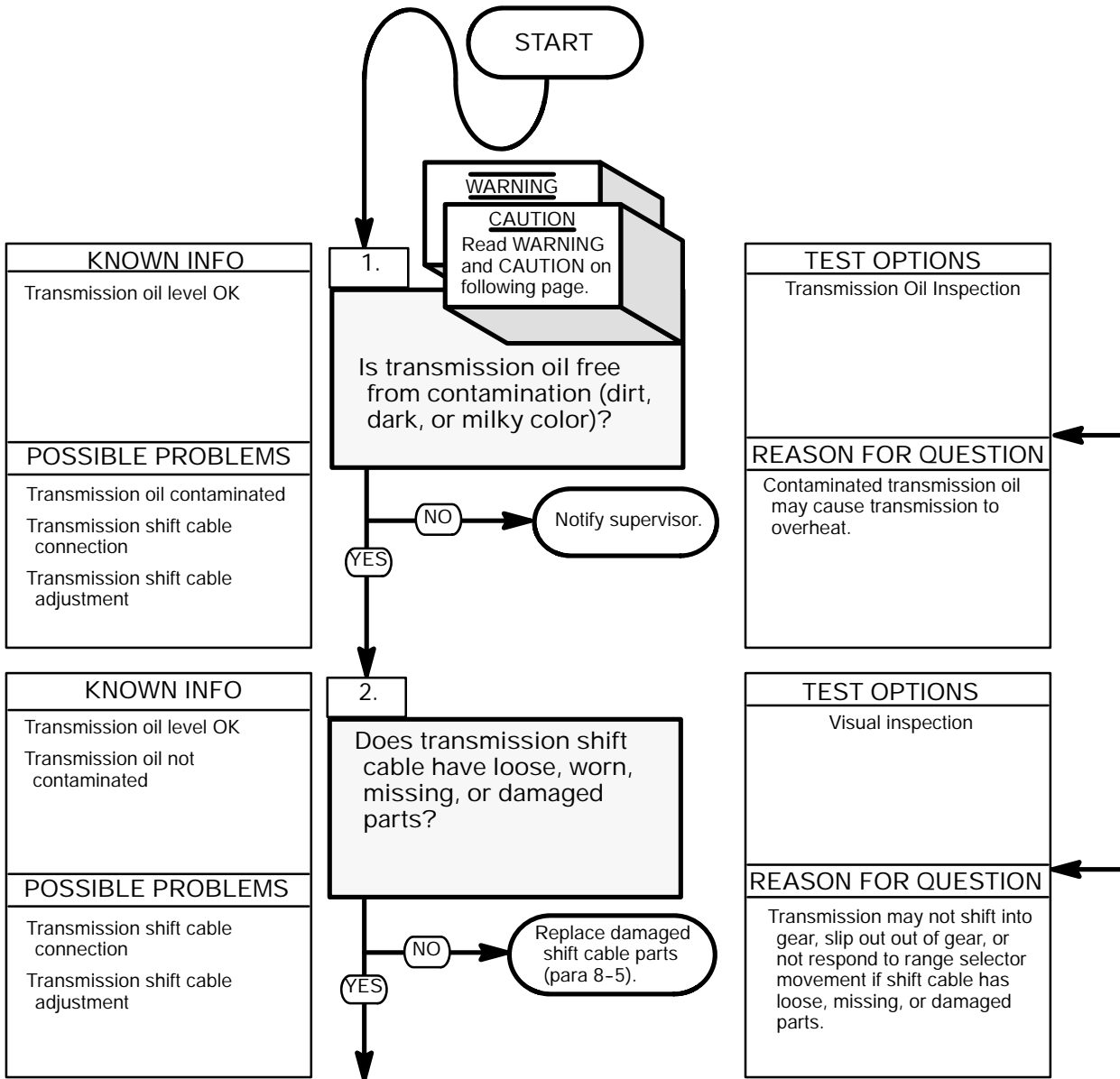
Check transmission oil lines and fittings for leakage and damage.



TRANSMISSION REMOVED FOR CLARITY



f3. TRANSMISSION WILL NOT SHIFT INTO GEAR, SLIPS OUT OF GEAR, OR OPERATES ERRATICALLY	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



TRANSMISSION OIL INSPECTION

WARNING

Do not drain transmission oil when transmission is hot. Severe injury to personnel may result.

CAUTION

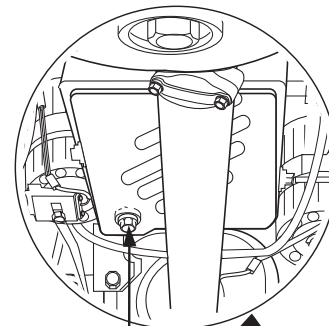
Transmission oil must be changed whenever there is evidence of oil breakdown or contamination. Oil breakdown or contamination may be caused from overheating transmission and is indicated by discoloration, strong odor, or oil analysis.

NOTE

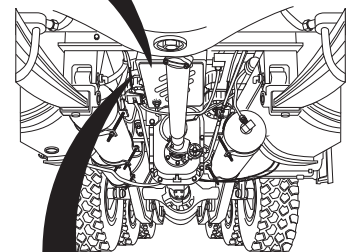
Transmission fluid capacity is 33 qt (31 L).

- (1) Place suitable container under transmission drain plug.
- (2) Remove drain plug from transmission and allow approximately 1 qt (0.9 L) of oil to drain into container.
- (3) Install drain plug on transmission.
- (4) Inspect oil for contaminants.
- (5) Fill transmission (LO 9-2320-360-12).

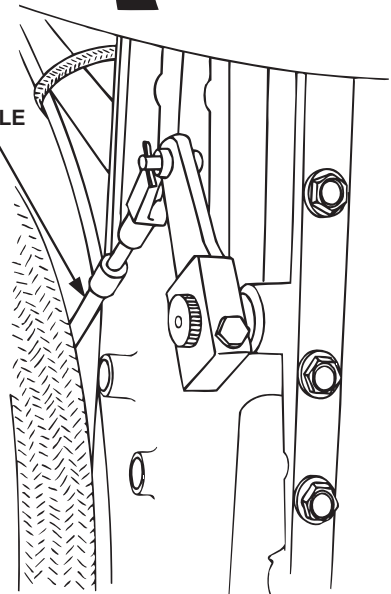
Check transmission shift cable for loose, worn, missing, or damaged parts.



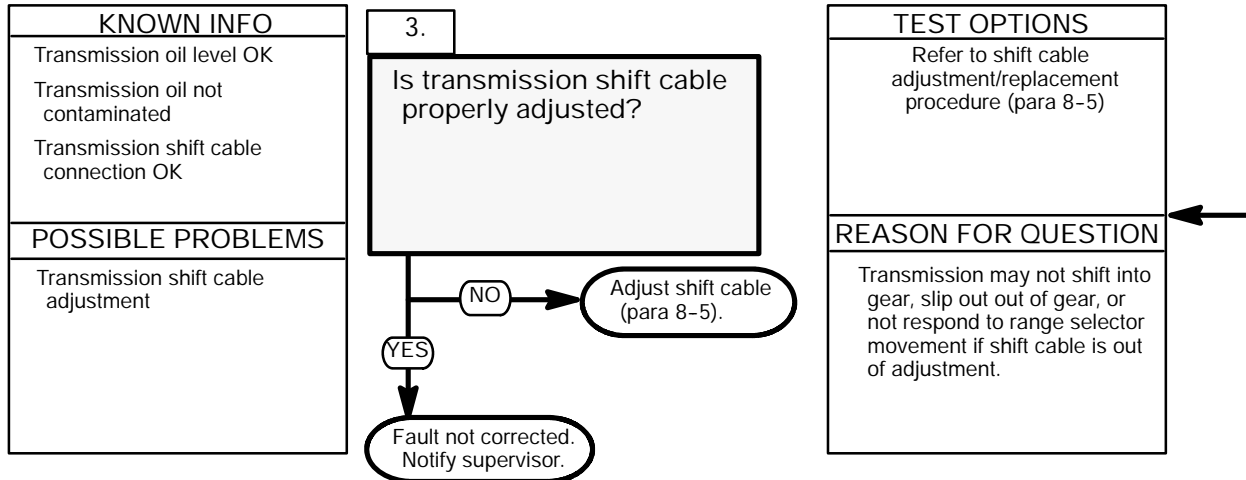
**TRANSMISSION
DRAIN PLUG**

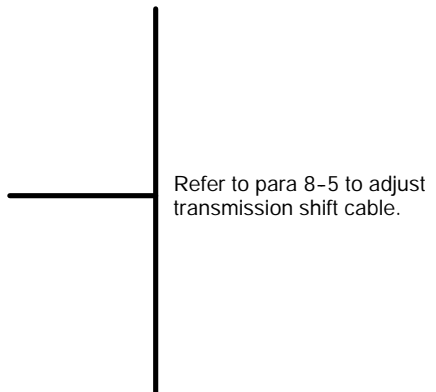


SHIFT CABLE

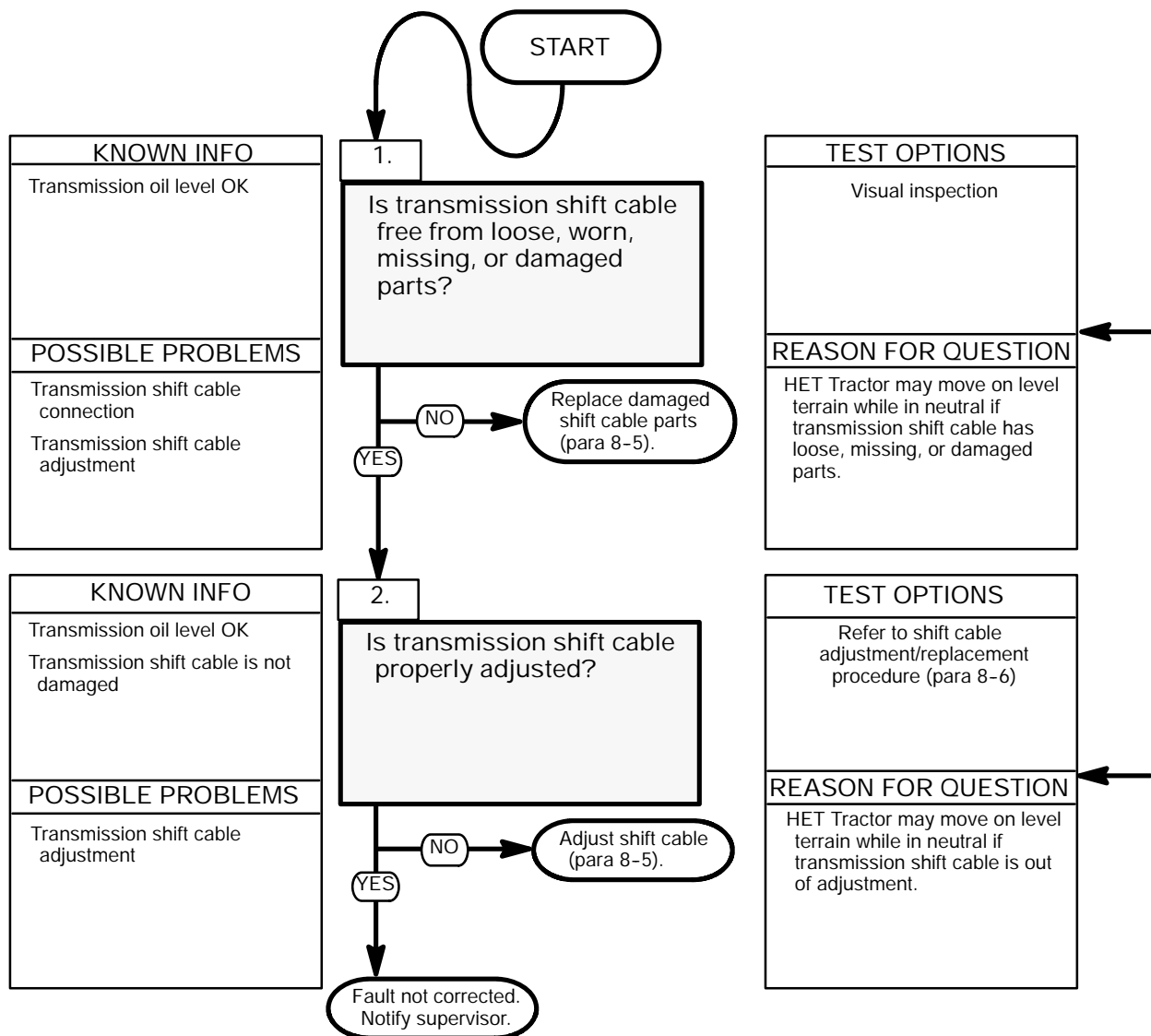


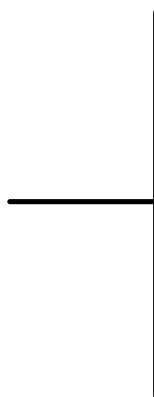
f3. TRANSMISSION WILL NOT SHIFT INTO GEAR, SLIPS OUT OF GEAR, OR OPERATES ERRATICALLY (CONT)



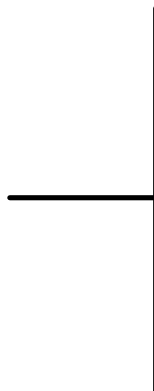
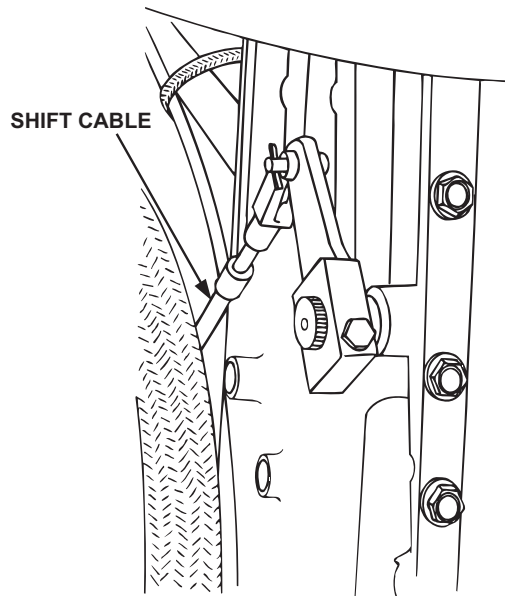


f4. VEHICLE MOVES IN NEUTRAL	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

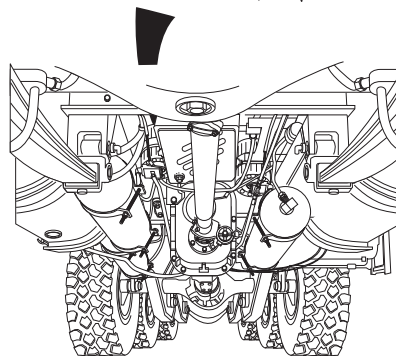




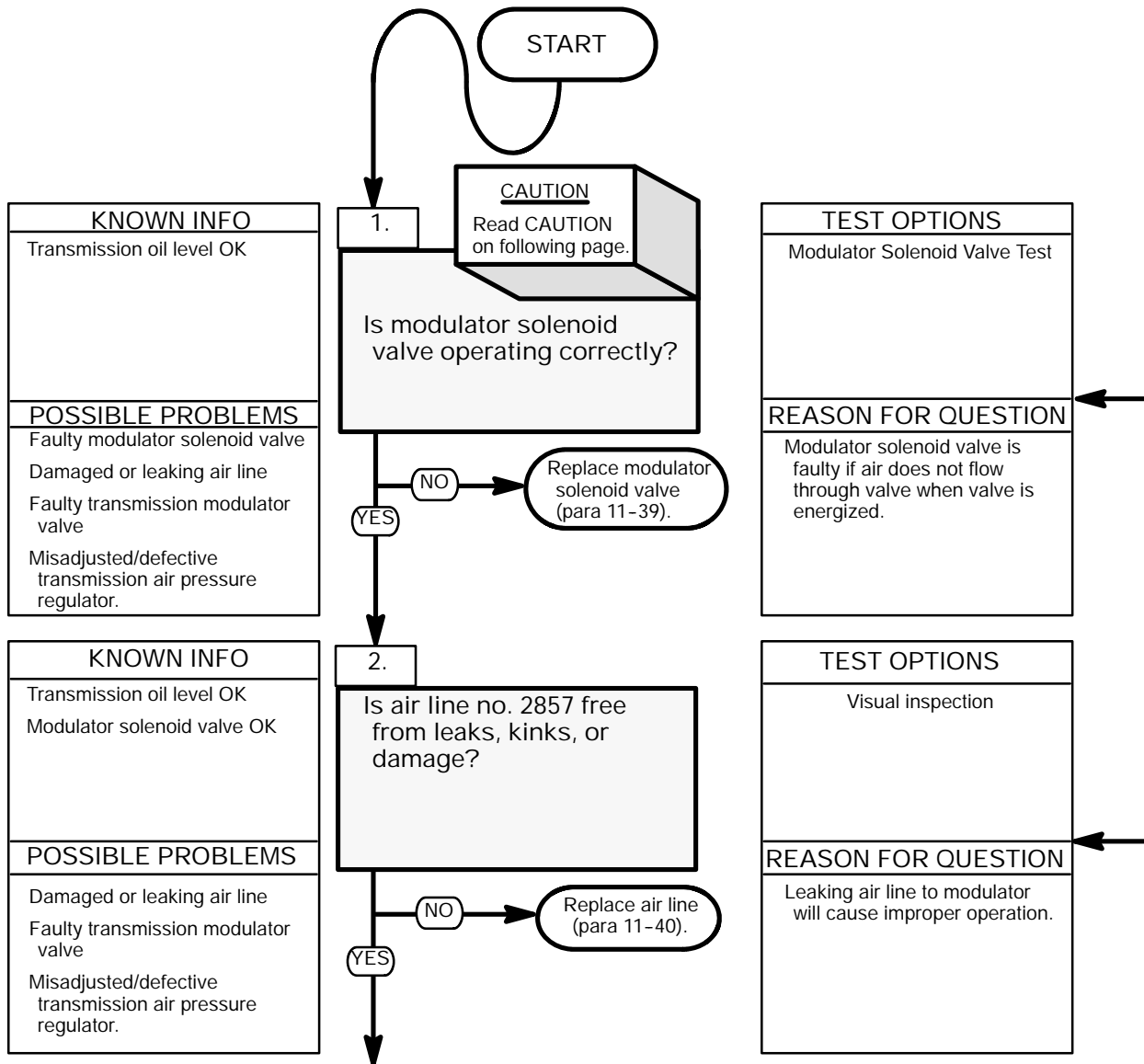
Check transmission shift cable for loose, worn, missing, or damaged parts.

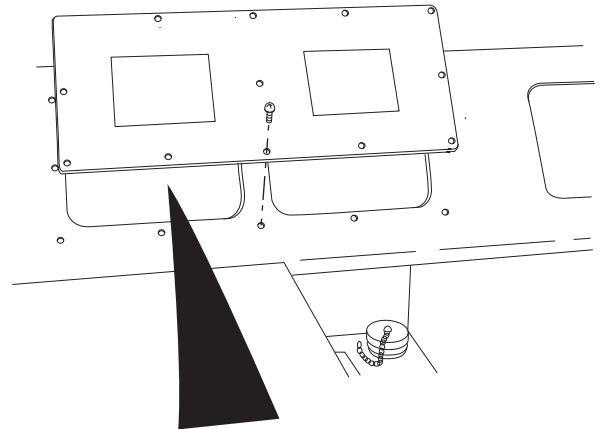
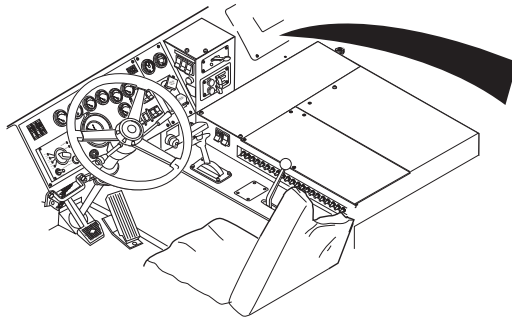


Refer to para 8-5 to adjust transmission shift cable.



f5. TRANSMISSION SHIFTS ROUGH	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked. Air system drained (TM 9-2320-360-10).	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (Item 47, Appendix F)
	Materials/Parts Compound, Sealing, Pipe Thread (Item 15, Appendix C)





WARNING
 Be sure to wear the proper eye protection to avoid personal injury.

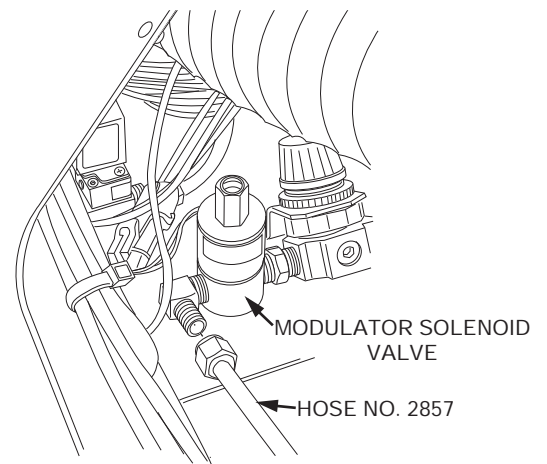
MODULATOR SOLENOID VALVE TEST

- (1) Remove 13 screws and dash access panel from dash.
- (2) Remove hose no. 2857 from modulator solenoid valve.

CAUTION

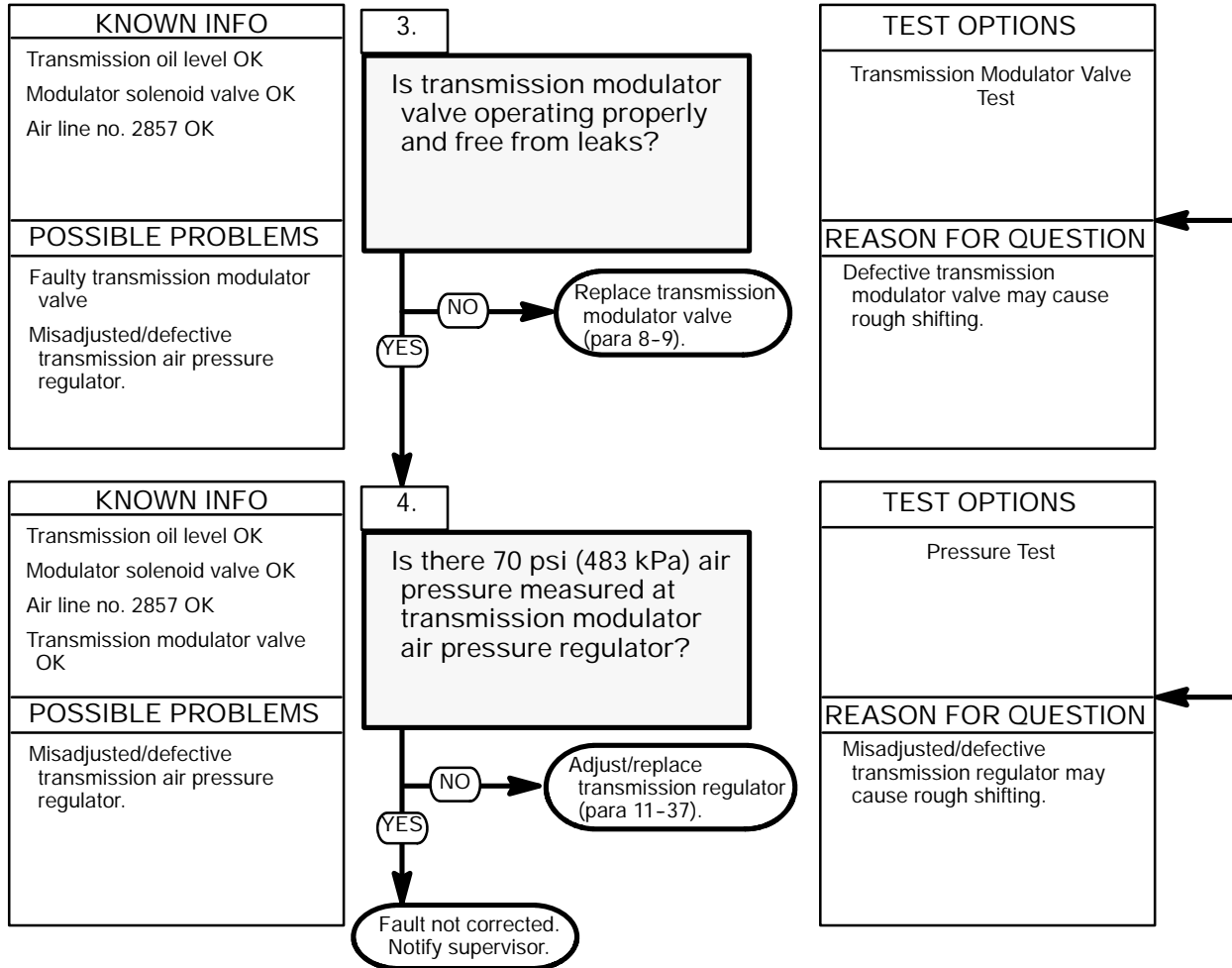
Use care when supplying power to solenoid valve. Crossing terminals will result in damage to solenoid valve and test equipment.

- (3) Apply external 24 volt power supply to solenoid valve.
- (4) Check for air flow through modulator solenoid valve
- (5) Install hose no. 2857 on solenoid valve.



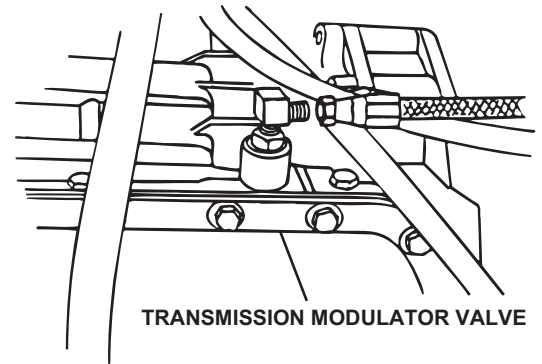
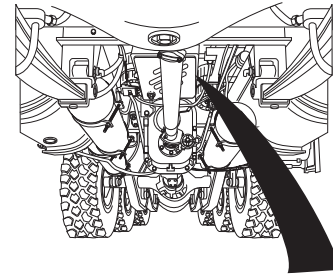
Inspect air line no. 2857 in doghouse, at manifold block and outside cab for leaks, kinks, or damage.

f5. TRANSMISSION SHIFTS ROUGH (CONT)



TRANSMISSION MODULATOR VALVE TEST

- (1) Remove air line no. 2857 from transmission modulator valve.
- (2) Inspect for external transmission fluid leaks and presence of transmission fluid inside air line no. 2857.
- (3) Remove transmission modulator valve (para 8-9).
- (4) Apply air pressure to air line fitting. Center plunger should move out when air pressure is applied.
- (5) Install transmission modulator valve (para 8-9).



PRESSURE TEST

- (1) Remove plug from regulator.
- (2) Install adapter and STE/ICE transducer on regulator.
- (3) Start engine (TM 9-2320-360-10) and allow air system pressure to build up to 120-125 psi (827-862 kPa).
- (4) Shut off engine (TM 9-2320-360-10).
- (5) Perform STE/ICE test #50 and observe pressure displayed.
- (6) Pull regulator knob to unlock air pressure regulator.
- (7) Adjust air pressure regulator to proper air pressure using STE/ICE Test #50. Turn knob clock wise to increase pressure or counterclockwise to decrease pressure.
- (8) Push in knob to lock air pressure regulator.
- (9) Drain air system (TM 9-2320-360-10).
- (10) Remove adapter and STE/ICE transducer from regulator.

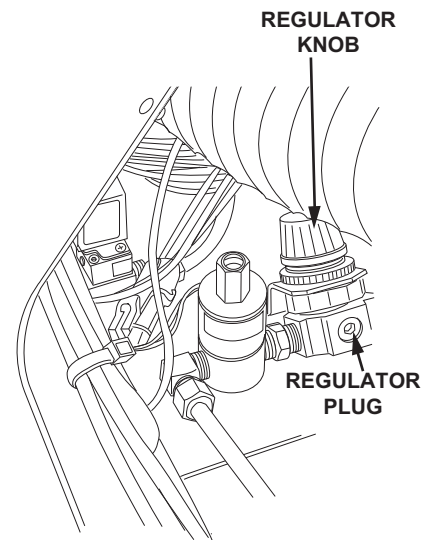
WARNING

Pipe thread sealing compound can burn easily, can give off harmful vapors, and is harmful to skin and clothing. To avoid injury or death, keep compound away from open fire and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.

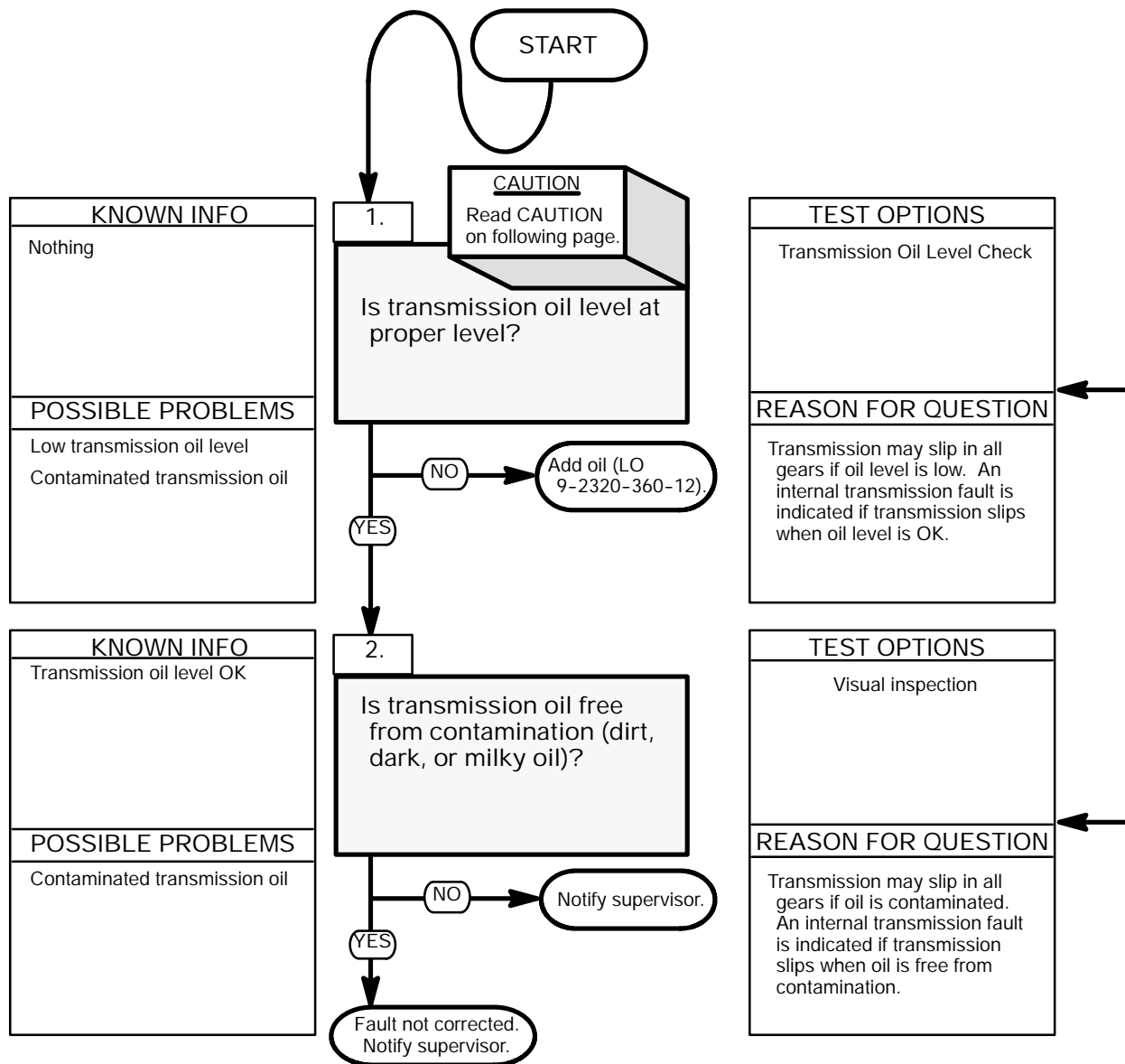
CAUTION

Use pipe thread sealing compound sparingly, only on pipe threads. Do not apply compound at hose connections. Failure to comply may result in component damage.

- (11) Coat threads of plug with pipe thread sealing compound.
- (12) Install plug on regulator.
- (13) Install dash access panel on dash with 13 screws.

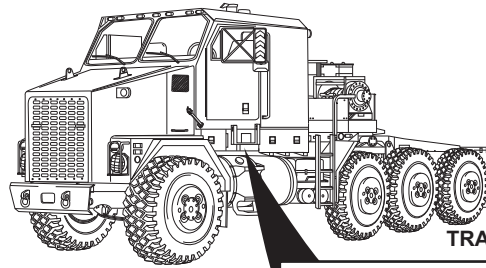


f6. TRANSMISSION SLIPS IN ALL FORWARD GEARS	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

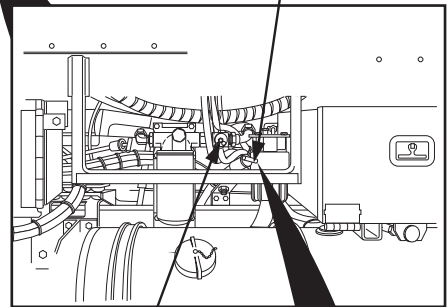


CAUTION

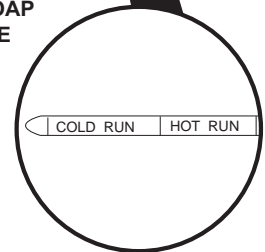
Transmission oil must be changed whenever there is evidence of oil breakdown or contamination. Oil breakdown or contamination may be caused from overheating transmission and is indicated by discoloration, strong odor, or oil analysis.



TRANSMISSION DIPSTICK



TRANSMISSION AOAP SAMPLING VALVE



TRANSMISSION OIL LEVEL CHECK

With engine running and transmission in neutral (N), check transmission fluid level on dipstick.

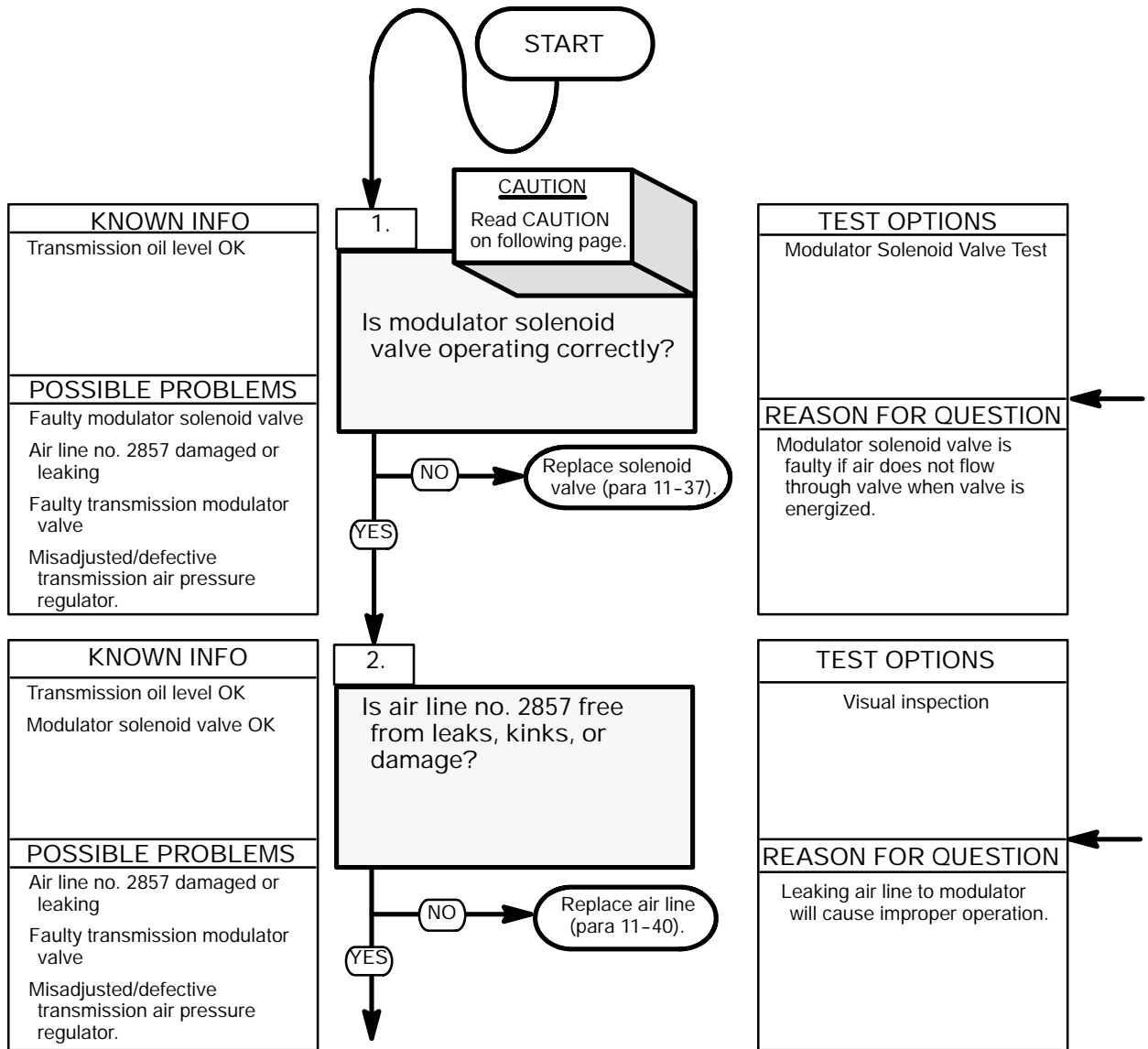
- a. If transmission fluid temperature is below 160 °F (71 °C), fluid level should be within COLD RUN area.
- b. If transmission fluid temperature is above 160 °F (71 °C), fluid level should be within HOT RUN area.

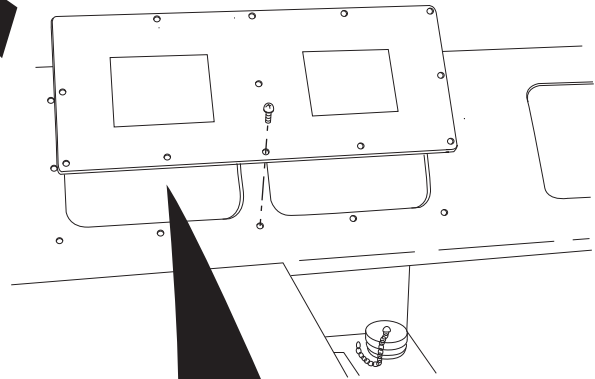
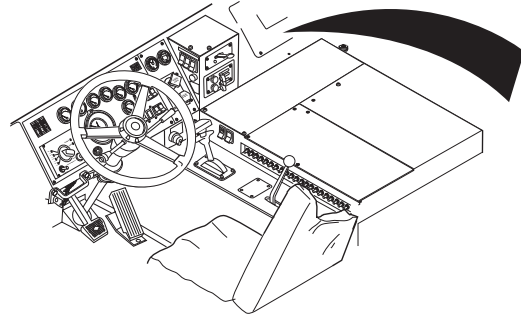
NOTE

Use clean suitable container to obtain sample.

- (1) Obtain 1 qt. (0.9L) transmission oil sample from AOAP sampling valve.
- (2) Inspect oil for contaminants.

f7. AUTOMATIC SHIFTS OCCUR AT TOO HIGH OR TOO LOW A SPEED	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked. Air system drained (TM 9-2320-360-10).	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (Item 47, Appendix F)
Materials/Parts Compound, Sealing, Pipe Thread (Item 15, Appendix C)	





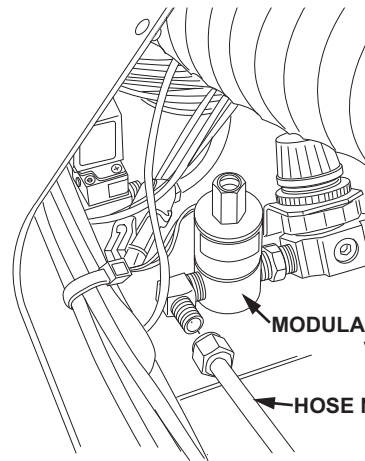
MODULATOR SOLENOID VALVE TEST

- (1) Remove 13 screws and dash access panel from dash.
- (2) Remove hose no. 2857 from modulator solenoid valve.

CAUTION

Use care when supplying power to solenoid valve. Crossing terminals will result in damage to solenoid valve and test equipment.

- (3) Apply external 24 volt power supply to solenoid valve.
- (4) Check for air flow through modulator solenoid valve
- (5) Install hose no. 2857 on solenoid valve.
- (6) Install dash access panel on dash with 13 screws.

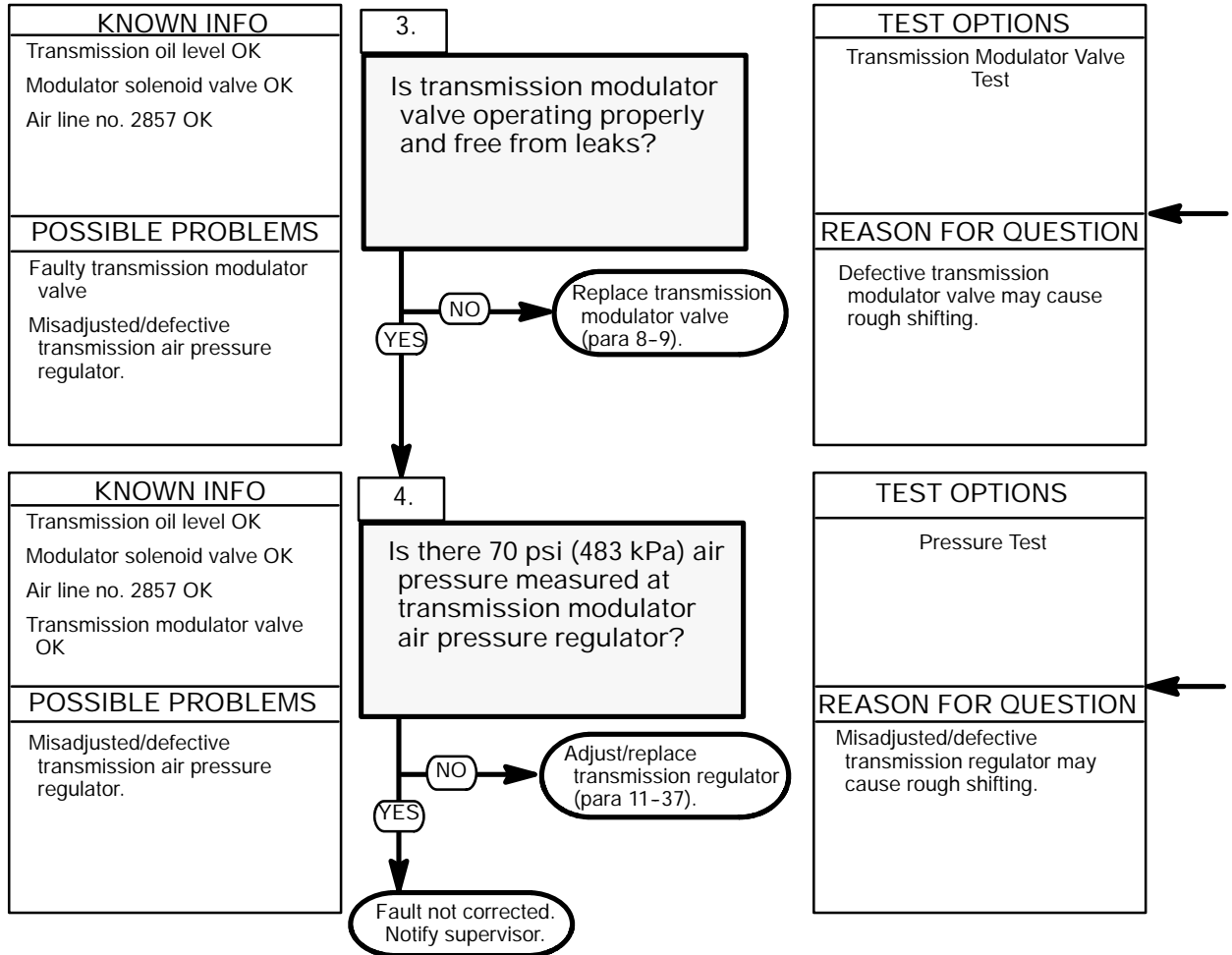


MODULATOR SOLENOID VALVE

HOSE NO. 2857

Inspect air line no. 2857 in doghouse, at manifold block and outside cab for leaks, kinks, or damage.

f7. AUTOMATIC SHIFTS OCCUR AT TOO HIGH OR TOO LOW A SPEED (CONT)

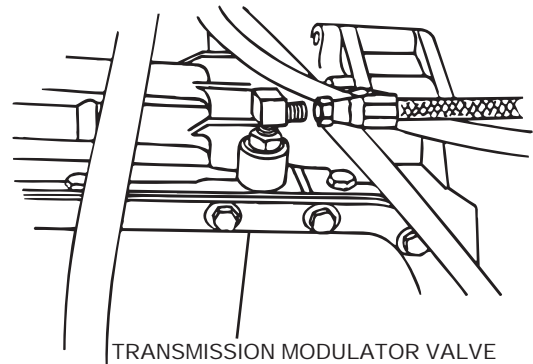
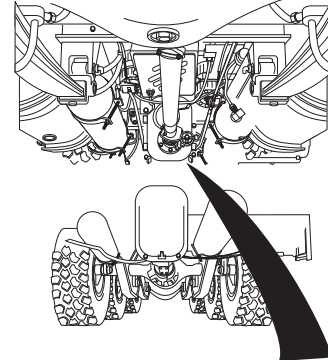


WARNING

Be sure to wear the proper eye protection to avoid personal injury.

TRANSMISSION MODULATOR VALVE TEST

- (1) Remove air line no. 2857 from transmission modulator valve.
- (2) Inspect for external transmission fluid leaks and presence of transmission fluid inside air line no. 2857.
- (3) Remove transmission modulator valve (para 8-9).
- (4) Apply air pressure to air line fitting. Center plunger should move out when air pressure is applied.
- (5) Install transmission modulator valve (para 8-9).



PRESSURE TEST

- (1) Remove plug from regulator.
- (2) Install adapter and STE/ICE transducer on regulator.
- (3) Start engine (TM 9-2320-360-10) and allow air system pressure to build up to 120-125 psi (827-862 kPa).
- (4) Shut off engine (TM 9-2320-360-10).
- (5) Perform STE/ICE test #50 and observe pressure displayed.
- (6) Pull regulator knob to unlock air pressure regulator.
- (7) Adjust air pressure regulator to proper air pressure using STE/ICE Test #50. Turn knob clock wise to increase pressure or counterclockwise to decrease pressure.
- (8) Push in knob to lock air pressure regulator.
- (9) Drain air system (TM 9-2320-360-10).
- (10) Remove adapter and STE/ICE transducer from regulator.

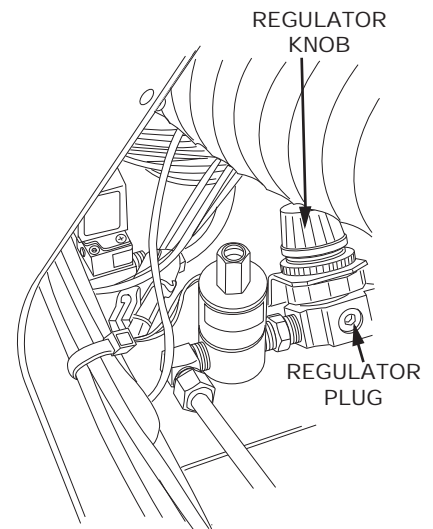
WARNING

Pipe thread sealing compound can burn easily, can give off harmful vapors, and is harmful to skin and clothing. To avoid injury or death, keep compound away from open fire and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.

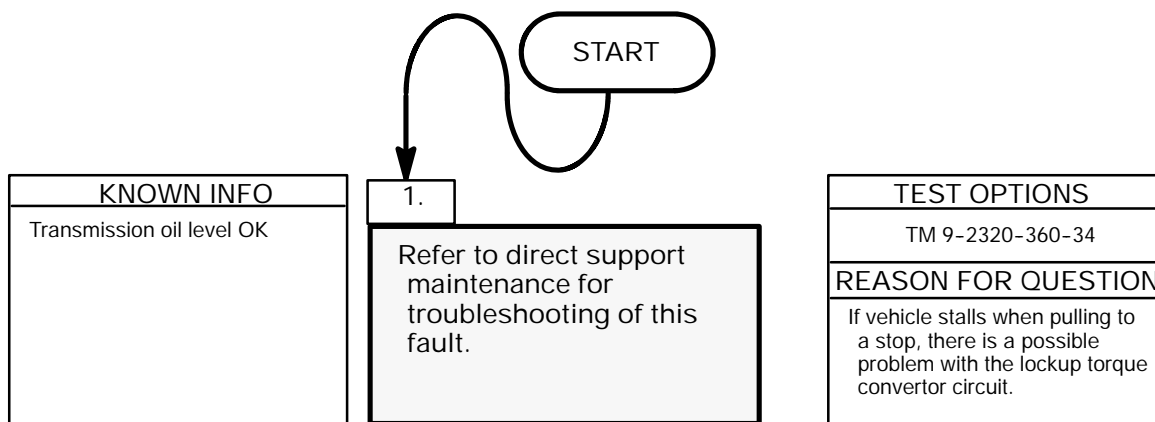
CAUTION

Use pipe thread sealing compound sparingly, only on pipe threads. Do not apply compound at hose connections. Failure to comply may result in component damage.

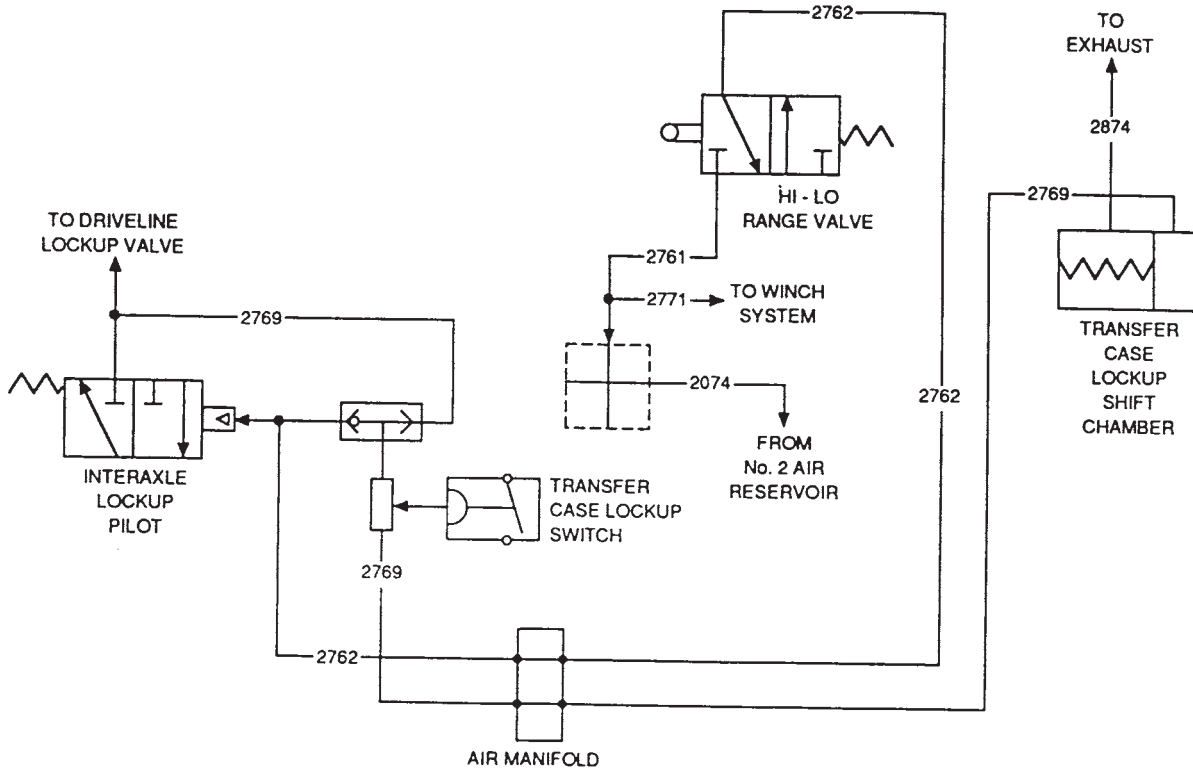
- (11) Coat threads of plug with pipe thread sealing compound.
- (12) Install plug on regulator.
- (13) Install dash access panel on dash with 13 screws.



f8. ENGINE STALLS AT IDLE WHEN IN GEAR
INITIAL SETUP Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.



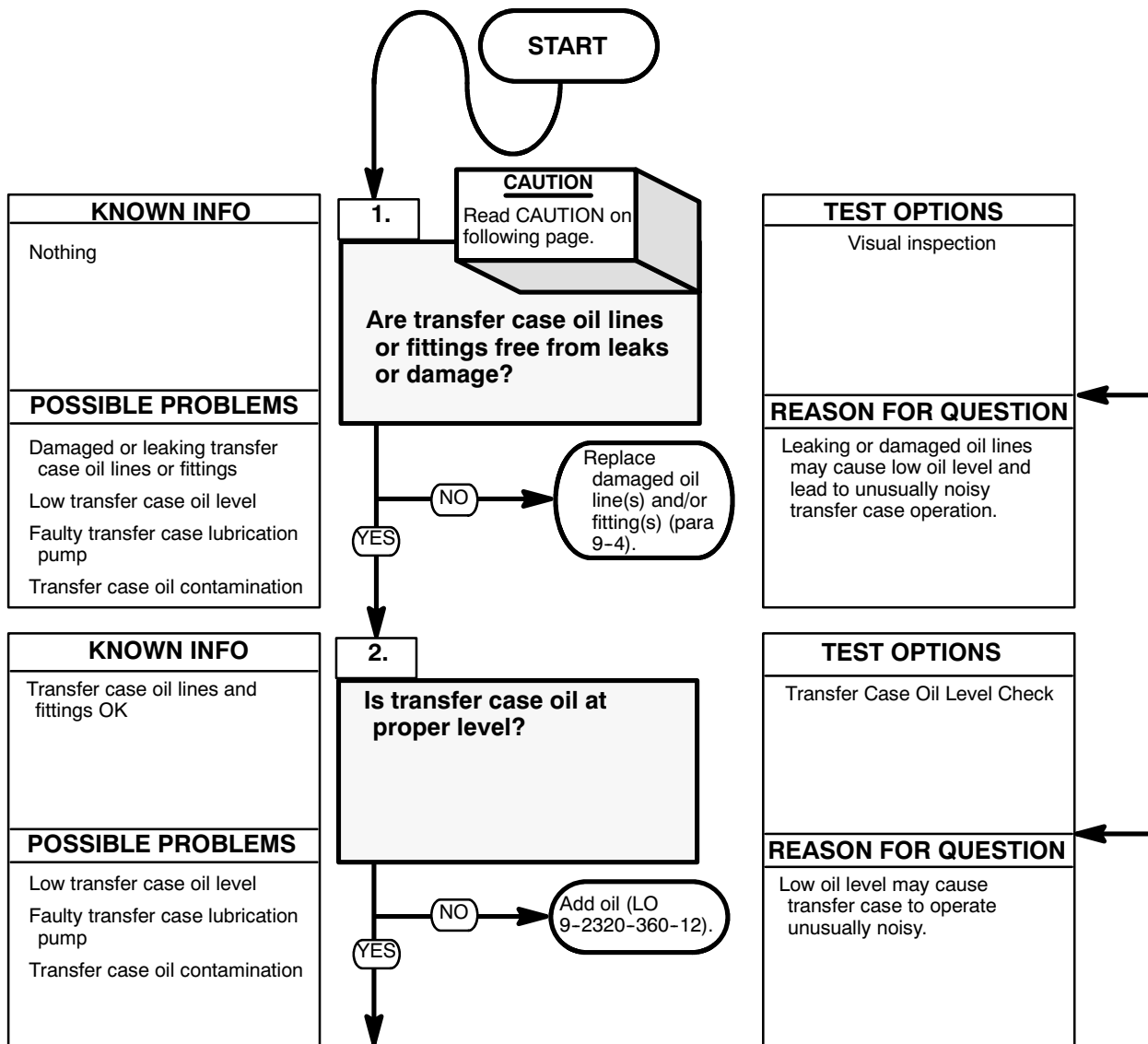
TRANSFER CASE AIR SYSTEM

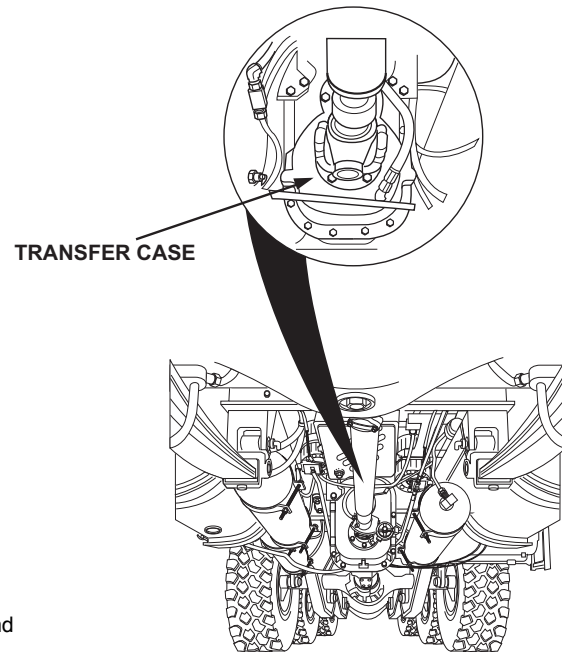


g. TRANSFER CASE

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>g1. Transfer case unusually noisy when operating.</u>	<u>2-656</u>
<u>g2. Transfer case does not shift into HIGH or LOW, or slips out of gear.</u>	<u>2-660</u>
<u>g3. Transfer case overheats. (T-CASE TEMP gage continuously reads over 250 °F (121 °C).</u>	<u>2-662</u>
<u>g4. Transfer case does not engage front axle when transfer case shift lever is positioned to LOW.</u>	<u>2-666</u>
<u>g5. Transfer case does not engage front axle when transfer case shift lever is in HIGH position, and DRIVELINE control is positioned to LOCK.</u>	<u>2-670</u>

g1. TRANSFER CASE UNUSUALLY NOISY WHEN OPERATING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

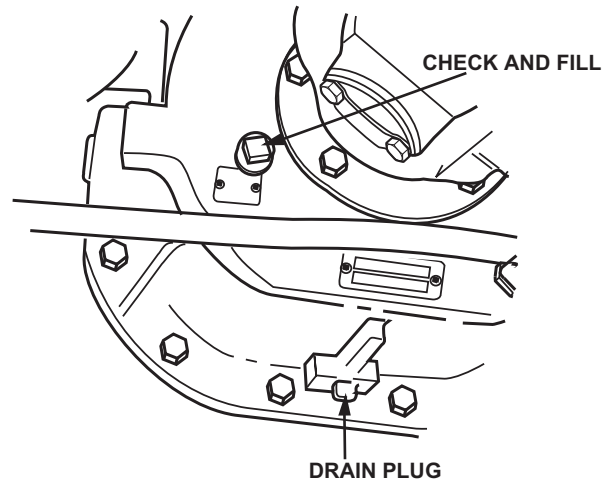




CAUTION

Transfer case oil must be changed whenever there is evidence of oil breakdown or contamination. Oil breakdown or contamination may be caused from overheating transfer case and is indicated by discoloration, strong odor, or oil analysis.

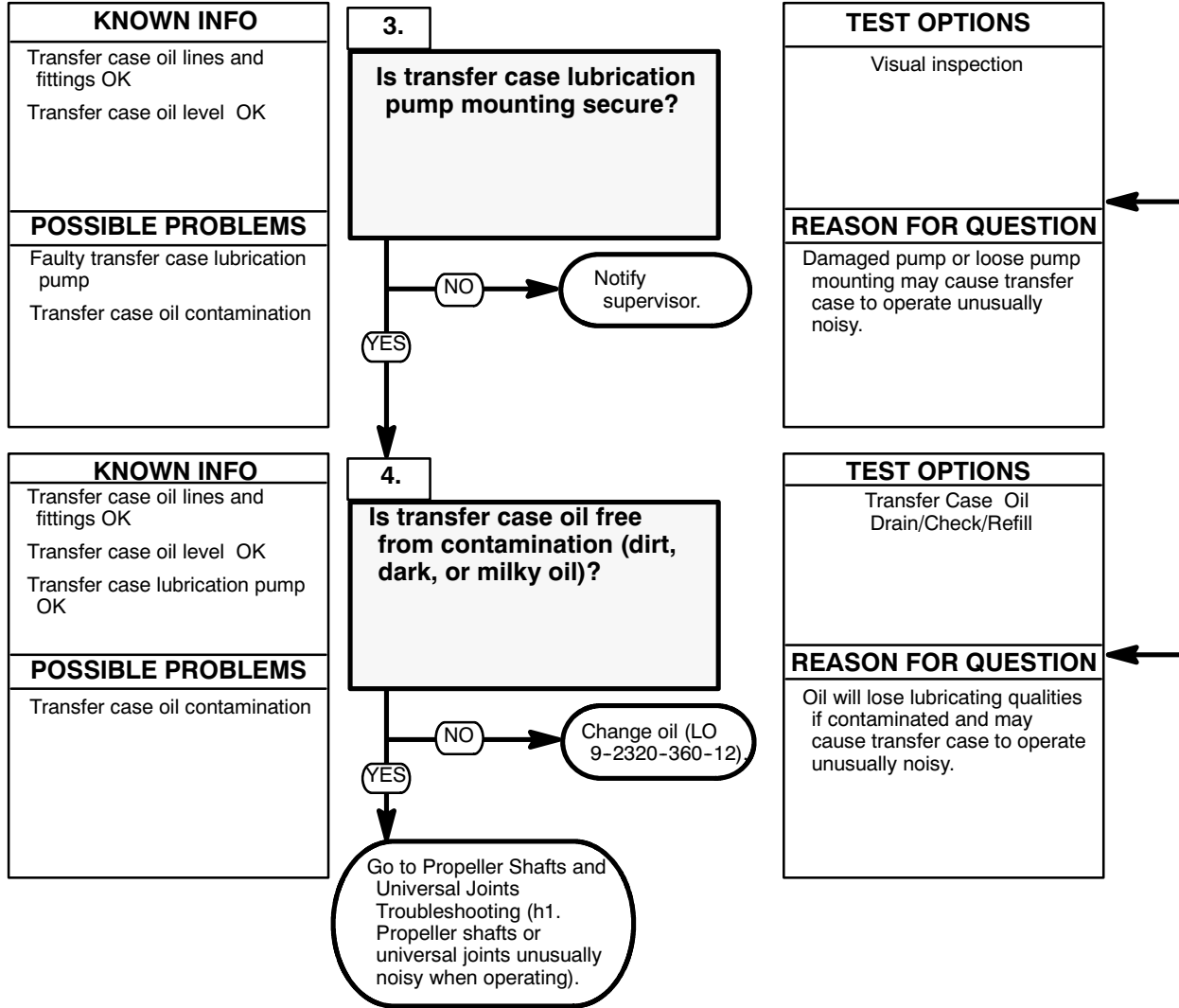
Check transfer case oil lines and fittings for leakage and damage.



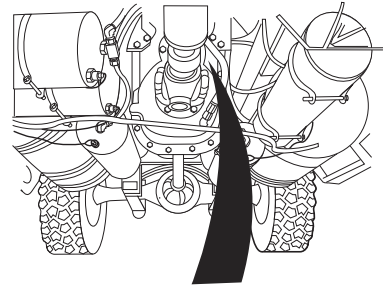
TRANSFER CASE OIL LEVEL CHECK

- (1) Turn engine off and chock wheels (TM 9-2320-360-10).
- (2) Place suitable container under transmission drain plug.
- (3) Remove oil level plug from transfer case.
- (4) Inspect oil for contaminants.
- (5) Install oil level plug on transfer case.

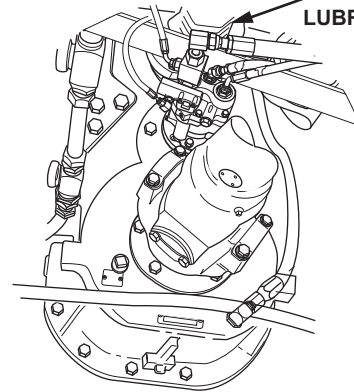
g1. TRANSFER CASE UNUSUALLY NOISY WHEN OPERATING (CONT)



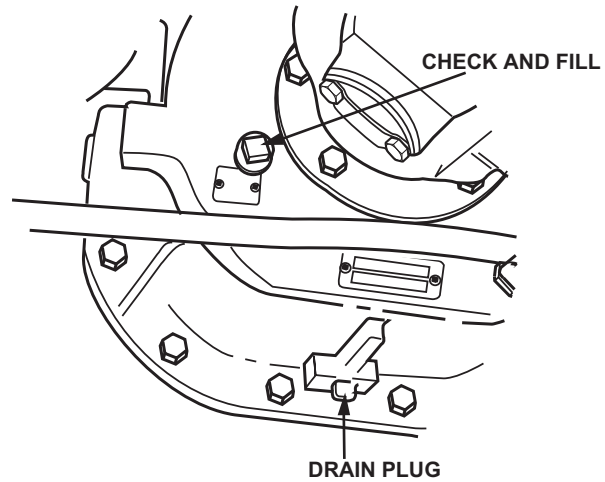
Check transfer case lubrication pump for damage, and for loose or missing mounting hardware.



TRANSFER CASE LUBRICATION PUMP

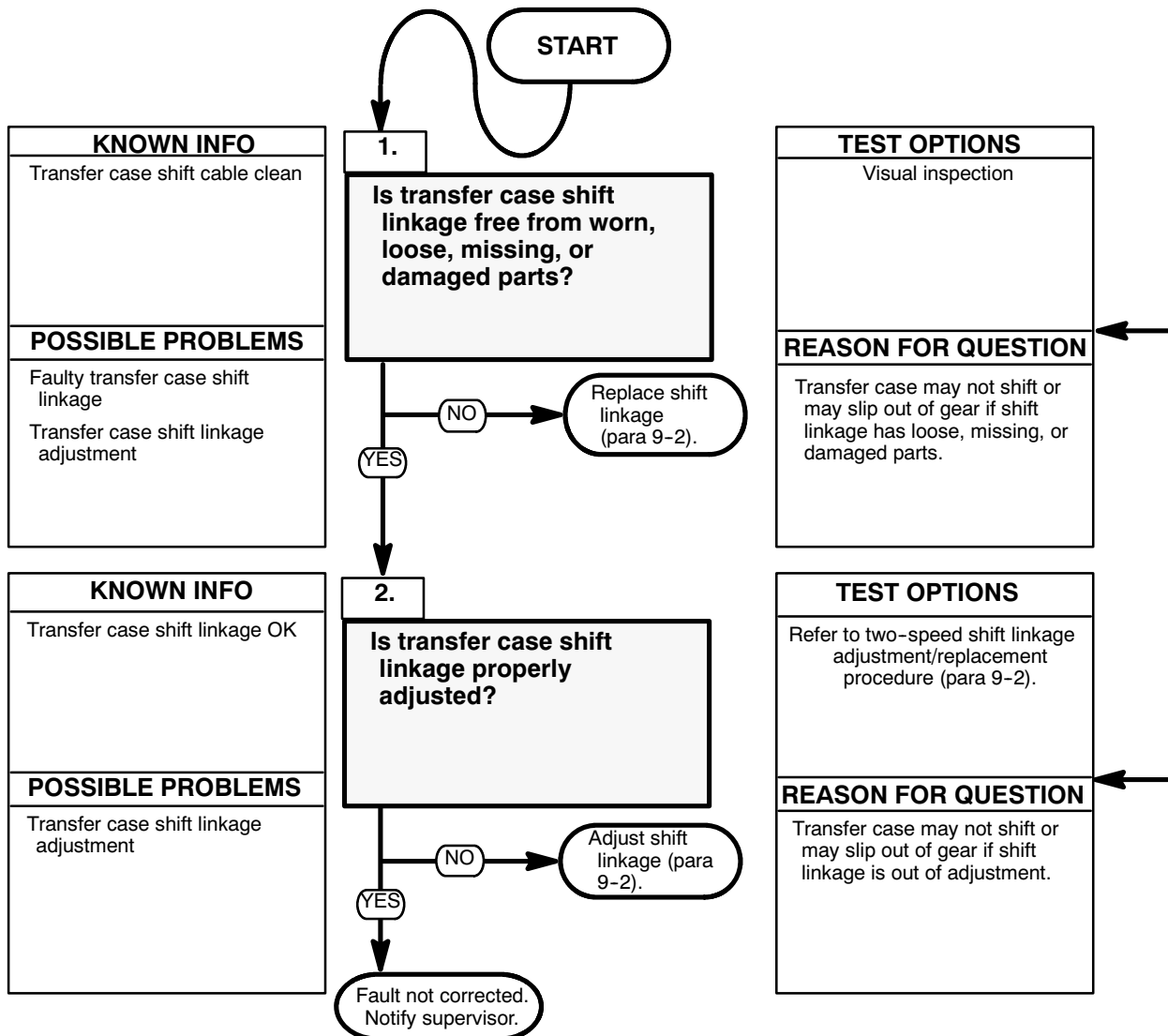


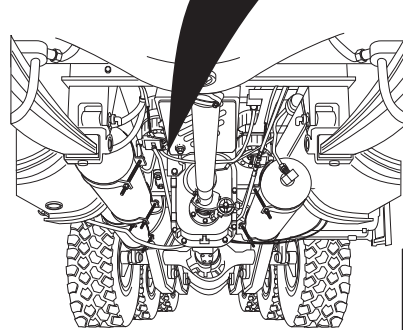
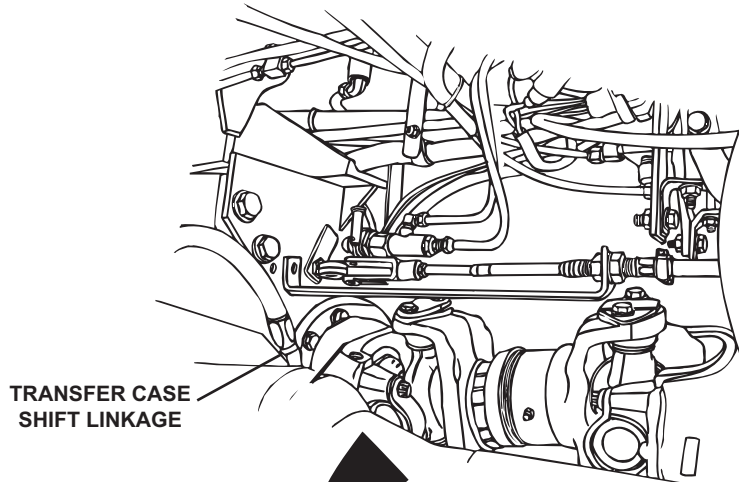
<p>TRANSFER CASE OIL DRAIN/CHECK/REFILL</p>
<p>(1) Place clean suitable container under transfer case drain plug.</p>
<p>NOTE</p>
<p>Transfer case fluid capacity is 5 qts (4 L).</p>
<p>(2) Remove drain plug from transfer case and allow approximately 1 qt (0.9 L) of oil to drain into container.</p>
<p>(3) Install drain plug on transfer case.</p>
<p>(4) Inspect oil for contaminants.</p>
<p>(5) Add oil that was removed to transfer case if it is not contaminated.</p>



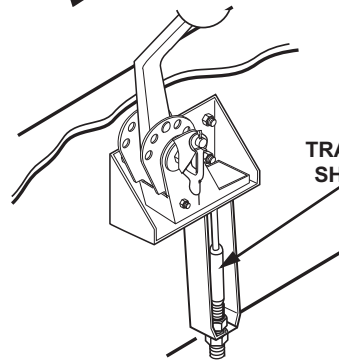
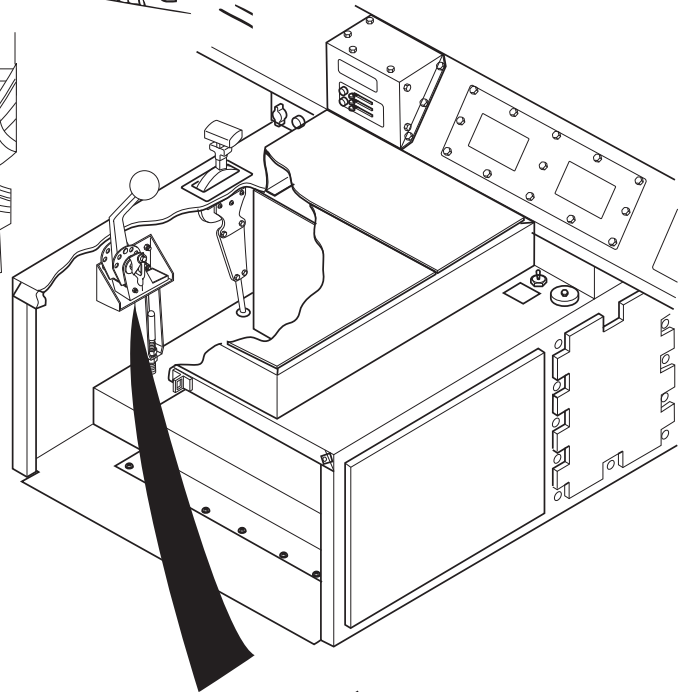
DRAIN PLUG

g2. TRANSFER CASE DOES NOT SHIFT INTO HIGH OR LOW, OR SLIPS OUT OF GEAR	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



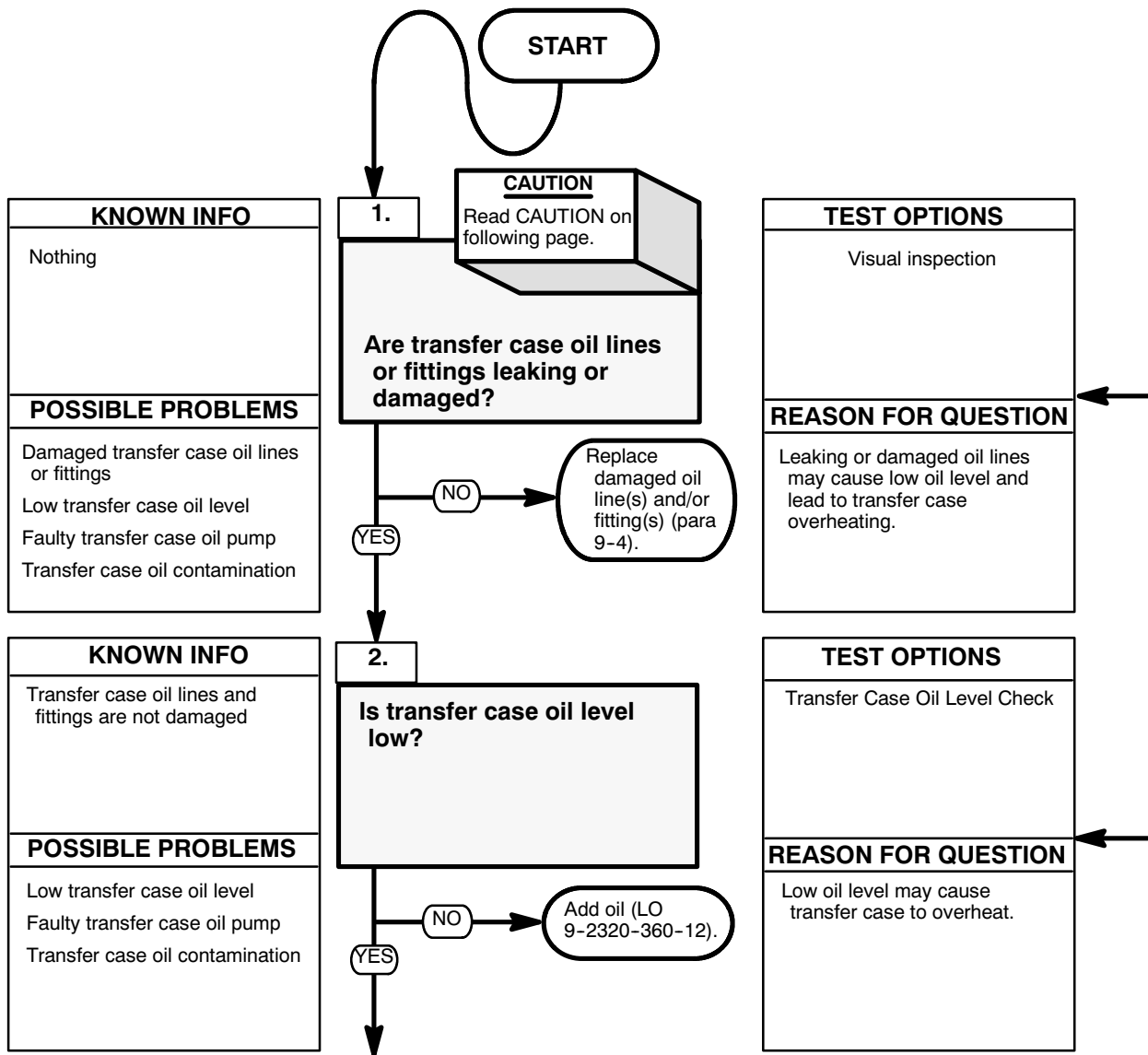


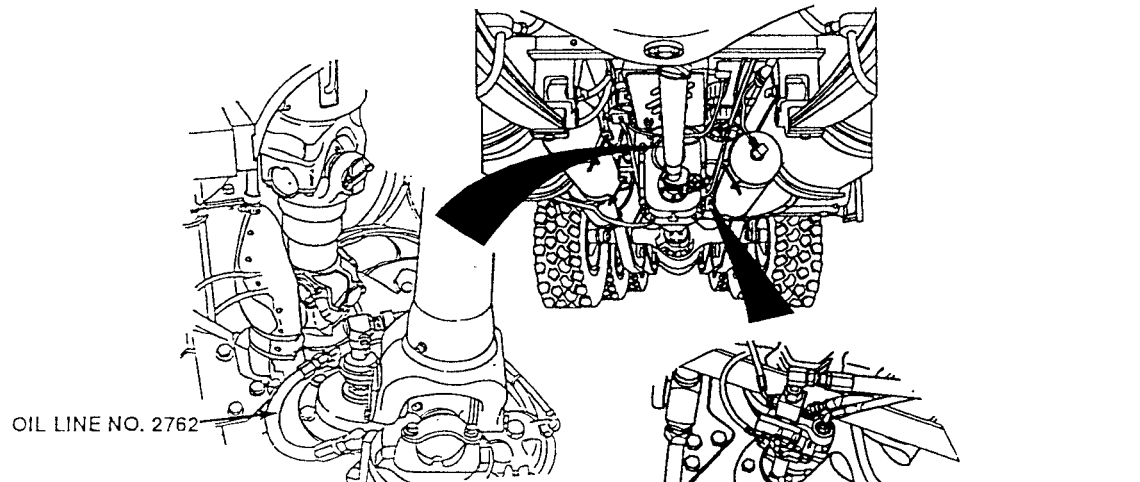
Check transfer case shift linkage for worn, loose, missing, or damaged parts.



Refer to para 9-2 to adjust transfer case shift linkage.

g3. TRANSFER CASE OVERHEATS (T-CASE TEMP GAGE CONTINUOUSLY READS OVER 250 °F (121 °C))	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

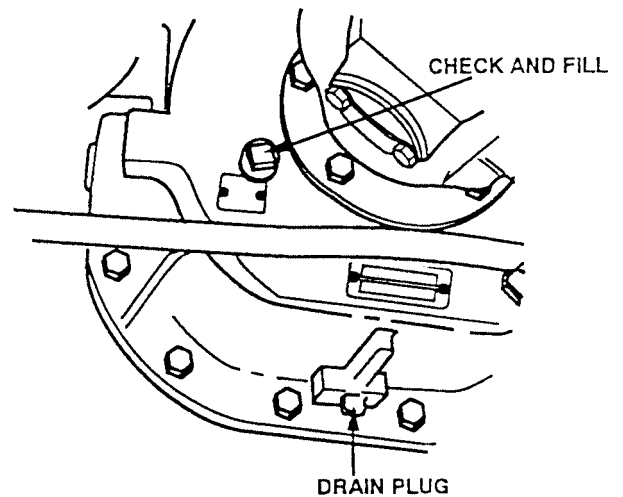




CAUTION

Transfer case oil must be changed whenever there is evidence of oil breakdown or contamination. Oil breakdown or contamination may be caused from overheating transfer case and is indicated by discoloration, strong odor, or oil analysis.

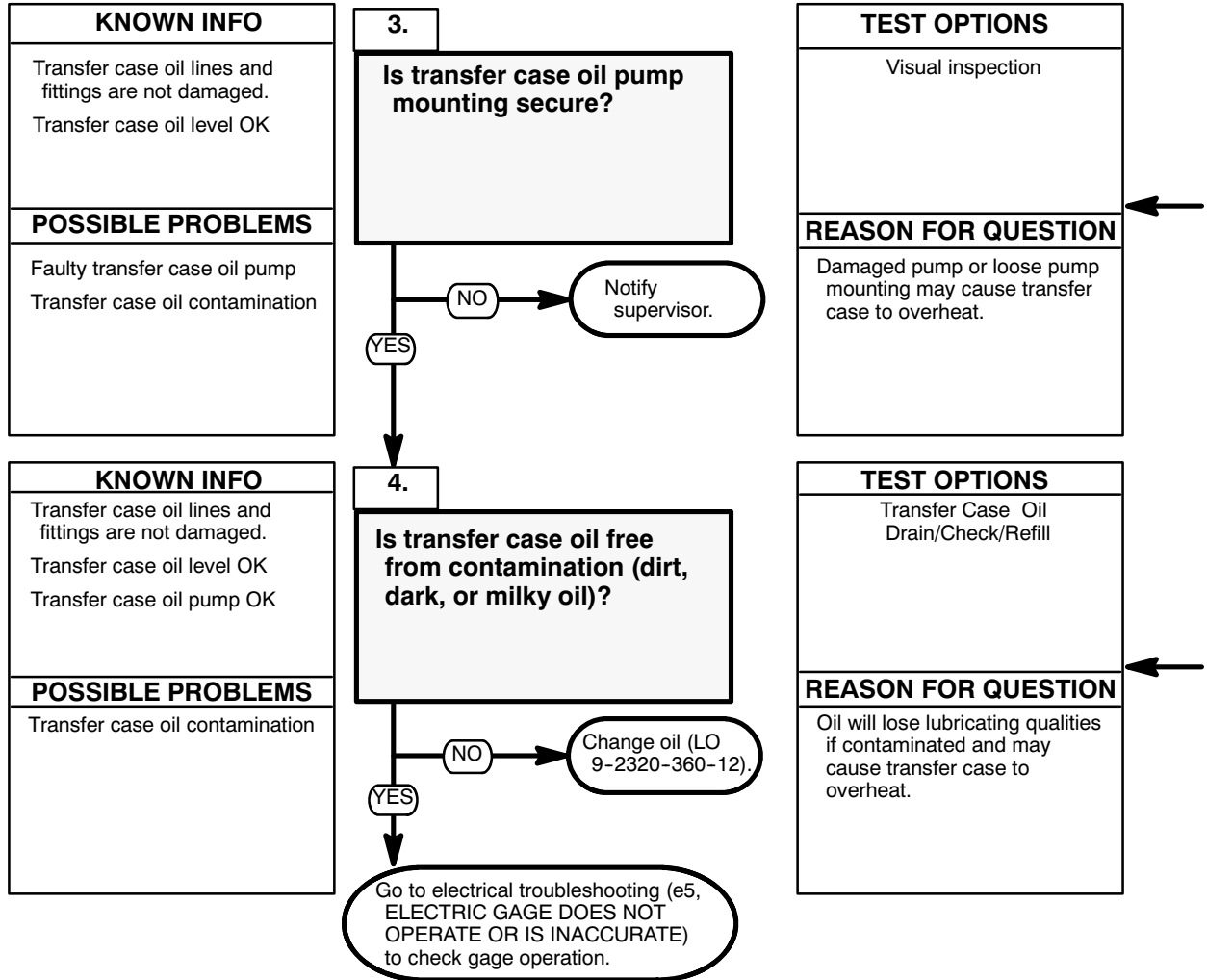
Check transfer case oil lines and fittings for leakage and damage.



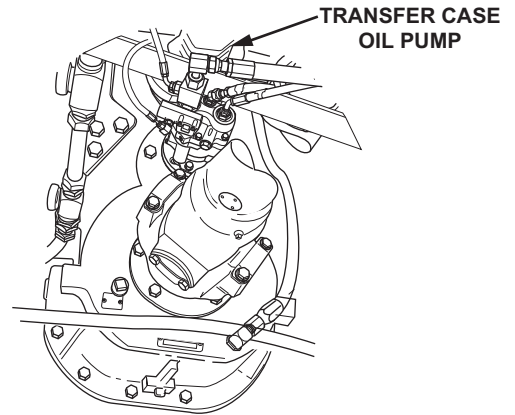
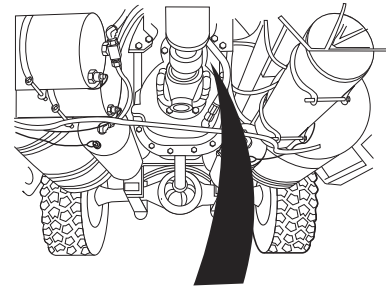
TRANSFER CASE OIL LEVEL CHECK

- (1) Turn engine off and chock wheels (TM 9-2320-360-10).
- (2) Place suitable container under transmission drain plug.
- (3) Remove oil level plug from transfer case.
- (4) Inspect oil for contaminants.
- (5) Change oil (LO 9-2320-360-12) if required.
- (6) Install oil level plug on transfer case.

g3. TRANSFER CASE OVERHEATS (T-CASE TEMP GAGE CONTINUOUSLY READS OVER 250 °F (121 °C)) (CONT)



Check transfer case oil pump for damage, and for loose or missing mounting hardware.



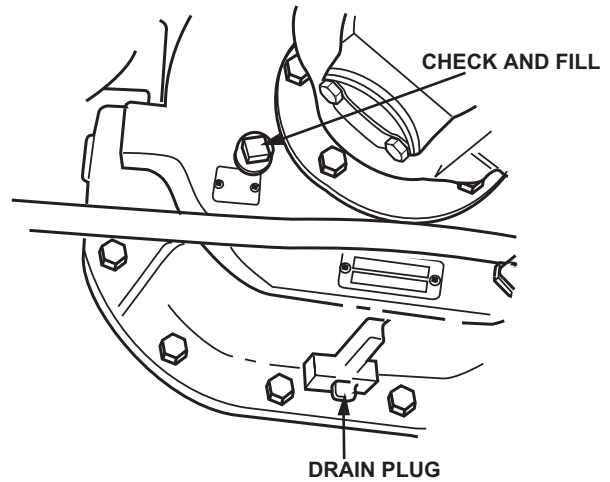
TRANSFER CASE OIL DRAIN/CHECK/REFILL

- (1) Place clean suitable container under transfer case drain plug.

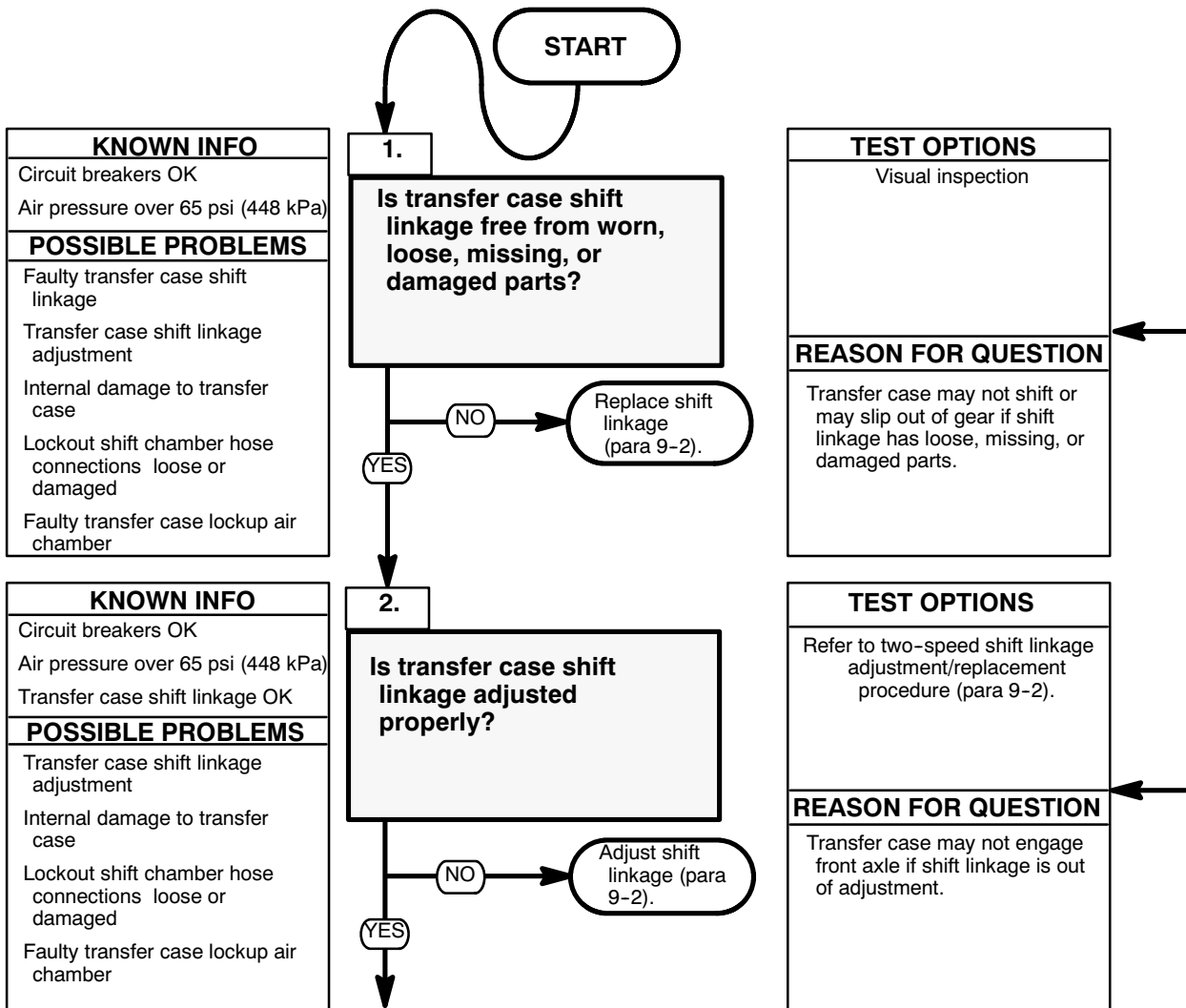
NOTE

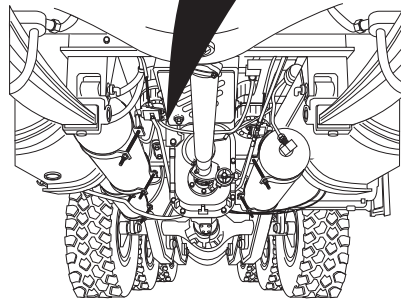
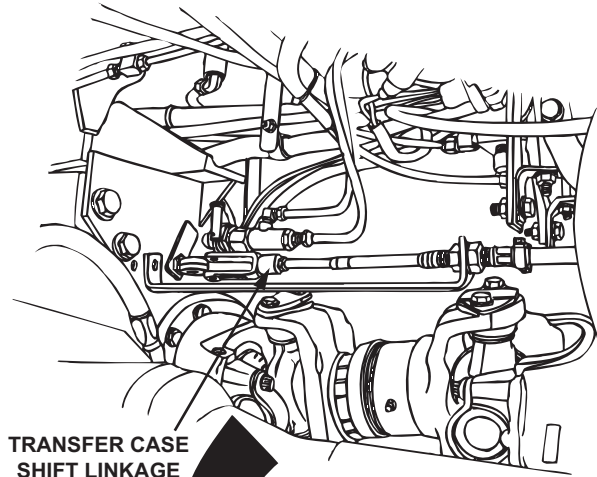
Transfer case fluid capacity is 5 qts (4 L).

- (2) Remove drain plug from transfer case and allow approximately 1 qt (0.9 L) of oil to drain into container.
- (3) Install drain plug on transfer case.
- (4) Inspect oil for contaminants.
- (5) Add oil that was removed to transfer case if it is not contaminated.

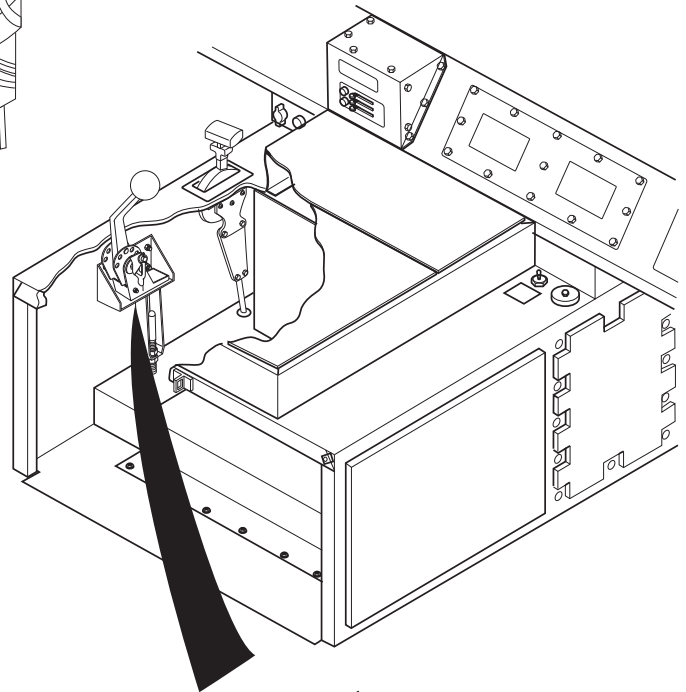


g4. TRANSFER CASE DOES NOT ENGAGE FRONT AXLE WHEN TRANSFER CASE SHIFT LEVER IS POSITIONED TO LOW	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)





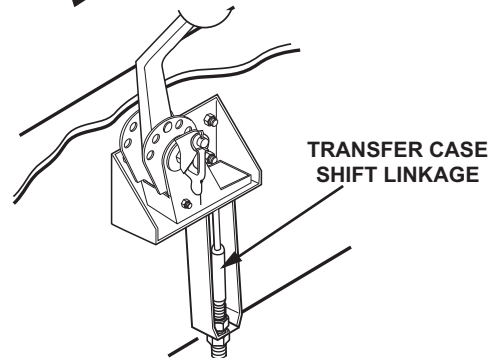
Check transfer case shift linkage for worn, loose, missing, or damaged parts.



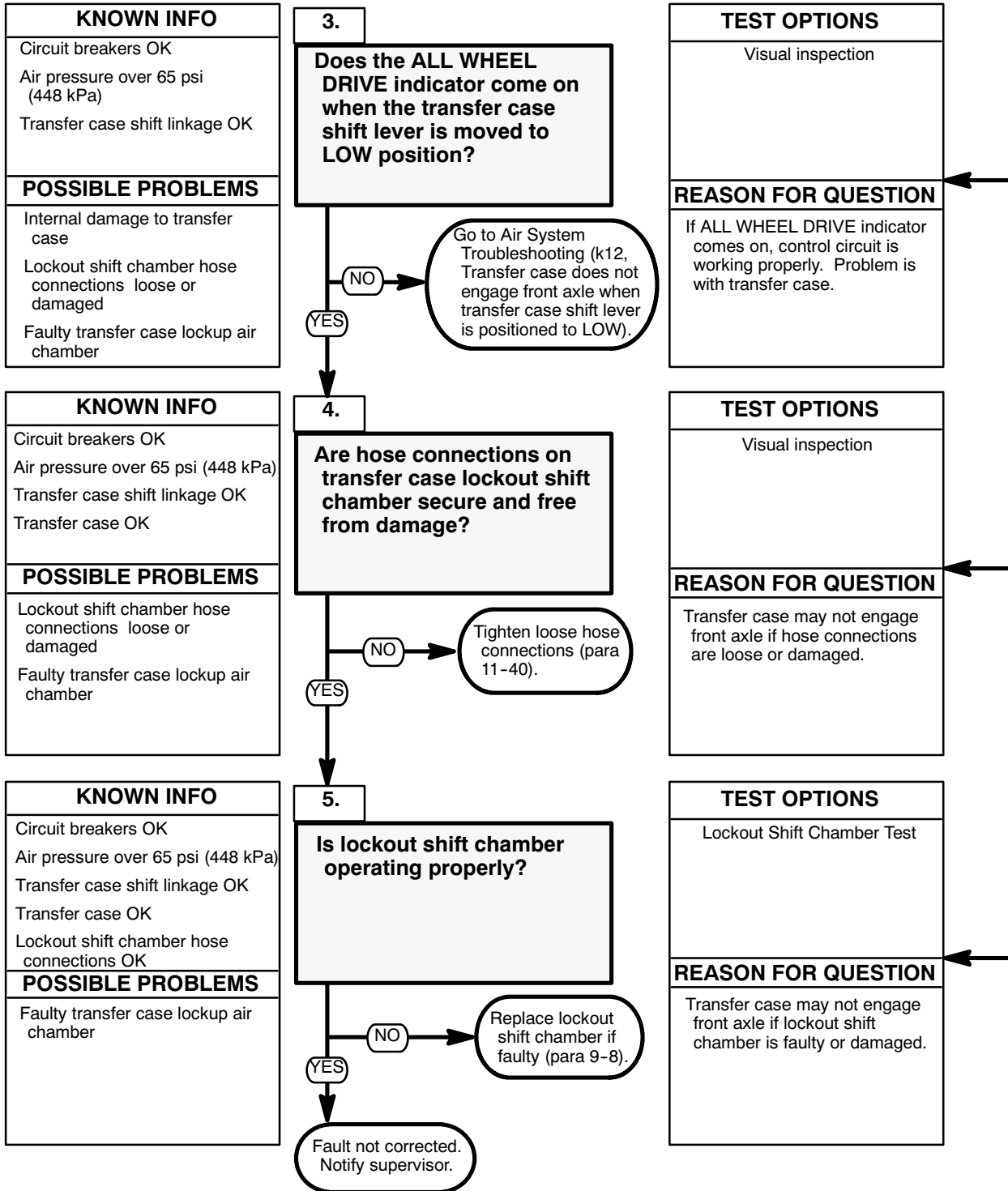
NOTE

Perform Air System Troubleshooting before starting steps given below.

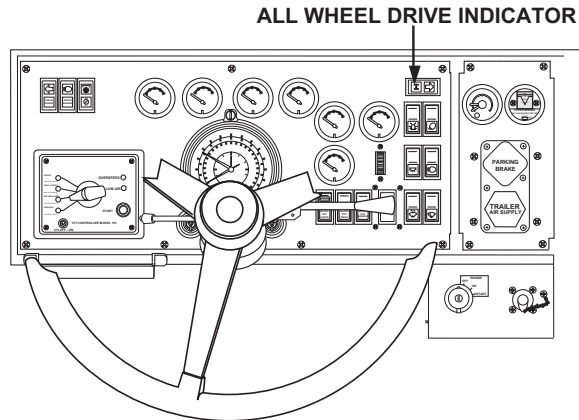
Refer to para 9-2 to adjust transfer case shift linkage.



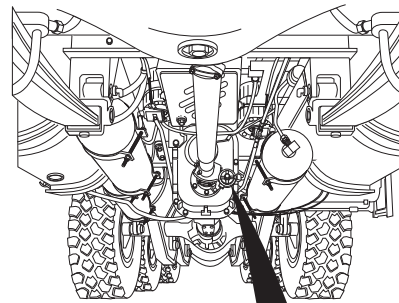
g4. TRANSFER CASE DOES NOT ENGAGE FRONT AXLE WHEN TRANSFER CASE SHIFT LEVER IS POSITIONED TO LOW



- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Move transfer case shift lever to LOW position (TM 9-2320-360-10), and observe light.
- (3) Turn engine switch to OFF position (TM 9-2320-360-10).



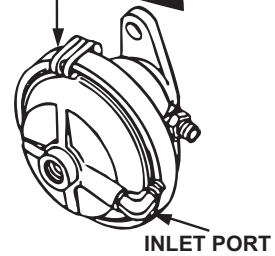
Check transfer case lockout shift chamber for loose hose connections and damage.



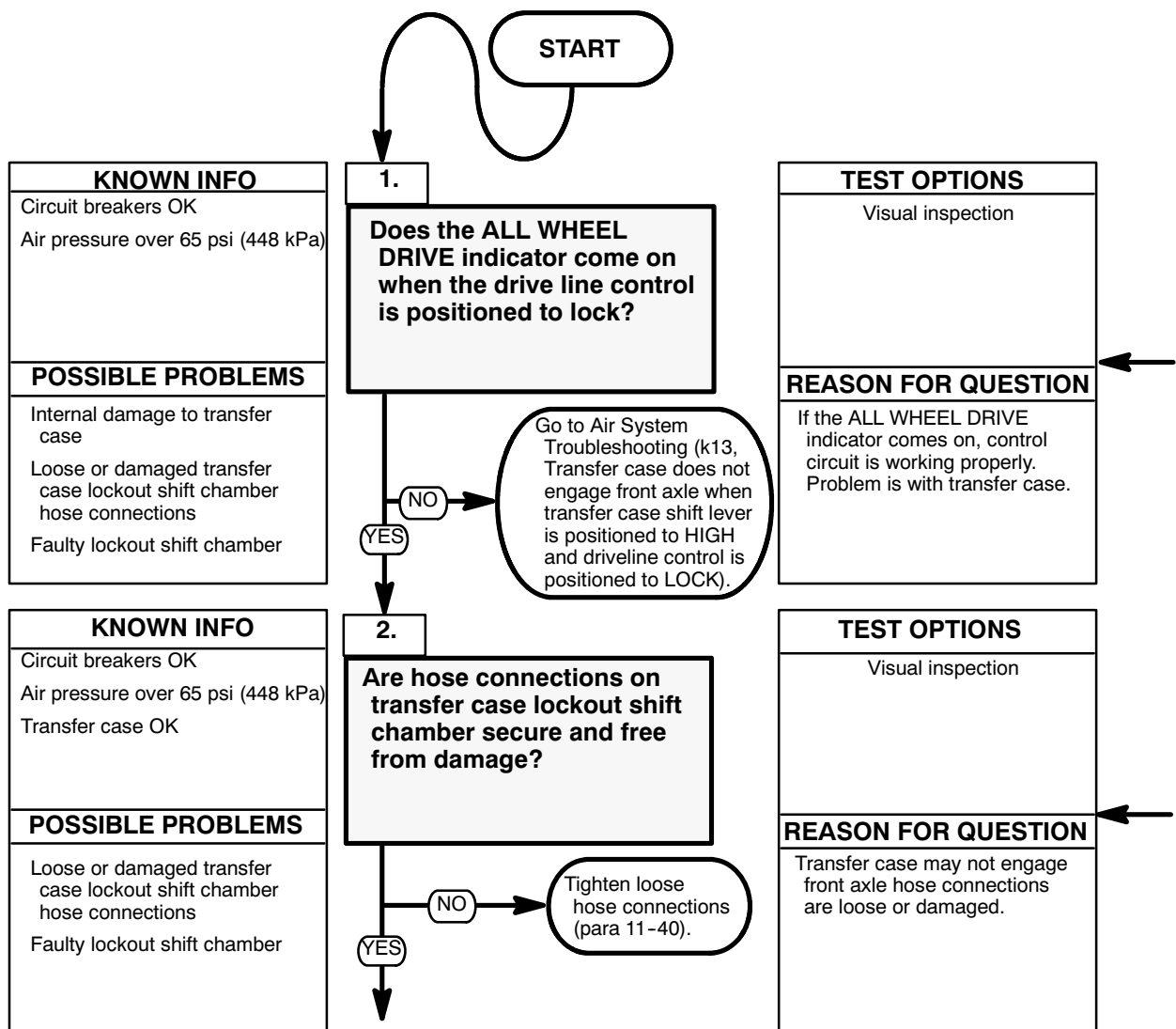
LOCKOUT SHIFT CHAMBER

LOCKOUT SHIFT CHAMBER TEST

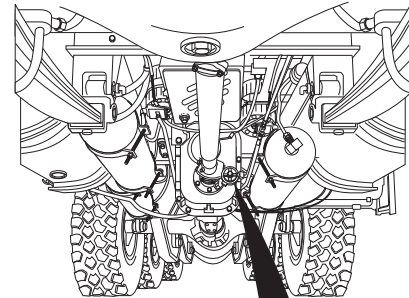
- (1) Remove lockout shift chamber (para 9-8).
- (2) Apply air pressure to inlet port.
- (3) Chamber is good if rod moves when air pressure is applied.



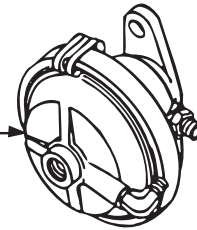
g5. TRANSFER CASE DOES NOT ENGAGE FRONT AXLE WHEN TRANSFER CASE SHIFT LEVER IS IN HIGH POSITION, AND DRIVELINE CONTROL IS POSITIONED TO LOCK	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Move driveline control valve to LOCK position (TM 9-2320-360-10), and observe light.
- (3) Turn engine switch to OFF position (TM 9-2320-360-10).

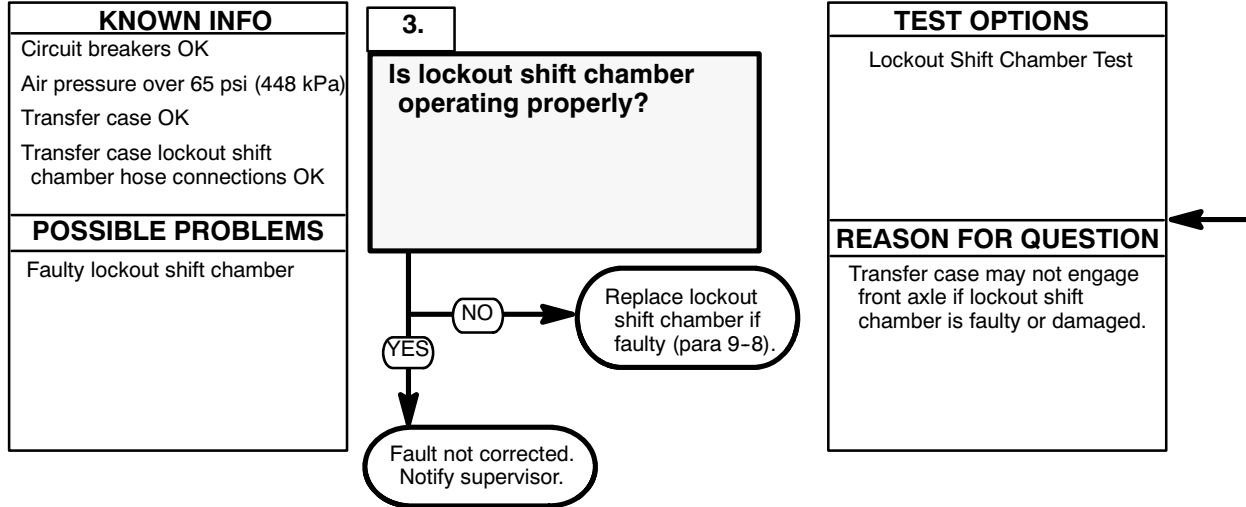


LOCKOUT SHIFT CHAMBER



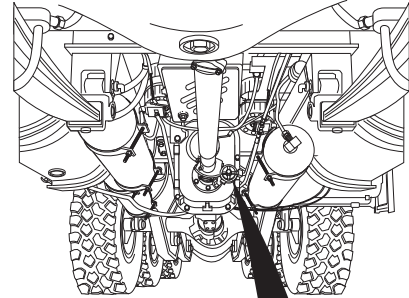
Check transfer case lockout shift chamber for loose hose connections and damage.

g5. TRANSFER CASE DOES NOT ENGAGE FRONT AXLE WHEN TRANSFER CASE SHIFT LEVER IS IN HIGH POSITION, AND DRIVELINE CONTROL IS POSITIONED TO LOCK (CONT)

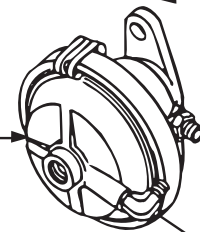


**LOCKOUT SHIFT
CHAMBER TEST**

- (1) Remove lockout shift chamber (para 9-8).
- (2) Apply air pressure to inlet port.
- (3) Lockout shift chamber is good if rod moves when air pressure is applied.



LOCKOUT SHIFT CHAMBER



INLET PORT

h. PROPELLER SHAFTS AND UNIVERSAL JOINTS

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>h1. Propeller shafts or universal joints unusually noisy when operating.</u>	<u>2-676</u>
<u>h2. Propeller shafts do not supply torque to axles or hydraulic pump.</u>	<u>2-680</u>

h1. PROPELLER SHAFTS OR UNIVERSAL JOINTS UNUSUALLY NOISY WHEN OPERATING

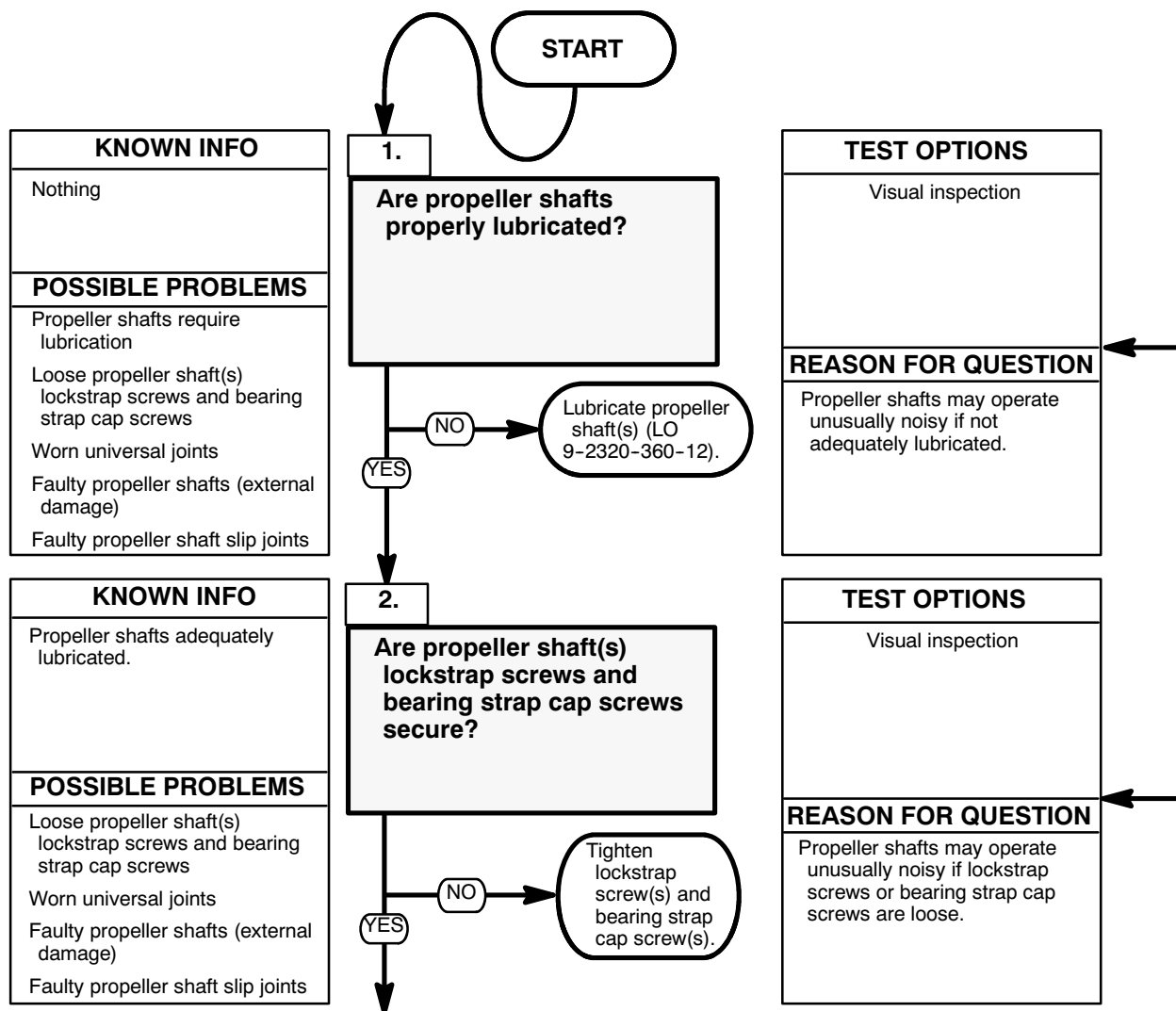
INITIAL SETUP

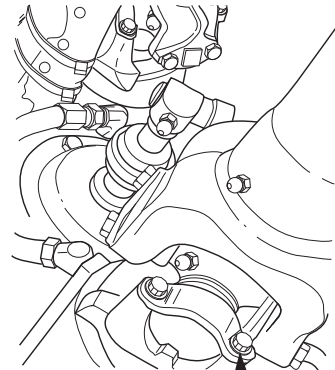
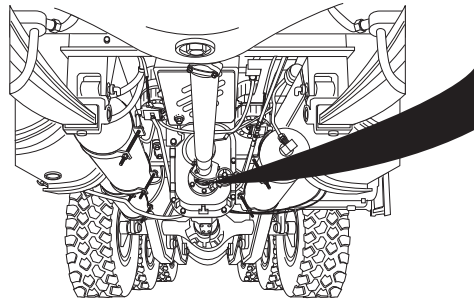
Equipment Conditions

Engine shut off (TM 9-2320-360-10).
 Parking brake on (TM 9-2320-360-10).
 Wheels chocked.

Tools and Special Tools

Tool Kit, Genl Mech (Item 54, Appendix F)





LOCKSTRAP SCREWS

Refer to LO 9-2320-360-12 to lubricate propeller shafts.

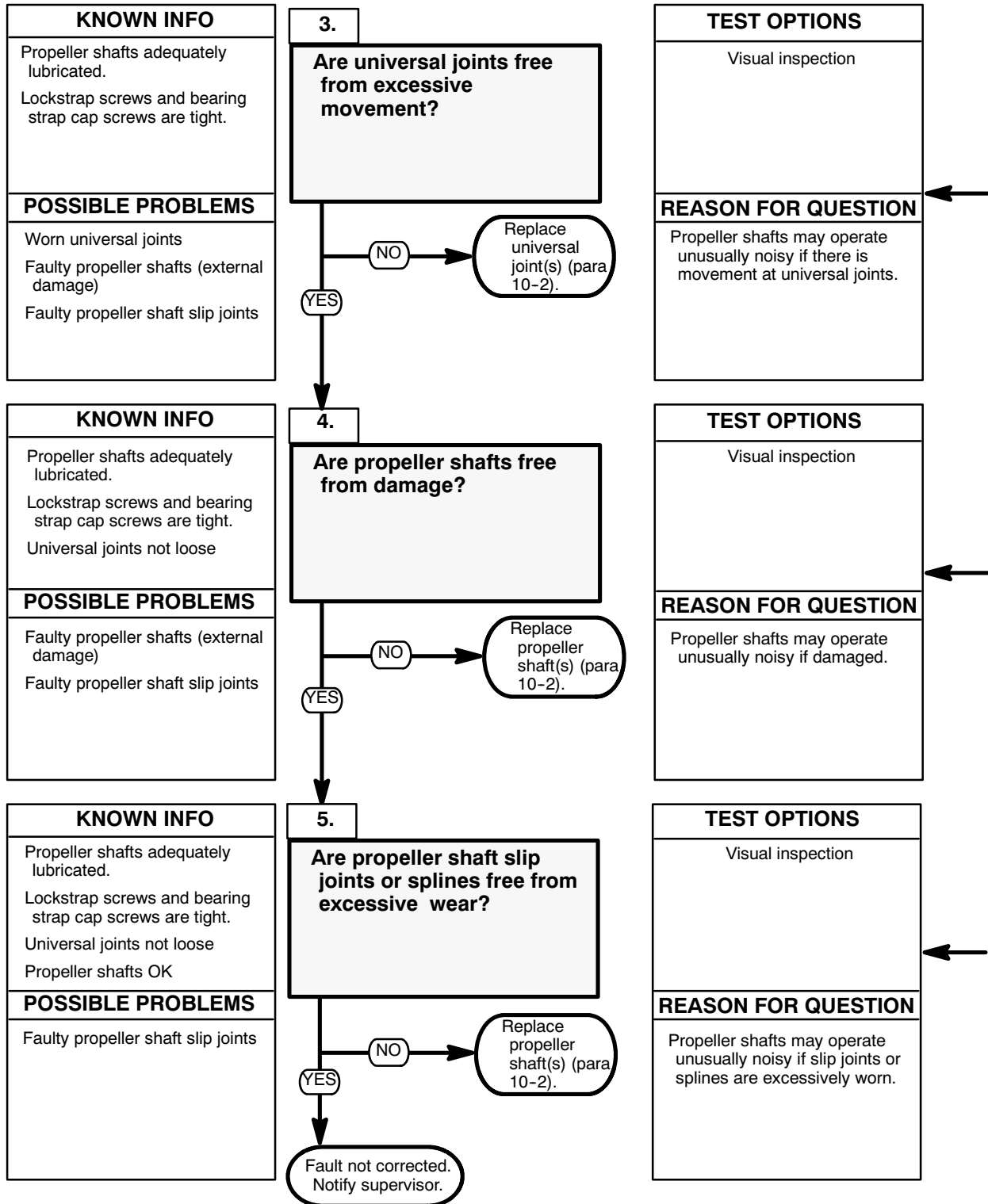
Check propeller shaft(s) lockstrap screws and bearing strap cap screws for looseness. Tighten all screws to proper torque value.

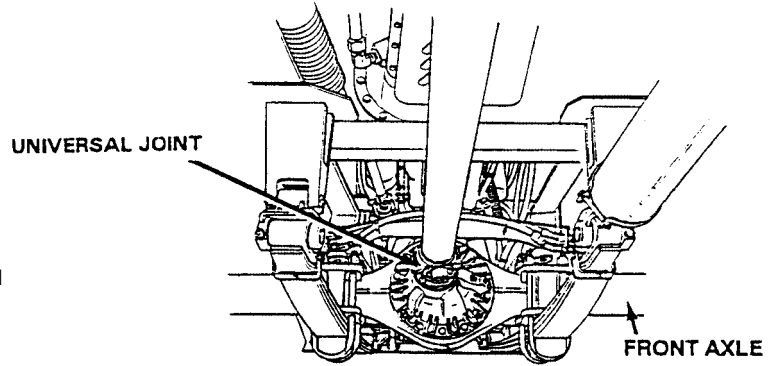
Table 2-10. Torque Requirements

Lockstrap Screw Torque Requirements	
Propeller Shaft	Torque Requirement
Transmission to Transfer Case	32-42 lb. ft. (43-57 N·m)
Transfer Case to #1 Axle	17-24 lb. ft. (23-33 N·m)
Transfer Case to #2 Axle	32-42 lb. ft. (43-57 N·m)
#2 Axle to #3 Axle	32-42 lb. ft. (43-57 N·m)
#3 Axle to #4 Axle	17-24 lb. ft. (23-33 N·m)

Bearing Strap Cap Screw Torque Requirements	
Propeller Shaft	Torque Requirement
Transmission to Transfer Case	130-135 lb. ft. (176-183 N·m)
Transfer Case to #1 Axle	55-60 lb. ft. (75-81 N·m)
Transfer Case to #2 Axle	130-135 lb. ft. (176-183 N·m)
#2 Axle to #3 Axle	130-135 lb. ft. (176-183 N·m)
#3 Axle to #4 Axle	55-60 lb. ft. (75-81 N·m)

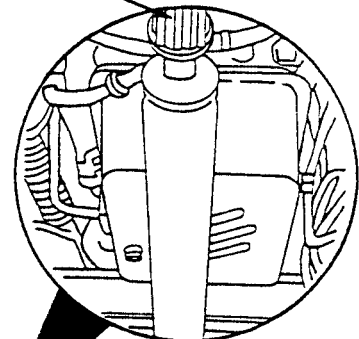
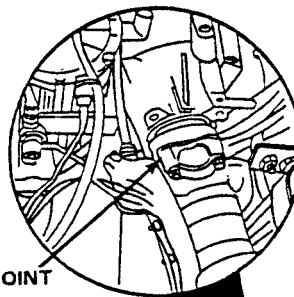
h1. PROPELLER SHAFTS OR UNIVERSAL JOINTS UNUSUALLY NOISY WHEN OPERATING (CONT)





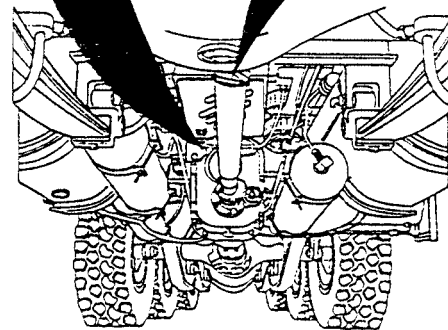
Check propeller shafts for excessive movement at universal joints. Any movement may indicate worn universal joints.

SPLINED SHAFT



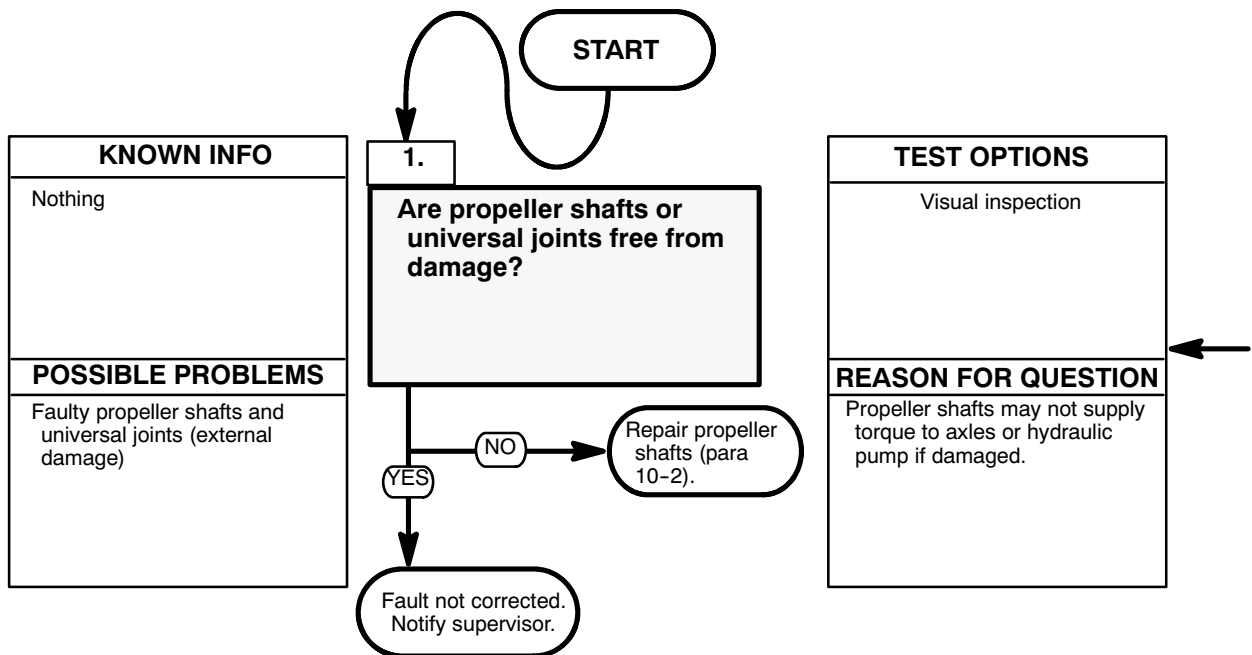
Check propeller shafts for damaged splined shaft, bent tubing, or missing balance weights.

UNIVERSAL JOINT

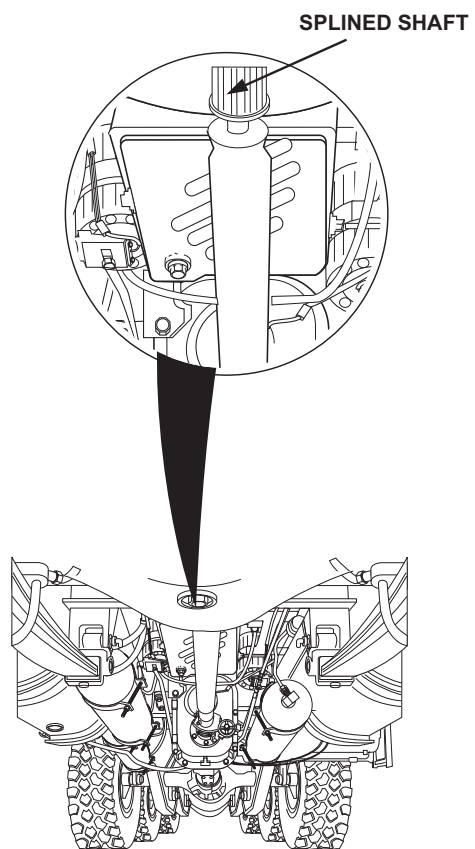


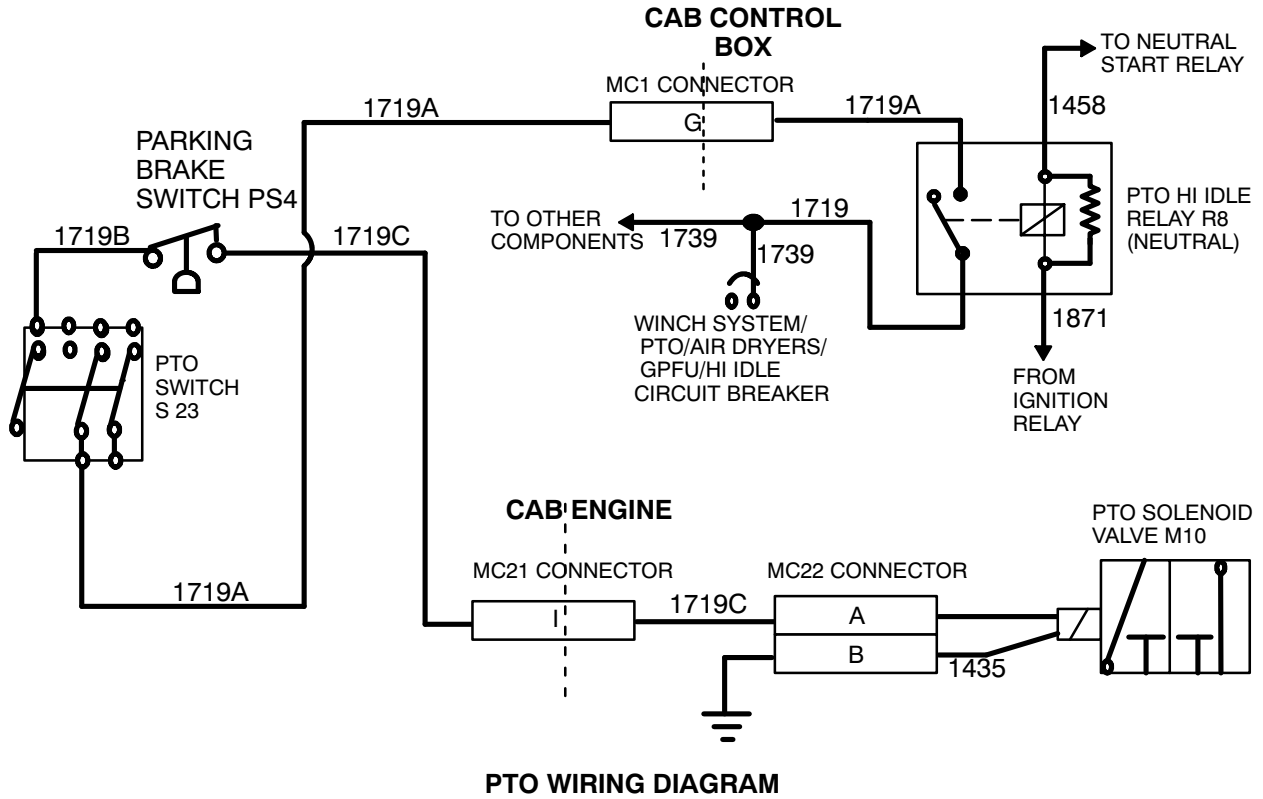
Inspect slip yoke for broken, damaged, or missing teeth. Check universal joint cross for wear.

h2. PROPELLER SHAFTS DO NOT SUPPLY TORQUE TO AXLES OR HYDRAULIC PUMP	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



Check propeller shafts for damaged splined shaft or bent tubing.

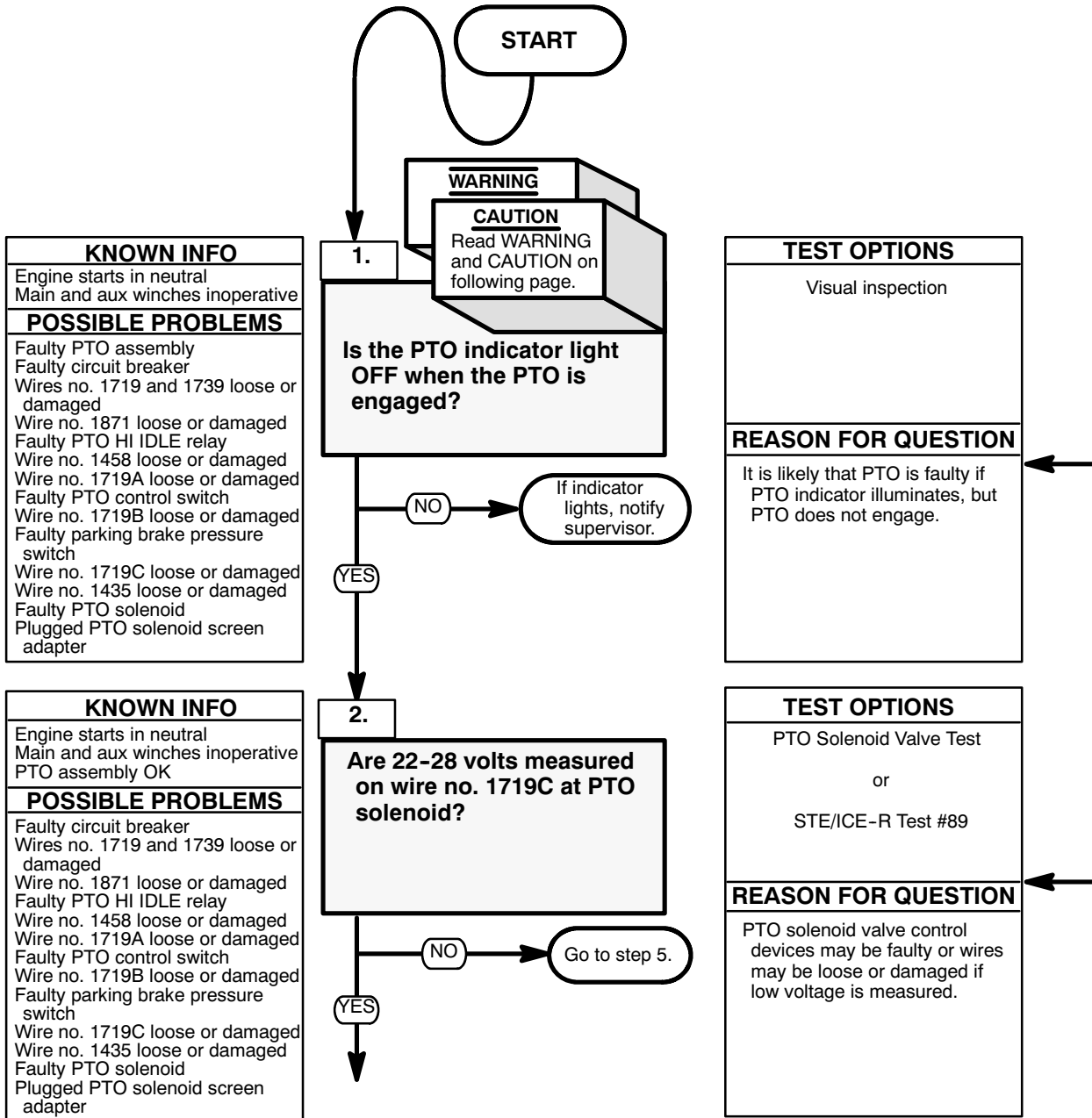




i. POWER TAKEOFF (PTO)

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>i1. PTO does not engage</u>	<u>2-684</u>
<u>i2. PTO makes excessive or unusual noise during operation</u>	<u>2-694</u>
<u>i3. PTO indicator does not light when PTO is engaged</u>	<u>2-696</u>

i1. PTO DOES NOT ENGAGE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) Pan, Oil Drain (Item 26, Appendix F)



WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

CAUTION

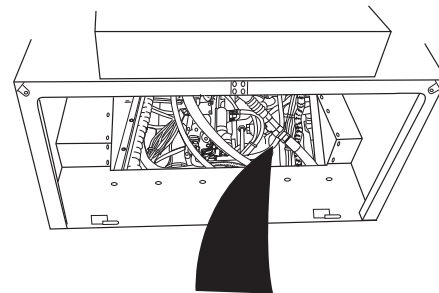
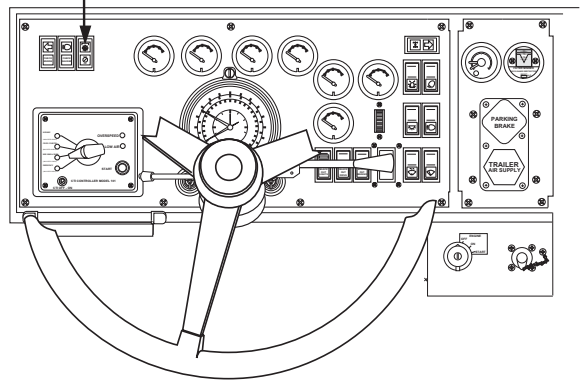
Batteries must be disconnected before tightening any connections. Failure to comply may result in damaged equipment.

NOTE

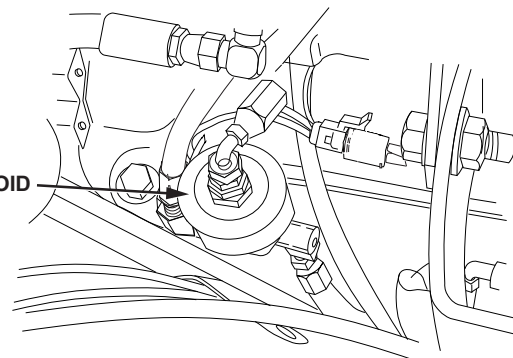
- Transmission range selector must be positioned to N (neutral) and PARKING BRAKE control pulled out before PTO will engage. If engine starts in neutral and reverse lights operate, neutral safety interlock circuit is operating properly.
- Engine must be running and PTO control switch placed in the ON position to perform this test.

Check if PTO indicator lights.

PTO INDICATOR



PTO SOLENOID VALVE

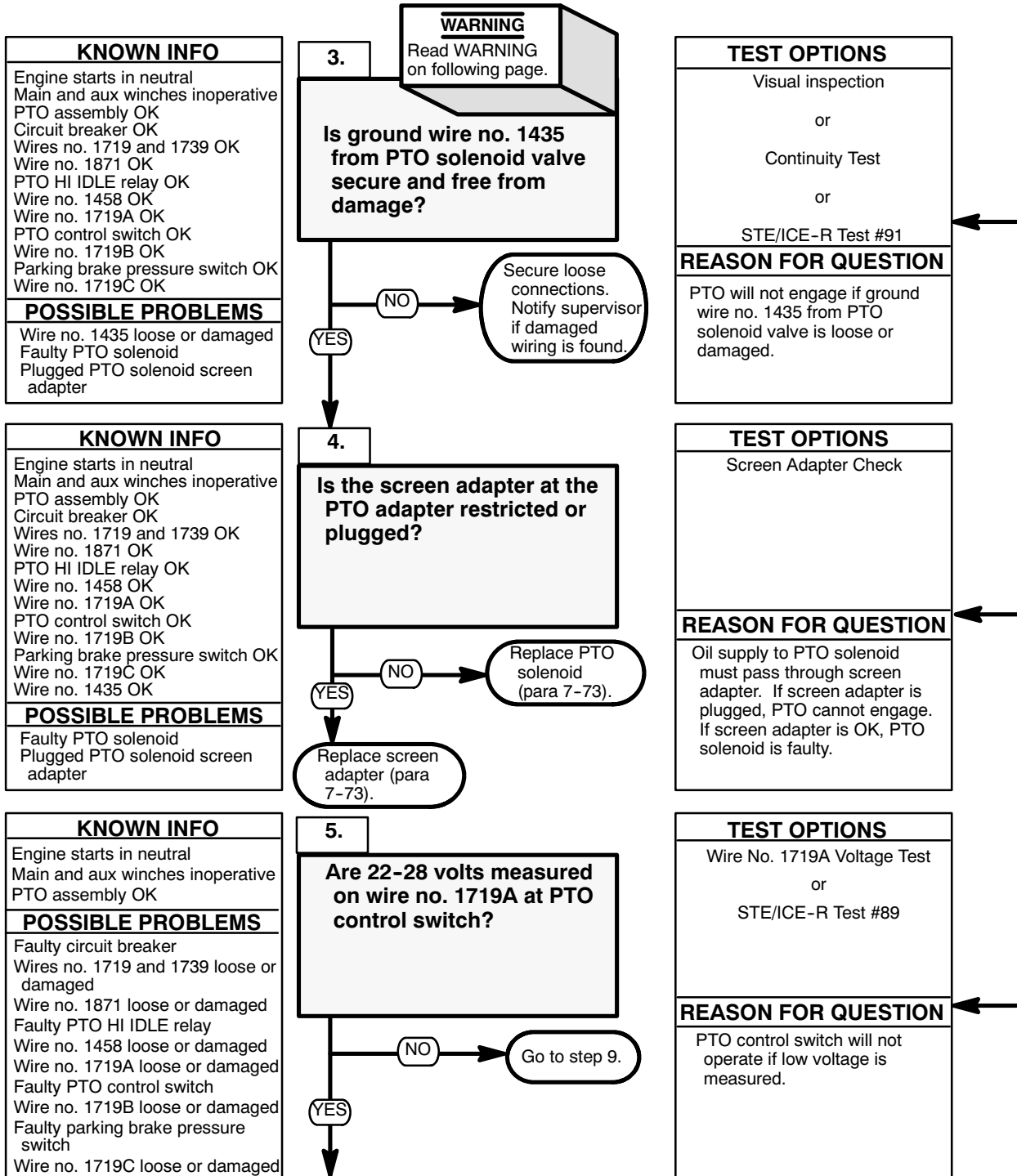


PTO SOLENOID VALVE TEST
NOTE

Engine must be running and PTO control switch placed in the on position to perform this test.

- (1) Place positive (+) probe of multimeter on no. 1719C wire at PTO solenoid valve.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

i1. PTO DOES NOT ENGAGE (CONT)

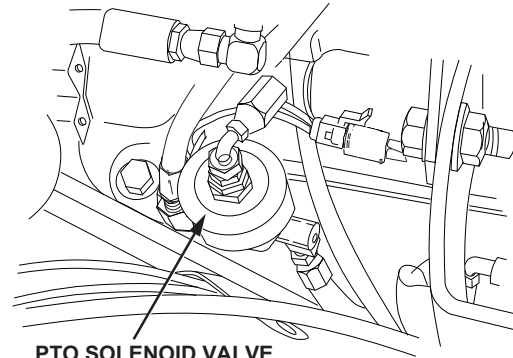


WARNING

Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

Check ground wire no. 1435 from PTO solenoid valve for loose connections, damage, and continuity.



PTO SOLENOID VALVE

CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

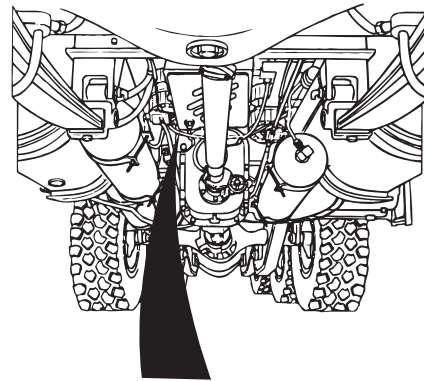
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

A reading of other than infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.



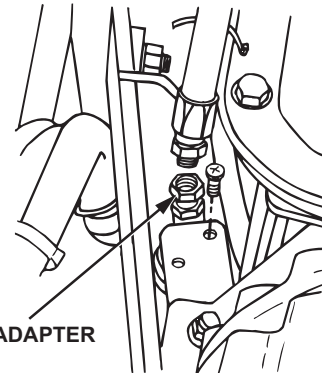
SCREEN ADAPTER CHECK

- (1) Place drain pan under PTO solenoid.
- (2) Remove hose no. 2851 from screen adapter.
- (3) Remove screen adapter from elbow.
- (4) Inspect screen adapter for restriction, foreign material or damage.

NOTE

If screen adapter is OK, do not perform steps (5) and (6).

- (5) Install screen adapter on elbow.
- (6) Install hose no. 2851 on screen adapter.



SCREEN ADAPTER

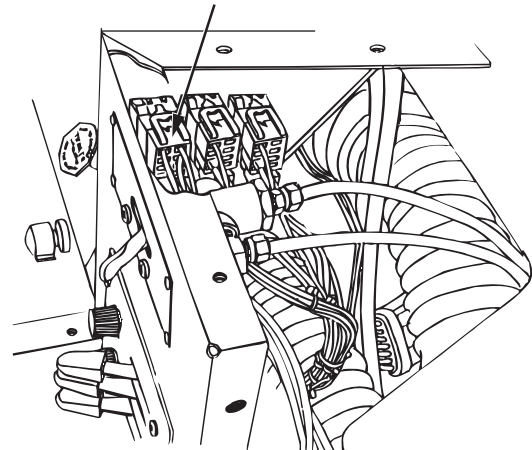
WIRE NO. 1719A VOLTAGE TEST

NOTE

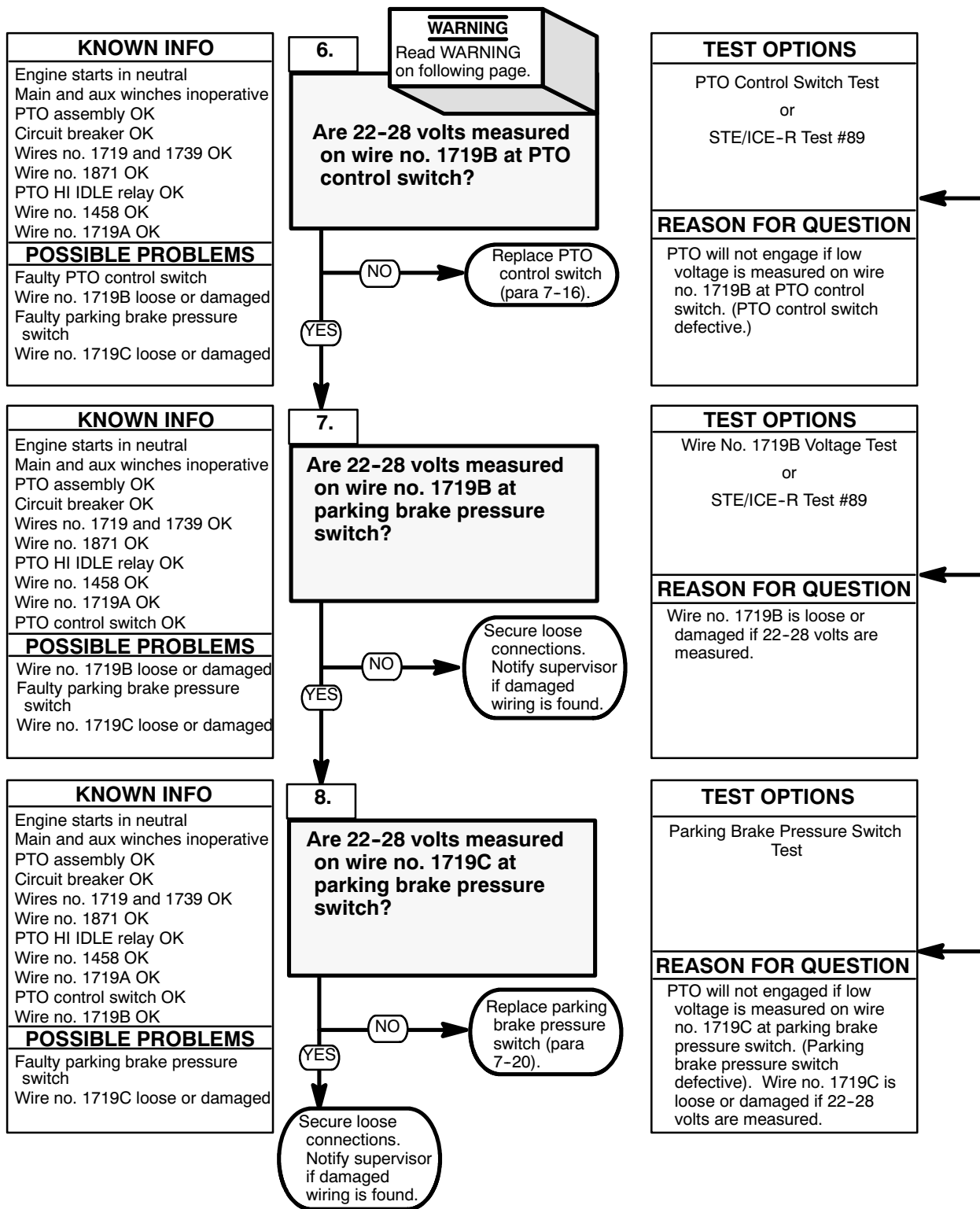
Engine must be running to perform this test.

- (1) Place positive (+) probe of multimeter on wire no. 1719A at PTO control switch.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

PTO CONTROL SWITCH

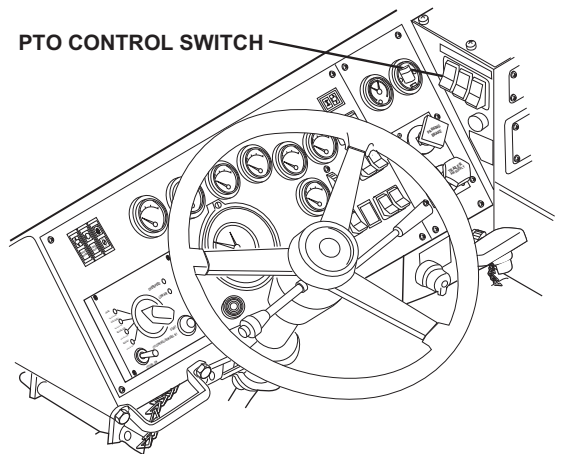


i1. PTO DOES NOT ENGAGE (CONT)



WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.



PTO CONTROL SWITCH TEST

NOTE

Engine must be running and PTO control switch placed in the on position to perform this test.

- (1) Place positive (+) probe of multimeter on no. 1719B wire at PTO control switch.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

WIRE NO 1719B VOLTAGE TEST

NOTE

Engine must be running and PTO control switch placed in the ON position to perform this test.

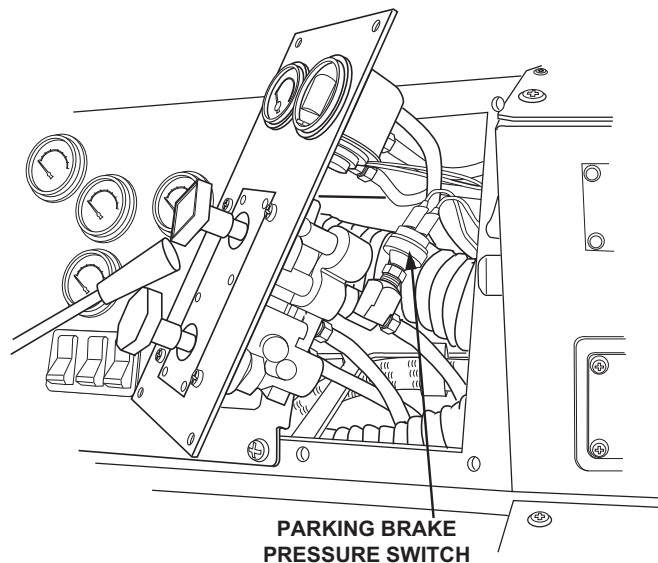
- (1) Place positive (+) probe of multimeter on wire no. 1719B at parking brake pressure switch.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

PARKING BRAKE PRESSURE SWITCH TEST

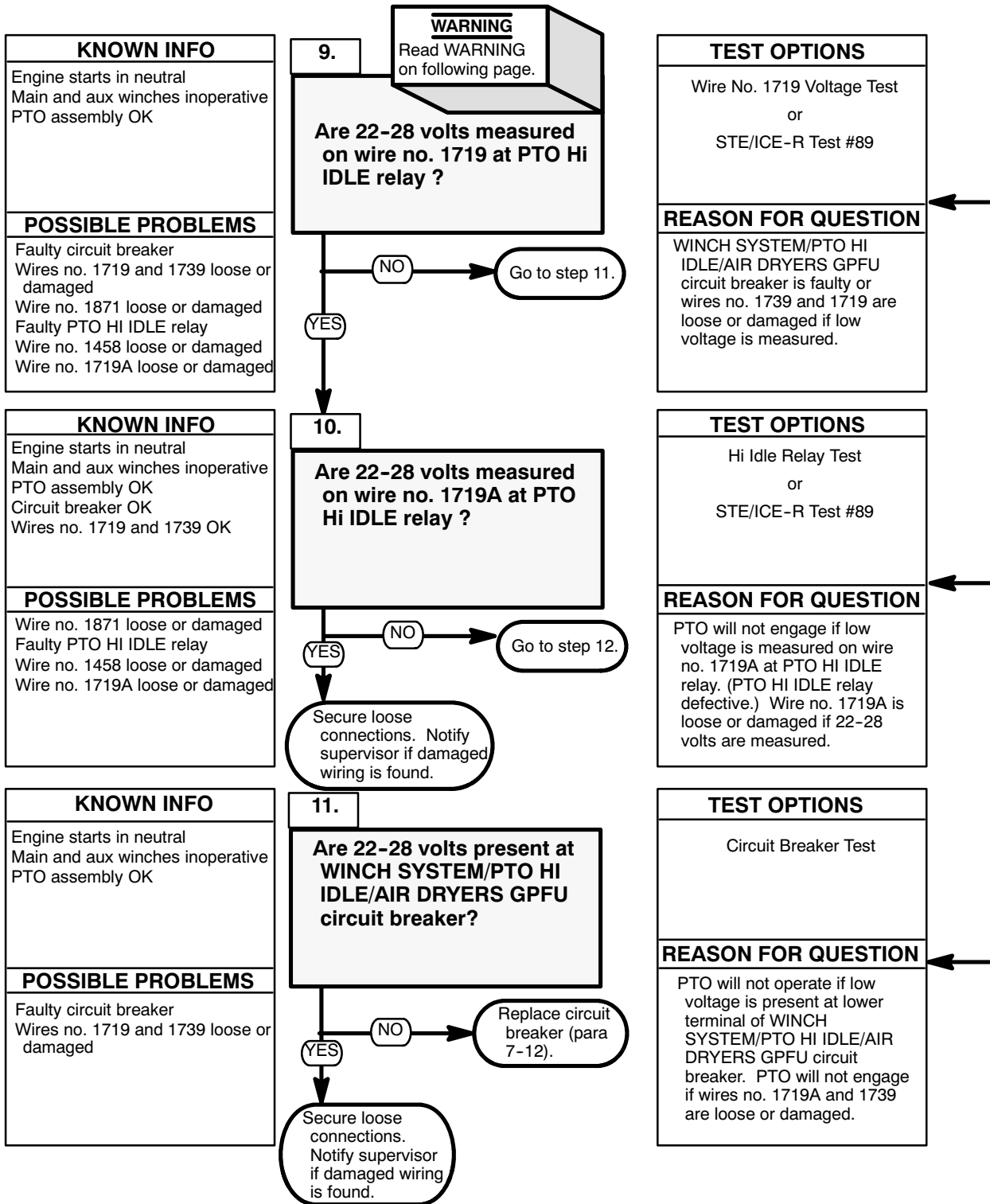
NOTE

Engine must be running and PTO control switch placed in the ON position to perform this test.

- (1) Place positive (+) probe of multimeter on wire no. 1719C at parking brake pressure switch.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.



i1. PTO DOES NOT ENGAGE (CONT)



WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

WIRE NO. 1719 VOLTAGE TEST

NOTE

Engine must be running and PTO control switch placed in the on position to perform this test.

- (1) Place positive (+) probe of multimeter on no. 1719 wire at P.T.O. HI IDLE relay.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

PTO HI IDLE RELAY TEST

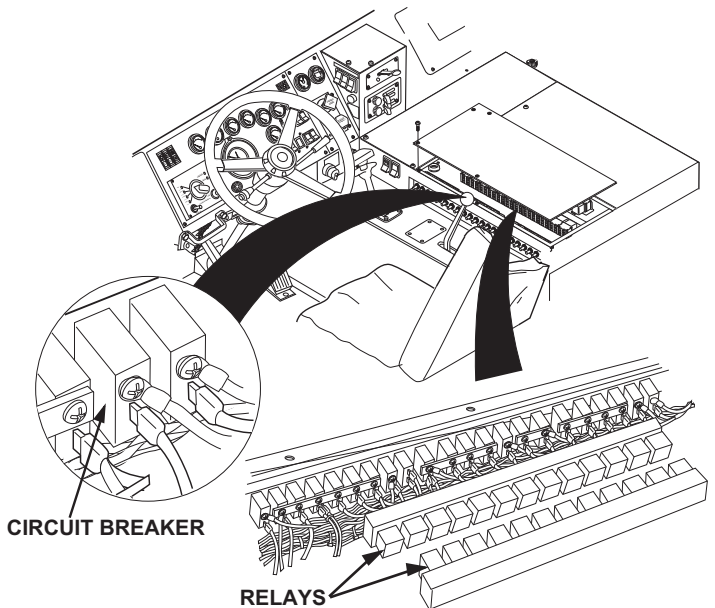
NOTE

Engine must be running and PTO control switch placed in the on position to perform this test.

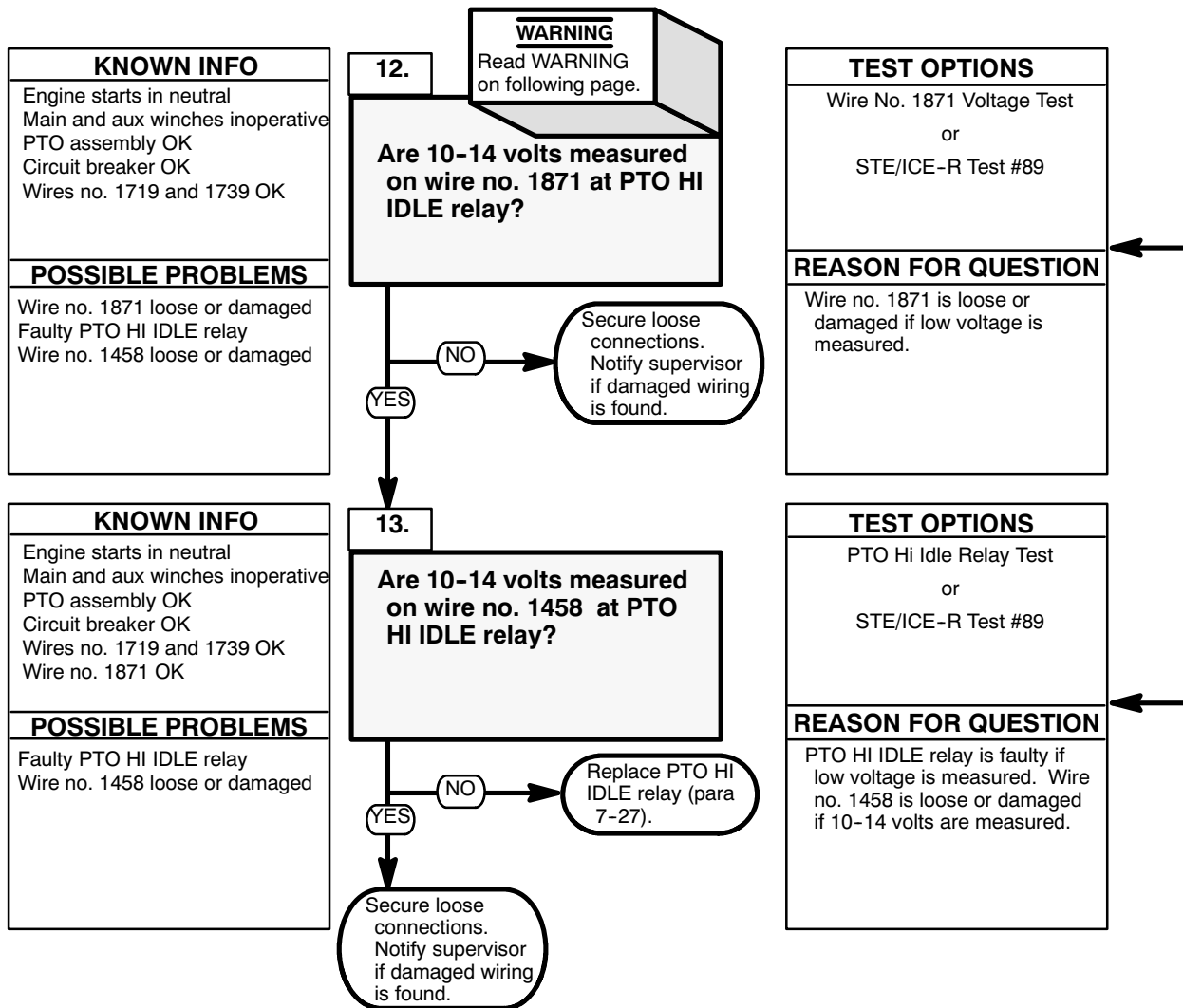
- (1) Place positive (+) probe of multimeter on no. 1719A wire at P.T.O. HI IDLE relay.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from console.
- (2) Turn ENGINE switch to ON position.
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (5) Turn ENGINE switch to OFF position.



i1. PTO DOES NOT ENGAGE (CONT)



WARNING

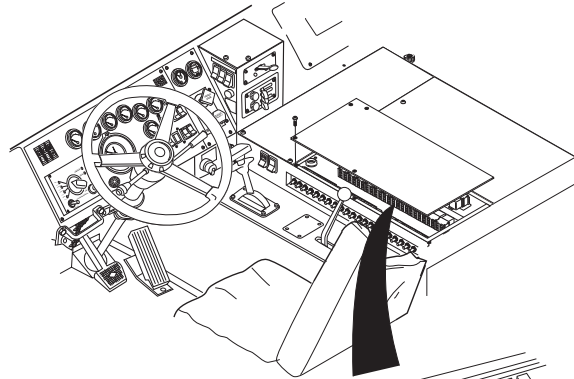
- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

WIRE NO. 1871 VOLTAGE TEST

NOTE

Engine must be running and PTO control switch placed in the on position to perform this test.

- (1) Place positive (+) probe of multimeter on no. 1871 wire at P.T.O. HI IDLE relay.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

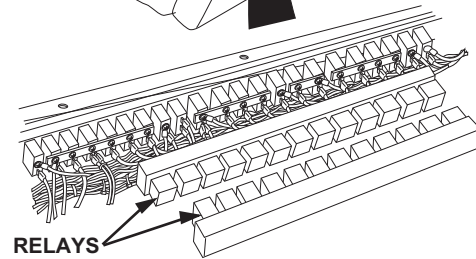


PTO HI IDLE RELAY TEST

NOTE

Engine must be running and PTO control switch placed in the on position to perform this test.

- (1) Place positive (+) probe of multimeter on no. 1458 wire at P.T.O. HI IDLE relay.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.



i2. PTO MAKES EXCESSIVE OR UNUSUAL NOISE DURING OPERATION

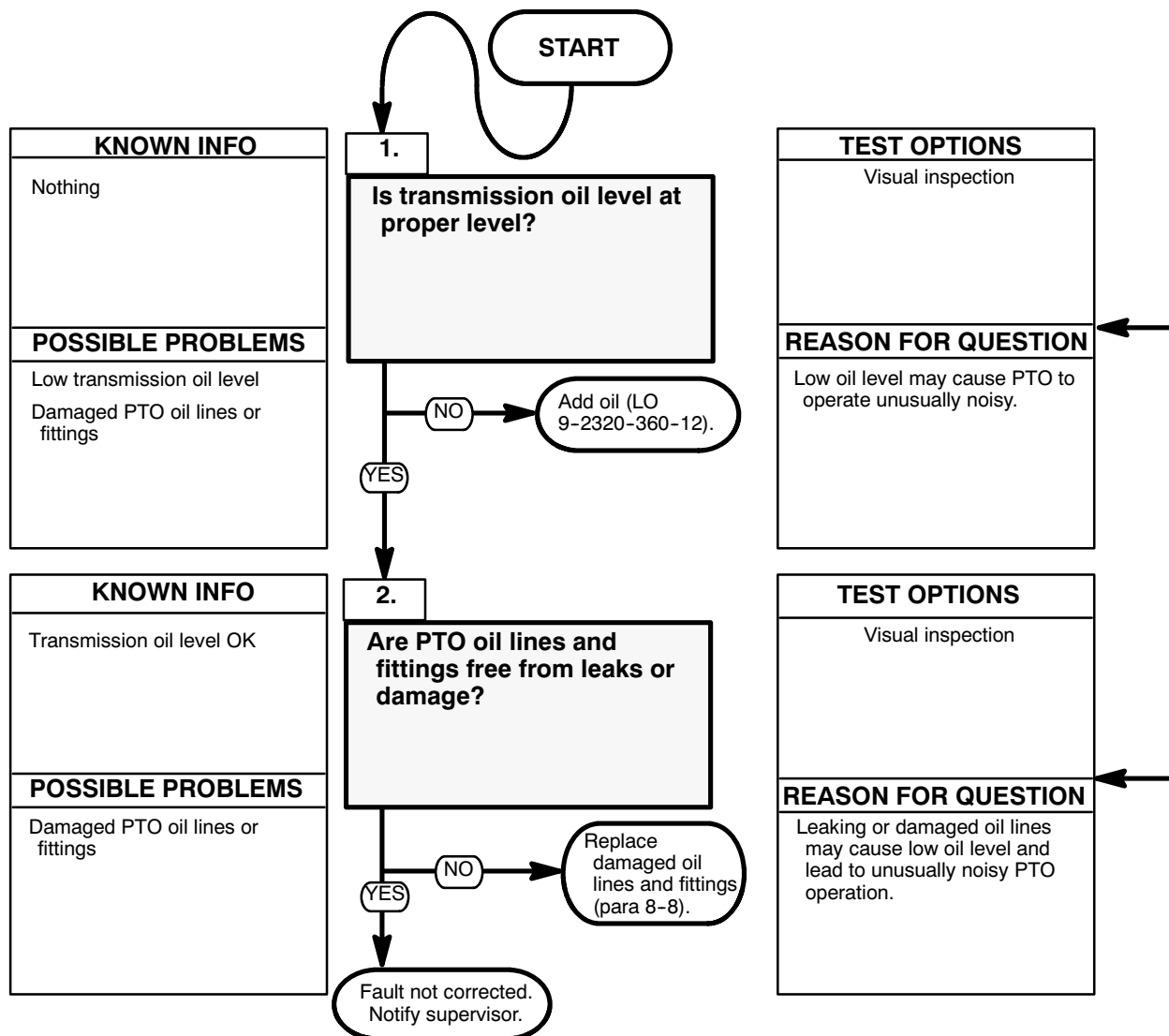
INITIAL SETUP

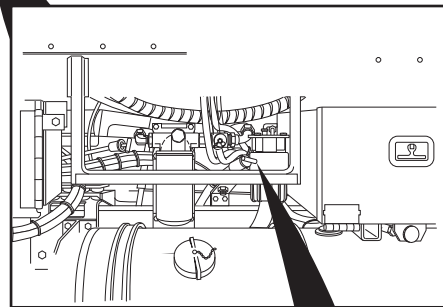
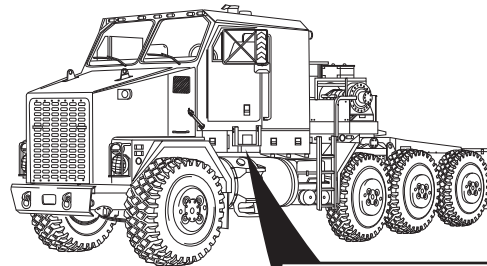
Equipment Conditions

Engine shut off (TM 9-2320-360-10).
 Parking brake on (TM 9-2320-360-10).
 Wheels chocked.

Tools and Special Tools

Tool Kit, Genl Mech (Item 54, Appendix F)

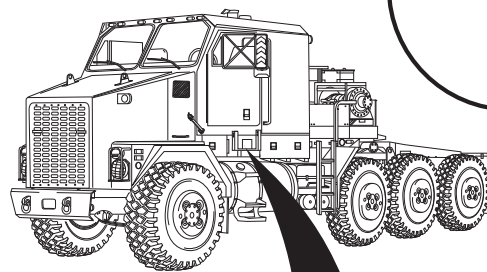
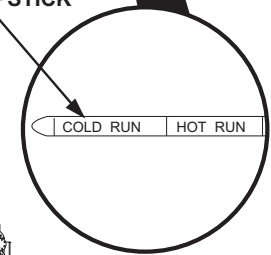




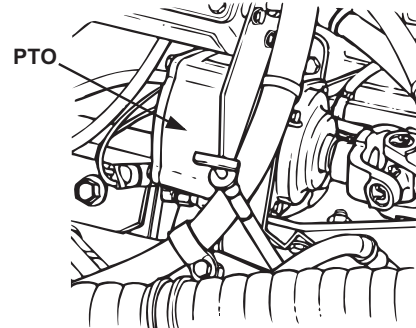
With engine running and transmission in neutral (N), check transmission fluid level on dipstick.

- a. If transmission fluid temperature is below 160°F (71°C), fluid level should be within COLD RUN area.
- b. If transmission fluid temperature is above 160°F (71°C), fluid level should be within HOT RUN area.

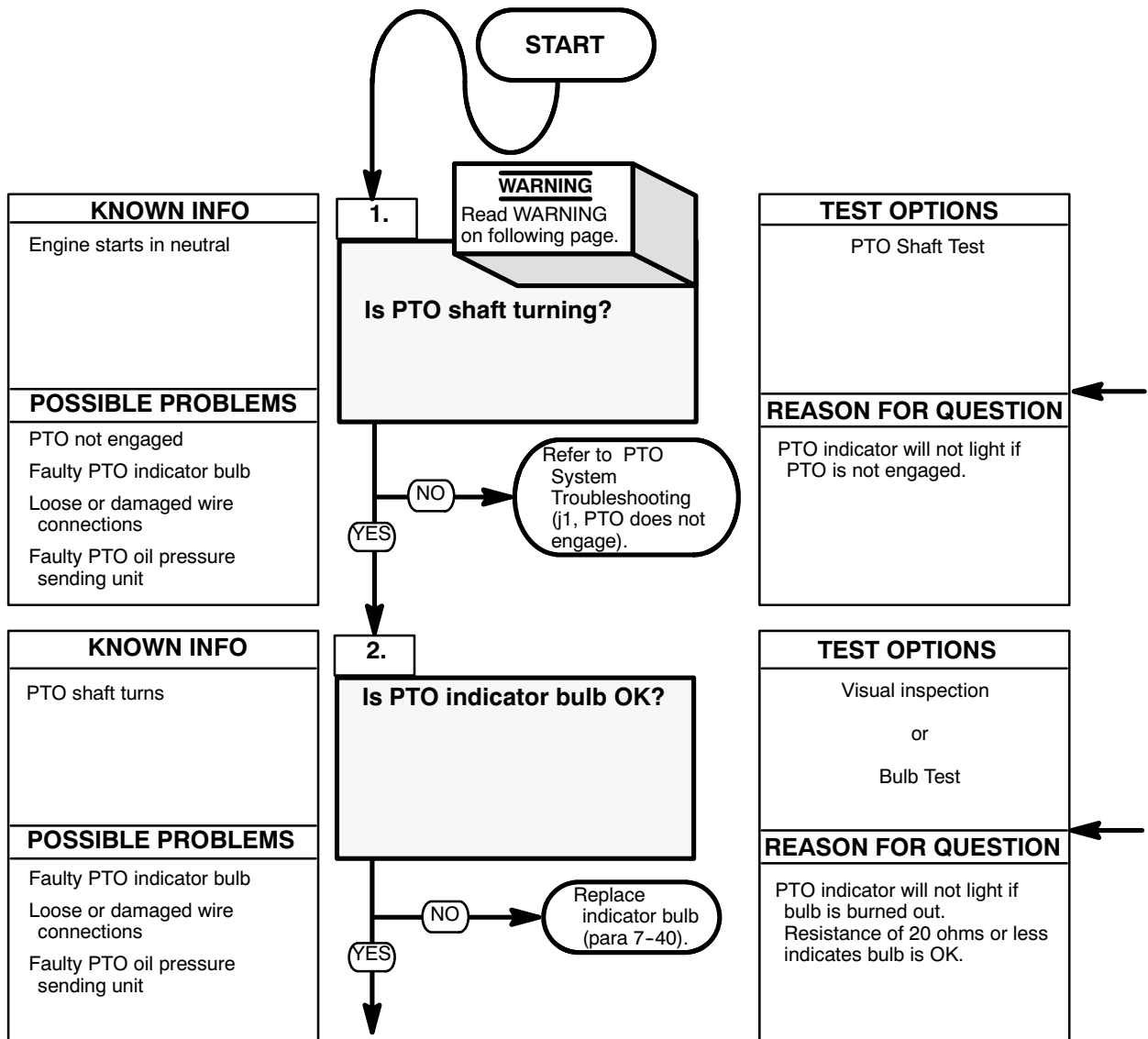
TRANSMISSION DIPSTICK

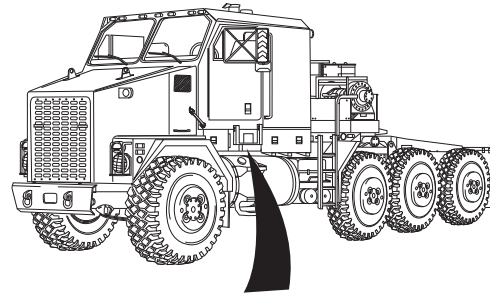


Check PTO oil lines and fittings for leakage and damage.



i3. PTO INDICATOR DOES NOT LIGHT WHEN PTO IS ENGAGED	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F)



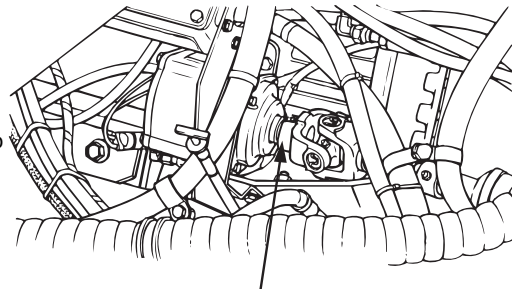


WARNING

Stay clear of moving parts. Failure to comply may result in injury or death to personnel.

NOTE

Transmission range selector must be positioned to N (neutral) and PARKING BRAKE control pulled out before PTO will engage. If engine starts in neutral and reverse lights operate, neutral safety interlock circuit is operating properly.

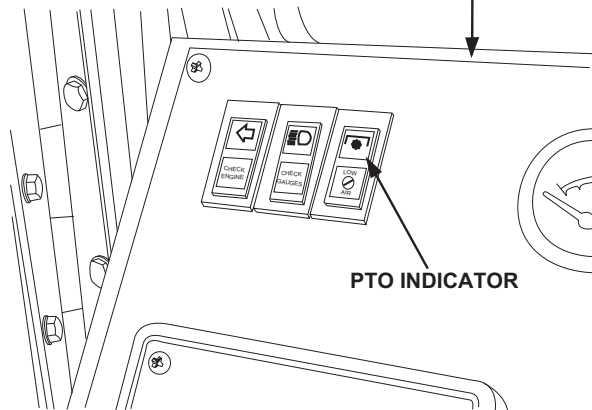


PTO PROPELLER SHAFT

PTO SHAFT TEST

- (1) Start engine (TM 9-2320-360-10).
- (2) Press PTO switch to ON position.
- (3) Check if PTO propeller shaft is turning.

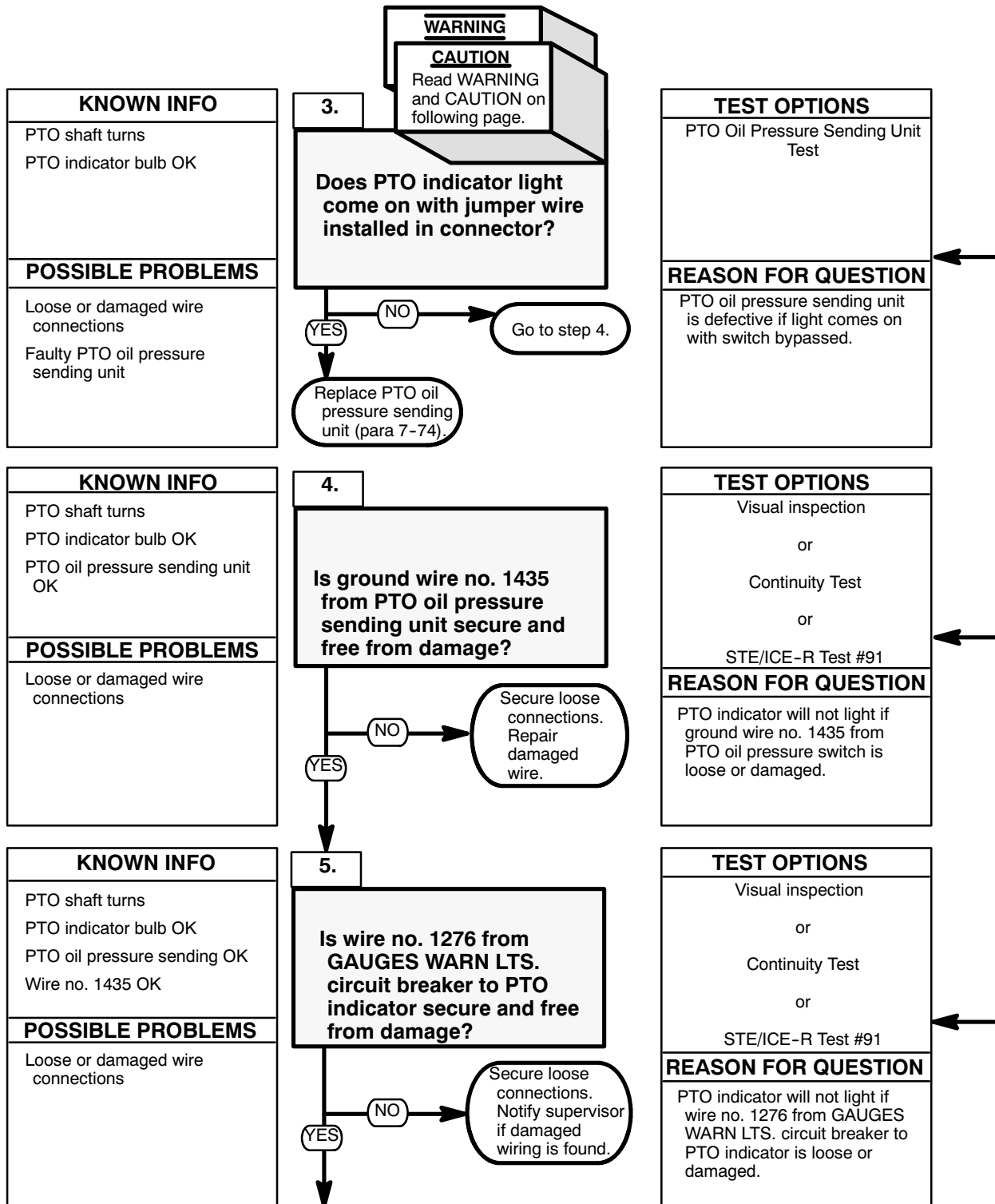
INSTRUMENT PANEL



BULB TEST

- (1) Turn engine switch to OFF position.
- (2) Remove PTO indicator bulb (para 7-40).
- (3) Read resistance between terminals of bulb.

i3. PTO INDICATOR DOES NOT LIGHT WHEN PTO IS ENGAGED (CONT)

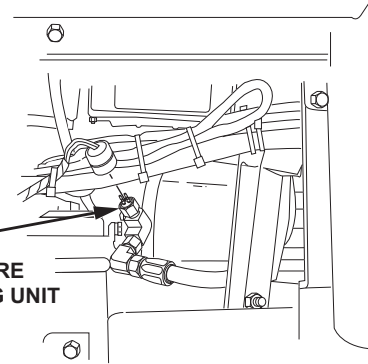
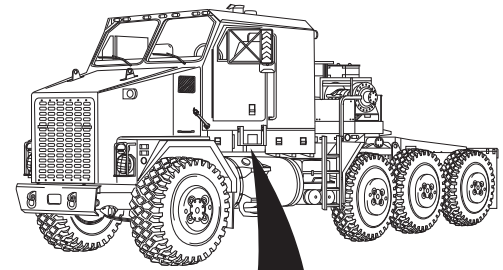


WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

CAUTION

Batteries must be disconnected before tightening any connections. Failure to comply may result in damaged equipment.



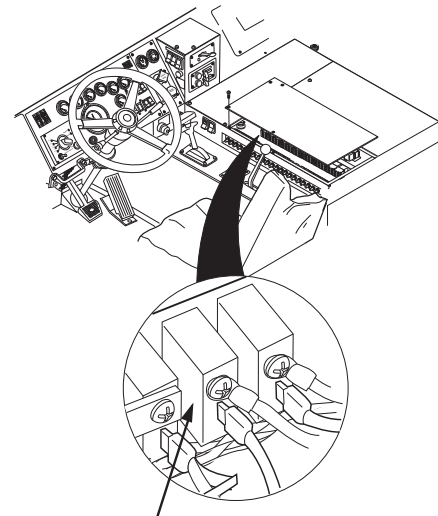
PTO OIL PRESSURE SENDING UNIT TEST

- (1) Remove connector from PTO oil pressure sending unit.
- (2) Install jumper wire between pins on PTO connector.
- (3) Turn engine switch to ON position and observe light.
- (4) Turn engine switch to OFF position.
- (5) Install connector on PTO oil pressure sending unit.

CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.
- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

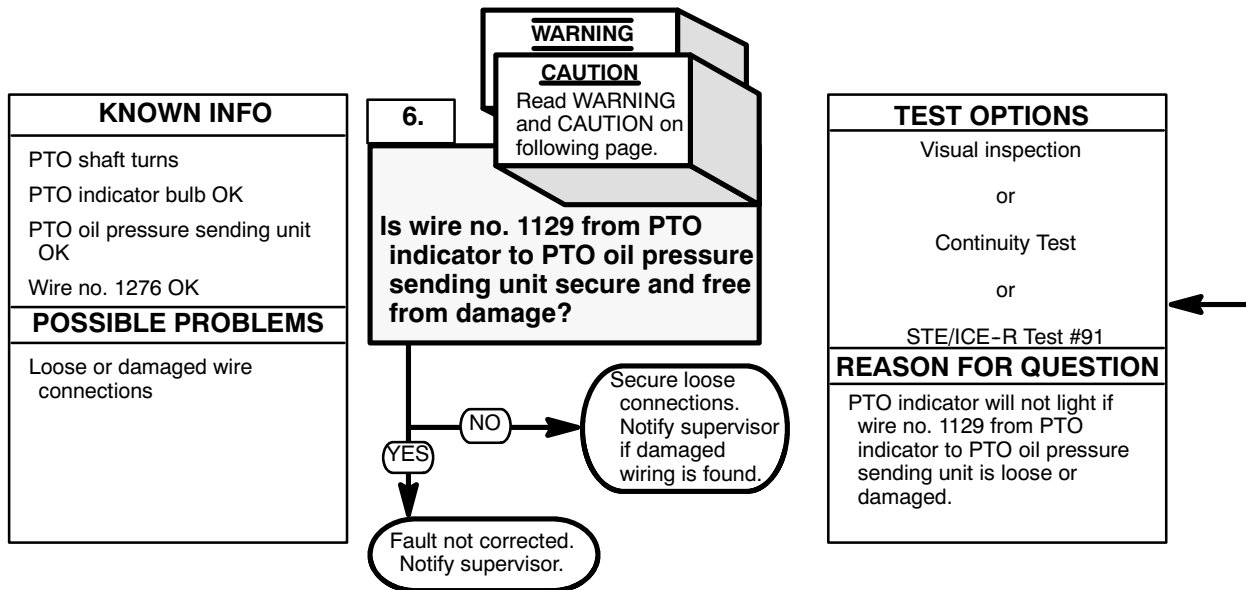
Check ground wire no. 1435 from PTO oil pressure sending unit for loose connections, damage, and continuity.



CIRCUIT BREAKER

Check wire no. 1276 from GAUGES WARN LTS. circuit breaker to PTO indicator for loose connections, damage, and continuity.

i3. PTO INDICATOR DOES NOT LIGHT WHEN PTO IS ENGAGED (CONT)



WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts electrical terminals a direct short may result in an instant heating of tools, damage to equipment, and injury to personnel.

CAUTION

Batteries must be disconnected before tightening any connections. Failure to comply may result in damaged equipment.

Check wire no. 1129 from PTO indicator to PTO oil pressure sending unit for loose connections or damage.

CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

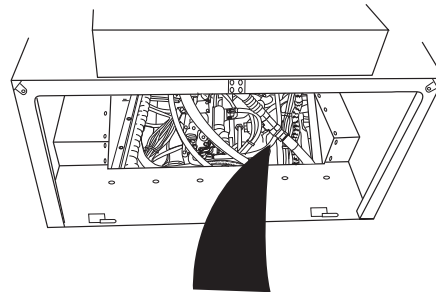
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

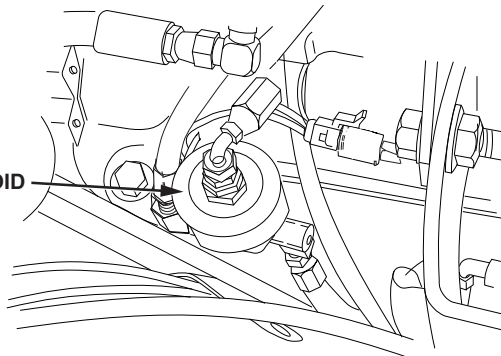
NOTE

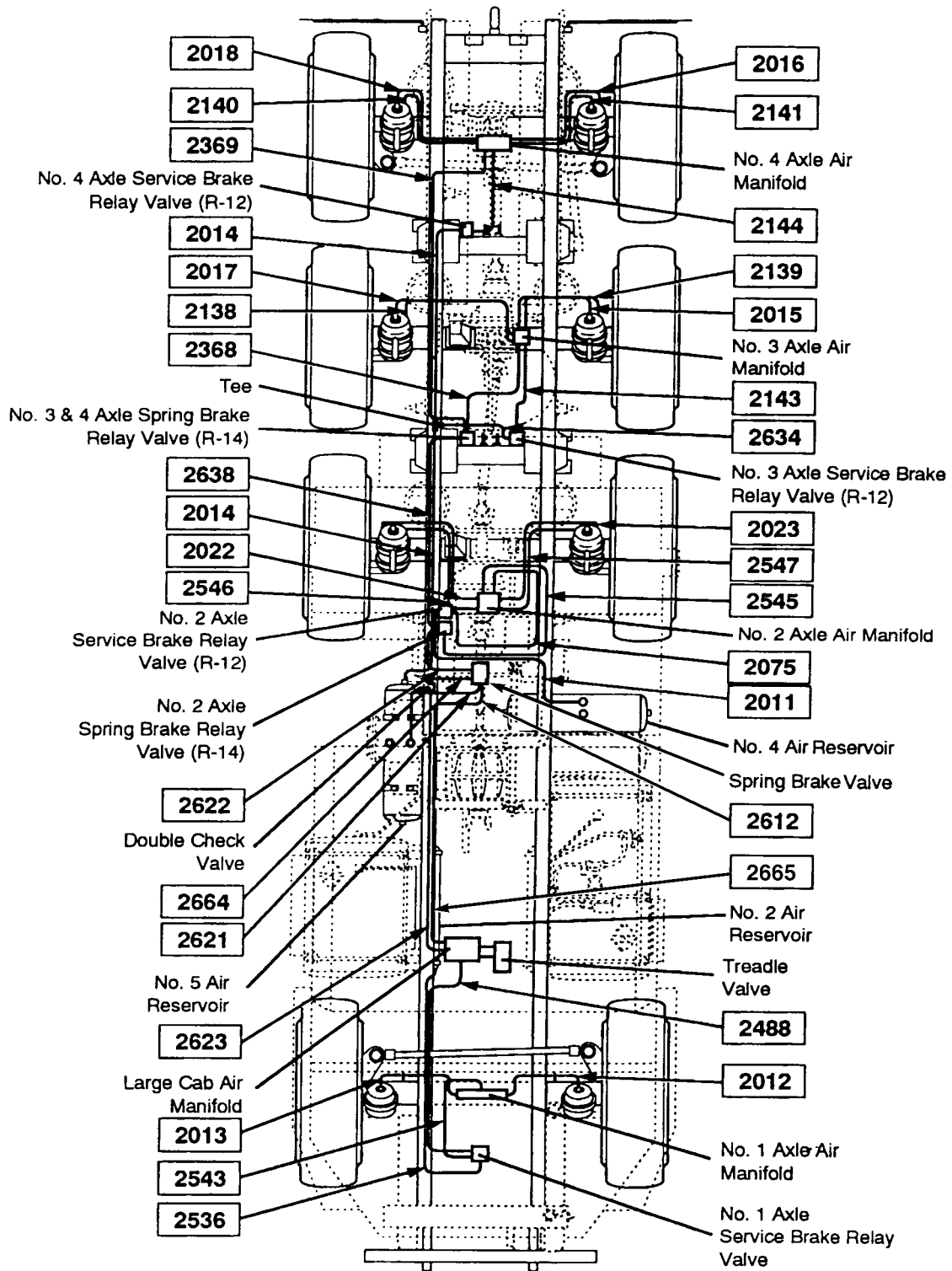
A reading of other than infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

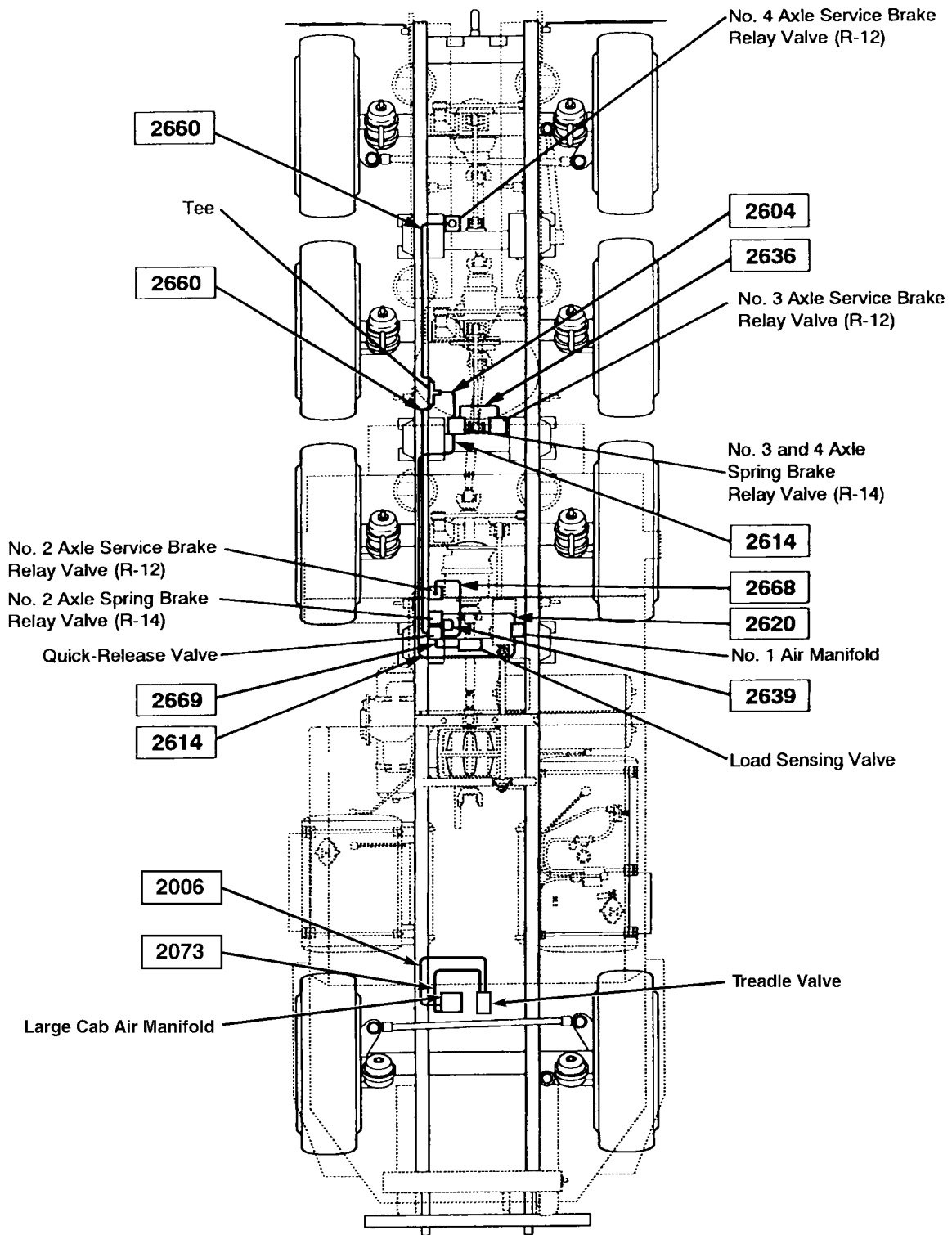


PTO
SOLENOID
VALVE





Brake Air Hose Diagram (sheet 1 of 2)

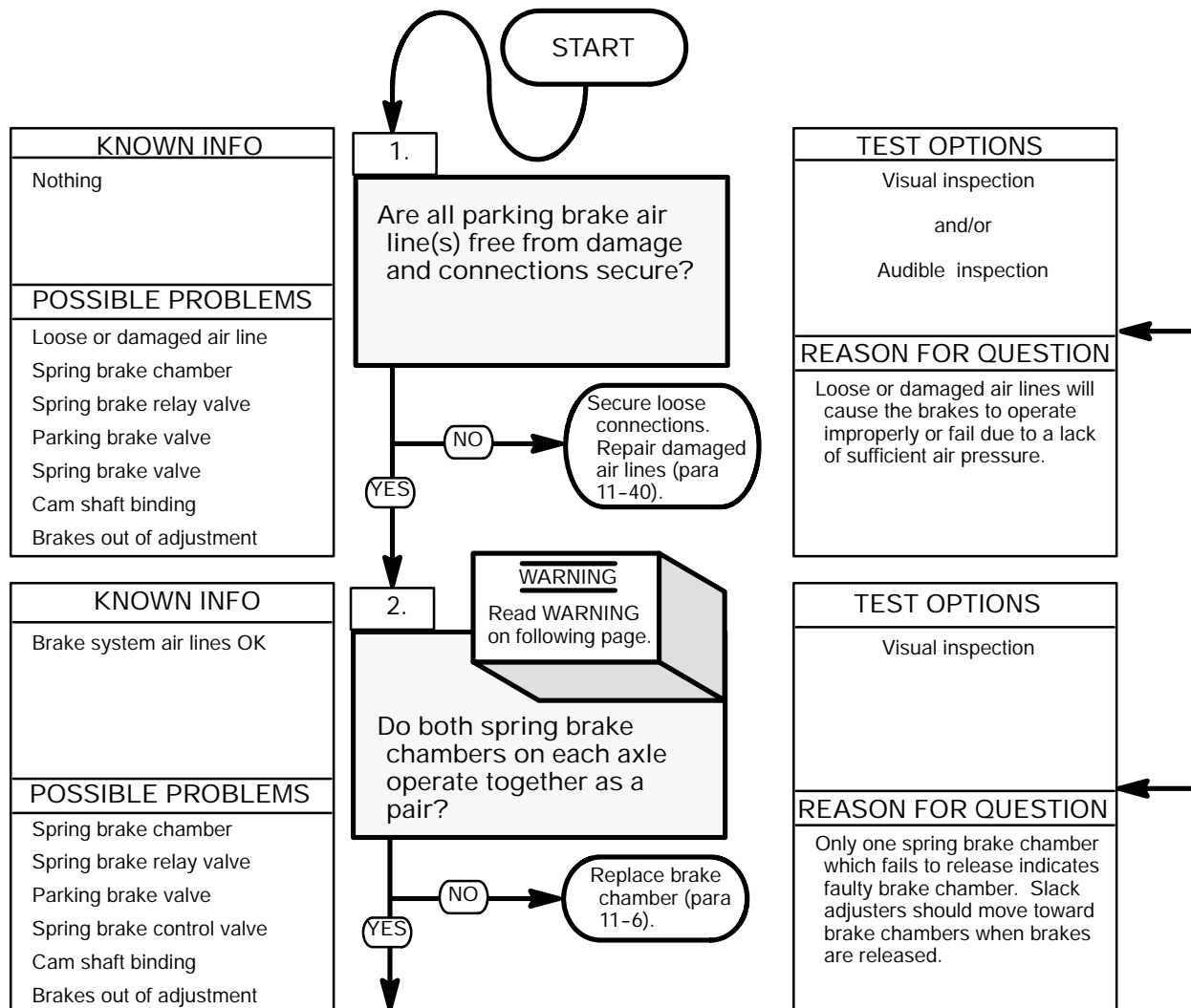


Brake Air Hose Diagram (sheet 2 of 2)

j. AIR BRAKE SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
j1. Spring brake(s) will not release	2-706
j2. Service brake(s) will not respond properly.	2-712
j3. Uneven braking (pulling)	2-714
j4. Service brake(s) fail to release/release slowly	2-718
j5. Service brake(s) grabbing	2-722
j6. Excessive loss of air pressure when braking	2-724
j7. Brake(s) overheat	2-728
j8. Spring brakes will not apply	2-732
j9. Automatic slack adjuster does not operate	2-736

j1. SPRING BRAKE(S) WILL NOT RELEASE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Materials/Parts Pin, Cotter (Item 155, Appendix G)
Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)	Personnel Required Two



WARNING

Due to the air system pressure, be sure to wear the proper eye protection to avoid personal injury.

NOTE

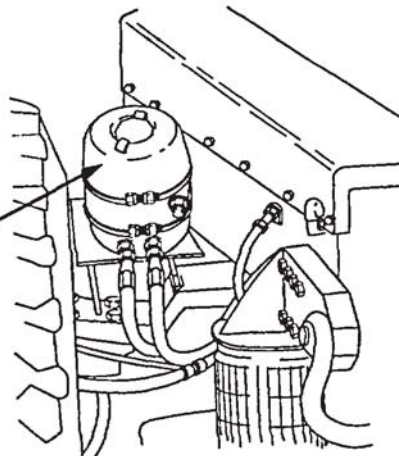
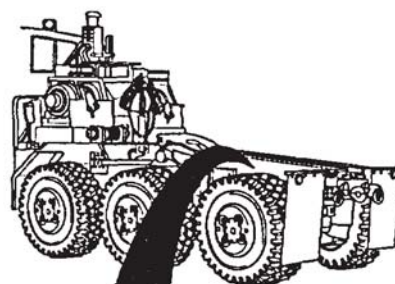
Air system pressure must be in the 90-125 psi operating range to begin brake system troubleshooting. If the air pressure cannot be maintained within operating range proceed to AIR SYSTEM TROUBLESHOOTING.

WARNING

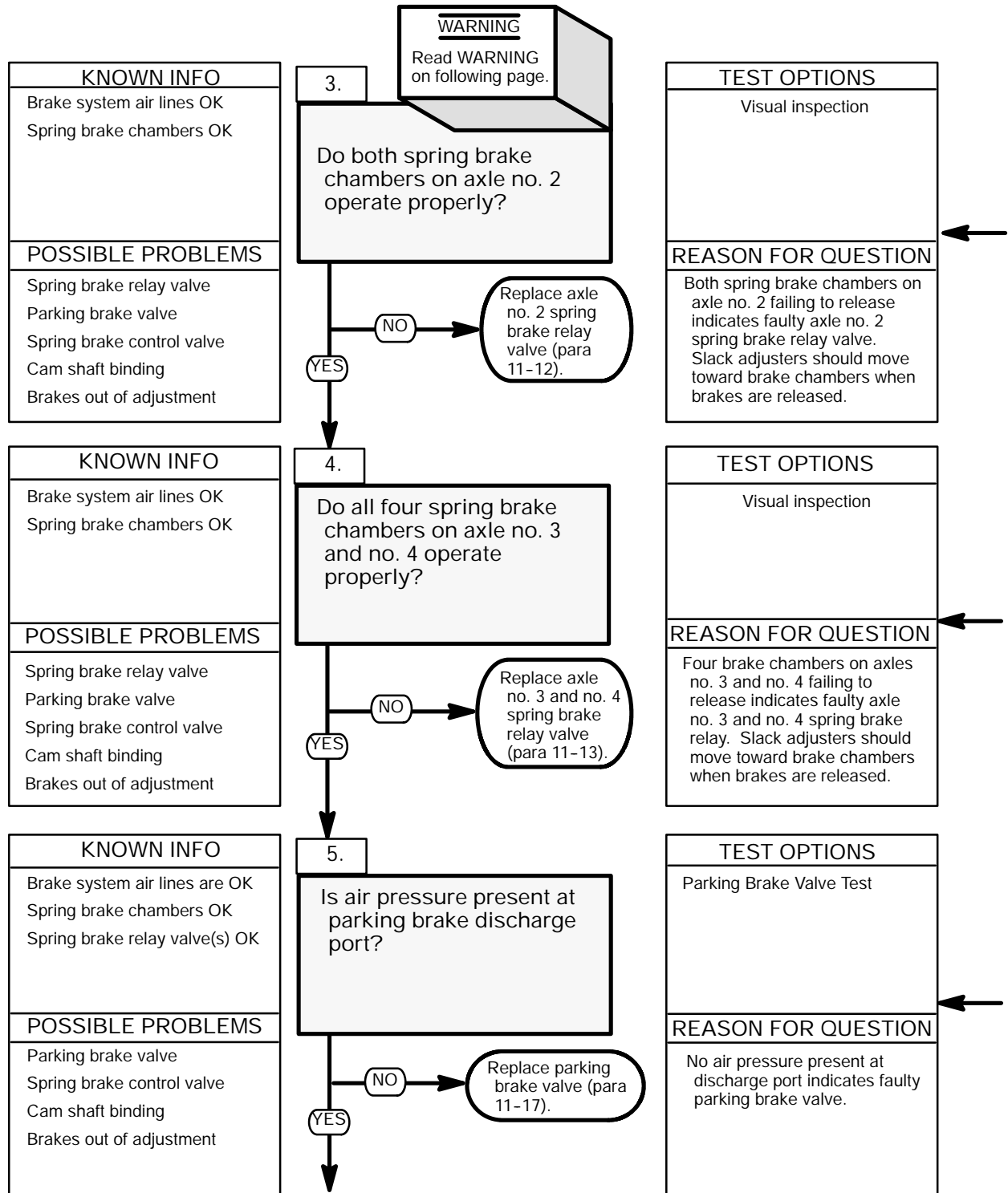
When working on parking brake control system vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

Push in parking valve while assistant observes spring brake chambers.

SPRING BRAKE CHAMBER



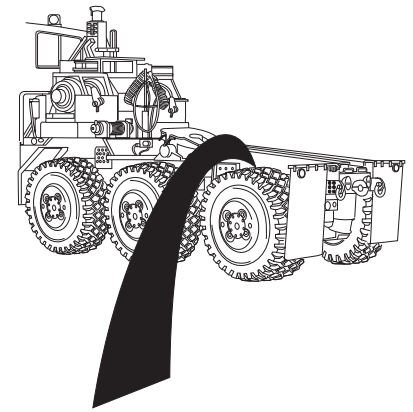
j1. SPRING BRAKE(S) WILL NOT RELEASE (CONT)



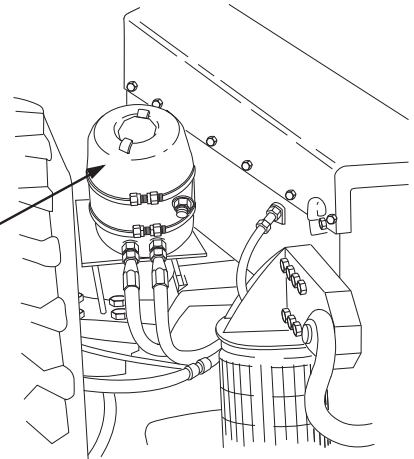
WARNING

When working on parking brake control system vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

Push in parking valve while assistant observes spring brake chambers.



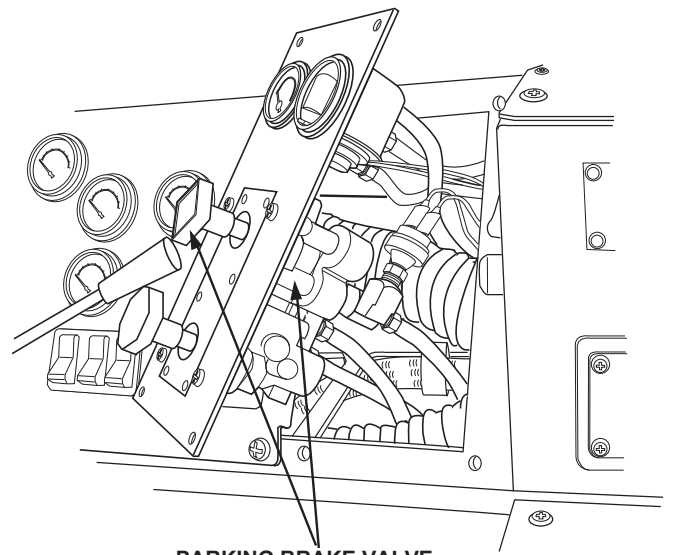
SPRING BRAKE CHAMBER



Push in parking valve while assistant observes spring brake chambers.

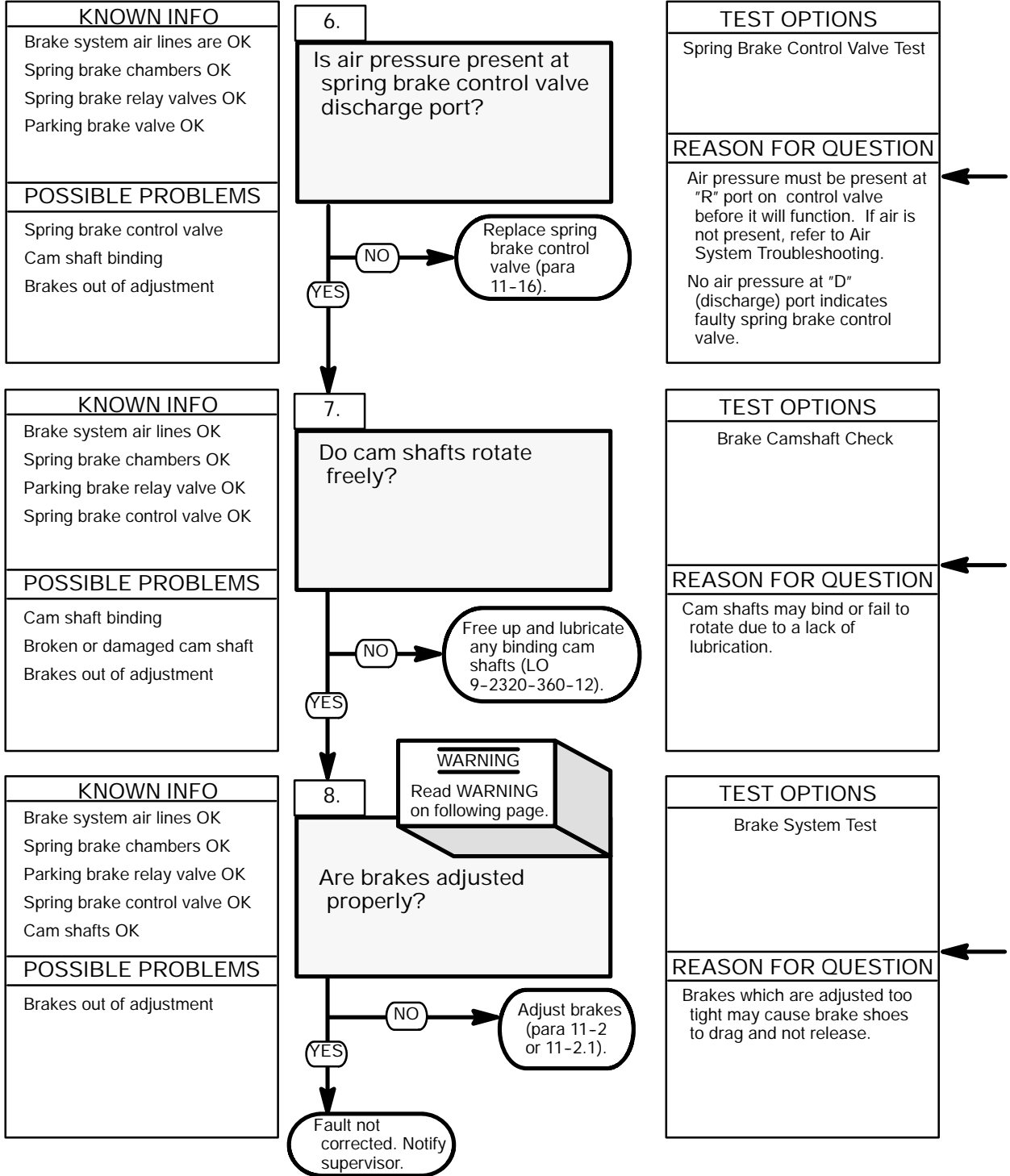
PARKING BRAKE VALVE TEST

- (1) Push in parking brake valve (TM 9-2320-360-10).
- (2) Loosen hose no. 2612 on parking brake valve and check for air escaping.
- (3) Tighten hose no. 2612 on parking brake valve.
- (4) Pull out parking brake valve (TM 9-2320-360-10).



PARKING BRAKE VALVE

j1. SPRING BRAKE(S) WILL NOT RELEASE (CONT)



WARNING

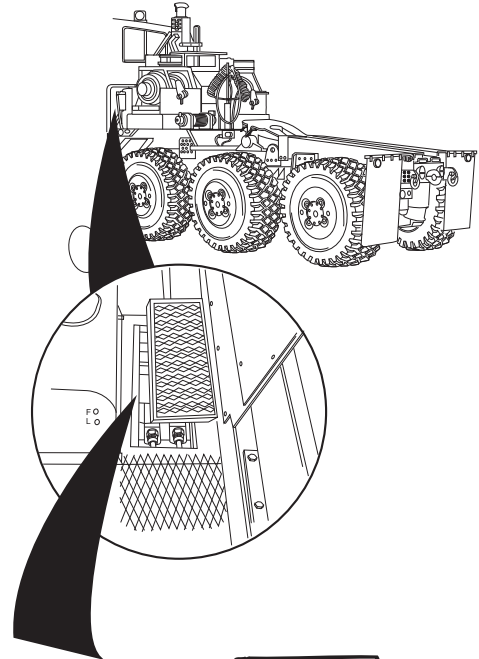
Due to the air system pressure, be sure to wear the proper eye protection to avoid personal injury.

SPRING BRAKE CONTROL VALVE TEST

NOTE

Air pressure must be present at "R" port on control valve before it will function.

- (1) Loosen hose no. 2621 at "R" port on spring brake control valve and check for escaping air.
- (2) Tighten hose no. 2621 on spring brake control.
- (3) Push in parking brake valve (TM 9-2320-360-10).
- (4) Loosen hose no. 2622 "D" (discharge) port on spring brake control valve and check for escaping air.
- (5) Tighten hose no. 2622 on spring brake control.
- (6) Pull out parking brake valve (TM 9-2320-360-10).



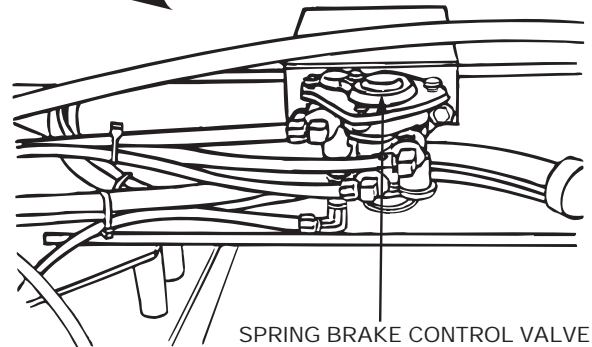
BRAKE CAMSHAFT CHECK

- (1) Remove cotter pin and clevis pin from slack adjuster. Discard cotter pin.

NOTE

Slack adjuster and camshaft should move with minimum effort away from brake chamber.

- (2) Lubricate brake camshaft (LO-2320-360-12) and move slack adjuster through range of travel.
- (3) Install clevis pin in slack adjuster and brake chamber with new cotter pin.



SPRING BRAKE CONTROL VALVE

WARNING

When working on parking break control system, vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

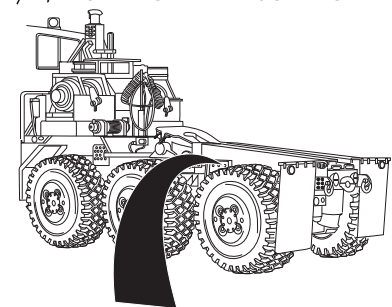
BRAKE SYSTEM TEST

- (1) Release parking brake (TM 9-2320-360-10).

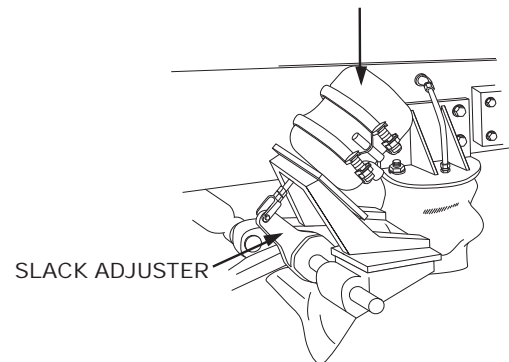
NOTE

Slack adjuster should move up to 2 in. (5 cm).

- (2) Check for movement of slack adjuster while assistant applies and releases treadle valve.
- (3) Repeat test at seven other slack adjusters.
- (4) Apply parking brake (TM 9-2320-360-10).

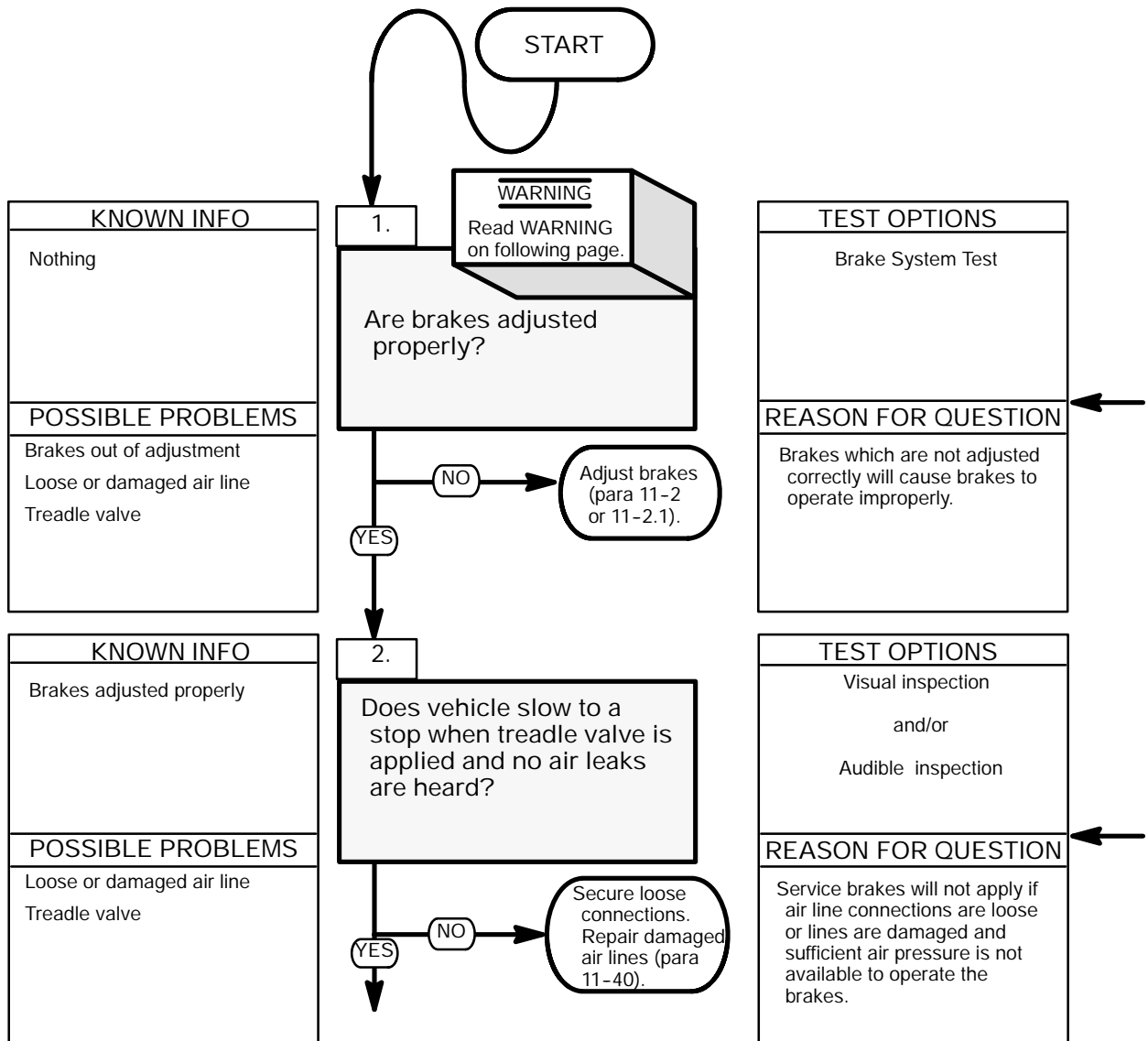


SPRING BRAKE CHAMBER



SLACK ADJUSTER

j2. SERVICE BRAKE(S) WILL NOT RESPOND PROPERLY			
<p>INITIAL SETUP</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two</p> </td> </tr> </table>		<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two</p>
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two</p>		

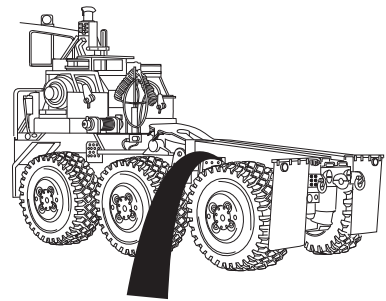


NOTE

Air system pressure must be in the 90-125 psi operating range to begin brake system troubleshooting. If the air pressure cannot be maintained within operating range proceed to AIR SYSTEM TROUBLESHOOTING.

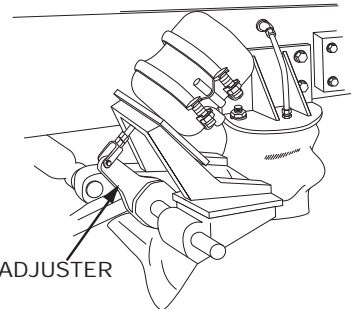
WARNING

Due to the air system pressure be sure to wear the proper eye protection to avoid personal injury. When working on parking break control system, vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

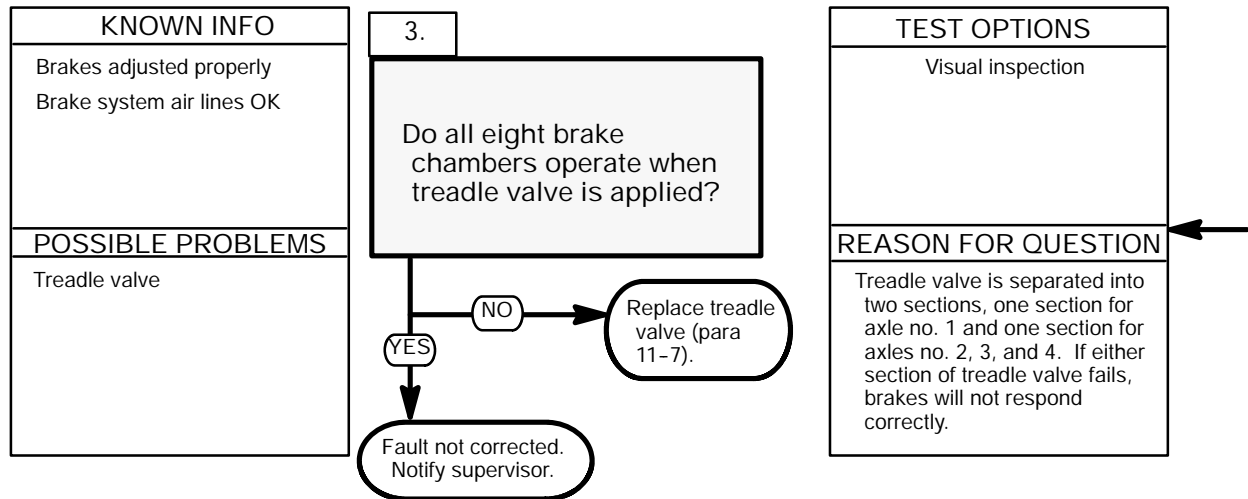


BRAKE SYSTEM TEST

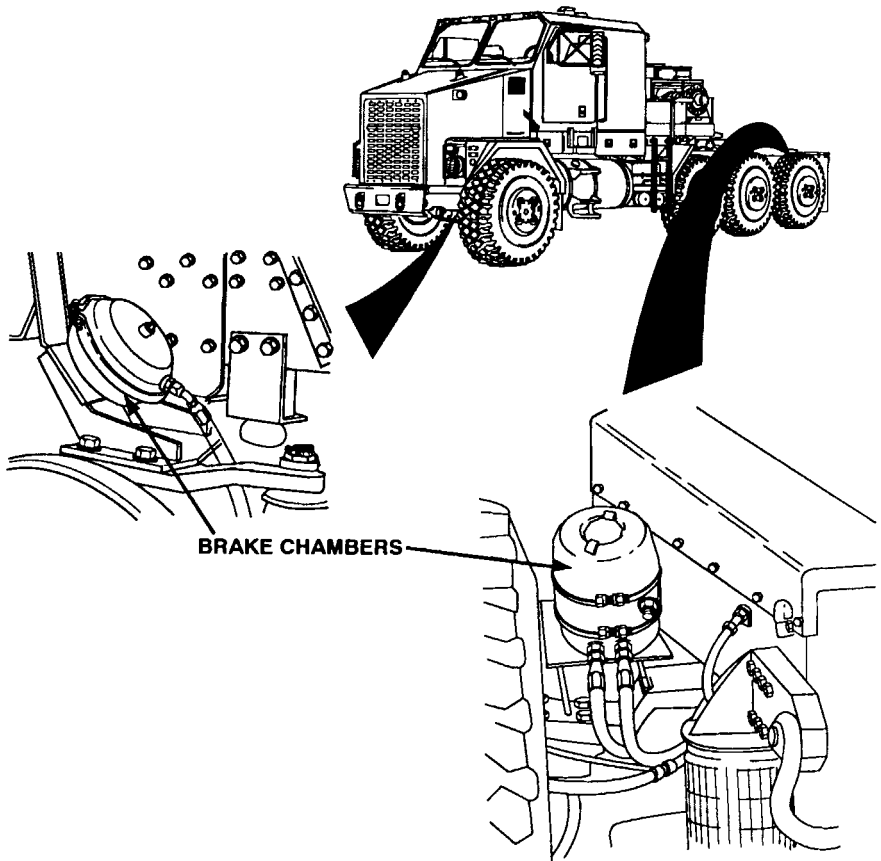
- (1) Release parking brake (TM 9-2320-360-10).
- (2) Check for movement of slack adjusters while assistant applies and releases treadle valve.
- (3) Apply parking brake (TM 9-2320-360-10).



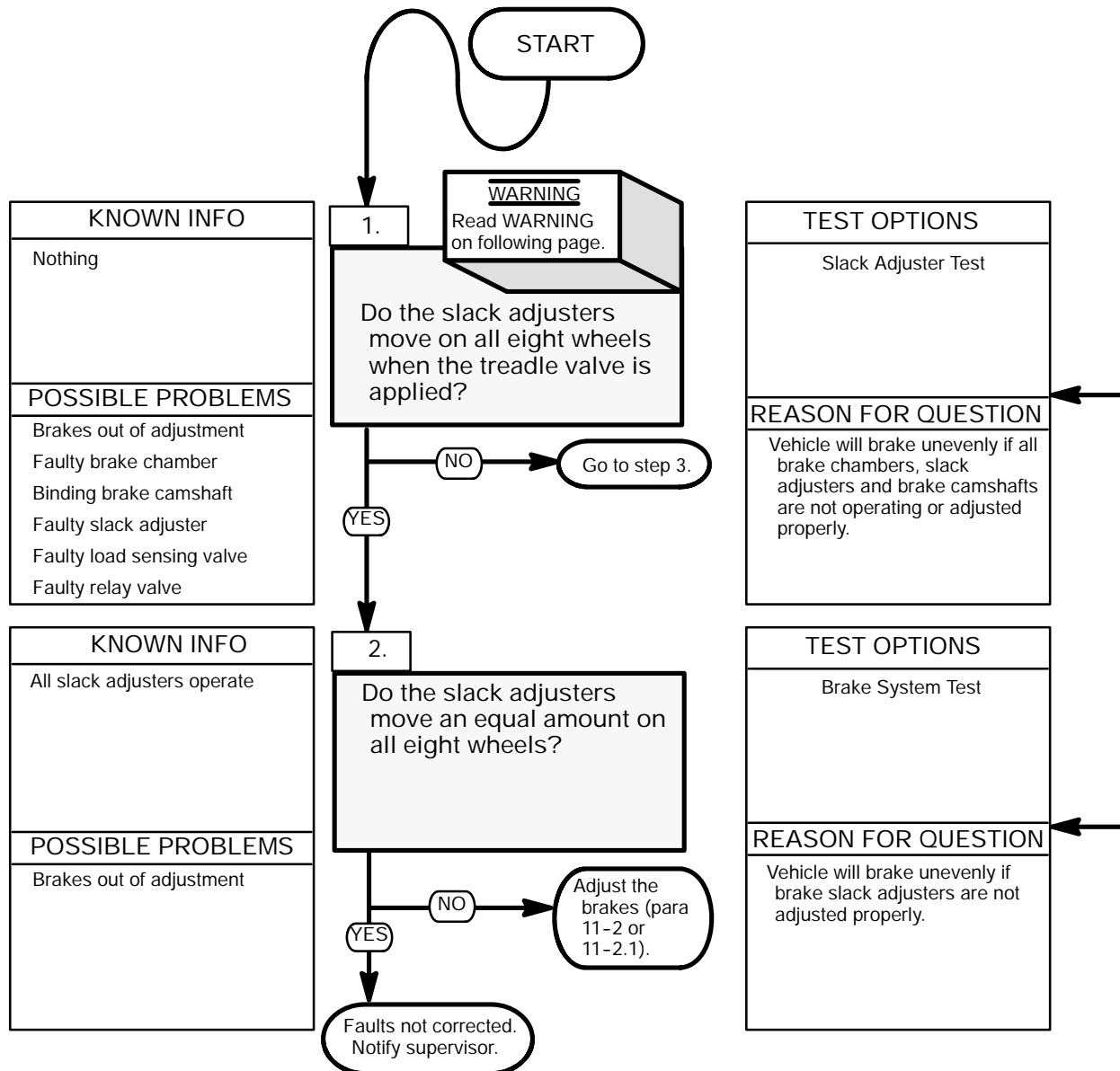
j2. SERVICE BRAKE(S) WILL NOT RESPOND PROPERLY (CONT)



Apply service brake while assistant observes the eight brake chambers for movement of rod.

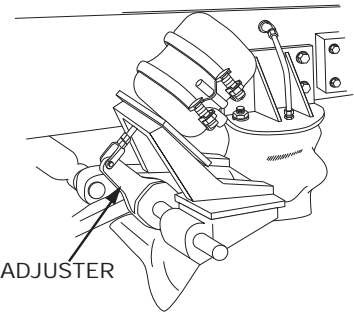
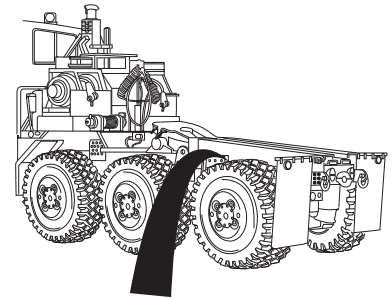


j3. UNEVEN BRAKING (PULLING)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two



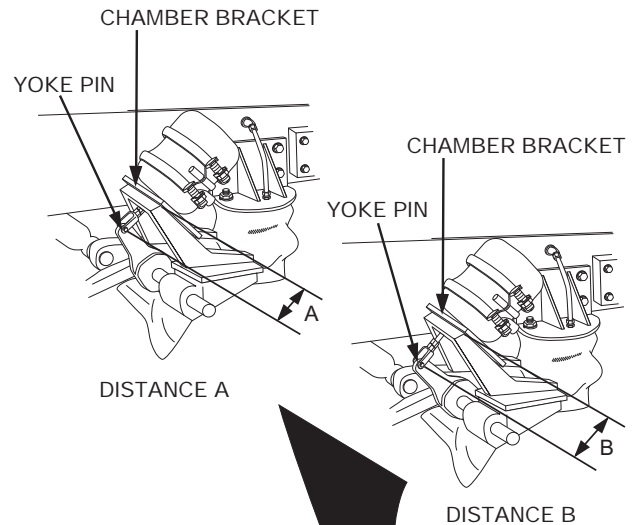
WARNING

Due to the air system pressure be sure to wear the proper eye protection to avoid personal injury. When working on parking brake control system vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.



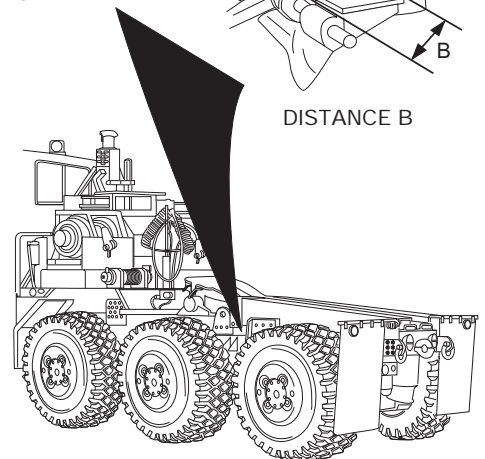
SLACK ADJUSTER TEST

- (1) Release parking brake (TM 9-2320-360-10).
- (2) Observe the rotation of all brake camshafts and slack adjusters while assistant applies and releases treadle valve.
- (3) Apply parking brake (TM 9-2320-360-10).

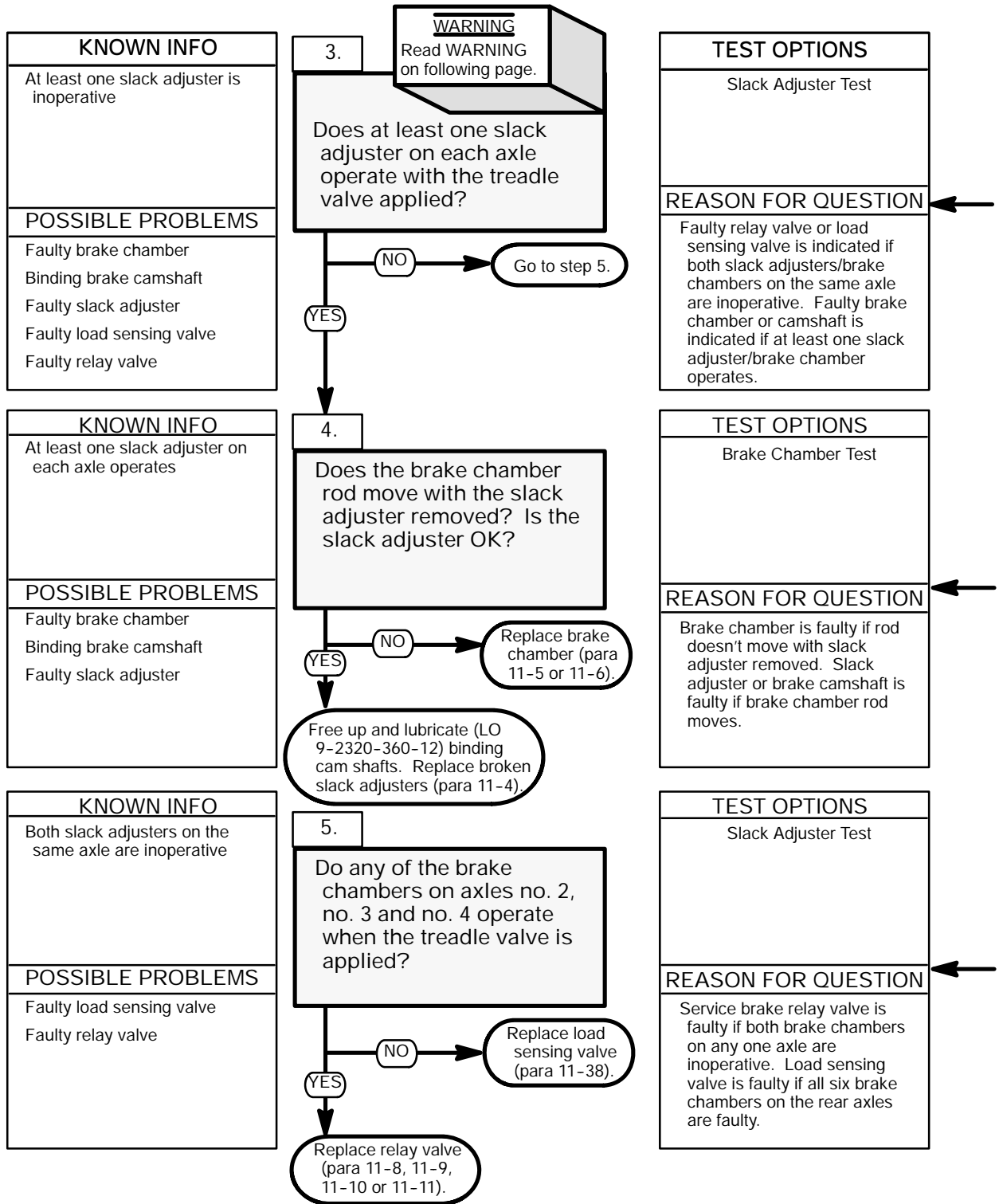


BRAKE SYSTEM TEST

- (1) Release parking brake (TM 9-2320-360-10).
- (2) Measure distance A between center of yoke pin and chamber bracket with brake treadle released. Record measurement.
- (3) Measure distance B between center of yoke pin and chamber bracket while assistant holds brake treadle down. Record measurement.
- (4) Subtract measurement A from measurement B. If difference is 2 in (50 mm) or more, adjust brakes (para 11-2).
- (5) Apply parking brake (TM 9-2320-360-10).



j3. UNEVEN BRAKING (PULLING) (CONT)

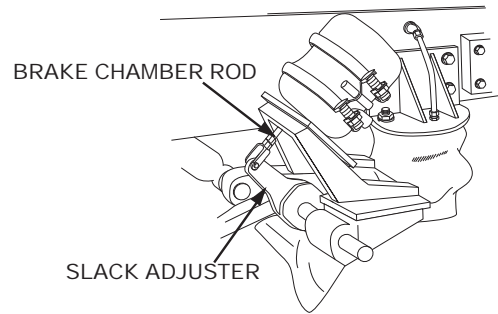


WARNING

Due to the air system pressure, be sure to wear the proper eye protection to avoid personal injury. When working on parking brake control system vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

SLACK ADJUSTER TEST

- (1) Release parking brake (TM 9-2320-360-10).
- (2) Observe the rotation of all brake camshafts and slack adjusters while assistant applies and releases treadle valve.
- (3) Apply parking brake (TM 9-2320-360-10).



BRAKE CHAMBER TEST

NOTE

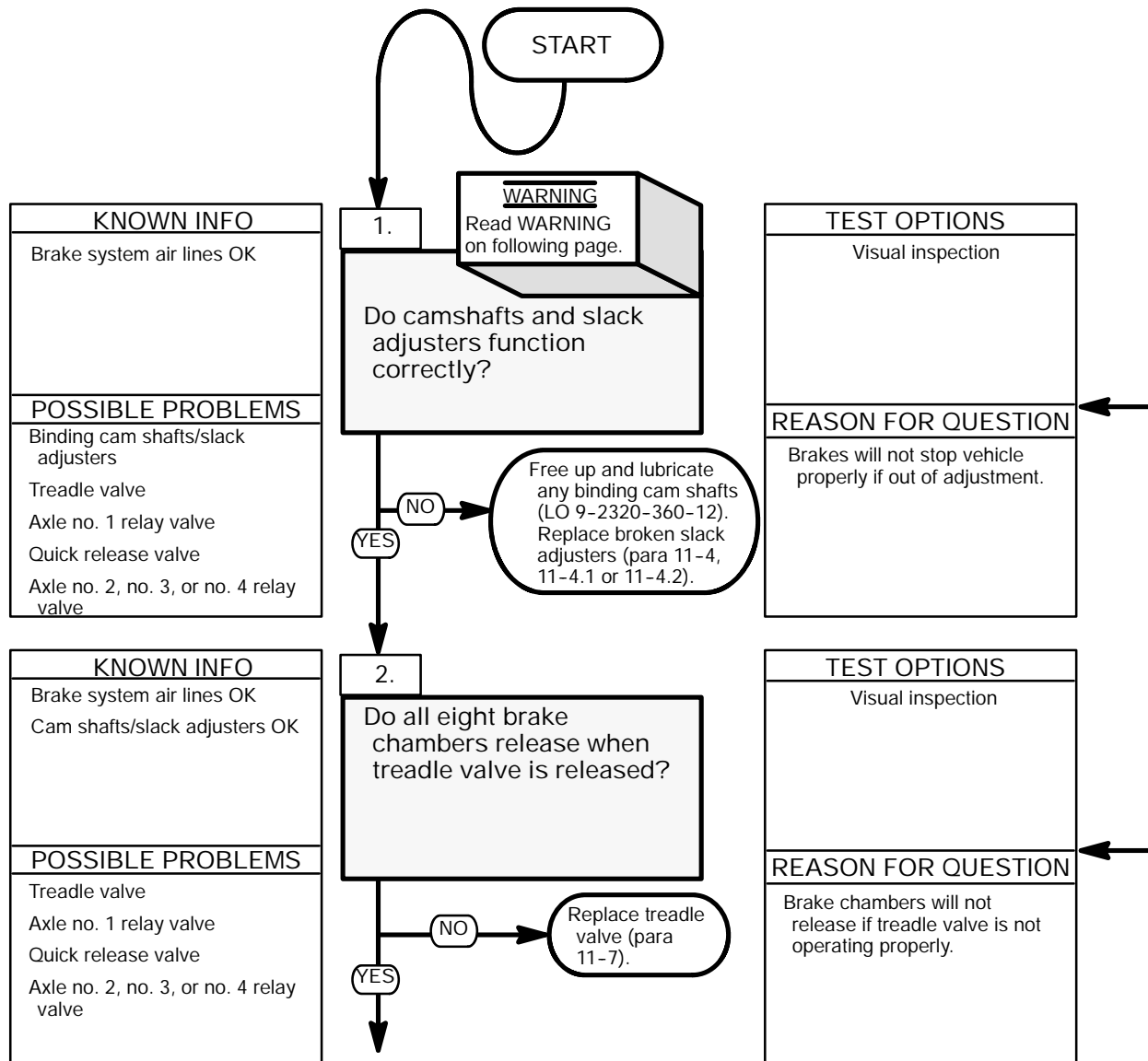
Notify supervisor if brake camshaft is binding and will not free up after lubricating.

- (1) Remove the slack adjuster which does not move from the brake camshaft (para 11-4).
- (2) Manually apply spring brake (TM 9-2320-360-10).
- (3) Release parking brake (TM 9-2320-360-10).
- (4) Check for movement of brake chamber rod while assistant applies and releases treadle valve.
- (5) Apply parking brake (TM 9-2320-360-10).
- (6) Manually release spring brake (TM 9-2320-360-10).
- (7) Install slack adjuster (para 11-4).

SLACK ADJUSTER TEST

- (1) Release parking brake (TM 9-2320-360-10).
- (2) Observe the rotation of all brake camshafts and slack adjusters while assistant applies and releases treadle valve.
- (3) Apply parking brake (TM 9-2320-360-10).

j4. SERVICE BRAKE(S) FAIL TO RELEASE/RELEASE SLOWLY	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two

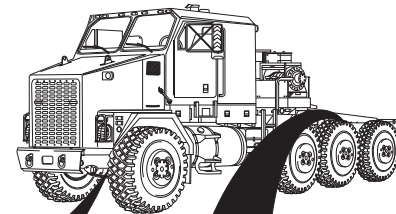
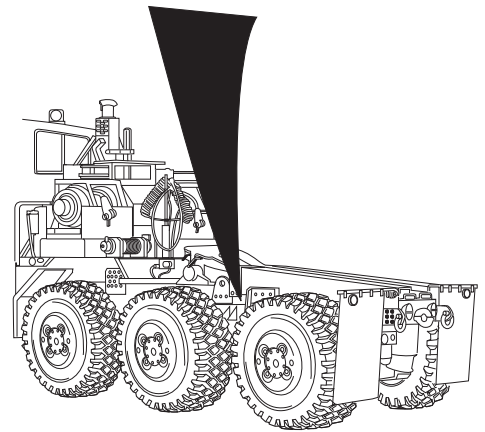
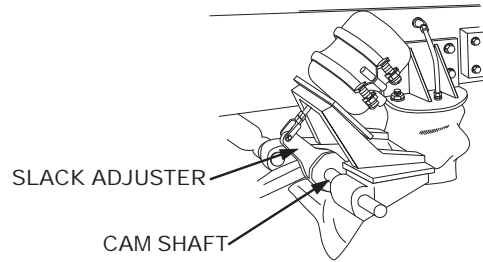


WARNING

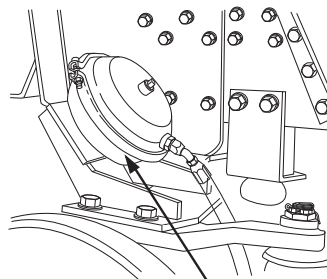
Due to the air system pressure, be sure to wear the proper eye protection to avoid personal injury. When working on parking brake control system vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

SERVICE BRAKE CHECK

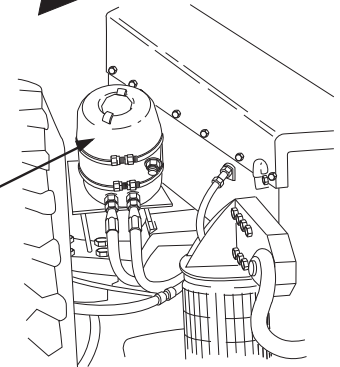
- (1) Apply service brake while assistant observes the eight cam shafts and slack adjusters.
- (2) Observe rotation of all cam shafts.
- (3) Free and lubricate any binding camshafts.
- (4) Observe the movement of all slack adjusters.



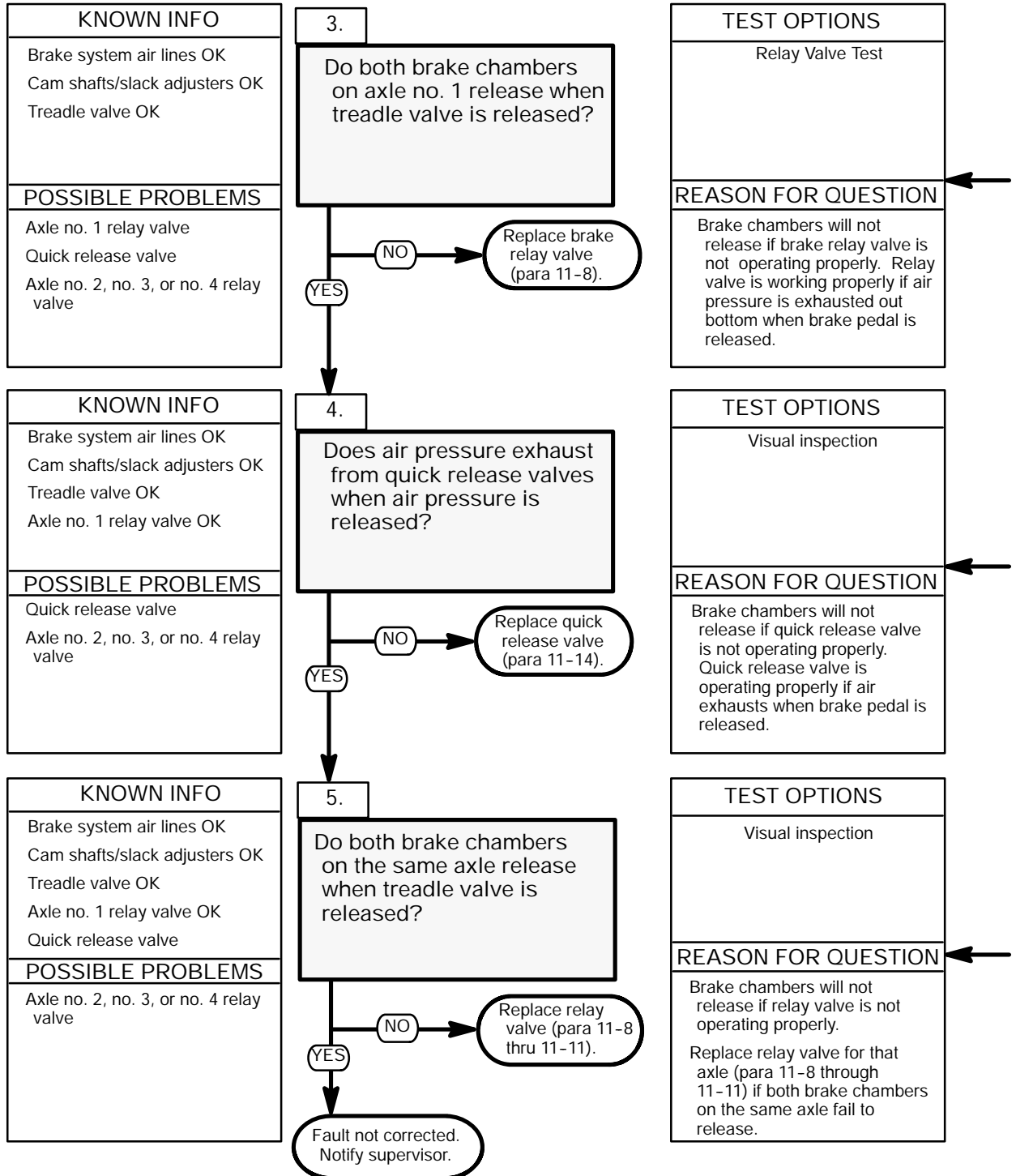
Release service brakes while assistant observes the eight brake chambers.

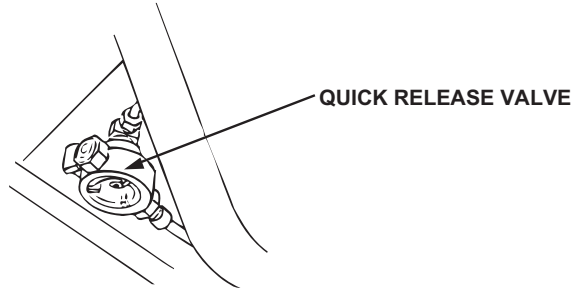
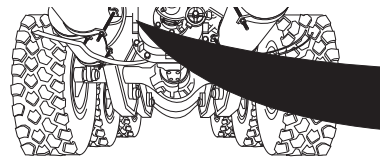


BRAKE CHAMBERS



j4. SERVICE BRAKE(S) FAIL TO RELEASE/RELEASE SLOWLY (CONT)

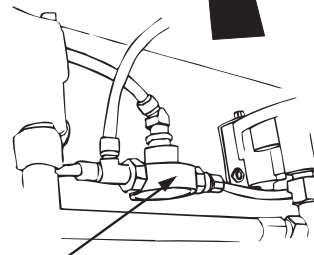
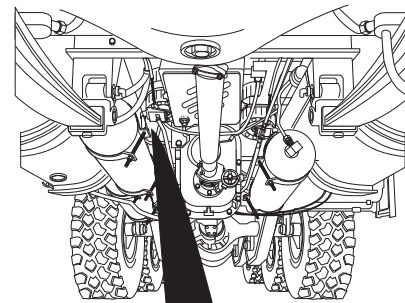




RELAY VALVE TEST

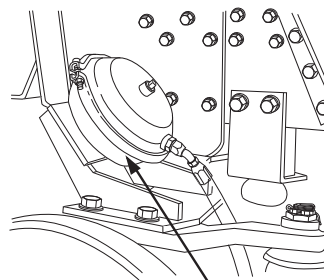
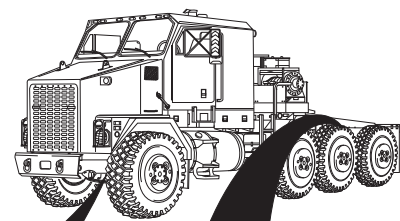
- (1) Release service brakes while assistant observes the two front brake chambers.
- (2) Observe no. 1 relay valve for air pressure exhausting when brake is released.

Release service brakes while assistant checks quick release valves for exhausted air.

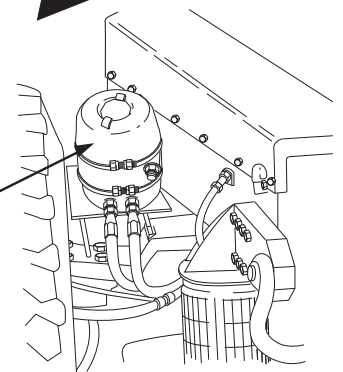


QUICK RELEASE VALVE

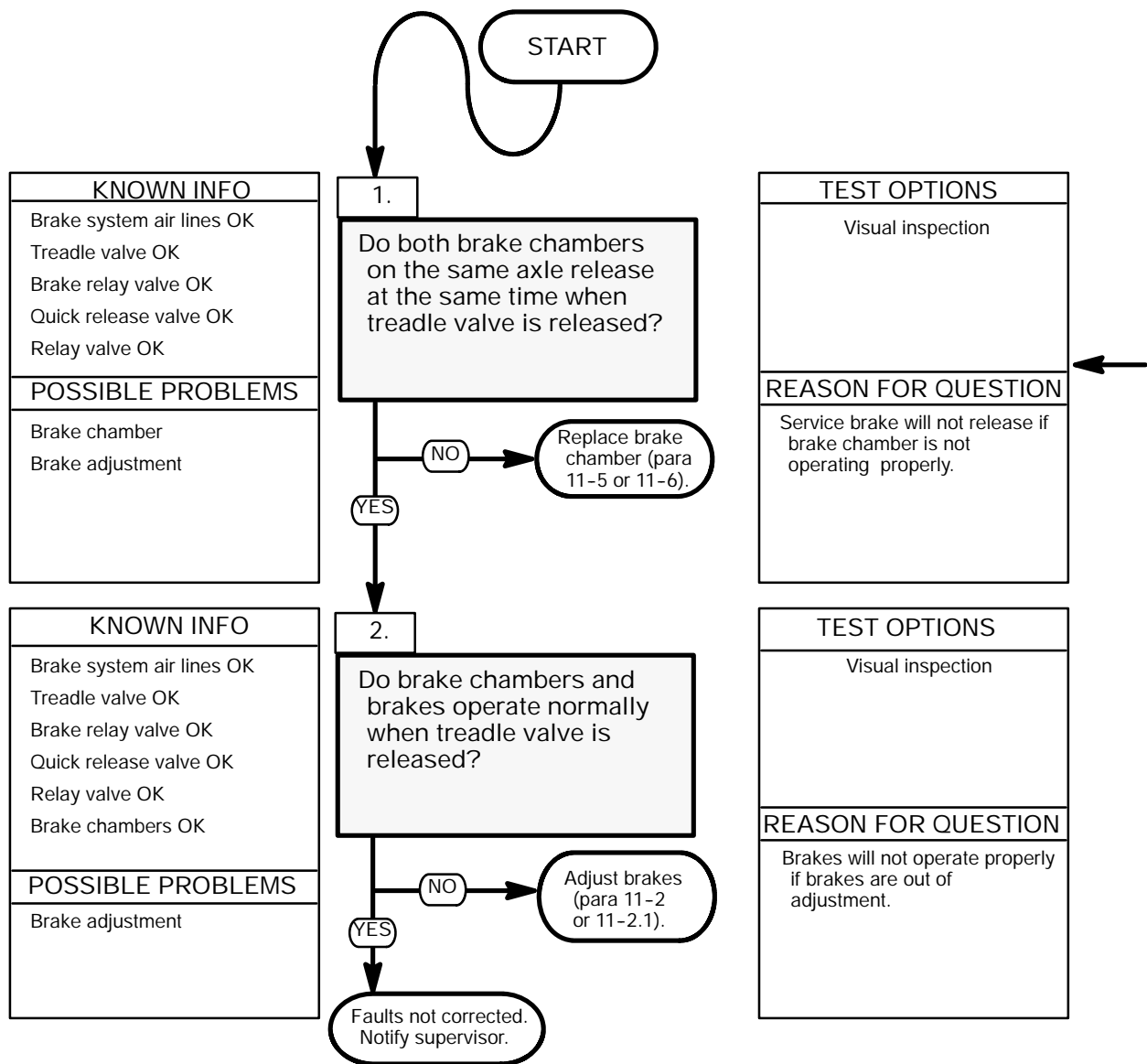
Release service brakes while assistant observes the six brake chambers on the three rear axles.

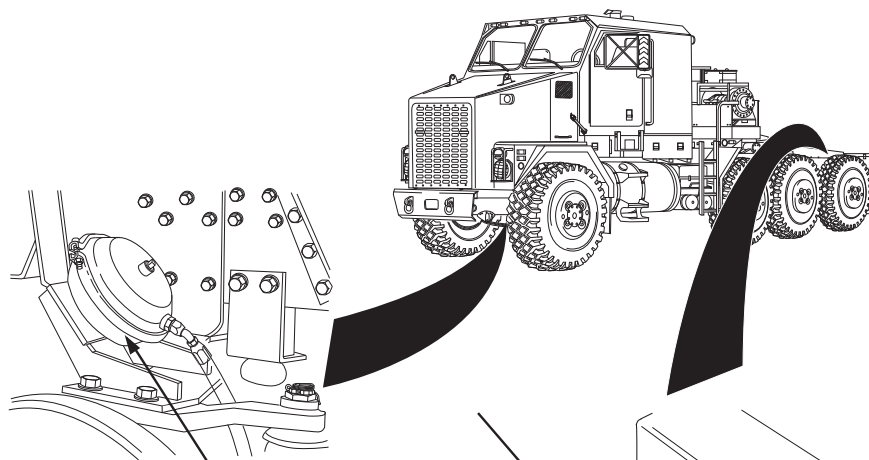


BRAKE CHAMBERS



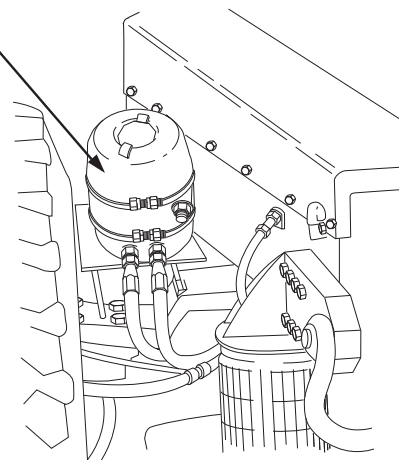
j5. SERVICE BRAKE(S) GRABBING	
INITIAL SETUP	
Equipment Conditions	Tools and Special Tools
Engine shut off (TM 9-2320-360-10).	Tool Kit, Genl Mech (Item 54, Appendix F)
Parking brake on (TM 9-2320-360-10).	Personnel Required
Wheels chocked.	Two



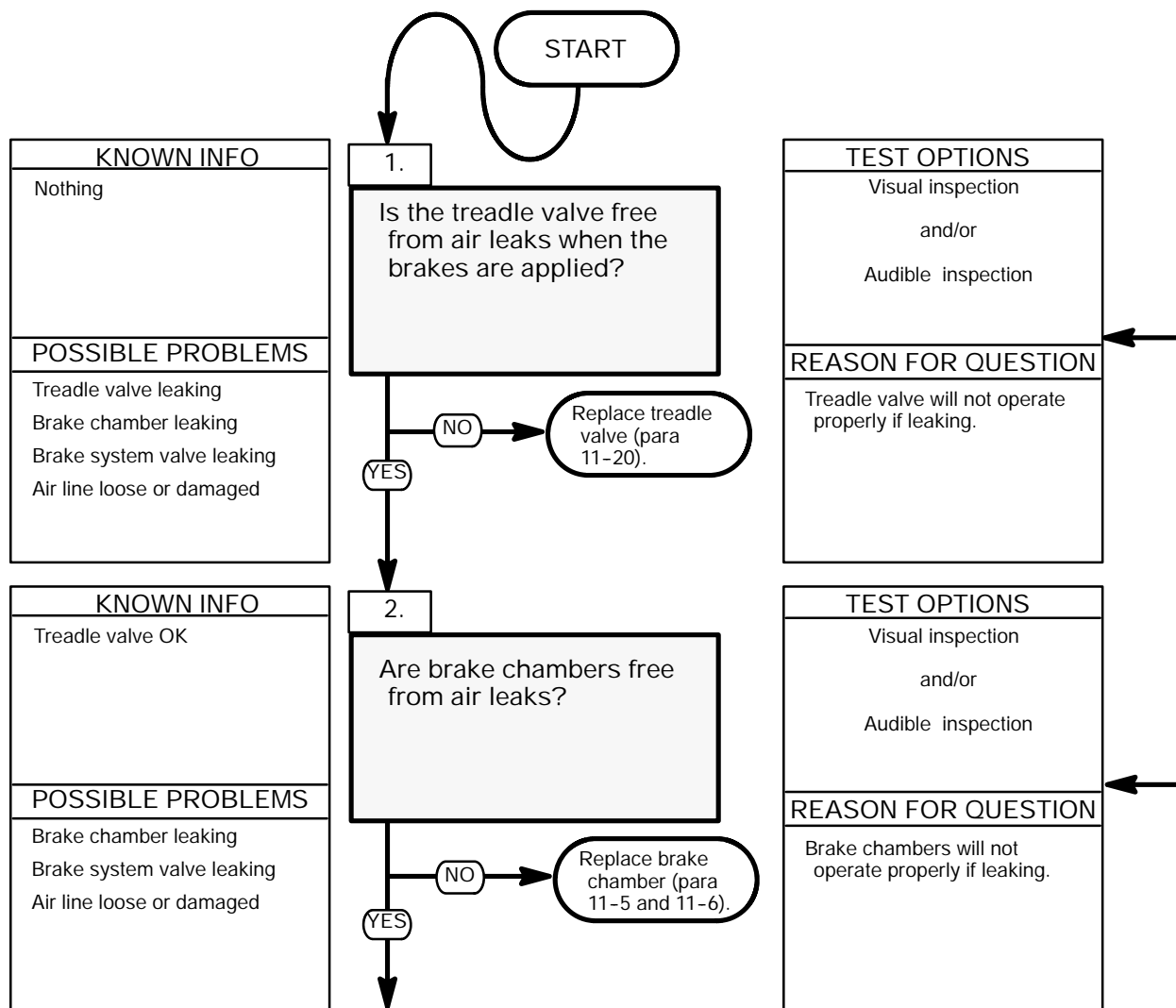


BRAKE CHAMBERS

Release service brakes
while assistant observes
the eight brake chambers.



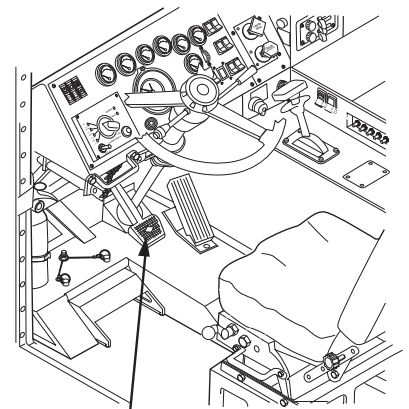
j6. EXCESSIVE LOSS OF AIR PRESSURE WHEN BRAKING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two



NOTE

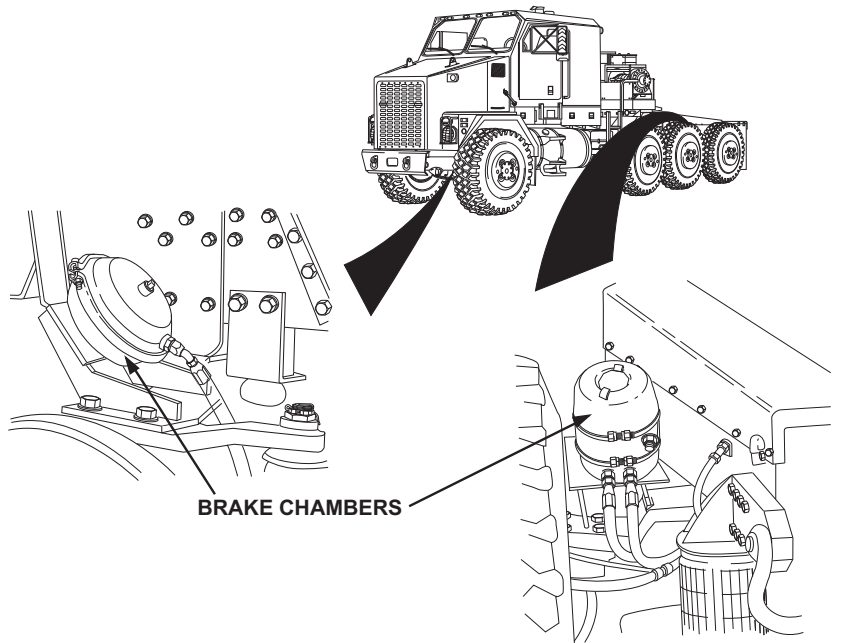
Air system pressure must be in the 90-125 psi operating range to begin brake system troubleshooting. If the air pressure cannot be maintained within operating range proceed to AIR SYSTEM TROUBLESHOOTING.

Press and hold treadle valve while checking for air leaks.



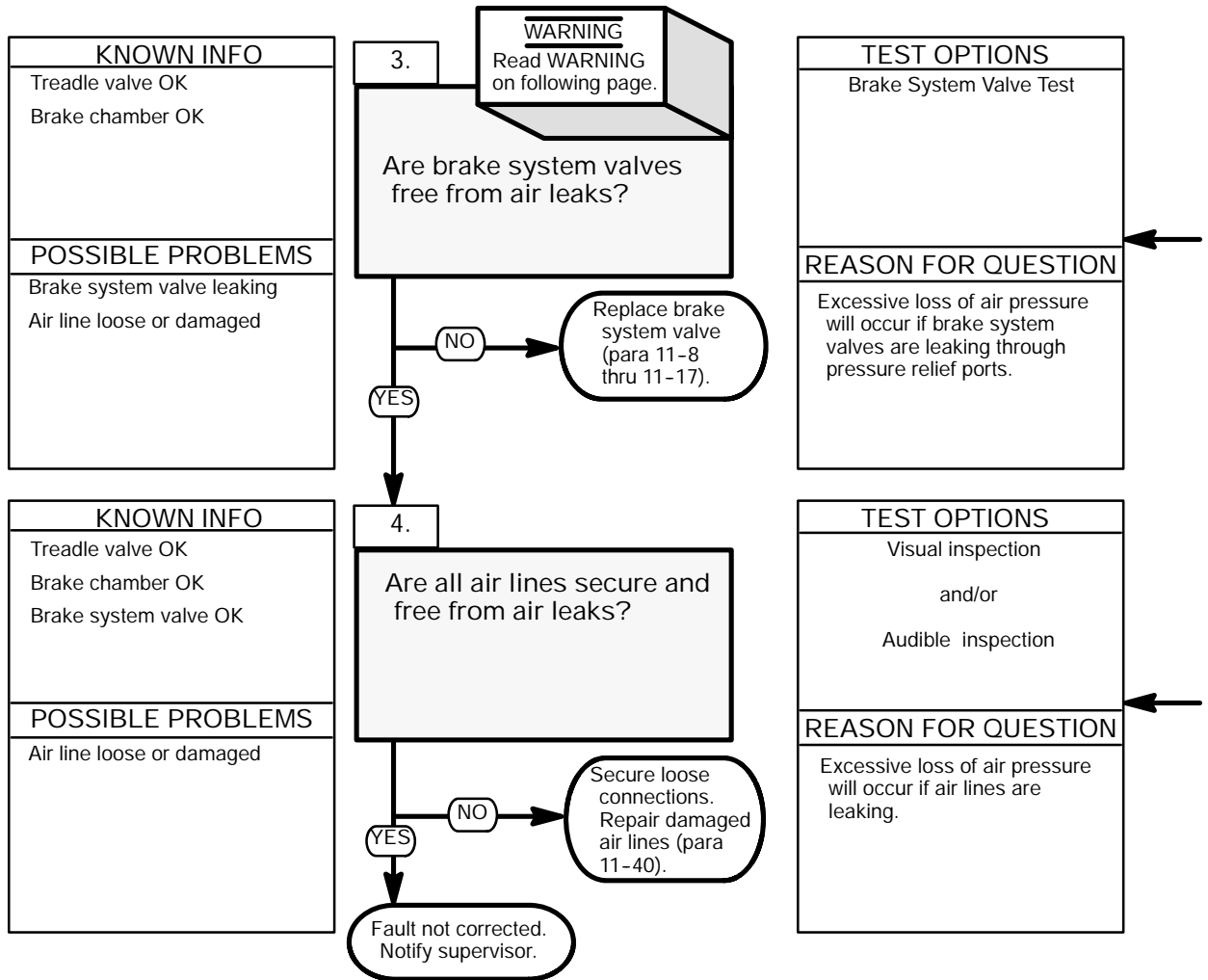
TREADLE VALVE

Press and hold treadle valve while assistant checks brake chambers for air leaks.



BRAKE CHAMBERS

j6. EXCESSIVE LOSS OF AIR PRESSURE WHEN BRAKING (CONT)



WARNING

Due to the air system pressure be sure to wear the proper eye protection to avoid personal injury. When working on parking brake control system vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

NOTE

Refer to brake air hose diagram (in front of this Troubleshooting section) for service relay valve locations.

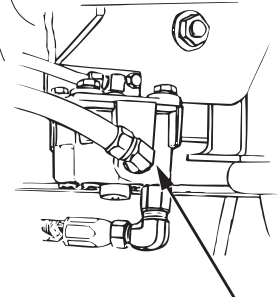
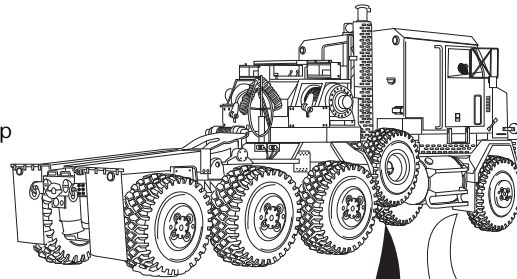
BRAKE SYSTEM VALVE TEST

- (1) Push in parking brake control.
- (2) Check service brake relay valves for air leaks, while assistant presses on treadle valve.
- (3) Pull out parking brake valve.

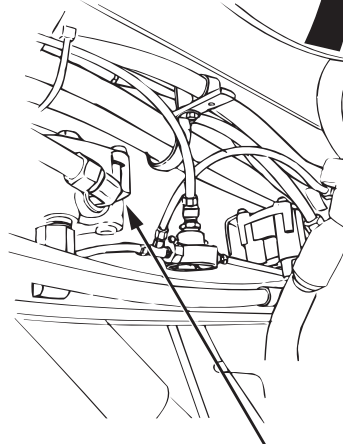
NOTE

Air system pressure must be in the 90-125 psi operating range to begin brake system troubleshooting. If the air pressure cannot be maintained within operating range proceed to AIR SYSTEM TROUBLESHOOTING.

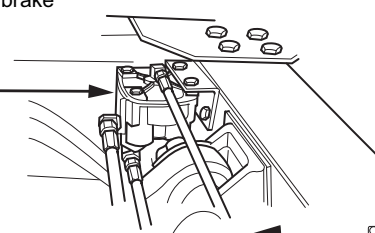
Operate treadle valve while assistant observes the air lines for audible noise or movement of the eight brake chambers.



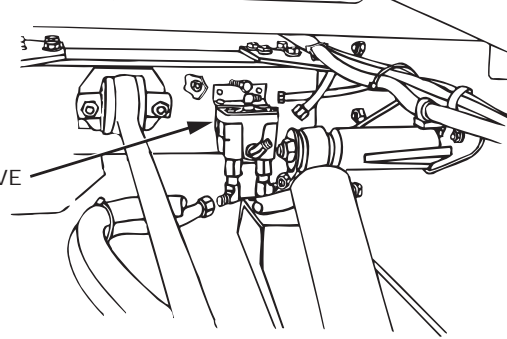
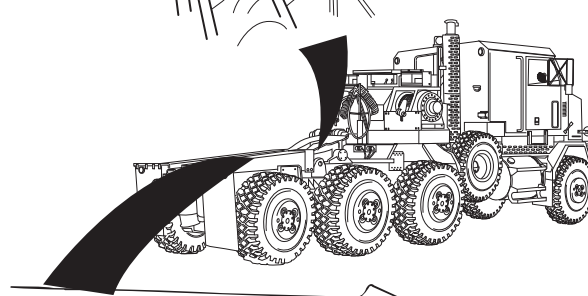
NO. 1 AXLE SERVICE RELAY VALVE



NO. 2 AXLE SERVICE RELAY VALVE

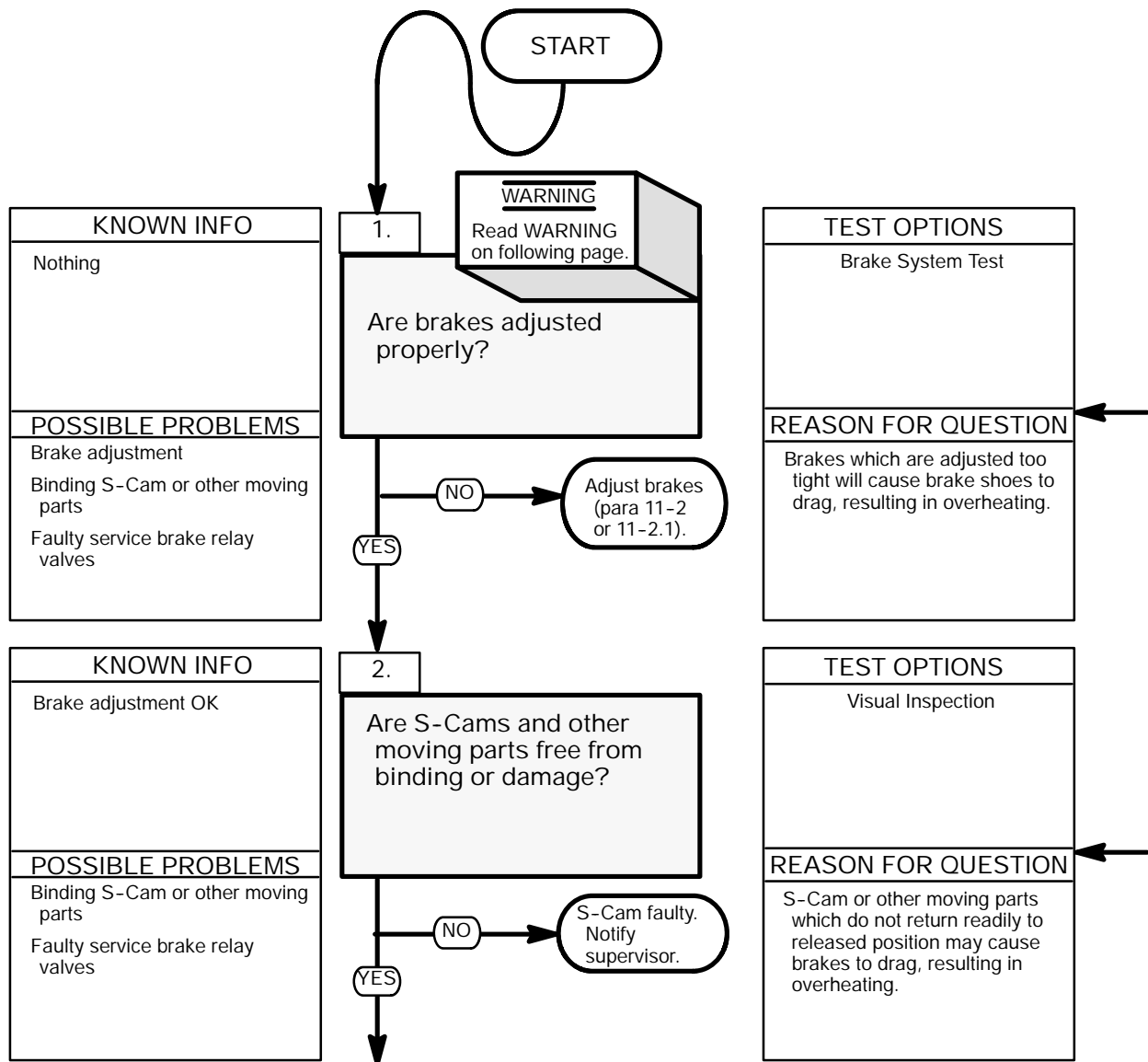


NO. 3 AXLE SERVICE RELAY VALVE



NO. 4 AXLE SERVICE RELAY VALVE

j7. BRAKE(S) OVERHEAT	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

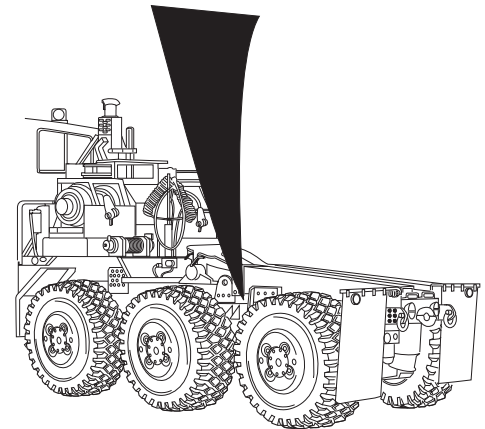
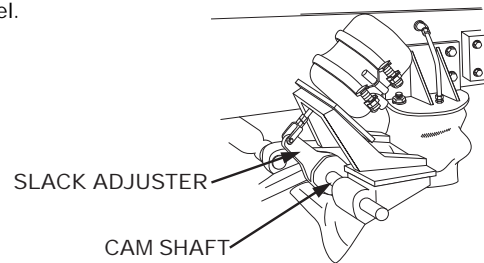


WARNING

Due to the air system pressure, be sure to wear proper eye protection to avoid personal injury. When working on parking brake control system vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

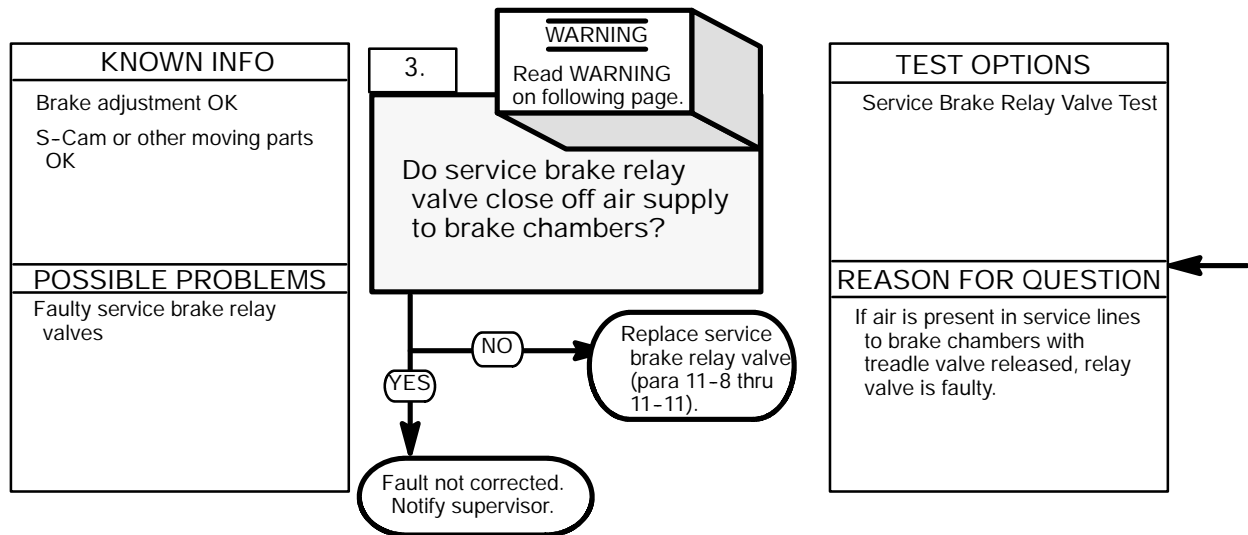
BRAKE SYSTEM TEST

- (1) Release parking brake (TM 9-2320-360-10).
- (2) Check for movement of slack adjusters while assistant applies and releases treadle valve.
- (3) Apply parking brake (TM 9-2320-360-10).



- (1) Remove brake drum(s) (para 11-3).
- (2) Check S-Cam and other moving parts for binding or damage.
- (3) Lubricate S-cam (LO 9-2320-360-12).

j7. BRAKE(S) OVERHEAT (CONT)



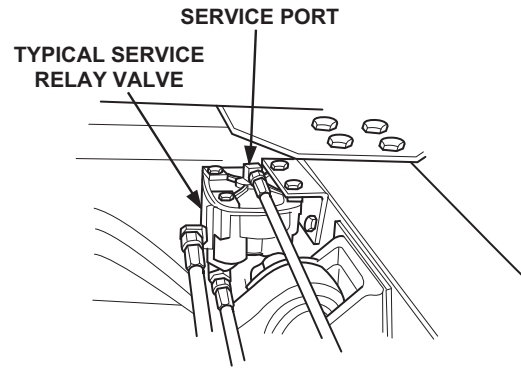
**SERVICE BRAKE RELAY VALVE
TEST**

- (1) Start engine (TM 9-2320-360-10).
- (2) Build up air pressure to 125 psi (862 kPa).
- (3) Release parking brake (TM 9-2320-360-10).
- (4) Apply and release service brake (TM 9-2320-360-10).

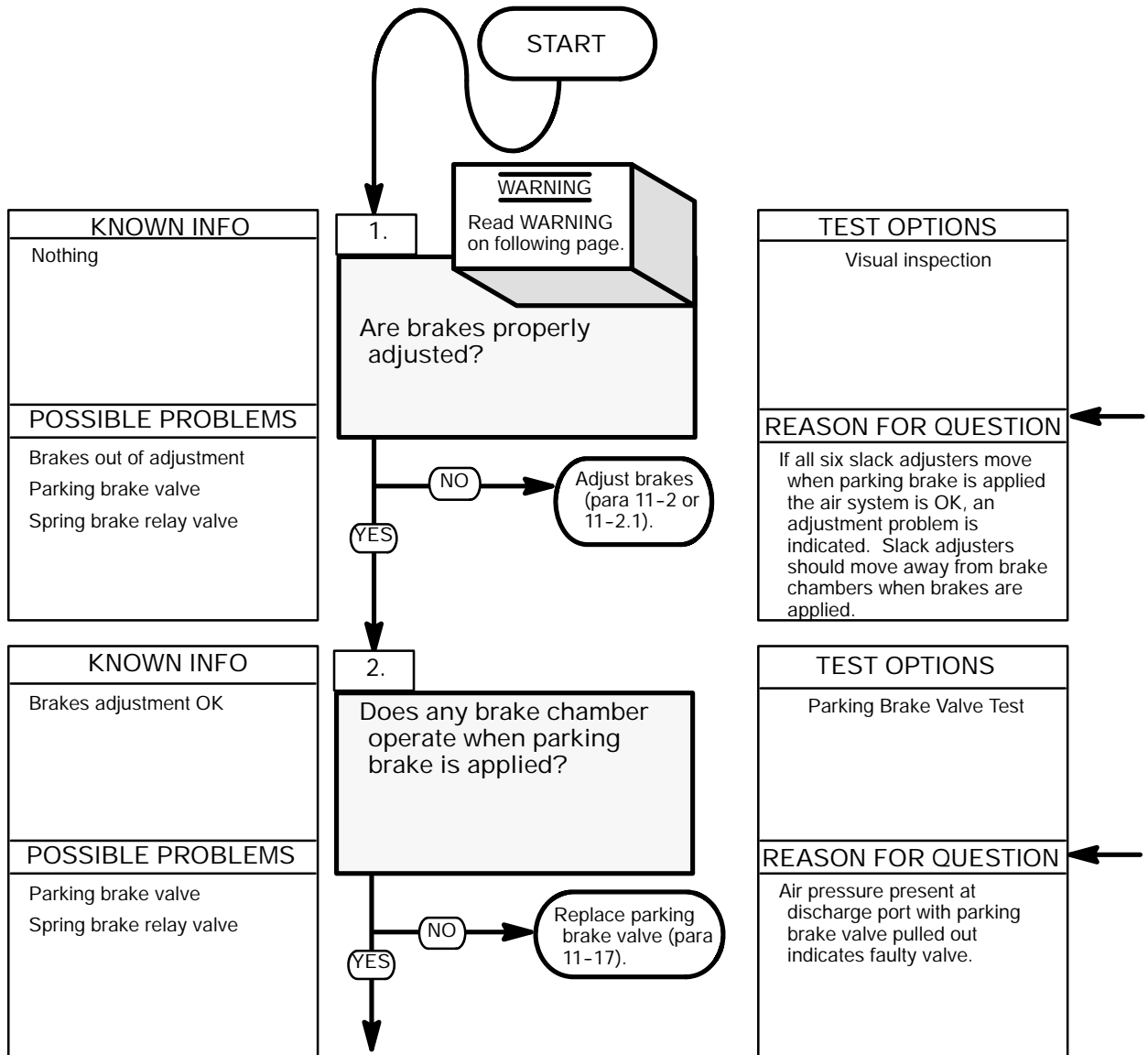
WARNING

Do not remove air line from relay valve. Air pressure may be present at air line. Failure to comply may result in injury to personnel.

- (5) Shut off engine (TM 9-2320-360-10).
- (6) Loosen air line on service port of service brake relay valve. No air should be present.
- (7) Tighten air line on service port of service brake relay valve.
- (8) Apply parking brake (TM 9-2320-360-10).



j8. SPRING BRAKE(S) WILL NOT APPLY			
<p>INITIAL SETUP</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none;"> <p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p> </td> <td style="width: 50%; vertical-align: top; border: none;"> <p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two</p> </td> </tr> </table>		<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two</p>
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two</p>		



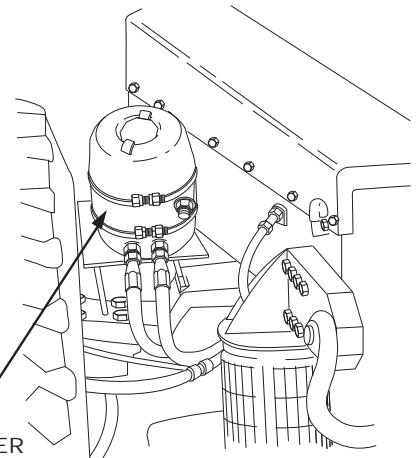
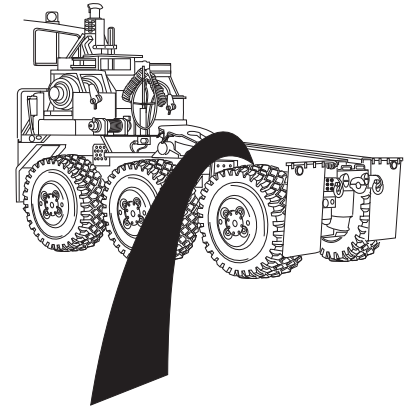
WARNING

Due to the air system pressure, be sure to wear the proper eye protection to avoid personal injury. When working on parking brake control system, vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.

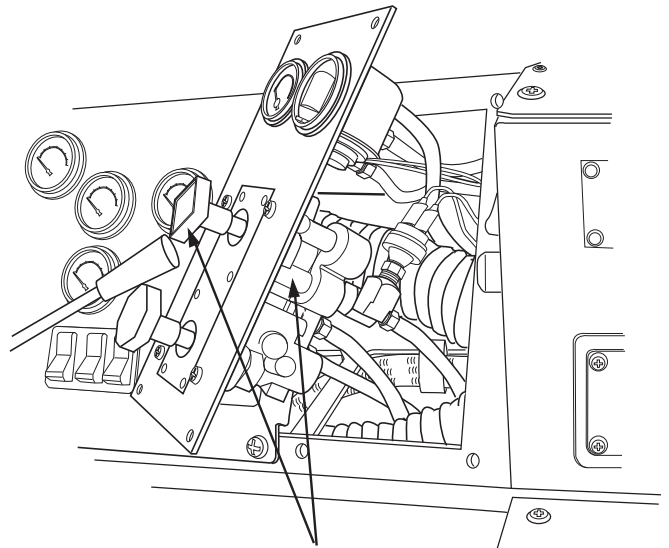
Apply parking brake while assistant observes the six spring brake chambers.

PARKING BRAKE VALVE TEST

- (1) Loosen hose no. 2612 on parking brake valve and check for air escaping.
- (2) Tighten hose no. 2612 on parking brake valve.

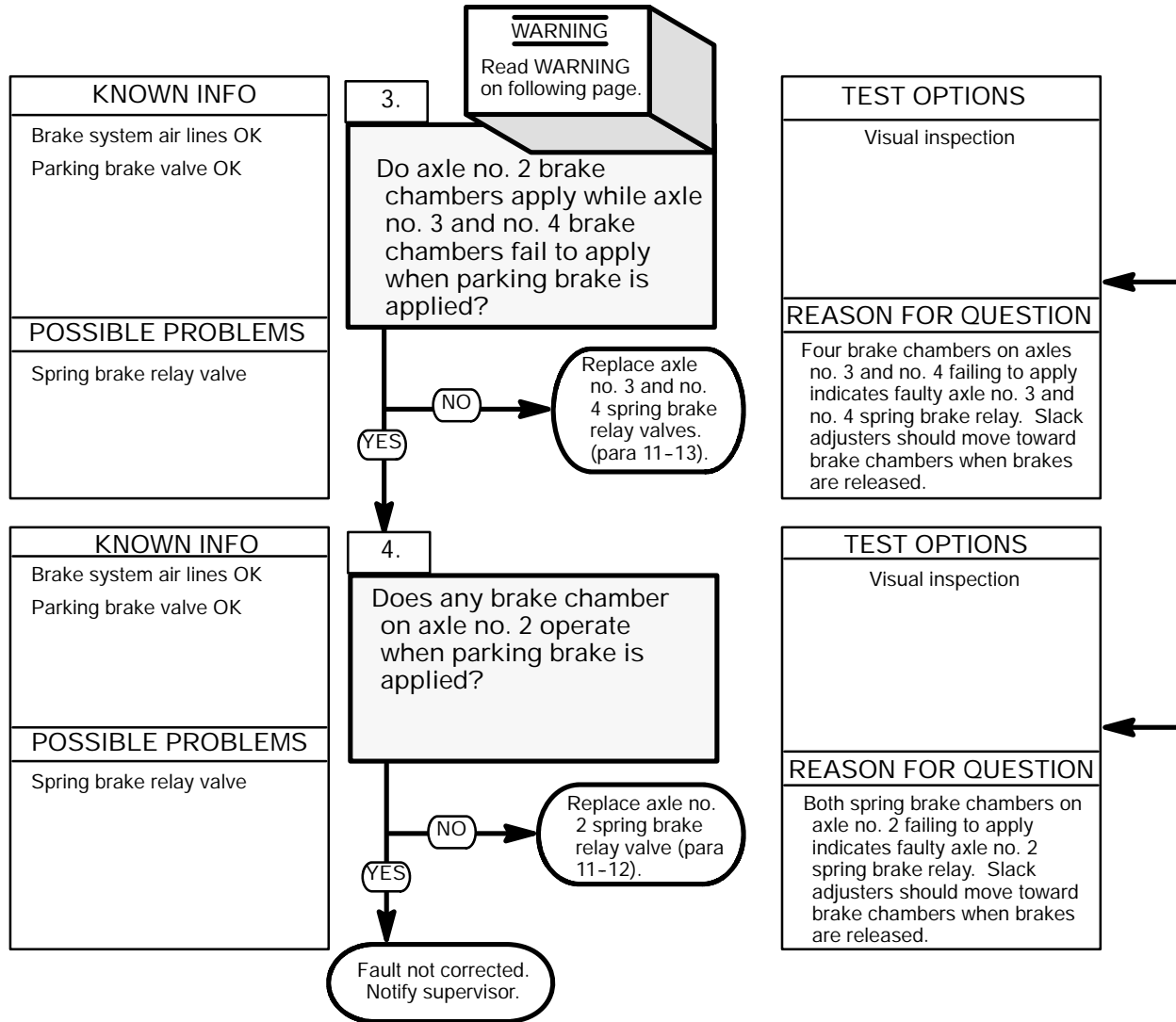


SPRING BRAKE CHAMBER



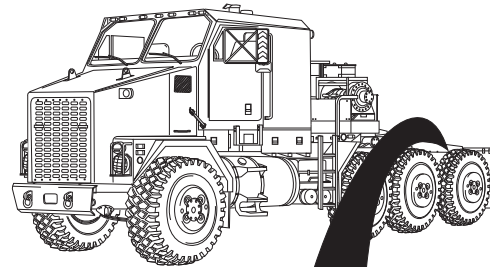
PARKING BRAKE VALVE

j8. SPRING BRAKE(S) WILL NOT APPLY (CONT)



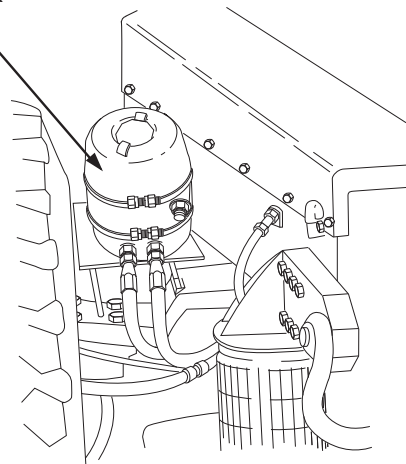
WARNING

Due to the air system pressure, be sure to wear the proper eye protection to avoid personal injury. When working on parking brake control system, vehicle may roll. Vehicle must be parked on level ground. Wheel chocks must be positioned in front of and behind one of the rear wheels to keep it from rolling. Failure to comply may cause serious injury or death to personnel.



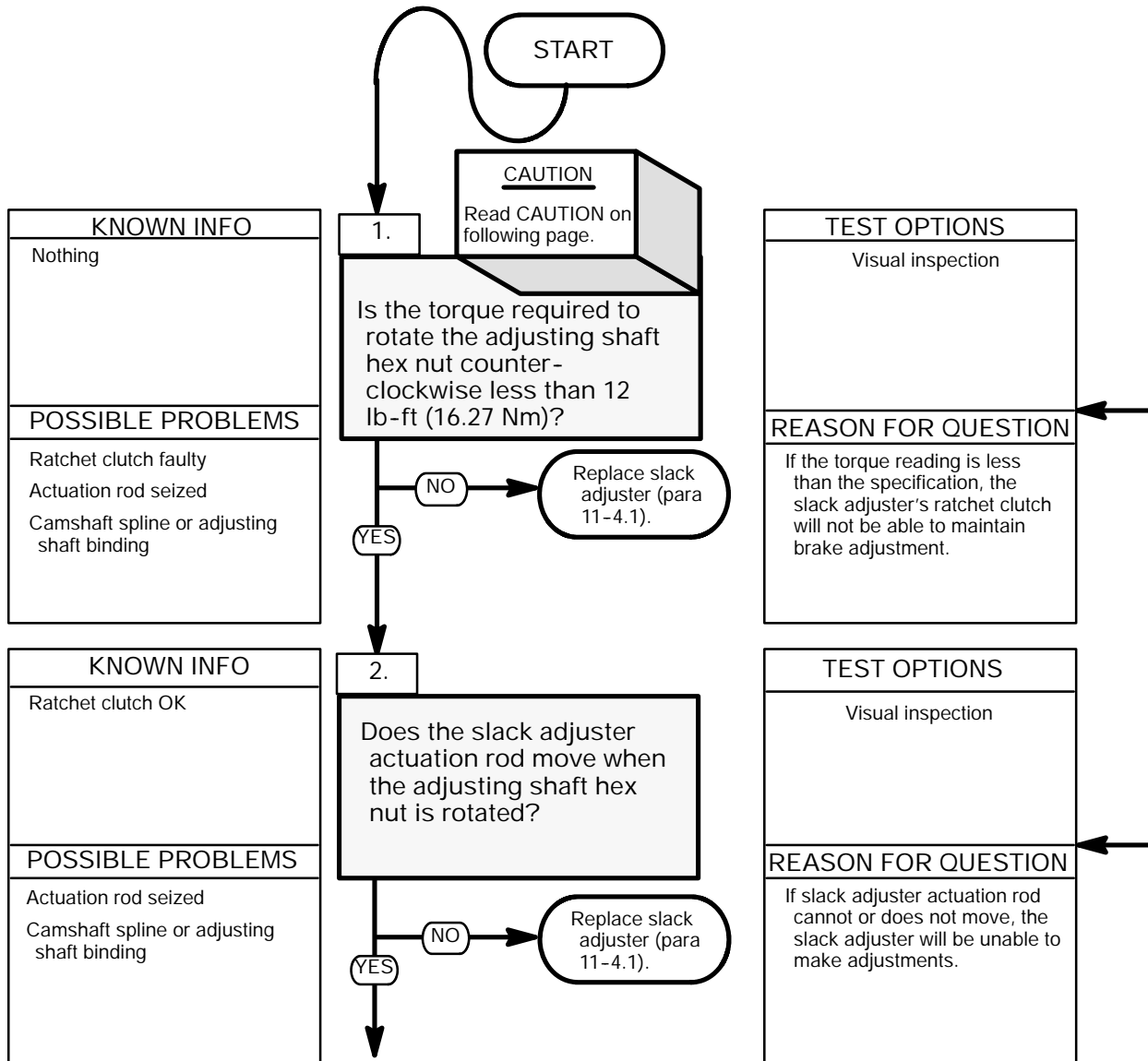
Push in parking valve while assistant observes spring brake chambers.

SPRING BRAKE CHAMBER



Push in parking valve while assistant observes spring brake chambers.

j9. AUTOMATIC SLACK ADJUSTER DOES NOT OPERATE			
<p>INITIAL SETUP</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none;"> <p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p> </td> <td style="width: 50%; vertical-align: top; border: none;"> <p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Wrench, Torque 0-200 lb-in (Item 72, Appendix F)</p> </td> </tr> </table>		<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Wrench, Torque 0-200 lb-in (Item 72, Appendix F)</p>
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Wrench, Torque 0-200 lb-in (Item 72, Appendix F)</p>		



CAUTION

Automatic slack adjusters cannot be disassembled. Never attempt to repair the assembly. Failure to comply may result in damage to slack adjuster.

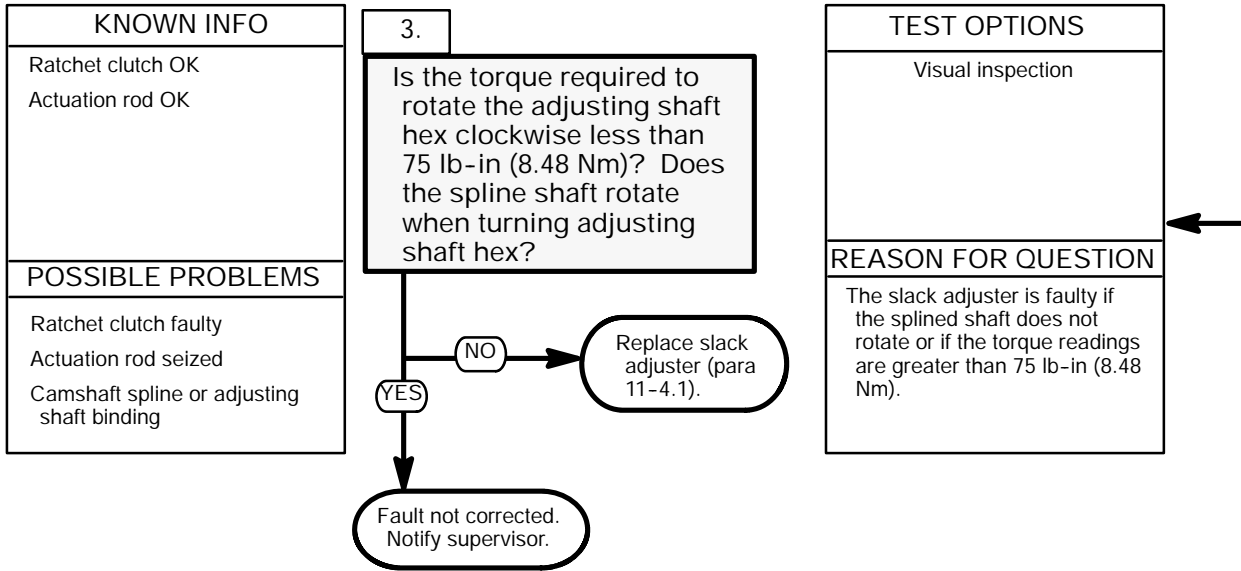
NOTE

This troubleshooting fault should only be used to troubleshoot Model A automatic slack adjusters.

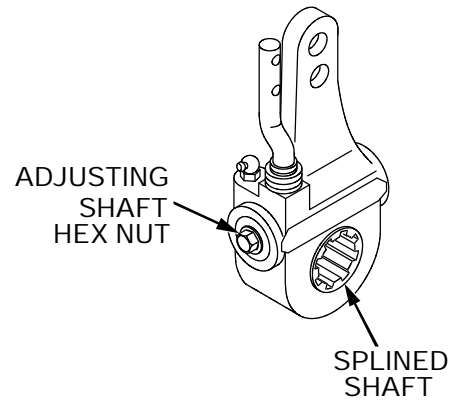
Using a torque wrench, turn the adjusting shaft hex nut counter-clockwise. The torque will increase to a peak value, then return to zero as the ratchet clutch disengages. Observe the peak reading displayed on the torque wrench.

- (1) Remove slack adjuster (para 11-4.1).
- (2) Rotate the adjusting shaft hex nut. A quarter turn of the adjusting shaft hex nut will result in full movement of the actuation shaft.
- (3) Observe whether actuation rod moves as slight force is used to turn the adjusting shaft. Turning the adjusting shaft clockwise will move the actuation rod into the slack adjuster; turning the shaft counter-clockwise will move the rod out.

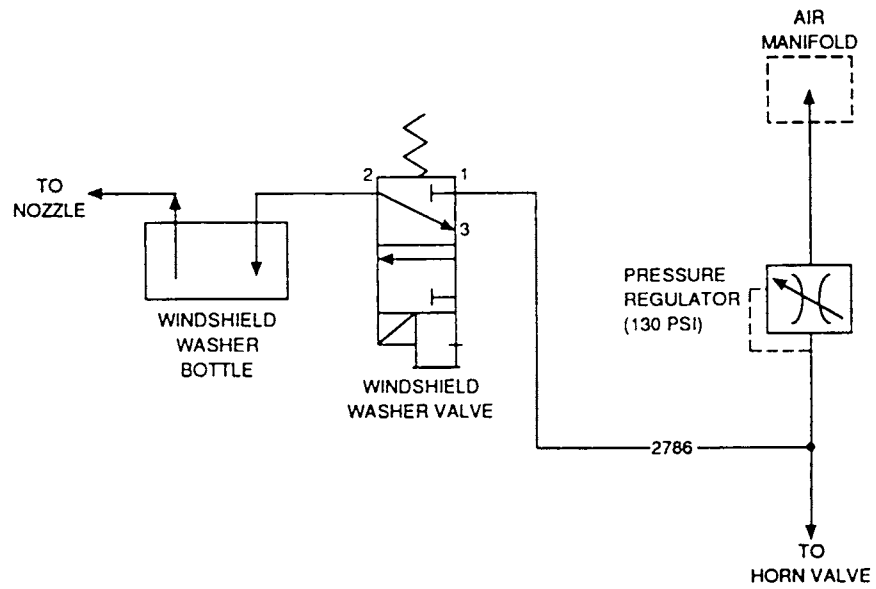
j9. AUTOMATIC SLACK ADJUSTER DOES NOT OPERATE (CONT)

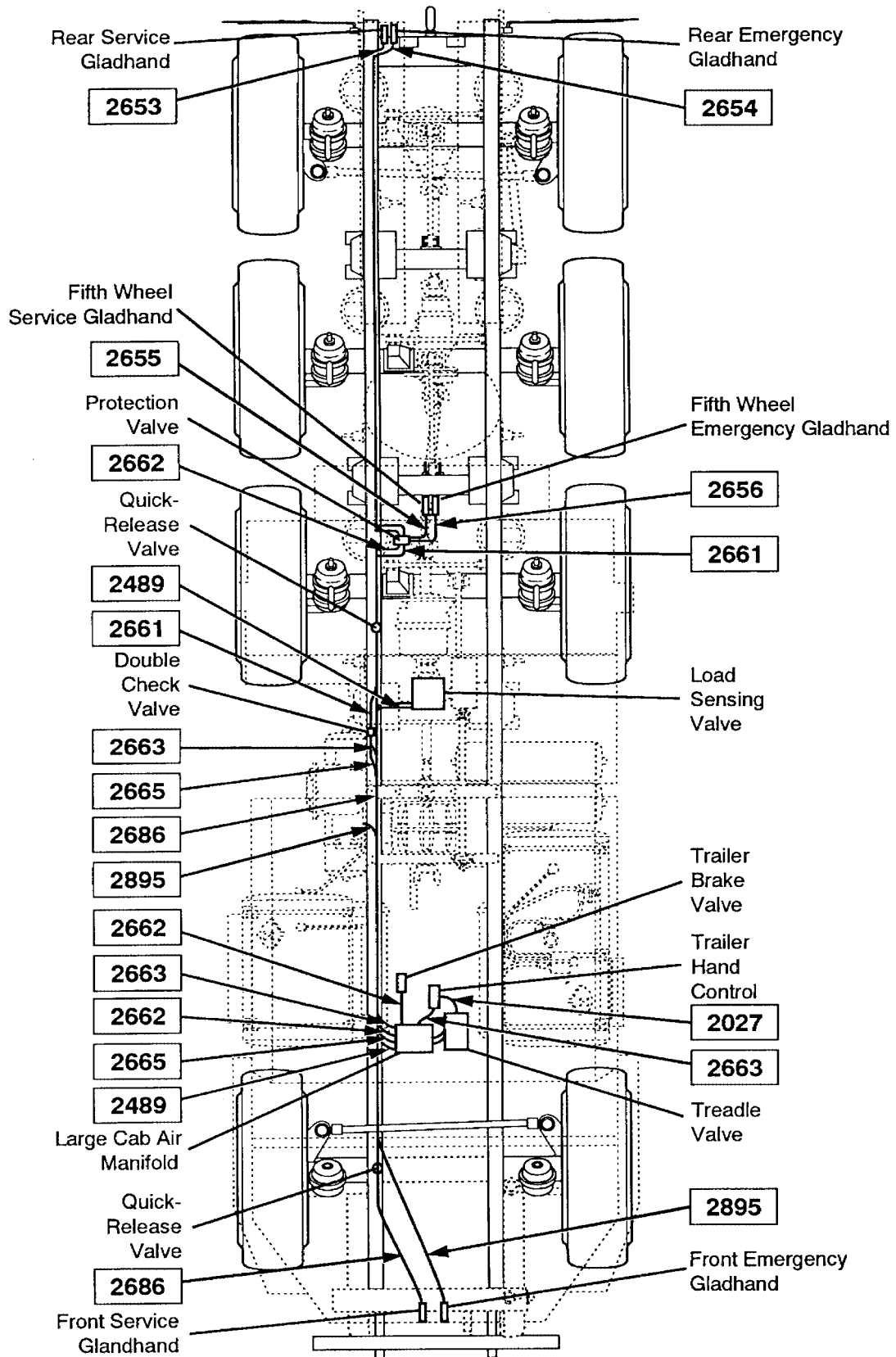


- (1) Using a torque wrench, rotate the adjusting shaft hex nut thru six full revolutions. The torque will increase to peak value, then return to zero several times during each revolution.
- (2) Note the torque readings and movement of the splined shaft while rotating adjusting shaft.
- (3) Install slack adjuster (para 11-4.1).

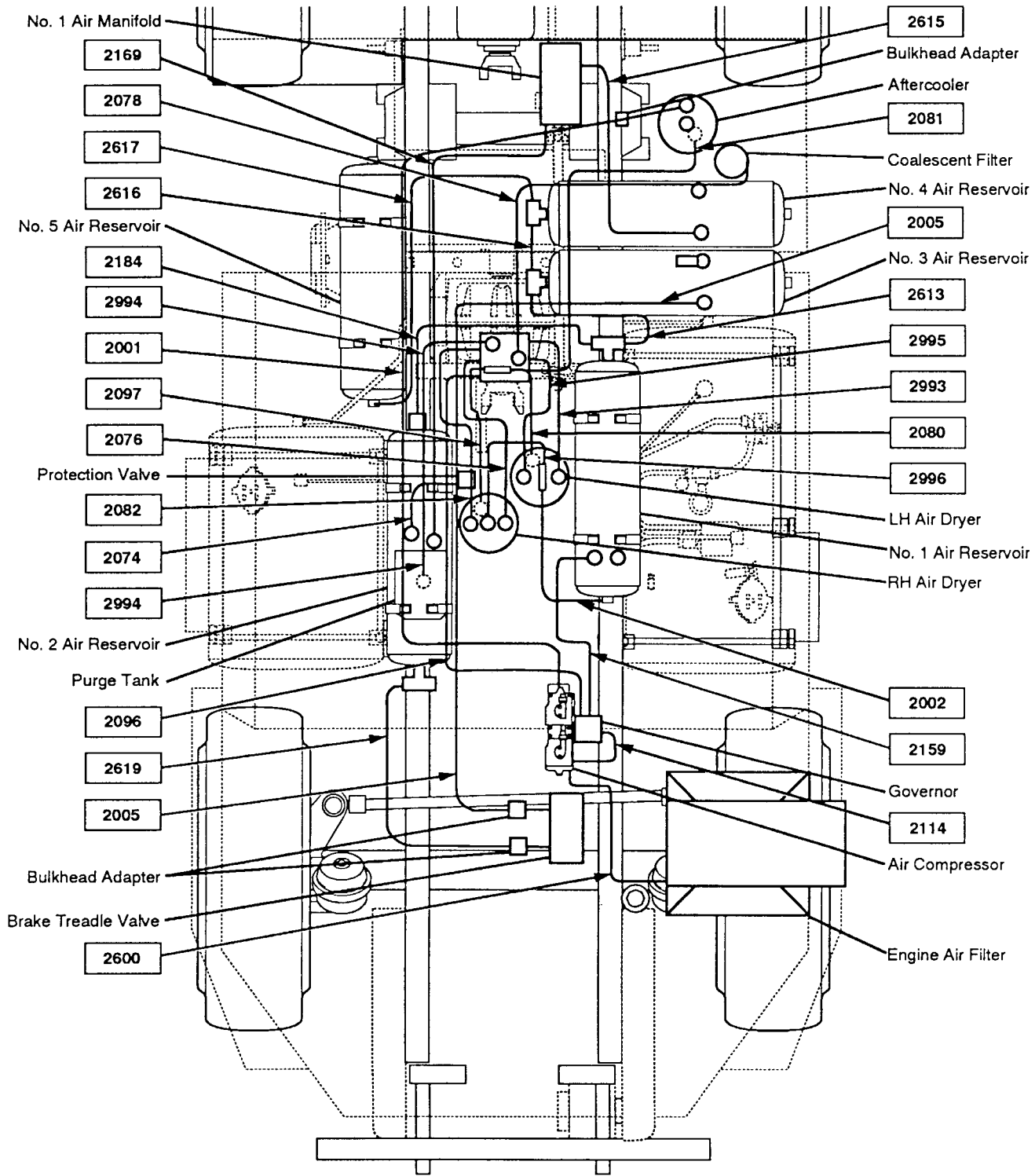


WINDSHIELD WASHER SYSTEM

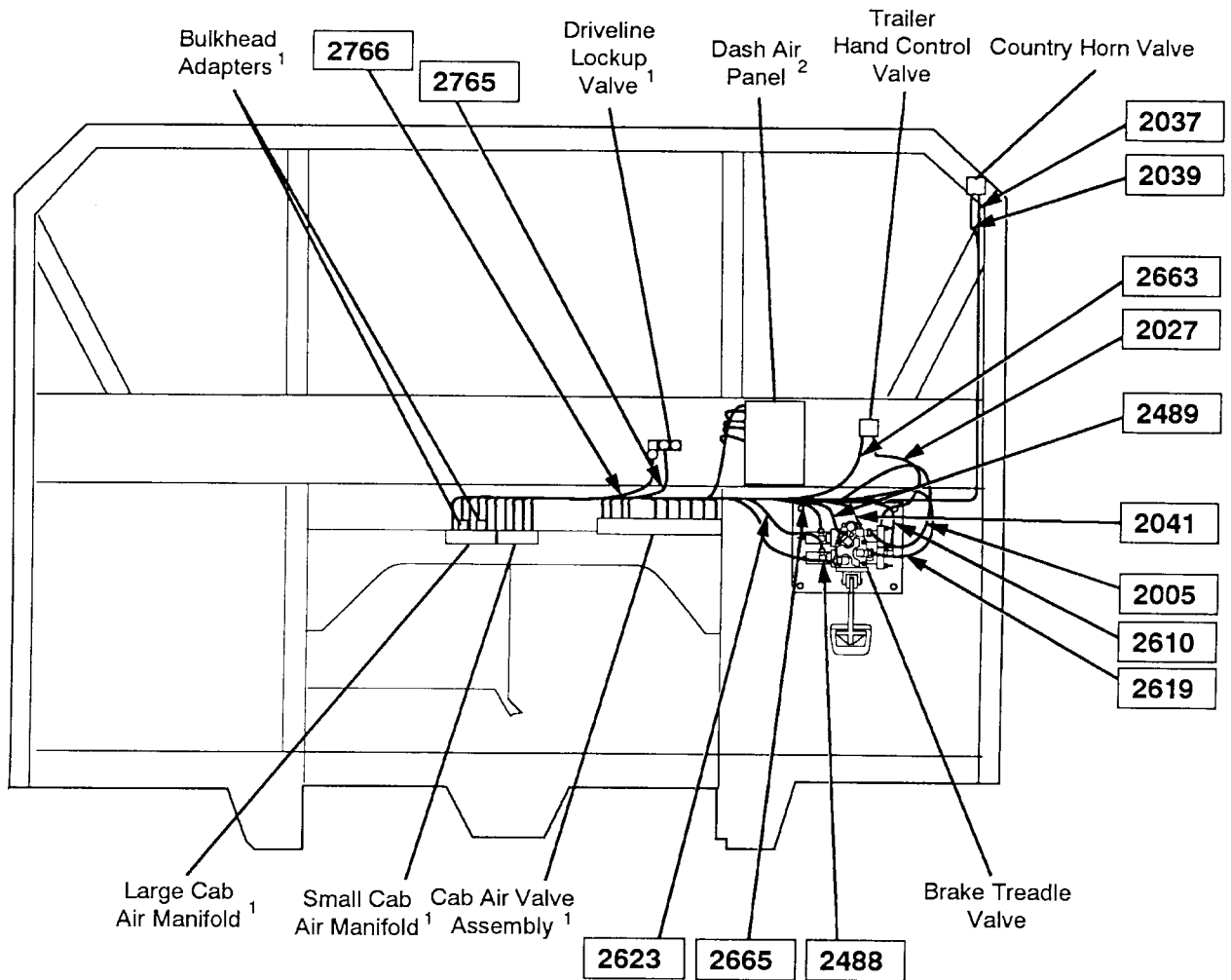




Emergency/Service Air Hoses



Air Supply Hose Diagram

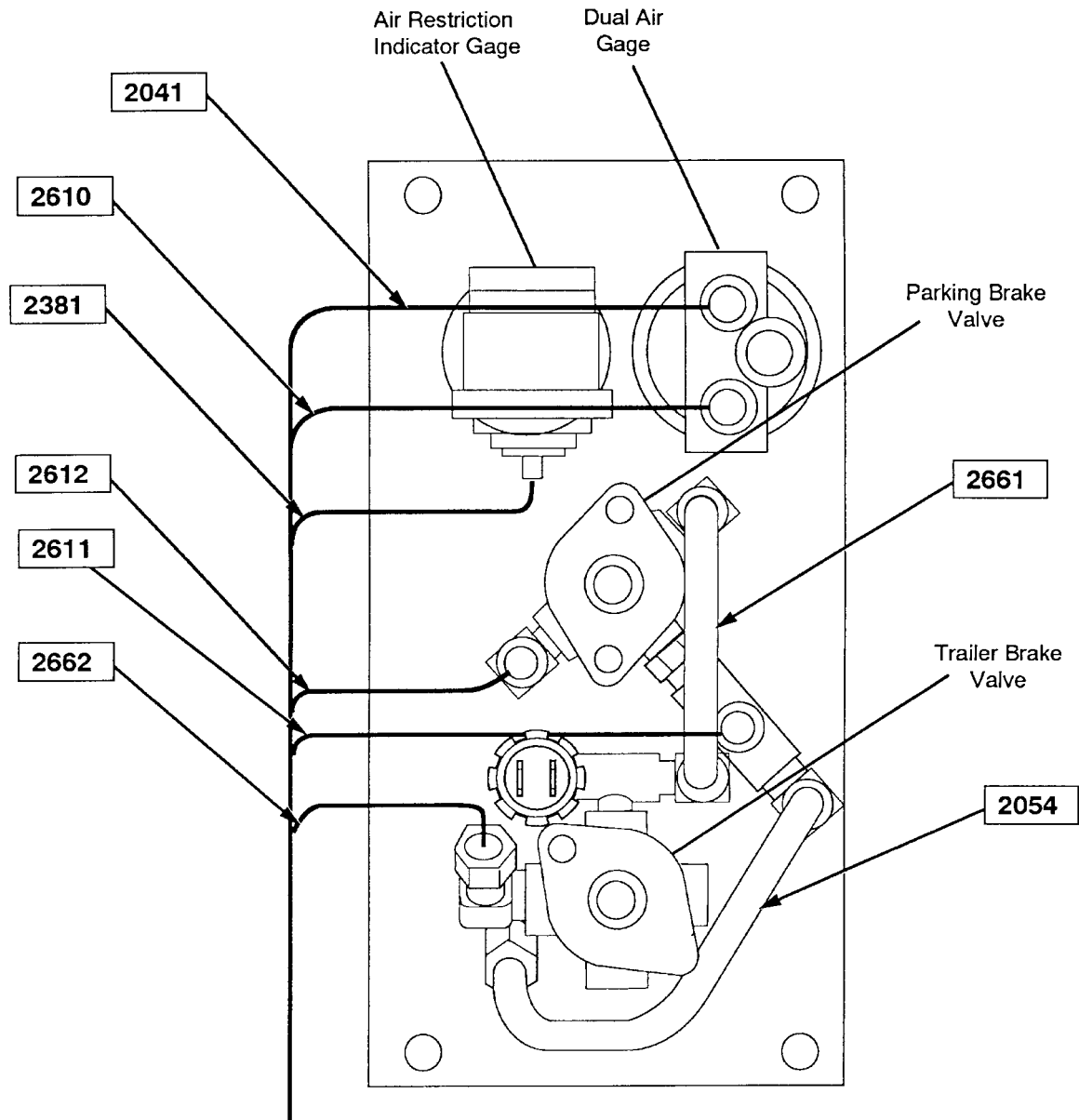


Notes:

- 1) See sheet 2 for detail.
- 2) See sheet 3 for detail.

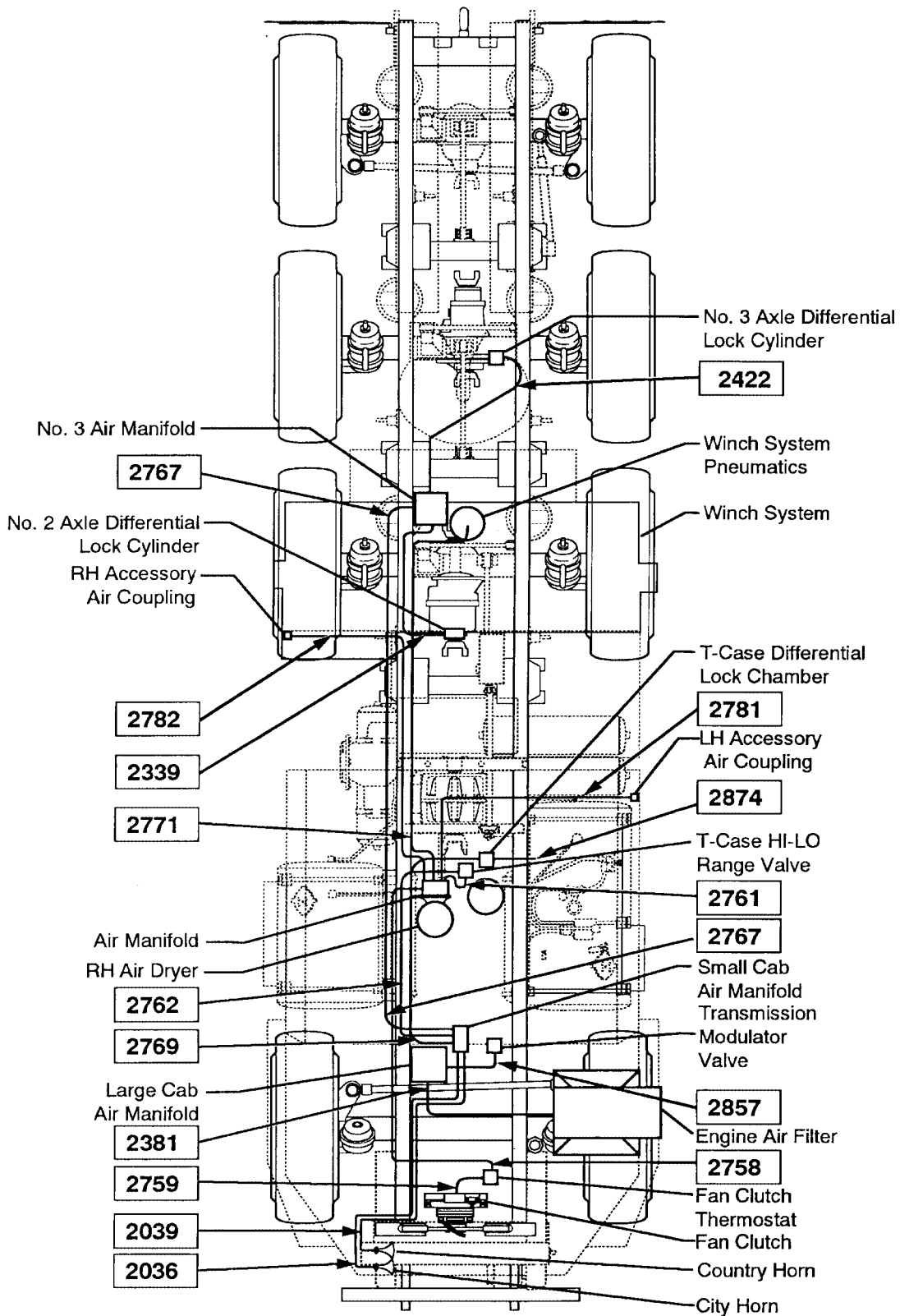
Front View of Cab Interior

Cab Air Hose Diagram (sheet 1 of 3)

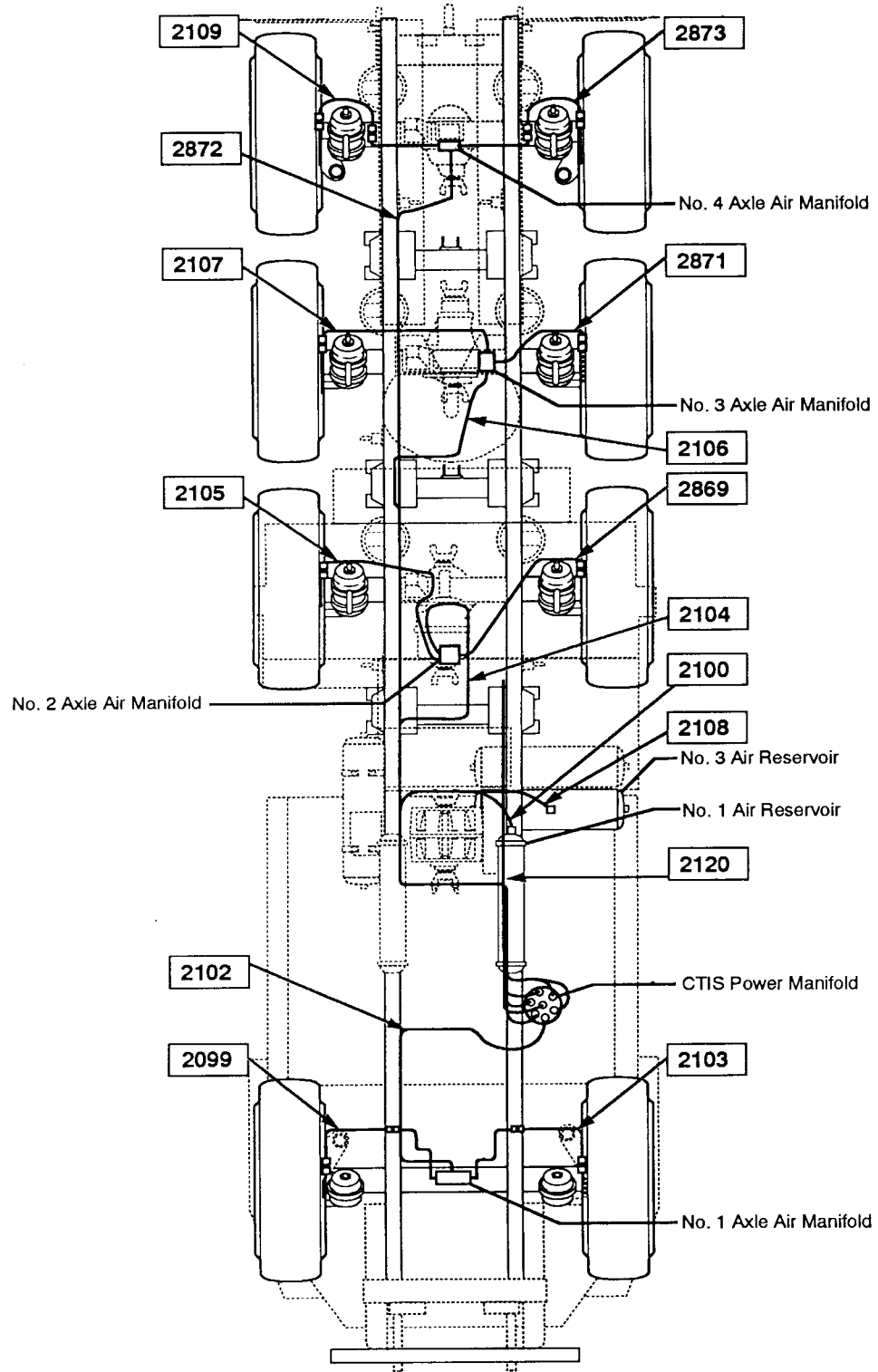


View of Dash Air Panel From Inside

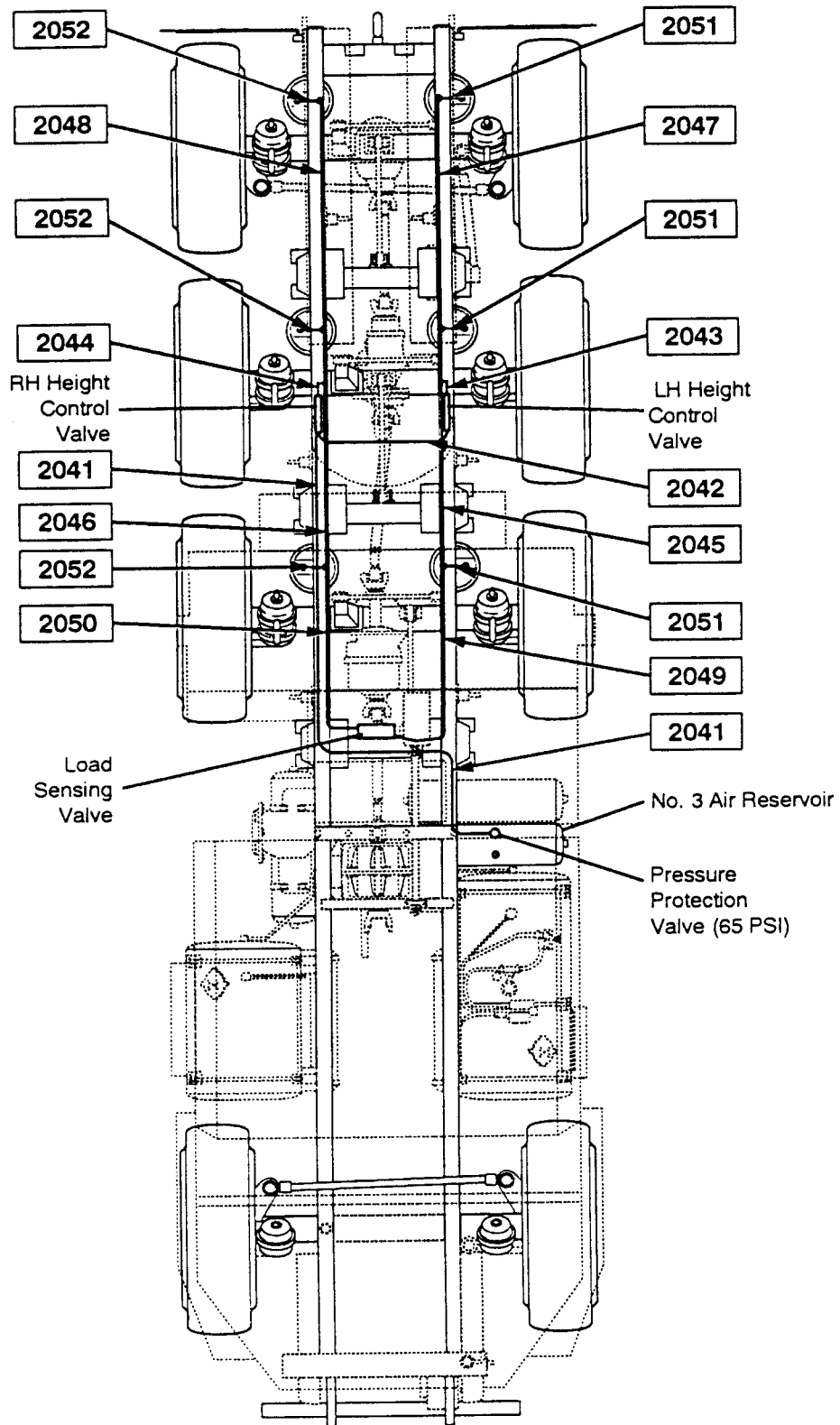
Cab Air Hose Diagram (sheet 3 of 3)



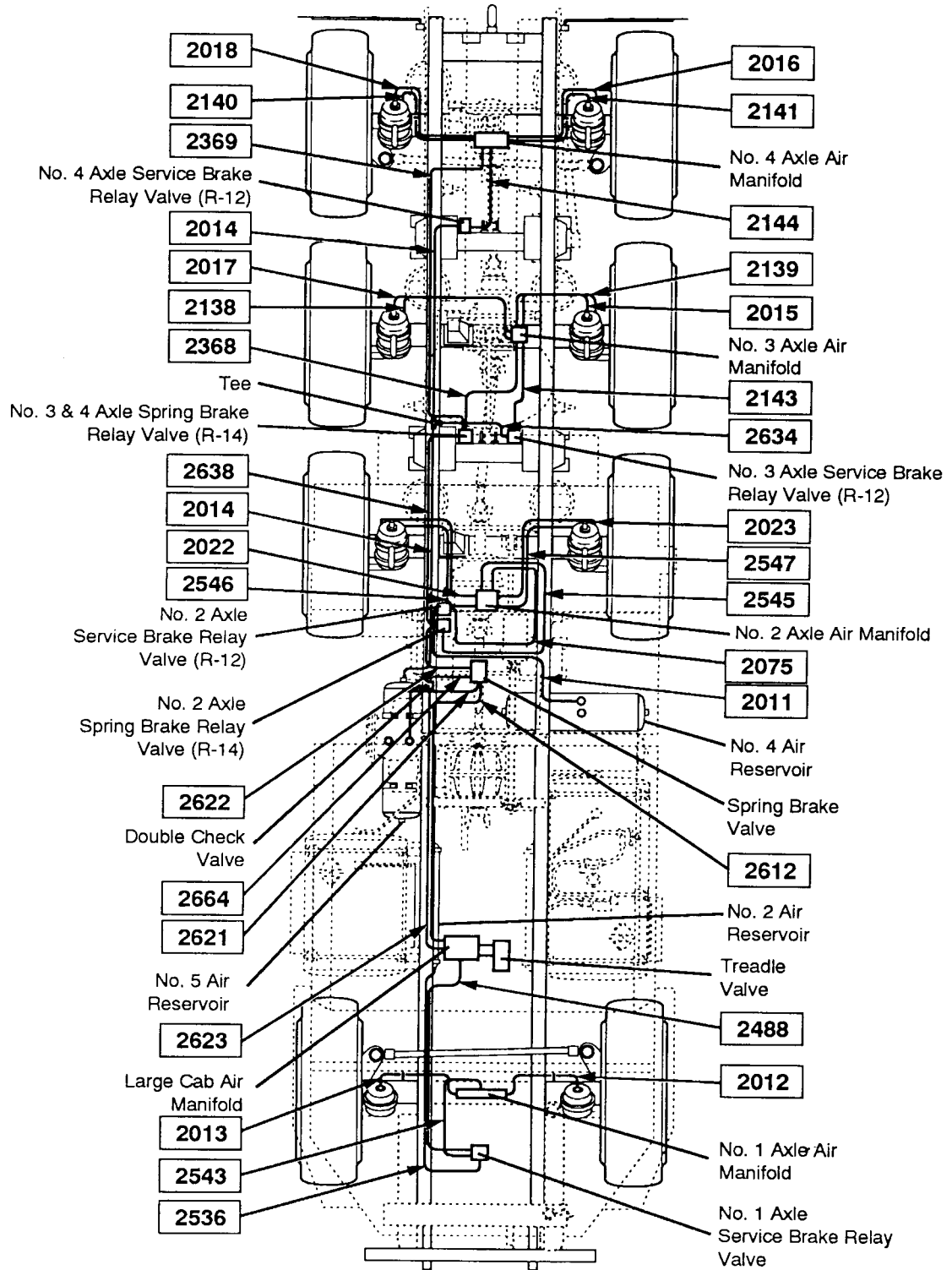
Accessory Air Hoses (Chassis/Engine)



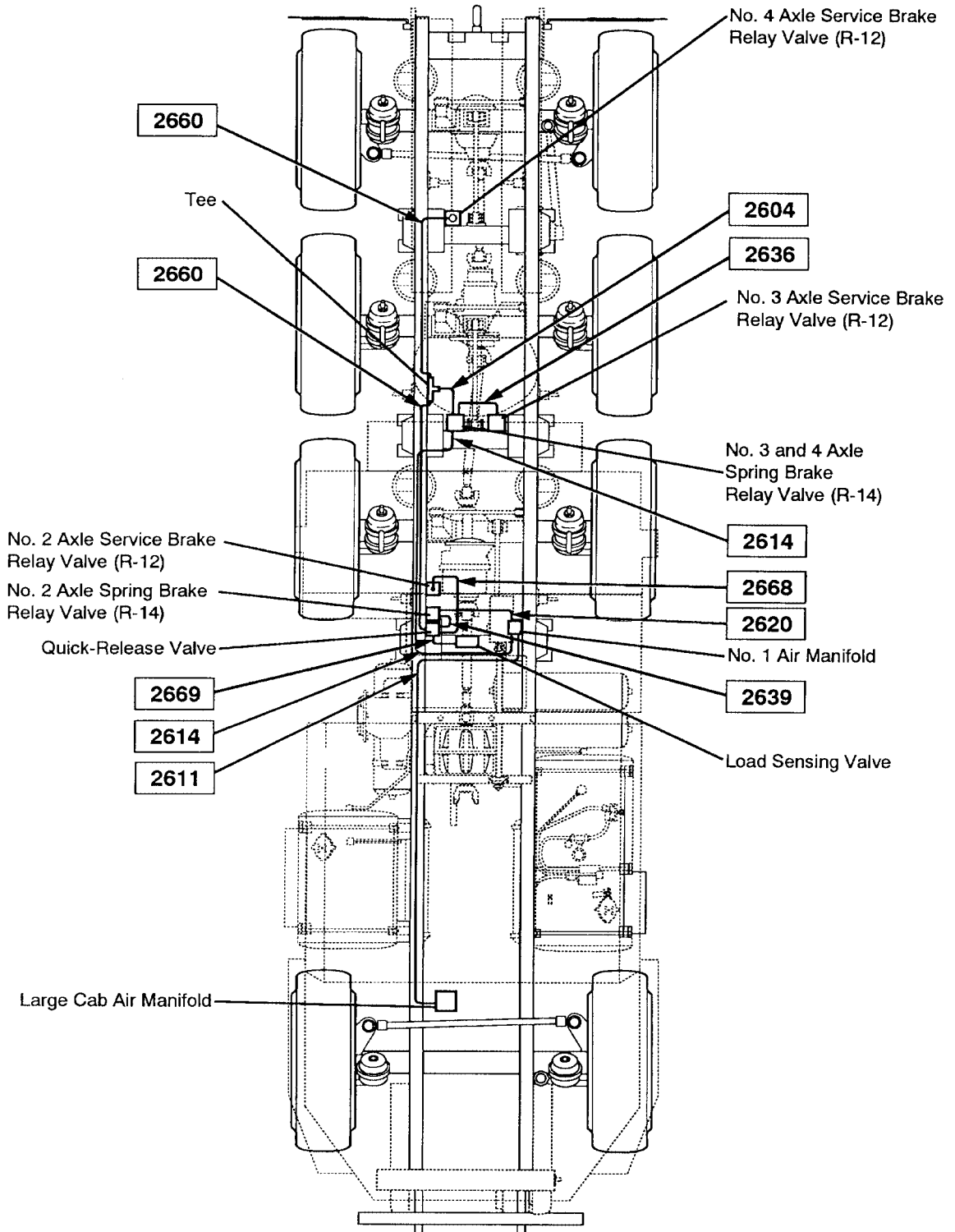
CTIS Air Hose Diagram



Suspension Air Hoses



Brake Air Hose Diagram (sheet 1 of 2)

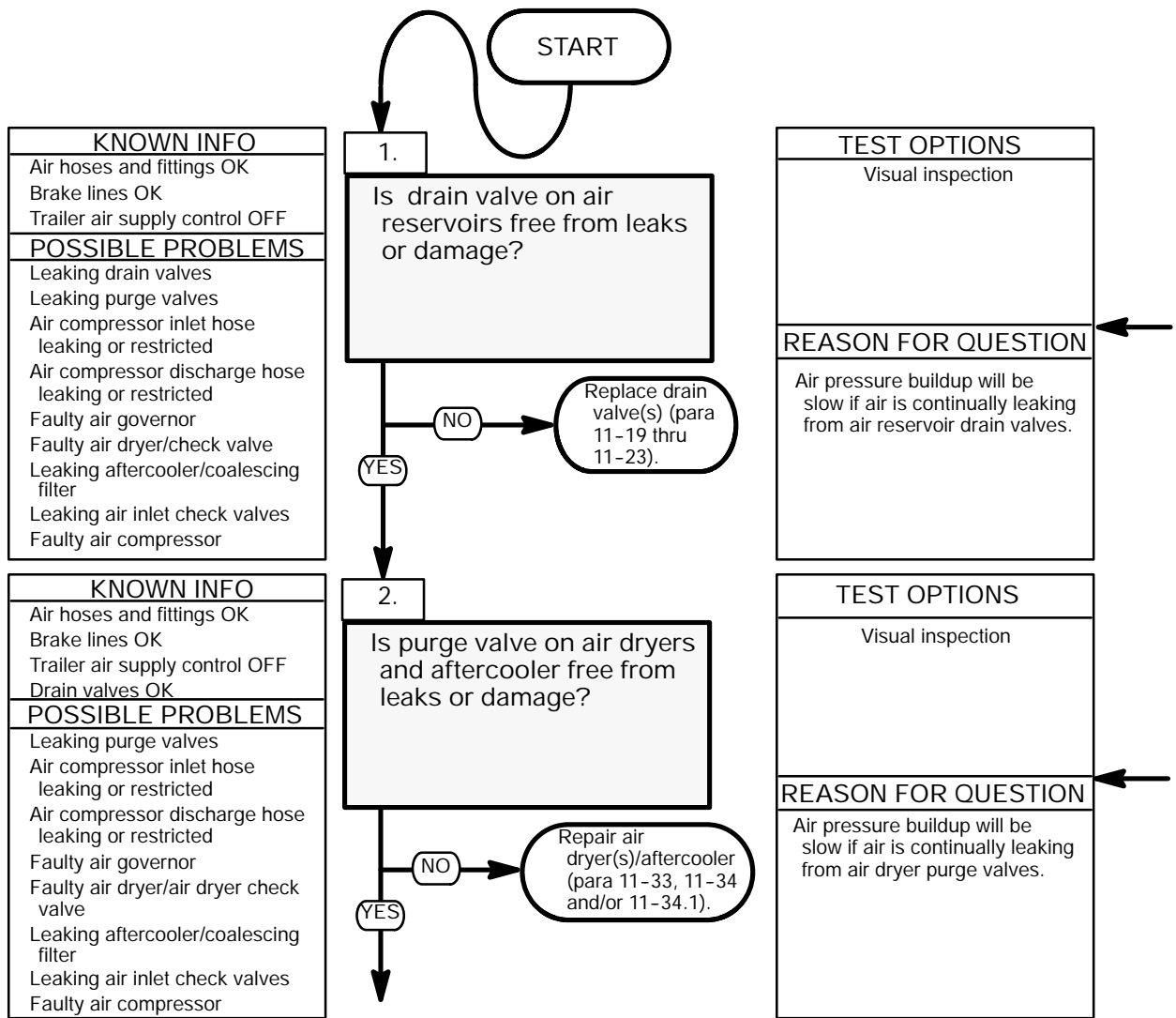


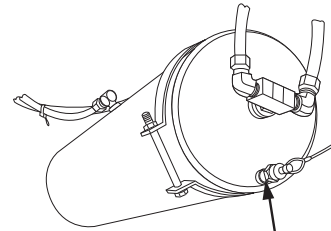
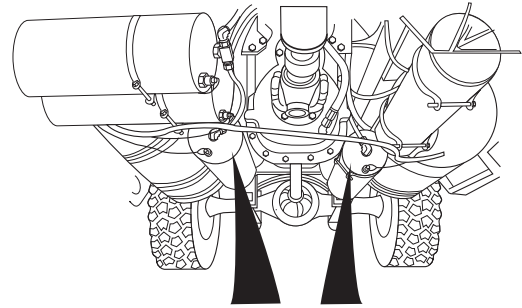
Brake Air Hose Diagram (sheet 2 of 2)

k. AIR SYSTEM

<u>Malfunction</u>	<u>Troubleshooting Procedure (Page)</u>
<u>k1. Air system loses pressure during operation or air pressure buildup is slow . . .</u>	<u>2-750</u>
<u>k2. Large quantity of moisture expelled from reservoirs</u>	<u>2-758</u>
<u>k3. Air dryer(s) continually purge</u>	<u>2-762</u>
<u>k3.1. Air dryer(s) fail to purge</u>	<u>2-762.4</u>
<u>k4. Relief valve on air dryer releasing air</u>	<u>2-764</u>
<u>k4.1. Relief valve on aftercooler releasing air</u>	<u>2-765.1</u>
<u>k5. Compressor fails to unload. (Air system pressure builds up to more than 125 psi (862 kPa))</u>	<u>2-766</u>
<u>k6. Noisy air compressor operation</u>	<u>2-768</u>
<u>k7. Coolant and/or lubricant leaks from compressor</u>	<u>2-772</u>
<u>k8. Air pressure drops rapidly after engine shutdown</u>	<u>2-776</u>
<u>k9. Windshield washer does not operate</u>	<u>2-780</u>
<u>k10. Horn (country) does not operate</u>	<u>2-786</u>
<u>k11. Horn (city) does not operate</u>	<u>2-790</u>
<u>k12. Transfer case does not engage front axle when transfer case shift lever is positioned to LOW</u>	<u>2-796</u>
<u>k13. Transfer case does not engage front axle when transfer case shift lever is positioned to HIGH and driveline control is positioned to LOCK</u>	<u>2-800</u>

k1. AIR SYSTEM LOOSES PRESSURE DURING OPERATION OR AIR PRESSURE BUILDUP IS SLOW	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



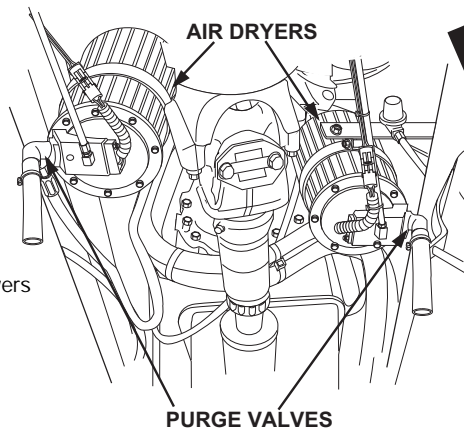
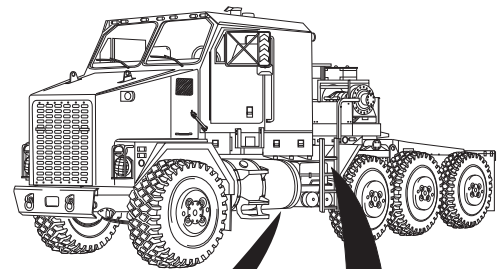


DRAIN VALVE

NOTE

It takes approximately eight to ten minutes for air pressure to increase from 0 psi (0 kPa) to 125 psi (862 kPa) when engine is at idle.

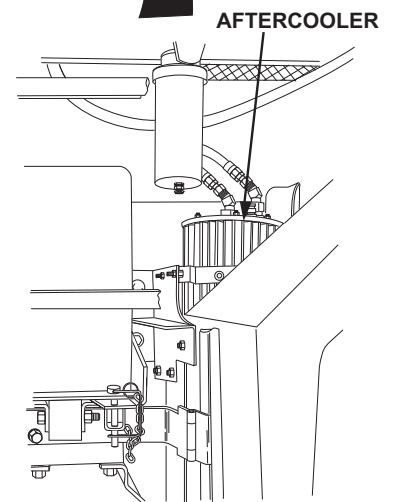
Check drain valve on air reservoirs for air leakage and damage.



AIR DRYERS

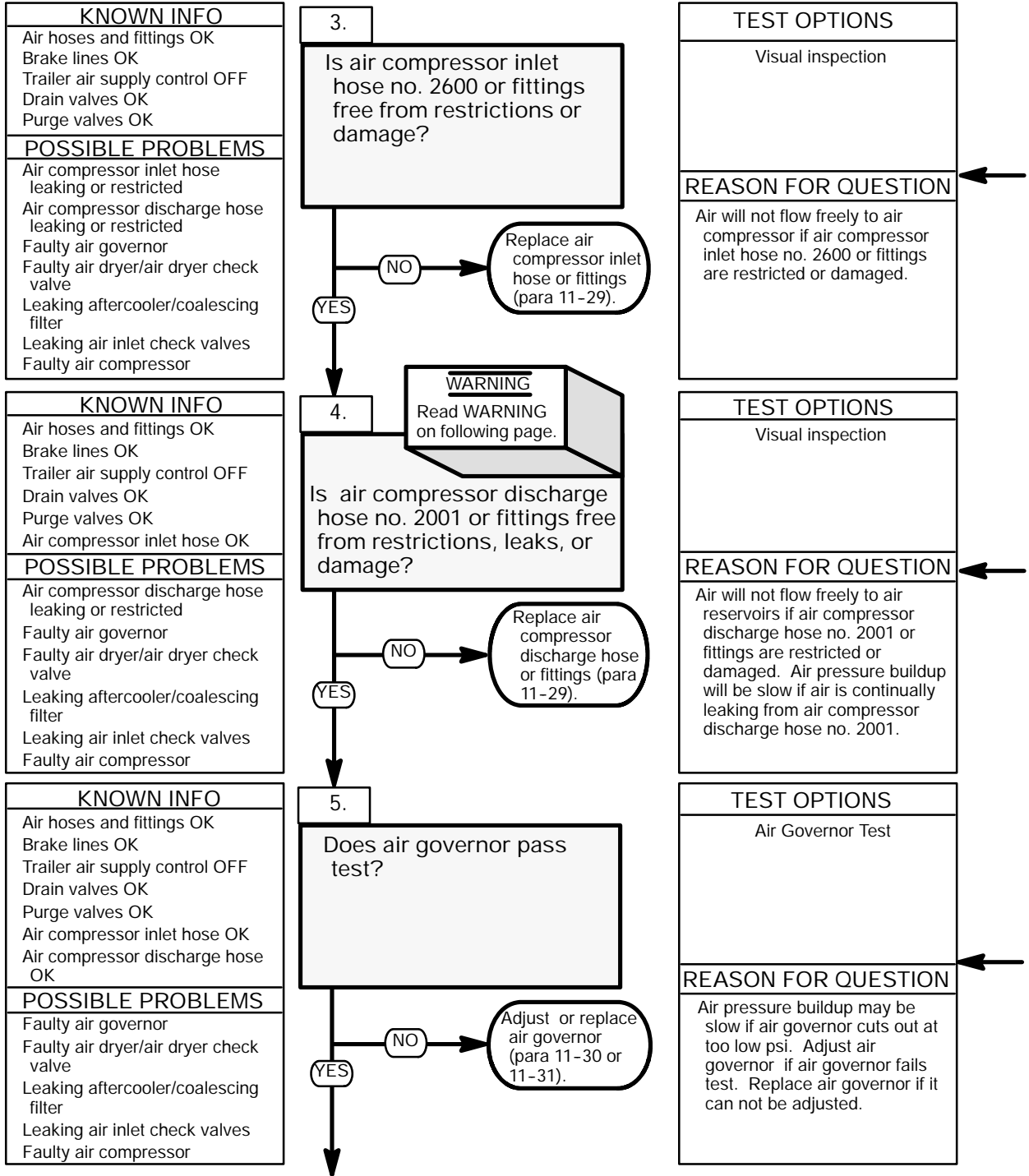
PURGE VALVES

Check purge valve on air dryers for air leakage and damage.



AFTERCOOLER

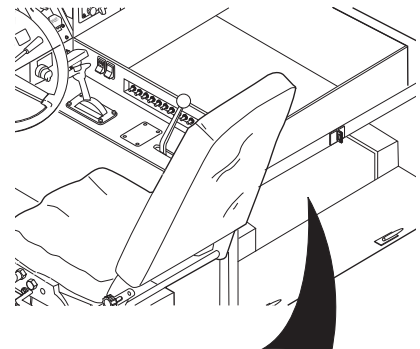
K1. AIR SYSTEM LOOSES PRESSURE DURING OPERATION OR AIR PRESSURE BUILDUP IS SLOW (CONT)



Check air compressor inlet hose no. 2600 and fittings for restrictions and damage.

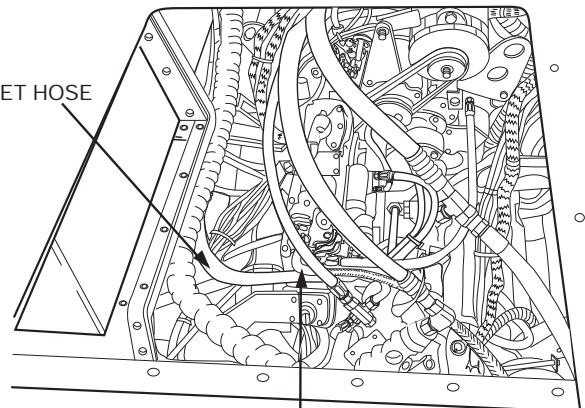
WARNING

Due to the air system pressure, be sur to wear the proper eye protection to avoid personal injury. Air compressor discharge hose no. 2001 gets extremely hot during normal air compressor operation. Allow sufficient time for hose to cool before performing inspection. Failure to comply may result in personnel injury.



Check air compressor discharge hose no. 2001 and fittings for restrictions, leakage, and damage.

INLET HOSE



DISCHARGE HOSE

AIR GOVERNOR TEST

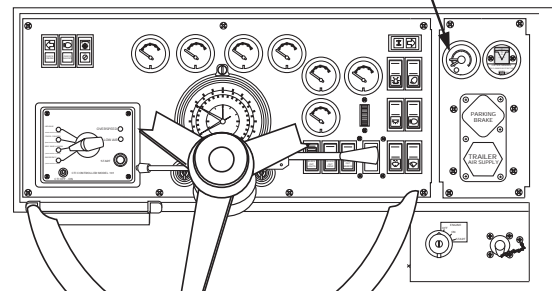
- (1) Start engine (TM 9-2320-360-10).
- (2) Watch AIR PRESS gage. Green and red needles should move up scale as pressure builds up.

NOTE

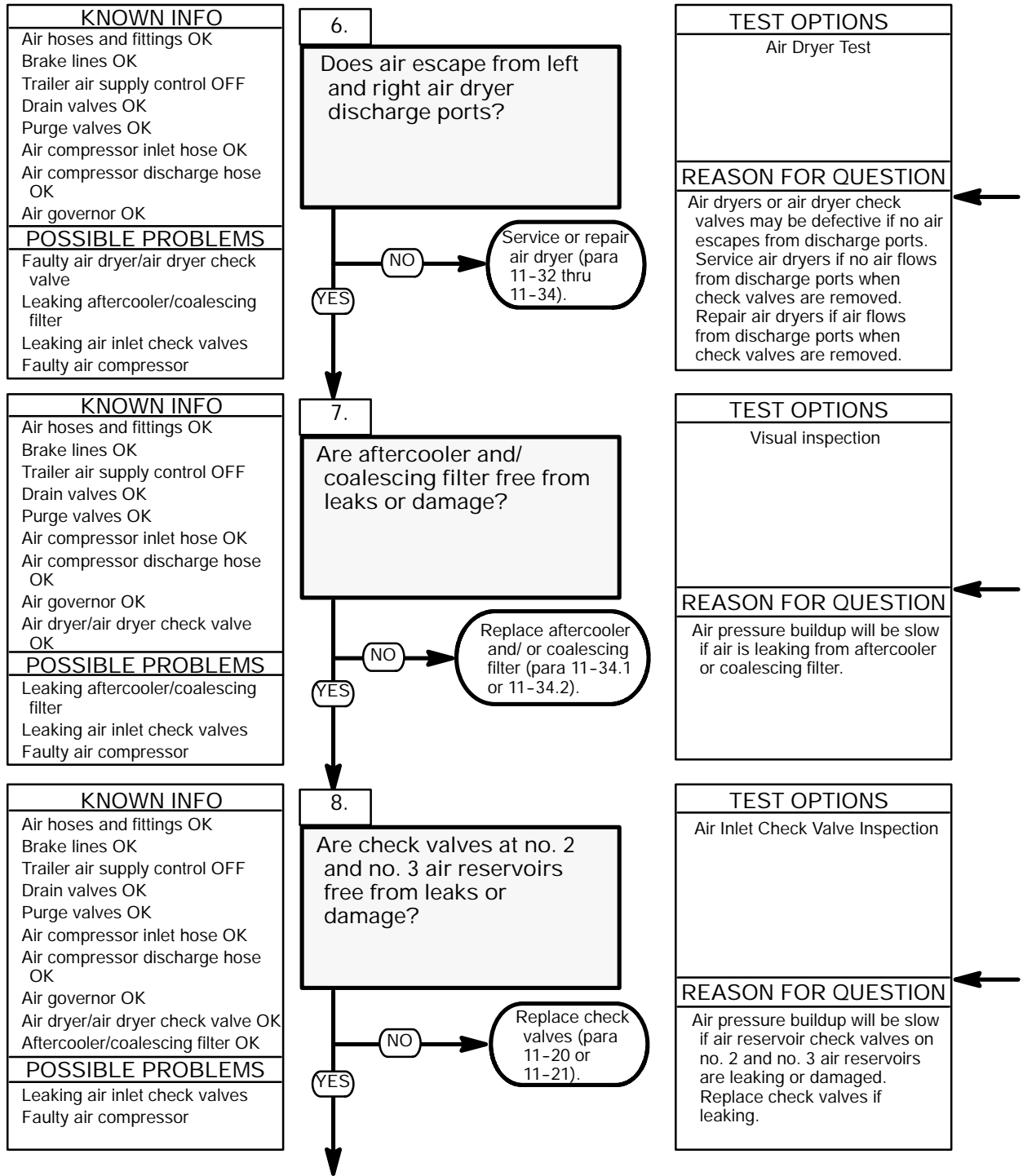
Air will be released from air dryers when air governor cuts out.

- (3) Check AIR PRESS gage when air governor cuts out. AIR PRESS gage should read 120-125 psi (827-862 kPa) when air governor cuts out. Air governor fails test if it does not cut out at 120-125 psi (827-862 kPa).

AIR PRESSURE GAGE



K1. AIR SYSTEM LOOSES PRESSURE DURING OPERATION OR AIR PRESSURE BUILDUP IS SLOW (CONT)



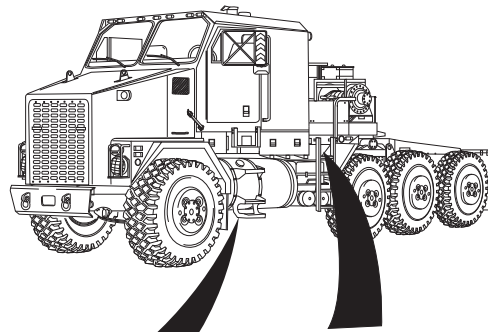
AIR DRYER TEST

- (1) Drain air system (TM 9-2320-360-10).
- (2) Remove air dryer discharge lines no. 2996 from left and right air dryers.

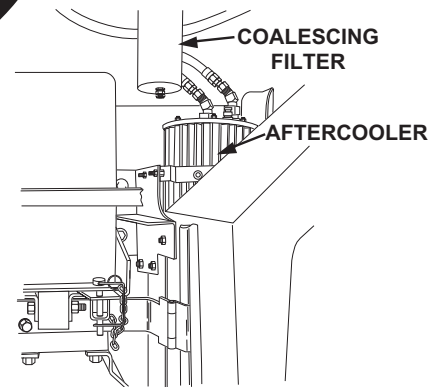
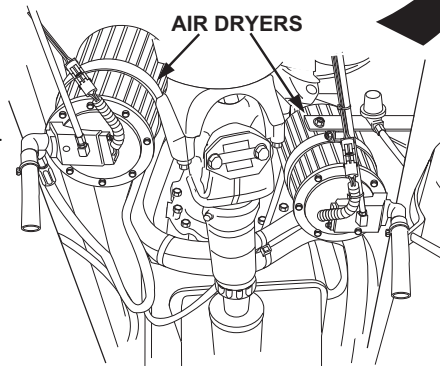
NOTE

There is no problem with air dryers if air flows from discharge ports.

- (3) Start engine (TM 9-2320-360-10) and check for air flow from left and right air dryer discharge ports.
- (4) Shut off engine (TM 9-2320-360-10).
- (5) Remove air dryer check valves if no air flows from discharge ports. Repeat steps (3) and (4).
- (6) Install air dryer discharge lines no. 2996 and check valves (if removed) on left and right air dryers.

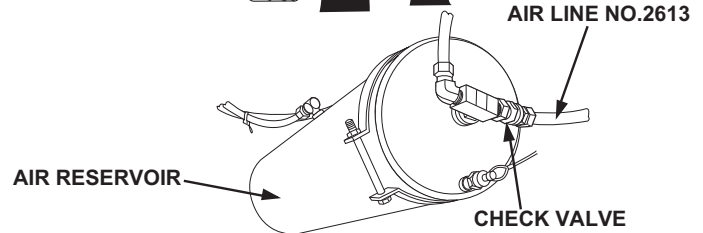
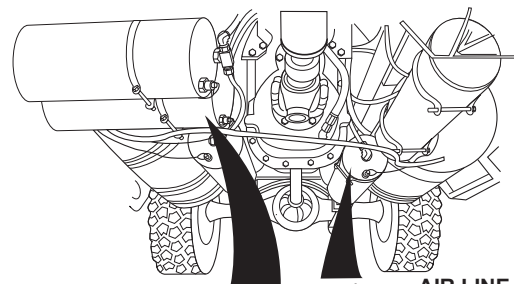


Check aftercooler and coalescing filter for air leaks.

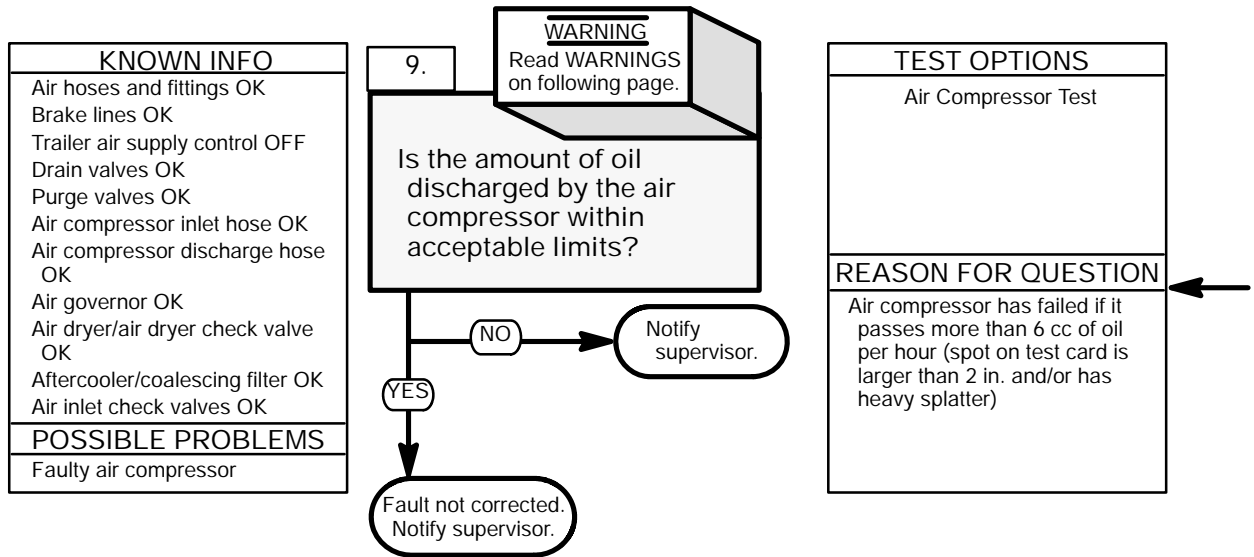


AIR INLET CHECK VALVE INSPECTION

- (1) Remove air line no. 2184 from no. 2 air reservoir check valve.
- (2) Remove air line no. 2613 from no. 3 air reservoir check valve.
- (3) Inspect check valves on no. 2 and no. 3 air reservoirs for air leakage.
- (4) Install air line no. 2613 on no. 2 air reservoir check valve.
- (5) Install air line no. 2184 on no. 3 air reservoir check valve.



k1. AIR SYSTEM LOOSES PRESSURE DURING OPERATION OR AIR PRESSURE BUILDUP IS SLOW (CONT)



AIR COMPRESSOR TEST

- (1) Drain air system (TM 9-2320-360-10).
- (2) Remove drain plug from no. 3 air tank.

WARNING

Due to the air system pressure, be sure to wear the proper eye protection to avoid personal injury. Air compressor discharge hose no. 2001 gets extremely hot during normal air compressor operation. Allow sufficient time for hose to cool before performing inspection. Failure to comply may result in injury to personnel.

- (3) Remove air compressor discharge hose no. 2001 and inlet hose no. 2600 from air compressor.
- (4) Start engine (TM 9-2320-360-10).
- (5) Operate engine at 2100 RPM for five minutes to bring air compressor up to operating temperature.
- (6) Reduce engine speed to 1800 RPM and maintain that speed.

WARNING

Use extreme care while holding cardboard when engine is running. Rotating engine accessories and hot engine parts may cause injury.

- (7) Hold a 5 in. x 10 in. (12.7 cm x 25.4 cm) piece of cardboard 1 in. (2.54 cm) from the discharge port for 1 minute.
- (8) Shut off engine (TM 9-2320-360-10).
- (9) Compare cardboard to the following:
 - a. No oil spot - compressor OK
 - b. Oil spot 2 in. (5 cm) or less, splatter off to one side, or light splatter - compressor OK
 - c. Oil spot greater than 2 in. (5 cm) and/or heavy splatter - compressor faulty
- (10) Install air compressor discharge hose no. 2001 and inlet hose no. 2600 on air compressor.

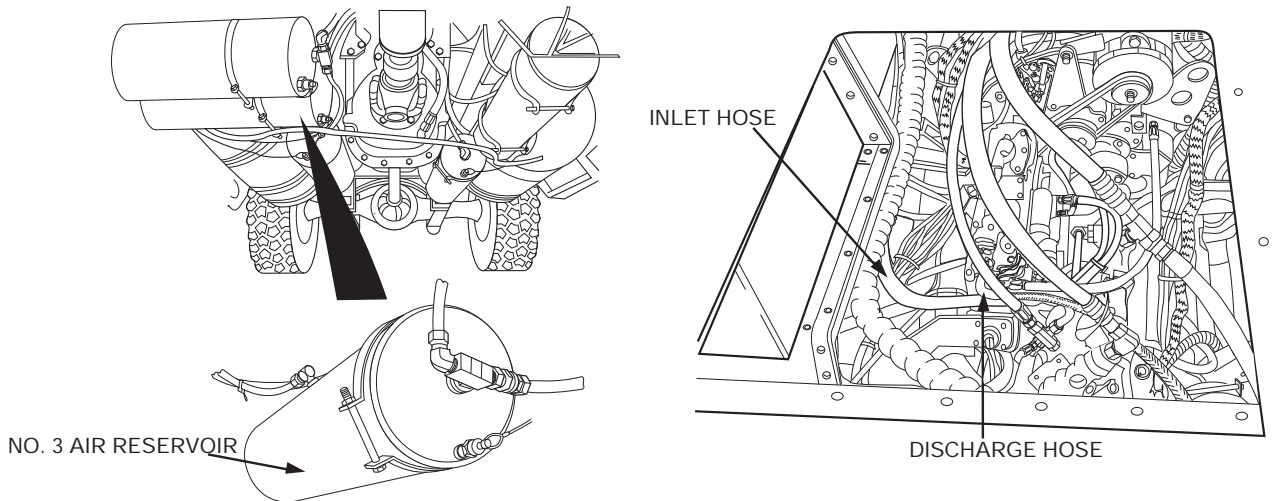
WARNING

Pipe thread sealing compound can burn easily, can give off harmful vapors, and is harmful to skin and clothing. To avoid injury or death, keep compound away from open fire and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.

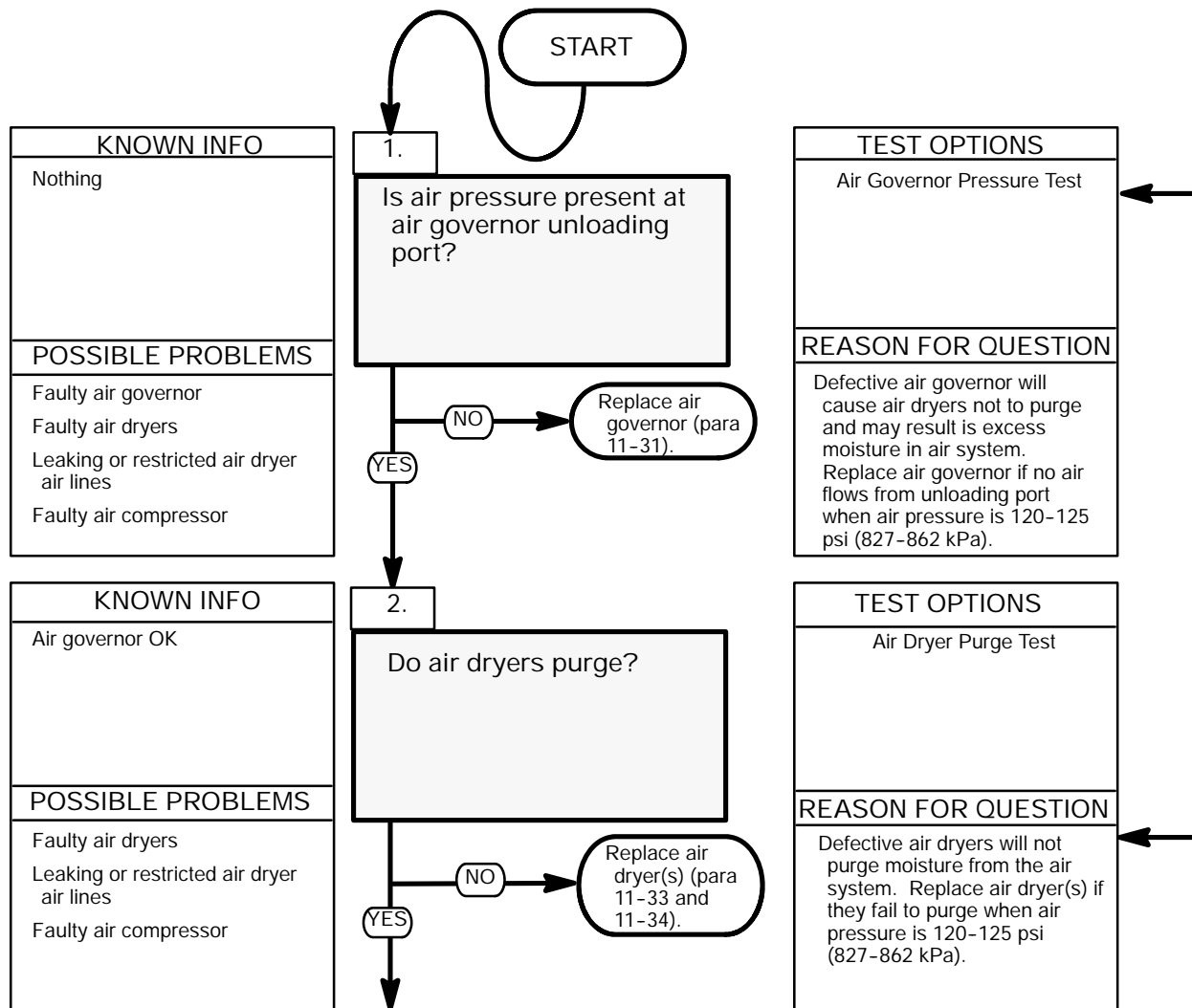
CAUTION

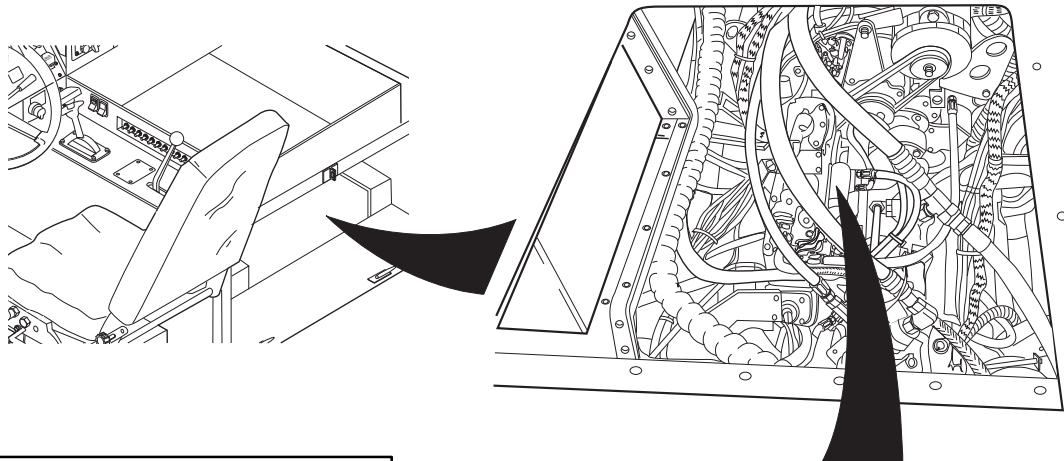
Use pipe thread sealing compound sparingly, only on pipe threads. Do not apply compound at hose connections. Failure to comply may result in component damage.

- (11) Coat threads of drain plug with pipe thread sealing compound.
- (12) Install drain plug in no. 3 air tank.



k2. LARGE QUANTITY OF MOISTURE EXPELLED FROM AIR RESERVOIRS	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

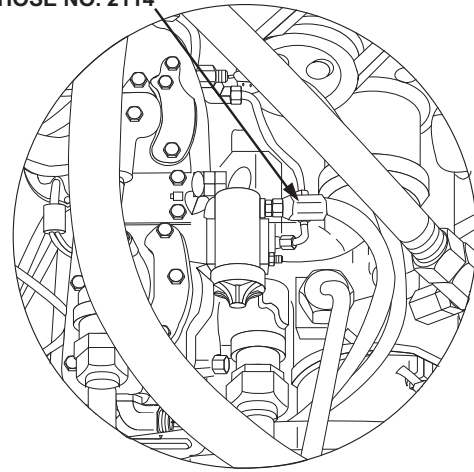




AIR GOVERNOR PRESSURE TEST

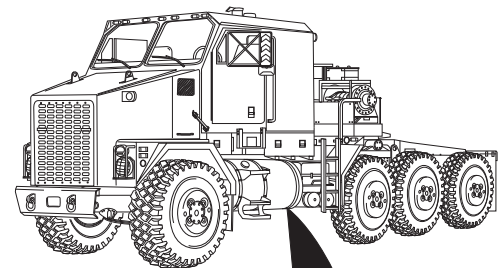
- (1) Remove hose no. 2114 from air governor.
- NOTE**
- Air should escape from air governor port when hose no. 2114 is removed and air pressure is at 120-125 psi (827-862 kPa).
- (2) Start engine (TM 9-2320-360-10) and allow air system pressure to build up to 120-125 psi (827-862 kPa).
 - (3) Shut off engine (TM 9-2320-360-10) when air pressure builds up to 120-125 psi (827-862 kPa).
 - (4) Install hose no. 2114 on air governor.

HOSE NO. 2114

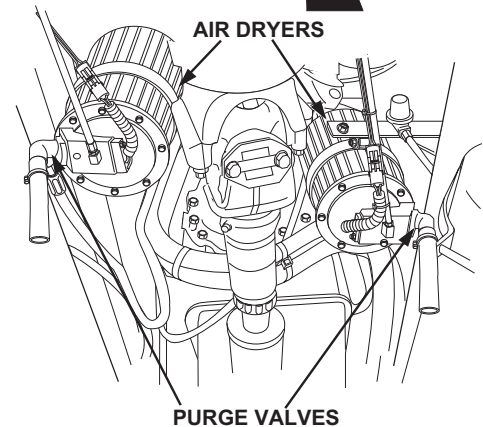


AIR DRYER PURGE TEST

- NOTE**
- Air dryers should purge when air pressure is at 120-125 psi (827-862 kPa).
- (1) Start engine (TM 9-2320-360-10) and allow air system pressure to build up to 120-125 psi (827-862 kPa).
 - (2) Listen for both air dryers to purge.
 - (3) Shut off engine (TM 9-2320-360-10) when air pressure builds up to 120-125 psi (827-862 kPa).

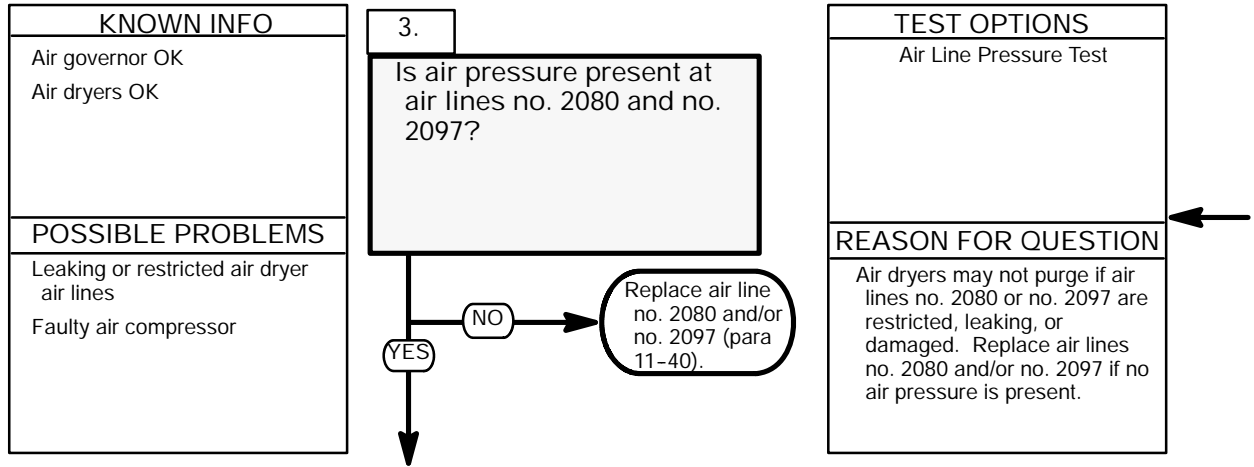


AIR DRYERS



PURGE VALVES

k2. LARGE QUANTITY OF MOISTURE EXPELLED FROM AIR RESERVOIRS (CONT)



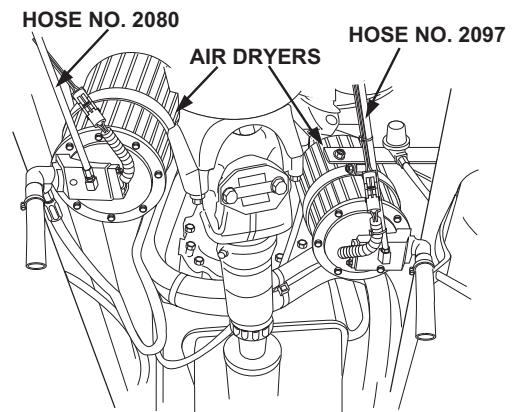
AIR LINE PRESSURE TEST

- (1) Remove hoses no. 2097 and no. 2080 from air dryers.

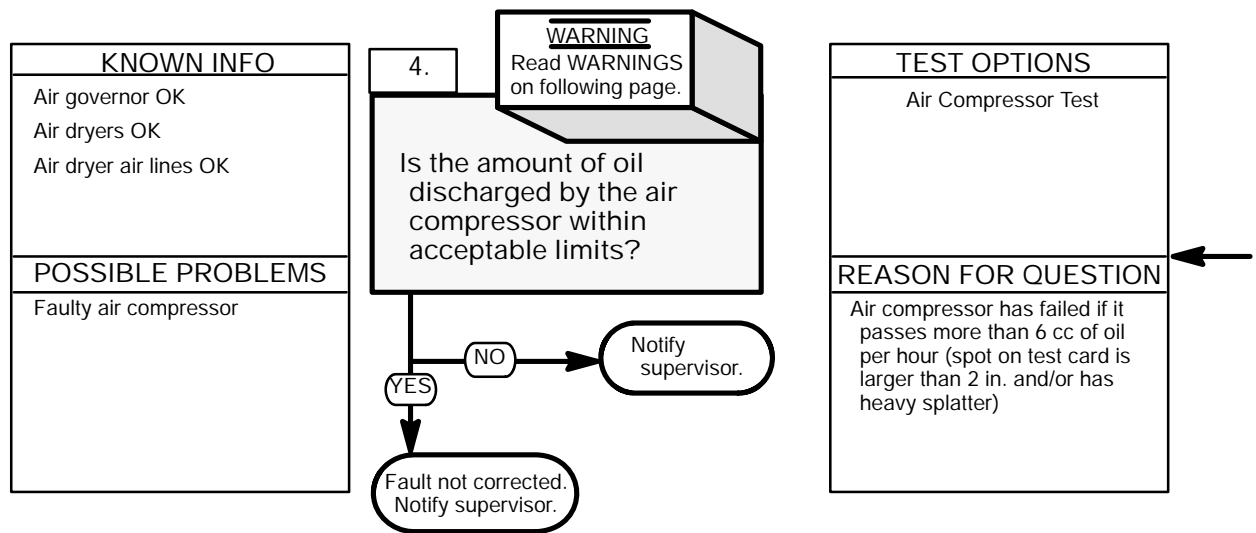
NOTE

Air should escape from hoses no. 2096 and no. 2097 when air pressure is at 120-125 psi (827-862 kPa).

- (2) Start engine (TM 9-2320-360-10) and allow air system pressure to build up to 120-125 psi (827-862 kPa).
- (3) Check for air pressure at air lines no. 2080 and no. 2097.
- (4) Shut off engine (TM 9-2320-360-10) when air pressure builds up to 120-125 psi (827-862 kPa).
- (5) Install hoses no. 2080 and no. 2097 on air air dryers.



k2. LARGE QUANTITY OF MOISTURE EXPELLED FROM AIR RESERVOIRS (CONT)



AIR COMPRESSOR TEST

- (1) Drain air system (TM 9-2320-360-10).
- (2) Remove drain plug from no. 3 air tank.

WARNING

Air compressor discharge hose no. 2001 gets extremely hot during normal air compressor operation. Allow sufficient time for hose to cool before performing inspection. Failure to comply may result in injury to personnel.

- (3) Remove air compressor discharge hose no. 2001 and inlet hose no. 2600 from air compressor.
- (4) Start engine (TM 9-2320-360-10).
- (5) Operate engine at 2100 RPM for five minutes to bring air compressor up to operating temperature.
- (6) Reduce engine speed to 1800 RPM and maintain that speed.

WARNING

Use extreme care while holding cardboard when engine is running. Rotating engine accessories and hot engine parts may cause injury.

- (7) Hold a 5 in. x 10 in. (12.7 cm x 25.4 cm) piece of cardboard 1 in. (2.54 cm) from the discharge port for 1 minute.
- (8) Shut off engine (TM 9-2320-360-10).
- (9) Compare cardboard to the following:
 - a. No oil spot - compressor OK
 - b. Oil spot 2 in. (5 cm) or less, splatter off to one side, or light splatter - compressor OK
 - c. Oil spot greater than 2 in. (5 cm) and/or heavy splatter - compressor faulty
- (10) Install air compressor discharge hose no. 2001 and inlet hose no. 2600 on air compressor.

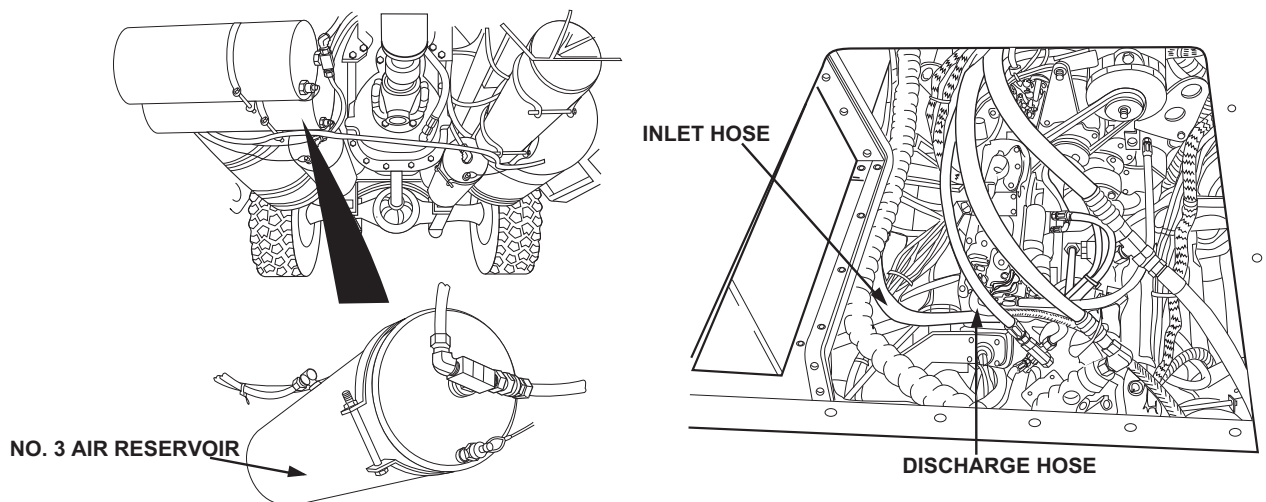
WARNING

Pipe thread sealing compound can burn easily, can give off harmful vapors, and is harmful to skin and clothing. To avoid injury or death, keep compound away from open fire and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.

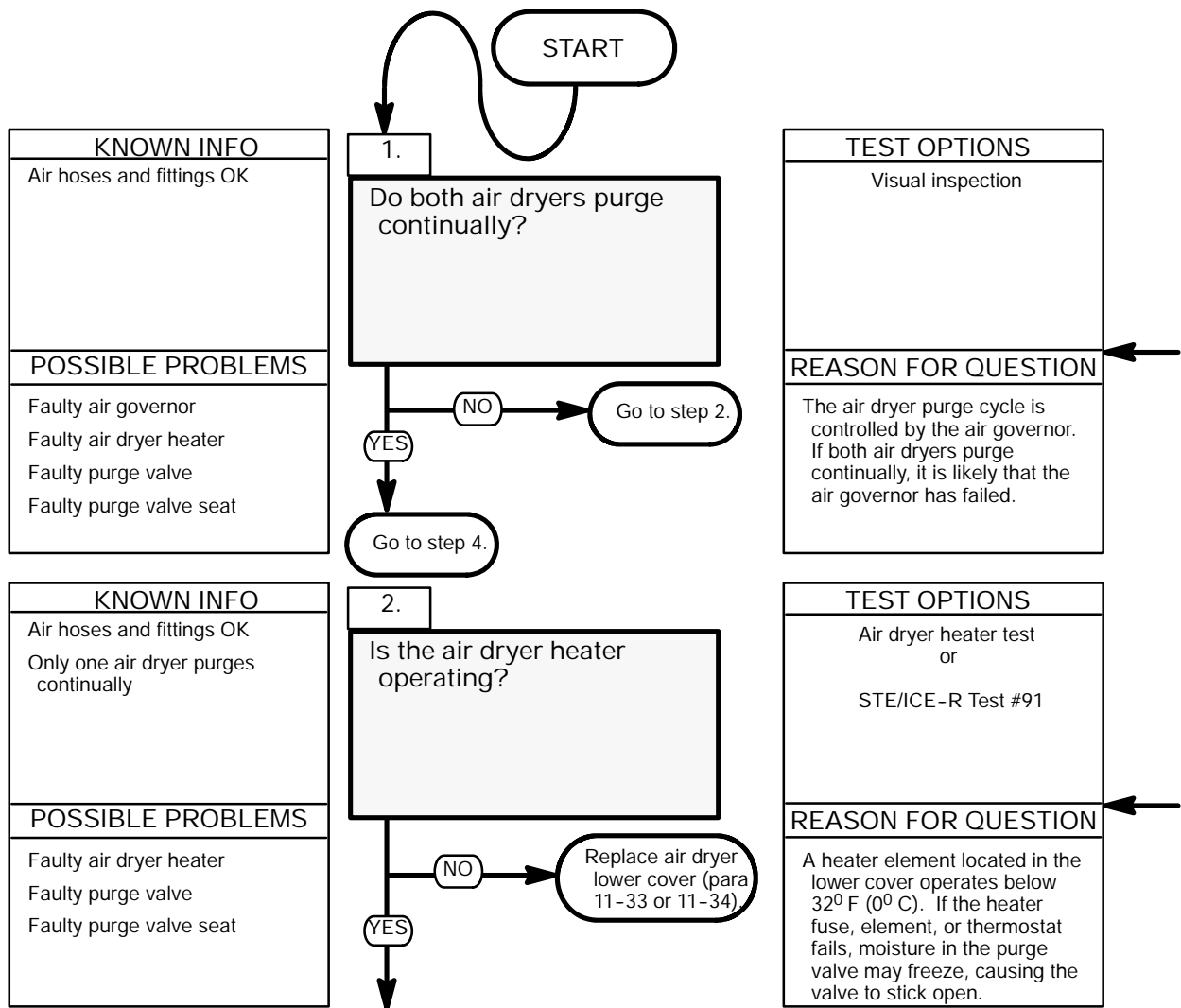
CAUTION

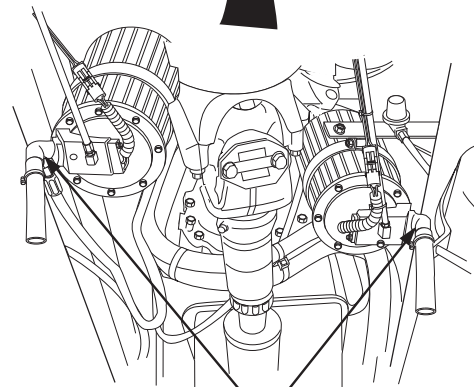
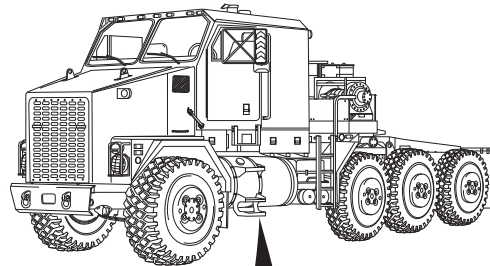
Use pipe thread sealing compound sparingly, only on pipe threads. Do not apply compound at hose connections. Failure to comply may result in component damage.

- (11) Coat threads of drain plug with pipe thread sealing compound.
- (12) Install drain plug in no. 3 air tank.



k3. AIR DRYER(S) CONTINUALLY PURGE	
<p>INITIAL SETUP</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p> </div> <div style="width: 45%;"> <p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)</p> </div> </div>	





PURGE VALVE

Check purge valve on both air dryers for air leakage.

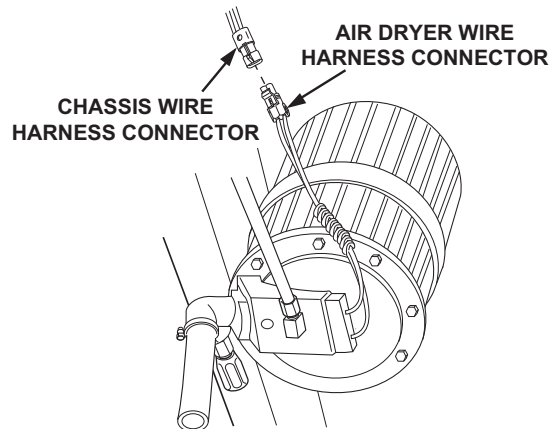
AIR DRYER HEATER TEST

- (1) Remove chassis wire harness connector (MC34 or MC35) from air dryer wire harness connector.
- (2) Connect multimeter leads to positions A and B of air dryer wire harness.

NOTE

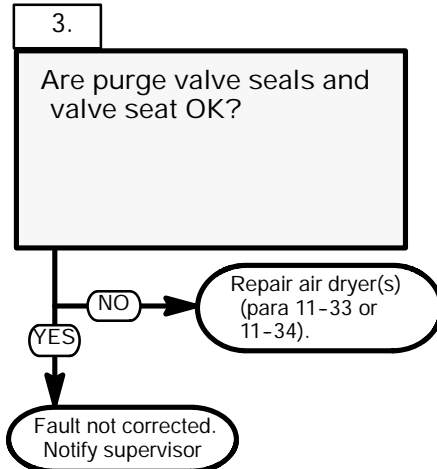
- A reading of infinity indicates an open circuit.
- An open circuit should be indicated at temperatures above 32° F (0° C).
- A complete circuit should be indicated at temperatures below 32° F (0° C).

- (3) Observe multimeter readings.
- (4) Install chassis wire harness connector on air dryer wire harness connector.



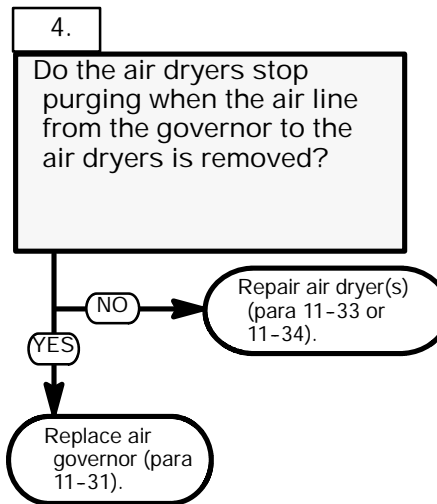
k3. AIR DRYER(S) CONTINUALLY PURGE (CONT)

KNOWN INFO
Air hoses and fittings OK Only one air dryer purges continually Air dryer heater OK
POSSIBLE PROBLEMS
Faulty purge valve Faulty purge valve seat



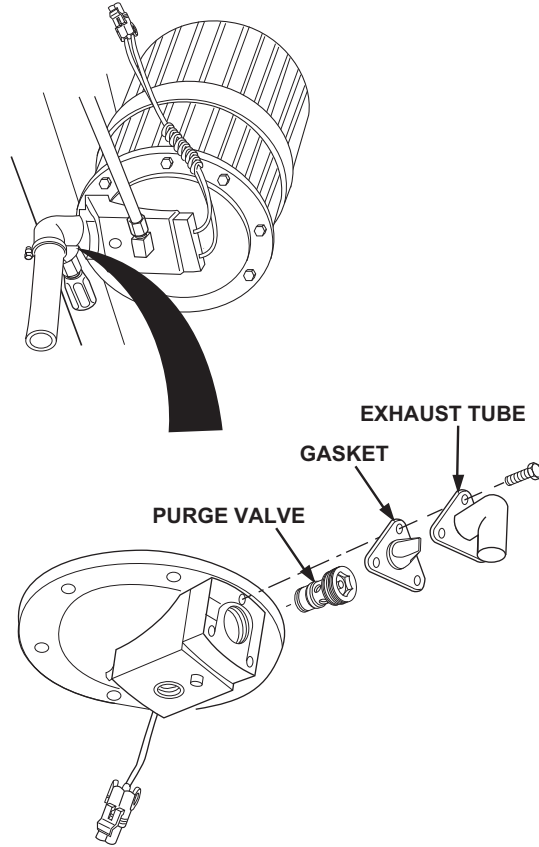
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Faulty purge valve seals or foreign material on the purge valve seat may cause the purge valve to leak.

KNOWN INFO
Air hoses and fittings OK Both air dryers purge continually
POSSIBLE PROBLEMS
Faulty air governor



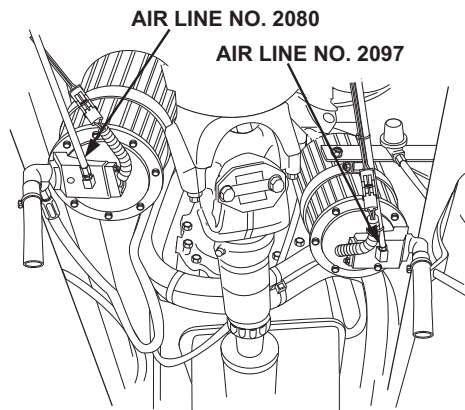
TEST OPTIONS
Air Governor Test
REASON FOR QUESTION
If the air dryer(s) stop purging when the air governor air line is removed, the problem is with the governor. If the air dryer(s) continue to purge the problem is with the dryer(s).

- (1) Remove three screws, gasket and exhaust tube from bottom cover.
- (2) Remove purge valve from bottom cover.
- (3) Inspect purge valve seals and purge valve seat.

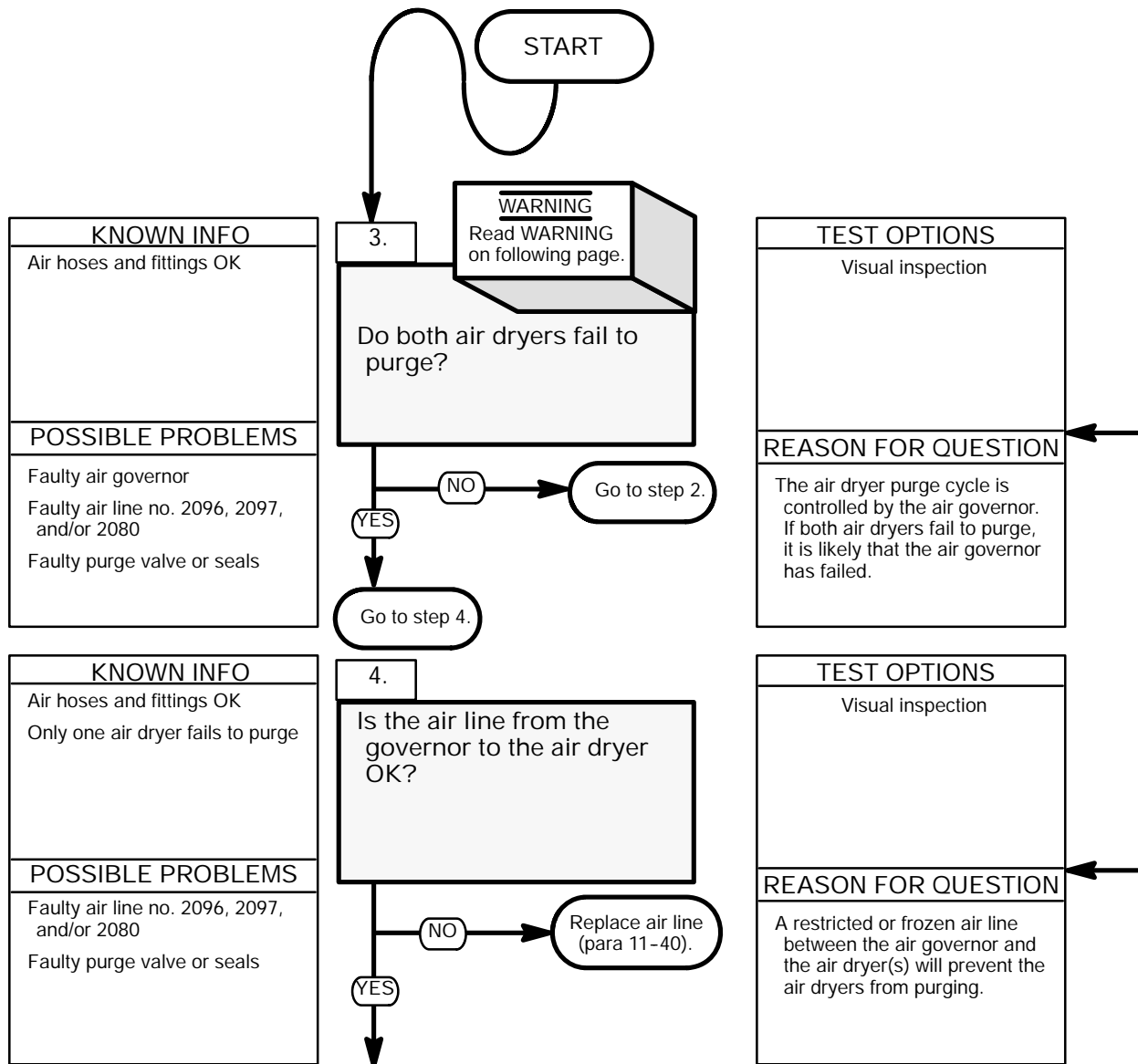


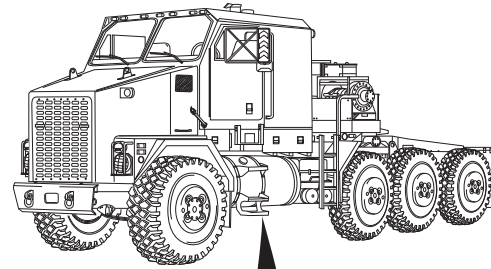
AIR GOVERNOR TEST

- (1) Remove air line (no. 2080 or no. 2097) from air dryer.
- (2) Check operation of purge valve.



k3.1. AIR DRYER(S) FAIL TO PURGE	
<p>INITIAL SETUP</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p> </div> <div style="width: 45%;"> <p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)</p> </div> </div>	



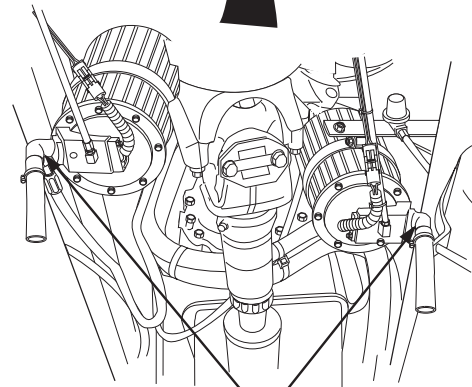


- (1) Drain air system to less than 100 psi (690 kPa).
- (2) Start engine (TM 9-2320-360-10).

WARNING

Keep out from under HET M1070 during test. Air exits air dryers at high velocity during purging. Failure to comply may result in injury to personnel.

- (3) Build air pressure to 120-125 psi (827-862 kPa) and observe for air dryers purging.



PURGE VALVE

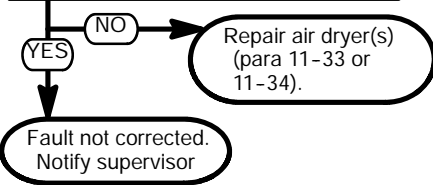
- (1) Remove lower engine access panel (para 16-2).
- (2) Inspect air lines no. 2096, 2080, and 2097 for kinks or other damage.

k3.1. AIR DRYER(S) FAIL TO PURGE (CONT)

KNOWN INFO
Air hoses and fittings OK Only one air dryer fails to purge Air lines no. 2096, 2097, and 2080 OK
POSSIBLE PROBLEMS
Faulty purge valve or seals

3.

Are purge valve and purge valve seals OK?



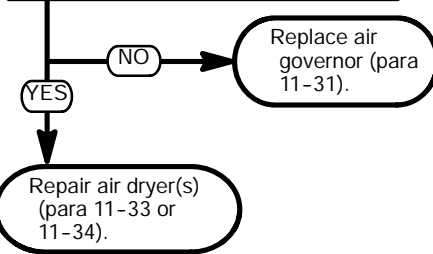
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Faulty purge valve seals may cause the purge valve to stick in the closed position.

KNOWN INFO
Air hoses and fittings OK Both air dryers fail to purge
POSSIBLE PROBLEMS
Faulty air governor

4.

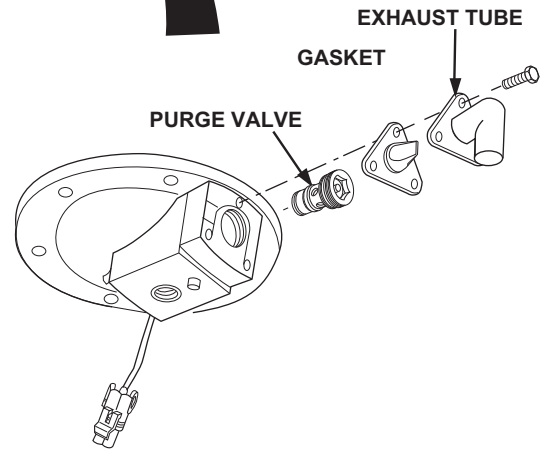
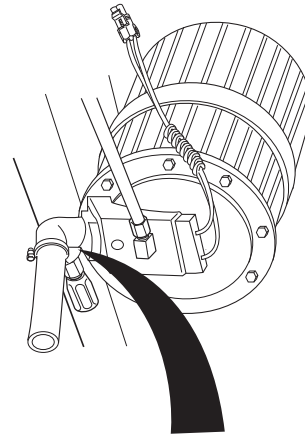
WARNING
Read WARNING on following page.

Is air pressure present at the unloader port of the air governor when the compressor unloads?



TEST OPTIONS
Air Governor Test
REASON FOR QUESTION
If no air is present when the air governor air line is removed, the problem is with the governor. If air is present, the problem is with the air dryer(s).

- (1) Remove three screws, gasket and exhaust tube from bottom cover.
- (2) Remove purge valve from bottom cover.
- (3) Inspect purge valve and seals for damage.



AIR GOVERNOR TEST

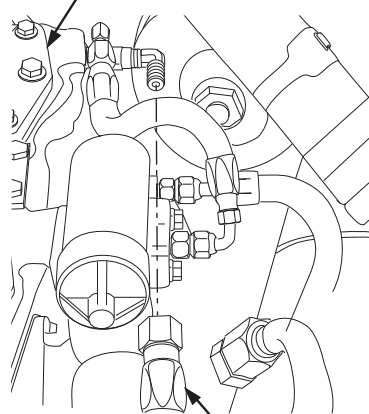
- (1) Drain air system to less than 100 psi (690 kPa).
- (2) Remove lower engine access panel (para 16-2).
- (3) Remove air line no 2096 from air compressor.

WARNING

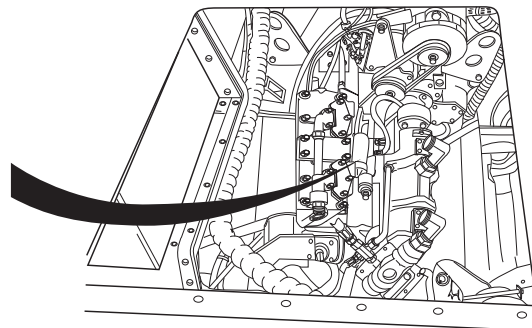
When working on a running engine, use caution around rotating parts. Tools, clothing, and hands may get caught causing serious injury or death to personnel.

- (4) Start engine (TM 9-2320-360-10).
- (5) After several minutes, air pressure gage should stop at 120-125 psi (827-862 kPa) as air compressor cuts out.
- (6) When compressor cuts out air should come out of governor port.
- (7) Shut off engine (TM 9-2320-360-10).

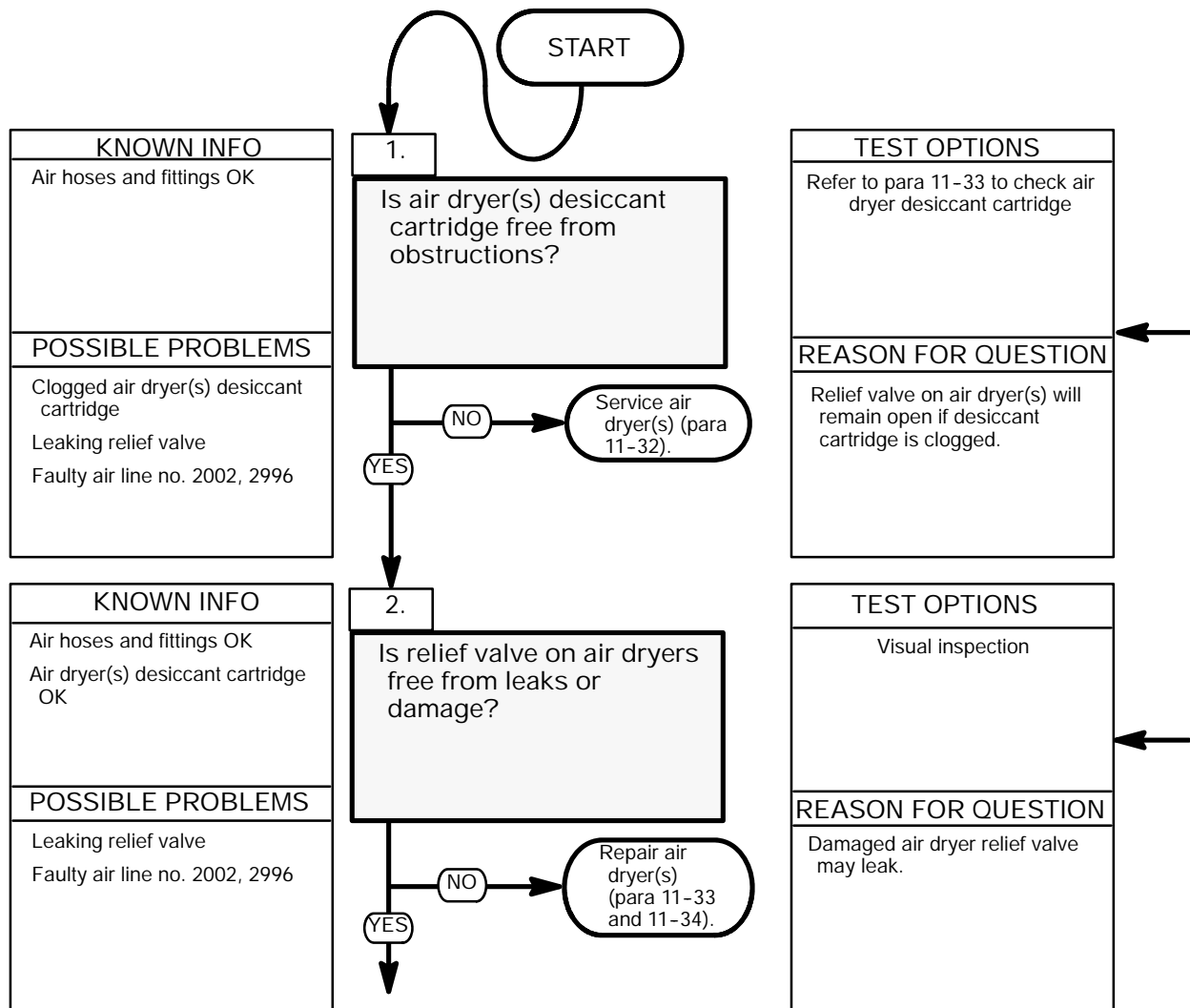
AIR COMPRESSOR



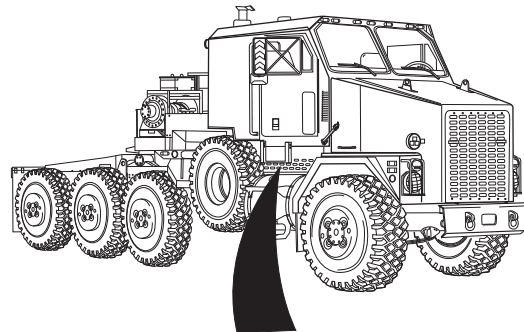
AIR LINE NO. 2096



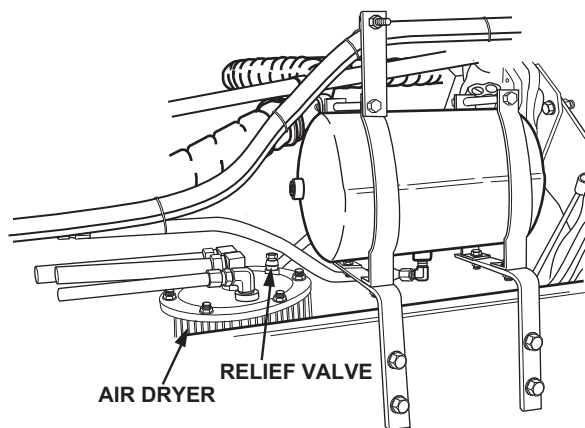
k4. RELIEF VALVE ON AIR DRYER RELEASING AIR	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



Refer to para 11-32 to service air dryers.

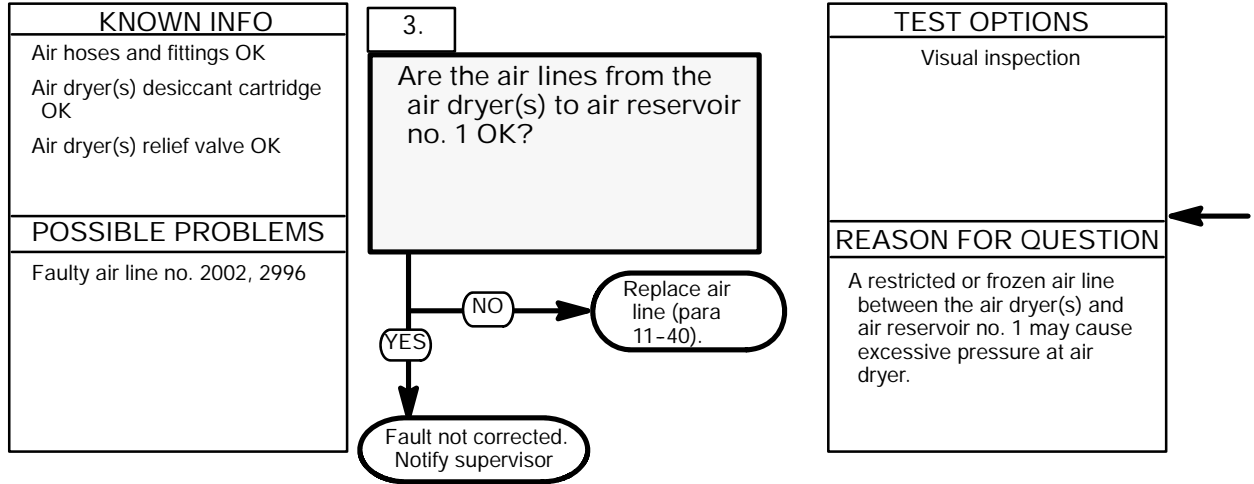


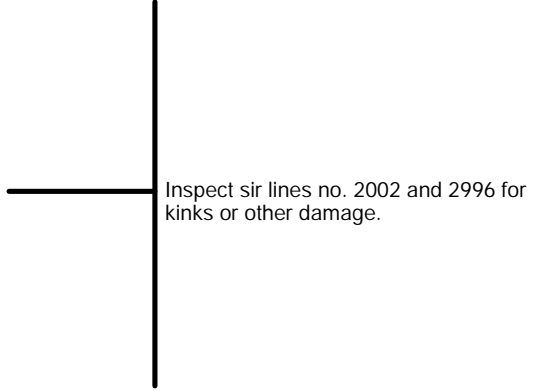
Check relief valve on air dryers for air leakage and damage.



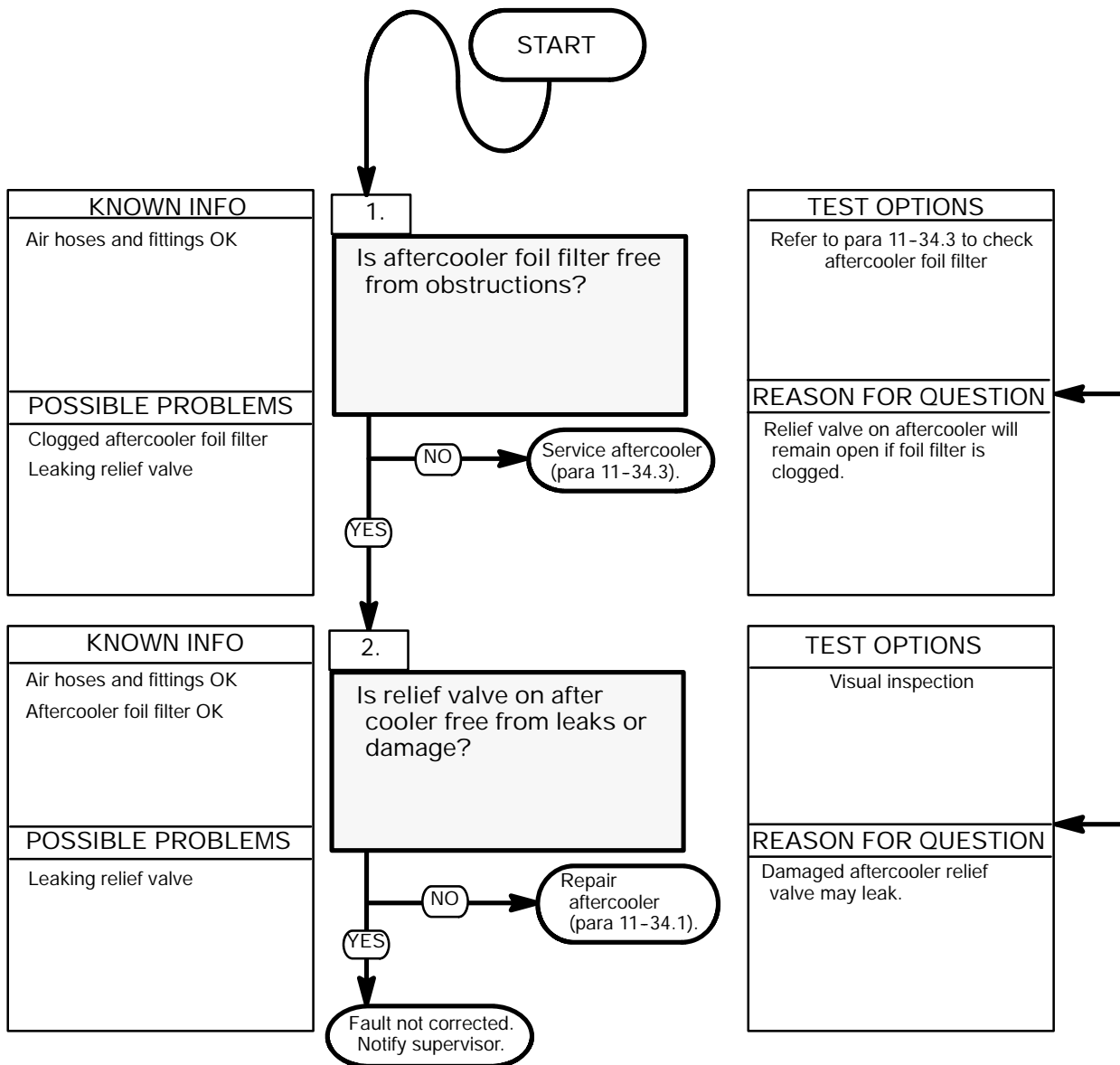
MUFFLER REMOVED FOR CLARITY

k4. RELIEF VALVE ON AIR DRYER RELEASING AIR (CONT)

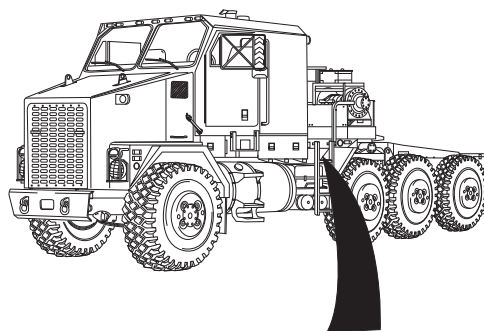




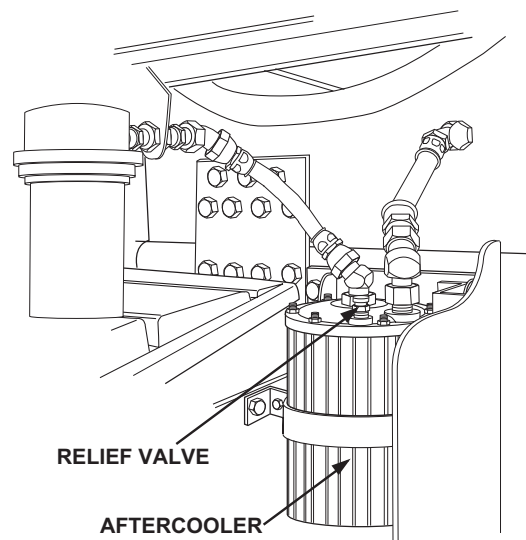
K4.1 RELIEF VALVE ON AFTERCOOLER RELEASING AIR	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



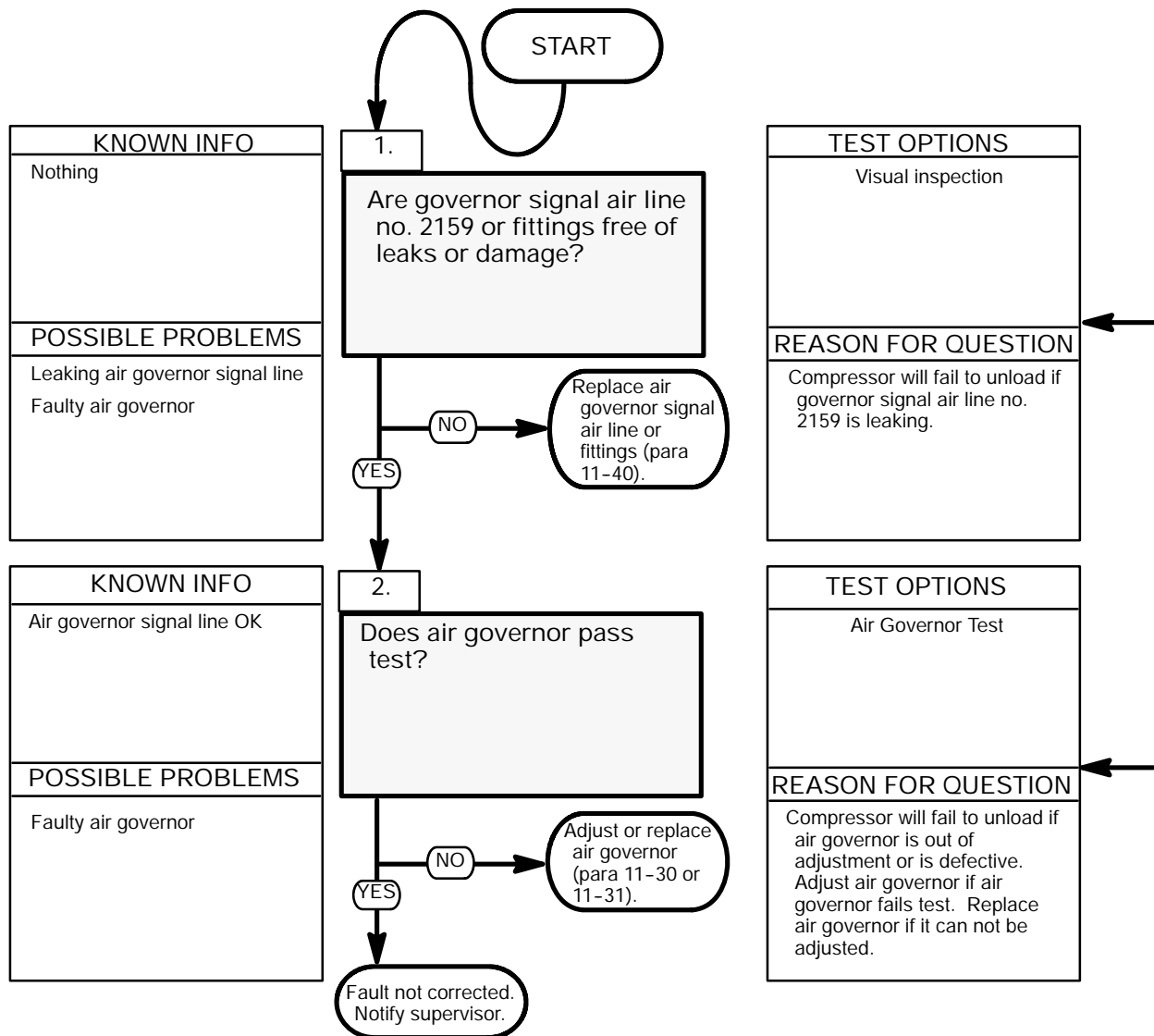
Refer to para 11-34.3 to
check foil filter in aftercooler.

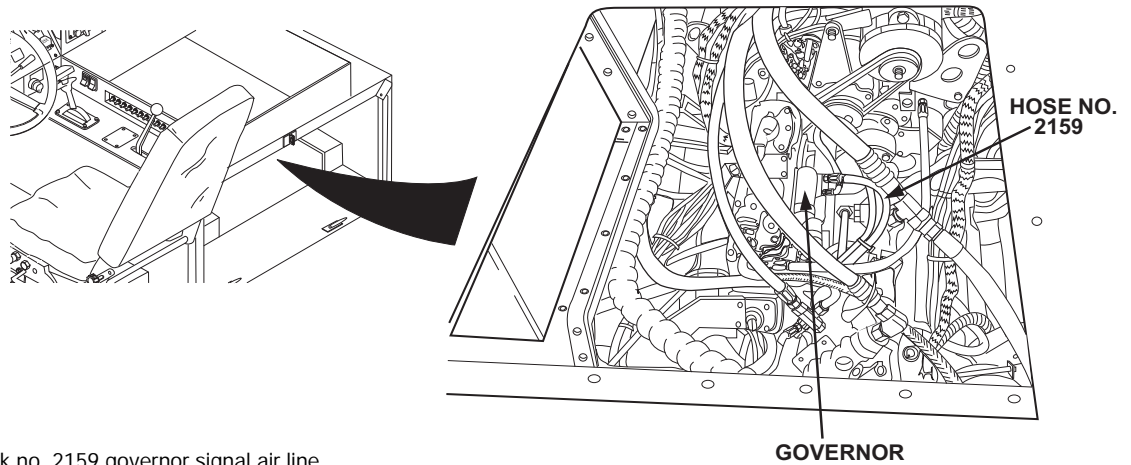
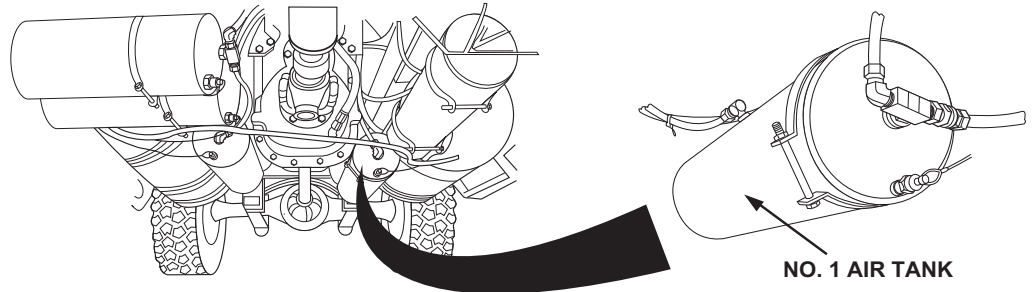


Check relief valve on aftercooler
for air leakage and damage.



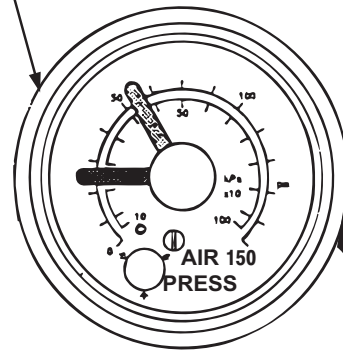
k5. COMPRESSOR FAILS TO UNLOAD. (AIR SYSTEM PRESSURE BUILDS UP TO MORE THAN 125 PSI (862 KPA))	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



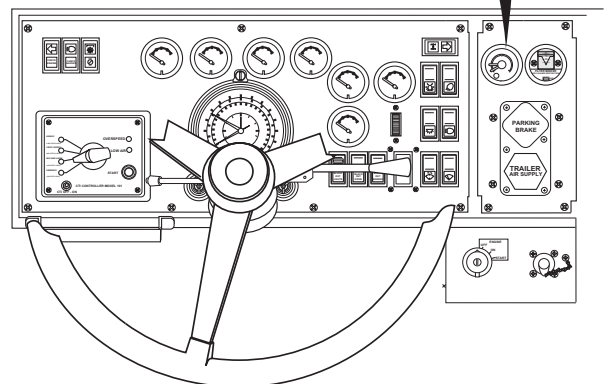


Check no. 2159 governor signal air line and fittings at governor and no. 1 air tank for air leakage and damage.

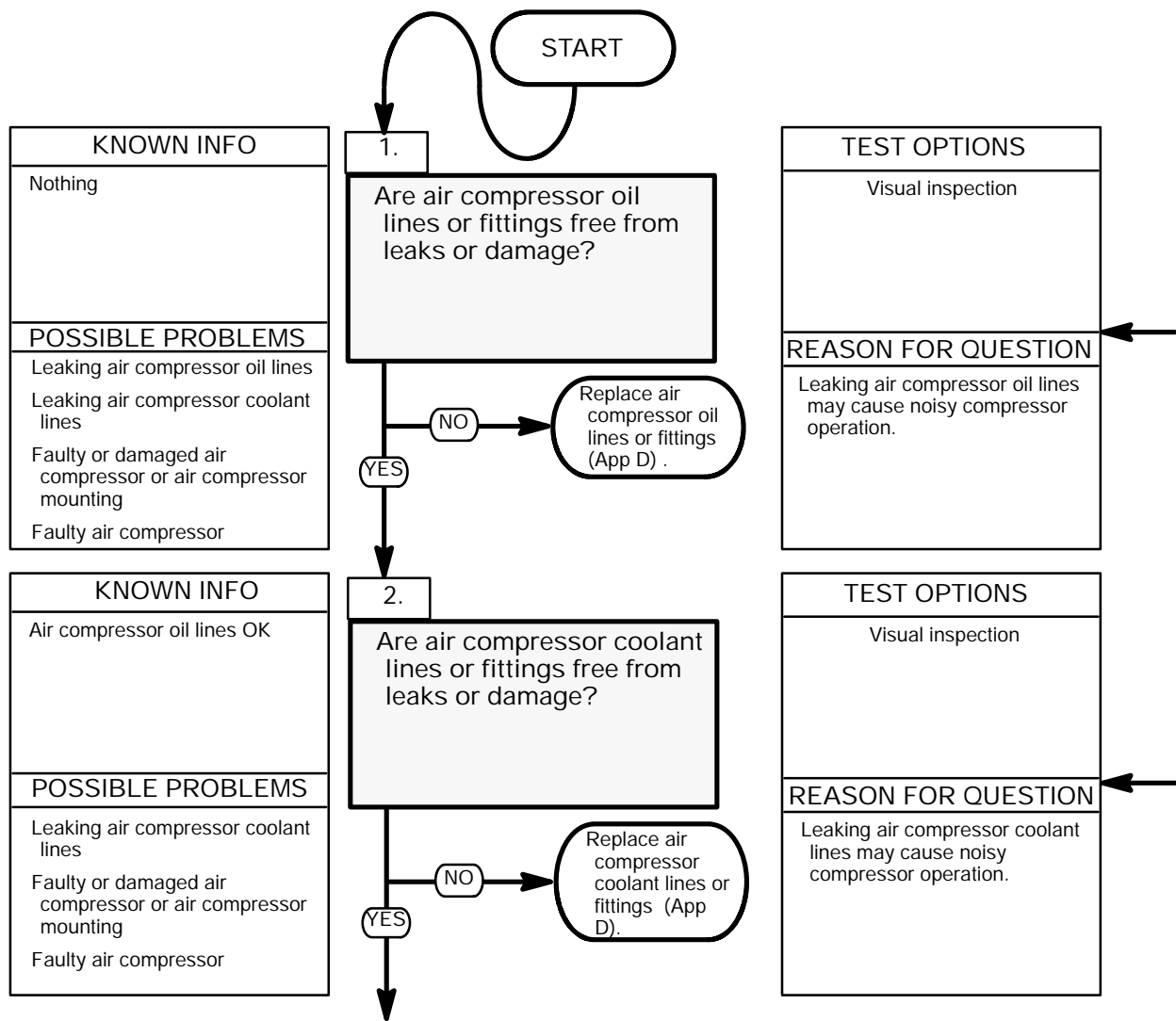
AIR PRESSURE GAGE



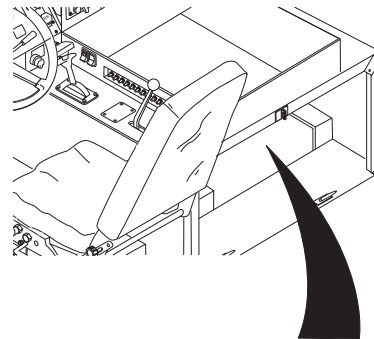
AIR GOVERNOR TEST	
(1)	Start engine (TM 9-2320-360-10).
(2)	Watch AIR PRESS gage. Green and red needles should move up scale as pressure builds up.
NOTE	
Air will be released from air dryers when air governor cuts out.	
(3)	Check AIR PRESS gage when air governor cuts out. AIR PRESS gage should read 120-125 psi (827-862 kPa) when air governor cuts out. Air governor fails test if it does not cut out at 120-125 psi (827-862 kPa).



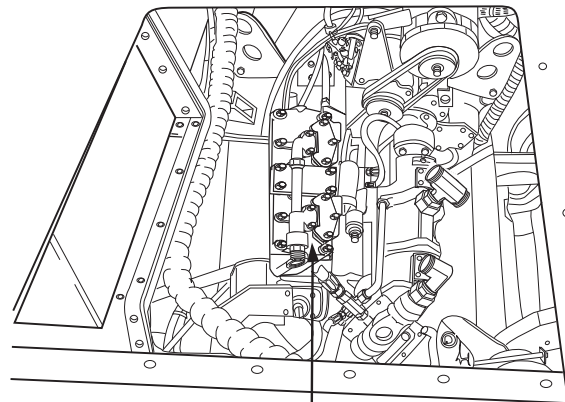
k6. NOISY AIR COMPRESSOR OPERATION	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



Check air compressor oil lines and fittings for leakage and damage.

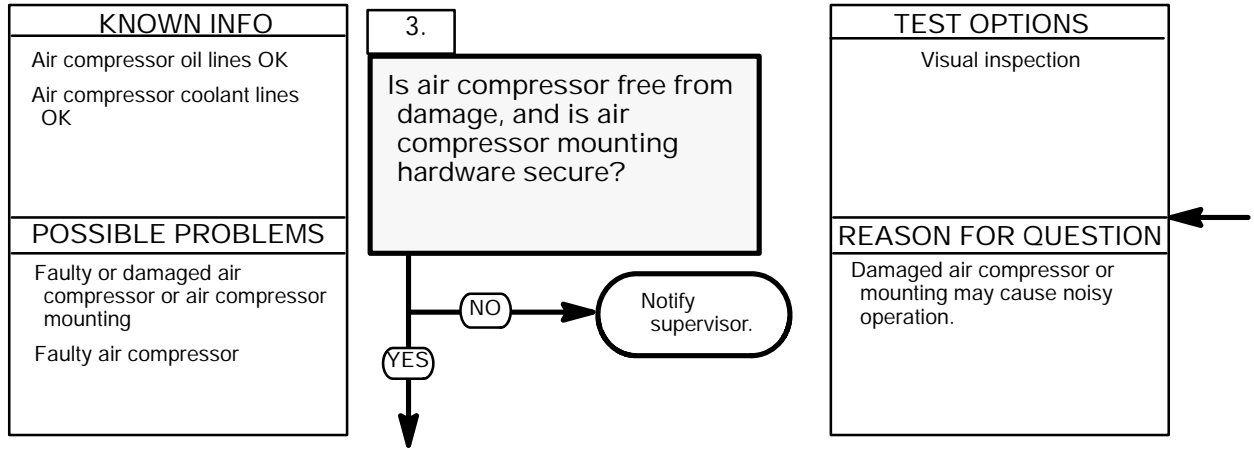


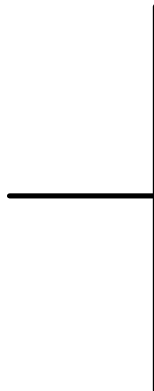
Check air compressor coolant lines and fittings for leakage and damage.



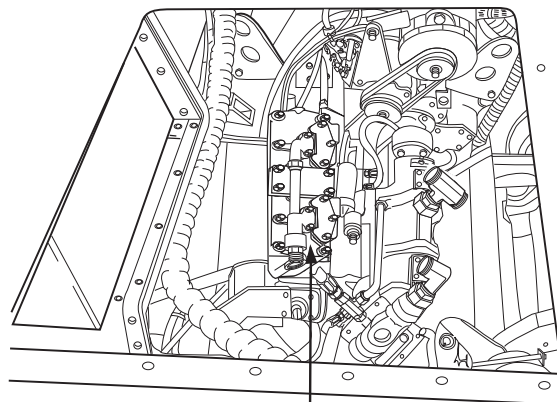
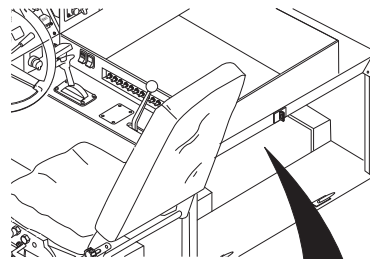
AIR COMPRESSOR

k6. NOISY AIR COMPRESSOR OPERATION (CONT)



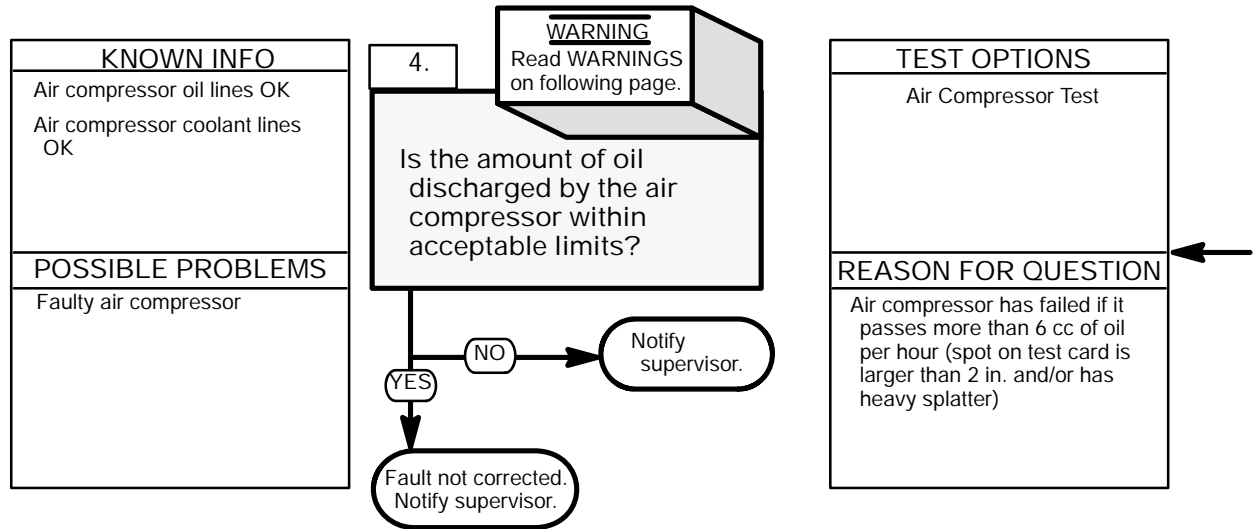


Check air compressor for damage, and for loose or damaged mounting hardware.



AIR COMPRESSOR

k6. NOISY AIR COMPRESSOR OPERATION (CONT)



AIR COMPRESSOR TEST

- (1) Drain air system (TM 9-2320-360-10).
- (2) Remove drain plug from no. 3 air tank.

WARNING

Air compressor discharge hose no. 2001 gets extremely hot during normal air compressor operation. Allow sufficient time for hose to cool before performing inspection. Failure to comply may result in injury to personnel.

- (3) Remove air compressor discharge hose no. 2001 and inlet hose no. 2600 from air compressor.
- (4) Start engine (TM 9-2320-360-10).
- (5) Operate engine at 2100 RPM for five minutes to bring air compressor up to operating temperature.
- (6) Reduce engine speed to 1800 RPM and maintain that speed.

WARNING

Use extreme care while holding cardboard when engine is running. Rotating engine accessories and hot engine parts may cause injury.

- (7) Hold a 5 in. x 10 in. (12.7 cm x 25.4 cm) piece of cardboard 1 in. (2.54 cm) from the discharge port for 1 minute.
- (8) Shut off engine (TM 9-2320-360-10).
- (9) Compare cardboard to the following:
 - a. No oil spot - compressor OK
 - b. Oil spot 2 in. (5 cm) or less, splatter off to one side, or light splatter - compressor OK
 - c. Oil spot greater than 2 in. (5 cm) and/or heavy splatter - compressor faulty
- (10) Install air compressor discharge hose no. 2001 and inlet hose no. 2600 on air compressor.

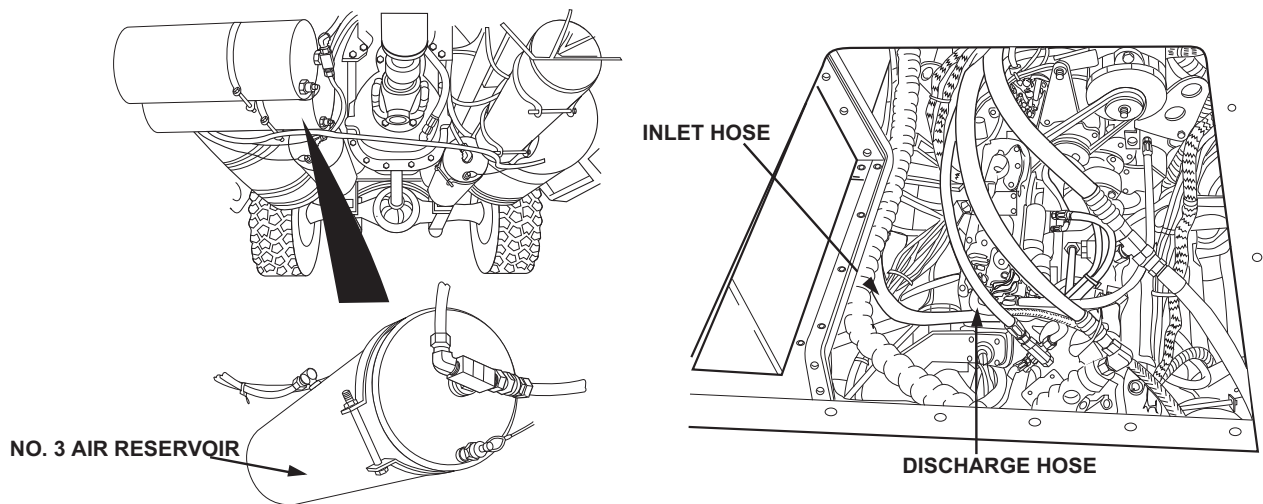
WARNING

Pipe thread sealing compound can burn easily, can give off harmful vapors, and is harmful to skin and clothing. To avoid injury or death, keep compound away from open fire and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.

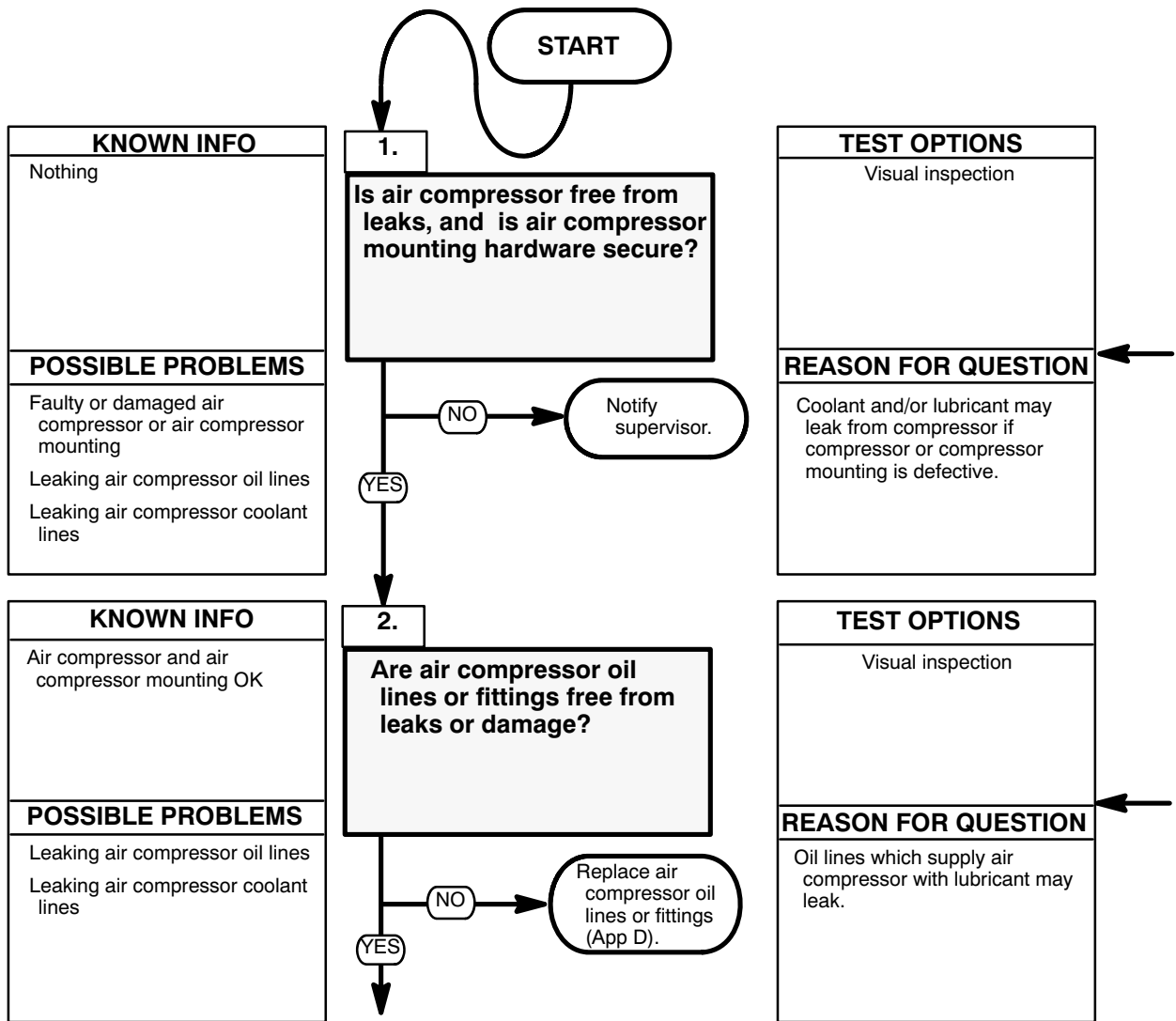
CAUTION

Use pipe thread sealing compound sparingly, only on pipe threads. Do not apply compound at hose connections. Failure to comply may result in component damage.

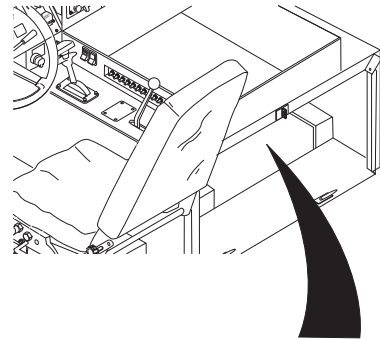
- (11) Coat threads of drain plug with pipe thread sealing compound.
- (12) Install drain plug in no. 3 air tank.



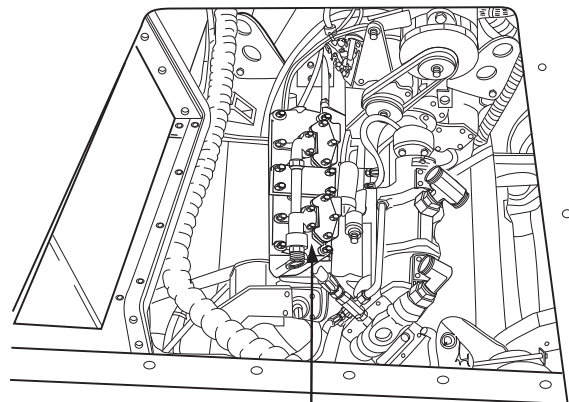
k7. COOLANT AND/OR LUBRICANT LEAKS FROM COMPRESSOR	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



Check air compressor for leaks, and for loose or damaged mounting hardware.

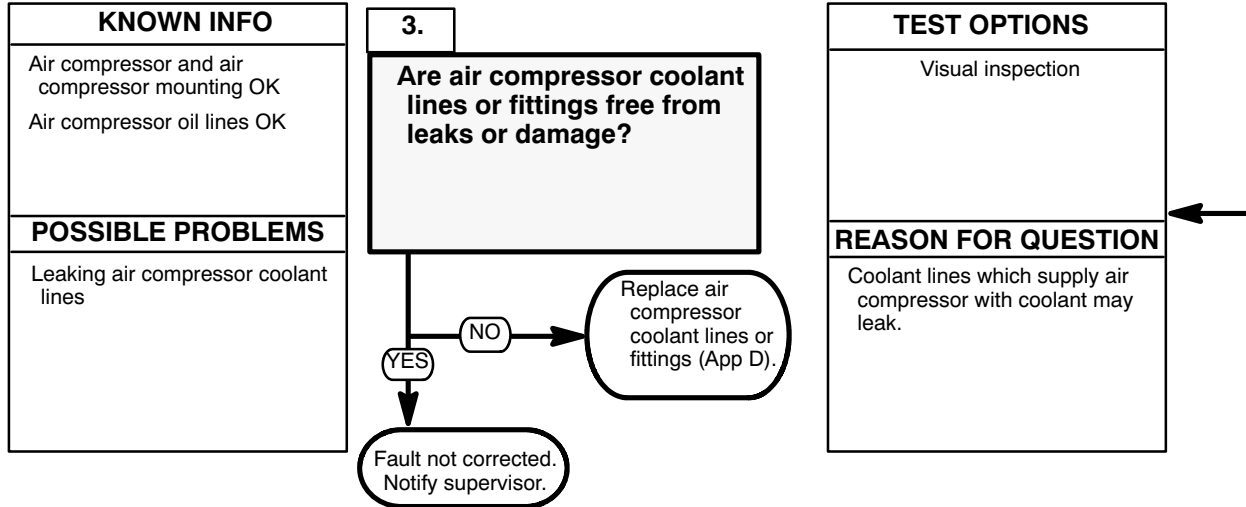


Check air compressor oil lines and fittings for leakage and damage.

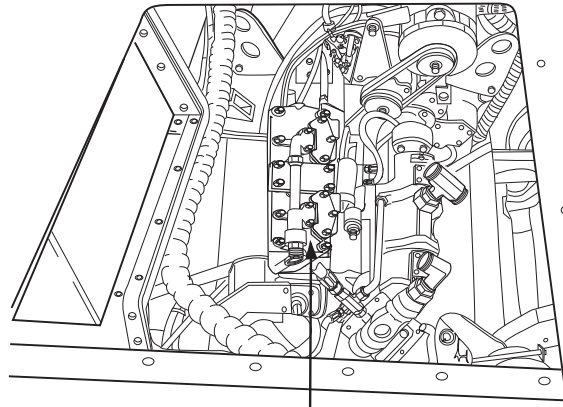
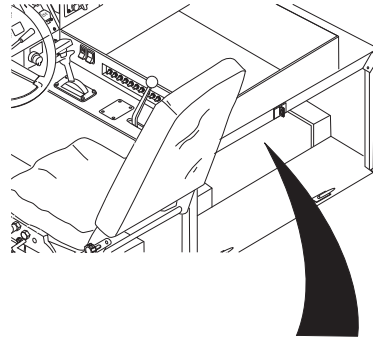


AIR COMPRESSOR

k7. COOLANT AND/OR LUBRICANT LEAKS FROM COMPRESSOR (CONT)

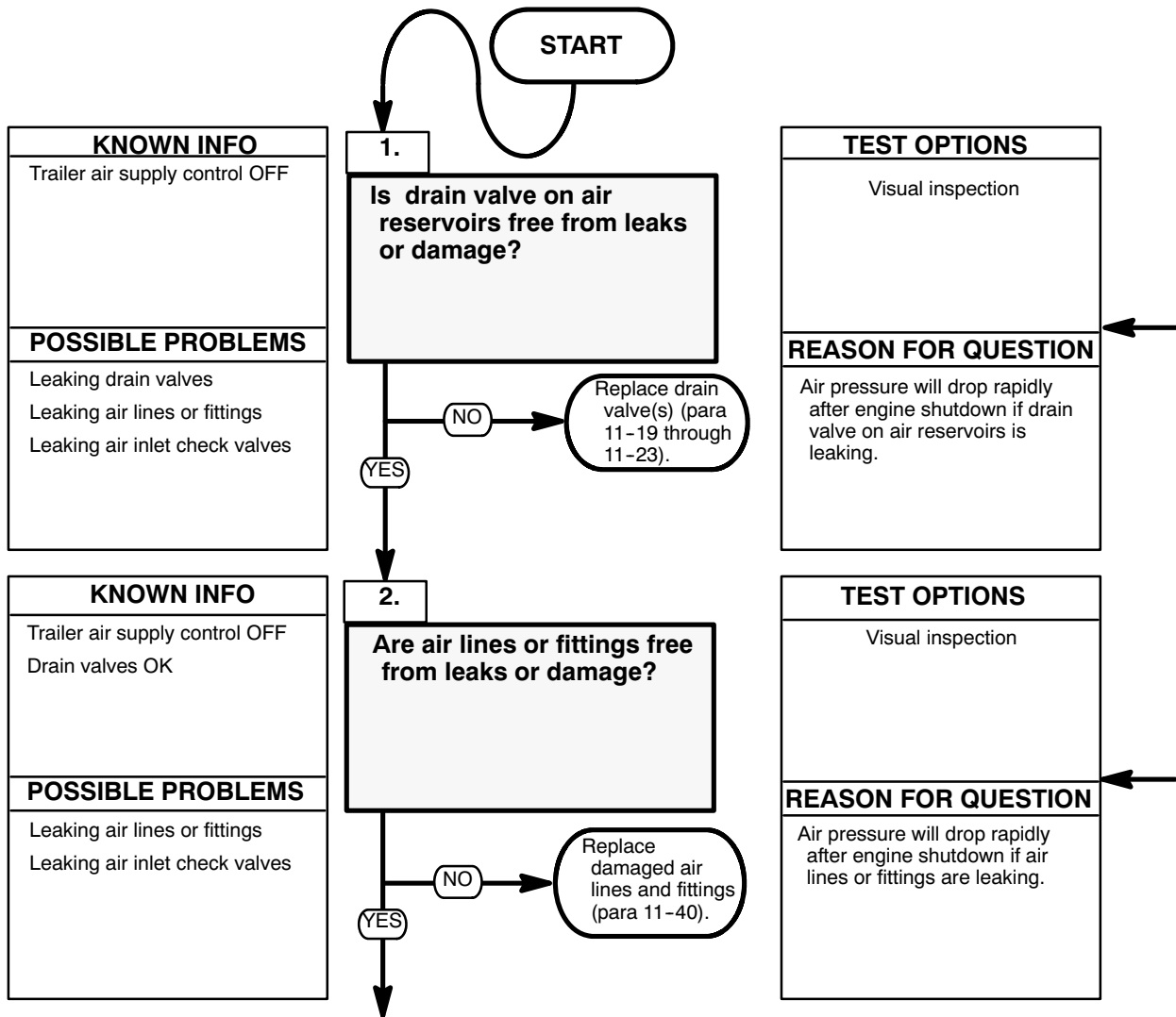


Check air compressor coolant lines and fittings for leakage and damage.

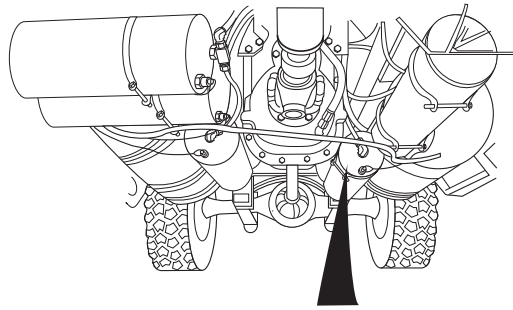


AIR COMPRESSOR

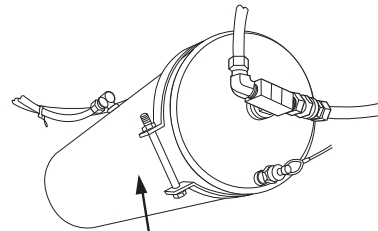
k8. AIR PRESSURE DROPS RAPIDLY AFTER ENGINE SHUTDOWN	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



Check drain valve on air reservoirs for leakage and damage.

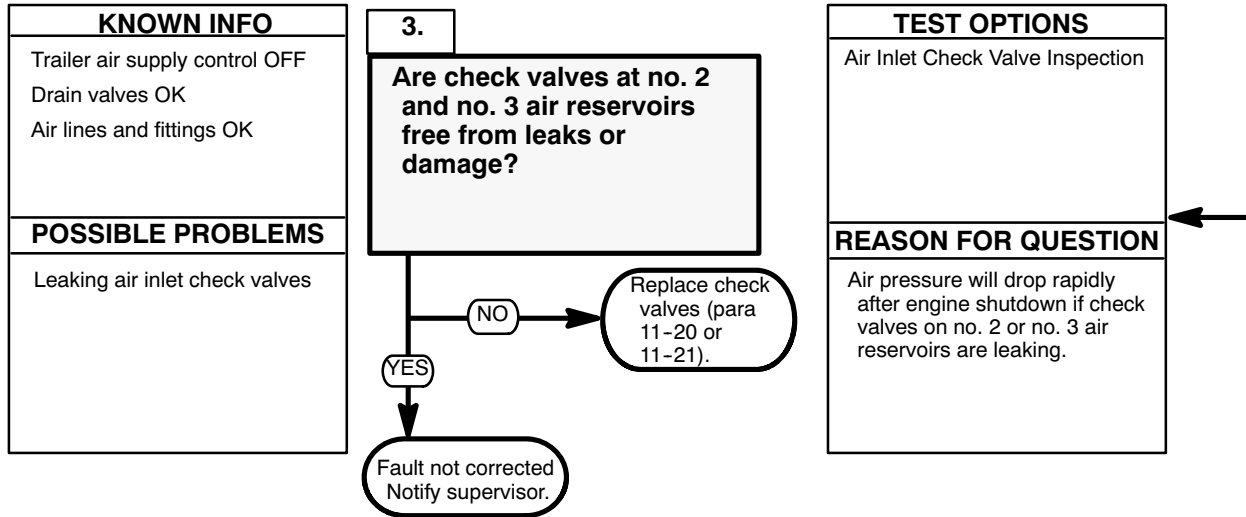


Check air lines and fittings for leakage and damage.



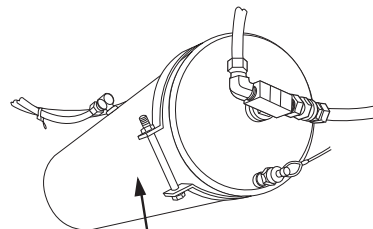
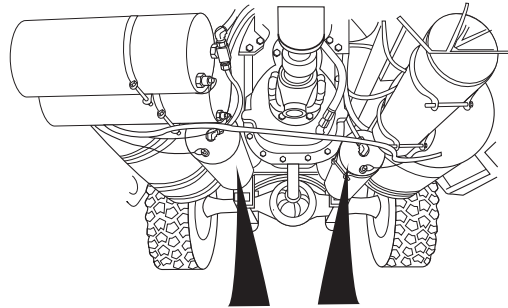
AIR RESERVOIR

k8. AIR PRESSURE DROPS RAPIDLY AFTER ENGINE SHUTDOWN (CONT)



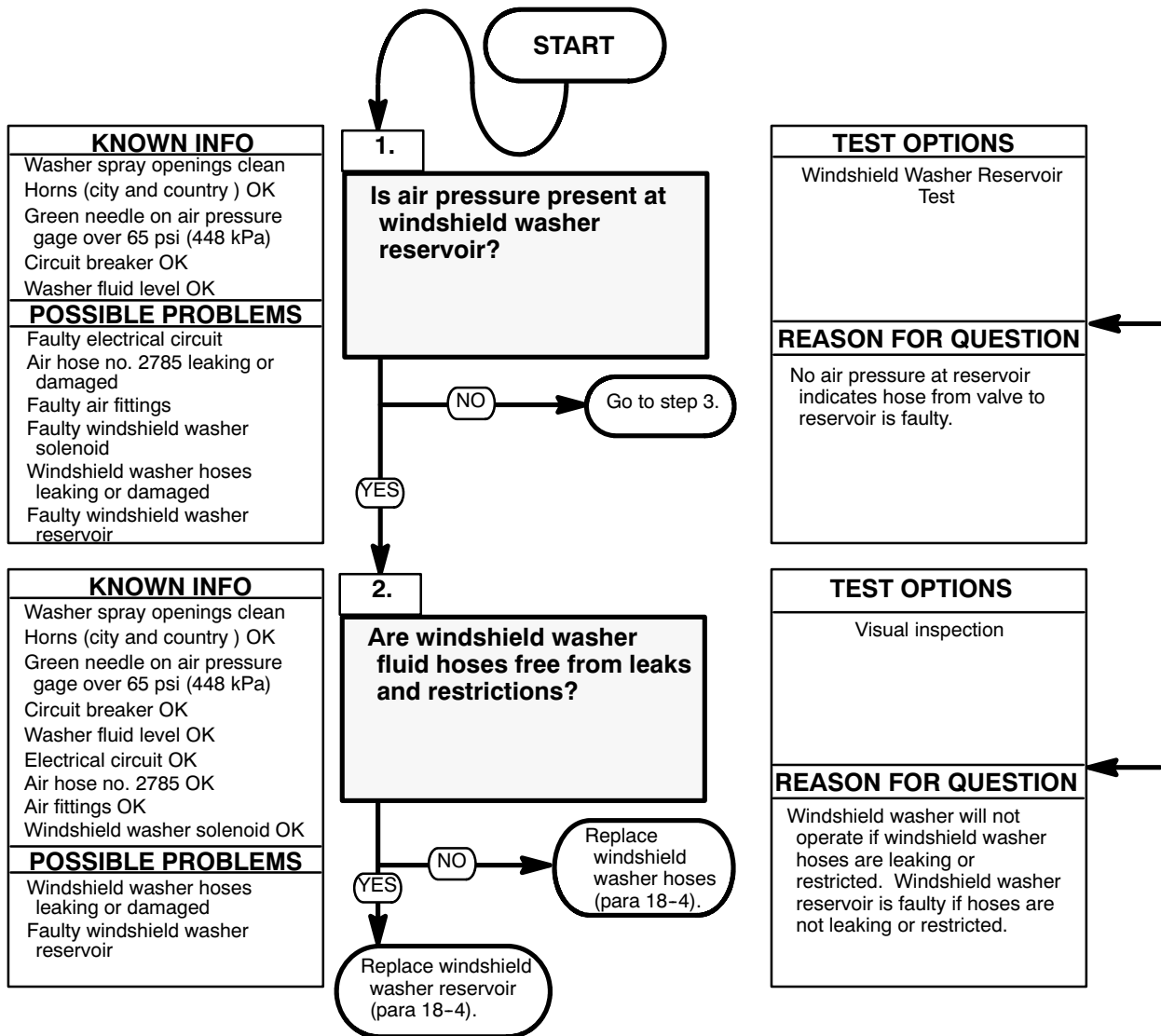
AIR INLET CHECK VALVE INSPECTION

- (1) Remove air line no. 2184 from no. 2 air reservoir check valve.
- (2) Remove air line no. 2613 from no. 3 air reservoir check valve.
- (3) Inspect check valves on no. 2 and no. 3 air reservoirs for air leakage.
- (4) Install air line no. 2613 on no. 3 air reservoir check valve.
- (5) Install air line no. 2184 on no. 2 air reservoir check valve.



AIR RESERVOIR

k9. WINDSHIELD WASHER DOES NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions</p> <p>Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools</p> <p>Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter, (Item 20, Appendix F)</p>



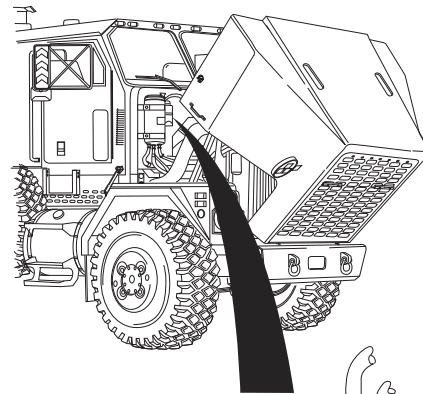
NOTE

Windshield washer will not operate until AIR PRESS gage reads greater than 65 psi (448 kPa).

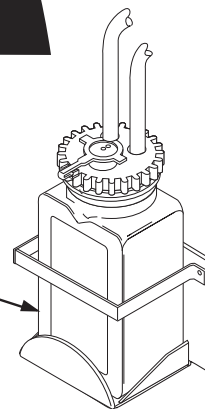
WINDSHIELD WASHER RESERVOIR TEST

- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Remove air supply hose from reservoir.
- (3) Press windshield washer switch while assistant checks for air.
- (4) Install air supply hose on reservoir.
- (5) Turn engine switch to OFF position (TM 9-2320-360-10).

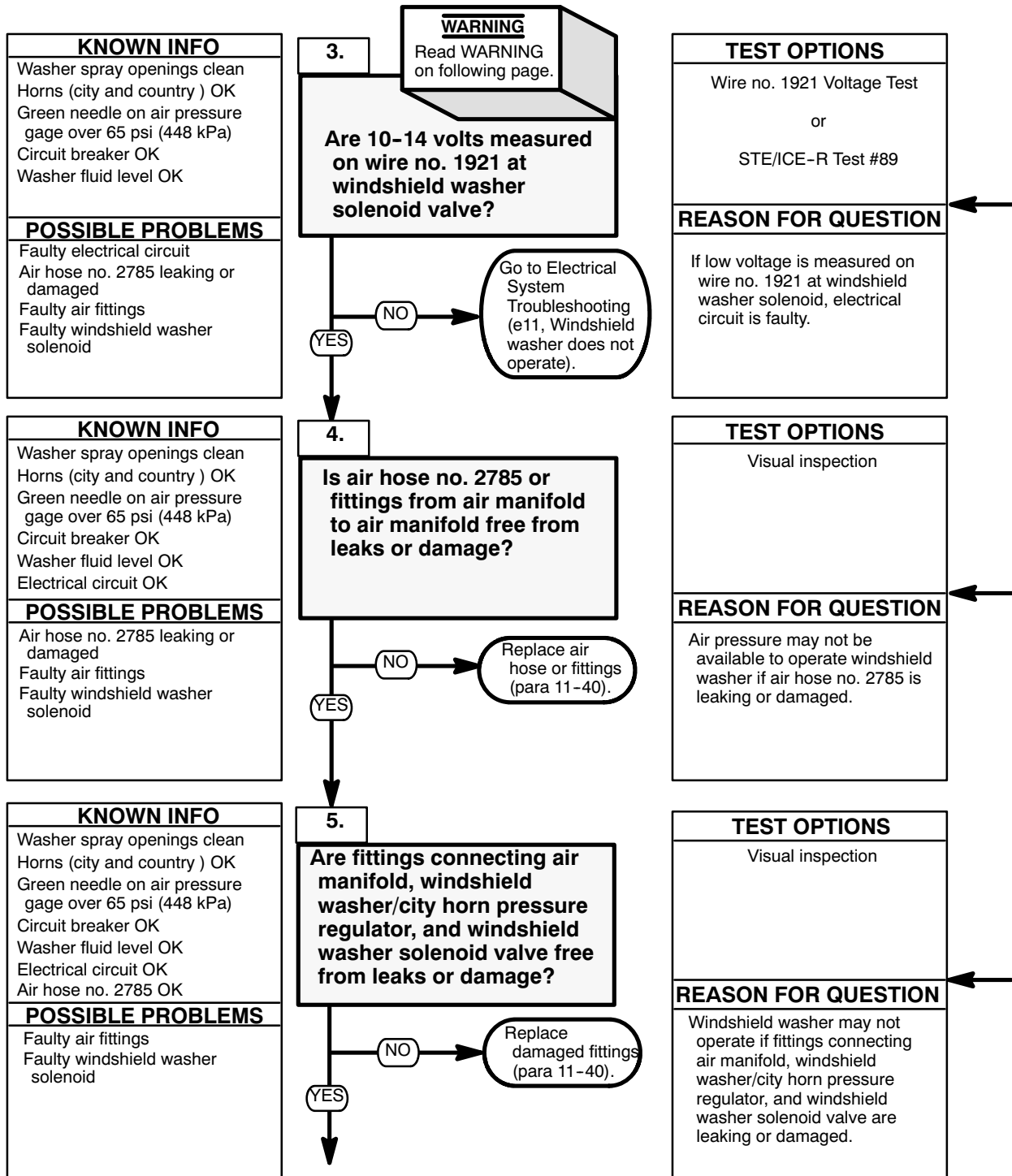
Check windshield washer hoses for leakage and restrictions.



WINDSHIELD WASHER RESERVOIR



K9. WINDSHIELD WASHER DOES NOT OPERATE (CONT)

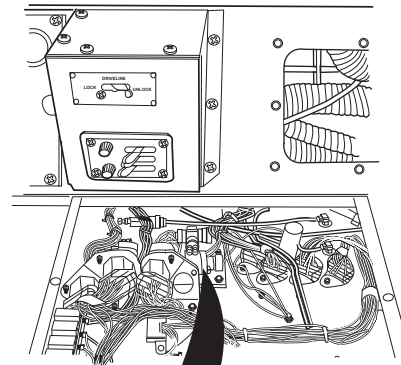


WARNING

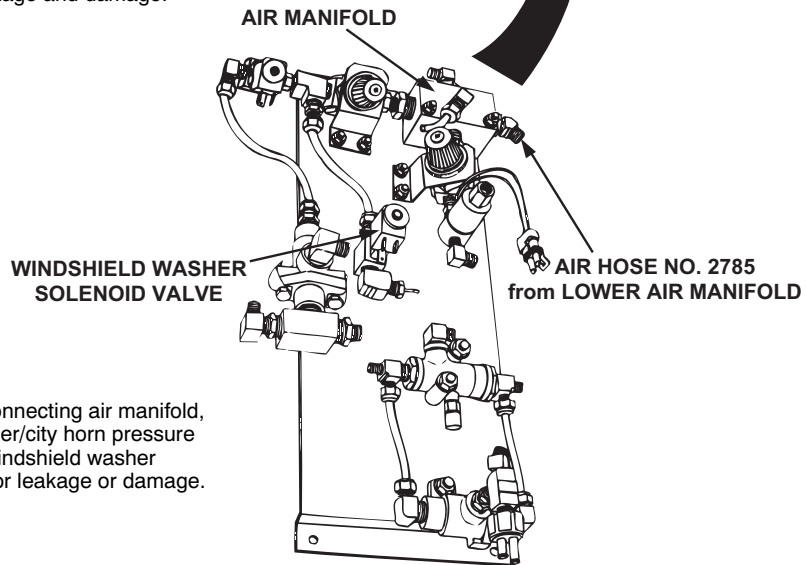
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1921 VOLTAGE TEST

- (1) Turn engine switch to ON position.
- (2) Place positive (+) probe of multimeter on wire no. 1921 at windshield washer solenoid valve.
- (3) Place negative (-) probe of multimeter on ground.
- (4) Press windshield washer switch and look for 10-14 volts on multimeter.
- (5) Turn engine switch to OFF position.

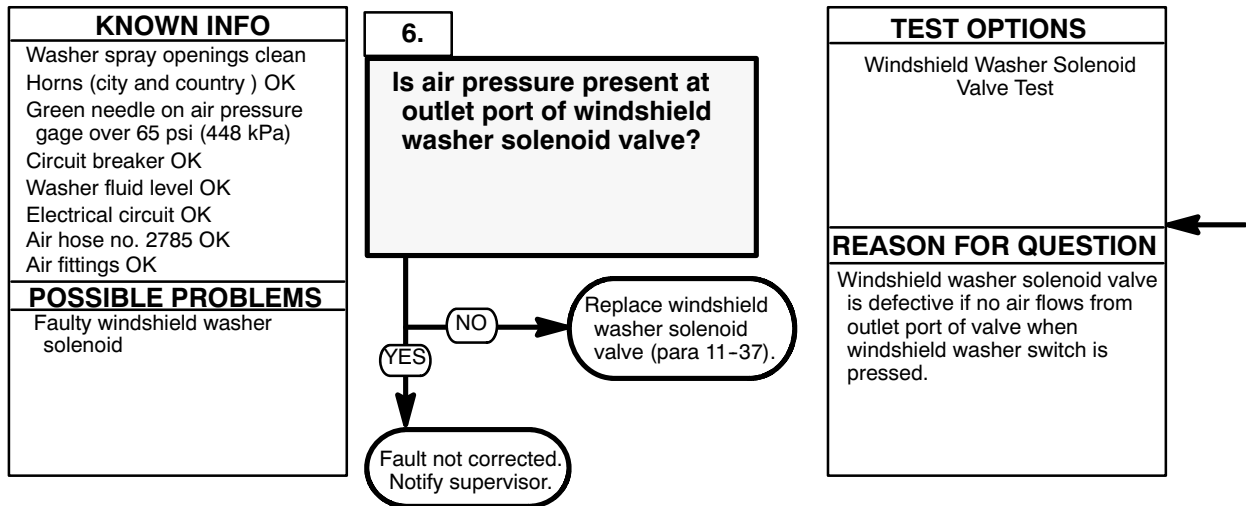


Check air hose no. 2785 and fittings from air manifold to air manifold for leakage and damage.



Check fittings connecting air manifold, windshield washer/city horn pressure regulator, and windshield washer solenoid valve for leakage or damage.

K9. WINDSHIELD WASHER DOES NOT OPERATE (CONT)

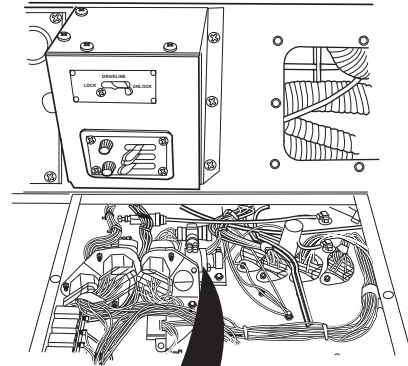


**WINDSHIELD WASHER
SOLENOID VALVE TEST**

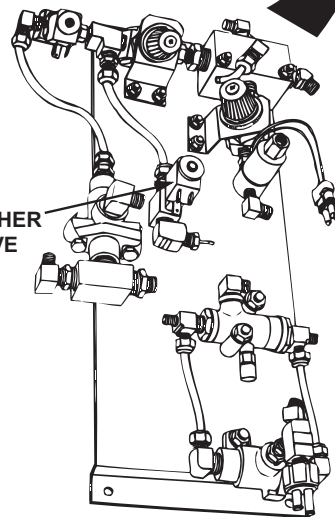
NOTE

Air pressure must be at least 65 psi (448 kPa) to perform test.

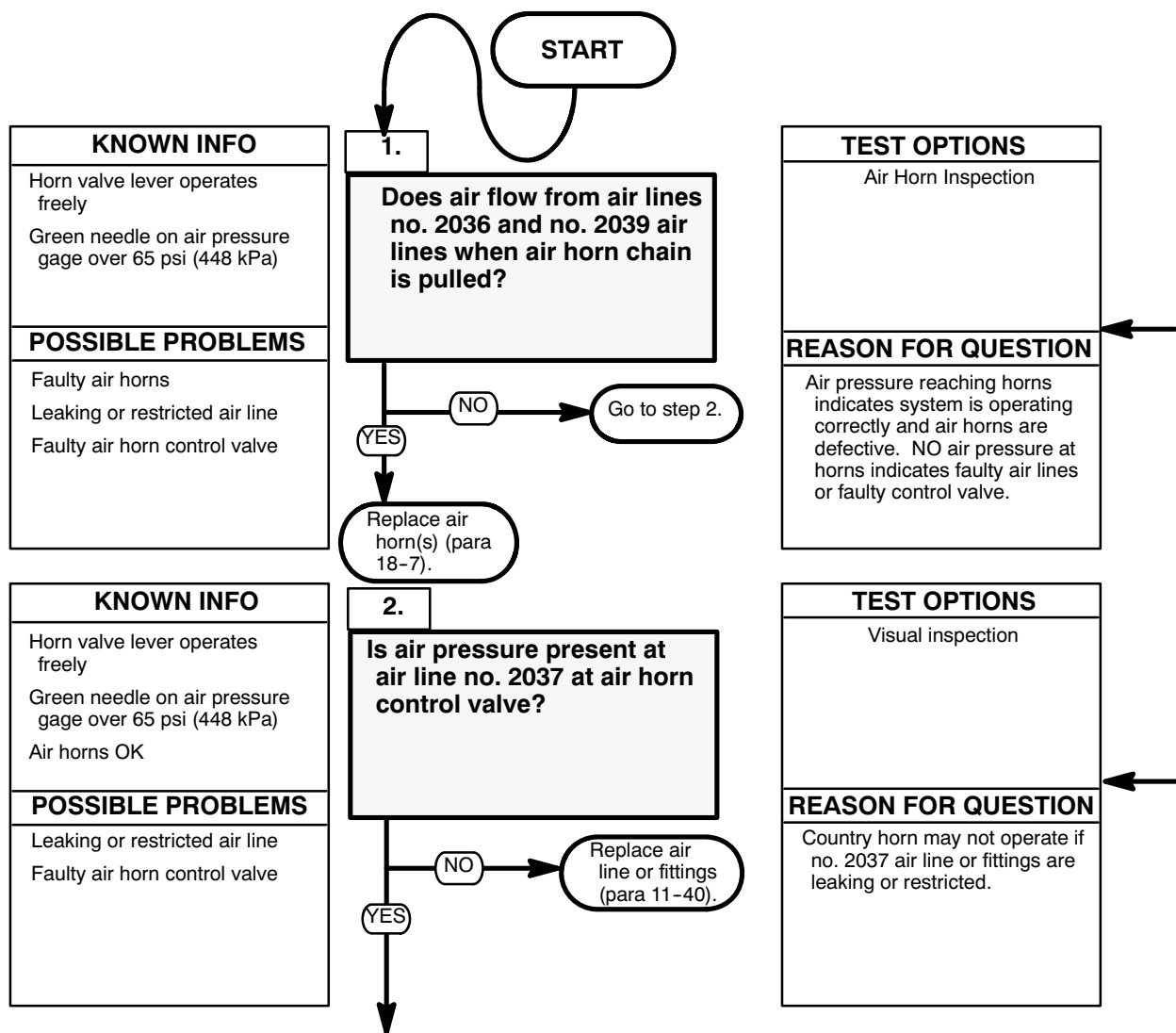
- (1) Remove clip and rubber hose from windshield washer solenoid valve.
- (2) Turn ENGINE switch to ON
- (3) Press windshield washer switch and check for air at outlet port of windshield washer solenoid valve.
- (4) Turn ENGINE switch to OFF.
- (5) Install rubber hose on windshield washer solenoid valve with clip.



**WINDSHIELD WASHER
SOLENOID VALVE**



k10. HORN (COUNTRY) DOES NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)</p> <p>Personnel Required Two</p>

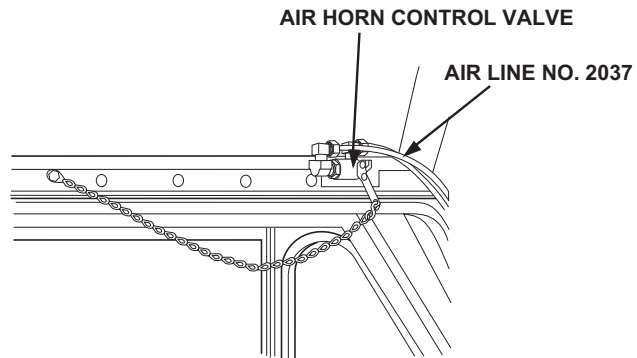


NOTE

- Country horn will not operate until AIR PRESS gage reads greater than 65 psi (448 kPa).
- Both air horns should operate when air horn control valve is activated with pull chain.

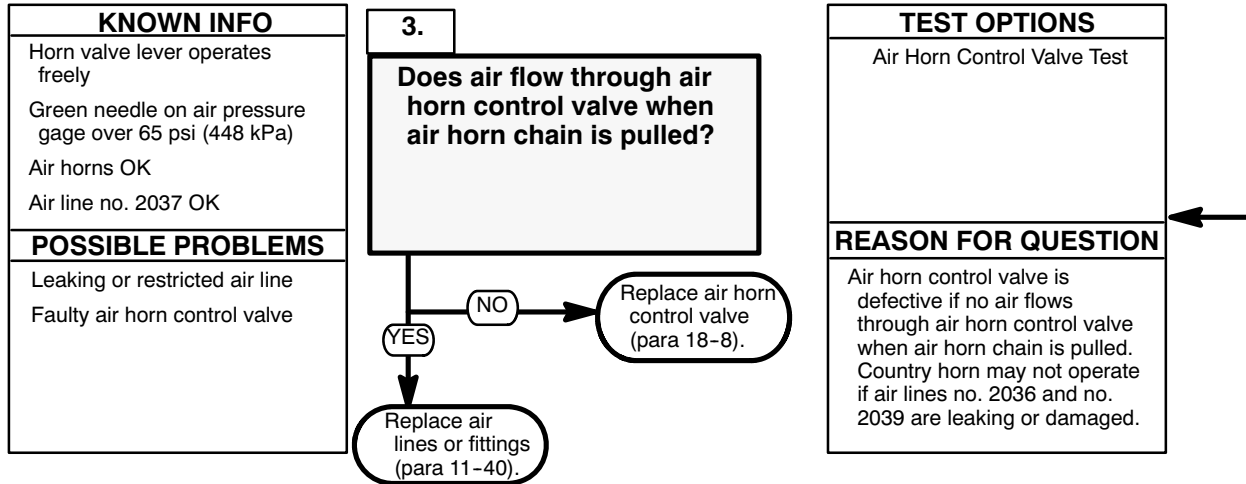
AIR HORN INSPECTION

- (1) Remove air lines no. 2036 and no. 2039 from air horns.
- (2) Pull air horn chain (TM 9-2320-360-10) while assistant checks for air at no. 2036 and no. 2039 air lines.
- (3) Install air lines no. 2036 and no. 2039 on air horns.



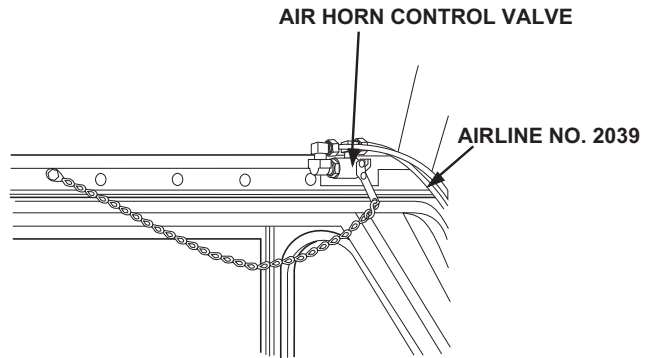
- (1) Check air line no. 2037 and fittings from air manifold to air horn control valve for leakage or damage.
- (2) Loosen air line no. 2037 at air horn control valve to check for air pressure.

K10. HORN (COUNTRY) DOES NOT OPERATE (CONT)

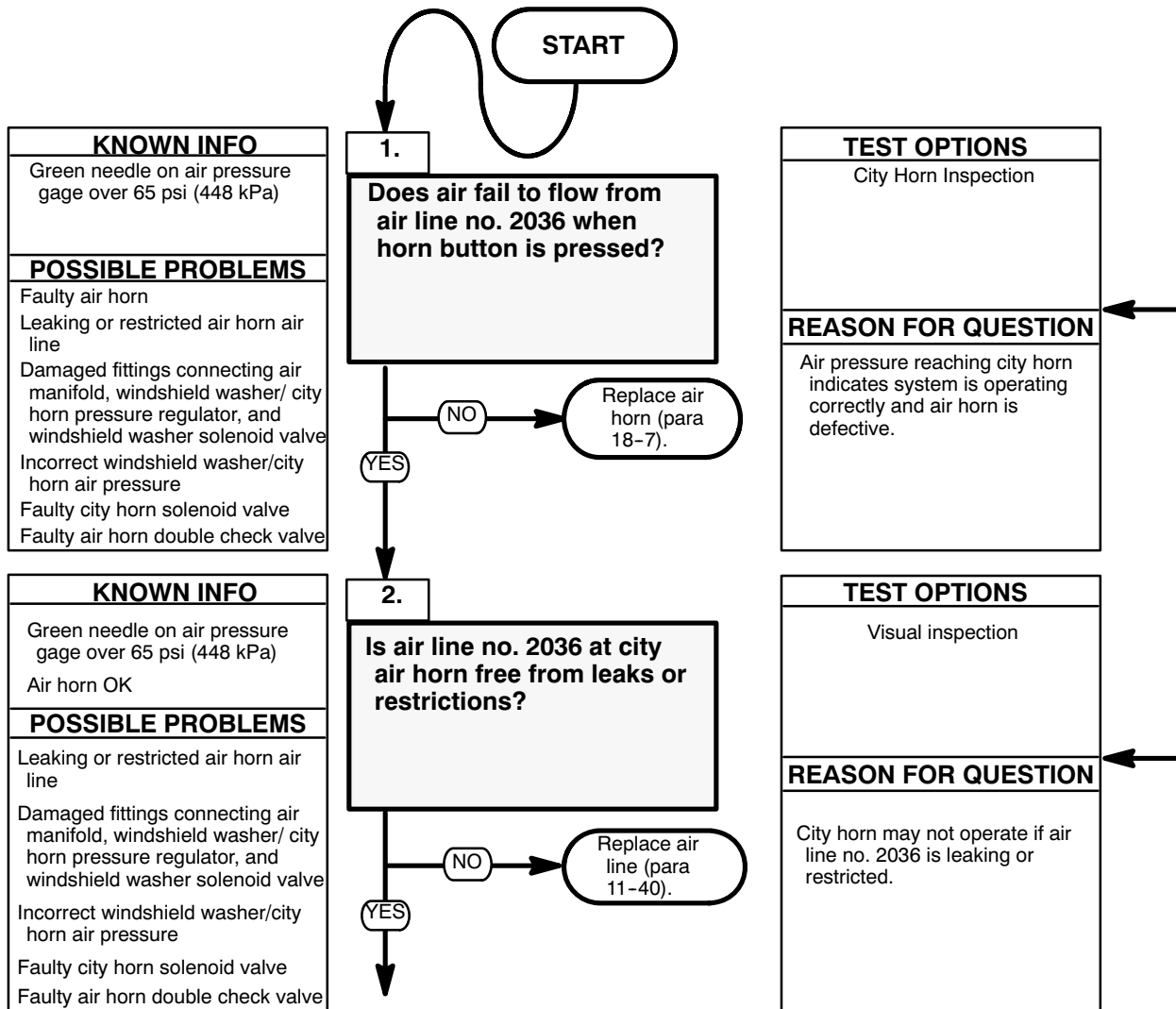


AIR HORN CONTROL VALVE TEST
--

- | |
|--|
| <ol style="list-style-type: none">(1) Remove air line no. 2039 from air horn control valve.(2) Pull air horn chain and check for air at control valve outlet port.(3) Install air line no. 2039 on air horn control valve. |
|--|



k11. HORN (CITY) DOES NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)</p> <p>Personnel Required Two</p>

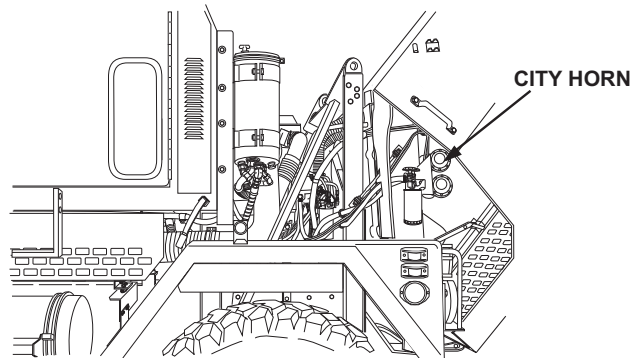


NOTE

- Perform Electrical System Troubleshooting (e7. Horn (city) does not operate) before performing steps below.
- City horn will not operate until AIR PRESS gage reads greater than 65 psi (448 kPa).
- City horn is the top air horn.

CITY HORN INSPECTION

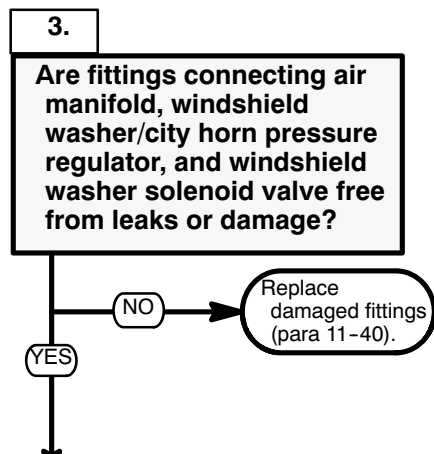
- (1) Remove air lines no. 2036 from city horn.
- (2) Turn ENGINE switch to ON (TM 9-2320-360-10).
- (3) Press horn button while assistant checks for air pressure at air line no. 2036.
- (4) Turn ENGINE switch to OFF (TM 9-2320-360-10).
- (5) Install air line no. 2036 on city horn.



Check air line no. 2036 at city air horn for leakage and restrictions.

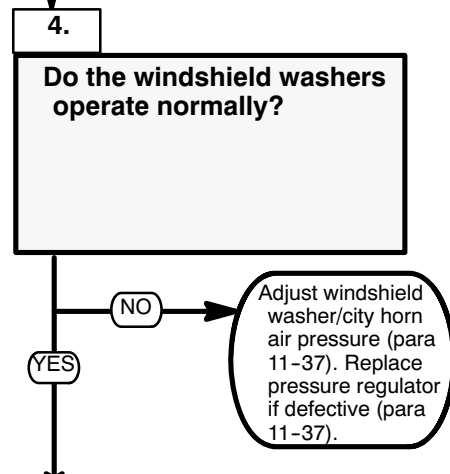
K11. HORN (CITY) DOES NOT OPERATE (CONT)

KNOWN INFO
Green needle on air pressure gage over 65 psi (448 kPa) Air horn OK Air horn air line OK
POSSIBLE PROBLEMS
Damaged fittings connecting air manifold, windshield washer/ city horn pressure regulator, and windshield washer solenoid valve Incorrect windshield washer/city horn air pressure Faulty city horn solenoid valve Faulty air horn double check valve



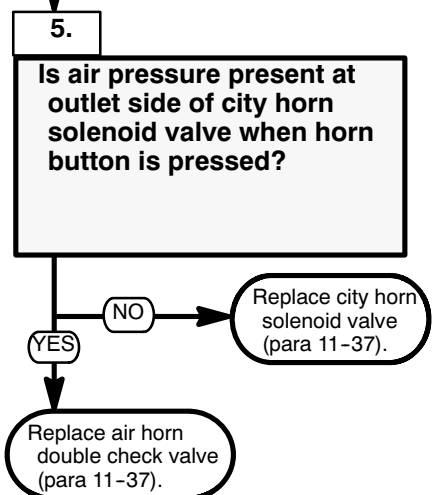
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
City horn may not operate if fittings connecting air manifold, windshield washer/city horn pressure regulator, and windshield washer solenoid valve are leaking or damaged.

KNOWN INFO
Green needle on air pressure gage over 65 psi (448 kPa) Air horn OK Air horn air line OK Fittings connecting air manifold, windshield washer/ city horn pressure regulator, and windshield washer solenoid valve OK
POSSIBLE PROBLEMS
Incorrect windshield washer/city horn air pressure Faulty city horn solenoid valve Faulty air horn double check valve



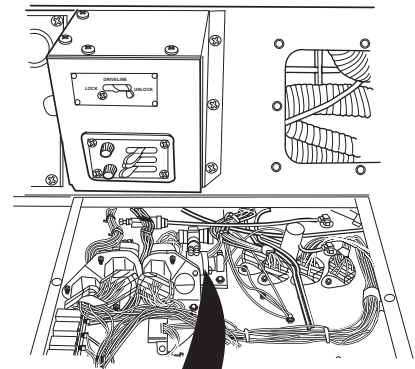
TEST OPTIONS
Refer to air pressure regulators adjustment procedure (para 11-37)
REASON FOR QUESTION
City horn and windshield washers share a common air source at the air pressure regulator. If the windshield washers also do not work, pressure regulator is faulty.

KNOWN INFO
Green needle on air pressure gage over 65 psi (448 kPa) Air horn OK Air horn air line OK Fittings connecting air manifold, windshield washer/ city horn pressure regulator, and windshield washer solenoid valve OK Windshield washer/city horn air pressure OK
POSSIBLE PROBLEMS
Faulty city horn solenoid valve Faulty air horn double check valve



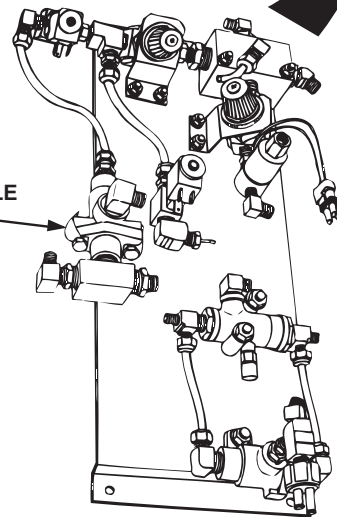
TEST OPTIONS
City Horn Solenoid Valve Test
REASON FOR QUESTION
City horn solenoid valve is defective if no air is present at outlet side of valve when horn button is pressed. Air horn double check valve is faulty if air is present.

Check fittings connecting air manifold, windshield washer/city horn pressure regulator, and windshield washer solenoid valve for leakage and damage.



Refer to para 11-37 to adjust or replace windshield washer/city horn air pressure regulator.

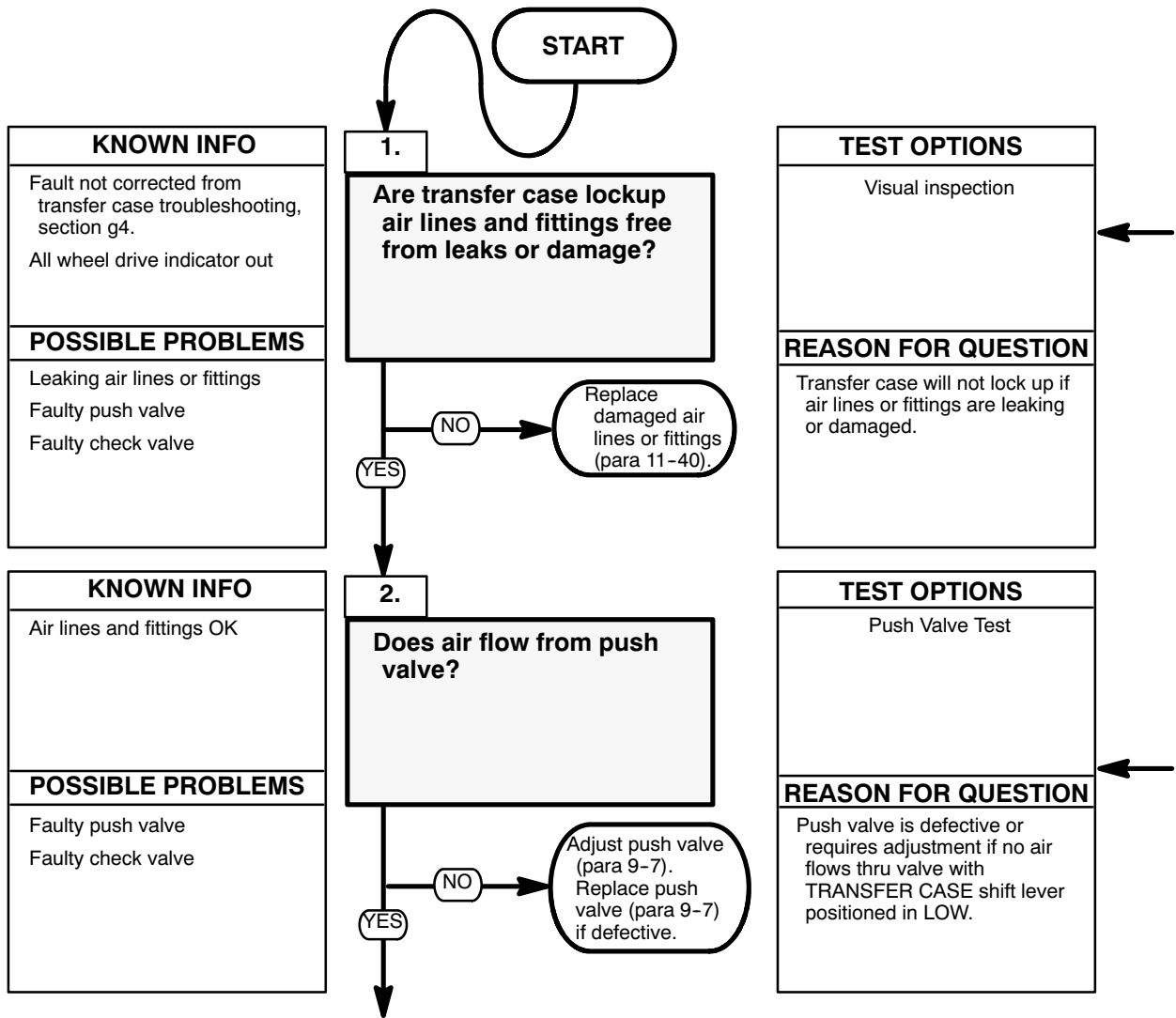
AIR HORN DOUBLE CHECK VALVE



CITY HORN SOLENOID VALVE TEST

- (1) Remove air line no. 2040 from city horn solenoid valve.
- (2) Turn ENGINE switch to ON (TM 9-2320-360-10).
- (3) Press horn button and check for air at outlet port of city horn solenoid valve.
- (4) Turn ENGINE switch to OFF (TM 9-2320-360-10).
- (5) Install air line no. 2040 on city horn solenoid valve.

k12. TRANSFER CASE DOES NOT ENGAGE FRONT AXLE WHEN TRANSFER CASE SHIFT LEVER IS POSITIONED TO LOW	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

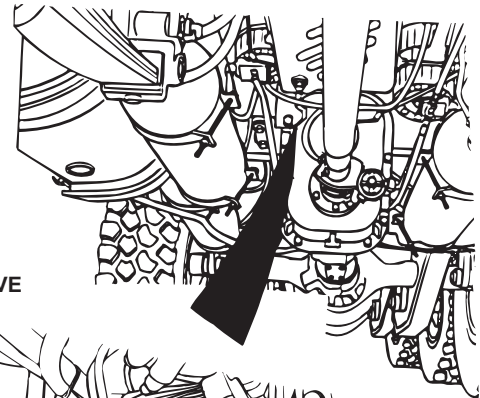


NOTE

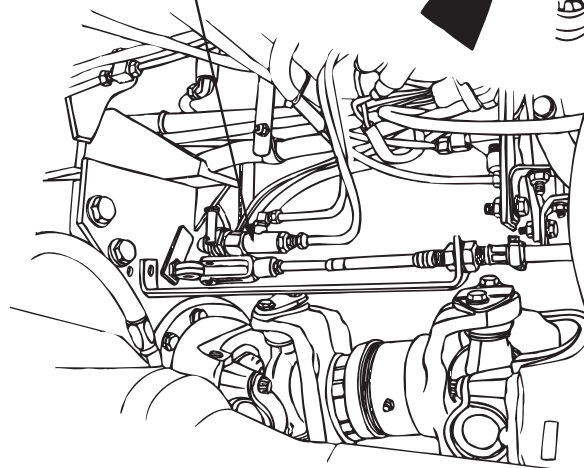
- Transfer case will not lockup until AIR PRESS gage reads greater than 65 psi (448 kPa).
- Perform Transfer Case Troubleshooting (g4, Transfer case dies not engage front axle when shift lever is positioned to LOW) before starting steps given below.
- Refer to air hose diagrams in front of this system troubleshooting section for air line locations.

Check the following air lines and fittings for leakage and damage.

- Air line no. 2074 from no. 2 air reservoir to air manifold
- Air line no. 2785 from air manifold to air manifold
- Air line no. 2765 from air manifold to driveline lockup valve
- Air line no. 2761 from air manifold to push valve
- Air line no. 2762 from push valve to interaxle lockup pilot valve
- Air line no. 2769 from interaxle lockup pilot valve to check valve
- Air line no. 2769 from check valve to transfer case lockout shift air chamber
- Air line no. 2766 from driveline lockup valve to interaxle lockup pilot valve



PUSH VALVE

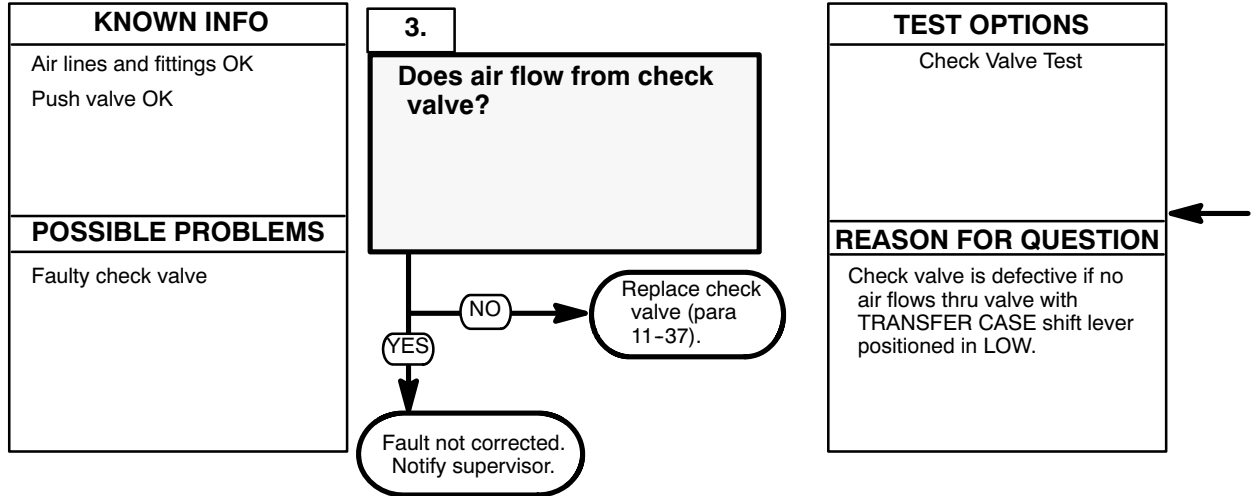


TRANSFER CASE BOOT REMOVED FOR CLARITY

PUSH VALVE TEST

- (1) Start engine (TM 9-2320-360-10) and allow air pressure to build greater than 65 psi (448 kPa).
- (2) Shut off engine (TM 9-2320-360-10).
- (3) Position TRANSFER CASE shift lever to LOW.
- (4) Loosen air line no. 2762 from push valve and check for air flow from push valve.
- (5) Tighten air line no. 2762 on push valve.

k12. TRANSFER CASE DOES NOT ENGAGE FRONT AXLE WHEN TRANSFER CASE SHIFT LEVER IS POSITIONED TO LOW (CONT)

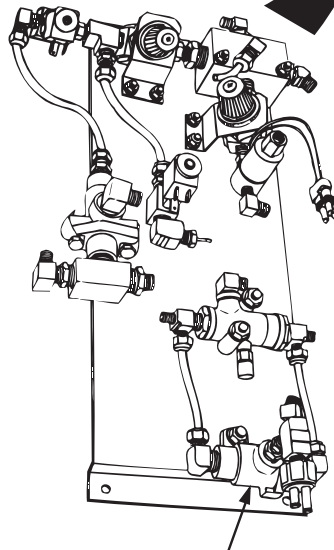
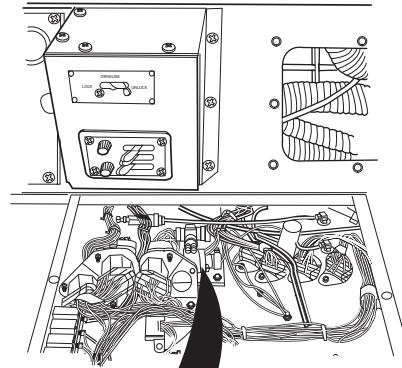


WARNING

Due to the air system pressure, be sure to wear the proper eye protection to avoid personal injury.

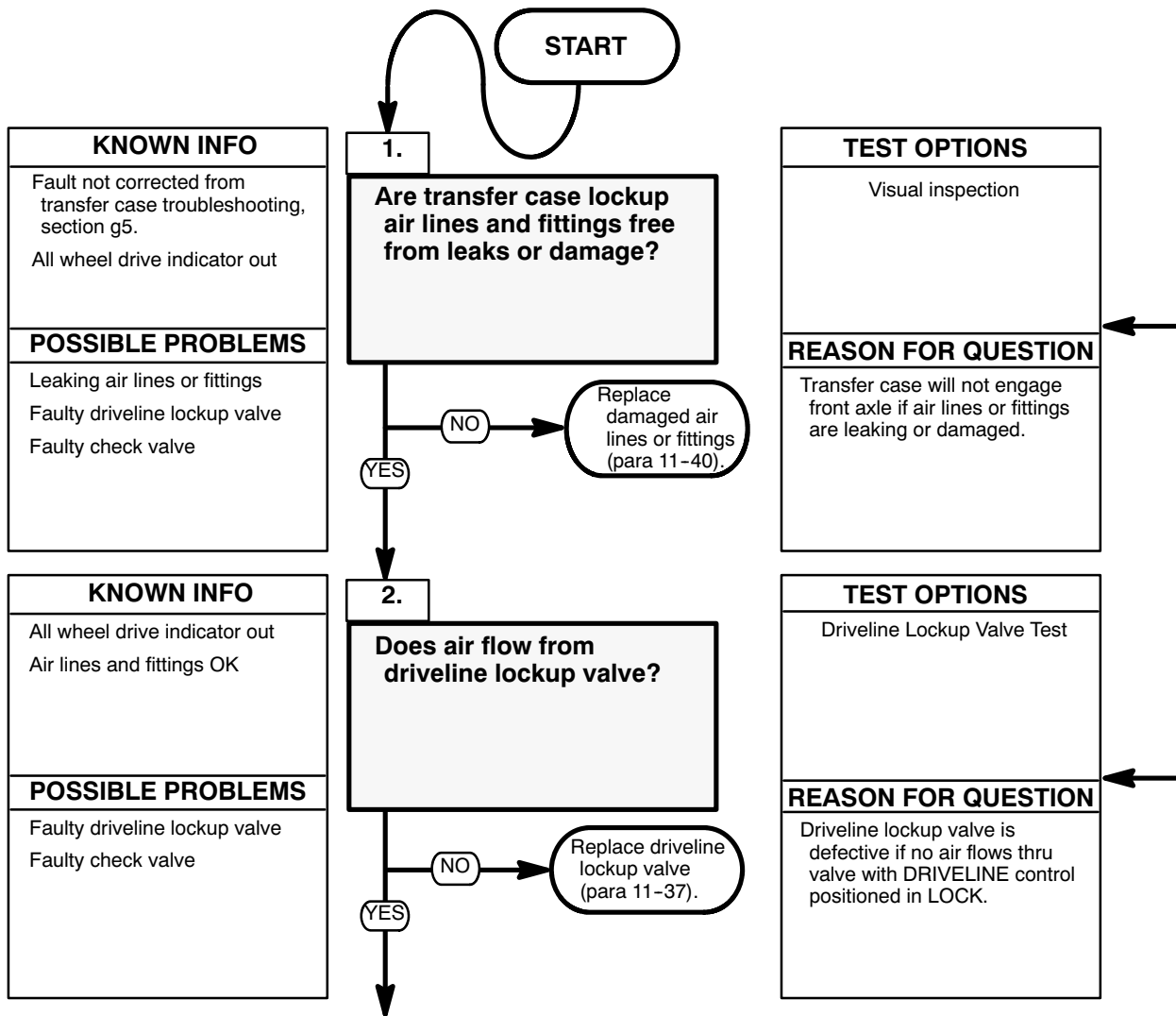
CHECK VALVE TEST

- (1) Start engine (TM 9-2320-360-10) and allow air pressure to build greater than 65 psi (448 kPa).
- (2) Shut off engine (TM 9-2320-360-10).
- (3) Position TRANSFER CASE shift lever to LOW.
- (4) Loosen air line no. 2769 from check valve and check for air flow from check valve.
- (5) Tighten air line no. 2769 on check valve.



HI-LO CHECK VALVE

k13. TRANSFER CASE DOES NOT ENGAGE FRONT AXLE WHEN TRANSFER CASE SHIFT LEVER IS POSITIONED IN HIGH AND DRIVELINE CONTROL IS POSITIONED IN LOCK	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



NOTE

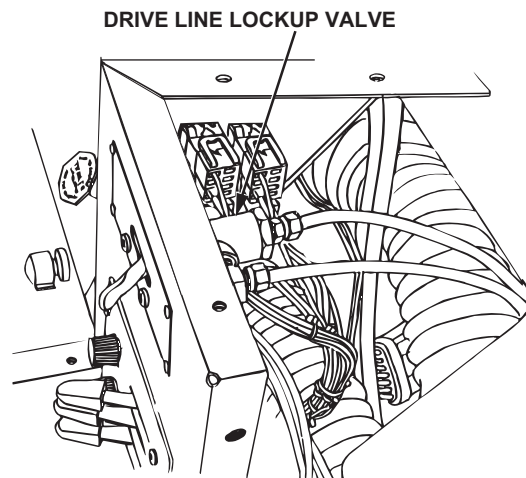
- Transfer case will not engage front axle until AIR PRESS gage reads greater than 65 psi (448 kPa).
- Perform Transfer Case Troubleshooting (g5, Transfer case does not engage front axle when shift lever is positioned in HIGH and driveline control is positioned to LOCK) before starting steps given below.
- Refer to air hose diagrams in front of this system troubleshooting section for air line locations.

Check the following air lines and fittings for leakage and damage.

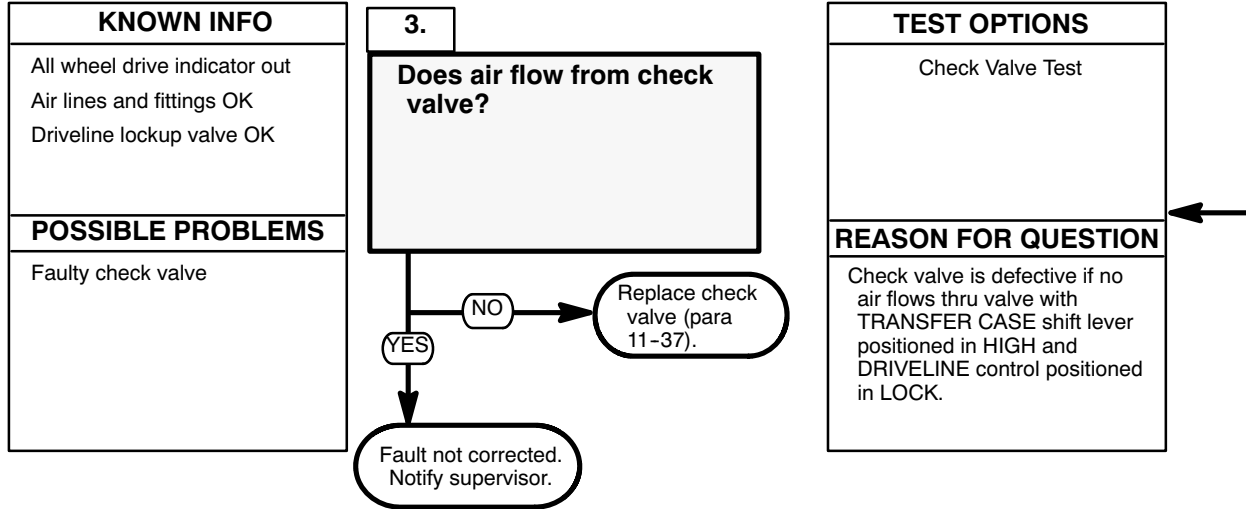
- Air line no. 2074 from no. 2 air reservoir to air manifold
- Air line no. 2785 from air manifold to air manifold
- Air line no. 2765 from air manifold to driveline lockup valve
- Air lines no. 2766 and no. 2769 from driveline lockup valve to transfer case lockout shift air chamber.

DRIVELINE LOCKUP VALVE TEST

- (1) Start engine (TM 9-2320-360-10) and allow air pressure to build greater than 65 psi (448 kPa).
- (2) Shut off engine (TM 9-2320-360-10).
- (3) Position DRIVELINE control to LOCK.
- (4) Loosen air line no. 2766 on driveline lockup valve and check for air flow from driveline lockup valve.
- (5) Tighten air line no. 2766 on driveline lockup valve.

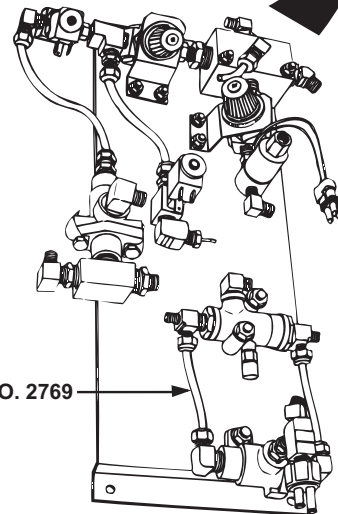
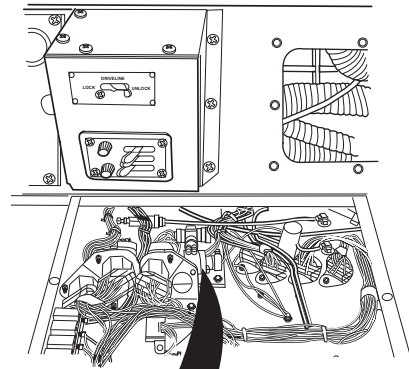


k13. TRANSFER CASE DOES NOT ENGAGE FRONT AXLE WHEN TRANSFER CASE SHIFT LEVER IS POSITIONED IN HIGH AND DRIVELINE CONTROL IS POSITIONED IN LOCK (CONT)



CHECK VALVE TEST

- (1) Start engine (TM 9-2320-360-10) and allow air pressure to build greater than 65 psi (448 kPa).
- (2) Shut off engine (TM 9-2320-360-10).
- (3) Position TRANSFER CASE shift lever to LOW.
- (4) Loosen air line no. 2769 from check valve and check for air flow from check valve.
- (5) Tighten air line no. 2769 on check valve.

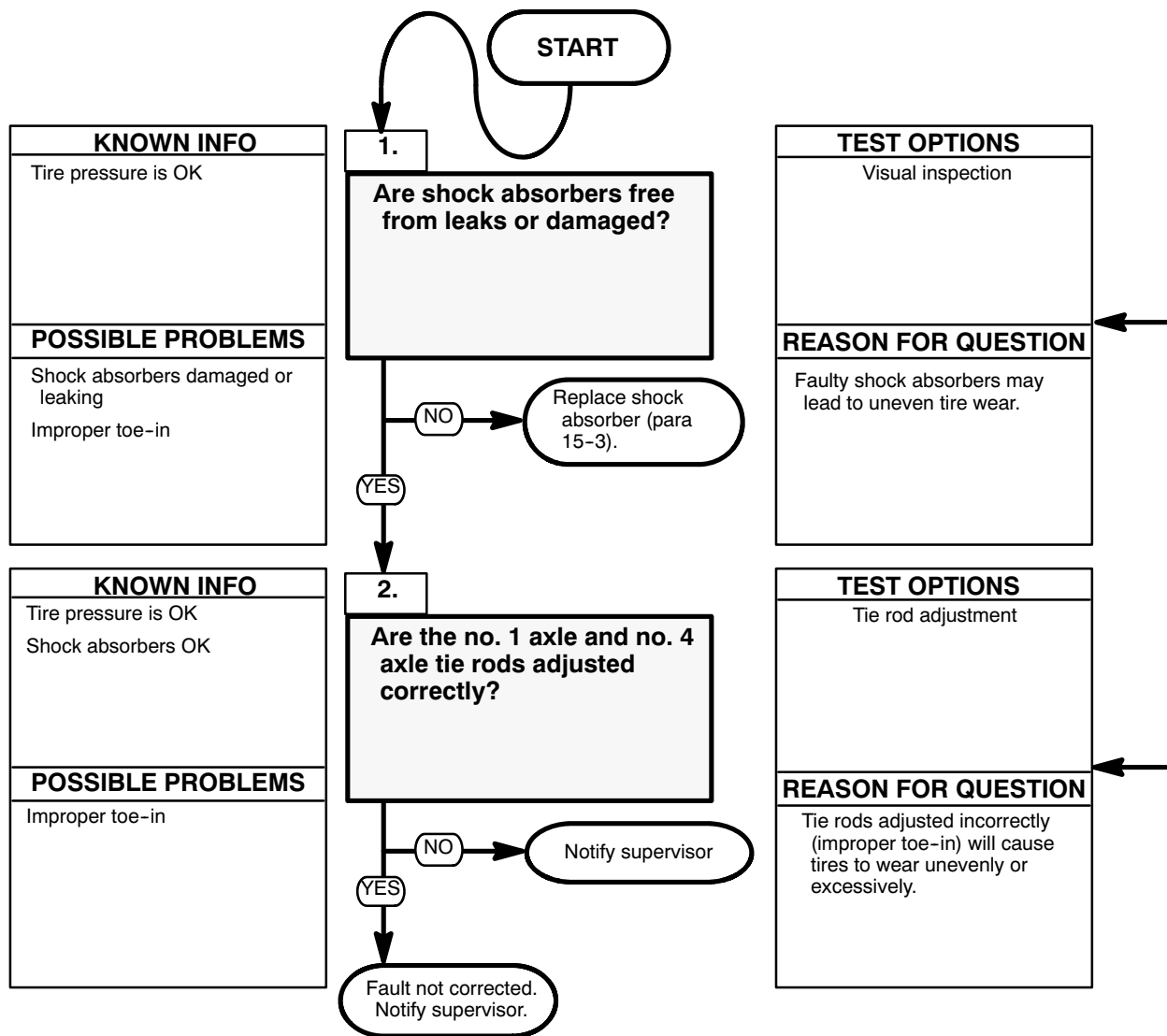


AIR LINE NO. 2769

m. WHEELS, TIRES, AND HUBS

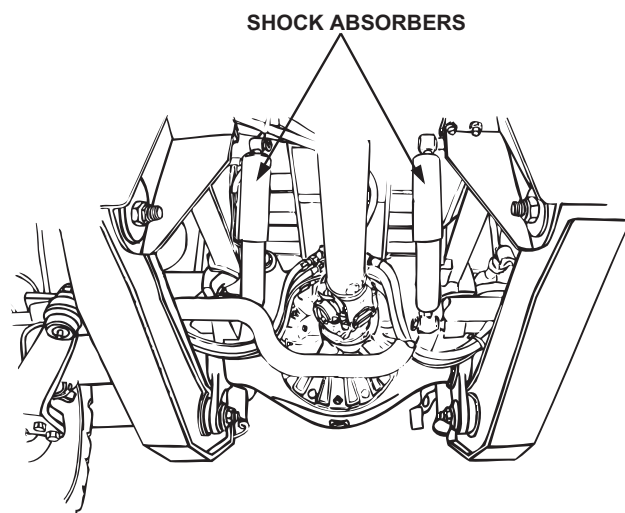
<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>m1. Tires wear unevenly or excessively</u>	<u>2-806</u>
<u>m2. Wheel wobbles or shimmies</u>	<u>2-808</u>

m1. TIRES WEAR UNEVENLY OR EXCESSIVELY	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

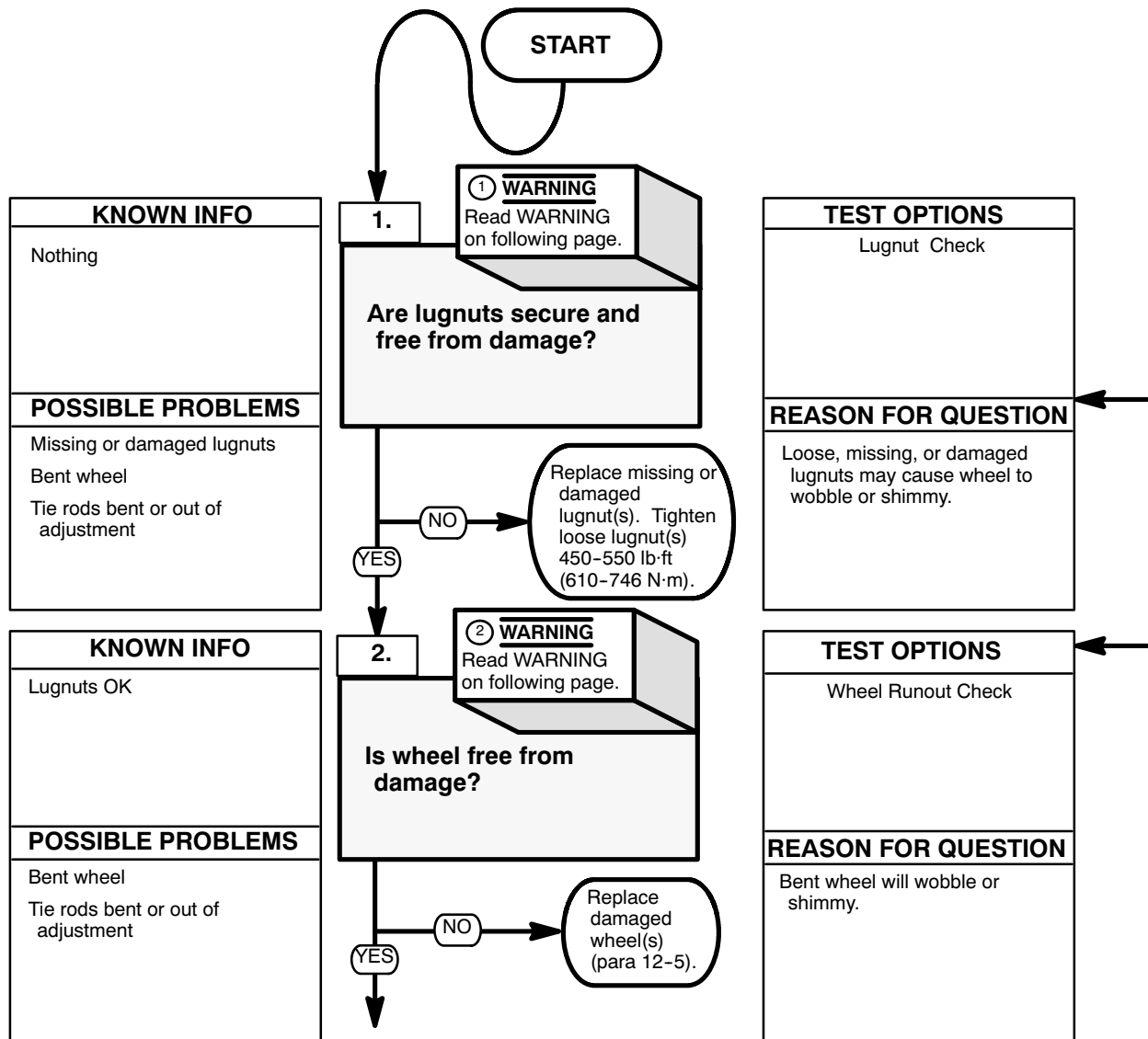


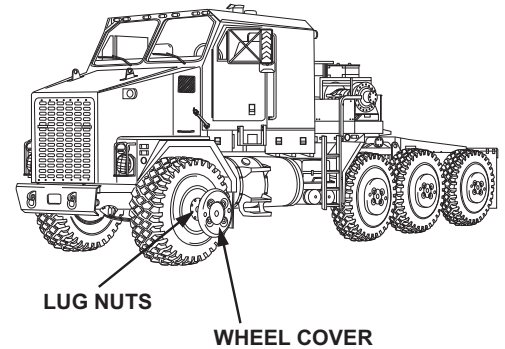
Inspect tires for excessive wear. Tires that have flat spots indicate a defective shock absorber. Inspect shock absorbers for leaks or damage.

Refer to tie rod adjustment procedure (para 13-4).



m2.WHEEL WOBBLES OR SHIMMIES	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)





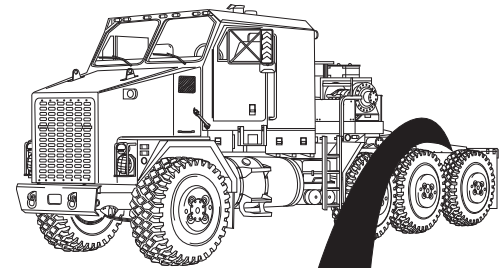
LUGNUT CHECK

- (1) Remove four nuts and wheel cover from tire assembly.

1 WARNING

After removing the wheel cover, if any bolts are found loose or broken, deflate the tire completely before attempting to loosen lugnuts. Failure to comply may result in injury to personnel.

- (2) Check if any lugnuts are loose, missing, or damaged.
- (3) Tighten loose lugnuts 450-550 lb-ft (610-746 N·m).
- (4) Install wheel cover on tire assembly with four nuts.



WHEEL RUNOUT CHECK

2 WARNING

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

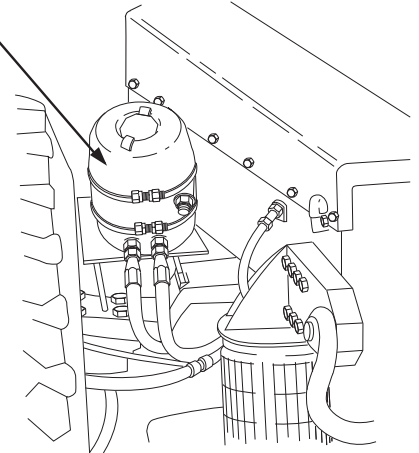
- (1) Jack up HET Tractor (TM 9-2320-360-10) one wheel at a time.

NOTE

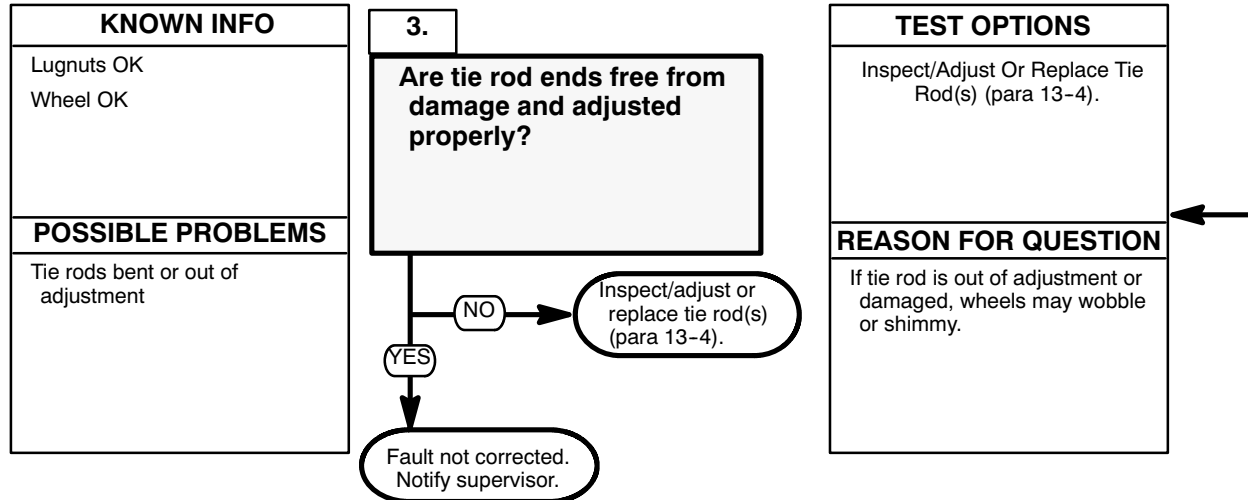
Perform steps (2) and (5) only if working on rear three axles.

- (2) Manually release spring brake (TM 9-2320-360-10).
- (3) Rotate tire to check for bent wheel.
- (4) Lower HET Tractor (TM 9-2320-360-10).
- (5) Manually apply spring brake (TM 9-2320-360-10).

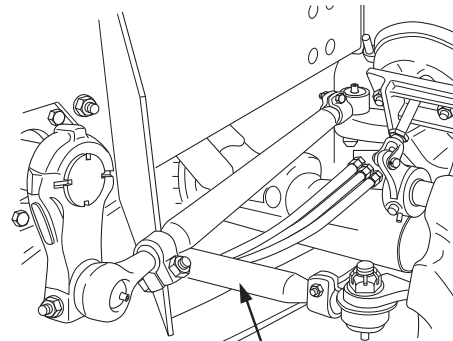
SPRING BRAKE CHAMBER



m2.WHEEL WOBBLES OR SHIMMIES (CONT)



Check front and rear tie rods for cracks, bends, and/or loose or damaged mounting hardware. Refer to para 13-4 for tie rod adjustment and/or replacement procedures.

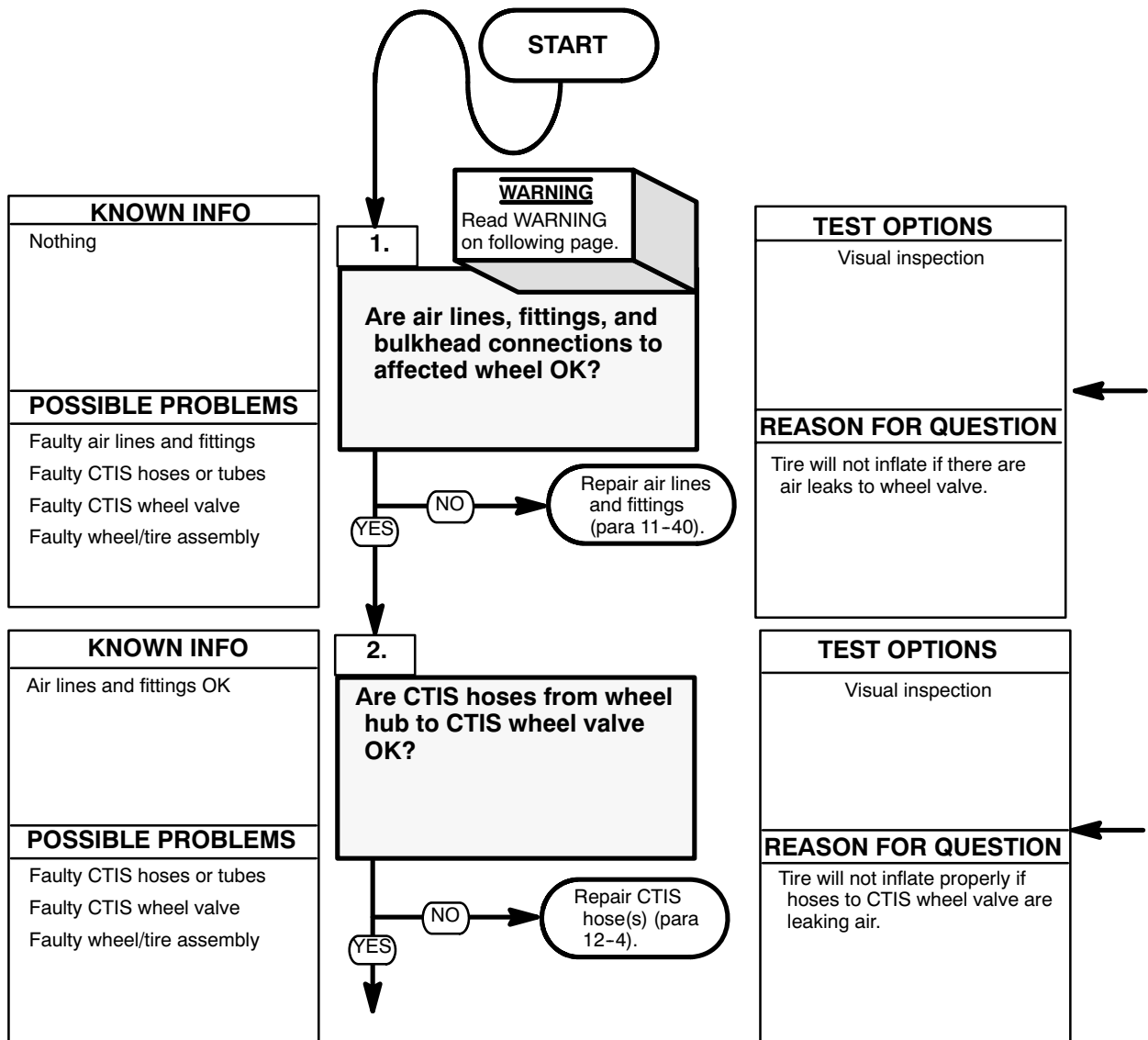


TIE ROD

n. CENTRAL TIRE INFLATION SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>n1. One tire will not inflate</u>	2-812
<u>n2. Excess inflation time, CTIS green indicator flashes too long or continually</u>	2-816
<u>n3. CTIS inoperative</u>	2-826
<u>n4. Tires do not deflate to lower pressure setting</u>	2-830
<u>n5. Tire pressures do not agree with CTIS settings</u>	2-836
<u>n6. Power manifold clicks continually/LOW AIR light flashing</u>	2-840
n7. Deleted	
<u>n8. Tires deflate upon completion of adjustment cycle</u>	2-852
<u>n9. CTIS low air indicator stays on over 90 psi (621 kPa)</u>	2-858
<u>n10. Overspeed light does not function</u>	2-862
n11. Deleted	

n1. ONE TIRE WILL NOT INFLATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Gage, Tire Pressure (Item 13, Appendix F) Goggles, Industrial (Item 14, Appendix F)
Materials/Parts Chips, Soap (Item 13, Appendix C)	

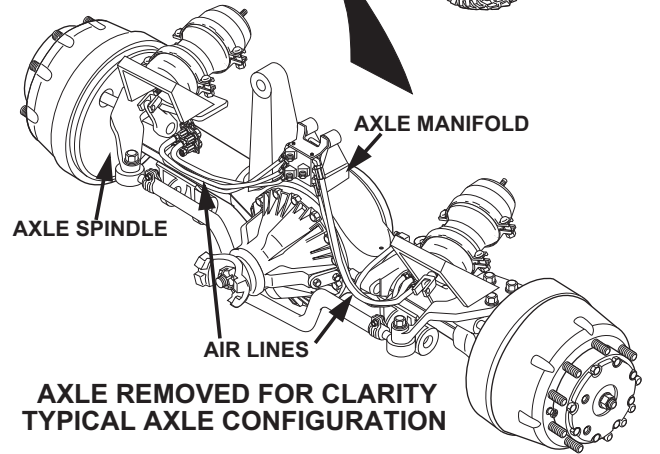
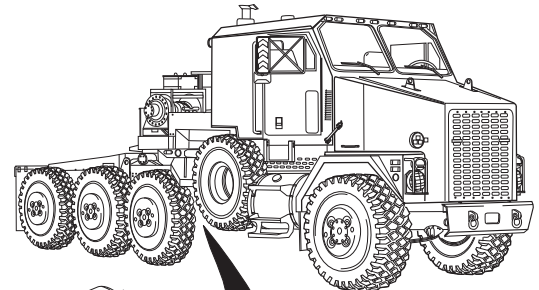


WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

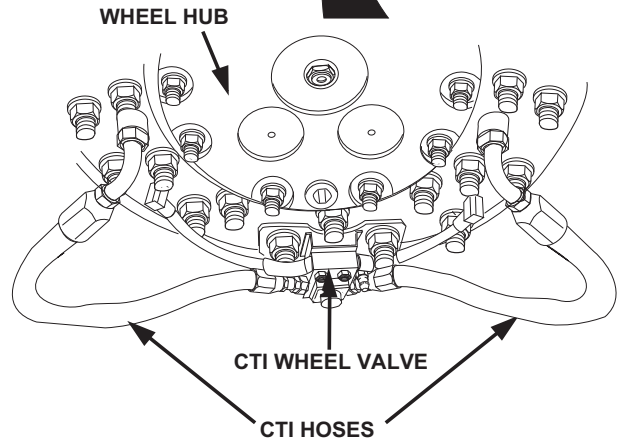
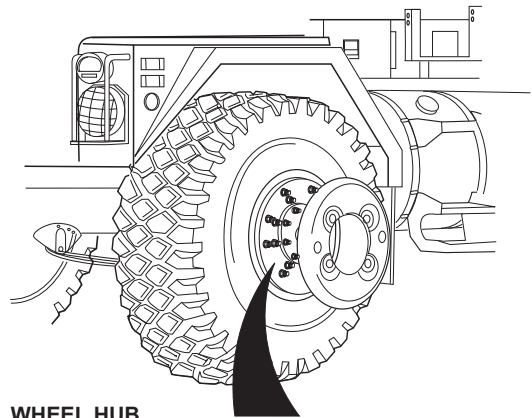
- Excessive inflation time, sometimes accompanied by low air light is normal with engine at idle and/or with use of air operated accessories.
- Air system pressure must be 120 psi (827 kPa) before beginning troubleshooting. If air pressure gage does not indicate 120 psi (827 kPa), wait for system air pressure to build before beginning troubleshooting.
- CTIS air lines are pressurized only when CTIS is in inflate, deflate, or test cycles.
- Tests 1 thru 4 can be made consecutively while the CTI system is in the inflate cycle.
- Soap solution may be used to detect air leaks.



- (1) Deflate tire to 60 psi (414 kPa) or less.
- (2) Start engine (TM 9-2320-360-10).
- (3) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (5) Check air lines, fittings and bulkhead connections from axle manifold to axle spindle for air leaks, damage, or crimps.
- (6) Shut off engine (TM 9-2320-360-10).

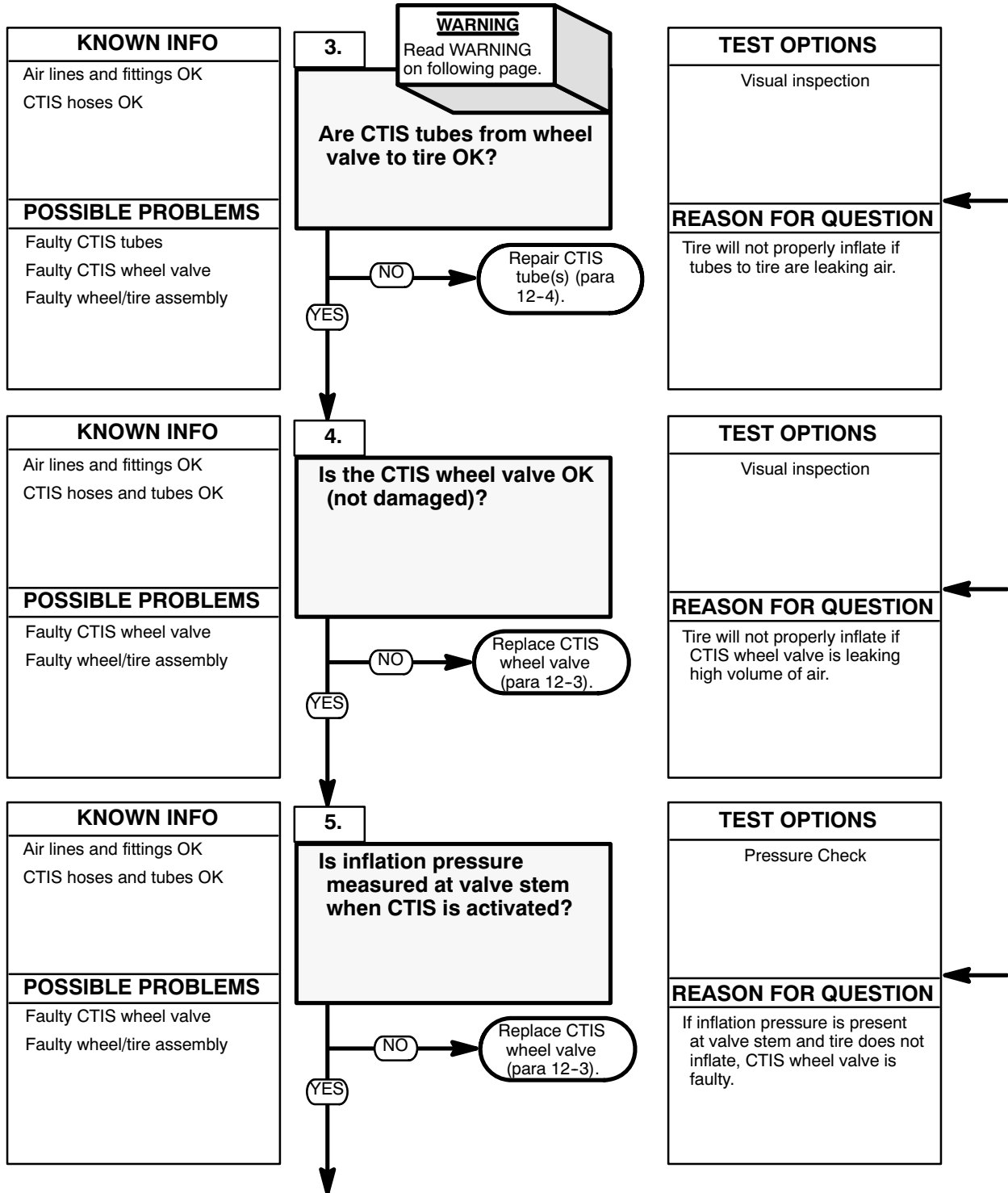
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.



- (1) Remove four nuts and wheel cover.
- (2) Start engine (TM 9-2320-360-10).
- (3) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (5) Check CTIS hoses from wheel hub to CTIS wheel valve for air leaks, damage, or crimps.
- (6) Shut off engine (TM 9-2320-360-10).

n1. ONE TIRE WILL NOT INFLATE (CONT)



WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check CTIS tubes from wheel valve to tire for air leaks, damage, or crimps.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

- Some air leakage may occur at breather during inflation/deflation cycles. Rapid exhaust of air at breather indicates a faulty valve.
- Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

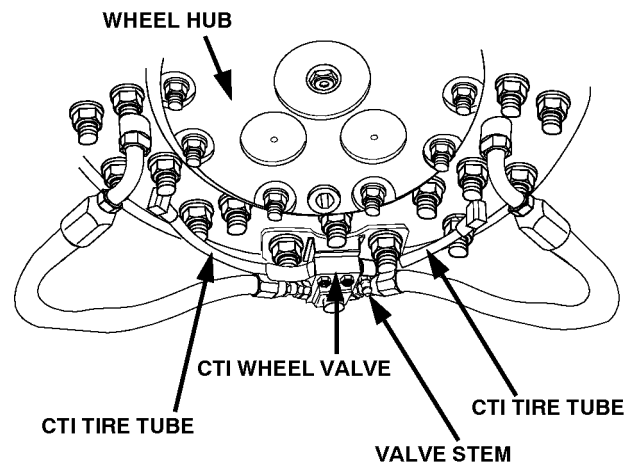
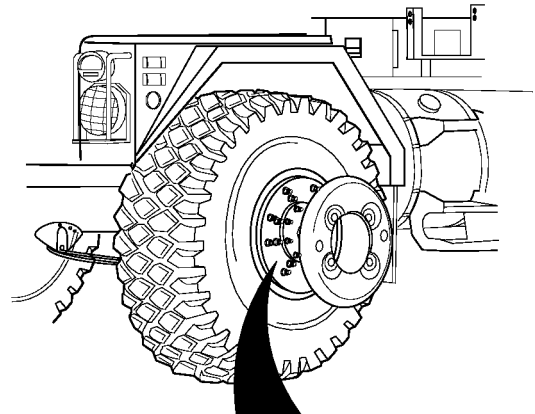
- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check CTIS wheel valves for air leaks or damage.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

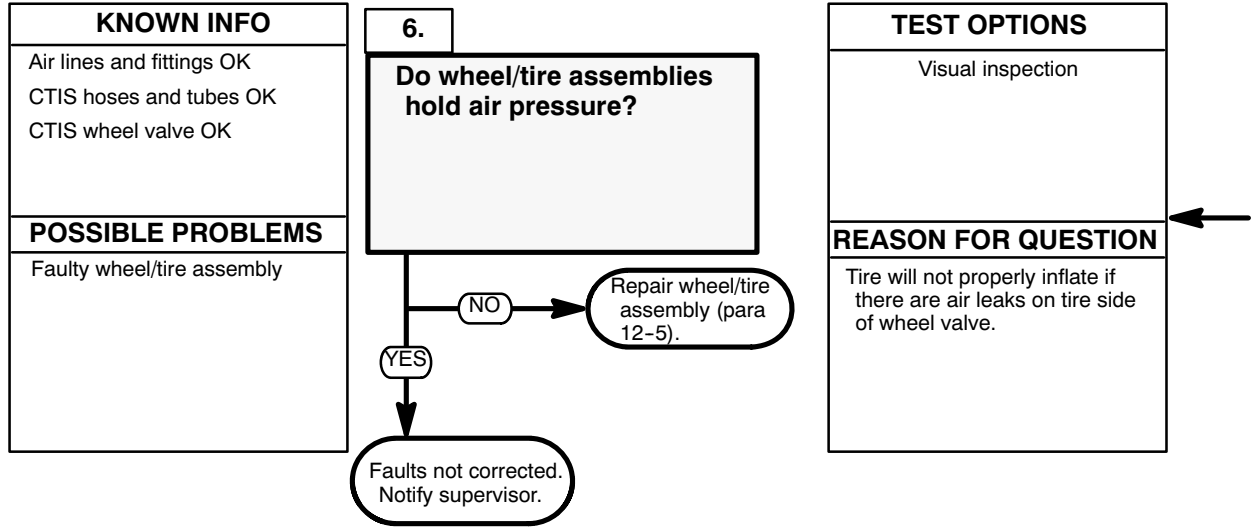
Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

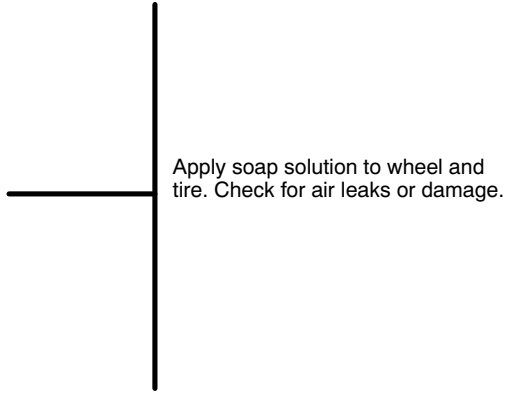
PRESSURE CHECK

- (1) Start engine (TM 9-2320-360-10).
- (2) Remove cap from valve stem.
- (3) Connect tire pressure gage to valve stem and record pressure.
- (4) Set CTIS switch to HIGHWAY position (TM 9-2320-360-10).
- (5) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (6) Reconnect tire pressure gage to valve stem and check for increased inflation pressure.
- (7) Shut off engine (TM 9-2320-360-10).

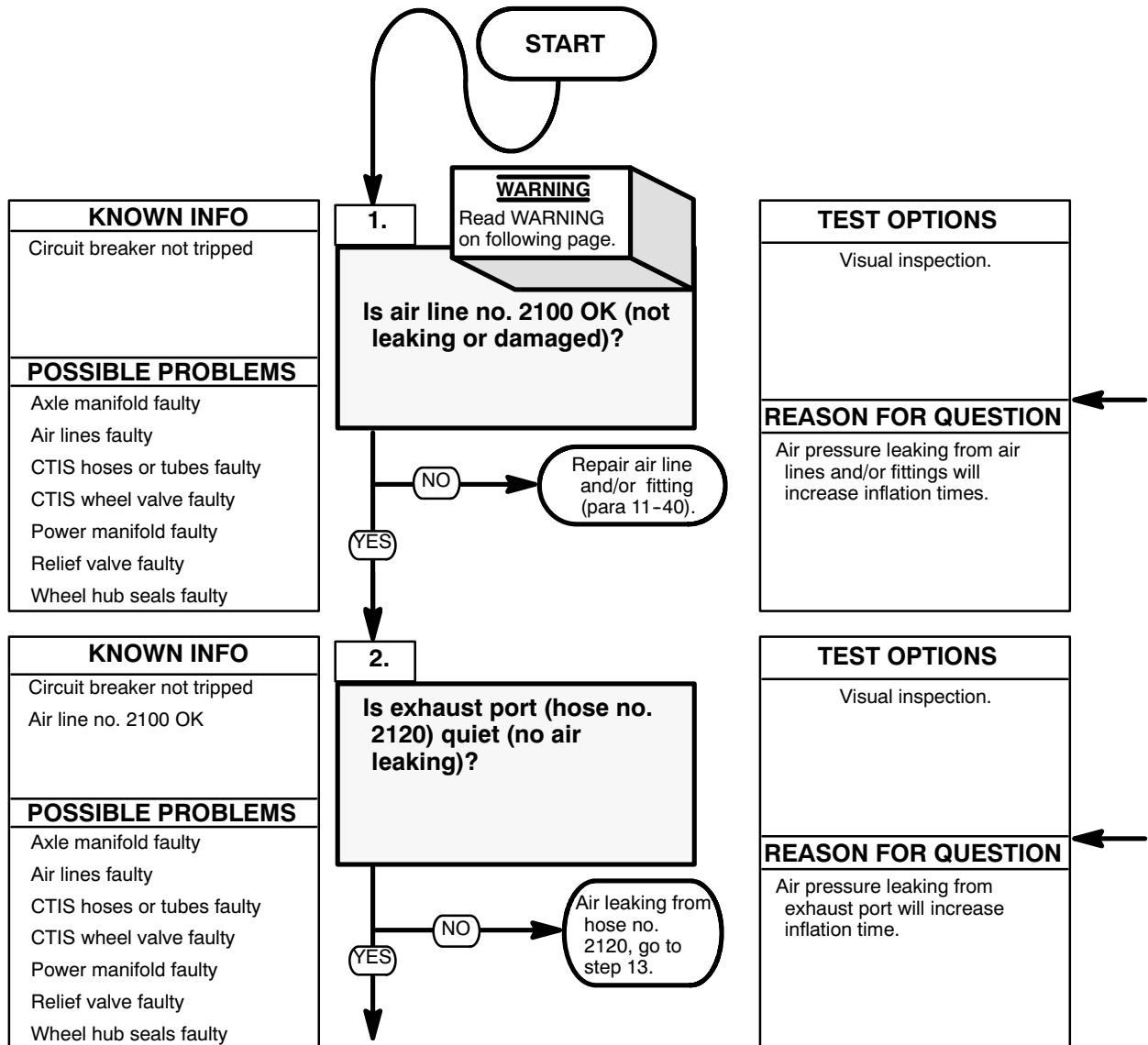


n1. ONE TIRE WILL NOT INFLATE (CONT)





n2. EXCESS INFLATION TIME, CTIS GREEN INDICATOR FLASHES TOO LONG OR CONTINUALLY, AIR LEAK DURING CTIS OPERATION	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Goggles, Industrial (Item 14, Appendix F) Multimeter (Item 20, Appendix F)
Materials/Parts Chips, Soap (Item 13, Appendix C)	



WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

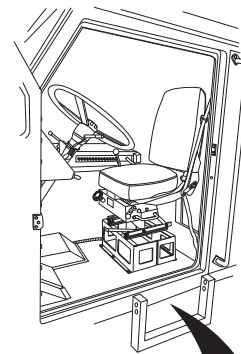
- The CTI system initially and periodically checks for system air leaks. The CTIS will display a flashing LOW AIR light and shut off if 6 psi cannot be maintained by the CTI system. The manifold will click during this test for approximately 1.5 minutes.
- Excessive inflation times (without low air light) are caused by minor leaks in CTI system.
- CTIS air lines are pressurized only when CTIS is in inflate, deflate, or test cycles.
- Tests 1 thru 5 can be made consecutively while the CTI system is in the inflate cycle.
- Normal inflation time from EMERGENCY to HIGHWAY setting is approximately 12 minutes at high idle.
- Excess inflation times, sometimes accompanied by a LOW AIR light is normal if engine is at idle RPM and/or air operated accessories are being used.
- Soap solution may be used to detect air leaks.

- (1) Deflate tire to 60 psi (414 kPa) or less.
- (2) Start engine (TM 9-2320-360-10).
- (3) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (5) Check air line no. 2100 from reservoir to supply port for air leaks, damage, or crimps.
- (6) Shut off engine (TM 9-2320-360-10).

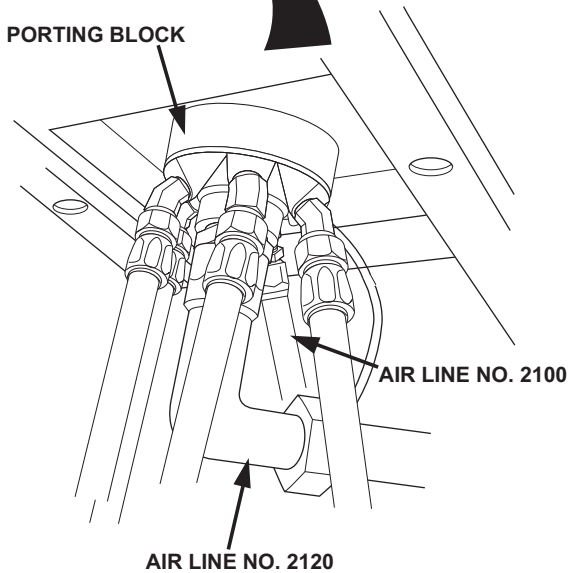
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

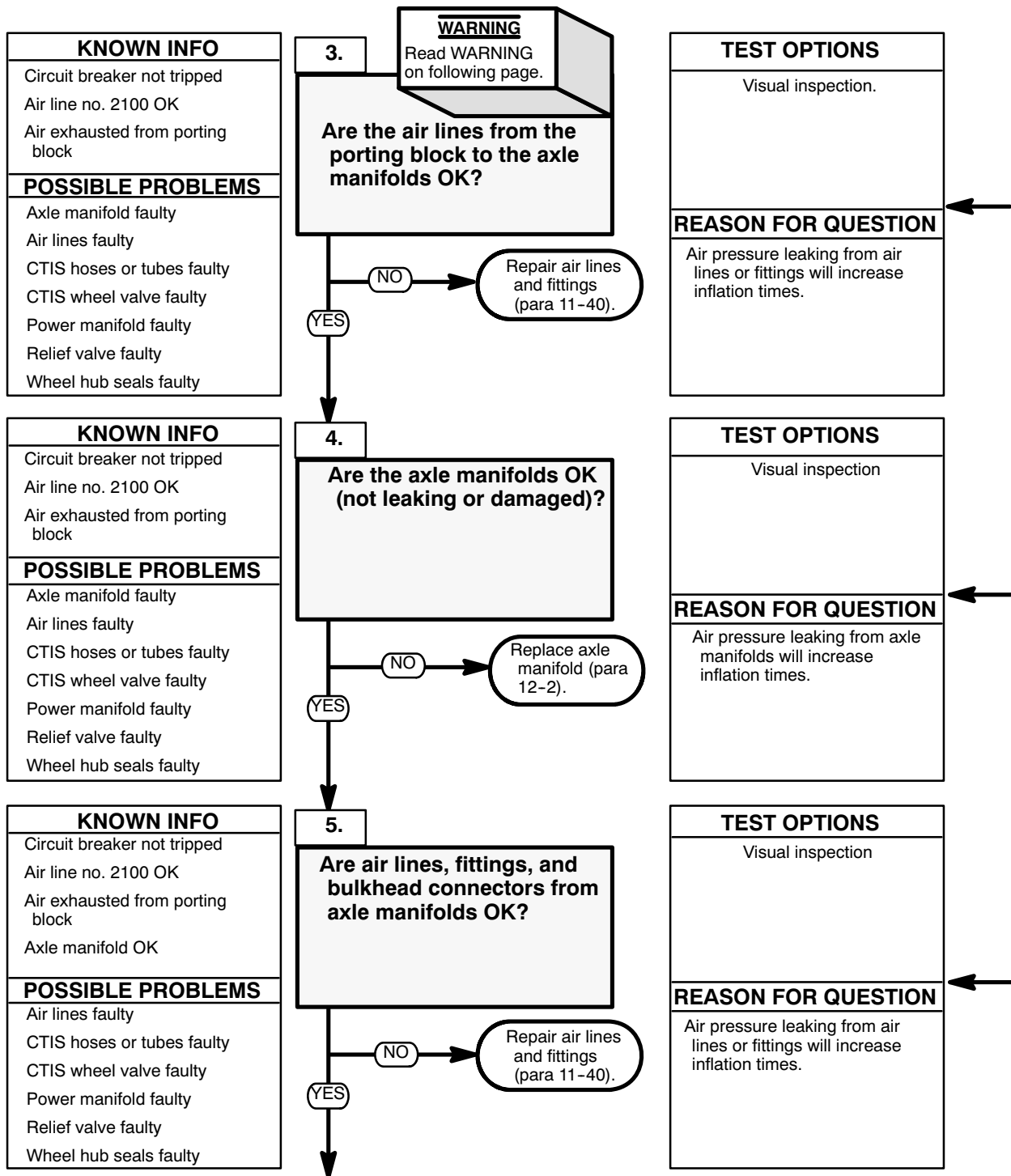
- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check exhaust air line no. 2120 from porting block for air escaping.
- (5) Shut off engine (TM 9-2320-360-10).



PORTING BLOCK



n2. EXCESS INFLATION TIME, CTIS GREEN INDICATOR FLASHES TOO LONG OR CONTINUALLY, AIR LEAK DURING CTIS OPERATION (CONT)



WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check air lines from the porting block to the axle manifolds for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

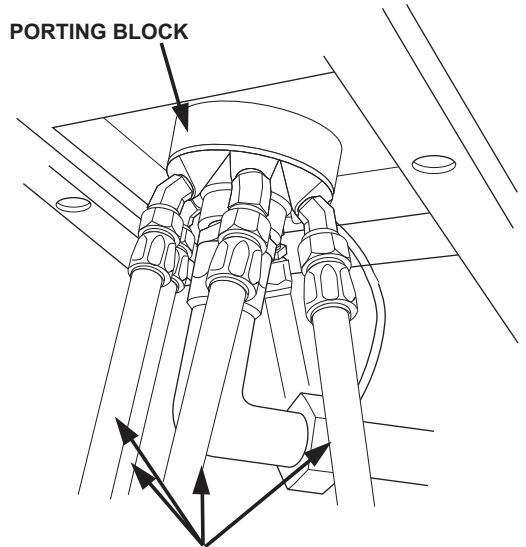
- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check axle manifolds for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

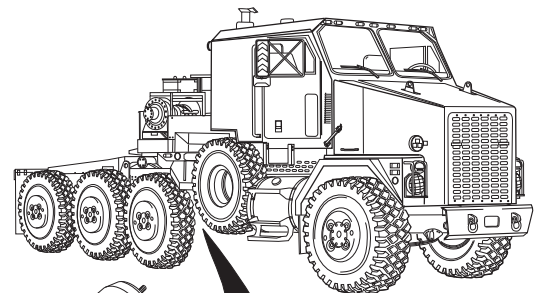
Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).
- (4) Check air lines, fittings and bulkhead connections from axle manifold to axle spindle for air leaks, damage, or crimps.
- (5) Shut off engine (TM 9-2320-360-10).

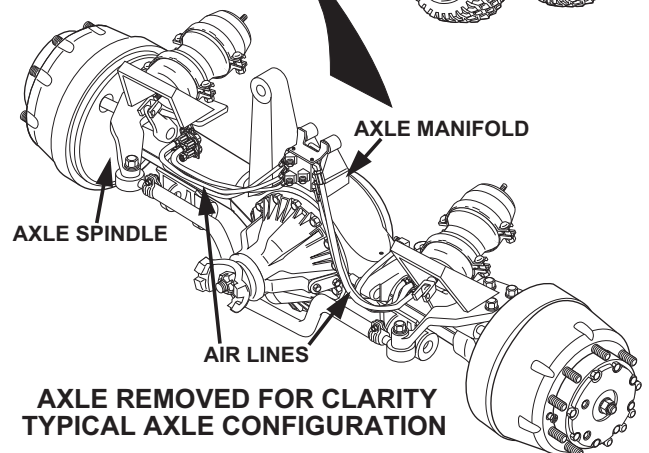
PORTING BLOCK



AIR LINES TO AXLE MANIFOLDS

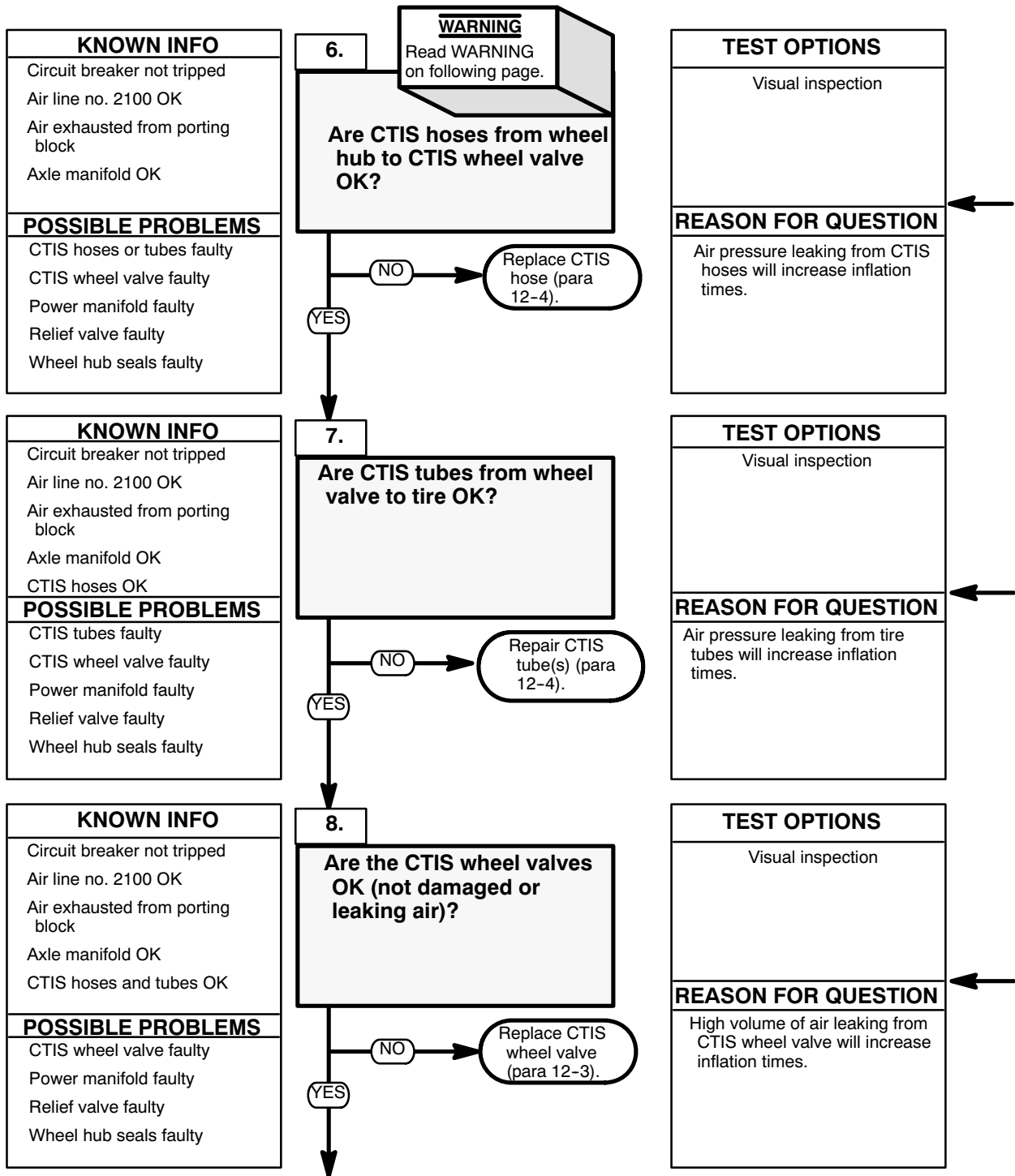


AXLE MANIFOLD



AXLE REMOVED FOR CLARITY
TYPICAL AXLE CONFIGURATION

n2. EXCESS INFLATION TIME, CTIS GREEN INDICATOR FLASHES TOO LONG OR CONTINUALLY, AIR LEAK DURING CTIS OPERATION (CONT)



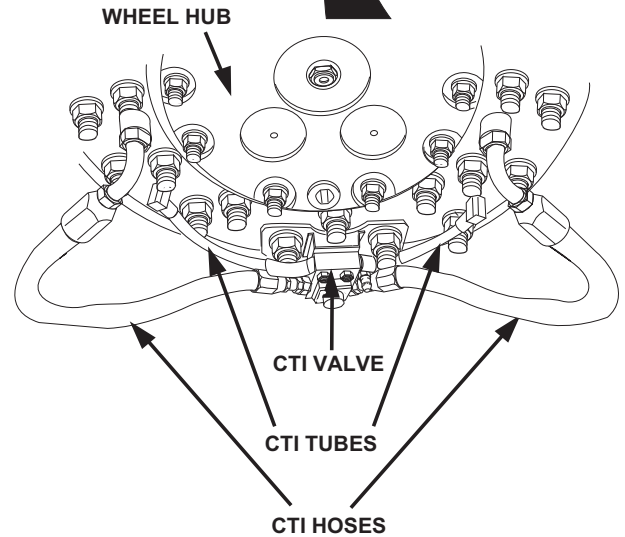
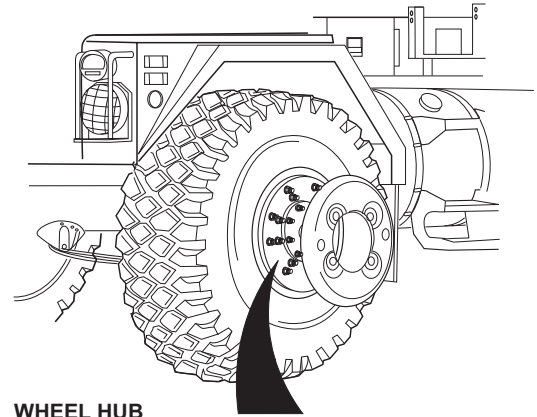
WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Remove four nuts and wheel cover.
- (2) Start engine (TM 9-2320-360-10).
- (3) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (5) Check CTIS hoses from wheel hub to CTIS wheel valve for air leaks, damage, or crimps.
- (6) Shut off engine (TM 9-2320-360-10).



NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

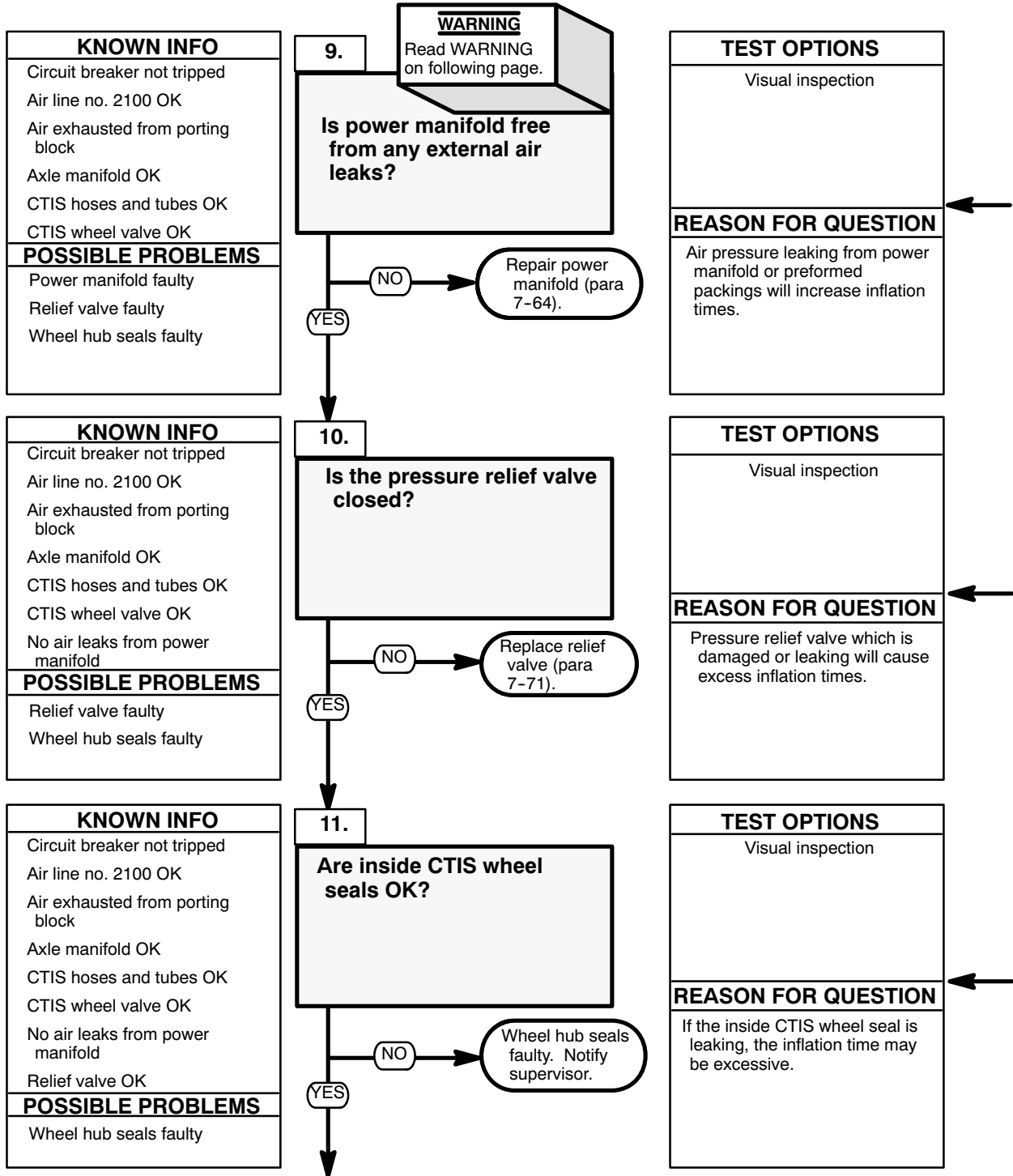
- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check CTIS tubes from wheel valve to tire for air leaks, damage, or crimps.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

- Tire must be deflated to 60 psi (414 kPa) or less to perform this test.
- Some air leakage may occur at breather during inflation/deflation cycles.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check CTIS wheel valves for air leaks or damage.
- (5) Shut off engine (TM 9-2320-360-10).

n2. EXCESS INFLATION TIME, CTIS GREEN INDICATOR FLASHES TOO LONG OR CONTINUALLY, AIR LEAK DURING CTIS OPERATION (CONT)



WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check CTIS power manifold casting and mounting base area for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

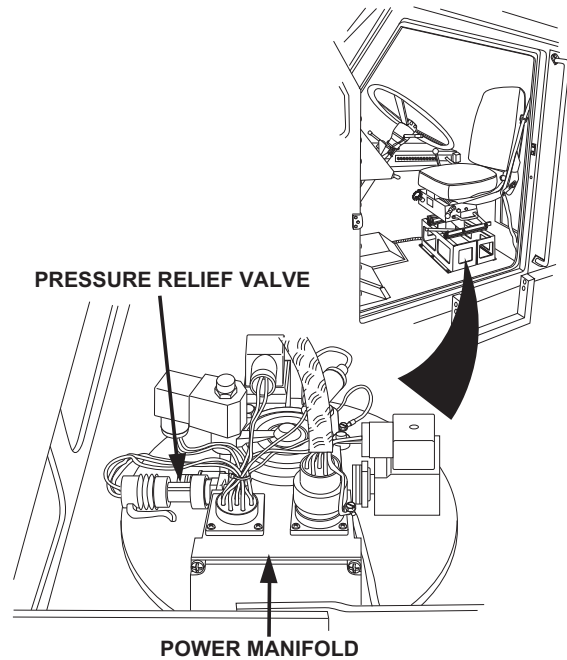
- Tire must be deflated to 60 psi (414 kPa) or less to perform this test.
- Pressure relief valve remains closed unless pressure to tires exceeds 85 psi (586 kPa)

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check pressure relief valve for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).

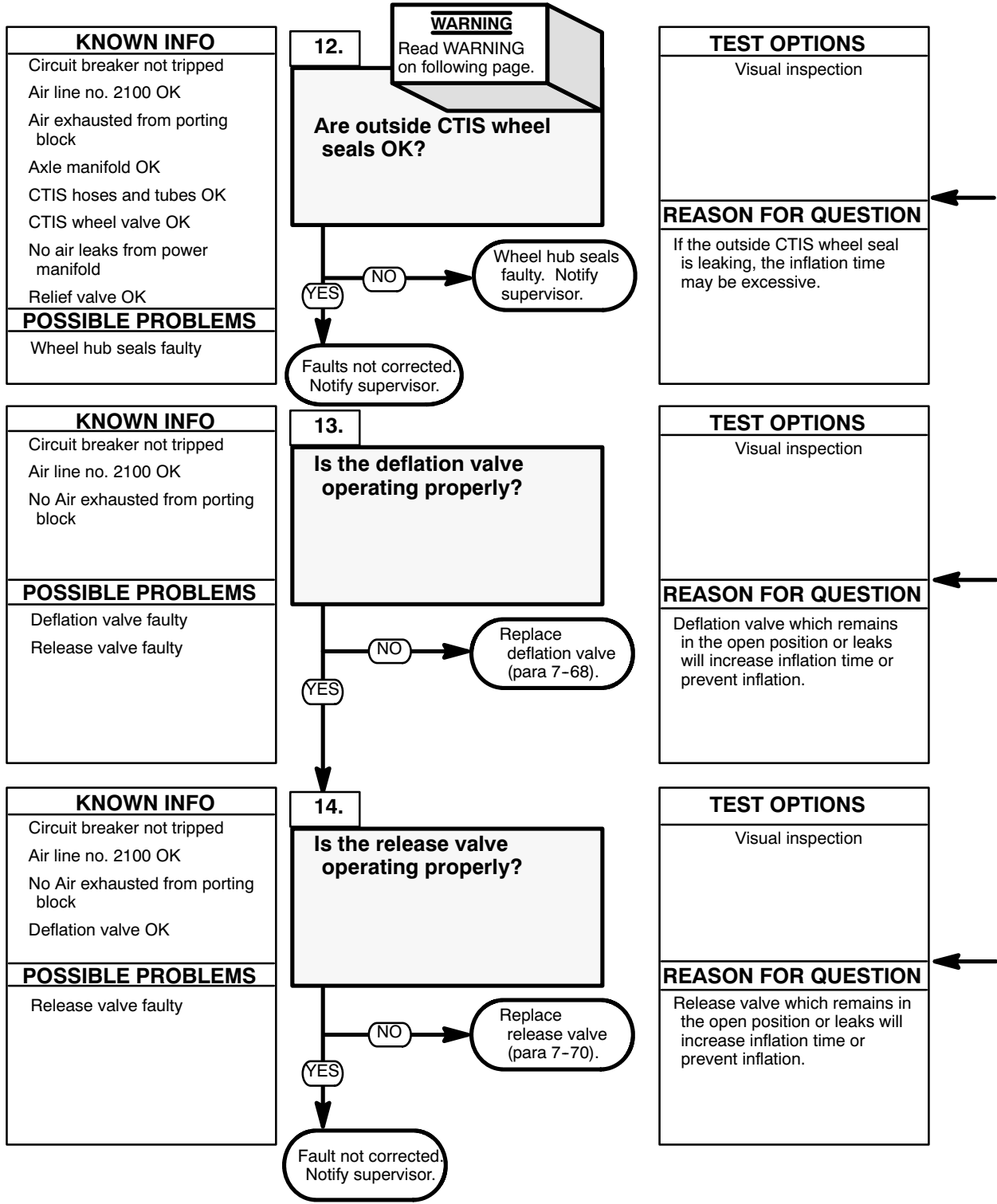
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check for air escaping from the inside portion of the wheel and tire assemblies.
- (5) Shut off engine (TM 9-2320-360-10).



n2. EXCESS INFLATION TIME, CTIS GREEN INDICATOR FLASHES TOO LONG OR CONTINUALLY, AIR LEAK DURING CTIS OPERATION (CONT)



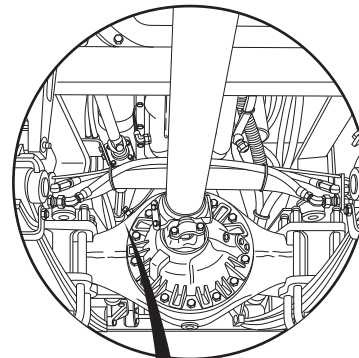
WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

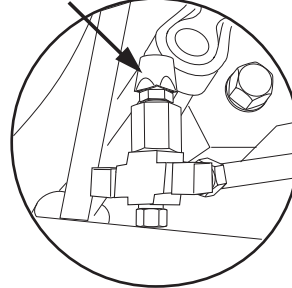
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check axle breathers for escaping air.
- (5) Shut off engine (TM 9-2320-360-10).



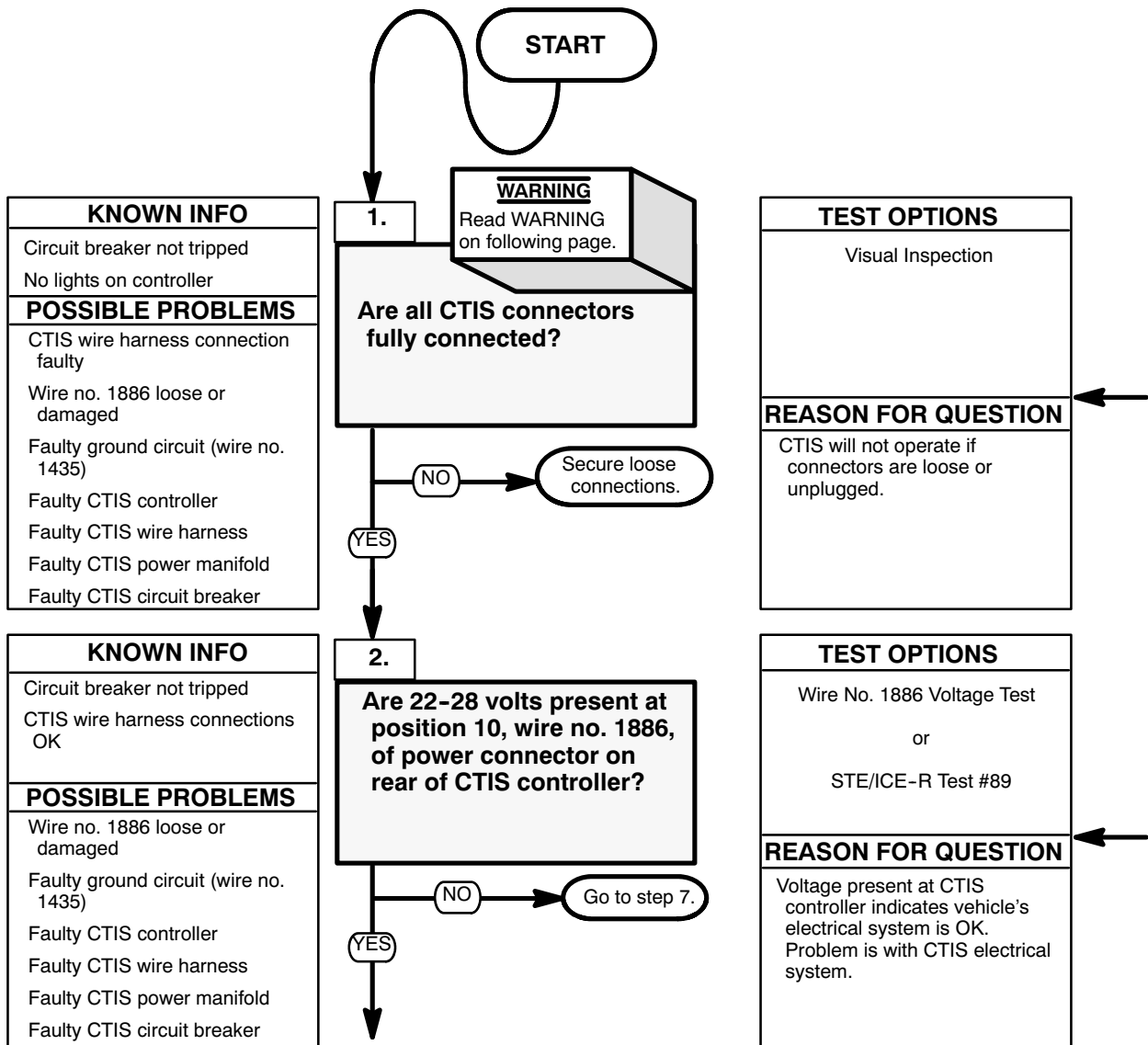
AXLE BREATHER



- (1) Remove deflation valve (para 7-68).
- (2) Inspect valve assembly for a broken spring, damaged diaphragm, sticking, or any other physical damage.
- (3) Install deflation valve (para 7-68).

- (1) Remove release valve (para 7-70).
- (2) Inspect valve assembly for a broken spring, damaged diaphragm, sticking, or any other physical damage.
- (3) Install release valve (para 7-70).

n3. CTIS INOPERATIVE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F)



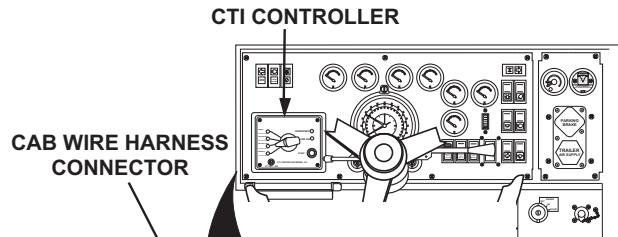
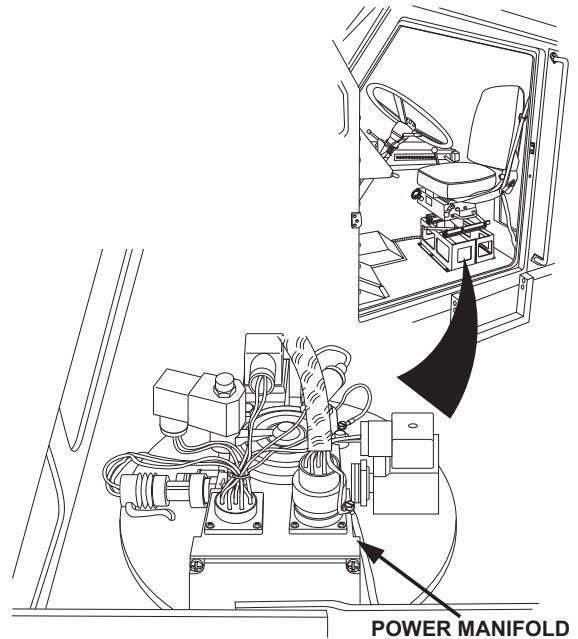
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

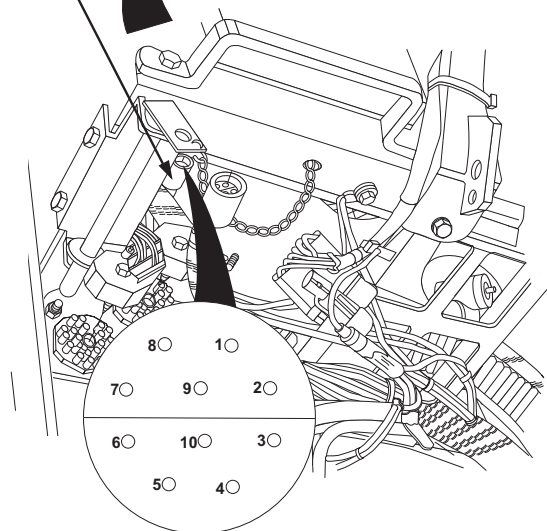
Air system pressure must be 120 psi (827 kPa) before beginning troubleshooting. If air pressure gage does not indicate 120 psi (827 kPa), wait for system air pressure to build before beginning troubleshooting.

Inspect CTIS power manifold and controller to see that all connectors are fully plugged in.

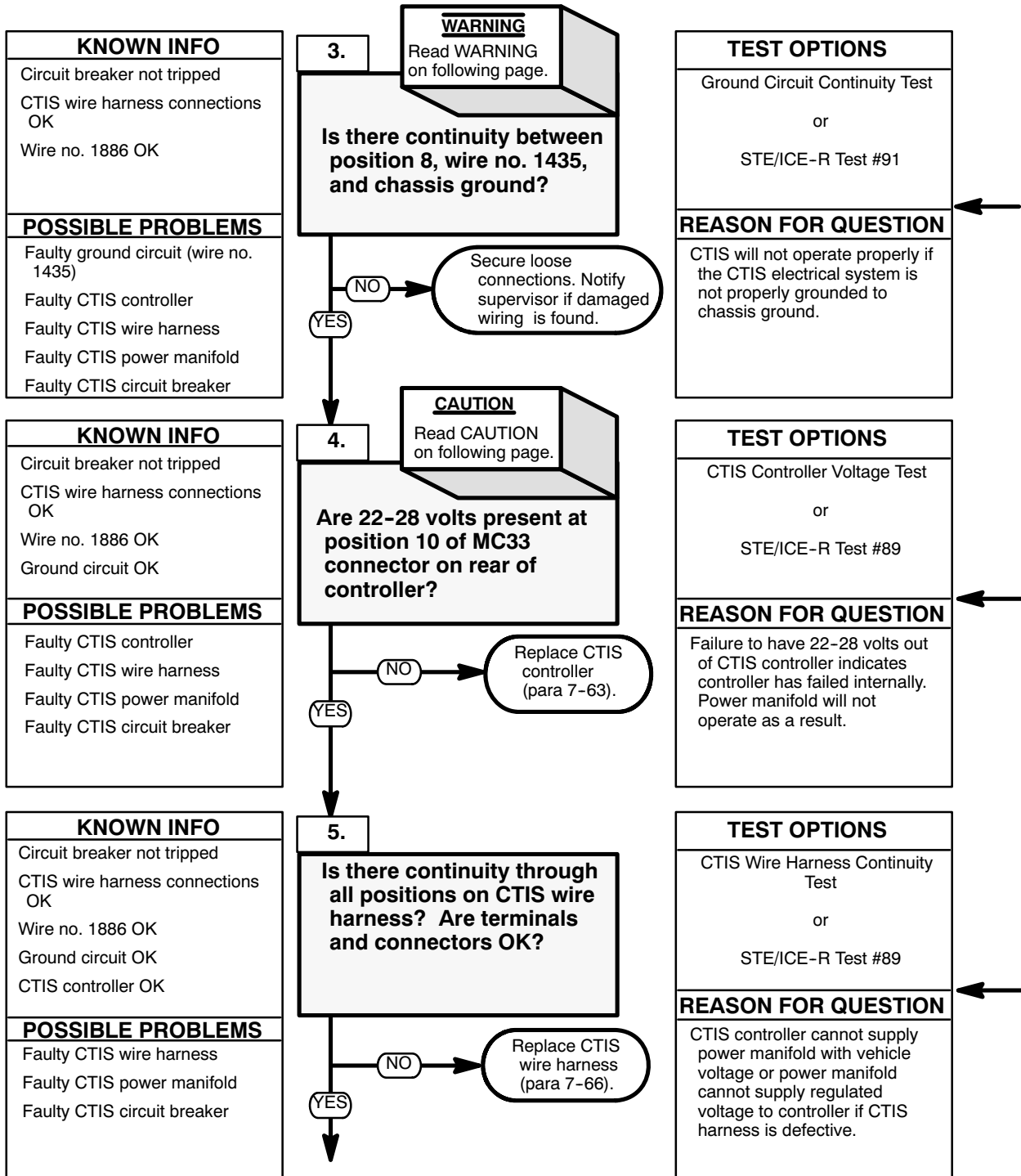


WIRE NO. 1886 VOLTAGE TEST

- (1) Remove cab wire harness connector from CTIS Controller.
- (2) Turn engine switch to ON position (TM 9-2320-360-10).
- (3) Place positive (+) probe of multimeter on position 10, wire no. 1886, of power connector.
- (4) Place negative (-) probe of multimeter on known good ground and look for 22-28 volts on multimeter.
- (5) Turn engine switch to OFF position (TM 9-2320-360-10).
- (6) Install cab wire harness connector on CTIS controller.



n3. CTIS INOPERATIVE (CONT)

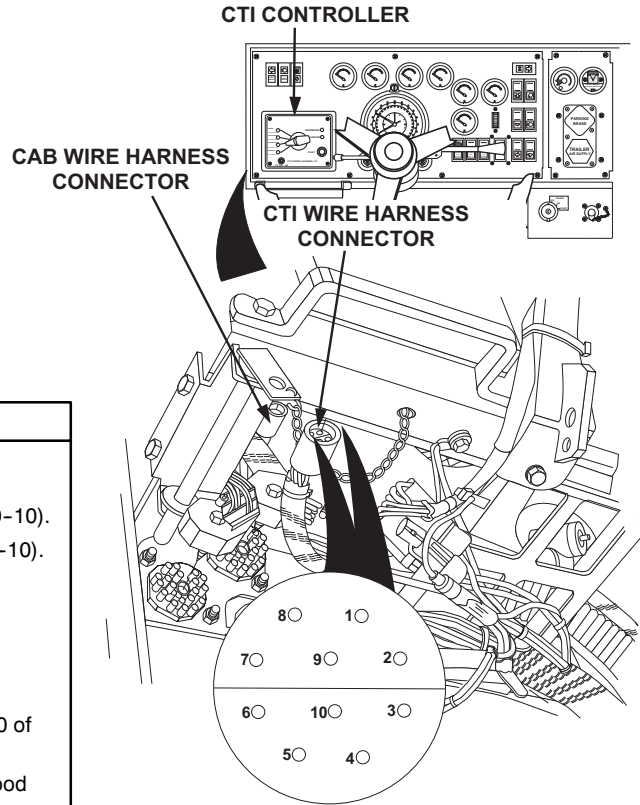


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

GROUND CIRCUIT CONTINUITY TEST

- (1) Disconnect cab wire harness MC31 connector from controller.
- (2) Place positive (+) probe of multimeter in MC31 connector , position 8.
- (3) Place negative (-) probe of multimeter on known good ground and multimeter for continuity.
- (4) Connect cab wire harness MC 31 to controller.



CTIS CONTROLLER VOLTAGE TEST

- (1) Remove CTIS wire harness connector from CTIS Controller.
- (2) Turn engine switch to ON position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).

CAUTION

Probe only terminals indicated in step (4). Failure to comply may result in damage to CTIS components, wiring or test equipment.

- (4) Place positive (+) probe of multimeter on position 10 of CTIS controller.
- (5) Place negative (-) probe of multimeter on known good ground and look for 22-28 volts on multimeter.
- (6) Move CTIS switch to OFF position (TM 9-2320-360-10).
- (7) Turn engine switch to OFF position (TM 9-2320-360-10).
- (8) Install CTIS wire harness connector on CTIS controller.

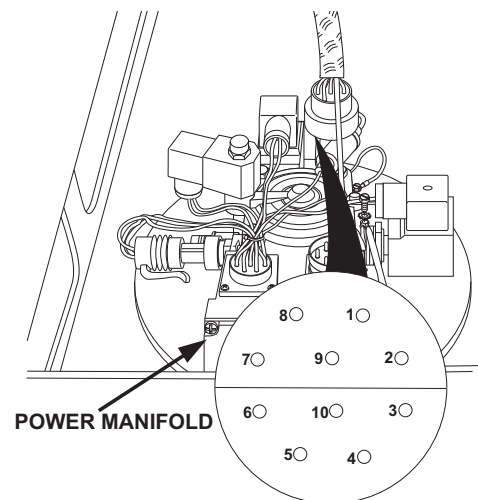
CTIS WIRE HARNESS CONTINUITY TEST

- (1) Disconnect CTIS wire harness connector from power manifold.
- (2) Disconnect CTIS wire harness connector from controller.

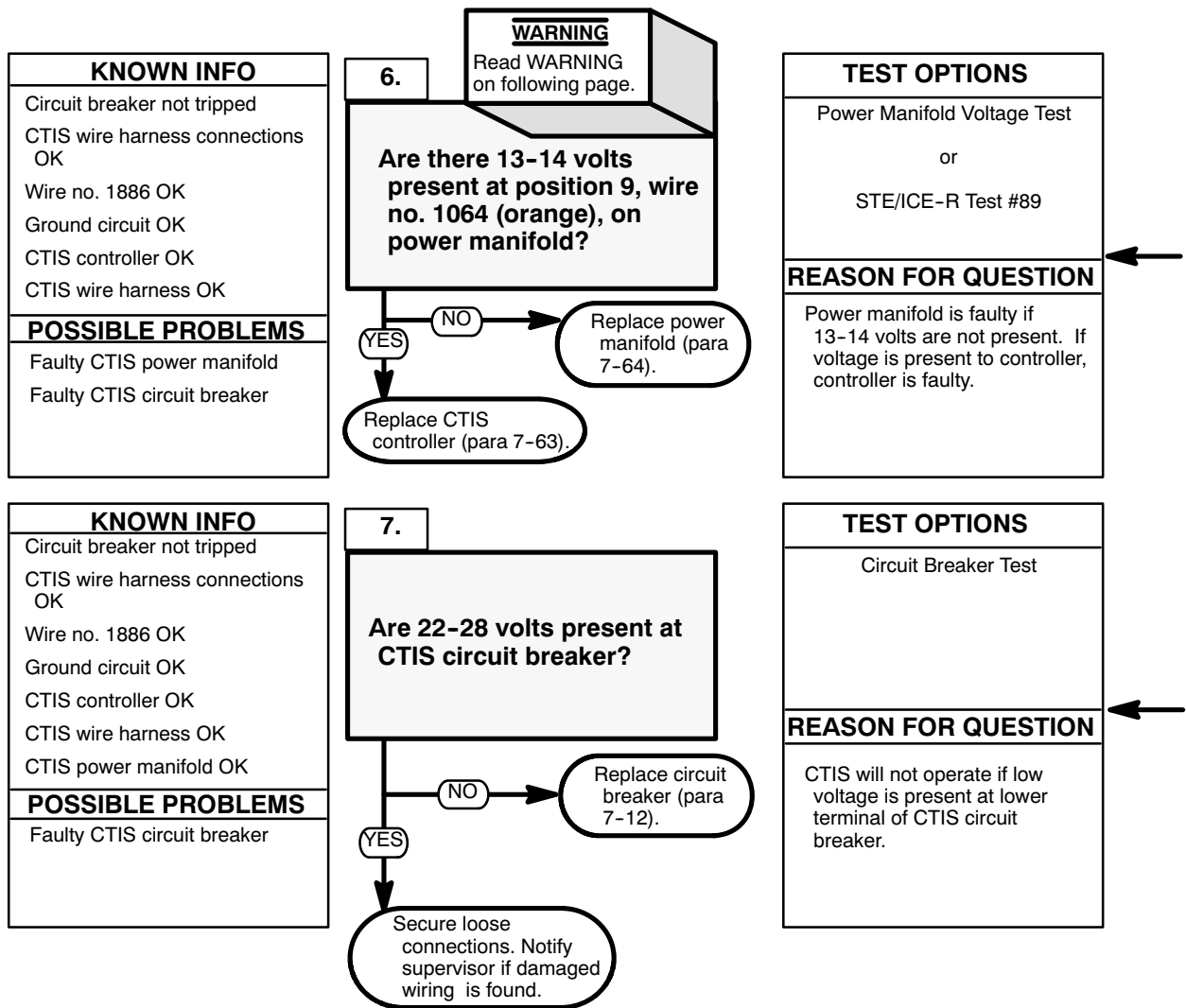
NOTE

Pay special attention to positions 1, 9, & 10.

- (3) Place positive (+) probe of multimeter on position 1 of connector at controller end.
- (4) Place negative (-) probe of multimeter on position 1 of connector at power manifold end and check multimeter for continuity.
- (5) Repeat steps (3) and (4) for remaining positions 2 thru 10.
- (6) Install CTIS wire harness connectors back on power manifold and controller.



n3. CTIS INOPERATIVE (CONT)



WARNING

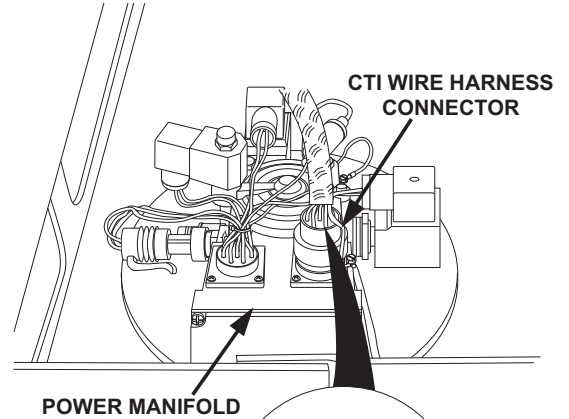
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

POWER MANIFOLD VOLTAGE TEST

NOTE

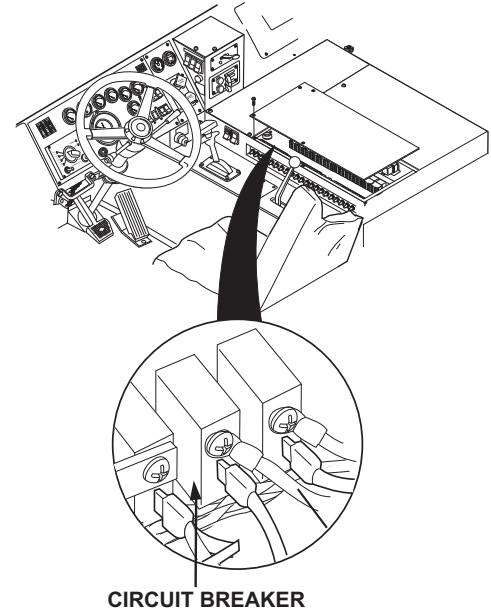
CTIS wiring harness must remain installed to controller and power manifold when performing this test.

- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Move CTIS switch to ON position (TM 9-2320-360-10).
- (3) Place positive (+) probe of multimeter on position 9, wire no. 1064 (orange), of CTIS wire harness connector at power manifold.
- (4) Place negative (-) probe of multimeter on known good ground and look for 13-14 volts on multimeter.
- (5) Turn engine switch to OFF position and move CTIS controller switch to OFF position (TM 9-2320-360-10).

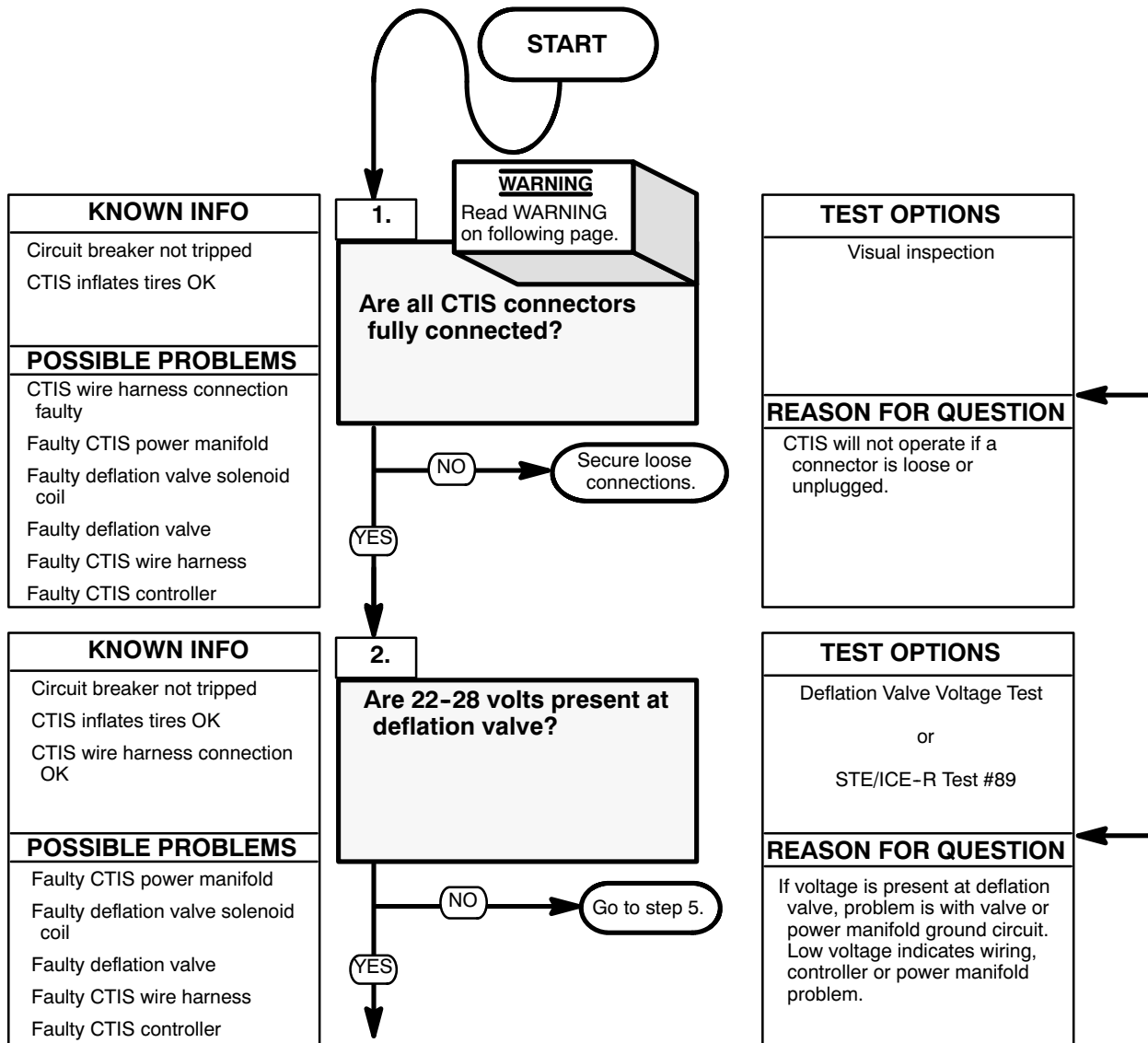


CIRCUIT BREAKER TEST

- (1) Remove eight screws and panel from electric control box.
- (2) Turn engine switch to ON position (TM 9-2320-360-10).
- (3) Place positive (+) probe of multimeter on lower terminal of circuit breaker.
- (4) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (5) Turn engine switch to OFF position (TM 9-2320-360-10).



n4. TIRES DO NOT DEFLATE TO LOWER PRESSURE SETTING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

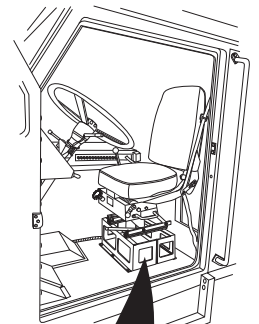
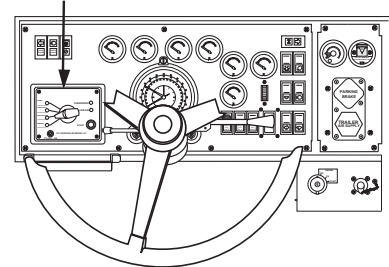
- Air system pressure must be 120 psi (827 kPa) before beginning troubleshooting. If air pressure gage does not indicate 120 psi (827 kPa), wait for system air pressure to build before beginning troubleshooting.
- CTIS air lines are pressurized only when CTIS is in inflate, deflate, or test cycles.

Inspect CTIS power manifold and controller to see that all connectors are fully plugged in.

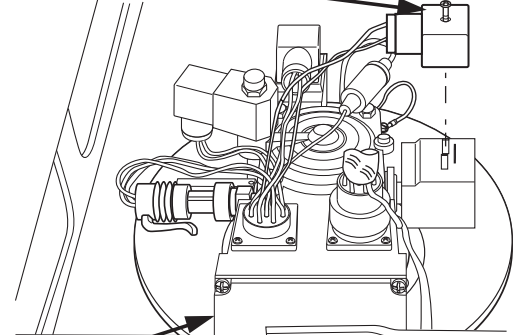
DEFLATION VALVE VOLTAGE TEST

- (1) Manually set tire pressures to 75 psi (517 kPa).
- (2) Disconnect deflation valve connector from power manifold.
- (3) Place positive (+) probe of multimeter on deflation valve connector, position 2.
- (4) Place negative (-) probe of multimeter on known good ground.
- (5) Turn CTIS selector switch to CROSS COUNTRY position (TM 9-2320-360-10).
- (6) Turn engine switch to ON position (TM 9-2320-360-10).
- (7) Move CTIS switch to ON position and/or press START button (TM 9-2320-360-10). Look for 22-28 volts on multimeter.
- (8) Turn engine switch to OFF position (TM 9-2320-360-10).
- (9) Connect deflation valve connector to power manifold.

CTI CONTROLLER

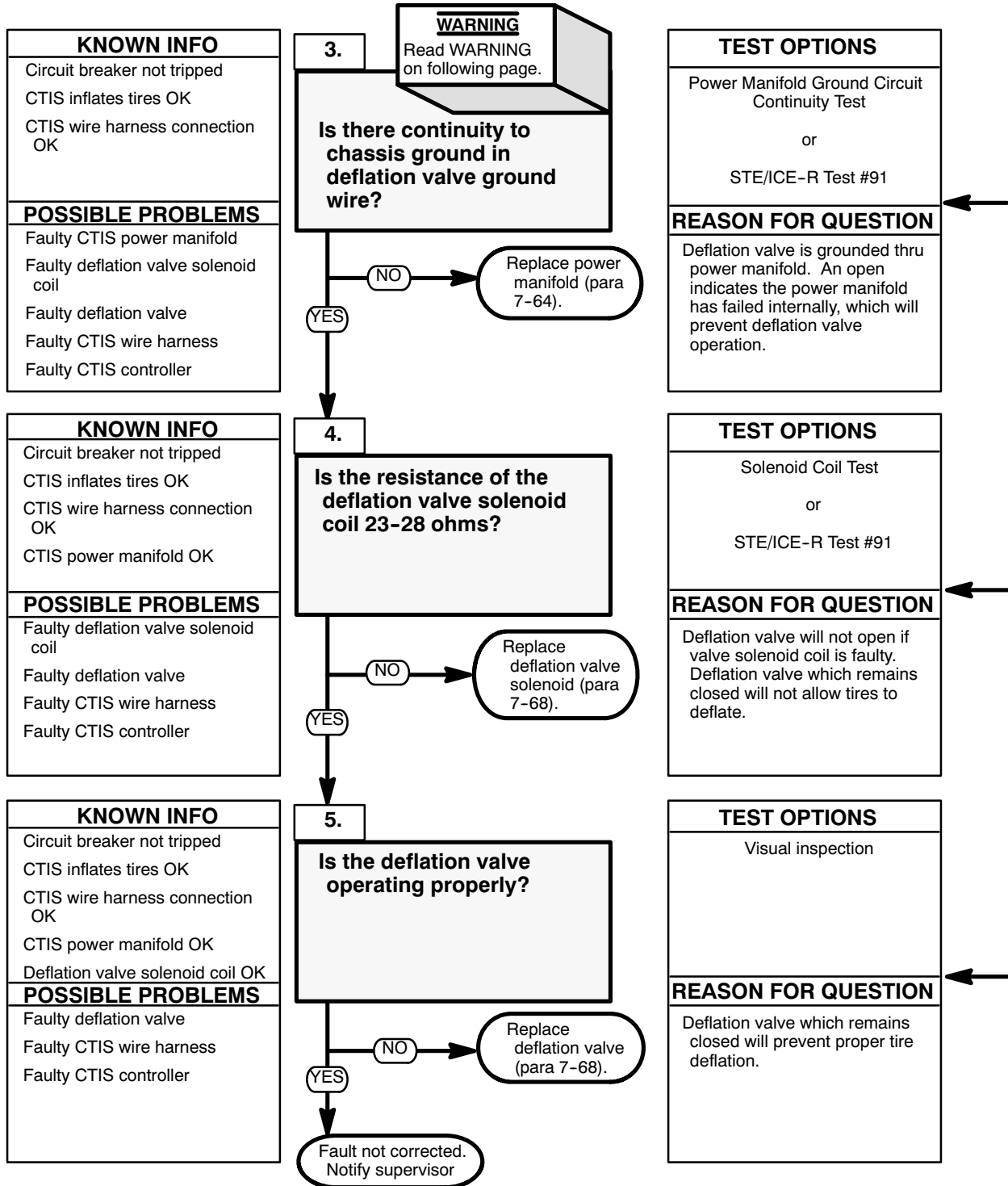


DEFLATION VALVE CONNECTOR



POWER MANIFOLD

n4. TIRES DO NOT DEFLATE TO LOWER PRESSURE SETTING (CONT)



WARNING

Wear safety goggles when performing leakage tests on valves and air hoses. Failure to comply may cause serious eye injury due to high air pressure.

WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

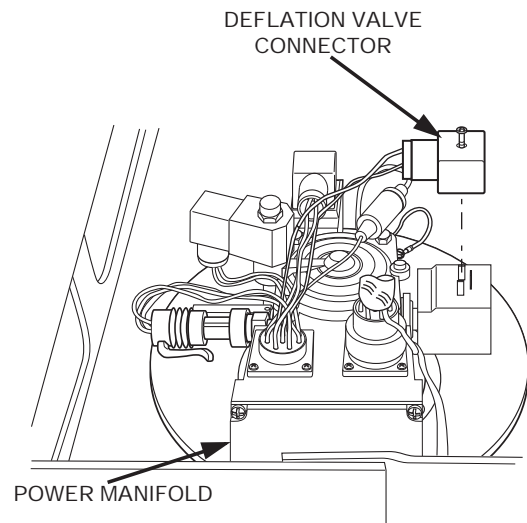
**POWER MANIFOLD GROUND
CIRCUIT CONTINUITY TEST**

- (1) Disconnect deflation valve connector from power manifold.
- (2) Place positive (+) probe of multimeter in deflation valve connector, position 1.
- (3) Place negative (-) probe of multimeter on known good ground and check multimeter for continuity.
- (4) Connect deflation valve connector to power manifold.

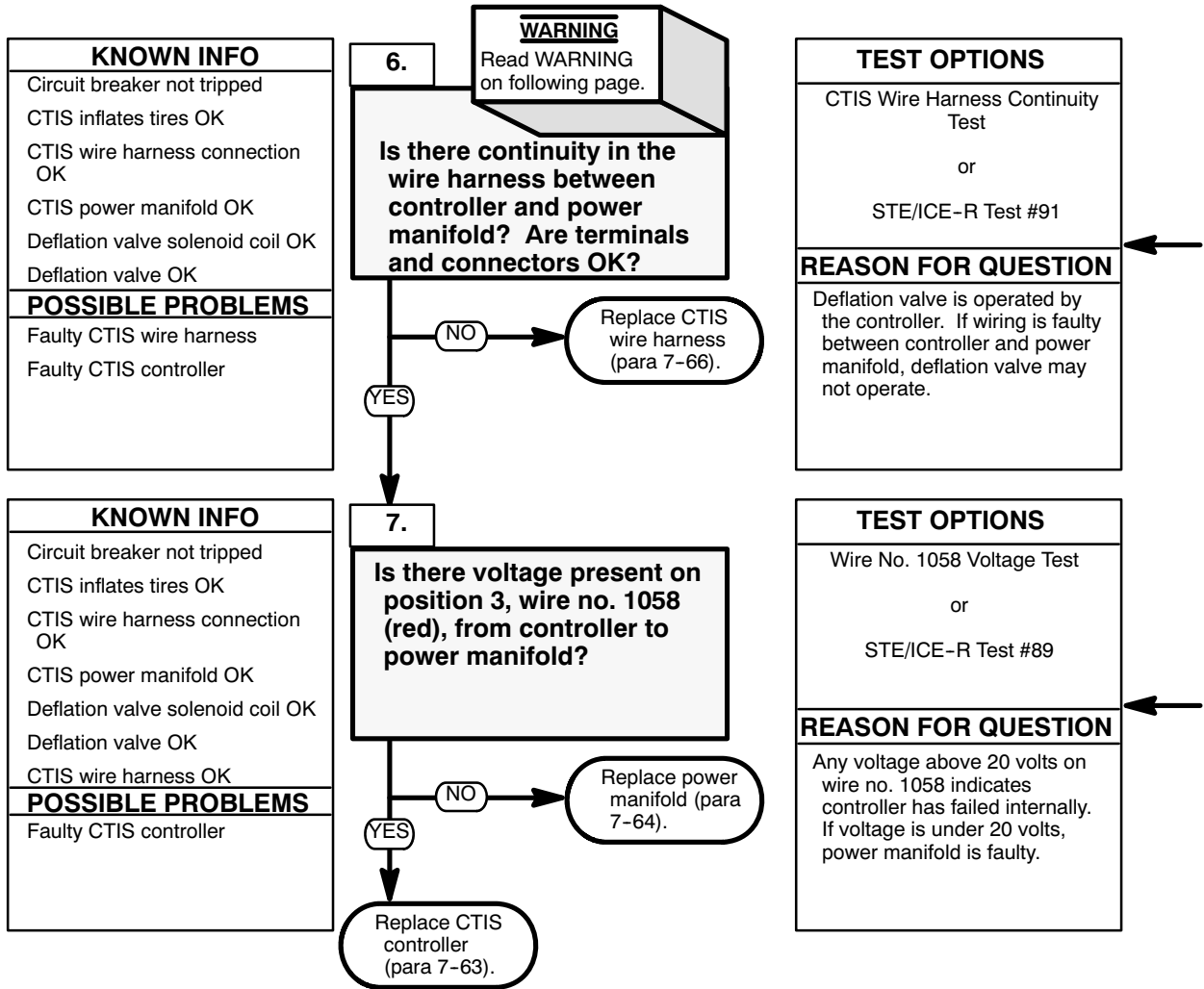
**DEFLATION VALVE
SOLENOID COIL TEST**

- (1) Remove connector from deflation valve solenoid.
- (2) Place positive probe (+) of multimeter on deflation valve solenoid position 1.
- (3) Place negative probe (-) of multimeter on deflation valve solenoid position 2 and check multimeter for continuity.
- (4) Install connector on deflation valve solenoid.

- (1) Remove deflation valve (para 7-68).
- (2) Inspect valve assembly for broken springs, damaged diaphragm, sticking, or any other physical damage.
- (3) Install deflation valve (para 7-68).



n4. TIRES DO NOT DEFLATE TO LOWER PRESSURE SETTING (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CTIS WIRE HARNESS CONTINUITY TEST

- (1) Disconnect CTIS wire harness connector from power manifold.
- (2) Disconnect CTIS wire harness connector from controller.

NOTE

Pay special attention to positions 1, 3, and 8.

- (3) Place positive (+) probe of multimeter on position 1 of connector at controller end.
- (4) Place negative (-) probe of multimeter on position 1 of connector at power manifold end and check multimeter for continuity.
- (5) Repeat steps (3) and (4) for remaining positions 2 thru 10.
- (6) Install CTIS wire harness connectors back on power manifold and controller.

WIRE NO. 1058 VOLTAGE TEST

NOTE

- CTIS wiring harness must remain installed to controller and power manifold when performing this test.
- Tire pressure should be over 60 psi to perform this test.

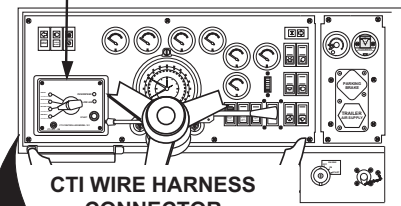
- (1) Turn engine switch to ON position and/or press start button (TM 9-2320-360-10).
- (2) Set CTIS controller selector to EMERGENCY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).

NOTE

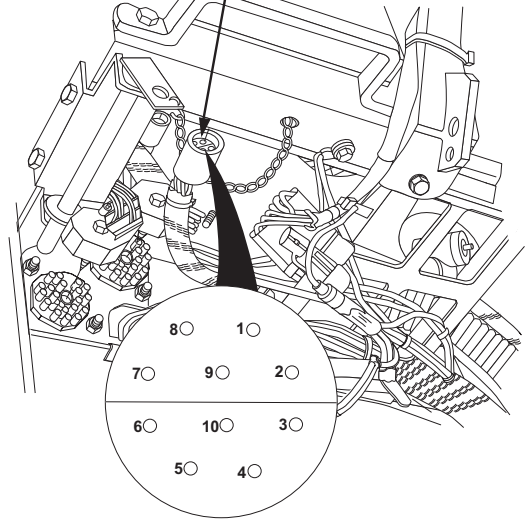
Wait for power manifold to stop clicking before continuing with test.

- (4) Place positive (+) probe of multimeter on position 3, wire no. 1058 (red), of CTIS wire harness connector at power manifold.
- (5) Place negative (-) probe of multimeter on known good ground.
- (6) Press CTIS START button and look for voltage on multimeter.
- (7) Turn engine switch to OFF position and move CTIS controller switch to OFF position (TM 9-2320-360-10).

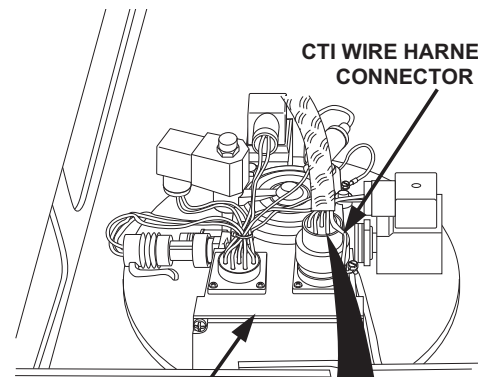
CTI CONTROLLER



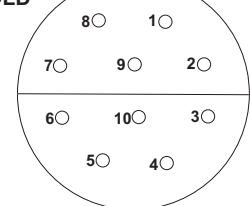
CTI WIRE HARNESS CONNECTOR



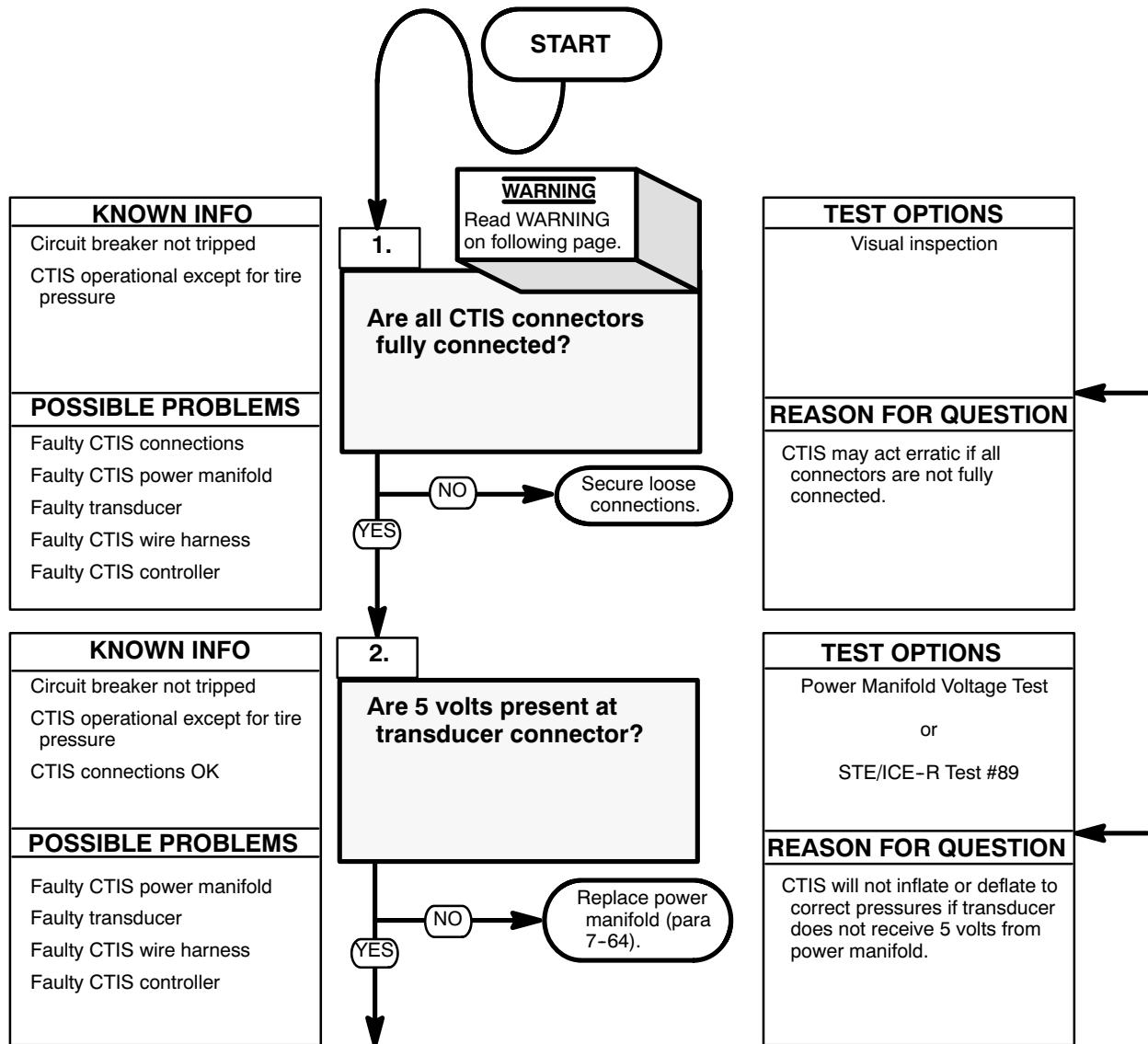
CTI WIRE HARNESS CONNECTOR



POWER MANIFOLD



n5. TIRE PRESSURES DO NOT AGREE WITH CTIS SETTINGS	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (Item 47, Appendix F)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Inspect CTIS power manifold and controller to see that all connectors are fully plugged in.

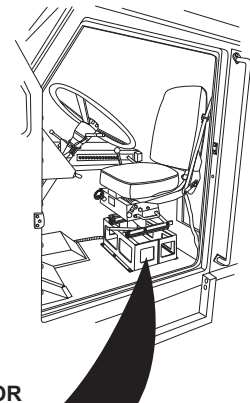
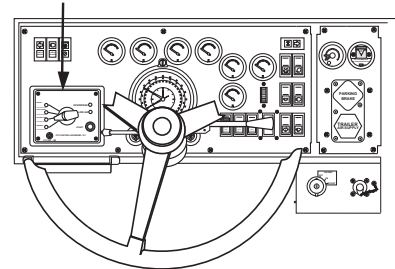
NOTE

Air system pressure must be 120 psi (827 kPa) before beginning troubleshooting. If air pressure gage does not indicate 120 psi (827 kPa), wait for system air pressure to build before beginning troubleshooting.

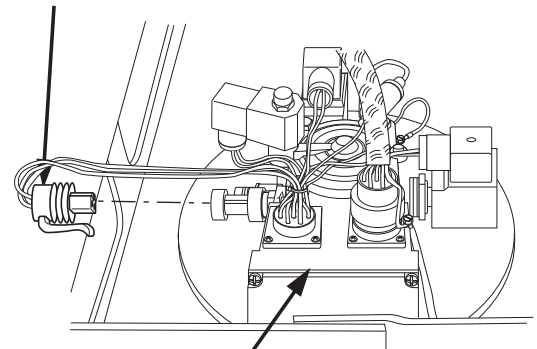
POWER MANIFOLD VOLTAGE TEST

- (1) Disconnect transducer connector.
- (2) Turn engine switch to ON position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or press start button (TM 9-2320-360-10).
- (4) Place positive (+) probe of multimeter on position b (black) transducer wire.
- (5) Place negative (-) probe of multimeter on known good ground and look for 5 volts on multimeter.
- (6) Connect transducer connector.

CTI CONTROLLER

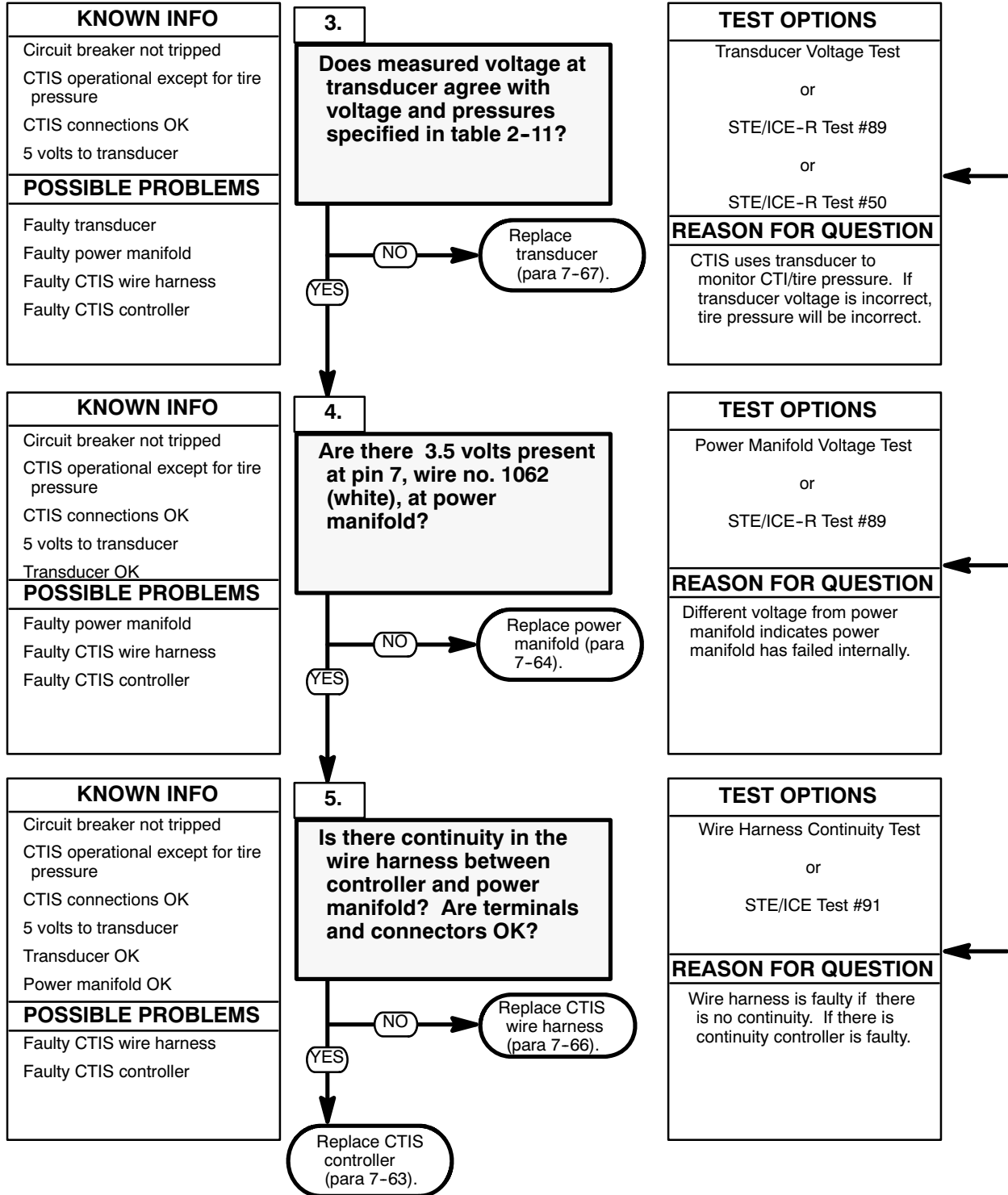


TRANSDUCER CONNECTOR



POWER MANIFOLD

n5. TIRE PRESSURES DO NOT AGREE WITH CTIS SETTINGS (CONT)



TRANSDUCER VOLTAGE TEST

NOTE

- Tire pressures must be between 20-30 psi (138-207 kPa) before beginning test to measure complete range of transducer voltage output.
- STE/ICE Test #50 is used to monitor pressures at porting block.

- (1) Remove hose no. 2102 and elbow from porting block.
- (2) Install STE/ICE adapter and 0-1000 psi (0-6895 kPa) pressure transducer on porting block.
- (3) Set CTIS controller to HIGHWAY setting (TM 9-2320-360-10).

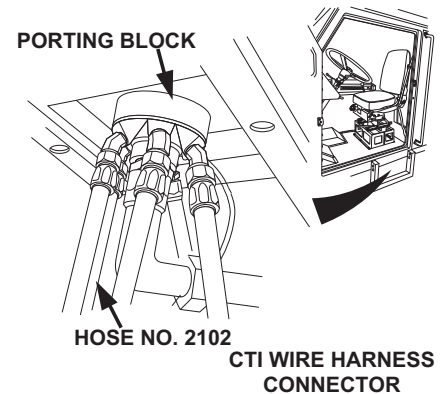
NOTE

CTIS wiring harness must remain installed to controller and power manifold when performing this test.

- (4) Place positive (+) probe of multimeter on position c (white) transducer wire.
- (5) Place negative (-) probe of multimeter on known good ground.
- (6) Start engine (TM 9-2320-360-10).
- (7) Move CTIS switch to ON position (TM 9-2320-360-10).
- (8) Press CTIS START button (TM 9-2320-360-10).
- (9) Record transducer voltage when porting block pressure reaches values shown in Table 2-11.
- (10) Shut off engine (TM 9-2320-360-10).
- (11) Remove STE/ICE pressure transducer and adapter from porting block.
- (12) Install elbow and air hose no. 2102 on porting block.

Table 2-11

PSI (plus/minus 0.2 volts)	Volts
75	3.5
70	3.3
60	2.9
50	2.5
40	2.0
30	1.7
20	1.3

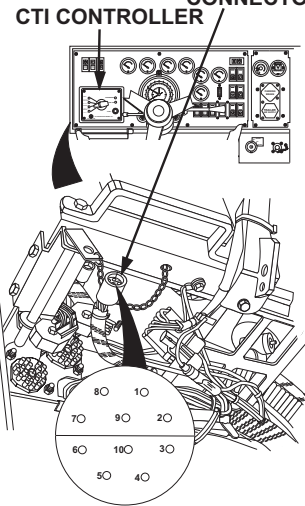


POWER MANIFOLD VOLTAGE TEST

NOTE

- Tire pressures must be 75 psi (517 kPa) before beginning test to measure correct transducer voltage output.
- CTIS wiring harness must remain installed to controller and power manifold when performing this test.

- (1) Place positive (+) probe of multimeter on position 7, wire no. 1062 (white), at controller.
- (2) Place negative (-) probe of multimeter on known good ground.
- (3) Start engine (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position (TM 9-2320-360-10).
- (5) Press CTIS START button (TM 9-2320-360-10) and look for 3.5 +/- .2 volts on multimeter.
- (6) Shut off engine (TM 9-2320-360-10).



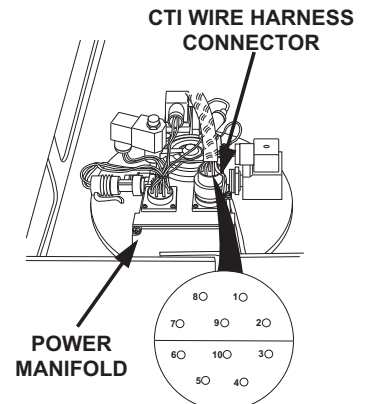
CTIS WIRE HARNESS CONTINUITY TEST

- (1) Disconnect CTIS wire harness connector from power manifold.
- (2) Disconnect CTIS wire harness connector from controller.

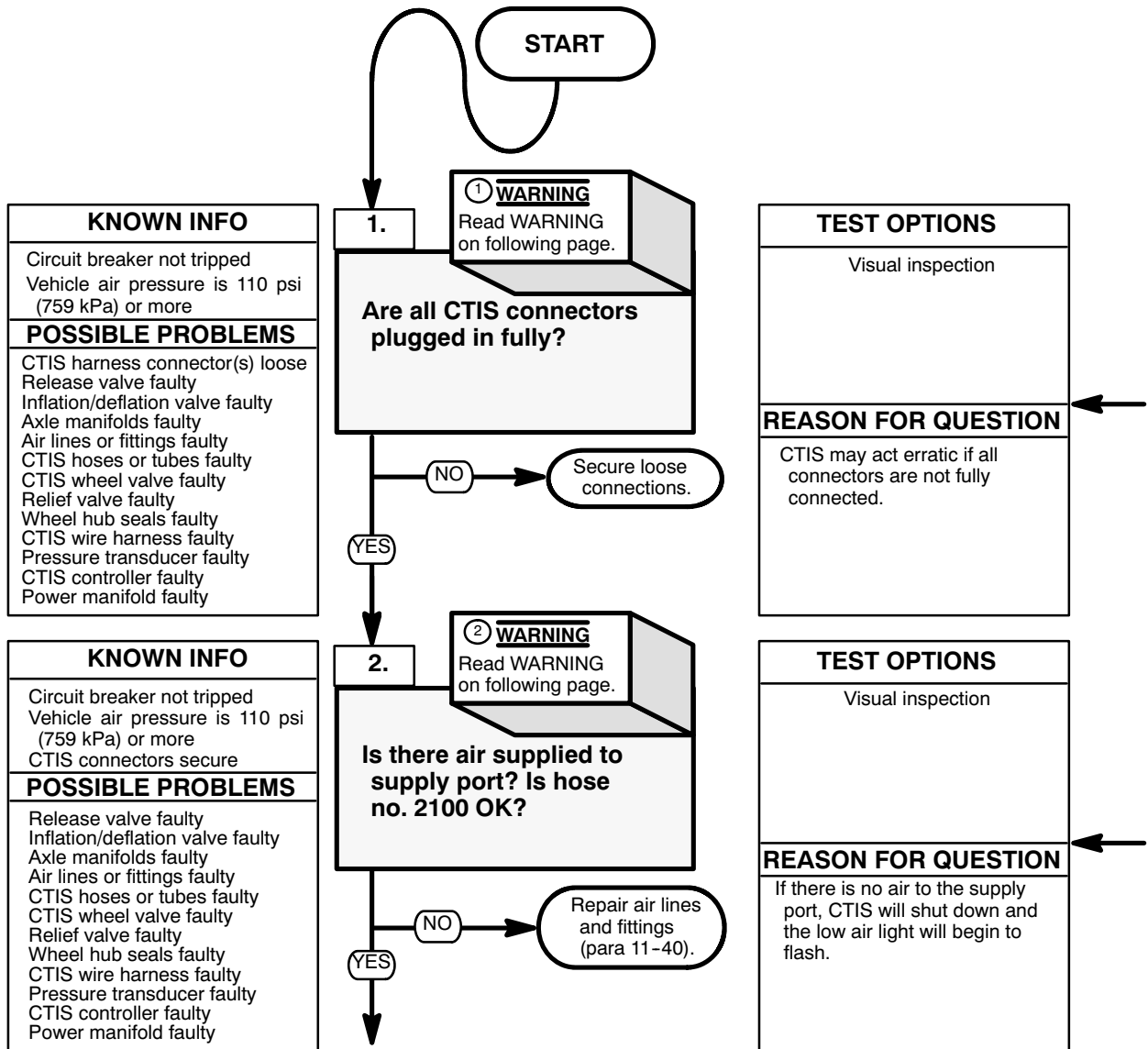
NOTE

Pay special attention to pin 7.

- (3) Place positive (+) probe of multimeter on position 1 of connector at controller end.
- (4) Place negative (-) probe of multimeter on position 1 of connector at power manifold end and check multimeter for continuity.
- (5) Repeat steps (3) and (4) for remaining positions 2 thru 10.
- (6) Install CTIS wire harness connectors back on power manifold and controller.



n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F) STE/ICE-R (Item 47, Appendix F)



1 WARNING

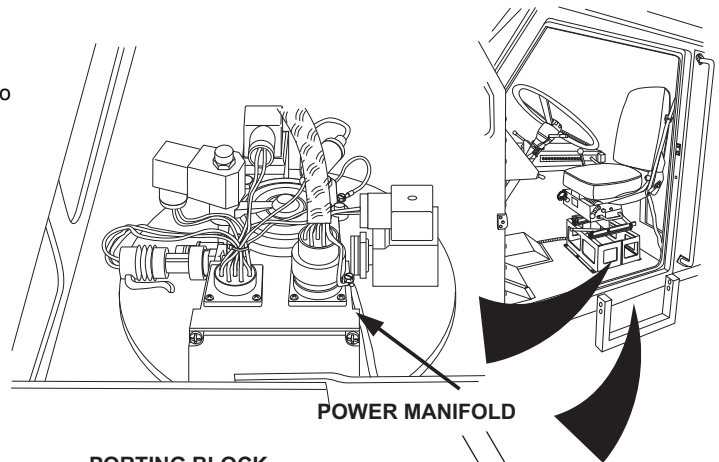
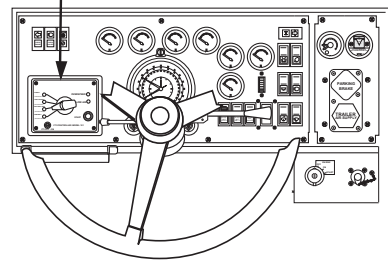
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

Air system pressure must be 120 psi (827 kPa) before beginning troubleshooting. If air pressure gage does not indicate 120 psi (827 kPa), wait for system air pressure to build before beginning troubleshooting.

Inspect CTIS power manifold and controller to see that all connectors are fully plugged in.

CTI CONTROLLER



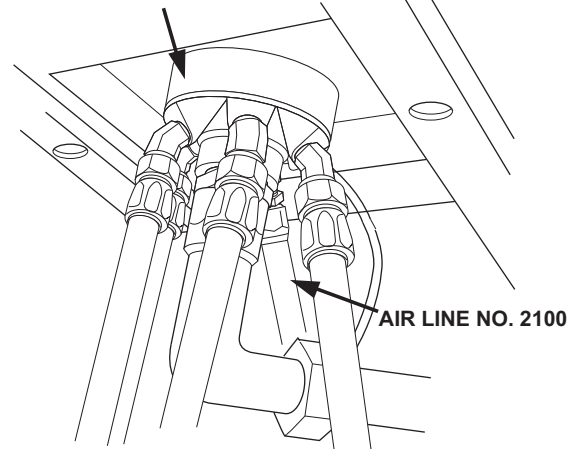
POWER MANIFOLD

2 WARNING

- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.
- Loosen but do not remove air line. Failure to comply may result in air line blowing off, causing injury to personnel.

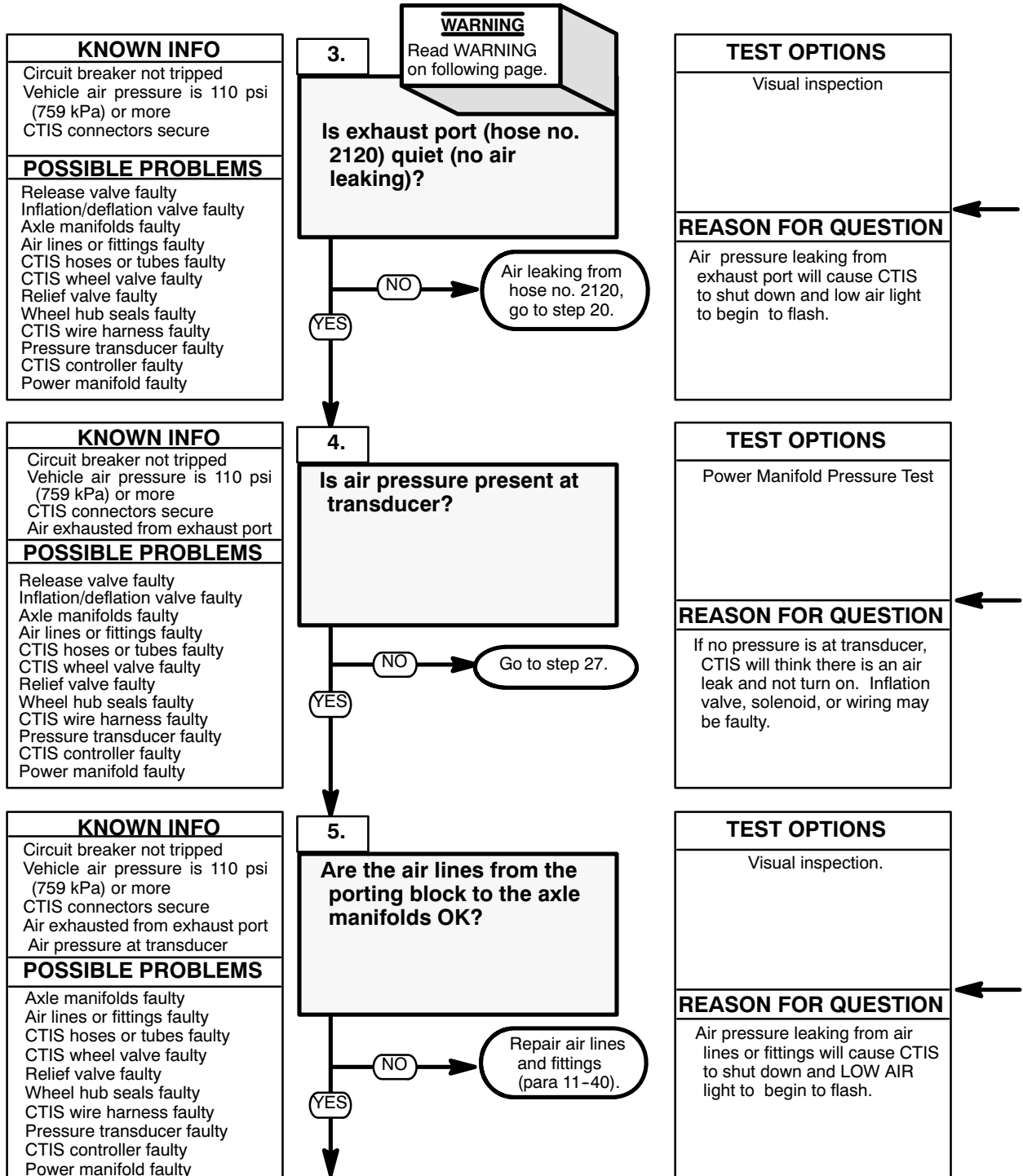
- (1) Loosen air line no. 2100 at porting block to check for air pressure.
- (2) Check air lines and fittings from air reservoir no. 1 to porting block for leakage or damage.

PORTING BLOCK



AIR LINE NO. 2100

n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

- The CTI system initially and periodically checks for system air leaks. The CTIS will display a flashing LOW AIR light and shut off if 6 psi cannot be maintained by the CTI system . The manifold will click during this test for approximately 1.5 minutes.
- Excessive inflation times (without low air light) are caused by minor leaks in CTI system.
- CTIS air lines are pressurized only when CTIS is in inflate, deflate, or test cycles.
- Tests 1 thru 5 can be made consecutively while the CTI system is in the inflate cycle.
- Normal inflation time from EMERGENCY to HIGHWAY setting is approximately 12 minutes at high idle.
- Excess inflation times, sometimes accompanied by a LOW AIR light is normal if engine is at idle RPM and/or air operated accessories are being used.
- Soap solution may be used to detect air leaks.

With engine shut OFF, listen for air leaking from exhaust port (hose no. 2120).

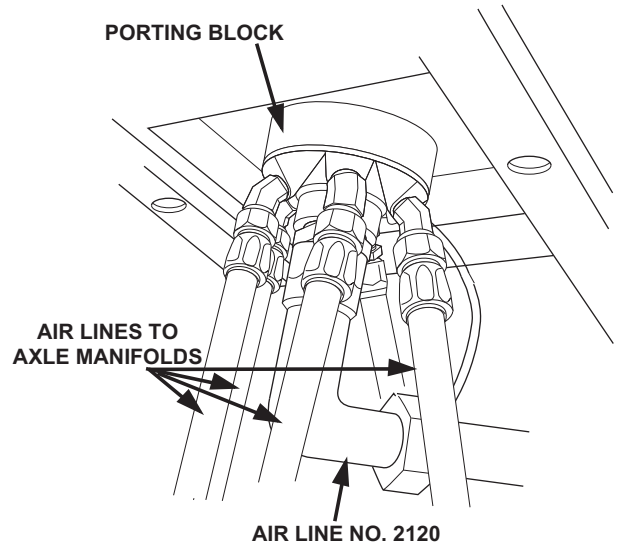
POWER MANIFOLD PRESSURE TEST

- (1) Remove transducer from power manifold (para 7-67).
- (2) Set CTIS to HIGHWAY setting (TM 9-2320-360-10).
- (3) Start engine (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position and/or press START button (TM 9-2320-360-10).
- (5) Check for any air pressure at transducer port on power manifold.
- (6) Shut off engine (TM 9-2320-360-10).
- (7) Install transducer in power manifold (para 7-67).

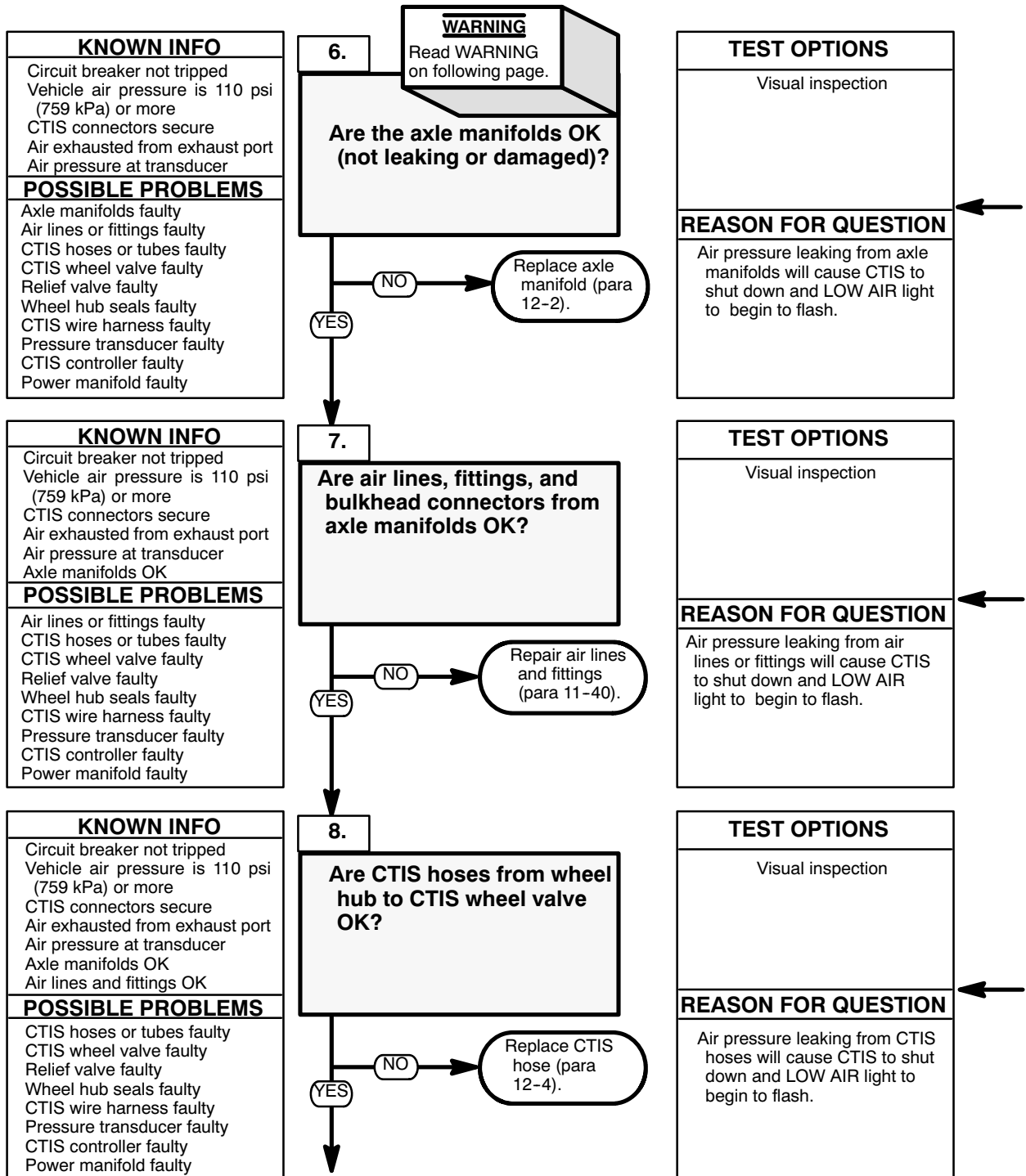
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check air lines from the porting block to the axle manifolds for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).



n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check axle manifolds for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

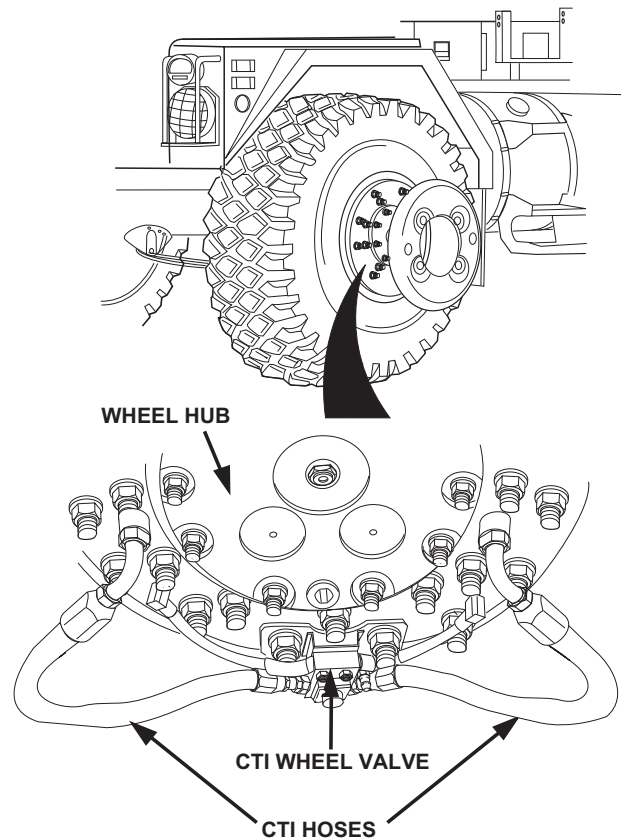
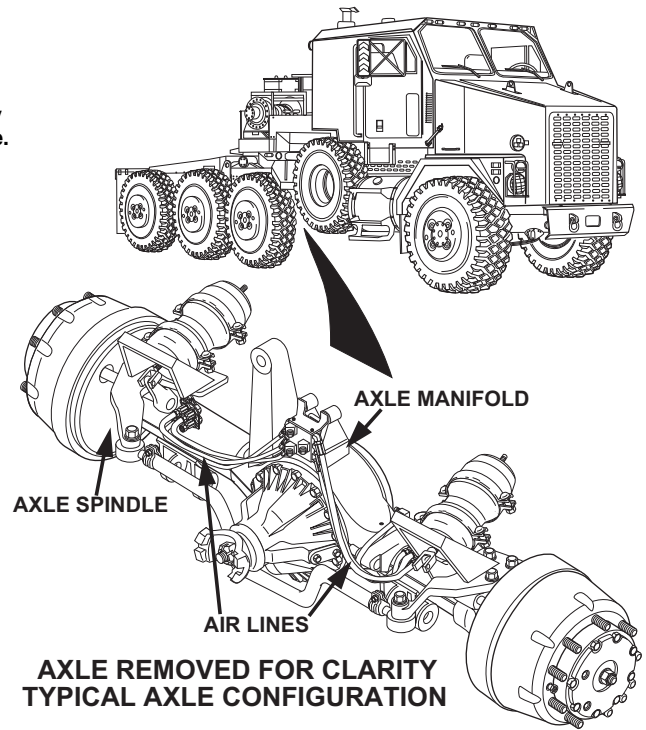
Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).
- (4) Check air lines, fittings and bulkhead connections from axle manifold to axle spindle for air leaks, damage, or crimps.
- (5) Shut off engine (TM 9-2320-360-10).

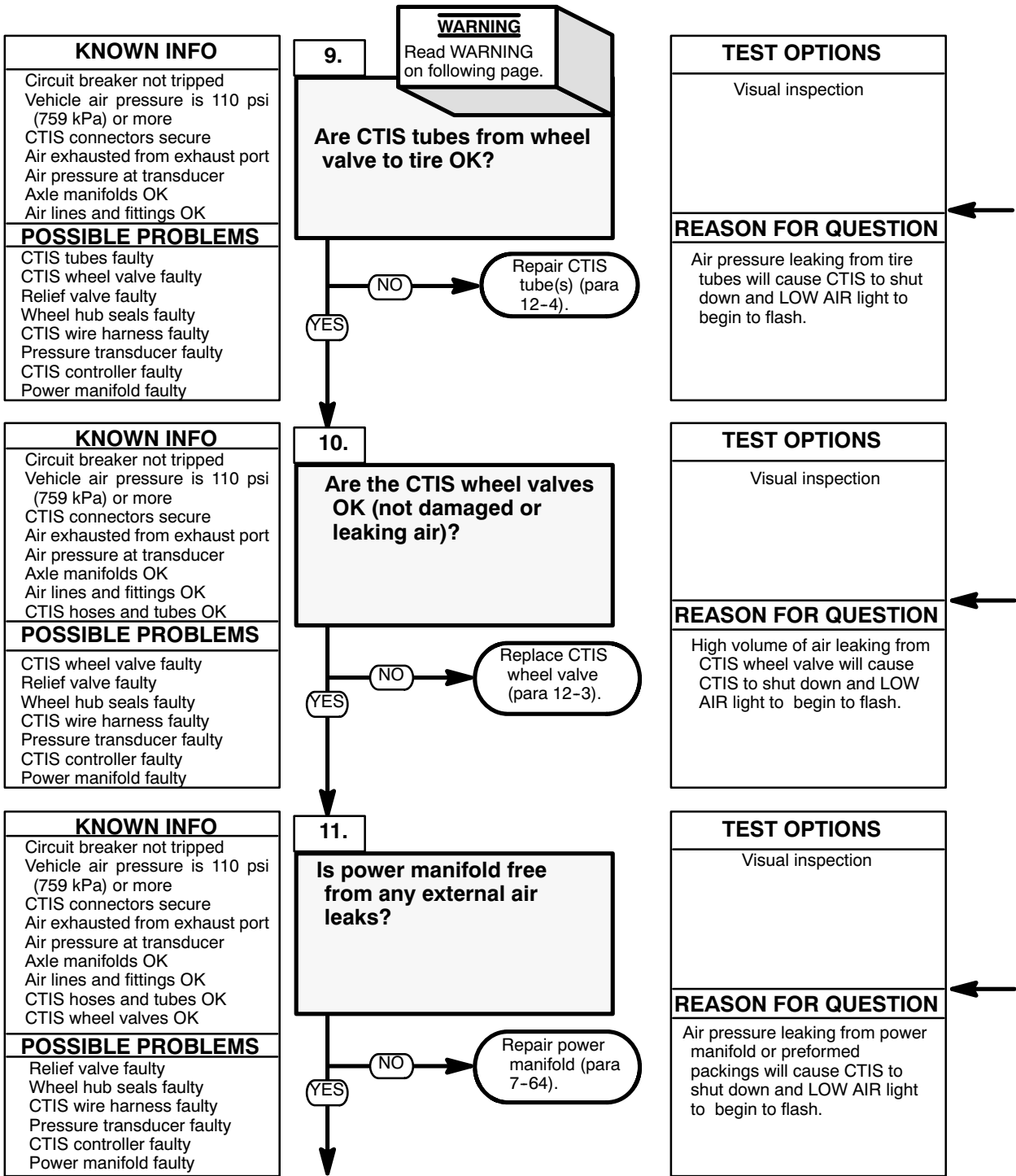
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Remove four nuts and wheel cover.
- (2) Start engine (TM 9-2320-360-10).
- (3) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (5) Check CTIS hoses from wheel hub to CTIS wheel valve for air leaks, damage, or crimps.
- (6) Shut off engine (TM 9-2320-360-10).



n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check CTIS tubes from wheel valve to tire for air leaks, damage, or crimps.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

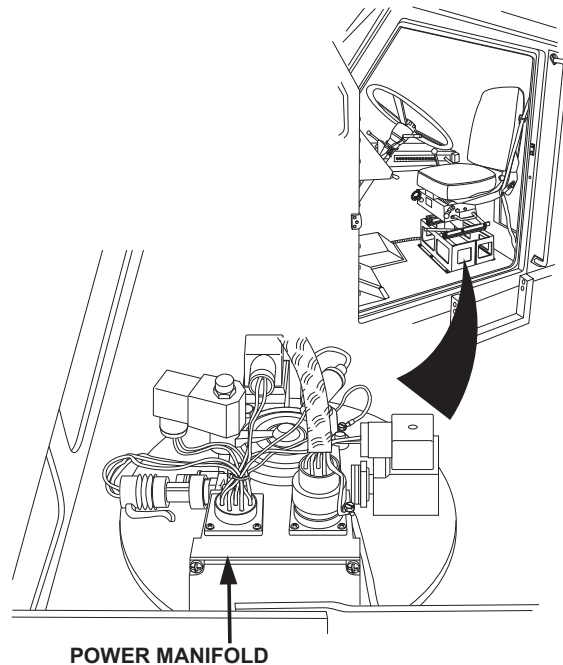
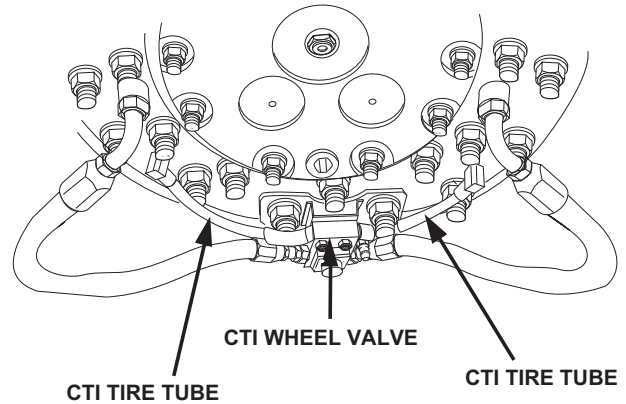
- Tire must be deflated to 60 psi (414 kPa) or less to perform this test.
- Some air leakage may occur at breather during inflation/deflation cycles.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check CTIS wheel valves for air leaks or damage.
- (5) Shut off engine (TM 9-2320-360-10).

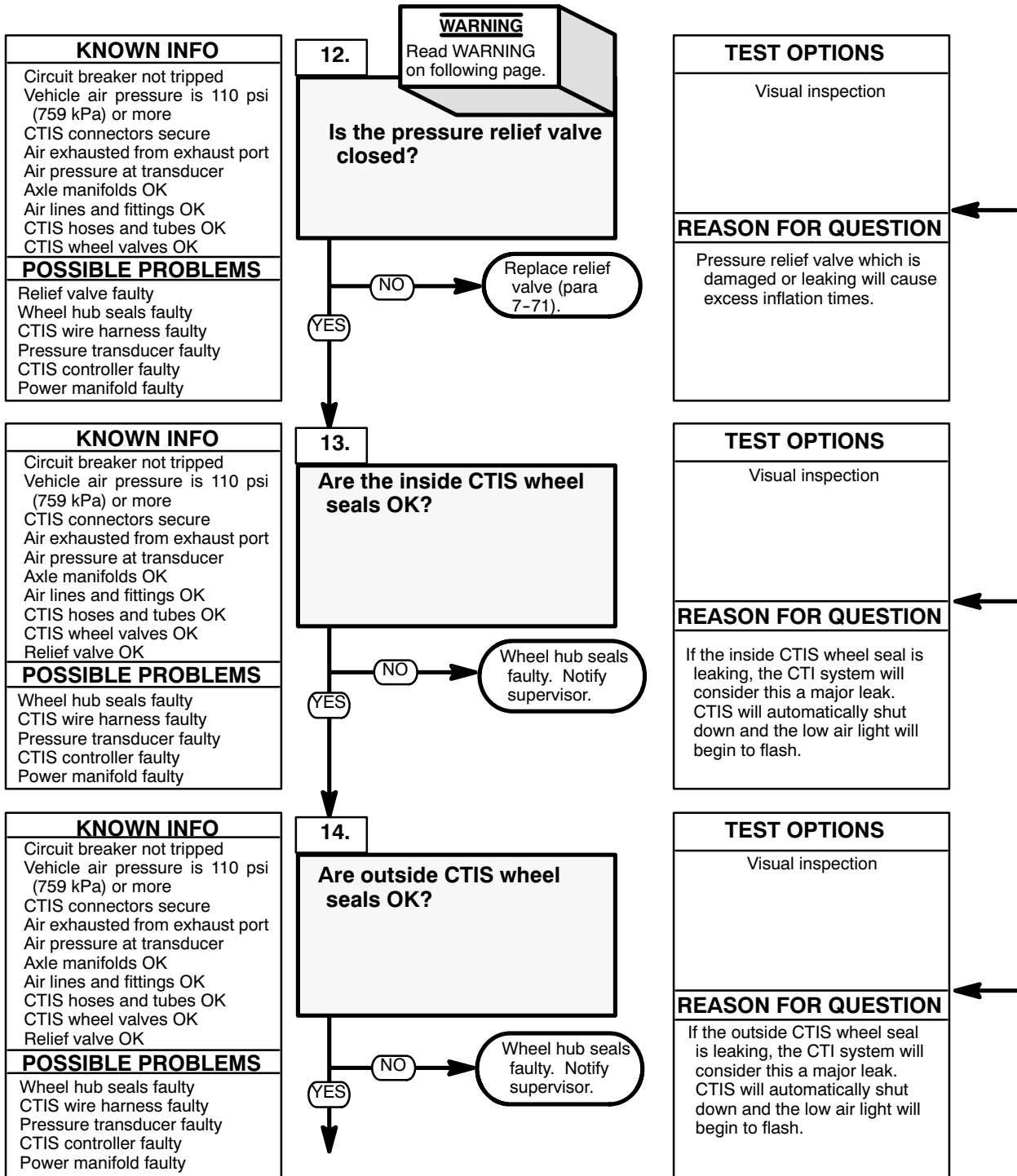
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).
- (4) Check CTIS power manifold casting and mounting base area for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).



n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

- Exercise extreme caution when working around wheels or under truck while engine is running. Movement of truck may cause severe injury or death.
- Wear safety goggles when performing leakage tests on valves air hoses. Failure to comply may cause serious eye injury due to high air pressure.

NOTE

- Tire must be deflated to 60 psi (414 kPa) or less to perform this test.
- Pressure relief valve remains closed unless pressure to tires exceeds 85 psi (586 kPa)

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check pressure relief valve for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).

NOTE

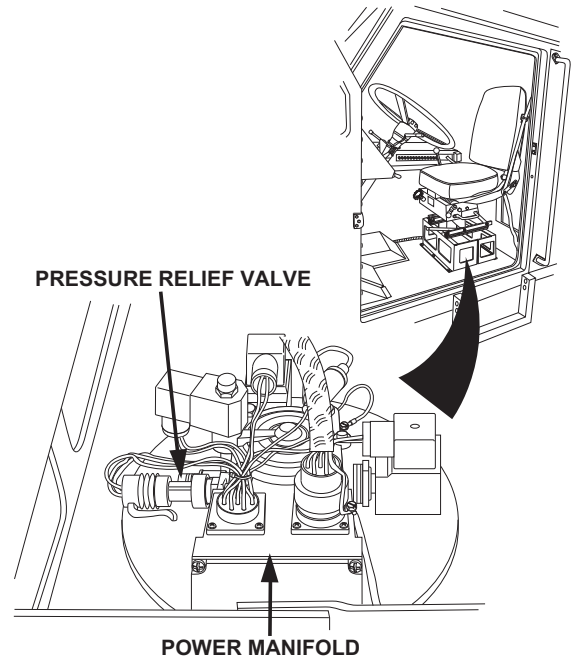
Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check inside wheel seals for air leaks.
- (5) Shut off engine (TM 9-2320-360-10).

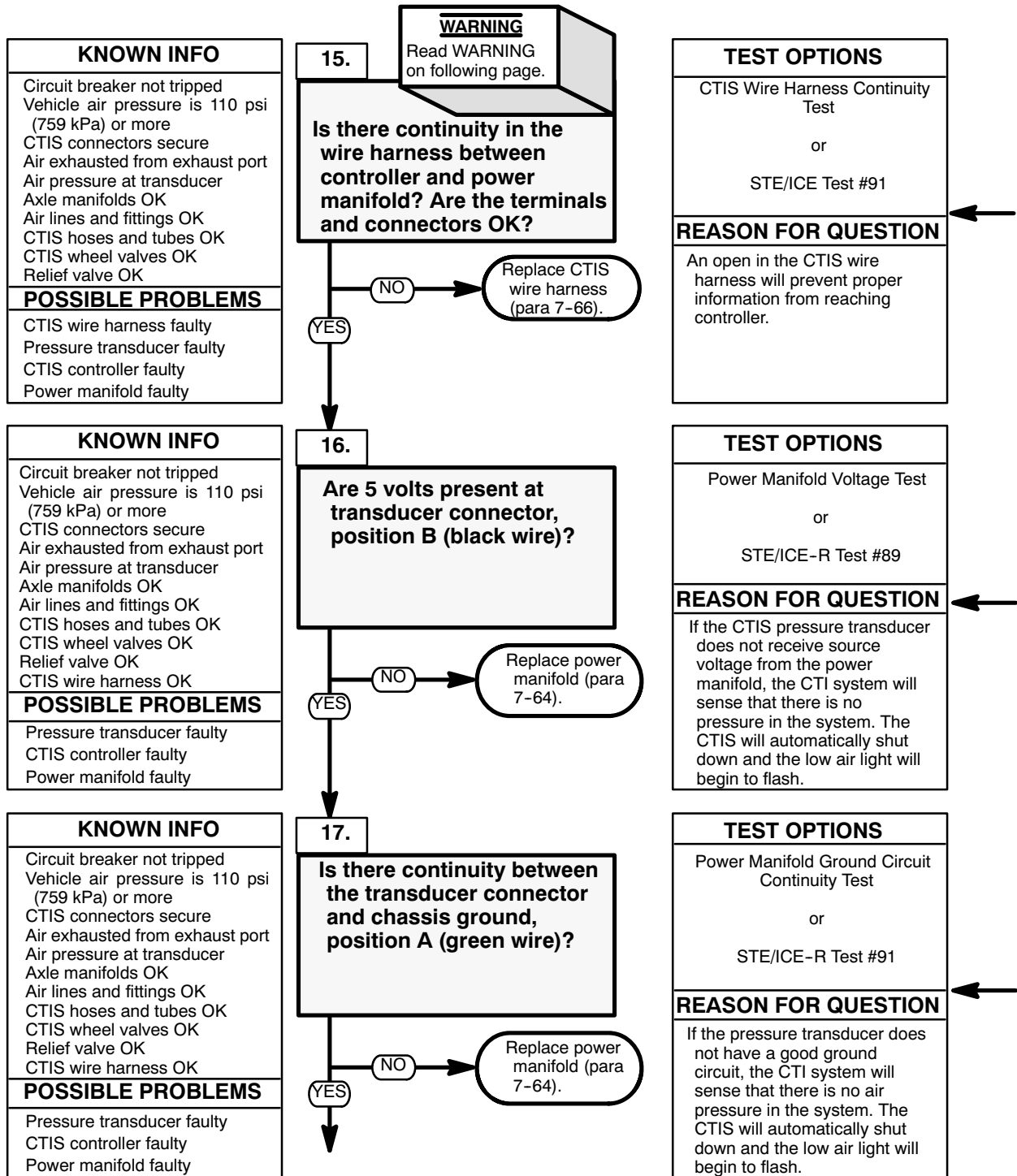
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check axle breathers for escaping air.
- (5) Shut off engine (TM 9-2320-360-10).



n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CTIS WIRE HARNESS CONTINUITY TEST

- (1) Disconnect CTIS wire harness connector from power manifold.
- (2) Disconnect CTIS wire harness connector from controller.

NOTE

Pay special attention to position 7 and position 1.

- (3) Place positive (+) probe of multimeter on position 1 of connector at controller end.
- (4) Place negative (-) probe of multimeter on position 1 of connector at power manifold end and check multimeter for continuity.
- (5) Repeat steps (3) and (4) for remaining positions 2 thru 10.
- (6) Install CTIS wire harness connectors back on power manifold and controller.

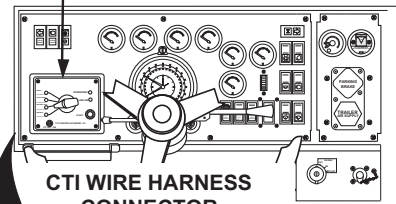
POWER MANIFOLD VOLTAGE TEST

- (1) Disconnect transducer connector.
- (2) Turn engine switch to ON position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).
- (4) Place positive (+) probe of multimeter on position b (black) transducer wire.
- (5) Place negative (-) probe of multimeter on known good ground and look for 5 volts on multimeter.
- (6) Connect transducer connector.

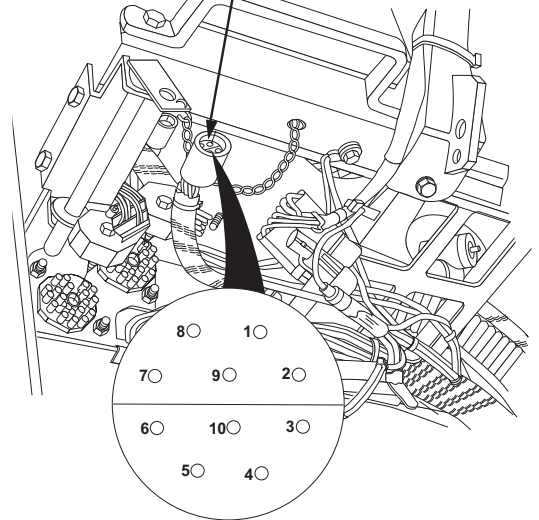
POWER MANIFOLD GROUND CIRCUIT CONTINUITY TEST

- (1) Disconnect transducer connector from power manifold.
- (2) Place positive (+) probe of multimeter on position a (green wire) of transducer connector to power manifold.
- (3) Place negative (-) probe of multimeter on known good ground and check multimeter for continuity.
- (4) Connect CTIS wire harness connector on power manifold.

CTI CONTROLLER

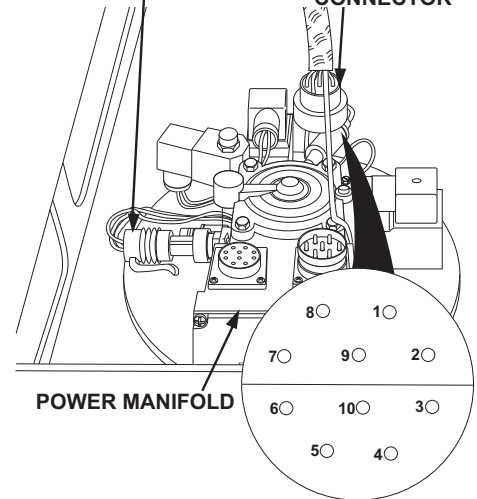


CTI WIRE HARNESS CONNECTOR



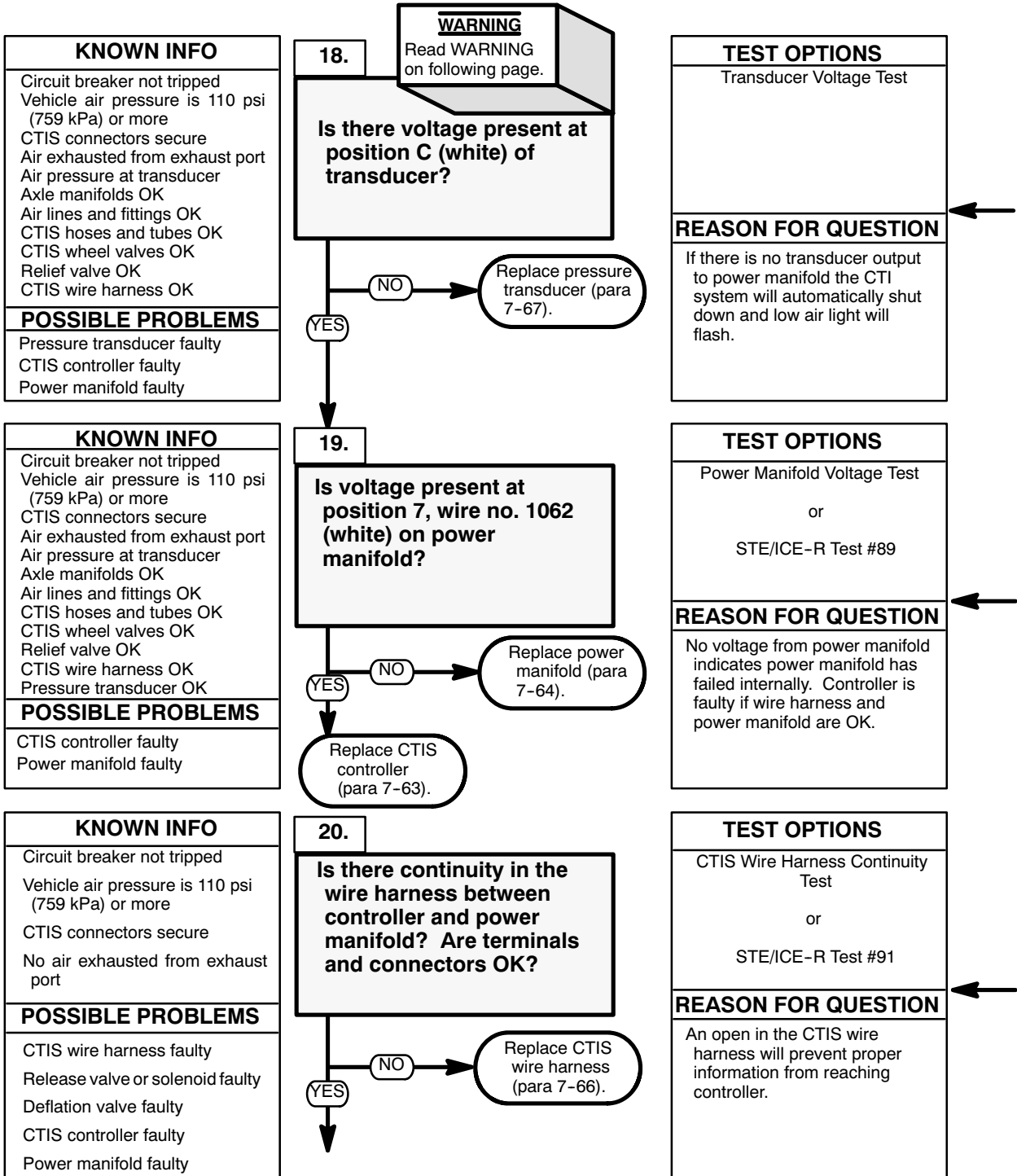
TRANSDUCER CONNECTOR

CTI WIRE HARNESS CONNECTOR



POWER MANIFOLD

n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

TRANSDUCER VOLTAGE TEST

- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Move CTIS switch to ON position (TM 9-2320-360-10).
- (3) Place positive (+) probe of multimeter at positions C (white) of transducer.
- (4) Place negative (-) probe of multimeter on known good ground and check multimeter for voltage.
- (5) Turn engine switch to OFF position (TM 9-2320-360-10).

POWER MANIFOLD VOLTAGE TEST

NOTE

- Tire pressures must be 75 psi (517 kPa) before beginning test to measure correct transducer voltage output.
- CTIS wiring harness must remain installed to controller and power manifold when performing this test.

- (1) Place positive (+) probe of multimeter on position 7, wire no. 1062 (white), at controller.
- (2) Place negative (-) probe of multimeter on known good ground.
- (3) Start engine (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position (TM 9-2320-360-10).
- (5) Press CTIS START button (TM 9-2320-360-10) and check for voltage on multimeter.
- (6) Shut off engine (TM 9-2320-360-10).

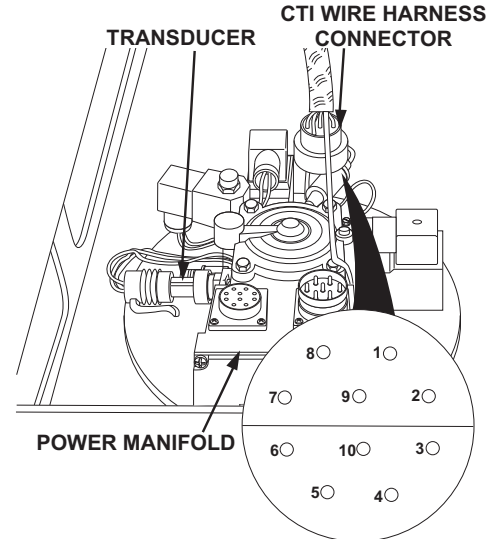
CTIS WIRE HARNESS CONTINUITY TEST

- (1) Disconnect CTIS wire harness connector from power manifold.
- (2) Disconnect CTIS wire harness connector from controller.

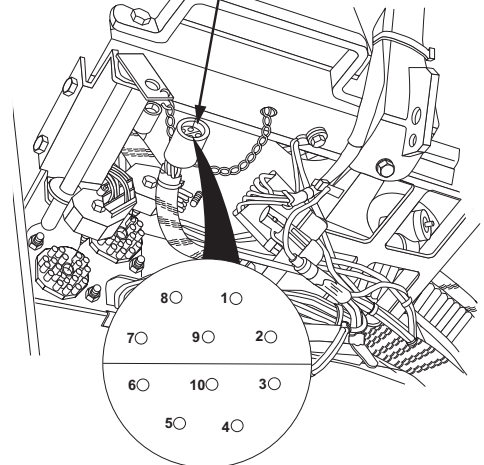
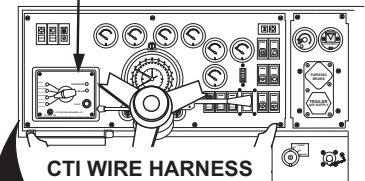
NOTE

Pay special attention to positions 1,3,4, and 7.

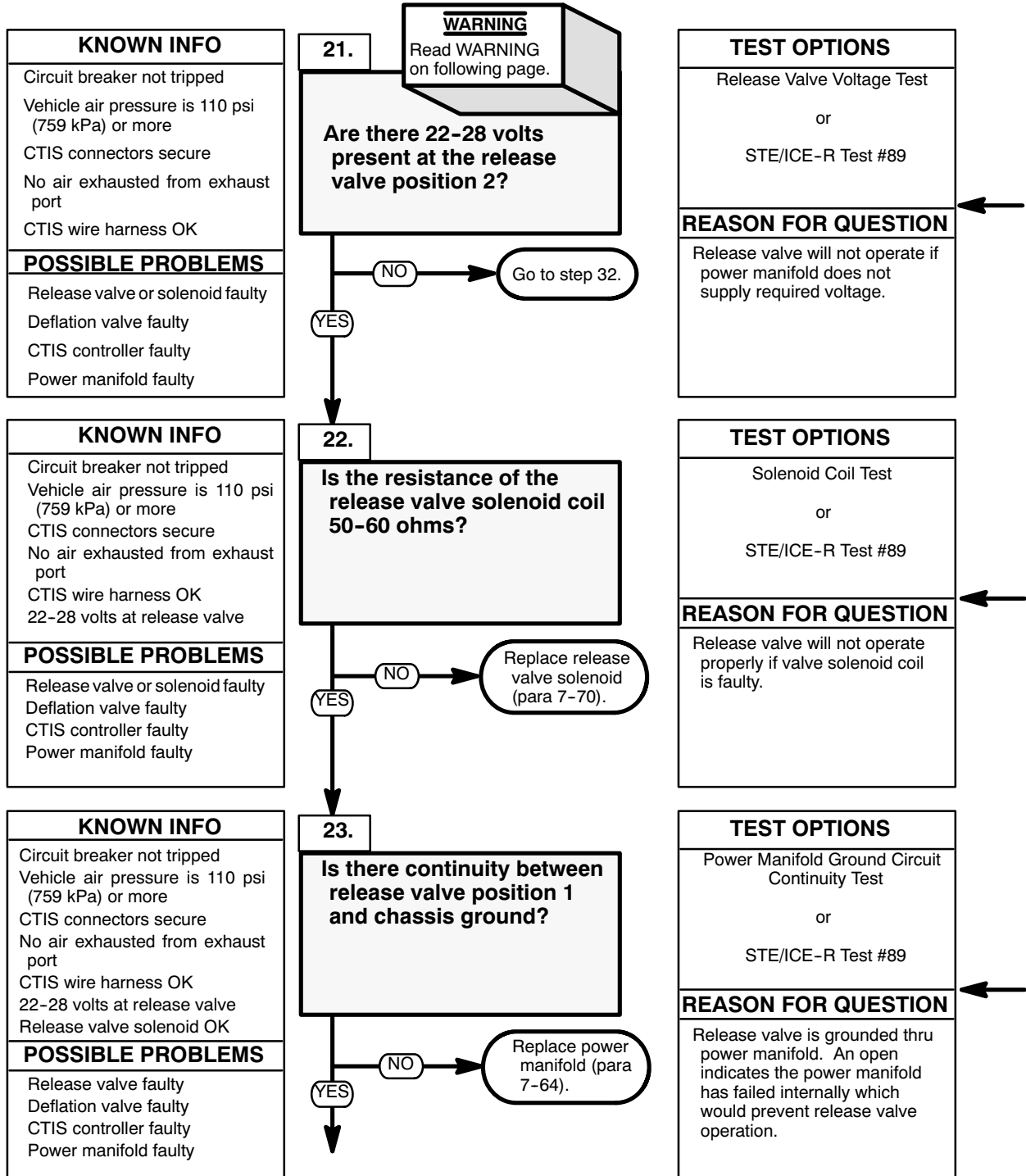
- (3) Place positive (+) probe of multimeter on position 1 of connector at controller end.
- (4) Place negative (-) probe of multimeter on position 1 of connector at power manifold end and check multimeter for continuity.
- (5) Repeat steps (3) and (4) for remaining positions 2 thru 10.
- (6) Install CTIS wire harness connectors back on power manifold and controller.



CTIS CONTROLLER



n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

RELEASE VALVE VOLTAGE TEST

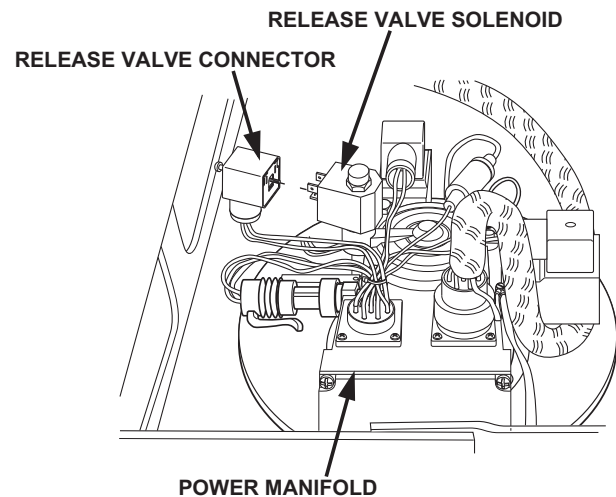
- (1) Disconnect release valve connector from power manifold.
- (2) Place positive (+) probe of multimeter on release valve connector, position 2.
- (3) Place negative (-) probe of multimeter on known good ground.
- (4) Turn engine switch to ON position (TM 9-2320-360-10).
- (5) Move CTIS switch to ON position (TM 9-2320-360-10).
- (6) Press START button and look for 22-28 volts on multimeter.
- (7) Turn engine switch to OFF position (TM 9-2320-360-10).
- (8) Connect release valve connector to power manifold.

SOLENOID COIL TEST

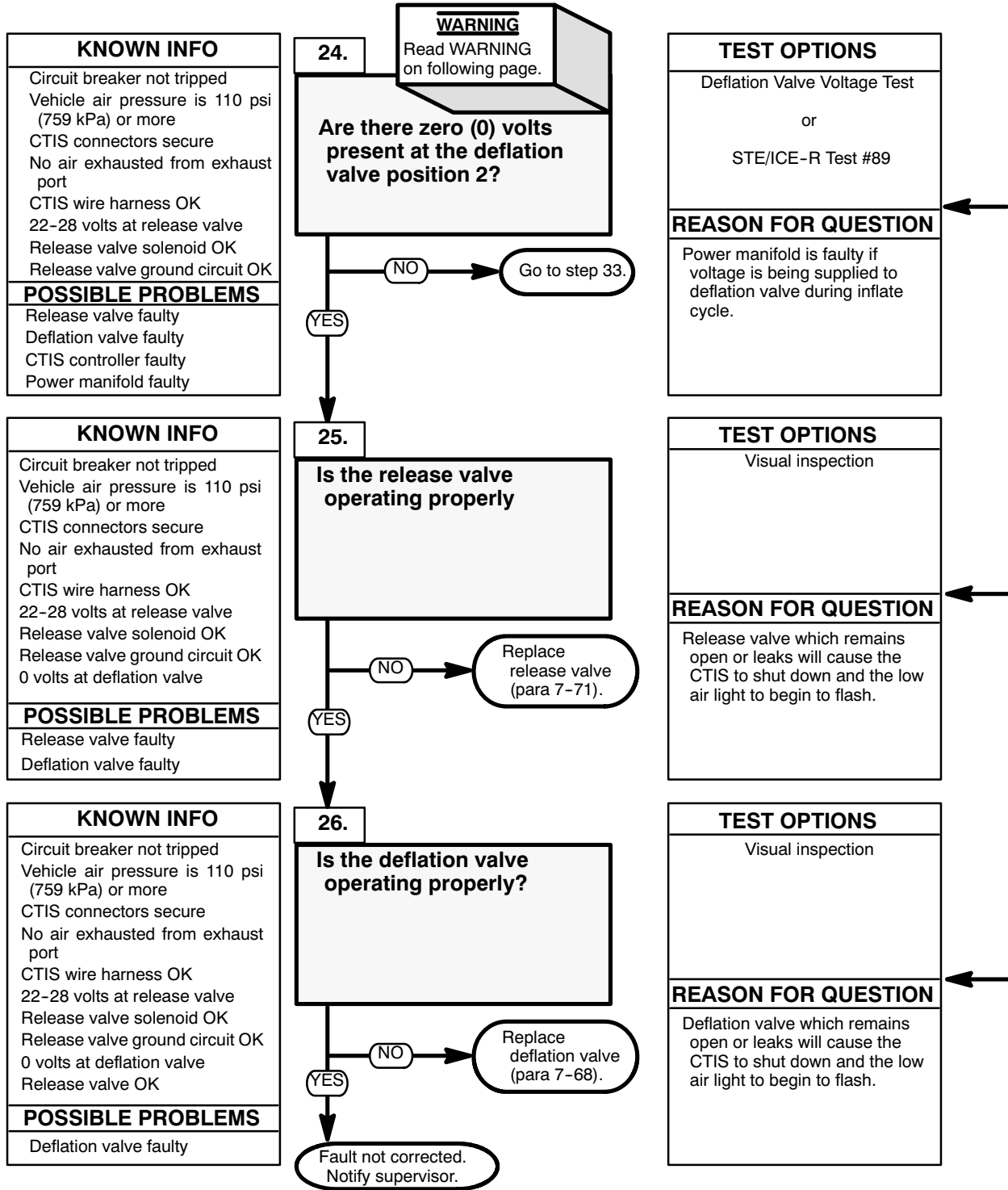
- (1) Remove connector from release valve solenoid.
- (2) Place positive probe (+) of multimeter on release valve solenoid position 1.
- (3) Place negative probe (-) of multimeter on release valve solenoid position 2 and look for 50-60 ohms on multimeter.
- (4) Install connector on release valve solenoid.

POWER MANIFOLD GROUND CIRCUIT CONTINUITY TEST

- (1) Disconnect release valve connector from power manifold.
- (2) Place positive (+) probe of multimeter in release valve connector, position 1.
- (3) Place negative (-) probe of multimeter on known good ground and check multimeter for continuity.
- (4) Connect release valve connector to power manifold.



n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)

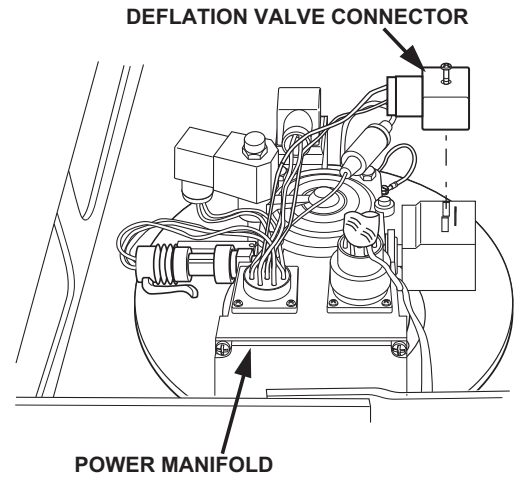


WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

DEFLATION VALVE VOLTAGE TEST

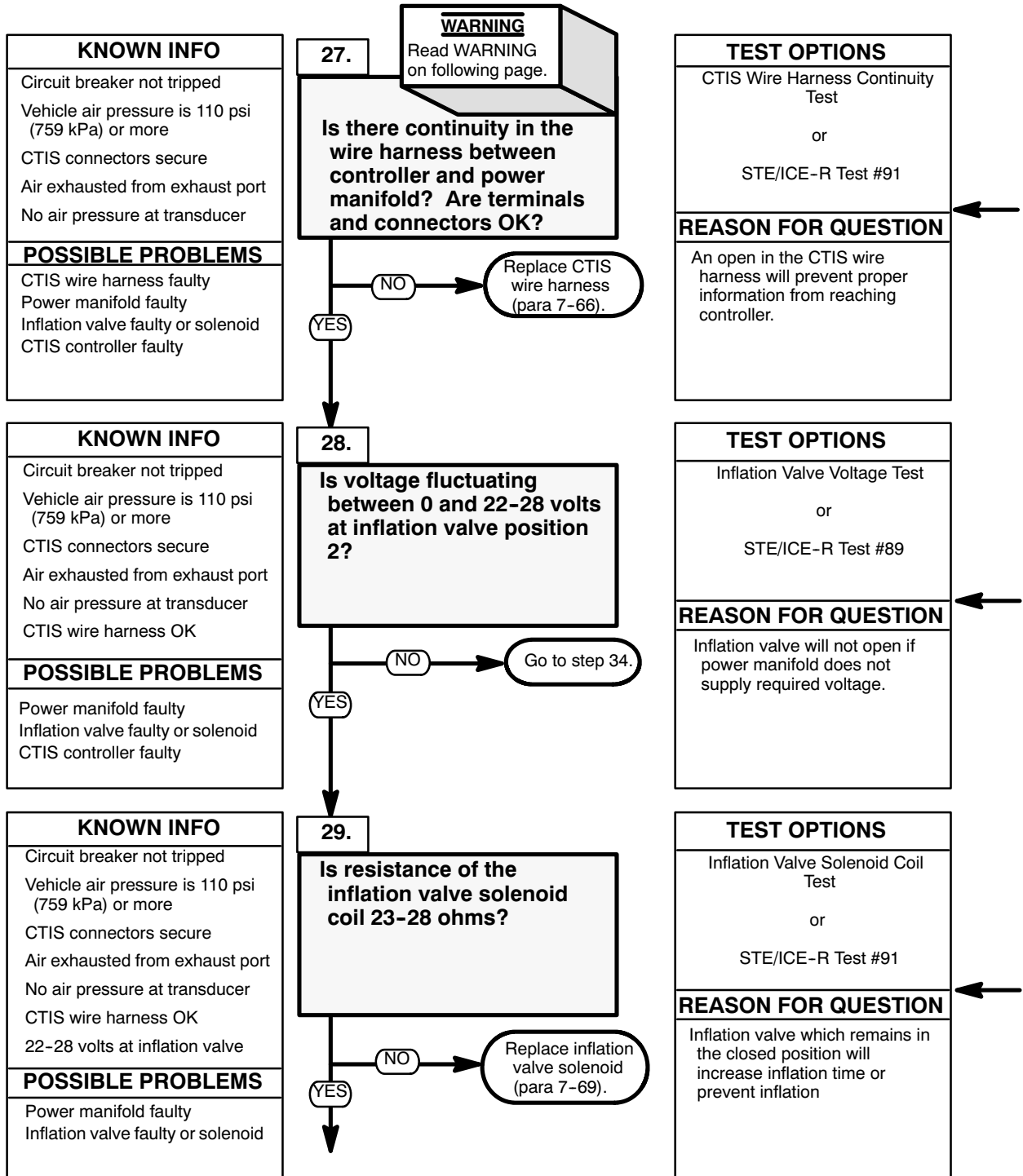
- (1) Disconnect deflation valve connector from power manifold.
- (2) Place positive (+) probe of multimeter on deflation valve connector, pin 2.
- (3) Place negative (-) probe of multimeter on known good ground.
- (4) Turn engine switch to ON position (TM 9-2320-360-10).
- (5) Move CTIS switch to ON position (TM 9-2320-360-10).
- (6) Press START button and look for 0 volts on multimeter.
- (7) Turn engine switch to OFF position (TM 9-2320-360-10).
- (8) Connect deflation valve connector to power manifold.



- (1) Remove release valve (para 7-70).
- (2) Inspect valve assembly for a broken spring, damaged diaphragm, sticking, or any other physical damage.
- (3) Install release valve (para 7-70).

- (1) Remove deflation valve (para 7-68).
- (2) Inspect valve assembly for a broken spring, damaged diaphragm, sticking, or any other physical damage.
- (3) Install deflation valve (para 7-68).

n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CTIS WIRE HARNESS CONTINUITY TEST

- (1) Disconnect CTIS wire harness connector from power manifold.
- (2) Disconnect CTIS wire harness connector from controller.

NOTE

Pay special attention to position 7 and position 1.

- (3) Place positive (+) probe of multimeter on position 1 of connector at controller end.
- (4) Place negative (-) probe of multimeter on position 1 of connector at power manifold end and check multimeter for continuity.
- (5) Repeat steps (3) and (4) for remaining positions 2 thru 10.
- (6) Install CTIS wire harness connectors back on power manifold and controller.

INFLATION VALVE VOLTAGE TEST

- (1) Disconnect inflation valve connector from power manifold.
- (2) Place positive (+) probe of multimeter on inflation valve connector, position 2.
- (3) Place negative (-) probe of multimeter on known good ground.
- (4) Turn engine switch to ON position (TM 9-2320-360-10).
- (5) Move CTIS switch to ON position (TM 9-2320-360-10).

NOTE

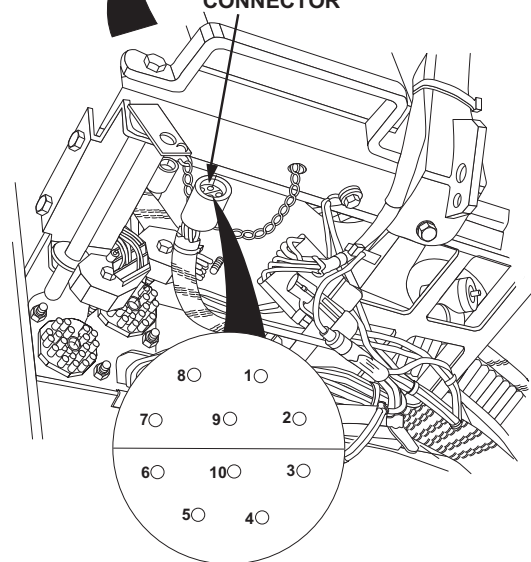
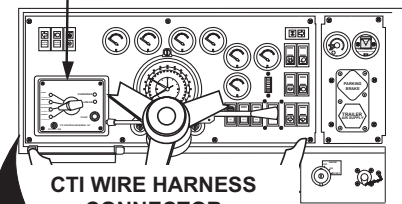
It is normal for voltage to fluctuate.

- (6) Press START button and look for 22-28 volts on multimeter.
- (7) Turn engine switch to OFF position (TM 9-2320-360-10).
- (8) Connect inflation valve connector to power manifold.

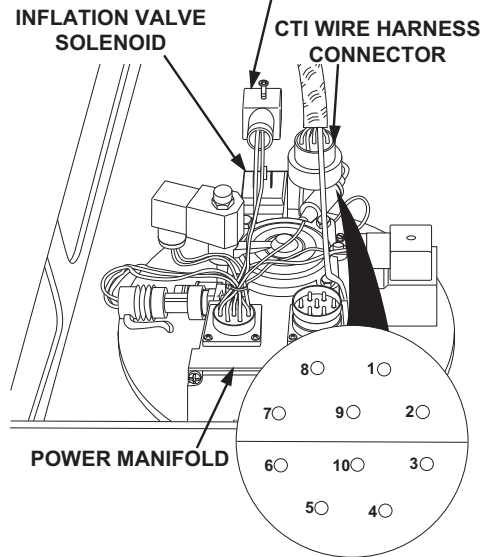
INFLATION VALVE SOLENOID COIL TEST

- (1) Remove connector from inflation valve solenoid.
- (2) Place positive probe (+) of multimeter on inflation valve solenoid pin 1.
- (3) Place negative probe (-) of multimeter on inflation valve solenoid pin 2 and look for 23-28 ohms on multimeter.
- (4) Install connector on inflation valve solenoid.

CTI CONTROLLER

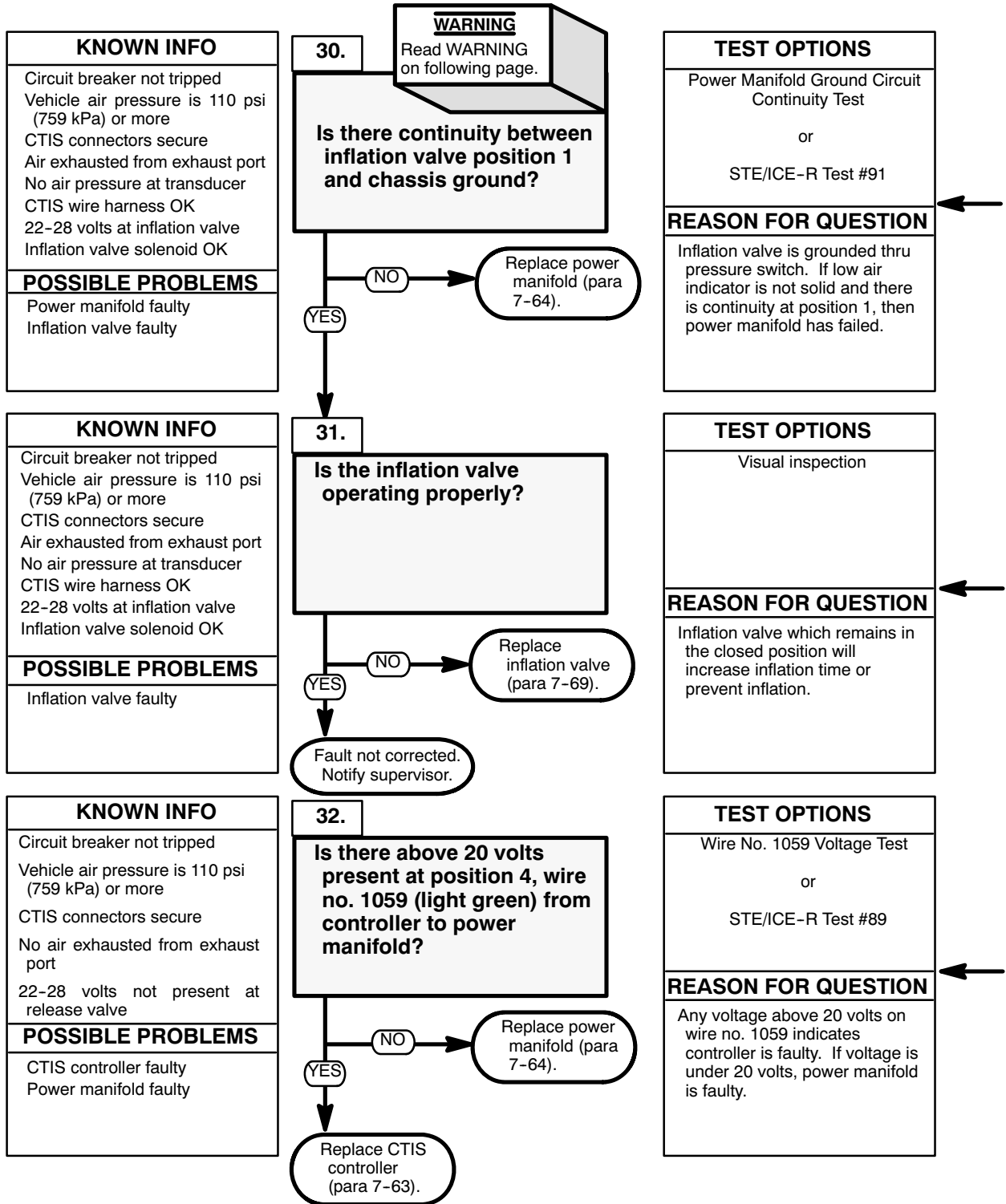


INFLATION VALVE CONNECTOR



POWER MANIFOLD

n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



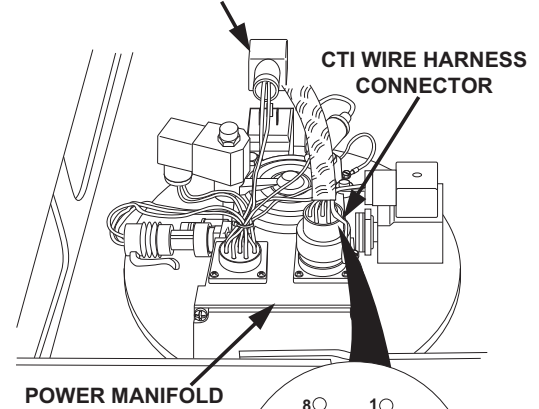
WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

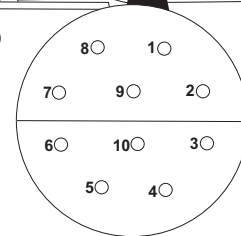
POWER MANIFOLD GROUND CIRCUIT CONTINUITY TEST

- (1) Disconnect inflation valve connector from power manifold.
- (2) Place positive (+) probe of multimeter in inflation valve connector, position 1.
- (3) Place negative (-) probe of multimeter on known good ground and check multimeter for continuity.
- (4) Connect inflation valve connector to power manifold.

INFLATION VALVE CONNECTOR



POWER MANIFOLD



- (1) Remove inflation valve (para 7-69).
- (2) Inspect valve assembly for a broken spring, damaged diaphragm, sticking, or any other physical damage.
- (3) Install inflation valve (para 7-69).

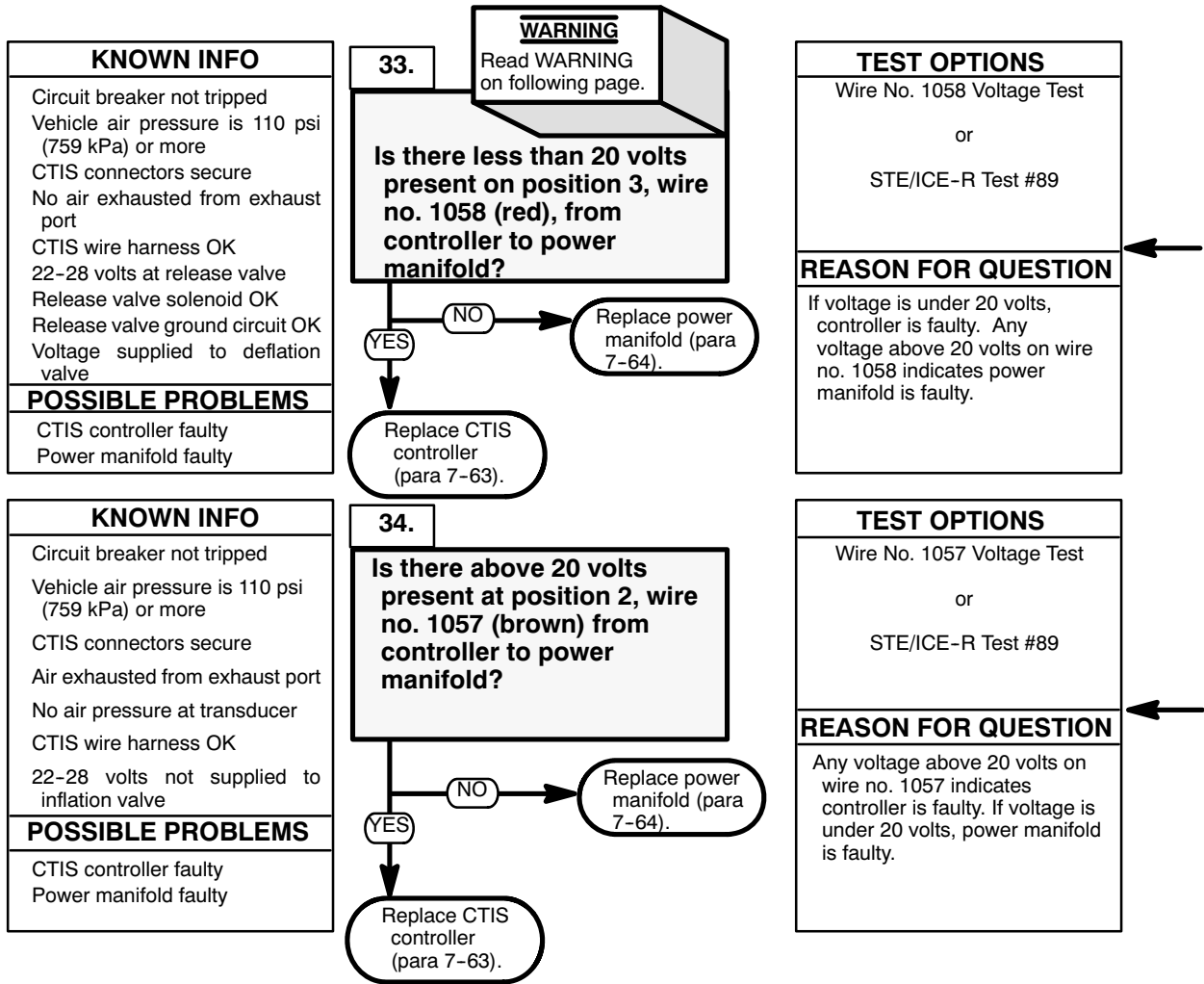
WIRE NO. 1059 VOLTAGE TEST

NOTE

CTIS wiring harness must remain installed to controller and power manifold when performing this test.

- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Move CTIS switch to ON position (TM 9-2320-360-10).
- (3) Place positive (+) probe of multimeter on position 4, wire no. 1059 (green), of CTIS wire harness connector at power manifold.
- (4) Place negative (-) probe of multimeter on known good ground.
- (5) Press CTIS START button and look for voltage on multimeter.
- (6) Turn engine switch to OFF position and move CTIS controller switch to OFF position (TM 9-2320-360-10).

n6. POWER MANIFOLD CLICKS CONTINUALLY/LOW AIR LIGHT FLASHING (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1058 VOLTAGE TEST

NOTE

- CTIS wiring harness must remain installed to controller and power manifold when performing this test.
- Tire pressure should be over 60 psi to perform this test.

- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Set CTIS controller selector to EMERGENCY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).
- (4) Place positive (+) probe of multimeter on position 3, wire no. 1058 (red), of CTIS wire harness connector at power manifold.
- (5) Place negative (-) probe of multimeter on known good ground.
- (6) Press CTIS START button and look for voltage on multimeter.
- (7) Turn engine switch to OFF position and move CTIS controller switch to OFF position (TM 9-2320-360-10).

WIRE NO. 1057 VOLTAGE TEST

NOTE

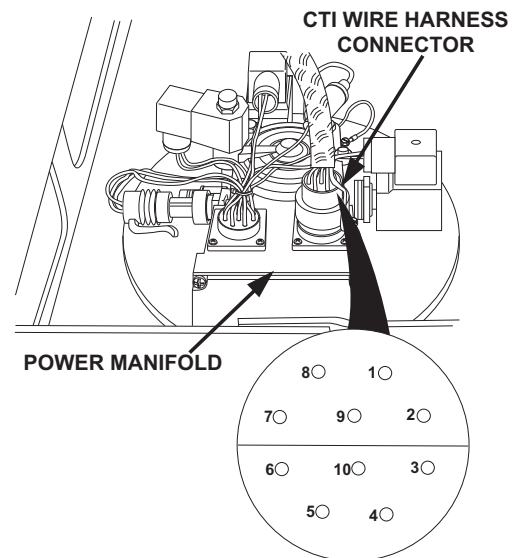
- CTIS wiring harness must remain installed to controller and power manifold when performing this test.
- Tire pressure should be over 60 psi to perform this test.

- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Set CTIS controller selector to EMERGENCY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).
- (4) Place positive (+) probe of multimeter on position 3, wire no. 1057 (brown), of CTIS wire harness connector at power manifold.
- (5) Place negative (-) probe of multimeter on known good ground.

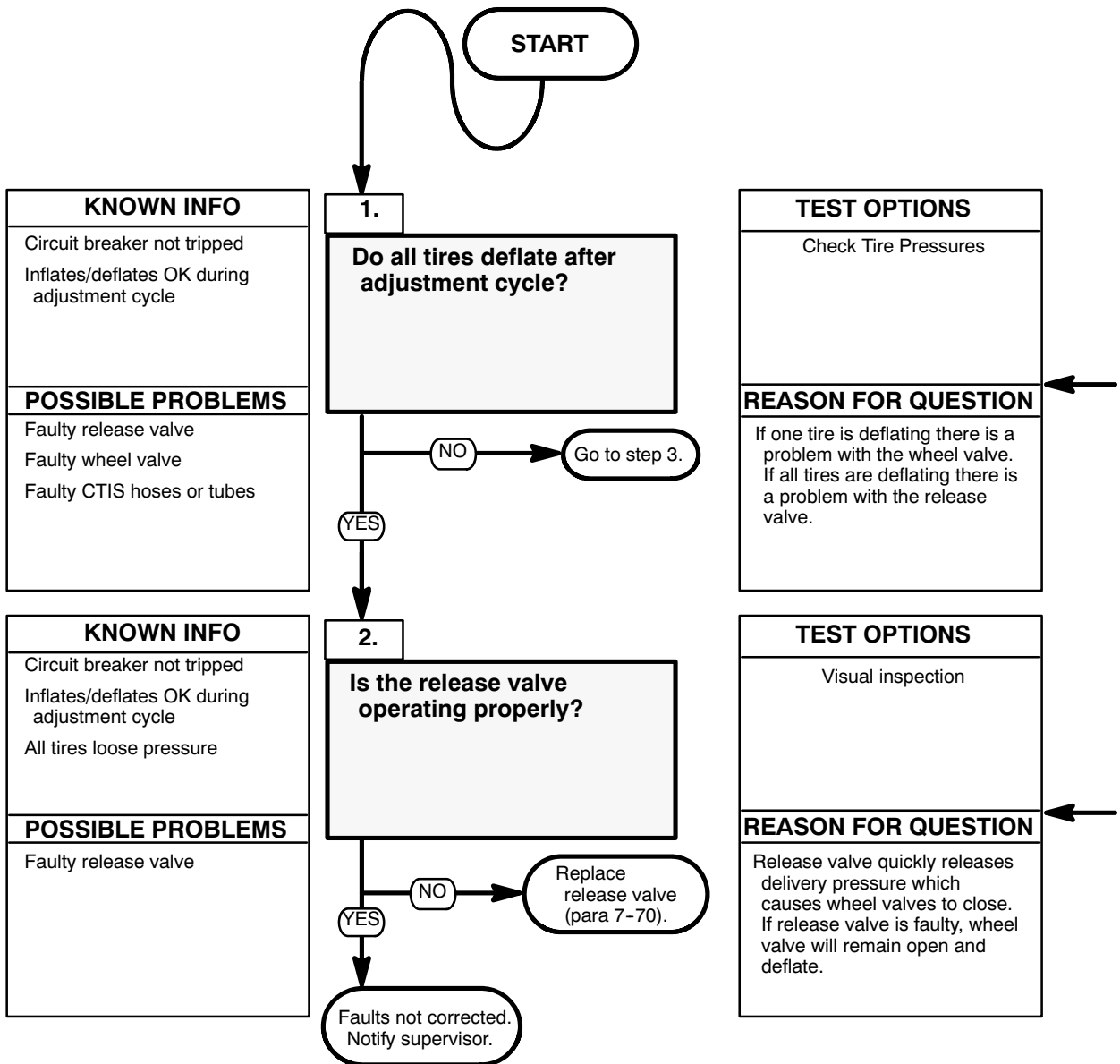
NOTE

It is normal for voltage to fluctuate.

- (6) Press CTIS START button and look for voltage on multimeter.
- (7) Turn engine switch to OFF position and move CTIS controller switch to OFF position (TM 9-2320-360-10).



n8. TIRES DEFLATE UPON COMPLETION OF ADJUSTMENT CYCLE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F)



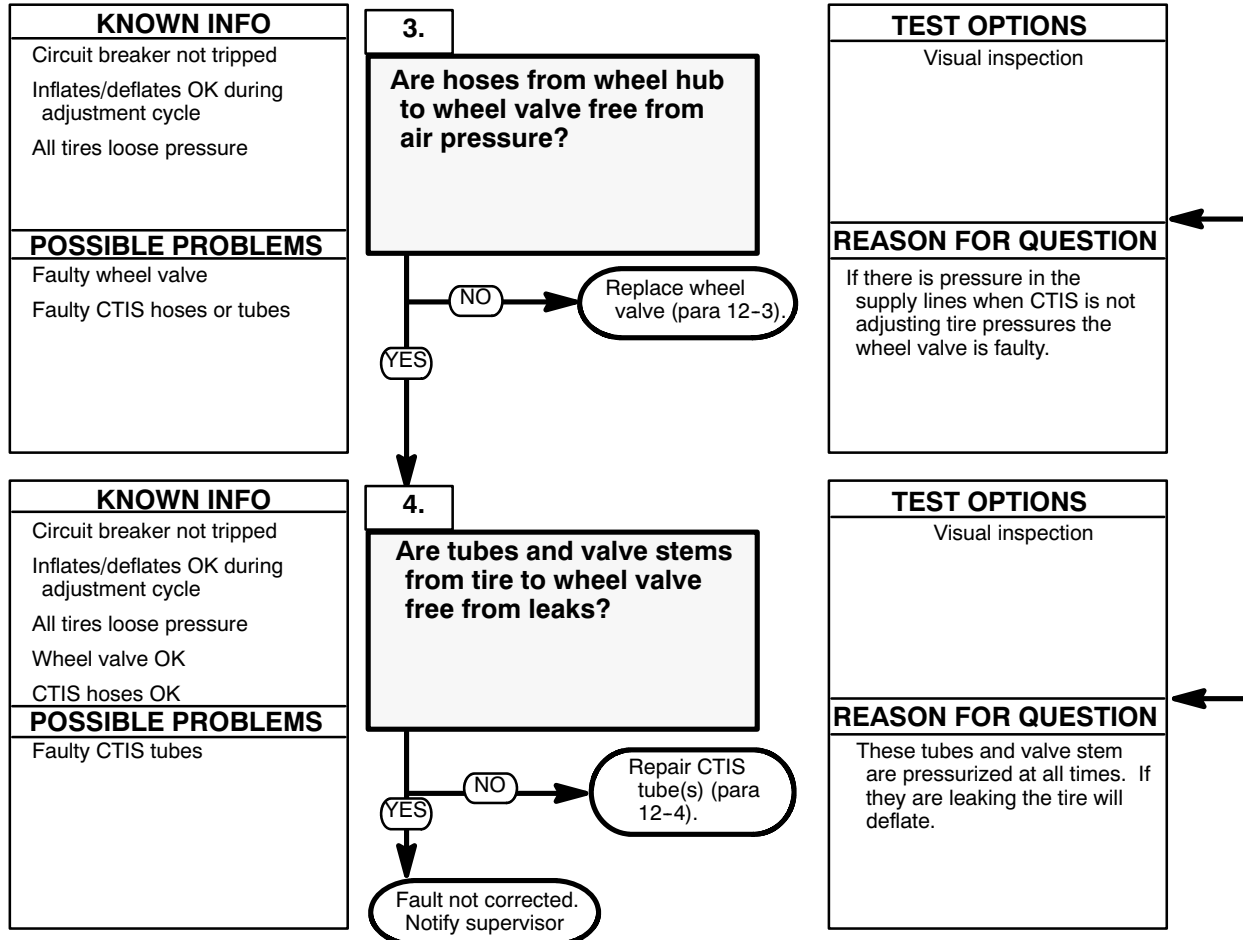
NOTE

- Air system pressure must be 120 psi (827 kPa) before beginning troubleshooting. If air pressure gage does not indicate 120 psi (827 kPa), wait for system air pressure to build before beginning troubleshooting.
- CTIS air lines are pressurized only when CTIS is in inflate, deflate, or test cycles.

Refer to Servicing Tires, (TM 9-2320-360-10).

- (1) Remove release valve (para 7-70).
- (2) Inspect valve assembly for broken springs, damaged diaphragm, sticking, or any other physical damage.
- (3) Install release valve (para 7-70).

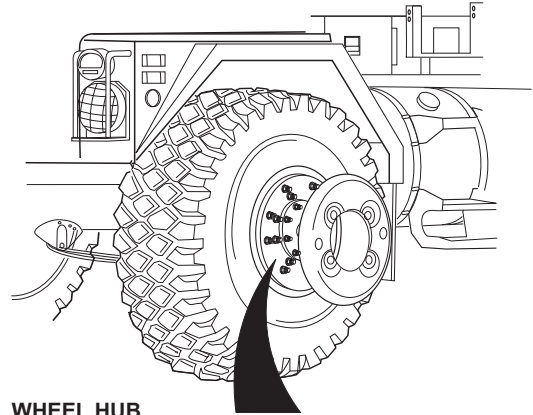
n8. TIRES DEFLATE UPON COMPLETION OF ADJUSTMENT CYCLE (CONT)



NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

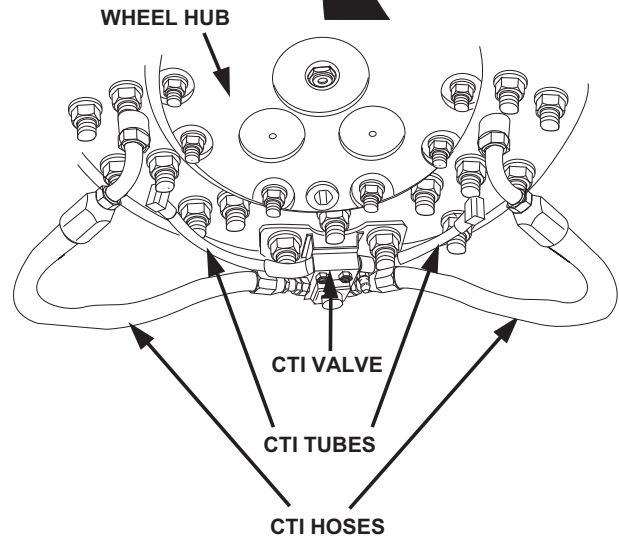
- (1) Remove four nuts and wheel cover.
- (2) Start engine (TM 9-2320-360-10).
- (3) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (4) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (5) Check CTIS hoses from wheel hub to CTIS wheel valve for air leaks, damage, or crimps.
- (6) Shut off engine (TM 9-2320-360-10).



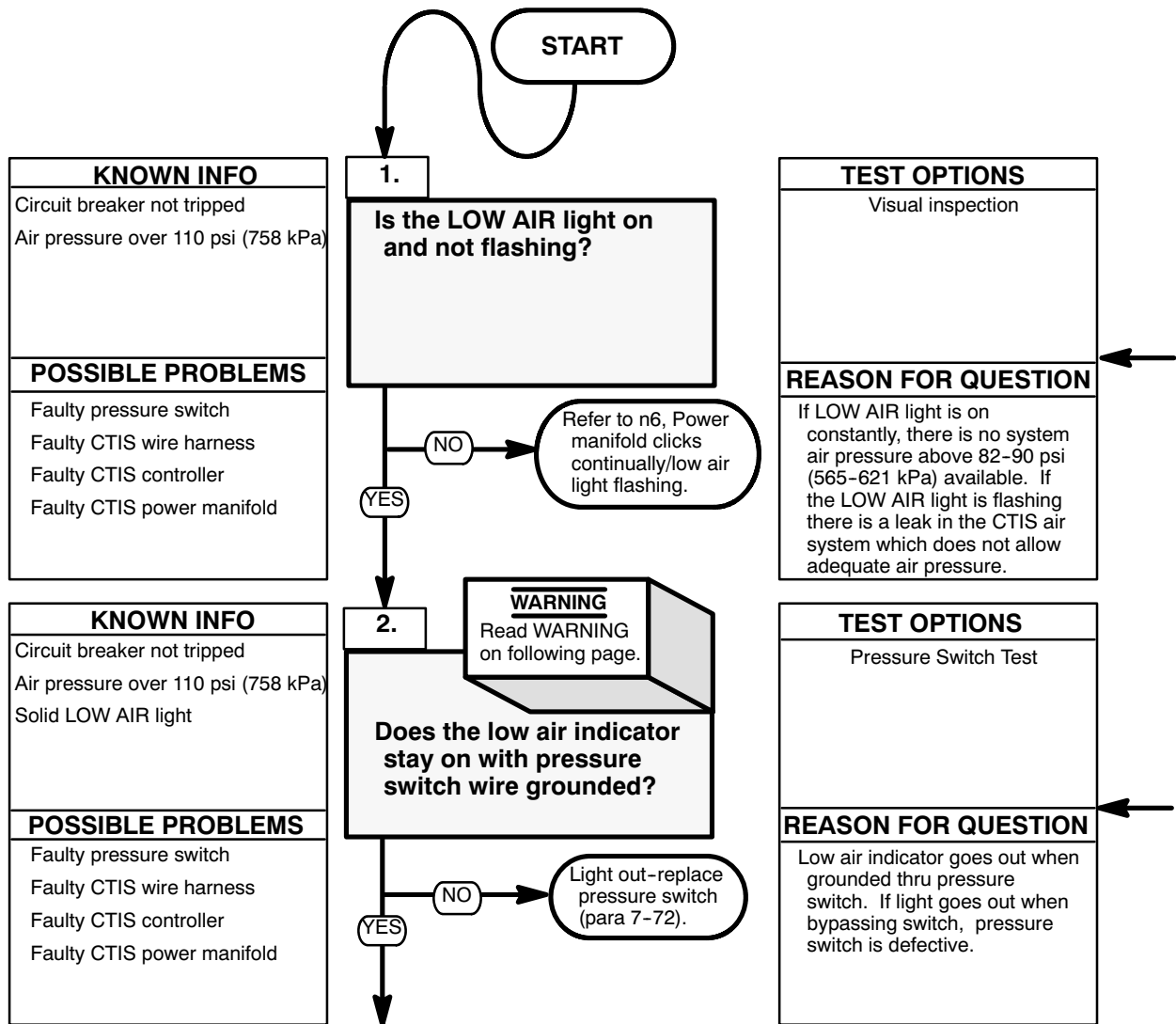
NOTE

Tire must be deflated to 60 psi (414 kPa) or less to perform this test.

- (1) Start engine (TM 9-2320-360-10).
- (2) Set CTIS controller selector to HIGHWAY position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position and/or push start button (TM 9-2320-360-10).
- (4) Check CTIS tubes from wheel valve to tire for air leaks, damage, or crimps.
- (5) Shut off engine (TM 9-2320-360-10).



n9. CTIS LOW AIR INDICATOR STAYS ON OVER 110 PSI (758 KPA)	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F)



WARNING

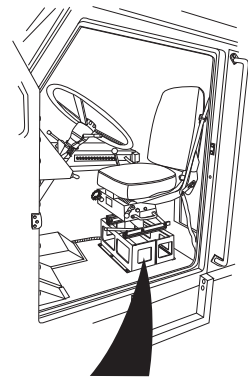
Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

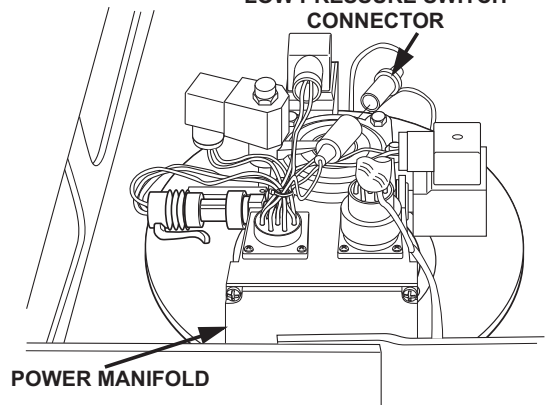
- The CTI system initially and periodically checks for system air leaks. The CTIS will display a flashing LOW AIR light and shut off if 6 PSI cannot be maintained by the CTI system . The manifold will click during this check for approximately 1.5 minutes.
- Air system pressure must be 120 psi (827 kPa) before beginning troubleshooting. If air pressure gage does not indicate 120 psi (827 kPa), wait for system air pressure to build before beginning troubleshooting.
- CTIS air lines are pressurized only when CTIS is in inflate, deflate, or test cycles.
- Tests 1 thru 5 can be made consecutively while the CTI system is in the inflate cycle.
- Normal inflation time from EMERGENCY to HIGHWAY setting is approximately 12 minutes at high idle.
- Excess inflation times, sometimes accompanied by a flashing LOW AIR light is normal if engine is at idle RPM and/or air operated accessories are being used.

PRESSURE SWITCH TEST

- (1) Disconnect single wire connector to low pressure switch.
- (2) Turn engine switch to ON position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).
- (4) Touch the power manifold end of the connector to known good ground and observe low air indicator light.
- (5) Turn engine switch to OFF position and move CTIS controller switch to OFF position (TM 9-2320-360-10).
- (6) Connect single wire connector for low pressure switch.

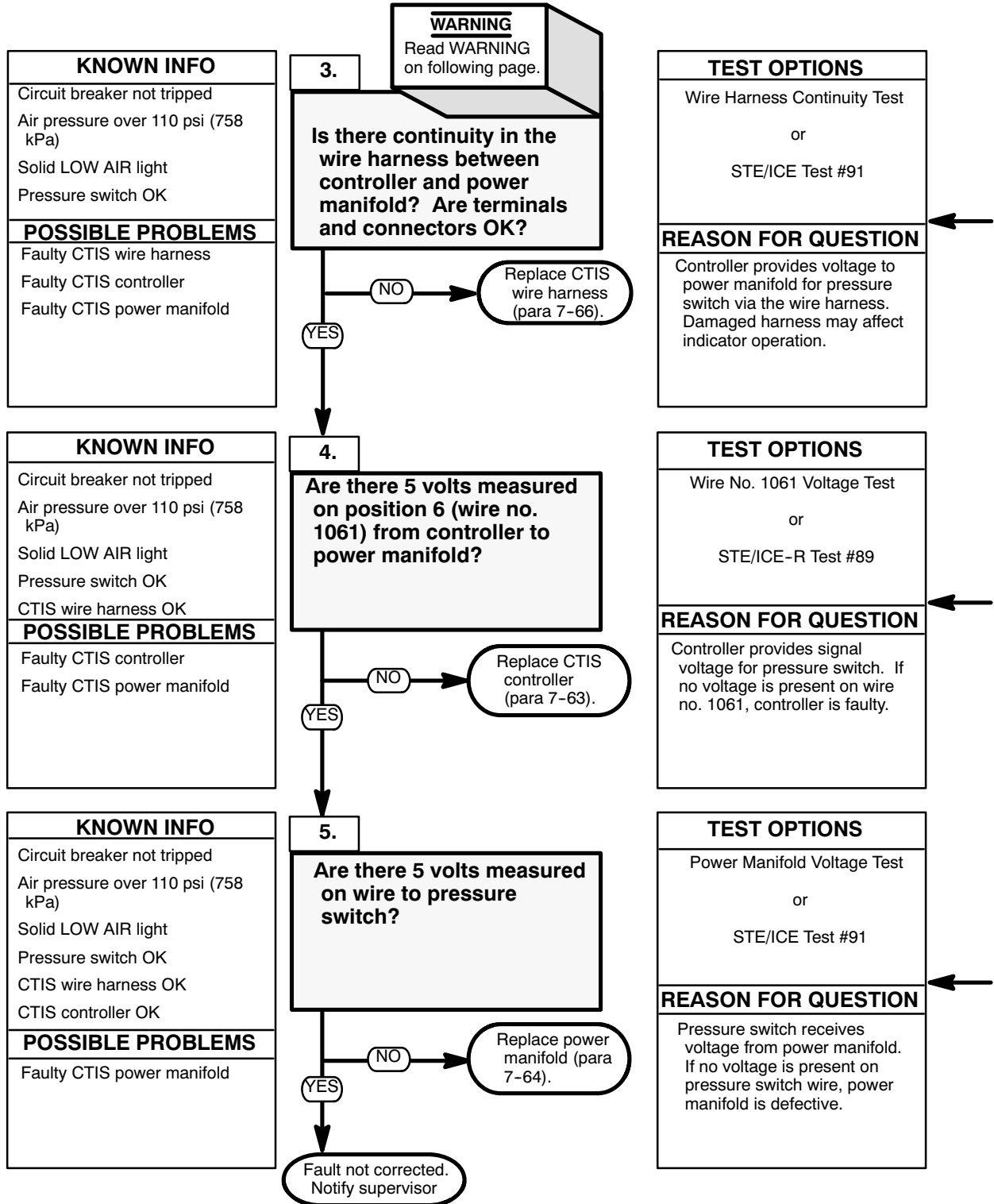


LOW PRESSURE SWITCH CONNECTOR



POWER MANIFOLD

n9. CTIS LOW AIR INDICATOR STAYS ON OVER 110 PSI (758 KPA) (CONT)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

CTIS WIRE HARNESS CONTINUITY TEST

- (1) Disconnect CTIS wire harness connector from power manifold.
- (2) Disconnect CTIS wire harness connector from controller.

NOTE

Pay special attention to position 6.

- (3) Place positive (+) probe of multimeter on position 1 of connector at controller end.
- (4) Place negative (-) probe of multimeter on position 1 of connector at power manifold end and check multimeter for continuity.
- (5) Repeat steps (3) and (4) for remaining positions 2 thru 10.
- (6) Install CTIS wire harness connectors back on power manifold and controller.

WIRE NO. 1061 VOLTAGE TEST

NOTE

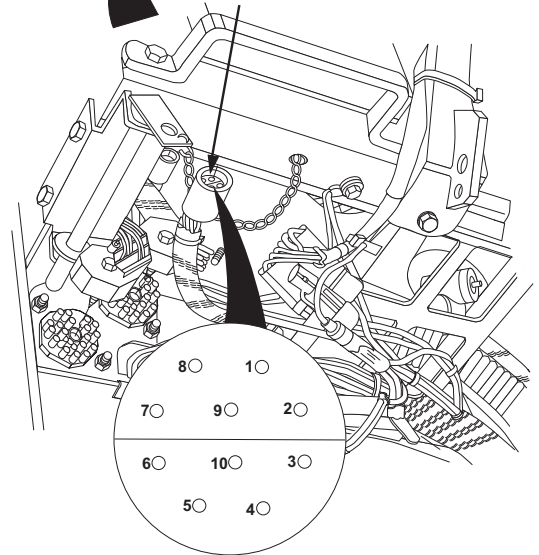
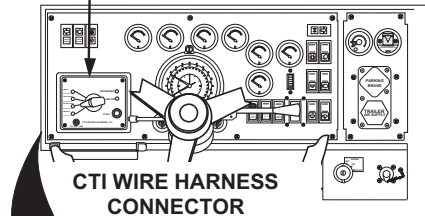
CTIS wiring harness must remain installed to controller and power manifold when performing this test.

- (1) Turn engine switch to ON position (TM 9-2320-360-10).
- (2) Move CTIS switch to ON position (TM 9-2320-360-10).
- (3) Place positive (+) probe of multimeter on position 6, wire no. 1061 (blue), of CTIS wire harness connector at power manifold.
- (4) Place negative (-) probe of multimeter on known good ground.
- (5) Press CTIS START button (TM 9-2320-360-10) and look for 5 volts on multimeter.
- (6) Turn engine switch to OFF position and move CTIS controller switch to OFF position (TM 9-2320-360-10).

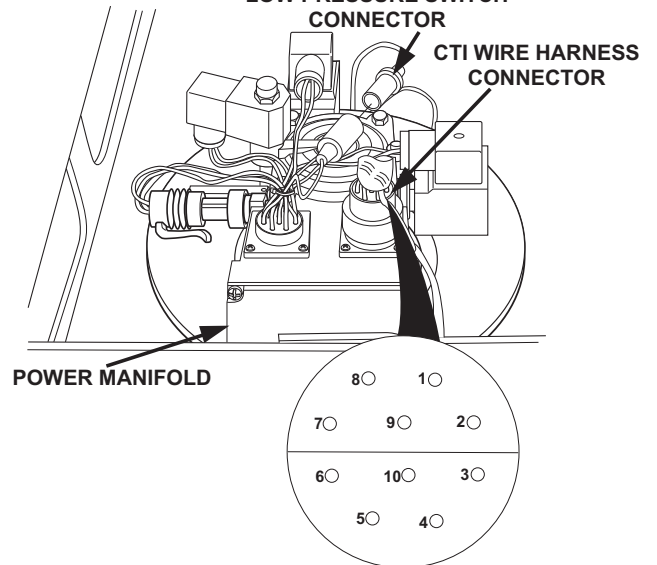
POWER MANIFOLD VOLTAGE TEST

- (1) Disconnect single wire connector to low pressure switch.
- (2) Turn engine switch to ON position (TM 9-2320-360-10).
- (3) Move CTIS switch to ON position (TM 9-2320-360-10).
- (4) Place positive (+) probe of multimeter on power manifold end of low pressure switch connector.
- (5) Place negative (-) probe of multimeter on known good ground and look for 5 volts on multimeter.
- (6) Turn engine switch to OFF position and move CTIS controller switch to OFF position (TM 9-2320-360-10).
- (7) Connect single wire connector for low pressure switch.

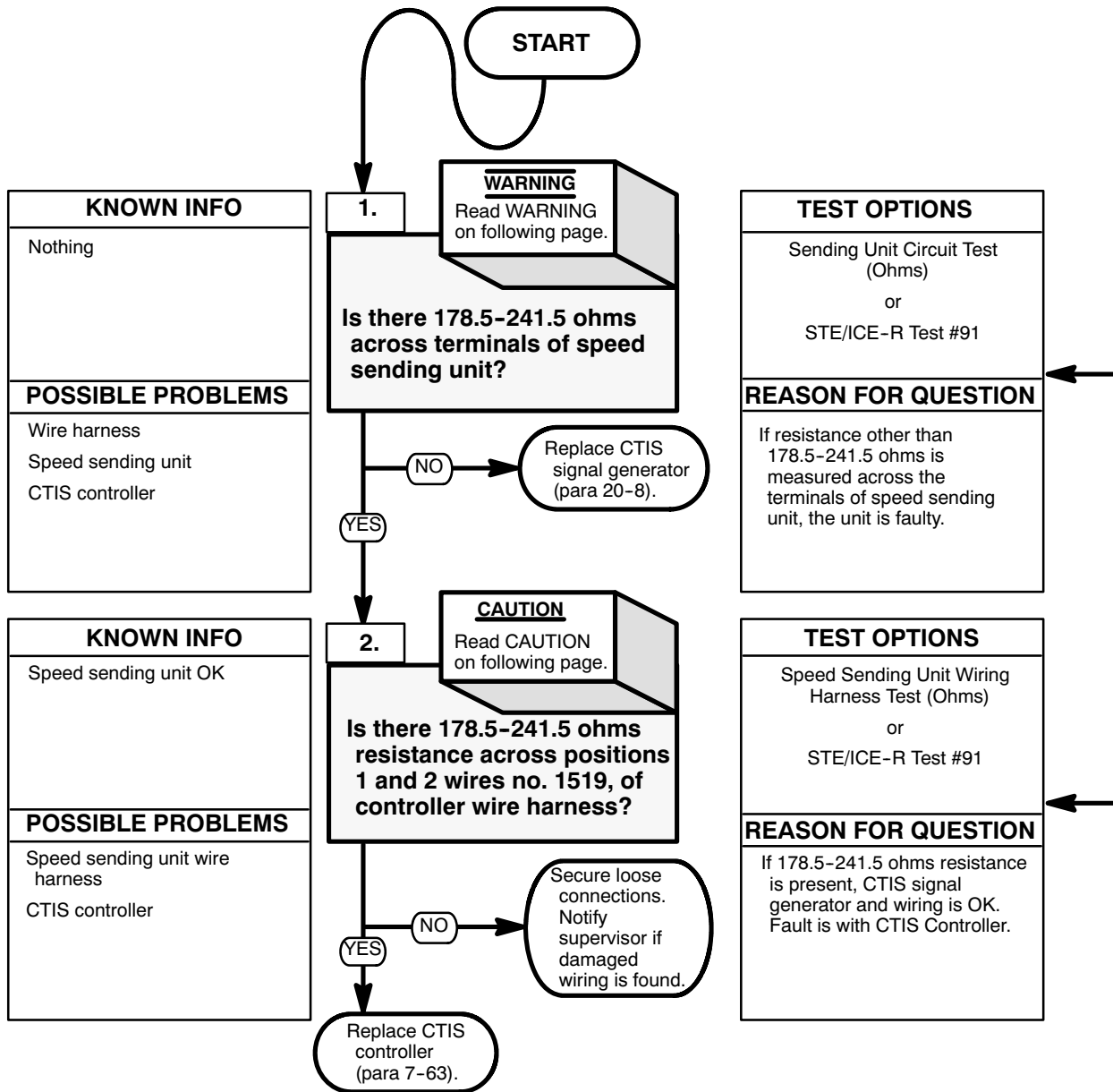
CTI CONTROLLER



LOW PRESSURE SWITCH CONNECTOR



n10. OVER SPEED LIGHT DOES NOT FUNCTION	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Multimeter (Item 20, Appendix F)



WARNING

Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

SPEED SENDING UNIT TEST

- (1) Disconnect Controller wire harness from speed sending unit on transfer case.
- (2) Connect negative (-) and positive (+) probes of multimeter across terminals of sending unit and look for 178.5-241.5 ohms on multimeter.
- (3) Connect Controller wiring harness to speed sending unit on transfer case.

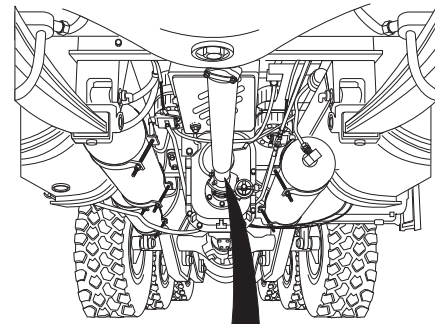
SPEED SENDING UNIT CIRCUIT TEST

- (1) Disconnect cab wire harness connector from rear of controller.

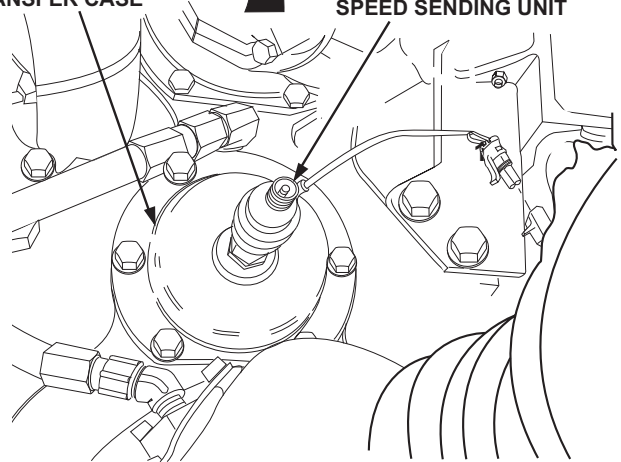
CAUTION

Probe only terminals indicates in step (2). Failure to comply may result in damage to CTIS components, wiring or test equipment.

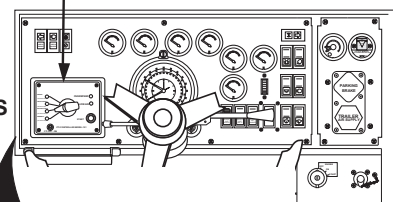
- (2) Connect negative (-) and positive (+) probes of multimeter between positions 1 and 2 and look for 178.5-241.5 ohms on multimeter.
- (3) Connect cab wire harness connector to controller.



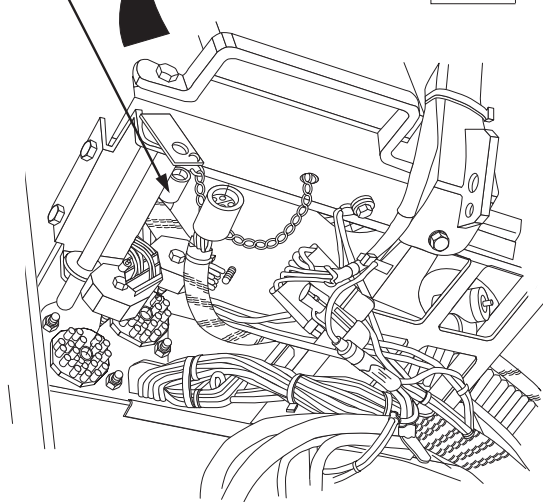
TRANSFER CASE SPEED SENDING UNIT



CTI CONTROLLER



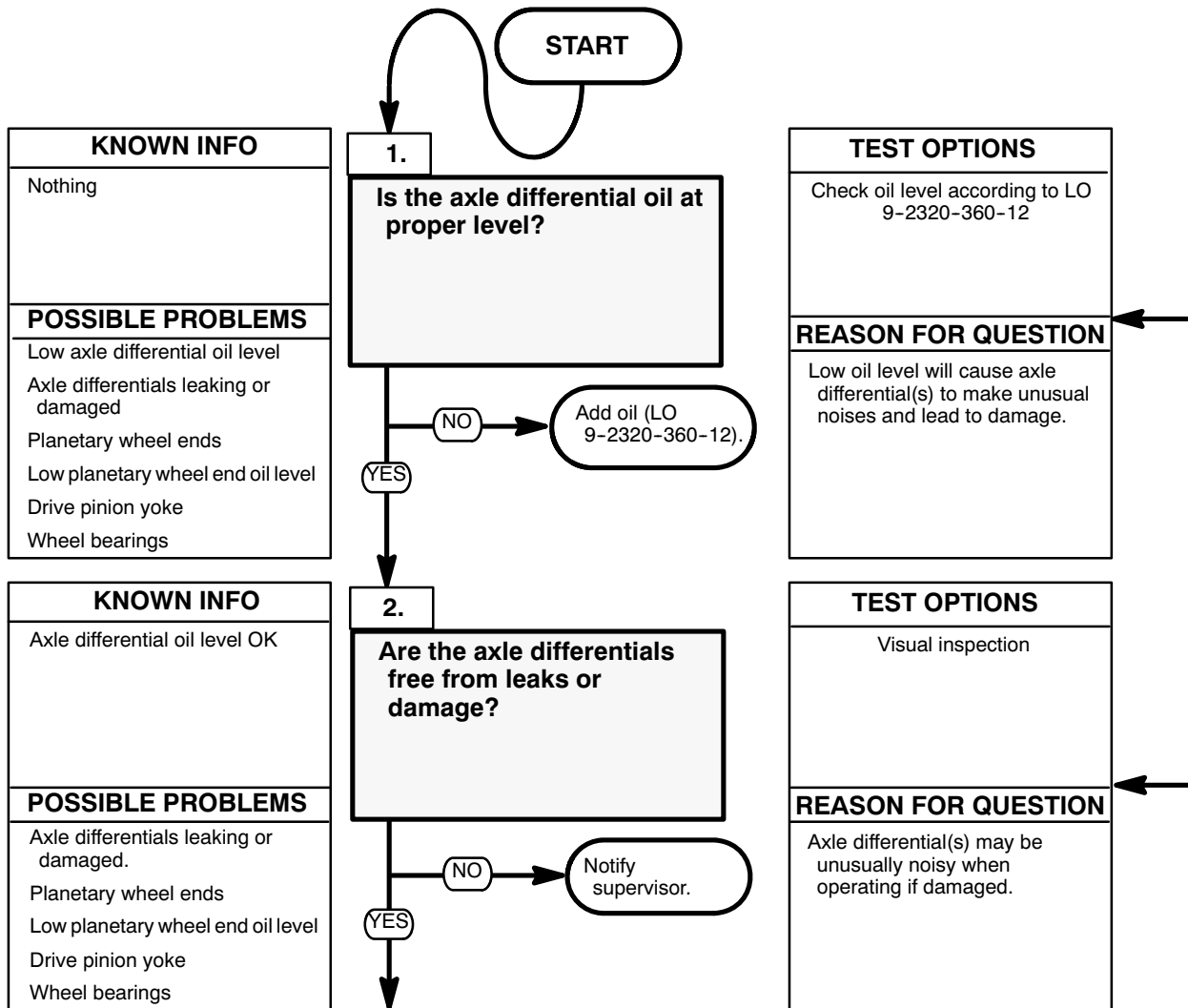
CAB WIRE HARNESS CONNECTOR



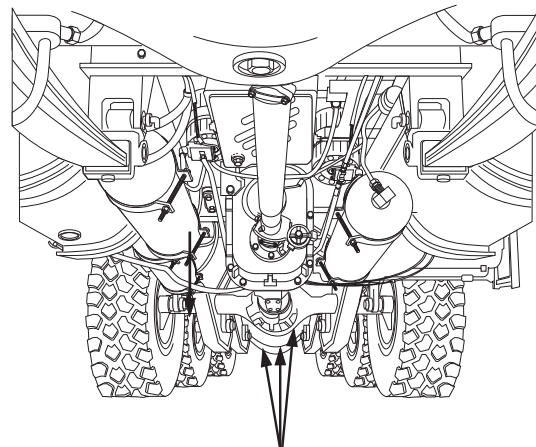
p. AXLES

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>p1. Axle unusually noisy when operating</u>	<u>2-876</u>
<u>p2. Interaxle lockup does not engage</u>	<u>2-882</u>

p1. AXLE UNUSUALLY NOISY WHEN OPERATING	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)
Personnel Required Two	



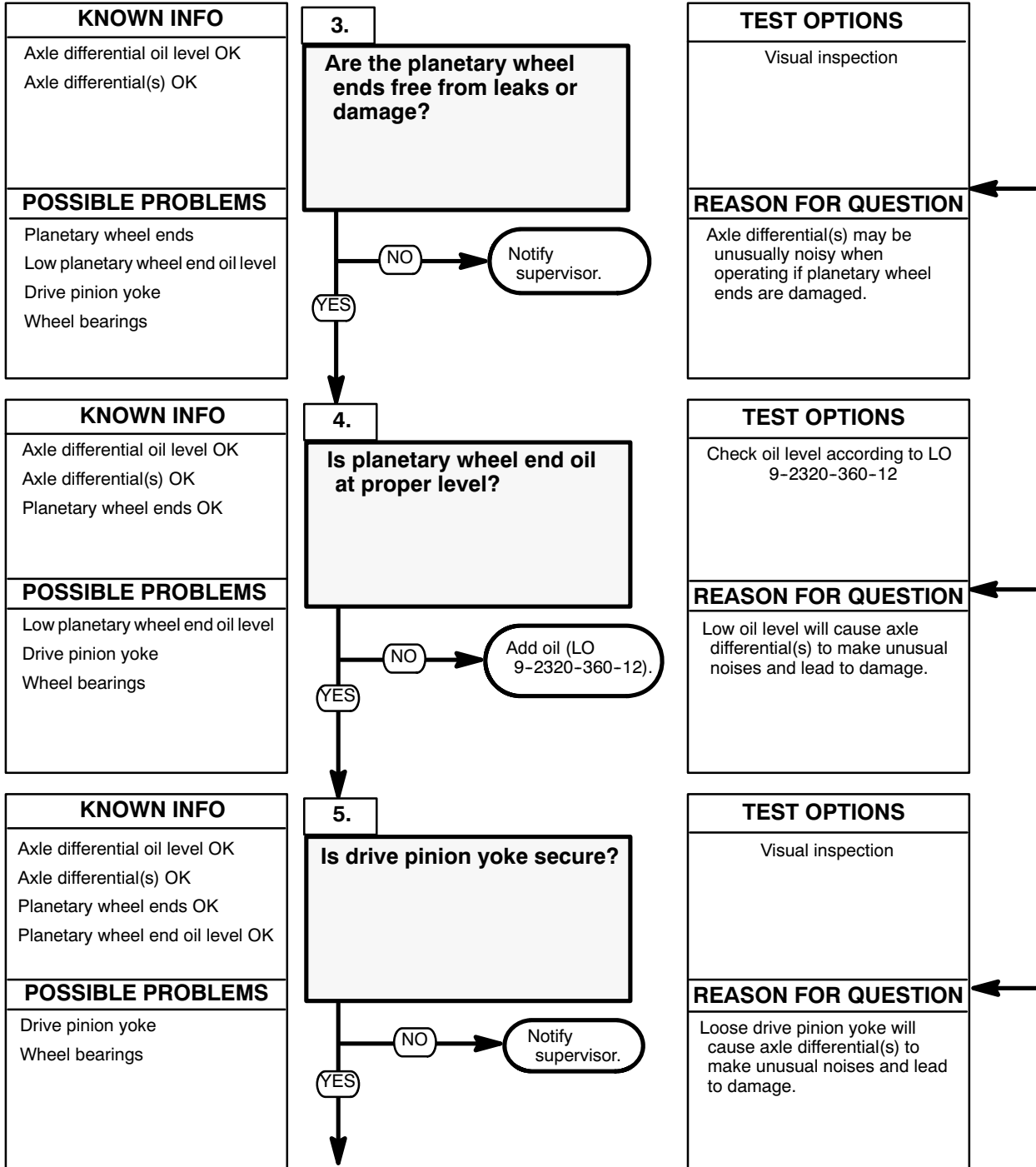
Refer to LO 9-2320-360-12 to check axle differential oil level.



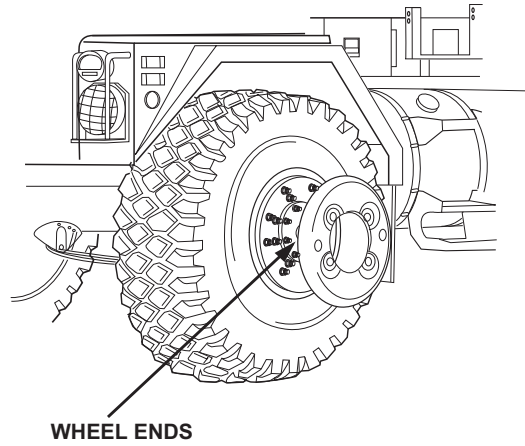
AXLE DIFFERENTIALS

Check axle for loose, missing, or damaged hardware. Check input and output shafts for leaks and damage.

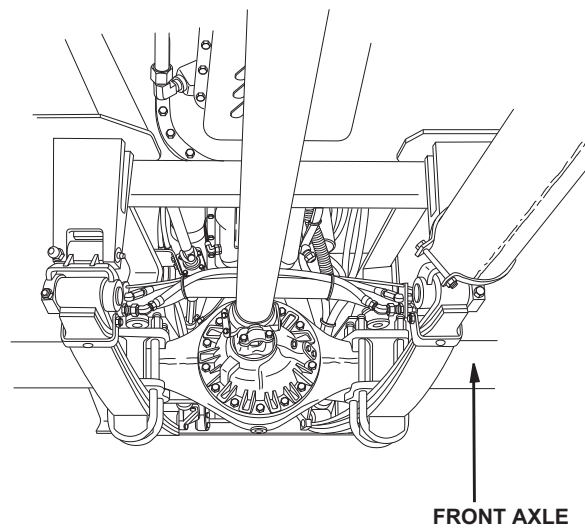
p1. AXLE UNUSUALLY NOISY WHEN OPERATING (CONT)



Check planetary wheel ends for leaks and for loose, missing, or damaged hardware.

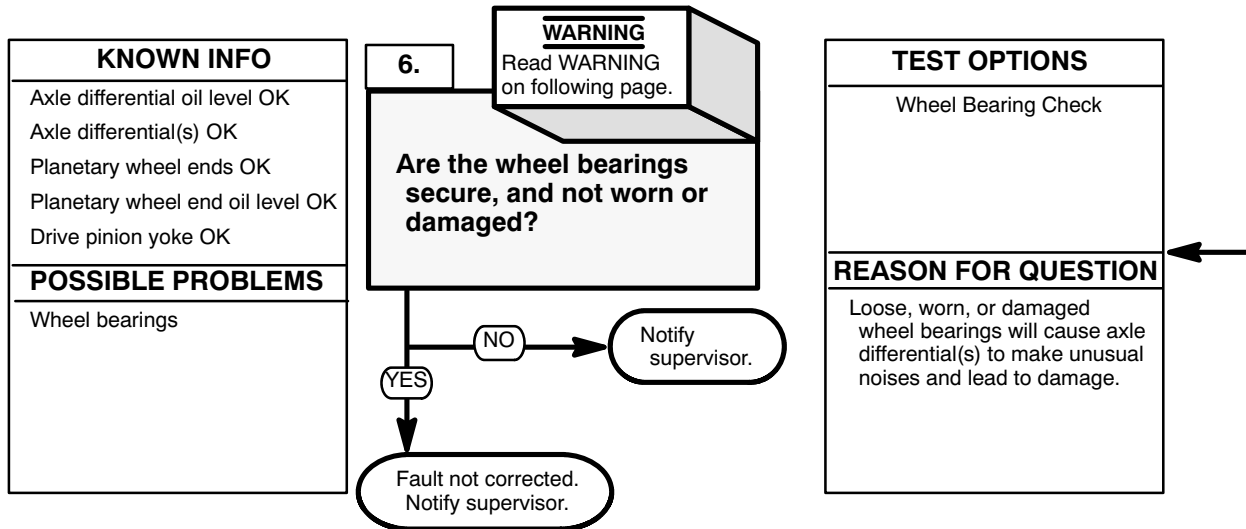


Refer to LO 9-2320-360-12 to check planetary wheel end oil level.



Check drive pinion yoke for looseness, and for missing or damaged hardware.

p1. AXLE UNUSUALLY NOISY WHEN OPERATING (CONT)



WHEEL BEARING CHECK**WARNING**

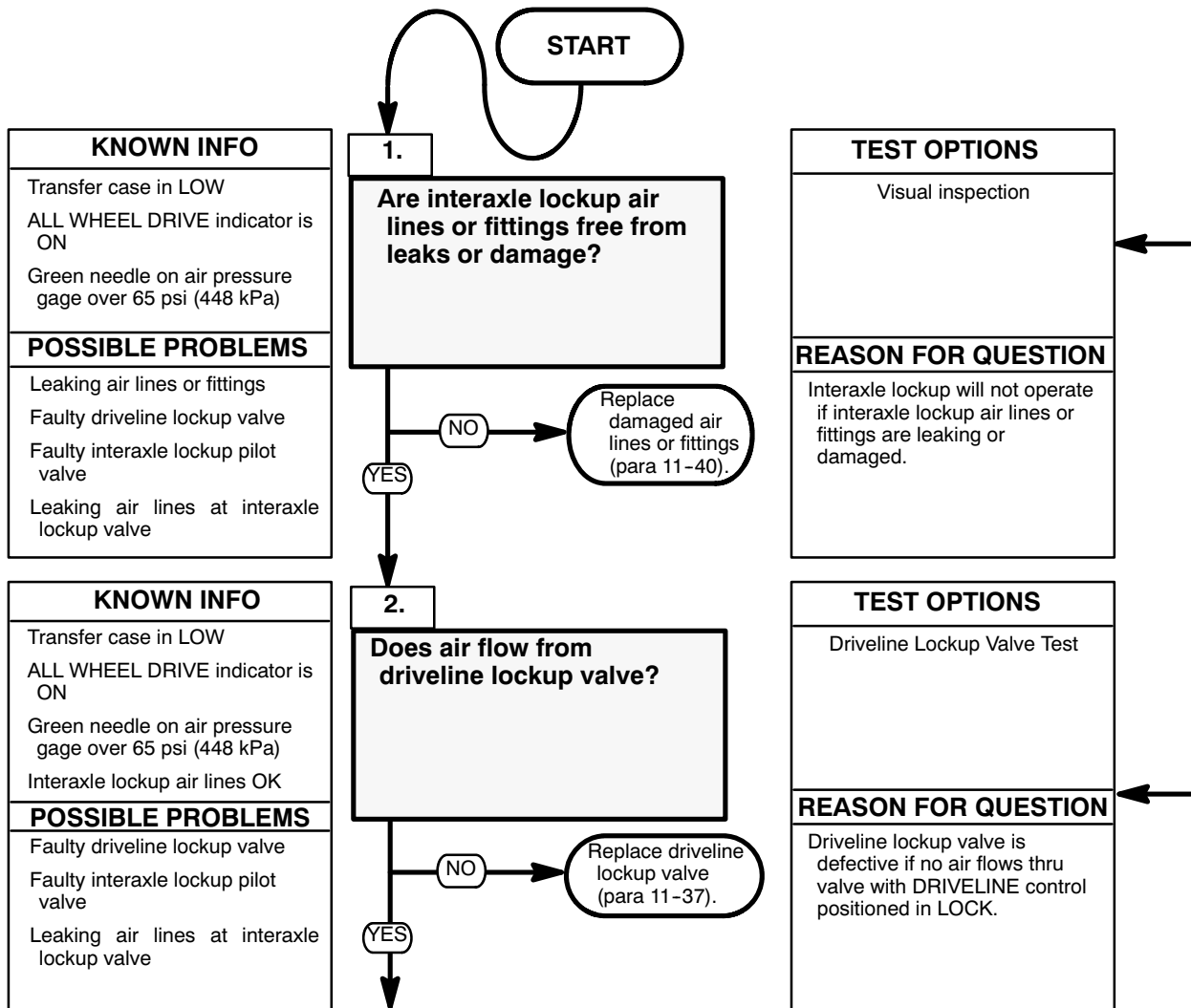
HET Tractor must be on level ground and wheels must be chocked before parking brake is released. Otherwise, HET Tractor may roll and cause personnel injury.

- (1) Remove tire (TM 9-2320-360-10) from axle that is unusually noisy when operating.

NOTE

- Wheel bearings are loose, worn, or damaged if hub is loose, or rotates roughly.
 - Perform step (2) only if working on rear three axles.
- (2) Chock wheels and release parking brake (TM 9-2320-360-10).
 - (3) Rotate hub and check for looseness or roughness.
 - (4) Install tire (TM 9-2320-360-10) on axle.
 - (5) Repeat steps (1) through (4) for other tire an axle.

p2. INTERAXLE LOCKUP DOES NOT ENGAGE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



NOTE

- Interaxle lockup will not operate until AIR PRESS gage reads greater than 65 psi (448 kPa).
- Interaxle lockup will only operate with TRANSFER CASE shift lever in LOW position and DRIVELINE control in LOCK position.
- Refer to air hose diagrams in front of this system troubleshooting section for air line locations.

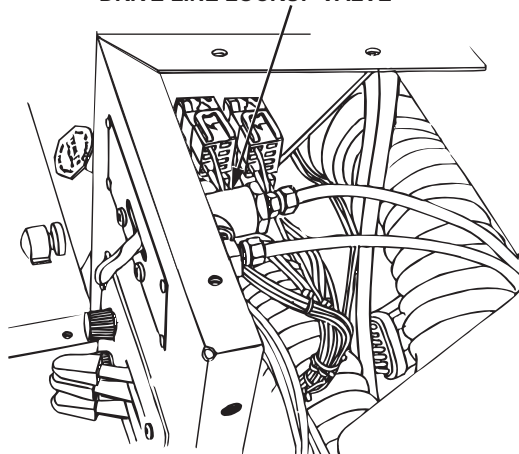
Check the following air lines and fittings for leakage and damage.

- Air line no. 2074 from no. 2 air reservoir to air manifold
- Air line no. 2785 from air manifold to air manifold
- Air line no. 2765 from air manifold to driveline lockup valve
- Air line no. 2766 from driveline lockup valve to interaxle lockup pilot
- Air line no. 2761 from air manifold to push valve
- Air line no. 2762 from push valve to interaxle lockup pilot valve
- Air line no. 2767 from interaxle lockup pilot valve to air manifold
- Air line no. 2339 from air manifold to interaxle lockup valve on no. 2 axle
- Air line no. 2422 from air manifold to interaxle lockup valve on no. 3 axle

DRIVELINE LOCKUP VALVE TEST

- (1) Start engine (TM 9-2320-360-10) and allow air pressure to build greater than 65 psi (448 kPa).
- (2) Shut off engine (TM 9-2320-360-10).
- (3) Position DRIVELINE control to LOCK.
- (4) Loosen air line no. 2766 on driveline lockup valve and check for air flow from driveline lockup valve.
- (5) Tighten air line no. 2766 on driveline lockup valve.

DRIVE LINE LOCKUP VALVE

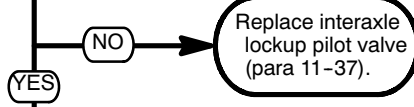


p2. INTERAXLE LOCKUP DOES NOT OPERATE (CONT)

KNOWN INFO
Transfer case in LOW
ALL WHEEL DRIVE indicator is ON
Green needle on air pressure gage over 65 psi (448 kPa)
Interaxle lockup air lines OK
Driveline lockup valve OK
POSSIBLE PROBLEMS
Faulty interaxle lockup pilot valve
Leaking air lines at interaxle lockup valve

3.

Does air flow from interaxle lockup pilot valve?

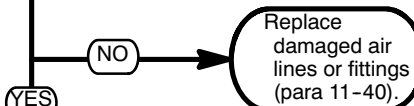


TEST OPTIONS
Interaxle Lockup Pilot Valve Test
REASON FOR QUESTION
Interaxle lockup pilot valve is defective if no air flows thru valve with TRANSFER CASE shift lever positioned in LOW and DRIVELINE control positioned in LOCK.

KNOWN INFO
Transfer case in LOW
ALL WHEEL DRIVE indicator is ON
Green needle on air pressure gage over 65 psi (448 kPa)
Interaxle lockup air lines OK
Driveline lockup valve OK
Interaxle lockup pilot valve OK
POSSIBLE PROBLEMS
Leaking air lines at interaxle lockup valve

4.

Is air present at interaxle lockup valve on no. 2 and no. 3 axle and air line connections not damaged?

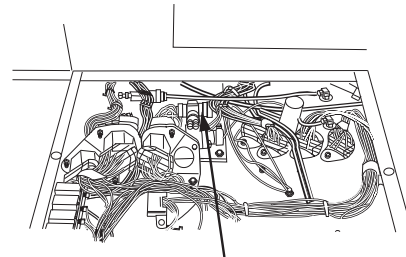


TEST OPTIONS
Interaxle Lockup Valve Test
REASON FOR QUESTION
Leaking or damaged air lines at interaxle lockup valve will cause interaxle lockup not to engage.

Fault not corrected. Notify supervisor.

INTERAXLE LOCKUP PILOT VALVE TEST

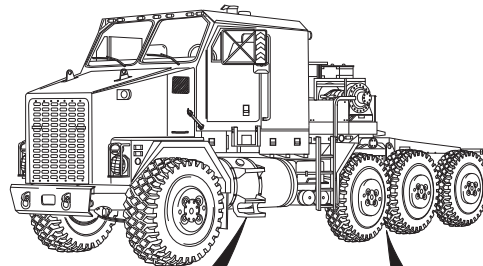
- (1) Start engine (TM 9-2320-360-10) and allow air pressure to build greater than 65 psi (448 kPa).
- (2) Shut off engine (TM 9-2320-360-10).
- (3) Position DRIVELINE control to LOCK and TRANSFER CASE shift lever to LOW.
- (4) Loosen air line no. 2767 on interaxle lockup pilot valve and check for air flow from interaxle lockup pilot valve.
- (5) Tighten air line no. 2767 on interaxle lockup pilot valve.



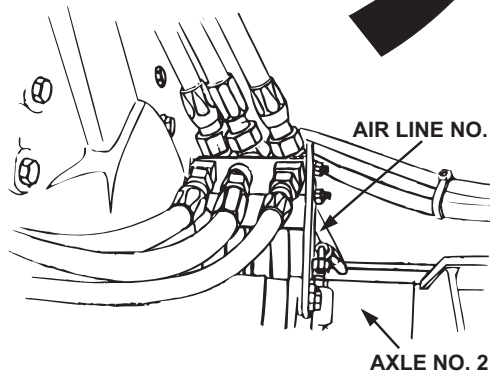
INTERAXLE LOCKUP PILOT VALVE

INTERAXLE LOCKUP VALVE TEST

- (1) Start engine (TM 9-2320-360-10) and allow air pressure to build greater than 65 psi (448 kPa).
- (2) Shut off engine (TM 9-2320-360-10).
- (3) Position DRIVELINE control to LOCK and TRANSFER CASE shift lever to LOW.
- (4) Loosen air line no. 2339 on axle no. 2 interaxle lockup valve and check for air flow to interaxle lockup valve. Inspect air line no. 2339 for damaged connections.
- (5) Tighten air line no. 2339 on interaxle lockup valve.
- (6) Loosen air line no. 2422 on axle no. 3 interaxle lockup valve and check for air flow to interaxle lockup valve. Inspect air line no. 2422 for damaged connections.
- (7) Tighten air line no. 2422 on interaxle lockup valve.
- (8) Check air lines no. 2339 and no. 2422 at axles no. 2 and no. 3 for loose or damaged connections.

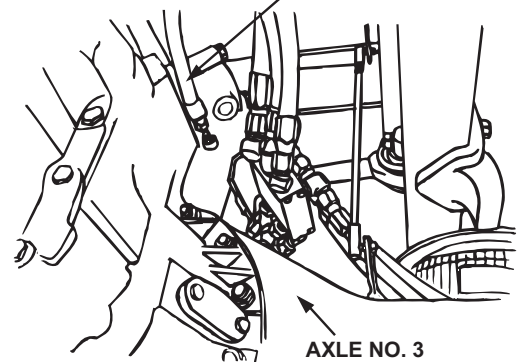


AIR LINE NO. 2422

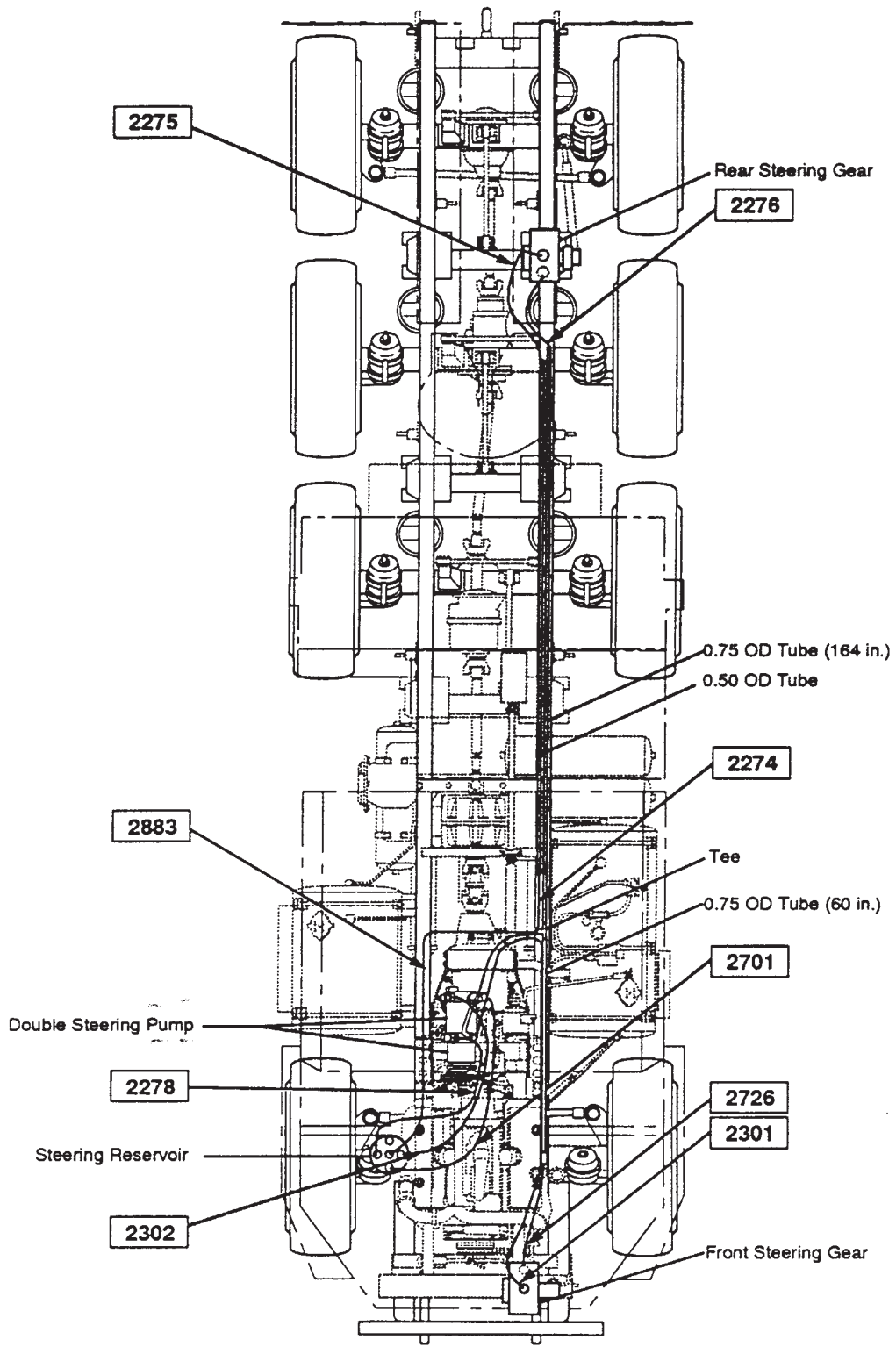


AIR LINE NO. 2339

AXLE NO. 2



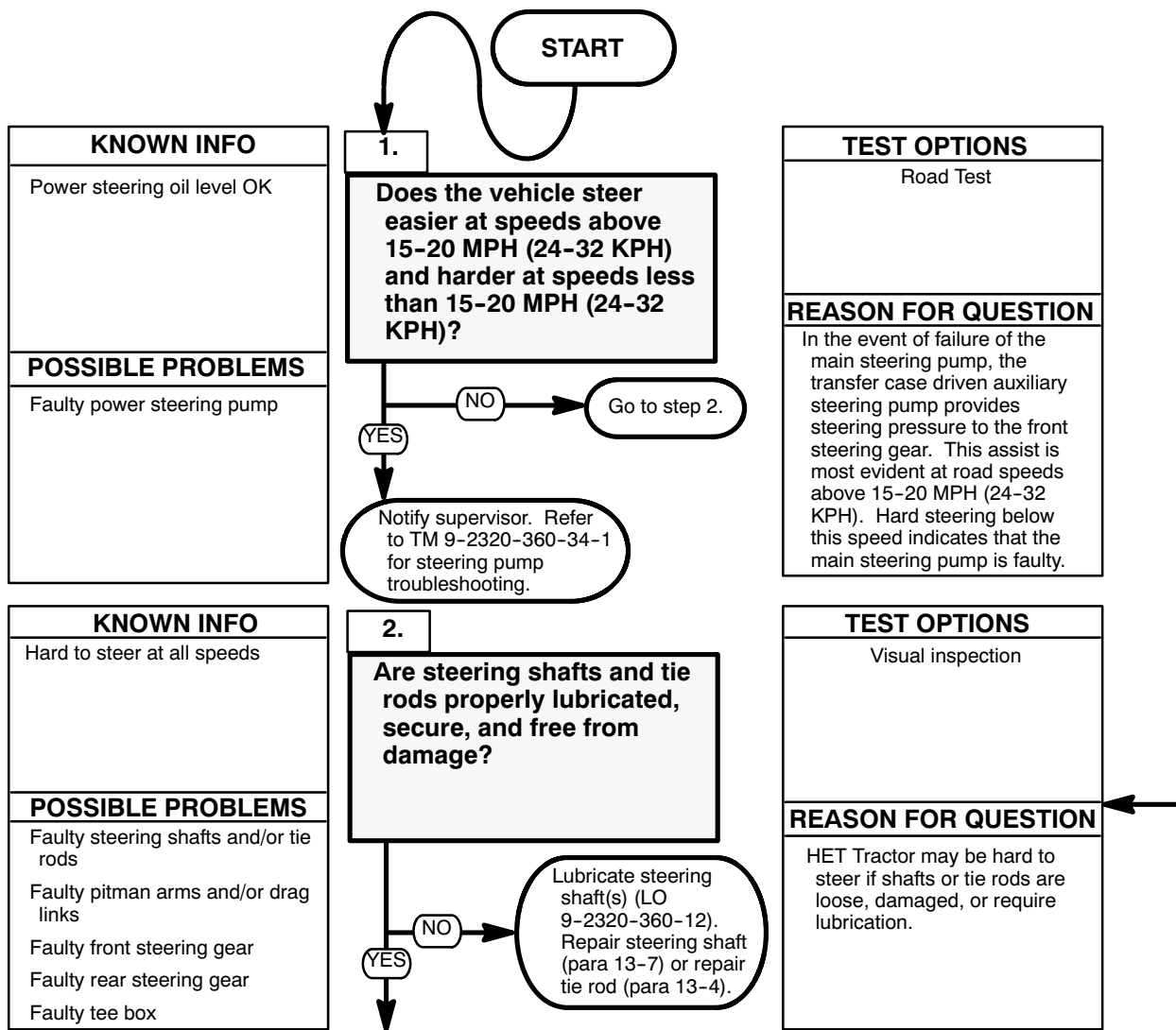
AXLE NO. 3

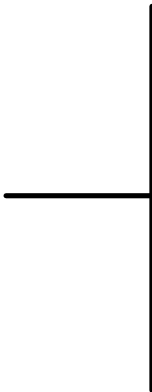


q. STEERING SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>q1. Hard to steer</u>	<u>2-888</u>
<u>q2. Wanders, pulls to one side, or shimmies</u>	<u>2-896</u>
<u>q3. Excessive play when turning steering wheel</u>	<u>2-902</u>
<u>q4. No response when turning steering wheel</u>	<u>2-906</u>
<u>q5. No response at no. 1 axle when turning steering wheel</u>	<u>2-908</u>
<u>q6. No response at no. 4 axle when turning steering wheel</u>	<u>2-912</u>
<u>q7. Steering binds, does not return to straight ahead after turns</u>	<u>2-916</u>

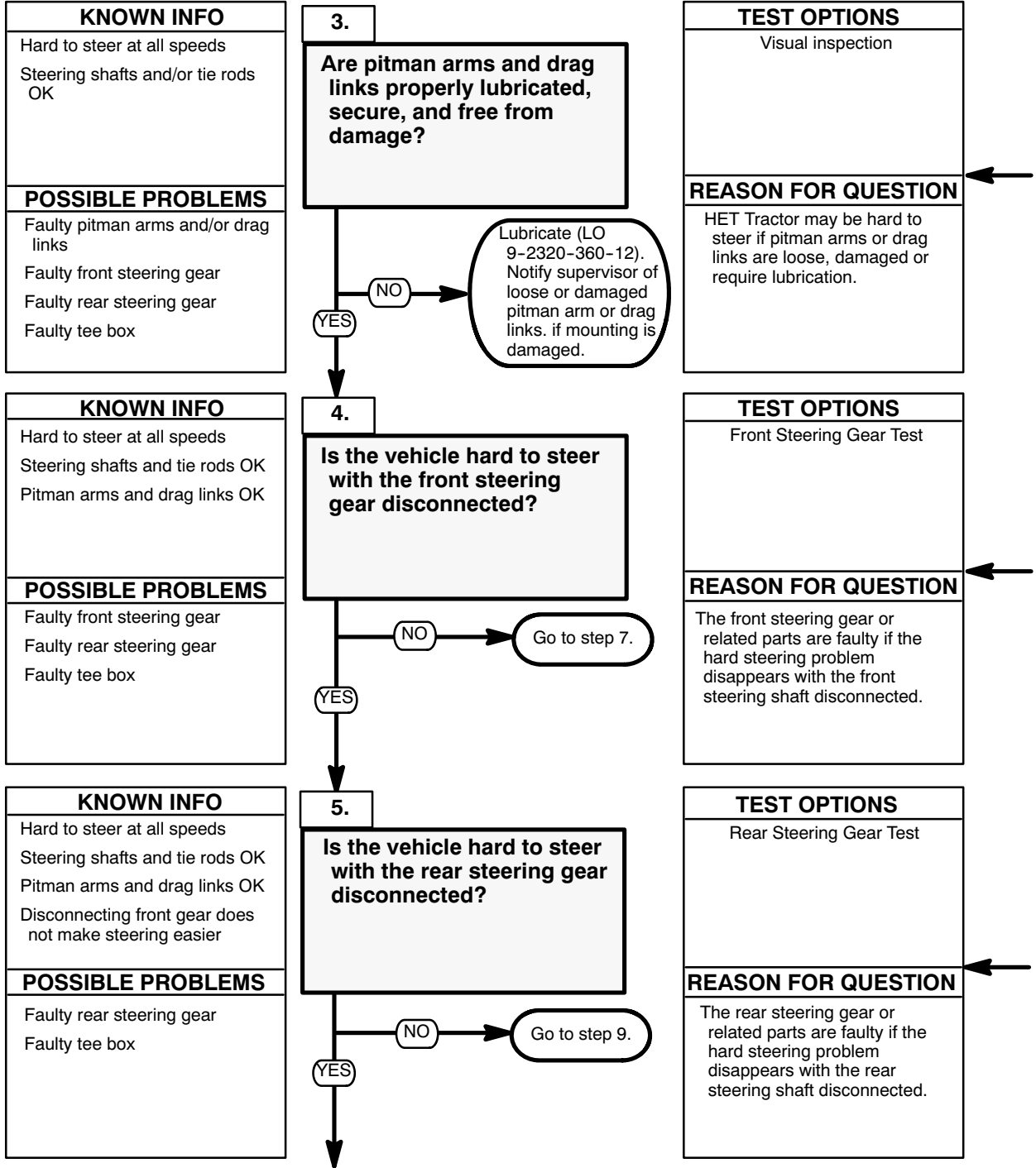
q1. HARD TO STEER	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)
	Materials/Parts Locknuts (2), (Item 56, Appendix G)



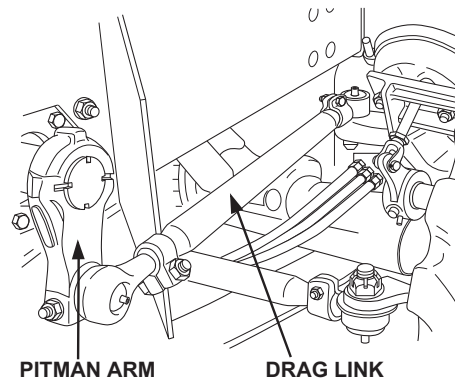


Check steering shafts and tie rods for damage, and loose or missing mounting hardware. Refer to LO 9-2320-360-12 to lubricate steering linkage.

q1. HARD TO STEER (CONT)

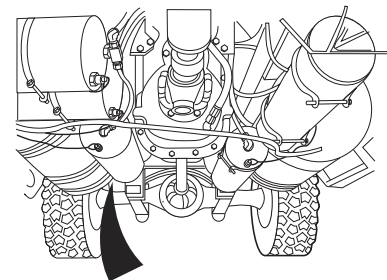


Check pitman arm and drag links for damage, and loose or missing mounting hardware. Refer to LO 9-2320-360-12 to lubricate steering linkage.



FRONT STEERING GEAR TEST

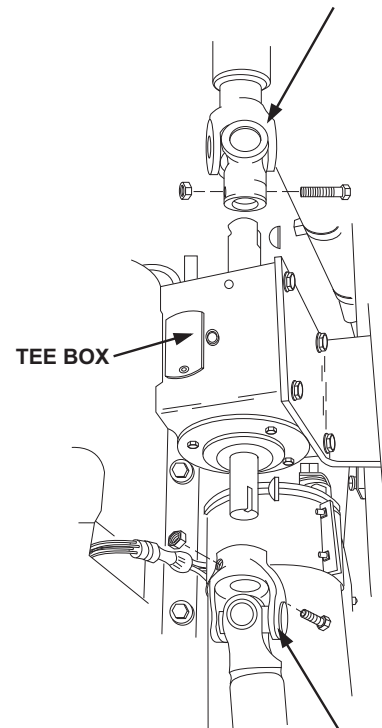
- (1) Remove locknut, screw and front steering shaft yoke from tee box. Discard locknut.
- (2) Start engine (TM 9-2320-360-10).
- (3) Detect steering effort while turning steering wheel from straight ahead to full left and full right positions.
- (4) Return steering wheel to straight ahead position.
- (5) Shut off engine (TM 9-2320-360-10).
- (6) Align slot on yoke with key on tee box shaft.
- (7) Install front steering shaft yoke on tee box with screw and new locknut.



FRONT STEERING SHAFT YOKE

REAR STEERING GEAR TEST

- (1) Remove locknut, screw and rear steering shaft yoke from tee box. Discard locknut.
- (2) Start engine (TM 9-2320-360-10).
- (3) Detect steering effort while turning steering wheel from straight ahead to full left and full right positions.
- (4) Return steering wheel to straight ahead position.
- (5) Shut off engine (TM 9-2320-360-10).
- (6) Align slot on yoke with key on tee box shaft.
- (7) Install rear steering shaft yoke on tee box with screw and new locknut.

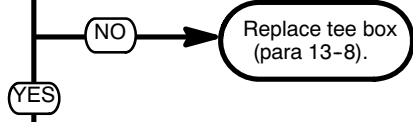


REAR STEERING SHAFT YOKE

q1. HARD TO STEER (CONT)

KNOWN INFO
Hard to steer at all speeds Steering shafts and tie rods OK Pitman arms and drag links OK Disconnecting front gear does not help Disconnecting rear gear does not make steering easier
POSSIBLE PROBLEMS
Faulty tee box

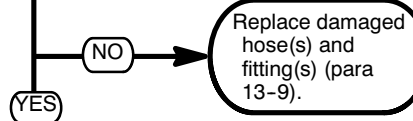
6.
Do tee box output shafts turn freely when top shaft is turned?



TEST OPTIONS
Tee Box Test
REASON FOR QUESTION
HET tractor may steer hard if tee box output shafts are binding.

KNOWN INFO
Steering is easier with the front steering gear disconnected
POSSIBLE PROBLEMS
Damaged front steering gear hoses and/or fittings Damaged front steering gear mounting

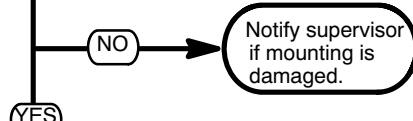
7.
Are front steering gear hoses and fittings free from leaks or damage?



TEST OPTIONS
Visual inspection
REASON FOR QUESTION
HET Tractor may be hard to steer if front steering gear hoses or fittings are leaking or damaged.

KNOWN INFO
Steering is easier with the front steering gear disconnected Front steering gear hoses and fittings OK
POSSIBLE PROBLEMS
Damaged front steering gear mounting

8.
Is front steering gear mounting secure and free from damage?



TEST OPTIONS
Visual inspection
REASON FOR QUESTION
HET Tractor may be hard to steer if front steering gear mounting is loose or damaged.

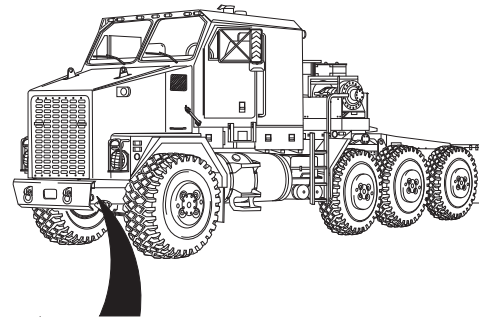
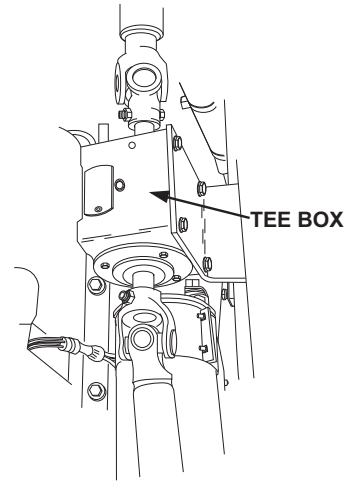
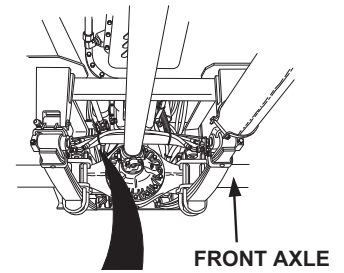
TEE BOX TEST

- (1) Remove screw and locknut from lower yoke of top steering shaft. Discard locknut.
- (2) Remove yoke from top tee box shaft.
- (3) Remove screw and locknut from yoke on front steering shaft. Discard locknut.
- (4) Remove yoke from front tee box shaft.
- (5) Remove screw and locknut from yoke on rear steering shaft. Discard locknut.
- (6) Remove yoke from rear tee box shaft.
- (7) Turn top tee box shaft to check for binding. Replace tee box (para 13-8) if it fails to turn smoothly or if it binds when top shaft is turned.
- (8) Align key on rear tee box shaft with slot in steering shaft yoke.
- (9) Install yoke on rear tee box shaft with screw and new locknut.
- (10) Align key on front tee box shaft with slot in steering shaft yoke.
- (11) Install yoke on front tee box shaft with screw and new locknut.
- (12) Align key on top tee box shaft with slot in steering shaft yoke.
- (13) Install yoke on top tee box shaft with screw and new locknut.

NOTE

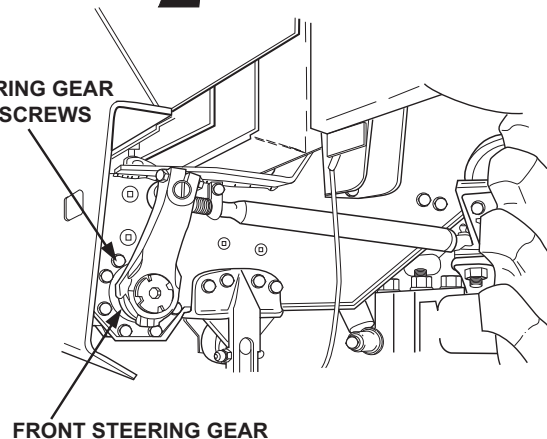
Refer to steering hydraulic hose diagram in front of this troubleshooting section for steering hose locations.

Check front steering gear, steering hoses, and fittings for leaks or damage.

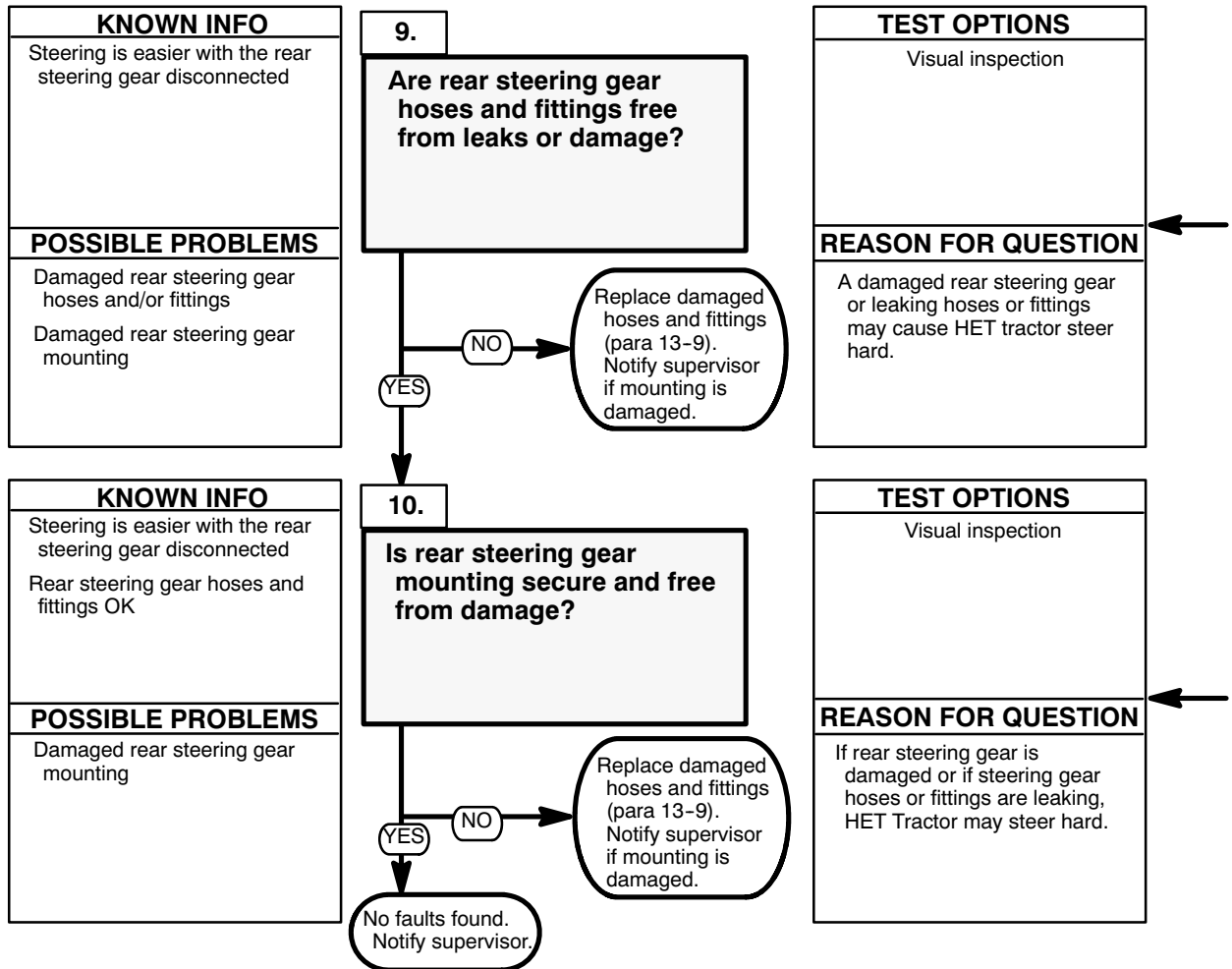


FRONT STEERING GEAR MOUNTING SCREWS

Check front steering gear mounting for damage.



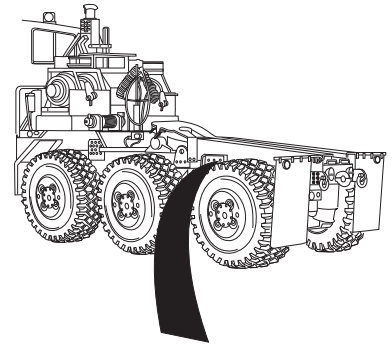
q1. HARD TO STEER (CONT)



NOTE

Refer to steering hydraulic hose diagram in front of this troubleshooting section for steering hose locations.

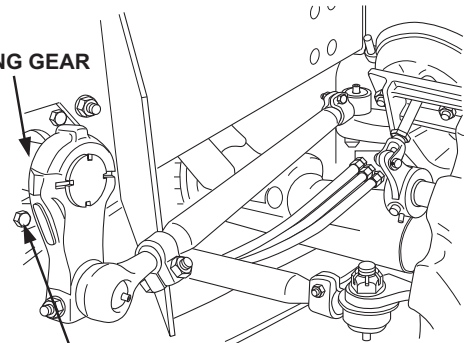
Check rear steering gear, steering hoses, and fittings for leaks or damage.



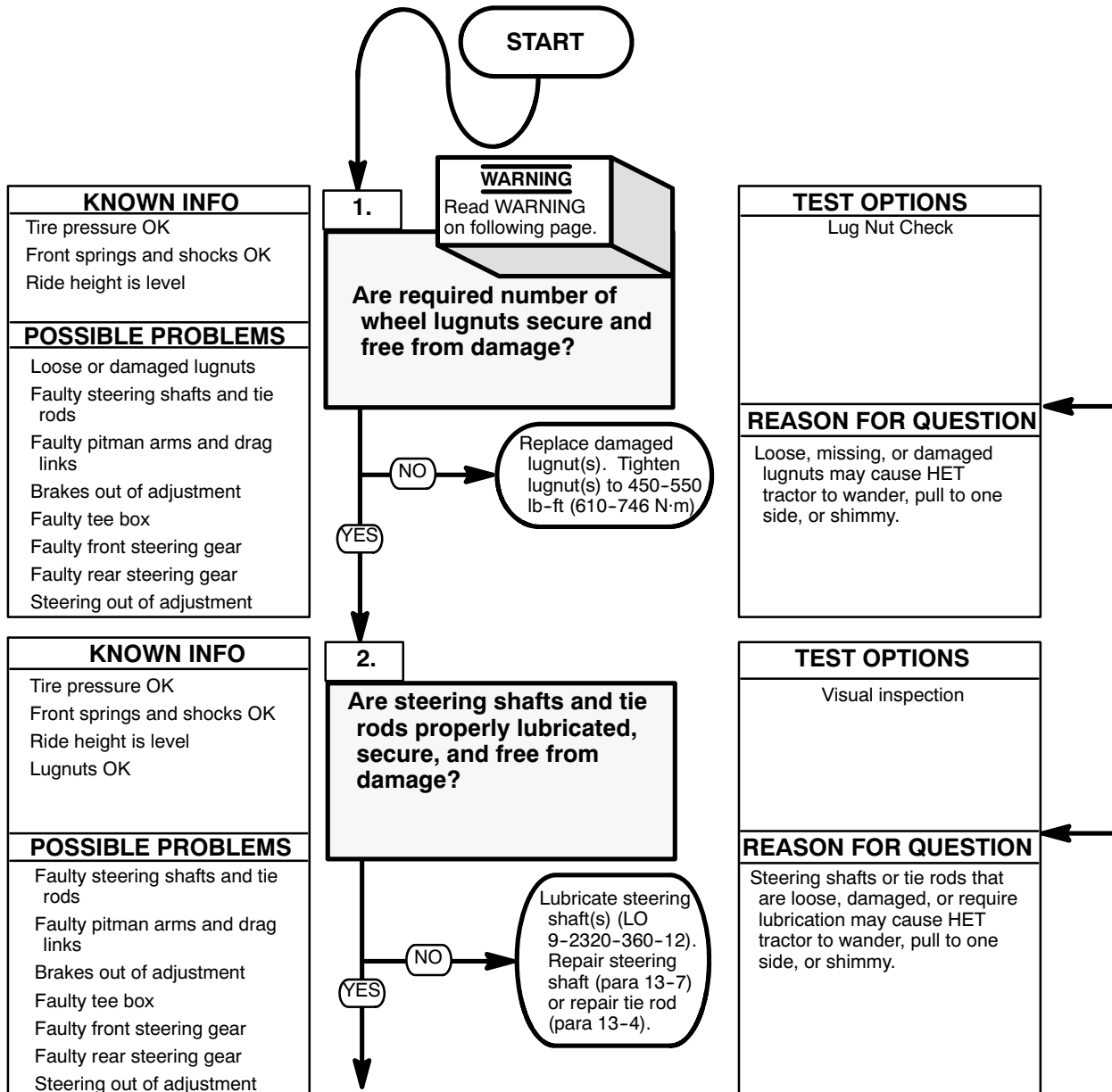
Check rear steering gear mounting for missing, loose, or damaged parts.

REAR STEERING GEAR

REAR STEERING GEAR MOUNTING SCREWS



q2. WANDERS, PULLS TO ONE SIDE, OR SHIMMIES	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Wrench, Torque 0-600 LB-FT (Item 74, Appendix F)



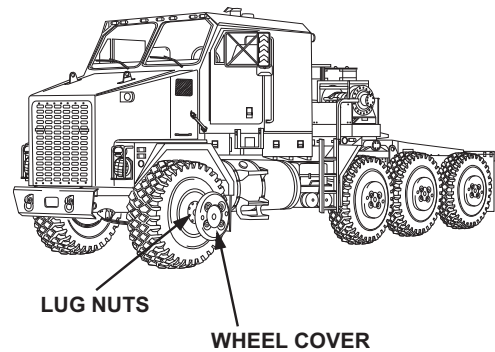
LUG NUT CHECK

- (1) Remove four nuts and wheel cover from tire assembly.

WARNING

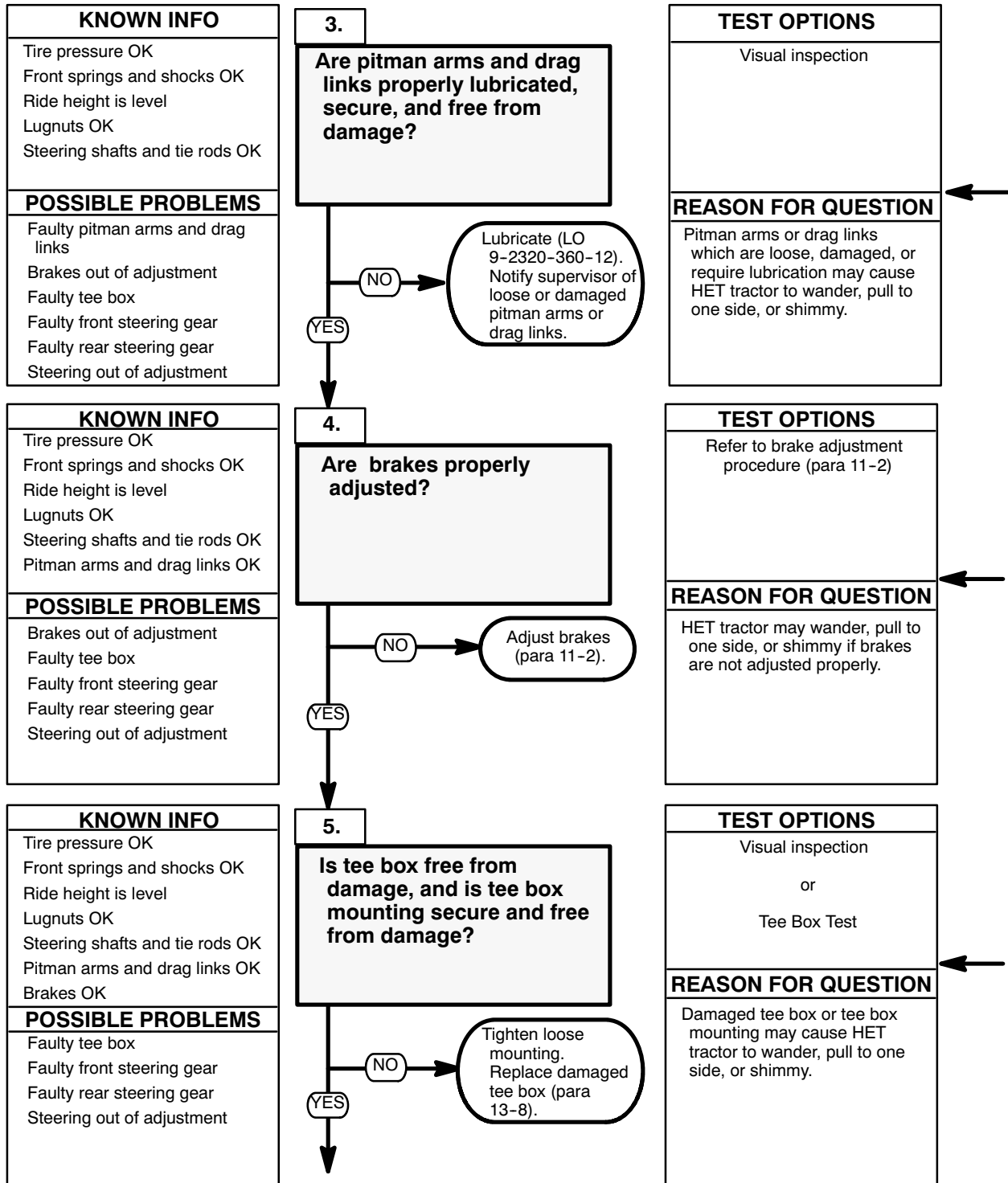
After removing the wheel cover, if any bolts are found loose or broken, deflate the tire completely before attempting to loosen lugnuts. Failure to comply may result in injury to personnel.

- (2) Check if any lugnuts are loose, missing, or damaged.
 (3) Tighten loose lugnuts 450-550 lb ft (610-746 N-m). Replace missing or damaged lugnuts.
 (4) Install wheel cover on tire assembly with four nuts.

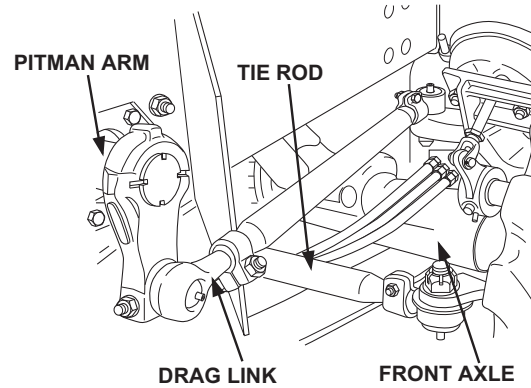


Check steering shafts and tie rods for damage, and loose or missing mounting hardware. Refer to LO 9-2320-360-12 to lubricate steering linkage.

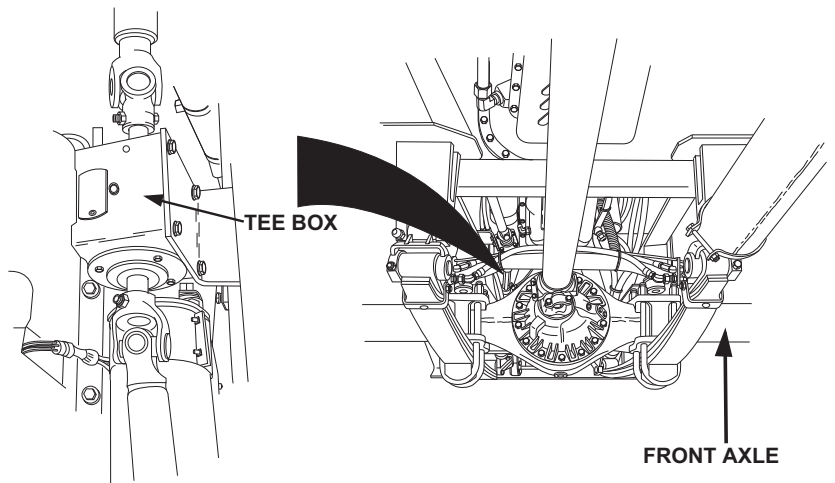
q2. WANDERS, PULLS TO ONE SIDE, OR SHIMMIES (CONT)



Check pitman arms and drag links for damage, and loose or missing mounting hardware. Refer to (LO 9-2320-360-12) to lubricate steering linkage.



Refer to para 11-2 to adjust brakes.



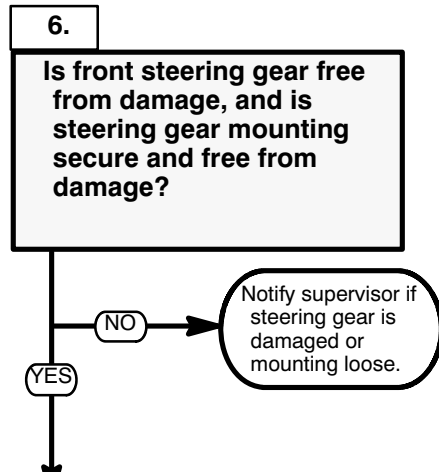
Check tee box for damage, and for loose or missing mounting hardware.

TEE BOX TEST

- (1) Remove screw and locknut from lower yoke of top steering shaft. Discard locknut.
- (2) Remove yoke from top tee box shaft.
- (3) Remove screw and locknut from yoke on front steering shaft. Discard locknut.
- (4) Remove yoke from front tee box shaft.
- (5) Remove screw and locknut from yoke on rear steering shaft. Discard locknut.
- (6) Remove yoke from rear tee box shaft.
- (7) Turn top tee box shaft to check for binding. Replace tee box (para 13-8) if it fails to turn smoothly or if it binds when top shaft is turned.
- (8) Align key on rear tee box shaft with slot in steering shaft yoke.
- (9) Install yoke on rear tee box shaft with screw and new locknut.
- (10) Align key on front tee box shaft with slot in steering shaft yoke.
- (11) Install yoke on front tee box shaft with screw and new locknut.
- (12) Align key on top tee box shaft with slot in steering shaft yoke.
- (13) Install yoke on top tee box shaft with screw and new locknut.

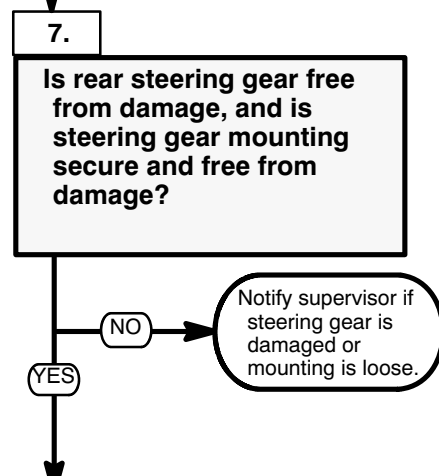
q2. WANDERS, PULLS TO ONE SIDE, OR SHIMMIES (CONT)

KNOWN INFO
Tire pressure OK Front springs and shocks OK Ride height is level Lugnuts OK Steering shafts and tie rods OK Pitman arms and drag links OK Brakes OK Tee box OK
POSSIBLE PROBLEMS
Faulty front steering gear Faulty rear steering gear Steering out of adjustment



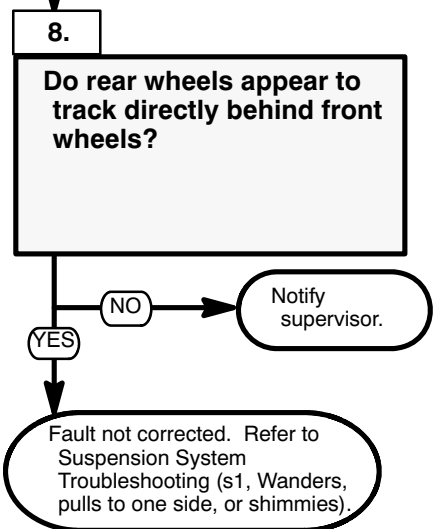
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damaged front steering gear or steering gear mounting may cause HET tractor to wander, pull to one side, or shimmy.

KNOWN INFO
Tire pressure OK Front springs and shocks OK Ride height is level Lugnuts OK Steering shafts and tie rods OK Pitman arms and drag links OK Brakes OK Tee box OK Front steering gear OK
POSSIBLE PROBLEMS
Faulty rear steering gear Steering out of adjustment

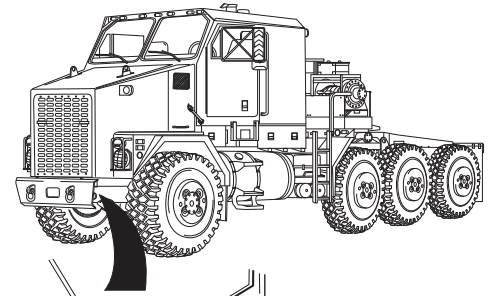


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Damaged rear steering gear or steering gear mounting may cause HET tractor to wander, pull to one side, or shimmy.

KNOWN INFO
Tire pressure OK Front springs and shocks OK Ride height is level Lugnuts OK Steering shafts and tie rods OK Pitman arms and drag links OK Brakes OK Tee box OK Front steering gear OK Rear steering gear OK
POSSIBLE PROBLEMS
Steering out of adjustment

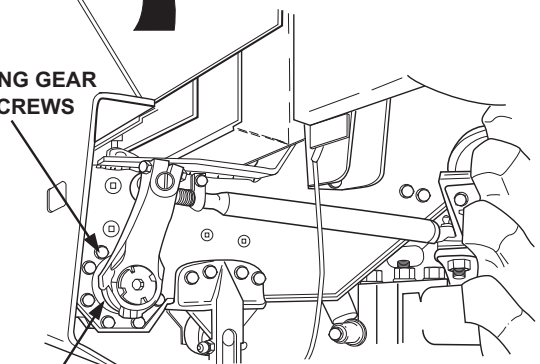


TEST OPTIONS
Visual inspection
REASON FOR QUESTION
If the steering system is not adjusted properly, HET tractor may wander, pull to one side, or shimmy.



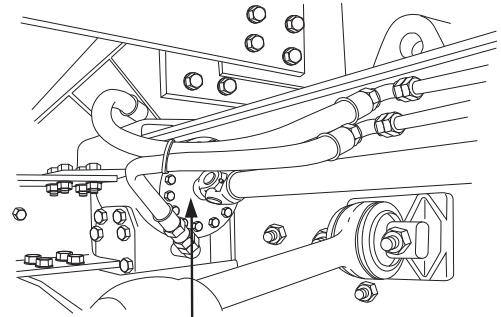
Check front steering gear for damage, and for loose or missing mounting hardware.

FRONT STEERING GEAR
MOUNTING SCREWS



FRONT STEERING GEAR

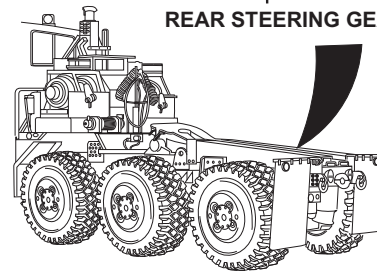
Check rear steering gear for damage, and for loose or missing mounting hardware.



REAR STEERING GEAR

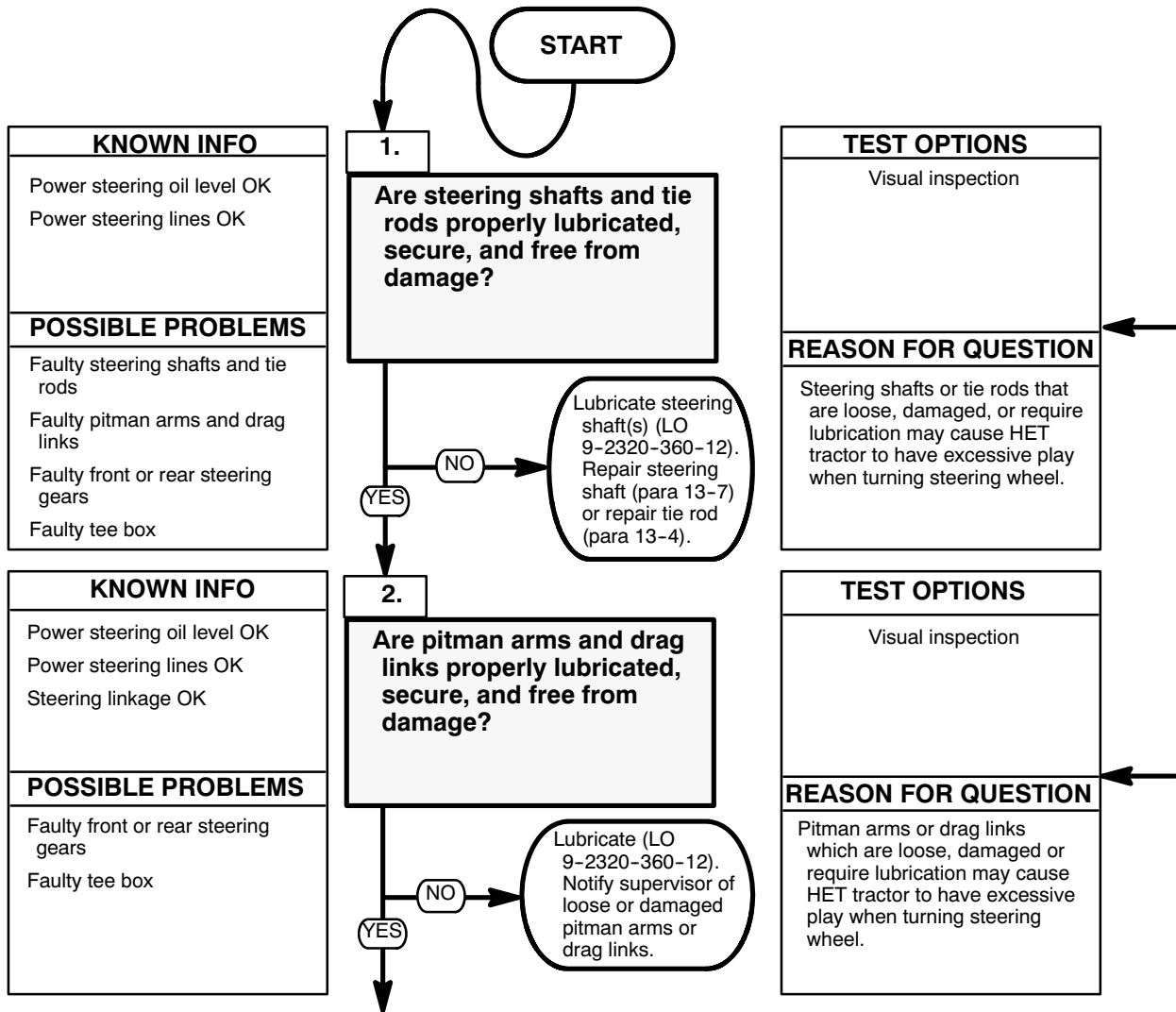
NOTE

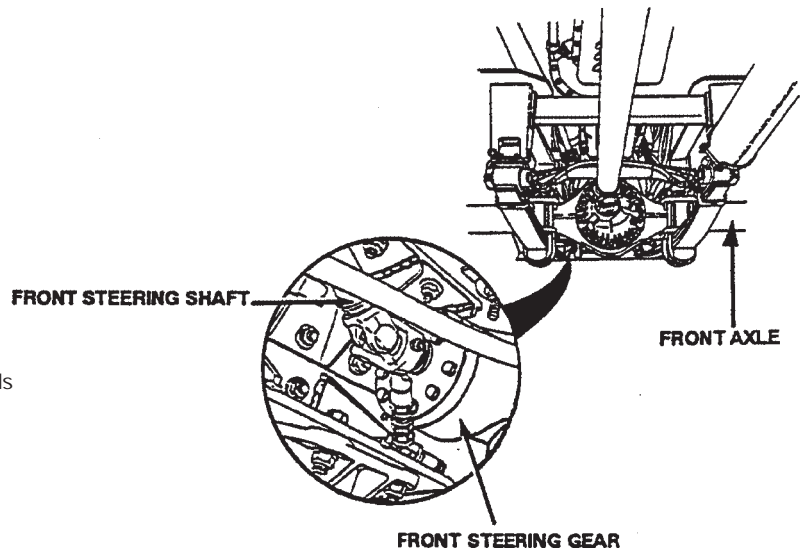
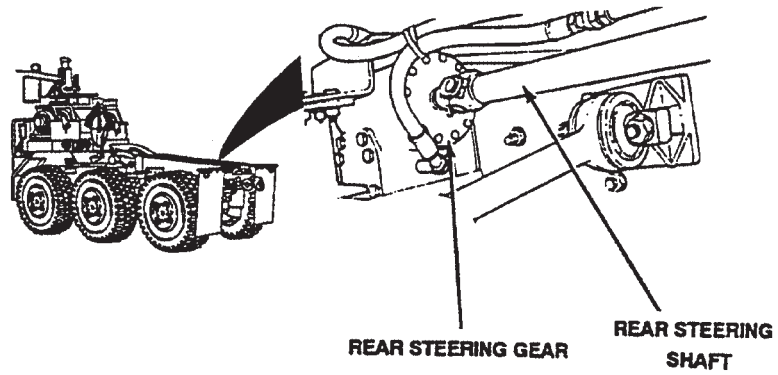
- This test is only for diagnostic purposes. Any adjustment must be performed by DS maintenance.
- Other surfaces where tire tracking can be observed can also be used. These include surfaces such as snow, mud, or sand.



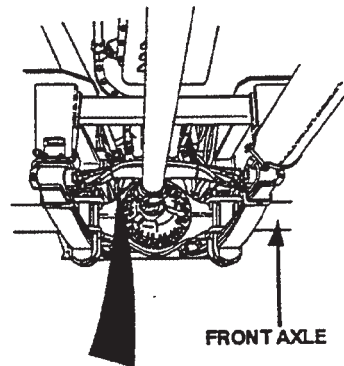
- (1) Drive HET tractor, straight ahead, thru water covered surface and on to dry pavement.
- (2) Observe where the tires on axle no. 4 pass over the tracks left by axle no. 1. The tires should overlap equally, on both sides, the tracks left by axle no. 1.

q3. EXCESSIVE PLAY WHEN TURNING STEERING WHEEL	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) Personnel Required Two

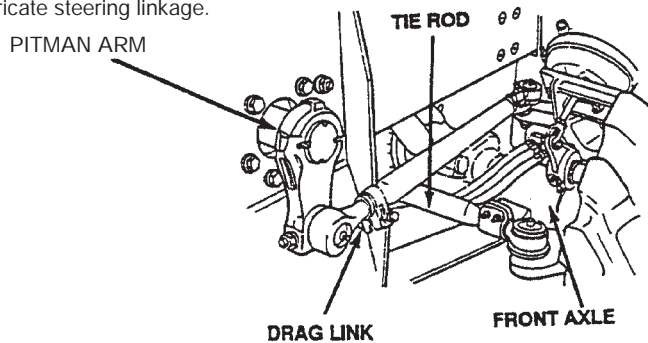




Check steering shafts and tie rods for damage and loose or missing mounting hardware. Refer to LO 9-2320-360-12 to lubricate steering linkage.



Check pitman arms and drag links for damage and loose or missing mounting hardware. Refer to (LO 9-2320-360-12) to lubricate steering linkage.

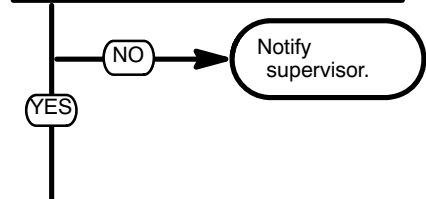


q3. EXCESSIVE PLAY WHEN TURNING STEERING WHEEL (CONT)

KNOWN INFO
Power steering oil level OK Power steering lines OK Steering linkage OK
POSSIBLE PROBLEMS
Faulty front or rear steering gears Faulty tee box

3.

Does steering gear pitman arm move immediately when turning input shaft?

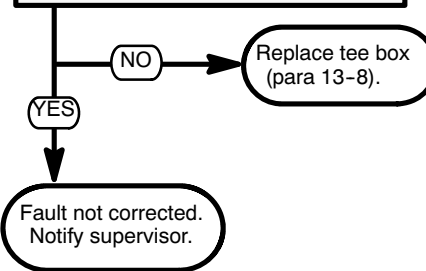


TEST OPTIONS
Steering Gear Preload Test
REASON FOR QUESTION
If steering gear input shaft turns before pitman arm begins to move, front and/or rear steering gear has excessive play.

KNOWN INFO
Power steering oil level OK Power steering lines OK Steering linkage OK Front and rear steering gears OK
POSSIBLE PROBLEMS
Faulty tee box

4.

Is top tee box shaft free from play before output shafts begin to move?



TEST OPTIONS
Tee Box Test
REASON FOR QUESTION
If there is play in top tee box shaft before output shafts begin to move, it may cause excessive play when steering wheel is turned.

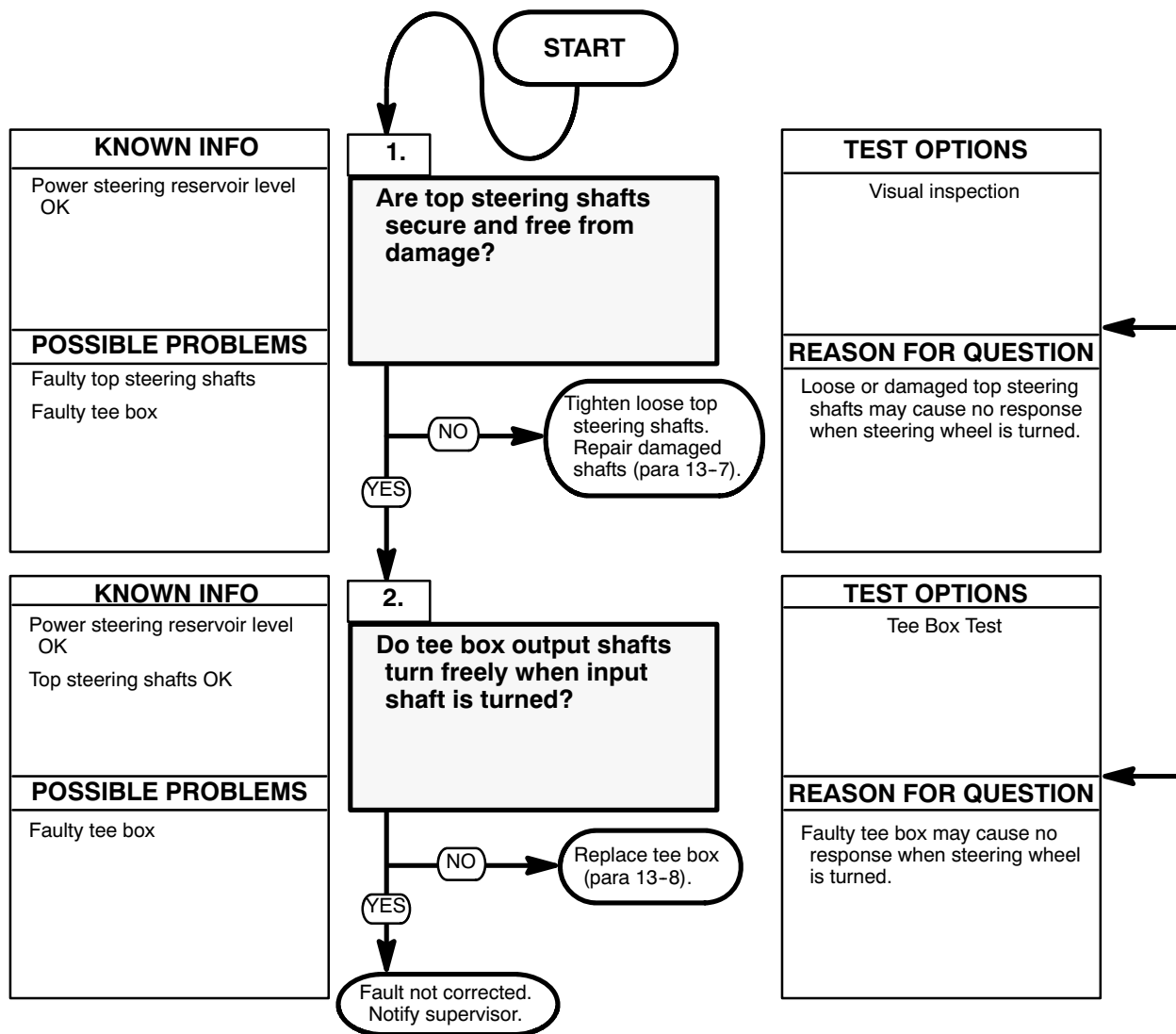
STEERING GEAR PRELOAD TEST

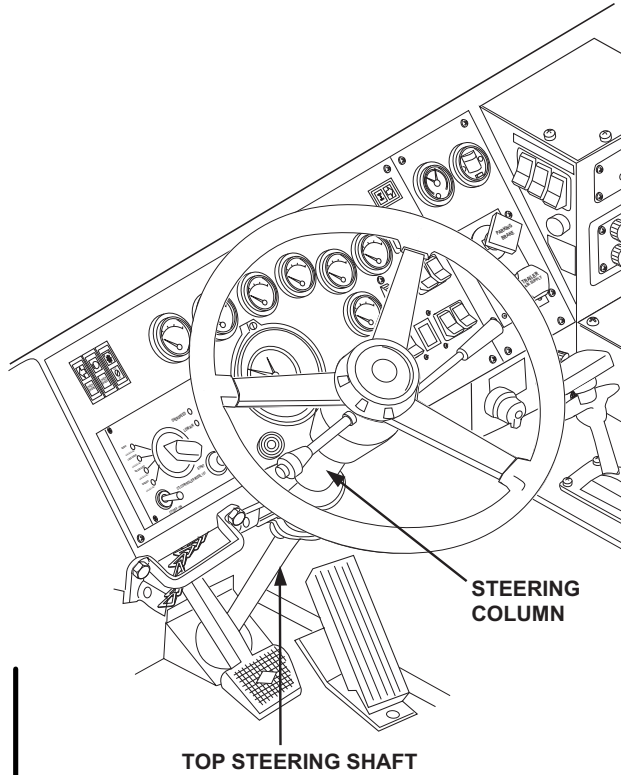
- (1) Start engine (TM 9-2320-360-10).
- (2) Turn steering wheel while assistant observes front steering gear input shaft and pitman arm.
- (3) Notify supervisor if there is any play in steering gear input shaft before pitman arm begins to move.
- (4) Repeat step (2) and (3) for rear steering gear.
- (5) Shut off engine (TM 9-2320-360-10).

TEE BOX TEST

- (1) Remove screw and locknut from lower yoke of top steering shaft. Discard locknut.
- (2) Remove yoke from top tee box shaft.
- (3) Remove screw and locknut from yoke on front steering shaft. Discard locknut.
- (4) Remove yoke from front tee box shaft.
- (5) Remove screw and locknut from yoke on rear steering shaft. Discard locknut.
- (6) Remove yoke from rear tee box shaft.
- (7) Turn top tee box shaft to check for binding. Replace tee box (para 13-8) if it fails to turn smoothly or if it binds when top shaft is turned.
- (8) Align key on rear tee box shaft with slot in steering shaft yoke.
- (9) Install yoke on rear tee box shaft with screw and new locknut.
- (10) Align key on front tee box shaft with slot in steering shaft yoke.
- (11) Install yoke on front tee box shaft with screw and new locknut.
- (12) Align key on top tee box shaft with slot in steering shaft yoke.
- (13) Install yoke on top tee box shaft with screw and new locknut.

q4. NO RESPONSE WHEN TURNING STEERING WHEEL	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

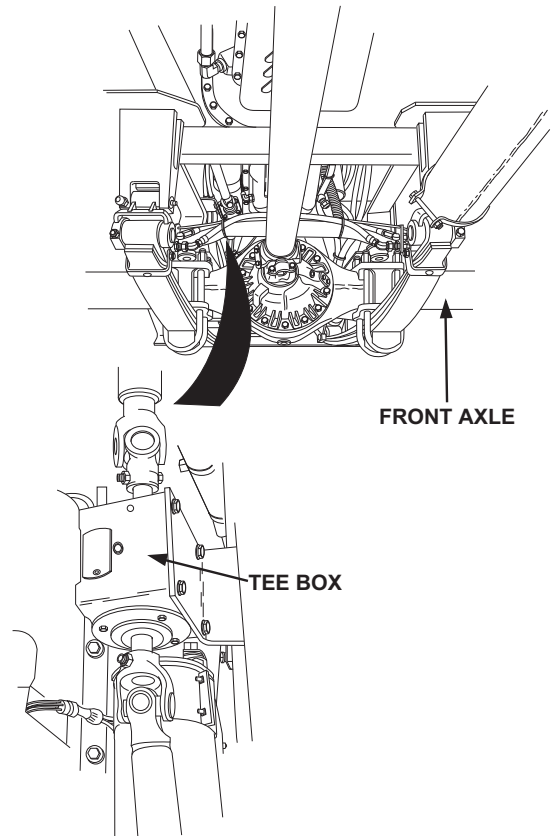




Check top steering shafts for looseness and damage.

TEE BOX TEST

- (1) Remove screw and locknut from lower yoke of top steering shaft. Discard locknut.
- (2) Remove yoke from top tee box shaft.
- (3) Remove screw and locknut from yoke on front steering shaft. Discard locknut.
- (4) Remove yoke from front tee box shaft.
- (5) Remove screw and locknut from yoke on rear steering shaft. Discard locknut.
- (6) Remove yoke from rear tee box shaft.
- (7) Turn top tee box shaft to check for binding. Replace tee box (para 13-8) if it fails to turn smoothly or if it binds when top shaft is turned.
- (8) Align key on rear tee box shaft with slot in steering shaft yoke.
- (9) Install yoke on rear tee box shaft with screw and new locknut.
- (10) Align key on front tee box shaft with slot in steering shaft yoke.
- (11) Install yoke on front tee box shaft with screw and new locknut.
- (12) Align key on top tee box shaft with slot in steering shaft yoke.
- (13) Install yoke on top tee box shaft with screw and new locknut.



q5. NO RESPONSE AT NO. 1 AXLE WHEN TURNING STEERING WHEEL

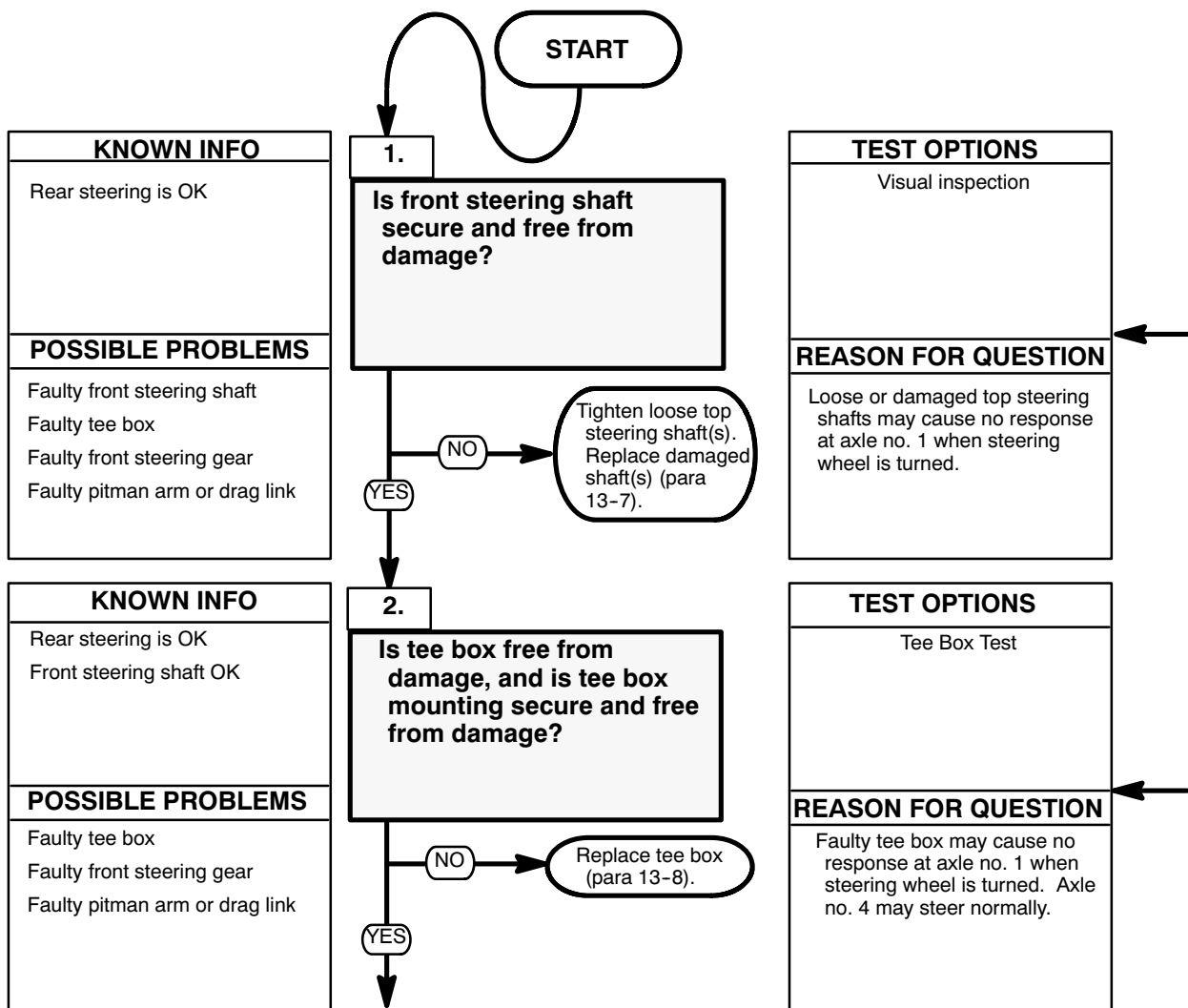
INITIAL SETUP

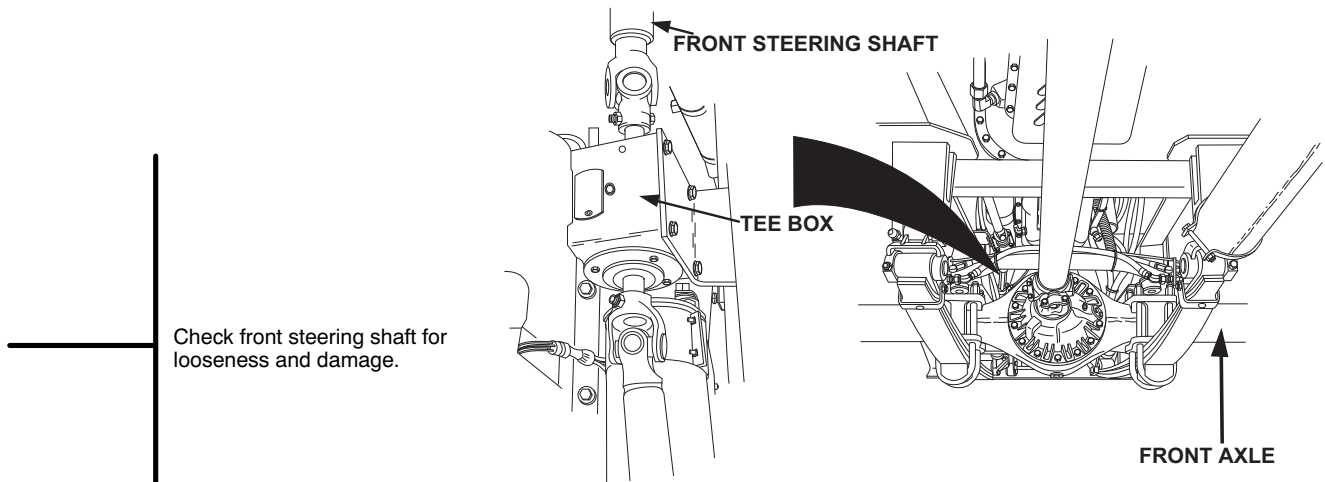
Equipment Conditions

Engine shut off (TM 9-2320-360-10).
 Parking brake on (TM 9-2320-360-10).
 Wheels chocked.

Tools and Special Tools

Tool Kit, Genl Mech (Item 54, Appendix F)



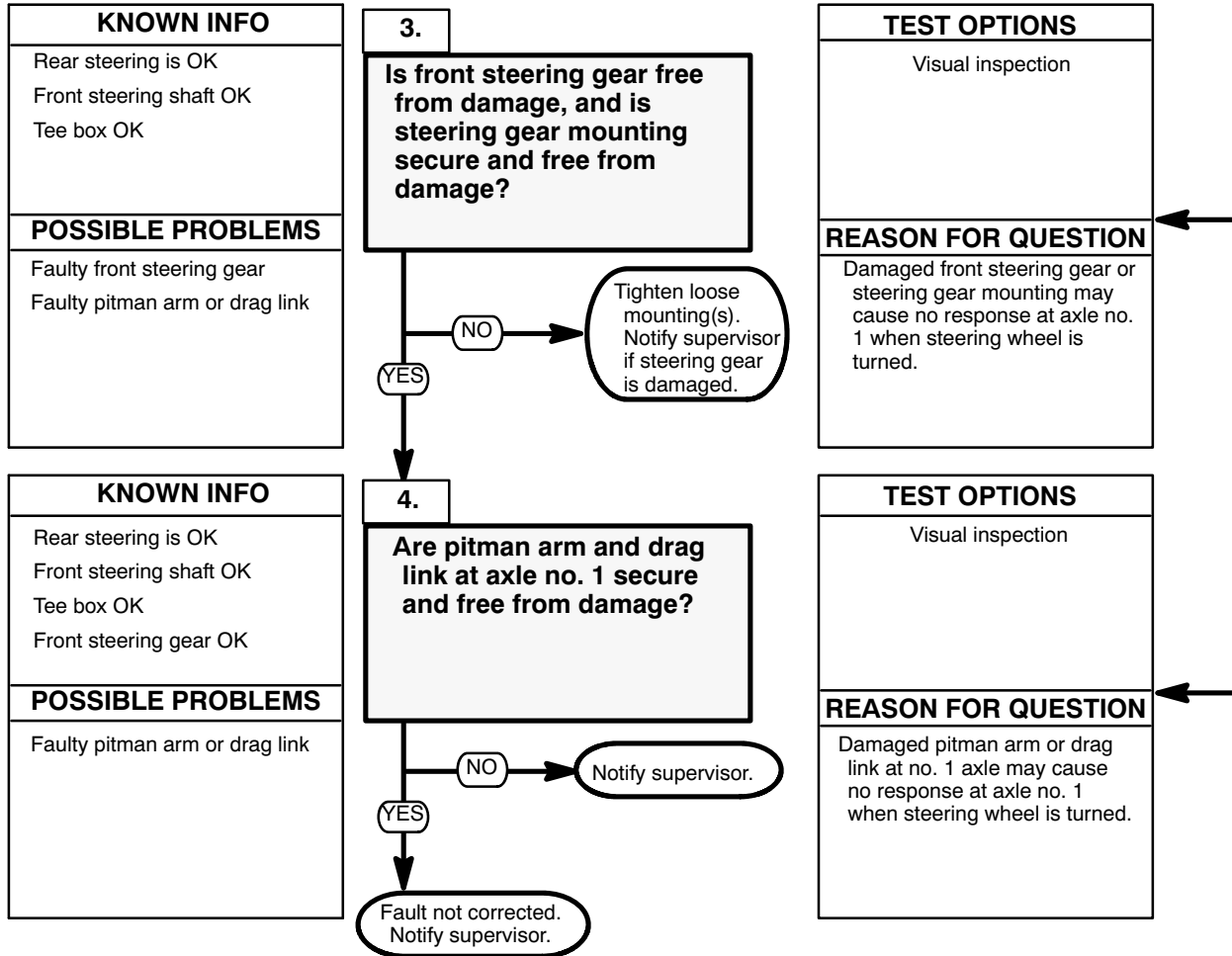


Check front steering shaft for looseness and damage.

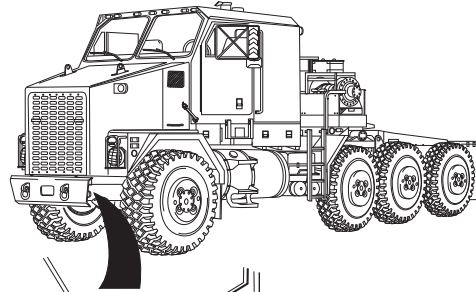
TEE BOX TEST

- (1) Remove screw and locknut from lower yoke of top steering shaft. Discard locknut.
- (2) Remove yoke from top tee box shaft.
- (3) Remove screw and locknut from yoke on front steering shaft. Discard locknut.
- (4) Remove yoke from front tee box shaft.
- (5) Remove screw and locknut from yoke on rear steering shaft. Discard locknut.
- (6) Remove yoke from rear tee box shaft.
- (7) Turn top tee box shaft to check for binding. Replace tee box (para 13-8) if it fails to turn smoothly or if it binds when top shaft is turned.
- (8) Align key on rear tee box shaft with slot in steering shaft yoke.
- (9) Install yoke on rear tee box shaft with screw and new locknut.
- (10) Align key on front tee box shaft with slot in steering shaft yoke.
- (11) Install yoke on front tee box shaft with screw and new locknut.
- (12) Align key on top tee box shaft with slot in steering shaft yoke.
- (13) Install yoke on top tee box shaft with screw and new locknut.

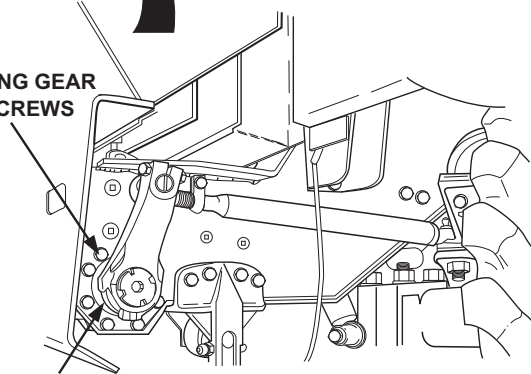
q5. NO RESPONSE AT NO. 1 AXLE WHEN TURNING STEERING WHEEL (CONT)



Check front steering gear for damage, and for loose or missing mounting hardware.

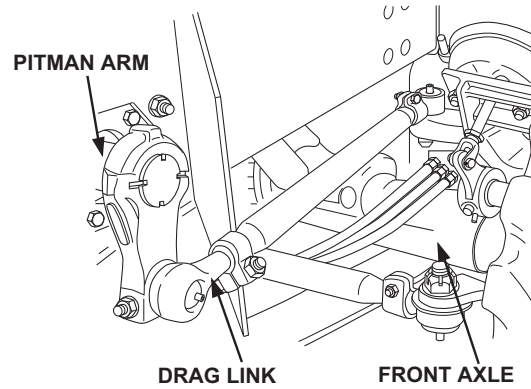


FRONT STEERING GEAR MOUNTING SCREWS



FRONT STEERING GEAR

Check pitman arm and drag link at no. 1 axle for damage and for loose or missing mounting hardware.

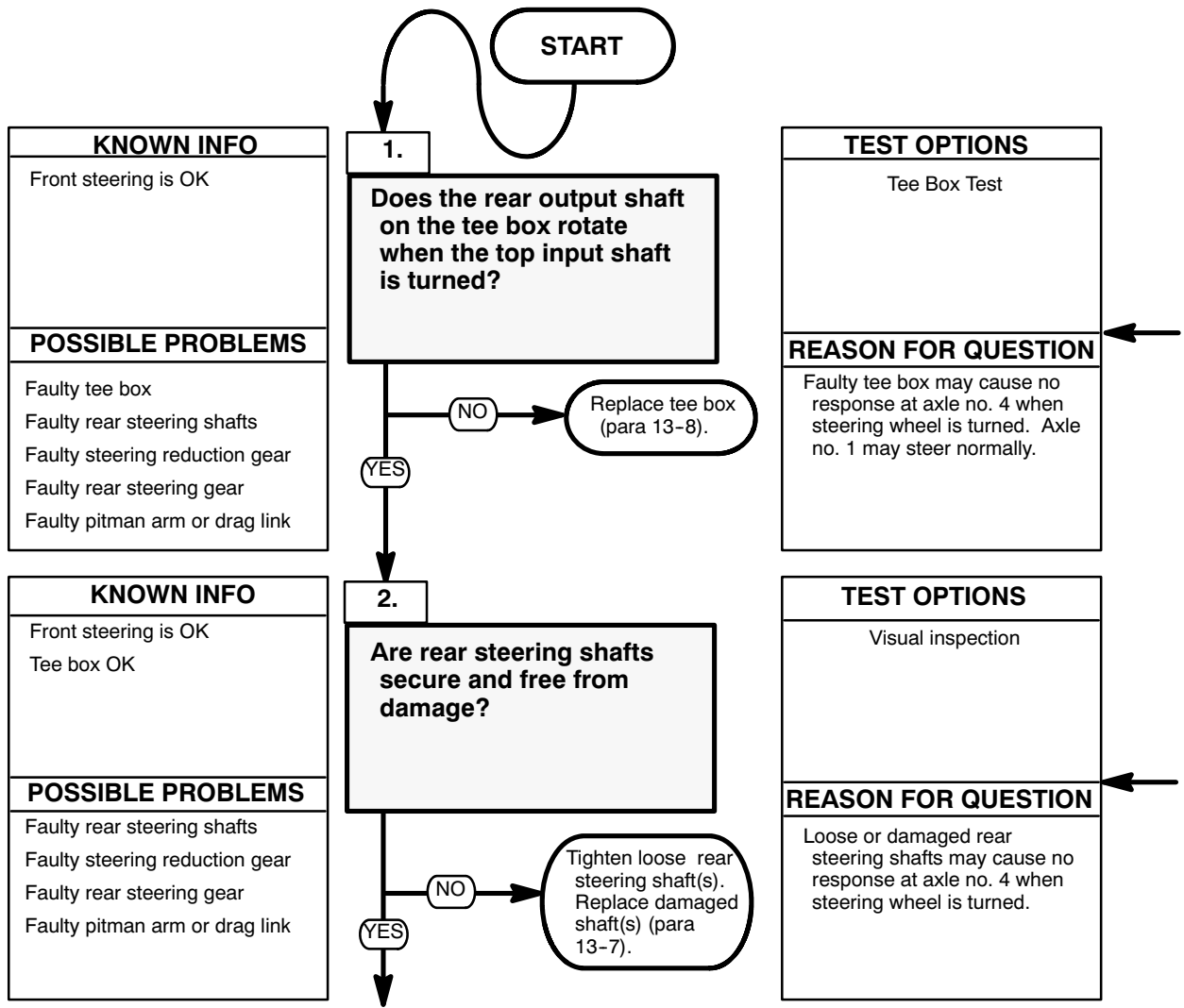


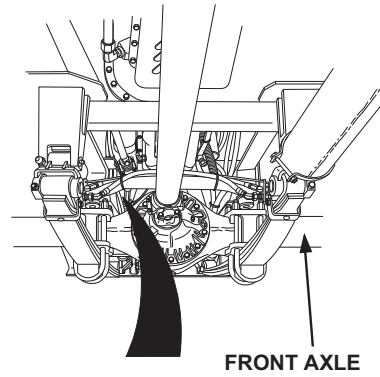
PITMAN ARM

DRAG LINK

FRONT AXLE

q6. NO RESPONSE AT NO. 4 AXLE WHEN TURNING STEERING WHEEL	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)
Personnel Required Two	

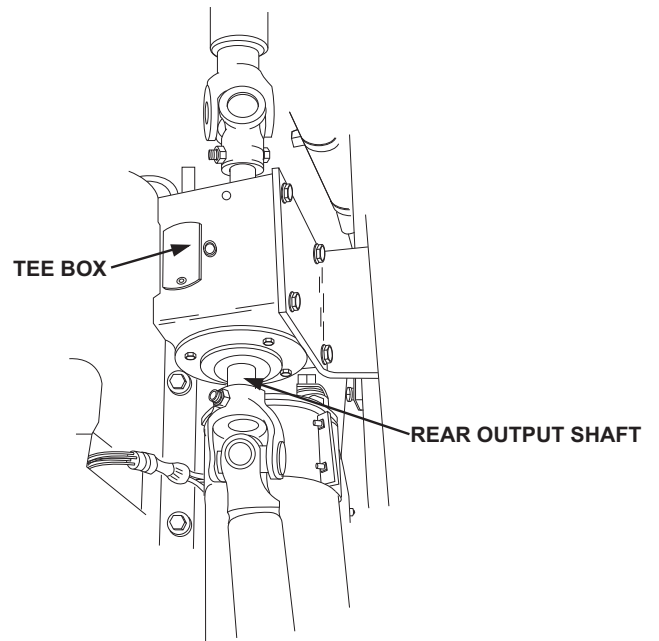




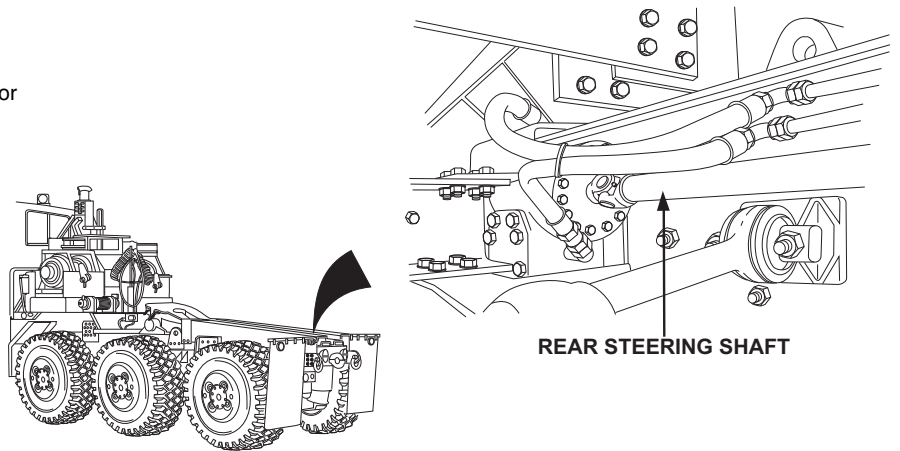
TEE BOX TEST

(14) Support axle no. 1 and axle no. 4 on jackstands (para 12-5).

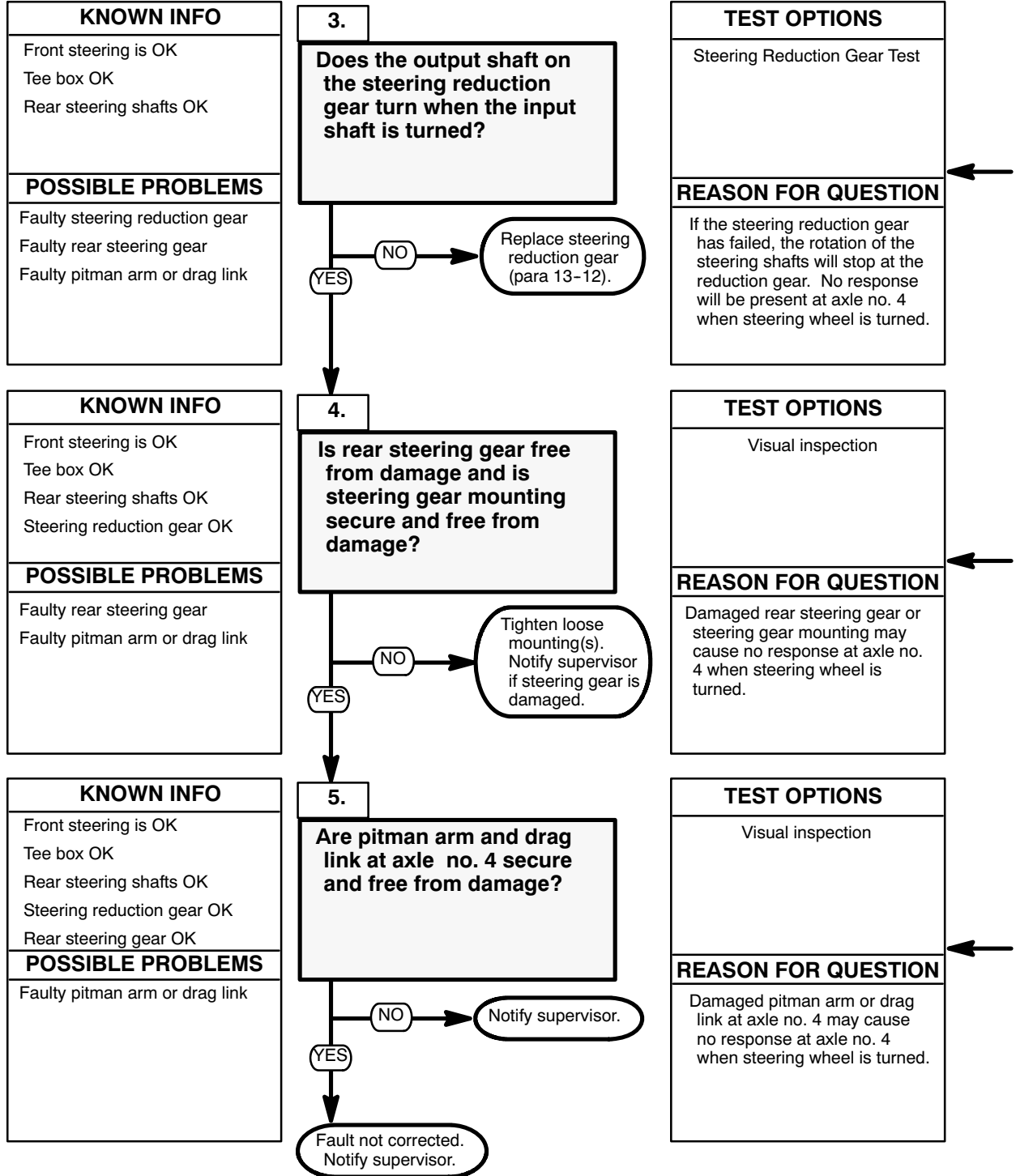
(15) Observe rear output shaft of tee box while assistant turns the steering wheel left and right.



Check rear steering shafts for looseness and damage.

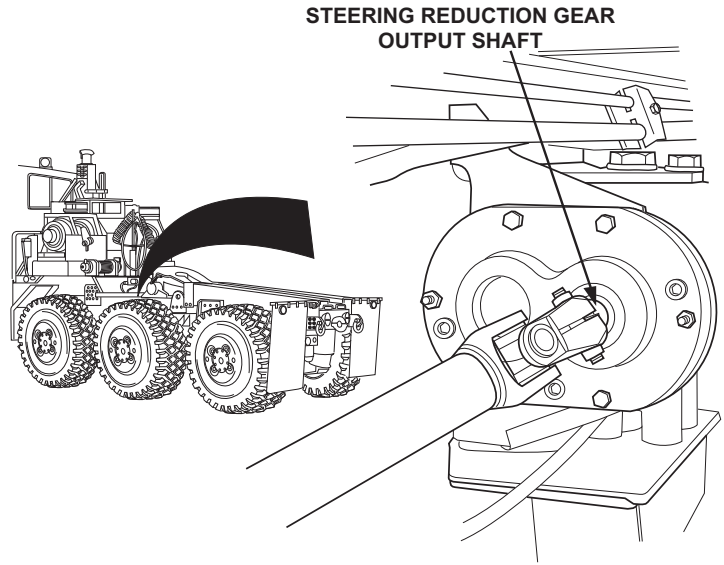


q6. NO RESPONSE AT NO. 4 AXLE WHEN TURNING STEERING WHEEL (CONT)



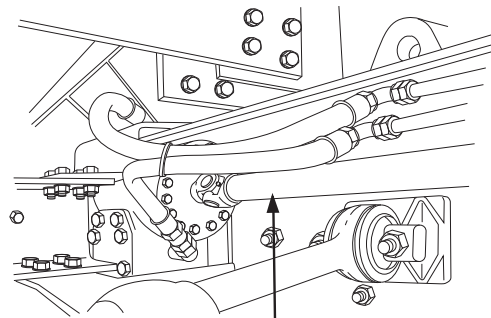
STEERING REDUCTION GEAR TEST

- (1) Observe output shaft of steering reduction gear while assistant turns the steering wheel left and right.
- (2) Remove jackstands from axle no. 1 and axle no. 4 (para 12-5).



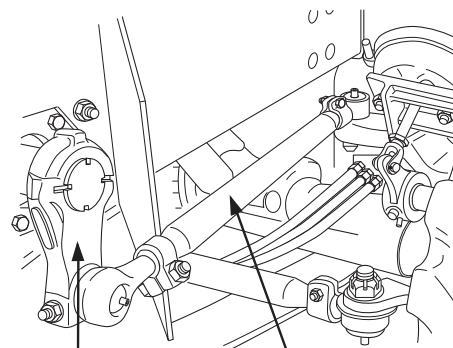
**STEERING REDUCTION GEAR
OUTPUT SHAFT**

Check rear steering gear for damage, and for loose or missing mounting hardware.



REAR STEERING SHAFT

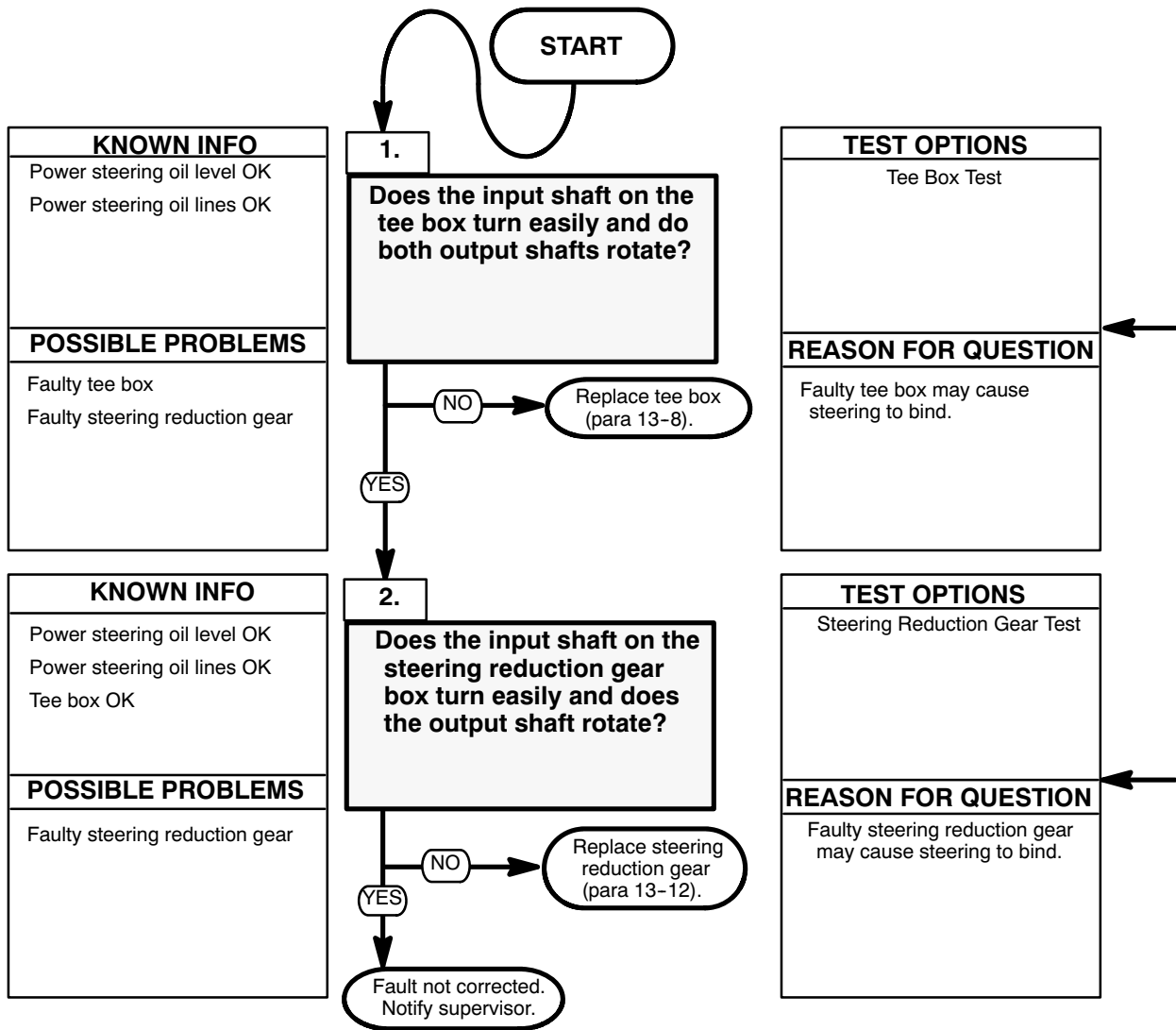
Check pitman arm and drag link at no. 4 axle for damage and for loose or missing mounting hardware.



REAR PITMAN ARM

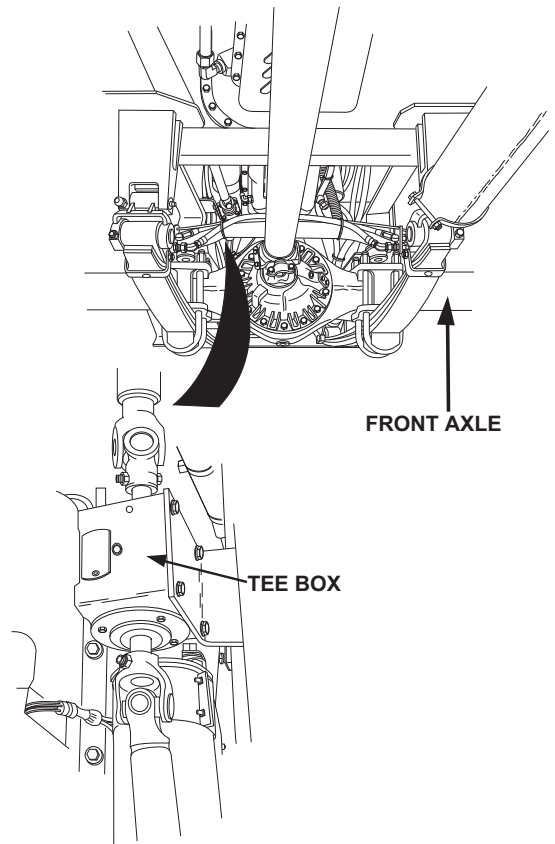
REAR DRAG LINK

q7. STEERING BINDS, DOES NOT RETURN TO STRAIGHT AHEAD AFTER TURNS	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



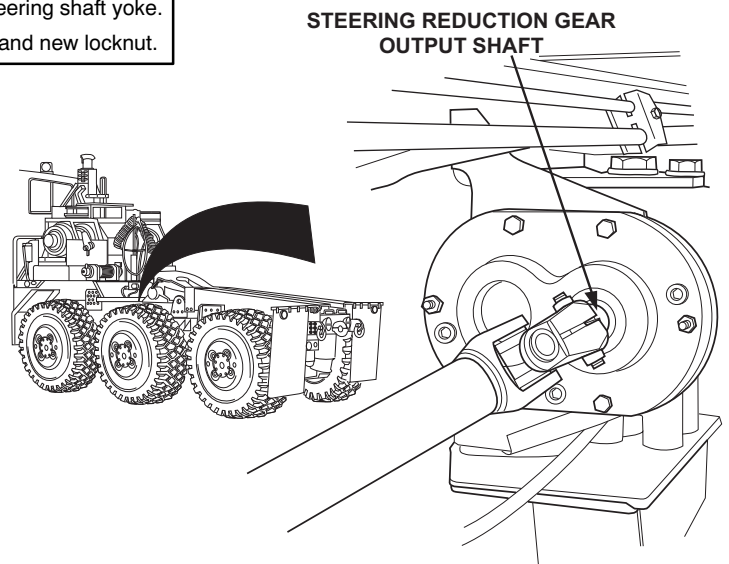
TEE BOX TEST

- (1) Remove screw and locknut from lower yoke of top steering shaft. Discard locknut.
- (2) Remove yoke from top tee box shaft.
- (3) Remove screw and locknut from yoke on front steering shaft. Discard locknut.
- (4) Remove yoke from front tee box shaft.
- (5) Remove screw and locknut from yoke on rear steering shaft. Discard locknut.
- (6) Remove yoke from rear tee box shaft.
- (7) Turn top tee box shaft to check for binding. Replace tee box (para 13-8) if it fails to turn smoothly or if it binds when top shaft is turned.
- (8) Align key on rear tee box shaft with slot in steering shaft yoke.
- (9) Install yoke on rear tee box shaft with screw and new locknut.
- (10) Align key on front tee box shaft with slot in steering shaft yoke.
- (11) Install yoke on front tee box shaft with screw and new locknut.
- (12) Align key on top tee box shaft with slot in steering shaft yoke.
- (13) Install yoke on top tee box shaft with screw and new locknut.



STEERING REDUCTION GEAR TEST

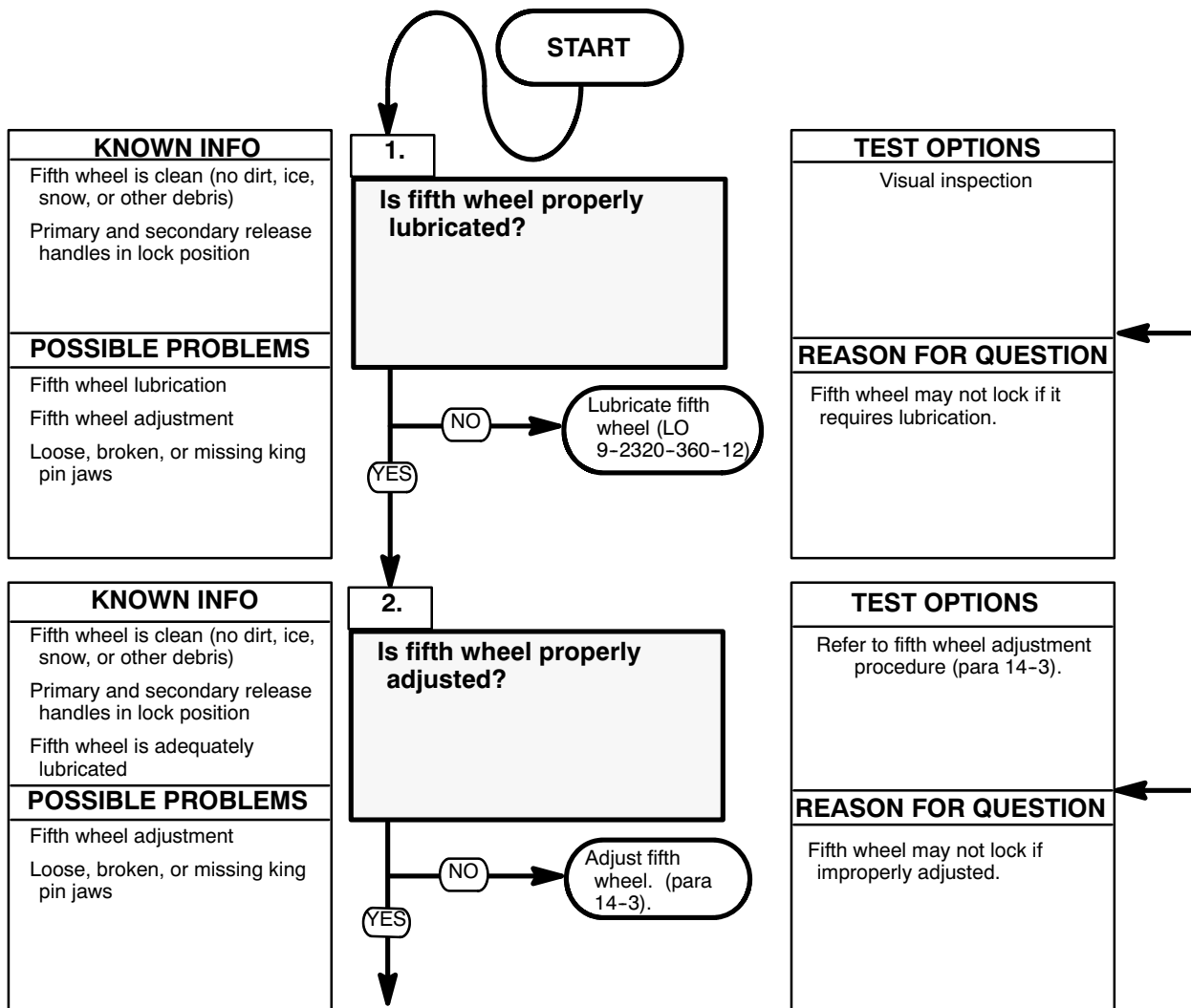
- (1) Remove screw and locknut from yoke of input shaft. Discard locknut.
- (2) Remove yoke from input shaft.
- (3) Remove screw and locknut from yoke on output shaft. Discard locknut.
- (4) Remove yoke from output shaft.
- (5) Turn input shaft to check for binding. Replace steering reduction gear (para 13-12) if it fails to turn smoothly or if it binds when input shaft is turned.
- (6) Align key on output shaft with slot in steering shaft yoke.
- (7) Install yoke on output shaft with screw and new locknut.
- (8) Align key on input shaft with slot in steering shaft yoke.
- (9) Install yoke on input shaft with screw and new locknut.

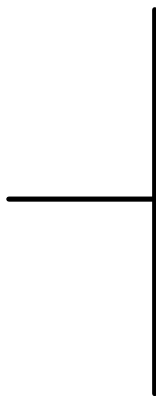


r. FIFTH WHEEL

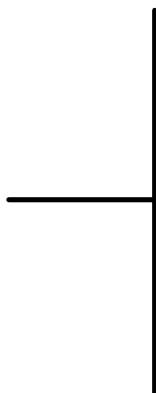
<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>r1. Fifth wheel will not lock when coupling trailer to HET Tractor</u>	<u>2-918</u>
<u>r2. Excessive movement of trailer king pin in fifth wheel</u>	<u>2-922</u>
<u>r3. Fifth wheel will not unlock when disconnecting trailer from HET Tractor</u>	<u>2-924</u>

r1. FIFTH WHEEL WILL NOT LOCK WHEN COUPLING TRAILER TO HET TRACTOR	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)





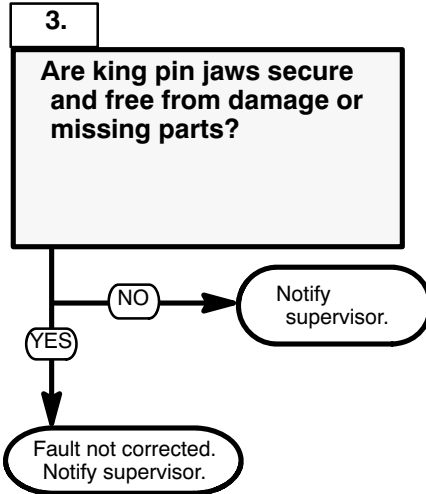
Refer to LO 9-2320-360-12
to lubricate fifth wheel.



Refer to para 14-3 to check for
proper fifth wheel adjustment.

r1. FIFTH WHEEL WILL NOT LOCK WHEN COUPLING TRAILER TO HET TRACTOR (CONT)

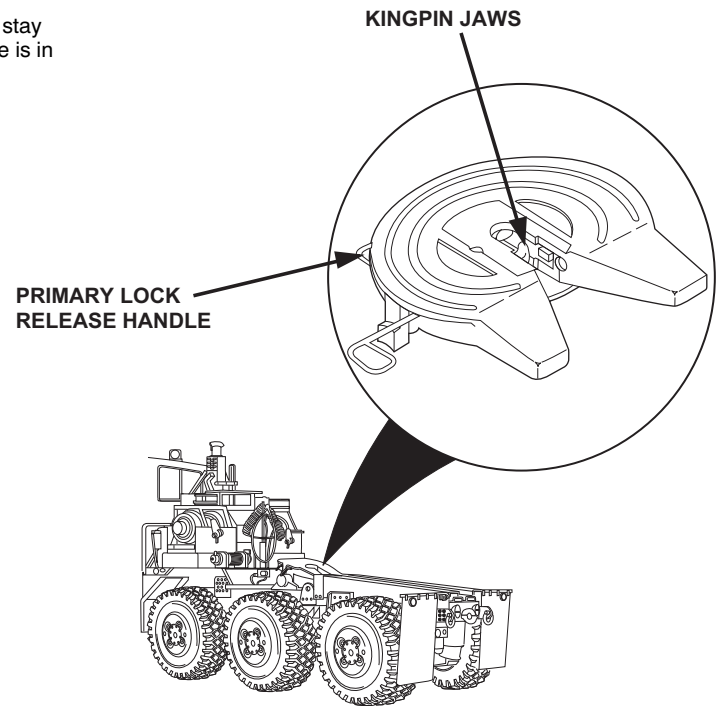
KNOWN INFO
Fifth wheel is clean (no dirt, ice, snow, or other debris)
Primary and secondary release handles in lock position
Fifth wheel is adequately lubricated
Fifth wheel is properly adjusted
POSSIBLE PROBLEMS
Loose, broken, or missing king pin jaws



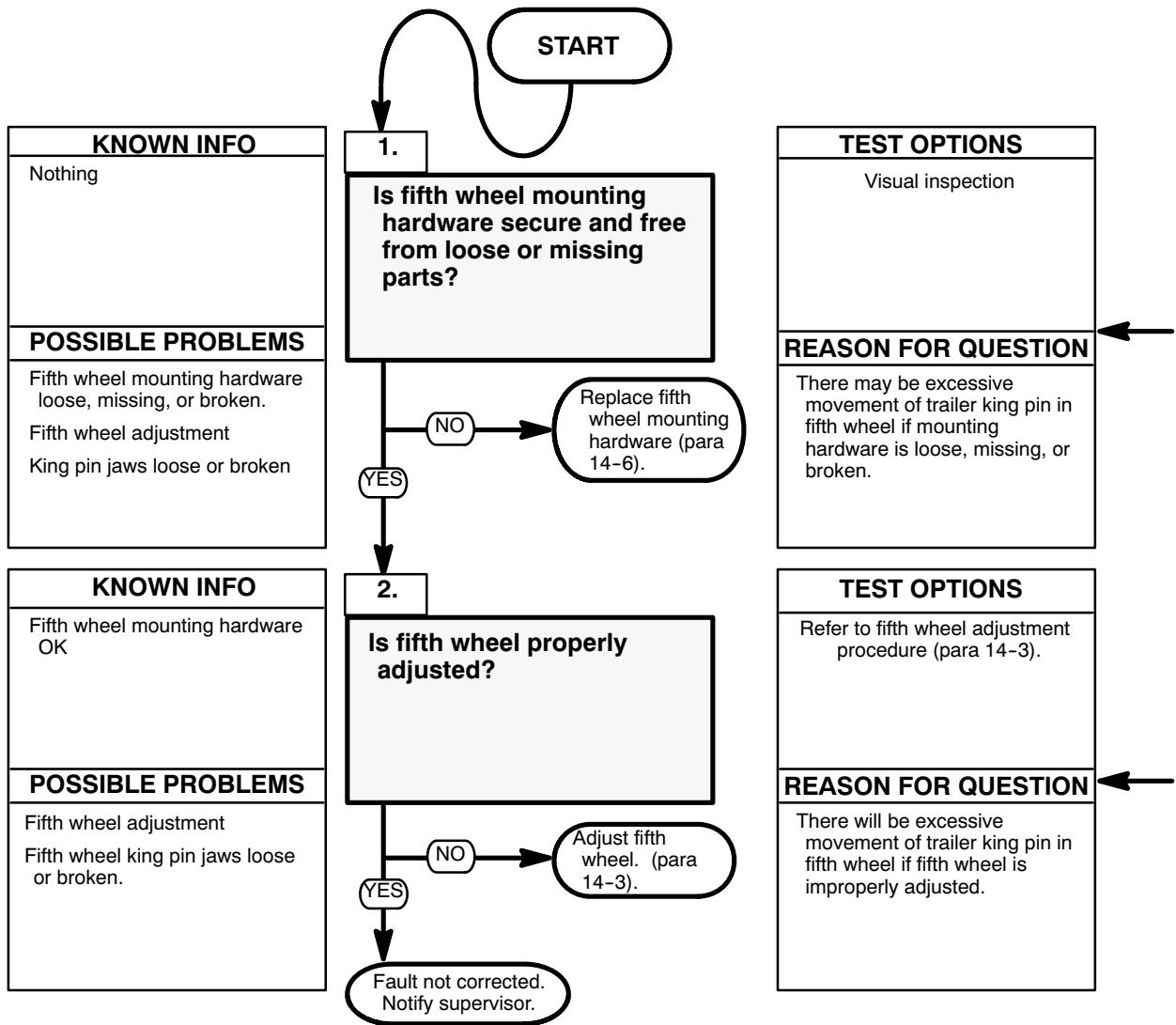
TEST OPTIONS
Visual inspection
REASON FOR QUESTION
Fifth wheel may not lock if king pin jaws are loose, broken, or missing.



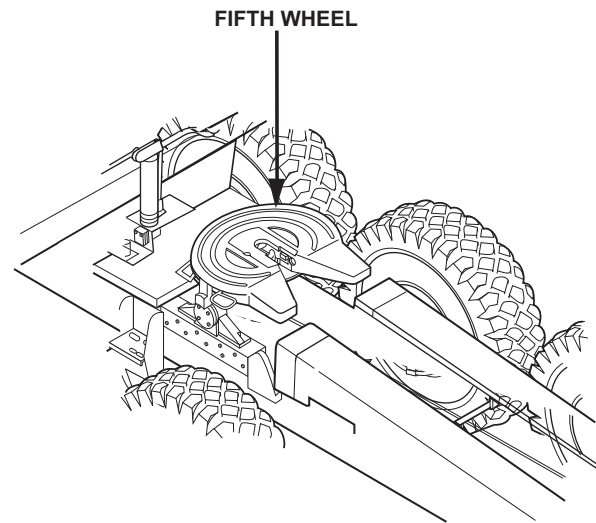
Check for loose, damaged, or missing kingpin jaws. Check that kingpin jaws stay open when primary lock release handle is in locked position (TM 9-2320-360-10).



r2. EXCESSIVE MOVEMENT OF TRAILER KING PIN IN FIFTH WHEEL	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)

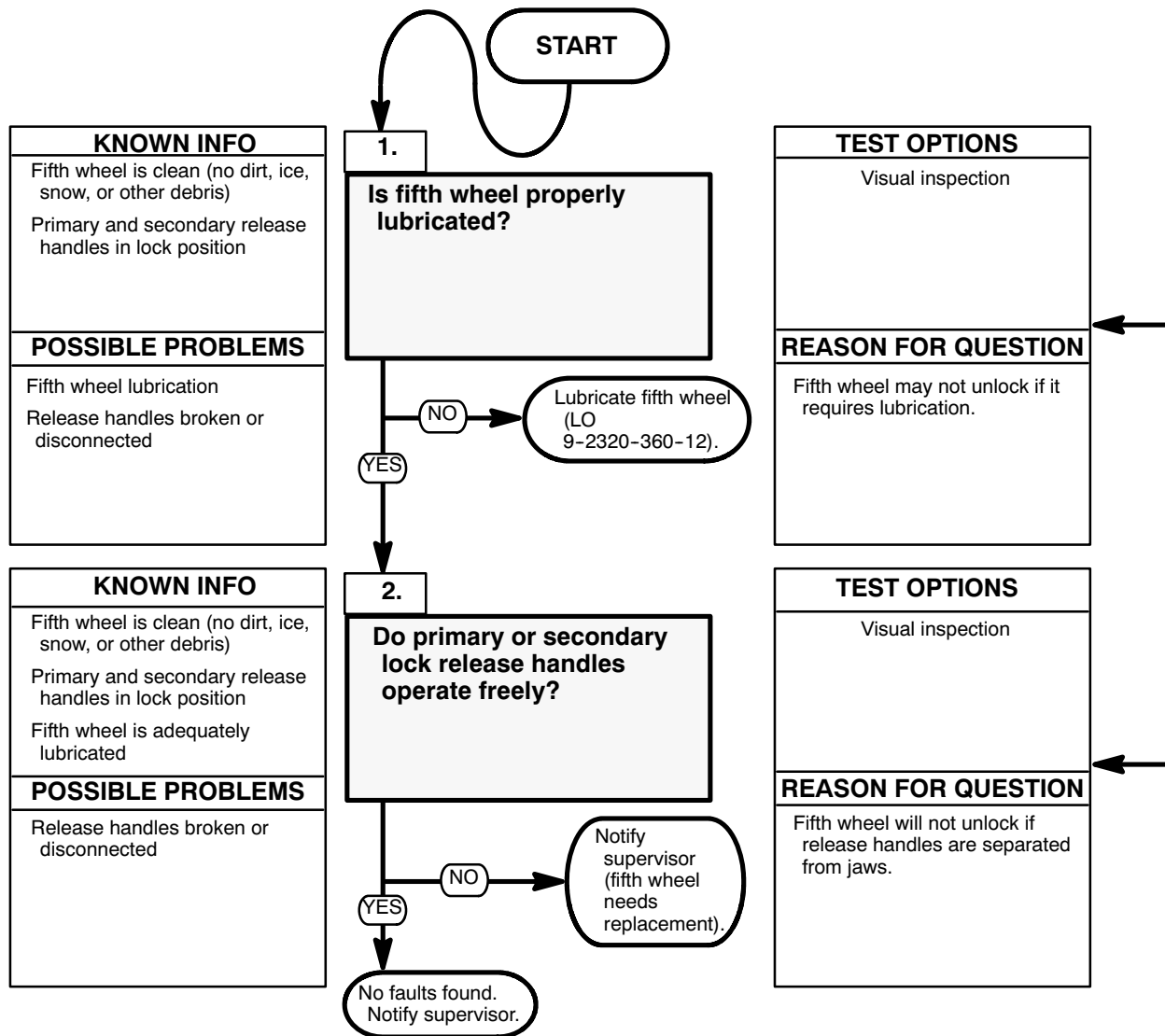


Check fifth wheel for missing or broken hardware. Locknuts should be tightened to 325 lb-ft (509 N·m). Replace any loose locknuts.

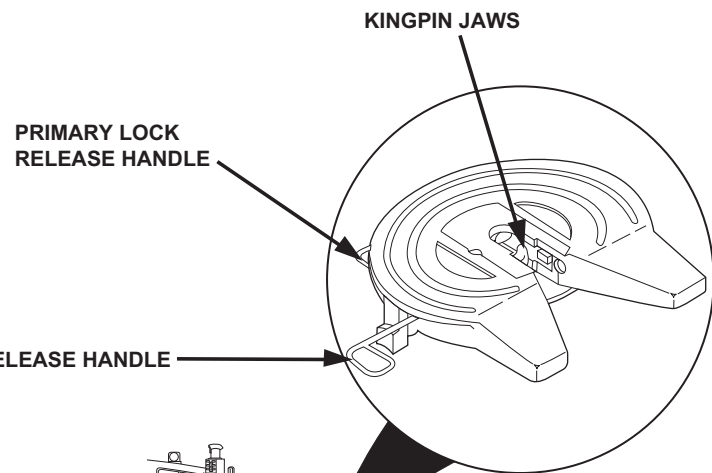


Refer to para 14-3 to check for proper fifth wheel adjustment.

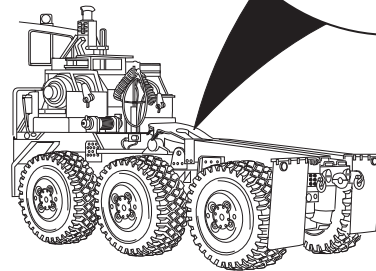
r3. FIFTH WHEEL WILL NOT UNLOCK WHEN DISCONNECTING TRAILER FROM HET TRACTOR	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



Refer to LO 9-2320-360-12
to lubricate fifth wheel.



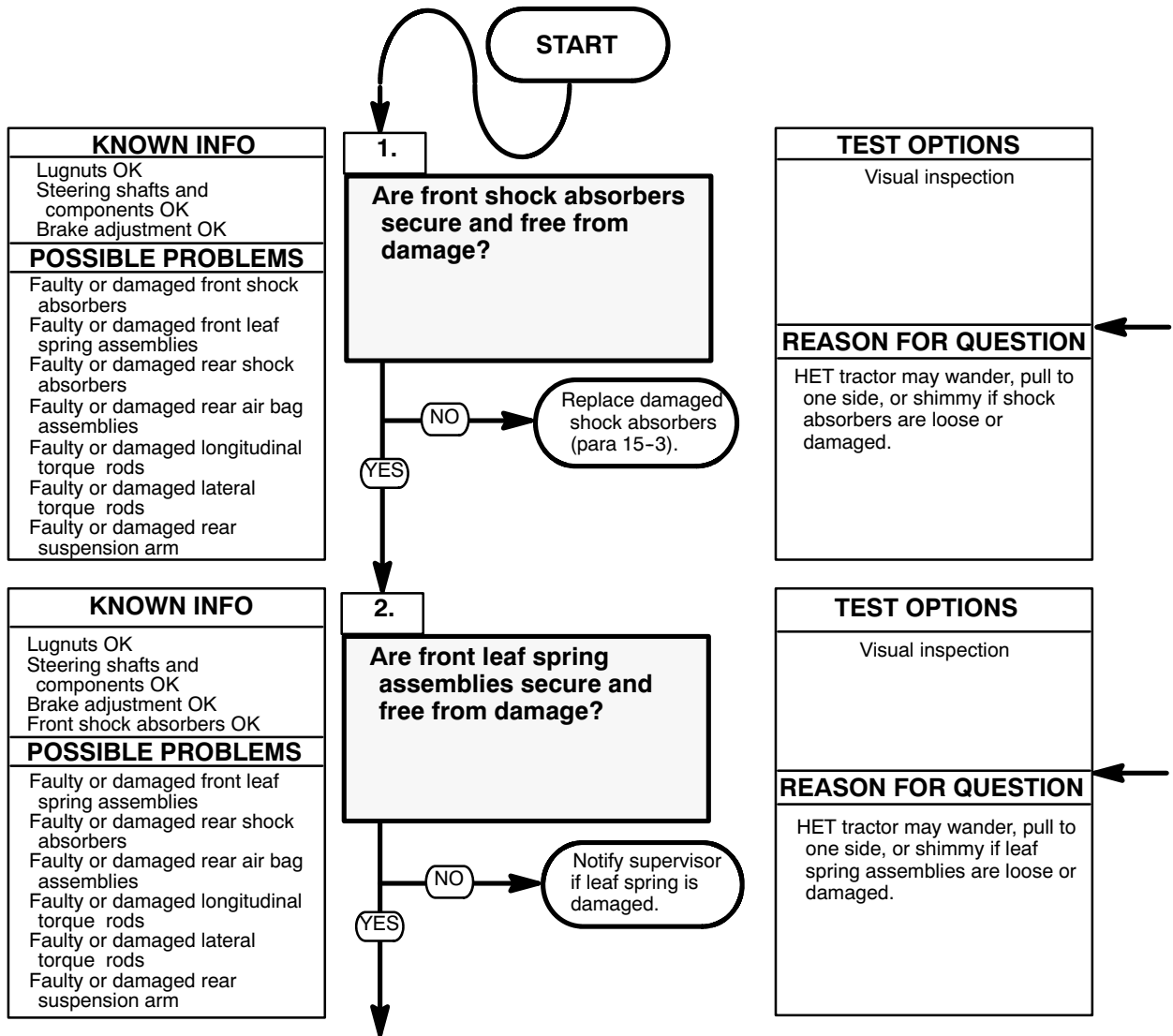
Attempt to perform trailer disconnect
procedure (TM 9-2320-360-10).



s. SUSPENSION SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>s1. Wanders, pulls to one side, or shimmies</u>	<u>2-928</u>
<u>s2. Leans to one side, or rear of vehicle sags</u>	<u>2-934</u>

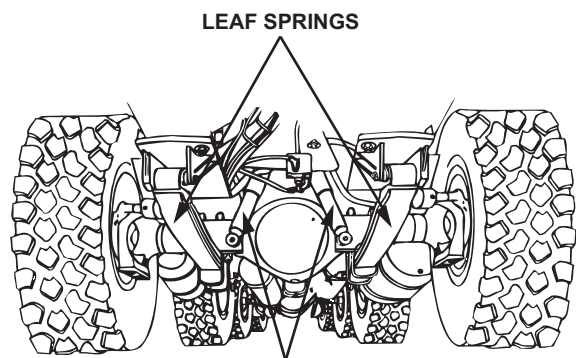
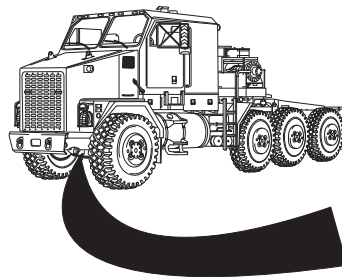
s1. WANDERS, PULLS TO ONE SIDE, OR SHIMMIES	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



NOTE

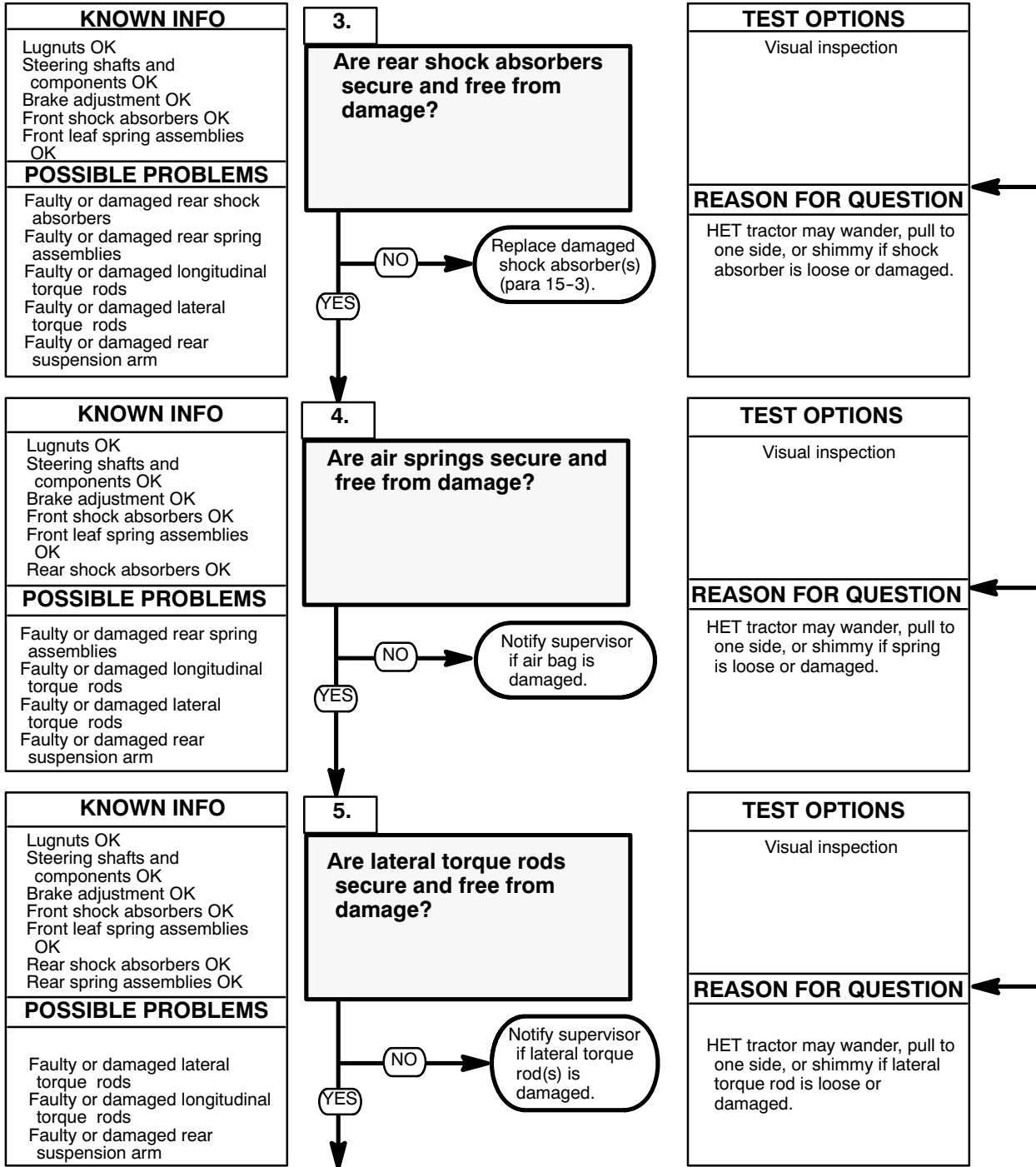
Perform Steering System
Troubleshooting - (q2, Wanders,
Pulls to One Side, or Shimmies)
before starting the steps given
below.

Check shock absorbers for damage or leaks,
and for missing mounting hardware.

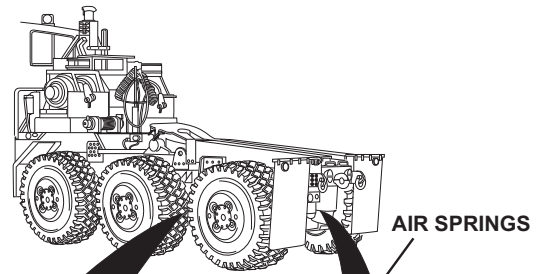


Check leaf springs for cracked or broken
leaves or missing spring clips.

s1. WANDERS, PULLS TO ONE SIDE, OR SHIMMIES (CONT)

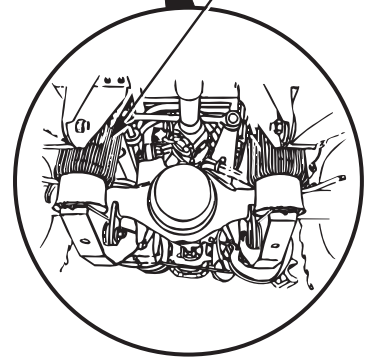
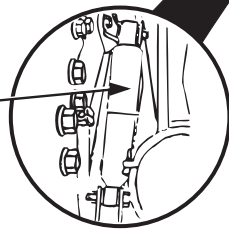


Check shock absorbers for damage or leaks, and for missing mounting hardware.



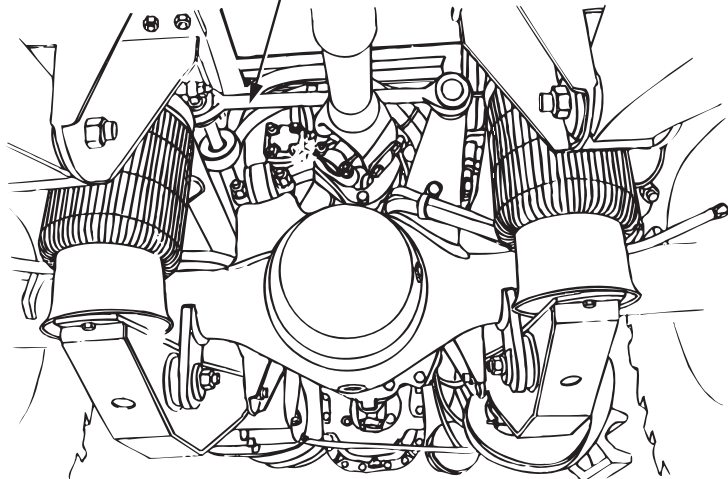
SHOCK ABSORBER

Check springs for damage or leaks, and for missing mounting hardware.

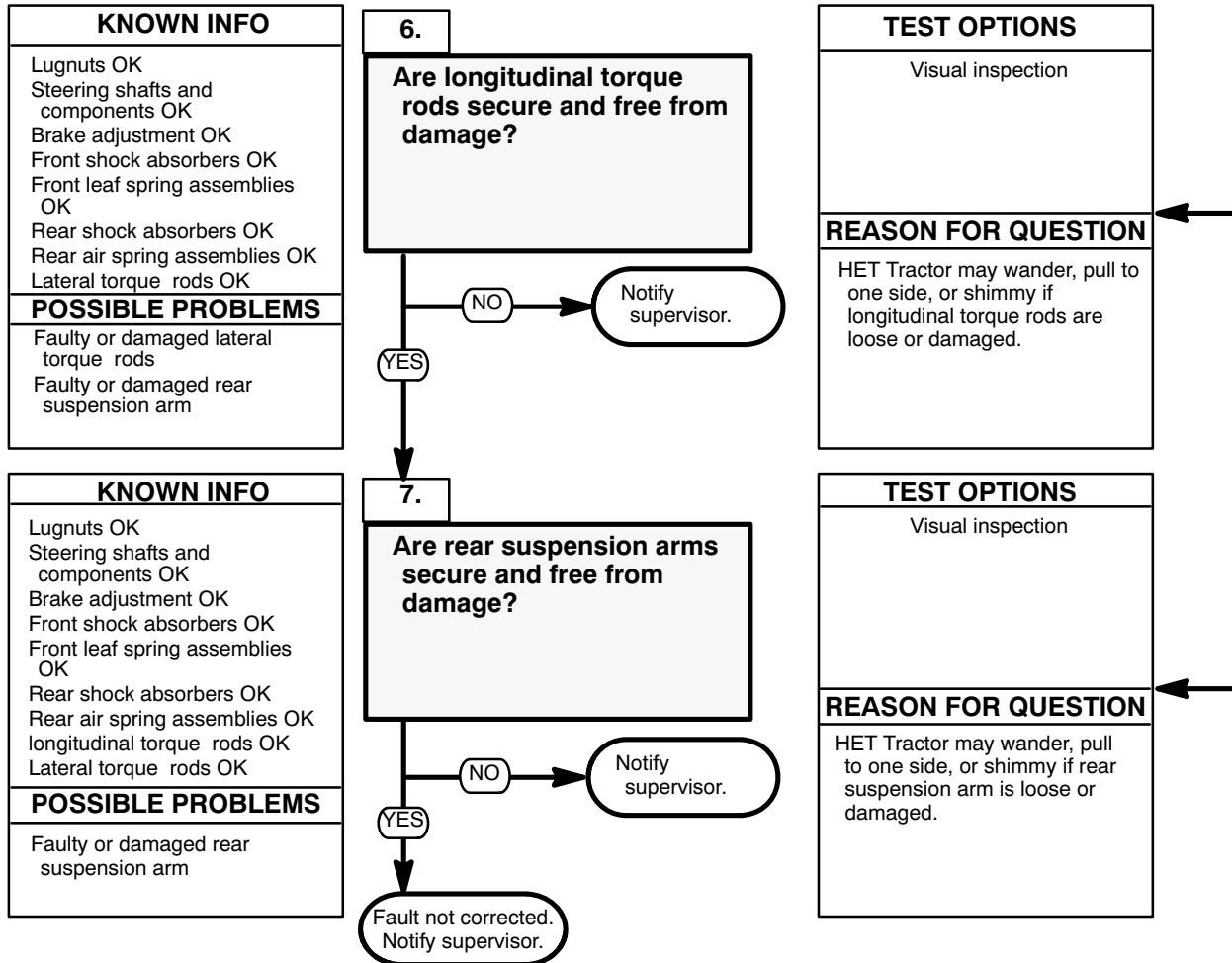


Check lateral torque rods at the three rear axles for damage, and for loose or missing mounting hardware.

LATERAL TORQUE ROD



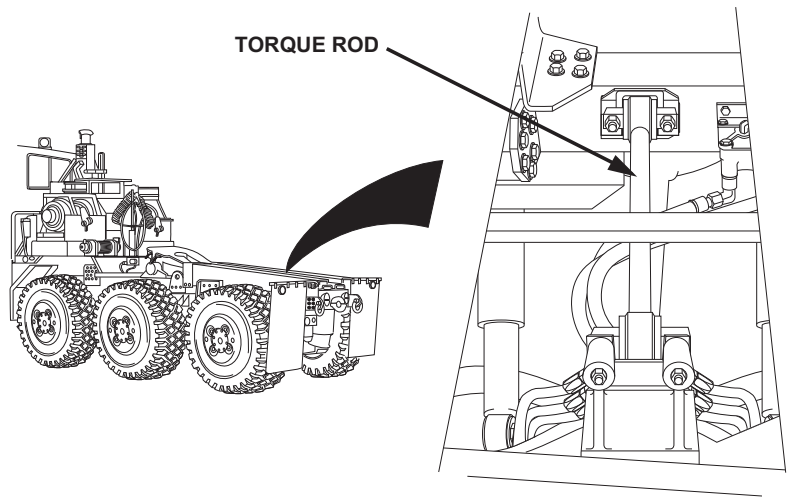
s1. WANDERS, PULLS TO ONE SIDE, OR SHIMMIES (CONT)



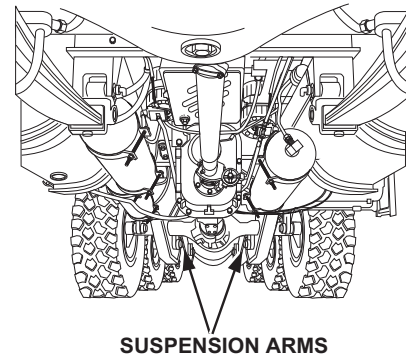
NOTE

Make sure torque of mounting screws is 212 lb-ft (287 N·m)

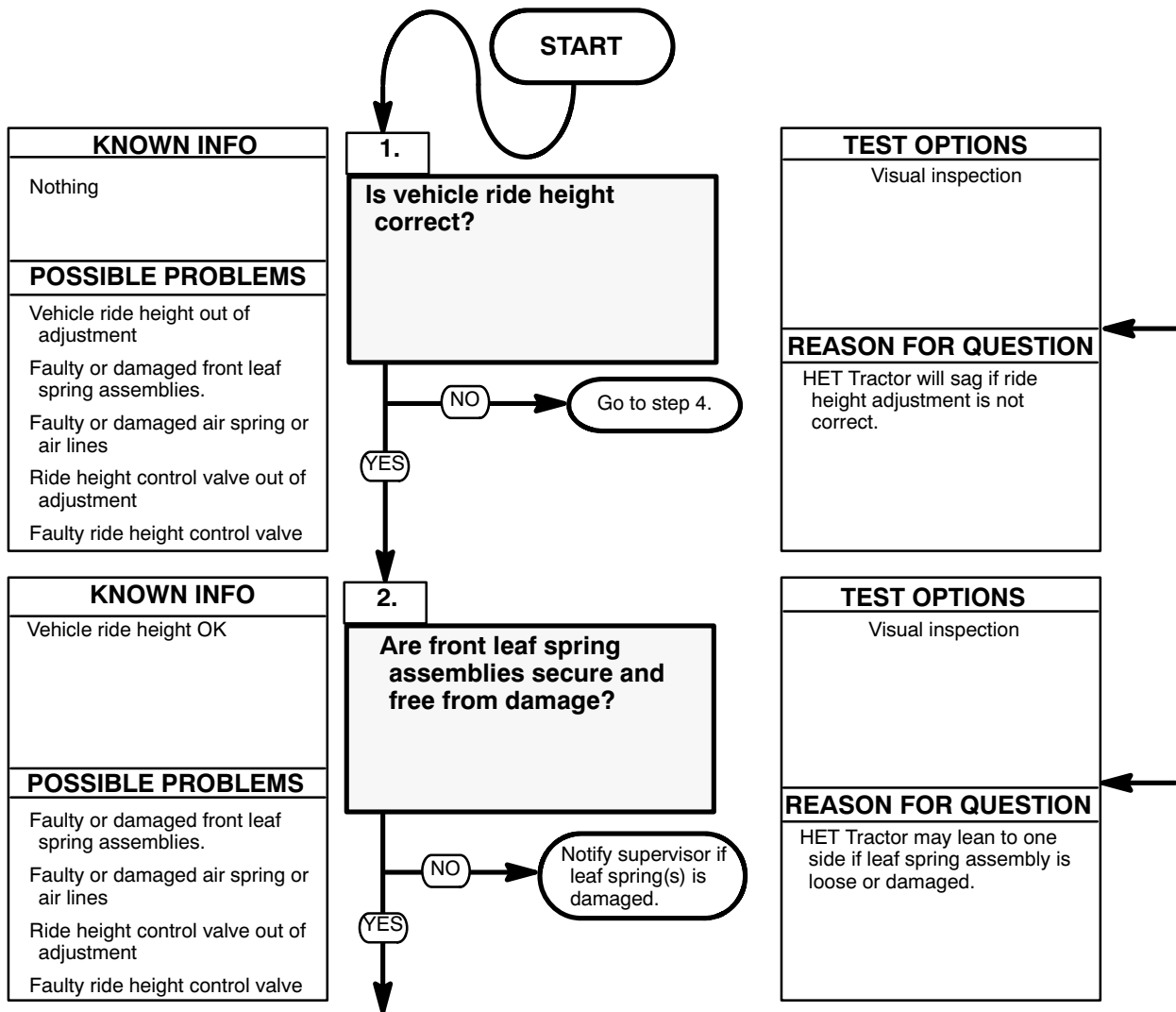
Check longitudinal torque rods for damage, and for loose or missing mounting hardware.

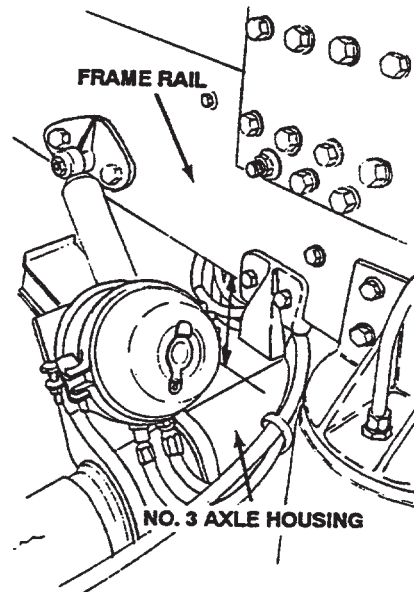


Check rear suspension arm for loose or damaged mounting hardware. Inspect suspension arm bushing for damage.

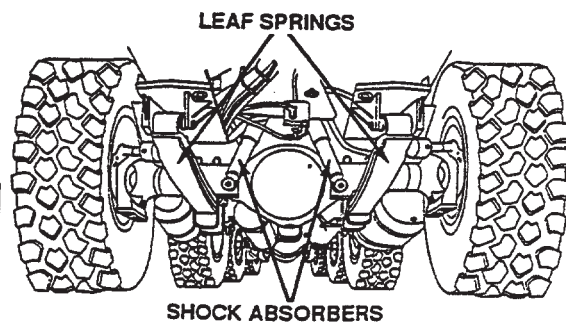
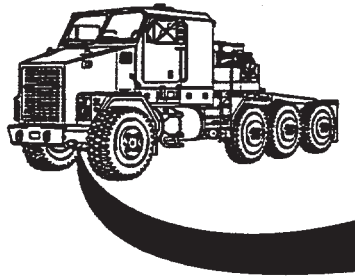


s2. LEANS TO ONE SIDE, OR REAR OF VEHICLE SAGS	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



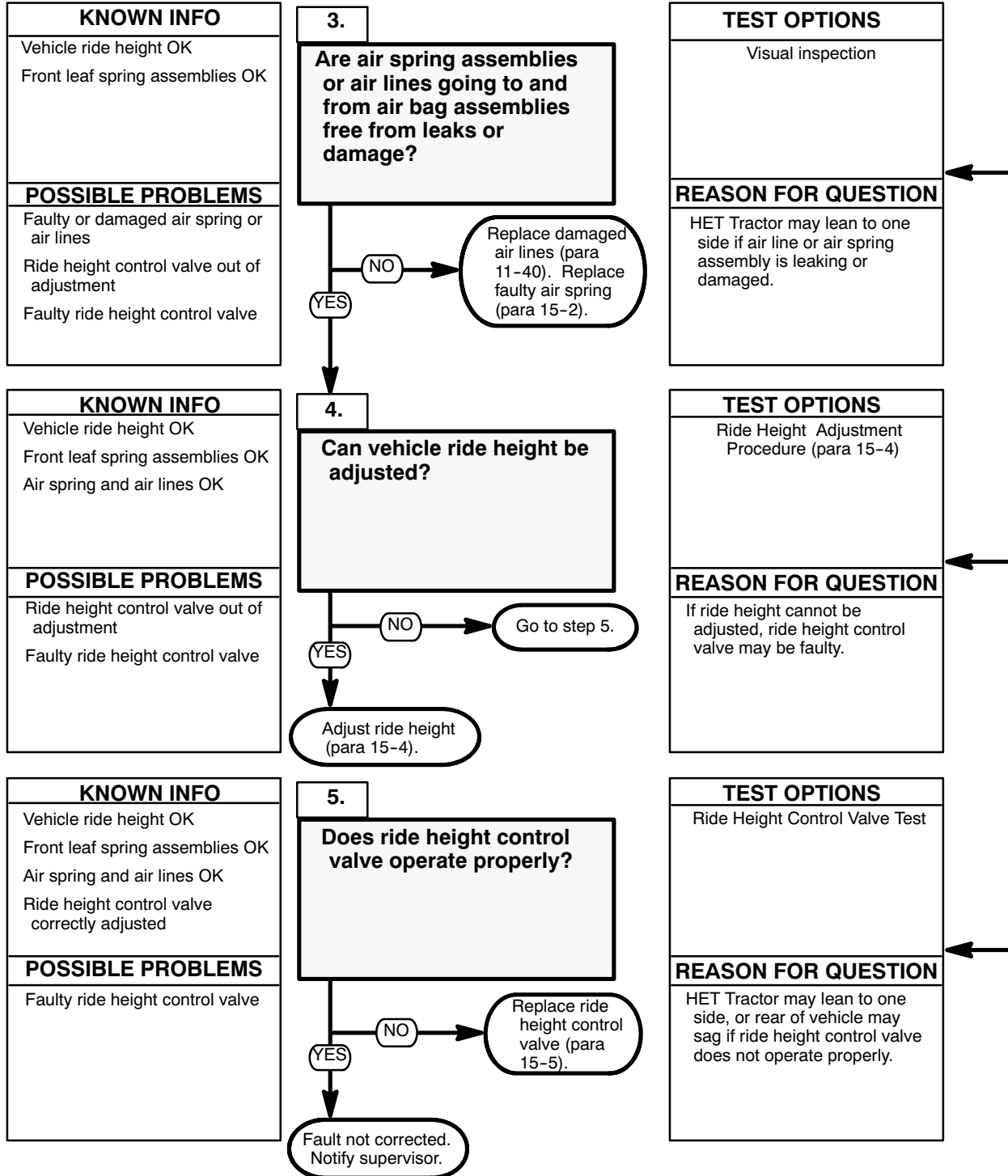


Measure distance from top of no. 3 axle housing to bottom of frame rail on left and right sides. Distance should be 9 in (22.9 cm) on both sides.



Check leaf springs for cracked or broken leaves or missing spring clips. Check shock absorbers for damage or leaks, and for missing mounting hardware.

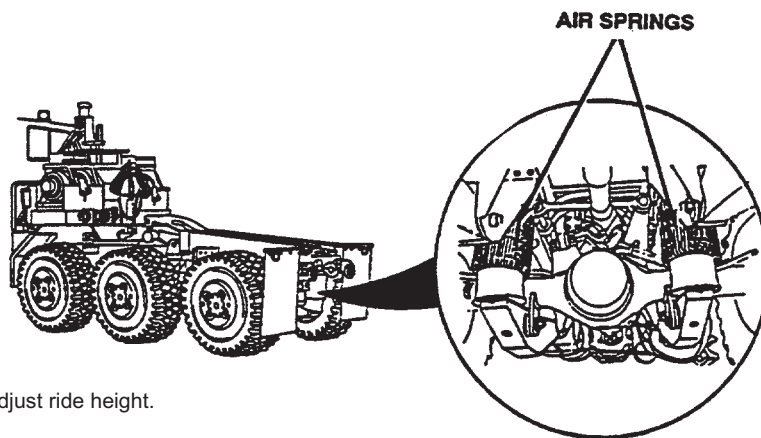
s2. LEANS TO ONE SIDE, OR REAR OF VEHICLE SAGS (CONT)



WARNING

Wear safety goggles when performing leakage tests on valves and air hoses. Failure to comply may cause serious eye injury due to high air pressure.

Check air springs for leaks, and for missing mounting hardware. Inspect no. 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, and 2050 air lines going to and from air spring assemblies for loose connections and damage.



Refer to para 15-4 to adjust ride height.

RIDE HEIGHT CONTROL VALVE TEST

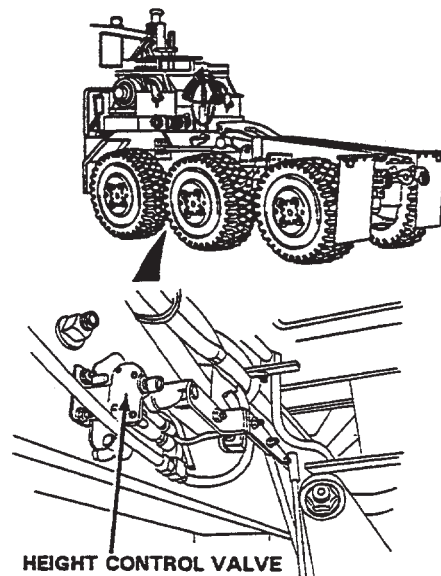
- (1) Start engine (TM 9-2320-360-10) and allow air pressure to build up in air reservoirs. Shut off engine (TM 9-2320-360-10) when air pressure has built up to at least 65 psi (450 kPa).

- (2) Remove screw, washer, and locknut from valve lever arm. Discard locknut.

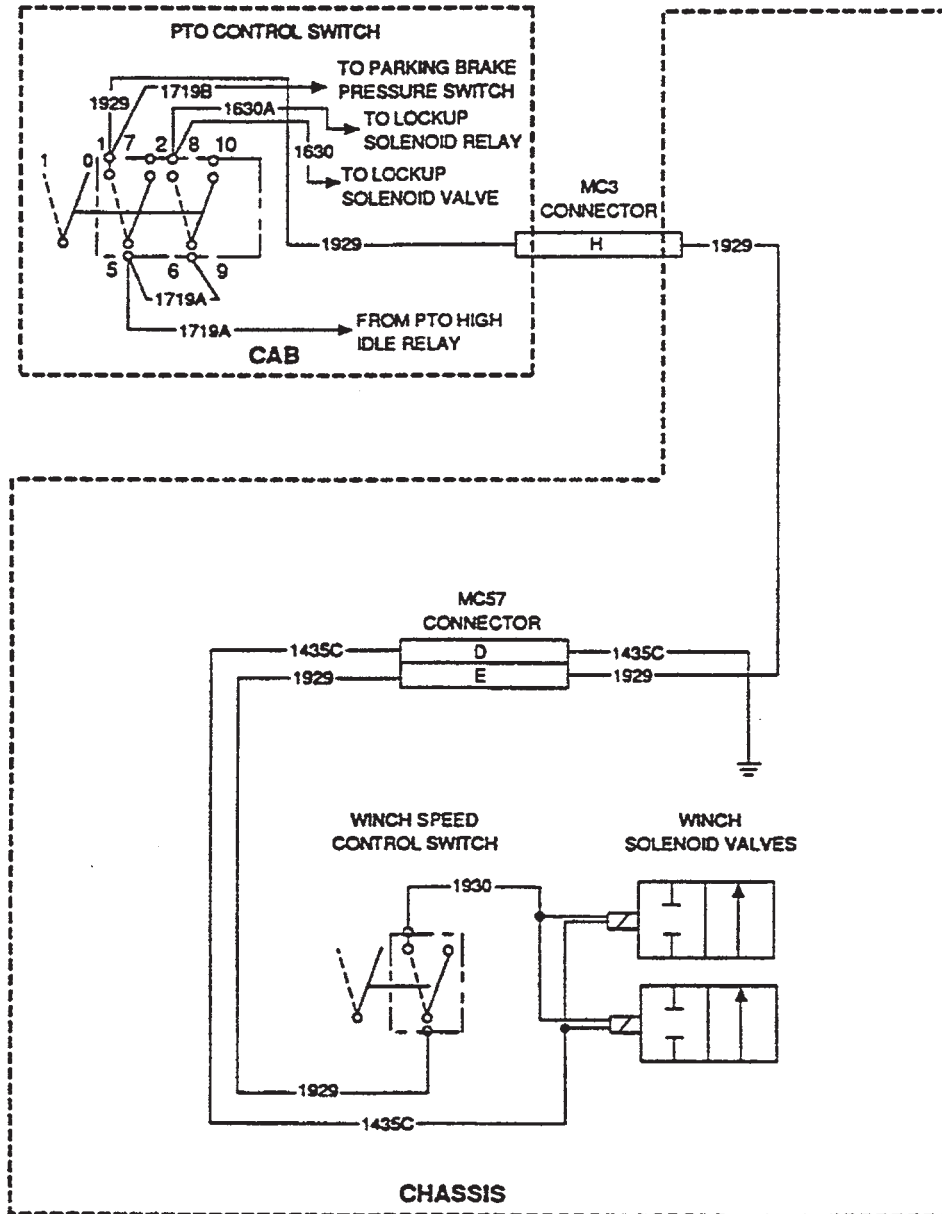
NOTE

Moving height control valve more than 1 inch in either direction will shut off air supply.

- (3) Pull up on height control valve. Air should flow into air springs.
- (4) Push down on height control valve. Air should exhaust from air springs.
- (5) Return height control valve to neutral position. Air should not flow into or out of air springs.
- (6) Replace height control valve (para 15-5) if it does not operate properly. Install valve lever arm to height control valve with screw, washer, and new locknut if height control valve operates properly.



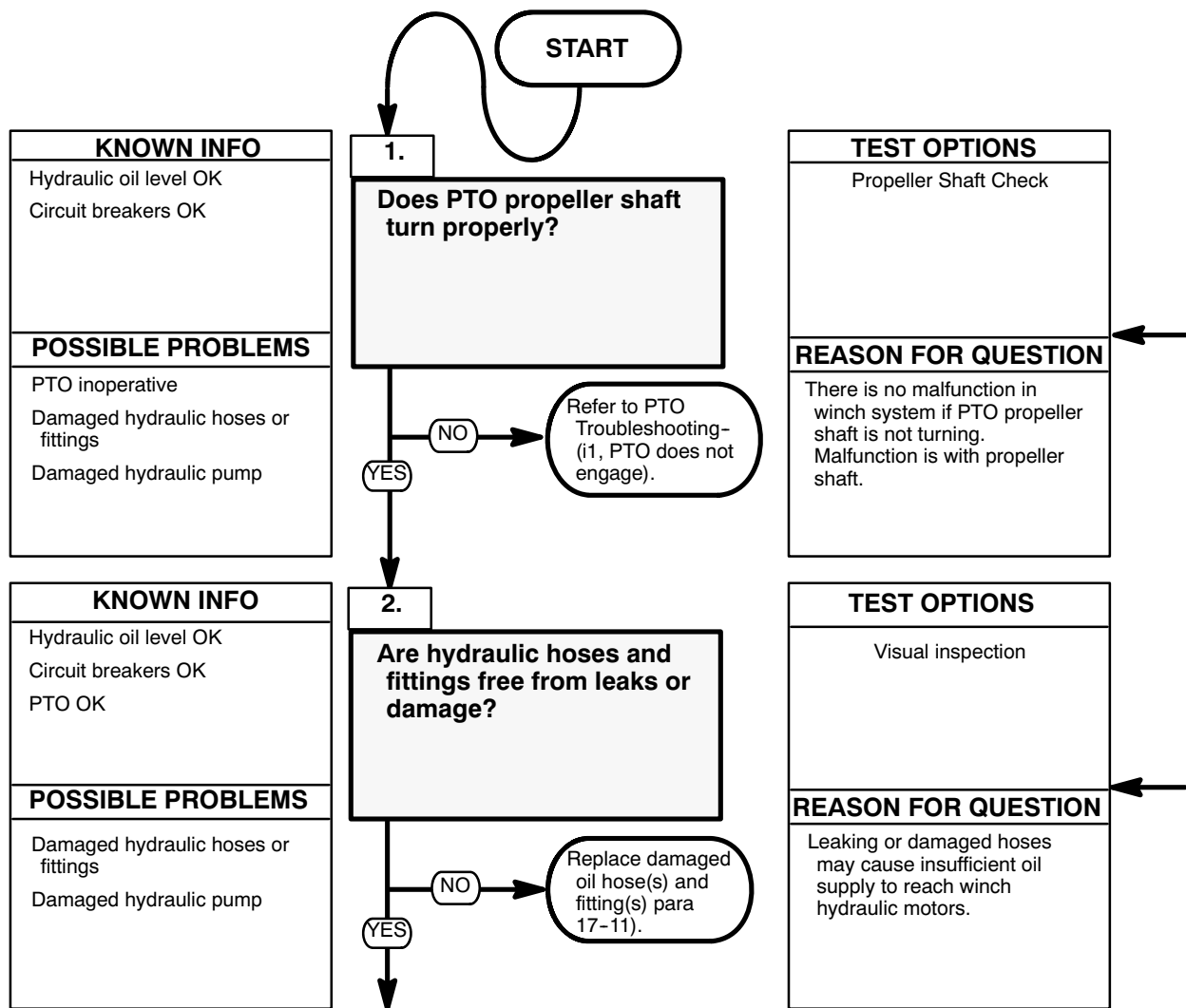
WINCH ELECTRIC CIRCUIT

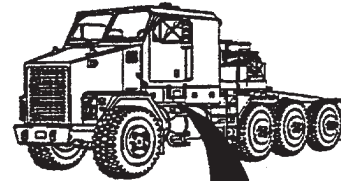


t. WINCH SYSTEM

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>t1. Both main winches and auxiliary winch do not operate</u>	2-940
<u>t2. One main winch does not operate in either direction</u>	2-944
<u>t3. Both main winches do not operate</u>	2-948
<u>t4. Auxiliary winch does not operate</u>	2-950
<u>t5. Cable hold down does not operate</u>	2-954
<u>t6. Main winch high speed will not work</u>	2-958
<u>t7. Engine does not operate at high idle when engine speed control switches are properly positioned</u>	2-962
<u>t8. Main winch or auxiliary winch makes excessive or unusual noise operates slowly, or jerks</u>	2-970
<u>t9. One main winch will not pull load</u>	2-974
<u>t10. One main winch will not pay out (using control valve)</u>	2-976

t1. BOTH MAIN WINCHES AND AUXILIARY WINCH DO NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)





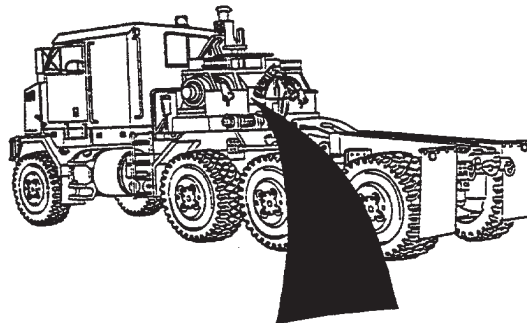
PROPELLER SHAFT

PTO PROPELLER SHAFT CHECK

- (1) Start engine and engage PTO (TM 9-2320-360-10).
- (2) Check if PTO propeller shaft is turning.

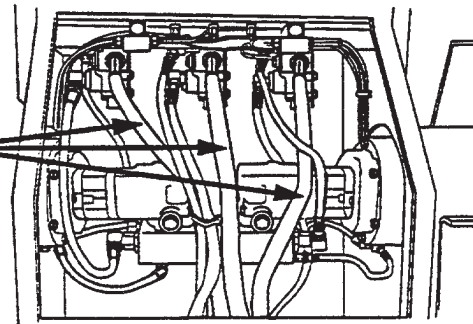
WARNING

Wear safety goggles when performing leakage tests on valves and hydraulic hoses. Failure to comply may cause serious eye injury due to high hydraulic pressure.

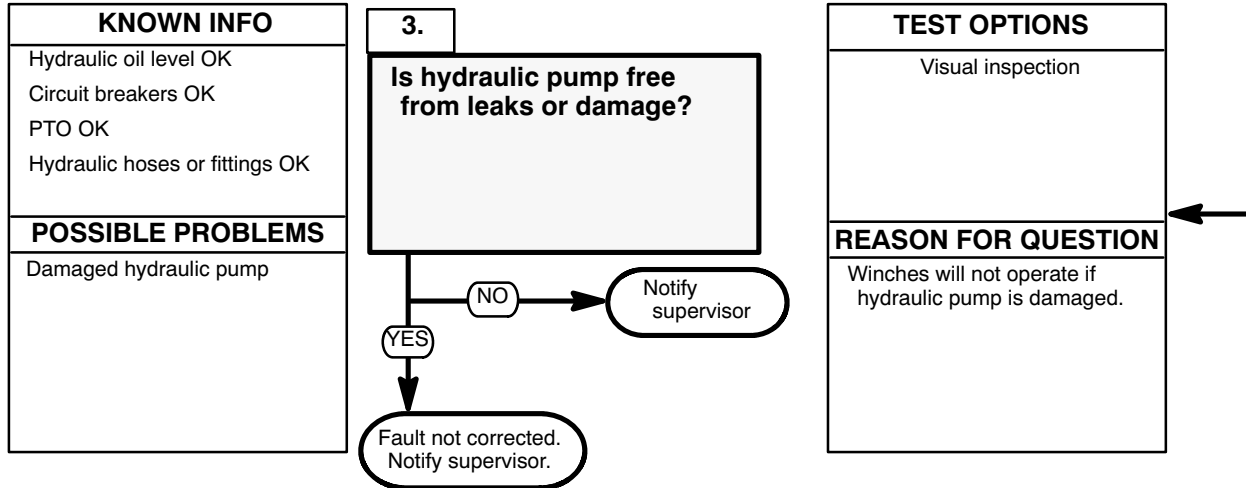


- (1) Remove control console panels (para 17-8).
- (2) Check hydraulic hoses and fittings for leakage or damage.

HOSES

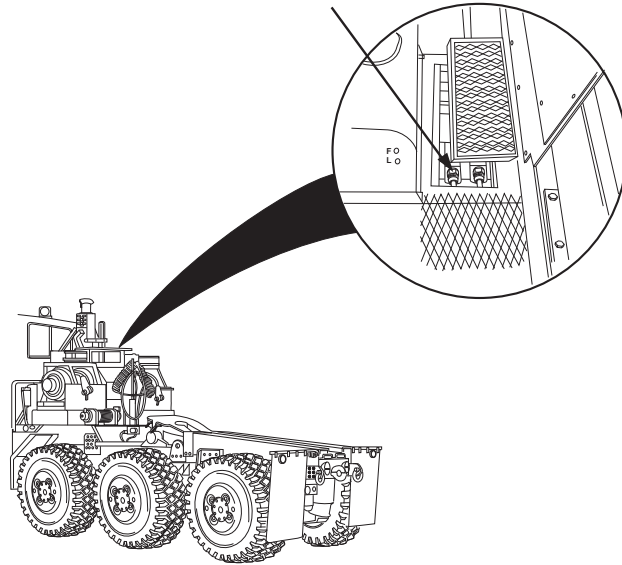


t1. BOTH MAIN WINCHES AND AUXILIARY WINCH DO NOT OPERATE (CONT)

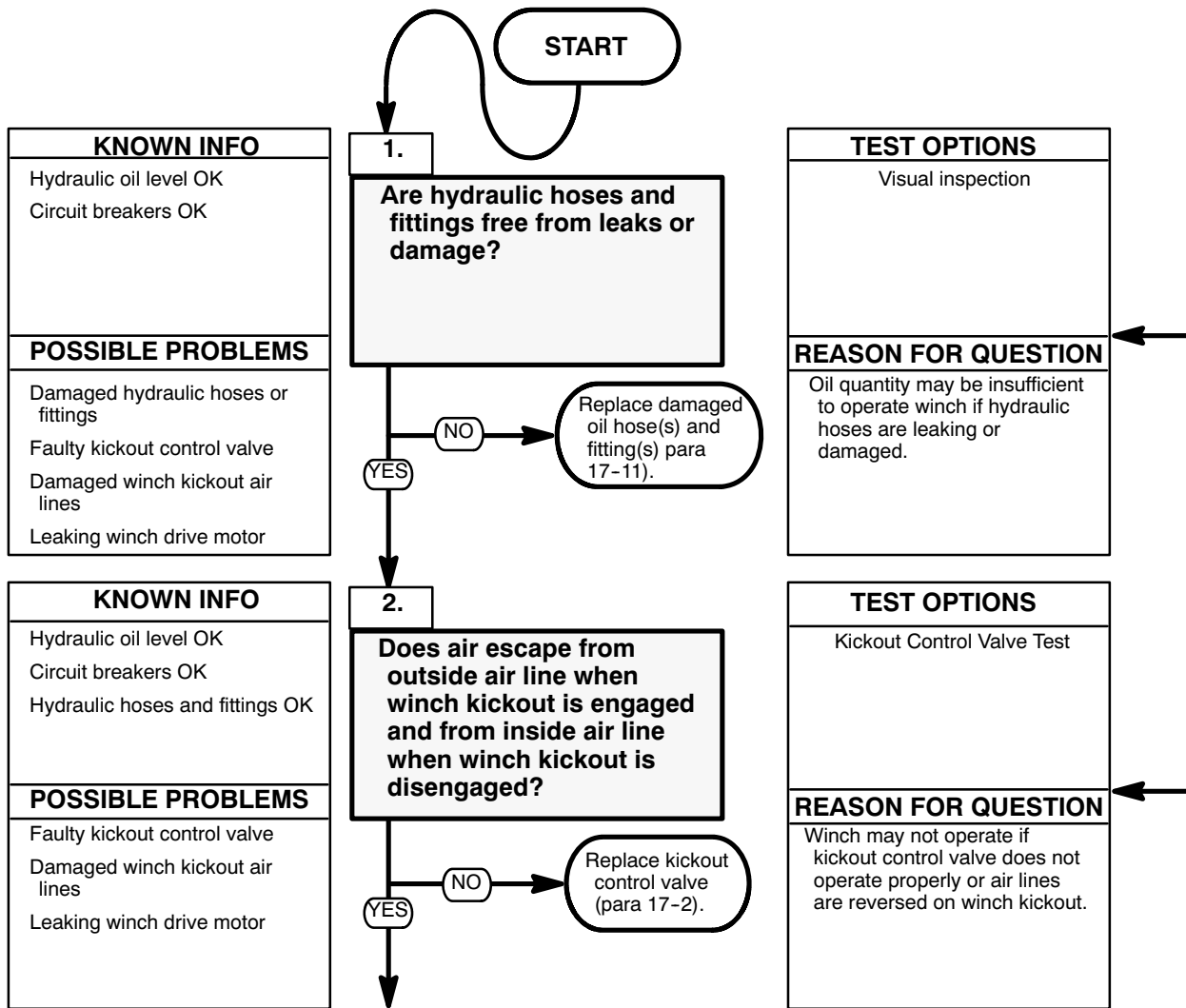


Check hydraulic pump for leakage or damage, and for loose or missing mounting hardware.

HYDRAULIC PUMP



t2. ONE MAIN WINCH DOES NOT OPERATE IN EITHER DIRECTION	
INITIAL SETUP	
<p>Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked. Control Console Panels Removed (para 17-8).</p>	<p>Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)</p> <p>Personnel Required Two</p>



WARNING

Wear safety goggles when performing leakage tests on valves and hoses. Failure to comply may cause serious eye injury due to high pressures.

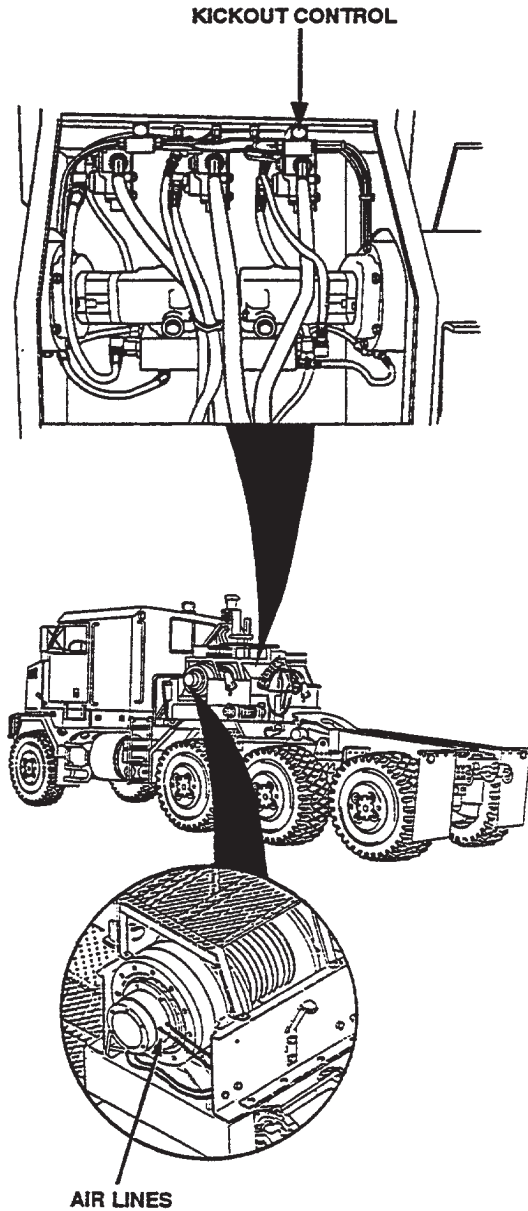
Check hydraulic hoses and fittings for leakage or damage.

KICKOUT CONTROL VALVE TEST

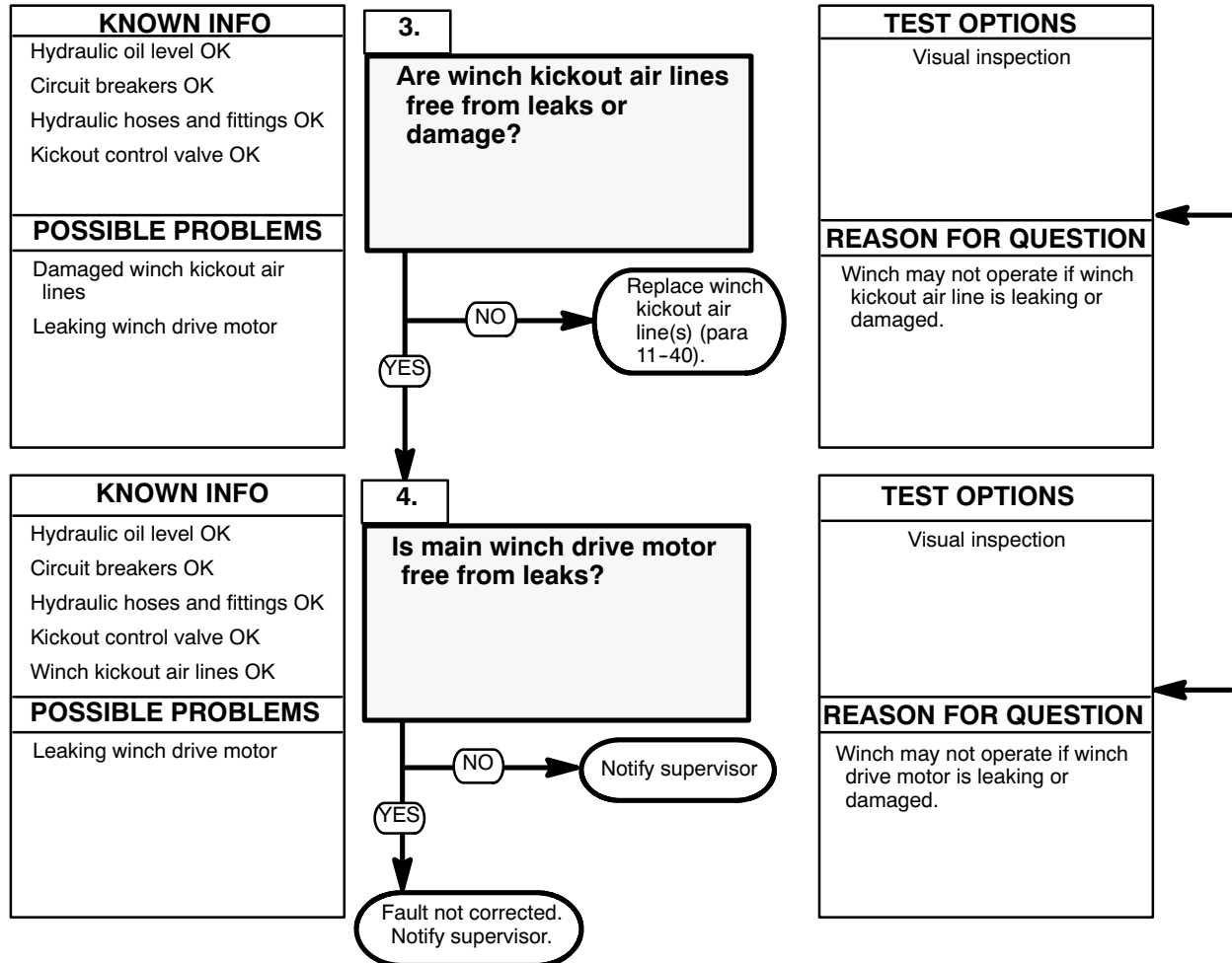
NOTE

AIR PRESS gage must read at least 65 psi (448 kPa) before winch kickouts will operate.

- (1) Start engine (TM 9-2320-360-10) and run until AIR PRESS gage indicates at least 65 psi (448 kPa).
- (2) Remove two air lines from winch kickout.
- (3) Engage winch kickout control. Air should escape from outside air line.
- (4) Disengage winch kickout control. Air should escape from inside air line.
- (5) Replace kickout control valve (para 17-2) if it does not operate properly.
- (6) Install two air lines on winch kickout if kickout control valve operates properly.



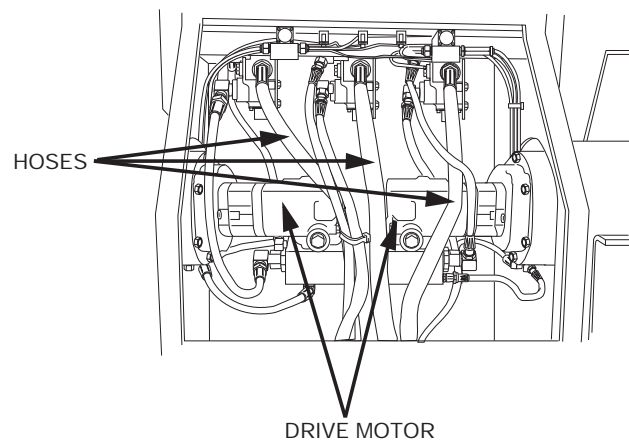
t2. ONE MAIN WINCH DOES NOT OPERATE IN EITHER DIRECTION (CONT)



WARNING

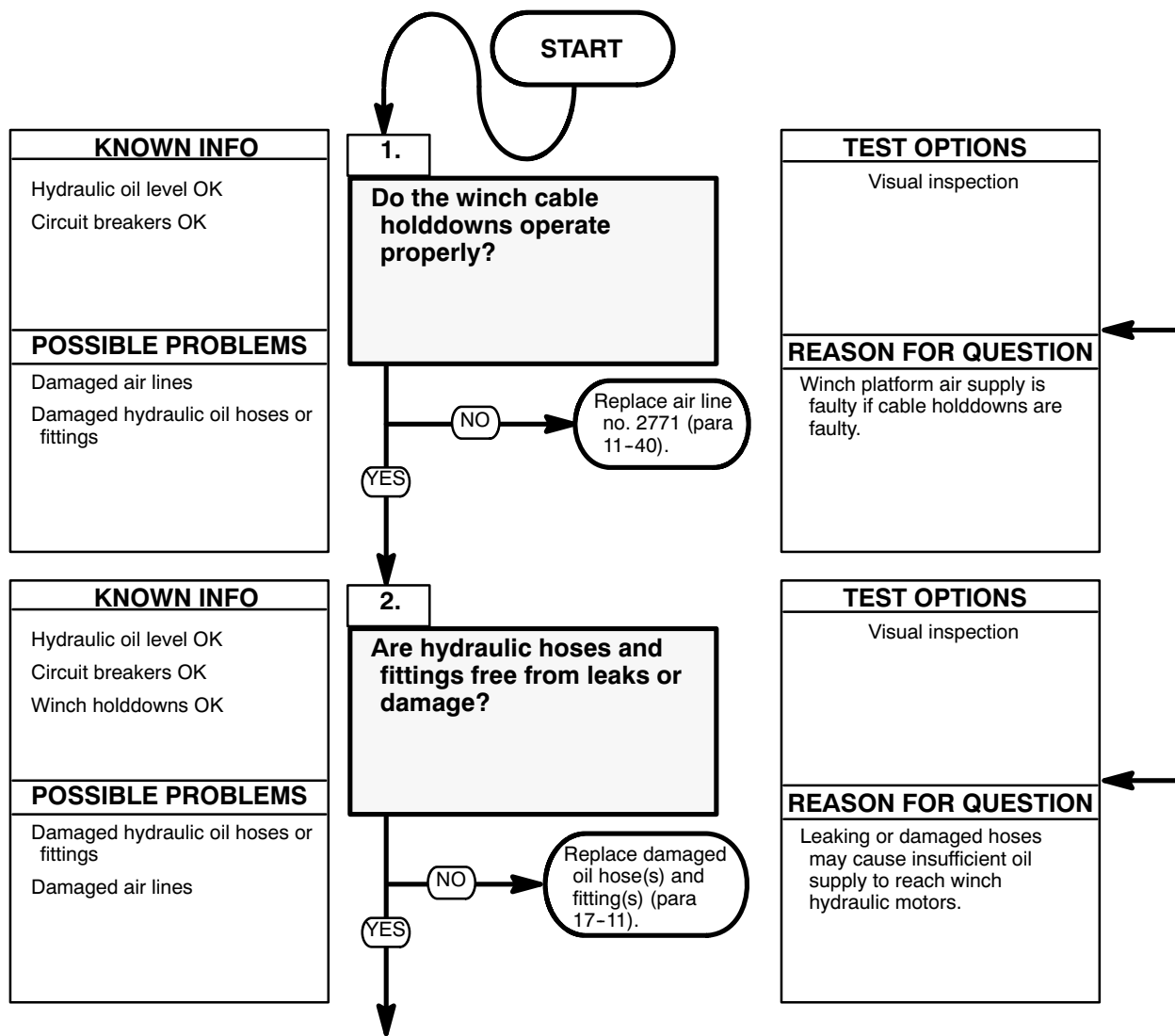
Wear safety goggles when performing leakage tests on valves and hoses. Failure to comply may cause serious eye injury due to high air pressure.

Check winch kickout air lines for leakage or damage.



Check main winch drive motor for leakage and damage, and for loose or missing mounting hardware.

t3. BOTH MAIN WINCHES DO NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions</p> <p>Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked. Control console panel removed (rear only) (para 17-8)</p>	<p>Tools and Special Tools</p> <p>Tool Kit, Genl Mech (Item 54, Appendix F)</p>

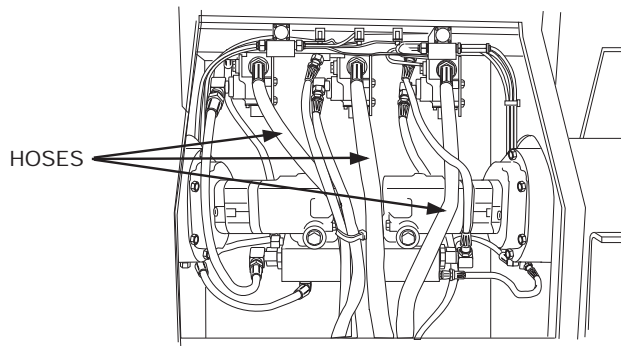
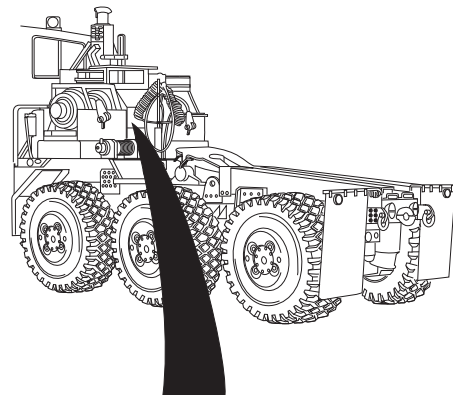
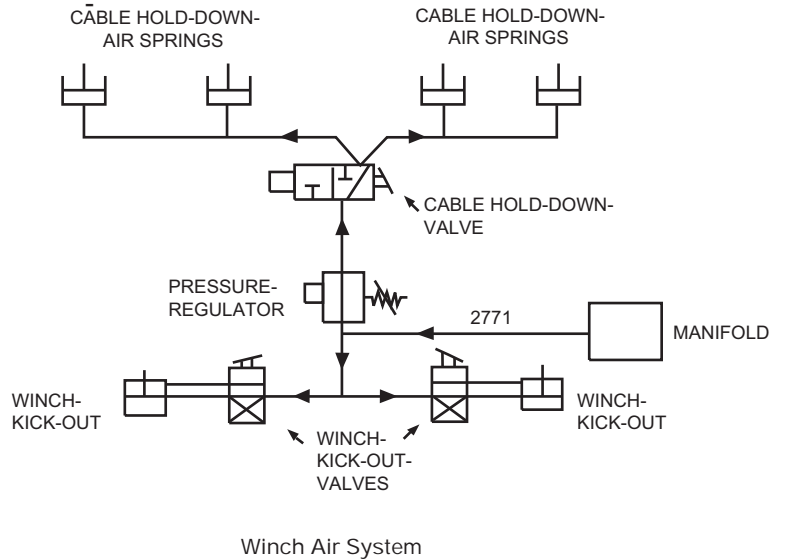


WARNING

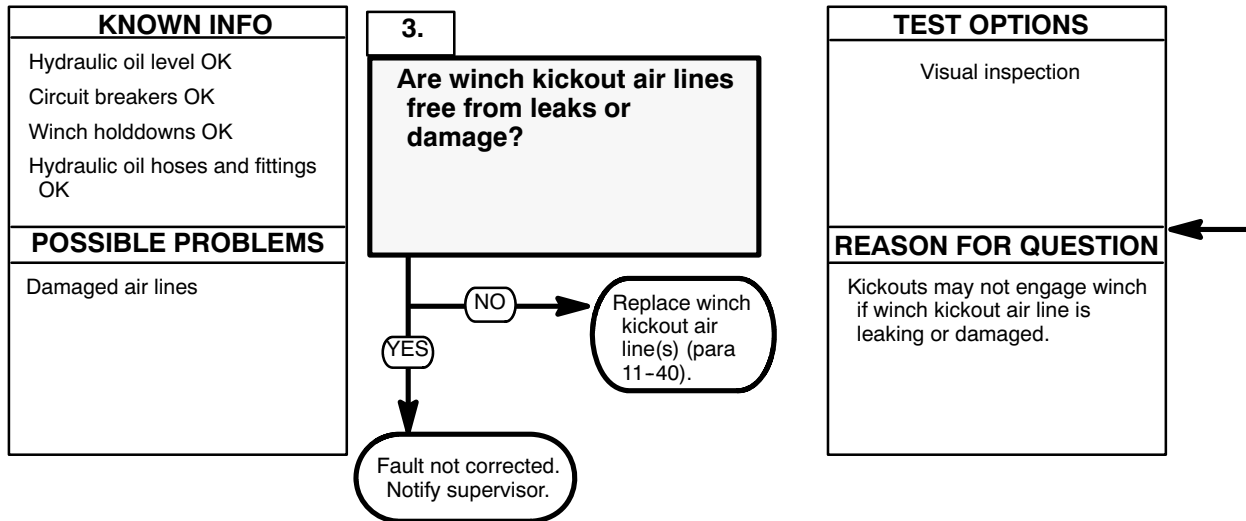
Wear safety goggles when performing leakage tests on valves and hydraulic hoses. Failure to comply may cause serious eye injury due to high hydraulic pressure.

Check air line no. 2771 from air manifold for leakage and damage.

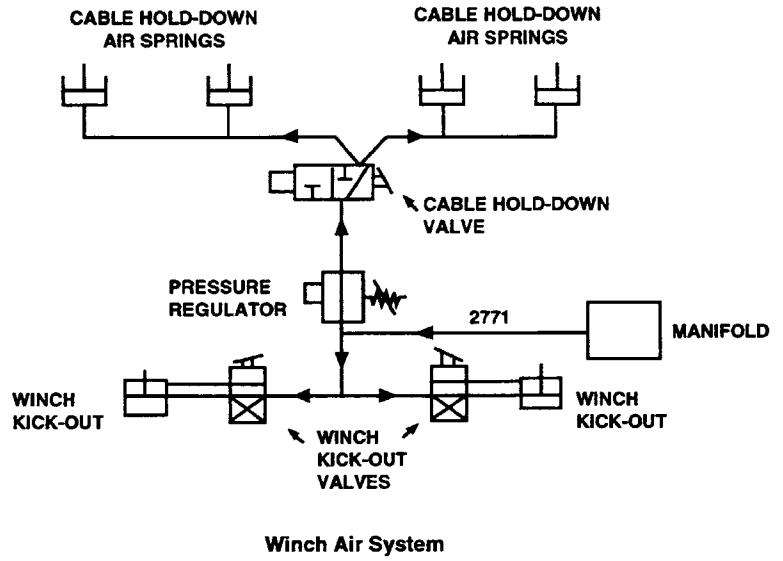
Check hydraulic hoses and fittings for leakage or damage.



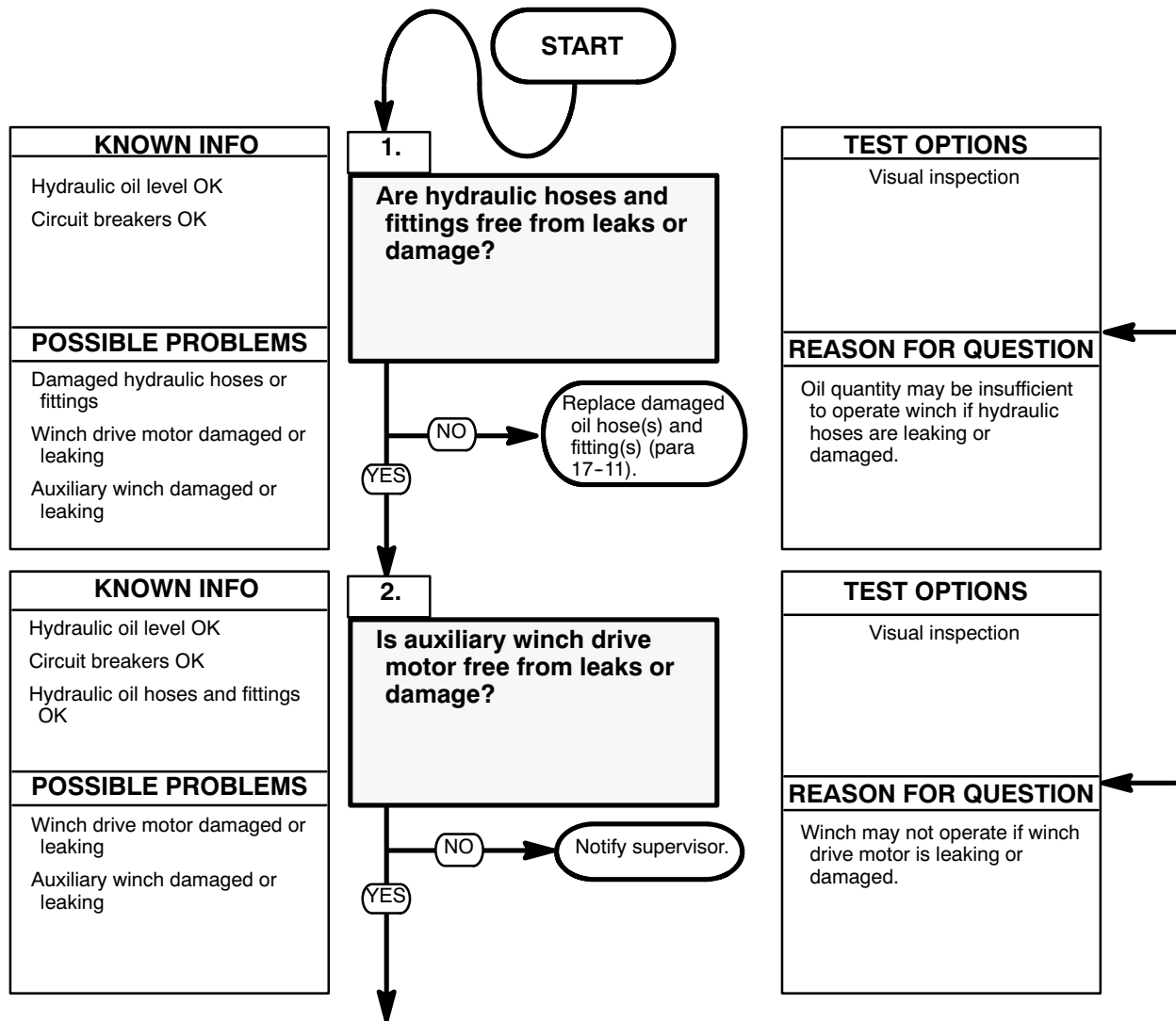
t3. BOTH MAIN WINCHES DO NOT OPERATE (CONT)



Check winch kickout air lines for leakage or damage.



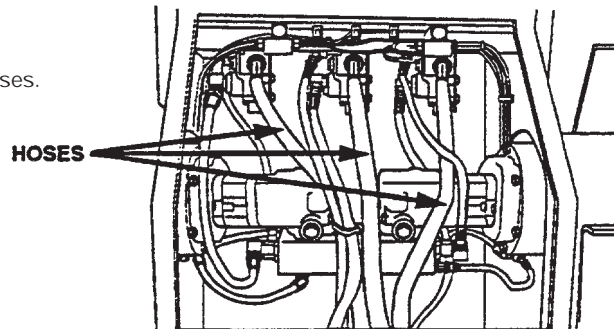
t4. AUXILIARY WINCH DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked. Control console panel removed (rear only) (para 17-8)	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



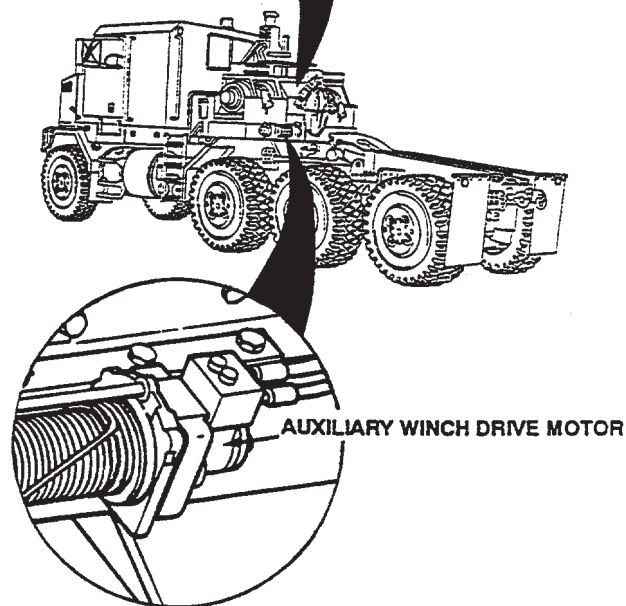
WARNING

Wear safety goggles when performing leakage tests on valves and hydraulic hoses. Failure to comply may cause serious eye injury due to high hydraulic pressure.

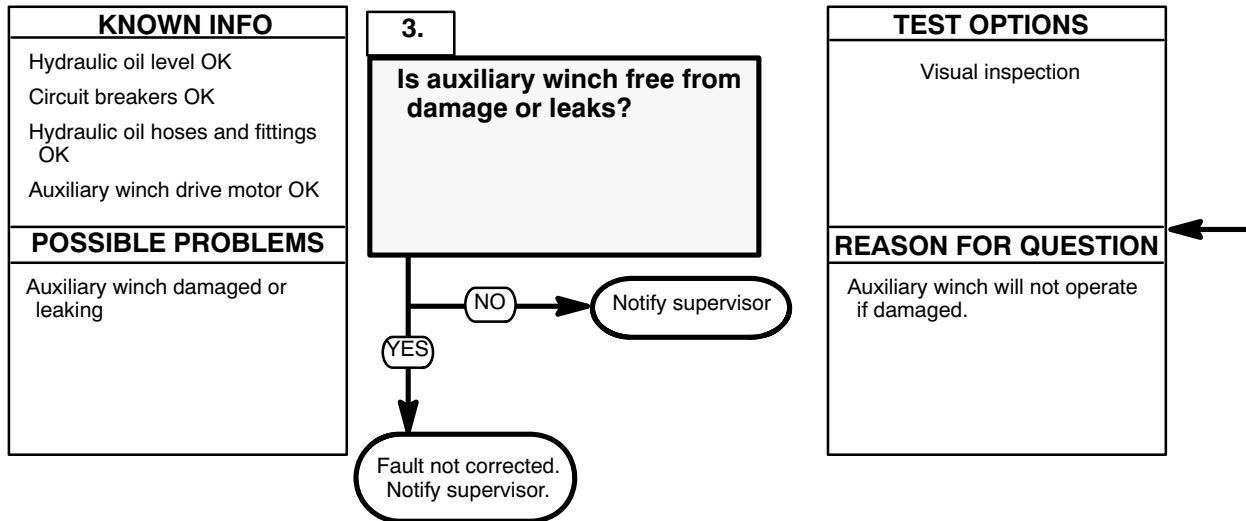
Check hydraulic hoses and fittings for leakage or damage.



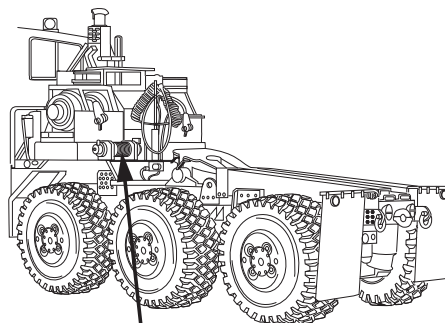
Check auxiliary winch drive motor for leakage or damage, and for loose or missing mounting hardware.



t4. AUXILIARY WINCH DOES NOT OPERATE (CONT)

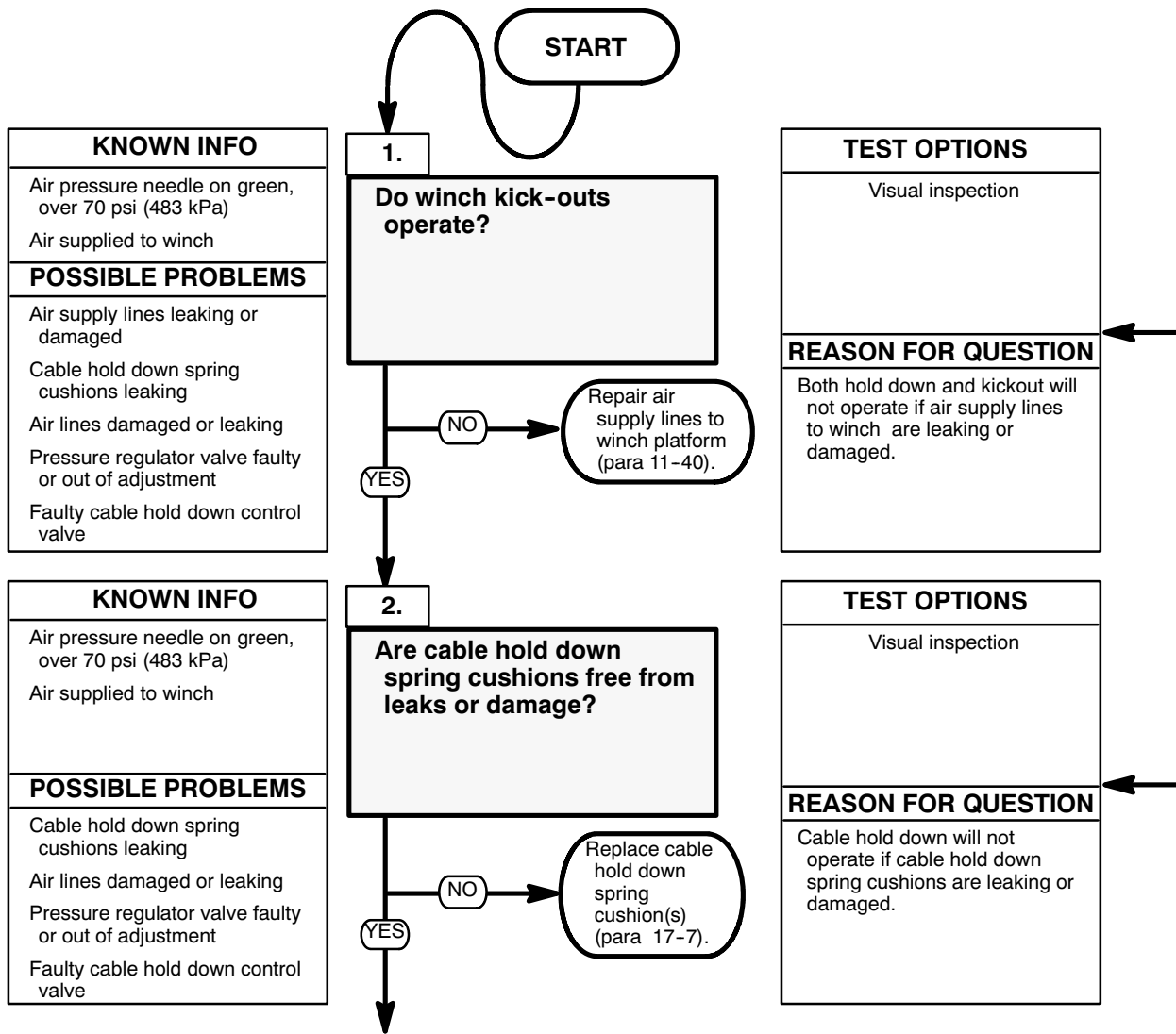


Check auxiliary winch for damage, and for loose or missing mounting hardware.



AUXILIARY WINCH

t5. CABLE HOLD DOWN DOES NOT OPERATE	
INITIAL SETUP	
<p>Equipment Conditions</p> <p>Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked. Control console panel removed (rear only) (para 17-8).</p>	<p>Tools and Special Tools</p> <p>Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F)</p>



WARNING

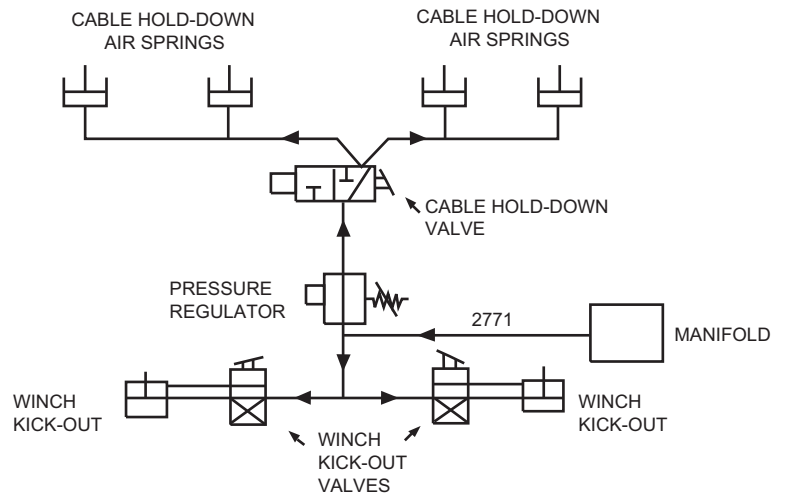
Wear safety goggles when performing leakage tests on valves and air hoses. Failure to comply may cause serious eye injury due to high air pressure.

Operate winch kickouts (TM 9-2320-360-10). If kickouts do not function, check air line no. 2771 from winch hold downs to air manifold for leakage and damage.

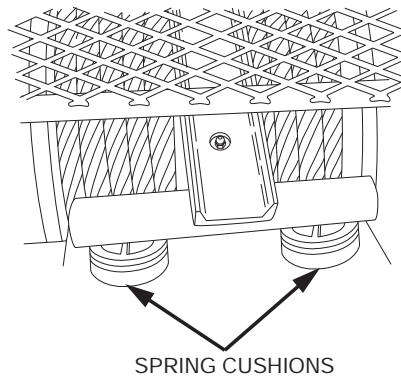
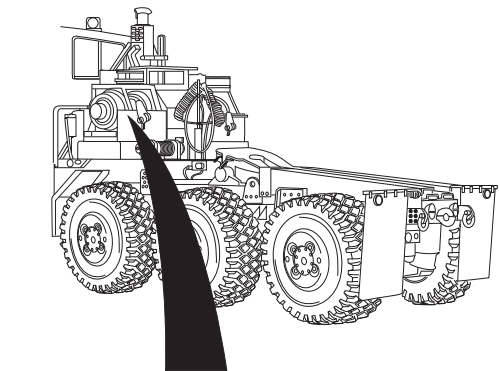
NOTE

AIR PRESS gage must read at least 70 psi (483 kPa) for cable hold down to operate.

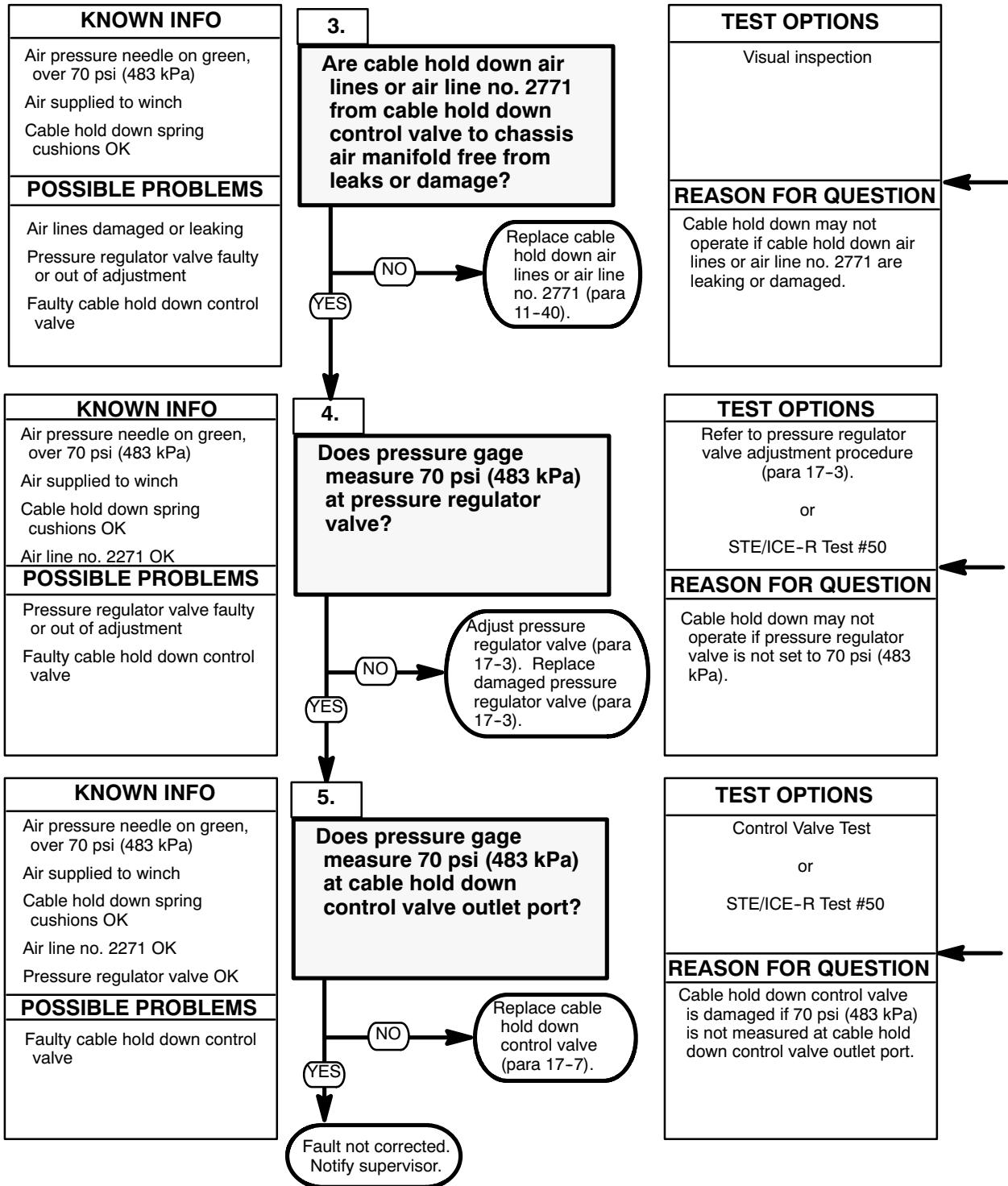
Check cable hold down spring cushions for leakage or damage.



Winch Air System



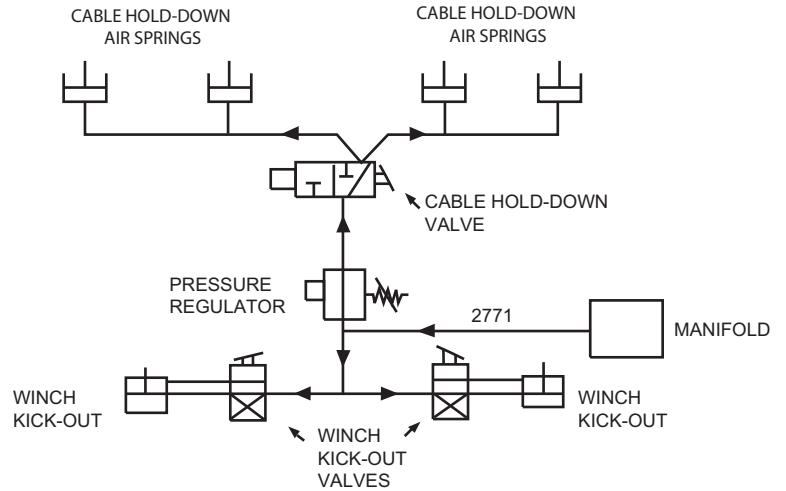
15. CABLE HOLD DOWN DOES NOT OPERATE (CONT)



WARNING

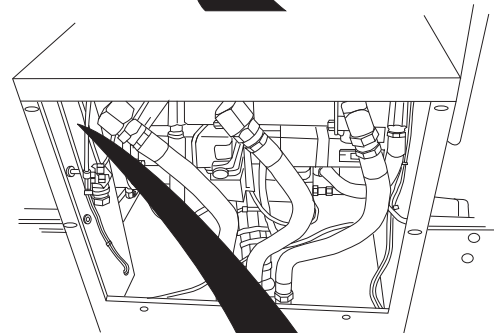
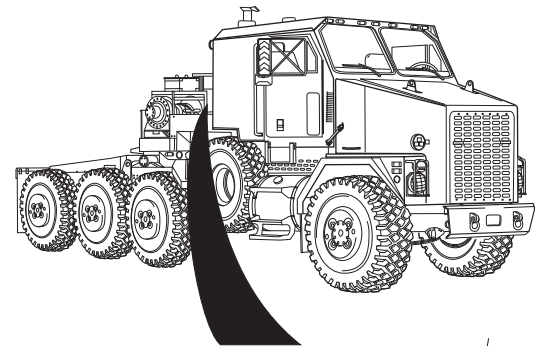
Wear safety goggles when performing leakage tests on valves and air hoses. Failure to comply may cause serious eye injury due to high air pressure.

Check cable hold down air lines and air line no. 2771 from cable hold down to air manifold for leakage or damage.



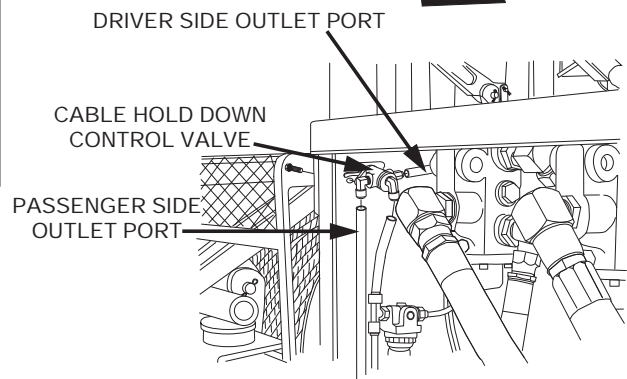
Winch Air System

Refer to para 17-3 to adjust pressure regulator valve.

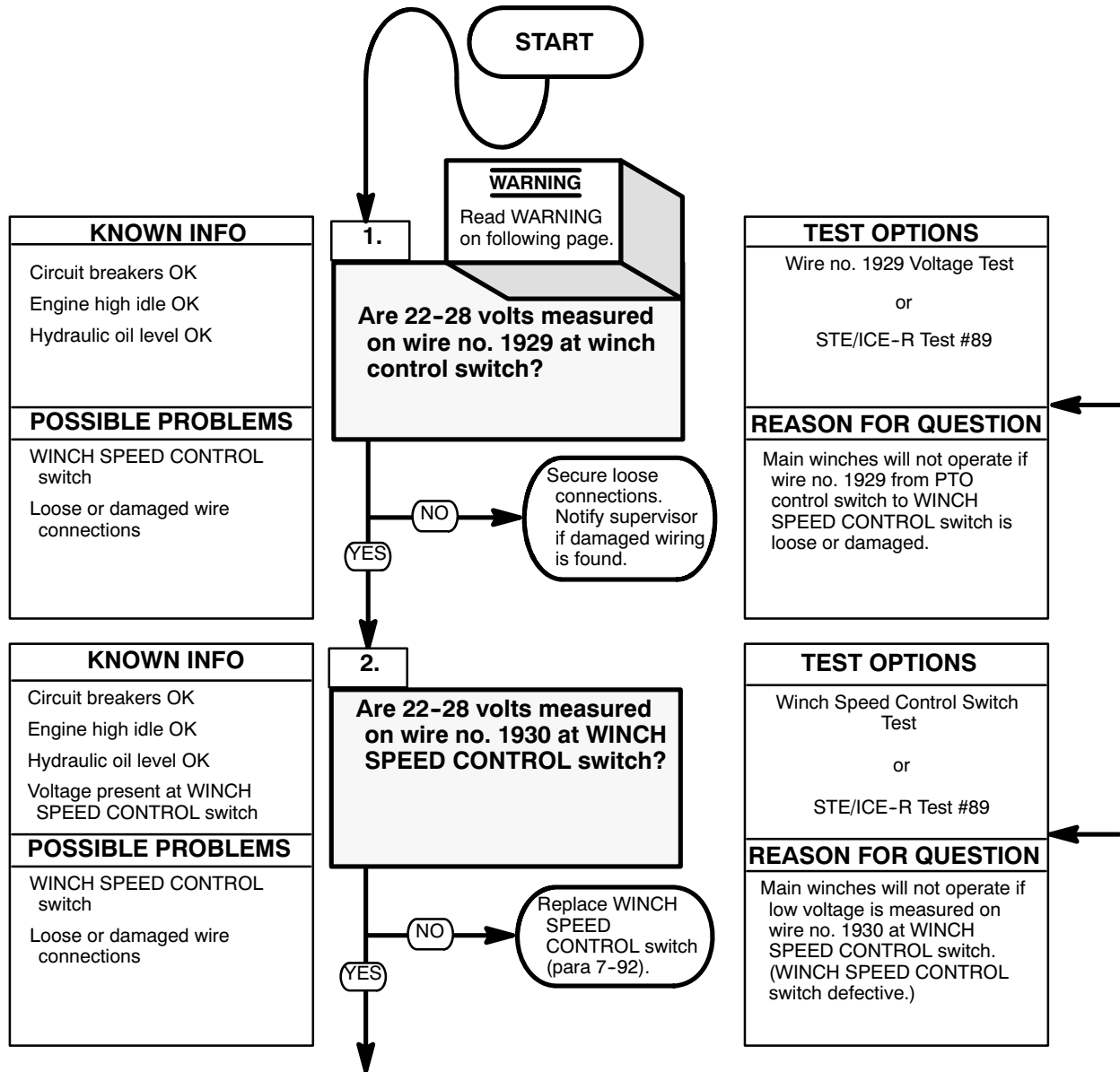


CONTROL VALVE TEST

- (1) Start engine (TM 9-2320-360-10) and run until AIR PRESS gage indicates at least 70 psi (483 kPa).
- (2) Remove air line from cable hold down control valve outlet port.
- (3) Connect pressure gage to cable hold down control valve outlet port.
- (4) Position CABLE HOLD DOWN control to ON (TM 9-2320-360-10) and check reading on pressure gage. Pressure gage should read 70 psi (483 kPa).
- (5) Replace cable hold down control valve (para 17-7) if pressure gage does not read 70 psi (483 kPa).
- (6) Install air line on cable hold down control valve outlet port if it operates properly.



t6. MAIN WINCHES WILL ONLY OPERATE IN ONE SPEED	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F) Multimeter (Item 20, Appendix F)



WARNING

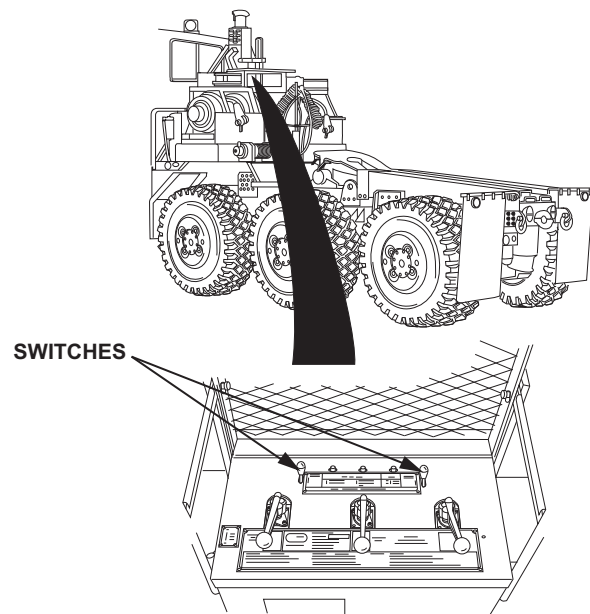
- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

Engine must be running and PTO control switch placed in the on position to perform this step.

WIRE NO. 1929 VOLTAGE TEST

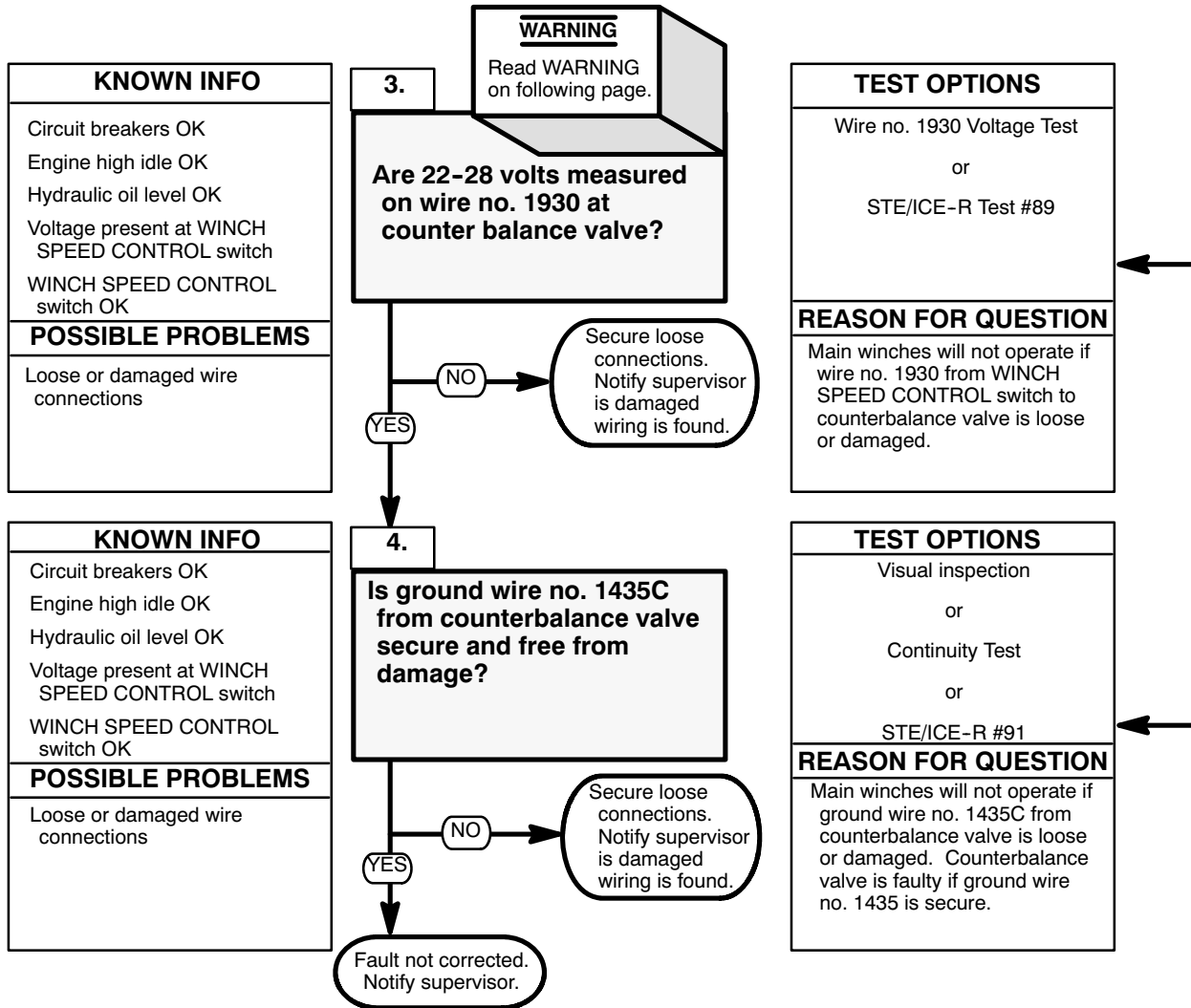
- (1) Place positive (+) probe of multimeter on wire no. 1929 at WINCH SPEED CONTROL switch.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.



WINCH SPEED CONTROL SWITCH TEST

- (1) Position WINCH SPEED CONTROL switch to HIGH.
- (2) Place positive (+) probe of multimeter on wire no. 1930 at WINCH SPEED CONTROL switch.
- (3) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (4) Replace WINCH SPEED CONTROL switch (para 7-92) if no voltage is measured.

t6. MAIN WINCHES WILL ONLY OPERATE IN ONE SPEED (CONT)

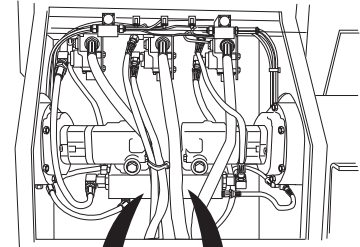
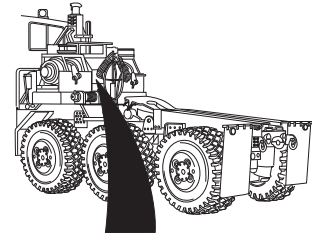


WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

WIRE NO. 1930 VOLTAGE TEST

- (1) Place positive (+) probe of multimeter on wire no. 1930 at counterbalance valve.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.



Check ground wire no. 1435 from counterbalance valve for loose connections, damage, and continuity.

CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

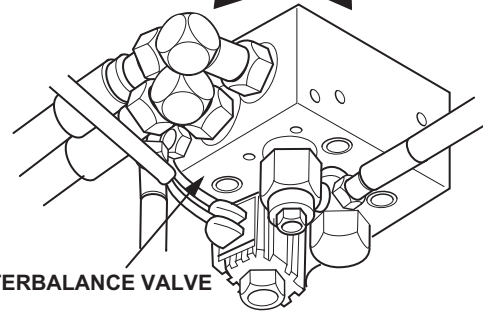
A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

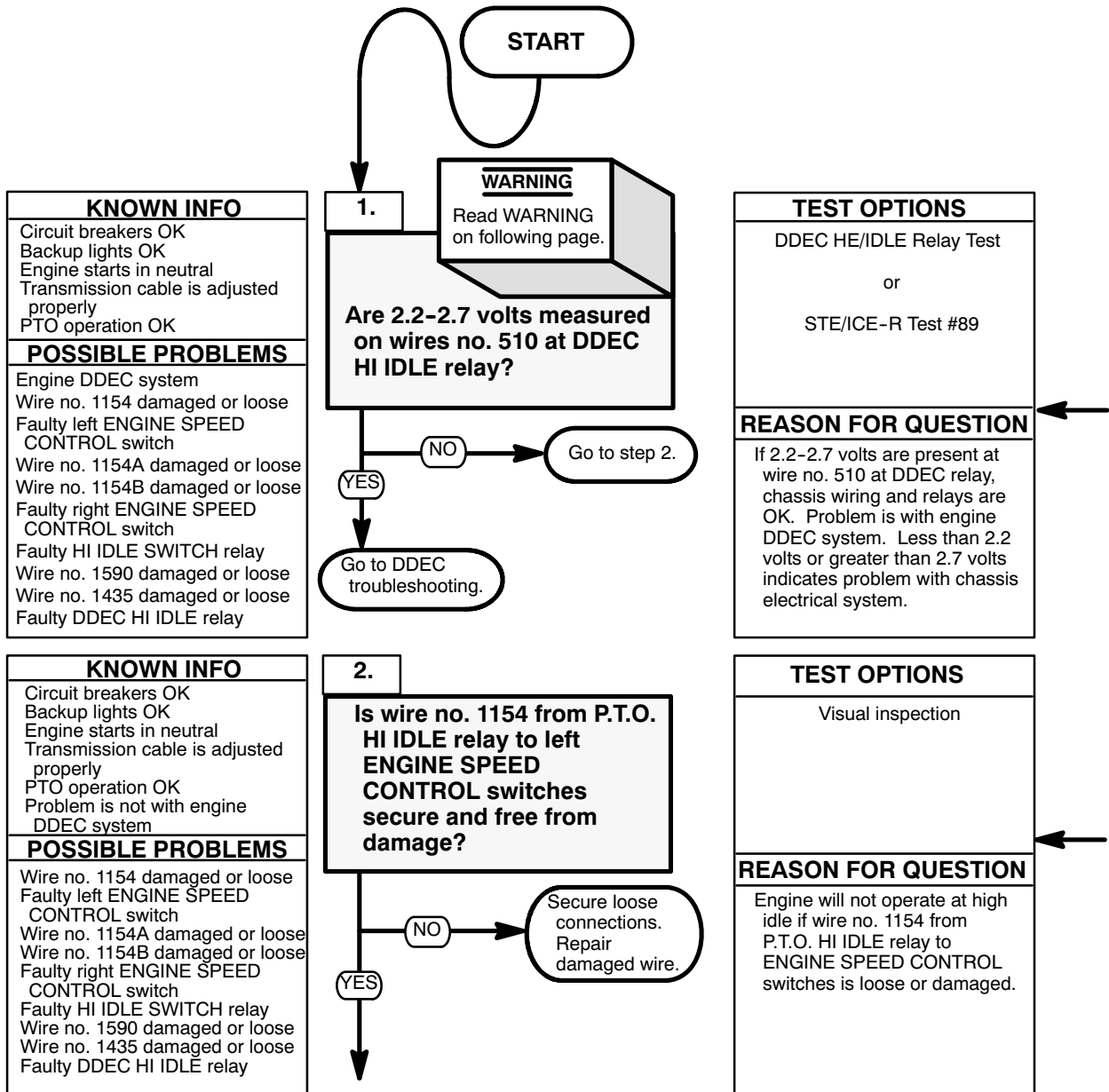
A reading of other than infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.



COUNTERBALANCE VALVE

t7. ENGINE DOES NOT OPERATE AT HIGH IDLE WHEN ENGINE SPEED CONTROL SWITCHES ARE PROPERLY POSITIONED	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F) Multimeter (Item 20, Appendix F)

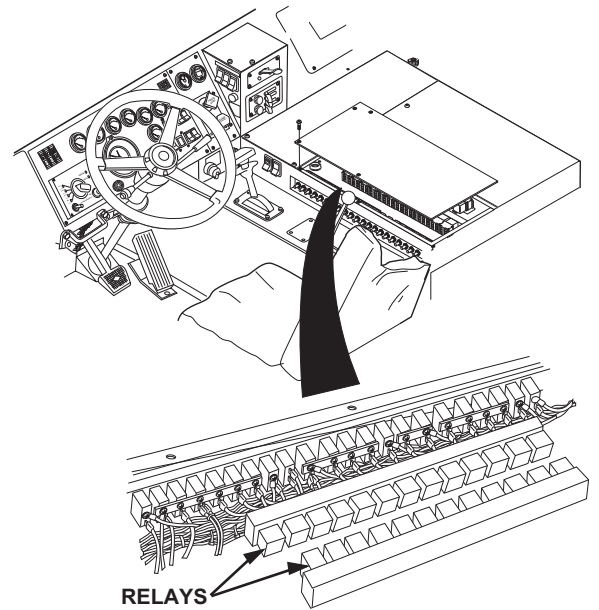


WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

NOTE

If voltage on wire no. 510 exceeds 4.7 volts for more than 2 seconds, DDEC will log Code 12.



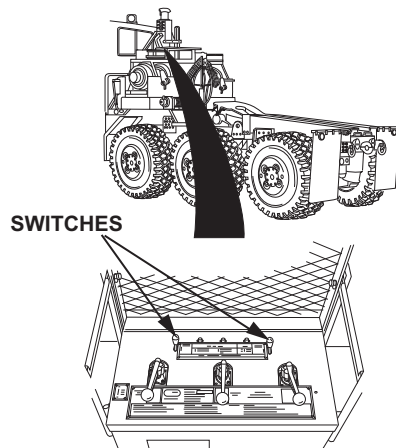
DDEC HI/IDLE RELAY TEST

NOTE

Engine must be running, PTO control switch placed in the on position, and engine speed control switches in the HIGH position to perform this test.

- (1) Place positive (+) probe of multimeter on wire no. 510 at DDEC HI IDLE relay.
- (2) Place negative (-) probe of multimeter on ground and look for voltage on multimeter.

Check wire no. 1154 from P.T.O. HI IDLE relay to ENGINE SPEED CONTROL switches for loose connections, damage, and continuity test.



CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

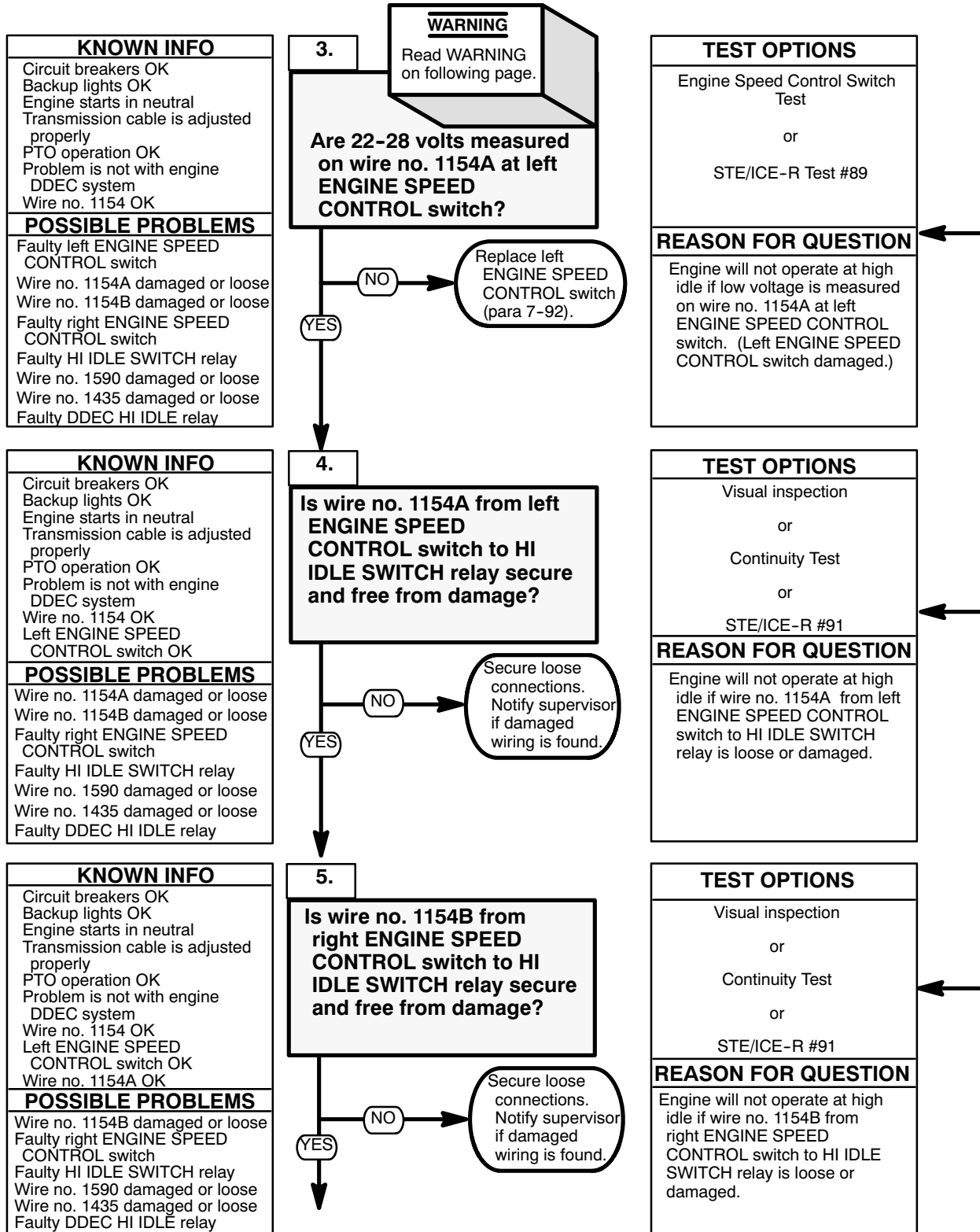
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

A reading of other than infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

17. ENGINE DOES NOT OPERATE AT HIGH IDLE WHEN ENGINE SPEED CONTROL SWITCHES ARE PROPERLY POSITIONED (CONT)



WARNING

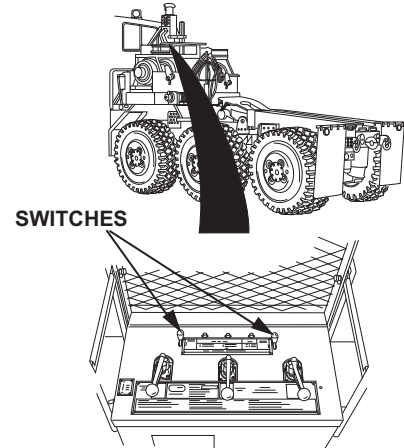
- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

ENGINE SPEED CONTROL SWITCH TEST

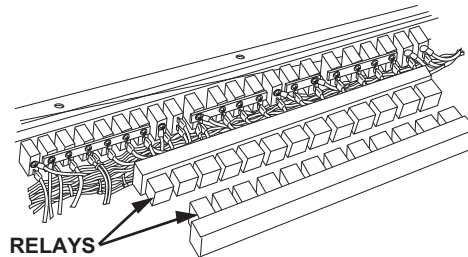
NOTE

Engine must be running, PTO control switch placed in the on position, and engine speed control switches in the HIGH position to perform this test.

- (1) Place positive (+) probe of multimeter on wire no. 1154A at left ENGINE SPEED CONTROL switch.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (3) Replace left ENGINE SPEED CONTROL switch (para 7-92) if no voltage is measured.



Check wire no. 1154A from left ENGINE SPEED CONTROL switch to HI IDLE SWITCH relay for loose connections, damage, and continuity test.



Check wire no. 1154B from right ENGINE SPEED CONTROL switch to HI IDLE SWITCH relay for loose connections, damage, and continuity.

CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit..

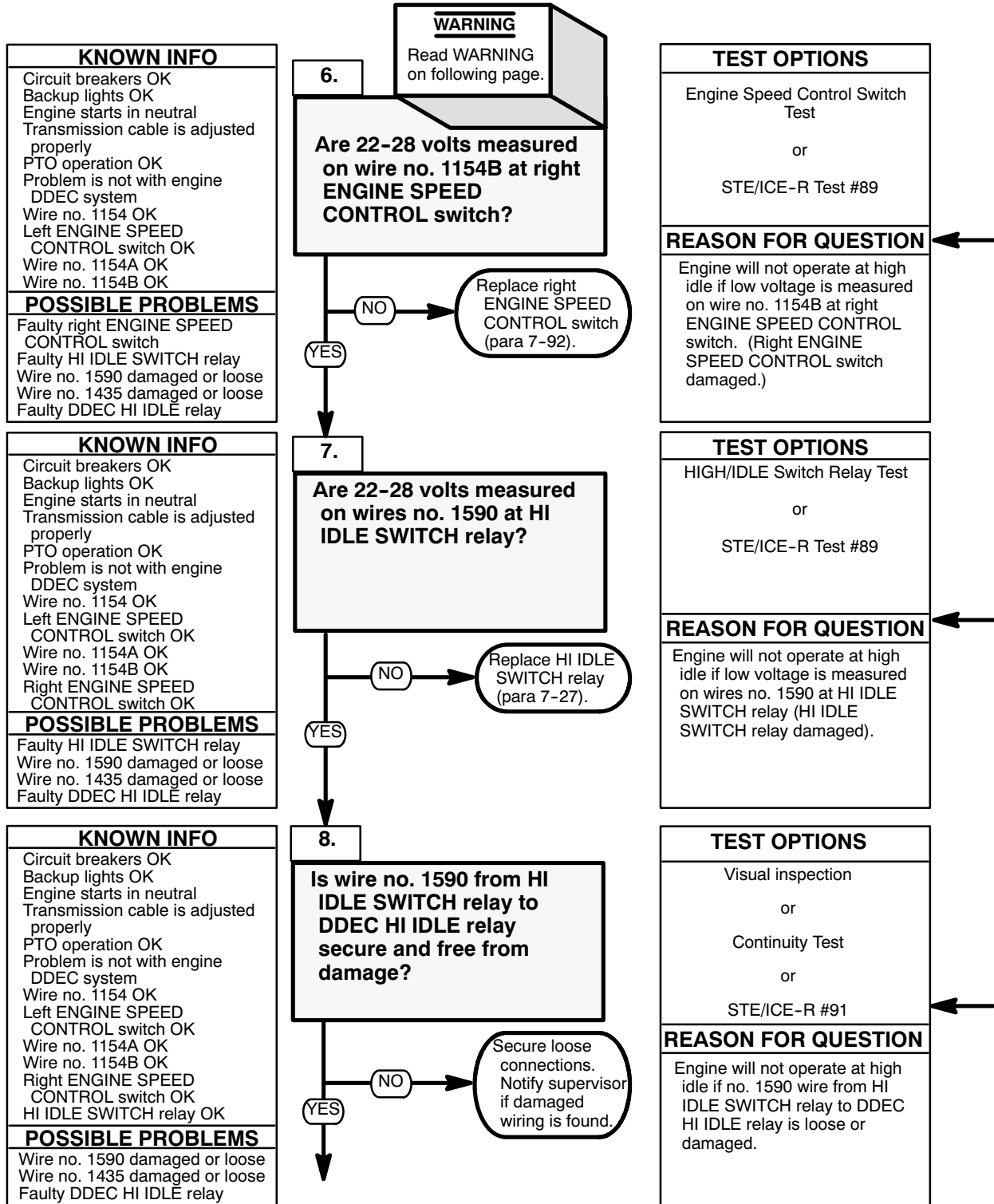
- (3) Connect multimeter leads to each end of wire.

NOTE

A reading of other than infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

17. ENGINE DOES NOT OPERATE AT HIGH IDLE WHEN ENGINE SPEED CONTROL SWITCHES ARE PROPERLY POSITIONED (CONT)



KNOWN INFO
Circuit breakers OK Backup lights OK Engine starts in neutral Transmission cable is adjusted properly PTO operation OK Problem is not with engine DDEC system Wire no. 1154 OK Left ENGINE SPEED CONTROL switch OK Wire no. 1154A OK Wire no. 1154B OK Right ENGINE SPEED CONTROL switch OK HI IDLE SWITCH relay OK
POSSIBLE PROBLEMS
Wire no. 1590 damaged or loose Wire no. 1435 damaged or loose Faulty DDEC HI IDLE relay

8.

Is wire no. 1590 from HI IDLE SWITCH relay to DDEC HI IDLE relay secure and free from damage?

NO → Secure loose connections. Notify supervisor if damaged wiring is found.

YES ↓

TEST OPTIONS
Visual inspection or Continuity Test or STE/ICE-R #91
REASON FOR QUESTION
Engine will not operate at high idle if no. 1590 wire from HI IDLE SWITCH relay to DDEC HI IDLE relay is loose or damaged.

WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

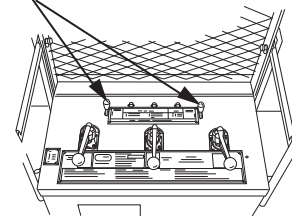
ENGINE SPEED CONTROL SWITCH TEST

NOTE

Engine must be running, PTO control switch placed in the on position, and engine speed control switches placed in the HIGH position to perform this test.

- (1) Place positive (+) probe of multimeter on wire no. 1154B at right ENGINE SPEED CONTROL switch.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (3) Replace right ENGINE SPEED CONTROL switch (para 7-92) if no voltage is measured.

SWITCHES

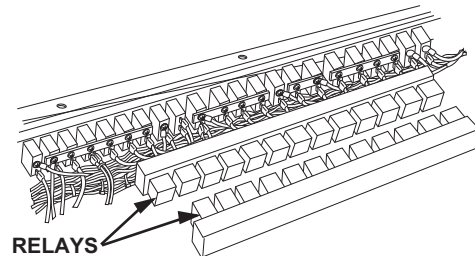


HIGH IDLE SWITCH RELAY TEST

NOTE

Engine must be running, PTO control switch placed in the on position, and engine speed control switches placed in the HIGH position to perform this test.

- (1) Place positive (+) probe of multimeter on wire no. 1590 at HI IDLE SWITCH relay.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.
- (3) Replace HI IDLE SWITCH relay (para 7-27) if no voltage is measured.



Check wire no. 1590 from HI IDLE SWITCH relay to DDEC HI IDLE relay for loose connections or damage.

CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit..

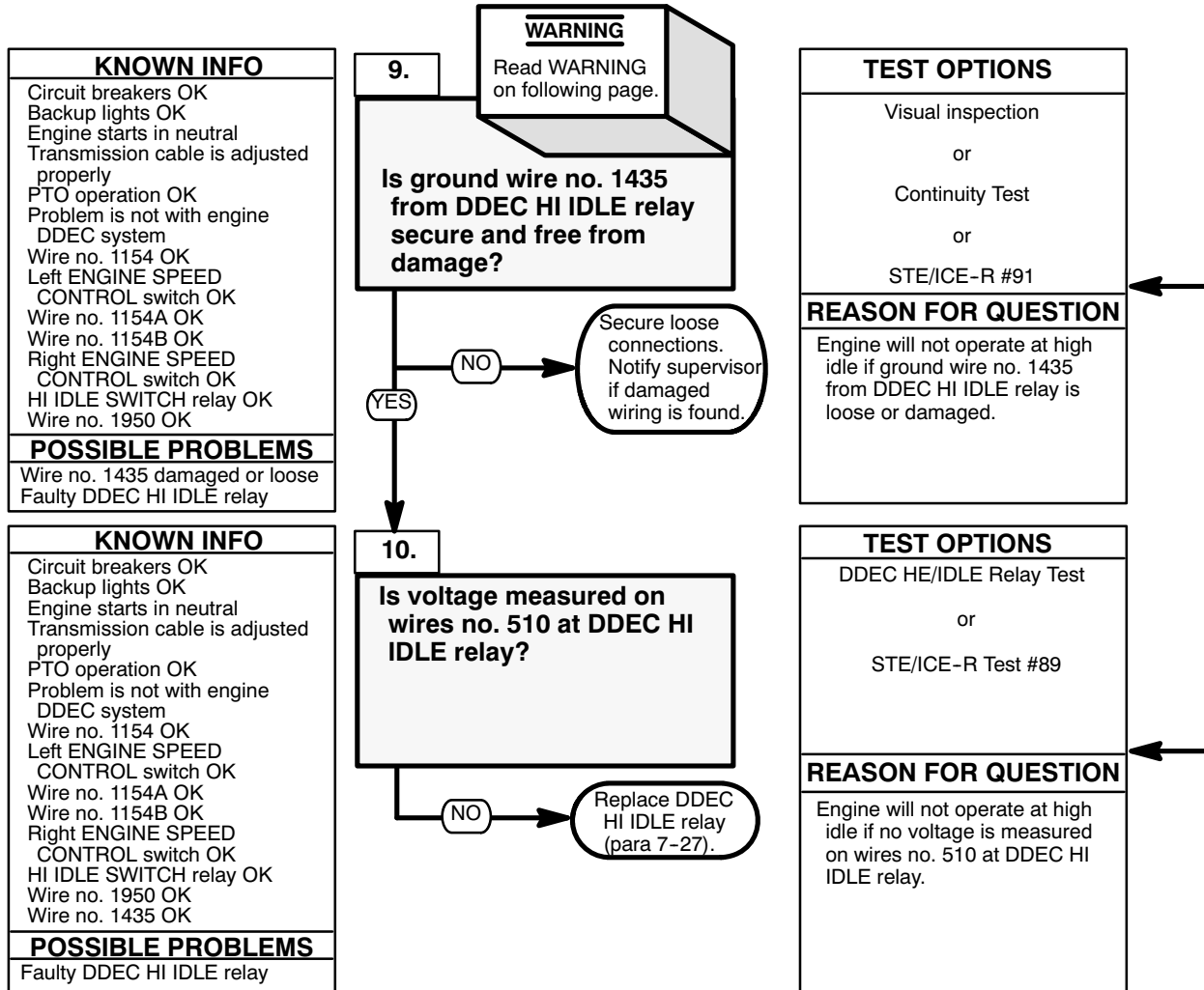
- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

A reading of other than infinity indicates a grounded wire.

- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

17. ENGINE DOES NOT OPERATE AT HIGH IDLE WHEN ENGINE SPEED CONTROL SWITCHES ARE PROPERLY POSITIONED (CONT)



WARNING

- Batteries must be disconnected before tightening any connections. Failure to comply may result in injury to personnel.
- Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor.

Check ground wire no. 1435 from DDEC HI IDLE relay for loose connections, damage, and continuity.

CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit..

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

A reading of other than infinity indicates a grounded wire.

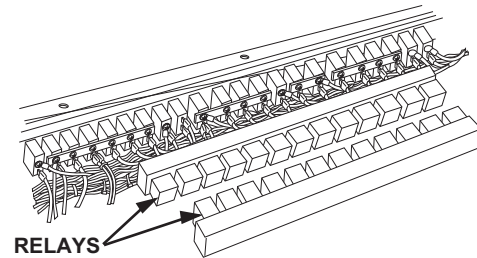
- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

DDEC HI/IDLE RELAY TEST

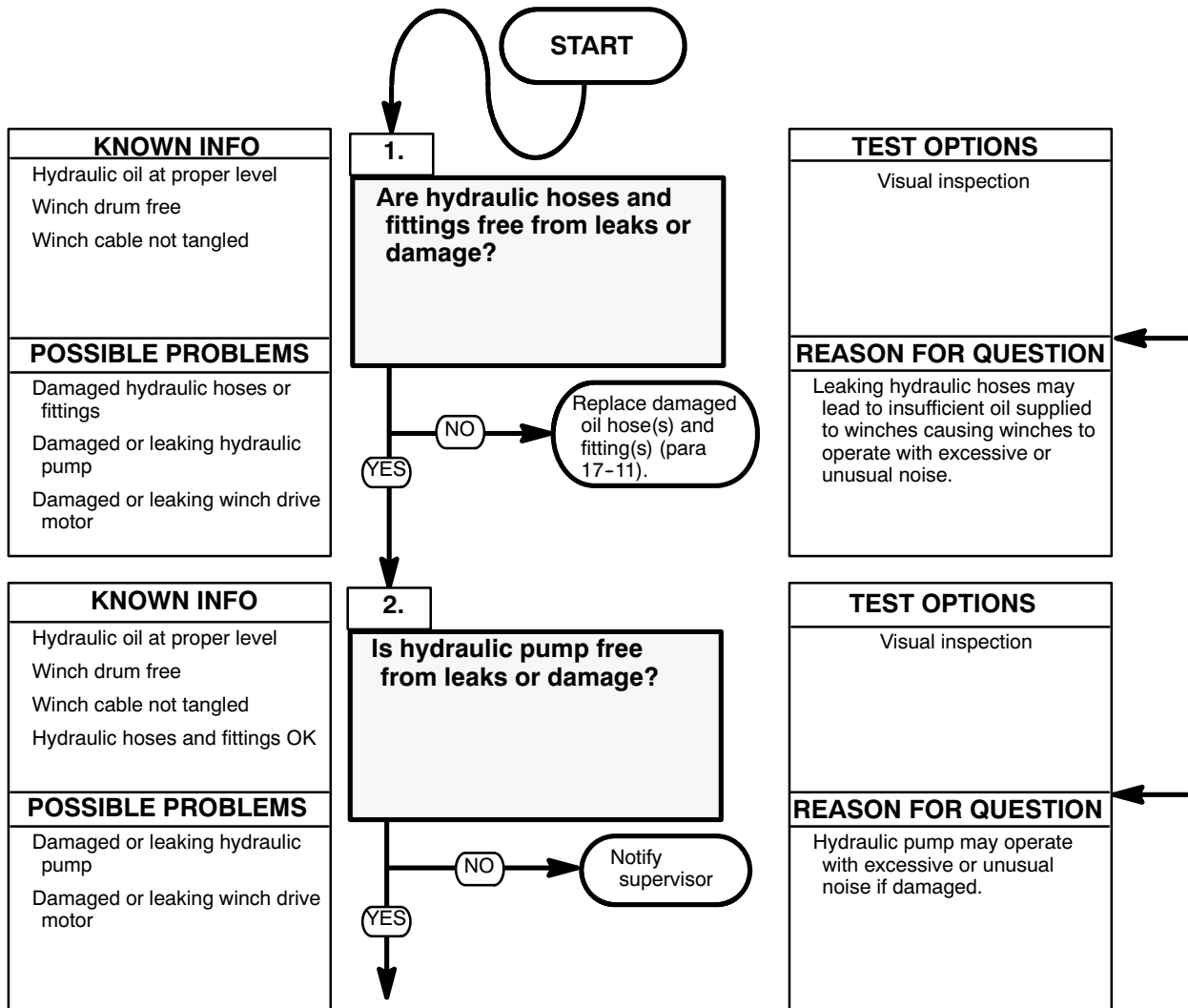
NOTE

Engine must be running, PTO control switch placed in the on position, and engine speed control switches in the HIGH position to perform this test.

- (1) Place positive (+) probe of multimeter on wire no. 510 at DDEC HI IDLE relay.
- (2) Place negative (-) probe of multimeter on ground and look for voltage on multimeter.
- (3) Replace DDEC HI IDLE relay (para 7-27) if no voltage is measured on wire no. 510.

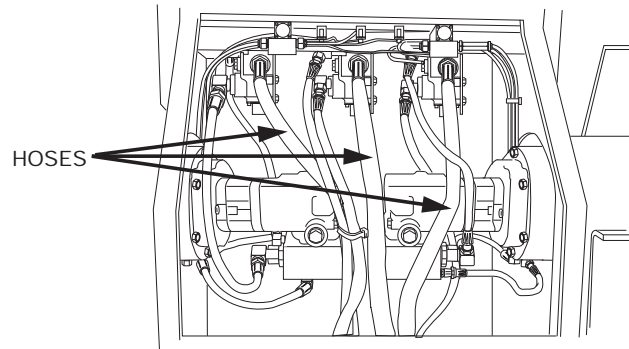
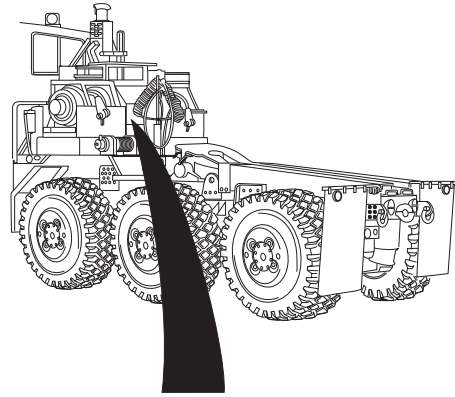


t8. MAIN WINCHES OR AUXILIARY WINCH MAKE EXCESSIVE OR UNUSUAL NOISE DURING OPERATION	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F)



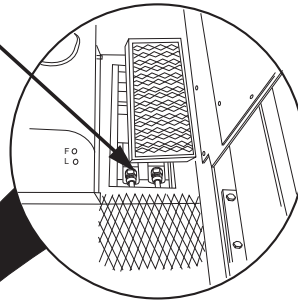
WARNING

Wear safety goggles when performing leakage tests on valves and hydraulic hoses. Failure to comply may cause serious eye injury due to high hydraulic pressure.

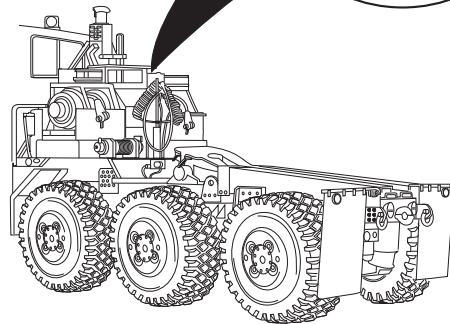


Check hydraulic hoses and fittings for leakage or damage.

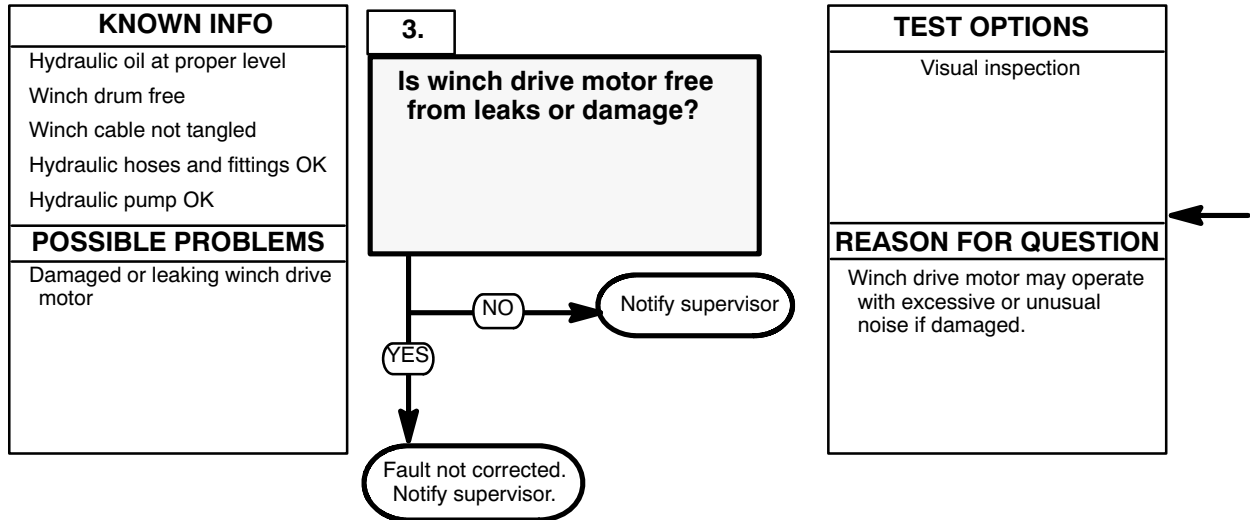
HYDRAULIC PUMP



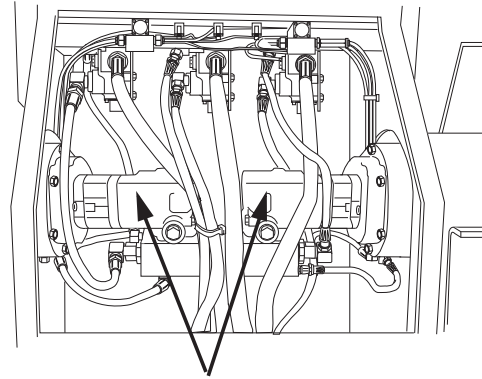
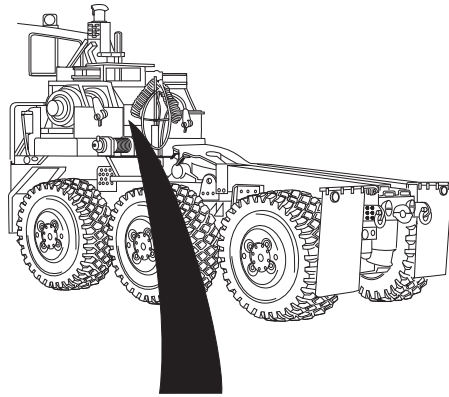
Check hydraulic pump for leakage or damage, and for loose or missing mounting hardware.



t8. MAIN WINCHES OR AUXILIARY WINCH MAKE EXCESSIVE OR UNUSUAL NOISE DURING OPERATION (CONT)

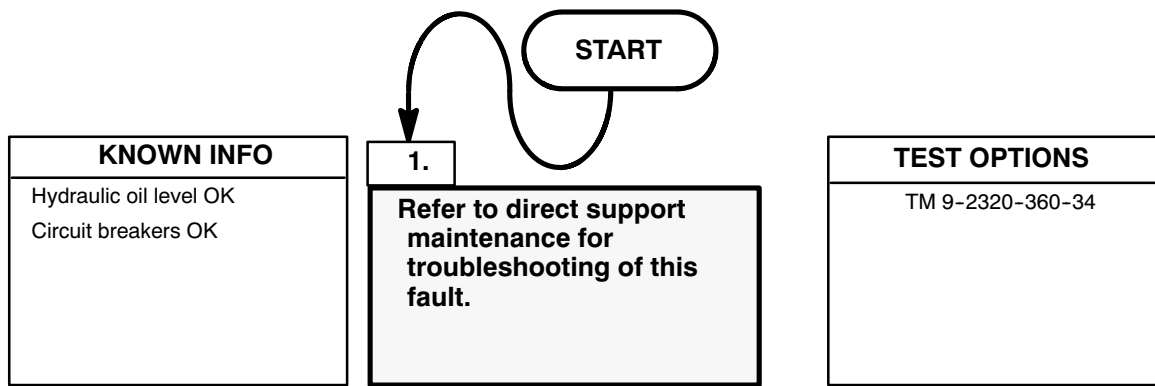


Check winch drive motor for leakage, and for loose or missing mounting hardware.

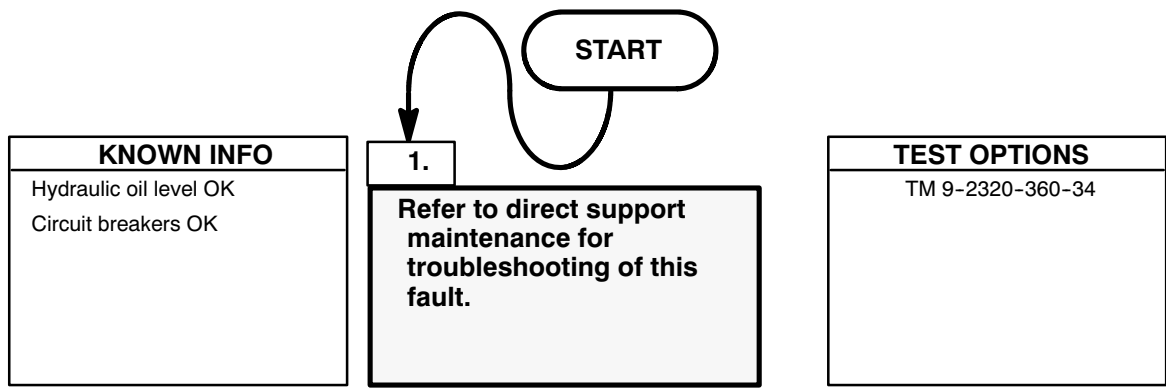


DRIVE MOTOR

t9. ONE MAIN WINCH WILL NOT PULL LOAD
INITIAL SETUP Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.



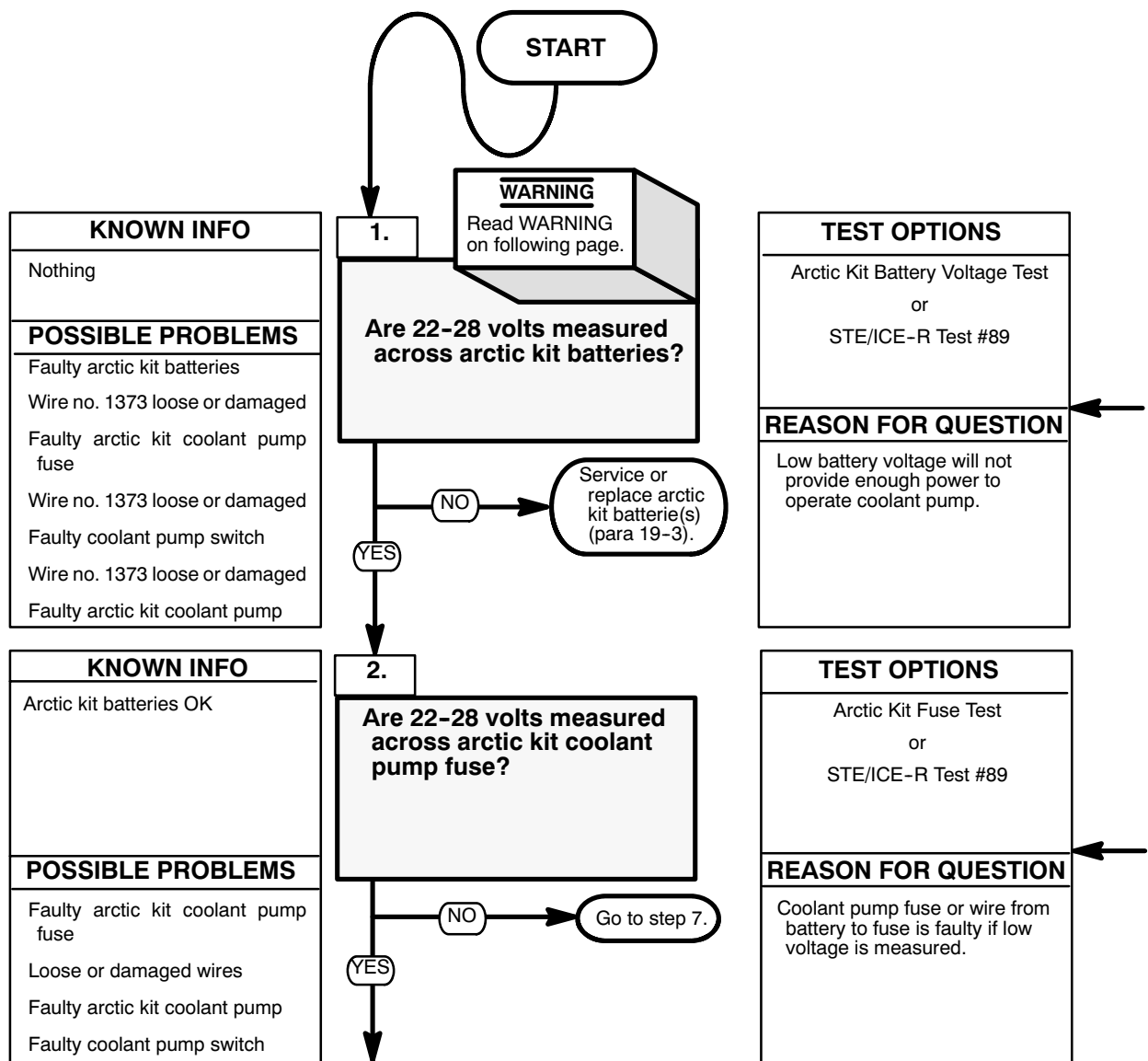
†10. ONE MAIN WINCH WILL NOT PAY OUT (USING CONTROL VALVE)
INITIAL SETUP
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.



u. ARCTIC KIT

<u>Malfunction</u>	Troubleshooting Procedure (Page)
<u>u.1 Arctic kit coolant pump does not operate</u>	<u>2-978</u>

u1. ARCTIC KIT COOLANT PUMP DOES NOT OPERATE	
INITIAL SETUP	
Equipment Conditions Engine shut off (TM 9-2320-360-10). Parking brake on (TM 9-2320-360-10). Wheels chocked.	Tools and Special Tools Tool Kit, Genl Mech (Item 54, Appendix F) STE/ICE-R (optional) (Item 47, Appendix F) Multimeter (Item 20, Appendix F)



WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes.

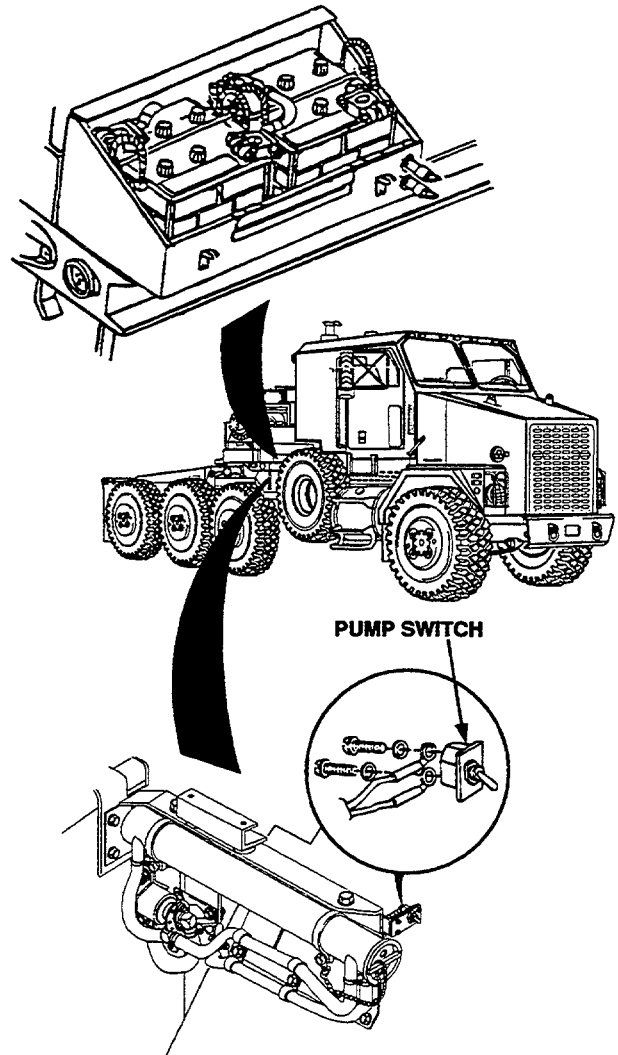
ARCTIC KIT BATTERY VOLTAGE TEST

- (1) Place positive (+) probe of multimeter on positive (+) battery post.
- (2) Place negative (-) probe of multimeter on negative (-) battery post and look for 22-28 volts on multimeter.
- (3) Service or replace arctic kit batteries (para 19-3) if less than 24 volts is measured.

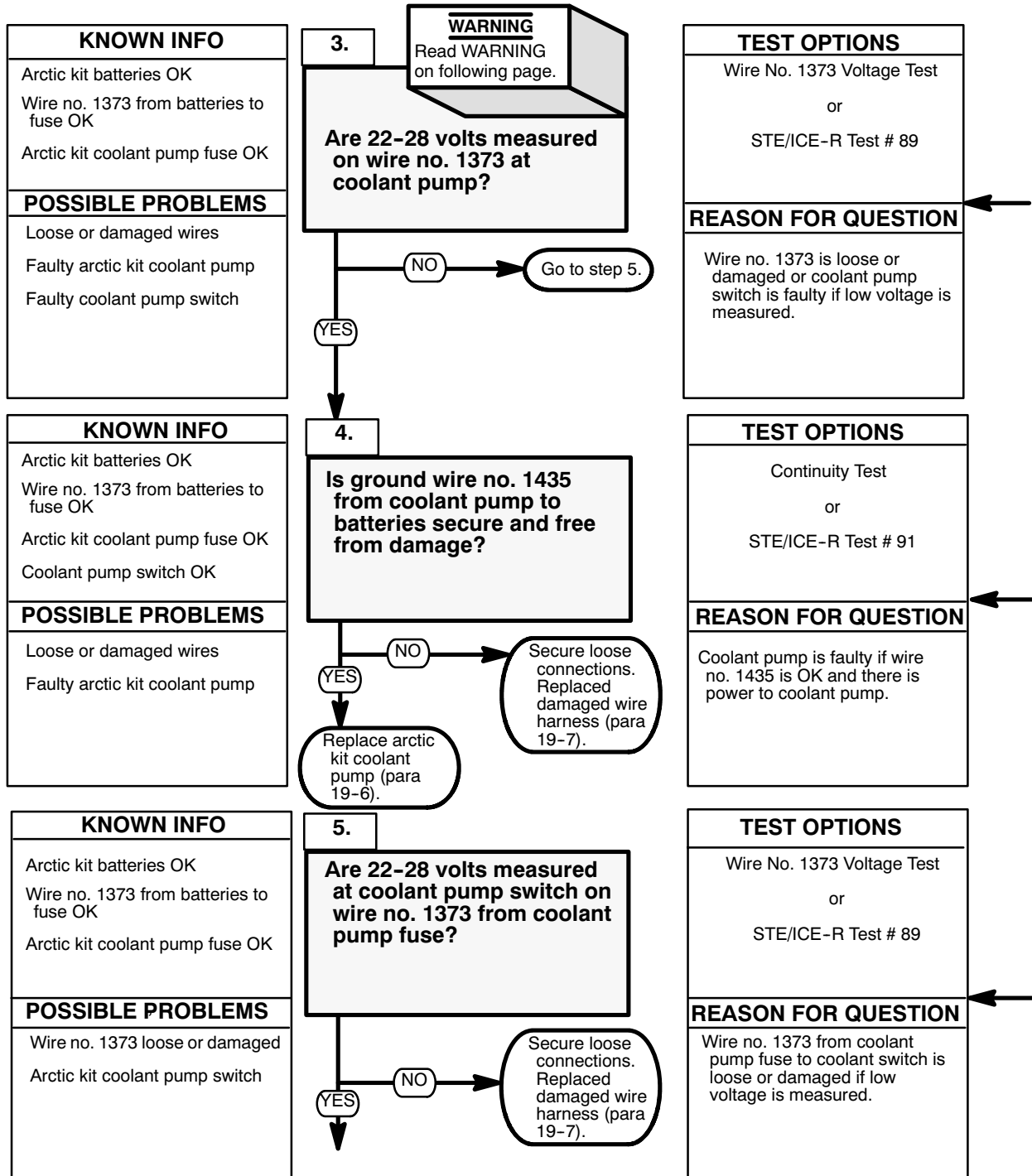
ARCTIC KIT FUSE TEST
NOTE

Arctic Kit pump switch must be positioned to on to perform this test.

- (1) Place positive (+) probe of multimeter on no. 1373 wire just after coolant pump fuse.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.



u1. ARCTIC KIT COOLANT PUMP DOES NOT OPERATE (CONT)



WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes.

WIRE NO. 1373 VOLTAGE TEST

NOTE

Arctic Kit pump switch must be positioned to on to perform this test.

- (1) Place positive (+) probe of multimeter on wire no. 1373 at coolant pump.
- (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

Check no. 1435 ground wire from coolant pump to batteries for loose connections or damage.

CONTINUITY TEST

- (1) Disconnect wiring from components at each end of wire.
- (2) Set multimeter to ohms position.

NOTE

A reading of infinity indicates an open circuit.

- (3) Connect multimeter leads to each end of wire and check multimeter for continuity.

NOTE

A reading of other than infinity indicates a grounded wire.

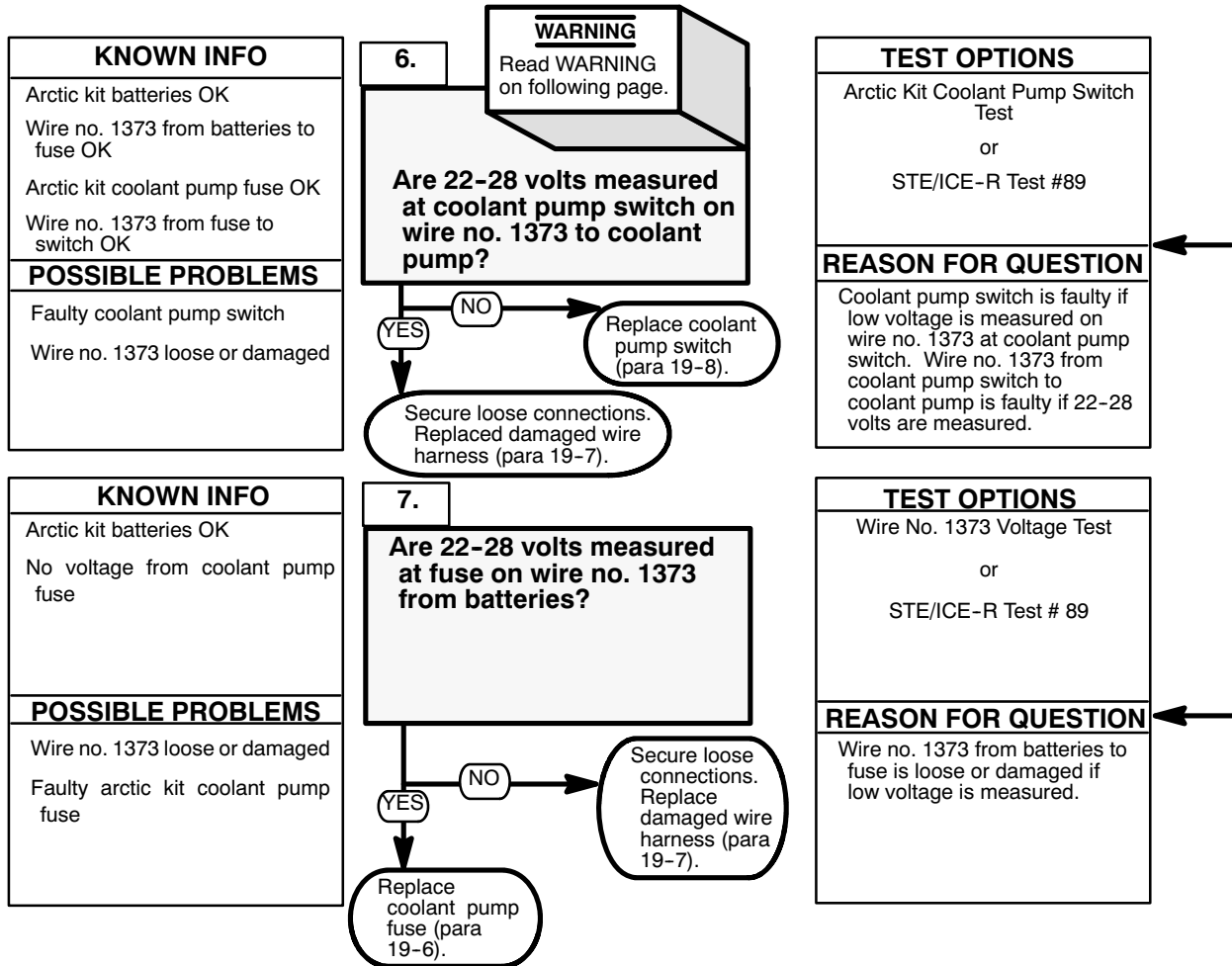
- (4) Remove multimeter lead from one end of wire and connect to chassis ground.

WIRE NO. 1373 TEST

NOTE

- Arctic Kit pump switch must be positioned to on to perform this test.
 - Test is made on terminal of switch with wire that goes to coolant pump fuse.
- (1) Place positive (+) probe of multimeter on no. 1373 wire at coolant pump switch.
 - (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

u1. ARCTIC KIT COOLANT PUMP DOES NOT OPERATE (CONT)



WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around HET Tractor. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Batteries can explode from a spark. Battery acid is harmful to skin and eyes.

ARCTIC KIT COOLANT PUMP SWITCH TEST

NOTE

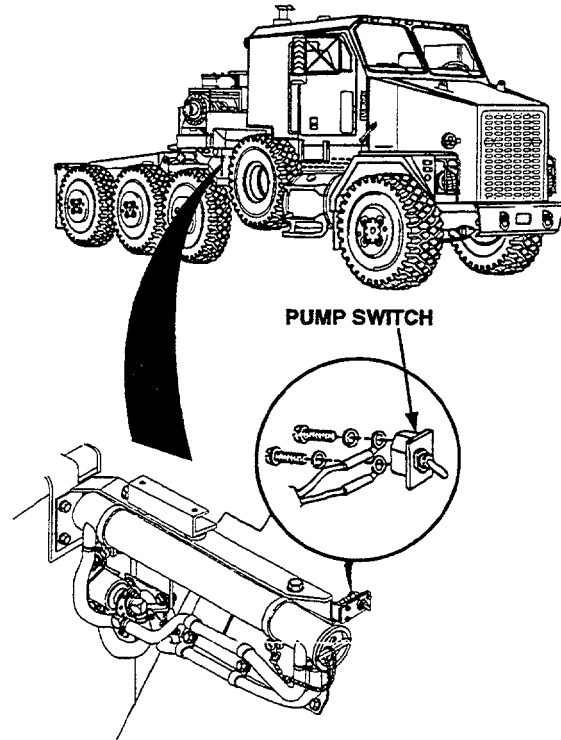
- Arctic Kit pump switch must be positioned to on to perform this test.
 - Test is made on terminal of switch with wire that goes to coolant pump.
- (1) Place positive (+) probe of multimeter on no. 1373 wire at coolant pump switch.
 - (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.

Check no. 1373 wire from positive (+) post on arctic kit battery to coolant pump fuse for loose connections or damage.

WIRE NO. 1373 VOLTAGE TEST

NOTE

- Arctic Kit pump switch must be positioned to on to perform this test.
- (1) Place positive (+) probe of multimeter on no. 1373 wire just before coolant pump fuse.
 - (2) Place negative (-) probe of multimeter on ground and look for 22-28 volts on multimeter.



Section V. MAINTENANCE PROCEDURES

2-14. MAINTENANCE INTRODUCTION

This section provides general procedures for equipment maintenance at the organizational level. If a special procedure is needed for maintenance of a component, the detailed procedure will be located in the chapter covering maintenance of that component.

2-15. GENERAL REMOVAL INSTRUCTIONS

a. Work Required. Remove only those parts needing repair or replacement. Do not disassemble a component any further than needed.

b. Preparation.

WARNING

Vehicle may move unexpectedly when working on it. Unless otherwise noted, parking brake must be applied and wheels chocked before performing maintenance. Failure to comply may result in injury or death to personnel.

- (1) Before removing any part of the electrical, winch hydraulic, or air systems, ensure system is not energized or pressurized. Disconnect battery cables. Relieve all pressure from air system. Ensure parking brake is applied and that all controls are in OFF position before starting a removal procedure.
- (2) Chock wheels: Wheel chocks should be positioned directly in front of and behind one of the rear wheels to keep vehicle from rolling.

c. Lifting. Always use a lifting device when lifting heavy parts. Ensure that load limit of lifting device exceeds weight being lifted. Position lifting device and sling before disconnecting part for removal.

d. Identification. Tag and mark all similar parts, such as electrical leads and hoses, before disconnecting and removing them. This will make proper assembly easier. Identify mating ends of electric, hydraulic, and air lines before they are disconnected.

e. Hoses. Hose numbers are identified in detailed procedures by a four-digit number. This corresponds with the numbers used on the air and hydraulic schematic.

f. Electrical Wires. Wire numbers are identified in detailed procedures by a four-digit number. This number corresponds with the numbers used on the electrical schematic.

2-16. GENERAL DISASSEMBLY INSTRUCTIONS

a. Cleanliness. Work area must be kept as clean as possible. This will prevent contamination of internal parts. This is true for valves, cylinders, and other hydraulic or air system parts.

b. Expendable Parts. Gaskets, packings, and seals removed during repair must be discarded and replaced with new parts. These items are usually damaged during removal. In the same way, lockwires, lockwashers, cotter pins, and like items must be replaced at time of assembly. Self-locking fasteners that loosen up must be replaced, not tightened.

c. Removing Seals. When removing gaskets, packings, or seals, do not use any tool that will scratch the surfaces next to these items.

d. Parts Protection. To prevent moisture and dirt from entering open housings, lines, and other openings, apply protective caps and plugs as soon as possible after disassembly. Wrap all removed parts in clean paper.

2-17. GENERAL CLEANING INSTRUCTIONS

WARNING

Solvent cleaning compound MIL-PRF-680 Type II and III may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Use respirator as needed. Accidental ingestion can cause irritation of digestive tract and respiratory tract, may cause lung and central nervous system damage. Can be fatal if swallowed. Inhalation of high/massive concentrations can cause coma or be fatal. First aid for ingestion: do not induce vomiting. Seek immediate medical attention. First aid for skin contact: remove contaminated clothing. Wash skin thoroughly with soap and water. If symptoms persist, seek medical attention. First aid for eye contact: flush with water for 15 minutes or until irritation subsides. If symptoms persist, seek medical attention. First aid for inhalation: move to fresh air. If not breathing, provide artificial respiration. If symptoms persist, seek medical attention. Keep away from open flames and other sources of ignition. Failure to follow this warning may result in injury or death to personnel.

- The flashpoint for type II solvent cleaning compound is 141-198°F (61-92C) and type III is 200-241°F (93-116C).
- Improper cleaning methods and use of unauthorized cleaning solvents may injure personnel and damage equipment.
- Fire extinguishers should be placed nearby when using solvent cleaning compound. Failure to follow this warning may result in injury or death.
- Cloths or rags saturated with solvent cleaning compound must be disposed of IAW authorized facilities' procedures. Failure to follow this warning may result in injury.
- Eye shields must be worn when cleaning with a wire brush. Flying rust and metal particles may cause injury.

CAUTION

- Never use fuel to clean parts. Fuel is highly flammable. Serious personal injury could result if fuel ignites during cleaning.
 - Petroleum solvents may damage parts that are in contact with hydraulic fluids.
 - Do not clean tires, lubricant seals, rubber hoses, or electrical components with solvent mixture.
- a. Cleaning Solvents. Use only approved cleaning solvents to clean parts. Solvent cleaning compound MIL-PRF-680 Type II and III is commonly used. Always work in a well-ventilated area.

WARNING

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

- b. Removing Deposits. After soaking parts in solvent, wash away deposits by flushing or spraying. Where necessary, brush with a soft bristle brush moistened in solvent. Use compressed air to dry all parts, except bearings. Bearings must be allowed to air dry.
- c. Tools. Do not use abrasive wheels or compounds for cleaning parts unless called for in detailed instructions. These procedures may weaken a highly stressed parts.
- d. Ball and Roller Bearings. When cleaning ball or roller bearings, place them in a basket and suspend them in a container of solvent cleaning compound. If needed, use a brush to remove caked grease, chips, etc. Avoid rotating bearing before solid particles are removed to prevent damaging races and balls. When bearings have been cleaned, coat them lightly with lubricating oil to remove solvent.
- e. Rubber Parts. Do not clean preformed packings or other rubber parts in solvent cleaning compound. These parts should be wiped clean with a clean, dry, lint-free cloth.

WARNING

Steam cleaning creates hazardous noise levels and severe burn potential. Eye, skin, and ear protection is required. Failure to comply may result in injury to personnel.

- f. Exterior Parts. Steam clean all exterior parts thoroughly before removing. This will make inspection and disassembly easier.

2-17. GENERAL CLEANING INSTRUCTIONS (CONT)

WARNING

Face shield must be used by personnel operating spray gun. Failure to comply may result in injury to personnel.

- g. Engine, Cab, and Body. Use a spray gun and solvent mixture for cleaning exterior of engine, cab, and body. Allow mixture to remain on item surface for about 10 minutes before rinsing. Rinse with hot water under 80 to 120 psi (550 to 830 kPa), if available. An ordinary garden hose with nozzle may be used if other equipment is not available. Rinse thoroughly.
- h. Passages. Check all oil passages and cavities for dirt or blockage. A thin, flexible wire should be run through oil passages to ensure they are not clogged. Individual passages that are dirty may be cleaned using a pressure spray gun and solvent cleaning compound.
- i. Electrical Parts. Electrical parts, such as coils, junction blocks, switches, and igniters, which use insulating materials, should not be soaked or sprayed with cleaning solutions. Clean these parts with a clean, lint-free cloth.
- j. Fuel Tanks. Pay special attention to all warnings and cautions when working on fuel tanks.

WARNING

Battery acid (electrolyte) is extremely harmful. Always wear safety goggles and rubber gloves and do not smoke when performing maintenance on batteries. Injury will result if acid contacts skin or eyes. Wear rubber apron to prevent clothing being damaged.

- k. Battery. Exterior surfaces of the electrical system and battery should be cleaned with a solution of baking soda and water. Apply solution with a bristle brush to remove any corrosion.

2-18. GENERAL INSPECTION INSTRUCTIONS

- a. Inspection. Inspection consists of checking for defects such as distortion, wear, cracks, and pitting. Clean all parts before inspection.
- b. Sealing Surfaces. Inspect all surfaces in contact with gaskets, packings, or seals. Ensure there are no nicks, burrs, or scratches. If any defect is found, remove or repair it as outlined in para 2-19.
- c. Bearings. Check bearings for rusted or pitted balls, races, or separators. Check balls and races for brinelling, abrasion, and serious discoloration. Following are causes for bearing rejection:
 - (1) Cuts or grooves parallel to ball or roller rotation.
 - (2) Pits
 - (3) Cracks.
- d. Drain Plugs. When removing drain plugs from transmission, engine, or hydraulic system components, inspect sediment adhering to plug. A few fine particles are normal. A build-up of grit or fine metal particles may indicate part failure. This inspection is effective in determining defective parts prior to internal inspection of parts.
- e. Splines. Inspect shaft splines for wear, pitting, rolling, peening, and fatigue cracks.

CAUTION

Hoses and nylon tubing that are kinked or chafed must be replaced. Hoses must be secured and routed properly. Failure to comply may result in sudden, unexpected hose failure.

f. Tubing and Hose. Check all hose surfaces for broken or frayed fabric. Check for breaks caused by sharp kinks or rubbing against other parts of the truck. Inspect hoses and lines for kinking. Inspect the fitting threads for damage.

g. Electrical Parts. Inspect all wiring harnesses for chafed or burned insulation. Inspect all terminal connectors for loose connections and broken parts.

CAUTION

Do not attempt to weld on HET Tractor without disconnecting all battery cables, DDEC electronic control module, alternators, and CTIS system. Failure to comply will damage electrical system.

h. Metal Parts. Visually inspect all castings and weldments for cracks.

2-19. GENERAL REPAIR INSTRUCTIONS

a. Nicks, Burrs, and Scratches. Remove nicks, burrs, and scratches from surfaces with crocus cloth.

b. Exterior Parts. Chassis and exterior painted parts may be resurfaced where paint is damaged or where parts have been repaired.

NOTE

Polished and machined steel parts not protected by cadmium, tin, copper, or other plating or surface treatment must be free of moisture when protective coating is applied.

c. Protective Parts. Protect bare metal surfaces from rusting when not actually undergoing repair work. Dip parts in, or spray them with, corrosion preventive compound. Aluminum parts may require protection in atmospheres having a high salt content.

d. Stud Installation. When installing studs in engine block and axle housings, use a driver designed for the stud to be installed. A worn stud driver may damage the end thread and make it necessary to use a die before a nut can be installed. This procedure will remove cadmium plating and allow corrosion, which will make future disassembly difficult and cause stud to be backed out with nut. Before installing a stud, inspect hole for chips and liquid. Blow out any foreign matter. Start stud by hand.

e. Electrical Parts. Replace all broken, worn, or burned electrical wiring. Wires with several broken strands must be replaced. Broken strands will increase the resistance of the wire and impair efficiency of electrical components, especially the ignition system. Wire numbers must be permanently identified on any new wiring.

f. Hoses. Replace all broken, frayed, crimped, or soft flexible lines and hoses. Replace stripped or damaged fittings. Replace entire flexible hose if fittings are damaged. Hose clamps should not crimp hoses. Hose numbers must be permanently identified on any new hoses.

g. Fasteners. Replace any bolt, screw, nut, or fitting with damaged threads. Inspect tapped holes for thread damage.

h. Dents. Straighten minor body dents by tapping with a soft-faced hammer while using a wooden block for backing.

i. Sheet Metal Repair. Repair minor sheet metal cracks by installing patches.

2-20. GENERAL ASSEMBLY INSTRUCTIONS

- a. **Preparation.** Remove protective coating from new parts before installation.
- b. **Preformed Packing Installation.** Lubricate all preformed packings with a thin coating of light mineral oil before installation. Uniformly press the preformed packing into position.

WARNING

Pipe thread sealing compound may burn or give off harmful vapors. It is harmful to skin and clothing. To avoid injury or death, keep away from open flame and use in well-ventilated area. If pipe thread sealing compound gets on skin or clothing, wash immediately with soap and water.

CAUTION

Use pipe thread sealing compound sparingly only on pipe threads. Do not apply compound to hose connections. Failure to comply may result in component failure.

- c. **Pipe Joints.** Use nonhardening pipe-joint compound when joining piping.
- d. **Gaskets.** Remove all traces of previous gasket and sealant before installing new gasket.

WARNING

On direct contact, uncured silicone sealant irritates eyes. In case of contact, flush eyes with water and seek medical attention. In case of skin contact, wipe off and flush with water.

- e. **Silicone Sealant.** Silicone sealant is often used instead of a gasket to seal mating parts. The mating parts must be clean, dry, and free of oil or grease for proper adhesion. After silicone sealant has been applied, the mating parts must be assembled immediately. Excess silicone sealant should be wiped off after assembling the mating parts.
- f. **Seal Rings.** Coat seal rings with oil and carefully install into their bores. If seal rings must be installed over threaded parts, temporarily wrap the threads with tape to protect the seal ring.
- g. **Bearing Lubrication.** Lubricate bearings before reassembly with the type of lubricant normally used in the related housing or container. This will provide lubrication during the first run-in until lubricant from system can reach the bearings.

2-21. GENERAL INSTALLATION INSTRUCTIONS

- a. Put hoses, tubes, lines, and electrical wiring in place by matching identification tags, markings on equipment, identification numbers given in task and schematic presented at the end of this manual.
- b. Use sealing compounds as required in each maintenance task.
- c. Screws and nuts must be tightened to values given in appendix E, Torque Limits, or values given in maintenance task.

Section VI. PREPARATION FOR STORAGE OR SHIPMENT

2-22. PREPARATION FOR STORAGE OR SHIPMENT

- a. Instructions in this section apply to the vehicle to make it available for use upon receipt after shipment. The storage instructions apply to vehicle being taken out of service for a period up to one year with vehicle exercise. If vehicles are inactive for more than one year they will use extended storage procedures.
- b. Refer to (AR 750-1) for detailed administrative storage instructions.
- c. Refer to (TB 9-2300-422-20) for security procedures.
- d. Perform Preventive Maintenance Checks and Services (PMCS) listed in table 2-1.
- e. Correct all deficiencies noted during the inspection if facilities are available. If repairs required are beyond the scope of unit maintenance, refer the deficiencies to direct and general support maintenance.
- f. Instructions pertaining to Basic Issue Items (BII) and Components of End Items (COEI) stowage locations are covered in appendix B and F of (TM 9-2320-360-10).
- g. Remove rust and corrosion, and scrape any flaked and peeling paint. Dry all surfaces to be painted and coated with preservatives. Refer to (TM 9-247), Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Material and Related Materials including Chemicals.
- h. Repaint surface, as required, to prevent against deterioration. Refer to (TM 43-0209) for painting instructions for Field Use, Color, Marking, and Camouflage Painting of Military Vehicles.

CAUTION

During storage tachograph will wear out paper charts. Teflon chart must be installed when in storage. Failure to comply may damage tachograph.

- i. Replace tachograph paper chart with teflon chart (para 7-15).

2-23. STORAGE MAINTENANCE PROCEDURES

a. Before placing a vehicle in storage, perform the following tasks:

- (1) Clean the exterior, interior of cab, engine, and undercarriage. Wash any oil, grease, or mud from tires.
- (2) Conduct a visual inspection of the vehicle. Check lubricant levels and tire pressures (CTIS highway setting). Correct any discrepancies.
- (3) Completely lubricate the chassis and all ancillary equipment in accordance with (LO 9-2320-360-12).
- (4) Check the coolant level. Test the coolant to ensure that the cooling system is protected against corrosion and temperatures down to -30°F (-34°C). Add antifreeze or corrosion inhibitors compatible with ethylene glycol base antifreeze if cooling system is not adequately protected (TB 750-651).
- (5) Ensure the fuel tank contains at least 20 gallons (75.7 L) of treated fuel. The fuel should be treated with Biobor J.F. (MIL-S-53021 (or equivalent) as a fungus inhibitor. The addition of 3 teaspoons of Biobor to 20 gallons of fuel will provide adequate protection against fungus growth. When storing a vehicle in freezing conditions, the addition of 3 ounces (88.7 ml) of isopropyl alcohol (MIL-A-10-428) to 20 gallons of diesel fuel will help prevent fuel line freeze up.
- (6) All fuel that is added to the vehicle during storage must be treated. While in storage, there must always be at least 20 (75.7 L) gallons of treated fuel in the vehicle's fuel tank.
- (7) Check condition of engine air cleaner. Replace if necessary (para 4-2).
- (8) Coat all exposed unpainted surfaces such as spools, drive shafts, and shift cables with grease.

CAUTION

Do not allow the baking soda solution to enter the batteries or damage to batteries will result.

- (9) Clean batteries and battery cables with a baking soda solution and rinse with fresh water. Add water to battery electrolyte if necessary. Check the specific gravity of the batteries regularly. Keep the batteries fully charged and clean (TM 9-6150-200-14).

2-23. STORAGE MAINTENANCE PROCEDURES (CONT)

(10) Protect spare tire from direct sunlight.

(11) If possible, store vehicles close together, out of direct sunlight, and away from electrical or generating equipment.

(12) Park vehicle to allow access for inspection, maintenance, and exercising.

CAUTION

Ensure tires are not resting on surface containing grease or oil. Failure to comply may result in damage to tires.

(13) Park vehicle so tires are not resting on surfaces containing grease or oil.

CAUTION

The DDEC system, tachograph, and turn signal flasher drain on batteries at all times. Batteries will discharge during storage if not disconnected.

(14) Disconnect batteries (TM 9-2320-360-20).

b. While vehicle is in storage, perform the following tasks monthly:

(1) Connect batteries (TM 9-2320-360-20).

(2) If engine is run every 30 days or less, use lubricating oil (OE/HDO MIL-L-2104). If engine is not run every 30 days or less, use preservative lubricating oil (MIL-L-21260C) grade 2 and change oil filter, or warranty will not be maintained.

(3) Conduct visual inspection of the vehicle. Check for oil leaks, lubricant levels, battery electrolyte, coolant level, and tire pressures (CTIS highway setting). Correct any discrepancies.

(4) Inspect oil can points. Lubricate if necessary (LO 9-2320-360-12).

(5) Shift transfer case to neutral, start engine, and idle for 10 minutes. After 10 minutes of engine idle, operate engine for 5 minutes at 1500 rpm or until the engine water temperature reaches 180°F (82°C). Shift the transmission slowly through all gear selector positions. Return the transmission to neutral and the transfer case to high range.

(6) Move vehicle 30 feet (9 m) forward and reverse.

(7) Idle engine 10 minutes before shutdown.

(8) Check grease coating on all chromium plated and unpainted surfaces. If grease was wiped from chromium plated or unpainted surfaces when vehicle was moved, recoat these surfaces.

(9) Disconnect batteries (para 7-61). If batteries are not going to be charged for over 30 days, remove from vehicle (para 7-57) and keep fully charged (TM-9-6150-200-14).

c. While vehicle is in storage, perform the following tasks quarterly:

(1) Perform all monthly tasks.

(2) Exercise all ancillary equipment (TM 9-2320-360-10). While operating winches, lubricate wire rope.

(3) Drive vehicle at least 1/4 mile (.4 km). While driving, shift transmission through all gear ranges.

d. While vehicle is in storage, perform the following tasks yearly:

(1) Perform all quarterly tasks.

(2) Clean the exterior, interior of cab, engine, and undercarriage. Wash any oil and grease from tires.

CAUTION

Do not allow the baking soda solution to enter the batteries or damage to batteries will result.

(3) Clean batteries and battery cables with a baking soda solution and rinse with fresh water. Add water to battery electrolyte if necessary. Check the specific gravity of the batteries regularly. Keep the batteries fully charged and clean (TM 9-6150-200-14).

(4) Completely lubricate the chassis and all ancillary equipment in accordance with (LO 9-2320-360-12).

(5) Check the coolant level. Test the coolant to ensure that the cooling system is protected against corrosion and temperatures down to -30°F (-34°C). Add antifreeze or corrosion inhibitors compatible with ethylene glycol base antifreeze if cooling system is not adequately protected (TB 750-651).

(6) Change engine oil and oil filter (paras 3-3 and 3-4). Change fuel filters. (paras 4-11 and 4-13).

e. Extended storage (vehicle inactive).

CAUTION

When vehicle is to remain inactive for more than 12 months, extended storage procedures must be performed to prevent damage due to rust, corrosion or organic growth in the fluids.

NOTE

When vehicle is to remain inactive for more than 12 months, extended storage procedures must be performed to maintain the vehicle warranty.

(1) Completely lubricate the chassis and all ancillary equipment in accordance with (LO 9-2320-360-12).

(2) Engine extended storage.

(a) Change oil and filter (paras 3-3 and 3-4). Add preservative lubricating oil (MIL-L-21260C), Grade 2.

(b) Seal off turbocharger inlet and outlet connections with moisture resistant tape.

(3) Transmission extended storage.

(a) Drain oil (LO 9-2320-360-12).

(b) Add two qt (1.9 L) of VCI-329 vapor corrosion inhibitor (MIL-L-46002B) or equivalent and then fill transmission to operating level with transmission fluid. Add 1 teaspoon of Biobor JF (MIL-S-53021) anti-fungicide (or equivalent) to the transmission fluid.

(c) Run the engine for approximately five minutes at 1500 rpm with the transmission in neutral (N).

(d) Drive the vehicle. Make sure the transmission shifts thru all ranges.

(e) Continue running the engine at 1500 rpm with the transmission in neutral until normal operating temperature is reached.

CAUTION

Do not allow transmission oil temperature to exceed 225°F (107°C) or damage to transmission may result.

(f) If normal operating temperature is less than 225°F (107°C), shift the transmission to forward range and stall the converter. Do not exceed 225°F (107°C). Idle engine for approximately five minutes with transmission in neutral (N).

WARNING

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

(g) When transmission is cool enough to touch, seal all openings and the breather with moisture-proof tape.

(h) Coat all exposed, unpainted surfaces with preservative grease such as petrolatum (MIL-C-11796), Class 2.

(i) If additional storage time is required, repeat steps (b) thru (h) at yearly intervals: except, it is not necessary to drain the transmission each year. Just add VCI-329 (MIL-L-46002) vapor corrosion inhibitor (or equivalent) and Biobor JF (MIL-S-53021) anti-fungicide (or equivalent).

2-23. STORAGE MAINTENANCE PROCEDURES (CONT)

- (4) Axle extended storage.

CAUTION

To avoid overfilling, drain oil before installing additive. Failure to comply may cause damage to equipment.

- (a) Drain amount of oil from axle that is equal to quantity of additive being added.
 - (b) Add 1.7 pt (0.8 L) VCI-326 vapor corrosion inhibitor (MIL-P-46002B) (or equivalent) to axles no. 1, 2, 3, and 4.
 - (c) Add 2.6 oz (76 ml) VCI-326 vapor corrosion inhibitor (MIL-P-46002B) (or equivalent) to planetary wheel ends of axles no 1, 2, 3, and 4.
 - (d) Drive vehicle approximately 1 mile (1.6 km) to mix additive with the axle oil.
 - (e) If additional storage time is required, repeat steps (a) thru (c) at yearly intervals.
- (5) Winch extended storage.

None required.

- (6) Transfer Case extended storage.

CAUTION

To avoid overfilling, drain oil before installing additives. Failure to comply may cause damage to equipment.

- (a) Drain amount of oil from transfer case that is equal to quantity of additive being added.
- (b) Add .5 pt (0.25 L) VCI-326 vapor corrosion inhibitor (MIL-P-46002B) or equivalent to transfer case.
- (c) If vehicle can be driven, drive vehicle approximately 1 mile (1.6 km) to mix additive. If vehicle cannot be driven, shift transfer case to neutral, start engine (TM 9-2320-360-10), with parking brake applied shift transmission thru all gear selections.

WARNING

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

- (d) When transfer case is cool enough to touch, seal breather with moisture proof tape.
 - (e) Coat all exposed, unpainted surfaces with preservative grease such as petrolatum (MIL-C-11796 grade 2) or equivalent.
 - (f) If additional storage time is required, repeat step (b) at yearly intervals.
- (7) Winch hydraulic system extended storage.

CAUTION

To avoid overfilling, drain oil before installing additives. Failure to comply may cause damage to equipment.

- (a) Drain amount of oil from winch hydraulic reservoir that is equal to the quantity of additive being added.
- (b) Add 8.5 qt (8 L) VCI-326 vapor corrosion inhibitor (MIL-P-46002B) or equivalent to winch hydraulic reservoir.
- (c) Operate all winches.
 - (1) Pay out and then pay in passenger side and drivers side main winches approximately 10 ft (3 m). Repeat this procedure two times.
 - (2) Pay out and then pay in auxiliary winch approximately 10 ft (3 m). Repeat this procedure two times.
- (d) If additional storage time is required, repeat steps (a) and (b) at yearly intervals.

(8) Steering hydraulic system extended storage.

CAUTION

To avoid overfilling, drain oil before installing additives. Failure to comply may cause damage to equipment.

(a) Drain amount of oil from steering hydraulic reservoir that is equal to the quantity of additive being added.

(b) Add 1.6 pt (0.75 L) VCI-326 vapor corrosion inhibitor (MIL-P-46002B) or equivalent to steering hydraulic reservoir.

(c) Operate steering system to mix additive. Turn steering wheel to full right and then full left positions. Repeat this cycle three times.

(d) If additional storage time is required, repeat steps (a) and (b) at yearly intervals.

(9) Steering reduction gear box 2.21 to 1 extended storage.

None required.

(10) Fuel system extended storage.

(a) Drain fuel tank.

(b) Change all fuel filters (paras 4-11 and 4-13).

(c) Ensure the fuel tank contains at least 20 gallons (75.7 L) of treated fuel. The fuel should be treated with Biobor J F, (MIL-S-53021) or equivalent. The addition of 3 teaspoons of biobor to 20 gallons of fuel will provide adequate protection against fungus growth. When storing a vehicle in freezing conditions, the addition of 3 ounces (88.7 ml) of isopropyl alcohol (MIL-A-10-428) to 20 gallons of fuel will help prevent fuel line freeze up.

(d) Run engine 5 minute to circulate clean treated fuel throughout the fuel system.

(e) All fuel that is added to the vehicle during storage must be treated. While in storage, there must always be at least 20 gallons (75.7 L) of treated fuel in the vehicle's fuel tank.

(f) Cap off fuel system.

(11) Battery extended storage.

Remove batteries from vehicle (para 7-57) and keep fully charged (TM 9-6150-200-14).

(12) Check the coolant level. Test the coolant to ensure that the cooling system is protected against corrosion and temperatures down to -30°F (-34°C). Add antifreeze or corrosion inhibitors compatible with ethylene glycol base antifreeze if cooling system is not adequately protected (TB 750-651).

f. When removing vehicle from storage, perform the following tasks:

(4) Install batteries (paras 7-57 and 7-61).

(5) Conduct a visual inspection to the vehicle and remove moisture proof tape from engine, transmission, transfer case, and fuel system. Check lubricant levels and tire pressures. Correct any discrepancies.

(6) Lubricate the chassis, ancillary equipment, and oil can points (LO 9-2320-360-12).

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By Order of the Secretary of the Army:


GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:


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PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION
SAMPLE								

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.)
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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
 1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
 1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 Lb
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches
 1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

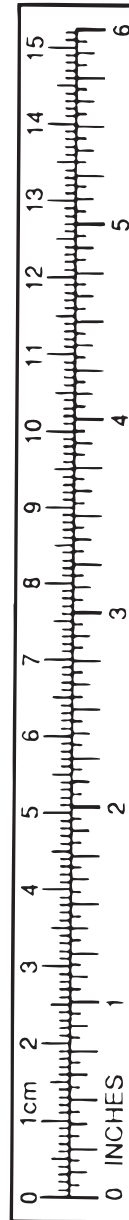
TEMPERATURE

$5/9 (°F - 32) = °C$
 212° Fahrenheit is equivalent to 100° Celsius
 90° Fahrenheit is equivalent to 32.2° Celsius
 32° Fahrenheit is equivalent to 0° Celsius
 $9/5 C° + 32 = F°$

APPROXIMATE CONVERSION FACTORS

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square 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 Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



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